thermoscientific

Operating Instructions DB-065 E

RadEye B20

RadEye B20-ER

Multi-Purpose Survey Meter

REVISIONS SHEET:

Rev.	Rev. state	Dept. resp.	Name	Rev. page	Cat. *)	Explanation
	27.07.07	RM&P-E	Pij			> **V 1.26**
A	22.07.08	RM&P-E	Pij	cpl.	A	> **V 1.50** Low Battery warning Set of time and date
B	08.06.2009	RM&P-E	Tr	9-7 to 9-10	A	Diagram added
C	13.10.2009	RM&Si-E	Ff	0-8 back	C	Name of company
D	17.01.2011	RM&SI-E	Pij	3-14 4-9 4-10	A	> **V 2.04** Accumulated counts BT-com cover Source test
E	16.02.2011	RM&SI-E	Pij	7-17	C	> **V 2.05** Menu selection
F	28.04.2011	RM&SI-E	Tr	9-2	A	Photon Energy range added

Rev.	Rev. state	Dept. resp.	Name	Rev. page	Cat. *)	Explanation
G	06.08.2012	RM&SI-E	Pij	 4-12 6-5 8-1 9-1 10-1 11-1 13-1	A	**> V 3.01** New document structure Change menu language Calibration expiration date Trouble shooting Maintenance Spare parts Optional accessories Annex
H	29.06.2015	RM&SI-EH ECN80271	Pij	cpl.	A	**from V 3.06**
I	06.03.2017	RM&SI-ES RM&SI-E	Ka Ff	6-6 Cover	A	**ECN 81136**

*) Category C: editorial correction
I: clearing improvement
A: substantial amendment

Explanations must be given, at least with Category A.

CONTENTS:

TABLE OF FIGURES:

SAFETY INSTRUCTIONS

Dose integration is performed only, if the instrument is in a dose rate measuring mode (R/h; Rem/h Sv/h Gy/h). In case the measuring range is exceeded, the value of the upper end of the dose rate measuring range is used for the dose integration.

The RadEye B20 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.

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 B20.

The instrument must not be used in explosive atmosphere.

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**

1. Introduction

The RadEye B20 and B20-ER are modern compact multi-purpose contamination meters for alpha, beta, gamma and X-ray radiation. By virtue of an optional gamma energy filter, gamma dose rate measurements from 17 – 1300 keV can be performed. For emergency response purposes alpha and beta contamination can be discriminated using another optional filter. In this context it is important to note, that users may select “R/h” as a display unit, with the understanding that the energy response characteristic is not altered by this selection. Within the RadEye B20 the relation 1 R = 1 rem =10 mSv = 8.77 mGy/h is used.

The instrument incorporates a sensitive GM pancake tube detector allowing the detection of low to medium radiation levels.

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 B20 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 B20 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 B20 / B20-ER is delivered in a box together with two AAA cells and an operating manual.

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

Ordering information for accessories see chapter11.

2.2 Inserting the battery

The two AAA-Alkaline cells as delivered with the instrument allow up to 900 h with RadEye B20 respectively 700h with RadEye B20-ER 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 0.00 cps. 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.

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.

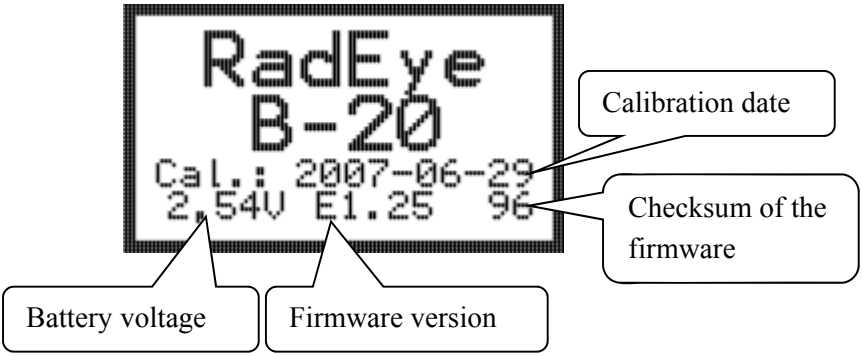
For mounting of the sleeve first put the instrument into the bottom of the sleeve. Then pull lower edges of the sleeve, one after the other into its right position.

First step

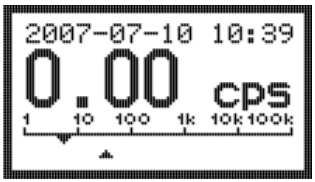
Second step

2.4 Switching the unit on

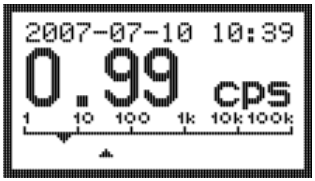
To switch on the RadEye B20, **keep** the ON button pressed for **at least one second**. The sound generator (beeper) is initiated. After switching the unit on, the RadEye B20 starts working with the parameters previously selected (operation mode, calibration factor, alarm thresholds etc.).



The RadEye B20 starts working with the parameters previously selected (measuring unit, operation mode, calibration factor, alarm thresholds etc.).
If the real time clock is set, actual time and date is displayed for 3s.



The RadEye B20 first displays 0.00 cps. 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 default values are reasonable for the majority of applications. For special applications the parameters (except calibration parameters) can be changed with the help of the optional PC-program “RadEye.EXE” from V1.30 and the cable 42540/29 or 42540/26. Furthermore, additional monitoring modes can be activated.

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 “▲/Info” and “▼/On“ 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 LEFT KEY	MENU DISPLAY VISIBLE IN		
			COUNT RATE (CPS, CPM)	DOSE RATE (REM/H, R/H, SV/H)	ACTIVITY (BQ, DPS, DPM)
Switch off		RadEye is switched off. Time and stored data are maintained	✓	✓	✓
Background	Start measurement	Start background measurement	✓		✓
	Set parameter	Edit preset time and preset count for background measurement			
	Scaler netto	Scaler with background subtraction			
	Ratemeter netto	Ratemeter with background subtraction			
Backlight		If selected the backlight is always on. Otherwise the backlight extinguishes after 10s	✓	✓	✓

Measuring unit	cps	Select Count rate (cps)	✓	✓	✓
	cpm	Select Count rate (cpm)			
	Bq	Select Activity (Bq)			
	dps	Select Activity (dps)			
	dpm	Select Activity (dpm)			
	rem/h	Select Dose rate (rem/h)			
	R/h	Select Dose rate (R/h)			
	Sv/h	Select Dose rate (Sv/h)			
	Gy/h	Select Dose rate (Gy/h)			
	Bq/cm^2	Select Activity (Bq/cm^2)			
Operation mode	Ratemeter ADF	Select Ratemeter ADF mode	✓	✓	✓
	Ratemeter Tau	Select Ratemeter Tau 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			
	Accumulated Counts	Display of accumulated counts instead of mean value			
Nuclide table		Displays the stored nuclides			✓

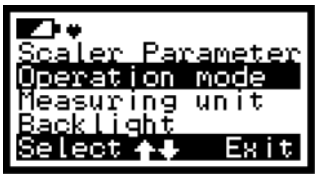
Alarm Count Rate		Allows setting of Alarm 1 and 2 for count rate mode (cps, cpm).	✓		
Alarm Activity		Allows setting of Alarm 1 and 2 for activity mode (Bq, dps, dpm).			✓
Alarm Dose Rate		Allows setting of Alarm 1 and 2 for dose rate mode (rem/h, R/h, Sv/h).		✓	
Alarm Dose		Allows setting of Alarm 1 and 2 for dose. This option is accessible only in dose rate mode (rem/h, R/h, Sv/h).		✓	
Clear Dose		Clears the accumulated dose. This option is accessible only in dose rate mode (rem/h, R/h, Sv/h).		✓	

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 time and date of the real time clock.			
	Language	Change the menu language of RadEye			
	Contrast	Adjusts the contrast of the LCD display			
	Edit Tau	Set time constant for measurement in Ratemeter Tau mode			

Alarm indication	LED	Enabling and disabling of the optical alarm	✓	✓	✓
	Sound	Enabling and disabling of the acoustic alarm and the audible indication of key-strokes			
	Vibrator	Enabling and disabling of the vibration alarm			
	LCD LED	Enabling and disabling of backlight illumi-nation on alam			
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 count rate mode. Some menu option may be different for dose rate and activity mode.

3.1.3 Background

This submenu for background measurement is only available in count rate and activity mode. “Start Bgr.meas.” starts the background measurement. “Set parameter” edit the preset time and count for background measurement. “Ratem.netto” enables the ratemeter mode with background subtraction. “Scaler netto” enables scaler mode with background subtraction.

3.1.4 Measuring unit

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

3.1.5 Operation mode

This submenu is used to select between ratemeter with ADF, ratemeter with classic linear filter and scaler mode. The "✓" shows the active configuration.

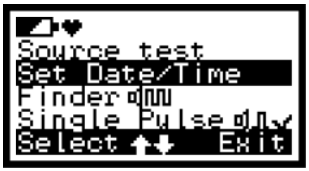
3.1.6 Scaler parameter

This submenu is used to set the parameters for scaler measurements. Preset TimeMode is used to measure a defined time. Preset CntMode is used to measure a defined number of counts. With "Auto restart" the RadEye B20 restarts automatically the measurement. "Set Time/Count" edit the preset time and count. "Accum. Counts" means the RadEye displays the accumulated counts instead of the mean value. This option is only effective with measuring units "cps" or "cpm".

3.1.7 Nuclide table

The submenu Nuclide table is only available in activity mode (Bq, dps, dpm, Bq/cm^2). A "✓" show the selected nuclide.

