CLOSED CORPORATION
SCIENTIFIC RESEARCH CENTRE "IKAR"

The product got prestigious awards at international events:

Gold medal
Geneva, Switzerland, 2004.
Silver medal
Brussels, Belgium, 2003.
Bronze medal
Geneva, Switzerland, 1994.

IZUMROUD-SI

CERTIFICATE AND MANUAL

Izhevsk

Attention! Read the manual carefully before switching on the installation.

1. Purpose

1.1. The installation "Izumrud - SI" (mod.04uni) is designed for contact and non-contact activation of liquids to obtain biologically, chemically and physically active aqueous solutions.

Activation of liquids converts them into non-equilibrium thermodynamic state with resonant microcluster structure.

Activated liquid possesses extra internal potential energy, which conditions its anomalous activity. The given property may be used to obtain new substances, to intensify various chemical, biochemical and physical processes, allowing for their express non-contact diagnostics. (http://www.ikar.udm.ru, http://www.ikar.udm.ru/pr.htm).

1.2. Functions, performed by the installation.

Basic:

- disinfection of drinking water with antioxidant properties (negative value of the oxidation-reduction potential (ORP));
- water activation for medicated baths;
- obtaining sodium or potassium hypochlorite;
- non-contact change of ORP of alcoholic and nonalcoholic beverages (juices, milk, tea, coffee, vodka, beer etc.), of medicinal herbs decoctions and infusions;
- non-contact change of ORP of infusion and dialytic solutions to negative values;
- obtaining anolytes and catholytes of low-salt water;

Service:

- manual, automatic, computer control; current, voltage, temperature protection;
- automatic current temperature and water level control, automatic preset control of degree of activation;
- optional link-up with complementary systems (pH-meter, analog inputs of other devices, 100-sensors multiplexer, remote control, display etc.)
- automatic tasks (up to 4 hours), time and date work schedule (start and stop), timer with up to 99 hours work assignment;
- determination of conductivity (general mineralization level), and temperature of water and aqueous solutions;
- determination of water activity (EMF is directly proportional to ORP);
- determination of current (consumed by the activator);
- determined data output on the master unit display and PC, their storage and mathematical treatment.

Before using activated water solutions look through the information on the attached CD or in the Internet (http://ikar.udm.ru/mis-rt.htm, http://ikar.udm.ru/stand.htm) carefully and consult the experts in the field. Do not experiment with yourself using disallowed and untested methods. Your comments and suggestions concerning the improvement of the installation will be very much appreciated (ikar@udm.ru).

2. Technical data

Standard container volume, l		15
Maximum activated liquid volume, l		200
Non-contact activated liquids volume, l • in infusion bags • in polystyrene or alimentary polypropylene cups		 2…4 0,70
Change of ORP from the initial value to the value, obtained after the activation process*, mV	• in active zone • in non-contact zone	+800…-1200 up to -400
Time of obtaining maximum change of degree of the activation*, h	• in active zone • in non-contact zone	0,5…1 1…2
Range of automatic temperature maintenance, °C		-30…+100
Range of conductivity determination, mcS		100…2000
Range of activation determination, mV		-1500…+1500
Supply voltage, V		220 ± 10%
Supply frequency, Hz		50
Rated electric parameters of the activator • "24 V" mode, Volt • "12 V" mode, Volt		 24 V (up to 3 A) 12 V (up to 6 A)
Power consumption, W • activator only • all devices (max)		 90 1850
Weight, kg		6
Dimensions, mm		450x320x180

* – depending on conditions of activation, composition and temperature of aqueous solution.

3. Package contents

3.1. Basic hardware:

			
№1 ☑	**№2** ☑	**№3** ☑	**№4** ☑
			
№5 ☑	**№6** ☑	**№7** ☑	**№8** ☑
			
№9 ☑	**№10** ☑	**№11** ☑	**№12** ☑

Fig. 1. Package contents

1. Master unit.
2. Pump as a unit.
3. Ready-fitted activator with a basic cathode and a supplementary cathode with a membrane (v. "3").
4. Plug activator (v. "2").
5. Standard container.
6. Normally closed water level sensor (red-coloured ring) and a heater* (500 W).
7. Process container and a funnel.
8. Syringe with a tube for sampling.
9. Rack with a bracket for sensors and a cup for samples.
10. Set of cables and sensors
    - temperature (all black)
    - basic for activation (with a blue ring)
    - supplementary for activation (with a green ring)**
    - conductivity (with a yellow ring)
    - PC-connecting cable (USB).
11. Process cups for non-contact activation.
12. Ready-fitted filter with a case for the activator.
13. Test tube with a 5% solution of HCl***
14. Certificate.

Notes:

* The heater is supplied with a cathodic protection cable; an answer cable is on the connector of the activator. Using the heater in aqueous solutions, it is necessary to connect both cables when the activator is on. At the end of the work, withdraw the heater and the activator from the solution.

** It is ordered separately (is out of the set).

*** The solution is used only to treat measuring electrodes. Working with the main activation sensor, take the silicone safety cap off its ending, and replace it at the end of the work.

The supplementary activation sensor and the cathode with a membrane should not be immersed into liquids with temperature higher than 40°C.

3.2. Extra packaging arrangement (at a special order).

1. Activator with two rod electrodes (Tesla plug):
    - v. "1" – Ti anode with ORTA coating* – Ti cathode (HPT1-0 alloy**) (electrolyte with NaCl aqueous solution);
    - v. "2" – Ti anode with Pt coating – Ti cathode (HPT1-0 alloy) (electrolyte with $NaHCO_3$ aqueous solution);
2. Activator with coaxial electrodes (Faraday cage):
    - v. "3" – ORTA anode – cathode (perforated stainless steel tube);
    - v. "4" – ORTA anode – cathode (perforated Ti tube, HPT1-0 alloy);

- v. "5" – Ti anode (HPT1-0 alloy) with Pt coating – cathode (perforated stainless steel tube);
- v. "6" – Ti anode (HPT1-0 alloy) with Pt coating – cathode (perforated Ti tube, HPT1-0 alloy);

3. Flow cooler (at the customer's request).
4. Solution topping electrovalve.
5. Electrodes for measuring ORP, pH of aqueous solutions, supplied with adapters to the master unit.
6. Switching multichannel device – multichannel multiplexer (number of channels at the customer's request) for sensors (activation, ORP, pH, ACC etc.).
7. Software (at the customer's request).
8. Supplementary equipment for double processing of catholyte (lowering salt concentration).
9. Compressor and extra equipment for: inhalations, spraying anolyte and catholyte, dental bleaching (to order).

Notes:
* ORTA – active ruthenium oxide coverage on the titanium basis
** HPT1-0 – high purity titanium

3. Application conditions

Ambient temperature +5…+30 ^{o}C, temperature of applied aqueous solutions +4…+80^{o}C, potable water according to sanitary code standard 2.1.4.1074.01, distilled water, dietary salt (NaCl), relative humidity up to 80% at +25 ^{o}C.

4. Device and principle of its operation

The device in its basic packaging arrangement includes a master unit; two activators with a pair of removable cathodes; a supplementary activator; a water pump with extra details; a filter with streamline body to place the activator, when it is needed to be put into a container with aqueous solution; a standard container; a rack; process container and details, which provide for the activation mode without immersion into aqueous solutions (Fig.1). Basic packaging arrangement provides for multifunctionality of the installation.

