MDS
Multi-Detector α/β Counting System
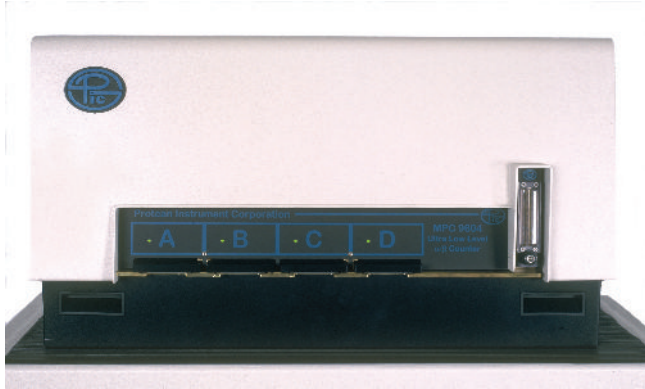
Key Features

- Third Generation Design with
  - Independent Sample Drawers
  - Independent Sample Detectors
  - Zero Adjacent Detector Crosstalk
  - Reliable Communications Protocol
  - Full Frontal Easy Service Access
  - Complete Modularity
  - Parallel Gas Distribution
  - GasPRO™ Flow Sensing
  - Dead-time Corrected Count Timer
- Field Expandable - 4 to 48 Detectors
- Lowest backgrounds in the industry
  - Four Inch 4π Virgin Lead Shield
  - Cosmic Guard Detectors
  - Selected Low Background Materials
  - Linear Low Voltage Power Supplies
- *Vista 2000* Comprehensive Software
  - MS Access™ Database (Non-relational)
  - Intuitive Database Navigation
  - Sample & Source Logs
  - QC Control Charts
  - Linked Count & Calibration Methods
  - Count Presets or Count to MDA
  - Standard & Custom Reports
- PC, Printer, and MS Windows™

The Solution for Throughput

The multi-detector system was conceived to provide high throughput for low background beta counting. These systems are ideal for applications looking to improve sample throughput when high sensitivity requirements dictate long counting times. One such application is the gross alpha/beta analysis of water and environmental samples. In this category Protean Instrument's MDS has no equal.

Anytime parallel processing of samples is called for a multi-detector system is the answer. The multi-detector alpha/beta counting system's main goal is to provide many sample channels allowing for parallel counting, in a compact footprint, at an economical price, without sacrificing performance. The first generation of these systems succeeded in meeting this goal but other issues soon surfaced that exposed a number of economic fallacies begging for a second and now a third solution.

The Previous Generations

One cost saving measure employed by first generation system included a common detector window. This imposed an increased window density and in turn limited low energy performance. A large single window is cheaper but is harder to change and a change affects the calibration of all detectors.

In addition, the common window makes these systems more susceptible to detector-to-detector performance variations due to atmospheric pressure changes. Efforts to reduce the footprint tightly packed the detectors. The close proximity of adjacent detectors allows channel-to-channel crosstalk from betas, x-rays, and gammas. The single large sample drawer employed means all samples start and stop as one. Initially these issues may or may not be considered as problems but if so, solution means compromise. If lowest cost and smallest footprint is your only criteria, you may be satisfied with a first generation system. Unfortunately only when it is too late will you appreciate the fallacies of your economic savings.

The second generation of systems represents more compromises that also attempted to fix first generation deficiencies - mainly to get rid of a common window and offer some detector modularity. Two problems persisted - adjacent detector crosstalk was reduced but not eliminated; and, operational independence of each detector was not realized.

Why is this important? Low level environmental type measurements are burdened with the task of proving a negative, i.e., the absence of activity. This need gave birth to

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High Performance

the concept of the MDA (minimum detectable amount). If a measurement's MDA is equal to or lower than a regulatory or safety limit, then you may report with some degree of certainty that the sample is at least acceptable based upon those regulations.

When selecting a system low MDA values are the prime criteria. The MDA value is dependent upon an instrument's background and efficiency performance, the sample's volume and/or mass, and the counting time. Conversely, since instrument performance and the sample's parameters may be at a practical limit and considered fixed, the only variable in the determination is the counting time - and this may be very long.

