

approved  
by PTB  
(government  
authority)



Dose indication in the state »Measure«

Optionally:  
Steel retaining clip



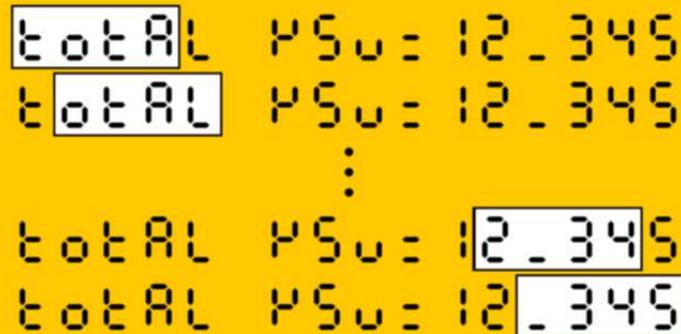
Indication of battery  
voltage in the standby  
state »Battery«

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:



- Programmable by a reader: Four dose alarm thresholds, one dose rate alarm threshold, identification and job number
- Autarkic mode (use without dosimeter reader) for special or emergency cases, test mode for radiological checks
- Upon keystroke indication of: time remaining until dose main alarm - battery voltage - identification number - 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
- Archive containing the data of the last 105 uses
- Approx. 5000 operating hours with a 9 Volt alkaline battery while measuring, approx. 13000 hours (1.5 years) in standby operation
- Robust waterproof housing made of aluminium die casting, LCD with large characters (character height 7 mm)

## ALADOX<sup>®</sup>-SYS

Direct-reading Alarming Dosimeter as a part of an Electronic Personal Dosimetry System, designed for the quantity  $H_P(10)$  caused by photon radiation (gamma and X-radiation)

ALADOX<sup>®</sup> is our trademark (German registration number 30 2008 063 088)

### GENERAL

ALADOX-SYS 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-SYS is the successor of our 219.x types of dosimeters, which means it is primarily intended to be used as a part of an electronic personal dosimetry system as can be found in large nuclear facilities such as power plants. Therefore it depends on dosimeter readers. Downwards compatibility assures that dosimeter readers originally designed for the older 219.x types may still be used with the new ALADOX-SYS without modification. Taking advantage of the additional functions of the ALADOX-SYS only requires upgrading the software of older dosimeter readers.

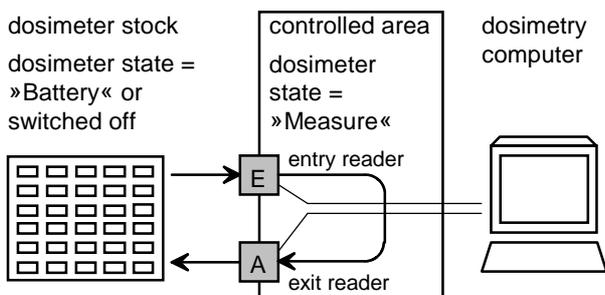
We manufacture microprocessor-based digital dosimeters since 1984, always using the same proven aluminium die-cast housing with a four-digit LCD and an integrated piezo speaker. All models use a GM counting tube as a detector known for its reliability and good long-term stability. The ALADOX series is 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 (autarkic standard version) and the ALADOX-F (version for fire brigades). There are separate data sheets for these other models.

The stainless steel clip (see cover picture) is an optional accessory only, because for a typical use in a nuclear facility (dosimeter worn in a closed breast pocket) the clip is more inconvenient than helpful. Should the clip become contaminated permanently, it may be replaced without rendering the entire dosimeter useless.

ALADOX-SYS 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.

### FUNCTIONS

A peculiarity of the ALADOX-SYS is that it has two states named »Battery« and »Measure« which come from the demands of an electronic personal dosimetry system. You can imagine such a system as follows:



In the stock the dosimeters wait for their next use. At that place they are either switched off or in the standby state »Battery« where they do not measure dose, but just indicate battery voltage and keep the data of their most recent use. A new use starts whenever the dosimeter is

initialised at the entry reader. This moves the dosimeter's state from »Battery« to »Measure«, clears the dose, and programs the dosimeter with individual alarm thresholds along with identification number and job number. The use ends by reading the dosimeter at the exit reader and returning it to the state »Battery«. Access control at the entry and dose recording at the exit are tasks of the dosimetry computer which the readers are connected to. As an additional precaution, the dosimeter stores the data of any use permanently in its archive.

While in the state »Battery«, the ALADOX-SYS can be switched off completely by a suitable combination of keystrokes, however not while in the state »Measure«. This avoids that intentional or inadvertent keystrokes could disrupt dose measurement. For the same reason, opening the battery compartment requires a special key.

ALADOX-SYS provides four dose alarm thresholds (three pre-alarms and one main alarm which cannot be reset) and one dose rate alarm threshold. All thresholds can be programmed by a dosimeter reader to (almost) any value. Exceeding the thresholds causes audible and visual warnings. Measured data such as dose and maximum dose rate can be read from the dosimeter. The wireless data transfer to and from a dosimeter reader goes through an inductive sensor in the battery compartment cover.

ALADOX-SYS permanently monitors its detector. In the state »Measure« it monitors battery condition and device temperature, too.

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

A standard 9 Volt alkaline battery lasts for approximately 5000 operating hours in the state »Measure« (at low radiation levels with all warnings off), and for approximately 13000 hours (1.5 years) in the state »Battery«.

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.

