

## RS-330/332 Multipurpose Gamma-Ray Spectrometer System

### Operator Manual

Revision 2.00 – May 2017

Firmware Version 0.90

Part Number D-1036



Sales, Support and Customisation

[www.GeoResults.com.au](http://www.GeoResults.com.au)

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RS-330

RS-332



Revision History			
Date	Revision	ECO #	Description
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February 2015	00.01	NA	Update front cover
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## Certificate of Origin

This is to certify that GEORADIS s.r.o., Novomoravanska 41 is the manufacturer of the RS-330x series Radiation Detectors. All instruments are designed, manufactured and assembled in Czech Republic.

### PRODUCT STATEMENT

RSI is responsible for Sales/Marketing and Customer Support for this product in North, Central and South America, China, Australia/NZ and most other areas of the world excluding EUROPE and JAPAN.

## ADVISORY

### NOTES:

- Users are advised that the manual and software supplied with the instrument is current when manufactured, however, a program of continuous improvement means that many new features are added and old ones improved upon. Users are advised to contact RSI directly for new releases including manuals and software. The most current version of the manual is provided in electronic format on the Product Support CD supplied with the instrument. Please refer to the electronic version of the manual for the most accurate interpretation.**
- USERS ARE REMINDED THAT THE RS-33X series, IN COMMON WITH OTHER SIMILAR INSTRUMENTS, USES A Sodium-Iodide or BGO (BISMUTH GERMANATE OXIDE) CRYSTAL AS THE DETECTOR. THIS CRYSTAL IS FRAGILE AND EVEN THOUGH THE UNIT HAS BEEN RUGGEDISED FOR FIELD USE, GREAT CARE SHOULD BE TAKEN TO AVOID ABUSING THE INSTRUMENT AS THE VERY EXPENSIVE CRYSTAL IS NOT COVERED UNDER WARRANTY.**



## **CONFIDENTIAL DISCLOSURE**

USERS ARE HEREBY NOTIFIED THAT THIS MANUAL CONTAINS TECHNICAL INFORMATION OF A PROPRIETARY NATURE. THIS INFORMATION IS NECESSARY FOR TECHNICALLY KNOWLEDGEABLE USERS TO UNDERSTAND SYSTEM OPERATION AND TO SATISFY THEMSELVES THAT THE SYSTEM IS PERFORMING CORRECTLY.

RADIATION SOLUTIONS INC ACCEPTS THAT IT IS THE RIGHT OF SUCH USERS TO BE PRIVY TO THIS INFORMATION. HOWEVER THIS DOCUMENTATION IS PROVIDED SOLELY FOR THE BENEFIT OF OWNERS OF THE RS-330/332 MULTIPURPOSE GAMMA-RAY SPECTROMETER SYSTEM AND DISSEMINATION OF THE DETAILED TECHNICAL INFORMATION PROVIDED MAY BE CONSIDERED AS LEGALLY CONTRAVENING THE NORMAL SUPPLIER/CUSTOMER RELATIONSHIP.

UNAUTHORIZED RELEASE OF DETAILED TECHNICAL INFORMATION TO A THIRD PARTY WILL BE CONSIDERED AS A CONTRAVENTION OF USER AGREEMENTS.

Manufactured by Radiation Solutions Inc, 5875 Whittle Road, Mississauga, Ontario, Canada, L4Z 2H4

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### System Requirements:

#### Hardware:

- Gadget straps for carrying.(optional)
- Car power outlet adapter (optional)
- USB PC cable with mini USB connector for device
- Power cable (Standard U.S. and European)

#### Software:

- RSanalyst v2.1.23

**NOTE: Refer to the RSanalyst User Manual (D-1180) for information concerning the operation and use of the RSanalyst software.**

## 1.0 INTRODUCTION

The **RS-330/332 Multipurpose Gamma-Ray Spectrometer System** is the new state-of-the-art in portable hand-held radiation survey instruments for high sensitivity assay applications. It offers an integrated design with full weather protection, large detector, easy to use and high sensitivity. It was designed as a multipurpose instrument to be usable in outdoor as well as in laboratory conditions.

There are 3 models available:

- i. **RS-330** – this is the base model and has a 3"x3" (21ci – 0.35L) Sodium-Iodide (**NaI**) detector
- ii. **RS-332** – a special model with a 2"x2" (6.3ci - 0.1L) Bismuth Germinate Oxide (**BGO**) detector with an internal collimator

The figure below shows the size difference between the RS-330, and the RS-332.



## 1.1 FEATURES and SPECIFICATIONS

- **RS-330 – 3” x 3” (21ci 0.35L)** Sodium-Iodide (**Nal**) detector provides high sensitivity performance due to the large crystal. Energy response is from 15keV - 3000keV.
- **RS-332** – a special model with a **2” x 2” (6.3ci - 0.1L)** Bismuth Germinate Oxide (**BGO**) detector with an internal collimator for special applications. Energy response is from 30keV - 3000keV.
- Sensitivities (1 MBq **Cs-137 @ 1m**): **RS-330 = 386 cps, RS-332 = 160 cps**
- Large Graphic **Color Transflective LCD display** 3.5” (90mm) diagonal and 360 x 240 pixels which ensure excellent readability in any outdoor conditions.
- Gyro stabilized screen
- Automatic light sensor that changes the standard Color screen to a Monochrome screen at higher light levels to permit easy readability even in strong sunlight
- Simple operation with a five-position **navigation joystick** with illuminated buttons
- Memory capacity – can store 8Gb (approximately **2000 samples**) of spectra, assay results, GPS coordinates and voice recordings.
- **USB** and **WiFi** connection
- Integrated **GPS**.
- Integrated **microphone** for voice recording
- Internal rechargeable **Li-ion battery** module.
- Typical **10+ hour** battery life at 20 °C.
- Size – **RS-330** - Diameter = max 4.9” (124.5mm) – Height = 21.2” (538.5mm)
- Size – **RS-332** - Diameter = max 4.9” (124.5mm) – Height = 18.1” (459.7mm)
- Weight – **RS-330** - 4 kg, **RS-332** = 8 kg
- Operational Temperature range **-10 to +50 °C** (limited by the display readability).
- **IP65 weatherproofing** – short term water immersion and fully dust protected.
- Strong aluminum casting construction, integrated detector, rubber shock absorber and thermal isolation.
- Well balanced, easy to hold and designed for easy operation in field conditions.
- New design state-of-the art electronics with advanced CPU capability with a fully digital spectrometer design
- Unique spectral analyze method, calibrated for different geometries and application. Measuring methods and Calibration are User Programmable.
- Energy compensated dose rate measurement.
- Automatic energy calibration based on natural background radiation.

**No external radioactive sources required for stabilization.**

**NOTE: The following acronyms are used for the remainder of this manual;**

Sodium Iodide (**Nal**) detector

Bismuth Germinate Oxide (**BGO**) detector

## 1.2 GENERAL

The RS-330 is designed as a portable handheld instrument. The design incorporates specifications for indoor as well as for outdoor applications in a wide range of temperature and humidity conditions. The RS-330 consists of a single body intended to be used in the vertical position (standing up) detector. The small diameter of the instrument allows the instrument to be easily placed in boreholes or tight shielding. The instrument is self-contained so there are no additional devices required for its full functionality.



The upper (gray) section contains the operating electronics, the display and controls.

The lower (red) section of the instrument contains the detector Crystal assembly with internal temperature and shock protection.

The bottom of the instrument is protected with a rubber boot. The boot is removable to permit bottom access but is fully weatherproof.

The battery is mounted between these sections.



A loudspeaker is installed at the rear of the unit behind the perforated grill as shown by this picture.

The "black" section below the loudspeaker is a rubber weather cover that is opened to give access to the battery Charger and USB connection.

**Users must only use the supplied USB and Charger cables supplied with the unit or the warranty may be voided.**



The top panel consists of a large display, a joystick (4 arrows + enter) and input jacks for microphone (MIC) and light sensor (SENS). A gray plastic lid under the handle hides the GPS the WiFi antenna is located below the display.

The joystick is made of five separate buttons. All buttons are protected with transparent rubber cover and illuminate (for scrolling) when user choices are required.

The instrument can be cleaned or decontaminated at any time with soapy water or ethyl/ isopropyl alcohol.



**NOTE: USERS ARE REMINDED THAT THE RS-330 SERIES OF INSTRUMENTS, IN COMMON WITH OTHER SIMILAR INSTRUMENTS, USES A Sodium-Iodide OR BGO CRYSTAL AS THE DETECTOR. THIS CRYSTAL IS FRAGILE AND EVEN THOUGH THE UNIT HAS BEEN RUGGEDIZED FOR FIELD USE GREAT CARE SHOULD BE TAKEN TO AVOID ABUSING THE INSTRUMENT AS THE VERY EXPENSIVE CRYSTAL IS NOT COVERED UNDER WARRANTY.**

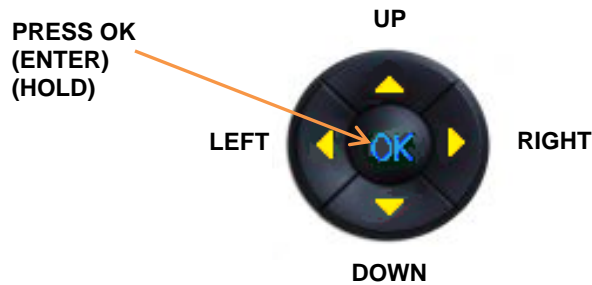
### 1.2.1 JOYSTICK OPERATION:

The joystick is used to toggle between displays and scroll through menus using five separate buttons, four arrow keys (UP, DOWN, LEFT and RIGHT), and a central **OK** (Enter) button.

The UP and DOWN arrow keys are used to scroll through menu selections, while the LEFT and RIGHT arrow keys are used to toggle between screens or to make selections (e.g. CANCEL or OK). When a choice is made the **OK** button is pushed to enter that selection.

Push and hold the **OK** button to **START** the device. The **OK** button if pushed while in a display screen will open a menu. If the **OK** button is pushed and held while the device is ON it will begin the Power **OFF** sequence.

**NOTE:** Specific joystick operation will be documented throughout this manual with the associated procedure.



## 2.0 SYSTEM OPERATION

### 2.1 OVERVIEW

This document only gives the practical information required by a Field Operator to use the RS-330 unit, A Reference Manual; Part # D-1037 is available to technicians needing information concerning the Parameter Settings and Calibration of the device.

**NOTE: THE UNIT WHEN POWERED ON FIRST GOES INTO THE SURVEY MODE AS THIS IS NORMALLY WHERE THE OPERATOR WANTS TO START. HOWEVER FOR THE PURPOSE OF THIS MANUAL, ONLY SECTIONS PERTAINING TO THE OPERATOR WILL BE EXPLAINED – REFER TO THE REFERENCE MANUAL PN D-1037 FOR PARAMETER SETTINGS, CALIBRATION AND DETAILED FUNCTION INFORMATION.**

### 2.2 BATTERY


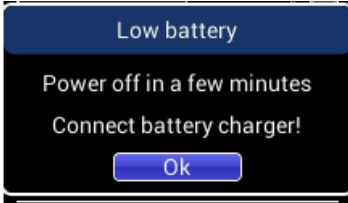
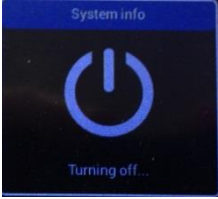
The RS-330 is powered from an internal Li-ion battery pack. Li-Ion batteries offer the best power per unit volume of any commercially available batteries but they are prone to damage if misused. To prevent these issues the pack is **NOT USER** replaceable and must be changed by trained personnel. For added protection only batteries with built-in protection are used and battery charging/discharging is automatically controlled.

Although the most critical conditions are automatically supervised by the systems' internal computer, the user is requested to ensure that these guidelines are followed:

- Never charge the unit when the temperature of the batteries drops below 0 degree Celsius, best charging conditions are around 20 degrees Celsius.
- Do not store the unit with a fully discharged battery – charge before storing for more than 1 week.
- Pay attention to warning messages on the units display – if any

#### 2.2.1 Battery Operation

The system is usually operated with the Li-ion battery pack in place which typically gives 8hr battery life.

- **Battery Icon** – a battery icon is shown at the top right of the display. If all **DARK** then the battery is full. As it discharges a white section appears. The icon figure example  shows approx. 60% battery life.
  - **Low Battery Warning** – if the battery drops below an estimated 10% capacity (30 minute life) then a pop-up window appears, a **LOW BATTERY** message advising the user to change battery packs or recharge the battery.
    1. When the batteries reach 6% capacity then a **POWER OFF IN A FEW MINUTES** message appears. 
    2. At 2% capacity a **POWERING OFF** message is displayed and the unit safely **POWERS OFF** for self-protection with a final warning message. **DATA PROTECTION** – when batteries need charging or replacement **NO MEMORY IS COMPROMISED** because all stored data is in non-volatile Flash Memory. 
- NOTE:** All data is stored in non-volatile Flash Memory, NO DATA is lost due to the device powering OFF, unless a reading was in progress during auto-shutoff.