The master unit (Fig.5) is a microprocessor, connected with the activator power unit and peripherals, performing functions of manual and automatic control, electrochemical processes control and power supply.

"Faraday cage" activator is a coaxial electrode pair with a central anode, made of titanium alloy BT1-0 with OPTA coating, which provides for continuous duty of the anode in NaCl solutions environment. Two removable cathodes are perforated stainless steel tubes (or nets). One of the cathodes has an ion-

exchanging membrane inside, the other is without membrane. Additionally, the installation may be completed with "Tesla plug" activators (see p. 3.2).

One of the activator characteristics is water-tightness, which provides for carrying out aqueous solutions electrolysis while the activator is immersed into a solution.

Water pump performs aqueous solutions circulation through the activator, increasing the activation volume up to 200 l.

The rack, process container and other details provide for obtaining anolytes and catholytes out of low-mineralized NaCl solutions (concentration of not more than 1.2 g/l).

The installation provides for non-contact activation of liquids (NAL). To this effect, the activator processes an auxiliary electrolyte, in which a dielectric container with various liquids is immersed. NAL is executed in a standard container.

The installation permits changing the aqueous solutions activation conditions widely (division and blending of anode and cathode fractions; ion transfer from anode to cathode zone and v.v; change of water anodic and cathodic treatment time limits at the expense of changing the rate of their flow between the electrodes). It also provides for obtaining electrochemically activated aqueous solutions (in particular, water with mineralization from 30 mg/l) with various combinations of physicochemical properties (ORP, pH, chemically active ion-radicals, active oxygen forms), which retain for a long time.

The installation's principle of operation is based on the effect of non-contact activation of liquids at non-diaphragm electrolysis, which was experimentally (1999) discovered by the authors [1]. Theoretical works by the author [2], which proved the possibility of stable resonance microclusters (RM) origination from two or more dipoles and their super-coherent emission (1984), preceded these experiments. At electrolysis, non-contact activated liquid under the influence of emission from contact-activated liquid, as it is at any other activation methods (magnetic, ultrasonic, laser etc.), passes into thermodynamically nonequilibrium state with resonant microcluster structure (http://ikar.udm.ru/pdf/ikar.pdf, http://ikar.udm.ru/sb43-1.htm).

NAL effect at non-diaphragm electrolysis permits obtaining thermodynamically nonequilibrium liquids with microcluster structure and negative oxidation-reduction potential without change of their chemical composition. Contact and non-contact activated liquids also possess extra potential energy due to resonant microcluster structure formation from oscillating dipoles (of water, OH^- etc.) near electrodes. At the basis of resonant non-linear dynamic systems theory, it is possible to show, that the electromagnetic emission of two synchronously oscillating dipoles [2] is super-coherent, having narrow frequency spectrum (quadrupole resonant effect) and decreasing $\sim 1/r^4$. See more details on NAL http://www.ikar.udm.ru/pr-1.htm.

1. Shironosov V.G., Shironosov Ye.V. Experiments on non-contact activation of liquids. Coll. of reports and theses of the 2nd International Symposium. Electrochemical activation in medicine, agriculture and industry (Moscow, 1999) http://www.ikar.udm.ru/sb15-12.htm

2. Shironosov V.G., Resonance in physics, chemistry and biology. Izhevsk. “Udmurtskiy Universitet”, 2001. 92 p. http://www.ikar.udm.ru/sb22.htm

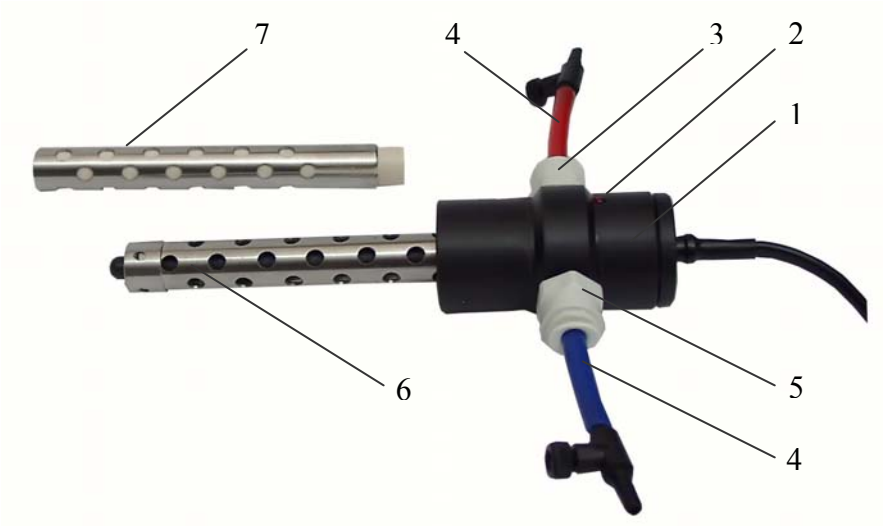

Fig. 2. Activator kit.

1. Activator body with the anode and the power cable.
2. Activator operation indicator.
3. Anolyte output fitting (red tube)*
4. Tube with a cock.
5. Catholyte output fitting (blue tube)*
6. Main perforated cathode (without a membrane) with a tip and a seal.
7. Supplementary perforated cathode with a membrane.

Notes:
* If the activator body is watched from the indicator side (red light-emitting diode), anolyte output fitting (red tube) will be on the right, and catholyte output fitting (blue tube) – on the left.

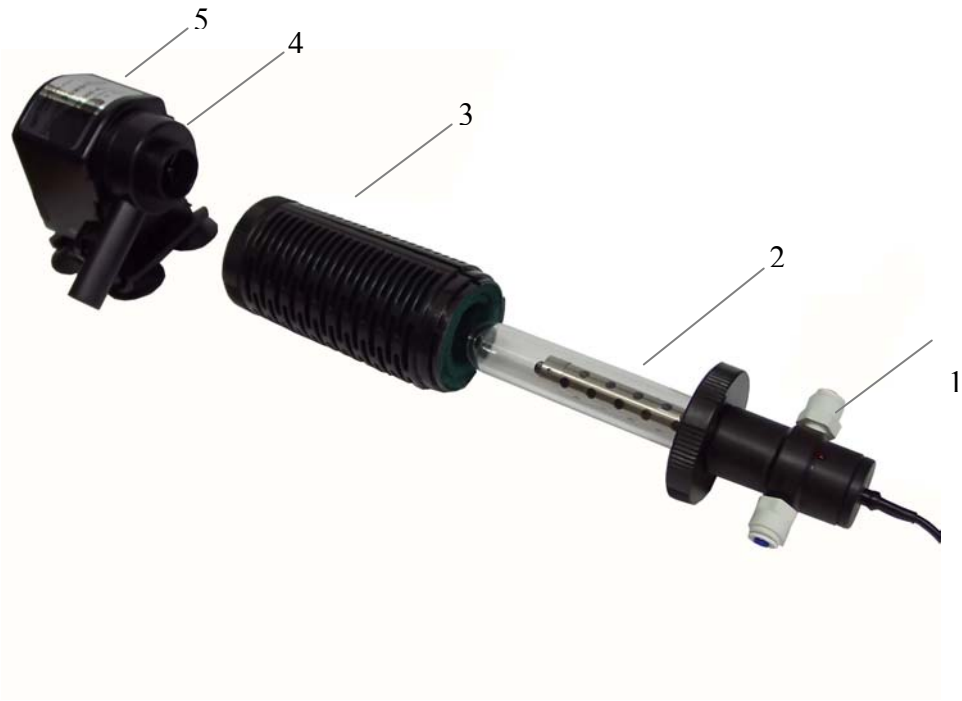

Fig. 3. Activator and water pump assembly.

