

**INSTRUCTION
MANUAL**

RADIOACTIVE CONTAMINATION ANALYSER



TYPE : RA1006A

NUCLEONIX SYSTEMS PRIVATE LIMITED

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CONTENTS

Sl.No.	Description	Page. No.
CHAPTER I	Introduction	01-02
CHAPTER II	Specifications	03-04
CHAPTER III	Case Studies	05-06
CHAPTER IV	System Interconnection Table	07-07
CHAPTER V	Operating Instructions	08-13
CHAPTER VI	Block diagram & Description	14-16
CHAPTER VII	Servicing Tips	17-18
CHAPTER VIII	Availing of equipment maintenance/ calibration services and warranty clause	18-24



AC power adaptor



Cable bunch

Unscrew, in anti clockwise to open the top part of the cylindrical enclosure for placing Marinelli beaker on to the detector.



Scintillation detector

For all other samples cap should be left in closed condition.



3"x3" NaI detector covered with Lead shielding arrangement



Electronic module front view



Electronic module rear view

CHAPTER – I

INTRODUCTION

Radioactive contamination (RaC) Analyser is a compact laptop/ tablet pc, based 1K MCA system with built in High voltage for detector bias & shaping amplifier, with (2"x2") or (3"x3") NaI scintillation detector covered with adequate lead shielding having sample chamber arrangement.

System configuration consists of:

- 1K MCA (USB interface) with built in high voltage & shaping amplifier module.
- Laptop / Tablet PC with windows operating system.
- (2"X 2") or (3"x3") NaI Scintillation detector with preamplifier.
- 40/50mm lead shielding with food sample chamber arrangement.
- Input power to MCA system ~ (100-240) VOLTS AC, 47-63Hz (excluding PC power).
- Power adapter output 12V @ 1A to MCA module (RaC Analyser Module).
- MCA data acquisition, processing and report generation software.

In a Nuclear disaster accident scenario, or NBC event, or criticality accident in a 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, vegetable, breads and other commodities including minerals for contamination.

It is well known that Radioactive Iodine and Caesium are by products of nuclear reactors which end, releasing radioactive contamination into the atmosphere in the event a major Nuclear disaster / accident. While I-131 has a radioactive half-life of eight days, caesium-137's half-life is about 30 years. Checking for Cs-137 & I-131 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 lot of powerful data processing & analysis features which include spectrum acquisition, printing, plotting, RoI selection – FIVE RoIs, smoothing, vertical, horizontal scale expansion etc. Software is made very user friendly.

FEATURES :

- ❑ 100% foolproof test for identifying RaC in “**Packed Food Stuffs**” (directly placed or in sample tray) such as meat, fish, milk, dairy products, vegetable, breads and minerals and also in food stuffs in liquid or solid form placed in Marinelli beaker.
- ❑ System can detect very low levels of contamination upto 0.05 Bq/gm.
- ❑ Compact state of art Electronic system comprising of 1k MCA (USB interface) with built-in High voltage & shaping amplifier
- ❑ Uses (2”x2”) or (3”x3”) NaI scintillation detector for sample analysis.
- ❑ Optional accessory: Marinelli beaker (1ltr to store food stuff, for analysis).
- ❑ Input power to MCA system ~ (100V-240) VOLTS AC, 47-63Hz (excluding PC power).

Software features:

- ❑ Spectrum calibration.
- ❑ Efficiency calibration, current Activity calculator.
- ❑ Spectrum file loading, saving, printing, plotting, multiple RoI Selection, up to (5- RoIs)
- ❑ Spectrum smoothing.
- ❑ Food stuff contamination report.
- ❑ Report generation for RaC in Bq/l or Bq/g with isotopic identification in food stuffs.
- ❑ Nuclide library.

CHAPTER – II

SPECIFICATION

Hardware features:

- **Detector** : (2"x2") or (3"x3") NaI scintillation detector integral assembly with built in pre amplifier
- **Resolution** : Better than 7.5% with Cs-137.
- **Detector Bias** : (0-1200V) @ 0.5A, Adjustable thru 1 trim pot to set required bias.
- **Shaping amplifier** : Built – in, Semi-Gaussian, bi-polar output.
- **ADC** : 1024 channels, successive approximation type.
- **Max. counts / channel** : 31 bit (2 Giga counts)
- **Pulse processing time** : 7 μ sec
- **INL** : Better than \pm 1%
- **Preset time** : 1 sec to 136 years
- **Lead shielding** : 40/50mm shielding to enclose detector & packed food stuff or food stuff in Marinelli beaker
- **1K MCA / AMP / HV module dimensions (RaC Analyser Module)** : 95 Width X 80 Height X 245 Length (approx)

Software features:

- Spectrum / calibration
- Efficiency calibration, current Activity calculator
- Spectrum file loading , saving, printing , plotting , multiple RoI
- Selection up to (5- RoIs)
- Spectrum smoothing
- Food stuff contamination
- Report generation for RaC in Bq / l or Bq / g with isotopic identification in food stuffs
- Nuclide library



