

- 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<sup>1</sup> 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 PC/FRAM and MGAHI<sup>2</sup> 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<sub>2</sub>-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  $\pm 12$  and  $\pm 24$  V.

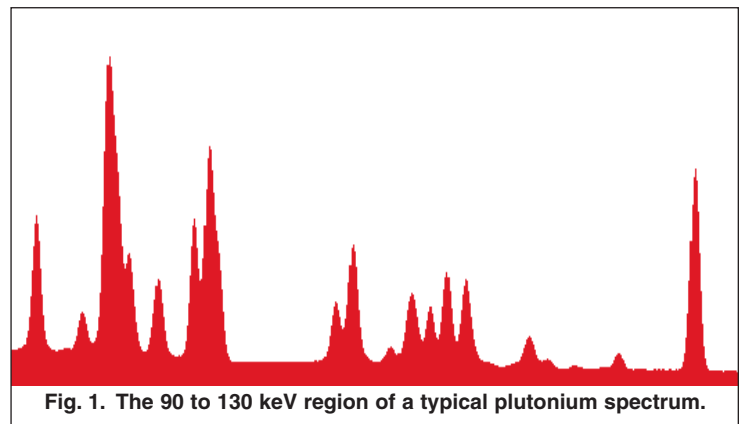


Fig. 1. The 90 to 130 keV region of a typical plutonium spectrum.

# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

## 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  $^{57}\text{Co}$  at 1 kcps and optimum shaping time.
- Shape specifications for Full Width Tenth Maximum (FWTM) to Full Width Half Maximum (FWHM) and Full Width Fiftieth Maximum (FWFM) to FWHM at <50 kcps for 122 keV photons from  $^{57}\text{Co}$ .
- SGD-16550P4 only: High rate specification of energy resolution at 122 keV photons from  $^{57}\text{Co}$  at 50 kcps with 1  $\mu\text{s}$  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 II mechanical cooling system.

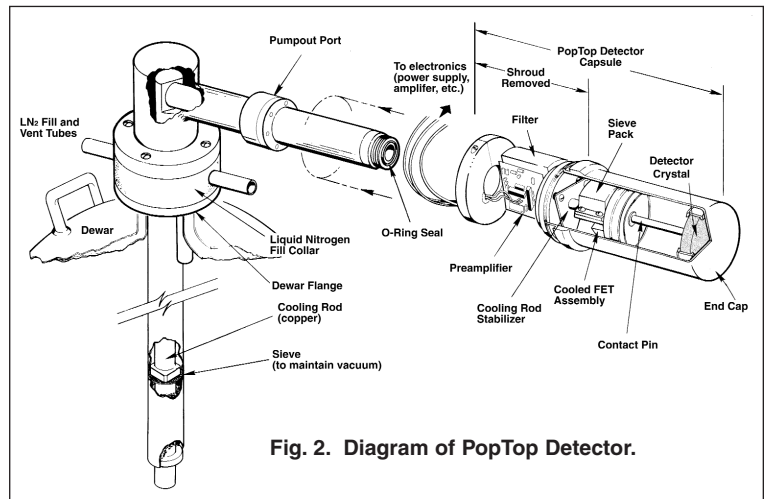


Fig. 2. Diagram of PopTop Detector.

## 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
- High Voltage Filter
- Cable Package

Preamplifier options are available.

<sup>1</sup>Specifically these codes are: FRAM from Los Alamos National Laboratory; MGA from Lawrence Livermore National Laboratory and TRIFID from Rocky Flats Plant.

<sup>2</sup>MGAHI is now included in the MGA-B32 suite of software available from ORTEC.

# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

## 2) Configure the Cryostat/Dewar Model

- Vertical Dipstick style (separate Dewar)
- Horizontal Dipstick style (separate Dewar)
- Portable with all-position or multi-position cryostat/dewar models
- Downlooking designed to be oriented with the detector pointing down
- Sidelooking 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 II mechanical cooler.

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.

