Digital Pulse Processor

DP5-X
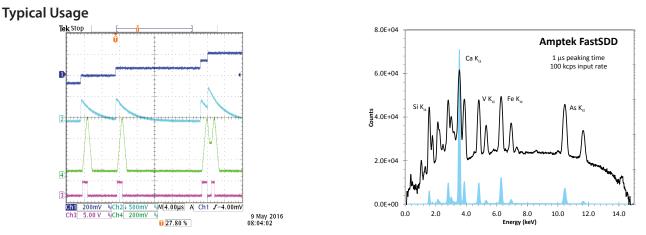
ADVANCED INFORMATION ONLY

• Shaping, MCA and power supplies   **• For use with Si-PIN, SDD and Fast SDD®**

Overview

The DP5-X is a compact, high performance digital pulse processor (DPP) and power supply board designed for use with Amptek's thermoelectrically cooled X-ray detectors, including the FastSDD®, SDD, and SiPIN. Measuring only 1.5" x 2.5" (3.8 x 6.4 cm) and drawing only 2.5 W (including power for the cooler), the DP5-X with detector can deliver a resolution as low as 124 eV FWHM at 5.89 keV and output count rate over 1 Mcps. The power supplies include a high efficiency switching regulator for cooling and a high voltage power supply, so only a 5 VDC source is needed. The DP5-X uses the same core signal processing logic as Amptek's other DP5 products, delivering the same performance. It supports USB and RS232 communications, using the same protocol (FW6) as Amptek's other DP5 products, so is compatible with software developed for other Amptek products.

The DP5-X is currently in development. Beta units are planned for Q3 2016. Amptek's DP5 or X123 can be used for development, since they share the same software and signal processing capability.
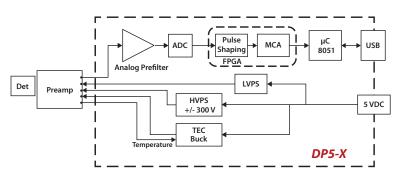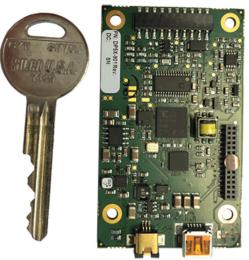
Typical Usage

Trace 1 above shows the input to the DP5-X, which is the output from a reset-type charge sensitive preamplifier. This is processed by the analog prefilter producing the prefilter output shown in Trace 2. This is digitized and then processed digitally, producing the DP5-X's shaped output shown in Trace 3. Finally, the DP5-X creates a multichannel anlayzer (MCA) type output spectrum shown in Graph 4.

Block Diagram and Drawing

DP5-X shown in actual size
Dimensions: 3.8 x 6.4 cm (1.5 x 2.5 in)

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SPECIFICATIONS

The key signal processing, MCA, and communications specifications are largely the same as the other products in Amptek's DP5 family. Please refer to the "User Manual for the DP5 Product Family" for more complete documentation and discussion.

Pulse Processor	
Full Scale	10 to 80 keV full scale energy for Amptek detectors. 1000 mV ADC input full scale.
Gain	Coarse gains of 4 and 14, fine gain with 13 bit resolution, software selectable
Pulse Shape	Trapezoidal
Peaking Time	Software selectable between 0.05 and 102 μs, e to semi-Gaussian shaping times of 0.02 to 45 μs.
Flat Top	63 software selectable values for each peaking time (depends on the peaking time), > 0.05 μs.
Baseline Restoration	Asymmetric, 16 software selectable slew rate settings
Fast Channel Peaking Time	0.05, 0.1, 0.2, 0.4, 0.8 μs (80 MHz) and 4x at 20 MHz
Fast Channel Pulse Pair Resolving Time	T_{fast} plus pulse risetime
Dead Time Per Pulse	1.05 times the $T_{peak} + T_{flat}$. No conversion time.
Maximum Count Rate	8×10^6 sec^{-1} (periodic). Output count rate of 1.4×10^6 sec^{-1} for a random input of 3.8×10^6 sec^{-1} (80 MHz)
Pulse Selection Options	Pile-up rejection, risetime discrimination, gate

Multichannel Analyzer	
Number of channels	256, 512, 1024, 2048, 4096, or 8192 channels.
Bytes per channel	3 bytes (24 bits) - 16.7M counts
Acquisition Time	10 ms to 466 days
Conversion Time	None
Presets	Time, total counts, counts in ROI, counts in channel
MCS Timebase	10 ms/channel to 300 s/channel
External MCA Controls	Gate input: Pulses accepted only when gated on by external logic. Input can be active high or active low. Software controlled.

Operating Modes	
MCA mode	Most common operating mode. The DPP acquires a pulse height spectrum, using the MCA in the FPGA, and reads this to the computer, over one of the interfaces, one software request. Readout intervals usually range from 0.1 s to a few seconds.
Counting mode	By reading only the status packet over one of the interfaces, one can obtain the input and output count rates at much shorter intervals than the entire spectrum can be read. Requires custom software.
Other modes	Supports List Mode and SCA Mode.

Communications	
USB 2.0 full speed (12 Mbps)	
RS-232 at 115.2k or 57.6k baud	

Hardware	
Microprocessor	Silicon Labs 8051F340 (8051-compatible core)
ADC	12 bit, 80 MHz
Firmware	Signal processing is programmed via firmware, which can be upgraded in the field.

Physical	
Dimensions	3.8 x 6.4 cm (1.5 x 2.5 in)
Weight	30 g

Power	
Nominal Input	@ +5 VDC: 700 mA (3.5 W) typical at full cooling 500 mA (2.5 W) typical with lighter cooling loads
Input Voltage Range	4 V to 9 V
Typical Input Current	4 V (@ 0.9 A) to 9 V (@ 0.4 A)
Regulator frequencies	All but HVPS > 1 MHz; HVPS: 60 kHZ
Power Source	External supply

Connectors	
J1	Power in (5 VDC)
J2	Preamp interface (10 pin flat flex, mates with Amptek PA210/PA230)
J3	Preamp interface (alternate 10 pin, 2 MM)
J4	Mini-USB
J5	AUX to interface with customer circuit board. Includes power in, USB, RS232, and auxiliaries

Mechanical Dimensions

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