# RT-21 – Super-Scint

User's Manual

Rev. 1.3 – Aug 2009



# CONTENTS

CONTENTS ..... 3
1 GENERAL ..... 5
1.1 Main Features ..... 5
1.2 RT-21T - version with the detector on the telescopic arm ..... 6
2 SYSTEM OPERATION ..... 8
2.1 Batteries ..... 8
2.2 Charging ..... 8
2.3 Button ..... 9
2.4 Display ..... 9
2.5 Power ON ..... 9
2.6 Main Working Mode ..... 9
2.7 Audio ..... 10
2.8 Reacquire Radiation Background ..... 10
2.9 Action Menu ..... 11
2.10 POWER OFF ..... 11
2.11 Low Battery ..... 11
3 PARAMETER SETUP ..... 12
3.1 Access to menus ..... 12
3.2 Date and time ..... 12
3.3 Display ..... 12
3.4 Audio ..... 13
3.5 Measurement ..... 14
3.6 Accessories ..... 14
APPENDIX A – DEFAULT PARAMETERS ..... 15
Contact to producer: ..... 15
NOTES AND WARNINGS ..... 16

# 1 General

The new RT-21 Super Scint is the state-of-the art in portable hand-held radiation survey instrument. It offers an integrated design with full weather protection, large detector, ease of use and the highest sensitivity in the market segment. .




## 1.1 Main Features

- RT-21 = 2x2" (6.3 cu ins) Sodium-Iodide detector provides High sensitivity performance due to the large Xtal. Energy response from 30 keV-3000 keV.
- 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 – 2M standard on newer units (512K memory units can be upgraded if required)
- New design state-of-the art electronics with advanced CPU 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
- Full IP66 weatherproofing – short term water immersion and fully dust protected
- Rechargeable battery kit supplied including NiMH battery pack module (4xAA) batteries, Universal Charger (110/220 VAC).
- Typical 8+ hour battery life at 15 °C on NiMH batteries
- Size 259 x 81 x 91 mm – 2.2 kg with batteries
- Operational Temperature range -20  to 50 degrees Celsius (display is the limit)
- Spare battery module for “instant” replacement
- Protective boot with carry straps.

## 1.2 RT-21T - version with the detector on the telescopic arm

RT-21 can be designed as a simple hand-held instrument or with the detector on the telescopic arm length 1 – 2 meters.  The model with telescope is labeled by character “T” following the model number.  The following picture shows two handles of the instrument necessary for better manipulation.  The basic dimensions are 122.5 x 8.5 x 13.5 cm and weight 3.5 kg.



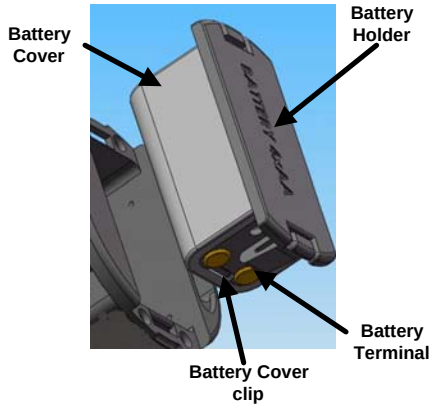
The main advantage of this model is comfortable manipulation during searching in hardly accessible positions in terrain, scrap yard or during searching for sources in the wagons or camions loaded by metal scrap.

Rotation of the black nut on the telescope to the right involves moving of the detector side out to set the proper telescope length. Rotation to the left fixes the current position of the detector.

The instrument can be manipulated only using the one handle on the telescope in case of its minimal length. Both handle manipulation is necessary when longer length is used.

# 2 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 RT-21 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 RT-21 unit.

## 2.2 Charging

If the Batteries are getting low, an audio beep prompts the user to view the display. If the Battery icon shows very little capacity left (message **LOW**) the battery pack should be changed. Manufacturer 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. 2 Battery modules supplied with each unit.

