

AIR or STACK MONITOR
NOBLE GAS, GROSS BETA-GAMMA PARTICULATE, & IODINE
Optional Alpha, Tritium, Carbon-14
PART OF THE TOTAL-6 SERIES AIR & STACK MONITORS
Model CAM-33 Series: CAM-33-2, CAM-33-3, CAM-33-4, CAM-33-6, CAM-3XG

FEATURES:

- TWO TO SEVEN CHANNEL SIMULTANEOUS MEASUREMENT OF:
- GAMMA PARTICULATE DYNAMIC COMPENSATION
- BETA-GAMMA PARTICULATE
- IODINE - MOLECULAR & ORGANIC
- NOBLE GAS – DYNAMIC COMPENSATION
- TOTAL NOBLE GAS, NOBLE GAS CURIE MeV (**CAM-3XG**)
- **OPTIONAL:**
 - ALPHA PARTICULATE
 - TRITIUM
 - CARBON-14 ~ ORGANIC & INORGANIC
- DETECTORS MORE SENSITIVE BY FACTORS OF 5-500 THAN REQUIRED BY NRC
- QUICK CHANGE FILTERS
- 17" COLOR MONITOR
- 4-20mA OUTPUT SIGNAL
- HIGH-CAPACITY OIL-LESS AIR PUMP
- REAL-TIME FLOW MEASUREMENT
- DATA ANALYSIS / ARCHIVE / RETRIEVAL
- RUGGED, CASTER OR SKID MOUNTED, SELF-CONTAINED CABINET; **OPTIONAL** - NRTL CERTIFIED CABINET



CAM-33

DESCRIPTION:

The **CAM-33 Series** are two to six channel air monitors for simultaneous, continuous measurement of Gamma Particulates, Gross Beta / Gamma Particulates, Noble gaseous radioactivity, and Iodine.

Batch sampling or dual sampling for continuous sampling during the course of an accident are options available with the CAM SERIES

- The **CAM-33-4** includes Alpha Particulates.
- The **CAM-33-6** has six channels for also measuring Alpha Particulates, Tritium, & Carbon-14.
- The **CAM-3XG** has three channels and measures Noble Gas energies: low, medium, and high with readout in Curie MeV or $\mu\text{Ci/cc}$.
- These are continuous duty, high capacity, rugged skid or caster mounted systems. Electronics consists of Computer with **17" COLOR LCD Monitor**.
- Shields are void free lead encased in welded steel and with stainless steel liners for long, useful life and easy decontamination.
- Filters are easily changed via quick disconnect, o-ring sealed filter holder. Shield can be opened for filter change or cleaning with minimum effort. All shield connections and openings are sealed against air leaks.



TECHNICAL ASSOCIATES

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The entire system is mounted in a self-contained rugged cabinet and comes complete with all cabling, connectors, and software in place, setup, and ready to operate.

SPECIFICATIONS for CAM-33 SERIES:

	CAM-33-2	CAM-33-3	CAM-33-4	CAM-33-6	CAM-3XG
Channels	Two	Three	Four	Six	Three
Activity Detected	<ol style="list-style-type: none"> Gamma Particulate Noble Gas 	<ol style="list-style-type: none"> Beta-Gamma Particulate Iodine Noble Gas 	<ol style="list-style-type: none"> Beta-Gamma Particulate Iodine Noble Gas Alpha Particulate 	<ol style="list-style-type: none"> Beta-Gamma Particulate Iodine Noble Gas Alpha Particulate Tritium Carbon-14 	<p>Noble Gases</p> <ol style="list-style-type: none"> Low Medium High Energies

STANDARD DETECTORS WITH QUICK CHANGE FILTERS:

Activity Detected	Gamma Particulate	Gross Beta-Gamma Particulate	Iodine	Noble Gas
Filters:	2" dia	2" dia.	2.5" dia x 1" thick	One Liter Chamber
Filter Type:	Glass Fiber Filter	Glass Fiber Filter	TEDA Activated Charcoal Cartridge	Stainless Steel Lined
Energy Range:	50 KeV – 5 MeV		60 KeV to 3 MeV (7 MeV optional)	0.03 MeV to 3 MeV (7 MeV optional)

