

Integrated HPGe Gamma Spectrometer System for Counting Laboratories and Mobile Laboratories



A Superior All-In-One Solution. . .

- Needs no LN₂ — ever: because of the "run forever" Stirling-cycle cooler.
- HPGe detector element encapsulated in a high reliability cryostat, with no need ever to thermal cycle on partial warm up.
- High stability digital signal processor built right in — no need for external electronics.
- Powered from a small 10–17 V DC supply, with a low waste heat output <20 watts: ideal for use in confined spaces and mobile labs.
- Built-in battery back up keeps LDM running for up to 3 hours in the event of power failure.
- Near silent in operation.

Laboratory Detector Module

LDM100-GEM

The LDM100-GEM is an all-in-one HPGe gamma-ray spectrometer for use in a variety of applications ranging from counting labs to mobile laboratories.

It requires only two electrical connections to be ready for use: a source of DC power (usually from the supplied AC/DC mains power adaptor, but equally well from a vehicle battery) and a USB connection to the host computer. There are no interconnecting cables required between subsystems.

Liquid nitrogen refrigerant IS NOT REQUIRED to cool the HPGe detector. The high reliability miniature Stirling-cycle cooler takes care of this. The cooler has the additional benefit of being "all attitude," that is to say unlike systems which employ liquid refrigerants, it can be moved at no risk, even while operational, important for mobile laboratory applications.

All LDMs are based on the same technology employed in the ORTEC Detective line of HPGe nuclide identifiers. The ultra-reliable hardened cryostat and robust Stirling-cycle coolers, field-proven hundreds of times over, are now available for a laboratory instrument. The hardened cryostat design allows removal or reapplication of power at any point of the cool down cycle. No longer does a partially warmed detector need to be cycled back to room temperature before cooling restarts.

Installation is simplicity itself — just attach to the stand and slide the detector up into the lead shield. Plug in the power cable and attach the USB cable to a PC or laptop. The initial cool down takes less than 12 hours, and you are ready to calibrate and count samples.

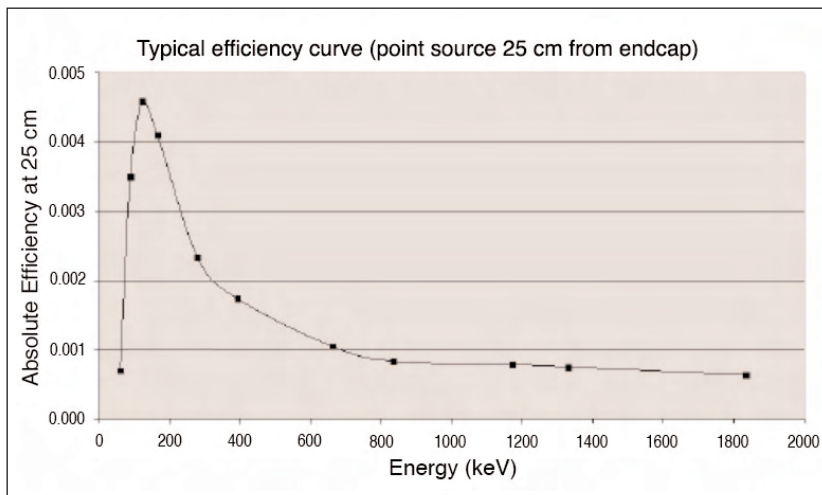
- All-in-one Integrated Package — rugged and compact with no interconnections — quick and easy to install.
- High Speed USB 2.0 connectivity: plug and play.
- Battery Backup — the internal battery provides up to 3 hours of operation in the event of a power failure, battery charge is maintained by an internal battery charger circuit inside the instrument housing.
- High Sensitivity — large (40% relative efficiency) HPGe detector.
- Hardened Cryostat — the HPGe crystal is housed in an all-metal-sealed, ruggedized cryostat, and cooled by a highly reliable miniature Stirling-cycle cooler. NO molecular sieve is used.
- High Stability Digital Signal Processor — built in to the system — no need for external electronics, just DC power and a USB connection.