1. Ready-fitted activator and a cathode without membrane.
2. Flanged streamline body filter.
3. Filter with a seal ring.
4. Receiving cover for the pump*.
5. Water pump.

* The standard installation set includes two versions of the receiving cover, two details to reverse water flow and a rubber plug.

Notes:

1) Put the cathode on the anode till it fits tightly into the slip-ring inside the activator.

2) Move the cathode without membrane (p. 6) carefully along the anode being sure not to damage the anode coating, the end of the cathode must go through the cathode end seal.

3) A cable with an extra socket for heater cathodic protection wire is brought out of the activator socket.

4) The cathode end may be made either of stainless steel or of fluoroplastic.

5) The cathode with membrane may be made of a stainless steel net.

6) Assemble the cathode with membrane in a way that the projecting membrane end could go inside the activator body.

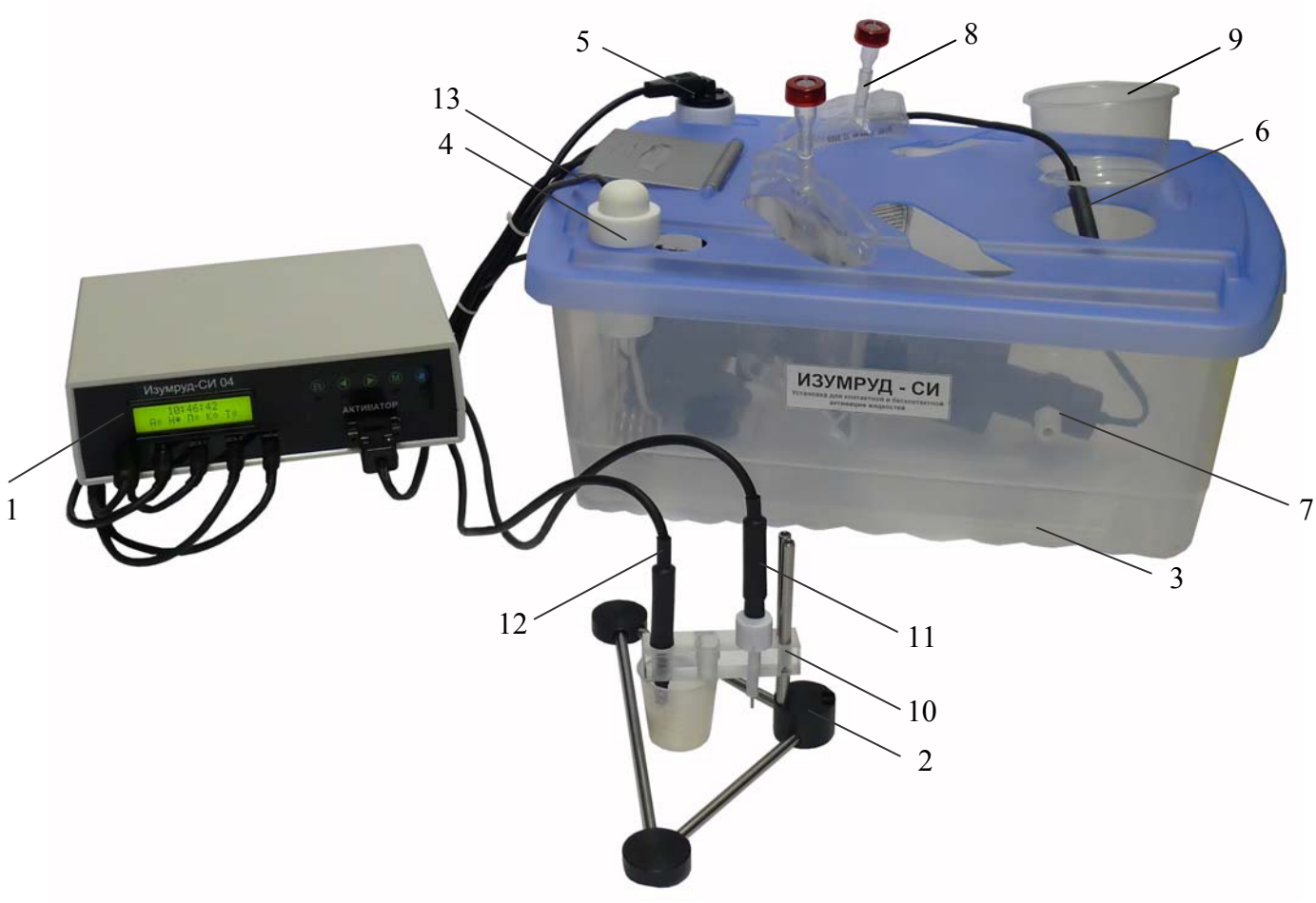

Fig. 4. Feasible assembly variant of the standard container for non-contact activation of aqueous solutions.

1. master unit
2. support (rack)
3. standard container
4. heater
5. level sensor
6. activation sensor
7. ready-fitted activator with pump and filter.
8. plastic bags with solutions
9. cups with solutions
10. bracket
11. mineralization sensor
12. activation sensor
13. temperature sensor (immersed into the solution inside the container).

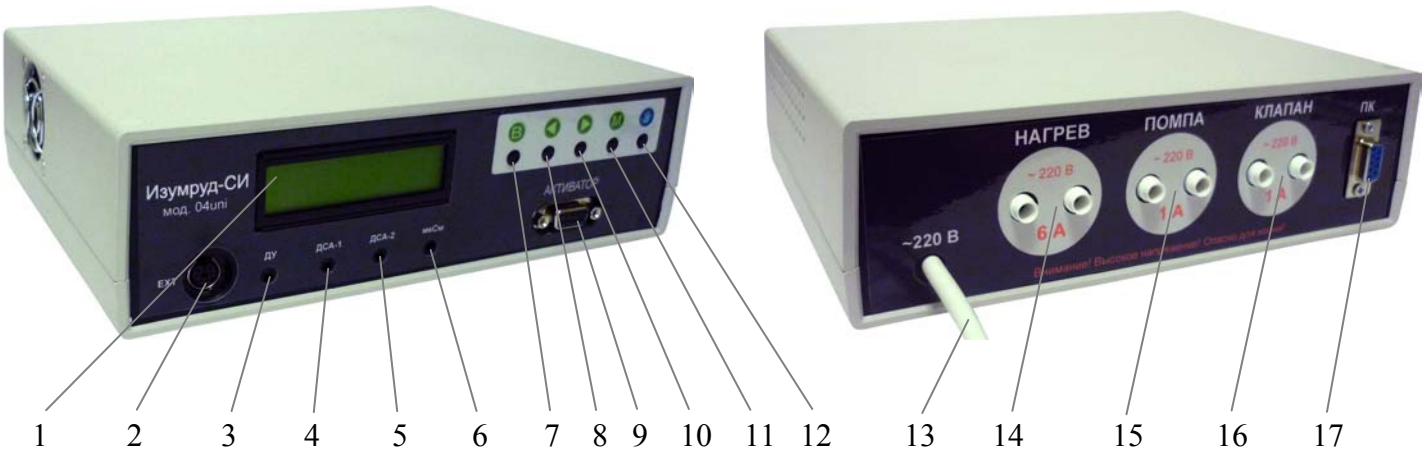

Fig. 5. Master unit.