## 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.**

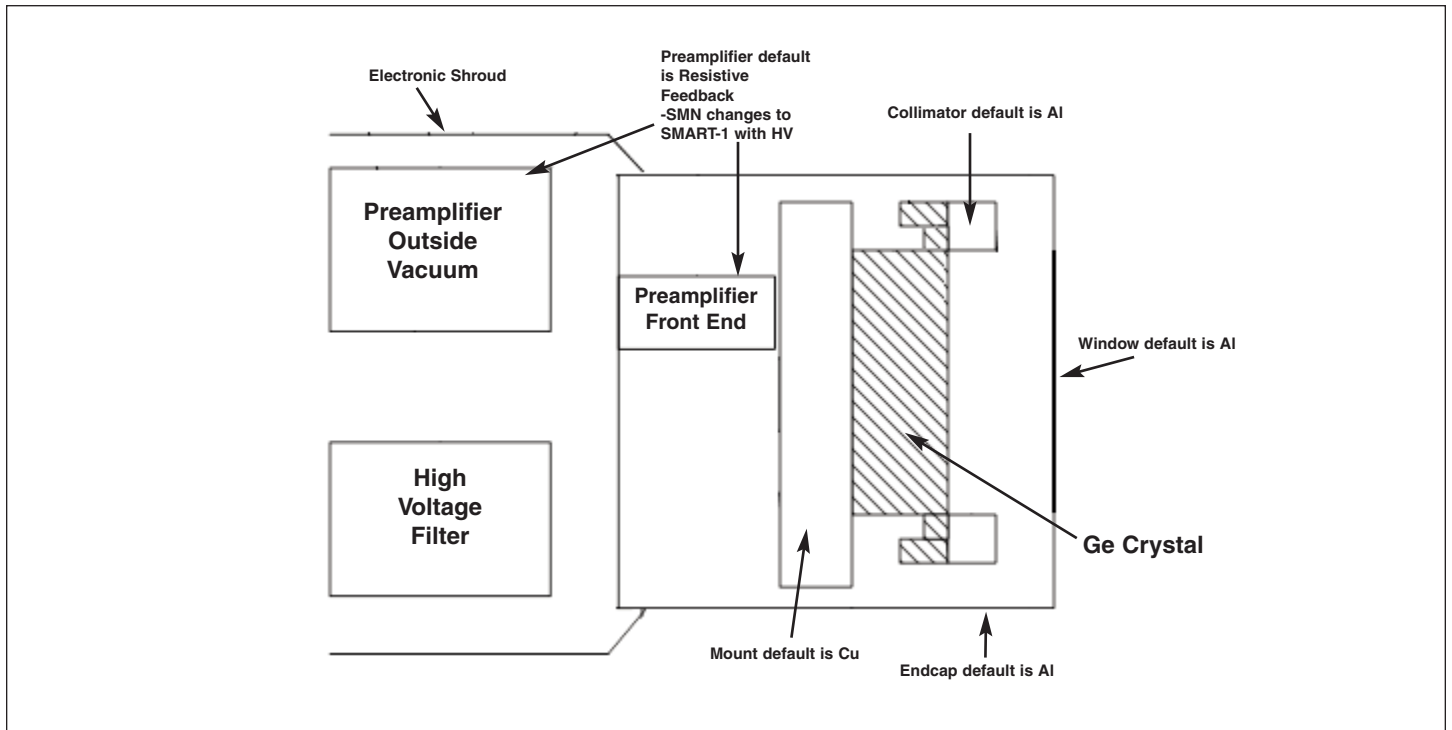
## Defining the Detector Model

- See ordering information for option compatibility.

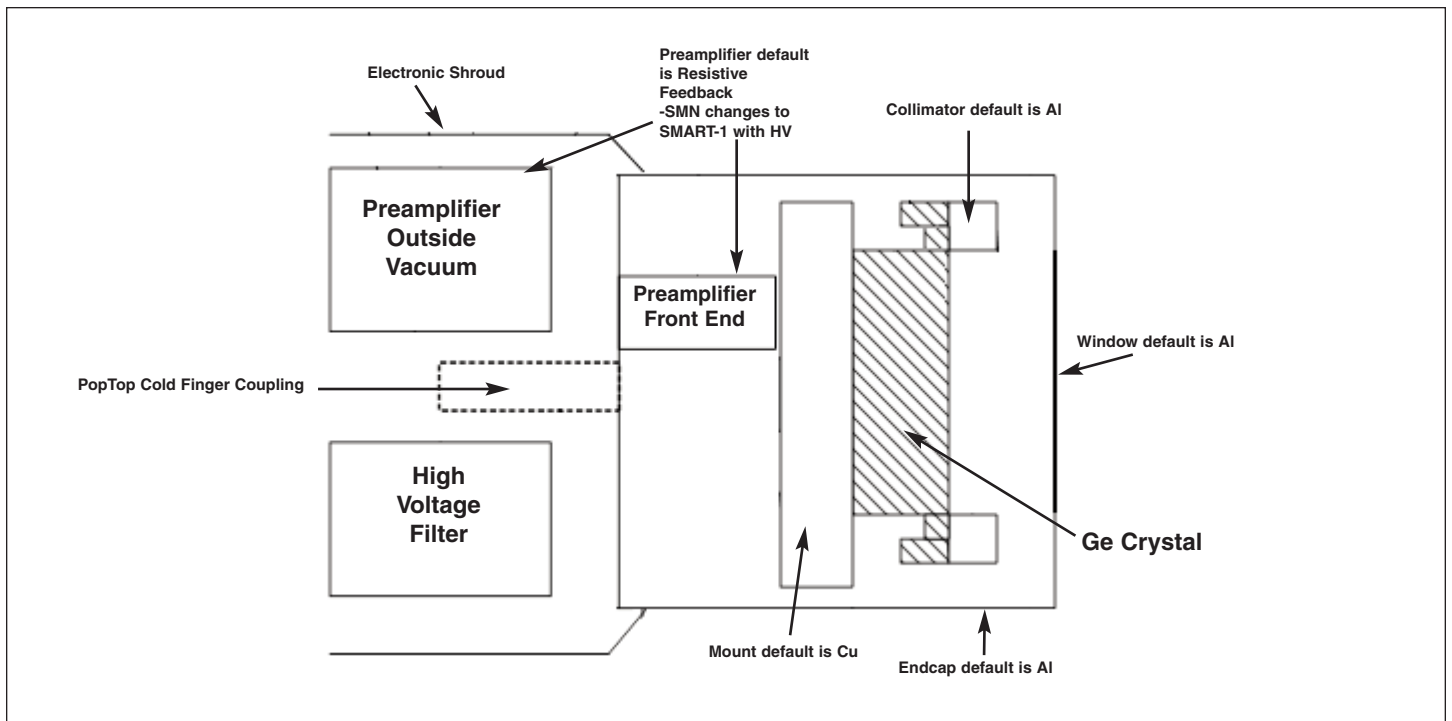
Base Model (example)	PopTop or Streamline	High Voltage Option (if required)
SGD-16550	P4 (PopTop) (Streamline)	-SMN

# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

## Streamline Detector Capsule



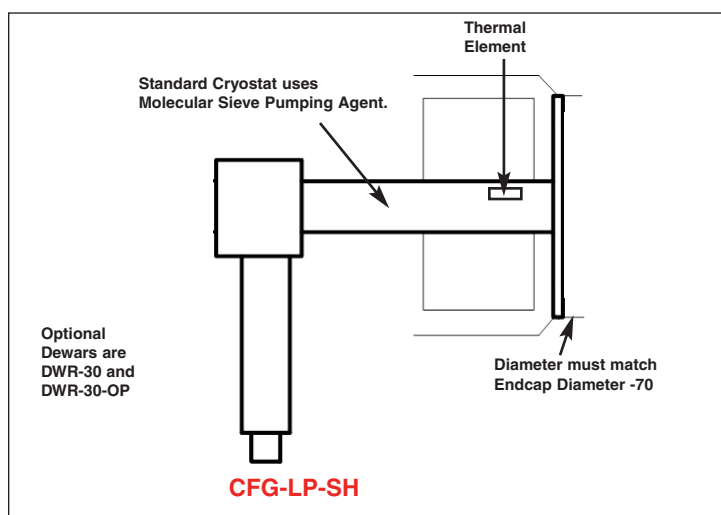
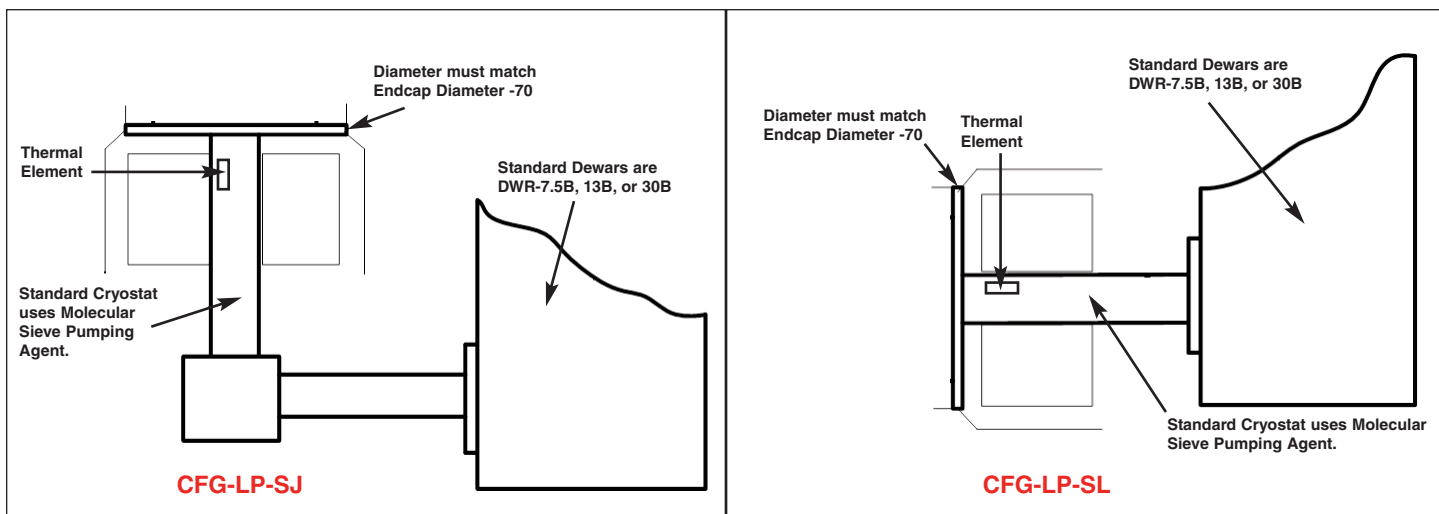
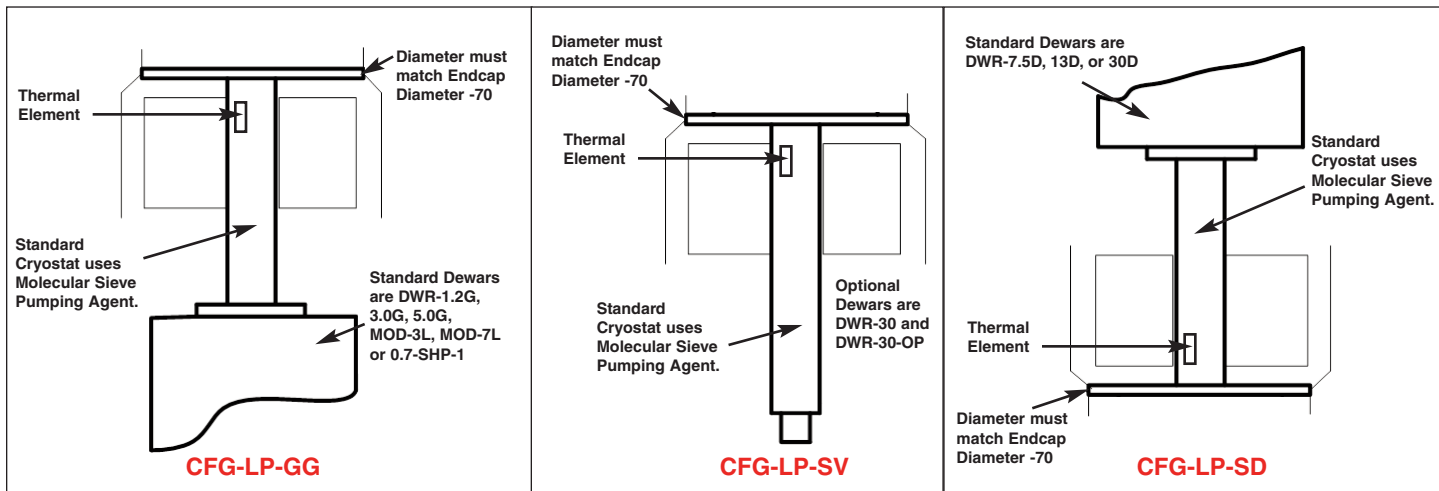
## PopTop Detector Capsule



# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

## 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.



# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

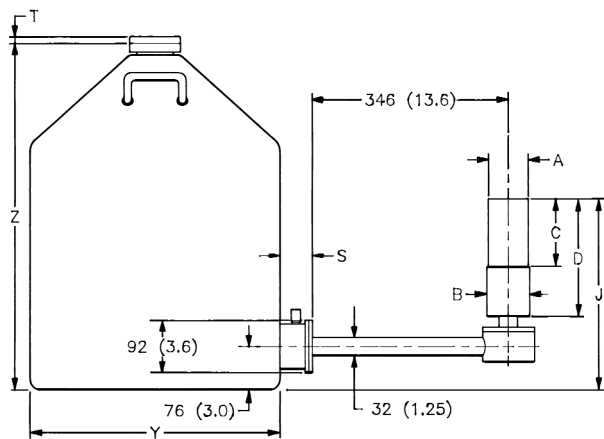
## PopTop and Streamline Dimensional Data

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.

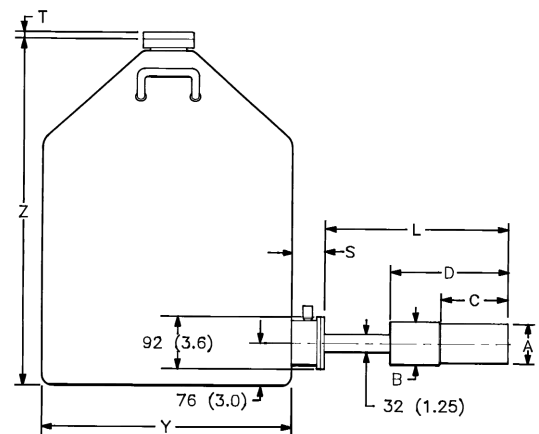
The PopTop capsule contains a vacuum unto itself. It can be mounted on any of the available cryostats, cryostat/dewar combinations, or the X-COOLER II mechanical cooling system.

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

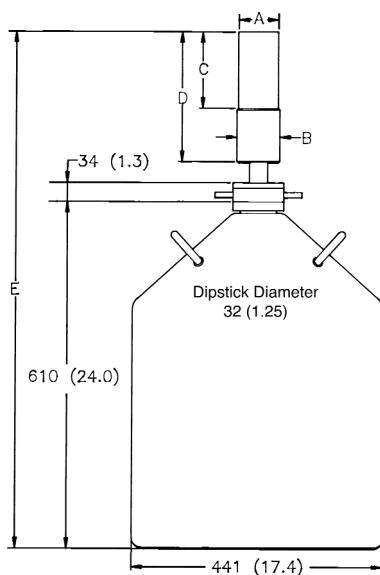
**Note: Cryostat/Dewar drawings are NOT to scale, see tables that follow for complete dimensions.**



