

## Desktop Digital X-Ray Spectrometer

### GENERAL DESCRIPTION

XIA's Digital X-ray Processor (DXP) family is a group of high rate, digitally-based, multi-channel analysis spectrometers designed for energy dispersive x-ray or gamma-ray measurements using semiconductor detectors. Intended for laboratory or industrial x-ray applications, the Saturn provides everything necessary to instrument a typical x-ray detector, incorporating one DXP spectrometer channel, preamplifier power supplies and detector bias HV all in a compact chassis. Digitizing at 20(40) MHz, available peaking times range from 0.25 to 80 (0.125 to 40)  $\mu$ sec with throughputs greater than 450 (700) kcps. The Saturn offers complete computer control over all amplifier and spectrometer functions including gain, filter peaking time, and pileup inspection criteria. The Saturn's digital filter significantly increases throughput compared to typical analog systems for comparable energy resolution but at a lower cost. Data can be collected either as spectra or as counts in preset regions of interest. Like other DXP family members, the Saturn can also be programmed to operate in various time dependent or phase locked data collection modes. The DXP Saturn can operate with a wide range of common detectors, including SiLi, HPGe or SDD detectors, with reset or rc feedback preamplifiers.

### FEATURES

- One channel of spectroscopy amplifier and digital pulse processing in a stand-alone box.
- Single unit replaces shaping amplifier, multi-channel analyzer, high voltage and preamplifier supplies at significantly reduced cost.
- Accepts a wide variety of x-ray detectors using preamplifiers of all common types.
- 20 or 40 MHz digitization rates available.
- Instantaneous throughput of over 450 (700) kcps possible with 20 (40) MHz digitization.
- Digital trapezoidal filtering, with programmable peaking times between 0.25 and 80 (0.125 and 40)  $\mu$ sec.
- High precision internal gain control.
- Pileup inspection criteria: fast channel peaking time, threshold, and maximum time over threshold.
- Accurate Input Count Rate (ICR) and live-time reporting for precise dead-time corrections.
- Multi-channel analysis to 8K spectra, or ROI readout to monitor preselected regions.



- External Gate and Sync signals synchronize data acquisition with external setup for x-ray mapping and other specialized applications.
- All digital control implemented through high speed USB2 port.
- Supplies preamplifier power on industry-standard DB-9 connector.
- Supplies detector bias HV up to 1000 V, either polarity, with LN2 sensor HV inhibit input.

### SPECIFICATIONS

#### Input (Analog)

**Signal Input:** Unity or x1/4 input attenuation, jumper selectable. Unity: 10 k $\Omega$  input impedance, voltage range  $\pm 10$  V(reset)/ $\pm 3$  V (feedback). At x1/4 attenuation, 1000  $\Omega$  input impedance,  $\pm 40$  V(reset)/ $\pm 12$  V(feedback) input range. Works with common reset or resistor feedback preamps of either polarity.

#### Inputs (Digital)

**Gate Input:** TTL logic input for externally timed data collection. Suppresses data collection when driven low; pulled high when unconnected.

**Sync Input:** (Special Order) TTL logic input to control time resolved data collection, including scanning and "phase locked" applications.

**HV Inhibit:** TTL logic level input; also works with normally-open or normally-closed switches. BNC connector, jumper set active HI or LO, as well as normally enabled or disabled.

## Power Outputs

**Detector Bias Supply:** High voltage  $\pm 1000$  V, SHV connector, push-button on/off, front panel adjust, 10 sec. on/off ramp time standard. Other options available.

**Preamplifier Supply:** standard preamp power voltages  $\pm 24$  V and  $\pm 12$  V, each to 100mA.

## Interface

**USB2:** High speed Universal Serial Bus achieves up to 5 MB/sec data transfer.

**OEM:** Auxiliary port with 24 programmable bidirectional I/O's is available for custom applications.

## Digital Controls (Set via USB2 Port)

**Gain:** 80X range controlled by 16 bit DAC. For use with x-rays up to 50 keV or more and preamplifiers with gains nominally in the 0.1 to 10.0 mV/keV range.

