

Miniature X-Ray Source

Mini-X

Mini-X is a self-contained, miniature X-ray tube system, which includes the X-ray tube, high voltage power supply and USB controller. Designed for X-ray fluorescence analysis applications - XRF.



Features

- 50 kV / 80 μ A
- Ag or Au target
- USB controlled
- Stable output
- Fast
- Low power
- Small

Mini-X is the first of its kind; a self-contained, packaged, miniature X-ray tube system, which includes the X-ray tube, the power supply, the control electronics and the USB communication to the computer. It is designed to replace radioisotopes in X-ray fluorescence analysis applications.

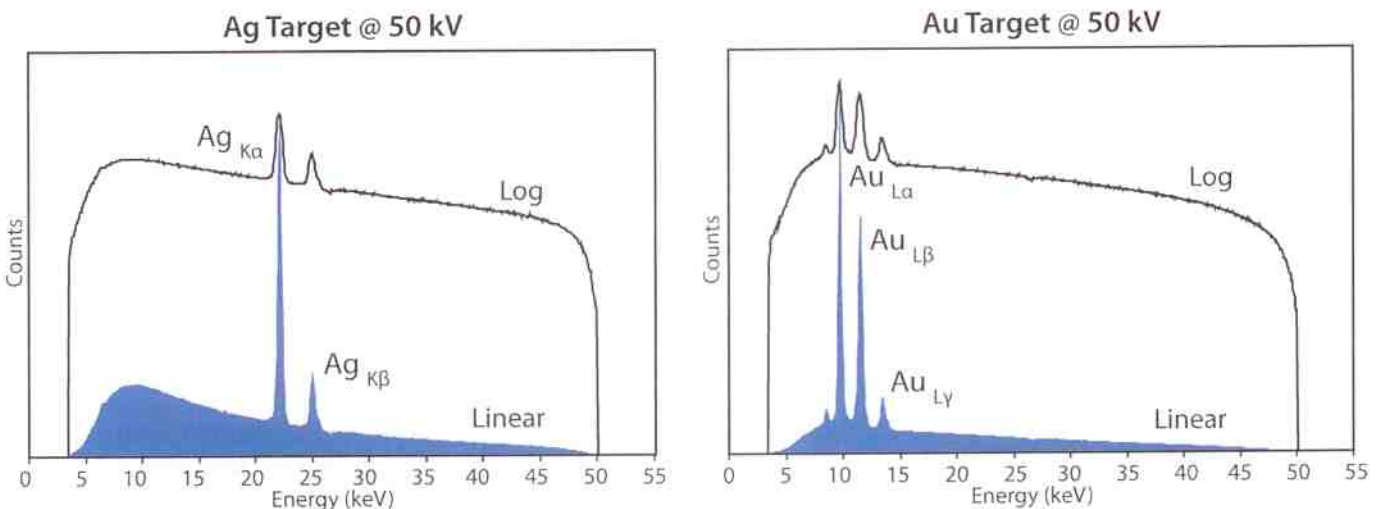
Mini-X has been designed to simplify the XRF process by providing a grounded anode, variable current and voltage controlled via USB and ease of operation. It features a 50 kV/80 μ A power supply, a gold (Au) or silver (Ag) transmission target, and a beryllium end window. It is designed for continuous operation in industrial environments.

To further simplify the use of Mini-X an AC adaptor is provided to supply the 12 VDC needed to power the system. The only connections needed to operate the tube are a USB cable and AC adaptor. A flashing red LED and a beeper warns the user when x-rays are present.

Applications

- X-Ray Fluorescence (XRF) analysis
- Portable systems
- OEM
- Process Control
- Research
- Teaching

Mini-X Output X-Ray Spectra



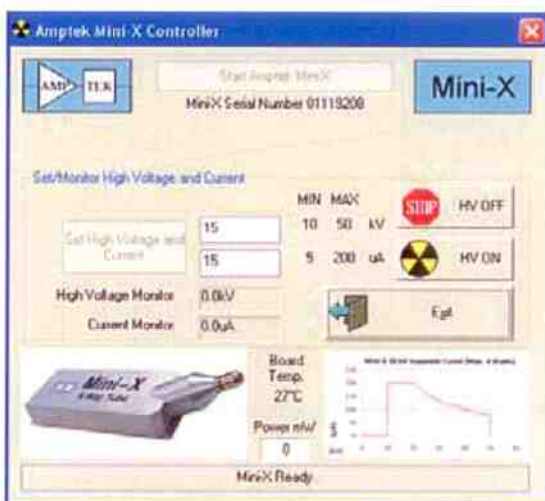
The Mini-X is based on the Newton Scientific Inc. miniature X-ray source.