Faced with varying count times and a system that doesn't have detector independence you have but one choice - count to the worst case condition (longest time) as dictated by the MDA. How can you maximize throughput with this dilemma? The answer is, let each detector independently adjust its counting times to meet the MDA and then replace each sample as it finishes. This is not possible with either the first or second generation of systems. For those that refuse to compromise Protean Instrument offers the third generation.

The New Generation

Protean Instrument's MDS is currently the only third generation multi-detector low background system for gross alpha/beta counting. To combat the problems associated with its predecessors, Protean's MDS combines several critical features into one system.

Performance Matters

The MDS has the lowest backgrounds in the industry. We achieve this for both alpha and beta by carefully selecting and using only low background materials. To enhance the beta background we then surround the counting chambers with four inches of newly mined (virgin) lead. Next we set a large area guard detector on top of the sample detectors such that it intercepts and rejects cosmic events that would otherwise register as betas - but it doesn't end there.

The MDS uses linear (non-switching) type low voltage power supplies to eliminate one source of electrical interference. We use spectroscopy grade amplifiers to shape and filter the detector signals. We bias the detector with a regulated high voltage supply. The high voltage and the detector signals are routed through shielded cables. The electronics is shielded with RFI guards and metal enclosures. In other words, background counts have many roots and require an equal number of remedies.

Two MPC-9604 units can be vertically mounted on the optional MDS-RACK shown above. If maintenance is necessary the lower unit is easily pulled forward for cover removal (as pictured). Squeeze the handle to release the brakes and the lower MPC-9604 glides forward on its roller bearing supported plate. Release the handle and the brakes engage. The heavy duty rack distributes the weight to reduce floor loading.

Repeatable counting geometry is assured using the removable sample carriers that adapt to different depths of planchets. Independent position sensors prevent erroneous data due to a partially closed drawer.
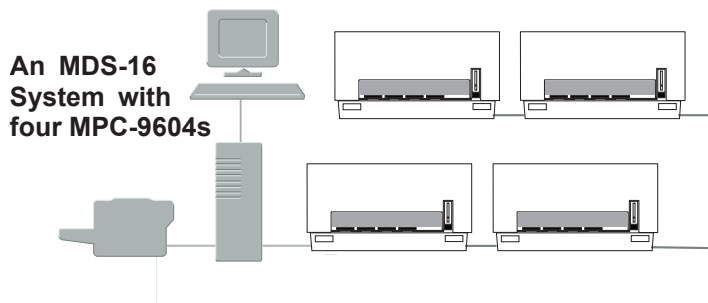
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Independent Operation

Communications between the PC and the MPC-9604 units is fast, reliable, and inexpensive utilizing IEEE RS-485 standards and Protean's exclusive PICNET II protocol. The control software automatically identifies new additions and configures itself to match.
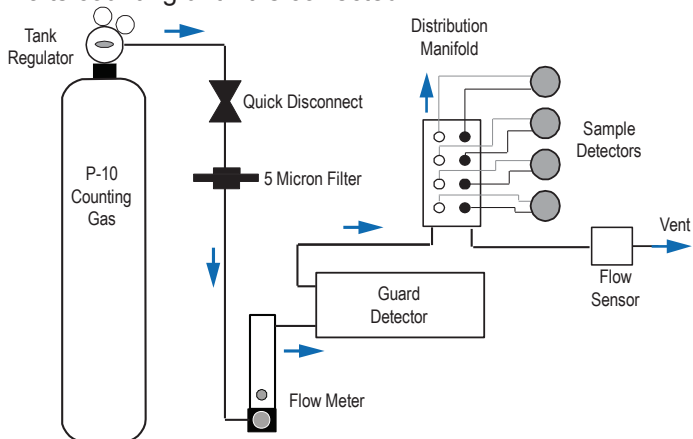
True Detector Independence

The advanced design of the MDS means each detector is individually controlled and is mechanically independent. Routine use of a counting channel, including sample loading and unloading, calibrating, counting, and routine maintenance, is done without affecting other detectors in the system.

