



# RT-30 Mk2 – SUPER IDENT

User's Guide

Rev. 1.1 – December 2021



## RT-30 Mk2 SUPER IDENT

### NOTE:

User's Guide Rev. 1.1 covers all firmware versions of RT-30 Mk2 launched before version 0.7 in all features.

There is required program Geomon of version 0.6.00 or higher for access to all functions and parameters of FW 0.7 via a PC

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## 1. GENERAL

The RT-30 Mk2 is the second generation of popular handheld gamma ray spectrometer RT-30. Strengths of the first generation were copied in the new model. There has to be highlighted a strong alloy body sealed against dust and water, protective removable rubber boot, comfortable grip and low weight. The Mk2 learned of the limitations of the first generation and features a large colored transreflective sun readable display, improved user's interface with five operation buttons, removable but well-sealed battery pack and clear and loud audio.



### 1.1. Main Features

- **RT-30 Mk2 – 2 x 2” (106 cm<sup>3</sup>)** Sodium-Iodide detector provides High sensitivity performance due to the large crystal. Energy response from 15 keV - 3000 keV.
- Alternative types of scintillators; ready for CsI/Tl, CsI/Eu, LaHalide, BGO, GAGG, Srl, Plastic scintillation detectors PVT
- Large Graphic Color LCD **Trans reflexive display** of size 360 x 240 dots ensures excellent readability in any outdoor conditions. The size is 3,5” diagonal. Automatic dimming.
- Simple operated with five-position **navigation joystick**. Positions of the joystick are illuminated.
- Memory able to store **10000 samples** what includes spectra or search profiles including gamma total, dose rate, neutrons and GPS coordinates optionally voice recordings.
- New designed state-of-the art electronics with advanced CPU capability.
- Special rugged mechanical design, robust aluminum construction. Rubber shock absorber and internal thermal isolation.
- Well balanced, easy to hold and designed for easy operation in field condition.
- **Full IP65 weatherproofing** – short term water immersion and fully dust protected.
- **Removable and rechargeable battery Li-ion** module.
- Typical **8+ hour** battery life at 20 °C.
- Size 290 mm length, 160 mm height and 100 mm width, Weight – 2,45 kg.
- Operational Temperature range **-10 to +50 °C** (display is the limit).
- Sensitivities 2x2” NaI/Tl (1 MBq from 1 m): Cs-137 160 cps.
- Modern spectrometer design. Fully digital.
- Advanced Nuclide Libraries, default and user's customizable
- Full energy compensated dose rate measurement.

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- Automatic energy calibration based on natural background radiation.  
**No external radioactive source required.**
- USB and Bluetooth and Wi-Fi connection.
- Integrated GPS.
- Integrated microphone for voice recording

### 1.2. Description

The RT-30 Mk2 is a portable handheld instrument. The design respects specifications for indoors as well as for outdoors applications in wide range of temperature and humidity conditions. The instrument is self-contained, there are no additional devices required for its full functionality.

The detector body is made of thin alloy, shaped to harbor internal shock absorbers and temperature isolation.

The bottom of the instrument is protected with rubber boot. The boot is removable and covers bottom lid closing access to removable battery pack.

There is USB-C connector on backside of the head assembly covered by a rubber lid. The USB-C standard takes care of data communication as well as battery charging.

A loudspeaker is hidden behind milled grid below handle grip.

Main panel consists of a large display, buttons joystick, holes for microphone and light sensor. A Bluetooth antenna as well as Wi-Fi is located near display under display frame sticker. The joystick is made of five separate buttons. Four of them are orbiting a central OK button. All buttons are protected with transparent rubber cover. Each of the buttons is illuminated.

The instrument can be cleaned or decontaminated any time using soap water or it can be also an ethyl alcohol or isopropyl alcohol used. All mechanical components were designed for highest possible robustness. The most fragile elements (detection crystal and photomultiplier) are bedded in shock absorbers regardless that fact user must pay attention to how the unit is used and prevent mechanical shocks.

A black circular lid made of plastic located on front wall of the instrument protects a GPS antenna.



## 2. SYSTEM OPERATION

### 2.1. Batteries

The RT-30Mk2 is powered from Li-ion battery pack build in the unit. The pack is removable by user after opening 4 bolts and removing lid. It can be charged in as well as outside of the unit. USB-C connector for external charging is allocated on battery pack. To increase protection of any damage caused by batteries the manufacturer uses only batteries with build in protection. Full control of charging and discharging of batteries is arranged by battery pack build in circuit.

The Li-ion battery is an excellent source of power for the unit but needs an extra care. Although the most critical conditions are watched by build in processor, user is requested to care of following:

- Never charge the unit when temperature of the batteries drops below 0 degree of Celsius. Preferable conditions are around 20 degrees of Celsius.
- Do not store the unit with fully discharged battery!
- Pay attention to warning messages of internal diagnostic.
- Do not replace single batterie in pack. The batteries have to be balanced.
- Only original spare battery pack can be used.
- Charge only using USB-C type of charger PD (Power Delivery) with minimum 36 W at 12 V.



### 2.2. Charging (Low batteries)

The RT-30 Mk2 has a full control of capacity of batteries. When the Battery charge is getting below 10% of capacity the message **LOW** notices the user that the battery pack must be charged soon. When the Battery charge drops below 5% the instrument switches itself OFF. We recommend as prevention of any data loss by uncontrolled termination of measuring activities to switch unit off. This action ensures complete and correct data storage.

Battery charging controller is build in battery pack. Chargeing status is communicated with main control processor. This allows to recharge the unit while operating without removing the batteries. The implemented charging controller is active during charging regardless a working status of the

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instrument. The unit can be charged in power on as well as in power off status. Indication of charging progress is arranged by yellow LED light located on frontside light ramp. LED light on indicates charging process. Light off means no charging and flashing light announces any error.

Only verified power adaptors delivered or approved by manufacturer can be used for charging. In case of use of a 12V DC car outlet this has to be fused. A user must prevent any direct connection to an auto battery without a fuse. Minimum fuse current shall not be less than 4A. Any non-fused connection may cause a fire or permanent damage.

**To charge** connect the unit to the 12V DC charger supporting USB-C standard and plugging connector in the hole located on rear terminal under rubber cover. Charging progress  indicates an icon shown on right top corner of display. The icon has animated filling pattern to indicate charging progress.

**The Manufacturer will not be held responsible for damage to the unit caused by use of improper adaptor. Connecting a wrong type may lead to unpredictable damage on the unit and will invalidate the warranty.**

The unit may operate on external power anytime. External power use is not time limited and suits for long term monitoring tasks (permanent monitoring stations).

### 2.3. Joystick

The RT-30 Mk2 has five control buttons associated in PUSH-BUTTON JOYSTICK. Each button is illuminated what is used for prompting expected actions. The Joystick has four buttons on sides creating an orbit around the fifth button in the center. The orbital buttons controls graphical cursor directions UP, LEFT, RIGHT and DOWN. The central button is used for confirmation and also for switching the unit ON and OFF.

Except switching ON and OFF all clicks of any button shall be performed as a short press of a finger on center of a button as long as a mechanical feedback (click) occurs. Then the finger pulls back. Any button click must be followed with any action of graphic users interface. User must pay attention to a feedback. The feedback can be a move of graphic display to different position, change of a value in editable boxes, starting on any action. To increase operability of some editable functions or spectrum browsers an auto repeat function on buttons is implemented. User shall push a button and hold as long as an expected number or cursor position occurs on screen.

### 2.4. Display

The Display is a backlit LCD trans reflective color display optimized for high contrast in outdoor conditions. Display backlighting is required in low light conditions to make the display readable. The Backlit is controlled automatically. Ambient light is measured by sensor under main panel. The

Display is used for various functions and messages. The trans reflective feature ensures magnificent readability even on bright sunlight.

## **2.5. Switching ON**

Press and hold the button OK as long as buttons illumination lights appears or for maximum three seconds. Following actions will continue. There is a message LOADING accompanied with animated progress circle hold for about five seconds. Then the display is replaced with a welcome screen consisting of manufacturer's logo, name of the instrument, serial number and firmware version number. Then the startup action continues and the unit switches after internal tests to a SURVEY mode.

## **2.6. Switching OFF**

To switch the unit OFF, press and hold the **Button** OK until the unit switches OFF. The other way to switch OFF the unit is to choose switch OFF function from MAIN MENU and confirm SWITCH OFF action. Shall it happen that the unit stops user interface function and there is no reaction on any key touch. To switch the unit OFF the user must hold the OK button pressed until the unit powers OFF.

## **2.7. Connection to devices**

Transfer of Recorded data from the unit as well as major parameters modification or remote operation can be provided via three different communication channels. There is one wire and two wireless standards to connect the unit with external devices.

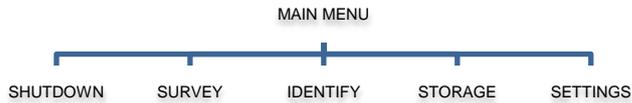
USB standard wire connection cares of all tasks between PC devices. Via USB there are accessible all measured data logged information and access to all parameters. A remote operation is also possible. A connection procedure description is a part of this User's Guide in section Supporting PC programs.

Bluetooth connection bypasses USB by wireless way in all functions and additionally there are modes for connection of special devices extending the RT-30 Mk2 functionality e.g. wireless headphones, high precision GPS receivers.

Wi-Fi connection is the most preferable way. It profits of worldwide use and presence of Wi-Fi devices and high speed. It is not only reserved for applications requiring direct LAN access. Beside Internet connection and far distance controlling mode this type of connection allows also creation of a network of RT-30 Mk2 e.g. in environmental monitoring applications or fix monitoring stations.

### 3. Access to working modes and Main menu

The Main menu is a root of tree of action's direct calls and submenus. The direct actions are Shutdown, Survey, Identify. Shutdown call leads to switching off the unit. Survey, Identify starts measurement procedures.

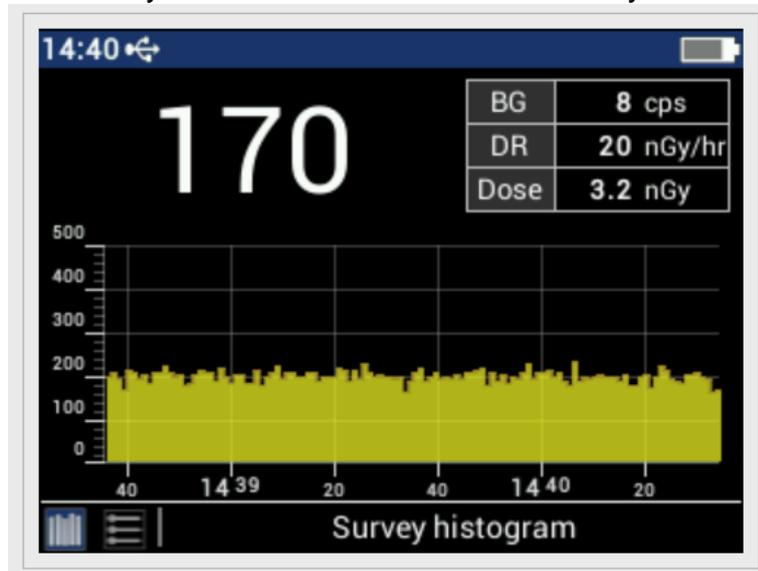


Activation of the two other items Storage and Settings leads to opening submenus for further access to Data Logs or Parameters. Return back to Main menu from procedures or submenus is arranged through an Action menu where selection of the last item of this menu returns to Main menu. See appendix for detailed map of functions and menus.

After power on the RT-30 MK2 starts immediately Survey process. A button OK is designed to call a subordinate menu **Actions** from active working procedures (Survey, Identify or Assay) or to confirm selection of an item in menus. For example. To go to Main menu from Survey or to switch to any supported feature user needs to touch OK to get Action menu then select **Main menu** or expected feature and confirm with OK again. To reach Main menu from Identify or Assay through related **Actions** menu use the same way.

## 4. Survey

The RT-30 MK2 unit associates two functions at a time. A sensitive gamma ray scintilometer accompanied with gamma spectrometer function working on backstage. The survey mode is rated for fast and easy sources targeting or as a stationary monitor of radioactivity. Survey is suitable for a sensitive gamma ray profile logging in terrain. Carrying unit as backpack or on any suitable moving device gives excellent gamma profile information. Each reading is completed with actual position of the unit in GPS coordinates and is stored on memory.



Survey mode starts automatically after power on or can be started from Main menu calling item Survey. While the unit is on a gamma spectrum is continuously collected on backstage. It is used for a real time gain compensation of the unit's temperature drift. In the same time is evaluated also actual dose rate and continues total dose integration since the unit is powered on.

Indication on display is partitioned into three fields – windows. The strip field in a top is status information bar. There are various pictograms displayed in this row. See the appendix for details about icons used. Actual time of the unit occupies the left corner. The middle of the row is used for plenty of icons. There are Gain stabilization, Recording, USB connection, Bluetooth connection active, GPS status and important error warnings icons. Shall be more icons to be displayed then there is space available, Icons are animated and rotates from left to right like headlines. Battery status is on the right side of the bar.

The left side of second window is reserved for Total Counts. There are up to five digits reserved for showing every second readings of recorded gamma ray incidents within last second (cps). The total counter is connected with a graphical histogram what occupies lower two thirds of display area. The histogram - recorder is used for easy orientation while searching. The recorder indicates intensities of radiation scans recorded during last 120 seconds. It allows to user fast and simple comparison of gamma-ray intensities in different positions of the unit while searching and easy determination of a most radioactive spot. The histogram's scale is auto ranging and the current amplitude is indicated with a little arrow left of the y scale. An x scale of the histogram is marked with actual time marks.

The right side of the second window is a table of most important on fly results. There are written last updated background values and current dose rate together with accumulated dose.

