

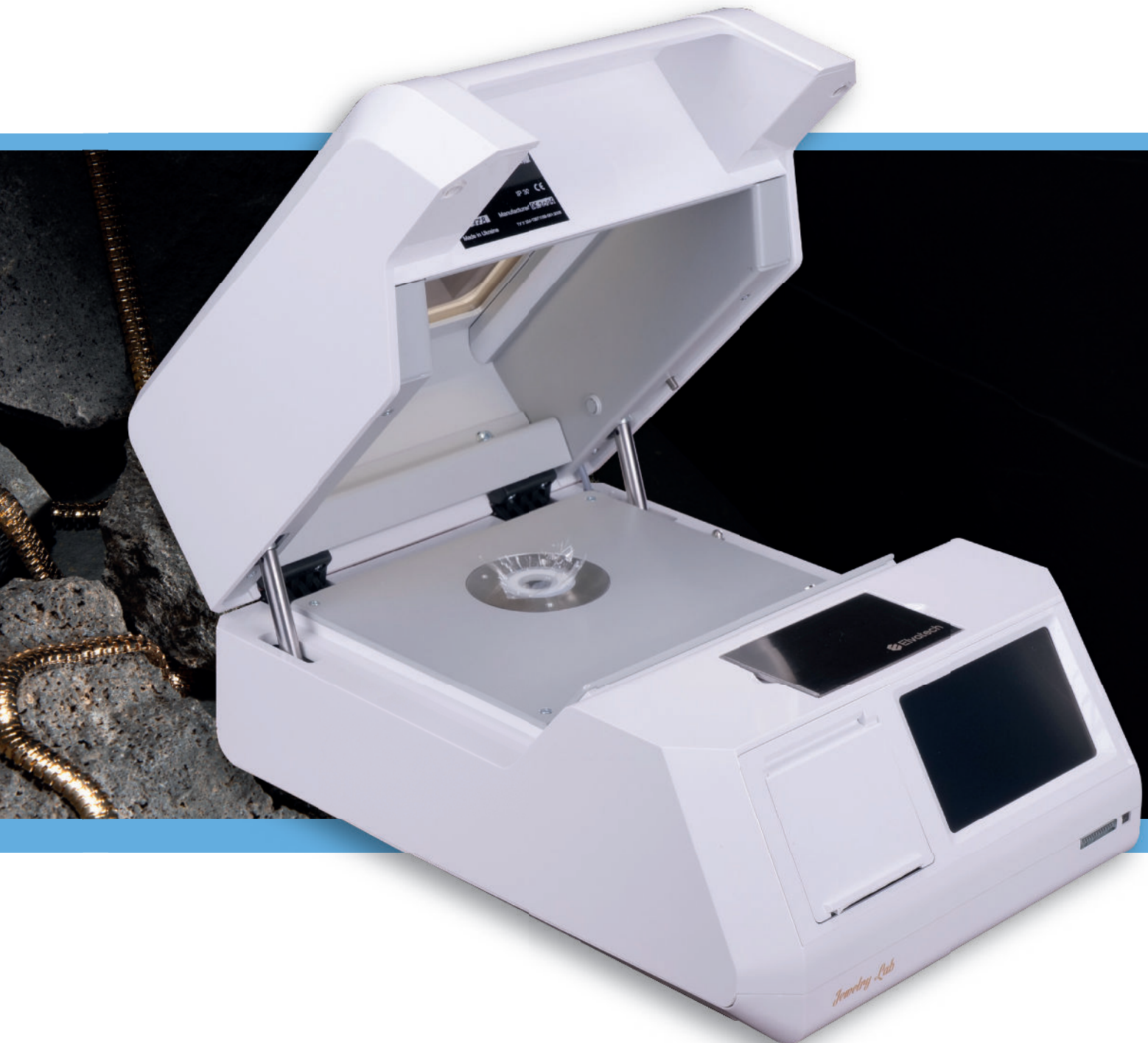
ElvaX

Jewelry Lab

USER MANUAL



Elvatech
Advanced XRF equipment and solutions



Elvatech 2021



IMPORTANT!



Before using the ElvaX Jewelry Lab spectrometer read this User Manual carefully. Spectrometer is a source of x-ray emission, which analyses the researched object. Before using the spectrometer it is mandatory to ensure radiation safety and users training.

Observe all safety instructions contained in this User Manual – s. 2.

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1. Introduction

1.1. Intended use, structure and the operating principle of spectrometer

ElvaX Jewelry Lab spectrometer is used for elemental analysis of analytes: measurement of mass concentration of chemical elements in alloys based on precious metals – gold, silver, platinum and platinum group metals.

The spectrometer can also be used for the analysis of other substances and materials in solid, powdered or liquid state with the appropriate analytical programmes provided by the manufacturer at the request of the user.

The scope of the ElvaX Jewelry Lab spectrometer is jewellery industry, customs control, object identification and assessment, control of quality of jewellery products.

The spectrometer implements the method for determination of elemental composition by characteristic fluorescent x-ray radiation of atoms in the sample. Characteristic radiation occurs when sample is irradiated with quanta emanating from x-ray tube (emitter), and registered with the device detector. Identification of elemental composition is based on the fact that each chemical element produces unique spectrum of its characteristic radiation.

1.2. Spectrometer supply package



Spectrometer



AC mains adapter 65-90W DC19V



Control sample – *Bronze*



Installation flash drive
with the software and instruction manual



Roll of Mylar protective film (2 m)



Control weight (*optional*)

