Thermo SCIENTIFIC

Operating Instructions DB-067 E

RadEye G20
RadEye G20-ER
RadEye G20-10
RadEye G20-ER10

X-Ray Gamma Survey Meter

REVISIONS SHEET:

Rev.	Rev. state	Dept. resp.	Name	Rev. page	Cat. *)	Explanation
	10.12.07	RM&P-E	Pij			> **V 1.32**
A	03.03.08	RM&P-E	Pij	cpl.	C	
B	03.04.08	RM&P-E	Tr	9-4	I	Diagram 9-2
C	28.07.08	RM&P-EH	Pi	cpl.	I	> **V 1.50** Low Battery warning
D	12.10.09	RM&SI-E	Ff	0-7, back	C	Name of company
E	02.02..11	RM&SI-E	Pi	4-8, 4-9, 7-13, 7-15	A	**> V 2.04** BT-com cover Source test
F	18.02.11	RM&SI-E	Pi	 7-16	C	**> V2.05** Menu selection
G	28.04.11	RM&SI-E	Tr	9-2	A	Photon Energy range added
H	12.09.12	RM&SI-EH	Pij	 4-12 6-6 8-1 9-1 10-1 11-1 13-1	A	**> V 3.01** Change of menu language Calibration expiration date New chapterl Rouble shooting Maintenance Spare parts Optional Accessories Annex
I	26.11.12	RM&SI-E	Tr	12-5	A	**Energy dependency**

*) Category C: editorial correction
I: clearing improvement
A: substantial amendment
Explanations must be given, at least with Category A.

CONTENTS:

TABLE OF FIGURES:

WEEE Compliance:

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist the detection of substances subject to the RoHS Directive are available at **www.thermo.com/WEEERoHS**

SAFETY INSTRUCTIONS

The RadEye G20 is suited to perform highly accurate dose measurements. It is however **not** intended for use as a legal personal dose meter.
The RadEye B20 is **not** well suited for pulsed radiation. There will be a significant under estimation at dose rates during pulse of more than 0.2 R/h.
In case the dose rate measuring range is exceeded, the value of the upper end of the dose rate measuring range is used for the dose integration.
The instrument must not be used in explosive atmosphere.
Do not use the unit if error messages appear on the screen.

The earphone connector at the bottom side of the instrument must be exclusively used by equipment that is specified for use with RadEye G20.

The RadEye G20 is **not** suited for pulsed photon radiation.

1. Introduction

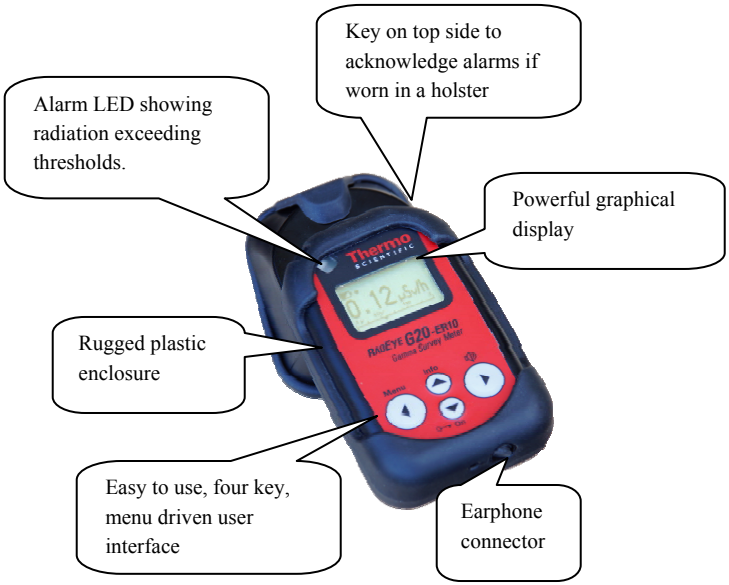
The instruments of the RadEye G20 series are modern compact survey meters for sensitive gamma and x-ray dose rate measurements. The instrument incorporates a sensitive GM pancake tube detector allowing the dose rate measurement from background levels. ER-versions extend the measuring range up to 100 mSv/h (10 rem/h respectively 10 R/h).

RadEye G20-10 and RadEye G20-ER10 are energy compensated according to the SI-standard units of ambient dose equivalent H*(10) (= “deep dose”) and show a flat response from 17 keV to 1.3 MeV. RadEye G20 and RadEye G20-ER are energy compensated according to roentgen units (40 keV to 1.3 MeV). In this context it is important to note, that users may select “R/h, Sv/h or rem/h” as a display unit, with the understanding that the energy response characteristic is not altered by this selection. Within the RadEye G20 family the relation 1 R = 1 rem =10 mSv is used.

The last 1600 mean and maximum values of the count rate or dose rate are recorded internally and can be read out via serial interface. Additionally the RadEye G20 logs the last 250 alarms, errors and changes of the configuration. All events can be read out via serial interface.

A real time clock is provided to add a time stamp to all buffer data. The characteristic feature of the RadEye G20 is the use of sophisticated low power technology components and microprocessor based fully automatic self checks. No maintenance is required.

All or selected menu functions described in 3.1 can be configured to be invisible and inaccessible by the user.
Thus the instrument can be configured to both, an extremely simple mode allowing just LCD-illumination and alarm acknowledgment to a very versatile mode for the more experienced user.



2. Installation and start-up

2.1 Scope of delivery

The RadEye G20 instruments are delivered in a box together with two AAA cells and an operating manual.

Ample space is provided for a data cable or a test adapter.

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Ordering information for accessories see chapter 11

2.2 Inserting the batteries

The two AAA-Alkaline cells as delivered with the instrument allow about to 900 h with RadEye G20/G20-10 respectively 700h with RadEye G20-ER/G20-ER10 of normal operation. AAA size rechargeable batteries can be used as well.

- Switch off the measuring instrument.

- Remove rubber sleeve.

- Open the cover of the battery compartment.
  Use of a coin is recommended.

- Exchange the batteries according to the shown polarity.
- Close the compartment cover hooks first, care for the rubber seal being in its groove.
- Switch on the unit again. (see chapter 2.4)

The instrument continues working in the operating mode set last (see chapter 3.2).

The measured values in the history memory remain stored.
The real time clock for time stamp of history values and logbook continue operation, if batteries are exchanged without delays. If Real Time Clock is set, actual time and date is displayed for 3 s (see chapter 2.4).
After power on the RadEye first display zero dose rate. After the first detector pulse the measurement will be started.

If correct timing information of logbook and history is required, the Real Time Clock should be set by means of the PC-program or via menu function “Set Time/Date”.

To keep RTC running during battery exchange, batteries must be exchanged without delays.
RTC will always be reset, if instrument is stored without batteries for more than 10 seconds.
History data and measurement parameters are stored permanently, even if batteries are removed.

Even without RTC information the relative time information of logbook and history is corrected to the actual PC clock time during read out unless the batteries had not been removed between the event and the data read out.

2.3 Mounting of the protection sleeve

The rubber protection sleeve improves ruggedness to mechanical shocks.

For mounting of the sleeve first put the instrument into the bottom of the sleeve. Then pull lower edges of the sleeve, one after the other into its right position.

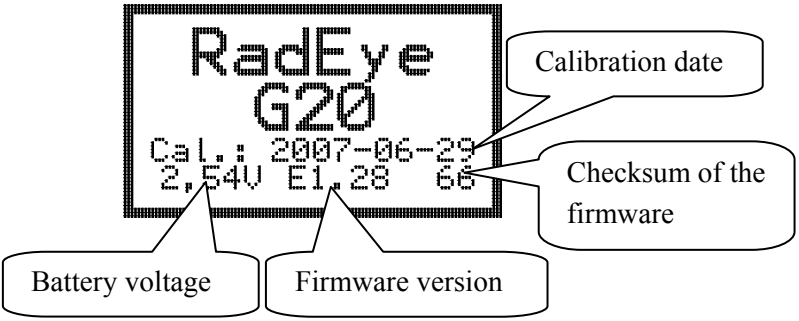
First step

Second step

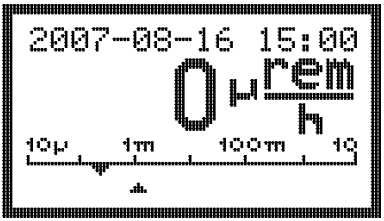
2.4 Switching the unit on (example refers to G20-10, calibrated in rem/h)

To switch on the RadEye G20, **keep** the "On/▼" button pressed for **at least one second**. The sound generator (beeper) is initiated.

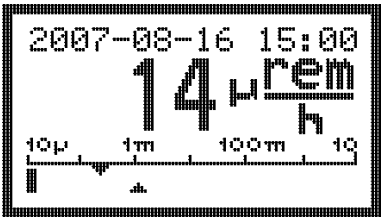
After switching the unit on, the RadEye G20 starts working with the parameters previously selected (operation mode, calibration factor, alarm thresholds etc.).



If the real time clock is set, actual time and date is displayed for 3s.



The RadEye G20 first displays 0 µrem/h. After the first detector pulse the measurement will be started.



With the setting of the history recording interval of 120 s, the last 52 hours of operation will be stored in the history memory.

The parameters (except calibration parameters) can be changed with the help of RadEye buttons and the optional PC-program "RadEye.exe" V1.30 and the cable 42540/29 or /26.
The calibration parameters can only be changed in the factory using special software tools.

3. Configuration

3.1 Menu functions

To enter the operating menu, press the “Menu” key.
Scrolling through the single menu options is effected by the “▲/Info” and “▼/On” keys.
The display returns to its initial default setting in case no key has been activated for more than 10 seconds.
A “✓” to be found behind some menu options means that the respective function is active.

The menu consists of a main menu and several sub menus. Some menu options are disabled for some operation modes and display modes.

Using the PC-Software and an interface adapter, any of the functions can be hidden. This allows the user to be given only the functions necessary to accomplish his measurement duties, thus simplifying the handling considerably.

To select a menu option, release the “◄/Menu” key as the respective menu option has been reached.

The meaning of the Menu key may change with the selected menu. The meaning is shown on the bottom of the display.
Change: Edit values
Off, **On**: Switching a function on and off
Select: Select a default display mode
Yes: Confirmation of an action
Exit: Exit menu
In Change menu the "▲/▼" keys are used to change a digit of an alarm value.

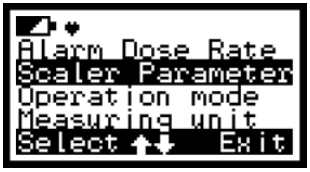
3.1.1 Menu structure

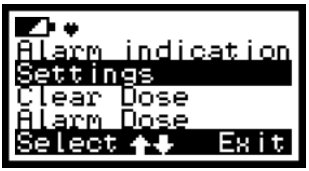
MENU DISPLAY	SUBMENU DISPLAY	DESCRIPTION OF THE FUNCTION ACTIVATED BY THE "◄/MENU" KEY
Switch off		RadEye is switched off. Time and stored data are maintained
Backlight		If selected the backlight is always on. Otherwise the backlight extinguishes after 10s
Measuring unit	rem/h	Select Dose rate (rem/h)
	R/h	Select Dose rate (R/h)
	Sv/h	Select Dose rate (Sv/h)
Operation mode	Ratemeter	Select Ratemeter mode
	Scaler	Select Scaler mode
Scaler parameter	PresetTimeMode	Scaler mode with fixed time
	PresetCountMode	Scaler mode with fixed count number
	Set time/count	Edit preset time and preset count
	Auto restart	Auto restart of scaler measurements
Alarm Dose Rate		Allows setting of Alarm 1 and 2 for dose rate mode (rem/h, R/h, Sv/h).
Alarm Dose		Allows setting of Alarm 1 and 2 for dose. (rem, R, Sv).

