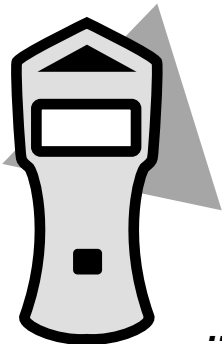


GAMMA-SCOUT®

Radiation Detector



GAMMA-SCOUT®



A product of
GAMMA-SCOUT Ltd.

...reliable radiation measurement!



Introduction	3
Features of GAMMA-SCOUT® Radiation Meter	3
Operating conditions, technical notes, CD and User's guide	4
Control panel	5
Ray selection switch	6
Radiation measurement	7
Indicating average over the past day from 00.00 to 24.00	7
Automatic alert level	7
What does a microsievert mean?	7
Normal values of exposure to radiation, limit values	8
Operating range of GAMMA-SCOUT®	8
Pulse counting	9
Pulse rate measuring	10
Time and date	11
Indicating time and date	11
Setting the time	11
Setting the date	11
Battery	12
Indicating the battery voltage	12
Battery change	12
Alert level	13
Exceeding alert level threshold (Alert-Version)	13
Programming the alert level	13
Log setting	14
Data log setting	14
"GAMMA-TOOLBOX" Software	15
System requirements	15
Data download cable	15
Software installation	15
Using the download software	16
Connecting the devices	16
Data transfer	16
Raw data display	17
Serial port mode and energy consumption	17
The log file	18
Reading, filing, charting data	19
Graphical display of data	20
Export of data to Excel	21
Menu options	21
Help	23
Gamma Scout	23
Info About	23
Info CSV-Files	23
Error messages	23
Radiation above the operating range	24
Notebooks with serial-ports <15V	24
Notebooks with USB-ports	24
Technical data	25

Features of GAMMA-SCOUT®- Radiation Meter

- **Measuring by pushbutton:** One push of a button is enough to start radiation measurement.
- **Tested precision instrument:** Each GAMMA-SCOUT® radiation meter is subjected to a final test supervised by the institute of radiation protection of a government controlled university of applied technology. Each unit receives a test certificate whose test number is identical to the unit number.
- **All ray types:** In contrast to normal radiation meters, GAMMA-SCOUT® can reliably measure not only gamma rays, but alpha and beta rays as well.
- **Permanent operation:** GAMMA-SCOUT® monitors radiation around the clock. Switch-on/-off is unnecessary, as is battery change.
- **Low power consumption:** Due to its modern electronic system, GAMMA-SCOUT® consumes very little power. This is why its battery will last up to ten years.
- **Large area of display:** All values and settings are indicated on an extra-large display.
- **Features:** An easy-to-understand display guides you through all device functions.
- **Data storage:** GAMMA-SCOUT® stores all registered pulses in its internal memory, and keeps them ready for you to use when desired.
- **Evaluation by computer:** The software which comes with the GAMMA-SCOUT® enables you to evaluate the measuring data with a computer.
- **Compact design:** GAMMA-SCOUT® is very compact in its dimensions, and small enough to fit a pocket.
- **Certification:** GAMMA-SCOUT® has been tested by TÜV (German Technical Control Board) for device safety. It meets all European CE standards as well as the "FCC 15 standard" of the USA. GAMMA-SCOUT® may be carried on aircraft.
- **Audio version:** GAMMA-SCOUT®w/ALERT features an audible alert when radiation levels exceed a user-programmed threshold.

Operating conditions, technical notes, CD and user's guide

This device complies with part 15 of the FCC rules. Operation is subject to the following conditions:

- **This device may not cause harmful interference.**
- **This device must accept any interference received, including interference that may cause undesired operation.**

Please take all the care that is necessary in connection with radioactivity, and observe the radiation protection regulations.

This manual was printed on 01.07.2003.