AMPTEK INC. 14 DeAngelo Drive, Bedford, MA 01730-2204 U.S.A.

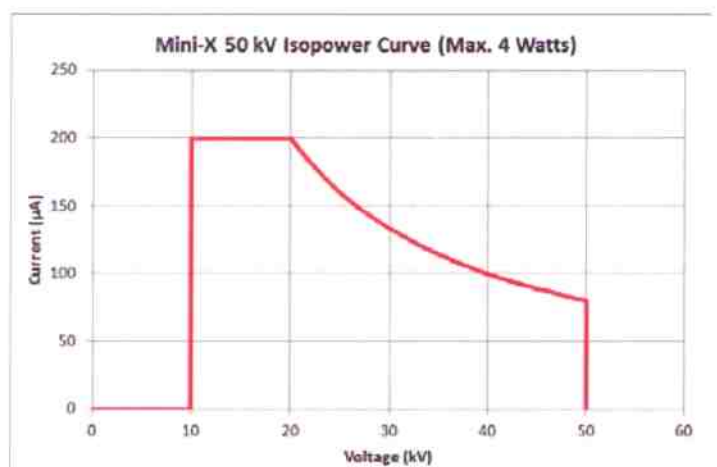
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Mini-X Specifications

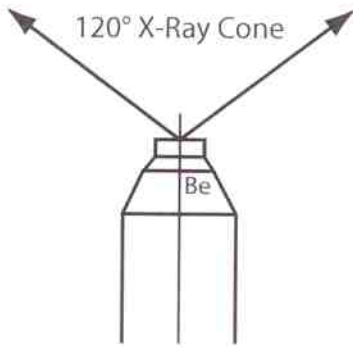
Target Material	Silver (Ag)	Gold (Au)
Target Thickness	0.75 μm ($\pm 0.1 \mu\text{m}$)	1 μm ($\pm 0.1 \mu\text{m}$)
Tube Voltage	10 to 50 kV	10 to 50 kV
Tube Current	5 μA min. / 200 μA max.	5 μA min. / 200 μA max.
Approximate Dose Rate	10 Sv/h @ 30 cm on axis, 50 kV and 80 μA	13 Sv/h @ 30 cm on axis, 50 kV and 80 μA
Approximate Flux	10 ⁶ counts per second/mm ² on the axis at a distance of 30 cm (50 keV/1 μA)	1.3x10 ⁶ counts per second/mm ² on the axis at a distance of 30 cm (50 keV/1 μA)
Continuous Power	4 W max. @ 100% duty cycle	4 W max. @ 100% duty cycle
Window Material	Beryllium (Be); window at ground	Beryllium (Be); window at ground
Window Thickness	127 μm	127 μm
Focal Spot Size	Approximately 2 mm	Approximately 2 mm
Output Cone Angle	120°	120°
Cooling	Air cooled	Air cooled
High Voltage Stability	< 0.03% RSD	< 0.03% RSD
Leakage Radiation	<5 $\mu\text{Sv/h}$ (0.5 mrem/h) at 5 cm with safety plug installed	<5 $\mu\text{Sv/h}$ (0.5 mrem/h) at 5 cm with safety plug installed
Power Consumption	9 W at 50 kV and 80 μA	9 W at 50 kV and 80 μA
Input Voltage	12 VDC (AC adapter included), connector	12 VDC (AC adapter included), connector
Control	USB, mini-USB connector (cable included)	USB, mini-USB connector (cable included)
Setting Time	Typical < 1 second	Typical < 1 second
Weight	360 g	360 g
Humidity	30 to 90% (non condensing)	30 to 90% (non condensing)
Operating Temperature	-10 °C to +50 °C	-10 °C to +50 °C
Storage Temperature	-25 °C to +60 °C	-25 °C to +60 °C
Safety Controls and Indicators	1) External hardware interlock 2) Flashing LED 3) Beeper	1) External hardware interlock 2) Flashing LED 3) Beeper
Software	Mini-X Control Software controls voltage and current Mini-X API for custom programming applications	Mini-X Control Software controls voltage and current Mini-X API for custom programming applications
Warranty	One year or 2000 hours, whichever comes first	One year or 2000 hours, whichever comes first



USB Software Interface. Allows the user to set the voltage and current as well as monitor both parameters.

