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Operating instructions

DREMPOLAR

Glass voltage measuring device

Made by: Drempolar Kft.
Date: July 21, 2009.

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Preface

The ***"Drempolar Glass Voltage Measuring Equipment" Operating Instructions*** apply to equipment with the **DREMPOLAR** identifier.

ATTENTION!

To operate the equipment, it is essential to read the entire operating instructions!
This applies in particular to equipment operating, monitoring and maintenance personnel!

The individual chapters only contain field-specific descriptions, so getting to know the entire equipment is only possible by reading each chapter!

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Designers Statement

For **the** documentation of the equipment with the identification mark DREMPOLAR .

43/1993 on labor protection. In accordance with the provisions of the MT Act, we declare that this documentation was prepared based on the laws, standards, regulations and other official regulations in force at the time of design, as well as taking into account the technological conditions specified in the machine specification. The documentation covers all important occupational safety issues in detail, describing the sources of danger and the solutions chosen to eliminate them.

Budapest, **July 21, 2009.**

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Dr. István POMOZI

Project manager

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1 Legal notice

1.1 Legal protection

The manual contains drawings and technical data, the use of which is permitted only to the extent necessary for the operation of the equipment. Transfer of data to third parties is only possible with the prior consent of the manufacturer.

1.2 Warranty The

manufacturer guarantees that the equipment complies with the data in the manual.

The manufacturer guarantees the correctness of the technical data, but draws attention to the fact that, depending on the setting of the machine, there is a deviation in terms of the energy carriers used. Drempolar Kft. reserves the right of development, so the design may differ slightly from the description. The deviation is always aimed at the realization of a higher technical standard or the protection of human life and safety.

1.3 Warranty conditions

The manufacturer guarantees the operation of the equipment for ***12 months*** from the date of handover , provided that the operator uses and operates the equipment as intended, as described in the manual. *The basic condition for proper use is a complete study of the manual.*

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2 Mechanical system description

2.1 Technical data

Electrical power supply:	~230V AC, 50Hz, 2.6A
Operating temperature:	+10ÿC ~ +40ÿC
Inclusion dimensions:	800 x 150 x 240 mm (length x height x width) + control PC approx.
Crowd:	5 kg + control PC
Measuring surface size:	5 x 4 cm
Optical resolution:	1280 x 1024 pixels

2.2 General description

After switching on, the device performs a self-check, during which it examines whether the electrical and mechanical components of the device are in a state suitable for measurement, takes background images, and, if necessary, performs optical calibration of the device. To record the background images, the object to be measured must not be placed in the optical path, but the background includes the immersion oil that may have been used during the measurement. For optical calibration, the optical path must be left completely free.

The device is ready for measurement approximately 90 seconds after switching on, if optical calibration was not required. The optical calibration takes a few more minutes, but it is only necessary in case of transport, service or contamination of the optical components, in such cases it is performed automatically at power-up. The optical calibration can also be started by the user using the control software.

After this, we can perform the glass stress measurement on the object placed in the optical path. During the measurement, the device stores all relevant data, so the object to be measured is no longer needed for the evaluation after the measurement. The evaluation can be performed independently of the measuring device using the saved measurement data.

The measurement and evaluation of the measurement is supported by the attached software. With the help of the software, we can determine the voltage distribution of individual details or sections of the object to be measured, and the measured voltages can be visualized using a number of built-in or individually defined palettes. The amount of glass stress can be queried in the angle of optical rotation measured in degrees, in the value of the optical path length difference causing the rotation in nm, or in MPa based on the knowledge of the material and optical properties of the measured object, even from pixel to pixel.

2.3 Measuring device

The framework of the measuring device is a stainless aluminum closed section with a protective layer of paint.

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The polarizer and analyzer module were mounted on the closed section.

The polarizer and analyzer modules must not come into contact with liquid.

Cleaning

- It is not necessary to clean the inside of the

device. • Clean the lenses at the ends of the optical measuring path with a compressed air cleaner clean with cleaning tools for optics.