Should a window need replacing on one detector, it can be done while other detectors continue to count. Post maintenance performance checks need be done only on the affected detector. You will spend more time counting samples and experience less down time. This degree of detector independence is available only with Protean's third generation MDS system.

Parallel Gas Flow with GasPRO™

Regulated P-10 gas enters each MPC-9604 through a quick disconnect, flows through a particle filter, a critical flow orifice that sets and limits the flow rate, a flow meter and then into a manifold that provides parallel (as opposed to serial) gas distribution to the detectors. Parallel flow is essential for independence and stability. A full explanation is provided in Protean's application note AN-0807. Protean's exclusive GasPRO™ featuring a low flow gas sensor monitors the system for any P-10 gas fault and halts counting until it is corrected.

Any sample drawer can be opened at any time with no affect on other samples.

Attention to detail is reflected in the MPC-9604's outstanding counting efficiency performance. Details such as detector uniformity, low density windows, precise counting geometry, low noise amplifiers, low crosstalk, dead time correction, etc., all combine to raise the bar for efficiency performance. Attention to detail sits the MDS apart from other systems and in a league of its own.

Systems from 4 to 48 Detectors

The core of the MDS system is the MPC-9604, a self-contained four detector unit. An MDS system consists of one or more MPC-9604 units, a control PC, a printer, and software. Each MPC-9604 unit contains four completely independent sample detectors, a guard detector, lead shielding, and all support electronics for that unit. The design of the MPC-9604 and control software allows for easy system expansion. Since each MPC-9604 is self contained, the only connections required are the interface cable, the P-10 gas supply, and the AC power.

Up to twelve MPC-9604 units can be connected to a single PC, for a maximum of 48 independent channels. You can start with a minimum system, and add additional capacity as your budget or work load expands.

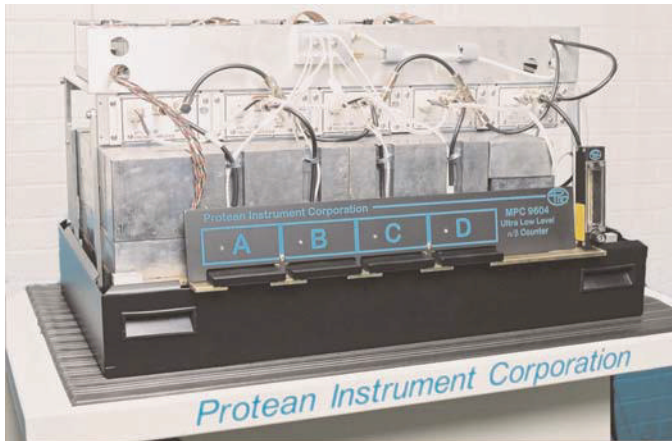**An MDS-16 System with four MPC-9604s**

Each MPC 9604 includes a self-contained gas distribution and flow monitoring system ready to connect to a regulated supply of P-10 gas (nominally 10 lbs/In^2).
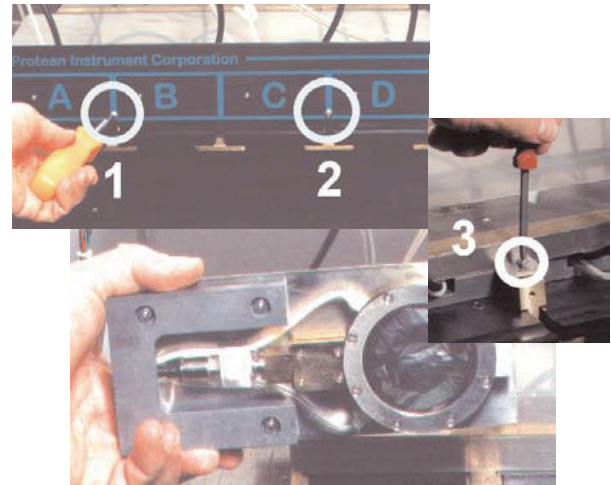
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Easy to Service

The MDS has the best "under the hood" design available. The top cover lifts off, and every component is immediately accessible - from the front of the instrument.

