# User manual


Rev. 1.6

# Index

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# 1. DEVICE INFORMATION

## 1.1 Overview

RStone™ is a sensor that measures the concentration of Radon in the environment in which it is located. It is designed to be used in different environments, where the Radon gas can accumulate more easily. The instrument is not suitable for measurements in the soil or fluids. Radon is an odorless, colorless and tasteless gas naturally present in soil and water, which penetrates into houses and workplaces through the building materials (from which it may also be released), whose accumulation can be harmful to health. Radon is part of the process of radioactive decay of Uranium. The World Health Organization (WHO) has determined that Radon is the second leading cause of lung cancer after cigarette smoking and it has recently lowered the concentration level associated with health risk from 1000 Bq/$m^3$ (Becquerel per cubic meter) to 100 Bq/$m^3$. Should the measured concentration of Radon be equal to or greater than the recommended level of 100 Bq/$m^3$, it would be advisable to undertake Radon mitigation counteractions in order to reduce its concentration to safety levels. More information concerning Radon can be obtained from:

http://www.who.int/ionizing_radiation/env/Radon/en/

A continuous measurement of Radon concentration in a period of time which ranges from a few hours to a week can provide a descriptive indication of changes in short-term concentration (for example, to assess changes attributable to the usage of a room or to quickly identify areas in which Radon concentration is higher).

A continuous measurement of Radon concentration of one month or more permits to describe more accurately the average concentration of Radon to which people who live in that area are subject (commonly known as "dose") and therefore the level of risk to which they are subject.

RStone™ allows carrying out both short- and long-term measurements of Radon concentration. In addition, through RKey™, it can be controlled from a PC via a wireless connection. RKey™ gives RStone™ additional features such as more flexible measurement scheduling and the generation of customized measurement reports. RKey™ is included in the RStone™ Plus or Pro packages, but it can also be purchased as a separate accessory for RStone™ Basic.

## 1.2 Safety

Please read carefully the information contained in this manual before installing and using the devices. Always follow the most basic safety precautions in the installation and use of the devices, including the following, which are valid for both RStone™ and RKey™:

**ALL THE PARTS OF THE PACKAGING (BOXES, CARTONS, PLASTIC BAGS, ETC…) ARE A CHOKING HAZARD TO CHILDREN. DO NOT KEEP THESE MATERIALS TO THE REACH OF CHILDREN.**

**IN PARTICULAR, RKEY™ IS A DANGER OF INGESTION FOR CHILDREN. KEEP RKEY™ OUT OF REACH OF CHILDREN.**

- **RStone™, RKey™, the power supply, cables, accessories and packaging must ALWAYS be kept out of reach of the children**;
- the device must be installed and/or used only indoor;
- **DO NOT** use the device if the power supply cord is damaged, refer to your place of purchase;

- **DO NOT** use the device if the case is damaged, refer to your place of purchase;
- the device **MUST NOT** be installed and/or used in environments where temperature might be below 5°C or exceeding 40°C;
- the device **MUST NOT** be installed and/or used outdoor;
- the device **MUST NOT** be installed and/or used in wardrobes, behind curtains, or near doors, windows or fans;
- the device **MUST NOT** be left, placed, installed and/or used near heat sources, in the direct sunlight or installed and/or used near water or other fluids, such as bath tubs, showers, swimming pools, wash basins, water-closets, bathroom fittings, washing machines, dishwashers;
- the sensor must not be immersed in water or any other liquid, **DO NOT** attempt to retrieve a sensor that has fallen into a liquid, **RISK OF ELECTRIC SHOCK!**
- the device **MUST NOT** be installed and/or used in environments near flammable gas and/or explosives, or where an explosive atmosphere might arise;
- in order to avoid condensation in the inner parts of the device, the device should be kept enclosed in a sealed plastic bag when moving it from a cold to a warm place, then wait at least 24 hours before removing the device from the bag;
- the device **MUST NOT** be installed and/or used in dirty or dusty environments or places where it might get hit or damaged;
- RStone™ is capable of detecting the presence of Radon in the immediate vicinity, thus the presence of Radon gas in adjacent rooms is not to be excluded;
- the presence of strong static or high frequency electric fields such as those emitted by televisions, radios, computers, cell phones and cordless phones, electrostatic discharges or other electrical and electronic equipment might cause the device to malfunction;
- the use of an external power supply other than that provided, is **EXPRESSLY PROHIBITED**: this could damage the device and cause malfunction, severe electric shock and fire;
- it is **EXPLICITLY PROHIBITED** to cut, modify, tamper or otherwise damage the power cord, there is a severe **RISK OF ELECTRIC SHOCK**.

*RStone™ is a Class II electrical insulation device. It is designed to operate safely without a protective earth (PE) conductor.*


*RKey™ is a Class III electrical insulation devices, since it is powered by a safety extra-low voltage (SELV) level.*

**ANY DAMAGE OR INJURY CAUSED BY NOT COMPLYING WITH THE SAFETY PRECAUTIONS ARE NOT COVERED BY WARRANTY. RSENS SRL SHALL NOT BE LIABLE FOR ANY DAMAGE OR INJURY TO HUMANS, ANIMALS AND THINGS.**

**ANY DAMAGE OR INJURY CAUSED BY TAMPERING OR MODIFICATION OF THE DEVICE BY THE PURCHASER OR ANY OTHER PERSON NOT AUTHORIZED BY RSENS SRL ARE NOT COVERED BY WARRANTY.**


## CAUTION! RISK OF ELECTRIC SHOCK!

**DO NOT OPEN THE DEVICE, DO NOT TAMPER WITH THE DEVICE OR WITH THE POWER CORDS! NO USER-SERVICEABLE PARTS INSIDE! DO NOT INSERT ANY OBJECT IN THE DEVICE VENTS.**

### 1.3 Battery replacement

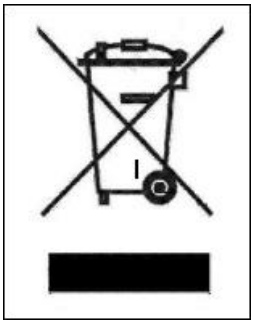
RStone™ contains a rechargeable lithium ion battery that allows extended operation in the absence of power line availability. In order to maximize the useful life of the battery it is recommended, when possible, to let the battery fully discharge before recharging it. The charge should always be complete. The rechargeable battery is subject to normal wear, thus as such it is not covered by warranty. If the operating time of the device after a full battery charge should decrease significantly, it is advisable to contact the service center to have the battery replaced with a fresh one.

**THE BATTERY MUST BE REPLACED ONLY BY RSENS TECHNICAL PERSONNEL!**

**Any attempt to replace the battery by the user or unauthorized personnel could result in damage, fire or explosion. RSens srl will not be liable in any way for any damage, explosion, or fire resulting from the replacement internal battery by the user or any other unauthorized personnel.**

The technical specifications of the battery are reported in paragraph 7.5.

### 1.4 End-of-life disposal of the device



**Information to the user about European Directives 2002/95/EC, 2002/96/EC and 2003/108/EC, concerning the reduction of hazardous substances in electrical and electronic equipment and waste disposal**

The symbol of the crossed trash can on the equipment or its packaging means that the product at the end of its useful life must be collected separately from other waste.

The user should, therefore, take the product to an appropriate recycling center for waste electrical and electronic equipment, or hand it to the dealer when buying a new equivalent product, on a one-to-one basis .

The separate collection for the deliver of the equipment to recycling, to treatment and environmentally compatible disposal helps avoid possible negative effects on the environment and health and promotes the reuse and / or recycling of materials that make up the equipment.

Illegal dumping of the product by the user involves the application of administrative sanctions provided for law.