1. Display.
2. Temperature sensor input (^{o}C).
3. Level sensor input (LS).
4. Main activation sensor input (AS-1).
5. Auxiliary activation sensor input (AS-2).
6. Electroconductivity senor input (mcS).
7. "Exit" button.
8. "Back" button.
9. Activator connection socket.
10. "Next" button.
11. "Menu" button.
12. "Hotkey" button.
13. Power cable.
14. Heater connecting socket.
15. Water pump connecting socket.
16. Water topping valve connecting socket.
17. PC-connecting socket.

The master unit is a microprocessor, which operates, controls and supplies the activator, the water pump, the heater (cooler) and water topping electrovalve. The unit has an output to the PC, 5 inputs for activation, electroconductivity, temperature and level of liquid sensors. There is also a socket for connecting optional devices (pH- and ORP-meters and up to 99 sensors, analog inputs of other devices and remote control). The master unit is fit out with current, temperature and voltage protection. Up to 4 independent programs can be set up according to time and date schedule.

The master unit allows of 3 types of the installation control:

- Manual.
- Automatic (up to 4 preset programs).
- PC-control with optional capabilities (real-time control of all the installation parameters, visual graphic or numeric display of current data, their record and keeping as files; view of the saved individual data ("blackbox"); renovation of firmware and of the program itself; automatic tasks and optional control via the Internet).

Master unit has 4 levels of protection:

- protection current of 6A and 3A for 12 V and 24 V respectively;
- adaptive current protection (auto switching over from 24 V to 12 V, adjusted through the menu);
- heating protection inside the master unit (optional);
- input voltage dump protection of the installation power supply (adjusted through the menu).

5.1. Master unit work description.

<u>Warning</u>. Connect sensors and peripherals to the master unit before plugging it in, do not immerse activation and conductivity sensors into solution with the activator inside.

Manual mode controlled functions:

- supply voltage switching over to 12 or 24 V ;
- "Heating" output on/off functioning;
- "Pump" output on/off functioning;
- "Valve" output on/off functioning;
- switching the activator on;

- view of parameters (voltage, current, activator power, temperature of aqueous solution, sensors data);
- automatic current temperature control;
- automatic aqueous solution level control;
- automatic preset activation level control.

Automatic mode controlled functions (for all kinds of tasks):

- all manual mode functions;
- assigned operation time, date and day of week (start and stop);
- sound signal (at the beginning/end of operation);
- task activation/deactivation.

Timer operation:

- assigned operation time from 1 min up to 99 h;
- display of remaining time;
- adjustable sound signal of the preset time end;
- device cutout on the timer response.

Master unit settings and capabilities:

- "Pump" output automatic control, linked up to the activator on/off functioning;
- automatic voltage changing from 24 V to 12 V in case of fault at 24 V;
- individual record of current data or tasks with duration of up to several days ("blackbox"), display of current memory fill, choice of interval between data record (from 5 sec to 255 sec, 5 sec interval), rapid "blackbox" erasure;
- "Pause" mode is turned off by pushing the "Exit" button and holding it down till the second sound signal (low-pitch tone), and it is turned on by pushing the "Exit" button and holding it down till the third sound signal (high-pitch tone);
- turning the "Heating" output off at the automatic temperature control mode in the absence of temperature sensor;
- overheat protection, when the temperature is 10 °C higher than the set value, "Heating" and "Activator" outputs turn off at that time;
- water lack protection turns "Heating" and "Activator" outputs off;
- display illumination and contrast range;
- ON/OFF positions of key and startup message volume;
- separate menu for current characteristics;
- adjusted duration of characteristics display in the main window.

Computer link:

- real time control of all the installation data;
- visual graphic or numeric display of current data, their record and keeping as files;
- view of saved individual data ("blackbox");
- renovation of firmware and the program itself;
- automatic tasks and optional control via Internet (at the customer's order).

5.1.1. Master unit setting-up procedures.

Being not quite sure what the settings at the previous session were (i.e. is the heater, pump, valve or the activator on and what the activation voltage is), disconnect all the sensors and peripherals. After that plug the master unit in and apply the following settings (see p. 5.2):

"**Mode**" menu

- "**Operation Type**" → "**Manual**"

"**Settings**" menu

- "**Power cutoff**" → "**Off**"
- "**Auto 24V -> 12V**" → "**Off**"
- "**Auto Pump control**" → "**Off**"
- "**Temp. protection**" → "**Off**"
- "**Water protection**" → "**Off**"

"**Manual**" menu

- "**Voltage**" → "**12 V**"
- "**Activation level sensors**" → "**(x)**"
- "**Activator**" → "**Off**"
- "**Pump**" → "**Off**"
- "**Temperature**" → "**(x)**"
- "**Heater**" → "**Off**"
- "**Water sensor**" → "**Off**"
- "**Valve**" → "**Off**"

Enter the "**Main Window**" from the menu and then cut off power from the master unit.

5.1.2. Switching the master unit on.

Connect the necessary sensors and peripherals to the master unit according to Fig.5. Plug the master unit in. Now the installation is ready to work.

5.1.3. "**Pause**" mode.

"Pause" mode is turned off by pushing the "Exit" button and holding it down till the second sound signal (low-pitch tone), and it is turned on by pushing the "Exit" button and holding it down till the third sound signal (high-pitch tone).

5.1.4. "**Auto 24V -> 12V**" function in the "**Settings**" menu.

When at the time of operation in "**24 V**" mode the operating current exceeds 3 A, "Auto 24V -> 12V" function may be activated (see p. 5.2.6), then the activator will switch over to "**12 V**" mode and continue working, otherwise current protection will operate and the activator will be switched off.

5.1.5. "**Auto Pump Control**" function in the "**Settings**" menu.

If the pump must be switched on while the activator is on, and switched off at the end of operation, the process may be simplified by activating "Auto Pump Control" function (see p. 5.2.6) to make the pump operate synchronously with the activator.

5.1.6. "**Temperature protection**" function in the "**Settings**" menu.

To prevent overheating of the solution while the activator is on, "Temperature protection" function may be activated (see p. 5.2.6) to turn the activator and the heater off when the temperature is 10 °C higher than the set value (see p. 5.2.2).

5.1.7. "**Timer**" mode.

"Timer" mode is used to set an interval, the end of which is marked with a sound signal and a minute blinking of the display (to stop it immediately push any button except the "Menu" one); the whole installation may be turned off ("Pause" mode will be activated). See the mode settings in p. 5.2.8.

5.2. Master unit menu.

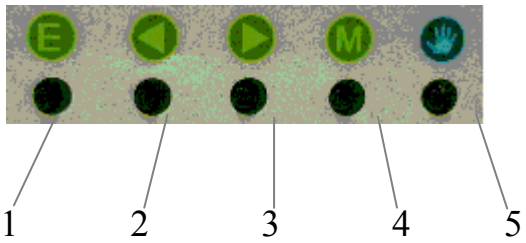

Fig.6. Menu buttons purpose.

1 – "**Exit**", 2 – "**Back**", 3 – "**Next**",
4 – "**Menu**", 5 – "**Hotkey**".

