

# PICO ENVIROTEC INC.

# AGRS

## Advanced Airborne Gammametry Spectrometer



### Features:

- Energy detection range 20 KeV to 3 MeV.
- 256 / 512 / 1024 channels
- Output is fully linearized and the Poisson Distribution is not affected
- Individual detector processing
- Real-time stabilization on natural radioactive elements.
- Extremely wide dynamic range: up to 250,000 cps per detector.
- Insignificant Dead Time
- Individual detector acquisition and live time is provided.
- Stabilization time of less than 40 seconds on the ground
- All data acquisition is accomplished via Ethernet, which eliminates bandwidth problems and permits remote monitoring and trouble shooting.
- Selectable sampling rates from 10 Hz to 0.1 Hz
- High level of self-diagnostics
- Automatic HV calibration and linearization based on natural radioactive elements (radioactive sources are NOT required). This permits field replacement of NaI(Tl) detectors and/or photomultiplier tubes.
- Multiple analog inputs
- GPS connectivity & synchronization
- input power: 10 to 35 VDC
- HV and analog gain digitally controlled by 16-bit D/A converter
- 14-bit A/D converter - 80 MHz FPGA master clock

The AGRS Advanced Airborne Gammametry Spectrometers are intelligent, self-calibrating gammametry spectrometers using large volume NaI (TI) detector arrays. They are widely used in geological and geophysical exploration and mapping as well as in environmental and nuclear surveillance.

The AGRS connects to data acquisition systems, such as Pico Envirotec's IMPAC, via high speed LAN (Ethernet) communication. This eliminates bandwidth problems (these systems support up to 20 detectors) and also permits remote monitoring and trouble shooting.

AGRS is suitable for airborne geophysical surveys where the maximum data throughput can be as high 250,000 counts per second per detector. An added benefit is that each detector and/or PMT in both of these systems may be easily replaced in the field by the user.

An Ethernet (LAN) communications protocol permits them to be connected to any "PC" compatible computer system running Windows-XP. All of the dedicated electronics modules are housed within the detector containers. By virtue of Pico Envirotec's proprietary application software, any personal computer may be transformed into a sophisticated Gamma spectrum analyzer.

Individual, independent, detector processing (each detector has its own spectrometer processor) allows for real time gain and linearity corrections. Pico Envirotec's ongoing research into system stabilization algorithms permits the AGRS spectrometers to be fully automated and self stabilizing on natural radioactive elements. This eliminates the requirement for regular, time consuming, and frequent system checking and re-calibration by the user. Furthermore it provides excellent accuracy and reliability of the gamma measurements.

Specially developed software algorithms provide results in absolute units of contamination and dosage automatically corrected from acquisition altitude to ground level equivalents.



Piper PA31 Navajo Survey aircraft featuring a high-sensitivity cesium magnetometer and an AGRS gammametry spectrometer with 33.6 litres of GSX sensor in the aircraft's cabin

Individual crystal detector signal processing provides an accurate control over each contributing sensor and provides the user with the best possible spectra alignment for the complete system.

New design techniques for the peak detection electronics almost completely eliminates "Pulse Pile Up" and "Dead Time" effects.

A new feature of the AGRS is its fully automated field calibration routine, which has eliminated the need for undertaking daily calibrations using radioactive sources. This radioactive sample-free approach is based solely on natural radiation and makes use of up to 8 photo peaks through the typical gamma-ray spectrum, and delivers excellent results concerning system integrity and quality.

AGRS gammametry spectrometers are provided free-of-charge with PEICalib Calibration Software and PEINatVerif Software.



AGRS with three GSX-1024/256 Gammametry spectrometer sensors is installed in this Beech B200SE King Air survey aircraft

## AGRS Advanced Gammaray Spectrometer

The AGRS gammaray spectrometers are widely used in geological and geophysical exploration and mapping as well as in environmental and nuclear surveillance.

Individual and independent detector processing provides real time gain and linearity correction. PEI's unique system stabilization algorithm makes the AGRS fully automated and self stabilizing on natural radioactive elements. This eliminates the requirement for regular and time consuming system checks and re-calibration and assures accurate and reliable gammaray measurements.

Specially developed software algorithms provide results in absolute units of contamination and dosage automatically corrected from acquisition altitude to ground level equivalents. Individual crystal detector signal processing provides an accurate control over each contributing sensor providing the user with

the best possible spectra alignment for the complete system. New design techniques for the peak detection electronics (see *Digital Peak Detector below*) almost completely eliminates 'pulse pile up' and 'Dead Time' effects.