MENU DISPLAY	SUBMENU DISPLAY	DESCRIPTION OF THE FUNCTION ACTIVATED BY THE "◄/MENU" KEY
Clear Dose		Clears the accumulated dose.
Settings	Battery type	Selection of battery type: rechargeable or non-rechargeable batteries. Correct low battery warning depends on this setting.
	Autosend	If activated, the instrument sends a data string periodically to the infrared port. This is used for radio transmission units.
	Single Pulse	Enabling and disabling of single pulse indication. Activation is done by audio keys (right button and top button). Alternative to "Finder".
	Finder	Enabling and disabling of audible radiation intensity. Activation is done by audio keys (right button and top button). Alternative to "single Pulse".
	Set Time/Date	Set date and time of the real time clock.
	Source test	Test the instrument with a small source
	Language	Change the menu language of RadEye
Alarm indication	LED	Enabling and disabling of the optical alarm
	Sound	Enabling and disabling of the acoustic alarm and the audible indication of keystrokes
	Vibrator	Enabling and disabling of the vibration alarm
Show alarm		Display of alarms stored in alarm log.
Text info		Displays the text stored in the RadEye
Bluetooth	Master	Combo: Enable automatic connection to another BTcom cover
	Remote/PC	Combo: Remote device PC: RadEye can be connected to a PC
	BTcom	Enable or disable the BTcom cover

3.1.2 Main menu

The main menu offers the following displays:





The above illustration depicts all menu options for the main menu possible for dose rate mode.

3.1.3 Measuring unit

This submenu is used to select the measuring unit for ratemeter and scaler measurements.

Attention:

Whether the instrument measures dose rate (G20 or G20-ER) or dose equivalent (G20-10 or G20-ER10) depends on the hardware of the energy filter and cannot be changed by the selected unit.
I. e. true R/h energy response is achieved only for RadEye G20

and RadEye G20-ER. However, for convenience reasons, the user may select this unit for RadEye G20-10 and RadEye G20-ER10 with the understanding that the measured quantity is still dose equivalent H*(10) and that the relation to the calibration is set as 1 R = 1 rem = 10 mSv.

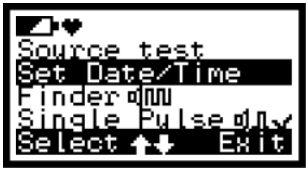
3.1.4 Operation mode

This submenu is used to select between ratemeter and scaler mode. A "✓" shows the active configuration.

3.1.5 Scaler parameter

This submenu is used to set the parameters for scaler measurements. "PresetTimeMode" is used to measure a defined time. "PresetCntMode" is used to measure a defined number of counts. With "Auto restart" the RadEye G20 restarts automatically the measurement. "Set Time/Count" edit the preset time and count.

3.1.6 Settings



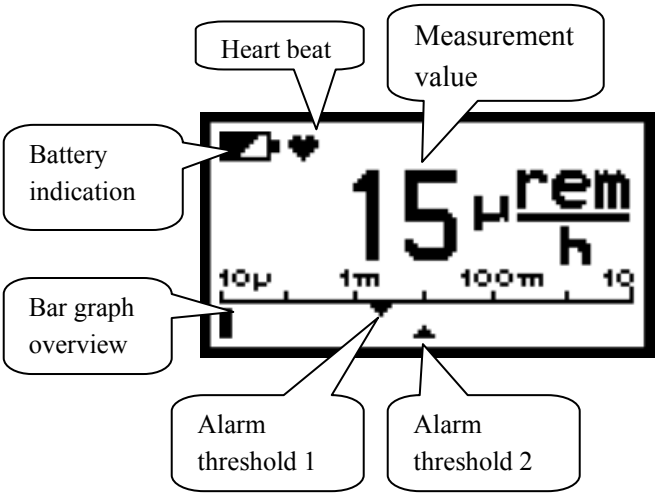
In this submenu it is possible to select between audible single pulse indication and finder mode. A "✓" shows the active configuration.
With "Autosend" the RadEye sends a data string periodically to the infrared port. "Batt.type" is used to set the correct threshold for warning message "LOW BATT". "Set Time/Date" sets time and date of the RTC. Submenu "Language" is used to change the langenage of RadEye menu.

3.1.7 Alarm indication

The submenu alarm indication is used to select the LED, sound and vibrator for alarming. A "✓" shows the active configuration.

3.2 Ratemeter

The standard display set by factory is indication of the actual dose rate.



Pressing the ▲/Info key shows upon the

- 1st click: the accumulated dose (rem, R or Sv) is shown. It displays the accumulated dose and the remaining time until the dose alarm 1 is reached, assuming the current dose rate will persist.
- 2nd click: the mean value and max value of the measured dose rate (R/h, Sv/h or rem/h), together with the time indicated since the last reset.
- 3rd click: standard display

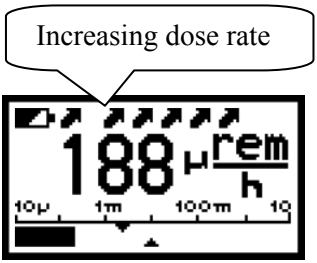
After 10 seconds or after 3rd click standard display with dose rate indication is activated again.

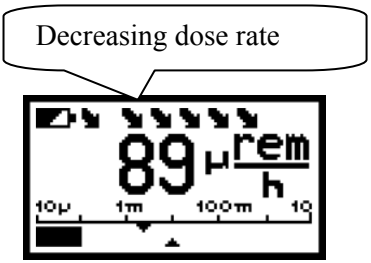
1st click

2nd click

3.2.1 Trend indication

A trend indication is given, if the measured dose rate is increasing or decreasing.



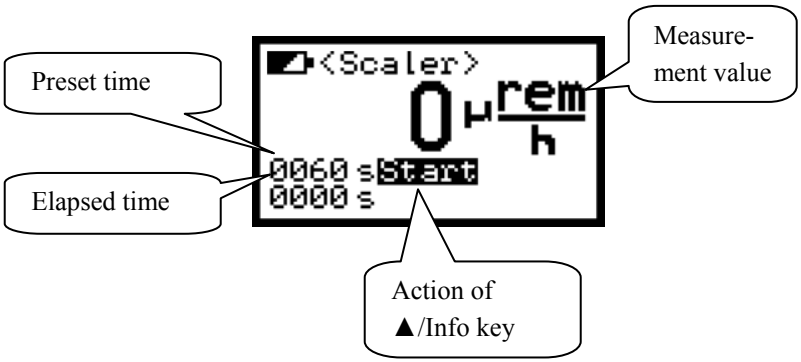


For accurate measurements, only readings without trend indication should be used.
A trend indication is not given at count rates of less than 1 cps.

3.3 Scaler mode

To enter the scaler mode select in the submenu „Scaler“.

The scaler mode starts with the parameter set in submenu „Scaler Parameter“.



To start the measurement, press the ▲/Info key. While the measurement is in progress “Stop” is blinking.

3.4 Alarm thresholds

There are two alarm thresholds each allocated to dose rate and dose.

In order to avoid dose alarms while using the instrument exclusively as a rate meter, the dose alarms can be set to the maximum level.

Configuration of the alarms is possible via infrared interface or via the menu.
As to the alarm activation, please also read chapter 4.2.

3.5 Setting alarm thresholds

The menu options **Alarm Dose Rate** and **Alarm Dose** allow the alarm thresholds to be modified. For this setting, the user has 255 seconds time. Changing the value is effected by pressing the "◄/Menu" (Change) button if the corresponding "Alarm" is selected:

To increment the number press the "▲/▼" arrow keys. To go on to the next digit or to quit the edit mode, menu use "◄/►" keys. Once the last number has been set, quit the editing mode by pressing the "Exit"-key. Then, the value set is saved and after 10s the unit returns to the basic display.

Example:

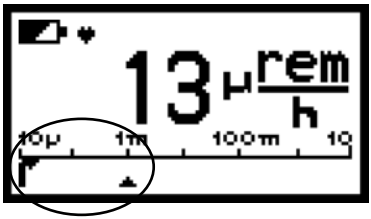
The dose rate alarm threshold must be changed.

Press “Menu” key, and ▲/▼keys until **Alarm Dose Rate** is selected.

Then enter change menu by pressing “Change” key.

Edit value by pressing ▲/▼, select digit by ◄/► keys
Pre unit “µ” and “m” may be chosen as well.

Leaving the last digit with the right arrow key:
Confirm storage of edited value pressing “yes”



The set points of the actual dose rate alarm thresholds are seen at the marks on the intensity bar scale. The upper mark shows alarm threshold 1, the lower mark shows alarm threshold 2

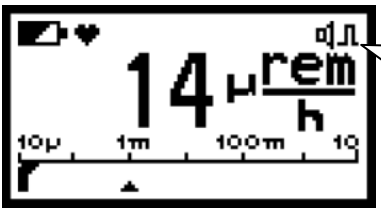
4. Operation

4.1 Audible single pulse indication and finder mode

With the single pulse indication being selected, each pulse of the detector generates a short audible signal emitted by the beeper.

An audible alarm signal caused by exceeding the alarm threshold is not given while single pulse indication or finder mode is active.

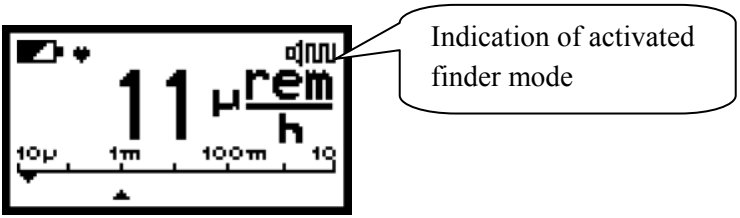
The single pulse indication must be enabled in the menu.
It is activated and deactivated by two times pressing the right or top button:



Indication of activated single pulse indication

Finder mode:
In the Finder mode, the sound frequency depends on the pulse rate of the detector. The more detector pulses above the count rate that is present at the moment of the activation of the finder mode are captured by the detector, the higher the tone.

The finder mode must be enabled in the menu.
It is activated and deactivated by two times pressing the right or top button:



4.2 Alarm indication

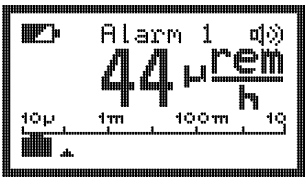
Each time the first alarm threshold is exceeded, the alarm devices beeper, LED and the vibrator become active, if they are enabled.

Alarm 1: LED slowly blinking, two frequency alarm tone

Alarm 2: LED quick blinking, continuous alarm tone

Dose Alarm: LED constantly on, continuous alarm tone, vibrator slow.

The alarm tone and vibrator are acknowledged by a short key depression, the LED remains pulsing. The alarm is extinguished, when the first alarm threshold is remained under.

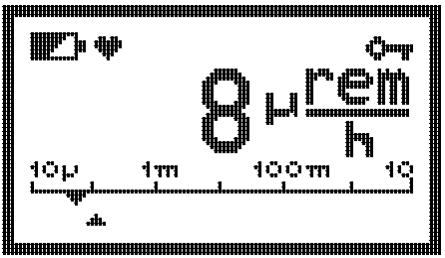


4.3 Additional information

In addition to the basic display, using the menu options, requests for further information can be started such as e.g. the setting of the enabling and disabling of the various alarm indicators.

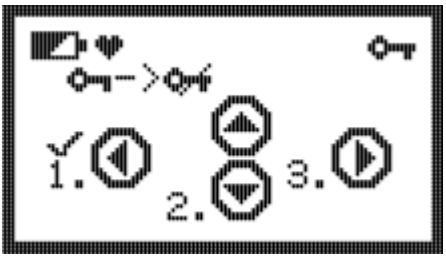
4.4 Key Lock

Pressing the "On/▼" key for at least 5 seconds, locks the key pad:



It is recommended to lock the keys when wearing the unit in the holster. Thus reduced battery time because of additional power consumption by illumination of the LCD or other unintended operations is avoided.

