# GT-25

# Directional Radiometric Gauge

User's Guide
Version 1.02 July 2013

# Content

*1. Introduction* 3
1.1. Control buttons 4
*2. Instrument operations* 5
2.1. Power supply and battery management 5
2.2. Power on / off 6
2.3. Interactive Menus user interface 6
2.4. Menus 7
2.4.1. Main Menu 7
2.4.2. Setup 7
2.4.3. Detector test 8
*3. Measuring* 9
3.1. Measure method 9
3.2. Profile measure 9
*4. PC tools and maintenance* 12
4.1. Program GT25con.exe 12
4.2. List of parameters 12
4.3. Data record structure 13
*5. Technical data* 14

# 1. Introduction

Two detectors gamma Ray scintillometer (front detector located in lead collimator, rear detector unshielded) in water resisting housing rated for determination of Uranium mineralization in very high local Background conditions, typically fore fields in mine.

In regular counting mode there are two detectors employed. Front detector is located in collimator made of lead. Collimator attenuates radiation coming from other directions but the front. The second – rear detector is mounted on backside of collimator and counts all radiation coming from all directions. Difference between front and rear detector is called Front to Back ratio. This way there is radiation coming from other direction except front stripped and floating radiation background is actively corrected. GT-25 is ideal for measurement of sources in areas with high and directional varying radiation Background. Typically mining tunnels, radioactive waste deposits etc.
Instrument can also be used in single detector mode as regular scintilometer.

GT-25 features:

- Robust mechanical design rated in extreme hard conditions
- Two scintillators CsI/Tl size ϕ20 x 25 mm
- PIN diode light collection
- Graphic LCD display with backlighting
- User interface driven by four backlighted buttons
- Data memory for minimum 250 profiles
- USB interface
- Results in ppm or Uranium equivalent

GT-25 housing is in “gun” shape. Display is mounted on rear wall together with four buttons. Fifth trigger button is located on handle. Batteries are in handle in separate compartments to eliminate any impact of battery leakage on instrument’s electronic. Access to batteries and two connectors in front of handle’s base is limited by flopping lid what builds barrier against water. Body of the instrument is from aluminum and heavy loaded surfaces and corners are protected by rubber coats. Instrument is fully waterproof.

## 1.1. Control buttons

GT-25 user interface is designed for easy control. There is graphical LCD display with interactive menu system and five control buttons. Four buttons are mounted under display and controls direction of cursor's moving. There are buttons for moving left, down, up and right. Fifth button is located on handle as trigger and is used as ENTER.

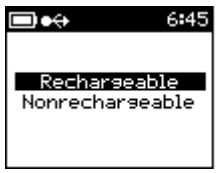


# 2. Instrument operations

## 2.1. Power supply and battery management

GT-25 is powered from four AA size battery cells. Rechargeable type NiCd or NiMH as well as nonrechargeable ALKALINE type suits in the unit. Manufacturer does not recommend use of dry cell type of batteries for high risk of electrolyte leakage. Charging is controlled by electronic build in instrument so removing of batteries is not required. Internal charger is powered from external power supply 12V DC minimum current 0,5A. Power supply outlet has to be plugged in connector located in handle base accessible after opening flopping lid. Battery condition is indicated on display by animated pattern of battery icon located in upper left corner of every screen.

Batteries are plugged in plastic cartridge pulled in compartment in handle. After unclipping of protection lid user gets access to screw cap. The cup secures cartridge in right position and seals compartment. After removing the cap the cartridge may be polled out towing on galloon pleated behind the cap. Inserting the cartridge back is inverse process. First push cartridge in the compartment. It is necessary so check position of terminals on cartridge against contacts in handle's compartment and position of the galloon to be pleated under cartridge. Next screw cap and clamp the lid.



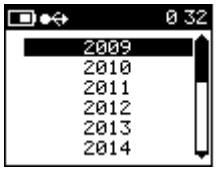

GT-25 has build in policy of used battery type. First power on after each battery change will start battery selection routine. The Battery Type selection is required to let the unit know which batteries are used. Battery discharge rates vary between battery types so that for Low Battery detection it is essential the unit knows the correct battery selection. Normally RECHARGEABLE batteries are the correct option for the GT-25 as this is what is supplied with the unit – but users can select to suit their requirements. Using UP or DOWN buttons user must select proper type of batteries and confirm selection by pushing ENTER.