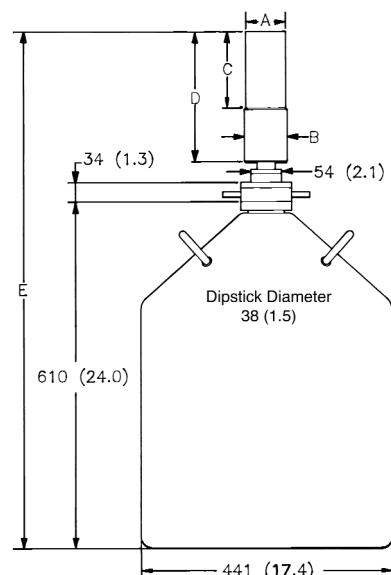
**CFG-LP-SJ, DWR-30B (or -13B or -7.5B)**



**CFG-PS4-30 (or -13 or -7.5)  
or  
CFG-LP-SL, DWR-30B (or -13B or -7.5B)**



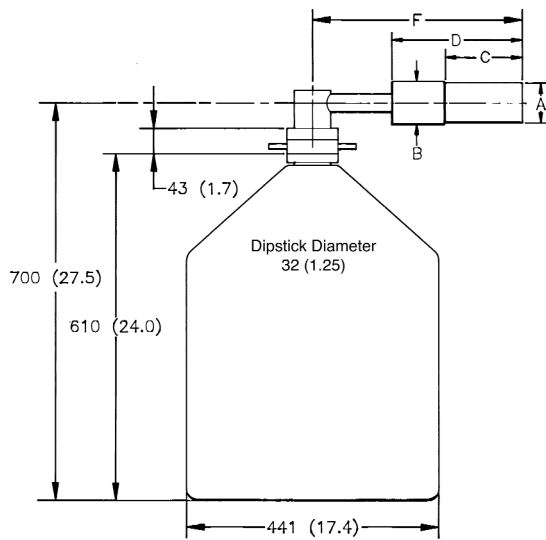
**CFG-LP-SV, DWR-30**



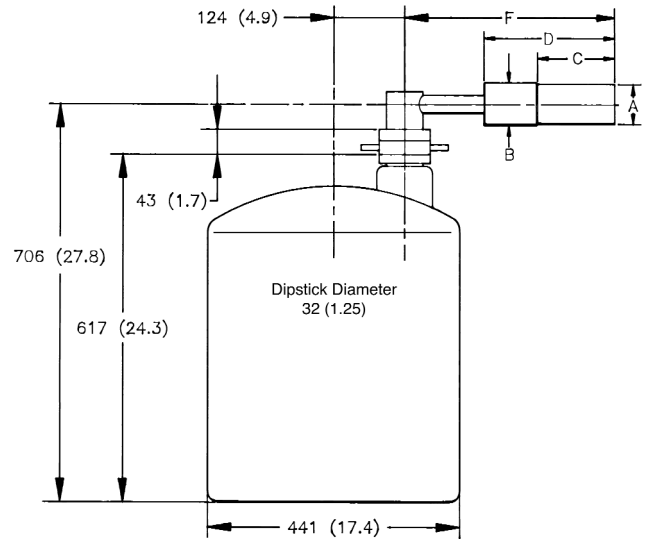
**CFG-PV4, DWR-30**

# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

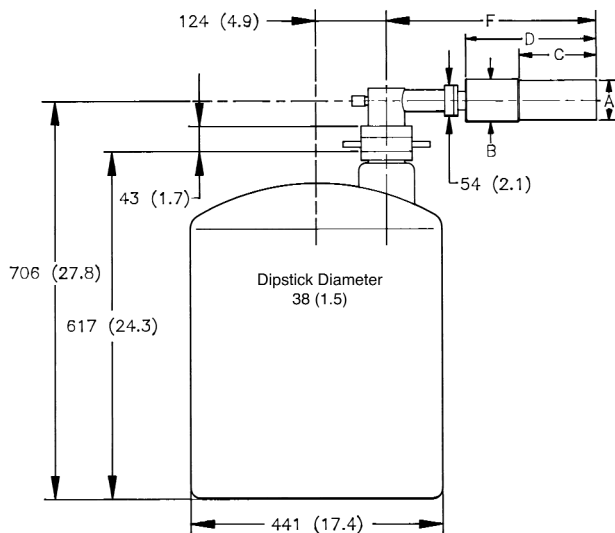
Note: Cryostat/Dewar drawings are NOT to scale, see tables that follow for complete dimensions.