1.3.Spectrometer appearance

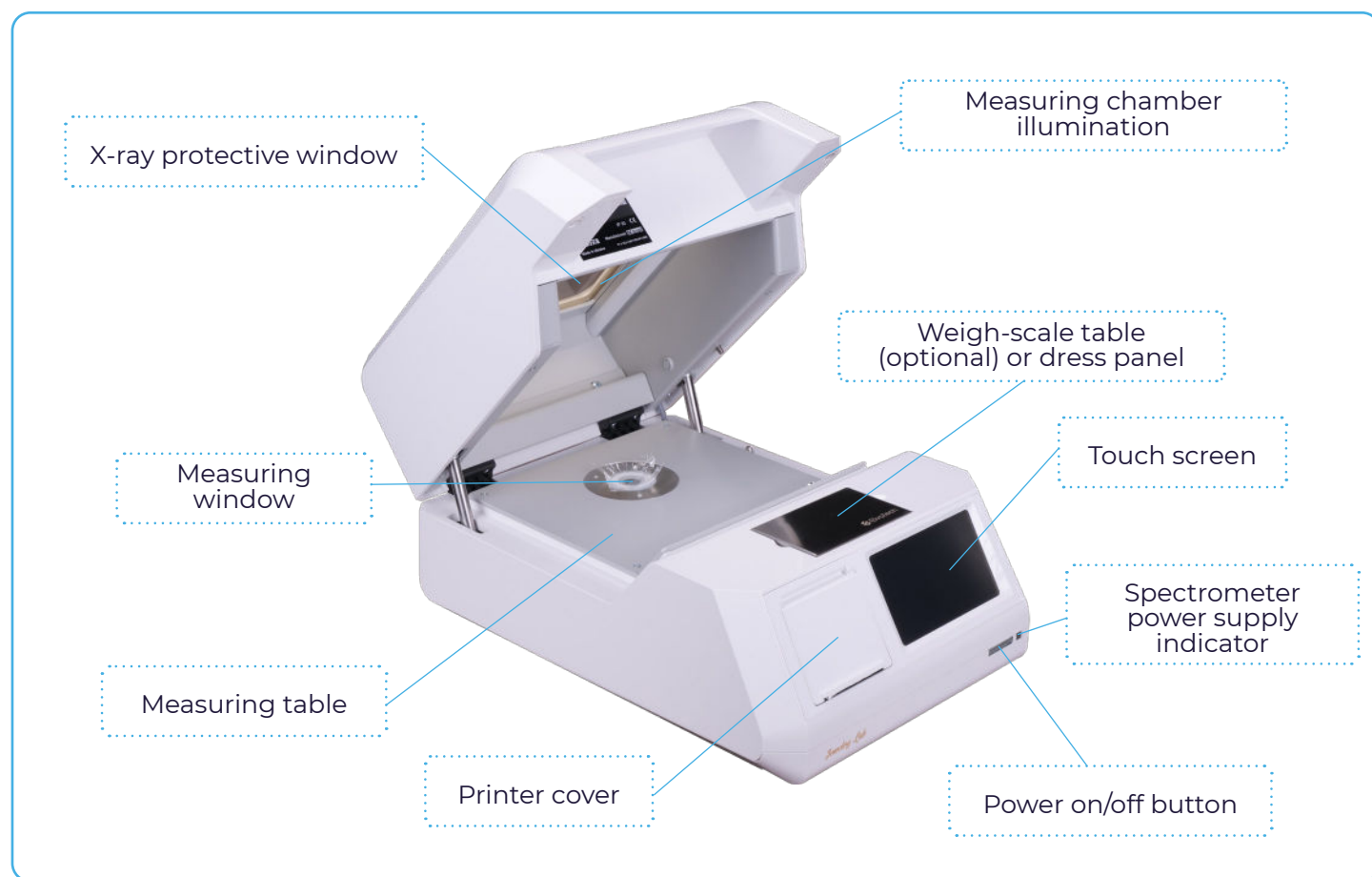


Fig. 1. Spectrometer with a raised lid of the measuring chamber

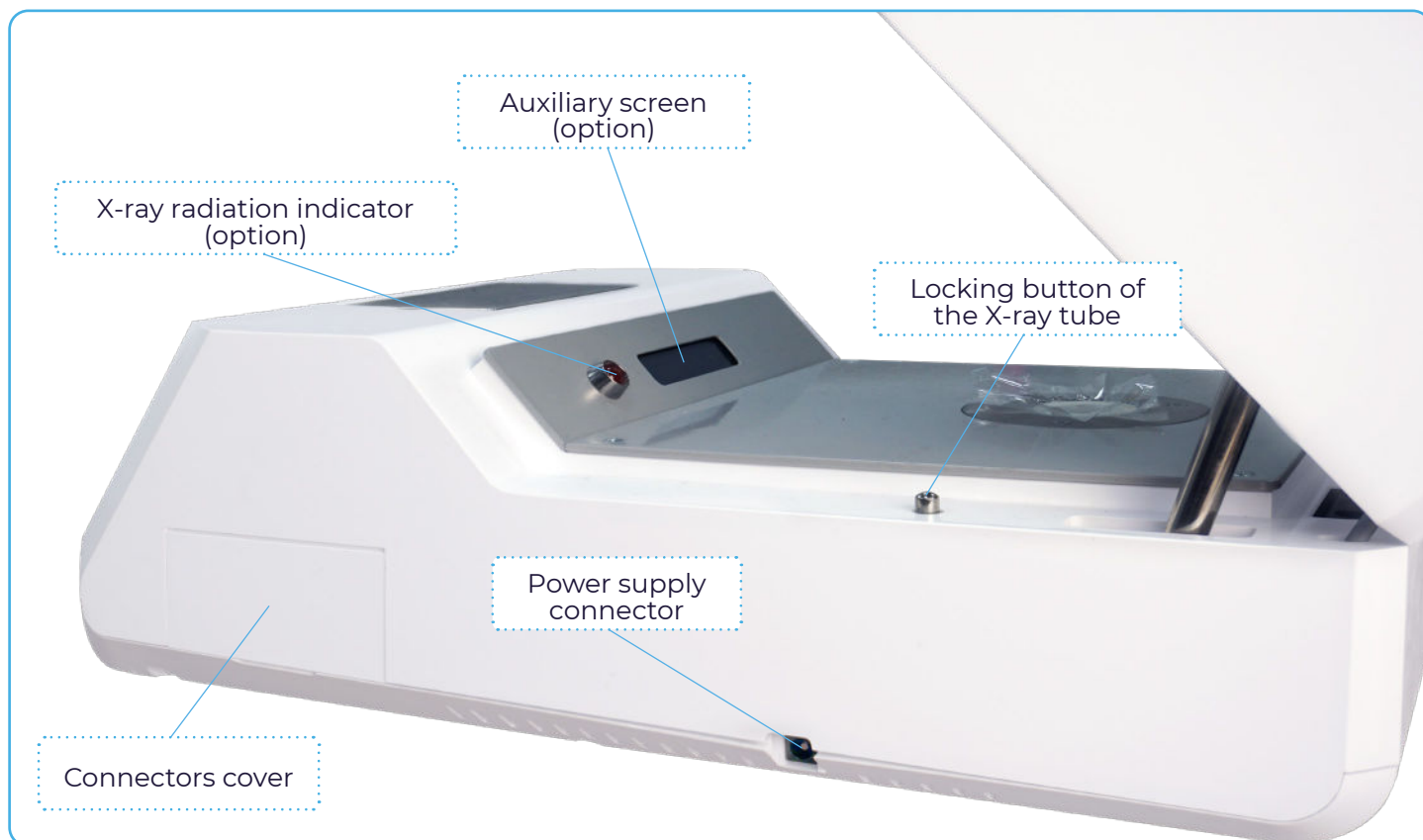


Fig. 2. Right side view

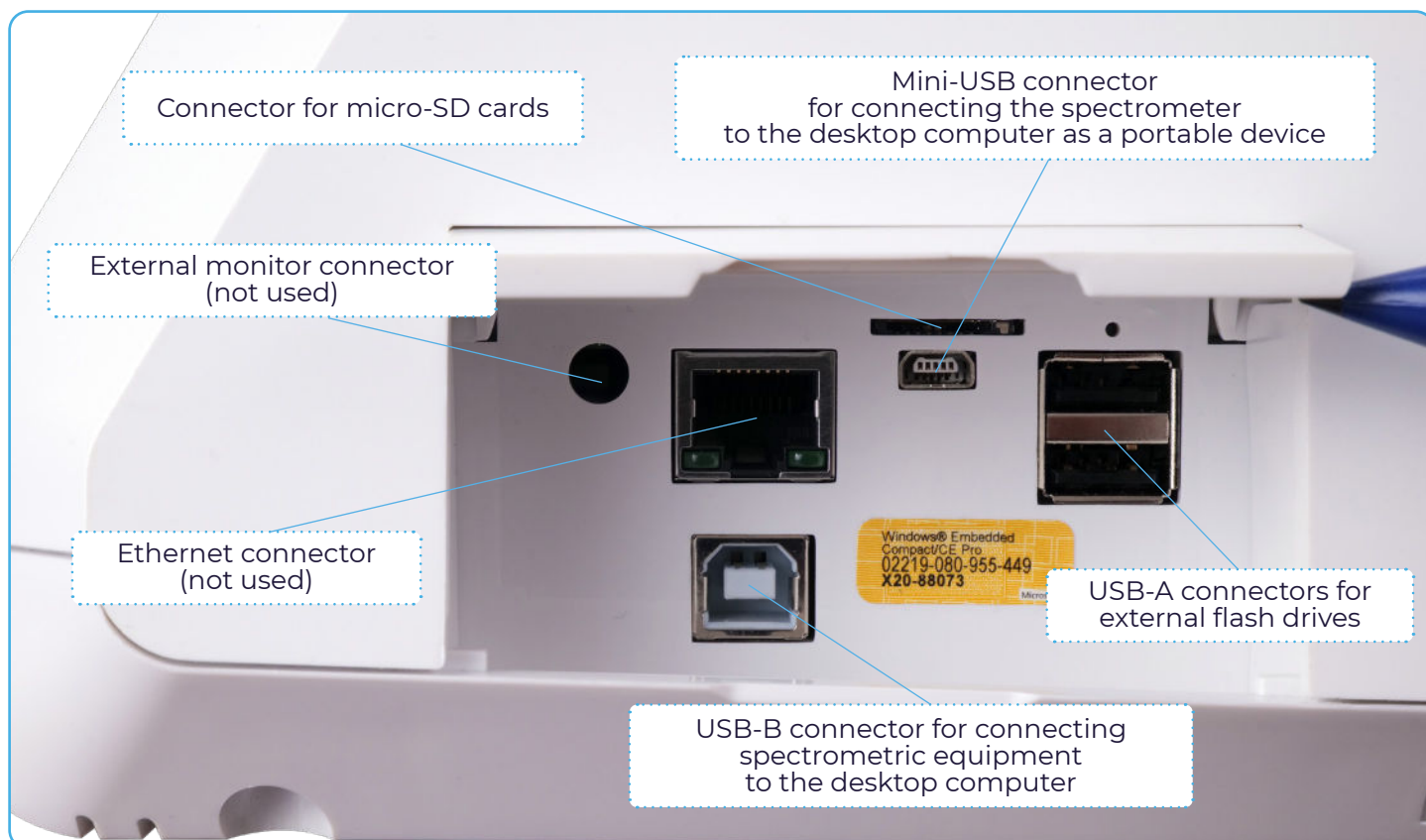


Fig. 3. The connectors located under the cover on the right side of the device

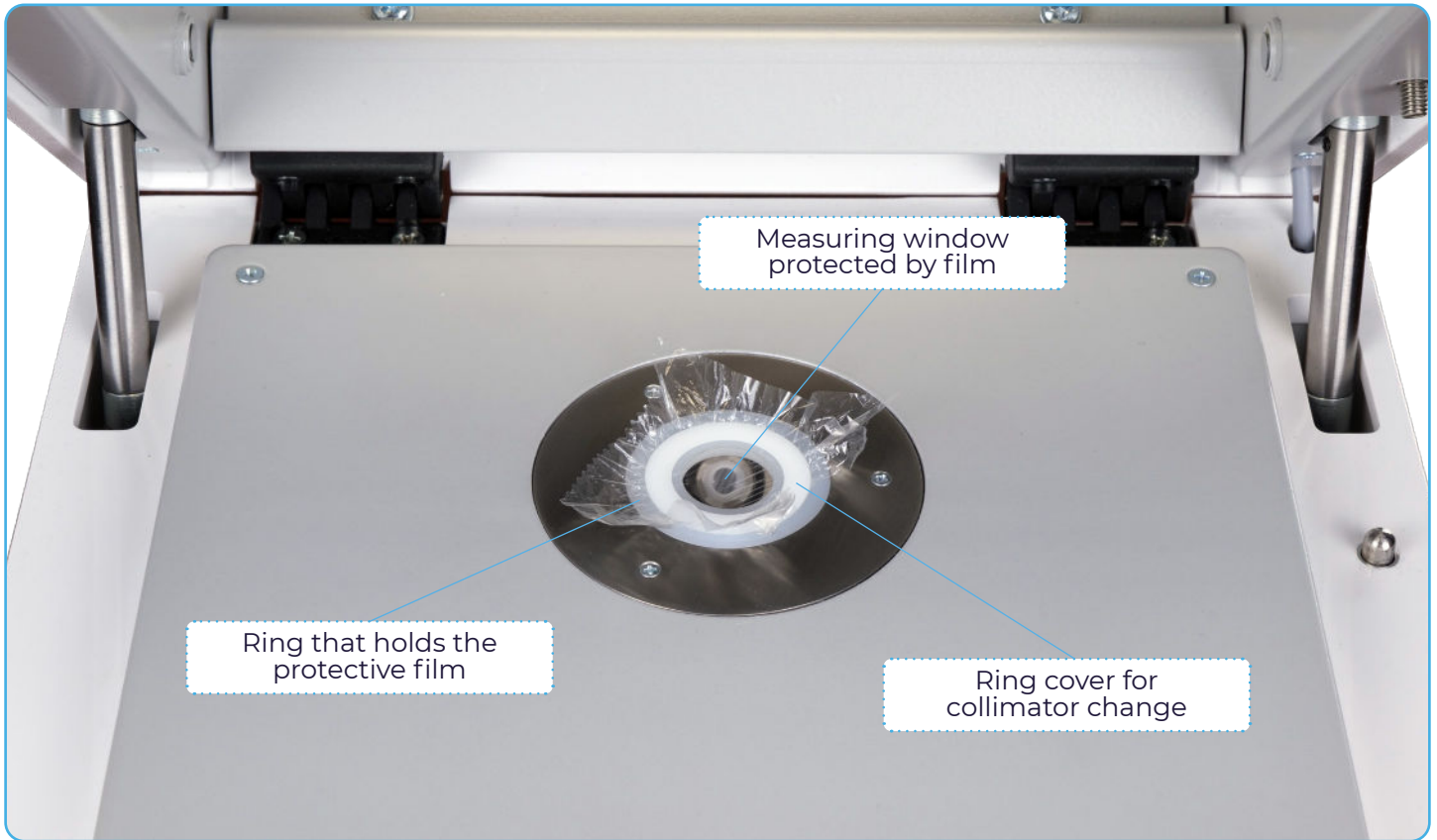


Fig. 4. The measuring chamber

2. Radiation safety



BEFORE USING



Before using the ElvaX Jewelry Lab spectrometer read this section carefully.

The spectrometer is a potentially dangerous device because it includes x-ray generator. However, working with the spectrometer will be safe if it is operated in accordance with this User Manual.

Spectrometer is made of x-ray protection materials to ensure that the radiation level around the device with the powered x-ray generator is absolutely safe (less than 1 $\mu\text{Sv/h}$) under the condition that the lid of the measuring chamber is closed. If the lid is opened with the spectrometer in the measurement mode, the locking device will come into action and x-ray radiation will be turned off automatically.

PLEASE NOTE! DO NOT USE SPECTROMETER WITH DEFECTIVE LOCK OR WITH THE LOCK BUTTON (fig. 2) BEING CONSTANTLY PRESSED!

Lock is in good condition if during the measurement:

- **with AC mains operation** – measuring chamber light bias (fig. 1) and x-ray indicator are on (fig. 2).
- **while running on battery** – the red LED inside the x-ray measuring chamber is on (fig. 2).

Locking is faulty if during the measurement none of the indicators are lit with red.

3. Working with the spectrometer in the measurement mode

3.1. Commissioning

Carefully read these instructions.

Unpack the device.

Check the package (s. 1.2) and the integrity of the spectrometer and its accessories. The device is intended for use in the following conditions:

- ambient air temperature +15...30°C
- relative air humidity up to 80% at 25°C;
- atmospheric pressure from 84 to 106.7 kPa (630 to 800 mm Hg).



IMPORTANT



After transportation at ambient temperatures below 10°C the device should be kept for 6 hours at room temperature before connecting it to the electricity mains.

Switching on the device which is brought from cold environment into a warm room can lead to damage!

Check the condition of the protective film in the measuring window of the device. If it is damaged, replace the film (s. 8.1).

Connect the device to the AC adapter and plug the adapter into a power outlet with the AC voltage from 100V to 240V. If the voltage is present in the mains, adapter will indicate it with the blue LED.

Turn the spectrometer on (s. 3.3) by pressing the button on the front panel and wait for the software to boot. Then wait for  icon in the upper right corner of the touch screen to disappear. The device is in the normal operation mode now.

Perform validation of the spectrometer (s. 3.12) with paying attention to the correct operation of the lock (s. 2) and lights (s. 3.6).

If the device is supplied with a battery (by the user's request), check the level of charge by touching

its icon in the upper-right corner of the spectrometer. If needed, the battery can be charged when spectrometer is left connected to the mains.

3.2. Powering the Spectrometer

Spectrometer is usually powered by the network adapter connected into the power outlet with the AC voltage of 100V to 240V. When powered from the mains, adapter indicates it with the blue LED, and the spectrometer power indicator (figure 1) lights up with green.

The icon  is displayed in the upper right corner of the screen if the spectrometer is turned on.

Upon request, the spectrometer can be supplied with built-in battery. The spectrometer is powered by the battery when no external power supply is available. In this case, the icon  is displayed in the upper right corner of the screen, and the power indicator goes off. When connected to the external power, the spectrometer charges the battery automatically, red arrow is added to the icon,  and the power indicator is turn blue and green. When the battery is fully charged, the power indicator turns green. You can estimate the battery's charge by the number of «cells» on the icon. The exact value can be found out by touching the icon (fig. 5).

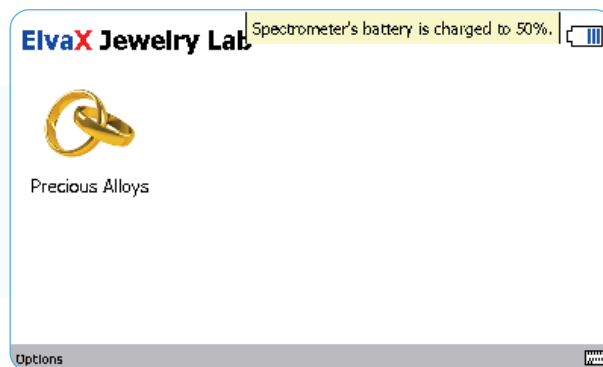


Fig. 5. Information on the battery charge of the spectrometer

When the external power supply is available, the battery will be charged regardless of whether the spectrometer is currently on or off.

When running on battery, the spectrometer switches off the fan to reduce power consumption and *does not switch on the illumination of the measuring chamber.*

A fully charged battery provides the spectrometer with at least 6 hours of operation. If the battery of the spectrometer falls below 20%, «Battery low» voice announcement will sound and a warning will be displayed (fig. 6).

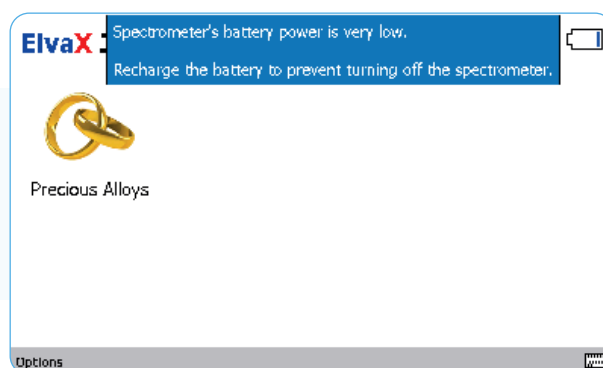


Fig. 6. Warning for the low battery charge of the spectrometer

3.3. Switching the Spectrometer On

Close the measuring chamber and turn on the spectrometer by briefly pressing the power button on the front panel. The button should turn blue.

The spectrometer software will start booting. For approximately 30 seconds the manufacturer's logo will be displayed, and then the main window of the programme with a choice of analytical tasks will appear. The number of tasks can be different depending on the user's request. fig. 7 shows the main window containing two tasks. fig. 8 shows the main window with one task corresponding to the main purpose of the ElvaX Jewelry Lab spectrometer.