Push the "**Menu**" button once to get an access to the menu points and subpoints. Use "**Next**" and "**Back**" buttons to browse through the menu. To exit the menu the "**Exit**" button is used. To change the menu points push the "**Menu**" button, the first parameter will blink as a result, then change the parameter, pushing "**Next**" and "**Back**" buttons, after that push the "Menu" button once more; if there are parameters left, the next parameter will blink, if not, the procedure of changing the parameters will end. Exit the parameters changing mode by pushing the "**Exit**" button. "**Hotkey**" is used to quickly refer to some menu points (of the "**Main window**" only). If the "**Exit**" and the "**Hotkey**" buttons are pushed in turn, the display will show a current active device. To change it with a following device in a closed circular process, push the "**Hotkey**" button, 2 sec interval after each push. If only the "**Hotkey**" button is pushed, the display will show the current device status condition. To change the condition of the selected devices, push the "**Hotkey**" button, 2 sec interval after each push.

5.2.1. Main window

Upper line – timepiece.
Lower line – by-turn output of current operation parameters (adjustable).

Main line symbols "**A H P V T**" with small diamonds next to them mean: **A** – activator, **H** – heater, **P** – pump, **V** – water topping valve, **T** – timer. If a small diamond is filled, the device is on, if not, then it is off.

5.2.2. Menu – "Manual"

Manual mode settings (choice of the devices operation functions).

Voltage – Activator voltage mode option (12 V or 24 V).
Activator – Switching-on of the activator. Operates automatically at using "Activation level sensors" function.
Pump – Switching-on of the pump.
Temperature – Temperature control function. Device type option: heater (↑ symbol) or cooler (↓ symbol).
Heater – Switching-on of the heater. Operates automatically at using "Temperature" function.
Water sensor – Switching-on of the water sensor (option of normally closed or normally open sensor). Used for water topping valve control.
Valve – Switching-on of the water topping valve. Operates automatically when the water sensor is on.
Activation level sensors – Maintenance of the activated solution potential level by switching on/off the activator. Choice between two sensors – AS-1, AS-2.

5.2.3. Menu – "Automatic"

Automatic mode settings. Time and date work schedule.

Task – X (1…4) – Choice of task. 4 tasks are provided for in the installation.
Condition – Task activation.
Period – Choice of task operation period according to scheduled date or day of week.
Days of week – Scheduled **s**witching-on of the installation (days of week).
Date – Start – Date of task operation start.
Date – Stop – Date of task operation end.
Time – Start – Time of task operation start.
Time – Stop – Time of task operation end.
Sound – Start – Accompanying sound of task operation start.
Sound – Stop – Accompanying sound of task operation end.
Parameters – Choice of device operation functions (see manual mode).

5.2.4. Menu – "Mode"

Choice of the device operation mode.

Type of Control – Choice of operation mode – Manual or Automatic.
Individual record – Turning on the individual record ("blackbox") of the devices operation parameters. Choice of parameters record periodicity. Display of free space for record in percent.

5.2.5. Menu – "Parameters"

Current readings of the installation work parameters.

AS-1, AS-2 – Effective value of activation sensors.
Current Voltage – Effective value of activator current and voltage.
Power – electric power, consumed by the activator.
Temperature – readings of the temperature sensor in degree centigrade (°C). Output of value ”**xxxx**” while the temperature sensor is disconnected.
Mineralization – readings of the electroconductivity sensor.

5.2.6. Menu – "Settings"

Current operation settings of the installation.

Power failure – Turning the installation into the "Pause" mode after system power cutoff.
Parameters – Choice of parameters and time of their display in the main line.
Display contrast range – Display contrast range settings.
Display illumin. – Turning-on of the display illumination.
Key sound – Turning-on of the keystroke accompanying sound.
Auto 24V -> 12V – Automatic change to the "12V" mode with a short-time sound signal in case of fault at "24V" mode. To reset this change push the "**Exit**" button and hold it down till the second low-pitch tone or change the current voltage (through the "**Manual**" menu or via "Hotkey" see p.5.2).

Auto Pump Contr. – Simultaneous switching on/off of the pump with switching on/off of the activator.
Temperature protection – Turning-on of the temperature protection. Suppresses operation of the heater (cooler) and the activator in case the temperature sensor readings are 10 degrees higher than the values, set in the manual or automatic mode in the proper menu.
Water protection – Turning-on of the water protection. Suppresses operation of the heater (cooler) and of the activator in the absence or water or when the water is filled into the container. "Water sensor" should be set up correctly, i.e. sensor type N.C. (normally closed in the absence of water) and N.O. (normally open in the absence of water).

5.2.7. Menu – "Clock"

Setting the clock and date.

5.2.8. Menu – "Timer"

Timer setting and launching.

Time – Time setting.
Condition – Timer operation condition.
Sound – Accompanying sound of the set time end.
Timer off – At the end of the set time all the devices will be off except the sound indication. The installation will turn into the "Pause" mode.

5.2.9. Menu – "Info"

Installation info: purpose, software version.

6. Security measures

6.1. Unpack the installation after 24 hours keeping at room temperature.
6.2. Retrieve all the parts from the transport container; check the package contents (see p.5).
6.3. Installation assembly, use and maintenance are to be executed strictly in compliance with the requirements, stated in the present registration certificate. The manufacturer is not responsible for any incidents, connected with incorrect assembly, use or maintenance, executed in defiance of operating instructions.
6.4. **Closing the activator electrodes with metal objects is strictly forbidden.**
6.5. Keep dry electric power supply sockets of the extension cord, power supply unit and the pump.
6.6. Connect the activator and the pump to the master unit only when they are immersed in water. Do not switch the pump on in the absence of water, as it may damage the device. Do not use the pump with the damaged body or power cord.
6.7. Exceeding power supply unit operation mode, stated in the certificate, is forbidden.
6.8. Do not touch walls of metal containers and water with the activator in it, while the device is on. If there is a necessity, switch the installation off.
6.9. Keeping or transporting the installation at the ambient temperature of less than 0° C with water inside is forbidden.
6.10. Do not expose parts of the installation to mechanical actions, particularly the electrodes.
6.11. Leaving the activator and the heater in aqueous solutions when the power supply unit is switched off at the end of the device operation (see p.7) or using aqueous solutions, not specified by the certificate, is forbidden.

7. Order of operation

This section specifies main (basic) types of operation, which may be executed in the "**manual**" mode.

The manufacturer recommends to start operation with the "**manual**" mode. Getting more familiar with the installation, pass on to the automatic mode (task operation, see p.5.2) and the PC-connected operation mode.

The manufacturer is not responsible for other kinds of work (not specified in p. 7), performed on the installation.

7.1. Determination of aqueous solutions characteristics (pH, ORP, T, °C)

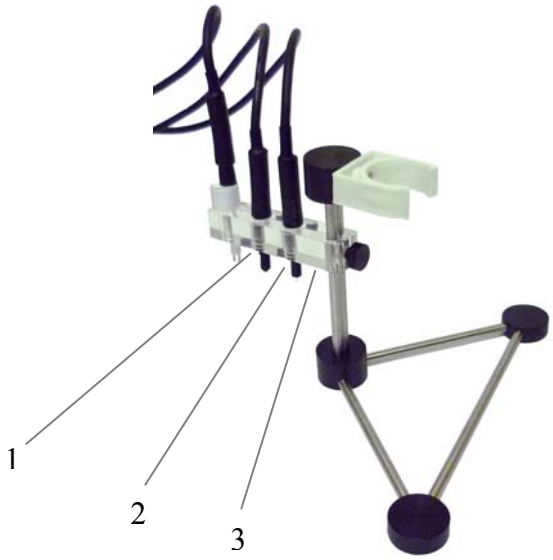

Fig.7. Rack with sensors in assembly

Sensors: 1 – electroconductivity, 2 – temperature, 3 – activation.