3.1.8 Settings



This submenu it is possible to select between audible single pulse indication and finder mode. A "✓" show 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". "Edit Tau" is used to edit the time constant for Ratemeter Tau mode from 1..60s.
"Language" is used to change the menu language of the RadEye between English, German, French and Russian.
Set the display contrast with menu item "Contrast".

3.1.9 Alarm indication

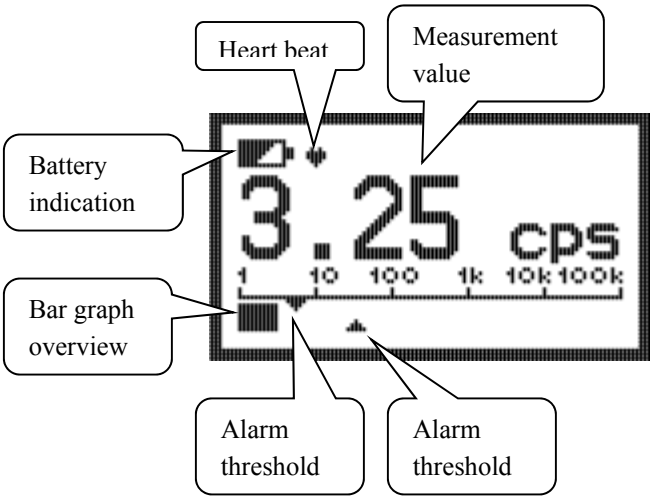
The submenu alarm indication is used to select the LED, LCD LED, sound and vibrator for alarming. A "✓" show the active configuration.

3.1.10 Bluetooth

"Master": Enable automatic connection to another Btcom cover module.
"Remote/PC": This module can be connected to the Master module
"BTcom": Enable or disable the BTcom cover.
Please read see also chapter 4.12. For more information please read the manual DB-093 E.

3.2 Ratemeter

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



Pressing the ▲/Info – key shows upon the

- 1st click: the accumulated dose (rem, R or Sv) is shown only if dose rate mode (rem/h, R/h, or Sv/h) is active. 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 peak, together with the time indicated since the last reset.
- 3rd click: standard display

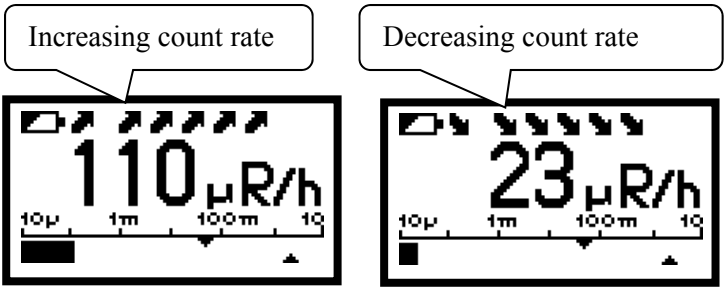
After 10 seconds or after 3rd click standard display with dose rate indication is activated again.

1st click
(only in dose rate mode)

2nd click

3.2.1 Trend indication

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

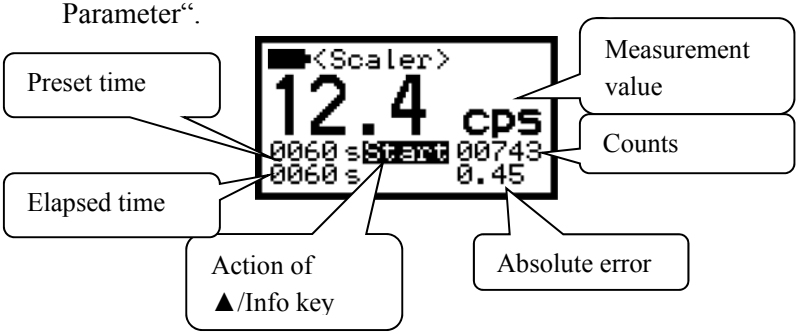


For accurate measurements, only readings without trend indication should be used.
A trend indication is not given at count rates of less than 1 cps.

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.
The error is calculated as follows:

$$F = \sqrt{\frac{RM}{tM} + \frac{R0}{t0}}$$

F: absolute error in cps
RM: measuring value in cps
tM: measuring time in s
R0: Background count rate in cps *)
t0: Background measuring time in s *)
*) Background count rate and Background measuring time are only used in combination with“Scaler netto”.
If measuring unit cpm, Bq, dpm or Bq/cm² is used, the error is displayed in the corresponding unit. The error is not shown in dose rate mode or “Accumulated counts” is active.

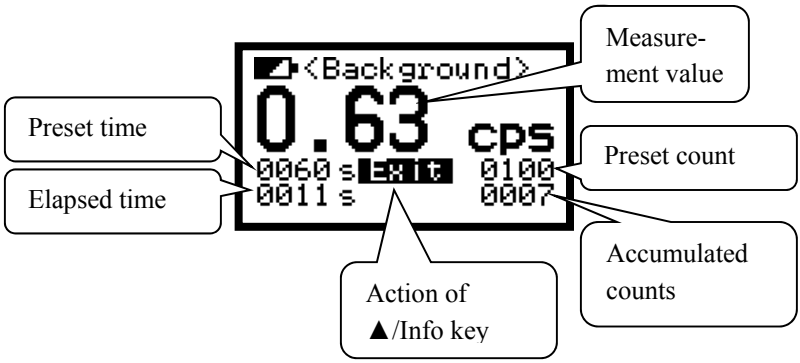
3.3.1 Accumulated counts

With accumulated counts selected via radeye.exe the RadEye shows the collected counts within the measurement time in place of the mean value. This option is only available in combination with measurement unit “cps” and “cpm”.

3.4 Background measurement

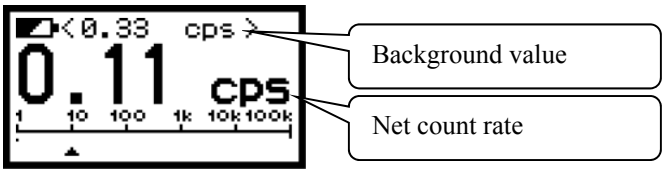
To enter background measurement select in submenu “Background” “Start Meas.”.

The background measurement starts with the parameter set in submenu option „Set parameter“. To start the measurement, press the “▲/Info” key. While the measurement is in progress “Exit” is blinking.



The measurement is finished if either the elapsed time arrived the preset time or the accumulated counts reached preset count.

The user is asked if he want to save this value („Yes“) or to discard this measurement (“No”)
With menu option “Ratem. netto” or “Scaler netto” selected, the background value will be subtracted from the measurement.



3.5 Alarm thresholds

There are two alarm thresholds each allocated to count rate, activity, 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 (chapter 7.5) or via the menu.
As to the alarm activation, please also read chapter 4.2.

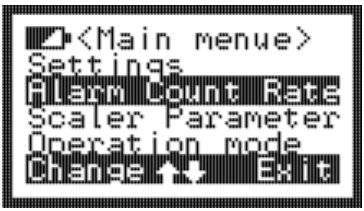
3.6 Setting alarm thresholds

The menu options **Alarm Count Rate**, **Alarm Activity**, **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 left (Change) button if the corresponding "Alarm" is selected:

To change the number, press the "▲/Info" or "▼/On" keys. To go on to the next digit or to quit the edit mode, menu use "◄" or "►" key.
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 count rate alarm threshold must be changed.

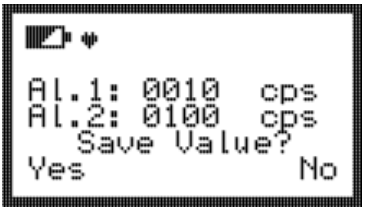
Press "Menu" key, and „▲/Info" or "▼/On" arrow keys until **Alarm Count Rate** is selected

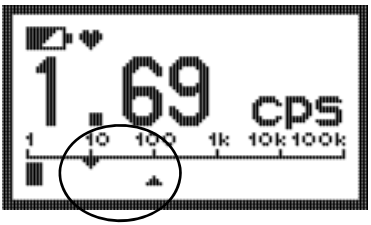


Then enter change menu by pressing "Change" key.

Edit value by pressing „▲/Info" or „▼/On" keys
select digit by left / right keys
Pre unit "k" may be chosen as well.

Leaving the last digit with the "►" 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.

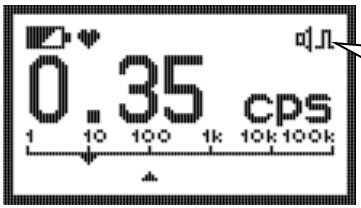
4. Operation

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 "►"or top button:

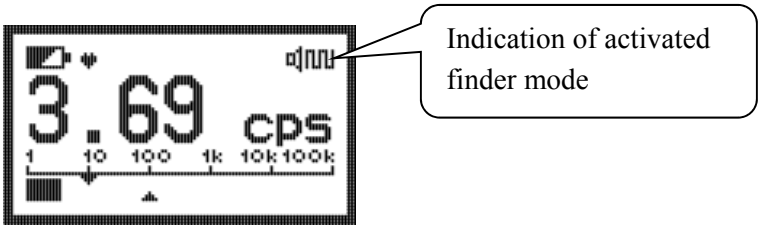


Indication of activated single pulse indication

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 "►" 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.

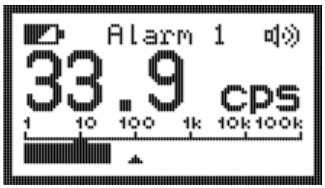
Alarm 1: LED slowly blinking, two frequency alarm tone

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. Dose alarm is only active when rem/h, R/h or Sv/h is selected.