**Shaping:** Triangular/Trapezoidal. Peaking time and gap (flat-top) time set independently: 0.25 - 80  $\mu$ s in small steps. Adjustable gap time may be used to eliminate ballistic deficit effects.

**Pileup:** Set fast channel filter time, pulse detection threshold, and fast channel pileup inspection test limits to achieve best results in each situation.

## Data Outputs (via USB2 port)

**Spectrum:** Up to 8192 channels standard, 24 bits deep. Multiple spectra can be stored with optional extra memory.

**Other:** Collection livetime; total counts; pileup rejected counts; baseline statistics.

**Scope mode:** Diagnostic ADC and baseline trace capture.

## Spectrometer Performance

**Resolution:** Comparable to best analog units. Excellent light element performance; Figure 1 shows the spectrum from a Carbon coated Beryllium oxide sample.

**Count Rate:**  $>1,000,000$  cps ICR,  $>450,000$  cps Output Count Rate (OCR).

**Throughput:** The finite tails of the digital filter allow optimal throughput for a given peaking time.

**Livetime/Deadtime Correction:** typically less than 1% change in area of Mn  $K_{\alpha}$  reference peak at 10 kcps in the presence of interfering Ag  $K_{\alpha}$  at 50 kcps for a 4  $\mu$ s peaking time.

**Pileup Inspection:** Pulse-pair resolution typically better than 200 ns after tuning to optimize performance on an application specific basis.

**Deadtime Correction:** Accurate ICR and live time outputs allow area of reference peak to be corrected to better than  $\pm 0.5\%$  accuracy from 0 to 120,000 cps at 4  $\mu$ s peaking time.

**Peak Stability with Rate:**  $< 0.05\%$ , up to four times the point of maximum throughput!

## Ordering Information

**Power Requirements:** 110 V at 0.2 A 50/60 Hz or 220 V at 0.1 A 50/60 Hz.

**Dimensions:** 9.75" W x 7.0" D x 3.8" H

**Weight:** net: 6.5 lbs., shipping: 9.0 lbs.

**Firmware:** The Saturn comes with downloadable files for its internal digital signal processing electronics. Updates available from the XIA web site.

**Software:** Basic host control software is provided; libraries are available to incorporate Saturn control into existing or custom data acquisition systems.

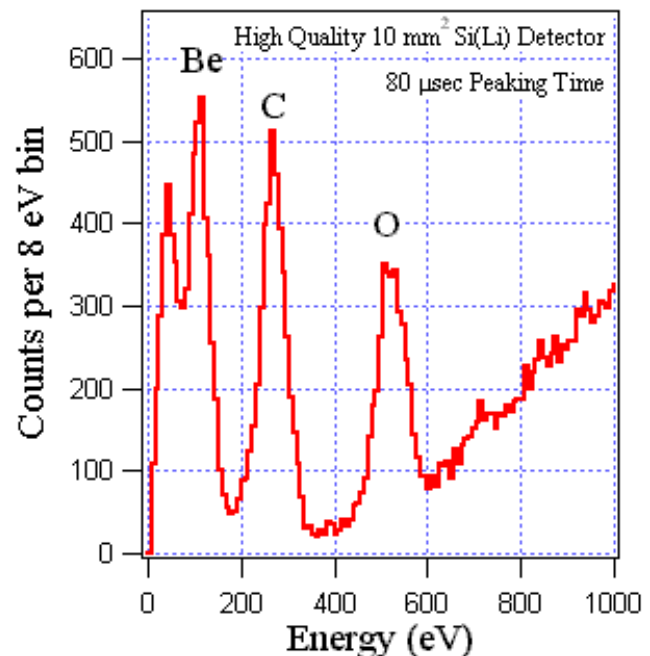


Figure 1: Spectrum of carbon-coated BeO taken at 80  $\mu$ s peaking time. The energy threshold was set low enough to show the separation of the noise peak and the Be  $K_{\alpha}$  peak at 110 eV.

XIA LLC

31057 Genstar Rd  
Hayward, CA 94544 USA  
© XIA, Feb 2008

510.401.5760 (tel)

510.401.5761 (fax)

www.xia.com

Email inquiries: sales@xia.com