

- **85-mm diameter and 30-mm thick high-purity germanium (HPGe) detector optimized for Actinide Bioassay measurements**
- **Large frontal active area with excellent photon sensitivity for photon energies above 10 keV**
- **Warranted Energy Resolution (FWHM) equal to or better than 600 eV at 14.4 keV**
- **Warranted Energy Resolution (FWHM) equal to or better than 650 eV at 122 keV**
- **Warranted Energy Resolution (FWHM) equal to or better than 1.9 keV at 1332 keV**
- **Warranted Peak to Compton ratio >55:1**
- **FW 0.1M/FWHM typically <2.0, FW0.2M/FWHM typically <2.9**
- **Can be used with X-COOLER II Mechanical Cooler**

ACTINIDE-85 is a high-resolution, high-purity germanium detector designed specifically for lung burden and whole body counting applications. It is based on the PROFILE FX-85, which employs a proprietary thin radiation entrance window (~10 microns Ge equivalent), in order to maximize low-energy efficiency.

The unique detector design combines large area and excellent energy resolution across a wide range of energy, with excellent peak shape, so important in analysis of complex spectra. The result is excellent sensitivity for the detection of small amounts of actinides such as uranium, plutonium, and americium, as well as higher energy fission products and naturally-occurring radioisotopes, in a distributed source such as the human lung.

The large frontal area (>54 sq cm) of ACTINIDE-85 provides high geometrical detection efficiency and superior resolution performance in the lower energy range of actinides such as Pu, Am and U, below around 400 keV, while the crystal depth of 30 mm means good stopping power and excellent relative efficiency at higher energies. The excellent warranted energy resolution at 1.33 MeV, combined with exceptionally good peak shapes, means that the ACTINIDE-85 is the ideal detector solution for analysis of fission products as well.

In lung burden measurements, large diameter detectors allow better coverage of the lung; with ACTINIDE-85, critically important energy resolution is maintained. The special mechanical construction of the cryostat allows two, three, or four ACTINIDE-85 detectors to be placed very close to each other and in contact with the subject. This configuration gives the maximum possible detector efficiency for human lungs. The detector cryostat is made of selected and qualified low background material, based not only on radioactive background characteristics, but also on long-term reliability. The detector endcap is made of an ultra-low background, high-strength carbon fiber composite which provides greater than 85% transmission for photon energy above 15 keV and nearly 100% transmission for photon energy above 20 keV. To further assure and verify low background quality, each detector is placed inside a graded-Z shielding and a background spectrum is taken for 100,000 seconds after assembly. This spectrum is delivered with the detector.

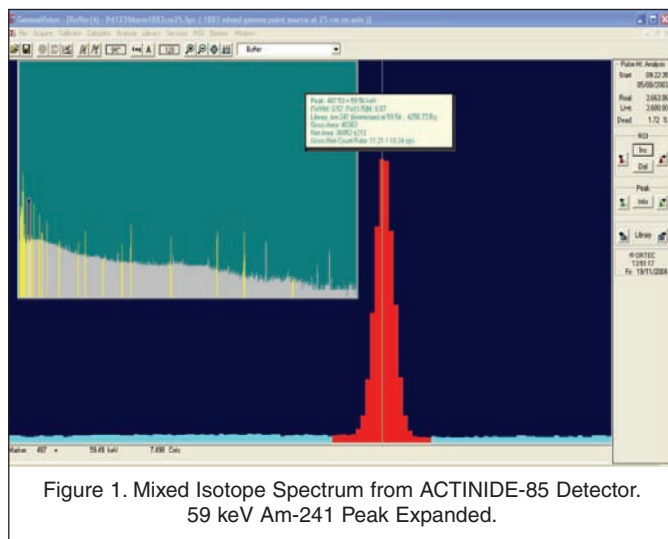


Figure 1. Mixed Isotope Spectrum from ACTINIDE-85 Detector.
59 keV Am-241 Peak Expanded.

Positioning

ORTEC ACTINIDE-85 detectors may be ordered in a variety of configurations to meet a variety of requirements for lung burden, body burden, and whole-body counting programs. ORTEC lung burden assessment systems allow independent detector positioning which provide for optimum detector placement and measurement efficiency. In general, positioning mechanisms should be made of carefully screened low-background materials and designed for ease of use and reliability.

Cryostat and Dewar

The standard ACTINIDE-85 is supplied with a 3.5L "high fill" dewar. Which provides a typical holding time of 48 hrs. A turn-key automatic LN₂ fill system is also available as an option.

ACT85-FILL Option

The ACT85-FILL option is an advanced, microprocessor-based solution designed to provide reliable level monitoring and control of LN₂. It is capable of supporting two ACTINIDE-85 detectors. If more than two detectors are to be used, multiple fill systems may be used. The unit operates by measuring sensor capacitance, which is directly related to the liquid level in the sensor. The system consists of the controller, sensors, and connecting coaxial cables. Cryogenic solenoid valves operated by the controller are included. All calibration data is password protected to prevent unauthorized modification and is stored in non-volatile memory. In most cases, factory calibration is included, but for highest accuracy the system can be field calibrated after installation is complete.

