

AEROSOL MONITORING

On-line Monitoring of Alpha, Beta and Gamma Radiation,
Atomic Iodine and Molecular Iodine

OUR PRECISION FOR YOUR SAFETY.
We measure radioactivity & radon
and calibrate your measurement system.

On-Line Aerosol Monitoring System AMS02

Profile: Measuring of radioactive aerosols, especially artificial nuclides in ambient breathing air

The aerosol measuring system applies two consecutive static filters, the first one for aerosol particles and a second planar filter for molecular iodine. The presence of non-natural radioactivity on either of the filters is detected by means of **alpha-, beta- and/or gamma-**counting. If a warning or alarm signal is generated, a third consecutive sampling and measuring unit is connected (optional), as the air leaving the **molecular iodine** filter enters an appropriate canister (Marinelli geometry and 4-Pi lead-shielded) filled with a specific absorber to separate **organic iodine** species which would escape the first two sampling devices. Activity of this unit, configured in Marinelli geometry, is measured by gamma counting. The static filter equipment is served by a manipulator from a stock of 500 filters.



MAIN TECHNICAL PARAMETERS

Size: 1095 x 695 x 1670/(2200) mm (L/W/H/(open))

Weight: approx. 600 kg

Power: 230 V AC / 50 Hz / 1000 VA

Environment: Temperature -15 °C to +25 °C

Relative humidity: 0 - 70 %

Accumulated air: Temperature -30 °C to +40 °C

Relative humidity: 0 - 99 %

Detectors:

Version B:

Iodine: 2" x 2" **Na(Tl)*** (2 pieces) resolution <7 % (¹³⁷Cs 662 keV)

Aerosol: **PIPS** 1700 mm² resolution 55 keV (α ²⁴¹Am) < 30 keV (β)

Aerosol: Coaxial germanium detector (**HPGe**) with electric cooling

No liquid nitrogen required - resolution 2.0 keV FWHM at

1.33 MeV relative efficiency 33% at 1.33 MeV

Version A:

Na(Tl)* scintillation detector replaces the HPGe detector - Resolution: minimum 7 % for 662 keV ¹³⁷Cs photopeak

Version C:

LaBr₃* or **CeBr₃*** scintillation detector replaces the HPGe detector. - Resolution: minimum 2.5 % (LaBr₃) or 4.1% (CeBr₃) for 662 keV ¹³⁷Cs photopeak.

*Scintillator: Crystal and photomultiplier tube of 2" (5.06 cm) diameter. 0.06 - 3 MeV energy range

Gain is automatic stabilised by the embedded ⁴⁰K peak energy. For LaBr₃ gain is automatic stabilised at own peak at 1468 keV energy.

Iodine filter facing a Na(Tl) gamma scintillation detector (Filter: Specific impregnated iodine filter of >95% adsorption capacity for **atomic or molecular** iodine, comprising a thin reinforced layer of specially impregnated active carbon).

| Limit of detection (LD) [Bq/m ³] | | | |
|--|---------------------------|--------|----------|
| Isotop filter/Detector | duration of air filtering | | |
| | 5 min | 1 hour | 24 hours |
| Normal Mode | | | |
| ¹³¹ I aerosol/NaI(Tl) | 5.4 | 0.8 | 0.066 |
| ¹³¹ I iodine/NaI(Tl) | 6.4 | 0.53 | 0.044 |
| ¹³⁷ Cs aerosol/NaI(Tl) | 4.1 | 0.67 | 0.056 |
| α-Activity (²³⁹ Pu) aerosol/PIPS | 1.5 | 0.5 | 0.042 |
| β-Activity (⁹⁰ Sr) aerosol/PIPS | 2.5 | 0.7 | 0.052 |
| ¹³⁷ Cs aerosol/HPGe | 6.7 | 0.77 | 0.006 |
| Off-Normal-Mode (organic iodine filter) | | | |
| ¹³¹ I iodine/NaI(Tl) | 8.7 | 0.72 | 0.058 |

