

approved  
by PTB  
(government  
authority)



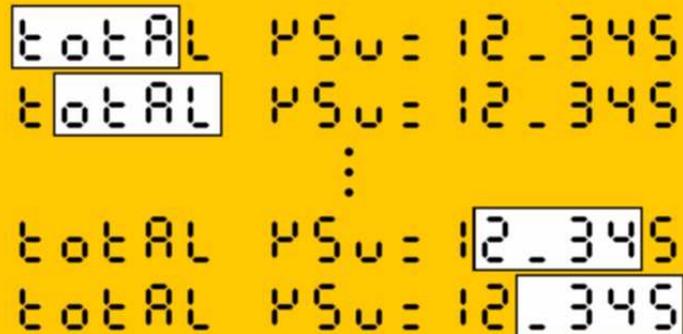
Dose Indication

In addition to standard dose indication, a variety of measurements and parameters can be viewed as messages moving through the four-digit display. Examples:

» bAtt = 8.6v «,  
battery voltage is 8.6 Volt:



» totAL  $\mu$ Sv = 12\_345 «,  
total device dose is 12 345  $\mu$ Sv:



- Ten threshold pairs for dose and dose rate
- Audible single pulse detection, can be disabled
- Upon keystroke indication of: time remaining until dose alarm - battery voltage - current, maximum and average dose rate - alarm thresholds - total device dose - device temperature - various device parameters
- Permanent monitoring of detector, battery condition and device temperature
- Sophisticated precautions against data loss caused by battery failure - measured data will be retrieved after switching on
- Programming mode to adapt the device to individual requirements, test mode for radiological checks
- Archive containing the data of the last 105 uses (reading the archive requires a dosimeter reader)
- Approx. 5000 operating hours with a 9 Volt alkaline battery
- Robust waterproof housing made of aluminium die casting, LCD with large characters (character height 7 mm)

## ALADOX®

Direct-reading Alarming Dosimeter for personal protection wherever there is a risk of increased photon radiation (gamma and X-radiation), designed for the quantity  $H_p(10)$

ALADOX® is our trademark (German registration number 30 2008 063 088)

## GENERAL

ALADOX is a battery-powered digital personal dose meter to measure the Personal Dose Equivalent  $H_p(10)$  caused by photon radiation (gamma and X-radiation). ALADOX is the successor of the **ALArming DOSimeter** ALADOS, however with **eXtended** functions.

We manufacture microprocessor-based digital dosimeters since 1984 always using the same proven aluminium die-cast housing with a four-digit LCD and an integrated piezo speaker. All models use a GM counting tube as a detector known for its reliability and good long-term stability. The ALADOX series is equipped with the meanwhile third generation of electronics, which became ready to go into production by the end of 2008, and which provides more functions at even lower power consumption. All models of the ALADOX family are designed for  $H_p(10)$ . Further members of this family are the ALADOX-F (version for fire brigades) and the ALADOX-SYS (system dosimeter as a part of an electronic personal dosimetry system). There are separate data sheets for these other models.

Alarm thresholds for dose and dose rate which may be selected from predefined values cause audible and visual warnings if certain radiation levels are exceeded. The audible single pulse detection, which can be disabled, provides an additional acoustic aid to recognise low dose rates. Battery condition, detector and device temperature are monitored permanently.

The key on the front side provides a clear tactile feel and serves for all operations including switching on and off.

The piezo speaker emits short melodies to guide the user and warning tones in case of alarms. Warning tones are particularly intense siren-like tones

The stainless steel clip (see cover picture) is included in the delivery. It can be taken off if it should be inconvenient when wearing the dosimeter, or if the dosimeter or the clip require decontamination. In case the clip cannot be fully decontaminated, it may be replaced without rendering the entire dosimeter useless.

The ALADOX is used primarily as a personal dosimeter in all areas in which persons are subject to an increased level of photon radiation, for example in nuclear power stations, nuclear physics laboratories in research and industry, radiotherapy, nuclear medicine, technical applications, and transportation of radioactive nuclides.

