

PINSPECTOR

OPERATING INSTRUCTIONS

High-quality optical pin inspection system

SICK
Sensor Intelligence.



Described Product Product name: Pinspector
Variants: Pinspector

Document-Identification Title: Pinspector operating instructions
Product number: 8020909
Version: 2.0
Stand: 2017-02-17

Manufacturer SICK CZ
Ukrajinská 2a, 101 00 Prague 10 – Czech Republic
Telephone: +420257911850
Fax: +420257810599
E-Mail: sick@sick.cz

Manufacturing Location SICK CZ
Ukrajinská 2a, 101 00 Prague 10 – Czech Republic

Trademarks MS-DOS is a registered trademark of Microsoft Corporation.
Windows is a registered trademark of Microsoft Corporation.
ADAM 6060 and Modbus are the trademarks of Advantech Co., Ltd.

Original-Documents The English edition 8020909 of this document is an original document of the SICK CZ.
For the correctness of an unauthorized translation, SICK CZ does not accept any Warranty.
If in doubt, contact SICK or your local representative.

Legal Notices Subject to change without prior notice

© SICK. Copyright reserved





Contents

Contents

1	About these operating instructions	8
2	General safety precautions.....	10
2.1	Safety guidelines.....	10
2.2	Intended use of the system.....	10
2.3	Specified laser safety instructions.....	11
2.3.1	1.3.1 Class 2M lasers.....	11
2.3.2	Class 3R lasers	12
2.3.3	Class 3B lasers	Chyba! Záložka není definována.
2.4	Electrical and mechanical safety	14
3	System overview.....	15
3.1	Inspection principle	15
3.1.1	Triangulation method.....	16
3.2	Pinspector measurement principle.....	18
3.3	Inspections supported by the Pinspector system	19
3.3.1	Inspection for Pin height & Pin position	19
3.3.2	Pin -hole fill inspection	21
3.4	Principles of communication between the control system and Pinspector ..	22
4	Managing logins	23
4.1	Default settings.....	23
4.2	Login	24
4.3	Changing the user name and password.....	25
5	Software settings	26
5.1	Pinspector program menu.....	27
5.1.1	File	27
5.1.2	View	28
5.1.3	Help.....	28
5.2	User interface for the Pinspector system	29
5.2.1	Measurement tab	30
5.2.2	Diagnosis tab	36
5.2.3	Settings tab	41
5.2.4	Inspection program database tab.....	49
5.2.5	Application status bar	53
6	Inspection Program Editor	55
6.1	Toolbox	56
6.1.1	Program steps	56
6.1.2	Scan evaluation	57

6.1.3	Telegram elements	57
6.1.4	Cameras.....	58
6.2	Program structure	59
6.2.1	Program header.....	59
6.2.2	Recycle bin.....	60
6.2.3	Cameras.....	60
6.3	Properties	61
6.4	Detail.....	61
6.5	User help.....	63
6.6	Error list	63
6.7	Save button	64
6.8	Program steps	65
6.8.1	Step - Scan.....	66
6.8.2	Step: Send telegram	74
6.8.3	Step: Setup outputs	81
6.8.4	Step: Log results.....	83
6.8.5	How to customize a directory path and filename	88

7 Operation 92

7.1	How to initiate the measurement.....	92
7.1.1	Automatic measurement mode.....	93
7.1.2	Manual measurement mode	94
7.2	How to obtain an image for the Inspection.....	95
	There are two options on how to create an image for the pin inspection, using the Inspection program editor:	95
7.2.1	Camera scan	95
7.2.2	Load images from the file	96
7.3	How to create a new inspection	97
7.3.1	Pin position and height inspection relative to the surrounding of the pin.....	97
7.3.2	Pin position and height position relative to the reference plane.....	100
7.3.3	Hole fill inspection.....	103
7.4	Action modes during pin analysis	106
7.5	How to save the scanned image	107
7.6	Template designer	108
7.6.1	Work flow on how to find the template designer.....	108
7.6.2	How to run the Template designer application	109
7.6.3	How to design the Template	109
7.6.4	How to assign an existing template to a selected Inspection	112
7.7	How to determine the pin position in millimeters	112
7.8	How to obtain the correct measured pin height.....	113

8 Inspections 114

8.1	Regulated guidelines for the inspection	114
8.2	Types of Inspections to add in the Scan evaluation block.....	114

8.3	Guidelines in selecting the regions for pin analysis	114
8.4	Inspection configuration	115
8.5	Pin-hole fill inspection	116
8.6	Pin height and Position inspection	117
8.6.1	Types of approach to measure the height and position of pins	117
9	Pinspector variants and system geometry	119
9.1	Pinspector D1.....	119
9.2	Pinspector E1	119
9.3	Pinspector E2	120
9.4	Factors of shadow occlusion	122
9.5	Types of shadow occlusion.....	122
10	Advanced applications	124
10.1	Parameters for inspection Algorithms	124
10.1.1	Pin- hole fill inspection.....	124
10.1.2	Method Connector pins measurement.....	125
10.2	Administration console.....	126
10.2.1	System Messages Tab	127
10.2.2	Telegram simulation tab.....	128
11	Maintenance	129
11.1	Care for Ranger camera and laser.....	129
11.2	Lens care.....	129
12	Troubleshooting.....	130
12.1	Measurement Tab.....	131
12.2	Application status bar	132
12.3	System messages file	133
12.4	How to properly align the laser with the camera	135
13	APPENDIX A: Technical Data.....	137
14	APPENDIX B: Camera and laser line Set-up guide.....	138
14.1	Ranger Geometry and Laser line geometry.....	138
14.2	Pinspector Communication	140
14.3	IO function and status codes	142
14.4	Pinspector program sequence	143
14.5	Template designer parameters.....	144
15	APPENDIX C: Pinspector variants	145
16	APPENDIX D: Pinspector Mounting bracket and geometry	147
16.1	Pinspector E1 camera and base plate assembly.....	147
16.1.1	Pinspector E1 base plate	151
16.2	Pinspector E2 camera and mounting plate assembly	152

16.2.1	Pinspector E2 Possible Mounting plates	153
17	APPENDIX E: Pinspector items definition.....	154
17.1	Pinspector Core package	154
17.2	Pinspector Core accessories	155
17.3	Pinspector selectable accessories	156
17.4	Additional hardware	158
18	APPENDIX F: Example of Pinspector E2 customer quotation components	159
19	APPENDIX G: Contact information.....	160

1 About these operating instructions

Scope

The current operating manual describes the SICK's Pinspector, assurance of quality control for printed circuit boards and connectors, during manufacturing and assembly. You can use this operating manual to answer any specific questions you may have about installation, operation, service, and troubleshooting the system.



Before starting to work with the system, read the operating instructions carefully to familiarize yourself with it. Knowing how to operate the system safely and correctly will help you avoid personal injury and property damage. It will also allow you to train future system operant.

Keep the operating instructions available at the production line for future reference.

Chapter	Target groups
Chapter 2 Safety guidelines	Operators
Chapter 3 System overview	Operators
Chapter 4 Managing logins	Operators
Chapter 5 Software settings	Operators
Chapter 6 Inspection Program Editor	Operators
Chapter 7 Operation	Operators
Chapter 8 Inspections	Operators
Chapter 9 Pinspector variants and system geometry	Installation personnel
Chapter 10 Advance applications	Installation personnel
Chapter 11 Maintenance	Service and maintenance personnel
Chapter 12 Troubleshooting	Service and maintenance personnel

Structure and target groups

The chapters in this document are arranged in a specific order. The structure will help you understand all the system functions and enable you to operate the system safely and correctly.

Special symbols and messages

The operating instructions contain special symbols and messages. It draws attention to potential concerns regarding safety and damage to property, as well as to provide helpful information.

Please read all the information carefully to avoid personal injury and property damage.

Typographical conventions

The operating instructions use the following typographical conventions:

Bold

Bold font is used for labels in illustrations.

Underscore

Underscored text indicates a cross-reference or a web address.

Monospaced

Monospaced font is used for communication protocol messages.

Symbols

Warnings and important information in this document are labeled with symbols. The warnings are introduced by signal words that indicate the extent of the danger. These warnings must be observed at all times and care must be taken to avoid accidents, personal injury, and material damage.

DANGER

... indicates a situation of imminent danger, which will lead to a fatality or serious injuries if not prevented.

WARNING

... indicates a potentially dangerous situation, which may lead to a fatality or serious injuries if not prevented.

CAUTION

... indicates a potentially dangerous situation, which may lead to minor/slight injuries if not prevented.

NOTE

... indicates a potentially harmful situation, which may lead to material damage if not prevented.

REFERENCE

A cross-reference is used to refer to other parts of these operating instructions or an external document.

2 General safety precautions

Overview

In this chapter you will find information on:

- How to operate the system correctly
- Intended use of lasers for the system
- Specified laser safety instructions for:
 1. Class 2M lasers
 2. Class 3R lasers
 3. Class 3B lasers
- How to avoid personal injury and property damage

2.1 Safety guidelines

Safety guidelines indicate actual or potential risks and dangers. Please read the safety guidelines carefully and adhere to them. Doing so will help prevent personal injury, property damage, as well as ensures correct and safe use of the system.

2.2 Intended use of the system

Pinspector is used to assess the manufacturing quality intended to detect the pins position on printed circuit boards and inside the connectors. The Pinspector system can measure the x, y, z position of pins with different components without the use of any mechanical instrument.

Do not use the system for any other purpose. The system may only be operated in accordance with its intended use.

The system has been manufactured in accordance with current industry regulations and in compliance with the requirements according to: EN 60825-1

The operator of the manufacturing line into which the system is to be integrated must provide

Measures for the safety of persons, and machines in accordance with statutory requirements.

The official and legal regulations for operating the system must always be complied with. It is prohibited to add any modification to the system components. The SICK company shall under no circumstances be liable for any loss or damage due to results of such modifications. Any claims made under the warranty shall render null and void.

2.3 Specified laser safety instructions

Overview:

- Laser safety for Class 2M, Class 3R, and Class 3B



Always bear in mind that the laser may be activated as soon as the Pinspector system is powered on.

The Pinspector system is equipped with a Class 2M laser according to IEC825-1 used by default.



3R and 3B class lasers can be used upon request, please ensure that additional safety measures must be applied, according to EN 60825-1.

2.3.1 1.3.1 Class 2M lasers

Class 2M lasers are products which produce either a highly divergent beam or a large diameter beam in the wavelength range 400 nm to 700 nm. Therefore, only a small part of the whole laser beam can enter the eye, limited to 1 mW, similar to a Class 2 laser product. However, these products can be harmful to the eye if the beam is viewed using magnifying optical instruments or for long periods of time.

Although, operators are not required to wear any special eye protection, they still need to observe safety precautions. The following avoid risk of exposure to the laser beam and to hazardous radiation:



- Do not stare into the laser beam.
 - Do not suppress the blink reflex intentionally.
 - Do not view the laser beam directly with optical instruments such as magnifying glasses, etc.
 - Avoid looking at the laser reflection.
 - Do not aim the laser beam at the eyes of a person.
 - Do not dismantle the laser from the ramp.
 - Do not open the housing of the laser optics.
 - Do not operate the Pinspector system and the lasers in particular for any purposes other than specified in this operating instruction.
-



Figure 1 2M laser (attached label)

2 GENERAL SAFETY PRECAUTIONS

2.3.2 Class 3R lasers

Class 3R lasers are considered safe when handled carefully. There is only a small hazard potential for accidental exposure. For visible-light lasers, Class 3R lasers' output power is between 1 milliwatt and 4.99 milliwatts. The nominal ocular hazard distance (NOHD) for the most powerful Class 3R visible beam laser 4.99 mW.

The tight beam (0.5 milliradian divergence) is 104 feet (32 m). The 4.99 mW Class 3R laser with a less-tight beam that spreads out faster (1 milliradian), the NOHD is 52 feet (16 m). This divergence is more typical of consumer laser.

A Class 3R laser is low powered. It normally would not harm eyes during a momentary exposure of less than $\frac{1}{4}$ second (within the aversion response* of the eye).

Do not deliberately stare or look into the laser beam, doing so can cause injury to the retina in the back of the eye. Laser protective eyewear is normally not necessary. A Class 3R laser is not a skin or materials burn hazard.



Figure 2 3R laser (attached label)

*Aversion response is the blinking of the eye or turning away from the beam.

2.3.3 Class 3B laser

Class 3B laser may have an output power of up to 500 mW (half a watt). Class 3B lasers may have sufficient power to cause an eye injury, both from the direct beam and from reflections. The higher the output power of the device the greater the risk of injury. Class 3B lasers are therefore considered hazardous to the eye. Exposure to the laser beam can cause eye injury. The extent & severity of the injuries will depend upon several factors including; the radiant power entering the eye, and the duration of the exposure.

Class 3B lasers are not suitable for general use by consumers.



The use of laser protective eyewear is suggested or recommended (depending on the laser's power level).

- The nominal ocular hazard distance (NOHD) for a lower-powered 50 mW. Class 3B visible-beam laser with a tight beam is (0.5 milliradian divergence) is 330 feet (100 m).
- The nominal ocular hazard distance (NOHD) for the most powerful 499 mW. Class 3B visible-beam laser with tight beam is 1,050 feet (320 m).



Figure 3 3 B laser (attached label)

2.4 Electrical and mechanical safety

- Make sure that the system is ready for operation, and all components are undamaged.
- Observe the work safety regulations of the mutual indemnity associations and Professional associations of the respective country during operation.
- Make sure that connection cables cannot come loose unintentionally or become damaged by moving system parts. We recommend that you use cable tray wherever possible.



Any damage caused due to misuse or negligence will have to be repaired at the purchaser's expense.

3 System overview

Overview:

This chapter will provide you the information about:

- Inspections supported by Pinspector system.
- Inspection principle
- Measurement philosophy
- Communication between the control system and Pinspector

Pinspector is an autonomous system, executing quality control measurement, and precise inspection of x, y, z pin position in PCBs. Including the presence of pins inside the connector (Hole-fill inspection). It is a laser-based optical system, comprising of SICK Ranger camera, objective, line laser, a control PC, and software. It also includes easy to use control interface, allows you to conveniently create the essential program for 3D image analysis.

Pinspector uses data from the high-speed camera creating a 3D image of the PCB and its pins/connector based on triangulation method. The images can be modified according to the manufacturer's specifications. The result is then sent to the control system and can be stored in a disk for future use.

3.1 Inspection principle

The Ranger camera system works accordingly with the triangulation method. The Ranger camera detects the laser line's projected light on the objects to be analyzed, and evaluates the shape of the scanned objects. The height of the detected laser line, determines the height of points measured on the object. Let's assume that the examined point on the object's surface is reflected with a laser beam. Thus, the pixel position of the camera chip, where the laser beam is projected, will then determine the height of the measured surface point. The difference between the top and bottom point, constitutes the height range. The measured object must steadily move under the Ranger camera system while the inspection is taking place. Thus, simultaneously determine the shape of the object with the laser line on a different Y axis. The measurement is activated using the control system or by the light sensor. The measurement is synchronized with pulses from the encoder and processed by the computer.



Please refer to the Operating manual for Ranger camera for detailed description and features of the SICK Ranger camera.

3 SYSTEM OVERVIEW

3.1.1 Triangulation method

The Ranger camera uses laser triangulation when measuring the height range. The object is illuminated with a laser line from one direction, and the Ranger camera is positioned at a different angle. The laser line produces a profile in the Ranger camera image sensor. The Ranger camera determines the height of each point on the profile and locates the vertical location of the laser line.

The Ranger and the laser line should be oriented so that the laser beam will appear along the object to be scanned. The laser line indicator installed behind the camera indicates in which direction the Ranger expects the laser line to be oriented. See [Figure 4](#)

As the target (or the camera and light source) moves, the Ranger camera creates a series of measurements along the object. See [Figure 5](#). The results of the created measurement are then collected as profiles, containing the measurement of the laser line projection, on a fixed location along the direction of the transportation.

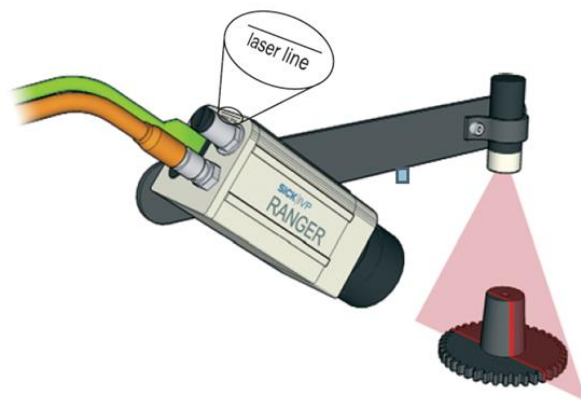


Figure 4 Triangulation method

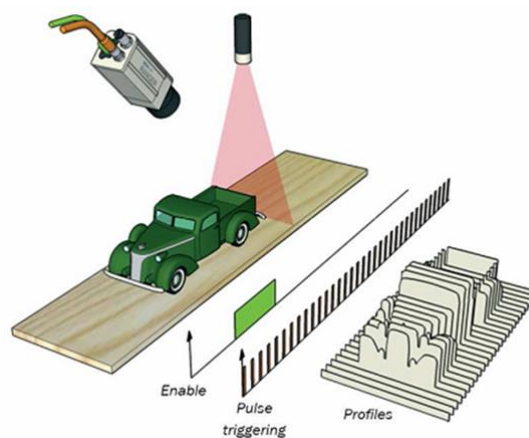


Figure 5 Scanning of a moving object

The values which are obtained from the camera during the measurement period are not calibrated. Their actual dimensions (in mm) are defined using the geometry of the system, along with the speed of the scanned object.

- x axis is represented with the column on the CMOS sensor, where the illuminated point from the laser is detected.
- y axis is determined through the sequence of the profiles (pulses of the encoder).
- z axis (height) is determined via the row on the CMOS sensor where the laser line is detected.

3.2 Pinspector measurement principle

Pinspector performs the process of executing the steps of the inspection program; e.g. taking measurements, sending results, etc. The process per inspected product/object needs to pass qualification, in order to satisfy the quality criteria. The inspection program can be created using the Inspection Program Editor.

The Inspection Program Editor contains building blocks available for engineers to create an inspection program. The building blocks supported by the Inspection Program Editor are:

- Scan
- Send telegram
- Set outputs
- Log results

Please refer to Program steps in [Section 6.8](#) as of [page 65](#) for the detailed description of these building blocks.

3.3 Inspections supported by the Pinspector system

3.3.1 Inspection for Pin height & Pin position

Height measurement against the surrounding area

This type of inspection can be applied in the system to measure the pin height against the surrounding plane surface (at the bottom of the pins). The bottom of the pin is used as a reference area. This inspection can only be functional, if the reference area allows visible Image's of FOV (field of view). The reference area serves as the Z-axis reference point.

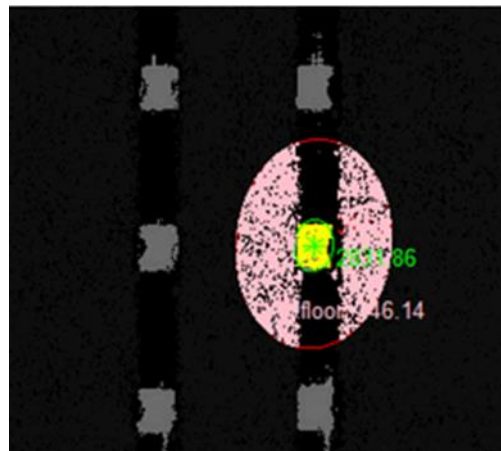


Figure 6 the pink shade represents the floor surface at the bottom of the pins used as the reference point.

Advantages of Height measurement against the surrounding area:

- User-friendly.
- The only set-up that the operating entity needs to adjust is the area for pin detection.
- All pins are automatically measured relative against their surrounding.



This measurement is only functional, if the surrounding area of the pin is sufficiently flat. The Algorithm discards 20% of the highest and lowest measured values in the surrounding area of the pin. The rest of the measured values is computed as average.

Height measurement against the virtual reference plane

The height of the pins can be measured against the virtual reference plane defined by four points. These points must be at the same plane. Four points are used to minimize the error and improve the repeatability of surface definition.

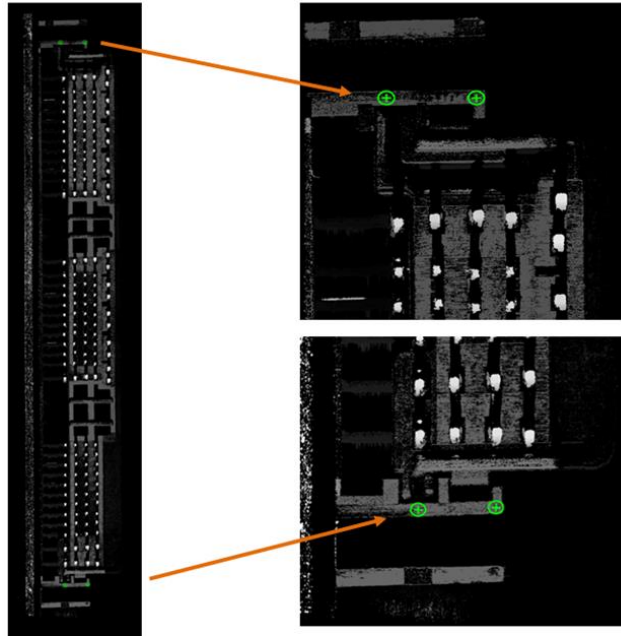


Figure 7 Scanned pins with defined points, applied for the virtual reference plane. The 3D data presents a 2D grayscale image. The lighter the shade of gray, the higher the point of reference area.

Advantages of Height measurement against the virtual reference plane

- Very effective for areas that are not sufficiently flat.
- Suitable for non-existing reference plane, due to occlusion or physical design of the product.



This inspection can only be utilized, provided that the 4-points on the product's surfaces are pre-defined to create the reference plane. In such cases, it can be challenging or may not be feasible for other production. Most esp. when the reference point does not fit in the camera's FOV).

3.3.2 Pin -hole fill inspection

This type of inspection detects the pins inside the conductive ring (Press-fit specific). This method is very effective, but it can only be used if the pins are visible to the camera system. In addition, it can also be useful if the pins are not extending beyond the board surface.



Figure 8 The Pins' tips should be visible through the conductive rings, to ensure proper pin detection during inspection. The pin tips should not extend too much beyond the board surface.



The conductive ring has to be visible on the scan, see example on [Figure 8](#) on page [21](#). The Algorithm inspects the visibility of the pins inside the conductive ring. You should not place the pin further inside the hole, because it will create *shadow occlusion, thus the pins will not be visible.

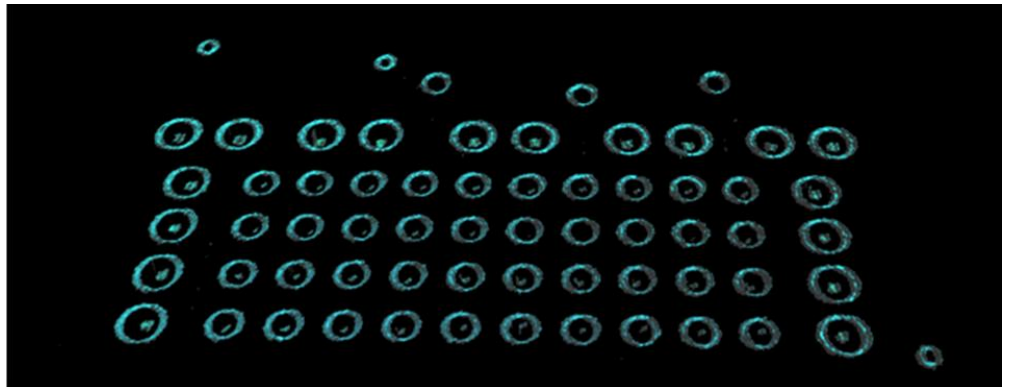


Figure 9 3D scanned pins in the conductive rings before press-fit.

Please refer to Factors of shadow occlusion on [Section 9.4](#) as of [page 122](#) for further details about shadow occlusion and how to prevent it.

3.4 Principles of communication between the control system and Pinspector

A brief description of the inspection process and exchange of commands:

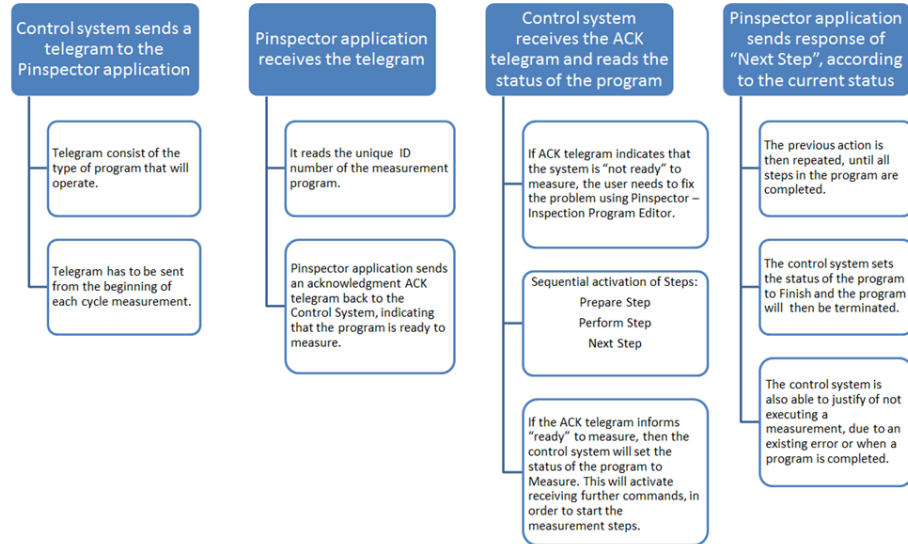


Figure 10 Principle of communication between the control system & Pinspector



- The Prepare step (the first command) has to be set up after the ACK telegram is received.
- A cycle of all three commands must take place at least once for every Pinspector program; Prepare step, Perform step and Next step.
- In the program, the Step: Log result will only require the use of Perform step command. While the Scan evaluation, Send telegram and Setup outputs always require the three commands; Prepare step, Perform step, and Finalize step.



You may find the detailed explanation in Pinspector communication [Section 14.2](#) as of [page 140](#).

4 Managing logins

Overview:

This Chapter will guide you on how to manage the:

- Default settings
- Login
- Changing the username & password

The following sections in the system are protected by a user login and password:

- Inspection program database tab
- Settings tab
- Administrator console



For detailed information about the Administration console, you can refer to [Section 9.2](#) as of [page 129](#). You find the Settings tab on [Section 5.2.3](#) of [page 41](#) and for Inspection program database tab of [Section 5.2.4](#) on [page 49](#).

4.1 Default settings

- User name: admin
- Password: admin



When changing your user name & password, please familiarize yourself with changing the user name & pass word on [Section 4.3](#) on [page 25](#).

4.2 Login

When you log in, please proceed as follows:

- Once you've activated the Inspection program database tab or Settings tab.
- The login dialog box will appear
- Enter your user name & password

The default settings are:

- User name: admin
 - Password: admin
- Afterwards, you may click the Login button on the login dialog box.

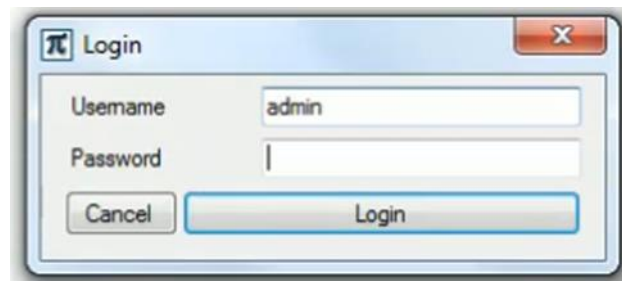


Figure 11 Login dialog box



When you are login for the first-time, a default setting will be provided for you.

4.3 Changing the user name and password

When changing your login information:

- You must activate the setting tab and Click the Change login button.
- Login using your old login username and password.
- Then, fill-in your new login username and password.
- Once you've managed your new login information, click the save button to save it.

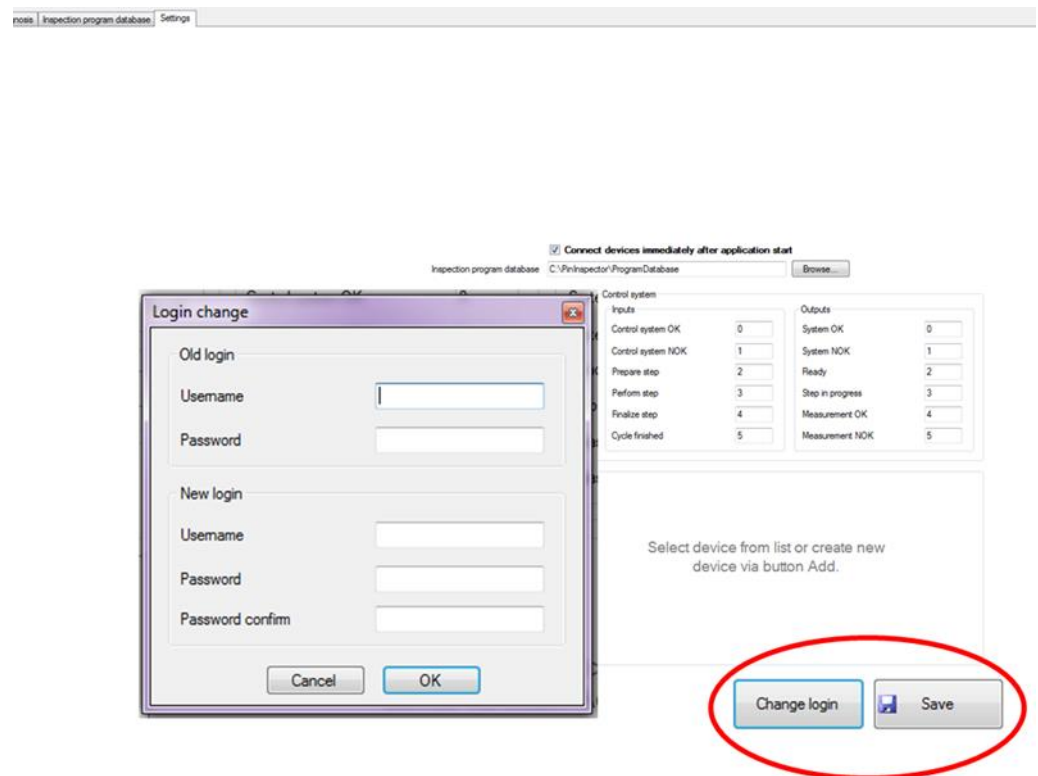


Figure 12 Login change dialog box



Please make sure that you have the original login information at hand, before changing your user login.



Keep your login password safe! There is only one current password in the system. Once your old password is lost or changed, then there are no possibilities to retrieve it.

5 Software settings

Overview:

In this Chapter, we will provide the information on how to:

- Understand the content of the Pinspector program
- Familiarize yourself with the User interface
- Operate each user interface tab

When running the Pinspector application for the first time, you must set up the software communications first within all the devices. It must be prepared before any initiation of inspections. All initial settings must be set up in the Settings tab.



Please refer to [Section 5.2.3](#) on [page 41](#) for the detailed description of the Setting tab's context and function.

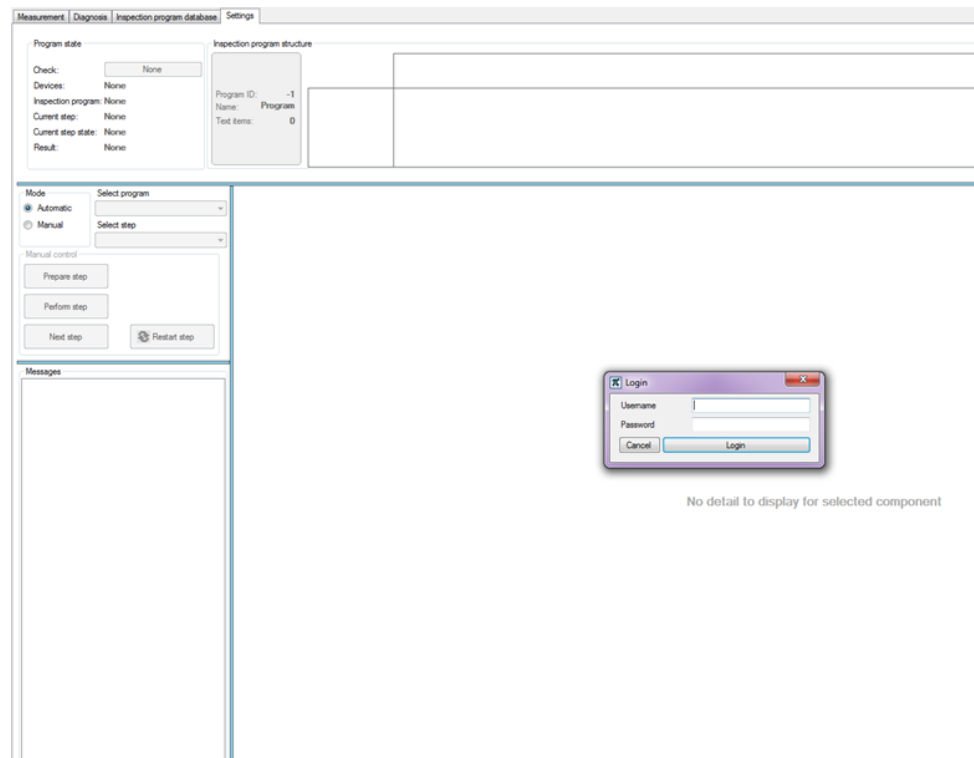


Figure 13 User interface

5.1 Pinspector program menu

You will find the program menu located on the upper right corner (for better space utilization), including the following items:

- File
- View
- Help

5.1.1 File

The File menu contains:

- Language –language input for GUI application (Pinspector supports English and Czech languages).
- Logout – logs out the operating entity.
- Exit –stops all devices and terminates the Pinspector application, whenever necessary.

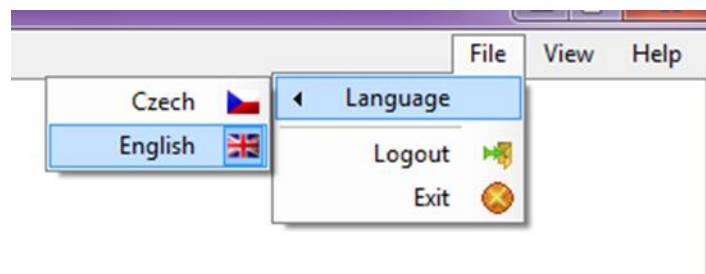


Figure 14 program menu's content window

5 SOFTWARE SETTINGS

5.1.2 View

- Full screen mode –Once you launch the application, the screen mode will always be maximized to full screen, as a default setting. You can click the drop-down button to switch the application screen from normal mode to full screen (vice versa).

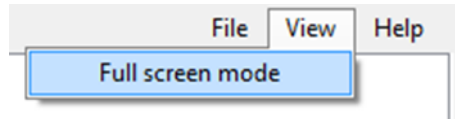


Figure 15 content menu

5.1.3 Help

- Documentation – The program supports English language input for PDF documentation.



Figure 16 Documentation content

- Administrator console – You can find the messages of the system components and detailed state inspection of measurement procedures in this window. Used for control analysis, simulation, and inspection of any existing errors in the system. The Administration console is extremely useful for you during system diagnostic.



You can find the detailed description for the Administration console on [Section 10.2](#) as of [page 126](#).

5.2 User interface for the Pinspector system

The Pinspector system graphical user interface is composed of four tabs. You can switch between these tabs, allowing you to navigate the different software functions:

- Measurement tab
- Diagnosis tab
- Settings tab
- Inspection program database tab



Please be informed that the Inspection program database tab and Settings tab are login sensitive. Only skilled engineers/ technicians can have access to these section.