Measuring position for **organic** iodine substances, Marinelli geometry, charcoal filter (Filter: cylindrical canister for organic-bond radioiodine)



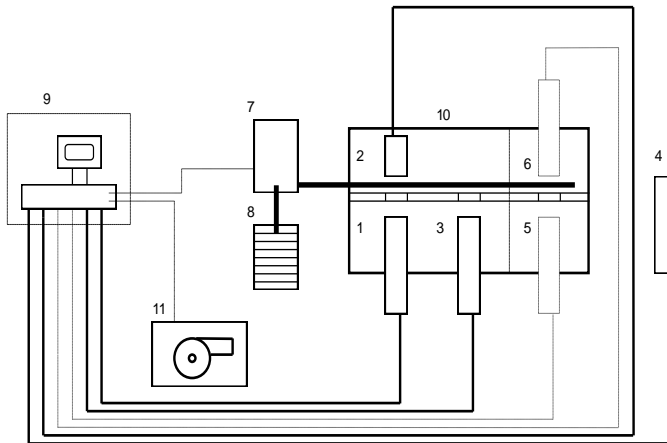
The equipment consists of the following units (fig.):

A. Unit for continuous sampling:

1. Aerosol filter + NaI(Tl), CeBr₃, LaBr₃ or HPGe detector
2. Aerosol filter + PIPS-detector
3. Iodine filter (molecular) + NaI(Tl)-detector
4. Iodine filter (organic) + NaI(Tl)-detector

B. Further units:

5. Optional, Special measuring equipment
6. Optional, Special measuring equipment
7. Filter manipulator
8. Racks for filters (filter stock)
9. Computer and control unit
10. Lead shielding
11. Maintenance-free air flow pump



Container for AMS02 with attachments



The insulated container has a window in which the air conditioning is built in and is equipped with a door with a standard lock and a door handle. Normally the door is installed at the front of the container, opposite the window/aircon. The roof is accessible and has loops for cranes. It has inside gutters and according to static calculations, it is suitable for 100 kg/sqm snow. Furthermore, a mast for a weather station can be mounted on one side of the container. On the frame of the roof a CEE-plug with 32A is installed, used for the power supply (3 x 400 V AC/50 Hz). Inside of the container is an insulating-protection and automatic cut-out, as well as a light with an on/off switch and some sockets (220 V). The floor is strengthened and enables a loading capacity of 800 kg/sqm. The container stands on a groundwork of concrete and is fixed with a corresponding anchoring (corresponding local regulations) in the groundwork. The container must be 100% level.



Technical data:

Outside dimensions / Weight:
Air conditioning / Radiators:
Options:

approx. 2.995 x 2.435 x 2.800 mm (L/W/H) / approx. 2.000 kg
nominal capacity in operation 1.2 kVA / 2 kVA
Weather Station, Environmental Gamma Probe, UPS

**On-Line Aerosol Monitoring
System AMS02-T**



The most important task of an air monitoring system is to give an alarm signal in the shortest time possible when the radioactivity in the monitored area exceeds the natural level. This unique industrial grade on-line monitor AMS02T was especially developed for this important and high demanding task with laboratory grade analytical performance.

The AMS02-T is a step-band filter device with simple maintenance-free mechanics and a **high resolution/low limits of detection** (24 hours cycle $<0.05 \text{ Bq/m}^3$ @ 137Cs) for the measurement of α , β , and γ -aerosol and elemental iodine (optional) - in just one unit.

The AMS02-T can be used either as a one-detector system (α , β or γ) or as a two-detector system (α , β and γ). In a two-detector system, a scintillation detector (**NaI, CeBr³ or LaBr³**) for aerosol gamma and **elementary iodine** measurement (optional) is used.

The unit can use two filter belts: 60mm wide glass fibre band and 60mm wide charcoal impregnated filter band (option).

$>4 \text{ m}^3/\text{h}$ special vacuum pump for **constant volume transport** (opt. $8 \text{ m}^3/\text{h}$)

The system offers online communication, electronic measurement data recording, network capability and can be **fully remote controlled**.