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.

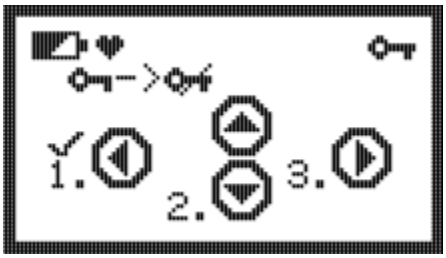
4.4 Key Lock

If "Key Lock" is enabled, 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.

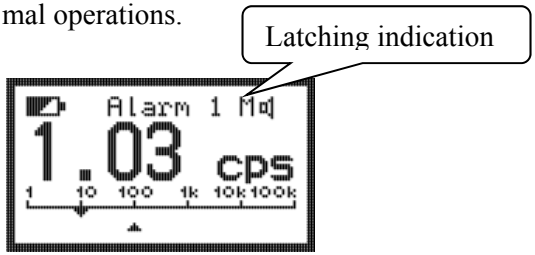
4.5 Earphone

For alarming in noisy environments or for undercover investigations an earphone is available. See ordering information chapter 11.4.

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

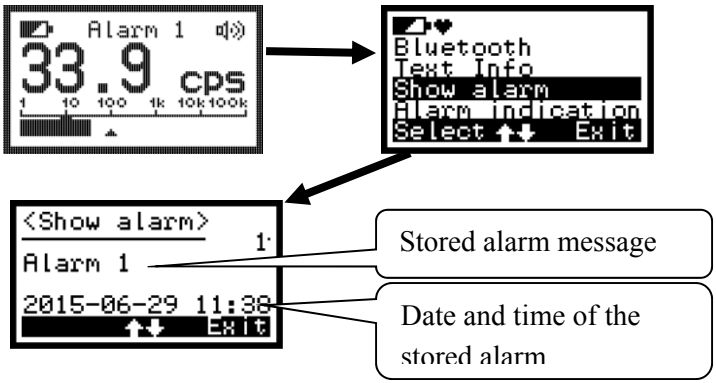
4.6 Alarm latching

Via PC-program it is possible to configure a 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

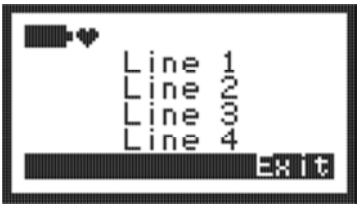
By selecting the menu item “Show alarm” the alarms stored in the alarm log are displayed together with the time of alarm and the actual time.



By pressing the "▲/Info" or "▼/On" 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".

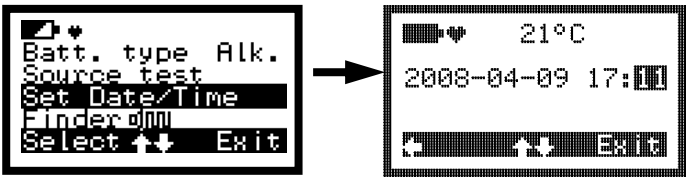


4.9 Display rotation

If enabled, a short press on the lower centre key („▼/On") flips the display. If the lower centre key is pressed again or if the 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

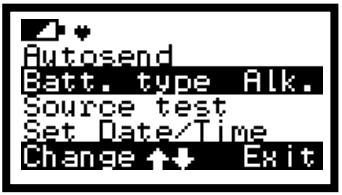
Setting of date and time takes place via menu item “Settings” → “Set Date/Time”.



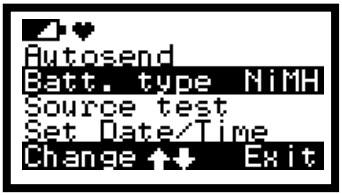
The setting uses the format YYYY-MM-DD hh:mm. The fields are selected with the “◄” or “►” key. With the keys “▲/Info“ or “▼/On“ the year, month, day, hour or minute can be changed. After setting the date and time the real time clock is set and is used for alarm logbook and history.

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 2.35V. See also chapter 6.5.



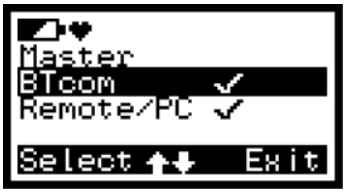
Battery type “Alkaline”



Battery type “NiMH”

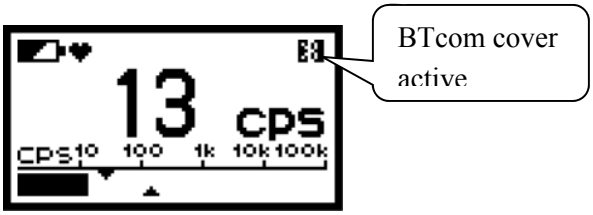
4.12 BTcom cover

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.



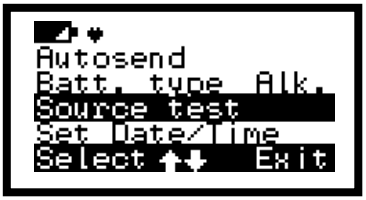
With menu item “BTcom”, the user may switch on / off the BTcom cover. “✓” means BTcom cover is active
With “Master”, the BTcom cover connects automatically to another BTcom cover. In this case, the RadEye cannot be connected to the PC. For more information please read the manual DB-093 E.
By selecting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



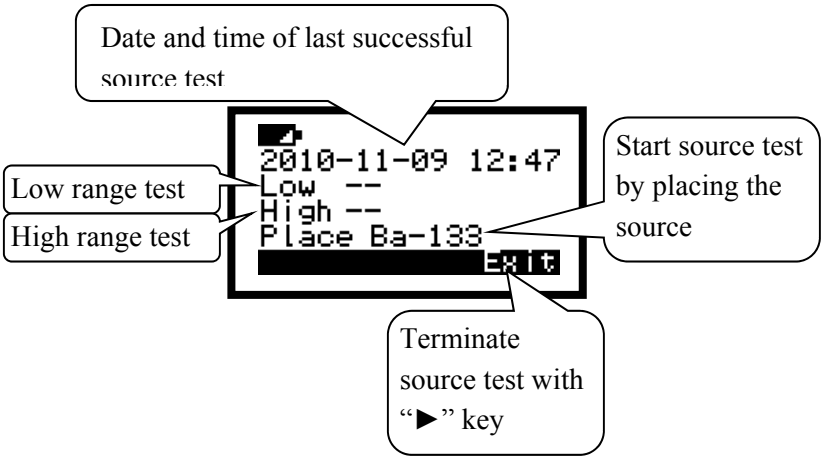
4.13 Source test

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

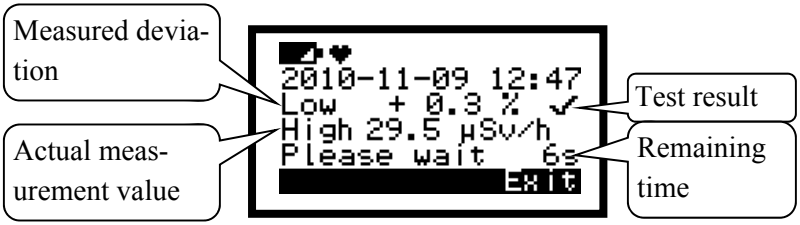


Source test starts with the parameters previously set with radeye.exe. Furthermore it is necessary to set the actual date and time.

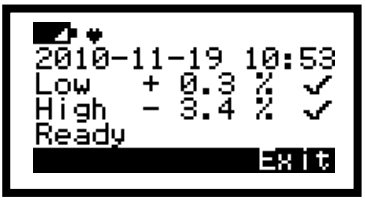
Start the source test without source. The RadEye check the background value. If the background is lower than 0.15 µSv/h the user is asked to place the source. High range test is only performed with RadEye B20-ER.



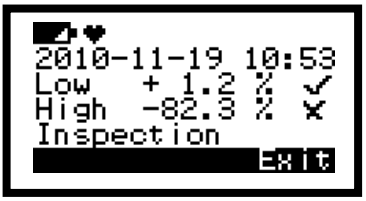
After placing the source, source test is started automatically. During measurement the display shows the actual measurement value. After measurement the deviation is calculated and displayed. The test is successful when the deviation is lower between -20% and +20%. During source test the alarm LED is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

4.15 Adjust display contrast

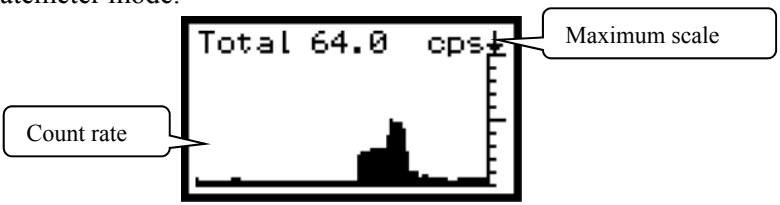
Here, the user can adjust the display contrast. This function is called in sub menu “Settings” “Contrast”.

4.16 Edit tau

The parameter of the time constant can be accessed via the menu item “Edit tau” in sub menu “Settings”. This value is used as filter time constant in operation mode “Ratemeter Tau”.

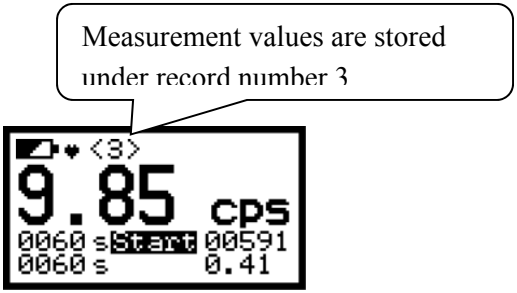
4.17 Graphic display

If enabled, one or more short presses on the “On/▼” key display a graphical view of the count rate. This display is only available in ratemeter mode.

