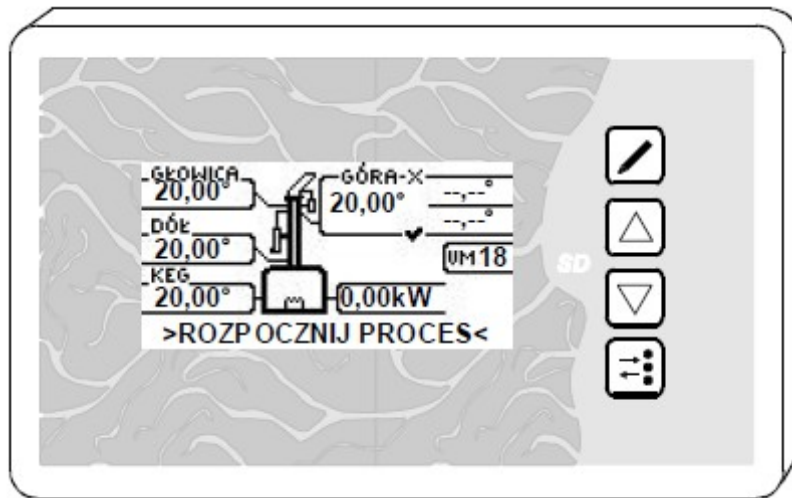


User's manual for distillation column controller
"SKN" from version 2.07

Please read this manual carefully before first operation of the controller.



INFORMATION FOR THE CONSUMER

The symbol presented on products or in documentation enclosed with them informs the non-operational electrical or electronic appliances shall not be disposed together with municipal wastes. When disposal, recycling or recovery of subassemblies is necessary, the right proceeding is to give over the appliance to a specialized collection point, where it will be taken over free of charge.



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The SKN controller is designed to control the process in LM/VM distillation columns. Functions of the controller make the column operation much easier. Main features of the controller:

- Two independent outputs 16A 230/400V.
- Cooling water electrovalve (NO relay output)
- LM electrovalve (max 12V 1,5A NO/NC)
- VM motorized valve (max 12V 40mA)
- Four thermometers with resolution of 0.01°C, including one of two sensors, which could control the VM valve
- Graphic display with high contrast

1. INSTALLATION RECOMENDATIONS

It is recommended to install the actuator in the area of heaters, in an enclosure protecting it against accidental flooding (having in mind such cases like leaking water connections, etc.). At the same time, the enclosure must provide free air flow that is necessary for cooling the SSR relay controlling the heaters. The plate should be fixed to the enclosure with plastic spacers provided in the kit. Using metal spacers may lead to a short-circuit, damage of the appliance or even electric shock of the user.

The control panel should be installed in a convenient place, having in mind there is a slot for memory card at the top of the panel – flooding the appliance from this side for sure would cause the electronic to be flooded. The panel is provided with its dedicated bracket. Put the panel on the bracket and then pull it down.

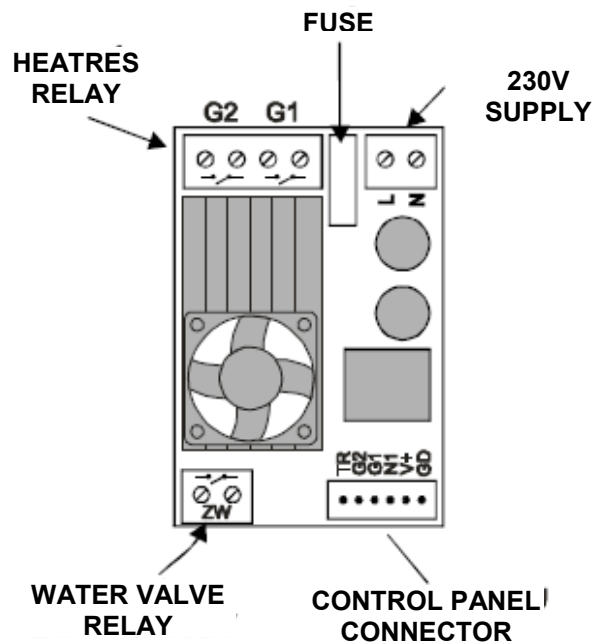
- Remember, the appliance is supplied with a dangerous voltage. Its electrical connection should be entrusted to a person with suitable knowledge and authorization. It is forbidden to use the appliance when its enclosure or wiring is damaged, also if there is only suspicion of malfunction of the system.
- The appliance may activate its output at any time without signaling this event, even if does not result from its operation cycle. It is forbidden to make any manipulation on the electrical part of the system when it is connected to the mains. It applies also to the low-voltage elements.
- Do not turn the appliance ON when the heaters are not covered with liquid – in case of unexpected turning ON they could be damaged. It should be considered to install additional (mechanical) heaters switch.
- The SKN controller has incorporated electronic relay (SSR) controlling the heaters, however it does not ensure reliable, mechanical heaters disconnection. Moreover, in case of its failure (overloading, short-circuit, etc.), most likely it will supply the heaters with full voltage.
- The supply connection should be easily accessible. It must ensure quick and trouble-free disconnection of the system from the mains at any time.
- The wires and connectors used should be suitable for the appliance power. It is recommended to install appropriate terminal box with appropriate breakers and differential protection.

