Technical description and operating instructions

Survey meter

OD-02
OD-02 Hx

IEC 60846-1 2009, modified [1]
compliant

Technical description
Operating instructions
Warranty & service sheet

STEP Sensortechnik und Elektronik Pockau GmbH
Siedlungstrasse 5-7
D-09509 Pockau

[1] IEC 60846-1 2009, modified
DIN EN 60846-1

Radiation protection measuring instruments -Environmental and/or directional dose equivalent (dose rate) meters and/or monitors for beta, X-ray and gamma radiation
Part 1: Portable measuring instruments and monitors for the workplace and the environment

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1. OD-02 Product characteristics / scope of services

The OD-02 is an easy-to-handle survey meter for measuring the directional dose / dose rate equivalent $H'(0{,}07;\Omega); \dot{H}'(0{,}07;\Omega)$ and the ambient dose / dose rate equivalent $H^*(10); \dot{H}^*(10)$ of mixed radiation fields (X-rays, gamma and beta radiation).

Optional OD-02 Hx:
The OD-02 is an easy-to-handle survey meter for measuring the photon- equivalent dose / - dose rate Hx ; $\dot{H}x$ of mixed radiation fields (X-rays, gamma and qualitatively beta radiation).

Product characteristics:

- Compact device consisting of display and control unit, probe, device support and a 0.7m connecting cable or optional up to 100m cable

- Radiation detector: air-opened ionization chamber (Volume 600cm^3)

- Measurand:
  - OD-02: Ambient and directional equivalent dose and -dose rate according to IRCU
  - OD-02Hx: Photon- equivalent dose / -dose rate

- Measurement range: 3 decades for dose, 6 decades for dose rate
  - Dose rate: 2 coarse measuring ranges: µSv/h and mSv/h
    3 fine measuring ranges* each: 20 / 200 / 2000
    * End values
  - Dose: 0…1999 µSv

- Automatic switching (auto ranging) of the fine measuring ranges

- Resolution display: 2 digits after the decimal point

- Extremely wide energy range:
  - Photons: 1 keV to 15 MeV
  - Beta: 40 keV to 2 MeV

- Measurement of continuous and pulsed radiation

- Battery operated and on customer request additionally with power supply (automatic switching)

- Possibility to transfer the measured values via USB, data recording, evaluation software available

- Possibility for setting the acoustic signaling and alarm thresholds (PC software required)

Scope of delivery:

- OD-02 display and control unit
- *Alternatively OD-02 Hx display and control unit*
- OD-02 probe with detachable wall reinforcement cap
- *Alternatively OD-02 Hx probe with detachable wall reinforcement cap*
- Device carrier
- 0.7m probe cable
- 4 x batteries LR06 (AA)
- Equipment case
- Technical description, operating instructions and calibration certificate

Optional equipment:

- USB cable and software for measurement evaluation via PC
- Power supply variant of the control unit (DC 5.3V / 3A)
- Variable probe extension cable up to 100 m upon customer request
- Acrylic plastic shielding for energy values E_γ > 15 MeV
- Wall holder for stationary application

2. Safety instructions

Sensitive parts such as the soft radiation chamber must be protected against mechanical influences. Damages to the soft radiation chamber can cause contact voltages of up to 400 V while switched on!

- The device may be opened by the manufacturer only. Infringing behaviour 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!
- The device must be transported with fitted acrylic plastic shielding in the equipment case!
- It is not permitted to use solvents or solvent containing cleaners!
- Prior to connecting and disconnecting plug connectors, the survey meter must always be switched off!
- Statutory provisions for regular re-tests of mobile equipment must be observed for the optional power supply according to BGV A3!

3. Components

The basic equipment of the OD-02 / OD-02 Hx includes:

- Device carrier (**1**)
- Connecting cable 0.7 m (**2**)
- Probe with detachable probe cable (**3**)
- Display and control unit (**4**)
- Wall reinforcement cap (**5**)

Fig. 1) *OD-02 Standard components (scope of services)*

The following equipment is optionally available:

- USB cable with software CD (**6**)
- Power supply (**7**)
- Acrylic plastic shielding (**8**)
- Extension cable up to 100 m (**9**)
- Wall holders for probe and display unit (**10**)

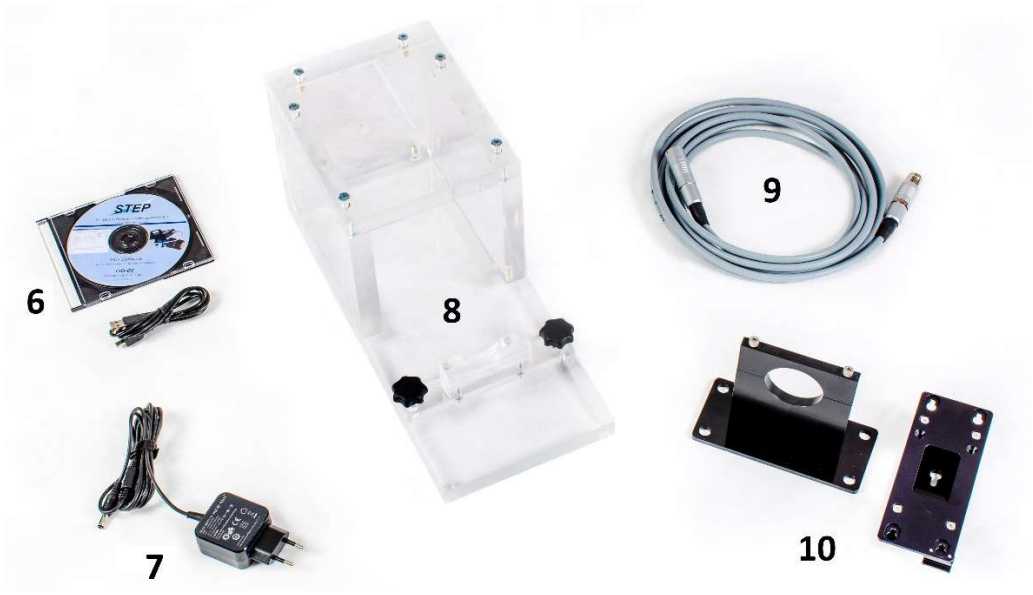


Fig. 2) *OD-02 optional equipment*

3.1. Control elements

11 LCD display

12 “Light / Reset dose / Reset Max dose rate“-button

13 T-button „History Table / switch dose, max dose rate“

14 Battery compartment

Fig. 3) *Control elements front and rear side*

15 On / Off and meter switch
16 Zero adjuster

17 Connection for external power supply (optional)
18 USB connection
19 Probe connection

Fig. 4) *Control elements and connections device front side*

3.1.1. Meter switch (15)

The meter switch serves for switching the device on and off, the selection of one of the measurement range decades (µSv/h, mSv/h and µSv) as well as for call of the function “adjustment of the electrical zero”. The functions are described in detail in the chapters 4 and 5.

3.1.2. Zero adjuster (16)

The zero adjuster permits electrical zero balancing of the OD-02 (see chapt. 4.1) in cases where the electrical zero lies beyond the pre-adjusted range.

3.1.3. “Light / Reset Dose / Reset Max Dose rate” button (12)

The display backlight is switched on by briefly pressing the “Light“/Reset Dose/Reset Max Dose rate” button and switched off by pressing this button once again. The backlight is automatically switched off after 60 min.

Caution: The lighting places load on the batteries and should therefore not be switched on unnecessarily.

When switching on the device, the backlight is automatically switched on.

In the dose rate measurement mode, the maximum value of the dose rate is additionally displayed or (in depends of the mode) a dose calculated from the dose rate as well as the progressing time is additionally indicated. These values can be reset by pressing the button 12 “Light / Reset Dose / Reset Max Dose Rate” and holding it for a while. In doing so, the indicated dose and time value is reset to zero and the maximum dose rate value will deleted.

3.1.4. T-button “History-Table / switch dose, max dose rate” (13)

In the measuring ranges µSv/h and mSv/h, this button permits the indication of a “measuring value history” table in the lower section of the LC display. By pressing the T-button, the average values of the dose rate, averaged over a period of 1 min., the cumulated dose and the related time mark are indicated in table form (see fig. 5).