Unlocking is performed according to the LCD instructions upon pressing any key:



Press left key first, then lower key and then right key.

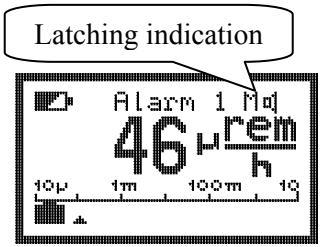
4.5 Earphone

For alarming in noisy environments or for undercover investigations an earphone is available. See ordering information page 2-1.

The earphone is connected at the bottom of the instrument after opening the rubber protection seal.

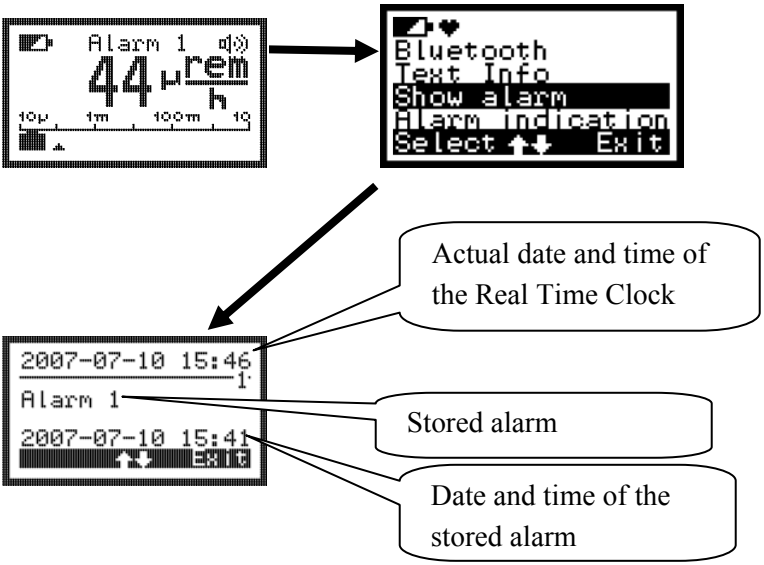
4.6 Alarm latching

Via PC-program it is possible to configure an alarm latching. Alarm latching means the alarm is stored for the configured time from 0 s (= off) to 9999 s.
A latched alarm is indicated by an “M” near by the alarm indicator. When the alarm is acknowledged the RadEye returns to normal operations.



4.7 Show alarm

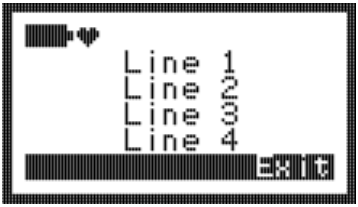
By selecting the menu point “Show alarm” the alarms stored in the alarm log are displayed together with the time of alarm and the actual time.



By pressing the ▲ and ▼ arrow keys you can scroll through the alarm log. By pressing the right button the display returns to the menu.

4.8 Text Info

Via PC program “RadEye.exe” it is possible to place text information in the RadEye. This text information can be displayed with the menu function “Text Info”.

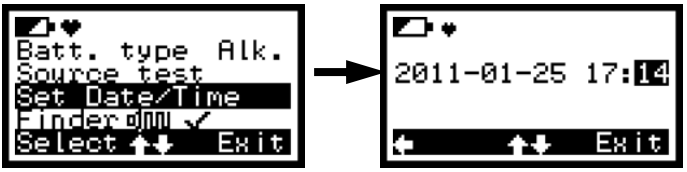


4.9 Display rotation

If enabled, a short press on the “On/▼” key flips the display. If the “On/▼” is pressed again or if “Menu/◄” button is pressed, the screen flips into the normal orientation. This feature is very useful in conjunction with the sample changer 42506/901001 in order to achieve a good reading angle when sitting at a table.

4.10 Set Date and Time

Setting of date and time takes place via menu function Setting → Set Date/Time.



The setting uses the format YYYY-MM-DD hh:mm. The fields are selected with the keys ◄/►. With the keys ▲/▼ the Year, month, day, hour or minute can be changed. After setting the date and time the real time clock is set and is used for alarm logbook and history.

4.11 Battery type

Selection of battery type: Rechargeable or non-rechargeable batteries. It is needed for correct low battery warning. Type “Alk.” has a threshold of 2.1V. Type “NiMH” has a threshold of 2.43V. See also chapter 6.5.

Battery type “Alkaline”

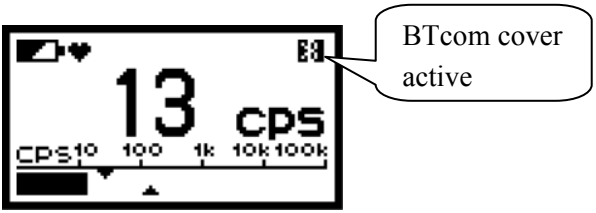
Battery type “NiMH”

4.12 BTcom cover

For detailed installation and operation procedure refer to BTcom cover manual DB-076 E which is delivered together with the Bluetooth battery lid.
The BTcom cover applies to the RadEye switched off.

With menu item “BTcom”, the user may switch on / off the BTcom cover. “✓” means BTcom cover is active
With “Master”, the BTcom cover connects automatically to another BTcom cover. In this case, the RadEye cannot be connected to the PC. For more information please read the manual DB-093 E.
By selecting “Remote/PC”, the BTcom cover is able to connect to a PC.

If the BTcom cover is active but not connected to any PC, a Bluetooth symbol is flashing. If the BT-communication is established, the symbol is always on.

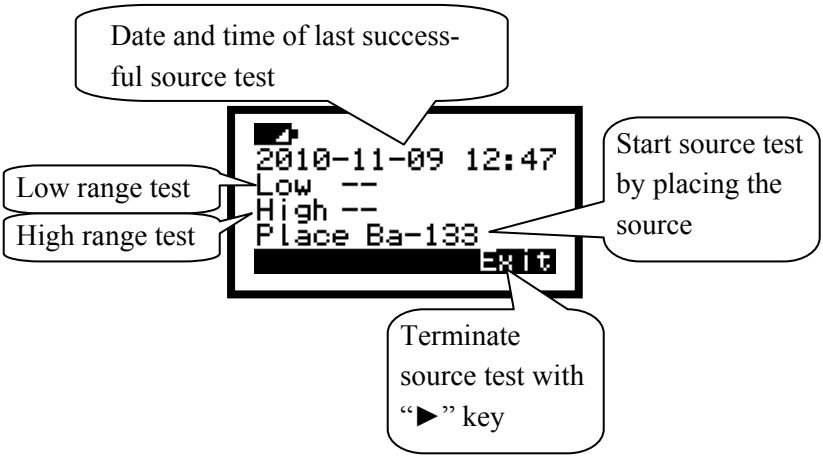


4.13 Source test

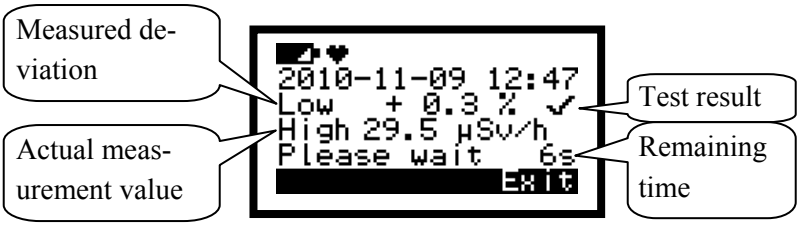
Source test is started with menu item “Source test” in submenu “Settings”.

Source test starts with the parameters previously set with radeye.exe. Furthermore it is necessary to set the actual date and time.

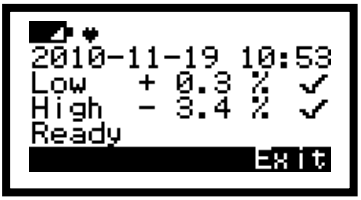
Start the source test without source. The RadEye check the background value. If the background is lower than 0.15 µSv/h the user is asked to place the source. High range test is only performed with RadEye G20-ER and G20-ER10.



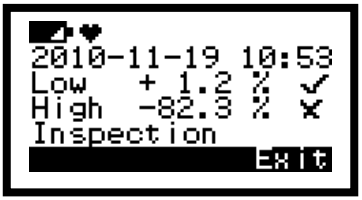
After placing the source, source test is started automatically. During measurement the display shows the actual measurement value. After measurement the deviation is calculated and displayed. The test is successful when the deviation is between -20% and +20%. During source test the alarm LED is permanently on.



At the end of source test, is displayed. If every test is successful the actual timestamp is stored and displayed together with the message “Ready”. If source test fails, the message “Inspection” is displayed.



Source test is successful



Source test fails. RadEye should be sent to inspection

4.14 Change menu language

Via menu item “Language” in submenu “Settings” the may change the language of the RadEye menu.

5. Measurement units

Direction of maximum response

To detect hidden radiation sources, the alarm threshold must be set to the lowest value that does not produce fail alarms. This is typical a value of 0.2 to 0.3 µSv/h (20 – 30 µrem/h, µR/h).
Due to it's almost 100 times higher efficiency for gamma emitters, the RadEye PRD is more suited for this task, than the RadEye G20.

For measurements at spots with high local contamination respectively dose rate, the extension adapters 42506/7075, /7076 and /7077 in conjunction with the adapter 42506/7078 can be used.

The user may as well select R/h as a displayed measuring unit with the understanding that 1 R/h is simply set equal to 1 Rem/h and that consequently energy dependant deviations to the exposure rate (and air kerma rate) will occur.

The RadEye G20-10 and G20-ER10 is factory calibrated to the ambient dose equivalent rate H*(10) in a depth 10 mm for Cs-137 gamma radiation (662 keV).

For details of the response curves see technical data section.

6. Functional test

When the instrument is switched on, it will show zero dose rate until the first detector pulse occurs.
The radiation meter performs continuous self-check routines. A complete failure of the detector during operation will be indicated after 1 minute on the LCD and be announced by the beeper. The same applies to the battery voltage.

6.1 Functional test

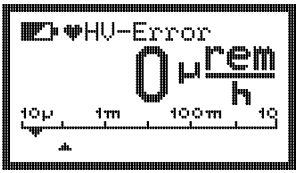
To carry out a simple test, shortly press any key. A short audible pulse has to be released and the LC display is illuminated for some seconds.

The heart symbol next to the battery indicator must be “beating”. This indicates that the cyclic tasks as calculating measurement values and checking for alarm thresholds are active.

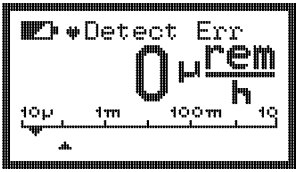
6.2 Failure indication

In case of a failure the beeper generates a sharp single pulse every 32 s.

The corresponding failure message is displayed in the LCD:



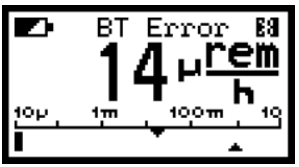
Error high voltage generation



No detector pulse within 128 seconds

EEPROM with calibration data shows EEPROM Read or EEPROM Write error.

A Watchdog Error indicates, that the micro controller has problems to work on it's tasks in a given timeframe. Reasons are strong electromagnetic pulses, firmware errors or hardware issues.

