

G3010-AGSS

Automated Gamma Spectroscopy System

Introduction

The ANTECH model G3010 Automated Gamma Spectroscopy System (AGSS) or automated sample changer is an effective solution for performing automated, unattended, high-resolution gamma spectroscopy (HRGS) measurements and analysis of bulk samples in a variety of sizes and types of containers such as Marinelli beakers.

The design draws on more than 20 years of collaboration with ORTEC® and is optimized for use with the ORTEC® range of high purity Germanium (HPGe) detectors, cryogenic systems and multi-channel analyzers, such as the ORTEC® DSPEC-50. The ANTECH automated sample changer design incorporates state-of-the-art technology including an Allen-Bradley® Programmable Logic Controller (PLC), servo drives and single cable motors with absolute encoders for robustness. Deploying modern and proven components provides a safe, low maintenance and highly reliable operational system.

Enhanced Productivity Features

- Fully automated for unattended system operation, minimizing operator labor and potential input errors
- Programmable scheduling system to optimize sample sequencing
- Advanced DC servo motors for high reliability, low maintenance and low noise levels negate the requirement for elaborate homing procedures
- Remote operation via Ethernet allows data to be viewed via and stored to any authorized networked PC
- Rapid changeover between sample batches and sample sizes;
- Integrated weigh-scale and barcode reader available as options

Key System Features

- Flexible design for a wide variety of sample sizes and container types
- Comprehensive choice of ORTEC® spectroscopic measurement and cooling systems
- Graded chamber for low measurement background
- Easy set-up for batch measurements and intuitive user interface for establishing a series of measurements
- Fully compliant to the European Machinery Directive and CE, the design is inherently safe with many in-built safety features, including: safe torque feature on drives; Allen-Bradley® Guardmaster® safety circuit to access door and interlocked electrical cabinet
- Embedded PC uses advanced, user-friendly software for scheduling and analysis, accessible either through remote desktop or direct connection
- Modern PC interface running ANTECH Gamma Sample Plus, advanced scheduling routines and rapid Ethernet/ USB interface with ORTEC® MCAs
- Enhanced operator access to both sample and measurement chambers
- Advanced measurement reporting formats



Fig 1. The ANTECH Model G3010-AGSS

Configuration

The AGSS utilizes an anodized extruded aluminum enclosure, which provides structural support for the 3-axis 'Pick and Place' system and acts as a safety barrier, ensuring safe automated operation of the system.

The upper level enclosure incorporates hinged, rigid 4 mm clear LEXAN™ (CE compliant strengthened polycarbonate) double door panels to provide visibility of the operating area and unobstructed access to the Marinelli beaker storage area. An additional LEXAN™ single door provides access to the measurement chamber.

The upper level doors are secured using Allen Bradley Magnetic safety switches to ensure safe operation and compliance with the European Safety Directives.

The lower level hinged opaque doors provide access to the inside of the sample changer which stores the detector, cryogenics system and multi-channel analyzer. Removable access panels are also provided to facilitate maintenance. The lower section of the AGSS houses the IP54 electrical enclosure and operator panel.



Fig 2. The ANTECH Model G3010-AGSS showing the higher and lower level access doors

Pick and Place Unit



Fig 3. Showing the 3 axes of the positioning system

The 3 axes of the positioning system incorporate precision linear slides, advanced servomotors and an industry-standard Allen-Bradley® closed-loop drive system. The shielded sample chamber top closure assembly is fully automated. Motors with absolute position encoders on each axis obviate the need for homing routines and software limits protect the system from over-travel.

A wide range of "sample" grippers are available for attachment to the vertical axis, from simple passive carriers to electrical grippers.

ANTECH can provide modifications to standard Marinelli beakers or cradles to encapsulate samples for passive carriers.

Measurement Chamber

The graded shielded measurement chamber consists of an epoxy-coated steel outer, 4-inches of virgin lead, with a tin and copper liner. It houses the HPGe detector and is sized to accept appropriate Marinelli beakers. A lead plug secures and locates the HPGe detector in the chamber base. The standard measurement chamber is based on the equivalent specification and dimensions of the ORTEC® model HPLB1-4B shielded measurement chamber.

