Technical description and user manual

Survey Meter
SM 8 D

(Version V1.5.1)

Sensortechnik und Elektronik Pockau GmbH

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Content:

Product description Survey Meter SM8D

The device Survey Meter SM8D is a microprocessor based pocket radio meter for a proof of small activities of alpha, beta, gamma and x-rays.

Area of application:

- Medicine, industry, development
- Measurement of ambient dose rate and dose in mixed alpha-, beta- and gamma radiation
- Assessment of workplaces regarding radiation protection

Technical characters:

- Easy for use, light and robust
- Uncompensated GM tube with thin mica window
- Based on microprocessor with graphical display incl. backlight
- Measure of dose rate and dose (µSv/h / µSv, cps / imp, Bq/cm²)
- Display of the last measured maximum value of the dose rate in [µSv / h]
- Wide energy range for photons (10 keV ... 1.3 MeV)
- Qualitative detection of Alpha-and Beta activity
- Surface activity determination
- Acoustic and optical signal of counter tube pulses
- Detection overflow of counter tube
- Detection exceeded measuring range
- With trend information in display
- Various alarm limits for dose rate adjustable in [µSv / h]
- USB interface with PC software (optional)

Contents:

- Survey Meter SM8D in case
- Energy compensating filter
- Set of battery
- Technical description

Optional accessories:

- USB cable
- CD with Software
- Probe tray with console

Fig. 1 *Survey Meter SM8D accessories*

1 Safety instructions

	Do not open the device. Risk of touch potential > 500V by opened and enabled device. Sensitive parts, such as sieve plate of detector, must be protected against mechanical influences. Risk of >500V contact shock by damaged or defective elements while switched on.

	The device may be opened by the manufacturer only. Infringing behavior will lead to invalidation of any warranty claims! The survey meter must always be stored in dry rooms! If the survey meter is not used for a period of more than one month, the batteries must be taken out of the device! The manufacturer does not assume any warranty for damages caused by leaking or incorrectly inserted batteries and the use of wrong battery types! It is not permitted to use solvents or solvent containing cleaners! Keep away from spurting water!