HPGe Detector and Cooler

The LDM100-GEM incorporates an ORTEC GEM Series P-type HPGe crystal that is 65 mm in diameter x 50 mm in length and 40% relative efficiency.

The large HPGe crystal increases sensitivity and reduces time to MDA. The "over-square" geometry means best absolute efficiency up to energies in excess of 2 MeV. All LDM100-GEM instruments use nominally identical germanium crystals. A cutaway drawing showing the construction materials is available on request from ORTEC and is suitable for most Monte-Carlo modeling programs. A typical relative efficiency curve is shown in figure 1.



Digital Electronics

Detector signal processing is achieved by advanced digital electronics. An active noise reduction filter (LFR), implemented in the digital spectrometer improves energy resolution by reducing the effect of mechanically generated microphonic noise. Full control of the electronics parameter settings is allowed from the user interface.

Laboratory Detector Module

LDM100-GEM

Instrument State-of-Health and Status

The LDM HPGe detector incorporates "SMART-1" diagnostics, which verify that it is operating properly. State-of-health and instrument status is available at a glance.

CONNECTIONS-32 programs, such as MAESTRO-32 which is included with the LDM, can read the state-of-health status parameters and display them on a PC or laptop that is connected to the instrument via USB 2.0. User-developed packages may read the status register through the LDM for maintaining the spectrum QA. (Ask for the ORTEC CONNECTIONS-32 brochure.)

MAESTRO-32 MCA Emulator Included

The latest version MAESTRO-32 MCA software is included with the LDM. It provides a standard graphical user interface and can be used to control all system parameters from the PC.

MAESTRO-32 is a member of the ORTEC CONNECTIONS-32 family of products and provides full networking with other ORTEC spectrometers and supporting computers. MAESTRO-32 includes features for identifying peaks, editing libraries, and creating, printing and saving Regions of Interest (ROI), performing energy calibrations, and automating tasks via using simple "Job Streams." For even more advanced spectrum analysis, GammaVision-32 is also available. (Request a brochure or download from www.ortec-online.com)

Create Your Own Custom Software with the Optional A11-B32 Toolkit

The A11-B32 CONNECTIONS-32 Programmer's Toolkit is also available for those who wish to integrate the LDM into their own software systems. The Toolkit offers ActiveX Controls to simplify programming with LabVIEW, Visual C++, and Visual Basic. For more information on the Toolkit, ask for the A11-B32 Programmer's Toolkit brochure or download from www.ortec-online.com.

Specifications

HPGe Detector Crystal

P-type high-purity germanium. Coaxial construction.

Dimensions 65 mm diameter x 50 mm length nominal.

Relative Efficiency 40% typical (ANSI/IEEE 325-1996).

Resolution 1500 eV @ 122 keV and 2.3 keV @ 1332 keV (FWHM Warranted at optimum settings).

Peak Shape 1.95 typical (FWTM/FWHM).

Cryostat and Cooler "Hardened" cryostat with high reliability, low power Stirling-cooler. The cryostat design is such that the LDM may be switched off at any time and power subsequently re-applied without waiting for a full thermal cycle (complete warm up before cool down), as is normal practice with a HPGe detector system. This feature greatly decreases potential detector "down-time", thereby increasing productivity.

Hardware

System Gain Settings

Coarse Gain 1, 2, 4, 8, 16, or 32.

Fine Gain 0.45 to 1.

Full Scale Energy Range ~40 keV to ~7 MeV.

Conversion Gain Software controlled from 512 to 16k channels.

Dead-Time Correction Extended live-time correction according to Gedcke-Hale method. Accuracy: Area of reference peak changes $\pm 3\%$ from 0 to 50,000 counts per second.

Digital Noise Suppression "LFR Filter."

Linearity

Integral Nonlinearity $< \pm 0.025\%$ over top 99.5% of spectrum, measured with a mixed source.

Differential Nonlinearity $< \pm 1\%$.

Digital Spectrum Stabilizer Controlled via computer, stabilizes gain and zero errors.

System Temperature Coefficient

Gain < 35 ppm/ $^{\circ}\text{C}$. [Typically 30 ppm/ $^{\circ}\text{C}$.]