5 SOFTWARE SETTINGS

5.2.1 Measurement tab

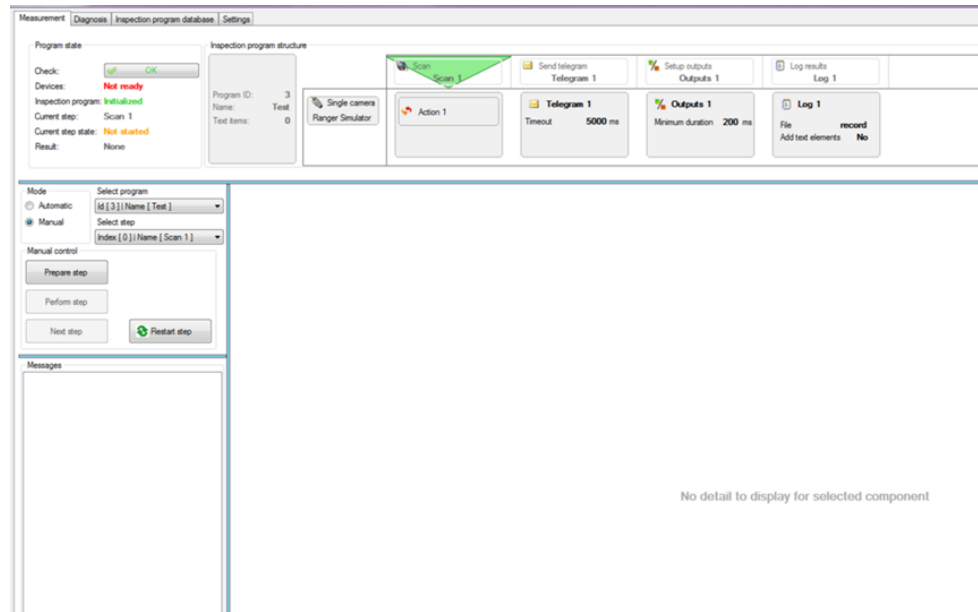


Figure 17 Measurement tab

The Measurement tab provides you a straightforward display of the inspection process either in Automatic or Manual measurement mode.



If you've selected the Automatic measurement mode, you may find that the entire section will be inactive. The measurement will start, once the Pinspector application receives the appropriate command from the control system. This command is sent via communication interface.



You may notice that the duration of each measurement depends on the size/ length of the inspected area. Including the velocity of the camera movement over the inspected area (i.e. presence of existing error, number of Inspection pins, et al.).

Measurement status

This section will show you the information of the current measurement status program.

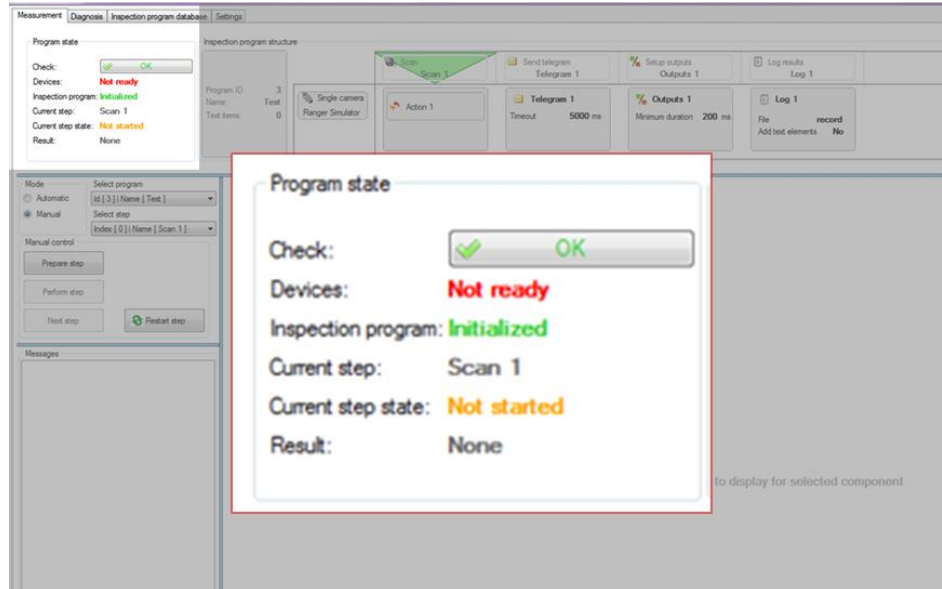


Figure 18 Program status box

- Click the „Check“ button.
- The “Result of program syntax check” will show. It will allow you to view the condition of the measurement, and assist you with warning remarks for any occurring error or defects.

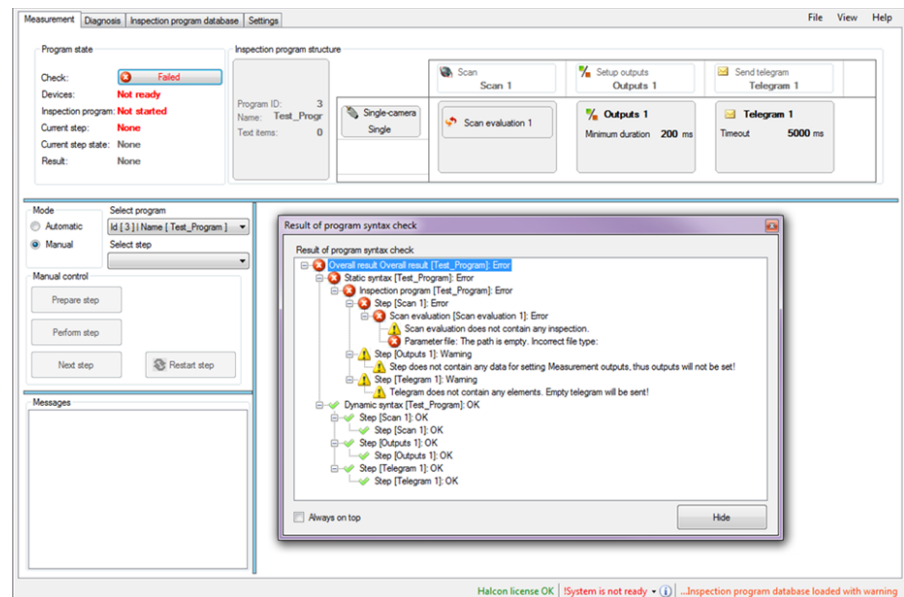


Figure 19 Program syntax check results



The Program state will indicate the following colored text status:

- **Red** – Indicates that there is a serious problem that needs to be addressed. Otherwise, the measurement will not be able to perform.
- **Green OK** - System is ready for measurement
- **Orange** – Indicates a forewarning that the program has an occurring problem. You can still perform the measurement even when the orange precaution is on. The error can be controlled when you click the button of the dialogue box, Results of the program syntax check.

Program structure

Displays the steps of the currently selected inspection program, highlighted by a green-triangle.

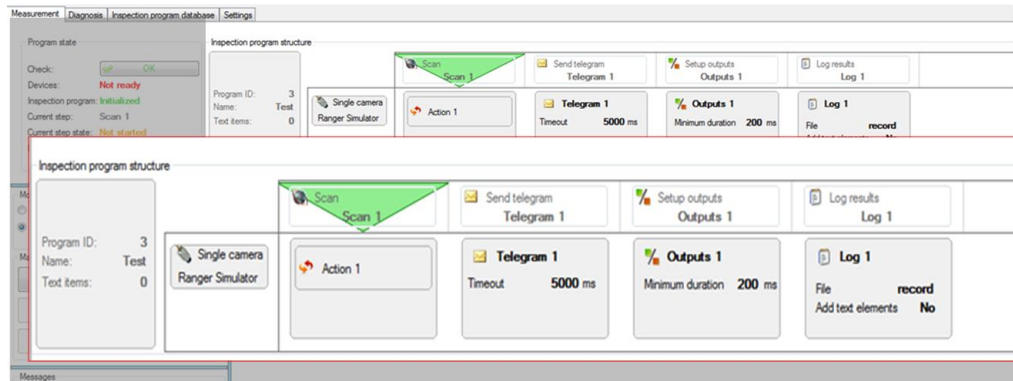


Figure 20 Program structure



- The program structure of the Measurement tab is similar to the set-up of the Inspection program Editor. The only difference with the Measurement tab's program structure is that the operating entity will not be able to choose or change the "Cameras" option. You can refer to the Inspection program editor on [Chapter 6](#) on [page 55](#) for further details.
- All components will successively display, if there will be no detected errors during the inspection (granted that all pins are detected and are within tolerance).



- If an error is detected during the program run, the component of the occurring error will display. The error will remain visible until another occurring error component will replace it.

Messages

Every program component notifies its status through a sequence of displayed real-time communication messages found in the message window. In this section, you can easily determine how the component was prepared, you can also track and resolve any occurring errors throughout its task. You can view each selected program step in the Messages box.

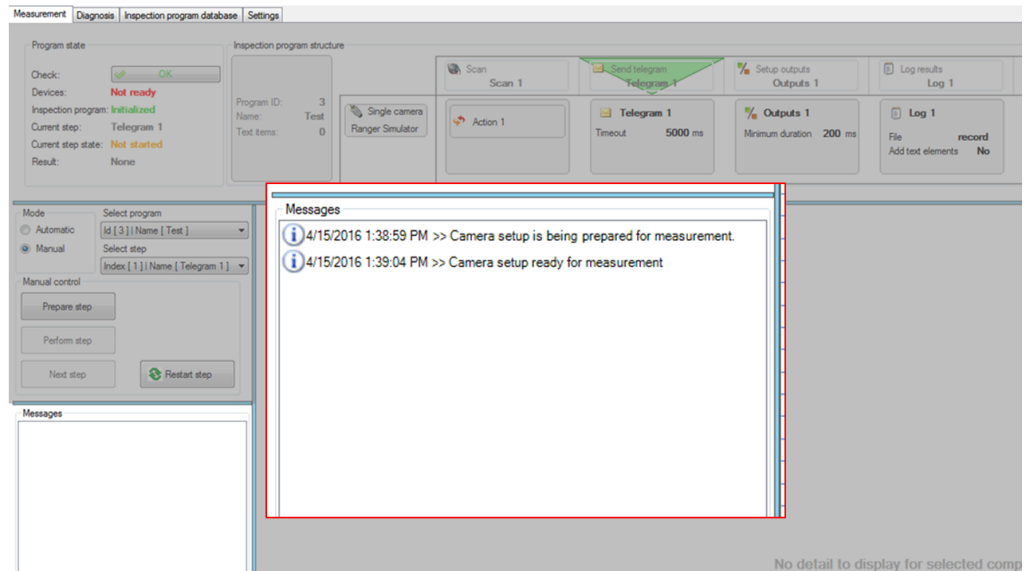


Figure 21 Message box

Detail

When the Scan evaluation is activated, the Detail window will distinctly show you the inspection result or the method definition. In the Detail section you can view whether the inspection has been executed or not, see [Figure 22](#) on [page 34](#).

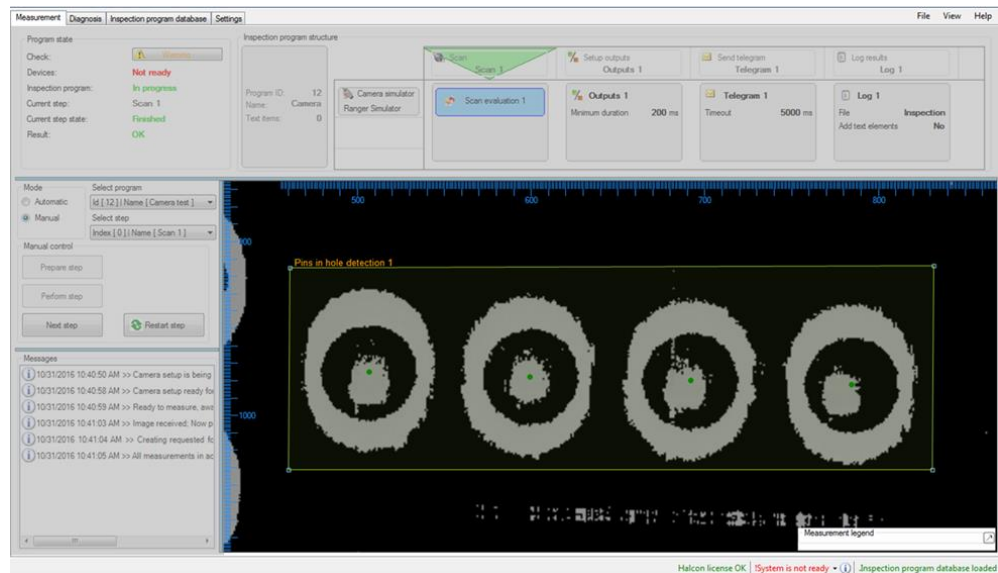


Figure 22 Detail box



You will notice that the Details section for the other components will remain blank. The Scan evaluation is the only program element component that can activate the Detail section.

Measurement control



When you've select the Manual measurement mode, then all signals from the control system will be automatically ignored!

When measuring in Manual mode, the system will notify its status, in the same manner as the Automatic measurement mode.

The Manual mode is meant for demonstration & testing purpose ONLY. In the production environment, the system always runs in Automatic mode.

Control elements for Manual measurement mode

- Selected program – enables you to select the program from the database, utilized for the inspection. The selection will not be influenced, unless the device is running.
- Selected step – allows you to select the step to run the program step (the Program structure will be highlighted with a green-triangle).
- Buttons – The activation of button will let you run your selected program. The sample shown on [Figure 23](#) demonstrates manual mode activation.

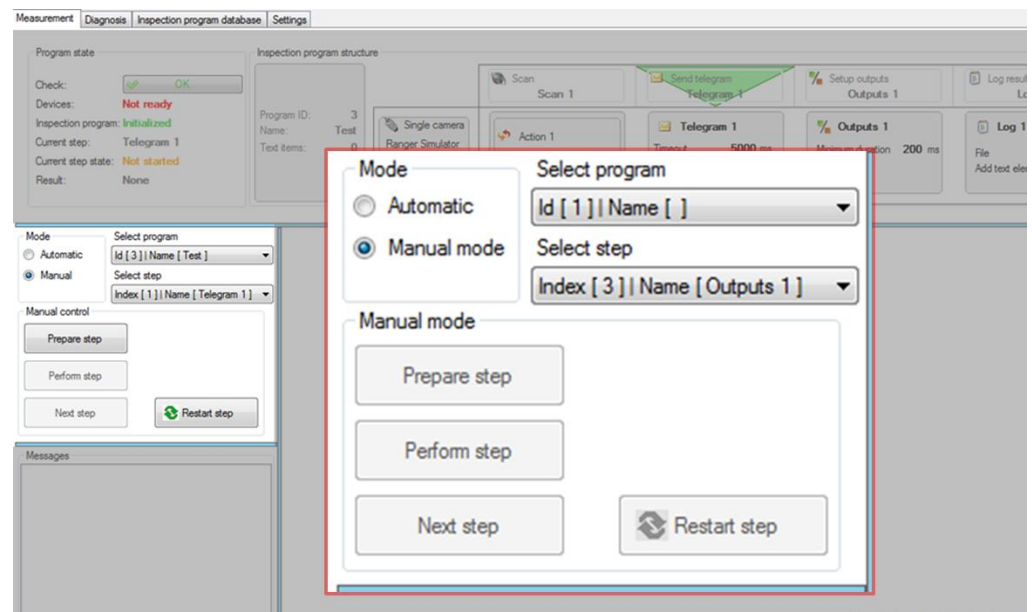


Figure 23 Measurement control section

5 SOFTWARE SETTINGS

5.2.2 Diagnosis tab

The Diagnosis tab allows you to view the status of the inspection; whether the inspection is operational or when an existing error is present.

You can only start the measurement in the Automatic mode, when all labels in the Diagnosis Tab are highlighted in **Green OK**, as well as **Orange** highlights. The Manual mode requires only one running camera.

RS-232

RS-232 displays the serial connection, communication between the Pinspector and the Control system.

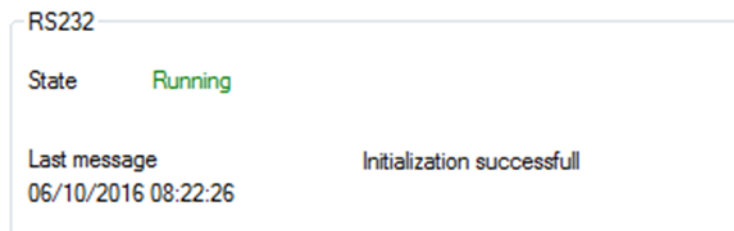


Figure 24 RS-232

IO module

The IO module displays the system Input/Output status.

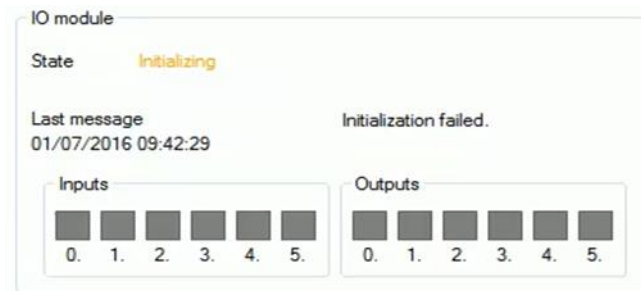


Figure 25 IO module



Colored text status:

GREEN – Enable

RED – Disable



You can refer to [Section 14.4](#) on [page 143](#). You will find that each Input and Output numeric codes have a significant meaning.

Control system – PC communication

Shows the state of the Control system and PC communication.

Control system --> PC		PC --> Control system	
Control system state	Unknown	System state	NOK
Requested step state	Unknown	Current step state	None
Requested program state	Unknown	Measurement state	None

Figure 26 Control system – PC communication

Cameras

The Cameras section displays the available cameras used for the application inspection.

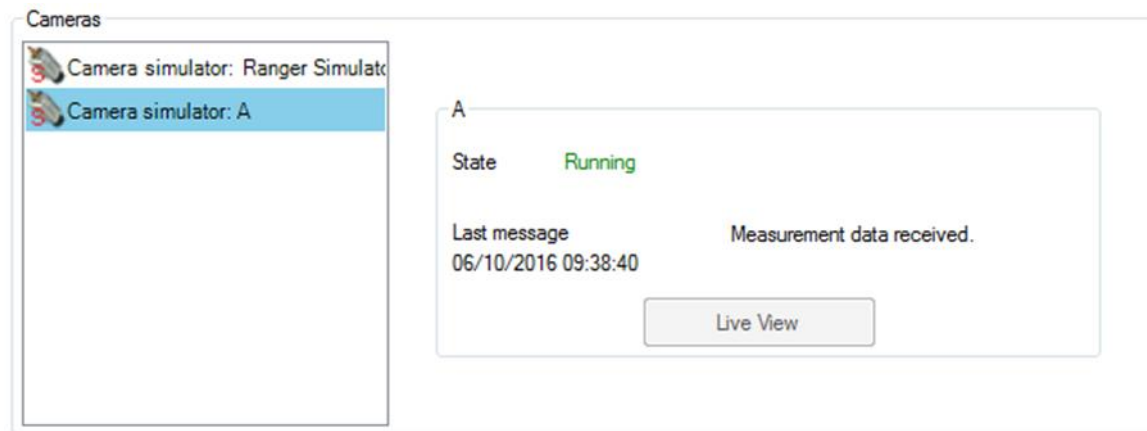


Figure 27 Live view



The system recognizes three different types of Cameras. You will notice that each Camera type is appointed with a red colored text:

S - Camera simulator: Ranger Simulator

M - Double-camera

Single-camera



You can learn more about the Camera variants on [Chapter 9](#) as per [page 119](#)

I. Live Image

The Live image window displays the current 2D image from the selected camera. You can enlarge and navigate the image using the mouse. The horizontal dashed line defines the area that represents the source for 3D imaging during inspection.

- You can click the camera from the Cameras section, found in the Diagnosis tab.
- Then click the Live view button.
- Afterwards, the Live view image window will appear.

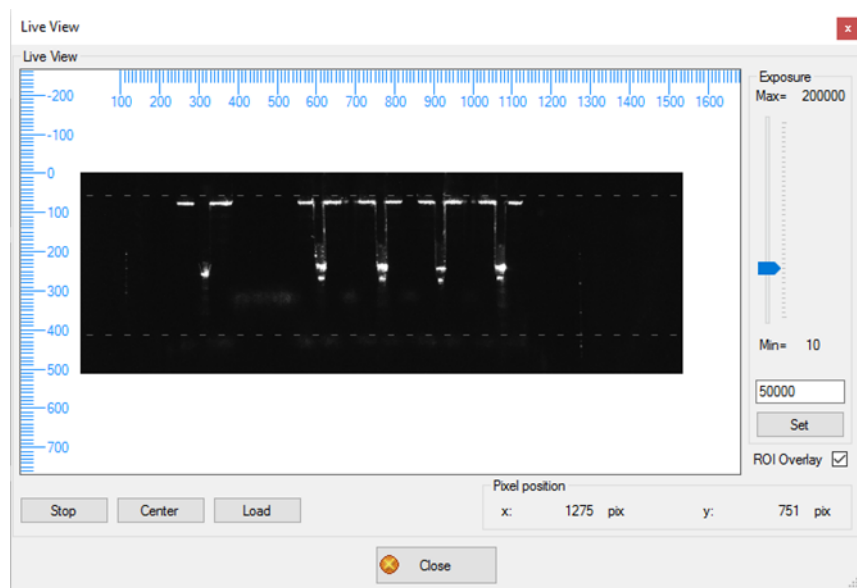


Figure 28 Live images window

Live image window options

- Start / stop – starts or stops the live image stream from the Camera.
- Center – aligns the image towards the center.
- Load – loads the parameterization file to the camera. After loading the file, the dashed lines will define the area representing the source for 3D imaging during inspection.
- Mouse position in pixels – current position of the mouse pointer in the image.
- Close – closes the live image window, and automatically returns the system to measurement mode (default mode).



If you do not see any dashed lines displayed, then you should load the appropriate Camera Parameter File. See [page 70](#)

5 SOFTWARE SETTINGS



The PC firewall can prevent successful connection of the Ranger camera.



Make sure that all defined pin or connector pin part must maintain in place within the dashed lines. The system will not be able to detect all pin tops position extending out of the upper/ lower dashed line!



If the dashed lines are still not visible, please contact your Pinspector integrator to resolve the problem.

5.2.3 Settings tab

The Setting tab allows you to set up the communication, as well as find, remove or add new cameras. The software communications within all the devices must be set up before any initiation of inspection.

- Click on the Settings tab, located on the main window of the Pinspector application.
- You will need your login information to activate the Settings tab.
- Once you've logged in, you will have access to manage the Settings tab elements.



The following subsections will further explain the contents of the Settings tab.

Program database

The inspection program database is a directory path, where the inspection programs are saved.

Connect devices after application starts

When you activate this option, it will establish the connection to all devices upon application launch. You can also deactivate the default mode by unticking the checkbox.

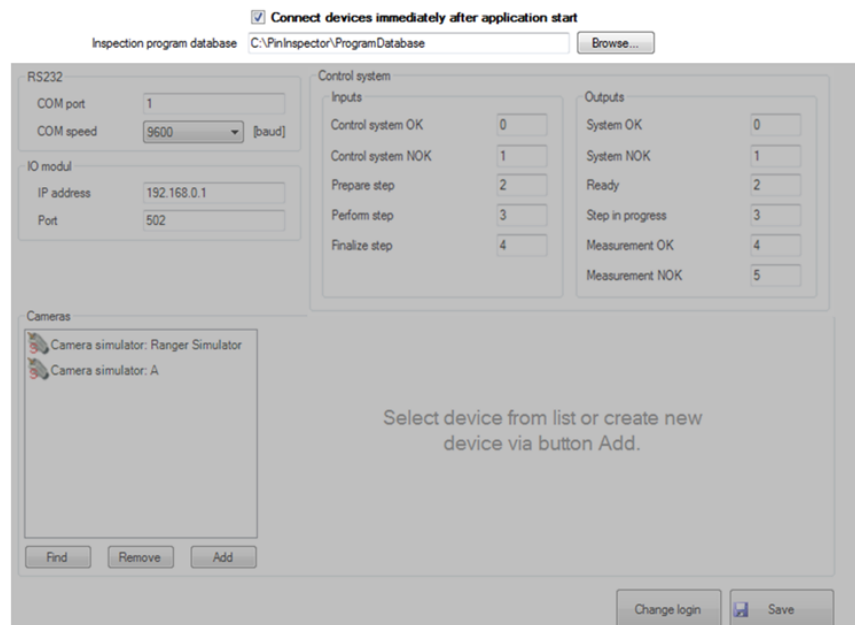


Figure 29 Program database

RS-232 settings for communication

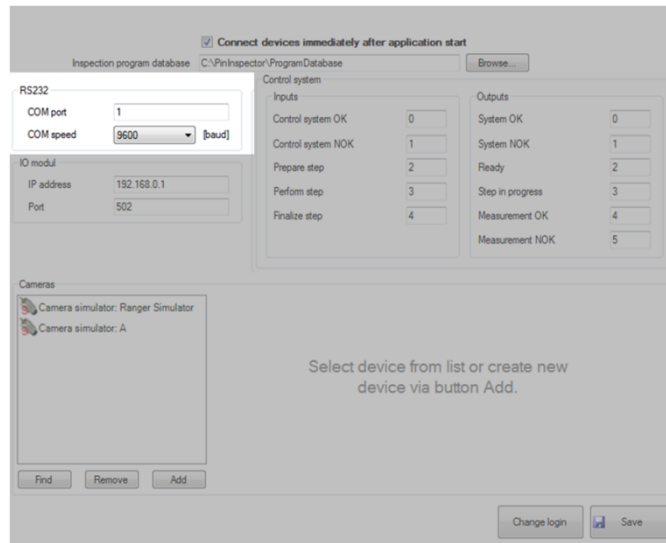


Figure 30 RS-232 dialog box

➤ **Com port - Communication port**

You will need to assign a channel for the communication port numbers to the Control system and the PLC. You can insert the required port number in the box.

➤ **Com speed - Communication speed**

You can select the required Communication speed from the corresponding dropdown list.

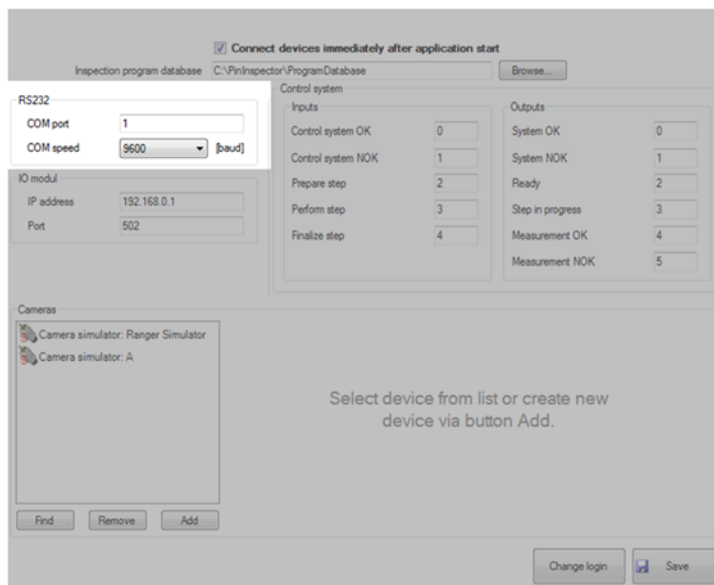


Figure 31 RS-232 dialog box

ADAM 6060

I. IO module

You can assign a series of numbers, from 0 to 4 for Input wires and from 0 to 5 for output wire as well. Output and Input wires must contain unique numbers.

- IP address – IP address of the IO module
- Port – port for the communication with the IO module (default setting is 502)

Figure 32 IO Module and control system dialog box

II. Control system

The control system contains the inputs and outputs of measurement results. Please see image on [Figure 32](#).

You can refer to [Table 3](#) on [page 142](#) for detailed information of IO functions and status codes.

Cameras

The Cameras section stores and provides the available cameras, which allows you to use the appropriate camera in the program. It also has the features to find, remove, or add the camera devices that will be utilized in the system.

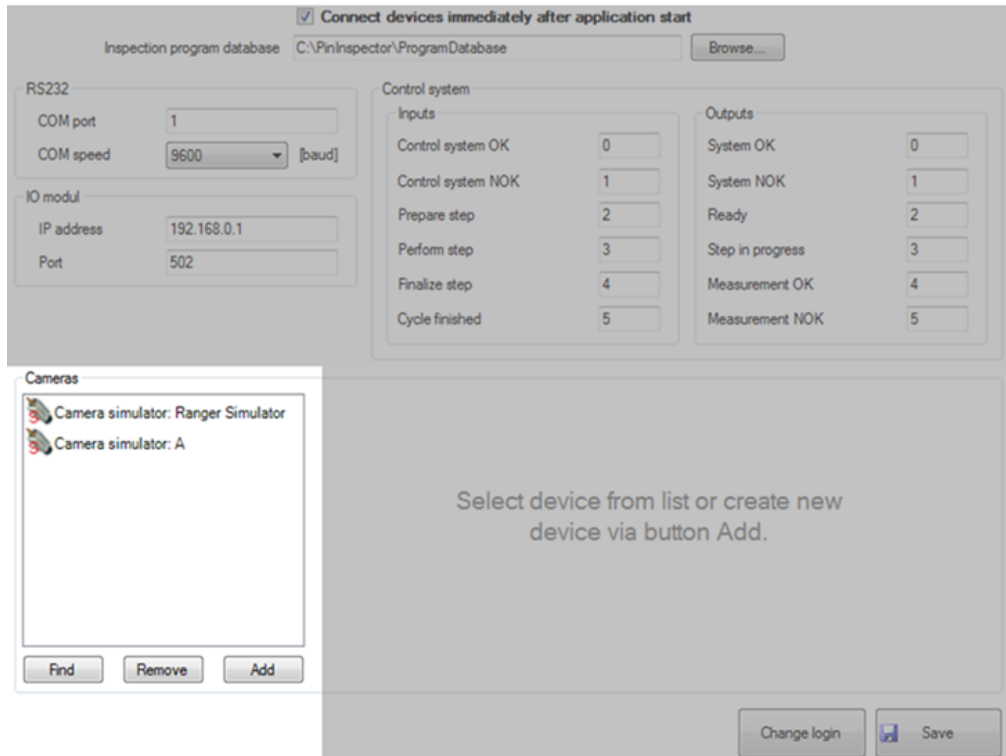


Figure 33 Cameras

I. Find

The Find button opens the menu for Ranger camera, where the application automatically searches for required camera available. You can follow this guideline when searching for camera devices:

- First, click the Find button on the Cameras section, to select the necessary camera to be utilized for the inspection.
- Then click the Ranger button and you will find the Camera Discovery dialog box appear.
- From the Camera Discovery dialog box, click the Find button, and the system will search for available cameras (it will take a few seconds to run).
- The available cameras in the system will then appear.
- You can select the required camera that you'll need for the inspection.
- Afterwards, click the Add Selected button.
- Finally, you can click the save button to save your new settings.

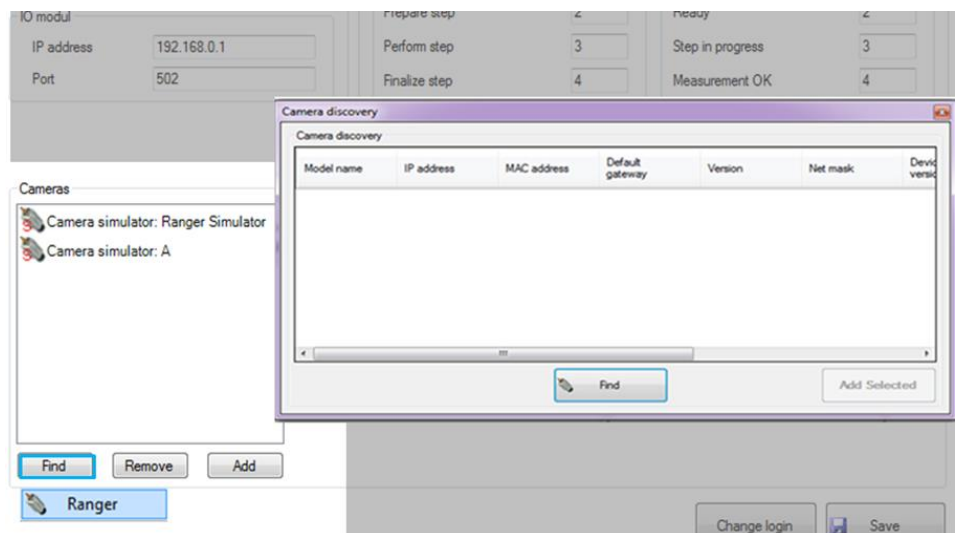


Figure 34 Finding a camera

II. Remove

Click the Remove button to delete the selected camera from the list.

- Click the Remove button.
- Afterwards, select the camera that needs to be deleted.
- Finally, click the Save button to save your new settings/option.

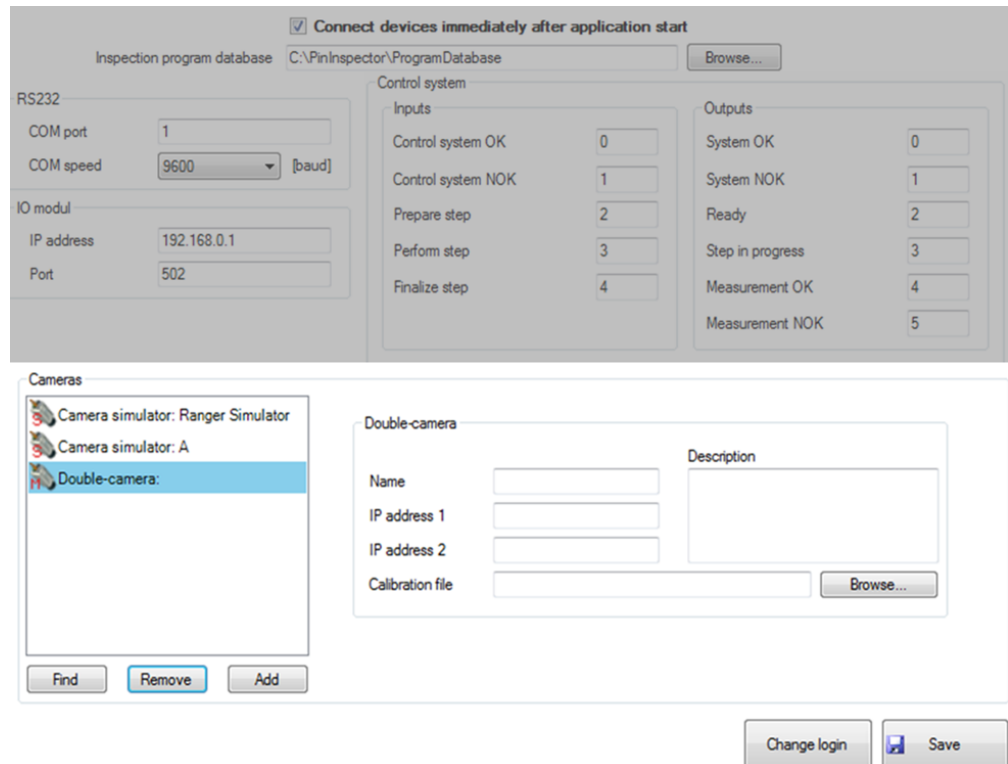


Figure 35 Removing a camera from the Scanning Devices

III. Add

You can Add the supplemental camera device into the Cameras section.

- One you click the Add button, the option menu will immediately appear.
- Click on the appropriate camera that you want to be added.
- You must fill in the needed data (name, IP address, description), to register the newly added Camera.
- When adding Double-camera*, you will need to provide two (2) unique IP address for each camera.
- Finally, you can click the Save button to save your new settings/option.

*Double-camera is composed of two individual cameras and each camera is positioned opposing each other. The geometry is designed for the Ranger cameras to act as a single camera in the system. The data from both cameras are then merged into one image. Therefore, you will need to provide two unique IP addresses and one calibration file for both cameras.

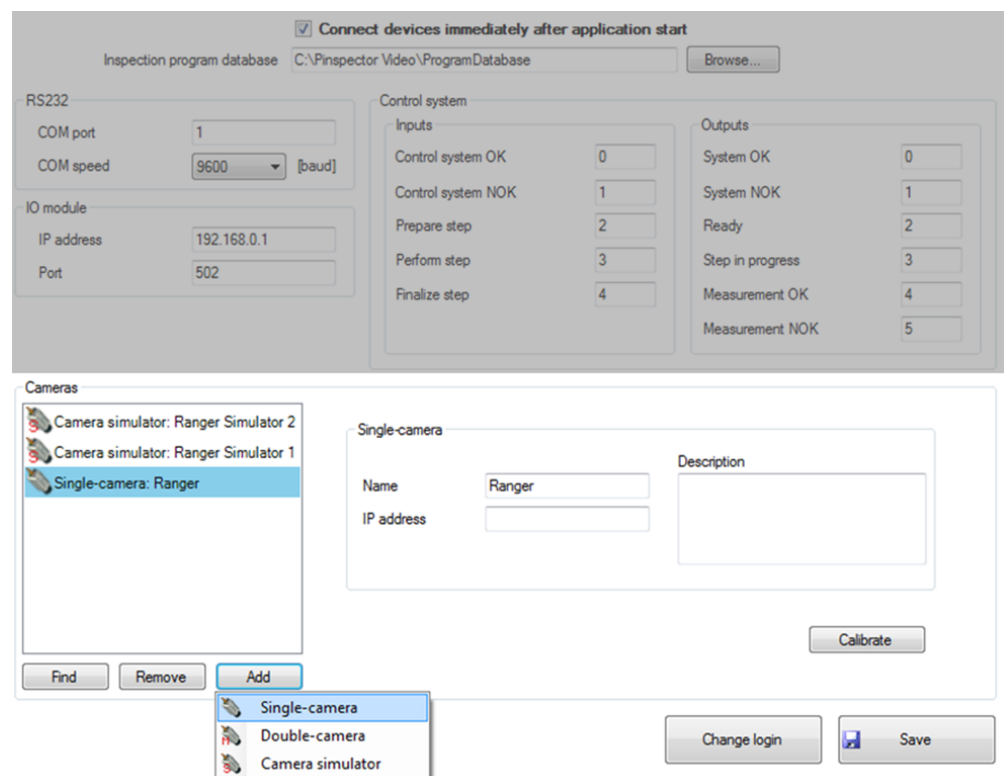


Figure 36 Adding a camera



- There are three Cameras recognized by the system. Only two types of Cameras are appointed with a red colored text:
 - **S** - Camera simulator
 - **M** - Double-camera (E2)
 - Single-camera (E1/D1)
- You can add any number of camera devices in the system.



