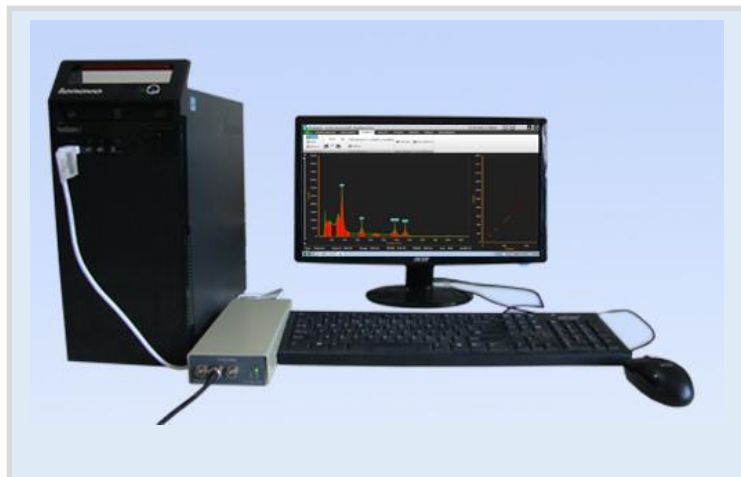


## A High-Resolution 8K MCA with USB Interface & AnuSpect-Gamma Spectroscopy software

**TYPE : MC 1001**

### Technical Data



#### FEATURES :

- ❑ Excellent MCA performance in terms of resolution, INL, DNL, etc.
- ❑ Universal connectivity to a wide range of PCs and laptops
- ❑ Unlike ISA / PCI cards, it stands outside a PC
- ❑ DNL: + or - 1% (with 1K conversion Gain)
- ❑ INL : + or - 0.05% F.S (with 1K Conversion Gain)
- ❑ Power requirement: 5V, ~500 mA through USB cable directly (No external power supply required).
- ❑ Latest MCA data acquisition & analysis software, Anuspect-Gamma Spectroscopy software is offered from (BARC, Mumbai) with this MCA.

Anuspect is a versatile software package for acquisition, analysis and display of gamma spectrometry data. It delivers on-screen exhaustive analysis and calibration of gamma spectra obtained from any gamma detector, supported by visually effective and user friendly Graphical User Interface (GUI). A Multi-Channel Analyzer (MCA) is an important part of nuclear spectroscopy system. The major requirement of MCA is for nuclear pulse height analysis in energy spectroscopy. The USB-MCA presented here, incorporates state of art technologies like FPGA, USB bus interface and precision analog electronics to meet the stringent system requirements in nuclear pulse spectroscopy. The resolution supported by the USB-MCA ranges from 256 channels to 8K channels selectable via software, making it suitable for all spectroscopy applications from low resolution (e.g. NaI-PMT) to high resolution (e.g.-Ge) systems.

The USB bus interface of the MCA provides an excellent connectivity with most of the new PCs and lap-top computers. The Anuspect software provided with the USB-MCA, seamlessly integrates with the hardware, featuring a range of standard functions required for analysis and acquisition.

Thus USB-MCA, along with external HP-Ge detector, spectroscopy amplifier and HV supply, forms a complete system for high-resolution spectroscopy applications.

USB MCA along with external NaI detector linear amplifier/spectroscopy and HV supply for a complete system for low resolution spectroscopy application

### SPECIFICATIONS

#### Hardware features:

- MCA resolution: 256, 512, 1K, 2K, 4K and 8K channels.
- Spectrum memory: 128K bytes single port SRAM.
- Max counts / channel: 31 bit (2 Giga counts).
- Pulse processing time: 7  $\mu$ s including ADC conversion time of 5  $\mu$ s.
- Pile up rejection: Active high TTL input from spectroscopy amplifier
- DNL: + or - 1% (with 1K Conversion Gain)
- INL : + or - 0.05% F.S. (With 1K Conversion Gain)
- MCA Input: Uni/Bipolar, Gaussian/TTL/tail pulses ranges 0-10V
- Power requirement: 5V, ~500 mA through USB cable directly (No external power supply required).



8K MCA (USB) Module



8K MCA (USB) Module

**System Software features:**

- Ideal software solution for advanced gamma spectroscopy application
- User interface panel for setting hardware (MCA) parameters
- Spectrum display (standard/zoomed, Linear/Log scale)
- Optimized peak search algorithm
- Nonlinear least-square fit of peaks with exponential tailed model
- Option for automatic addition of peaks at channels with high residue after fit based on user's criteria.
- Energy, peak shape and efficiency calibration
- Nuclide identification and activity calculation
- Comprehensive report generation for analysis results.

**File Menu:** For spectrum file saving & loading multiple format options have been given to the user. Additionally calibration files (\*.cal), previously saved, can be loaded for energy, shape, efficiency calibration.

**Edit Analysis Library:** This option is used to create and update nuclide libraries that are used for qualitative and quantitative analysis of radio nuclides.

Options are provided for the following functions :

1. Add new nuclide/gamma line

2. Delete existing nuclide/gamma line
3. Import new library
4. Save library in text format.

**Online Analysis Menu:** It holds functionality for the spectrum acquisition.

**Hardware Setup:** MCA hardware specifications must be set before online acquisition.

The following options can be set:

1. MCA Mode: Pulse Height Analysis (PHA) or Multi Channel Scaling (MCS)
2. Timer Mode: Live or Clock
3. MCA Resolution-(25 channels-8K channels)
4. Setting Baseline, ULD, LLD.

**Peak Search:** A standard peak search algorithm is implemented for offline analysis. The peaks are marked on the spectrum as follows:

- Adding & deleting a peak
- Peak info
- Peak report.