Wrong battery type may lead to battery damage ( leakage ) in case that is charged improper type (ALKALINE) or may lead to situation that rechargeable batteries will not be charged because charger was switched off after selection NON RECHARGEABLE. Battery selection menu is every time accessible from Main Menu through item SetUp – Batteries.

## 2.2. Power on / off

Trigger button of instrument's handle (ENTER) is used for switch on /off. Switch ON requires pressing ENTER and holding it until an introductory screen appears on display. Then leave the button.

Switch OFF may be done two ways. First way is force hardware switch off and this way is recommended every time when program stacks and soft switch off feature is not accessible. Holding ENTER button pressed for long time (more then 5 second) will lead to switch off all electronic circuits. Second way is to activate item Switch off from Main Menu.

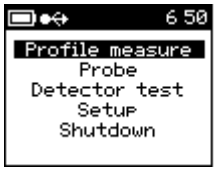



## 2.3. Interactive Menus user interface

GT-25 features graphical interactive user interface. For fast orientation in supported services and simple access to them was developed system menus driven by five buttons. Selection and activation of services is mediated through cursor. It is graphical indication of currently selected item. There are four buttons under display driving cursor move in specific direction. It is button for left, down, up and right move. After selection of an item and pressing fifth button on handle (function ENTER) program activates related function or service. This way user browses in menus, changes parameters and starts processes.




There are examples of different types of menus in pictures. All menus have common section. It is a header bar harboring from left to right: Battery icon with animated inside pattern for indication of remaining charge, section for status icons e.g. USB icon informing about active USB connection and running actual time.




Input of values is arranged through set of pre defined values. Each suitable set is displayed as list of items in scrollable menus. After selection of value and confirmation ENTER is modified value of related parameter. As an example there is a menu for selection of the year from date parameter. There is also type of menu for entering of flexible identification parameters. This is arranged the way that user has access to each position of string of predefined length – move right and left and can change character allowed for each digit pressing up or down button. All allowed characters are in round around set. To speed up browsing in character sets up and down button supports auto repeat function.

## 2.4. Menus

### 2.4.1. Main Menu

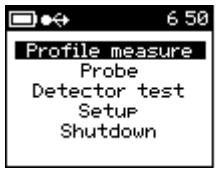
Following functions are accessible from Main Menu:

**Profile measure** leads through identification process to measuring of particular radiation profile.

**Probe** allows fast and easy pre – measurement of spots without databasing of results.

**Detector test** fast self-control of functionality.

**SetUp** of work parameters




**Shutdown**, selection and activation of this item leads to switching off the unit.

### 2.4.2. Setup

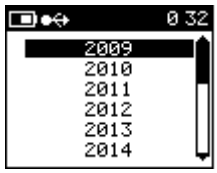
Menu Setup consists of list of parameters these are changeable directly in unit. There are:

**Date and time**, opens list of variables (Year, Month etc.) and to each



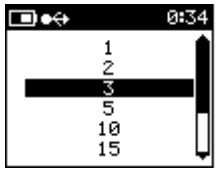







variable it exists list of allowed values what is accessible after selection of variable and press ENTER. Position of the cursor in the list of values responds with actual value of parameter. Selection of new value and it's confirmation with ENTER leads to rewriting of value in actual parameter and return to previous menu. Example in pictures demonstrates a sequential for setup of the year.

**Measure time** sets measure time in seconds.



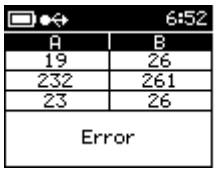

**Battery** menu for selection of battery type.

**Language** user can choice one of languages implemented. All messages and menus will be written in chosen language.

**Go Back** means return in previous menu.

### 2.4.3. Detector test

is full automated procedure for instrument health check. Build in routines and criteria set by user allows self check and assessment of functionality. Parameters for test are accessible only from PC console and must be set up or change by supervisor. Minimum and maximum detectable levels must be related to local test standard. Before starting test routine the unit must be attached to local testing standard which expected response was set in working parameters. There are




Params.test_a_min = 0 threshold for minimum on detector A
Params.test_a_max = 0 threshold for maximum on detector A
Params.test_b_min = 0 threshold for minimum on detector B
Params.test_b_max = 0 threshold for maximum on detector B

Result of the test is announced on display. In our example there is discovered any error. It is recommended to consult problem with manufacturer or distribution center. To leave test press ENTER.

