

## CONTINUOUS AIR MONITOR (ALPHA & BETA) TYPE : AM 732A

### Technical Data



- FEATURES :**
- State-of-art electronics design using controllers with embedded code, I<sup>2</sup>C, micro-wire bus based devices makes the equipment compact and highly reliable.
  - Loose Mylar ZnS (Ag) scintillator deposited on support, coupled to 2" PMT is used as Alpha detector.
  - 16x2 LCD display is used for display of count-rate status and other information.
  - Detachable hand-held keypad for configuration of the instrument.
  - built-in for remote monitoring & diagnostics.
  - 4-20mA current loop o/p for full-scale range of each channel.
  - Count-rate display additionally provided on SIX-digit SEVEN-segment display.
  - Built-in pump failure detection and alarm
  - Ethernet port with MODBUS-TCP compliance.

### SPECIFICATIONS

The Continuous air monitor (Alpha) shall be capable of monitoring airborne releases of alpha-emitting radio nuclides. The instrument shall comprise an air sampler cum detector assembly and an electronic unit. The detector shall be of ZnS (Ag) type. The electronic unit shall comprise low voltage supplies, High voltage supply, Pre-amplifier & Amplifier, Count rate meter and Alarm generation module.

**AIR-SAMPLER CUM DETECTOR ASSEMBLY :** The air sampler cum detector assembly shall consist of a filter holder 60mm dia, a suction chamber with two nozzles (air inlet and outlet) of size 3/4 serrated and detector housing. Typical drawing will be provided to the successful bidder.

Air sampler shall be fabricated with stainless steel SS 304L. Minimum 4 numbers of threads shall be provided for free and smooth fixing and removal of each part of the sampler assembly. Air sampler shall be designed and fabricated to achieve the

particle collection efficiency more than 99% for air particles down to 0.3 micron size on glass filter paper. It shall be designed considering the iso-kinetic properties particles for uniform dust collection over entire filter paper area.

The Detector assembly for Alpha monitoring shall have the following specifications:-

- Detector and size : ZnS(Ag) phosphor, 50mm dia coupled to a matched photo-multiplier with pre-amplifier.
- Window Thickness : 1.5 mg/cm<sup>2</sup> light-sensitive pin-hole free aluminized mylar with protection against puncture.
- Detector Efficiency : Not less than 25% for plutonium alpha particles over the entire window area.

**SUCTION / VACUUM SYSTEM :** This Suction / Vacuum system shall provide the required suction for drawing air through the filter paper in the air sampler assembly. The system shall comprise a Dry type, noise-free, continuous duty, pump-motor set.

**Vacuum pump-motor set:**

- Free air displacement : 150 liters/min
- Ultimate vacuum : 200 mm Abs(22" Hg)
- Pressure : 1.4 Kgs/cm<sup>2</sup> (20 lbs.)
- Duty : Continuous.
- Electric Motor : 3/4 HP, 1440 RPM with gear box, 230V AC, capacitor start, single phase TEFC B-56 frame, Class —B" insulation, continuous rating Crompton or equivalent.
- 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 : 1/4 serrated nozzles.
- Vibration : suitable anti-vibration pad.
- Cooling : Air cooled.

- Silencer : The pump shall be provided with a silencer to give a noise free operation.
- Pump failure alarm : Pump failure alarm indication shall be provided on the instrument and the same shall be wired on the remote console.
- Make : The pump shall be of M/s Tawde make.

**Flow measurement and regulation:**

- The instrument shall have Air rotameter 50-200 lpm. with ¼ serrated SS nozzles for connection to 12 mm ID PVC tubing.
- Rotameter shall be mounted in a tamper-proof manner in the air sampling line.
- An additional rotameter shall be provided with necessary tubing so that the pump can be operated at the rated flow rates without overheating or excessive throttling.
- Needle valve shall be provided to isolate and for setting / adjusting the flow rate.
- Provision shall be given to discharge the hot air from the vacuum pump

**Electronic unit:** The electronic Unit shall comprise of a Low voltage power supply, EHT supply unit, countrate meter based on Microprocessor/microcontroller, and an audio visual alarm system.

**Low voltage power supply:** The low voltage power supply unit shall supply the DC power supplies required for the operation of the electronic module. It shall have a very good line voltage and load regulation. It shall be fitted with Mains line filters to avoid line interferences.

**EHT supply:** It shall provide an EHT voltage for the working of the Photomultiplier tube. Its output shall be continuously variable from +300V to +1500V. Output shall be adjustable by screwdriver and EHT can be shown on the display using the detachable keypad

**Pre-amplifier and amplifier:** The Pre-amplifier & amplifier module shall be compatible with the ZnS Scintillation detector. It shall provide the amplification and shaping for the pulse signals from the detectors. The output of the amplifier will be given to the Count rate meter for further data processing and display.

