

# INSTRUCTION MANUAL

## COUNTER TIMER (AT) (Microcontroller based)



**TYPE : CT541A**

## **NUCLEONIX SYSTEMS PRIVATE LIMITED**

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## CHAPTER - II

### FRONT PANEL & REAR PANEL CONTROLS

#### 2.1. FRONT PANEL CONTROLS AND INDICATIONS

##### 2.1.1. POLARITY SWITCH

Positive & Negative : Selects the polarity of the input signal for counting.

2.1.2. **INPUT** : It is a BNC connector which receives the input pulses to be counted.

2.1.3. **DISC** : CT541A has a pulse height discriminator (trimpot) with variable (bias from 100 mV to 10V which is set to approximately 300mV by default.

##### 2.1.4. INTELLIGENT KEY PAD

- (a) PROG key button : This key is used to select the program option from the menu for further modifications.
- (b) START key button : This is used for starting of acquisition and printing, once all the programme parameters have been set.
- (c) STOP key button : This key can be used to terminate acquisition and printing inbetween. In the normal course acquisition will stop automatically at the end of preset time and the data printing will stop once the end serial number setting for printing has reached.
- (d) INC/DEC key button : These keys are used while setting the program parameters to increment and decrement a value or to change the option selected to another value available.
- (e) STORE key button : This key is used for storing the readings or data values in the following way, in the manual mode of storing only.

At the end of acquisition for a preset time if user presses this button, data counts will be stored and the sl.no. in the display increments to the next value.

In CPS/CPM modes the current CPS/CPM is saved on pressing this button.

##### 2.1.5. LCD DOTMATRIX DISPLAY

This is a 8 X 2 alpha numeric LCD dotmatrix and responds to all the commands from the keypad and displays programme parameters, data counts, preset and elapsed times etc.,

#### 2.2. REAR PANEL CONTROLS AND INDICATIONS

2.2.2. **TO PRINTER** : This is a 25 pin D-female connector through which one can connect a printer (with centronics interface cable) for direct printing of data.

2.2.3. **SERIAL PORT (RS232)** : This is a 9 pin D-female connector having RS232 compatible signals for serial data communication to a P.C. Under software control from a PC, the stored data readings from this unit can be downloaded into PC. (Software can be supplied at extra cost)

## CHAPTER - III

### SPECIFICATIONS

<b>Input (s)</b>	:	100 mV to 10V, unipolar or positive bipolar semigaussian pulse from Single Channel Analyser
<b>Pulse width</b>	:	0.5ms (min)
<b>Polarity</b>	:	Positive or Negative
<b>Input Impedance</b>	:	1.0K ohms
<b>Input counts capacity</b>	:	999999 counts
<b>Input frequency (max)</b>	:	1MHz
<b>Pulse height Discriminator</b>	:	100mV-10V by a preset provided on front panel
<b>Display</b>	:	18x2 LCD dotmatrix display has been provided to indicate data counts & Elapsed time
<b>Preset time</b>	:	0-9999 seconds
<b>Command Buttons</b>	:	START, STOP, PROG, STORE, INC & DEC command buttons have been provided on the front panel keyboard
<b>Modes of Data Acquisition</b>	:	a. Counts for a preset time b. CPS c. CPM
<b>Timer Preset Time Setting</b>	:	Programmable through switch control buttons
<b>Data storage</b>	:	Upto 1000 readings
<b>Programmability</b>	:	Includes selection of preset time storing / recalling of data, starting and stoping of acquisition, lable assignment for data counts such as BG (back ground), ST (standard) and SM (samle).
<b>Printing option</b>	:	This module has built in parallel port for data printing.
<b>Data transfer</b>	:	This module additionally has built-in RS232C serial port for down loading the data into PC.

## CHAPTER - IV

### OPERATING INSTRUCTIONS

#### 4.1. SYSTEM INTERCONNECTIONS

Connection		Remarks cable to be used
From	To	
SCA out	CT541A Input on Front Panel	BNC to BNC (for Modular Gamma ray spectrometer system only)
Personal computer serial port	RS232 I/O connector on Rear Panel of CT541A	RS232 serial cable
Printer (Optional)	Printer Connector on Rear Panel of CT541A	25 pin D to D connector printer cable

#### 4.2. INSTRUCTIONS ON INTELLIGENT KEYPAD COMMANDS

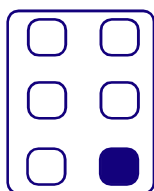
When we switch on the unit, the display will show up,