Fig. 1 : Packed food stuffs that can be analyzed using this system

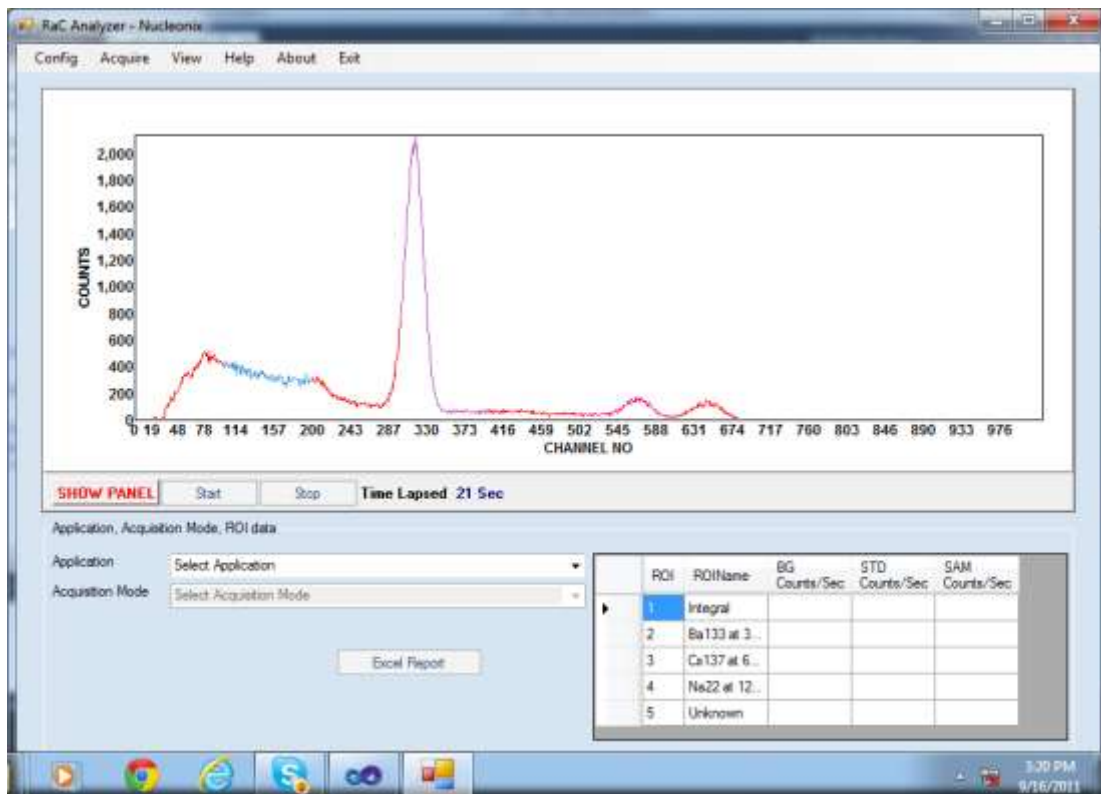


Fig. 2 : 1K MCA, PHA spectral window showing Cs-137 & Co-60 spectra

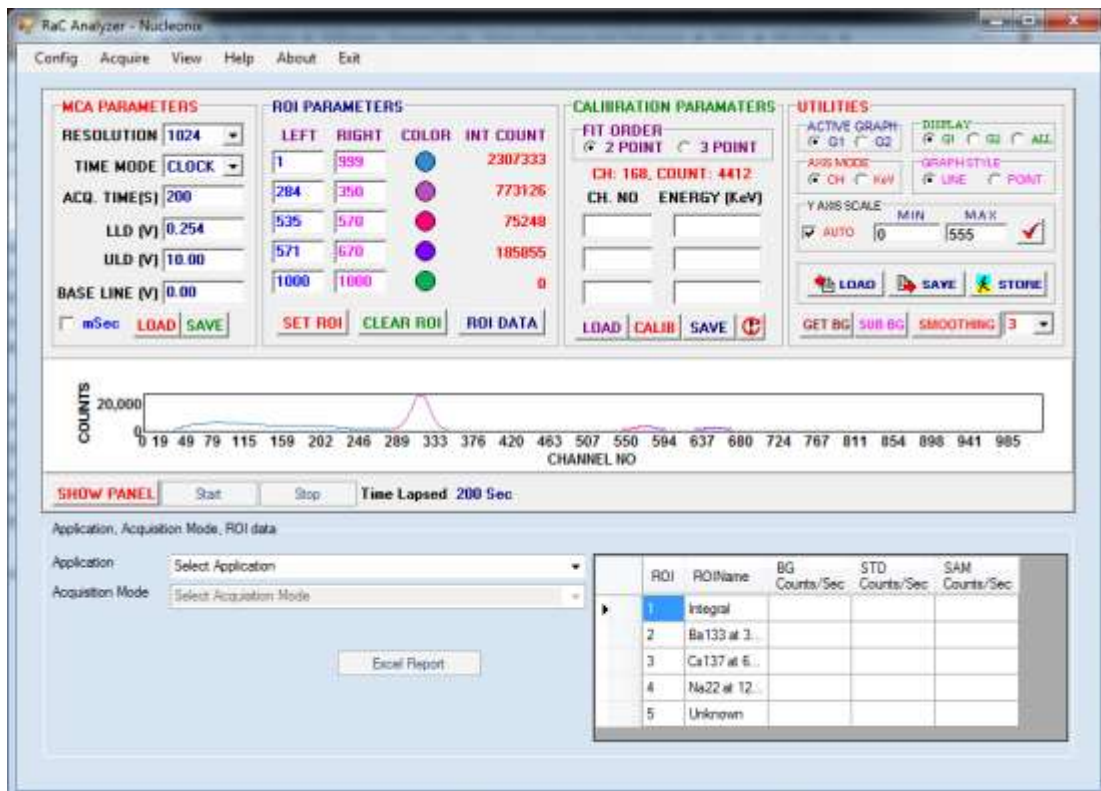


Fig. 3: 1K MCA with configuration panel

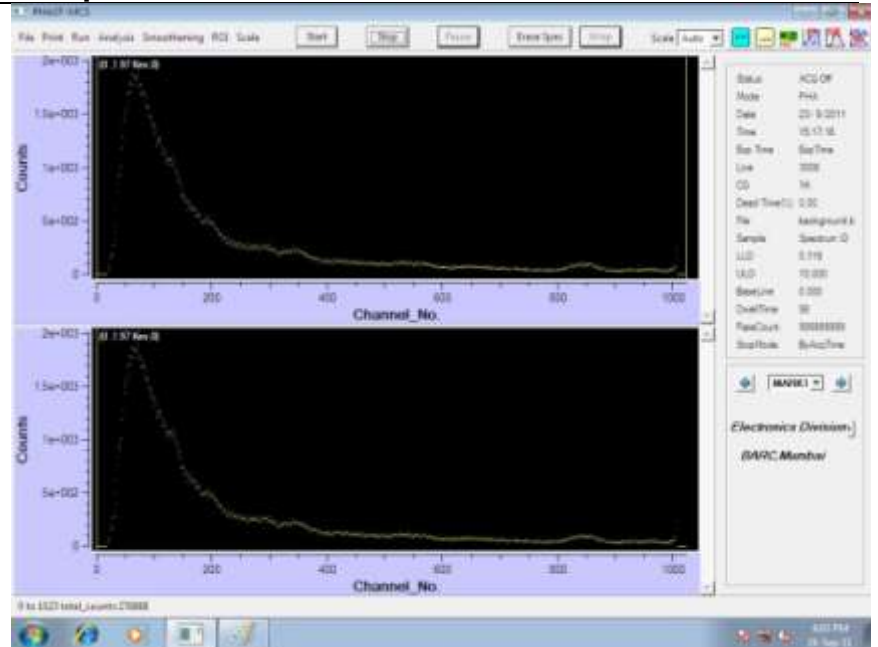
CHAPTER - III CASE STUDIES

Typical measurement data [using 3"x3" NaI (TI) Scintillation Multi-channel Spectrometer]

Spectra of Background and Food Samples :

