Specifically designed to meet the demanding requirements of isotopic ratio software codes used in Safeguards and NDA.

Excellent resolution is maintained over a wide range of count rates, enhancing measurement flexibility.

Available in a full range of crystal diameters.

Extensive range of cryostats with multi-orientation dewar options for applications requiring portability.

Compatible with all existing Safeguards multichannel analyzers.

The precise measurement of isotopic ratios required in Safeguards and non-destructive assay (NDA) applications places a severe demand on the techniques of gamma-ray and x-ray spectroscopy. Figure 1 demonstrates the complexity of the 90–130 keV region of a typical Pu spectrum. The choice of energy region(s) for analysis depends specifically on the sample type and origin and the material matrix.

National laboratory software codes written to obtain highly accurate isotopic ratios, must deal with these spectra to analyze low-energy and/or high-energy regions in which groups of peaks are located close together. Each code requires exceptional system resolution and stability in order to achieve accurate unfolding of these regions.

Recent safeguards development trends have led to a growing requirement of isotopic ratio determinations involving higher energy gamma-rays. Such needs spring from the need to measure attenuated samples, such as those found in waste assay and in certain homeland security applications. Software codes such as FRAM and MGAHI can now determine Pu isotopic ratios from the higher energy regions of the spectrum. As a consequence, it is desirable to produce HPGe detectors that offer improved higher energy performance, while maintaining the excellent resolution characteristics required in such applications.

The ORTEC Safeguards series include both coaxial and planar geometry detectors, specifically designed to meet the demands of the applications software used for isotopic ratio determination, have been developed to strike an optimum balance between low-energy resolution and high-energy efficiency.

SGD planar detectors are compatible with ALL conventional MCA types, although optimum performance will be obtained when used with the ORTEC Digital Signal Processing Spectrometers.

All SGD planar detectors feature the following:

- Choice of fixed, portable, and custom cryostats, including the latest MOD multi-orientation dewar option.
- Robust aluminum endcap
- Streamline preamplifier assembly
- LN-Free option

The latest low-power resistive feedback preamplifier with “no ring” output, suitable for use with all existing types of MCA systems. Power consumption less than 25 mA at ±12 and ±24 V.

**Application Considerations**

For safeguards accountancy measurements involving the verification of declared materials values, the sample is usually presented in a pure form in a purpose-designed thin-walled container. This occurs with routine safeguards inspection programs, when a portable system is employed.
The Following Specifications are Provided for SGD Planar Detectors

- Active crystal diameter and depth.
- Energy resolution at 122 keV photons from $^{57}$Co at 1 kcps and optimum shaping time.
- Shape specifications for Full Width Tenth Maximum (FWTM) to Full Width Half Maximum (FWHM) and Full With Fiftieth Maximum (FWFM) to FWHM at <50 kcps for 122 keV photons from $^{57}$Co.
- SGD-16550P4 only: High rate specification of energy resolution at 122 keV photons from $^{57}$Co at 50 kcps with 1 µs shaping time.

Configuration Guidelines

PopTop or Streamline (non-PopTop) Configuration

The essence of a PopTop detector system is that the HPGe detector element, preamplifier, and high voltage filter are housed in a detector “capsule” which is then attached to an appropriate cryostat (Figure 2.)

In so called Streamline systems, the detector capsule is NOT demountable. Detector capsule and cryostat share the same vacuum. In configuration terms, this requires a cryostat or cryostat/dewar selection with the cryostat having a matching diameter to the capsule endcap. A cryostat must always be ordered with a Streamline capsule, because they are integral.

The actual PopTop capsule has its own vacuum. It can be mounted on any of the available cryostats, cryostat/dewar combinations, or the X-COOLER III mechanical cooling system.

Steps to Configure Your ORTEC HPGe Detector

1) Configure the Detector Model
   - Capsule type (PopTop or Streamline)
   - Crystal dimensions and specifications
   - Endcap and window
   - Mount
   - Preamplifier
   - Cable Package

Preamplifier options are available.

