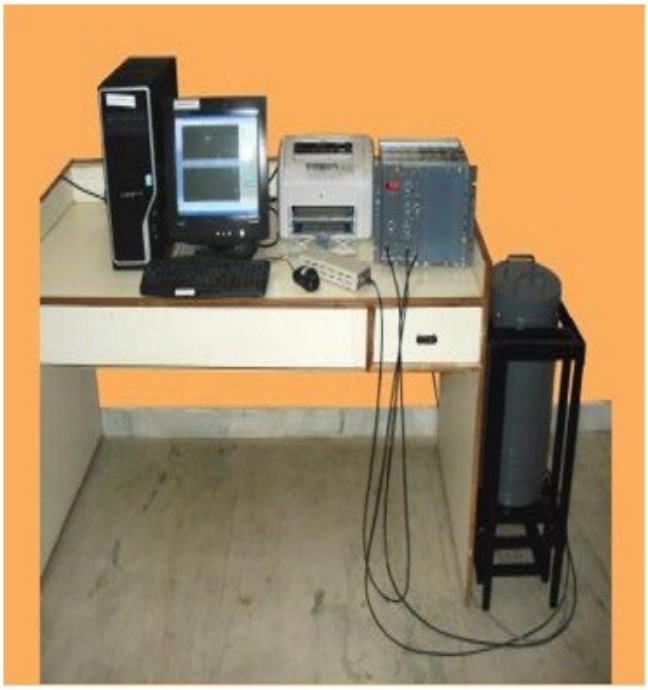
RADIOACTIVE CONTAMINATION ANALYSER
for Food Samples Analysis

TYPE: RA1006A

Technical Data



FEATURES:

- 100% fool proof test for identifying RaC in packed food stuffs(directly placed in sample container such as meat fish, milk, dairy products, vegetable oils, breads & minerals etc.,and also in food stuffs in liquid or solid form placed in marinelli beaker.
- System can detect very low levels of contamination upto 0.05Bq/g.
- Compact state of art of Electronic system comprising of 1K MCA(USB Interface).
- Uses (3"x3") or (4"x4") NaI scintillation detector for sample analysis.
- Optional Accessory:Marinelli Beaker/1 Ltr to store food stuff for analysis.

Radioactive contamination Analyzer (RaC) RA1006A : RA1006A is a laboratory instrument. It measures Radioactive Contamination (RaC) in food samples such as Meat, Fish, Milk Dairy Products like chocolate, Edible oils, minerals etc. It is highly recommended for Radio Analytical Labs.

In a Nuclear disaster accident scenario, or NBC event or critically accident in an nuclear fuel cycle or Radiological emergency,it becomes necessary to check for Radioactive Contamination in and around the Nuclear accident or event. It may be necessary to measure quality of air,water ,Dust,Rain water,packed food stuffs,such as meat,fish,milk,dairy products,vegetables, breads & other commodities including minerals etc.,for calibration.

It is well known that Radioactive Iodine and Caesium are bi-products of nuclear reactors which end,releasing radioactive contamination into the atmosphere in the event a major Nuclear disaster / accident. While Iodine-131 has a radioactive half life of 8 days,Caesium 137 half life is about 30 years. Checking for Cs137 and I131 contamination becomes more important on account of this.

This system gives isotopic details in addition to quantification of the Radioactive contamination present in the food stuff. System has alot of powerful data processing and analyzing features which includes spectrum acquisition,Printing,Ploting,ROI selection-5 ROI's,smoothening ,vertical,Horizontal scale expansion etc., Software is made user friendly.

The system configuration consists of MINIM BIN with power supply (MB403),High Voltage (HV502),Linear Amplifier (LA520) or Spectroscopy Amplifier(SA524)and 8K MCA, 3”x3” or 4"x4" NaI scintillation detector with 50/60mm lead shielding, personal computer system, software for isotopic data acquisition & contamination report generation software.

SPECIFICATIONS

MINIBIN AND POWER SUPPLY MB 403:

Accommodates SIX / EIGHT single bit modules or combination of multiple widths with Amphenol connectors. Minim bin is primarily designed with the objective of conserving bench space and to achieve significant saving in cost of the Minim bin 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 are provided on the right extreme side of the bin.

Minim bin Dimensions:

11.75"width X 11.00 depth (up to 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%) AC, 50Hz.

D.C Output: +12V@1.5A, -12V@ 1.5A, +24V @ 0.75A, -24V@0.75A and maximum wattage 72 watt.

