

# PET FACILITY RADIATION MONITORING SYSTEM

MODEL ~ PET-CAM-511

## FEATURES:

- COMPLETE PET FACILITY AIR MONITORING SYSTEM
- REAL-TIME CONTINUOUS
- 9 DETECTION CHANNELS
- 2 AREA MONITORS
- EASY INTEGRATION INTO FACILITY INFRASTRUCTURE
- HIGH CAPACITY OIL-LESS AIR PUMP
- DETECTION OF:
  - POSITRON
  - PARTICULATE BETA/GAMMA
  - IODINE
  - NOBLE GASES
- 3 IN-PROCESS DETECTOR MONITORS: DUCTS OR CHARCOAL TRAPS
- FINAL RELEASE STACK MONITOR HAS 3 DETECTORS
- PHYSICALLY SEPARATES AND MONITORS CONTAMINANTS INTO:
  - PARTICULATES
  - AIRBORNE CHEMICALS
  - AIRBORNE AERSOLS
  - NOBLE & INERT GASES
- RUGGED SKID OR CASTER MOUNTED



## DESCRIPTION:

The PET-CAM-511 is a continuous duty, high capacity, rugged skid or caster mounted systems.

### Electronics:

- 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.
- Computer with 17" COLOR LCD Monitor.

### Shields:

- Void free lead encased in welded steel with stainless steel liners for long, useful life and easy decontamination.
- Open for filter change or cleaning with minimum effort.
- All connections and openings sealed against air leaks.

**Filters** are easily changed via quick disconnect, o-ring sealed filter holder

**Air Moving System** is based on a high capacity oil less air pump capable of delivering 120 lpm (4cfm) free air including Real Time flow rate measurement and data analysis.

**Monitor Sensitivity: More sensitive on all channels by factors of 5 to 500 than is required by USNRC and other Regulatory Agencies.**



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7051 Eton Ave., Canoga Park, CA 91303

818-883-7043 (Phone) ~ 818-883-6103 (Fax) ~ 818-836-0381 (Cell)

[sales@usnuclearcorp.com](mailto:sales@usnuclearcorp.com)

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## CHANNEL & SENSOR SPECIFICATIONS

LOCATION	SENSOR	FILTER TRAP	SETTING	DETECTION
<b>IN PROCESS CHANNELS</b>				
Cyclotron Vault	2" NaI	Duct (Strap On Style)	511 KeV	
Hot Cells (2 ea)	2" NaI	Filter Bank	511 KeV	
<b>FINAL RELEASE CHANNELS</b>				
Particulates	2" dia GM	Particulate Filter	Beta/Gamma	Beta/Gamma
Chemicals	2" NaI	Charcoal	511 KeV	
Gases	2" dia GM	Gas Chamber	Beta/Gamma	<sup>13</sup> N, <sup>11</sup> CO <sub>2</sub>
Bypass Flow	Mass Flow	Venturi	Liters/Minute	LPM
<b>AREA MONITOR CHANNELS</b>				
Cyclotron Vault	GM	n/a	Gamma	mR/hr (or uSv/h)
Chemistry Lab or Hot Cell	GM	n/a	Gamma	mR/hr (or uSv/h)
<b>OPTIONAL</b>				
Wide Gamma	3" NaI	Strap On Style	Wide Gamma	All Gamma
Wide Gamma MCA	3" NaI+	Duct or Filter	MCA	Isotope Identifier per Library

## THE SYSTEM CONSISTS OF 3 SUB-SYSTEMS.

1. Main console including final release sensors.  
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.  
The standard unit is operated from 115 V single phase, 60 Hz; 220V optional, 50 or 60 Hz.
2. Interactive control station computer with full read-outs and alarms can be placed in control room or RAD supervisors' office, etc.
3. In-Process & Area Monitor Detectors- report to the main control (1) and to control station (2).



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### SPECIFICATIONS FOR PET-CAM-511

**CHANNELS:** Nine (9)  
**ACTIVITY DETECTED:** Positron Annihilation, Beta-Gamma Particulate, Airborne Chemicals, Noble Gas.