Compact Design

The MDS conserves lab space and since rear access is not required, no space is wasted. Each MPC-9604 unit is designed to fit on a standard lab bench, or you may consider the optional mobile cart (ACC-02), or an optional multiple unit rack (MDS-RACK). Multiple units need not be crammed in a single location - the PICNET II interface works at distances of many meters with high noise immunity using inexpensive network cables. Put them where you need them.

The MDS-RACK is not included but is a highly recommended option for vertically mounting two MPC-9604 units. The lower shelf pulls out for easy access to the lower unit.

Rack Dimensions:
44" D x 40" W x 21" H (Bottom shelf) x 42" H (Top shelf).

Detector and Window Access as easy as 1 - 2 - 3

Any MDS detector and window can be accessed by removing 2 front panel screws and 1 internal screw.

The detector slides out easily with one hand - *from the front of the system - without lifting a single lead brick!*

Easy to Maintain

When you need it, Protean's third generation MDS was designed for easy service - service was not an afterthought. Older generations were intended to be serviced by factory trained engineers only. The MPC-9604's front access and modularity - from the sample detector through to the electronics - minimizes down time and spare parts inventory costs.

Detectors and detector windows are completely accessible from the system front without lifting a single lead brick. Detector windows are affordable and can be changed in less than 10 minutes, without interrupting any other detector in the system! Electronics are modular and accessible from the front of the system - no rear access required - no wasted space.

The MDS is designed to minimize down time and to maximize counting effectiveness in every possible way.

Service & Applications Support

When you need it, Protean stands behind its products with the most experienced team of applications and service experts in the industry.

Vista 2000

System information and controls are displayed on clear, informative screens - screens designed to let you focus on counting samples, not running a PC.

Control Software

The MDS is controlled through Protean Instrument's comprehensive *Vista 2000* software. *Vista 2000* is a MS Windows based application used exclusively with Protean Instrument's extensive line of alpha/beta counting instrumentation. This software not only supports the MDS system but will also simultaneously support single detector windowless units and units with automatic sample changers among others.

All data for the system is contained in a Microsoft Access™ database with a simple, reliable, intelligent design. Within the database, all sample counting data is contained in a single data table. The combination of an industry standard format, and a simple date structure mean analysis and reporting is easy. You spend less time learning how to program report generators and database applications, and more time counting samples.

Samples and their specific parameters are logged into the database as batches and linked to a predefined count method. The count method is linked to predefined calibration methods that include detector specific calibration records. Samples are assigned to detectors from the sample log. The specified count method includes reporting units, maximum permissible concentration levels, alarm levels and messages, MDA techniques, default parameters, count presets.
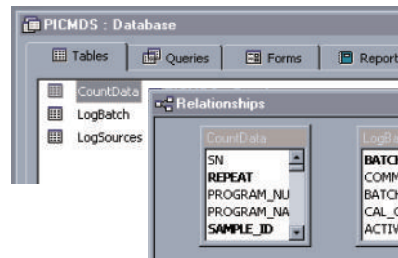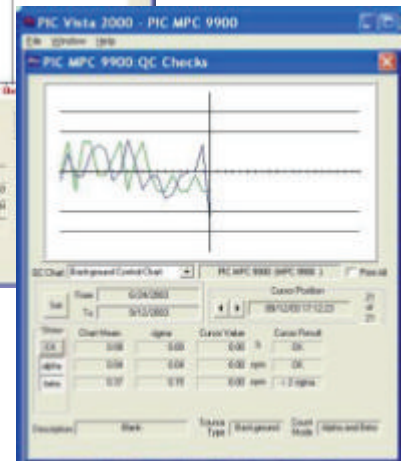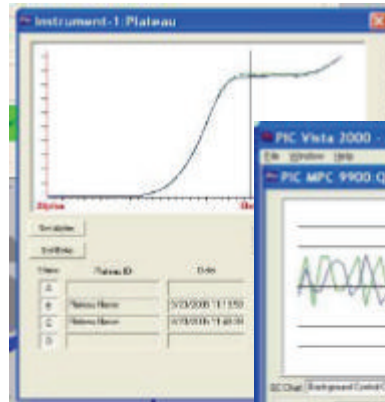

The Simple non-relational open access database architecture is easy to understand and allows for true archival of data.