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.

HIGH VOLTAGE UNIT (HV 501):

- Output voltage variable continuously from 0V to 1500 volts.
- Output current (max) 1mA.
- Load & Line regulations: Better than 0.5% of full scale.
- Indefinite over load & short circuit protections and self-recovery.
- Output ripple less than 20mv.
- Dimensions: Single / Two-bit module.

LINEAR AMPLIFIER

Input Polarity : Positive or Negative

Input Impedance : 93 ohms

Total Gain : Typical 600 +/-10% with 1 micro second time constant

Gain Adjustment :
Controlled by three gain controls
Accuracy : +/-10%

a. Input attenuator : Attenuator factors x 2.5 & x 1
b. Coarse gain : 0.2, 0.5, 1,2,3,5 & 8 by rotary switch
c. Fine gain : About adjustable by a ten turn helipot and knob/ precision dial.

Pulse shaping : Differentiating and integration RC time constants variable from 0.1 micro second to 5 micro second in sequence of 0.5, 1, 2, 3, 6, 10 with a provision of switching integration IN/OUT

Amplifier Rise Time : Better than 100 nano seconds with no integration and 0.1 micro second differentiation constant.

Output : 0 to 8V positive, 12V maximum unipolar.

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Output Impedance : Approximately 93 ohms

Amplifier noise : Equivalent input noise 10 micro volts rms typical at maximum gain and 1 microsecond integration and differentiation

Linearity : The integral non-linearity is less than 0.15% from 200 mV to 8 mV at 1 micro sec time constant, integration IN.

Power Requirement :
+24V at 45mA
-24V at 40mA
+12V at 20mA
-12V at 5mA

Dimensions : Standard two width module

Temperature Stability :
0.1 % per degree centigrade

Module connector :
Amphenol connector type 26-159-24P-H (24 pin type) by default or NIM standard, as per AEC specifications TID 20893 (Rev) Type AMP 204186-5.

OR

SPECTROSCOPY AMPLIFIER

A. PERFORMANCE

Gain Range : Continuously variable from X4 to X1500.

Pulse Shaping : quasi-gaussian and quasi-triangular.

Shaping time : 0.5, 1, 2, 3, 6 and 10 µs

Input Noise : 5 mv r.m.s with 3 µs shaping time

Overload : Recovers to within 2% of baseline in 15x shaping time from x200 overload.

Integral Non-Linearity : < 0.05% from 0 to 10V.

Crossover Walk : Bipolar zero cross over walk is < ± 3 ns in 50:1 dynamic range.

B. CONTROLS

FINE GAIN : Front panel 10 turns precision potentiometer provides a continuously adjustable, gain factor from 0.5 to 1.5.

COARSE GAIN : Front panel six-position switch selects gain factors of X20, X50, X100, X200, X500 and X1000.

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PZ: Adjustment of the PZ cancellation using 20-turn potentiometer on the front panel.

POS/NEG: Front panel toggle switch for selecting either positive or negative input polarity for signals.

ATN : A front panel toggle switch selects an input attenuation factor of X1 or X2.5

SHAPING: Front panel six position switch for selecting shaping times of 0.5, 1, 2, 3, 6 and 10 µs.

TRI/GAUSS : Front panel toggle switch for selecting quasi-gaussian or quasi-triangular unipolar output shape.

BAL : Adjustment to match the gains of normal and differential reference inputs for maximum common mode noise rejection in DIFF mode using 20 turn potentiometer on the front panel.

LIM : A push-button switch on the front panel to prevent oscilloscope input from overloading and thus enabling observation of the baseline in sensitive ranges of the scope.

LEAD SHIELD:

This Lead Shield is designed to shield 3”x3” / 4"X4" Scintillation NaI detector,Detectors of NUCLEONIX make. It is built-up of interlocking rings with bottom and top plates.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. The inside of the lead shield is lined with Aluminum to Minimize scattering. Thickness 75mm, accommodate 3” scintillation detector including sample of 3” overall size or of 100mm to accommodate 4"x4" NaI Detector with inner lining of 2mm cadmium and 1mm Copper.

MARINELLI BEAKER:

Sample container in reference geometry suitable for solid or liquid samples, fits into scintillator screening.Circular structure around the scintillator crystal enables high detection probability. In connection with the screening it allows the measurement of low activity samples. This beaker slids over the Crystal and lands on it.