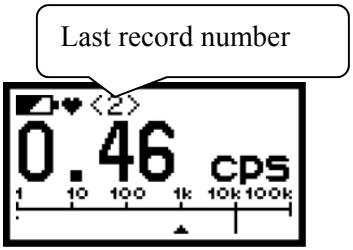


4.18 Manual data logging

Measurement values in scaler mode are stored in with history with a record number. The record number is shown in the display.



When setting the history time interval to 0s the actual counting rate with a record number is stored in the history by a long press on ▲/Info key. The last saved record is shown in the display.



5. Measurement units

5.1 General Count Rate Measurements (cps; cpm)

These are the most general measurement units (cps = counts per second; cpm = counts per minute). The displayed value is independent of any specific calibration factor which may not be available for a contamination with unknown nuclides. Both gross count measurements and net count measurements can be performed. The selection can be performed by the PC-settings or in the menu <Background> by tagging <Ratem. netto> and/or <Scaler netto>. The background count rate for these netto measurements can be determined via a background measurement in the menu <Background>. The derived background count rate can be stored and is used for all following net measurements. This value is always displayed in the top section of the LCD in order to remind the user that the measured value has been corrected by that particular count rate value.

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 1cps to 2 cps.
Due to it's almost 100 times higher efficiency for gamma emitters, the RadEye PRD is more suited for this task, than the RadEye B20.

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.

In order to get an indication of the presence of alpha contamination, the alpha-blocker can be attached to the entrance window of the detector: In the case of pure alpha radiation, the count rate will be reduced essentially to the background count rate, while beta and gamma radiation will be reduced only slightly. Please note that very low energy beta radiation or gamma radiation below approximately 10 keV will behave quite similar to alpha radiation in respect to the use of the alpha filter. For a reliable

measurement of alpha contamination a surface contamination detector with true alpha beta discrimination is required (e.g. RadEye AB 100).

5.2 Surface Contamination (Bq; dps; dpm, Bq/cm^2)

Up to 15 nuclides together with their related calibration factors can be stored in the RadEye B20. The name of isotopes, the number of available nuclides as well as their 4 Pi efficiency can be edited in the PC-software.
The user of the RadEye B20 can select the required isotope in the menu <Nuclide>. This selected nuclide (e.g. Co-60) is displayed in the LCD (eventually alternating to the subtracted background activity in case of a net measurement).

5.3 Dose Rate (Sv/h; R/h; Rem/h, Gy/h)

The RadEye B20 can be used to measure dose equivalent rates (Sv/h, Rem/h) – eventually by using appropriate gamma energy filters.
If the energy filter is applied, the RadEye switches over to dose rate display automatically.

The user may as well select R/h or Gy/h as a displayed measuring unit with the understanding that 1 R/h is simply set equal to 1 Rem/h (1Gy/h = 0.8 7719 Rem/h) and that consequently energy dependant deviations to the exposure rate and air kerma rate will occur.

The RadEye B20 and B20-ER is factory calibrated to the ambient dose equivalent rate H*(10) in a depth 10 mm for Cs-137 gamma radiation (662 keV).
Without any energy filter, the displayed dose rate is a good measure of the ambient dose equivalent rate H*(10) above 150 keV. From 20 keV to 150 keV the dose rate is overestimated. Furthermore the displayed dose rate is a good approximation for the directional dose equivalent rate H'(0,07) in a depth 0.07 mm for beta radiation and for gamma radiation in the range from 5 keV to 12 keV.

By use of the gamma energy filter 425068582 a very flat response in terms of the ambient dose equivalent rate H*(10) "deep dose" in a depth 10 mm is achieved for gamma energies 17 keV to 1.3 MeV.

For details of the response curves see technical data section.

6. Functional test

When the instrument is switched on, it will show zero count rate, dose rate or activity 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

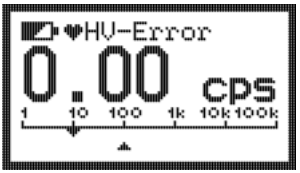
To carry out a simple test, shortly press any key. A short audible pulse has to be released and the LC display is illuminated for some seconds.

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.

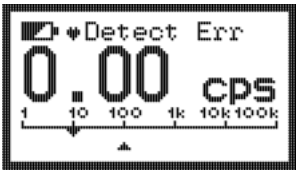
6.2 Failure indication

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

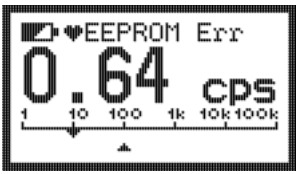
The corresponding failure message is displayed in the LCD:



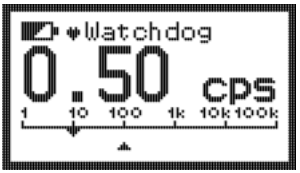
Error high voltage generation



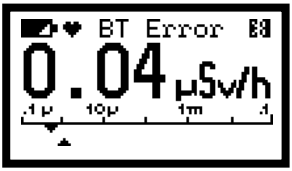
No detector pulse within 60 seconds



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



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

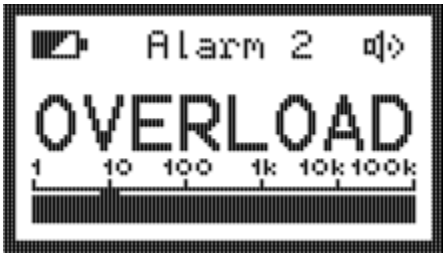


The BTcom cover failed to initialize the Bluetooth module

6.3 Overload indication

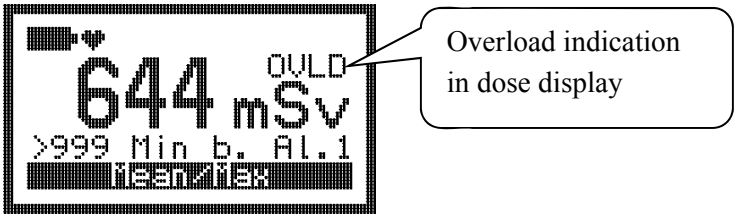
If the count rate exceeds the maximum count rate or the dose rate exceeds the maximum dose rate an overload indication is given.

	Maximum count rate	Maximum dose rate
RadEye B20	10,000 cps	200 mR/h 200 mrem/h 2 mSv/h 1.75 mGy/h
RadEye B20-ER	500,000 cps	10 R/h 10 rem/h 100 mSv/h 87.7 mGy/h



Overload indication in count rate display

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

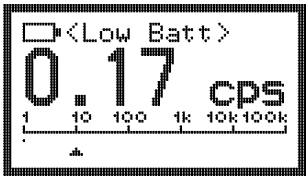


6.4 Response test with test adapter

The test-adapter 42506/8571 offers a convenient way to verify the radiation response performance of the RadEye B20. This "check source" contains 9 g of natural Lu_2O_3 (which corresponds to approximately 450 Bq Lu-176). Due to self-absorption in the Lu_2O_3 ceramics bulk material, the beta surface emission rate is only approximately 20 1/s, which results in a net count rate of the RadEye B20 (without Alpha blocker or gamma filter) of 5 cps. 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 Lu_2O_3 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 < 0.5 cps, the net count rate of 5 cps is sufficient to verify the response within 20 seconds for a 10 % statistical uncertainty.

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 acoustic 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:

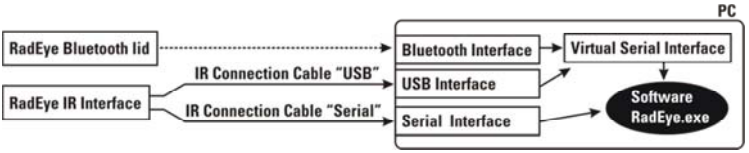
If the expiration date is enabled and the RTC is not set (e.g. after change of batteries) the following warning message is shown at start up.

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

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

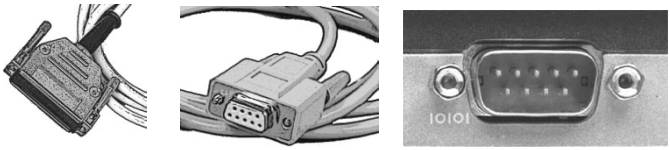
Details about the Bluetooth communication are provided through the manual DB-076 E delivered with the optional Bluetooth battery cover. Please note that the connected PC must be equipped with a Bluetooth interface as well.

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.

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

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.

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 software RadEye.exe

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 B20 Device Parameters

The Frame "RadEye B20" contains the unit's serial number and version number of the software. Click on the Read button, the Parameters of RadEye B20 will be read out from device and shown in the Frame.

