Sick Lector 631 code reader

Hardware setup guide

Ensurance™

Version 11/2019

1   Important Information

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> **USING THE ENSURANCE™ SYSTEM.**

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About Ensurance

Ensurance is a software used to manage tag personalization process activities in smart label production, including memory programming, data printing, quality testing, and data verification. The software provides a graphical user interface (GUI) for the machine operator, the necessary tools for production engineers to create and edit process definitions, and it manages processing equipment and in-process dataflow.

The Ensurance personalization system is intended to be used in production environment as a part of a machine, and operated by professional personnel. It should be noted that if antennas or other radiating elements are used with the system, local regulations may limit the frequency range and transmit power that can be used. Particularly, related to RAIN/UHF reader, regulations related to features, such as channel-hopping and dwell time are specific to country. If the device is transported to different region, please check that settings and reader type comply with the local regulations.

About this document

Ensurance system can be added with a camera-based Sick Lector code reader for reading registering printed codes and verifying printed code data. Ensurance supports Sick Lector family readers, and the standard option is SICK Lector 631. This document describes how to set up and use Sick code reader, the key specifications related to personalization, and typical troubleshooting scenarios.

Related documentation

Manufacturer's technical documentation. This manual includes information on the process options and relevant performance data related to Ensurance Smart label processing system. More technical information is available from device-specific documentation by manufacturer.

3rd party software manuals. Ensurance system provides the whole toolchain for managing and utilizing SICK readers, but the vendor also provides the SOPAS Engineering Tool which can be used for troubleshooting and applying advanced settings. The software is referred to in this documentation. Operating instructions are available through the product's own documentation.

3 Technical information

3.1 Supported models

Ensurance supports camera-based code reader Sick Lector 631. For many parts, other models from Sick Lector and Sick Lector Pro family are also compatible, but official support is provided only for the particular Sick model. Sick Lector 631 is available with different lens options which should be chose according to reading distance and areas planned for the application. Standard option provided with Voyantic Ensurance system is S-lens (f/8 17.5 mm).

3.2 Functions and performance

The supported code scanner supports both registering printed codes and verifying data on the printed code. Application enables processing 1D codes, 2D codes, stacked codes, and labels with multiple codes. Reference data for code verification may be fixed or dynamically acquired in-process (e.g. from file, or tag memory). Optical character recognition (OCR) is not supported. Thus, evaluating printed characters or printing quality is not possible. The focus is manual, but the reader features an auto setup function which adjusts the picture capture parameters relative to ambient lighting conditions. The key specifications for the supported code reader model and information of the available lens types are listed in tables below. More detailed technical information is available from product datasheet and manuals.
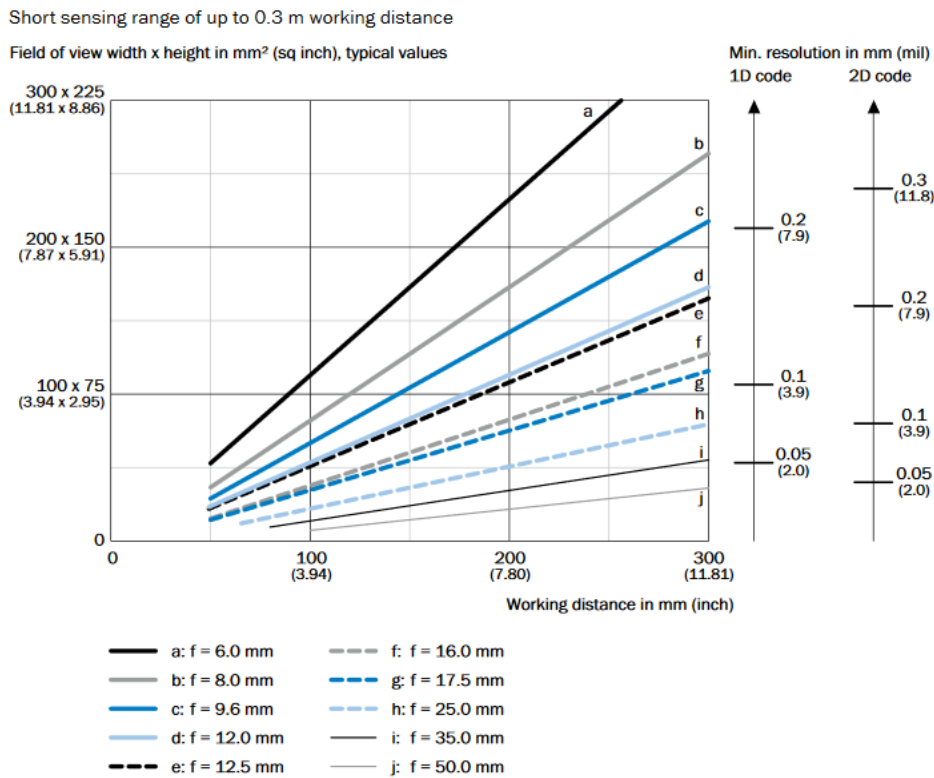
Short sensing range of up to 0.3 m working distance

Field of view width x height in mm² (sq inch), typical values

Min. resolution in mm (mil)

a: f = 6.0 mm
b: f = 8.0 mm
c: f = 9.6 mm
d: f = 12.0 mm
e: f = 12.5 mm
f: f = 16.0 mm
g: f = 17.5 mm
h: f = 25.0 mm
i: f = 35.0 mm
j: f = 50.0 mm

Fig 1. Sick Lector Pro 631 is available with several lens types affecting read range and area

Table 1. Technical specifications for code reader supported by Ensurance.

Supported models	Sick Lector 631
Functions	Single code reading, multi-code reading, data verification (no OCR)
Supported code types	**Barcode types (1D):** Interleaved 2 of 5, Codabar, Code 128, Code 32, Code 39, Code 93, GS1 DataBar GS1-128/EAN 128, Pharmacode, UPC/GTIN/EAN. **Postal codes:** United States Postal Service (POSTNET, PLANET, USPS4SCB), Australian Post, Royal Mail (RM4SCC, Post Singapore), Dutch KIX Post, Swedish Post. **2D/Stacked code types:** Data Matrix ECC200, GS1 Data Matrix, MaxiCode, PDF417, QR Code[1]
Scan area	Typical scan distance is 200 mm and scan area of roughly 80 mm x 60 mm (with lens f=8 17.5 mm focal length, other lens types are available on request.)
Performance	**Single code reading time**: Approx. 7-100 ms, depending on the code type and dimensions. Typical read time is 10-30 ms (needs to be verified case-by-case). **Throughput**: Depends on the scanning speed and repeat length. Example: For a label with 25mm pitch and single data matrix code with reading time of 100ms, max capacity is 600 units/min = 36k UPH, or 15 mpm in terms of liner speed.

[1] QR-code required to have square form eyes.

3.3   Licensing and options

The code reading option for Ensurance includes the SICK Lector 631 device and an accessories package. Additionally, the Ensurance license for code reading and verification are included. There are no license options directly linked to code reading functionality, but additional Ensurance software options may be required if specific in-process data processing functionality is required for the application. The list of parts and introduction to supporting software is provided in Chapter 4.1. Ensurance licensing is discussed Ensurance software manual.

Standard options	**Hardware:** Sick Lector 631 camera-based code scanner unit Accessories package: - cables and connectors - camera IO-box with power connector and IO's - lens (standard option f/8 17.5 mm focal length, other types available upon request) **Supporting 3rd party software** - SOPAS is available from Sick website. **Code scanning functions** - Code registration, including the supported code types - Printed code verification, including the supported code types - No OCR **Data management**: - static data - data from file - basic in-process data conversions
Optional features	Special in-process data conversions

4 Setup instructions

4.1 Code reader system parts

Code reading options for Ensurance includes the Sick lector 631 code reader with accessories needed for operating the reader with Ensurance system. Normal delivery kit contents are listed below. Check that everything is available before going on with the set-up process.

Hardware:

- Sick barcode reader unit

- Camera lens (standard option f/8 17.5 mm focal length, other types available upon request)

- Ethernet data cable

- IO-signal and power cable between reader and integration box

- Sick integration box with machine IO signaling and power supply pins

Software:

- Ensurance GUI is available in Ensurance installation media (license for barcode reading included)

- Manuals and other documentation provided on the USB stick

- Manufacturer's configuration tool (SOPAS Engineering Tool) is available from their webpage

Fig 2. Sick camera and accessories added with extra D15 IO-connector and standard power supply connector with the integration box.