7.1.1. Take a rack with a bracket out of set, settle the sensors in the bracket, connect sockets of the sensors with the proper sockets of the master unit. Switch on the master unit.

7.1.2. Take a cup and a syringe for samples out of the set, fill the cup with 35 ml of aqueous solution. Bring the cup with a sample close to the sensors and immerse them 10…15 mm deep.

7.1.3. Enter the "Parameters" menu, select the proper point with readings of the sensors, pushing "**Back**" and "**Next**" buttons.

*** Electroconductivity and activation sensors must not be used simultaneously, the temperature of the solution for conductivity measurements should be 24°C.**

7.2. Activation and disinfection of water (with volume of 10…200 l)

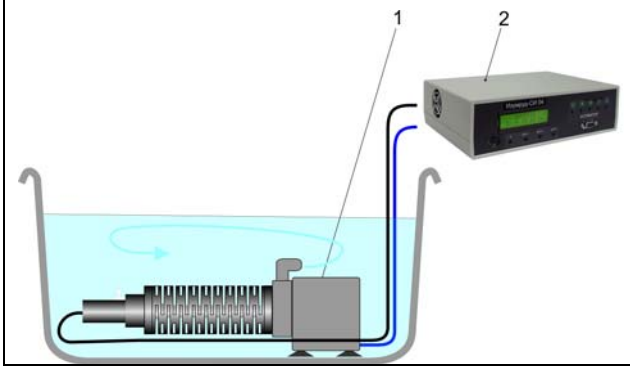

Fig. 8. Installation assembly for containers of 10…200 l capacity:

1 – activator, assembled with the filter and the pump;
2 – master unit.

7.2.1. Assemble the activator with the basic cathode (see Fig.2) and the pump according to Fig.3.

7.2.2. Immerse the activator assembled with the pump in the container filled with water of not more than 2 g/l mineralization (Fig.8). Set the heater, temperature sensor, water level sensor and water topping valve (which is out of basic set), the supplementary activation sensor if necessary (Fig.1).

7.2.3. Implement the order of master unit operation procedures (see p.5.1.1 and p.5.1.2), set up "24 V" mode, set up the timer (see p.5.1.7) at sufficient time for obtaining negative ORP of water: 5 min for volume of 10 l, 40 min for volume of 200 l. Switch on the activator (p.5.2.2) and the pump (or the "**Auto pump control**" function, see p.5.1.5).

7.2.4. The following parameters can be controlled in the process of the device operation: current, voltage, temperature (continuously), electroconductivity, degree of activation (ORP), hydrogen ions concentration (pH) (by sampling, see p.7.1., p.3.2).

7.2.5. At the end of timer operation "**Pause**" mode will be turned on. Switch off the activator (see p.5.2.2) and the master unit. Withdraw the activator and the pump from the container, rinse them with clean water and dry them up.

7.2.6. Attainable ΔORP values will make -300…-400 mV. Special conditions are required for continuous keeping of negative ORP values of water (http://www.ikar.udm.ru).

7.3. **Disinfection and activation of bottled potable water**

Fig.9. Activator in assembly with a bottle of potable water.

7.3.1. Assemble the activator with a basic cathode (see Fig.2) with tubes and cocks and without the pump, while the cocks must be shut off. Connect the activator to the bottle and settle them in the rack. (see Fig.9).

7.3.2. Implement the order of master unit operation procedures (see p. 5.1.1 and p.5.1.2), set up "24V" mode, set up the timer (p.5.1.7): from 1 to 3 min (potable water bottle capacity of 0.5…1.5 l). Switch on the activator (see p.5.2.2).

7.3.3. Activate bottled non-carbonated water with mineralization of less than 0.3 g/l or 600 mS (see p.7.1); note that activation of carbonated water leads to formation of oxidants, water will be disinfected, but its taste will be unpleasant.

7.3.4. At the end of timer operation "Pause mode" will be turned on. Switch off the activator (see p.5.2.2) and the master unit. Pour the water out through the cock, pressing the bottle periodically. Withdraw the activator, rinse it with clean water and dry up.

7.3.5. Attained degree of activation can be checked (see p.7.1).

7.4. Water activation for medicated baths

Hydrotherapy is based on the temperature, mechanical and chemical factors of water influence upon the human organism. Hydrotherapy influences cardiovascular and central nervous systems, trains organism adaptive mechanisms, provides for restoration of homeostasis (physiological equilibrium) and recovery.

Electroactivated water (EAW), obtained on the "Izumrud-SI" installation (mod.04uni) possesses reducing properties, its oxidative-reductive potential value is negative. Water of this kind influences the biological potential of body cells and the processes, which take place in them.

Skin of an adult has large area, so influence of EAW at hydrotherapeutic procedures on the body, as compared with tap water, is considerably more intensive. Skin is a receptor organ, which effects contact with the environment. On application of hydrotherapeutic procedures, originating receptor activation transfers to CNS and invokes body complex responses. It is known, that biologically active points (BAPs), which have a certain electric potential of 40…60 mV, are found on the surface of human skin. BAPs are connected with all the internals, including endocrine glands, and integrate into a special system, consisting of meridians. Change of the internals functional activity results in the change of BAPs electric potential and vice versa, change in BAPs electric potential changes the internals functional activity. EAW with negative electric potential normalizes BAPs bioelectric potential.

BATHS – saline-free, mineralized, with aromatic and medicinal substances, cool, warm and hot, are an available physiotherapeutic agent of medical and preventive exposure.

SHOWER – hydrotherapy procedure with a significant mechanical (massage) factor.

Bath and shower with EAW are more effective medical and preventive agents, than bath and shower with tap water.

Set up the installation for bath ionization according to Fig. 8.

7.4.1. Fill the bath with potable water of +(38…42) ^{o}C.

7.4.2. Assemble the activator with the basic cathode (Fig.2) without tubes and cocks; connect the pump to it (Fig.3), immerse both in the middle of the bath (Fig.8).

7.4.3. Implement the order of master unit operation procedures (see p. 5.1.1 and p.5.1.2) and set up the timer (see p.5.1.7) at the time of 60 min. Switch on the activator (see p.5.2.2) and the pump (or the "**Auto pump control**" function, see p.5.1.5).

7.4.4. At the end of timer operation "**Pause mode**" will be turned on. Switch off the activator (see p.5.2.2) and the master unit. Withdraw the activator and the pump. Bath with activated water is ready. Rinse the activator and the pump with clean water and dry them up. Do not use the pump after the activation process, to mix additives, introduced into bath while it is ready, like mineral salts, medicinal herbs infusions or decoctions, and abstergents.

7.4.5. The following parameters can be controlled in the process of the device operation: current, voltage, temperature (continuously), electroconductivity, degree of activation (see p.7.1).

Take out the installation before having a bath.

7.5. Obtaining sodium hypochlorite*

7.5.1. Prepare a non-metallic container with capacity of not less than 10 l, not less than 320 mm wide (length of the activator and the pump in assembly) for obtaining hypochlorite. Standard container may suit as well.