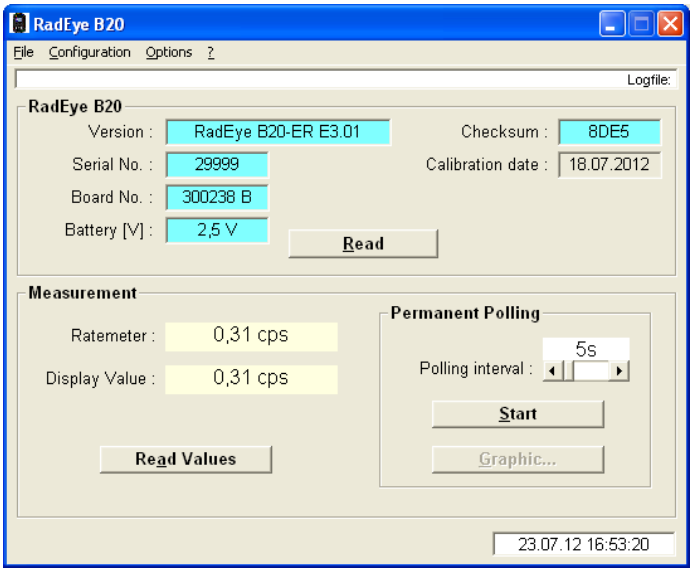


Figure 7-1: Main Window

7.4.2 Measurements

After pressing the button Read Values the current measurement value is 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 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.

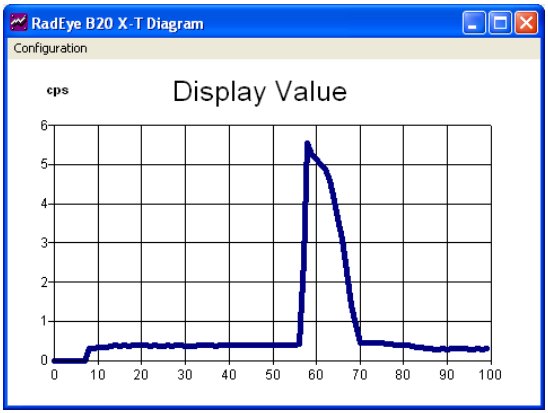


Figure 7-2: Measurement graphics

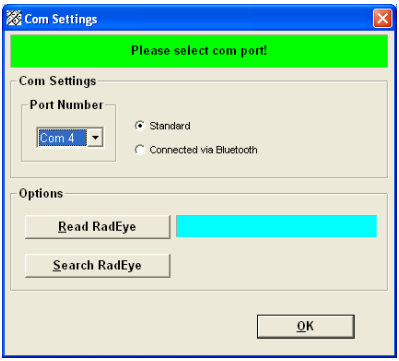
7.4.3 Creating a Measurement File

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.

7.4.4 Select serial interface

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



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 DB-076 E 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.

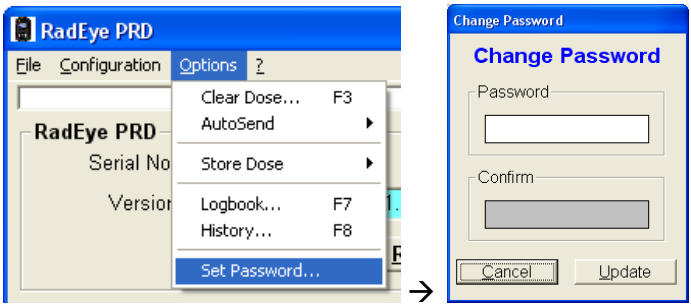


Figure 7-3: Password Setting

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

Figure 7-4: Password reminder

On the **Configuration** / **RadEye B20…** 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

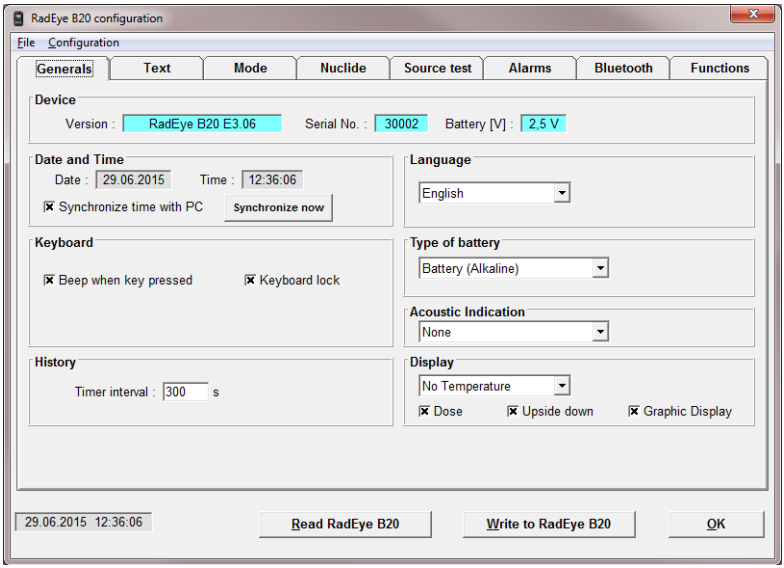


Figure 7-5: General configuration

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 display.

7.5.2 User defined text

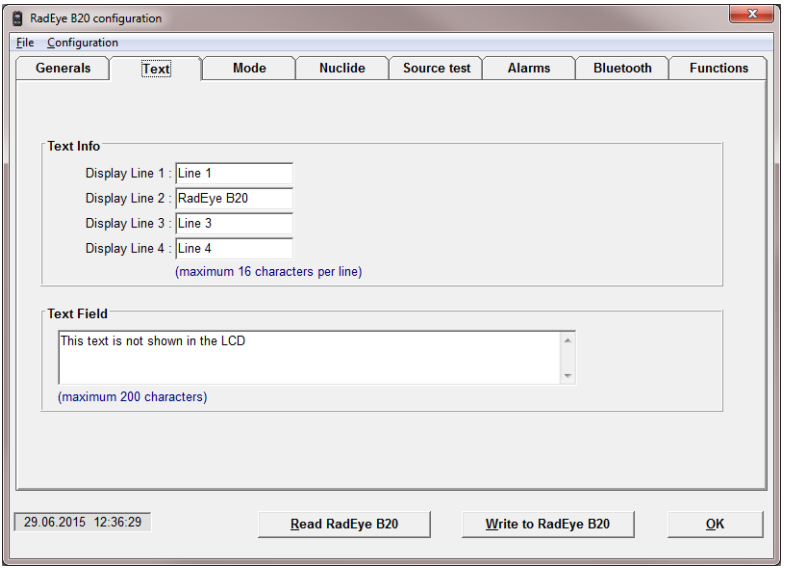


Figure 7-6: User defined text

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

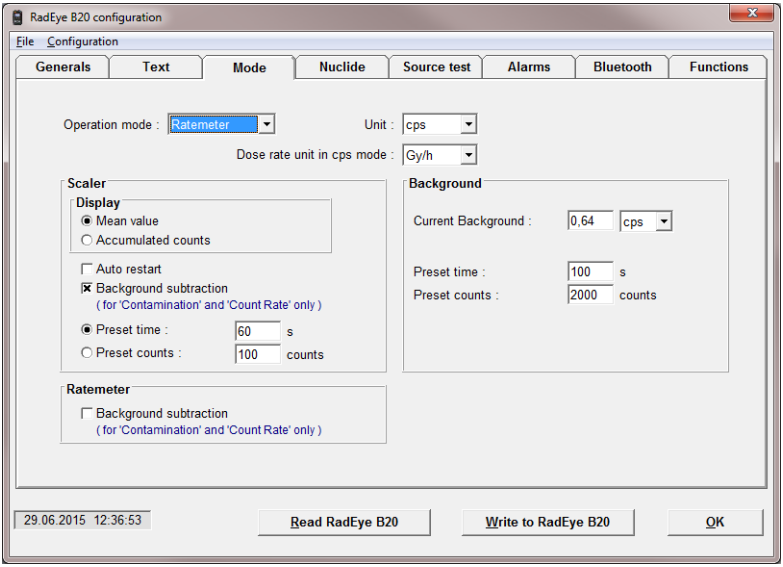


Figure 7-7: Mode setting

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 Nuclide data

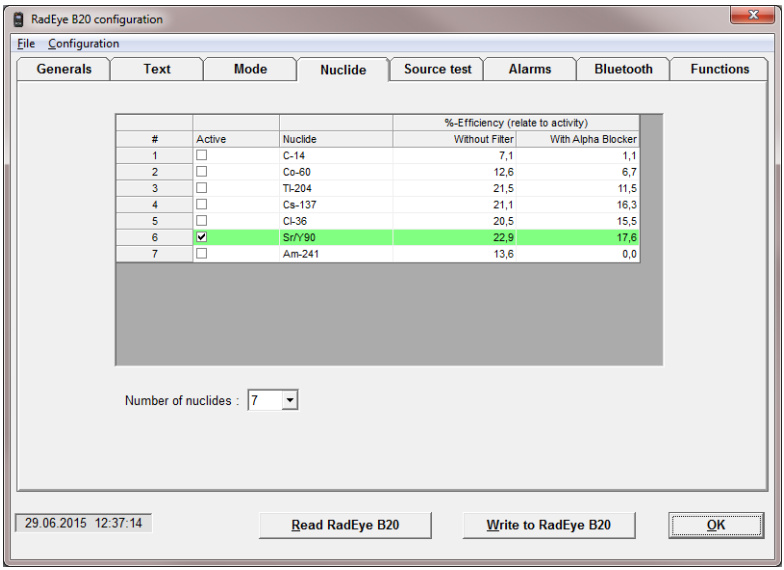


Figure 7-8: Nuclide information

On the “Nuclide” tab, the user may edit the nuclide table.

