

Technical Description and Operator's Manual

Survey Meter

SM 5 D



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Survey Meter SM 5 D

The Survey Meter SM 5 D is a hand-held, battery powered radiometer to measure the local dose rate of gamma radiation, x-rays as well as the area activity of beta and alpha radiation.

Areas of application:

- Medicine, Life-Sciences, Industry, research and development facilities
- Dose-rate measurements in photon fields
- Evaluation of workplaces

Technical features:

- Simple use
- Light-weight and robust
- Display range of dose rate: 0.00 $\mu\text{Sv/h}$... 299 $\mu\text{Sv/h}$
- Wide energy range for photons (10 keV ... 2 MeV)
- Qualitative detection of Beta radiation with energies greater than 35 keV
- Measurement of area activity of beta and alpha radiation
- Averaging at 60 seconds of the dose rate
- Acoustical impulse detection
- Counting tube overload indication
- Background lighting

The complete package contains:

- 1 Survey Meter SM 5 D
- 1 Transport Bag
- Set of batteries
- 1 Technical Description and Operator's Manual, Calibration Certificate



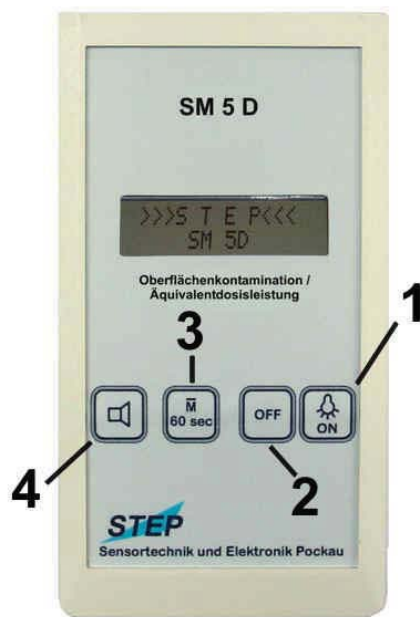
1 Safety Instructions



Do not open the device. In case of damages a contact voltage of up to 450 V may be reached at power-on state!

2 Design and control elements

The SM 5 D is a handheld device to measure the local dose rate of gamma radiation, x-rays as well as the area activity of beta and alpha radiation.



- 1 Switch "Power on" / Light
- 2 Switch "Power off"
- 3 Switch "Average value" (60 sec)
- 4 Switch "Buzzer on / off"

- 5 Detector
- 6 Battery compartment

Fig. 1 Survey Meter SM 5 D

3 Technical Data

Measuring value	Local dose rate [$\mu\text{Sv/h}$] Area activity [Bq/cm^2]
Display range	Local dose rate of gamma radiation and x-rays 0.00 $\mu\text{Sv/h}$ to 299 $\mu\text{Sv/h}$ (calibrated at Co-60) Overload indication Area activity (calibrated at Am-241 and Sr-90) 0.00 to 199 $\text{Bq/cm}^2 \cdot k_a$ 0.00 to 199 $\text{Bq/cm}^2 \cdot k_b$
Energy ranges	Photons: 10 keV to 2 MeV Beta: > 35 keV (qualitative detection)
Intrinsic error	< 25 % referring to Co-60 < 25 % referring to Sr-90 < 25 % referring to Am-241
Radiation detector	End-window Geiger-Mueller tube (area mass density < 2 mg/cm^2)
Overload capacity	10 times
Power supply	2 x 1.5 V (battery type AA)
Operating lifetime	Typically > 100 h with alkaline cell @ background radiation level (background lighting is turned off)
Weight	400 g
Dimensions (L x W x H)	152 mm x 83 mm x 35 mm
Output	Digital on LCD Acoustic
Operating temperature	From 0°C to +50°C
Relative humidity	75 % @ 30 °C

Note: Technical specifications are subject to change without notice.