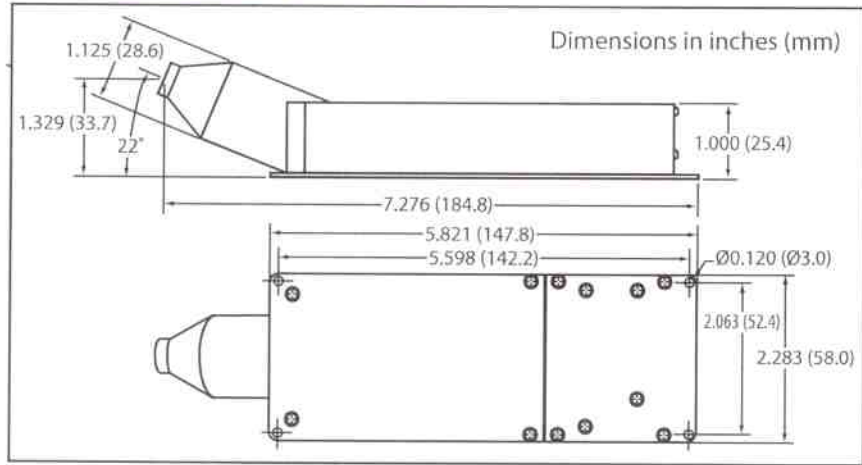


Mini-X Mechanical Dimensions

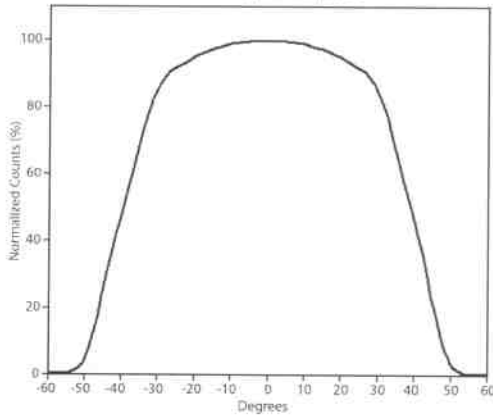


Mini-X 120° cone.

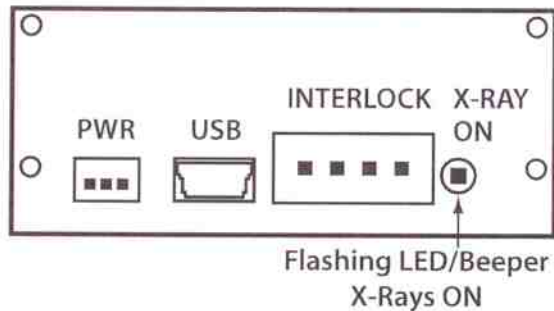
NOTE: When using the 2 mm collimator, the X-ray cone is 5°.



Mini-X Angular Response

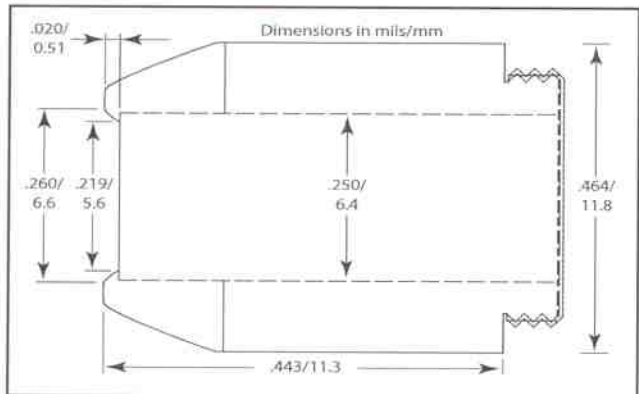


Back panel connectors



Collimator and Safety Plug

The Mini-X is provided with a collimator to facilitate its use in XRF applications. It consists of a brass collimator with an aluminum (Al) insert and a cover that screws into the Mini-X. The collimator has a 2 mm diameter hole. The brass safety plug when installed, reduces the flux from an operating tube to less than 2.5 mrem/h at 5 cm away in accordance with Requirements 5.2.2.2.2 of the NBS Handbook for Radiation Safety for X-Ray Diffraction and Fluorescence Analysis Equipment.



Collimator cover mechanical dimensions (mils/mm).