2 Control elements

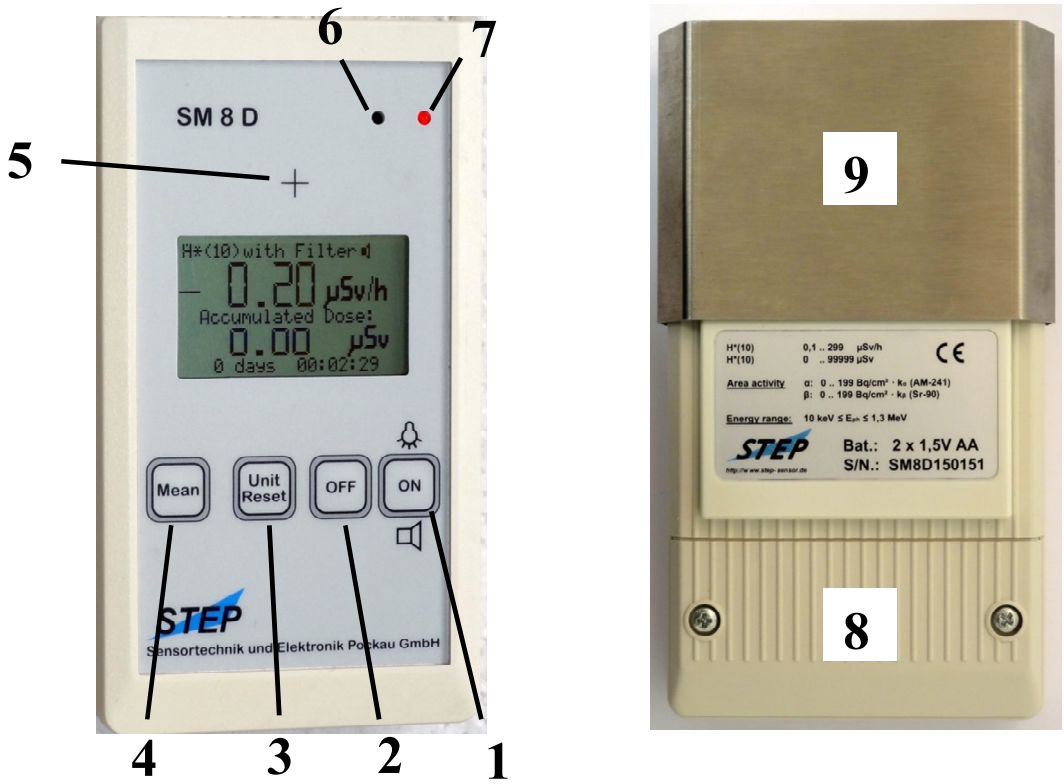


Fig. 2 *Survey Meter SM8D*

1 Button „ON“
“Backlight“ (press briefly)
“Acoustic signal“ (longer press)

2 Button „OFF“

3 Button „Unit / Reset“
“Unit” “ (press briefly)
“Reset“ (longer press)

4 Button „Mean“
(display table with mean values)

5 Center of Detector

6 Voice pipe for acoustic signal of counts

7 LED for optical signal of counts

8 Battery casing

9 Energy compensation filter

3 Principle of measurement

The pocket radio meter SM8D is a radiation measurement device, based on GM counter tube with thin mica window. The detector is a no energy compensated end window counter tube for Alpha, beta, gamma and x- rays. The pulse of counter tube are electronically formed, integrated and displayed as the average digital. The counter tube window has a basis weight of ≤ 2 mg / cm², whereby the measurement is possible of beta radiation from 35 keV and of alpha radiation.

4 Technical data

Measurement range	Dose rate:	0,1	-	999 µSv/h
	Dose:	0	-	99999 µSv
	Count rate:	0	-	1799 cps
	Dose:	0	-	99999 imp
	Surface activity:	0,1	-	999 Bq/cm²
Sensitivity	6 cps / µSv/h (based on Co-60)			
Energy	Photons:	10 keV -		1,3 MeV
	Beta:	> 160 keV		(qualitatively)
	Alpha:	> 2 MeV		
Radiation detector	GM tube with thin mica window (basic weight < 2 mg/cm²), not energy compensated, effective diameter 44,5 mm (1,77 in.)			
Reading output	LC- Graphic- Display with backlight, LED for optical signal of counts Buzzer for acoustical signal of counts			
Alarm	Selection of 6 alarm thresholds 1/3/5/10/50 and 100 µSv / h Acoustic alarm when exceeded			
Data output	USB interface			
Power supply	2 Alkaline Battery of type LR06 (AA), 1,5 V Battery life typical 35 hours with alkaline cells (by radiation background and backlight off) Alternatively: 2 Rechargeable Accu's Type: AA (Mignon) , NiMh / NiCd, 1.2 V Attention: The use of rechargeable batteries reduces the duration of use of the device depending on capacity			
Operating conditions	Temperature 0 °C ... + 50 °C Rel. air humidity. 75 % (by 30 °C)			
Weight	ca. 450 g			
Dimensions	152 x 83 x 35 mm (Length x Width x Height)			
Accessories	- PC Software for display, analysis and saving of measurements - USB cable - Probe tray and console			

Note: The manufacturer reserves the right to change in the sense of technical progress.

5 Using the measurement device

5.1 Battery

Please insert 2 batteries AA 1.5V AA into the battery compartment. Pay attention for correct polarity!