## 2.2.2 Battery Charging

The RS-330 has a built-in battery charger that allows the batteries to be recharged while operating the unit (without removing the batteries). In addition the unit can be charged when switched OFF. When the charger is plugged in a YELLOW LED shows that charging is in progress. Light ON = charging, light OFF = charge complete or unplugged, light FLASHING means an error occurred while charging.

**NOTE:** 12VDC charging (car battery) can be carried out using the supplied car lighter socket cable with an internal fuse for battery protection.

The charging progress is indicated by the battery icon on the display – WHITE = full charge, a pulsing icon means the charge in progress.

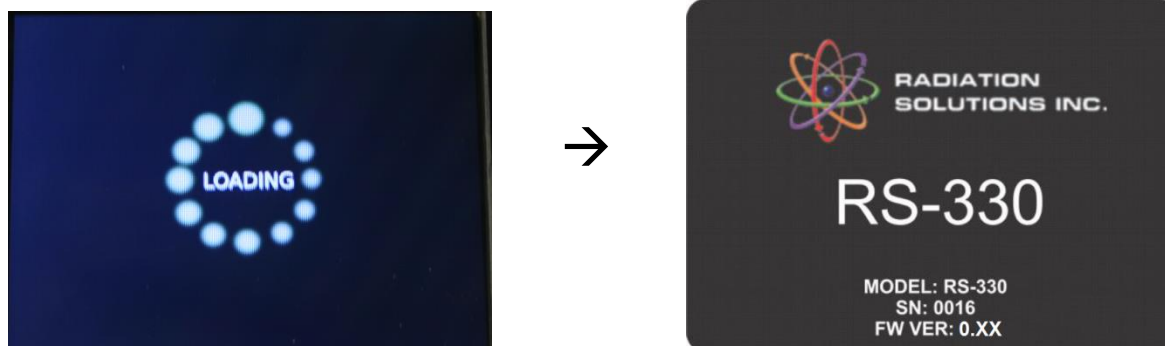
**NOTE:** The supplied Battery Charger must be used at all times as the Manufacturer will not be held responsible for damage to the unit caused by using an improper battery charger. Connecting the wrong type of charger may lead to unpredictable damage of the unit and will invalidate the warranty. (Contact RSI – see [Appendix Z](#) for information)

## 2.3 POWER DEVICE

### 2.3.1 Power Device (ON)

Press and hold the **OK** button for approx. 2 seconds until the display lights up, then release.

After a few seconds a “LOADING” message is displayed for approximately 3 seconds, during this time the system is performing complex internal testing to check that all parts of the unit are fully functional – any problems will be reported to the user.



### 2.3.2 Shutdown Device (OFF)

To switch the unit **OFF**, choose the **Shutdown** icon in the Main Display and select **YES**. The other way to switch OFF the unit is to press and hold the **OK Button** for approx. 10 seconds until the unit automatically switches **OFF**.

PRESS OK  
(ENTER)  
(HOLD)



The **Operator Menu** will display in either the **SURVEY** Mode or the **ASSAY** Mode by pressing the **OK** button with a short **CLICK**. The **UP** and **DOWN** arrows will be lit. Use the **DOWN** button to scroll to the **Main Menu**. Use the **LEFT** and/or **RIGHT** button to scroll to **Shutdown**. **ENTER** the selection by pressing the **OK** button. The **Exit** requestor will confirm you want to Shut Down.



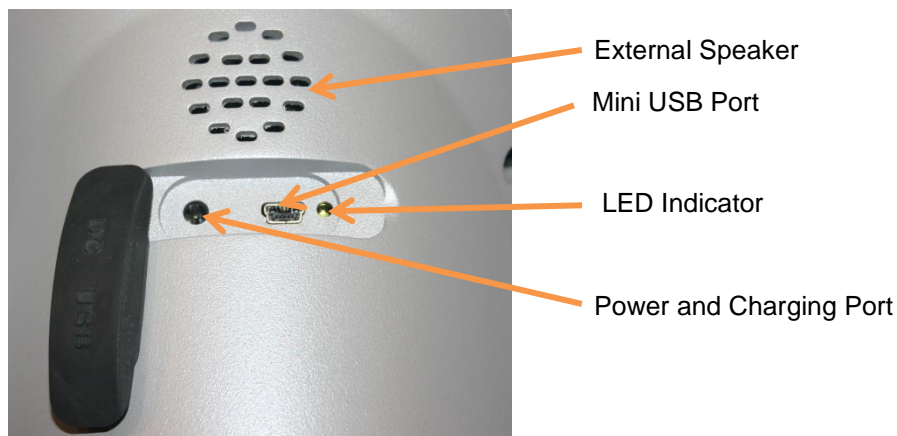
## 2.4 DISPLAY

RSI carried out extensive experimentation to determine the best display to use. The final unit selected is a trans-reflective LED color display. Extensive Field testing showed that a BLACK background with white numbers showed absolutely AUTOMATICALLY to a MONOCHROME mode for external bright sunlight usage. This combination of color balance and light sensor gives excellent readability under all light conditions.

**NOTE:** About 3 seconds after the units' **Title Screen** appears the display changes to the **SURVEY MODE**.



## 2.5 EXTERNAL CONNECTIONS



**PC Connection:** Connect the supplied USB cable to the computer and connect the mini USB connector to the device.

**Power & Charging:** Connect the supplied power cord (U.S. or EURO) to the Power plug on the device. This will also charge the internal battery.

## 2.6 CONNECTIVITY

There are 3 ways to connect a unit to a PC for Data Transfer, Parameter change or Remote operation:

- a) USB – supports all 3 functions
- b) WiFi - supports all 3 functions

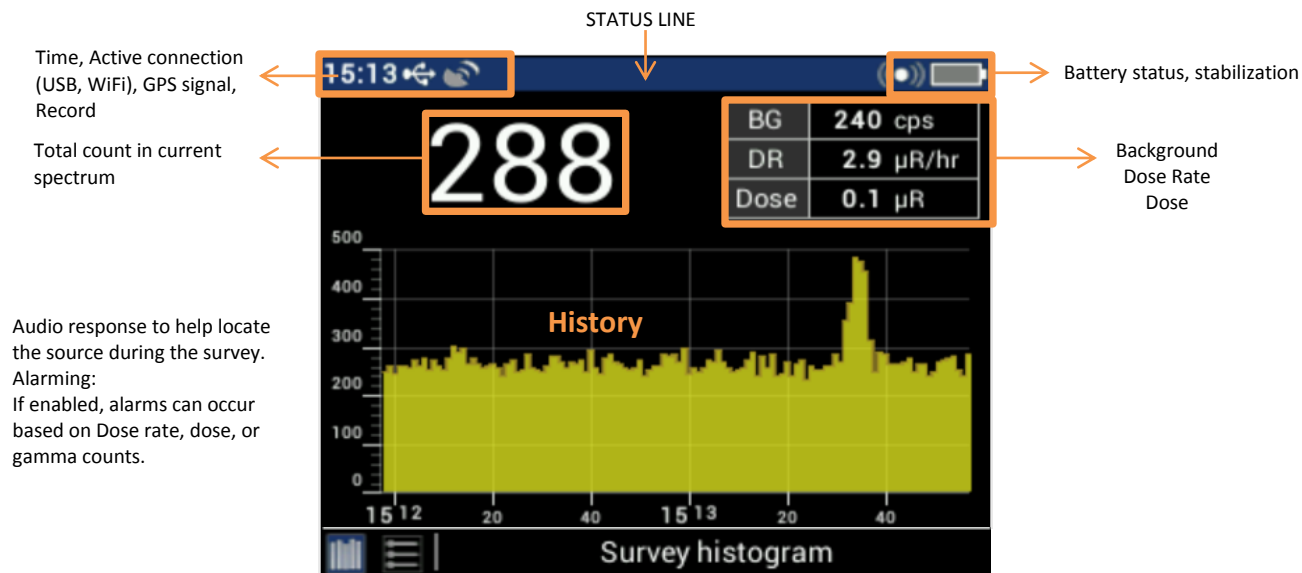
Bluetooth (future) – used for covert audio connection

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## 3.0 SURVEY

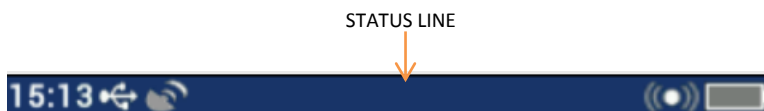
### 3.1 SURVEY MODE

About 3 seconds after the units' **Title Screen** appears the display changes to the **SURVEY MODE**:



The SURVEY display as above has various data components:

#### a) TOP BAR



Shows various icons and messages:

- Current time (time zone can be adjusted)
- Various ICONS are shown:



= USB – shows the USB is connected to a PC



= GPS – shows that the integrated GPS system is functioning and collecting data



= RECORDING – shows Data RECORDING in progress and data is being stored in internal memory



= WiFi connected to local network



= Battery charge icon – **DARK** is full – White shows usage

- **MESSAGES (STATUS LINE)** - typical messages are:
  - **SYSTEM OK** – means Normal Operation
  - **LOW BATTERY** – means battery level is below 10% capacity so needs charging
  - **SYSTEM ERROR** – means the system has automatically detected an error
  - **STAB ERROR** – means the auto stabilization system has problems so Assay data is compromised

**NOTE: See Reference Manual D-1037 for a full list of messages and recommended actions.**

- b) **TOTAL COUNT** Display from the Gamma detector in counts/second used for SURVEY applications – this display is updated 1/second. Max display is **999,999 cps**



- c) Data table for real-time user information

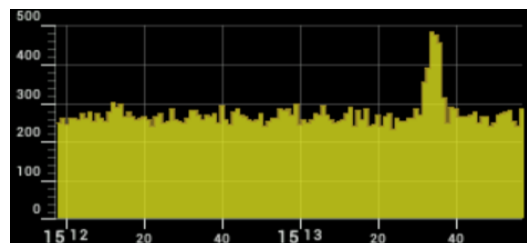
- **BG = BACKGROUND** – this is the currently computed local radiation background which is updated automatically
- **DR = DOSE-RATE** – this is the currently computed Dose-Rate in selected units

BG	24 cps
DR	0.9 nSv/hr
Dose	4.0 nSv

**NOTE: The Dose Rate calculation may not be accurate until the System stabilizes (max 2 minutes), so the DR may show a display something like DR <4738uR. Once Stabilization is OK (Stab icon is visible) then the Dose rate will be correct.**

- **Dose = Accumulated DOSE** – this is the instantaneous Dose Rate **accumulated** from the time the unit was last reset (powered ON)

- d) **GRAPH DISPLAY** – this real-time graphic display is updated 1/second and displays 120 seconds of current data. The data is auto scaled vertically as changes occur. This graph is useful to see small changes in the local radiation levels that have occurred which the user may have missed when scanning.



The lower X-axis shows the time the data was taken.

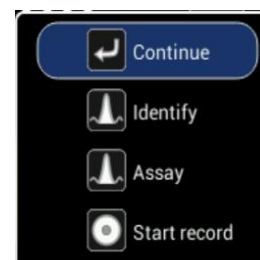
## 3.2 AUDIO

The RS-330 has a specially designed **audio** capability that is updated 20 times/second to ensure maximum SURVEY usage. This audio is used to locate the maximum radiation level and its' audio tone varies with intensity. So at "NORMAL" background radiation levels the audio is silent with the very occasional beep to show it is active. When the radiation level exceeds the programmed threshold, the audio tone begins and the pitch increases as the radiation intensity increases. Thus the unit can be easily used in an **EYES-FREE** mode to locate radioactive material.

## 3.3 MENU

During **SURVEY**, if the user presses **OK**, a menu appears permitting various options to be selected. The Up/Down Arrow joystick keys permit user selection on the display. Pressing the joystick **OK** button selects the highlighted function.

- **CONTINUE** – this selection moves back to the **SURVEY** display with no other action (often used by a user pressing **OK** by accident)
- **IDENTIFY** – this starts the Identify process detailed in [Chapter 5.0](#).



