

FAQ -- PM12 Gamma Portal Monitor

Q1. What are the highlight features of the PM12 ?

A1. The PM12 provides complete personnel coverage using eight large area scintillation detectors. The detectors are identical; three are located on each side of the portal, plus one for the head and one for the feet.

PM12 has a large touch-screen colour LCD and really easy set-up via embedded Windows XP.

Innovative features include:

Quickscan, Quick Background, internal database logging and optimised ^{60}Co alarms, USB connectivity for memory stick, printer, camera and keyboard.

There are 5 possible modes of operation: walk through, one step, two step, three step or stand & turn.

PM12 can be fitted with an inlet barrier and electrically controlled folding exit door.

Q2. How is the PM12 calibrated using threshold settings ?

A2. Five energy thresholds are factory set in the PM12:-

T1 is the lowest, set just above the noise level.

T2 is set at the ^{137}Cs peak energy 662keV

T3 is set for higher energy levels (>700keV).

T4 is set just above the ^{60}Co peak energy 1.3MeV

T5 is set at Cosmic energy level.

The optimum working voltages for each scintillation detector are set during HV scanning to a specific T1/T2 ratio. The PM12 is then calibrated against a ^{137}Cs reference source at the centroid and at 5cm from each detector (IEC recommendation) or 3" from each detector (US recommendation). This is precise and once calibrated against ^{137}Cs the PM12 is also fully calibrated for ^{60}Co .

It is not strictly necessary to recalibrate against ^{60}Co , but during final PM12 factory testing, calibration certificates are provided for both nuclides.

Q3. How does the Cobalt 60 Window setting work ?

A3. When this function is enabled, the PM12 monitors the energy window above ^{137}Cs (T3) and below ^{60}Co (T4). Only higher energy measurements and higher energy backgrounds are analysed in this channel. Because the typical background countrate at higher energies is less, the statistics for the ^{60}Co are much better, enabling a rapid assessment of the contribution from ^{60}Co .

Q4. How does the Low Energy discrimination setting work ?

A4. The Low Energy option on the menu selects energy measurements above the noise threshold (T1) and below ^{137}Cs (T2). If this profile is higher than the normal countrate distribution, the PM12 will indicate that low energies are present (such as those applicable to medical contaminants).

Q5. What is the “Portal approach time” function, and how useful is it?

A5. As each user approaches the PM12, the background readings of each detector may be slightly screened or attenuated, or even elevated if the user has some surface contamination. To minimise these effects, a typical default of 2 seconds is applied to the background readings used in the PM12 alarm calculations, thus ignoring the (possibly) erroneous countrate contribution as the user approaches.

In higher background conditions the “Portal approach time” may have to be adjusted to 3 or more seconds, and the next user required to wait, say, behind a 3 metre approach line.

Q6. How do the five modes of operation differ ?

A6. Walk Through mode:

As the user walks through the PM12, the monitor takes 100msec scans and rolls them into a 400msec average monitoring time, continuing this process until the user leaves the monitor. High speed and low speed user transits are signalled as errors, to ensure correct monitoring speed.

One step mode:

The user is instructed to stand centrally in the portal while the count proceeds. This provides a general overall contamination result.

Two step mode:

The user is instructed to stand with his back against one wall, and then to stand with his front against the other wall. This provides good measurements close to the user's front and back.

Three step mode:

The user is instructed to stand in the centre of the portal, while a measurement is taken. Then the user places his back against one wall to monitor, then the user stands with his front to the other wall for a final measurement. This gives the most comprehensive coverage, but requires 3 contamination monitoring stages.

Stand and turn mode:

The user is instructed to stand centrally in the portal, and then to turn to face one wall for the second stage of monitoring. This gives all round response with a minimal monitoring time. This provides comprehensive (or isotropic) coverage, whilst minimising background attenuation due to the body.

Q7. How are the detector sum zones used ?

A7. The 2 or 3 detector sum zones may be selected and enabled if potential contamination is likely to be spread across the user's clothing. Contributions from adjacent detectors are then added together to establish if an alarm condition exists. Individual detectors have the lowest MDA, and sum zones have a slightly higher MDA. The MDA limits can readily be viewed on the diagnostics information screen.

Q8. How does the Quick Background option work ?

A8. The PM12 normally measures background in 1 second samples and rolls this into a simple 100sec rolling average. When the user is being monitored, the previous rolling measurements are frozen and used in background subtraction algorithms. However, after several users have been monitored the PM12 will request a background update, then measuring a further 100sec background. If Quick Background is selected, the PM12 algorithm compares current background statistics with the selected alarm setting, and only counts for a background time to meet current settings. Normally much less than 100secs.

Q9. How does the Quickscan option work ?

A9. The max and min monitoring times are set via the Parameter 2 menu. The PM12 compares the actual foreground count rate with the background and alarm statistics set, and measures the user for a time between maximum and minimum. If Quickscan is enabled a user may monitor for a much shorter time than the maximum if the PM12 detects a “really clean” or a “really dirty” statistical situation. The instrument will review the count rate at each Quickscan period, to identify if the counting statistics have been met for the foreground count rate.

Q10. Can I reduce false alarms ?

A10. Several factors can contribute to unexpected false alarms.

Background *attenuation and scatter* from the user's body may be significant:- consider using the attenuation menu options.

Extra lead and side wing *screening* can reduce the background countrate, as the plastic scintillators are only partially shadow shielded:- consider using in a lower background location or adding lead.

As the PM12 is usually assessing a quite small alarm count in a large background count, then *alarm thresholds* may be set too low:- consider adjusting the alarm level to a more realistic setting.

Other users should not stand adjacent to the PM12 as this will cause *background fluctuations*:- consider queuing the next or approaching users behind a 3 metre waiting line.

Consider setting the centroid alarm at a higher level than the "contact" alarms. Most false alarms are due to the centroid measurement, but individual detectors are far more sensitive.

If Co-60 is a common nuclide, base the alarm levels on the Co-60 window, which should be less sensitive to gross background changes.

Q11: Why does my instrument sometimes fall outside the variance test limits?

A.11. The variance test may be used soon after the PM12 is installed to confirm the background stability of the detectors. Check that the variance limits are set to the recommended default values before using this function:

100 counting cycles;
10 second count period;
Upper variance 1.5;
Lower variance 0.67

Apparent failure may be due to changing background conditions, so it is recommended to carry out this testing overnight or when the PM12 is not in normal use. It may be necessary to repeat the variance test for marginal failures.

In high background environments it may be appropriate to amend the default values.

Q12: What software is used in PM12?

A12.

- The database used is SQL Server Express
- This database is setup for single user access. Remote access to the database is disabled.
- The operating system is Windows XP Embedded. This operating system only includes the components of the WinXP operating system that are essential to operation of these products.
- The instrument application is run from within WinXP user mode. The application should not be run from within Administrator mode.
- Security patches to the operating system will be provided by ThermoFisher, after an in-house review. Patches will be provided where appropriate and essential.
- Updates to SQL Server Express will be provided by ThermoFisher, after an in-house review. Updates will be provided where appropriate and essential.

Q13: How is remote access provided?

A13.

- VNC Server is installed on every product. Remote access to the desktop is only possible through VNC.
- The IP address plus a security password are needed to access the PM12.