# 2. PRODUCT DESCRIPTION

## 2.1 Front panel

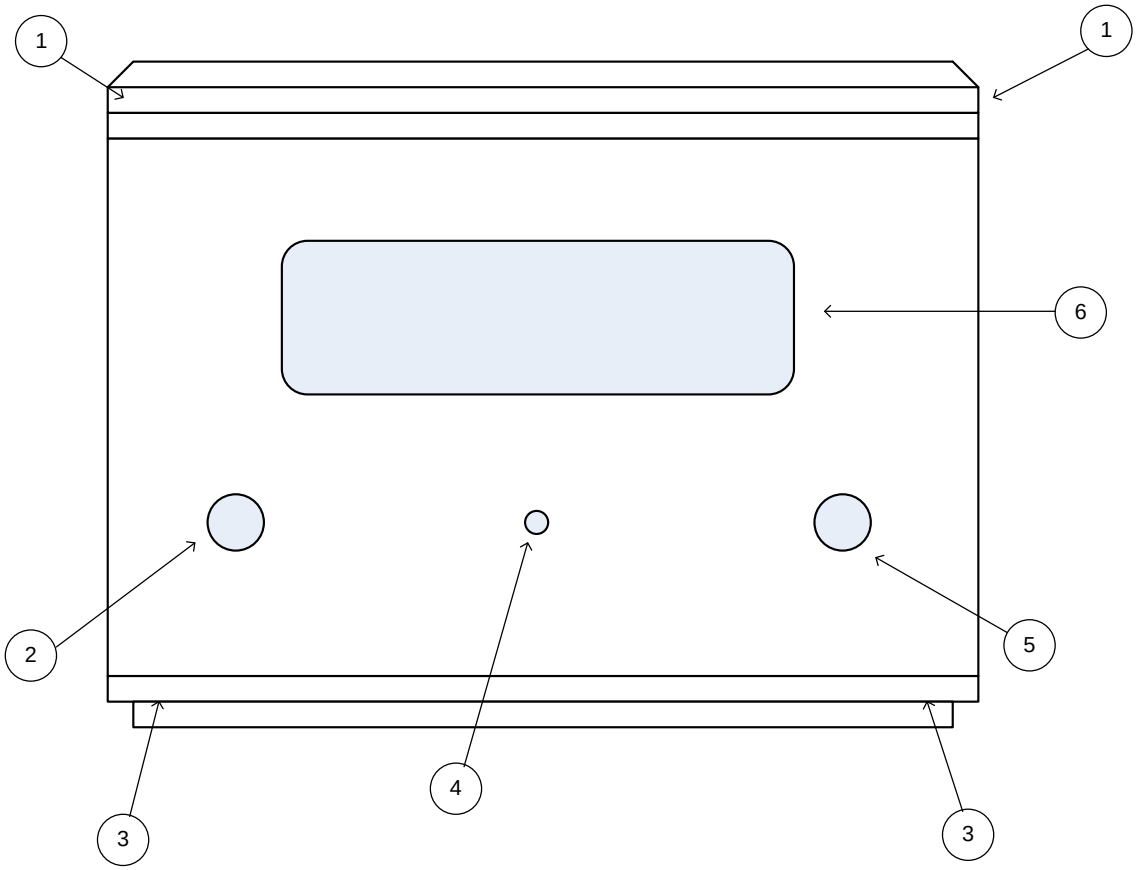



*Figure 1. Front view of RStone™*

1. Vents
2. “MENU” push button
3. Vents
4. Red LED
5. “ENTER” push button
6. Liquid crystal display

## 2.2 Rear panel

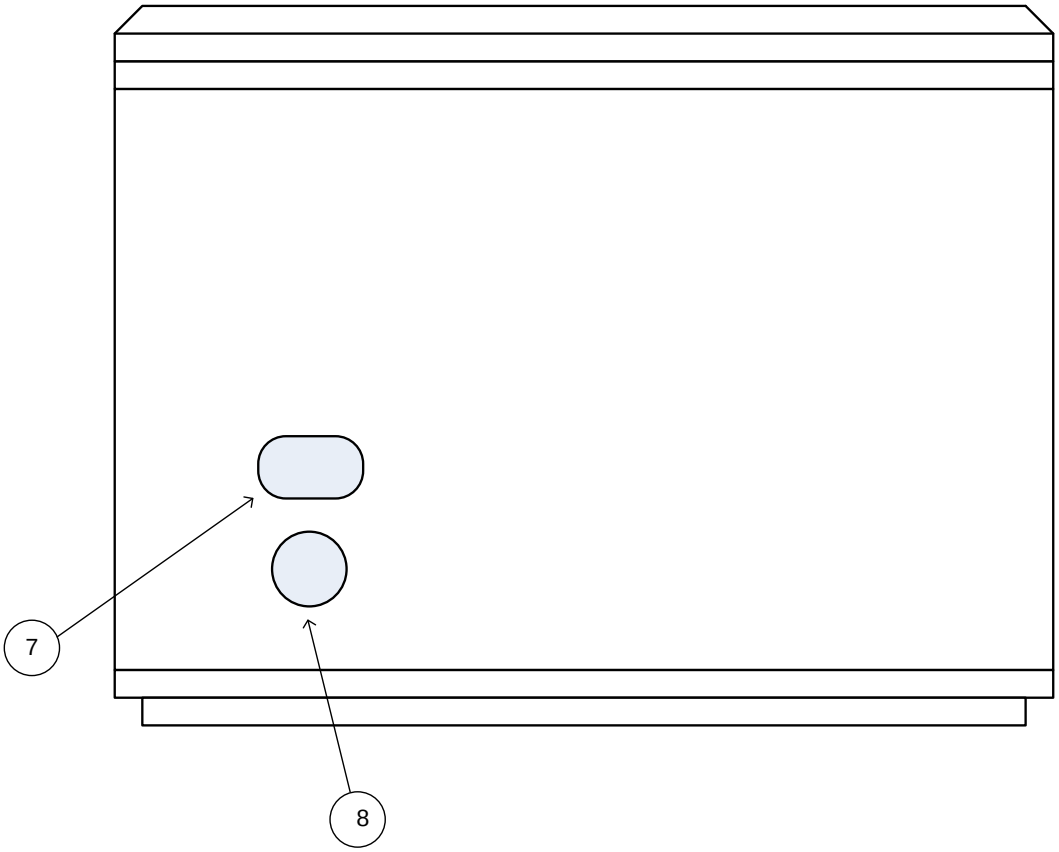



*Figure 2. Rear view of RStone™*

7. On/off rocker switch
8. Power supply jack (10V DC)

## 2.3 Power adapter

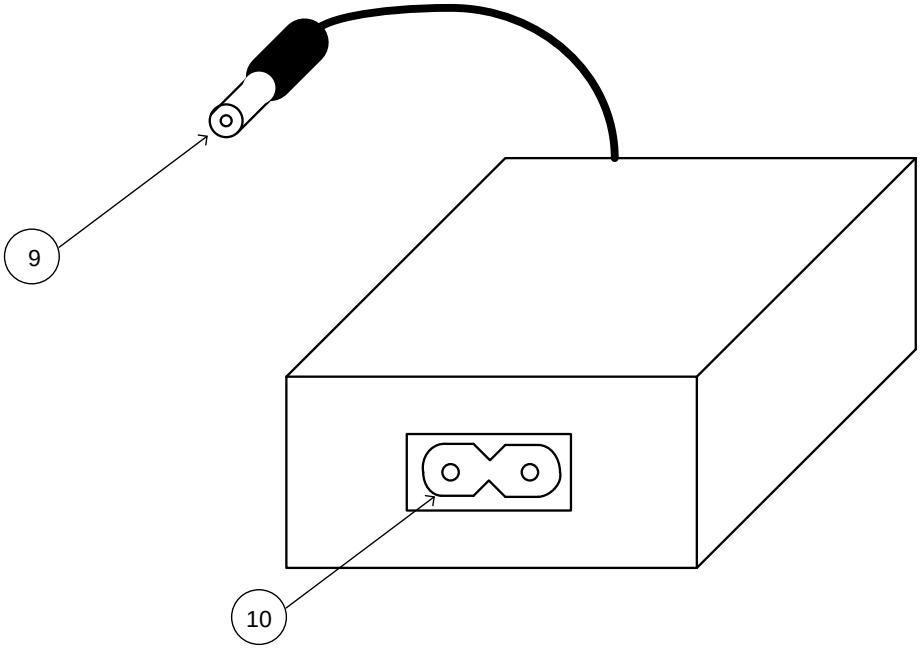



*Figure 3. View of the power adapter*

9. Power supply plug (10V DC)
10. Mains inlet (100-240 V AC – 50/60Hz)

## 2.4 Label

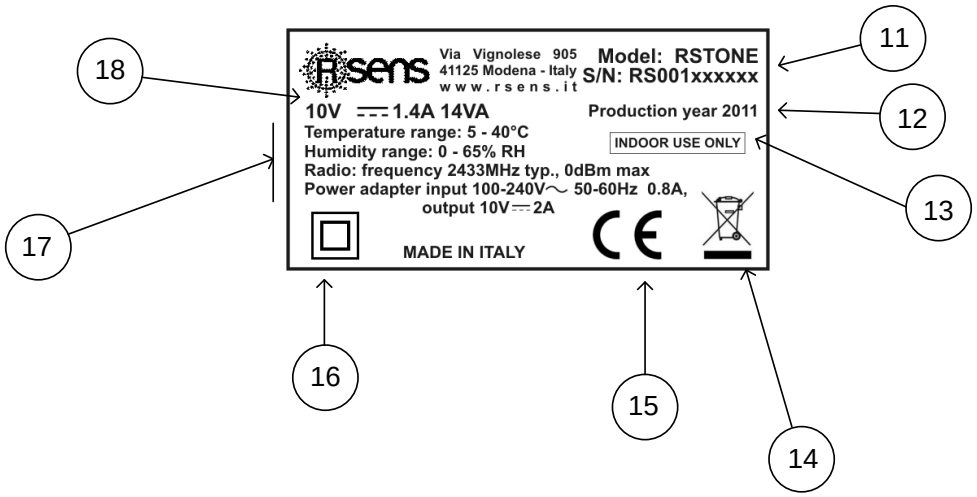



*Figure 4. RStone™ label*

11. Model and serial number of the device
12. Production year
13. The device must be used in indoor environments only
14. The device must be collected separately from other waste, see paragraph 1.3
15. The device complies to the EU safety standards and requirements
16. The device is provided with double electrical insulation (Class II) and is designed to operately safely without protective earth
17. Environmental and technical operating specifications. Technical specifications of the power adapter, see paragraph 2.3. Please refer to Chapters 7 and 8. An explanation of the label items follows:
    - *Temperature range*: it is the ambient temperature range within which the device can be stored and used;
    - *Humidity range*: it is the ambient relative humidity range within which the device can be stored and used;
    - *Radio*: the operating parameters of the RStone™ onboard wireless-device: this interface operates at a typical frequency of 2433 MHz with a maximum radiated power equal to 0 dBm. This interface communicates with RKey™;
    - *Power adapter*: technical specifications of the external power adapter, see paragraph 2.3. Mains input range (from 100 to 240 V with frequency in the range 50 to 60 Hz and maximum input current 0.8 A) and the output characteristics (yields 10 V DC, 2 A max) are reported;
18. Rated DC voltage and current at input power supply jack 8

# 3. PRODUCT INSTALLATION

## 3.1 Package contents

First of all make sure that all these items are inside the package:

- RStone™
- Power adapter
- Power cord
- Quick start guide
- Certificate of Warranty
- R&TTE Declaration of Conformity
- RKey™ (only RStone™ Plus and RStone™ Pro)

## 3.2 Preliminary tasks

If the product has been kept at a temperature below 0°C it is recommended to let it acclimate in the environment in which you intend to use it for 24 hours inside its original packaging, before removing it from the box.

**Thoroughly inspect RStone™, RKey™ (if applicable), the external power supply and power cords. Should any of these items be damaged do not proceed with the installation, do not turn the device on and contact your dealer.**

If no damage is found, please follow these steps for proper installation of the product, by referring to Figures 1, 2 and 3 (for the use of RKey™ see Chapter 5):

- Make sure that the on/off rocker switch 7 of RStone™ is in the "O" position (i.e. off).
- Plug the power cord into the mains inlet 10 of the power adapter.
- Plug the power supply plug 9 into the power supply jack 8 of RStone™.
- Plug the power cord to an appropriate mains outlet.

**WARNING! PLUG THE POWER CORD TO A NORMAL DOMESTIC MAINS OUTLET RATED AT 230V - 50Hz IN THE E.U. OR RATED AT 120V - 60Hz IN THE UNITED STATES.**

**The power supply operates properly with an input voltage between 100V AC and 240V AC with a frequency between 50Hz and 60Hz.**

**WARNING! CONNECTION TO A MAINS OUTLET OF RATINGS DIFFERENT FROM THOSE STATED ABOVE MAY CAUSE FATAL DAMAGE TO THE SYSTEM, FIRE OR EXPLOSION.**

RStone™ internal battery is now charging, if it is not fully charged. A drained battery can take up to 10 hours of time to fully charge.

## 3.3 System settings

For a precise identification of the time of beginning and end of a measurement, RStone™ is provided with an internal clock powered by a small backup battery that keeps the date and time

information updated even when the system is off, when the rechargeable battery is low and the mains supply is not available.

It is possible to set the language of the messages shown by display 6.

To set the language, the date and the time, the internal rechargeable battery must be charged or there must be the external power supply connected to an available mains outlet.

Please follow this procedure:

- Turn on RStone™ by setting the on/off rocker switch 7 to the "I" (i.e. on) position.

  *The display shows a welcome screen. Hour is 00:00*

- Press button 2 – "MENU" until the display reads "SETUP"
- Press button 5 – "ENTER"
- Press button 2 – "MENU" until the display reads "SET LANGUAGE"

  *The display reads: "SET LANGUAGE"*

- Press button 5 – "ENTER"

  *The display reads "ENGLISH"*

- Press button 2 – "MENU" until the display shows the desired language.
- Press button 5 – "ENTER" to confirm your choice

  *The display reads "SET LANGUAGE"*

