

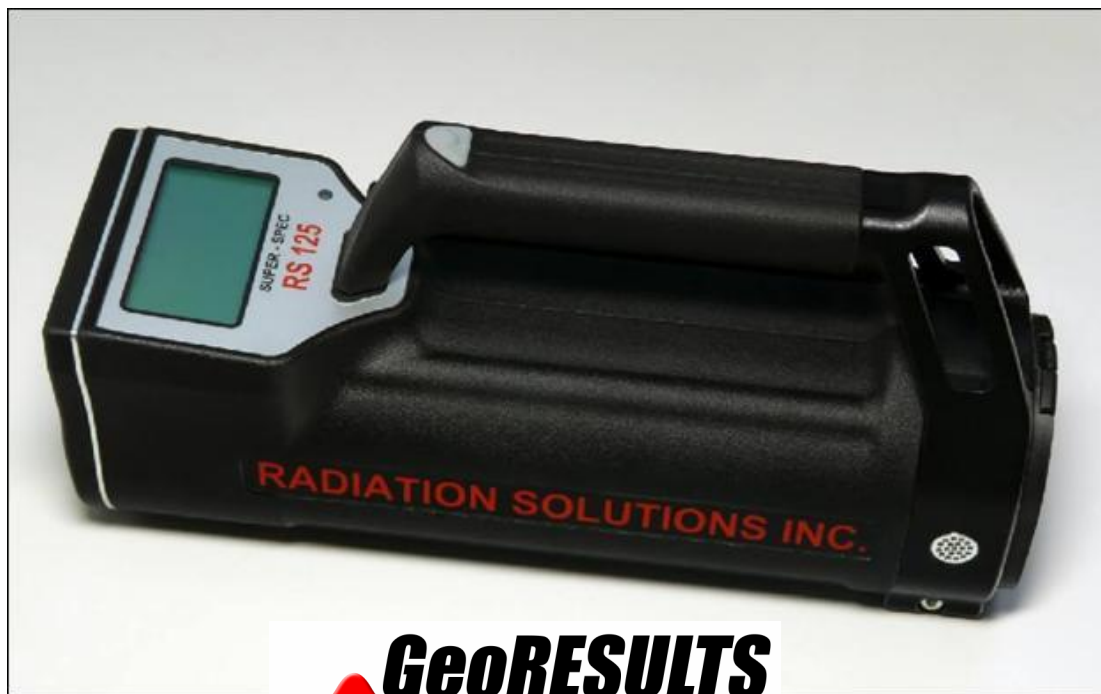


RS-125/230 User Manual

Revision 1.05 – December 2015

Firmware Version 5v95

Part Number D-1009



Sales, Support and Customisation

www.GeoResults.com.au

Ph: 0428 147 973

Revision History			
Date	Revision	ECO #	Description
May 20, 2014	01.00	NA	New PN and Rev in accordance with PN restructuring and QCBD software issues
Aug 18, 2014	01.01	15	Update Revision History
Oct 21, 2014	01.02	38	Correct Title Page (RS-125/230)
April 28, 2015	01.03	62	Update to Firmware Version 5v95
Nov 06, 2015	01.04	85	Change company address
Dec 11, 2015	01.05	90	Update with new screenshots

Product Manual - Disclaimers:

Due to our efforts to continuously improve this product; specifications, dimensions, operating features and procedures described in this manual are subject to frequent changes. The printed version of this manual reflects only the configuration current at the time of printing. 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.

PRODUCT STATEMENT

The RS-125 and RS-230 are a joint venture between RADIATION SOLUTIONS INC a Mississauga (Toronto) based geophysical equipment manufacturer and GEORADIS a Czech Republic based design company who were previously part of Exploranium but are now an independent private company.

ADVISORY

NOTE: Users are advised that the manual and software supplied with the instrument are current when manufactured, however, a program of continuous improvement means that many new features are added and old ones improved with time. [Users are advised to contact RSI directly for new releases including new manuals and software.](#)

NOTE: USERS ARE REMINDED THAT THE RS-125/230, IN COMMON WITH OTHER SIMILAR INSTRUMENTS, USES A Sodium-Iodide 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 SUPER-SPEC HANDHELD DETECTOR 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:

- **Protective boot** with carry straps.

Software:

- GEORADiS RSAnalyst (check with RSI for latest software and firmware upgrade)

NOTE: The latest software, firmware and documentation version are available from RSI (see [Appendix Z](#)). **Updating the software alone may update undocumented features so the rule is if you want to update – then update BOTH the RSAnalyst and the units’ internal FIRMWARE.**

1.0 INTRODUCTION

1.1 GENERAL

The new RS-125/230 Spectrometer is the state-of-the art in portable hand-held radiation spectrometer survey instrument for the Geophysical industry. It offers an integrated design with full weather protection, large detector, ease of use and the highest sensitivity in the market segment. This unit offers users a full Assay capability with internal data storage and PC data retrieval and display.

NOTE: The only difference between the 2 units covered in this manual are:

- RS-125 has a 6.3 cu in Sodium-Iodide detector.
- RS-230 has a 6.3 cu in BGO detector that offers performance similar to a 21 cu in Sodium-Iodide detector.

For simplicity the manual refers only to the RS-125 but system operation is identical for RS-230 instruments.

Users are advised that the manual and software supplied with the instrument were current when manufactured however a program of continuous improvement means that many new features are added and old ones improved with time. **Users are advised to contact RSI directly for new releases including new manuals and software.**



1.2 MAIN FEATURES

- **RS-125 = 2x2" (6.3cu ins)** Sodium-Iodide detector provides High sensitivity performance due to the large xtal. Energy response from 30 keV-3000keV.
- **RS-230 = 2x2" (6.3cu ins)** BGO detector provides typically 3x equivalent performance over comparably sized Sodium-Iodide detectors.
- Full ASSAY capability with data in **%K and ppm U and Th.**
- **NO radioactive sources required for proper operation.**
- **USB** connection for data retrieval.
- **Bluetooth** support for data transfer.
- Large easy to read **5 digit display** updated at 1/sec – giving a wide dynamic range, no overflow, no range controls. Graphic display LCD with white backlight with automatic dimming -128 x 64 pixels, 28 x 60mm size.
- Simple **ONE BUTTON OPERATION** – no parameter setups required for normal operation.
- Fast response, easy-to-hear **AUDIO** at 20/sec sampling making source location easier and eyes free.
- **512K** memory standard on older units – **4M** standard on newer units (512K memory units can be upgraded if required).
- New design state-of-the art electronics with advanced CPU/spectrometer capability.
- Special rugged design, robust aluminum casting construction with a heavy duty **"Rubberized"** outer coat which works as a shock absorber and provides thermal isolation.
- Outer coating gives a **good grip even when wet**, is simple to maintain and permits easy decontamination if required.
- Well balanced, easy to hold and designed for **one hand operation.**
- **RUGGEDISED** integrated carrying handle.
- **Fully weatherproof** – fully water and dust protected.
- **Rechargeable battery kit** supplied including NiMH battery pack module (4xAA) batteries, Universal Charger (110/220VAC) and a 12V cigarette lighter charge cable.
- Typical **8+ hour** battery life at 15^o C on NiMH batteries.
- Size 10.2" x 3.2" x 3.6" – 4.4lbs **with batteries** (259x81x91mm – 2Kgs: RS230=2.2Kgs).
- Operational Temperature range **-20 to 50 degrees** Celsius (display is the limit).
- Spare battery module for **"instant"** replacement.
- **Protective boot** with carry straps (supplied standard with 2008 units but available as an option for older units).

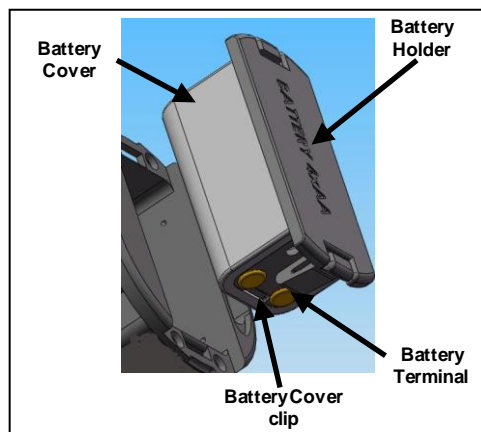
N.B. See Chapter 4.0 for summary of new software system changes. Note that this manual incorporates all changes in the current release.



2.0 SYSTEM OPERATION

2.1 BATTERIES

- a) **LOAD BATTERIES in HOLDER** - the unit is shipped with the batteries separate. Remove the Battery Cover by depressing the Battery Cover Clip at each side. Load the 4 x AA cells with negative at the spring end. Slide the battery Cover back in place ensuring that the side guides are lined up – if all OK the Cover should fit smoothly on.
- b) **LOAD BATTERIES in UNIT** – slide the Battery Holder into the base of the RS-125 with the battery Terminals on the side of the copper terminals in the unit. (if in incorrectly the unit will not power on). If all is OK the 2 side mounted clips should “click” into place to hold the Battery Pack solidly into the RS-125 unit.



THE RS-125 / 230 ARE SHIPPED WITH CHARGED BATTERIES. HOWEVER OVER A PERIOD OF TIME THESE BATTERIES WILL DISCHARGE SO USER ARE ADVISED TO FULLY CHARGE BATTERIES BEFORE USE (4hrs MINIMUM).

2.2 BUTTON

The RS-125 Super-Spec instrument has only ONE control that is the front panel **PUSH-BUTTON** referred to as **BUTTON**.

This Button is actually mounted on the face of the instrument but with the normal handle attached, connection to the Button is via a mechanical link from the Button on the handle.

The Button has 2 primary actions:

- **CLICK** – This is a click (SHORT) and release (less than 1 second button action).
- **LONG** – This is a click (LONG) and hold action typically held for 3 seconds with display feedback.



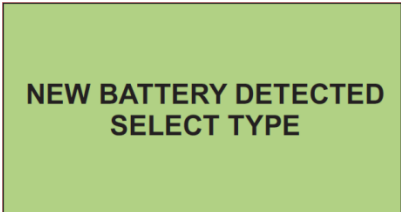
2.3 DISPLAY

The Display is a back lighted LCD display optimized for high contrast in outdoor conditions. Display Backlighting is required in low light conditions to make the display readable but this reduces battery life so to optimize battery life the backlighting automatically comes on ONLY when required. The Display is used for various functions and messages.



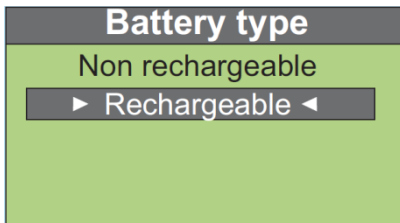
2.4 POWER ON after BATTERY CHANGE

Press the **BUTTON** until the unit beeps then release the **BUTTON**. The battery change label is shown.



NEW BATTERY DETECTED
SELECT TYPE

The next display requires battery type selection.



Battery type
Non rechargeable
▶ Rechargeable ◀

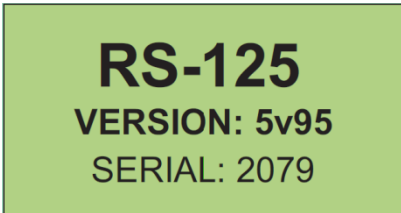
NOTE: The Battery Type selection is required to let the unit know which batteries are used. Battery discharge rates vary between battery type so that for Low Battery detection it is essential the unit knows the correct battery selection. Normally RECHARGEABLE batteries are the correct option for the RS-125 as this is what is supplied with the unit – but the user can select to suit their requirements.

CAUTION: USERS SHOULD BE CAREFUL NOT TO LOAD non-RECHARGEABLE BATTERIES SUCH AS ALKALINE, INTO THE UNIT WHEN CHARGING THEM. EVEN THOUGH THE UNIT IS PROTECTED AGAINST THIS, EVENTUALLY THE ALKALINE BATTERIES WILL LEAK AND DAMAGE THE INSTRUMENT.

CLICK the **BUTTON** (short less than 1 second) to move between selections. Once the correct selection is highlighted hold the **Button** (LONG-CLICK) until the selection background changes – release the **Button** for the correct selection.

The next display is the start-up display and shows for 3 seconds then changes to the **SURVEY** display (see [Section 2.6](#) below).

NOTE: The software version will be **5v95** in this case.

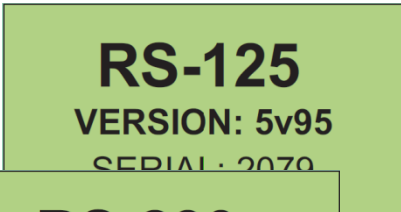


RS-125
VERSION: 5v95
SERIAL: 2079

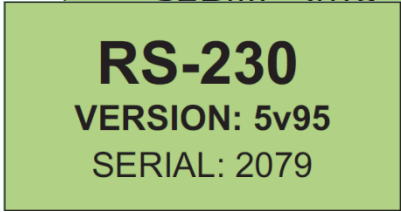
2.5 POWER ON normal

Press the **BUTTON** until the unit beeps and the sign on display is seen, then release the **BUTTON**. After 3 seconds the sign on display changes to the SURVEY DISPLAY.

NOTE: The Version# is the installed software version of the unit. In any communication with RSI regarding system performance, it is very helpful to specify the SERIAL # and the SOFTWARE VERSION to enable better trouble shooting support.



RS-125
VERSION: 5v95
SERIAL: 2079



RS-230
VERSION: 5v95
SERIAL: 2079

2.6 SURVEY DISPLAY

The Survey Display is segmented as shown in the figure.

Local Time: settable to Local Time in Parameter Setup – [Section 3.1](#)

Battery Status: an Icon that shows current status of the battery.

ALKALINE batteries

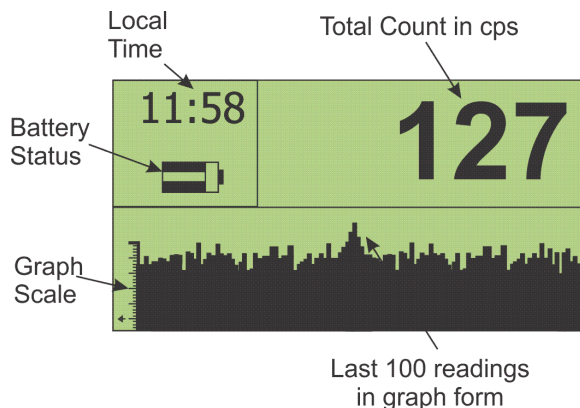


RECHARGEABLE batteries



Total Count: current radiation level in counts/second units.

Graph: the last 100 readings are shown in graphical form. The right hand reading is the oldest and the left hand is the latest. This helps the user to look for small changes they might have missed.



2.7 AUDIO

- a) **INTERNAL** - the RS-125 has an audio speaker inside the unit. The audio system is activated when the radiation level gets above a certain internally computed Audio Threshold. Once the Audio Threshold is exceeded then the Audio INTENSITY will reflect the incoming count rate to provide a varying INTENSITY level that relates directly to count rate and therefore local radiation intensity.

In this manner a hands-free survey can be carried out that is usually highly recommended in many field situations where often the eyes are selecting the terrain so, without proper audio feedback, some significant count levels could be missed if the eyes are distracted. The Audio system can be fine-tuned in Parameter setup if required.

- b) **BLUETOOTH AUDIO**

Since the unit has Bluetooth (BT) connectivity, a new feature is the ability to use a BT earphone system for improved audio in very noisy areas (rivers, rain etc.) See section 3 below to activate the selected BT earphone system (the RS-125 assumes that VOLUME control is on the earphone as is normal on most units) – see section 4 for special parameter changes for Audio.


2.8 STABILIZATION

Spectrometer systems like the RS-125 use an integrated SPECTROMETER system to provide data for analysis of ASSAY results. The accuracy of these results is a function of many items but a very significant one is spectrometer stability. It is crucial that the system spectrometer maintains a stable operational mode independent of temperature etc. To provide accurate Assay data the spectrometer **must be stabilized** to also give data independent of local conditions that could affect the data.

To achieve this, the RS-125 has a **FULLY AUTOMATIC** spectrum stabilization system integrated inside the unit that uses the low radiation levels from surrounding geology to perform this analysis. In principle the system accumulates spectra **INTERNALLY** while

System
not stabilized

the system is powered ON and once a high enough level has been achieved then a complex analysis takes place to determine the correct spectrum position. This analysis results in an error measurement that the system uses internally to correct these effects. Note that this process is completely independent of the user. Typical Automatic Stabilization takes 5-10 minutes depending on local conditions.

Once the system is fully stabilized a new icon  appears on the display above the Battery icon to show the analysis is complete – see figure. The RS-125 can continue to be used in the SURVEY mode while this fully automatic process is carried out in the background.

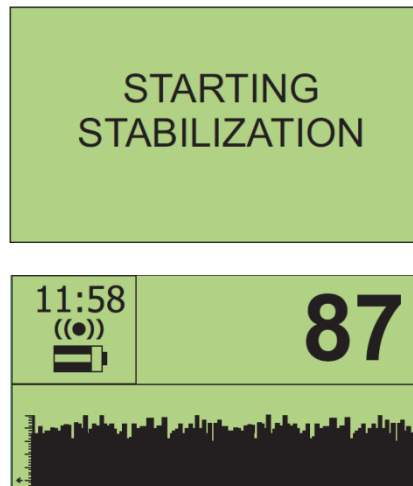
If the system is **NOT** stabilized and the user attempts an **Assay**, an error message appears and **the unit beeps 3 times**. **If the user ignores this warning, the Assay continues** – note that under these conditions the quality of the Assay data is questionable as system Stabilization is incorrect so the data could be roughly **OK** if stab is close but really bad data if Stab is significantly in error. The stab status is shown on the data retrieved to the PC for data verification.

In previous software versions, Stabilization was inhibited during Assay to minimize data errors. However if users are taking repeated Assays this means that Stabilization will be suspended for a long period of time and during this period the system could drift causing significant data errors.

To prevent this happening in Ver. 5v95 the Stabilization accumulation of data is NOT interrupted by the Assay process.

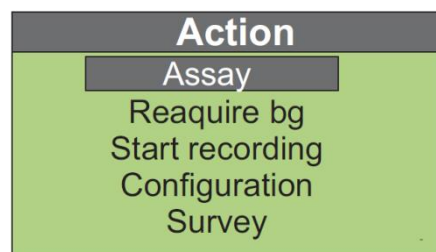
In fact an auto correction is implemented so that if at the end of Assay a Gain correction is required, the system automatically computes the potential Gain error and corrects the data to minimize system errors.

In addition the unit beeps every time it stabilizes as a reminder to the user that all is well. This can be inhibited if judged to be a problem – contact RSI. See [Appendix Z](#) for Contact Information.



2.9 ACTION

The RS-125 only has one **BUTTON** as noted above. To achieve the required system functions **CLICK** (short) and a Menu appears. The user navigates up and down this menu using **CLICK** (short) and the highlighting moves with the selection. Once the selection is made, hold the **Button** until the background changes from Dark to Light (typically 2-3 secs) then release the Button to make the selection.



Selections:

- Assay** – activates the ASSAY capability of the system (see [Section 2.10](#) below)
- Reacquire bg** – rests system background (see [Section 2.11](#) below)
- Start recording** – activates the RECORDING capability of the system (see [Section 2.12](#) below)
- Configuration** – permits parameter changes (in firmware versions before ver. 5.19, parameter selection was accessed on power up but v5.19 has made setup easier) - (see [Chapter 3.0](#) below)
- Continue survey** – this selection returns to the previous SURVEY display with NO change in background setup levels.

2.10 ASSAY

NOTE: THE DISPLAY MUST SHOW THE STAB ICON BEFORE THE ASSAY DATA IS VALID.



If **ASSAY** is attempted with incorrect Stabilization an error message will appear on the display and the unit will beep 5 times. Correct action is to press the button once to terminate the **ASSAY** and wait until the unit is stabilized (normally 2-5 mins max).

When the **ASSAY** selection is made the **ASSAY** mode starts and a new display is seen

Meas Time – When the sample starts, a preset Sample Time parameter shows the sample time on the right and a count up timer showing the sample progress on the left.

Once the first 30 secs sample point is reached an Assay result is shown. Each additional 30 secs the Assay data is recomputed and updated on the display.

For best accuracy the full count period should be permitted. However in very anomalous areas sample times as low as 60 seconds give very good data due to the large detector size.

Guidelines are:

- 60 secs** – anomalous area – low quality data is fine – fast sampling is required to get maximum data for an area in a short period of time
- 120 secs** – **(DEFAULT)** anomalous area – medium quality data is fine – fast sampling is required to get maximum data for an area in a short period of time
- 180 secs** – medium anomalous area – good quality data is required
- 240 secs** – medium to low anomalous area – high quality data is required
- 300-1800 secs** – low anomalous area – maximum quality data is required

Note if the sample period is set ABOVE 999 secs then for display limitation reason, the “Meas time” is shown as a % of completion starting at 0.1%.