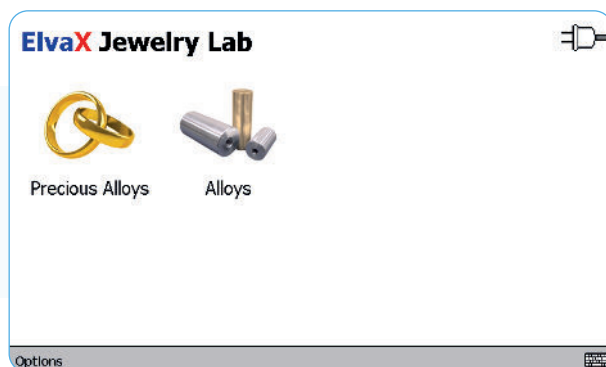


Fig. 7. The main window of the programme with two analytical tasks

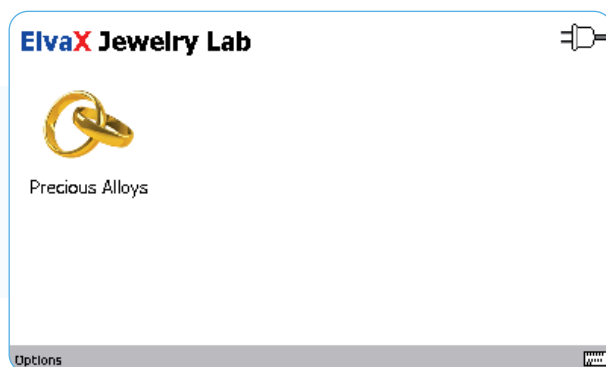


Fig. 8. The main window of the programme with one analytical task

After loading is completed, the programme will automatically switch to the latest analytical task used (fig. 9). Thus, the spectrometer will be ready to continue the work with the same task with which the user was working before the device was switched off.

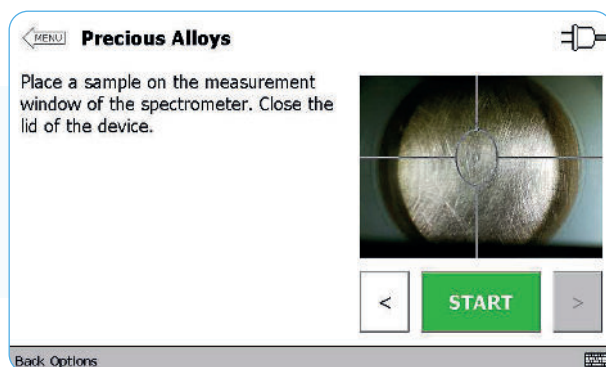


Fig. 9. Window of the measurement mode of the Precious Alloys analytical task

Note: if a spectrometer is supplied with protection against unauthorised use, the user will be prompted to enter his/her password during booting (fig. 10). After the password is successfully entered, the spectrometer will continue to load. The user password is specified on a separate sheet attached to the spectrometer.

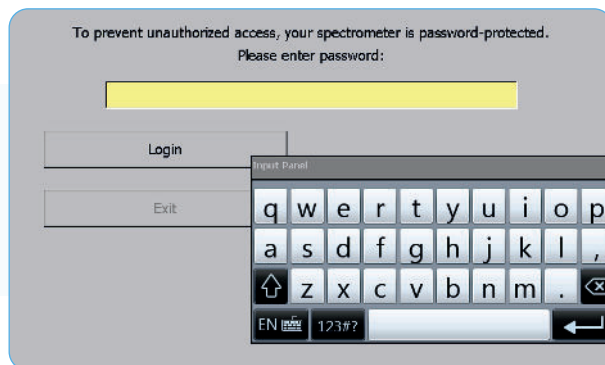


Fig. 10. Password request

3.4. Switching the Spectrometer Off

Briefly press the power button on the front panel of the spectrometer. The spectrometer will beep and the static picture labelled «Switching Off...» will appear, and after a while the spectrometer will be switched off.

3.5. Description of the Measurement Mode Window

After selecting one of the analytical tasks in the main window by touching its icon, the window for measurements will appear on the screen (fig. 11). This window includes the basic controls of the spectrometer the user will have to face with in his/her work.

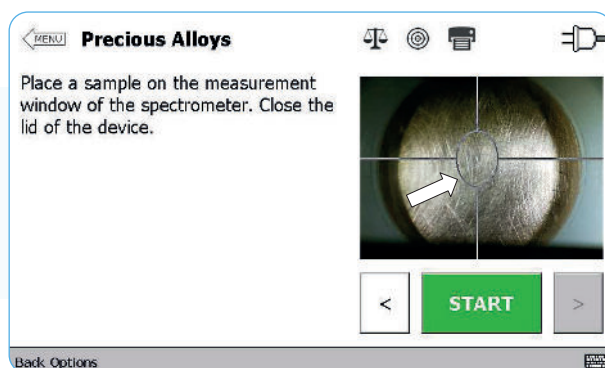


Fig. 11. Measurement Mode Window

An arrow-like Menu touch button located in the upper left corner is used for returning to the main window with a choice of analytical tasks. The name of the running analytical task – Precious Alloys – is displayed next to the arrow.

The left half of the screen displays composition of the object under examination and tips for the user.

The right half shows image of the object under examination obtained from the built-in video camera placed under the measuring window. The target with an oval in the middle (white arrow on fig. 11) outlines a spot on the sample surface exposed to x-ray radiation. The analysis will be carried out mainly for the surface portion within the oval.

The video image can be enlarged to full-screen by touching it. Re-touch will return the video image to normal size.

A row of touch buttons is located in the centre above the video image:

- 
Tapping this button will open a window that displays the result of sample weighing on the built-in scales *(this button appears only if the spectrometer is equipped with weights).*
- 
Tapping this button will open the window for selecting the operating collimator, which affects the size of the analyzing area on the sample *(this button appears only if the spectrometer is equipped with a collimator changer).*
- 
Tapping this button prints a displayed measurement result with the built-in printer *(this button appears if the spectrometer is equipped with a printer).*

The upper right corner contains the power mode icon. Touching the icon displays additional information (in particular, battery charge of the spectrometer in percentage):

- 
The spectrometer is powered by AC power
- 
The spectrometer is powered by built-in battery
- 
Built-in battery is being charged

Status icon of the spectrometer may be shown to the left of the icon:

- 
This icon appears if temperature of the spectrometer parts is outside the operating range (for example, cooling of the detector has not been completed). After switching the device on it is necessary to wait for the cooling of the detector to operating temperature. When it is done, the icon disappears and the spectrometer is ready for operation.
- 
This icon appears when the spectrometer emits x-rays during sample measurement. The icon will disappear when x-ray tube is off.

The bottom left corner contains the **Back** touch button to return to the main window with the choice of analytical tasks and the **Options** button which opens the settings menu of the running analytical task.

Several touch buttons are located under the video image:

- 
Measurement start button. During the measurement, it turns into a red STOP button.
- 
Buttons for browsing results of measurements performed previously.
- 
The on-screen keyboard button. Usually, when text typing is expected, on- screen keyboard appears automatically. Tapping this button will show or hide the keyboard forcibly.

3.6. Spectrometer Light Alarms

The power button on the front panel of the spectrometer (fig. 1):

<i>is not on</i>	the spectrometer is switched off
<i>lit up with blue</i>	the spectrometer is switched on

The **power indicator** located to the right of the power button (fig. 1):

<i>lit up with green</i>	the spectrometer is plugged in; in case the spectrometer is equipped with a built-in rechargeable battery – the battery is fully charged
<i>lit up with green and blue</i>	the spectrometer is powered by the mains, the built-in battery is being charged
<i>is not on</i>	the spectrometer is powered by battery
<i>red light flashes</i>	charge of the built-in battery is below 10%

X-ray indicator inside the measuring chamber (fig. 2).

<i>lit up with red</i>	x-ray generator is on
<i>is not on</i>	x-ray generator is off

Measuring chamber illumination (fig. 1)

<i>lit up with white or bluish</i>	the spectrometer is switched on
<i>lit up with red</i>	x-ray generator is on

Note: If the spectrometer is powered by a built-in battery, measuring chamber illumination **does not turn on** to decrease power consumption.

3.7. Measuring a Sample



BEFORE STARTING



Before starting a measurement, **read s. 2!**

Open the cover of the spectrometer and put an object onto the measuring window film. The study area of the object should be located within oval «target» on the screen and fit as tight as possible to the protective film. Do not use force when putting objects on the film in order to avoid its tearing and detector damage!

Close the lid, and the spectrometer will start measuring automatically.

Note: if auto start of measuring on lid closing is inconvenient, it can be disabled in the settings (s. 6.2). In such a case when lid is closed, touch the **START** sensor button to start the measurement.

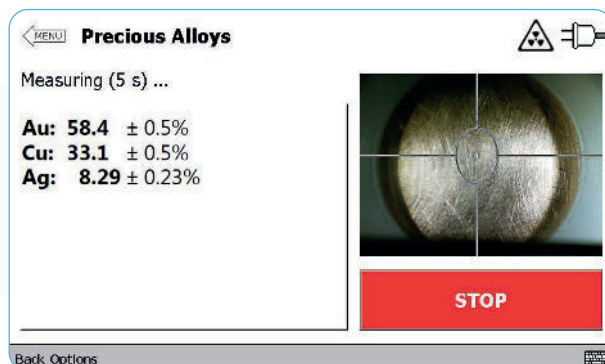


Fig. 12. Measurement process

With the beginning of the measurement, x-ray generator will turn on, and the icon  will appear in the upper right corner of the screen (fig. 12). The work of the generator is also indicated with the red illumination of the measuring chamber. If the spectrometer is powered by the battery, to reduce energy consumption, the illumination will not turn on; instead of this, the red x-ray radiation LED will be lit up inside the measuring chamber.

As measurements proceed, the screen will show the intermediate results of the analysis and the time from the beginning of the measurement.

The final result of the analysis will be shown on the screen after the measurement completes:

- when the specified time of measurement for the analytic task expires (s. 3.10);
- if the **STOP** sensor button is pressed;
- if the lid is opened during the measurement.

Measurement will also stop if the spectrometer by low x-ray count rate detects that there is no sample on the measuring window.

3.8.Displaying a Measurement Result

The spectrometer can display the measurement result in multiple views:

- **Spectrum** – a graphical representation of spectral x-ray lines;
- **Composition** – a list of detected elements in the sample and their concentrations
- **Alloy** – complements the composition with the alloy grade corresponding to the composition (see s. 3.8.1). This result view is available only in alloy tasks.
- **Fineness of Precious Metal** – complements the composition with precious metal fineness and the result of the plating/gold plating detection (see s. 3.8.2). This result view is available only in precious metals related tasks.

Difference in views is shown in fig. 13 – fig. 16.

Au: 58.5 $\pm 0.5\%$
Cu: 33.3 $\pm 0.4\%$
Ag: 8.13 $\pm 0.20\%$

Fig. 13. Measurement result is in the **Composition** view mode.

Evt-Au-585 (100% match)

Au: 58.5 $\pm 0.5\%$
Cu: 33.3 $\pm 0.4\%$
Ag: 8.13 $\pm 0.20\%$

Fig. 14. Measurement result is in the **Alloy** view mode.

Gold 14.0K

Plating not detected

Au: 58.5 $\pm 0.5\%$
Cu: 33.3 $\pm 0.4\%$
Ag: 8.13 $\pm 0.20\%$

Fig. 15. Measurement result is in the **Fineness of Precious Metal** view mode.

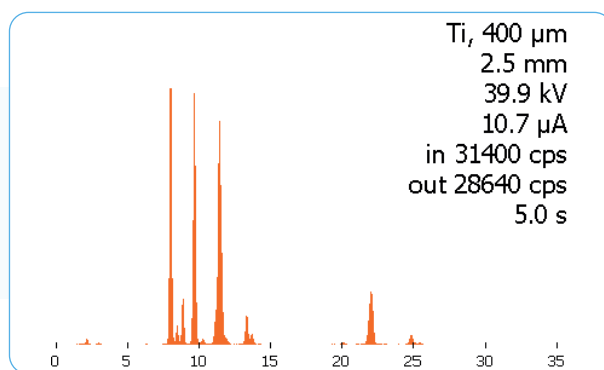


Fig. 16. Measurement result is in the **Spectrum** view mode.

For each analytical task manufacturer chose the most suitable view for the task. To select a different view, click the **Options** button at the bottom of the measurement window and on the menu that appears, select the appropriate option (fig. 17).

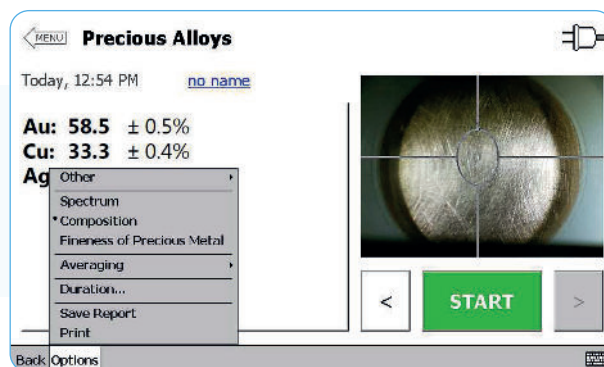


Fig. 17. The choice of the view of measurement result.

3.8.1. The nuances of the alloy grades determination

To identify the alloy grade, built-in libraries of the most common alloys are used. At the user's request, they can be changed or extended.

When looking for the most appropriate grade, the software takes into account the fact that the spectrometer is incapable of detecting light elements present in the sample. In particular, the spectrometer with PIN detector confidently registers elements beginning with Ti (Z=22), and in case of the

SDD detector – starting with Mg (Z=12). When comparing, light elements are discarded in a special way, so that the samples, in which the portion of light elements is less than 15%, can be correctly graded using only detectable heavy elements. Of course, it does not concern grades with differences only in light elements.