- Press button 2 – "MENU" until the display reads "SET TIME"
- Press button 5 – "ENTER"

  *The display reads "SET HOUR"*

- Press button 5 – "ENTER"

  *The display reads "HH:00"*

- Press button 2 – "MENU" to increase the hours until the correct is displayed (from 00 to 23)
- Press button 5 –"ENTER" to confirm

  *The display reads "SET HOUR"*

- Press button 2 – "MENU" until the display reads "SET MINUTE"
- Press button 5 – "ENTER" to confirm

  *The display reads "MM:00"*

- Press button 2 – "MENU" to increase the minutes until the correct value is displayed (from 00 to 59)

- Press button 5 –“ENTER” to confirm

  *The display shows “SET MINUTE”*

- Press button 2 – “MENU” until the display reads “BACK”
- Press button 5 –“ENTER”

  *The display reads “SET TIME”*

- Press button 2 –“MENU” fino until the display reads “SET DATE”
- Set day, month and year in a similar fashion.
- Eventually press button 2 – “MENU” until the stand by screen is displayed

  *The display should now read the correct date and time*

It is now possible to place RStone™ in the desired environment to be monitored. The instrument can operate properly both when it is powered via the external power supply and when it is operated by battery power. In the latter case, the sensor body can be operated in places where there is no power line availability.

## 3.4 How to correctly position the sensor

The sensor allows to measure the concentration of Radon in the environment where it is placed. To obtain an accurate measurement it is recommend that you follow these simple guidelines. Approximately a sensor allows to measure the concentration of Radon in a closed environment of about 50 $m^2$. If the environment is larger, then it is advisable to make multiple measurements by placing the sensor in different areas of the environment.

The sensor body must be positioned in a flat, stable place, raised at least 50 cm above the floor. The sensor body has the vents 1 and 3, which - for the proper operation of the instrument - must not be blocked. It 'is therefore advisable not to place the sensor body behind curtains, doors or windows or in a place whose conformation may hinder or obstruct the vents or alter the flow of air within the instrument. It is therefore recommended to maintain a minimum distance of 25cm between the sensor body and the walls and 50cm between the sensor and doors, windows, radiators, stoves, air conditioners.

Due to the layout of a building, the concentration of Radon varies from room to room. Because Radon escapes from the soil and from the building materials themselves, the sensor should be placed in a basement or a cellar where possible, but also in rooms at different floors, when possible, in order to obtain a measurement which is descriptive of the maximum concentration of Radon in the environment. It is recommended that measurements of Radon concentration be carried out even in those environments where people spend most of their time, such as bedrooms. It is indeed important to quantitatively assess the radiation dose received from exposure to Radon.

In general it is advisable to take measurements while keeping closed the doors and windows of the environment in which the measurement is taking place. If the environment is provided with a ventilation system, keep it in the normal operating condition.

# 4. BASIC USE OF RSTONE™

This chapter explains the basic tasks to take a measurement and then to view the results. For advanced use of the device, see the Chapter "5. Advanced use of the device".

## 4.1 Browsing the menu items

RStone™ is provided with an user interface consisting of a backlit display 6, a red LED 4, the pushbutton “MENU” 2 and the pushbutton “ENTER” 5, as shown in Figure 1.

It is useful to become familiar with the simple menu system of RStone™, and learn how to browse the single menu items

RStone™ is provided with two groups of menu items:

- the device programming menu group;
- the measurement menu group.

The device programming menu group is the one which is enabled at the device power up and it is useful to configure the device (date, time, units of measure, recall of previous measurement results). It also allows the user to set and start a measurement. This group of menus is not active during a measurement. When the system is in the programming mode, the LED 4 blinks slowly at a frequency of about one flash every second.

The measurement menu group is active during measurements and allows the user to check at any time the status of the current measurement and preview the data currently available. It also allows the user to stop a measure that is currently in progress. During a measurement, the red LED 4 blinks very slowly at a frequency of about one blink every 5 seconds. At the end of a measurement, the system returns to the programming status and the device programming menu group is active.

Each of the two menu groups features a variety of menu items. Figures 6 and 7 give the complete structures of the two menu groups.