FOR EASE OF USE THE SAMPLE PERIOD IS NORMALLY SET TO 120 secs AS THIS VALUE GIVES GOOD QUALITY DATA IN MOST CONDITIONS. See Chapter(s) 3 and 4 to change to suit users requirements.

At the end of the preset Assay period the sample stops and the audio continuously beeps to advise user of the end of sample. The user takes the unit and presses the **Button** to stop the audio and inspect the display results. Note the display top label now shows “**ASSAY RESULTS**”.

Note that the **K** data is shown in % and the **U** and **Th** data in **ppm** (parts/million – N.B. ppm/10,000=%). The **Total Count** is usually shown in DOSE units (Sv/ Gy, R) to give users an idea of the relevant Dose information and can be used as an overall indication of radiation intensity.

System
not stabilized

Assay Progress	
Time	30/120s
Dose Rate	-
K	-
U	-
Th	-

Assay Complete	
Time	120/120s
Dose Rate	38.4nGy/h
K	1.1%
U	29.3ppm
Th	11.5ppm

Assay Results	
Time	120/120s
Dose Rate	38.4nGy/h
K	1.1%
U	29.3ppm
Th	11.5ppm

Assay #11
2015/12/7 11:15:03

The user can then view/note these results then press the **BUTTON** again and the display shows:

The user has approximately 3 secs to note the TIME or the Spectrum # to enable them to relate the stored data to the actual sample location when data is retrieved from the unit. Alternatively the user can note the **TIME** on the RS125 display **BEFORE** the sample is started as perhaps an easier way to record the data results relationship to sample location. The data is stored in system memory and can be retrieved later (see Section 4). NOTE: when the unit is initially setup the first spectrum is #0, after that they increment 1, 2, 3 etc. Even when data is erased this continues so if the last spectrum of the day was #46 then the first spectrum of the next day could be #47 the next #48 etc. This number continues to increment indefinitely so identical sample #'s cannot occur. This method of “universal spectrum numbering” helps in minimizing data confusion.

SHORTEN ASSAY PERIOD

At any time **AFTER THE FIRST 30 SECS** - the user can **stop** the Assay progress by a short **CLICK** of the Button – the display then shows the Assay Results with the time shown at whatever it stopped at. This is NOT recommended as the quality of the data depends a lot on the sample time.

Selecting a fixed sample time (usually 120 seconds) and ensuring all users wait for full sample completion, is a sensible way to maintain overall data quality.

Assay Results	
Time	30/120s
Dose Rate	38.4nGy/h
K	1.1%
U	29.3ppm
Th	11.5ppm

DATA MEMORY LIMITS: Refer to section 4 (MEMORY) to determine system memory limitations and selections. The user is recommended to download data each day to prevent data loss.

GPS with ASSAY

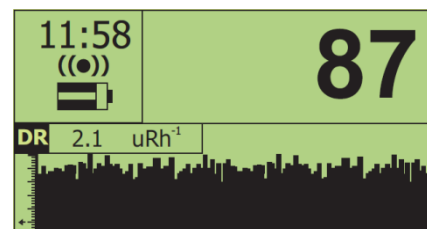
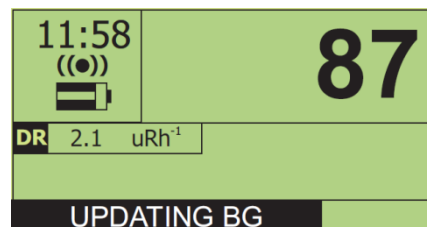
If a GPS unit is configured (linked) to the RS unit then GPS location data is recorded at the end of the Assay period. To conserve GPS battery power it is only necessary for the GPS to be powered ON for a short time during the Assay sample period. To assess this – at the start of Assay power the GPS to ON and there should be a flashing cross-hair below the battery icon. Once the GPS has a good lock on satellite data, the cross-hair goes steady. As soon as this steady-state is seen the GPS coordinated have been transmitted to the RS unit so the GPS can now be powered OFF. Of course the GPS can stay on at all times if battery conservation is not a problem.

SPECIAL FUNCTIONS – see [Section 4.5.5](#) Settings - Measurement for special Assay actions.

2.11 Reacquire Bg

When in the SURVEY mode of operation, the AUDIO THRESHOLD is set using a preset parameter – usually 1 Sigma for Geophysical application. When the unit is powered on, after internal checks the first 3 x 1 second samples are averaged and the Audio Threshold computed from this average – then the Audio is enabled. If the count level exceeds this threshold the audio sounds as described above. However in many areas the local background changes and this causes threshold problems.

As an example if the local background level was 100 cps then at 1 Sigma the Audio Threshold = 110 cps (100 + 1 Sigma). So if the count rate goes above 110 cps the audio will sound. However if the local Background increases substantially to 300 cps then the audio will be on continuously and the audio will not seem as sensitive to small local changes. Similarly if the local Background goes down to 50 cps then the local radiation would



have to increase very substantially before the audio sounds – thus effectively desensitizing the audio system.

To overcome this “problem” AT ANY TIME the user can briefly touch the **BUTTON** and select the **Reacquire bg** selection. Then the system will return to the SURVEY display and the system will automatically recompute the Audio Threshold and the message “UPDATING BACKGROUND” will be seen on the display for the 3 seconds of the update. This means the user can “retune” the Audio Threshold at any time thus keeping the audio threshold optimized.

2.12 Start RECORDING

The RS-125/230 now has a RECORDING capability that permits automatic recording of **TOTAL COUNT** data and/or **ASSAY RESULTS** into memory to permit line profiles etc. In addition an external **GPS** unit can be interfaced directly into the unit via the Bluetooth connection and the GPS data **integrated directly into the internally stored data memory**.

NOTE: MEMORY – system memory is allocated to suit users requirements. (See [Section 4.5.5.3](#) for details and changes).

a) RECORDING WITH GPS

The system has been developed to work with Bluetooth (BT) GPS and communicates data directly to the RS-125/230 unit(s). However the GPS output data stream NMEA (GGA format) is common to all units so other GPS units should also work.

GPS INITIALIZATION

Setup the GPS recording link as described below in Section 3. Once the GPS is activated (linked) to the RS-125/230, data recording can start.

From the Main Menu select “**Start recording**” and new icons appear on the display as shown in the figure.

The “**R**” symbol shows that recording is ON and the **cross-hairs** show the GPS connection. If the cross-hair symbol is flashing this means that the GPS has not found a good satellite lock so data recorded in the system for Lat/Long are ZERO. When the GPS acquires satellites the cross-hair is solid showing proper location data is being recorded.

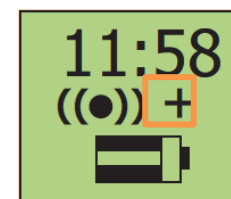
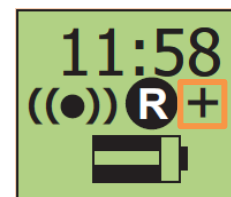
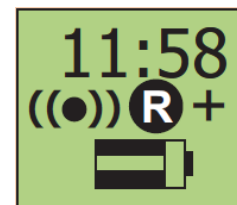
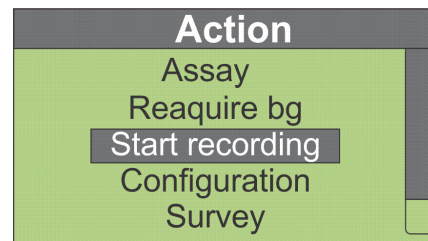
NOTE: When the GPS is activated it does nothing until the **START RECORDING** selection is made. Then the unit starts to automatically acquire satellites to get a good lock. It is very common that it takes 5-10 minutes to get a good lock with as many satellites as are available (this is the equivalent of a cold start. Once it has found ALL the satellites available it only needs 3 to get a good position. This means that once it has got all the satellites available it can continue to give good data even in areas where many satellites are lost.

c) WITHOUT GPS

If no GPS is connected or activated Profile recording can still occur. From the Main Menu select “**Start recording**” and new icons appear on the display as shown in the figure. The “**R**” symbol shows that recording is ON and the flashing GPS cross-hairs still appears but may be ignored.

c) STOP RECORDING

From the Main Menu select “**Stop recording**” and the record icon will disappear, the flashing GPS cross-hairs still appear but may be ignored.



2.13 DATA RECORDING GENERAL

The data recording action, when the



symbol is shown means that the selected data is being recorded.

Section 2.13.a), b), & c) below permits the user to select whether to record TOTAL COUNT data only, ASSAY RESULTS only or both.

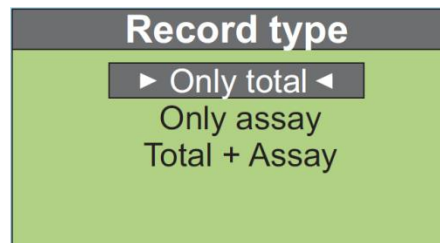
a) TOTAL COUNT data only

Set parameters as required:

RECORD TYPE = Total only

Total scan period = 1- 20 secs (e.g.1 sec)

MEMORY allocation as in section 4, selected to suit recording needs.



When **START RECORDING** is selected then Total Count data is stored in memory at the selected rate (Total scan period) of 1 sample/sec (or as selected).

The data is stored in 30 sample data blocks. If an external GPS is integrated, the GPS data is stored every 30 samples – if no GPS is connected the GPS data is stored as zeros.

Some users want to record GPS data at a faster data rate. This can be done but some memory gets sacrificed – see [Appendix B](#).

When data recording is complete press the Button to see the menu and select **Recording OFF** to terminate recording.

RS-Analyst is used to retrieve this profile data see section 4 for more details.

b) ASSAY RESULTS data only

User must select:

RECORD TYPE = Assay only

Assay scan period = 30-1800 secs (e.g. 30 sec)

MEMORY allocation – as described in section 4.9

Parameter setup can be done manually as described in [Chapter 3.0](#) but it is much easier to do via PC connection as shown in [Chapter 4.0](#).

When **START RECORDING** is selected then **Assay Results** only (no spectra) data is going into memory at the selected rate of 30 secs/sample.

The data is stored in a txt file, if an external GPS is integrated the GPS data is also stored – if no GPS is connected the GPS data is stored as zeros.

When data recording is complete press the Button to see the menu and select **Recording OFF** to terminate recording.

RS-Analyst is used to retrieve this profile data as shown below in a space delimited file that can be read into Excel as required – see [Chapter 4.0](#) for more details.

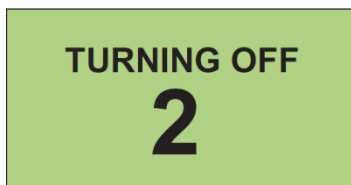
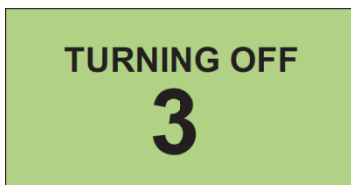
c) TOTAL + ASSAY data

In this case BOTH the Total Count + GPS data and the Assay Results + GPS data are stored in their appropriate memory locations and can be retrieved as described in [Appendix A](#).

NOTE: 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.

2.14 POWER OFF

To power OFF the unit, press and hold the **BUTTON** and the unit powers OFF. The display shows a countdown "**TURNING OFF 3**", "**TURNING OFF 2**", "**TURNING OFF 1**" then the unit finally powers off. Sometimes this countdown sequence can take a few seconds before initiating if the unit is "busy" but typically no more than 5 seconds before the countdown sequence starts. If the **BUTTON** is released at any time before power OFF, the unit will continue to function.



2.15 LOW BATTERY

If the Batteries are getting low, an audio beep prompts the user to view the display. If the Battery icon shows very little battery left the battery pack should be changed. RSI recommends that a spare Battery Pack is carried at all times to prevent field problems as changing is a few seconds task with NO loss of stored data.

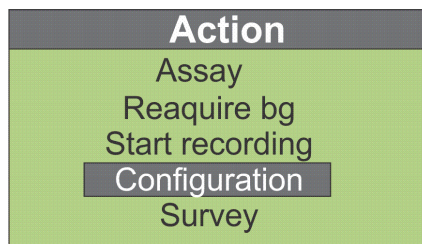
Two battery modules are supplied with each unit.

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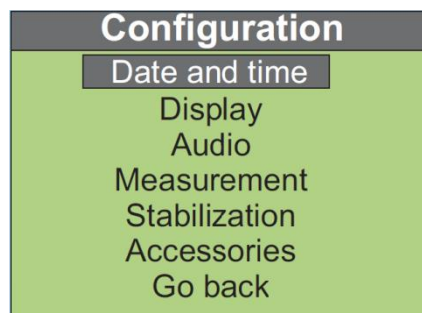
3.0 CONFIGURATION (Manual Method)

[\(Chapter 4.0 shows a much simpler way of parameter changes via the PC\)](#)

Select **CONFIGURATION** for the display reached by clicking **BUTTON**.



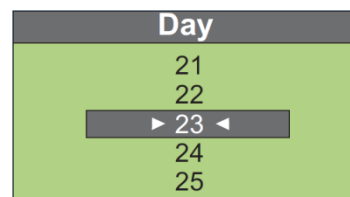
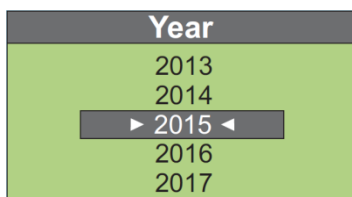
- a. **CLICK** (short press of the **BUTTON**) to move down the menu. The screen highlights the selection. Move down the menu until the required parameter is reached then **LONG CLICK** (press **BUTTON** until the backlighting of the display changes from White figures on a Black background to the opposite) – then release the **BUTTON** to select this parameter.
- b. Once the parameter is selected use **CLICK** (short **BUTTON**) to move down the menu selection. Once the correct one is reached **LONG CLICK** (hold **BUTTON** until the background changes) then release the **BUTTON** to select.

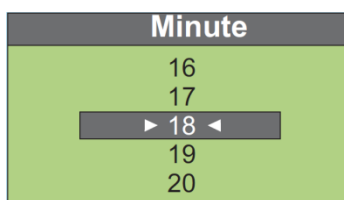
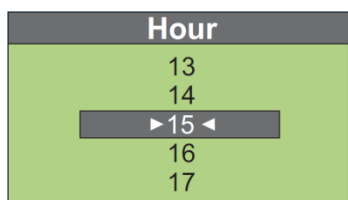


3.1 Configuration (PARAMETERS)

a. **DATE and TIME**

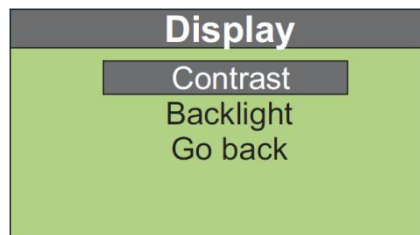
- i. **YEAR** - YEAR for the internal **CLOCK**. The display shows 2006, 2007, 2008 etc. **CLICK** to select the right **YEAR** then **LONG-CLICK** to set this selection.
- ii. **MONTH** - this sets the **MONTH** for the internal **CLOCK**. The display shows Apr, May, Jun etc. **CLICK** to select the right **MONTH** then **LONG-CLICK** to set this selection.
- iii. **DAY** - this sets the **DAY (DATE)** for the internal **CLOCK**. The display shows 1, 2, 331. **CLICK** to select the right **DAY** then **LONG-CLICK** to set this selection.
- iv. **HOUR** – this sets the **HOUR** for the internal **CLOCK**. The display shows 0,1,2,3...23. **CLICK** to select the right **HOUR** then **LONG-CLICK** to set this selection.
- v. **MINUTE** - this sets the **MINUTES** for the internal **CLOCK**. The display shows 0,1,2,3...59. **CLICK** to select the right **MINUTE** then **LONG-CLICK** to set this selection.
- vi. **GO BACK** – return to the Configuration menu.





b. DISPLAY

- i. **CONTRAST** sets the Display CONTRAST. Selections are -3, -2, -1, 0, 1, 2, 3. -3 to -1 lightens the display, +1 to +3 darkens it. Normally “0” is a good average selection. **CLICK** to select the right setting then **LONG-CLICK** to set this selection.
- ii. **BACKLIGHT** – this sets the Display BACKLIGHT.. Selections are AUTO, ON, OFF.

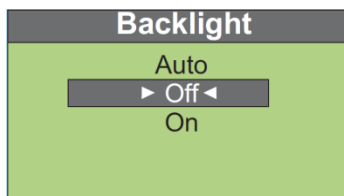
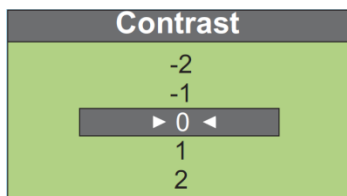


AUTO = the system automatically selects the required Backlighting using a light sensor to set the required level. This is the best selection but in dark shadow areas the Backlighting will come ON to make the display more visible. While often this is a required feature the downside of this is a significant reduction in battery life by typically 40% if the Backlighting is ON all the time.

ON = overrides the light sensor and sets the Backlighting ON all the time.

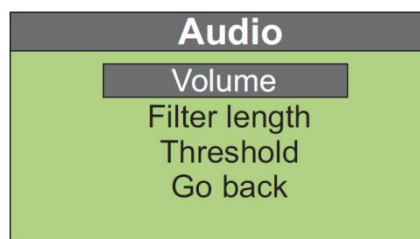
OFF = sets the Backlight permanently Off to conserve battery life.

- iii. **GO BACK** – return to the Configuration menu.



c. AUDIO

- i. **VOLUME** - this enables or disables the audio survey system. Selections are ON, OFF
 ON = Audio is enabled
 OFF = Audio is disabled



For Geophysical applications set to **ON** as Audio Survey is an essential operational requirement, the OFF mode is used for special applications

- ii. **FILTER LENGTH** – this sets the filtering parameters to optimize the audio system response for different applications. Selections are 1-10 and indicate the number of 50mS samples are averaged.

1 = shortest filter thus the fastest audio response

10 = longest filter giving the slowest response

SHORT filters give fast response but don't give such a “smooth” response to a slowly increasing field.

LONG filters give a very smooth “even” response for a slowly moving field but tend to minimize short term local effects

For most Geophysical applications a setting of “9” is appropriate

- iii. **THRESHOLD** - this sets the Audio response threshold. Selections are 1x to 5x Sigma levels of the average of the first 3 samples. If 3 Sigma is selected then when the unit starts the local radiation BACKGROUND is averaged for a 3 second period (display shows **Updating Background**).

This local background average is then used to compute the selected 3 Sigma (3 Standard deviations) level and this is ADDED to the average background to set the AUDIO THRESHOLD. Each new radiation sample (at a 20/sec rate) are tested against this AUDIO THRESHOLD and if above it then the audio sounds.

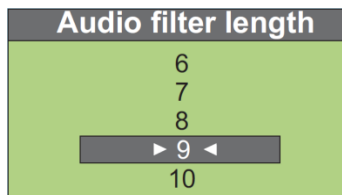
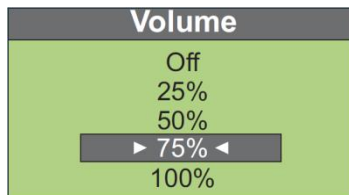
As an example – a typical local background level could be 100 cps (counts/second). So a selection of 3 Sigma would set the Audio Threshold = $100 + 3 \times \text{Sq Rt of } 100 = 100 + 30 = 130$. So if the count level goes above 130cps the audio will sound.

Once the Audio Threshold is exceeded; then the Audio INTENSITY will reflect the incoming count rate to provide a varying INTENSITY level, that relates directly to the count rate and therefore local radiation levels. In this manner a hands-free survey can be carried out that is usually highly recommended in many field situations where often the eyes are selecting the terrain, so without proper audio feedback some significant count levels could be missed if the eyes are distracted. For most GEOPHYSICAL applications, a **1 Sigma level is recommended and this is the DEFAULT setting**. This means that occasionally the unit will “chirp” on local background but this is often comforting as a means of ensuring the unit is functioning.

In some other operational areas this random chirping can distract the user so for these SPECIAL applications a 3 Sigma level can be used.

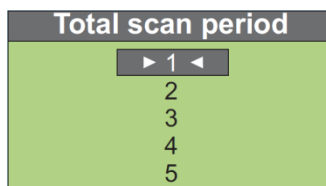
CLICK to select the right setting then **LONG-CLICK** to set this selection.