2) Configure the Cryostat/Dewar Model
   - Vertical Dipstick style (separate Dewar or Mobius Recycler)
   - Horizontal Dipstick style (separate Dewar or Mobius Recycler)
   - Portable with all-position or multi-position cryostat/dewar models
   - Downlooking designed to be oriented with the detector pointing down
   - Side-looking designed to be oriented with the detector horizontal at the bottom of the dewar
   - “J” configuration designed with the detector attached near the bottom of the dewar and a right angle bend in the cryostat orienting the detector to look up.

A cryostat and dewar or other cooling device are required for operation.

If a PopTop detector has been selected, you can choose a PopTop style cryostat, cryostat/dewar combination or the X-COOLER III mechanical cooling system.

If a Streamline detector has been selected, you must choose a cryostat or cryostat/dewar model for the detector to be mounted on and vacuum sealed. The cryostat or cryostat/dewar combination diameter must match the endcap diameter of the selected detector.

---

Specifically these codes are: FRAM from Los Alamos National Laboratory; MGA from Lawrence Livermore National Laboratory and TRIFID from Rocky Flats Plant.

MGAHI is now included in the MGA-B32 suite of software available from ORTEC.
Detector Options

SMART-1 Option (-SMN)

The SMART-1 option monitors and reports on vital system functions, and can save authentication codes and report the code at a later time. It has the high voltage included, so none of the instruments require an external high-voltage power supply.

The SMART-1 is housed in a rugged ABS molded plastic enclosure and is permanently attached to the detector endcap via a molded-strain-relieved sealed cable. This eliminates the possibility that the detector will suffer severe damage from moisture leaking into high-voltage connectors. The SMART-1 can be positioned in any convenient place and does not interfere with shielding or other mounting hardware.

SMART-1 Detector Interface Module.

Base Model (example) | PopTop or Streamline | High Voltage Option (if required) |
----------------------|----------------------|----------------------------------|
SGD-16550             | P4 (PopTop)          | -SMN                             |
                     | (Streamline)         |                                  |

Defining the Detector Model

• See ordering information for option compatibility.

SMART-1 Detector Interface Module.
High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay
Product Configuration Guide

Streamline Detector Capsule

PopTop Detector Capsule
Streamline Cryostat and Cryostat/Dewar Assemblies
Streamline systems (detector capsule and cryostat) share the same vacuum, requiring a cryostat or cryostat/dewar selection with the cryostat having a matching diameter to the capsule endcap.

- **Standard Cryostat** uses Molecular Sieve Pumping Agent.
- Diameter must match Endcap Diameter -70
- **Standard Dewars** are DWR-1.2G, 3.0G, 5.0G, MOD-3L, MOD-7L or 0.7-SHP-1

- **Optional Dewars** are DWR-30, DWR-30-OP and MOBIUS-ST

- **Standard Cryostat** uses Molecular Sieve Pumping Agent.
- Diameter must match Endcap Diameter -70
- **Standard Dewars** are DWR-7.5D, 13D, or 30D

- **Optional Dewars** are DWR-30, DWR-30-OP and MOBIUS-ST

- **Standard Cryostat** uses Molecular Sieve Pumping Agent.
- Diameter must match Endcap Diameter -70
- **Standard Dewars** are DWR-7.5B, 13B, 30B and MOBIUS-B

- **Optional Dewars** are DWR-30, DWR-30-OP and MOBIUS-ST
PopTop and Streamline Dimensional Data

Streamline systems (detector capsule and cryostat) share the same vacuum, requiring a cryostat or cryostat/dewar selection with the cryostat having a matching diameter to the capsule endcap. A cryostat must be ordered with a Streamline capsule.

The PopTop capsule features an internal vacuum arrangement. It can be mounted on any of the available PopTop cryostats, cryostat/dewar combinations, or the X-COOLER III mechanical cooling system.

The cryostat and dewar drawings that follow are to be used in conjunction with the accompanying tables of dimensions.

