

# GAMS2

Compact gamma spectroscopy measuring system



The compact gamma assay system GAMS 02 is designed for characterization (radionuclides activities measuring) of radioactive waste stored in drums with volume from 20l to 200l (200l default). The measured values are used for radionuclides content declaration and hot-spots identification for further treatment of characterized materials or package sets. The assay system is manufactured according to the nuclear industry standards and safety regulations. Any standard HPGe detector may be used with the assay system (with conventional LN<sub>2</sub> cooling mobile Dewar vessel or with electro-mechanical cooler).

## BENEFITS

- *Type-approval certificate under Czech Republic law TCM441/11 – 4882*
- *State metrology verification certificate 9011-OL-U7573-GAMS2.2011*
- *Waste-packages activity measurement – ISO 14850*
- *Safety of machinery EN 60204-1 – certificate HS631*

## KEY FIGURES

Up to 1 GBq

*Measuring range*

40keV – 3MeV

*Energy range*

7 drums/hour

*Measuring capacity*

## PRODUCT DESCRIPTION

The system consists of three main parts:

The drum station dedicated for the controlled rotating of the drum and for drum weighing. Scale system weighs up to 600 kg with an accuracy of 0.2 kg. The drum station includes a rotating pedestal with stainless steel centering spines and has possibility of independent power supply. The drum station is placed on centering positioning system capable to assure measurement in 0.5 ÷ 2 m distances from the object.

The measuring part contains HPGe semiconductor detector with energy range from 40 keV up to 3000 keV, electrical cooling system (optionally liquid nitrogen cooling system LN<sub>2</sub>), spectrometric measurement system consisting of digital MCA, detector lead shielding of 100 mm thick (front side 150 mm), height-adjustable positioning system in the range of 100 - 1 200 mm, backup UPS power supply and control and power systems. Detector is housed in a shielded and collimated module to minimize the interference from environmental and plant background.

The evaluation part contains an evaluation PC with GAMSCONTROL and GAMWIN software. The evaluation system is connected to the measuring part via LAN or Wi-Fi interface. The system can also be controlled by remote management.

## CONTROL SOFTWARE

- **GAMWIN SW (included)**
  - Comprehensive Spectroscopy Analysis Software package
- **GAMSCONTROL**
  - management of the whole process of measuring and checks. This SW controls the entire device and all of its components, allows to configure and manage all the system settings.
  - samples, results and reporting management software intended for storage of the measured and application data
  - data review and visualization

## PRODUCT SPECIFICATION

### Detector

ORTEC GEM Coaxial HPGe Detector (PopTop, SMART version)

### MCA

ORTEC DSPEC jr 2.0 –16k channels portable HPGe MCA

### Cooling system

Electrical Cooler ORTEC ICS

### Positioning system

Shiftable positioning unit for moving of the detector on vertical axis (height range 100 - 1 200 mm)

### Drum station

Drum rotating station/unit with certified tensometric scale. Weighting range up to 600 kg with accuracy of 0.2 kg. Detector – object distance 500 mm, 1 000 mm, 2 000 mm.

### Collimators and shields

Standard fixed lead collimator with two changeable collimating slots (low and high activity). Lead side shielding 100 mm, front 150 mm, 1 mm copper and 0.5 mm tin liner.

### System calibration

Factory efficiency calibration for 200L drums (Monte Carlo Techniques).

### Dimensions

Height 1800 mm, width 900 mm, depth 1 200 mm

### Drum station dimensions

Height 500 –570 mm, width 850 mm, depth 850 mm

### Weight (fully assembled)

Measuring device: 700 kg, drum station: 100 kg

### Start-up time

< 10 min (without detector cooling time)

### Power supply

1/3 NPE ~ 50Hz 230/400V TN-S.

### Operating and storage temperature

From 0 up to 30 °C with ventilation unit, from 0 up to 50 °C with air-condition unit (operating), from -20 up to 60 °C (storage).

### Relative air humidity

< 80 % (non-condensing)

### Power consumption

2200 VA (MAX), surge protection type 3

### Backup power supply

AC 230V / 6A, time coverage of power interruption: 5 min (measuring part)

### Maximum activity limit

Cs-137 1E6 Bq/kg, Co-60 1E8 Bq/kg, Am-241 1E4 Bq/kg

### Accuracy

Typically better than 10% (uniform source and matrix distributions)

### Min measuring time

5 minutes

### Integral nonlinearity

< ±0.025% over top 99.5% of spectrum

### Temperature stability

< 0.0075%/°C (at temperatures varying between 10–60 °C).

