



RIFTEK
Sensors & Instruments



LASER INSPECTION SYSTEM

RF096-Insp Series

User's manual

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1 Safety precautions

- Use supply voltage and interfaces indicated in the system specifications.
- In connection/disconnection of cables, the system power must be switched off.
- Do not use the system in locations close to powerful light sources.

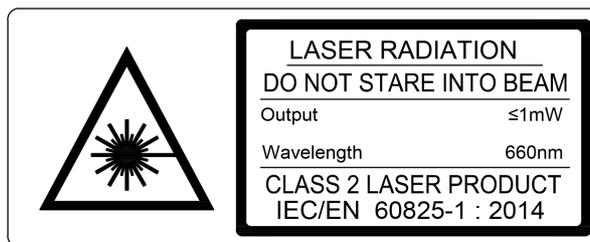
2 CE compliance

The system has been developed for use in industry and meets the requirements of the following Directives:

- EU directive 2014/30/EU. Electromagnetic compatibility (EMC).
- EU directive 2011/65/EU, “RoHS” category 9.

3 Laser safety

The system makes use of an c.w. 660 nm wavelength semiconductor laser. Maximum output power is 1 mW. The system belongs to the 2 laser safety class according to IEC/EN 60825-1:2014. The following warning label is placed on the laser body:



The following safety measures should be taken while operating the system:

- Do not target laser beam to humans.
- Do not disassemble the laser sensor.
- Avoid staring into the laser beam.

4 General information

The system is designed for non-contact detection of the debris inside the circular grooves of different technological objects, for example, brake calipers and so on. The system can be used also for groove seal profiling (seal deformation inspection). Custom-ordered configurations are possible with parameters different from those shown below.

5 Basic technical data

Parameter		Value	
		Version 1	Version 2
Inspected grooves diameter range, mm		35...53	25...30
Minimal size of detected debris, mm		0.03 (thickness) x 0.1 x 0.1	
Space resolution (points/turnover)		3200	
Laser sensor linearity, μm		± 10	
Inspection time, s		1,2	
Light source		red semiconductor laser, 660 nm wavelength	
Output power, mW		<1	
Laser safety class		2 (IEC60825-1)	
Laser beam shape		Round	
Laser spot size, mm		0.1 (beginning of the range) - 0.2 (middle of the range) - 0.35 (end of the range)	
Output interface	parametrization, profile data and inspection result transfer	Ethernet (UDP)	
	logical (AL)	0...1 (low level) - power supply (high level), V	
Command input (IN)		0...1 (low level) - from 4.5 to 24 (high level), V	
Power supply, V		9...24	
Power consumption, W		3 (standby mode), 20 (scan mode)	
Environment resistance	Enclosure rating	IP67	
	Vibration	20 g / 10...1000 Hz, 6 hours for each of XYZ axes	
	Shock	30 g / 6 ms	
	Operating ambient temperature, $^{\circ}\text{C}$	-10...+60, (-30...+60 for the sensors with a built-in heater)	
	Permissible ambient light, lx	30000	
	Relative humidity, %	5-95 (no condensation)	
Storage temperature $^{\circ}\text{C}$		-20...+70	
Housing material		aluminum	
Weight (without cable), gram		1100 + magnet holder (280 gram)	1100

6 Example of item designation when ordering

RF096-Insp-V-Dmin/Dmax-M

Symbol	Description
V	Version: 1 or 2.
Dmin	Minimal diameter for inspection, mm.
Dmax	Maximal diameter for inspection, mm.
M	Cable length, m.

Example: RF096-Insp-2-25/30-3 – Laser inspection system RF096-Insp, version 2, diameter inspection range 25...30 mm, cable length 3 m.

7 Structure and operating principle

Operation of the system is based on the scanning of the item surface by a laser triangulation sensor. (**NOTE:** Version 1 uses a binocular sensor).

The system contains the laser sensor mounted on the rotation module. Radiation of a semiconductor laser from the sensor is focused onto the item surface. Radiation reflected by the surface is collected by two input lenses of the sensor. The sensor rotates and scans the surface. Distance to the surface, measured by the laser sensor, and a corresponding angle of rotation form the polar coordinates of the surface. A built-in signal processor analyzes the surface profile and detects the presence of debris on the surface.