OPTIONAL DETECTORS

Activity Detected	Gamma Particulate	Alpha Particulate	Organic Carbon-14	Tritium
Detector Type:	HPGe	2" diameter	2.5" diameter	Dual Ion Chamber
Filter Type:	Glass Fiber Filter	Glass Fiber Filter	TEDA Activated Charcoal Disk	Stainless Steel Lined
Resolution:	Less than 0.5% FWHM @ 662 KeV			



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DETECTORS for CAM-33 Series:

- **Particulate Beta-Gamma:** 2" diameter GM or optional Proportional Detector. **(1 each)**
OPTIONAL: HPGe electrically cooled
- **Iodine:** 2" dia x 2" long NaI(Tl) Model PGS-3LI (Spectroscopic Grade) **(1 each)**
- **Gas Standard:** 2 inch diameter GM **(2 each)**
- **Noble Gas Curie MeV:** 2" dia x 2" long NaI(Tl) Model PGS-3LI (Spectroscopic Grade)
- **Background Shielding:** 3" lead; 4 pi
- **Crosstalk Shielding:** 1 inch lead placed between adjacent detectors.
- **Detector Sensitivity:** **Monitor is more sensitive on all channels by factors of 5 to 500 than is required by USNRC and other regulatory agencies.**
- **Calibration:** Follow on screen instructions for user settable automatic calibration.
- **Decontamination:** Shields are straight-through bore with Stainless Steel liner for easy decontamination. Other wetted parts are Stainless Steel for quick and easy replacement.
- **Temperature Range:** 23° F to 131° F (-5° C to 55° C)

DETECTOR TYPE	1 MINUTE	1 HOUR	10 HOURS	1 DAY	1 WEEK
PARTICULATE BETA-GAMMA	6 x 10 ⁻¹⁰ µCi/ml	1 x 10 ⁻¹¹ µCi/ml 3.7 x 10 ⁻⁷ Bq/ml	1 x 10 ⁻¹² µCi/ml 3.7 x 10 ⁻⁸ Bq/ml	6 x 10 ⁻¹³ µCi/ml 2.4 x 10 ⁻⁸ Bq/ml	1 x 10 ⁻¹³ µCi/ml 4 x 10 ⁻⁹ Bq/ml
IODINE	3 x 10 ⁻⁹ µCi/ml	1 x 10 ⁻¹¹ µCi/ml 3.7 x 10 ⁻⁷ Bq/ml	1 x 10 ⁻¹² µCi/ml 3.7 x 10 ⁻⁸ Bq/ml	6 x 10 ⁻¹³ µCi/ml 2.4 x 10 ⁻⁸ Bq/ml	1 x 10 ⁻¹³ µCi/ml 4 x 10 ⁻⁹ Bq/ml
GAS-STANDARD RANGE	6 x 10 ⁻⁷ µCi/ml	1 x 10 ⁻⁷ µCi/ml 3.7 x 10 ⁻³ Bq/ml	2.7 x 10 ⁻⁸ µCi/ml 1 x 10 ⁻³ Bq/ml	1 x 10 ⁻⁸ µCi/ml 3.7 x 10 ⁻⁴ Bq/ml	2.7 x 10 ⁻⁹ µCi/ml 1 x 10 ⁻⁴ Bq/ml
GAS STANDARD RANGE ~ CAM-3XG					
10 Ci-MeV per WEEK			100 KCi-MeV per WEEK		
1 mCi-MeV per MINUTE			10 Ci-MeV per MINUTE		

OPTIONAL DETECTORS:

- **Gamma Particulate** HPGe electrically cooled **(1 each)**
- **Alpha Particulate** 2" diameter Mica window GM **(1 each)**
- **Organic Carbon-14** 2" diameter Kapton window GM **(1 each)**
- **Inorganic Carbon-14** CO₂ Dual Ion Chamber **(1 each)**
- **Tritium** Dual Ion Chamber **(1 each)**



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Measurement Ranges of Optional Detectors	Bottom of Range	Top of Range 4 Decade Model	Top of Range 6 Decade Model
Tritium	10 ⁻⁷ µCi/cc	10 ⁻³ µCi/cc	10 ⁻¹ µCi/cc
Inorganic Carbon-14	10 ⁻⁸ µCi/cc	10 ⁻⁴ µCi/cc	10 ⁻² µCi/cc
Organic Carbon-14	10 ⁻⁹ µCi/cc	10 ⁻⁵ µCi/cc	10 ⁻³ µCi/cc
Alpha Particulate	5 x 10 ⁻⁸ µCi/cc	10 ⁻⁴ µCi/cc	N/A

