Aer 5200/5300

Portable Alpha/Beta Continuous Online Air Monitor (CAM)

The Aer5200 monitors continuously the ambient air to detect airborne radioactive aerosols (LLRD). Typical application fields are nuclear facilities, the NORM industry, mines and nuclear medicine (e.g. DIN ISO 16639 / VDE 0493-1-6639).

The aerosols will be deposited on the surface of a filter by the internal pump and will be analysed by spectroscopy. The natural background due to Radon and Gamma irradiation will be fully compensated.

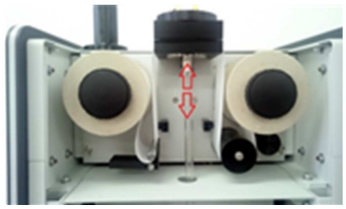
The Aer5200 is instantly ready for operation after powering. The intuitive touch screen operation and the straight forward menu structure allow the operation even by unskilled staff. The ergonomic design, big wheels and low weight makes it easy to relocate the instrument if required. The stylish unit with plain surfaces can be easily de-contaminated.

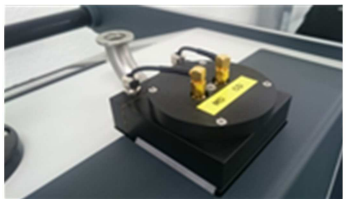
The pump works very quiet. The open face air inflow, in combination with a regulated flow rate ensures a uniform and low-loss deposition of the aerosols on the filter surface. The large active filter diameter and the long filter tape used in the filter stepping unit results in outstanding operation periods without intervention. The unique mechanism for dynamic filter sealing avoids leakages as present in conventional movable-filter solutions. Optionally, the unit may be equipped with a vacuum adapter (KF/DN16) to connect sampling pipes or flexible tubes. Particle losses at the inlet become negligible by the special construction. Contaminated filter pieces can be cut out easily for further analysis due to the quick stepping drive access.

All parameters, necessary for proper operation are monitored continuously and are part of the stored measurement data. A flexible alert system warns the user in case of the exceedance of a threshold or any deviation from the regular operation mode.

The Aer5300 offers a detector/filter unit separated from the body of the instrument. This allows the user to place the sampling head independently under conditions with limited space.

There are many options for additional detectors/sensors (e.g. NaI probe with nuclide identification) and system integration.





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Aer 5200 – Technical Data

Detector

- 1200mm² ion-implanted silicon detector
- Option “G”: double detector for dynamic Gamma background compensation
- Energy range 80keV...3MeV (Beta); 3…10MeV (Alpha)
- Counting efficiency (4π) approx. 20%
- Open face sampling for minimum collection losses

Sampling

- Standard version with open face sampling (free inflow of ambient air)
- Option “S”: Air inlet by a vertical standard vacuum pipe connector (KF/DN16) and filter stepping unit for stack monitoring
- Option “F”: manually changeable filter (d = 47mm) instead of the filter stepping unit

Filter/Stepper

- Membrane filter tape (PTFE); 5µm pore size; length 30m; width 65mm; good for more than 300 filter steps
- Deposition rate >99,9%
- Active filter test with respect to perforation and exhaustion
- 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

- Oil-less, long-life, low noise quality rotary van pump (Becker)
- Nominal air flow 35 SLPM (adjustable range 30 to 50 SLPM)
- Processor controlled air flow for constant deposition conditions (mass flow sensor)
- Pressure drop across the filter 15…100mbar (at 35 SLPM)
- Noise emission approx. 51dBA (in 1m distance)

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
- Equilibrium Equivalent Concentration (EEC) for Radon and Thoron daughter products in Bq/m³
- Separate channel for Alpha gross counting in cps or Bq
- Option: dose rate in µSv/h
- 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

LLRD Sensitivity

- approx. 25cpm/(Bqh/m³)

Measurement range

- 10000Bqh/m³ (50000DACh(Pu))
- 0.6MBq/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

- 2GB SD card (> 1,200,000 data records)
- Storage of all measured raw data incl. spectra

Handling

- Touch screen 6cm x 9cm (4.5”); Graphic 240 x128
- High contrast even in direct sunlight
- Backlight
- Key switch
- Intuitive, straight forward menu structure

Interface

- USB, RS232 (RS422/RS485 optionally)
- 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)
- Option: relay contacts instead alert light tower

Power supply

- 230VAC/50Hz
- Approx. 500VA
- Internal NiMH buffer battery 12V/3.8Ah for more than 12 hours operation in case of mains power interruption (without pump)
- Self-coiling power cord

Housing

- Ergonomic and smart design
- Ease of decontamination
- 1110mm x 520mm x 490mm
- 54kg
- 8” tyres for good portability

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

- Separate filter unit (connection by hose and cable)
- Wall mounted housing
- Sodium Iodide gamma probe (2” x 2”) with spectroscopy and nuclide identification
- GM tube for dose rate measurement
- 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 or 36mm diameter and 185Bq nominal activity such as Eckert & Ziegler AMR02011/CDR02011 or AMR03011/CDR03011 or similar
- Flow rate check on top of the filter using adapter dome and low differential pressure air flow meter ($\Delta p < 15$mbar @35l/min)

Aer 5300

The Aer5300 offers a separated (instead of the fixed one) detector/filter unit. The unit is connected by a flexible tube and a cable to the body of the instrument. Thus, the sample can be taken at the preferred place (where contamination is most likely) even in case of limited space.

Dimensions

- Foot print (width x length): 308mm x 180mm
- Height: 175mm plus height of detector head

Connections

- Flexible tube with quick lock connector (max. 6m)
- Cable (connectors at both sides; max. 6m)

Positioning

- The detector/filter unit must be operated only in right up position (detector up)
- The unit is fixed on top of the instrument body during transportation

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.

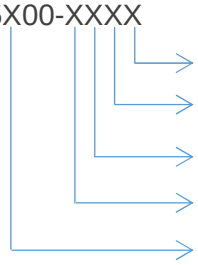
Alpha LLRD									
Po-218 *)	Detection limit T = 1min			Detection limit T = 5min			Detection limit T = 15min		
Bq/m³	Bqh/m³	DACh	Bq/m³	Bqh/m³	DACh	Bq/m³	Bqh/m³	DACh	Bq/m³
10	0.92	4.6	55	0.38	1.9	4,6	0.22	1.1	0.9
20	1.25	6.2	75	0.54	2.7	6,5	0.33	1.6	1.3
50	1.92	9.6	115	0.88	4.4	10,6	0.58	2.9	2.3
100	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 Aer5X00-XXXX

Aer 5X00-XXXX



„D" – with dual spectrometer – special modification for Thorium (Th227) therapy *)

„S" – with vacuum adapter for stack monitoring

„F" – fixed filter holder for single filter, diam. 47mm

„G" – double detector for dynamic gamma background compensation

„2" – trolley-mounted standard version

„3" – trolley-mounted version with removable filter/detector unit

„4" – wall-mounted version with fixed installed filter /detector unit

„5" – wall-mounted version with removable filter/detector unit

*) options D and G cannot be combined