### Instability during a continuous work

Less than 0.0075%

## OPERATIONAL INFORMATION

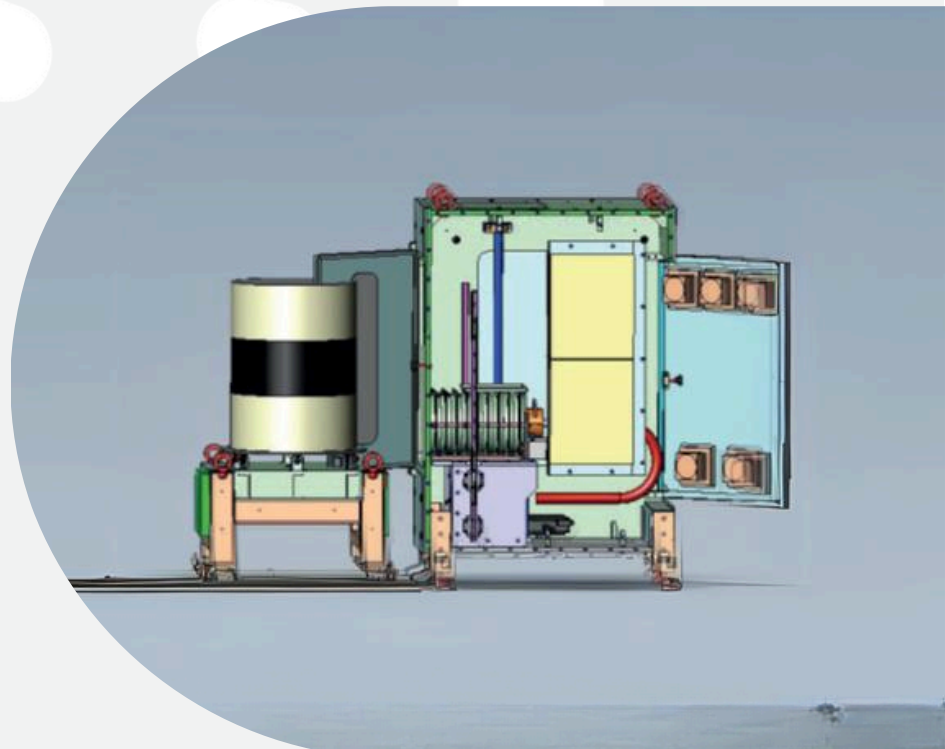
Measurement process is initiated after the system stability and background check. After loading of the drum on the drums station and its registration the system starts the measurement according to the settings and set measuring positions (e.g. 3 positions on vertical axis). Measurement process can run in manual or in a fully automatic mode.

After initiating of the measurement the detector is set up on the first position (lowest layer of the drum) and the drum starts to spin. If the measurement in given position is completed (the spectrum is acquired) the measuring system automatically goes to the next layer (this process is repeated for all measuring positions). Overall, it is possible to adjust six height measuring layers with a resolution of 40 mm. The measurement is completed after measuring of all the set layers / positions. In case of detector overloading the measurement is automatically elongated. If the detector overload reaches 80 %, the measurement is stopped and it is necessary to change the collimation slot or shift the drum station to another measuring position (further from the detector). The results of each measurement analysis are stored in a local database on the evaluation PC.

The assay system allows measuring of the radionuclides emitting gamma photons in the energy range from 40 keV. The photons generate electric pulses that are amplified in a pre-amplifier, and subsequently processed and digitized in a digital signal processor. Digital signal is stored in a multichannel analyzer as gamma-ray spectrum. Measured spectra are transferred to a computer, and using professional gamma spectrometric application GAMWIN displayed, analyzed and evaluated. The final measurement result is transferred and stored in database.

The result of the measurement is an output protocol which comprises an identification of the load, radionuclide composition, total mass activity, MDA, combined measurement uncertainty and other necessary information.

Minimum measurement time for a load is about five minutes (three measuring positions). The measuring system has an internal diagnostics of the state of individual subsystems.



## OPTIONS AND ACCESSORIES

### Local control unit

Compact graphic/touch terminal for in-site manual control of system components, system diagnostics and setting of the system parameters with LCD operator touch panel and emergency stop switch.

### Advanced MCA

ORTEC DSPEC 50 – DSP-Based Gamma Ray Spectrometers for Germanium Detectors for High-Rate Spectroscopy Applications. 16k channels MCA, highly stable against variations in count rate and temperature, PHA and List Mode acquisitions, automated set-up (Automatic Pole Zero Adjust, Baseline Restorer, and Optimize), digital spectrum stabilizer, USB 2.0 and Ethernet capability (TCP/IP protocol), large front panel display for system status information, support for all HPGe detector types, advanced DSP Algorithms (ZDT“loss free” dead-time correction with uncertainty calculation, Low Frequency Rejection (LFR) mode, ResolutionEnhancer, Enhanced Throughput Mode).

### Integrated system

ORTEC IDM – Interchangeable HPGe Detector Module - All-in-one integrated HPGe detector,cooler (Stirling-cycle), cryostat, and signal processing electronics, internal battery for ~2.5 hours followingpower failure. Large HPGe detector (85 mm x 30 mm HPGe crystal), coaxial construction, P-type high-purity germanium. Relative Efficiency >50% typical (ANSI/IEEE 325-1996), energy resolution  $\leq 1400$  eV @ 122 keV and  $\leq 2.3$  keV @ 1332 keV, peak shape 1.9 typical (FWTM/FWHM). Integral Dose Rate Monitor, 16k channels digital MCA, USB connectivity.

### Collimators and shields

Automatically adjustable collimator according to the activity and/or geometry – slot opening angle 0-90°.

### LN2 filling system

50-liter self-pressurized dewar, 6-foot transfer line, pressure-fill bayonet, and withdrawal device.

### System Calibration

Factory efficiency calibration for 100l and/or 50l and/or 20l drums. The system automaticallychanges the efficiency calibration according to used type of drums (Monte Carlo Techniques).

### Application interface

Application interface from/to external application (XML).

## MINIMUM DETECTABLE ACTIVITY

NUCLIDE	MDA [kBq]
Mn-54	0.6
Co-57	23.0
Co-58	1.4
Co-60	0.9
Zn-65	1.2
Ag-110m	1.8
Cs-134	1.6
Cs-137	2.1
200L drum, metal material, 360 s acquisition time, 40 % detector relative efficiency, 80 mm collimator.	

## PRODUCT APPLICATION

- Gamma spectrometric measurement of waste
- Decommissioning of nuclear facilities