



**«LIDA-2D» –  
CONTACTLESS EXTERNAL DIAMETER MEASUREMENT OF CYLINDRICAL  
PRODUCTS  
User manual**

**72884111.425800.77.01 RE**

Ekaterinburg  
2021

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# 1 DESCRIPTION AND OPERATION

## 1.1 Designation

The «LIDA-2D» Unit (hereinafter referred to as the Unit) is designed for contactless measurement of external diameters of cylindrical products and visualization of measurement results on a PC screen.

The Unit's functions include:

- contactless measurements of external diameters of cylindrical products;
- display of measured values of external diameters on the PC screen in numerical and chart form;
- calibration of the Unit with the software;
- control of two universal digital outputs for connecting external alarm devices;
- storage of a database of product sizes with the possibility of editing;
- storage and access to the measurement results database;
- exporting a measurement report in Excel.

This Unit is a smart virtual measuring system (according to GOST R 8.673-2009 and GOST R 8.818-2013).

## 1.2 Operating conditions of the Unit

Operating temperature range: from 10 to 35 °C;

Relative humidity: from 40 to 75 %;

Air pressure: from 84 to 106.7 kPa (from 630 to 800 mm Hg).

In terms of resistance to climatic effects, the Unit corresponds to the NF 4 group of GOST 15150-69.

The storage and transportation conditions of the Unit correspond to group 1 of GOST 15150-69.

## 1.3 Specifications

Table 1.1 – Main parameters and characteristics of the Unit

Name of the parameters and characteristics	Value
Diameter measuring range, mm	25 – 650
Absolute error of measurement, not more, mm	±0.1
Digital interface	RS-485, Ethernet 10/100
Power supply voltage, V	220
Power consumption, W, not more	100
Overall dimensions, not more, mm	1886×619×230
Continuous working time	unlimited

1.3.1 In accordance with GOST 52931-2008, the Unit belongs to the following performance groups:

- resistance to ambient temperature and humidity – V1;
- resistance to air pressure – P1.

#### 1.4 Design specifications

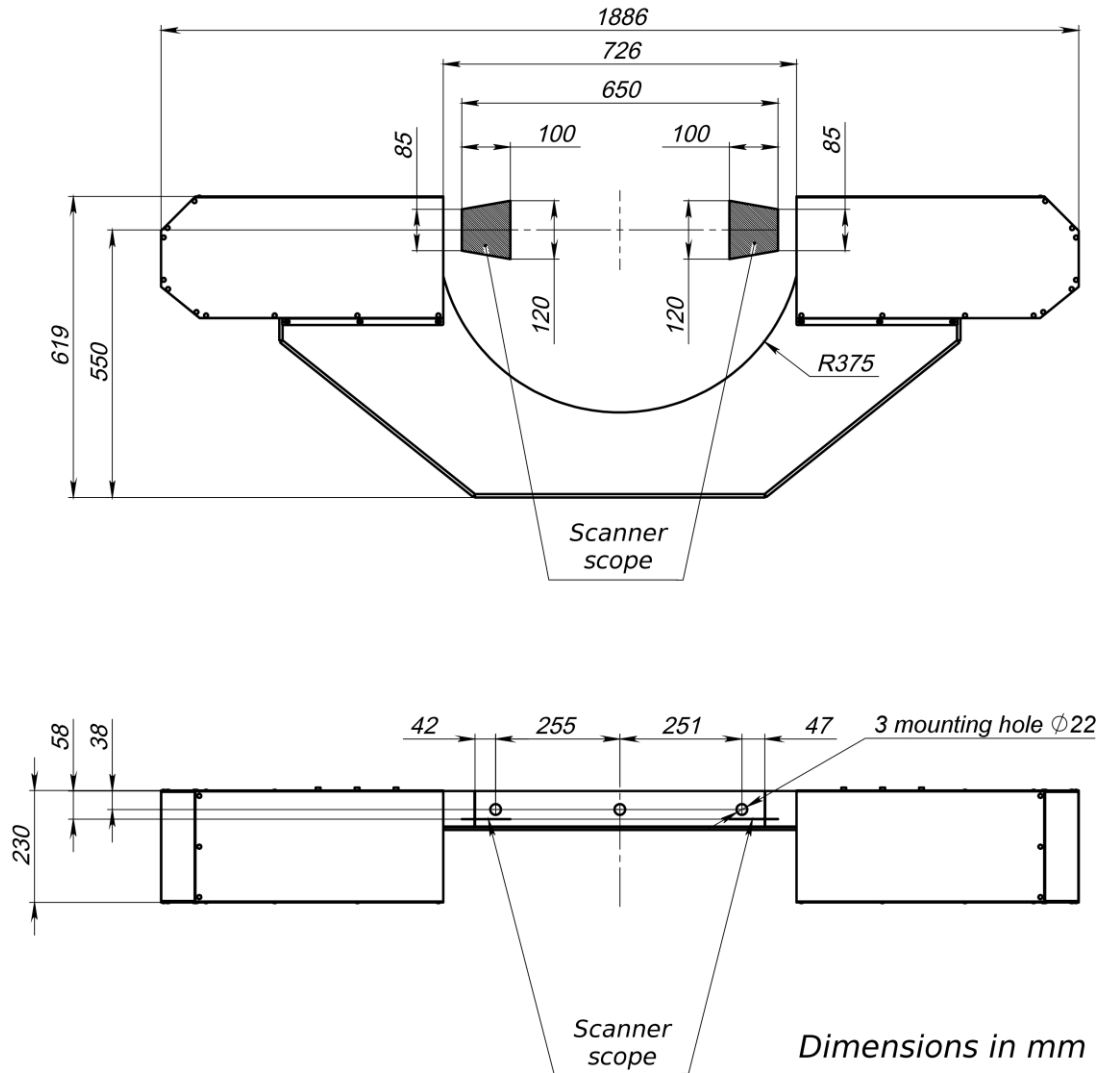


Figure 1.1 – Design specifications of Unit

## 1.5 Delivery set

Table 1.2 – Delivery set of the Unit

Name and designation	Pcs.
Gaging block of the «LIDA-2D» Unit	1
Remote monoblock with installed software	1
Automation cabinet	1
«LIDA-2D» – contactless external diameter measurement of cylindrical products. User manual 72884111.425800.77.01 RE».	1

## 1.6 Structure and operation

Unit appearance is shown in the figure 1.2.

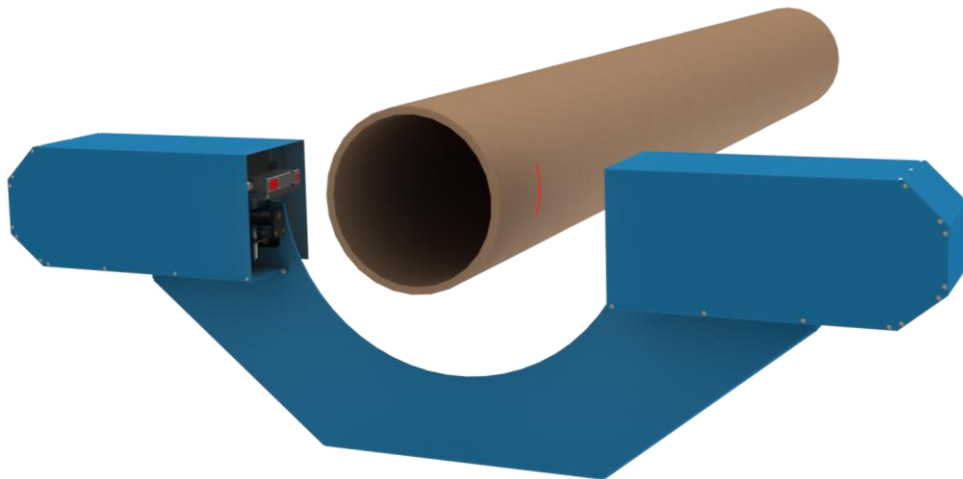


Figure 1.2 – Unit appearance

The gauging block of the Unit contains LS2D laser scanners located on both sides of the measured product. The software receives and transmits commands to LS2D scanners via the Ethernet interface.