The RT-21 has a build in battery charger. This allows re-charge batteries while operating or w/o removing the battery cartridge off the unit. Only rechargeable batteries of NiCd or NiMH type are rated for use with RT-21. Regardless of capacity of used batteries the build in charger will accommodate charging current and perform charging fully automatic. To activate the charger must be plugged in a 12 V DC supply in connector hole in rear wall under rubber cover. Next must be set up parameter **Battery type** to **Rechargeable**. Unit automatically requires setting this parameter every time if battery cartridge was replaced. Immediately after power on the unit will issue a request for selecting proper battery type. Entering a wrong battery type may lead to unpredictable damage on the unit. Batteries of type Alkaline or dry batteries may not be charged. The battery type parameter must be set in position **Non rechargeable**. The unit may operate on external power anytime if the proper battery type is selected. Charging progress is indicated on display in information section by animated icon .

Manufacturer is not responsible for damages on the unit cased with use of improper batteries.

## 2.3 Button

The RT-21 Super-Scint instrument has only ONE control that is the front panel PUSH-BUTTON referred to as **BUTTON**. The Button has 3 primary actions:

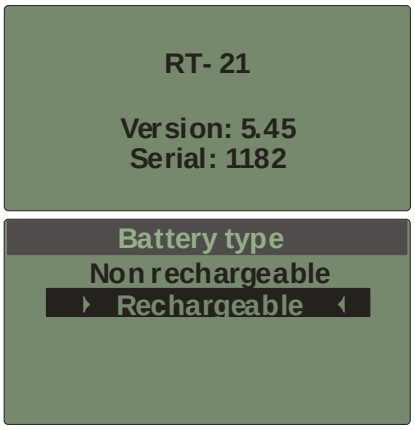
- Short CLICK (less then 1 second button action)
- Long CLICK – typically 3 second with display feedback
- Extra long CLICK for instrument switch OFF.

## 2.4 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. The Backlight is controlled automatically. Ambient light is measured by sensor under main panel. The Display is used for various functions and messages.

## 2.5 Power ON

Press the button. Following actions will continue.



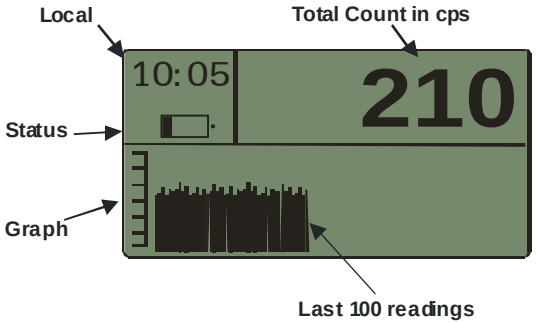

The display shows the initial information about the instrument type, firmware version and serial number. The unit automatically recognizes if new batteries were inserted. In this case there is necessary to inform the unit about the type of the batteries used. Message “NEW BATTERY DETECTED SELECT TYPE” is followed with Battery type screen. Using a button click user will select “Non rechargeable” for Alkaline type or “Rechargeable” for NiCD or NiMH type of batteries. Long click enters the selection and the units continue in starting up sequence.

Every next start until battery change will begin with introduction screen accompanied with loud beep and then automatic jump in survey mode.

## 2.6 Main Working Mode

The Survey Display is segmented as shown in the figure.

**Local Time**: settable to Local Time in Parameter Setup



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

 ALKALINE batteries

 RECHARGEABLE batteries

**Total Count**: current radiation level in counts/second units. There are up to five digits showing every second number of recorded gamma incidents (cps). The maximal value is **65 535** cps. The count rates close to this value (let say **above 50 000 cps**) can mean the dangerous level of radiation. The operator should stay in that area as short time as possible and call to the responsible person.

**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

The RT-21 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 the count rate and therefore local radiation intensity. Rules for audio threshold set up are in the next chapter. There can be also activated a Bluetooth audio headphones secret scanning.

## 2.8 Reacquire Radiation Background

When in the **SURVEY** mode of operation the **AUDIO THRESHOLD** is set using the 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.