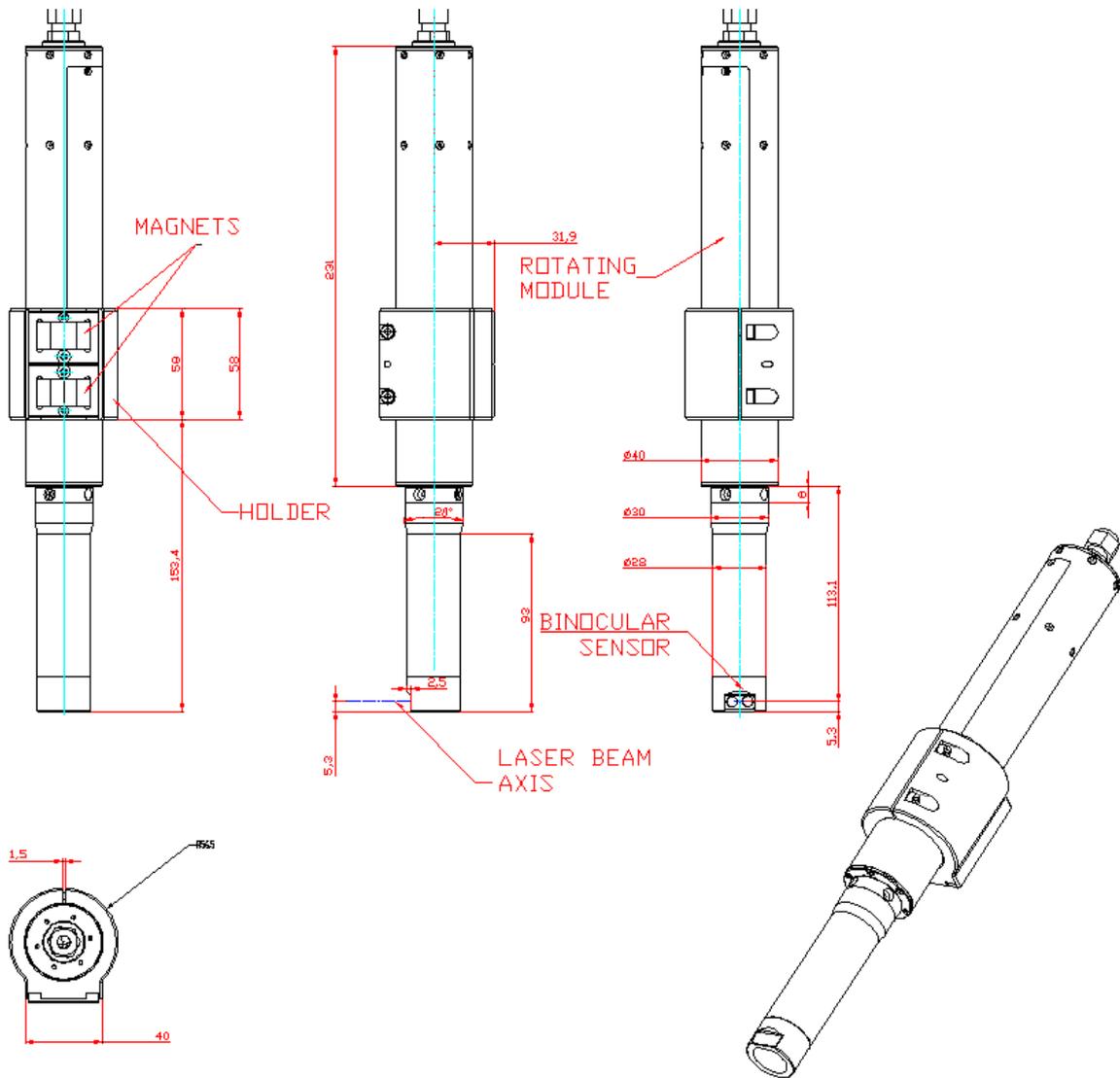


Figure 1.1. Version 1

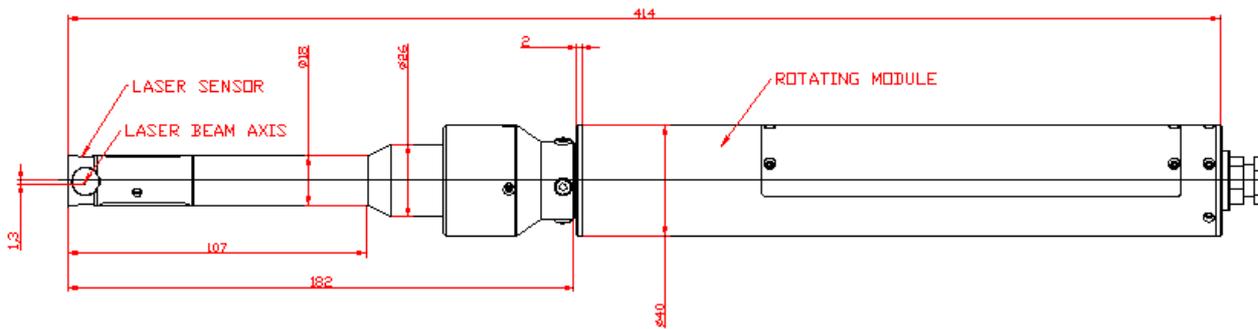


Figure 1.2. Version 2

8 Dimensions and mounting

8.1 Overall and mounting dimensions

Overall and mounting dimensions of the system are shown in Figures 1.1. and 1.2. The housing is made of anodized aluminum. The front panel of the laser sensor has a glass window for laser beam output and for receiving radiation reflected from the object under control. The system is equipped with a connector. The housing also contains a mounting frame with magnets (Version 1 only).

8.2 Overall demands for mounting

The system is positioned so that the object under control (brake caliper groove, for example) has to be placed within the working range of the system and on the laser beam axis.



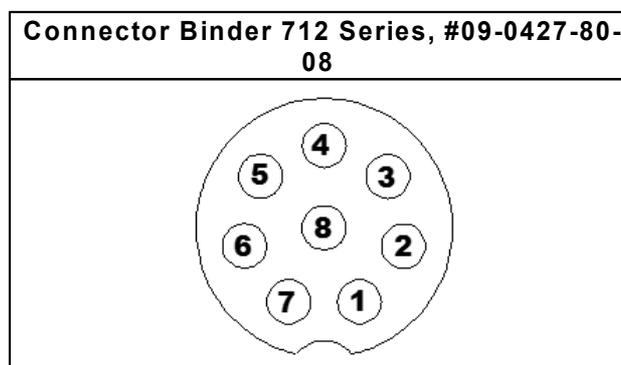
ATTENTION!

The system must be grounded – static electricity may cause the failure of electronic components.

9 Connection

9.1 Designation of connector contacts

View from the side of connector contacts used in the system is shown in the following figure.



Designation of contacts is given in the following table:

Pin number	Assignment
1	TX+
2	Power-
3	RX-
4	AL (output)
5	IN (input)
6	TX-
7	RX+
8	Power+

9.2 Cables

Designation of cable wires is given in the table below:

Pin number	Assignment	Wire color	
RJ-45	1	TX+	White-orange
RJ-45	2	TX-	Orange
RJ-45	3	RX+	White-green
RJ-45	6	RX-	Green
free lead	-	AL (output)	White-blue
free lead	-	Power+	Blue
free lead	-	IN (input)	White-brown
free lead	-	Power--	Brown

10 Intended use

10.1 Preparation for use

Preparation of the system includes:

- visual inspection;
- installation on a linear translation system or robot and connection to power supply and controller;
- adjustment according to the item for inspection.

10.1.1 Visual inspection

Before operating, it is needed to ensure of the serviceability of the equipment, check the cable, ground wire. Check the condition of output window and, if necessary, wipe them with a soft cloth. Rotate the laser sensor by hand and check smooth progress.