4.2 Initial settings

4.2.1 Setting static IP address for the reader

In order to make application of the reader simple, it's recommended to set static IP address for the reader. IP settings of the reader are configured through SOPAS Engineering tool. If the software has not been installed before, the installer is available through the manufacturer's website and does not require an additional license.

When the program is ran, it will automatically detect SICK devices connected to the network. Once the reader has been located, double click on the Lector on the right-hand pane to add it to the project. Install the device specific drivers from the file provided on the Ensurance installation media (\Drivers\lector65x_V2.8.0.9.sdd). If no file can be found, the software will prompt to select the appropriate driver from a list of products.

Once the installation has been completed, perform the following steps to set the device IP address.

1. Click on the icon highlighted in red on Fig 3 to open IP settings dialog.

2. To set a static IP in the IP settings dialog (), select 'Use the following IP settings' highlighted in red and click on 'Automatic'. This should populate the IP address and Subnetmask fields with values. Press 'OK' to finish setting the IP. If the IP has changed, a list of previously used configurations can be accessed under 'History…'. Select an appropriate configuration and press 'OK' to proceed.

3. Verify that the IP was set correctly by double clicking on the device icon shown in Fig 3. The program will prompt to select a user interface, select standard. If no errors appear, the IP communications have been correctly set and the next steps may be taken.
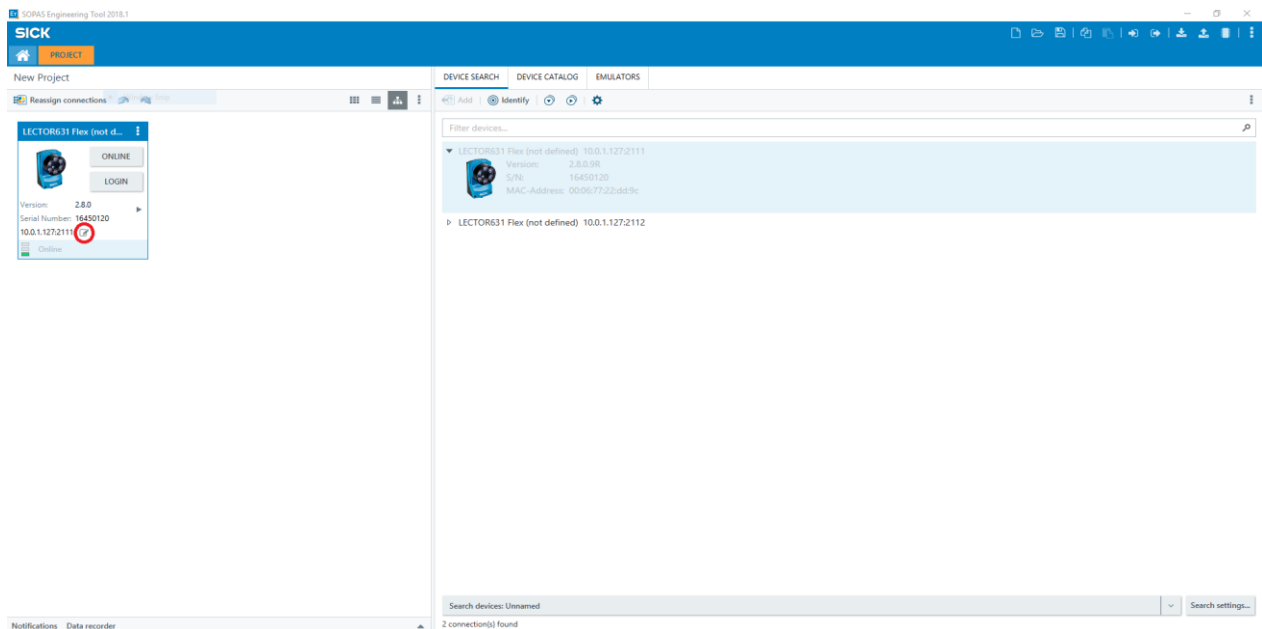

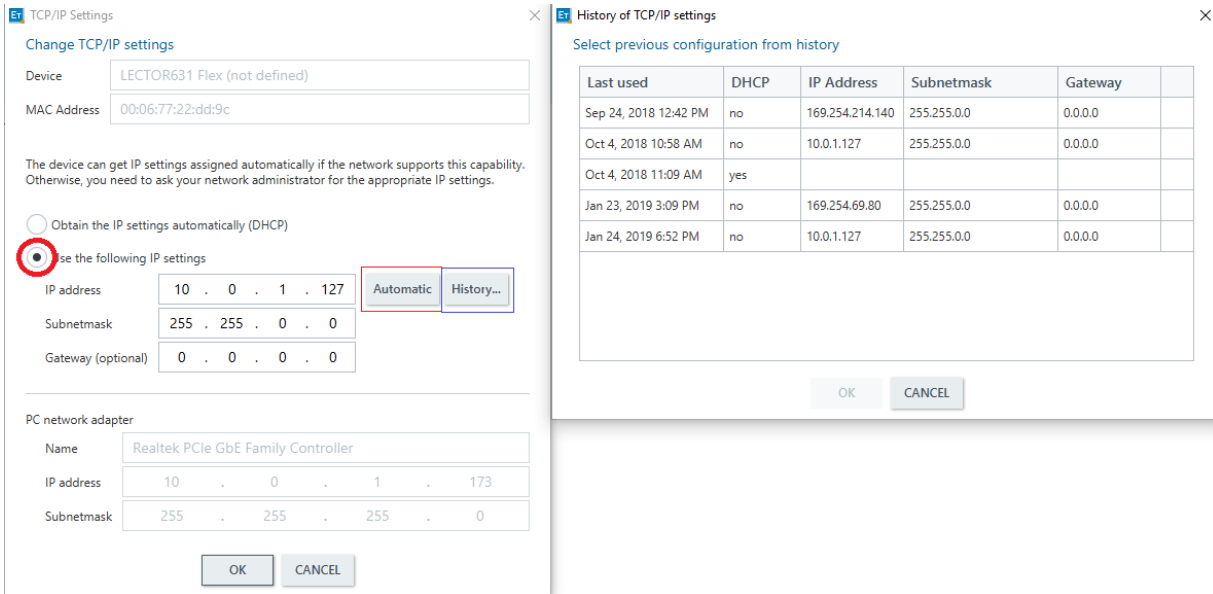**Fig 3.** Open IP settings dialog by clicking the button highlighted in red.

Fig 4. IP-settings dialog.

4.2.2   IO signaling interface

The Barcode reader comes with a SICK CDB650-204 connector module which forms the signaling interface for the machine. The default I/O-signaling schema is presented in Fig 6 and functional pins to be connected into the machine presented in Fig 5. In addition to signal pins, the connector module has switches that affect how it routes signals. Their default values are presented in Fig 7.
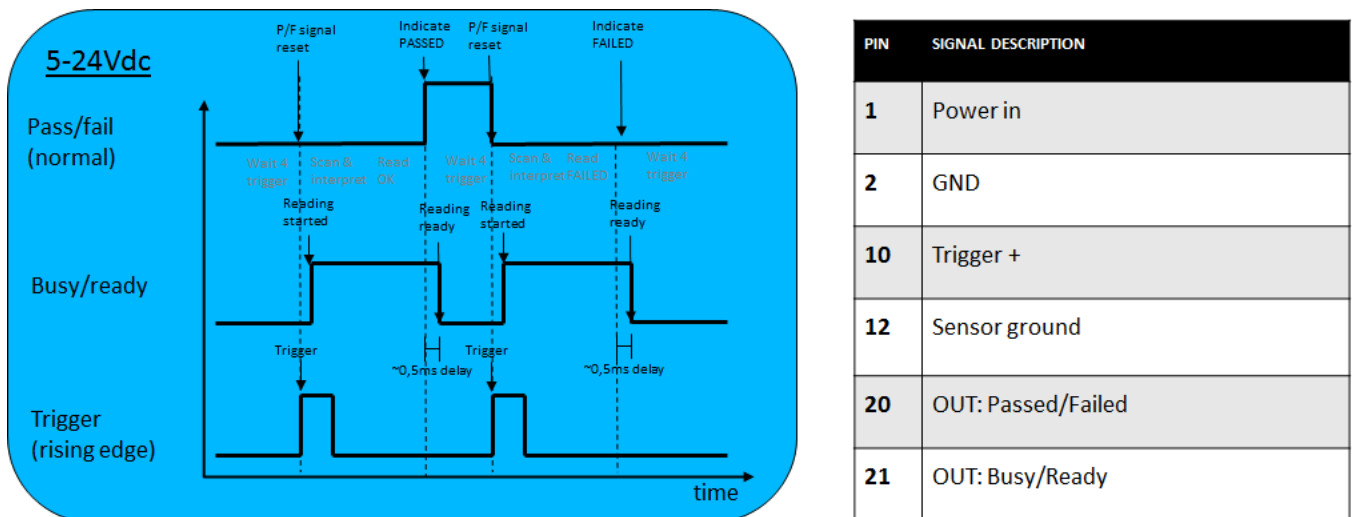

