RADIATION COUNTING SYSTEM With Dual Scintillator Probe (for simultaneous Counting of Alpha & Beta in a given sample)
Type: RC605D & DS166.

Technical Data

FEATURES :

- System uses dual scintillator probe with lead collar to minimize gamma background and gives excellent efficiencies with minimal crosstalk.
- Measures gross alpha-beta activity / contamination in air, water and other environmental samples.
- Highly recommended for radio analytical labs / environmental survey labs at Nuclear power stations.
- Manufactured confirming to ANSI N 42.17.Complies to IS-9000 part III & V, for climatic tests.
- Built-in USB port facilities data downloading into PC.
- Counts in two channels with counts capacity of 999999, preset time of 9999 sec.
- Variable HV (0-1500V), 0.5mA.
- Electronics built-in facilitates simultaneous counting of β & α activity in a given sample using dual scintillator probe.

Radiation Counting system, type **RC605D** manufactured by NUCLEONIX is a versatile state of art integral counting system designed around eight bit microcontroller chip for using with a variety of detector probes such as Alpha / Beta / Gamma / Dual scintillator detector probes for alpha, beta or simultaneous (alpha-beta) counting.

RC605D is highly recommended for gross alpha/beta activity / contamination measurements (in water & other environmental samples) with one of the detector probes, as required. This system can be used in analytical radio labs, Health physic counting labs and Environmental survey labs at Nuclear power stations. Dual scintillator based probe is the latest addition & most desirable and recommended for simultaneous counting of alpha & beta activity in a given sample , thus it saves time when compared to using of separate probes for counts of β & α.

RC605D amplifies the detector output and converts them to digital pulses for counting and display the recorded counts for a preset time. There are two internal counters which facilitate connection to dual scintillator (β & α) based probe, which provides simultaneous counting of alpha & beta activity in a given sample.Microcontroller design facilitates programmability for background, standard and sample counting. The data can be downloaded into PC or printed directly onto a printer. System facilitates counting of samples deposited either on planchets or filter paper.

Applications: This system will find applications for counting of air activity, wipe, environmental samples, including air, water (river, lake, pond, ground & sea waters). System can be used by testing labs, Environmental survey labs at Nuclear Plants, in normal or in a Nuclear disaster scenario.

SPECIFICATIONS

P.M. Input (From α , β scintillation detector probe):

(a) Polarity : Negative
(b) Amplitude : -100 mV (min)

Programmability:
Includes selection of Preset Time, Storing / Recalling of data, starting and stopping of acquisition, label assignment for data counts BG (Background), ST (Standard) & SP (sample) etc,.

HV Output: HV (0-1500V) @1mA continuously variable through front panel keypad in steps of 1 volt, ripple less than 20mV, line & load regulation better than 0.05%. EHT is shown on LCD display.

Counts Capacity: 999999 counts in both channels

Presetcycles / Iterations:1- 3

Command Buttons: START, STOP, PROG, STORE, INC & DEC command buttons have been provided on the front panel key pad

Paralysis Time: A choice of three paralysis times 250, 350 and 550 micro sec plus OFF position selected through PROG key.

Data Communication Software:
(Optional at extra cost)
Can be provided for serial transfer of data readings into PC.

Counting channels (internal): Two

RTC: Built in RTC provides real time clock information which is stamped in the activity report when printed. Built in Real time clock facilitates the user to generate sample analysis reports with RTC stamping. Both date month & time in hrs and minutes are printed.

Scintillation detector probe socket: This is a UHF / MHV socket facilitates connection to a variety of probes namely

   i. Alpha probe (AP165) or
   ii. Beta scintillation probe (BSP-1) or
   iii. Dual scintillation probe (DS 166-1) or
   iv. Dual scintillation probe (DS 166-2)

Preset time: 1 to 9999 secs. Settable through keypad.

Data Storage: Upto 1000 readings.

Printer Port: Built-in centronics port facilitates connection to a printer for direct data printing selectively.

HV indication: On LCD dot-matrix provided.

Display: 20x2 LCD dot-matrix display has been provided to indicate data counts, Elapsed Time and HV.

USB Serial Port: Built-in USB port facilitates data downloading into PC.

Power: Unit is powered through a 12V adapter.

Operating Temperature: 0 to 50°c
Relative Humidity: Upto 90%
Mechanical Dimensions: 256mm(W)X135mm(H)X325mm(D) Approx.

APPLICATIONS:

This system can be used for counting α, β samples using individual probes or simultaneous counting of (β & α) activity using dual Scintillator probe on a 25mm dia planchet or 50mm dia filter paper obtained from air samplers, or continuous air monitors in a Nuclear facility. System can also be used for wipe sample counting in nuclear counting lab of a Nuclear power plant or similar facility. Also this system can be used in a University for teaching lab experiments in a physics department.

