RadioAstroLab Srl

USER MANUAL

ULTRASOUND GENERATORS KIT

RAL700SL generator + RAL250L interface
RAL700SL_A generator + RAL250L interface

Ultrasonic cleaning systems

Model for installation on ultrasound bath

RAL700SL + RAL250L

RAL700SL_A + RAL250L

Thank you for purchasing the RADIOASTROLAB ultrasonic generator. Before using the generator, read this manual carefully. It is recommended to keep the user manual received from the manufacturer handy.

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Congratulations on your choice!
A high-quality product was chosen. The instruction manual is an integral part of this product. It contains important information on safety, use and disposal. Before using the product, familiarize yourself with all the instructions relating to controls and safety. Use the product only as described and for the indicated areas of use. Keep this instruction manual carefully. In case of transfer of the product to third parties, also deliver all the related documentation.

We recommend that you read this manual carefully before proceeding with the installation of the ultrasound generator, scrupulously following what is reported below.

Our ultrasonic generators are mainly made for civil, industrial and electromedical use; however, in the latter case, it is necessary to ascertain whether, in the country of use, there are particular regulations in this regard.

In case of problems with the generator, it is recommended to read this manual before contacting the technical assistance service.

Important
It is advisable to keep the packaging materials of the equipment, as they could be useful for a possible sending for repair.

Transport damage due to poor packaging of the generator or user interface, when sent for repair, is not covered by the warranty.

RadioAstroLab reserves the right to make changes, even without notice, on the devices and on this documentation in order to improve their performance and effectiveness.

INTRODUCTION

An ultrasound cavitation of adequate power that propagates inside a fluid is the only way to satisfy the most demanding and sophisticated requests for washing and cleaning mechanical parts, objects of complex shape and instruments in the professional, industrial and medical sectors. The applications of this technique are numerous and remarkable. The micro-vibrations of the liquid, which propagate with considerable intensity and effectiveness, very quickly remove the dirt and grease particles present on the surfaces of objects, even in hidden and inaccessible areas, especially when combined with the catalyst effects of temperature (heating fluid) and specific detergents.

The ultrasonic power is generated by a group of piezoelectric transducers which, powered by electricity with appropriate power and frequency, convert it into vibrational mechanical energy. The power and frequency of work are chosen based on the type and size of the objects to be treated and the washing tank: delicate and small materials (optics, jewelry, goldsmiths, medical instruments ...) will generally be treated with lower powers and higher frequencies, while larger robust mechanical parts will require higher powers and lower frequencies. Typically, the frequencies used in industrial washing systems range from 22 kHz to 60 kHz.

It can be understood that the generator-transducer group is the "heart" of an ultrasonic washing system. The generator in particular must be reliable, guarantee continuous operation with maximum efficiency and manually or automatically manage the control of the functional parameters to satisfy every need. For these reasons we have developed a complete series of machines for the professional washing sector, with powers from a few hundred to thousands of watts, in the stand-alone countertop and kit versions (generator unit and user interface unit connected via cable). We also offer our generators to replace any faulty or obsolete electronic part of existing washing systems, after verification and characterization of the piezoelectric transducer-tank assembly in our laboratories or by the customer.

Our robust and sophisticated electronic generators are equipped with microprocessors dedicated to the control of the transducers and to the management of the functions, they allow the programming of the operating parameters and the accessory functions. It is possible to synchronize the operation of several generators connected in parallel, each intended to pilot a group of transducers, to configure high power systems (master-slave operation), or to pilot the generators remotely via serial commands or digital commands and / or analog via PLC. On request it is possible to implement special functions for specific applications.

Our generators are enabled, on request, for use in the 4.0 industry. More specifically the following parameters can be remote controlled: ultrasound on/off, temperature detection, timer start, power regulation.

TERMS OF USE

- The applied load must not exceed that indicated on the back label on the generator.
- The ON / OFF button of the interface does not electrically isolate the internal parts of the kit. To isolate the generator, disconnect the tank from the mains power supply.
- Do not open the container of the ultrasound generator, as inside there can be dangerous voltage parts even in the absence of a mains; however, there are no user-serviceable parts inside.
- The front control panel is intended for manual operations; do not press on the panel with sharp or pointed objects.
- The generator has been designed to operate in closed, clean environments, free of flammable liquids and corrosive substances and not excessively humid.