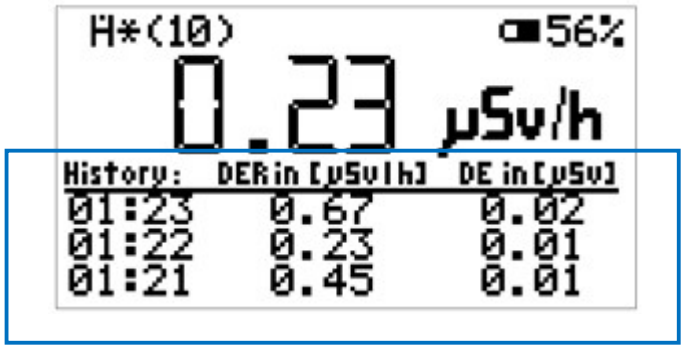


Fig. 5) *Display of the measuring value history table.*

It is possible to display an overall amount of 15 measuring values in the table. If more than 15 measuring values are reached, the prior data is automatically overwritten. Pressing the T-button once again allows the processing of the saved measuring values. When all saved measuring values are processed, the indication “End of Table” (see fig. 6) appears in the upper section of the LC display.

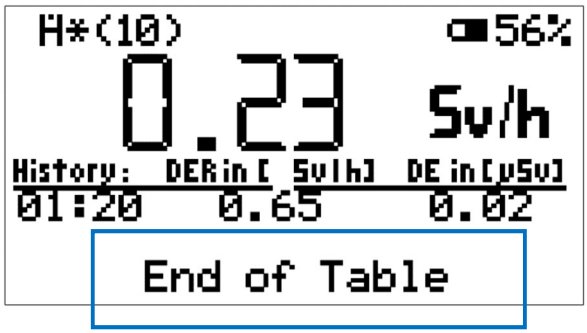


Fig. 6) *Display “End of Table”.*

Switching back to the initial measuring range display can be realised by pressing the T-button once again.
The switch between “dose” and “max. dose rate” can be realized by pressing the button 13 “History Table / switch dose, max dose rate” and holding it for a while (about 4 sec., see fig. 7 and 8).

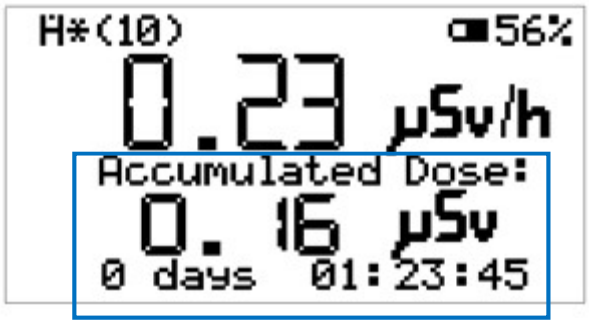


Fig. 7) *Mode “dose rate“: Display “Accumulated Dose”.*

Fig. 8) *Mode “dose rate“: Display “Max dose rate”.*

3.1.5. External power supply (option)

The OD-02 can be operated by means of an internal (batteries) as well as by means of an external DC voltage supply (5.3V / 3A). Switching between the two modes is automatically when the power supply unit is plugged in.
In the power supply mode, a small plug symbol (see Fig. 8a) appears in the display at the top right and the display illumination is permanently switched on. In battery mode, the battery status in percent can be seen here (see Fig. 8b). For safety reasons, use only the power adapter supplied with the device.

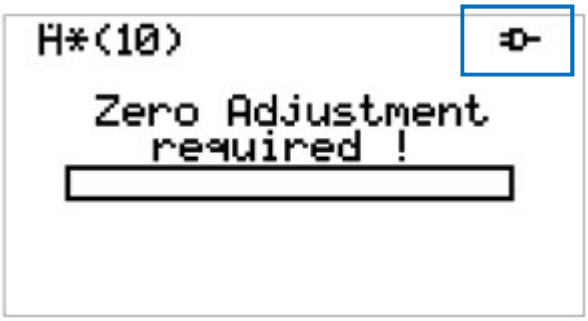


Fig. 8a) *Power supply mode*

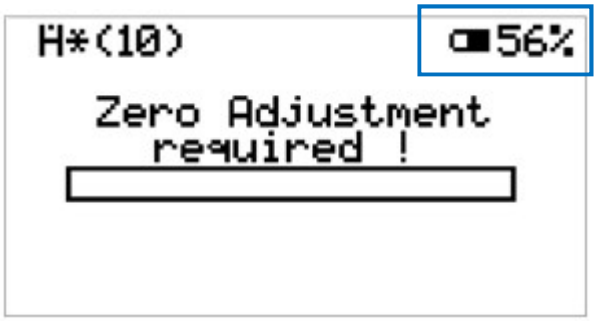


Fig. 8b) *Battery mode*

3.1.6. USB interface

The survey meter is equipped with a USB interface for reading out the measuring values. For its use, special software as well as a corresponding connecting cable is optionally available.

4. Measuring principle

According ICRU Directive applies for dosimetry of beta radiation (within an energy range of equal or less than 2 MeV as well as of low energy photon radiation ≤ 12 keV) the measurement unit directional dose equivalent $H'(0{,}07)$ and the directional dose rate equivalent $\dot{H}'(0{,}07)$.

For X-ray and gamma radiation exceeding this energy values, the ambient dose equivalent $H*(10)$ and the ambient dose rate equivalent $\dot{H}*(10)$ represent the essential measuring values. The separate detection of the dose equivalents H*(10) and H'(0.07;Ω) with the OD-02 is carried out by means of measurements with or without wall reinforcement cap (5):

Measuring probe without wall reinforcement cap	Measuring value = $\dot{H}'(0{,}07)$ / $H'(0{,}07)$
Measuring probe with wall reinforcement cap	Measuring value = $\dot{H}*(10)$ / $H*(10)$

The respective dose equivalent is indicated in the upper section of the display (see fig.9).

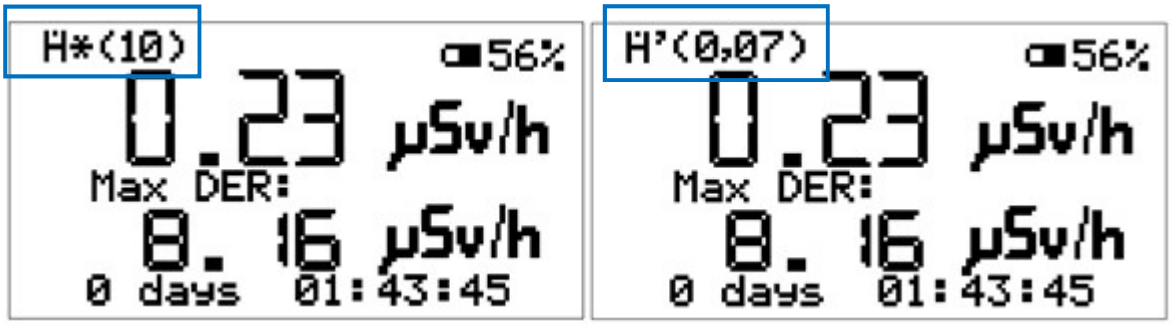


Fig. 9) *Display of the dose equivalents*

Beta radiation of up to 2 MeV (Sr/Y-90) is sufficiently shielded by the fitted wall reinforcement cap, so that in such cases the measuring variables are $H*(10)$ / $\dot{H}*(10)$.

Optional OD-02 Hx:
In countries, which <u>have not introduced</u> metrics according ICRU- Directive, the considered measurement unit of photon equivalent dose / - dose rate is: Hx ; $\dot{H}$x

The large energy range of dosimeter required the use of wall reinforcement cap in dependence of radiation type and energy:

Radiation	Energy	Wall reinforcement cap	comment
Photons	1 – 80 keV [1]	No	H´(0,07)
Photons	12 keV – 15 MeV [1]	Yes	H*10
Photons	15 MeV – ca. 25 MeV [1]	Yes with additional moderator cap	H*10
Beta	40 keV – 2 MeV	No	H´(0,07)

[1] Area of ensuring the secondary electron balance of the ionization chamber.

The measured unit of OD-02 Hx is shown in first line of display:

The factor of the applied ionisation chamber of OD-02 / OD-02 Hx amounts to approx. 4.2 fA/µSv·h^{-1}. The current generated by the ionisation chamber is transformed into processable voltage by means of the probe electronics. For that purpose, a transimpedance amplifier converts the current via a switchable feedback network into a proportional voltage signal. This voltage signal is scanned in steps of 80 ms in both dose rate modes.

Short dose rate pulses (pulse duration < 500 ms) are therefore not detected or detected incorrectly. Therefore, we recommend using the measuring mode “Dose” for measurements in pulsed radiation fields.