- **ASSAY** – this starts the Assay process detailed in [Chapter 4.0](#).
- **START RECORD** – permits data recording
- **PAUSE** – pauses recording
- **REACQUIRE BG** – permits the user to “reset” the local background
- **MAIN MENU** – returns the user back to the Top menu

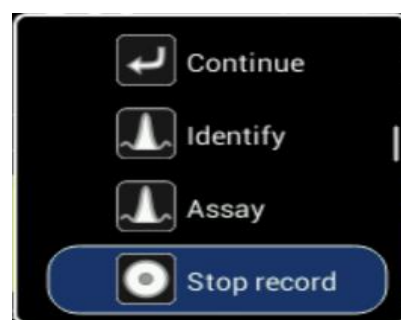
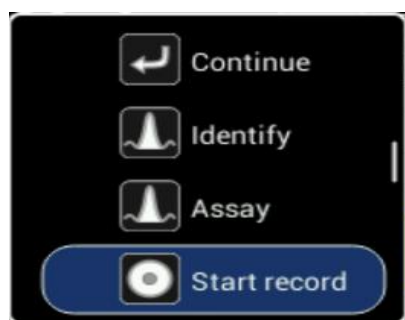
### 3.3.1 Start Record

In the **SURVEY** Mode users often want to record data to be used for traversing or mapping applications. The RS-330 has an extensive recording storage capability.

If the **START RECORD** option is selected the “circle R” icon is displayed at the top of the display to show that recording is in progress.



Data for all sensors and GPS is recorded 1/second with 10,000 samples of data storage provided = 2.8hrs of continuous data.



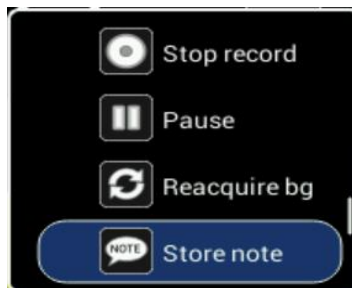
Select **OK – STOP RECORD** to terminate the recording process.

#### 3.3.1.1 Store Note / Record Note

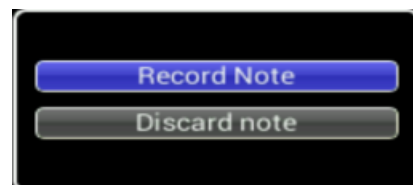
When the RS-330 is placed in the **RECORD Mode** the User can add an Audio Note to the spectrum data at any time. This process is used to record an audio note of information relevant to the sample. This could be **LOCATION, WEATHER CONDITIONS** or whatever data is useful for future analysis. This option utilizes a small microphone embedded in the unit just below the display (MIC). In order to ensure the system is fully watertight unfortunately the microphone must be masked for protection. This means that for best audio results the User should “speak” as close as possible to the display unit with a reasonably clear voice level. Experimentation will show the best procedure to suit the user.

The process is as follows **IF THE RS-330 is in the RECORD MODE:**

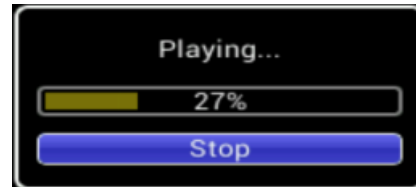
- Press **OK - STORE NOTE (SURVEY Mode) OK - RECORD NOTE (Assay Mode)** and a new display appears, the rest of the procedure is the same for either the Survey or Assay Mode(s)



Select **RECORD NOTE** in the new display. The upper progress bar shows the time available to record the note = **15 seconds**. Speak reasonably loudly and clearly (close to the MIC port on the RS-330 front panel) during the time the progress bar is visible. If finished you

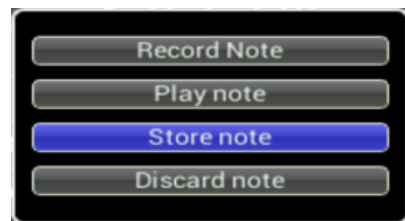


can press **STOP** or wait for the timeout. The recording will be played back before the Record Note Options screen appears.



When the note is complete an Options Screen appears and the user can:

- **PLAY NOTE** = replay the note to be sure all is OK
- **RECORD NOTE** – make a new recording
- **STORE NOTE** – log the note into memory where it can be retrieved later (integrated with the data)
- **DISCARD NOTE** – cancel the note



Click on **Store note** when complete. You will not be given any prompt telling you that a note was saved or given an ID.

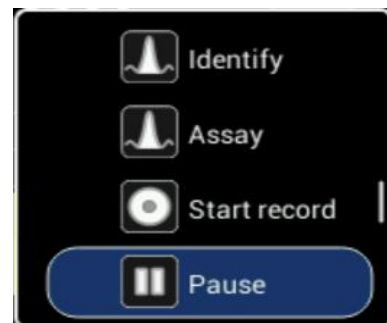
Repeat the procedure as often as you like. Multiple notes can be taken per survey.

You will not see any indication of a note when the data is read from the device into RSAnalyst. When the survey data is exported all the audio notes will be exported along with it.

### 3.3.2 Pause

This command “freezes” the instrument **TEMPORARILY** and is used to REVIEW data.

In this **PAUSE** Mode – the user can use the **ARROW** keys go back into the previously recorded data to review data. Note that current data is buffered during this **PAUSE** for review process. Press **OK** and scroll to **RESUME**, it then runs the data display to the **CURRENT** data buffered in memory **so no data is lost during the review process**.



### 3.3.3 Reacquire BG

The local Radioactive Background (BG) is used to set the SURVEY audio Threshold. This BG level is stored in the unit when it is powered ON.

Inside the unit various settings select the best BG usage. Typically the setting selected means the BG reference level is being continually updated to utilize the best levels.

The reason this is important is only for AUDIO surveying because as noted above the local BG is used to select the threshold level that the audio SURVEY tool uses to enable its audio.



A key problem here is best explained with an example, using the figure below. The example shows a FIELD condition. In this example for simplicity the device is being used to locate radioactive material in three AREAS of Interest:

- **160cps (Green)** this is the local background AWAY FROM THE AREAS of Interest because the unit is seeing radiation from all around it.
- **120cps (Yellow)** – this is the background at AREA 1 this displays the local background so it is significantly lower.
- If the unit BG is set at the 160cps – then the Audio Threshold = 223cps so it will **NOT** sound the audio when the 200cps source location is passed.

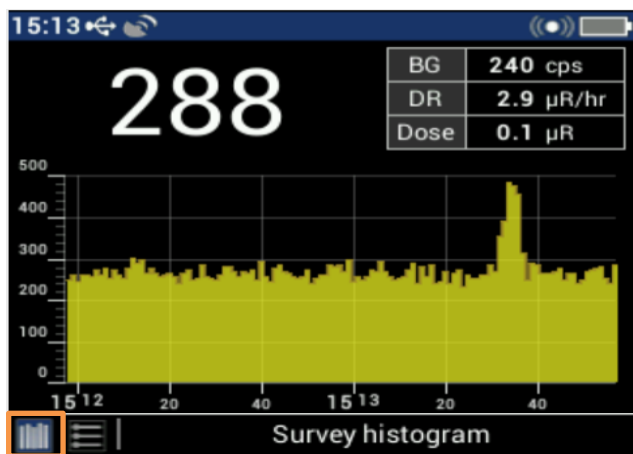


- **200cps (Red)** - However if the unit is positioned at the 120cps point and then the **REACQUIRE BG** selection is made, the Audio Threshold is then 175cps so the 200cps source will give an audio response.

**NOTE:** Of course if the radiation source signal is quite large then such a small BG change has little affect, so under most circumstances the **REACQUIRE BG** step is not required. However if you scan the area and find NOTHING, using the **REACQUIRE BG** process defined above may make the source easier to find.

### 3.3.4 Onfly Assay Results

When the Survey Histogram is ready use the joystick and click it to the right, this opens the **Onfly assay results** screen.



Click Joystick to RIGHT →

Area_300ABC			
1	K	-	%
2	U	-	ppm
3	Th	-	ppm
4	Am	-	kBq/m2
5	Ba	-	kBq/m2
6	Co	-	kBq/m2

Onfly assay results

The Display changes to Onfly Assay results, clicking the joystick to the LEFT will toggle the screen back to Survey Histogram

Customers Recording Data in OnTheFly Assay mode may find that if the device had been previously setup for Record Mode that the sequential order or chronological numbering for saved files will be affected, as the device is also storing data for OnTheFly storage. It appears that the sequential numbering is skipping as the device is storing data on the fly. Each Record assay and OnTheFly assay is assigned a unique ID. From affected customer's data it appears that assays were being saved while the "OnTheFly" option was started. In this case the unit would assign an ID to the Manual (Record) assay and skip the OnTheFly assay, thus resulting in non-sequential ID numbering. To prove this is happening compare the time stamps of the exported "Manual assay" data and the "OnTheFly assay" data. When you export the data the "OnTheFly assays" will be the ones that have a blank space in the total column while the Manual assays will contain all the data.

## 4.0 ASSAY

The RS-330 Multipurpose Gamma Center is a highly sensitive system. The large volume detector with a 1024 channel spectrometer enables the use of highly sophisticated algorithms for gamma spectra evaluation. A unique evaluation algorithm allows determining concentration of natural radioactive elements as well as manmade radioisotopes in various applications.

Besides most common applications in Geology, the RS-330 also has applications for tasks in Waste Management, Environmental Measurements etc. The Assay process is fully automated and does not require special user's effort and data results give the user all the necessary information for detailed analysis.

### 4.1 STABILIZATION

**NOTE:** For accurate Assay results the system must be stabilized to remove any effects from local temperature changes or component aging inside the unit. This is an **automatic** process that is carried out continuously.

If the system is NOT stabilized the Assay will be in error. The user is advised by audio/visual message. If the user attempts to make an Assay reading when the system is not ready, a Warning Message will appear on the display to advise the user.



This icon on the top right of the display is also a visual indication that the system is fully stabilized and is good-to-go.

**NOTE RE AUTO STABILIZATION:** ALL electronic systems drift with time due to temperature effects as well as component aging. Any drifts causes spectral distortion so the ASSAY is compromised. The techniques used to remove these drifts effects on the spectra are called STABILIZATION. Unlike older technology units that require embedded sources for Gain stabilization, the RS-330 uses LOCAL RADIATION BACKGROUND as a reference. From power ON it takes typically 3-5 minutes for the system to be “good to go” and the Stab icon appears. As time progresses the RS-330 automatically analyses local radiation background and if any drift is seen it is automatically corrected WITH NO USER INTERACTION. If the auto analysis system fails for any reason the user is alerted that ASSAY is compromised, but this is a very rare event.

#### NOTES RE AUTO-STABILIZATION:

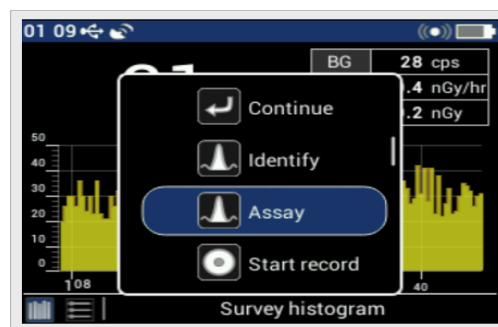
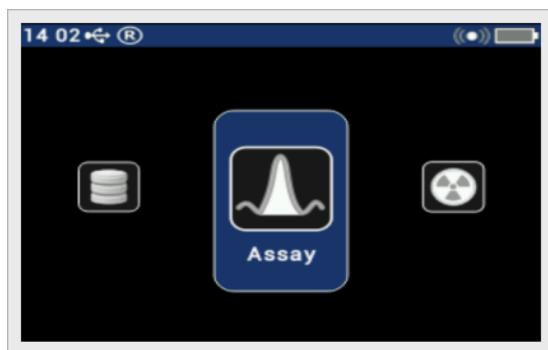
- a) When the unit is powered OFF, it remembers where the auto-gain settings are so when powered ON again it can start at these same settings. Usually this means a fast start up with a 2-3 minute warmup time sufficient to get final stabilization.
- b) **TEMPERATURE CHANGE** – if there is a very significant temperature change between power OFF and power ON especially if the unit is OFF for a long period, startup is slower. Under these conditions it could take the unit up to 15 minutes to auto-stabilize

**IF THE UNIT TAKES LONGER THAN 15 MINUTES TO STABILIZE PLEASE CONTACT RSI. (See [Appendix – Z](#))**

## 4.2 ASSAY MODE

As noted above, **ASSAY** cannot be started before the system auto-stabilization is **OK**, once the device is stabilized proceed as follows:

- Select **ASSAY** from the Survey Operator Menu (to the right) or the Main Menu (below) and press **OK** to activate this function.



- The **ASSAY** routine starts and the following display is seen.

NOTE: The label and details of the display are controlled by the **Analysis Method** selected. For the **RS-332** with internal collimator the **Analysis Method** would be **Colim\_300**.