A standard 9 Volt battery serves as the power supply. The low power consumption allows approximately 5000 operating hours with an alkaline battery (at low radiation levels with all warnings off). The ALADOX is autarkic in the sense that its operation does not require any additional devices or tools.

A permanent memory not requiring any auxiliary batteries contains measured data and individual parameters. After an unplanned disruption of power (battery failure) the measured data are retrieved from that memory thus continuing the interrupted use without any loss of important data.

ALADOX provides an inductive sensor in its battery compartment cover allowing wireless data transfer to and from an optional dosimeter reader.

ALADOX is approved by PTB (the German National Bureau of Standards) as a personal dosimeter for the quantity  $H_p(10)$ . Note that the PTB approval even applies to the labels on the instrument and the operating manual. Therefore, if the labels on the instrument or the operating manual are others than the approved German editions,

the approval is no longer valid. This is why we do not specify the PTB approval number on instruments carrying other than German labels. Apart from the labels and the operating manual, the instrument's international English version is identical to the approved German version

## PROGRAMMING MODE

The programming mode allows to adapt the dosimeter to individual requirements. The following items can be programmed and will be stored permanently:

- Permanent dose storage (dose will be kept across switching off) enabled: »yes/no«.
- Clearing a permanently stored dose.
- Thresholds for dose and dose rate which shall be valid after switching on. The thresholds have to be chosen from a set of ten predefined threshold pairs, see Technical Data.
- Audible single pulse detection enabled after switching on: »yes/no«.
- Choosing the language for the Display Sequence from these: German, English, French, Italian, Spanish.
- Not a programming, but an additional function: Enters a special test mode allowing a radiological check in a very convenient way.

## MEASURING DOSE AND DOSE RATE

Dose and dose rate (current and average rate) are measured simultaneously. Dose is indicated permanently, current dose rate only in case of dose rate warning. Current, maximum and average dose rate can be viewed as part of the DISPLAY SEQUENCE.

With the aid of the already mentioned programming mode you may teach the instrument whether the dose shall be kept across a switching off.

## TOTAL DEVICE DOSE

ALADOX provides a second dose memory for the total device dose. All dose values the dosimeter has ever measured are accumulated in this memory location. There is no way to clear the device dose, neither through some operation nor through a reader. You may view the device dose by pressing the key.

## DISPLAY SEQUENCE

A short keystroke starts a sequence of moving messages presenting the following measured data and parameters one after the other:

- Audible single pulse detection enabled »yes/no«.
- Time remaining until dose alarm (the time that will elapse - considering the current values of dose and dose rate - until the dose alarm threshold is caught).
- Battery voltage.
- Current dose rate.
- Maximum dose rate which occurred so far.
- Dose alarm threshold.
- Dose rate alarm threshold.
- Average dose rate.
- Device temperature.
- Total device dose.
- Permanent dose storage enabled »yes/no«.
- Program version (software release).
- Serial number.

**WARNINGS**

- **Dose Warning:** Flashing dose indication and intermittent siren-like tone (two tones per second). Can be reset by pressing the key. As soon as dose increased by a certain amount, dose warning is repeated. That »post-alarm« occurs at steps of 2% of the dose alarm threshold, or at steps of 0.001 mSv if the threshold is lower than 0.050 mSv.
- **Dose Rate Warning:** Dose rate indication »hxx« for »xxx« mSv/h (the flashing »h« in the first place stands for »per hour«) and intermittent siren-like tone (one tone per second). Can be reset by pressing the key. Dose warning takes precedence over dose rate warning in case both should occur simultaneously.
- **Detector Failure:** Flashing message »dEF.« and continuous siren-like tone. Can be reset by pressing the key, however will be reminded of at one-minute intervals by a short sound and repeating the flashing message »dEF.«.
- **Battery Warning:** Flashing message »bAtt« and continuous siren-like tone. Can be reset by pressing the key, however will be reminded of at five-minute intervals by a short sound and repeating the flashing message »bAtt«.