- iv. **GO BACK** – return to the Configuration menu.



d. **MEASUREMENT**

- i. **TOTAL SCAN PERIOD** – the user selects the SCAN data rate for Recording Total Count data – selections are 1-20 secs – **default = 1 sec**



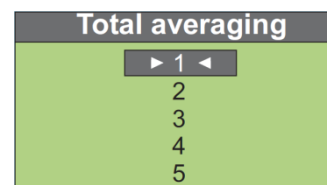
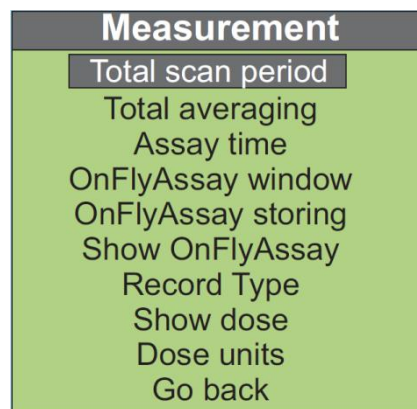
- ii. **TOTAL AVERAGING** – this sets the filtering of the display numeric data. Selections are 1,2,3,4,5 and these are Moving Average parameters.

1 = NO filtering at all so numeric data is displayed as recorded – normally recommended for Geo users and the DEFAULT setting

3 = a 3 point filter so the numeric data displayed is a 3 point moving average updated at a 1/sec rate

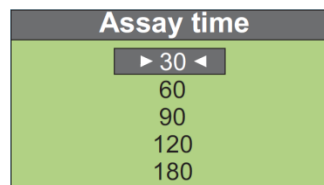
5 = a 5 point moving average

In most Geophysical applications the user utilizes the AUDIO to find the approximate peak intensity location and the NUMERIC data to select

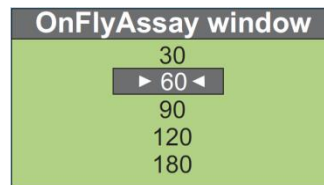


the actual hot-spot. In this application a setting of “1” gives the fastest response but the other settings are available as required.

- iii. **ASSAY TIME** – the user selects the SCAN data rate for recording Assay Results data – selections are 30-1800 secs – **default = 30 sec**. Note that Assay auto scan **SPECTRA** are **NOT** stored in memory to conserve memory space however normal Assay still stores full spectral data.

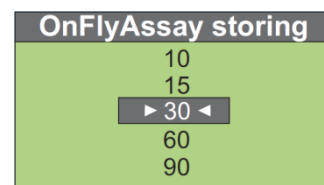


- iv. **OnFlyAssay Window** – sets the period in seconds that the On-the-fly Assay data is averaged for. Assay data below 20 secs is very noisy so normally this parameter should be set to a minimum of 30 (secs). Note that these data are computed as a running average on a 1/sec basis.



Thus when started, for the first 30 seconds no data is computed until this time period is achieved then a 30 second average is computed. This average is then updated at a 1/second rate and used as required.

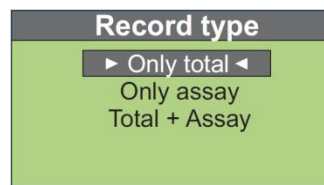
- v. **OnFlyAssay storing** – sets the period in seconds at which the On-the-fly Assay results computed as noted in (iv) above are stored in data memory during recording.



- vi. **Show OnFlyAssay** – sets the period in seconds at which the On-the-fly Assay results computed as noted in (iv) above are displayed.

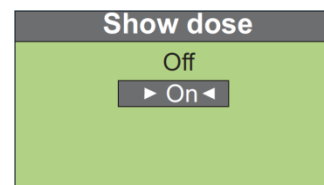


- vii. **RECORD TYPE** – this selects the type of data recording method used when START RECORDING (SCAN mode) is selected. Also see MEMORY selection in [Chapter 4.0](#).

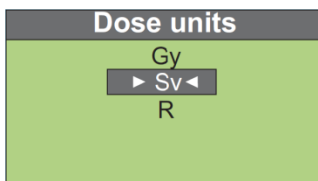


- **Only total** – selection means that **START RECORDING** only stores **TOTAL COUNT** data and **GPS**.
- **Only Assay** – selection means that **START RECORDING** only stores **ASSAY RESULTS** data and **GPS**.
- **Total+Assay** – selection means that **START RECORDING** stores **TOTAL COUNT + ASSAY RESULTS** data and **GPS**.

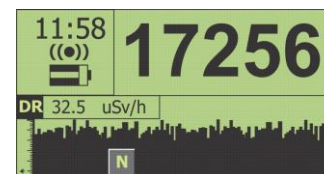
- viii. **Show Dose** – this allows the user the ability to show the **DOSE RATE** on the front display. Note the Dose Rate is computed from KUT data results and is referred to as the GEOPHYSICAL ASSAY. Users should note that if (for example) an artificial isotope such as Cesium-137 is placed near the unit, the Count rate will change as the system sees the radiation but the Dose Rate will be essentially unaffected as Cs-137 is outside the KUT calculation matrix.



- ix. **DOSE UNITS** – user can select **R**, **Gy** or **Sv** as required.



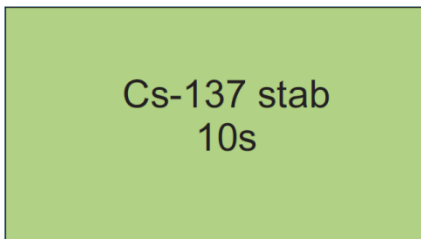
- x. **GO BACK** – return to the Configuration menu.



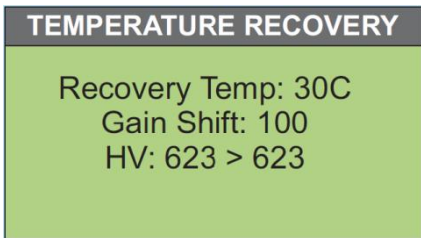
e. STABILIZATION

- i. **CS STABILIZATION** – permits the user to carry out stabilization using a Cesium-137 source. This is a special capability sometimes useful if the unit has serious troubles.

It requires the availability of a Cesium-137 typically 1-10uCi spaced a few inches away from the face of the unit (1uCi against the face, 5uCi 2” away, 10uCi – 6” away is recommended). Once the source is positioned, activate the selection and the unit will stabilize itself automatically on the Cesium source. When it says **COMPLETE**, remove the source and carry on as usual. The advantage of this capability is that Cesium-137 is a very defined source so if the units stabilization is completely lost, the **Cs stabilization** can often fully recover it. Huge improvements to v5.19 firmware and following versions make this feature non-essential but under special circumstances it is useful. Consult RSI before using this feature if unsure.



- ii. **TEMP.RECOVERY** – under special circumstances an abrupt change of temperature can sometimes make the Gain adjustment step computed by the automatic system stabilization fail, this is especially true of the BGO detector in the RS-230. To help the system recover if a unit will NOT stabilize within 5 minutes – select this **Temp.recovery** option. The unit will then reload the original calibration data at the factory corrected to the local temperatures. After this action the unit should stabilize **OK**.

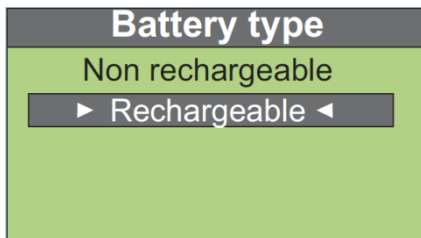
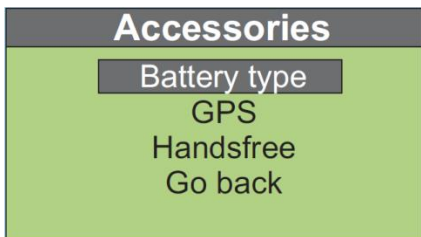


f. ACCESSORIES

- i. **BATTERY TYPE** – This sets the type of Battery used. Selections are “**Non rechargeable**” or “**Rechargeable**”

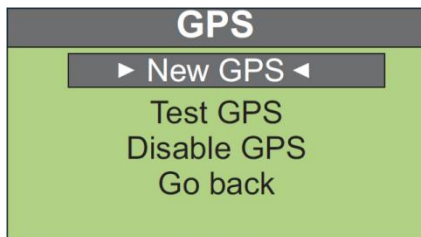
Non rechargeable = selects Alkaline non-Rechargeable batteries. It is highly recommended that if non-rechargeable batteries are used then ONLY ALKALINE batteries be chosen. Some non-Alkaline non-rechargeable batteries can leak and cause problems inside the instrument. If non-Alkaline are used then remove the battery clip after use to avoid this fairly common leak problem.

Rechargeable = the internal battery system will automatically select battery type so NiCd or NiMH batteries can be used. However NiMH batteries (2500 series) are highly recommended as NiCd batteries have significant operational limitations in prolonged use (also see [Chapter 5.0](#)).

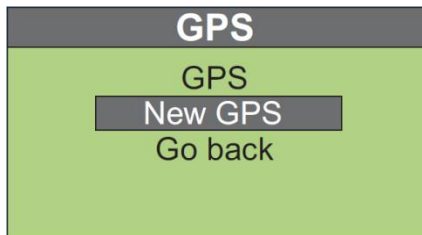
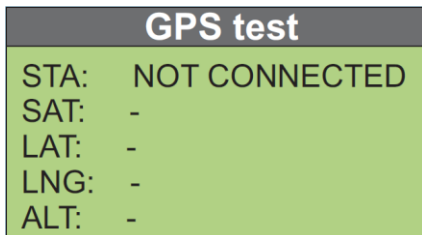
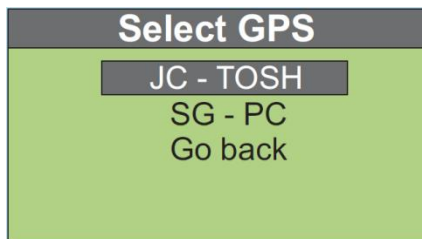
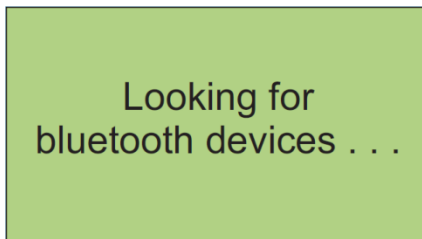


- ii. **GPS** - this selection is used to couple an external GPS to the system by Bluetooth (BT) link. The users’ manual of the GPS should be consulted to ensure that the unit batteries are charged. Once batteries are OK switch the units BT capability to **ON**.

NOTE: Not all GPS models were tested but most BT GPS models using GGA are expected to work.

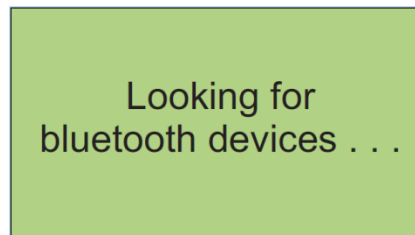


Choose - **Select GPS** – display shows “**Looking for Bluetooth devices**” then various messages and finally the “**Select GPS**” display is seen. Use the Button to cursor down to select “**Garmin GPS 10**”, then LONG Button down until the reverse video changes to select the device. Message says “**Connecting to device**” and then finally “**GPS connected**” then the display goes back to the main menu. Exit the menu to go back to the Survey screen.



- iii. **HANDSFREE** - this selection is used to connect the RS-125 to an external BT earphone system. In the example below a JAWBONE system is described but most BT compatible earphone are supported. The earphone user manual should be consulted to ensure that the units' batteries are charged. Once batteries are **OK** switch the units BT capability to **ON**.

Choose - **Select HF** – display shows “**Looking for Bluetooth devices**” then various messages and finally the “**Select Handsfree**” display is seen as in figure. Use the Button to cursor down to select “**Jawbone**”, then LONG Button down until the reverse video changes to select the device.



Message says “**Connecting to device**” and then finally “**Handsfree connected**” then the display goes back to the main menu. Exit the menu to go back to the Survey screen, enable the BT device and a special icon should be seen on the tope left of the display below the clock.



Now if the unit internal audio activates to show the presence of radiation the earphone audio mirrors this data. Note that the earphones own audio level control is used to control volume.

- iv. **GO BACK** – return to the Configuration menu.

4.0 PC CONNECTIONS

NOTE: The PC data retrieval and display program supplied to support the RS-xxx portable instruments is being frequently updated to add user required features. RSI has discontinued supplying software on a CD as it quickly becomes obsolete. The latest software, firmware and documentation version is available from RSI – Contact RSI Service for the latest link to Firmware/Software upgrades (see [Appendix Z](#) for contact information).

NOTE: New versions of RSAnalyst may NOT be compatible with the current device firmware but the Analyst PC Software update process also permits updates of the firmware inside the RS-125 or RS-230 as required. So the rule to update is – update BOTH the RSAnalyst PC Software and the unit's internal FIRMWARE as detailed below.

NOTE: The RS-125 and RS-230 instrument(s) is a joint development of RSI and our sister company GEORADIS so some software screens may be labeled GEORADIS as required.

4.1 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). Then open this file and **UNZIP** it as required.



4.2 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 and System 7. A minority of users have experienced installation problems, concerning computer setup configurations. If these 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 **INSTALL.EXE**. Double click this file then select **RUN**.

When this screen is seen – click “**Install Georadis RSAnalyst**”.

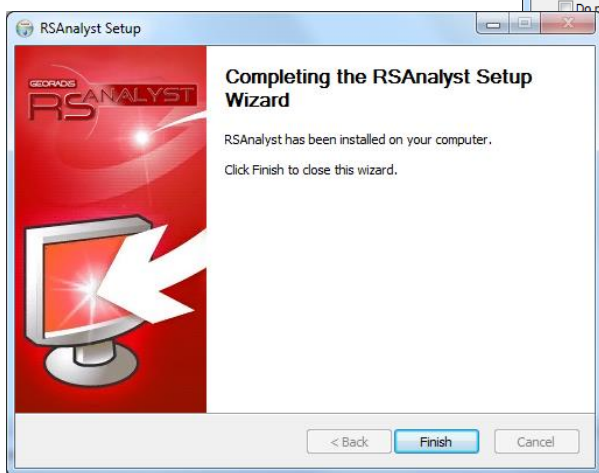
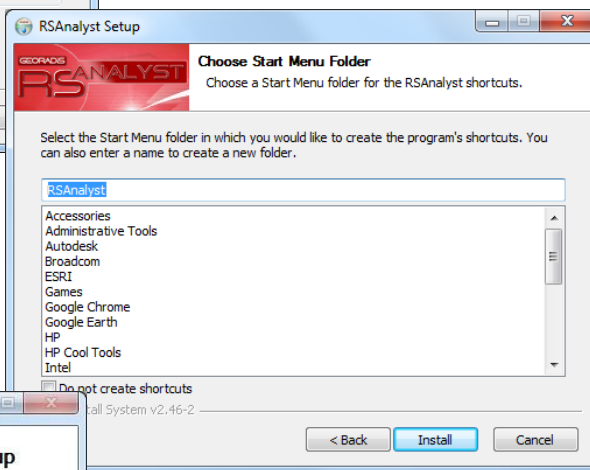
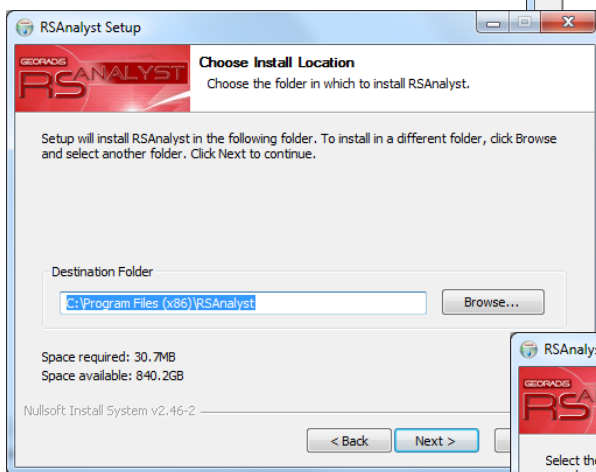
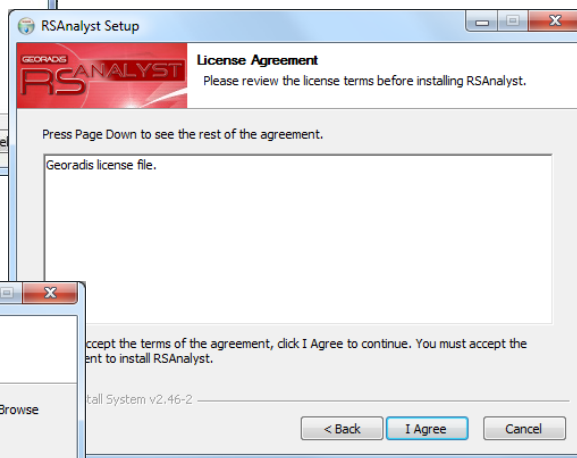




Follow prompts to complete installation.

N.B. Users requiring USB connection (as opposed to Bluetooth) should then go back to the selection menu and select **“Install Georadis USB driver”**.

When this is complete select **EXIT** to terminate the process.



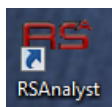
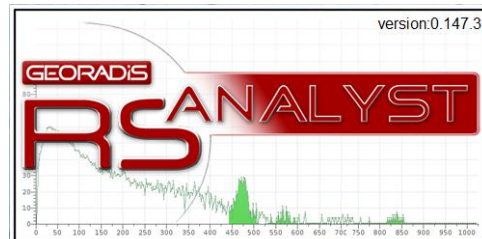
Then **FINISH** to complete the final installation.

The process is now complete and a new icon is located on the Windows Desktop

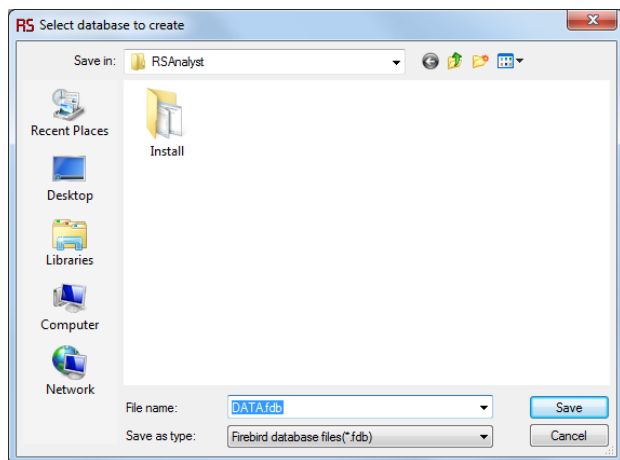
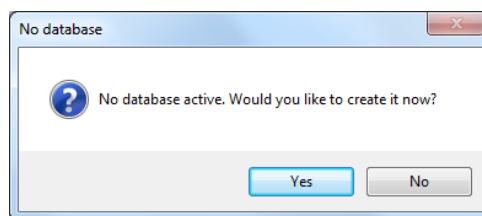
NOTE: ONCE THE NEW RS-ANALYST IS INSTALLED - USERS ARE STRONGLY ADVISED TO UPGRADE THE SYSTEM FIRMWARE TO IMPLEMENT BUG FIXES AND NEW FEATURES. HOWEVER WHEN THIS IS DONE ALL DATA IN THE UNIT IS ERASED! USERS SHOULD RETRIEVE STORED DATA FROM THE UNIT BEFORE UPGRADING.

4.3 STARTUP RSAnalyst

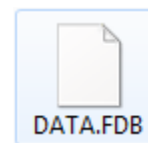
The system stores all data in a Firebird database and this may be created upon startup.



Double-click the **RS-Analyst** icon on the desktop. The **No database** message is displayed – click **YES**, choose the sub-directory (e.g. **RSAnalyst** and choose a database name (e.g. **Data**).

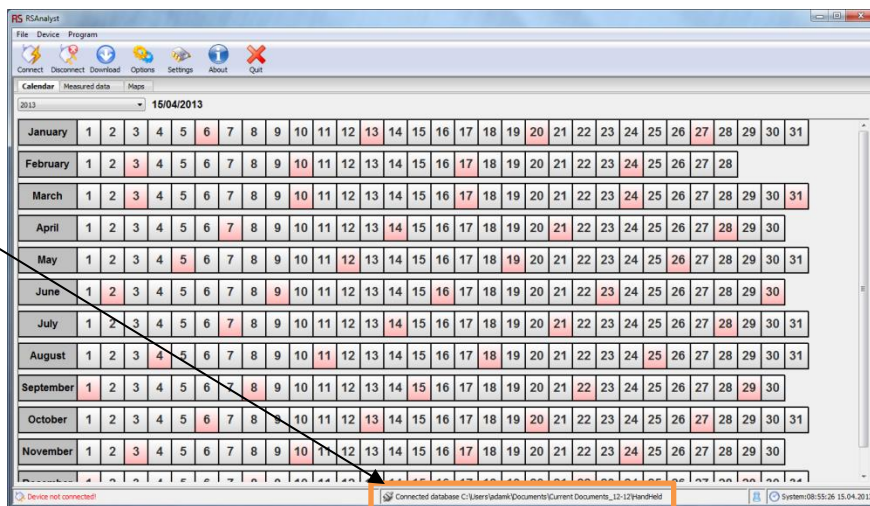


A Firebird formatted data base will be set up named **DATA** on the RSI sub-directory and all data will be stored there until a different database is created.

