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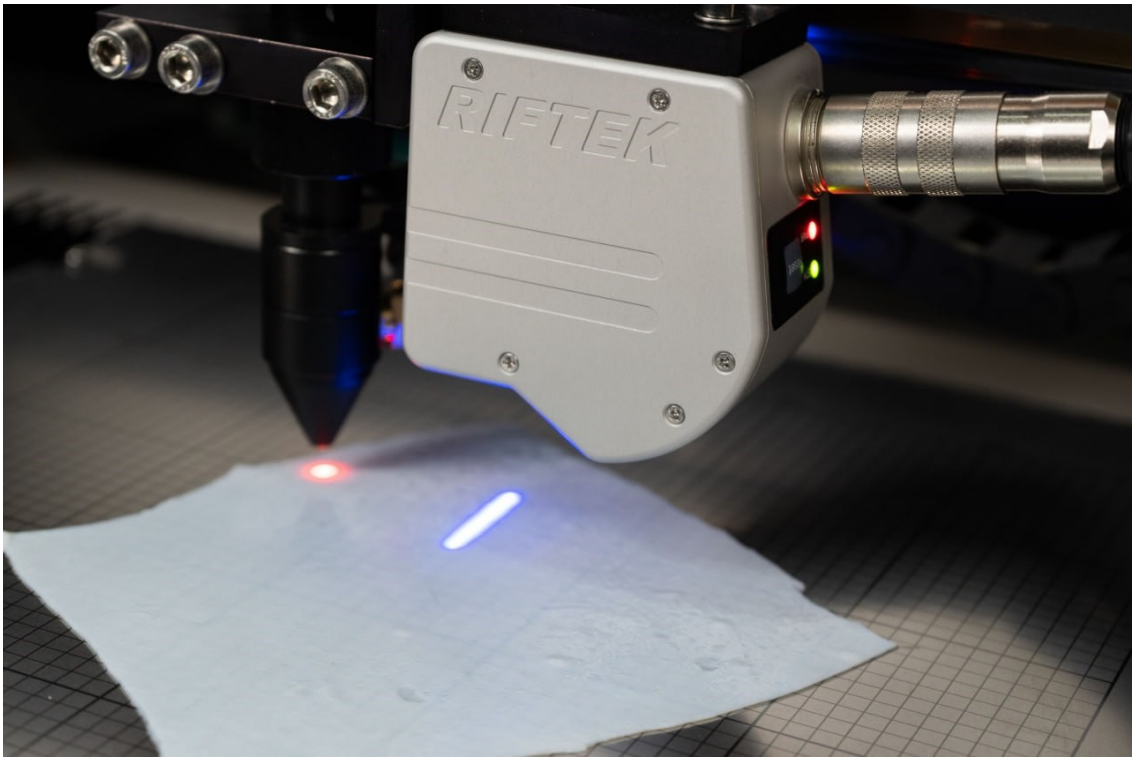

LASER SYSTEM FOR BIOLOGICAL TISSUE THICKNESS MEASUREMENT AND CUTTING

RF751 Series

User's manual

www.riftek.com
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Contents

1. Safety precautions

- Only persons who have studied this User's Manual are allowed to work with the system.
- Use the supply voltage and interfaces indicated in the specification.
- When connecting/disconnecting cables, the system must be powered off.

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. General information

The system is designed for non-contact automated thickness control and cutting of biomaterials used in cardiac and vascular surgery.

The main functions of the system:

1) Measuring the distribution of the thickness of the biomaterial over the area and building a height map.

2) Optimal placement of product patterns on the height map of the biomaterial in accordance with the specified thickness.

3) Laser cutting of biomaterial in accordance with patterns.