LIMITATION OF LIABILITY

The manufacturer declines all responsibility for any damage resulting from failure to observe the instruction manual, improper use, non-professional repairs, unauthorized modifications or use of non-approved spare parts.

INTENDED USE

This kit has been designed to power and control washing tanks for ultrasonic cleaning. Any use other than or beyond the foregoing is considered improper. The appliance is not intended for use in commercial or domestic environments. Any claims for damages resulting from improper use, inadequate repairs, execution of unauthorized modifications or use of unapproved spare parts are excluded. The risk lies solely with the user.

BASIC SAFETY WARNINGS

When using the device, observe the following safety warnings:

- Before using the product, check for visible damage. Do not use the product if it is damaged or has fallen.
- Protect cables from damage that could be caused e.g. from sharp edges, hot spots, interlocking or crushing. In the event of damage to cables or connections, have repairs carried out by authorized specialist personnel or customer service.
- This appliance must not be within reach of children and people with reduced physical, sensory or mental abilities or insufficient experience or knowledge. Children must not play with the appliance. Cleaning and maintenance by the user must be carried out by authorized and competent personnel.
- Have the device repaired only by authorized specialist personnel or by customer service. Repairs not carried out professionally can cause dangers for the user and lead to the voiding of the warranty.
- Avoid arbitrary changes to the device.
- The appliance must not be opened by the user.
- Do not expose the appliance to direct sunlight, open flames or high temperatures: it could overheat and suffer irreparable damage.
- Protect the device from moisture and liquid penetration. Never immerse the appliance in water and do not place containers containing liquids (e.g. vases) near it.
- If you notice unusual noises, a burning smell or the development of smoke, immediately switch off the appliance and disconnect all the cable connections from it. Have the appliance checked by a qualified technician before using it again.

PUTTING IN ACTION

Unpacking

Take all the components from the package and remove all the packaging material.

Checking the supplied material

The equipment includes the following components:

- RAL700SL / RAL700SL_A ultrasonic generator module with cable to connect to the interface
- RAL250L interface module with cable to connect to the generator
- Temperature probe connected via cable to the interface module and to be fixed in the washing tank (see notes on page 10)
- This instruction manual.

PLEASE NOTE:

Check if the supplied material is complete and if it shows visible damage. In the event of incomplete delivery or in the event of damage due to transport or inadequate packaging, contact the direct line for assistance.

Installation and power supply

The assembly of the generator and the interface inside the washing machine is responsibility of the customer, in compliance with what is indicated in the following pages. Pay particular attention to the positioning of the generator in order to leave sufficient ventilation space. For the mounting of the interface module, you can find on page 11 the dimensions in mm of the holes to be drilled on the panel.

To power the US generator it is necessary to:

- Place the machine in an appropriate environment.

ATTENTION: the device must be positioned in a dry and airy environment, away from heat sources, direct solar radiation, flammable liquids and gas sources. Carefully avoid any possibility of infiltration inside the machine.

- Connect the group of piezoelectric transducers (electrically connected in parallel and in phase) to the generator. The cables used must be of adequate section and covered with an insulating sheath in silicone rubber resistant to high temperatures. It is important to phase-connect the transducers to ensure proper system operation. Furthermore, depending on the type of transducer used, a terminal could be in contact with the metal wall of the washing tank, electrically connected to the protective earth.
- Pay particular attention to minimize disturbances, by spacing the cables (especially the transducer cables from the rest of the wiring), avoiding lengths greater than those necessary for extracting the generator from the tank for quick repairs, and avoiding grouping the wiring together.
- Check all the connections and the integrity of the protection fuses.

ATTENTION: make the connections between the US generator and the piezoelectric transducer assembly with the appliance turned off and the power cable not connected.