- Perform periodical maintenance of the appliance. After first few cycles of operation, check especially the connections operating under significant load, retightening might be necessary.
- It is forbidden to use the system in places that can catch fire from the wires used, it is forbidden to store flammable materials in the neighborhood of the system operation.
-
- Metal elements of the appliance must be grounded. Please keep in mind the fluids are perfect conductors, therefore each element must be grounded even though apparently it is isolated (e.g. with hose) from the other elements.
- It is forbidden to leave the system connected to the mains without supervision of a person with suitable knowledge and skills.

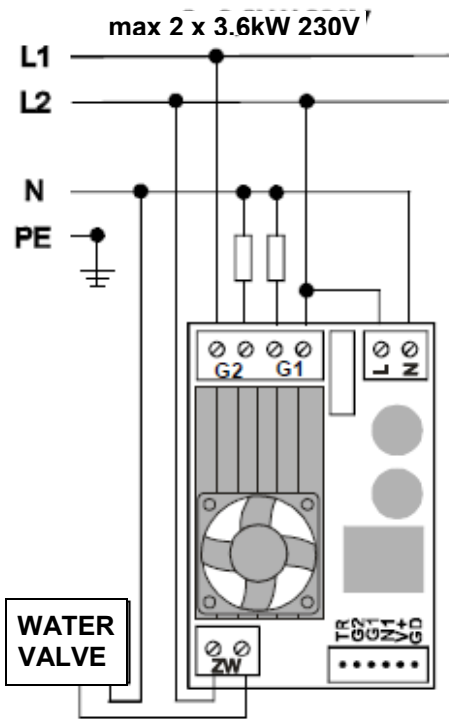
| | |
|------------------------------|--------------------------|
| Electronic supply voltage | 230V AC +/-30% |
| Electronic power consumption | Max 18W |
| Heaters supply voltage | Max 400V AC |
| G1 & G2 output current | Max 16A each |
| Water valve max current | 1A |
| LM valve max current | 1.5A |
| VM valve max current | 40MA |
| Temp. measurement resolution | 0.01°C |
| Temp. measurement accuracy | +/-3°C (0 – 100°C range) |

1.1. HIGH-VOLTAGE PART

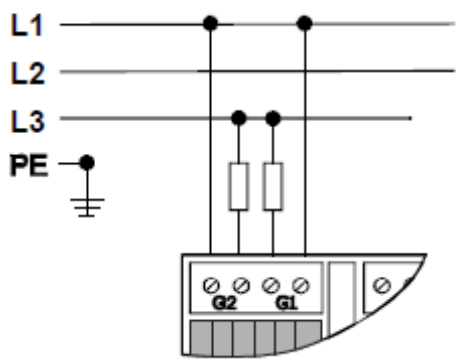
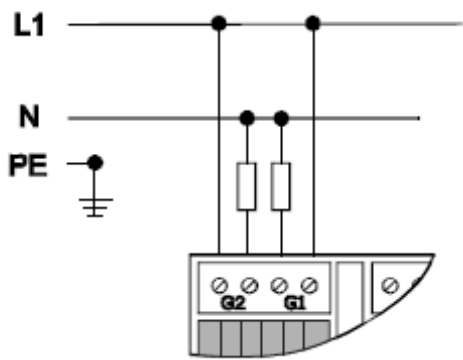
The following diagrams show the examples of connection of this part of the appliance. The mains voltage that is necessary for the electronics shall be connected to **L N** terminals, paying attention the phase wire should be connected to “L”.