4. Structure and operating principle

4.1. Structure

The structural scheme of the system is shown in Figure 1. The system is implemented on the basis of a CNC laser cutting machine with a Ruida controller or similar. The machine is controlled via a central computer using specialized software. The 2D laser scanner is mounted on the movement system of the machine. In the measurement mode, the CNC system of the machine moves the sensor line by line (snake) over the material. The sensor measures the distance (Z coordinate) to the surface of the material. Data pickup from the sensor is synchronized with its movement (XY coordinates) and the result is transmitted to the computer via the Ethernet port. The software creates a material height map (X,Y,Z).

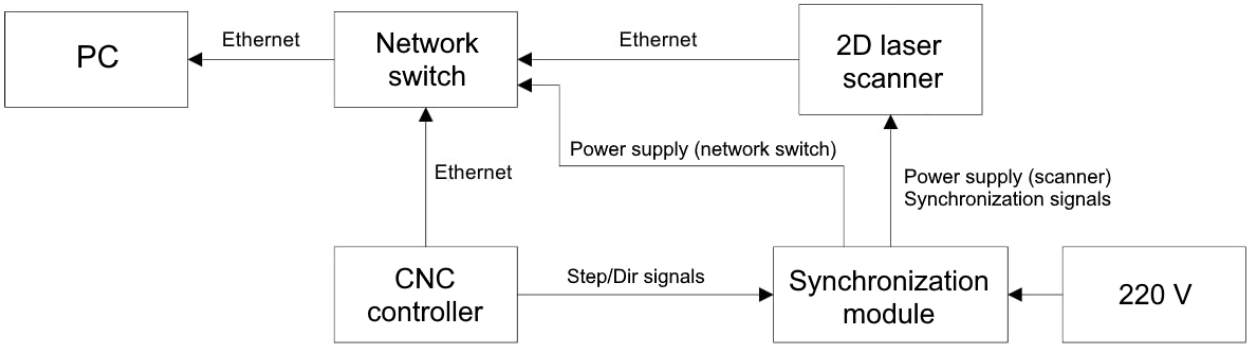


Figure 1 - Structural scheme

4.2. Operating principle

The operation of the system includes the following stages:

1. Calibration. At this stage, the system scans the surface of the object plate and generates a height map in the scanner coordinate system.

2. Measurement of the biomaterial thickness and formation of its height map. At this stage, the system scans the surface of the biomaterial placed on the object plate. The thickness of the biomaterial is calculated as the difference between the heights of surface of the biomaterial and the object plate.

3. Programmatic placement of patterns selected from the database on the height map of the biomaterial.

4. Laser cutting of the biomaterial in accordance with the location of the patterns.

5. Basic technical data

Parameter	Value
Measurement object	pericardial tissue for making prostheses
Measured parameter	thickness distribution
Thickness measurement error, mm	±0.03
Scan area size	determined by the model of the laser cutting machine
Scan speed, up to, mm/s	100
Power supply	Three-phase AC network with frequency (50±1) Hz, rated voltage 220/380 V with voltage tolerance ±10%
Template file format	.dxf
2D laser scanner	RF627.Blue-25/10-8/11
Operating frequency, profiles/s	1000

6. Software

6.1. Main window

To start working with the system, go to the software folder and run **LaserNC.exe**.

