

**GAMMA RAY SPECTROMETER  
(Microcontroller based)  
TYPE : GR 611M**

Technical Data



**FEATURES :**

- Microcontroller based, compact, rugged, light weight, portable and modular in construction.
- MINIM systems conserve bench space and significant savings in cost is achieved because of optimal design.
- Uses Microcontroller based Counter/Timer with advanced features for data acquisition & data outputting.
- Along with Scintillation Detector one can use it as a Gamma ray spectrometer or as a gamma counting system.
- Highly regulated variable EHT from 0 to 2000V
- Linear amplifier with adj gain and choice of shaping time constants.
- Single channel analyser facilitates both integral, differential or window counting.

The Gamma Ray Spectrometer (Microcontroller based) Type GR 611M consists of a MINIM based modular counting unit and a Scintillation Detector Type SD 150/151/160W. The Spectrometer can also be used for Gamma Counting applications. This MINIM based system has added advantage of savings in cost and also conserves bench space because of its optimal design. This system is configured around MINI BIN and Power Supply Type: MB 403 with the following Modules:

High Voltage Unit Type: HV 502  
 Linear Amplifier Type: LA 520  
 Single Channel Analyser Type: SC 530  
 & Counter Timer Type: CT 541A

(Microcontroller based), having unique built-in user programmable features for data acquisition & data outputting.

**SPECIFICATIONS**

**MINIBIN AND POWER SUPPLY**

**MB 403 :**

**Mini bin :**

Accommodates SIX / EIGHT single bit modules or combination of multiple widths with Amphenol connectors. Minibin is primarily designed with the objective of conserving bench space and to achieve significant saving in cost of the Minibin based systems. Bussed wiring is provided to the power connectors to distribute +/- 12V and +/- 24V. A control panel with ON/OFF switch, low voltage test sockets is provided on the right extreme side of the bin.

**Minibin Dimensions :**

11.75"width X 11.00 depth (upto connectors) X 8.75" height.

**Power supply :**

This is either two and half bit module or a compact box type enclosure fitted at the back of this bin, which generates highly regulated D.C voltages.

**Input :** (230V + 10%) A.C, 50Hz.

**D.C Output :**

+12V @ 1A, -12V @ 1A, +24V @ 0.5A, -24V @ 0.5A 48 watts maximum.

**Regulation :** Better than +/- 0.1%

**Noise & Ripple :** Less than 3 mV

**Stability :**

+/- 0.5% after a 24 hr warm-up at constant line, load & ambient temp.

**II. HIGH VOLTAGE UNIT (HV 502) :**

- a. Output voltage variable continuously from 0V to 2000 volts
- b. Output current (max) 1mA
- c. Load & Line regulations : Better than 0.005% of full scale
- d. Indefinite over load & short circuit protections and self recovery
- e. Output ripple less than 20mv.
- f. Dimensions : Single / Two bit module

**III. LINEAR AMPLIFIER (LA 520) :**

- a. Input Polarity : Positive or Negative
- b. Total gain (Typical) : 800 (approx)
- c. Output (Unipolar) : 0 to 8V
- d. Max. output (Unipolar) : 12V
- e. Dimensions : Two bit module

**IV. SINGLE CHANNEL ANALYSER (SC 530) :**

- a. Input : Unipolar or bipolar with a +ve leading edge 0 to 10V
- b. Pulse Pair resolution (approx): 0.6 micro sec.
- c. Output pulse polarity : +Ve  
Pulse amplitude : +5V  
Pulse width : 0.5 micro sec
- d. LLD output pulse amplitude : +5V  
Output pulse width : 0.5 micro sec  
Base line variable by : 10 turn  
Base line variation : 0 to 10V by helical potentiometer
- e. Window width continuously : Variable by helical potentiometer  
(0 - 1) V in window mode  
(0 - 10) V in normal mode
- f. Dimensions : Single bit module

**V. COUNTER TIMER (CT 541A) : COUNTER / RATEMETER:**

This is a microcontroller based state-of-art Counter / Timer unit having lot of advanced features.

- a. Input : 100mV to 10V, unipolar or positive bipolar semi-gaussian pulse
- b. Pulse width : 0.5 micro sec (min)
- c. Polarity : Positive or Negative
- d. Input impedance : 1K (approx)
- e. Input Counts Capacity : 999999 counts

- f. Pulse Height Discrimination : 100mV - 10V by a preset provided on front panel
- g. Counts Indication : 16x2 dotmatrix LCD display
- h. Modes of Data Acquisition : a. Counts for a preset time  
b. CPS  
c. CPM
- i. Storage facility : upto 1000 readings
- j. TIMER  
Preset Time Setting : Programmable through tactile switch control buttons
- k. Preset Time / Elapsed Time : on 16x2 dotmatrix LCD display
- l. Preset Time Range : 1 to 9999
- m. Built-in printer port facilitating direct data printing
- n. Additional Options :  
i. Data communication software for down loading of data can be given at extra cost .  
ii. External hand held keypad with cable.