During the measurement process, the LS2D sensors determine the distance to the measured object. The measurement results are transmitted to a computer where the current diameter value is calculated and displayed, as well as saved in a database.

Each scanner Unit has two universal digital outputs with an open collector, which can be used to connect external alarm devices.

## **1.7 Marking and sealing**

Scanners of the Unit contain the following marking in accordance with the requirements of GOST 26828:

- laser hazard sign in accordance with GOST IEC 60825-1-2013;
- explanatory sign with the inscription:

**LASER APERTURE**

- the logo of the manufacturer «NPP Prisma»;
- the model name of the scanner Unit;
- serial number;
- explanatory marking of the hazard class of the laser wavelength and maximum radiation power of the applied laser in accordance with the requirements of GOST IEC 60825-1-2013, names GOST IEC 60825-1-2013, as well as information about the manufacturer.

The Unit's scanners contain a semiconductor laser with a power of no more than 15 mW of hazard class 3B (GOST IEC 60825-1-2013), so the explanatory marking contains the following text:

**LASER RADIATION**

**AVOID EXPOSURE TO BEAM**

**CLASS 3B LASER PRODUCT**

Sealing of the Unit is performed by the company's TC department after the acceptance procedure using self-destructing stickers made typographically.

## **1.8 Packaging**

Packaging of components of the Unit is made according to GOST 9181-74 in retail containers made of corrugated cardboard.

The Unit must be positioned horizontally in the retail container to avoid shakes and vibration. The container must be completely filled.

Containers must be marked in accordance with the requirements of GOST 14192 and handling signs «FRAGILE», «TOP», «KEEP DRY».

## **2 SAFETY MEASURES**

**ATTENTION! WHEN WORKING WITH UNIT'S SCANNERS AT A DISTANCE OF LESS THAN 2 METERS, PLEASE, AVOID THE DIRECT OR MIRROR LASER RADIATION IN THE EYES.**

During the operation and the maintenance, it is necessary to follow the requirements of the GOST

12.3.019-80, «Guidelines for the operation of electric installations of consumers», «Guidelines for the labour protection during operation of consumer electrical installations» and the GOST IEC 60825-1-2013.

Only the engineers and technicians who have been specially instructed and studied this user manual are admitted to the work with the Unit.

Any connection to the Unit and its maintenance should only be performed when the device is powered off.

**DO NOT USE THE UNIT IN AGGRESSIVE ENVIRONMENTS CONTAINING ACIDS, ALKALIS, OILS, ETC.**

### 3 PREPARE FOR WORK

**ATTENTION!** Do not install the Unit in the humidity condensation areas on the optical surfaces of the scanners or where direct sunlight or artificial light enters the aperture of the receiving lenses. It can cause errors in the measurements.

Connect the Unit by plugging it in with the appropriate power and computer cables. The connection is made only when the devices are powered off.





Power up the Unit and wait till both scanners turn on their lasers.

The IP addresses of LS2D scanners correspond to 192.168.1.146 and 192.168.1.147. For the Unit to work correctly, the following settings must be set on the PC:

Subnet mask: 255.255.255.0;

IP- address PC: 192.168.1.100

In Windows OS, perform the following operations to configure the network connection, depending on the operating system version:

Windows Vista	Windows 7	Windows 8	Windows 10
Key combination  +R or Start Menu →Run... Type «control». Press OK or Enter 			
Network and Sharing Center → Manage Network Connections	Network and Sharing Center → Change adapter settings		
 Right click on the desired local network connection →Properties 			
Select «Internet Protocol Version 4 (TCP/IP)» then click «Properties»			Select «IP Version 4 TCP/IPv4)» then click «Properties»

In a new window (see the figure 3.1), enter the above network settings, click «OK», and click «OK» again.

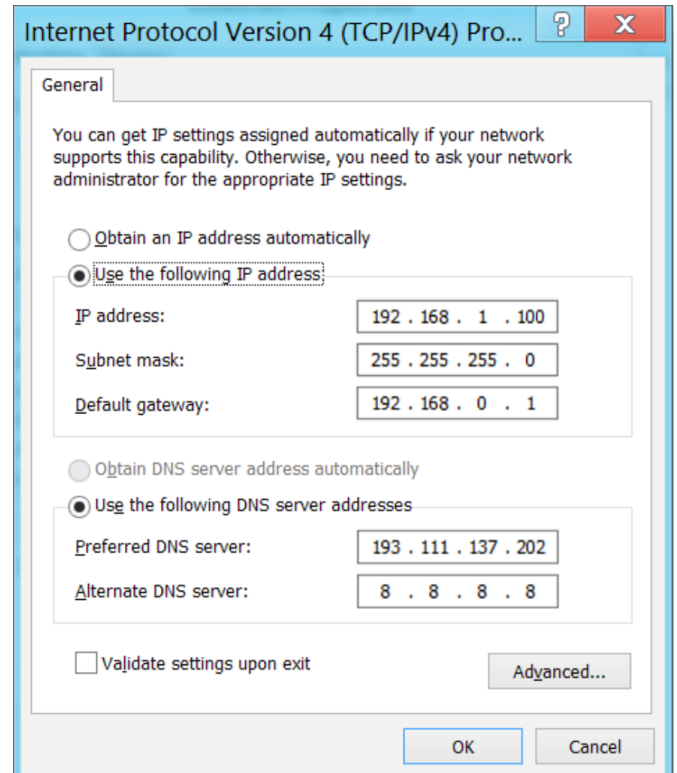
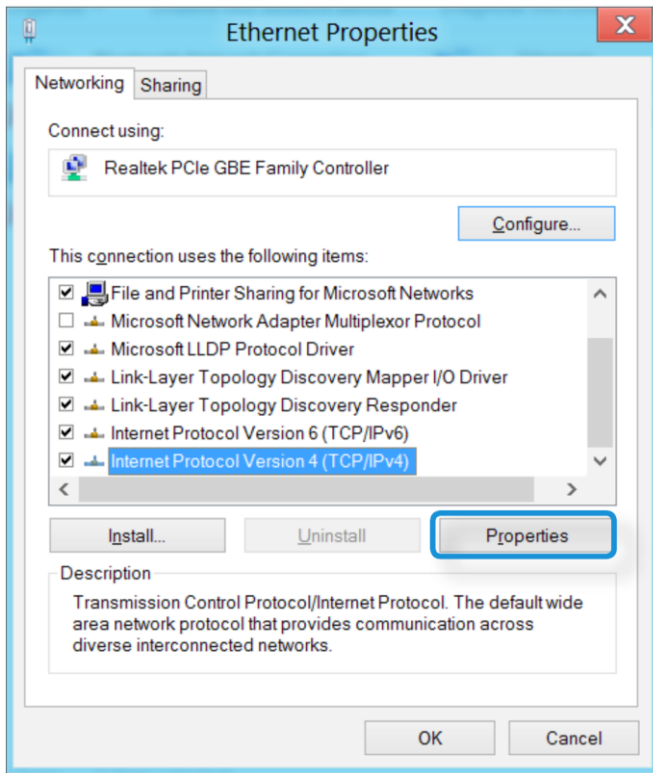


Figure 3.1 – Example of network connection setting to work with the Unit scanners in Windows 10



## 4 WORK WITH THE SOFTWARE

Work with the Unit is carried out by means of LIDA-2D.exe software.