Please refer to the SICK Ranger E/D Operation manual, for further information.

IP address

Each Camera is identified with a unique ID and IP address of the camera within the entire network.

- You must enter a unique name for the added camera.
- Type in the unique IP address for the camera.
- Or when you're adding a Double-camera, then you will need to provide two unique IP addresses for each camera.

The screenshot shows a software interface for configuring cameras. On the left, a list titled "Cameras" contains three entries: "Camera simulator: Ranger Simulator", "Camera simulator: A", and "Double-camera: Camera 1". Below this list are "Find", "Remove", and "Add" buttons. On the right, the "Double-camera" configuration form is displayed. It includes a "Name" field with "Camera 1" entered, two "IP address" fields (labeled "IP address 1" and "IP address 2"), and a "Calibration file" field with a "Browse..." button. A "Description" text area is also present. At the bottom right of the interface are "Change login" and "Save" buttons.

Figure 37 Camera's IP address

5.2.4 Inspection program database tab

When you activate the Inspection program database tab, a window will appear containing all existing inspection programs which were created earlier. Each inspection program has a unique ID. You can modify the inspection programs for different production outputs, either to:

- Refresh
- Add
- Edit
- Delete

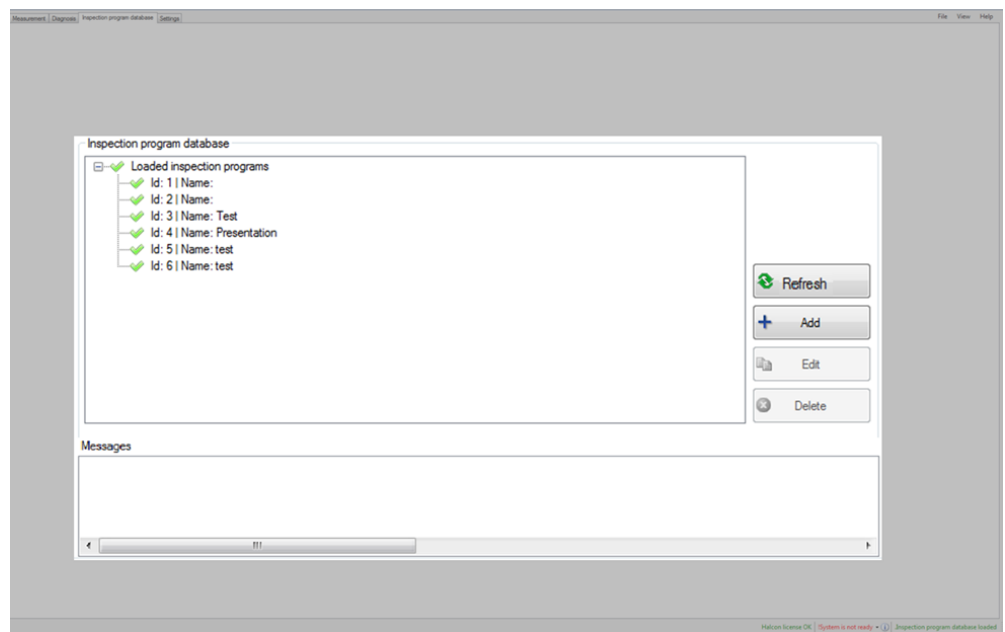


Figure 38 Inspection program database tab



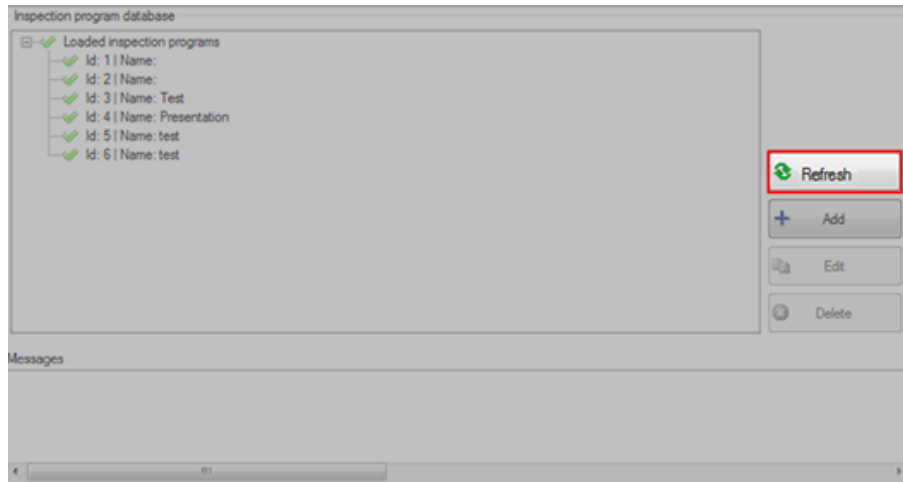
The Inspection program database is login password protected. When you activate the Add or Edit buttons, it will transfer you to the Pinspector – Inspection program editor to create or Edit an inspection. Please refer to [Chapter 6](#) as of [page 55](#) for further details.



This section is only relevant to you if you are logged in as an Administrator. An Administrator is someone who has the authority to access the Inspection program database tab.

Refresh

When you select this button, it will reload the entire database from the hard drive.



Add

- When adding a new inspection, click the Add button to activate the Inspection program editor, found in Once activated.
- It will enable you to create a new Inspection Program.

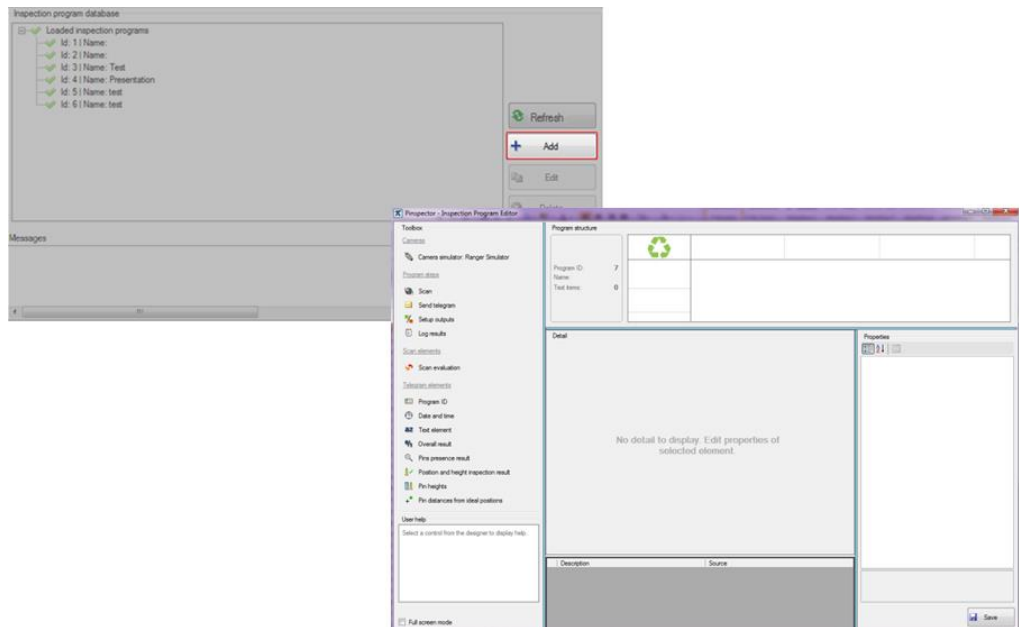
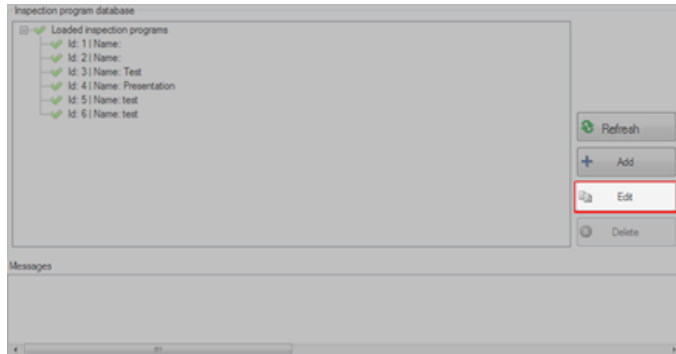


Figure 39 Pinspector –inspection program database

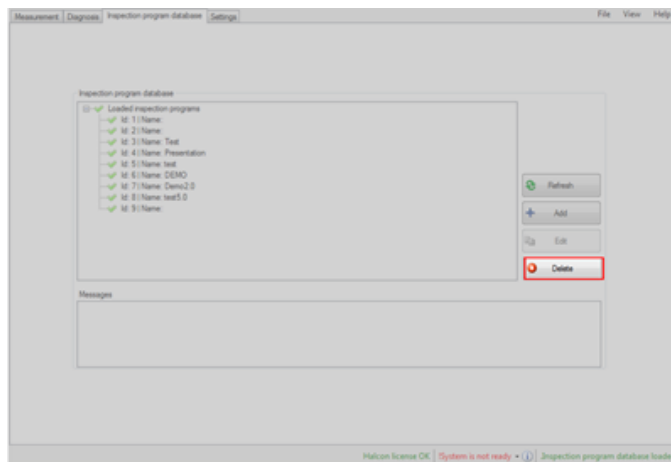
Edit

In order to make changes with one of the programs, you must select the inspection that needs editing, and then click the Edit button. Afterwards, it will give you access to the Inspection program editor window. Editing can be done within the Inspection program editor.



Delete

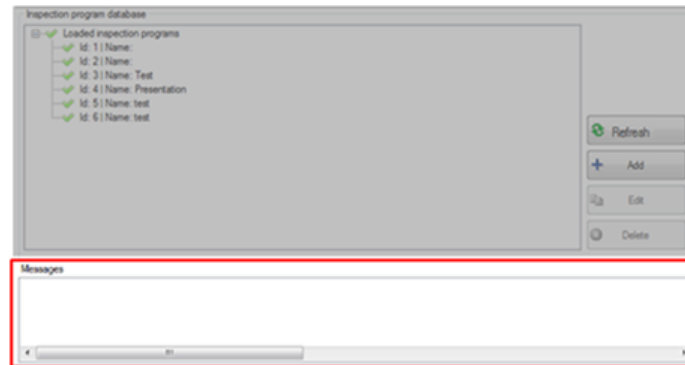
When you select this option, you will be able to delete the selected Inspection Program from the database. Just click the inspection that needs to be removed and click the Delete button.



5 SOFTWARE SETTINGS

Messages

The Messages displays the information regarding the program status. It will inform you of any occurring error or inaccuracy, and it can also assist you on how to resolve the problem



All programs are saved in the Program database directory folder. You can set it up in the Settings tab through the Inspection program database.



Authorized specialists are the only persons that should carry-out the installation, repair, and troubleshoot the Pinspector system.

5.2.5 Application status bar

You will find the status bar directly at the bottom part of the application window. It utilizes color highlights to indicate the current status of the system.

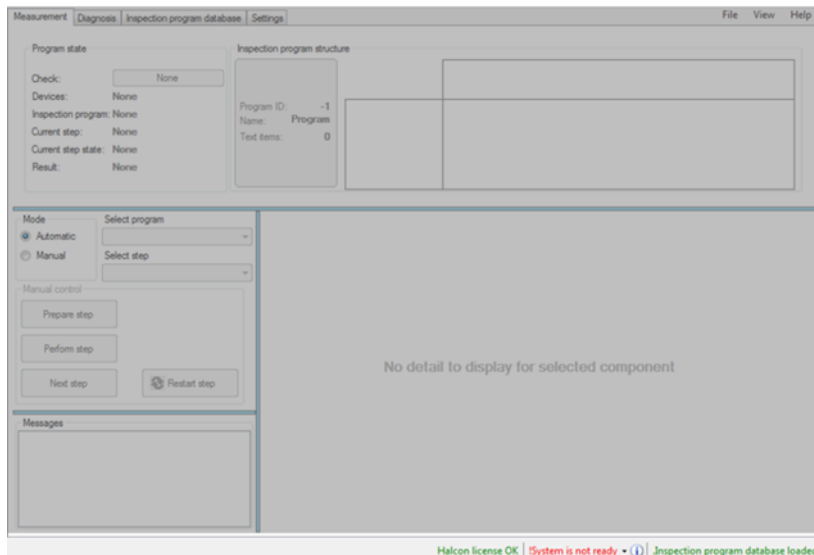


Figure 40 Application status bar

Halcon license

The Halcon license informs the status of the Halcon imaging library license, granting access into the imaging library, utilized by the Pinspector application.

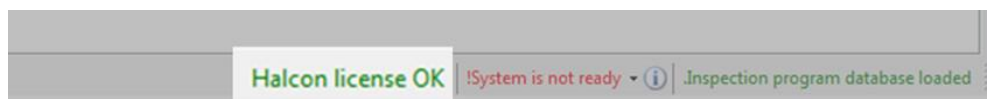


Figure 41 Halcon button

The license consists of two parts:

- License file – located in the license directory of the Halcon runtime library, that can be installed in the computer (file name license*.dat)
- Hardware key (USB-dongle) – USB key, needs to be inserted into one of the USB ports of the computer, while the Pinspector application is running.



Without a properly installed USB-dongle drive, the license will not perform.

Status of the Pinspector system

By clicking this bar, it allows you to start up or stop all running devices. It will also display the list of over-all requirements, monitored by the system status check.

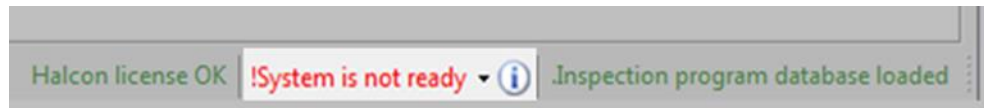


Figure 42 Pinspector system status

Program database

When you activate this bar, it will display the loading status of the program database.

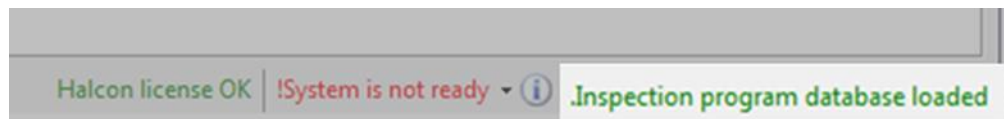


Figure 43 Application status bar

6 Inspection Program Editor

Overview:

This Chapter will guide you with the following information:

User interface content and definition of Inspection Program Editor

- Program steps definition and function.
- Functions of Details and Properties.
- How to create, load, or scan an image.
- How to create the inspection area.



You must login from the Inspection program database first, in order to access the Pinspector - Inspection program editor. See [Section 5.2.4](#) as of [page 49](#).

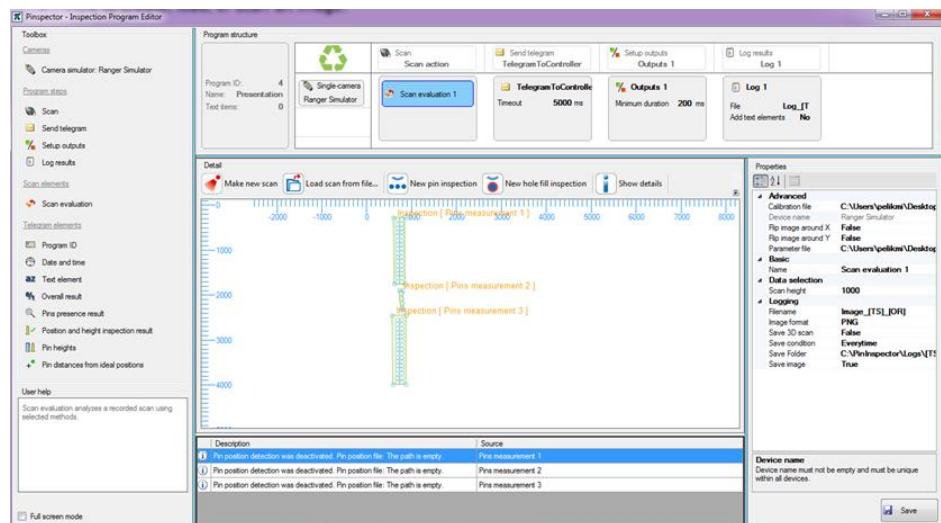


Figure 44 Inspection program editor interface

6 INSPECTION PROGRAM EDITOR

6.1 Toolbox

The Toolbox contains a list of available components to create an inspection using the Inspection program editor.

- You can set the required components into the Program structure, using the drag & drop method.

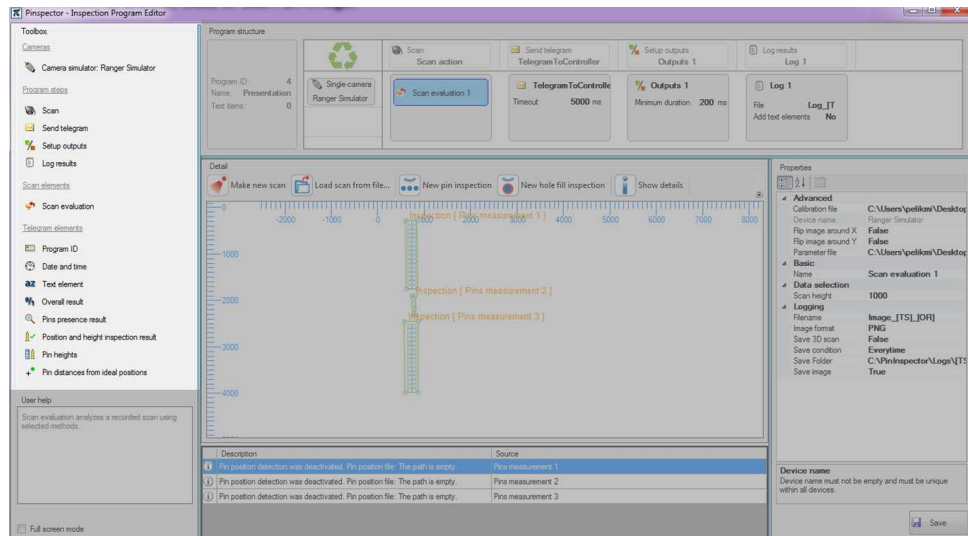


Figure 45 Toolbox

6.1.1 Program steps

The Program steps contain a series of steps, which are placed into the Program structure. You can find the Program step in the Toolbox section.

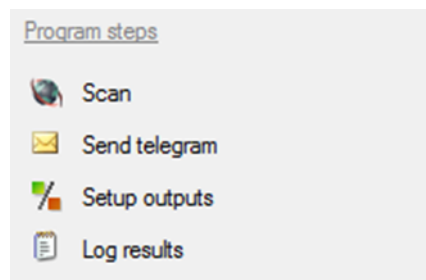


Figure 46 Program steps

6.1.2 Scan evaluation

Scan evaluation is the only scan action that you can place in the Scan step of the Program structure. It is mandatorily used when a Camera is applied in the Inspection program editor.

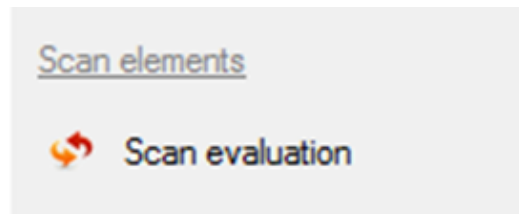


Figure 47 Scan evaluation

6.1.3 Telegram elements

Telegram elements contain the supplementary information, when composing the telegram results. You can add these elements into the Detail section of the Telegram definition.

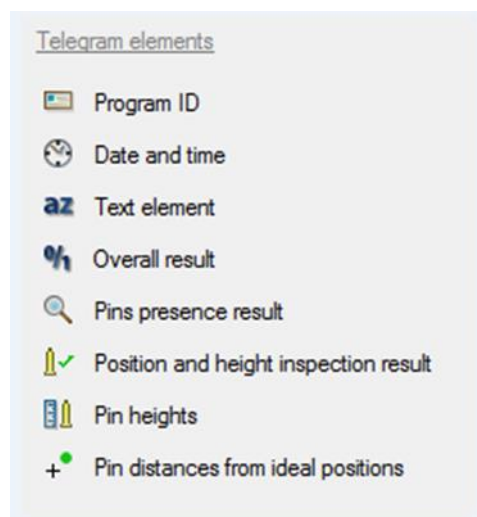


Figure 48 Telegram elements

6 INSPECTION PROGRAM EDITOR

6.1.4 Cameras

The Cameras section, displays the list of devices that have already been configured. You can add these cameras into the Program structure.

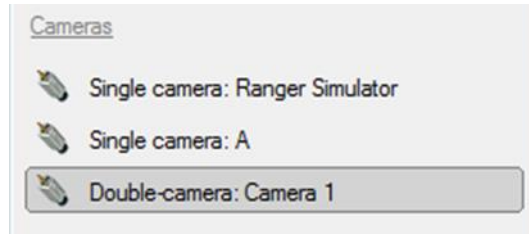


Figure 49 Toolbox – Cameras

6.2 Program structure

You can create or design the Inspection program structure by inserting the components from the Toolbox into the Program structure. The Program structure also displays the currently selected Program header, Cameras, and Program steps.

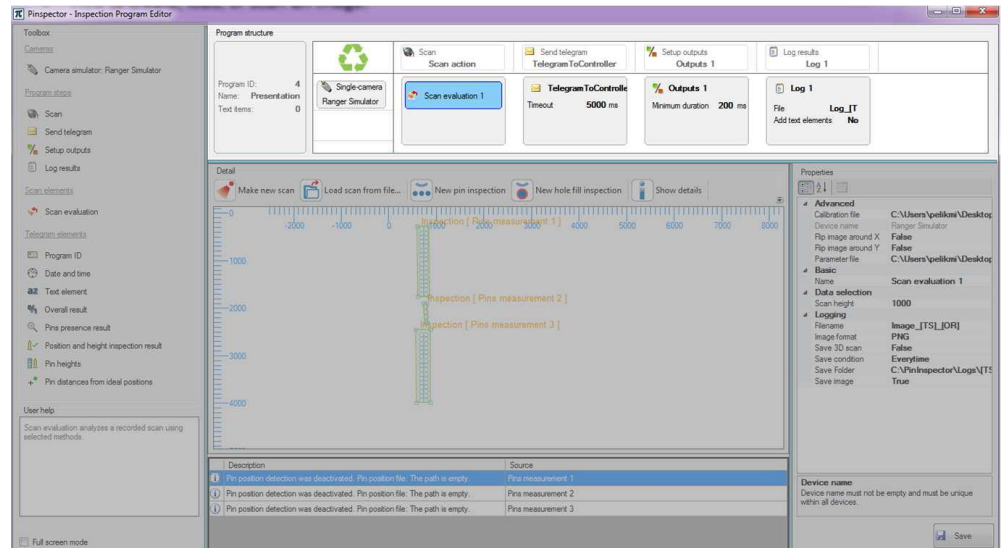


Figure 50 Inspection program editor – Program structure

6.2.1 Program header

Program header displays the program ID, name, and number of text items. The text items are received from the Program telegram.

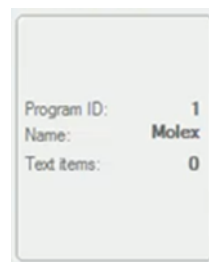


Figure 51 Program header

- Program ID – ID number of the program. The number has to be unique in the database within the programs. The control system recognizes the Program ID and determines which program will be used for the inspection.
- Program name – Name of the program. The name must be defined and unique between all programs. There is no restriction with the use of variable names for the program name.
- Text items – The program telegram must receive the number of text elements from the control system before the cycle starts. This information (E.g. serial number of inspected item) is used for login purposes.

6 INSPECTION PROGRAM EDITOR

6.2.2 Recycle bin

In this section, you can select and delete the component steps that are non-essential for the measurement. You can drag & drop it from the Program structure and into the recycle bin. You can also delete it by simply pressing the Delete key on your keyboard.



Figure 52 Recycle bin

6.2.3 Cameras

The Cameras window is located underneath the Recycle bin window. You can choose from the selection of installed Cameras to be utilized for the Inspection program editor. You must select at least one camera in order to create an inspection, to ensure the proper performance of the program.

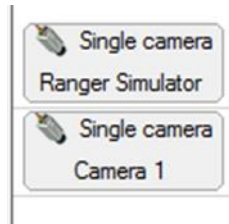


Figure 53 Scanning cameras

6.3 Properties

The Properties section contains a list of the component's settings. Each listed setting comprises specific parameters that can be efficiently edited.

- The Properties information will appear, whenever you select or click a component in the Program structure.
- It also gives you access to the Program Details and User help command information.

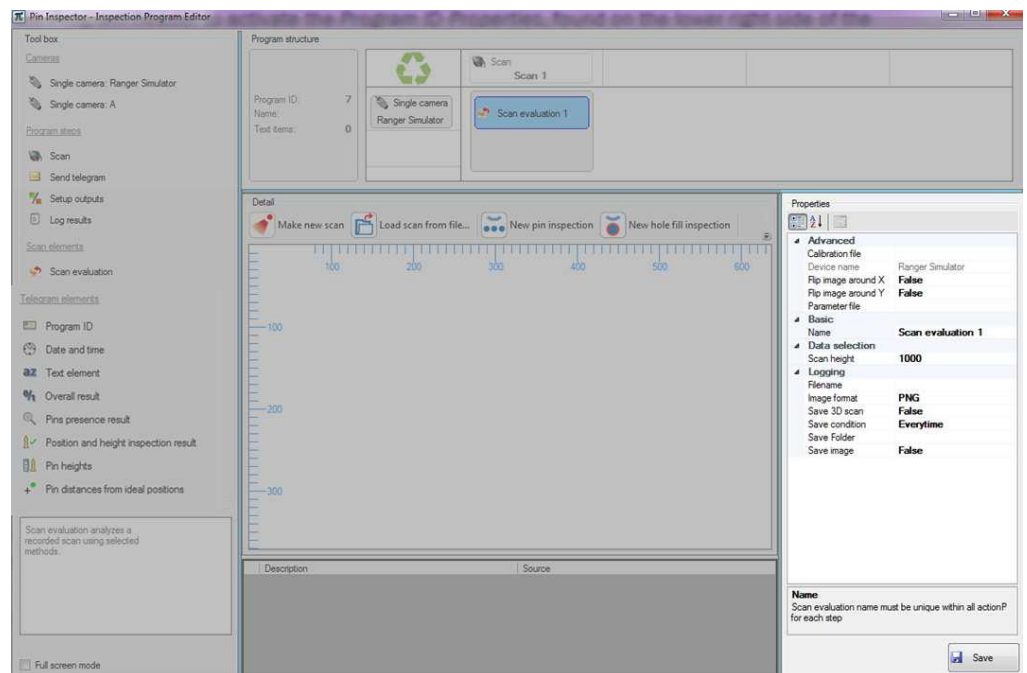


Figure 54 Properties

6.4 Detail

The Detail section contains the different types of Inspection approach, Template designer, pin details, and how to scan or load an image. This section also implements editable fields for graphical detailing. You can select these options from the Inspection program editor – Toolbox components.

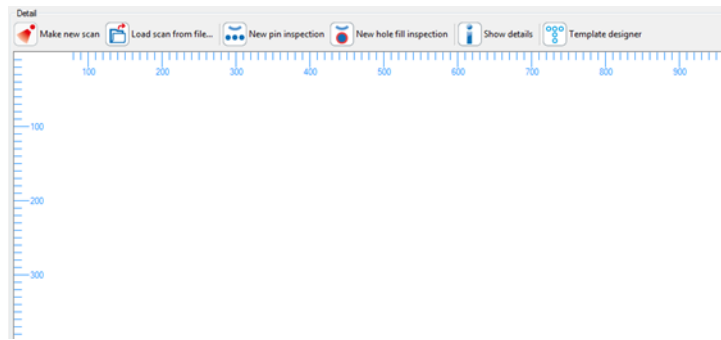


Figure 55 Detail



For each selected component in the Program structure, the Detail section will display the component's specified features. Only a few Program components can display their information on the Detail window.

6.5 User help

User help will provide you the assistance for each of the currently selected program component.

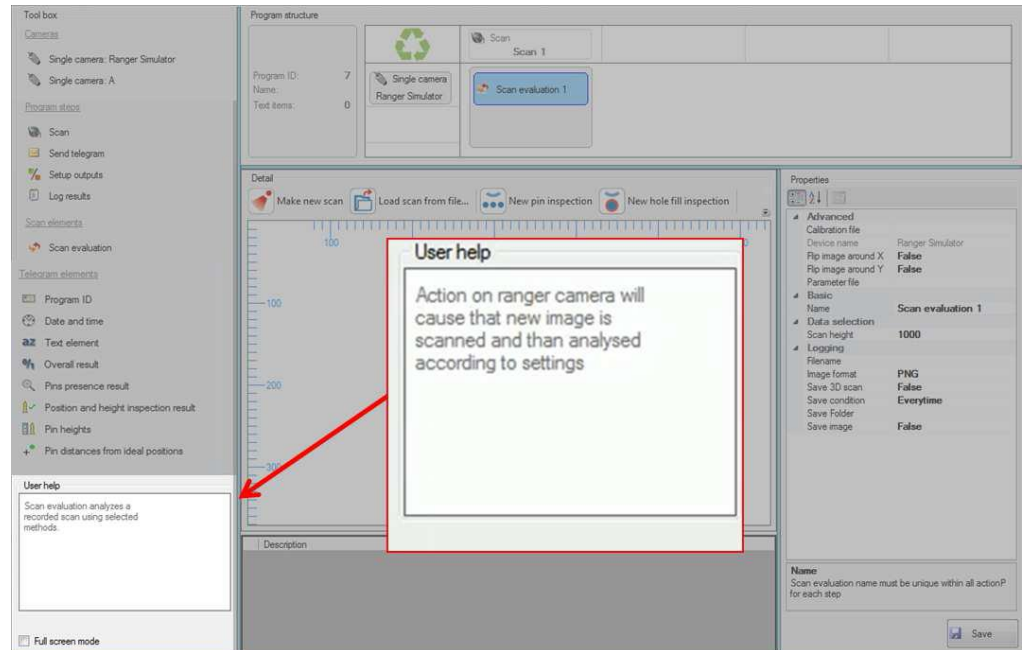





Figure 56 User help menu

6.6 Error list

This window displays the Inspection Program Editor's occurring errors, forewarning, and information. The program will not run, if one red message is present. But with the presence of yellow warning messages, the program can still be able run without any problem.

You can double-click on the error description result and it will guide you to which Scan evaluation the error belongs.

The Error list will show red, yellow, or info symbols:

-  - Error
-  - Warning
-  - Information




	Description	Source
	Pin position detection was deactivated. Pin position file: The path is empty.	Pinmeasurement 1
	Step does not contain any data for setting Measurement outputs, thus outputs will not be set!	Output 1
	Save folder: The path is empty.	Inspection 1

Figure 57 Description display



You cannot run the Inspection program if at least one red warning error is present in the description results. Although, the Inspection program can still function even when a yellow warning icon occurs.

6.7 Save button

You can click this button to Save the Inspection Program into the database. It is also possible to save the Inspection Program, even if it's not completed yet or if any error is present. You can Edit and finalize it later.

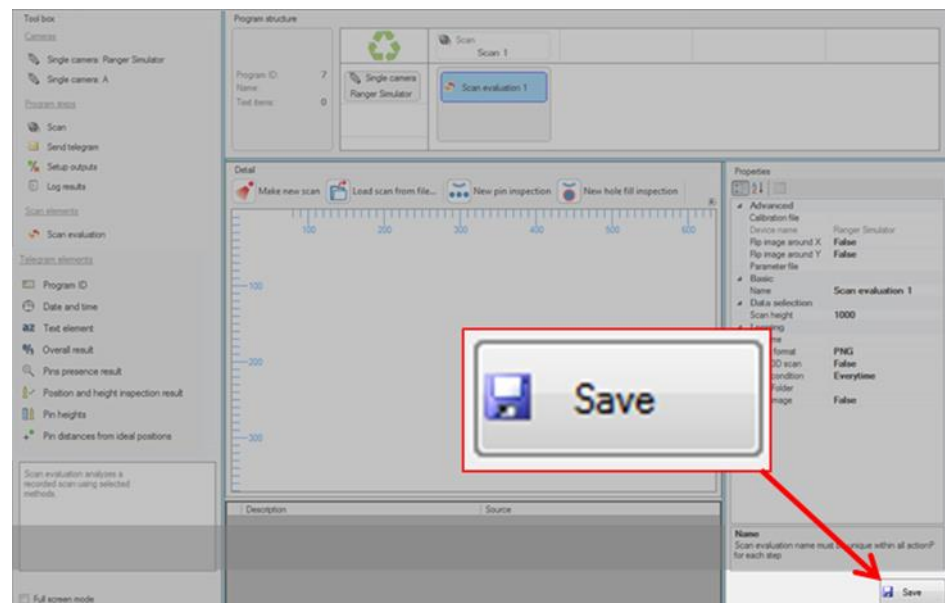


Figure 58 Save button



You cannot run the Inspection Program if at least one red warning error is present in the description results. See [Figure 57](#) on [page 63](#).

6.8 Program steps

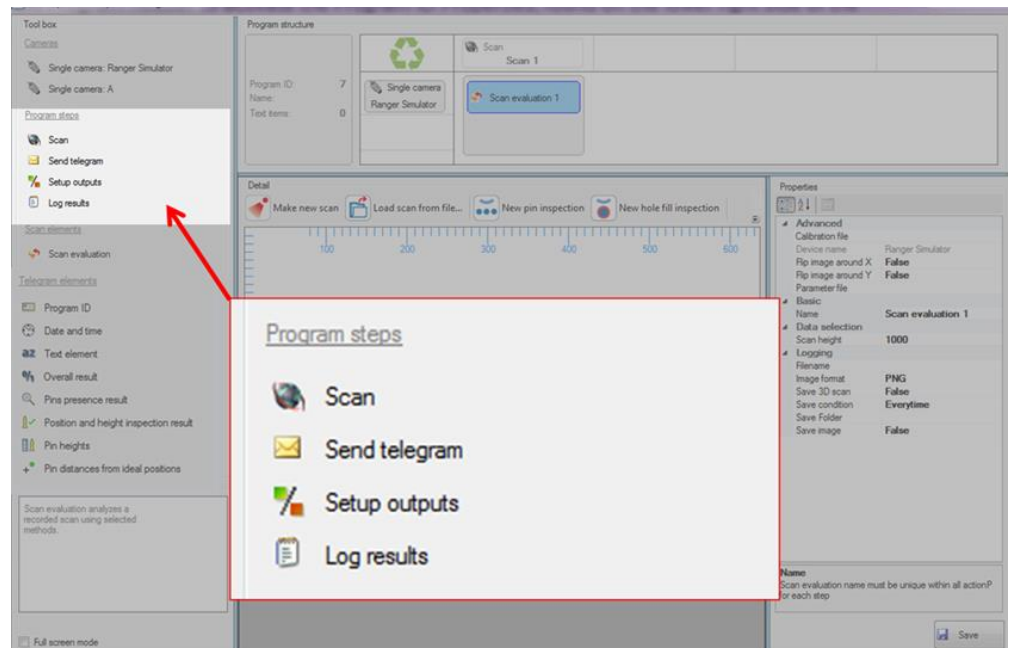


Figure 59 Program steps

The Inspection program editor contains the Program steps which are essential to create an inspection. In this section, all Program steps will be explained including the definitions and Properties settings.

- Name – The name of the step must be defined and unique between all program steps. The variables for the Program steps have no restrictions.

Applies to all Steps:

- Scan Step
- Send Telegram
- Setup Outputs
- Log results

- Description – section for the operating entities notes.