7.5.2. Pour potable water into the container and add sodium chloride on the basis of 1.2 g/l.

7.5.3. Assemble the activator with the basic cathode (Fig.2) without tubes and cocks; connect the pump to it (Fig.3), settle both on the bottom of the container, assemble the installation according to Fig.8

7.5.4. Implement the order of master unit operation procedures (see p. 5.1.1 and p. 5.1.2), set up the timer (see p. 5.1.7) at the time of 80 min. Switch on the activator (p. 5.2.2) and the pump (or the "**Auto pump control**" function, see p. 5.1.5).

7.5.5. The following parameters can be controlled in the process of the device operation: current, voltage, temperature (continuously), electroconductivity, degree of activation. At a special order of an active chlorine sensor active chlorine content (ACC) may be controlled as well.

7.5.6. At the end of timer operation "**Pause mode**" will be turned on. Switch off the activator (see p.5.2.2) and the master unit. Withdraw the activator and the pump from the container, rinse them with clean water and dry them up.

Example of obtaining sodium hypochlorite*

Table 2.

Activator operation time for the capacity of 10 l, min.	80
ACC, mg/l	200

* Note: high-purity hypochlorite may be obtained out of pharmaceutical isotonic solution of sodium chloride for infusions (0.9 %), diluting it with distilled water eightfold. See to the cleanliness of the container, the pump and the activator at that.

7.6. Non-contact activation of liquids

7.6.1. Assemble the activator with the basic cathode (Fig.2), without tubes and cocks, connect the pump (Fig.3).

7.6.2. Place the activator and the pump into the standard container (Fig.4) in the middle of its bottom, pour sodium chloride solution (1.2 g/l) into it, carry the activator and the pump power cords through a lidded hole in the container's cover.

7.6.3. Lay down the container's cover, settle the containers with liquids for non-contact activation: infusion bags, polypropylene cup (0.5 l and 0.2 l) with potable water, beverages, medicinal herbs infusions or decoctions.

7.6.4. Take the necessary sensors (temperature, electroconductivity, activation, water level sensors) out of the set, connect them with the master unit. Place the temperature and water level sensors into the container together with the heater, connect the cathodic protection cable, place the supplementary activation sensor into the test container for non-contact activation, settle the electroconductivity sensor and the main activation sensor into the rack from the set.

7.6.5. Implement the master unit operation procedures (see p.5.1.1 and p. 5.1.2.), Take samples of aqueous solutions for contact and non-contact activation, determine their parameters (p.7.1).

7.6.6. Set up the "12 V" mode, "Temperature" of 30 ^{o}C and "x" regulation type, switch on the pump (or "**Auto Pump Control**" function, see p. 5.1.5), "Temp. protection" function (see p. 5.1.6), switch on the "Activator" (see p. 5.2.2). Control the following parameters in the process of the device operation: current, voltage, temperature (continuously), electroconductivity, degree of activation (ORP), hydrogen ions concentration (pH) (by sampling, see p.7.1).

7.5.7. When the required degree of activation is reached, switch off the "Activator" (see p. 5.2.2). Switch off the master unit. Withdraw the activator and the pump from the container, rinse them with clean water and dry them up.

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* Do not place activation and electroconductivity sensors in the solution at a time (which may lead to incorrect readings), the temperature sensor may be placed in the solution with either of the sensors.

The solution with the activator may contain only the temperature sensor, placing mineralization and activation sensors in it is forbidden.

7.7. Obtaining anolytes and catholytes of aqueous solutions

7.7.1. Dilute the pharmaceutical isotonic solution of sodium chloride (0.9 %) with 10 parts of distilled water, preparing 0.5 l of 0,09 % aqueous solution of sodium chloride. Prepare two containers 0.25 l each.

7.7.2. Assemble the activator with a supplementary cathode and an ion-exchange membrane, tubes with cocks (Fig.2) without water pump.

7.7.3. Assemble the installation according to Fig.10. Pour the prepared solution into the process container and keep it there for 5 min (to saturate the membrane).

7.7.4. Settle the temperature sensor into a hole in the bottom of the process container.

7.7.5. Install the main activation sensor and the electroconductivity sensor into the bracket of the rack.

7.7.6. Implement the order of master unit operation procedures (see p. 5.1.1 and p.5.1.2). Set up "12 V" mode, "Temperature" of 30 ^{o}C and "x" regulation type, "Temp. protection function" (see p.5.1.6), switch on the "Activator" (see p.5.2.2).

7.7.7. 5 min after the activation process has begun open the cock and direct the solution flow out of the anolyte outlet cock (see Fig.2) into the prepared container with an expenditure of 1.8 l/h (swift flow of drops, not forming a stream). Next, open the catholyte inlet cock and regulate its flow with the same expenditure, as for the anolyte.

7.7.8. Control the following parameters in the process of the device operation: current, voltage, temperature (continuously), electroconductivity, degree of activation (ORP), hydrogen ions concentration (pH) (by sampling, see p.7.1). Immerse activation sensor and electroconductivity sensor into the sample in turn. At a special order of an active chlorine sensor active chlorine content (ACC) of the anolyte may be controlled as well.

7.7.9. Keep the process in progress until the level of the liquid will fall down to the upper part of the activator.

7.7.10. At the end of the process the results will be the following: 0.2 l of catholyte with pH = 11…12 and ORP = -150…-300 mV and 0.22 l of anolyte with pH = 3.3…4.5 and ORP = +1000…+1200 mV with active chlorine content of 250…350 mg/l.

7.7.11. At the end of operation switch off the activator (see p. 5.2.2) and the master unit. Pour out the remaining solution, disconnect the activator, take the cathode out of the activator body and place the cathode into a case for cleansing. Pour distilled water into the case, put a cover on and keep for an hour. Then pour the water out and keep

the cathode in the case under cover till the next time its operation is required.

7.7.12. When extra volumes of anolyte and catholyte are needed, the process may be repeated after 2 hours, starting with p.7.7.1.

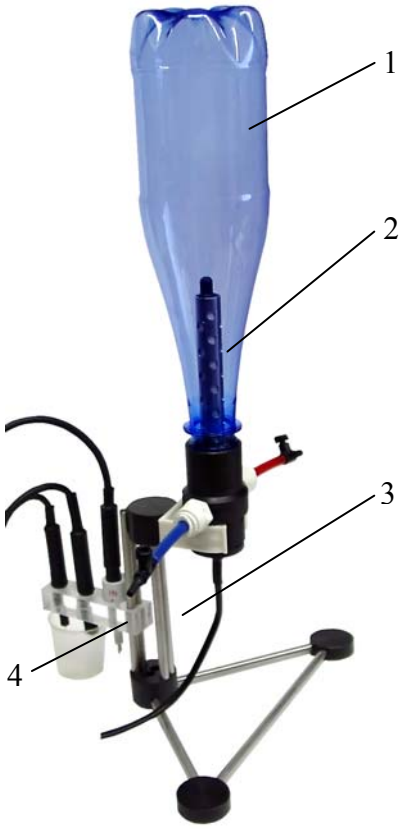

Fig. 10. Installation assembly for obtaining anolytes and catholytes of aqueous solutions

1. Process container.
2. Activator.
3. Rack.
4. Bracket with sensors.

Attempts to obtain larger volumes of anolyte and catholyte by adding sodium chloride solution into the process container are forbidden as they may cause ion-exchange membrane overheating and damage. Temperature of the solution during the operation time should not exceed 40 °C.

