RI FTEK
Sensors & Instruments

PIPE INNER DIAMETER MEASUREMENT MACHINE
RF096-32/42-80 Series

User's Manual

22, Logoi sky tract, Minsk
220090, Republic of Belarus
tel/fax: +375 17 281 36 57
info@riftek.com
www.riftek.com

Certified according to ISO 9001:2008
Contents

1. Safety precautions.................................................................................................................. 3
2. CE compliance.......................................................................................................................... 3
3. Laser safety.............................................................................................................................. 3
4. General information................................................................................................................... 3
5. Basic technical data................................................................................................................... 4
6. Example of item designation when ordering............................................................................ 4
7. Structure and operational principle.......................................................................................... 4
8. Connection.................................................................................................................................. 5
9. Network setting.......................................................................................................................... 5
10. Service program......................................................................................................................... 6
   10.1. System requirements........................................................................................................... 6
   10.2. Installation............................................................................................................................. 6
   10.3. License activation............................................................................................................... 7
   10.4. Pipe Check............................................................................................................................ 7
       10.4.1. Main window.................................................................................................................. 7
       10.4.2. Calibration..................................................................................................................... 8
       10.4.3. Measurement procedure............................................................................................... 9
       10.4.4. Templates settings......................................................................................................... 10
       10.4.5. Log................................................................................................................................ 13
11. Troubleshooting........................................................................................................................ 13
12. Technical support....................................................................................................................... 13
13. Warranty policy.......................................................................................................................... 13
14. Distributors................................................................................................................................. 14
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 the machine in locations close to powerful light sources.
   - To obtain stable results, wait about 20 minutes after the machine activation to achieve uniform warm-up of the laser sensor.

2. **CE compliance**
   The machine has been developed for use in industry and meets the requirements of the following Directives:
   - EU directive 2014/30/EU. Electromagnetic compatibility (EMC).

3. **Laser safety**
   The laser sensor of the system makes use of a c.w. 660 nm wavelength semiconductor laser. Maximum output power is 1 mW. The sensor belongs to the 2 laser safety class. The following warning label is placed on the housing:

   ![Laser Safety Label](image)

   The following safety measures should be taken while operating the sensor:
   - Do not target laser beam to humans.
   - Do not disassemble the sensor.
   - Avoid staring into the laser beam.

4. **General information**
   The machine is designed for contactless scanning and geometrical parameters measurement of inner diameter of pipes, bushes, holes, tubes, and so on.
   Field of application: large-scale production.
5. Basic technical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter measurement range, mm</td>
<td>32...42</td>
</tr>
<tr>
<td>Diameter measurement accuracy, µm</td>
<td>±5</td>
</tr>
<tr>
<td>Depth of measured hole, mm</td>
<td>≤80</td>
</tr>
<tr>
<td>Linear translation accuracy, µm</td>
<td>±20</td>
</tr>
<tr>
<td>Quantity of measured sections</td>
<td>not limited, programmable</td>
</tr>
<tr>
<td>Light source</td>
<td>red semiconductor laser, 660 nm wavelength</td>
</tr>
<tr>
<td>Laser sensor output power, mW</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Laser safety class</td>
<td>2 (IEC60825-1)</td>
</tr>
<tr>
<td>Output interface</td>
<td>Ethernet</td>
</tr>
<tr>
<td>Power supply</td>
<td>220 V AC</td>
</tr>
<tr>
<td>Environmental resistance</td>
<td>Vibration</td>
</tr>
<tr>
<td></td>
<td>20 g / 10...1000 Hz, 6 hours for each of XYZ axes</td>
</tr>
<tr>
<td></td>
<td>Shock</td>
</tr>
<tr>
<td></td>
<td>30 g / 6 ms</td>
</tr>
<tr>
<td></td>
<td>Permissible ambient light, lx</td>
</tr>
<tr>
<td></td>
<td>30000</td>
</tr>
<tr>
<td></td>
<td>Relative humidity, %</td>
</tr>
<tr>
<td></td>
<td>5-95 (no condensation)</td>
</tr>
<tr>
<td></td>
<td>Operating ambient temperature, °C</td>
</tr>
<tr>
<td></td>
<td>0...+45</td>
</tr>
<tr>
<td></td>
<td>Storage temperature, °C</td>
</tr>
<tr>
<td></td>
<td>-20...+70</td>
</tr>
<tr>
<td>Housing material</td>
<td>aluminum</td>
</tr>
</tbody>
</table>

Note: machine parameters can be changed for a specific task.

