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APPLICATION NOTE

Thermo Scientific iPCM12

Installed personnel contamination monitor

Abstract

The iPCM12 takes contamination personnel monitoring to a new level. The unique sculpted geometry utilized in the Thermo Scientific™ PCM2 is combined with the serviceability of the Thermo Scientific IPM9 and the breakthrough electronics of the Series 12 monitors.

Key Features:

- Excellent geometry for alpha and low energy beta detection
- Improved sensitivity due to smaller detector size
- Sum zones for distributed contamination
- Detectors easily accessible from front panel
- QuickScan technology to reduce count times
- PC-controlled, with Windows™ operating system
- Ability to monitor changing background
- Poisson statistics for accurate assessment of alarm probabilities
- Thermo Scientific™ ViewPoint™ compatible
- Gamma option kit with shadow shieding
- Optional ingress/egress doors

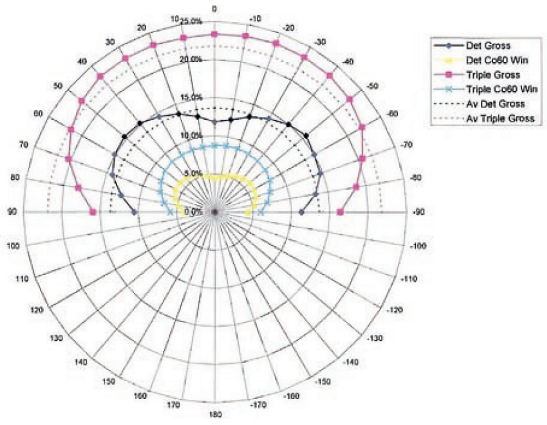
Thermo Scientific iPCM12 utilizes 21 gas detectors in monitoring the body, head, hands, and feet. The detectors are split into four detection zones to minimize the background during monitoring, and achieve the best detection limits. Three optional detectors can be mounted to monitor the side of the foot, the shoulder, and the top of the head. The very best geometry is ensured, with sprung detectors making contact with the arm and the top of the shoe. Sum zones may be applied across all detectors, providing at least 250 zones per measurement and counting channel.

Multi-language voice prompts provide verbal instructions during monitoring to ensure correct positioning and actions required following an alarm. In the event of an alarm, a large touchscreen monitors displays the location of the contamination. The USB security dongle allows supervisors access to diagnostic modes to further investigate the results.

The software is based on the 12 Series instruments. Results are stored in a database, providing both local and remote access. A QuickScan algorithm allows for faster beta and gamma contamination monitoring, particularly useful when the required monitoring time for beta and/or gamma would be longer than for alpha.

A gamma option provides up to nine scintillation detectors, monitoring the body, head, and feet. With this option, users can set both gross and ^{60}CO alarms.

Carefully designed gamma scintillation detectors provide exceptionally good body uniformity within the lead shadow shielding. Embedded PM tubes are fitted inside each detector, and the full height wall of sculpted detectors ensures complete coverage for all sizes of users.



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Typical variants

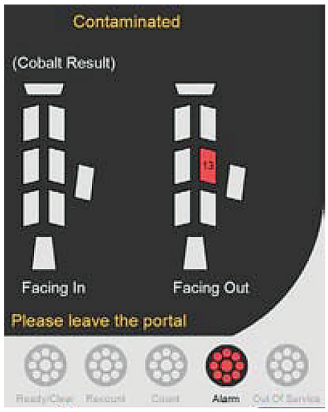
iPCM12A - Open booth style fitted with gas flow counters. This is the smallest footprint variant. Can be fitted with interface controller for customer's inlet and outlet turnstiles.

iPCM12B – Closed booth style fitted with gas flow counters. Can be optionally fitted with inlet/outlet barriers or electrically controlled full height inlet/outlet swing doors.