<b>COUNTER *</b> <b>TIMER * AT</b>	for 3 Sec.
---------------------------------------	------------

<b>NSPL</b> <b>HYD</b>	for 3 Sec.
------------------------	------------

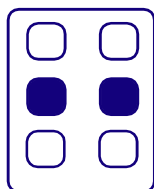
##### 4.2.1. ACQUISITION MODE SELECTION

By default, display changes to,



<b>ACQ MODE</b> <b>PR.TIME</b>
-----------------------------------

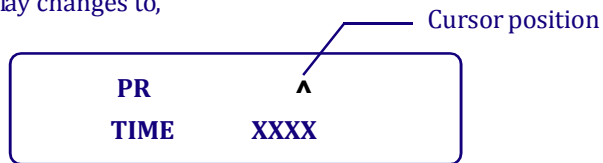
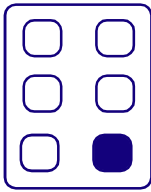
This signifies that by default "acquisition is in preset time mode". Because in majority of the situations counting is done for a preset time set.



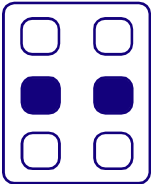
If you want other modes of acquisition such as CPS (Counts per second) or CPM (Counts per minute) then press **s** or **t** keys to select required mode.

### 4.2.2. PRESET TIME SETTING

By pressing PROG key, display changes to,



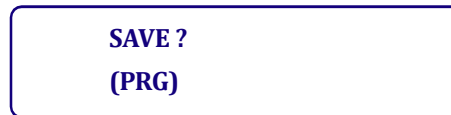
This displays the previous preset time for counting. We can change the preset time by the following way.



s Key can be used to increase the value at the cursor position.

t Key can be used to shift the cursor position to the left.

By the above method set the required PRESET TIME for acquisition. One can keep pressing "PROG" key till below text is displayed on the display.



This signifies that the set (programmed) parameters and their values are to be saved for operation of the equipment. User can save the parameters by pressing s or t key. If these parameters are not saved, system will take and work according to the earlier programmed parameter.

Once programme parameters are saved user will find the display as

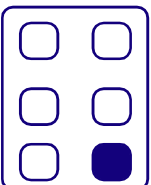


Now the user can go for starting of data acquisition as mentioned under 4.2.13.

Steps (4.2.3), (4.2.4) & (4.2.5) have been provided as additional programming features for researchers/other users in DAE & NPCIL etc.,

### 4.2.3. TO VIEW NUMBER OF READINGS STORED

Now by pressing PROG key again display changes to,



This displays the current number of data readings stored.

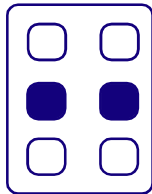
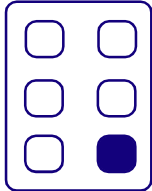
#### 4.2.4. LABEL ASSIGNMENT FOR A DATA READING

Label assignment is required and will be quite useful for Researchers and Health physicists who may be counting Beta/Samples or research samples. They will record background count, a reading with standard source and followed by this number of readings with different samples. So, a feature for label assignment has been added in the micro controller software,

BG = Background  
ST = Standard  
SP = Sample

Before acquisition for each reading label is to be assigned. If same label is to be continued after a particular assignment, then user need not do any thing, the same label will continue till such time one changes it

By pressing PROG key, display changes to,



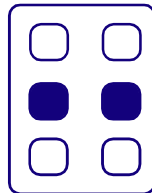
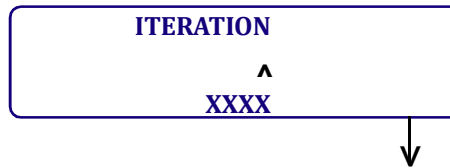
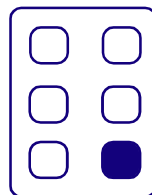
XX:

Label can be changed by using  $\text{S}$  or  $\text{T}$  keys, options are SP (Sample), ST (Standard), BG ( Background) and  $\blacksquare$  (No lable).

#### 4.2.5. ITERATION PROGRAMMABILITY FOR A READING

Iteration programmability is another useful feature that has been provided. Sometimes user may like to iterate a reading 2 or 3 times. The system allows this and it displays averaged reading only, at the end of two or three iterations. Acquisition for iterations once initiated will go till all the iterations are completed. Users intervention is not required.