Fig. 3 *Battery Survey Meter SM8D with batteries*

Note: It's also possible to use Rechargeable Accu's
Type: AA-Mignon, NiMh / NiCd, 1.2 V ,capacity ≥ 2000 mAh

5.2 Energy Compensation Filter

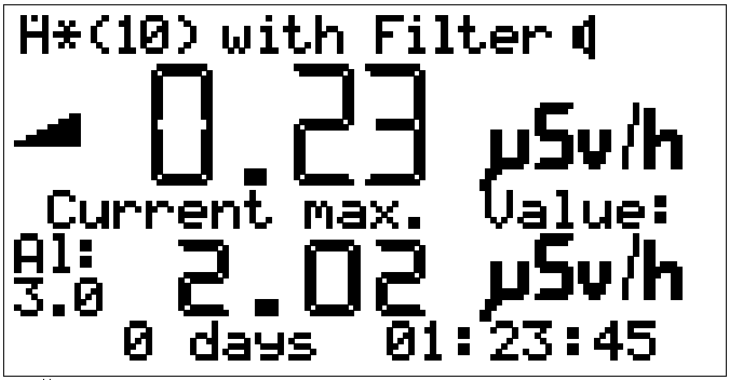
Initially, the unit is delivered with an energy compensation filter. This can be moved within the guides laterally in the housing. The energy compensation filter can be positioned in front of the detector entrance window, depending on the application and the measurement unit:

Fig. 4 *Backside of Survey Meter SM 8 D without (left) and with (right) energy compensation filter*

5.3 Switching ON / OFF

Press the button “ON” for turn on the device on. The start screen displays the device name and the software version for a short time.

The device is ready for measurement after a few seconds.
After switching on, the device is in measuring mode "dose rate" and the last measured maximum value is displayed:



The unit is switched off by pressing the button “OFF”.

5.4 Backlight – Enable / Disable

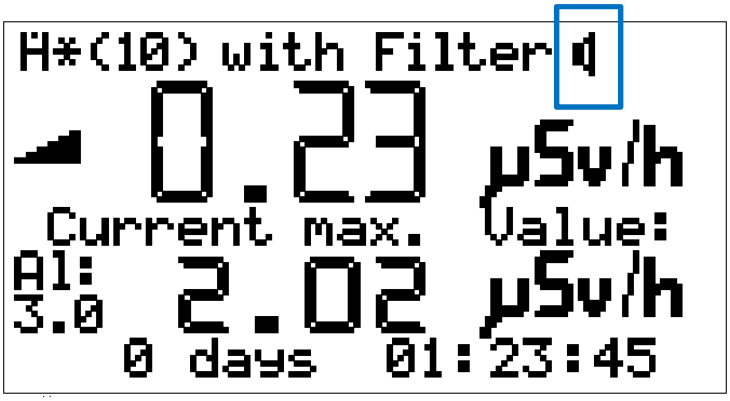
When the device is switched on, the backlight is automatically switched on.
You can activate / deactivate the LED backlight of graphic display by briefly pressing button "ON” (+ Backlight / Buzzer).
The LED backlight turns off automatically after 60 seconds.

Attention: The lighting stresses the batteries and should therefore not be switched on unnecessarily.

5.5 Enable / Disable Acoustic signal

The acoustic signal is automatically activated after device is turned on. It is shown by the speaker icon on the top right on display.

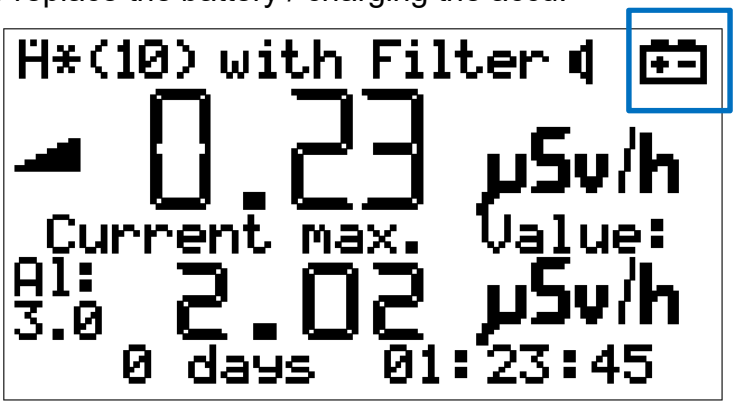
You can enable / disable the buzzer for acoustic signal with a longer press (> 3 seconds) of button "ON" (On / Backlight / Buzzer). The speaker icon shows the state:



5.6 Battery status

The battery/accu charge status is constantly monitored. The display shows an insufficient supply voltage by flashing the battery icon.