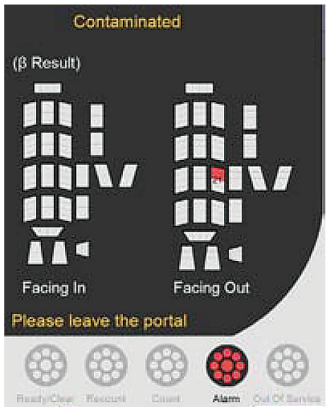
iPCM12C – Closed booth style fitted with gas flow counters, plus high sensitivity gamma scintillators within a lead shadow shield. Can be optionally fitted with barriers or full height swing doors.

Features

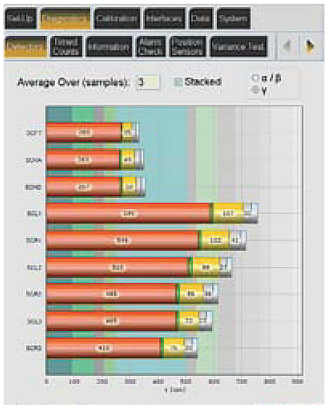
- Excellent alpha and low energy beta detection geometry, building on the proven PCM2 design
- Coverage area greater than PCM2 with almost 17,000 cm^2 detection area
- Beta contamination detection limits improved by one-third compared to PCM2
- Alarms may be set on single detectors, or sum zones, leading to very low detection limits for distributed contamination
- Quickscan may be used, significantly reducing counting time, without compromising the statistical probabilities of detection or false alarm
- Changing background indication signal will highlight significant changes in background radiation
- Rapid recovery from background changes with a dynamic background counting time
- Changing conditions alarm indicates if there is a significant change in the count rate during the monitoring period, invalidating the measurement
- All background, measurement, source checking, event log, voltage scanning is stored to an SQL database within the monitor
- Each Measurement result may be stored against a personnel identifier
- Set-up, configuration and diagnostic information is accessed via a touchscreen LCD
- User screens and voice prompts in user-selectable language
- Dongle security, with three security levels
- Calibration Integrity checking
- Windows operating system and Series 12 Software based upon that in SAM12 and PM12
- USB and Ethernet connectivity
- Carefully designed to provide easy access to all detectors and electronics
- Easy and fast calibration using automatic source detection



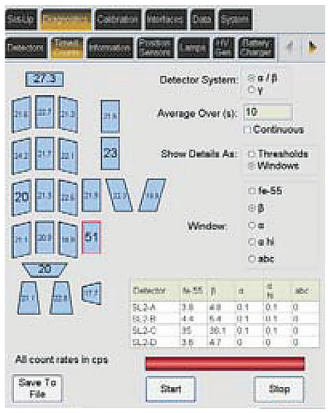
CONTAMINATION ALARM - ^{60}CO



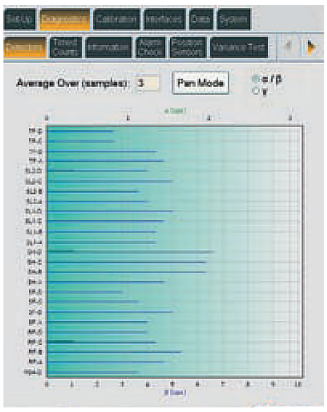
CONTAMINATION ALARM - β



DIAGNOSTIC DISPLAY
GAMMA SCINTILLATORS



DIAGNOSTIC DISPLAY
GAS FLOW DETECTOR WINDOWS



DIAGNOSTIC DISPLAY
GAS FLOW α/β - PAN MODE

Radiological Specification

Gas flow detectors – BETA body average efficiencies (4π) at 5 cm – as defined in IEC61098 for P7.5 gas (argon/methane)

^{36}Cl	6.7 % without summing	7.6 % with summing
^{60}Co	3.6 % without summing	4.1 % with summing

Typical MDA on contact with standard protection grille, in 0.1 µSv/h (10 µR/h) background

^{14}C	^{60}Co	^{137}Cs	^{36}Cl	^{241}Am	^{238}U
42 Bq	30 Bq	23 Bq	24 Bq	3 Bq	4 Bq

Note 1: with *high efficiency hex protection grille* option these MDA's are reduced by typically 25 %
Note 2: nominal ß / ɣ background count rate is ~8 cps in 0.1 µSv/h