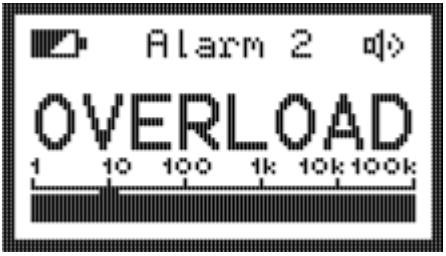


The BTcom cover failed to initialize the Bluetooth module

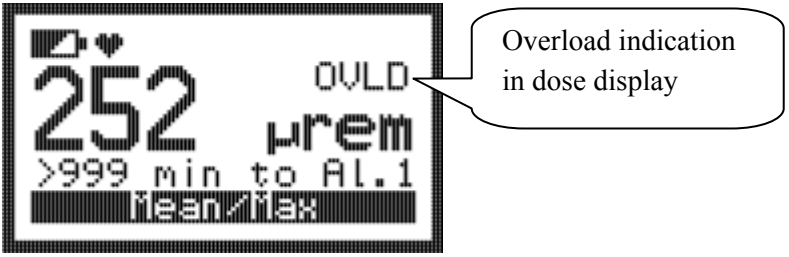
6.3 Overload indication

If the count rate exceeds the maximum count rate, or if the dose rate exceeds the maximum dose rate an overload indication is given.

	Maximum dose rate
RadEye G20 RadEye G20-10	200 mR/h 200 mrem/h 2 mSv/h
RadEye G20-ER RadEye G20-ER10	10 R/h 10 rem/h 100 mSv/h



The dose value is marked with an overload indication, if a dose rate overload occurred since the last dose reset.

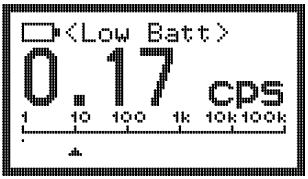


6.4 Response test with test adapter

The test-adapter 42549/48 offers a convenient way to verify the radiation response performance of the RadEye G20. This “check source” contains 50 g of natural Lu2O3 (which corresponds to approximately 2400 Bq Lu-176). Due to the low resulting gamma dose rate this yields a net dose rate of the RadEye G20-10 of approximately 0.25 µSv/h. The operational advantage of the test-adapter is given by the fact that each and every individual adapter has the same emission rate, and that due to the long life time (3.6E10 years), which exceeds the age of the universe significantly, neither source specimen, nor half life corrections need to be performed. Furthermore the specific radioactivity (approximately 48 Bq/g) of natural Lu2O3 is well below the threshold values according to IATA, respectively NRC (USA) or StrSchV(Germany) in respect to the scope of dangerous goods definition and transport regulations of radioactive material.
At a typical background count rate < 0.1 µSv/h, it is sufficient to verify the response within 300 seconds for a 10 % statistical uncertainty.
For a faster response verification Ba-133 check sources (or other gamma sources) in the range of 100 – 400 kBq are suggested.

6.5 Low Battery warning

If the battery voltage is below the configured threshold (see chapter 4.11) the following warning appears:



The beeper generates a single pulse every 32s. This acoustic warning can be suppressed by pressing the alarm acknowledge key. After 8h this warning comes up again. The battery needs to be changed. However, the RadEye can still be operated for several hours.

If the battery voltage falls below 2V, the battery symbol starts flashing. An acoustic warning is generated every 8s and can't be acknowledged. The battery needs to be changed as soon as possible.

6.6 Calibration expiration date

If the expiration date is enabled and date is expired, the following warning message is shown at start up of the RadEye:

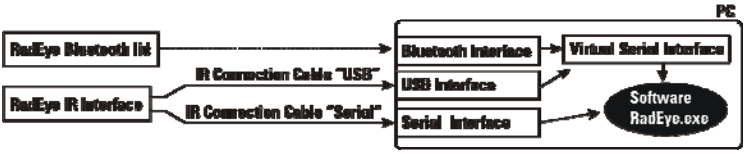
If the expiration date is enabled the RTC is not set (e.g. after change of batteries) the following warning message is shown at start up.

After acknowledge the RadEye works as usual.
The expiration date can be changed with the tools “CalRadEye” or “RadEyeSetCalibDate”.

7. PC configuration

7.1 Ways to connect to a PC

A RadEye unit can be connected to a PC either by either serial interface, USB interface or by Bluetooth [TM 1].



7.1.1 Wireless connection via Bluetooth

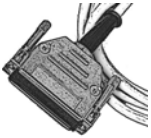
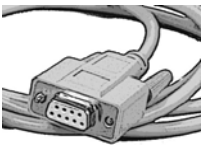
Details about the Bluetooth communication are provided through the manual DB-076 E delivered with the optional Bluetooth battery cover. Please note that the connected PC must be equipped with a Bluetooth interface as well.

[1] Bluetooth is a trademark of Bluetooth SIG, Inc., Bellevue, Washingston, U.S.A.

7.1.2 Cable connection

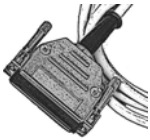
It is recommended to use the optional RadEye desktop holder to align the RadEye's IR window with the IR window of a connection cable.

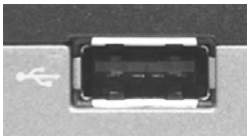
The optional serial adapter cable is used to connect to a RS232 port of a PC.


This serial port is selected directly in the RadEye.EXE software (see also chapter 7.4.4).

Alternatively, the optional USB connection cable is used to connect to an USB port.





Using the USB connection requires the installation of driver software that will generate a virtual serial port that can be selected in the RadEye.EXE software. The driver is delivered on the RadEye.EXE software installation CD ROM.

Installation of a connection cable

Using the hardware provided and without exerting too much force, attach the connections of the adapter cable to the PC and to the RadEye desktop holder.

7.2 Connection to a PC

The connection of the RadEye to a PC requires an adapter cable.

Adapter cable Order No. 42540/29 is used to connect to a RS232 port of a PC.

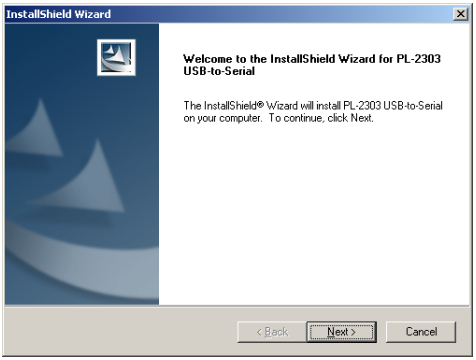
Adapter cable Order No. 42540/26 is used to connect to an USB port. Using the USB port requires installation of driver software first.

Using the hardware provided and without exerting too much force, attaches the connections of the adapter cable to the PC and to the RadEye desktop holder.

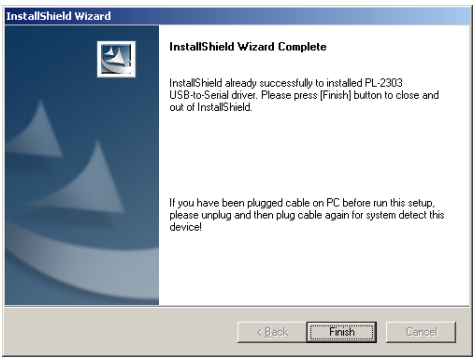
The following steps will show how to install the USB-driver under Windows XP.

Power on your computer and boot to Windows.

Run the driver setup program “RadEye-USB.exe”. Click **Next** to continue and start the installation.



Wait until the InstallShield Wizard informs you that driver is successfully installed.



Click the **Finish** button to close the InstallShield program. If you have plugged the adapter into the PC while running the setup installation, please unplug and replug the adapter for the system to detect the device.

7.3 Installation of the optional RadEye.EXE software

Open the file “Setup.EXE” on the optional RadEye.EXE Software installation CD Rom and follow the installation guideline. The installation generates a RadEye.EXE Icon on the desktop.

7.4 Starting the program

The icon can be used to start the software RadEye.exe by double click.
Once the RadEye.EXE program has been started, device parameters are displayed on the screen.

7.4.1 RadEye G20 Device Parameters

The Frame "RadEye G20" contains the unit's serial number and version number of the software. Click on the Read button, the Parameters of RadEye G20 will be read out from device and shown in the Frame.

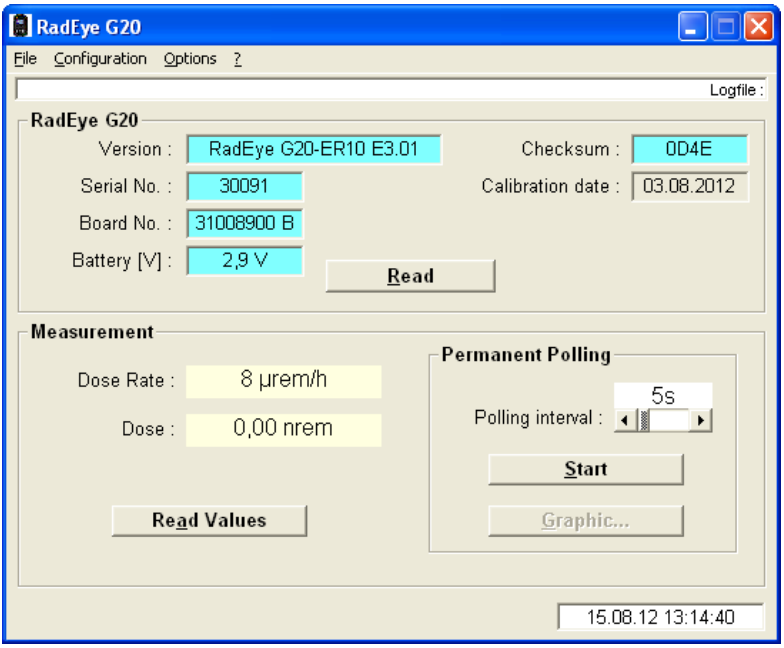


Figure 7-1: Main Window

7.4.2 Measurements

After pressing the button Read Values the current Count rate, dose rate and dose are displayed in this frame.
With button Start the measured value is read from the unit at a certain polling interval. Use the scroll bar to define the polling interval. You can select a value between 1 and 3600 seconds. The dose rate can be displayed numerically and graphically. Click on the Graphics… . A diagram is displayed that gives a representation of the dose rate values versus the time.

The current measured value is added at the right-hand side, and the diagram is shifted to the left. Up to 100 measured values can be represented. The graduation of the ordinate is automatically adjusted to the measured values supplied by the unit.

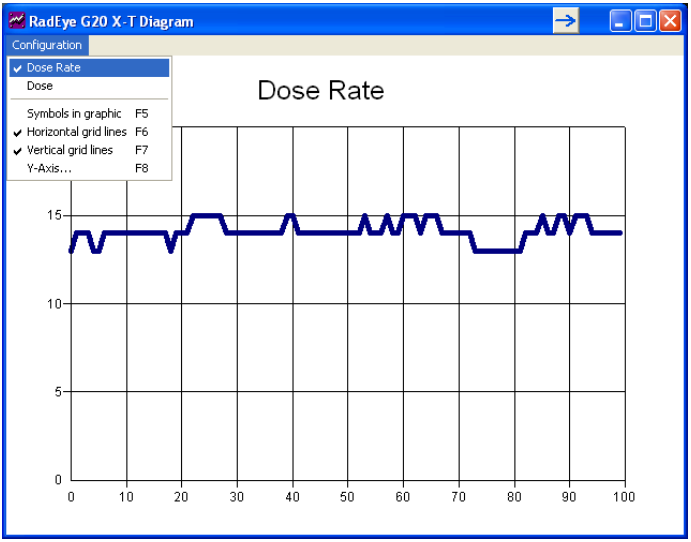


Figure 7-2: Measurement graphics

Via menu “Configuration” the user is able to display the dose and to personalize the diagram.

7.4.3 Creating a Measurement File

The actual measured values Count rate and Dose rate that are shown in the "Measurement" display field can be stored in a measurement file.

To do this, open the File menu, click on **Open Logfile...**, and enter path and name. The file is stored with the file name extension ".log".

If another file of the same name exists, the system asks whether that file shall be overwritten or the new measured data shall be appended to the existing data.