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Calibration & QC Links

Count to MDA

Vista 2000 ensures that each detector has its own unique set of calibration records. If your methods require mass attenuation correction, each detector has its own independent correction coefficients. *Vista 2000* and the MDS supports true count to MDA. In this case the counting time is automatically optimized for each sample with MDA values calculated individually for each detector based upon sample specific and detector specific calibration parameters using MDA equations selected from a set of the most widely used methods.
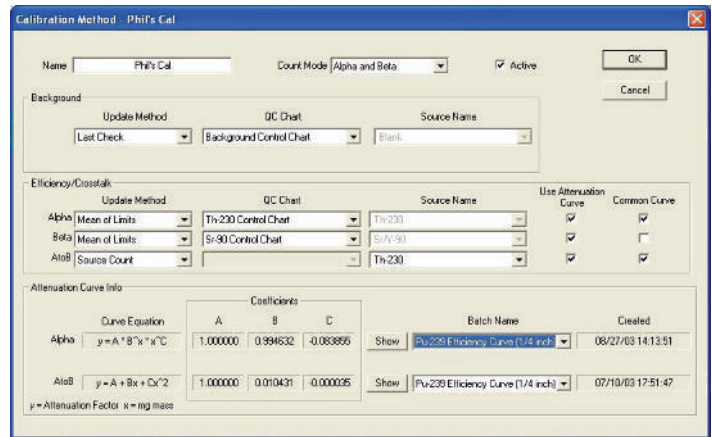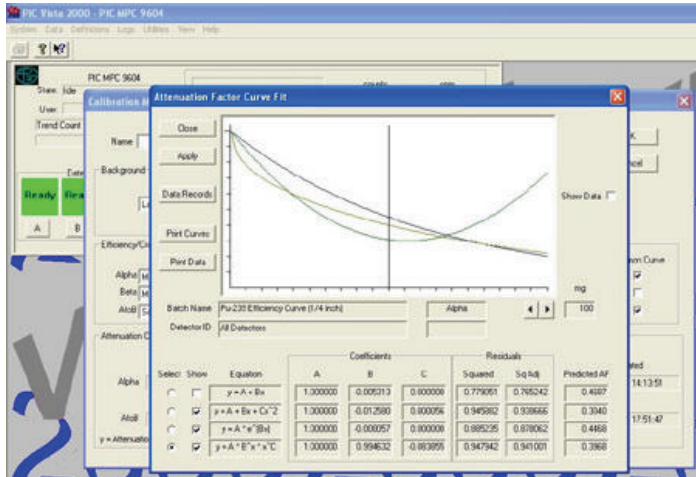
Diverse Calibrations

Differing sample analysis procedures require differing counting methods, differing calibration methods, differing reporting methods, and differing reporting units. *Vista 2000* adapts to virtually every situation.

Whether your procedure uses single point constant mass efficiency calibrations, single point linked to a control chart, infinite thickness, variable mass with attenuation curves, common attenuation curves, or detector specific attenuation curves - *Vista 2000* will adapt.

Vista 2000 doesn't tell you how to do your job ... it provides the tools that allow you to do your job.

- Vista 2000 Contains Comprehensive QC Functionality
- Define - View - Print Control Chart Data & Charts
- Trending Routines for Testing & Troubleshooting

Easy to Use QC Functions

Vista 2000's flexible QC features are simple to set up and simple to use. Permanent data storage for Control Charts is provided in the MS Access™ database. Control Chart results may be automatically linked to calibration records.