- After **30 seconds**, data appears on the display and the data is updated every 30 seconds until the sample ends (default setting is 5 mins but user can change).
- At the bottom of the display the sample period progress is seen (7/300 = 7 seconds of a 300 second sample).
- At the **end** of the sample period the final results are seen, as explained below

K_U_T_300			
1	K	-	%
2	U	-	ppm
3	Th	-	ppm
4	Dose	-	μR
5	Dose rate	-	μR/hr

7/300

### 4.2.1 Assay Results Screen

The figure (to the right) shows a screen with typical Assay results explained as follows:

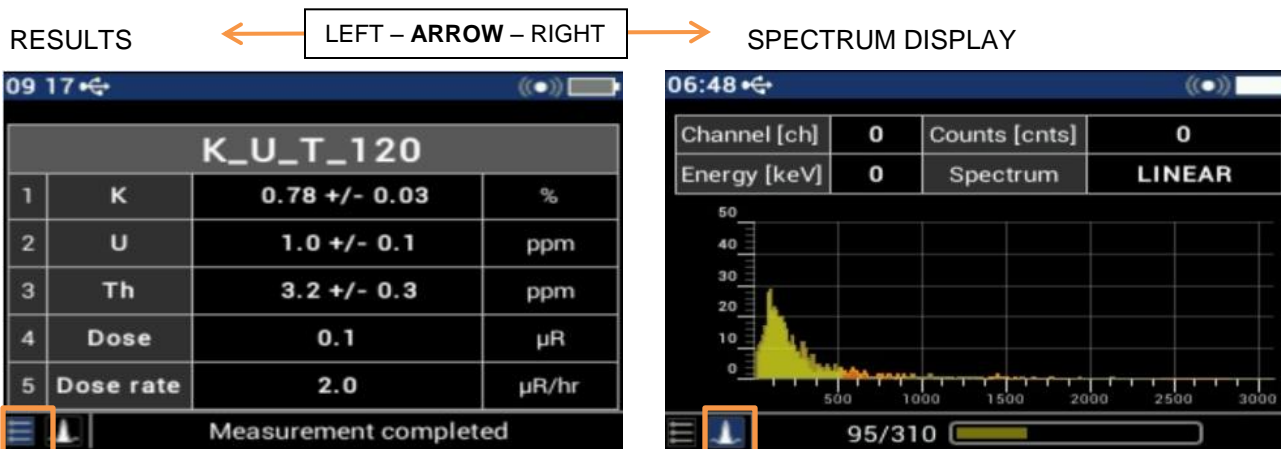
- Col 1 – a numeric list of all the data results
- Col 2 – the label of the data typically:
  - K** (Potassium-40)
  - U** (Uranium/Radium)
  - Th** (Thorium-232)
  - Dose**
  - Dose rate**
- Col 3 – data results (note that in the Cal file a lower detection limit is set as below this level the data may be inaccurate. e.g. <3.0 means the low detection limit was set at 3.0 and the actual results are lower than this.
- Col 4 – data units (% , ppm, uSv etc.)

K_U_T_300			
1	K	0.99 +/- 0.03	%
2	U	< 3.0	ppm
3	Th	< 8.0	ppm
4	Dose	0.2	μR
5	Dose rate	2.9	μR/hr

Measurement completed

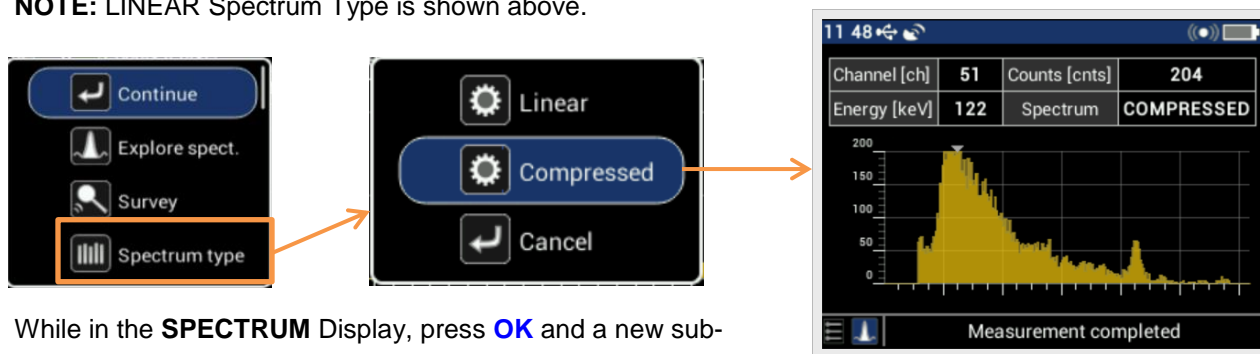
### 4.2.2 Spectrum Display

While the data is accumulating or at the end of the sample, using the Left/Right Arrow joystick keys the user can switch the display between the RESULTS and the SPECTRUM Display(s).

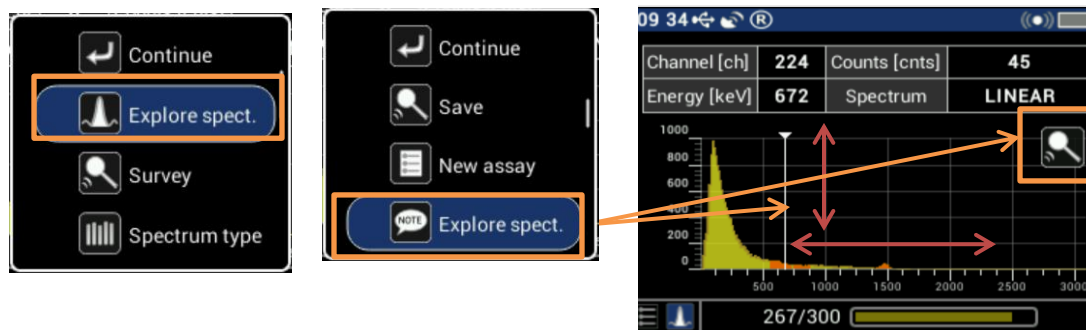


The Spectrum Type can be changed in the SPECTRUM Display by pressing the **OK** button and a new sub-menu appears. Scroll to Spectrum Type, which will open the Spectrum type options.

**NOTE:** LINEAR Spectrum Type is shown above.



While in the **SPECTRUM** Display, press **OK** and a new sub-menu appears.



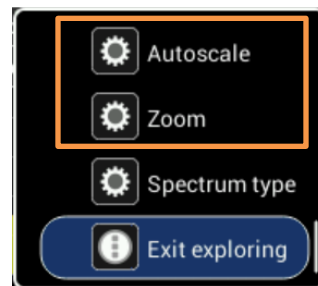
**NOTE:** The sub-menu appears differently when the **OK** button is pushed, before or after the measurement is complete.

Select '**Explore spect**' to go into the spectrum display mode (the magnifying glass icon shows that you are in this mode). In this mode the joystick arrow keys can be used to move a cursor along the X-axis to see Channel #/Energy and Counts at the channel required and the Up/Down arrow keys change the Vertical Scale.

The main spectrum is displayed in **YELLOW** but selected ROIs are highlighted in **RED**.

The Spectrum Display can be changed from **Linear** to **Compressed** at any time by pressing the **OK** button to open the sub menu and choosing **Spectrum type**.

**NOTE:** Pressing the **OK** button will open a sub-menu with options to **Autoscale or Zoom** in the graph.



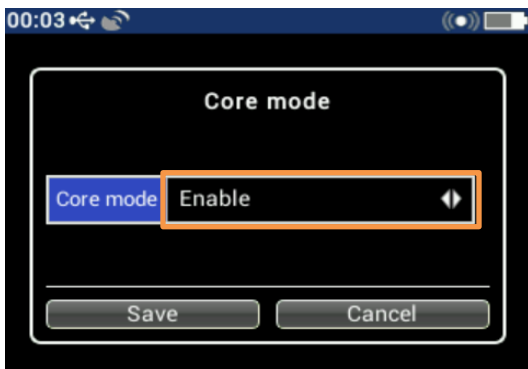
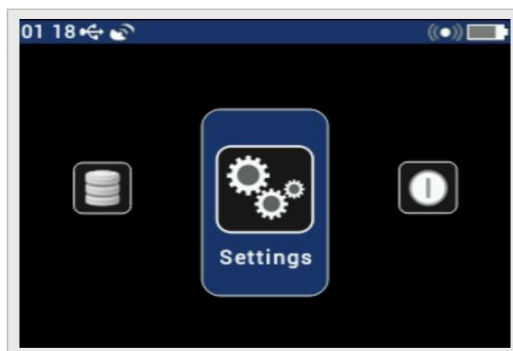
To **exit** this screen select **OK** – then **Exit exploring** to go back to the normal mode of operation.

### 4.2.3 Core Method - Sampling

**Core Method** is available for both RS-330 and 332. It comes pre-installed on the RS-332 with internal collimator the **Analysis Method** would be **Colim\_300**. Customers wishing to use their existing RS-330 devices need to contact RSI for the correct add-on or order this option when purchasing new units.

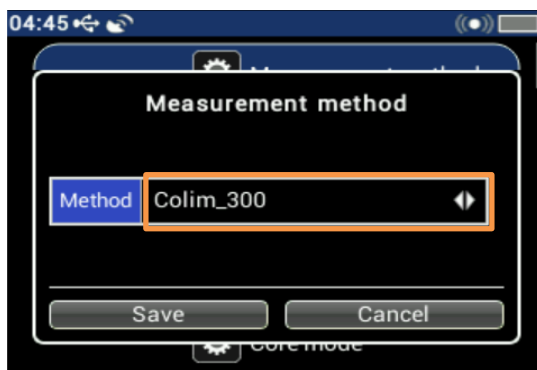
Core method is part of the “**Assay**” (refer to **Section 5.2**). After setting up Core mode, When taking a core measurement, first choose “Assay”.

Turn Core method ON as follows: **Settings > Measurement > Core mode > Choose Enable**

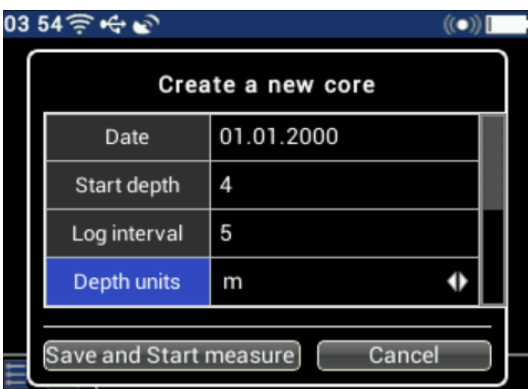


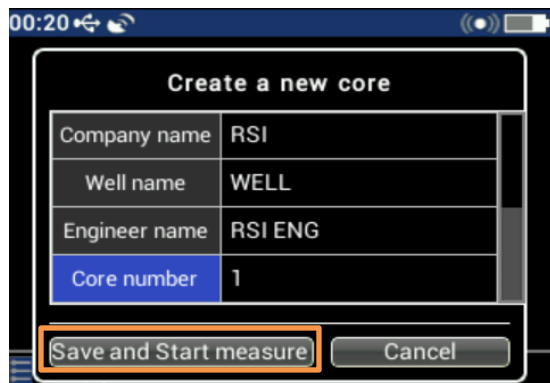
Then choose the desired measurement method. Note that “Colim\_300” indicates the collimated RS-332 model.

**DO NOT choose this option if you have RS-330 model. Choose the file installed on the RS-330 for Core Mode.**

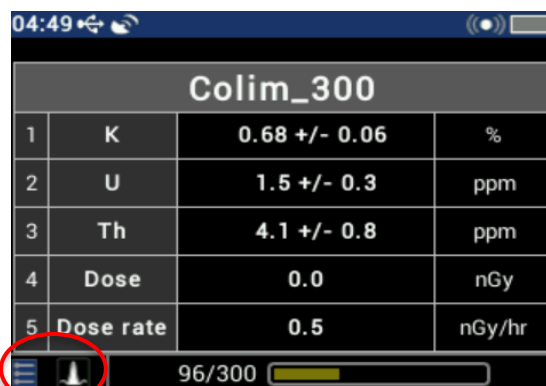


When taking a new core measurement. Select “**Assay**”. The window below will pop up to guide the user, fill out the information for the new core, a scroll bar is located on the right side, scroll down to complete the form.

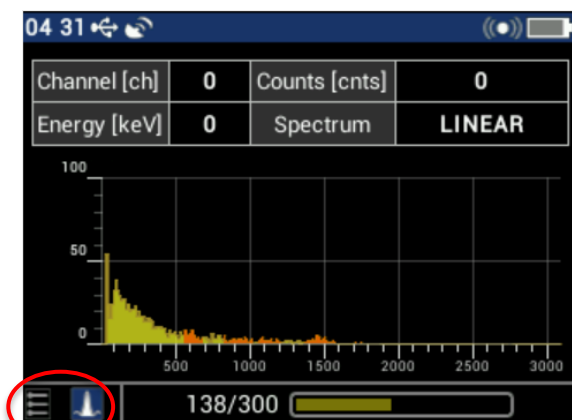




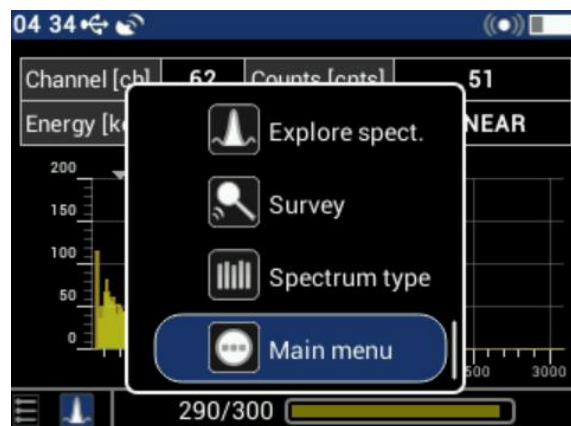
When the form is complete choose “**Save and Start measure**” to begin the procedure of spectrum analysis.



