Aer 5400

Trolley or wall mounted Alpha/Beta Continuous Air Monitor

Applications:

- for monitoring airborne radioactive substance (**LLRD**) activity concentrations and measuring radon / thoron equivalent equilibrium concentration (**EECRn** & **EECTh**) and/or potential alpha energy concentration (**PAEC**) at workplaces
- in nuclear facilities
- in the NORM industry
- in mining operations
- in nuclear medicine (Th-227, Ra-223 and Rn-219)
- For taking samples from ducts and chimneys of nuclear facilities

Features:

- continuous monitoring of breathing air for airborne long-lived radioactive aerosols (LLRD) and short-lived radon decay products
- assessment and minimization of inhalation hazards for workers
- alert workers to high levels of airborne activity
- spectroscopic separation of the nuclides and complete compensation of the natural radon background for the LLRD measurement
- menu navigation via touch screen
- all parameters relevant for reliable operation are continuously monitored and are part of the stored measurement data
- flexible alarm system
- filter tape for 330 steps or nearly 1 year at one filter change/day

Detector type	400 or 1200mm² ion-implanted silicon detector option „G“: double detector for dynamic gamma background compensation (2 x 1200 mm2 each detector)
Energy range	80-150keV…3MeV (beta) (depends on detector size) 3…10MeV (alpha);
Counting efficiency	approx.. 20% (4π)
Sampling	open face and closed sampling with automatic filter sealing for minimum collection losses
Filter /Stepper	membrane-filter tape (PTFE), 5µm pore size; length 30m, width: 65 mm, sufficient for >330 Filter changes deposition rate >99.9% filter pressure mechanism for maximum tightness of the collecting device active filter test with respect to perforation and exhaustion fast, tool-less replacement of filter coils more than 12 month autonomous operation in “normal” environment configurable trigger for filter stepping (e.g. each sample interval, fixed period, filter exhaustion, activity detected) required period for filter replacement <2s
Pump	built-in („Rn“- version) or extern oil-less, long-life, low noise quality rotary van pump (Becker) (extern) OR membrane type pump (intern) nominal air flow 35 SLPM (adjustable range 8 to 50 SLPM depending on pump type and instrument version) processor controlled air flow for constant deposition conditions (mass flow sensor) pressure drop across the filter 15…100mbar (at 35 SLPM) noise emission approx. 60dBA (in 1m distance) other vacuum supplies may be connected instead of the pump
Weight of ext.pumps	VT4.4 – 7 kg (4,1 m³/h) VT4.8 – 11,5 kg (8,0 m³/h)

Results	exposure for alpha and beta emitters (LLRD) in Bqh/m³
	dose for Alpha and Beta emitters in µSv or DAC-hrs (dose coefficients adjustable by user)
	detection of Natural Uranium with automatic selection of the U_{nat} dose coefficient
	average activity concentration for Alpha and Beta emitters in Bq/m³
	(E)quilibrium (E)quivalent (C)oncentration (EEC) for radon and thoron daughter products in Bq/m³
	(P)otential (A)lpha (E)nergy (C)oncentration (PAEC) for radon and thoron daughter products in nJ/m³
	separate channel for alpha gross counting in cps or Bq
	option: dose rate in µSv/h
	option: gamma spectrum (for NaI detector)
	option: gas concentration in ppm
	temperature, humidity, pressure, battery voltage
	flow rate, filter exhaustion, filter stepping, end of filter tape
	signals Alert, Warning, Good
Standards	IEC 60761-1 IEC 60761-2 IEC 61578 IEC 61577-3 IEC 1263 CE,VDE DIN ISO 16639 (VDE 0493-1-6639)
Compensation	compensation of natural Radon background by Alpha spectroscopy with dynamic fitting of peak shape with respect to progressive filter exhaustion
	upper alpha energy threshold for LLRD = 5,6MeV
	static compensation of gamma background
	option: dynamic compensation of gamma background by double detector
	dynamic shock rejection (mechanical shock) by pulse signal shape analysis

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LLRD Sensitivity	approx. 25 cpm/(Bqh/m³)
Messbereich	0 … 10.000 Bqh/m³ (0 … 50 000 DACh(Pu)) 0,6 MBq/m³ over 1 minute
Measurement	up to 16 user definable sampling cycles (1s to 1year) predefined sampling cycles 1, 5, 15, 60 minutes predefined test cycles
Detection limits	see tables below
Alert indication	configurable alert thresholds for all measured results alert tower with green, yellow and red light, 360° visible 90dB signal buzzer alert indication at display alert reset is configurable (either with confirmation by the user or automatic reset if the alert condition is no longer present) pre-defined alerts for LLRD activity, low/high count rate, filter perforation, end of filter tape
Data storage	2 GB SD-card (> 800 000 data records) storage of all measured raw data incl. spectra
Operation / Display	touch screen 6cm x 9cm (4.5”); Graphic 240 x128 high contrast even in direct sunlight backlight key switch intuitive, straight forward menu structure
Interfaces	USB, RS232, RS422/RS485 option: Net Monitors wireless (ZigBee) option: TCP/IP (Ethernet/WLAN) 6 additional configurable analogous sensor inputs 1 additional counter input (for models without GM-tube option only) 3 alert outputs related to the signal lights 1 additional switch contact for external components
Power supply	230 VAC/50 Hz (option 110 VAC/60 Hz) approx. 500 VA internal NiMH-buffer battery 12 V / 3,8 Ah for more than 12 h operation in case of mains power interruption (without pump)
ATEX category	no
Housing	stainless steel IP65 ease for decontamination
Versions	wall mounted or trolley