Temporary testing and trouble shooting use trending functions that are similar to the Control Charts but not linked to the database to prevent clutter.
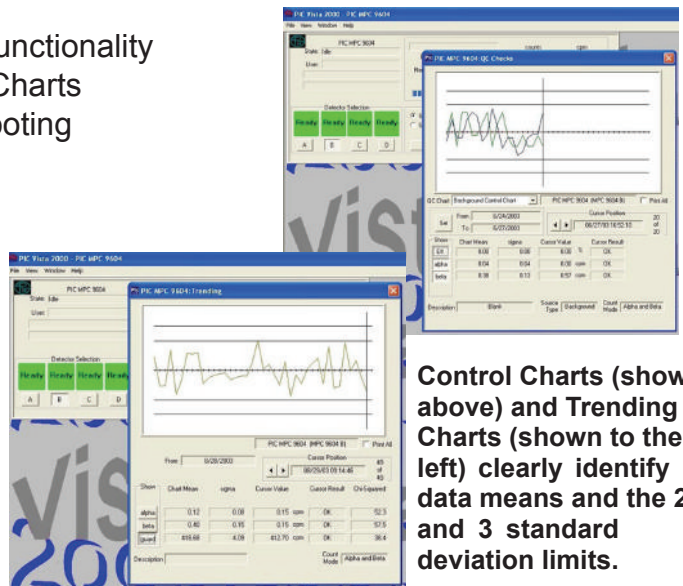
Control Charts (shown above) and Trending Charts (shown to the left) clearly identify data means and the 2 and 3 standard deviation limits.

Library of Reports

Vista 2000 contains a set of standard reports written as XML files and designed to satisfy the majority of user applications.

- Detailed Reports

- Short Reports

- Wipes Reports

- Air Filter Reports

Custom reports can be developed and linked into *Vista 2000* for seamless operation.

Custom and standard reports use *Vista 2000*'s database navigator to extract batches of samples easily and intuitively.

Alpha/Beta Count Results
Sample Activity Report

PIC MPC 9604 - B   Address: *1*

Sample ID *EAG99-1690-02*   Repeat *1*
           EAG99

Batch ID *1690*

Count Routine *Gross Alpha Beta EPA 900.0 (Soil)*   Detector Volts *1,515.0*

Sample Qty   0.100 *g*   sd   0.000 *g*
Residual Wt   100.000 *mg*   sd   0.000 *mg*

Count Date 10/25/1999 11:20   Collection Date 1   Half Life   0.00 *days*
                                Collection Date 2 8/25/1999 00:00   Decay Factor 1.000

Sample Count Time   60.00 *mins*   Background Count Time   1,000.00 *mins*

	Efficiency %	Attenuation Factor	Activity Divisor	Background cpm	Gross counts	Gross cpm	Net cpm
Alpha	19.930	0.349	1.000	0.054	11	0.183	0.129
				0.007	3.317	0.055	0.056

Alpha/Beta Count Results
Summary Activity Report

Count Routine *Gross Alpha Beta EPA 900.0 (Soil)*
Batch ID *1690*

Sample ID *EAG99-1690-02*
           EAG99
Sample Qty   0.100 *g*   Count Date 10/25/1999 11:20
Residual Wt   100.000 *mg*   Sample Count Time   60.00 *mins*

Alpha   8.383 ±   7.238 *pCi/g*   838.257 % of MPC
                                     MDC is Greater Than Limit
Beta   10.980 ±   4.024 *pCi/g*   365.985 % of MPC
                                     MDC is Greater Than Limit

Sample ID *EAG99-1690-05*
           EAG99
Sample Qty   0.100 *g*   Count Date 10/25/1999 12:27
Residual Wt   100.000 *mg*   Sample Count Time   60.00 *mins*

Alpha   13.784 ±   8.716 *pCi/g*   1,378.372 % of MPC
                                     MDC is Greater Than Limit
Beta   6.430 ±   3.464 *pCi/g*   214.317 % of MPC
                                     MDC is Greater Than Limit

Sample ID *EAG99-1690-09*
           EAG99
Sample Qty   0.100 *g*   Count Date 10/25/1999 14:15
Residual Wt   100.000 *mg*   Sample Count Time   60.00 *mins*

Alpha   7.302 ±   6.906 *pCi/g*   730.235 % of MPC
                                     MDC is Greater Than Limit
Beta   5.957 ±   3.348 *pCi/g*   198.552 % of MPC
                                     MDC is Greater Than Limit

Customize Reports Using:

- A third party XML report generator purchased from Protean, or

- MS Access™ Report Writer and let Protean convert it to a compatible XML file, or

- Protean on a contract basis and your specifications (ask for quote).