When outputting the result, the degree of the grade conformity to the composition is pointed in brackets following the name of the alloy (fig. 18). If the extended composition view is used (**Compare to Alloy**), then for each element, to the right of the detected concentrations, the expected value is given, taken from the descriptions of the grade. If the grade does not contain spectrometer-invisible elements, the expected values will strictly adhere to the concentrations specified in the standard for the grade.

If the grade does contain spectrometer-invisible elements, the shown expected values will be above the standard: they are the result of recalculated standard concentrations after discarding of the invisible elements.

99% match to 316 Ti		
Fe:	66.19 ± 0.23%	61.05 – 72.92
Cr:	16.55 ± 0.19%	16.00 – 18.23
Ni:	12.30 ± 0.18%	10.00 – 14.18
Mo:	2.51 ± 0.02%	2.00 – 3.04
Mn:	1.83 ± 0.13%	< 2.03
Cu:	0.40 ± 0.09%	—
Ti:	0.13 ± 0.18%	< 0.71

Fig. 18. Alloy grade, composition and expected concentrations in the **Compare to Alloy** view.

3.8.2. The nuances of the definition of precious metals fineness

The spectrometer determines caratage value for **gold** samples and standard millesimal fineness for **platinum, palladium, silver** samples. The following list of standard millesimal fineness is used:

Gold	caratage value rounded to the 1st digit after the decima point
Platinum	999, 950, 900, 850
Palladium	999, 850, 500
Silver	999, 960, 925, 875, 830, 800, 750

Note: at the request of the user, the list of precious metals and their fineness grades can be changed.

Fineness grades are calculated by rounding up to 2 decimal digits in the percentage record, i.e. silver 92.494% is 875° (rounded to 92.49%), while 92.495% is 925° (rounded to 92.50%).

Also, during analyses for gold or platinum samples, evaluation is made, whether its x- ray spectrum is alike to a spectrum of a solid material or to the spectrum of thin plating with precious metal. Valuation – «Plating not detected», «Plating possible», «Plating very possible» – appears below the fineness grade (fig. 14).



IMPORTANT



The detection of thick plating (*over 20 μm*) is very unlikely! In such cases, non-standard composition of the sample should be a warning note.

If plating was not analysed (for example, due to a lack of measurement time or because it is not detected for this kind of metal), «Plating not investigated» will appear under the fineness grade.

3.9. Saving a Measurement

Each completed measurement **is automatically saved** in the database of measurements with date/time stamp. If the measurement is needed to be referenced in the future, it can be given a name. To do this, after completion of the measurement, tap the blue underlined «no name» text to the right of the date/time of the measurement. In the opened window (fig. 19), enter the name of the sample and tap the **OK** button.

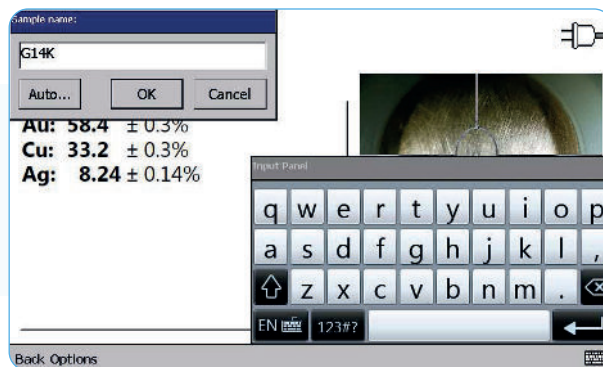


Fig. 19. Enter the name for the measurement

To view previously completed measurements, use the sensor back  and forth  browsing buttons.

See. s.4 for restrictions on the number of stored measurements and on the possibilities for their viewing and exporting.

3.10. Duration of Measurement

The duration of the measurement affects the accuracy of its results. The longer the duration is, the higher the accuracy is, but the longer waiting time of the result is. Therefore, the measurement time for each analytical task was chosen by the manufacturer so as to ensure the desired accuracy for the task with a minimal time.

The duration of the measurement may be changed by the user: increased to improve the accuracy or decreased to speed up the analysis (with increasing concentration uncertainties). To do this, tap the **Options | Measurement** duration, and in the opened window (fig. 20) change the existing value and tap the **OK** button.

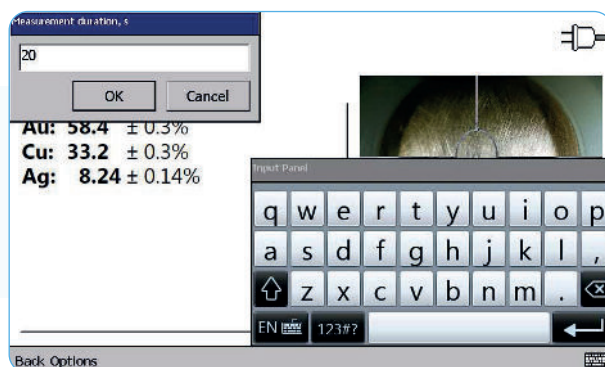


Fig. 20. Editing the duration of measurement

Note: uncertainties are displayed next to the concentrations of the elements. At the request of the user, uncertainties can be hidden. To disable/enable displaying of m uncertainties or to change the number of digits after the decimal point, refer to the manual the supplier for instructions.

3.11. Averaging Measurement Results

To improve measurement accuracy, the software can calculate an average of multiple measurements. To activate this feature, tap **Options | Averaging** in the mode window (fig. 21).

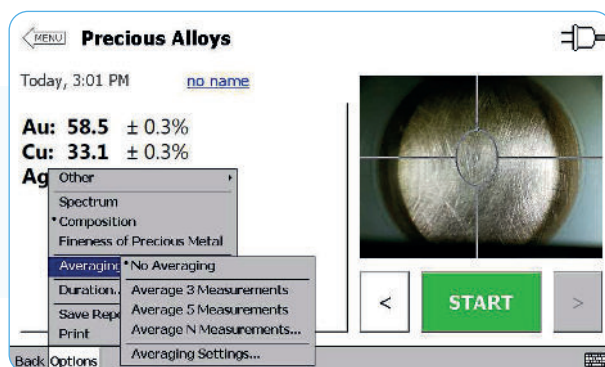


Fig. 21. Averaging menu

In the opened menu, select the necessary number of measurements for averaging – **No averaging**, **Average 3 Measurements**, **Average 5 Measurements**. To perform averaging on a different number of measurements, choose **Average N Measurements** item and enter that value in a newly opened window.

After averaging has been selected (for example, by three measurements), additional inscription **1/3** will be added to **START** button text (fig. 21). Before performing a second measurement, it will change to **2/3**, before the third one – **3/3**. Measurement number in the averaging series is also displayed to the right of the date/time of the measurement (fig. 22).

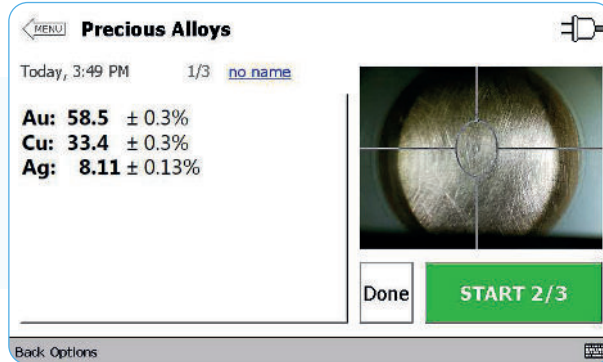


Fig. 22. Performing a measurement with averaging

Once all the measurements in the averaging series are done, the software will automatically calculate and display the average result which will be marked with $\Sigma(3)$. The **START** button will again display «1/3», indicating readiness to begin a new series of averaging (fig. 23).

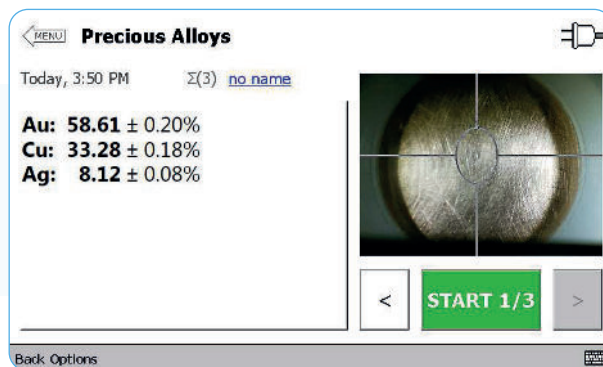


Fig. 23. The result of averaging

Completing the averaging series and viewing the result of averaging is also possible even all the measurements in the series are performed. To do this, tap the **Done** touch button to the left of the **START** button. The programme calculates the average result for already performed measurements in a series; number of measurements will be indicated in the label to the right of the date/time, such as $\Sigma(2)$.

By default, averaging works as follows. For each individual measurement in a series, its composition is calculated, and the arithmetic average of these individual compositions is the result of averaging. Averaging is done once on completion of all the measurements in the series (or by break with the **Done** button). Both the end result of averaging and individual measurements are saved in the database.

If necessary, you can change the way how averaging is performed. To do this, tap **Options | Averaging | Averaging Settings**. In the opened window (fig. 24) you can change the default mode of averaging – **Average composition** for **Average spectrum**. In this case, the programme will generate average spectrum from x-ray spectra of the separate measurements. Composition obtained from the analysis of this spectrum will be the result of averaging.

To save only the final averaged result in the database of the entire series of measurements, uncheck the **Save individual measurements** box. To see intermediate results of averaging after each individual measurement, check the **Display intermediate averages** box. Interim averaging results are not stored in the database.

To save changes in the settings, tap **OK** button.

To return to the measurement mode without averaging, go to the menu **Options | Averaging** and select **No averaging**.

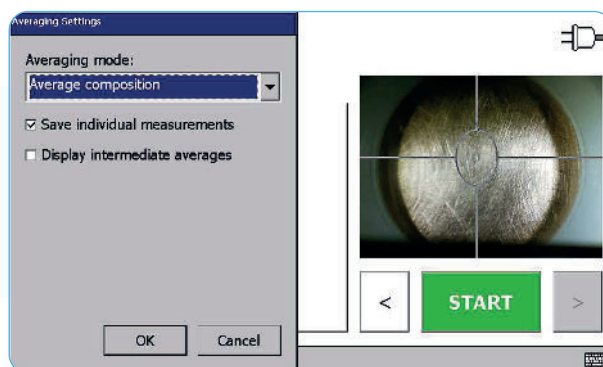


Fig. 24. Averaging settings

3.12. Validation of the Spectrometer Performance

Periodically, at least once a month, it is recommended to check the correctness of the spectrometer operation.

To carry out the check, place the supplied Bronze sample onto the measuring window. Carry out the measurement and compare the resulting composition to the table in the calibration certificate. If the concentrations deviations from the certified values are within the range specified in the calibration certificate, the spectrometer performance is considered correct.

When the measured concentrations are out of range, contact the manufacturer.

4. Additional Features of the Spectrometer

4.1. Working with the Collimator Changer

The spectrometer analyses a sample in a limited area of the sample surface, which is marked by an oval «target» in the image of the sample transmitted with integrated video camera.

The size of this area («spot») is determined by the opening diameter of the collimator installed in the path of x-ray radiation beam from the radiating element to the sample.

Upon user's request, the ElvaX Jewelry Lab spectrometer can be supplied with a mechanical collimator changer with different opening diameters. This allows the user to select the size of area being analyzed.

If the spectrometer is equipped with a collimator changer, touch button  is displayed at the top of the measurement window. Tapping this button will open a window that shows the image of the sample with superimposed targets, corresponding to different collimators installed in the device (fig. 25). Subscriptions specify minimum (usually horizontal) spot size in millimetres.

Targets might be displaced from the centre and have different degrees of elongation, as the size and position of the spots were determined with direct physical measurements on a specific spectrometer, rather than with theoretical calculations.

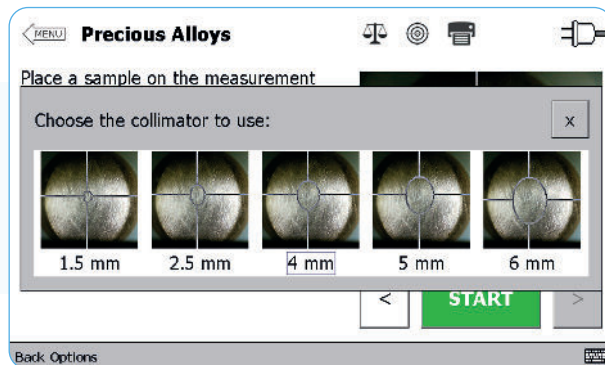


Fig. 25. Collimator selection window

To select the desired collimator, tap the corresponding image. The window will close, and you will hear the sound of changer rotation.

Changes of operating collimator apply only to the currently active analytical task. In other words, each analytical task remembers its operating collimator and with the transition from the main window to the task sets the changer to the desired position.

4.2. Working with Built-in Weigh-scales

Upon the user's request, the ElvaX Jewelry Lab spectrometer can be supplied with built-in weigh-scales. This allows the user to record the weight of the samples measured into the analysis results. The range of measured weights is 0 ... 200 g with a measuring resolution of 0.01 g.



IMPORTANT



Built-in weigh-scales have a high sensitivity as to shaking, so at the commissioning of the spectrometer, after each movement of the device, and at least once a day (at the beginning of the spectrometer operation) conduct a control weighing of the weight supplied with the spectrometer. In case of deviation from the specified weight for more than $\pm 0.05\%$ (0.05 g for a 100-gram weight), calibrate the weigh-scales (see. s. 4.2.2).