### 4.1 Designation

The software functions include:

- communication with laser scanners of the Unit;
- indication of the status of communication with laser scanners;
- display of scanner measurement results;
- calculation and display of the measured diameter;
- calibration of the Unit;
- control of universal digital outputs used to connect external alarm devices;
- saving the measurement results in a database;
- exporting of a report with measurement results in Excel.

### 4.2 Basic information

Software appearance LIDA-2D.exe at start-up is shown in the figure 4.1

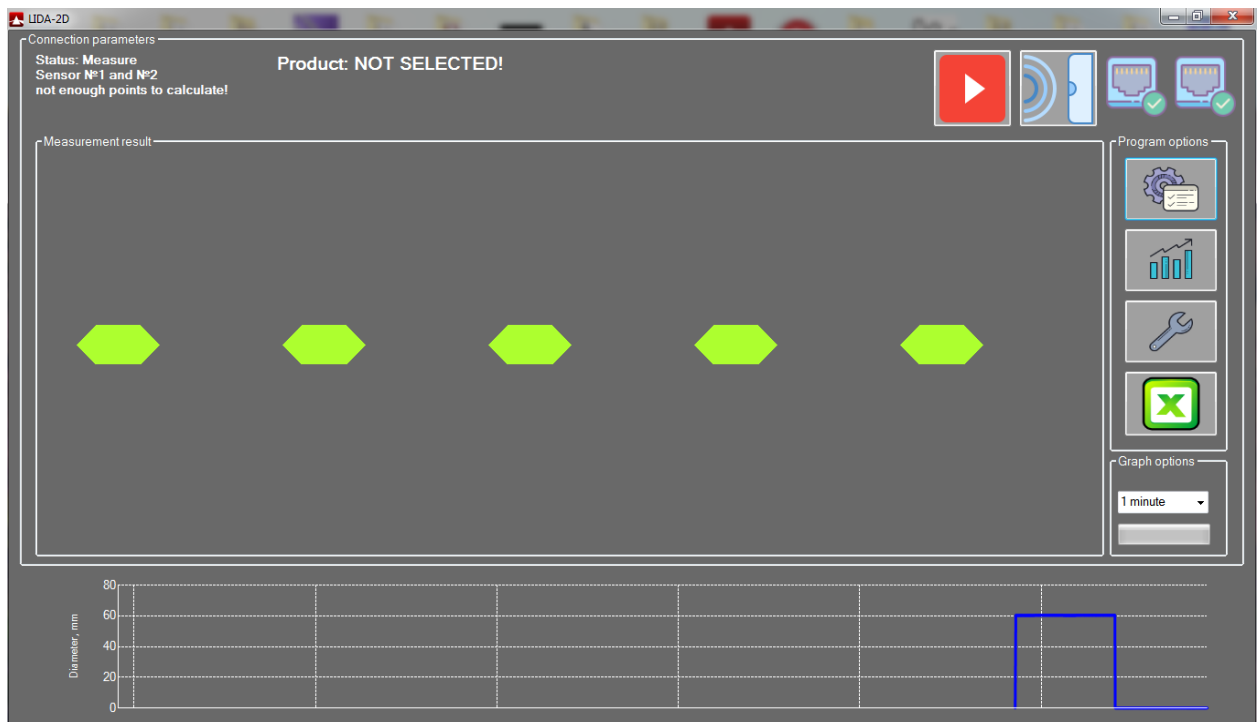




Figure 4.1 – Software appearance LIDA-2D.exe

The program window consists of panels whose names and purposes are shown in the table 4.1.


Table 4.1 – Assignment of program panels LIDA-2D.exe

Panel name	Destination
«Connection parameters»	contains connection status indicators for laser scanners of the Unit
«Measurement result»	displays the current result of measuring of the external diameter of the product
«Program options»	contains buttons for setting up the program, calibrating of the Unit, work with scanner measurement results, and exporting data to Excel
«Graph options»	contains a time interval for displaying measurement results on the chart and an indicator of the process of saving data to Excel-file

After starting the program LIDA-2D.exe communication is established with Unit scanners. Each LS2D sensor has its own communication indicator on the «Connection parameters» panel, which changes from  to  when the connection is established.

### 4.3 Work with a list of types of measured products

#### 4.3.1 Creating of a new type of the measured pipe

To create the type of product to be measured, click the «Product options» button () on the «Program options» panel. A window with a list of products located in the database (see the figure 4.2) will be opened.

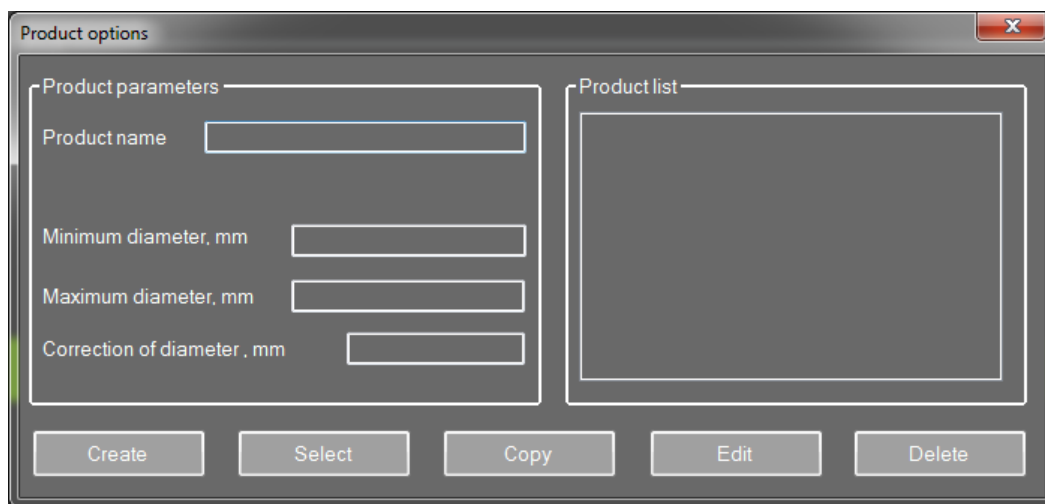


Figure 4.2 – Appearance of the «Product options» window

Clicking the «Create» button opens the «Product creation» window for entering parameters for a new pipe type (see the figure 4.3).

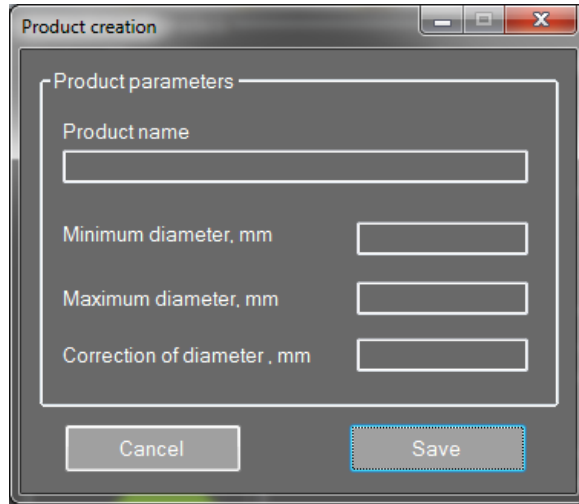


Figure 4.3 – Window for creating a new product type

In the «Product name» field, enter a unique designation for the type of pipe to be measured, and in the «Minimum diameter, mm» and «Maximum diameter, mm» fields, enter the diameter tolerance limits. It is important that the minimum diameter value is less than the maximum. When entering a fractional number, separate by the comma («,»).

