poCAMon

Personal Alpha/Beta Continuous Air Monitor (CAM)

Applications:

- for monitoring activity concentrations of **airborne radioactive aerosols (LLRD)** and measurement the radon / thoron equivalent equilibrium concentration (**EECRn** & **EECTh**) and/or the potential alpha energy concentration (**PAEC**) at workplaces
- in nuclear facilities
- in the NORM industry
- in mining companies
- in nuclear medicine

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
- warning of workers in case of high levels of airborne activity
- spectroscopic separation of the nuclides and the complete compensation of the natural radon background for the LLRD measurement
- battery life of more than 30 hours

Detector	400mm² ion-implanted silicon detector, open face sampling for minimum collection losses
Energy range	0.15 ... 3MeV (Beta); 3 … 10MeV (Alpha)
Counting efficiency	approx. 20% (4π)
Filter	membrane filter (PTFE); 3µm pore size; 25mm dia. with neoprene sealing deposition rate >99,9% active filter test with respect to perforation and exhaustion tool-less replacement of the filter more than 1 month operation in “normal” environment
Pump	low noise quality rotary van pump nominal air flow 3l/min (adjustable range 1.5 to 3l/min) processor controlled air flow for constant deposition conditions pressure drop across the filter 5…20mbar (at 3l/min) noise emission approx. 48/51dBA (in 1m/30cm distance)
Results	Equilibrium Equivalent Concentration (EEC) for radon and thoron daughter products in Bq/m³ 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 separate channel for Alpha gross counting in cps or Bq or Markov Algorithm for Radon daughter product grab sampling potential alpha energy concentration (PAEC) in J/m³ flow rate, filter exhaustion, battery voltage

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Standards	IEC 60761-1 IEC 60761-2 IEC 61578 IEC 61577-3 IEC 1263 CE
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 dynamic shock rejection (mechanical shock) by pulse signal shape analysis
LLRD Sensitivity	approx. 2 cpm/(Bqh/m³)
Measurement range	0…125 000Bqh/m³ (0…625 000 DACh(Pu)) 7.5MBq/m³ over 1 minute or 16kBq/m³ over 8 hours
Measurement	up to 16 user definable sampling cycles (1s to 1year) predefined sampling cycles 1 and 30 minutes as well as 12 hours filter analysis (without pump
Detection limits	see tables below
Alert indication	configurable alert thresholds for all measured results bright alert LED with yellow and red light 85dB 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
Data storage	2 GB SD-card (> 1 200 000 data records) storage of all measured raw data incl. spectra
Display	large alphanumerical display 4 x 20 characters high contrast even in direct sunlight backlight

Operation	three buttons, operation with gloves possible Intuitive, straight forward menu structure
Interface	USB, Net Monitors wireless (ZigBee optional)
Power supply	12V/3.8Ah Standard NiMH battery pack power adapter 18V/3A
ATEX category	no
Housing	ergonomic and smart design easy to decontaminate
Dimensions	106mm x 56mm x 200mm
Weight	1.3kg
Environmental conditions	0 … 50 °C 5 … 95 % rF. non-condensing 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	GPS receiver
Calibration/Test	factory calibration in a radon daughter product atmosphere with aerosol generator test sources Am-241 (Alpha), Cs-137 (Beta), Co-60 (Beta); recommended are area sources with 25mm diameter and 185Bq nominal activity such as Eckert & Ziegler AMRB25499, CDRB25498, CKRB25500 or similar flow rate check on top of the filter using adapter dome and low differential pressure air flow meter ($\Delta p < 10$mbar @3l/min)

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Scope of delivery	USB cable
	charger/power supply adapter
	user manual both instrument and SW (on CD as .pdf-file)
	calibration certificate
	aerosols filter (1+10 pcs.)
	transport suitcase
	harness for comfortable wearing (optional)

Detection Limits

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

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

Additionally for Beta measurement:

- F = 0.6
- gamma background = 0.1 µSv/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 = 10min			Detection limit T = 30min		
Bq/m³	Bqh/m³	DACh	Bq/m³	Bqh/m³	DACh	Bq/m³	Bqh/m³	DACh	Bq/m³
10	8.14	40.7	488	0.95	4.73	5.7	0.51	2.6	1.0
20	8.14	40.7	488	1.28	6.38	7.7	0.71	3.5	1.42
50	8.14	40.7	488	1.95	9.74	11.7	1.13	5.6	2.3
100	9.46	47.3	567	2.74	13.7	16.5	1.66	8.3	3.3

Beta LLRD									
Po-218 *)	Detection limit T = 1min			Detection limit T = 10min			Detection limit T = 30min		
Bq/m³	Bqh/m³	DACh	Bq/m³	Bqh/m³	DACh	Bq/m³	Bqh/m³	DACh	Bq/m³
10	10.5	0.053	632	3.12	0.016	18.7	1.77	0.009	3.6
20	13.2	0.066	794	3.98	0.020	23.9	2.28	0.011	4.6
50	19.1	0.096	1150	5.84	0.029	35.0	3.35	0.017	6.7
100	26.0	0.130	1560	8.02	0.040	48.1	4.61	0.023	9.2

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

The detection limits for a 12 hours measurement using filter analysis mode (without pump) after complete decay of Radon daughters are 0.01 Bqh/m³ (0.06 DACh; 0.001 Bq/m³) for Alpha and 0.2 Bqh/m³ (0.001 DACh; 0.017 Bq/m³) for Beta emitters.

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