Once you have pressed OK to confirm the entries, the measurement logfile is created and the polling measured data is stored in the scan interval you have defined. An open measurement file is indicated by the name and the path of the measurement logfile that appears in the top right-hand corner of the window.

To terminate data storage, open the File menu and select the **Close Logfile** menu item. No further data is recorded.

Open the **File / View Logfile...** menu to view the measurement logfile.

For training and demonstration a prior recorded logfile can be replayed by opening **Replay logfile**.

With the buttons Start and Stop together with the polling interval the replay can be controlled.

Close Replay switches back to accessing measurement values via infrared interface.

The measurement logfile is an ANSI text file with columns that are separated by <TAB>. This enables this file to be read easily into other programs (such as Excel) where the data can be processed.

The first line of the measurement logfile contains the unit name, the file name, and the path. Serial number and Device identification are specified on the second line.

Date and time of the measurement are specified in the columns under the field names "mm.dd.yy" and "hh:mm:ss". The time setting corresponds to the PC system time.

The "Counter" column contains the numerical value of the counter measurement. The "Unit" column informs about the unit. The "Dose Rate" column contains the numerical value of the dose rate measurement. The "Unit" column informs about the unit (rem/h, Sv/h or R/h).

7.4.4 Select serial interface

Via **Configuration / Com settings**... menu another window is opened from which you may select the corresponding interface.

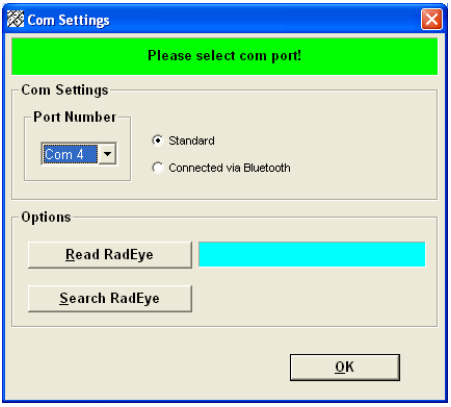


Figure 7-3: Select serial port

If the connection shall be established with the optional Bluetooth battery cover, then option “Connected via Bluetooth” must be activated. Please refer also the manual db076e delivered with the cover.
“Read RadEye” is used to check the connection to the device.
“Search RadEye” scans all Com-Ports to detect a RadEye.
This action may need some time, depending on the number of available Com-ports.

7.5 Configuration

The configuration of the RadEye can be protected with a password.

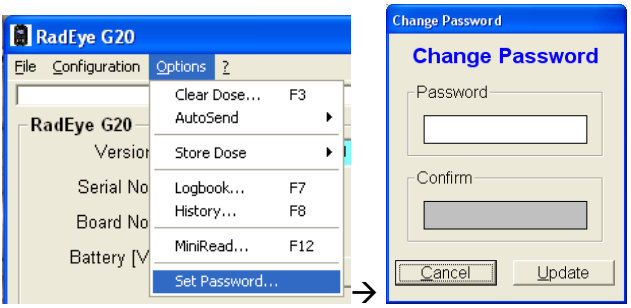


Figure 7-4: Password Setting

No password is set during the first installation of the software. A reminder window is activated, if the configuration window is opened.

Figure 7-5: Password reminder

On the **Configuration** / **RadEye G20…** menu, the following parameters can be modified:

- Unit
- Time interval of the history
- Temperature display
- Acoustic indication
- Alarm level for all basic displays
- Signaling types
- Additional surveillances
- Active menu functions
- Settings for source test

7.5.1 General configuration

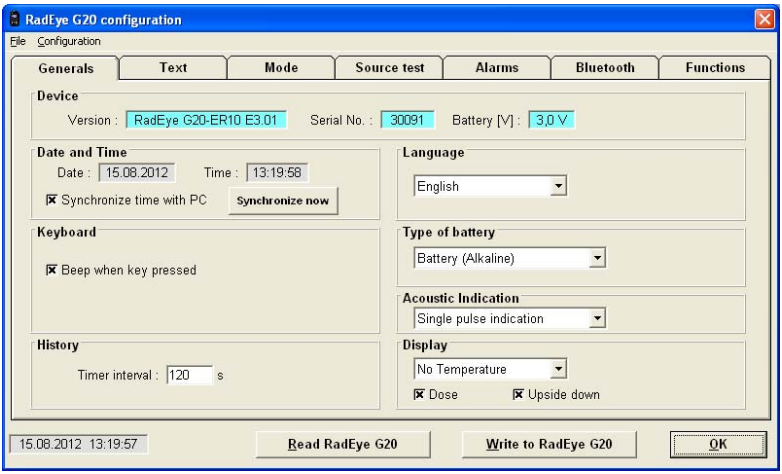


Figure 7-6: General configuration

On the “Generals” tab, the user may set the used filter, the time interval for the history memory (1...43200s), the kind of the acoustic rate indication (single pulse, finder 4.1), type of battery, menu language and temperature.

7.5.2 User defined text

Figure 7-7: Menu selection

On the tab “Text” it is possible to store a text in the RadEye.
In the field “Text Info” the user can define 4 lines text, which can be displayed on the LCD by the RadEye (see 4.10).
In the field “Text Field” it is possible to store a text with up to 200 characters in the RadEye. This text can not be displayed by the RadEye.

7.5.3 Mode setting

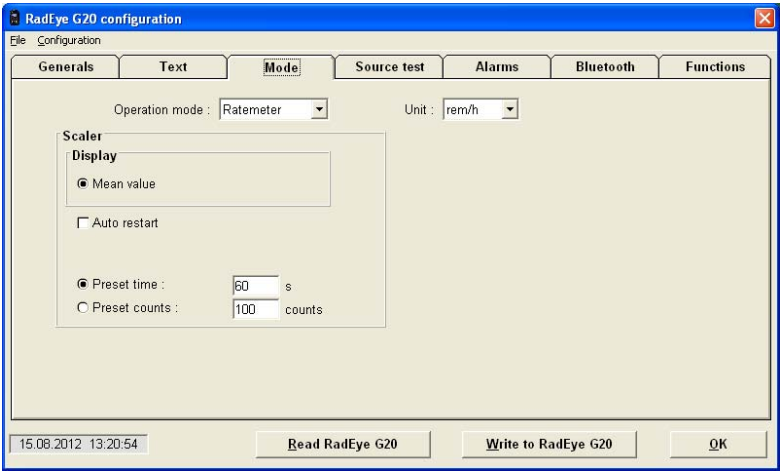


Figure 7-8: Mode setting

On the “Mode“ tab, the user may set the operation mode, the physical unit, parameters for background measurement and parameters for scaler mode.

7.5.4 Source test

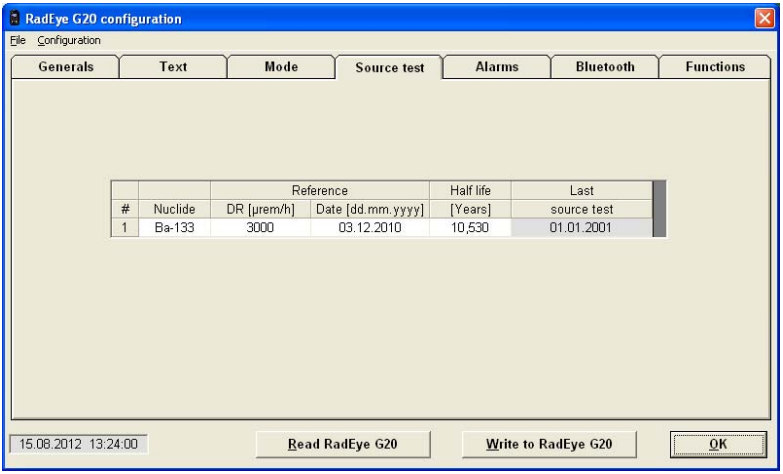


Figure 7-9: Source test parameter

This tab is used to provide the function “source test” with the right data.

Nuclide: This name is prompted in function “source test”

Reference dose rate: dose rate of this nuclide at reference date

Reference Date: reference date for this source

Half life: Half life time of this nuclide.

Last source test: date and time of the last successful source test

7.5.5 Alarm setting

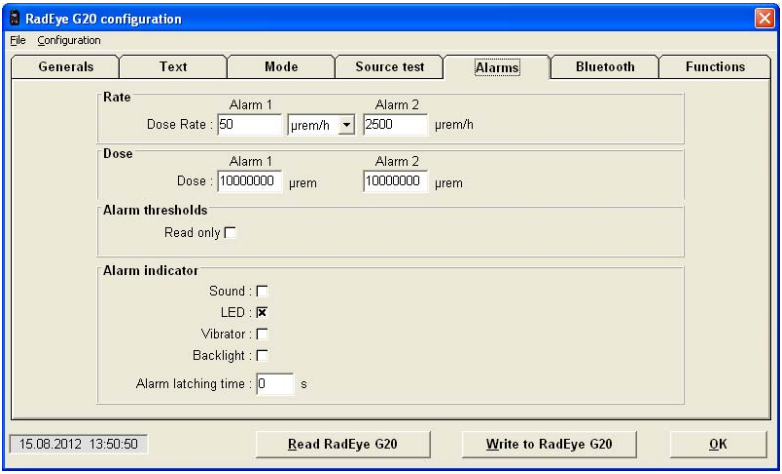


Figure 7-10: Alarm setting

The “Alarm” tab offers the user the possibility of making the alarm settings for the single basic displays. Furthermore, the options on this tab allow beeper and additional alarm monitoring processes to be configured.

7.5.6 Bluetooth

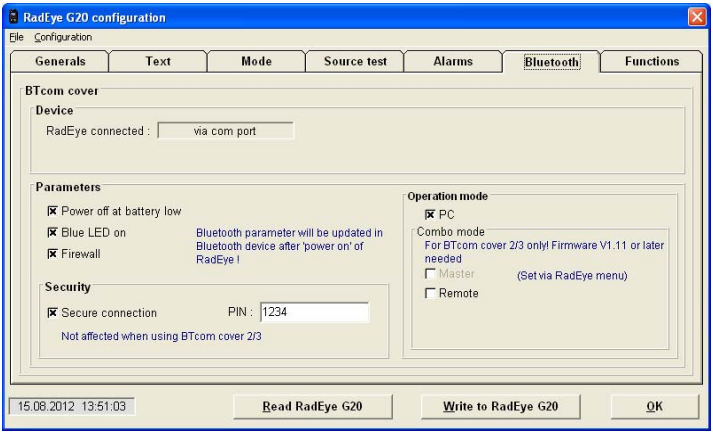


Figure 7-11: Bluetooth

Here the user may configure the BTcom battery cover. The frame "**Device**" informs about firmware version, serial number and the physical address of the BTcom cover (not the RadEye B-20!).

The Parameter "**Blue LED on**" relates to the blue LED at the backside of the battery cover that shows the connection status.

Setting "**Power off at battery low**" the BTcom cover powers off automatically if battery low status is detected to increase battery life. "**Secure connection**" uses the PIN code that can be edited in the right field.

With "**Autoconnect**" the BTcom cover connects automatically to another paired BTcom cover. In this state, the BTcom cover cannot be connected with the PC.

For more information please read the manual which is delivered together with the BTcom cover.