The automated top closure employs the same graded shielded construction within a protective housing running on hardened rollers on a V-rail and flat track to optimize durability. Over-run protection is provided and the proximity sensors confirm the lid position to ensure safe and correct operation.

The measurement chamber and automated sliding lid mechanism are supported and positioned by an epoxy-coated steel support frame with an integrated leveling system. The base of the support frame provides a location for interchangeable trays to position either the hose from a cryogenic cooler (X-Cooler 3), a 30 liter liquid nitrogen Dewar, a Mobius condensing liquid nitrogen cooling system or an ICS (integrated cooling system) unit.

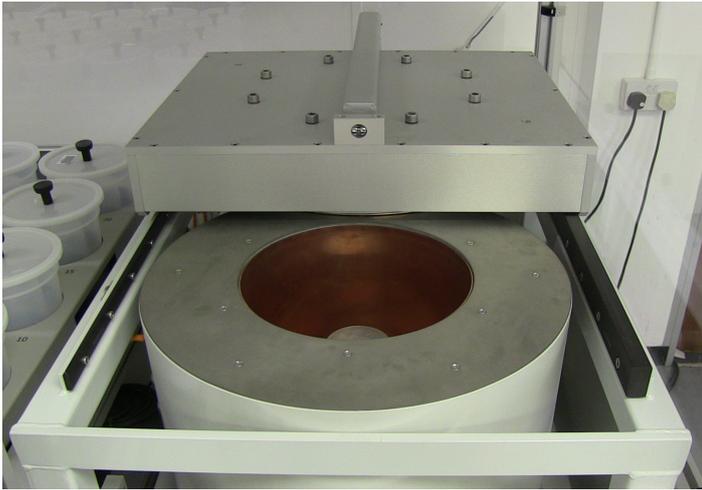


Fig 4. The measurement chamber with the automated sliding lid mechanism



Fig 5. The UHMW Polyethylene tray

Sample Tray

Sample location trays are manufactured from UHMW Polyethylene for wear resistance, weight reduction and for wipe-down convenience, meeting FDA and USDA guidelines for food processing and handling. Trays are available as standard for various Marinelli beakers as per the sizes below and can be readily changed without the need for tools. Typically, the trays can contain 12 x 4-liter, 20 x 2-liter, 20 x 1-liter, 25 x 0.5-liter or 30 x 0.25-liter beakers.

Other sizes are available upon request.

Other containers can be accommodated, including scintillation vials, small beakers, charcoal and paper filters and sample bottles in various sizes.

Electrical System

An IP54 rated enclosure houses the electrical supply, safety breaker, low voltage distribution, Programmable Logic Controller (PLC), motion control and safety system. The configuration exceeds the requirements of European Directives for wiring and EMC.

To facilitate rapid commissioning, cables are connected using high integrity plugs and sockets.

The only external connections required are a single-phase mains power supply, and RJ45 Ethernet and USB connection to allow for remote connection to the embedded computer. In keeping with the requirements of the European Safety Directives, entry to the cabinet requires power isolation by means of a lockable isolation switch.



Fig 6. The electrical, safety and motion control system for the ANTECH G3010-AGSS

The electrical panel is located at an ergonomic height on the front of the cabinet. Operation of the emergency stop button removes all power from the drive system. Individual power supply to the HPGe detector, cryogenic system and the Multi-Channel Analyzer (MCA) maintains functionality in emergency stop conditions.

The panel provides the operator with both indication and control lighting to identify the system condition. 'Power' and 'Motion' lights indicate operation, whilst 'Fault' and 'Emergency Stop' buttons provide a safe operational environment. The "Open/ Close" switch is key-operated and provides manual over-ride for the opening and closing of the measurement chamber top closure.



Fig 7. The lockable isolation switch



Fig 8. The electrical panel of the ANTECH G3010-AGSS

The Gamma Ray Spectroscopy System

The spectroscopy system of the AGSS uses ORTEC® components and analysis software and is based on the nearly 50 years of experience at ORTEC® in designing Gamma ray detection and analysis systems.

HPGe Detector

The design of the AGSS draws on more than 20 years of collaboration with ORTEC® and is optimized for use with a wide range of ORTEC® HPGe detectors. The choice of detector will depend on the application to which the system is applied.