Background

Total (integral) counts : 276888

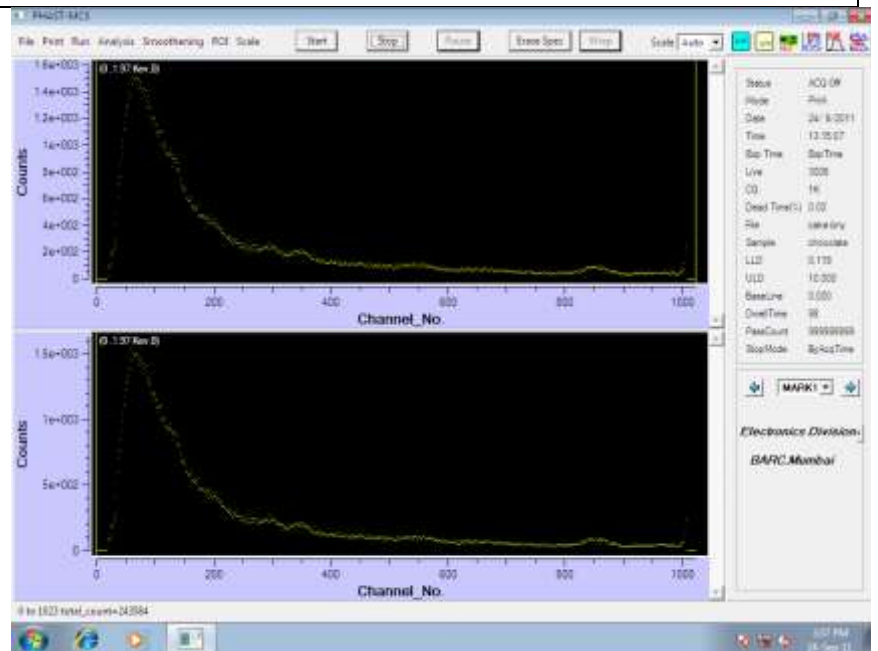


Background spectrum



**Packed Chocolate
(Sample-1)**

Total (integral) counts : 243584

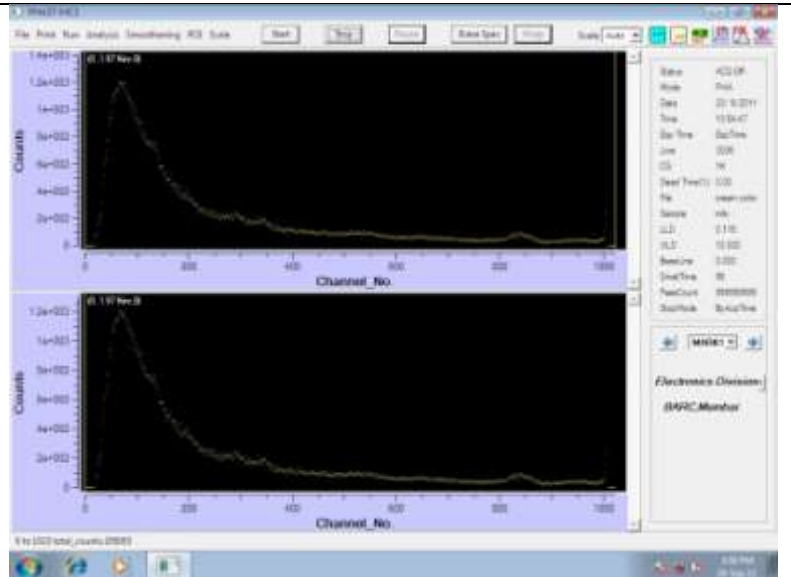


Sample-1 spectrum



**Packed Milk
(Sample-2)**

Total (integral) counts : 205053

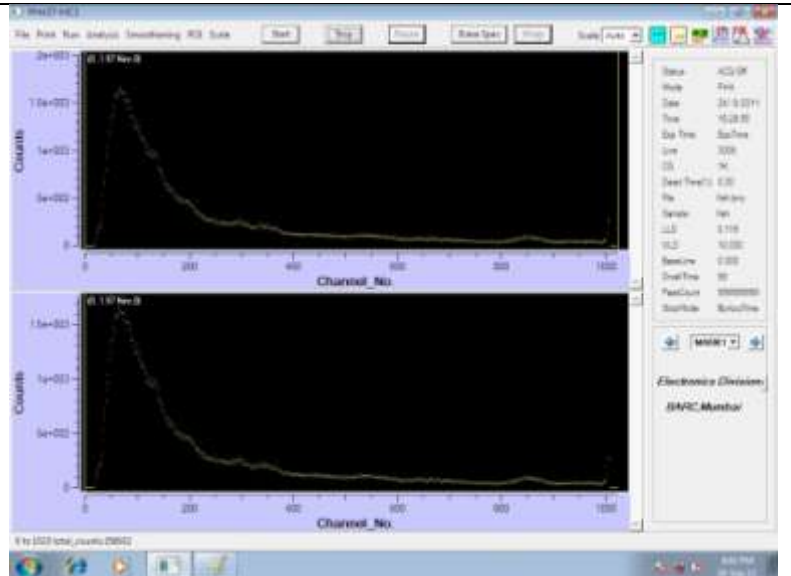


Sample-2 spectrum



**Packed Fish
(Sample-3)**

Total (integral) counts : 256932



Sample-3 spectrum

Analysis of the data:

The background and food samples' spectra are acquired for a period of 3000 seconds. In comparison with the background spectrum, no additional peaks were observed in the food samples' spectra. Further the total (integral) counts of all the food samples were less than the total (integral) counts of background. This is because when the detector is covered with the food samples, some of the background that is supposed to reach the detector gets absorbed in the food samples, thereby resulting in the reduction of total (integral) counts. The amount of reduction in the total (integral) counts depends on the density of the food samples.