4 Measuring principle

The survey meter SM 5 D is an end-window tube operated dose rate and area activity-meter. The impulses released in the counter are formed electronically, integrated and indicated as average value digitally. The window of the counter has an area mass density of $\leq 2 \text{ mg/cm}^2$, which allows the measurement of beta-ray emission starting from 35 keV and of alpha radiation.

5 Performing measurements

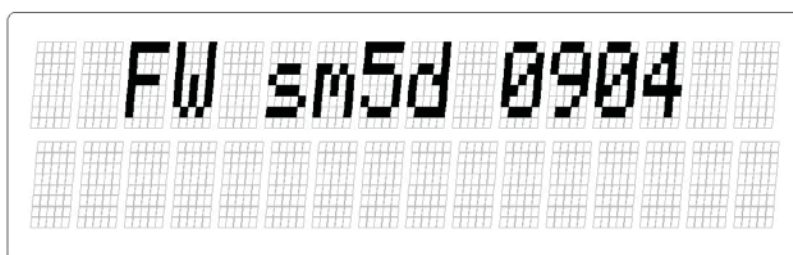
Preparation

Insert 2 batteries 1,5 V, type AA. Ensure that batteries are inserted in the correct polarity.

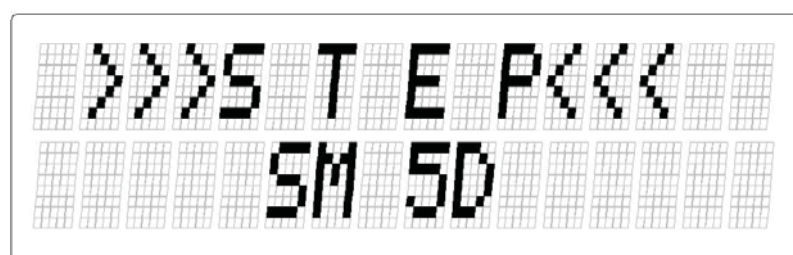
Performing measurements

1. Power on / activate background lighting:

Power on the device (switch 1 in Fig. 1). For a short time the message of the current program version appears in the display:



followed of the equipment designation:



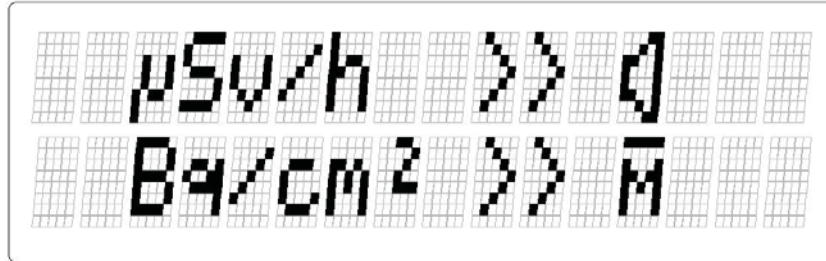
The device will be ready for measurement within a few seconds.

Note:

The background lighting will turn off automatically after 10 seconds. To reactivate it push switch 1 "Power on / light" (Fig. 1). The background lighting is turned on for 10 more seconds.

2. Measurement mode pre-selection:

After approximately 4 s the following measurement variable selection appears on the display. For selection of the local dose rate ($\mu\text{Sv/h}$) press the key 4 „acoustic signal ON/OFF“ or for the measurement of the surface activity (Bq/cm^2) the key 3 „calculation of average values “(fig. 1).

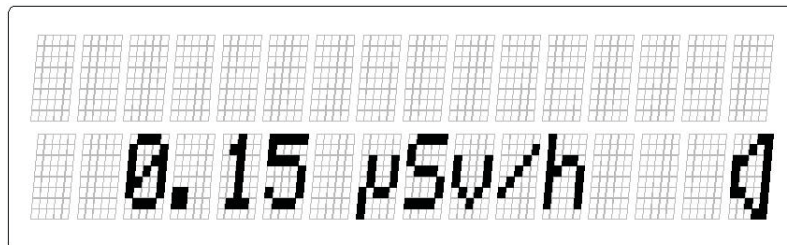


Note:

After this selection a change to the other measurement variable during the operation is not possible. To change to the other variable the device has to be switched off and on again.