Dimensions	540mm x 360mm x 200 mm <18 kg (wall mounted cabinet) 1350mm x 510mm x 360mm <35 kg (with trolley and pump)
Environmental conditions	
Temperature	0 … 50 °C
Rel. humidity	5 … 95 % rF. non-condensing
Bar. pressure	800 … 1100 mbar
Software dVISION	remote control data transfer, visualization data management, export to text files system configuration creating / editing of measurement cycles network management
Additional options (on request)	separate filter unit (connection by hose and cable) GM counter for dose rate measurement GPS receiver electrical valve for flow regulation (wall-mounted version, for working with a vacuum supply provided by the customer)
Calibration /Test	factory calibration in a radon daughter product atmosphere with aerosol generator test sources Am-241 (Alpha) and Cs-137 (Beta); recommended are area sources with 25mm or 36mm diameter and 185Bq nominal activity such as Eckert & Ziegler AMRB22757/CDRB22758 (d 30 mm x 0.8 mm) flow rate check on top of the filter using adapter dome and low differential pressure air flow meter ($\Delta p < 15$mbar @35l/min)

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Detection Limits

The detection limits stated in the tables below are valid for following operational conditions:

- flow rate = 35l/min
- $k_{1-\alpha}$ =3 (99.8%)
- $k_{1-\beta}$ = 1.65 (95%)
- 1DAC(Pu) = 0.2Bq/m³ (10CRF835)
- 1DAC(Sr90) = 200Bq/m³ (10CRF835)

Additionally for beta measurement:

- F = 0.6
- gamma background = 0.1µSv/h

The assumption for the detection limit of the concentration is a momentarily step-like increase of air activity concentration up to the detection limit at the beginning of a sampling interval. Furthermore, it is presumed that there was no LLRD activity deposited on the filter.

Alpha LLRD									
Po-218 *)	Detection limit T = 1min			Detection limit T = 5min			Detection limit T = 15min		
Bq/m³	Bqh/m³	DACh	Bq/m³	Bqh/m³	DACh	Bq/m³	Bqh/m³	DACh	Bq/m³
10	0.92	4.6	55	0.38	1.9	4,6	0.22	1.1	0.9
20	1.25	6.2	75	0.54	2.7	6,5	0.33	1.6	1.3
50	1.92	9.6	115	0.88	4.4	10,6	0.58	2.9	2.3
100	2.70	13.5	168	1.33	6.7	16,0	0.95	4.7	3.8

Beta LLRD									
Po-218 *)	Detection limit T = 1min			Detection limit T = 5min			Detection limit T = 15min		
Bq/m³	Bqh/m³	DACh	Bq/m³	Bqh/m³	DACh	Bq/m³	Bqh/m³	DACh	Bq/m³
10	2.75	0.014	165	1.21	0.006	14.5	0.69	0.004	2.8
20	3.74	0.019	224	1.65	0.008	19.8	0.95	0.005	3.8
50	5.76	0.029	345	2.55	0.013	30.7	1.47	0.007	5.9
100	8.06	0.040	483	3.58	0.018	43.0	2.06	0.010	8.3

*) The activity concentration of Po-218 is always less than the one of Rn-222

Possible modifications of Air Monitor Aer 5X00-XXXX

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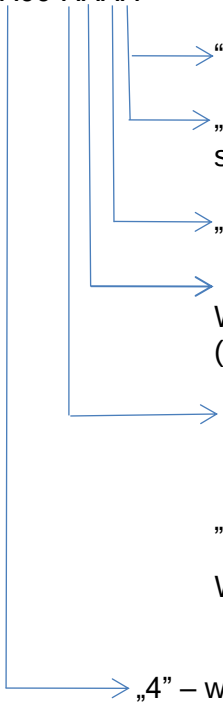

- "FU" – with a frequency converter for a pump control
- „XFG" – with dual spectrometer–
  special modification for thorium (Th227) therapy
- „S" – with special adapter for stack monitoring
- „F" – fixed filter holder for single filter, diam. 47mm
  Without „F"– automatic filter changing facility with membrane filter tape (PTFE)
- „G" – double Si-detector 1200 mm² for dynamic gamma background compensation
  OR
  „Rn" – measurement of EEC/PAEC Rn & EEC/PAEC Th only, no LLRD

  Without „G" – single Si-detector 1200 mm² with static gamma background compensation
- „4" – wall-mounted HV-aerosol monitor with fixed measuring head
- „5" – wall-mounted HV-aerosol monitor with movable measuring head

*) options XFG and G cannot be combined