High Resolution XRF Spectroscopy Combined with High Reliability

The Complete SDD Modules combine best SDD chip performance with real vacuum housing. The excellent energy resolution at moderate temperatures and short shaping times is accomplished in a vacuum housing with reactivatable getter and sensors for monitoring the vacuum over detector lifetime.

The Complete XRF Detector System
is the operation platform for Silicon Drift Detector (SDD) modules in the Complete Series. It provides the X-ray signal of the sample with high speed and high resolution as analogue output. The system allows monitoring of the vacuum conditions inside the SDD modules and supports the reactivation of the getter, holding the module vacuum down, which guarantees a long lifetime with undisturbed performance.

The High Resolution Detector System
works with external analogue shapers, ADC and multichannel analyzer (MCA) as well as with digital pulse processor (DPP). It provides the analogue output signal and a gate signal synchronized with the reset pulse. The SDD voltages as well as the reset pulse are generated internally.

Application in Microanalysis and Industry
Individually pre-adjusted system parameters and the right selection of the SDD types and the module windows lead to optimum performance and reliability for your specific application.

XRF Windows
Planar Thin Windows (Si$_3$N$_4$) allow detection of low energy photons starting from C-K$_\alpha$. For all other XRF applications, where light element analysis is not needed, Beryllium windows are the standard.

A Second Peltier Cooler Option
helps to dissipate the heat from the module. This allows to operate the XRF detection system in warm environments.
**Functionality**

The XRF Detector System consists of a Silicon Drift Detector module and a detector housing including preamplifier electronics and cooling interface (Fig. 1).

The SDD chip is mounted in a vacuum module with reactivatable getter and pressure sensor for monitoring the vacuum. The SDD chip is cooled by a small thermoelectric cooler (Peltier 1). Optionally, a second peltier element (Peltier 2) is integrated in the detector system housing to support the heat dissipation to the external heatsink where the detector has to be mounted. The temperature of the SDD chip is measured by means of a small temperature diode on chip level. Furthermore, a PT-1000 sensor is installed at the end of the cooling rod and can be used for controlling the bias current for Peltier 2.

The SDD is operated in a charge sensitive amplifier configuration with pulsed reset mode. PNDetector’s SDD’s are characterized by the chip-integrated Junction Field Effect Transistor (JFET). This unique feature reduces the parasitic capacitances to a minimum and enables optimum performance at short processing times. The signal charge collected at the SDD anode is reset by the reset diode (Fig. 3). The XRF-detector works in comparator mode, i.e. the reset pulse sets in as soon as the voltage of the output signal reaches a certain threshold (“reset on demand”). Together with the reset pulse, a gate signal is created for the data processing with analogue shaper, ADC and MCA (Fig. 3).

**XRF Detector System output signals:**

- Signal polarization: positive
- Ramp voltage range*: symmetric ±0.2V ... ±2.0V
- Gain*: 5 ... 15mV/keV
- Reset frequency: reset on demand 200Hz ... 20kHz
- Gate signal, length*: TTL, 5 ... 50µs
- Chip temperature signal: -2.78mV/K
- Module pressure signal: calibrated

*preadjusted according to the application
The Complete - XRF Detector System

Characteristics

Energy Resolution
@ moderate chip cooling

Light Element Performance

Throughput

XRF Window Options

The Complete – XRF Detector Systems XRS

<table>
<thead>
<tr>
<th>System</th>
<th>Active SDD chip area</th>
<th>FWHM*</th>
<th>Peak-to-Background</th>
<th>XRF Window</th>
<th>Collimator</th>
</tr>
</thead>
<tbody>
<tr>
<td>XRS-10-130-xxx-BeP Complete</td>
<td>10 mm²</td>
<td>129 eV</td>
<td>4,500</td>
<td>Beryllium</td>
<td>Zr Ø 3.2 mm</td>
</tr>
<tr>
<td>XRS-30-128-xxx-BeP Complete</td>
<td>30 mm²</td>
<td>127 eV</td>
<td>10,000</td>
<td>Beryllium</td>
<td>Zr Ø 5.8 mm</td>
</tr>
<tr>
<td>XRS-10-125-xxx-BeP Complete</td>
<td>10 mm²</td>
<td>125 eV</td>
<td>15,000</td>
<td>Beryllium</td>
<td>Zr Ø 3.1 mm</td>
</tr>
<tr>
<td>XRS-10-125-xxx-PTW Complete</td>
<td>10 mm²</td>
<td>125 eV</td>
<td>15,000</td>
<td>PTW</td>
<td>Zr Ø 3.1 mm</td>
</tr>
</tbody>
</table>

Other versions available on customer request.

*) typ. values @ Mn-Kx, -30 °C, input count rates 2-20 kcps, shaping time 1-2 µs, respectively peaking time 4.8 µs, when measured with DPP
The Complete - XRF Detector System

Dimensions

Option:
Tube length can be modified according to customer requirements.

Power Supply

<table>
<thead>
<tr>
<th>XRF Detector system power supply</th>
<th>Typ.</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low voltage</td>
<td>+12 V</td>
<td>11.9V ... 12.1V (30mVpp ripple)</td>
</tr>
<tr>
<td>Low voltage</td>
<td>-20 V</td>
<td>-19.9V ... -20.1V (30mVpp ripple)</td>
</tr>
<tr>
<td>High voltage</td>
<td>-180V</td>
<td>-179V ... -181V (30mVpp ripple)</td>
</tr>
<tr>
<td>1st Peltier current</td>
<td>0.6 A</td>
<td>0 ... 1.5 A</td>
</tr>
<tr>
<td>2nd Peltier current (optional)</td>
<td>0.6 A</td>
<td>0 ... 2.5 A</td>
</tr>
</tbody>
</table>

PND Supply Unit XRU may be used for power supply, temperature control and pressure monitoring inside the modules.

Contact PNDetector:

PNDetector GmbH
Otto-Hahn-Ring 6
81739 München
Germany

Phone: +49 (0)89 – 309087-100
Fax: +49 (0)89 – 309087-110
Email: sales@pndetector.de
www.pndetector.de

June 2018

Connectors