



Low Energy Germanium Detector

(LEGe)



Nuclear



Healthcare



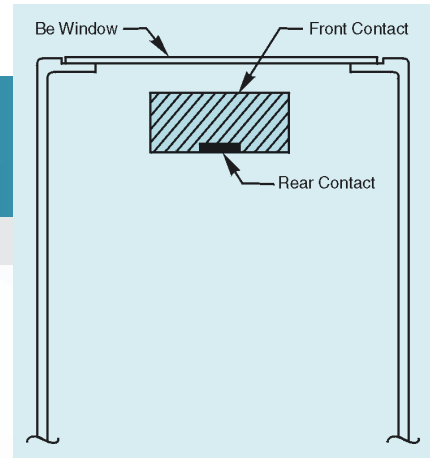
Homeland Security & Defense



Labs and Education



Industrial and Manufacturing



LEGe Detector

FEATURES & BENEFITS

- Thin front and side contact, allowing spectroscopy from 3 keV up
- Wide range of sizes allows selecting the best detector for your application
- Low noise and consequently high resolution at low and moderate energies
- Equipped with Intelligent Preamplifier
- USB 2.0 Serial Interface

APPLICATIONS

- Low energy gamma spectroscopy
- X-ray absorption spectroscopy
- Nuclear safeguards
- XRD, XRF

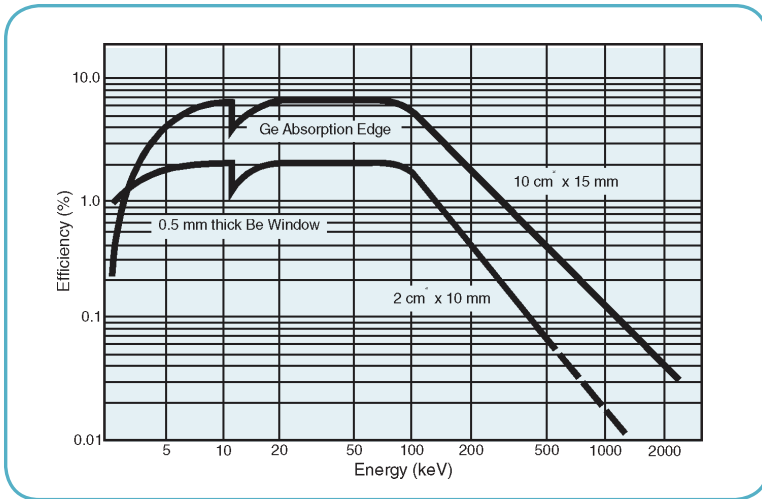
DESCRIPTION

The Low Energy Germanium Detector (LEGe) is in all aspects optimized for performance at low and moderate energies and has specific advantages over conventional planar or coaxial detectors. The LEGe detector is fabricated with a thin front and side contact. The rear contact is of less than full area which gives a lower detector capacitance compared to a planar device of similar size. Since preamplifier noise increases with detector capacitance, the LEGe affords lower noise and consequently better resolution at low and moderate energies than any other detector geometry. Unlike grooved planar detectors, there is little dead germanium beyond the active region. This, and the fact that the side surface is charge collecting rather than insulating, results in fewer long-rise time pulses with improved count rate performance and peak-to-background ratios.

The LEGe detector is available with active areas from 50 mm² to 2000 mm² and with thicknesses ranging from 5 to 20 mm. For applications involving moderate gamma-ray energies, the LEGe may well outperform a more expensive large volume coaxial detector. The efficiency curve given below illustrates the performance of a typical LEGe detector.

To take full advantage of the low energy response of this intrinsically thin window detector, LEGe cryostats are usually equipped with a thin (1 to 20 mil) beryllium window. A LEGe cryostat can also be equipped with a 0.6 mm carbon epoxy window which improves ruggedness over the Be window, but still has a good low energy transmission. For applications at energies above 30 keV, the LEGe can be provided with a conventional 0.5 mm Aluminum window. In any case, a wide range of available CANBERRA cryostats allows optimizing the detector configuration for your application.

Low Energy Germanium Detector (LEGe)



Absolute Efficiency Curve for LEGe Detector with 25 mm Spacing Between Source and End Cap



Comparison of low energy transmission for different available window

PREAMPLIFIERS

The choice between a reset type preamplifier and a RC feedback preamplifier is linked to the detector size.

The **reset type preamplifier** is the CANBERRA I-TRP model. An integrated transistor resets the preamplifier. This makes the I-TRP notably free from the spurious effects as seen in POR preamplifiers such as long recovery time associated with LED illumination of the FET. The short recovery lends itself better to high count rate applications and the FET itself contributes less noise, resulting in **better resolution**, especially with short amplifier or pulse processor time constants. The high gain of the I-TRP makes it less suited for use with higher energies as the reset rate will increase rapidly at the expense of throughput.