7.5.7 Menu configuration

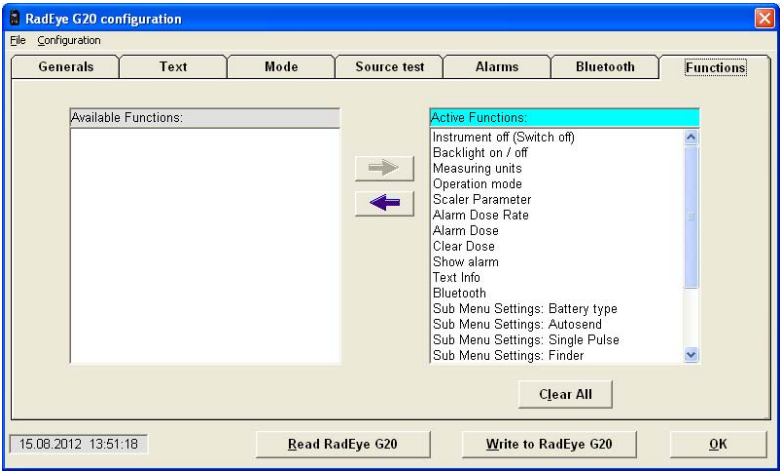


Figure 7-12: Menu selection

On the "Functions" tab, the functions available to the user can be selected to speed up access to frequently needed functions. For example, if LED alarm is always active and rate level indication is never used, these functions can be hidden for the user.

Once the settings of the parameters are finished, these parameters have to be sent to the RadEye G20 by clicking on the Write to RadEye G20 button.
Parameters including the selected menu configuration can be saved with **File / Save as…** as parameter file (*.cfg). A saved configuration can be reloaded using the menu **File / Open…** and sent to RadEye G20.

7.6 History

Via the Options / **History** menu, the values stored in the Rad-Eye G20 data memory can be read out, represented in a x/t diagram and saved to the hard disk of the computer. These data subsequently can be read in and further processed in a spreadsheet program.

Time interval of History storing can be set from 1s to 43200 s (12 hours). 1600 measurement values can be stored.

The following figure depicts for example the curve of the dose rate over the last two days at a time resolution of 120 s. Clearly various levels resulting from different locations and points with high peaks can be recognized.

Every scaler measurement is stored as well. You can click on a specific date point and the measured value, date and time as well as the measuring time will be displayed.

For ratemeter data the blue line shows the mean values, the red line the maximum value within the time interval.

If batteries are removed, the time reference is lost. In the diagram time information is only provided for history values with valid timing entries.

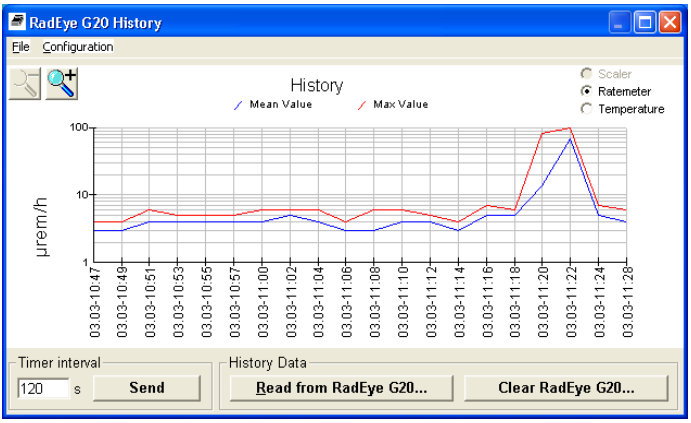


Figure 7-13: History read out

Clicking at the graph, each individual, stored measured value can be displayed:

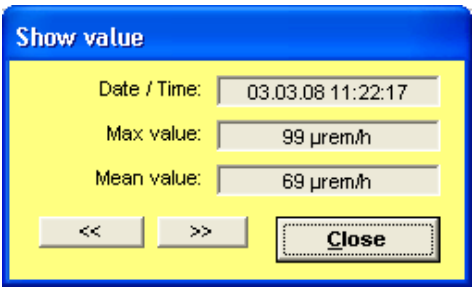


Figure 7-14: Single history value indication for Ratemeter data

7.7 Logbook

Changes in configuration, occurring alarms and errors are logged in a buffer.

These saved events can be read out via **Options / Logbook…** .

The logbook is shown as a table, and can be saved to PC hard disc or printed.

The logbook has a maximum of 250 data sets. Several events at the same time are saved as one record. At the display every event is shown in one line for better overview. The date and time of the PC is used for time relation.

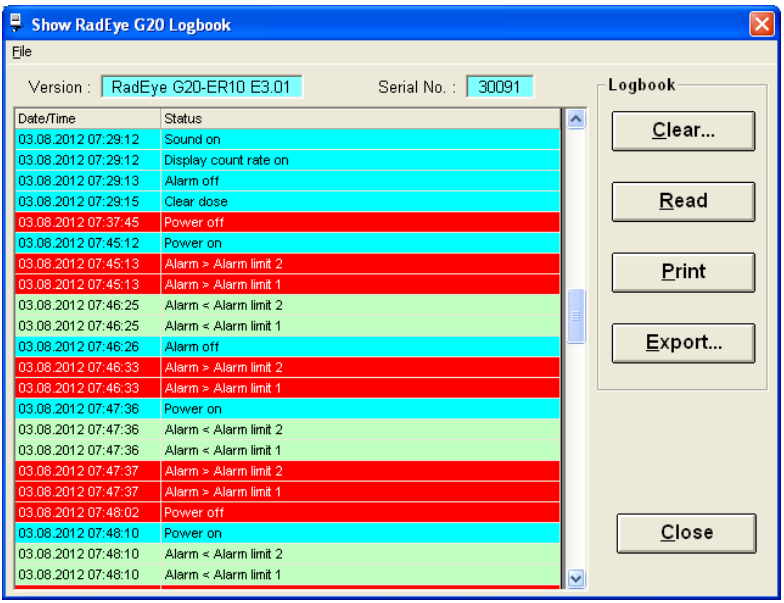


Figure 7-15: Logbook

8. Trouble Shooting

8.1 RadEye doesn't power on

8.1.1 Press "On" for at least one second

Keep the button "▼" pressed until the LED and the sound is active. If the button is pressed only shortly, then the start up routine is not activated. The LED may flash then only very shortly.

8.1.2 Check battery

If the RadEye does not respond to a long press (> 1s) of the "▼" button, then please use the following step by step procedure:

A) Remove the current batteries

B) Clean the battery contacts

C) Check the required orientation of the batteries according to the printed "+" symbols in the battery compartment.

D) Insert two -"AAA" with sufficient capacity: Rechargeable AAA batteries should be completely loaded, non rechargeable batteries should supply together at least 2.3 Volt under load.

E) Press the "▼" button for more than one second (see also 8.1.1)

8.2 Reading data from the start up screen

The start up screen shows important data like the last calibration, the current voltage and the firmware version.

This screen stays active as long as the "▼" button is kept pressed during the power on of the RadEye device.

8.3 The RadEye doesn't show the menu items as described in the manual

The items available in the RadEye menu can be disabled or enabled via the RadEye.EXE software. The factory setting has all menu functions enabled. Please refer to chapter 7.5.7, menu settings. Next, please check the firmware version of your RadEye (see chapter 2.4) and compare your version number with the revision table of this manual at the beginning of the document. The revision table shows the introduction of new functions together with the according firmware version.

8.4 The RadEye shows an error message in the display's top line

Please refer also to chapter 6.2. If one of the following failures is indicated, then the RadEye must be repaired by the Thermo Scientific bench repair team:

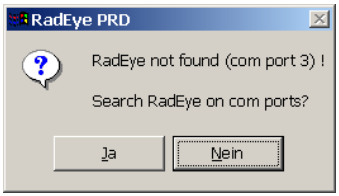
```
HV-Error
Detect Err
EEPROM Err
Watchdog*
```

Please contact our Customer Service for more details.

*) Please see the failure description in the above referenced chapter. If the failure was related to a strong electromagnetic pulse scenario and the failure went away afterwards, then a repair may not be necessary. A diligent observation of the RadEye proper operation after the failure is strongly recommended.

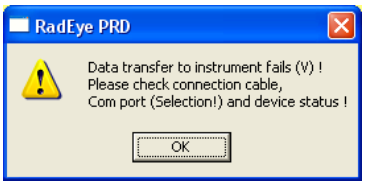
8.5 The RadEye is not found in the software

If the connection between the RadEye and the computer can't be established with a selected serial port (COM port), then the program shows the bellow message first:



The RadEye.EXE software offers to search for a connection to the RadEye unit on other available serial ports.

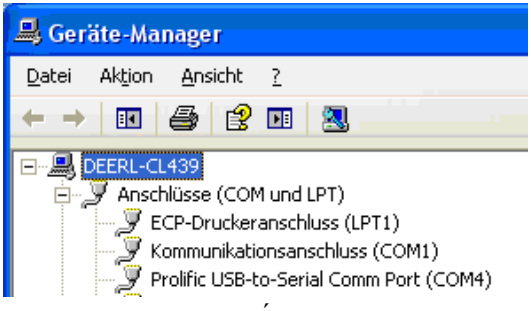
If there is a faulty connection between the unit and the computer, the program shows the error message “Data transfer to instrument fails”



In this case, you must check whether:

- The RadEye has been positioned correctly in the desktop holder (with rubber boot) and the RadEye is turned on.
- The infrared transmission windows are clean
- The correct serial interface has been selected.

It is recommended to use the Windows system tools to determine the occupation of the currently active serial ports. Virtual serial ports are labeled accordingly for identification.



Device Manager showing the virtual driver for USB „Prolific“ at COM 4

Open next the serial interface step window in the RadEye.EXE software: **Configuration / Com settings...** menu. The used serial port has to be selected next.

8.6 RadEye lost date and time settings

The date and time information is lost, each time the batteries are removed or below the required voltage for operation. The simplest way to program the date and time is to use the “synchronize” function of the optional RadEye.EXE software. Please refer to chapter 7.5.1. Else the current date and time can be set also through the RadEye’s menu “Settings” / “Set Date / Time”

8.7 RadEye's battery status is lower than expected

Please check if the correct battery type is selected under "settings" / "Batt. type" and change the type in case. Rechargeable batteries supply a voltage of 1.2V each, while Alkaline batteries provide 1.5V.

Rechargeable batteries offer also a more steep drop from acceptable battery voltage to "battery low" than Alkaline types.

8.8 History data shows the wrong time and date

See chapter 8.6.

9. Maintenance

9.1 Recommended maintenance

The RadEye is basically maintenance free.

9.1.1 Source test

It is recommended to perform a source test routine with the optional Lutetium test adapter on a regular basis. The source test routine is described in chapter 4.13.

Level of usage	Period between Source tests
Intensive, changing climate	3 month
Normal, daily usage	6 month
Low	12 month

9.1.2 Cleaning the instrument

The rubber boot should be removed and cleaned separately. The RadEye unit shall be cleaned with a moist tissue (only water as cleaner). The rubber boot shall be washed in water. Do not use aggressive chemicals like organic solvents.

9.1.3 Remove batteries for storage

It is highly recommended to remove both AAA batteries from the battery compartment, if the RadEye unit is stored for a longer period (> 1 week) to avoid damage through battery leakage.

10. Spare Parts

10.1 Available spare parts

Item	Part Number
Front foil RadEye G20	42506703036
Front foil RadEye G20-ER	42506703038
Front foil RadEye G20-10	42506703037
Front foil RadEye G20-ER10	42506703039
Battery cover complete	425067033
Rubber shock protection (rubber boot)	42506850013
Rubber shock protection detector side	42506850011
Battery IEC-LR03 Micro 1,5V ENERGIZER E92 (1 pack = 2 batteries)	SM164600012

10.2 Recommended spare parts

Battery IEC-LR03 Micro 1,5V ENERGIZER E92 (1 pack = 2 batteries)	SM164600012

11. Optional Accessories

11.1 Earphone for RadEye series (425067037)

The usage of the earphone is recommended, if the RadEye is switched into FINDER mode and disturbance through noisy environment shall be compensated.

The earphone is plugged into the RadEye's socket at bottom of the unit. The cable length is 1.2m.

11.2 Extension adapter

For measurements at spots with high local dose rate, the extension adapter in conjunction with the RadEye adapter can be used.