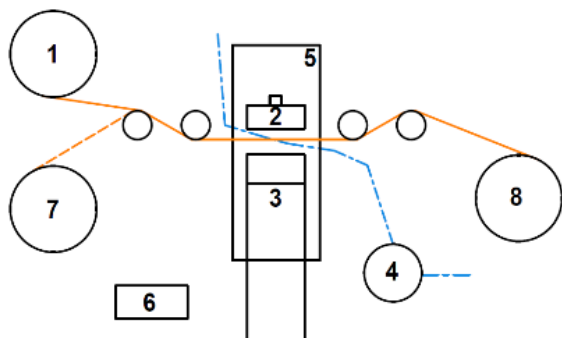
An external gamma probe for measuring the ambient dose rate and a **meteorology station** can be offered as an option.

The **4 π lead shielded** measuring chamber ensures very low limits of detection and maximum background suppression.

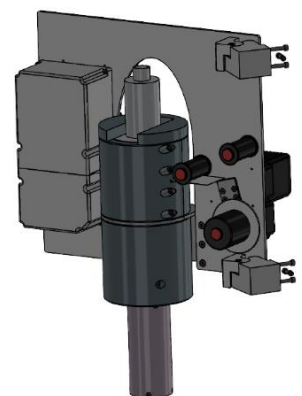
Precisely matched air filtering geometry and related devices for **air pumping and flow control**.

The **evaluation algorithms** have been refined over decades, continuously further developed, and maximized through an innovative unique isotope identification for Online Spectra analyses and readout. The combination of α , β , and γ detectors with our unique algorithms delivers the **best background compensation** on the market, even with variations in natural radiation backgrounds.

Main parts



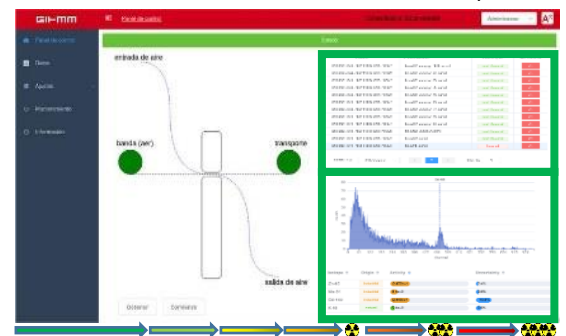
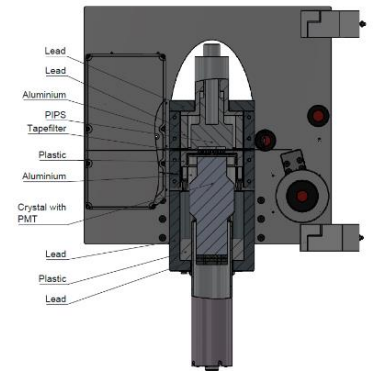
1. Aerosol filter-tape
2. PIPS-detector
3. NaI(Tl), CeBr₃ or LaBr₃ detector
4. Vacuum pump
5. Lead shielding
6. Control unit
7. Carbon tape
8. Filter Tape Rewinder





Main functions:

- Fully remote controllable
- Network and data communication
- Parameters set-up
- Continuously automatic energy calibration
- Efficiency calibration and test procedures
- Analytical Spectrometry analysis
- Gamma Background compensation
- Threshold settings – freely programmable
- air pumping and flow rate control/measurement
- 4,5 m³/h nominal flowrate @20°, 700 mbar, 50 Hz - constant volume transport
- Live spectrum acquisition
- Full gamma spectra (4k)
- Full α / β spectra (1k)
- Filter storage for continuous operation >6 months (@ normal 24-hour cycle)
- default 24 hours automatic filter change, user configurable



- artificial activity concentration (Bq/m³) / statistical uncertainty
- alert threshold (Bq/m³), alarm threshold (Bq/m³), visual alert and/or alarm for thresholds Energy stabilization
- Status information – End of Filter band 1 week in advance, temperature, maintenance service for pump (only once in 24 months necessary), measuring time, Air inlet temperature, etc.
- Immediately alerts - malfunctioning, urgent maintenance needed to prevent damages, radiological incidents, e.g., abnormal increments of radiation or dose levels, etc. via E-mail – Optionally at site via signal tower and hooter.

