

GAMMA RADIATION SPECTROSCOPY SYSTEM FOR REAL-TIME RADIATION MONITOR

GAMON-S

APPLICATIONS AND SCENARIOS

The **GAMON-S** gamma radiation spectroscopy system is designed for early environmental warning and emergency response. It runs automatic real-time analysis of surrounding gamma emitting isotopes for detecting radiological threats.

On-field installation allows **GAMON-S** to easily monitor wide surrounding areas, detect small deviations from natural background thanks to the high detector efficiency, to provide detailed reports on the radioisotopes found.

The **GAMON-S** has redundant alarm types, extended radiation dose rate range and configurable isotope-based alarm levels.

The **GAMON-S** can be deployed in multiple scenarios ranging from the public event fast deployment to the nuclear reactor perimeter monitoring. The **GAMON-S** can be deployed in:

- ring monitor systems around nuclear facilities;
- nationwide environmental monitoring networks;
- area monitor system in nuclear research laboratories;
- portable, mobile measurement stations for emergency response and public security.

DESCRIPTION

The **GAMON-S** spectrometer series has been designed for outdoor real-time radiation monitoring, for early environmental warning and emergency response. It can operate in harsh weather conditions, and it is protected from rain and moisture. The **GAMON-S** can be deployed in a wide range of scenarios, as in permanent ring monitoring as well as in moving monitoring stations. Thanks to the integrated GPS the system position can be easily monitored real time.

The **GAMON-S** spectrometer runs automatic isotope identification and isotope related dose rate evaluation. The real-time data processing and the defined isotope-based alarm allow **GAMON-S** to detect the presence of artificial nuclides in a short time window and more effectively compared to traditional dose rate meters.

The user can select the isotopes to be identified from the library and adjust the thresholds of the isotope-related alarms. The spectrum stabilization is obtained through temperature and identification of natural occurring radionuclides as the ^{40}K .

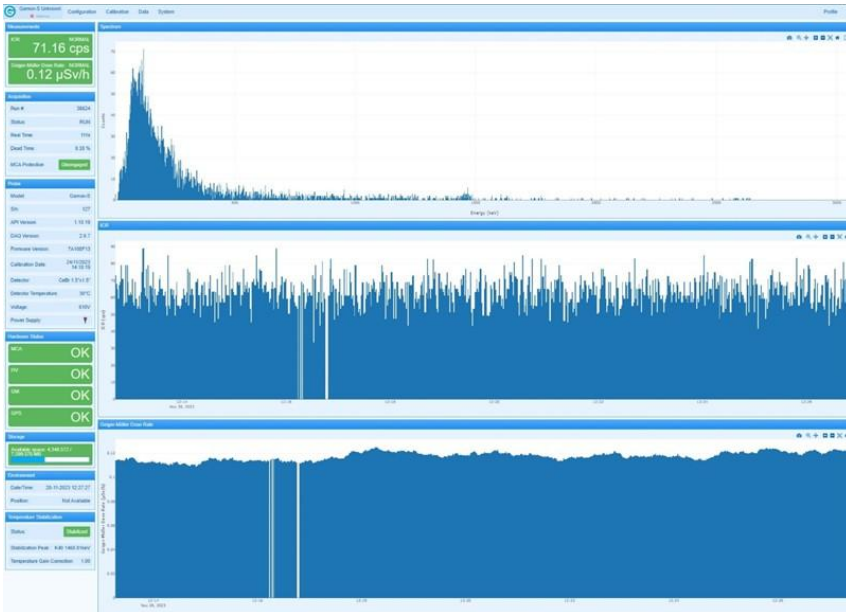


The gamma detector is composed by an inorganic scintillation crystal which can be either NaI(Tl), CeBr₃ or LaBr₃(Ce). NaI(Tl) is preferable for its high light yield and moderate cost, LaBr₃(Ce) for its excellent energy resolution and CeBr₃ for its good energy resolution and low internal radioactivity.

Signals from scintillation detector is pre-amplified and the pulse is digitized by a 12 bit 62.5 MHz fADC. Digital signal shaping and pulse height analysis is performed by a digital MCA with 2048 channels.

The spectroscopy detector is configured to collect gamma interactions in the energy range from 30 keV to 3 MeV, even though alternative energy ranges can be configured on request. It provides statistically accurate dose rate measurements in the range starting from 1 nSv/h and up to 500 μ Sv/h depending on the detector dimension and composition. An additional Geiger-Mueller counter extends the dose rate measurement up to a level of 10 Sv/h in the energy range from 50 keV to 2 MeV.

The **GAMON-S** spectrometer can be provided with wired connections, RJ45 Ethernet and USB 2.0 port, or embedding additional wireless interfaces as Wi-Fi and GPRS/LTE. The operator can select the preferred communication interface.



The **GAMON-S** embedded ARM based CPU stores the data in an internal non-volatile memory of 8 GB which guarantees up to 1 year storage with 15-minute reports. The spectrometer CPU runs a web interface to allow the user to easily configure the data acquisition and the isotopic analysis. Security level of the web interface can be configured by the user to avoid unauthorized setting changes.