3. Measurement:

After choice of the measurement variable the background appears with $\mu\text{Sv/h}$ or Bq/cm^2 in the display depending from selection (natural background, dependent from region, approximately up to $0,5 \mu\text{Sv/h}$). After switching the equipment on, the acoustic signal is activated automatically and is represented with the loudspeaker symbol right down in the display :

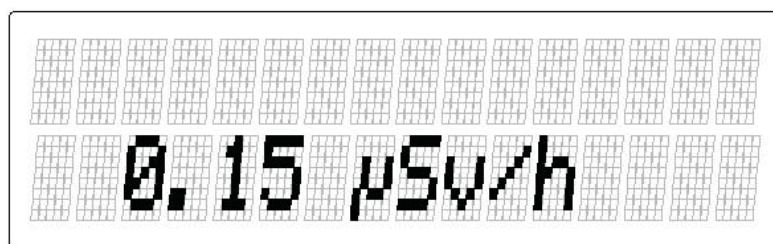


Note:

Depending from region a natural radiation of $0,1 - 0,5 \mu\text{Sv/h}$ is present. Due to random nature of radiation the value normally fluctuates.

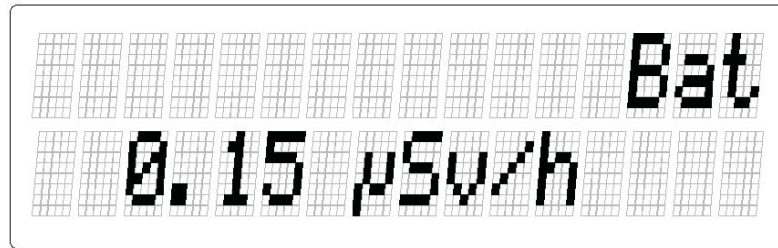
4. Acoustic Signal (deactivation by button 4):

For acoustic impulse detection, please push the switch 4 „Buzzer on / off“ (Fig. 1). Depending from this, the buzzer symbol is represented or faded out in the lower right corner of the display.



5. Battery state:

Check battery state. Note that a low battery is indicated by displaying “Bat” in the upper right display corner.

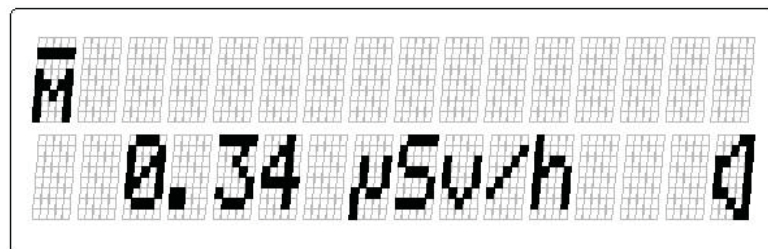


In case of a low battery indication please replace the batteries.

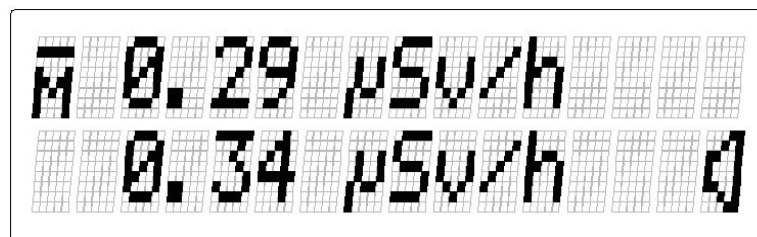
6. Averaging:

Due to the random nature of the nuclear radiation the measured value fluctuates. In order to improve the accuracy of the measurement you can calculate the average value of data obtained during one minute.

