CONTINUOUS AIR MONITOR (BETA)

TYPE: NXG_CAM_BG

FEATURES:

- State-of-art electronics design using SBC, controllers with embedded code, I2C, SPI bus based devices makes the equipment compact and highly reliable.
- Collection efficiency for Air sampler assembly is better than 97%.
- 5" Color TFT Display is used for display of count-rate status and other information.
- Touch Screen user interface is provided for configuration of the instrument.
- Ethernet port built-in for remote monitoring and diagnostics.
- 4-20mA current loop o/p for full-scale range of each channel.
- Count-rate indication is provided on the TFT Display.
- Uses imported pump of Gast Inc, USA make.
- Designed using Plastic Scintillator to give good Beta efficiencies.
- Beta efficiency : $\geq$ 25% with calibrated Sr^{90} / Y^{90}.
- Flow meter to indicate flowrate.
  Option (A) : Digital Flow meter
  Option (B) : Rotameter

Introduction : Continuous Air Monitor, Type: NXG_CAM_BG manufactured by Nucleonix Systems, is a Plastic scintillator based continuous air monitoring system, designed using state-of-art electronics and is primarily used for, checking Beta activity present in the form of suspended particulate in air. It is very much essential to monitor the quality of air in & around Radiochemical plants, reprocessing plants in disaster scenario and other strategic locations.

It essentially has an air suction system comprising of a suction pump, rotameter or digital flow meter to measure air flow rate, suction chamber with arrangement for trapping of suspended dust particulate onto the filter paper. Plastic scintillator based detector assembly, facing the filter paper counts, Beta particulate activity simultaneously in CPM /CPS/Bq on continuous basis.

Air-sampler detector assembly consists of a filter holder 60mm dia, a suction chamber with air inlet and outlet & detector housing fabricated with stainless steel. Beta detector consists of plastic scintillator of 50mm diameter, coupled to matched PMT with Pre-amplifier. Detector efficiency achieved for Beta is about 25% with Sr^{90} / Y^{90} and Collection efficiency obtained is better than 97% is achieved with this design. Suction chambers design facilitates the user to easily replace the filter paper periodically as per the requirement.

Electronic module: This will indicate, the air sample activity deposited on the filter paper in terms of CPM/ CPS/ Bq .Other built-in electronic sub-systems include HV module, SMPS, controller card, EMI/EMC filters, current loop circuit, relay & relay driver circuit, etc .Front panel has TFT display with touch screen, alarms indication on TFT display, audio buzzer, etc. Enclosure has connectors for connecting to Scintillation probe, 17 pin I/O connector, test sockets, Ethernet connector, A.C. mains switch, fuse holder etc. This module will provide alarm annunciation both visual and aural when the activity exceeds preset level. This system provides current loop output; relay output on 17 pin I/O connector. Ethernet port facilitates connection to NXG_RadGrid / SCADA for data communication for visualization of CAM parameters.

SPECIFICATIONS

The electronic unit comprises of low voltage power supply, High voltage supply, Pre-amplifier & Amplifier, Count rate meter and Alarm generation module. The electronic unit and the detector assemblies are mounted inside a single floor mounted trolley.

(A) Air-Sampler cum Detector Assembly(Beta):

The air sampler cum detector assembly for beta consists of a filter holder 60mm dia., a suction chamber with two nozzles (air inlet and outlet) of size ¼" serrated and detector housing.

Air samplers are fabricated with stainless steel SS 304L. Air sampler is designed and fabricated to achieve the particle collection efficiency better than 97% for air particles down to 0.3 micron size on glass filter paper.

Plastic scintillator based detector assembly measures Beta activity present in a given sample separately. It uses plastic scintillator coupled to a 2" PMT. To minimize the gamma background adequate lead collar / brace shielding has been provided.

PERFORMANCE WITH BETA SOURCE:

Efficiency for beta(Guaranteed): with calibrated Sr^{90} / Y^{90} standard source ≥25%.

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

Vacuum pump-motor set: Free air displacement: Rated for 115 liters/min.

Ultimate vacuum: 200 mm Abs (22" Hg).

Pressure: 1.4 Kgs/cm^2 (20 lbs) Duty: Continuous.

Electric Motor : ¼ HP,1440 RPM with gear box, 230V AC, capacitor start, start,single phase\TEFC B-56 frame, Class "B" insulation, continuous rating.

Vanes: Made of self-lubricant special H17 grade graphite.

Bearings: Sealed ball bearings. Mountings: Pump and motor mounting shall be on a common base plate.

Drive: "V" belt and pulley driven (belt covered by belt guard).

Air inlet/outlet: ¼" serrated nozzles. Vibration:suitable anti-vibration pad.

Cooling: Air Cooled.

Very low noise pump, Audio noise @ 1metre is less then 50db.