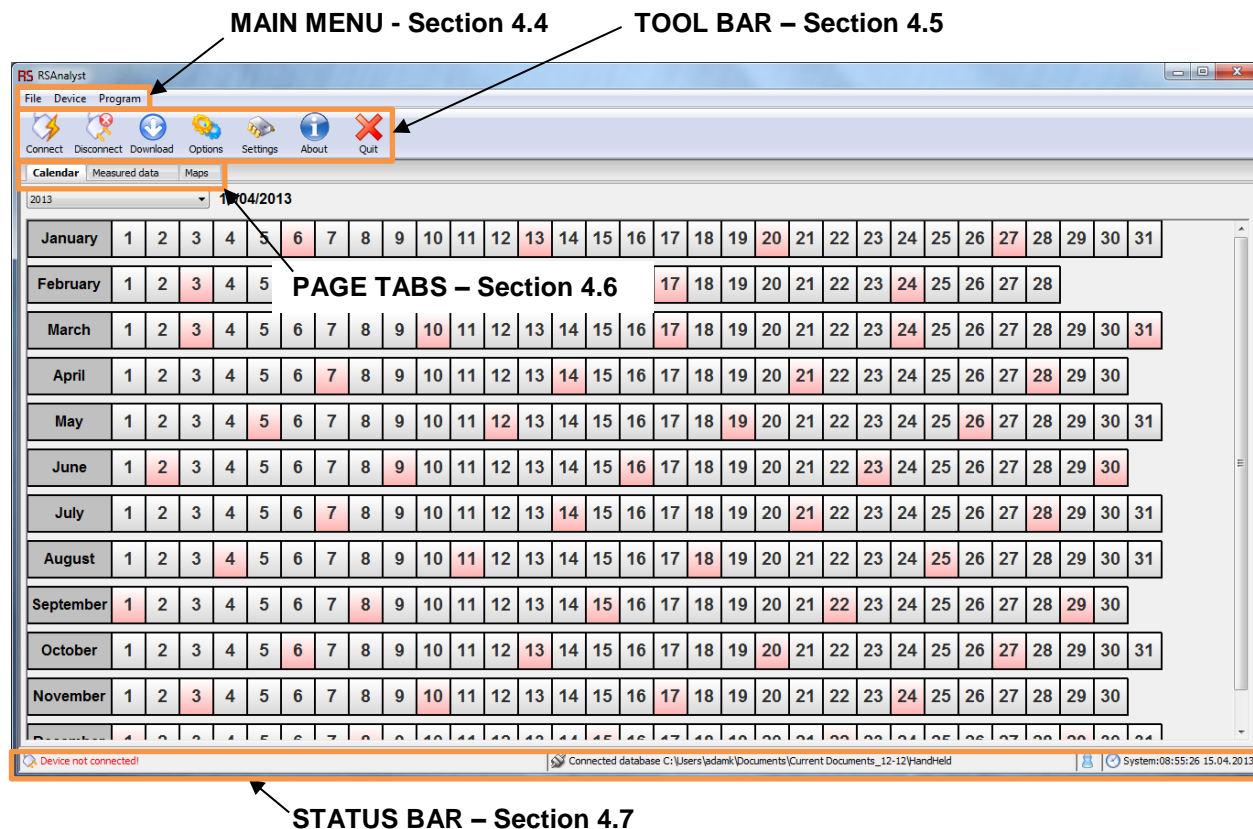


The screen will then open the page as displayed:

Current Database will be shown here:



4.3.1 RSAnalyst SYSTEM SOFTWARE

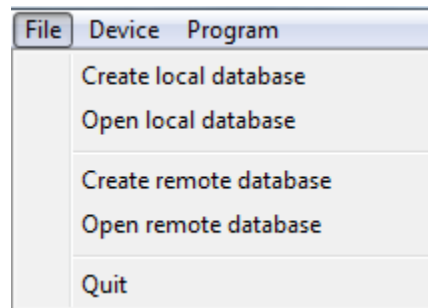


4.4 MAIN MENU



4.4.1 FILE

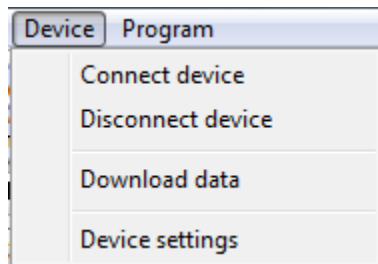
- **Create local data base** – select this to create a new Database stored in a required location with a selected name as needed.
- **Open local database** – permits users to select a local data base that already exists and add data to it.
- **Create remote database** – select this to create a new Database stored remotely with a selected name as needed.
- **Open remote database** – permits users to select a remote data base that already exists and add data to it.



NOTE: A single database can support many RS-121 units with data selection using the units' serial number.

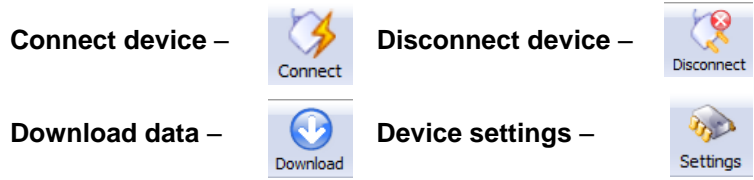
Quit – Stop program, a requestor will be displayed for user confirmation.

4.4.2 DEVICE

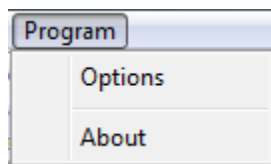


See the **TOOL BAR** for information on the **Device Special functions**.

The following special functions are repeated in the Tool Bar;



4.4.3 PROGRAM



See the **TOOL BAR** for information on the **Program Special functions**.

The following special functions are repeated in the Tool Bar;



4.5 TOOL BAR



4.5.1 CONNECT:



Connection of the **RS-125/230** unit to the **PC system** can either be made by local **USB** connection or via **Bluetooth (BT)**.

- a) **Connection Via USB** - connect the supplied USB cable, plug the USB connector into the unit below the rubber flap at the end.

With the **RS-230** unit powered **ON** and the **RS-Analyst** program displayed on the PC.

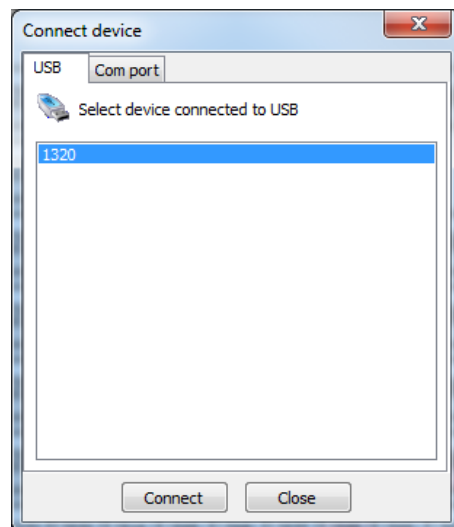
Click this icon to establish a connection.



The unit's serial number will be shown in a data box (e.g. **2025**) – click **OK**.

“**Connected device #2025**” will be displayed on the Status bar - bottom left on the PC screen, and a **USB icon** will be shown on the RS unit.

The unit is now fully connected.



b) Connection Via BLUETOOTH (BT)

NOTE: All except the early RS units have BT capability – however in the early units the software did not support this BT technology. In the latest software 5vXX this BT is fully supported. Users are advised that if they need BT capability, then install the new v5xx software included in the download package using the USB connectivity THEN test the BT to be sure all is OK. Contact RSI if you have problems problems.

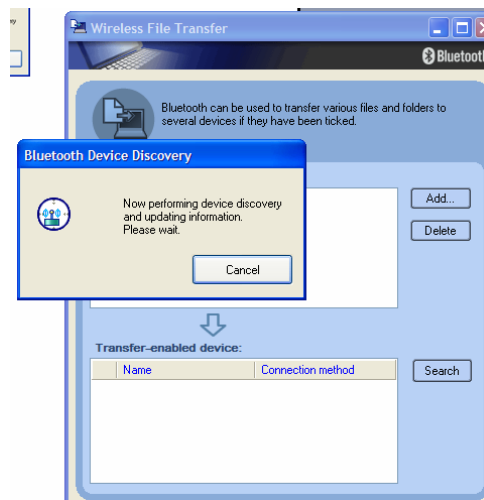
Typically data transfer is 3x faster using USB connections.

The following is a typical Windows XP setup. User setup may slightly differ depending on the Operating System but in principle the connection linkage is the same.

Power **ON** the RS-121 unit and place it within 1m of the PC being used.

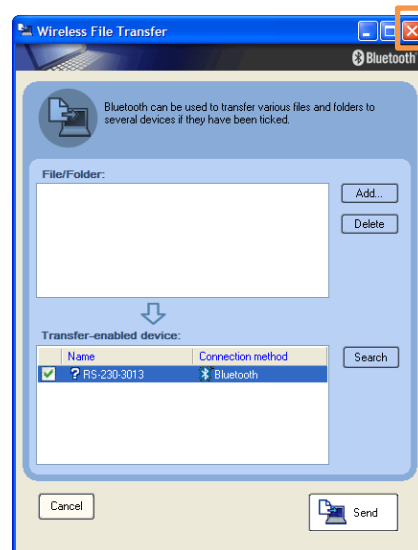
On the PC select **START – All Programs – Bluetooth – Wireless Data Transfer.**

This display appears as the unit searches for BT devices nearby.

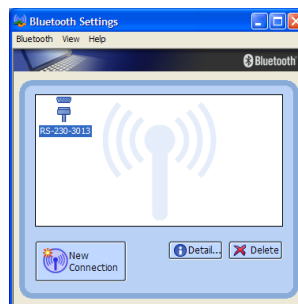


This display shows the unit has been found. Click the box (green check sign in the picture).

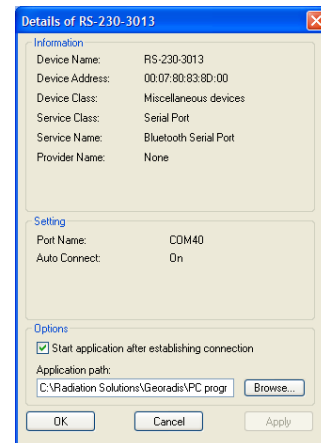
Close this window (red X at top right of the box) At the bottom right tray the BT sign will be seen; – right click on this and select **Bluetooth settings.**



A new display is seen click **DETAILS** (sometimes a BT Password is asked for – if required enter **0 0 0 0**)



Inspect the second display for **PORT NAME** – in this case **COM40**.





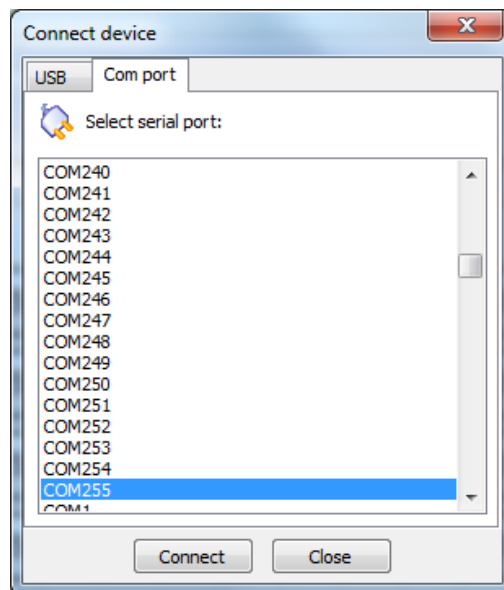
In **RS-Analyst** – click **Connect** then **Com Port** on the pop up box.

Select **COM40** and click **CONNECT**.

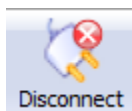
“**Connected device #1234**” will be displayed on the Status bar - bottom left on the PC screen, and a **USB icon** will be shown on the RS unit.

The unit is now fully connected.

NOTE: The setup information will be saved to RSanalyst and the PC and will automatically link the BT on the COM port# previously defined.



4.5.2 DISCONNECT:



Pressing the **Disconnect** icon will disconnect the RS-unit from the PC and the RSanalyst software from either the local **USB** connection or via **Bluetooth (BT)**.

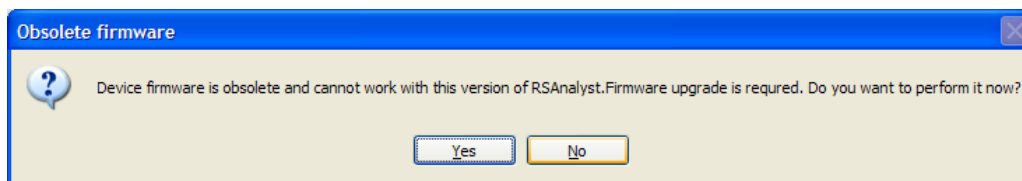
4.5.3 DOWNLOAD:



Click this icon to start data transfer from the **RS unit** into the **PC database (DATA)** – final message is “**Downloaded ### records**” – click. **OK.**

Download Selection = Wrong Firmware:

Some older units with non 5vxx s/w need upgrading before Analyst can be used, as data formats are very different. If this is the case the following message box will appear.

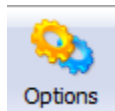


NOTE: USERS ARE ADVISED TO UPGRADE THE SYSTEM FIRMWARE TO IMPLEMENT BUG FIXES AND NEW FEATURES (see Maintenance [Section 4.5.5.4](#)). HOWEVER WHEN THIS IS DONE ALL DATA IN THE UNIT IS ERASED! USERS SHOULD RETRIEVE STORED DATA BEFORE UPGRADING.

USERS WITH 117F SOFTWARE PLEASE CONTACT RSI BEFORE UPGRADING

Select **YES** – then the procedure is the same as NEW SOFTWARE (see Maintenance [Section 4.5.5.4](#)).

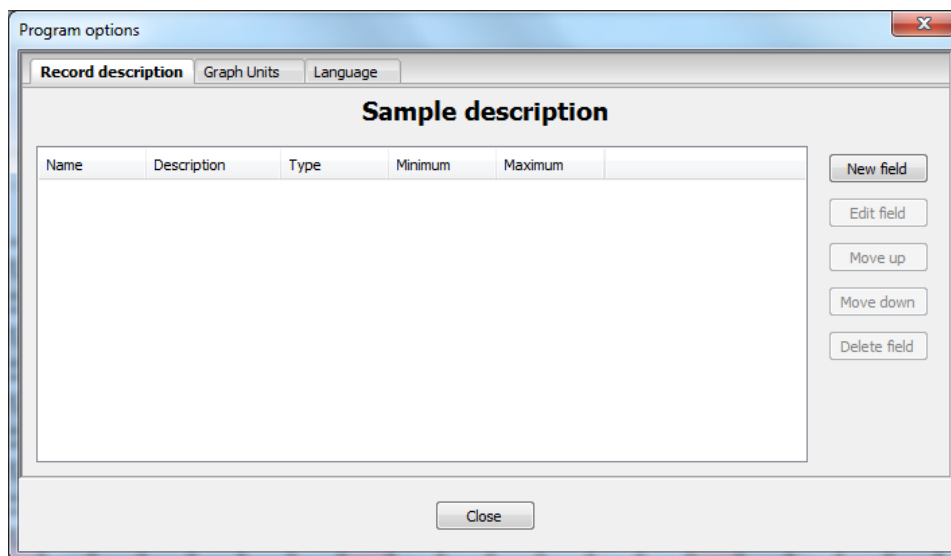
4.5.4 OPTIONS:



ADDING COMMENTS/NOTES

A special feature of RSAnalyst is the ability to mark data on the display to add comments related to the data.

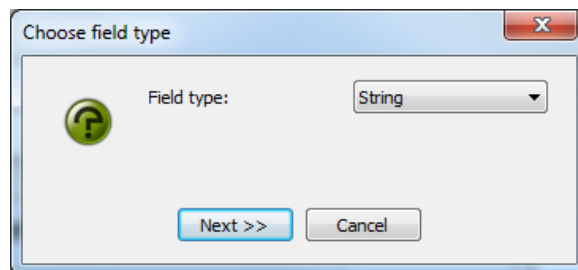
Record Description:



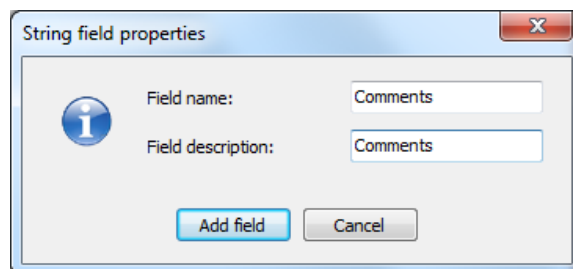
Select **NEW FIELD** –

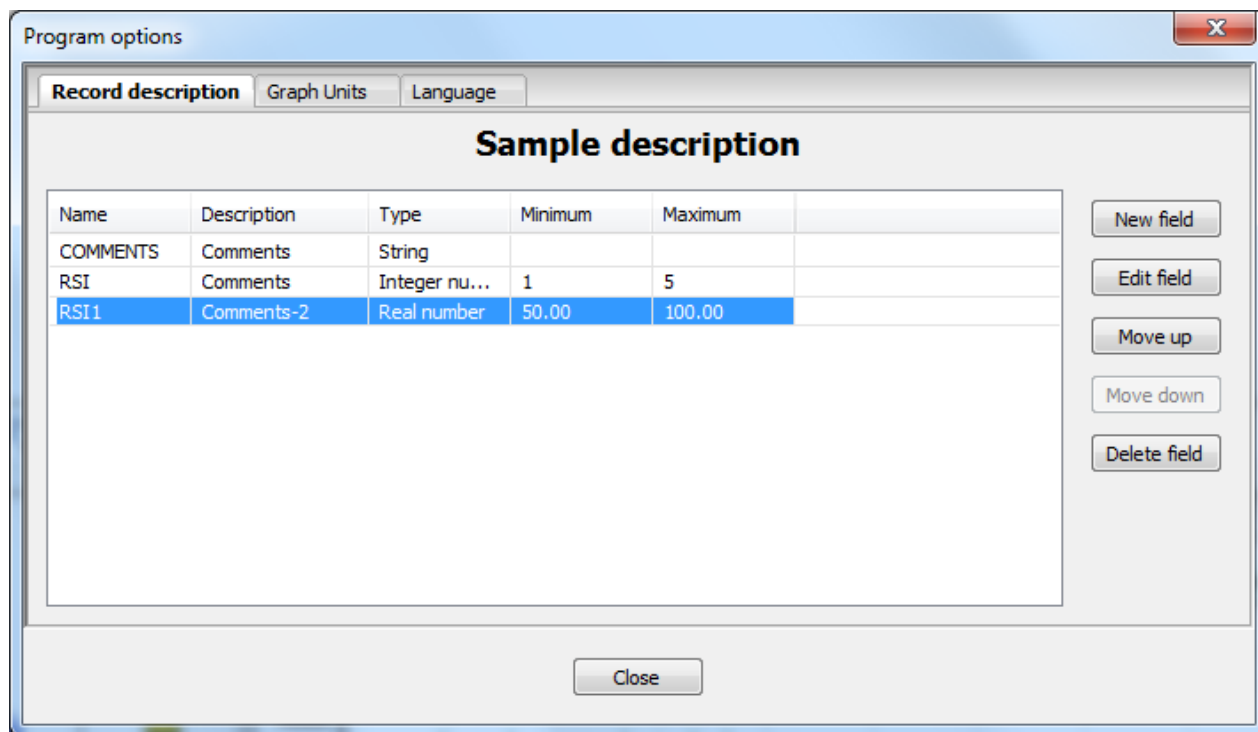
The selections are: Integer, Real Number and **String**.

Choose **FIELD TYPE** on this data box. Select **STRING** as this gives a large space for comments – then **NEXT**.



Then enter in a **FIELD NAME** (e.g. Comments) then a **Field Description** (e.g. Comments) and click **ADD FIELD**.





Edit Field – This will open the Field Property dialog box for the selected field.

Move Up – This will move the field up one in the listing.