In this case please replace the battery / charging the accu.



5.7 Selection of different measurement modes

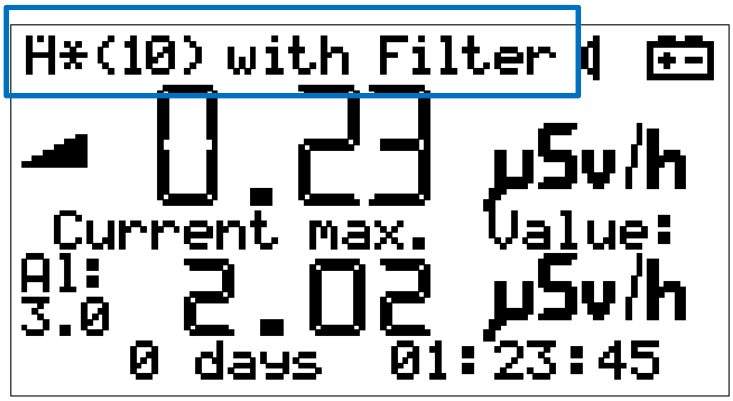
With SM8D you can measure in different modes:

- dose rate in µSv/h and dose in µSv
- dose rate in cps and dose in imp
- the surface activity in Bq/cm²

You can select the measurement mode by shortly pressing the button „Unit / Reset“.

5.8 Measurement mode: Dose rate in µSv/h

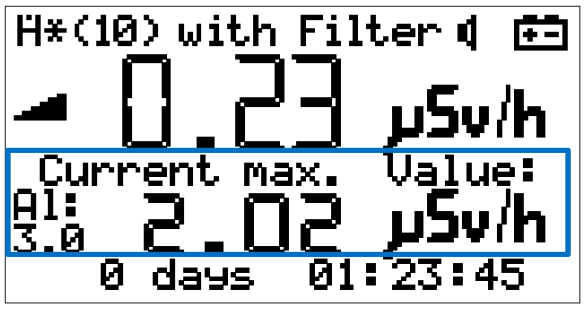
When the device is turned on, you measure the dose rate in µSv/h and corresponding dose in µSv. Please use the compensation filter for measure H*(10). This information is also displayed in first line:



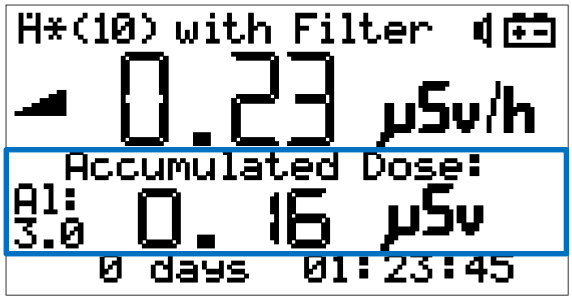
Optional display of the maximum value of the dose rate or the dose:

In the lower part of the display 2 display options are available:

Display maximum value



Display dose:



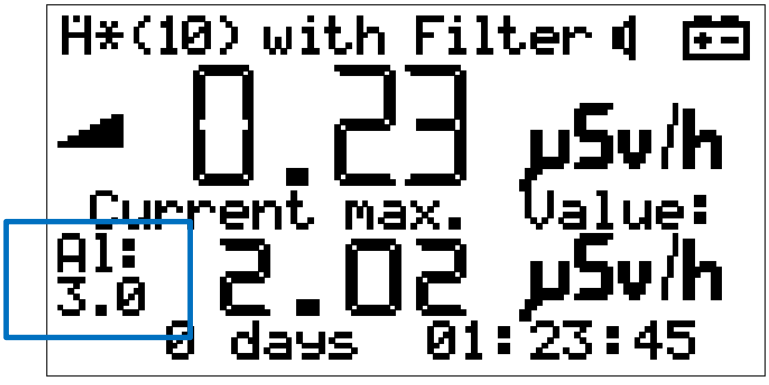
This display option can be toggled by simultaneously pressing the T4, Mean 'button when switching on the device.

Display selected alarm limit:

In the device 6 fixed alarm limits are selectable:

none / 1.0 / 3.0 / 5.0 / 10 / 50 or 100 µSv / h

If an alarm limit has been selected, it will appear in the display:



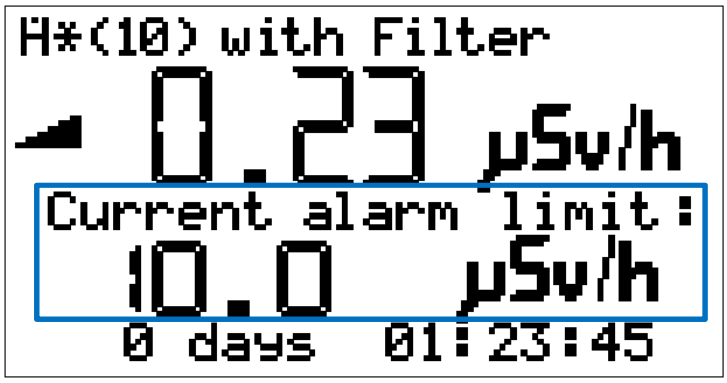
If the alarm limit is exceeded, the audible alarm is activated.

Attention:

In alarm mode 'Pulse rate' in [cps] and 'Surface activity' in [Bq / cm2] no alarm limit is active!

Selection of alarm limit:

The selection is made by long pressing of button T4 “Mean” until the current alarm limit appears in the display:



By shortly pressing button T4 'Mean', you can scroll through the fixed alarm limits.
A long press on T4 will confirm the currently displayed alarm limit.

Reset maximum value / dose and time:

The dose value and time can be reset by longer pressing the button „Unit / Reset“.

	You should be use always the compensation filter to measure the dose rate, because the detector has a strong energy dependent response!

5.9 Measurement mode: Dose rate in [cps] and dose in [imp]

You can select this measurement mode by briefly pressing the button „Unit / Reset“:

In this mode the SM8D measured the dose rate in **C**ount **p**er **S**econd and the corresponding dose as sum of counts in **Imp**ulse , based on time which is display in bottom line:

Reset Dose and Time:

The dose value and time can be reset by longer pressing the button „Unit / Reset“.

5.10 Measurement mode: Surface activity in [Bq/cm²]

You can select this measurement mode by briefly pressing the button „Unit / Reset“.

The calibration factor of the α- and β-area activity is preselected fixed for nuclides Am 241 (α) and Sr (Y) 90 (β), based on DIN ISO 7503 part 1,

Please calculate the area activity by using the calibration factor kβ (beta) or kα (alpha) as follow:

Measurement result for beta radiation (surface activity in Bq / cm²):
Measured value M = displayed value x calibration kβ

Measurement result for alpha radiation (surface activity in Bq / cm²):
Measured value M = displayed value x calibration kα

The calibration factor kβ (beta) or kα (alpha) are determined by calibrated area radiation sources.