Pump failure alarm: Pump failure alarm indication is provided on the instrument and the same is also wired onto the remote console.

Make: Gast Inc, USA.

Count-rate meter: The count rate measurements are carried out by the Data acquisition unit from the corresponding radiation type detected by the Plastic scintillator detector. Important features of the count rate meter are listed below.

Unit: CPM / CPS / Bq **Ranges:** 0 - 50000 CPM
(or) 0 2000 CPS (or)
0 - 50000 Bq, with provision for unit selection and range adjustment.

Time Constant: Between 60 to 1 sec automatically varying inversely with count-rate through out the range.

Display: Color TFT Display is used for display of count-rate and hardware status indication & for visualization of preset alarm and other parameters.

Display updating: First reading on Power ON within 12 secs.

Time Constant: 60 sec to 12 sec automatically varying inversely with the radiation level.

Abrupt detection: Update the current reading within 1 sec and return to normal mode.

Overload: Senses overload above 200% of full-scale and indicates on display "OL"

Over-range: Senses if the radiation field being measured has exceeded the measurement range of the instrument and upto 200% of the instrument and displays "OFl". inject

Recorder output: 4 to 20 mA, with 600 ohm load for each channel
Recorder output stability

(a) Non-linearity: Max = 0.025% of Span.

(b) Offset current (Io=4mA):Max= 0.0005% of Span / C.

(c) Span Error (Io=20mA): Max= 0.005% of Span / C

Accuracy: +/ - 5% Full scale.

Calibration Accuracy: +/- 5% throughout the range.

TestingFacilities: Provision to Feed a suitable pulse generator signal for simultaneously testing of Count Rate meter will be provided on the rear panel. Additionally a test pulse mode through software for checking count- rate meter will be provided .

Audio Visual Alarm system: The instrument indicates Alarm status on the TFT display for Active and Normal conditions. Two sets alarm relays will be provided.

Alarm range: 1CPS/CPM/Bq to full scale reading

Alarm setting: The alarm level setting will be carried out through Ethernet port with PC with password protection.

Alarm Indication :

a) Red flashing large area windowdisplay on TFT display.
b) Loud audio tone (single / dual frequency tones).
c) Tri-color Tower LED for indication of alarms condition& fault.

Alarm annunciation scheme:
As tabulated below

Parameter Status	TFT display Visual indication / Tower LED	Audio
Normal	Steady Green	OFF
Preset Alarm	Flashing Red	ON
On ACK	Steady Red	OFF
Back to normal	Steady Red	OFF
Reset on Preset Alarm	Steady Red	OFF
Reset on normal	Steady Green	OFF

Instrument Controls:

a) Acknowledgment switch / button for muting audio.

b) Reset switch / button for resetting the Alarm indication and alarm relay.

c) Power ON/OFF switch with PowerONindication

Instrument Fault Indications

a) **EHT failure:** Visual alarm with flashing yellow "EHT" message on TFT display

b) **Detector Failure :** Visual alarm with flashing yellow "d-FI" message on TFT display

a) 4 - 20 mA linear proportional to full scale display output. Current output will be able to drive load of 600 ohms. Output circuitry will be able to drive 200 mtrs. of twisted pair of wires.

b) Two sets of potential free contacts of Alarm relay (Change over). Contact rating 3 Amp at 250 VAC. The relay will be energized on normal condition and de-energised under alarm condition.

c) Remote alarm acknowledgement and reset signals for the field instruments.

d) Indication of instrument fault condition (detector, EHT & LV supplies failure), over range &

e) Overload conditions byup-scale of 4-20 mA. (22.5 mA).

f) All these signals will be terminated on 17 pin sockets (Allied Connectors). The corresponding mating plug with5 mtr cable will be supplied with the monitor.

RJ 45 connector for Ethernet port .

Computer Interface:
The monitor shall have a Ethernet 10/ 100 Mbps port for interfacing with a remote Windows. The features supported by Ethernet port are given below.

- The PC and the monitor shall operate in a client-server configuration and the software protocol will be MODBUS/TCP.
- The PC as the host shall give commands and send queries. The monitor will carry out various functions in response to the queries.
- The firmware of the monitor shall be able to send / receive the instrument data to/from the Host PC on demand.

Self-Diagnostics: The monitor has built-in self diagnostics. On being powered it will perform tests to ensure that all components and sub systems are functioning properly. It will check for the Power supply, High Voltage Supply, Detector, Counting and measuring circuits, Alarm Systems and Display Systems.

- The firmware is designed for high reliability and availability.
- Test points are 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 will be provided with an indicator LED. Spike suppressor and line filter are provided.

Environment:
The instrument is designed to be able to withstand temperature up to 50^0 C and relative humidity upto 90% in radiation areas.

Environmental compliance:
As per IS 9000 Part III & IV

EMI / EMC compliance:
As per IEC 61000 / ANSI N42.17