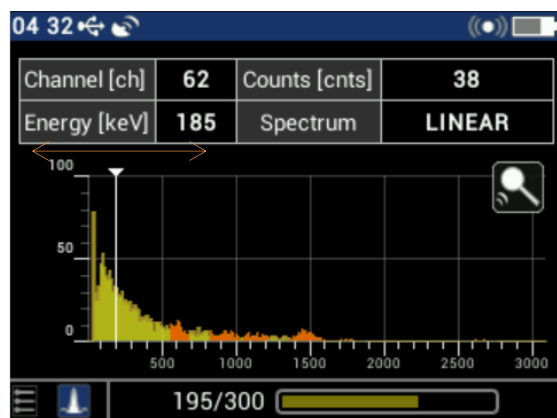
The icon at the bottom left of the screen is the option to toggle between the table and spectrum



Click the “OK” button to display the menu items. The options are; Explore spect, Survey, Spectrum type or Main Menu. Choose to explore spectrum or change Spectrum Type.

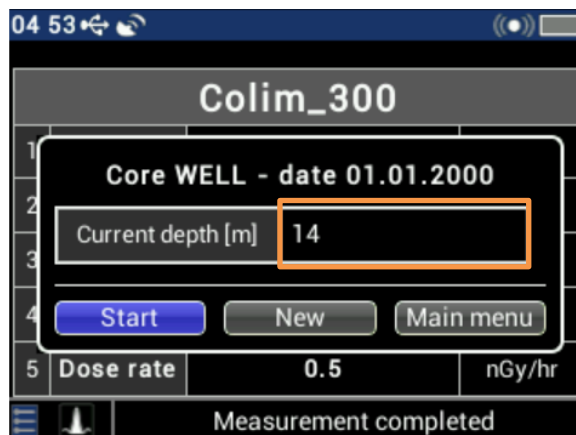


User can move the cursor left and right.



The measurement result(s) are automatically saved and a prompt will display the following options: **Start** – Start the next measurement, **New** – begin a new measurement, or go back to the **Main Menu**.

The depth for the next measurement was calculated from the core info the user had previously input. If the User requires changing the depth, it can be changed by choosing it and entering the data with the displayed keyboard.



**RSAnalyst - Refer to RSAnalyst User Manual D-1180 for more information.**

After downloading the data into RSAnalyst, choose **Measure Data** from tool bar on left.

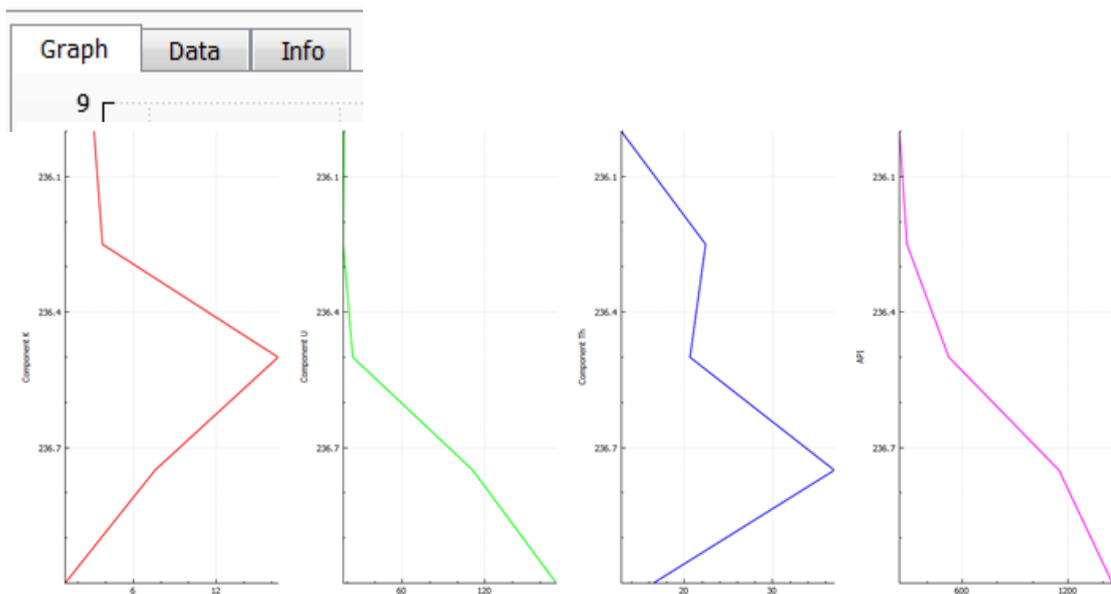
Choose **Core Measurements**, and **Core Log** from **All Measurements**, the **Graph tab** shows K, U, Th result(s) graph and API unit

The screenshot shows the RSAnalyst software interface. On the left is a vertical toolbar with icons for 'Calendar', 'Measure', 'Connect device', 'Disconnect device', 'Download data', 'Device parameters', 'Device settings', 'Options', and 'Quit'. The main window displays a table of measurements and a graph. A dropdown menu is open over the table, listing measurement types: 'All measurements', 'Assay measurements', 'Identification measurements', 'Survey measurements', 'Alarms', and 'Core measurements'. The table below shows the following data:

ID	Time	Type	Voice note	Latitude	Longitude	Altitude	Num. satellites
37	14:03:42	Alarm - GAMMA LEVEL 1		0°0'0.00" N	-2147483648°0'0.00" E	4.35767e-39 m	-1

The graph below the table shows a green line representing counts over time. The y-axis is labeled 'Counts' and ranges from 15 to 90. The x-axis is labeled 'Time' and shows a value of 8. The graph title is 'All Measurements'.

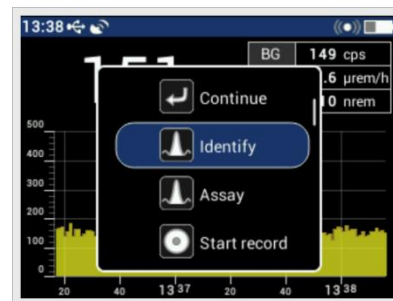
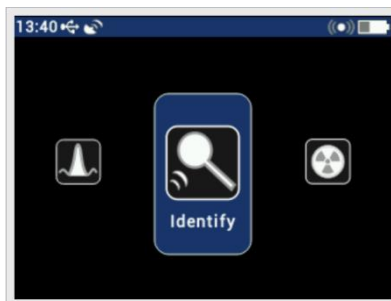
ID	Time	Type	Voice note	Latitude	Longitude	Altitude	Num. satellites
1	57	01:27:52	Alarm - GAMMA LEVEL 1, DOSE RATE LEVEL 1	-	-	-	-
2	2227	03:29:26	Assay	43°37'33.10" N	79°40'21.28" W	192.9 m	10
3	2	03:29:26	Core log	-	-	-	-



## 5.0 IDENTIFY

Enter the Identify Mode by either:

- Selecting the **IDENTIFY** icon from the Main Menu (Left Figure)
- Selecting the **IDENTIFY** option from the Survey Mode Menu (Right Figure)



### 5.1 IDENTIFY MODE

At the end of the 60 second count period the unit will beep to show that the analysis sample is complete. An automatic analysis takes place and the results are displayed as shown.

- **Status** - the system is setup so that every time an **IDENTIFY** is carried out a requestor will pop-up before changing modes asking user if the sample should be saved.
- **ID 1** = this shows that these data are saved as Nuc ID data point #1. When the memory is reset (purged) it resets this counter to start at "1".
- **K-40 – NAT** – shows the Isotope ID = Potassium 40, it is a **NAT**ural source type.

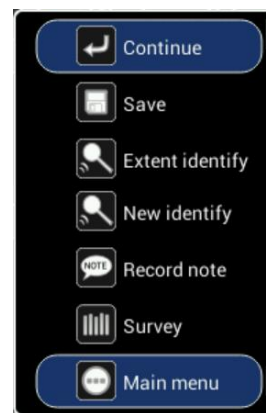
Identified nuclides	
Nuclide	Type
1 K-40	NAT

Measurement completed

#### 5.1.1 Identify Menu

After viewing the data ID results display, pressing **OK** gives this display with more functions: In this menu the **Up/Down Arrow keys** permit user selection which is highlighted. Pressing **OK** selects the highlighted function.

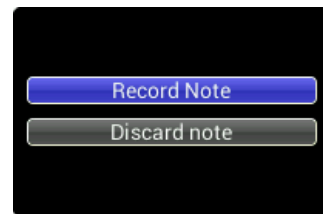
- CONTINUE** – returns to the IDENTIFY Mode.
- SAVE** – saves the spectrum in memory, note if **Autosave** has already been implemented then **Save** writes the same sample on top of the original one.
- EXTEND IDENTIFY** - extend the sample for an additional period. If the first sample is inadequate over the set time period, adding another sample period may suffice. If the results show **NON-IDENTIFIED** then a sensible step is to select the **EXTEND IDENTIFY** option. This then adds another 60 second sample (if set as the time period) to the first sample to make a 120 second sample.



When the sample is complete the Nuclide ID analysis takes place and the results displayed. There is **NO LIMIT** to the number of times that **EXTEND IDENTIFY** can be used but in practice in most cases if no result is obtained in 180 seconds then there is a high probability that the data signal is too low for analysis. In this case good practice is to go back to **SURVEY**, relocate the source maximum point then repeat the **IDENTIFY** process. Note that each extend identify adds to the original sample so the ID# of the data does not change, but inside the data the extra length sample period is noted.

- NEW IDENTIFY** – this permits the user to start a completely new **IDENTIFY** process exactly the same process as shown above.

- e) **RECORD NOTE** – this process is used to record an audio note of information relevant to the sample. This could be **LOCATION, LICENSE PLATE** or whatever data is useful for future analysis. This option utilizes a small microphone embedded in the unit just below the display. In order to ensure the system is fully watertight unfortunately the microphone must be masked for protection. This means that for best audio the user should “speak” as close as possible to the display unit with a reasonably clear voice level. Experimentation will show the best procedure to suit the user. See [Section 3.3.1.1](#) for detailed information.



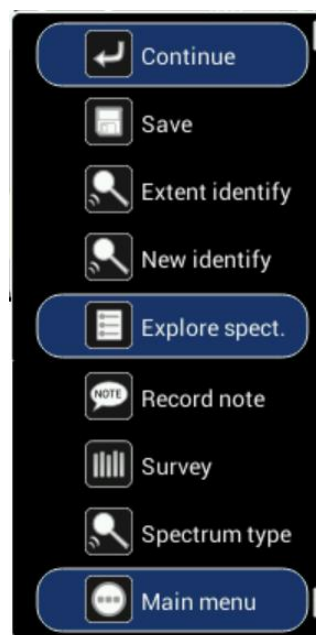
- f) **SURVEY** – Goes to the SURVEY Mode.

**MAIN MENU** – returns to the Main Menu for additional selections

### 5.1.2 Identify – Graphic Menu

Click on **OK** button to open the Options Menu in the Graphic Window.

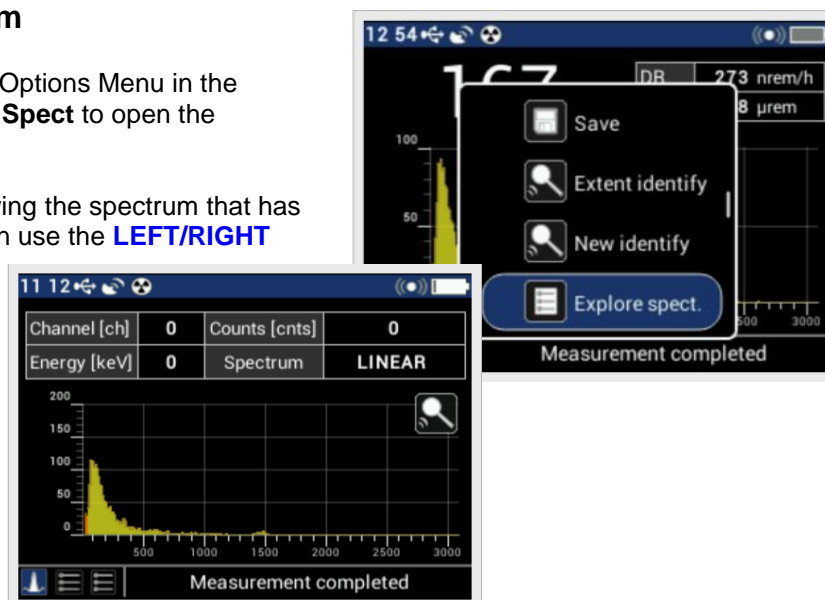
- CONTINUE** – Returns to the Identify Mode.
- SAVE** – Manually saves the sample to the hard drive before changing modes.
- EXTEND IDENTIFY** - Extends the sample for an additional period. If the first sample over the time period is inadequate, adding another sample period may suffice. If the results show **NON-IDENTIFIED**
- NEW IDENTIFY** – Repeats the Identify process.
- EXPLORE SPECT** – See [Section 5.1.3](#).
- RECORD NOTE** – Permits data recording – see [Section 3.3.1.1](#)
- SURVEY** – Opens the SURVEY Mode
- SPECTRUM TYPE** – Allows the User to choose the Spectrum Type as LINEAR or COMPRESSED.
- MAIN MENU** – Opens the Main Menu.