PIN	SIGNAL DESCRIPTION
1	Power in
2	GND
10	Trigger +
12	Sensor ground
20	OUT: Passed/Failed
21	OUT: Busy/Ready

Fig 5. IO-signaling pins and signals available in the Sick integration box.
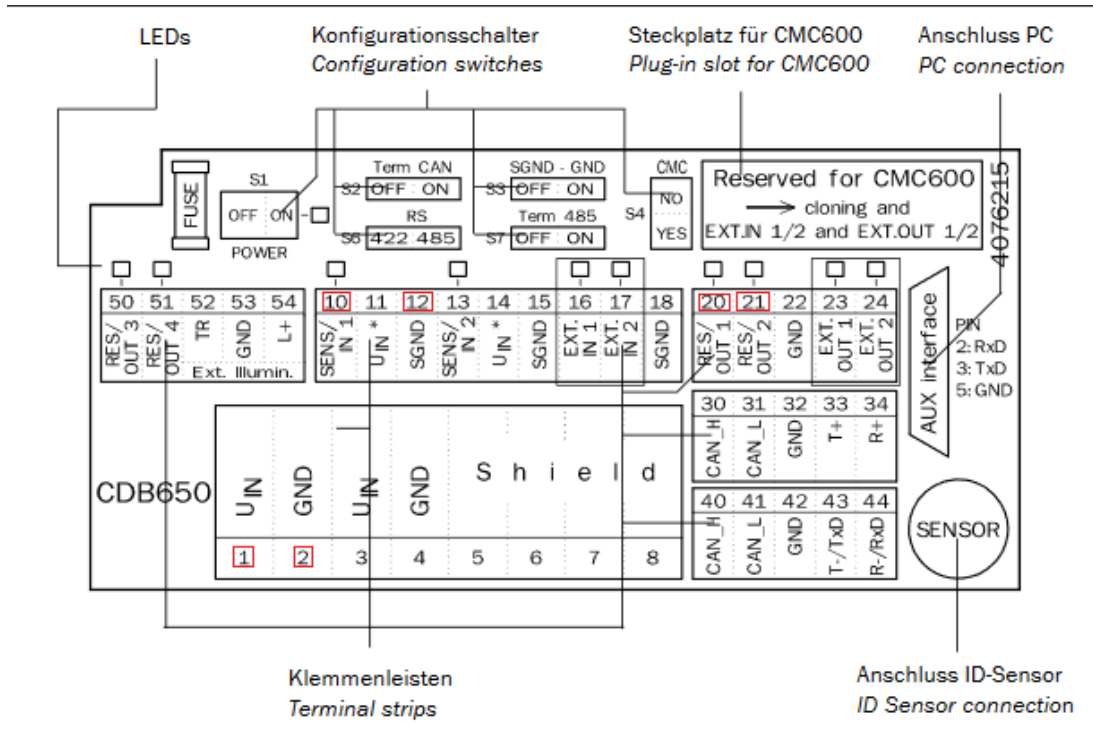
Fig 6. Pinout of the Sick integration box.

Switch	Function	Default
S 1 (Power)	Power supply: ON: Supply voltage U_{IN}^* on OFF: Supply voltage U_{IN}^* off	ON
S 2 (Term CAN)	CAN bus termination: ON: 120 Ohm resistor connected OFF: No termination	OFF
S 3 (SGND-GND)	Reference potential for sensor GND: ON: Connected to ID sensor GND OFF: Floating	ON
S 4 (CMC)	CMC600 integration: "YES": CMC600 connected to Aux interface of the ID sensor "NO": CMC600 not connected	NO
S 6 (RS 422/485)	RS 422/485 selector: ON: RS 485 OFF: RS 422	OFF
S 7 (Term 485)	RS 422 termination (receiver): ON: 120 Ohm resistor connected OFF: No termination	OFF

Fig 7. Default signals in the Sick integration box.

4.3 Preparation for job

Setting up the code reader, involves eight steps

1. Initial reader settings
2. Setting the reader position and adjusting image quality
3. Defining region of interest (ROI)
4. Detect the code type and set the image acquisition parameters
5. Setting-up timeout value for the reading process
6. Defining the task for the reader: read or verifyRead
7. Testing the setup and verifying performance
8. Saving the ready settings to a configuration file

In Ensurance system, the code reader setup can be tested and configured using Ensurance Code Reader Setup Tool include in the Ensurance software package. With a sample code, this tool enables the user to define region of interest, timeout parameters, test the acquisition to verify that the settings are valid, and finally save the settings to a configuration file once the setup is considered to be ready.

1. Initial reader settings

To run the Code Reader Setup Tool, browse to Ensurance folder and run *Code Reader Setup Tool.exe*. Once the program window opens, first click "Connection test" to verify that the code reader can be detected. Then click "Reset Reader to Default" if the setup procedure is to be started from blank, or "Upload Parameters from File" if a readily built configuration file is to be used as the starting point for the setup.

2. Setting the reader position and adjusting image quality

The first thing is to make sure the code is in the field of view of the camera and distance and focus adjusted so that the image retrieved is clear to enable robust image detection. When using Ensurance Code Reader Setup Tool, bring the sample code into the correct trigger position and click Continuous shooting. Next, adjust camera position until the code is visible in the image window, and then adjust reading distance and focus to enhance the quality of the acquired image. In Sick Lector 631, the focus is adjusted by turning a screw in the top of the camera. Once the image is clearly visible in the window with a fair margin of extra space around, the first round of setup is done. Finish this phase by stopping continuous image capture.
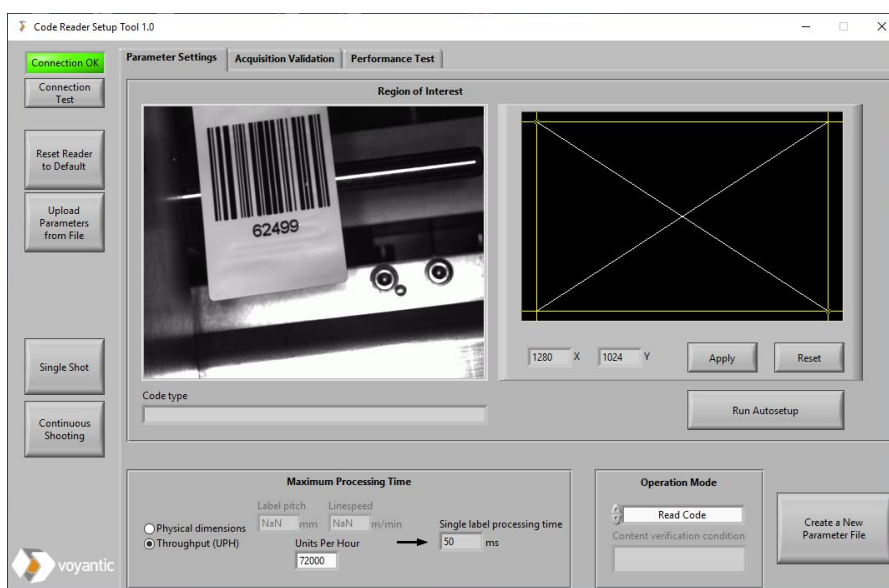

Fig 8. Positioning of the reader and adjusting image quality

3.   Defining the region of interest (ROI)

Once the basic settings are ready, the next step is to reduce slack from the image capture. The key parameter for efficient barcode reading is fitting the Region of Interest (ROI) according to the code to-be-captured. In principle, the tighter the fit, the faster it is to locate and register the code, but it's also important to leave some room for code position variance during runtime. The quiet zone is a parameter which indicates the proximity of non-code objects to the code. To allow enough margin and secure robust code registration, it's recommended to set the quiet zone as at least the width of the smallest element multiplied by 10 for 1D codes and the width of an element on each size for 2D codes.