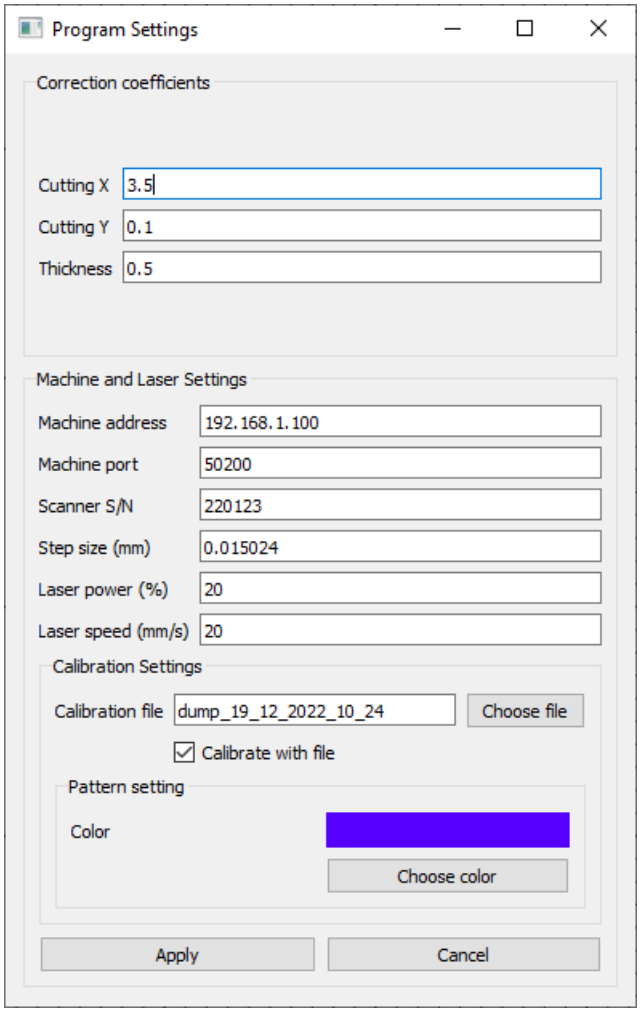
The main window:

Description of interface elements:

#	Element	Description
	Interface language	Language selection button.
	Patterns import	Pattern file import button.
	Carriage movement	Buttons for controlling the manual movement of the carriage.
	Scanning speed	This button opens a panel for entering the movement speed.
	Start cutting	Start cutting the biomaterial in accordance with the pattern.
	Stop cutting	Stop cutting the biomaterial.
1	-	Area for building a height map and placing patterns.
2	-	Thickness color scale.
3	-	Software settings.
	Remove all patterns from the workspace	Remove all imported patterns from the working area, keeping the height map.
	Reset cutting map	Remove the cutting map from the working area.
	Home	Return the carriage to its starting position.
	Scanner calibration	Start the calibration process.
	Start scanning	Start the scanning process in the specified area.

6.2. Program settings

To open the program settings, click  . The **Program Settings** window will appear. To apply the specified settings, it is necessary to click the **Apply** button. If no changes are required, click the **Cancel** button.



Description of parameters:

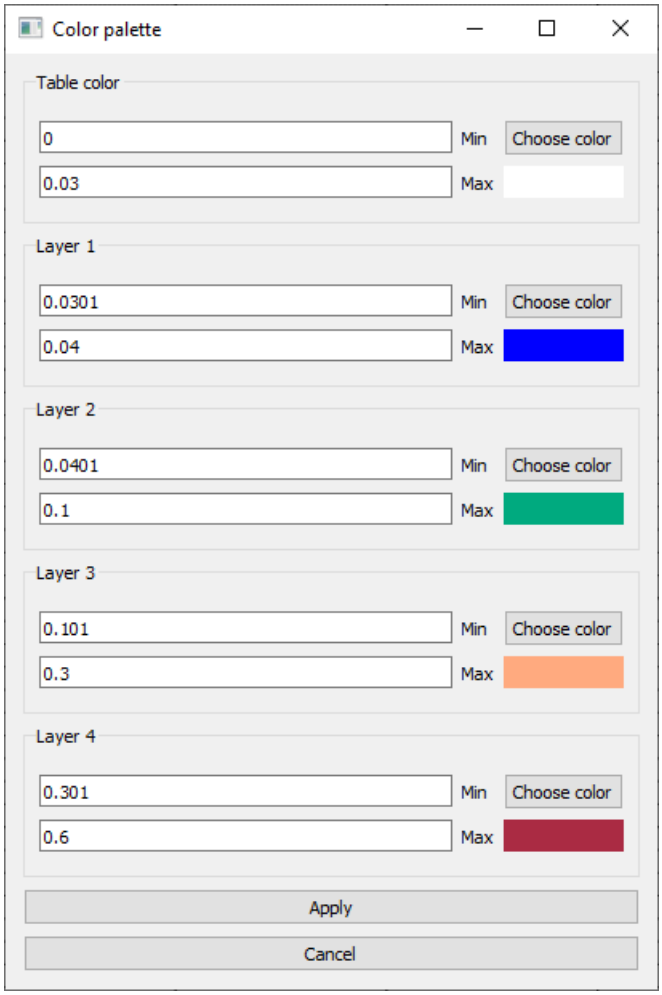
Name	Description
Cutting X, Cutting Y	These values are set to correct the starting position of laser cutting along the corresponding axes. They can be used when it is necessary to adjust the cutting coordinates due to possible deformations of the material or equipment errors. Correction coefficients are specified in millimeters and are usually set depending on the characteristics of the material and machine settings.
Thickness	This value is specified in millimeters and is used to correct the scan data. This coefficient can be added to the resulting data to take into account the possible measurement error caused by various factors, such as material deformation and penetration of laser radiation into the material.
Machine address	The network address of the machine controller.
Machine port	The network port of the machine controller.
Scanner S/N	The unique address of the laser scanner. It is used to search for and connect to the scanner, as well as for software licensing.
Step size (mm)*	The number of millimeters per pulse of the machine stepper motor driver. This parameter is used for correct rendering of the final result*.
Laser power (%)	The laser power of the cutting machine. Values: from 1 to 100%.
Laser speed (mm/s)	The speed at which the carriage moves when cutting the material.
Calibration file	Selecting the calibration file.
Pattern setting	Selecting the color of the imported pattern.