**VII. EXPERIMENTS :**

- Calibration and determination of the resolution of the spectrometer
- Study of complete spectra of sources such as CS-137, Co-57, Co-60, Zn-65, Na-22 and to locate the photo peak, X-ray peak, compton Escape peak etc.
- To find the photo peak efficiency of a NaI (TI) Crystal of given dimensions for a different energy gamma rays.
- To determine the strength of a given source
- To find the energy and relative intensity of gamma rays in an isotope emitting more than one gamma ray.

**VIII. APPLICATIONS :**

The system finds wide range of applications in nuclear research and academic fields which include:

Analysis of gamma radiation Identification of unknown isotopes and their relative abundance.

Measures the strength of radio activity of sample.

Useful in radiotracer techniques.

Can be use for protein bound iodine studies in medicine using well type scintillation head etc.

Swipe sample counting in Health Physics Labs.

## ACCESSORIES FOR GAMMA RAY SPECTROMETER SYSTEM

### (a) SCINTILLATION DETECTORS

Nucleonix Systems offers wide range of NaI Scintillation Detectors of different sizes both with flat & well type crystals, to meet the requirements of wide range of users for Gamma ray spectrometry measurements.

Scintillation detectors offered include 1"x1", 2"x2" & 3"x3" NaI integral assemblies with built-in pre-amplifiers. These detector assemblies give excellent stability, superior performance & good resolution in the range of 8.0 to 9.5% for Cs-137. Scintillation detectors of other sizes can be offered against user specific requirements also.



Important Specifications	Detector Type		
	SD 151	SD 152/SD152 W	SD 153/ SD 153W
1. Flat/Well type NaI crystal	SD 151	SD 152/SD152 W	SD 153/ SD 153W
2. Crystal Sizes	1" x 1"	2" x 2"	3" x 3"
3. a. Flat crystal b. Well Size (applicable for	---	0.656" dia x 1.546" deep	0.656" x 1.546" deep
4. Photo multiplier	R6095 of Hamamatsu or its equivalent	EMI 9857 or 9266 or its equivalent	EMI 9305 or its equivalent
5. Resolution (Better than)	8.5 %	8.5 %	9.5 %
6. Pre-amplifier	Built – in	Built – in	Built – in
7. Gain (Approx.)	25	25	25
8. Noise (RMS. referred to input)	Less than 50 $\mu$ V	Less than 50 $\mu$ V	Less than 50 $\mu$ V
9. Operating Voltage	600 to 900 V	700 to 900V	700 to 900V
10. Out put	Positive Tail Pulse	Positive Tail Pulse	Positive Tail Pulse
11. Output impedance	90 Ohms	90 Ohms	90 Ohms
12. Power Requirement (Typical)	-12V @ 12 mA	-12V @ 12 mA	-12V @ 12 mA

### GAMMA REFERENCE STANDARD SET TYPE: GS 290

Gamma Reference Standard Set Type: GS290 consists of a set of FIVE/SIX Gamma sources evaporated and sealed on 25mm dia x 5mm plastic disc covering ranging from 100KeV upto 1.33MeV energies with activity in the range of 2 to 5 micro curie. A reference chart for this is given below. The accuracy of these sources is in the range of +/-10%. All these discs sources are enclosed in a neatly polished wooden box.

Isotope	Energy MeV	Nominal Activity	Half life
Co-57	0.123	2-5 $\mu$ ci	273 Days
Ba-133	0.36 (Main)	2-5 $\mu$ ci	7.5 Years
Na-22	0.511; 1.280	2-5 $\mu$ ci	2.6 Years
Cs-137	0.662	2-5 $\mu$ ci	30 Years
Co-60	1.17; 1.33	2-5 $\mu$ ci	5.3 Years
Mn-54	0.835	2-5 $\mu$ ci	312 days



**Note :** BRIT is not able to supply this Mn-54 at present. In view of this we are able to give only 5 sources in the Gamma Reference set.

**LEAD SHIELDING FOR SCINTILLATION DETECTOR  
TYPE : LS 250**

This Lead Shield is designed to shield Scintillation Detectors of NUCLEONIX make. LS 250 is built-up of SEVEN interlocking rings with bottom and top discs. The bottom ring is provided with a small opening so that the cables from the Scintillation Detector Pre-amplifier base could be taken out for connecting to the Gamma ray spectrometer counting system.

This Lead Shield Type: LS 250 is compact and just enough to accommodate any of the Scintillation Detectors supplied by NUCLEONIX. The top disc is provided with handle to lift is away for introducing the source on the flat crystal top and liquid vial into the well type crystal respectively. The building block type of construction of lead shield makes it convenient to assemble. The inner side of the lead shield is lined with Aluminium to minimise scattering.



**Dimensions**

- a. External : 200mm dia x 433mm height
- b. Internal : 120mm dia x 360mm height
- c. Weight : Approx. 92 Kgs.

**FREE EXPERIMENTAL BOOK LET**

A booklet called "Experiments with Gamma Ray Spectrometer" will be supplied with each Gamma Ray Spectrometer kit, when you purchase. This illustrates in details about the experiments that can be done using this kit. Each experiment write-up contains, list of items required, experimental procedure, experimental data, analysis & computations, graphs etc.