Using the barcode reader setup tool, the region of interest can be set by moving the yellow edges on the ROI adjustment screen, When moving the edges, the new region of interest can be seen as a yellow box on the captured image window as well (Fig 9). When adjustment is ready, click "Apply" to apply new setting, and finally capture a test image by clicking "Single Shot". If the region of interest is still too large, move edges again, and repeat the sequence. In case the area seems too tight, click "Reset", and redo the adjustment procedure. Once the image is clearly visible in the image capture window with appropriately tight fit and enough quiet zone around it, the ROI setup is ready. The minimum suggested ROI is 20% x 20% of the total resolution. A warning indicator will appear next to the active resolution indicators to show that the current ROI is smaller than the suggested value. If this is a consistent issue, consider changing the working distance instead.
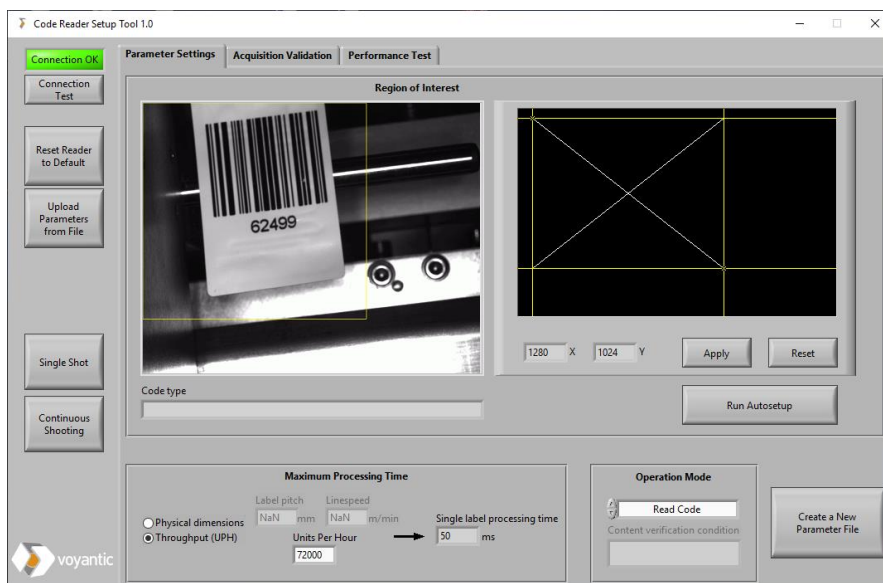

Fig 9. Adjustment of the region of interest

4.   Detect the code type and set the image acquisition parameters

Once the ROI is set, click 'Run Autosetup" to let camera automatically adjust its own the image acquisition parameters and detect the code type. The acquisition parameter adjustment is made for the selected region of interest. so cropping bright and reflective areas out improves the result of autosetup. The detected code type is shown under the image after autosetup is complete.
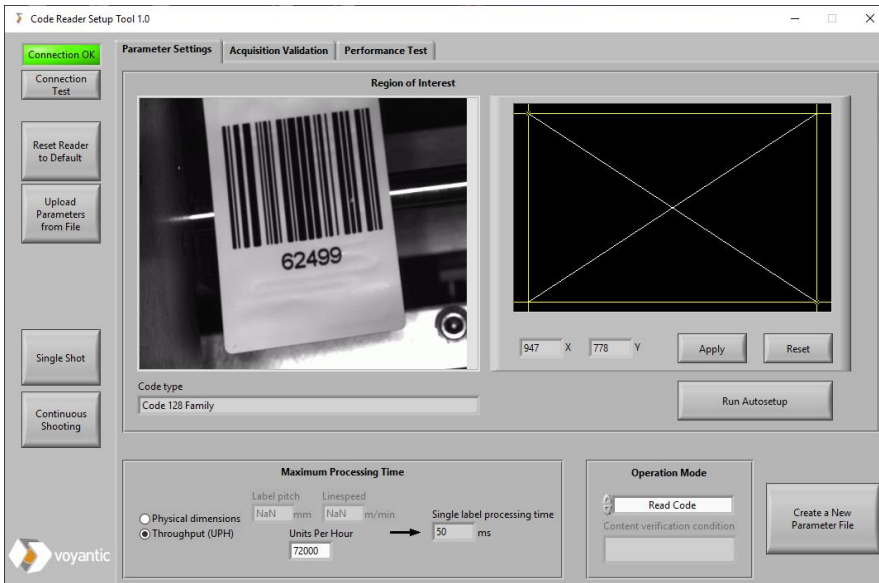
Fig 10. ROI setup and Autosetup are ready

5. Setting-up timeout value for the reading process

Last critical performance-related setting is to set the timeout for the code registration operation. Camera-based code reading works so that a picture is taken first. Then, the embedded processing unit seeks to interpret picture and locate a valid code. Image capture is fast (typically less than 1ms) and that's the time the code has to stay in the field of view. Interpretation and code recognition, on the other hand, is slower and timeout limit is defined to prevent the reader to get stuck searching a code when it fails to locate one. It should be long enough to enable enough time for the interpretation, and also short enough to not slowing down the speed of the personalization process. Typically, reading a single code takes 7-150ms, but there is no harm to allow more time if the personalization process is slower. One logical way to define the value is to first define process speed and then define the longest possible timeout which does not slow the process down. In the setup tool, the value can be conducted on the basis of the target throughput (timemout = UPH/3600), or linespeed and pitch (timeout = linespeed/(60xpitch).
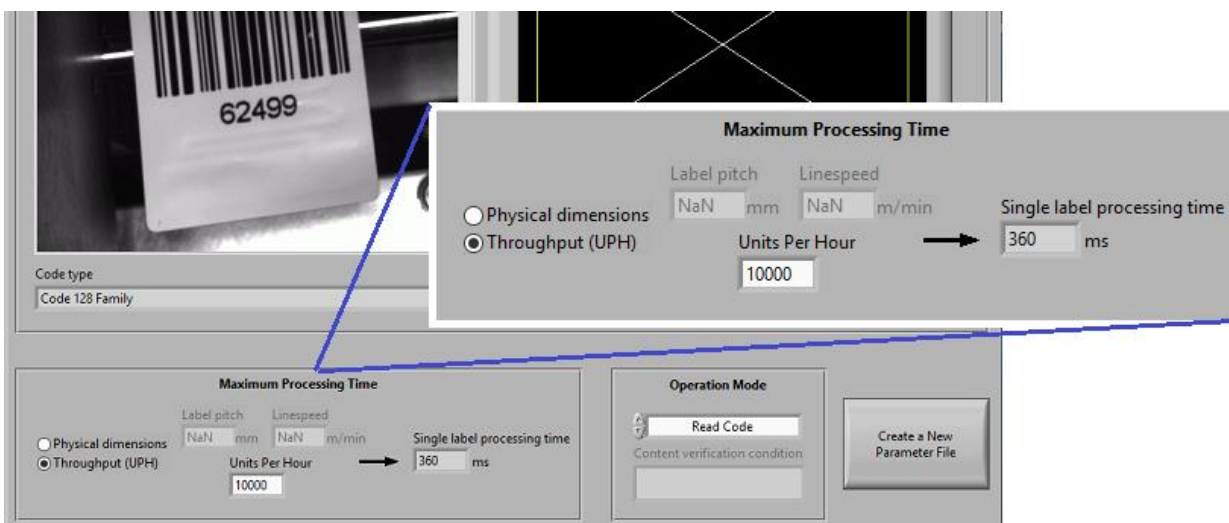