By pressing PROG key, display changes to,



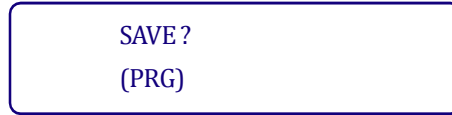
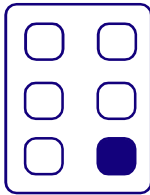
By default '1' is displayed. Number of iterations can be changed by using  $\text{S}$  or  $\text{T}$  keys. INC key is used for adjusting digit & DEC key is used for scrolling. (Maximum no. of iterations 999)



**4.2.6. SAVING PROGRAMMED PARAMETERS**

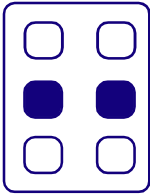
All the programmed parameters are to be saved by the user before he can start acquisition. Without saving, the system will use the previous parameters for acquisition.

By pressing PROG key, display changes to,



SAVE?

To save the above parameters press *s* or *t* keys

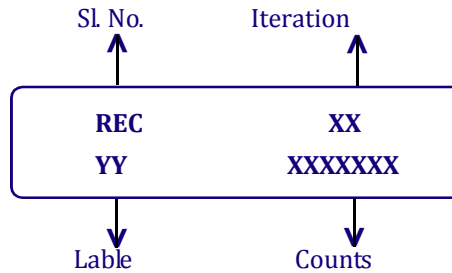
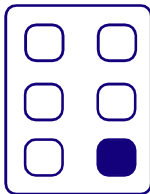


"OK" will be displayed on saving of parameters (PRG)

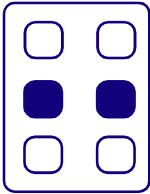
**4.2.7. RECALL DATA READINGS**

This is a very useful feature that has been provided in this unit. At the end of storing/saving of a set of readings, this feature will enable the users to recall the readings on to the display.

By pressing PROG key, display changes to,



Recall serial number can be changed by *s* or *t* keys.



**4.2.8. STORING OF DATA READINGS**

This system has CMOS memory to store upto 1000 readings. Storing can be initiated in two ways.

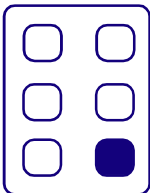
- (a) MANUAL
- (b) AUTO

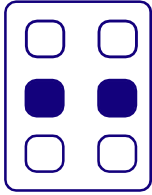
User can select any of these options. In manual mode at the end of acquisition of each reading the user has to press "STORE" command button once for each reading.

In AUTO mode, each of the data readings iteration and average data gets saved into memory along with lable. At the end of counting average data is also stored. User intervention is not required.

While acquisition is going on, user may observe that at the end of each acquisition, the Sl.No. pointer will be incremented by one where the data counts will be stored.

By pressing PROG key, display changes to,





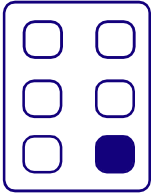
Default mode is MANU, to change to AUTO manual mode press s or t AUTO mode is used to store data automatically after acquisition (PR.TIME)

#### 4.2.9. PRINT COMMAND FOR DATA READINGS PRINTING

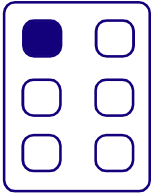
After setting the limits for Sl.No. both for start & end, printing can be carried out by invoking this command. Ofcourse it is assumed that a **centronics interface compatible printer** has been connected to this counting system through a cable.

A sample print out is enclosed in the following page.

By pressing PROG key , display changes to,

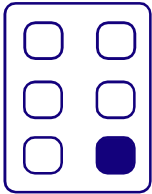


Press START to print the entire data stored in the EEPROM.

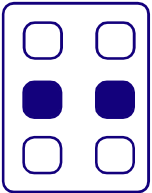


#### 4.2.10. TO ERASE MEMORY

By pressing PROG key , display changes to



Now press s or t button to erase memory



Menu	Options
ACQ mode	Pr. Time CPS CPM
Preset Time	----
SlNo. (A/O)	----
Label	■ ■ SP ST BG
Iteration	01-99
Save? (PRG)	OK / skip
Recall	----
PRINT DATA	----
STORE DATA	AUTO MANUAL
ERASE MEMORY	----

### 4.3. OPERATING PROCEDURE

#### 4.3.1. INSTALLATION

The Counter Timer CT541A of NUCLEONIX make, serves primarily as a constituent unit of modular nuclear counting systems, housed in the standard Modular Instrumentation Bin type IB401 or Minim based. The bin has attached power supply type PS402 or MB403 to power all the constituent units of the system.

