TECHNICAL SPECIFICATIONS

## Topaz-HR – A compact Digital MCA for High-Resolution Gamma-Ray Spectrometry

INTRODUCTION

Topaz-HR is a compact, stand-alone digital Multi-Channel Analyzer (MCA), which is able to perform a Pulse Height Analysis (PHA) of the signal produced by high resolution gamma-ray semiconductor detectors, such as Hyper-Pure Germanium Detectors (HPGe). These detectors are commonly used in high-resolution gamma-ray spectrometry, an analysis method extensively used by advanced radio-analytical laboratories as part of comprehensive nuclear analytical methods. The Topaz-HR MCA can also be used with detectors with lesser energy resolution, such as scintillators like NaI (Tl), $LaBr_3$, $CeBr_3$, etc.

The Topaz-HR is supplied with a basic software package that allows the user to control the device, and to acquire and visualize the energy spectrum. The software incorporates an advanced and easy-to-use "discovery" function that can be used to detect automatically all BrightSpec-built MCAs that are physically connected to the PC or in the immediate network neighborhood. Alternatively, the MCA is offered with our full-featured, advanced Gamma-ray spectrometry software package - bGamma. This software allows the user to perform data acquisition and spectrum analysis within the same software framework, including all necessary calibrations, and radioactivity quantization per radionuclide in the sample.

A set of programming libraries is also available, which makes the incorporation of the Topaz-HR into existing radiation systems or setups very easy. The programming libraries are available for MS Windows, Linux and Mac operating systems.

DESCRIPTION
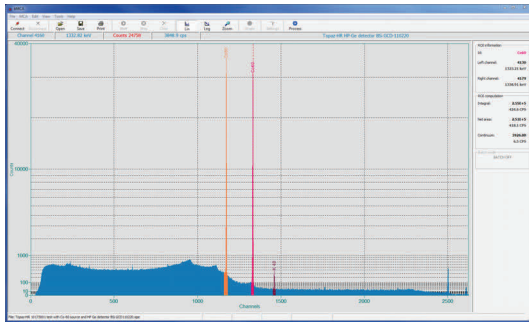
The Topaz-HR is an advanced, fully digital, compact Multi-Channel Analyzer. This device is used to process the electronic pulses typically produced by high-resolution semiconductor detectors such as Hyper-Pure germanium detectors (HPGe). However, the MCA can also be connected to other types of detectors, including scintillators (e.g. NaI(Tl), $CeBr_3$ or $LaBr_3$, etc.), which makes it a valuable and multi-purpose device, a "must have" in your lab.

The MCA implements several advanced modes of data acquisition: Pulse Height Analysis (PHA), Multi-channel scaling (MCS), LIST and Timestamped-LIST mode (TLIST). For the latter, each recorded pulse is stored with the arrival time stamp in addition to the pulse height information (energy). In TLIST mode the event time resolution is better than 30 nano-seconds. The Topaz-HR design incorporates the latest advances in digital electronics, the core of the MCA is its 14-bit high-quality fast flash ADC running at 50 Ms/s, a 100 MHz DSP processor and a 200 MHz CPU. The device has a spectral memory of up to 16 384 (16K) channels of 32-bit depth available for any acquisition mode.

The device includes a low-noise High Voltage bias supply which is able to generate an output from 0 to 6000 Volts, as well as a low voltage supply (±24 and ±12 Volts) intended to power the most commonly found pre-amplifiers via a standard DB9 connector.

The Topaz-HR transfers acquired data via a high-speed USB connection to the PC with data transfer rates of 480 Mbit/sec. The MCA is powered using an external low-noise AC/DC power supply, which is included in the delivered package. The MCA is encased into a rugged aluminum box with all the necessary connectors for the detector and auxiliary signals, plus one USB (mini-B) for the PC. In the front panel several LEDs signalize the status of the device and data acquisition.

The device can be controlled with our basic acquisition software (bMCA software), which is freely downloaded from our website. Alternatively, the MCA control is incorporated into our fully-featured Gamma-ray spectrometry analysis software— **bGamma**. An attractive package price can be obtained when ordering the MCA together with bGamma software. **The programming libraries for Windows®, Linux™ and macOS are available as well.**
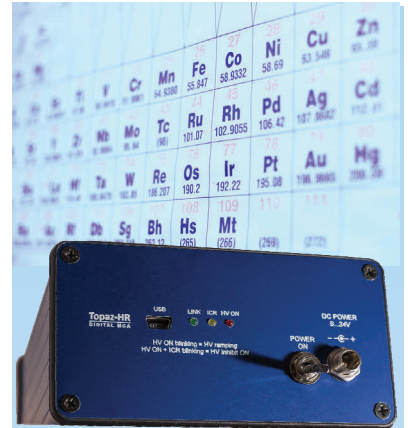
FEATURES

- Fully digital, ultra-compact Multi-Channel Analyzer (MCA), suitable for high energy resolution semiconductor detectors like HPGe

- Fast flash 14-bit ADC (50 Hz) with a 100 MHz DSP and a 32-bit CPU at 200 MHz

- **Advanced spectroscopy acquisition modes: PHA, MCS, LIST and TLIST. TLIST with 30 ns resolution**

- Hi-speed data transfer rate (480 Mbit/sec) over USB

- Up to 16K channels 32-bits depth for any acquisition mode

- Includes 6 kV 350 μAmp detector's high voltage bias supply with automatic ramping and output inhibit

- Includes pre-amplifier power supply +/-24V @ 125 mA and +/- 12V@ 250 mA

- Supports both RC and pulse-reset type of pre-amplifiers. Implements automatic reset pulse detection

- Miniature design combining low power consumption with low noise

- Includes two user-programmable I/O ports.