max 2 x 3,6kW 230V



max 2x 6,4kW 400V



Water valve. The SKN controller is not designed to supply the water valve from its own power supply. The water valve should be supplied from the mains 230V or separate power supply. The ZW connector should be simply considered as a switch, which will close its contacts when the controller wants to activate the water circulation. It enables to use only NC valves.

The heaters, depending on their operation voltage, should be connected according to one of the diagrams, considering GH1 and G2 outputs as the serial switches. If the heaters (or their sections) are of different power, remember the power connected to the particular output – it will be needed for further configuration of the appliance.

ATTENTION! The “grey” factory enclosure of the execution part ensures proper cooling for current sup to 10A (for each G1 and G2). If the excepted current is to be higher, it should be considered to place the execution part in different enclosure providing adequately better ventilation.

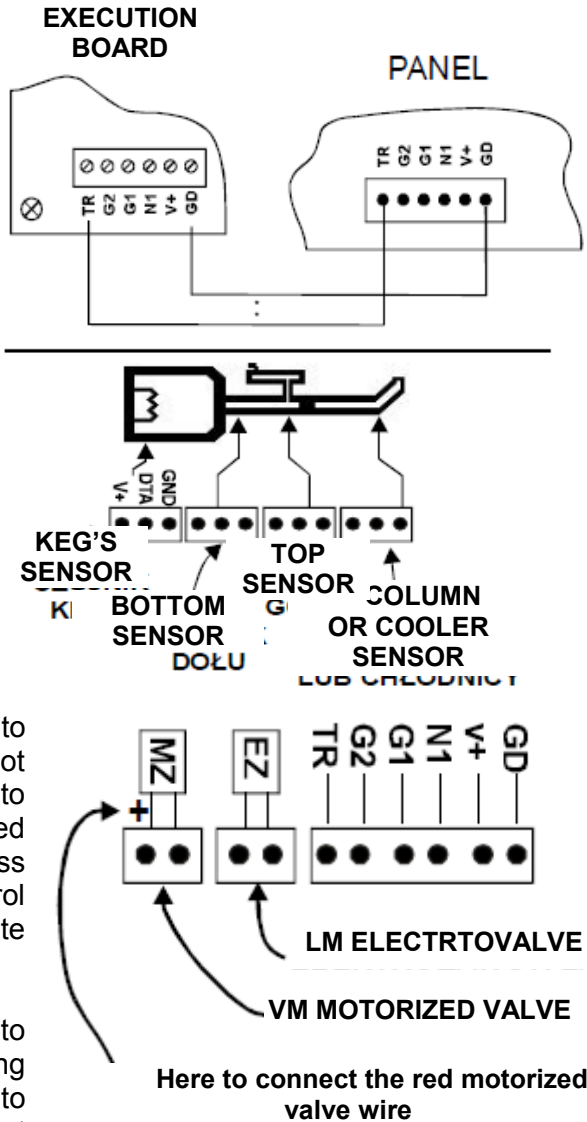
1.2. LOW-VOLTAGE PART

The control panel and the execution part should be connected with the cable enclosed. The respective terminals should be connected at both ends (i.e. GD-GD, V+-V+, etc.). There is a connector at the panel that could be easily detached.

The temperature sensor should be installed in the column according to its manufacturer recommendations, leaving circa 1 cm of the metal part protruding, if it would be necessary to remove it (possibility to hold it with pliers, etc.). The measurement point of the column should be connected with respective terminal of the panel. DS18B20 circuits, operating in “normal” or parasite power, are used as the temperature sensors, the wire colors are important. Ground (GND) is brown, Data line (viewed from the connectors and label side) (DTA) is white, supply is green. Mistake could damage the sensor.