For a detailed inspection of the histogram a user can **Pause recording**. This will happen after call of Action menu by pressing OK button followed with selection Pause and its confirmation with OK button again. In this mode the screen freezes and there is given time to user to inspect the recorded histogram. A user can use UP, RIGHT, DOWN and LEFT buttons to move position of the histogram on x as well as y scale to see time or amplitude details. Return to actual mode is performed after pressing OK button and selecting of **Resume** followed by OK confirmation. It is important that during the pause the unit keeps recording of actual data on backstage and no data of search profile are lost.

### 4.1. Audio and voice recording

The RT-30 MK2 has an audio loudspeaker inside the unit. The audio system is used in various modes. In the search mode 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 frequency will reflect the incoming count rate. The frequency pitch is proportional to count rate. Rules for audio threshold set up are in the next chapter.

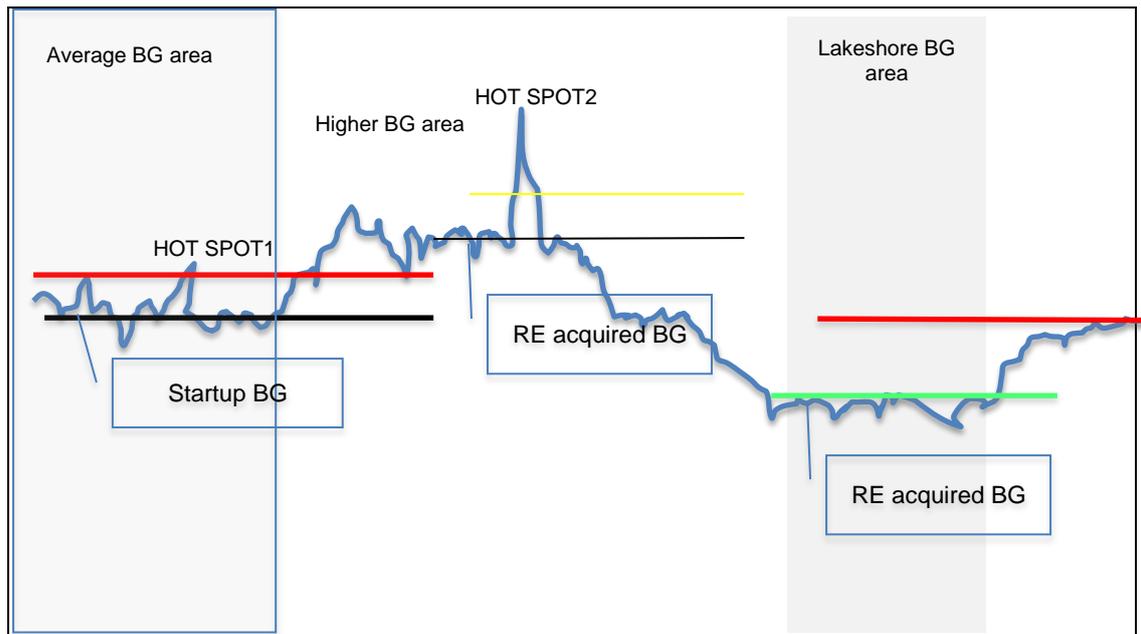
Audio system is used for recording of spoken messages and comments of a user in assay or identification mode. Important information about measurement can be spoken to a build in microphone in front panel and re played before saving. The voice in digital form is then attached to a spectrum. Voice notes are exported in wmf format and can be replayed on a PC. The voice notes are editable prior storing on memory.

The audio system is also used to inform user about important statuses of the instrument. Various warnings are broadcasted.

### 4.2. Re-acquire Radiation Background

We use a following condition for demonstration how the audio in survey mode works. Let set the **AUDIO THRESHOLD** to one sigma. Immediately as the unit is powered on and starts Survey or the Survey is engaged from any menu, the first 10 readings of total counts in cps averaged and the Audio Threshold is computed from this average. The threshold responds to a value of the average plus one standard deviation of the averaged data. If the count level exceeds this threshold the audio starts sound as described above. However in many areas and conditions the local background may vary and it may cause threshold problems, false alarms or sensitivity failure. It is important then to be able to accommodate the audio threshold to local conditions any time.

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There is an example when the local background level is 100 cps then at 1 Sigma the Audio Threshold = 110 cps ( $100 + 1 \text{ Sigma}$ ). See the red line in Average BG area what demonstrates the threshold. So if the count rate goes above 110 cps the audio will sound. Indication of a hot spot 1 is possible. However the local Background may increase substantially let say to 200 cps (user moved from an open space to a building e.g.) then the audio will be on continuously and the frequency pitch will not be sensitive enough to small local changes so the hot spot 2 will be missed due false alarm. Re adjustment of the threshold is essential to accept higher background condition. The new threshold is 214 cps. It may happen an opposite case. If the local Background drops down e.g. to 50 cps (Lakeshore area) then the local radiation would have to increase very substantially (above 214 cps) before the audio sounds what means that even as high source radiation as from hot spot 2 can be missed because it sits on a low background and total counts of the source will not reach the threshold. This effectively desensitizes the audio system. The new re adjustment on Lakeshore area sets the threshold to 57 and maintains high sensitivity to hot spots.

To overcome this “problem” AT ANY TIME the user can briefly touch the **Button OK** and choose the **Reacquire BG** from action menu list then the system will automatically return to the Survey display and the system will re-compute the Audio Threshold. A message **UPDATING BACKGROUND** will be kept on the display for the 10 seconds while the background update process is active.

This means the user can “re-tune” the Audio Threshold at any time thus keeping the audio threshold optimized. The actual background level is indicated in the table on search display.

### 4.3. Actions

The RT-30 MK2 has the joystick as noted above. To achieve the required system functions CLICK the OK button and the Action Menu appears. The user navigates up and down this menu using clicks on proper buttons. To prompt a user to use only sensible buttons the expected are illuminated. Highlighted icons on display moves with the selection. Once the item is selected press OK and the selection is confirmed and the unit starts action.

- a) **Identify** - starts a spectrum measurement and perform Nuclide Identification - see chapter IDENTIFICATION.
- b) **Reacquire BG** – the unit starts new background measurement. This is announced with message **UPDATING BACKGROUND**. Then a new audio threshold is computed and set up. A new actual averaged background is indicated in the table on search display.
- c) **Start recording** – activation will start the recording of the count rate measured (cps) and dose rate. Data are recorded every second with actual GPS coordinates. Once selected and the units is recording readings the item Start recording in action menu is replaced by **Stop recording**. This way a user can Start or Stop in flip flap mode.
- d) **Pause** – leads to pausing survey histogram move. The values on display and histogram are not updated. A user can user left and right button to move cursor through survey histogram bars and can take readings of past scans. While the user browses the paused display the unit continues with scanning on backstage.
- e) **Resume** – resume returns display to actual position of last scanned sample. The Pause function is left and histogram resumes to actual position from backstage buffer.
- f) **Main Menu** – return to instrument's root menu.
- g) **Continue** – activation will switch off the action menu and keeps all background values without change.

### 4.4. Recording to Memory

Gamma Ray intensities and dose rate accompanied with GPS coordinates can be recorded to memory. There is a huge space allocated for Survey in memory. Data are saved every second. Data stream is exportable via supporting PC programs. See section about PC tools.

**Start recording** is accessible from menu **Action** what appears immediately after OK button click while unit works in Mode – Survey. Next the user moves highlighted cursor bar to position **Start recording** (using up or down button clicks) and activates it with OK Button press. Unit switches back into Survey. Memory storage starts promptly. Icon **R** in the information bar indicates process of continuing data storage. To Stop recording user must revoke menu **Action**. Selecting and activating **Stop recording** user will interrupt data storage and the unit will return to basic Survey mode again. User can read, browse recorded data and manage memory with PC support program GeoMon or browse profiles on units screen using functions from Survey log.

## 5. Spectrometer features

The RT-30 MK2 Multipurpose Gamma Center is a High Sensitive Handheld Spectrometer. Build with large volume NaI/Tl detector with 1024 channel analyzer (MCA) gives a solid base for highly sophisticated algorithms for gamma spectra evaluation. A new powerful Microprocessor allows engaging complicated statistical method to be used in the unit. A unique evaluation algorithm allows determining concentration of natural radioactive elements as well as manmade radioisotopes in various applications. Beside most common application in geology the RT-30 MK2 is perfectly suitable for tasks in waste management, environment and general monitoring. The whole assay process is fully automated and does not require special user's effort. Information about concentrations and their confidence are printed in a result table.

### 5.1. Warming Up

As other devices based on NaI/Tl (or BGO) scintillation detector the RT-30 MK2 must compensate amount of lite of the detector to ambient temperature. Unlike other units the RT-30 MK2 profits of radiation of natural background where information enough to provide gain correction precisely is. There is no requirement to use any man made radionuclide for warming up process.

Warming up and hold on correct working parameters is automated process running continuously after power on. For all the time while the unit is ON there is spectrum measurement process active (all background process) and actual gain deviations are compensated. Exposition of the unit to other than natural sources (search for unknown source and identification of radionuclides) will temporally postpone any gain correction. Recovery of the self-compensation process starts immediately as the unit is back on natural background level. Method of self-compensation uses spectral patterns of K-40, Ra-226 and Th-232 with their library templates to be compared. Any shift from ideal position leads to gain adjustment. After switch-on the unit prompts to Survey. Warming up process starts immediately on backstage – system is collecting actual spectrum. Collected spectrum is evaluated every 30 seconds and unit's gain is tuned. Evaluation progress is indicated with flashing icon **((o))** located on the information bar. Once the unit sets the gain to the correct value the icon **((o))** holds in info bar on display and the unit is fully ready to work. The gain correction process is active all the time and access to any other functions of user's interface e.g. setup menus will not interrupt it.

Because sensitivity of NaI/Tl to temperature is relatively high and unit may compensate big differences in gain, to save time it is recommended to let unit running for all the time even when assay is not needed. The unit can be powered on external power. While in idle, the unit will proportionally compensate any temperature drift and hold unit ready to go any time. Should it happen that the unit was stabilized and finally switched off in very different ambient temperature then other day when is switched on again? The warm up process started next day will have to compensate a huge drift off previous last

work gain setup what may take longer time but no longer than 15 minutes. Exposing the unit to higher radioactivity than natural background will work contra productive. In case there is no way to perform warm up process for any reason e.g. extremely low local background typically on glaciers or on a sea user can use maintenance function and re-stabilize the unit using external source of Cs-137. The radioactive source Cs-137 is not delivered with the instrument. All process of warming up is logged and can be reported via supporting programs. In case of gain stabilization troubles contact manufacturer for advice.

### 5.2. Dose rate

Unique algorithms build in a firmware of RT-30 Mk2 in used for real time gamma dose rate evaluation from gamma spectra of NaI/Tl detector. The measured dose rate is within range 10 nGy/hr - 100 mGy/hr and matches all requirements of IEC 60846 standard. The response is fully compensated in energy range 60 keV – 1,5 MeV. The maximum dose range is sufficient enough to give an early warning on dose rate levels allowed for public.

The angle response of the detector used is very uniform there is not much limitation which way the unit shall be oriented towards coming radiation to get correct values but please be reminded that a central reference point of the unit is 35 millimeters from the bottom and 45 millimeterers from the front side of the instrument. Compare **Appendix A** – calibration point of the instrument. The preferable direction of irradiation is towards the bottom.

Dose rate and dose readings are visible during survey action and are recorded together with gamma total counts. The RT-30 Mk2 is primary calibrated in **Air Kerma** in units of **Gy/hr**. There is possible to convert and display readings in **Ambient dose equivalent** rate in **Sv/hr**. Conversion between these two quantities are made with coefficients recommended by IRPA (International Radiation Protection Agency). User's access to Dose unit parameter is through **Main menu – Settings – Measurement – Dose units**.

### 5.3. Identify

Since firmware version 0.5 the RT-30 Mk2 equipped with NaI/Tl type of detector there is implemented also Nuclide Identification function. An advanced peak search algorithm is called and detected peaks pattern is compared with library of nuclides. To extend flexibility for users there are two types of nuclide libraries supported. A permanently build in library consists of most common gamma emitting radionuclides and the selection was done upon twenty years of experience of cooperation with customers. This library is fixed as default and cannot be changed by user. Should be a need for library modification a user may use "USER LIBRARY". The user library is implemented as plugin file in text format and a user can modify it by its own. There is recommended to contact manufacturer prior any change for detailed explanation of meanings of records and eliminate any false identification issues.

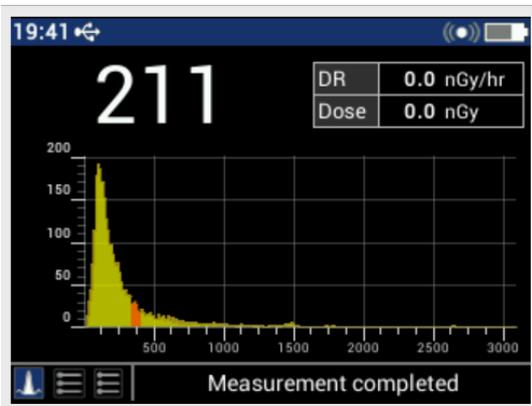
5.3.1. Starting Nuclide Identification



It is highly important for Nuclide Identification function that a gain is set correctly and position of peaks in spectrum is right. Let suppose that the unit has been switched on and the warming up process has been finished. There is the icon ((o)) present in info bar on all screens and **green LED** is ON in the front of the instrmt. The Identify process can start. First click **OK** Button to activate menu **Action**. Then

selection and activation of position **Identify** by OK. Or go from **Main Menu** selecting **Identify** icon - see picture. Spectrum acquisition starts immediately and a new screen appear on display. It consists of three screens. To see a progress of gamma spectrum acquisition, extend size of spectrum displayed and offer a service for detailed spectrum browsing there is graphic interface.

