



GR1 Family

Compact CZT Spectrometer



Compact high-resolution gamma ray detection and nuclide identification

KEY FEATURES

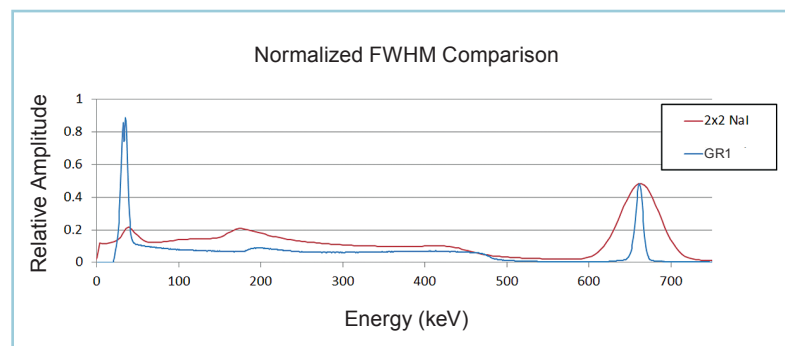
- All-in-one detector, electronics, and MCA
- Pre-set Gain, 1 cm³ CZT solid state detector
- Miniaturized package: 25 x 25 x 63 mm, 60 g
- Optional Generic ISOCS™ characterization available
- USB connection to PC for control and power
- Power consumption: <250 mW
- Optional I/O ports for energy and timing outputs and gate inputs
- Interface to Genie™ 2000 software for spectral analysis
- Optional compact shield/collimator assembly and tripod/carrying case kit

DESCRIPTION

The GR1 family offers high performance gamma spectroscopy in a compact, fully-integrated package. Designed for both laboratory and field use, this unit contains a preamplifier, shaping amplifier, baseline restorer, HV supply and MCA. The advanced signal electronics requires no cooling and provides ready access to spectroscopy data over the mini-USB port. The power consumption is less than 250 mW, so no external power is required. This makes the GR1 ideal for many portable spectroscopy applications where size, weight and power constraints are very important.

The 1 cm³ CZT detector provides gamma spectra with significantly improved FWHM resolution as compared to NaI scintillators. This greatly improves the identification capability for many important isotopes (such as Thorium and Radium daughters in the background) with closely spaced gamma lines.

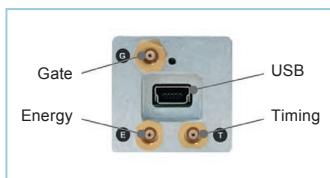
The GR1 family includes four models, each with a 1 cm³ CZT solid state detector. The GR1 and GR1+ are provided in a clean rectangular package, with no external signal connectors (only the mini USB connector). The “+” designation provides an option for a higher performance detector (better FWHM resolution; see chart for details).



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The GR1-A and GR1-A+ are provided in the same rectangular package as the GR1, except that three MCX connectors are also included to allow access to the energy and timing signals as well as an input gate. These signals allow the units to be tailored for specific applications in nuclear research and academia.

Energy Output: shaped and buffered detector output pulses with amplitude proportional to energy suitable as input to an external multichannel analyzer (MCA).



GR1-A with connectors

Timing Output: logic pulse triggered by each detected event and coincident with each output pulse.

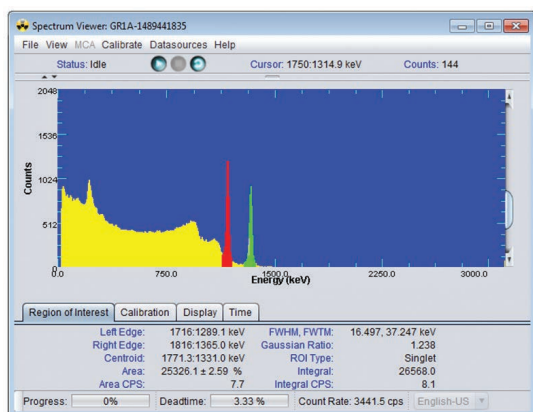
Gate Input: used to suppress pulse height output via the USB interface for anticoincidence. Energy and timing outputs are unaffected.