Calibration is also necessary if the readings with an empty table of weigh-scales exceed ± 0.3 g.

If the spectrometer is equipped with weights, touch button  is displayed at the top of the measurement window. Tapping this button opens a weighing window (fig. 26).

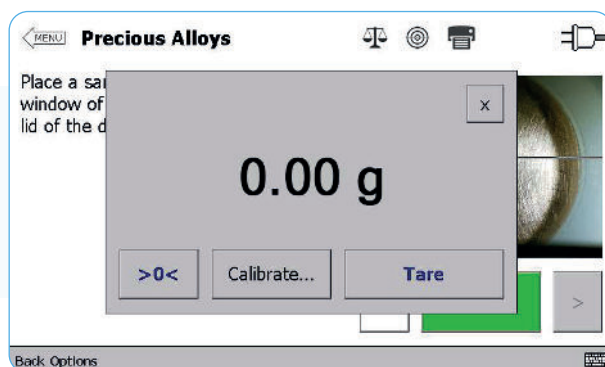


Fig. 26. Weighing window

Also, the spectrometer can be configured to automatically open weigh-scales window if the spectrometer lid is open, and the object is found on the weigh-scales table (s. 6.4).

4.2.1. Sample weighing

For the sample weighing, the spectrometer should be in the measurement mode of one of the analytical tasks, i.e. not in the main window.

If the automatic opening of the weigh-scales when loaded is **off** (default setting):

1.	Open the weigh-scales window by tapping the touch button  at the top of the screen. Open the device lid. Wait for the readings to stabilise – the grey colour of weight will change for saturated black. Ensure that with an empty table, the weigh-scales show 0.0 g. If it is not true, and readings are within ± 0.3 g, click the >0< button to reset the readings to zero. If the readings with an empty table exceed ± 0.3 g, calibrate the weigh-scales (s. 4.2.2).
2.	Place the measured sample at the centre of the table and wait for the readings to stabilise. Weighing is completed.

If automatic weigh-scales opening when loaded is **turned on** in the settings (s. 6.4):

1.	Open the device lid. If with an empty table weigh-scales window automatically opens, wait for the readings to stabilise – the grey weight colour will change for saturated black. If the readings are within the range of ± 0.3 g, click the >0< button to reset the readings to zero. The weigh-scales window will disappear, as in this mode the weigh-scales window opens only at the non-zero readings. If the readings with an empty table exceed ± 0.3 g, calibrate the weigh-scales (s. 4.2.2).
2.	Place the measured sample at the centre of the table. The weigh-scales window will open automatically. Wait for the reading to stabilise. Weighing is completed.

If you put the weighing object on the measuring window after weighing and then measure the object after closing the lid and, its weight will be automatically recorded in the analysis result (fig. 27). Opening the spectrometer lid is interpreted as an intention to work with another sample, so after opening the lid and up to the next weighing, spectrometer will take weight of measured samples as unknown.

If you make several measurements of the same sample in a row and want its weight to be recorded in each of the analysis results, do not open the lid between measurements.

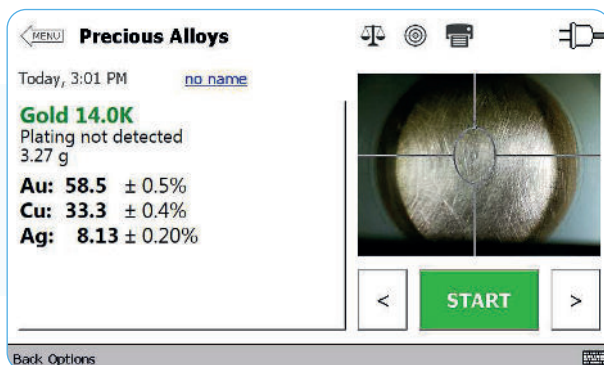


Fig. 27. Sample weight in the analysis result

If weighing of the object should be performed in the tare, first set the empty container on the table and click the **Tare** button in the weigh-scales window so that spectrometer can memorise its weight. After that, put the object into the container, and the weigh-scales will show its net weight, which will be indicated with the **Net weight** inscription in the upper left corner. To return to normal weighing mode, click **Reset tare** button.

4.2.2. Weigh-scales calibration

For the calibration of the weigh-scales, spectrometer should be in the **measurement mode** of one of the analytical tasks, i.e. not in the main window.

1.	Open the device lid. If the weigh-scales window does not open, tap the touch  button at top of the screen. In the weigh-scales window, tap the Calibrate button. Calibration of the weigh-scales is considered to be a protected function, so the programme will ask the password. Enter xrf and tap the Login button. A new window opens with the calibration instructions (fig. 28).
2.	Make sure that the weigh-scales table is empty. When the spectrometer registers readings stability of the empty weigh-scales, the Calibrate 0 button will be enabled. Tap it.
3.	Put the control weight, which is supplied with the spectrometer, onto the weigh-scales table exactly in the centre and enter the weight in grams in the Weight field. When the spectrometer registers readings stability of the loaded weigh-scales, the Calibrate W button will be enabled. Tap it.
4.	Weigh-scales calibration is completed. Close the calibration window by tapping X in the upper right corner. Make sure the weigh-scales window shows the correct weight of the control weight. Remove the weight from the table and make sure that the weigh-scales window shows 0.0 grams or is automatically closed.

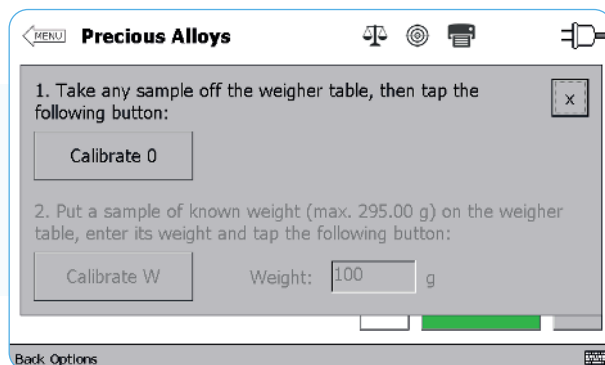


Fig. 28. Weigh-scales calibration window

4.3. Working with Built-in Printer

Upon user's request, the ElvaX Jewelry Lab spectrometer can be supplied with built-in thermal roll printer. This allows the user to quickly print the result of the analysis of any performed measurement.

If the spectrometer is equipped with a printer, touch button  is displayed at the top of the measurement window. Tapping this button will send the measurement on the screen to the printer (fig. 29).



Fig. 29. Printing of a measurement report

Optionally, you can enable automatic printing of each measurement performed (s. 6.5). If the printer is out of paper, replace the empty roll for a new one according to s. 8.2.

5. Storing and Exporting Measurement Results

Performed measurements, i.e. x-ray spectra of samples with the results of their analysis are **automatically** saved in databases that are stored on the internal flash memory of the spectrometer or an external flash drive. Each analytical task stores the measurement in a separate database. The number of stored measurements is specified in the settings of the spectrometer (see s. 6.6). When this number is exceeded, the oldest measurements are automatically removed.

In factory configuration spectrometer saves 300 recent measurements for each analytic task, and uses internal memory of the built-in computer for database storage. Optional flash drive is not required.

5.1. The principle of archival and deletion of old measurements

By default, spectrometer stores the last 300 measurements for each analytical task. When 301 st measurement is performed, the oldest measurement is deleted. All of the 300 recent measurements are

available for scrolling with  and  buttons in the measurement mode.

If the settings (s. 6.6) specify to store more than 300 measurements per task (for example, 1,000) in order to prevent delays, two databases in the measurement process are used – operating and archive. When 301st measurement is complete, the oldest measurement is not deleted but moved into the archive. When the total number of measurements in the analytical task exceeds 1,000, the oldest measurement is deleted from the archive. Last 300 measurements of the task are available for scrolling with  and  buttons. Measurements moved to archive are **not available for scrolling** in the measurement mode, but all the information about them can be exported into logs (s. 5.3.3).

5.2. Choosing the Drive for Measurements Storage

The internal memory of the built-in computer is enough to ensure storage of 300 and 1,000 measurements per analytical task. Storing a larger number of measurements might require an external flash drive permanently inserted in the USB-A connector of the spectrometer (fig. 3). For this purpose you can use any flash drive of a reliable manufacturer.



WARNING



Do not use the setup flash drive as measurement storage device!

Using the setup card can cause loss of original calibration data of the spectrometer stored on it. It also can lead to the accidental re-installation of the software and data that results in deletion of all the configuration changes made by the user during work.

Working drive and the number of stored measurements are specified in the spectrometer settings (s. 6.6)

5.3. Export of Measurement Results to a Desktop Computer

There are several options for exporting the measurements results performed with the ElvaX Jewelry Lab spectrometer. You may:

- Export a single measurement in the form of an **HTML file** which can be opened with any Internet browser on the desktop computer. Appearance of the HTML report is identical to the image on the screen of the built-in computer (see s. 5.3.1).
- Export a single measurement as an **RTF document**, which can be opened on the desktop computer with most text editors, such as Microsoft Word. Appearance of RTF report can be configured. The spectrometer is pre-installed with several predefined report templates. You can amend the existing or create a new one by inserting all the additional information which you wish to see in the reports – the company name, logo, address, etc. (see s. 5.3.2)
- Export a log of measurements made during a certain period of time, in the form of **CSV tables** that can be opened on the desktop computer with most spreadsheet applications, such as Microsoft Excel. The logs contains the date/times and the names of measurements, concentrations of the detected elements, as well as technical information about measurements (see s. 5.3.3)

By default, as a place for export, an external flash drive is used. That is, before exporting insert a drive from any manufacturer into USB-A spectrometer connector (fig. 3), and after exporting remove the drive and

insert it into the desktop computer. Please do not use the setup flash drive for this purpose since it can cause the loss of original calibration data of the spectrometer stored on the setup drive and can lead to accidental reinstallation of the software and data.

If the spectrometer is connected as a portable device to a desktop computer with Microsoft Windows OS (s. 7.2), it is possible to export results without any additional drive, by changing export settings so that reports and logs can be stored in the internal memory of the built-in computer. On a desktop computer, they can be found in Windows Explorer (My Computer) under the portable device's icon (s. 6.7).

4.2.2. Weigh-scales calibration

To export the report on the measurement displayed on the screen, insert the flash drive into the USB-A connector of the spectrometer (fig. 3) and click **Options | Save Report** (fig. 30).

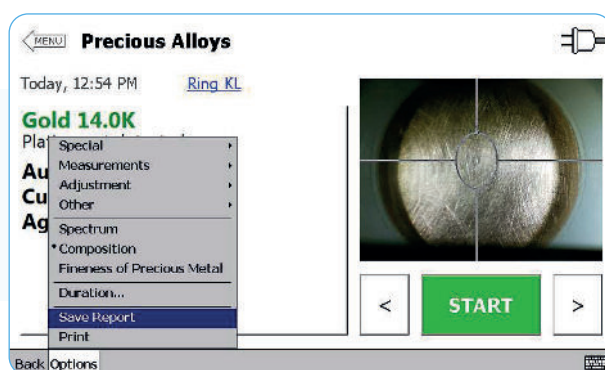


Fig. 30. Saving a report on a single measurement

By default, the report will be saved in the *HTML file in the ElvaX Jewelry Lab folder* on the flash drive. When the drive is inserted into a desktop computer, this report can be opened by any Internet browser. The report view will be identical to the image on the screen of the spectrometer (fig. 31).

Date: 9/23/2015, 12:54 PM
 Sample name: Ring_KL
Gold 14.0K
 Plating not detected
Au: 58.5 ± 0.5%
Cu: 33.3 ± 0.4%
Ag: 8.13 ± 0.20%
 Measured by ElvaX Jewelry Lab spectrometer

Fig. 31. Example of HTML report

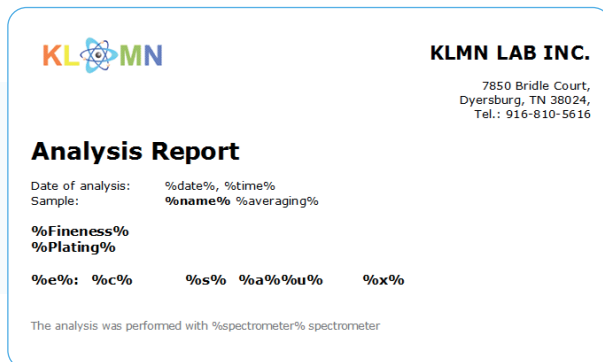
To specify a different folder to export the measurements, for example, to work without additional USB flash drive, go to the export settings (s. 6.7).

5.3.2. Exporting a report of a single measurement as an RTF document

To have reports in user's style and with user's additional information, RTF templates technology is provided.

The report template is a text document formatted in accordance with the user's needs and containing placeholders – special words surrounded by percent characters (such as %date%, %conc%, etc.). Placeholders

are replaced by actual values when the report of a measurement is being saved. For instance, the following template (fig. 32) will produce the following report: (fig. 33).