- **Over-temperature Warning:** Flashing message »60°C« and continuous siren-like tone. Can be reset by pressing the key, however will be reminded of at five-minute intervals by a short sound and repeating the flashing message »60°C«.

**ARCHIVE**

The dosimeter's archive keeps track of its last 105 uses. Each of the 105 archive records contains these data:

- Date and time when the use started (only if the dosimeter's clock was set by a dosimeter reader).
- Dose received during the use and duration of the use.
- Maximum dose rate during the use and the time since start when the maximum dose rate occurred.
- Identification number and job number (only if the dosimeter was used together with a reader).
- Marking how the use ended (switching off, battery failure, command from dosimeter reader).
- Markings for special events during the use (reader involved, detector failure, over-temperature > +60°C, under-temperature < -30°C).

Reading the archive requires a dosimeter reader. The archive may help to solve doubtful events.

**OPTIONAL ACCESSORIES**

**Dosimeter Reader 667.9**

Among other things, this reader allows to:

- Set the dosimeter's clock,
- Read all data measured,
- Program the dosimeter with special alarm thresholds as well as identification number and job number,
- Read the dosimeter's archive,
- Record dose automatically on the computer of an electronic personal dosimetry system (however, if this shall be the dosimeter's main application, the model ALADOX-SYS is strongly recommended instead).

The Dosimeter Reader 667.9 is connected to the RS232 interface COMx of a standard PC. Delivery includes our standard software WinEPDS for simple dose recording. However, the user does not depend on this software. All commands available for the RS232 interface are specified in the reader's manual thus enabling the user to create his own PC software for the reader.



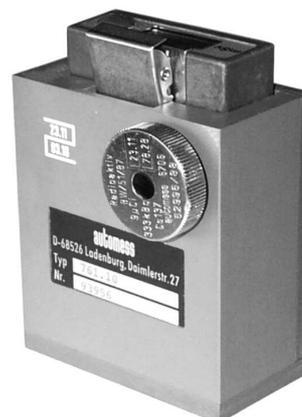
**Source Holder 761.10**

The following optional accessories are required for a radiological check:

- Check source 6706 (nominal activity 333 kBq Cs-137) or equivalent source according to DIN 44427 (*note: handling this source may require official permission!*)
- Source Holder 761.10.

This equipment allows to expose the dosimeter's counting tube to a well-defined dose rate. The dosimeter is placed into test mode by the aid of the programming mode. It now measures and indicates average dose rate. Additionally it monitors that conditions are constant. As soon as the coefficient of variation has achieved a limit of one percent, the instrument notifies the user that the measurement is considered to be accurate enough. Now the average dose rate can be taken as the check reading. All this works automatically. The only thing the dosimeter cannot save you is to correct the reading to the source's activity loss caused by radioactive decay, and to enter the check reading in your files.

A check measurement takes about five minutes in case of a source with nominal activity.

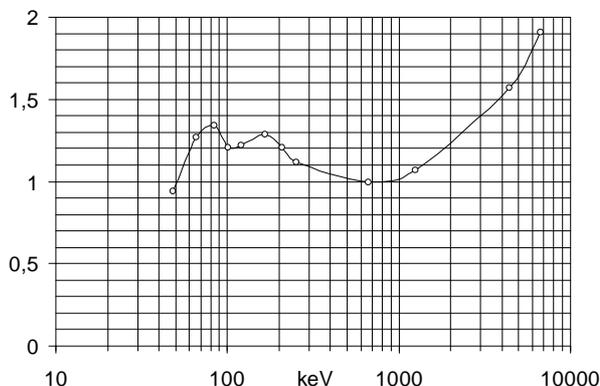


**TECHNICAL DATA**

Note: Specifications marked <sup>(PTB)</sup> have been verified by the PTB type approval.