Referring to such structures, the following rules hold:

- by pressing the button 2 – “MENU” the user moves VERTICALLY between two adjacent menu items
- by pressing the button 5 – “ENTER” the user moves HORIZONTALLY between two adjacent menu items, the rightmost of the two being a submenu of the left one

This is sketched in Figure 5.

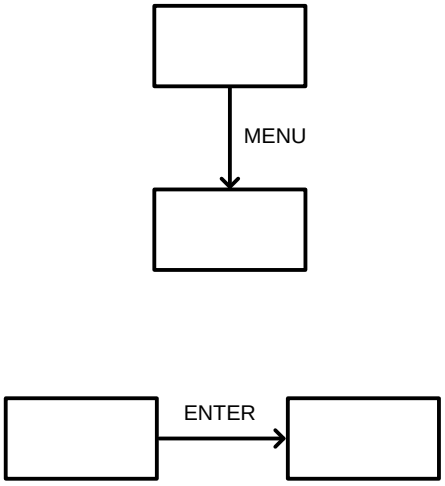



*Figure 5. Browsing the menu items*

Figure 6 shows how to browse the menu items.

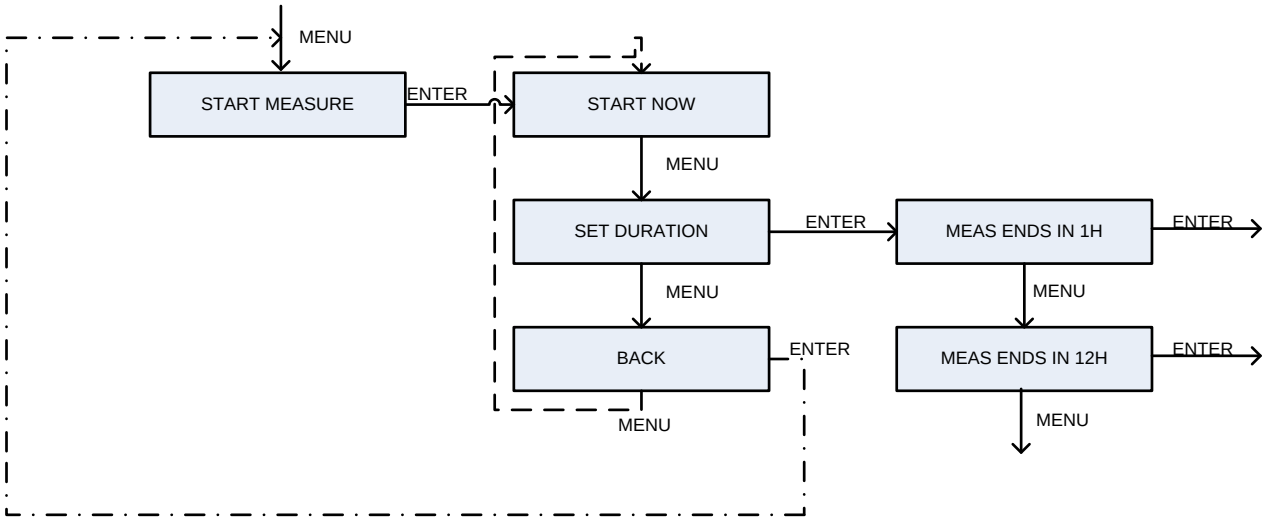



*Figure 6. Browsing the menu items*

For example, if the current menu item is "SET DURATION", by pressing the button 2- MENU one goes to the next item ("BACK"), whereas by pressing the button 5 - ENTER one goes to the menu item "MEAS ENDS IN 1H" .

If the current menu item is "BACK", by pressing the button 2 – MENU one goes back to the first item of the same menu level (following the dashed line) , by pressing button 5 - "ENTER" one goes back to the parent menu items, (following the dash-dot line, not shown in the following menu structures to avoid impairing their readability).

In the previous example, if the current menu item is "BACK", by pressing button 2 – MENU one goes back to the menu item "START NOW"; instead pressing button 5 – ENTER one goes back to "START MEASURE" of the parent menu item level.