For this push the switch 2 „Average value“ (Fig. 1), then the symbol \bar{M} appears in the upper left corner of the display.



The internal measurement starts. After 60 seconds the average value of the dose rate or area activity appears in the upper line of the display:



By renewed pressing of the key 2 (fig. 1) you'll deactivate the calculation of average values and the message in the upper line will be deleted. To activate a further average value measurement press the key 2 again.

Note:

The measured average value remains visible in the display up to the start of a further average value measurement!

6 Evaluation of measurement results

Result of measurement for gamma radiation (dose rate measurement in $\mu\text{Sv/h}$):
Measured value directly readable at the display
Measured value M = display value
Reference nuclide Co-60

According to DIN ISO 7503, part 1, the calibration factors of the α - and β - surface activity were preselected and adjusted firmly to the nuclides Am-241 (α) and Sr-90 (β). To determine the measurement's result of the surface activity, multiply the indicator value by calibration factors.

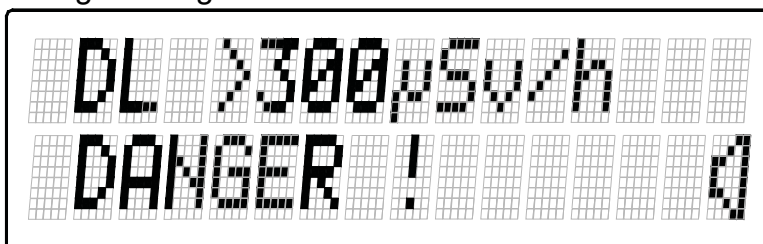
Result of measurement for beta radiation (area activity [Bq/cm^2])
read the display value
measurement value M = display value x calibration factor k_β

Result of measurement for alpha radiation (area activity [Bq/cm^2])
read the display value
measurement value M = display value x calibration factor k_α

The calibration factors k_α and k_β for the determination of the surface activities were fixed by calibrated large surface reference emitters, with well-known surface emission rates. At practical measurements, the possible self absorption of the alpha and beta-ray emission in the contaminated layer has to be considered.

7 Alarm messages

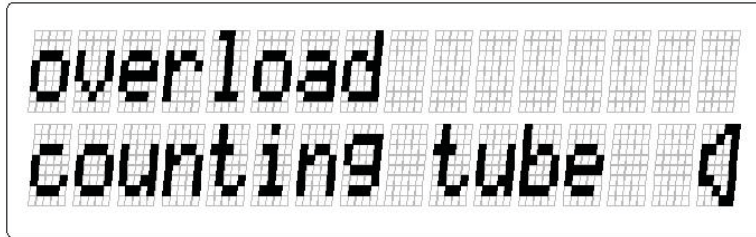
In case of an overrun of more than 300 $\mu\text{Sv/h}$ of dose rate, the display will show the following message:



DL >300 $\mu\text{Sv/h}$
DANGER !

Note: The buzzer will be activated automatically (continuous tone) !

During an overload of the counting tube, in case of very high dose rates, the following message will appear in the display :



Note: The buzzer will be activated automatically (continuous tone) !

8 Shipment

- For shipment and storage, the case supplied by the manufacturer shall be used.
- Prior to long-time storage and transport the batteries must be removed and stored at the place provided in the case.

9 Maintenance

Avoid contamination of the device. If the device is intended to be operating in contaminated environments use appropriate protective means (e. g. plastic bag). If the device has been possibly contaminated, use a wet cloth for decontamination. Do not use substances like petrol, acetone, etc. since the polystyrene housing can be damaged.



Do not open the device. In case of damages a contact voltage of up to 450 V may be reached at power-on state!

There are no serviceable parts inside. Refer all servicing to the manufacturer.

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10 Decontamination

If you have to take into account that the equipment became polluted with radioactive substances (contaminated), an appropriate cleaning with a damp cloth has to be done.

Solvents (gasoline, acetone etc.) may not be used!