The spectrum integration time can be adjusted by the user. Each spectrum acquired is saved together with the onboard analysis report. Hourly and daily reports are also automatically generated. The embedded web interface can

MAIN FEATURES

- Gamma radiation spectroscopy system based on scintillation detector and Geiger-Mueller counter
- Based on an active standalone MCA device for the digitization of outdoor gamma spectroscopy signals
- Onboard web interface for easy configuration of isotope-based alarms
- Internal database for summary reports and plots, easily generated by the embedded web interface
- Robust spectrum stabilization algorithms
- Big onboard data storage for long autonomous data taking
- Designed for operating outdoor in extreme weather conditions from -40 to +60 °C
- Robust case, designed to guarantee IP68, including the power and the communication connectors
- Design for easy wall and pole mounting
- Wired and Wireless communication interfaces: USB 2.0, Ethernet, Wi-Fi and 3G/4G LTE
- Quick and easy to install and to operate thanks to onboard web graphical interface
- Easy integration into the CAEN Gamon Monitoring Center (GMC) Software
- Reachback functionality through CAEN GMC

OPTIONS

The **GAMON-S** gamma spectrometer embeds wired communication interfaces or with enhanced connectivity through the integration of Wi-Fi and 3G/4G LTE wireless interfaces. The monitoring system has IP68 connectors for USB 2.0 and RJ45 Ethernet ports.

Standard Gamma Spectroscopy System:

- USB, Ethernet interfaces;
- 12 VDC power plug.

Wireless Gamma Spectroscopy System:

- USB, Ethernet interfaces;
- 12 VDC power plug;
- 3G/4G LTE and Wi-Fi, optional weather station, optional backup battery.

The **GAMON-S** gamma spectrometer can be also integrated in monitoring stations for tailored solutions.

Gamma spectroscopy Monitoring Station:

- Pole or wall mounted with main power supply;
- Various kinds of supports available (pole, tripod, stainless steel stand);
- Backup battery;
- Optional solar panel power supply;

generate plots and summary tables showing the data available in the system internal database.



The full spectrometer is designed to guarantee IP68, including the power and the communication interface connectors. The spectrometer case has been designed to ease wall or pole mounting, or the integration for permanent and mobile monitoring stations. The spectrometer can embed a backup battery for temporary power shortage.



The **GAMON-S** spectrometer can interface an external configurable weather station for correlating possible dose rate variations due isotopes deposited by the rain. It integrates an internal temperature sensor for gamma spectrum stabilization.

Crystal	Size	Photopeak efficiency (cps/uSv/h @662keV)	Total efficiency (cps/uSv/h @ 662 keV)	Resolution (FWHM@662 keV)	H*(10) Rate range
Nal(Tl)	2"x2"	360	1.850	< 7.5%	1 nSv/h - 300 uSv/h
Nal(Tl)	3"x3"	1.200	4.300	< 7.5%	1 nSv/h - 100 uSv/h
CeBr ₃	1.5"x1.5"	190	1.040	< 4.0%	1 nSv/h - 500 uSv/h
CeBr ₃	2"x2"	520	2.000	< 4.0%	1 nSv/h - 300 uSv/h
LaBr ₃ (Ce)	1.5"x1.5"	190	1.040	< 3.0%	1 nSv/h - 500 uSv/h
LaBr ₃ (Ce)	2"x2"	520	2.000	< 3.0%	1 nSv/h - 300 uSv/h

TECHNICAL SPECIFICATIONS

Scintillation Detector

- Available scintillation crystals:
 - Nal(Tl) 2" x 2", 3" x 3"
 - LaBr₃(Ce) 1.5" x 1.5", 2" x 2"
 - CeBr₃ 1.5" x 1.5", 2" x 2"
- Other dimensions on request
- Energy range (scintillator): 30 keV ÷ 3 MeV
- Dose rate accuracy (scintillator): < 10%

Geiger-Mueller

- Compensated dual tube dosimeter
- Energy range: 50 keV ÷ 2 MeV
- Dose rate range (GM): 10 nSv/h ÷ 10 Sv/h
- Dose rate range (GM + scintillator): 1 nSv/h ÷ 10 Sv/h
- Linearity: < 10% from 100 nSv/h to 1 Sv/h

Sensors

- GPS
- Temperature internal sensor

Communication interfaces

- Ethernet RJ45
- USB 2.0 port
- Communication protocol TCP/IP
- Connector protection level IP68

Options (available on request)

- Rain sensor
- Weather station (configurable)
- Wi-Fi
- 3G/4G LTE
- Standing support (configurable)
- Battery-powered cabinet for stand-alone use
- Solar power supply
- Transport rugged case

Software

- Integrated web interface
- Local database and data repository
- Periodic, hourly and daily report generation
- Periodic integration time: 1, 5, 10, 15, 30 min
- Spectrum stabilization with temperature and natural background isotopes
- Configurable isotope library
- Three adjustable levels of isotope-related alarms
- Storage: 1 year with 15 min reports

Power supply

- Power consumption: < 4 W
- Voltage: 5 ÷ 12 VDC
- Power connector protection IP68

Physical dimensions and weight

- Length: 91.5 cm
- Diameter: 14.0 ÷ 17.0 cm
- Weight: up to 8 kg

Environmental

- Temperature range -40 ÷ 60 °C
- Protection level IP68 outdoor extreme weather conditions
- Relative humidity: 100% (waterproof)



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