The LM electrovalve should be connected to the EZ connector. Polarization (+/-) is not important. The electrovalve cable, due to interferences created in it, should be shielded and possibly short, should not be put in harness with other cables. The controller enables control of both NO and NC valves, appropriate configuration to be done in menu.

VM valve has an incorporated drive, thanks to which, the controller may control its opening rate independently. It should be connected to the MZ connector. Connecting here not recommended element may lead to the output failure. Polarization is important, one of the wires is always red and it should be connected to “+”. In case of inverted connection, the valve would operate in opposite direction making the column correct operation impossible. Correct installation could be check by means of input/output test (point 3.2), where the symbol “+” visible on the display means opening and “-” – closing.









2. FIRST TURN ON AND CONFIGURATION

After making sure that everything is installed correctly, fill up the tank or disconnect the heaters and turn on the supply. After a few seconds, the appliance should display the main screen with the column diagram and temperature values in its particular elements. It is recommended to perform a few operations in the service menu.

1. Restore factory settings (operation described in point 3.3).

2. Check operation of particular outputs, select operation points of VM and LM Valves (3.2).
3. Configure initially the controller (point 3.4)




3. SERVICE MENU

This menu includes essential parameters of the controller. To enter this menu, press and hold for a few seconds the  button, when the logo screen appears press the  button and wait for a few seconds. Navigation within this menu is done with the   buttons, select appropriate function with . To exit this menu press and hold for a few seconds the  button or turn ON the supply again.





3.1. SEMI-AUTOMATIC MODE



This function makes it possible to control the process with significant participation of the user without alarms signalization. The user may, at any time, change the power and turn the cooling water valve ON/OFF. The only automatic function is VM valve control on the basis of temperatures entered by the user. The top value is an OFF temperature, and the bottom value is an ON temperature. Top sensor or bottom sensor is used to control this valve, according to settings in menu 4.5. Setting of the VM valve opening rate is done same way as in the automatic mode.

T1...T4 designations refer to successive temperature sensors (T1 is the head, T2 – bottom, etc.). When entering this function, the clock visible in the upper part of the screen is activated. It does not control the process, it is only to help the user.

In this mode, data logging into SD card is also active. Holding for a few seconds the  button depressed would cause the controller restarting. To accept the new valve position, press the  button (editing this parameter) or simply move to edit next parameter (press the  button).

3.2. INPUT/OUTPUT TEST

In this menu, each output can be activated manually. The  button activates the output, the  button deactivates the output. Transition between parameters is looped and it is done with the  button. To exit this menu press and hold for a few seconds the  button or turn ON the supply again.





Control of the VM valve, designated as MZ is done with the   buttons. The visible “+” symbol should cause the valve opening and “-” its closing, 0 means the valve is stopped.

Control of the LM valve, designated as EZ is done with changing the values – above some threshold the valve “engages” and below “releases”. To find the optimal value controlling the valve, carefully increase the value and note when the valve operates. Increase this value further by circa 10...15%, then disconnect and reconnect the valve connector paying attention if this operation has produced next and unequivocal valve operation within 30 s. Then enter the value obtained as Dt parameter value in output settings (point 3.4.2).








Setting too high values could cause the power supply overload and its shut-down (controller restart). If such effect occurs without the valve operation, it means this valve is not suitable

for this controller. Quite squealing or delayed operation of the valve after disconnection of its connector is a natural behavior.

3.3. RESET

Hold the  button depressed for a few seconds – the controller will restart. At the moment when the logo screen appears, press the  button, shortly after instead of main screen the menu with a list of operations will appear. With the  button move to “reset” and press the  button. The controller will restart with factory settings. This function does not “cure” the controller wonderfully and it is not a solution for all the problems with its operation that usually might arise from not understanding its principal of work and wrong settings. Instead, it causes necessity of resetting all the parameters.

3.4. ADDITIONAL SETTINGS

Hold the  button depressed for a few seconds – the controller will restart. At the moment when the logo screen appears, press the  button, shortly after instead of main screen the menu with a list of operations will appear. With the  button move to “additional settings” and press the  button, first parameters – display contrast – will come up. Change the value with the   buttons, confirm the value and move to next parameter with the  button. It is not possible to move back to previous parameter. To save the changes move across all the parameters. The controller will restart.