Note: Cryostat/Dewar drawings are NOT to scale, see tables that follow for complete dimensions.

Dimensions are for reference only and subject to change, if dimensional constraints are critical, contact the factory.
Note: Cryostat/Dewar drawings are NOT to scale, see tables that follow for complete dimensions.
Dimensions are for reference only and subject to change, if dimensional constraints are critical, contact the factory.
High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay
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Note: Cryostat/Dewar drawings are NOT to scale, see tables that follow for complete dimensions. Dimensions are for reference only and subject to change, if dimensional constraints are critical, contact the factory.
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Note: Cryostat/Dewar drawings are NOT to scale, see tables that follow for complete dimensions. Dimensions are for reference only and subject to change, if dimensional constraints are critical, contact the factory.

SGD Planar Detector Dimensions

- Dimensions are for reference only and subject to change.
- If dimensional constraints are critical, contact the factory.

<table>
<thead>
<tr>
<th>Dim.</th>
<th>Unit</th>
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<th>Streamline</th>
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<td>75</td>
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<td></td>
<td>(in)</td>
<td>(.01)</td>
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<td>C</td>
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<td>D</td>
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</table>
Gamma Gage and Side-Looking Dewar Dimensions

- Dimensions are for reference only and subject to change.
- If dimensional constraints are critical, contact the factory.

<table>
<thead>
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<th>Dim.</th>
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<td>(11.9)</td>
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<tr>
<td>R</td>
<td>mm</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<td>(0.4)</td>
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<tr>
<td>S</td>
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<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>(0.3)</td>
<td>(0.3)</td>
<td>(0.3)</td>
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<tr>
<td>T</td>
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<td>5</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>mm</td>
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<td>419</td>
</tr>
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<td></td>
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<td>(9.0)</td>
<td>(10.5)</td>
<td>(16.5)</td>
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</tbody>
</table>

Example Model Numbers

Streamline Configuration

| SGD-16550 | 16-mm diameter, 15-mm deep SGD planar detector with 70-mm diameter endcap. |
| SGDLP-16525-SMN | 16-mm diameter, 10-mm deep SGD GLP planar detector with 70-mm diameter endcap and SMART-1 preamplifier and high voltage supply. |

| CFG-1.2G | 1.2 liter all-position dewar for Gamma Gage cryostat. |
| CFP-3 | Portable Gamma Gage cryostat with 3 liter all-position dewar. |

| CFG-LP-GG-70 | Portable Gamma Gage cryostat with matching 70-mm diameter flange. |
| DWR-30 | 30 liter top port dewar that accepts “dipstick” style cryostats. |

PopTop Configuration

| SGD-16550P4-SMN | 16-mm diameter, 15-mm deep SGD planar detector with 70-mm diameter endcap and SMART-1 preamplifier and high voltage supply. |

| CFG-PG-3 | Portable Gamma Gage cryostat with 3 liter all-position dewar. |

| SGDLP-36585P4 | 36-mm diameter, 13-mm deep SGD GLP planar detector with 70-mm diameter endcap. |
| CFG-PD4-7.5 | Downlooking cryostat with 7.5 liter dewar. |
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Ordering Information
- For Streamline, remove the “P4” from the model number.
- Available with internal shielding, contact the factory for details.
- If dimensional considerations are critical, contact factory.
- Cryostat and dewar or other cooling device are not included with detector.
- Cryostat and dewar or other cooling device are required for operation.
- A cryostat must be ordered with a Streamline detector.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Active Diameter (mm)</th>
<th>Thickness (mm)</th>
<th>Warranted Resolution @122 keV</th>
<th>Warranted FW.1M/FWHM</th>
<th>Warranted FW.02M/FWHM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGD-16550P4</td>
<td>16</td>
<td>15</td>
<td>550 @ 1 kcps 6 µs 615 @ 50 kcps 1 µs</td>
<td>1.87 @ &lt;50 kcps 2.5 @ &lt;50 kcps</td>
<td></td>
</tr>
<tr>
<td>SGDGLP-06480P4</td>
<td>6</td>
<td>5</td>
<td>480 @ 1 kcps 6 µs</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>SGDGLP-10485P4</td>
<td>10</td>
<td>7</td>
<td>485 @ 1 kcps 6 µs</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>SGDGLP-16525P4</td>
<td>16</td>
<td>10</td>
<td>525 @ 1 kcps 6 µs</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>SGDGLP-25545P4</td>
<td>25</td>
<td>13</td>
<td>545 @ 1 kcps 6 µs</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>SGDGLP-32570P4</td>
<td>32</td>
<td>13</td>
<td>570 @ 1 kcps 6 µs</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>SGDGLP-36585P4</td>
<td>36</td>
<td>13</td>
<td>585 @ 1 kcps 6 µs</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