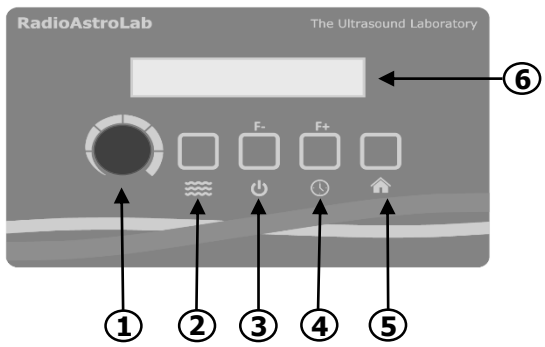
- Connect the generator power cable to the 230 Vac - 50/60 Hz single-phase mains, making sure that the mains socket has a secure connection to the earth circuit.

THE CONTROL PANEL: FUNCTIONS

The control panel of the US generator (Figure. 1) includes:

1. Knob for variation of power, and of other parameters when the system is in programming mode;
2. Button for activating the solenoid valve for draining the liquid out of the tank;
3. START-STOP button to start or stop the ultrasound treatment; in frequency setting mode, it allows to decrease the frequency value;
4. Button for enabling the delayed stop TIMER; in frequency setting mode, it allows to increase the frequency value;
5. HOME button to access the parameter selection and programming mode;
6. LCD display (backlit, with white characters on a blue background) for viewing the operating parameters;

Fig. 1



Once the system is powered, after an acoustic signal the display shows a short welcome message (fig. 2), followed by the screen with the basic operating information (main window - fig. 3):

Fig. 2

Fig. 3

NB: the indications on the firmware versions may change according to the updates.

The first line of the main window (fig. 3) indicates:

- the percentage of power set (from 30% to 100%) with respect to the maximum value, variable by means of the rotary knob;
- the state of the US generator (ON or OFF);
- the TIMER status for the delayed shutdown of the generator: the set standard time is 30 minutes.

The second line displays:

- the activity of the thermostat and the temperature of the liquid in the tank;
- the status of the liquid discharge electric pump: the word "pm" is displayed when the electric pump is running, no wording when the electric pump is not active;
- operating frequency of the US generator expressed in Hz.

The parameters just described have been made immediately accessible to the operator as they are more frequently used in ultrasound washing applications. Using the HOME programming button, with ultrasound treatment in OFF mode, it is possible to access the selection and modification menu of the aforementioned parameters, as described in the following paragraphs. The system confirms the validity of each command by emitting an acoustic signal. **If no operations are performed within 20 seconds of accessing the parameter programming mode, the system automatically returns to the man window (emitting a short acoustic signal), without saving any parameters that have been modified.** With the ultrasound treatment ON, it is possible to act only on the knob for the instantaneous power regulation and on the START-STOP command of the ultrasounds.

- **TIMER SETTING**

From the main window, with ultrasound OFF, pressing the TIMER button allows you to change the factory value of the deferred timer (30 min). The timer will only start counting when the ultrasound cycle starts.

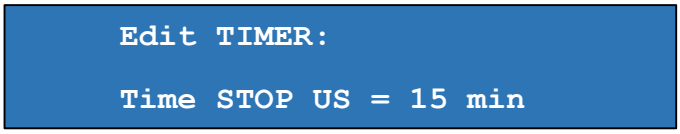


Fig. 4

By turning the knob, you can change the standard 30-minute time in 1-minute increments. The delay time can be adjusted in intervals of 1-30 minutes. TIMER activity is indicated by the flashing "*" symbol next to the corresponding text on the home screen.
Each time the system is turned on, the TIMER maintains the last set value.

- **TEMPERATURE SETTING**

From the main window, with ultrasound OFF, two short presses of the HOME button will allow access to the setting of the desired temperature in the washing tank (fig. 5). Each time the system is turned on, the parameters displayed will be the last set.