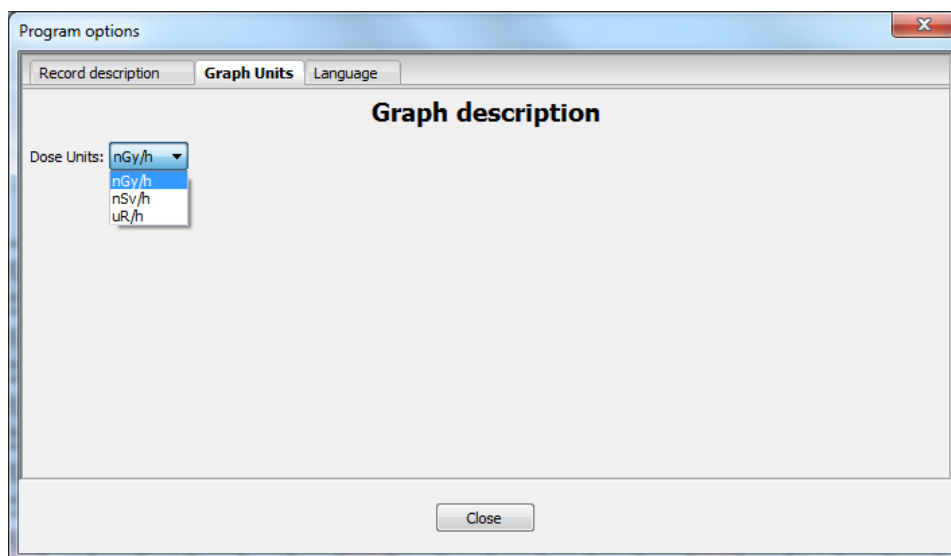
Move Down – This will move the field down one in the listing.

Delete Field – This will remove the field from the list.

Graph Units:

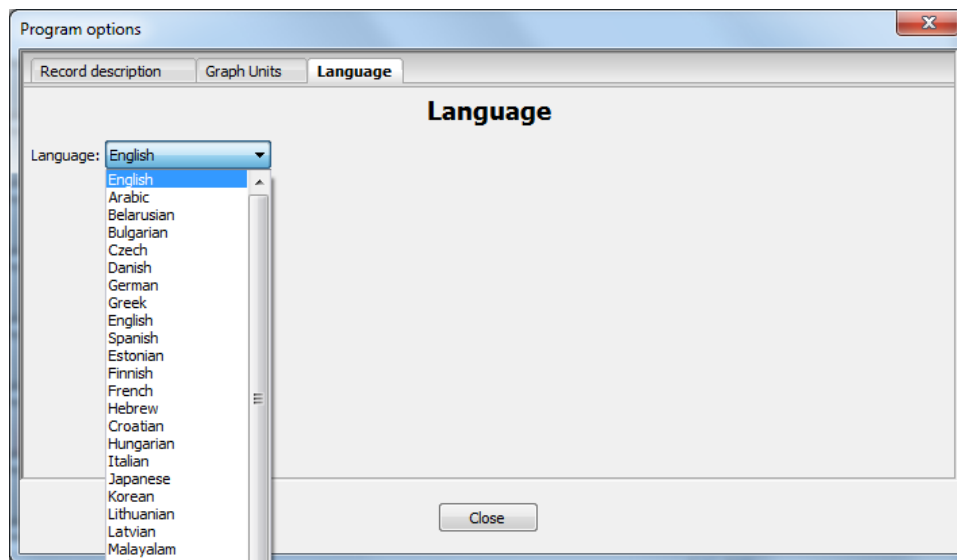
Dose Units can be selected from a drop-down menu.

The selections are: **nGy/h**, **nSv/h** and **µR/h**. This will set the **Dose Unit** for the charts.



Language:

Thirty-four languages are supported and can be selected from a drop-down menu. **English** is the default language. This window allows the User to setup the language used for menus and instructions.



4.5.5 SETTINGS:



Settings

Selecting this icon opens the **Device Settings and Maintenance** Window. The window has the following tabs: **Device Setting**, **Stabilization Log**, **Memory** and **Maintenance**.

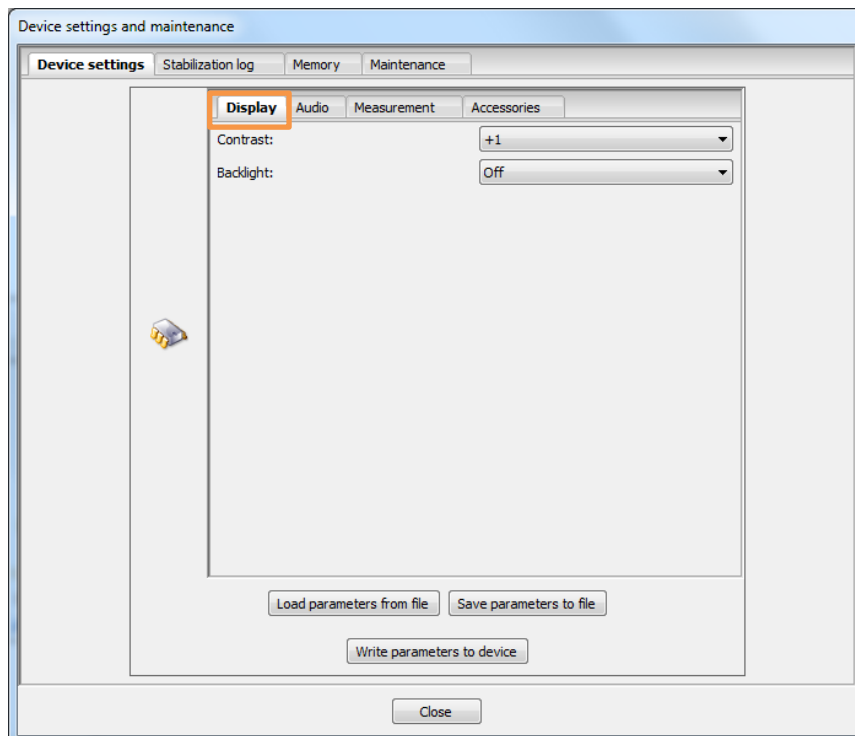
4.5.5.1 DEVICE SETTINGS - TAB

The Device Settings window is a User Set of parameters as shown here. The Window has four tabs; **Display**, **Audio**, **Memory** and **Accessories**.

DISPLAY:

Contrast = adjusts display contrast – range +3 > -3 - normally **0**

Backlight = backlight options – selection – ON, OFF, AUTO - normally **Auto**



AUDIO:

Audio volume = selections ON, OFF - usually **ON** (permits muting if required).

Audio filter length = permits audio response adjustments by filtering changes – for Geophysics usually **9**

Audio threshold = selections x1 to x6 sigma – for Geophysics usually **1x sigma**.

MEASUREMENT:

Total scan period – the sample period (minimum 1 sec) for K/U/T/Total data to be stored on the RECORDING (SCAN) mode described above – usually **1 sec** for fast surveys or **2-5 secs** for slower traverses

Total averaging = permits the front panel instrument display to use running averaging to “smooth” data viewing – for Geophysics usually **1**

Assay time = sets the time period used when an ASSAY is taken - selection 30-1,800 secs - **120 secs** is a sensible selection under most conditions

On-fly assay window = the sample period (30 - 300 secs) for Assay data to be computed on the RECORDING (SCAN) mode described above – usually **30 secs**. This is really a moving average period updated at 1/sec

On-fly assay store time = the sample period (10 - 300 secs) for Assay data to be stored on the RECORDING (SCAN) mode described above – usually **30 secs** but some users want faster data storage so this parameter can be set to 10 secs if required

Show on fly assay – YES or NO. If **YES** is selected then during recording the main data display screen changes to show real-time Assay on the fly.

Record type = permits data selected in RECORDING (SCAN) mode - selections:

- **only SURVEY** – only Total Count at the selected rate
- **only ASSAY** – only Assay data at the selected rate
- **both SURVEY and ASSAY** – both data sets at the selected rates

NOTE: Ensure MEMORY selection is adjusted correctly to permit the required amount of data recording space – see [Section 4.5.5.3](#) for more information.

Dose rate units = selects the Dose units used in the “Total” display on the units display during Assay.

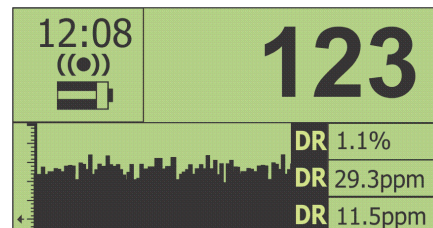
Selections are:

- R – Exposure Rte
- Gy – Absorbed Dose
- Sv – Dose Equivalent

Action after assay – normally set to Save Immediately.

Show dose rate – normally set to Yes.

Record after startup – normally set to **NO**. If YES then when the unit is powered ON, it immediately enters the Scan mode (same as selecting Start Recording from the main unit’s menu).



ACCESSORIES:

Battery type = none-rechargeable or rechargeable - usually **rechargeable**.

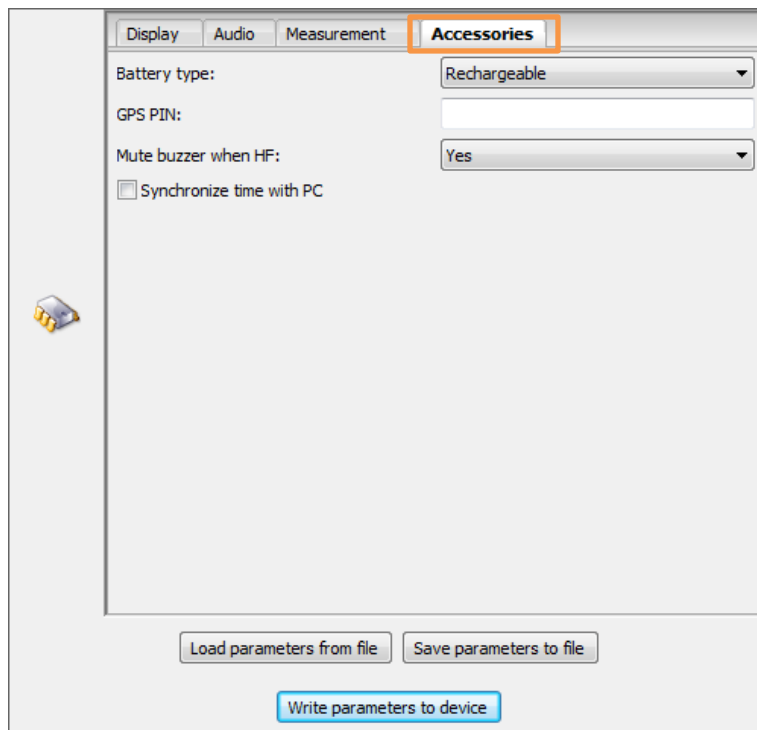
GPS PIN – some GPS units require a PIN number for handshaking

Mute buzzer when HF – if selected the Audio buzzer in the instrument is muted when the BT Headphone is selected.

Synchronize time with PC = if this box is checked then the PC will sync the time of the RS unit to the current setting on the PC.

PARAMETER CHANGE:

Under special conditions some internal parameters of the unit may need to be adjusted. If



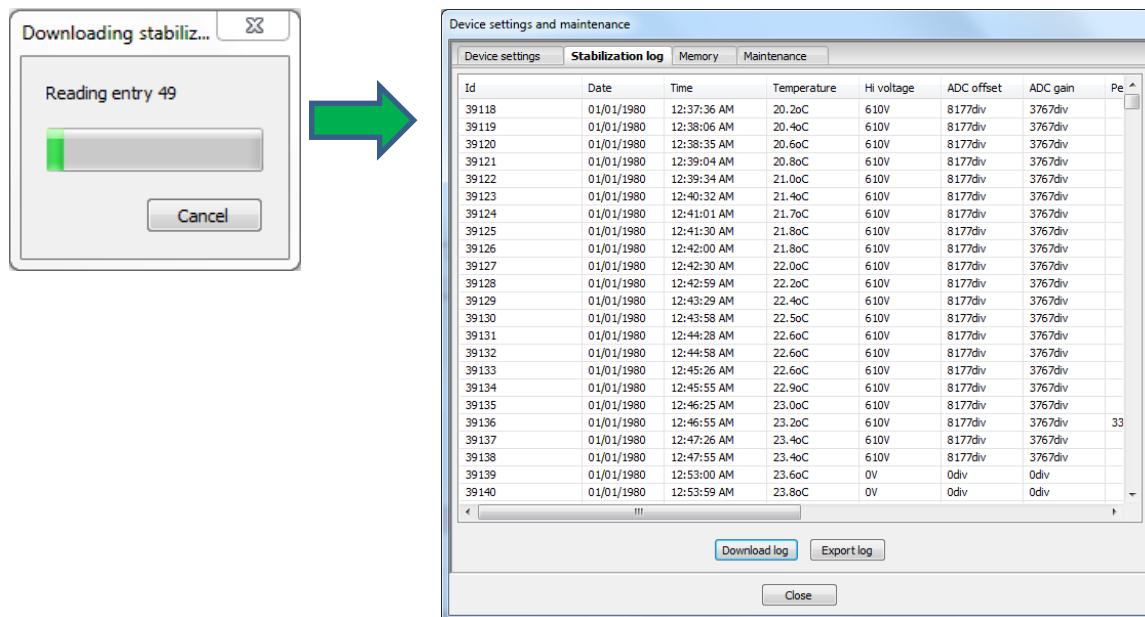
this is required RSI will send the user a special file with these parameter changes embedded. To load this file click the **Load Parameters from File** button then selecting the appropriate file and follow the prompts.

In addition users can save a copy of the parameter file by clicking on the **Save Parameters to File** button or read in a new one with special parameter settings as required.

Press **Write Parameters to device** to load these settings into the unit ([also see Section 4.5.5.4](#))

4.5.5.2 STABILIZATION LOG

This tab selection permits users to access the internal Stabilization records of the unit. If the unit is acting incorrectly it is possible that the stabilization is causing problems. This selection permits the Stab Log to be downloaded and viewed (**Download Log**) or more useful is (**Export Log**) which outputs the data into a text file which can be exported and then emailed to RSI for analysis.

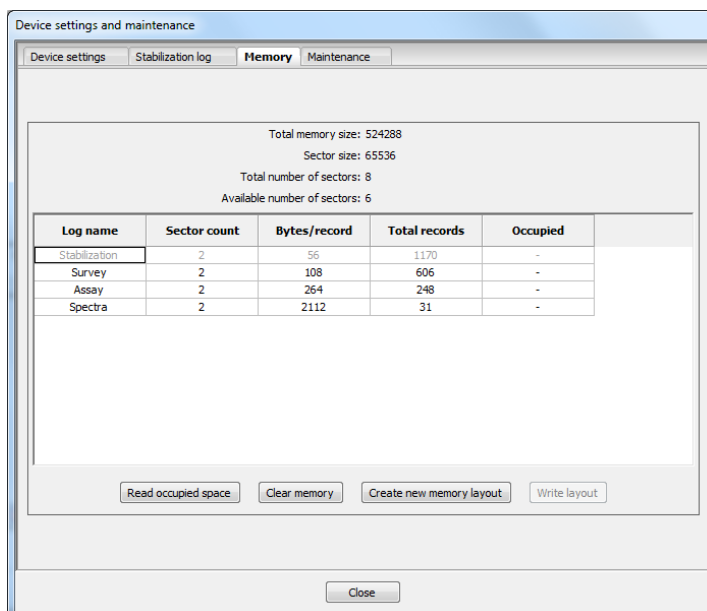


4.5.5.3 MEMORY

The RS series of units were initially released with **512K** and later **2Mb** of memory but all units are currently shipped with **4Mb** of memory. Older units can be upgraded to **4Mb** if required at a nominal fee.

In v5.xx s/w the available memory can be allocated to the various functions and this is done inside RSAnalyst.

NOTE: the memory can be re-allocated at any time but this re-allocation ERASES ALL DATA IN MEMORY so users should download any data before allocation is attempted.



READ OCCUPIED SPACE – shows how much memory is currently in use.

CLEAR MEMORY – this command is used to clear data memory once data has been transferred to the PC – **most users transfer data daily then clear the memory to minimize data confusion and in low memory units.**

CREATE NEW MEMORY LAYOUT – this command allows the users to set the memory to suit their application – refer to the tables below for information to enable correct selection – when this selection is made the unit automatically checks memory size and advises users of the number of sectors available to allocate.

OLDER UNITS with 512KB data = 6 sectors

MEMORY ALLOCATION						
512K	User set Sectors	Total # of records	# samples/record	total # samples	Sample rate secs	Data storage Hrs
SCAN - TOTAL	2	630	30	18,900	1	5.3
SCAN - ASSAY	2	248	1	248	30	2.1
ASSAY-spectrum	2	31	1	31	*	*
SCAN - TOTAL	6	3150	30	94,500	1	26.3
SCAN - ASSAY	0	0	1	0	30	0.0
ASSAY-spectrum	0	0	1	0	*	*
SCAN - TOTAL	0	0	30	0	1	0.0
SCAN - ASSAY	6	1241	1	1,241	30	10.3
ASSAY-spectrum	0	0	1	0	*	*
SCAN - TOTAL	0	0	30	0	1	0.0
SCAN - ASSAY	0	0	1	0	30	0.0
ASSAY-spectrum	6	155	1	155	*	*

The user can allocate memory in blocks so user can select 0, 2, 3, 4, 5 or 6 sectors. The table below shows memory allocation and shows what data storage is available so the user can change the sectors to suit the application.

Note that in all memory selections, 1 sector in each selection is reserved for data buffering. So if you choose 4 sectors, you really only get data storage in 3. This is taken into account when the unit displays how much data can be stored and is only relevant if users are attempting to calculate the memory space.

NOTE: The memory can be re-allocated at any time but this re-allocation ERASES ALL DATA IN MEMORY so users should download any data before allocation is attempted.

NOTES:

Scan-Total – is in 30 sample data blocks whereas the SCAN-Assay is 1 sample/block. The above table shows these details and also shows how much data storage is available (in hrs) for the various combinations.

The **ASSAY-spectrum** of course has no time limit period as this is FULL SPECTRUM recording + ASSAY results at a data rate determined by the user manual sampling habits.



Units with 2MB memory = 24 sectors

2MB memory details

2Mb	User set Sectors - max 26	Total # of records	# samples/record	total # samples	Sample rate secs	Data storage Hrs
SCAN - TOTAL	4	1890	30	56,700	1	15.8
SCAN - ASSAY	8	1737	1	1,737	30	14.5
ASSAY-spectrum	14	403	1	403	*	*

Units with 4MB memory = 58 sectors

4MB memory details

4Mb	User set Sectors - max 58	Total # of records	# samples/record	total # samples	Sample rate secs	Data storage Hrs
SCAN - TOTAL	20	11529	30	345,870	1	96.1
SCAN - ASSAY	20	4716	1	4,716	30	39.3
ASSAY-spectrum	18	527	1	527	*	*

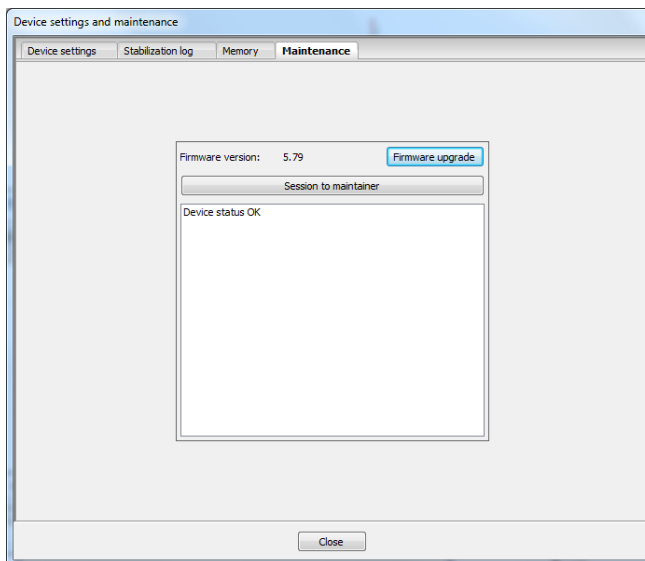
4.5.5.4 MAINTENANCE

This tab selects various maintenance features:

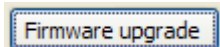
Firmware version – this shows the current software version.

Firmware upgrade – this process permits users to **UPGRADE** software to the latest version. **NOTE: The UPGRADE process ERASES data in memory so current data should be downloaded before doing an upgrade.**

NOTE: FOR ALL SYSTEM FIRMWARE UPGRADES ENSURE THE UNIT IS POWERED OFF AS SOME EARLIER VERSIONS OF SOFTWARE CAUSE UPLOAD PROBLEMS IF POWER IS ON.

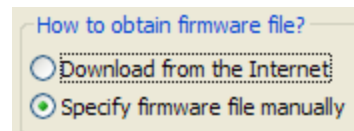


BEFORE STARTING A FIRMWARE UPGRADE, ENSURE THAT THE RS INSTRUMENT IS CONNECTED TO THE CHARGER AS IF BATTERY LEVELS ARE TOO LOW, UNDER SOME CONDITIONS THE FIRMWARE UPGRADE PROCESS CAN CRASH THE MEMORY AND UNIT MUST BE RETURNED TO THE FACTORY TO RECOVER.