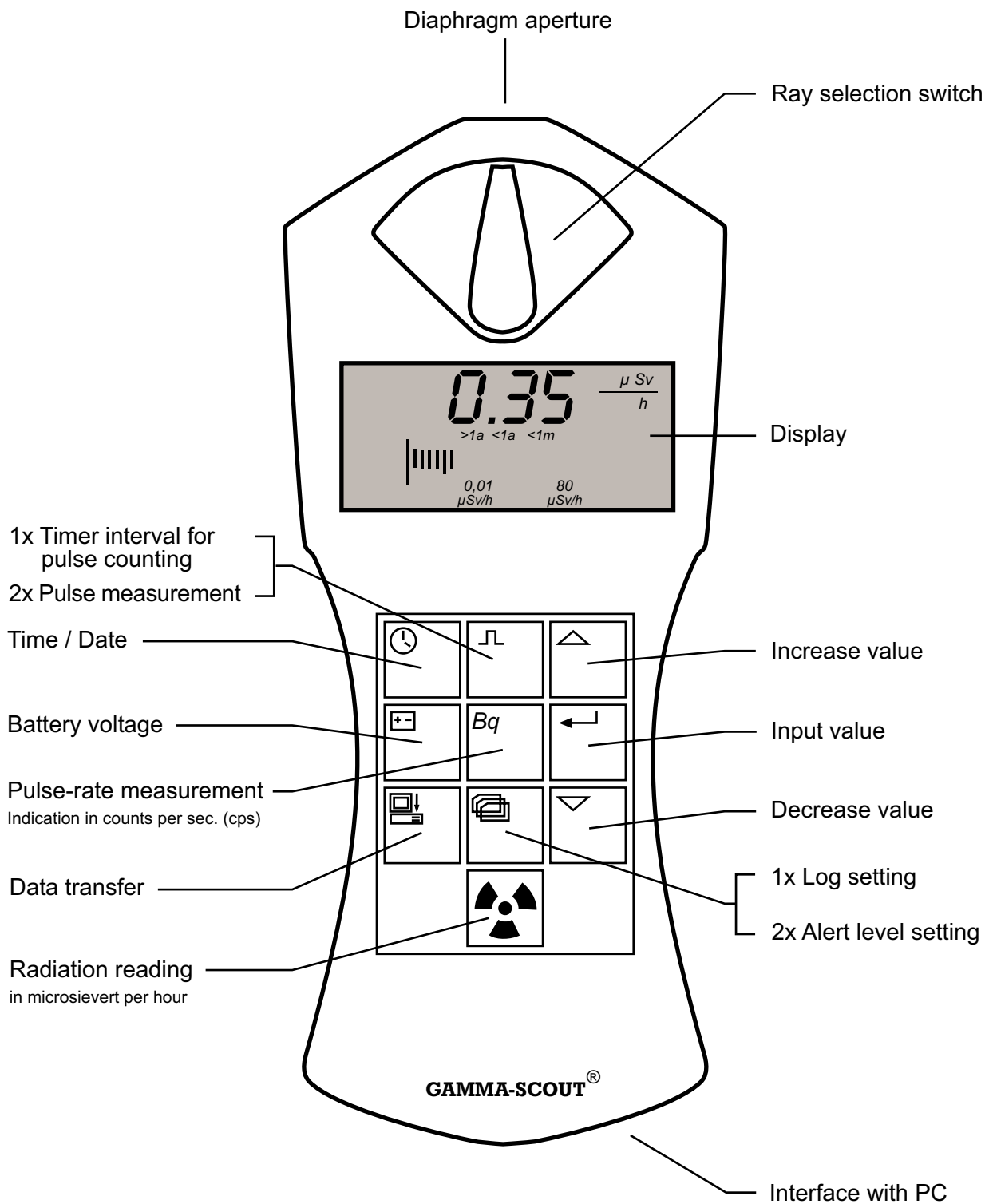
Enclosed is a CD ROM, which contains Gamma-Scout-Toolbox, a data-converting software.

System requirements:

PC-operating-system ©WIN98 / SE, ©WIN NT 4.0, ©WIN 2000, ©WIN XP.

The software is available in German and English version. You will find the text of this manual on CD-ROM. Updates of software and manual are available for download at our internet site "www.gamma-scout.com".

Please register at our website to get further information about important modifications.



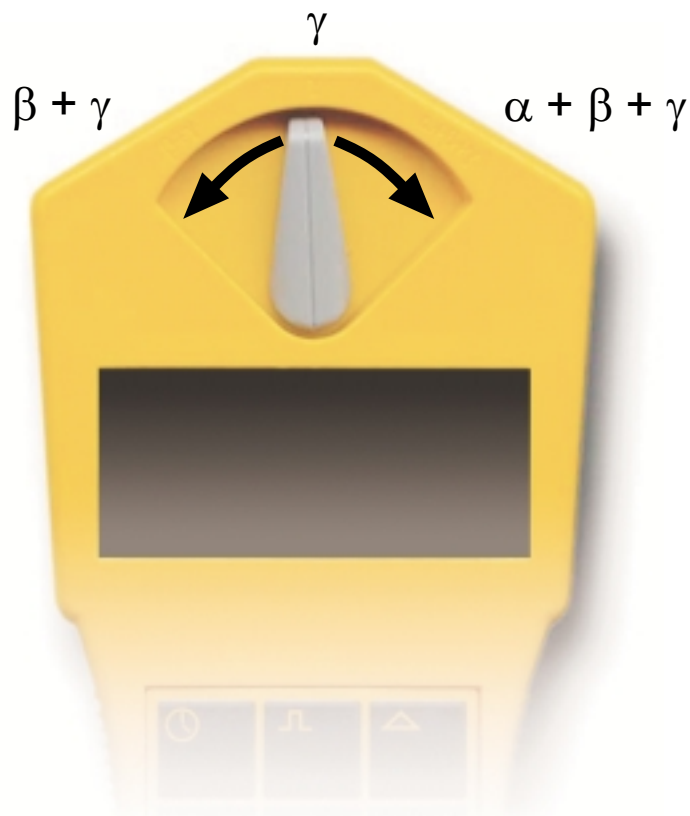
Your GAMMA-SCOUT® is equipped with a Geiger-Müller counter tube enabling you to detect not only gamma rays but alpha and beta rays as well.

With the ray selection switch you can limit the ray types you want to measure:

- Set the selection to centre position (γ symbol) if you want to detect gamma rays only. With the switch in this position, an aluminium plate screens the counter tube window against alpha and beta rays.
- Turn the switch to the left, i.e. counterclockwise (to the $\beta + \gamma$ symbols) if you want to measure gamma and beta rays but no alpha rays. Now, an aluminium foil screens the counter tube window against alpha rays.
- Turn the switch to the right, i.e. clockwise (to the $\alpha + \beta + \gamma$ symbols) if you wish to measure all three ray types. This switch position opens the counter tube window for access by the three types of ray.

For normal measuring, place the ray selection switch at center position. Alpha and beta rays are limited in range to a few centimetres or metres, and can therefore be detected only when very close to the radiation source.

This also explains why it makes little sense to keep the ray selection switch constantly open - an added reason being that the counter tube window may be damaged in this exposed position.



In standard mode, GAMMA-SCOUT® informs you quickly and reliably about current radiation exposure. Within the operational measuring range of GAMMA-SCOUT® the pulses per period are converted to equivalent dose by the ratio 114.67 [pulses per minute / μSv per hour]..