In the measuring mode “Dose”, the ionisation current created in the ionisation chamber by means of the radiation field is used for charging a capacitor, what makes it possible to measure also short dose rate pulses in the measurement mode “Dose”.

In order to transmit the amplified signal without signal losses to the display unit via an appropriate cable of variable length, an output driver was integrated. At the same time, the driver amplifies the signal in such a way that it is optimally adjusted to the display system. The survey meter is equipped with an automatic switch for fine measurement range decades.

4.1. Electrical zero adjustment

An electrical zero adjustment of the measurement device must be carried out prior to every measurement since the sensitive electronic system depends on the ambient temperature, the inherent noise and other influencing factors.
When switching on the device by actuating the meter switch (15), the device automatically requests a zero adjustment (see fig. 10).

Fig. 10) *Zero adjustment request*

For that purpose, the meter switch is set to the position “ZERO”. The device automatically performs a zero adjustment (see fig. 9).

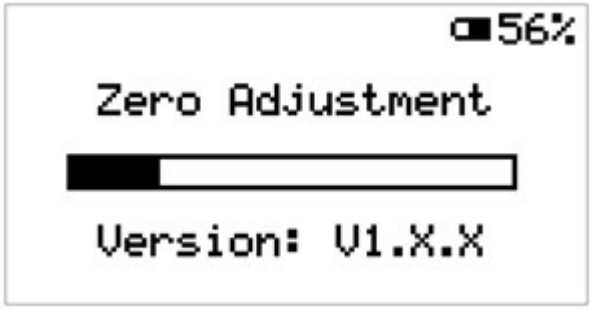


Fig. 11) *Zero adjustment*

After a few seconds, the zero adjustment is completed. If the automatic adjustment ranges from -5 to +5, the following message appears on the display:

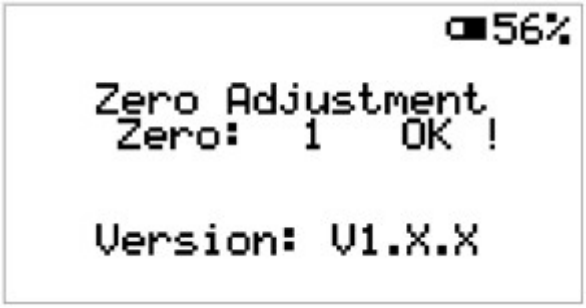


Fig. 12) *Zero adjustment O.K.*

In doing so, the value 1 in the example shown above corresponds to a value 0.01 in the respective measuring range. If the automatic adjustment lies beyond this range, the following message appears on the display:

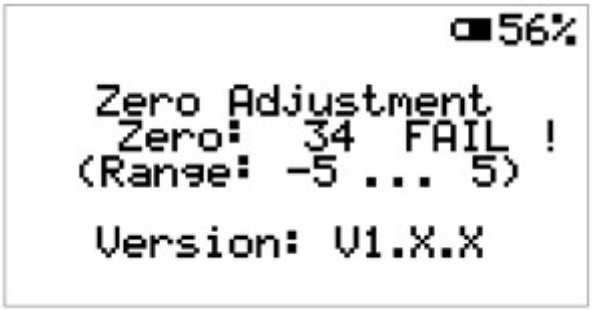


Fig. 13) *Zero adjustment beyond the specified range*

In this case, the indicated value must preferably be adjusted to 0 by means of the electrical zero adjuster (16)

- After having adjusted the electrical zero, the zero adjuster (16) must not be actuated any longer.
- Measurements in the different measurement ranges necessarily require a zero adjustment.
- We recommend preferably adjusting the indicated value to 0 also in case of a positive automatic zero adjustment.

4.2. Calculated air pressure correction

The changes of air pressure and temperature cause air pressure changes in the ionisation chamber, resulting into faulty measuring values.
For compliance with the indicated error tolerances, all measuring values M must be related to reference conditions (20 °C, 101.3 kPa).

This possibility for correction considers the influence of air pressure changes on the measuring result. For that purpose, it is important to know the air pressure and the temperature at the measuring location in order to determine the correction factor. The correction factor f is indicated in the nomogram in the appendix or can be calculated using the following the formula:

$$f = \frac{101{,}3}{p/kPa} \cdot \frac{273 + \vartheta/°C}{293} = \frac{760}{p/Torr} \cdot \frac{273 + \vartheta/°C}{293}$$

p	-	Air pressure in kPa / torr
ϑ	-	Temperature in °C.

The corrected measuring value M_0 results from:

$$M_0 = M \cdot f$$

M	-	Indicated measuring value
f	-	Correction factor

5. Measurement preparation and performance

Prior to the first measurement the device must be commissioned as follows:

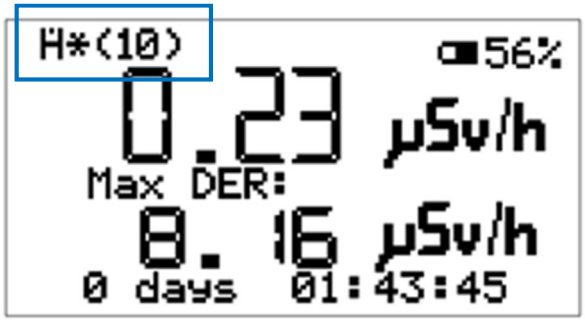
1. Insertion of the batteries in the battery compartment (14) at the rear side of the display unit. For opening the battery compartment, a recess is provided at the lower part of the cover. Care must be taken to ensure that the batteries are inserted with the correct polarity as indicated on the bottom of the battery compartment.

2. The measuring probe is connected with the display unit via the plug connector. Therefore, the meter switch (15) must be in the position OFF.

	The measuring device must exclusively be switched on if the measuring probe is connected.

5.1. Preselection of the measuring variables

The measuring variables ambient dose $H^*(10)$ and ambient dose rate equivalent $\dot{H}^*(10)$ are measured <u>with</u> wall reinforcement cap (delivery status) and indicated in the upper section of the display:



After the removal of a wall reinforcement cap, care must be taken that the marks on the wall reinforcement cap coincide with the marks on the soft radiation chamber at fitting (fig. 14).

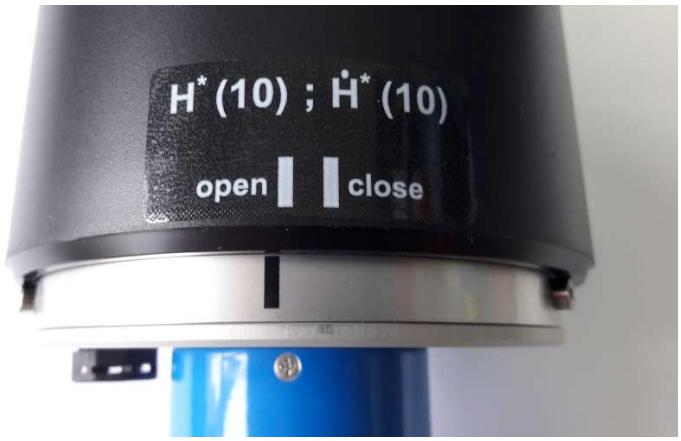
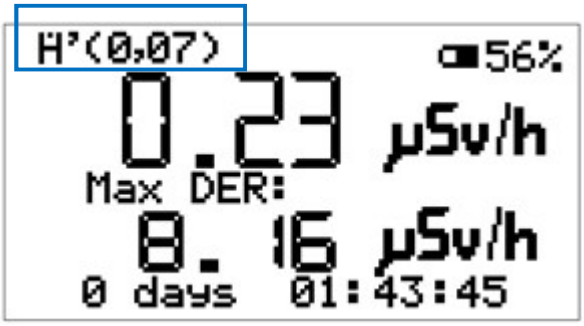


Fig. 14) *Interlock of the wall reinforcement cap*

If the wall reinforcement cap (5) is removed, the indicated measuring value at dose equivalent measurement corresponds to $H'(0{,}07)$ and to $\dot{H}'(0{,}07)$ at dose rate equivalent measurement. Both measurement units are indicated on the display:



Optional OD-02 Hx:
In countries which have <u>not</u> introduced metrics regarding ICRU- Directive, the measurement unit is the photon dose equivalent / - dose rate: Hx ; $\dot{H}$x

The large energy range of dosimeter required the use of wall reinforcement cap in dependence of radiation type and energy:

Radiation	Energy	Wall reinforcement cap	comment
Photons	6 – 100 keV [1]	No	Hx
Photons	100 keV – 15 MeV [1]	Yes	Hx
Photons	15 MeV – ca. 25MeV [1]	Yes with additional moderator cap	Hx
Beta	160 keV – 2 MeV	No	Qualitatively

[1] Area of ensuring the secondary electron balance of the ionization chamber.