2.4 Control PC

Control PC components:

- barebone computer with external power supply;
- 17" monitor;
- keyboard; •

mouse.

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3 Electrical description

3.1 Measuring device

The measuring device does not require an external power supply. It receives the power required for its operation from the PC via the PC's USB and FireWire interfaces.

3.2 Control PC

The control PC and monitor must be connected to the 230V electrical network.

3.3 Connecting cables

Standard cables are required to connect individual parts of the equipment to each other. Use a PC power cable to connect the control PC and the monitor to the electrical network. A VGA monitor cable must be used to connect the monitor and the control PC. Use USB and FireWire cables to connect the measuring device and the control PC.

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4 Handling and maintenance

4.1 Delivery

Delivery is possible with a transport vehicle with a closed loading space.

Make sure that there are no loose parts or tools left in the equipment (e.g. due to maintenance or rebuilding).

Let's clean the equipment.

During transport, make sure that the equipment is secured in all directions of movement relative to the transport vehicle.

The attachment points must be protected against damage.

During the delivery of the equipment, the measuring device must be considered as a unit, it must not be disassembled or disassembled. The control PC can be broken down into its main components.

4.2 Installation, commissioning

The condition for installing the equipment is the provision of adequate electrical power supply (see technical data)

Commissioning

1. Remove the packaging. 2.

Adjust the machine to its place of operation.

3. If the machine is put into operation after storage, clean each exterior parts from dirt deposited on them.

4. In the case of commissioning after storage, it is carried out in the Maintenance chapter written.

5. Connect the computer case to the monitor.

6. Connect the control PC to the measuring device using two USB cables and a FireWire cable.

7. Connect the control PC and the monitor to the electrical network.

4.3 Lubrication and maintenance

Maintenance operations may only be performed by a specialist who knows the internal structure of the equipment, who has studied the manual and who is experienced in the individual fields and has the appropriate

qualifications. It is generally accepted that the equipment must be shut down during maintenance work

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connect from the mains.

The internal parts of the measuring device do not require lubrication.

General maintenance and upkeep

Cycle	Works	Time
When turned on	• Check machine condition by visual inspection	**required** ~1 minute
Every week	• Check machine condition by visual inspection • Machine cleaning • Check connection cables for looseness • Check screws by retightening	~5 minutes

The equipment is kept clean with a dry cloth; in case of greater contamination, a wet wipe with detergent (household) is recommended. The use of thinner is not allowed, because it can damage the painted or plastic parts of the machine, as well as the insulation of the electric wires, so the equipment becomes dangerous! Clean the lenses at the ends of the optical measuring path with a compressed air cleaner or cleaning tools for optics.

Inspections are the conditions for reliable operation and accident-free operation.

At least once a week, the entire equipment must be checked by a qualified maintenance person. Its task is to guarantee the safe operation of the equipment, inspect the entire equipment, uncover mechanical damage, loose parts and screws, check for breaks in electrical wires and repair them. After the visual inspection, the functions and reliability of the equipment must be checked.

It is important to check the screws of the equipment by tightening them.

4.4 Storage

Before storing, clean the equipment of dirt.

We check the mechanical integrity of the machine. If we find an error, correct it.

Carry out checks and all maintenance tasks according to the maintenance instructions, regardless of the previous maintenance cycle.

The equipment can be stored in a dry room with a temperature between +5ÿC and +40ÿC. If possible, ensure a dust-free environment. If this is not possible, we cover the mechanical units of the equipment with plastic film.

The equipment can be stored for a maximum of 1 year without any other maintenance. In the case of storage for more than one year, the above preparation and inspection instructions must be carried out every year in order to preserve the condition.

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4.5 Work and environmental protection

Labor protection

From the point of view of occupational health and safety, it is generally accepted that maintenance operations can only be carried out by a specialist who knows the structure of the equipment, who has studied the manual and who is experienced in the individual fields and has the appropriate qualifications.