6. Example of item designation when ordering

RF096-Dmin/Dmax-L

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dmin/Dmax</td>
<td>ID measurement range, mm.</td>
</tr>
<tr>
<td>L</td>
<td>Hole depth, mm.</td>
</tr>
</tbody>
</table>

Example: RF096-32/42-80 – Pipe Inner Diameter Measurement Machine RF096, diameter measurement range - 32...42 mm, depth of measurement - 80 mm.

7. Structure and operational principle

Operation of the machine is based on the principle of laser scanning of rotating pipe inner surface by triangulation laser point sensor.

Structure of the machine is shown in Figure 1.
where:
1 - measurement module,
2 - controller with the power supply,
3 - foot switch,
4 - personal computer with a service program.
The measurement module structural design is illustrated in Figure 2.

The measurement module includes a base, on which the rotation mechanism and the linear movement mechanism are installed. The housing of the measurement module is equipped with a signal tower (not shown).

The rotation mechanism includes a stepper motor (1), encoder (2), shaft (3) with a V-block (4). The transmission of rotation from the stepper motor (1) to the shaft (3) is carried out by means of a belt drive (5). The V-block (4) is intended to install the controlled pipe (6) and has two plate springs (7), which intended for holding the pipe on the V-block, and a calibration ring (8). The pipe must be pressed to the thrust plate (14).

The linear movement mechanism includes guide rails (9), carriage (10), stepper motor (11), end switch (12). The carriage (10) is moved by a ball screw, and carries a laser triangulation sensor (13).

The machine operates as follows:
The operator installs the controlled pipe (6) into the V-block (4). On the operator's command, a laser sensor (13) moves into the control zone of the calibration ring (8), and the V-block (4) is driven to rotate. During rotation, a laser sensor measures the distance to the surface of the ring in synchronization with the angle of rotation determined by the encoder (2). Upon completion of one turn of the V-block, a laser sensor moves to the next control position, and the measurement process is repeated. The number of diameter control sections along the pipe is defined by the software.

Radial coordinates of the calibration ring surface and controlled pipe are transmitted to the PC for calculating the required geometric parameters.

8. **Connection**

Make connections in accordance to block diagram shown in Figure 1. Connect measurement module to controller by means of two cables (Ethernet and Power supply). Connect foot switch to controller. Connect controller to PC and to 220 V AC.

9. **Network setting**

The machine is shipped with the following default network configuration: IP address of the machine – 192.168.1.3.

Configure your PC's network card in the following address space: 192.168.1.X. Connect the machine directly to your PC or through the network switch.
10. **Service program**

In order to work with the machine, you need to install the RFClearView software, and to activate the license.

10.1. **System requirements**

The main requirements for using RFClearView:
- Operating system Windows 7 and later.
- Video card and video card drivers, which support OpenGL 2.1 and later.

10.2. **Installation**

Before starting the installation, read the following information. The RFClearView software comes in two versions – 64 and 32 bits. To determine a correct version, refer to the System Properties window or to your system administrator.

Setup files for each version exist in two implementations:
- Standalone setup file (*RFClearViewSetup_offline.exe*) contains a version of RFClearView on the date of the setup file creation.
- Setup file via the internet (*RFClearViewSetup_online.exe*) will download and install the latest version of RFClearView.

Download links of the latest versions:
- **Windows x64**:  
  - [Download](https://riftek.com/media/rit/repos/installers/RFClearViewSetup_online_x64.exe)  
  - [Download](https://riftek.com/media/rit/repos/installers/RFClearViewSetup_offline_x64.exe)
- **Windows x32**:
  - [Download](https://riftek.com/media/rit/repos/installers/RFClearViewSetup_online.exe)  
  - [Download](https://riftek.com/media/rit/repos/installers/RFClearViewSetup_offline.exe)

The installation is performed by the specially created installer. To start the installation, you need to run the setup file `RFClearViewSetup_online.exe/RFClearViewSetup_offline.exe`.

When you run the installation, Welcome Window appears:

![Welcome Window](image)

To continue with the installation, click **Next**.