The second screen is a table of radionuclides identified and the third screen shows details about detected peaks. User may switch between screens anytime using right and left button key.



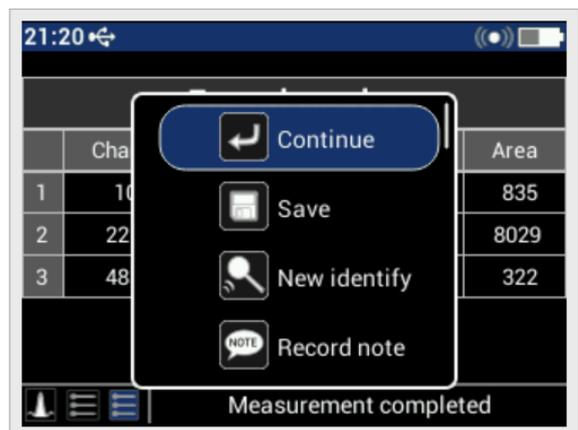
A screenshot of the 'Identified nuclides' table. The time is 20:05. The table lists three nuclides: Cs-137 (IND), K-40 (NAT), and Th-232 (IND). At the bottom, it says 'Measurement completed'.

	Nuclide	Type
1	Cs-137	IND
2	K-40	NAT
3	Th-232	IND

A screenshot of the 'Found peaks' table. The time is 20:06. The table lists four peaks with their channel, energy, FWHM, and area. At the bottom, it says 'Measurement completed'.

	Channel	Energy	Fwhm	Area
1	10.8	32.4	28.79%	834
2	221.9	665.6	7.70%	7948
3	486.2	1458.5	6.01%	247
4	865.9	2597.7	4.64%	63

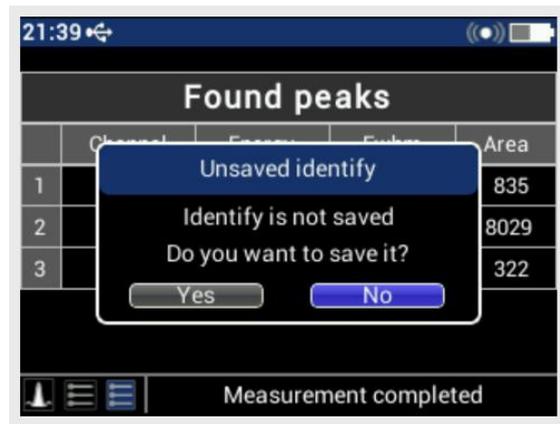
Spectrum **Save** function, extension of previous sample measurement **Extent identify**, start of new identification **New identify**, access to dictaphone (voice notes for measured spectrum) **Record note**, return to **Survey** or end of measurement and return to **Main menu** are available from the action menu. After pressing the **OK** button, their



## RT-30 Mk2 SUPER IDENT

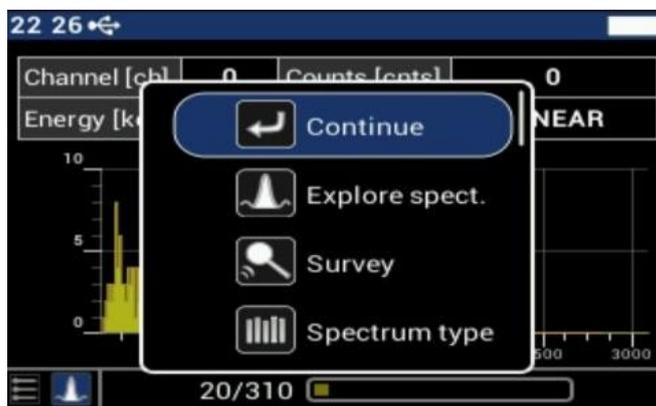
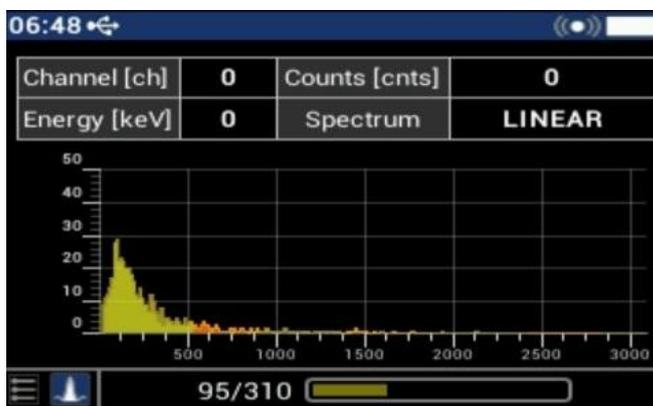
menu will appear on the screen. **Continue** returns the display to the previous state without performing any action.

Saving results. If the user does not save the spectrum and tries to leave the menu, he is prompted to save the results.



### 5.3.2. Spectrum display.

To switch from results table to spectrum screen must user use right or left button. For indication of direction are used two icons in down left corner of the both screens. The left icon indicates table of results and the right one spectrum. Actual selection is highlighted with blue background. Beside the common objects like information bar and time progress area the spectrum screen shows table with cursor channel position, related energy and counts and plots a spectrum.



LINEAR spectrum or compressed 256 channel nonlinear spectrum. Next is **Main menu** to return back.

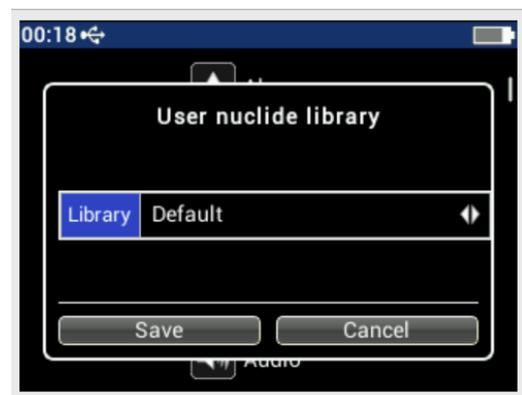
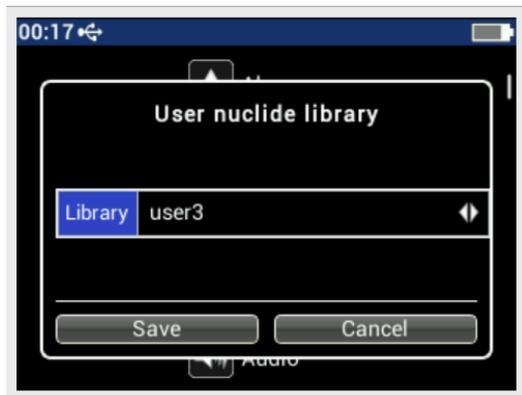
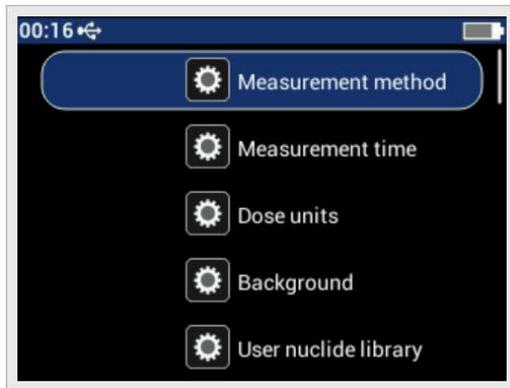
An actual measured spectrum is animated on display. Once engaged **SPECTRUM BROWSER** mode there are active all direction buttons for x and y scaling, zooming of selected regions and spectral cursor move. While pushed the arrow button the cursor moves proportionally in direction of the arrow button. Its position over particular channel is displayed in a table above spectrum. Channel position in index number, related energy in keV and actual channel counts informs about spectrum details. There are additional services supporting the browser. After OK press a list of services pops on spectrum screen. Services are **Continue** to return back again without any change, next

**Zoom** to enlarge x scale for details, **Auto Scale** to rearrange spectrum proportions, **Spectrum type** and Exit **exploring**.

### 5.3.3. Selecting of Nuclide Library

Selection of active Nuclide Library used for identification can be made either on unit using proper setup function in section Settings or via PC and program Geomon. The Geomon arranges a direct access to proper parameter and user selects library from popup menu. It is important to know that a user library file has to be transferred in the unit otherwise there is no other selection than Default possible.

To engage proper library in a field without a PC a user has to call function Settings from Main Menu and select item User nuclide library. Then using left or right button to select expected library and confirm selection by touching button down to highlight Save followed pressing OK. User may leave menu without a change selecting Cancel.



## 6. DATA MEMORY

The RT-30 MK2 controls a huge Solid State Memory. There is enough room for measured data, voice comments, information about position of the unit and there are logged all information about gain stabilization including spectra used as well as reports of internal system messages and events. Access to logs and basic browser operation is common for all types of logs.

The common access is from **Main menu – Storage**, followed by selection of type of log. Once selected and activated there are three action items. To let read **All records** of selected type and put on a list or to use a date **Filter** to get only logs between chosen days. Result of loading procedure is a list of logs available. For details the user must select one item of the list and confirm with OK button. The last item of the list returns back to previous menu.

### 6.1. Identification results log

The Identification log is a database of spectra and results of nuclide identification. Identified nuclides and peaks found are included and filed. All spectrum browsing features are ready for scaling, zooming etc. Return back is arranged via action menu with items **Continue**, **Reload**, **Graph**, **Results** and **Back to Logs**.

### 6.2. Survey profiles log

The **Survey log** is organized as a stream of total counts in **cps**, dose rates, integrated dose values. GPS coordinates are also recorded, including the number of satellites used, the coordinates of the British BND system (Easting, Northing, Elevation), the quality of the GPS signal and the accuracy of position determination (GPS HDOP = horizontal dilution of precision).

### 6.3. Stabilization log

The gain **Stabilization log** offers a table of the most important stabilization inputs and outputs. They are in the columns: Index **Id**, **Date**, stabilization event **Time**, and stabilization **Result**. The stabilization result is OK when the unit gain is corrected. Otherwise, a message appears stating problems caused by failed gain stabilization. An additional note is in the next **Pattern** column. The next six columns are used for detailed information about the nominal position of the **Selected peak** in the channels, the found position of the **Found peak**, as well as information on the high voltage adjustment before **HV old** and after **HV new** stabilization event. The last columns show the fine gain adjustment before **Gain old** and after **Gain new** stabilization. All of this information is for maintenance purposes and may be requested by authorized personnel in the event of any gain adjustment failures resulting in incorrect identification or dose rate.

### 6.4. System log

The system log is used to file all important system announcements and is organized as a simple strings output. It is used by maintainer or manufacturer for any service events.

## 7. PARAMETER SETUP

**Warning:** Change or improper set up of some parameters may have a negative impact on function of the unit. Uncertain meanings of parameters shall be consulted with manufacturer.

### 7.1. Access to parameters

There is a structured menu user interface integrated in the unit to help a user set up selected basic working parameters. Access to all parameters is possible only via remote connection from the PC. Limited set of parameters accessible from unit's user interface are described in this section. Menus are organized into function groups. To browse in menus there are used short Button clicks for step by step move or button hold to engage an auto repeat function. The **Main menu** is accessible from **Survey** after short button click or from other menus redirecting to Main menu. While in Main menu a selection of service **Settings** and its activation with OK Button press leads to root of parameter's structure. The structure consists of names of function groups and each group is entered after its selection followed by OK button confirmation. For return from a group to previous level there is a service **Go Back** in each menu.

### 7.2. Date and time

Date and time setup is arranged in three sections. One for date the other for time and the third for time zone. Year, month and day or hour, minute and second are kept in separate editable window. Only one window is active for edit at a time. Selection of nearby window is arranged by right and left button. Increase or decrease the value in the window by up and down buttons.

### 7.3. Display

Display setup consists only from one parameter for adjustment of contrast. Values are editable by right and left button.

### 7.4. Audio

Audio section arranges access to three parameters. Audio volume, audio mode and sweep threshold. Audio volume allows muting or adjusting loudspeakers volume. Audio mode defines signaling after exceeding of alarm threshold. It can be chosen Silent, Frequency Sweep or Alarm. Frequency sweep activates audio indication where frequency pitch is proportional to registered number of gamma ray incidents in last second. Alarm means activation of horn signal once the threshold is crossed. The horn is on as long as the alarm message is served and confirmed. Sweep threshold is a multiplicative factor of standard deviation of averaged background. See section Survey for details.

### 7.5. Measurement

Measurement time can be re adjusted. Dose units - selection of dose measurement quantity. Background - parameters for different type of

background evaluation in Survey mode. Floating background automatically copies slow changes of background radiation during a day. It is used for permanent monitoring applications. Factory method reset for recovery of default calibration.

## 7.6. Calibration

Calibration section consists of many sensitive parameters. It is recommended not to change any prior contacting a maintainer and full understanding of meanings. Next are parameters important for fast preparation of the unit for measurement.

In some unpredictable circumstances may happen that rule for gain stabilization fails. Mainly it happens due lack of presence of natural radioisotopes in local background. There are known cases where the unit was used on vessel on a sea or thick layers of ice on glaciers where high shielding efficiency of the water almost suppressed any local radiation. To resume correct working set up there is accessible Cs calibration utility.

### Cs calibration

It will perform basic gain setup. To use this item user needs weak source of Cs-137 (not delivered with the unit). The source TS-9 can be ordered as an option.

## 7.7. Accessories

### 7.7.1. GPS logging

GPS receiver is an integral component of the RT-30 MK2. The GPS antenna is located on top of the head between handle supports. For a best performance the antenna shall stay clear of metal or high conductive materials what may shield a signal from satellites.