In the "Correction of diameter, mm" field, enter the diameter correction in millimeters. This parameter is necessary for adjusting the diameter of products made of various materials (cardboard, plastic, acrylic, metal, etc.). you can enter a negative value. A negative value reduces the calculated diameter by the entered value, and a positive value increases it.

To save the changes, fill in all the fields. The «Save» button creates an entry in a table with a list of products in the database.

Clicking the «Cancel» or «Close» buttons cancels the operation.

#### 4.3.2 Editing the type of existing product

The «Copy», «Edit» and «Delete» buttons (see Figure 4.2) they are used for copying, editing and deleting the selected product type in the «Product list» area respectively. It is not allowed to create the same product names.

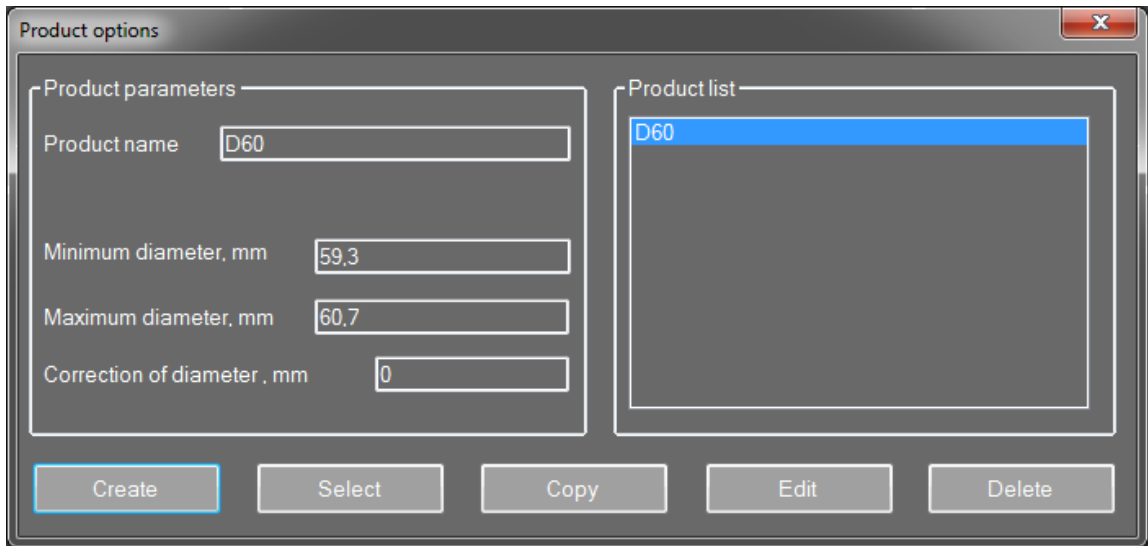


Figure 4.4 – Example of the «Product options» window for the created type of measured product

### 4.3.3 Choosing the product type

To select the type of pipe to be measured, select its name in the «Product list» field and click the «Select» button.

The «Product options» window will close automatically and the selected pipe type with its parameters will be displayed in the main window of the LIDA-2D program in the «Connection parameters» panel.

Purple bounding lines will appear on the diameter control graph (see Figure 4.5).

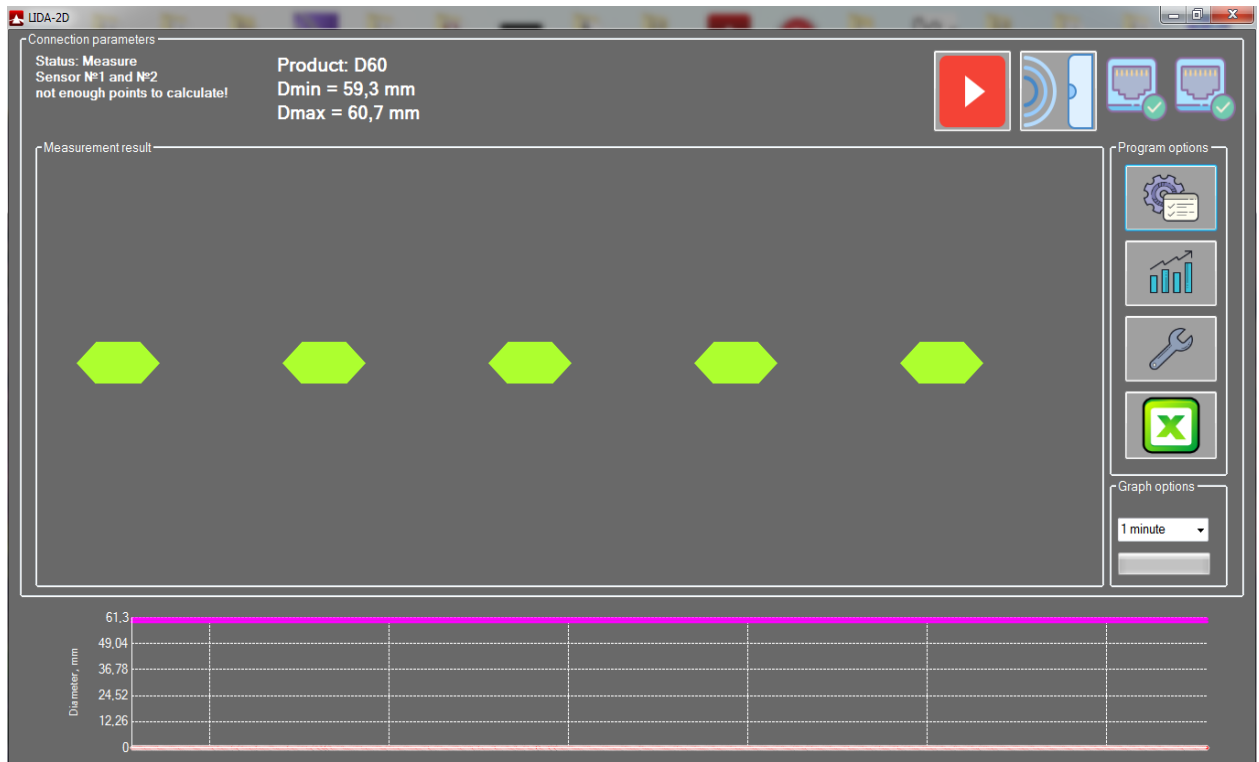


Figure 4.5 – Main window of the program after selecting the product type

#### 4.4 Enable/disable universal digital outputs.

To enable the operation of the universal digital outputs of the sensor, click the «Allarm enable/disable» button located on the right side of the «Connection parameters» panel. After that, the button will change its state from disabled (🔊🔇) to enabled (🔊🔈). The button state is saved when the LIDA-2D program is closed.

Assignment of universal digital outputs:

Digital output №1 – Insufficient number of points for diameter calculation (object outside scanner range).

Digital output №2 – The object is out of the specified diameter range (specified in the «Minimum diameter», «Maximum diameter» fields of the «Product creation» window, see p. 4.3.1).

The active state of the output corresponds to the closing of two output pins.