Indicating current radiation

- Pressing the  button puts GAMMA-SCOUT® into standard mode, and its display shows you the present radiation in microsievert per hour - not only as a value but, also in the form of a bar chart. Note that for a small radiation value, this bar chart appears only as a single line. In order to visualize the volume of detected radiation, there is a bar diagram on the groundline of the display using symbols as >1a (stay for more than 1 year until accumulation of the legal maximum of 50 mSv p. a.), <1m (less than 1 month for accumulation) etc.

Indicating average over the past day from 00.00 until 24.00

- Pressing the  button a second time causes the average radiation over the last day (midnight to midnight taken from the GAMMA-SCOUT® clock) to be displayed for a few seconds, again in microsievert per hour. The  symbol in the display will blink. Note that this function is not available for up to 48 hours after first putting the device into operation.

Automatic alert level

- When exceeding the user programmed alert level, GAMMA-SCOUT® generates an audio alert (a beep every 2 seconds) and displays the blinking  icon. This icon continues blinking after radiation fall back until the user has deleted it by pressing the  button twice.

What does a "microsievert" mean?

In physics, three types of radioactive rays are known: alpha, beta and gamma rays. They differ not only in their physical characteristics but also in their effects on humans.

To make these three ray types comparable in their effects on humans, a value has been created which defines the biological effects of rays: it is referred to as dose equivalent whose unit is the sievert (called equivalent dose).

1 REM = 0,01 Sievert (Sv)

Based on the counted radiation pulses, the different components of a radiation mix are converted into a common measure for the biological effect. In this a "standard mix" is used: cobalt 60. Conversion into the dose equivalent refers to the gamma quantum of the cobalt 60 radionuclide with a quantum energy of approx. 1.2 MeV (megaelectron volt).

Relation of GAMMA-SCOUT® : 114,67 pulse per minute = 1,0 $\mu\text{Sv/h}$

Normal values of exposure to radiation, limit values

German regulations on radiological safety contain a list of radiation exposure values für 1988 (comments on §28 of the Federal Ordinance für Radiological Safety, Federal Bulletin 11/6144, page 5). According to this list, the average value of natural exposure to radiation during 1988 is 2.4 millisievert (mSv). An average of 1.55 mSv in 1988 had to be added as due to civilizational causes, of which 1.5 mSv originated from medical treatments.

By law, operators of technical equipment are prohibited from causing more than 1.5 mSv p.a. of radiation impact on the environment (§44 of the above ordinance), with upper limits of 0.3 to 1.8 mSv p.a. applying to discharge of air and water directly affecting humans, depending on the part of the body concerned (§45, same ordinance). Since 1996, the upper limit für operators of technical equipment has been decreed by the European Community to be adopted by national laws as 1.0 mSv p.a. (EC Gazette L 159, 39th volume, 29 June, 1996).

Adding the mentioned 2.4 mSv p.a. from natural causes and the new limit value of 1.0 mSv p.a. from technical sources (as just referred to), but leaving aside the exposure in connection with medical treatment which depends on the individual case, the result is an upper limit of 3.4 mSv p.a. or 0.4 microsievert per hour if this exposure continues over the entire year.

Natural environment at Heidelberg, Germany has a radiation level of about 0,1 - 0,2 Mikro-Sv/h.

Below the digits of the detected dose on the display, a bar chart is visualizing how long the user may stay in this environment, until he accumulates the x-ray load of 50 mSv p.a., the mentioned upper level for professionally X-ray exposed people.

Operating range of GAMMA-SCOUT®

GAMMA-SCOUT® is used to control x-ray impact at home and on the job. Very strong x-ray load above 80.00 µSv/h (nuclear core conditions) cannot be measured with this technique. In case of overflowing this upper limit, GAMMA-SCOUT® displays (N.N.N.N...) and sets the  icon into the display. Reset the  icon by double-pressing the  button. Data from overflow-status is marked with (*) in the download table.

Pulse counting

GAMMA-SCOUT® can also be used as a normal Geiger counter, in which case it simply counts the number of pulses received without converting them into the sievert unit. This function is always of advantage if the measuring values are to be integrated into existing processes and procedures or if the measuring process itself is to be demonstrated or checked.

GAMMA-SCOUT® stores the received pulses in its internal memory.



Switching on the pulse count

- Press the  button to switch GAMMA-SCOUT® to the pulse count mode. The display then shows the pulse symbol. Counting did not yet start. A second pressing of the button will start the counting.
- Press the  button if you want to set a measuring time:
 - For the measuring time to count in seconds, press the  button once.
 - For the measuring time to count in minutes, press the  button twice.
 - For measuring time to count in hours, press the  button three times.
- Now set the exact value of the desired measuring time, using the  and  button.
- Start measuring by pressing the  button a second time. The pulse symbol flashes in the display during the measuring time.
- If a measuring time was set, the pulse symbol flashes until the end of the measuring time, after which it is steady again. The display now shows the number of pulses counted for the programmed interval.
- You can stop measuring in two ways:
 - by pressing the  button once again. The measuring result remains visible in the display;
 - by choosing another mode of operation. This makes the measuring result disappear.

Pulse rate measuring

In the pulse rate measuring mode, the pulses registered by the counting tube are continuously measured and converted into a pulse rate. The unit of this pulse rate is cps (counts per second).

Info: Counts per second is not exactly the same as „activity” of the nucleus, given in Becquerel.



Indicating the pulse rate

Press the  button to switch to the pulse rate measuring mode. The  symbol will flash for the duration of measuring. After measuring, the  symbol is steady again.

Pulse rate measuring gives the average number of pulses per second. Since radiation intensity may strongly fluctuate on a short-term basis, this indication of average rate will of course be the more exact the longer the measuring is done.

GAMMA-SCOUT® gives you a first result within a few seconds, then automatically prolongs the measuring time up to 4096 seconds in order to produce as exact an average value as possible.