As soon as GPS service is enabled and a position is fixed following icon



appears on top bar of each screen. Up to date information about GPS status, number of satellites and actual position are accessible through **Settings – Maintenance – GPS status**.

Once available the GPS coordinates are automatically integrated in survey records as well as in assay or identification results. The GPS receiver can be disengaged also in **GPS Status** screen after pushing button **OK** and selecting **GPS Turn OFF** or from Accessories menu setting parameter GPS to disable.

### 7.7.2. USB port

The USB port can be used in two different modes. There are Direct and Ethernet. Each mode specifies its own communication protocol.

The Direct mode is used for cable connection between the RT-30 MK2 and a PC via USB hub.

The Ethernet mode emulates a TCP/IP communication between the unit and any suitable access point via USB. Setting up in Ethernet mode is required in case of a connection in local area networks.

The Serial mode is a simple serial communication level mainly used for hardware debugging or in special applications.

See section appendix for How to connect the RT-30 MK2 with a PC.

### 7.7.3. Wi-Fi connection

A build in Wi-Fi transmitter extends a communication range of the RT-30 MK2 to be capable to work within WLAN. This allows maintaining or operating the unit worldwide using internet or intranet networks. A discrete login information will be required for successful connection therefore any cooperation with a local IT personal is needed. For the communication is essential to connect the RT-30 MK2 Wi-Fi with a local Wi-Fi router or Wi-Fi wireless access point. There are utilities build in the RT-30 MK2. Go through Main menu – Settings – Connections – Wi-Fi. There are:

Wi-Fi scan. This starts the activity of Wi-Fi receiver and check for Wi-Fi networks in range of the unit. List of available networks is displayed then. After selecting a network using up down buttons and confirmation of selection on the list the user is requested to enter a password. A graphic keyboard interface driven by UP, RIGH, DOWN, LEFT an OK key is used. This way can be typed all combinations in letters, numbers and special characters.

### 7.7.4. Bluetooth

Bluetooth® technology is designed to establish a wireless connection between your RT-30 MK2 device and a Bluetooth enabled device. You must pair your RT-30 MK2 device with a Bluetooth® enabled device before you can connect to it. For more information about preparing the Bluetooth enabled device for pairing, see the documentation delivered with the Bluetooth enabled device.

## **8. Maintenance**

### **8.1. Hardware maintenance**

The RT-30 MK2 is designed to be resistant of harsh outdoor condition. Regardless of it is important to remember it is a delicate measuring instrument calibrated for high sensitive and precise measurements. There are used very sensitive components – scintillation crystal and photomultiplier and any negative impact may change its performance and void calibration. All devices handling with low radiation levels **MUST BE** maintained with extra care of potential surface contamination by radioactive elements. Any extra protection using vinyl bags or similar is recommended.

In case of the units contamination there is recommended to use ethyl alcohol and soft towels for its decontamination.

The manufacturer recommends to establish a simple measuring – verification point. It may be a fixed point in building, backyards or solid sample what may be used from time to time for re measuring purposes. In case of loosing long term stability manufacturer shall be contacted for advice.

An extra attention shall be paid to battery charging. See chapter System Operation for details.

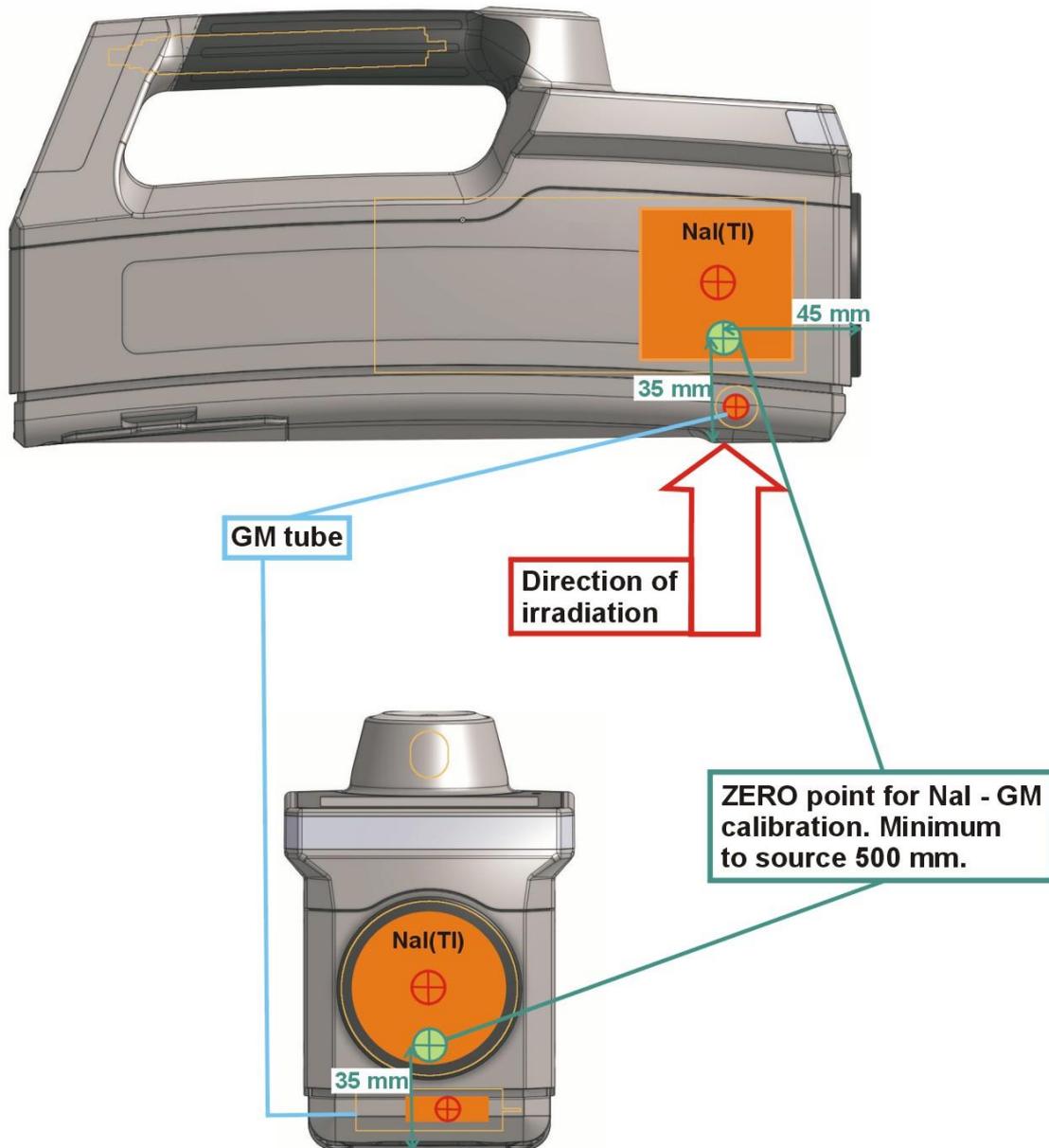
### **8.2. Software maintenance**

A core of the RT-30 MK2 is made on powerful multicore microprocessor in embedded PC like environment. To eliminate any trouble caused by unauthorized access there is only limited set of parameters accessible and user can control only selected databases. The RT-30 MK2 performance and features are permanently improved and any owner of the instrument may upgrade current firmware free of charge. In case of trouble related to functions or firmware updates there is a maintenance hot line established and user is encouraged to contact manufacturer. Majority of problems can be resolved remotely and due high efficient communication channels a solution is fast and effective. The manufacturer also files all important data of the instrument from production setup period for system recovery.

## 9. APPENDIX A: CALIBRATION

The position of the detectors inside the instrument and dose rate calibration point location is shown on the following picture:

### Calibration Point of RT-30 Mk2



## 10. APPENDIX B: TECHNICAL DATA

### Detectors

Standard option

*Nal/(TI),  $\Phi 51 \times 51 \text{ mm}$  (2" x 2"), 104 cm<sup>3</sup> (6.3 in<sup>3</sup>), all RT models  
BGO,  $\Phi 51 \times 51 \text{ mm}$  (2" x 2"), 104 cm<sup>3</sup> (6.3 in<sup>3</sup>), GT-32 Mk2 model  
Photomultiplier diameter 2", bialkali*

*Energy compensated GM tube with RT-30G Mk2, RT-30GT Mk2 and RT-30N Mk2  
He-3 Neutron tube with RT-30N Mk2*

Special option

*CsI/(TI), CsI/Eu, LaH, Srl, GAGG, YAP ,  $\Phi 51 \times \text{max } 120 \text{ mm}$  (2" x max 5"),  
SiPM array*

### Spectrometer

1024 channel, 40 MHz DSP, Linear Energy corrected  
Pile-up Rejector, 200 ns Resolution  
Energy range 20keV - 3,0 MeV, expandable up 10 MeV

### Scintillometer

Sampling period 20/second  
Acoustic and video alarm, 4 LED indicators  
Moving average and integration

### Dose Meter

Energy corrected air kerma rate for Nal detector and also ambient dose rate  
equivalent H\*10  
Extended range with GM tube 100 mGy/h (10 R/hr)

### Gamma ray sensitivity at 1m (Nal/TI 2x2")

160 cps/1MBq for Cs-137  
75 cps/1MBq for Am-241  
270 cps/1MBq for Co-60

### Display

Colour LCD, 360 x 240 dots, 72 x 54 mm (3.5"), Sun readable  
Automatic Backlight

### Acoustic indication

audio frequency is proportional to measured count rate  
Speaker, dia. 28 mm + Built-in Microphone

### Control

Illuminated Navigation Joystick, 5 positions

### Data Storage and Transfer

32 GB memory for spectra, search profiles and dose, min. 10000 Samples with full  
Spectra, Data Position  
USB-C, direct and Ethernet mode, Bluetooth 1.2 Class 2 and Wi-Fi

## RT-30 Mk2 SUPER IDENT

### **GPS Support**

Internal - GNSS engine for GPS/QZSS, GLONASS, 56-channels

NMEA 0183

External GPS connectable

### **Power**

Rechargeable Li-ion 7.2 V / 6600 mAh (Panasonic CGR18650CG/2S3P) – min. 8 hours of operation at 20°C

External AC adapter USB-C 60W for charging or measurement

### **Environmental**

IP-65 Dust and Water resistant

Operating temperature range -10°C to +50°C

RFI/EMF Shielding complies with FCC(47 CFR part 15) for

Class A CE Certification

### **Size and weight**

Size L x W x H 29 cm x 10 cm x 16 cm

Weight 2,45 kg

### **Standard accessories:**

Carrying Durable Suitcase

Battery charger

GeoMon Software

USB cable

User's guide

Calibration protocols

### **Optional accessories:**

Shoulder Carrying Harness

Spare Battery Pack

## 11. APPENDIX C: IMPORTANT ICONS and MEANINGS



Alarm message. Check alarm list for pended alarms



Battery status.



Bluetooth active



Warning or error message. See Status Log for details



GPS active and location fixed



GPS active and searching for satellites to get fixed



Survey recording in progress



Data are being written on Solid Disc



Unit stabilized

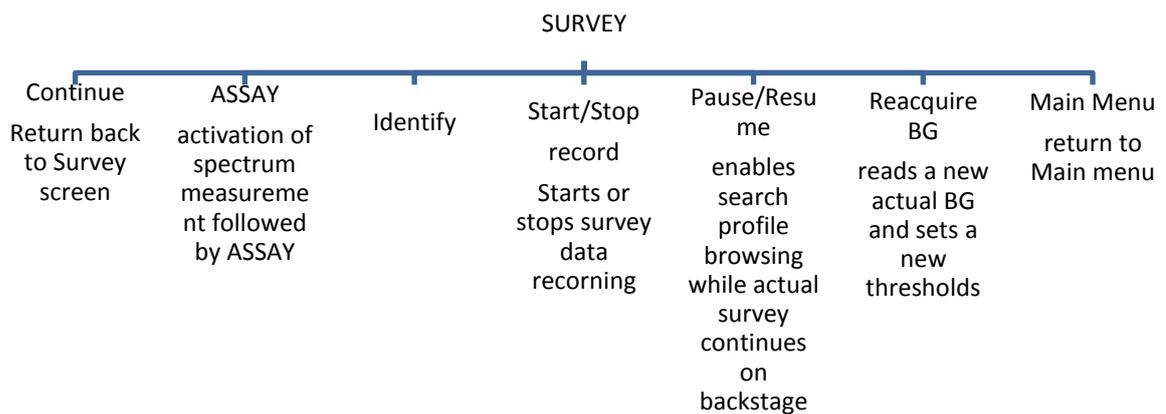
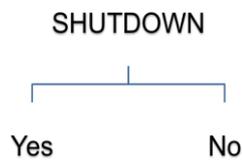
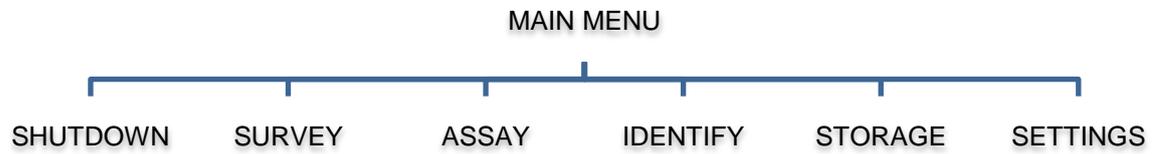