ANTECH are able to supply the appropriate measurement chamber location plug to ensure correct positioning and shielding of the HPGe detector.

HPGe Cooling

Cooling of the HPGe detector can be accomplished by one of 4 methods supplied by ORTEC®:

- Liquid Nitrogen with Dewar sizes up to 30L
- Mobius, Condensing Liquid Nitrogen HPGe Detector Cooling system
- X-Cooler, Liquid-Nitrogen-Free Cooling
- ICS – Integrated Cooling System



Fig 9. L-R: the ORTEC® ICS, ORTEC® HPGe detector, ORTEC® X-Coller 3 and the ORTEC® Mobius

Multi-Channel Analyser

A choice of ORTEC® DSP-based Gamma-Ray Spectrometers or multi-channel analyzers is available for use with the AGSS. The choice includes the ORTEC® DSPEC jr 2.0, DSPEC Pro and the DSPEC-50.

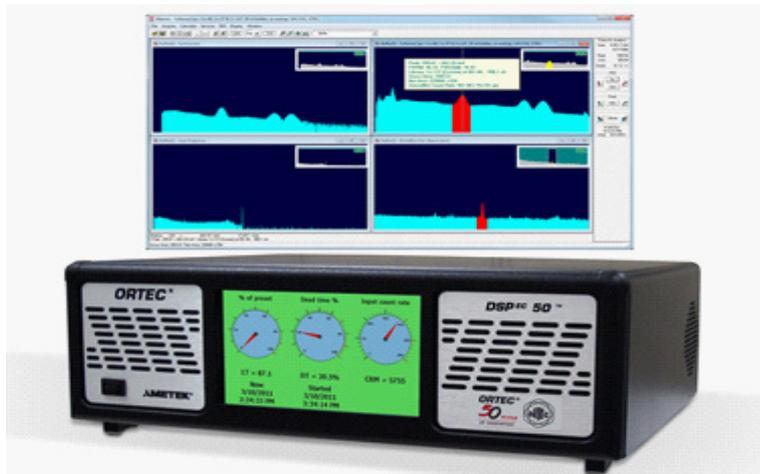


Fig 10. Showing the ORTEC® DSPEC jr 2.0 (top left), DSPEC Pro (bottom left) and DSPEC 50 (above)

Software

The AGSS software consists of two interactive components: ANTECH Gamma Sample Plus software and ORTEC® GammaVision® spectroscopy measurement and analysis software. ANTECH Gamma Sample Plus software schedules the measurements and commands the PLC, which directs the 3-axis motion control 'Pick and Place' system. Sample batches and sample sizes can be rapidly inter-changed and the scheduling of the next batch is permissible whilst the current batch is being measured.

ORTEC® GammaVision® is an all-inclusive gamma spectroscopy measurement and analysis application which contains all the basic and advanced features needed for accurate and consistent radionuclide identification and quantification.

The intuitive interface in ORTEC® GammaVision® is easy to both learn and to operate. There are embedded multi-channel analyzer controls; advanced spectrum analysis functions, and automation for routine operations, quality control and security. There is extensive analysis and detection limit capability to accommodate a variety of applications:

- Optional report writer with MS access data
- Storage and crystal reports for custom reports
- Automation scripting for consistent measurement processes
- Simplified calibration using wizards and interactive editors