6 INSPECTION PROGRAM EDITOR

6.8.1 Step - Scan

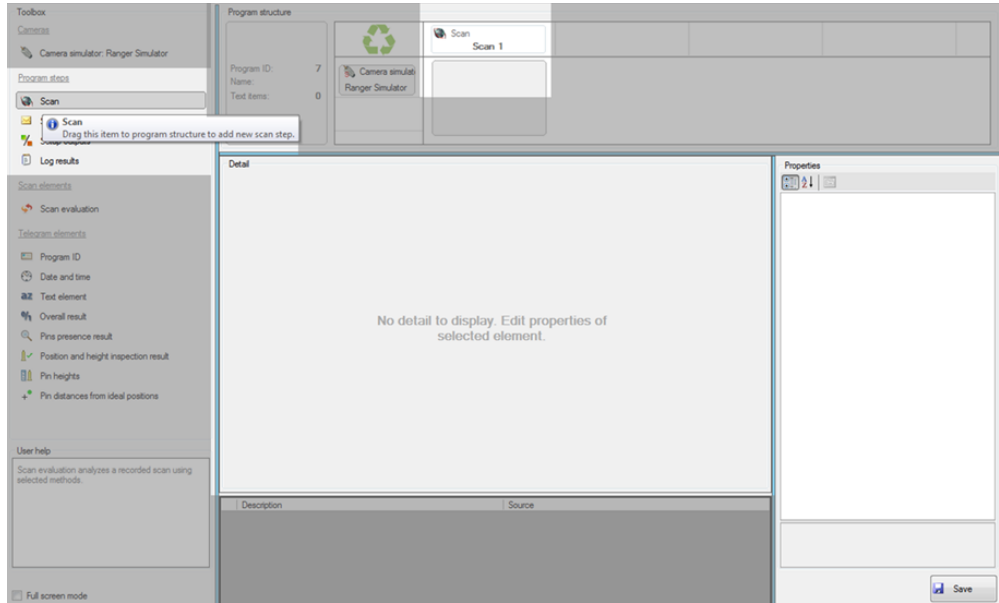


Figure 60 Scan

Scan - Properties

The step: Scan does not require any Properties settings.

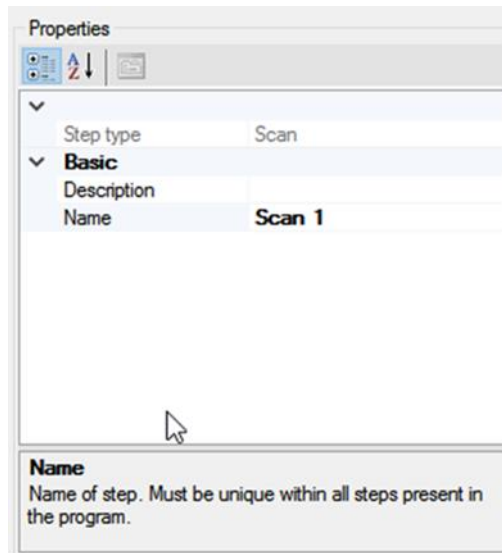


Figure 61 Properties of Scan step

Scan - Detail

The Detail section for the step: Scan does not require any set-up.

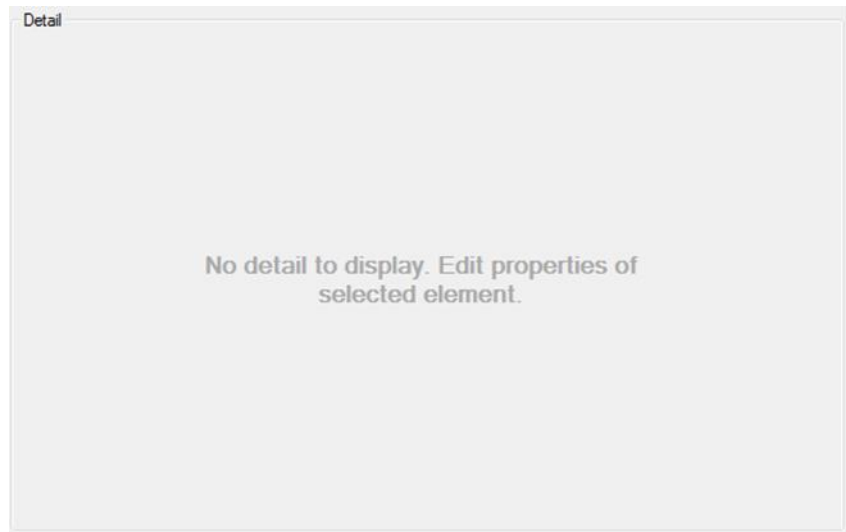


Figure 62 Detail of Scan step

Scan evaluation

The Step: Scan needs to be inserted before placing the Scan evaluation into it. The camera parameters are defined in the Scan evaluation and the operating entity can set various Inspections into it.

The Scan evaluation can only be added into the step: Scan, with at least one added camera. No scan is performed without any scan evaluation in the step: Scan. See image on

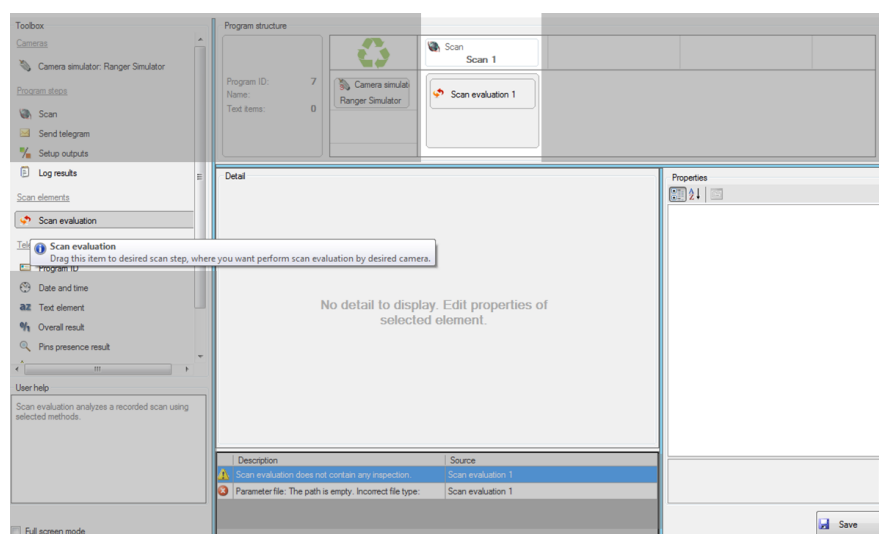


Figure 63 Scan evaluation

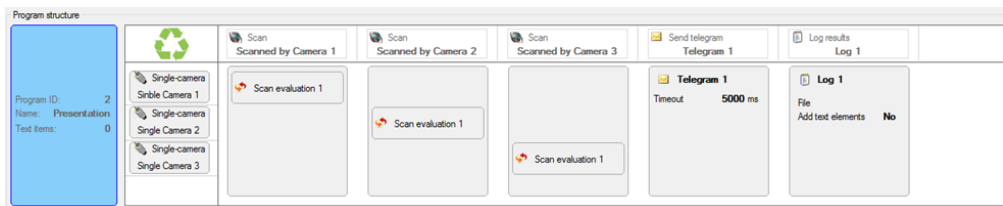
6 INSPECTION PROGRAM EDITOR

The following samples will demonstrate possible scanning sequences. From these variations, the customers can define the scanning sequence according to the design of their PCBs.

This sample demonstrates three camera- setups with separate Scan evaluation steps. This approach performs the entire scanning inspection on PCBs all at the same time.

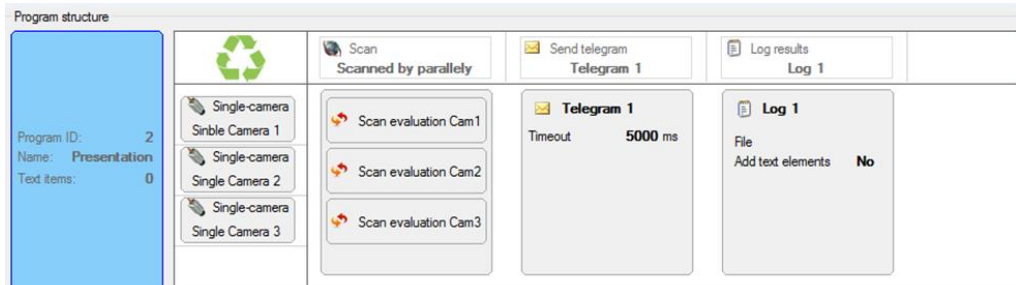
During scanning the camera moves in a sequential manner:

- Camera 1 will start scanning.
- Once it's done, Camera 2 will start to scan from start to finish.
- Finally, Camera 3 will scan from start to end.



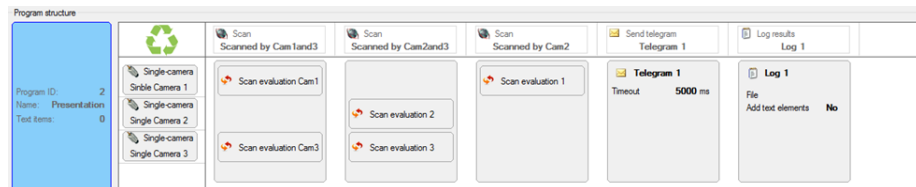
The next sample demonstrates sequential three cameras scan. Only one step is needed to acquire all scans.

- Camera 1, Camera 2, and Camera 3 are scanning at the same time (in parallel).



The third sample demonstrates the combination of parallel & sequential scans.

- Camera 1 and Camera 3 scans in parallel.
- Once the first scan's done, the second step: Scan for Camera 2 and Camera 3 will start in parallel motion.
- Finally on the third step: Scan, camera 1 will scan in a sequential manner



Each inserted Scan evaluation will be connected to a specific camera. When the camera is deleted from the program structure, then all Scan evaluation blocks coherently linked with the camera will also be deleted.

I. Scan evaluation – Properties

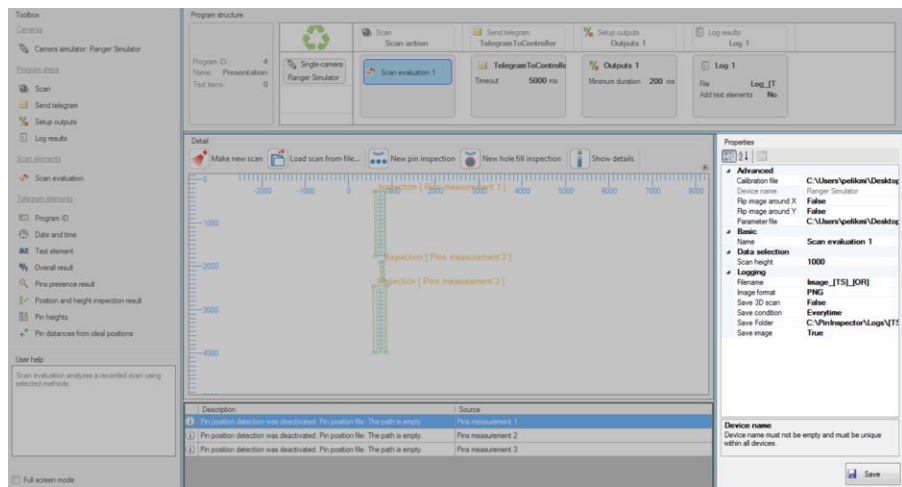


Figure 64 Scan evaluation properties

i. Advanced section

- Calibration file – the first step when measuring the position of the pins, is to define the calibration file for scanning. The external application defines the calibration.

The Calibration file has to be filled only, if the Pin Position File is selected/filled in.

- Device name – name of the utilized camera.
- Flip image around X – if the value is True then image will be flipped around X axis, no changes for False value.
- Flip image around Y – if the value is True then the image will be flipped around Y axis, no changes for False value.
- Parameter file – the parameter file will be loaded into the Camera before the image is acquired. This parameter must be set with “Every time“, otherwise an error message will display and the program will not be able. Please refer to [Section 6.6](#) on [page 63](#) for further details.

Camera Parameter file - the path to the file can be determined from the “Parameter file” – a property of the Scan evaluation Step. You can find the Camera Parameter File contains .prm extension C:\Data\ParameterFile\parameter_file.prm in the configuration folder. See [Chyba! Nenalezen zdroj odkazů.](#) Camera Parameter file.

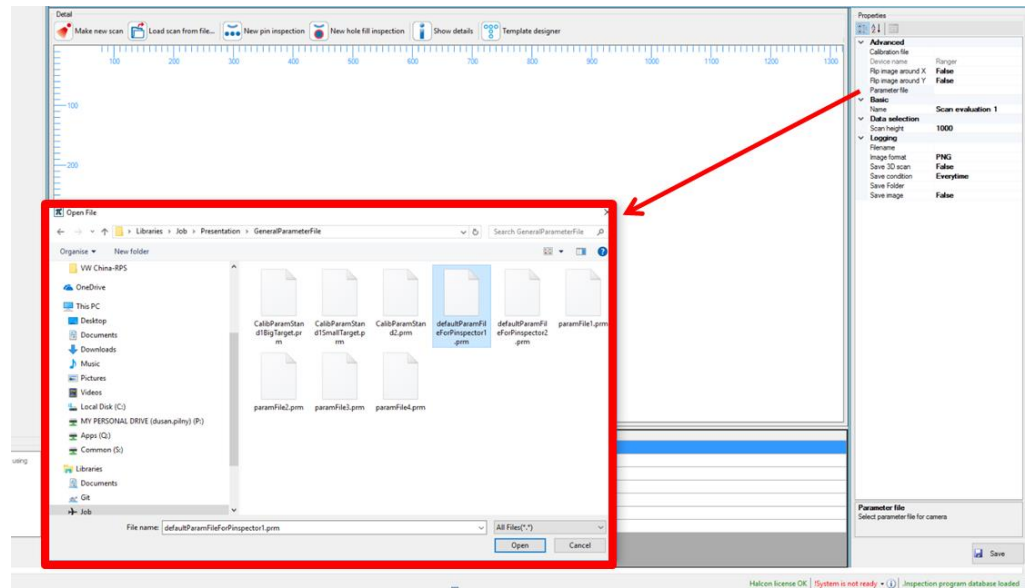
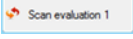


Figure 65 Camera parameter file

you can activate the Properties section upon clicking the  button.

- once activated, you will find the properties section on the right-hand side of the Inspection program editor.
- now click the parameter file, found in the properties window.
- the configuration folder will appear immediately.

II. Basic section

- Name of Scan evaluation – name for the Scan evaluation block has to be unique in each step: Scan. The Name will be used as a reference in the Inspection program editor. There are no restrictions with the use of variable names for the Scan evaluation.

III. Data selection

- Scan height – represent the number of profiles from where the 3D image is created, it determines how many scans the camera can make. Specifically, the height of the displayed image. You must adjust this parameter so that all pins are visible in the image.

IV. Logging section

- Filename format - format of the filename for the images. If you leave this field blank, then it will use the time stamp as the filename.
- Image format - format of the 2D image with results of the overlay. Three available options PNG*, JPG, BMP.
- Save 3D scan
 - if True then the raw 3D scan data are saved to the selected folder.
 - Select the Save 3D scan, if you would like to save the file in DAT & XML formats.
- Save condition
 - if Every time option is selected, then all images are saved.
 - if NOK option is selected, then only the images saved are with failed inspections.
- Save folder - the operating entity can save and define the Inspection into the selected folder. You can also define the file name for: Time stamp [TS], Overall result [OR], and Text element [TE].
- Save images
 - if True then the 2D scan, including the overlay of inspection results are saved to the selected folder.
 - Select the Save image, if you wish to save the file in JPEG format.



There are extensive possibilities on how to set up the filename and save folder. Please refer to [Section 6.8.5](#) on [page 88](#) for further details.



PNG* format is highly recommended for these files. It has the best image quality/ image size ratio.



Scan evaluation block can only be added to the step: Scan, if the program has a defined Camera.

I. Scan evaluation - Detail

The Scan evaluation will display a window showing the scanned images taken by the camera. It will also include the set-up of the ROI (region of interest) for the pin inspection.

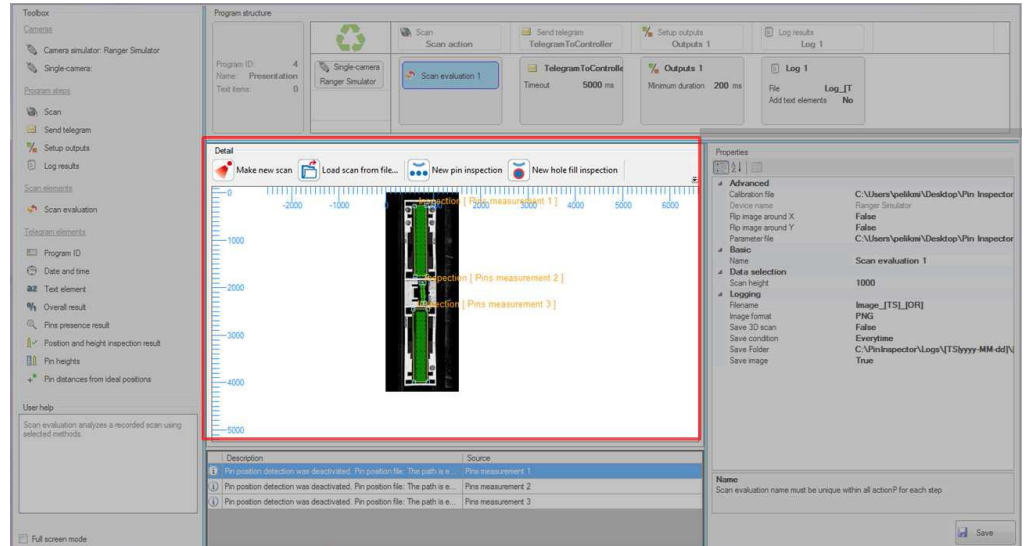


Figure 66 Scan evaluation Detail

6.8.2 Step: Send telegram

This step ensures to send the user-defined telegram using the RS-232 line. The telegram consists of elements that can be added into the telegram from the Tool box window. By default, the text of the telegram (individual elements) is divided using “|” character. The delimiter can also be customized.

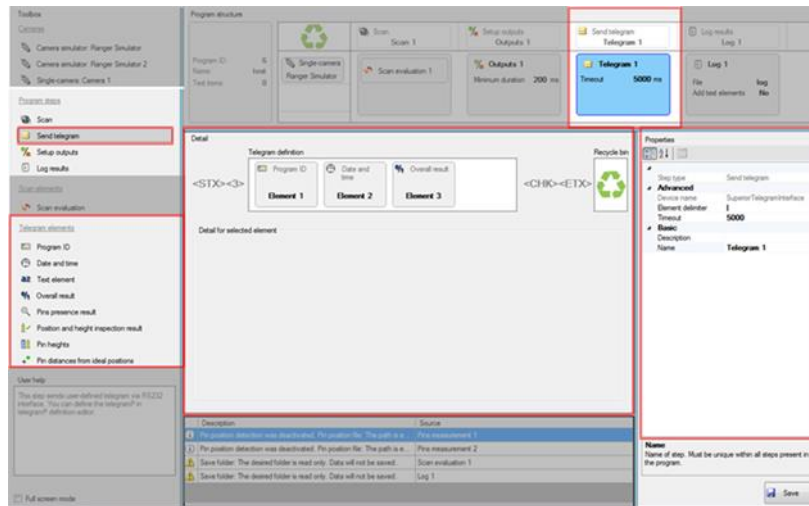


Figure 67 Send telegram

Telegram - Properties

Step: Send telegram has the following additional properties:

1. Advanced section
 - Element delimiter – defines the ASCII character that separates the individual elements.
 - Time limit – defines the waiting time of the program for the acknowledgement telegram. If there is no acknowledgment telegram received at this time, then the Step will terminate with an error.
2. Basic section
 - Description - notice section for operating entity.
 - Name - name of the step. The name has to be defined and unique between all program steps.

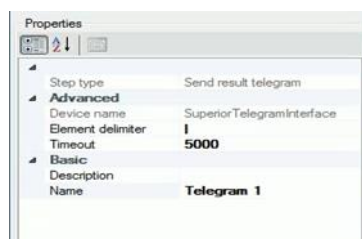


Figure 68 Telegram properties

Telegram definition - Detail

This step contains elements to create the telegram, see [Figure 69](#). Individual elements can be added from the Toolbox window, using the drag & drop method. All elements have the following common features:

- Name – name of element (optional)
- Description – notice section for the operating entities (optional).

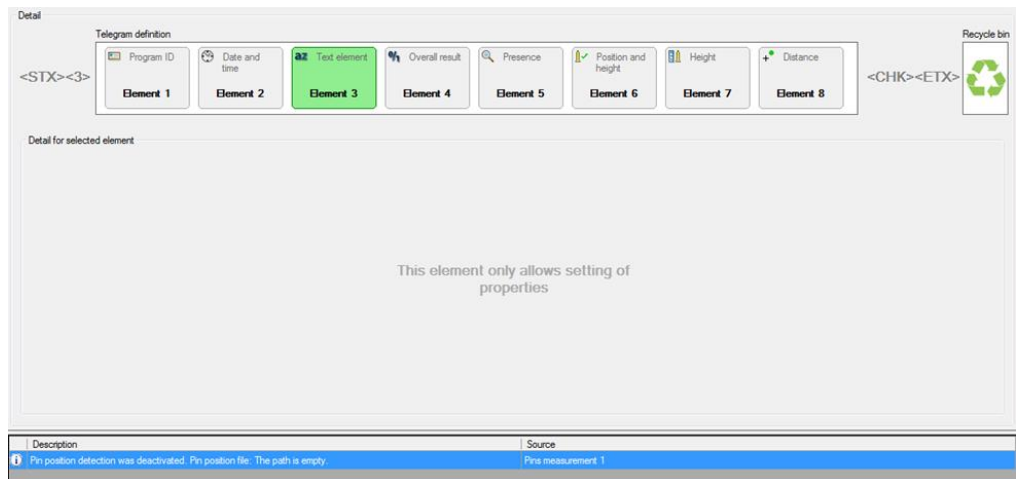


Figure 69 Detail contents for send telegram



All elements can be deleted either through drag & drop into the Recycle bin or pressing the Delete key.

Telegram elements

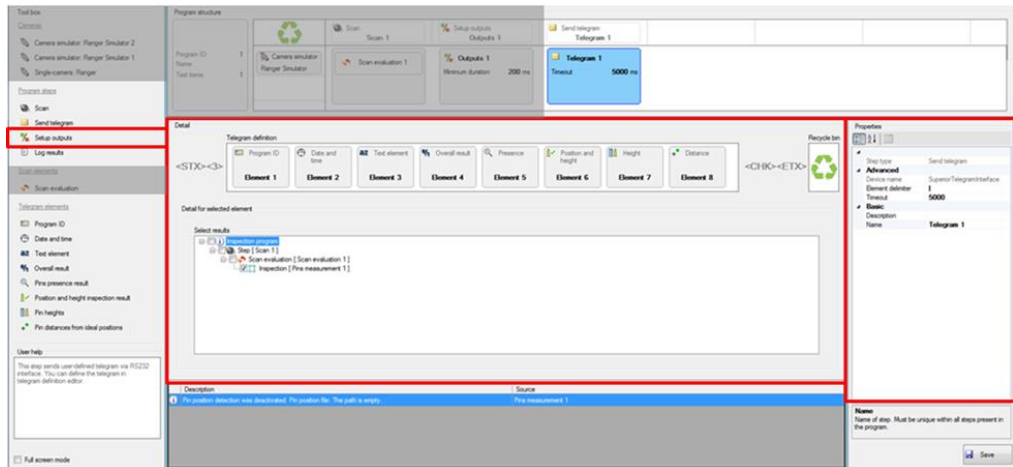
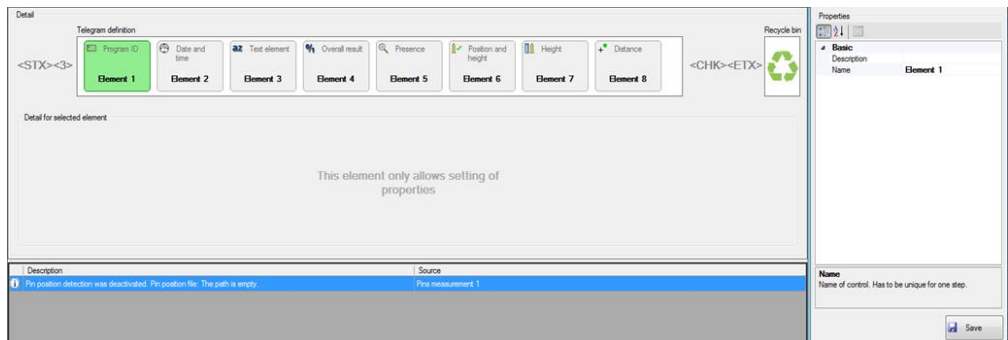


Figure 70 telegram elements



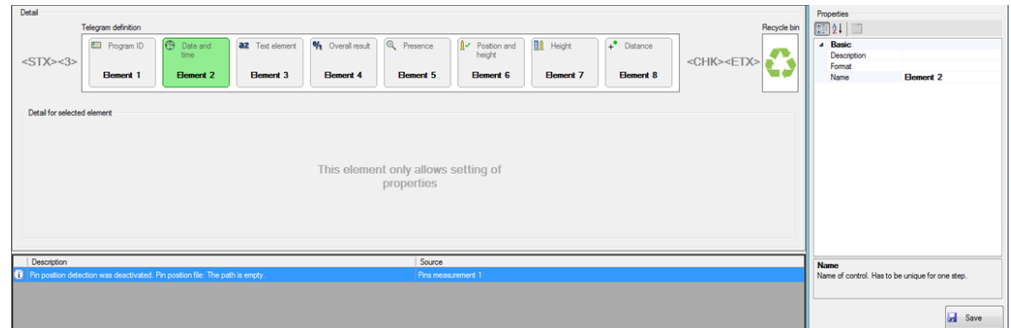
When one of the following Telegram elements is selected, it will immediately switch the Detail feature of the selected telegram element.

- Program ID – it is necessary to enter the Program ID into the telegram, it helps identify the current program.

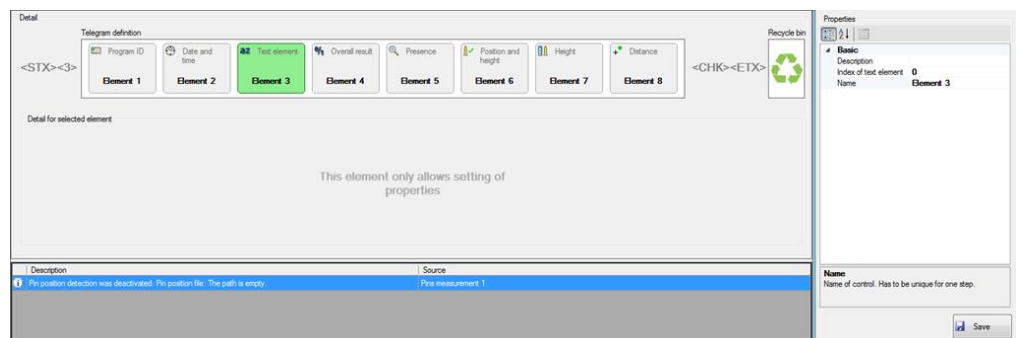


It is necessary to insert the Program ID in the telegram definition. It provides assistance to the control system in identifying the currently running program.

- Date and time – indicates the date and time when the telegram was created. You can select the format using the attribute Format. For further details on how to set out the date and time, you may refer to [Section 6.8.5](#) on [page 88](#).



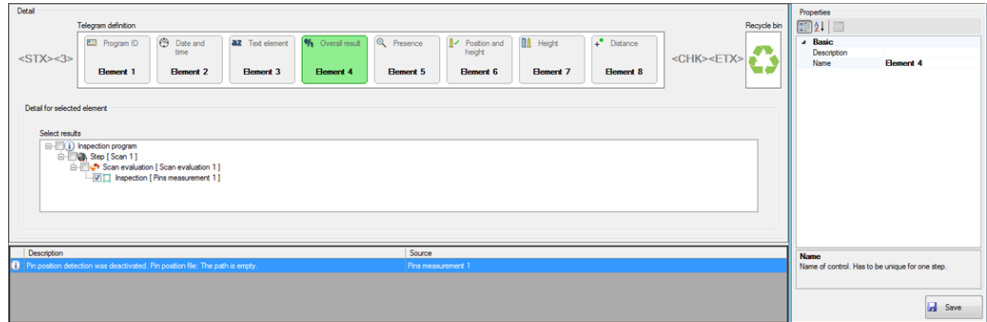
- Text element – are folder elements received from the control system. You can define the content of the text element using the attributes in the Telegram element index.



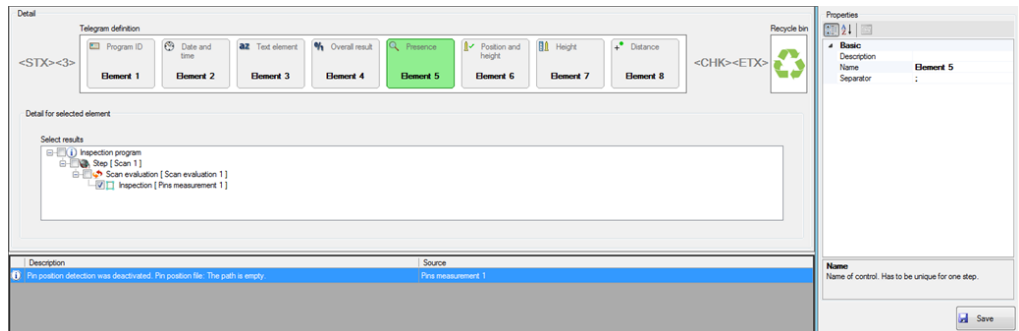
The index of text element must contain the same number of text item, identical as the Program header.

6 INSPECTION PROGRAM EDITOR

- Overall result – The Overall result - Details enables you to select the inspection, used for calculating the results. 0 (if at least one method is negative in the measurement result). 1 (if all of the selected inspections have positive results) will be added into the telegram.

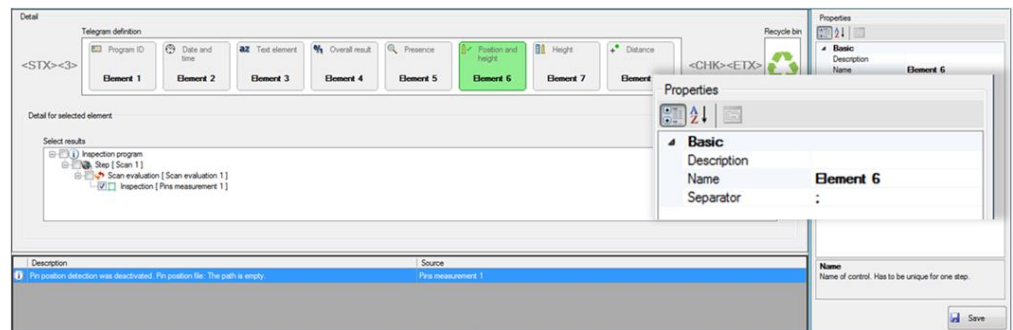


- Pin presence result - this element adds the list of results into the outgoing telegram, whether a separate pin was found (1) or not (0).

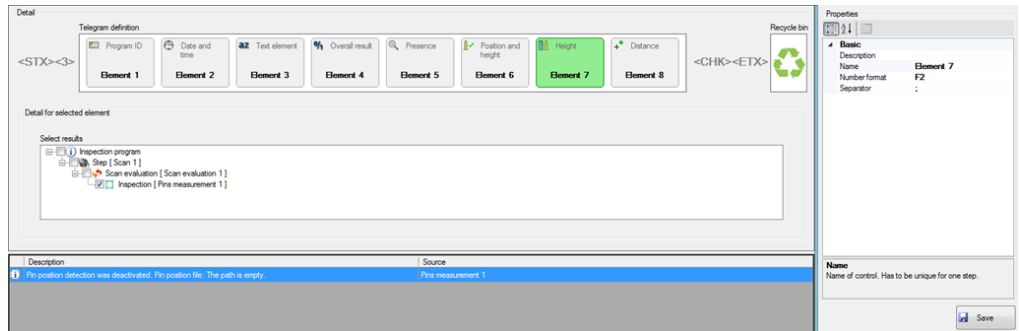


- Position and height inspection results – Position and height inspection results Details enables you to select the inspections. These inspections can be used to build a sequence of individual results, where each pin is presented with one character. One of these characters is possible:
 - (OK) – correct pin height and position
 - M (missing) – pin not detected
 - H (wrong height) – pin height is out of tolerance
 - P (wrong position) – pin is positioned out of the selected tolerance
 - B (wrong position and height) – pin has height as well as position out of tolerance

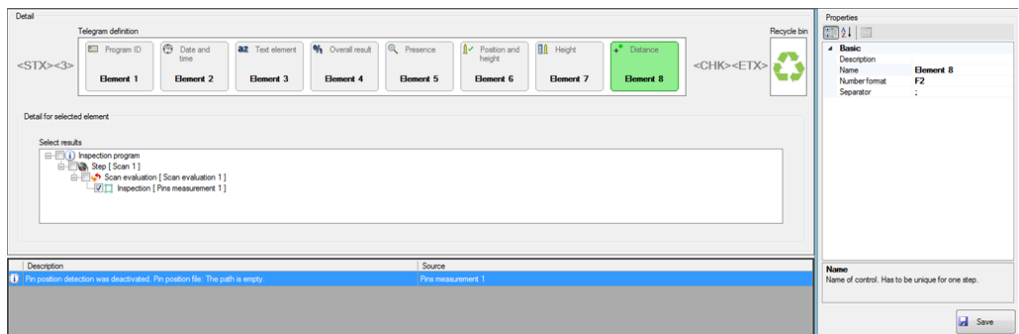
The pins are arranged according to ID and are divided by a separator. The separator can be defined in the attribute separator.



- Pin heights – The Pin heights element, adds the list of measured pins to the outgoing telegram. The pins are organized according to ID, and are divided by a separator. The separator can be defined in the attribute separator.



- Pin distances from ideal positions – This element enables you to add the list of pin distances, from the ideal position to the outgoing telegram. The pins are organized according to ID, and are divided by a separator. The separator can be defined in the attribute separator.



6.8.3 Step: Setup outputs

The step for Setup outputs ensures to set up the Measurement OK and Measurement NOK outputs. The measurement result will be based on the selected inspections. The outputs are deactivated after the elapsed time, defined by the parameter Minimum duration.

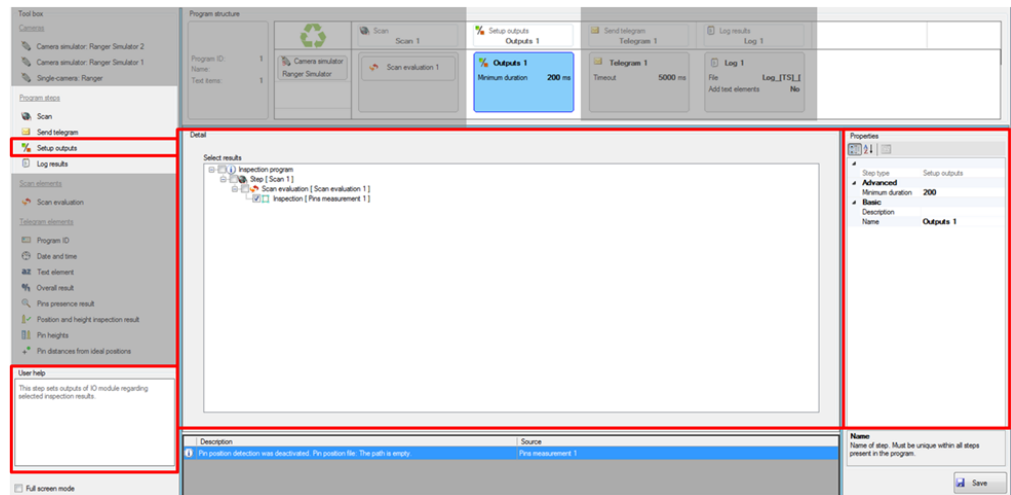


Figure 71 Setup outputs

Setup outputs - Properties

The properties section for Step - Setup outputs feature the following additional attributes:

1. Advanced
 - Minimum Duration – defines the minimal time of how long the Outputs will be turned on, depending on the Properties of the Minimum duration. During this period, the status of the step is set to Running. Afterwards, the status is set to Finished.
2. Basic
 - Name – Name of the step that has to be defined and unique between all program steps.
 - Description – notice section for the operating entity.

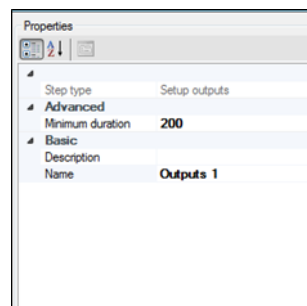


Figure 72 Properties of Set-up Output step

Setup outputs - Detail

The Step detail allows the selection of inspections, used to calculate the inspection result.

