BETA-GAMMA HAND, FOOT & CLOTHING MONITOR

TYPE: NXG_HFC1_BG

Technical Data

FEATURES :

- Developed using state of art ARM9 based SBC working on Windows CEOS platform and FPGA technologies.
- Provided with a 10” colour TFT display for graphical & multi-lingual user interface during measurement mode. Voice & visual languages supported – English, Hindi, Tamil, Telugu & Marathi.
- Uses GM133 for Hand, Foot & Clothing channels.
- Uses I/O interface is through a detachable keypad & colour TFT display
- Built-in Ethernet interface using MODBUS protocols allow centralized monitoring and fault diagnostics.
- Monitor design ensures continuous maintenance free operation in harsh atmospheric conditions in Radiochemical plants.
- Designed in accordance to IEC61098 performance specification for personnel monitors.
- Built-in fault diagnostics for fault location or bypassing.

Beta-Gamma Hand, Foot & Clothing Monitor NXG_HFC1_BG manufactured by NUCLEONIX SYSTEMS primarily serve as a personnel monitoring system for checking the contamination of hands, foot & clothing of radiation worker / technicians working in Nuclear Power Plants, reactors, Radiochemical plants and other similar installations.

This instrument has been developed using state of art Uses SoC, based on ARM Cortex A9 dual core CPU at 1GHZ, HDMI & extensive use of pheripheral devices & Ethernet interface has been integrated.GUI & multi-lingual user interface & corresponding voice messages are facilitated by a color TFT monitor with integrated speakers.

Guidance to the user during monitoring in the form of colour graphic monitor for left / right hand / foot & status indications during monitoring & at the end of monitoring are a unique feature for Nucleonix systems make.

Advanced fault diagnostic features facilitate the user to diagnose the problem easily. Also provision for faulty channel bypassing feature has been provided. Ethernet communication interface using MODBUS protocol facilitate remote monitoring, configuration & fault diagnostics.

Each Hand & Foot detector assembly shown in figure is modular in construction with two detectors plugged onto a single pre-amp box, facilitating easy maintenance in case of problems.

SPECIFICATIONS

The Beta Gamma Hand, Foot and clothing monitor shall comprise a set of detectors and an electronic unit.

DETECTORS:

a) Hand probes:

- Number of monitoring channels: 4 (Right hand upper & lower, Left hand upper & lower).
- Detector type : Halogen quenched G.M. detectors Type LND 719 or equivalent.
- Detector Wall Material : 40 - 60 mg/cm^2
- Detection Efficiency : 5 - 6% for Sr-90 Beta for each face of the hand with phantom source.
- Probe Construction : Each channel shall have 2 G.M. detectors. The detectors shall be provided with Lead shielding of 12 mm thickness to keep the background counts below 100 counts in 20 secs. counting time. They shall be fabricated and fitted in the instrument so that they can be detached easily for maintenance.
- Sensitive Area. : 300 sq. cm.
- Protection Grill : The whole detector assembly shall be protected by a suitable thin metallic grill.
- Detector dimensions and performance shall conform to IEC 61098 specifications.

b) Foot probes:

- Number of monitoring channels: 2 (Right foot and Left foot).
- Detector type: Halogen quenched G.M. detectors Type LND 719 or equivalent.
- Detector Wall Material : 40 - 60 mg/cm^2
- Detector Plateau : Shall have minimum plateau length of 100 volts and shall be insensitive to ordinary light.
- Detection Efficiency : 3-4% for Sr-90 Beta with a phantom source.
- **Probe Construction** : Each channel shall have 2 G.M.detectors. The detectors shall be provided with necessary Lead shielding of 12mm thickness to keep the background counts below 100 counts in 20 secs. Counting time. They shall be fabricated and fitted in the instrument so that they can be detached easily for maintenance.
- **Sensitive Area** : 300 sq. cm.
- **Protection Grill :** The whole detector assembly shall be protected by a suitable thin metallic grill and foot support.
- Detector dimensions and performance shall conform to IEC 61098 specifications.

c) Clothing probe:

- **Number of monitoring channels:** one
- **Detector type :** Halogen quenched G.M. detectors Type LND 719 or equivalent.
- Detector Wall Material : 40 - 60 mg/cm^2
- **Detector Plateau :** Shall have minimum plateau length of 200 volts and shall be insensitive to ordinary light.
- **Detection Efficiency :** Greater than 2 - 2.5% for Beta gamma over complete detector area.
- **Probe Construction :** Hand-held type; Side window probe in a protective housing with a rotatable shutter for cutting off beta particles. It shall be placed on a holder with micro-switch assembly on the side of the monitor. On lifting the detector, the monitoring shall be started.
- Detector dimensions and performance shall conform to IEC 61098 specifications.

ELECTRONIC UNIT :

The electronic unit consisting of the following

a. Signal processing and display unit.
b. Mother board
c. Switched mode LV supplies unit
d. 7 channel pre-amplifier unit
e. High voltage power supplies unit

Signal processing and display unit : The signal processing & display unit comprising of an ARM9 based SBC & 10" LCD is the data acquisition & control device. It carries out the following functions of

- User interface during configuration & measurement through the 10" TFT display and optical sensors.
- Counting of pulses from 13 individual detectors.
- Storage of last 100 acquired data and last 100 contamination data.
- Configuration of various parameters like PM time, BG time, BG dwell time, Low BG set point, High BG set point, Alarm set point, Baud rate, Device ID, IP address, Voice & visual guidance languages, fault diagnostic configuration, detector efficiency, detector status etc.
- Generation of voice guidance messages through stereo O/P sound device during measurement cycle.
- Initiates / terminates measurement cycle by sensing optical sensors status.
- Communicates to remote PC through Ethernet port using MODBUS protocol.