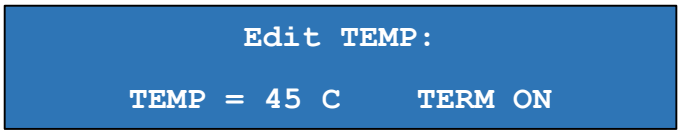


Fig. 5

Fig. 6

By turning the knob it is possible to vary the heating temperature in 1 degree steps. The range within which the heating temperature can be varied is 0-90°C. A hysteresis of ± 1°C with respect to the set threshold value is provided. The thermostat will be enabled only if the desired temperature is above 20°C; in this case, the wording TERM ON will be displayed on the temperature screen (fig. 5), otherwise the wording TERM OFF will be displayed. By pressing the HOME key you will return to the main window storing the desired temperature (Fig. 6). Depending on the parameters just set, the indication of the temperature in the main window can be preceded by:

- asterisk symbol: thermostat active; the heater is working to heat the water and keep it at the set temperature (Fig. 6);
- no symbol: thermostat is active, the heater is not operating as the desired temperature is already in the tank;
- Minus symbol: the thermostat is not active, the tank water remains at room temperature, always detected in real time.

WARNING: Please consider that in some cases the position of the knob does not exactly reflect what is shown on the display, as the knob in addition to adjusting the power is also used in setting the temperature and the timer. For example: from the main screen you set the power to maximum (100) by turning the knob completely clockwise; then you may decide to set a timer, by entering the appropriate section of the menu and changing the parameter with the knob. Upon returning to the main screen, the power will still be at maximum, but the knob will probably be in another position and not completely clockwise. In this case, you must always rely on what is indicated on the display and not on the position of the knob indicator. However, every time you want to intervene on a parameter through the knob, it will immediately calibrate itself on the current values of that parameter.

- **SETTING OF AUTOMATIC SWITCH-ON OF RESISTORS WITH POWER SUPPLY**

From the main screen, with ultrasounds OFF, three short presses of the HOME button will take you to access the option that allows the resistances to be turned on once the machine receives the power supply (fig. 7). This option is useful if the machine is powered prior to the arrival of the dedicated operator, who will find the water already at the desired temperature, saving useful time. The temperature considered will be the one set in the appropriate menu item.

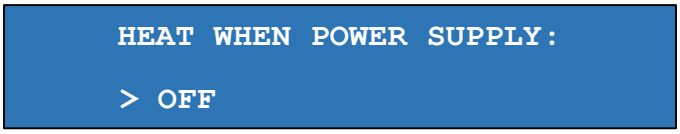


Fig. 7

By default the generator is supplied with this option in OFF mode. By holding down the START-STOP key and briefly pressing the TIMER key, it will be possible to change the parameter from OFF to ON and vice versa. Pressing the HOME key will exit this setting and store the displayed parameter: if the ON mode has been selected, a short warning message will be displayed before returning to the main screen, inviting you to check the liquid level in the tank (Fig. 8) , as also indicated in the note below; from this moment on, each time the machine is switched on, the resistances will also be started, to allow the liquid in the tank to reach the set temperature. To set the temperature, from the basic screen with ultrasonic OFF, two short presses of the HOME button will allow you to access this function. To allow the preheating function to be activated, it will be necessary to set a temperature higher than the one read by the probe itself or higher than the ambient temperature, or the desired temperature for switching on the heating elements. Once the temperature has been set, to memorize the chosen parameter, you will need to press the HOME button to exit the screen. This step, after the machine has been turned off, will allow the last parameter set to be stored once it has been turned on again. This will be recognizable by observing the symbol preceding the temperature indication in the main screen: if the next time the machine is switched on the temperature is preceded by an asterisk (fig. 9), it means that the resistances are actually already active, without having activated them manually as it would be required if this option was set to OFF.

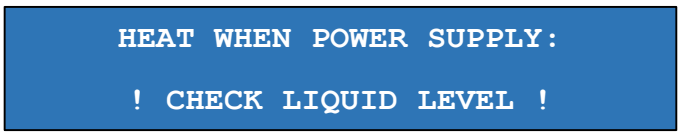


Fig. 8

Fig. 9

PLEASE NOTE: if this option is active, it is essential that the tank contains the necessary quantity of liquid; switching on the heating elements with the tank empty would damage the entire system. RadioAstroLab declines all responsibility for damage caused by failure to comply with these instructions. For preventive purposes and to comply with the regulations in force, RadioAstroLab also supplies its generators in the version with the management of a level sensor, for tanks equipped with this sensor. We are available for any further information on the matter.

- **ULTRASOUND CYCLE FUNCTION**

From the main window, a short press of the dedicated button will start or stop the ultrasound cycle. If the TIMER function is not active, the cycle will be carried out until the user presses the START-STOP button again.