10.1.2 Installation

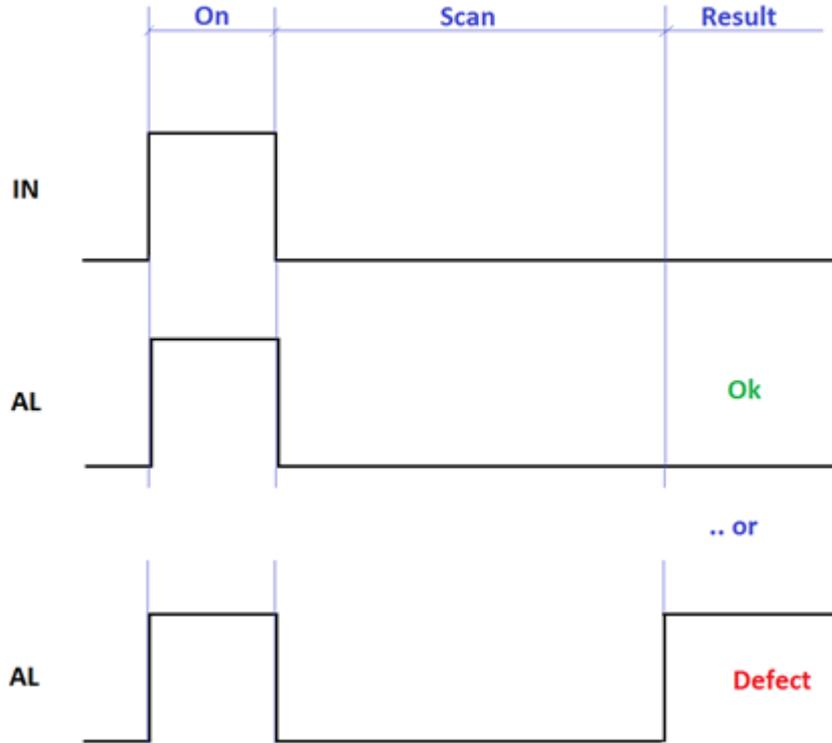
Install the system on a robot or linear translation system. (Note: as an option, the system can be fixed and the robot sets the item in control position). Make the electrical connections in accordance with cable wires designation. Ethernet interface is used for profile data and inspection result transfer and system parametrization, but for main work with the system you may use two logical lines only, see the next section.

10.1.3 Adjustment

The system is positioned so that the object under control (brake caliper groove, for example) has to be placed within the working range of the system and on the laser beam axis. Some of the recommendations for adjustment are presented in the next section.

11 Operating the system

The inspection cycle is fully automated and operation of the system is reduced to the work with two logical signals.



1. To start the inspection cycle, set a high logic level on IN input. By the wave-rise of the IN pulse (transition to a high level) the triangulation sensor turns the laser ON. (**NOTE:** This state (high level on IN input) can be so long as you need, so you can use it for visual adjustment of laser beam according to the groove. To do it, set level HIGH, rotate the laser sensor by hand and check the position of laser spot along all the groove).
2. Set a low logic level on IN input. By the wave-fall on the IN pulse (transition to a low level) the rotation module begins to rotate the laser sensor. **NOTE:** You may use AL output to control connection between the system and controller. AL output repeats the signal the system gets on IN input.
3. The laser sensor makes one revolution (scans all the groove).
4. The system transmits the result of inspection on AL output. Low level - OK (no debris), High level - debris detected.
5. To inspect the next item, repeat points 1-4.

12 Service program

12.1 Function

The service program is intended for:

- Testing and demonstration of work of the Inspection system.
- Setting of some system parameters.

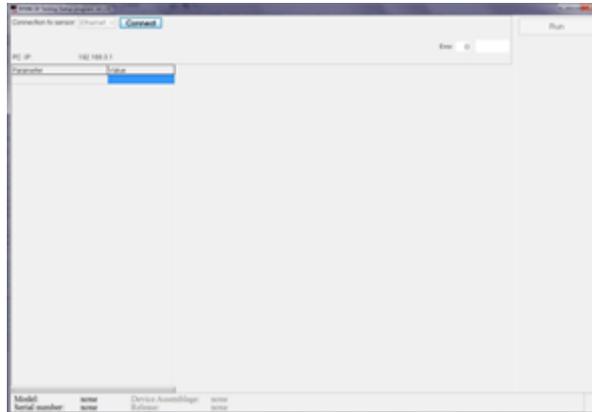
12.2 Network setting

All systems are shipped with the following default network configuration: IP address of the system – 192.168.0.3.