3.4.1 DISPLAY SETTINGS

Here you can select the LCD screen contrast.

3.4.2 OUTPUT SETTINGS

Here you can select the LCD screen contrast.

LM TYPE – specify the valve type (NO – normally open or NC – normally closed)

Dt – parameter controlling the valve. The SKN controller controls the electrovalve in sophisticated way, in order to reduce heating of the valve and make it possible to use valves form a wide range of valves, which would not be suitable for direct operation with this appliance (e.g. excessive coil power, operation voltage different then 12V). Correct value of this parameter should be obtained testing the valve operation, available in the menu “Input/Output test” (point 3.2).

Then you could define how the heaters will work.

G1 modulated, G2 continuous – Heater connected to G2 output will operate continuously, even if set at minimum power. Essential power adjustment will be done with G1 heater.

G1 and G2 modulated. Both heaters will be turned On and Off at the same time.

G1/G1 power – the controller shows absolute power in kilowatts (kW), not relative in percents. Therefore, to obtain correct value it is necessary to enter nominal power of particular heaters. Both the above ways of control have one common feature, the controller realizes so called group control with a few seconds period. Contrary to phase control, it eliminates the necessity to use expensive noise filters, ensures good quality of control, however it may cause light dimming in pace of heaters operation. Therefore, it is

recommended to work in mode of G1 modulated and G2 continuous, where the modulated heater will be supplied form different phase then lighting.

Max VM opening – defines the maximum valve opening. When running the process it will be impossible to select higher valve opening, reducing the possibility to select higher capacity then the column can provide and frequent process destabilization at beginning phase of collecting the heart.

Min VM opening – means minimum opening. When running the process it will be impossible to select lower opening. Also the controller itself will no go below this vale if the opening correction option is active. Use a value at which the rate of collection is still reasonable. Setting too low value or even total closing would cause the controller to encounter a problem with transferring to tails when the close time principle is selected, or would case unnecessarily long collection of the heart and energy consumption.

3.4.3 SENSORS SETTINGS

This menu consists of two screens. In the first of them you can define what sensors will be connected the controller, and therefore their correct operation should be checked.

Sensor alarm – leaving the sensor crossed out informs the controller that give sensor will not be connected. The selected sensors are being checked only during process running (before you can disconnect them freely). If during process running the controller detects a problem, appropriate message will be displayed and acoustic signal will sound.

From this moment, the user has a minute to confirm/cancel the error by pressing any button, otherwise after indicated time the controller will stop the process.

The error will be cancelled automatically if the sensor comes back to its normal operation. Next error from the same sensor would appear only if even for a moment correct signal from this sensor reappear, it means permanently defected sensor would be signaled only once.

Such method of proceeding ensures determined reaction to an error, however excludes immediate and not necessary column shut down e.g. due to accidental sensor disconnection. It gives the user possibility to make proper decision without needless stress.


Head sensor as – to select head or cooler.

This function brings also changes in the main screen or process menu. Setting the sensor as a head sensor would add to menu an additional option of process ending after obtaining at it the specified temperature (without it, still the other sensors will be selectable).


Setting the sensor as a cooler sensor would add an additional option of the cooler temperature control.


Reading correction. This option enables correction of the temperature sensors readings. Value in parenthesis shows an actual temperature taking into account the correction entered. Please remember the DS18B20 sensors are quite good thermometers and practically offers much smaller error then described in the specifications. Small difference from the actual temperature is meaningless for the controller, so this correction is purely a cosmetic function. Differences exceeding a few degrees might indicate sensor defect.

4. PROCESS SETTINGS MENU

Here you can configure the entire process. To enter this menu, press the  button at the moment when main screen is visible and no parameters are being changed. To exit this

menu, pres the same button again. The   buttons rewind the menu or change parameters values after entering the editing menu.

Entering the editing of a given screen, moving to next parameters, and exiting the editing is possible with the  button.

Turning Off and long holding of the  button depressed when making changes would not save them (saving into memory is done with exiting the editing). Principles of the process might be also changed during its running. Remember, however, such changes have immediate impact so unexpected process interruption or move to next phase may happen. The entire distillation process runs according to subsequent, below listed principles.