The measured unit of OD-02 Hx is shown in first line of display:

Caution!
The inlet windows of the soft blasting chamber are mechanically very sensitive!
After measurement completion, the acrylic plastic shielding must be refitted on the probe and the device must be switched off.

	Note: Measurements in electromagnetic fields, e.g. next to mobile phones, etc. must be avoided because these could influence the measuring results.

5.2. Dose rate equivalent measurement

Prior to performance of dose rate equivalent measurements, the meter switch (15) must be adjusted to the switch position “ZERO” and the electrical zero adjustment must be carried out when the measuring device is switched on. In case of deviations, the indicated value must preferably be adjusted to 0 by means of the electrical zero adjuster (16) (see 4.1.).

For dose rate equivalent measurements, the meter switch (15) must be adjusted to the position “µSv/h” or “mSv/h” after the electrical zero adjustment has been carried out. In doing so, the device switches to the run-in mode (see fig. 15).

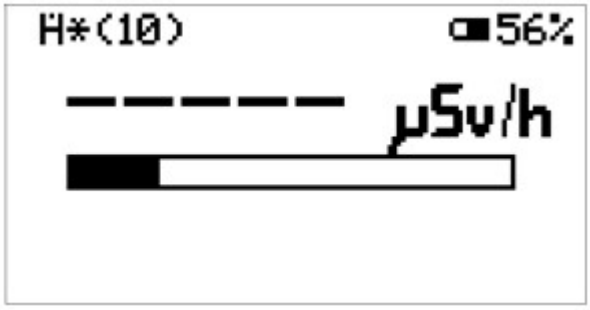


Fig. 15) *Display in run-in mode for the measuring mode µSv/h.*

The “run-in” of the device takes 30 sek. The progress is shown in the bargraph. After the run-in, the actual value of the dose rate equivalent is indicated and the measurement can be started (see fig. 16).

Fig. 16) *Display in the measurement mode µSv/h.*

In the dose rate equivalent measuring mode, the maximum dose rate value and the progressing time are additionally indicated in the lower area of the display. The maximum dose rate value refers to the indicated time. The maximum dose rate value, the indicated cumulated dose can be reset by pressing the button 12 “Light / Reset dose / Reset Max Dose rate” and holding it for a while. In doing so, the maximum dose rate value, the indicated dose and time value is reset to zero.

	- For an exact dose determination as well as for measurements in pulsed radiation fields, the measuring range “Dose” should be selected!

	- The function “Reset dose” of the button 12 is only active in the measuring mode “Dose rate”.

5.3. Dose measurement

In the dose rate equivalent measuring mode, the dose calculated from the dose rate and the progressing time are additionally indicated in the lower area of the display. The indicated cumulated dose can be reset by pressing the button 12 “Light / Reset dose” and holding it for a while. In doing so, the indicated dose and time value is reset to zero.

For an exact dose determination as well as for measurements in pulsed radiation fields, the measuring range “Dose” should be selected.

For that purpose, the following must be carried out:

For dose measurements, the meter switch (15) must be adjusted to the switch position „ZERO“ and the electrical zero adjustment must be carried out when the measuring device is switched on. In case of deviations, the indicated value must preferably adjusted to 0 by means of the electrical zero adjuster (16) (see 4.1).

For dose measurements, the meter switch (15) must directly be switched to the measuring range “µSv” after the adjustment of the electrical zero has been carried out. The dose measurement starts when the switching process is completed. The following message appears on the display:

Fig. 17) *Display in the dose measuring mode µSv.*

For resetting the displayed dose value, the operating position “Zero” must be selected by means of the meter switch 15. The electrical zero adjustment must be carried out again. Subsequently, it is possible to switch back to the operating position “Dose” by means of the meter switch 15. The dose and the time value counting is now started from zero again.

5.4. Display of the excess of the measurement range

At excess of the limits (2000) of the measurement range decades “µSv/h“, “µSv“ and “mSv/h“, the excess of measurement range is indicated on the display by means of the value **> 1999** using the corresponding measuring unit (see fig. 18 a). In the measuring mode “dose”, the display of the dose value **> 1999 µSv** (see fig. 18 b) is kept also without radiation field and must be reset for a new measurement according to point 5.3.

Fig. 18 a) *Display overflow of measurement range in mode "Dose rate".*

Fig. 18 b) *Display overflow of measurement range in mode „Dose".*

5.5. Special remarks for measurement performance

- The calibration of the survey meter OD-02 is carried out at 1.25 MeV (Co-60) (homogeneous radiation field). The point of reference (chamber centre of gravity) is marked on the detector by means of a line.
- Beta radiation with a maximum energy value of 2 MeV (Sr-90/Y-90) is sufficiently shielded by means of the fitted wall reinforcement cap. Therefore, only the measuring variable $H*(10)$ is detected. In case of beta radiation with higher energy values, a measurement uncertainty of at least 20 % must be assumed at the determination of $\dot{H}*(10)$.
- If required, the correction of the air density influence on the response of the air-opened ionisation chamber can be carried out by means of calculation based on the nomogram in the appendix
- After the radiation with high dose rate equivalents, a resetting time of up to 2 minutes in the measurement mode "dose rate" must be observed.
- Impacts and mechanical stresses on the measuring probe (e.g. at fitting the wall reinforcement cap) may influence the measuring values to be displayed.

Optional für OD-02 Hx:

- The calibration of the survey meter OD-02 Hx is carried out at 1.25 MeV (Co-60) (homogeneous radiation field). The point of reference (chamber centre of gravity) is marked on the detector by means of a line.
- Beta radiation with a maximum energy value of 2 MeV (Sr-90/Y-90) is sufficiently shielded by means of the fitted wall reinforcement cap. You can measure Beta radiation only qualitatively > 160 keV (see 4. or 5.1)

- If required, the correction of the air density influence on the response of the air-opened ionization chamber can be carried out by means of calculation based on the nomogram in the appendix
- After the radiation with high dose rate equivalents, a resetting time of up to 2 minutes in the measurement mode “dose rate” must be observed.
- Impacts and mechanical stresses on the measuring probe (e.g. at fitting the wall reinforcement cap) may influence the measuring values to be displayed.

5.6. Note about battery life

- Note that the total current consumption of the device is at ca. 20% higher at switched on background lighting. The battery life indicated in the specifications refers to a switched off display lighting.
- The battery symbol in the LCD display (see Fig. 19) shows the battery status in percentage. Under 5%, the battery symbol is flashing and the control unit honks regularly.

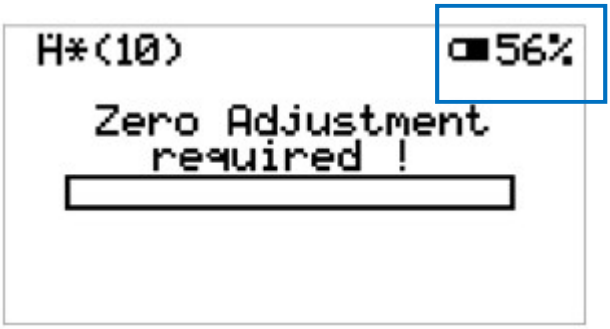


Fig. 19) *Display: battery status in percentage*

- When replacing the batteries, it must be ensured that the batteries are inserted with the correct polarity. After having replaced the batteries, it is recommended to ensure the correct insertion via the display by switching on the device.
- A long-term period with inserted batteries must be avoided as the contact material may be affected by electrolyte leakage.
- It is recommended to use a high quality alkaline or lithium batteries. Alternatively can be used NiMH / NiCd accumulators[1]. Zinc-carbon batteries are not recommended as there is a high risk of electrolyte leakage.

[1] The percentage status of batteries (see Fig. 19) is optimized for alkaline batteries. If the NiMH / NiCd cells are used, the battery indicator will display for about 35% less.

5.7. Use of the device carrier

For mobile use, it is possible to connect the measuring probe (3) to the display unit (4) via the device carrier (1) (delivery status). In doing so, the survey meter can be compactly operated (delivery status see fig. 20).