7.5.5 Source test

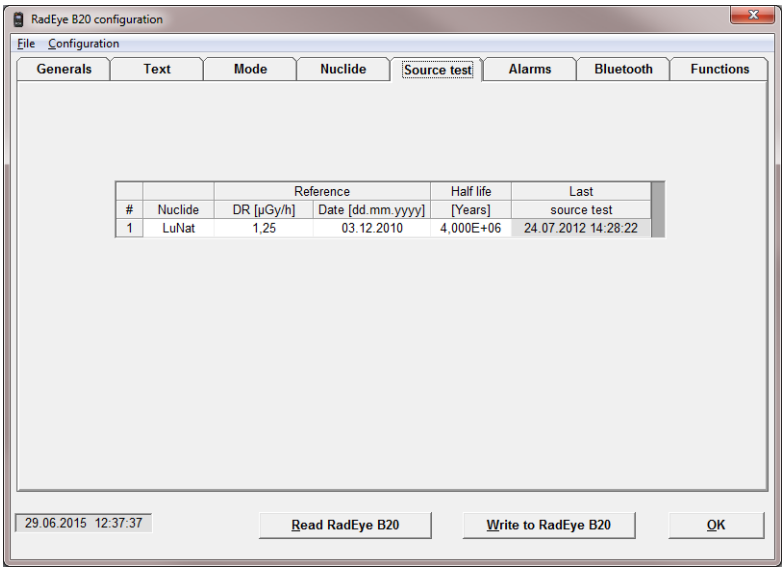


Figure 7-9: Source test parameter

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

7.5.6 Alarm setting

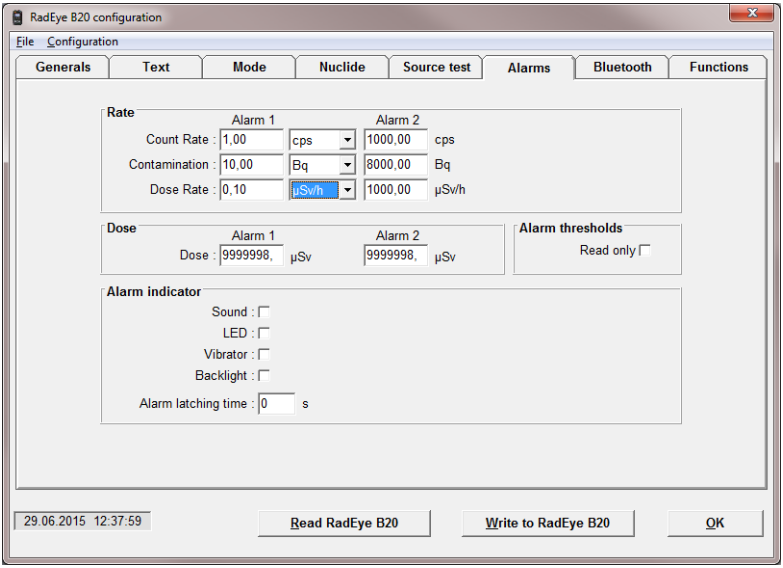


Figure 7-10: Alarm setting

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.

7.5.7 Bluetooth

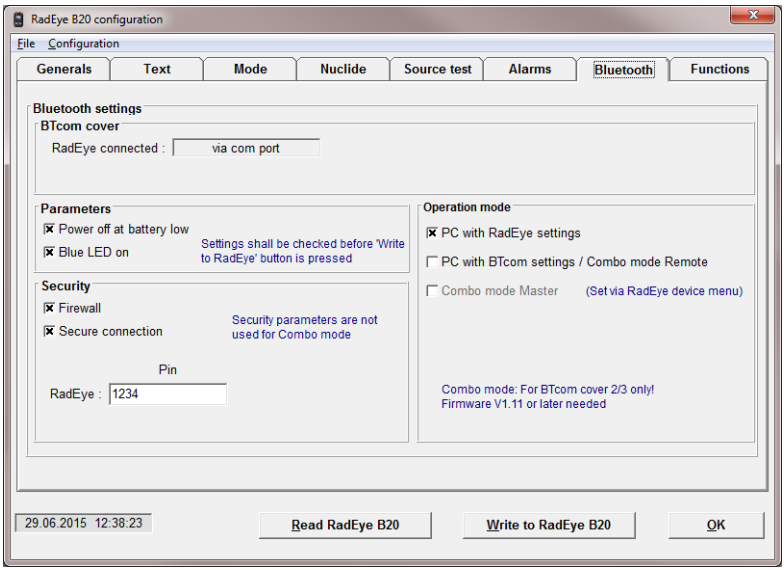


Figure 7-11: Bluetooth

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). This information is only visible, if the RadEye is connected via Bluetooth.

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 down automatically if battery low status is detected to increase battery life of the RadEye. "Secure connection" uses the PIN code that can be edited in the right field.

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

7.5.8 Menu configuration

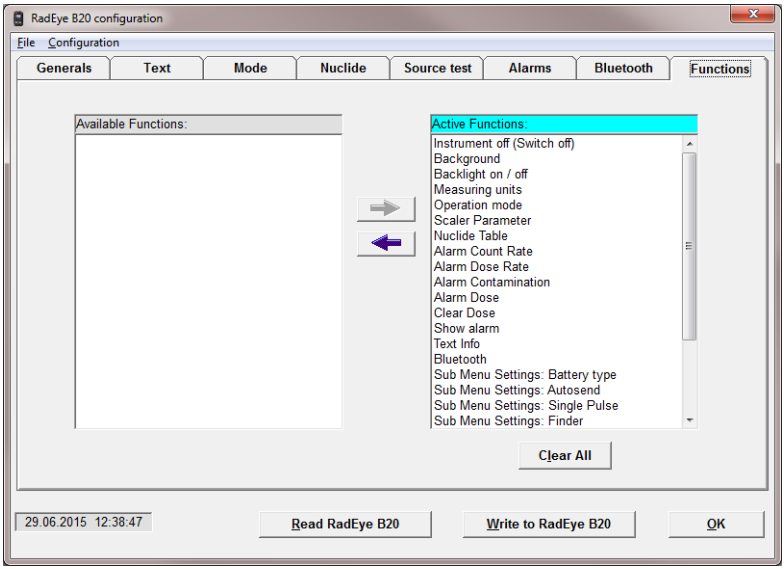


Figure 7-12: Menu selection

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 setting of the parameters is finished, these parameters have to be sent to the RadEye B20 by clicking on the Write to RadEye B20 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 B20.

7.6 History

Via **Options** / **History** the values stored in the RadEye B20 data memory can be read out, represented in an 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.
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.

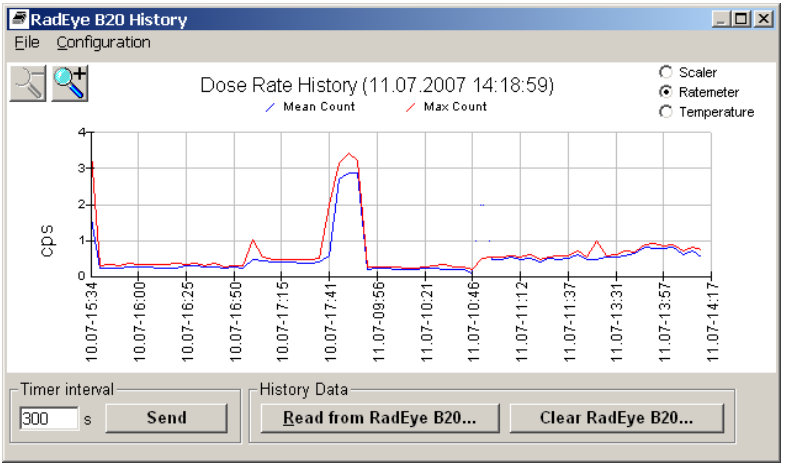


Figure 7-13: History read out

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

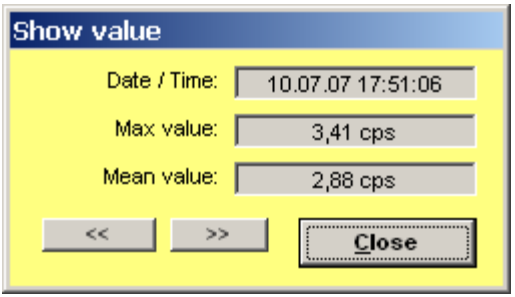


Figure 7-14: Single history value indication

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.
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). This information is only visible, if the RadEye is connected via Bluetooth.
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 down automatically if battery low status is detected to increase battery life of the RadEye. "Secure connection" uses the PIN code that can be edited in the right field.
For more information please read the manual which is delivered together with the BTcom cover.

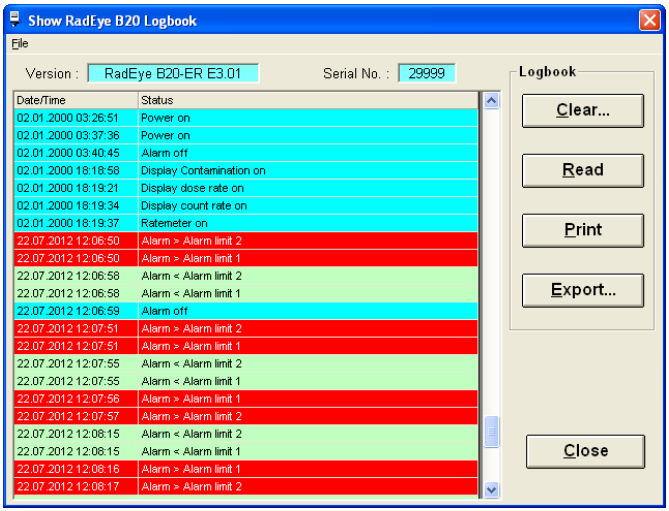


Figure 7-15: Logbook

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, 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:

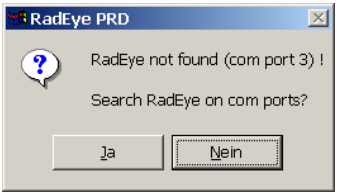
```
HV-Error
Detect Err
EEPROM Err
Watchdog*
```

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:



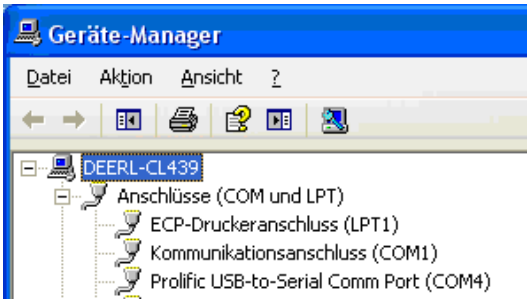
The RadEye.EXE software offers to search for a connection to the RadEye unit on other available serial ports.

