



RIFTEK
Sensors & Instruments



3D LASER SORTING MACHINE

RF1010SS Series

User's manual

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1. Safety precautions

- Use supply voltage and interfaces indicated in the machine specifications.
- In connection/disconnection of cables, the machine power must be switched off.
- Do not use machine in locations close to powerful light sources.
- To obtain stable results, wait about 20 minutes after machine activation to achieve uniform scanner warm-up.
- Avoid metal chips getting into the machine body;
- Do not allow foreign objects to get between moving and stationary parts of the measuring machine after turning it on;
- Do not obstruct the movement of moving parts of the machine;
- Friction parts of the ball screw assembly should be kept clean and be lubricated;
- The machine should be grounded and connected to ground line via a separate lateral line;
- It is not recommended to connect other devices and networks to the host computer.

2. Electromagnetic compatibility

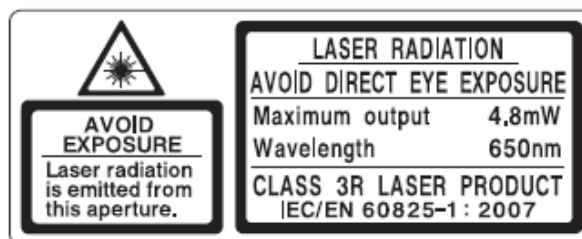
The machine have been developed for use in industry and meet the requirements of the following standards:

- EN 55022:2006 Information Technology Equipment. Radio disturbance characteristics. Limits and methods of measurement.
- EN 61000-6-2:2005 Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments.
- EN 61326-1:2006 Electrical Equipment for Measurement, Control, and Laboratory Use. EMC Requirements. General requirements.

3. Laser safety

The machine makes use of laser scanner. Laser scanner belongs to the 3R laser safety class according to IEC 60825-1:2007.

The scanner makes use of an c.w. 660 nm wavelength semiconductor laser. Maximum output power is 5 mW. The following warning label is placed on the laser body:



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

- Do not target laser beam to humans;
- Avoid staring into the laser beam through optical instruments;
- Use protective goggles when operating the sensor;
- Avoid staring into the laser beam;
- Do not disassemble the sensor.

4. General information

The measuring machine is designed for non-contact measurement of geometrical parameters of objects, specifically sunflower seeds, and is a standalone software/hardware system.

Technical characteristics of the machine can be changed for a specific task.

5. Structure and operating principle

The work of the machine is based on the principle of 3D laser scanning of object/objects with subsequent construction of a 3D computer model and determination of geometrical parameters from the model.

The machine structural design is illustrated in Figure 1.

The machine consists of a table 1 whereon a frame structure 2 is located with a guide 3. Installed on the guide 3 there is a carriage 4 with a laser scanner 5. The carriage 4 is driven by a stepper motor 6 by means of a ball screws assembly (not shown). In the extreme positions of the carriage 4 there are limit switches (not shown). An indicating unit 7 is mounted on the frame structure 2. On the side plate of the machine there is a power connector 8 (220V) and two network jacks 9 for Ethernet connection. Connection of the machine to PC 10 is via the network switch 11.