Fig. 20) *Display unit and probe engaged on the device carrier.*

Therefore, the four fastening bolts (see fig. 21) on the lower side of the display unit (4) must be engaged in arrow direction in the recesses on the device carrier (1). Prior to locking the display unit on the device carrier, the display unit (4) and the measuring probe (3) must be separated from each other. It must be ensured that the device is switched off.

Fig. 21) *Engagement principle display unit / device carrier*

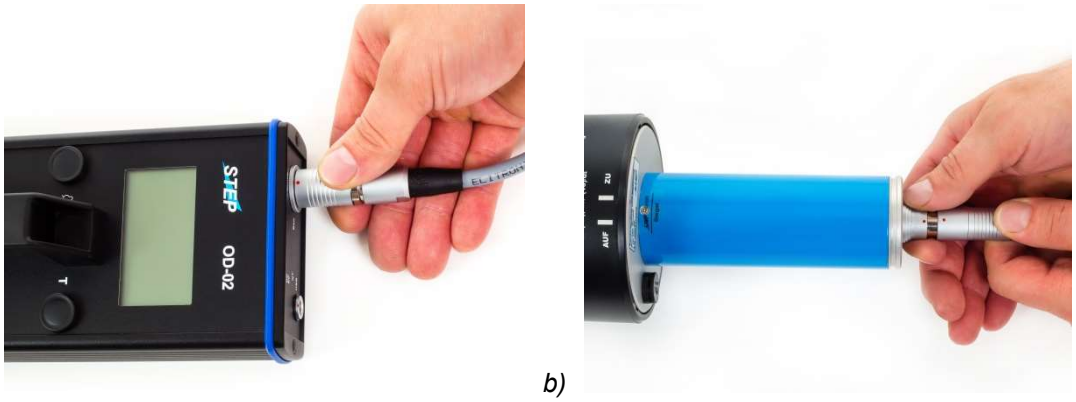
The probe must be fixed in the device carrier according to fig. 20 and secured by means of the locking screw. Subsequently, the probe and the display unit can be reconnected with each other via the probe cable.

In order to disconnect the display unit and the measuring probe from the device, the steps must be carried out in reverse order. When removing the display unit, the interlock (see fig. 22) must be moved downwards.

Fig. 22) *Unlocking of the display unit at the device carrier.*

The disconnection of the plug connection between probe cable and display unit is carried out by holding the ribbed connector part with the thumb and the index finger and pulling for separation from the bushing (see fig. 23a).

The disconnection of the plug connection between probe cable and measuring probe is carried out by moving the connector at the probe backwards (at the ribbed part) during disconnection (see fig. 23b).
During connection or disconnection, the plugs must not be turned out of position.



a) *b)*

Fig. 23) *Disconnection of the plug connectors measuring probe cable.*

	Measuring probe and display unit must be separated at disconnected state only! When separating, do not turn the connector out of position.

5.8. Warning thresholds

From firmware version 2.1.0 (September 2021), it is possible to set warning thresholds and acoustic signaling of the dose rate in the device. For activation / definition of the warning thresholds, the PC software (optional accessory) from version 3.0 is required.

The settings can be called up with the following command (see Fig. 24).
The device must be switched on and connected with USB cable.

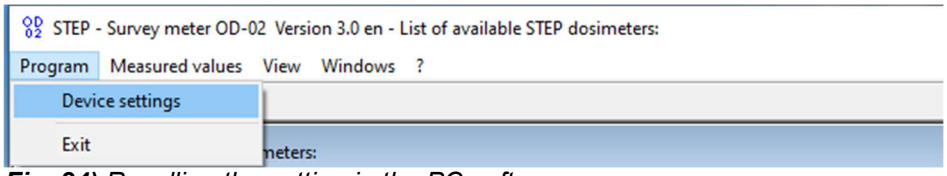


Fig. 24) *Recalling the setting in the PC software*

According to Fig. 25, the following settings are possible:

- Activation of acoustic signaling of dose rate (read further point 5.9. - acoustic signaling).
- 3 alarm levels of dose rate for measuring range µSv/h
- 3 alarm levels of dose rate for measuring range mSv/h
- 3 alarm levels of dose for measuring range µSv

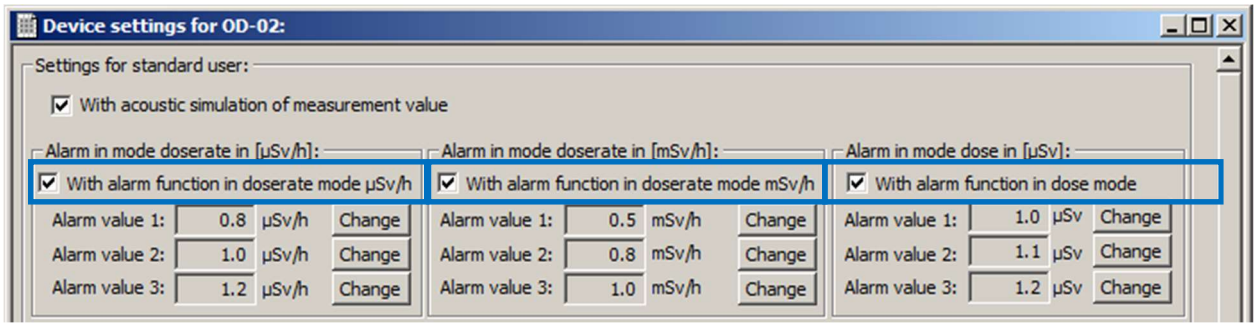


Fig. 25) *Setting options for acoustic signaling and alarm thresholds*

The alarm thresholds can be set separately for each measuring range (dose rate in µSv/h, dose rate in mSv/h, dose in µSv).
If one or more alarm levels are set, this display appears shortly after the instrument is switched on (see Fig. 26)

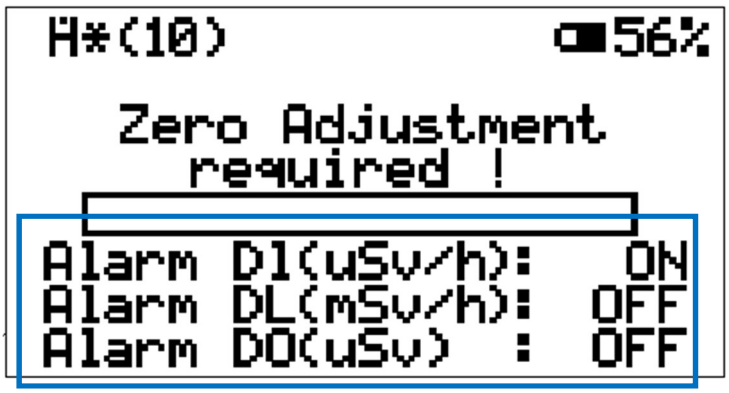


Fig. 26) *Start screen with display of active alarm thresholds*

When switching over, all 3 set alarm thresholds are displayed one after the other when the alarm is activated (see Fig. 27)

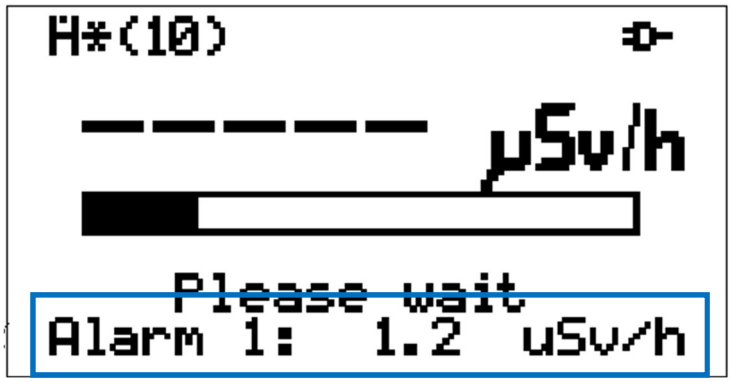


Fig. 27) *Alarm threshold displayed when switching over*

During the measurement, the activation of the alarm thresholds is permanently signaled with symbol “A" (Fig. 28)

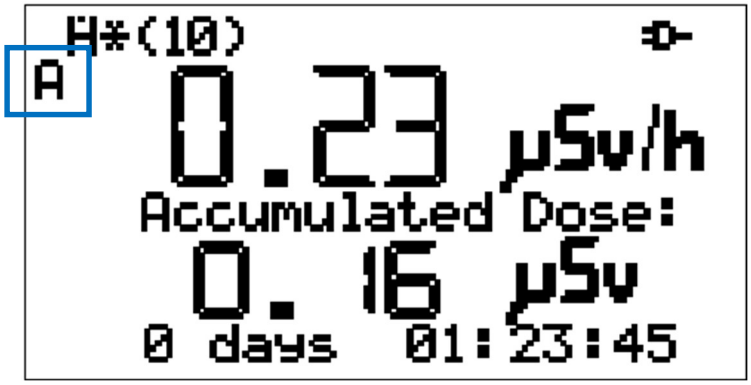


Fig. 28) *Alarm threshold(s) activated*

When the alarm is active, the **A1**, **A2** or **A3** symbol flashes (depending on which alarm level has been reached) and a pulsating signal tone is active (Fig. 29).