##### a. INSERTING THE MODULE INTO THE BIN

The Bin is fitted with channels at the top and bottom to help guide in and position the modules. To insert the module into the Bin the projected edges at the top and bottom right hand side of the module should be positioned into the channel grooves and the unit pushed right in, until the 24 pin power connectors of the bin and module fully engage. The captive screws on the module should then be tightened.

##### b. POWER TO WORK THE MODULE

The input power to work the module is fed through the connector at the rear side of the module. This connector mates with one of the output connector sockets of PS402 or MB403 supply when the module is slid into the bin.

#### 4.3.2. OPERATION

Normally CT541A unit receives input signals from single channel Analyser or paralysis time unit or from a coincident unit etc. These signals are digital pulses with positive polarity and can be in the range of 100mv to 10v or TTL compatible signals.

Once the CT541A is plugged into the instrumentation bin, connection may be made to input BNC with a single cable from a unit whose OUTPUT to be counted for preset time.

## **CHAPTER - V**

### **PC COMMUNICATION (optional)**

Serial Data Communication software for downloading data from Counter Timer to PC can be provided separately at extra cost. Necessary instructions for using this software are been provided in the help file (in floppy).

## CHAPTER - VI

### BLOCK DIAGRAM & DESCRIPTION

This is an advanced nuclear counting module designed around microcontroller chip 89C52. CT541A module can receive input signals from single channel analyser or paralysis time unit or from a coincident unit or any other similar unit or directly from a pulse shaping amplifier.

Input signal can be unipolar or positive bipolar semi-gaussian pulse or TTL pulse of positive or negative polarity. In the input circuit there is a discriminator with polarity selection for the input pulse. Comparator output after gating is sent to a counter chip (PCF8583) for counting.

Microcontroller chip reads the counts from counter chip, which is connected through I<sup>2</sup>C bus.

8x2 LCD dotmatrix display is connected to a port and a few control lines with the controller chip for data counts and preset time display.

Serial port has been configured for data communication to PC.

Parallel port configured enables one to connect this unit directly to a printer for data printing.

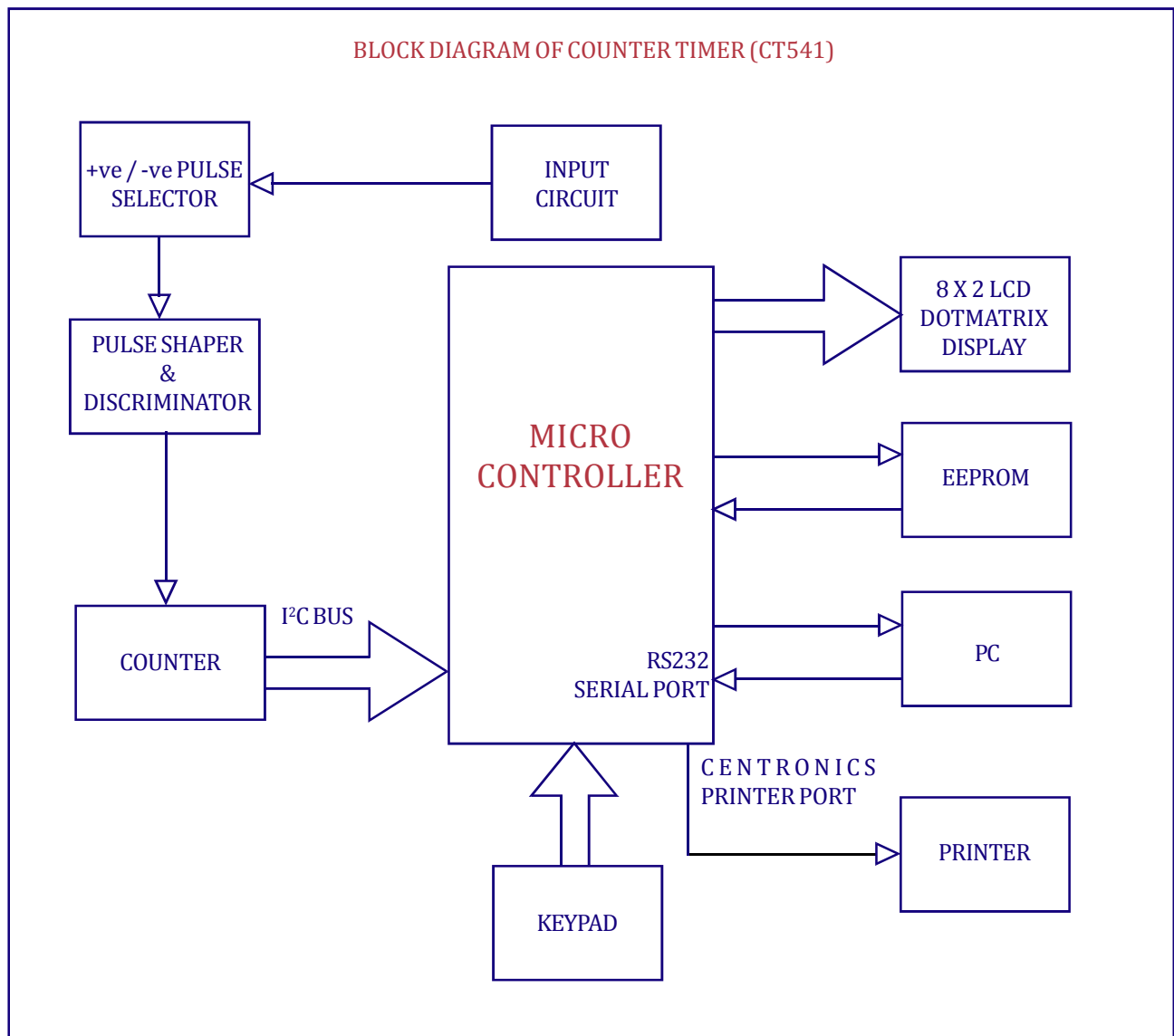
Keypad with command buttons has been connected to microcontroller to facilitate the user interface with the unit for operation under software control.