Detectors:

- Alpha/Beta measurement
 - PIPS 1700 mm² resolution ~@55 keV (α 241Am), ~@30 keV (β). -> large surface for best results.
- Gamma measurement:
 - NaI(Tl), CeBr³ or LaBr³(Ce) in different geometries based on our GSP-detector family are based on latest digital pulse-processing electronics, FPGA and DSP algorithms and 4k resolution

Features and Highlights

- α, β and/or γ in just one compact outdoor unit (temp.contr.)
- 4π Lead shielding for max. background suppression
- Special vacuum pump for **constant volume transport**
- LD values: <0.05 Bq/m³ of ¹³⁷Cs after 24 h sampling cycle
- Storage >6 months of glass fibre filter tape
- Innovative unique **isotope identification**
- Fully remote controllable
- Multi-channel analyser: 4K
- NaI(Tl), CeBr³ or LaBr³(Ce) – (on request <2.5% @¹³⁷Cs)
- Options: meteorology station, 8m³/h pump, external gamma probe, UPS, Iodine measurement, mobile Version

| | |
|----------------------------|--------------------------------|
| Working temperature | -10°C...+40°C / up to 90 % RH. |
| Protection class | IP54 |
| Input Voltage | 230 VAC / 50 Hz |
| Power consumption | <200 VA |
| Dimension | HxWxL = 186x60x60 cm |
| Weight | approx. 150kg |
| Mounting | Floor Mounted |



**On-Line High Volume
Aerosol Sampling Unit ASU120/200**



The **online High-Volume** Air sampler ASU comes in **2 models** and **6 configurations** (NaI, CeBr₃ or LaBr₃ in 2 different geometries) for spectrum and isotope identification and optional weather station.

The ASU contains two consecutive static filters, the first one is for **aerosol particles** and the second filter is for **molecular iodine**. Besides its high nuclear detection capability, the sampler using maintenance-free mechanics.

As aerosol filters coupled to air pumps are capable of accumulating particles from large volumes of air onto a small surface, their radioactive content can be determined with good measuring efficiency thus allowing **advantageously low detection and warning levels**.

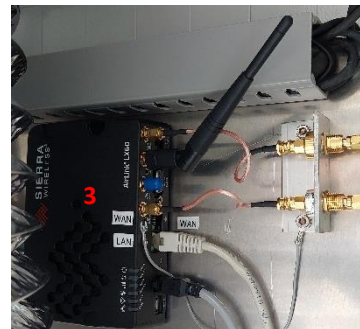
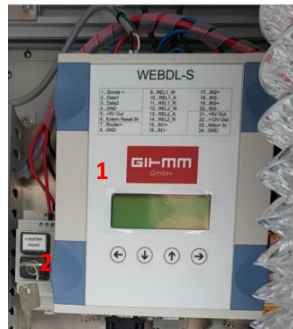
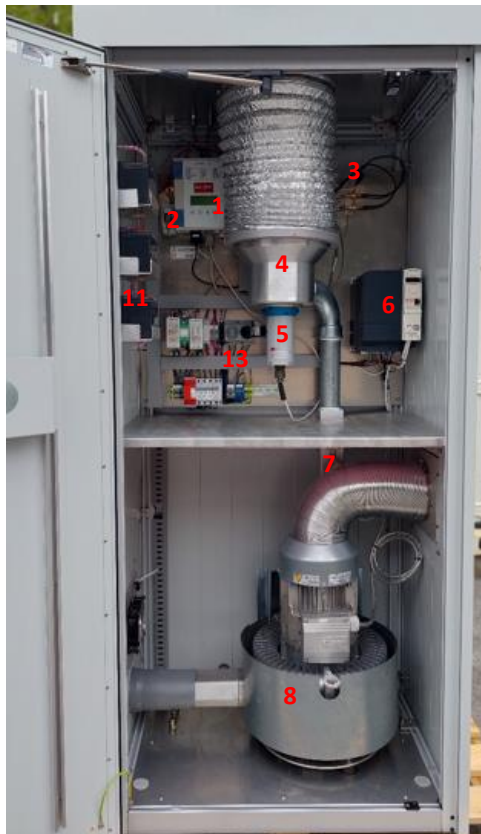
The primary function of the ASU is sampling air through filters and measuring the activity of the retained aerosols. The unit sends **Warning and Alarm messages** when the activity exceeds predefined levels.