GAMMA-SCOUT® has an integrated quartz clock whose display you can activate by pushbutton. Time and date are used to register the measured radiation. The PC- supported software has a feature to synchronize the GAMMA-SCOUT® date and time with your PC-clock (see page 21). The GAMMA-SCOUT® clock serves to file data.



Indicating time and date

- Press the  button to call the time. The display shows the time according to setting plus the  symbol.
- Press the  button a second time to call the date. The display shows the date according to setting plus the  symbol.

Setting the time

- First, call the time by pressing the  button. Then press the  button to set the hours. Both hour digits flash in the display. With the  and  buttons, set the hours forwards / backwards as desired. Confirm the set value with the  button.
- Press the  button a second time to set the minutes. Both minute digits flash in the display. With the  and  buttons, set the minutes forwards / backwards as desired. Confirm the set value with the  button.
- If you wish to set the seconds as well, press the  button a third time. The display shows the two minute digits together with the flashing digits for the seconds. With the  and  buttons, set the seconds forwards / backwards as desired. Confirm the set value with the  button.

Setting the date

- Press the  button twice to call the date display. See description "setting the time".

You can stop the setting of the clock at any time by pressing the  button. For stopping the year setting, press the  button a fourth time.

GAMMA-SCOUT® is powered by a Lithium/Thionyl chloride cell of 2.7-3.7 voltage. The device will continue functioning until the cell voltage is down to 2.7. When the voltage drops below this value, the battery symbol will appear in the display. The stored data should then be read from the internal memory. Nevertheless, the data will be retained even at total breakdown of voltage, and can then be read when the device is serviced.

Do not open the GAMMA-SCOUT, but ship it to the maintenance service !

Indicating the battery voltage

Press the  button to have the existing battery voltage indicated. The display will show the cell voltage available when the electronic system is under maximum load.

Battery change

In case of battery change, the maintenance service has to reset some electronic parameters
Therefore, battery change can only be made by the manufacturer.

Exceeding alert level threshold (Alert Version)

GAMMA-SCOUT®w /ALERT features an audio beep that sounds when radiation levels exceed a specific user-programmed level. The default alert level is 50 µSv/h (i.e. 50 mSv p.a. = maximum exposure level for professionally X-ray exposed and supervised people, under current EU regulations). Along with the audio alert, the display will also show the  icon.

Programming the alert level

The  button pressed once is for control of the protocol (see above).

A second pressing changes to status "alert level programming". The set level is displayed. The button  increases , the button  decreases the threshold. The new value is displayed blinking. The lowest possible value is 1,0 µSv/h. The step change is 1,0 µSv/h. The maximum possible radiation value (and upper limit of GAMMA-SCOUT®) is 80 µSv/h. Press the button  to save the new selected level.

GAMMA-SCOUT® automatically logs the number of pulses measured, and stores this data in its internal memory. This data can be read and processed by a computer.

The logging process is factory-set so that GAMMA-SCOUT® will accumulate the pulses each week, storing them as weekly values. On this basis, the capacity of the memory is sufficient to log the weekly values over a period of 10 years.

As the following table shows, you can also set shorter logging intervals, with corresponding reductions in the storage capacity:

Logging interval	Display	Storage capacity
1 week	7d	Approx. 10 years
1 day	1d	Approx. two years
1 hour	1h	four weeks
10 minutes	10 min	Approx. four days
1 minute	1 min	Ten hours

Data log setting

- Press the  button to switch to log mode. The display shows the log symbol . Briefly, the bargraph will appear in addition, indicating how much log memory is still available. Each bar equals 4% of memory.
- By pressing the  button, you select more frequent logging and, consequently, shorter logging intervals.
- By pressing the  button, you select less frequent logging and, consequently, longer logging intervals.
- By pressing the  button, you enter the finally selected value of logging interval.

GAMMA-SCOUT® automatically prolongs the logging interval to a week as soon as the memory capacity is more than 3/4 full. You can transfer the logged data to a computer at any time, and then clear the memory of your GAMMA-SCOUT® for fresh use. The next section gives you detailed information on this subject.

Using Gamma-Tool software, you can transfer the data (Gamma-Hex-Dump), which GAMMA-SCOUT® has logged in its memory, to a computer and convert them into list or graphic form for further processing. Connect GAMMA-SCOUT® with the serial port of your personal computer and press  button on control panel to set data transfer mode.

System requirements

For use of "GAMMA-TOOLBOX", the system must meet the following requirements:

© MS-Windows PC with a free COM interface (on the back of your PC)

Gamma-Tool software supports the following operating systems at the moment;

©WIN 98 / SE, ©WIN NT 4.0, ©WIN 2000, ©WIN XP.

Data download cable

GAMMA-SCOUT® comes with a cable to connect the COM-Port of your computer with its interface. Open the interface cover at the bottom-side on GAMMA-SCOUT®.