Based on the above, we can conclude that **the food samples are free from Radioactive contamination.**

CHAPTER – IV
SYSTEM INTERCONNECTIONS TABLE

Sl.No.	Cable	Length (Meters)	From	To
1	5 pin D-type Female to Female connector	1.5	Scintillation detector, 5 pin D-type male socket	LV socket on the rear panel of RaC Analyser RA1006A – Data Acquisition Module
2	UHF to MHV connector	1.5	UHF side is to Scintillation Detector UHF female socket	HV OUT on the Rear panel of RaC Analyser RA1006A – Data Acquisition Module
3	BNC to TNC connector	1.5	BNC side is to Scintillation Detector BNC female socket	TNC is to INPUT (from detector) on the Rear panel of RaC Analyser RA1006A – Data Acquisition Module
4	+12V Adaptor power connector	1	AC mains socket	Power adaptor on the Rear panel of RaC Analyser RA1006A – Data Acquisition Module
5	USB connector	1	PC/Laptop	USB socket (to PC/Laptop) on the Rear panel of RaC Analyser RA1006A – Data Acquisition Module
6	BNC to BNC connector	1.5	AMP OUT on Front panel of RaC Analyser RA1006A – Data Acquisition Module	CRO for Amplifier OUTPUT checking

CHAPTER - V

OPERATING INSTRUCTIONS

1. Make all the interconnections as shown in the interconnection table and also under block diagram description.
2. Switch on the PC.
3. Switch on the AC mains power for the RaC Analyser (DAM), by connecting A.C Power adaptor connector.
4. Switch on the High voltage (by pressing down the ON/OFF Rocker switch on the Front panel of RaC Analyser module).
5. Execute the application by clicking on the RaC Analyser shortcut. (It is assumed that RaC Analyser Software is preloaded into PC and installed).
6. User login will appear.
7. Enter User name : admin
Password : nspl123
8. Click on the 'login' button.
9. RaC Analyser main screen will appear.
10. Click on the 'SHOW PANEL' button.
11. Various configuration parameter namely, 'MCA parameters, RoI parameters, Calibration parameters and Utilities' are displayed.
12. Nucleonix systems provides factory settings for most of the configuration parameters and they must be loaded every time the application is run.
13. In the 'MCA parameters' frame, click on LOAD button in the window that opens, select the filename 'Factory setting_MCA program_2000sec.MCA' and click OPEN button.
14. This will load Factory settings for MCA parameters as below :
 - Resolution : 1024
 - Time mode : clock
 - Acq. Time : 2000 sec
 - LLD (V) : 0.2
 - ULD (V) : 10.00
 - Base Line (V) : 0.00
15. In the 'Calibration Parameters' frame', select '2 point'. Then, click on LOAD button. Select 'Factorysetting_calibparams_2point_BaCo.CAL' file and click on OPEN

button. To overwrite the current calibration settings with the loaded one, click on 'Next' to save.

- Let us now enter the RoI parameters. RoIs are predefined Regions of Interest. RoIs are defined for Radioisotopes that are most likely to be found in the sample. The left value corresponds to Starting channel number of RoI and right value corresponds to Ending channel number of RoI. Each RoI can be set to a different colour. Spectrum will appear in these colours in different RoIs. Based on system calibration, the RoI values are given at the time of installation.

The RoIs values for Food / Liquid samples for the present RaC Analyser are as below;

RoI	Channel Number	
	Starting	Ending
RoI 1 for Cs-134	330	400
RoI 2 for I-131	110	225
RoI 3 for Cs-137	265	330
RoI 4 for K-40	600	660
RoI 5 for unknown energy	As required	As required

Enter the above RoI values in the respective columns.

To set the newly entered RoI values, click on SET RoI button.

The RoI values for Steel samples for the present RaC Analyser are as below;

RoI	Channel Number	
	Starting	Ending
RoI 1 for Integral counts		
RoI 2 for Ba-133	110	225
RoI 3 for Cs-137	265	330
RoI 4 for Co-60	470	640
RoI 5 for unknown energy	As required	As required

Enter the above RoI values in the respective columns.

To set the newly entered RoI values, click on SET RoI button.

RaC Analyser for Foods/Liquids- RoI definitions:

- Let us understand the Grid, that displays acquired data. (The Grid appears at the bottom of the screen).

The RoIs shown in the Grid correspond to RaC Analyser for Food / Liquids. We have just finished entering the RoI Starting and Ending channel numbers.

- RoI 1 captures counts from Cs-134 decay at 800 keV.
- RoI 2 captures counts from I-131 decay at 364 keV.
- RoI 3 captures counts from Cs-137 decay at 662 keV.
- RoI 4 captures counts from K-40 decay at 1460 keV.

- (e) RoI 5 can be defined for unknown peaks, that is, if peaks are found in regions other than RoI 1 or 2 or 3 or 4.

RaC Analyser for Steel samples- RoI definitions:

18. Let us understand that the Grid that displays acquired data.
The RoIs shown in the Grid correspond to RaC Analyser for Metals. We have finished entering the RoI starting and Ending channel numbers.
 - (a) RoI 1 captures Integral counts from all channels.
 - (b) RoI 2 captures counts from Ba-133 decay at 364 keV.
 - (c) RoI 3 captures counts from Cs-137 decay at 662 keV.
 - (d) RoI 4 captures counts from C0-60 decay at 1170 keV and 1330 keV.
 - (e) RoI 5 can be defined for unknown peaks, that is, if peaks are found in regions other than RoI 2 or 3 or 4.
19. **Acquiring background (BG)** : After loading Factory calibration settings, the system is ready to acquire the data. It is a good practice to start by taking the background (BG) spectrum every time the application is run. Before we start acquiring the data, ensure that there are no samples or standard sources inside the lead chamber. Also, lead chamber's lid is closed.
Now, click on ACQUIRE menu and select BACKGROUND.
 - (a) Click on START button.
 - (b) Observe the background spectrum building up.
(In case connections are not made properly, or system is not functional, background spectrum will not build up. You may see only a line. Then please refer to our trouble shooting video, and also Servicing Tips given in Chapter-VI of this manual.
In case you want to stop the acquisition for whatever reason, you may do so by clicking STOP button).
 - (c) Wait until the background acquisition is over.
 - (d) Background count rate (CPS) in each RoI is calculated and transferred to the Grid.
 - (e) These background values hold good until the application is running or the day is over.
20. Now, we can proceed to Acquisition of Sample data.
Click on ACQUIRE Menu and Select SAMPLE.
21. Remove the lid of the lead chamber

LOADING OF FOOD SAMPLE & ACQUIRING DATA.