KLMN LAB INC.
7850 Bridle Court,
Dyersburg, TN 38024,
Tel.: 916-810-5616

Analysis Report

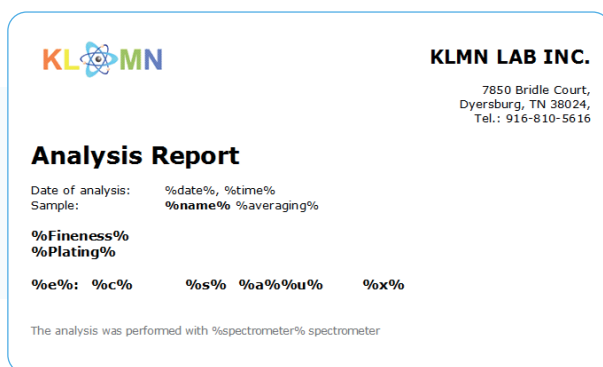
Date of analysis: %date%, %time%
Sample: %name% %averaging%

%Fineness%
%Plating%

%e%: %c% %s% %a% %u% %x%

The analysis was performed with %spectrometer% spectrometer

Fig. 32. Example of a report template with place-holders



KLMN LAB INC.
7850 Bridle Court,
Dyersburg, TN 38024,
Tel.: 916-810-5616

Analysis Report

Date of analysis: %date%, %time%
Sample: %name% %averaging%

%Fineness%
%Plating%

%e%: %c% %s% %a% %u% %x%

The analysis was performed with %spectrometer% spectrometer

Fig. 33. Example of a report with actual values instead of place-holders

There are several predefined report templates pre-installed in the spectrometer. To see the available templates and choose the template to be used in the analytical task, tap **Options | Other | Report Format** in the measuring mode (fig. 34).

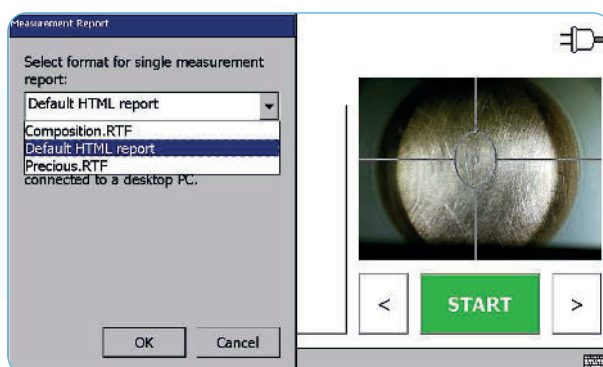


Fig. 34. Selection of the report format

For instance, if *Composition.RTF* template is chosen, tapping **Options | Save Report** will write an RTF report for the displayed measurement on screen in the export directory (by default, *ElvaX Jewelry Lab* on the external USB flash drive; before saving a report, the drive must be inserted in the USB-A connector (fig. 3)). When the drive is inserted into a desktop computer, this report can be opened with most text editors, such as Microsoft Word.

Recommended procedure for **creating your own report template**

1.	Connect the spectrometer to a desktop computer with Microsoft Windows OS as a portable device (s. 7.2)
2.	Locate the \Application Data\Elvatech\ElvaXCe\Jxxx\CustomReports folder on a portable device in the Windows Explorer (My Computer). (where Jxxx is the serial number of your spectrometer, for example, J033).
3.	Copy existing templates (RTF-files) to any folder on your computer.
4.	Among the copied files, select the template that you want to customize, and make a copy of it with a distinctive name, such as <i>My report.rtf</i> .
5.	Open <i>My Report.rtf</i> and edit it according to your needs, e.g. put your logo image, address, footer information, styling etc. or remove placeholders (%xxx%) for data you don't want to be in reports.
6.	Save <i>My Report.rtf</i> and copy it to CustomReports folder on the PDA.
7.	In the measurement mode, tap Options Other Measurement Report , select <i>My report.rtf</i> in the list, and then tap OK .
8.	Test the template by saving a report of any measurement using Options Save Report . By default, reports are saved to the <i>ElvaX Jewelry Lab</i> folder on the external USB flash drive. If anything needs to be changed, just correct the <i>Myreport.rtf</i> located on your desktop computer, and then copy it to the CustomReports folder in the spectrometer.

5.3.3. Exporting a logs of measurements as CSV tables

To export a log with information about a series of measurements made within a certain period of time, exit the measurement mode into the main window by tapping the **Menu** touch arrow button in the upper-left corner of the screen. In the main window, tap **Options | Adjustment | Measurement Exporting** (fig. 35).

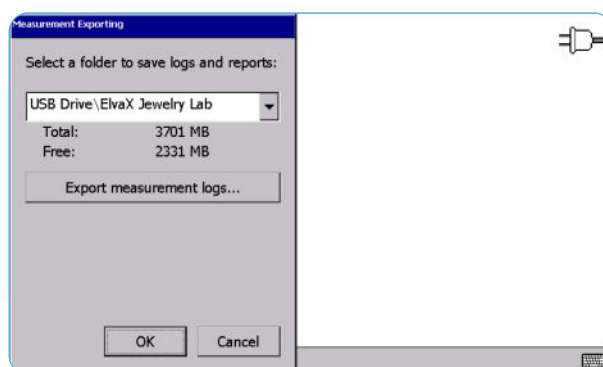


Fig. 35. Parameters of measurement export

In the opened window, specify a folder to be used for logs and reports. By default, it is the ElvaX Jewelry Lab folder on the external USB flash drive. So, to continue export, insert drive into a USB-A connector (fig. 3), and then tap the **Export measurement logs** button. In the new opened window (fig. 36), specify what measurements are to be exported – made today, dated within a range, or all stored – and tap the **OK** button.

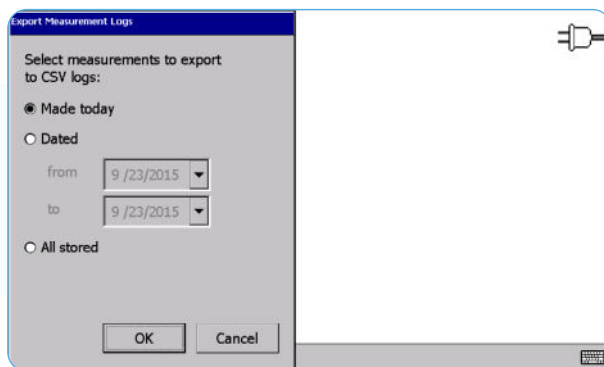


Fig. 36. Parameters of log export

The software will search all databases, including archives (see s.5.1), for measurements that meet the chosen date condition, and will export information on them as CSV logs. A separate log will be created for each analytical task. When the flash drive is inserted into the desktop computer, these logs can be opened by most spreadsheet applications, such as Microsoft Excel (fig. 37).

	A	B	C	D	E	F	G	H	I	J	K	L
1	Date	Time	Reading	Averaging	Name	Filter1	Voltage1	Current1	RealTime1	InCPS1	OutCPS1	Filter2
2	6/18/2015	17:44	1		Evt-Al-SUS	2	35	102.7	1.29	328192	242322	
3	6/18/2015	17:47	2		Evt-Si	2	35	114.3	1.28	190312	154981	
4	6/18/2015	17:48	3		Evt-Cu-174	2	35	10.3	1.36	397626	313822	
5	6/18/2015	17:49	4		Evt-Cu-175	2	35	10.3	1.28	419656	332842	
6	6/18/2015	17:50	5		Evt-Cu-126	2	35	10.5	1.28	398987	316190	
7	6/18/2015	18:04	6		Evt-Cu-126	2	35	11	1.28	394966	313377	
8	6/18/2015	18:06	7		Evt-Cu-391	2	35	9.2	1.28	412288	323756	
9	6/18/2015	18:11	8		Drz-Al-186	2	35	96.9	1.28	328671	246182	
10	6/18/2015	18:14	9		Drz-Al-185	2	35	97	1.35	326575	244568	
11	6/18/2015	18:15	10		Drz-Al-184	2	35	94.3	1.28	329223	248009	
12	6/18/2015	18:17	11		Drz-Al-183	2	35	98.5	1.38	326992	244416	
13	6/18/2015	18:19	12		Drz-Al-182	2	35	92.9	1.36	331127	248833	
14	6/18/2015	18:23	13		Drz-Al-181	2	35	98.7	1.35	329357	246102	
15	6/18/2015	18:27	14		Drz-Al-205	2	35	57.8	1.28	359555	280030	

Fig. 37. Example of CSV log

The log displays the date/times and the names of measurements, concentrations of the detected elements, as well as technical information on measurements. List of the exported columns is fixed. You can delete unneeded columns and format the table according to your liking in Microsoft Excel. Do not forget to save the edited table as an XLS file since CSV format does not support formatting.

In the settings window (fig. 35), you can specify a different folder for the export of logs and reports, for example, to work without additional USB flash drive (s. 6.7).

6. The Spectrometer Settings

The spectrometer settings menu can be accessed via the **Options** touch button in the screen's lower left corner in the main window of the programme (fig. 38). If the spectrometer is in measurement mode, go to the main programme window by tapping the **Menu** touch arrow button in the upper left corner of the screen.

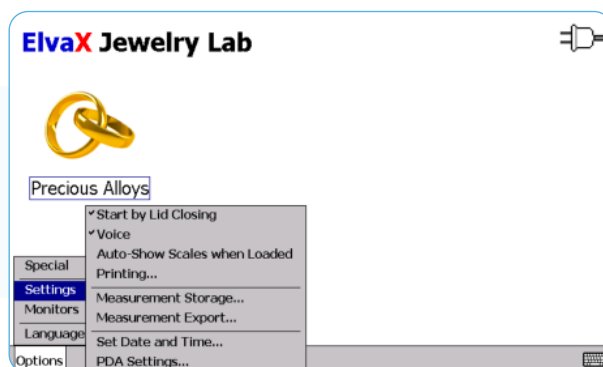


Fig. 38. The spectrometer settings menu in the main window of the programme

6.1. Selecting Language of User Interface

Spectrometer software's user interface is implemented in multiple languages. To change the interface language, go to the main programme window, and in the **Options | Language** menu select an item with the desired language name (fig. 39). Program will restart – it will take about 15 seconds – with the interface in a new language.

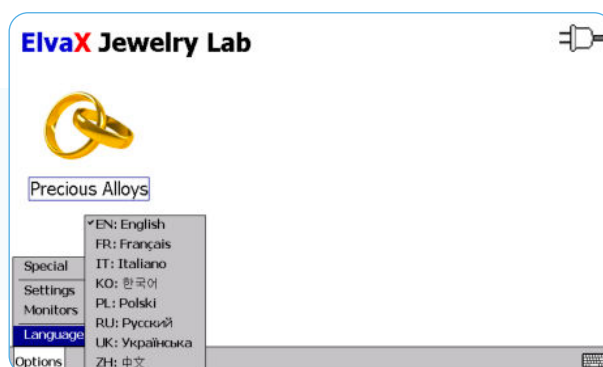


Fig. 39. User interface language selection menu

6.2. Starting Measurements by Lid Closing

In the original configuration of the spectrometer, while your program is in measurement mode, measurement of a sample automatically starts each time the lid is closed.

If this behaviour is inconvenient, you can disable automatic start. Go to the main programme window, and in the **Options | Settings** menu (fig. 38) untick the **Start by Lid Closing** item. After this, measurement will start only by tapping the **START** touch button.

6.3. Measurements Audio Feedback

By default, spectrometer measurement process is accompanied by voice messages («Done», «Cool-down not completed», and so on).

To disable voice feedback, go to the main programme window, and in the **Options | Settings** menu (fig. 38) untick the Voice item.

6.4. Weighing Window Behaviour

If the spectrometer is equipped with built-in weigh-scales, by default, weigh-scales window appears on the screen only when the user taps  touch button at the top of the screen.

The spectrometer can be configured so that the weigh-scales window will open automatically when the lid of the spectrometer is open (and it is in the measurement mode), and an object is detected on the table of weigh-scales by non-zero readings.

To do this, go to the main programme window, and in the **Options | Settings** menu (fig. 38) tick the **Auto-Show Scales when Loaded** item.

Note: this item does not appear in the menu if there are no weigh-scales in the spectrometer.

6.5. Printing Settings

If the spectrometer is equipped with a built-in printer, you can find *Printing* item in the **Options | Settings** menu of the main programme window (fig. 38). This item opens the printing settings window (fig. 40).

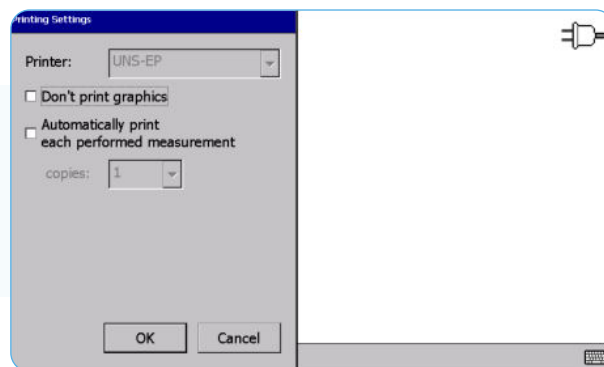


Fig. 40. Printing settings

Check the **Don't print graphics** if you want to remove the logo from printout or speed up the printing process. Note: if unchecked, the spectrometer prints a manufacturer logo. Upon request, it can be replaced with a user's logo.

Check the **Automatically print each performed measurement** so that the spectrometer should print each measurement on its completion. In the **copies** edit, specify the desired number of automatic printouts for a measurement (usually 1).

6.6. Measurement Storing Settings



Before changing settings, get familiar with the principle of storing and deleting of measurements used in spectrometer, **sections 5, 5.1, 5.2**.

To open the measurement storage settings in the main programme window, go to the main programme window, and in the **Options | Settings** menu (fig. 38) select the **Measurement Storage** item.