USB active

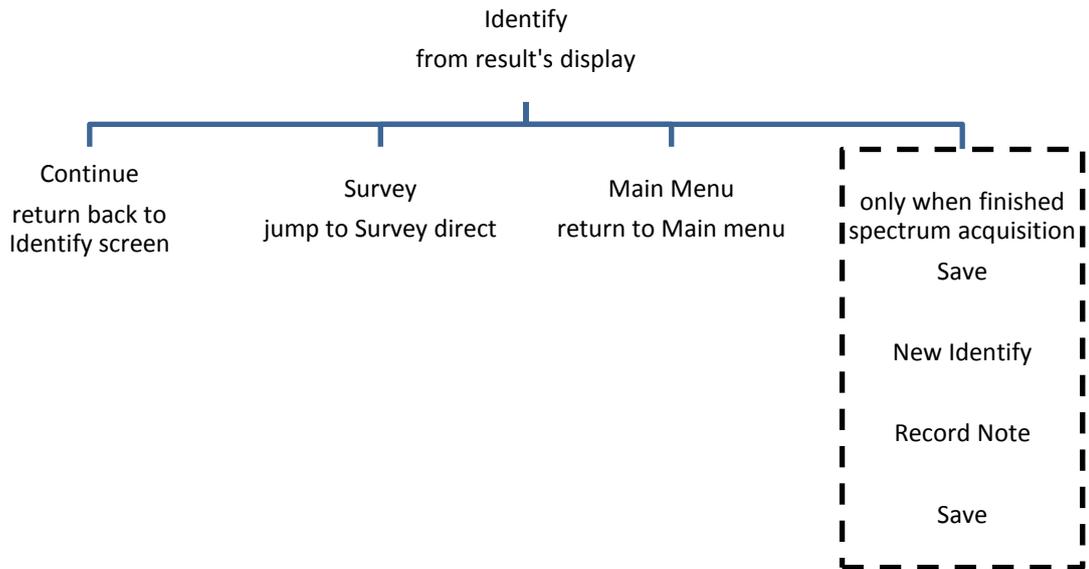
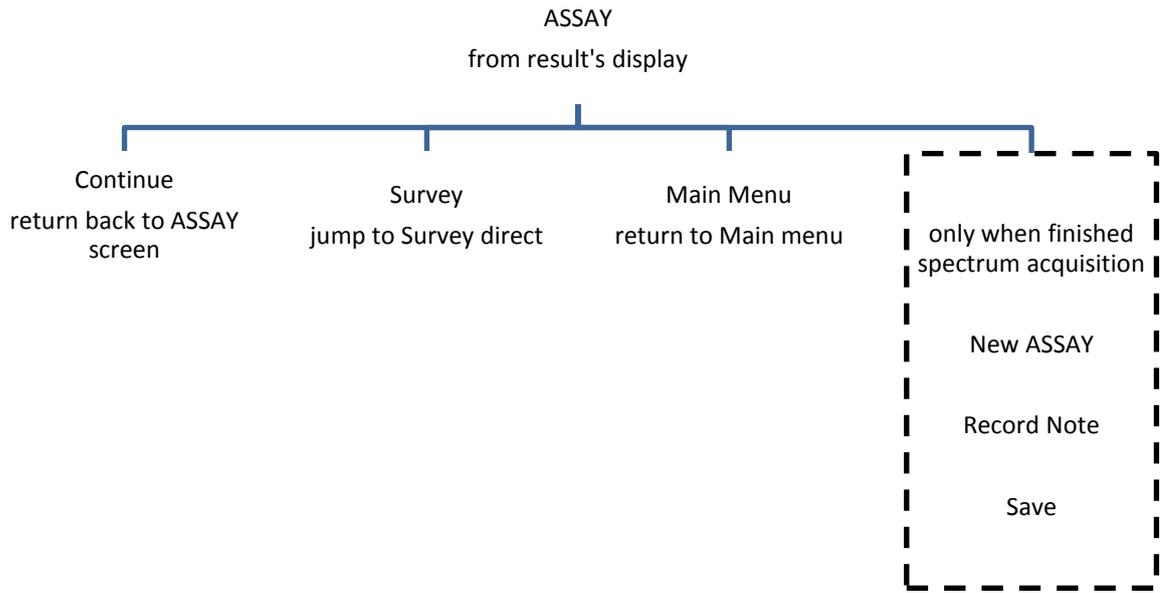


Wi-Fi active and connected

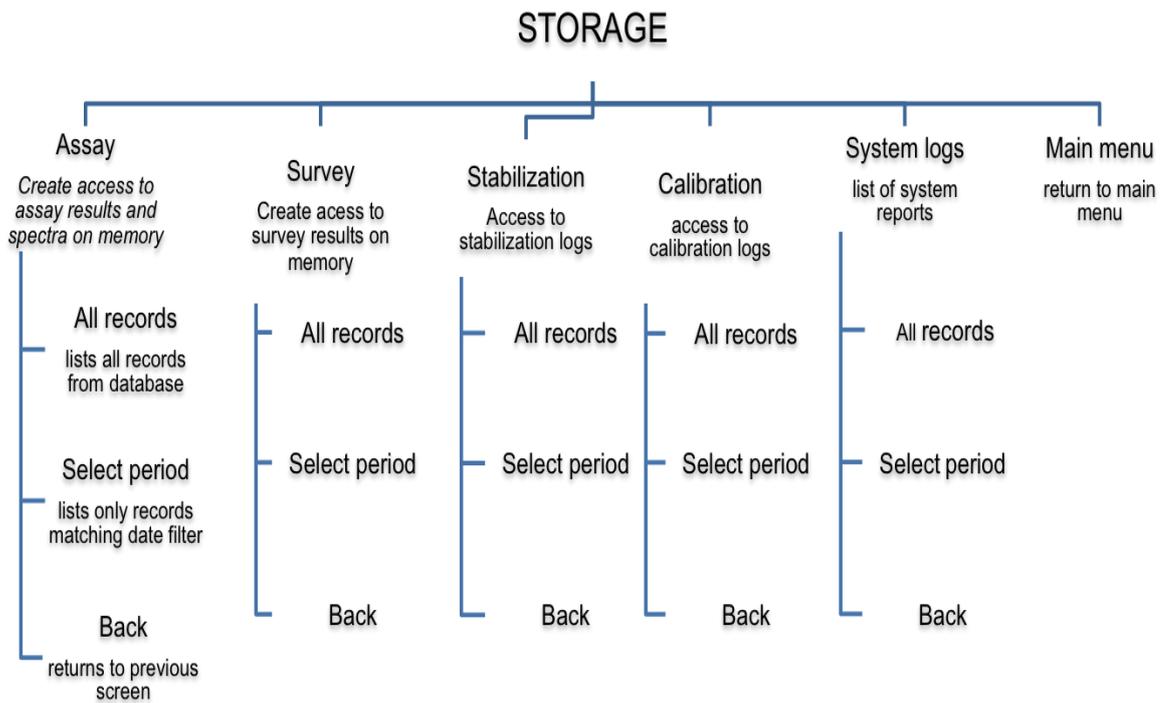
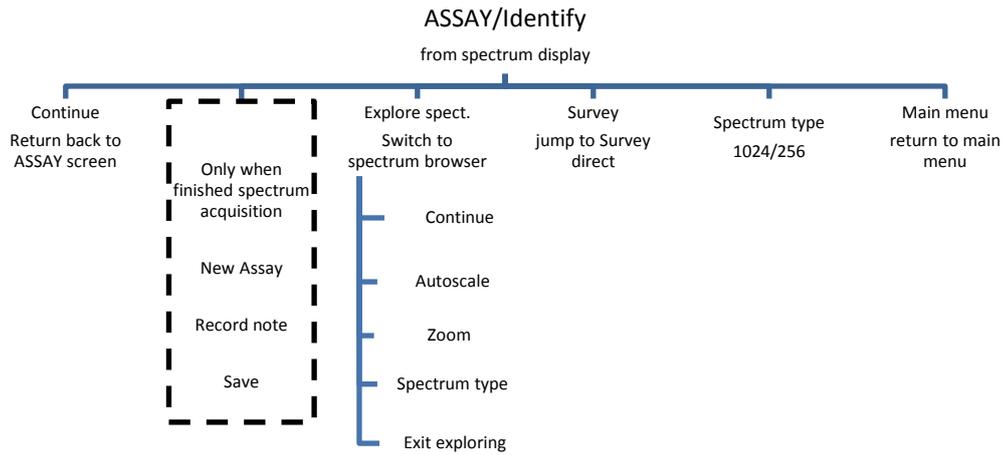
## 12. APPENDIX D: MAP OF ACTIONS



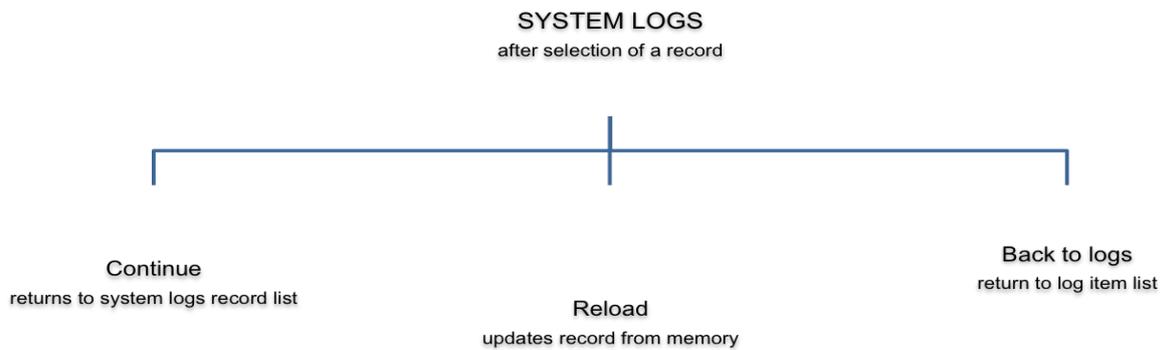
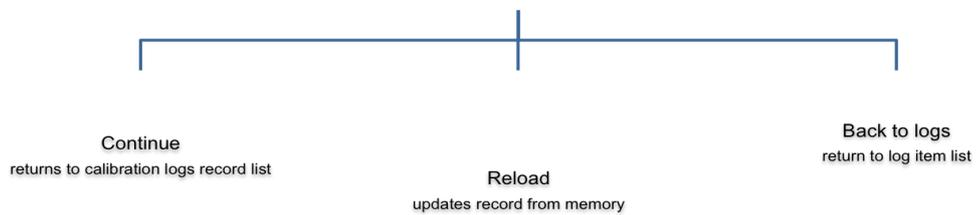
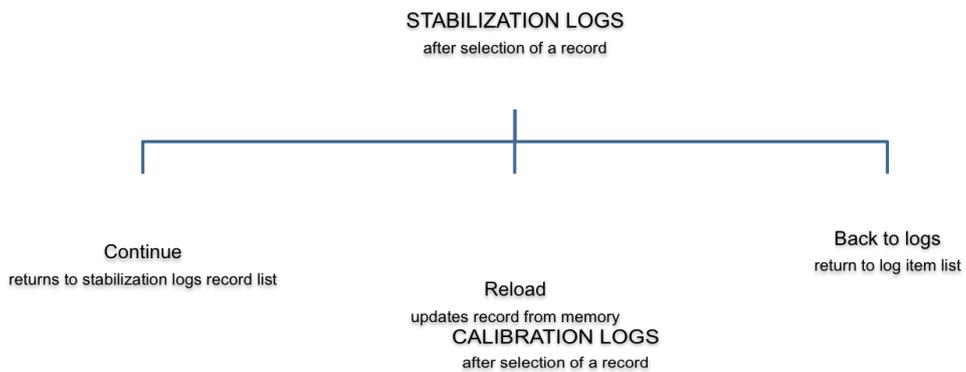
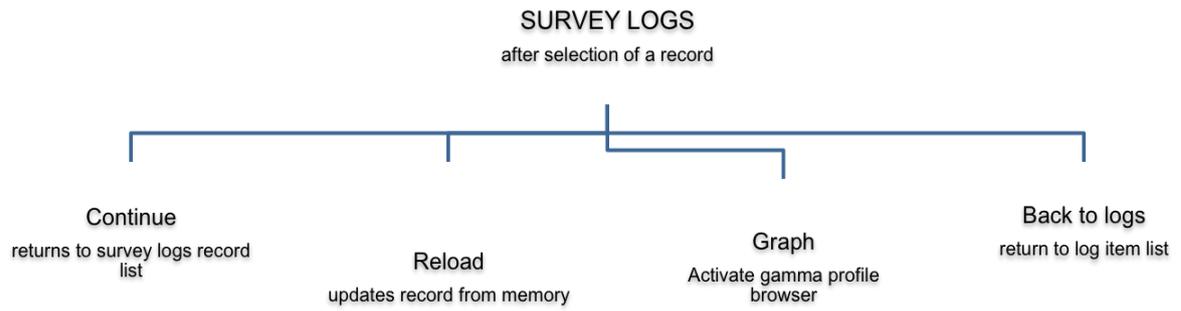
# RT-30 Mk2 SUPER IDENT