#### 4.5 Work with the software in calibration mode. Viewing the signal from scanners

Calibration is necessary to align the coordinate system of the LS2D №1 sensor with the coordinate system of the LS2D №2 sensor. In the process of calibration, the LS2D sensors' inclination angle and displacement coefficients are calculated relative to each other.

For calibration, a rectangular standard should be set horizontally between LS2D sensors. Then click the «Calibration parameters» button (🔧) in the «Program options» panel. This will open the «Calibration setting» window (see Figure 4.6, a).

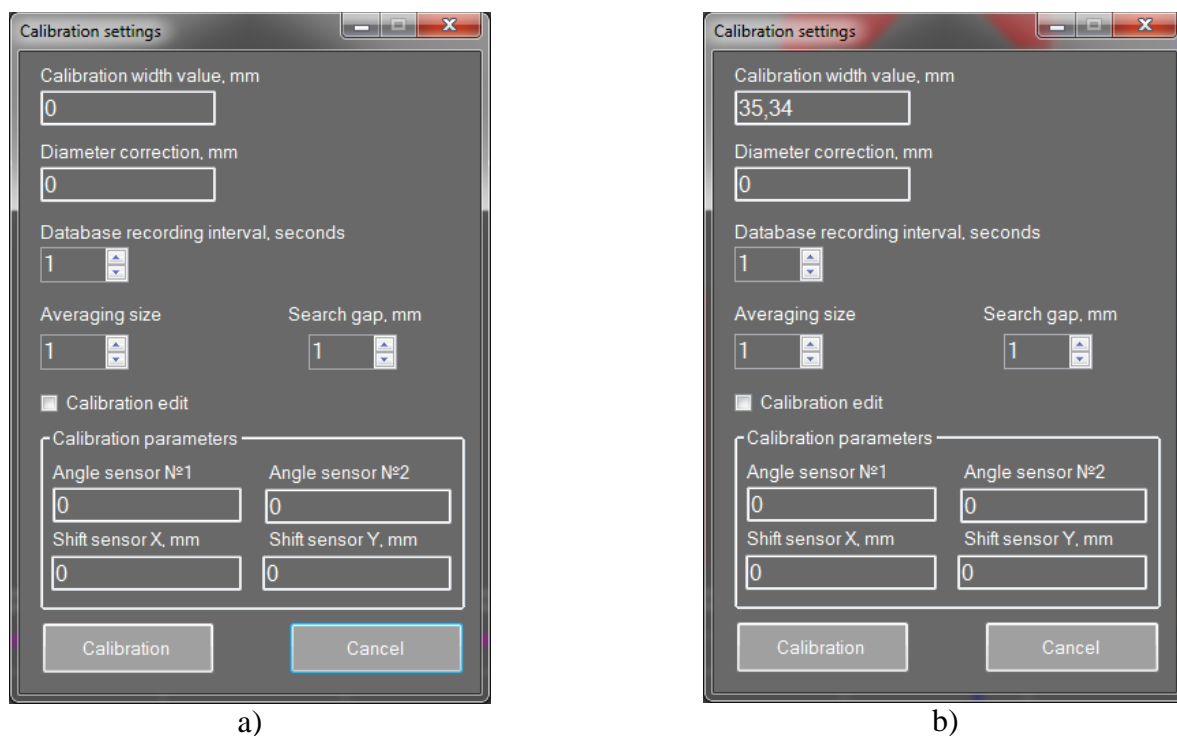

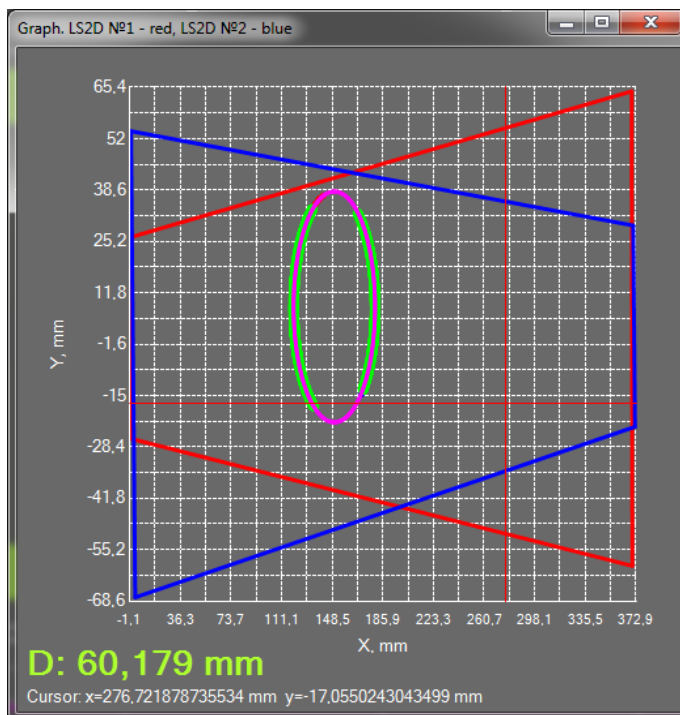


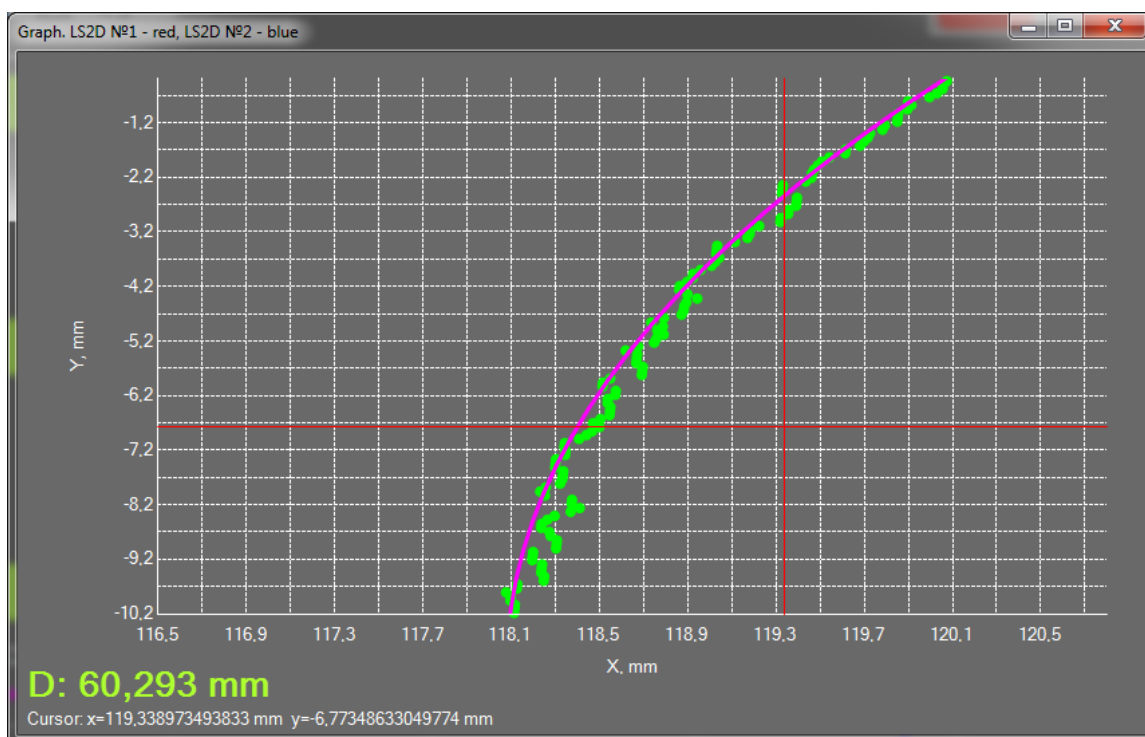
Figure 4.6 – «Calibration settings» window: a – before making changes; b – after making changes

In the «Calibration width value, mm» field, set the width of the installed calibration standard (see Figure 4.6, b). Then click the «Calibration» button.

