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**Ph: 0428 147 973**

## **RS-500**

### **Advanced Digital Gamma-Ray Spectrometer**

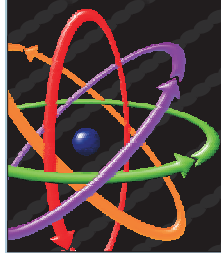
For Airborne Geophysical Exploration  
and Geological Mapping

#### **Unique Features**

- Industry leading technology and performance
- 1024 channel resolution
- Individual crystal ADC and processing
- No distortion as each crystal output is fully linearized permitting multi-crystal summing without distortion
- Effectively no signal degradation
- No radioactive test sources required for system setup or system performance validation.
- Extremely wide dynamic range
- High level of self diagnostics
- World wide usability, fully multi-peak automatic gain stabilization on natural isotopes
- Easy system integration into users data systems
- Data compression - individual crystal spectral data storage can be achieved with no effective increase in data volume



**RADIATION SOLUTIONS INC**



# RS-500 - Fly with confidence knowing you are acquiring quality radiological data, accurately the first time.



Introducing the revolutionary RS-500 digital airborne gamma-ray spectrometer to be used for the detection and measurement of low level radiation from both naturally occurring and man-made sources. When flying remote areas, in extreme weather conditions and with a limited flight budget it is important to know you have the technology you need to gather high quality radiological survey data, accurately the first time.

## ● **Supersedes all other airborne systems**

The RS-500 utilizes advanced, leading edge DSP / FPGA \* technologies, making all current available systems obsolete by a significant factor and places the RS-500 in a class of it's own.

The RS-500's advanced technology and software techniques provide laboratory levels of spectral data performance that were previously unachievable on airborne platforms, assuring the user the highest quality data every time.

The RS-500 is a fully integrated system that includes an individual **Advanced Digital Spectrometer (ADS)** for each **crystal within the detector box.** The ADS is a high resolution (1024 channel) gamma spectrometer that makes the measurement of both the naturally occurring and man made radioactive elements as transparent and automatic an operation as possible, with minimal interaction from the user.

## ● **Ease of use, operator friendly**

Although the system is designed for minimal operator interaction, the user can monitor the data and system performance with their own data acquisition or on a computer with the RadAssist software. The RadAssist software provides a variety of displays for system set-up and performance monitoring.

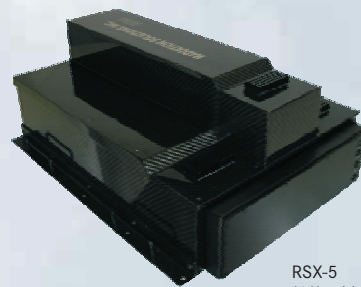
A high level of self diagnostics and performance verification routines are implemented with automatic error notification. With the multiple data verification methods employed, the user is assured that the resulting maps and products they produce for their customers are of high quality and accuracy.

## ● **Key, unique features**

- **Accurate "the first time" technology**  
The advanced digital design using FPGA/DSP technology and signal processing provides a more stable operation, with less drift, producing a pure spectra that results in better data for you. In addition to the externally recorded data, the RS-500 series records the last 24 hours that can be easily retrieved if required.
- **Effectively no Dead-time** as each crystal has it's own A / D converter within it's own ADS.
- **1024 channel resolution** for any number of crystals at up to 10x per second.
- **Menu selectable** 1024, 512 or 256 channel output.
- **Individual crystal ADC and processing** resulting in improved pulse pile-up rejection, zero dead time, and a higher throughput.
- **Virtually no distortion**, each crystal output is fully linearized permitting multi-crystal summing without distortion.
- **Effectively no signal degradation** when summing an unlimited number of crystals - common on most current systems.
- **No radioactive test sources** required for system setup. or for system performance validation.
- **Extremely wide dynamic range** 250,000 cps for each crystal providing >20x improvement on signal throughput compared to older systems.
- **High level of self diagnostics** with sophisticated error correction & reporting requiring less operator interaction.
- **Fully multi-peak automatic gain stabilization** on natural isotopes for world wide use.
- **Easy system integration** into User's existing data systems.
- **Data compression**, individual crystal spectral data storage can be achieved with no effective increase in data volume.



RSX-4 (16L)



RSX-5  
(16L with 4L  
up detectors)



\*DSP = Digital Signal Processing

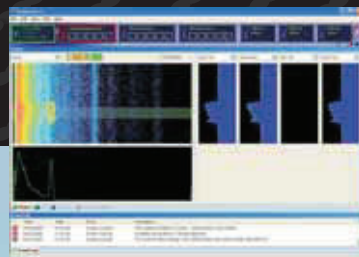
\*FPGA = Field Programmable Gate Array



RadAssist parameter setup menus



RadAssist system data monitoring displays



## ● RadAssist software

The RS-500 airborne spectrometer is supplied with RadAssist, a user monitoring and control software. The software runs under Windows XP and contains pull down menus for setting the operating parameters, including visual monitoring displays. RadAssist allows the user to set the operating parameters as well as the output data format, including the selection of 1024, 512 or 256 channel resolution.

The user may install the software on their Data Acquisition System (DAS) or alternatively use an external computer to setup and monitor the system. If the DAS is running under an operating system other than Windows XP, the data output may be recorded and monitored either via Ethernet or RS-232 directly from the detector.

## ● Detector technology & communications

The revolutionary technological advancement in the RS-500 system is in the achievement of **full linearization** of all the detectors individually. When the spectral summing of multiple detectors is performed, it is without spectral degradation or distortion. RS-500 can be fully integrated into a user's existing data acquisition system or operated as a stand alone system storing the data in the internal memory.

