KETEK GmbH

Digital Pulse Processor
Standalone
DPP-SA

User’s Manual
(Version 1.0, June 2009)
- Digital Pulse Processor
- 25MHz Clock Frequency
- Digital Gated Integrator Pulse Forming
- 16 programmed Peaking Time Constants
- INL ±0.5 LSB
- DNL <1.0%
- Peak Shift < 1 channel
- Digital Base Line Restoring
- Peak Detection and Pile-Up Rejection
- Threshold Settings
- Digital Gain Settings
- Built-In Oscilloscope
- 8k built-in Multi Channel Analyzer
- Timing Block
- Electronic Control of Sensor Parameters
- Sensor Parameters Reading
- USB 2.0 Full Speed
- MCDWIN Acquisition Software for Windows XP
- DLL optional

Description

The KETEK Digital Pulse Processor (DPP) is a specially designed pulse forming amplification board for KETEK VITUS Silicon Drift Detectors (SDD), that offers a fully digital, low noise, software controlled and high performance digital shaping amplifier. It shows excellent energy resolution, low peak shift, high linearity, high throughput and stable input count rate behaviour with low peak shift and stable energy resolution for count rates up to 500,000 counts.
Geometry and Dimensions

Digital Pulse Processor Standalone Board:

Pin Configuration

Power Connector:

Red LED showing correct polarity.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Voltage</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+12V / max. 500mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-12V / max. 100mA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*It is highly recommended using linear regulated power supplies!*

USB Connector:

Standard USB-A connector, green LED showing connection to host PC

Preamplifier Input Connector:

Lemo Coax Type *FFS.00.250*, Preamplifier Output vs. GND

FPGA Programming Connector:

14-pin Connector on Top Side
### Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Polarity</strong></td>
<td>Both negative and positive Input Pulses</td>
</tr>
<tr>
<td></td>
<td>Jumper selected</td>
</tr>
<tr>
<td><strong>Operating Voltages</strong></td>
<td>+12V±5% / max. 500mA</td>
</tr>
<tr>
<td></td>
<td>-12V±5% / max. 100mA</td>
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<tr>
<td><strong>Power Dissipation</strong></td>
<td>max. 2W</td>
</tr>
<tr>
<td><strong>Dimensions (W x L)</strong></td>
<td>80mm x 54mm <em>(without connectors)</em></td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>18mm</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>USB 2.0 Full Speed</td>
</tr>
<tr>
<td><strong>Peaking Times [µs]</strong></td>
<td>16 different free programmable steps:</td>
</tr>
<tr>
<td><strong>Threshold</strong></td>
<td>16 different Threshold Levels defining the Pile-Up-Rejector Sensitivity</td>
</tr>
<tr>
<td><strong>Gain</strong></td>
<td>Digital: 16 different gain adjustments (Gain = 0: OFF)</td>
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<tr>
<td></td>
<td>Analog: Jumper selected gain from 0.5 to 16</td>
</tr>
<tr>
<td><strong>INL</strong></td>
<td>&lt;±0.5LSB</td>
</tr>
<tr>
<td><strong>DNL</strong></td>
<td>Dependant on Peaking Time:</td>
</tr>
<tr>
<td></td>
<td>0.1 to 1%</td>
</tr>
<tr>
<td><strong>BLR</strong></td>
<td>Fully automatic Baseline Restoration</td>
</tr>
<tr>
<td><strong>Peak Detection</strong></td>
<td>Dependant on Threshold Setting</td>
</tr>
<tr>
<td><strong>Pile Up Rejector</strong></td>
<td>Dependant on Threshold Setting, always operative</td>
</tr>
<tr>
<td><strong>Main Clock</strong></td>
<td>25MHz</td>
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<td><strong>Pulse Shape</strong></td>
<td>Digital Gated Integrator</td>
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<tr>
<td><strong>Max. Count Rate</strong></td>
<td>500kHz</td>
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<tr>
<td><strong>MCA Channels</strong></td>
<td>256 to 8192 software selectable</td>
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<td><strong>Channel Depth</strong></td>
<td>22bits, 4.2 Mega Counts</td>
</tr>
<tr>
<td><strong>Preset Time</strong></td>
<td>256ms to 24 days</td>
</tr>
<tr>
<td><strong>SPI Interface</strong></td>
<td>Electronic setting and reading of sensor parameters <em>(optional)</em></td>
</tr>
<tr>
<td><strong>Interface</strong></td>
<td>USB 2.0 Full Speed</td>
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<td><strong>Communication</strong></td>
<td>8bit FIFO</td>
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<td><strong>Oscilloscope</strong></td>
<td>Software controlled</td>
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<td></td>
<td>showing the digitally shaped pulses</td>
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<tr>
<td><strong>Software</strong></td>
<td>PC Based Real Time Spectrum Acquisition and Control Software MCDWIN for Windows XP</td>
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<tr>
<td><strong>DLL Driver</strong></td>
<td><em>(optional)</em></td>
</tr>
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</table>
Input Characteristics