This High-Volume Aerosol Sampling unit placed in an outdoor aluminium **thermo-isolated housing** and is **lockable**. A special feature of the unit is that we use an **air flow meter**,

which controls the speed of the pump via a PID controller. This is to keep the airflow constant over the entire filter cycle.

The pump itself is set on damping elements to keep the noise level and vibrations to a minimum.

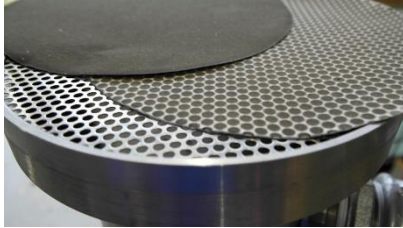
The use of **special silencer technology** reduces the noise level to the technically feasible minimum.



1. Data logger
2. Control Elements (Key lock, Reset Button)
3. Router
4. Filter Holder
5. Gamma Probe
6. Frequency Controller
7. Flowmeter
8. Pump
9. Weather station
10. Special Silencer
11. Batteries
12. Security Lock
13. Electronic Panels



Technical data



| | ASU 120 | ASU 200 |
|---|--------------------------------------|----------------------------|
| Nominal volume flow rate qn regulated: 7 days nonstop working* | 100 m ³ /h+/-2% regulated | 150 m ³ /h+/-2% |
| Maximal Aerosol binding capability: | 1100 [mg] | 1100 [mg] |
| Aerosol filter: fibreglass | Ø 240 [mm] | Ø 240 [mm] |
| atomic iodine filter: PACI | Ø 240 [mm] | Ø 240 [mm] |
| organics iodine filter: charcoal | da158xdi95x h78[mm] | da158xdi95x h78[mm] |
| Accuracy of measuring of air volume: | ± 2 % | ± 2 % |
| Efficiency of retention aerosol filter: | 0,3 µm; 99.8 % | 0,3 µm; 99.8 % |
| Efficiency of retention of atomic iodine filter: | 99.9 % | 99.9 % |
| Efficiency of retention of organic iodine filter: | 90.0 % | 90.0 % |
| Side channel blowers: | max. 2,05 kW; 230V; 50Hz | max. 4,8 kW; 400V; 50Hz |
| Noise level from 6 m: | 56 dBA | 60 dBA |
| Basic area (with socket): | 1000 x 1000 mm | 1000 x 1000 mm |
| Height (without weather station): | ~220 cm (~195 cm) | ~220 cm (~195 cm) |