### Multi-detector pack systems

In applications where multiple detector packs are implemented, RSI offers an optional low profile (1U), RS-501 interface unit.

### Communications

Each detector pack is fully self-sufficient and communicates on the Ethernet data bus with support for an unlimited number of detector packs. This provides for optimum operational performance with no technical limitations on data accuracy. There are two data communication protocols available, Ethernet and RS-232. The primary communication is by Ethernet (TCP/IP). Data can be output simultaneously on the RS-232 port to a user's data acquisition system supporting older standard formats.

The Detector Processing Unit (DPU) continuously monitors the state of health of the individual crystals and the system. Each crystal is individually gain stabilized using a sophisticated multi-peak approach effectively eliminating the need for any pre-stabilization with external sources.



## ● Transparent and automatic operation

The RS-500 is easy to interface and extremely operator friendly. The RS-500 is readily set-up or modified through the use of the supplied **RadAssist** utility software. Once configured, The RS-500 performs **spectral stabilization both on the ground and in the air automatically without the need of test sources.**

The measurement of the radioactive elements has been made as transparent and automatic an operation as possible. The readiness of the system can be simply monitored by the built-in indicators or by the use of the RadAssist program. The user can decide on the level of interaction that is required for their survey.

## ● Advanced Digital Spectrometer (ADS)

The "heart" of the RS-500 system is the proprietary Advanced Digital Spectrometer (ADS) module. Each individual NaI crystal detector has its own high speed (60 MHz) analog to digital converter and a DSP/FPGA processor assembly. This module converts the analog signal from the detector to a digital spectrum with a **1,000,000 channel** resolution. Using a unique detector energy calibration curve stored in the ADS module, the spectrum is linearized and compressed to the system's native 1024 channels.

With high speed the adaptive DSP processing allows each pulse to be corrected if necessary without distortion at a very high data throughput rates - up to 250,000 cps / crystal detector. The combination of zero dead time, improved pulse pileup rejection, individual crystal linearization and accurate detector summation results in an exceptionally clean spectra.

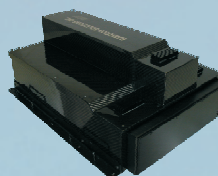
This 1024 channel spectrum is unique in the industry as it is fully linearized, without changing the Poisson distribution performance. The exceptional advantage of this new proprietary process is that any number of individual detectors can be summed together with essentially no spectral degradation for subsequent data analysis.

This design permits essentially unlimited data throughput operation giving the system a very large dynamic range, often required in high count or specialty nuclear site surveillance situations.

## Technical specifications



RSX-4 (16L)



RSX-5  
(16L with 4L up detectors)

### Spectrometer

Channels	1024
Differential nonlinearity	<0.2% over top 99.5%
Integral nonlinearity	<0.01% over top 99.5%
Zero dead time(1)	✓
Baseline restoration	Digital (IPBR) <sup>(2)</sup>
Pulse shaping	Digital (AOPS) <sup>(3)</sup>
Pile-up rejection	Digital (<40nS)
Pile-up contamination	<1% @ 250kcps

Sample rate	0.1-10 sec <sup>-1</sup>
Timing	Internal/External
Gain stabilization	Automatic multi-peak
I/O	Ethernet
	RS-232 19200-115200 bit/s
	USB memory stick

### Outputs

Composite spectrum	✓
Individual spectra	✓
State of health	✓

### Inputs

Detector configuration	✓
Operational parameters	✓
Trigger signal	✓
Calibration data	✓

### Detectors

RSX-4	4 x 4L NaI(Tl)
RSX-5	4+1 x 4L NaI(Tl)
Energy resolution	<8.5% <sup>(4)</sup>

### Power

RSX-4	9-40 VDC, 50 W
RSX-5	9-40 VDC, 55 W

### Weight

RSX-4	91 kg (200 lb)
RSX-5	114 kg (250 lb)

### Size

RSX-4	690 mm x 573mm x 177mm <sup>(5)</sup> (28.80in x 22.56in x 6.97in)
RSX-5	690 mm x 573mm x 288mm (28.80in x 22.56in x 11.32in) <sup>(5)</sup>

### Environmental

Operating Temp.	-30°C to +45°C
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- Notes**
- <sup>(1)</sup> The RS-500 has no dead time in a traditional sense. A live time clock will be adjusted for loss of system measured pile-up rejections to give an apparent dead time to ensure the absolute count rate is correct.
  - <sup>(2)</sup> IPBR - Individual Pulse Baseline Restoration. The baseline is established for each individual pulse for maximum pulse height accuracy.
  - <sup>(3)</sup> AOPS - Automatic Optimized Pulse Shaping. Pulses are continuously analyzed and the signal pulse shaping adjusted for optimum performance.
  - <sup>(4)</sup> Stated energy resolution is for new systems. Refurbished system performance depends on quality of Xtals supplied.
  - <sup>(5)</sup> The dimension includes removable mounting rails



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Pty Ltd  
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Radiation Solutions Inc. is a Canadian company specializing in nuclear instrumentation for the detection, measurement and analysis of low level ionizing radiation from both naturally occurring or man made sources.

RSI's focus is the design and manufacture of airborne and mobile systems using advanced DSP (Digital Signal Processing) technology. This technology provides a level of quality previously only attainable in laboratory equipment.

RSI's philosophy is to work as closely as possible with customers in all aspects of the product life cycle including; product requirement, application, training, support and product improvement. It is this philosophy that will enable RSI to supply industry leading software techniques and hardware components that not only meet, but exceed the customer's requirements.