RADIATION COUNTING SYSTEM WITH ACCSSORIES FOR ALPHA SAMPLE COUNTING

(For measuring gross alpha activity / contamination)
RADIATION COUNTING SYSTEM
TYPE: RC 605A

Technical Data

FEATURES :

- Measures gross alpha 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.
- Complies to Interference test as per IEC61000 or equ.
- Efficiency with Am241/Alpha probe : Better than 26%.
- Counts capacity 999999, preset time 9999 sec.
- Variable HV (0-1500V), 0.5mA
- Typical Background ≤ 7 counts in 1 hr (0.002 CPS)
- Facilitates connection to Alpha probe for gross Alpha sample.
- Minimum detectable activity(MDA): Better than 0.00847 Bq in 3600 sec.

Radiation Counting system, type **RC605A** 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 scintillator detector probe or End window G.M detector probe.

RC605A is Highly recommended for gross alpha activity / contamination measurement (in water & other environmental samples) with alpha probe AP165 connected, for Radio analytical labs, Health physic counting labs and Environmental survey labs at Nuclear power stations.

Radiation Counting System essentially has a processor card and other electronic circuits to generate continuously variable HV upto 1500V to be applied to scintillation detector Probes (α, β, γ) or End window G.M.Tube, amplify the detector output and convert them to digital pulses for counting and displaying the recorded counts for a preset time.

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 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, γ scintillation detector probe):
(a) Polarity : Negative
(b) Amplitude : -100 mV (min)

G.M. Input (From G.M. Counter):
(a) Polarity : Negative
(b) Amplitude : -500 mV (min)
(c) Built-in load resistor : 4.7 or 3.3M Ohms

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

Preset time:1 to 39999 secs. Settable through keypad

Preset cycles / Iterations:1 to 99

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.

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

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 MHV socket for connecting toα, γ. UHF socket for βscintillation Probe.

G.M. Socket:MHV connector for connecting to G.M. Detector.

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.

Plateau Measurement: Facility to measure plateau of detection automatically is provided.

USB Serial Port: Built-in USB serial port facilitates data down loading into PC.

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

Power: Unit is powered through a 12V adapter.

Operating Temperature:0 to 50^{o}c

Relative Humidity: Upto 90%

Mechanical Dimensions:
256m(W)X135mm(H)X325mm(D) Approx.

TYPICAL ALPHA / BETA / GAMMA SAMPLE COUNTING REPORT

BGD CPM	:	0000		PTIME (BG)	:	0300
CPM OF STD	:	00092		PTIME (ST)	:	0300
DPM OF STD	:	00265		PTIME (SP)	:	0300
EFF. OF STD	:	034.7				
*FLOW RATE	:	01.00	(lit/min)			

SL.NO	LABEL	RTC	COUNTS	P.TIME	VOL( )	Bq/VOL	Iter
0001	BG	11:43 06-09	0000CPM	000180	---	----	---
0002	STD	11:52 06/09	000160CPM	000060	0010dps	26.56% Eff	
0003	SP1	11:47 06/09	000196	000060	0000 ml--	0000.00Bq/ml--	01
0004	SP2	11:48 06/09	000180	000060	0001ml--	0009.03Bq/ml--	01
0005	SP3	11:50 06-09	000187	000060	0010ml--	0000.93Bq/ml--	01

APPLICATIONS:

This system can be used for counting **α, β or γ** samples on a 25mm dia planchet or 47/50mm dia filter paper obtained from air samplers, or continuous air monitors in a Nuclear facility. System can also 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 ALPHA SAMPLE COUNTING SYSTEM

Technical Data

(A) ALPHA PROBE TYPE : AP 165

Alpha Probe type AP165 manufactured by NUCLEONIX is meant to be used along with **Radiation Counting System** model **RC 605A** for counting alpha samples. Radiation Counting System along with Alpha Probe essentially works as an Alpha Counting System.

Alpha Probe of NUCLEONIX make is essentially an integration of ZnS (Ag) scintillator screen, optically coupled to a 2" PMT & covered by a pin hole free aluminized mylar foil to provide, sealing against ambient light. Scintillations received by PMT because of Alpha particles will be converted to electrical charge and inturn to voltage pulses. Each of these events after amplification in the RCS will be counted. The required high voltage is applied (which is typically 900V) through RCS to the Alpha Probe.

Probe has a drawer assembly which facilitates sample placement on sample tray for counting applications. The counting samples are usually deposited on planchets of 25mm diameter or filter paper upto 38mm diameter.

SPECIFICATIONS

Detector material: ZnS (Ag) Screen covered with Aluminized mylar foil.

Density :20mg/cm^2

Efficiency: Better than 26% (guarantee),30% (typical) for Americim-241 alpha.

Background counts : $\leq$ **7** counts in one hour

Background Range : 0.002 CPS

MDA Typical (as measured with Background in Hyderabad at our works):0.00847Bq.

NOTE: MDL vary in your place depending upon the background at your place

Photomultiplier tube: Low noise PMT of ETL or Hamamatsu make or its equivalent.

Size :50.8 dia (2")

Operating Voltage Range:700 to 1050V

Operating Voltage (typical): 900V $\pm$ 50V

Drawer Assembly: Holds both 25mm dia SS planchets or 50mm dia filter paper.

OTHER ACCESSORIES:

(A) 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.

(B) ALPHA STANDARD SOURCE: Am241 alpha standard source 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.

(C) OPTIONAL ACCESSORIES:

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

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

(iii)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.

$$MDA = BG\ (cpm) + \{(3*(BG)_{1/2})/t\}$$

Where t is the time in minutes

Minimum Detectable Activity (MDA) calculations for Radiation Counting System (RC605A):

For Counting samples:

Example (1) : What is the MDA for a counter with background of 7 counts in 1 hour?

MDA = $\{0.1166+ \{(3*(7)^{1/2})/60\}$
$=0.1166+ \{(3*2.645)/60\}$
=0.2488 CPM
=0.004146 CPS.

Thus any gross alpha counts over 0.2488CPM can be considered to be due to radioactivity. That is to say any gross counts above 15 counts 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 (2) : What is the MDA (in Bq) for a counter with background of 7 counts in 60 minutes and an efficiency of 26% for the nuclide of interest?
MDA = $\{(3*(7)^{1/2})/60\}$ =0.1322 CPM
=0.1322/0.26 (efficiency) =0.5084 DPM
0.5084 DPM=0.00847 DPS or 0.00847Bq