* In most cases, this parameter is unique for each machine. It is set only once when changing the machine or machine equipment.

6.3. Color palette

The color palette makes it possible to split the thickness of the material into color layers when building its height map.

To adjust the color palette, double-click on the thickness scale in the working area of the main window. After setting the parameters, click the **Apply** button. If no changes are required, click the **Cancel** button.



7. Intended use

7.1. Preparation for work

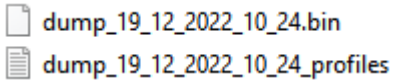
1. Check if the machine is turned on.
2. Start the software.
3. Wait for the program to find and connect to devices.
4. After successful connection, you can start working with the system.

NOTE. If the scanner or machine is not available for connection, a message will be displayed stating that one of the devices is unavailable.

7.2. Calibration

Before starting the calibration, make sure that the carriage is in the starting position and the object plate is installed in the machine. Start the calibration by clicking the **SCANNER CALIBRATION** button. During calibration, the scanner passes over the entire calibration plate. After the calibration is completed, the program will display a message about its success or failure. If successful, the calibration files will be saved in the program folder with a name containing the date and time of their creation.

An example of calibration files:

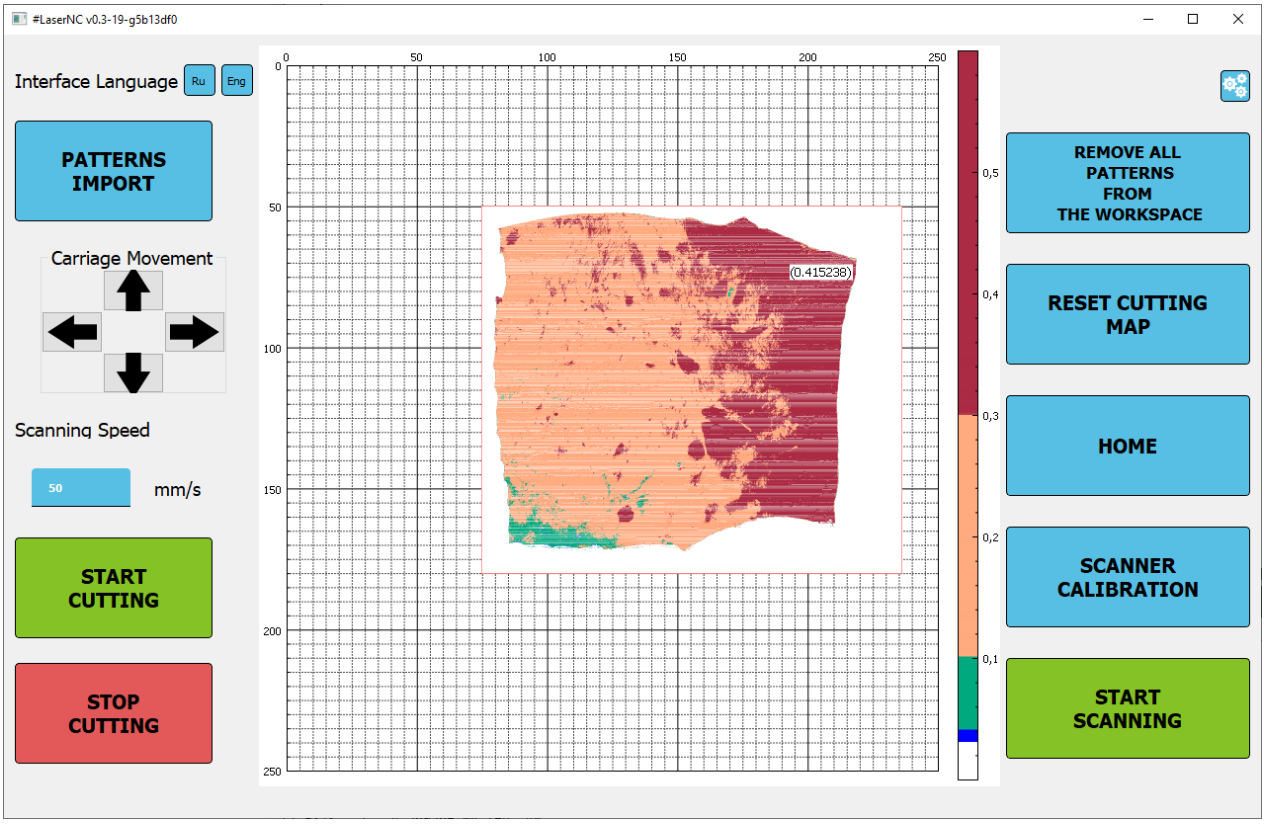


7.3. Scanning

To scan the biomaterial, follow these steps:

- Make sure that the machine carriage is in the starting position.
- Place the biomaterial on the object plate and straighten it carefully.
- Select the scan area with the mouse. For convenience, the grid on the screen corresponds to the grid on the surface of the object plate.
- Click the **START SCANNING** button to start the scanning process.
- Scanning will be performed within the selected area.
- If necessary, the scanning process can be repeated.

After the successful completion of the scanning process, a biomaterial height map will be built in the working area of the program. To control the thickness at a specific point, you need to move the cursor over it. The thickness value will be displayed next to the cursor.



7.4. Importing and placing patterns

To import a pattern, do the following:

