

20149 Milano - Via Correggio, 19
Tel e Fax +39 02 46.92.865
www.radtech.it - email : info@radtech.it

Measuring unit comprising contamination probe 6150 AD-k and dose rate meter 6150 AD, which can also be used separately
Sealed proportional counting tube, instantly ready to measure, no filling or flushing necessary
Switch for alpha and alpha/beta/gamma measurements Four parallel operating modes with various callable displays:
pulse rate - average pulse rate
maximum pulse rate - accumulated number of pulses Sellable alarm thresholds Automatic range switching, simple operation
Microprocessor-controlled compensation of counting tube tolerances:
extremely accurate measurements combined with full interchangeability of probes and instruments Extremely low current consumption

CONTAMINATION MONITOR 6150ADK

with large-area counting tube for alpha, beta and gamma radiation

APPLICATION AND DESIGN

The contamination monitor 6150 ADK is an instrument for tracing and measuring contamination on persons (clothing, hands, shoes), in the environment, at workstations and on equipment and objects. It comprises the contamination probe 6150 AD-k and a meter 6150 AD. The detector which is used is a sealed large-area, proportional counting tube, which does not need to be flushed with counting gas. The thin window of the counting tube enables the alpha, beta or gamma radiation to be verified. The highly sensitive detector permits the natural ambient radiation to be measured; changes in this radiation of 10 to 20 percent can be detected by measurements lasting only a few minutes.

The large-area counting tube, which has an aluminium-foil window, is located on the underside of the aluminium housing of the contamination probe 6150 AD-k. The thin counting-tube window is protected by a fine, stainless-steel mesh, which is highly transparent and easy to replace.

The sealed counting tube, which is filled with an inert-gas mixture, does not require either a gas supply or filling/flushing. This considerably simplifies handling, since the contamination meter 6150 ADK is ready to measure instantly. Unlike butane/propane-flushed counting tubes there is no fire or explosion hazard, and the precautionary measures and operating restrictions relating to these hazards can therefore be dispensed with.

The grip of the probe has an articulation which can be locked, to allow the orientation of the measuring surface to be matched to the position of the hand. If a detachable handle is used, measurements can be performed comfortably on the ground from a standing position.

The dose rate meter is normally fitted to the probe, secured with a knurled screw and connected to the cable end of the probe via the probe socket. If an intermediate cable is used (max. length 100 m), the dose rate meter and the probe can also be used separately. The intermediate cable is connected to the socket in the housing of the probe, and the connector at the end of the cable to the connector holder (see picture). This simplifies measurements at relatively inaccessible points; contamination measurements on the underside of a vehicle or on the wheel case, for example, are more difficult using compact, one-hand instruments.

The major advantages of the contamination meter are its simple handling, which is optimized for a wide range of measuring conditions, its compact design, its robust construction and its lightness. Error-free operation is ensured by the extensive automation of the range switching procedures as well as the unambiguous displays. The microprocessor-controlled compensation of the production-related counting tube tolerances ensures extremely accurate measurements in conjunction with full interchangeability of the instruments and probes.

OPERATION

When the instrument is switched on, an initial check is performed of all elements in the display unit, of the loudspeaker and of the battery voltage. The pulse rates are displayed simultaneously in analog and digital form on a liquid-crystal display unit (LCD), "ext 0" is always indicated in the top left-hand corner of the display of the 6150 AD to identify the probe.

Calibration factors (equivalents of 1 s^{-1} in Bq/cm^2) and efficiencies of the probe 6150 AD-k (typical values)

Predominant radiation type	Isotope	Energy MeV	Is^{-1} Bq/cm ²	Efficiency approx. %	Switch position	Probe distance from cont. surface
, a	Am 241	5,5	0,074	8,0	"a"	3,4 mm air
			0,056	10,6	"apy"	
P	C14	0,16	0,182	3,2		12 mm air
	Co 60	0,31	0,058	10,1		
	Cs137	0,51	0,026	23,0		
	1131	0,61	0,026	23,0		
	Cl 36	0,71	0,026	23,0		
	Sr90/ Y90	0,54/2,3	0,011 (Sr 90)	53,5 (23 Sr90) +30,5 Y90)		
y	Co 60	1,2/1,3	0,511	1,15		Discriminator plate + 9 mm air
	Cs137	0,66	2,69	0,22		

The relatively high sensitivity for Sr 90 is due to the fact that Sr 90 is in a state of radioactive equilibrium with its daughter product Y 90, and thus two (3-particles/second) are emitted per Bq Sr 90, namely one by the Sr 90 and one by the Y 90. Example: After subtracting the background, a pulse rate of 15.3 s^{-1} was measured in the "a" position. Assuming that only Am 241 is involved, the resulting values are as follows: averaged over the surface of the counting tube (170 cm^2), the surface contamination is $15.3 \times 0.074 = 1.13 \text{ Bq/cm}^2$. The total activity below the probe surface is $15.3/8 \% = 1530/8 = 191.25 \text{ Bq}$.

