Automation und Messtechnik GmbH

approved
by PTB
(government
authority)

- ➢ **Detectors: Built-in GM counter and external probes**
- ➢ **Gets all the benefits from a modern microprocessor: Automatic range selection, smart time constant, digital calibration providing high accuracy, recognises external probes automatically**
- ➢ **Simultaneously measures current value, average value, and maximum value of dose rate, as well as accumulated dose (non-volatile dose memory provided)**
- ➢ **Alarm thresholds for both dose and dose rate including one freely programmable threshold each**
- ➢ **Automatic battery monitoring**
- ➢ **Approx. 3000 operating hours with a 9 V alkaline battery**
- ➢ **Robust waterproof aluminium die-cast housing**
- ➢ **Serial RS232 interface for connection to a PC**

6150AD®

Universal Radiation Meter for Measuring Photon Radiation (Gamma and X-radiation), and for Detecting Alpha and Beta Radiation if Operated with External Probes

6150AD® is our trademark (German registration number 303 55 582)

APPLICATION

The 6150AD is a portable, battery operated dose rate meter to measure photon radiation (gamma and X-radiation). A built-in GM counting tube serves as the detector.

As implied by the letters »AD« in its name, the 6150AD displays the current dose rate in both analog and digital form. Furthermore, it permanently measures dose rate mean value, dose rate maximum value, and accumulated dose.

All models have alarm thresholds for dose rate, some models also for dose. Some models have programmable thresholds that allow you to set alarm thresholds to any value within the instrument's range. All models support audible single pulse detection.

The display is a static (non-multiplexed) LCD the backlight of which can be switched on by pressing a key. In order to save batteries, the backlight automatically goes off after ten seconds.

The housing is made of waterproof aluminium die casting and has a dark grey scratch-resistant coating which is much more robust than enamel or similar. Two eyelets at the bottom corners of the instrument serve to fasten the carrying strap.

The top side carries four keys made of silicone rubber, which provide a clear tactile feel, and which can be easily operated even with heavy working gloves. A piezo buzzer emits audible signals using the housing area among the four keys as a diaphragm, so that no hole is required for a loudspeaker. The instrument is thus easy to decontaminate. The reverse side carries a short form instruction label and the battery compartment cover, which is fitted with two twist locks.

The socket on the left-hand side of the instrument serves to connect external probes and includes an RS232 output to transmit dose rate indication to a computer.

6150AD Models

Serial production started as early as in 1986. Since then, the appearance did not change, but the interior did. Meanwhile, the third electronic hardware generation was introduced in 2004, and detectors designed for the new measuring quantity Ambient Dose Equivalent H*(10) became available replacing those for the old quantity Exposure Dose J_S.

Basically, there are two detectors with different ranges, and the instrument may have »additional functions« or not. This makes a total of four basic models as indicated in the table below (the former 6150AD3 and AD4 models are no longer required because they where replaced with AD5 and AD6).

model summary:

model	range up to	additional functions
6150AD1 (/H, /E)	1 Sv/h	no
6150AD5 (/H, /E)		yes
6150AD2 (/H, /E)	10 mSv/h	no
6150AD6 (/H, /E)		yes

Models with extensions »/H« or »/E« are designed for H*(10). They only differ in compatibility with probes:

Compatibility (yes/no) of 6150AD models with probes:	model 6150...		
	ADx J_S	ADx/H H*(10)	ADx/E H*(10)
probes for J_S	yes	yes	no
probes for H*(10) /H models	yes	yes	no
probes for H*(10) /E models	no	no	yes

We had to create the »/E« models particularly for the German market, because the German PTB requires basic meter and probes to use the same quantity. Therefore, the PTB approval only applies to »/E« models.

How to select your model? If dose rates above 10 mSv/h are unlikely to occur, the 6150AD2 or AD6 is preferred because its higher sensitivity makes it better suited at low levels. Should you require H*(10) according to your national regulations, choose the »/H« model or the »/E« model if you wish to avoid that the 6150AD will work with old non-H*(10) probes. It depends on the application whether you prefer the »additional functions« (at no extra cost). The only argument against the additional functions is that they will necessarily make operation slightly more complicated. The additional functions are:
- Protection against unintentional switching off (requires two consecutive key pushes in the ground state),
- Non-volatile memory for the internal tube's dose,
- Dose warning,
- Programmable alarm thresholds for dose and dose rate,
- Better resolution (more places after the decimal point) when indicating dose, alarm threshold, and so on,
- Indication of the relative standard deviation of the dose rate average value,
- Recognising the Scintillator Probe 6150AD-b (/H, /E).

OPERATION WITH EXTERNAL PROBES

External probes designed for different tasks make the 6150AD a versatile meter for radiation protection. When connected, probe type and calibration parameters are recognised automatically.