Internal view of the generator and example of application of the interface on the customer's plate, to be installed on the tank. Panel overlay supplied on demand.

- **LIQUID DISCHARGE FUNCTION IN THE TANK**

From the main window, with ultrasounds OFF, a long pressure of the dedicated key will allow the immediate discharge of the liquid present in the tank. This will be confirmed by the appearance of the word "pm" in the second line of the main window. A short press of the button will stop the discharging action.

```
PW=100 US-OFF  TIMER=20m
*TEMP=45C pm FRQ=24250Hz
```

SIGNALS AND ALARMS

- <u>Overload or over-temperature alarm</u>

When a generator malfunction occurs due to:
- an overload in the output circuit that powers the piezoelectric transducers (reversible condition)
- an excess of operating temperature (reversible condition)
- the interruption of the protection fuse in the power supply circuit (irreversible condition);

the main screen shows the wording in Fig.11 accompanied by an acoustic signal, then it returns to the main screen. The ultrasounds are immediately deactivated, as indicated in the appropriate section of the main screen. It is possible to manually restart the ultrasound cycle with the last parameters set, but if the cause of the alarm has not been resolved, the system will still return the signal. In the event of power supply overload or excess temperature (reversible conditions), it will be sufficient to try to start the cycle again after a few minutes to allow the machine to return to adequate operating conditions. If the signal persists, it is possible that the problem is the fuse: in this case you can try to replace it and start the cycle again, otherwise it’s advisable to contact our support.

```
! OVERLOAD-TEMP ALARM !
US GENERATOR OFF
```

Fig. 11

- Probe failure alarm

The system measures the temperature of the washing liquid using a PTC thermistor (positive temperature coefficient) mechanically assembled so that correct thermal contact with the metal walls of the tank is guaranteed, and electrically connected to the user-interface control module. If the sensor is not connected or damaged (for any reason, the electrical connection of the temperature sensor with the electronic control board is interrupted), the system signals the fault by replacing the temperature measurement in the main window with the wording “temp fault” as shown in Fig. 12.
The signal remains active until the thermistor connection is restored.

Fig. 12

PLEASE NOTE: The precision in measuring the temperature depends on the assembly method and on the mechanical contact between the sensor and the walls of the tank. It is necessary to fix the sensitive part of the thermistor supplied (the one indicated by the red arrow in Fig. 13) ensuring a stable contact along its entire length. It is also advisable to position the sensor in an area of the tank away from any heating elements (such as, for example, the self-adhesive flexible electric resistances coated with silicone rubber, applied to the external surfaces of the washing tank, frequently used in ultrasound systems), but in a position such that the local wall temperature is representative of the liquid temperature. Often it is necessary to experimentally optimize the position of the sensor by checking the measurement using a sample thermometer immersed in the liquid.

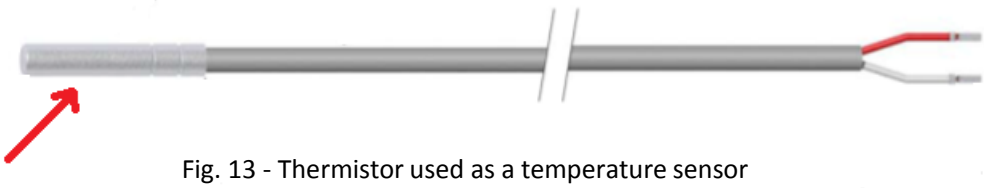


Fig. 13 - Thermistor used as a temperature sensor

- Insufficient water level alarm

Option available only if the tank is equipped with a dedicated level sensor.
Both with active and inactive cycle, if the sensor installed inside the tank does not detect the washing liquid because it is at a lower level than its position, an intermittent acoustic signal is emitted, and the display returns the H20 ALARM screen as indicated in Fig. 14. The warning remains active until the tank is refilled with the quantity of liquid sufficient for detection by the sensor.
If the alarm occurs while an ultrasound cycle is active, it is immediately blocked, and thus the operation of the resistors; once the adequate liquid level has been restored, it will be necessary to manually restart the cycle, which will reactivate with the last parameters set.