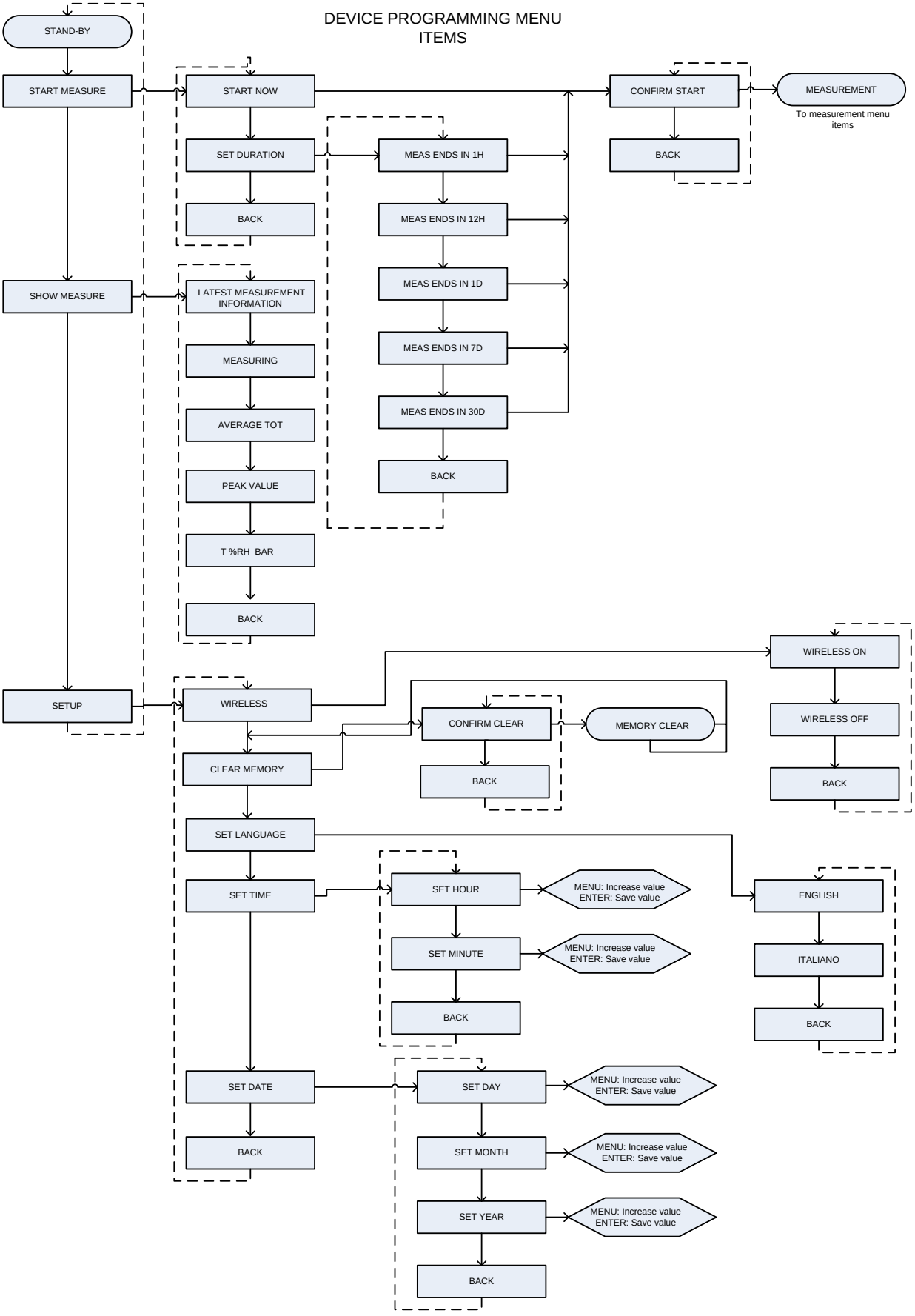



*Figure 7. Device programming menu items*

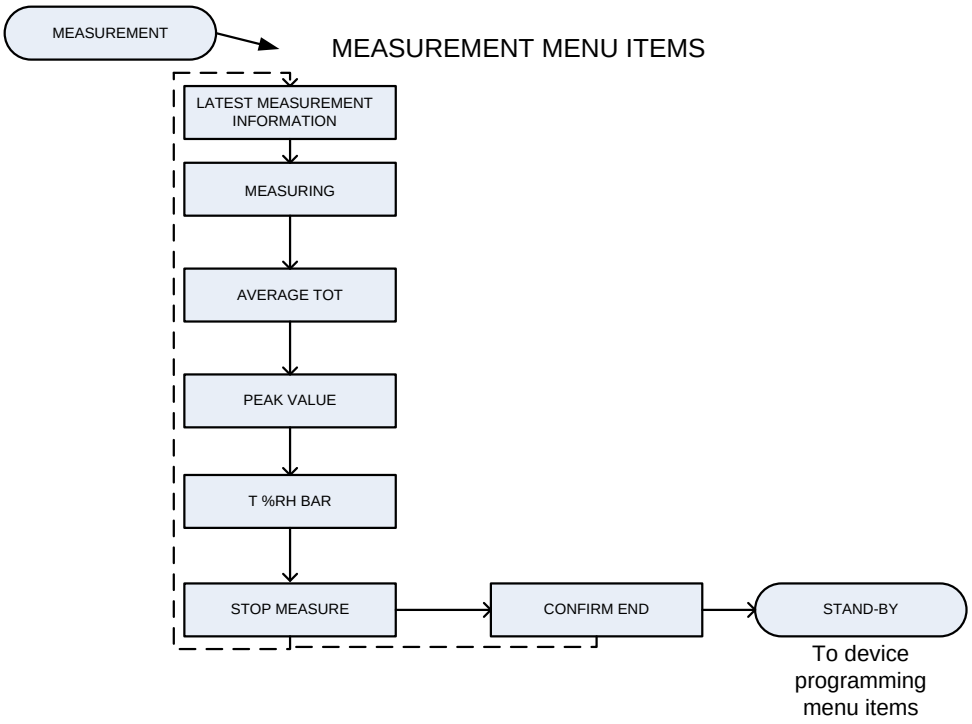



*Figure 8. Measurement menu items*

## 4.2 Programming and executing a measurement

RStone™ allows the user to issue a measurement having the following fixed durations:

- indefinite – terminated by the user
- 1 hour
- 12 hours
- 24 hours
- 7 days
- 30 days

It is recommended to refer to the sketch of the menu structures shown in Figures 6 and 7.

### *How to program a measurement having indefinite duration*

To make a measurement having indefinite duration, being in the programming mode and in stand-by, reach the menu item START MEASURE > START NOW > CONFIRM START then press button 5 – ENTER.

RStone™ is now performing a measurement and the display shows the measurement menu.

To end the ongoing measurement, refer to the measurement menu shown in Figure 7 in order to reach the menu item STOP MEASURE > CONFIRM END then press button 5 – ENTER. The display now shows the device programming menu items and RStone™ is in stand-by.

### *How to program a measurement having fixed duration (1 hour, 12 hours, 24 hours, 7 days, 30 days)*

To make a measurement having fixed duration –referring to the device programming menu in Figure 6- reach the menu item START MEASURE > SET DURATION > MEASURE ENDS IN 1H (or the desired duration) > CONFIRM START then press button 5 - ENTER.

RStone™ is now performing a measurement and the display shows the measurement menu.

To end the ongoing measurement, refer to the measurement menu shown in Figure 7 in order to reach the menu item STOP MEASURE > CONFIRM END then press button 5 – ENTER. The display now shows the device programming menu.

The display now shows the device programming menu and RStone™ is in stand-by.

## 4.3 View the measurement data

The system is capable of displaying the data provided by the latest measurement completed or the provisional data obtained from a measurement in progress. In both cases the quantities that can be displayed are as follows:

- Menu item: "MEASURING". Concentration during the latest 60 minutes of measurement: the instrument upgrades every hour the Radon concentration value. This value represents the most recent concentration value measured by the instrument, in $Bq/m^3$.

- Menu item: "AVERAGE TOT". Overall average concentration: it represents the average value of Radon concentration since the beginning of the measurement.

- Menu item: "PEAK VALUE". Peak value of the concentration from the beginning of the measurement: it represents the highest value of Radon gas concentration recorded by the instrument since the beginning of the measurement.

- Menu item: "T %RH BAR". Temperature, relative humidity and barometric pressure: these parameters are updated once every hour and provide key information used by the instrument for the computation of the concentration of Radon gas in the environment. The temperature is measured in degrees centigrade (Celsius), the relative humidity is expressed as a percentage and the barometric pressure is in bar.

- Menu item: "LATEST MEASUREMENT INFORMATION". Timing and measurement sequential numbering: the system is provided with an internal non-volatile memory that allows all the measurements to be saved. Each of them is assigned a sequential number and each of them keeps track of the time of beginning and end of the measurement. RStone™ is able to show the sequential number and the start time of the latest measure completed or in progress. Referring to Figure 9: *nn* measurement sequential number; *hh:mm* hours and minutes of the beginning of measurement *nn*, *dd/mm/yyyy* day when such measurement began.

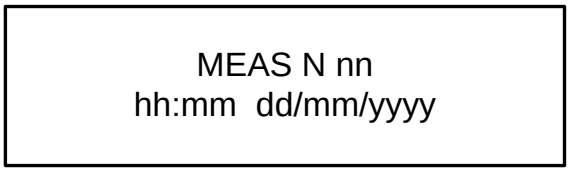



*Figure 9. Menu item displaying the latest measurement information*

### *How to display the data of the most recent completed measurement*

This is possible only when the instrument is NOT currently carrying on a measurement: the enabled menu items are those of the device programming group, sketched in Figure 7.

Reach the menu item SHOW MEASURE, then press button 5 – ENTER to gain access to the list of the parameters that can be displayed. Browse such list by using button 2 – MENU then select the parameter to be displayed by pressing button 5 – ENTER.

Example: to display the average overall concentration reach the menu items SHOW MEASURE > AVERAGE TOT, then press button 5 – ENTER.

The information thus obtained are those of the latest completed measurement.

### *To preview the data of an ongoing measurement*

This is possible only while the instrument is carrying on a measurement: thus the enabled menu is the measurement menu sketched in Figure 8.

Press button 2 – MENU until the display shows the parameter of interest.

The information thus obtained pertains to the currently ongoing measurement.

## 4.4 Exceeding the risk concentration level

If, during a measurement, the system detects a level of Radon gas concentration greater than 200 $Bq/m^3$ the display backlight will flash until either button 2 or 5 are pressed. When one of these buttons is pressed, the sensor returns to the measurement mode.

**Exposure to high Radon concentrations is extremely harmful to health. If it is found the presence of Radon concentrations above the alarm threshold it is recommended to limit the stay in that environment to the minimum necessary, air it regularly and ask the competent authorities to take action as appropriate in this condition in order to find possible solutions for the problem. It is strongly recommended in this case that a more detailed analysis is carried out in order to determine the annual average concentration of Radon and then evaluate possible counteractions.**

## 4.5 Clearing the non-volatile memory of RStone™

**WARNING! THIS CAUSES THE LOSS OF ALL DATA OF ALL MEASUREMENTS STORED IN RSTONE™!**

This is possible only when the system is in its programming state. Referring to the device programming menu sketched in Figure 7, reach the following item:

SETUP > CLEAR MEMORY > CONFIRM CLEAR, then press button 5 – ENTER to definitely erase ALL the memory content.

# 5. ADVANCED USE OF THE DEVICE

## 5.1 Introduction

RStone™ has some advanced operating modes that allow a better exploitation of device capabilities.
The sensor body has its own internal proprietary wireless radio interface which allows the user to manage configuration and measurement functions by using a personal computer equipped with the application software EasyRadon or RadonPro.

To exploit such wireless communication capability, it is necessary to use RKey™, which is a USB device that provides the sensor body RStone™ with a wireless access point . RKey™ is standard with RStone™ Plus and RStone™ Pro, while it can be purchased separately in the case of RStone™ Basic. A single RKey™ can control up to 10 RStone™s by means of RadonPro and one RStone™ only by means of EasyRadon. Anyway, the distance of wireless communication between RStone™ and RKey™ can reach 50m in the open space.

The advanced features provided by the use of RStone™ in conjunction with RKey™ and EasyRadon or RadonPro are :

- capability of programming a measurement of user-defined duration;
- capability of accessing all the measurements stored in the non-volatile memory of RStone™;
- capability of printing a report on performed measurements. Moreover, RadonPro allows also measurement data to be exported as CSV (comma-separated values) files, so that they can be edited by means of any spreadsheet;
- RadonPro allows controlling a sensor network made of up to 10 RStone™ devices. Thus it is possible to manage multiple RStone™ sensors to create a map of Radon concentration in wide environments.

To use the instrument in remote control mode the wireless radio interface of RStone™ must be enabled. This is possible only when the device is in programming mode, so refer to the programming menu, shown in Figure 7.

To enable the wireless interface in RStone™ reach the following menu item:

SETUP > WIRELESS > WIRELESS ON then press button 5 – ENTER.