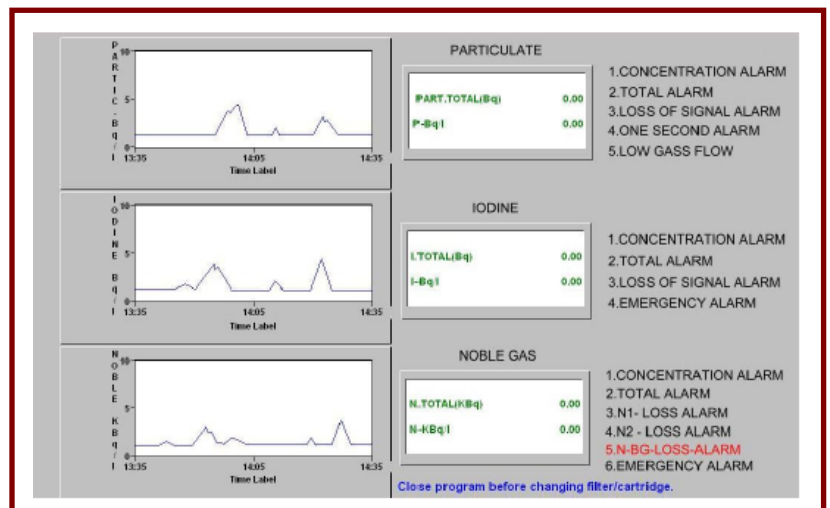
Each Detector is Protected Against Corrosion & Moisture by Design, Construction, & Ultra Thin Window.

Display Mode:

- Model CAM-33 Series features a Computer with a Color LCD Monitor.
- Alpha or Numeric or Graphic
- Direct read out in concentration Bq/l or other units.
- Daily total activity reads through the CAM-33 in KBq or Curies, etc.

Display Screens:

- **Main Display**
- **Data Review Screen**
- **System Test Screen:**
 - Change Filter
- **User Settable Energy Set -Up Screen:**
 - Configure Energies
 - Engineering Units
- **Alarm Alert Screen**
 - Audio / Visual
 - Low Air Flow
 - Loss of Signal
- **Additional Information Screens**



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Airborne Activity	Model	TOTAL-6-TCI- H ³	TOTAL-6-TCO- H ³	TOTAL-6-TC- H ³	CAM-33-3-1P	CAM-33-3	CAM-33-4	CAM-33-6	CAM-3XG
	Chemical Form								
Tritium H3	T ₂ , HTO T ₂ O	YES	YES	YES	OP	NO	OP	YES	OP
Carbon C-14: Inorganic Organic	CO ₂ Various	YES	YES	YES OP	OP			OP YES	OP OP
Particulate	Alpha				YES	OP	OP	OP	OP
Particulate	Beta				YES	YES	YES	YES	OP
Iodine				OP	YES	YES	YES	YES	OP
NOBLE GAS – GROSS - ALL				YES	YES	YES	YES	YES	YES
NOBLE GAS – Curie MeV									YES
ARGON				OP				OP	YES
XENON				OP				OP	YES
KRYPTON				OP				OP	YES
RADON		RX	RX	RX				OP - RX	

Number of Channels:

YES = Measures Each Separately

RX = Rejects

OP = Optional

NOTE: TOTAL-6-TCO- H³ = Tritium plus Organic Carbon-14
 TOTAL-6-TCI- H³ = Tritium plus Inorganic Carbon-14

Models TOTAL-6-TCO-H³ & TOTAL-6-TCI- H³ work best if no other nuclides are present



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ELECTRONICS:

High Voltage Supply:	Separately variable from 0 to 2,000 VDC at 200 μ a on scintillation or proportional channels.
LCD Color Monitor:	17" Monitor; real time concentration & accumulated dose for all Channels
Accuracy:	+/- 10% except for resolution loss and statistical variation
Alarms:	Alarms are user settable to any trigger level User may set additional alarms with relay outputs.
Low Level Alarm:	Automatic Reset
High Level Alarm:	High level alarm remains activated until RESET button is pushed
High Flow Alarm:	Optional
Alarm Indicator Lights:	Red-high level; Amber-low level count for each channel, plus more indicators shown on LCD Monitor.
Audio:	1,000 Hz, greater than 80 db
Outputs:	Alarm Condition Outputs: 1. Logic Level Signal 2. Contact Closure or Opening
Standard Installation:	Cabinet: Shielded heavy gauge steel. Skid or caster mounted 4 five-inch ball bearing casters. Two of these are full 360 degree swiveling.
Special Safety:	Loss of system vacuum air flow alarm and relay switch closure. Loss of signal alarm. All system circuits fused.
Power:	120 VAC – 220 VAC; optional 50/60 Hz
Features:	Thermal protection on motor. Positive Displacement Pump.

ELECTRONIC SYSTEM DESCRIPTION:

Electronics are plug-in modules allowing change or addition of function as needed and allowing rapid repair by substitution of modules in the field. The modular system is covered by **T/A's** unique exchange warranty, in addition to the full one-year warranty covering all T/A products.

1. CPU with data acquisition
2. Multi-Channel Analyzer with Isotope Identification (**MCA-ID**) with standard radioactive Iodine and active chemicals. (Library of isotopes may be tailored)
3. MCA-ID standard on Gamma scintillation detectors and optional with solid state detectors.
4. Engineering units: Sv, mCi/R, Bq, cps, etc. user specified
5. High Resolution, 17" LCD Color Monitor Display & Audio
6. Mouse & Keyboard
7. 3 Channel 4-20mA output optional
8. High-capacity hard drive - Stores programs, room for additional new software functions in the future
9. Non-volatile 1 year data storage. Data stored every 2 minutes all year.
10. Specialized Air Monitor software custom tuned and designed for the CAM-33 Series Air Monitors.



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11. Outputs:

- ❖ Ethernet LAN Connection
- ❖ USB Ports

User manuals shipped with instrument.

AIR MOVING SYSTEM:

The air moving system is based on a high-capacity oil less air pump capable of delivering 120 lpm (4cfm) free air and including Real time flow rate measurement and data analysis.

Air Pump:	Extremely rugged continuous duty
Pumping System:	Oil-less Pump noise is reduced by heavy duty internal muffler
Pump Motor:	3/4 Horsepower, 50/60 Hz capacitor start, induction run
Flow Control:	Flow Regulator Controls the flow from 0-4 cfm, +/- 0.2 cfm
Flow Rate:	Factory setting is at 4 cfm. Mass flowmeter with pressure transducer which feeds Real-Time data to CAM-33 software.
User Settable Flowrate:	On screen Flow Rate Display 0 to 4 or 0-120 lpm
Inlet and Outlet:	20 foot 3/4" hose inlet: 6 meter 2.5 cm I.D 20 foot 1" hose outlet. May be extended

WEIGHT, DIMENSION, SHIPPING:

Dimensions:	29" wide x 31" deep x 41" high - exclusive of casters.
Weight:	1800 lbs. (Lighter weight model available with 1" shielding. See CAM-33-3-1P) 1100 lbs CAM-33-2 (2 Channels)
Shipping Weight:	1900 lbs.

SYSTEM OPTIONS:

- Caster or Skid Mount
- Grab Sample Port
- Three push-button Detect & Test sources (License exempt quantities) of the three channels.
- Flow rate can be increased to 30 cfm with larger pump and minor changes in the plumbing
- Shrouded probe or other air collection Nozzles are available
- Touch screen feature on the LCD color monitor
- Titanium detector cover
- Positive position motor driven check sources with LED position indicator with greater "throw length" to preserve low background when source is retracted and to give trouble free operation.
- 4-20mA output signals - 3 channels included. Additional channels optional.
- 1" Lead (Pb)shields produce a lighter-weight more compact system. (**CAM-33-3-1P**)
- UPS Battery Back Up - 60 minutes minimum