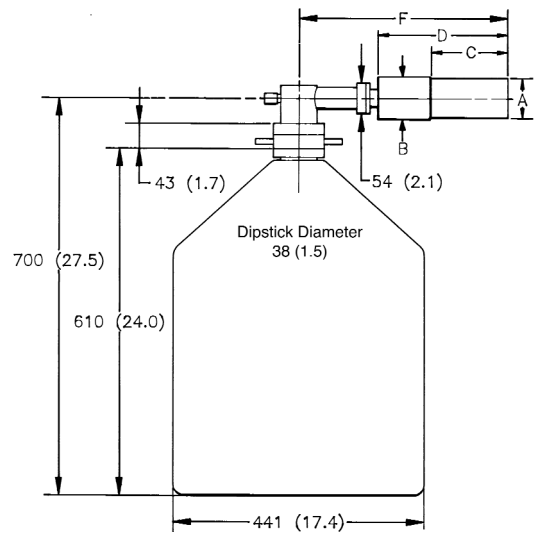
**CFG-LP-SH, DWR-30**



**CFG-LP-SH, DWR-30-OP**



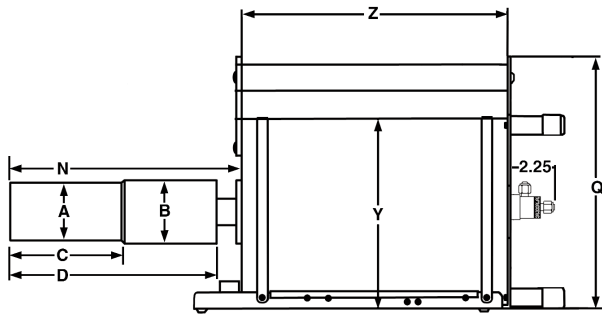
**CFG-PH4, DWR-30-OP**



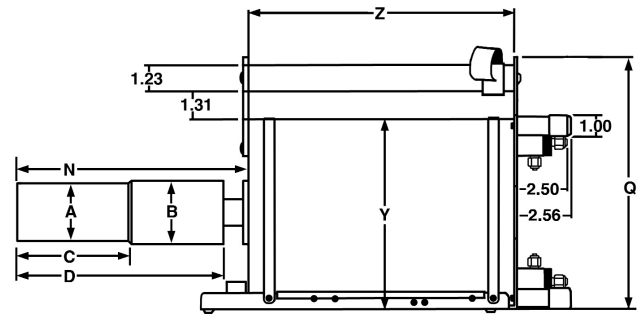
**CFG-PH4, DWR-30**

# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

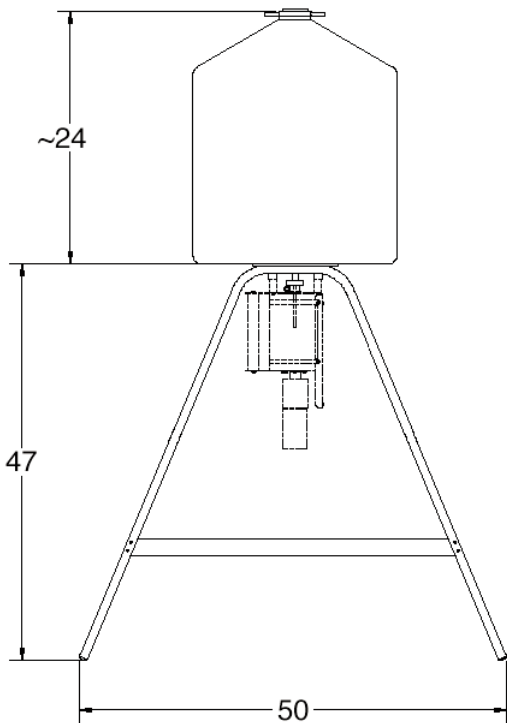
Note: Cryostat/Dewar drawings are NOT to scale, see tables that follow for complete dimensions.



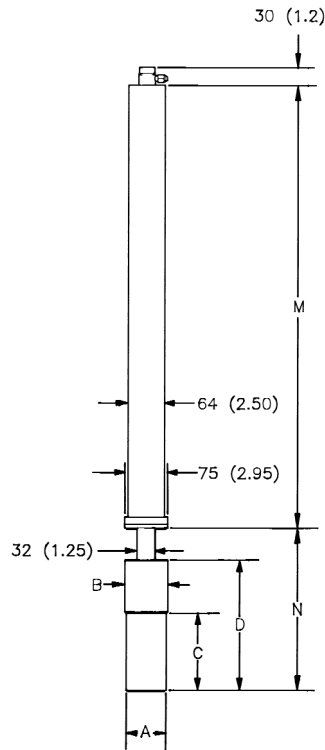
**CFG-PG4-1.2 (or -3 or -5)  
or  
CFG-LP-GG, DWR-1.2G (or -3.0G, -5.0G)**



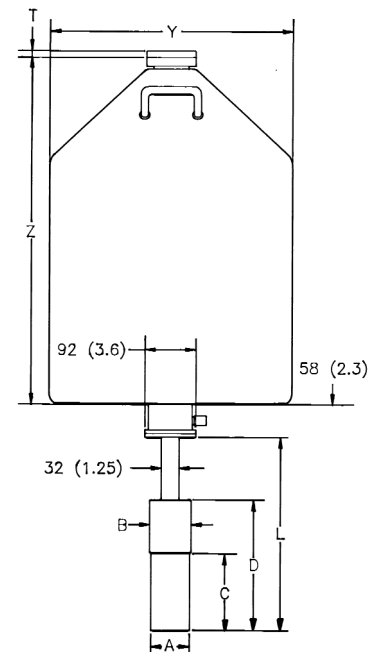
**CFG-PMOD4-3 (or -7)  
or  
CFG-LP-GG, DWR-MOD3L (or -MOD7L)**