RadEye adapter	42506/7078
Handle 0.35m	42506/7075
Handle 1.2m	42506/7076
Handle 4m	42506/7077

11.3 Test adapter for RadEye G20 (4254948)

This test adapter contains 50g Lutetiumoxide. Typical net dose rate for RadEye G20: 25µrem/h (25µR/h, 0.25Sv/h)

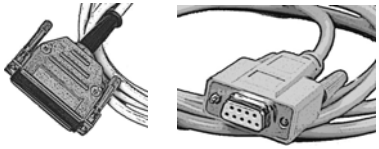
Please see chapter 4.13 and chapter 9.1.1 about the usage of the test adapter.

11.4 Desktop holder (425067060)

Alignment between the RadEye's IR data interface window and the IR interface of a PC connection cable is insured with the usage of the desktop holder. Please see chapter 7.1.2 for details.

11.5 IR connection cable serial (4254029)

The IR plug of the connection cable can be fixed easily by screws at the desktop holder. The PC connection plug is a 9 pin sub D type for serial COM ports.



Please see chapter 7.1.2 for details. Cable length = 1.2 m

11.6 IR connection cable USB (4254026)

The IR plug of the connection cable can be fixed easily by screws at the desktop holder. The PC connection plug is a 9 pin sub D type for serial COM ports.

Please see chapter 7.1.2 for details. Cable length = 1.2 m

11.7 Bluetooth battery cover (425067087)

The standard battery lid is replaced with the Bluetooth battery cover. Please see chapter 7.1.1 for details.

11.8 RadEye car- and wall holder with accumulator charging circuit

Safety instructions

1. Only use NiMH – accumulators, no primary batteries (Alkaline –manganese, zinc – carbon ...)
2. Only use two accumulators of the same type (manufacturer, rated capacity ...)
3. Only charge accumulators having the same discharging state
4. Never use defective accumulators (penetrating/emerging electrolyte, damaged housing...)

RadEye car holder : 42506/7065

The RadEye car holder 42506/7065 serves as supporting device and power supply unit for the operation of a RadEye instrument in a vehicle. For convenient mounting to the dashboard one of the mechanical adaptors 42506/7061 ... 64 is required.

Together with a power supply unit 42506/7066, this support is also suitable for a cost attractive stationary ambient monitoring. Via the alarm contact, power consuming external alarm indicator can be operated.

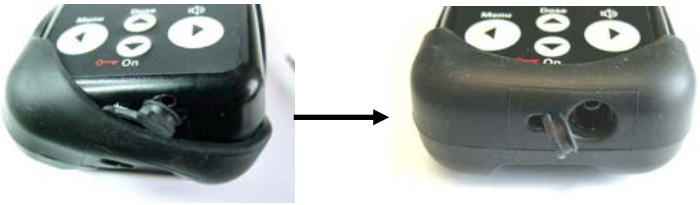
The RadEye car- and wall holder combines several functions.

(1) Mechanical holding device for instruments of the RadEye-family
(2) Accumulator charger unit with temperature controlled charging of NiMH accumulators in the device
(3) Infrared interface for direct connection to the serial interface of computers
(4) Alarm contact for connecting alarm indicators up to a power of 24W (at 24V, see RadEye area monitor 42506/80)

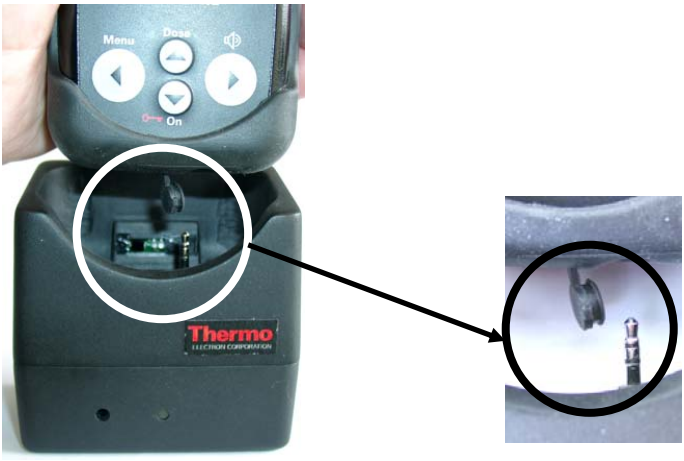
Before plugging the RadEye into the Car holder the rubber protection plug at the phone jack has to be opened:

Carefully remove the protection sleeve and open the phone jack

Remount the protection sleeve (see chapter 2.3). A small screw driver for the protection plug might be helpful. The phone jack must left be open, and the protection plug must be perpendicular to the protection sleeve.



Then insert the RadEye into the car holder. Make sure that the protection plug is not mechanically interfering with the charging pin of the car holder.



11.8.1 Accessories for dash board mounting of car holder 42506/7065 (including charging function) holder 42506/7060 (mechanical holder only)

Goose neck adaptor kit 42506/7061

Pivot arm adaptor kit 42506/7062


Knuckle joint adaptor kit 42506/7063


Goose neck adaptor kit with suction cup 42506/7064

11.8.2 Accessories for data transmission using the car adaptor

RS232 connecting cable 2m:
SM1685 35223

USB 1.1 to RS232 adapter cable:
SM1685 35251

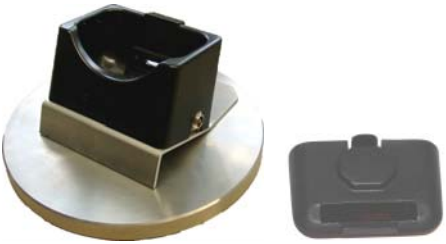
USB 2.0 to RS232 adapter cable:
SM1685 35255

11.8.3 Accessories for AC – operation of the car adaptor

Power supply with cigarette lighter socket 42506/7066
for mains operation of the car holder 42506/7065

11.9 RadEye inductive charger

The RadEye holder serves as supporting device and, in combination with the special battery lid 42506/7034, power supply unit for the operation of a RadEye instrument in a vehicle. For convenient mounting to the dashboard one of the mechanical adaptors 42506/7061 … 64 is required.



Note: The charging function of this device requires the battery latch 42506/7034. Without the above mentioned part no charging will be achieved.

Safety instructions

1. Only use NiMH – accumulators, no primary batteries (Alkaline – manganese, zinc – carbon ...)
2. Only use two accumulators of the same type (manufacturer, rated capacity ...)
3. Only charge accumulators having the same discharging state
4. Never use defective accumulators (penetrating/emerging electrolyte, damaged housing...)
5. The bottom of the housing (aluminum heat sink) gets warm (50°C, 120°F max.).
6. Not for use in open convertibles.
7. Do not put cards with magnet stripes (f.e. credit cards, parking cards, phone cards, etc.) near the mounted warning symbol. The magnetic field could erase the data from your card.
8. Clearance of at least 50cm (20”) between charger and car radio is recommended.

11.9.1 LED indicators

State	**LED (green)**
Voltage supply on	On
Voltage supply off	Off

12. Technical data

12.1 RadEye G20-10 and RadEye G20-ER10

Radiation type: Gamma, X-ray radiation

Measured quantities: **Ambient Dose Equivalent H*(10) and Rate**

Measuring range:

	Maximum dose rate
RadEye G20-10	2 mSv/h 200 mrem/h
RadEye G20-ER10	100 mSv/h 10 rem/h

Overload display: overload indication up to 10 Sv/h (1000 rem/h)

Linearity error: max. ± 10 % in the measuring range

Alarm threshold: Two alarm thresholds for dose and dose rate each. Default setting: see chapter 2.4

Audible alarm intensity: 85 dB at a distance of 30 cm

Response time (to reach 90 %):	typ.: 10 s for background to 100µrem/h (1µSv/h) typ.: 5 s for background to 300µrem/h (3µSv/h) typ.: 2 s for background to 1mrem/h (10µSv/h)
Photon Energy range:	17 keV – 1.3 MeV: error less than ±30% 17 keV – 3 MeV: IEC 60846-1 (2009) for dose and dose rate measurement
Energy dependence:	see Diagram 12-1
Direction of max. response:	perpendicular to the center of the detector surface
Reference point:	on the axis of the direction of max. response, 10 mm depth
Angular dependence:	see Diagram 12-3 to Diagram 12-6
Working temperature:	-20°C ... + 50°C
Storage temperature:	-25°C … + 50°C
Relative humidity:	< 93 % at 35°C non condensing
Operating voltage:	1,8 ... 3.3 V
Degree of protection:	IP 32 according to EN 60 529
EMC:	Disturbance emission : EN 61000-6-3 Immunity : EN 61000-6-2
Mechanical shock:	Drop onto a concrete surface 0,8 m with protection sleeve
Size:	120 mm x 70 mm x 70 mm Without rubber protection

Weight:	around 300g including AAA cells and protection sleeve
Internal memory:	The last 1600 measured values are saved and can be read out via PC program. Max- and mean value of dose rate. The time interval is factory preset to 120s by default. Logbook with 250 entries for changes of configuration, occurring alarms and errors.
Averaging filters:	Dose Rate filter type: **A**dvanced **D**igital **F**ilter (ADF) Digital RC-Filter with time constant 1s.....180s, depending on dose rate and dose rate changing.
Power consumption at 3V:	≈ 4 mA: normal operation without alarm signals and LCD illumination RadEye G20-10: ≈ 1 mA RadEye G20-ER10: ≈ 1,2 mA ≈ 25 mA with illuminated LC display ≈ 18 mA LED alarm ≈ 30 mA acoustic alarm ≈ 30 mA vibrator alarm

Battery service life:	**RadEye G20-10:** ≈ 900h using two alkaline AAA cells depending on the operating mode ≈ 600h using 800mAh NiMH accu (type "Ready tot use") **RadEye G20-ER10:** ≈ 700h using two alkaline AAA cells depending on the operating mode ≈ 450h using 800mAh NiMH accu (type "Ready tot use")

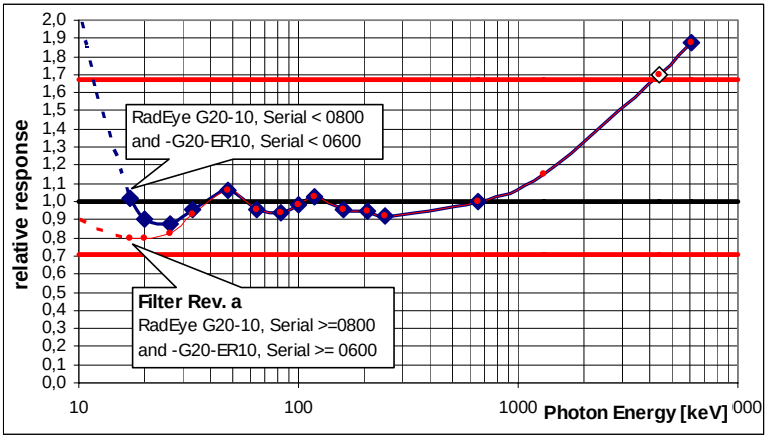


Diagram 12-1: Energy dependence for ambient dose equivalent H*(10)