Software Installation

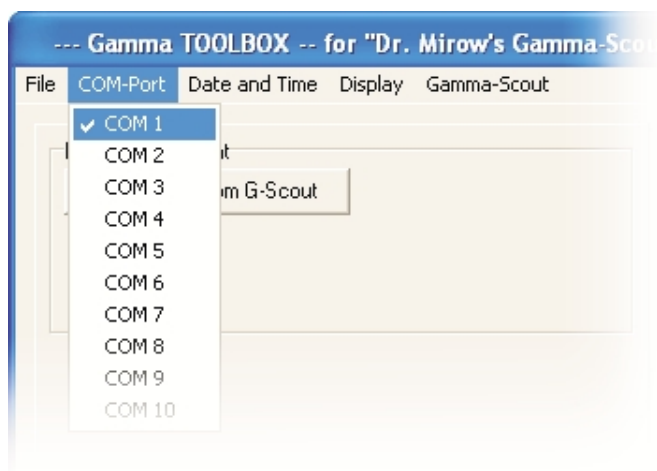
1. The included CD-ROM contains GAMMA-TOOLBOX software with auto-installation routine and a pdf-formatted file, GAMMA-TOOLBOX Manual. You need to install "©Adobe Acrobat Reader" to read or print this pdf-file, which you can download from the website < www.adobe.com >.
2. Place your CD-ROM in your CD-ROM drive. If the autostart function of your CD-ROM is not automatically activated within the operating system, you must then manually start the software unpacking installation by executing the file "Inst_E_Gamma_xyz.exe" (xyz = version). The installation window will appear on screen. Please choose any directory (i.E. C:\GammaGammaScout\...) to install GAMMA-TOOLBOX to your system. Click „Extract" button to unpack and copy the required program files into selected directory.
3. In case of using the software for data reading, start GAMMA-TOOLBOX software by double-clicking "GammaTool.exe" from the directory where you have installed the program on your harddrive. If you wish, you can create an icon on your desktop.

Using the download software

Start your GAMMA-TOOLBOX software from the desktop via click on "GammaTool.exe". When you start the program for the first time you will be requested to choose any serial port of your computer. The program will use this preselected port later on.

Connecting the devices

After having connected your GAMMA-SCOUT® with your computer, using the supplied connection cable, please choose the selected COM-port in the pull-down menu. (i.e. COM1:).



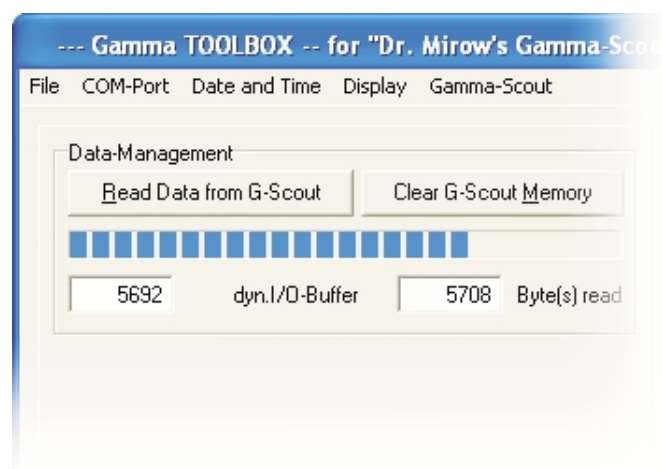
If the port is not present, or already used by any other device, an error message window will appear.

Every time you start the program please be sure your GAMMA-SCOUT® is connected via the serial port of your computer

Data transfer

Click "Read G-Scout"-Button to start data transfer from the memory of GAMMA-SCOUT® to your PC.

If the data transfer cable is not connected properly, or GAMMA-SCOUT® has not been set in data transfer mode by pressing the  button on its keyboard, an error message will pop up on your screen.



Raw-data display

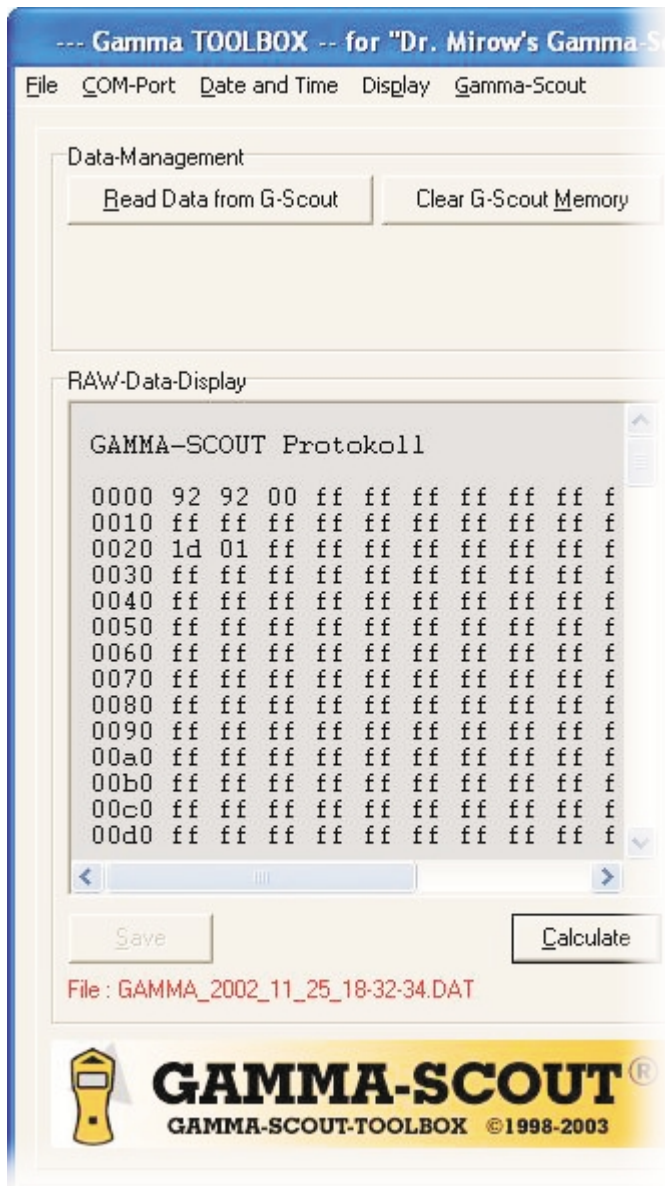
The transferred data is now visible in Raw-Data-Display. The generation of the raw-data is filing this data in the directory where the gamma-toolbox software has been installed. This automatic

generation of the raw-data is using the names

„GAMMA_YYYY_MM_DD_Hr-Min-Sec.dat”
and

„GAMMA_YYYY_MM_DD_Hr-Min-Sec.csv”
Via the button „Save” the user can store these two files in a directory and name of his own choice.