### 5.1.3 Exploring the Spectrum



Click on the **OK** button to open the Options Menu in the Graphic Window. Scroll to **Explore Spect** to open the Spectrum window.

The Spectrum Window opens showing the spectrum that has just been analyzed and the user can use the **LEFT/RIGHT Arrow Keys** to move a cursor along the spectrum to show **Channel/Energy and Counts** at that location.

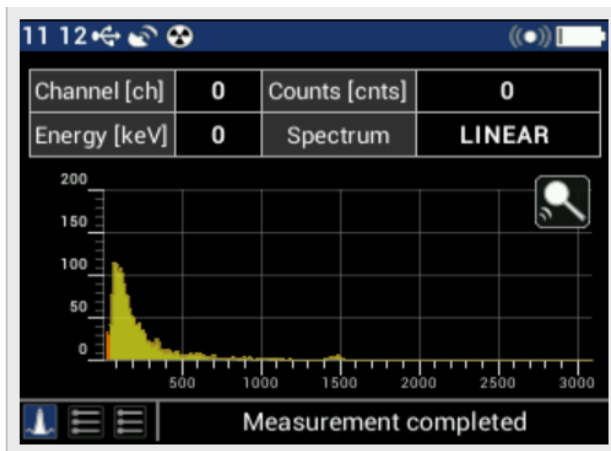
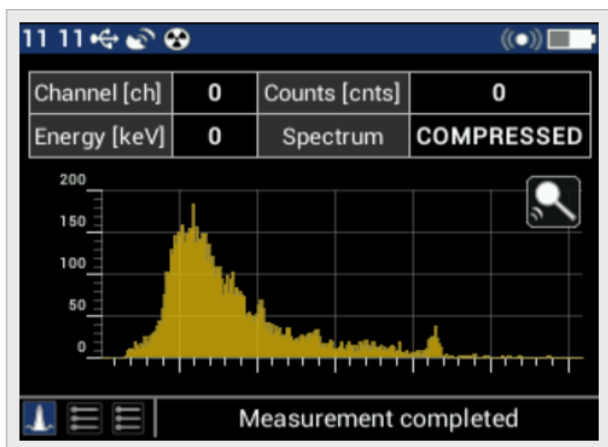


Clicking **OK** in the **Explore Spect** window opens the following menu of tools:



- **CONTINUE** – returns User to the spectrum graph.
- **AUTOSCALE** sets the vertical scale automatically to contain the maximum. This will place a white magnifying glass in the upper right corner of the graph. 
- **ZOOM** = permits changing the Vertical scale using the Arrow Up/Down keys. This will place a green magnifying glass in the upper right corner of the graph. 

- **SPECTRUM TYPE** - Toggles the graphic between LINEAR and COMPRESSED.



- **EXIT EXPLORING** – Returns to the Identify Mode.

**NOTE:** The **SPECTRUM Menu** is specific to the Identify Mode.

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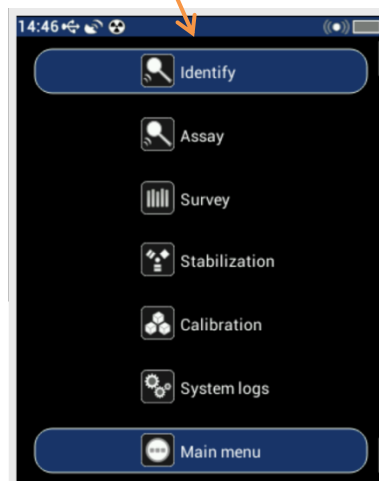
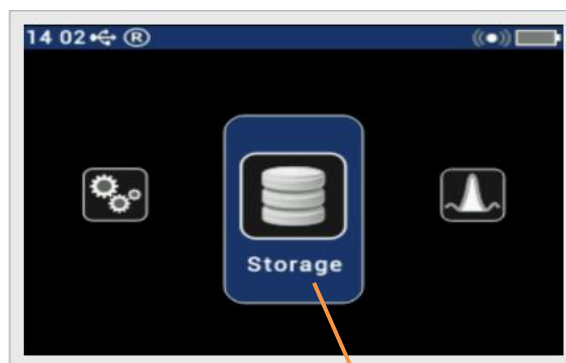
## 6.0 DATA STORAGE and PC CONNECTIONS

### 6.1 DATA STORAGE

The **RS-330** has a large non-volatile Solid State Memory drive, so data is automatically saved to memory when power is switched OFF. Data recordings are essentially unlimited for measured data, voice comments and information about the location of the unit as well as auto-logged data of system performance to permit analysis in case of issues.

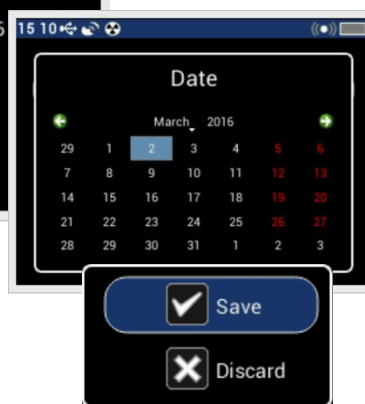
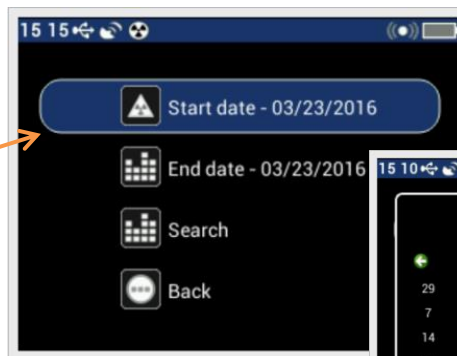
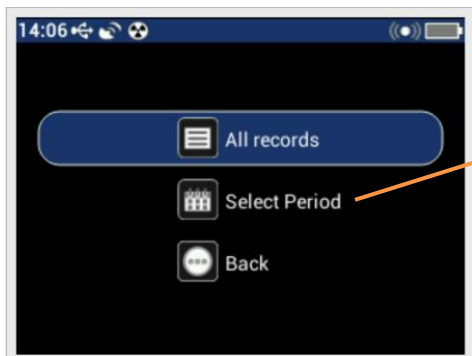
To view the Data memory contents, select **Storage** from the **Main Menu** then select any of the stored data sets.

- **Identify** (refer to [Section 6.1.1](#))
- **Assay** (refer to [Section 6.1.2](#))
- **Survey** (refer to [Section 6.1.3](#))
- **Stabilization** (refer to [Section 6.1.4](#))
- **Calibration** (refer to [Section 6.1.5](#))
- **System Logs** (refer to [Section 6.1.6](#))



Once the category is selected, the user can choose to inspect **ALL RECORDS** or filter the data by Date and Time range (from a calendar).

**Note:** This is typical for all selections.



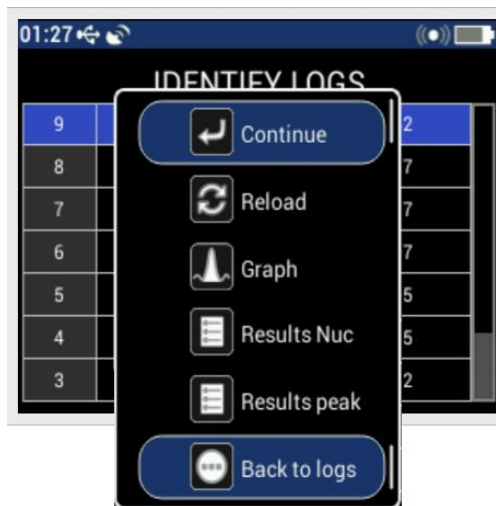
First enter the **START Date** and **Save**, the Start date will appear on the DATE Options screen. Enter the **END Date** and **Save**, the End date will appear on the DATE Options screen. Choose **SEARCH** and the chosen Storage Option will collect data from the requested time period.

### 6.1.1 Identify Log

The Identify logs; consists of ID results and spectra. Pressing **OK** gives additional options:

The Selections are:

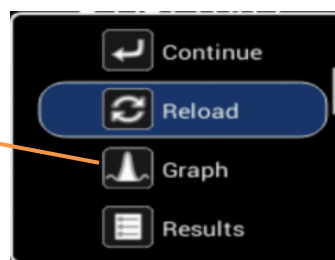
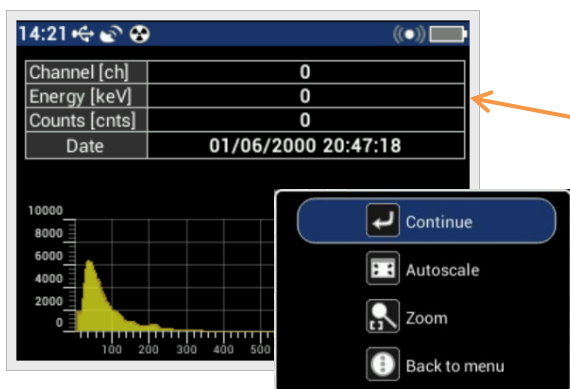
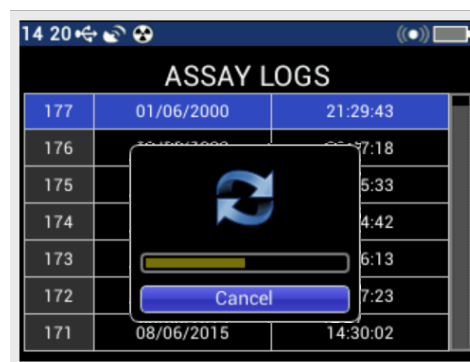
- **CONTINUE** – returns to the previous display.
- **RELOAD** – reloads the data into the database for display and selection.
- **GRAPH** – select a data file from Identify Logs, then press **OK** and the selected data file is shown as a graphical display with custom section.
- **RESULTS Nuc** – select a data file from Identify Logs, then **OK** and the selected data file data results are shown.
- **RESULTS Peak** – select a data file from Identify Logs, then **OK** and the peak results are shown.
- **BACK TO LOGS** – back to the Logs menu.



### 6.1.2 Assay Log

The Assay logs; consists of assay results and spectra. Pressing **OK** gives additional options:

- **CONTINUE** – this goes back to the previous display.
- **RELOAD** – reloads the data into the database for display and selection.
- **GRAPH** – select Graph from the Menu, then press **OK** and the selected data file is shown as a graphical display with custom section.



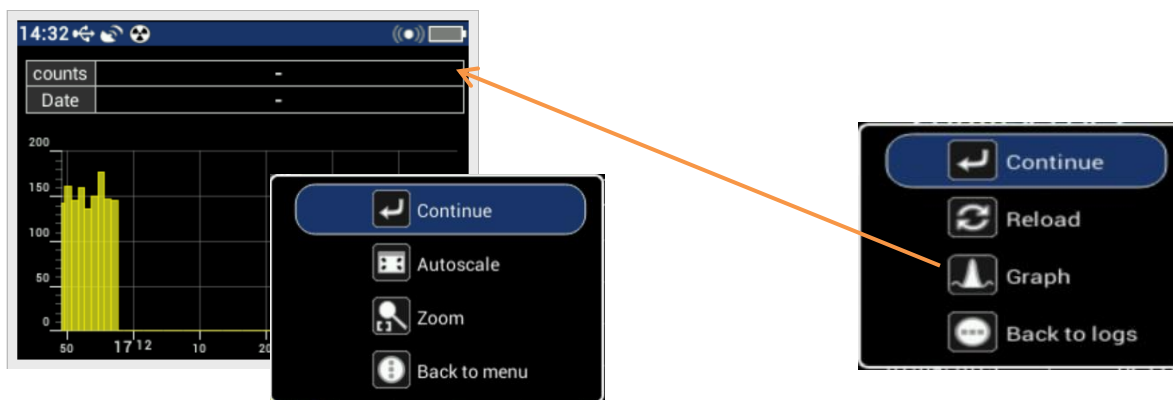
- **RESULTS** – select Results from the Menu; then press **OK** and the selected file data results are shown.
- **BACK TO LOGS** – back to the Logs menu

Area_300			
1	K	< 0.00	%
2	U	140 +/- 8.5	ppm
3	Th	185 +/- 23.0	ppm
4	Dose	1.7	µrem
5	Dose rate	103	µrem/hr

### 6.1.3 Survey Log

The Survey logs; consists of survey and analysis results. Once in this mode then pressing **OK** gives additional options:

- **CONTINUE** – this goes back to the previous display
- **RELOAD** – reloads the data into the database for display and selection.
- **GRAPH** – select Graph from the Menu, then press **OK** and the selected data file is shown as a graphical display with custom section.