ACTIVITY DETECTED	POSITRON	BETA-GAMMA PARTICULATE	AIRBORNE CHEMICALS	NOBLE OR INERT GASES
<b>SAMPLE COLLECTOR</b>	Existing Ducts	2" dia Filter	2.5" dia x 1" thick	One Liter Chamber
<b>FILTER TYPE</b>	Existing Ducts	Glass Fiber Filter	TEDA Activated Charcoal Cartridge	Stainless Steel Lined
<b>SAMPLE COLLECTION EFFICIENCY</b>	Per Best Geometry	Up to 99% Efficiency at 0.3 micron particle size	60 KeV to 3 MeV (25 KeV to 7 MeV optional)	60 KeV to 3 MeV (7 MeV optional)

**Detector:** 5 each  
 1 each  
 1 each  
 2 each

**Positron:** 511 KeV: 2 inch diameter NaI(Tl) (Spectroscopic Grade)  
**Particulate Beta-Gamma:** 2 inch diameter GM or optional Proportional Detector  
**Iodine:** 2 inch diameter NaI(Tl) Model PGS-3LI (Spectroscopic Grade)  
**Noble Gas Standard Range:** 2 inch diameter GM or Optional Proportional Detectors

**Shielding:** 3 inch Lead; 4pi. Plus 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:** On screen instructions for user-assisted automatic calibration.

**Decontamination:** Shields are straight-through bore with Stainless Steel liner for easy decontamination. Other wetted parts are stainless steel or quick and easy replacement

**Corrosion:** Each detector is protected against moisture by design, construction and 0.0005" window.

Type of Detector	1 Minute	1 Hour	10 Hours	1 Day	1 Week
<b>Particulate Beta-Gamma Cs-137, Co-58, etc</b>	$6 \times 10^{-10}$ uCi/ml/min	$1 \times 10^{-11}$ uCi/ml $3.7 \times 10^{-7}$ Bq/ml	$1 \times 10^{-12}$ uCi/m $3.7 \times 10^{-8}$ Bq/ml	$6 \times 10^{-13}$ uCi/ml $2.4 \times 10^{-8}$ Bq/ml	$1 \times 10^{-13}$ Bq/ml $4 \times 10^{-9}$ Bq/ml
<b>Airborne Chemicals 511KeV, etc.</b>	$3 \times 10^{-9}$ uCi/ml/min	$1 \times 10^{-11}$ uCi/ml $3.7 \times 10^{-1}$ Bq/ml	$1 \times 10^{-12}$ uCi/m $3.7 \times 10^{-8}$ Bq/ml	$6 \times 10^{-13}$ uCi/ml $2.4 \times 10^{-2}$ uCi/ml	$1 \times 10^{-13}$ Bq/ml $4 \times 10^{-9}$ Bq/ml
<b>Gas-Standard Range Xe-133, etc</b>	$6 \times 10^{-7}$ uCi/ml	$1 \times 10^{-7}$ uCi/ml $3.7 \times 10^{-3}$ Bq/ml	$2.7 \times 10^{-8}$ uCi/ml $1 \times 10^{-3}$ Bq/ml	$1 \times 10^{-8}$ Bq/ml $3.7 \times 10^{-4}$ Bq/ml	$2.7 \times 10^{-9}$ Bq/ml $1 \times 10^{-4}$ Bq/ml