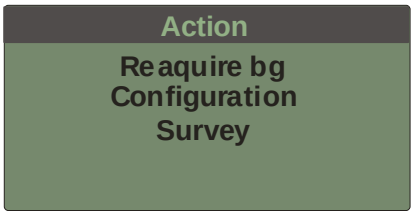
As an example if the local background level was 100 cps then at 1 Sigma the Audio Threshold = 110 cps (100 + 1 Sigma). So if the count rate goes above 110 cps the audio will sound. However if the local Background increases substantially to 300 cps then the audio will be on continuously and the audio 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 automatically 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

## 2.9 Action Menu




The RT-21 only has one **BUTTON** as noted above. To achieve the required system functions **CLICK** 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.

a. **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.
b. **Configuration** – activation move the instrument to the setting of parameters described in chapter 3.
c. **Survey** – activation will switch the screen back in the survey mode and keeps all background values without change.

## 2.10 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. At anytime before power OFF, if the **BUTTON** is released the unit continues to function.

Switching off process is independent on any working status of the unit. It may happen that the turning off sequence will not appear on display (the unit can be overwhelmed with other tasks – typical with USB of Bluetooth devices) but the switching off process continues on background and the unit will shut down w/o any indication.

## 2.11 Low Battery

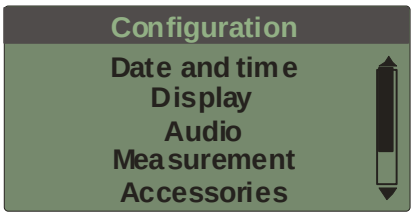
If the Batteries are getting low, an audio beep prompts the user to view the display. If the Battery icon shows very little battery left the battery pack should be changed. RSI recommends that a spare Battery Pack is carried at all times to prevent field problems as changing is a few seconds task with NO loss of stored data. 2 Battery modules supplied with each unit.

# 3 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.

## 3.1 Access to menus

There is a structured menu user interface used to help the user set up of basic working parameters. Menus are placed into function groups. To browse in menus the user uses short Button clicks, to activate service or jump to level back long Button press is used. The root menu is accessible from Main Working Mode – **Survey** after short button click, selection of the service **Configuration** and activation with long Button press – compare chapter 2.9. Next menu consists of names of function groups.




There are **Date and time**, **Display**, **Audio**, **Measurement** and **Accessories**. Through function groups the user will go to the list of discrete parameters. Selection and activation logic is always the same. To select - **short click**, to activate - **long press**. Each discrete parameter holds a set of permitted values. User must select one of them and confirm it by long press of the Button. To leave from menu to previous level there is a service **Go Back**.

## 3.2 Date and time

Set up unit's date and time is important for correct stamping of stored data. Year, month, day, hour and minute must be set separately from the list of predefined values. There are:




**Year** 2007, 2008, 2009 - 2024.

**Month** 01, 02, - 12.

**Day** 0 - 31.

**Hour** 00 - 23.

**Minute** 00 - 59.

**Go Back** Return to previous level.

## 3.3 Display




**Contrast** Almost all LCD devices are more or less sensitive on ambient temperature. The LCD used in RT-21 is rated to operating range from

-10 °C to +50 °C. Manufacturer set the contrast at room temperature. Parameter contrast allows correct adjusted contrast in seven steps. By default there is 0. Scale of values is: **-3**, **-2**, **-1**, **0**, **1**, **2**, **3**.

**Backlight** This parameter controls backlighting of the display. There are three modes. Mode **Auto** activates sensor of ambient light. The backlit is then controlled automatically. Selecting **ON** user switches the backlit permanently ON and to switch it OFF there is opposite choice **OFF**.

**Go Back** Return to previous level.

## 3.4 Audio

**Volume** Values in scale are percentages of maximum power of voice amplifier. For permanent switch OFF (e.g. if headphones are used) there is value **OFF**. Scale: **25 %**, **50 %**, **75 %** and **100 %**.

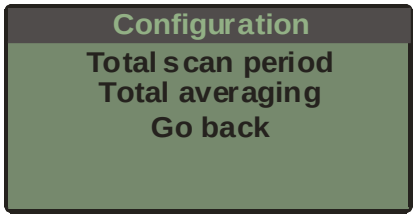



**Filter length** Pitch of the audio tone in Main Working mode depends on intensity of gamma ray incidents. The more incidents the higher tone is transmitted. Deviation of incidents (it is a physics, intensity is never a constant value) leads to fast frequency changing (the unit does it 20 times per second) what can create additional tone modulation what may create some discomfort to the user. To make the tone more smooth there is a way to engage numerical smoothing. Moving average filtering over giving number of samples will do the job. The user can select filter length between **1**, **2**, through **10** samples.