* normal environmental conditions

Technical modifications are subject to change

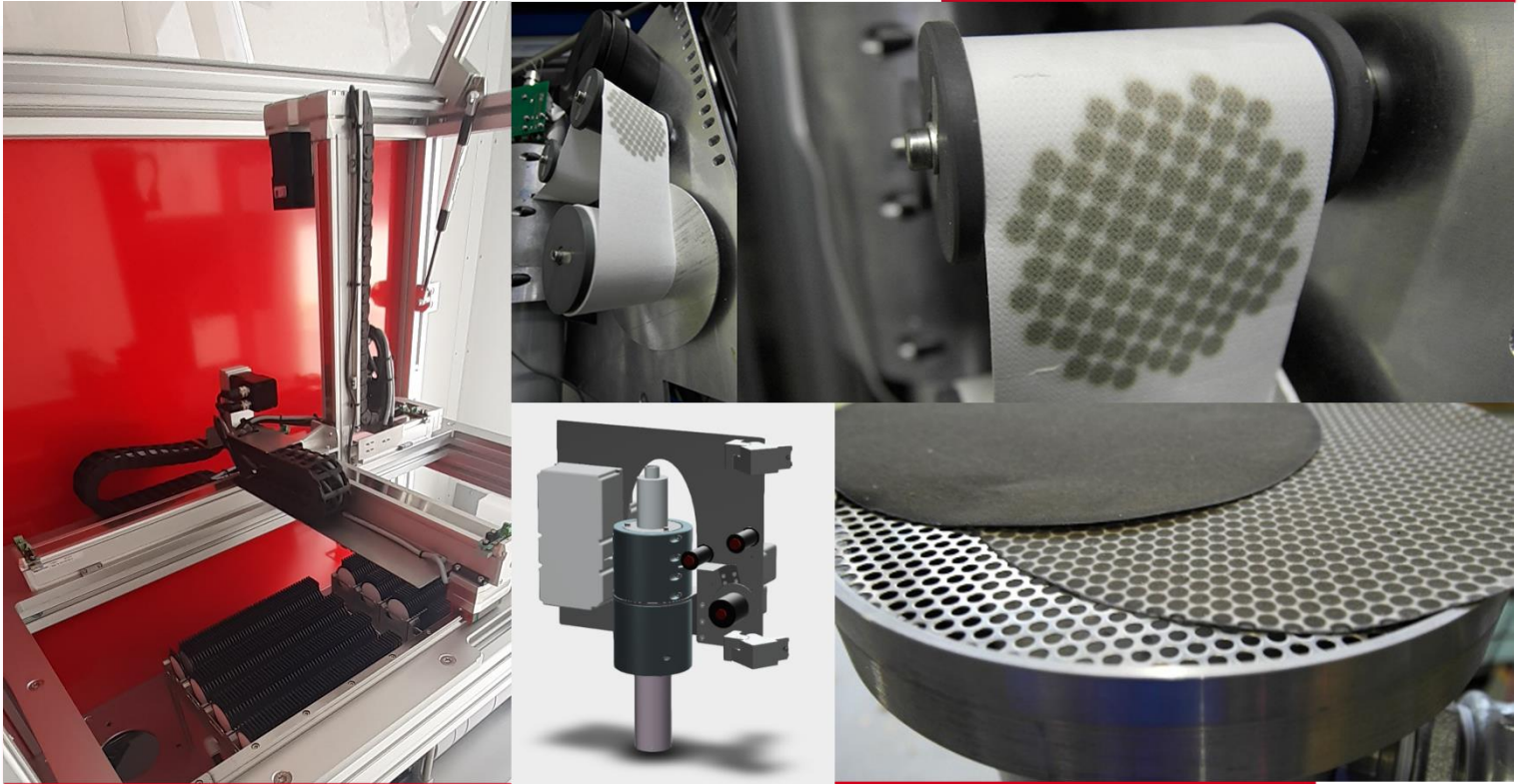


| | 2" NaI detector (CeBr ₃ or LaBr ₃ on request) | 3" NaI detector |
|------------------------|---|--|
| Type: | GSP02/232 | GSP02/232 |
| Detector size: | 2" x 2" | 3" x 3" |
| Measuring range: | 10 ⁻² ÷ 10 ⁴ Bq/m ³ | 10 ⁻² ÷ 10 ⁴ Bq/m ³ |
| Crystal Energy range: | 30 keV ÷ 3 MeV | 30 keV ÷ 3 MeV |
| Energy resolution: | < 7% FWHM at Cs-137 | < 7% FWHM at Cs-137 |
| Multichannel analyser: | 1024 channel | 1024 channel |
| Temperature range: | -30°C ÷ +60°C | -30°C ÷ +60°C |
| Interface: | RS-232 | RS-232 |

Technical modifications are subject to change

V.4.0

V2.0



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