**DWR-S/F**



**CFG-PSHP4  
or  
CFG-LP-GG, DWR-0.7-SHP-1**



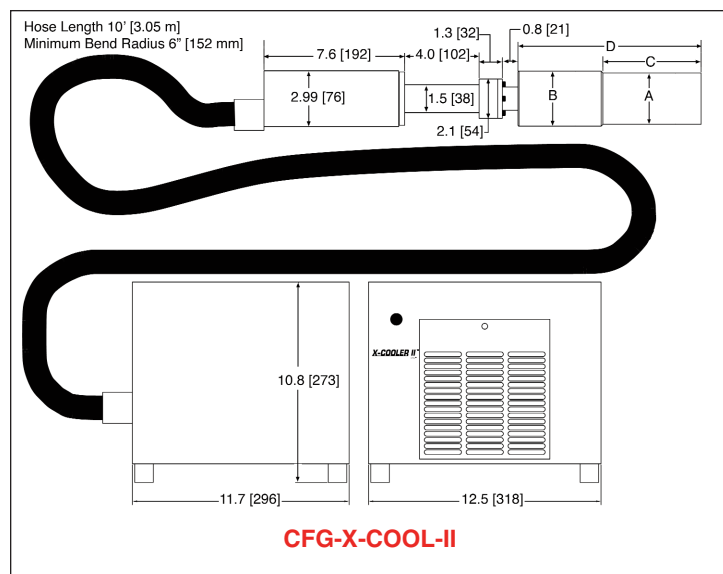
**CFG-PD4-30 (or -13 or -7.5)  
or  
CFG-LP-SD, DWR-30D (or -13D or -7.5D)**

# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

## SGD Planar Detector Dimensions

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

Dim.	Unit	Tol.	PopTop	Streamline
A	mm (in)	0.3 (0.01)	70 (2.75)	70 (2.75)
B	mm (in)	0.3 (0.01)	75 (2.95)	75 (2.95)
C	mm (in)	5 (0.2)	135 (5.3)	71 (2.8)
D	mm (in)	8 (0.3)	250 (9.8)	182 (7.2)
E	mm (in)	8 (0.3)	947 (47.3)	854 (33.6)
F	mm (in)	18 (0.7)	396 (15.6)	305 (12.0)
J	mm (in)	10 (0.4)	X X	318 (12.5)
L	mm (in)	18 (0.7)	338 (13.3)	274 (10.8)
M	mm (in)	10 (0.4)	790 (31.1)	X X
N	mm (in)	8 (0.3)	278 (10.9)	215 (8.5)



## Gamma Gage and Side-Looking Dewar Dimensions

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

			Cryostat/Dewar or Dewar Type							
			CFG-PG4 and DWR-x.xG			CFG-PMOD4 and DWR-MOD-xL		CFG-PS4, CFG-PD4, DWR-xxB and DWR-xxD		
			VOLUME			VOLUME		VOLUME		
Dim.	UNIT	TOL. ±	1.2L	3L	5L	3L	7L	7.5L	13L	30L
Q	mm (in)	13 (0.5)	229 (9.0)	302 (11.9)	302 (11.9)	229 (9.0)	302 (11.9)	X X	X X	X X
R	mm (in)	10 (0.4)	X X	X X	X X	X X	X X	174 (6.9)	174 (6.9)	155 (6.1)
S	mm (in)	7.6 (0.3)	X X	X X	X X	X X	X X	77 (3.0)	77 (3.0)	60 (2.3)
T	mm (in)	5 (0.2)	X X	X X	X X	X X	X X	10 (0.4)	10 (0.4)	13 (0.5)
Y	mm (in)	5 (0.2)	157 (6.2)	229 (9.0)	229 (9.0)	157 (6.2)	229 (9.0)	224 (8.8)	307 (12.1)	442 (17.4)
Z	mm (in)	5 (0.2)	229 (9.0)	267 (10.5)	419 (16.5)	292 (11.5)	320 (12.6)	452 (17.8)	429 (16.9)	610 (24.0)

# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

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## Example Model Numbers

### Streamline Configuration

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SGD-16550	16-mm diameter, 15-mm deep SGD planar detector with 70-mm diameter endcap.
CFG-LP-GG-70	Portable Gamma Gage cryostat with matching 70-mm diameter flange.
DWR-1.2G	1.2 liter all-position dewar for Gamma Gage cryostat.
SGDGLP-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-LP-SV-70	Vertical “dipstick” style cryostat with matching 70-mm diameter flange.
DWR-30	30 liter top port dewar that accepts “dipstick” style cryostats.