Now RStone™ tries to connect to a RKey™ within communication range. After the connection has been established and for all the time the connection is maintained, RStone™ can ONLY be controlled remotely via a PC and RKey™ by means of EasyRadon or RadonPro. Although RadonPro offers more functionalities with respect to EasyRadon, both softwares basically share the same user interface. Therefore, in the following paragraphs the phrase “Control Software” will be used to identify either EasyRadon or RadonPro without distinction. In those cases where one of them is explicitly referred to, that software will be referenced by means of its own name.

## 5.2 How to install the control software

To install the control software, first of all download it from www.rsens.it. In order to let it work properly, it is recommended to install the software prior to connecting RKey™ to the computer for the first time. The control software requires a personal computer with the following minimum requirements:

- Pentium® processor or similar, clock frequency 1 GHz or higher
- At least 512 MBytes of RAM
- At least 1 GByte of free space on the hard disk
- Windows XP Service Pack 3 operating system or later

To make the Control Software work properly, it is necessary to install Microsoft® .NET Framework version 4.0. Should that software not be already installed on the PC, the install procedure will ask for the installation and will proceed to complete it.

In order to install the control software, open the folder where it has been downloaded and double-click “Setup.exe” to begin the installation procedure. Figure 10 shows the startup screen of the installation procedure. Only the procedure for EasyRadon is displayed, since the one for RadonPro is the same.


*Figure 10. Startup screen of the installation procedure for the control software*

Click “Next” to proceed with the installation. Figure 11 shows the following screen.

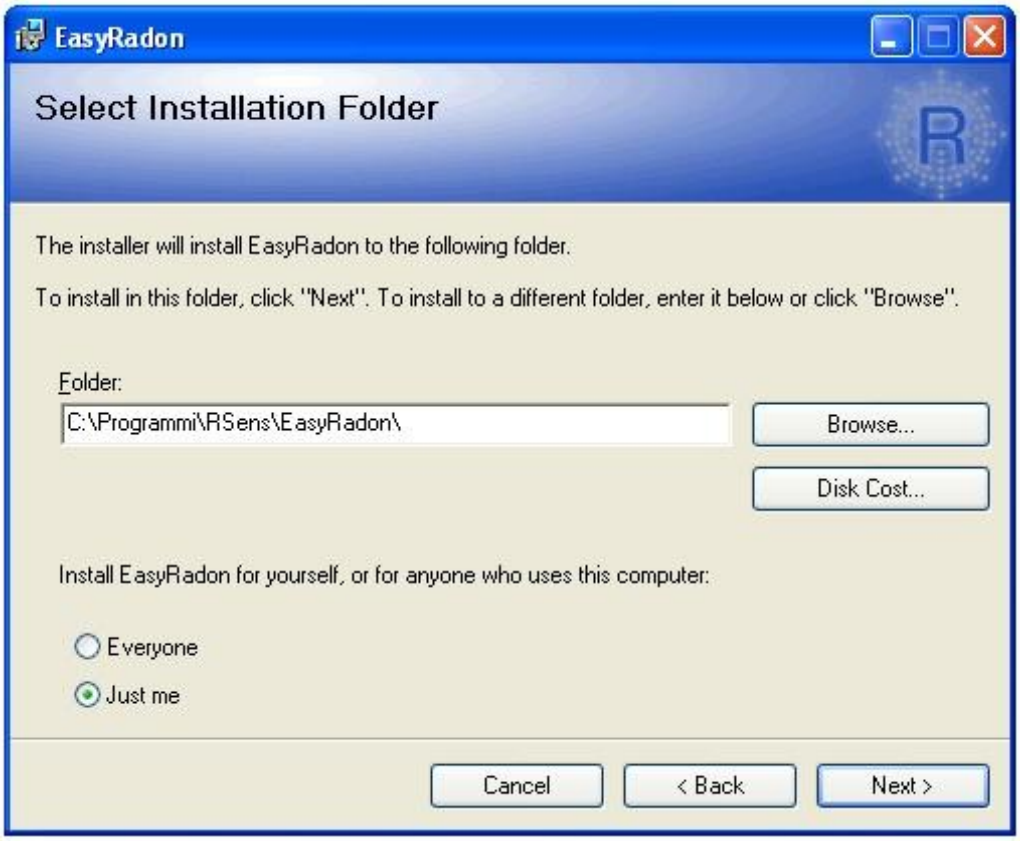



*Figure 11. Choice of the installation folder*

Although it is recommended to keep the default settings, it is possible to customize the target installation folder. To do this click “Browse” and then select the desired folder from the displayed list.
Then, choose whether the software is to be installed for the current user or for all the user accounts of the PC. Then click “Next”. Figure 12 shows the following screen.

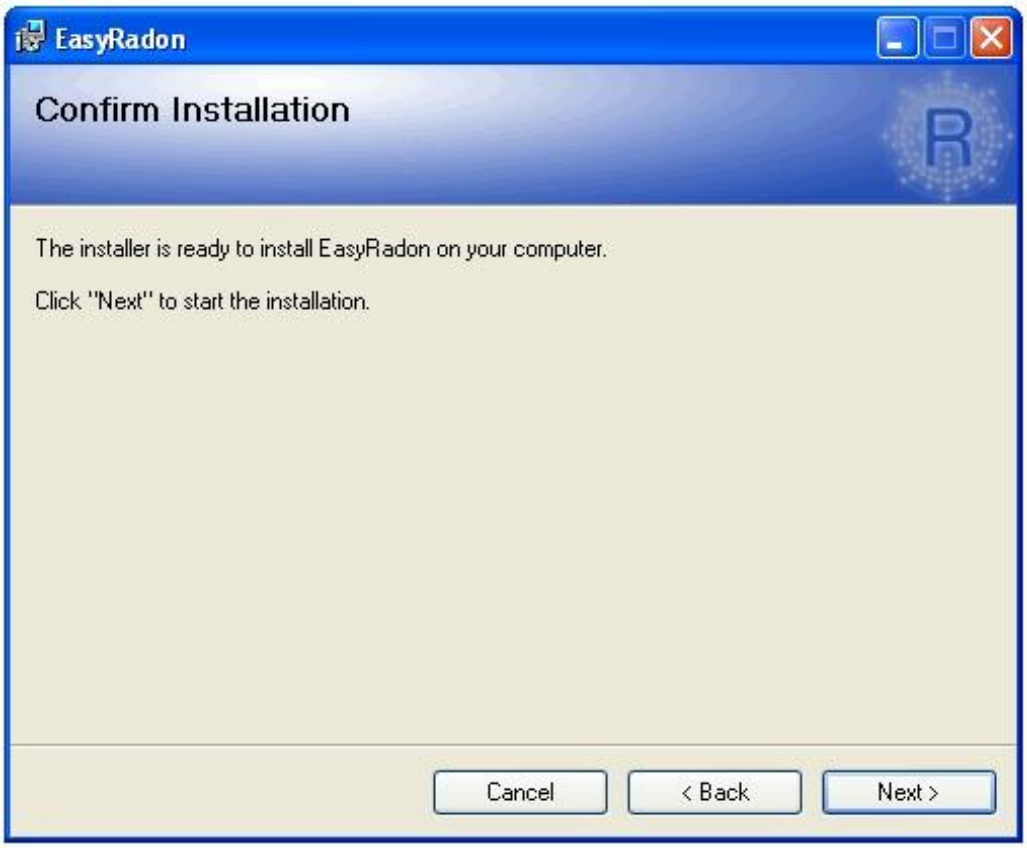



*Figure 12. Installation confirmation*

By clicking “Next” the system will install the control software and all the required drivers onto the PC. The process might last several minutes. At the end of the installation process, a link to the control software will be created on the Desktop and an entry will be placed in the Start menu.

## 5.3 Installation of RKey™

The installation procedure of the control software will also install the USB drivers for RKey™. This makes the installation of RKey™ easy. Please make sure that the control software has been correctly installed before RKey™ is plugged for the first time into a USB port of the PC. This will avoid potential installation issues. After installing the control software, plug RKey™ into a free USB port of the PC. The computer will recognize the connected device and then it will copy the driver files into the correct folder. This might take several minutes. After the installation of RKey™ has been completed, the user is notified that RKey™ has been correctly installed.

## 5.4 Controlling RStone™ by means of the control software

The first time the control software is launched, the user is required to enter the 11-character serial number of the RKey™ device that will be used. By inserting a wrong serial number it will not be possible to use the software.

It is possible to change the RKey™ to be used with the software at any time, simply by entering the new RKey™ serial number in the “Registration” item of the “Help” menu.

The control software has been designed in order to ensure the utmost ease of control of RStone™ using your PC. Figure 13 shows a screenshot of the main window. First, you can configure the control software for what concerns the language and, in the case of RadonPro, the working directory.

