

MCA527

Digital Miniature Multi Channel Analyzer



The MCA527 is a battery powered high performance 16K Multi-Channel Analyzer/Multi-Channel Scaler module with the performance of a laboratory grade MCA. High voltage supply for detector and preamplifier power supply are integrated as well as an internal coarse amplifier and digital filter. Together with a detector it forms a small-size gamma spectroscopy system, which is well suited to the demands of field measurements for international safeguards, environmental monitoring, nuclear waste treatment facilities, radioactive transport control and similar applications.

Furthermore, the MCA527 supports a vast number of different detectors and its 16K resolution is adequate to support high resolution gamma spectrometry with HPGe detectors. As the MCA527 works with digital filtering, it allows to set a broad range of filter time constants and it is also tolerant to largely differing preamplifier signal shapes.

The application programs from our MCA software family are free of charge and allows to operate the device as a general purpose multi channel analyzer, multi channel scaler, universal counter, neutron coincidence counter or oscilloscope.

Hardware Specification

Amplifier

Hardware-based coarse amplifier with 5 discrete gain steps
Input DC coupled, offset adjustable and depending on polarity of input signal.
Linearity better than 0.1%.
Input voltage range $\pm 12V$

ADC

14bit, 10 MSps
Integral non-linearity $< 0.05\%$
Temperature stability of gain $< 50\text{ppm}/^\circ\text{C}$

Digital signal processing

Double differential trigger filter, or single differential low energy low count rate trigger filter, special slow trigger filter to support slow scintillation detectors as CsI or Srl.

Pile-up-suppression, pulse pair resolution $\sim 400\text{ns}$, depending on trigger filter.

Automated and manual adjustment of trigger threshold.

Shaping time adjustable in the range $0.1 - 25.5\mu\text{s}$.

Flat top adjustable $0 - 15\mu\text{s}$.

Maximum number of channels: 16K

Differential non-linearity $< 1\%$ for 4K resolution and $1\mu\text{s}$ shaping time.

Base line restorer with adjustable averaging.

PZC adjustment, detector decay time constants from $40\mu\text{s}$ to 1ms can be compensated.

Peak stabilization possible.

Direct input: for analyzing signals with fall times $< 40\mu\text{s}$ or Gaussian shaped signals.

Oscilloscope mode shows signal as well as trigger filter and main filter signals.

Modes of operation

- PHA (pulse height analysis), result is a histogram of pulse height.
- MCS (multi channel scaling): registers number of counts in subsequent time intervals. MCS mode allows to acquire an integral PHA spectrum in parallel to the MCS acquisition.
- Gated operation: gated events (e.g. light pulses) are collected in a second spectrum and can be used for stabilization. Also applicable with anticoincidence setups.
- Extended gated operation: events are collected in up to eight spectra according to the time elapsed since the last gating signal.
- Sample mode: Input signal is recorded without processing, similar to an oscilloscope.
- Autonomous repeat mode: makes series measurements and stores them in up to 32GB (FAT32 μSD card) internal non volatile memory.

- (optional) List mode: registers sequentially the time between two subsequent events. Can be combined with emulation of the behavior of neutron coincidence counters / shift registers.

Spectrometric performance:

Resolution (FWHM) for typical 500mm^2 planar HPGe detector for count rates $< 10000\text{cps}$ and an Am241 source at 59keV :

$< 510\text{eV}$ at $1\mu\text{s}$ shaping time

$< 460\text{eV}$ at $2\mu\text{s}$ shaping time

Usable spectral range from 100% down to 0.13% (e.g. 3 keV to 2300 keV) with optimized system.

Throughput in memory:

$> 75\text{kps}$ in memory at 140kps input rate and $0.5\mu\text{s}$ shaping

$> 35\text{kps}$ in memory at 50kps input rate and $2\mu\text{s}$ shaping time

Preamplifier power supply, high voltage

$\pm 12V$, 60mA

$\pm 24V$, 60mA

Detector HV up to $\pm 5\text{kV}$, polarity and peak voltage depends on module inserted. Default is the HV3600, possible are also the HV5000, HV3000(obsolete) or HV1000.

Extras

Internal temperature measurement, MCA temperature is saved with spectrum.

SUB-D9/pin3: Aux. analog input, 11 bit, $0 - 10V$

SUB-D9/pin5: HV inhibit, can also be used as auxiliary analog voltage input or as resistance meter.

SUB-D9/pin8: 1-wire interface to connect temp sensors.

Extension port (possibility to connected e.g. GPS receiver or other customized extensions)

Power supply:

Rechargeable Li-Ion batteries, operation time $10 - 25\text{h}$, depending on detector connected. Battery charger included.

Computer Interface

Ethernet, USB, RS-232 (up to 3MBaud)

Bluetooth (adapter to extension port as accessory)

Mechanical

Housing $164\text{mm} \times 111\text{mm} \times 45\text{mm}$ without connectors; weight 820g .

SHV plug for HV, BNC for Signal, Lemo (size 00) for gate input, SUB-D9 for preamplifier supply and auxiliary inputs, sockets for power supply, interface, LED for status and switch for ON/OFF.

Environmental

Operational temperature range: $0 - 50^\circ\text{C}$.

Humidity up to 90%, non condensing, IP42.

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