22. Load the solid Food Sample (Place the Food Sample, say, Bread on the surface of the detector).
23. The sample height can be upto a maximum of 20cm.
24. The Acquisition time is 2000 sec.
25. Click on the START button.
26. Observe the sample spectrum building up.
27. Once sample acquisition is over, the countrates in various RoIs are transferred to the Grid.
28. Every RoI is shown in a different colour.
29. Observe if you find any noticeable peaks.
30. If you do not find any noticeable peaks or if you find peaks in RoIs that are defined for most likely Radioisotopes, then straightaway enter sample details like Name, Weight / Volume etc.
31. The Text Box KeV of unknown peak can be left empty, if no unknown peaks are found.
32. Suppose that an unknown peak was found in the sample spectrum.
33. We must identify the RoI for the unknown peak.
34. To identify RoI, Axis mode must be in CH (Channel No.).
35. The spectrum must be expanded in the region where peak is found.
36. You can expand the spectrum by clicking the spectrum window and dragging the mouse diagonally from upper left side to lower right side, capturing the area of the peak. While dragging, left mouse button must be in clicked position.
37. Record the channel number at which peak appears, by moving the mouse over the spectrum peak and observing value of channel number & counts in calibration Parameters frame.
38. RoI 5 will begin at Peak channel Number minus 10% of Peak channel Number and will end at Peak Channel Number plus 10% of Peak Channel Number.
39. As an example, if Peak is found at Channel number 800, then set RoI 5 from 720 to 880. Enter these values in 5th row of RoI Parameters and click on SET RoI button. Click on RoI DATA to recalculate the counts in each RoI. Click on Upgrade Grid button to obtain new RoI 5 values into the Grid.
40. To return the spectrum mode to Normal view from Expanded view, click on a point on the spectrum window and drag the mouse to left and upwards and leave it. While dragging back, left mouse button should be in clicked position.

41. Now, having identified the RoI for unknown isotope, we must now find out the energy at which the Peak occurs. To do this, click on UTILITIES frame and select KeV. This changes X-axis to KeV (Energy mode). You can switch between KeV and CH (Channel number) mode whenever required.
42. Record the energy at which the peak appears. You can expand the spectrum if required. This is to be entered in KeV of Unknown PK Text Box in the 'Sample Details frame'.

ENTERING SAMPLE DATA FOR SOLID FOOD SAMPLE AND REPORT :

43. Enter the Name of Sample, Sample Height in **cm** and weight in **gm** in respective Text Boxes.
44. Click on EXCEL REPORT button to generate Excel Report.

LOADING OF LIQUID SAMPLE & ACQUIRING DATA :

45. Remove the top cover of the Detector Assembly by unscrewing the same.
46. Place the Marinelli Beaker in Position covering the Detector.
47. Pour one litre water sample or liquid in the Marinelli Beaker.
48. The Acquisition time is 2000 sec.
49. Repeat steps from 25 to 42.

ENTERING SAMPLE DATA FOR LIQUID SAMPLES :

50. Enter the Name of sample, sample volume in **ml** in respective Text Boxes.
51. Click on Excel Report Button to generate Excel Report.

INTERPRETATION OF RESULTS OF RaC ANALYSER SOLID FOOD / LIQUID REPORT :

52. Observe that the Excel Report generated shows Activity in 4 RoIs – Cs-134, I-131, Cs-137, and K-40. Additionally, 5th RoI shows Activity of unknown Radioisotope, if its Peak Energy was entered in 'Sample Details Frame'.
53. Observe how the efficiency of the Detector varies with gamma energy.
54. Also notice that Activity Calculation takes into account, the Decay Fraction of the isotope. As an example, Cs-137 has a Decay Fraction of 0.85. It means that for every 100 disintegrations, only 85 gamma rays are generated. Hence, to obtain the true activity, we must divide the Activity of the Sample by Decay Fraction.

55. The column of our interest is **Bq/gm** or **Bq/ml**. Observe the values in this column. The activity is measured in Becquerels (Bq).

1 Becquerel (Bq) equals one disintegration per second (DPS).

56. Note that acceptable limits differ from country to country. Compare with the Acceptable limits for your country and draw conclusions. If any of the values exceed the Acceptable limits, then it means that the sample is contaminated. Type the results in RESULTS column. You can print, sign & archive the report for record purposes.

LOADING OF STEEL SAMPLES & ACQUIRING DATA :

57. Load the steel sample (Place the steel sample on the surface of the detector).

58. The sample height can be upto a maximum of 2.5cm.

59. The acquisition time is 2000 sec.

60. Repeat steps from 25 to 42.

ENTERING SAMPLE DATA FOR STEEL SAMPLES AND REPORT :

61. Enter the name of the sample, sample weight in gm in respective Text Boxes.

62. Click on Excel Report button to generate Excel report.

INTERPRETATION OF RESULTS OF RAC ANALYSER – STEEL SAMPLE REPORT :

63. Observe that the report shows Activity in 4 RoIs – Integral, Ba-133, Cs-137 and Co-60. Additionally 5th RoI shows Activity of Unknown Radioisotope, if its Peak Energy was entered in 'Sample Details Frame'.

64. Observe how the Efficiency of the Detector varies with Energy.

65. Also notice that Activity Calculation takes into account, the Decay Fraction of the isotope. As an example, Cs-137 has a Decay Fraction of 0.85. It means that for every 100 disintegrations, only 85 gamma rays are generated. Hence, to obtain the time activity, we must divide the Activity of the Sample by Decay Fraction.

66. The column of our interest is Bq/gm. Observe the values in this column. The activity is measured in Becquerels (Bq).

1 Becquerel (Bq) equals one disintegration per second (DPS).

67. Note that acceptable limits differ from country to country. Compare with the Acceptable limits for your country and draw conclusions. If any of the values exceed the Acceptable limits, then it means that the sample is contaminated. Type the results in RESULTS column.

CHAPTER – VI

BLOCK DIAGRAM & DESCRIPTION

This system, as seen from the block diagram consists of the following sub-systems.

1. A.C power adaptor
2. 3" x 3" NaI scintillation detector
3. RaC Analyzer RA1006A data acquisition module, comprises of MCA card, Adj, High voltage module to provide detector bias & shaping amplifier PCB.
4. Laptop computer / Tablet PC

A.C power adaptor: This draws power from the A.C power source and gives +12V, D.C @1A as the output.

This output is connected to the data acquisition module.

RaC Analyser RA1006A - (DAM): Block diagram indicates – Front panel (FP) & Rear panel (RP) of this Data acquisition module separately with appropriate connectors & inter-connections.

Inter-connections to and from this DAM, to the scintillation detectors are indicated in the block diagram.

These are (1) Low voltage supplies required for the scintillation detector are taken through 5 pin to 5pin cable, from the DAM to scintillation detector. This provides required low voltage power supplies. (2) Detector bias, required for the scintillation detector is taken through MHV to UHF cable from the RA1006A – DAM to the scintillation detector. (3) Pre-amplifier output, generated in the scintillation detector at BNC socket is taken to RA1006A – DAM, through a BNC to TNC cable. TNC female connector being on DAM.

RA1006A - DAM contains three sub-systems namely –

Multi Channel Analyser (MCA)

HV module (0-1200V @ 0.5A) and

Shaping amplifier PCB

High voltage module provides required detector bias voltage to the PMT of the scintillation detector. It is factory set & user is advised not to disturb it. (There is a trimpot adj. provided on the Front panel (FP) of DAM for HV adj.).