Fig. 29) *Alarm threshold A2 is reached at the moment (symbol "A2" flashes)*

If the radiation sinks under the set alarm threshold, the signal tone stops and the symbol **A1**, **A2** or **A3** (depending on which alarm threshold was reached) no longer flashes, but remains in the display as an indicator of the alarm threshold reached. This symbol can be cancelled with a "Reset" (key 12 in Fig. 3). After the reset, the "A" appears again as indicator for activated alarm threshold.

Fig. 30) *Alarm threshold A2 has been reached (symbol "A2" remains as a sign)*

5.9. Acoustic signaling

In the device it is also possible to activate acoustic signaling of the dose rate. This means, that the device increases the frequency of the pulse tone with the increasing dose rate. This allows the user to be notified acoustically of the intensity of the dose rate without having to monitor the display continuously.
This setting can be activated only for dose rate and it applies to both µSv/h and mSv/h measuring range.

The setting can be retrieved with the following command (see Fig. 31)

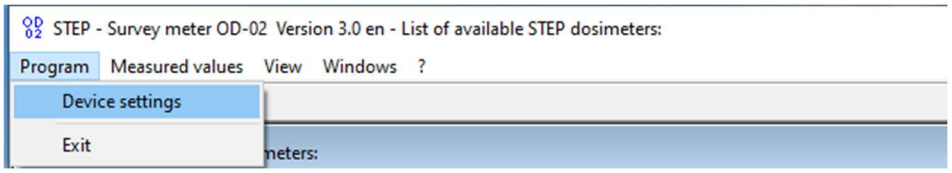


Fig. 31) *Setting options for acoustic signaling and alarm thresholds*

Activate / deactivate the setting (Fig. 32).

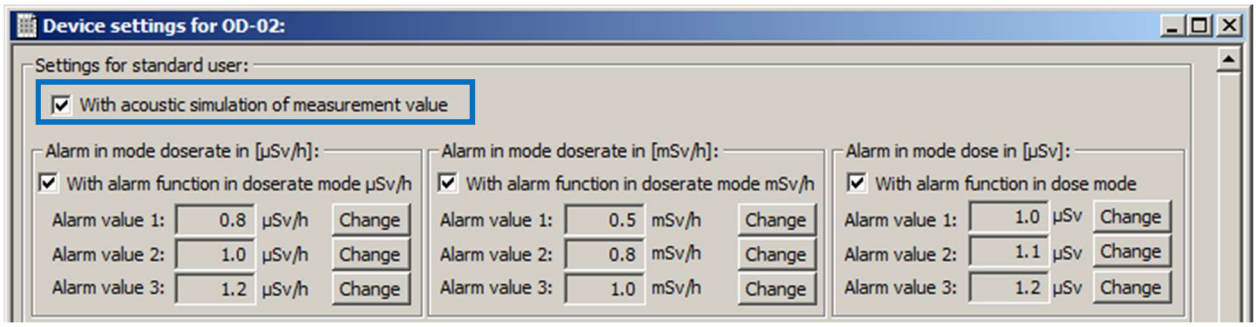


Fig. 32) *Acoustic signaling activated*

If this acoustic signaling is activated, a symbol of the loudspeaker appears in the dose rate mode (see Fig. 33).

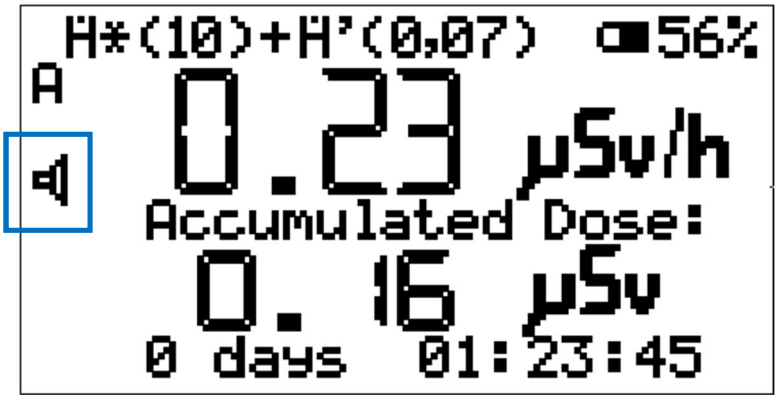


Fig. 33) *Acoustic signaling is active*

6. Storage, handling and transport instructions

- Prior to long-time storage and transport, the batteries must be taken off and stored at the place provided in the case.
- Condensation actuation on the device must be avoided.
- Storage in chemically aggressive and polystyrene dissolving vapours is not admissible.
- Transport and delivery must be carried out in the manufacturer provided transport case only.
- Transport must be carried out with fitted wall reinforcement cap.

	The manufacturer does not assume any warranty for damages caused by leaking, incorrectly inserted batteries and the use of wrong battery types!

7. Cleaning of the device

If in the exceptional case cleaning should be necessary, this must be carried out by means of a damp cloth.

A cleaning of the ionisation chamber made of foam polystyrene is impossible. For measurements in danger of measuring probe contamination, the ionisation chamber must therefore be equipped with a protective coating (e. g. PE bag).

	Polystyrene solving agents, such as fuel, benzol or acetone containing substances, must not be used.

8. Service

Inspections and recalibrations shall be performed by the manufacturer only.

STEP Sensortechnik und Elektronik Pockau GmbH
Siedlungsstraße 5-7
D-09509 Pockau-Lengefeld
Phone: 037367 / 9791
Fax: 037367/77730
Email: info@step-sensor.de

From the manufacturer's side, we recommend a regular inspection and recalibration of the device every 1 to a maximum of 2 years.

Important note:

	A destruction or removal of the ionisation chamber can cause contact voltages of up to 400 V while switched on.

Technical data

Measure unit:

OD-02	Ambient dose equivalent $H^*(10)$ Ambient dose rate equivalent $\dot{H}^*(10)$ Directional dose equivalent $H'(0{,}07;\Omega)$ Directional dose rate equivalent $\dot{H}'(0{,}07;\Omega)$
OD-02 Hx	Photon equivalent dose Hx Photon equivalent dose rate $\dot{H}x$

Measure range:

Dose	1 coarse measurement range:	µSv
	3 fine measurement ranges*: (final values)	20 / 200 / 2000
Dose rate	2 coarse measurement ranges:	µSv/h and mSv/h
	3 fine measurement ranges*: (final values)	20 / 200 / 2000

**auto ranging fine measurement ranges*

Energy range:

Photons OD-02

- *Without wall-reinforcement cap*	1 keV … 12 keV for measure unit $H'(0{,}07;\Omega)$ and $\dot{H}'(0{,}07;\Omega)$
- *With wall-reinforcement cap*	12 keV ... 15 MeV for measure unit $H^*(10)$ and $\dot{H}^*(10)$
- *With acrylic plastic shielding*	15 MeV … cca. 25MeV for measure unit $H^*(10)$ and $\dot{H}^*(10)$

Photons OD-02 Hx

- *Without wall-reinforcement cap*	6 keV … 100 keV
- *With wall-reinforcement cap*	100 keV ... 15 MeV
- *With acrylic plastic shielding*	15 MeV … cca. 25MeV

Beta radiation

OD-02	40 keV … 2 MeV
OD-02 Hx	qualitatively 160 keV … 2 MeV

Angle of incidence
(referred to probe longitudinal axis)

-90° .. + 90° (Photons)
-45° .. + 45° (Betas, without wall reinforcement cap)

Uncertainty of measurement:

		Coefficient of variation
Zero eff. …	0,5 µSv/h	< 35%
0,5 µSv/h …	4 µSv/h	< 15%
4 µSv/h …	20 µSv/h	< 10%
20 µSv/h …	100 µSv/h	< 5%
100 µSv/h …	2000 µSv/h	< 3%
1 mSv/h …	2000 mSv/h	< 3%