# 3. Measuring

## 3.1. Measure method

GT-25 is designed for determination of response on radiation coming from specific direction in high radiation background field. Principle is based on compare of responses from two detectors mounted in one axes where one of the detector is collimated and the second detector is all directional. Counts of collimated detector are corrected for level of current radiation background measured with all directional detector. To increase sensitivity and precision it is recommended to perform measurements direct on surface and hold the unit in upright position. Instrument is protected against scratching and contamination with rubber protectors. Measuring result is number what says how much radiation was registered from front direction. If there is the background radiation overpowering the response from front direction, result of stripping may be negative and it that case there is displayed 0.
There is also possible to use GT-25 as single detector scintilometer. This is allowed in mode probe where counts of each detector are displayed.

GT-25 was designed to support daily production planning and monitoring in mines. Therefore there is sophisticated memory data management to safe measured mining profiles in transparent system and allow to user easy browsing in memory. All measurements are accompanied with date and time sticker and each profile with its identification string and code name of the operator.

## 3.2. Profile measure

To ensure right data identification there is data base system build in the firmware of the unit. It requires enter of identification codes. The first code is used for identification of operator who performed measurements. The second seven digits code keeps information about location of the place where a radiation profile is to be measured.

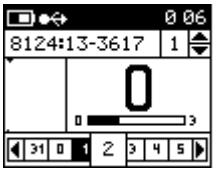
- **Log-in** A four digits numerical code is used for operator's ID. It allows enough code combinations for 9999 operators. To enter operator's ID it is generated menu **ID uživatele**. There are four digits. Each digit is serviced by buttons UP and DOWN the way that every button press increased (button UP) or decreases (button DOWN) number of selected digit. Set of characters used is limited for numerical and special characters only. There are 0, 1, 2 …9, +, -, /, and space. Moving from one digit



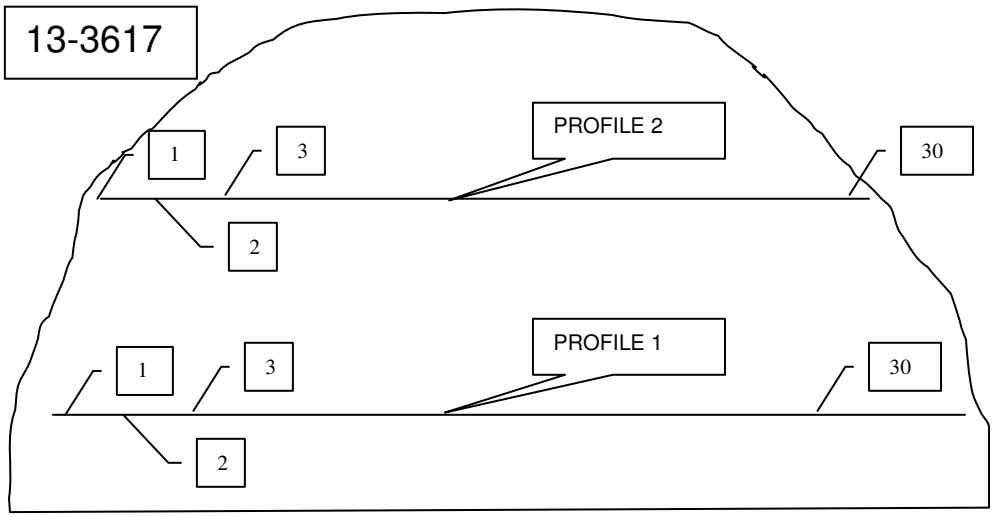
to another is arranged by buttons RIGHT and LEFT. Confirmation of inserted code performs after moving cursor on position OK and pressing button ENTER. The unit continues in next menu what is entering of locality description.