Currently these probe types are supported:

Probes indicating dose rate in Sv/h:	
	6150AD-15 (/H, /E) high range gamma probe (useful range 1 mSv/h to 9.99 Sv/h)
	6150AD-18 (/H, /E) low range gamma probe (useful range 2 µSv/h to 9.99 mSv/h)
	6150AD-t (/H, /E) wide range Teletector probe with two counting tubes (useful range 2 µSv/h to 9.99 Sv/h), also allows to detect beta radiation
	6150AD-b (/H, /E): high sensitivity scintillator probe (useful range 50 nSv/h to 100 µSv/h) with wide energy range (20 keV to 7 MeV). Note: requires 6150AD5 or AD6 (/H, /E).
Probes indicating pulse rate in s⁻¹ (note that these probes work with any 6150AD model):	
	6150AD-17 alpha-beta-gamma probe, also for detecting contamination
	6150AD-0 general purpose pulse probe, e.g. contamination probe 6150AD-k (figure), gamma tracking probe Cerberus 763
	6150AD-19 cup-like probe for detecting contamination in liquids

This data sheet will not discuss probe specifications. There are separate data sheets for the probes.

FUNCTIONS

Dose Rate Indication and Dose Rate Warning

Dose rate indication is provided in digital and analog form simultaneously. The analog scale covers two decades and consists of 32 bar graph segments arranged in the shape of an arc. Two adjacent ranges always overlap by one decade. The 6150AD automatically switches ranges, where a short sound calls the user's attention every time the range was changed.

The loudspeaker key switches audible single pulse detection alternately on and off. The loudspeaker symbol in the upper right corner indicates that it is currently on. In case of dose rate alarm, there is an intermittent alarm tone, and the loudspeaker symbol flashes (with /E models, the analog scale divisions additionally flash). Pressing the loudspeaker key will put the alarm tone out, whereas the symbols will continue to flash.

Connecting an external probe makes the probe type appear as »ext xy« in the upper left corner. Ranges and units are selected automatically. This example shows a probe 6150AD-17 which is indicated in s^{-1} (pulses per second).

Dose rate indication is the ground state. Pressing the arrow key calls other states which will now be discussed shortly.

Dose Rate Average Value

The dose rate average value is particularly useful at low dose rates, where direct dose rate indication is subject to strong statistical fluctuations. The average value provides, though at the expense of measuring time, a much better statistical accuracy. The digits will flash as long as the statistical error (one relative standard deviation) is greater than 5%. The flashing will stop as soon as the 5% limit is achieved. The 6150AD5 and AD6 (/H, /E) additionally allow to view the standard deviation.

Viewing and Setting the Dose Rate Alarm Threshold
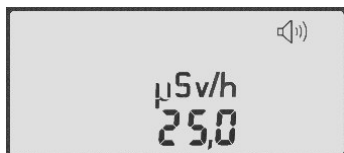
The loudspeaker symbol in the upper right corner shows that this indication concerns a threshold, not a measured value. The loudspeaker key allows to select a threshold from a set of fixed values, which in case of the 6150AD5 and AD6 (/H, /E) additionally includes the user programmable threshold.
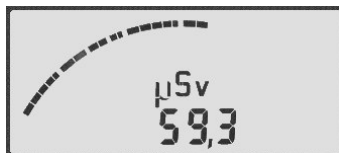
Dose Rate Maximum Value

The »max« symbol shows that this indication concerns the maximum dose rate value since the 6150AD was switched on. This value can be useful after a job like, for example, measuring the spatial distribution of a radiation field.

Dose and Dose Warning

The dose is displayed digitally and as an analog bar representing the dose as a portion of the dose alarm threshold. Because of the non-volatile memory, dose may be non-zero after power-up. In case of dose alarm the 6150AD automatically goes into this state. The full scale bar and the loudspeaker symbol will be flashing, accompanied by an intermittent alarm tone Resetting the dose to zero is only possible directly after power-up.

With the »simple« models 6150AD1 and AD2 (/H, /E) the dose is always zero after power-up, and there is no analog dose indication, because these models do not provide dose warning.

Viewing and Setting the Dose Alarm Threshold (Smart Models 6150AD5 and AD6 (/H, /E) only)
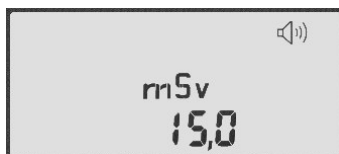
The loudspeaker symbol in the upper right corner shows that this indication concerns a threshold, not a measured value. The loudspeaker key allows to select a threshold from a set of fixed values including the user programmable threshold.

Battery Voltage and Battery Monitoring

This function allows to view the voltage of the 9 volt battery at any time. Voltages below 5.5 volt produce battery warning, consisting of the flashing battery symbol in the upper right corner of the LCD and a continuous alarm tone. Pressing the loudspeaker key will put the alarm tone out and make the battery symbol appear steadily. This automatic battery warning is issued in any state of the 6150AD, not only during battery voltage indication.

OPTIONAL ACCESSORIES

Source Holder 761.1

The source holder 761.1 serves to mount the check source 6706 (333 kBq Cs-137) or equivalent onto the 6150AD in a well-defined position. This allows reproducible radiological checks.