For measurements with danger of contamination, the equipment should be operated in a suitable protection casing (PL bag).

Appendix

Diagramm 1: Energy response SM 5 D

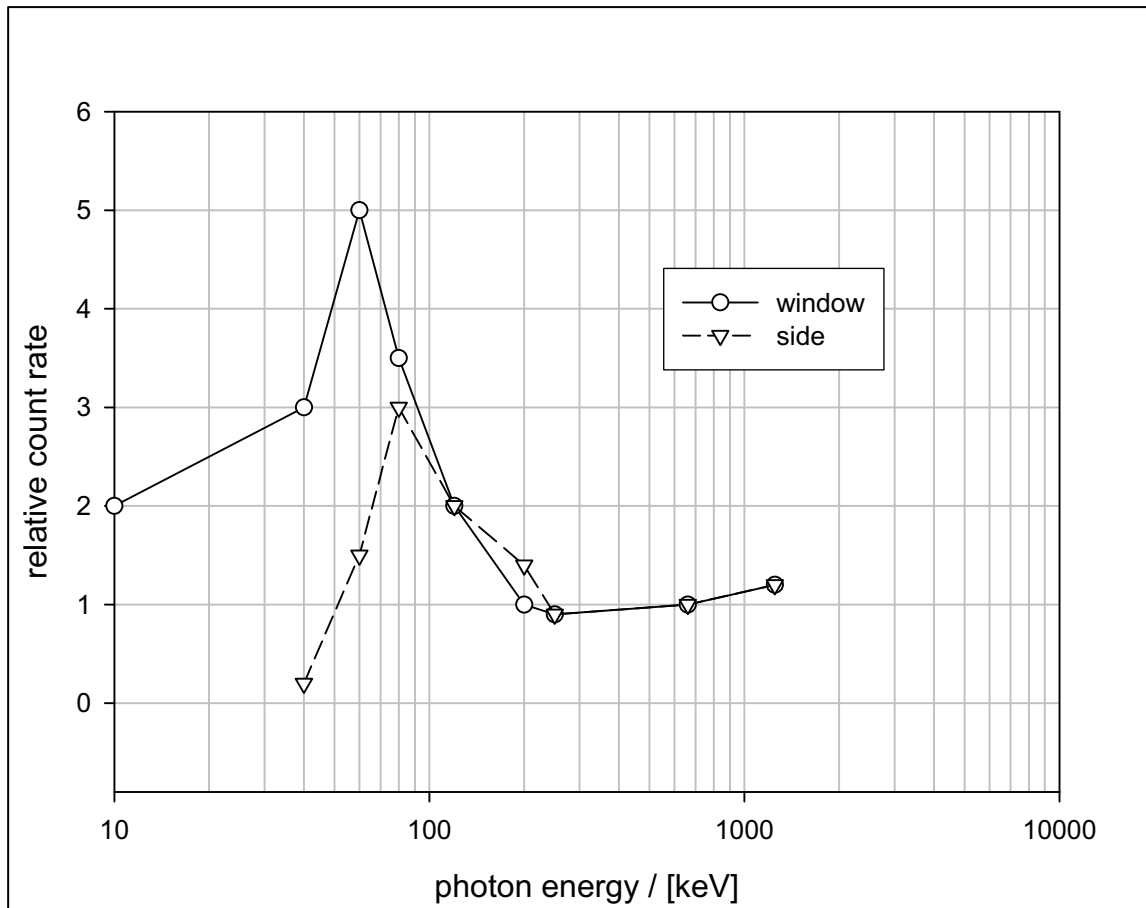


Diagramm 1) Energy Response of counting tube detector SM 5 D.

Product accompanying document

SM 5 D

Device: Survey Meter SM 5 D

Serial number of the device : _____

Serial number of detector : _____

Program version : _____

Date of test : _____

Device tested by : _____

Date of shipment : _____

Repairs : _____

Notes: _____