Adjustment, repair and maintenance work may only be carried out with flawless, safe and appropriate tools. The manufacturer is not responsible for accidents and damage to parts resulting from this. During these works, the occupational health and safety regulations of the operator are the guiding principles.

Environmental

protection The materials and tools used during the transportation, storage, and maintenance of the equipment must comply with the environmental protection laws and regulations applicable to the operator and the operator's own internal environmental protection regulations. If such a document is not available, the packaging materials used must be recyclable and the lubricants used must be environmentally friendly. The operator must ensure the selective collection, generation and removal of waste materials.

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5 Operation

5.1 Launch

1. Check that all connecting wires are properly connected.
2. Check that the equipment is connected to the electrical network.
3. We check that the optical path is clean and free of objects to be measured. If we intend to measure in immersion oil, the oil jar is placed together with the oil in the optical path.
4. Start the device with the PC start button on the controller.
5. The software performs a self-check after startup and is usually ready for measurement 90 seconds after switching on. If it proves necessary during the self-test, it also automatically runs the calibration, which takes a few minutes. The self-check process can be followed on the login screen of the software, on the *Start* tab.

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5.2 Calibration

1. Select the *Start* tab.

2. If we deem it necessary, we can start the device check ourselves by clicking the *New test* button.

3. If we deem it necessary, we can start the calibration ourselves, which takes a few minutes by clicking the *Recalibrate* button.

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5.3 Termination

1. In the *File* menu, select *the Exit* menu item.

2. Confirm your intention to exit by clicking the *Yes* button in the pop-up dialog box.

3. Press the right mouse button.
4. In the menu that appears, select *Power off .*

5.4 Measurement

1. Select the *Measurement* tab.

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2. If you want to measure in front of a background different from the previously taken base images, prepare the background you want to use for the new measurement (immersion oil) in the optical path and press the *New base images* button.

3. Place the object to be measured in the optical path.

4. Press the *Start Search* button. The live view is at the bottom left of the screen visible.

5. Adjust the object to be measured until the part to be measured falls into the camera into his image.

6. With the option *compared to the selectable line* checked on the right side of *the* live image, by pressing and holding down the left mouse button, you can draw a straight line in the direction of which the measuring device will immediately set the analyzer, so you can shape the live image so that the detail to be measured is better visible (this option does not affect the measurement, only the adjustment). You can set the analyzer in the direction of the indented line or perpendicular to it by selecting the *pull* or *push* options.

7. The long *Voltage finder* on the right side shows the magnitude of the maximum and average intensity visible on the live image. A small red level mark shows the maximum value reached. This stored maximum value can be deleted by pressing the *Delete* button.

8. The visibility of the live image can also be helped with the slider labeled *Shutter* at the bottom right (this option does not affect the measurement, it only helps with the setting).

9. The spatial extent of the measurement can be narrowed by selecting the *Only measure within the rectangle* option and selecting a square on the live image by pressing and holding the right mouse button.

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10. Press one of the meter buttons. If you want to perform a quick measurement (at a low resolution), press the *Quick measurement* button. If we need Average resolution, select the *Normal measurement* button. If we need a high resolution, press the *High resolution measurement* button.

11. Wait until the measurement is finished.
12. When the measurement is finished, the preliminary result of the measurement appears in the top four figures, which can be evaluated in detail and customized, as described in the *Evaluation* chapter.

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5.5 Evaluation

The software installed on the control PC is also suitable for controlling the measuring device and evaluating the measurement results. A version of the software **that** can be installed on Windows is available via the website http://drempolar.com, which is not suitable for controlling the measuring device, but for evaluating the measurement results .

The measurement results consist of two parts, which can be saved or read separately or together. One is called "images" and contains the actual results of the measurement. The other name is "ROI" and represents the parameters set during the evaluation, the graphs that can be calculated from them.

1. Select the *Results* tab. If we previously performed a measurement, here immediately the measurement results are visible.

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2. Using the buttons of the *Scan* box, previously saved measurement results can be read from a USB stick. To do this, first plug a flash drive into one of the available USB ports.

