

poCAMon

Personal Alpha/Beta Continuous Air Monitor (CAM)

The poCAMon (personal online continuous air monitor) monitors continuously the breathing air to detect airborne radioactive aerosols (LLRD). Typical application fields are nuclear facilities, the NORM industry, mines and nuclear medicine.

The poCAMon combines a very compact design with a high flow rate and long battery life. Its size and weight are acceptable for wearing by a person. The unit measures long-lived aerosols (alpha and beta) as well as short-lived Radon daughters by alpha spectroscopy and beta gross counting. The instrument detects if only natural Uranium aerosols are present in the atmosphere. Especially for mining companies, we offer a version with integrated sensors for carbon monoxide and combustible gases. The instrument will be automatically disconnected from power if 20% of the lower explosion limit is detected.

The radioactive aerosols and particles are collected on the surface of a high resolution membrane filter. The alpha and beta decays on the filter are measured by a semiconductor radiation detector. This allows a perfect separation of the different decay products and the complete Radon background compensation for the LLRD results.

The high pump rate of 3Lpm is suitable for low detection limits. The low noise rotary van pump is processor controlled and guarantees a constant flow rate over the whole measuring time. The user will be warned if the filter has to be replaced.

With the 3.8 Ah NiMH battery pack, the poCAMon achieves an operation time of more than 30 hours (>20 hours for version with gas sensors). The battery voltage is monitored and generates an alert if it is lower than an adjustable threshold. The powerful charger recharges the unit within two hours.

A bright alpha numeric display and the simplified keypad (three buttons) allow the operation even under harsh conditions.

The quality control is a main issue of any radiation measurement. Therefore the poCAMon records a complete alpha spectrum for each measured value. This allows the monitoring of the device's perfect operation in each moment of the measurement.

All measured data are stored in a 2GB memory card and can be accessed with a PC or laptop via a USB interface. Data transmission and device control can also be done via a ZigBee adapter (Net Monitors) or via a server for stationary operation with network access. The GPS receiver is an optional feature of the instrument.



poCAMon – Technical Data

- Detector**
- 400mm² ion-implanted silicon detector
 - Energy range 0.15..3MeV (Beta); 3...10MeV (Alpha)
 - Counting efficiency (4π) approx. 20%
 - Open face sampling for minimum collection losses
- Filter**
- Membrane filter (PTFE); 3 μ m 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 μ Sv 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
 - Flow rate, filter exhaustion, battery voltage
- 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. 2cpm/(Bqh/m³)
- Measurement range**
- 0...125000Bqh/m³ (0...625000 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**
- 2GB SD card (> 1,200,000 data records)
 - Storage of all measured raw data incl. spectra
- Handling**
- Large alphanumerical display 4 x 20 characters
 - High contrast even in direct sunlight
 - Backlight
 - Three buttons, operation with gloves possible
 - Intuitive, straight forward menu structure
- Interface**
- USB, Net Monitors wireless (ZigBee)
- Power supply**
- Standard NiMH battery pack 12V/3.8Ah
 - Power adapter 18V/3A
- Housing**
- Ergonomic and smart design
 - Ease of decontamination
 - 106mm x 56mm x 200mm
 - 1.3kg

Closer to your application

- Ambient conditions**
- 0...50°C
 - 5...95%rH, noncondensing
- Software dVISION**
- Remote control
 - Data transfer, visualization
 - Data management, export to text files
 - System configuration
 - Creating/Editing of measurement cycles
 - Network management
- Additional options**
- CO and Methane sensors for usage in underground mines
 - GPS receiver
- 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 diameter and 185Bq nominal activity such as Eckert & Ziegler AMR02011/CDR02011 or similar
 - Flow rate check on top of the filter using adapter dome and low differential pressure air flow meter ($\Delta p < 10\text{mbar}$ @3l/min)
- Accessories**
- USB cable
 - Charger/power adapter
 - Harness for comfortable wearing

Detection Limits

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

- Flow rate = 3l/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 = 10min			Detection limit T = 30min		
Bq/m ³	Bqh/m ³	DACH	Bq/m ³	Bqh/m ³	DACH	Bq/m ³	Bqh/m ³	DACH	Bq/m ³
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/m ³	Bqh/m ³	DACH	Bq/m ³	Bqh/m ³	DACH	Bq/m ³	Bqh/m ³	DACH	Bq/m ³
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 0.01Bqh/m³ (0.06DACH; 0,001Bq/m³) for Alpha and 0.2Bqh/m³ (0.001DACH; 0.017Bq/m³) for Beta emitters.