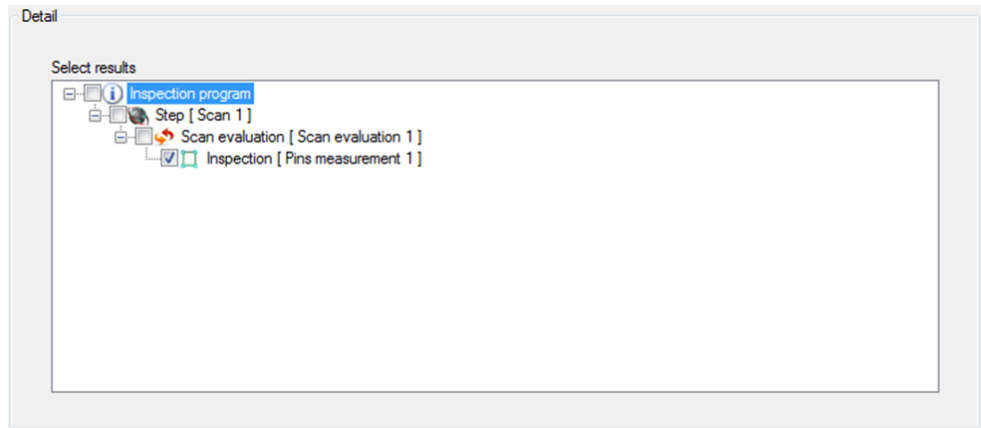


Figure 73 Detail of Setup Outputs step

6.8.4 Step: Log results

The step Log results save the inspection results to the local hard drive. You can select the saved results in the same manner as the Setup outputs.

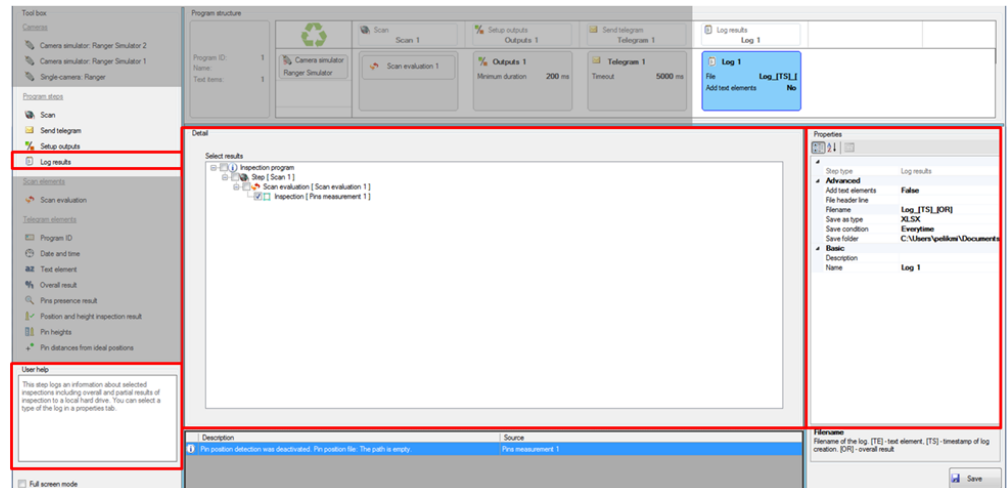


Figure 74 Log results



The Step: Log result will only require the use of Perform step. The Scan evaluation, Send telegram and Setup outputs always require the three commands: Prepare step, Perform step, and Finalize step.

Log results – Properties

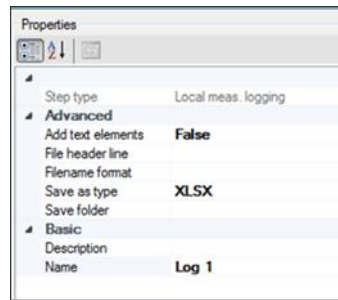


Figure 75 Log results Properties

The Properties for Step: Log results feature the following additional attributes;

1. Advanced

- Add text elements – if you select this option then all text elements that are received from the Program telegram will be added to the file.
- File header – the text is shown at the beginning of each file.
- Filename format – filename format for the log files. If you leave this field blank, then the time stamp will be used as filename.
- Save as type – the category of the log file.

XLSX – data are saved to Microsoft Excel file. The following image is a sample of the log file.

Figure 76 An example of XLSX file when saving the data.

LOG – text file with tab-separated values. File has .log extension.

TXT – text file with tab-separated values. File has .txt extension.

- Save folder – all the logs are saved to this specific folder.
- Save condition – if Everytime option is selected than all logs are saved after every inspection. If Nok option is selected, only the logs with failed inspections will be saved.



There are extensive possibilities on how to set up the filename and save folder. For further details, see [Section 6.8.5](#) as of [page 88](#).

2. Basic

- Description – Name of the step. The name has to be defined and unique between all program step.
- Name – notice section for the operating entity.

Log results

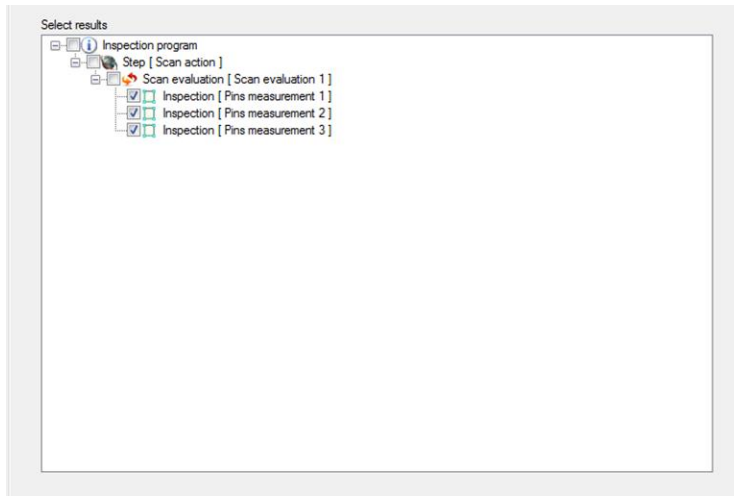


Figure 77 Detail section for the Log results

Step Detail selects the inspection and these selected inspections are saved to the file. Each inspection is saved in the file together with its name followed by all available inspections results:

- Inspection of filled holes named “Pins in hole detection – Region 1“ that contains four pins. The input produced in the log file for this inspection will be:

Pins in hole detection – Region 1

1	0
2	1
3	1
4	1

The number on the first column represents pins’ ID, and the second information represents whether the pin was found inside the conductive ring or not.

0 = not found

1 = found

- Pin inspection named “Pins region 1” that contains four pins. The input produced in the log file for this inspection will be:

```
measure1
1 | 1 | 1.51
2 | 1 | 1.50
3 | 1 | 1.49
4 | 1 | 1.48
5 | 0 | 0
6 | E | 1.47
7 | N | 1.28
```

Pin Region - 1

Pins region 1_01 20.92 52.85 0.13 OK 4.98 OK 0.30 -0.20 0.20 5.00

Pins region 1_02 20.92 55.89 0.07 OK 4.98 OK 0.30 -0.20 0.20 5.00

Pins region 1_03 20.97 58.61 0.11 OK 5.00 OK 0.30 -0.20 0.20 5.00

Pins region 1_04 20.96 61.60 0.23 OK 5.01 OK 0.30 -0.20 0.20 5.00

The number in the first column represents the pins' ID, including the inspection area name. It uniquely identifies the pins in the log file.

1. position X
2. position Y
3. distance to ideal position
4. position result
5. height
6. height result
7. position tolerance radius
8. lower height tolerance
9. upper height tolerance
10. ideal height

6.8.5 How to customize a directory path and filename

The directory path and filename can be specified using the patterns enclosed in square brackets []. These markers [] are automatically replaced with a relevant data of information. This option enables the operating entity to insert a relevant pattern of information into the directory path and the filename:

- Date & Time – Information of the current date and time.
- Inspection Result – Information about the results of inspection.
- Text Element – Set of characters sent by the control system.



The operating entity can use as many markers according to preference without any restriction. Although, the maximum length of a path in OS Windows is defined as 260 characters and the markers [] are case-sensitive.

Date & Time

[TS] - Pattern entry of the current date and time information

- To insert the current date and time: 2016 28 January 12:30:00, see the following examples:

Directory path pattern defined by the operating entity:

C:\Job\Data\Inspection\Log_[TS]\ → C:\Job\Data\Inspection\Log_2016-01-28 12-30-00\
00\
00\

C:\Job\Data\[TS]\Log_[TS]\ → C:\Job\Data\2016-01-28\Log_2016-01-28
12-30-00\Log_2016-01-28 12-30-00

Filename pattern defined by the customer:

Connector_img_[TS].png → Connector_img_2016-01-28 12-30-00.png

As shown from the mentioned examples, the time stamp [TS] marker behaves the same as [TS|yyyy-MM-dd hh-mm-ss], by default.

Generally, time information can be somewhat redundant, it is better to tailor your marker [] specifically according to your preference. Time format can also be augmented to:

Date & Time information **[TS|Time Format]**

This marker results in an insertion of date and time information. But only patterns comprised in Timer Format string are then used for Data & Time transformation. See description:

Time Format is a set of patterns representing the current Date and Time information (year, month, day, hour, minute, and second).

yyyy - Year pattern

MM - Month pattern

dd - Day pattern

HH - Hour pattern

mm - Minute pattern

ss - Second pattern

These patterns can be combined into one string in any order. See sample:

Defined pattern:	
Current date & time	2016 28 January 12:30:00
[TS yyyy_MM_dd]	2016_01_28
[TS dd-MM]	28-01
[TS HH-mm-ss]	12-30-00



There are more possibilities for date formatting. For further details, please visit this page: <https://msdn.microsoft.com/en-us/library/8kb3ddd4%28v-vs.110%29.aspx>

Examples:

Directory path pattern: defined by the customer with a current result of OK.	
C:\Job\Data\Inspection[TS yyyy-MM-dd]\Log\	C:\Job\Data\Inspection2016_01_28\Log\

Filename pattern: defined by the customer with a current result of NOK.	
Connector_img_[TS HH-mm-ss].png	Connector_img_12-30-00.png

Inspection Result

- [OR] - Helps the operating entity to create the directory path or the filename containing the overall result of an inspection. Once the component passed an inspection, the marker [OR] will then be replaced with OK, otherwise by NOK.

Sample of a component with passed current inspection: Overall result - OK	
C:\Job\Data\Inspection\Log_[OR]\	C:\Job\Data\Inspection\Log_OK\
Connector_img_[OR].png	Connector_img_OK.png



If the component fails, the path and the filename will be defined as shown:

C:\Job\Data\Inspection\Log_[OR]\	C:\Job\Data\Inspection\Log_NOK\
Connector_img_[OR].png	Connector_img_NOK.png



You cannot tailor this marker [] specifically according to your preference.

Text Element

[TE] – This marker will be replaced with a text string, defined by a control system at the start of measurement. This string has to be sent to the application, from the control system, before the start of measurement sequence.

Moreover, the control system can send a list of text strings to the application. In this case, the first of the text strings can replace the marker. Use the following marker to choose one specific text string:

[TE|No.] - This marker will be replaced with one specific text string from the list.

No. - Index of the desired text string starting from 1. It cannot be greater than the length of the text string list sent from the control system to the application.



When using one of the defined strings; it is necessary to use the enhanced marker [TE|No.].

Examples:

Directory path pattern defined by the customer: List of pattern sent to the Pinspector:
CMX
12345678900

C:\Data\ConnectorSupplier_[TE|1]\Inspection[TS|yyy-MM-dd]\[OR]\ →
C:\Data\ConnectorSupplier_CMX\Inspection2016-01-28 \OK\

Filename pattern defined by the customer:

Img_SN[TE|2].png → Img_SN12345678900.png

7 Operation

This Chapter will guide you on how to:

- initiate an inspection in Automatic or Manual mode
- create new inspection for Pin inspection or Hole-fill inspection
- create new Pin inspection according to surrounding of the pin or the reference plane
- define the inspection area
- load images from the file or from the camera
- operate the Template designer

7.1 How to initiate the measurement

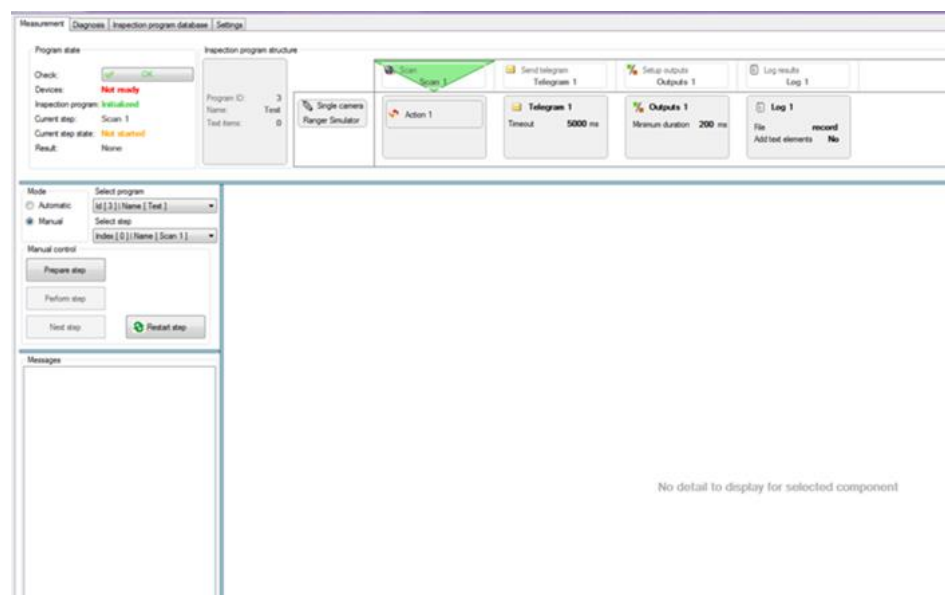


Figure 78 Measurement tab

7.1.1 Automatic measurement mode

The Inspection will start almost immediately, once you've selected the Automatic mode button. The inspection starts right after the Pinspector application receives the appropriate command from the control system. This command is sent via communication interface. The communication interface will function according to the given instructions from the control system.

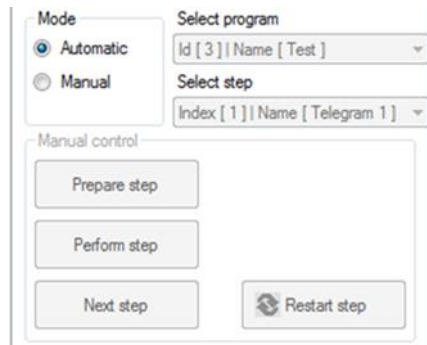


Figure 79 Measurement control window in Automatic mode



When you've selected the Automatic measurement mode, the menus of the measurement control window will be deactivated.



The System status should not contain any errors; otherwise, it will hinder the proper performance of the system.

7.1.2 Manual measurement mode

When you chose the Manual measurement mode, then the following control elements will be made accessible:

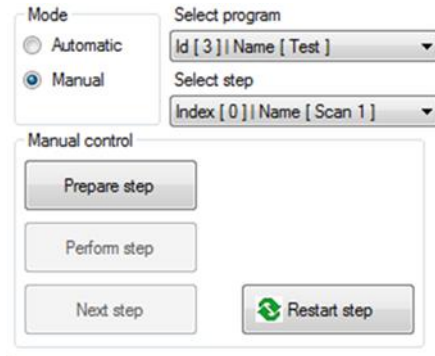


Figure 80 Measurement control window in Manual mode

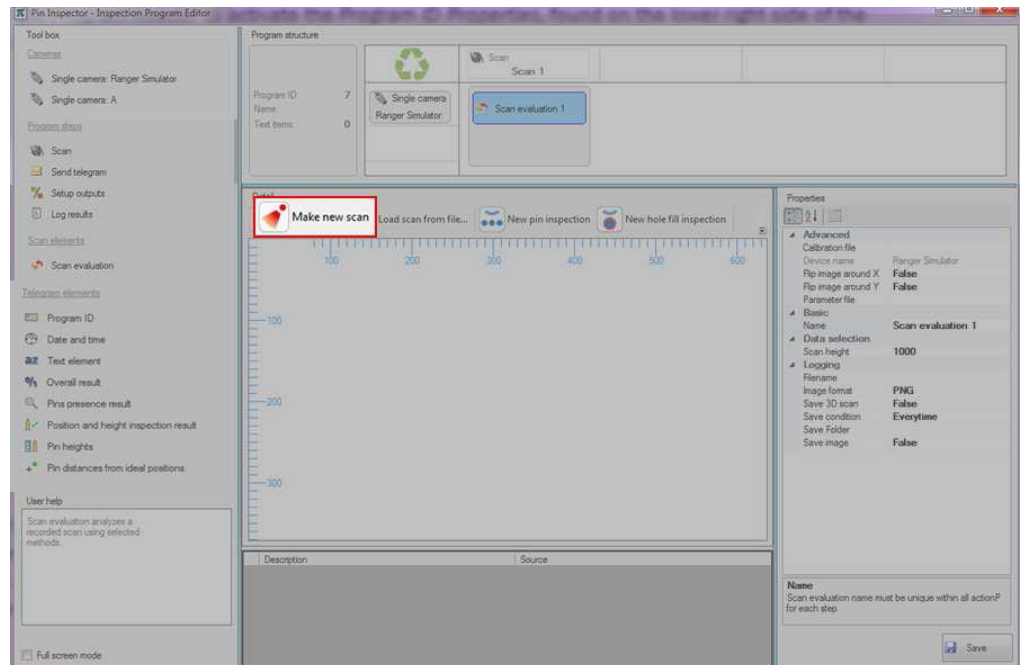
- You can click one of the applicable Program components (using the drop-down button), for the ID program and step.
- We highly recommend selecting the first step Index [0], because the following steps will most likely require the results of the first step as their prerequisites.
- Then, select the Program ID name.
- As well as, the Step.
- Activate the Steps, clicking chronologically in this order:
 - Prepare Step
 - Perform Step
 - Next Step


You will notice that the currently performing step, found in the Inspection Program Structure, will be highlighted with a green-triangle. The Messages and Details will also display for each selected section. See [Figure 78](#) of [page 92](#).

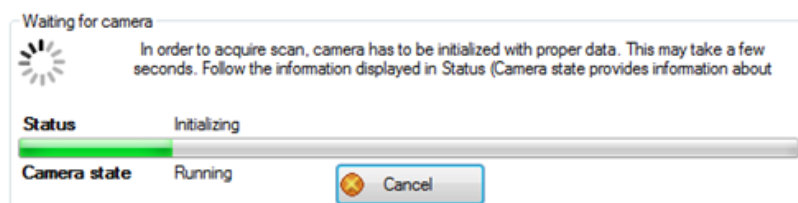
7.2 How to obtain an image for the Inspection

There are two options on how to create an image for the pin inspection, using the Inspection program editor:

7.2.1 Camera scan



- You can press the Make new scan  button, located on the upper left corner of the Scan evaluation - Detail window.
- The Pinspector application will upload the parameter file to the Cameras (which will take a few seconds). A confirmation message will appear, stating that it is ready to scan the image. See the following image.



- At this moment, it is necessary to ensure that the scanned object is in motion and the camera is triggered.

7.2.2 Load images from the file

It is possible to load the 3D image using Load scan from file .
The 3D scan consists of two following files:

- .dat extension (contains the 3D data)
- .xml extensions (contains description on how the 3D data align in the data file).

You may perform the following steps to load the image:

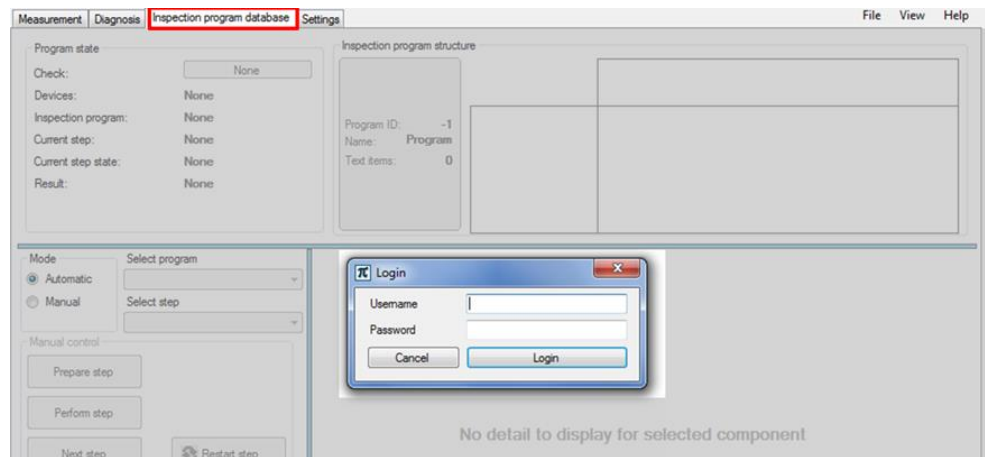
- Click the button found in the Detail toolbar and select one of the files mentioned earlier. In order to load the 3D data properly, one from the two files must be selected.

7.3 How to create a new inspection

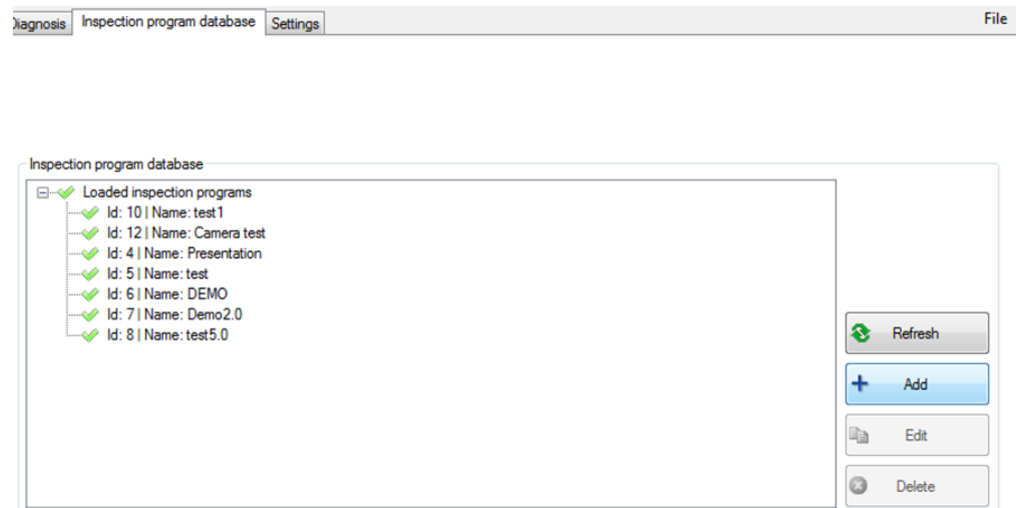
Please follow these guidelines when creating a new inspection for:

7.3.1 Pin position and height inspection relative to the surrounding of the pin

- Activate the Inspection program database tab and log in.

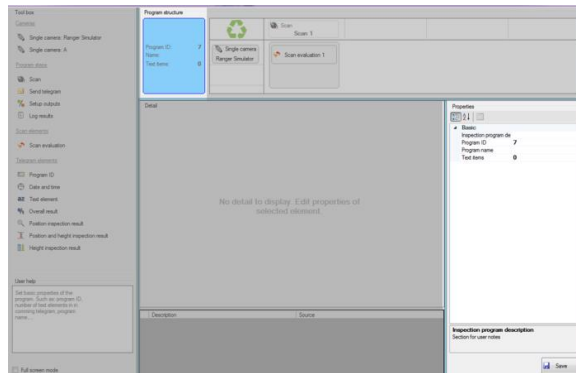


- When you logged in, click the Add button.

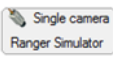


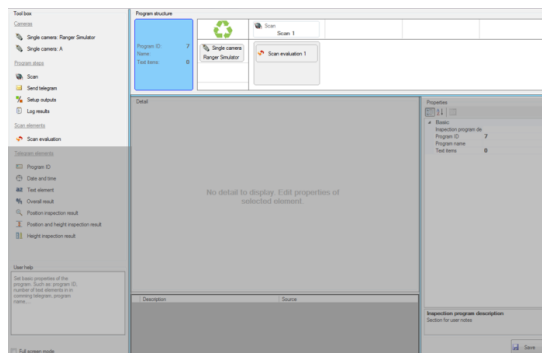
- Once activated, you will find the Program structure on the upper right-hand section of the Toolbox.

- Click the Program header to activate the Program Properties, found on the lower right-hand corner of the window.



- Fill in the information for the Program name.

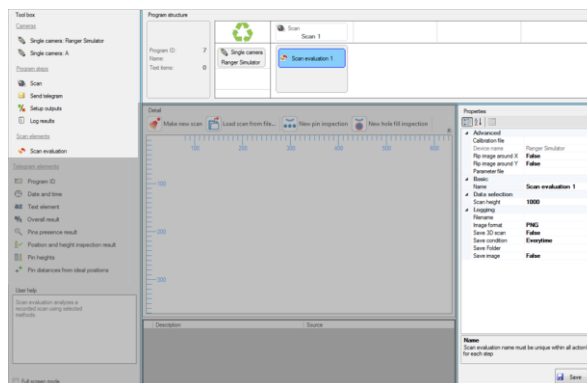
- Next, drag & drop the camera  from the Toolbox and into the first column of the Program Structure.



- Drag & drop the Scan action  and place it into the second column of the Program structure.

- Now insert the Scan evaluation  into the Scan action.

- Click the Scan evaluation in the program structure to activate the Scan evaluation Properties.

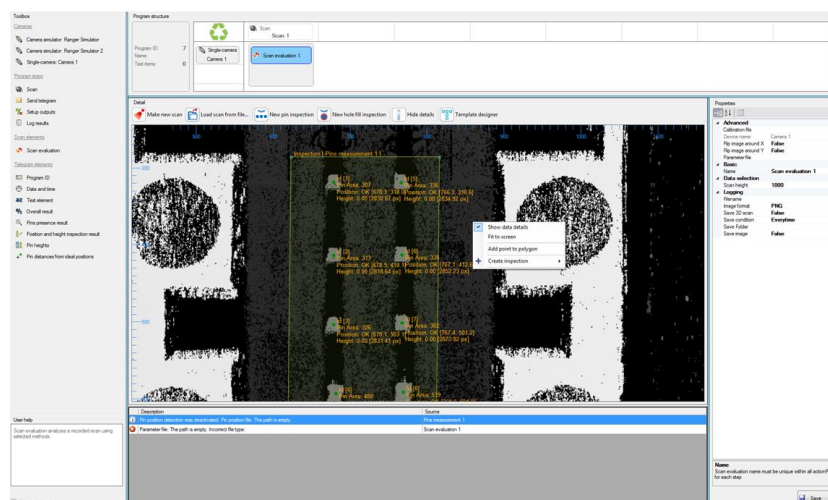


- In the Advanced section of the Properties window, you can select the Calibration file from the folder.



The selection is only necessary if you choose the Template file or if you want to measure the real height of the pins.

- Click and fill in the Parameter file.
- You can also customize the condition of when to save the image. You can either select Every time or Only when inspection fails.
- Finally, you may now select the button.
- After you've selected the type of inspection, you must now define the region for inspection.
- Click the polygon points over the scanned image to mark the region of inspection where the measurement should perform. The polygon needs to have at least three points. You can finalize the creation of the polygon by clicking/ connecting on the initial point of the created polygon.



- You can now click the inner region of the polygon and rearrange the polygon accordingly.
- Afterwards, go to the Base surface setting, found in the Properties window, and set to Surrounding of the Pin.

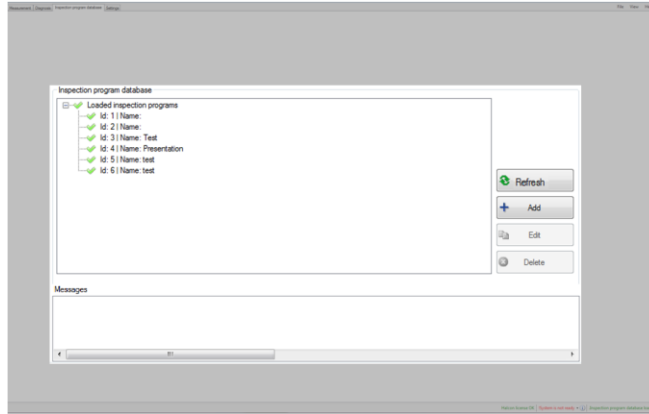


Please be informed that the context menu has two versions, found in [Section 7.4](#) as of [page 106](#). The position of the mouse cursor defines the element of the context menu.

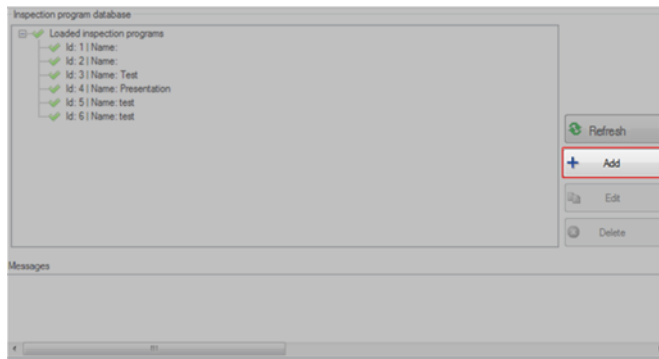
You can entirely delete the inspection area, by selecting the Delete inspection option from the context menu or press the Delete key.

7.3.2 Pin position and height position relative to the reference plane

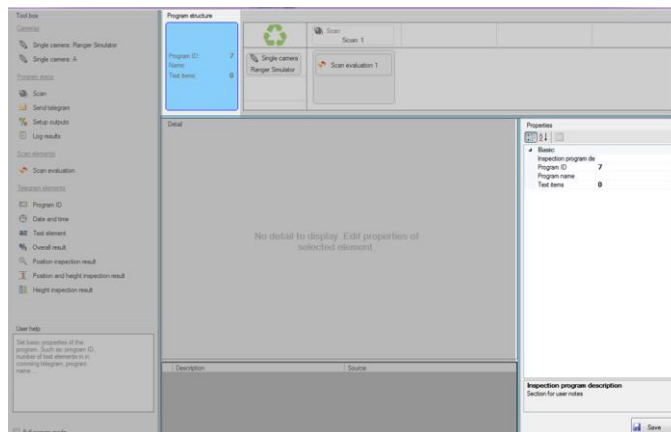
- Once you activate the Inspection program database tab, you will need the log in information to access the inspection program editor



- Click the Add button.

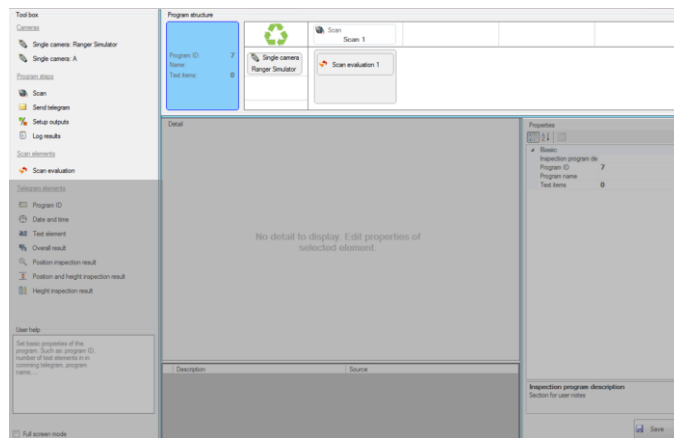


- Once opened, you will find the Program Structure on the upper right-hand section of the Toolbox section.
- Click the program header to activate the Program ID Properties, found on the lower right side corner of the window.

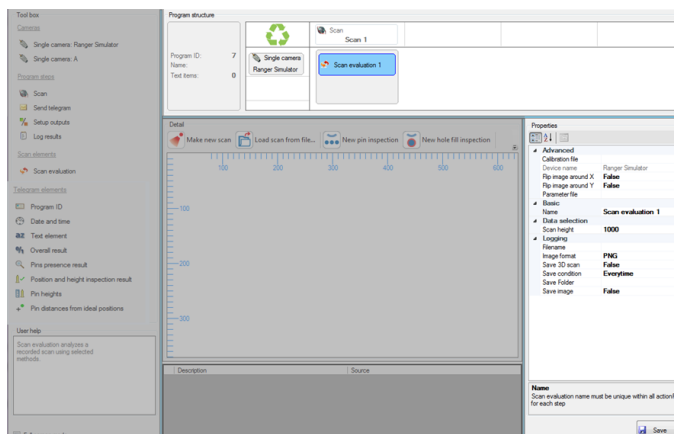


- Fill in the information for the Program name.

- Next, drag & drop the camera from the Toolbox and into the Program structure.



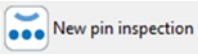
- Now drag & drop the Scan action and place it into the second column of the Program structure.
- and insert the Scan evaluation into the Scan action.
- Click the Scan evaluation in the program structure to activate the Scan evaluation Properties.



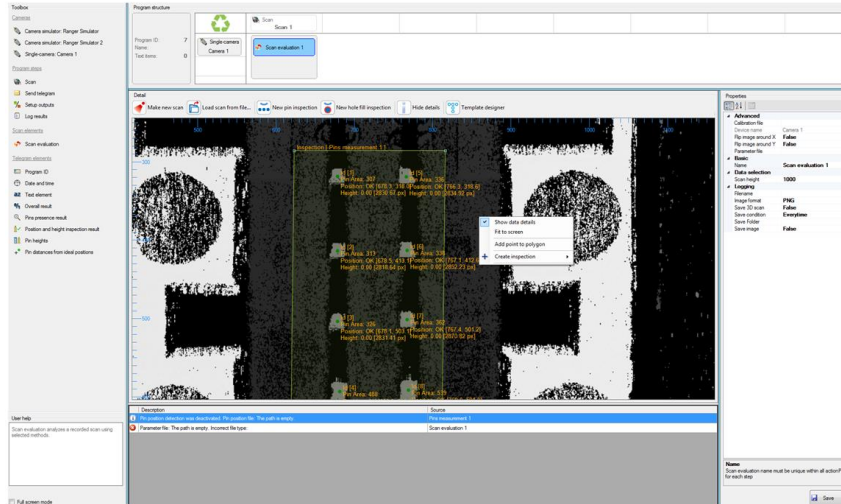
- In the Advanced section of the Properties window, select the Calibration file from the folder.

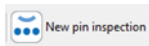


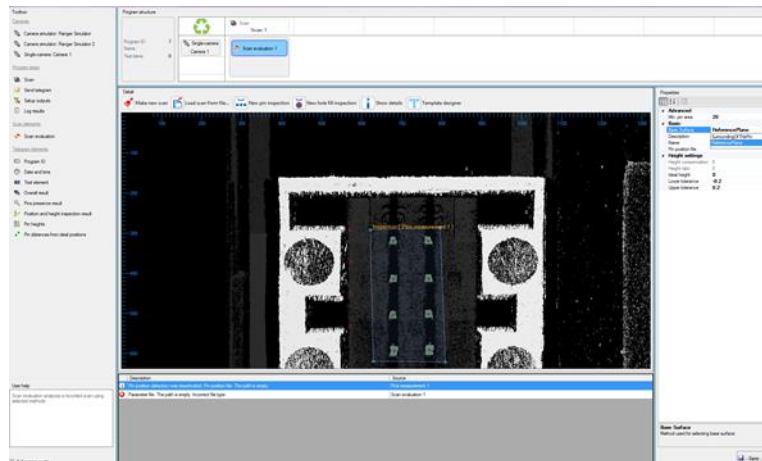
The selection is only necessary if you chose the Template file or if you want to measure the real height of the pins.

- Then, click the  button.
- After selecting the type of Inspection, you can define the region for inspection.

- Click the polygon points over the scanned image to mark the region of inspection where the measurement should perform. The polygon needs to have at least three points. You can finalize the creation of the polygon by clicking/ connecting to the initial point of the created polygon.



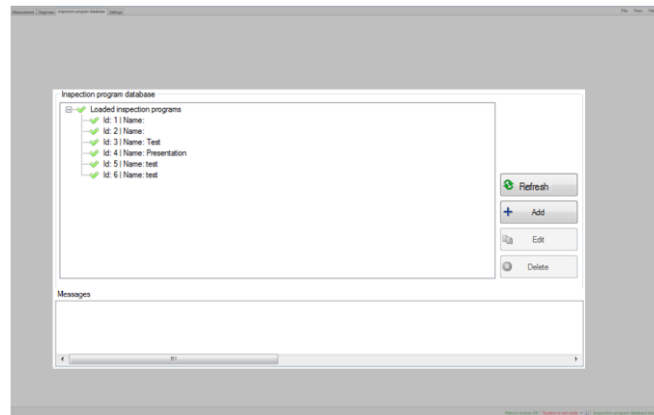
- You can activate the  button. Set the inspection parameters and arrange the polygon accordingly.
- Afterwards, go to the Base surface setting, found in the Properties window, and set to Reference Plane.