The ACT85-FILL system is supplied complete, except for the bulk LN₂ storage tank. It comprises

AMI model 286 Multi-Channel LN ₂ Level Controller	Qty 1
Flow-Through LN ₂ Level Sensor	Qty 2
Cryogenic Solenoid Valve	Qty 2
Safety Pressure Relief Valve	Qty 2
Flexible Vacuum Jacketed LN ₂ Transfer Line	Qty 2
Cryogenic Liquid Pressure Regulator	Qty 2

ACT85-FILL Operation Modes

Normal Mode utilizes two capacitance sensor inputs and allows these to operate independent control valve outputs to perform two basic auto-fill functions at the same time.

Auto-Changeover Mode allows the system to automatically switch from one supply storage cylinder to the next.

Pre-Cool Mode minimizes unwanted liquid boil-off in the target vessel at the start of an auto-fill cycle.

Further details available on request.

X-COOLER II Mechanical Cooling Option

The ORTEC X-COOLER II can be employed as an alternative to liquid nitrogen to cool the ACTINIDE-85 detector.

The use of LN₂ is costly, time consuming, and (of particular concern for lung burden assessment) is potentially hazardous. In addition, the presence of LN₂ can be intimidating to personnel. X-COOLER II is a proven, economical alternative to LN₂ for whole-body counting. It can be shown that the savings in LN₂ alone will mean that the investment in the X-COOLER II is recovered in a timescale as short as one year.

ACTINIDE-85

HPGe Lung Monitor Detector

Specifications

Model	Crystal Dimensions ¹		Energy Resolution (FWHM) ^{2,3}				Peak Shape ²			Nominal Relative Efficiency %	Endcap Diameter mm
	Diameter Nominal	Length Minimum	14.4 keV Warranted (eV)	46 keV Typical (eV)	@ 122 keV Warranted (eV)	@ 1.33 MeV Warranted (keV)	FW.1M/ FWHM Typical	FW.02M/ FWHM Typical	P:C Warranted		
ACT85	85	30	600	625	650	1.90	2.00	2.90	55	50	108

¹Smaller crystal dimensions are available. Contact your ORTEC Sales Representative or the Main Factory.

²FWHM = Full Width at Half Maximum; FW0.1M = Full Width at One-tenth Maximum; FW.02M = Full Width at One-Fiftieth Maximum; total system resolution for a source at 1000 counts per second measured in accordance with ANSI/IEEE Std. 325-1996, using ORTEC standard electronics.

³Measured at optimum shaping time using ORTEC analog or digital electronics.

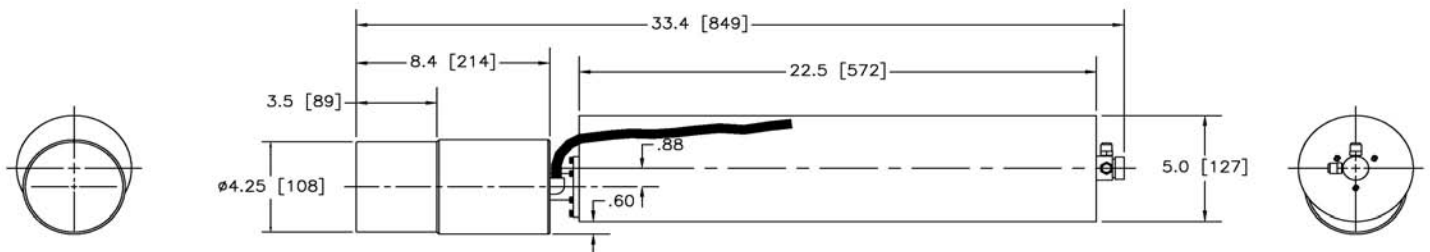
⁴The proprietary contact employed by the ACTINIDE-85 detector offers exceptionally high transmission at energies below 40 keV. Some instability in transmission may occur below 20 keV if stored uncooled at room temperature for extended periods of time (20–25°C or above). It is therefore recommended that the ACTINIDE-85 detector be kept cold, limiting the exposure to elevated ambient storage temperatures for applications which demand minimally varying efficiency below 20 keV.

Ordering Information

Model	Description
ACT85	ACTINIDE-85 detector, CFG-LB-GEM-GG low-background cryostat with Carbon Fiber endcap and DWR-3.5HF high-fill dewar
B/PFA-HF	Bayonet Pressure Fill Adapter for the DWR-3.5HF
ACT85-FILL	Complete Automatic Fill System and Level Monitor for up to two ACTINIDE-85 Detectors (requires storage dewar)
ACT85P4-RB	ACTINIDE-85 detector in reduced background PopTop capsule with Carbon Fiber endcap for use with X-COOLER II

Options

SMART-1-P	SMART-1 detector option for positive bias detector. To order, add SMART-1-P as a separate line item.
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3.5 Liter High Fill Dewar

PRELIMINARY PRINT
DIMENSIONS SUBJECT
TO CHANGE

FOR OPERATION TILTED NO MORE THAN 45° FROM VERTICAL.
NOMINAL 3.5 LITER LN2 CAPACITY

ACTINIDE-85

HPGe Lung Monitor Detector

Specifications subject to change
042208

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