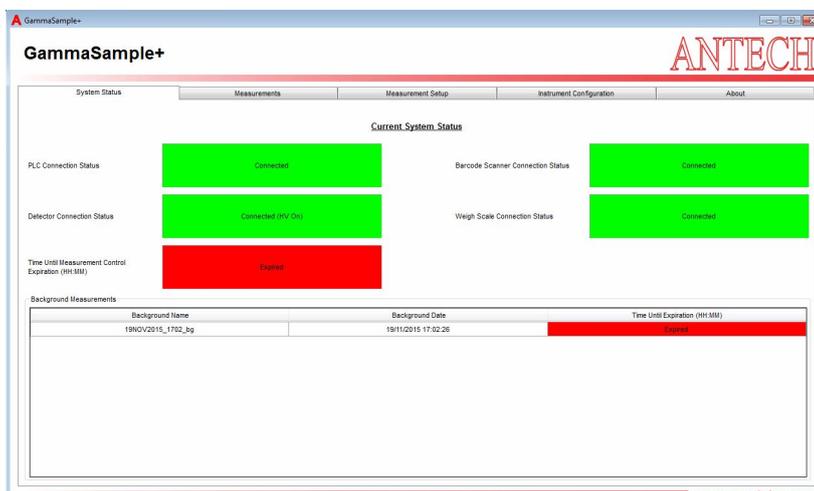


Fig 11. The ANTECH Gamma Sample Plus software user interface

The ORTEC® GammaVision software is seamlessly integrated with the ANTECH Gamma Sample Plus software to provide a unified system. The system is controlled through an embedded control computer which includes Windows 7 operating system, 64-bit processor, the ANTECH Gamma Sample Plus software and ORTEC® GammaVision® software.

The user-friendly operator interface incorporated into ANTECH Gamma Sample Plus software was developed with the needs of gamma ray spectroscopists at the forefront.

The user interface permits:

- User level assignment and security
- Machine and measurement set-up
- Manual Setup and Configuration
- Diagnostics functions and user help
- Multiple data output and reporting options
- Access to user manuals

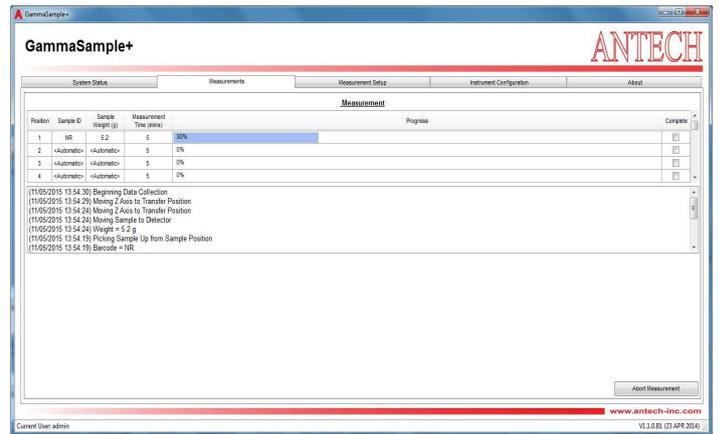


Fig 12. A view of the ANTECH Gamma Ray Spectrum Analysis software user interface

Automation Enhancements

A barcode reader option is available to eliminate manual operator input of sample details in the batch settings and ensures that the measurement result is automatically assigned to the correct sample. Mounted on the 'Pick and Place' unit, the barcode reader identifies the sample identification printed on the barcode and fixed to the lid of the Marinelli beaker. Data gathered is automatically assigned to corresponding reports.

A weigh-scale option is also available to eliminate the requirement for the operator to manually weigh and subsequently input the sample weight into the system computer. The integrated weigh-scale, located on the vertical axis, automatically determines the sample weight prior to analysis and the net weight is provided in the analysis.

Compliance

The ANTECH AGSS sample changer is fully CE compliant with:

- European Community Machinery Directive
- European Community EMC Directive
- European Community Low Voltage Directive
- European Community WEEE & RoHS Directives

In addition, the system has been designed to fulfil the requirements for North America with application of NFPA 70 & 79 and to conform to the requirement of Underwriters Laboratories (UL).

Documentation

All ANTECH AGSS systems are provided with a full and comprehensive documentation package which includes information regarding:

- Packing and shipping data
- Installation procedure and drawings
- In depth review of all sub-assemblies
- Software description
- Software installation
- Software tutorial and examples
- Comprehensive maintenance schedule
- Suggested spares holding
- Troubleshooting guide

Specifications

Dimensions W x D x H	1850mm x 1200mm x 2600mm (full mast elevation)
Sample changer electrical power requirements	230V +/-10% 50/60Hz, 6 Ampere (maximum), Single Phase + Earth *
Chamber inner dimensions	Ø 279mm x 406mm
Marinelli beaker capacity	0.25 liter to 4 liter (user configurable)
Shielded measurement chamber	Equivalent specification and dimensions to the ORTEC® model HPLBS1-4B shielded measurement chamber, with automated sliding lid modification
Motion control electronics	Allen-Bradley® PLC servo drives and motors

* Other voltages/ frequencies by option

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