Follow the guidelines in dialog boxes of the installer.
10.3. License activation

In order to activate the license, click  in the upper right corner of the program window, go to the About tab, and click the link with the license type name. The activation window appears:

![Activation Window](image)

Next, enter your email and confirm it, select Confirm license, enter the activation key, and click Activate.

10.4. Pipe Check

10.4.1. Main window

Run RFClearView, click on the sign located on the upper right corner of the program window, and select Pipe Check:

![Main Window](image)

The selected program will be highlighted in blue. To hide the Application Mode panel and to expand Pipe Check on the entire window, click again.
The main window:

The main window description:

<table>
<thead>
<tr>
<th>Address</th>
<th>TCP/IP address of the machine. Note: the machine and your PC must be in the one subnet.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe</td>
<td>Pipe type selection.</td>
</tr>
<tr>
<td>Write log</td>
<td>Write log option.</td>
</tr>
<tr>
<td>Open log folder</td>
<td>Open the folder with log files.</td>
</tr>
<tr>
<td>Noise filter size (%)</td>
<td>10% by default.</td>
</tr>
<tr>
<td>Smooth filter size (%)</td>
<td>30% by default.</td>
</tr>
<tr>
<td>Repeat count</td>
<td>Number of intermediate positions for one position.</td>
</tr>
<tr>
<td>Splash delta (µm)</td>
<td>Distance between intermediate positions.</td>
</tr>
<tr>
<td>Connect</td>
<td>Connect to the machine.</td>
</tr>
<tr>
<td>Start</td>
<td>Start the measurement.</td>
</tr>
<tr>
<td>Stop</td>
<td>Stop the measurement.</td>
</tr>
<tr>
<td>Disconnect</td>
<td>Disconnect from the machine.</td>
</tr>
<tr>
<td>Calibrate</td>
<td>Calibrate the machine.</td>
</tr>
</tbody>
</table>

10.4.2. Calibration

Attention!
The machine must be calibrated by using the calibration pipe every time when you switch it on.

To perform the calibration procedure, follow the steps below:
- Insert the calibration pipe into the V-block.
- Go to the main window.
- Select Calibration from a drop-down list:

  ![Pipe Calibration](image)

  - Connect to the machine - click Connect.
  - Start the calibration process - click Calibrate.
  - Wait until the calibration is complete.

Calibration settings can be changed. Click Disconnect, then click the icon on the left side of the main window, and go to the Calibration tab.

The Calibration tab:
You can use the default calibration parameters or set them manually (if necessary). If you have changed the parameter value and did not click Save yet, you can reset this change by clicking the Reset button.

To restore the default values of all calibration parameters, click Reset to factory values.

The calibration by using the calibration pipe is necessary. Optionally, you can also calibrate the machine by calibration ring. Options Reset calibration and Calibrate every time are applied only to the calibration by ring. In case of the calibration error, click Reset calibration. To calibrate the machine by ring every time before measurement, select the Calibrate every time option.

To save the changes, click Save.

Click Back to return to the main window.

Note. Do not click Back and Templates before you have saved calibration settings, because in this case all changes will be reset.

### 10.4.3. Measurement procedure

Once the system has been calibrated by using the calibration pipe, it's ready to work. To perform the measurement, follow the steps below:

1. Select the pipe from the Pipe drop-down list (how to create pipe descriptions, see Par. 10.4.4.).
2. Select the Write log option (if necessary).
3. Click Connect.
4. Insert the pipe into the V-block (the pipe must be pressed to the thrust plate).
5. Click Start (or press the foot switch).

When you click Stop during the measurement process and then click Start again, the measurement will be repeated from the beginning.

Upon completion of the measurement process, a signal tower blinks green or red (depending on the final result: green – success, red – fail), and the program displays the measurement results as shown on the screenshot below:
Pass - measurement results are within the tolerances.
Fail - measurement results are beyond the tolerances.