Pressing **OK** will open a submenu of tools; the selections being Continue, Autoscale, Zoom and Back to menu.

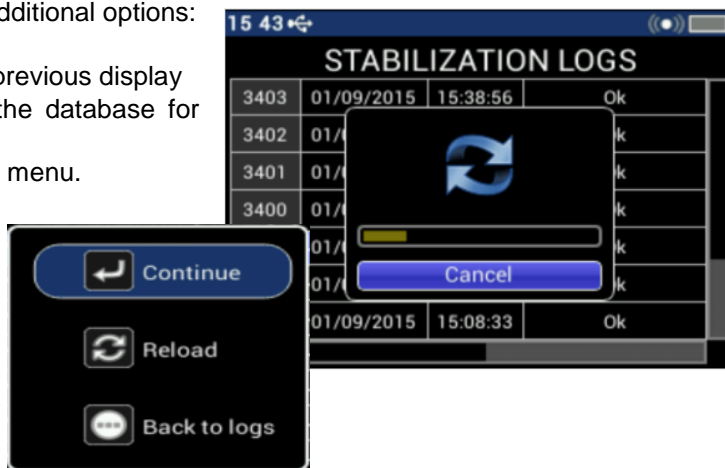
- **BACK TO LOGS** – back to the Logs menu. .

### 6.1.4 Stabilization Log

The stabilization log offers a table of the most important stabilization inputs and outputs. There are in columns: Index, Date, and Time of stabilization event and stabilization result. The stabilization result is **OK** when unit's gain is corrected but any stabilization errors will have a message. The next six columns are used for detailed information about peak differences in channels of nominal peak position, information about high voltage adjustment before and after stabilization and fine gain adjustment before and after stabilization. The information is primarily for specialist support. In case of problems, RSI may ask for the Stabilization Log to be emailed – see PC connections below.

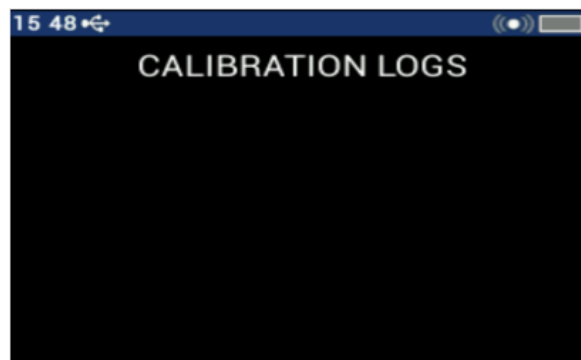
Once in this mode then pressing **OK** gives additional options:

- **CONTINUE** – this goes back to the previous display
- **RELOAD** – reloads the data into the database for display and selection
- **BACK TO LOGS** – back to the Logs menu.



## 6.1.5 Calibration Log

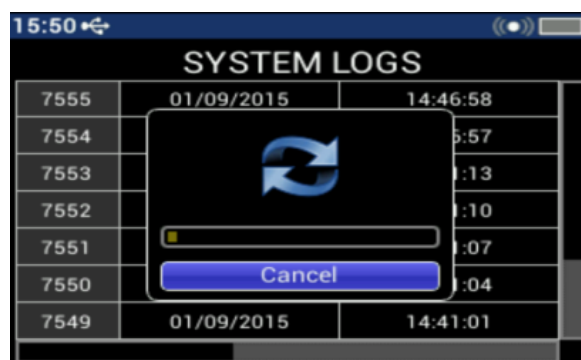
Future usage



## 6.1.6 System Log

The system log is used to file all important system information. In case of problems, RSI may ask for the Stabilization Log to be emailed – see PC connections below.

RSI supplies an ancillary program called **RSAnalyst** to enable easy parameter setup for the users (Refer to the **Reference Manual D-1037** for more information). This allows the sophisticated user with multiple systems to be sure that system Parameters are the same for each unit. Doing this manually as described above is onerous so the PC program makes it simpler.



**NOTE:** For security reasons some parameters can **ONLY** be set via the PC to prevent incorrect system operation by unauthorized personnel.

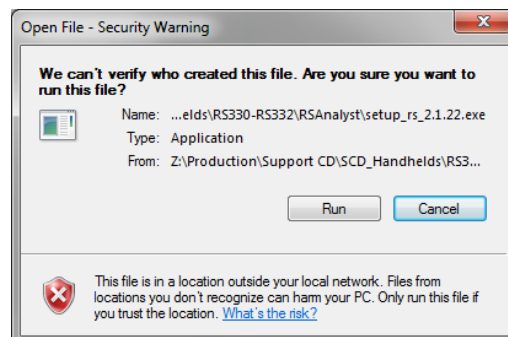
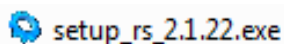
## 6.2 PC Software Download

Setup a new sub-directory on the USER PC – named as required - (e.g. **RSI**). Click on the link [sent to you by RSI Service](#) (see [Appendix Z](#) for contact information). Choose **SAVE** when requested, then select the correct sub-directory to download the software to (e.g. **RSI**). Open this file and **UNZIP** it as required.

## 6.3 Install RSAnalyst

**NOTE:** This software has been designed to run on all current Microsoft OS systems. The software has been successfully installed and heavily tested on a variety of computers including Win2000, WinXP, WinXP Professional, Vista, System 7, System 8.1 and System 10. A minority of users have experienced installation problems, concerning computer setup configurations. If problems persist, contact RSI for support.

Use Windows Explorer to look at the sub-directory where the downloaded file exists (e.g. **RSI**) – locate the file named **setup\_rs\_2.x.xx.exe**. Double click this file then select **RUN**.

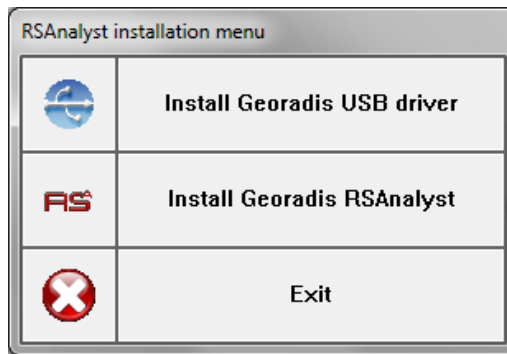


When this screen displays – click **“Install Georadis USB driver”**. This will install the device driver that properly connects the USB cable to the RS-330/332 device and the laptop with the RSAnalyst software.

Choose **“Install Georadis RSAnalyst”** from the RSAnalyst installation menu and follow the prompts.

Choose **Exit** when finished.

**RSAnalyst** will place an icon for the software onto your desktop.

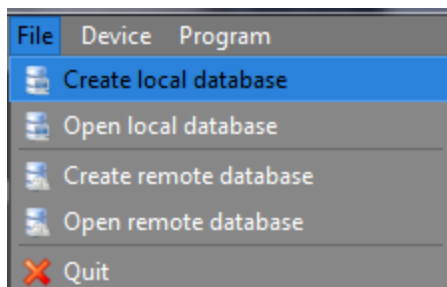
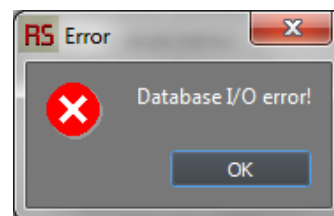


## 6.4 Startup RSAnalyst

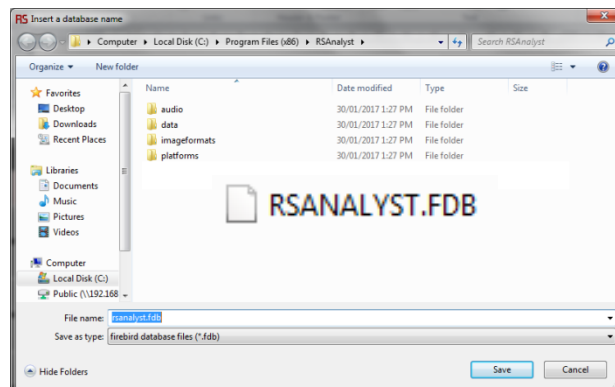
RSAnalyst requires the user to create a database in order to download data from the device. The system will store all data in the created RSANALYST.FDB database upon startup.



Double-click the **RSAnalyst** icon on the desktop. The **database** message is displayed – click **OK**, choose the sub-directory (e.g. **RSAnalyst – File → Create local database**).



A Firebird formatted data base will be set up named **RSANALYST.FDB** on the RSI sub-directory and all data will be stored there.

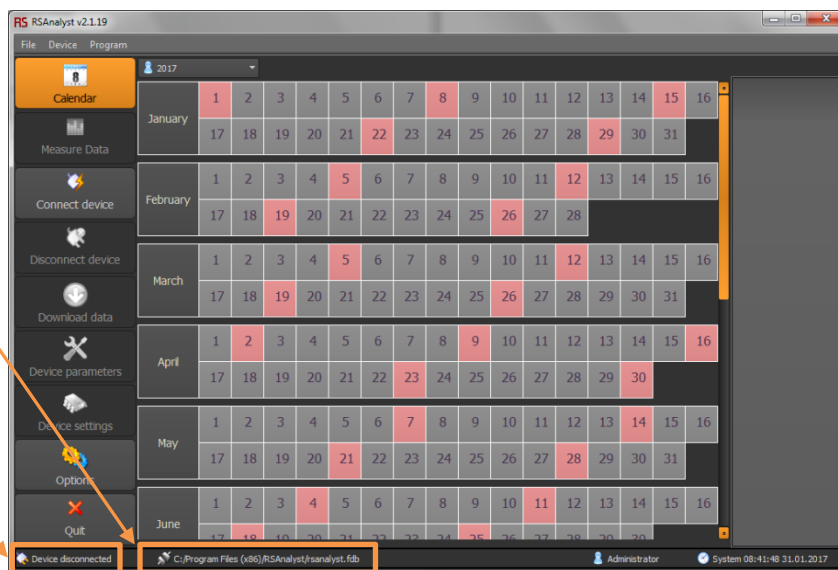


The program RSAnalyst opens with the Main screen as displayed below:

The screen will then open the page as displayed:

Current Database will be shown here:

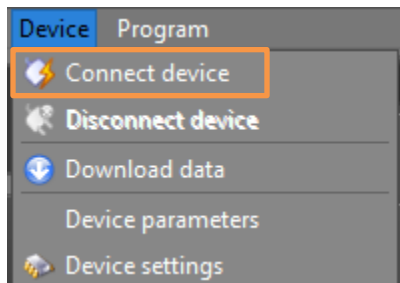
Device Connection



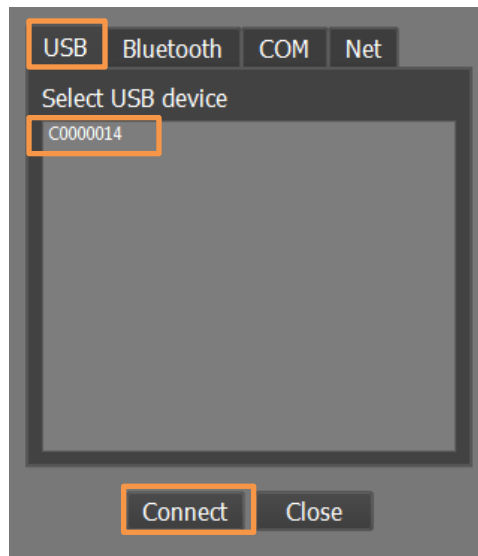
### 6.4.1 Connect Device

NOTE: Before starting be sure to connect the USB cable between the device and the PC.

To connect a device (RS-330/332) go to the Menu located at the top of the Main Screen and choose **Device → Connect Device**.



Clicking menu item **Device** → **Connect Device** opens the Connect Dialog box, choose **USB** and select the USB device shown. Click the **Connect** button.



**NOTE:** Refer to the [RSAnalyst User Manual \(D-1180\)](#) for information concerning the operation and use of the RSAnalyst software.