4.1. HEATING

First process stage. Here you can define the power of heating, at what temperature of the column bottom the electrovalve of cooling water should be activated and what temperature of the column top should start the watering stage.

4.2. ENFORCED WATERING

Consists of three attempts of watering with pauses the purpose of which is better wetting of the column packing. This option is aimed at controlled filling of the column with water. When not sure how to set up these parameters, it is recommended to set up much longer time then expected (even tens of minutes) and control the watering process with self-contained changes of power from the main screen. And then enforce transition to a next stage (described in point 5). Such method ensures comfortable work without a pressure of time and necessity of restarting the process in case of its omitting.

4.3. COLUMN STABILIZATION

This principle determines the power and time of stabilization.

4.4. HEADS COLLECTION

Fourth stage. This principle defines the power effective from this moment and a time for which the user can collect so called kindling and heads. During this stage the LM valve is being open, and the VM valve is still closed.

4.5. HEART COLLECTION

Fifth stage. This principle defines how the main product will be collected, the user decides what jump from the temperature of the day is to cause the end of collection. Which sensor (column top or bottom) will control the VM valve. Beginning value of the VM valve opening and a step decreasing each next valve opening. The temperature of the day is to be defined automatically by the controller during its operation. From the moment of starting this stage, the user may at any time, from the main screen, change the opening/closing temperature and the current valve opening level. For the time of heart collection, the LM valve is being closed.

4.6. TAILS COLLECTION







Sixth stage. The VM valve is being closed, the LM valve is being reopened. This stage can be induced if the selected principle is met. You can select the type of sensor (keg, bottom or top) and temperature value to be obtained at this sensor, or maximum time of the VM being closed. In order to use the temperatures in particular column points, first it is recommended to perform the column test and find out these values (spread of the sensor parameters, the column operation conditions, etc.).

A better solution might be the principle of VM closing time. When the column is good (and the accessories set correctly), the valve will start to close in the very ending phase of collection and each next closing will be longer and longer. The so far observations indicate the time of a level of 10 min. should be enough.

4.7. PROCESS ENDING

With proper parameters setting, in this principle the controller may end the process directly from the heart collection (skipping the tails). The user defines how long the cooling shall be active after the heaters are turned off, and how to detect the end of process. It could be in result of exceeding the temperature in the KEG or the column bottom or top.

5. THE APPLIANCE OPERATION

The main screen with the column view enables a few functions such as beginning and end of process, transition to next stage or modification of parameters during operation. Enter the functions selection by pressing the  button. When the process is stopped, it is possible only to restart the process (pressing the  button). During process running you can move to a next stage, quickly change the VM valve temperature, change the power currently used or end the entire process. In case of changing the valve opening rate, after changing the value press the  button, or simply move to another parameter pressing the  button (changing the valve opening is effective only when the valve is opened). The second screen displays information on the VM valve operation, it means the current or previous times the valve was closed. This information enables to make a decision on the possible settings corrections, ending the process or to be familiar with the process status in general. Here you can also see the temperature of the cooler located in the execution part. Navigation between these screen is possible by pressing the   buttons.

It is possible to enter the menu and change the process principles during process running, however remember the modification of the current stage may cause its unexpected ending and transition to a subsequent stage.

6. MEMORY CARD

The appliance makes it possible to record the significant operation parameters into memory card, or to updates the controller software quickly.

Only SD/MicroSD cards of up to 32GB can be used with this appliance. There is no guarantee the appliance will function correctly with all types of cards meeting these requirements.

6.1. OPERATION PARAMETERS REGISTER


Each start of process in automatic or semiautomatic mode causes the controller to generate a new .csv file, where the data will be regularly registered. Active registering into the card is being signaled with regular flashing of the SD icon in the front of the controller. Such a file could be imported into calculation sheet. Each next file has an ascending number in its name, the file creation date is random. It is forbidden to move or remove the card from the appliance when the process is started. It could cause the file to be damaged or the process to be interrupted.

6.2. SOFTWARE UPDATE

Updating process is simple, however the appliance not covered with warranty could be damaged. Each update attempt is recorded in the controller together with a file fragment. Do not load a software other than designed for this appliance. During updating it could happen the controller will cease its correct operation and e.g. activate its outputs (a risk of heaters damage, etc.)