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 steeper 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 B20	42506703035
Front foil RadEye B20-ER	42506703034
Battery cover complete	425067033
Rubber shock protection (rubber boot)	42506850013
Grid	42506850004
Top panel	42506850003
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 Filter

Filter H*(10) **42506/8582**

Filter H'(0,07) **42506/8583**

By use of the energy filter 425068583 the displayed dose rate is a good approximation for the directional dose equivalent rate H'(0,07) in a depth 0.07 mm for beta radiation and for gamma radiation in the range from 5 keV to 12 keV.
By use of the gamma energy filter 425068582 a very flat response in terms of the ambient dose equivalent rate H*(10) "deep dose" in a depth 10 mm is achieved for gamma energies 17 keV to 1.3 MeV.

Alpha-Blocker 42506/8581

In order to get an indication of the presence of alpha contamination, the alpha-blocker can be attached to the entrance window of the detector: In the case of pure alpha radiation, the count rate will be reduced essentially to the background count rate, while beta and gamma radiation will be reduced only slightly. Please note that very low energy beta radiation or gamma radiation below approximately 10 keV will behave quite similar to alpha radiation in respect to the use of the alpha filter.

11.2 Extension adapter

For measurements at spots with high local contamination respectively 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 First Responder Laboratory Kit (425069011)

Delivery without
RadEye B20

The laboratory kit contains:

- Sample changer for RadEye B20 (42506901001)
- Sample planchets with different heights
- Disposable gloves, spatula
- Filter ∅50mm

11.4 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 1.2 m.

11.5 Test adapter for RadEye B20 (425068571)

This test adapter contains 9g Lutetium oxide. Typical net count rate for RadEye B20: 6cps

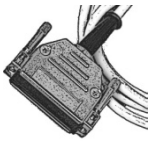
Please see chapter 4.13 and chapter 9.1.1 about the usage of the test adapter.

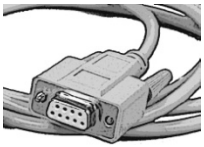
11.6 Desktop holder (425067060)

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.

11.7 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.

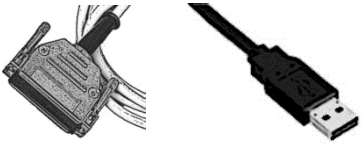




Please see chapter 7.1.2 for details. Cable length = 1.2 m

11.8 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 USB port.



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

11.9 Bluetooth battery cover (425067087)

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

11.10 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

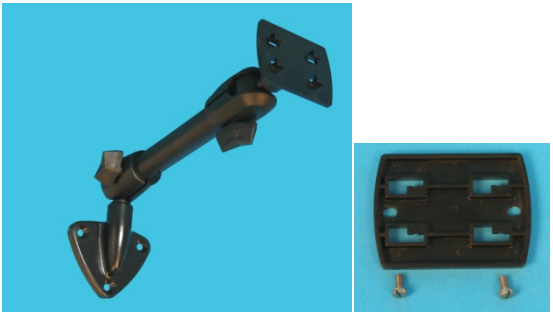
Remount the protection sleeve (see chapter 2.3). A small screw driver for the protection plug might be helpful. The phone jack must left be open, and the protection plug must be perpendicular

to the protection sleeve.

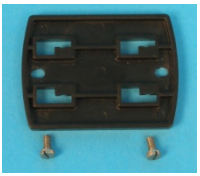
Then insert the RadEye into the car holder. Make sure that the protection plug is not mechanically interfering with the charging pin of the car holder.

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

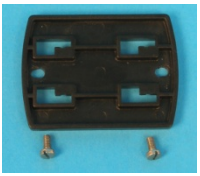
Goose neck adaptor kit 42506/7061



Pivot arm adaptor kit 42506/7062

Knuckle joint adaptor kit 42506/7063

Goose neck adaptor kit with suction cup 42506/7064

11.10.2 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

11.10.3 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

11.11 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.

11.11.1 LED indicators

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

12. Technical data

12.1 RadEye B20

Radiation type: Alpha, Beta, Gamma, X-ray radiation

Measured quantities: Count rate (cps, cpm)
Surface contamination (Bq, dps, dpm, Bq/cm^2)

With gamma filter 42506/8582:
Ambient Dose Equivalent H*(10) and Rate

Without filter:
Directional Dose Equivalent H'07 for beta radiation (100 keV – 800 keV average energy) and for photon energies 6 – 10 keV

Measuring range:

	Maximum count rate	Maximum dose rate
RadEye B20	10,000 cps	2 mSv/h 200 mrem/h (200 mR/h) (1.75 mGy/h)
RadEye B20-ER	500,000 cps	100 mSv/h 10 rem/h (10 R/h) (87.7 mGy/h)

Overload display: overload indication up to 10 Sv/h

	(1000 R/h)
Linearity error:	max. -15 … +22 % in the measuring range
Sensitivity:	Am-241: 28 %; Co-60: 25 %; C-14: 19 % Referring to surface emission rate (2 Pi) App. 4 cps/µSv/h (Cs-137)
Alarm threshold:	Two alarm thresholds for count rate, activity, dose and dose rate each. Default setting: see chapter 2.4
Audible alarm intensity:	At least 80 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 1mR/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 when H*(10) filter is used
Energy dependence:	see Diagram 12-1 and Diagram 12-2
Direction of max. response:	perpendicular to the middle of the counter tube
Reference point:	on the axis of the direction of max. response, 9 mm behind the grid
Angular dependence:	see Diagram 12-3 to Diagram 12-5
Working temperature:	-20°C ... + 50°C
Storage temp:	-25°C … + 50°C
Ambient air pressure:	700 hPa … 1100 hPa

Relative humidity:	10 ... 93 % at 35°C
Operating voltage:	1,8 ... 3.3 V, Battery low voltage starting from 2.1 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 0,7m with protection sleeve
Size:	130 mm x 67 mm x 62 mm With 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 count rate and 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. Classic linear Ratemeter with adjustable Tau 1..60s

Power consumption at 3V:	Normal operation without alarm signals and LCD illumination RadEye B20: ≈ 1 mA RadEye B20-ER: ≈ 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 B20:** ≈ 900h using two alkaline AAA cells depending on the operating mode ≈ 600h using 800mAh NiMH accu (type "Ready tot use") **RadEye B20-ER:** ≈ 700h using two alkaline AAA cells depending on the operating mode ≈ 450h using 800mAh NiMH accu (type "Ready tot use")

2 Pi efficiency values

Measured on 100 cm² traceable source; emission rate area adjusted for (20 cm² / 100 cm²)

	direct	with rubber shock protection	with Alpha-Blocker	with H*(10) Gamma Energy-Filter
Am-241	28 %	23 %	0,1 %	
C-14	19 %	16 %	3	
Co-60	24 %	21 %	13%	2 %
Tl-204	37 %	32 %	22 %	
Cs-137	39 %	34 %	28 %	2 %
Cl-36	33 %	28 %	26 %	2 %
Sr/Y-90	36 %	31 %	27 %	5 %

4 Pi efficiency values
Measured on 100 cm² traceable source; efficiency area adjusted for (20 cm² / 100 cm²)

	direct *)	with rubber shock protection	with Alpha-Blocker *)	with H*(10) Gamma Energy-Filter
Am-241	13 %	11 %		
C-14	7 %	6 %	1	
Co-60	13 %	11 %	7 %	1 %
Tl-204	19 %	18 %	12 %	
Cs-137	23 %	21 %	17 %	1 %
Cl-36	20 %	17 %	16 %	1 %
Sr/Y-90	22 %	20 %	18 %	3 %

*) RadEye B-20 default configuration

12.2 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 RadEye on, Backlight switched off *)	20…24h Accumulator 800mAh, discharged
Charge time RadEye switched off	18…20h Accumulator 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.