## 7.0 ALARMS

The RS-330 has a very sophisticated alarm capability that can be adjusted to suit any user requirements. Note that this Audio/Visual ALARM capability is separate from the normal audio tone change with intensity used to locate radioactive sources. The main purpose of the ALARM capability is to set various safety levels into the unit to warn of hazardous conditions.

**NOTE: ALARMS** is not active in the **Main Menu** until the parameter is turned ON under the **SETTINGS → Alarms** menu. Once turned ON, ALARMS will be displayed in the Main Menu. The following Alarms can be activated; Gamma, Dose Rate and Dose, and the threshold for these can be setup (refer to the **Reference Manual D-1037** for information on Threshold Settings). The function of these ALARMS is as follows:



### 7.1 GAMMA ALARM

The Gamma Alarm capacity permits the system to alarm the user if there is a small change in the local radiated Gamma field. Since the local Background fluctuates randomly due to physics, for best sensitivity the **LOCAL RADIOACTIVE BACKGROUND** is used as a base for alarm analysis.

When the unit is powered ON, it automatically stores a 3 second average of the local background (BG) in memory. The **Gamma Alarm Threshold** is set to Standard Deviation (SD) units with the threshold above this background.

For statistical reasons if a 3SD level was set then an alarm would occur typically within 100 seconds due to normal background fluctuations, so these low levels have no merit.

If the Gamma Alarm is to be used the User should determine the alarm threshold level, determine its' amplitude then select a SD setting to ensure reliable detection. In practice setting the threshold 3SDs below the peak level of interest is a conservative approach.

**ALARM ACTION:** if the radiation levels exceed the preset Threshold the following occurs:

- A very loud audio warning occurs and a pop-up box appears displaying a clear warning as shown.
- **MUTE HORN** is highlighted so press **OK** to cancel the loud audio
- An ALARM icon appears on the top of the display
- A **G ALARM** message appears on the top of the display showing this is a Gamma Alarm



- A new pop-up box appears with options:



- **CONTINUE** – if this is selected the pop-up box is removed but the Alarm Icon stays in place as well as the **G1 ALARM** message so this means the Alarm has been acknowledged but not removed. If this option is selected then the Top Menu ALARMS icon is selected to finally remove the alarm. **In most cases this is not a useful option so it is not recommended for normal use.**
- **RESET ALARMS** – this selection cancels the alarm so the pop-up box is removed, the alarm icon and message are also removed
- **NOTE** – allows user to insert an Audio Note in the manner described previously

**NOTE: IN MOST GEO APPLICATIONS, THE GAMMA ALARM CAPABILITY HAS LITTLE MERIT BECAUSE THE USER WILL UTILIZE THE AUDIO AND COUNT RATE VARIANCE TO LOCATE THE SOURCE OF INTEREST IN SURVEY MODE.**

## 7.2 DOSE RATE ALARM

The Dose Rate Alarm capability permits the user to alarm the system if there is a potentially hazardous radiation field detected for personnel safety.

In normal GEO Survey activities very high levels of radiation are extremely unlikely but the Dose Rate Alarm can be set to a level that is acceptable to local surveying and will alarm if real hazard levels occur.

For this reason the Dose Rate Alarm is set at a high level consistent with user safety.

**ALARM ACTION:** if the radiation levels exceed the preset Threshold the following occurs:

- A very loud audio warning occurs and a pop-up box appears on the display
- A pop-up box displays a clear warning as shown.
- Users should move at least 10ft (3m) away then select **MUTE HORN**
- The unit will wait 10 seconds and then test the alarm level again – if above the level the alarm sequence is repeated.



**NOTE:** The **Alarm Threshold** selected should be carefully chosen to a level that is acceptable to the local operation. In most cases this can be quite a high level setting because when the alarm occurs the user immediately moves away so Exposure hazard is extremely limited. Setting a low level for this alarm will interfere with normal survey operations so it is recommended that this alarm level be reserved for real hazard levels only.

## 7.3 DOSE ALARM

The Dose Alarm capacity permits the user to alarm the system if there is a potentially hazardous radiation field detected for personnel safety.

It must be noted that the DOSE ALARM accumulates all the Dose Rate data that occurs and is intended to be used to limit the total Dose Accumulation to the user to a level determined by local regulations and operational restrictions.

**NOTE: THAT WHEN THE DOSE ALARM ACTIVATES, IT OF COURSE CANNOT BE RESET BECAUSE THE DOSE LEVELS WILL CONTINUE TO ACCUMULATE. THE ONLY WAY TO RESET THESE DOSE LEVELS IS TO POWER OFF THE UNIT WHICH RESETS THE DOSE ACCUMULATION TO ZERO ON POWER ON.**

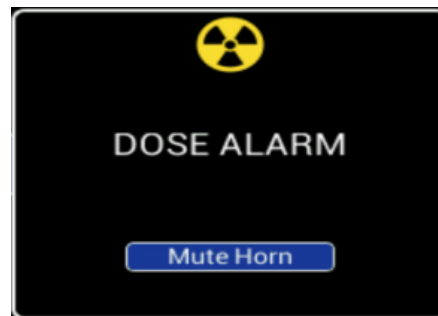
In normal Survey activities very high levels of radiation are extremely unlikely as in the vast majority of cases the radioactive source is located inside a vehicle or container and the intervening material absorbs a huge amount of the radiation.

However in rare cases a vehicle/container could contain a breached source (a source could have dropped and been damaged) in which case local radiation fields could be hazardous.

For this reason the Dose Alarm is set at a high level consistent with user safety.

**ALARM ACTION:** if the radiation levels exceed the preset Threshold the following occurs:

- A very loud audio warning occurs and a pop-up box appears on the display.
- A pop-up box displays a clear warning as shown.
- Users should move at least 10ft (3m) away then select **MUTE HORN**.
- The unit will wait 10 seconds and then test the alarm level again – if above the level the alarm sequence is repeated.
- As noted above the unit must be powered **OFF** to reset this alarm level.



**NOTE:** The **Alarm Threshold** selected should be carefully chosen to a level that is acceptable to the local operation. In most cases this can be quite a high level setting because when the alarm occurs the operator should immediately moves away to limit the **Exposure Hazard**. Setting the alarm threshold to low level will interfere with the normal survey operations, so it is recommended that this alarm level be reserved for real hazard levels only.

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## Appendix A TECHNICAL DATA

### Detector:

**RS-330:** NaI (TI), volume 345 cm<sup>3</sup>, dimensions  $\phi$  76 x 76 mm (3"x 3"), resolution FWHM at 662keV, less than 7, 2%.

**RS-332:** BGO, volume 104 cm<sup>3</sup>, dimensions  $\phi$  50.8 x 50.8 mm (2"x 2"), resolution less than 11.5%, shielded with 25mm (1") of lead.

**Spectrometer:** – 256 and 1024 channel, Energy Linearity Corrected, Pile Up Rejecter, Dead-time correction. Energy range 15keV – 3.0MeV

**Scintillometer:** – Sampling period 20/second

**Gamma ray sensitivity:** (1MBq Cs-137 1 m): **RS-330** = 386 cps, **RS-332** = 160 cps

**Dose meter:** Dose rate measurement range: Cs-137: 0.1 nSv/hr. 100 microSv/hr.

Energy compensation range: 30keV – 1500keV

**Gain stabilization:** Based on Naturally Occurring Radio Isotopes. Gain stabilized continuously in fully automated mode.

**Sensitivities:** Single measurement of areal soil contamination. Time of measurement 300s

Sensitivities are in minimum detectable concentrations/activities (Cs-137)

Potassium: 0.3%

Uranium: 0.9 ppm

Thorium: 1.5 ppm

Cesium 137: 400 Bq/m<sup>2</sup>

**Spectra evaluation:** Unique spectral analyze method, calibrated for different geometries and application. Measuring methods and Calibration are User Programmable.

**Measuring modes:** Single and repeated measurement mode

**Display:** Graphic, Color, Transflective LCD, 360 x 240 dots, 72 x 54 mm (3.5"), Sunlight readable

**Audio:** Speaker, diameter 28 mm + Built-in Microphone

**Data Storage:** 8Gb (approximately 2000 samples with full Spectra, GPS and Voice Message)

**GPS:** 2.5m CEP

**Communication:** Data Transfer, Remote Control and Diagnostic by:

- USB 2.0
- WiFi 802.11n

**Power:** Rechargeable Li-ion 7.2 V / 6600 mAh

– minimum 10 hours of measurement @ 20 °C.

External AC adapter (12 V / 1 A) for charging or measurement

**Remote control:** Full remote control via WiFi and USB, real time data transfer

**Position:** Integrated GPS receiver, GPS navigate down to –162 dBm and -148 dBm cold start

**Date and time precision:** Synchronized with GPS

**Language:** English by default. Languages can easily be changed simply by changing the plug in file.  
Scripts are in UNICODE

**Environmental:** Operating temperature range -10 °C to +50 °C  
Storage temperature range -20 °C to +60 °C  
RFI/EMF Shielding complies with FCC (47 CFR part 15) for Class A, CE Certification

**Size and weight:** **RS-330:** Diameter 124.5mm x 538.5mm height (4.9" x 21.2") Weight 4 kg  
**RS-332:** Diameter 124.5mm x 459.7mm height (4.9" x 18.1") Weight 8 kg

## Appendix B QUICK START GUIDE

### B.1 QUICK-OVERVIEW

To start using the unit ASAP various basic parameters need to be adjusted (refer to **Reference Manual D-1037**).

The unit as shipped by the factory is configured as follows:

Parameter	SET as DEFAULT (FACTORY)	Ref. Section (D-1037)	Device Change RS330/332 Chapter	PC Change RSanalyst Chapter
DOSE UNITS	R (NA) Sv (EU)	Chap 8 / Chap 10	Section 8.2	Section 10.3
BACKGROUND	ENABLE	Chap 8 / Chap 10	Section 8.2	Section 10.3
SAMPLE TIME	300 secs	Chap 8 / Chap 10	Section 8.2	Section 10.3
METHOD	USB-DIRECT Mode	Chap 10	NA	Section 10.2 / 10.3
ALARMS	OFF / DISABLE	Chap 8 / Chap 10	Section 8.1	Section 10.3
AUDIO MODE	FREQ. SWEEP / SURVEY	Chap 8 / Chap 10	Section 8.5	Section 10.3
AUDIO VOLUME	100%	Chap 8 / Chap 10	Section 8.5	Section 10.3
DATE/TIME	User set	Chap 8 / Chap 10	Section 8.6	Section 10.3

### B.2 PC PROGRAMS

RSI supplies a PC program with the system:

- **RSANALYST** – for Parameter Changes (**See the RSanalyst User Manual D-1180** for more information)

### B.3 RECOMMENDED START

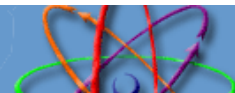
RSI recommends users start to use the system as follows:

- Manually change the required parameters (we recommend that a trained technician prepare the device with the proper parameter settings for an Operators' use) (refer to **Reference Manual D-1037 as well as RSanalyst User Manual D-1180**).
- Collect and store data on the device.
- Install **RSAnalyst** (see [Section\(s\) 6.2, 6.3 and 6.4](#) for information) and use this application to retrieve and archive data as required.

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## Appendix Z WARRANTY

**RSI RADIATION SOLUTIONS INC**



### Radiation Solutions Inc Warranty

The **RS-330** is a delicate instrument and contains components (Crystal, Photomultiplier) which are very shock sensitive. **The detector assembly is not covered under warranty.**

Manufacturer warrants to the original purchaser of Equipment that for the Warranty period, the Equipment will be free from material defects in material and workmanship.

- a) The “Warranty Period” begins on the date the Equipment is delivered and continues for 12 months.
- b) Any repairs under this warranty must be conducted by an authorized company service representative.

Excluded from the warranty are problems due to accidents, misuse, misapplication, storage damage, negligence, or modification to the Equipment or its components

**Repairs of defects will be performed by RSI at no charge to the Buyer**, subject to the limitations. To request warranty service, the Buyer must call RSI’s service coordinator for a return material authorization (RMA) number.

**The Buyer is responsible for all** the shipping, customs clearance costs and risk of loss of returning the repaired or replaced Products to the Buyer. RSI will own all parts removed from repaired Products or all Products replaced.

**RSI’s warranty does not include breakage of the crystal for any reason.** RSI does warrant the detectors to be complete and fully operational to their published specifications at the time of delivery and to maintain the minimum resolution and performance for a period of one year under normal operating condition.

**Complete details of the “Standard Terms and Conditions” may be obtained by contacting RSI.**

**For more information or to make a warranty claim contact RSI.**

#### Contact Information

Phone: (905) 890-1111  
Fax: (905) 890-1964  
Email: [service@radiationsolutions.ca](mailto:service@radiationsolutions.ca)  
[sales@radiationsolutions.ca](mailto:sales@radiationsolutions.ca)