Contact efficiencies (2π) on *high efficiency hex protection grille*

^{241}Am	^{14}C	^{36}Cl	^{55}Fe
39 %	30 %	49 %	33 %

Gamma scintillation detectors – Body average efficiencies (4π) at 5 cm – as defined in IEC61098

^{60}Co	10 % without summing	16 % with summing

Minimum Detectable Activity – on contact with standard protection grille, in 0.1 µSv/h (10 µR/h) background

	BODY	HAND	FOOT
^{60}Co	510 Bq	390 Bq	190 Bq
^{60}Co window	390 Bq	280 Bq	94 Bq

TRIPLE SUM ZONES

Typical ɣ background count rate for body detector 700 cps within lead shadow shielding in 0.1µSv/h

Mechanical Specification

	iPCM12A (Open booth)	iPCM12B (Closed booth)	iPCM12C (Closed booth with doors + gamma kit)
External Height	222 cm	222 cm	224 cm
External Width	94 cm	94 cm	94 cm + swing door access: 60 cm each
External Depth	74 cm	133 cm	133 cm
Internal Access	50 cm wide, 200 cm high	50 cm wide, 200 cm high	50 cm wide, 200 cm high
Weight	300 kg	500 kg	1700 kg (including lead)

Environmental

Operational range	0 °C to + 45 °C
Humidity	Up to 95 % RH non-condensing
Storage	-10 °C to +50 °C
IP rating	IP50

Gas requirement

Recommended	P7.5 (7.5 % Methane, 92.5 % Argon)
Alternatives	P5, P10, Argon (90 %)/CO2(10 %)
Nominal gas consumption	at 30 cc/min, small cylinder ~25 days, large cylinders ~120 days

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Parameter settings

Units	pCi, nCi, µCi, mCi, Ci, dpm, Bq, kBq
Monitoring time	3 s to 300 s
Probability of false alarm	0.1 to 10 sigma
Probability of detection	0.1 to 10 sigma

User options

Quickscan	Faster monitoring for users who are either clearly clean or clearly contaminated
Language	Various language options
Changing background	Minimum sigma that will trigger a reassessment of the background
Probability conditions	Minimum sigma that will halt monitoring and trigger a reassessement of the background
Alarm selection	Alarm level settings for α / ß / ɣ and for ^{60}Co (scintillation detectors only)
Calibration streams	Mixed nuclide selection and assessment
RCC	Residual contamination check may be undertaken after a contaminated article is removed from the monitor
Sum zone selction	Enabling α / ß summing zones, and ɣ centroid or ɣ summing zones (scintillation detectors only)

Accessories

AE0221A	Side of foot GAS FLOW kit
AE0222A	GAMMA scintillation kit with 2 cm lead shadow shielding
AE0223A	Head detector GAS FLOW kit
AE0224A	Head detector GAMMA scintillation kit with lead shield
AE0227A	Camera kit
AE0229A	Spare GAS FLOW purged detector kit
AE0237A	Enclosed booth controlled barrier kit - for inlet
AE0237B	Enclosed booth controlled barrier kit - for outlet
AE0238A	Enclosed booth DOOR LH+RH kit
AE0239A	Enclosed booth LH SWING DOOR kit
AE0240A	Enclosed booth RH SWING DOOR kit
A92169/D	iPCM12 security dongle
AE0246A	Calibration jig ALPHA ^{241}Am, 2 x 2 kBq
AE0247B	Calibration jig BETA ^{36}Cl, 2 x 2 kBq
AE0247A	Calibration jig BETA ^{137}Cs, 2 x 2 kBq
AE0247C	Calibration jig BETA ^{99}Tc, 2 x 2 kBq
AE0244B	USB barcode reader - integrated
AE0245A	High transmission (63%) grille set, (NB: standard set has 50% transmission)
AE0251A	Shoulder detector GAS FLOW kit
AE0272A	Dry contact output for each iPCM12 operational condition

Find out more at **thermofisher.com/radiationmeasurement**

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