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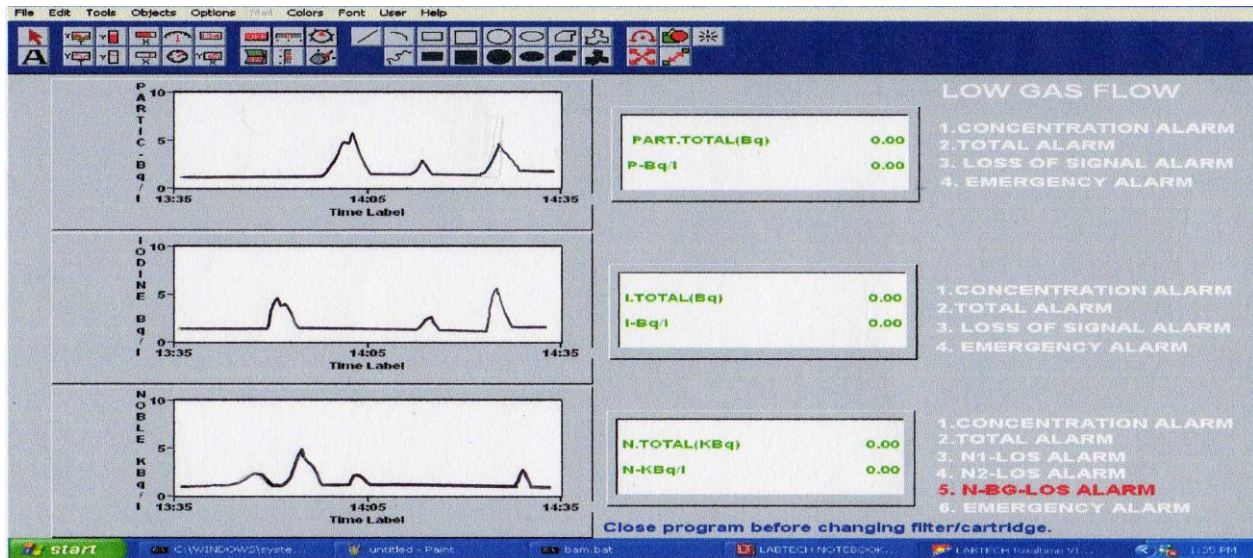
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**Display Mode:** Model PET-CAM-511 features a Intel Processor Computer with a Color LCD Monitor. Reads out directly in concentration Bq/m<sup>3</sup> or other units.

**Operation:** When PET-CAM-511 continuous air monitor is in normal operation, the Color LCD Monitor displays:



**High Voltage Supply:** Separately variable from 0 to 2000

VDC at 200 uA on scintillation or proportional channels.

**LCD Color Monitor:** 17 inch Monitor shows Real Time Concentration & Accumulated Dose for all Channels

**ACCURACY:** ± 10% except for resolution loss and statistical variation.

**ALARMS:** Alarms are pre-settable to any trigger level.

**Low level Alarm:** Automatic Reset

**High Level Alarm:** High level alarm remains activated until RESET button is pushed.

**Alarm Indicator Lights:** Each of the 8 channels has on-screen, RED High alarm indicator & also activates audio alarm and relay.

Each of the 8 channels also has on-screen low count/self-test indicator which can also activate a maintenance required relay.

**Audio:** 1000 Hz, greater than 80db.

**AIR MOVING SYSTEM:** For Effluent Channels

**Air Pump:** Extremely rugged continuous duty.

**Pumping System:** Pump noise is reduced by heavy duty internal muffler.

**Oil less Pump Motor** 1/3 Horsepower, 50/60hz, capacitor start, induction run.

**Real-time Flow rate:** On screen Flow Rate Display 0 to 4 or 0-120 lpm.

**Inlet and Outlet:** 20 foot 1" hose inlet: 6 meter 2.5 cm I.D.  
20 foot 1" hose outlet. May be extended.



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**Flow Rate:** Factory setting is at 4 cfm.  
Mass flow meter feeds Real Time data to PET-CAM-511 software.

**Outputs:** Alarm Condition Outputs:  
1. Logic Level Signal, 2.Contact Closure or opening, 3.Ethernet LAN Connection

**INSTALLATION:** Cabinet of heavy gauge steel.  
Skid or caster mounted With 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 are Fused.

**OPTIONS:** Three Channel push-button check sources (License Exempt Quantities) to **Detect & Test** any of the lead shielded channels.  
Flow rate can be increased to 30 cfm with minor changes in the plumbing.

**Features:** Thermal Protection on Motor. Positive displacement Pump

### WEIGHT & DIMENSIONS:

**Dimensions:** 29" wide by 31" long by 41" high exclusive of casters.

**Weight:** 1,600 lbs. (Lighter weight models are available with 1" Shielding.)

**Shipping Weight:** 1,750 lbs.

### ELECTRONIC SYSTEM:

1. CPU with data acquisition
2. High Resolution, 17" LCD Color Monitor Display
3. Mouse
4. OPTIONAL: Graphic Printer for hard copy –graphical printout shows trend data.
5. 4-20mA interface is provided for up to 3 channels.
6. Keyboard
7. Audio
8. Manuals
9. Minimum 200 gigabyte hard drive – Stores programs, plus room to add additional new software functions in the future.
10. Specialized Air Monitor software custom tuned and designed for the CAM-33 Air Monitor.
11. Ethernet-LAN port allows for duplicate PC display in supervisor's office.