Wall Holders

The wall holder 761.8 serves to store (not operate) the 6150AD at a wall. The wall holder with AC adapter 761.13 allows stationary operation of the 6150AD from the 230 V mains.

Bags and Cases

There is a variety of bags and cases for safe storage and transportation of the 6150AD and its accessories.

SUPPLEMENTARY DEVICES (see separate data sheets)

The **Gamma Alarm Station 859.x** accommodates one 6150AD and makes alarms particularly well noticeable, for example through flashlights.

The **Probe Multiplexer 861.x** connects up to ten probes to a single 6150AD and scans the probes either automatically, manually, or according to an external computer command. This allows monitoring several locations with one 6150AD and several probes according to a time-slice method.

The **TELDOS** system radio-transmits the 6150AD's dose rate indication to a PC over distances of up to 500 m.

TECHNICAL DATA

	6150AD1 (/H, /E) 6150AD5 (/H, /E)	6150AD2 (/H, /E) 6150AD6 (/H, /E)
Detector (energy compensated)	GM tube ZP1310, effective length 16 mm, sensitivity approx. 500 pulses per µSv	GM tube ZP1200, effective length 40 mm, sensitivity approx. 5800 pulses per µSv
Measuring quantity	/H, /E models: ambient dose equivalent H*(10); others: exposure dose J_s	
Energy range	/H, /E models: 45 keV - 2.6 MeV others: 45 keV - 3 MeV	60 keV - 1.3 MeV
Angular range	±45° around preferential direction (perpendicular to the front side)	
Analog (A) and digital (D) dose rate range	A: 1 µSv/h to 1000 mSv/h D: 0.0 µSv/h to 999 mSv/h	A: 0.1 µSv/h to 10 mSv/h D: 0.00 µSv/h to 9.99 mSv/h
Useful dose rate range (low fluctuations)	0.2 mSv/h to 999 mSv/h	2 µSv/h to 9.99 mSv/h
Time constant	8 s, 1 to 2 s on sudden significant changes in dose rate	
Instrumental background	< 20 nSv/h	
Linearity of dose rate measurement	deviation max. ±10%, calibration with Cs-137	
Overload resistance	up to 50 times the amount of the full range dose rate	
Average dose rate digital range	0.000 µSv/h to 9.999 mSv/h value flashes as long as standard deviation is greater than 5%	
Digital dose range	6150AD1 (/H, /E): 0 µSv - 9.99 Sv 6150AD5 (/H, /E): 0.00 µSv-9.99 Sv	6150AD2 (/H, /E): 0 µSv - 99.9 mSv 6150AD6 (/H, /E): 0.00µSv-99.9mSv
Fixed dose rate alarm thresholds	25 µSv/h 250 µSv/h 1 mSv/h 2.5 mSv/h 10 mSv/h (disabled)	7.5 µSv/h 25 µSv/h 100 µSv/h 2 mSv/h 3 mSv/h (disabled)
Fixed dose alarm thresholds (smart models 6150AD5 and AD6 only)	15 mSv 100 mSv 250 mSv (disabled)	1 mSv 2 mSv (disabled)
User programmable alarm thresholds	one freely programmable threshold for each dose and dose rate (smart models 6150AD5 and AD6 only)	
Audible single pulse detection	yes, may be turned on and off with loudspeaker key	

	6150AD1 (/H, /E) 6150AD5 (/H, /E)	6150AD2 (/H, /E) 6150AD6 (/H, /E)
Display illumination	EL-lamp, goes on when pressing the illumination key, continues for ten seconds after releasing the key	
LCD test (all segments on)	automatically after switching on while the on/off key is kept down	
Temperature range	-30°C to + 50°C, deviation max. ±10% referred to indication at +20°C	
Humidity	nominal range 0 to 95% within specified temperature range	
Atmospheric pressure	nominal range 60 to 130 kPa (600 to 1300 mbar)	
Geotropism	none (no change of response as a result of gravitational effects)	
Power supply	9V battery (alkaline according to IEC 6LR61 recommended) or 9V accumulator (rechargeable battery)	
Battery life with 6LR61	approx. 3000 hours (approx. 60 hours with illumination)	
Battery check	voltage is indicated digitally after switching on, or later if requested with the arrow key	
Supply voltage	nominal range 5.5 to 10 Volt	
Battery monitoring	automatic visual and audible warning if battery voltage goes below 5.5 Volt	
Housing	aluminium die-cast, waterproof, protection class IP 67 according to DIN 40050	
Buzzer	piezo buzzer inside the housing	
Dimensions	130 x 80 x 29 mm³	
Weight	approx. 400 g	
Carrying strap (included)	plastic, easy to decontaminate, length 1 m	

Energy Response
Normalised to Indication at Cs-137 (662 keV)

- ○ 6150AD5
- ▲ 6150AD5/H, /E
- □ 6150AD6
- ■ 6150AD6/H, /E

SCANTEC Industries NV
Westkaai 7•B-2170 Merksem - Antwerpen•België
Tel. : +32 (0)3/646 99 44•Fax : +32 (0)3/644 04 05
e-mail : info@scantecnv.be

BGI