- With the *Scan* button, you can scan the entire measurement result (including ROI images t)

- You can scan images with the *Scan* Images button. In this case, the previously set evaluation parameters (ROI) are kept by the program, they are not read from the file.

- With the *ROI scan* button, the program only scans the ROI, the measurement results are not changed.

3. The measurement results can be saved to a pen drive using the *Save* box buttons. To do this, first plug a flash drive into one of the available USB ports.

- The *Save All* button allows you to save both the images and the ROI.

- Only the evaluation images are saved with the *Save images* button.

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- Only the evaluation parameters (ROI) can be saved with the *Save ROI* button away.

4. With the help of the buttons in the *Export* box, we can export graph data, images, graph images or the entire screen.

- The *Keep setting (jpg)* option saves a jpeg image while keeping the ROI set by the user.

- With the *Export All* button, the program saves the four evaluation images in jpg format, as well as the linear and area graphs in tabular form.

- The *graphs* can be saved in tabular format with the Export graphs button in form.

- You can save graph *images* as jpg with the Export graph images button format.

- You can use the *Export images* button to save the evaluation images as jpg format.

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- You can use the *Export screen* button to create a picture in jpg format of the entire screen. After pressing the button, the program waits for 5 seconds and only then saves the image, so we have the opportunity to select another tab. This function always saves only the main screen, not other windows.

5. Using the buttons of the *Magnification* box, the displayed result images we can zoom in or place a 1 mm square grid on them.

- You can use the *Original zoom* button to enlarge the image until it is complete fit in the evaluation views as a whole.

- You can use the *Zoom in* button to enlarge the evaluation images shown in the views. The same function can be achieved by rolling the mouse wheel upwards.

- You can use the *Zoom Out* button to zoom out the evaluation images shown in the views. The same function can be achieved by rolling the mouse wheel down.

- With the *Square grid* button, you can turn on or off a 1 mm square grid on the evaluation images.

- You can activate or deactivate the image movement function with the *Image movement* button. When switched on, you can move the evaluation images by holding down the left mouse button.

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6. The name of the saved measurement appears in the *Name* box.

7. The time of the measurement is shown in the *Date and time* box.

8. The various evaluation parameters can be set in the *Parameters* box.

- The *Int. cutoff* parameter can be used to set the intensity threshold value (0 ~ 255) at which the program does not evaluate pixels with a lower intensity value.

- The *Mag. cutoff* parameter can be used to set the voltage threshold value (in units of phase shift degrees) at which pixels with lower voltage values are not evaluated by the program.

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• The thickness of the measured glass object can be specified with the *Thickness* parameter. This is needed to calculate the voltage values.

• We can select the material of the measured glass object.

You can create a new glass type with the *New glass type* button.

The name of the glass type, its Brewster's constant and its extinction must be entered in the pop-up dialog window.

With the *Delete glass type* button, we can delete a previously added glass type if the data was entered incorrectly or if we no longer need the given glass type.

• Using the *From image* option, the program calculates the thickness of the object to be measured from the measured intensity values. (This feature must be purchased separately.)

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- With the *Line average* parameter, you can specify in what environment the measurement results are averaged along the line selected on the evaluation image when creating graphs along the line.

- With the *Magnification* parameter, you can specify the value of the zoom used in the measurement (only in the case of a zoom measuring device).

9. Status messages of the program are displayed in the *Status* box.

10. In the *List* box, you can specify that the main data of the measurements is automatic to which file it should be saved.

- You can choose the name of the file where the main characteristics of the measurements will be saved automatically.

- In the *Comment* field, you can enter any text that will be saved in the comment section of the automatically saved file.

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11. The *Direction* box shows the distribution of the direction of the measured voltage.