Filters

There are many reasons to use filters on the x-ray tube. They can help eliminate low energy photons to create a clean background and they can filter the characteristic lines of the tube's target. Keep in mind that when any filter is used it reduces the flux coming out of the tube. An Al filter reduces the flux much less than a Mo or Ag filter. The higher the Z of the filter or the thicker the filter, the less flux will be available. It is therefore necessary to raise the current of the x-ray tube to compensate. Please see <http://www.amptek.com/minix.html> for output spectra with various filters.

Filters Provided		
Material	Thickness (µm/mils)	# Provided
Al	1016 / 40	5
Al	254 / 10	5
Cu	25.4 / 1	3
Mo	25.4 / 1	2
Ag	25.4 / 1	1
W	25.4 / 1	1



The Mini-X shown with the Amptek XR-100CR X-Ray Detector and PX5 Digital Pulse Processor.



The Mini-X mounted on MP1 with X-123SDD.



The Mini-X and X-123SDD shown with vacuum couplings.

Mini-X-OEM X-Ray Tube for XRF



The Mini-X-OEM X-ray tube is not the same as the Mini-X.

The Mini-X has a USB interface to control the voltage and current through PC software. The Mini-X is an end-user, packaged device.

The Mini-X-OEM is controlled by user supplied analog voltages

Radiation Precautions

The Mini-X is intended to generate x-ray radiation during normal operation. The Mini-X has been designed to focus radiation in the designated output direction, however radiation in other directions is possible and should be addressed with shielding and/or monitoring in the final application.

Radiation Levels external to the X-ray tube housing with the brass safety plug ON do not exceed 25 $\mu\text{S}/\text{h}$ (2.5 mrem/h) measured 5 cm from the surface of the housing in accordance with Requirements 5.2.2.2.2 of the National Bureau of Standards (NBS) Handbook for Radiation Safety for X-Ray Diffraction and Fluorescence Analysis Equipment.

Examples of Shielding (that comply with the above standard)

1 mm (0.040 inch) of Pb will result in radiation levels of 0.5 mrem/h.

6.35 mm (0.250 inch) of Fe will result in radiation levels of 0.5 mrem/h.

3.18 mm (0.125 inch) of Brass will result in radiation levels of 2.5 mrem/h.

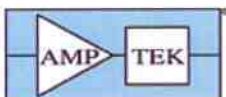
The inside of the housing can also be lined with 3.18 mm (0.125 inch) of aluminum (Al) in order to absorb the XRF from the shielding material.

Caution

The Mini-X is only one component of an X-ray instrument. It is the responsibility of the user, the OEM customer, or experimenter to provide a fail safe metal enclosure to prevent escaping radiation while using this product. The final product (turn-key system) must comply with local government regulations to protect personnel from exposure to radiation. Amptek Inc., bears no responsibility for the incorrect use of this product.

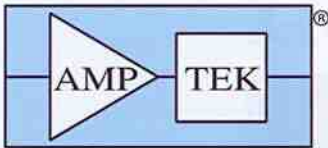
Caution

This device produces X-Rays when energized. To be operated only by qualified personnel.



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X-Ray Solutions



Gamma Ray Detectors



Charge Sensitive Preamplifiers and Front-End Electronics Space Applications



OEM's #1 Choice

Products for Your Imagination
www.amptek.com

DIGITAL PULSE PROCESSORS



Digital Pulse Processor
Shaping Amplifier
MCA
Power Supplies



Size: 3.5 in. x 2.5 in.

Features of the PX5:

- Compatible with all Amptek detectors & detectors from other manufacturers
- 80 MHz ADC
- Trapezoidal and CUSP shaping
- Reduced ballistic deficit
- High count rate capability & stability
- High throughput & pile-up rejection
- MCA with 8 k channels
- USB, RS232 & Ethernet interface
- Free software for instrument control, data acquisition, and analysis
- Free Software Developer's Kit (SDK)
- Oscilloscope mode

Features of the DP5:

- 80 MHz ADC
- Replaces both shaping amplifier and MCA
- Supports both reset and feedback preamplifiers of either polarity
- 16 SCAs
- Configurable for use with PMTs
- For OEM or custom laboratory use
- Highly configurable

GAMMA RAY DETECTION SYSTEM

Scintillation Detector (NaI) & Digital Pulse Processor



•Homeland Security •Nuclear Plant Monitor

Features of the GAMMA-RAD5:

- Ruggedized scintillator and PMT
- Gain stabilized in software
- Ethernet, RS232 & USB interfaces for robust communications
- USB powers entire system
- Flexible architecture for tailoring interface
- For OEMs and custom users

PMT DIGITAL TUBE BASE

Use with *Your* Scintillation Spectrometer



Includes:

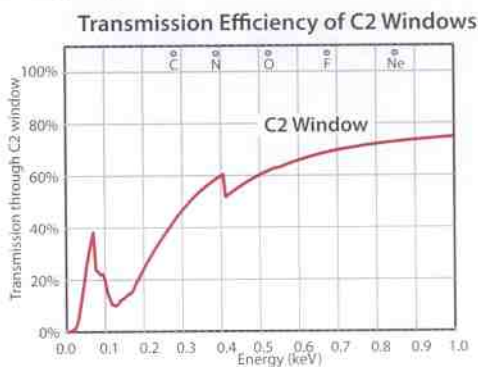
- Digital pulse processor with charge sensitive preamplifier & MCA
- All power supplies (low voltage and high voltage)
- Interface hardware and PC software
- 14 pin photomultiplier tube base

FAST SDD® WITH C2 WINDOW

For EDS (SEM) Applications

Features of the C2 Windows:

- High intrinsic efficiency
- Low energy response
- Measure elements down to Carbon
- Low cost



X-RAY TUBE



Includes:

- X-ray tube
- Power supply
- Control electronics
- USB communication

Features of the Mini-X:

- 50 kV/80 μ A
- Silver (Ag), Gold (Au), Rhodium (Rh) or Tungsten (W) target
- USB controlled
- Stable output
- Fast - Low power - Small size
- Self-contained system

Applications

- X-Ray Fluorescence analysis
- Portable systems
- OEM
- Process control
- Research and teaching

visit www.amptek.com for complete specifications

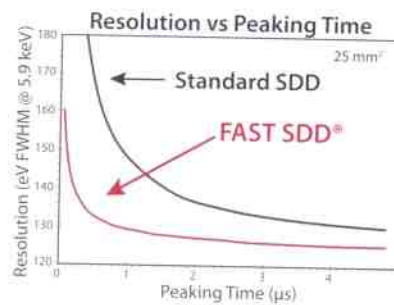
X-RAY AND GAMMA RAY DETECTORS

•Solid State Design •Easy to Use •Low Cost

OEM's #1 Choice
For XRF

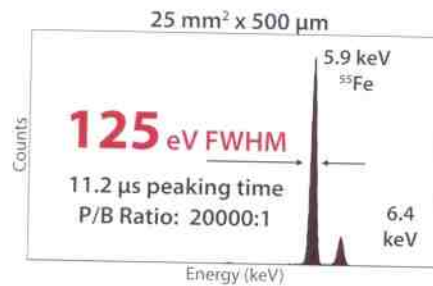
FAST SDD®

- Ultimate Performance
- >1,000,000 CPS



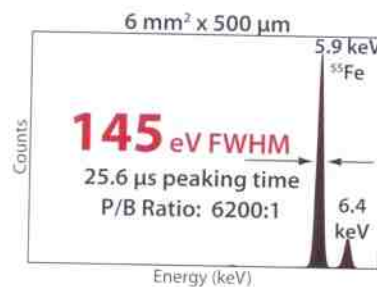
SDD

- High Performance



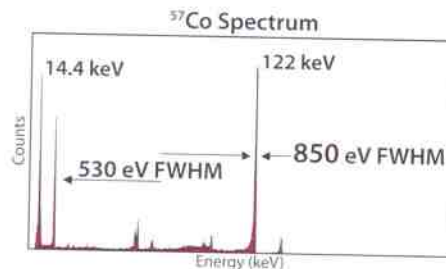
Si-PIN

- Best Value



CdTe

- X-Ray & Gamma Ray



Ask about our
XRF Experimenter's Kit
educational discount.



visit www.amptek.com for complete specifications

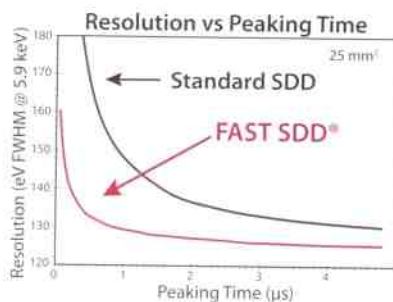
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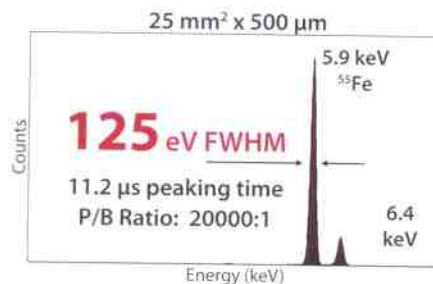
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- Ultimate Performance
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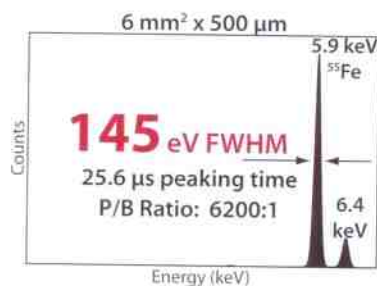
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- High Performance