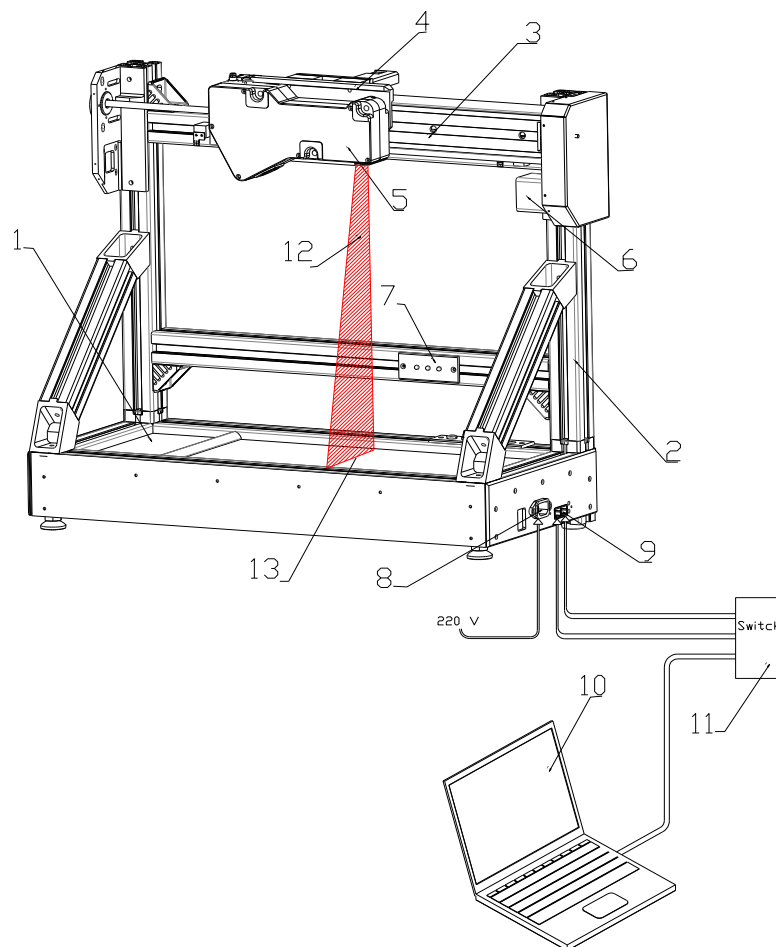


Figure 1

Laser radiation 12 of a scanner 5 is formed into a line 13 and is projected onto the table 1 where objects to be controlled are located. The laser line length corresponds to the table width. The resulting images of the contour (section profile) of the objects located on the table are analyzed by the scanner signal processor which calculates the

distance to the object (Z coordinate of points) for each of a plurality of points along the laser line on the object (X coordinate of points).

The machine works as follows.

The laser scanner mounted on the carriage moves along the table 1, the direction of the movement being the coordinate Y. The laser scanner determines the coordinates of the object profile points (X, Z) at fixed regular linear intervals along the Y coordinate defined by the stepper motor drive. As a result, a 3D computer model of the scanned area is obtained in the form of a cloud of points with known coordinates (X, Y, Z). An example of the model is shown in Fig. 3. The required geometrical parameters of the object are calculated from the resulting 3D model.

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Figure 1

6. Basic technical data

| Parameter | Value |
|---|--|
| Scanning range Y-axis, mm | 400 |
| Scanning range, Z-axis, mm | 300 |
| Scanning range X (start of measurement, Z-axis), mm | 130 |
| Scanning range X (end of measurement Z-axis), mm | 240 |
| Measurement accuracy, X,Z axes, μm | ± 150 |
| Measurement accuracy, Y axis, μm | ± 20 |
| Sampling rate, profiles/s | 250 |
| Speed, mm/s | 25 |
| Parameters under control | length, width, height |
| Dimension, mm | 730x415x180 |
| Weight, kg | 40 |
| Power supply | alternating-current mains with sampling rate (50 ± 1) Hz, nominal power 220 with allowable stress $\pm 10\%$. |
| Power consumption, W | 50 |
| Environment conditions | Environment temperature: $+1..+35^{\circ}\text{C}$ Relative humidity 25-65% |

7. Dimensions

The dimensions of the machine are shown in the picture 3.