The **RC feedback preamplifier** is the CANBERRA iPA – Intelligent Preamplifier model. This preamplifier uses a resistor to continuously discharge the feedback capacitor. This allows for **higher total energy throughput** because no time is lost due to the reset signal. Additionally RC feedback preamplifiers do not exhibit non-active counting times caused by a reset signal, which can be important in applications like safeguards measurements. However, the addition of the feedback resistor adds noise to the system which causes a small resolution degradation at low energies.

The Intelligent Preamplifier (iPA) included with this style of HPGe detector has an improved, low power analog front stage providing excellent resolution and count rate performance.

An integrated digital back-end makes use of the detector sensors to continuously monitor and store all relevant parameters and status information. This data, which may be trended over time, allows the user to take preventative measures if a key parameter starts to shift and ultimately improves equipment availability and productivity.

It also enables setup and tuning of the preamplifier through digital controls rather than potentiometers.

The preamplifier status information, on board log file and digital controls are accessible through a USB 2.0 serial connection and software application which is provided with the iPA.

See the “Intelligent Preamplifier” specification sheet for more details.

With these performance differences in mind, CANBERRA typically offers:

- the **I-TRP** on small LEGe’s (50 and 100 mm²), where low energy resolution counts,
- the **iPA** on the larger LEGe models, which are usually optimized for higher total energy rates.

GENERAL SPECIFICATIONS AND INFORMATION

Model Number	Area (mm ²)	Thickness (mm)	Be Window Thickness mm (mils)	Resolution (eV FWHM)** (at optimum settings)		Preamplifier Type
				5.9 keV	122 keV	
GL0055	50	5	0.025 (1)	145	500	I-TRP
GL0110	100	10	0.025 (1)	160	500	I-TRP
GL0210	200	10	0.15 (5)	195* (170)	520	RC*
GL0510	500	10	0.15 (5)	250	550	RC
GL0515	500	15	0.15 (5)	250	550	RC
GL1010	1000	10	0.5 (10)	300	620	RC
GL1015	1000	15	0.5 (10)	300	620	RC
GL2020	2000	20	0.5 (20)	400	680	RC

* I-TRP preamplifier available as option.

** Resolution: FWTM less than or equal to two times the FWHM.

The feedback resistor in LEGe models with resistive feedback preamplifiers is selected to optimize resolution and count rate performance. Maximum energy rate for 200 mm² and 500 mm² LEGe models is 20 000 MeV/s and 40 000 MeV/s for 1000 mm² models and larger.

For certain applications LEGe detector specifications may differ from these listed above. E.g. for safeguards measurements both detector and electronics need to be optimized for measurements in moderate energy range and high count rates.

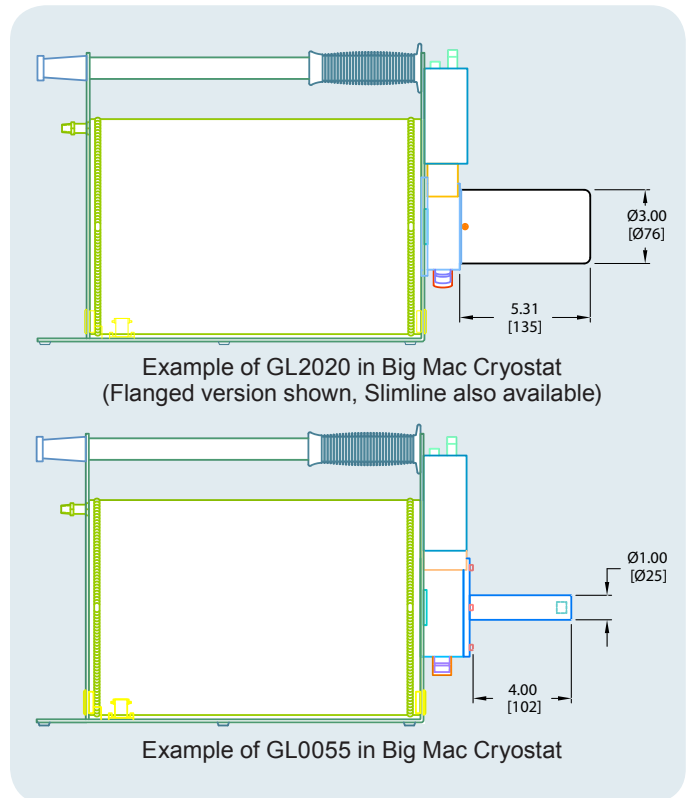
ENDCAPS AND CRYOSTATS

The models GL0055 and GL0110 will come in a 1 in. diameter by 4 in. long endcap on a flanged-style or retractable cryostat. The Dewar or electric cooler can be chosen from our wide range of available options.

Larger LEGe models will come in a 3 in. diameter aluminum endcap. Slimline or flanged cryostats can be selected and, again, a wide range of Dewars or electric coolers is available to choose from.

MULTI-ELEMENT ARRAYS

The LEGe models GL0055 and GL0110 are also available in CANBERRA's discrete multi-element array detectors. Their thin side contact and full-area front window make them very well suited for these applications as it allows close-packing of the array pattern to minimize dead space between the elements. More information is available in our Germanium Array Detector documentation.



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