Mother board :

Motherboard PCB houses the Signal processing PCB, High voltage module, SBC, 20channel counter board and LV power supply circuits. It is powered by 24VDC supplies from Switched mode LV supplies unit located separately.

Switch mode power supplies unit : A switched mode power supplies unit generates the necessary PC voltages of +24. It is also provided with a line filter & other EMC suppression components.

7 channel pre-amplifier unit :
This unit comprises of 7 individual pre-amplifier modules used for connecting the -ve tail pulses to TTL coming from each of the GM detectors. HV bias to the GM tubes is fed through the pre-amplifier unit.

- **Counting Range :**
  0 to 9999 counts
  0 to 9999 CPS
  0 to 9999 Bq
  0 to 99999 CPM
  On overflow the display shall indicate 'OR'

- **Timing range :**
  Pre-settable from 1 to 99 seconds in 1 sec steps for COUNTS, Bq, CPS or CPM modes for Hand and Foot monitoring. Time constant for checking the Clothing monitoring is 5 seconds with display being refreshed every second.

HUMAN MACHINE INTERFACE:

Indications & controls:

Mains switch : The mains switch shall be provided inside the cabinet of the monitor.

Optical sensor : The monitor shall be provided with optical sensor inside the detector cavities for initializing the counting.

Test switch :
Through detachable keypad, provision to check the background is given.

Visual alarm :
Each channel visual mimic indication is provided on the colour TFT display.

Audio Alarm : Loud audio tone.

Audio Instructions :
Audio instructions shall be generated for clear, contaminated, instrument fault, monitoring in progress and incomplete operation.
Multi-lingual messages shall be played back in either Hindi / Tamil / Telugu/ Marathi based on the selection.

Operational Guidance :
Operational guidance messages shall be displayed Before monitoring, On Clear, On Contamination and On Incomplete operations shall be generated in either Hindi / Tamil / Telugu / Marathi apart from the primary language English.

Incomplete operation :
Multi- lingual textual indication accompanied by audio alert are generated when counting is interrupted.

Clear Indication :
Green mimic indicator will be ON when all the channels are clear on the TFT display.

Counting in progress Indication :
Busy indication will be ON and Time left is displayed when counting is in progress.

Visual display :
10" colour LCD display.
Given below is a partial list of the functions being carried out by the visual display.

- Display normal status messages.
- Visual display of monitoring in progress (including count down of time in seconds)
- Display of individual channel readings
- Alarm annunciation
- Background checking and display
- Instructions for use.
- Self explanatory, language independent symbols / user instructions.

Computer interface (Optional):
The monitor shall have a Ethernet 10/100 Mbps port for interfacing with a remote IBM PC-compatible computer. The features supported by Ethernet port are given below.

- The PC and the monitor shall operate in a host-slave configuration and the software protocol will be MODBUS / TCP
- The firmware of the monitor shall be able to send the instrument data like Instrument ID, Instrument type, Maximum counting range, Timer range, alarm settings, alarm status, current reading etc. to the Host PC on demand.
- The firmware shall be able to receive commands from Host PC and carry out the setting of different parameters like Instrument ID, Instrument type, Maximum counting range, Timer range, alarm settings, instrument address etc.
- The PC as the host shall give commands and send queries. The monitor will carry out various functions in response to the queries.

Power supplies:
The monitor shall have a High voltage power supply unit for the detectors and a low voltage power supply unit which supplies the DC power supplies required for the Electronic unit. It shall have a very good line voltage and load regulation for all the supplies. It shall be fitted with Mains line filters to avoid line interferences.
The High voltage output shall be adjustable by handheld configurator or host PC and EHT should be displayed on the display on demand. The EHT shall adjustable from 300 V to 1500 V DC.

Instrument fault indication :
Fault diagnostics are carried out periodically and any failures are reported on the display like LV, HV and detector failures.Fault indications shall be cleared automatically if normal status is resumed.

HOUSING:

- Most of the modules of the Electronic unit and detectors shall be integrated into a column shaped cabinet with castor wheels.
- The hand probes shall be fitted so that both the hands can be inserted and the optical sensors inside the cavities are activated when hands are placed to start monitoring.
- The modules shall be plug in type with all the controls and display on the front panel.
- The cabinet shall be pest-proof, rugged & elegant.

Self diagnostics :
The monitor shall have built-in self diagnostics. On being powered it shall perform tests to ensure that all components and sub systems are functioning properly.

It shall check for the Power supply, High Voltage Supply, Detector, Counting and measuring circuits, Alarm Systems, Display Systems and communication port.

The firmware should not halt monitoring / data acquisition function any time. The firmware shall be designed for high reliability and availability.

Test points shall be provided for checking the EHT voltage and for connecting external input pulse signals.

Input Power :
230VAC +/-10%, 50Hz, single phase supply. Power ON/OFF indication shall be provided with an indicator LED. Line filter and spike suppressor shall be provided.

Environment :
The instrument shall be able to withstand temperature upto 50°C and relative humidity upto 90% in radiation areas.

Hand Detector Assembly

Foot Detector Assembly

Foot Assembly Dust Tray

Clothing Probe with GM133 (LND 719)