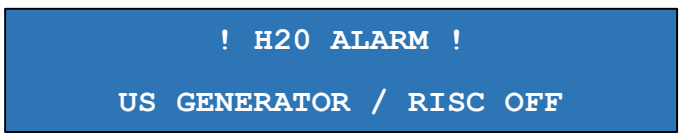


Fig. 14

FRONT PANEL ASSEMBLY INSIDE THE CUSTOMER TANK

The arrangement of the interface inside the tank is responsibility of the customer, in compliance with the indications on the following pages. Refer to Fig. 15 for the dimensions in mm of the holes to be drilled on the panel.

NOTE: Be sure that the display does not come into contact with any metal part of the tank, as this can reduce the electromagnetic immunity of the interface board.

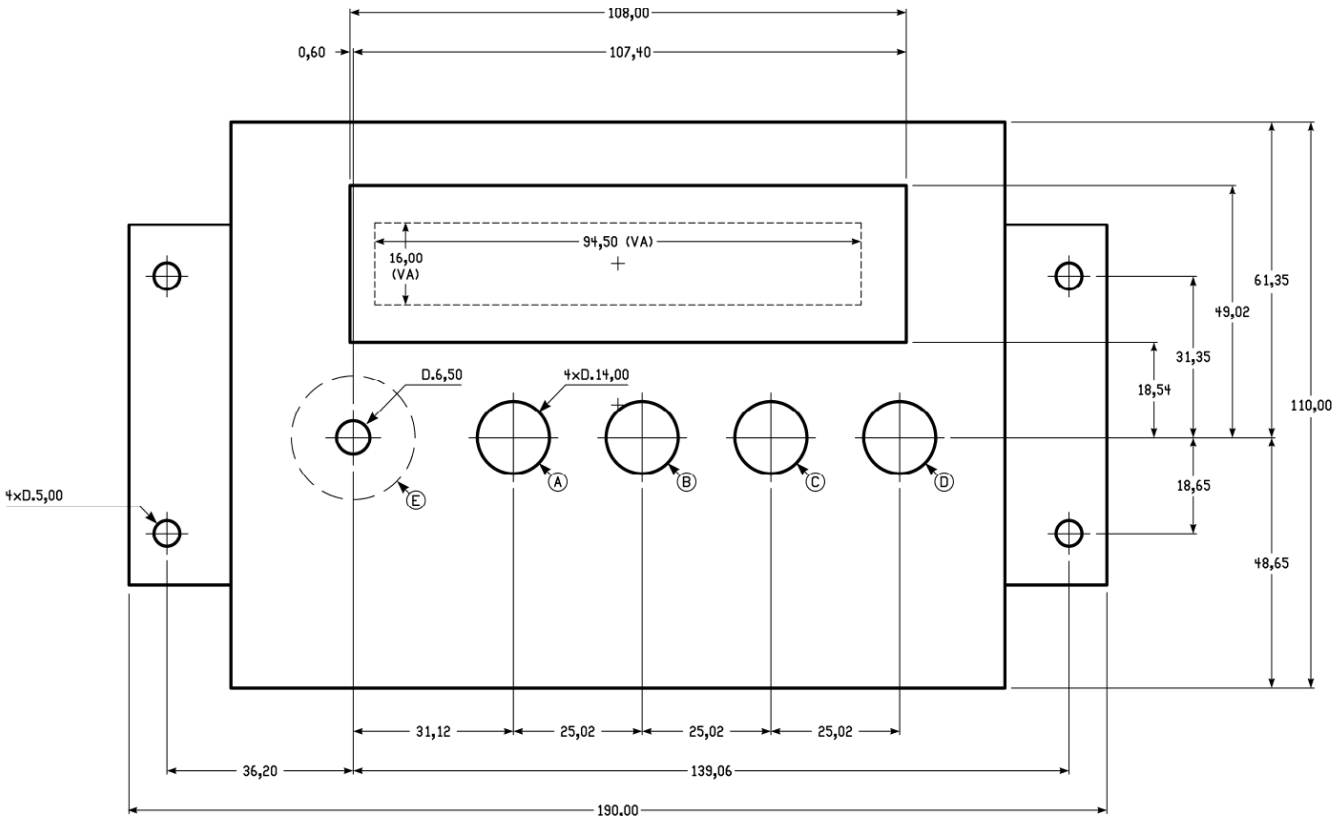


Fig. 15

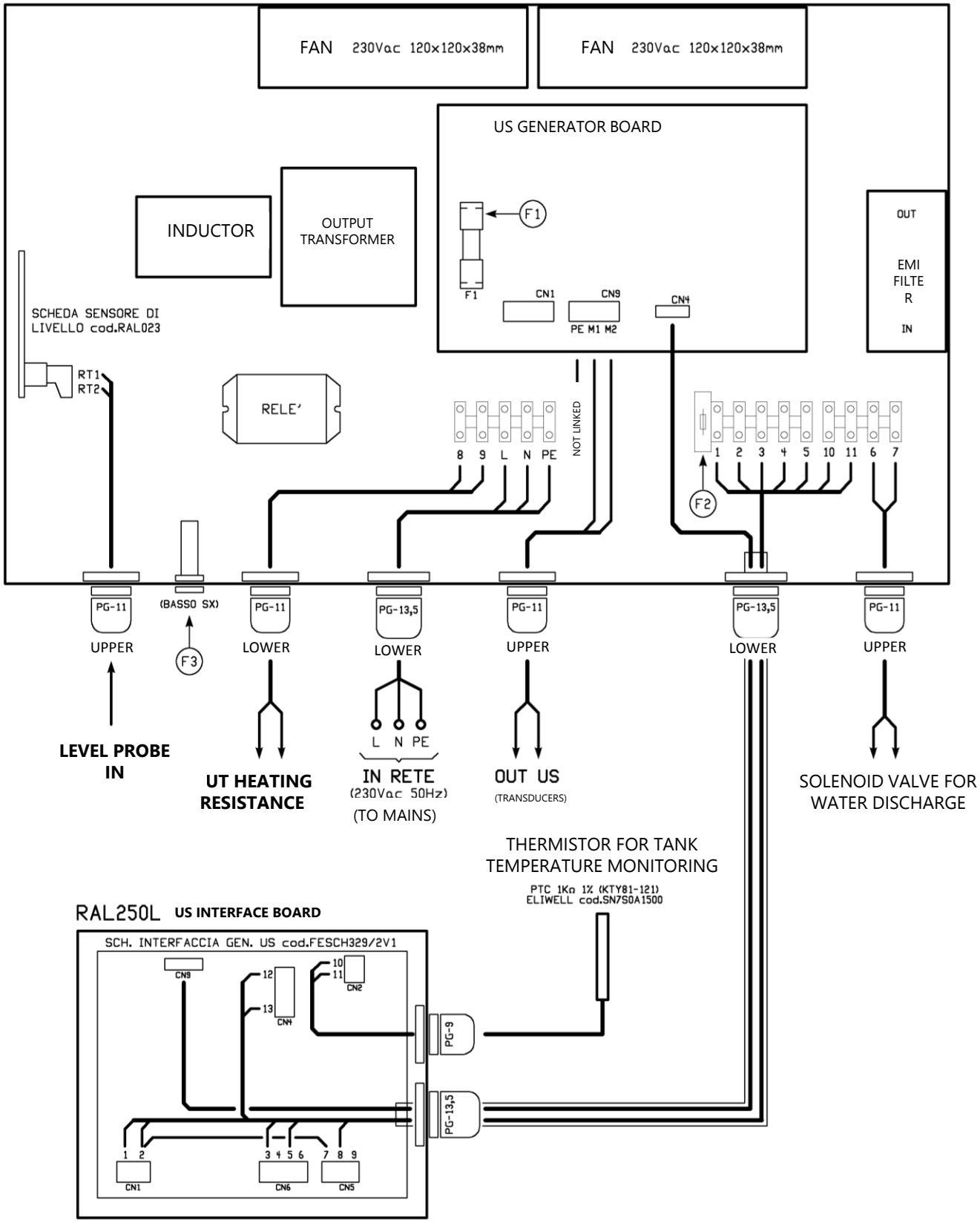
TECHNICAL FEATURES

ATTENTION: The features listed below are standard; the models of this device may vary according to the power and frequency needs received by customers. We recommend that you always refer to the technical information on the silver labels placed directly on the generator module and on the interface module in your possession.