Ensure that the unit is connected via USB then click this button to start the process.

In this screen select **“Specify firmware file manually”**.



Follow prompts and select the *.gfw file included in the upgrade package.

When this screen is seen - ensure that the batteries are charged up and/or the Charger is plugged in as if the power dips during the upgrade process the memory could crash and the unit would then be unusable and must be returned to the factory.

Then click “NEXT” to start the process.

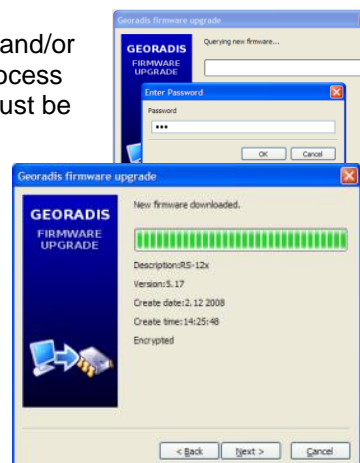
The firmware is then uploaded into the unit via USB and this takes approximately 5 minutes.



Once the process is complete a new screen appears.

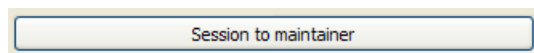
The user selects “FINISH” and the new firmware is “flashed” into the memory of the unit and replaces the old firmware. If all is OK the unit disconnects itself from the PC and restarts – users hears a beep.

Unplug the USB port – power the unit OFF. The power ON and verify that the latest software version has been loaded.

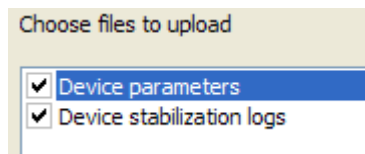


SERVICE AIDS

For Maintenance support some special features have been added to the **RSAnalyst** software but they require the system to be connected to a PC that is connected to the Internet to function as designed.



If Maintenance is required, connect the unit via USB then click this button.



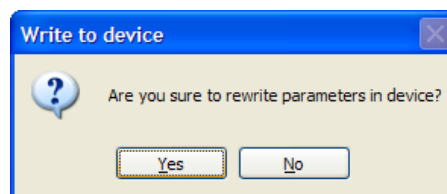
User selects a checked box (or cancels all and **OK** to go back).

Device Parameters:

If user is experiencing problems with the unit they should discuss this with RSI (by email (at service@radiationsolutions.ca)). RSI may ask the user to send the PARAMETER file to RSI as parameter setting errors can cause problems. In this case check the “**Device parameters**” box only and then click **OK**.

The program then extracts the parameter file from the unit and sends it to RSI. When RSI receives this file they inspect it and if changes are required RSI modifies this parameter file and notifies the user by email.

The user then connects the unit to the PC and the PC to the Internet and selects the “**Device parameters**” check box then **OK**. This time the system logs onto the RSI site, searches for the new parameter file (by unit serial number) and automatically downloads the special customer file that



RSI has loaded there after asking if OK to rewrite as in the figure.

Using these methods, RSI can make it very easy to help the user fine tune their units to resolve specific problems.

Device Stabilization Logs:

If user is experiencing problems with the unit's Stabilization performance they should advise RSI by email (at service@radiationsolutions.ca). When convenient connect the unit to the PC via USB and connect to the Internet. Then click "**Session to maintainer**" and select the "**Device stabilization logs**" then **OK**. The software will then automatically extract all relevant Stabilization data from the system and send it to the RSI FTP site where RSI Service can access it. RSI Service will then analyze and communicate as required to resolve the issues.

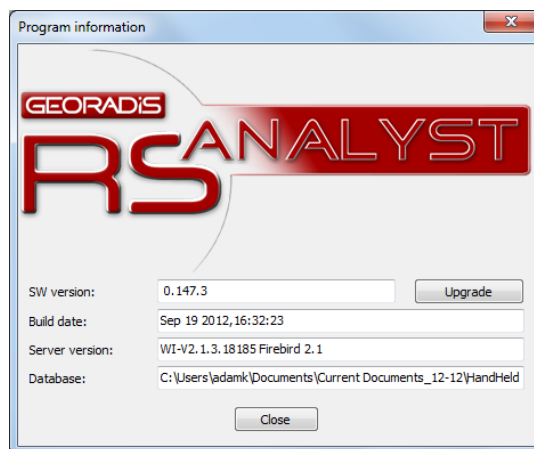
Error details – the final data display on the maintenance page is the error status. The RS unit has various internal errors that are messaged on the display of the unit as a **!** below the clock display. Currently the only way to understand this message, is to connect to the PC and view this screen display. If errors occur, inspect this screen then contact RSI for resolution and advice.

Device status OK

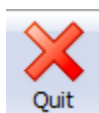
4.5.6 ABOUT:



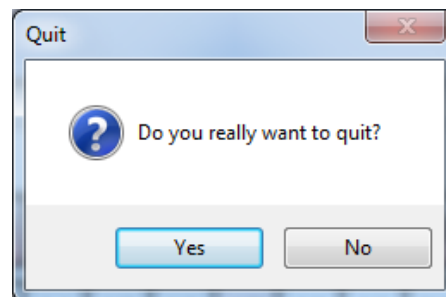
Selecting the About Icon displays the **About RSanalyst** window. This will give you the current information about the software installed. The User may also Upgrade the software by using the **Upgrade** button **but this may upgrade undocumented features so it is not recommended unless advised by RSI**. The **Close** button will close the window and return to the program.



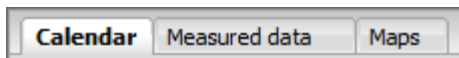
4.5.7 QUIT:



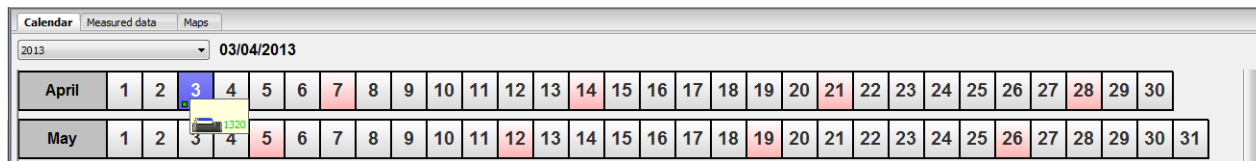
Clicking on the **Quit icon** will display a confirmation window for the user to confirm that the program is to be terminated. Pressing the Yes button will terminate the program.



4.6 PAGE TABS

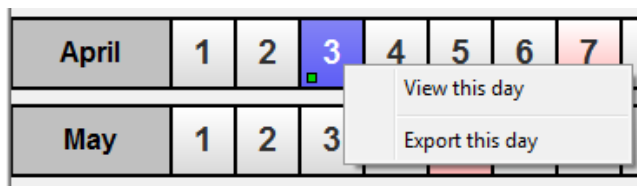


4.6.1 CALENDAR Page



The main Data Display is a calendar format (**Jan-Dec 03/04/2013** section shown above).

Data is shown on this calendar with colored icons (pink = Sunday of each month) and positioning the cursor over one date block shows the serial # of the data available (example above shows ser # **1320**). The database can store data from an unlimited # of RS instruments but for ease of use the data is distributed by DATE to make access easier.

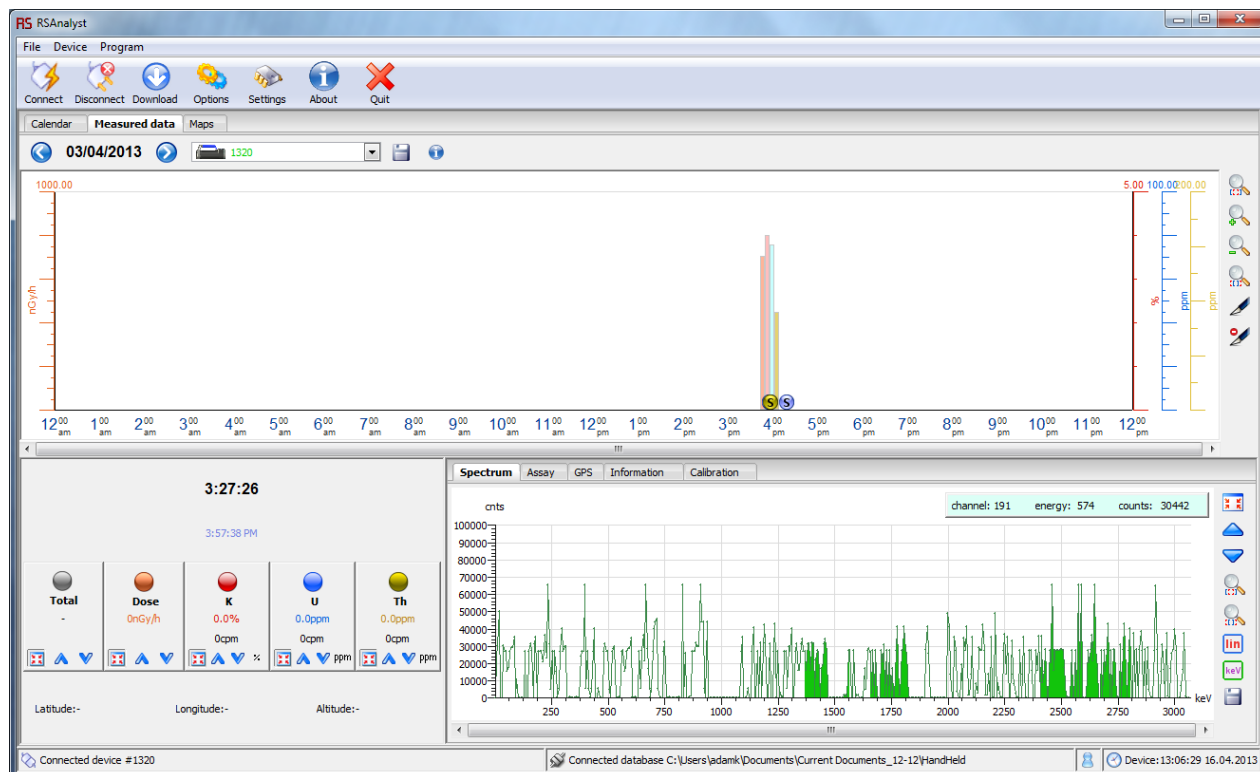


Right click the selection and a pop up will give the user the choice to **“View this day”** or **“Export this day”**. This will open the Measured Data Page.

Double-click any **DATE** selection and the data page moves to the **MEASURED DATA** page.

4.6.2 MEASURED DATA Page

This complex display is explained as follows:

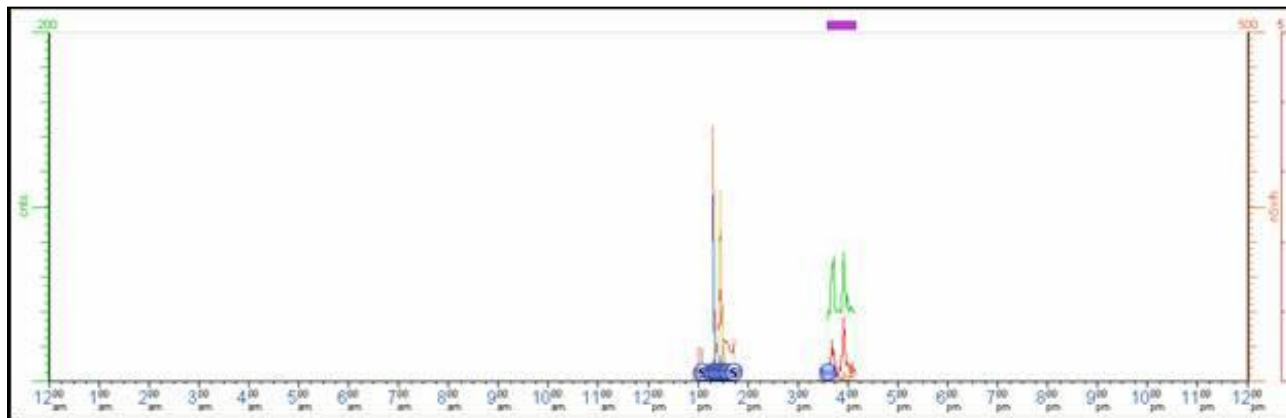




This shows the date of the data selection and the arrows permit moving up down the calendar as required.



Permits selection of the instrument serial number of interest (as noted previously the database can store data from many instruments – however for simplicity many users open different databases for each instrument to prevent data confusion.

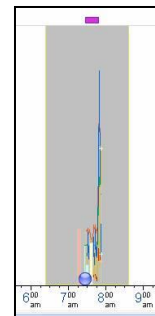


The next data block shown below shows the selected DATE full 24hr display on which the data is shown at the time it was accumulated.

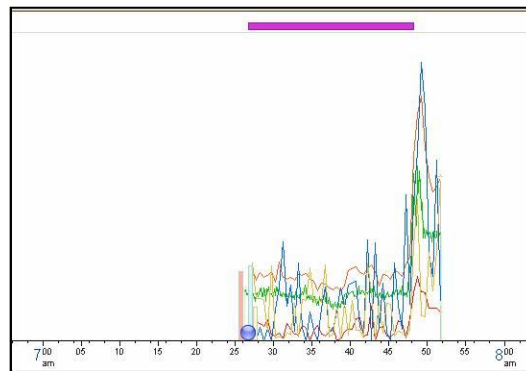
This data for demo purposes shows a mix of data – some ASSAY and some SCAN data as any type of data may be recorded in the instrument and thus be in the database.



This icon is used to **ZOOM** the data display. To zoom data – select this icon first – then use the mouse and left button to select a section of the data – the selection is shown in GREY as in the figure.



Release the left button and the data is now **ZOOMED** as shown. This process can be repeated until the data is in a convenient view size.



These icons can be used to zoom manually.



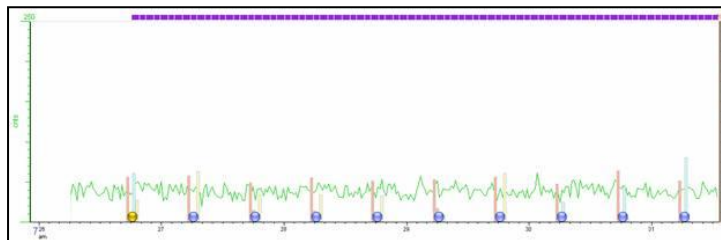
this icon zooms fully OUT to show all the data and permit zoom selection as required.

These data were taken with the RS unit set to record TOTAL count at 1/sec and ASSAY data at 1/30 secs. The display is formatted to view the data separately to avoid confusion.

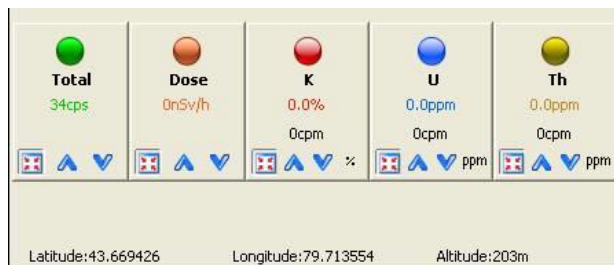
ASSAY SCAN data at selected SCAN rate (typically 30 secs)

In the above example the left side of the display shows some vertical histogram data with a blue ball – this is the **ASSAY** data. To see it use the ZOOM capability and highlight only this section of the data and zoom it to see a display like below.

This display shows the individual 30 sec data for K, U and Th in a histogram format with the GREEN line being the Total Count data. The bottom left data block shows the color scheme – **RED = K** etc. Position the cursor over any histogram selection and the lower left data block shows the numeric results. Also the PURPLE line above shows that GPS data was taken so the cursor selection also shows GPS coordinates.

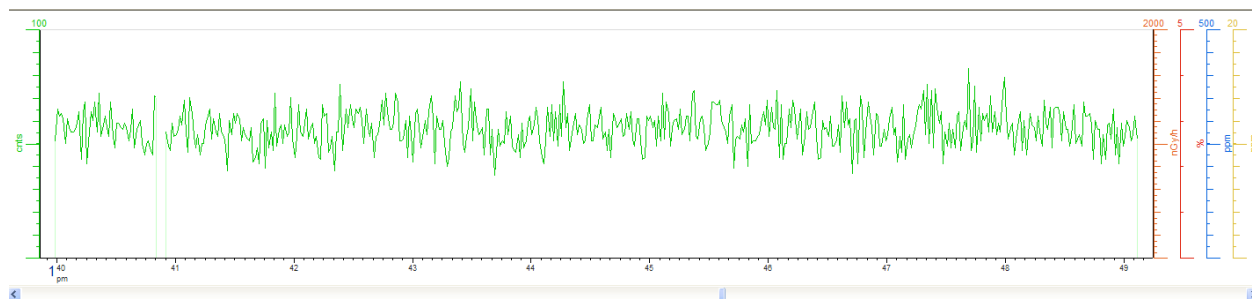


Once again moving the cursor along the data permits numeric and GPS data to be seen in the lower left data box.



SURVEY DATA at selected rate (typically 1/sec) -

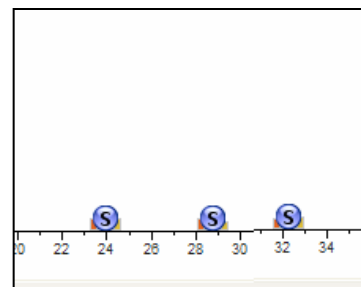
If the whole data set is zoomed then the ASSAY data is suppressed and the raw Total Count data is seen as a graph – see figure below.



“NORMAL” ASSAY DATA

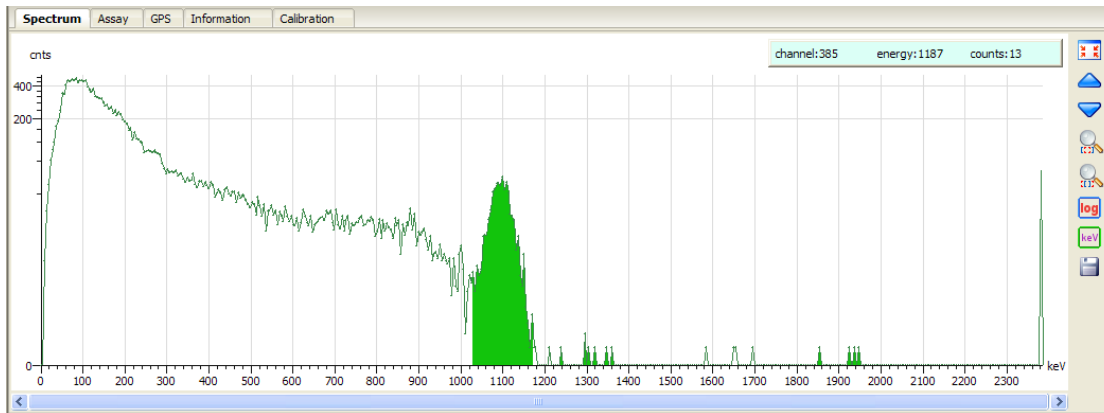
The data stored by the user with the ASSAY selection (typically 120 secs) is also viewable on these displays. The example below is such a data set.

The data marked as “**S**” are the individual stored ASSAY results. Click on any “**S**” to see the data.



SPECTRUM DISPLAY

Click on any of the spectral data (denoted by an “S”) and the full 1024 channel spectrum is seen. The cursor can be used to see Channel #, keV and cts for any channel in the spectrum. The spectrum can also be vertically scaled using the buttons and a LOG button permits easier viewing of higher energy low count rate events



This display has 5 tabs:

SPECTRUM – spectral display of the selected point

ASSAY – Assay data of the selected point

GPS – GPS data of the selected point

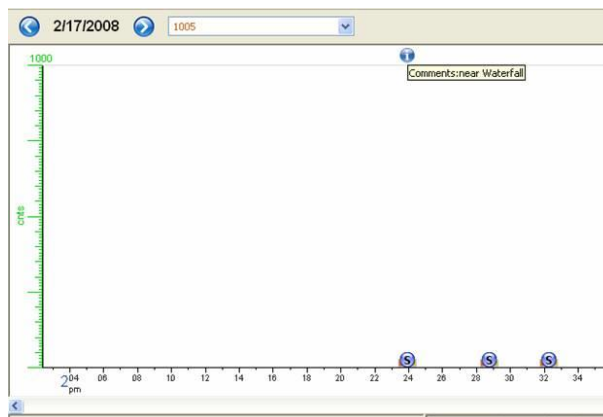
INFORMATION – gives additional data

CALIBRATION – gives the full cal matrix of the selected data point



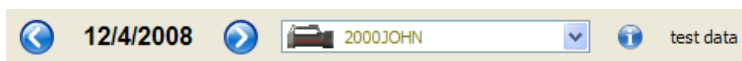
Now this Comments ability is added, to insert data click the left pen icon (ADD – the one with a red mark is REMOVE). The position the cursor at the data point of interest and click it. Immediately data box will appear and the user can add comments (e.g. near Waterfall).