The final result is shown below the tables (Result).
Take note that the final result can be Pass or Fail depending on the following:

<table>
<thead>
<tr>
<th>Minimum diameter</th>
<th>Maximum diameter</th>
<th>Average diameter</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fail</td>
<td>Fail</td>
<td>Fail</td>
<td>Fail</td>
</tr>
<tr>
<td>Fail</td>
<td>Fail</td>
<td>Pass</td>
<td>Fail</td>
</tr>
<tr>
<td>Fail</td>
<td>Fail</td>
<td>Pass</td>
<td>Fail</td>
</tr>
<tr>
<td>Fail</td>
<td>Fail</td>
<td>Fail</td>
<td>Fail</td>
</tr>
<tr>
<td>Fail</td>
<td>Pass</td>
<td>Fail</td>
<td>Fail</td>
</tr>
<tr>
<td>Pass</td>
<td>Fail</td>
<td>Fail</td>
<td>Fail</td>
</tr>
<tr>
<td>Pass</td>
<td>Pass</td>
<td>Fail</td>
<td>Pass</td>
</tr>
<tr>
<td>Pass</td>
<td>Fail</td>
<td>Fail</td>
<td>Pass</td>
</tr>
<tr>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
<td>Pass</td>
</tr>
</tbody>
</table>

Next, if you intend to measure pipes of the same type, change the pipe in the V-block (see step 4), and click Start.

If you want to change the pipe type, it is necessary to disconnect from the device (click Disconnect), and to follow steps 1-5.

If you want to change settings, it is necessary to disconnect from the device (click Disconnect), and to click on the left side of the main window.

10.4.4. Templates settings

Click on the left side of the main window.
When there are no saved pipe descriptions in the program, the program prompts to create one:
Click **Create pipe description**, enter the name into the **Pipe name** field, and click **Ok**.

When the pipe description is created, it is necessary to add the measurement positions and to set tolerances for each of them.

For every pipe you must set at least one measurement position. To add the measurement position, click **Add position**.
Next, it is necessary to set parameters for every position:

- Measurement position: the **Position** field (mm)
- Tolerances: Minimum, Maximum and Average diameter (mm)

It is necessary to set tolerances (-/+ ) and a nominal value (the **Nominal** field) for the selected diameter type (minimum/maximum/average):

To remove the tolerances, you need to click `next to the ones you want to remove.

To add the new tolerances, you need to click `.

To remove the position, click in the bottom part of the position area.

**Note.** Do not click **Back** and **Calibration** before you have saved the pipe description, because in this case all changes will be reset.

If you want to create a new pipe description, click **Pipe > Add pipe**, enter the name into the **Pipe name** field, and click **Ok**.

If you want to remove the pipe description, click **Pipe**, select one from the list, click **Remove selected**, and confirm the action.

To pass to another pipe, click **Pipe**, select one from the list, and click **Ok**.
When you have set all parameters and saved the pipe description, click Back to return to the main window in order to start the measurement.

10.4.5. Log

To save results to the log files (CSV), select the Write log option. To open the log folder, use the special button:

![Log folder button](image)

⚠️ You can select the Write log option only when the device is not connected in the program.

### 11. Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>You cannot connect to the device in the program</td>
<td>Device is turned off</td>
<td>Make sure that the device is turned on (red button on the controller).</td>
</tr>
<tr>
<td></td>
<td>Power supply</td>
<td>Check the power supply.</td>
</tr>
<tr>
<td></td>
<td>Cables</td>
<td>Make sure that all cables are connected properly.</td>
</tr>
<tr>
<td></td>
<td>Subnet conflict</td>
<td>Check network settings. The device and your PC must be in the one subnet.</td>
</tr>
<tr>
<td>Incorrect results</td>
<td>Calibration error</td>
<td>Check calibration parameters. Recalibrate the machine by using the calibration pipe.</td>
</tr>
<tr>
<td>No log files</td>
<td>Program settings</td>
<td>Make sure that the Write log option is enabled.</td>
</tr>
</tbody>
</table>

### 12. Technical support

Technical assistance, related to incorrect work of the device and to problems with the service program, is free. Requests for technical assistance should be addressed to support@riftek.com, or by phone +375-17-2813513.

When contacting technical support, please provide the detailed description of the problem.

### 13. Warranty policy

Warranty assurance for the Pipe Inner Diameter Measurement Machine RF096-32/42-80 Series – 24 months from the date of putting in operation; warranty shelf-life – 12 months.