- Four red reference points will instantly appear and position itself right next to the upper left corner of the created polygon.
- Now, select where to place the reference points on the plane.

7.3.3 Hole fill inspection

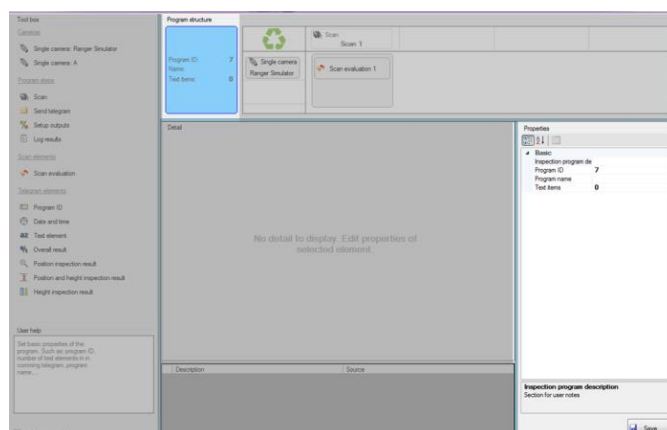
- You must activate the Inspection program database tab and login.



- Click the Add button.

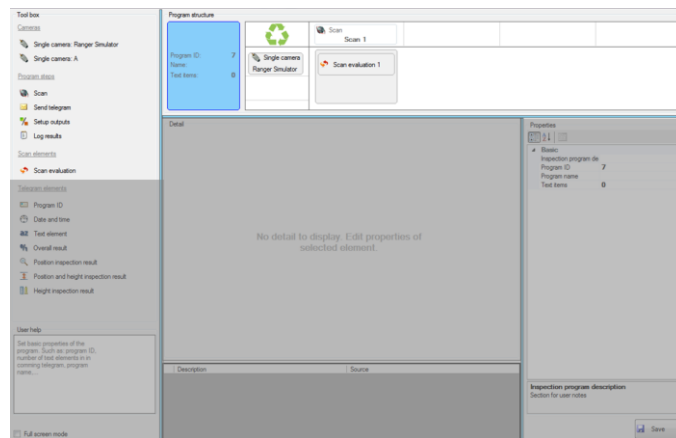


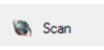
- Once opened, you will find the Program Structure on the right-hand section of the Toolbox section.
- Click the Program header to activate the Program ID Properties, found on the lower right side of the window.

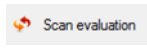


- Fill in the information for the Program name.

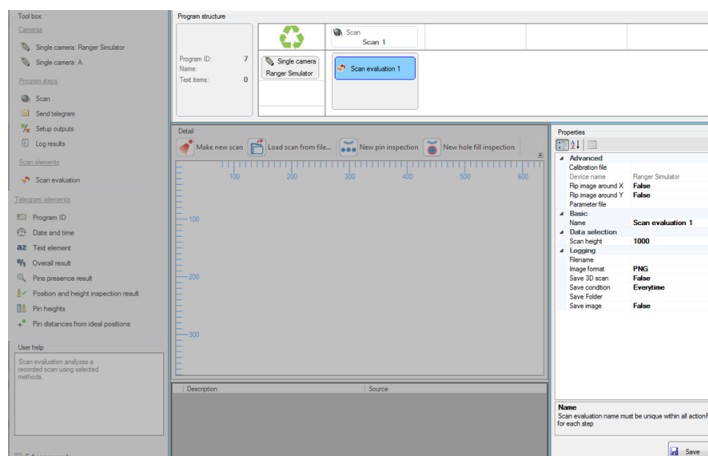
- Next, drag & drop the camera  from the Toolbox and into the Program structure.



- Do the same with the Scan action 

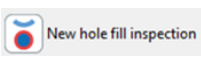
- As well as the Scan evaluation 

- Click the Scan evaluation in the program structure to activate the Scan evaluation Properties.

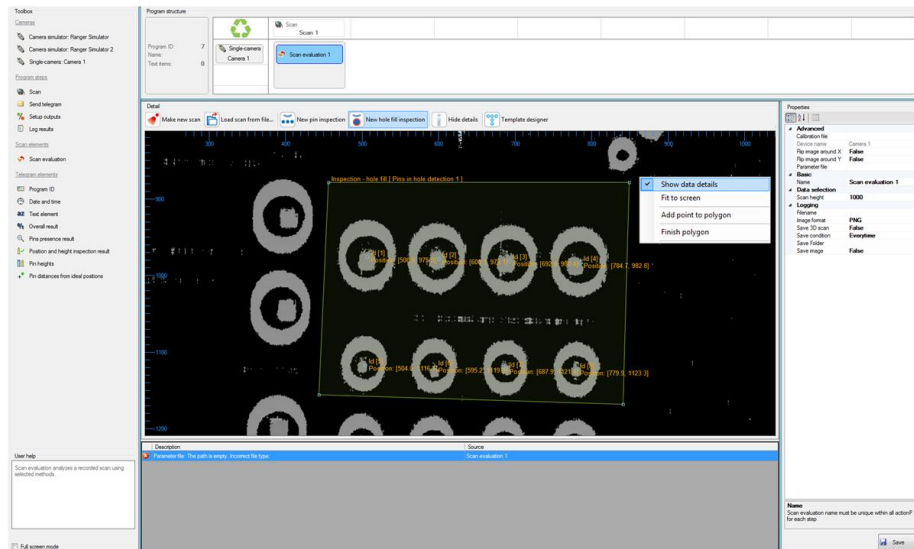


- In the Advanced section found in the Properties window, select the Calibration file from the folder.

- Click and fill in the Parameter file

- Now, select  and define the region for inspection.

- Click the polygon points over the scanned image. You will notice that it will mark the region of inspection where the measurement should perform. The polygon needs to have at least three points. You can finalize the creation of the polygon by clicking/ connecting to the initial point of the created polygon.



To continue the entire Program steps for each type of Inspections. Please refer to [Section 6.8](#) as of [page 65](#).



Furthermore, see [Chapter 8](#) on [page 114](#). Reading these chapters will guide you on how to design the Inspection program efficiently. You can refer to [Section 6.8.5](#) on [page 88](#), on how to customize a Directory file & file name.

7.4 Action modes during pin analysis

The context menu has two versions. When you right-click the mouse button, the position of the mouse cursor will define the element version of the context menu.

1. First version – the context menu will appear when the mouse cursor is clicked within the polygon region.
2. Second version - when the mouse cursor is clicked outside the polygon region.

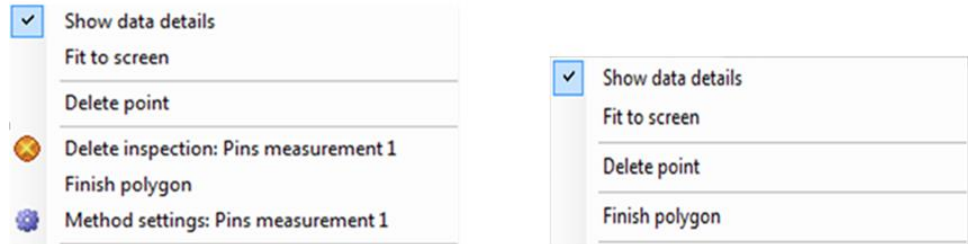


Figure 81 two versions of context menu

- Show data details – when you activate this option, there will be additional information displayed right next to the pins (e.g. pin position, height, ...).
- Fit to screen – zooms the image to fit into the screen window.
- Add point to polygon – this option enables you to add additional points to the existing polygon area. When you click this option, you will be asked to select two polygon points where the additional point will be positioned.
- Delete point – this option will be displayed only if the cursor is over the polygon point. It deletes the polygon point under the mouse cursor.
- Finish polygon – this option is only available when defining the polygon area. It will create the edge between the first and the last added point.

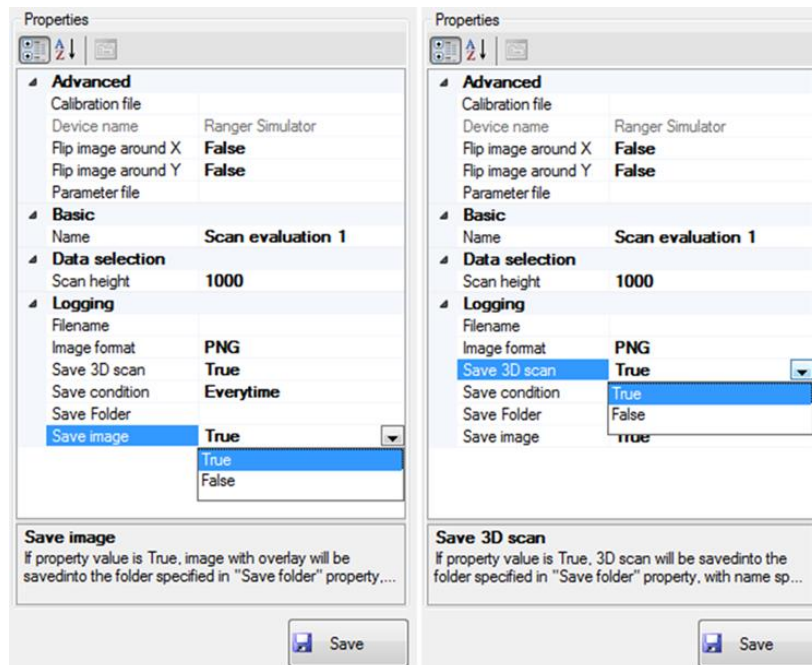
Additional actions:

- Combination of keys – (Ctrl + left mouse button), enables the entire movement of the polygon region.
- Zoom feature – the scroll wheel has a useful feature to zoom the detail window in and out. Click on the detail window & move the scroll button up & down.
- Single-point drag – you can click-drag one of the polygon points that you wish to move. It is very useful particularly when re-designing the polygon points.

7.5 How to save the scanned image

You can save the scanned image by setting the Save 3D scan or Save image to True, these settings are both optional. The Save image can be stored in JPG file, while the Save 3D scan can be stored in DAT and XML files. When setting the Save 3D scan or Save image to False, you must then follow these guidelines:

1. Click the icon in the program structure to activate the Scan evaluation Properties.
2. You must fill in the File name: `Img_rec[TS]_[OR]`.
3. If you wish to save an image of the scanned connector, then set the Save folder and fill in the Folder name. `C:\Data\[TS]yyyy-MM-dd\[OR]`.



4. You can also customize the save condition, when or in which period to save the image. You can either select, Every time or If Nok.



You can perform this procedure while creating a new inspection.



Please refer to [Section 6.8.5](#) as of [page 88](#).

7.6 Template designer

The purpose of this application is to create a template representing the ideal positions of all examined pins, including the tolerances of each pin position. It will be later used for inspection analysis. The Template designer application is the most efficient and straightforward way to design pin tolerances. The Template designer features a template containing a set of elements with a modifiable circle/ ellipse element. The center of the element corresponds to the ideal pin position and circumference of the element, corresponding to the maximum tolerance of the pin position. The template can be saved to the local hard drive as a pin position file formatted in *.txt, which can then be loaded and reconfigured. The file can be later assigned to any inspection.

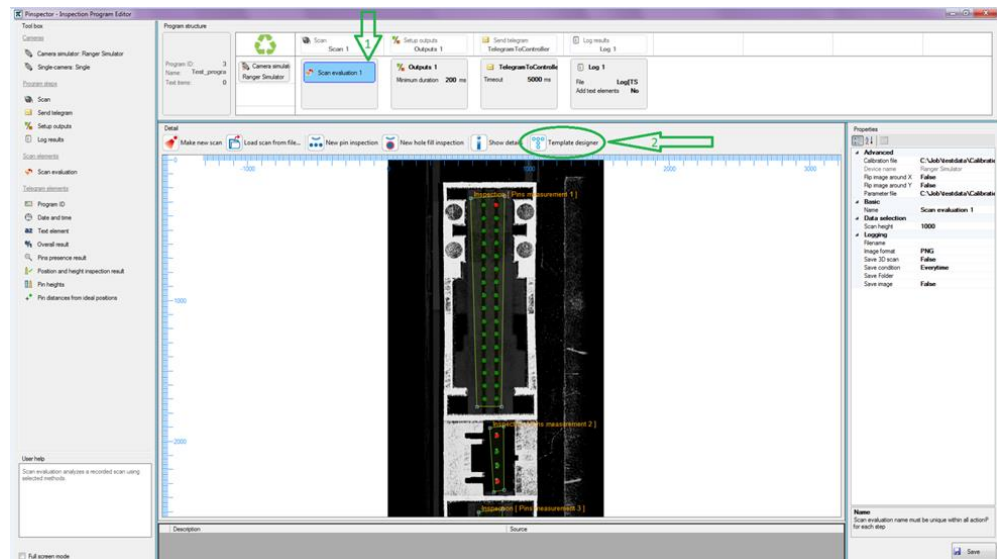
7.6.1 Work flow on how to find the template designer

- Inspection Program database
- “Open one of the loaded Inspection programs”
- Inspection program editor
- Program structure
- Scan evaluation Detail
- Template designer

Please refer to [APPENDIX A:14.5](#) on [page 144](#) for further data information.

7.6.2 How to run the Template designer application

- Go to the Inspection program editor section and click the Scan evaluation found in the program structure tab.
- Then click the Template designer icon, found on the top section of the Detail window.
- Once activated, the application starts immediately.



7.6.3 How to design the Template

The Template designer is designed to customize templates and instantly add more than one defined element.

- Set the parameters first, according to the connector scheme and physical dimension. Once the parameters are all set, click the Add button and a new template will be added into the designer plane.

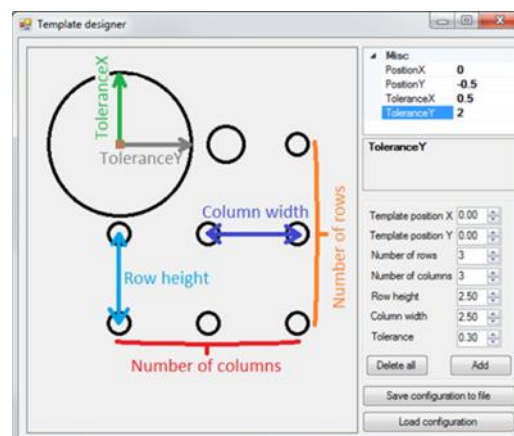


Figure 82 template set-up

7 OPERATION

- It is possible to add templates that can be combined. Set new parameters and press the Add button again. You can combine both of the created templates into the designer plane.
- You may customize each template element, by setting the Position X, Position Y, Tolerance X, or Tolerance Y.

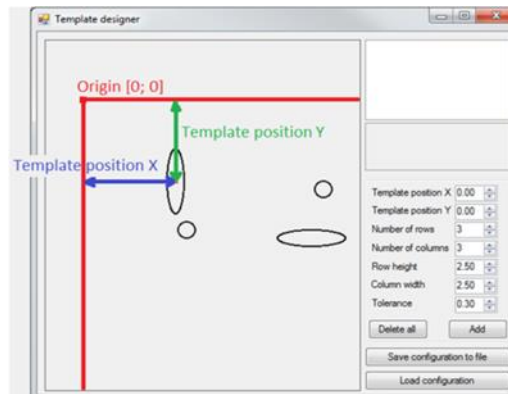


Figure 83 Position X, Y and Tolerance X, Y set-up



To load a template from the file, press the Load configuration button, this way you can modify the previously created pattern. You may easily delete the elements from the designer plane, simply press the button Delete all. You can delete each element individually, by clicking the desired element and press the Delete button using your keyboard.

The created Template file can be edited manually in the text editor when needed. The file contains list of pin positions, together with their tolerance radiuses. One row of the file represents the definition of one-pin position with tolerance. The first two numbers are X and Y position coordinates the pin. The third and fourth numbers represent the tolerance radius along X and Y axis respectively. All values are in millimeters. The example of such file is as follows:

```
0.0 0.0 0.3 0.3
0.0 3.8 0.3 0.3
0.0 7.6 0.3 0.3
3.9 0.0 0.3 0.3
3.9 3.8 0.3 0.3
3.9 7.6 0.3 0.3
```

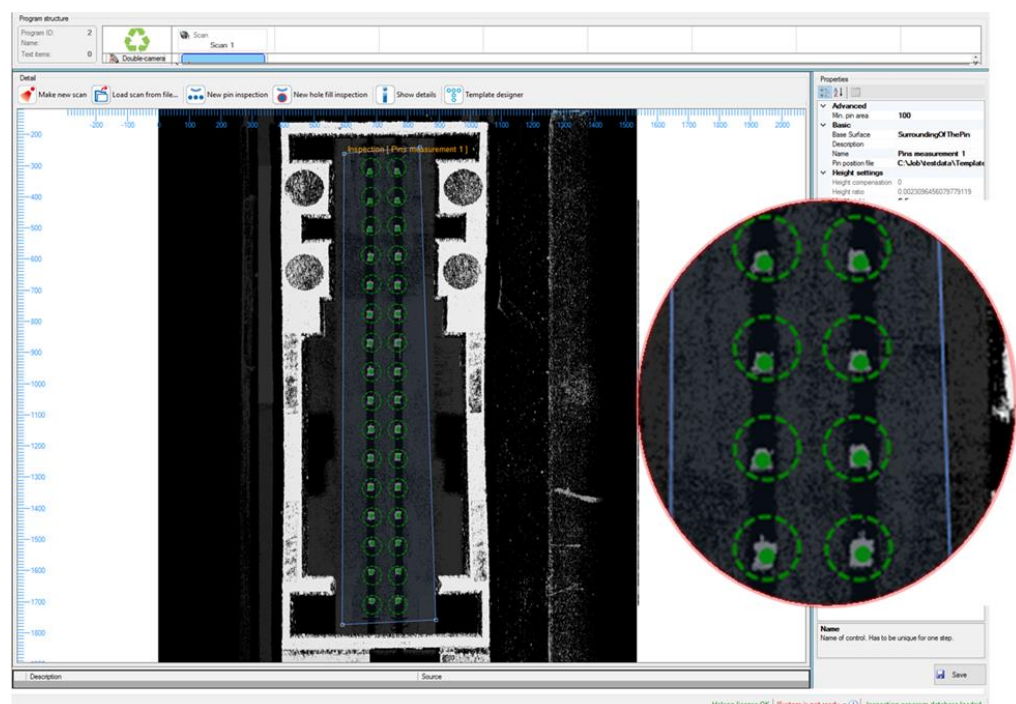


Figure 84 Dashed circle, represents the template's virtual tolerance hole.



This parameter needs to be set on the file, with pin positions in the inspection settings. The template will then be used as part of the measuring algorithm. Thus, all pins will come through the defined virtual tolerance holes. See image in [Figure 84](#).

7.6.4 How to assign an existing template to a selected Inspection

- Select your desired inspection, found in the Scan evaluation.
- Then set a path to the desired pin position file that you've previously created.
- The Pinspector application will immediately load the template and will calculate to fit the template into all pins existing in the selected inspection. The calculation is performed in a manner to minimize the distance between the real position and the relevant ideal position of all pins. In case when an inspected pin is surrounded with the appropriate element, then this element will turn green. Indicating that the pin has passed the inspection, or turns red for failed. The image shown on [Figure 85](#) is an example of the best possible fit with a sample of one pin failed.

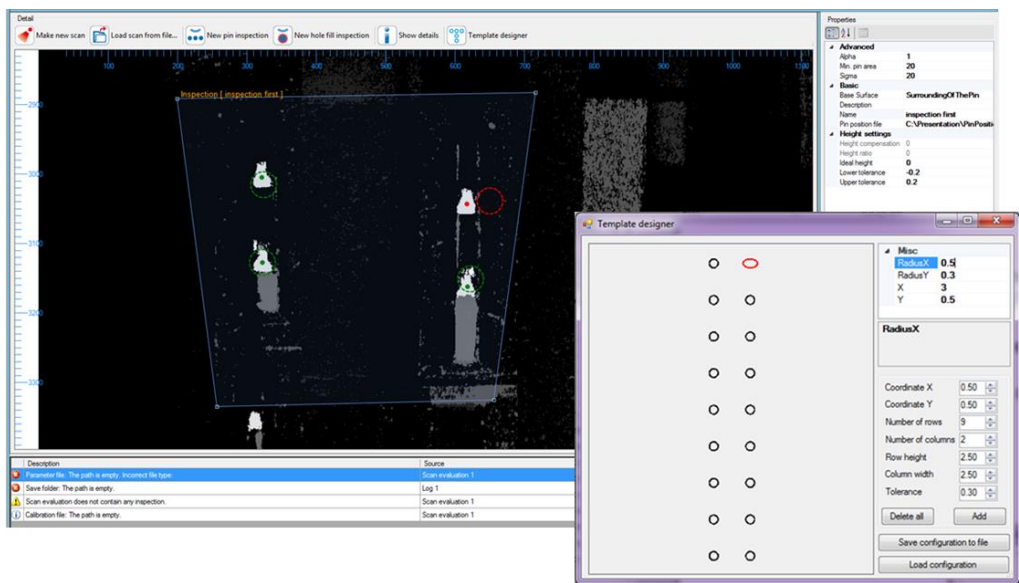


Figure 85 Template designer

7.7 How to determine the pin position in millimeters

- It is necessary to set the file path to the Camera's Calibration file, which can be found in the Parameter File with calibration.

Inspection properties → Advanced → Calibration file

- You can find this file in the Pinspector application Installation Directory in subdirectory configuration with name configuration.xml
- In case, there are more than one camera pairs in the system, then more files will be identified according to numbers. It will correspond with the concrete camera pair.

7.8 How to obtain the correct measured pin height

It is necessary to set the Height Settings for the given inspection in the Properties window. You should follow these steps:

- You must wait until the image acquisition is finished and image analysis is performed.
- Measure the several pins as accurately as possible from the given region, in order to know their real height in millimeters
- Then click (left mouse button) the pins in the image, to select the measured pins. These pins will then be added to the list displayed in the Properties window.
- To each added pin, you must enter the measured height in millimeters – the recalculated ratio will calculate automatically.
- Afterwards, enter the ideal height, the upper, and lower tolerance.



Due to different pin shapes, the algorithm does not measure the highest point of the pin tips. It utilizes a more rugged approach. Which is why we need to train the system with real pin samples of known heights. The Algorithm will use the provided real pin height to adjust the internal parameters, so that the system can measure more accurately.

8 Inspections

For each Scan evaluation block, it is possible to define any number of Inspections.

8.1 Regulated guidelines for the inspection

- The polygon defines the region of interest where the inspection is performed.
- The type of inspection should be performed within the selected ROI.
- Values of method settings and measurement algorithm.

8.2 Types of Inspections to add in the Scan evaluation block

- Pin hole fill inspection – is an inspection that searches for pins and their placement before press-fit.
- Pin height & position inspection – is an inspection to measure the pin position and height.

8.3 Guidelines in selecting the regions for pin analysis

One group of pins is defined as follows:

- Pins should be close to each other, having the same height and same width!



You should not place the pin in one region with different attributes/ characteristics!

- You must create the regions only in close approximation with the selected group of pins. Do not leave unnecessarily large spaces around the pins! On the edge of the region, you should leave ample space, similar to the distance between the neighboring pins.
- By dragging the vertices of the polygon, you can change the shape of the region.
- Combination of keys (Ctrl + left mouse button), enables the entire movement of the polygon region.



Each inspection has its detailed configuration. When selecting a particular inspection, click on the respective polygon and the configuration can be viewed/ modified in the Properties window.

8.4 Inspection configuration

After selecting the Inspection, its configuration will be displayed in the Properties window. For all types of Inspection, the following settings for the Properties window are available:

- Name – name of inspection used for referencing its results. This name has to be unique between all methods in one scan.
- Description – place for operating entity notices.
- Values for inspection algorithm – only the experienced operating entity can Edit the items in the Advanced category.



Inexpert editing of items in the Advanced category can result in non-functioning of inspection!

8.5 Pin-hole fill inspection

This Inspection recognizes the pin tips on the inspected board, and its placement before press-fit. After creating the polygon, the holes within the polygon will be automatically located. The position of the pins will then be derived from the hole position.

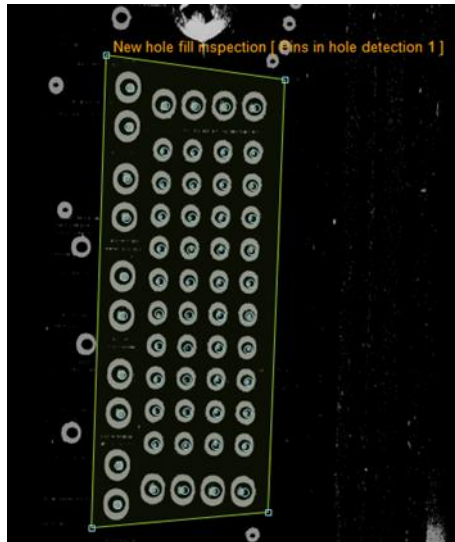


Figure 86 a sample of a New hole fill Inspection

Algorithm teach-in process

- During inspection definition, the Algorithm attempts to detect and familiarize the position of the pin holes.
- Algorithm that runs during measurement uses the trained position to identify whether the defined position is composed of empty black circle. Emphasizing whether a pin is missing in the pin hole.



The Algorithm can sometimes fail to automatically find the pins in holes during the teaching process. The Algorithm tries to find the circles during the teaching process. We highly recommend scanning the conductive rings without the positioned pins.

8.6 Pin height and Position inspection

This inspection measures the height and position of pins, either for connector pins or PCBs. The height of pins can be measured in two ways.

8.6.1 Types of approach to measure the height and position of pins

Height measurement relative to the pin surroundings

- After pin detection, the pin's surrounding is then set as the reference plane.
- The pin height is then measured from this plane.

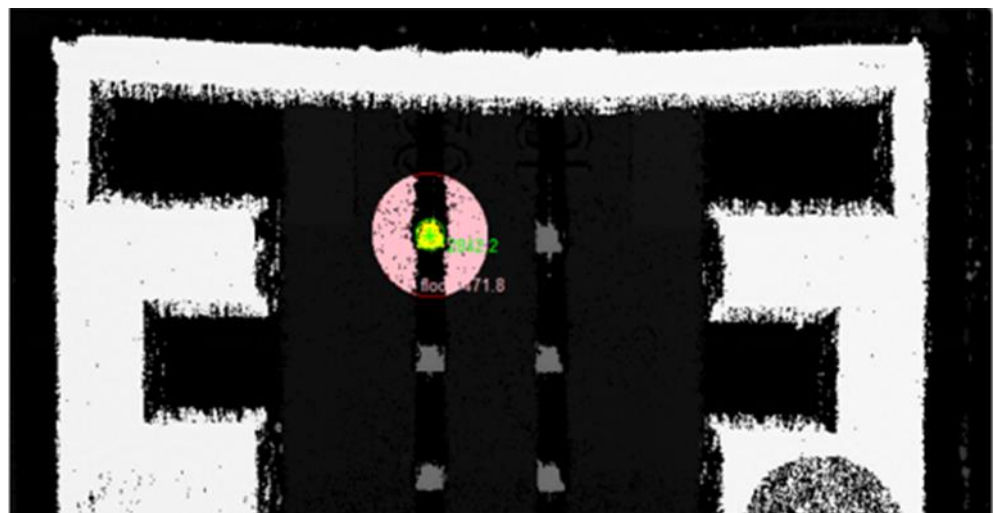


Figure 87 the pink color represents the pin surroundings.

Height measurement relative to the reference plane

- It can be used if the bottom of the connector is not visible due to height of the connector housing side walls. Additionally, it is also used for rugged pin surroundings (insufficient depth of field).
- The reference plane will be defined using four points.

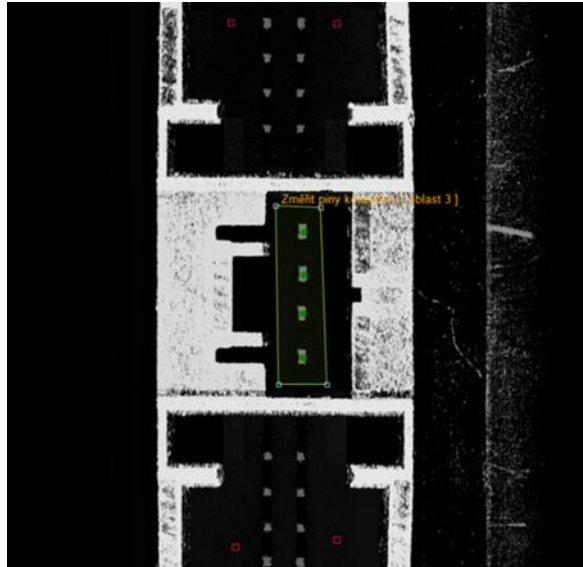


Figure 88 selecting the reference points, defining the virtual plane using 4-points



These points are in a form of small red squares, see [Figure 88](#). We need to place the red points as far as possible from each other. Leaving enough space will minimize the occurrence of error, especially when the system is generating the reference plane.

The pin positions are inspected using the defined template. The file defined through the parameter Template file is found in the Properties window.

9 Pinspector variants and system geometry

Overview:

- Ranger camera variants used for the Pinspector system
- System configuration
- Cameras and laser line

9.1 Pinspector D1

- Consist of Single-camera/ aka Ranger D50 camera, line laser, and Pinspector software (cables and encoder).
- Value solution, used for less demanding applications
- Suitable for measuring 3D only in applications without high-speed requirements.
- The scanning speed is from 200 to 1000 scans per second (depending on the number of utilized rows in the camera sensor).

9.2 Pinspector E1

- Consist of Single-camera/ aka Ranger E50 camera, laser line, and Pinspector software (cables and encoder).
- Faster solution with scanning pace from 1000 to 6000 scans per second (depending on the camera configuration).



Pinspector E1 and D1 versions are also called as Single-camera. The image on [Figure 90](#) represents the most conventional configuration used which can be further modified.

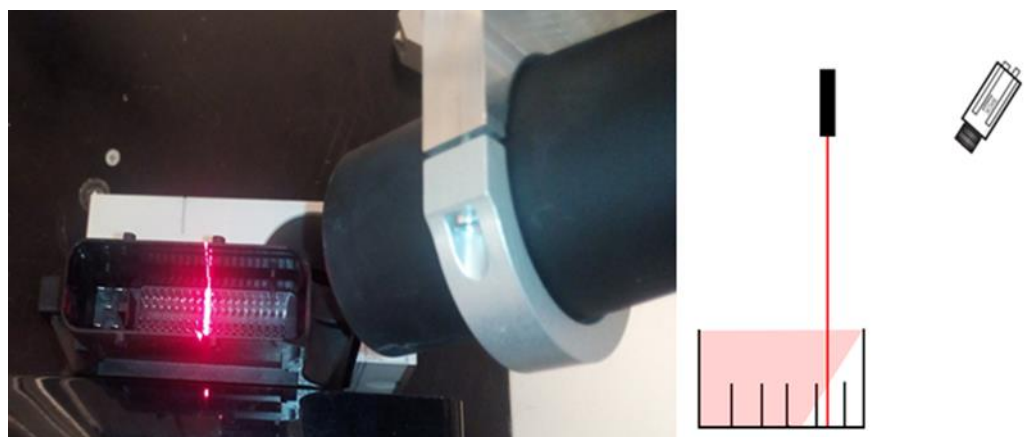
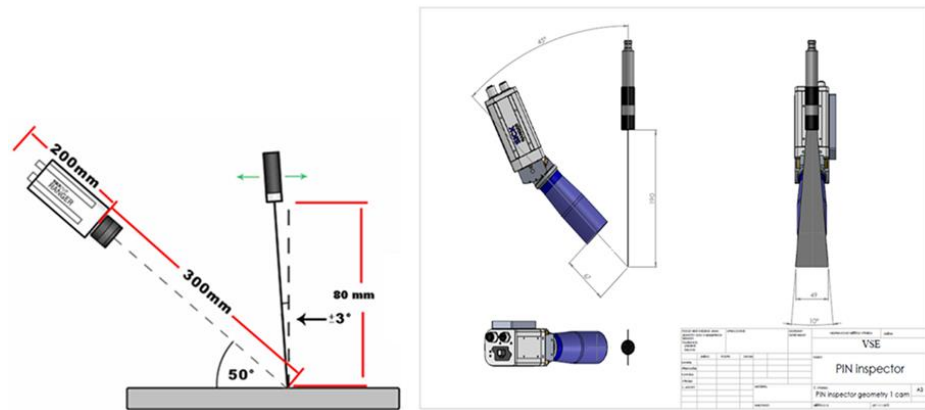


Figure 89E1 and D1 triangulation geometry

Figure 90 E1 and D1 triangulation geometry



9.3 Pinspector E2

- Consists of two Ranger E50 cameras, line laser and Pinspector software (cables and encoder).

By using Pinspector E2, the cameras simultaneously captures the scans on each side of the connector pins. Camera one detects and camera two complements the missing data. As a result, a single scan is produced containing all aspects of the pins. It can be used as a source for image analysis. Double-camera is highly recommended to prevent shadow occlusions.



Please be informed that Pinspector E2 version is also known as Double-camera.

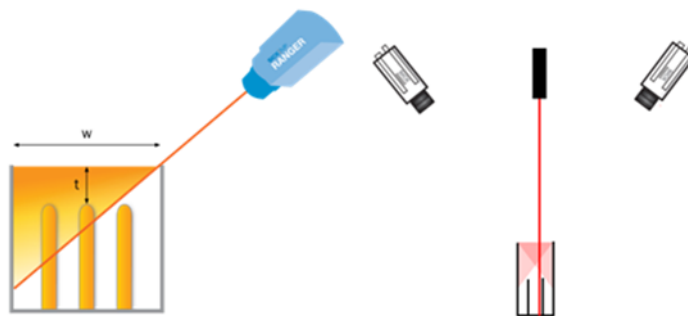


Figure 91 E2 version / Double-camera

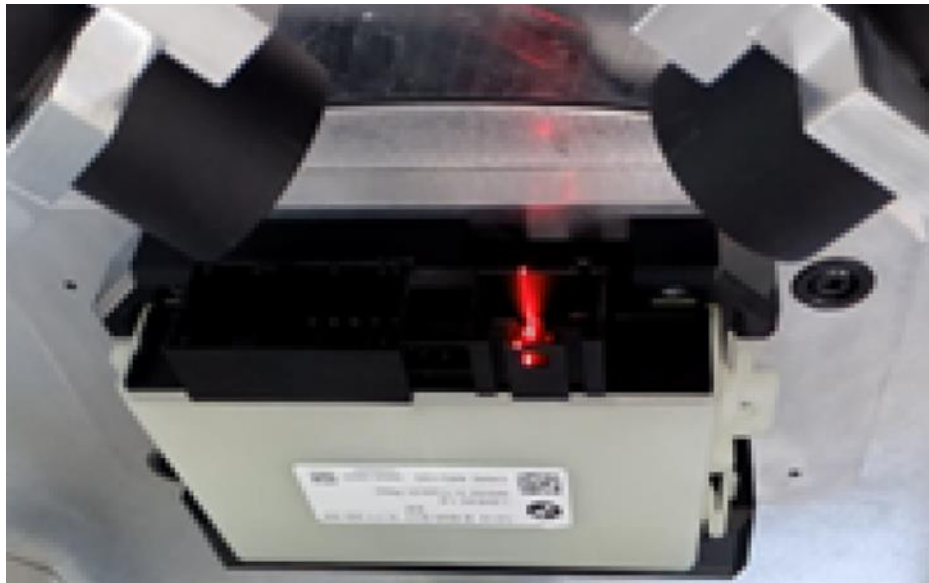
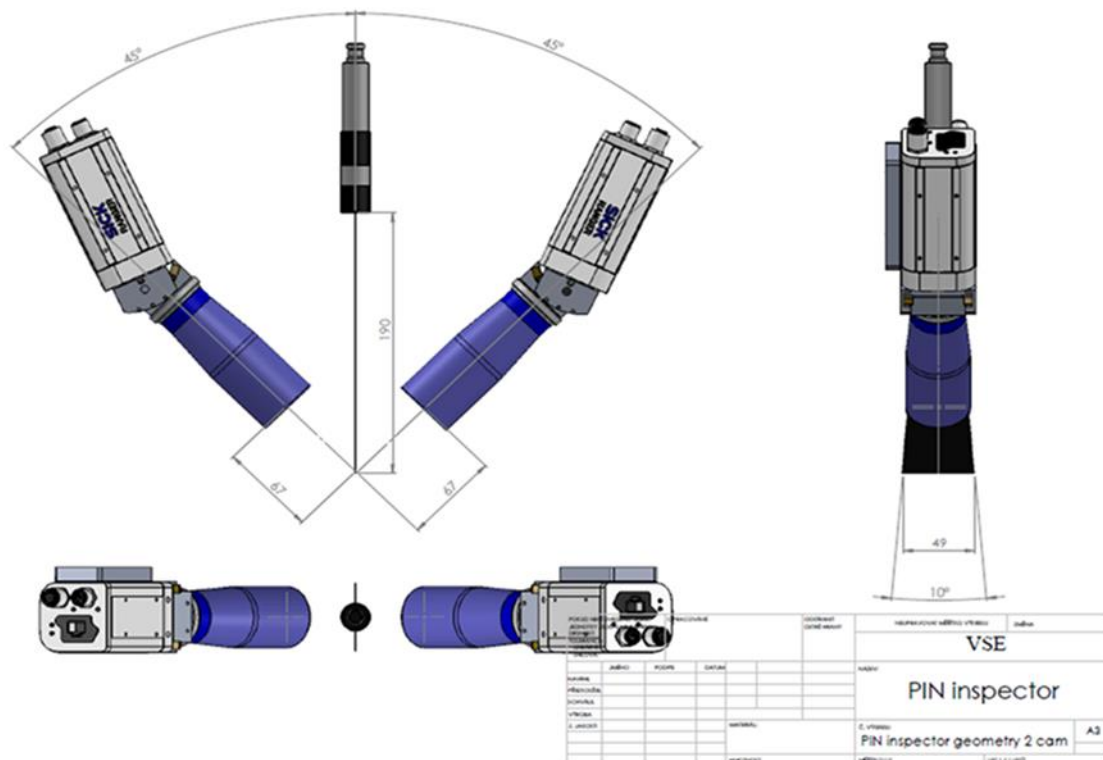


Figure 92 Triangulation of actual cameras & laser line



You can learn more about Ranger E1, D1, and E2, by referring to the Ranger E/D Operation manual.