- From the drop-down menu, you can choose how to interpret the voltage direction
  - Vertical plus - horizontal minus: On the voltage graph, the voltage in the vertical direction will be positive, and the voltage in the horizontal direction will be negative.
  - Vertical minus - horizontal plus: On the voltage graph, the voltage in the vertical direction will be negative, and the voltage in the horizontal direction will be positive.
- With the *Palette* button, you can select the palette you want to use for displaying the distribution. This palette also appears below the buttons.
- You can use the *Image export* button to save the image of the distribution in jpg format.
- With the *Palette export* button, the image of the currently used palette can be saved in jpg format.

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- With the *Copy to clipboard* button, the distribution image can be copied to the clipboard, for example for pasting into a document.

12. In the *Magnitude* box you can see the distribution of the magnitude of the measured voltage.

- From the drop-down menu, we can choose how we want to represent the voltage (Voltage (MPa); Path length difference in nm; Path length difference in wavelength; Rotation angle in degrees; Optical phase shift in degrees; Optical phase shift in radians; Birefringence in natural units).

- With the *Palette* button, you can select the palette, which is the distribution we want to use it for display.

- You can use the *Image export* button to save the image of the distribution in jpg format.

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- With the *Palette export* button, the image of the currently used palette can be saved in jpg format.

- With the *Copy to clipboard* button, the distribution image can be copied to the clipboard, for example for pasting into a document.

13. In *the Combined* box, the direction and magnitude of the measured voltage is combined distribution can be seen.

- With the *Palette* button, you can select the palette you want to use for displaying the distribution. This palette also appears below the buttons. We can create a combined palette ourselves.

- You can use the *Image export* button to save the image of the distribution in jpg format.

- With the *Palette export* button, the image of the currently used palette can be saved in jpg format.

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- With the *Copy to clipboard* button, the distribution image can be copied to the clipboard, for example for pasting into a document.

14. The distribution of the measured intensity is shown in the *Intensity* box.

- With the *Palette* button, you can select the palette, which is the distribution we want to use it for display.

- You can use the *Image export* button to save the image of the distribution in jpg format.

- With the *Copy to clipboard* button, the distribution image can be copied to the clipboard, for example for pasting into a document.

15. By double-clicking on any small distribution, it will also appear enlarged in the large bottom image. The small distributions and the enlarged distribution can be enlarged and moved in parallel, and the line, area and point designations are inherited from each other.

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16. You can create a linear graph by pressing and holding the middle mouse button. If you don't drag the mouse, just press and release the middle mouse button, you will get a line that runs across the width of the entire image passing through the given point. The voltage and direction section measured along the selected line is shown in the upper two graphs on the right side.
17. By pressing and holding the right mouse button, you can select an area on the images. The histogram of voltage and direction values within the selected area is shown in the lower two graphs on the right side.
18. If the image moving status is off, you can select a point on the images with the left mouse button. The program displays the direction, magnitude and intensity values that can be measured at these points in the frame of small pictures.

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19. Voltage values that can be measured along the selected line on the upper graph on the right side we can see.

By holding down the left mouse button and moving the mouse on the graph, the position of the selected point in the images follows the current point of the graph. On the graph, the current point is indicated by a small blue arrow above the curve. The top of the graph shows the current voltage value and the distance of the measurement point from the beginning of the line.

- With the *Export* button, you can save the current image of the graph in jpg format.

- With the *Copy to clipboard* button, you can copy the current image of the graph to the clipboard, for example for pasting into a document.

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20. On the second graph on the right side, the direction values that can be measured along the selected line we can see.

By holding down the left mouse button and moving the mouse on the graph, the position of the selected point in the images follows the current point of the graph. On the graph, the current point is indicated by a small blue arrow above the curve. At the top of the graph, you can see the current reference value and the distance of the measurement point from the beginning of the line.

- With the *Export* button, you can save the current image of the graph in jpg format.

- With the *Copy to clipboard* button, you can copy the current image of the graph to the clipboard, for example for pasting into a document.

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21. Voltage can be measured within the designated area on the third graph on the right we can see a histogram of values.