The pulse rates are displayed in s^{-1} (pulses per second). This display can be converted to Bq/cm^2 for some isotopes in accordance with the "Calibration factors" table, providing the isotopes are known. It is not possible to identify the isotopes with the probe 6150 AD-k, though the probe can differentiate between alpha, beta and gamma radiation. The probe is linear up to pulse rates of approximately $20000 s^{-1}$ ($20k s^{-1}$). If this value is exceeded, the display continues to rise, but there will be an increasing negative error due to counting losses.

Depending on the switch position, the probe is sensitive either to alpha radiation only or to alpha, beta and gamma radiation when the discriminator plate is removed. If the discriminator plate is fitted, alpha and beta rays are absorbed, but also gamma rays reach the counting tube. The following procedure should therefore be observed in order to trace and measure surface contamination: Set the switch to "a(3y)" and remove the discriminator plate, so that all types of radiation are detected. If an increase in the pulse rate is observed, the type of radiation can be determined as follows: Set the switch to "a" and read off the a-radiation component. Then return switch to "a(3y)", attach discriminator plate and read off the y-component. The (3-component is derived from the total display minus the a-component minus the y-component.

IMPORTANT: The background must always be subtracted for a quantitative evaluation. It should be noted that the background is different in the "a(3y)" position (approx. $5-7 s^{-1}$) and in the "a" position (approx. $0,05 s^{-1}$)!

The contamination monitor 6150ADK can be used in all operating modes of the dose rate meter 6150 AD. When the instrument is switched on, it determines the pulse rate and simultaneously stores the average pulse rate, the maximum pulse rate measured after it was switched on and the total accumulated pulses since it was switched on. These values are stored and continuously updated, and can be called in digital form on the display unit by pressing the button.

The "average value" mode permits low radiation values to be measured considerably more precisely than is possible with normal pulse rate measurements. The alarm thresholds can be set to different values or deactivated; alarms are both audible and visual. An audible indication of single pulses can be switched on or off separately.

The illumination button must be pressed to illuminate the liquid crystal display; the illumination remains on for approximately 10 s after the button has been released. When the battery approaches the end of its service life, a (resettable) audible

FUNCTIONS OF BUTTONS ON THE 6150 AD (all buttons must be pressed for approx. 0,3 s)

Button	Press x	Effect
	I x	Switch on. The display and loudspeaker are tested whilst it is pressed. When it is released, the battery voltage is displayed, and after 2 s the pulse rate. AD1/AD2: Instrument switched off. AD3/AD4/AD5/AD6:
	II x	a) In initial state (pulse rate display): instrument switched off.
	:2 x (within approx. 3 s)	b) If average pulse rate displayed: average value reset and recalculated. c) If maximum pulse rate displayed: maximum value reset and recalculated. d) In all other states: no function.
cU-	1x	Display illumination; illumination remains on for approx. 10 s when button released.
^>	1 X	Display average value of pulse rate since instrument was switched on or since average value was last reset. The digital display flashes if the statistical error is greater than 5 %. Four
	2x	
	3x	
	4x	
	5x	
	6x(5xonAD1/2)	
	7x(6xonAD1/2)	
	8x(7xonAD1/2) 1 x	
	(approx. 2 s)	
	1 x	a) Battery alarm: continuous tone reset. b) Pulse-rate display: alarm tone reset if alarm threshold exceeded, otherwise audible indication of pulses switched on/off. c) Alarm-threshold display: alarm threshold set. d) Pulse count alarm (AD3/AD4/AD5/AD6 only): alarm tone reset and display changed automatically to pulse rate (initial state).

MEANINGS OF DISPLAY SYMBOLS ON 6150 AD

- <|> Alarm threshold exceeded (pulse count or pulse rate): symbol flashes. Alarm-threshold display (pulse count or pulse rate): symbol lit continuously. Pulse-rate display: symbol lit continuously if audible indication of pulses on.
-) Flashes (and continuous alarm tone output) towards end of battery service life. Symbol remains continuously lit when alarm tone reset.

alarm and a visual alarm are output. The current battery voltage can be checked at any time by pressing the call button. The current consumption of the instrument is extremely low - approximately 500 service hours (without illumination) can be achieved using an alkaline-manganese battery. Zinc-carbon batteries or NiCd storage batteries may also be used.