Warranty repair is not provided in the cases of incorrect connection and mechanical damage, including opening the housing.
14. Distributors

AUSTRALIA
Applied Measurement
Australia Pty Ltd

BENELUX
Altheris B.V.
Viekweg 17a
2266KA Leidschendam
The Netherlands
Tel: +31 70 3924421
Fax: +31 70 3644249
sales@altheris.nl
www.altheris.com

BULGARIA, HUNGARY
RMT Ltd.
R Zahradni 224
739 21 Paskov, Czech Republic
Tel: +420 558640211
Fax: +420 558640218
rmt@rmt.cz
www.rmt.cz

BRAZIL
CAPI Controle e Automação Ltda
Rua Itororó, 121, CEP 13466-240
Americana-SP, Brazil
Tel: +55 19 36047068
Fax: +55 19 34681791
capi@capicontrole.com.br
www.capicontrole.com.br

CHILE
Verne SpA
Apoquindo 2818, oficina 31,
Las Condes, Santiago, Chile
Tel: +56 2 228858633
info@verne.cl
jsaavedra@verne.cl
www.verne.cl

CHINA
Zhenshangyou Technologies Co., Ltd.
Rm 2205-2210, Zhongyou Hotel
1110 Nanshan Road, Nanshan
District 518054 Shenzhen, China
Tel: +86 755-26528100/8011/8012
Fax: +86 755-26528210/26435640
info@51sensors.com
www.51sensors.com

CHINA
Shanghai micron-metrology com., Ltd.
Room 602 unit 4, lane 399,
Mudan road, Pudong New district
Shanghai, China
Tel: +86-21-68416510
sales@micron-metrology.cn
www.micron-metrology.cn

FRANCE
DB Innovation (ALTHERIS France)
26, avenue de la Mediterranee
34110 Frontignan France
Tel: +33-467786166
Fax: +33-467740134
dbi@altheris.fr
www.altheris.fr

FINLAND
TERÄSPYÖRÄ-STEELWHEEL OY
RAILWAY INSTRUMENTS ONLY
Juvan teollisuuskatu 28
FI-02920 ESPOO, Finland
Tel: +358 400 422 900
Fax: +358 9 2511 5510
steelwheel@steelwheel.fi
www.teraspyora.fi

GERMANY
Disynet GmbH
Breyeller Str. 2
41379, Brueggen
Tel: +49 2157 8799-0
Fax: +49 2157 8799-22
disynet@sensoren.de
www.sensoren.de

CHINA
JRKtech Co., Ltd.
1F, Building 9, 100 Xianlie Rd.,
Guangzhou, China
Tel: +86 755 85267190/
+86 15989362481
Fax: +86 755 85267190
shengz_k@163.com
www.jrktech.com

CHINA
Shanghai micron-metrology
com., Ltd.
Room 602 unit 4, lane 399,
Mudan road, Pudong New district
Shanghai, China
Tel: +86-21-68416510
sales@micron-metrology.cn
www.micron-metrology.cn

FINLAND
TERÄSPYÖRÄ-STEELWHEEL OY
RAILWAY INSTRUMENTS ONLY
Juvan teollisuuskatu 28
FI-02920 ESPOO, Finland
Tel: +358 400 422 900
Fax: +358 9 2511 5510
steelwheel@steelwheel.fi
www.teraspyora.fi

FRANCE
DB Innovation (ALTHERIS France)
26, avenue de la Mediterranee
34110 Frontignan France
Tel: +33-467786166
Fax: +33-467740134
dbi@altheris.fr
www.altheris.fr

GERMANY
Disynet GmbH
Breyeller Str. 2
41379, Brueggen
Tel: +49 2157 8799-0
Fax: +49 2157 8799-22
disynet@sensoren.de
www.sensoren.de

CHINA
JRKtech Co., Ltd.
1F, Building 9, 100 Xianlie Rd.,
Guangzhou, China
Tel: +86 755 85267190/
+86 15989362481
Fax: +86 755 85267190
shengz_k@163.com
www.jrktech.com

CZECH REPUBLIC
RMT Ltd.
Zahradni 224
739 21 Paskov, Czech Republic
Tel: +420 558640211
Fax: +420 558640218
rmt@rmt.cz
www.rmt.cz

FRANCE
DB Innovation (ALTHERIS France)
26, avenue de la Mediterranee
34110 Frontignan France
Tel: +33-467786166
Fax: +33-467740134
dbi@altheris.fr
www.altheris.fr

GERMANY
Disynet GmbH
Breyeller Str. 2
41379, Brueggen
Tel: +49 2157 8799-0
Fax: +49 2157 8799-22
disynet@sensoren.de
www.sensoren.de