Offset < 3 ppm/ $^{\circ}\text{C}$.

Overload Recovery At maximum gain, recovers to within 2% of rated output from X1000 overload in 2.5 non-overloaded pulse widths. (Measured using the MAESTRO InSight Oscilloscope.)

Pulse Pile-Up Rejector Automatically set threshold. Pulse-pair resolution typically 500 ns.

Digital Gated Baseline Restorer Computer controlled adjustment (High, Low and Auto). U.S. Patent No. 5,912,825.

LLD Digital lower level discriminator set in channels. Hard cutoff of data in channels below the LLD setting.

ULD Digital upper level discriminator set in channels. Hard cutoff of data in channels above the ULD setting.

Laboratory Detector Module

LDM100-GEM

Ratemeter Count-rate display on MCA and/or PC screen.

Dimensions

LDM 25.28 H x 6.5 W x 6.275 in D
(64.21 x 16.51 x 15.94 cm)

LDM at full stand extension 45.42 in H (115.37 cm)

Stand Height 30.75 in (78.11 cm)

Stand Base 17 W x 16 in D (43.18 x 40.64 cm)

Endcap Only

Endcap Diameter 3 in (76 mm)

Endcap Length 6.2 in (157.5 mm)

Weight

LDM 16 lb (7.26 kg)

Stand 15 lb (6.80 kg)

Input Power 10–17 V dc 30 Watt or via auto-sensing mains powered battery charger.

Internal Battery Life >3 hours at 25°C with a cold detector on fully charged internal battery. The unit is expected to be kept running once cold.

Operating Temperature 0 to +30°C,

Relative Humidity <90% at 30°C, non-condensing.

Ordering Information

Model	Description
LDM100-GEM	Laboratory Detector Module with MAESTRO-32 MCA emulation software, USB cable, Universal Mains adaptor and detachable stand for use under counting laboratory lead shield.

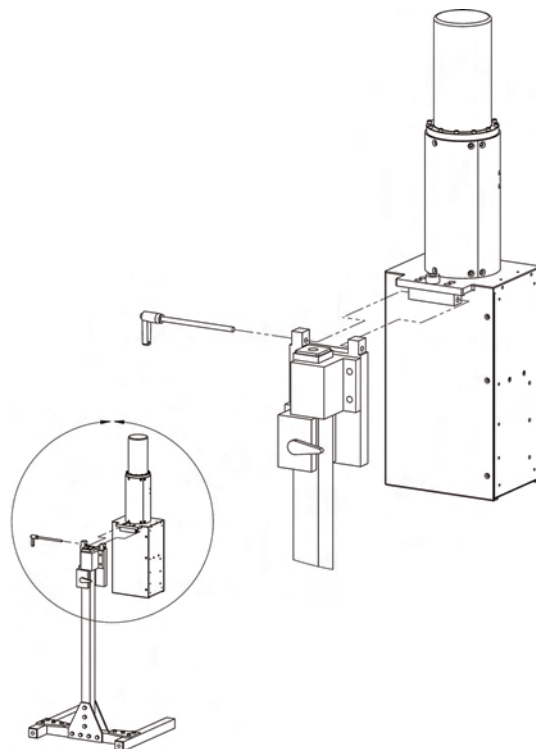
Cool Down Time The high reliability cooler is designed for continuous operation. The cooler life is expected to exceed 50,000 hours continuous operation. Initial cool down time depends on ambient temperature, but is typically <12 hours at 25°C.

Communications Ports 1 USB connection for control of the MCA from an external computer.

Software

The LDM100-GEM is fully supported by the latest versions of the highly successful MAESTRO-32 MCA Emulator (included) as well as the well-known ORTEC Gamma Spectroscopy packages such as GammaVision-32 for generalized HPGe spectrum analysis, PC/FRAM and MGAHI for Pu and U isotopic ratio analysis and ISOPlus for in-situ waste assay analysis.

The integral USB connection in the instrument hardware provides full PC control, real-time live MCA display, fast data transfer of single and multiple spectra to the PC, and full ORTEC CONNECTIONS network support. Separate software product brochures are available on request.



Specifications subject to change
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