- **ID locality.** Main purpose of ID locality is clear and simple marking of measured data to be saved on database in simple order and it's later browsing. Eliminating papers and other simple notes in mine environment is one of the features of the unit. ID locality code is possible to input via users interface same way as was Log-in. There is also a way to enter list of localities from PC prior beginning work and user only selects pre-set ID from list. The first item on the list of localities is **New meas** what has to be selected and activated when there is no other suitable code ready. After selection or entering a new code and leaving through OK and ENTER like in Login starts measurement of new profile.




- **Profile measure**. A profile means sequention of measured points in any area. Typically an equidistant grid on fore wall in mines etc.




An example shows a profile with 30 measuring spots. Build in user interface tabularly shows to user what point of the profile is measured. It allows to go back and re-check the reading. For exact orientation there are following elements on display. A complete ID stamp. It is a combination of Operator's ID and locality ID. In our case it is 8124:13-3617. A small window right of the ID identifies number of measured profile within locality. It is obvious from picture

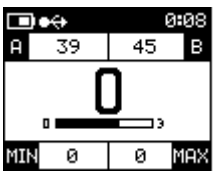
that lower profile on the wall was measured down close to bottom and the second profile under ceiling. Central part of the display is splitted in two windows. The window on the left harbors grafhical histogram showing measured intensities along profile. Current measured intensity is displayed right in large digits. Scrolling bar under intensity indicator shows measuring time left and is animated. Bottom bar consists of boxes with sequention numbers. Each box represents position on profile. Return or jump to any position performs after pressing buttons right or left. Measure process was for easy use simplified. Measurement starts with pre defined position on box 0 what is the first point of profile. Press of ENTER button starts measurement. Every next press of the ENTER button will restart measurement of this particular point. To move to next point user must press ENTER and hold it so long until pointer jumps to next point of profile (about 2 seconds). This way with simple sharing short and long press of one button is easily measured whole profile. Browsing along the profile is made with buttons RIGHT and LEFT. Switching between profiles with buttons UP and DOWN. To leave measure screen is necessary to activate End of Measurement what will apear everytime when number of preselected profiles was spent. With button UP user selects pofile 1, then 2. Next click will lead to End of Measure because in our case there were only two profiles expected. Number of profiles and points on profile is changeable. Parameters

Params.profile_num = 2
Params.point_num = 32

Are accessible via PC tool GT25con.exe.

Typing ENTER button when End of Measure screen is on will terminate measurement are return in Main menu.

- **Browsing** of measured profiles. If user enters after Login in any of profiles on the list and the profile has been measured it allows to browse measured values. However re-measuring is not allowed, memory is locked for rewrite. This status is indicated with icon lock in ID bar. Browsing is made via user interface driven with four button.
- **Probe** for fast scanning of any place without data base management. Allows fast measure. Also counts from each detector and reached minimum and maximum are indicated on screen. Measure triggers press of ENTER button. To leave service press any of direction buttons.



# 4. PC tools and maintenance

## 4.1. Program GT25con.exe

--- GT-25 CONSOLE ---
ver:0.1

1. No device
2. USB
3. COM port

Select connection type[2]:0. No device
1. '60000001'

Select device[1]:
Connecting device...Ok.
--- MAIN MENU ---

[he] help - displays help
[ve] version - displays device firmware version
[sa] status - displays device status
[gs] get serial - displays device serial number
[ss] set serial - sets device serial number
[gt] get time - displays device date/time
[st] set time - sets device date/time
[gp] get params - displays device params
[sp] set params - sets device params
[gm] get mca - displays mca params
[sm] set mca - sets mca params
[me] measure - measures spectra
[te] test - test
[cg] create gfw - creates firmware file
[up] upload gfw - uploads firmware file
[fl] flash fw - uploads firmware file
[re] restart - restarts device
[cl] clear logs - clears measure log
[ml] meas log - retrieves measure log
[gs] get screen - captures screen
[ q] quit - quits program

## 4.2. List of parameters

Params.use_lp = 0
Params.user_login = 1
Params.batt_rechargable = 0
Params.batt_capacity = 2000
Params.init_gain1 = 255
Params.init_gain2 = 255

```
Params.init_LLD1        = 90
Params.init_LLD2        = 180
Params.init_ULD1        = 1023
Params.init_ULD2        = 1023
Params.meas_time        = 3
Params.test_time        = 10
Params.contrast         = 33
Params.profile_num      = 2
Params.point_num        = 32
Params.cal_bg           = 0.416600
Params.cal_res          = 0.012820
Params.test_a_min       = 0
Params.test_a_max       = 0
Params.test_b_min       = 0
Params.test_b_max       = 0
Params.language_id      = 1
```

It is recommended by manufacturer to change only following parameters from the list:
**meas_time** if preset values in the units list does not fit.
**profile_num** to modify number of profiles per locality
**point_num** to change number of points on profile.
In coordination with local methodologist it is recommended to modify parameters **test_a a test_b min a max** the way to reflect real expected resposes from local specific standard.