ACCESSORY FOR SIMULTANEOUS ALPHA-BETA SAMPLE COUNTING

(A) DUAL SCINTILLATOR (α & β) PROBE WITH 1" PMT DS166 - 1

Dual Scintillator probe DS166 - 1 designed, developed & manufactured by Nucleonix systems measures simultaneously both alpha and beta activity present in a given sample. It uses dual Scintillator covered with aluminized mylar which is coupled to 28mm PMT, facilitating one to count 25mm/28mm dia **planchet samples.** To minimize the gamma background adequate lead collar shielding of 50mm surrounding the PMT enclosure & 50mm lead base plate(s) have been provided, surrounding the PMT & drawer assembly.

➤ PERFORMANCE SPECIFICATIONS:

PMT used	: 28mm PMT
Scintillator	: Dual Scintillator (ZnS+Plastic)
Operating voltage	: Typically from 800V to 900V
Specially designed	: Lead shielding of special geometry
Lead Shielding	: surrounding the detector portion as required.

➢ **PERFORMANCE WITH ALPHA SOURCE:**

Efficiency for alpha : with calibrated Am241 standard source $\geq$ 28%

Standard source used: Eckert and Ziegler make alpha wide area reference source of activity 1.020KBq

Beta cross talk : while counting with alpha source alone $\leq$ 2.25%

Alpha channel background : < 3 to 4 counts in one hour.

➢ **PERFORMANCE WITH BETA SOURCE:**

Efficiency for beta: with calibrated Sr90, Y-90 (combined efficiency) standard reference source $\geq$ 40%, Efficiency for only Sr90 will be $\sim$ 20%.

Cross talk : into alpha channel $\leq$ 0.2%

Standard source used: Eckert and Ziegler make beta wide area reference source of activity 1.13KBq

Background of beta channel : (without source) $\leq$ 3.5 CPM (due to gamma)

OTHER ACCESSORIES:

(B) PLANCHETS: SS and aluminum planchets are required to place the prepared environmental samples for counting. These planchets are of 25mm dia & have a depth of 2mm. These are designed to fit into the sample / source holder / drawer of the detector assembly.

(C) ALPHA STANDARD SOURCE: Am241 alpha standard source of eckart & Ziegler can be supplied as an optional item. This is an electro deposited source on an SS planchet. Typical activity is in the range of 3000 to 5000 dpm.

(D) BETA STANDARD SOURCE: Sr90 beta standard source can be supplied as an optional item. This is a beta wide area reference source of make Eckert & Ziegler. Typical activity is in the range of 1500 to 3000 dpm.

(E) OPTIONAL ACCESSORIES:

(F) Count Net - RS485 based networking software (for multiple systems network).

(G) Data Communication Software: for data downloading from a single system.

(H) Dot Matrix Printer: Radiation Counting System has a built-in centronics printer port; it can be directly connected to a printer. Data readings stored in the unit can be downloaded onto the printer (Care should be taken while choosing the printers not all printers are compatible. Please consult Nucleonix systems for choosing your printer).

MINIMUM DETECTABLE ACTIVITY (MDA) CALCULATIONS:

The minimum detectable activity is that amount of activity under the same counting time gives a count which is different from the background by 3 times the standard deviation of the background counting rate

$$MDA = BG \text{ (cpm)} + \{(3*(BG)^{1/2})/t\}$$
Where t is the time in minutes

Minimum Detectable Activity (MDA) calculations for dual scintillator based radiation radiation counting system RC605D:

For alpha samples:

Example: What is the MDA for a counter with background of 2 counts in 1 hour? MDA = $\{0.0333 + \{(3*(2)^{1/2})/60\}$

=0.0333+0.0707
=0.1040cpm
=0.001733cps

Thus any gross alpha counts over 0.1040cpm can be considered to be due to radioactivity. That is to say any gross counts above 6.24 per hour can be considered to be due to radioactivity To calculate the

MDA in terms of Bq, divide by the efficiency of the detector

The lower the MDA, the more accurately the activity of samples with low counting rates can be determined. This can be statistically achieved by increasing the counting time and /or by decreasing the BG

Example: What is the MDA (in Bq) for a counter with background of 2counts in 60 minutes and an efficiency of 30% for the nuclide of interest?

MDA = $\{(3*(2)^{1/2})/60\}$ =0.0707cpm =0.0707/0.30 (efficiency) =0.235dpm =0.235DPM=0.003928dps or 0.003928Bq

For beta samples:

Example: What is the MDA for a counter with background of 240 counts in 60 minutes? MDA = $\{4 + \{(3*(240)^{1/2})/60\}$

=4+0.775
=4.77CPM

Example: What is the MDA (in Bq) for a counter with background of 240counts in 1 hour and an efficiency of 38% for the nuclide of interest?

MDA = $\{(3*(240)^{1/2})/60\}$ =0.7745cpm
0.7745/0.38 (efficiency) =2.038dpm
2.038DPM=0.0339dps or 0.0339Bq

Thus any gross beta counts over 0.7745cpm can be considered to be due to radioactivity. That is to say any gross beta counts above 47 per hour can be considered to be due to radioactivity