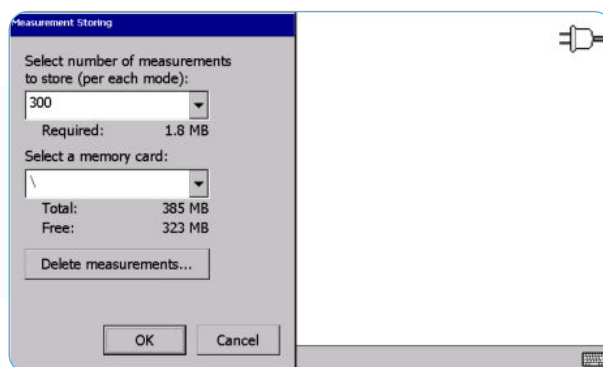


Fig. 41. Measurements storing parameters

In the opened window (fig. 41), you can select the number of **measurements stored** in each analytical task - 0, 300, 1,000, 3,000, 10,000, and **memory card** for storage. In the original configuration it is 300 measurements and internal memory, «\».

In the **Required** field, the programme calculates amount of space needed to store the chosen number of measurements. The **«Free»** field shows the amount of space available on the selected card. The programme will not accept the change if the required space exceeds the free one.

If there is not enough internal memory to store the chosen number of measurements, use an external USB flash drive from a reliable manufacturer. The drive must be permanently inserted into the spectrometer's USB-A connector (fig. 3). It will appear as «USB Drive» in the memory card list. Please do not use the setup flash drive as measurement storage device!

If you made changes to settings, confirm them by tapping the **OK** button.

6.7. Measurement Exporting Settings

To open the measurement export settings, go to the main programme window, and in the **Options | Settings** menu (fig. 38) select the **Measurement Export** item.

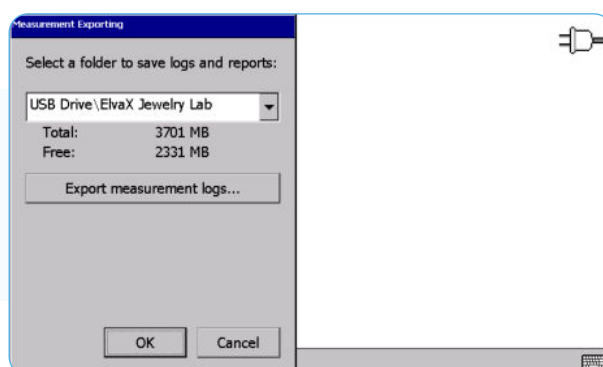


Fig. 42. Measurement exporting parameters

In the opened window (fig. 42), you can choose a **folder** to be used as destination when exporting measurement logs and reports. By default, it is the ElvaX Jewelry Lab folder on the external USB flash drive. In this configuration, export procedure is the following: you insert a flash drive into the spectrometer's USB-A connector (fig. 3), perform export (s. 5.3), remove the drive from the spectrometer and insert it into the desktop computer.

If you have a Microsoft Windows OS running desktop computer, you can export measurement to it **without using any additional drive**. To do this, select a folder in the internal memory of the spectrometer – \ElvaX Jewelry Lab or \My Documents\ElvaX Jewelry Lab. When spectrometer is connected to the

desktop computer as a portable device (s. 7.2), these folders will be accessible in the Windows Explorer (My Computer). In this configuration, remember to periodically delete unnecessary reports and logs to avoid the internal memory running out.

If you made changes to settings, confirm them by tapping the **OK** button.

6.8. Setting Date and Time

To set the date and time of the spectrometer, go to the main programme window, and in the **Options | Settings** menu (fig. 38) select the **Set Date and Time** item. The window will open where you can change the current date, time, and time zone (fig. 43). Confirm the changes by clicking the **Set** button.

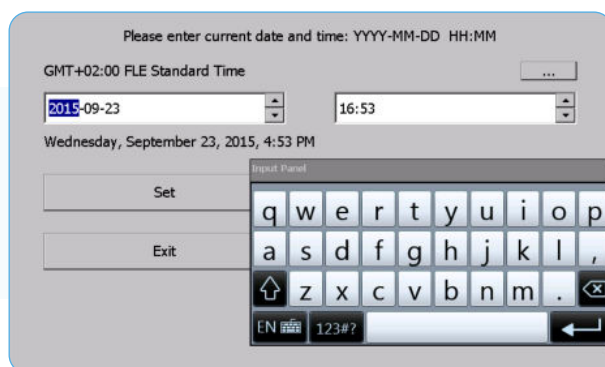


Fig. 43. Setting date and time

6.9. Built-in Computer Settings

Some specific tasks, for example, spectrometer touch screen calibration, may require access to operating system settings of the built-in computer.

To do this in the main programme window, go to the main programme window, and in the **Options | Settings** menu (fig. 38) select the **PDA Settings** item. Computer settings window will open (fig. 44). To return to the main programme of the spectrometer, tap «x» in the upper right corner of the screen.

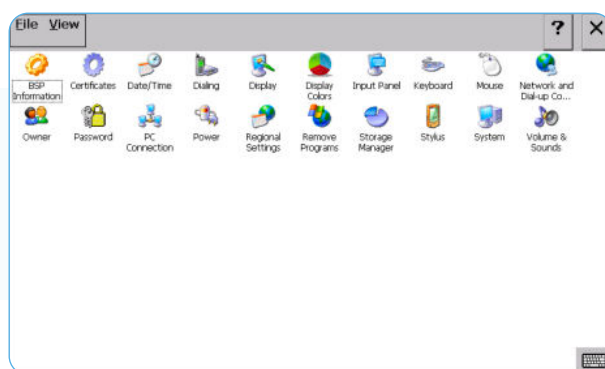


Fig. 44. Computer settings window

7. Connecting the Spectrometer to a Desktop Computer

7.1. Connecting as spectrometric device to operate the spectrometer with ElvaX 4 software

Spectrometric equipment of the device can be controlled both with the built-in computer software and

with the special ElvaX 4 programme running on a desktop computer with Microsoft Windows OS. This programme provides full control over the capabilities of the spectrometer and allows you to inspect the acquired spectra. with the special ElvaX 4 programme running on a desktop computer with Microsoft Windows OS. This programme provides full control over the capabilities of the spectrometer and allows you to inspect the acquired spectra.

To make the spectrometer controlled by ElvaX 4:

1.	Contact the supplier for ElvaX 4 software, install the application and the spectrometer driver on your desktop computer.
2.	Turn the spectrometer on and wait for it to boot.
3.	Insert one end of the USB cable into the USB connector of the desktop computer, the other end into the spectrometer's USB-B connector (fig. 3). <i>The cable is not included in the standard package but can be supplied on request of the user.</i>
4.	Wait for the desktop computer's operating system to detect the spectrometer and to install it as a external device.
5.	Run the ElvaX 4 application. It will detect the spectrometer and show its serial number in the status bar.

While the spectrometric equipment is connected to a desktop computer, it is disconnected from the embedded computer as indicated by icon  in the upper-right corner of the screen. Operating the spectrometer with touch screen becomes temporarily impossible.

After you disconnect the spectrometer from a desktop computer, the connection will be automatically restored in 5-10 seconds, and the «red x» icon will be replaced with one of the power supply icons.

7.2. Connecting as a portable device to access the internal memory

The spectrometer can be connected as a portable device to a desktop computer with Microsoft Windows OS, allowing the internal flash memory of the spectrometer to be available via Windows Explorer (My Computer).

To connect the spectrometer as a portable device:

1.	Install service software onto the desktop computer:
a)	For Microsoft Windows Vista, 7, 8 – Microsoft Windows Mobile Device Center 6.1: 32-bit – http://www.microsoft.com/en-us/download/details.aspx?id=14 64-bit – http://www.microsoft.com/en-us/download/details.aspx?id=3182
b)	For Microsoft Windows XP operating system – Microsoft ActiveSync 4.5 32/64-bit – http://www.microsoft.com/en-us/download/details.aspx?id=15
2.	Turn the spectrometer on and wait for it to boot.

3.	Insert one end of the USB cable into the USB connector of the desktop computer, the other end into the spectrometer's mini-USB connector (fig. 3). <i>The cable is not included in the standard package but can be supplied on request of the user.</i>
4.	Wait for the desktop computer's operating system to detect the spectrometer and to install it as a portable device.
5.	Open the <i>Windows Explorer (My Computer, This PC)</i> , and then find the spectrometer in the list of portable devices. Now, the internal flash memory of the spectrometer is available for work as another drive/device of your computer.
6.	If you chose to export the measurements into the internal memory of the spectrometer (s. 6.7), you will find reports and logs in the <i>\ElvaX Jewelry Lab</i> folder (or <i>\My Documents\ElvaX Jewelry Lab</i> , depending on which folder was selected in the export settings).
7.	If an external flash drive is inserted into the spectrometer, it will be shown as <i>USB Drive</i> under the portable device.



IMPORTANT



Be extremely careful when working with the internal flash memory. Damage to the contents of the *\Windows* folder may cause failure of the built-in computer. **Please work in strict accordance with these Manual** and do not remove anything outside the *\ElvaX Jewelry Lab* and *\My Documents\ElvaX Jewelry Lab* folders.

Connecting the spectrometer as a portable device does not interrupt connection between the built-in computer with spectrometric equipment and therefore you can continue operating the spectrometer using the touch screen.

7.3. Connecting to duplicate image on the screen of an external computer

If the spectrometer is connected as a portable device to the computer with the Microsoft Windows OS, it is possible to display the image from the spectrometer screen in a window of the desktop computer and control the spectrometer through this window **using mouse and keyboard**.

To duplicate image from the spectrometer to the desktop computer:

1.	Connect the spectrometer as a portable device (s. 7.2).
2.	Open the <i>Windows Explorer (My Computer, This PC)</i> , and locate the spectrometer in the list of portable devices. Open it and locate the \Windows\RemoteControl folder. In the folder, locate the PDA Remote Control.exe file. Copy this file to any folder of the desktop computer.

3.	Run the PDA Remote Control.exe on the desktop computer. If the notification <i>Windows Firewall has blocked some features of this programme</i> opens, reply Allow access . If the message <i>The OS or CPU of this device is unknown to this application</i> appears, ignore it by clicking OK .
4.	The window will appear with the image identical to the spectrometer screen (fig. 45).

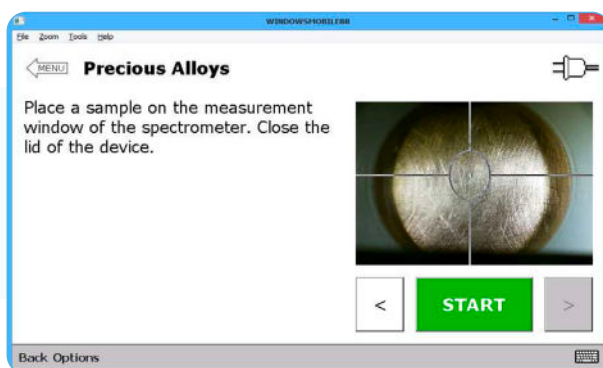


Fig. 45. The window of *PDA Remote Control.exe* programme

5.	Clicking the mouse in this window is equivalent to tapping the touch screen of the spectrometer, and instead of the onscreen keyboard, you can use a desktop computer keyboard.
6.	If for some reason the connection to the spectrometer is broken, the window turns black. After reconnection, restart <i>PDA Remote Control.exe</i> to renew the image synchronisation.

8. Maintenance

8.1. Replacing Protective Film in the Measuring Window



Protective radiolucent film in the measuring window of the spectrometer prevents from damage the thin window of the costly detector located a centimetre under the film. Damage to the detector window requires its complete replacement and is not covered by warranty!

Therefore, replace the film with extreme caution!

The replacement must be carried out when the film is damaged or dirty. Even if the dirt is not visible to the naked eye, the film should be changed periodically, as each object under study leaves subtle traces containing particles of its material. When such traces accumulate, they may be detected by the spectrometer and that will distort the measurement results.

To replace the film, remove its retaining ring (fig. 4). To do this, pull the protruding edge of the film over the ring. The ring comes off with the film. Cut about 6-7 cm of new film from the roll, place it above the window, and gently press it with the ring so that the surface of the film over the window becomes moderately taut and smooth. Use only radiolucent film which is supplied with the spectrometer. If the film

is run out, please contact the supplier of the spectrometer.

8.2. Replacing Paper Roll in the Built-in Printer

The equipped with a built-in printer spectrometer uses paper for thermal printers of 65 microns thickness. The maximum allowable diameter of a roll is 59 mm, maximal width is 58 mm.

To replace the paper roll, open the cover of the built-in printer until it stops at the internal limiter. Do not attempt to open the lid wider than that provided by the design of the device, otherwise it may break.

Holding the lid in the open position, remove the empty roll with the plastic axle from the printer. Remove the empty roll from the axle and put a new one on, freeing (peeling off) the edge of the paper. Hold the roll as follows: when the paper is unwound down, it gets detached from the roll's rear side regarding to you, and the paper's inner side is facing you. Keeping this orientation, insert the roll with the axle into the printer while keeping the printer cover open, and move the axle through special guides in the device housing (fig. 46). After placing the roll inside the printer, pull some paper over and close the cover until it clicks. Unwound end of the paper should be fixed with cover and peek out of the device. The printer is ready for further work.



Fig. 46. Replacing the paper roll for the built-in printer

8.3. Replacing the Spectrometer's Battery and the Clock Battery

The spectrometer battery is located inside the spectrometer. If it needs replacement, for example, due to the significant reduction in the working time of the spectrometer with a fully charged battery, contact the service centre.