Comments are seen as shown:



Create note

Comments:



If the blue **i** is clicked, then users can enter info in the Comment field created above (e.g. **test data**) and this will appear next to the **i** button to permit users to label the data.

4.6.2.1 DATA EXPORT

All recorded/displayed data can be output as txt files.



Selects the EXPORT data process. The data box shows all Serial Numbers of data in the database – select as required.

User can select various data output:

SURVEY – retrieves the SURVEY scan data in a txt file

ASSAY – retrieves the SURVEY scan data in a txt file

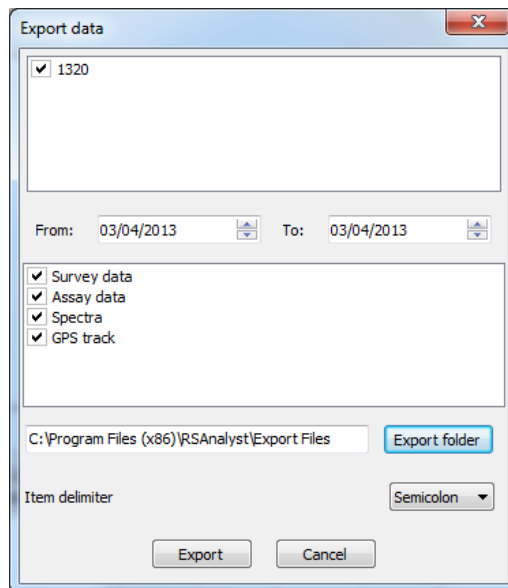
SPECTRA – retrieves all stored spectra in full 1024 channel data format as a txt file

GPS TRACK – retrieves GPS data as a txt file

Most users should select ALL options just to be sure.

EXPORT FOLDER – user can select the sub directory where the data is exported to

Select **EXPORT** – and all data files are transferred to the selected directories where they can be viewed as required (Excel Text data import etc.). The data is exported with embedded headers labeling data columns.



Typical export data into Excel

Use Delimited by semi-colon to properly separate data columns, see examples below:

a) ASSAY data

ID	Date	Time	Temperature	Stabilized	Total(ppm)	Total(cpm)	K(ppm)	K(cpm)	U(ppm)	U(cpm)	Th(ppm)	Th(cpm)	Dose	Dose units	Latitude	Longitude	Altitude
100	2/22/2008	14:56:33	22	1	33.7	283.8	0.15	17.3	0.8	7.6	2.69	5.2	13.49	nGy/h	43.636	-79.67861	192
101	2/22/2008	14:57:04	22.1	1	38.7	325.5	0.56	34	0	3.5	3.96	7.3	17.96	nGy/h	43.636268	-79.680163	198
102	2/22/2008	14:57:33	22.1	1	29.3	246.2	0.22	21.4	0.09	7.6	5.02	9.4	16.89	nGy/h	43.636425	-79.679847	203
103	2/22/2008	14:58:03	22.1	1	35.2	296.3	0.68	36	0	0	5.21	9.4	22.9	nGy/h	43.636427	-79.67984	200
104	2/22/2008	14:58:33	22.1	1	35.7	300.5	0.3	27.7	1.56	9.7	1.46	3.1	16.3	nGy/h	43.636423	-79.67984	201
105	2/22/2008	14:59:03	22.1	1	31.3	262.9	0.33	17.3	0	0	0.56	1	5.77	nGy/h	43.636418	-79.679832	193
106	2/22/2008	14:59:33	22.1	1	30	252.4	0.13	21.4	2.43	11.8	0.24	1	15.54	nGy/h	43.636413	-79.67982	191
107	2/22/2008	15:00:03	22.1	1	33.3	279.6	0.41	23.5	0.18	1.4	0	0	6.37	nGy/h	43.636403	-79.679815	191
108	2/22/2008	15:00:33	22.1	1	35.7	300.5	0.13	6.8	0	0	1.73	3.1	6.32	nGy/h	43.636398	-79.679812	191
109	2/22/2008	15:01:03	22.3	1	29	244.1	0.17	11	0	1.4	1.69	3.1	6.83	nGy/h	43.636393	-79.679808	195
110	2/22/2008	15:01:33	22.3	1	27.8	233.6	0.31	23.5	0.63	5.6	1.57	3.1	11.75	nGy/h	43.636393	-79.679808	196
111	2/22/2008	15:02:03	22.3	1	29.8	250.3	0.48	29.8	0.11	3.5	1.63	3.1	11.27	nGy/h	43.636397	-79.679808	192
112	2/22/2008	15:02:32	22.3	1	32	269.1	0	6.8	1.07	5.6	0.42	1	6.94	nGy/h	43.636398	-79.679808	192

b) SURVEY

	Date	Time	Temp	Smp	rate	s1	2	3	4	5	26	27	28	29	S30	Lat	Long	Alt
45	2/12/2008	15:36:12	19.2	30	1	35	44	46	41	40	41	44	47	45	34	43.622975	79.669925	190
46	2/12/2008	15:36:41	19.4	30	1	37	36	38	37	41	34	37	51	44	37	43.624885	79.672477	189
47	2/12/2008	15:37:11	19.4	30	1	38	44	38	46	35	36	25	33	42	39	43.626872	79.675147	191
48	2/12/2008	15:37:41	19.6	30	1	55	34	34	34	24	46	41	45	29	31	43.628152	79.677157	197
49	2/12/2008	15:38:11	19.8	30	1	34	36	37	42	40	28	36	37	45	41	43.627118	79.67879	192
50	2/12/2008	15:38:41	20	30	1	49	45	49	49	44	44	40	42	42	41	43.626533	79.67953	192
51	2/12/2008	15:39:11	20	30	1	33	39	49	49	39	65	47	51	63	56	43.626643	79.67979	193
52	2/12/2008	15:39:41	20.2	30	1	69	72	55	74	62	69	80	64	68	56	43.629507	79.681785	194
53	2/12/2008	15:40:11	20.2	30	1	69	57	50	58	61	51	70	53	64	73	43.632143	79.678108	198
54	2/12/2008	15:40:41	20.4	30	1	62	64	64	69	65	86	80	80	67	66	43.634382	79.672393	196
55	2/12/2008	15:41:11	20.4	30	1	69	69	57	71	70	64	61	72	68	72	43.636583	79.665713	193

In the above example, the data have been exported from **RSAnalyst** and imported into Excel. Some columns have been deleted from the data set to make the figure above clearer.

Note that the GPS location data shown after sample #30 is the position of Sample #1.

c) SPECTRA

The Assay data spectra file is stored in memory as an *.spc file and the example shows one such file imported into Excel. Data assignment as follows:

data 1 = LiveTime in mSec

data 2 = Clock Time (mSec) = (set time - # secs x 39mSec)

data 3 = spectral chn 1

data 1026 = spectral channel 1023 = Cosmic channel

data 1027 = Linearization coefficients

114725	LiveTime
114960	Clock Time
0	chn 1
1	chn 2
0	chn 3
0
2
0
103	chn 1023
7.47 1.880176 2.970002 0.000140	chn 1024

d) DATA-Serial#.kml

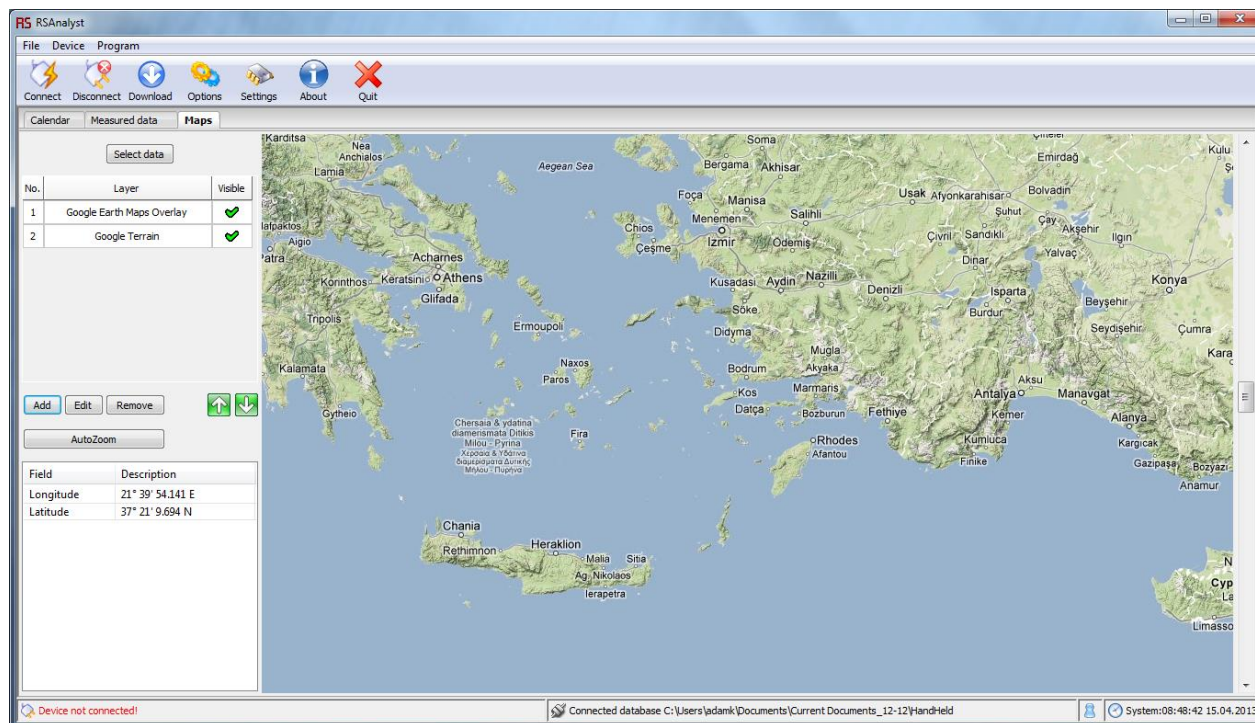
This data file contains only the **GPS** coordinate data and is intended for direct import into **GOOGLE EARTH**. Once imported the track position can be seen with Google’s GIS terrain overlays and is useful to confirm and inspect survey location.

4.6.3 MAPS Page

4.6.3.1 GENERAL

Map Layers requires an update to the **RSAnalyst** software rev – 0.147.2 or better.

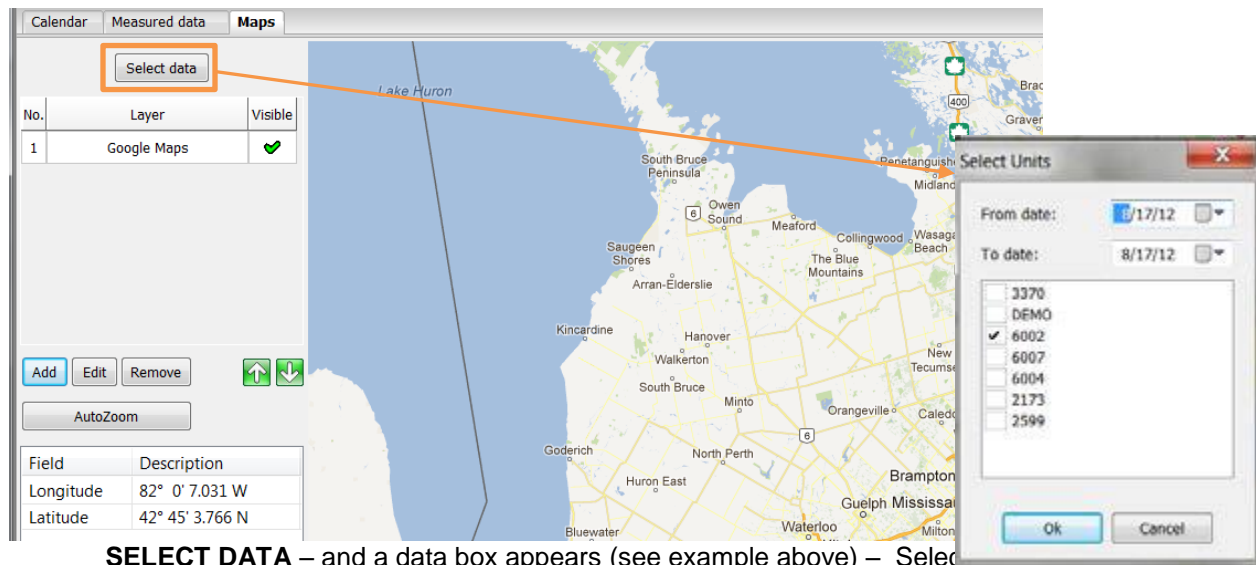
Selecting the Maps tab will open the following Page:



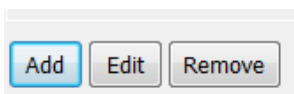
4.6.3.2 HOW TO USE MAPS:

Start **RSAnalyst**, collect and import data as usual. For this example a limited data set was collected in the vicinity of the RSI plant. The dataset is small but it is sufficient to explain functionality.

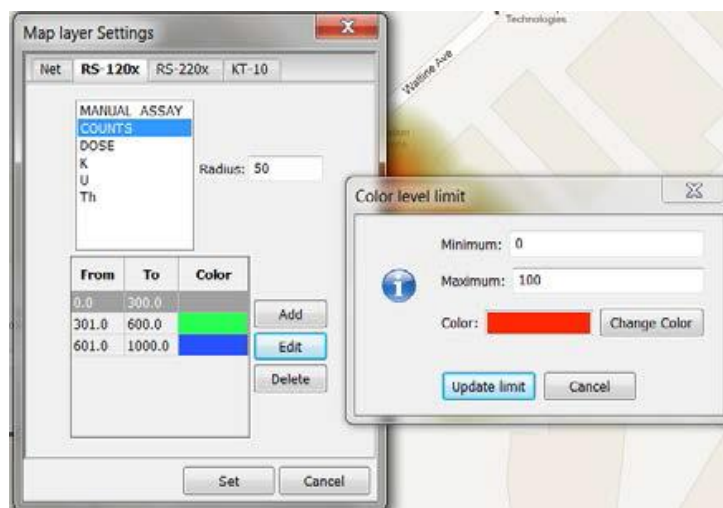
- a) Select the **MAPS Tab** – the display will look similar to the example below.



- c) Select the Add button –

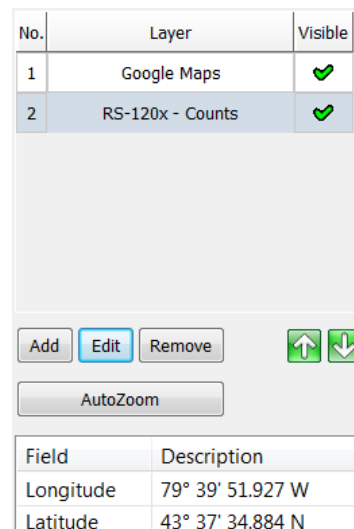


- d) Select the RS-120x Tab and Counts if Total Count Recorded.
- e) Click **EDIT** and then select one of the data lines by clicking on it. Adjust the Max/Min and Color to suit, then select **UPDATE LIMIT** to accept the changes.
- f) Select **RADIUS** – the concept here is that the User should decide what radius of coverage has been achieved during the data traverses. Typically with a detector held 1m above the ground on traverse, then a maximum of 5m path is appropriate (but the User can experiment).



- g) Press **SET** when entered.

h) The data entry screen (located in the upper left) should look like this.



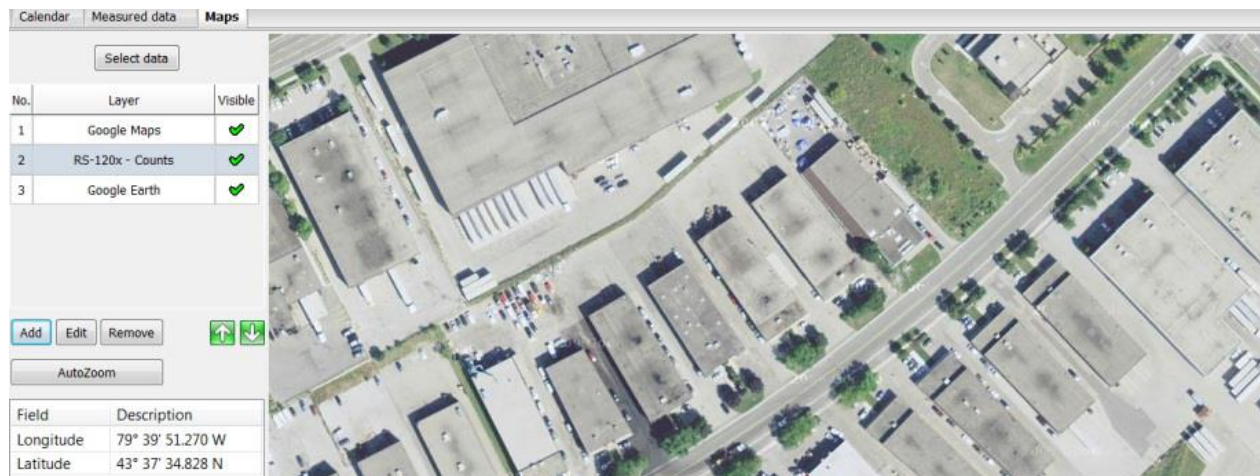
Various map layers can be added by pressing **ADD** again, selecting from the display then **SET** to add the layer.

Note that each layer has its own zoom limits (e.g. **GOOGLE TERRAIN** has much lower zoom than **Google Maps**) so the user needs to experiment to decide which layers they want. Once decided, select the non-required layer and select REMOVE to get eliminate them.

In the example only **GOOGLE MAPS** and **GOOGLE EARTH** are selected



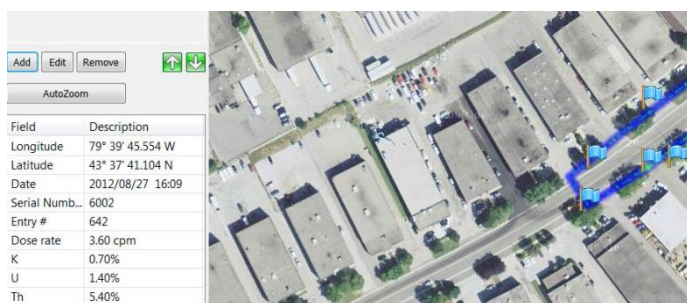
i) Click **AUTOZOOM** to locate your dataset in the center of the screen and the max zoom level to display all the data. Data may look like this with no data showing:



j) Use the **UP/DOWN** green arrows to cycle through the layers to display the data as required and use **ZOOM** (right hand slider or mouse wheel) as required – the test data set looks like this:

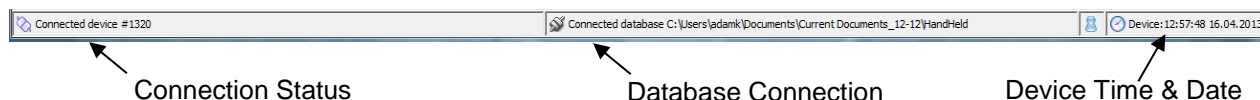


k) **ASSAY** – adding ASSAY data is a similar process and the map shows the ASSAY data collection points as blue flags.



l) Position the cursor on any of the flags and the data from that location is displayed on the bottom left.

4.7 STATUS BAR



5.0 Rechargeable Battery SET

This set comprises 3 items:

- 4 x NiMH AA batteries (2500mA)
- 115V AC line adapter (or International 115/220V)
- Vehicle charging cable

PROCEDURE:

- a) **Batteries** - The user should mount the 4 batteries in the RS unit as described in [Section 2.1](#).

For AC operation – connect the supplied line cord to the DC input connector of the RS unit (hidden under the waterproof tab on the bottom of the unit). The display shows this icon/message to show that charging is taking place:



Once connected to the AC line the unit should take typically 4 HOURS (at 20⁰ C) to reach full charge – longer at colder temperatures. Leaving the unit connected to the AC line overnight is OK but don't leave it connected for an indefinite period (more than 24 hrs) or potential battery damage could occur.

If the icon labeled POWER SUPPLY appears this means that the **wrong batteries are selected**. Power off the unit, remove and replug in the battery holder then on power on, select **RECHARGEABLE** batteries.



POWER SUPPLY

NOTE: The batteries supplied with the RS-125 unit are NiMH rechargeable batteries. It is best to “condition” these batteries when first used to ensure a good battery life. The ideal form of conditioning is:

- fully charge the batteries in the unit – minimum of 4 hours
- completely discharge the unit – 10 hours
- fully charge the batteries a second time – minimum of 4 hours
- completely discharge the unit a second time – 10 hours
- fully charge the batteries a third time – minimum of 4 hours
- completely discharge the unit a third time– 10 hours

Now the batteries should give their optimum life. Try to ensure at least 2 charge/discharge cycles.