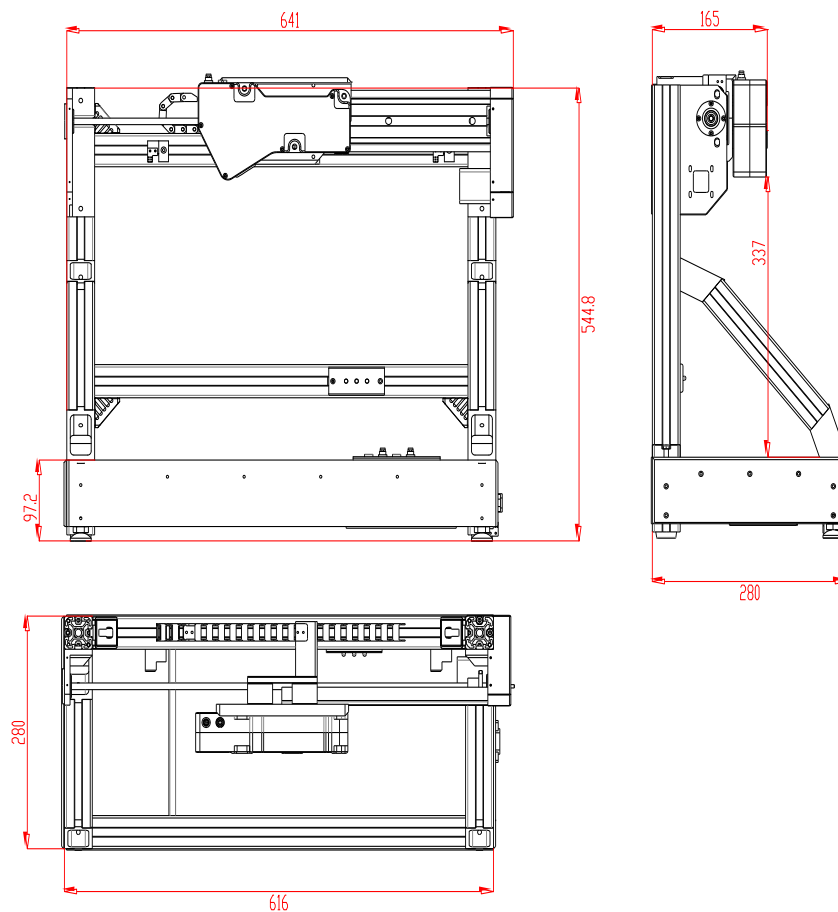


Figure 3

8. Preparation for work

- Connect the machine according to Fig. 1.
- Install Qt version 4.8.0 libraries, Microsoft redistributable package 2010. The library set up program **vc redistrib.exe** is on CD which is part of the supply package. The software is adapted to the OS Windows XP, Vista, 7 environments.
- Perform network settings. Ethernet network address space is 192.168.1.X, mask word is 255.255.255.0. IP address of the PC should be in the space specified, X must not be equal to 10 (display unit address) and 15 (laser scanner address).
- It is not recommended to connect other network devices and networks to the host computer.
- Calibrate the machine in accordance with par. 9.4.

8.1. Necessary conditions

Necessary conditions to ensure correct operation of the machine are as follows:

- seeds should not be in touch with each other so that the size of the gap must be such that when the laser beam falls between the seeds the scanning area should be lit by the beam.
- seeds should not touch restrictive skirting around the table perimeter.

9. Operating the machine

The geometric parameters measurement cycle is fully automated and operation of the machine is reduced to the work with the program

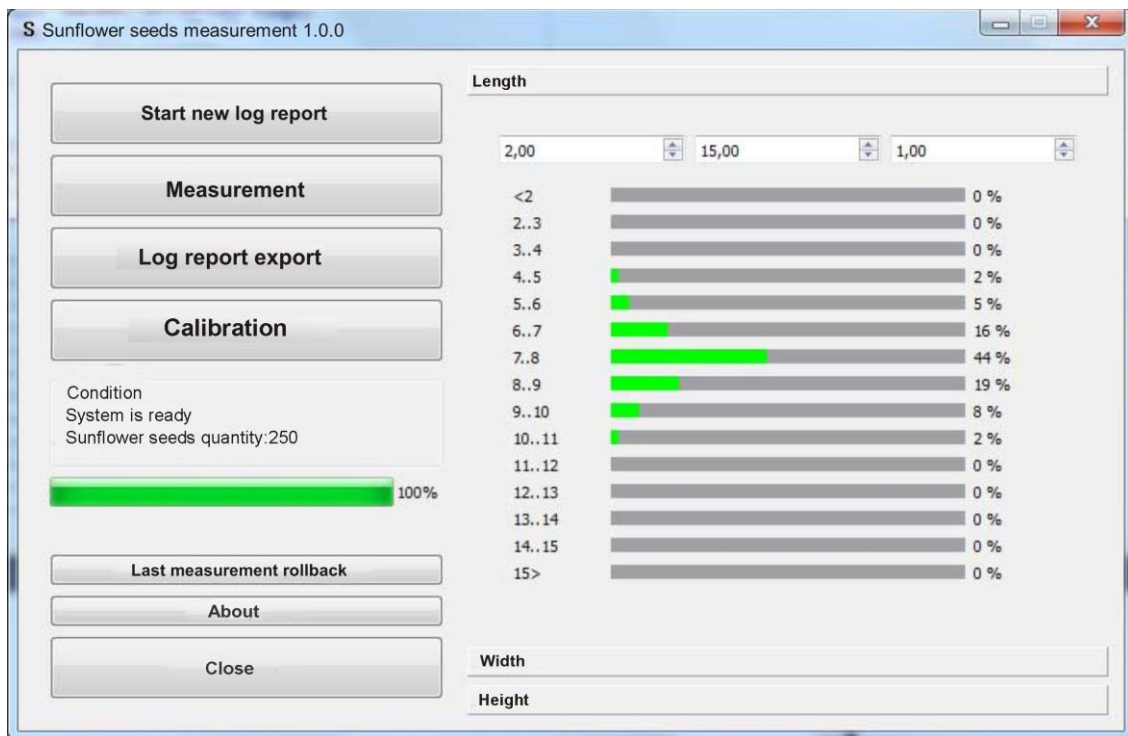
The program ensures:

- control of the machine in the operation process and debugging modes,
- receiving data from the scanner and construction of a 3D model
- mathematical calculations
- input of sorting parameters
- logging of the results
- control of the machine status
- control of LED indications
- calibration of the machine

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9.1. Working window of the program

Run the RFSeeds program. When run, the program automatically scans the network devices and connects to them. If the connection is successful the status line displays "System Ready", and the working window emerges which is shown in Fig. 4. Otherwise, description of the connection error emerges.



Picture 4

Control keys are located in the left part of the window. Key functions are as follows:

Start new log report – deletion of all accumulated data;

Measurement – start measurement procedure;

Log report export – formation of log report with measurement results;

Calibration – start calibration procedure;

Last measurement rollback – deletion of the last measurement out of data array.

The right part of the window contains:

three tabs – **Length**, **Width**, **Height**, and the field boxes common for the tabs:
 the box for displaying the histogram of the distribution of seeds in size,
 the box for setting the group interval as well as the upper and lower limits of the size range in histogramming.

9.2. Measurement procedure

- Check (form) the parameters of the histogram.
- Place the seeds on the table in accordance with the requirements of par. 8.1.
- Click the **Measurement** key. Scanning session will start. If the scanner is not located at the beginning of the range, it will first be moved to the starting position and then scanning will start. The slider in the center of the program window will display dynamics of the scanning process.
- When the scanning is finished, the program will display the number of scanned seeds and their size distribution.
- The result of each subsequent scanning is added to the previous results. To delete the accumulated data before scanning, click **Start new log report** key.
- If incorrect or incomplete scanning has been obtained, the results can be removed from the accumulated data using the **Last measurement rollback** key.

9.3. Logging the results

To obtain log report, click the **Log report export** key. An example of the report is shown below.

22.12.2012 16:15:55.330

Total amount of sunflower seeds

Length

| | | |
|--------|----|------------|
| ...4 | 1 | 0.813008 % |
| 4..5 | 0 | 0 % |
| 5..6 | 1 | 0.81 % |
| 6..7 | 0 | 0 % |
| 7..8 | 0 | 0 % |
| 8..9 | 0 | 0 % |
| 9..10 | 1 | 0.81 % |
| 10..11 | 5 | 4.06 % |
| 11..12 | 15 | 12.19 % |
| 12..13 | 29 | 23.57 % |
| 13..14 | 26 | 21.13 % |
| 14..15 | 6 | 4.87 % |
| 15..16 | 4 | 3.25 % |
| 16..17 | 2 | 1.62 % |
| 17..18 | 1 | 0.81 % |
| 18..19 | 8 | 6.50 % |
| 19..20 | 7 | 5.69 % |
| 20..21 | 5 | 4.06 % |