Klick on the button „Calculate”, the data are displayed as readable table on the same screen as the raw-data (ctn. p.19).



Serial port mode and energy consumption

In „PC-Serial port mode” the energy consumption of GAMMA-SCOUT®’s battery is increased. Do only activate this mode when Gamma-Toolbox requests you by info-window. Save battery life of your GAMMA-SCOUT® and switch from ”serial-port-mode” back to ”measuring-mode” by pressing the button  on GAMMA-SCOUT® panel. If the user forgets to switch back to „measuring-mode”, GAMMA-SCOUT® will switch back automatically after 3 minutes of not using the serial interface.

The log-file

In case of a problem with reading or converting the raw data (hexa-decimal) to the table ready to read, the software must protocol this problem in the „log file“. Typically, the software does not pop up this log file.

In raw-data calculation the checking results of the particular data-strings are written into a log-file. Click button "Save Log-File", if you want to save this file.



Exit this step via button „Close“.

Reading, filing, charting data

After the raw-data have been converted into table-format (see page 17), the following window is displayed. Data may be printed or saved via "Save calculated data" as text file (.txt).

Choose file name and target directory. The file will be formatted automatically. Data may be converted to graphics on screen via the button "Show data in graphical display".

Calculated Data

Gamma-Scout -- Calculation of Raw-Data --

"File : GAMMA.DAT"

The ID of your Gamma-Scout is : 009299

**Measurements with overflow
of the counter-tube
(max. 80 Microsievert per hour) are signed with "-".**

[cps] means 'Counts Per Second' (Impulses Per Second)

PROCESSED DATA :

Nr.	Range	from	to	Impulses	Rate [cps]
1	Set/Tm.	14:00 01/22/03	14:05 01/22/03	0000000092	0.307
2	Set/Tm.	14:05 01/22/03	14:07 01/22/03	0000000033	0.275
3	Set/Tm.	14:07 01/22/03	11:25 01/23/03	0001084416	14.142
4	Week	11:25 01/23/03	11:25 01/30/03	0000000773	0.001
5	Week	11:25 01/30/03	11:25 02/06/03	0000000240	0.000

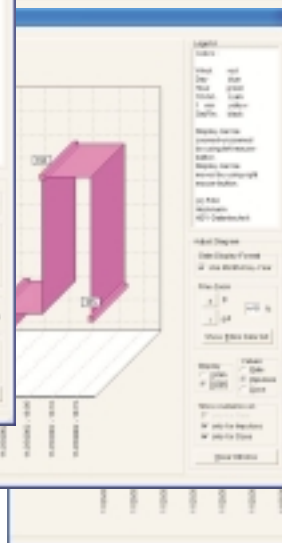
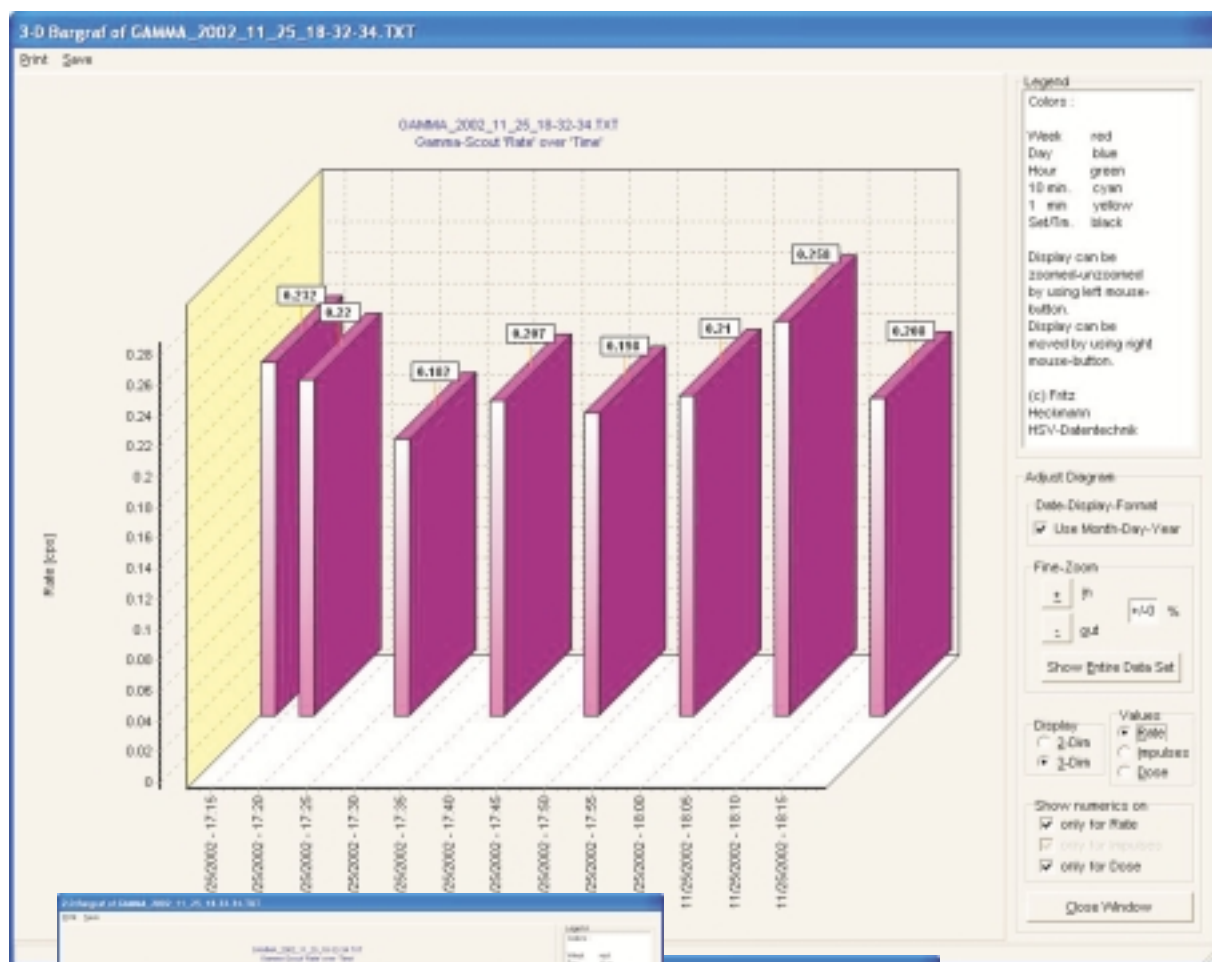
Gamma-Scout ID : 009299