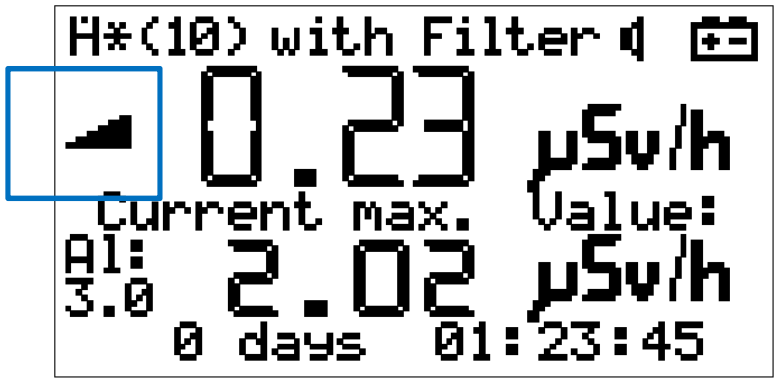
Note: The potential self-absorption of alpha and beta radiation in the contaminated layer in practical measurements.

For maximum sensitivity with alpha and beta measurements, please don't use energy compensation filter.

5.11 Trend information

The device calculates the trend of dose rate of last minute. An icon show the trend:

Rising:



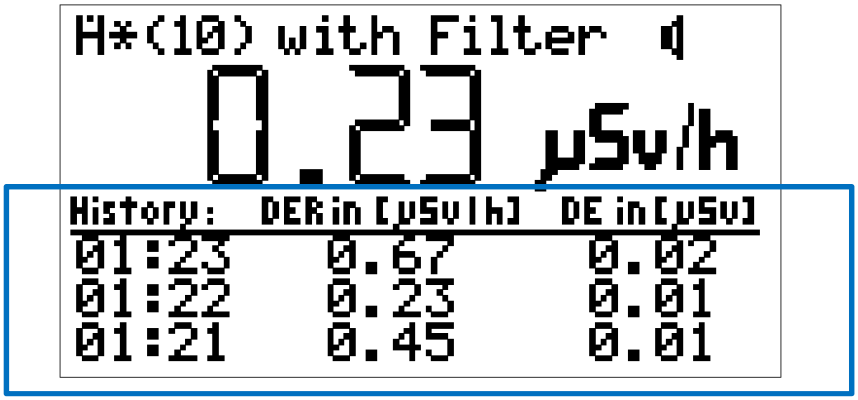
Falling:

In order to reduce measured value deviations, it is recommended to read the measured value with a straight bar graph (not rising or falling).

5.12 Button ‘Mean’ , show history table

The SM8D calculates a mean value over 1 minute and saves the last 15 values in internal storage / table.

By a short press of button “Mean” the table will be displayed:



You can scroll through the table by another short press of button “Mean”. When reaching the end of table, the follow info appears:

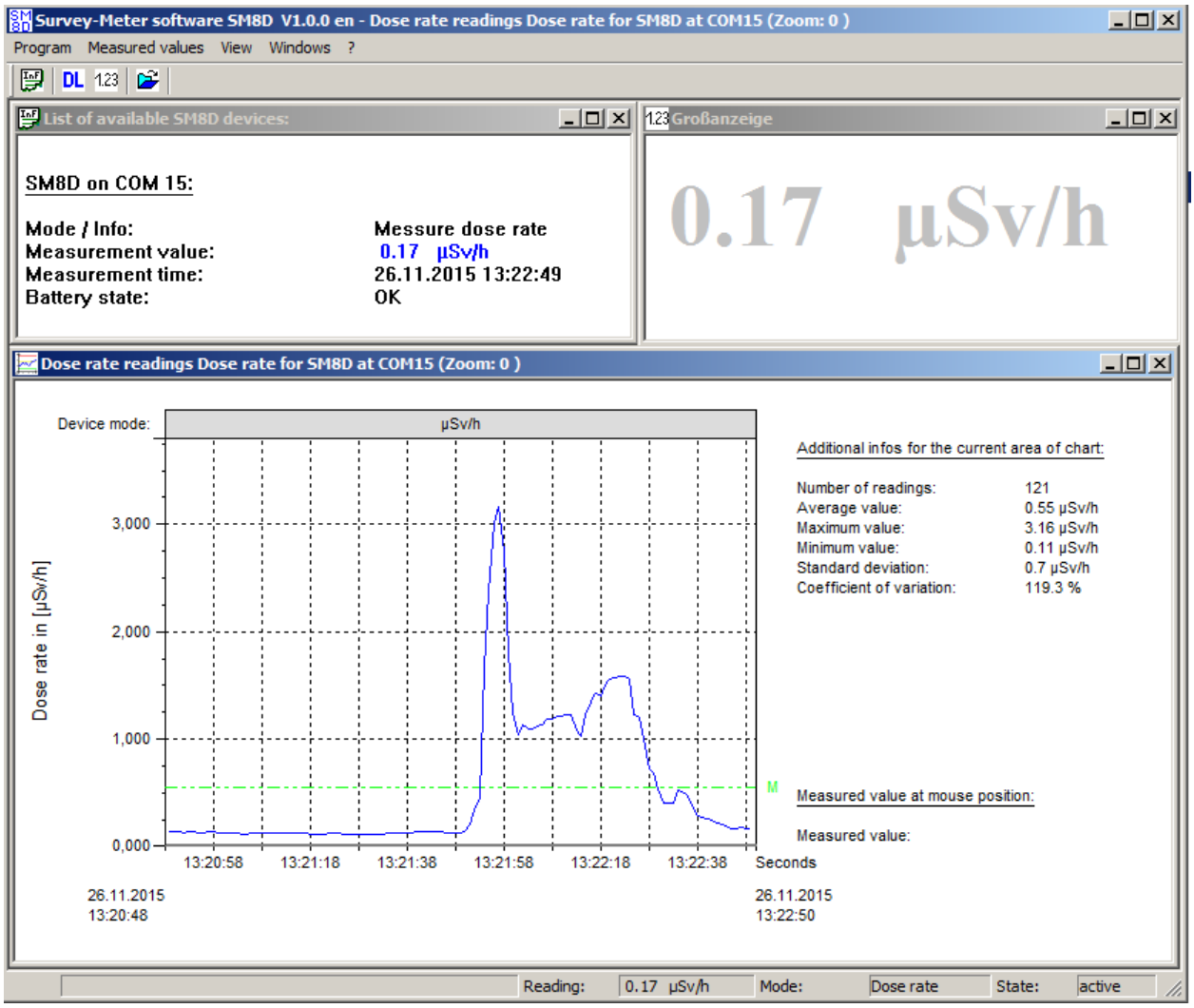
You can leave the mode / table with a further press on the button “Mean”.

5.13 USB interface

The SM8D can communicate with PC over USB interface For this an optional software is available

Fig. 5 *USB interface*

The optional PC- Software displays the measurement values in different modes. You can also save measurement files and analyze current readings.



Further information is available in software manual.

6 Function check

Functional control should be performed with a test probe (e.g., Cs-137) with known activity / dose rate.

If a test probe is not available, a rough check can be carried out by measuring the natural zero effect. The following measured values should be displayed:

Dose rate in [µSv/h]:	0,10 - 0,40 µSv/h
Dose rate in [cps]:	0,50 - 2,00 cps

Note:

The radioactive background is slightly different and depending on local conditions, but always **> 0** !

7 Alarm and Error

The SM8D detect an exceeding of the own measurement range! In this case appear:

Extremely high levels of radiation may lead to physical overload of the device. In these cases also the display "overflow" appears. The warning on the display is conjunction with an intermittent sound of the buzzer.

The SM8D checked automatically the correct function of internal counting tube. When the tube is defect, the following warning appears in the device display:

The following error causes are possible:

- Counter tube mechanically destroyed (Caution: high voltage!)
- Failure of the internal high-voltage
- Failure other internal electronic components.