The standard models have resolution at 662 keV of <2.5%. The Plus models have enhanced resolution at 662 keV of <2.0%. These options allow you to match your photopeak resolution requirements to your budget. Otherwise, the standard and Plus models are the same.

GR1 Family Variants	Detector Size mm	Resolution at 662 keV	USB	Gate Input	Timing Output	Energy Output
GR1	10 x 10 x 10	<2.5%	✓	–	–	–
GR1+	10 x 10 x 10	<2.0%	✓	–	–	–
GR1-A	10 x 10 x 10	<2.5%	✓	✓	✓	✓
GR1-A+	10 x 10 x 10	<2.0%	✓	✓	✓	✓

S545C: Genie Bridge Spectrum Viewer

Genie Bridge Spectrum Viewer is the ideal way for Mirion customers to use the GR1 and SIGMA family probes as it provides easy access to Genie 2000 and ISOCS efficiency calibrations. This light-weight application allows users to connect to the detector and acquire a spectrum, and then export it to Genie 2000 for analysis.



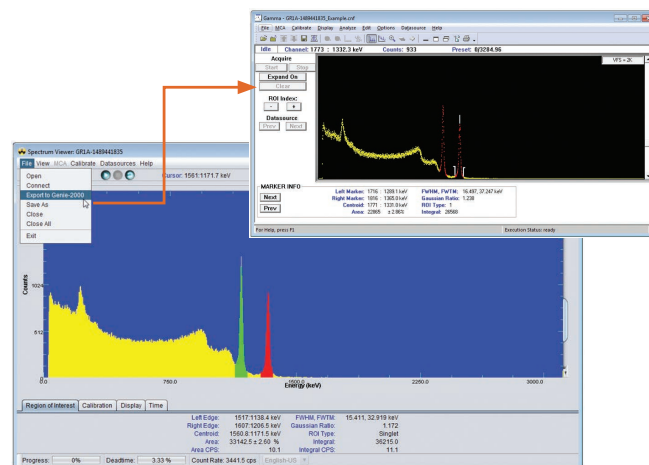
Device Connection: Connecting to a detector is extremely easy. Simply insert the detector's USB connection cable into the computer's USB port and launch the Genie Bridge application. Select *File*, then *Connect*, and choose the detector from drop down list of Discovered Devices. Then start acquiring!

Device Configuration: The user can also adjust the lower level discriminator (LLD) to reduce low end noise and apply an energy or shape calibration. All other settings are preconfigured in the device itself, so no other adjustments or inputs are needed.

Spectrum Analysis & Export: Create an ROI in Genie Bridge Spectrum Viewer simply by dragging the mouse from left to right over a region. An ROI will automatically be created, and the data tab will update with metrics for the peak, such as: number of counts, centroid, FWHM, and more.

To analyze the spectrum, Export to Genie is done with just three clicks:

1. Select *File*, then *Export to Genie 2000*
2. Provide a spectrum name and *Save*
3. Genie is automatically opened with the spectrum loaded and ready for analysis



Genie Bridge Spectrum viewer is qualified on Windows® 7 x64 and Windows 10 x64 English operating systems. The application is provided on the Canberra™ website for free download, and also can be provided on a CD and shipped for a nominal price. Please note that S500, S502, or S504 Genie Basic Acquisition is required to be installed for Export to Genie 2000 functionality.

ISOCS/LabSOCS™ Support

Quantitative measurements can be performed without the use of calibration sources using the mathematical efficiency calibration software ISOCS/LabSOCS. The GR1 family supports ISOCS efficiency calibrations. This characterization permits the user to calculate mathematical efficiencies using either ISOCS or LabSOCS software (sold separately). The ISXCZT-GR1 is the generic ISOCS characterization for the GR1 detectors. This is applicable for the GR1, GR1+, GR1A and GR1A+. This characterization has accuracy of 18-20%. For more accurate characterization, a detector specific characterization can also be requested.