Fig 11. Timeout setting adjustment

6. Defining the task for the reader: read or verifyRead

Once the actual camera setup is ready, the operator still needs to identify the type of operation the reader is supposed to conduct. Ensurance allows reader to be used for reading or verifying printed codes. When using the Code Reader Setup Tool, the task type is defined by choosing the right option from the "Operation mode" pull-down menu. If the verifyRead mode is selected, the operator can also fill-in a reference value to be used later for testing the operation.
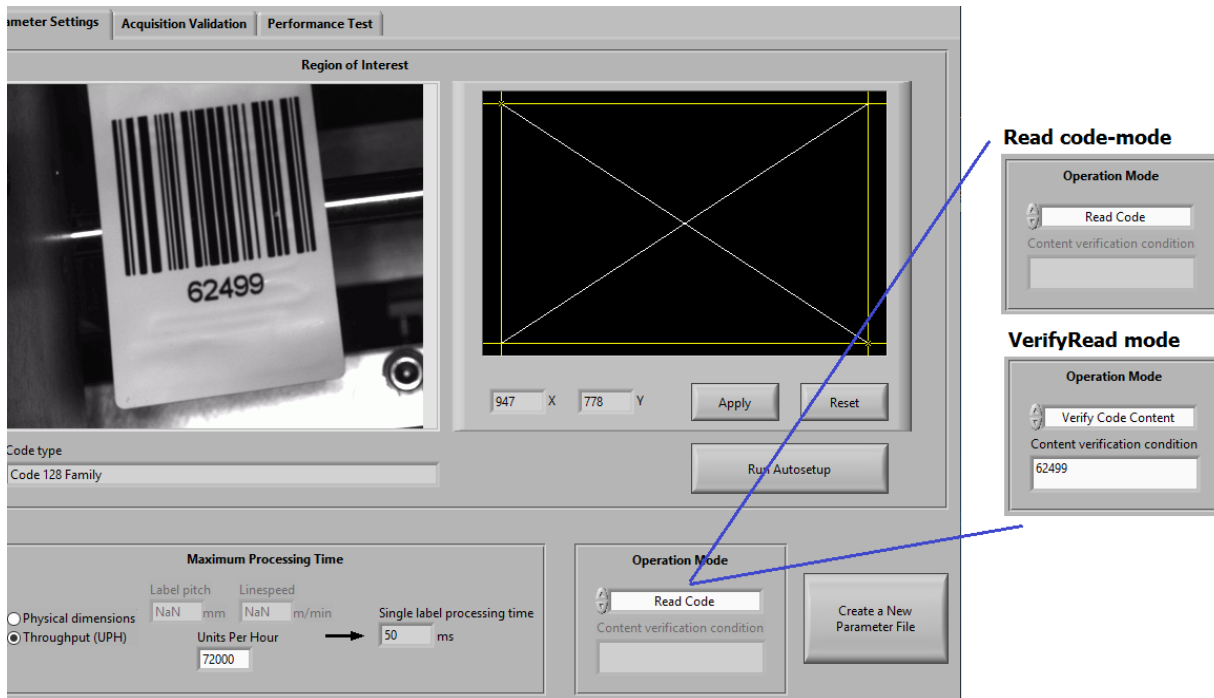

Fig 12. Definition of the reader operation mode

7. Testing the setup and verifying performance

As all of the reading settings have been set-up, the operator still needs to test the settings to verify the functionality in practice. Ensurance Coder Reader Setup Tool provides two testing modes: acquisition test (Fig 13) and performance test (Fig 14).

Acquisition test is activated by selecting "Acquisition Validation" page. In this mode, the reader can be set to capture a single image by clicking: "Single Shot" or to continuously capture images by clicking "Continuous Shooting". Whichever the mode, the GUI will indicate for each captured image if the code reading task or code verification task was performed successfully and what type of code type was detected. Moreover, it will also show yield and counts for the tested codes. Continuous Shooting mode is again practical, if the operator wishes to test operation with multiple tags, or if there are problems with the image acquisition and reader position or focus, for instance, needs to be adjusted.

Performance test is activated by selecting "Performance Test" page. In this mode, operator should set a tag to a trigger position, choose how many repetitions are done, and click "Single Shot" to set the test sequence to start. The software will trigger the reader as many times as defined by the operator and cunt yield for the repeated tasks. Graph indicates the outcome of individual tests, and if settings are valid, the yield of 100% should be reached. If not, reader settings need to be checked.

8.   Saving settings to a configuration file

Once the setup process and verification tests have been successfully completed, the settings can be stored to a configuration file. To do that, select "Parameter Settings" page, click "Create a New Parameter File" button, and follow any instructions provided on the screen. Save the file to a known position since it's going to be needed later in the Ensurance case generation.
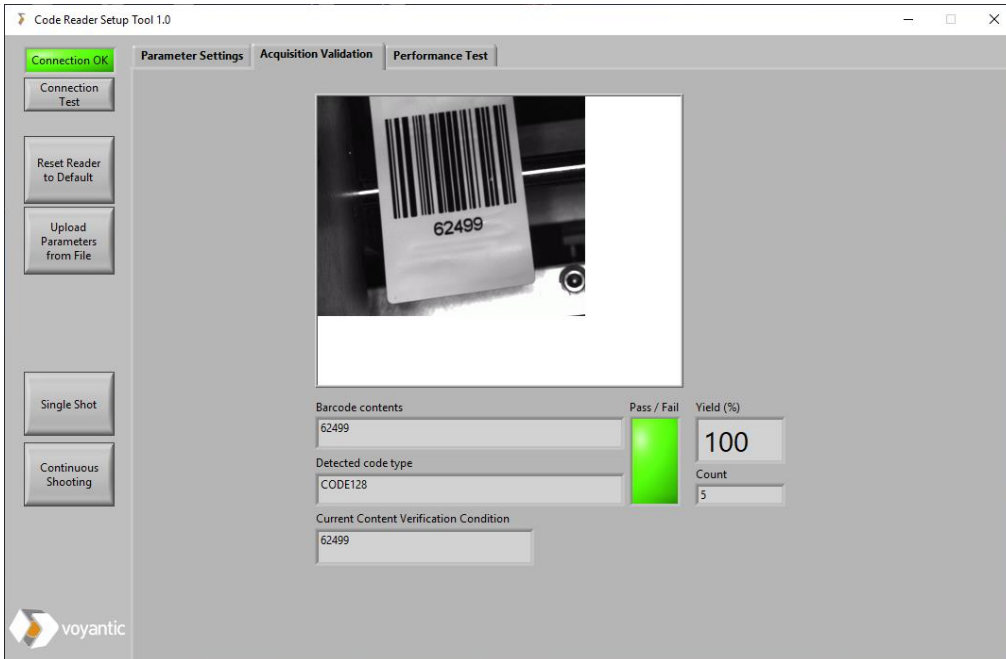

Fig 13. Acquisition validation test window in barcode reader setup tool
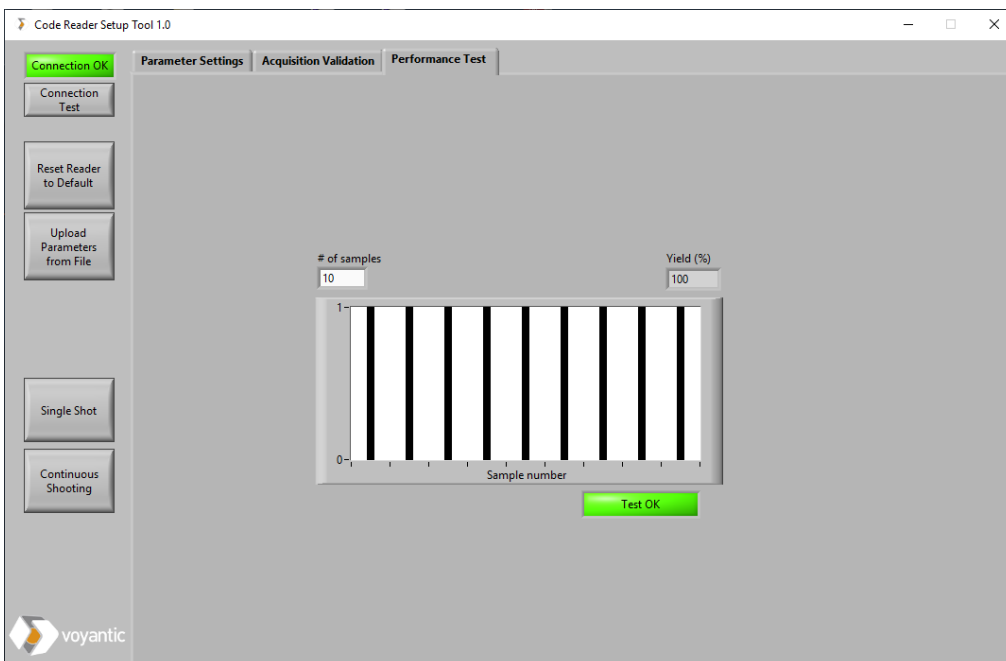

Fig 14. Performance test window in barcode reader setup tool.