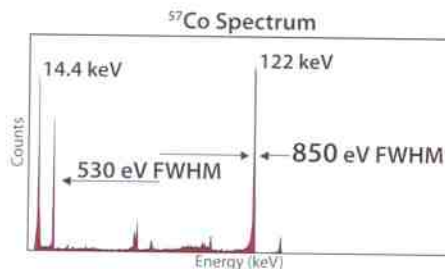
Si-PIN

- Best Value



CdTe

- X-Ray & Gamma Ray



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DIGITAL MULTICHANNEL ANALYZER

Features of the MCA8000D:

- For use with traditional analog pulse shaping
- High speed ADC (100 MHz, 16 bit) with digital pulse height measurement
- 8k data channels
- Minimum pulse peaking time 500 ns
- Conversion time 10 ns
- Sliding-scale linearization
- Differential nonlinearity $<\pm 0.6\%$
- Integral nonlinearity $<\pm 0.02\%$
- Two peak detection modes: first peak after the threshold (nuclear spectroscopy) or absolute peak after the threshold (particle counter calibration in clean rooms)
- Two TTL compatible gates for coincidence and anticoincidence
- Supports USB, RS-232, and Ethernet communication interfaces
- USB powered
- Free Display Acquisition Software supports ROI, energy calibration, peak information, MCA configuration, and file management
- Free Software Developer's Kit (SDK)

FITS IN A SHIRT POCKET

The MCA8000D is a full featured, low power digital multichannel analyzer intended to be used with a wide variety of detector systems.



Dimensions: 5 x 2.8 x 0.8 in
125 x 71 x 20 mm
Weight: <165 g

CHARGE SENSITIVE PREAMPLIFIERS

Your complete source for high performance preamplifiers and amplifiers

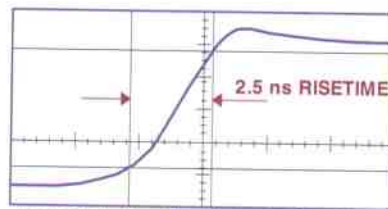
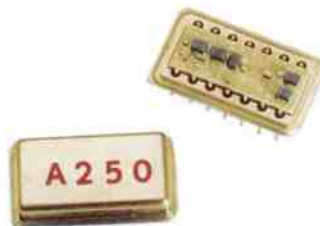
See <http://www.amptek.com/hybrids.html> for Selection Guide



Noise @ 0 pF: 670 eV FWHM (Si)
~76 electrons RMS
Noise Slope: 13 eV/pF with Low C_{iss} FET
11.5 eV/pF with high C_{iss} FET
Fast Rise Time: 2.5 ns

Features of the COOLFET:

- Thermoelectrically Cooled FET
- 3 internal FETs to match detector
- Lowest Noise and Noise Slope
- AC or DC coupling to the detector
- Both Energy and Timing outputs
- Optional input protection
- Easy to use



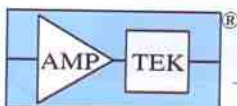
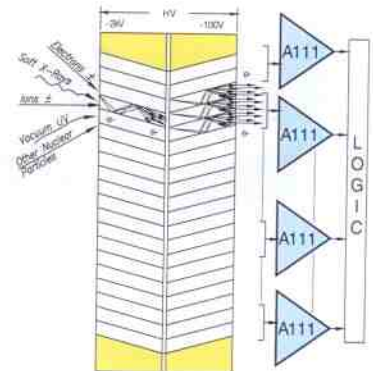
Horizontal = 2 ns/div. Vertical = 500 mV/div.

Features of the A250:

External FET
FET can be cooled
Noise: <100 e⁻ RMS (Room Temp.)
<20 e⁻ RMS (Cooled FET)
Gain-Bandwidth $f_c > 1.5$ GHz
Power: 19 mW typical
Slew rate: >475 V/ μ s



A Microchannel Plate (MCP) Array Connected to Multiple A111s



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AMETEK
MATERIALS ANALYSIS DIVISION

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