8. Maintenance

8.1. At the time of activator operation thick white scurf forms on the cathode (scurf of alkali elements hydroxides). To remove it, cathode regeneration procedure is needed.

8.2. Cathode regeneration is carried out by putting the cathode into 5% solution of hydrochloric acid (or 9% solution of acetic acid or even 20% solution of citric acid) for 1…2 min and further rinsing with clean water. Cathode regeneration is carried out in the case, included in the set.

8.3. All plastic details of the activator are to be washed with warm water (T = 40 °C) and detergents, not containing abrasives. After washing dry them up with soft cloth.

9. Malfunctions and methods of their elimination

Malfunction	Possible reason	Elimination method
No display illumination while the master unit is switched on.	No/insufficient supply voltage.	Check and recover supply voltage.
Only the upper line is displayed or the master unit is in deadlock, not responding to keystrokes.	High supply voltage interruption.	Install a proper surge filter or unplug and plug again the master unit.
The activator is out of order.	No contact on the cathode.	Enlarge the cathode contact part diameter by bending the cathode in a little.
The pump is out of order.	The pump is broken.	Change the pump.
The heater is out of order.	The heater is broken. No temperature sensor signal.	Change the heater. Connect the temperature sensor to the master unit.
"Pump" and "Valve" outputs are out of order, while "Heater" is OK	Fault at these outputs, protective jumper burned.	Repair at the service centre.

10. Manufacturer's warranties

10.1. Manufacturer guarantees normal installation work provided that all the said exploitation conditions, security and maintenance measures will be observed.

10.2. Guarantee period – 1 year.

10.3. If installation failures arise during the guarantee period through the manufacturer's fault, the installation with the certificate in the factory package should be returned either to the manufacturer or to the maintenance centre http://www.ikar.udm.ru/dil.htm for guarantee repair or change.

Opening the master unit and the activator during the guarantee period is forbidden; otherwise repair will be carried out at the customer's expense.

Note: The manufacturer reserves the right of introducing changes into the product design and configuration, unconditioned by the present certificate.

11. Acceptance certificate

The installation "Izumrud-SI" (mod.04uni), factory №_____ corresponds to a standard 5156-034-00206807-04 and recognized as ready for exploitation.

Release date_____

QCD representative_____ L.S.

Date of sale_____

Special features of measuring ORP in the negative range of values. Method of experiment.

(Piskaryov I.M., Aristova N.A., Tugoloukov S.N.)

Lack of reliable and recognized electro-chemistry standards presents a problem at measuring ORP in the negative range of values. Any solution, prepared in air, rapidly absorbs atmospheric oxygen. The absorption of oxygen leads to the rapid and uncontrollable increase of ORP to positive values. Standards exist for positive ORP values if only the uptake of oxygen from the air does not play a significant role.

Easy-to-use portable off-the-shelf devices (pencils) are made on the basis of electrodes, manufacturing secrets of which are not revealed. Calibration of such devices on standard solutions of potassium ferricyanide and ferrocyanide in positive ORP range does not guarantee their accuracy with negative ORP values. Usage of platinum electrodes and standard reference electrodes (for example, chlorine-silver) may at first sight guarantee the correct result.

However, it is essential that the platinum electrode is pure. The measurand is the potential difference between the two electrodes. Input resistance of a metering circuit is large but not infinite, it is usually 10^{10} - 10^{12} ohms. When EMF = 0.1 V, the current of the metering circuit will be $\sim 10^{-13}$ A or 10^{-13} coulomb per second. It will be recalled that the electron charge is $1.6 \cdot 10^{-19}$ coulomb. I.e. in the chain with R = 10^{12} ohms $\sim 10^{6}$ electrons flow per second. Let our "battery", which is one of the electrodes, consisting of impurities settled on platinum, deliver a current for approximately 1 hour. During this time about 10^{10} electrons will pass through the circuit. Hence, the amount of impurities is less than $10^{10} / 6.03 \cdot 10^{23} \approx 10^{-13}$ mole. I.e. a small impurity for a long time can influence the readings of the device, which measures potential. Moreover, the more perfect the device is, the larger its input resistance is, so the smaller number of impurities can influence the measurement results. Therefore, if we are to measure the negative ORP values, the calibration of the device on a standard solution of potassium ferricyanide and ferrocyanide does not characterize the state of the electrodes and the accuracy of measurements.

During the experiments, measures were taken to maintain the purity of the platinum electrode. At the end of each working day the platinum electrode was immersed in a solution of high purity hydrochloric acid HCl (1:5) diluted with double-distilled water. In the morning before measurements, the electrode was washed twice with distilled water. Nevertheless, no one can prove that such a procedure guarantees the purity of the electrode, because there is no reference mark adopted for negative ORP values. For example, the standard solution for a positive ORP gave the same result even if the measured potential was around +100 mV instead of -200 mV, obtained after washing the electrode with hydrochloric acid and water.

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Closed corporation scientific research centre "IKAR"
Ecological safety installations and systems for home, office and clinical use
http://www.ikar.udm.ru/avk_com.htm


(мод. 01)


(мод. 02)


(мод. 03)


(мод.01– 03)


(мод.01d)


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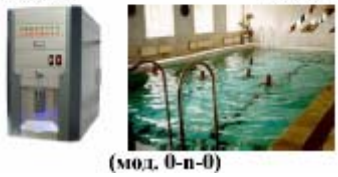
(мод.04) "Влада"


(мод. 0-п-0)

Aeroionizer "LCh-1" (compact household plasma jet - Chizhevsky's lamp) human health-related device, increasing quantity of light negative ions in the room air and compensating for the ion deficiency at workplaces of PC users, suitable for aeroionotherapy and indoor air ionization and protection against the so-called "display disease".

Device modifications: mod. 01 – portable multi-purpose device,
mod. 02 – built-in wall and ceiling panels devicев,
mode. 03 – built-in the 5" module of the computer central processing unit.

"Izumroud-SI" – multi-purpose installation for making potable water with a set mineral composition and antioxidant properties, obtaining detergent, disinfecting and sterilizing solutions on its basis.

Device modifications: mod. 01 – obtaining potable ionized water with negative ORP value and a set mineral composition**;**
mod. 02 – mod. 01 functions + pH and ORP values control;
mod. 03 – mod. 02 functions + obtaining
detergent, disinfecting and sterilizing solutions;
mod. 01d – installation of shared usage on the dispenser basis;
mod. 01os – for obtaining high-quality activated water with the set mineral composition and antioxidant properties; the installation is fit with a built-in controller and three flow sensors with a two-level indication system to monitor operation of the following systems: the osmosis (water purification), activation (water ionization) and mineralization (mineral composition);
mod. 01 railway – autonomous variant for railway and water transport;
mod. 04 – multi-purpose system for obtaining activated liquids with negative ORP value (potable water, beverages, medicine, blood) by methods of contact and non-contact activation for the household use and use in other branches of economy (medicine, agriculture, industry, petroleum production);

"Vlada" – electric thermos for obtaining activated water at home (contact and non-contact activation of aqueous solutions).

mod. 0-n-0 – installation for obtaining detergent, disinfecting and sterilizing solutions, also for water sterilization in the swimming-pools.