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5   Maintenance and troubleshooting

5.1   Maintenance

The device is for the most part maintenance free. The key component to keep clean is the camera lens. In a production environment dust and dirt can accumulate on the lens and make the code reader perform sub optimally. For further information refer to the manufacturer instructions under maintenance and care.

5.2   Troubleshooting

5.2.1   All tags fail

Problem 1: The code is outside of the Region of Interest (ROI)
This issue can be verified by opening the Code Reader Setup Tool. For this purpose, the ROI tool with hardware trigger should be enabled. Run Reelsurance normally and observe the image area in the Code Reader Setup Tool. Check that the entire code is visible in the picture and the image area is not too tightly cropped.

Solution: Increase the ROI. Do this by selecting "Parameter Settings" page in the Code Reader Setup Tool. Stop the code at the trigger position. Adjust the ROI such that the entire code is visible, allowing for some fluctuation in either x- or y-directions. Run a number of samples to verify that the issue has been remedied. Save the changes to the desired configuration file by clicking on "Create a New Parameter file".

Problem 2: The PASS condition is not applicable
The condition for PASS may be configured to be dependent on variables. Check the current condition in the Code Reader Setup Tool under the "Parameter Settings" tab. If content verification is enabled, two factors need to be considered.

Solution: Firstly, the content verification may be incorrectly configured. Check that the condition and the update logic if using variable data is correct. Secondly, if there is a file from which the content for each tag is retrieved, verify that the correct file is referred to in the case configuration.

Problem 3: Insufficient processing time. If the line speed is too high or the processing time too short, it might result in a situation where no code can be read.

Solution: Assuming that the correct code type is selected, and a code indicative of the lot is in the ROI, select the "Parameter Settings" tab on the Code Reader Setup Tool. If running in continuous mode, adjust the processing time by either selecting the wanted UPH or by measuring the tag pitch and selecting the desired line speed. Then, by clicking start it may be checked whether the allotted processing time is sufficient to process the code consistently. If the yield % rises by increasing the processing time, it indicates that the selected processing time was too short. Refer to Chapter 4.3 for guidelines how to maximize the yield and throughput of a product.

Problem 4: Code cannot be optically verified. This issue can be divided into two parts:

- **Problem 4a:** Code reader depth of field is misadjusted. This is the result when the distance between the code reader and the code has been changed or the focus has been adjusted without adjusting the other one accordingly as well.

  Solution: Adjust the distance or the focus screw until the image appears sharp.

- **Problem 4b:** Code resolution does not match camera operating range. The code reader has an operating area of code smallest item size relative to distance. Please refer to Fig 15 to determine the minimum code resolution that works at the set working distance. To determine the resolution of the code, measure the smallest element on the code, preferably with a caliper. The smallest element refers to the thinnest black or white line on a 1D code or the size of a single square, referred to as module after this, on a 2D code.

  Note for using Videojet print design software: Usually the smallest bar's width (or white area) consists of a multiple of the smallest unit a printer can produce, given for a printer in DPI (dots per inch). This parameter can be adjusted by changing the code magnification -field in Clarity. For 2D codes the module size may be selected in Clarity.

  Solution: Select an appropriate working distance given the resolution of the code that is to be read. After selecting the distance, adjust the focus screw on the barcode reader until the image appears sharp. Refer to Chapter 4.3 for information how to do this with Ensurance Code Reader Setup Tool.

  Understanding Fig 15

  In order to determine the maximum working distance for a given code, measure its resolution. In Fig 15 code resolutions are shown on the righthand y-axis. Extrapolate from the measured resolution value to the line depicting the working area of the selected lens. The x-co-ordinate where these lines intersect indicates the minimum working distance for that resolution.
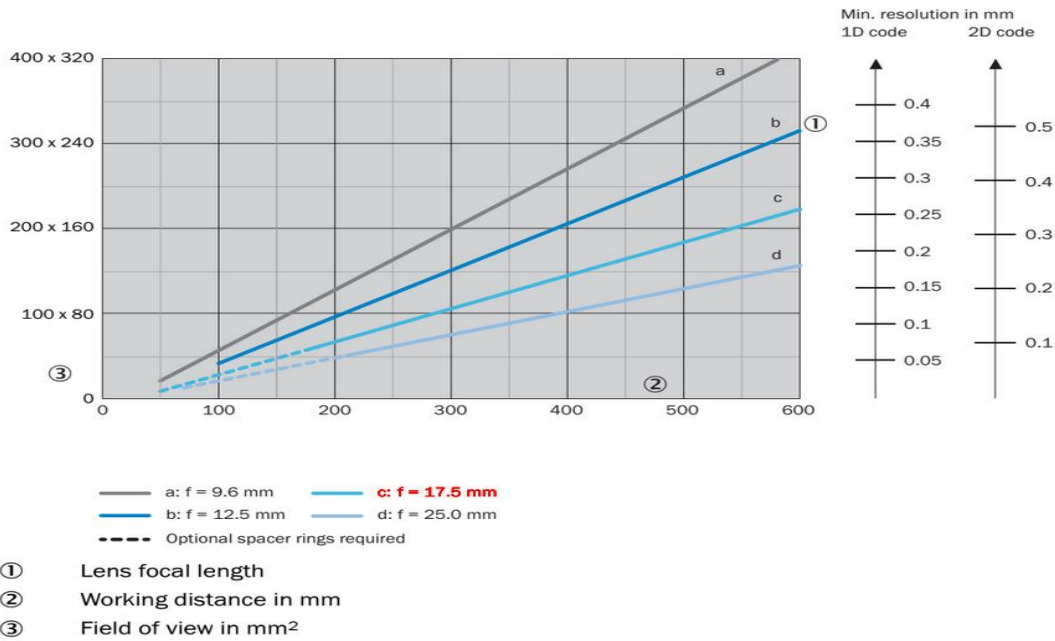
<table>
<tr><td>①</td><td>Lens focal length</td></tr>
<tr><td>②</td><td>Working distance in mm</td></tr>
<tr><td>③</td><td>Field of view in mm²</td></tr>
</table>

Fig 15. Minimum code resolution at different working distances with highlighted default option

Problem 5: Image will not appear sharp even if the focus screw has been turned till the end.

Solution: Examine Fig 16 to check if the working distance appears on the dotted line. In this case consider increasing the distance between the code reader and the code or installing spacer rings to the unit, for more details refer to Fig 16. The code reader delivery includes one of each 1.5, 2.3 and 3 mm spacer rings. Please note that installing a spacer ring in necessary <u>only</u> when the image cannot be made sharp by adjusting the focus screw. Achieving a working distance of sub 70 mm is possible, but those accessories are not included in the delivery.