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MDS ORDERING INFORMATION

MDS systems are designated as -4, -8, -12, or -16, depending upon the total number of detectors. All MDS-XX systems will include one MPC-9604 unit per four detectors; gas line fittings and tubing, and two-stage gas tank regulators† (one per 8 detectors). Systems supplied to the U.S. domestic markets include a factory supplied PC including a Microsoft Windows operating system, Protean's *Vista 2000* control software, a laser printer, and installation. Export systems include a locally supplied PC and printer with installation provided by the nearest authorized Protean representative. *Vista 2000* requires a computer running Microsoft Windows 2000 or Windows XP as a minimum. The computer must have a native RS-232-C interface (converted USB ports will not work).

†Tank regulators use a US standard tank thread (CGA-350 *.825"-14NGO-LH-EXT*) and may require adapters not supplied by Protean.

MPC-9604 COUNTING PERFORMANCE

Each MPC-9604 contains four independent 2.25 inch diameter pancake style gas flow proportional sample detectors and a large area gas flow proportional cosmic guard detector. Each sample detector has a field replaceable (low cost) aluminized window with a nominal density of 100 $\mu g/cm^2$, 1 sample carrier with inserts for 1/8 inch, 1/4 inch, and 5/16 inch planchets per detector (planchets are not included). Each of the four channels of a MPC-9604 exhibits the following performance specs.

		Alpha	Beta
Background:	Typical	0.03 - 0.07 cpm	0.4 - 0.7 cpm
	Warranted	$\leq$ 0.1 cpm	$\leq$ 0.9 cpm

(Background values are dependent on environment and altitude. Warranted values are as measured at factory under controlled conditions.)

Efficiency:	Typical	Po^{210}	40%	Sr^{90}/Y^{90}	55%
		Am^{241}	40%	Cs^{137}	40%
		Th^{230}	40%;	Tc^{99}	35%

(Efficiencies are typical values; energy and geometry dependent; as measured at factory under optimized conditions with factory specified sources; and, measured using P-10 counting gas.)

Plateau:	Slope	< 1.5% /100V	< 2.5% /100V
	Length	> 1000 volts	> 200 volts

(Plateau measurements use point sources at optimum geometry using P-10 counting gas. Alpha plateaus use Po^{210} : beta plateau use Sr/Y^{90})

		Alpha to Beta	Beta to Alpha
Crosstalk:	(Instrument induced)	< 0.1%	< 0.1%
	(Naturally occurring)	Source Dependent	Source Dependent
	(Refer to Applications Note AN-0108)		

Detector Uniformity: > 95% over active area

Dead Time Correction: tested to 300,000 counts per minute with < 1.5% dead time loss for each detector channel simultaneously and independently.

Count Modes: alpha only or simultaneous alpha + beta

MPC-9604 Physical

Gas-PRO™: failsafe P-10 monitoring system senses breaches in flow

Gas flow: nominally set to 60 cc/min with a critical flow orifice. Each unit includes a rotameter style flow meter and a parallel feed gas distribution manifold for the counting gas Nominal inlet pressure 10 psi (15 psi recommended maximum)
(Refer to Applications Note AN-0807)

Shield: 4" (10 cm) thick selected virgin lead.

Size: 32" W x 16" D x 16" H (81.3 cm W x 41 cm D x 41 cm H)

Weight: Installed 1200 lbs (545.5 kg)
Shipping 1400 lbs (637 kg)

AC Power: 117 Vac, < 1.7 A, 50/60 Hz; 230 Vac, < 0.9 A, 50/60 Hz

Environment : 10 - 40º C; 20-90% humidity, non-condensing

Options

MPC-9604: Self contained four-detector unit to add counting capacity to an existing MDS system.

MDS-RACK: Heavy duty rack assembly to holds two MPC-9604 units.

ACC-02: Wheeled cart holds one MPC-9604 unit.

(All specifications are subject to change without notice.)

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