SGD Planar Detector Options
- -SMN SMART-1 detector option for negative bias detector, add “-SMN” to the model number.

SGD Planar PopTop Cryostats and Dewars

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFG-PD4-7.5</td>
<td>Down-looking Cryostat with 7.5-liter Dewar</td>
</tr>
<tr>
<td>CFG-PD4-13</td>
<td>Down-looking Cryostat with 13-liter Dewar</td>
</tr>
<tr>
<td>CFG-PD4-30</td>
<td>Down-looking Cryostat with 30-liter Dewar</td>
</tr>
<tr>
<td>CFG-PG4-1.2</td>
<td>Gamma Gage Cryostat with 1.2-liter Dewar</td>
</tr>
<tr>
<td>CFG-PG4-3</td>
<td>Gamma Gage Cryostat with 3-liter Dewar</td>
</tr>
<tr>
<td>CFG-PG4-5</td>
<td>Gamma Gage Cryostat with 5-liter Dewar</td>
</tr>
<tr>
<td>CFG-PH4</td>
<td>Horizontal Cryostat (Dipstick type). Choose DWR-30, DWR-30-OP, MOBIUS-PT or MOBIUS-PT-DET.</td>
</tr>
<tr>
<td>CFG-PMO4-3</td>
<td>Gamma Gage Cryostat with 3-liter Multi-Orientation Dewar</td>
</tr>
<tr>
<td>CFG-PMO4-7</td>
<td>Gamma Gage Cryostat with 7-liter Multi-Orientation Dewar</td>
</tr>
<tr>
<td>CFG-PS4-7.5</td>
<td>Side-Looking Cryostat with 7.5-liter Dewar</td>
</tr>
<tr>
<td>CFG-PS4-13</td>
<td>Side-Looking Cryostat with 13-liter Dewar</td>
</tr>
<tr>
<td>CFG-PS4-30</td>
<td>Side-Looking Cryostat with 30-liter Dewar</td>
</tr>
<tr>
<td>CFG-PS4-MOBIUS-B</td>
<td>Side-Looking Cryostat with Mobius Recycler 28-liter Dewar</td>
</tr>
<tr>
<td>CFG-PSPH4</td>
<td>Down-Looking Shallow-Hole Probe with 0.7-liter Dewar</td>
</tr>
<tr>
<td>CFG-PV4</td>
<td>Vertical Cryostat (Dipstick type). Choose DWR-30, DWR-30-OP, MOBIUS-PT or MOBIUS-PT-DET.</td>
</tr>
<tr>
<td>MOBIUS-PT</td>
<td>Mobius Recycer.</td>
</tr>
<tr>
<td>MOBIUS-PT-DET</td>
<td>Mobius Recycler 28-liter Dewar for purchase in combination with PopTop detector and vertical or horizontal dipstick cryostat.</td>
</tr>
<tr>
<td>DWR-30</td>
<td>30-liter Dewar</td>
</tr>
<tr>
<td>DWR-30-OP</td>
<td>30-liter Offset-Port Dewar</td>
</tr>
<tr>
<td>DWR-S/F</td>
<td>Storage Fill Dewar for CFG-PG4-X</td>
</tr>
<tr>
<td>CFG-X-COOL-III-115</td>
<td>X-COOLER III with PopTop connector using 110-120 V ac, 60 Hz Input Power</td>
</tr>
<tr>
<td>CFG-X-COOL-III-230</td>
<td>X-COOLER III with PopTop connector using 220-240 V ac, 50 Hz Input Power</td>
</tr>
</tbody>
</table>
SGD Planar Streamline Cryostats