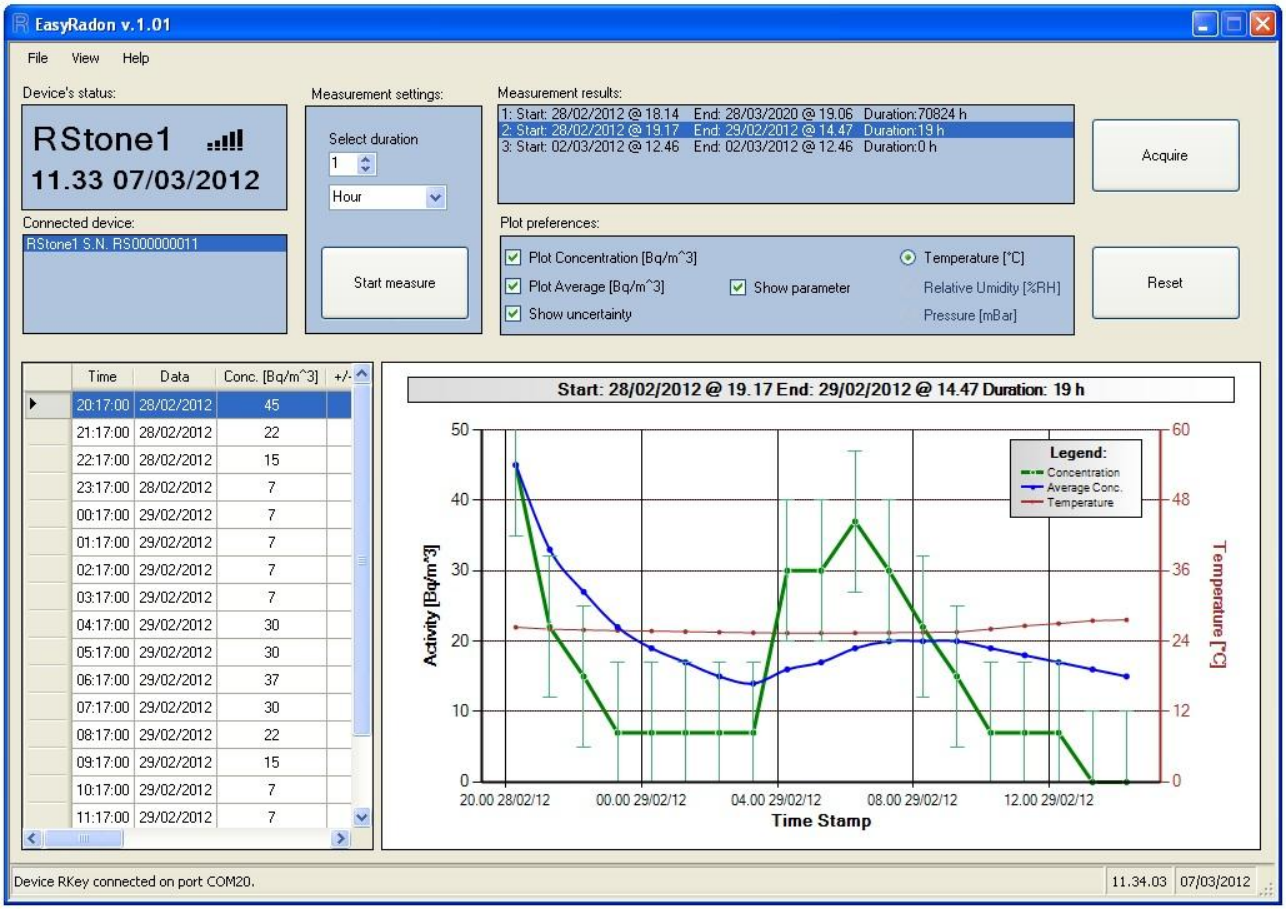



*Figure 13. Control software main window. EasyRadon is shown.*

### *Setting the language*

First set the language, click on the menu item "View" and then "Settings". Select the language by clicking on "Italian" or "English".

### *Setting the working directory (RadonPro only)*

By clicking on the menu item "View" and then "Settings", the user can specify the folder where RadonPro measurement reports are to be saved in CSV format.

In order to remotely control one or more RStone™s, RKey™ must be connected first.

### 5.4.1 Connection of RKey™

The connection of RKey™ to a computer USB port must be done before launching the control software. After the software has been launched, it will automatically connect to RKey™. A message in the bottom side of the control software main window confirms the succesful connection of RKey™ and the virtual COM-port number assigned to the device.

Should such message not appear, it is suggested to close the control software, unplug RKey™ then repeat the connection procedure outlined before.

### 5.4.2 Remote connection to RStone™

After making sure that the connection between the control software and RKey™ has been established, to remotely control RStone™ it is necessary to enable its wireless radio interface. To do this, follow the procedure outlined in Section 5.1. After activating the wireless interface, the first responding RStone™ within communication range is detected automatically by the control

software. Up to 10 RStone™s can be connected to RadonPro. To connect more than one RStone™ with RadonPro, click “Find new RStone™” in the “File” dropdown menu. EasyRadon allows only one RStone™ to be controlled. In the case EasyRadon is used and multiple RStone™s are within communication range, the software will connect to the first one responding. A list of discovered devices is shown in the left window called "Connected device". Note that in the case of RadonPro this list is updated automatically when one or more RStone™s are connected or disconnected. If, within that list, the user clicks on one of the devices listed (that is, connected) , its status is shown in the window called "Device Status".

The "Device Status" window shows the following information: name of the selected device, signal strength of the wireless link between the device selected and RKey™, date and time set in the device. When RStone™ is performing a measurement, each value of Radon concentration collected is associated with the time instant when such value was collected. It is thus recommended to keep the PC system date/time up to date.

### 5.4.3 How to program a measurement of user-defined duration

In the case of RadonPro, in order to program a measurement having a user-defined duration, the user must first click on the RStone™ device to be programmed within those in the list of devices found in the "Connected device" window. Notice that the serial number of the RStone™ is displayed alongside the device name, so that it can be precisely identified among the other RStone™s listed. Instead, in the case of EasyRadon, only one RStone™ is listed therefore it is not necessary to click on the name of the device.

Then, in the "Measurement settings" window, use the dropdown menu below the text "Select duration" to set the duration of the measurement.

Now, by clicking on the button "Start measure" the user-defined measurement will be programmed in RStone™. The measurement starts immediately. After doing this, the user can quit the control software (see Section 5.4.8) and disconnect RKey™ since the programmed information and timing are stored in RStone™.

### 5.4.4 Downloading measurement data from RStone™

After carrying out the procedure for connecting RStone™ devices to the control software, according to the procedure outlined in Section 5.4.2, the list of the currently connected devices is shown in the "Connected device" window on the left. By clicking on a connected device from the list, the window labeled "Measurement Results" shows the list of measurements carried out and stored in the non-volatile memory of the selected RStone™ device. These are available for download. For each measurement stored into the non-volatile memory of RStone™ the following information are reported: sequential numbering, date and time of the beginning of the measurement, date and time of its end and its total duration. Click on the measurement you want to download on the PC, then click the "Acquire" button.

Of course, in the case of EasyRadon it will not be necessary to click on the selected device name to display measurement information since only one RStone™ will be listed.

The download time is strongly dependent on the measurement duration. Typically, it takes approximately 1 s to download the data of 6 hours of measurement.

While data are being downloaded, they are represented in a graph in the center of the main window of the control software. The plot represents time-courses of quantities measured by the instrument. By means of the “Plot preferences” checkboxes it is possible to configure the graph

choosing the measured quantities to be displayed. Available quantities are: Radon concentration ($Bq/m^3$), average Radon concentration ($Bq/m^3$), Temperature (°C), Relative Humidity (%RH) and Pressure (mbar). Relative Humidity and Pressure are not available in EasyRadon. Moreover, measurement uncertainty for Radon concentration can be displayed both for EasyRadon and RadonPro.

A table on the left side of this chart is populated with data as they are downloaded. Each row of this table refers to measurement data representative of 60 minutes of time. For each measurement point, the collection time (column "Time"), the day (column "Date"), and the available measured quantities are reported. With RadonPro, such table can be selected, copied (Ctrl+C) and then pasted (Ctrl+V) into any spreadsheet. This allows the user to access measurement data and postprocess them (if necessary). Moreover, RadonPro saves table data into a CSV file stored into the working directory specified in Section 5.4.

Notice that downloading a measurement does not remove it from RStone™ non-volatile memory.