Lens	Working distance (mm)									
	50 - 65	60 - 95	70 - 90	80 - 100	90 - 120	100 - 130	110 –	150 - 210	190 - 500	300 - ∞
17,5 mm lens #5330231	2,3mm + 3mm *note	1,5mm + 2,3mm *note	2,3mm		1,5mm			**	**	**

*note: use 15distance bracket and light extension, 20795501, and medium hood, 2079127

** no distance rings needed

**Fig 16.** Distance ring configuration for default lens

5.2.2 Tags fail sporadically

The root causes overlap with "**All tags fail**". Typically, this might be caused either due to codes being at the outside of the Region of Interest (ROI)' or insufficient processing time. Refer to Chapter 4.3 for more information on how to adjust them.
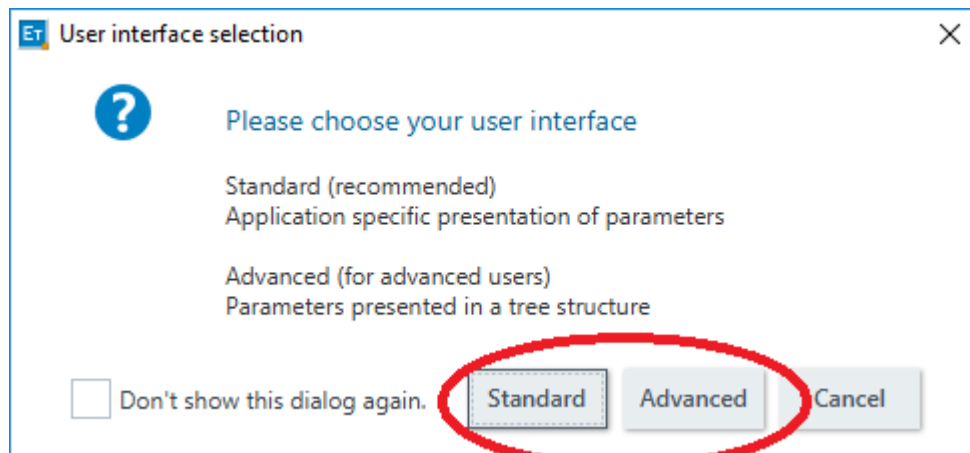
6 Appendix – Creating a configuration file in SOPAS
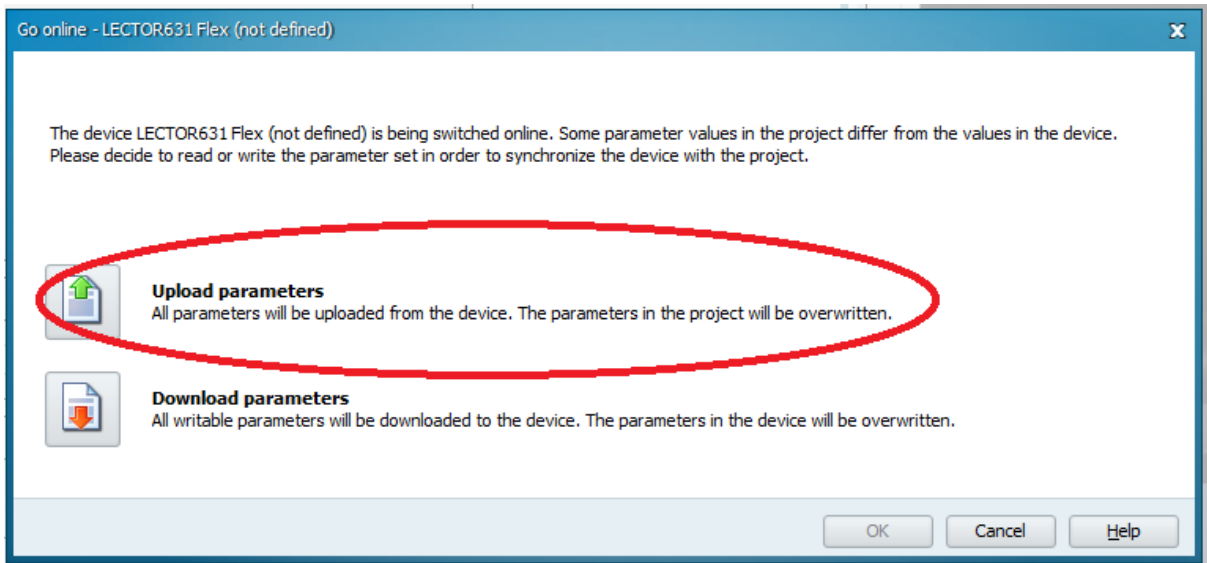
6.1 Establishing connection

Add Lector to project (double click on found devices, highlighted in red) and then double click on the icon which appears (highlighted in blue).
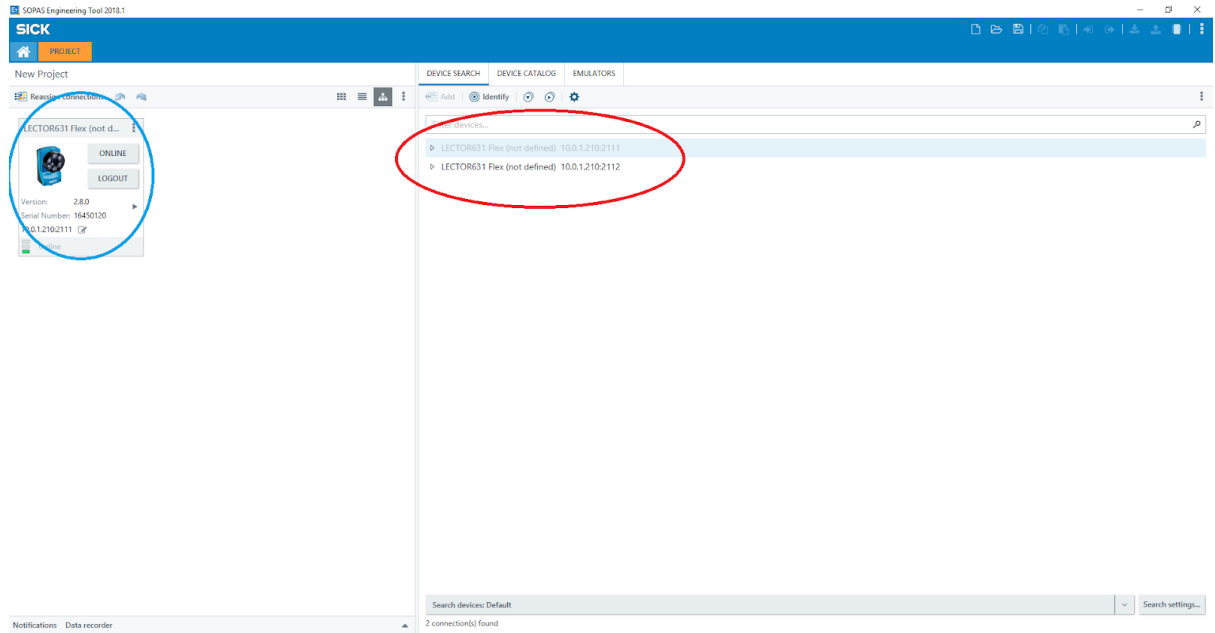
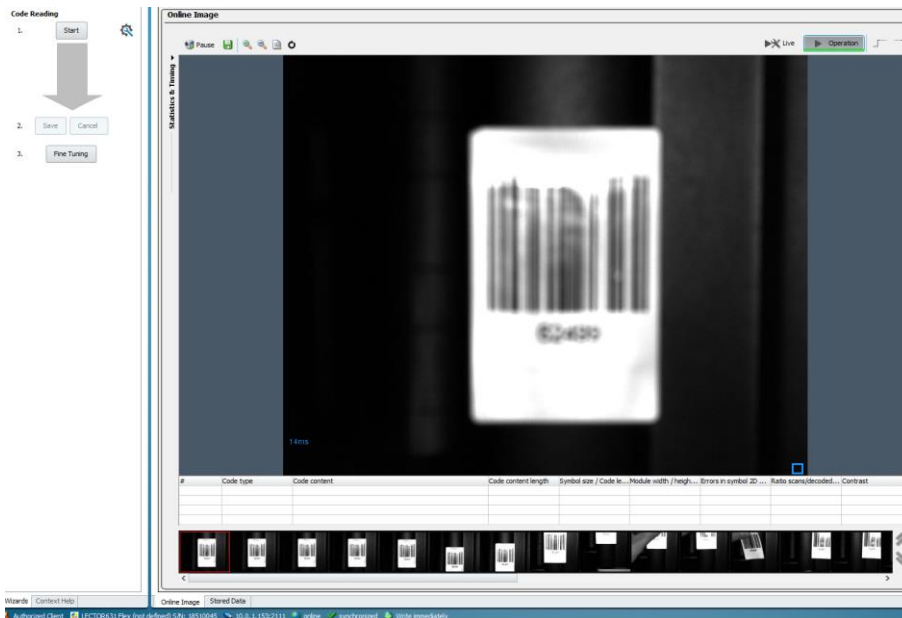Select either Default or advanced view, when prompted, do <u>NOT</u> enable "Do not show this dialogue again"