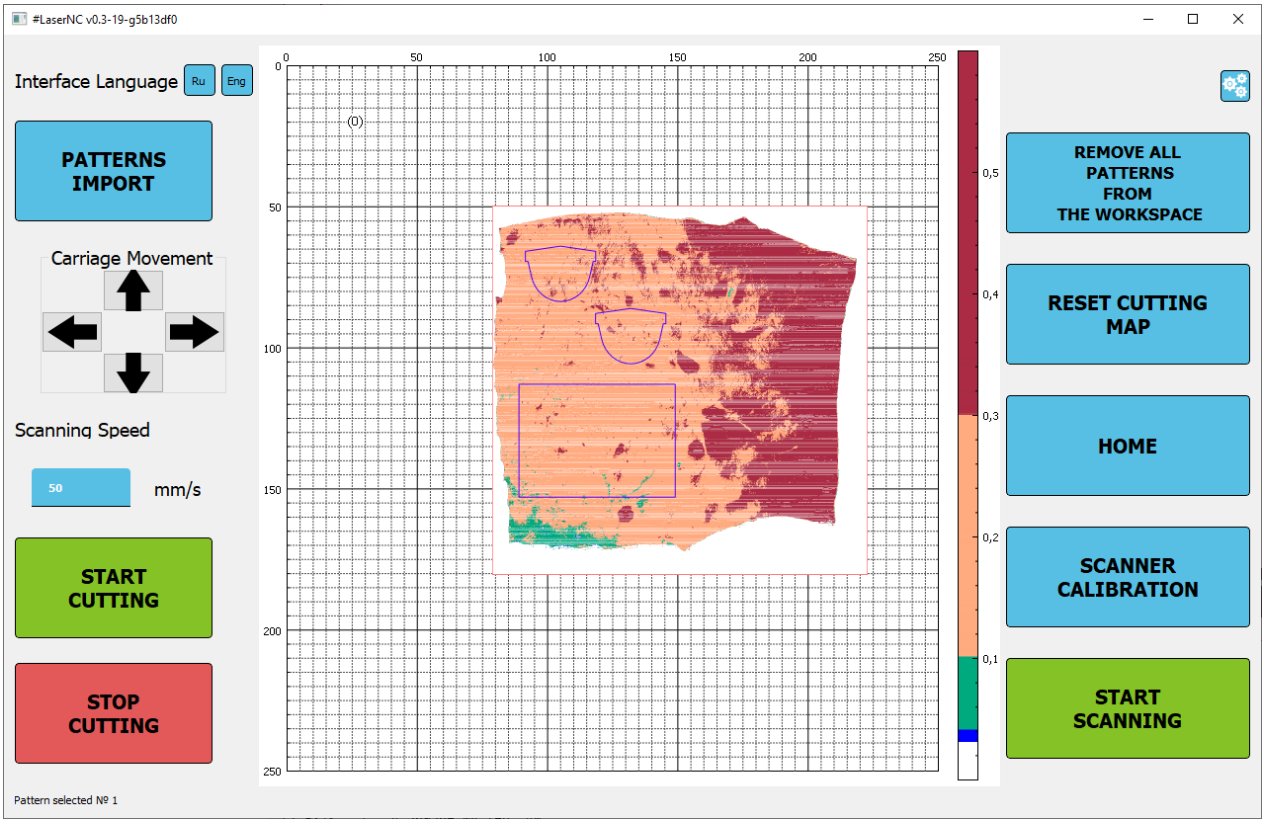
- Click the **PATTERNS IMPORT** button.
- In the window that appears, select the required pattern in **.dxf** format. The selected pattern will be placed in the working area.

For optimal placement of the pattern on the height map, the following operations can be performed:

- To move, select a part with one click, and then hold down the left mouse button or use the arrows on the keyboard.
- To delete, press the **Delete** key on the keyboard.
- To copy and paste, call the context menu by pressing the right mouse button on the pattern, or use the hotkeys (**Ctrl+C** – copy, **Ctrl+V** – paste).

- To rotate, call the context menu by pressing the right mouse button, and then specify the rotation angle in the input field, or rotate the pattern with the mouse wheel.

NOTE. Patterns must be formed as broken lines, since the laser cutting machine only accepts data in this form. The number of patterns for import is not limited.



7.5. Cutting

After placing the patterns on the height map of the biomaterial, the cutting operation can be performed. Before cutting, make sure of the following:

- The water cooling system of the cutting laser is turned on and working properly.
- Blowing is turned on.
- The machine cover is closed.

To start cutting, click the **START CUTTING** button.
The system will cut the material in accordance with the patterns.
To forcibly stop cutting, click the **STOP CUTTING** button.

8. Warranty policy

Warranty assurance – 24 months from the date of putting in operation; warranty shelf-life – 12 months.

9. Revisions

Date	Revision	Description
10.04.2023	1.0.0	Starting document.

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