By holding down the left mouse button and moving the mouse over the graph, the program displays the current voltage value and the area of points with such a voltage value at the top of the graph. The voltage value selected in this way is indicated by a small blue arrow above the graph. With the right mouse button, we can select a limit value, above which voltage values higher than this limit value are indicated in red, and the size of the area with a voltage value higher than this limit value is also indicated at the top of the graph.

- With the *Export* button, you can save the current image of the graph in jpg format.

- With the *Copy to clipboard* button, you can copy the current image of the graph to the clipboard, for example for pasting into a document.

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22. In the lower graph on the right side, you can see the histogram of the direction values that can be measured within the designated area.

By holding down the left mouse button and moving the mouse over the graph, the program displays the current direction value and the area of points with such a direction value at the top of the graph. The voltage value selected in this way is indicated by a small blue arrow above the graph. With the right mouse button, you can select a limit value, above which guideline values are indicated in red on the graph, and the size of the area with a guideline value greater than this limit value is also indicated at the top of the graph.

- With the *Export* button, you can save the current image of the graph in jpg format.

- With the *Copy to clipboard* button, you can copy the current image of the graph to the clipboard, for example for pasting into a document.

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5.6 Settings

The settings are available through the *Settings* menu.

1. You can change the default parameter values by selecting the *Results settings* menu item.

   By selecting the menu item, a dialog box appears in which you can enter the default values of some parameters of the evaluation interface. You can also set the ID number of the polarizer and analyzer modules of the measuring device here.
   After customizing the values, press the *Set* button to save the settings.

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2. You can create a new one by selecting the *Create user palette* menu item combined user palette.

In the table that appears, you can specify which voltage direction, voltage magnitude, and intensity values the program should use for display.

The interpretation of the voltage values entered in the magnitude field can be selected in the drop-down list in the lower part of the window. To specify the color, we need to specify the values of the red, green and blue components. The color corresponding to the selected color components is shown in the *color* column. The set palette can be saved with the *Exit* button. For modification , we can load an existing palette with the *Scan* button.

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3. You can display the currently used palette with the *Display user palette* menu item user palette.

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You can set the maximum size value, then click the *Update* button and the program will update the image of the palette. We may need this if the palette hides fine details at small magnitude values, because the maximum magnitude value is so large that these fine details are all in the immediate vicinity of the center of the palette. The image of the palette can be saved in jpg format with the *Palette export* button.

The user palette shows which color the program uses for display in case of which direction and magnitude of voltage. The color to be used appears on the circular palette from the center to the periphery in the same direction as the direction of the tension compared to the vertical, at a distance corresponding to the magnitude of the tension from the center.

4. With the *Direction palettes* menu item, you can display the currently used direction palette.

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The image of the palette can be saved in jpg format with the *Palette export* button.

The direction palette shows which color the program uses for the display in case of voltage in which direction. The color to be used appears on the circular palette from the center towards the periphery in the same direction as the direction of tension compared to the vertical. The direction palette always has a radial structure.

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5. With the *Magnitude palettes* menu item, you can display the currently used magnitude palette.

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The image of the palette can be saved in jpg format with the *Palette export* button.

The size palette shows what color the program uses for displaying the voltage. The color to be used is visible on the palette at a distance from the bottom corresponding to the magnitude of the voltage.

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6. The software running on the control PC can be updated using the *Update* menu item.

- Plug a pen drive into one of the available USB ports.
- In the file selection dialog box that appears when selecting the menu item, select the file with the .dru extension sent by the manufacturer, which contains the latest version of the program.
- Press the *OK* button.
- Start the program again.

5.7 Error management, troubleshooting

The device performs a self-check at start-up. If it shows an error, turn off the device, clean the optical components and turn it back on. If the software still displays an error, call the service department. If it indicates an error during measurement, turn off the device, clean the optical components and turn it back on. If the software still displays an error, call the service department.

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5.8 General operating instructions

ATTENTION!

When operating the equipment, only the operator operating the machine may be in the immediate vicinity of the machine.

ATTENTION!

In order to avoid accidents, the equipment may only be operated by a trained operator!

It is the responsibility of the operator to develop and train the workers' educational material.