DP5 Digital Pulse Processor

Features

- Replaces both shaping amplifier and MCA
- Supports both reset and feedback preamplifiers of either polarity
- Configurable with a charge sensitive preamplifier for use with PMTs
- For OEMs or custom laboratory users
- Highly configurable

Pulse Processing & MCA

- Trapezoidal shaping
- Peaking time commandable from 0.1 to 102.4 µs
- Commandable flat top duration from 0.05 to 51.2 µs
- 4,000,000 cps periodic
- Pile-up rejection & risetime discrimination
- Up to 8k output MCA channels

Communications

- Interfaces: RS-232, USB, Ethernet, I^2C, auxiliary
- Oscilloscope mode - DAC output for pulse monitoring and adjustment
- Onboard µcontroller with 8051-compatible core
- Software for PC data acquisition and control (includes API)
- Many configurable auxiliary inputs and outputs



Physical

- Low Power: 600 mW typical
- Small Size: 3.5 in x 2.5 in

Applications

- X-ray and gamma ray detectors
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- Portable, battery operated systems
- OEM & Special Applications
- Process Control
- Research and Teaching

Overview

The Amptek DP5 is a state of the art, high performance, low power digital pulse processor. It digitizes the preamplifier output signals, replacing both the shaping amplifier and MCA in a traditional, analog spectroscopy system. The DP5 offers several clear advantages over traditional systems, including improved performance (very high resolution, reduced ballistic deficit, higher throughput, and enhanced stability), enhanced flexibility, low power consumption, small size, and low cost.

The DP5 represents the latest generation in digital pulse processing, an enhanced replacement for Amptek's DP4. The DP5 operates at higher count rates than the DP4, with faster shaping times, better pile-up rejection, and better dead time correction; offers lower electronic noise and a wider gain range; includes additional features such as a "List Mode" and additional spectral display options; and improved interfacing, including faster se- rial communication, an Ethernet interface, and onboard power supplies.

Its physical dimensions are compatible with the DP4. The software is designed to be as backward compatible as possible: software written for the DP4 will be fully functional, reproducing the DP4's capabilities, while additions with minor changes to the software will permit access to the full capabilities of the DP5.

The DP5 is suitable for OEMs and for users needing custom capabilities.

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DP5 Specifications

PULSE PROCESSING PERFORMANCE	
Gain	Combination of coarse and fine gain yields overall gain continuously adjustable from x0.84 to x127.5
Coarse Gain	16 log spaced coarse gain settings from x1.12 to x127.5
Fine Gain	Adjustable between 0.75 and 1.25, 10 bit resolution
Gain Stability	<20ppm/°C ()
ADC Clock Rate	20 or 80 MHz, 12 bit ADC
Pulse Shape - Trapezoidal	Semi-Gaussian amplifier with shaping time τ has a peaking time of 2.2 τ and is comparable in performance with the trapezoidal shape of the same peaking time.
Peaking Times	30 software selectable peaking times between 0.2 and 102 µs, corresponding to semi-Gaussian shaping times of 0.1 to 45 µs.
Flat Top Times	16 software selectable values for each peaking time (depends on the peaking time), >0.05 µs.
Max Count Rate	With a peaking time of 0.2 µs, 4 MHz periodic signal can be acquired.
Dead Time Per Pulse	1.05x peaking time. No conversion time.
Fast Channel Pulse Pair Resolving Time	120 ns
Pile-Up Reject	Pulses separated by more than the fast channel resolving time, 120 ns, and less than 1.05x peaking time are rejected.
Baseline Restoration - Asymmetric	16 software selectable slew rate settings.
MCA PERFORMANCE	
Number of channels	Commandable to 256, 512, 1024, 2048, 4096, or 8192 channels.
Bytes per channel	3 bytes (24 bits), 16.7 M counts.
Preset Acquisition Time	10 ms to 466 days.
Data Transfer Time	USB: 1k channels in 12 ms; RS-232: 280 ms
Conversion Time	None