**Threshold** Indication of increased radioactivity is performed by audio signal. The unit will engage audio every time when actual value of total counts will overshoot an internal threshold. The threshold is computed by following way: After switch-on and every time when requested by the user (service Reacquire bg) a new radiation background is measured. Background samples are taken (together 60 samples) within 3 seconds. From these values average value and standard deviation are calculated. The actual threshold is then last average value plus its standard deviation times factor. The user can choose factor from scale **1**, **2**, through **6**.

**Go Back** Return to previous level.

## 3.5 Measurement

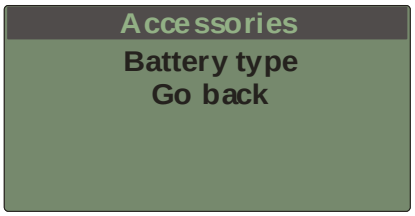



**Total scan period** Time is an important factor to increase sensitivity in Survey mode. In case of extremely weak sources the user can extent sampling time in Survey mode up to 20 second per sample. Scale: **1**, **2**, through **20**.

**Total averaging** To suppress fast changes of total counter on display there is possible to damp it. Damping uses floating average method over giving number of samples. There are selectable **1**, **2**, through **5**.

**Go Back** Return to previous level.

## 3.6 Accessories




**Battery type** It is very important parameter. It controls battery charger build in the unit. If the unit is powered from an external power supply and Battery type is set to **Rechargeable** then charging of batteries will perform. In case there are used other type of batteries then NiCd or NiMH the battery type must be set to **Non rechargeable.** Wrong battery type parameter may lead to charging batteries not rated for this process (alkaline, dry batteries) what may damage the unit. **Damages caused by charging of improper batteries cannot be covered under warranty**.

**Go Back** Return to previous level.

# APPENDIX A – Default Parameters

| Parameter | Interval | Default value | Description |
|---|---|---|---|
| Contrast | -3 to 3 | 0 | Contrast of display |
| Backlight | Auto, On, Off | Auto | Backlighting mode |
| Battery Type | Non rech | Non rech | Rechargeable |
| Audio | On, Off | On | Acoustic indication |
| Audio Threshold | 1-5 | 1 | BG Standard deviation multiplication factor |
| Audio Filter | 3-10 | 9 | Frequency pitch smoothing |
| Display Averaging | 1-10 | 1 | Moving average |

## Contact to producer:

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# NOTES and WARNINGS.

**Note:**

**Users are reminded that the RT-21, in common with other similar instruments, uses a sodium-iodide crystal as the detector. These crystals are fragile and even though the unit has been ruggedized for field use, great care should be taken to avoid abusing the instrument as the very expensive crystal is <u>not covered under warranty assembly if defects to the detector assembly are caused by mishandling, accident or other improper use.</u>**

**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. Georadis warranty covers only those defects which arise as a result of normal use of this product, and does not cover any other problems which arise as a result of

d. improper use outside the product's specification
e. mishandling, including immersing in liquids, dropping or subjecting to external hard shocks
f. being subjected to extreme environmental conditions or rapid changes in such conditions
g. improper maintenance or modification and unauthorized opening
h. accident or other acts beyond the reasonable control of Georadis
i. The “Warranty Period” begins on the date the Equipment is delivered and continues for 24 months.
j. Any repairs under this warranty must be conducted by an authorized Company service representative.

**Certificate of Origin:**

**This is to certify that GEORADIS s.r.o., Brno is the only manufacturer of Radiation Detectors series RT-21, RT-21, RT-21, RT-21, RT-21, RT-21T and RT-21T. All instruments are designed, manufactured and assembled in Czech Republic.**

**Instruments of this series obtained a certificate according to Directive 2004/108/EC (electromagnetic compatibility) and fulfill the requirements of EU norms and CE directives.**