The calibration check can be evaluated on the chart. To do this, click the «Graph» button  in the «Program options» panel. As a result, a window will open in which you can view the signal (profile of the measurement object) from scanners (see Figure 4.7).



a)



b)

Figure 4.7 – «Graph» window after calibration: a – with the pipe sample installed; b – with the pipe sample installed (zoomed in).

The chart shows the range and measured points of scanner №1 in red, the range and measured points of scanner №2 in blue.

Green color indicates the points by the coordinates of which the diameter or calibration coefficients are calculated (depends on the mode<sup>1</sup>).

The purple color shows the calculated diameter (in diameter measurement mode) or the approximated straight line (in continuous calibration mode) from which the tilt coefficient of the sensor is calculated.

To make corrections to the calibration coefficients, it is necessary in the «Calibration parameters» area of the «Calibration settings» window to set the fields «Angle sensor №1» (tilt factor of the scanner №1), «Angle sensor №2» (tilt factor of the scanner №2), «Shift sensor X» (shift along the X axis of the scanner №2), «Shift sensor Y» (shift along the Y axis of the scanner №2) (see Figure 4.6). The chart after making corrections to the calibration coefficients is shown in Figure 4.8.

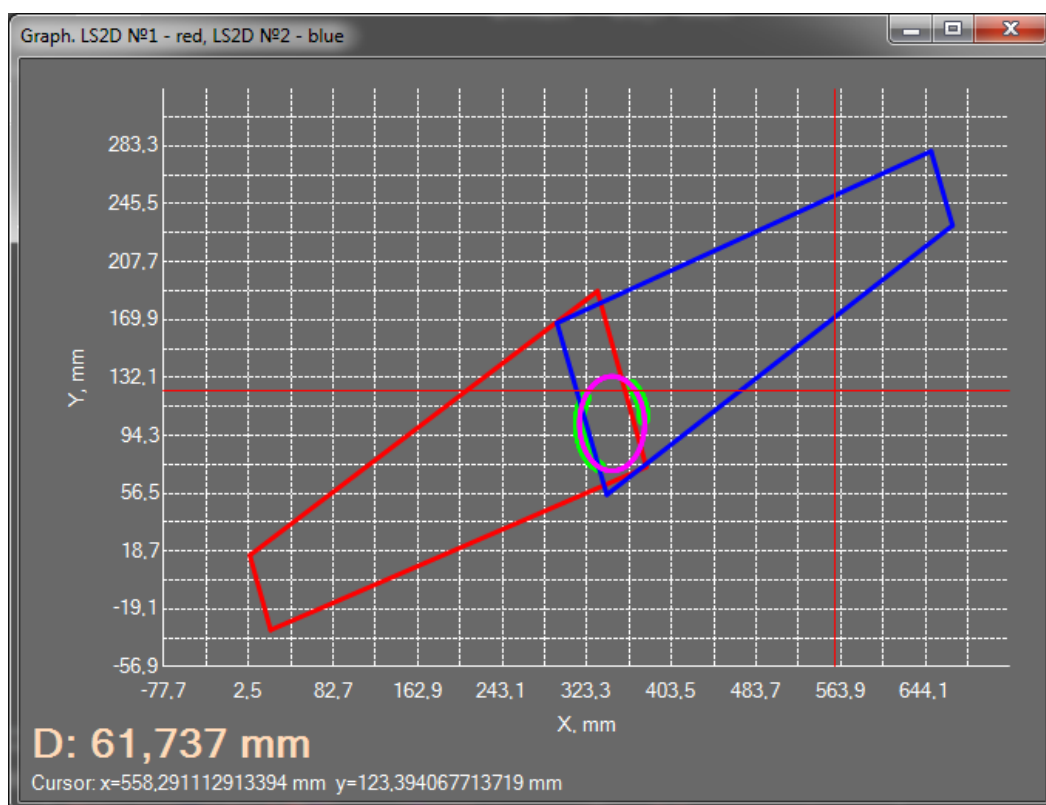


Figure 4.8 – The chart after making corrections to the calibration coefficients

To set the continuous calibration mode you need to check the «Calibration edit» checkbox in the «Calibration settings» window (see Figure 4.9). In this mode, calibration is performed continuously.

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<sup>1</sup> If the «Calibration edit» checkbox is not checked in the "Calibration settings" window, the diameter measurement mode is selected. If this checkbox is checked, the continuous calibration mode is selected.

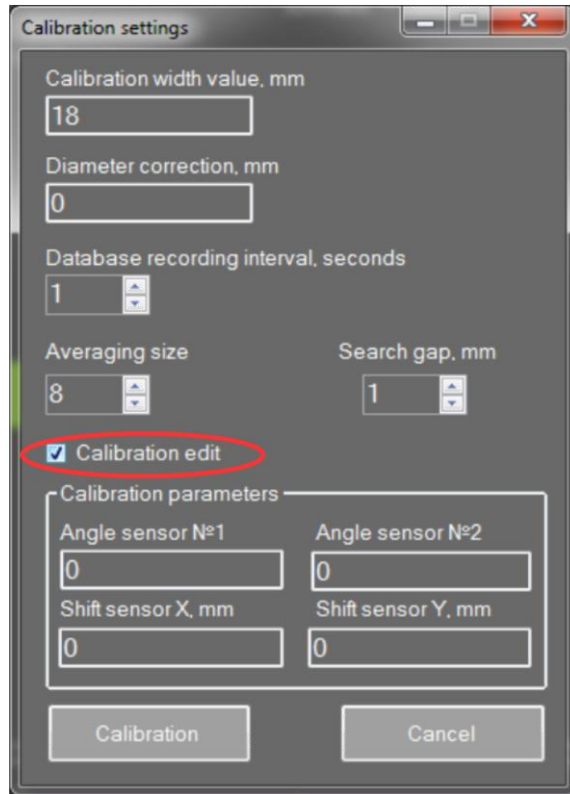


Figure 4.9 – «Calibration settings» window with «Calibration edit» checkbox checked

You can see the calibration process on the graph. In the continuous calibration mode, the diameter value is not displayed (see Figure 4.10).