Construction specifications	GENERATOR	INTERFACE
Weight in kg	9	0,505
Dimensions in mm	316 x 236 x 128	200 x 120 x 95
Electrical input characteristics		
Rated input voltage	230 Vac	230 Vac
Rated input frequency	50/60 Hz	50/60 Hz
Rated input current	See external label	-
Line fuse	See external label	-

NOTE: Regarding the size of the generator and interface, leave enough space in the tank for the cables to exit from the cable glands and for proper positioning.

RAL700SL / RAL700SL_A



CLEANING

Clean the external surfaces of the generator and the interface with a slightly damp cloth.

CAUTION:

- Prevent the penetration of liquids into the devices. They can cause irreparable damage.
- Do not use aggressive or abrasive detergents to avoid damaging the surface of the devices.
- Carry out all cleaning operations taking care that the devices are disconnected from the network.

STORAGE AND DISPOSAL

Store the appliance in a dry place, free of dust, humidity, liquids and not exposed to direct sunlight.

Disposal of the appliance

At the end of its useful life, the appliance is not disposed of together with normal waste, but is sent to appropriate collection points, recycling centers or disposal companies.
Disposal is free of charge to the user. Respect the environment and dispose of the device in accordance with the relevant directives. Inquire at the municipal administration.

Disposal of the packaging

It is advisable to keep the packaging materials of the equipment, as they could be useful for a possible sending for repair.

However, it is recommended to dispose of the packaging material by carrying out separate waste collection and in any case in compliance with current local regulations and environmental protection standards.

WARRANTY

Dear Customer,
This appliance has a 1 year warranty from the date of purchase. If this product shows defects, you are entitled to legal rights against the seller of the product. The warranty described below does not constitute any limit to these legal rights.

Warranty conditions
The warranty period starts on the date of purchase. Please keep the invoice well. The latter is necessary as proof of purchase. If within a year from the date of purchase of the product there is a defect in the material or manufacture, we will repair or replace the product free of charge. This warranty service assumes that the defective device and the proof of purchase (purchase invoice) are presented within the term of one year and that you describe in writing what the defect is and when it is highlighted. If the defect falls under our warranty, your product will be repaired or replaced by a new one. With the repair or replacement of the product does not start a new warranty period. The manufacturer is not liable for malfunctions or damage caused to the machine due to bad installation, use not according to what is described in this manual or due to the use of unsuitable external components.

Warranty period and legal claims of defects
The warranty period is not extended by warranty interventions. This also applies to replaced and repaired parts. Any damage and defects that may already exist at the time of purchase must be reported immediately after the appliance has been unpacked. The repairs carried out after the expiry of the warranty period are subject to a fee.

Scope of the warranty
The appliance has been carefully manufactured according to strict quality directives and duly tested before delivery. The warranty is valid for material or manufacturing defects. This warranty does not extend to components of the product exposed to normal wear and tear, which can therefore be considered as components subject to wear or damage that occur on delicate components, such as e.g. switches, batteries or parts made of glass.
This warranty is void if the product has been damaged or used or has undergone maintenance in a non-compliant way. For proper use of the product, all instructions set out in the instruction manual must be strictly followed. It is imperative to avoid methods of use and actions that the instruction manual does not recommend or warns against.
The warranty lapses in the event of improper use or tampering, use of force and interventions not carried out by our authorized service branch.

Warranty case handling

To ensure that your request is processed quickly, please follow the instructions below:

- Keep the invoice as proof of purchase and the item code handy for any request.
- The item code is shown on the identification plate or on an incision on the product, on the front page of the instruction manual or on a label applied to the back or bottom of the product.
- In the event of malfunctions or other types of defects, first contact the customer service department indicated below by telephone or e-mail.
- Once the product has been registered as defective, it can then send it to us, providing the proof of purchase (invoice), a description of the defect and an indication of the date on which it was presented, to the address of the customer service that has been communicated to you.

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