Software Options

There are two additional software options available to communicate with the GR1 family of sensors besides the S545C Genie Bridge Spectrum Viewer utility already mentioned.

GR1 Family Compact CZT Spectrometer

K-Spect Software

The K-Spect software can be downloaded free of charge from the Kromek website. It establishes communications with the GR1 enabling MCA control functions, spectrum acquisition, display, basic analysis and storage functions. Together, the GR1 and K-Spect software establish a basic gamma-ray spectroscopy system that is suitable for qualitative spectral inspection and ROI based gamma analysis.

Kromek SDK

The GR1 family of sensors is also supported by a software Kromek development kit (SDK). These software tools can be purchased from Mirion to allow end users to develop customized software applications to interact directly with the GR1. The tools provide complete setup and control of the key MCA functional parameters. The SDK supports both Windows and Linux-based systems. Some programming knowledge is required to implement this product.

GR1 Collimated Shield, Tripod and Carrying Case

GR1-SHIELD: Shield and Collimators for GR1 detector

The GR1 family is very well suited for *in-situ* applications requiring easy transport and setup in sometimes difficult operating environments. The GR1-Shield is a multi-purpose assembly that allows the effective shielding, collimation and positioning of any GR1 CZT Spectrometer. This solution includes shielding surrounding the sides and back and a versatile set of collimators for the front. The assembly provides a minimum of 2 cm Tungsten around the spectrometer to reduce background effects. The GR1 Shield can be used with any of the four models in the GR1 Family. The total weight of the complete shield assembly is 10.4 kg (23 lb).

The Shield Assembly has multiple collimation geometry options:

- Front shielding with a 35 mm diameter opening
- Reducing plugs that fit into the 35 mm diameter opening providing:
 - 8 mm diameter opening
 - 2 mm diameter opening
 - 0 mm diameter opening
- 180° opening (front shield plate with 35 mm opening removed)

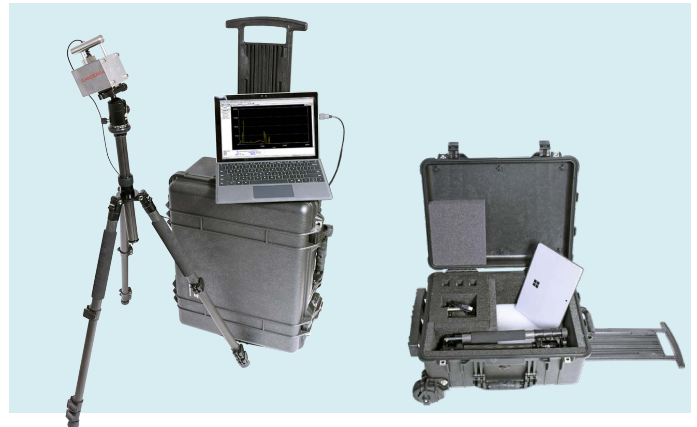


GR1-ACC: Tripod and carrying case for GR1-SHIELD

The heavy duty tripod is built from 8-layer carbon fiber to make it both lightweight and sturdy. The legs extend and lock in place with tabs that can be easily manipulated wearing gloves. The legs can be fully folded up and reversed to fit into a custom compartment in the carrying case.

There is a 1/4-20 threaded hole on the bottom of the shield to accept the tripod mounting screw.

The Shield Carrying Case will hold the GR1 with shield and collimator set, laptop computer, tripod and miscellaneous cables. It is a Pelican brand heavy duty case with custom internal molded foam to secure the heavy Tungsten items.



Features include:

- Integral 10.2 cm (4 in.) diameter x 3.8 cm (1.5 in.) wide heavy duty polyurethane wheels with stainless steel bearings
- Water resistant, crushproof and dust resistant
- Automatic pressure equalization valve and O-ring seal; keeps water out
- Retractable extension handle
- Overall Dimensions: 60.4 cm (23.8 in.) x 46.6 cm (18.3 in.) x 30.7 cm (12.1 in.)
 - Weight of case without components: 11 kg (24 lb)
 - Weight of case with all components: approximately 22 kg (50 lb).