MULTI-CHANNEL ANALYZER (8K MCA):

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. HP-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 application software provided with the USB-MCA, seamlessly integrates with the hardware, featuring a range of standard functions required for analysis and acquisition.

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 µs including ADC conversion time of 5 µs.
- Pile up rejection: Active high TTL input from spectroscopy amplifier
- DNL: + 1% for 1K Resolution
- INL: + 0.05% F.S for 1K Resolution.
- MCA Input: Single channel, 0 to +10 volts
- Power requirement: 5V, ~500 mA through USB cable directly (No external power supply required)

Software features:

Important software features include * spectrum display in two windows * marker selection (two) for ROI Detection & bracketing the peaks of interest, multiple

ROI selection, deletion of ROIs etc.

File Handling: Involves storing, loading of complete Spectrum.

Print/Save: peak report, Activity report, ROI Report.

Acquisition: With pause option.

Erase: Erasing spectrum from memory.

Spectrum Analysis: Find peak, Shape calibration, Energy calibration, Shape calibration, Efficiency Calibration, Activity Calculation, etc.,

Provided ROI Option: Insert and Deletion.

Scale: X-axis can be chosen as Channel number (or) Energy axis (in Kev) & Y - axis has range from 256 to 64M in binary steps with auto scaling option. Y-scale can be linear or log LLD, ULD & base line is soft selectable in built Isotope library for isotope selection & matching.

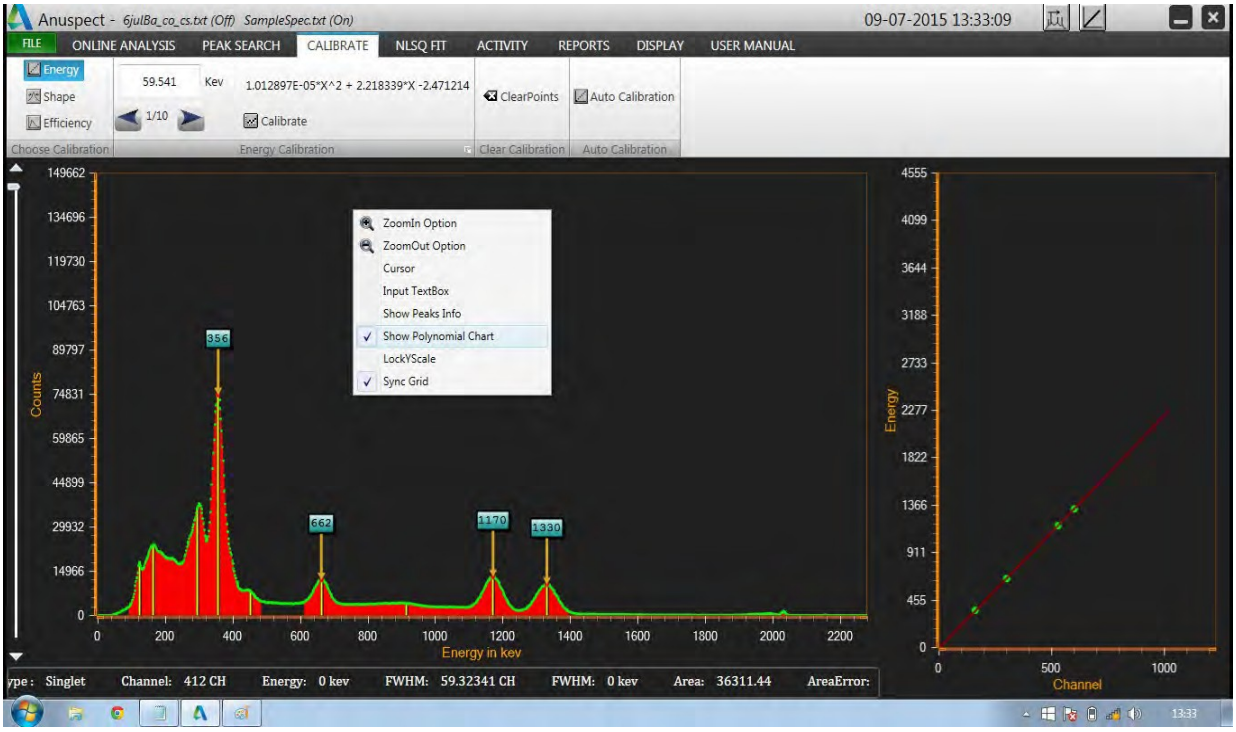

Fig. Energy Calibration