### 5.4.5 Creating a measurement report

It is possible to create a measurement report and print it. In order to do this, the measurement data of interest must be preliminarly downloaded according to the procedure outlined in Section 5.4.4. When the data downloading process is finished, select the menu “File” and then “Print Report” to print a measurement report of the selected measurement. Such report includes the same plot as displayed in the control software and measurment time information such as duration and measurement start- and stop- time. In addition, environmental quantities as measured by the instruments are reported. RadonPro is capable of including optional operator and customer information in the report: after clicking “Print Report”, the user is requested to specify whether operator and customer information are to be included in the report. The generated report will include such information as requested.

### 5.4.6 Clearing the non-volatile memory of RStone™

**WARNING! This procedure will erase ALL the data of ALL MEASUREMENTS from the non-volatile memory of RStone™. After this procedure it will no longer be possible to retrieve such data!**

To erase the memory of RStone™, connect the device as described in Section 5.4.2. Select the device from the list of devices found by clicking on the device of interest. After the list of stored measurement appears in the "Measurement Results" window, click on the "Reset" button. As a proof of deletion, the list of the measurements should now be empty.

### 5.4.7 Getting Help

To download the latest version of this guide, click on the “ Help" drop-down menu , then "Help" and then "Online Help", or simply press Ctrl+H.

### 5.4.8 Quitting EasyRadon

To quit EasyRadon simply access the "File" drop-down menu then "Close". The same effect occurs with the key combination Alt+F4.

# 6. CARE AND MAINTENANCE

The product is equipped with vents (1 and 3, Figure 1), which must be kept free from dust in order to get an accurate measurement of the concentration of Radon gas in the environment. Prevent an excess of dust from depositing onto the sensor body. To clean RStone™ gently weep its body with a clean soft dry cloth approximately once a week. Do not use chemicals, which could damage the device and potentially cause fire or explosion. Do not use either liquid or a wet cloth, because the liquid might leak inside the device and potentially cause damage, fire, explosion. Do not touch a wet device, because there is a risk of electric shock.

**Always follow the most basic safety rules and follow the instructions given in Section "1.2 Safety".**

If the device is to be transported or stored for a long time, it is recommended to enclose it within its original packaging, using a plastic bag for each item. Prevent the device from suffering shocks, falls, or exposure to excessive heat or cold or excessive moisture. Refer to Section 7.1. A device that has been kept, stored or transported at temperatures below 0°C prior to use must be allowed to acclimate to room temperature for at least 24 hours in its own sealed bag, in order to avoid condensation.

# 7. RSTONE™ TECHNICAL SPECIFICATIONS

## 7.1 General

| | |
|---|---|
| *External supply voltage input* | 100-240 VAC, 50-60 Hz, 0.8 A |
| *RStone™ voltage input* | 10 V, 1400 mA |
| *Temperature (storage and working)* | 0°C – 40°C |
| *Relative humidity (storage and working)* | 0% RH – 95% RH |
| *Battery Life* | 15 days typ. |
| *Storage capacity* | 100 measurements of 1 year each |
| *Dimensions* | 16x16x11 cm |
| *Weight* | 1.8 kg |

## 7.2 Radon concentration measurement

| | |
|---|---|
| *Measuring range* | 0 $Bq/m^3$ … 5 $MBq/m^3$ |
| *Sensitivity* | 5 count/h @ 100 $Bq/m^3$ |
| *Uncertainty* | 20% after 4h @ 150 $Bq/m^3$ or after 1h @ 500$Bq/m^3$ *(coverage factor k=1)* |
| *Blank count rate (null Radon concentration)* | 0.05 count/h (1.2 $Bq/m^3$) |
| *Update rate* | 60 minutes |
| *Alert threshold* | 200 $Bq/m^3$ (ref. Eur. Recomm. 90/143/Euratom) |

## 7.3 Other environmental measurements

| | |
|---|---|
| *Temperature full-scale range* | -40°C … +125°C |
| *Temperature resolution* | 0.04°C |
| *Temperature accuracy* | ± 0.3°C typ. |
| *Pressure full-scale range* | 50 kPa … 115 kPa |
| *Pressure resolution* | 0.15 kPa typ. |
| *Pressure accuracy* | ± 1 kPa typ. |
| *Relative humidity full-scale range* | 0% RH … 100% RH |
| *Relative humidity resolution* | 0.7% RH |
| *Relative umidity accuracy* | ± 2% RH typ. |

## 7.4 Radio wireless interface

| | |
|---|---|
| *Frequency* | 2433 MHz nominal |
| *Data rate* | 250 kbaud max. |
| *Channel bandwidth* | 200 kHz |
| *Maximum output power* | 0 dBm |
| *Modulation* | MSK |

## 7.5 Rechargeable battery

| | |
|---|---|
| *Type* | Rechargeable Li-Ion |
| *Voltage* | 7.2 V |
| *Capacity* | 10 Ah |
| *Charge mode* | CC-CV |
| *Charge current* | 1100 mA max. |
| *Charge time* | 10 h typ. |

# 8. RKEY™ TECHNICAL SPECIFICATIONS

## 8.1 General

| | |
|---|---|
| *Supply voltage* | 5 V, USB-supplied |
| *Current* | 60 mA |
| *Temperature (storage and working)* | 0°C – 40°C |
| *Relative humidity (storage and working)* | 0% RH – 95% RH |
| *Size* | 6.5x2.3x1.5 cm excluding the USB prong |
| *Weight* | 12 g |

## 8.2 Radio wireless interface

| | |
|---|---|
| *Frequency* | 2433 MHz nominal |
| *Data rate* | 250 kbaud max. |
| *Channel bandwidth* | 200 kHz |
| *Maximum output power* | 0 dBm |
| *Modulation technique* | MSK |

## 8.3 USB interface

USB 2.0, compatible with USB 1.1.

# 9. REGULATORY FRAMEWORK

RStone™ and RKey™ comply with the requirements of the European Directive 1999/5/CE (R&TTE) and have passed the conformity test as per the following harmonized standards. Refer to the R&TTE Declaration of Conformity

| |
|---|
| EN 61010 – 1 (RStone™) |
| EN 60950 -1 (RKey™) |
| EN 301 489 - 17 |
| EN 301 489 - 1 |
| EN 300 328 |
| EN 61326 |

CE

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# 10. WARRANTY

## 10.1 General

a) This instrument and its accessories are warranted by RSens srl against defects in materials and workmanship for a period of one year from the date of original purchase from RSens. During the warranty period, RSens will repair, or at its option, replace an instrument found to have such defect, at no charge to the customer. **THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OF FITNESS, WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. THIS EXPRESSED WARRANTY EXCLUDES COVERAGE OF AND DOES NOT PROVIDE RELIEF FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND OR NATURE, INCLUDING BUT NOT LIMITED TO LOSS OF USE, LOSS OF SALES OR INCONVENIENCE. THE EXCLUSIVE REMEDY OF THE PURCHASER IS LIMITED TO REPAIR, RECALIBRATION, OR REPLACEMENT OF THE INSTRUMENT AT THE OPTION OF RSENS.**

b) This warranty does not apply if the product, as determined by RSens, is defective due to either failure to follow RSens's installation and use instructions, abuse, misuse, or modification or service performed by someone other than a RSens authorized repair and calibration facility. Misuse and abuse include, but are not limited to, subjecting the instrument to environmental conditions outside the specified limits or allowing the instrument to become contaminated by radioactive materials.

c) In order to obtain warranty repair service, the instrument must be returned, freight prepaid, to the facility cited in 10.3b below. The purchase date, vendor invoice, or customer purchase order should be included, along with a statement of the problem. Instruments will be returned transportation prepaid to the operative facility cited in 10.3b below.

d) Because the original manufacturer's warranty applies, the following items are specifically excluded from this warranty: photomultiplier, photodetectors, Geiger-Mueller and proportional tubes; batteries; ancillary devices, including, but not limited to, printers, computers, display devices, etc.; and other components as may be specified in this manual.

## 10.2 Calibration

a) This instrument is warranted to be calibrated at the time of shipment. If a question arises and RSens determines that the initial calibration is in error, the instrument will be re-calibrated by RSens at no charge. RSens is not responsible for calibrations performed by independent laboratories, nor any calibration fees incurred prior to or subsequent to RSens warranty service.

b) The return policy is as stated in 10.1c above.

## 10.3 Non-warranty service

a) Repairs and/or replacements not covered by this warranty may be performed by RSens or a factory authorized service location. Estimates of repair charges may be requested.

a) The cost of transportation into and out of the service location will be the responsibility of the customer. The instrument should be shipped to:

**RSens srl**
Via Vignolese, 905/b
41125 Modena (MO) – ITALY

*phone* (+39) 059-2056262 | *fax* (+39) 059-2056262