### DISPLAY SEQUENCE

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

- Time remaining until dose main alarm is caught, considering the current values of dose and dose rate (in state »Measure« only).
- Battery voltage (in state »Measure« only).
- Dose (in state »Battery« only).
- Current dose rate (in state »Measure« only).
- Maximum dose rate (always).
- Identification number (always).
- Dose alarm thresholds (always).
- Dose rate alarm threshold (always).
- Average dose rate (in state »Measure« only).
- Device temperature (always).
- Total device dose, i.e. the sum of all dose values ever measured (in state »Battery« only).
- Software release (in state »Battery« only).
- Serial number (in state »Battery« only).

In the state »Battery«, measured data are those of the most recent use which has already ended. In the state »Measure«, these data are those of the current use.

## WARNINGS

- **Dose Warning:** Flashing dose indication and intermittent siren-like tone (two tones per second). The three pre-alarms can be reset by pressing the key, the main alarm cannot.
- **Dose Rate Warning:** Dose rate indication »hxxx« 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«.

The failure warning »dEF.« may occur in both states »Battery« and »Measure«, whereas the other warnings can only occur in the state »Measure«.

## ACCESSORIES

### Dosimeter Readers

The Dosimeter Reader 667.9 (see Figure below) is connected to the RS232 interface COMx of a standard PC. Delivery includes our standard software WinEPDS for a simple electronic personal dosimetry system. This includes the possibility to read the dosimeter's archive. 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.



Other types of dosimeter readers are available for large electronic personal dosimetry systems. Such large projects can hardly be composed just of standard components, but usually need customising. Please contact us.

## SPECIAL FUNCTIONS

In special or emergency cases (e.g., if the entire dosimetry system failed), the ALADOX-SYS can be operated in an autarkic mode without any dosimeter reader.

A special test mode allows a radiological check in a very convenient way. Date and validity period of the check can be programmed into the dosimeter and may be used as a condition for access control.

The language for the Display Sequence can be chosen from these: German, English, French, Italian, Spanish.

## 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.
- 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.
- 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.

### Battery Compartment Key 878.1.2

The battery compartment can be opened and closed with this special key. The need for that special key avoids that dose measurement can be interrupted by easy removal of the battery.

### 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 a test mode particularly designed for this purpose. 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.

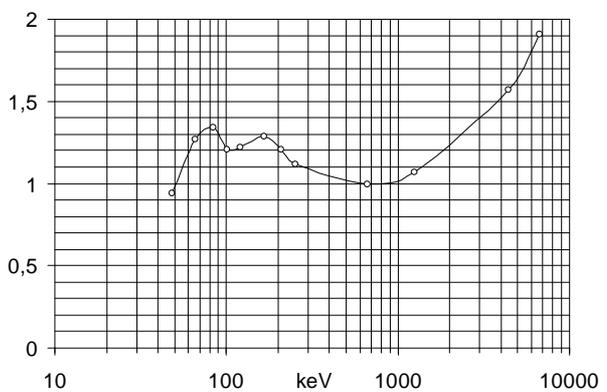
A check measurement takes about five minutes in case of a source with nominal activity.

**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	Alarm tone	piezo speaker, ~ 3 kHz, ~ 85 dB(A) at a distance of 30 cm		
Measured quantity	personal dose equivalent H <sub>p</sub> (10) caused by photon radiation	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)		
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%)	Atmospheric pressure	nominal range 60 to 130 kPa (600 to 1300 mbar)		
Preferential direction	perpendicular on the marking spot on the large surface	Geotropism	none (no change of response as a result of gravitational effects)		
Display	four-digit 7-segment liquid crystal display (LCD) with three decimal points between the four digits	Supply voltage range	5.0 Volt to 10.0 Volt, electronic reverse polarity protection		
Dose measuring range <sup>(PTB)</sup>	0.010 mSv to 9999 mSv (= 10% reading accuracy at the lower limit)	Power supply	standard 9 Volt battery (alkaline according to IEC 6LR61 recommended)		
Dose indication: four auto-ranging formats	0.000 - 9.999 mSv 10.00 - 99.99 mSv 100.0 - 999.9 mSv 1000 - 9999 mSv	Battery life with a 9 Volt alkaline battery	in state »Measure« at low levels of up to 0.2 mSv/h: approx. 5000 h (speaker off), in state »Battery« approx. 13000 h (1.5 years)		
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«	Housing	aluminium die-cast, waterproof, protection class IP 67 according to DIN 40050, easy to decontaminate		
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	Dimensions	height 97 mm, width 60 mm, depth 23 mm (excluding clip)		
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.	Weight	approx. 130 g excluding battery and clip, approx. 190 g including battery 6LR61 and clip		
Programmable alarms for dose and dose rate	three dose pre-alarms, one dose main alarm which cannot be reset, one dose rate alarm	Regular maintenance	not necessary because there are no parts wearing out (in particular no auxiliary battery for data retention)		
Further data programmable by dosimeter reader	Identification number and job number (seven places each), date and time, date and validity period of most recent successful check	Required accessory	battery compartment key, part number 878.1.2		
Monitoring the battery	automatic warning if voltage drops below 5.5 Volt	Opt. accessory	stainless steel retaining clip		
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>08.03</td></tr></table>	23.52	08.03
23.52					
08.03					
Indication of various data	see section »DISPLAY SEQUENCE« on page 2				
Permanent memory	flash memory, data retention 100 years, no auxiliary battery required				
Dosimeter reader	wireless inductive interface for reader provided				

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



- SUBJECT TO CHANGE WITHOUT NOTICE -