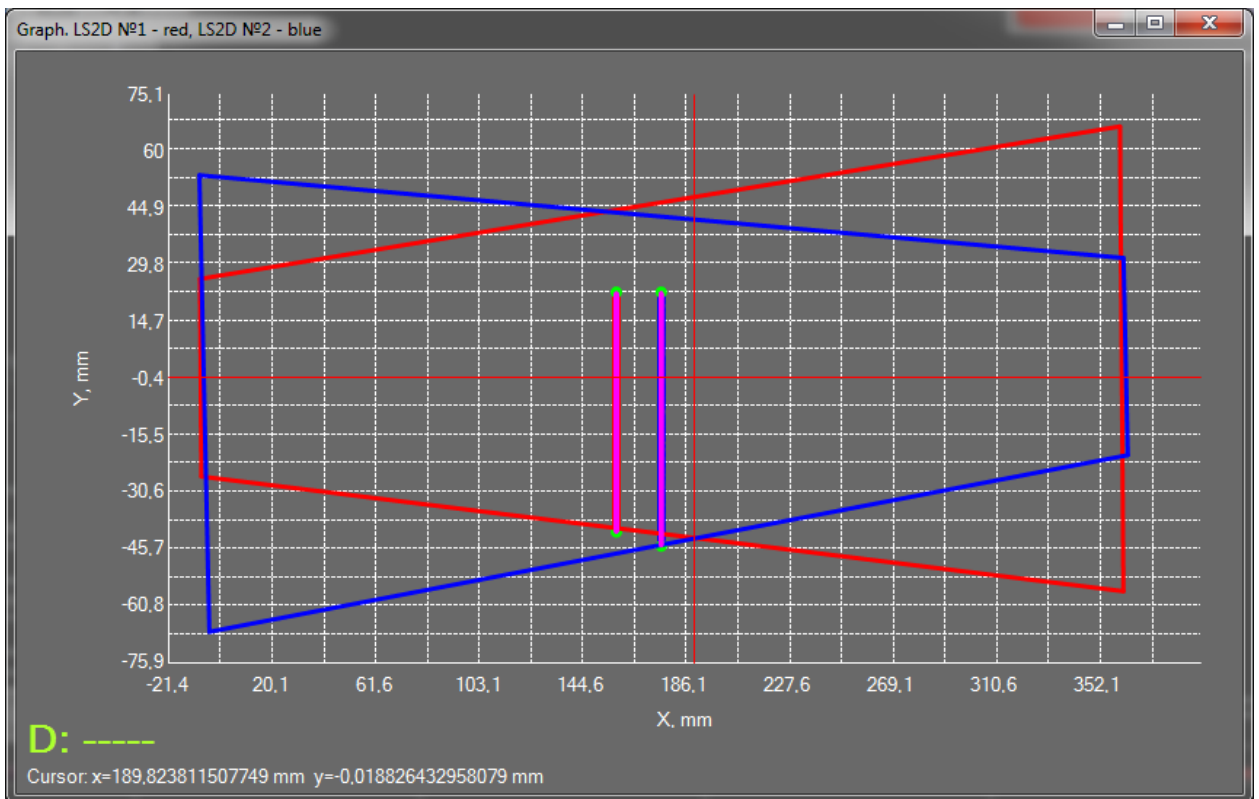


Figure 4.10 – «Graph» window with continuous calibration mode set



In figure 4.11, red dots indicate the measurement results of scanner №1, purple dots indicate the line after approximation of the surface of the calibration standard, and green dots indicate the angle of the calibration standard.

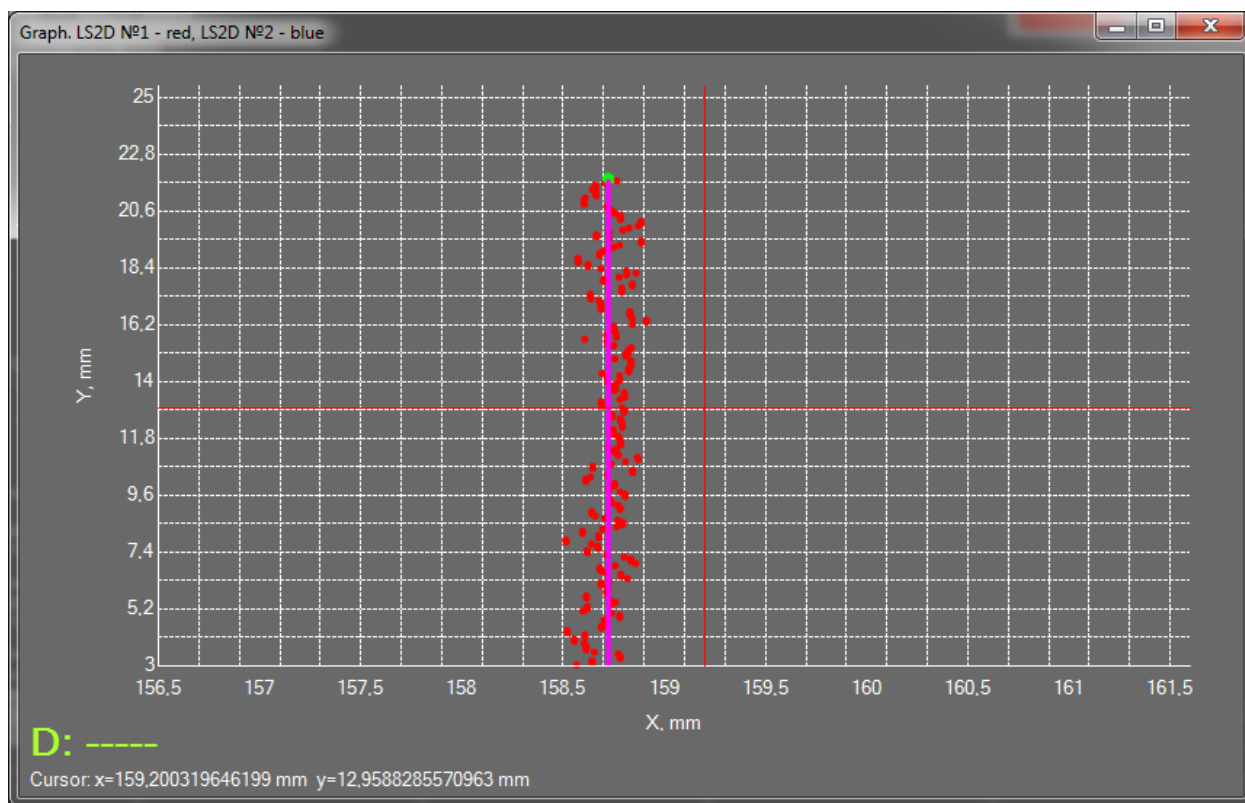


Figure 4.11 – Zoomed in one edge of the calibration standard.

Scaling of the chart is performed by selecting the left mouse button of the area of interest in the direction from left to right or by scrolling the mouse wheel. You can return to the initial scale by selecting any area of the chart from right to left. You can move the image along the coordinate grid using the right mouse button held down.

#### 4.6 Work with the software in measurement mode

The appearance of the program window in the measurement mode is shown in Figure 4.12.



Figure 4.12 – The appearance of the program window in the measurement mode

The object diameter is measured automatically by approximating the points of the LS2D sensor scan results with the circle equation. Before calculating the diameter, these points are selected (continuous profile search). For this, the longest sequence of points is selected, the difference in coordinates of which is less than the specified gap in the «Search gap, mm» field of the «Calibration settings» window. This data processing is necessary to exclude random factors that distort the diameter calculation.

Moving averaging filter is used for diameter measurement result averaging. The window size corresponds to the number of diameter measurements and is set in the «Averaging size» field of the «Calibration settings» window.

The measurement results are displayed in numerical form on the «Measurement result» panel, and in the form of a graph - at the bottom of the main program window.

#### 4.6.1 Viewing the measurement results in numerical form

The measurement result is presented in numerical form with an accuracy of 0.01 mm. The diameter value is displayed in the range from 0 mm to 999.99 mm.

The measured diameter value, which is within the specified product type limits, is highlighted in green.

The universal digital output is used to connect additional equipment to signal the Unit status.

When the measured diameter value exceeds the specified product type limits, the color of numbers in the «Measurement result» panel changes from green to red. At the same time the contacts of universal

digital output №2 of LS2D sensors are closed, if the operation of digital outputs is enabled.