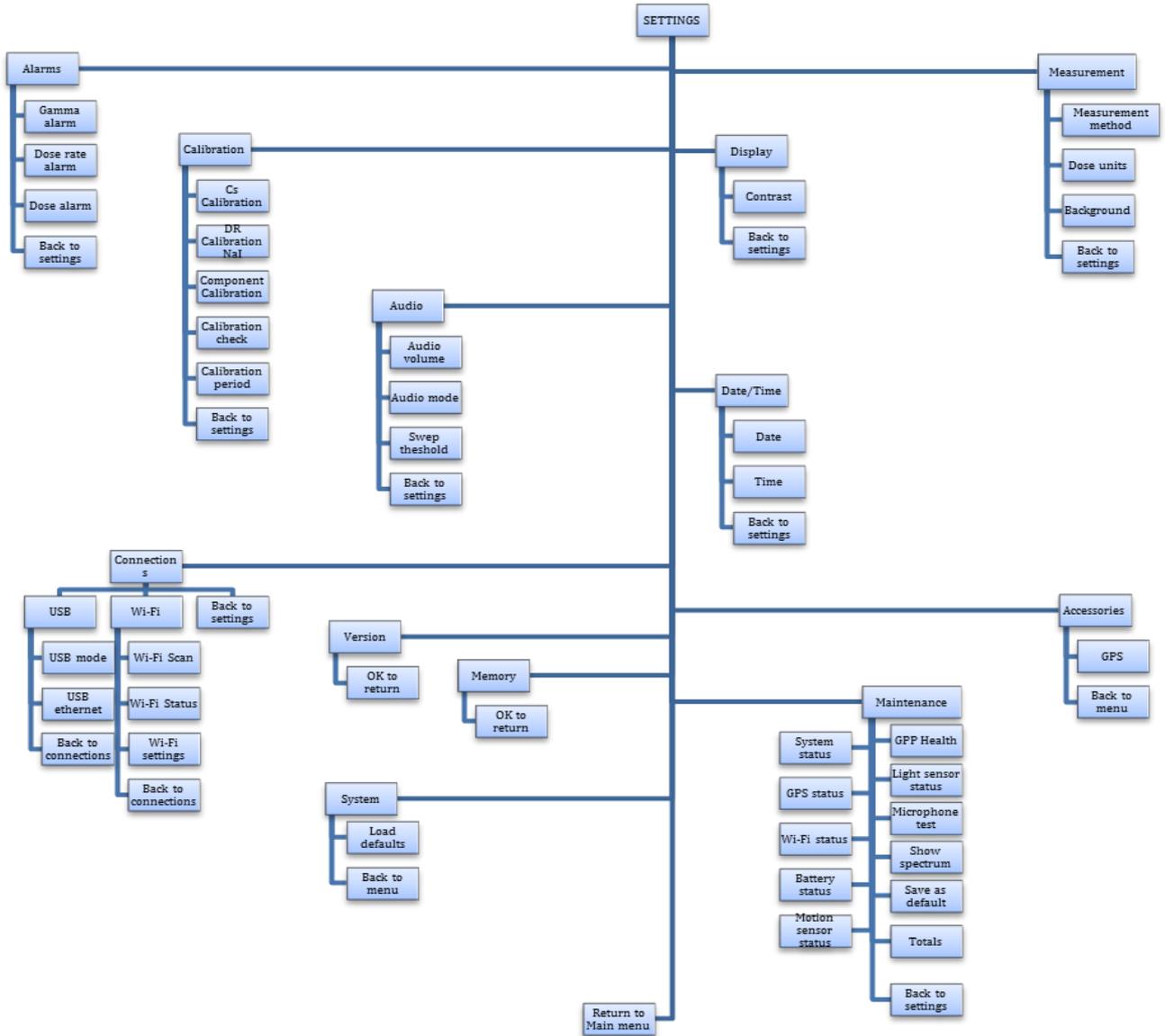
# RT-30 Mk2 SUPER IDENT



# RT-30 Mk2 SUPER IDENT



# RT-30 Mk2 SUPER IDENT



## 13. APPENDIX E: Nuclide Libraries

### 13.1. Default Library

There are hardwired following radionuclides:

Ra 226, Eu 152, U 235, U 233, Th 232, Pu 239, Ga 67, I 131, Ba 133, Tl 201, Cs 137, K 40, Co 60, Tc 99m, Co 57, Am 241, Ir 192, In 111, Na 22, Kr 85, Cr 51, Cd 109, Xe 133

### 13.2. User Library

0	NU	NAT	4	5	-150.0	0.010	186.0	0.030	352.0	0.370	609.0	0.460	1120.0	0.150	1760.0	0.160	2204.0	0.050
1	Ra-226	IND	3	5	295.0	0.200	352.0	0.370	-609.0	0.460	1120.0	0.150	1760.0	0.160	2204.0	0.050	768.0	0.010
2	Eu-152	IND	3	9	40.0	0.570	121.0	0.284	245.0	0.080	344.0	0.260	778.0	0.960	867.0	0.040	964.0	0.140
3	LEU	SNM	2	4	1001.0	0.005	766.0	0.090	-185.0	0.550	93.0	0.050	143.0	0.050	60.0	0.010	0.0	0.000
4	Ag-108m	IND	3	5	79.0	0.071	434.0	0.898	-614.0	0.900	723.0	0.900	20.0	0.100	0.0	0.000	0.0	0.000
5	U-233	SNM	2	2	440.0	0.010	725.0	0.010	584.0	0.090	677.0	0.050	150.0	0.010	0.0	0.000	0.0	0.000
6	HEU	SNM	2	2	185.0	0.550	143.0	0.110	93.0	0.050	60.0	0.010	662.0	0.020	0.0	0.000	0.0	0.000
7	Th-232	IND	3	9	77.0	0.200	239.0	0.450	338.0	0.110	2615.0	0.640	911.0	0.280	583.0	0.170	967.0	0.220
8	Th-232	IND	1	1	2615.0	0.640	239.0	0.450	338.0	0.110	77.0	0.200	911.0	0.280	583.0	0.170	967.0	0.220
9	HEU	SNM	2	2	6666.0	0.000	185.0	0.050	662.0	0.020	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
10	LEU	SNM	2	2	6666.0	0.000	1120.0	0.020	142.0	0.010	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
11	Pu-239	SNM	3	6	-6666.0	0.000	59.0	0.010	662.0	0.010	380.0	0.010	722.0	0.010	340.0	0.010	0.0	0.000
12	Neut	IND	2	5	-6666.0	0.000	511.0	0.010	847.0	0.000	1238.0	0.010	2223.0	0.010	0.0	0.000	0.0	0.000
13	RGPu	SNM	3	7	59.0	0.010	380.0	0.010	210.0	0.090	96.0	0.050	418.0	0.010	340.0	0.010	662.0	0.010
14	RGPu	SNM	3	6	-59.0	0.010	380.0	0.010	119.0	0.010	418.0	0.010	210.0	0.010	340.0	0.010	148.0	0.010
15	Ga-67	MED	3	4	93.0	0.360	184.0	0.200	300.0	0.160	393.0	0.040	494.0	0.010	888.0	0.010	0.0	0.000
16	I-131	MED	2	5	-364.0	0.810	722.0	0.020	637.0	0.070	80.0	0.030	505.0	0.010	0.0	0.000	0.0	0.000
17	Ba-133	IND	2	4	81.0	0.360	302.0	0.180	-356.0	0.690	280.0	0.070	31.0	0.010	160.0	0.060	150.0	0.060
18	Np-237	SNM	3	4	87.0	0.150	-145.0	0.050	198.0	0.020	310.0	0.010	0.0	0.000	0.0	0.000	0.0	0.000
19	Tl-201	MED	2	2	70.0	0.500	167.0	1.000	135.0	0.250	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
20	Se-75	MED	2	3	-136.0	0.300	265.0	0.150	405.0	0.050	70.0	0.010	96.0	0.010	199.0	0.010	0.0	0.000
21	Mo-99	MED	3	4	-141.0	0.300	181.0	0.200	370.0	0.050	741.0	0.100	922.0	0.010	0.0	0.000	0.0	0.000
22	Sm-153	MED	2	2	-102.0	0.050	41.0	0.200	70.0	0.010	143.0	0.030	170.0	0.010	0.0	0.000	0.0	0.000
23	Cs-137	IND	1	1	662.0	0.850	32.0	1.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
24	Cs-134	IND	2	2	-605.0	0.970	796.0	0.850	570.0	0.230	475.0	0.010	0.0	0.000	0.0	0.000	0.0	0.000
25	Co-60	IND	2	2	1173.0	1.000	1332.0	1.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
26	K-40	NAT	1	1	1460.0	1.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
27	Co-57	IND	1	1	125.0	0.850	90.0	0.050	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
28	Am-241	IND	1	1	60.0	0.360	30.0	0.080	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
29	Ir-192	IND	2	2	314.0	0.830	468.0	0.480	606.0	0.080	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
30	In-111	MED	2	2	171.0	0.900	245.0	0.940	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
31	Na-22	IND	2	2	511.0	1.800	1274.0	1.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
32	Zn-65	IND	2	2	511.0	0.050	-1115.0	0.500	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
33	F-18	MED	1	1	511.0	1.400	185.0	0.050	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
34	Kr-81m	MED	2	2	514.0	1.000	446.0	0.190	185.0	0.050	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
35	Ba-133sh	IND	1	1	-356.0	0.690	302.0	0.180	280.0	0.070	383.0	0.090	81.0	0.360	31.0	0.010	0.0	0.000
36	Cd-109	IND	2	2	88.0	0.990	22.0	0.037	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
37	Xe-133	IND	2	3	-80.0	0.360	31.0	0.380	162.0	0.010	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
38	U-238sh	IND	1	1	1000.0	0.005	766.0	0.090	93.0	0.050	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
39	Tc-99m	MED	1	1	141.0	1.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
40	Cr-51m	MED	1	1	320.0	0.100	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000
41	Te-132	IND	1	1	228.0	0.880	29.0	0.520	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000

## 14. APPENDIX F: NOTES and WARNINGS

The RT-30 MK2 is a delicate instrument and contains components (Crystal, Photomultiplier) very shock sensitive. **The detector assembly is not covered under warranty.**

### **Warranty:**

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

- a) The "Warranty Period" begins on the date the Equipment is delivered and continues for 24 months.
- b) Any repairs under this warranty must be conducted by an authorized Company service representative.
- c) Excluded from the warranty are problems due to accidents, misuse, misapplication, storage damage, negligence, or modification to the Equipment or its components.

WARNING: Li-ion battery

**Lithium-ion cells and battery packs may get hot, explode or ignite and cause serious injury if exposed to abuse conditions. Be sure to follow the safety warnings listed below:**

Do not connect the positive terminal and negative terminal of the battery to each other with any metal object (such as wire).

- Do not carry or store battery together with necklaces, hairpins or other metal objects.
- Do not pierce the battery with nails, strike the battery with a hammer, step on the battery or otherwise subject it to strong impacts or shocks.
- Do not expose battery to water or salt water, or allow the battery to get wet.
- Do not place the battery in or near fire or other high temperature locations.
- Do not place the battery in direct sunlight, or use or store the battery inside cars in hot weather.
- Do not disassemble or modify the battery. The battery contains safety and protection devices, which, if damaged, may cause the battery to generate heat, explode or ignite.

This is a Wi-Fi® enabled device subject to restrictions of use in some member states of the European Community.

## **Certificate of Origin**

**This is to certify that GEORADIS s.r.o., Novomoravanska 41 is only manufacturer of Radiation Detectors series RT-30 MK2. All instruments are designed, manufactured and assembled in Czech Republic.**

### **Manufacturer:**

**GEORADIS** s.r.o.  
Novomoravanska 41  
619 00 Brno  
Phone: +420 541 422 231  
Fax: +420 541 422 232  
e-mail: [info@georadis.com](mailto:info@georadis.com)

## 15. APPENDIX G: Supporting software tools

### 15.1. Geomon

The Geomon is versatile utility for basic maintenance of the RT-30 MK2 as well as for simple data access or remote control. It is running on Windows XP and all later platforms including Windows 8. A version for Linux operating systems is also available. The geomon is distributed in form of self installation program. Follow instruction after starting installation batch file. In case of using a windows operating system it is necessary to install proper USB driver. The driver is also delivered in form of self installation package. From time to time it is necessary to update the driver for a new operating systems. New USB drivers are downloadable from manufacturer's web sites.

### 15.2. Connection to device

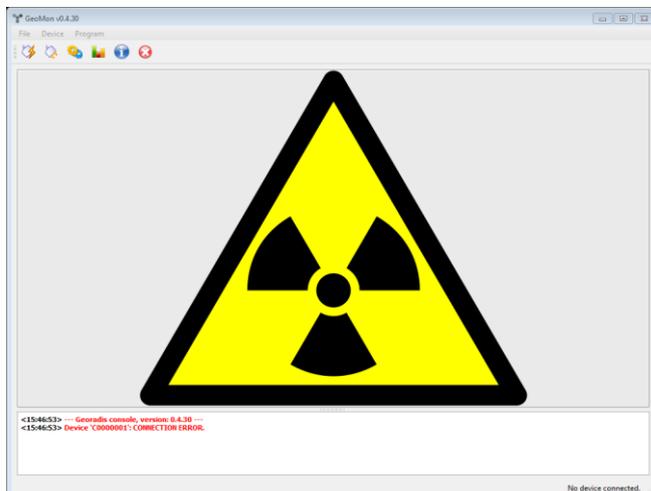
A connection to a RT-30 MK2 can be done on three different hardware platforms. The most common is to use a direct USB connection of a RT-30 MK2 with a PC. The second solution is possible via Bluetooth port. The third possibility is to use wireless WiFi connection to a WiFi router. This way is possible to operate the unit remotely within WLAN worldwide.

#### 15.2.1. USB and Bluetooth connection

Both types of connection require the same procedure by Geomon, a difference is only assignment of proper drivers for hardware support of USB hubs or Bluetooth transmitters. For details a user shall check guidelines delivered with a PC or Bluetooth devices.

As long as a proper USB hub or a Bluetooth device is recognized by PC and successfully assigned to a right driver a control over communication takes over a Georadis USB Driver delivered with the RT-30 MK2 unit. The USB driver recognizes a request for connection from a RT-30 MK2 and interacts between ports and the Geomon.

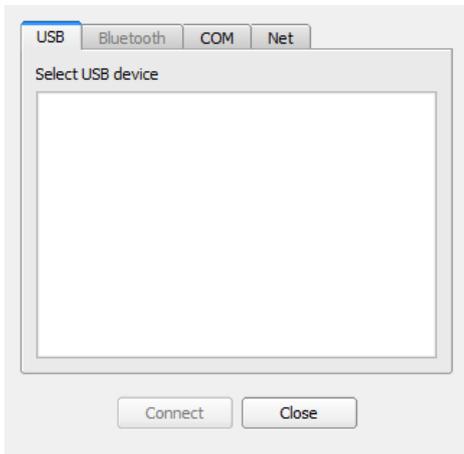
A next step is to call function Connect device accessed through Main menu and section Device or to touch Speed button Choose a device to connect below Main menu bar.