Linearität	± 5%
Sättigungsdefizit	- 5% @ 2000 mSv/h

Radiation detector

OD-02

Type	Air-opened ionisation chamber
Volume	600 cm^3
Mass per area of chamber	35 $mg \cdot cm^2$
Entry window	3.3 $mg \cdot cm^{-2}$ (PET foil metallised on one side)
Wall reinforcement cap	550 mg/cm^{-2} , detachable
Preferred direction	Axial
Point of reference	marked on detector
Chamber voltage	+ 400 V (mSv/h, µSv) + 40 V (µSv/h)

OD-02 Hx

Type	Air-opened ionisation chamber
Volume	600 cm^3
Mass per area of chamber	35 $mg \cdot cm^2$
Entry window	Not available
Wall reinforcement cap	550 mg/cm^{-2} , detachable,
Preferred direction;	Axial
Point of reference	marked on detector
Chamber voltager	+ 400 V (mSv/h, µSv) + 40 V (µSv/h)

Warm-up time 2 minutes

Power supply

Batteries	4 batteries or rechargeable accu type LR06 (AA)
Current consumption	approx. 80 mA @ 5 V
Battery lifetime	approx. 35 h
Check battery voltage	Capacity and Battery symbol on display
External DC voltage supply (optional)	5,3VDC / 3A

Dimensions

Measurement probe	diameter 112 mm, length 260 mm
Display unit	250 mm x 108 mm x 42 mm (L x W x H)
Cable length	0.7 m (standard)

Weight

Measurement probe	600 g
Display unit	900 g (incl. batteries)

Display screen LCG graphic display with backlight
resolution 128 x 64 dpi

Operating conditions

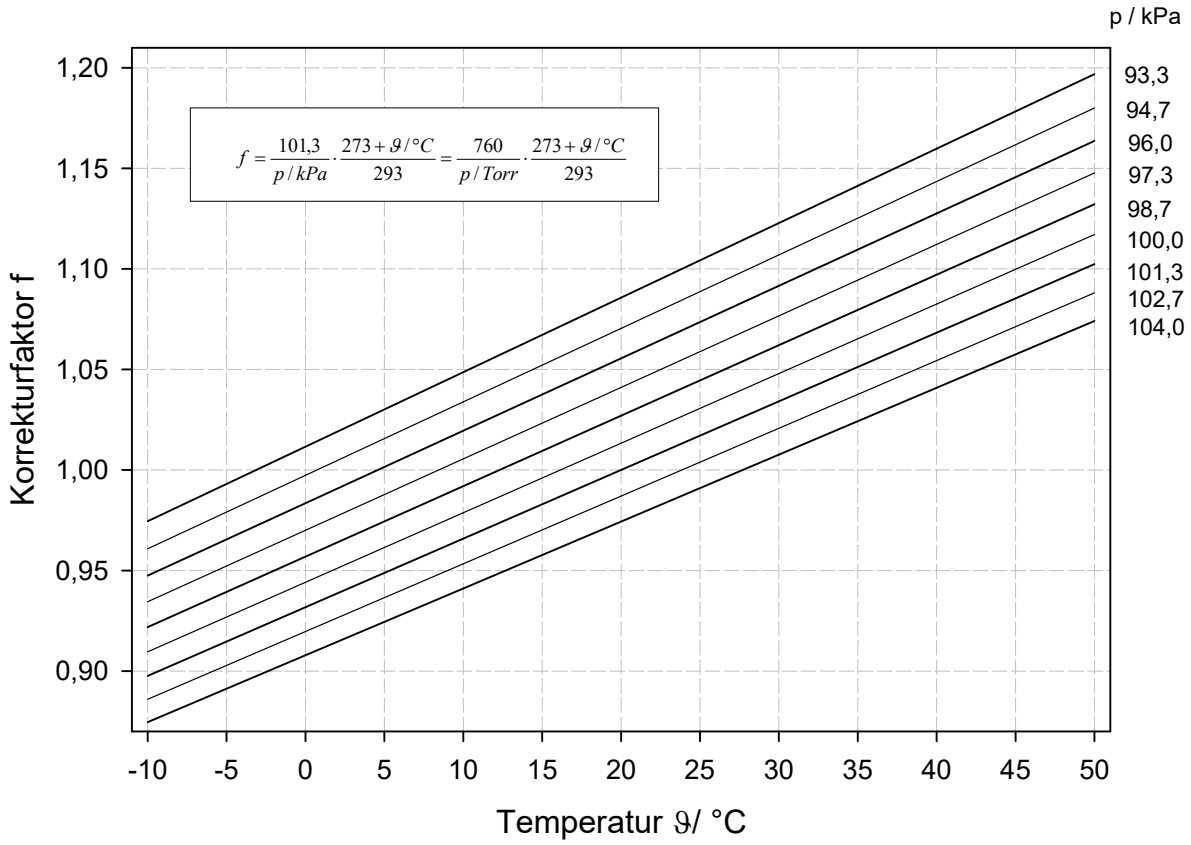
Operating temperature range	0 ... + 45 °C (for operation)
Storage and transport temperature range	- 20 ... + 55 °C (for storage and transport)
Air pressure	80 ... 110 kPa
Relative air humidity	max. 80 %

EMC test According to EN 61000

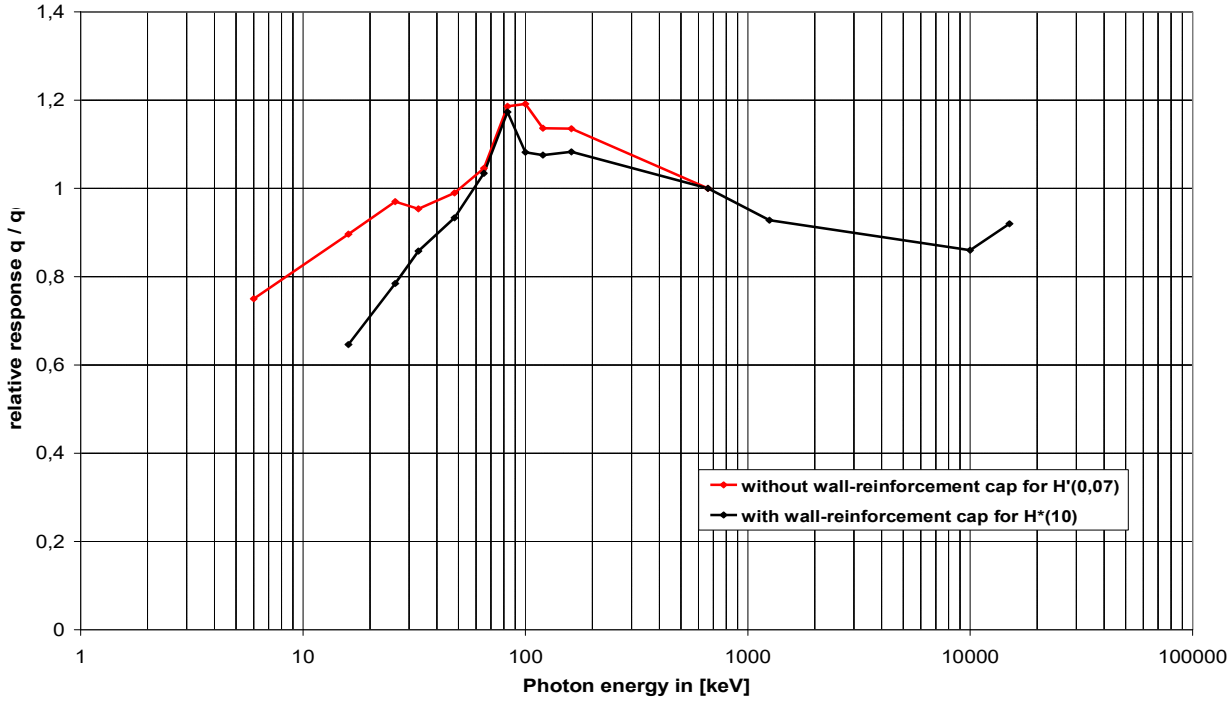
The manufacturer reserves the right to any modification of the specifications in terms of technical progress.