**Shape Calibration:** This analysis program calibrates peak fitting models consisting of polynomial background, Gaussian peak; optional smoothly joined exponential tail on low energy side or both high & low sides.

- Poly background + Gaussian
- Poly background + Gaussian + Low exponential tail
- Poly background + Gaussian + Low exponential tail + High exponential tail.

**Energy Calibration:** The energy calibration is computed from a linear least squares fit of channel number v/s energy.

**Efficiency Calibration:** This option is for calibrating the efficiency of the spectrometer. With the provided dps values at known peaks for a known nuclide, efficiency is calculated using the equation involving dps, cps & gamma abundance. Both, log polynomial and power equations are supported.

**Non Linear Least Square Fit:** Earlier calibrated shape model will be fitted for all the peaks in the spectrum.

**Activity:**

**Compute Activity:** This option is for calculating the activity of unknown samples if the efficiency calibration is available.

**Report Generation :**The various reports that are displayed in this windows are:

- Peak Reports
- Activity Calculation Report

**Display:** Option related to spectrum display window can be accessed from this menu.

**Display Cursor:** Checking on this box displays a cursor on the screen. Information regarding the energy, counts and the position of the cursor (channel no.) is displayed on screen besides the cursor.

**Zoom In:** Select the zoom in option and a window appears at the top displaying the area currently zoomed. Drag the mouse to select the rectangle of interest.

**Zoom Out:** Exits the zoom mode.

**Grid View:** Spectrum view displays the entire spectrum & peaks information. ROI view displays information related to select ROI only.

**PHA Mode features :**

- Exp. Time : The time for acquisition in seconds (for PHA and MCS both)
- Timer Mode: Live / clock mode (for PHA only) (Default: Live).
- Conversion Gain: This is used to set conversion gain of the MCA. (for PHA only) (Default : 8K)(256 channels-8K channels)

LLD (volts) : This is used to set lower discrimination level of the MCA (Set range : 0.1 to 10 volts)

- ULD (volts) : This is used to set upper level discrimination level of the MCA (set range : 0.1 to 10 volts)
- Baseline (volts): This is used to set baseline of the MCA (range: -2V to +2V volts).

**Advantages:**

The USB-MCA is designed with state of art technologies to meet the stringent requirements of nuclear instrumentation and hence offers many distinct advantages including the following:

- Excellent MCA performance in terms of resolution, DNL, etc.
- Universal connectivity to a wide range of PCs and notebook computers.
- Unlike ISA/PCI cards, it stands outside a PC.
- Simple to install, operate and handle.
- Low power operation, operates with USB bus power only.

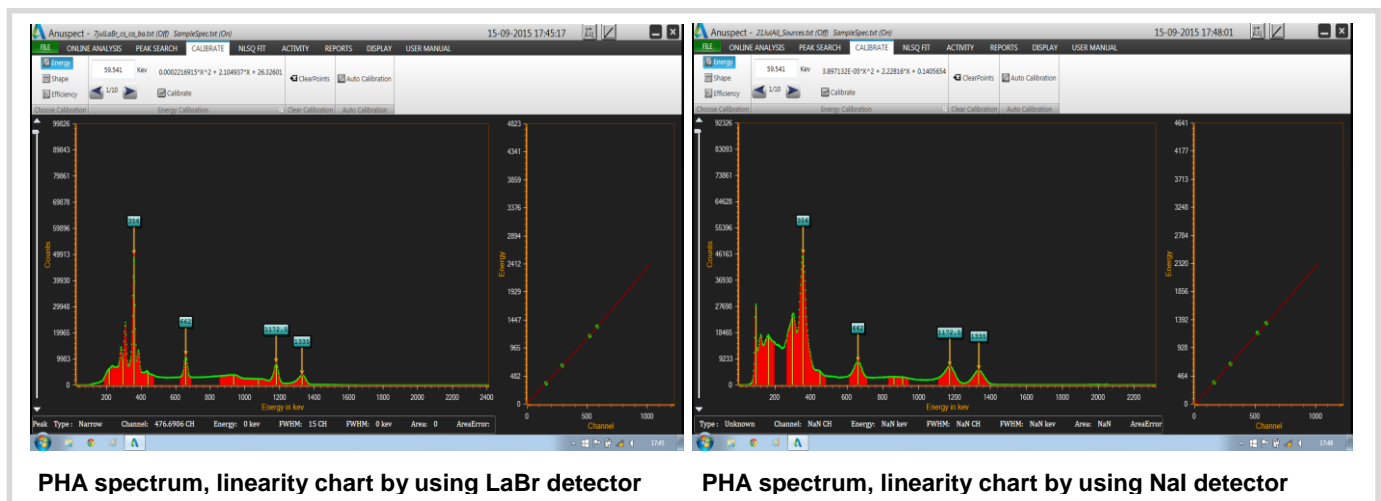
**PC Configuration Requirements :**

- Operating system-Windows XP with SP3 or higher
- CPU-Higher than Pentium-4
- Memory -2GB RAM
- Graphics Hardware-DirectX9.0C or higher (optional).

**Applications:**

The USB-MCA is useful for high resolution pulse height analysis (up to 8K channels) and high count rate systems (with a typical dead time of 7µsec maximum). The hardware with associated software installed in a pc makes state of art Multi-Channel Analyzer system. It is useful for high resolution X-ray and gamma ray spectrometry work in following areas:

- Isotope research
- Nuclear reactors
- Accelerators
- Universities
- Other R&D.



PHA spectrum, linearity chart by using LaBr detector

PHA spectrum, linearity chart by using NaI detector

**Important Note:** 8K MCA (USB) module and AnuSpect are offered by Nucleonix systems, based on the technology received from B.A.R.C., Mumbai.