A new window appears on screen. There are four tabs on top: USB, Bluetooth, COM and Net. On behalf of successful assignment of a RT-30 MK2 to proper hardware device driver a serial number of the RT-30 MK2 connected appears in a window. It means when a USB connected the serial number of the unit is printed in window on tab USB. A Bluetooth connection belongs to the

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Bluetooth tab window etc. To complete connection a user must select the serial number of requested instrument (there can be more instrument supported in the same time) and confirm button Connect.



After that the main screen of the Geomon will switch to allow access to all supported features of the RT-30 MK2.

### 15.2.2. WiFi connection

Like other devices with Wi-Fi connection support the RT-30 MK2 requires to pass a login and authorization process for a local Wi-Fi network. Therefore cooperation with a local IP personal is required. Once the RT-30 MK2 and a PC are connected to a network a user can specify and type RT-30 MK2 internal IP address in edit box. The internal IP address of RT-30 MK2 may be changed. The change must be done directly on the unit. There are supported IP standards for 4 and also 6 bytes addresses. User can also edit gateways. Services for IP modification are in Main menu - Connections – WiFi – WiFi Settings.

For reason of complexity and many local LAN limitations the manufacturer cannot offer an easy guide for Wi-Fi connection. In case of trouble a user is welcome to contact manufacturer to get a specific support.

## 15.3. Commands

### 15.3.1. Parameters

There is arranged a limited access to working parameters. Only parameters related to measuring modes units may be changed by user and their improper change will not lead to instrument's malfunction. Parameters are called by names and there is an edit box for each of them.

Parameters:

Params.active\_meas\_method = 1  
*Selection of 1 of 6 possible methods of measurement*

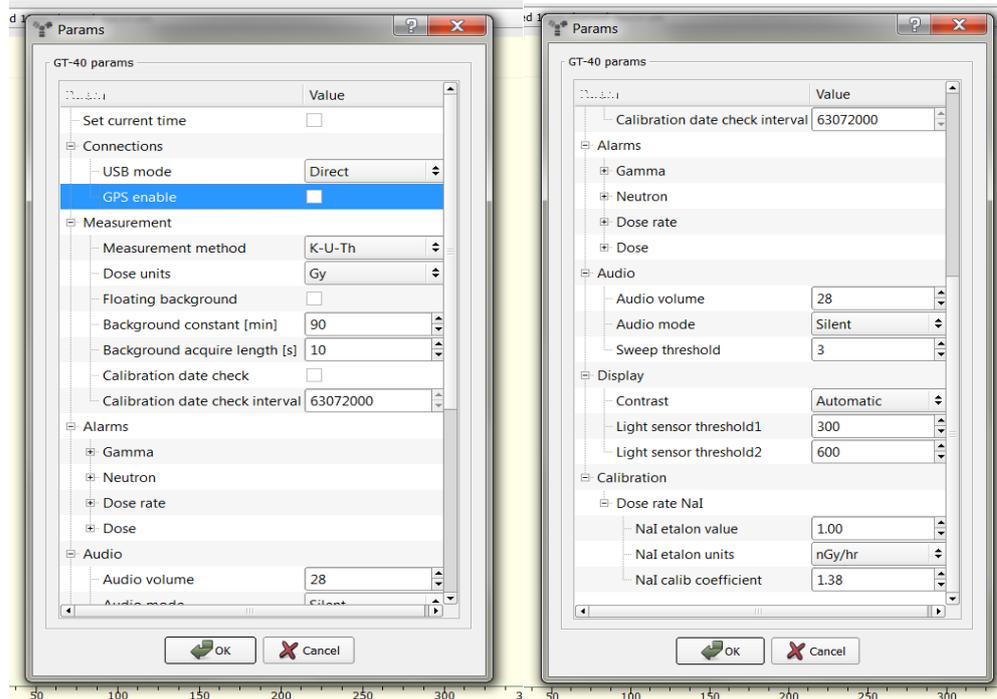
Params.audio\_mode = 1  
*Audio mode*

Params.audio\_sweep\_threshold = 3

Params.audio\_volume = 50

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*Loudness in percentage 0 - OFF*



Params.bg\_acquire = 10

*Number of readings for background requirement*

Params.bg\_const = 90

*Time interval for floating background.*

Params.bg\_floating = 0

*Enables floating background (system automatically copies slow background variations) or uses a fix background.*

Params.calib\_check = 0

Params.contrast = 0

*Display contract parameter*

Params.dose\_alarm\_status = 0

*Dose alarm mode*

Params.dose\_alarm\_threshold\_I1 = 4

Params.dose\_alarm\_threshold\_I2 = 5

Params.dose\_alarm\_threshold\_I3 = 6

Params.dose\_alarm\_threshold\_I4 = 7

Params.dose\_alarm\_unit = 0

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Params.dose\_rate\_alarm\_status = 0

Params.dose\_rate\_alarm\_threshold\_count = 3

Params.dose\_rate\_alarm\_threshold\_I1 = 4

Params.dose\_rate\_alarm\_threshold\_I2 = 5

Params.dose\_rate\_alarm\_threshold\_I3 = 6

Params.dose\_rate\_alarm\_threshold\_I4 = 7

Params.dose\_rate\_alarm\_unit = 0

Params.dose\_units = 1

*Dose rate units. 0 – Gy/hr, 1 – Sv/hr*

Params.gamma\_alarm\_status = 0

Params.gamma\_alarm\_threshold\_count = 3

Params.gamma\_alarm\_threshold\_I1 = 3

Params.gamma\_alarm\_threshold\_I2 = 4

Params.gamma\_alarm\_threshold\_I3 = 5

Params.gamma\_alarm\_threshold\_I4 = 6

Params.gps\_enable = 0

*GPS ON/OFF*

Params.nai\_dr\_calib = 1.23

*Dose rate calibration factor*

Params.nai\_dr\_nominal = 626

Params.nai\_dr\_units = 0

Params.usb\_mode = 0

*USB working mode – Direct – Ethernet - Com*

Manufacturer can change all other parameters only. There are two ways how to do it.

1. Upload of a parameter set file verified by manufacturer. For that there are implemented function Upload parameters.
2. Remote connection to manufacturer where all maintenance is performed by manufacturer in real time.

### 15.3.2. Upload Firmware

The RT-30 MK2 is a complex instrument and a new features supporting variety of new applications are being implemented continuously. From time to time it is recommended to check manufacturers web for a new software revisions. Firmware uploading process is then required.

Firmware upload is a delicate process where any unpredictable action may lead to system damage and complications with system recovery. There are implemented policy rules to minimize failure rate but still remains a few items what has to be arranged by a user.

1. Prior firmware upload check battery status. The RT-30 MK2 MAY NOT switch off during firmware update due lack of battery power. The upgrade can be done with battery charger ON.
2. In no circumstances the unit can be switched OFF by user while transferring files for a PC or updating.
3. Do not unplug USB cable
4. Do not switch off a PC before the process of upgrade is finished.

Before starting upgrade process a user must know where to get a new firmware package. One of the sources is a direct access to manufacturer's FTP. The access is arranged through a link sent by manufacturer. The user must download firmware file using any web browser and save the file in any local folder on his PC.

The second possibility is to let download the file directly by Geomon. There is an alternative for locations with very poor internet connection and a user can get new firmware file on a solid memory medium like CD, DVD or memory stick.

Firmware upload procedure:

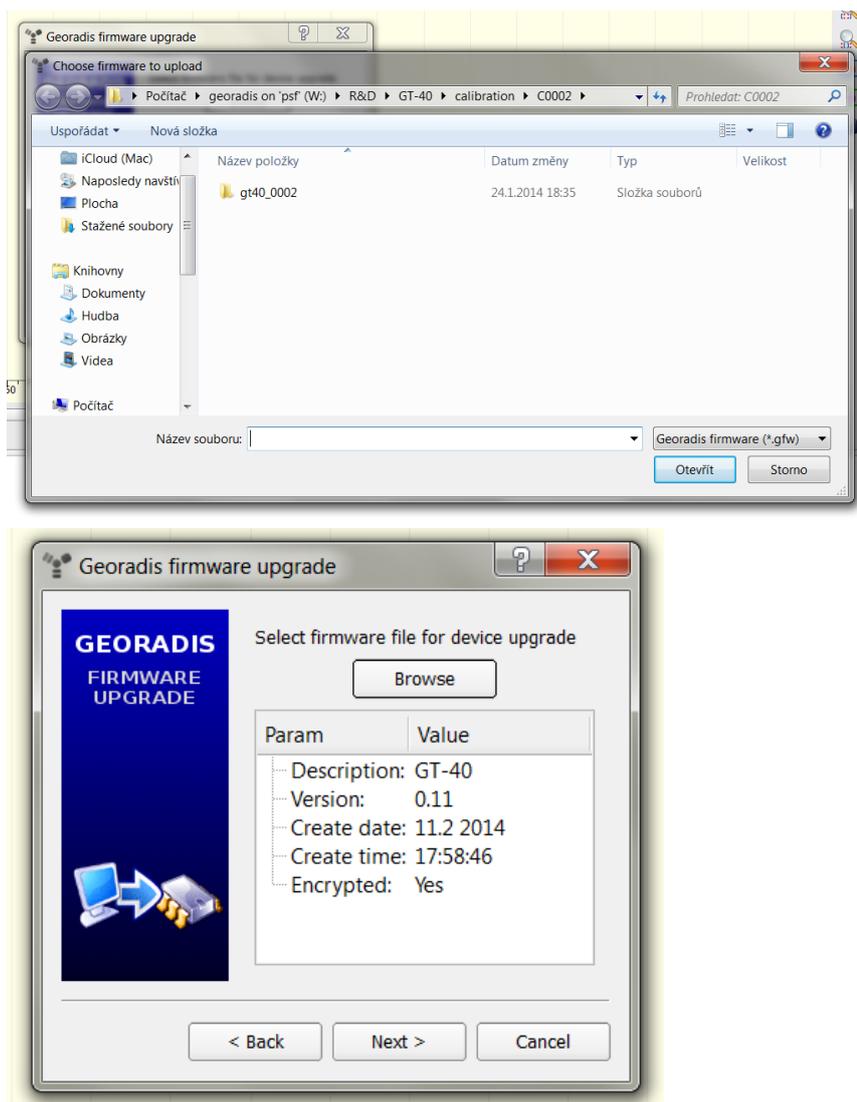
1. Download a new gfw file and save in a local file folder.
2. Start Geomon
3. Switch On the RT-30 MK2
4. Connect USB cable
5. On Geomon connect device
6. Activate button Upload firmware
7. Check manual selection of a gfw file



8. Use Browse button to select gfw file



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### 9. Touch Next to start update process

The update routines will check completeness of the new fgw file and will transfer it in the RT-30 MK2. Once finished a process of re-writing of the old firmware is started. It is critical to interfere somehow with the unit during re writing. Once the process is completed the RT-30 MK2 will restart and a new firmware version is in charge.

Any unpredictable behaving must be consulted with manufacturer. This may prevent complication of damaging file system of the unit. In case the user is not fit enough to do upgrade itself manufacturer can do an upgrade using a remote access to the unit.