**Count-rate meter:**

- 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 : Auto Ranging direct reading, 6 digit 7 segment LED display & 16x2 LCD display. 6x7 LED display is interfaced using multiplexed display driver and is used for display of count-rate and hardware status indication & 16x2 LCD for visualization of preset alarm and other parameters
- Display updating : First reading on Power ON within 12 secs.  
Normal (Slow) : 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 fullscale 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 "OFI"

**Recorder output :** 4 to 20 mA, with 600 ohm load.

**Recorder output stability**

- a) Non-linearity : Max = 0.025% of Span
- b) Offset current (I<sub>o</sub>=4mA) : Max = 0.0005% of Span / °C
- c) Span Error (I<sub>o</sub>=20mA) : Max = 0.005% of Span / °C

- Accuracy : +/- 5% Full scale.
- Calibration Accuracy : +/- 5% through out the range.
- Testing Facilities : Provision to inject a suitable pulse generator signal for routine testing of Count rate meter shall be provided on the rear panel. Additionally a test pulse mode through software for checking count-rate meter shall be provided
- Instrument "ON" Indication : Large Area Green LED Lamp. This will indicate the Normal condition also.

**Audio visual alarm system:**

- Alarm range : 1 to full scale reading
- Alarm setting : The alarm level setting shall be carried out through Ethernet port with handheld configurator / PC with password protection.
- Alarm Indication :
  - a) Red (LED) flashing large area window display
  - b) Loud audio tone (dual frequency tones)
- Alarm annunciation scheme: As tabulated below;

Parameter Status	Visual indication (Red LED)	Audio
Normal	OFF	OFF
Abnormal (Active)	Flashing	ON
On ACK After being abnormal	Steady Red	OFF
Reset after returning to Normal	OFF	OFF

- **Instrument Fault indication:**
  - a) EHT failure: Visual alarm with flashing red LED indication & "Eht" message on display
  - b) Detector failure: Visual alarm with flashing red LED & "d-FL" message on display.
  - c) Microprocessor / microcontroller failure: Visual alarm with flashing green lamp.
  - d) Fault indications shall be cleared automatically if normal status is resumed.

**Housing :**

All the modules of the Electronic unit shall be housed in rack mounted type cabinet. The modules shall be plug in type and all the controls and display on the front panel. The enclosure shall comply with IP-21.

**Remote /External Console:**

- 4 - 20 mA linear proportional to full scale display output. Current output shall be able to drive load of 600 ohms. Output circuitry shall be able to drive 200 mtrs.of twisted pair of wires.
- Two sets of potential free contacts of Alarm relay (Change over). Contact rating 3 Amp at 250 VAC. The relay shall be energized on normal condition and de-energised under alarm condition.
- Remote alarm acknowledgement and reset signals for the field instruments.
- Indication of instrument fault condition (detector, EHT and LV supplies failure), over range & overload conditions by up-scale 4-20 mA. (22.5 mA)
- Pump failure alarm contact.
- All these signals shall be terminated on a 17 pin socket (Allied Connectors). The corresponding mating plug with 5 mtr cable shall be supplied with the monitor. Wiring scheme shall be got approved from the user.
- RJ 45 connector for Ethernet port

**Computer interface :**

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 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 the instrument data like instrument ID, instrument type, input range, display range, alarm settings, alarm status, current reading, diagnostic status of EHT/GM tube 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, input range, display range, alarm settings, Ack, Reset, instrument address etc.

**Data storage of radiation history :**

4MB of flash memory for storage of dose rate history with time stamp for the port 24 hrs is provided. This could be dumped to the PC on command.

**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 and Display Systems. All the alarms generated during diagnostics shall be Auto Reset type.

The firmware shall 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. Shall be provided with spike suppressor and line filter. Power ON/OFF indication shall be provided with an indicator LED.

**Environment :**

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

The instrument enclosure and detector assembly shall comply with IP-21. Electronic units shall withstand cumulative radiation dose of 10000 Rad. (30 years of operation).

**Instrument trolley:**

- All the hardware like Vacuum pump, Air sampler - detector assembly, rotameters, Electronic unit etc may be fitted in an Instrument trolley made of M.S.
- The trolley shall be provided with castor wheels with locks / breaks.
- The trolley shall be powder coated with Siemens Grey colour.
- Front and Rear sides shall have doors with magnetic lock.
- The doors shall be provided with holes to facilitate air suction from surroundings.
- The vacuum pump shall be fitted at the bottom with guards & shock absorbers.
- Pump discharge (hot air) shall go out of cabinet.
- Two Mains supply boards with required sockets, indicators and switches / MCBs shall be provided inside the trolley.
- One power board shall be used for Vacuum pump and the other shall be used for electronic unit.
- Internal PVC tubing shall be done between Suction head, rotameter, pump etc.