: 123

Width

| | | |
|--------|----|---------|
| ...2 | 0 | 0 % |
| 2..3 | 0 | 0 % |
| 3..4 | 2 | 1.62 % |
| 4..5 | 3 | 2.43 % |
| 5..6 | 13 | 10.56 % |
| 6..7 | 38 | 30.89 % |
| 7..8 | 47 | 38.21 % |
| 8..9 | 12 | 9.75 % |
| 9..10 | 6 | 4.87 % |
| 10..11 | 1 | 0.81 % |
| 11..12 | 0 | 0 % |
| 12..13 | 0 | 0 % |
| 13..14 | 0 | 0 % |
| 14..15 | 0 | 0 % |
| 15... | 1 | 0.81 % |

Height

| | | |
|--------|----|---------|
| ...1 | 0 | 0 % |
| 1..2 | 0 | 0 % |
| 2..3 | 2 | 1.62 % |
| 3..4 | 24 | 19.51 % |
| 4..5 | 66 | 53.65 % |
| 5..6 | 28 | 22.76 % |
| 6..7 | 2 | 1.62 % |
| 7..8 | 1 | 0.81 % |
| 8..9 | 0 | 0 % |
| 9..10 | 0 | 0 % |
| 10..11 | 0 | 0 % |
| 11..12 | 0 | 0 % |
| 12..13 | 0 | 0 % |
| 13..14 | 0 | 0 % |
| 14... | 0 | 0 % |

9.4. Calibration

For the first start of the machine and once a month it is recommended to calibrate the machine. To do this, remove all items from the working surface of the machine table and click **Calibration**. When the system status changes (e.g., because of transportation, reassembly), calibration must be carried in a mandatory manner.

9.5. Indicating lights

The indicating lights (see. Fig. 1) show the current status of the machine.

- Red LED is lit – failure;
- Blue LED is lit – machine is ready for operation
- Yellow LED is lit – scanning is in process

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10. Maintenance

10.1. General instructions

Maintenance of the machine is carried out to ensure constant-ready status and continued availability of its work and to prevent premature failure.

10.2. Maintenance procedure

10.2.1. Daily maintenance work

Daily maintenance includes:

- Visual inspection of the machine,
- Checking of completeness,
- Inspection of the units and elements that make up the machine,
- Checking for any damage of the structural elements, power and instrument cables, indicators and connectors,
- weakening of screw connections and insulation failures,
- Before starting work, it is necessary to wipe the input and output laser scanner windows with a soft dry cloth.

10.2.2. Weekly maintenance work

Weekly maintenance includes:

- cleaning of laser scanner windows with a dry soft lint-free cloth from contamination or dirt;
- checking of free movement of the carriage

10.2.3. Yearly maintenance work

Authenticated calibration of the laser scanner should be made once a year

11. Routine repairs

Trouble-shooting instructions are given in the following table.

| Trouble | Possible cause | Corrective actions |
|------------------------|---|--|
| Incorrect measurements | Effects of extraneous illumination source | Remove extraneous illumination source or protect the machine against its effects |
| | Dirty laser scanner windows | Clean scanner windows |
| | Software malfunction | Reload the computer |
| | Seeds are in touch with each other | Fulfill condition in par. 8.1. |

| | | |
|---|--|-----------------------|
| | | |
| | Scanner displacement | Calibrate the machine |
| Scanner is out of the scanning range | Return scanner to the scanning range with the help of TestSignalBlock.exe program (included in delivery set) | |
| The program fails to connect with the scanner | Perform diagnostics of the scanner with the help of rf620et-sp.exe program and using description of the scanner. When adjusting the system the DHCP server may be necessary, it is included with the software (tftpd32) in the delivery set. | |
| Connection to the machine fails | Check network connections, run the TestSignalBlock.exe program with RFSeeds out of line. If LEDs are not controlled by clicking checkboxes in this program, it means that the indicating unit is out of order. If LEDs are controlled but there is no connection to motor (all motor setting field values = 0), it means that the motor drive is out of order. | |
| | Check Ethernet connection, the work of the network IC card (100 Mb/s connection should be used), firewall and antivirus program settings. The network should also allow broadcast access. | |

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12. Warranty policy

Warranty assurance for the 3D Laser measurement machine RF1010SS - 24 months from the date of putting in operation; warranty shelf-life - 12 months.