

Four-Channel PXI Digital X-ray Processor

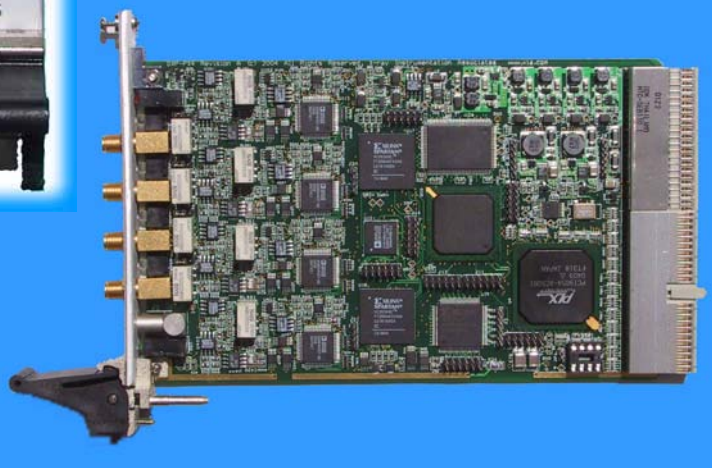
OVERVIEW

The DXP xMAP packages 4 high speed digital spectrometers into a compact, 3U PXI/cPCI module. Each spectrometer offers a peaking time range of 0.1 - 100 μ s, and can output up to 1,000,000 cps into the spectrum. The DXP-xMAP offers excellent noise performance, which suits it for energy dispersive x-ray measurements over the extended energy range 0.2-100 keV using multi-element detector arrays with preamplifiers of any gain. It offers computer control over all amplifier and spectrometer controls including gains, peaking times, and pileup inspection criteria. The DXP's trapezoidal digital FIR filters achieve significantly enhanced throughputs at comparable energy resolutions when compared to analog systems, but at a lower cost per detector. Energy resolution is nearly independent of count rate up to maximum throughput. The full computer interface allows all data taking and calibration operations to be automated, greatly reducing the possibility of human error. Data can be collected either into a full spectrum of up to 8K channels or into up to 32 regions of interest (ROI's) and passed to the host without stopping data collection. The full spectrum allows peak fitting and/or deconvolution to be done on a detector by detector basis, leading to more accurate intensity extractions, particularly where scatter peaks are changing rapidly with energy. The DXP-xMAP operates easily with a very wide range of common detector/preamplifier systems of either polarity, including pulsed optical reset, tran-

sistor reset, and resistive feedback varieties. The DXP-xMAP offers several timing modes, including fast scanning with full MCA readout or multiple ROI's, as well as list mode readout, where time and energy are stored for each event. The onboard memory manager allows full access to the data even during data collection. To allow deadtimeless operation for fast scanning, the memory can be organized into two completely independent banks, allowing readout of one bank while the other is filled. Peak readout speeds across the PCI interface exceed 100 MB/sec.

FEATURES

- Single PXI/cPCI module contains 4 channels of pulse processing electronics with full MCA per channel.
- Peaking time range: 0.1 to 100 μ sec
- Maximum throughput up to 1,000,000 counts/sec/channel.
- Digitization: 14 bits at 50 MHz
- Low noise front end offers excellent resolution, and provides excellent performance in the soft x-ray region (150 - 1500 eV).
- Operates with virtually any x-ray detector. Preamplifier type is computer controlled.
- 16 bit gain DAC and input offset are computer controlled.
- Pileup inspection criteria are computer selectable.
- Accurate ICR and livetime for precise deadtime correction and count rate linearity.
- Multi-channel analysis for each channel allows optimal use of data.
- Facilitates automated gain setting and calibration to simplify tuning array detectors.
- External Gate allows data acquisition on all channels to be synchronized.
- All runs can be synchronized between modules using the LBUS signal connecting all the modules together.
- 4 MB of high-speed memory allows ample storage for timing applications such as mapping with full spectra or multiple ROI's. Memory can be read at the full PCI speed.
- Peak PCI transfer rates exceed 100 MB/sec.



SPECIFICATIONS

INPUTS

Analog: Four preamplifier inputs, jumper-selectable input gain. 0dB (x1): 10 kohm impedance, +/- 8V range. 12dB attenuation (1/4 gain): 1kohm, +/- 32V, jumper selectable. Works with common reset or resistive feedback preamplifiers of either polarity.

Digital: (TTL) Each module has a single LEMO connector which can be programmed to be used for any of the following functions:

Gate: input for externally timed data collection. Suppresses collection when actively held low.

Sync: Logic input to control time resolved data collection, such as scanning.

LBUS: Used to connect the backplane bussed run synchronization line between PXI segments.

All digital signals are bussed along the PXI backplane. For Gate and Sync, one signal per backplane segment must be provided.

DATA I/O

Interface: Compact PCI standard, 33 MHz, 32-bit

Digital Controls:

Gain: 100x range, controlled by 16-bit DAC. Preamplifier gain range 0.1 to 10 mV/keV at standard settings.

Filtering: Peaking times 0.1 - 100 μ s. Adjustable flat top to eliminate ballistic deficit effects.

Pileup: Fast channel filter time, pulse detection threshold, and fast channel pileup inspection test limits may be set independently to achieve best results in every x-ray energy regime.

Data collection: MCA limits, bin widths, ROI's

Data Outputs:

Spectrum: Up to 8192 channels (32 bits deep).

ROI's: Up to 32 ROI regions can be defined.

Timing: Multiple spectra or sets of ROI's can be stored; continuous operation is possible using memory in dual-bank configuration.

Statistics: All values required for pileup correction are available: livetime, realtime, input events, output events.

Diagnostics: ADC trace, baseline distribution, baseline history

SOFTWARE

XIA provides xManager, a software package for setting up detector arrays and generating configuration files for use by other control packages. Handel, a comprehensive set of C libraries, simplifies integration of DXP-xMAP control into existing data collection packages. Several complete control packages are available, either commercially or as open-source from National Laboratory groups. Remote server type operation will also be offered.

PERFORMANCE

Resolution: state of the art, detector dependent.

Count Rate: OCR to 1 Mcps max (at ICR > 2 Mcps)

Throughput: The output count rate (OCR) approaches theoretical values based on input count rate (ICR) and deadtime τ_d , where τ_d equals 2 times peaking time plus dwell time: $OCR = ICR * \exp(-ICR * \tau_d)$.

Integral Non-linearity: $\leq 0.1\%$ over full scale output range.

Pileup Inspection: Pulse-pair resolution typically better than 100 ns unless limited by signal risetime.

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Please verify application critical requirements with XIA before purchase and/or use.

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