## 4.3. Data record structure

```
1: 2008/01/01 00:05:06 '3/15':'03 -432'
        profile 1:    0    3    55    21    1050    874    365    257    114    54    21
10    2    1    0    0    .    .    .    .    .    .    .    .    .    .    .    .    .    .

        profile 2:    .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
                .    .    .    .    .    .    .    .    .    .    .    .    .    .    .
```

Data are exported in text format ASCII. As delimiters are used space characters. Every record starts with sequential number in our example 1: Next there is date time stamp and ID of the operator and ID of location. Profile starts with marker profile x: where x is number of particular profile on locality. Void places on profile are marked with dot for simple synchrony.

# 5. Technical data

| | |
|---|---|
| Detectors: | CsI/Tl ϕ 20 mm x 25 mm |
| Energy range: | 0.12 – 3 MeV |
| Collimator: | ϕ 40 mm, depth 50 mm |

Sensitivity in front to back direction:
Front detector 12 cps/MBq/m Cs-137
Rear detector 3 cps/MBq/m Cs-137

Sensitivity in back to front direction:
Front detector 4 cps/MBq/m Cs-137
Rear detector 11 cps/MBq-m Cs-137

| | |
|---|---|
| Data memory: | 1 GB micro SD Card |
| Communication interface: | USB |
| Display: | 104 x 81 dots, 40 x 32 mm<br>LCD with backlight |
| Dimensions: | W x H x D: 8 x 25 x 16 cm |
| Weight: | 2 kg |
| Power supply: | 4xAA NiMH or NiCd cell<br>External power DC 12V/ 0,5A |
| Operation length: | Minimum 24 hours at 20°C |
| Temperature range: | -20°C - +50°C |
| Environmental: | IP 68 |
| Packing: | GT-25 scintilometr<br>USB cable<br>Power adaptor 220V/50Hz to DC 12V/ 0,5A<br>CD with PC software tools<br>Suit case<br>User's guide |
| Manufactured by: | GEORADIS s.r.o., Novomoravanská 321/41,<br>619 00 Brno, Czech Republic<br>www.georadis.com |

**Strojírenský zkušební ústav, s. p., Brno, Česká republika**
*Engineering Test Institute, public enterprise, Brno, Czech Republic*

# CERTIFIKÁT
# *CERTIFICATE*

podle směrnice 2004/108/ES (elektromagnetická kompatibilita)
*according to Directive 2004/108/EC (electromagnetic compatibility)*

Číslo
*Number* **E-31-00014-10**

| | |
|---|---|
| Držitel certifikátu - výrobce<br>*Owner of certificate - manufacturer* | GEORADIS s.r.o.<br>Hudcova 56b, 621 00 Brno<br>Česká republika - *Czech Republic* |
| Výrobek<br>*Product* | Směrový radiometr<br>*Directional radiometer* |
| Typové označení<br>*Type designation* | GT - 25 |
| Podklad pro vydání certifikátu<br>*Basis of certificate* | Závěrečný protokol č. 31-8619 ze dne 2010-01-25<br>*Final Report No. 31-8619 dated 2010-01-25* |

Strojírenský zkušební ústav, s. p. potvrzuje, že výše uvedený výrobek splňuje základní požadavky směrnice 2004/108/ES (nařízení vlády č. 616/2006 Sb.).

*The Engineering Test Institute confirms that the above-mentioned product fulfils the essential requirements of Directive 2004/108/EC (Government Regulation No. 616/2006 Coll.).*

Brno 2010-01-25

STROJÍRENSKÝ ZKUŠEBNÍ ÚSTAV, s.p. CZ 1

.....
Ing. Petr Mašek
ředitel - *Director*

**E-31-00014-10, strana - *page* 1 (1)**