The AGRS features:

- Energy detection range 20 KeV to 3 MeV.
- 256 / 512 / 1024 channels
- Output is fully linearized and the Poisson Distribution is not affected
- Individual detector processing
- Real-time stabilization on natural radioactive elements.
- Extremely wide dynamic range: up to 250,000 cps per detector.
- Insignificant Dead Time
- Individual detector Acquisition and Live time is provided.
- Stabilization time of less than 40 seconds on the ground
- All data acquisition is accomplished via Ethernet, which

eliminates bandwidth problems and permits remote monitoring and trouble shooting.

- Selectable sampling rates from 10 Hz to 0.1 Hz
- High level of self-diagnostics
- Automatic HV calibration and linearization based on natural radioactive elements (radioactive sources are NOT required). This permits field replacement of NaI(Tl) detectors and/or photomultiplier tubes.
- analog inputs
- GPS connectivity & synchronization
- input power: 10 to 35 VDC
- HV and analog gain digitally controlled by 16-bit D/A converter
- 14-bit A/D converter - 80 MHz FPGA master clock

In addition to the full spectra, up to 8 special windows (Regions of Interest) may be collected and recorded along with the status of each detector.

*GSX-512 Sensor, part of a Pico Envirotec's IRIS rapid-response radiation monitoring*



*& surveillance system installed in a Czech Army helicopter*

## DPD-1 Digital Peak Detector

The DPD-1 Digital Peak Detector is an advanced technology design used to detect unipolar signals from nuclear or other spectrum based detection devices. In comparison to analog type peak detectors the DPD-1 exhibits very low noise characteristics and excellent linearity. The technology is based on a high-speed-sampling analog to digital con-



*DPD-1 Digital Peak Detector in PC-104 format*

verter transmitting collected values into a large logic array circuit.

A proprietary firmware algorithm reliably detects the peak of the signal, then transfers the peak value into the digital processor where they are summed and stored. Counted peaks are transferred on request to the host computer via hi-speed Ethernet communication link.

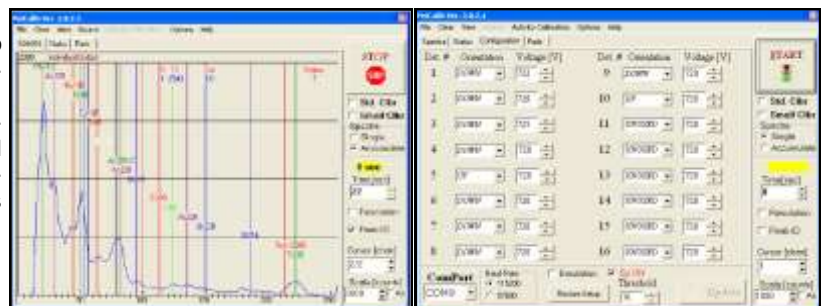
## PEICalib Gammaray Spectrometer Calibration Program

The **PEICalib** Gammaray Spectrometer Calibration Program is a powerful and versatile application tool for testing and calibrating Pico Envirotec's AGRS gammaray spectrometers, permitting the user to adjust individual detector parameters. The program recognizes the connected spectrometer automatically and retrieves all preset parameters.

The program allows the user to change threshold limits, individual crystal high voltage, and "up-down" orientation for each detector. An automated calibration process provides complete tun-

ing of the individual detectors as well as the entire detector array.

PEICalib is provided free with every AGRS-10 Advanced Digital Gammaray Spectrometer.



## GSX Gammaray Sensors

The NaI(Tl) sensors for use with AGRS range from the *GSX-128 Sensor* with its single 2 litres of detector, to the *GSX-1024/256 Sensor* with its two arrays of detectors, comprising 16.8 litres “downward-looking” and 4.2 litres “upward-looking”. The sensor housings are all thermally insulated and shock-mounted. The AGRS electronics are installed inside the housing, together with temperature, barometric pressure and relative humidity sensors.

The GSX sensors may be linked together in virtually any combination. Typically, a fixed-wing airplane system would utilize two or three *GSX-1024 Sensors* for a total of 33.6 or 50.4 litres of detector, whereas a helicopter system would typically utilize various *GSX sensors* for a total of 16.8 litres of sensor, although larger volumes are not unusual.

The GSX sensors include the following models;

*GSX-128 Sensor* - 2 litres of NaI(Tl) crystal detectors

*GSX-256 Sensor* - 4.2 litres of NaI(Tl) crystal detectors

*GSX-512 Sensor* - 8.4 litres of NaI(Tl) crystal detectors



*A helicopter-borne (Bell 206B3 Jet Ranger) horizontal magnetic gradiometer system with a GSX-1024/256 sensor installed in a rack underneath the forward part of the cabin*

*GSX-1024 Sensor* - 16.8 litres of NaI(Tl) crystal detectors

*GSX-1024/256 Sensor* - 16.8 litres of NaI(Tl) crystal detectors “downward-looking” and 4.2 litres “upward-looking”.