DIFFERENCES BETWEEN BASIC UNIT TYPES 6150 AD1 / AD2 ADS /AD4 / ADS / AD6

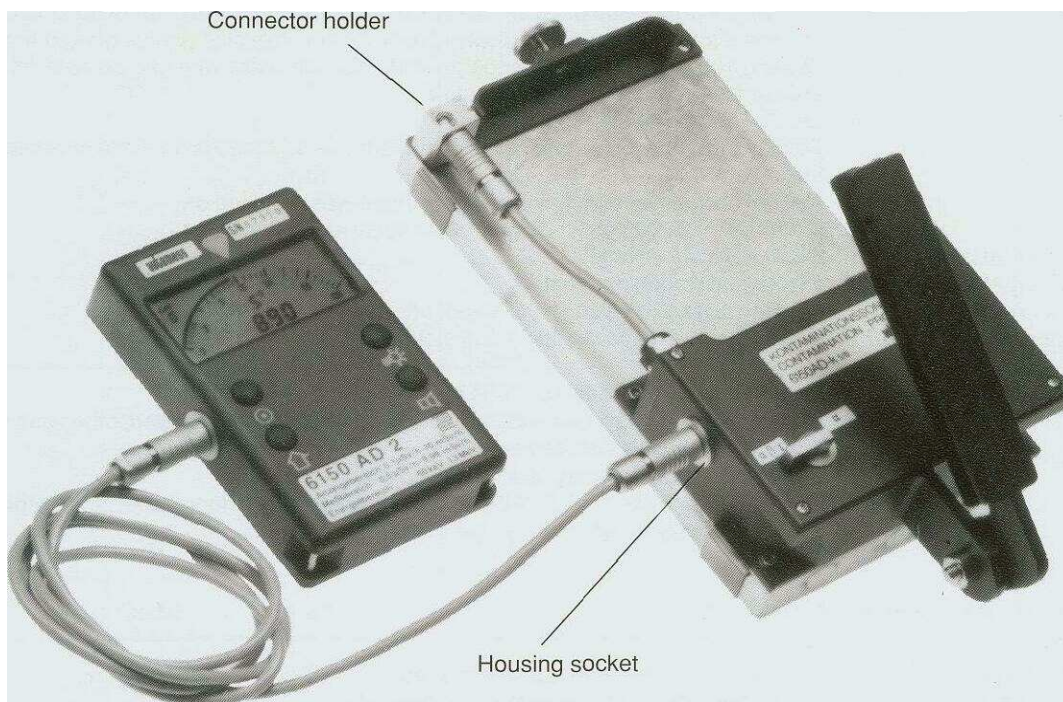
The results of the measurements are irrespective of the basic unit type which is used. The 6150 AD3/AD4/AD5/AD6 however offer additional options - pulse-rate and pulse-counting alarm thresholds can be programmed individually, and the average-value and maximum-value displays can be reset and restarted (see description of 6150 AD3/AD4/AD5/AD6). The differences in operation are shown in the "Functions of buttons" table.

TECHNICAL DATA

Radiation detector	large-area, proportional counting tube, sealed
Conting tube filling	Inert gas mixture
Counting tube window	
Dimensions	170 x 100 (mm), active area 100 cm ²
Thickness	2,75 mg/cm ² (aluminium)
Operating modes, switchable	1) Alpha measurement 2) Alpha/beta/gamma measurement
Discriminator plate, detachable	Stainless steel, 1 mm thick
Background with ambient radiation	Approx. 0.05 s ⁻¹ in „a" mode Approx. 6 s ⁻¹ in "a(3'y" mode

Sensitivity Pulse rate display	See "Calibration factors" table Analog: 0.1 s ⁻¹ to approx. 40k s ⁻¹ Digital: 0.01 s ⁻¹ to approx. 40k s ⁻¹
Alarm when measuring exceeded range	Flashing digital display at pulse rates > 20k s ⁻¹ 0.001 s ⁻¹ to 9999s ⁻¹ , min. 400 pulses o:< 5 %
Display range for average value	AD 1/2: 1 s ⁻¹ to 9999 s ⁻¹ AD 3/4/5/6: 0.01 s ⁻¹ to 9.99k s ⁻¹
Display range for maximum value	AD 1/2: 1 to 9999 AD 3/4/5/6: 1 to 999k
Display range for pulse counting	AD 1/2: sellable to 0/7/25/ 100/2000/3000 s ⁻¹ AD 3/4/5/6: settable to 0/7.5/25/ 100/2k/3ks ⁻¹ or to a freely programmable value
Pulse rate alarm threshold	AD 3/4/5/6 only: sellable to 0 or to a freely programmable value
Pulse count alarm threshold	-15 ⁰ Cto+50 ⁰ C Via 6150 AD, service life 500 h with alkaline-manganese battery
Temperature range	Aluminium, protection class IP 67 as per DIN 40050 210x120x90 (mm) Approx.
Power supply	
Housing	1.7 kg (overall) Length approx. 80 cm
Dimensions	
Weight	
Handle (optional)	

SUBJECT TO CHANGE WITHOUT NOTICE



CONTAMINATION MONITOR 6150 ADK
Operation with extension cable



AUTOMATION UND MESSTECHNIK GMBH • DAIMLERSTRASSE 27
TELEPHONE + 49-6203-9503-00, TELEFAX +49-6203-9503-29 e-mail:
info@automess.de • www.automess.de

D-68526 LADENBURG