Save calculated data

Show data in graphical display

Graphical display of data

Data can be displayed in two- or three dimensional form as rate-, pulse- or dose-chart. These charts are printable and can be saved as Bitmap (.BMP) or windows metafile format (.WMF).

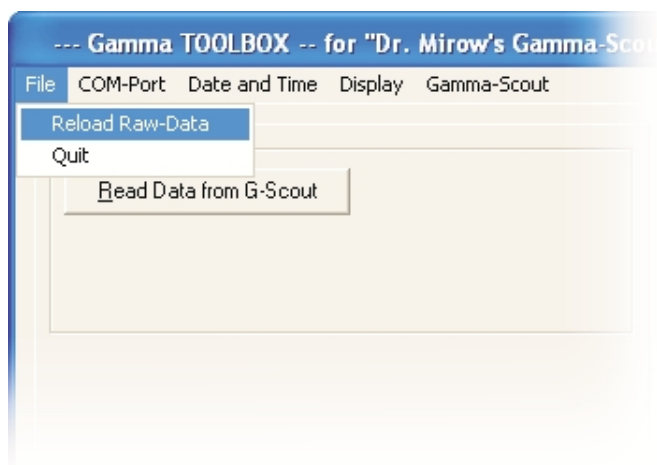


Export of data to Excel

If you wish to handle GAMMA-TOOLBOX generated csv-file data (see page 17) with ©Microsoft Excel, you can import it as explained in Gamma-Toolbox, "Gamma-Scout / Info CSV-Files".

Menu options

The functions in the main-menu are "File", "COM-Port", "Data and Time", "Display" and "Gamma-Scout".

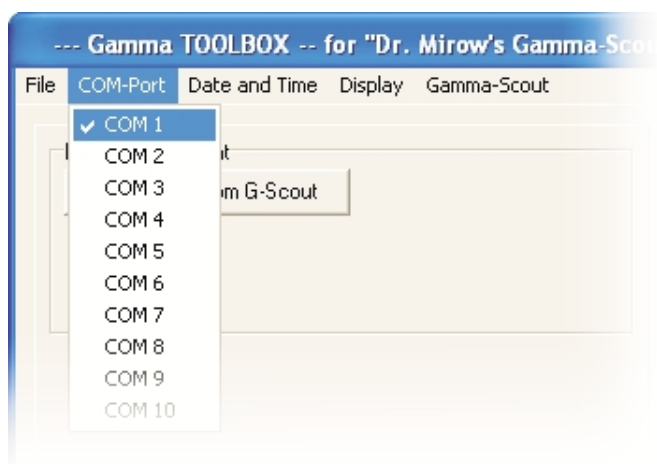


- **File / Reload Raw-Data :**

Choose „Reload-Raw-Data“ to call data previously stored.

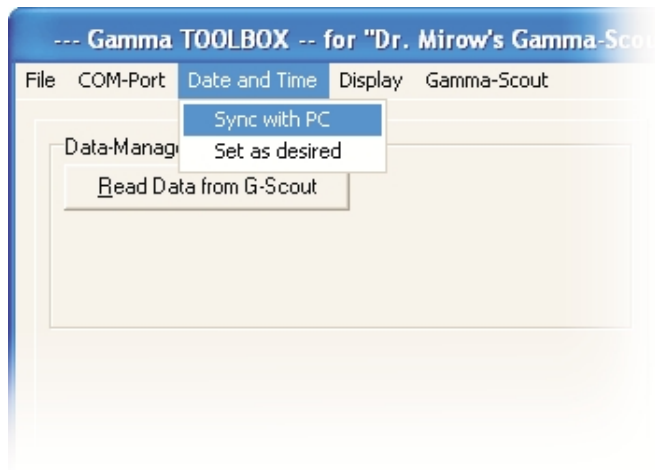
- **File / Quit :**

Choose "Quit" to exit program.



- **COM-Port :**

Choose the number of serial-port of your computer, which is connected to GAMMA-SCOUT®.



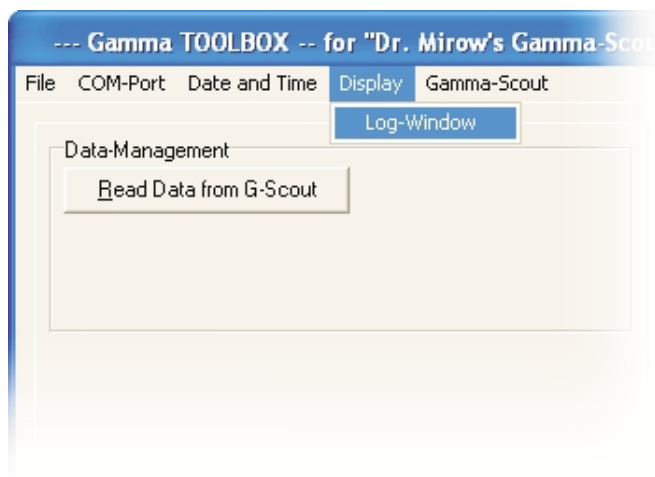
Date and Time

- **Sync with PC :**

Choose „Sync with PC” to synchronize time and date of GAMMA-SCOUT® with your PC.