SPECIFICATIONS

PERFORMANCE

- Detector Volume – 10 x 10 x 10 mm CZT detector.
- Energy Range – 30 keV to 3.0 MeV.
- Energy Resolution – <2.5% FWHM at 662 keV (Standard Models); <2.0% FWHM at 662 keV (Plus Models).
- Electronic Noise – < 10 keV.
- Maximum Recommended Throughput (USB) – 25,000 cps.
- Number of Channels – 4096 (12 bit).
- Differential Non-Linearity – <±1%.
- Integral Non-Linearity – <±0.02%.

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PHYSICAL

- Size – 25 x 25 x 63 mm (1 x 1 x 2.5 in.).
- Weight – 60 g (2.1 oz).

INPUTS/OUTPUTS

- Power – 250 mW.
- Mini-USB (all models) – Signal and Power (Power consumption: 250 mW).
- MCX Ports (“A” models only).
 - Energy Output – Rise time: 3 μ s; Decay time: 10 μ s; Output impedance: < 150 ohms; Maximum throughput (analog): 50,000 cps.
 - Timing Output – Shape: TTL compatible rectangular pulse; Amplitude: 5.0 V; Duration: 8 μ s; Output impedance: < 150 ohms; Timing Resolution: < 100 ns.
 - Gate Input – Threshold: 3 V; Maximum input voltage: 5 V; Input impedance: 10 kohms; Timing: Input must be above threshold from at least 0.5 μ s before the energy signal maximum to at least 2 μ s after it.

Note: In the absence of any connection the gate input is held low and all pulses are processed normally.

ENVIRONMENTAL

- Operating Temperature – 0 to 40 °C (32 to 104 °F).

COMPLIANCE STANDARDS

(Tested by the National Physical Laboratory)

- ANSI N42.31 (2003) “Measurement procedures for resolution and efficiency of wide-bandgap semiconductor detectors of ionizing radiation”.
- ANSI N42.34 (2006) Section 7.1 “Performance criteria for hand-held instruments for the detection and identification of radionuclides”.
- BS EN 62327:2011 Section 9.6 “Hand-held instruments for the detection and identification of radionuclides and for the indication of ambient dose equivalent rate from photon radiation”.
- NPL Good Practice Guide No. 14 “The examination, testing and calibration of portable radiation protection instruments”.
- Environmental: meets or exceeds: EN55011:1998 +A1:1999 +A2:2002 (Radiated Emissions), EN61000-4-2:1995 +A1:1998 + A2:2001 (Immunity to ESD), EN61000-4-3:2002 (Radiated Immunity).

ORDERING INFORMATION

GR1	Gamma-Ray Spectrometer with – 2.5% FWHM resolution at 662 keV – Without MCX I/O ports
GR1+	Gamma-Ray Spectrometer with – 2.0% FWHM resolution at 662 keV – Without MCX I/O ports
GR1-A	Advanced Gamma-Ray Spectrometer with – 2.5% FWHM resolution at 662 keV – With MCX I/O ports (includes 3x MCX to BNC adaptors)
GR1-A+	Advanced Gamma-Ray Spectrometer with – 2.0% FWHM resolution at 662 keV – With MCX I/O ports (includes 3x MCX to BNC adaptors)

Other Related Products

- ISXCZT-GR1 – Generic ISOCS Characterization for the GR1, GR1+, GR1-A or GR1-A+
- SIGMA25 – USB enabled CsI scintillator (1” x 1” x 1”) detector with integrated MCA
- ISXCSI25 – Generic ISOCS Characterization for the SIGMA25
- SIGMA50 – USB enabled CsI scintillator (1” x 1” x 2”) detector with integrated MCA
- ISXCSI50 – Generic ISOCS Characterization for the SIGMA50
- LAB CPG (10 x 10 x 10) – 1 cm³ CZT detector for use with external MCA electronics
- TN-15 – USB enabled Thermal Neutron Detector
- GR1-SHIELD – Shield and Collimators for GR1 detector
- GR1-ACC – Tripod and carrying case for GR1-SHIELD



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