Clock battery is used to maintain the operation of the internal clock at the time when the spectrometer is off. In case of its discharge or failure, the spectrometer will ask to enter the current date and time each time when it is switched on. Lifetime of the clock battery is difficult to predict, it is measured in years. The need to replace the clock battery is unlikely to occur; if this happens, contact the service centre.

8.4. Monitoring the Spectrometer Status

The spectrometer provides continuous monitoring of the operating parameters of the device, the knowledge of which can be useful for maintenance of the spectrometer. This information is accessible through the **Options | Monitors** menu in the main programme window (fig. 47).

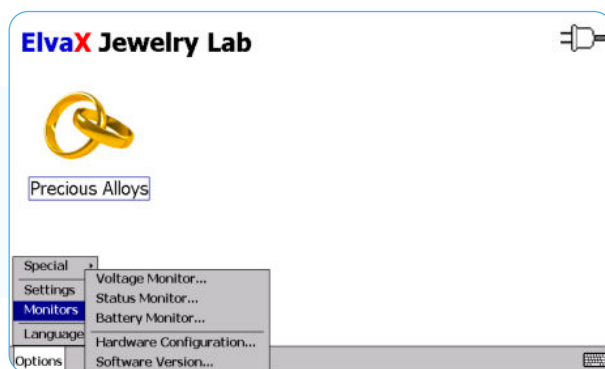


Fig. 47. Monitors menu

The voltage monitor shows the values of the basic parameters of the electronic components of the spectrometer: the internal power supply voltage, current and voltage of the x-ray tube, the temperature of the radiating element shell, the voltage on the detector cooler, the temperature of the body and the crystal detector, detector high voltage, current input and output count rates in the digital processor (fig. 48).

The status monitor shows the values of the logical flags: whether the radiation is allowed, whether the radiator is on, whether the cover is opened, whether the operating temperatures are within limits etc. (fig. 49).

The battery monitor shows a report on the state of the power supply system of the spectrometer and embedded computer: whether the power is supplied from the AC adapter or not; whether spectrometer is equipped with the battery or not; level of charge; whether the battery is being charged at the moment; how long it can supply a spectrometer; how long it takes to fully charge the battery; whether built-in computer is powered; whether a separate computer's battery pack is installed; level of charge and whether it is being charged currently (fig. 50).

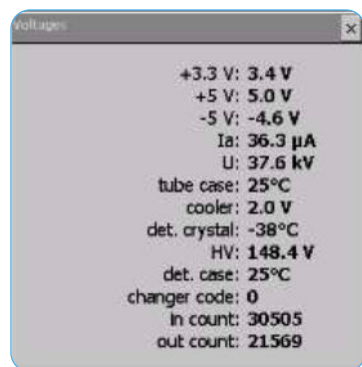


Fig. 48. The test voltages

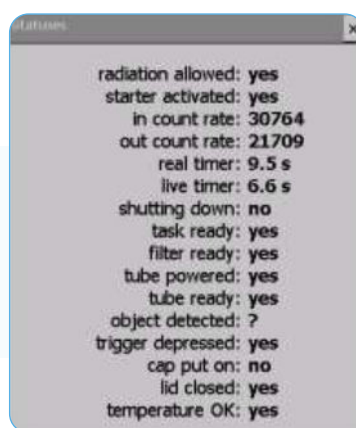


Fig. 49. The status monitor

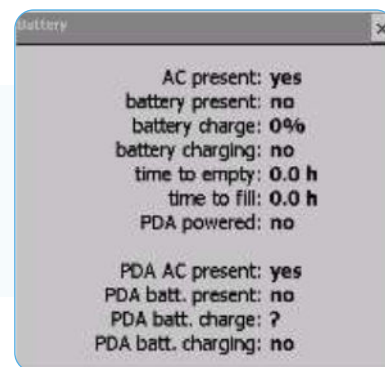


Fig. 50. The battery monitor

Being open, these monitors do not block the further work with the spectrometer. In particular, having one or more monitors opened, you can move to the measurement of any analytical tasks and track parameters change during the measurement.

To close the monitor, tap a small cross in its upper right corner.

8.5. Determining the Software Version and Serial Number of the Spectrometer

Being open, these monitors do not block the further work with the spectrometer. In particular, having one

or more monitors opened, you can move to the measurement of any analytical tasks and track parameters change during the measurement.

To close the monitor, tap a small cross in its upper right corner.

8.5. Determining the Software Version and Serial Number of the Spectrometer

To get the serial number and brief information on the spectrometer, go to the main programme window, and in the **Options | Monitor** (fig. 47) select the **Hardware Configuration** item. The window that appears on the screen will display the device serial number, the type of the detector and filters (fig. 51).

By selecting **Software Version** item in the **Options | Monitors** menu, you can check the version of software installed in the spectrometer, and the revision number of the calibration data of the spectrometer (fig. 52).

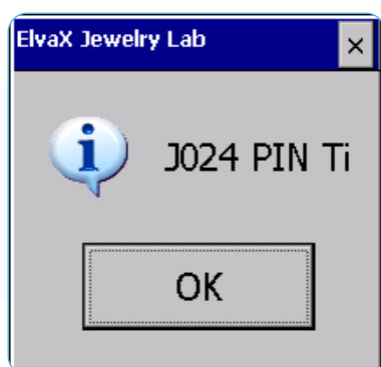


Fig. 51. The serial number and configuration

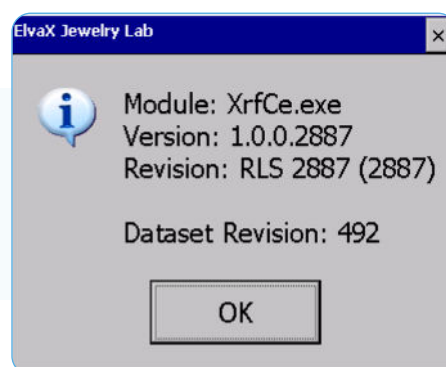


Fig. 52. Software Version of the spectrometer

8.6. Reinstalling Spectrometer Software



Reinstalling software and calibration data of the spectrometer restores its default settings and overwrites the changes made by the user during operation. This operation does not affect the measurements; ***when you reinstall the software, the measurements are not deleted.***

Thus, reinstalling the software can be used to cancel all intended and unintended changes in the settings of the spectrometer. Nevertheless, reinstallation is not recommended unless it is absolutely necessary.

A copy of the software and calibration data for the ElvaX Jewelry Lab spectrometer is recorded to a flash drive supplied.

To reinstall the software, turn the spectrometer on, wait for it to complete booting, and wait for at least 30 seconds extra. Insert the setup flash drive into the USB-A connector (fig. 3). The setup will start automatically and ask to confirm the installation. Click OK. Preliminary steps, such as removing or exiting software, are not required. Upon completion, the programme will ask for confirmation to reboot the computer.

The same procedure is used for updating software or operational data for the spectrometer, for example, in order to provide new functionality or to add analytical task. The manufacturer generates the content of the new setup flash drive and sends it to the customer in any way possible. Usually, content is packed in ZIP-archive and uploaded onto the company's website, and a link to the file is sent to the customer along with instructions. Customer has to download the archive, extract its contents to a blank flash drive and insert it in the operating spectrometer to run the standard installation process.

9. Technical Data

The range of detectable elements	From Ti (Z= 2) to U (Z=92)
Operating conditions – ambient temperature; – relative humidity; – atmospheric pressure;	from +10 to 30°C; to 80% at 25°C; from 84 to 106.7 kPa (from 630 to 800 mm Hg);
X-ray tube	W anode, 40 kV max. (optional 50 kV max.) 100 µA max. Option: Rh or Ag anode for the analysis of light elements Option: automatic change of filters for 5 positions
X-ray detector Detector type Active area Resolution ability	The silicon PIN-diode with thermoelectric cooling (optional SDD detector) 6 mm ² (25 mm ² for SDD) <165 eV to 5.9 keV of energy (<140 eV for SDD)
Electronics Digital pulse processor Multi-channel pulse analyser Data processing Display	Pulse processor based on 80 MHz DSP Pile-up pulses rejection Selection by pulse shape Automatic adjustment to count rate 4096 channels Built-in computer, 1 GHz CPU 4-inch colour touch screen with high resolution
Software Operating system Algorithms for quantitative analysis	Windows CE for embedded computer WindowsXP/Vista/7/8 for PC The method of fundamental parameters and empirical calibration
Dimensions	390 mm (L) x 205 mm (H) x 275 mm (W)
Weight (maximum with all options)	No more than 9.7 kg
Battery operation time	No less than 6 hours

10. Standards Compliance

The spectrometer electrical safety complies with **IEC 61010-1**.

The spectrometer electromagnetic compatibility complies with **IEC 61326-1**.



DECLARATION OF CONFORMITY

This document is to confirm that the instruments manufactured by company Elvatech, Ltd listed below comply with the following directives:

The Electromagnetic Compatibility Directive (EMC): 2004/108/EC

The Low Voltage Directive (LV): 2006/95/EC

ElvaX series X-Ray Fluorescence Spectrometer SER-01

(Models: ElvaX, ElvaX Light, ElvaX Industrial, ElvaX Mini, ElvaX ProSpector, ElvaX Art, ElvaX Geo)

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11. Warranty Policy

Elvatech Ltd., the manufacturer, or its official representative (hereinafter – the Company) warrants compliance to the end user of the delivered device with main parameters and technical data specified in the operation manual of the device, provided that the user adheres to the rules and conditions of operation, transportation and storage.

Warranty period is **12 months** from the date of commissioning of the device by the user, but not more than 12.5 months from the date of device receipt by the consumer from the Company.

Warranty repairs are conducted by the manufacturer or its geographically closest official representative on the basis of an official complaint, which must specify symptoms of the problem and the conditions of their manifestation.

Repairs may include replacement of the failed unit (part) of the device or the entire device as a whole if the repair cannot be made by replacing the unit. Replacement of the device or unit is carried out for a new functionally intact or for the used device (unit) in a state no worse and with no more operating time than the device (unit) which failed. Following warranty repair, the warranty period is prolonged for the period from the date of dispatch of the appliance for repair to the consumer to the date of receipt of the repaired device from the Company by the customer. The dates enshrined in the motor waybills are applied. Replacement of the part, which does not affect the settings and/or performance of a device, is not a reason for the extension of the warranty period.

The company's warranty policy covers only the cost of the replaced parts, materials and labour to replace them. For improper performance of warranty obligations, the Company bears a financial liability in the amount that cannot be greater than the price of the failed device considering its wear.

The cost of sending the failed device, for warranty repairs and back to the consumer is to be paid by the consumer, as well as all taxes, duties, risks and related expenses associated with the shipment. When sent, the device must be packed in the original Company's packaging; otherwise the warranty repair is impossible.

Device replacement under warranty is only possible after receipt of a failed device.

The warranty does not cover instances where the device: was not operated properly; received external damage (for example, the destruction of the detector window); tampered without the Company's permit; serviced by unauthorized Service Centre; operated with the use of non-original components, parts, or Company's software; failed as a result of the force majeure.

The Company declares unconditional implementation of warranty obligations as soon as possible, except the cases determined as force majeure.

The Company assumes no liability for any financial or other losses incurred by the consumer due to the decisions taken on the basis of the readings of the Company's devices.

12. The Procedure for the Provision of Maintenance and Spare Parts

Please send orders for maintenance, repair, and spare parts delivery to the address of the manufacturer or its geographically closest official representative.

Address of the manufacturer:

📍 **50, Mashynobudivna Street, Kiev, Ukraine, 03680, Elvatech Limited Liability Company,**

☎ **+38-044-599-1143**

✉ **office@elvatech.com.**

Representatives of Elvatech are stated at  www.elvatech.com.

13. Disposal

After the completion of operation (decommissioning) period, the spectrometer is to be returned to the factory of the manufacturer for disposal of the x-ray radiating element.

Appendix 1. Recommendations for Sample Preparation and Analysis

Make sure that the protective film on the device measuring window is clean and not damaged. Any dust on the surface of the window can have a significant impact on the results of the analysis.

For protective film and measuring cuvettes, contact the supplier of the spectrometer.

Analysis of Metal Samples

Make sure that the sample is located in the centre of the window. If possible, close the entire window with the sample.

If you research samples of small size, set the measuring time more than usual.

Note plating on the sample. The possible depth of analysis of the metal sample is not more than 0.5 mm.

Rusty, polluted or painted surface can distort the results of the analysis. Clean the surface before the analysis with a clean file. Samples of small size can be stripped with a lathe or milling machine. After stripping, make sure to remove the sawdust and shavings from the sample surface. Use a clean cloth soaked in alcohol.

When measuring samples of light alloys, they must have a flat surface. For the measurement of light alloys, always place the protective film of Ultralene type.

Analysis of Bulky Samples

Chop bulk materials before measuring using mill to ensure the homogeneity of the sample. Put prepared material in clean special measuring cuvette in the amount of not less than $\frac{2}{3}$ of the cuvette volume. When assembling the cuvette, always use clean protective film.

Bulky materials containing light elements need to be pressed into a «pill» before the measurement, doing this you must use the protective film of Ultralene type.

Analysis of Liquid Samples

Pour prepared material in clean special measuring cuvette in the volume of not less than $\frac{2}{3}$ of the cuvette volume. When assembling the cuvette, always use clean protective film.

If the sample material is volatile, use open cuvette so that the change in volume would not result in the bending of the cuvette surface.

If there are light elements in the sample, you must use the protective film of Ultralene type.