It is natural that after updating the controller will signal an error of the settings recorded in the memory. Even if the controller does not display such message, reset it to factory settings.

Updating shall be always done in the following sequence:

- Save the file with a software to be loaded into the controller into the card.
- Check and possible modify the file name to S_SKN (or S_SKN.hex if your system shows file extensions).
- Insert the card into the controller with the supply turned off.
- Turn the controller on with the  button depressed.

The SD icon will flash a few times, then during a few seconds it will flash quickly, then slowly. If the update is successful, the controller will start up automatically with the new software. If instead, the SD icon will flash regularly it means update failure. Number of flashes informs the cause of failure:

2 flashes: problem with the card, try to format it or use another card

3 flashes: the expected file not detected

4-6 flashes: problem with the file content (e.g. damaged)

If there is any problem with the memory card, first operation should be its formatting for FAT32 file system. Correct updating process (software uploading) takes about 10 seconds.

The appliance does not react to supply application, the panel does not light, the fan does not rotate.

Check the supply connections, check the fuse.

The appliance does not react to supply application, the panel does not light, the fan rotates.

Check correct connection of the low- and high-voltage parts, disconnect the electrovalve and the temperature sensors.

One of the heaters works, its control lamp on the execution panel does not light.

If the connection is correct (the output used to work), the most likely the output is damaged due to short-circuit.

One of the heaters works, its control lamp on the execution panel does not light.

Check the connection between the low- and high-voltage parts.

One of the heaters works, its control lamp on the execution panel lights.

Check the heater connection and its efficiency.

The panel resets at the moment of LM valve operation, or it does it in cycles trying to turn on.

Disconnect the VM valve, it is an excessive load for the controller. Check the VM valve for the possible short-circuit, check the valve type (NO/NC), check/reduce the Dt parameter.

The controller displays a memory error.

Such situation can happen after software updating or sporadically due to disturbances (e.g. shut-down during settings modifications).

One of the heaters work when it should not, its control lamp on the execution panel lights.

Check the connection between the low- and high-voltage parts.

One of the heaters does not work, its control lamp on the execution panel lights.

Check the connection between the low- and high-voltage parts.

One of the heaters does not work, its control lamp on the execution panel lights.

Check the connection between the low- and high-voltage parts.

Immediately after process start, there is an error of cooler overheating.

Sensor on the execution panel damaged (service is necessary) or incorrect connection between the low- and high-voltage parts.

Cooler overheating error appears some time after the process start.

Cooling of the execution part is ineffective, ventilation holes are obstructed, the execution part heats up from the tank, the heaters connected are of excessive power.

The controller displays error for a sensor that is not connected.

Configure correctly the sensors used.

The panel resets at the moment of LM valve operation, or it does it in cycles trying to turn on.

Disconnect the VM valve, it is an excessive load for the controller. Check the VM valve for the possible short-circuit, check the valve type (NO/NC), check/reduce the Dt parameter.

The controller displays a memory error.

Such situation can happen after software updating or sporadically due to disturbances (e.g. shut-down during settings modifications).

If the above suggestions do not solve the problem, contact the manufacturer.

Serial number

Date of sale and stamp

WARRANTY CARD

- The manufacturer warrants correct operation of the appliance for a period of 24 months from the date of sale.
- Factory defects revealed within the above period will be eliminated free-of-charge within 14 working days from the date of receiving it to the service. Before sending the appliance back, contact the manufacturer.
- Return the appliance cleaned directly to the manufacturer (it will significantly shorten the repair time) at your cost, in a package ensuring its proper protection, enclosing the proof of purchase and the warranty card correctly filled in. Enclose also contact data of the claiming person (shipping address, telephone number) and precise failure description.
- Warranty is void if the seal or the label with serial number is not intact.
- Warranty does not cover failures not resulting from the manufacturer errors, e.g. not approved design modification, improper installation or use, overloads, atmospheric discharges, mains overvoltages, fouling or flooding, mechanical damages.
- Warranty card that is illegible, not fully filled out, or with traces of unauthorized corrections is invalid!
- This warranty card does not exclude nor limit the consumer rights resulting from the regulations of the laws.