Appendix

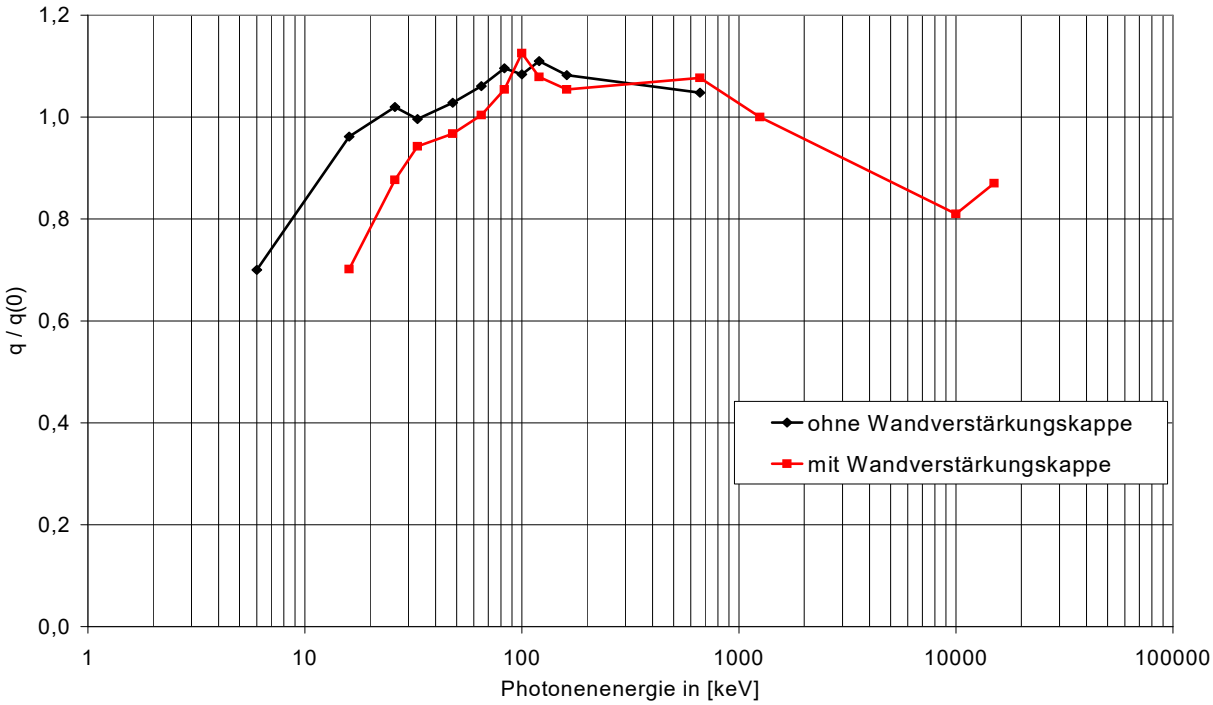
Nomogram (air pressure and temperature compensation)



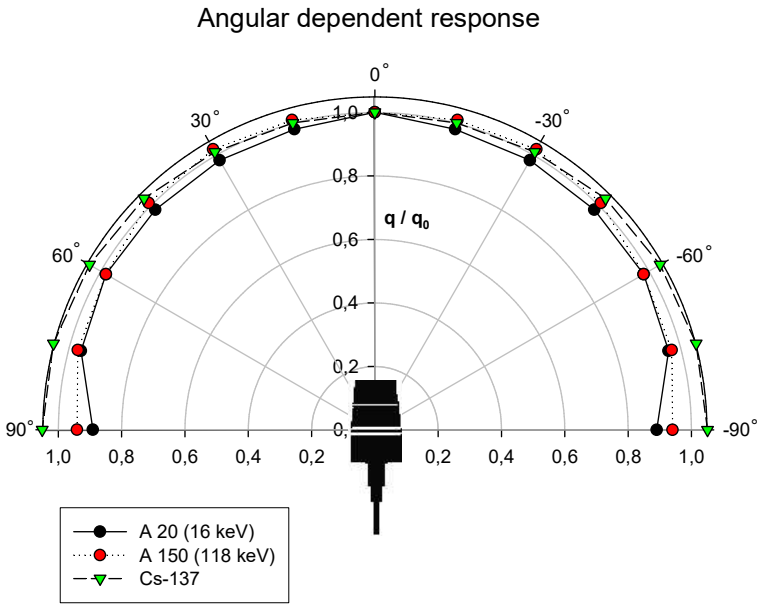
Energy dependent response OD-02:



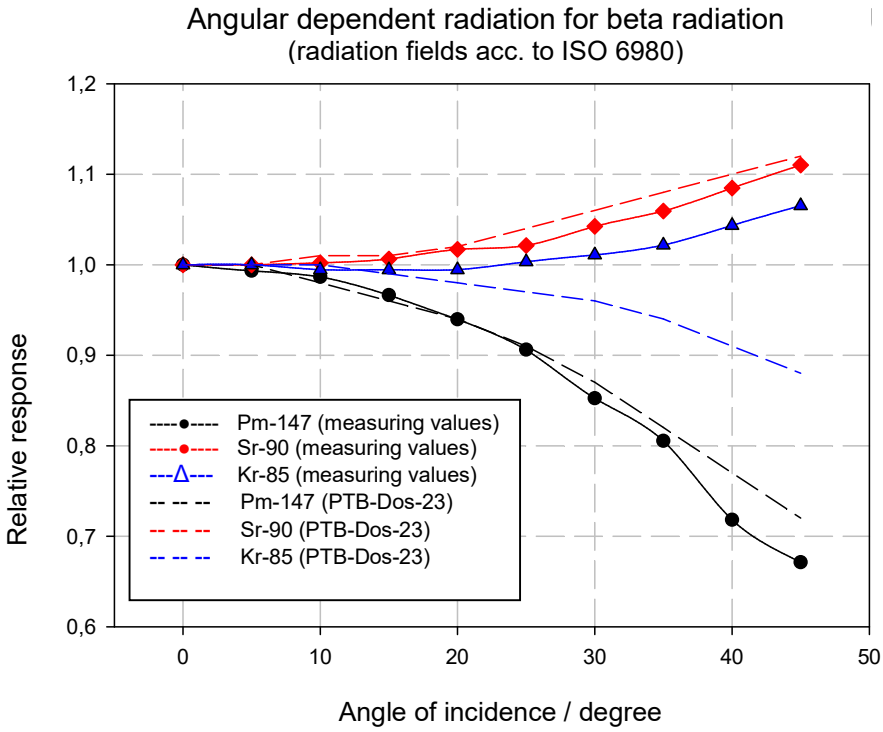
Energy dependent response OD-02 Hx



Angular dependent response for photon radiation



Angular dependent response for beta radiation



Relative response for various beta energies (characteristic values)

Radiation	Isotope	Energy in keV	Relative response	Direction of incidence
Beta	Sr-90/Y-90	800	0.70	axial
Beta	Kr-85	240	0.30	axial
Beta	Pm-147	60	0.20	axial

Operation and warranty sheet of device

Type: ☐ **OD-02** ☐ **OD-02 Hx**

Serial number: ……

External power supply : available ☐ not available ☐

Internal software version: ……

Final inspection date: ……

Warranty period: **24 months**

Start date warranty period: ……..… Stamp and signature

Service notes: ……

……

……

……

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EC Declaration of Conformity

The manufacturer / placing on the market

STEP Sensortechnik und Elektronik Pockau GmbH

hereby declares that the following product

Product description:	**Radiation protection Local dosimeter OD-02**
Model designation:	OD-02 / OD-02Hx
Serial number:	starting from OD02201901
rom year of manufacture:	2020

complies with all relevant provisions of the applied legal regulations (hereinafter) - including their amendments in force at the time of the declaration. The sole responsibility for issuing this declaration of conformity lies with the manufacturer. This declaration relates only to the OD-02 local dosimeter in the condition in which it was placed on the market; parts and/or interventions subsequently fitted by the end user are not taken into account.

The following harmonised standards were applied:

DIN EN 60846-1	Radiation protection measuring instruments -Environmental and/or directional dose equivalent (dose rate) meters and/or monitors for beta, X-ray and gamma radiation Part 1: Portable measuring instruments and monitors for the workplace and the environment
DIN EN 61000	Electromagnetic compatibility (EMC)

Name and address of the person authorised to compile the technical file:

Dr. Werner Schüler
STEP GmbH
Siedlungsstraße 5-7
D-09509 Pockau-Lengefeld

Place: Pockau-Lengefeld
Date: 04.01.2020

Dr. Werner Schüler