*Top - the new GSX-1024/256 sensor with its two arrays of detectors, comprising 16.8 litres “downward-looking” and 4.2 litres “upward-looking”*

*Left - the new GSX-1024/256 sensor with the NEW IMPAC system*



*Typically, a fixed-wing airplane system utilizes two GSX-1024/256*



*sensors for a total of 33.6 litres of detector “downward-looking” and 8.4 litres “upward-looking”*

## GSX-HeliPAK Gammaray Detectors

*GSX-512 HeliPAK Detector* - the *GSX-HeliPAK Detector* comprises 8.4 litres of NaI(Tl) crystal detectors packaged in a thermally insulated, shock-mounted detector assembly. However, HeliPAK detectors, unlike conventional GSX Detectors, are specially fabricated hermetically-sealed and Canadian STC-certified (*Bell 206L & 407*) containers for installation outside of the helicopter cabin attached to the helicopter landing skids. The crystal sensors are mounted end to end in the containers, rather than side by side. As a result all the surfaces of each crystal are exposed providing maximum sensitivity from each detector.



*Two GSX-HeliSPEC Gammaray Detectors installed on a Bell 206L Long Ranger helicopter for a total of 16.8 litres of detector.*

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## About Pico Envirotec

Pico Envirotec Inc. (PEI) is a Canadian company, established in 1992. Since 1998 it has been engaged primarily in manufacturing advanced instrumentation for use in airborne and ground **geophysical surveys for mining, oil and gas and environmental applications**. PEI's **core expertise** is the development and manufacture of instrumentation for remotely measuring magnetic, gravity and gammaray radiation data, using real-time data acquisition and precise satellite (GPS) **navigation and positioning**. **Because of PEI's close co-operation** with other geophysical companies, it provides complete, integrated, turnkey airborne or ground geophysical systems for acquiring geophysical data for either mining, oil and gas or environmental applications. This is made possible by its development of "intelligent" instruments, using advanced technology, which facilitates easy and safe integration of just about any sensor or measuring device into a system. The AGIS and the new IMPAC (airborne data acquisition systems for airborne geophysical exploration), IRIS (Integrated Radiation Information System for environmental monitoring), and the PGIS (Portable Geophysical Information System) are PEI's most successful systems based on this "intelligent" philosophy.

During the many years PEI has been in business, it has installed more than 100 airborne systems on a wide variety of aircraft and helicopters for clients that include mining companies, exploration services companies, and government agencies. Airborne systems designed, built, integrated and installed by PEI are flying in many countries around the world, including Canada, USA, UK, Austria, Australia, Brazil, China, Czech Republic, Germany, South Africa, India, Brazil, France, Sweden, Finland, Italy, Egypt, Mexico, Libya, Russia, and Norway. These airborne survey systems include sensors for taking measurements of magnetics and magnetic gradients, gammaray spectrometry, time-domain EM and gravity.

During this same time frame, PEI has also delivered many portable, mobile and base station systems based on its PGIS technology. These systems included sensors for magnetic and/or magnetic gradient measurements and gammaray spectrometry, with GPS for navigation and/or positioning of the acquired data.

## IMPAC Integrated Multi-Parameter Airborne Console

The NEW IMPAC is a real-time data acquisition and navigation system that combines all of the features of the AGIS-XP and MMS-4 instruments into an integrated package housed in a single 19in rack-mountable console. IMPAC utilizes a modular structure and is highly flexible, easy to reconfigure and user friendly, permitting a wide variety of PEI "intelligent instruments" and third party sensors and instruments to be interfaced. Precise time synchronization provides recording of data and aircraft coordinates into a single data file.



*Pico Envirotec's NEW IMPAC Integrated Multi-Parameter Airborne Console*



*IMPAC and P-THEM consoles installed in equipment rack*

### Main Features:

- Rack-mountable airborne data acquisition system
- Windows-XP operating system
- Colour LCD touch screen / keyboard assembly
- Imbedded 4-sensor magnetometer processor - sampling rates up to 100Hz
- Real-time & post survey magnetic compensator
- Imbedded GPS navigation module
- AGRS-10 Advanced Gammaray Spectrometer
- Imbedded Geo-iMAGE-Lite digital imaging system
- Multiple instrumentation interfaces
- GPS synchronisation, 1 pulse-per-second (PPS)
- Ethernet & RS-232 communication
- Data recording directly to solid-state hard disk drive
- Multiple USB and serial ports
- Eight 16-bit differential analog input channels