Second PCB is a shaping amplifier PCB. This amplifies the signals received from the scintillation detector pre-amplifier & provides input to the ADC of the MCA card.

MCA card takes this input & processes these semi-Gaussian shaped pulses to acquire pulse height spectrum, of the isotopes of the **sample** under study.

3"x3" NaI scintillation detector:

This essentially has 3"x3" NaI crystal scintillator, optically coupled to photomultiplier tube & pre-amplifier. It takes low voltage supply & HV detector bias from the RA1006A - DAM & gives pre-amplifier output signals. These are positive tail pulses of 500mV to 1 volt in amplitude & approx.15 μ sec in fall time.

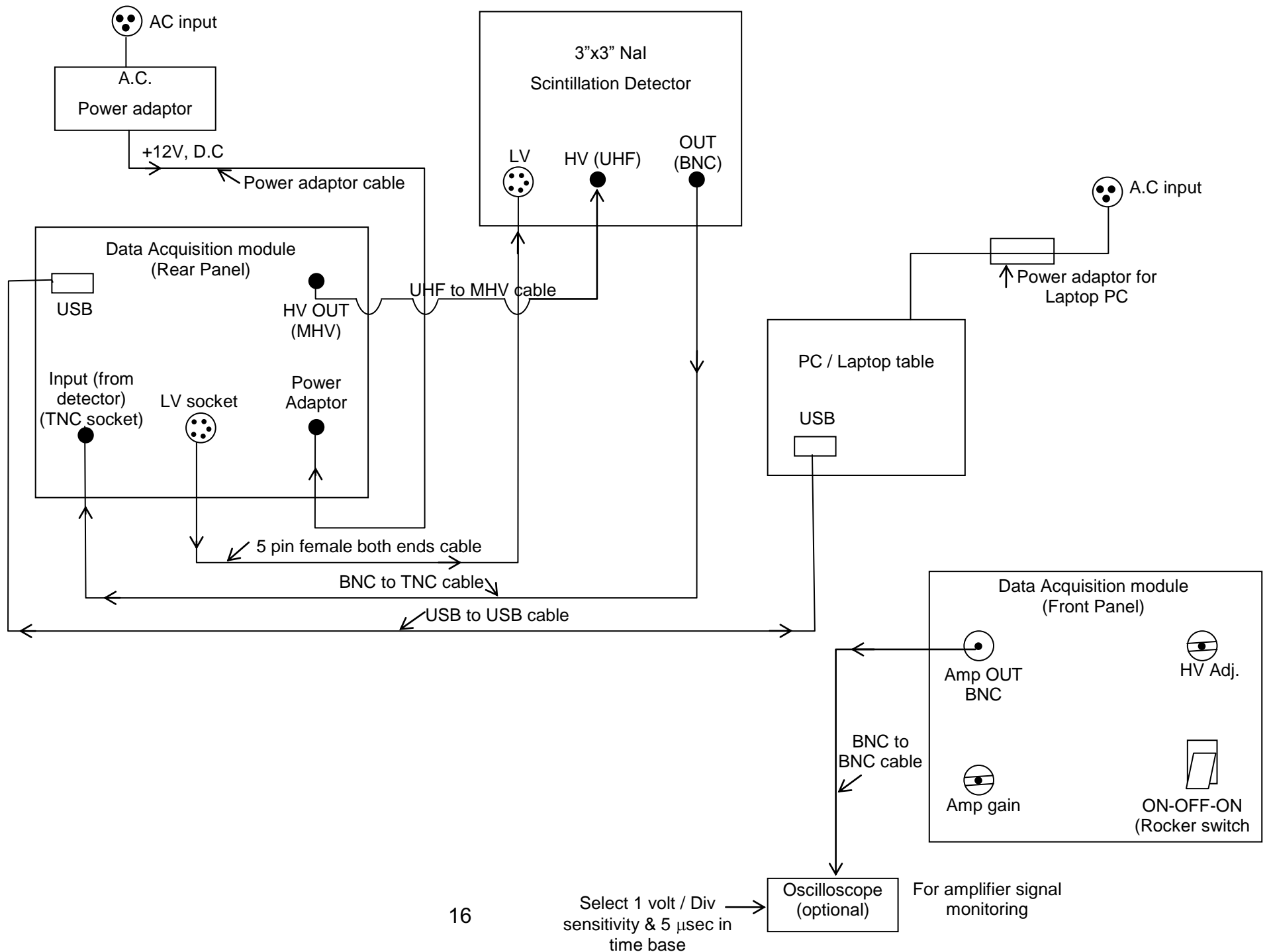
MCA card:

MCA card has successive approx ADC and FPGA based digital logic with firmware & memory to carryout PHA data acquisition & analysis.

Laptop PC with RaC analyzer software:

Laptop PC with windows 7.0 Operating system can be used for loading RaC analyzer software. 'Read me' file provided in the CD will give details on how to install the software. This software once invoked will fetch data on continuous basis from data acquisition module to acquire PHA spectrum of the sample under study. Once acquired, spectrum can be analyzed for activity of the sample. Contamination levels both in **Bq/g** or **Bq/liter**, with isotope identification / energy that has contaminated can be found out using our processing software which also generates analysis report.

For further details go through software & operating procedure for sample analysis.



CHAPTER – VII

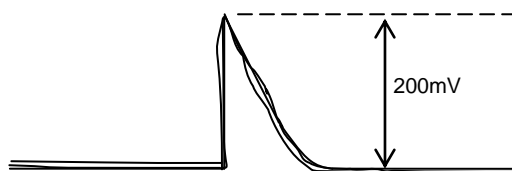
SERVICING TIPS

- Hanging problem
- Spectrum disappears

Hanging problem : Once software dialog box gets hanged menu spectrum may not acquire. Then first close the dialog box and remove the USB cable from UNIT / PC, remove adaptor pin. Again reconnect them (USB cable & adaptor pin) properly. Then run the software as usual.

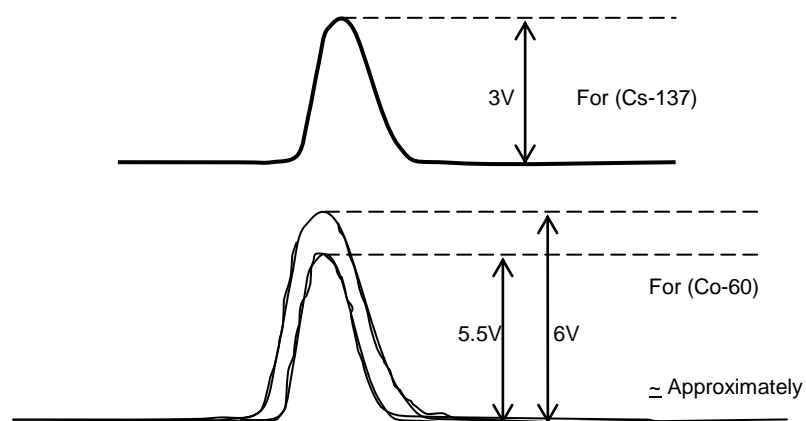
Spectrum disappears : After double clicking on the RaC Analyser Icon, start the acquisition. If there is no spectrum, then follow the following tips.