EEPROM has been wired up and connected to microcontroller for data storage and retrieval.

Under software control this unit acquires data acquisition in three modes.

- a. Preset scaler mode
- b. CPS mode
- c. CPM mode

and data acquired thus can be displayed, saved/recalled, printed or downloaded to PC.



## CHAPTER - VII

### AVAILING OF MAINTENANCE/ CALIBRATION SERVICES AND WARRANTY CLAUSE (with in India)

#### 7.1 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 mal-function 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.

#### 7.2 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.

- 1 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.
- 1 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.
- 1 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.
- 1 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.
- 1 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.
- 1 Please indicate in your correspondence equipment model & serial number.
- 1 All the equipments are to be sent to our works only on door delivery basis.
- 1 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.
- 1 Nucleonix Systems will not receive the equipments sent by other modes of transportation, such as Rail/ Road.
- 1 After servicing, equipments will be sent back by same mode of transport such as XPS/GATI/COURIER/RPP.

- 1 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.
- 1 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**

- 1 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.
- 1 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.
- 1 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.
- 1 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.
- 1 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.
- 1 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.
- 1 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.
- 1 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.
- 1 For any additional information send an e-mail to info@nucleonix.com, Atten: Customer support division.

## **7.3 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:**

- 1 For minor problems, which can be handled by customers, servicing tips have been provided in the user manual / servicing manual.
- 1 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.
- 1 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.
- 1 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
- 1 During & after warranty, any Freight charges & customs clearance charges are to be borne by customers, both ways.
- 1 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.
- 1 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.

#### 7.4 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.

#### 7.5 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.

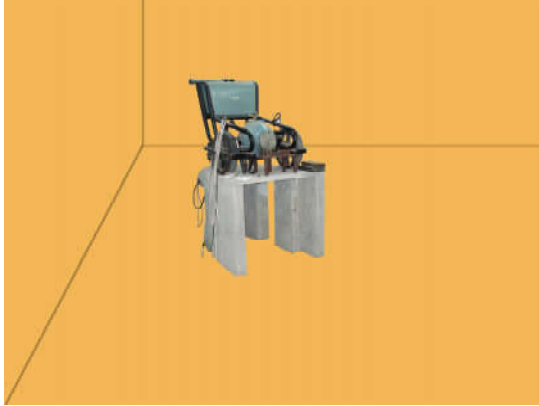
This calibration service has NIST Traceability standard. Calibration of all portable radiation monitors, survey meters, contamination monitors, Area monitors etc., is carried out in this lab upto 1 R/hr max dose rates.



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%



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

## 7.5 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:

- 1 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:

- 1 Equipment services offered will be prompt & timely
- 1 Nucleonix systems maintain required spares, spare tested PCBs, detectors & other critical components which may become obsolete.
- 1 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.
- 1 Nucleonix Systems will maintain Engineers at your disposal to attend to AMC calls on time
- 1 Without AMC prompt service calls are not guaranteed.
- 1 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:

- 1 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.