- Compact MCA with size of 126x106x56 mm in the aluminum case, weight < 200 grams

- Available programming libraries for Windows and Linux Operating System (upon request)

- **Can be incorporated into full-featured and powerful Gamma-ray spectrometry software: bGamma**
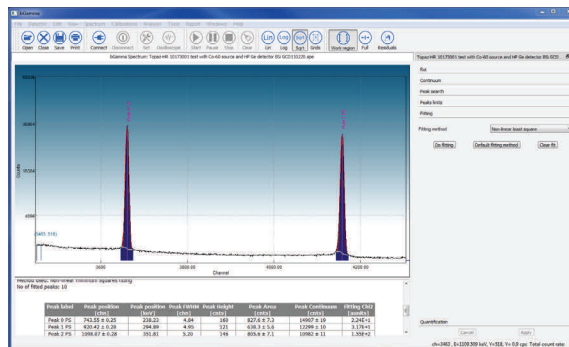
BRIGHTSPEC

is a dynamic engineering company providing novel designs and innovative solutions in the field of nuclear electronics, nuclear instrumentation and software development for radiation detection.

TECHNICAL SPECIFICATIONS

Device

♦ 14-bit high-performance flash ADC, 50 Ms/s sampling rate.

♦ 100 MHz DSP processor.

Data acquisition

♦ Spectral memory sizes of 256, 512, 1024, 2048, 4096, 8192 and 16 384 (16K) channels of 32-bits depth.

♦ Supports both RC and pulse-reset type of Pre-Amplifiers.

♦ Acquisition modes : PHA, MCS, LIST mode and TLIST mode.

    ♦ LIST and TLIST modes with better than 30 nsec event time resolution.

♦ Analog gain from x1 to x256. Coarse gain with amplification factors of 1, 2, 4, 8, 16, 32, 64 and 128. Fine gain from 1 to 2 in steps of 1/16384 (~ 0.000061)

♦ Upper and Lower Level Discriminator settings given in channels.

♦ Automatic reset pulse detection or via external signal.

♦ Preset acquisition times from 0.005 seconds to approx. 0.65 years.

♦ Built-in several preset acquisition modes:

    ♦ By preset time value (real or live times)

    ♦ By counts (in ROI)

    ♦ By external control signal or

    ♦ Combination of any above

MCS

♦ Spectral memory sizes of 256, 512, 1024, 2048, 4096, 8192 and 16384 channels, depth 32-bits.

♦ Dwell time from 0.005 seconds to "count-forever".

Digital Settings

♦ Trapezoidal pulse shaper.

♦ Rise Time: from 0.1 to 12 μs in steps of 0.2 μs.

♦ Flat Top: from 0.1 to 8.0 μs in steps of 0.1 μs.

♦ Adjustable Fast discriminator threshold.

♦ Digital Base Line Restorer (BLR).

♦ Pile-Up Rejector (PUR).

♦ Analog and adjustable Poles/Zero cancellation correction.

♦ Dead time correction with fine-tuning capability.

Power Supply

♦ Device power by external low-noise AC/DC power adaptor 9-24V (supplied), 15W max.

♦ Preamplifier power supply: +- 24 V @ 125 mA and +-12V @ 250 mA.

♦ HV power supply: 0 to 6000 V, 350 μA with automatic ramping. Dual polarity, but fixed at factory.

♦ External HV Inhibit control.

GPIO

♦ Two user-programmable I/O lines.

♦ Can be used as external counters, external data acquisition control, etc.

Data communication

♦ High-speed USB 2.0, up to 480 Mbit/s.

♦ Standard 3-meter long USB cable supplied.

Physical

♦ MCA box: length 126 mm, width 106 mm, height 56 mm.

♦ Weight: less than 200 grams (including box).

♦ Connectors :

    ♦ <u>Front</u>: EXT DC barrel-type, USB mini-B.

    ♦ <u>Back</u>: SHV for high voltage output, 3x BNC for signal and GPIO, DB9 connector for preamplifier power.

♦ Indicators:

    ♦ Red LED for detector high voltage status.

    ♦ Yellow LED for incoming count rate (ICR).

    ♦ Green color LED for power and communication status.

    ♦ Read and Yellow LED blink synchronously in case of HV fault.

Other

♦ The device is supplied with a basic software to control operation, data acquisition and visualization.

♦ Upon request: set of programming libraries for Microsoft Windows® and Linux.

Optional

♦ The MCA can be supplied with the full-featured Gamma-ray spectrometry software—**bGAMMA**, at an attractive combined package price.

Certifications

♦ The device is CE compliant.

CE
CERTIFIED