- Check whether the green LED is glowing or not (if not)
Check the voltage (+12V) at end of the adaptor pin with multimeter. (Check in DC mode). (If not replace the adaptor)
- Check low voltage at LV socket on the front panel of the USB card (5 pin I/O connector with respect GND. 5th pin GND and 1st pin – 12V) if not check connectivity are OK inside the module.
- Switch ON the HV rocker switch and check the high voltage at MHV connector (HV OUT) 500V+ (if not check HV module and adjust HV adj. trimpot which is provided on the rear panel of the USB card).
- Check the pre-amplifier o/p from base of the detector RG-58 cable with TNC connector in the oscilloscope should be +ve tail pulse typically.



(If not, replace the LV cable. Then also if it is not alright problem may be in the pre-amp or bleeder socket or detector)

- After making all connections as per given instructions and make sure that all OK
Then check the amplifier OUTPUT in the oscilloscope from Amp OUT connector which is provided on the rear panel of the USB card should be (+ve) Gaussian pulse



If not adjust Amp gain adj. trimpot which is provided on the rear panel of the USB card.

Above all OK

Then run the acquisition

CHAPTER – VIII
AVAILING OF MAINTENANCE/ CALIBRATION SERVICES AND
WARRANTY CLAUSE(with in India)

8.1 GENERAL

As per the warranty clause of the company, we provide one year warranty during which period we provide free service at our works. Hence in case of any malfunction in our instruments, you are requested to send the unit back to our works by RPP/COURIER/SPEED POST PARCEL/GATI/XPS/door delivery. We shall arrange immediate rectification/replacement within two weeks from the date of receipt of the equipment at our place. Please note that the equipment will be serviced at our works only.

The equipment is to be sent to:

The Servicing Department
NUCLEONIX SYSTEMS PRIVATE LIMITED
Plot No: 162 A & B, PHASE II, I.D.A. Cherlapally,
Hyderabad - 500 051 Ph: 040-27263701/329145448/32918055
E-mail: info@nucleonix.com www.nucleonix.com

For all the Radiation monitoring equipment, detectors built-in or external probes will not have one-year warranty, but only inspection warranty at the time of supply is provided. Since detectors will / may have fragile glass construction, we do not provide warranty. In case of failure of these components, Nucleonix will supply detector replacement at cost-cost price.

Note: In respect of all types of portable radiation monitors, it may be necessary to checkup and recalibrate the equipment once a year at our works.

8.2 EQUIPMENT REPAIRS / SERVICING POLICY (WITH IN INDIA)

(a) During Warrantee

The following procedure is to be followed by the customers with in India for availing services/ repairing facility during warrantee period.

- Equipments are to be **sent to our works** for availing free repair services during warrantee, after the customer receives approval from the customer support division, by sending an e-mail.
- For all equipments, costing less than 6.0 lakhs one year warrantee & free service is offered, when the equipments are sent to our works only. For larger systems such as installed systems, networked systems, specialized systems, costing more than 6.0 lakhs during one year warrantee, free service is offered at site. Field service Engineer will be deputed subject to warrantee terms & conditions.
- This does not include personal computer related problems, for which local computer service provider of the PC vendor is to be contacted. Also for software related problems online support will be provided. Software support doesn't include cleaning of virus problems etc.
- When the equipments are sent to our works for warrantee services, they are to be properly packed with adequate cushion to prevent any transportation damages. **Nucleonix Systems** is not responsible for damages or loss during transportation.
- Packing / Freight charge is to be borne by customer when he sends the equipment to our works. However when we return after servicing packing will be Nucleonix responsibility & Freight charges will be to your account. Only services are free.
- Please indicate in your correspondence equipment model & serial number.
- All the equipments are to be sent to our works only on door delivery basis.
- For Door Delivery Transportation contact XPS/GATI cargo in your city / town or a reliable courier service to pick the consignment from your place. For their nearest local address & phone no's look into their websites. Transit insurance if the customer feels is necessary it is to be covered.
- Nucleonix Systems will not receive the equipments sent by other modes of transportation, such as Rail/Road.
- After servicing, equipments will be sent back by same mode of transport such as XPS/GATI/COURIER/RPP.
- All types of Radiation detectors, glass ware, PMTs etc which are fragile are not covered in warrantee, if the failure is due to physical damage, external or internal due to shock, dropping, miss-handling etc. If the failure is due to a natural fault then only it is covered under warrantee for a limited period of three months. However complete electronics is covered for 1 year warrantee.
- You can also send the equipment personally to our works for repairs either during or after warrantee, after fixing up with our service dept (Customer Support Division). If possible we may repair on same day or your person can stay for a day or two & get it repaired & or calibrated.

(b) After warrantee Services

- On expiry of 1yr warrantee if you like to send the equipment (low cost less than 6.0 lakhs) for repairs to our works, you may please observe the following procedure.
- Send an e-mail with details mentioning that you agree to pay service charges which includes: Basic service charges per unit / module in the range of Rs: 2500 to Rs : 10,000 depending on the sophistication of the unit calibration charges (if applicable for your equipment) + cost of components + packing charges + Return Freight charges @ actual.
- Once our customer support department responds & requests you to despatch the equipment to our works for repairs, you may do so by following the steps given below.
- Followed by this you can send the equipment straight away if it is within 5 yrs old. If the equipment is beyond 5 yrs old, then also you can send it for repairs, however only after you receive confirmation from Customer Support Division, that it is repairable & is not an obsolete model. If the design is obsolete then customer support division (CSD) may give you 'buy back' offer to replace with new model or upgrade it with electronic circuit boards & enclosure.
- For all installed equipments costing above Rs: 6.0 lakhs which are larger in size & for which field servicing only is recommended, you can obtain a quotation with relevant details by sending an e-mail & avail the services accordingly.
- For all field servicing jobs, since we need to depute engineers, it is likely, to take time & also it will cost more which includes Engineer's TA & DA etc., apart from basic service charges + cost of spares etc. Please note that basic service charges will be different for different products depending upon sophistication.
- Also in some cases it may not be possible to fix-up the problems in the field itself, in such cases we may advise you to send them to our works.
- For all jobs to be serviced in the field, customer is requested to provide adequate details on the nature of problems, to enable our engineer to come prepared with adequate spares.
- For any additional information send an e-mail to info@nucleonix.com, Atten: Customer support division.