Detector	GM counting tube ZP1310 or equivalent, energy compensated, diameter 5 mm, sensitive length 16 mm, sensitivity approximately 500 pulses per µSv	Permanent memory	flash memory, data retention 100 years, no auxiliary battery required		
Measured quantity	personal dose equivalent H <sub>p</sub> (10) caused by photon radiation	Dosimeter reader	wireless inductive interface for reader provided		
Nominal ranges for photon energy and angle of incidence <sup>(PTB)</sup>	65 keV to 3 MeV (reference energy is 662 keV of Cs-137) and ±60° around preferential direction. Relative error +40% / -14% (max. allowed +67% / -29%)	Alarm tone	piezo speaker, ~ 3 kHz, ~ 85 dB(A) at a distance of 30 cm		
Preferential direction	perpendicular on the marking spot on the large surface	Climate <sup>(PTB)</sup> (nominal ranges for ambient temperature and relative humidity)	-30°C to +60°C and 0% to 95% relative humidity, maximum error of indication ±2% (max. allowed: +18% / -13%) referred to indication at +20°C and 65% relative humidity (LCD response time increases below -10°C)		
Display	four-digit 7-segment liquid crystal display (LCD) with three decimal points between the four digits	Atmospheric pressure	nominal range 60 to 130 kPa (600 to 1300 mbar)		
Dose measuring range <sup>(PTB)</sup>	0.010 mSv to 9999 mSv (= 10% reading accuracy at the lower limit)	Geotropism	none (no change of response as a result of gravitational effects)		
Dose indication: four auto-ranging formats	0.000 - 9.999 mSv 10.00 - 99.99 mSv 100.0 - 999.9 mSv 1000 - 9999 mSv	Supply voltage range	5.0 Volt to 10.0 Volt, electronic reverse polarity protection		
Dose rate indication: three auto-ranging formats	h0.00 - h9.99 mSv/h h10.0 - h99.9 mSv/h h100 - h999 mSv/h where »h« stands for »per hour«	Power supply	standard 9 Volt battery (alkaline according to IEC 6LR61 recommended)		
Linearity <sup>(PTB)</sup> (change in response as a function of dose and dose rate)	±2% (max. allowed: +18% / -13%) in the dose measuring range of 0.01 mSv to 9999 mSv and the dose rate nominal range of 50 nSv/h to 1 Sv/h	Battery life at low radiation levels of up to 0.2 mSv/h	approximately 5000 hours with 6LR61 battery (speaker off)		
Time constant and coefficient of variation of dose rate measurement	time constant one second if dose rate changes suddenly, eight seconds if it changes slowly. Coefficient of variation lower than 5% at dose rates greater than 0.2 mSv/h.	Housing	aluminium die-cast, waterproof, protection class IP 67 according to DIN 40050, easy to decontaminate		
Alarm thresholds: choice from ten fixed threshold pairs for dose and dose rate	0.010 mSv / 0.20 mSv/h 0.020 mSv / 0.20 mSv/h 0.050 mSv / 0.20 mSv/h 0.100 mSv / 0.20 mSv/h 0.200 mSv / 0.20 mSv/h 0.500 mSv / 0.50 mSv/h 1.000 mSv / 1.00 mSv/h 2.000 mSv / 2.00 mSv/h 5.000 mSv / 5.00 mSv/h 10.00 mSv / 10.0 mSv/h	Dimensions	height 97 mm, width 60 mm, depth 23 mm (excluding clip)		
Audible single pulse detection	may be enabled or disabled during operation by a longer keystroke	Weight	approx. 130 g excluding battery and clip, approx. 190 g including battery 6LR61 and clip		
Monitoring the battery	automatic warning if voltage drops below 5.5 Volt	Regular maintenance	not necessary because there are no parts wearing out (in particular no auxiliary battery for data retention)		
Monitoring the detector	automatic warning if detector fails (no pulse detected during a period of 15 to 20 minutes)	PTB approval no. (applying to German version)	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>23.52</td></tr><tr><td>08.02</td></tr></table>	23.52	08.02
23.52					
08.02					
Indication of various data	see section »DISPLAY SEQUENCE« on page 2				

*Energy Response Referred to H<sub>p</sub>(10, 0), normalised to Response at Cs-137 (662 keV)*



- SUBJECT TO CHANGE WITHOUT NOTICE -