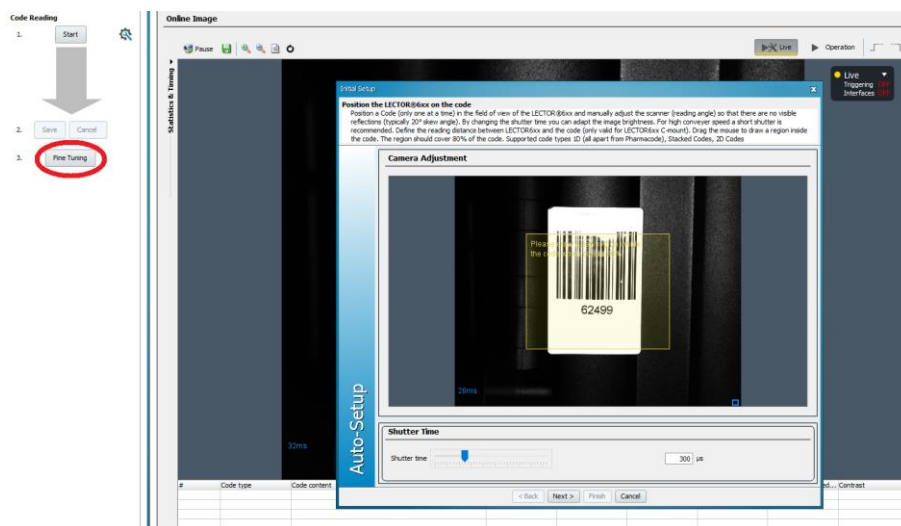When prompted, select Upload from device

6.2   Performing autosetup

Click on live to receive images from the code reader. Adjust the code so that it appears in the picture. Adjust the focus screw if necessary.
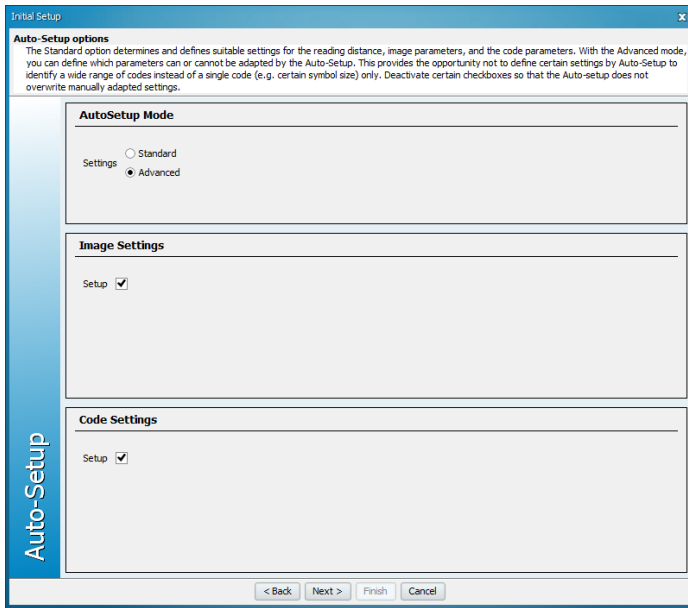
Once the image appears sharp, click on "Fine Tuning" on the left hand pane. A window will pop out, follow the instructions. Once satisfied, click on "Next >".

Select "Advanced" and click on "Next >".

The code reader will iterate the image acquisition parameters for optimum contrast. Once finished, it will report if the process was successful. If the intended code is highlighted by a green bounding box, it can be read even if either "Image Settings" or "Code Settings" failed. Click on Finish to end autosetup. The UI will become momentarily unresponsive as the updated parameters are sent to the code reader.
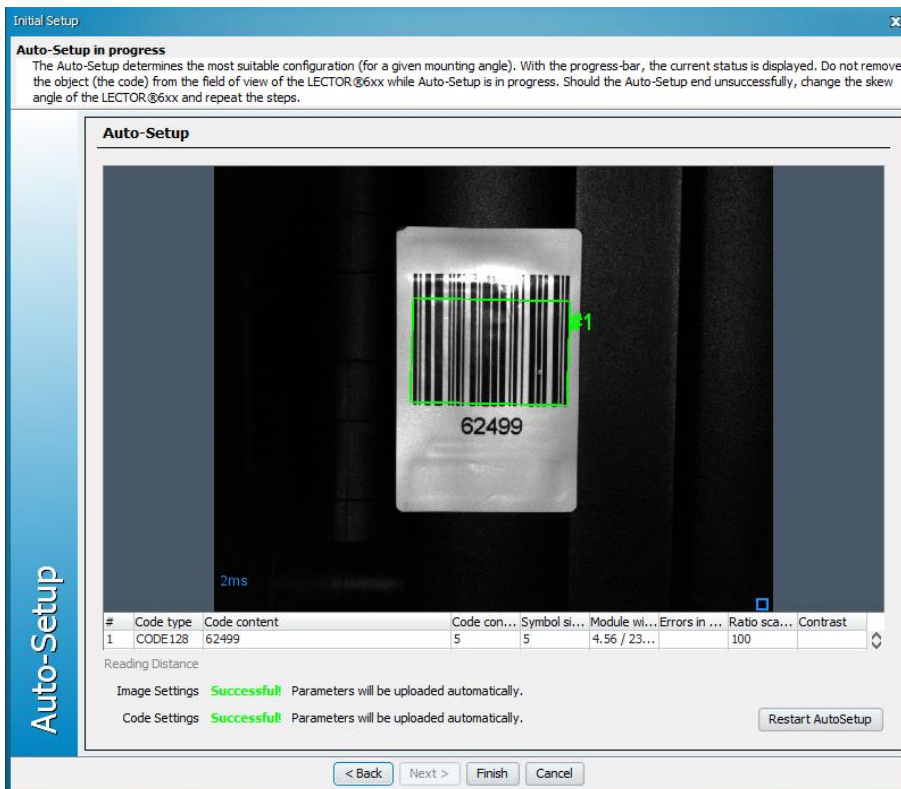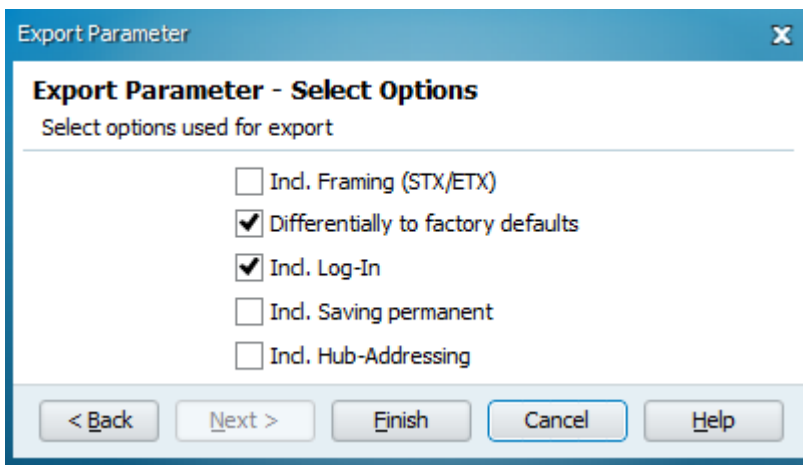
6.3   Exporting device settings to text file

Click on Lector631 Flex (device name)->Parameter->Export to text file.
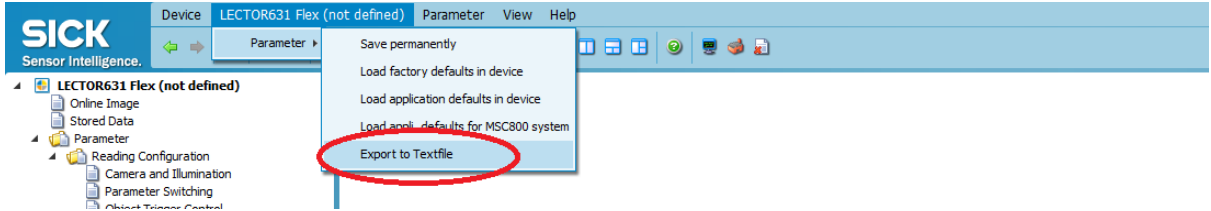
Select the name and path of the text file, click on "Next >". When saving confirm that the file settings are as follows:

Click on "Finish" to create the file. SOPAS will give a popup indicating a successful write of the file and its path.