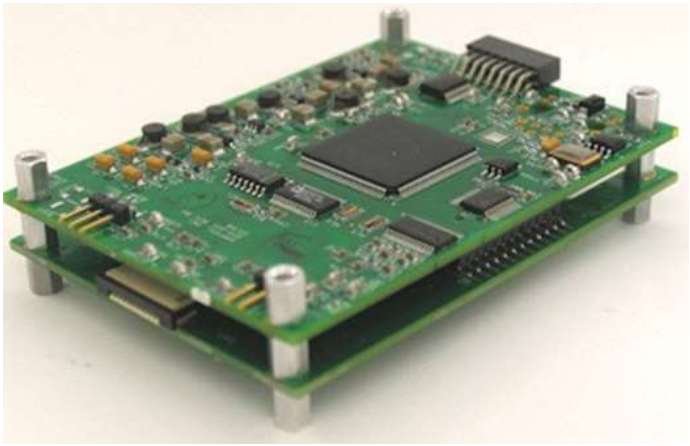
Presets	Time, total counts, counts in an ROI, counts in a channel.
MCS Timebase	10 ms/channel to 300 s/channel
COMMUNICATIONS	
RS-232	Standard serial interface ≤115 Kbaud.
USB	Standard 2.0 full speed (12 Mbps).
Ethernet	Standard 10base-T.
CONNECTIONS	
Analog Input	The analog input accepts positive or negative going pulses from a charge sensitive preamplifier. 1x3 right angle header Molex part number 22-28-8032. NOTE: Can be configured with a charge sensitive preamplifier for use with PMTs. Contact Amptek for details.
Power	+5 VDC. Hirose MQ172-3PA (55).
RS232	Standard 2.5 mm stereo audio jack.
USB	Standard USB mini-b jack.
Ethernet	Standard Ethernet jack.
Auxiliary	2x8 16-pin 2 mm spacing (Samtec part number ASP-135096-01). Mates with connector Samtec P/N TCMD-08-S-xx.xx-01.
DAC Output	Used in oscilloscope mode to view the shaped pulse and other diagnostic signals. Range: 0 to 1 V. 1x2 right angle header Molex part number 22-28-8022.
POWER	
+5 V	80 MHz clock: 200 mA (1 W) typical 20 MHz clock: 180 mA (0.9 W) typical
Input Range	+4 V to +5.5 V (at 0.25 to 0.18 A typical)
Initial Transient	2 A for <100 ns
Power Source	External supply or USB bus.
PHYSICAL	
Size	3.5" x 2.5"
Weight	32 g
GENERAL AND ENVIRONMENTAL	
Operating Temperature	-40 °C to +85 °C.
Warranty Period	1 year.
Typical De vic e Lifetime	5 to 10 years, depending on use.
Long-term Storage	10+ years in dry environment.
Typical Storage and Shipping	-40 °C to +85 °C, 10 to 90% humidity non-condensing.
Compliance	RoHS Compliant

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PC5 and Interface

The DP5 itself has its own power supplied so only needs a +5 V DC input. When using the DP5 with Amptek detectors, additional power supplies are needed for the detector and preamp. Amptek provides the PC5 board that mates with the DP5 and provides power to Amptek detectors.

The PC5 provides power to Amptek XR-100 detectors from a +5 VDC source. This board is intended for those using Amptek de- tectors and preamps. The USB interface cannot supply enough current to operate the XR100, so an external DC supply is required, which must be between 2.5 and 5.5 V.



DP5 board (top) mated with the PC5 board (bottom) →

Software

There are two distinct software packages that are needed for the DP5: 1- embedded software that runs on the microcontroller on the DP5 (firmware), and 2- acquisition and control software that runs on the attached computer. Amptek's control and acquisition software, DPPMCA is available for download at www.amptek.com anytime. Also available, are several Software Development Kits with examples to aid in software development for OEM and custom applications.

Embedded Software – Firmware : The embedded software is responsible for controlling the pulse processing, controlling the MCA, carrying out some data processing, and interfacing with the personal computer. This software is fixed and cannot be modified by the user. Firmware updates will be released by Amptek and can be uploaded in the field by the user.

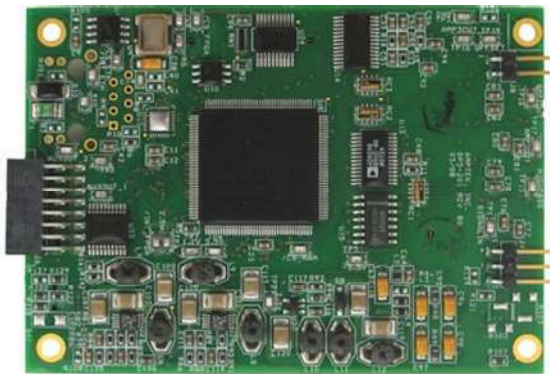
DPPMCA Software : The DP5 can be controlled by the Amptek DPPMCA display and acquisition software. This software can be used for control and display of the DP5 and supports regions of interest (ROI), calibrations, peak searching, and so on. Example of DPPMCA display and acquisition software.

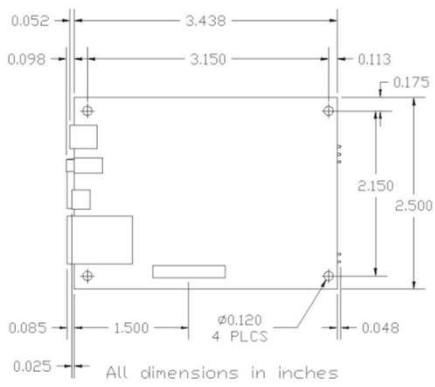
Several Software Development Kits (SDK's) with examples to aid in software development for OEM and custom applications. There are SDK's for several software languages and operating systems available. Most of the SDK's are available on online for download at any time, but there may be others available on request. Contact Amptek Technical Support if you are interested in a language or feature but can't find it online.

Convenient Demonstration Software is available that permits the user to set the DP5 parameters, to start and stop data acquisition, and to save data files. It is provided with source code and can be modified by the user. This software is intended as an example of how to manually control the DP5 through either the USB or RS-232 interface without the DPP API.
Example of demonstration software supplied with the DP5 for data acquisition (source code provided).

Optional XRF Quantification Software: XRF-FP2 Quantitative Analysis Software for X-ray Fluorescence applications. Please see our web site: http://www.amptek.com/

DP5 Mechanical Dimensions





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