9.4 Factors of shadow occlusion

- The camera is not able to view behind the object's features.
- Because of the fan angle of the laser, where the laser line itself can be occluded.
- The laser triangulation is not suitable for scanning the parts of an object located behind high features.

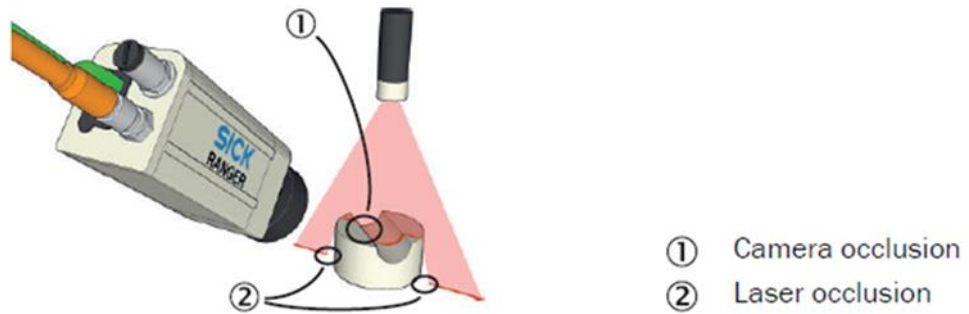


Figure 93 Different types of occlusion (source: Ranger E/D Reference Manual)

9.5 Types of shadow occlusion

- Camera occlusion – based on the camera's perspective, the object that the camera needs to view is hidden (occluded) by another object. E.g. when the camera cannot detect the laser line on the object.
- Laser occlusion – is where the laser has no information about the focused object, because the light is blocked (occluded) by another object. E.g. when the laser cannot properly illuminate the parts on the object.

Connector pins are placed deep in the connector. Resulting with a situation where some pins are located behind the side wall of the connector housing, leaving these pins not visible to camera.

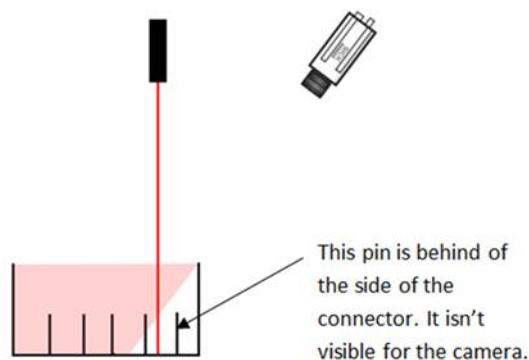


Figure 94 The white shade represents the restricted area from the camera's visibility.

The inspection of pins inside the connector, usually requires the use of Double-camera. Used to effectively inspect the pins that are beyond the edge of the connector, as well as for pins that are positioned deep inside the connector. This configuration can prevent the occurrence of occlusion shadow.

This issue can be resolved by using two cameras, see [Figure 95](#). We can scan all the pins in the connector utilizing this approach.

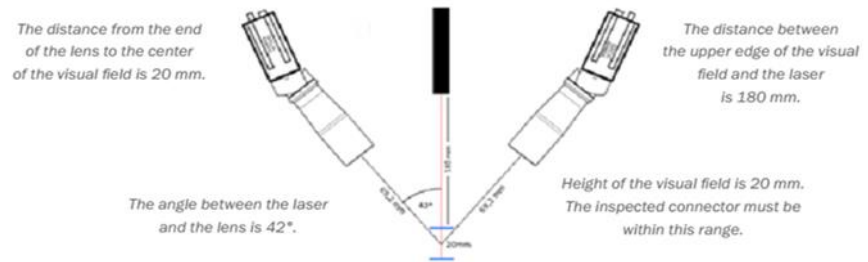


Figure 95 Double-camera configuration



The size of the hole/ slot must be twice bigger than the distance between the top of the pins and edge of the connector. Please see the comparison in the configuration shown in [Figure 96](#) and [Figure 97](#).

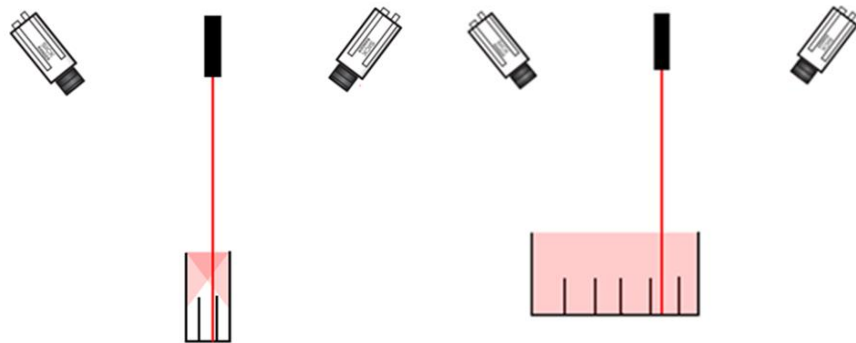


Figure 96 Narrow/ restricted space of connector box

Figure 97 Wider connector box

10 Advanced applications

The Pinspector application contains considerable number of settings that are inoperative for the average operating entity. However, Pinspector enables more experienced operating entity to control every aspect of the measurement. Pinspector troubleshoot the problems to quickly analyze the situation and acquires an immediate solution.



Editing of items performed by inexperienced editor, in the Advanced category, can result in non-functional measurement.

10.1 Parameters for inspection Algorithms



Advanced operating entities who are familiar with the principles of Scan evaluation, are the only ones who can change the algorithm settings. Changing the values unskillfully can lead to incorrect measurement evaluation.

10.1.1 Pin- hole fill inspection

Principle of the inspection is the detection of empty circular shapes on the board scan. The Pinspector application detects for bright pixels (representing the pins) that can be found inside the circular shape form. If an empty circle is not found in the area where pin is expected, then the hole is considered to be filled and pin is detected.

The inspection has the following settings parameters:

- Minimal hole area – minimal number of pixels for detected hole.
- Maximal hole area – maximal number of pixels that should have the detected hole.
- Minimal circularity – minimal circularity of the hole. Circularity is described using the following relation:

$$C = \frac{F}{max^2\pi}, \quad (1)$$

Where F is the space of the region, max represents the maximal distance of the edge of the region from the center. Circularity is equal to 1 for circular region and less than one for every other.

- Maximal circularity – maximal value of circularity for the hole (defined with the deformation of the scanned image).
- Hole radius addition – number of pixels added to the calculated hole radius.
- Half of annulus thickness – half of the hole thickness in pixels.
- Black pixels in the ring – participation of black pixels in the hole ring.
- Participation of detected pin – participation of non-black pixels in the hole to be sure that the hole is correctly filled with the pin.
- Scale Y – relation of Y axis to X axis. If the image is scaled using this value, then the real proportion will be received. Usually the image is slightly deformed caused by the scanning pace.
- Local area radius – size of area around the defined pins. This value is used in case when around the pin is also the scanned board. If the board is not visible, then the hole is not detectable. It is not possible to determine if the hole is correctly filled.
- Minimal non-black pixel ratio threshold for finding the measurement – minimal ratio of non-black pixels for detection of board in the pin surrounding.
- Halfway pin threshold – threshold for pin detection for those pins that are not correctly placed.
- Threshold for height of board – threshold for detection whether the board is in correct height. If the height of the board is different to the taught-in position and the difference is greater than this value, then it is marked as wrong.
- Threshold for pin detection are not properly placed.

10.1.2 Method Connector pins measurement

This method enables the measurement for height and position of pins in the connector. This method has the following Parameter settings:

- Min. pin area – minimal number of pixels for detection of pin.

10.2 Administration console

Administration console can be displayed by clicking on the Pinspector main menu (Help -> Admin console). This window enables the detailed inspection of the measurement procedure. It is used for analysis or simulation purposes to control the system's behavior.

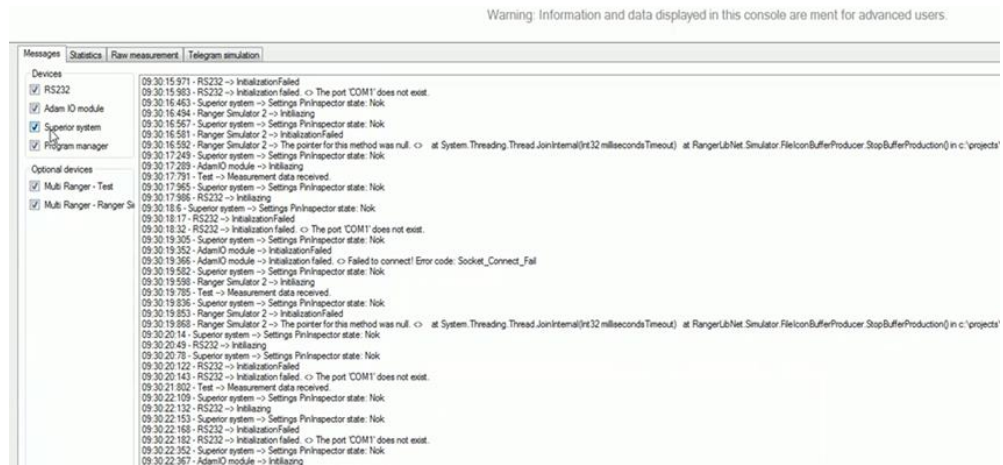


Figure 98 skilled programmers use the message file for system analysis

The Administration console is composed of two Tabs:

1. System Messages Tab
2. Telegram simulation Tab

10.2.1 System Messages Tab

The System message tab will display the messages in real-time sequential manner, including the recorded time stamp.

The time format: hour.minute.second.millisecond.

You can proceed as follows:

- When you click the Administration console (found in upper right corner of the Program me), in the Help menu

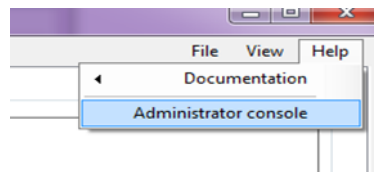


Figure 99 Administrator console

- The diagnosis box will display a stream of incoming and outgoing information from the Messages tab, see [Figure 98](#) on [page 126](#). You can control the status of the system and identify any existing problem or error.



If you'll find any errors, please send the Messages file to your SICK Company representative. Sending the Message file helps minimize on-site diagnostic hours and in a timely manner.

10.2.2 Telegram simulation tab

The Telegram simulation tab is used to simulate telegrams transmitted from the control system to Pinspector application. The defined messages are then sent to the control system.

For two available serial ports connected with LapLink® cable. You can use this tab to simulate the received telegrams from the control system.

- COM port – you can choose a number of a free port on the computer (RS-232 COM port should be selected in application settings).
- Open – the selected port is opened to rate 9600 bauds (the same rate must also be given on a second port in the application settings).
- Telegram – enter the telegram that you want to send. STX, CHK, and ETX will be added automatically to the telegram.
- Send – sends the telegram.

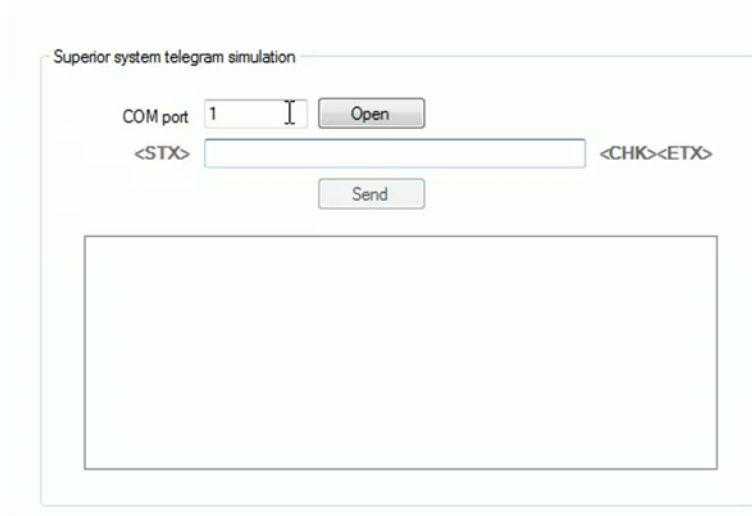


Figure 100 telegram simulation dialogue box



Input of text STX, CHK, and ETX, will be added automatically to the telegram, necessary for the telegram.

11 Maintenance

Overview:

- Ranger camera and Laser
- How to handle and keep the lenses clean

11.1 Care for Ranger camera and laser



Turn off the laser power before maintenance!

If you are using a Ranger camera with a laser accessory, then the power to the laser must be turned off before performing any maintenance. Failure to turn-off this power when maintaining the unit, may result in hazardous radiation exposure.

11.2 Lens care

- You must clean the lens (coated glass) carefully with the use of a soft, damp cloth (using a mild cleaning agent).



We only recommend cleaning the lenses when necessary. Proper maintenance will render full reading rate of the lenses.

12 Troubleshooting

Overview:

- How to identify Errors & Faults
- How to resolve the problem using the Measurement Tab
- How to resolve the problem using the Settings Tab
- How to save the Messages file from the Administration console
- Who to contact for assistance



You can be able to identify the errors & faults by opening the Measurement tab or Settings Tab.



Green – colored text indicates that the program is OK/ Ready to start.

Orange – colored text indicates that the program has some faults but can still be run, and it is still possible to continue the measurement.

Red – colored text indicates that the program cannot be executed, and you must contact immediately a skilled Professional to resolve the problem.

12.1 Measurement Tab

- You may check the errors in the system, the Program Status will indicate:
 - **Red** colored text status, that indicates Failed measurement
 - **Green** OK colored text indicates that the system is ready for measurement.
 - **Orange** colored text indicates that the program has an occurring error.

- When you click the Check button, the "Result of program syntax check" will appear.

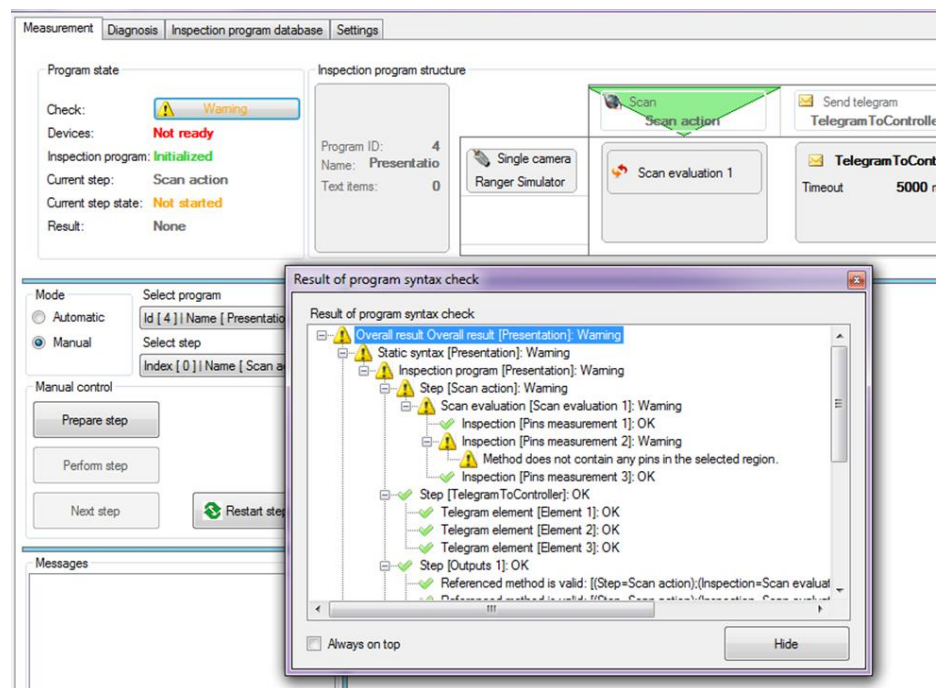


Figure 101 Measurement Tab displays the "Results of program syntax check"

12.2 Application status bar

- You will find at the bottom right corner of the window, the system will indicate:
- !System is not ready - Red colored text.
 - OK - Green colored text.
 - Orange colored text indicates that there is an existing system fault. You can monitor it in the „result of the program syntax check“ dialog box.

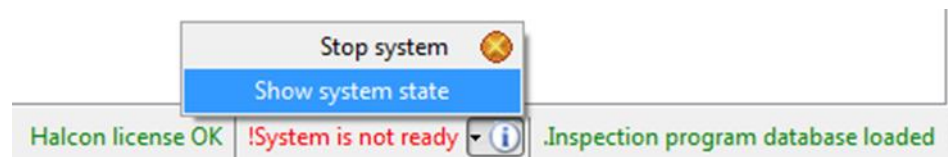



Figure 102 Application status bar



When you click the  INFO symbol, it will display the “Show system state” menu showing the status of the system. The window will show the list of occurring defects, it will also inform and assist you on how to resolve the problem.

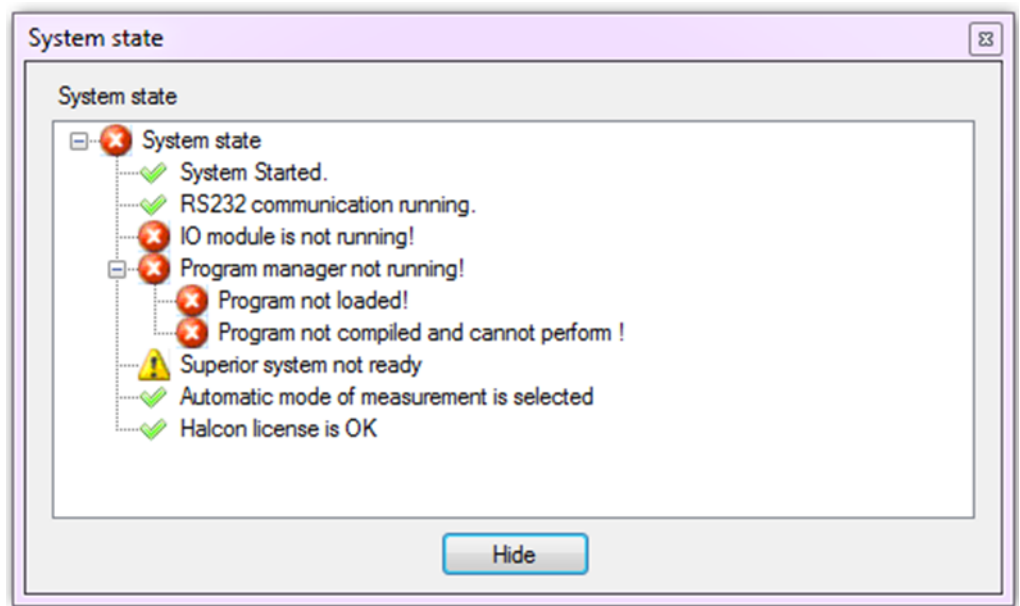


Figure 103 System state dialog box

12.3 System messages file

You can utilize the system messages tab to track the messages in the system. The messages are displayed in a sequential manner, alongside with their designated time stamp.

Please follow the guideline to save the Message file:

- Go to the Help menu (on the upper right corner), and click Administration control, the administration console dialog box will then appear.
- At the bottom left corner of the Administration dialog box. Tick Save on the check box, to automatically save your messages into the Pinspector Folder.

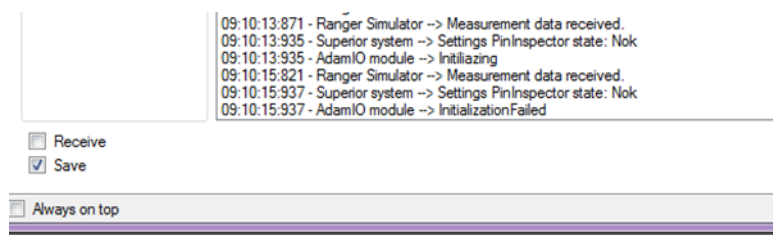


Figure 104 Message file

- Go to the main Pinspector folder.
- Double-click the messages folder. Once clicked, it will show all messages that you've recently saved.



12 TROUBLESHOOTING

If you found any error in the system, send your Message file in advance to your SICK Company representative. Sending the message file in advance will render an efficient diagnostic analysis in a timely manner.

SICK has a global network of subsidiaries and service technicians, providing you faster and more efficient support at any time. If you have any questions or problems with Pinspector system, please don't hesitate to contact your SICK Company representative.



Please refer to [Section 10.2.1](#) as of [page 127](#) for further details.

12.4 How to properly align the laser with the camera

Ranger image mode can be used to check if the laser is in correct position. Focus plane for the lenses with Scheimpflug adjustment is quite shallow and in constant distance from the lens. It is set perpendicular to the board plate see [Figure 105](#)

Telecentric lens TCSM024 has a range of 3-mm depth of field (DOF), which will make it easier to detect if the object is out of focus.

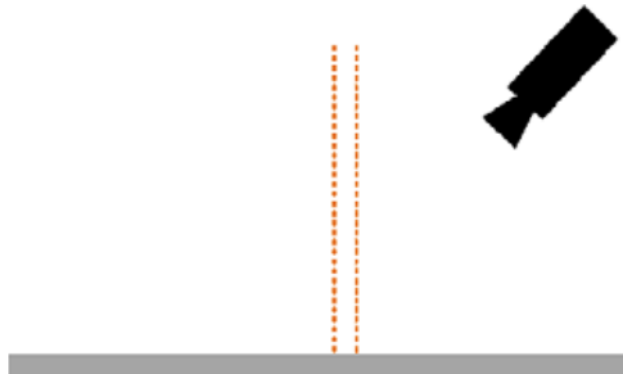


Figure 105 Focus plane set perpendicular to the board plate

Objects will be correctly focused between the two orange dashed lines. The laser light must be within this region, otherwise proper 3D data from the camera cannot be acquired. See [Figure 106](#)

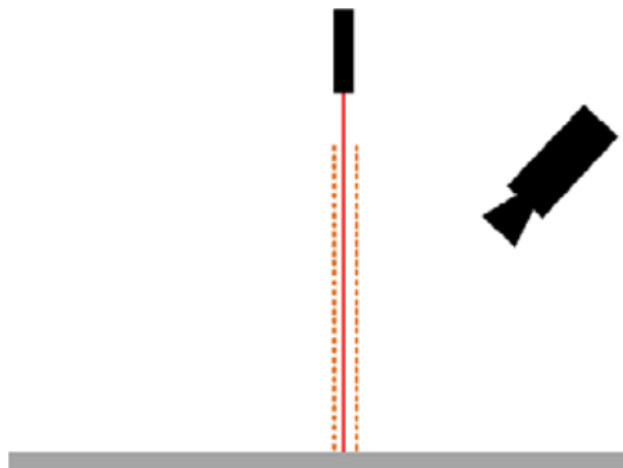


Figure 106 laser light positioned within the laser dashed lines

To properly align the laser, please proceed as follows:

- Use Ranger Studio to detect the focused region.
- After connecting to Ranger (with the Connect button), select Image mode.
- After pressing the start button, 2D image from the camera will be displayed.
- In case the images from camera are very dark, you must increase the exposure time. It can be done in the Edit window. You can open this window by clicking the Edit button on the left side of the main window. Select Image mode and the Exposure time parameter should appear. You may adjust these parameters to brighten or darken the images. External light can be also used to improve image quality. The Lens has highest F-number (8), so images are quite dark with default exposure values.
- The focus plane must be detected in order to position the laser correctly. It will be helpful to use a box or any other rectangular object with any printed text on its side to find the focus plane. When the text appears sharp, it means that the focus plane have been established.
- The laser line must be positioned on the edge of the box to ensure that the laser line must be within the focus plane. See [Figure 107](#)

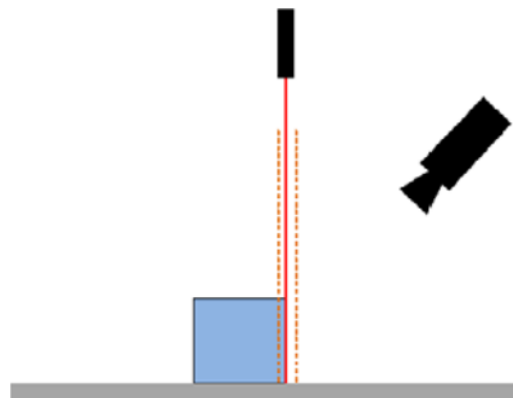


Figure 107 laser line positioned at the edge of the box



Please check if the laser projector is properly focused. Use the focusing screw on the laser to focus the laser correctly. The laser line will appear very thick when out of focus, thus the laser line should be as thin as possible.

13 APPENDIX A: Technical Data

Advantech *ADAM - 6060		
IO Module	Display	
	LED Indicators	Status, Comm, Link, Speed
	Voltage supply	
	Power Requirement	10 VDC~30 VDC
	Digital I/O	
	Frequency Input	DI counters (32-bit + 1-bit overflow, 3 kHz max.)
	Input	Channels - 6
	Output	Channels - 6-ch relay support pulse output
	General	
	Watchdog Timer	System (1.6 seconds) & Communication (programmable)
	Peer-to-Peer	Yes
	GCL	Yes
	Communication protocol	Modbus® TCP, TCP/IP, UDP, and HTTP
	Connector	1 x RJ-45 (LAN) & 2 x plug-in terminal block (I/O and power)
	Input voltage	Dry contact: Logic level 0: close to GND Logic level 1: open Wet contact: Logic level 0: 0 VDC~3 VDC Logic level 1: 10 VDC~30 VDC
Web language support	XML, HTML 5, Java Script	

*For detailed information about ADVANTECH ADAM - 6060 product specifications, please visit their website at: http://www.advantech.com/products/a67f7853-013a-4b50-9b20-01798c56b090/adam-6060/mod_c3b0fabb-dce7-4a64-bcb7-7e0cbfda0364

14 APPENDIX B: Camera and laser line Set-up guide

This chapter will provide you instructions and information on how to set up the cameras and laser line.

14.1 Ranger Geometry and Laser line geometry

The geometry of the optical components of Pinspector system depends on the specific requirements for pin inspection. For press-fit it is typically used the configuration shown in Figure 108

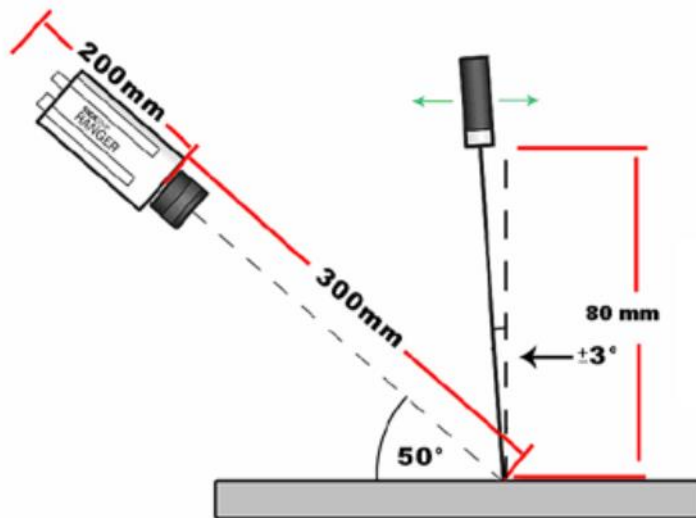


Figure 108 Ranger E1/D2 version, suitable for press-fit configuration

Inspection of pins in the connector usually requires using two Ranger cameras. Providing accurate inspection if the pins are sticking out of the connector box. The configuration in [Figure 109](#), is typically used for pin inspection inside the connectors. This configuration can prevent the occurrence of shadow occlusions.

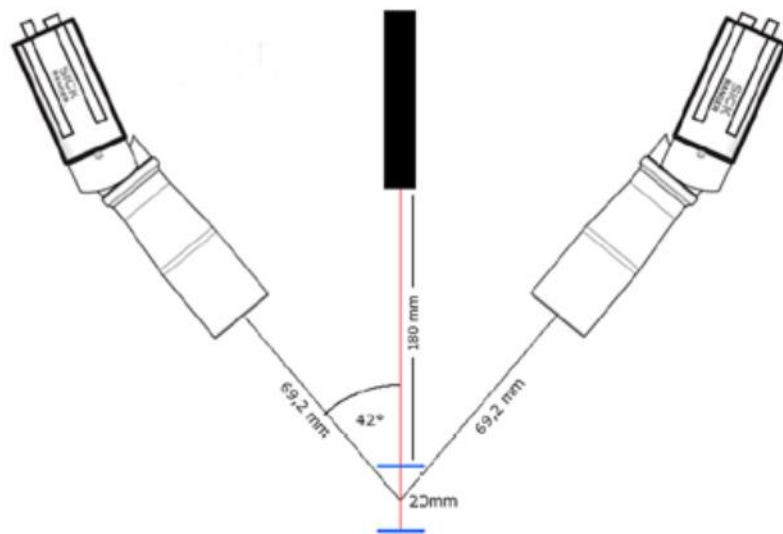


Figure 109 Ranger E2 version or Double camera scanning, suitable configuration for pin connectors

- The distance from the end of the lens to the center of the visual field is 20 mm.
- The distance between the upper edge of the visual field and the laser is 180 mm.
- The angle between the laser and the lens is 42°.
- Height of the visual field is 20 mm. The inspected connector must be within this range.



All actions can be accomplished using drag & drop approach. It doesn't usually require any outsourced assistance.

14.2 Pinspector Communication

The following table illustrates the communication between the PC and the control system (PLC). The communication utilizes R232 telegrams and digital module ADAM, containing 6 digital Inputs/Outputs.

Table 1 RS-232 Telegram PLC -> PC

Telegram direction	Name	Description
PLC -> PC	Program selection	<p>The telegram has the following features:</p> <ul style="list-style-type: none"> Telegram contains number of the Program, which is used in the next cycle. Telegram has to be received at the start of every measurement. If the telegram is received before the Program is finalized, then it will cause instant cancelation of the current Program. Thus, resetting the measurement from the beginning. Structure of the telegram is: <p><STX> 01 Program number TEXT<CS><ETX></p> <ul style="list-style-type: none"> <TEXT> - means that the telegram can contain arbitrary number of text values. These text values can be used further in Pinspector application. For example, to log images/result base on product ID sent as text value from PLC. It Acknowledgement telegram will be sent in the following format: <p><STX>01 <ACK or NOK><CS><<ETX>.</p>
	Step selection	<ul style="list-style-type: none"> This telegram select step, which will be used in next step. Structure of the telegram is: <p><STX> 02 Step number<CS><ETX></p> <ul style="list-style-type: none"> The sent Acknowledgement telegram format is arranged as: <p><STX>02 <ACK or NOK><CS><<ETX>.</p>
PC -> PLC	Result	<ul style="list-style-type: none"> This telegram is sent out when the Result Telegram Action is inserted into the Program. Structure of the telegram is: <p><STX> 03 result<CS><ETX></p> <ul style="list-style-type: none"> Acknowledgement telegram must be sent in the following format: <p><STX>03 <ACK or NOK><<CS><ETX>.</p>

Table 2 Digital inputs/outputs

Type	Name	Description
Inputs	Control system OK	Signalize the Pinspector that the supreme system is OK and that the inspection can commence. If not enabled, then the scans will not be processed!
	Control system NOK	Signalize the Pinspector that supreme system is NOK and the measurement cannot progress. If not disabled, then scans will not be processed!
	Prepare step	This input must be enabled at the time when next Program-Step can be prepared for performance. The Input Perform and Finalize step must be disabled, called Prepare step Command
	Perform step	This input must be enabled at the time when current Program Step can be performed. The Input Prepare and Finalize step must be disabled, called Perform step command
Outputs	System OK	This output is enabled when the following conditions are met: <ol style="list-style-type: none"> 1. All devices are initialized 2. Program is loaded and doesn't contain any errors.
	System NOK	This output is enabled, when one of the conditions mentioned for output System OK is not met.
	Step ready	This output is enabled, as soon as the Pinspector is prepared to perform actual step.
	Step in progress	This output is enabled until Pinspector finishes <ul style="list-style-type: none"> ➤ Current step
	Measurement OK	This output is enabled for a specified time, when the Program contains Result Outputs Step and condition programmed in the step is True. Otherwise, it is disabled.
	Measurement NOK	This output is enabled for a specified time, when the Program contains Result Outputs Step and condition programmed in the step is False. Any other time is disabled.

14.3 IO function and status codes

Table 3 The control system informs the Pinspector application about its state using this wire input wire.

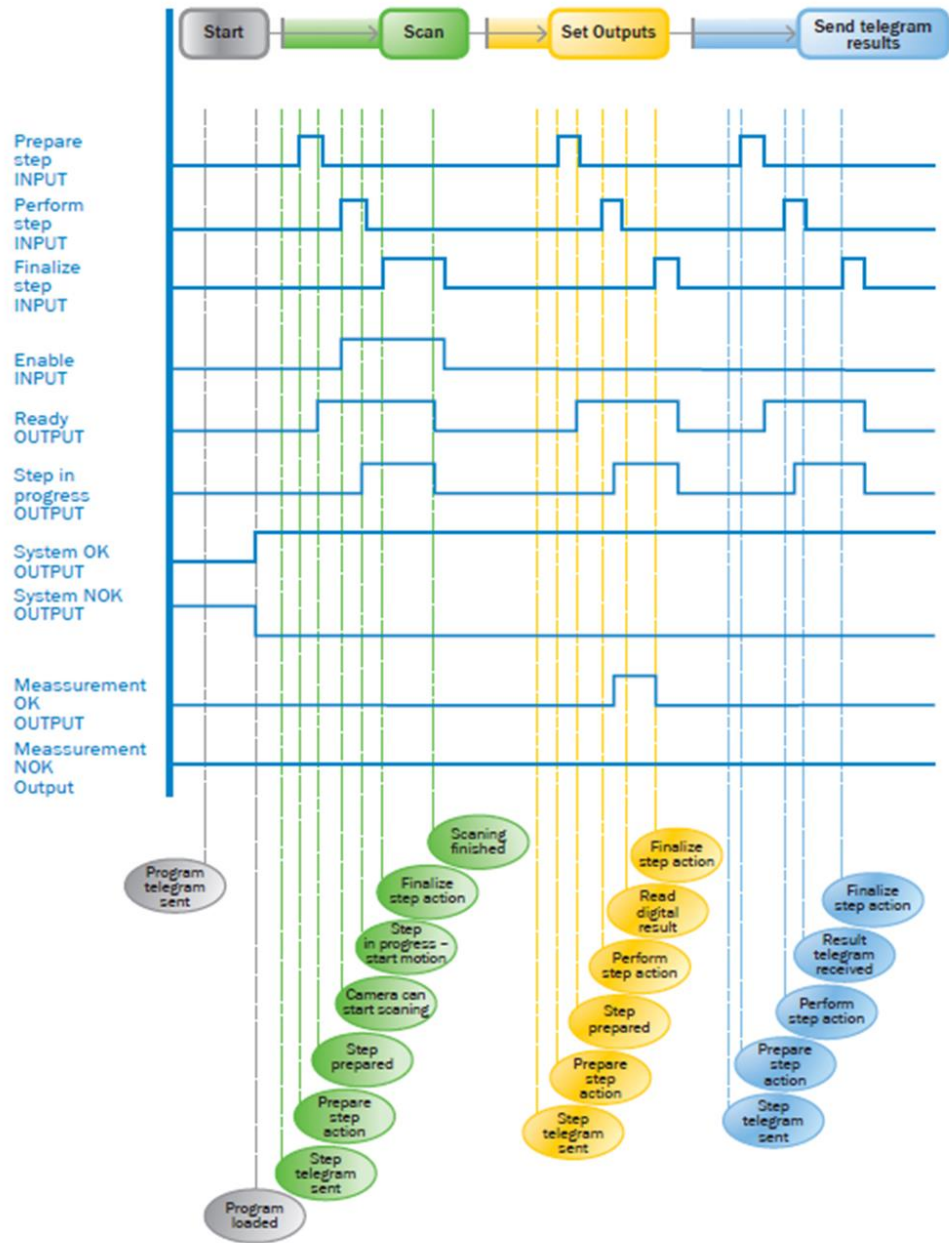
INPUTS results			OUTPUTS results		
ENABLED CODES	SYSTEM STATUS	FUNCTION	ENABLED CODES	SYSTEM DESCRIPTION	FUNCTION
0	Supreme System OK	PLC reports that it is ready for inspection.	0	System OK	When displayed, the system is functional and it can proceed to take measurements. Such status is reached after selecting a program for inspection.
1	Supreme System NOK	PLC reports that it is not ready for inspection.	1	System NOK	When displayed, the system's requirement to function was not fulfilled.
2	Prepare Step	Switching the input serves as a command, to select the next step in program and its preparation to start.	2	Ready	Indicates that the current program step is ready.
3	Perform step	Command to execute the currently prepared step.	3	Step in progress	Indicates that the current step was just executed
4	Finalize step	Command to finalize the current step, after it was completed.	4	Measurement OK*	The output is defined as the program step Set-up outputs (see Inspection Program Editor).
5			5	Measurement NOK**	The output is defined as the program step Set-up outputs (see Inspection Program Editor for more details).