- **Set any time :**

Choose "Set any time" to set date and time of GAMMA-SCOUT® by your choice (i.e. in different time zones).



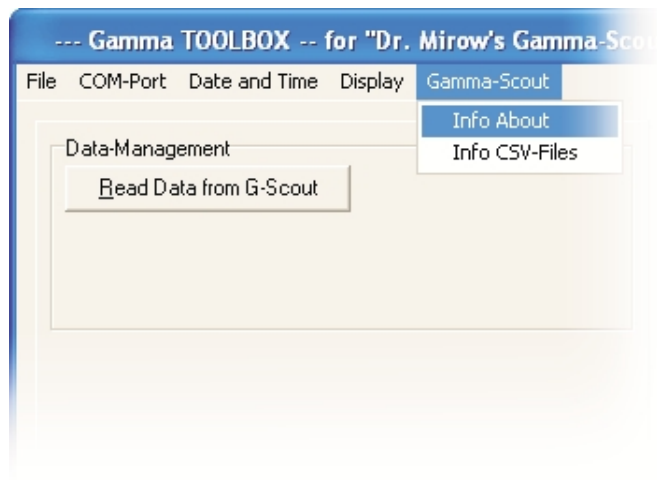
Display

- **Log-Window :**

Select "LOG-Window".

Now the screen reporting the data conversion procedure will pop up.

Help



Gamma-Scout

- **Info About** (Where and how to get help):

Choose menu „Info About” to get information about the operating system of your PC and your GAMMA-SCOUT, the version number and the manufacturer of GAMMA-TOOLBOX-software. If you need help the help-desk <gamma@hsv-datentechnik.de> must know this system information.

- **Info CSV-Files :**

Choose menu „CSV-Files” to get more information about the "csv-file", which Gamma TOOLBOX generates to make possible further editing in ©Microsoft-Excel.

Error messages:

If the download program runs to an undefined status, error messages will be displayed. If you request help from <gamma@hsv-datentechnik.de> please report this error messages and your system parameters.

Radiation above the operating range

If GAMMA-SCOUT® measures dose rates > 80 microsievert / h, these values are marked with (*).

If this overflow occurs over a longer interval, the sum of the entire interval will be marked with (*).

Notebooks with serial-ports < 15 Volts

Some notebooks use serial ports with non standard voltage level. In this case GAMMA-SCOUT® cannot build the proper electronic link to your PC. Please use a serial voltage level changer, easily obtained in the accessory market. If you contact our technical-service for help, the type of your PC must be known.

Notebooks with USB-ports

Some notebook manufacturers prefer USB-ports and do not use COM-ports anymore. In this case you must use a matching "USB-to-COM" adapter, which is available on the market. This kind of adapter translates "USB" into "serial", and communication between the PC and GAMMA-

Display	Liquid-crystal display (LCD), 4-digit, numeric with dimension, quasi-analogue logarithmic bar chart. Operating mode indicators	
Ray detector	End-window alpha-beta-gamma detector counting tube according to the Geiger-Müller principle Stainless steel housing with neon halogen filling Measuring length 38,1 mm, measuring diameter 9,1 mm Mica window 1,5 bis 2 mg/cm ² Gamma sensitivity 114,67 pulses per minute at Co-60 radiation = 1µSv/h in energy band of ambient radiation Zero rate <10 pulses per minute with screening by 3mm Al and 50mm Pb Operating temperature -20 bis +60°C, operating voltage approx. 450 V	
Ray types	($\alpha + \beta + \gamma$)(alpha)	from 4 MeV
	β (beta)	from 0,2 MeV
	γ (gamma)	from 0,02 MeV
Ray selection	$\alpha + \beta + \gamma$	without shielding
	$\beta + \gamma$	Al foil approx. 0,1 mm, shields off α completely
	γ	Al shielding approx. 3 mm Shielding off α completely and β to 2 MeV, weakens γ less than 7%
Life	Approx. 10 years	at 20°C and natural environmental load
Power-consumption	On average less than 10 microamperes	
Memory	2 Kbyte	
Housing	impact-resistant Novodur plastic	
Dimensions	Length 163 mm x width 72 mm x height 30 mm	
Interference protections	European CE standard, US-standard FCC15	
Service	Dr. Mirow/GAMMA-SCOUT P.O.Box 1346, D-69198 Schriesheim Fax ++49 6220 / 6640 E-Mail: drmirow@gamma-scout.com	
State	01.07.03 (Right of modification reserved)	

Physical Term	New Unit	Old Unit	Relation
Aktivität	Becquerel (Bq) 1 Bq = 1/s	Curie (Ci)	1 Ci = $3,7 \cdot 10^{10}$ Bq 1 Bq = $2,7 \cdot 10^{-11}$ Ci = 27 pCi
Ion Dose I	Coulomb / kg	Röntgen (R)	1 R = $2,58 \cdot 10^{-4}$ C/kg 1 C / kg = 3876 R
Energy Dose D	Gray (Gy)	Rad (rd)	1 rd = 0,01 Gy 1 Gy = 100 rd
Equivalent Dose H	Sievert (Sv)	Rem (rem)	1 rem = 0,01 Sv 1 Sv = 100 rem