- c) **DC operation** - If an AC source is not available the supplied VEHICLE charging cable can be used - this requires access to a 12V (max 20V) battery. Connect the supplied Vehicle Charging Cable to the DC input connector of the RS unit (hidden under the waterproof tab on the bottom of the unit). Connect the Cigarette lighter plug on the cable to the appropriate Vehicle connection – RS display should show the “**CHARGING**” message as noted above. Typical charge is 4 HOURS (at 20⁰ C) to reach full charge – longer at colder temperatures. NB Ensure that the Vehicle connection is powered on (red LED on the connector) as some units power OFF when the ignition key is switched off (check that the unit is displaying the “**CHARGING**” label as shown above even when ignition is OFF)..

NOTE: Starting a vehicle can cause many bad voltage transients on the power line that can damage sensitive electronic equipment. For this reason users are advised to unplug the charger during vehicle starting.

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Appendix A - ASSAY ANALYSIS

Comments re Precision:

General

The RS-125 Portable Gamma Spectrometer units have an integrated 6.3 cu ins Sodium-Iodide detector for Gamma Ray detection. This very large sensor coupled with the 1024 channel spectrometer capability of the unit permit high levels of sensitivity for Geophysical prospecting.

However like all instruments, measurement accuracy is dependent on a variety of factors. This note briefly explains the basic errors related to instrument measurement and computes approximate system Precision capabilities.

Errors

There are various primary sources of error.

- a) STATISTICAL – if we assume the calibration parameters are 100% correct then the accuracy of a reading is strictly related to the statistical noise of the counting, so if we count long enough we can reach any degree of precision and accuracy.
- b) CALIBRATION - there are some level of errors when the unit is calibrated, so the measured calibration matrix is offset relative to the correct matrix. This will result in a systematic small error component that effects the accuracy. For levels below approximately the pad concentrations of 8% K, 50ppm U, and 140ppm Th – with an Assay Time of 2 min, this systematic error is small compared to the statistical error and can be ignored. At higher levels or if the counting time is extended (4 minutes at 4%K, 25 ppm U, 70 ppm Th) this error will get comparable to the statistical error and keep increasing faster than the statistical error.
- c) GEOMETRY - the other factor that should be considered is the geometry. The assumption in computing the assay results inside the unit is that the detector is looking at a semi-infinite half space of uniform material. In more practical terms this means the instrument is averaging a circular area approximately 3 feet diameter. Thus if the rocks inside this 3ft zone are fully homogenous, then the Assay results from the instrument will approximate that of Chemical assay – however in the field this assumption is difficult to ensure so in most cases the Assay are an excellent INDICATION of the level of actual chemical assay results.
- d) COUNTING TIME – the length of the sample (Assay) time is a function of the users requirements. In the past, 300 secs (5 mins) was used as the standard to suit all field conditions as this gave good results in even low level areas. However much exploration now takes place in relatively high grade areas where this long assay period is not necessary and for many users this 5 min period was considered excessive. For this reason the RS-125 is factory set at 120 secs (but changeable by the user to suit their field requirements). When the sample starts, a preset Sample Time parameter shows the sample time on the right and on the left is a count up timer showing sample progress. Once the first 30 secs sample is reached an Assay result is shown. Each additional 30 secs the Assay data is recomputed and updated on the display.

For best accuracy the full count period should be permitted. However in very anomalous areas sample times as low as 60 seconds give very good data due to the large detector size.

Guidelines are:

60 secs – anomalous area – low quality data is fine – fast sampling is required to get maximum data for an area in a short period of time.

120 secs – anomalous area – medium quality data is fine – fast sampling is required to get maximum data for an area in a short period of time

180 secs – medium anomalous area – good quality data is required

240 secs – medium to low anomalous area – high quality data is required

300 secs – low anomalous area – maximum quality data is required

IN THE ANALYSIS BELOW 120 secs ASSAY PERIOD IS ASSUMED

The table below shows the estimated error bars at the 1 Sigma level, so +/- 1 sigma is a good estimate of data precision but only errors (a) are included in this assessment.

a) RS-125 DATA

K %	1 sigma K%	1 sigma U ppm	1 sigma Th ppm
0	0.000	0.000	0.000
0.1	0.030	0.041	0.006
1	0.096	0.130	0.019
5	0.214	0.291	0.042
10	0.303	0.412	0.060
U ppm	1 sigma K%	1 sigma U ppm	1 sigma Th ppm
0	0.000	0.000	0.000
1	0.043	0.307	0.027
10	0.135	0.970	0.087
100	0.427	3.067	0.274
1000	1.349	9.698	0.866
10,000	4.27	30.67	2.74
Th ppm	1 sigma K%	1 sigma U ppm	1 sigma Th ppm
0	0.000	0.000	0.000
1	0.023	0.237	0.539
10	0.072	0.750	1.705
100	0.228	2.373	5.391
1000	0.721	7.504	17.047
10,000	2.28	23.7	53.9

NOTE: The above data have been computed taking into account the errors described. However as described above the final absolute precision levels are a factor of many of the errors described, some of which are hard to quantify for the reasons noted. For this reason the quoted error levels should be used in a relative rather than an absolute manner to ensure technical accuracy.

ZERO RESULTS

Under certain conditions some Assay results go to zero. This is caused by statistical noise errors interfering with the matrix calculation of Assay computation. Using the statistical noise calculations above, as an example if you have a 120 sec sample and a 100ppm Thorium sample with 10ppm Uranium, then the assay result for +/-1SD will be Th=100+/-5.5ppm and U=10+/- 3.3ppm thus in some samples **U could = 0.00**. This “noise” error can be minimized by taking very long Assay samples which reduces the scatter.

CROSS INTERFERENCE - for varying concentrations of e.g. Potassium there are error components for not only K but also U, Th etc. If you have a mix of K, U, Th - the combined errors can be found by taking the square root of the sum of the square of errors. If for example you have 1% K, 10 ppm U, and 10 ppm Th the combined K error is $\text{SQRT}(0.096^2 + 0.135^2 + 0.072^2) = 0.18$.

b) RS-230 DATA

The RS-230 data is approximately 2x better than the RS-125 data noted above due to the BGO detector technology.

REFERENCE

The above data is based on Calibration data derived from RSI Calibration Pads. These pads are technically defined in the 1991 Geological Survey of Canada paper #90-23 titled “**Transportable Calibration Pads for Ground and Airborne Gamma-Ray Spectrometers**” by Grasty, Holman and Blanchard. This paper fully describes the manufacture and the assay testing of the material to verify the pad calibration results. Window widths of ROIs and cal standards were defined to IAEA standards as required.

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Appendix B - Fast GPS Sampling on Total Count Data

Some users want to record GPS data at a faster rate when recording Total Count data. Firmware Versions including and after v5.19 permits this but there are some compromises.

In the normal software, Total Count scan data is recorded in data blocks of 30 samples, after which GPS is recorded. This memory block size is not practical to change however users can adapt the scan rate to get faster GPS data.

To do this, users should load a special parameter file named “**GPSfastscan.txt**” that should be supplied with the new software but can be obtained from RSI as required.

This txt file looks like this:

```
Params.survey_rec_len = 30
```

Change the number as required for example to **15**, then store the file (only use Notepad or WordPad – don't use WORD as it adds formatting characters that will cause file loading problems) Then load the file into the unit using the method detailed in [Section 4.5.5.1](#) under **PARAMETER CHANGE**.

In the above example if **Total Scan Period = 1** and the above file sets “**Survey_rec_len**” = **15** – then when RECORDING is started, the Total Count data is recorded at a 1/sec rate for 15 samples then the GPS is recorded and the recording repeated.

NOTE: In this case the allotted memory determined during memory partitioning is actually half of what is indicated because memory is allocated for 30 samples of data and only 15 are being recorded. However the new units with 4MB of memory have 58 sectors for allocation, (see [Section 4.5.5.3](#) for more information) so memory capacity should not be a problem.

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Appendix C – RS-230 System Stabilization and Data Reliability

C.1 GENERAL

This technical note is intended as a guide for users of the RS-230 and provides details concerning auto stabilization and data reliability.

C.2 STABILIZATION

In the early versions of the RS-230 firmware (software inside the unit), under certain conditions some units had intermittent problems stabilizing. RSI carried out extensive experimentation and with various improvements in the analysis system, the current version of firmware (5v95) is very reliable and robust.

However **if the user has concerns with stabilization** the following are the steps they should take with RSI to resolve these problems:

- a) **UPGRADE F/W to 5v95** – this version seems very robust so the first step is to power the unit on and see what version is currently used by the unit. If it is not **5v95**, then contact RSI to receive the **5v95.gfw** file that is loaded into the unit via **RSAnalyst**.
- b) **LOAD CORRECT PARAMETERS** – RSI can supply users with a set of recommended parameters which are then loaded into the unit via **RSAnalyst**. These parameters are optimized for the RS-230 and contain special settings which have shown to be optimum under most conditions.
- c) **STABILIZATION TEST** – with both (C.2.a) and (C.2.b) above accomplished, it is recommended that the user plug a battery charger into the unit and let it run in the SURVEY mode for at least 4 hours but preferably longer. To simplify issues, RSI recommends that after the **Stabilization Test**; that users download the Stabilization File using **RSAnalyst** and email it to **RSI-Service** at service@radiationsolutions.ca for proper assessment (see [Appendix Z](#)).
- d) **ADJUSTED PARAMETERS** – under some circumstances, after assessing the data RSI may send a new set of Parameters to tweak the systems performance. In this case we will ask you to repeat step (C.2.c) to be sure all is now **OK**.

This procedure usually resolves most of the issues; if not, the system probably has a hardware problem and needs to be returned to factory for service.

Contact RSI-Service at service@radiationsolutions.ca.

C.3 DATA RELIABILITY

Some users have carried out repeatability experiments and sent the data to RSI to review/address the repeatability results.

In many situations the data scatter is due to the unit not being properly stabilized. The procedures noted above in (C.2) should resolve this. However if stabilization is **OK**, very significant errors can easily occur during data experiments by changing geometry between the detector and the source used for the test. In most cases users would utilize a somewhat radioactive rock. The main problem here is that such sources act like point sources and small geometry changes cause significant data errors. When the raw data (of concern) is sent to RSI, it is impossible for us to comment as we have no knowledgeable of how the experiments were performed.

NOTE: In the following tests the GR-320 (by Exploranium, now obsolete) was once the “standard”, is used as a baseline in comparison to the RSI RS-230 unit.

a) “SOURCE”

To minimize the Geometry issues, RSI utilized our 1m x 1m concrete test pads that contain small amounts of K, U and Th. The advantage here is that the pads are homogeneous over the 1m x 1m area thus small geometry changes will have little effect.

The picture shows the experiment with 2 x RS-230 and 2 x GR-320 making simultaneous measurements.



b) TEST PROTOCOL

To keep the experiment as close as possible to field work, RSI set all units for a “standard” 120 second sample time.

All units were run for at least 4 hours prior to the measurements to ensure system stabilization was OK.

The RS-230 units continue to stabilize on or off the pad, whereas the GR-320 stabilization must be switched off. To minimize this operational limitation of the GR-320, after each data set the units were all run on the K pad with stabilization enabled so the GR-320 could fine tune itself before the next data set.

Data was taken on each of the Potassium, Uranium and Thorium pads with 10 x 2 minute samples for each unit.

c) RESULTS

The table shows the data on the Uranium and Thorium pads. 320.1832 = GR-320 serial #1832 and 230/3373 is RS-230 serial #3373 etc.

The Uranium pad is nominally **52.9 ppm** - the Thorium pad is nominally **136 ppm**

Normally we use an 85% geometry correction factor as even the 1m x 1m test pads are not infinite size but for this experiment we used 80% as the detectors were offset.

So after correction the data should show the Uranium = **42.3 ppm** and Thorium = **108.8 ppm**

230/320 testing - on pads	ppm							
	U pad	120secs			Th pad	120secs		
	320/1832	320/2017	230/3373	230/3375	320/1832	320/2017	230/3373	230/3375
	47.6	45.6	41.8	42.9	116.4	112.3	101.1	105.0
	45.2	45.2	44.8	41.5	119.4	123.1	110.3	104.2
	48.3	45.3	43.6	42.2	119.9	115.8	100.5	104.6
	45.0	41.6	42.3	42.3	123.1	122.9	107.0	106.6
	45.8	46.5	43.3	40.3	122.7	117.1	101.6	106.6
	47.3	46.9	42.3	44.3	117.0	117.9	109.3	105.6
	44.8	45.4	42.8	42.8	119.8	114.8	105.1	106.7
	45.0	48.4	40.5	44.1	121.9	118.6	108.8	107.1
	46.2	44.0	43.7	43.0	121.0	112.4	110.9	104.9
	47.3	45.3	41.5	42.1	122.3	117.0	105.8	101.8
Average ppm	46.3	45.4	42.7	42.6	120.3	117.2	106.0	105.3
SD	1.3	1.8	1.2	1.2	2.3	3.7	3.9	1.6
Average SD	1.3		1.2		3.0		2.7	
Max ppm	48.3	48.4	44.8	44.3	123.1	123.1	110.9	107.1
Min ppm	44.8	41.6	40.5	40.3	116.4	112.3	100.5	101.8
Max SD	1.6	1.7	1.7	1.5	1.2	1.6	1.2	1.1
Min SD	1.1	2.1	1.7	1.9	1.7	1.3	1.4	2.2

This data clearly shows identical repeatability between the computed Assay data from the RS-230 and the GR-320, as well as excellent data repeatability for both. The GR-320 data is slightly higher on the U and Th side but within normal statistical range.

The next table shows the same data but using the stripped counts/time period rather than the ppm.

230/320 testing - on pads	cps							
	U pad	120secs			Th pad	120secs		
	320/1832	320/2017	230/3373	230/3375	320/1832	320/2017	230/3373	230/3375
	1,741	1,826	1471.6	1511.4	1,780	1,772	1757	1824.4
	1,652	1,812	1575.4	1467.2	1,826	1,940	1912.6	1809.8
	1,777	1,823	1534	1484.4	1,831	1,829	1745.8	1815.2
	1,664	1,686	1491.2	1487.4	1,881	1,933	1858.8	1850.0
	1,681	1,887	1523	1432.6	1,876	1,849	1764	1851.8
	1,727	1,868	1487.2	1551.6	1,794	1,863	1896.6	1836.2
	1,651	1,816	1507.8	1511.6	1,830	1,811	1825	1860.4
	1,653	1,931	1435.2	1550.8	1,863	1,872	1890.6	1823.4
	1,686	1,767	1537.4	1510.8	1,849	1,777	1925	1769.0
	1,730	1,825	1459.8	1482.0	1,865	1,849	1837.6	1830.2
Average	1696.3	1824.2	1502.3	1499.0	1839.4	1849.7	1841.3	1827.0
Theory sigma	44.6	66.5	41.7	36.5	33.9	56.8	67.0	26.2
Actual Sigma	41.2	42.7	38.8	38.7	42.9	43.0	42.9	42.7
Real Sigma	17.0	51.0	15.4	13.0	26.3	37.1	51.4	33.8
Variation (%)	1.0	2.8	1.0	0.9	1.4	2.0	2.8	1.8

SUMMARY

RS-230 Stabilization issues can be easily resolved using the procedures noted above (see Section C.2).

NOTE: The RS-230 shows excellent repeatability of the data and the data shows that it is essentially equivalent in performance and data reliability to the GR-320 system often referred to as the "standard". The GR-320 uses a 21 cubic inch NaI crystal whereas the RS-230 uses a 6.3 cubic inch crystal. The GR-320 is now obsolete and no longer available.

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Appendix D Calibration of the RS-125 and/or RS-230

NOTE: To be performed on User Accessible Test Pads.

D.1 GENERAL:

The RS-125 and RS-230 units supplied by RSI have been calibrated on specially designed Test Pads. Dr. R.L. Grasty et al made a series of test pads for calibration and they are distributed around the world. In addition some specialty users have constructed their own pads.

Many users want to re-calibrate their instruments 1/year and if they reside outside of Canada it imposes a significant cost burden to send the units back to RSI for calibration.


This procedure explains the process the user must follow to use local test pads to calibrate their unit.

D.2 REQUIRED ITEMS

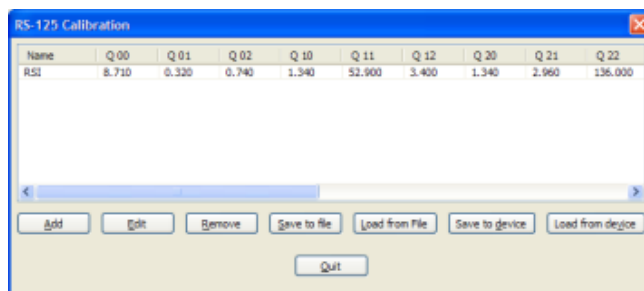
- 1 Detailed technical information about the Test Pads being used
- 2 RS-Analyst version 0.110 or higher + Pad Calibration plug in (contact RSI if required).

D.3 LOAD CALIBRATION FILE

Obtain the technical information about the pads and enter the following data:

- a) Unzip patch file (rs125calib.zip) and move extracted rs125calib.dll file to the RS-Analyst installation directory : \.....\RS-Analyst\plugins\rs125calib.dll
- b) Start RS-Analyst and verify that version level is 0.110 or higher.
- c) Verify that the Calibration plug in is installed – icon as shown here 
- d) Connect the unit to **RS-Analyst** by (Blue-tooth) BT or USB as normal.

- e) Click the icon and select **Add** from the next display.



- f) Enter a pad name (e.g. **RSI test pad**) then enter data in the table:

Q 00: K pad data for K
 Q 01: K pad data for U
 Q 02: K pad data for Th
 Q 10: U pad data for K
 Q 11: U pad data for U

Q 12: U pad data for Th
 Q 20: Th pad data for K
 Q 21: Th pad data for K
 Q 22: Th pad data for K
 Q 30: Blank pad data for K
 Q 31: Blank pad data for K
 Q 32: Blank pad data for K
 Q 40: 0
 Q 41: 0
 Q 42: 0
 COR 0: K pad geometric correction (e.g. 0.857 = 85.7%)
 COR 1: U pad geometric correction (e.g. 0.857 = 85.7%)
 COR 2: Th pad geometric correction (e.g. 0.857 = 85.7%)
 COR 3: 1
 COR 4: 1

- g) Select **Create profile**
- h) Click on **Save to file** and store the file for future use: example name = Oz's test pad
- i) Next select **Save to device** to load the data into the unit, if all is **OK** a message should display; **"Master Parameters were successfully updated"**.
- j) The pad calibration file is now permanently loaded into the unit and will remain there until new pad data is loaded.

D.4 ENABLE CALIBRATION MODE

Loading the Calibration Parameters:

Find the file "**Enable Calibration Mode.txt**" which was sent with the **calibpatch.zip** package.

With the unit still connected to **RS-Analyst**, select **Device Parameters**.



Select the **Device Settings** tab.

Select the **Load Parameters from file** button.

Browse to select the **Enable Calibration Mode.txt** file and click **Open**.

A message is displayed "**Are you sure you want to rewrite parameters**" – say **YES**.

A "**Success**" button is displayed – click **OK**.

The unit is now capable of **Pad Calibration** using the pad data previously installed.

D.5 CALIBRATE UNIT

- a) Ensure the unit has fully charged batteries.
- b) Run the unit on the desk for at least 1 hour to ensure it is fully stabilized.
- c) Go to the vicinity of the Test pads and on the unit select **Configuration → Calibration → Pads calib.**
- d) Then select **Default device BG**. Display shows “**Using default device background**”, click the Button to go back to the menu.
- e) Then Place the unit upside down in the middle of the pad so the battery compartment is facing up/ rubber top is touching the pad. Now select **K pad**, after 300secs the unit will beep and the display will show **K saved**.
- f) Repeat this process for the **Uranium pad** but this time select **U pad**.
- g) Repeat this process for the **Thorium pad** but this time select **Th pad**.
- h) Repeat this process for the **Background pad** but this time select **Bg pad**. Note that the Bg pad measurement will take 600sec.
- i) Then select **Calculate matrix** – and after a few seconds the display will show “**Matrix calculated**”.
- j) Select **Go back**.
- k) Select **disable calibration mode**.
- l) Return to the survey mode screen.
- m) Test the unit.

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Appendix Z WARRANTY



Radiation Solutions Inc Warranty

RS-125 (Super-Spec) and RS-230 (BGO Super-Spec) series products are provided with a one (1) year return to factory limited warranty against defects in materials and workmanship from the date the Products are placed at the disposal of the Buyer at the named place of delivery. **The warranty does not cover damage caused by improper use or unauthorized repairs.**

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
sales@radiationsolutions.ca