*When the measurement result is entirely correct.

**If the measurement result is not entirely correct.

14.4 Pinspector program sequence

Table 4 Program diagram



14.5 Template designer parameters

Table 5 Parameters of template designer

Template designer Parameters	
Template position X	X coordinates of the center of top-left most element
Template position Y	Y coordinates of the center of top-left most element
Number of Rows	Number of rows to be added to a template
Number of Columns	Number of columns to be added to a template. The total number of elements added to a template given from the Number of Columns * Number of Rows.
Row height	Distance along axis Y between centers of two neighbor circles placed in the same column
Column width	Distance along axis X between centers of two neighbor circles placed in the same row
Tolerance	Tolerance of pin position. Maximum deviation along both axes X and Y. In this case Tolerance X = Tolerance Y.
Tolerance X	Tolerance/Maximum deviation along the axis X of selected element
Tolerance Y	Tolerance/Maximum deviation along the axis Y of selected element
X – Ideal pin position	X coordinates of the center of selected element.
Y – Ideal pin position	Y coordinates of the center of selected element.

15 APPENDIX C: Pinspector variants

Pinspector D1 (part number 1082566)

Pinspector D1 is based on 3D camera Ranger D50. It is the value system with feature restrictions using Ranger D camera – low scanning speed, fewer algorithm possibilities in the Ranger settings.

Pinspector E1 (part number 1082568)

This variant uses Ranger E50 camera. Otherwise, the accessories are the same as the Pinspector D1.

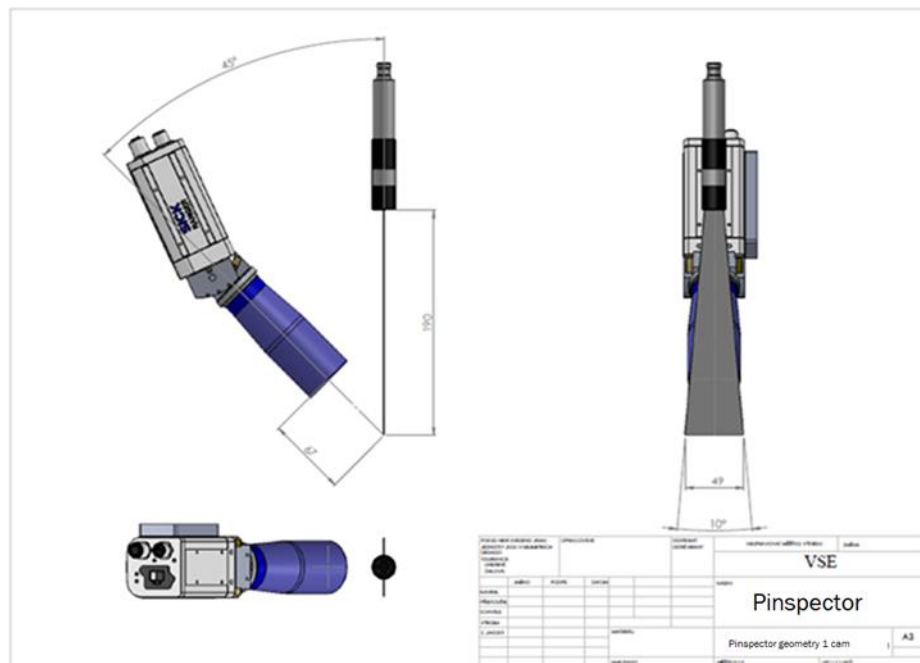


Figure 110 Pinspector E1/ D1 geometry with Scheimpflug lens

Pinspector E2 (part number 1082567)

Pinspector E2 is based on 2 x Ranger E50 cameras to eliminate the occlusion shadows projected by the connector walls.

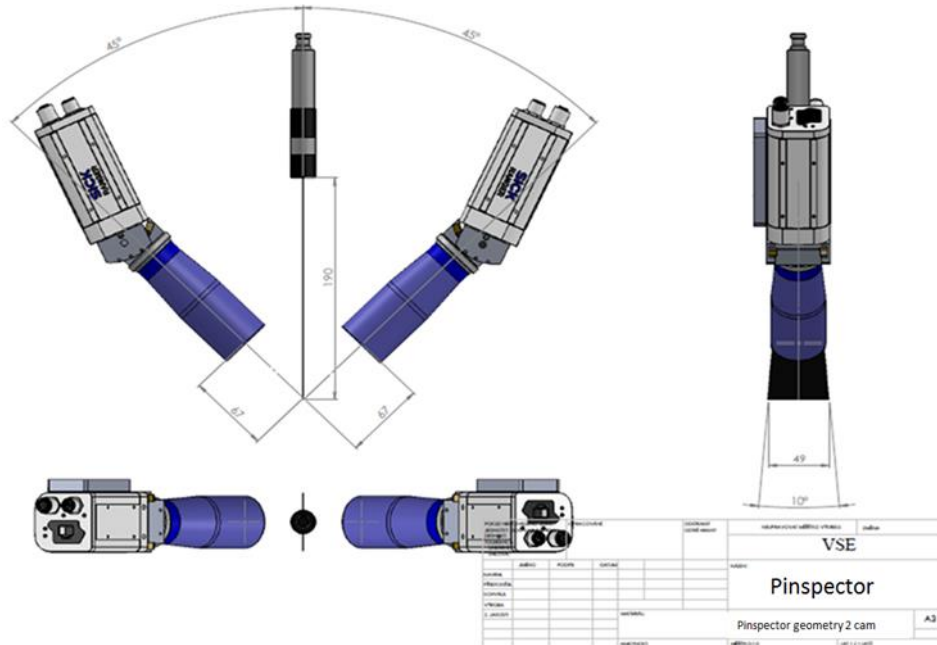


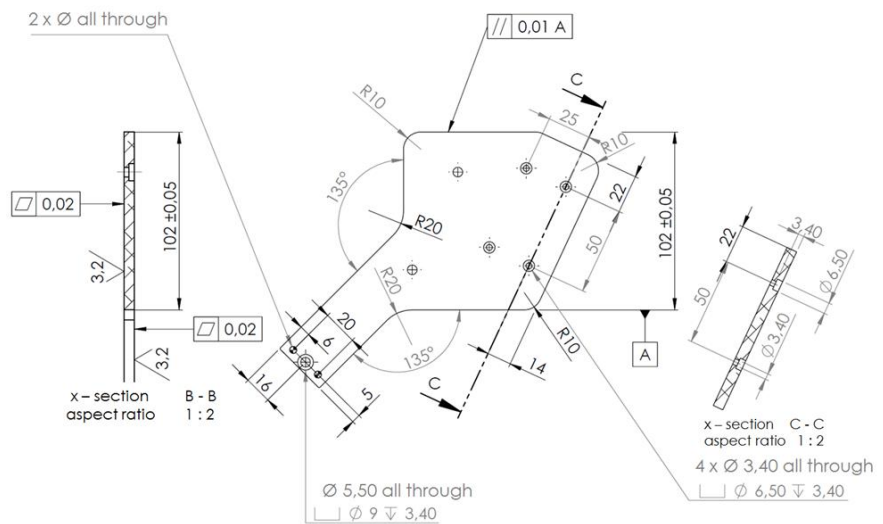
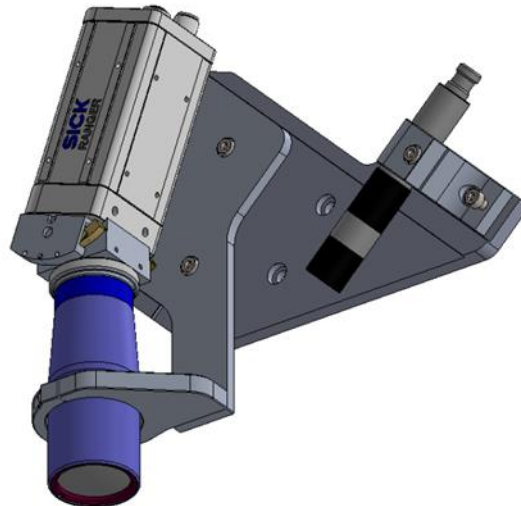
Figure 111 Pinspector E2 geometry with Scheimpflug lenses

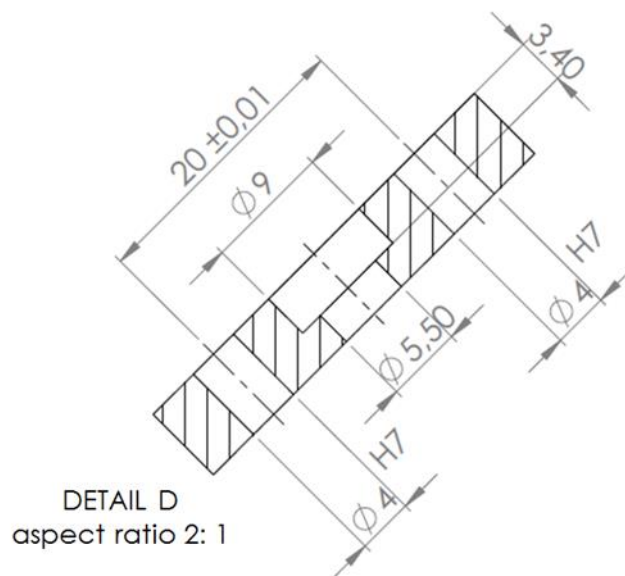
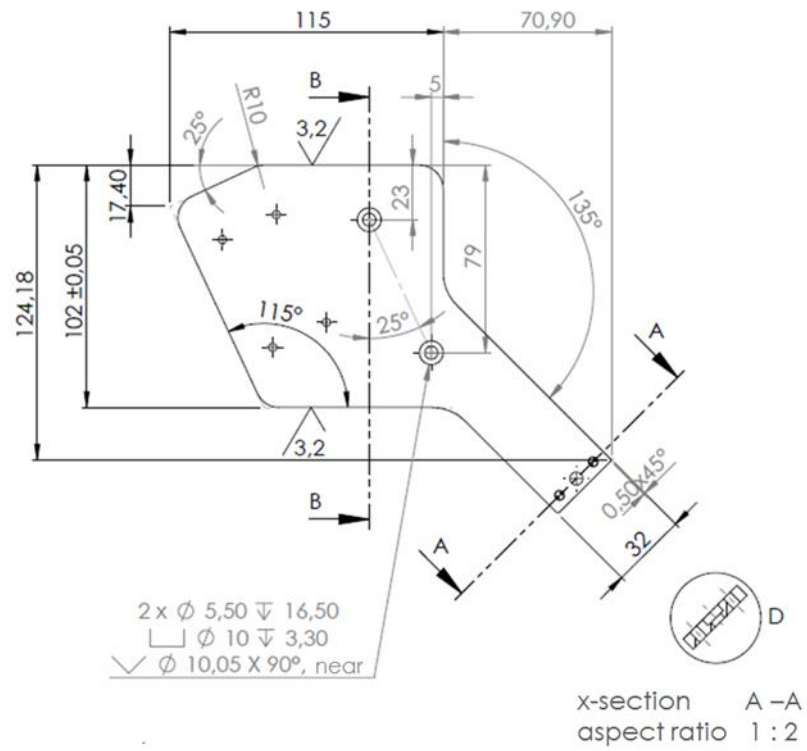


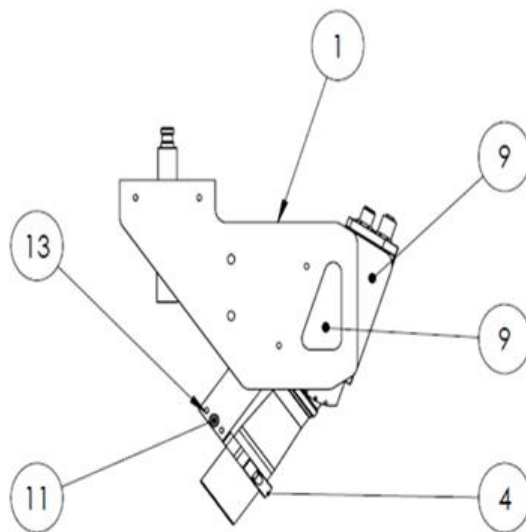
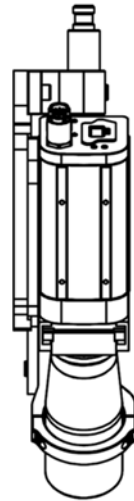
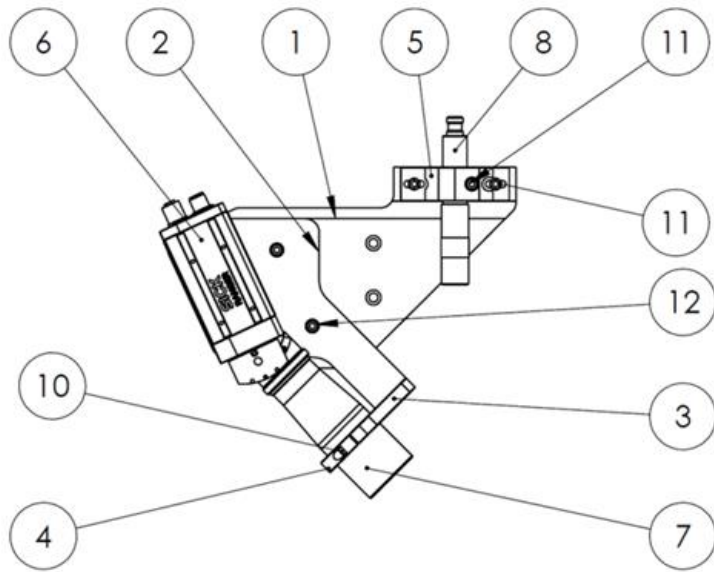
Figure 112 E1/D1 Variants and E2 Variants

16 APPENDIX D: Pinspector Mounting bracket and geometry

16.1 Pinspector E1 camera and base plate assembly







16 APPENDIX D: PINSPECTOR MOUNTING BRACKET AND GEOMETRY

Item number	Part number	Description	Quantity
1	Base plate 1 cam	VSE - Drawing	1
2	Plate cam 1	VSE - Drawing	1
3	Lens_holder_side	VSE - Drawing	1
4	Lens_holder_top	VSE - Drawing	1
5	Laser holder 1-2 cam	VSE - Drawing	1
6	Ranger	VSE - Drawing	1
7	Lens	TCSM024 Opto-engineering	1
8	Laser ZM18	Z laser	1
9	ISO 4762 M3 x 6--6N	Item	4
10	DIN 912 M3 x 16--16N	Item	2
11	DIN 912 M5 x 16--16N	Item	4
12	DIN M5 x 10--10N	Item	2
13	Parallel Pin ISO 8734 - 4 x 12 - A - St	Item	2
SICK - VSE			
PINSPECTOR E2			

16.2 Pinspector E2 camera and mounting plate assembly

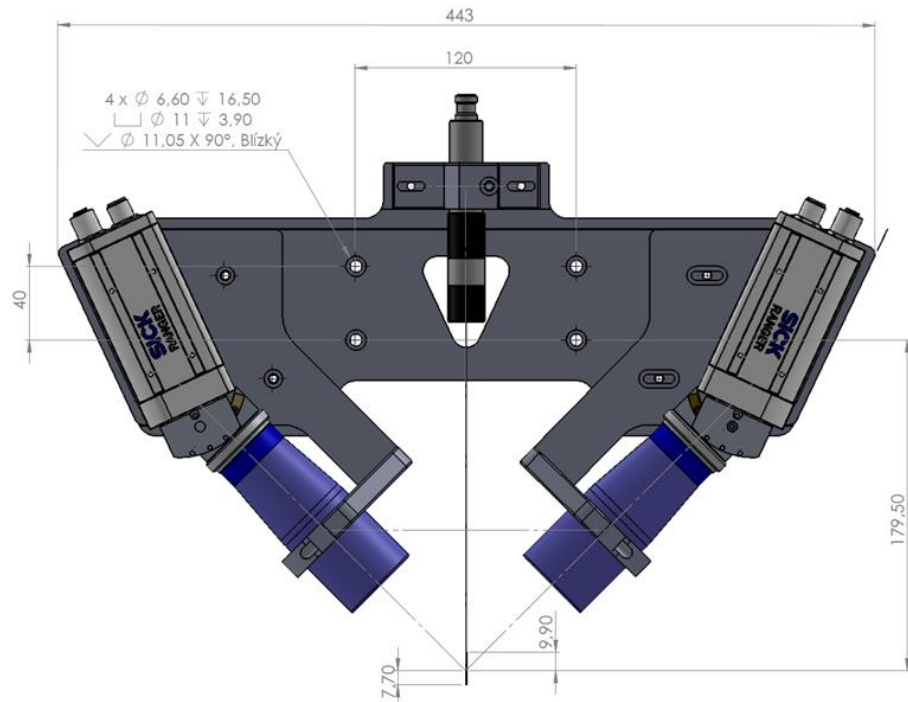
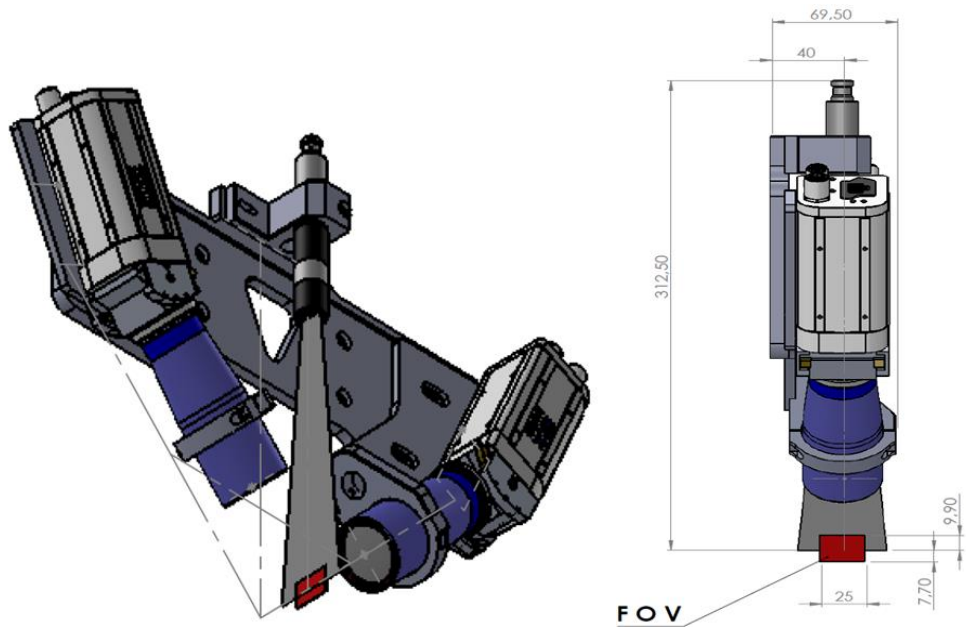


Figure 113 Pinspector E2 assembly



16.2.1 Pinspector E2 Possible Mounting plates

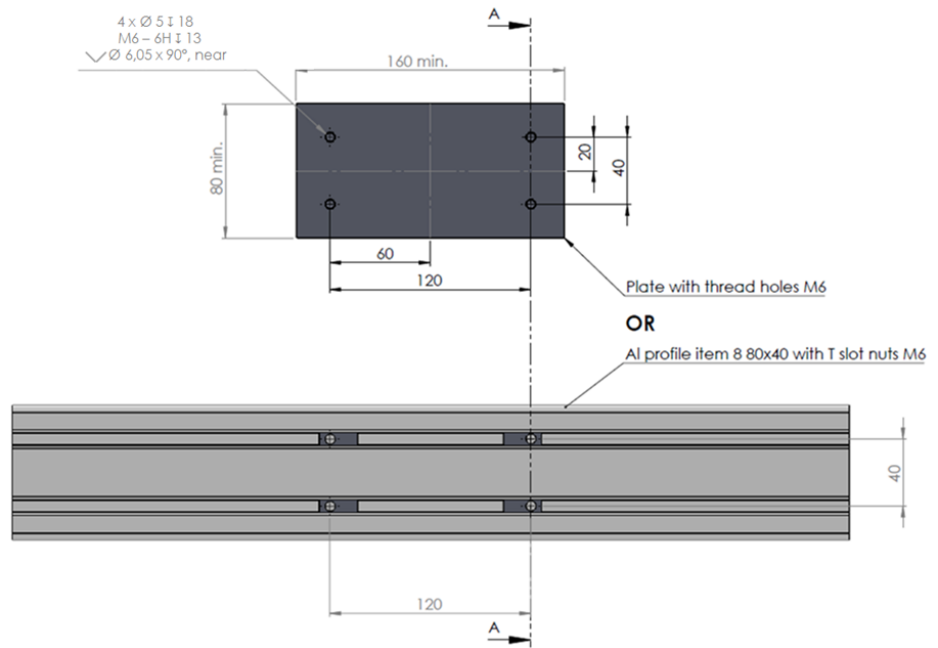
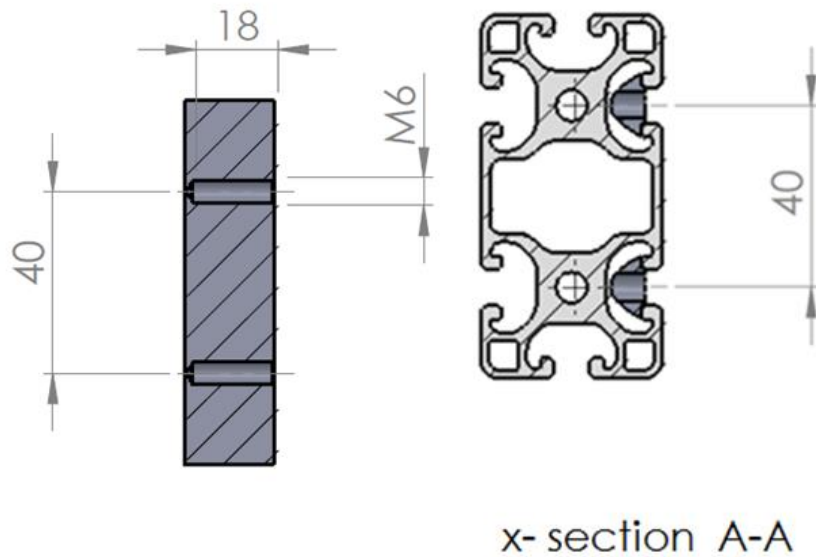
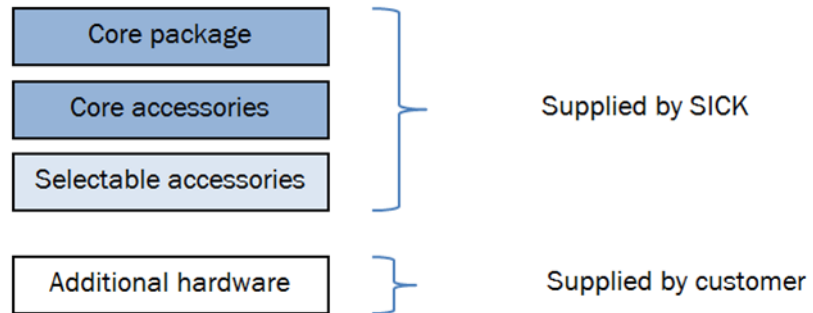


Figure 114 Pinspector E2 Possible Mounting plates



17 APPENDIX E: Pinspector items definition

The Pinspector system consists of three main packages supplied by SICK, and one package which is supplied by the customer or system integrator:



17.1 Pinspector Core package

The Pinspector mandatory Core package items are listed under one part number. See [Chapter 15](#) Pinspector variants

The items included in this package:

- Ranger camera/cameras (camera type is based on the Pinspector variant)
- Pinspector software license (the main Pinspector software package)
- Halcon license (mandatory item required by Halcon producer)
- Halcon dongle (USB hardware key)

1082566	Pinspector-D1001	Pinspector D1 Core package
1082568	Pinspector-E1001	Pinspector E1 Core package
1082567	Pinspector-E2001	Pinspector E2 Core package

17.2 Pinspector Core accessories

Pinspector system was designed requiring flexibility. The Core package is basically the base of the system with Core accessories, offering customization in case of customer special requirements. The Core accessories list can expand in the future based on the specific demands. VSE support team will always recommend proper setup, based on the respective application, and corresponding feasibility study.

- Line laser (red laser class 2 M with 10° fan angle)
- Triangulation mounting bracket (bracket for aligning camera with the laser)
- IO module (Ethernet – binary outputs converter)
- Lens (Bi-telecentric lens with Scheimpflug principle)
- Calibration target 125 mm (target used for after installation system calibration)

List of mandatory Core accessories

6062134	Z8M18S3-F-640-1p10	Line laser M18, 640 nm, 10°, 2 M class
6062134	BEF-PININS-002	Triangulation mounting bracket for E1, D1
2088777	BEF-PININS-001	Triangulation mounting bracket for E2
6062140	A-6060-eth	IO module Ethernet / 6 IN / 6 OUT
5334447	TCSM024	Bi-telecentric lens
2088775	PINCAL-024-16-125	Pinspector calibration target 125 mm

17.3 Pinspector selectable accessories

Selectable accessories complement the Core package and Core accessories. They must be added according to the installation site requirements. Customer should choose the lengths of cables and encoder type (flange type, shaft type etc.).

- Camera power cables
- Ethernet cables for camera and IO module
- Encoder cables for camera
- Power cables for laser
- Encoder and encoder accessories

List of recommended power cables

6020633	DOL-1208-G02MA	Power cable, 2 m
6020993	DOL-1208-G05MA	Power cable, 5 m
6022152	DOL-1208-G10MA	Power cable, 10 m
6022153	DOL-1208-G15MA	Power cable, 15 m

List of recommended Ethernet cables for camera-PC and PC-IO module connection

6034636	SSL-0J08-G01MES01	Ethernet cable, 1,5 m
6034635	SSL-0J08-G03MES01	Ethernet cable, 3 m
6033029	SSL-0J08-G05MES01	Ethernet cable, 5 m
6033030	SSL-0J08-G10MES01	Ethernet cable, 10 m
6033031	SSL-0J08-G20MES01	Ethernet cable, 20 m

List of recommended camera-encoder cables

6032452	STL-1208-G02MAC1	Camera - encoder cable, 2 m
6032453	STL-1208-G05MAC1	Camera - encoder cable, 5 m
6032455	STL-1208-G20MAC1	Camera - encoder cable, 20 m

List of recommended laser power cables

6009382	DOL-1204-G02M	Laser power cable, 2 m
6009866	DOL-1204-G05M	Laser power cable, 5 m
6010543	DOL-1204-G10M	Laser power cable, 10 m
6010753	DOL-1204-G15M	Laser power cable, 15 m

List of recommended encoder and encoder accessories

1036726	DFS60A-S4PC65536	Programmable encoder, 65 k pulses, RS422, TTL
1072254	Type: PGT-10-Pro	Programming tool for programmable encoders
6032866	DOL-1208-G02MAC1	Encoder cable, 2 m
6032867	DOL-1208-G05MAC1	Encoder cable, 5 m
6032868	DOL-1208-G10MAC1	Encoder cable, 10 m
6032869	DOL-1208-G10MAC1	Encoder cable, 20 m

17.4 Additional hardware

To finalize the Pinspector installation, there must be a few additional components. These components are usually supplied by the customer, since they can have their own vendor lists or specific brand discounts. VSE can supply this hardware upon request, contact support.vse@sick.cz

- PC / IPC (computer on which the Pinspector software will run)
- Gigabit Ethernet switch with Ethernet Jumbo packet support
- Cable for serial communication between PC and control system

PC / IPC hardware requirements:

- 4 Core CPU min. 1 GHz
- 8 GB RAM
- 100 GB HDD
- 1Gbit Ethernet card with Ethernet Jumbo frames support (Ranger cameras need to be connected to the PC using dedicated Gigabit Ethernet network. If PC must be connected to the company network, then another Ethernet card will be needed.
- 1x COM port
- 3x USB ports
- Microsoft Windows 7 or higher

Ethernet switch requirements:

- Gigabit Ethernet with Jumbo frames supports
- At least four ports for E1/D1 version or five ports for E2 version.

18 APPENDIX F: Example of Pinspector E2 customer quotation components

Pinspector E2	Pinspector-E2001	1082567	1x
Line laser	Z8M18S3-F-640-lp10	6062134	1x
Triangulation bracket	BEF-PININS-001	7084110	1x
IO module	A-6060-eth	6062140	1x
Lens	TCSM024	5334447	2x
Calibration target	PINCAL-024-16-125	7084112	1x
Camera power cable	DOL-1208-G05MA	6020993	2x
Ethernet cable for camera	SSL-0J08-G10MES01	6033030	2x
Ethernet cable for IO module	SSL-0J08-G01MES01	6034636	1x
Camera encoder cable	STL-1208-G05MAC1	6032453	2x
Laser power cable	DOL-1204-G05M	6009866	1x
Encoder*	DFS60A-S4PC65536	1036726	1x
Encoder cable	DOL-1208-G10MAC1	6032869	1x
PC	Customer supplied according to VSE requirements		1x
Switch	Customer supplied according to VSE requirements		1x

* It is possible to connect two Ranger cameras to one encoder (please refer to Ranger operating manual)

The difference between Pinspector E1 or D1 quotations, are the number of needed cables and lenses in reference to one camera, used in the setup.

19 APPENDIX G: Contact information

For additional requests regarding system customizations, or feasibility studies, please contact us by:

Email: Support.VSE@sick.cz

Mobile: +420 720 942 992

Fax: +420 257 810 559

Vision Solution Engineering s.r.o.
Ukrajinská 2a
10100 Praha 10 – Vršovice
Czech Republic

20 List of figures

Figure 1 2M laser (attached label)	11
Figure 2 3R laser (attached label)	12
Figure 3 3 B laser (attached label)	13
Figure 4 Triangulation method.....	16
Figure 5 Scanning of a moving object	16
Figure 6 the pink shade represents the floor surface at the bottom of the pins used as the reference point.	19
Figure 8 The Pins' tips should be visible through the conductive rings, to ensure proper pin detection during inspection. The pin tips should not extend too much beyond the board surface.	21
Figure 9 3D scanned pins in the conductive rings before press-fit.	21
Figure 10 Principle of communication between the control system & Pinspector	22
Figure 11 Login dialog box	24
Figure 12 Login change dialog box.....	25
Figure 13 User interface	26
Figure 14 program menu's content window	27
Figure 15 content menu.....	28
Figure 16 Documentation content	28
Figure 17 Measurement tab	30
Figure 18 Program status box	31
Figure 19 Program syntax check results.....	31
Figure 20 Program structure.....	32
Figure 21 Message box.....	33
Figure 22 Detail box	34
Figure 23 Measurement control section	35
Figure 24 RS-232	36

Figure 25 IO module.....37

Figure 26 Control system – PC communication37

Figure 27 Live view38

Figure 28 Live images window39

Figure 29 Program database.....41

Figure 30 RS-232 dialog box42

Figure 31 RS-232 dialog box42

Figure 32 IO Module and control system dialog box43

Figure 33 Cameras.....44

Figure 34 Finding a camera.....45

Figure 35 Removing a camera from the Scanning Devices46

Figure 36 Adding a camera47

Figure 37 Camera’s IP address48

Figure 38 Inspection program database tab49

Figure 39 Pinspector –inspection program database50

Figure 40 Application status bar53

Figure 41 Halcon button53

Figure 42 Pinspector system status.....54

Figure 43 Application status bar54

Figure 44 Inspection program editor interface.....55

Figure 45 Toolbox.....56

Figure 46 Program steps56

Figure 47 Scan evaluation57

Figure 48 Telegram elements57

Figure 49 Toolbox – Cameras58

Figure 50 Inspection program editor – Program structure59

Figure 51 Program header	59
Figure 52 Recycle bin	60
Figure 53 Scanning cameras	60
Figure 54 Properties	61
Figure 55 Detail	62
Figure 56 User help menu	63
Figure 57 Description display	63
Figure 58 Save button	64
Figure 59 Program steps	65
Figure 60 Scan	66
Figure 61 Properties of Scan step	66
Figure 62 Detail of Scan step	67
Figure 63 Scan evaluation	67
Figure 64 Scan evaluation properties	70
Figure 65 Camera parameter file	71
Figure 67 Scan evaluation Detail	73
Figure 68 Send telegram	74
Figure 69 Telegram properties	74
Figure 70 Detail contents for send telegram	75
Figure 71 telegram elements	76
Figure 72 Setup outputs	81
Figure 73 Properties of Set-up Output step	81
Figure 74 Detail of Setup Outputs step	82
Figure 75 Log results	83
Figure 76 Log results Properties	84
Figure 77 An example of XLSX file when saving the data	85

Figure 78 Detail section for the Log results86

Figure 79 Measurement tab.....92

Figure 80 Measurement control window in Automatic mode.....93

Figure 81 Measurement control window in Manual mode94

Figure 82 two versions of context menu..... 106

Figure 83 template set-up 109

Figure 84 Position X, Y and Tolerance X, Y set-up..... 110

Figure 85 Dashed circle, represents the template’s virtual tolerance hole. 111

Figure 86 Template designer..... 112

Figure 87 a sample of a New hole fill Inspection 116

Figure 88 the pink color represents the pin surroundings. 117

Figure 89 selecting the reference points, defining the virtual plane using 4-points..... 118

Figure 90E1 and D1 triangulation geometry 119

Figure 91 E1 and D1 triangulation geometry 119

Figure 92 E2 version / Double-camera..... 120

Figure 93 Triangulation of actual cameras & laser line 121

Figure 94 Different types of occlusion (source: Ranger E/D Reference Manual) 122

Figure 95 The white shade represents the restricted area from the camera’s visibility. 122

Figure 96 Double-camera configuration 123

Figure 97 Narrow/ restricted space of connector box 123

Figure 98 Wider connector box 123

Figure 99 skilled programmers use the message file for system analysis..... 126

Figure 100 Administrator console..... 127

Figure 101 telegram simulation dialogue box..... 128

Figure 102 Measurement Tab displays the “Results of program syntax check” 131

Figure 103 Application status bar 132

Figure 104 System state dialog box.....	133
Figure 105 Message file	133
Figure 106 Focus plane set perpendicular to the board plate	135
Figure 107 laser light positioned within the laser dashed lines.....	135
Figure 108 laser line positioned at the edge of the box	136
Figure 109 Ranger E1/D2 version, suitable for press-fit configuration	138
Figure 110 Ranger E2 version or Double camera scanning, suitable configuration for pin connectors	139
Figure 111 Pinspector E1/ D1 geometry with Scheimpflug lens	145
Figure 112 Pinspector E2 geometry with Scheimpflug lenses	146
Figure 113 E1/D1 Variants and E2 Variants	146
Figure 114 Pinspector E2 assembly.....	152
Figure 115 Pinspector E2 Possible Mounting plates	153

21 List of tables

Table 1 RS-232 Telegram PLC -> PC.....	140
Table 2 Digital inputs/outputs.....	141
Table 3 The control system informs the Pinspector application about its state using this wire input wire.	142
Table 4 Program diagram	143
Table 5 Parameters of template designer	144