8 Transport and Storage

Please remove the batteries during longer storage and during transport. The manufacturer assumes no liability with respect damage caused leaking batteries.

9 Maintenance

Repairs and maintenance can be performed only by authorized personnel. In this case, please send the device to the manufacturer:

STEP Sensortechnik und Elektronik Pockau GmbH
Siedlungsstraße 5-7
D-09509 Pockau-Lengefeld
Germany

Telefon ++49 37 367 97 91
Fax ++49 37 367 77730
Mail info@step-sensor.de

	Do not open the device, because the device worked with internal high voltage up to 500V.

10 Decontamination

Should the meter be easily contaminated by radioactive materials, so you can clean it with a damp cloth.

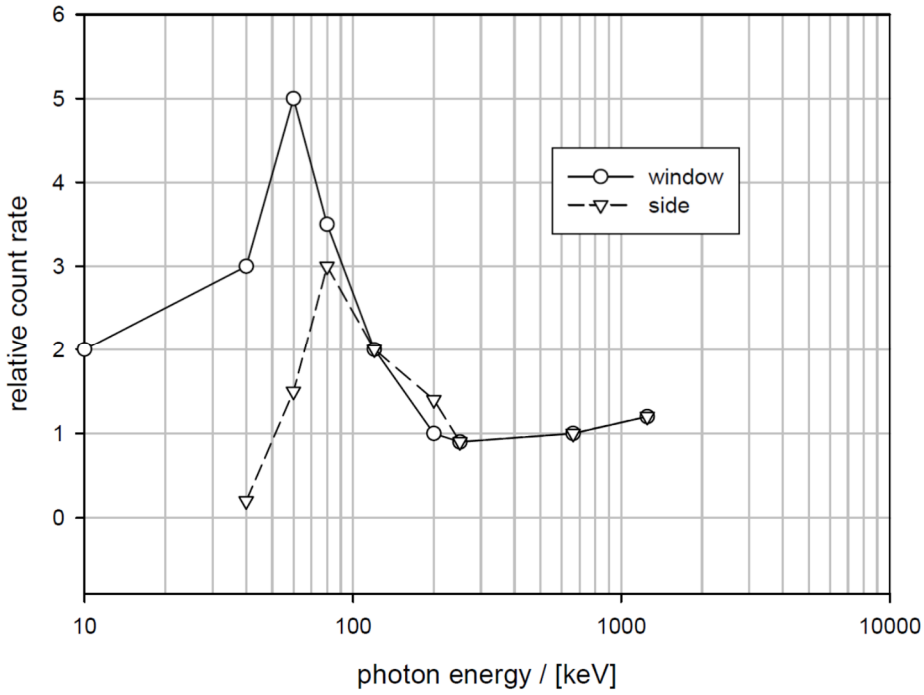
Important: Please don't' use solvents (benzene, acetone, etc.) for cleaning!

For measurements with a risk of contamination, the product should be operated in a suitable protective sheath (polyethylene bag).

In case of strong contamination you should immediately contact the manufacturer!

Appendix

Energy independent response SM8D



Declaration of Conformity

We, manufacturer

STEP Sensortechnik und Elektronik Pockau GmbH
Siedlungsstraße 5-7
09509 Pockau-Lengefeld
Germany

declare that our product

Survey Meter
SM 8 D

1

meets the requirements of standard

IEC / EN 61000

Marks of Complimance CE

Date: 12th of June 2017

Signature:

Name: Dr. Schüler
Managing Director

Device accompanying card
SM8D

Device: Survey Meter SM8D

Serial number: _____

Serial number of detector: _____

Program version: _____

Sensitivity for Cs-137: _____ cps / $\mu Sv h^{-1}$

Calibration factor: k_α = _____ k_β = _____

Date of test: _____

Tested by: _____

Date of expedition: _____

Repairs: _____

_____

_____

Note: _____

_____

_____

_____

Place, date, name examiner, signature: _____