8.3 EQUIPMENT REPAIRS / SERVICING POLICY (FOR EXPORTS)

Equipments, manufactured & exported are subjected to a well defined quality assurance (QA) plan & Factory acceptance tests (FAT). Nucleonix systems has the following policy to provide maintenance support to overseas customers either directly or through international dealers / distributors.

(a) During & after warranty:

- For minor problems, which can be handled by customers, servicing tips have been provided in the user manual / servicing manual.
- Also most of the equipments have built-in fault diagnostic features which will indicate to the user nature of problem in the equipment. Based on the visual indication in the instrument Display, user can take corrective action or contact Nucleonix systems by email for help.
- Nucleonix systems will guide in localizing the defective part / module or sub-system by interacting with the customer if required. Skype will be used for communication.

- During warranty free replacement of sub-system or board (PCB) will be done. However customer has to send defective sub-system back to Nucleonix system with-in 15 days on arranging replacement.
- During & after warranty, any Freight charges & customs clearance charges are to be borne by customers, both ways.
- If it is a manufacturing defect, then Nucleonix system will bear the replacement cost of sub-system / unit. However any Freight charges & customs clearance charges in their country are to be borne by customer.
- After warranty, services will be similar to that of services during warranty. However, customer will have to pay for cost of parts replaced, freight charges both ways & customs clearance charges in both the countries. Nucleonix systems plans to introduce audio visuals on web or on CDs to facilitate product demonstration, installation & minor maintenance very soon.

8.4 HOW TO AVAIL CALIBRATION SERVICES (FOR INDIAN CUSTOMERS)

Nucleonix Systems offers radiation calibration services to its customers. Calibration services are provided for Nucleonix Systems manufactured products only, in general, as a company policy.

How to avail calibration services:

It is best advised that each of the Radiation monitors including Area monitors are calibrated once in a year. When you want to send your Radiation monitor / Area monitor / Contamination monitor for calibration to our works. You may send the equipment for calibration, by following the steps given below:

1. Our standard calibration charges per equipment (All types of Radiation monitors including portable survey meters, contamination monitors & Area Gamma Monitors) are Rs: 2500 + Packing + Freight charges. You can email a '**work order**' accepting these charges.
2. Email your **work order** and despatch / send the equipment to our works if it is 5 years old or less including details of mode of transport sent with docket particulars.
3. Also mention in your work order & clearly indicate that you will agree to pay calibration charges & also equipment repair charges additionally if the unit is faulty & requires repairs before one can take it up for calibration.
4. You are requested to ensure **good packing** to avoid any transportation damages. Especially if there are external detector probes, they are to be packed with sufficient soft foam to ensure no damage in transportation.
5. Use only the specified following mode of transportation system for dispatching on door delivery basis. XPS/GATI cargo / Courier/RPP/Speed Post parcel etc. Send the equipment on freight paid basis. (Equipments sent by other methods such as Rail/Road etc will not be collected). Also you can cover for transit insurance **both ways** if you wish. Nucleonix system is not responsible for any transportation damages or loss during transportation both ways.
6. Immediately on receipt of the equipment, we will send an acknowledgement & also a proforma bill by email/ post.
7. Based on the proforma bill, once we receive the payment, equipment will be dispatched back by similar mode of transportation as mentioned above.

8.5 HOW TO AVAIL CALIBRATION SERVICES (FOR FOREIGN CUSTOMERS)

Foreign customers can calibrate Nucleonix make Radiation monitors/equipments in their country at any of their accredited Radiation calibration labs. Nucleonix systems will be happy to provide any help and guidance if needed, for calibration. Alternatively if you send the equipment here to India we can also provide calibration services.

Calibration Standards Lab & Facility:

We have two calibration labs.

- i. Low Level Calibration Lab.
- ii. High Dose Rate Calibration lab.

Low Level Calibration Lab: This has a Cs-137, 165 mCi standard. "Gamma Survey Instruments Calibrator" from Amersham.

This calibration service has NIST Traceability standard. Calibration of all portable radiation monitors, survey meters, contamination monitors, Area monitors etc., is carried out in this lab upto 1 R/hr max dose rates.



Gamma Survey instruments calibrator has Cs-137 source 161.5 mCi as on 05 Aug 2002. It is basically a gamma survey instruments calibrator procured from AEA Technologies UK/USA. Has NIST traceability accuracy within +/- 7%

High Dose Rate Calibration Lab: This lab has a 8 Ci , Co-60 standard housed in a CRC-2 camera, operated remotely viewed through CCTV arrangement. High dose rate survey meters, High level Area monitors etc are calibrated in this lab. This CRC-2 camera is housed in a separate concrete building. All the radiation monitors manufactured by Nucleonix Systems are authentically calibrated at this facility, before they are shipped / dispatched.



CRC-2 camera has Co-60 standard obtained from Bhabha Atomic Research Centre, Mumbai. It is a certified source.

8.5 ANNUAL MAINTENANCE CONTRACT (AMC)

Annual maintenance contract (AMC) services:

For all sophisticated instruments & systems and also for installed monitors & networked systems in a nuclear facility or a Radiological lab or in a Medical cyclotron facility where no. of instruments are networked, it is advised that customer enters into an economical Annual maintenance contract with Nucleonix system.

Detailed AMC proposal can be obtained from our customer support division (CSD), by giving required inputs.

Inputs required by our CSD to send you AMC proposal:

- Name, year & date of purchase, Sl. Nos. of equipments, Model No's, No. of equipments for which AMC is required. Additionally no. of calls per annum required for preventive & breakdown maintenance may also be indicated.

Advantage of entering into AMC:

- Equipment services offered will be prompt & timely
- Nucleonix systems maintain required spares, spare tested PCBs, detectors & other critical components which may become obsolete.
- Obsolescence in electronics is quite rapid. If you enter into AMC guaranteed service for the period of AMC will be the responsibility of Nucleonix Systems.
- Nucleonix Systems will maintain Engineers at your disposal to attend to AMC calls on time
- Without AMC prompt service calls are not guaranteed.
- If some critical components become obsolete, then Nucleonix systems may request you to upgrade the product with new model or new electronics which may be expensive if you are not under AMC.

Training on maintenance / servicing:

- To a limited extent, we offer training on maintenance / repairs at our works to customers on chargeable basis. Details can be obtained from our customer support division, by customers who may require such services.