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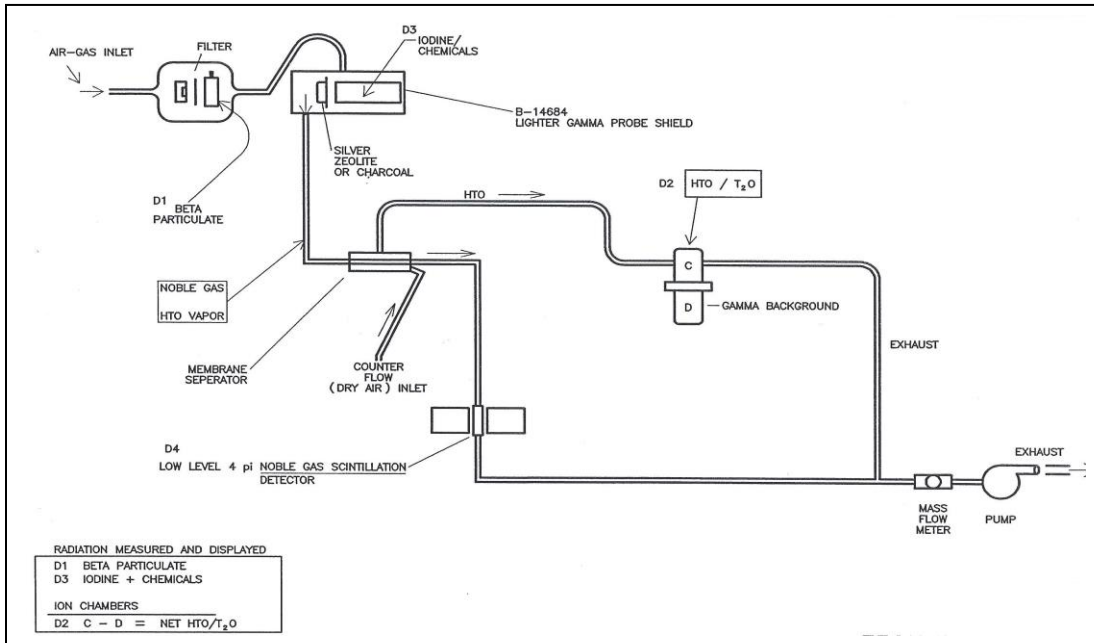
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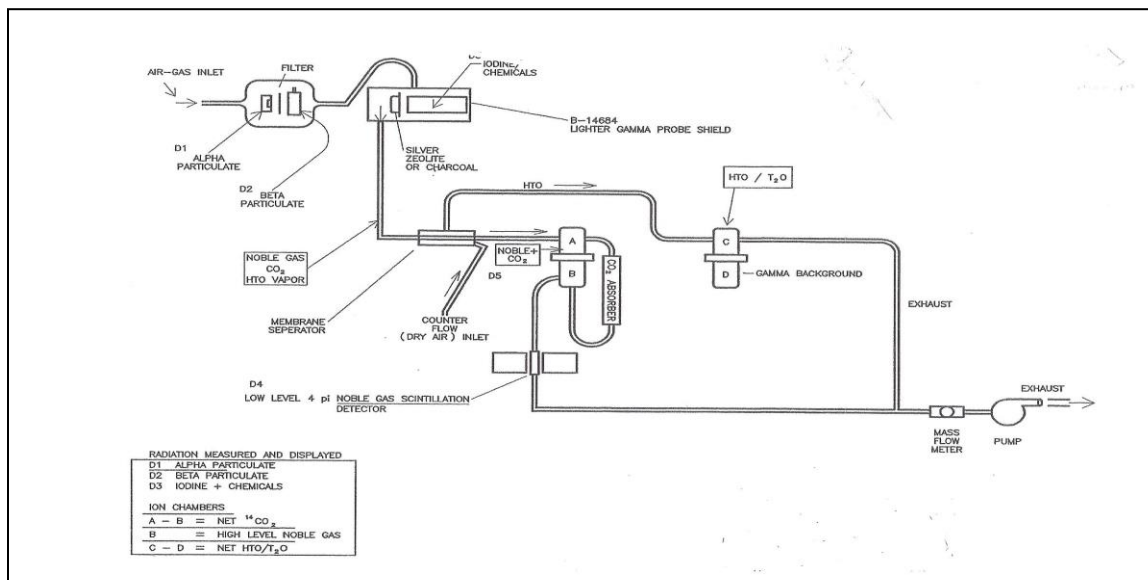
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- Power Stabilizer
- Nationally Recognized Testing laboratory (NRTL) certified cabinet



CAM-33-4



CAM-33-6



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