If there is no scanned object, the «Measurement result» panel displays «- - - -» (at the same time the contacts of the universal digital output №1 of LS2D sensors are closed and the contacts of the digital output №2 are opened if the operation of these outputs is enabled.).

#### 4.6.2 Viewing a graph of measurement results in real time

The calculated diameter values in real time are displayed on the graph located at the bottom of the program window. This graph also shows the upper and lower limits of the diameter range for the selected product type. The calculated diameter value that is outside the specified range is displayed in red.

The measured diameter values are displayed on the graph for the last time interval specified in the drop-down list of the «Graph options» panel (see Figure 4.13).

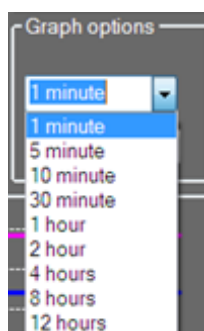


Figure 4.13 - Example of selecting the interval for displaying data on a graph

### 4.7 Database structure

The database contains a table with a list of products and tables of measurement results.

The product list table consists of the «Product name», «Minimum diameter», «Maximum diameter» and «Correction of diameter» entries.

The table of measurement results consists of «Date and time» and «Diameter value» entries.



An entry in a list of products table and a new table with a unique identifier are created in the database to store the measurement results for a new type of pipe.

The database file is titled DB.sqlite and it is stored in the software folder. If this file is missing, it is created automatically at start-up of the LIDA-2D.exe.





We do not recommend working with a database larger than 4 GB. Therefore, it is recommended to delete (move) periodically the DB.sqlite file from the folder with the LIDA-2D software.

You can open the DB.sqlite database file using a third-party SQLiteStudio application for viewing, and editing. Keep in mind that manipulations with the database can lead to a violation of its structure and connections, and, as a result, to the incorrect operation of the LIDA-2D.exe application.


## 4.8 Changing the interval for recording the results to the database. Diameter measurement correction

To start saving the calculation results to the database, click the «Start/Stop record to database» button (  ) in the main program window and the button will change the image to  . Clicking the «Start/Stop record to database» button again shall stop the recording to the database.

The database is recorded at the interval specified in the «Database recording interval, seconds» field of the «Calibration settings» window.

When writing to the database, the  and  buttons are unavailable. After stopping writing to the database, the  and  buttons are active again.

## 4.9 Export of measurement results from a database to Excel

You can save measurement results in Excel by clicking the «Export» button (  ) on the «Program options» panel.

In the opened window, specify the time interval of the exported and the product type (see Figure 4.14) and click the «Export» button.

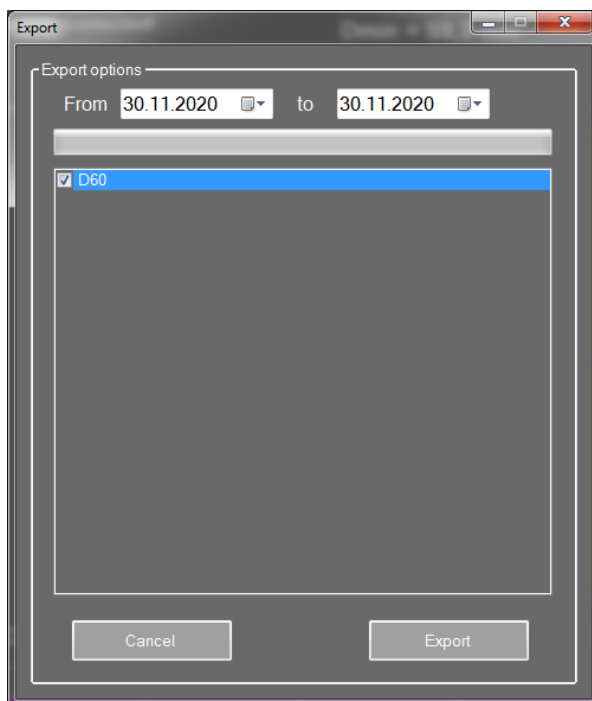


Figure 4.14 – The «Export data» window at the product type selection

In the dialog box that opens you need to specify the path to save the file. Then wait for the export procedure to finish. When the export is complete, the message shown in the figure below will be displayed.

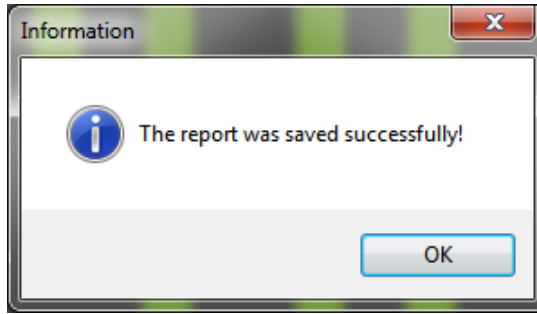


Figure 4.15 – Message about the end of export in Excel

The process of saving to an Excel file is displayed on the indicator of the «Graph options» panel

You can view saved data using any editor that supports.xls format. View of the report in Excel is shown in the figure 4.16.

	A	B
1	Products = D12	
2	Dmin = 11	
3	Dmax = 13	
4	9/3/2020 17:49	13.39118
5	9/3/2020 17:49	13.39559
6	9/3/2020 17:49	13.41761
7	9/3/2020 17:49	13.47011
8	9/3/2020 17:49	13.51286
9	9/3/2020 17:50	13.54309
10	9/3/2020 17:50	13.57519
11	9/3/2020 17:50	13.60738

Figure 4.16 – Example of a report with measurement results in Excel

## 5 TRANSPORTATION AND STORAGE

The Unit can be transported in closed transport of any type at any distance. Packaging must be secured in vehicles in accordance with the rules applicable to the respective types of transport.

Storage and transportation conditions must comply with group 1 according to GOST 15150.

Shakes and vibrations are not allowed.

The air in the room should not contain dust, acid and alkali vapours, as well as gases that cause corrosion.

## 6 MAINTENANCE

### 6.1 General guidelines

Maintenance of the Unit during operation consists of technical inspection, and verification of metrological characteristics of laser scanners.

Technical inspection of the Unit is carried out by the service personnel at least once a month and includes the following operations:

- cleaning the Unit from dust and dirt;
- wiping the protective glasses of scanners with cotton wool soaked in rectified alcohol as they become dusty;
- checking the reliability of external connections.

When cleaning the scanner's protective glasses do not use abrasive cleaning agents that can cause scratches. Defects found during the inspection should be immediately eliminated.

## **6.2 Safety measures**

During the maintenance, one should follow the safety measures described in p. 2.

## **6.3 Unit repair**

The Unit repair is carried out by the manufacturer, OOO «NPP «Prisma»:

<http://www.prizmasensors.ru>

[e-mail: prizma\\_sensors@inbox.ru](mailto:prizma_sensors@inbox.ru)

tel. +7 (343) 268-45-72.

## **7 MANUFACTURER'S WARRANTY**

The manufacturer guarantees that the Unit comply will work without failure for 24 months from the date of purchase at following the terms of operation, transportation, storage and installation.

The time spent by the Unit in the warehouse for 6 months is not included in the warranty period if the storage conditions are met.

In the event of a malfunction of the Unit under the required conditions of operation, transportation and storage, the manufacturer is obliged to eliminate the malfunction free of charge. In this case, the warranty period is extended for the time elapsed from the date of filing the complaint until the Unit is put into operation.

The manufacturer reserves the right to make changes to the design that does not impair the technical characteristics of the product.

The manufacturer prematurely removes its warranty obligations in case of non-compliance with the conditions of operation, transportation, and storage.