Configure your PC's network card in the following address space: 192.168.0.X. Connect the system directly to the PC or through the network switch.

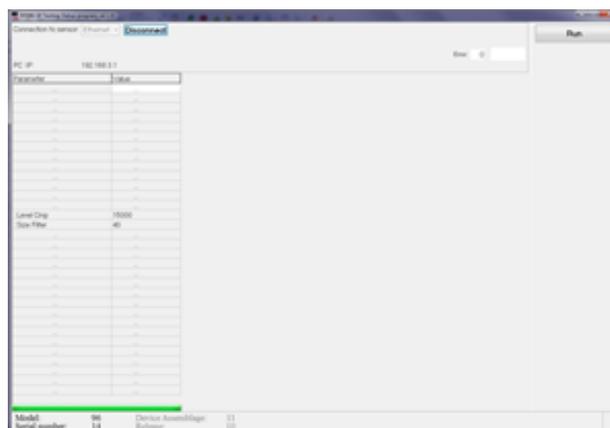
12.3 Working with the program

Once the program is started, the main window emerges:



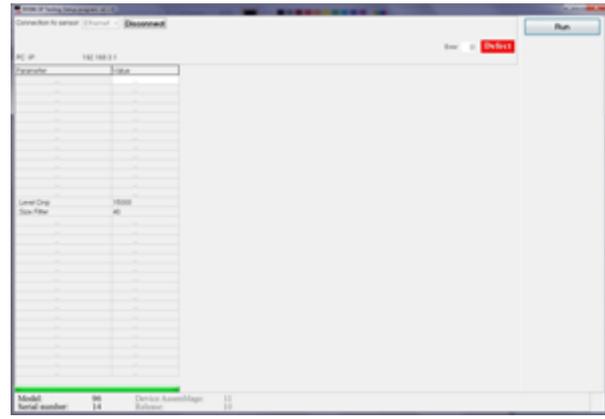
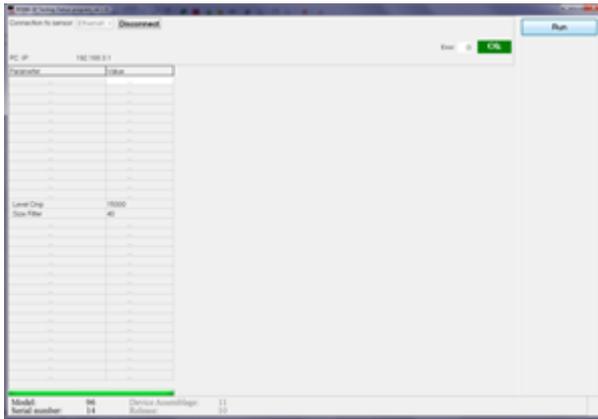
Where: PC IP is IP address of PC. **NOTE:** This PC address has to be recorded in the text file "PC IP ADDRESS", placed in the folder with a program.

Click the **Connect** button to connect to the sensor. If connection is successful, the name of the button changes to **Disconnect**.



To start the inspection cycle, click **Run**.

The laser sensor makes one revolution and the program shows the result of inspection - **OK** or **Defect**.



12.4 Parameters

You can change and customize two parameters of the system:

- **Level CMP.** It is a threshold level for digital filter that is used to search defects on the surface profile. Increasing this parameter allows to decrease the influence of profile noise.
- **Filter size.** It is a size of filter. Increasing this parameter allows to decrease the influence of profile noise on the inspection result.

When working with the parameters, it should be borne in mind that when power is OFF, the parameter values are stored in nonvolatile FLASH-memory of the system. When power is ON, the parameter values are read out to RAM of the system. In order to retain these changes for the next power-up state, click the right key of the mouse on the **Parameters** panel and select **Write to FLASH**.

13 Warranty policy

Warranty assurance for the Laser Inspection System RF096-Insp Series – 24 months from the date of putting in operation; warranty shelf-life – 12 months.

14 Revisions

Date	Revision	Description
20.09.2019	1.0.0	Starting document.

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