- Dewar required. Select dewar from SGD Streamline Dewars.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFG-LP-GG-70</td>
<td>Gamma Gage Cryostat</td>
</tr>
<tr>
<td>CFG-LP-SD-70</td>
<td>Down-Looking Cryostat</td>
</tr>
<tr>
<td>CFG-LP-SH-70</td>
<td>Horizontal Cryostat (Dipstick type)</td>
</tr>
<tr>
<td>CFG-LP-SJ-70</td>
<td>J-type Cryostat</td>
</tr>
<tr>
<td>CFG-LP-SL-70</td>
<td>Side-Looking Cryostat</td>
</tr>
<tr>
<td>CFG-LP-SV-70</td>
<td>Vertical Cryostat (Dipstick type)</td>
</tr>
</tbody>
</table>

SGD Planar Streamline Dewars

<table>
<thead>
<tr>
<th>Cryostat</th>
<th>Model No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFG-LP-GG</td>
<td>DWR-1.2G</td>
<td>1.2-liter All-Orientation Dewar</td>
</tr>
<tr>
<td>CFG-LP-GG</td>
<td>DWR-3.0G</td>
<td>3.0-liter All-Orientation Dewar</td>
</tr>
<tr>
<td>CFG-LP-GG</td>
<td>DWR-5.0G</td>
<td>5.0-liter All-Orientation Dewar</td>
</tr>
<tr>
<td>CFG-LP-GG</td>
<td>DWR-MOD-3L</td>
<td>3-liter Multi-Orientation Dewar</td>
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<tr>
<td>CFG-LP-GG</td>
<td>DWR-MOD-7L</td>
<td>7-liter Multi-Orientation Dewar</td>
</tr>
<tr>
<td>CFG-LP-GG</td>
<td>DWR-0.7-SHP-G</td>
<td>0.7-liter Shallow-Hole Probe Dewar</td>
</tr>
<tr>
<td>CFG-LP-GG</td>
<td>DWR-S/F</td>
<td>Storage/Fill Dewar for DWR-XG</td>
</tr>
<tr>
<td>CFG-LP-SJ, SL</td>
<td>DWR-7.5B</td>
<td>7.5-liter Side-Looking Dewar</td>
</tr>
<tr>
<td>CFG-LP-SJ, SL</td>
<td>DWR-30B</td>
<td>30-liter Side-Looking Dewar</td>
</tr>
<tr>
<td>CFG-LP-SJ, SL</td>
<td>MOBIUS-B</td>
<td>Möbius Recycler 28-liter Side-Looking Dewar</td>
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<tr>
<td>CFG-LP-SD</td>
<td>DWR-7.5D</td>
<td>7.5-liter Down-Looking Dewar</td>
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<td>CFG-LP-SD</td>
<td>DWR-13D</td>
<td>13-liter Down-Looking Dewar</td>
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<td>CFG-LP-SD</td>
<td>DWR-30D</td>
<td>30-liter Down-Looking Dewar</td>
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<tr>
<td>CFG-LP-SV, SH</td>
<td>DWR-30-OP</td>
<td>30-liter Offset-Port Dewar</td>
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<tr>
<td>CFG-LP-SV, SH</td>
<td>DWR-30</td>
<td>30-liter Dewar</td>
</tr>
<tr>
<td>CFG-LP-SV, SH</td>
<td>MOBIUS-ST</td>
<td>Möbius Recycler 28-liter Dewar for purchase stand alone</td>
</tr>
<tr>
<td>CFG-LP-SV, SH</td>
<td>MOBIUS-ST-DET</td>
<td>Möbius Recycler 28-liter Dewar for purchase in combination with Detector</td>
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