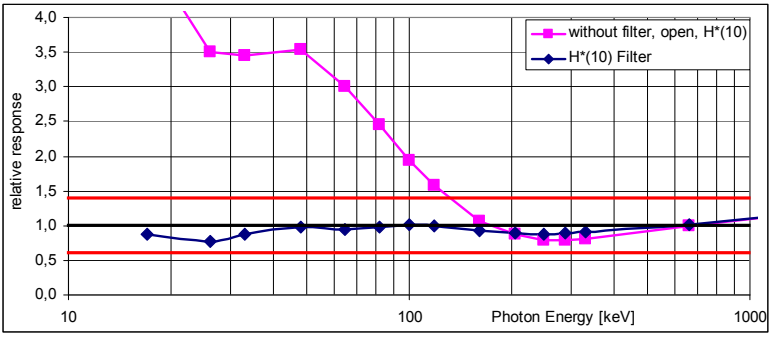


Diagram 12-1: Energy dependence for ambient dose equivalent H*(10)

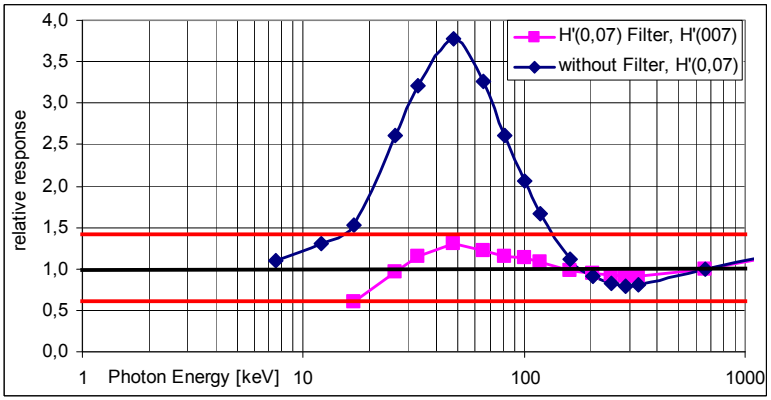


Diagram 12-2: Energy dependence for directional dose equivalent H'(0,07)

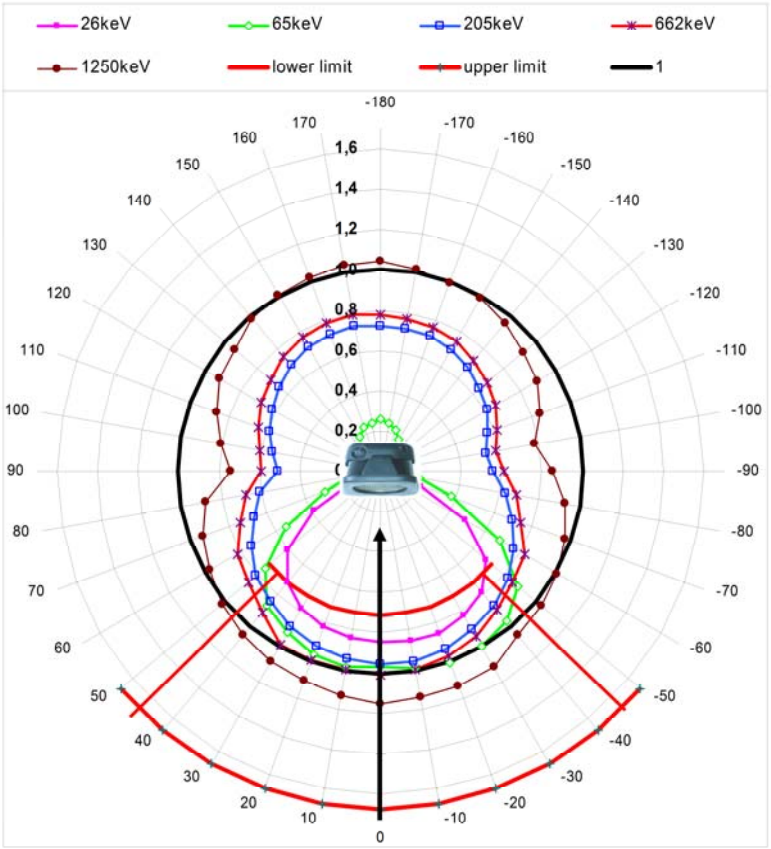


Diagram 12-3: Angular response for H*(10) gamma filter relative to Cs-137

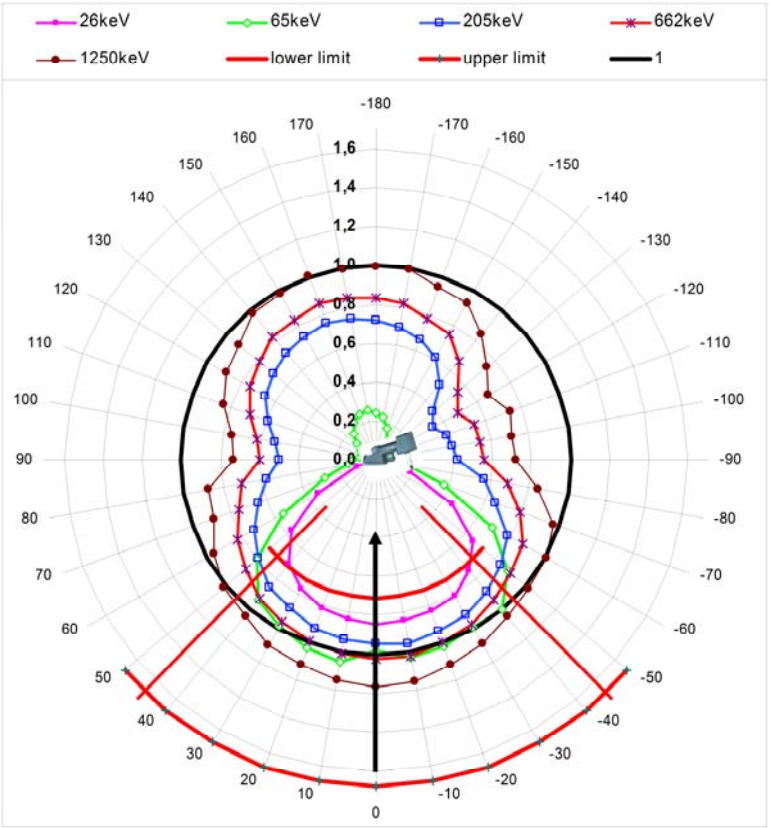


Diagram 12-4: Angular response for H*(10) gamma filter relative to Cs-137

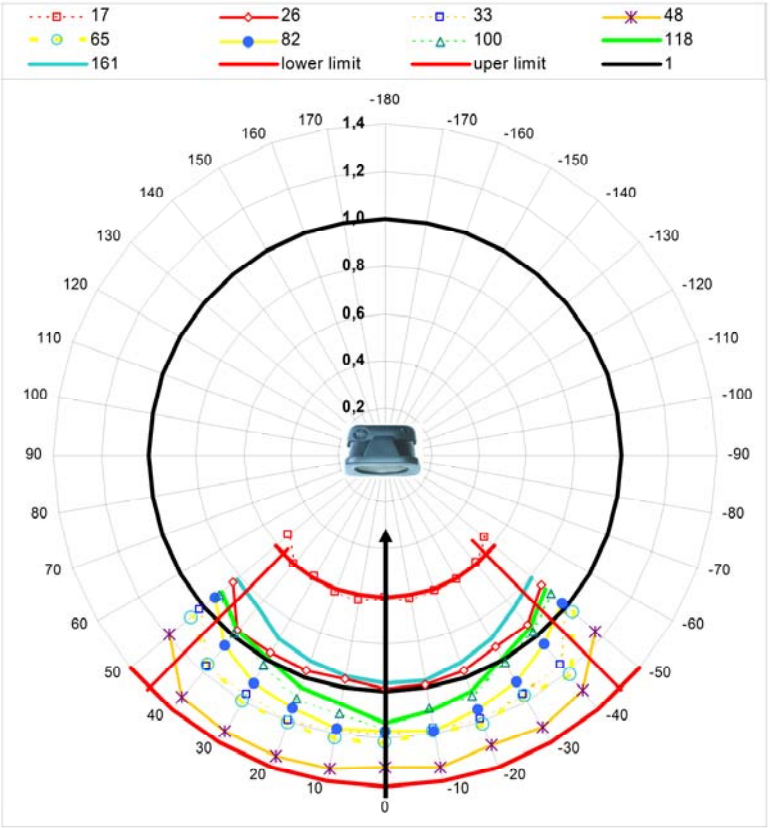


Diagram 12-5: Angular response H'(0,07)

12.3 Firmware revisions

V 1.50

- Low Battery warning
- Automatic Filter select

V 1.52

- Error eliminated: The RadEye displays year “201:” instead “2010”.
- Trending indication with multiple arrows.

V 2.04

- New menu item “Bluetooth”
- Accumulated counts
- 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

V 3.06

- New Russian language
- New feature: Display of mR/h instead of µR/h
- A acoustic signal and a flashing Alarm-LED at the end of a scaler measurement
- Manual data logging
- Error resolved: With option "Alarm Read Only" under the menu item "Alarm Dose Rate" the "/ h" was missing
- Feature key lock is configurable
- Error resolved: when changing scaler background, Time/Count values change automatically.
- New measuring unit “Gy/h”
- Graphic display
- Alternative classic Ratemeter operation mode
- Data set number is increased at the start of a scaler measurement

13. Annex

13.1 Factory Settings RadEye B20

Item	Factory default 4250674
Language	English
Measuring unit	Sv/h
Type of battery	Battery (Alkaline)
Mode	Count rate [cps]
Acoustic indication	Single pulse indication
Keyboard	Beep when key pressed
Display temperature	°C
Display dose	Active
Display option “upside	Disabled
History timer interval	120 s
Text display line 1	Line 1
Text display line 2	RadEye B20
Text display line 3	Line 3
Text display line 4	Line 4
Text field	This text is not shown in the LCD.
Alarm 1, Display ‘Dose	0.50 µSv/h
Alarm 2, Display ‘Dose	25.00 µSv/h
Alarm 1, Dose	10 Sv
Alarm 2, Dose	10 Sv
Alarm thresholds read	Disabled
Alarm indicator, Sound	Enabled
Alarm indicator, LED	Enabled
Alarm indicator, Vibra-	Enabled
Alarm latching time	0s
Active functions	All available functions are active

Item	**Factory default 4250674**
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

14. Service contact

To request repair or calibration services, please use the online RGA (Return Goods Authorization)
process at:

http://www.thermoscientific.com/servicerepair

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