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## TECHNICAL ASSOCIATES STANDARD MODULAR SERIES – ALL SOLID STATE:

- 1 ea. Digital Acquisition Board
- 4 ea. 5202 with amplifiers including fully adjustable single channel analyzer for scintillation detectors.
- 1 ea. MV-5.12.24 Low Voltage Power Supply Module.
- 4 ea. HV individual +/- 1% stable high voltage for each detector group.  
Once the high voltage levels are set by the technician, they do not change.
- 1 ea. HP DeskJet Color Inkjet Printer -OPTIONAL
- 2 ea. MAL-B3 Alarm Module
- 1 ea. BAM-SWX Pump Power Control Module
- 1 ea. Mass Flow Meter with on-screen display

## IMPORTANT FEATURES TO NOTE WITH TA'S PET-CAM-511 Air Monitors

- 4-20mA output signals – 3 channels
- Big 17" Color LCD Monitor
- LABTECH Virtual Instrument Software
- Real-Time Mass Flow meter
- Final release detectors with 3" Lead (Pb) shields light weight with compact Beta/Gamma Detectors
- Positive Position check sources with "throw length" and trouble free operation.

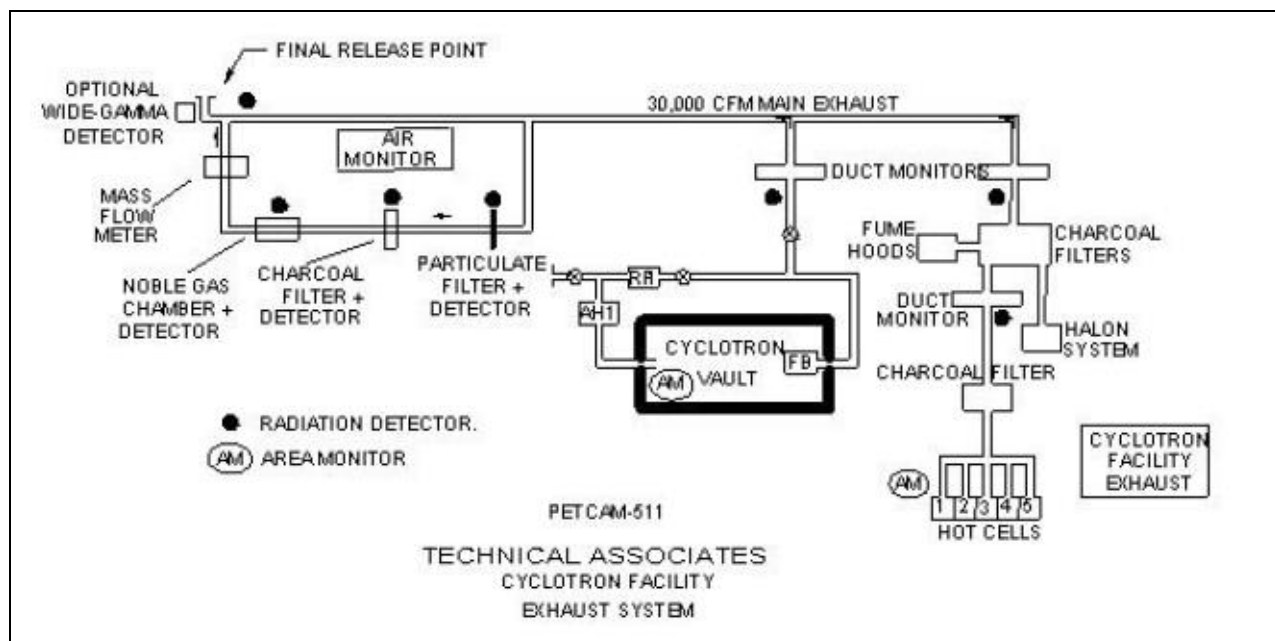
**PLEASE SEE SOFTWARE "SCREEN SHOTS" FOR CAM-33 ON  
TA'S WEB PAGE "ALPHABETICAL LIST OF PRODUCTS"**

## Recommended Reading

*Gaseous Radioactive Effluent Restrictions, Measurements, And Minimization At A PET/Cyclotron Facility.*

P.S. Plascjak, K.K.Kim, S.W. Googins and W.C. Meyer Jr.

Cyclotron Facility, National Institutes of Health, Bethesda, MD 20892, USA



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