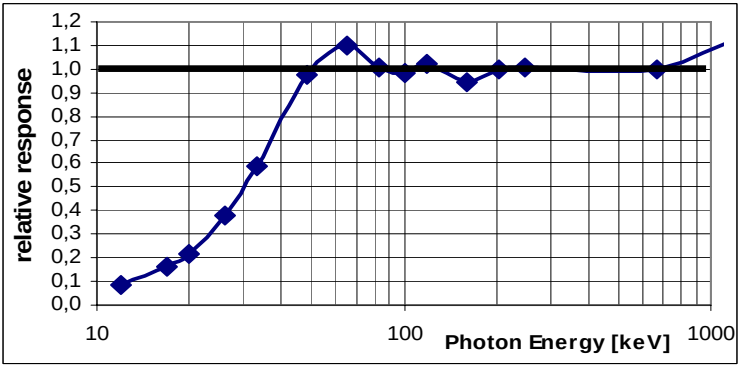


Diagram 12-2: Relative Gamma response RadEye G20 and RadEye G20-ER

Direction of maximum response and reference point

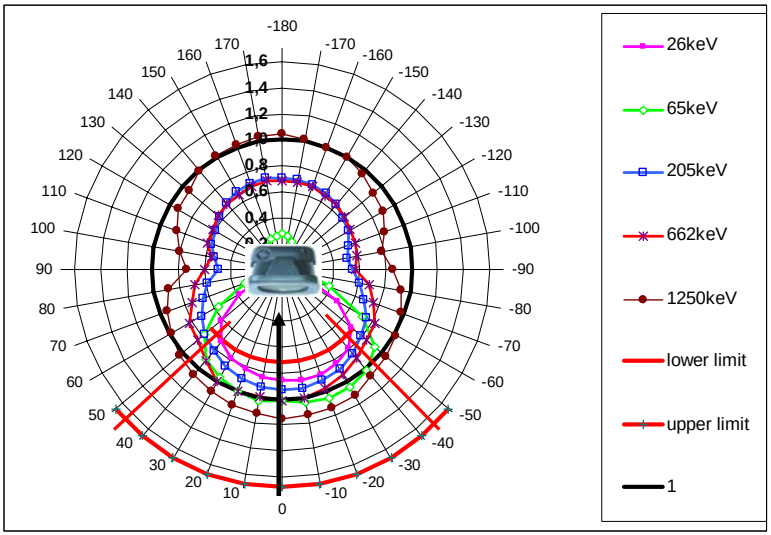


Diagram 12-3: Angular response, relative to Cs-137

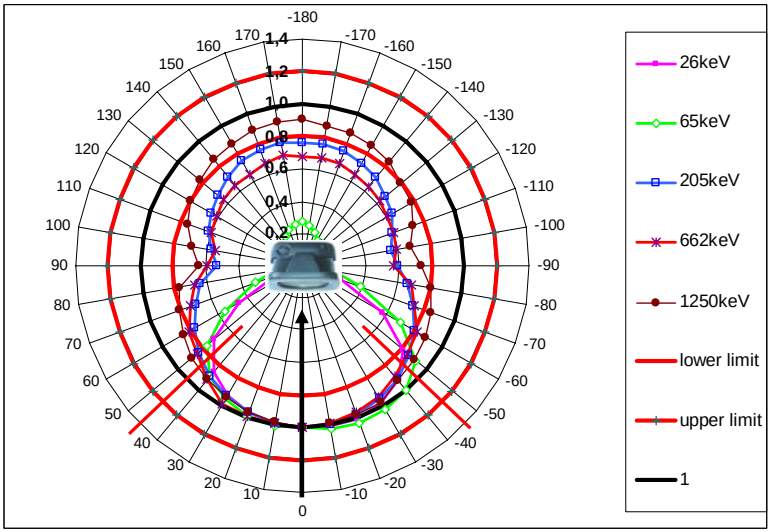


Diagram 12-4: Angular response, normalized

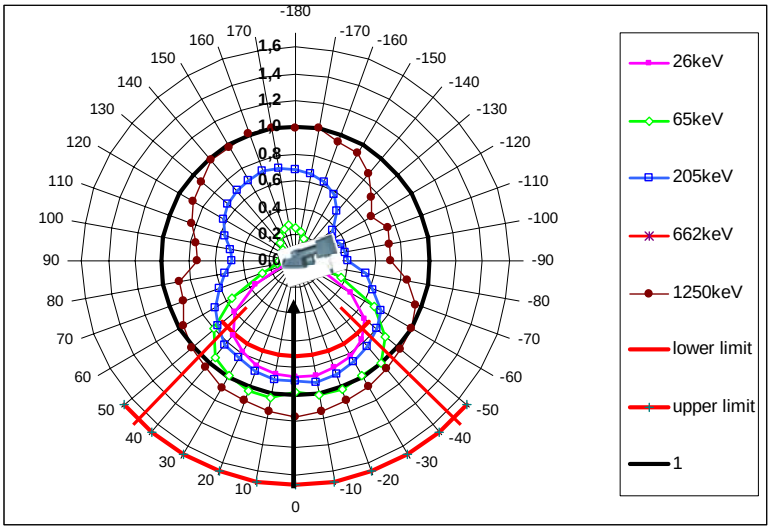


Diagram 12-5: Angular response relative to Cs-137

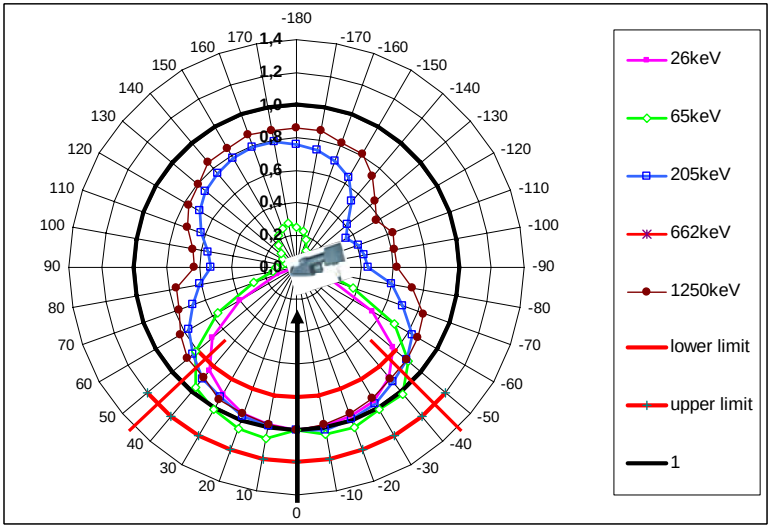


Diagram 12-6: Angular response, normalized

12.2 RadEye G20 and RadEye G20-ER

Radiation type: Gamma, X-ray radiation

Measured quantities: **Exposure Dose Rate**

Measuring range:

	Maximum dose rate
RadEye G20	200 mR/h
RadEye G20-ER	10 R/h

Overload display: overload indication up to 1000 R/h

Linearity error: max. ± 10 % in the measuring range

Alarm threshold: Two alarm thresholds for dose and dose rate each. Default setting: see chapter 2.4

Audible alarm intensity: 85 dB at a distance of 30 cm

Response time (to reach 90 %): typ.: 10 s for background to 100 µR/h
typ.: 5 s for background to 300 µR/h
typ.: 2 s for background to 1mR/h

Photon Energy range: 40 keV – 1.3 MeV: error less than ±30% for dose and dose rate measurement

Energy Dependence Diagram 12-2

Direction of max. response: perpendicular to the center of the detector surface

Reference point: Center of the detector, 10mm depth

Angular dependence: Diagram 12-4 and Diagram 12-6

Working temperature:	-20°C ... + 50°C
Storage temperature:	-25°C … + 50°C
Relative humidity:	< 93 % at 35°C non condensing
Operating voltage:	1,8 ... 3.3 V
Degree of protection:	IP 32 according to EN 60 529
EMC:	Disturbance emission : EN 61000-6-3 Immunity : EN 61000-6-2
Mechanical shock:	Drop onto a concrete surface 0,8 m with protection sleeve
Size:	120 mm x 70 mm x 70 mm Without rubber protection
Weight:	around 300g including AAA cells and protection sleeve
Internal memory:	The last 1600 measured values are saved and can be read out via PC program. Max- and mean value of dose rate. The time interval is factory preset to 120s by default. Logbook with 250 entries for changes of configuration, occurring alarms and errors.
Averaging filters:	Dose Rate filter type: **A**dvanced **D**igital **F**ilter (ADF) Digital RC-Filter with time constant 1s.....180s, depending on dose rate and dose rate changing.

Power consumption:	≈ 4 mA: normal operation without alarm signals and LCD illumination RadEye G20-10: ≈ 1 mA RadEye G20-ER10: ≈ 1,2 mA ≈ 25 mA with illuminated LC display ≈ 18 mA LED alarm ≈ 30 mA acoustic alarm ≈ 30 mA vibrator alarm
Battery service life:	**RadEye G20-10:** ≈ 900h using two alkaline AAA cells depending on the operating mode ≈ 600h using 800mAh NiMH accu (type "Ready tot use") **RadEye G20-ER10:** ≈ 700h using two alkaline AAA cells depending on the operating mode ≈ 450h using 800mAh NiMH accu (type "Ready tot use")

12.3 RadEye inductive charger:

Operating voltage	11,5…15V_{DC}
Current consumption	150…200mA With supply from 14V, charging current 50mA
Accumulator charging current	40…52 mA
Charge time	20…24h Accumulator
RadEye on,	800mAh, discharged
Backlight switched off *)	
Charge time	18…20h Accumulator
RadEye switched off	800mAh, discharged
Ambient temperature	-20…+50°C Operation –40…+70°C Storage 0…40°C Accumulator charge
Ambient pressure	300…2000 hPa

*) During operation with backlit LCD, the battery charge is sustained only.

12.4 Firmware revisions

V 1.32
First edition.

V 1.50
- Low Battery warning
- Automatic Filter select

V 1.51
- Display error in cpm-Scaler-mode eliminated

V 2.04
- New menu item “Bluetooth”
- Source test

V 2.05
- Sub menu “Alarm indication” is maskable

V 3.01
- New firmware for new hardware
- Change of menu language via menu item „Language“
- Revised sub menu „Bluetooth“
- New feature: Calibration expiration date

13. Annex

13.1 Factory Settings RadEye G20 / G20-ER

Item	Factory default
Language	English
Measuring unit	R/h
Type of battery	Battery (Alkaline)
Mode	Ratemeter
Acoustic indication	Single pulse indication
Keyboard	Beep when key pressed
Display temperature	Disabled
Display dose	Active
Display option “up-side down”	Disabled
History timer interval	120 s
Text display line 1	Line 1
Text display line 2	RadEye G-20
Text display line 3	Line 3
Text display line 4	Line 4
Text field	This text is not shown in the LCD.
Alarm 1	50 µR/h
Alarm 2	2.50 mR/h

Alarm 1, Dose	1000 R
Alarm 2, Dose	1000 R
Alarm thresholds read only	Disabled
Alarm indicator, Sound	Enabled
Alarm indicator, LED	Enabled
Alarm indicator, Vibrator	Enabled
Alarm latching time	0s
Active functions	All available functions are active
Bluetooth: Power off at battery low	Enabled
Bluetooth: Blue LED on	Enabled
Bluetooth: Firewall	Enabled
Bluetooth: Secure connection	Enabled
Bluetooth PIN	1234
Bluetooth: operation mode	PC

13.2 Factory Settings RadEye G20-10 / G20-ER10

Item	Factory default
Language	English
Measuring unit	Sv/h
Type of battery	Battery (Alkaline)
Mode	Ratemeter
Acoustic indication	Single pulse indication
Keyboard	Beep when key pressed
Display temperature	Disabled
Display dose	Active
Display option “up-side down”	Disabled
History timer interval	120 s
Text display line 1	Line 1
Text display line 2	RadEye G-20
Text display line 3	Line 3
Text display line 4	Line 4
Text field	This text is not shown in the LCD.
Alarm 1	0.50 µSv/h
Alarm 2	25.00 µSv/h
Alarm 1, Dose	10 Sv
Alarm 2, Dose	10 Sv
Alarm thresholds read only	Disabled

Alarm indicator, Sound	Enabled
Alarm indicator, LED	Enabled
Alarm indicator, Vibrator	Enabled
Alarm latching time	0s
Active functions	All available functions are active
Bluetooth: Power off at battery low	Enabled
Bluetooth: Blue LED on	Enabled
Bluetooth: Firewall	Enabled
Bluetooth: Secure connection	Enabled
Bluetooth PIN	1234
Bluetooth: operation mode	PC

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