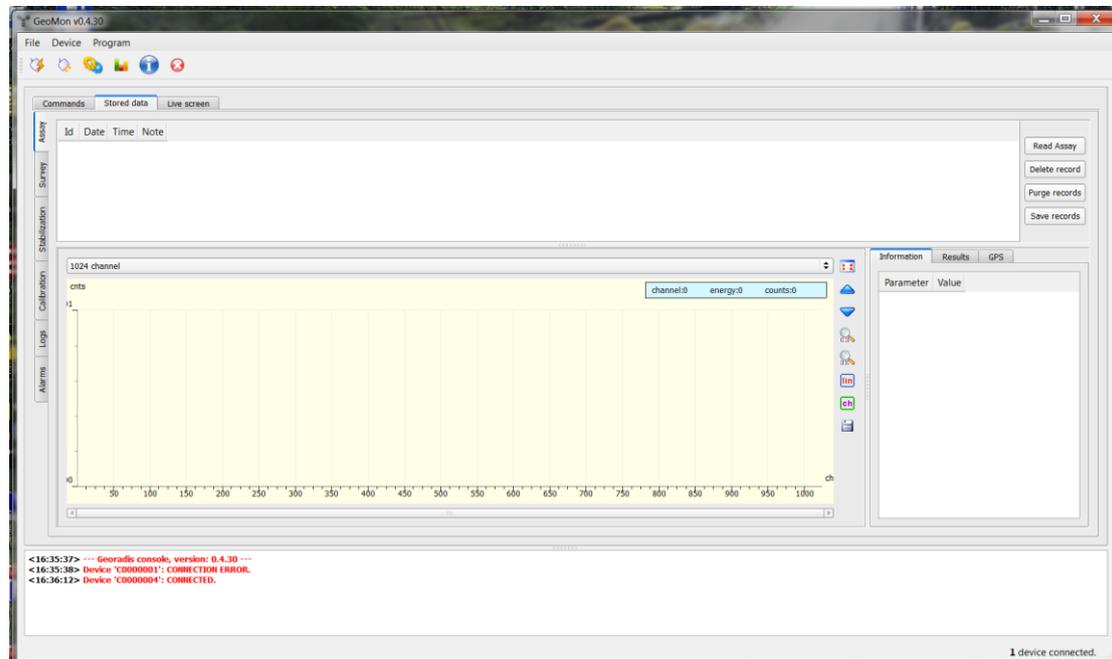
## 15.4. Stored data

### 15.4.1. Identification and Survey data

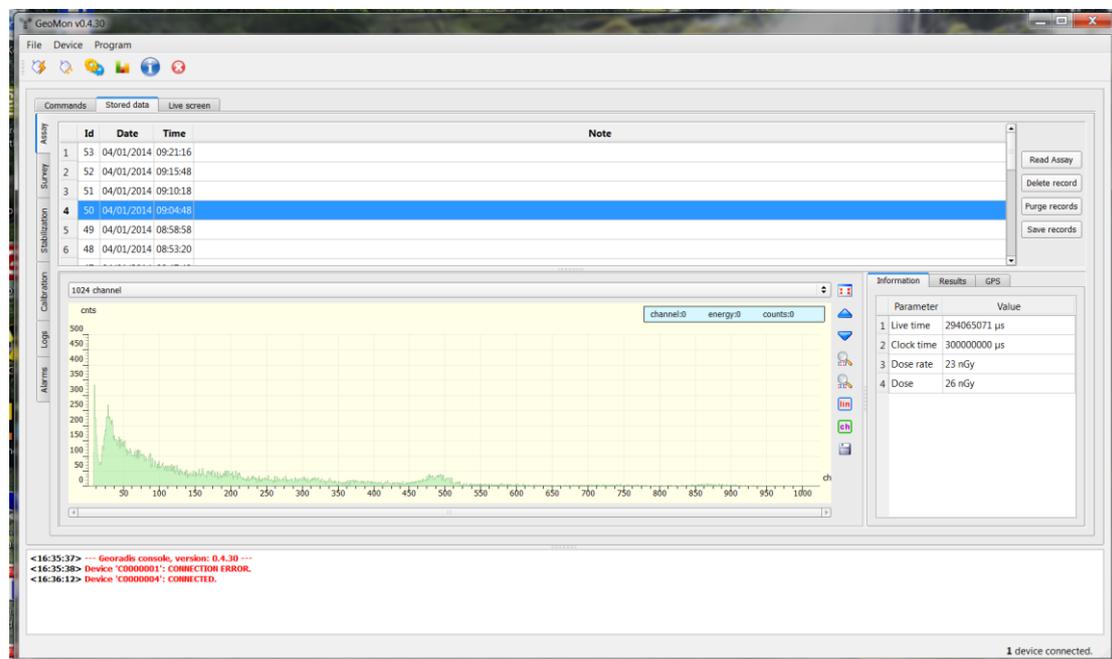
The Geomon is to be used for measured data download from the RT-30 MK2 and converting in a data files. RT-30 MK2 data structures are complex and

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results of different work modes are filed separately. For easy orientation the Geomon groups each working mode on designated list. Vertical tabs on left side of each list arrange switching between lists. There are tabs for **Identify**, **Survey**, **Stabilization**, **Logs** and **Alarms**. There are arranged following functions on each of the list.



**Read** ..... - (e.g. Read Assay) transfers all records from the RT-30 MK2.

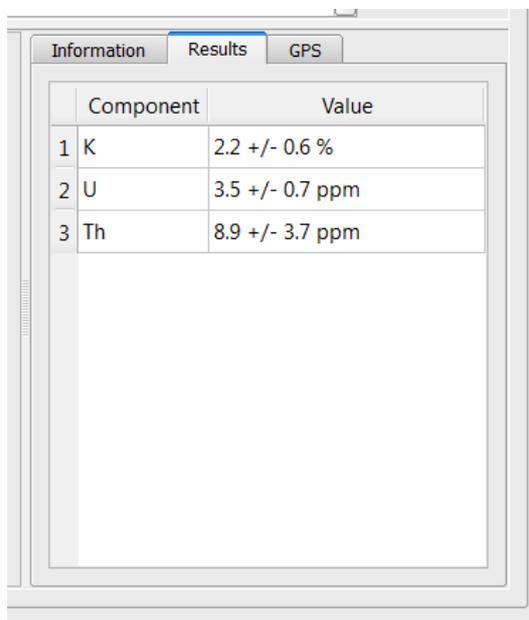


List of records with identification number ID, date and time respectively note are listed in table on the left of function buttons. A user may browse the list up or down and select record. All other properties of a record are shown in other two windows. Spectrum of an assay or survey profile record is plotted in window in the middle of the screen. A user can browse plot in details using UP or DOWN arrow button to change y-scale, to extend x-scale for zooming

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details. A partial spectrum can be exported in a text file format after activation of diskette labeled button.

Computed results and all information related with measurement are accessible in right window. A user can be informed about measuring time, dead time, computed concentrations and also GPS coordinates of place of measurement.



	Component	Value
1	K	2.2 +/- 0.6 %
2	U	3.5 +/- 0.7 ppm
3	Th	8.9 +/- 3.7 ppm

### Delete record.

Records in the RT-30 MK2 can be maintained from Geomon application. A single record highlighted can be deleted from RT-30 MK2 database after pressing button Delete record. To delete all records in the unit the user touch button **Purge records**.

**Save records** leads to opening a folder structure on user's PC and storing all records within the structure.

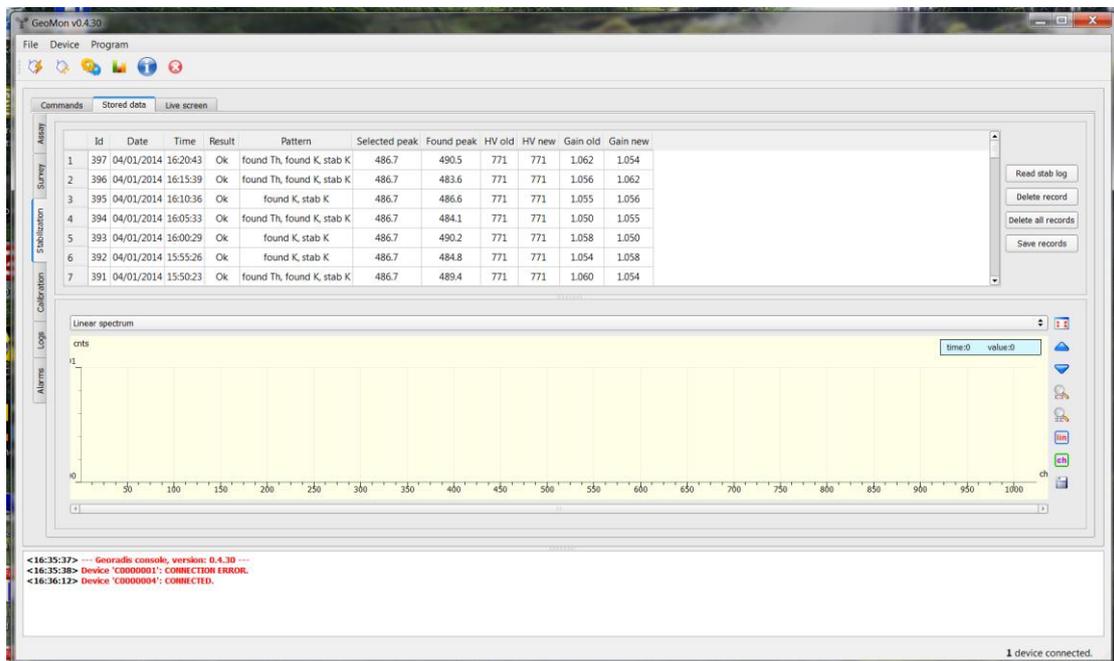
### 15.4.2. Stabilization LOG

Stabilization log is one of the most important sources of information about long-term performance of the instrument and its condition. While the RT-30 MK2 is on a continuous gain stabilization process is active. A background spectrum is accumulated and every 30 seconds analyzed for peaks present. List of peaks found gives a pattern what has to be matched with pattern of energy nominal of natural radioactive elements. Results of these iterations together with spectra are then logged.

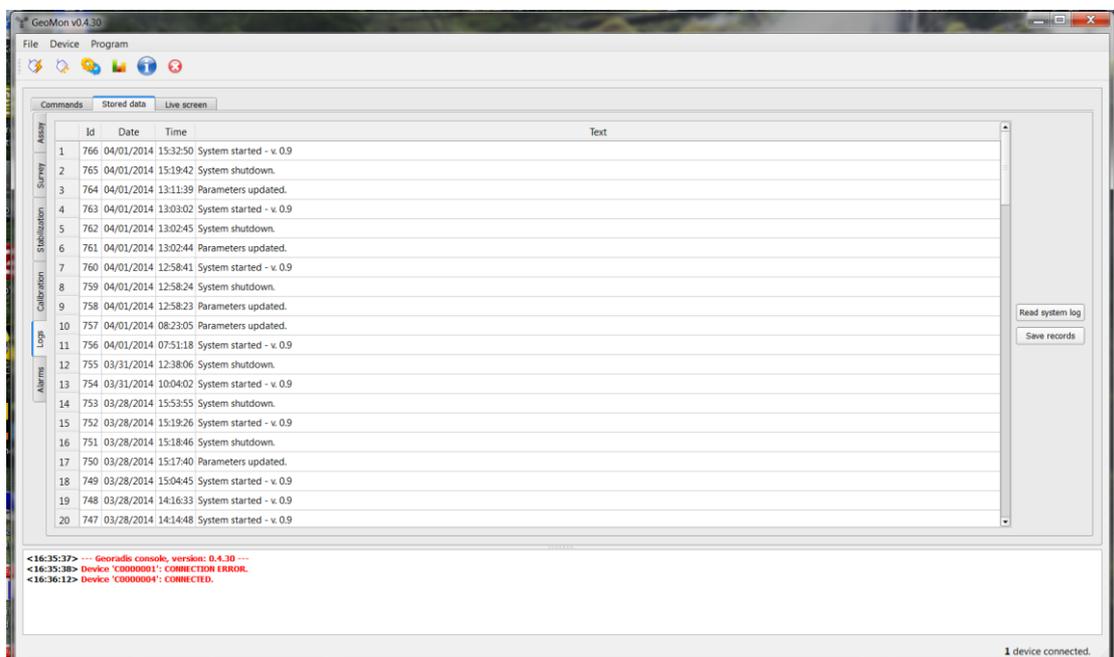
Operation with data is similar to assay or survey records. Following are meanings of texts in columns. ID is a record identification number. The number is important and spectra files are named with this unique number. Date and Time have standard meaning. Result reports if the stabilization was accepted as valid and gain adjusted is correct or if unit is still not warmed up. Pattern informs about nuclides found and used for stabilization. There is important information for experts about quality of local background and also

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about confidence level of gain stabilization. The least confidence level has K only stabilization because there is only single K-40 peak used. The more elements are identified the higher is the confidence.

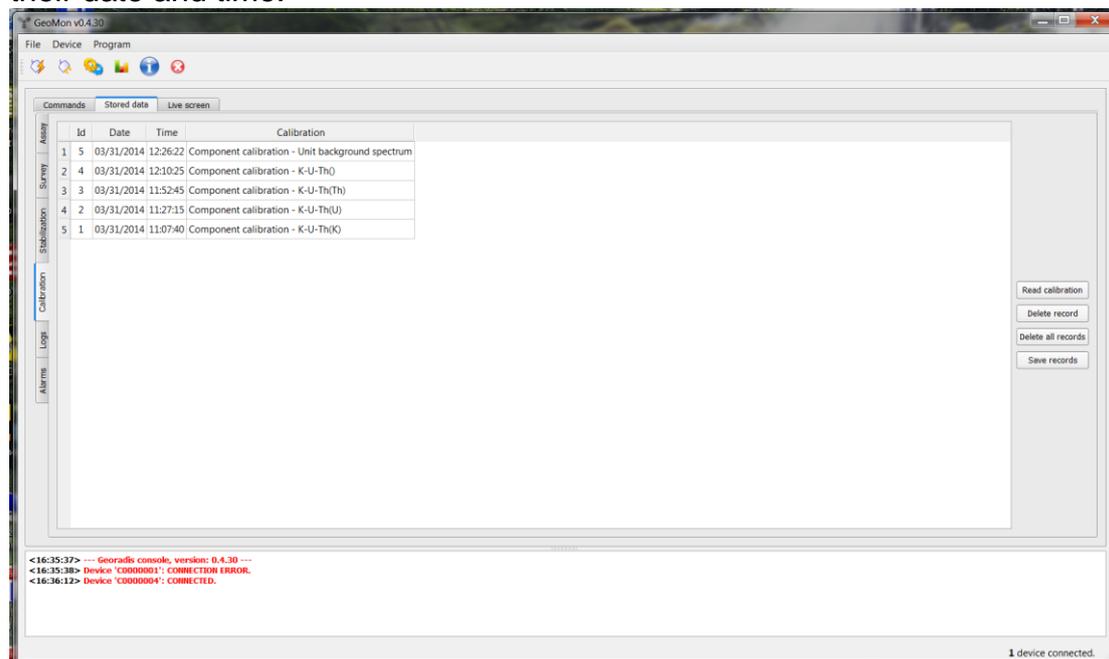


Manufacturer asks from time to time a user to send stabilization log in case of any trouble. A next source of information about health of the instrument is System log. There are written all important system messages. Both logs are very important for remote maintenance. User cannot delete the system log.



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Last part of logged information is a list of calibration attempts. The log may help to user in case of uncertainty about proper calibration spectra used or their date and time.



### 15.5. Remote operations

Wide connectivity of RT-30 MK2 predestines it to be used as a remote measuring point. A remote operation is supported on all levels of connection – it means USB, Bluetooth or Wi-Fi and with using WLAN there is no distance limit for it. A simple application integrated in Geomon emulates RT-30 MK2 display and five buttons for instrument operating. Using remote there is no limit on any function of the instrument. In case of slow connections on far distance there is selectable a refreshing period of signals. During work the remote can be interrupted anytime due data transfer or setup.

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