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### PopTop Configuration

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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.
SGDGLP-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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# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

## 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.

Model No.	Active Diameter (mm)	Thickness (mm)	Warranted Resolution @122 keV	Warranted FW.1M/FWHM	Warranted FW.02M/FWHM
SGD-16550P4	16	15	550 @ 1 kcps 6 $\mu$ s 615 @ 50 kcps 1 $\mu$ s	1.87 @ <50 kcps	2.5 @ <50 kcps
SGDGLP-06480P4	6	5	480 @ 1 kcps 6 $\mu$ s	N/A	N/A
SGDGLP-10485P4	10	7	485 @ 1 kcps 6 $\mu$ s	N/A	N/A
SGDGLP-16525P4	16	10	525 @ 1 kcps 6 $\mu$ s	N/A	N/A
SGDGLP-25545P4	25	13	545 @ 1 kcps 6 $\mu$ s	N/A	N/A
SGDGLP-32570P4	32	13	570 @ 1 kcps 6 $\mu$ s	N/A	N/A
SGDGLP-36585P4	36	13	585 @ 1 kcps 6 $\mu$ s	N/A	N/A

## 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

- Dewar included except where marked \*.

Model No.	Description
CFG-PD4-7.5	Down-looking Cryostat with 7.5-liter Dewar
CFG-PD4-13	Down-looking Cryostat with 13-liter Dewar
CFG-PD4-30	Down-looking Cryostat with 30-liter Dewar
CFG-PG4-1.2	Gamma Gage Cryostat with 1.2-liter Dewar
CFG-PG4-3	Gamma Gage Cryostat with 3-liter Dewar
CFG-PG4-5	Gamma Gage Cryostat with 5-liter Dewar
CFG-PH4	Horizontal Cryostat (Dipstick type). Includes LNTC1.5WH. Dewar not included.* Choose DWR-30 or DWR-30-OP.
CFG-PMOD4-3	Gamma Gage Cryostat with 3-liter Multi-Orientation Dewar
CFG-PMOD4-7	Gamma Gage Cryostat with 7-liter Multi-Orientation Dewar
CFG-PS4-7.5	Side-Looking Cryostat with 7.5-liter Dewar
CFG-PS4-13	Side-Looking Cryostat with 13-liter Dewar
CFG-PS4-30	Side-Looking Cryostat with 30-liter Dewar
CFG-PSHP4	Down-Looking Shallow-Hole Probe with 0.7-liter Dewar
CFG-PV4	Vertical Cryostat (Dipstick type). Includes LNTC1.5WH. Dewar not included.* Choose DWR-30 or DWR-30-OP.
DWR-30	30-liter Dewar
DWR-30-OP	30-liter Offset-Port Dewar
DWR-S/F	Storage Fill Dewar for CFG-PG4-X
CFG-X-COOL-II-115	X-COOLER II with PopTop connector using 110-120 V ac, 60 Hz Input Power
CFG-X-COOL-II-230	X-COOLER II with PopTop connector using 220-240 V ac, 50 Hz Input Power

# High-Performance Germanium Planar Detectors for Safeguards and Non-Destructive Assay Product Configuration Guide

## SGD Planar Streamline Cryostats

• Select dewar from SGD Streamline Dewars. Dewar included except where marked\*.

Model No.	Description
CFG-LP-GG-70	Gamma Gage Cryostat Dewar
CFG-LP-SD-70	Down-Looking Cryostat with Dewar
CFG-LP-SH-70	Horizontal Cryostat (Dipstick type). Includes LNTC1.25WH. Dewar not included.*
CFG-LP-SJ-70	J-type Cryostat with Dewar
CFG-LP-SL-70	Side-Looking Cryostat with Dewar
CFG-LP-SV-70	Vertical Cryostat with (Dipstick type). Includes LNTC1.25WH. Dewar not included.*

## SGD Planar Streamline Dewars

For Cryostat	Choose	Description	
CFG-LP-GG	DWR-1.2G	1.2-liter All-Orientation Dewar	Included with Cryostat
	DWR-3.0G	3.0-liter All-Orientation Dewar	Included with Cryostat
	DWR-5.0G	5.0-liter All-Orientation Dewar	Included with Cryostat
	DWR-MOD-3L	3-liter Multi-Orientation Dewar	Included with Cryostat
	DWR-MOD-7L	7-liter Multi-Orientation Dewar	Included with Cryostat
	DWR-0.7-SHP-1	0.7-liter Shallow-Hole Probe Dewar	Included with Cryostat
CFG-LP-SJ, SL	DWR-S/F	Storage/Fill Dewar for DWR-XG	
	DWR-7.5B	7.5-liter Side-Looking Dewar	Included with Cryostat
	DWR-13B	13-liter Side-Looking Dewar	Included with Cryostat
CFG-LP-SD	DWR-30B	30-liter Side-Looking Dewar	Included with Cryostat
	DWR-7.5D	7.5-liter Down-Looking Dewar	Included with Cryostat
	DWR-13D	13-liter Down-Looking Dewar	Included with Cryostat
CFG-LP-SV, SH	DWR-30D	30-liter Down-Looking Dewar	Included with Cryostat
	DWR-30-OP	30-liter Offset-Port Dewar	
	DWR-30	30-liter Dewar	

Specifications subject to change  
083011

**ORTEC**<sup>®</sup>

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