Power Supplies Input:

- Low-noise, external, regulated, bipolar, DC power supply delivering:
  - $+12\text{V} \pm 5\%$, $I \leq 0.5\text{A}$; Ripple and noise $\leq 50\text{mV}$, no HF spikes
  - $-12\text{V} \pm 5\%$, $I \leq 0.1\text{A}$; Ripple and noise $\leq 50\text{mV}$, no HF spikes

Preamplifier Input:

The input accepts negative or positive (jumper selected) ramped input pulses having:
- rise time $< 700\text{ns}$
- step height pulses from 0 to 1000mV
- max. $\pm 5\text{V}$ input voltage range
  no Pole-Zero Cancellation necessary.

SPI Interface:

- 8 parameter control channels
- 8 parameter reading channels
- Parameter control accuracy – 12 bit
- Parameter reading accuracy – 12bit
- SPI interface to the digital pulse processor
- On board 50 ppm/K reference
- On board filtering
- Control and measurement of VITUS SDD

Digital Pulse Processor Block Diagram
Jumper Selection

Input Polarity:

Analog Gain cascaded in three steps:

*Single steps are multiplied! Gain and Polarity is labelled on the board.*
**Preamplifier Input Signals**

**Ramped Output Signal**
- **Adjusted output range of** -5V to +5V
- **Reset frequency of approx. 500ms**
  (measured with KETEK VITUS SDD only leakage current without any x-ray source)

**Falltime of Ramped output signal**
- **During reset sequence** (approx. 1µs)
  (measured with KETEK VITUS SDD only leakage current without any x-ray source)
Internal Reset Pulse measured on output in for Reset on detector side, supplied to a KETEK VITUS SDD. Pulse height is approx. 800mV and pulse width is approx. 1µs.

External Reset Pulse supplied to a KETEK VITUS SDD. Pulse height is approx. 3.5V and pulse width is approx. 1µs.
Step like output signal on ramped output with Fe-55 source. Step height of each detected pulse is approx. 22mV. Each pulse for Fe-55 source creates a step like pulse of 3.7mV/6keV which leads to a gain of approx. 5.75. This is also the value calculated from the preamplifier electronic.

Connection Diagram

from Preamplifier
Ramped reset type signal

±12V

USB 2.0 to host PC
Communication via MCDWIN Software or DLL
Installation Procedure

Please make sure to uninstall all virtual Com-Port drivers (VCP) before installing the KETEK DPP-Software and D2XX-Drivers!

- Start Windows (2000/XP) on your computer with USB port disconnected
- Insert the KETEK AXAS-D CD-ROM/USB Stick
- Open directory “\DPP\Software” and run the “setup.exe” file
- Follow the instructions of the installation assistant
- Open directory “\DPP\Software\d2xxdriv\” of the CD-ROM and copy the “FTD2xx.dll” file in the directory “C:\DPP\” where the setup was proceeded
- Open the “DPP.INI” file in the “C:\DPP\” directory with any editor and change the following line:
  
  ...  
  range=4096,4096,4096,4096,4096,4096  
  ...  
  into  
  ...
  range=8192,8192,8192,8192,8192,8192  
  ...
- Double click the DPP-Desktop-Icon to start the DPP-Software

Parallel Measurements:

- For use of more than one AXAS-D units change number of devices in “DPP.INI” file.
Start Up Procedure:

- Connect external power supply (+/-12V) to AXAS-D
- Connect AXAS-D to USB port of your running PC-System
- Click the button “yes, this time only” in the window “Found new Hardware Wizard” and then “next” button.
- In the next window enable “Install from a list or specific location (Advanced)” and confirm by clicking “next”
- In the window “Hardware Update Wizard” click on “Search for the best driver in these location.” and enable “include this location in the search:”
- Click “Browse” and search CD-ROM directory “DPP_Software\d2xxdridv” and confirm by clicking “ok”.
- Click on the button “next”
- The new hardware (USB Serial Port) is installed
- Open file “DPP.exe” by double clicking the icon on the desktop
- The DPP is connected to your PC-System

AXAS-D Settings:

- Click on the following button

![Image](image)

- Click on the button „SDD Settings“ on the new window “DPP Settings”
- At this window you can change the settings from the SDD:
  - D5 [V]: 0
  - R18 [V]: -130
  - RD/FETB[V]: -5
  - BACK[V]: -65
  - IGR[V]: 0
  - R1[V]: -20
  - D7 Cooling [V]: -2.5
  - TEMP [K]: 240
  - THRESHOLD: 12
  - GAIN: 10
  - Peaking[µs]: 4.5
- After changing any values you have to click on the “set values”-button

Close Application:

- Close DPP
- Close DPP server
**AXAS-M: Analytical X-Ray Acquisition System – Modular**

Block Diagram

Optional DLL Driver on request!