

### Application Guide

	General Health Physics	General Radiochemistry	Smear Counting	Air Filters	Water Samples (EPA)	Nuclear Power Plant Use	Alpha Counting Only
WPC-9550	Excellent	OK	Best	Best	Good	Best	Excellent
WPC-9550-PC	Best	OK	Best	Best	Good	Best	Excellent
WPC-9550-FC	Excellent	OK	Best	Best	Good	Best	Excellent
IPC-9025	Good	Best	Good	Good	Best	Good	Excellent
MDS-4/8/12/16	Good	Best	Good	Excellent	Best	Good	Excellent
WPC-9450	OK	OK	OK	Excellent	NR	NR	Excellent
WPC-2000-FC	Excellent Depends on # of samples	OK	Excellent for small # of samples	Excellent for small # of samples	NR	Excellent especially at work sites	Excellent
MPC-2000-B	Excellent Depends on # of samples	OK	Excellent for small # of samples	Excellent for small # of samples	NR	Excellent especially at work sites	Excellent
MPC-9300	Excellent Depends on # of samples	OK	Excellent for small # of samples	Excellent for small # of samples	Excellent for small # of samples	Good	Excellent
MPC-9900	Not Recommended	Not Recommended	Excellent for Alpha Only	Excellent for Alpha Only	Excellent for Alpha Only	NR	Excellent



MDS-4/8/12/16: Best for high sample volume with high counting sensitivity (long count time) requirements.



IPC-9025: Best all around counting performance. Highest sensitivity plus automatic sample handling.



WPC-9550: Best all around smear/swipe/air filter counter. Especially good with high sample volumes with short ( 1-30 minute) count times.



MPC-9900: Best for high throughput alpha counting requirements. Allows compact multiple sample systems that can be expanded easily.



MPC-9300: Best for small sample volume, but high sensitivity requirement.



WPC-9550-FC: Best for labs with significant training overhead. Can be customized to closely match existing procedures and requirements.



MPC-2000-B/FC: Best for field screening or point of use counting with a relatively low sensitivity requirement.



WPC-9450: Best for general counting of samples up to 5 inch diameter.

# Performance Specifications



Performance	IPC-9025	WPC-9550	WPC-9450	MDS	MPC-9300	MPC-2000	MPC-9900	
Alpha Bkg. CPM <sup>(3)</sup>	.05/.05	.05/.05	.15/.2	.05/.05	.05/.05	.05/.1	.05/.1	
Beta Bkg. CPM <sup>(3)</sup>	.4/.5	.4/.5	2.5/5.0	.4/.5	.4/.5	40/60	40/60	
Alpha Efficiency % <sup>(4)</sup>	Po <sup>210</sup> - 42%/49% Th <sup>230</sup> - 42%/49% Am <sup>241</sup> - 42%/50%	Po <sup>210</sup> - 42% Th <sup>230</sup> - 42% Am <sup>241</sup> - 42%	Am <sup>241</sup> - 42%	Po <sup>210</sup> - 42% Th <sup>230</sup> - 42% Am <sup>241</sup> - 42%	Po <sup>210</sup> - 42%/49%	Po <sup>210</sup> - 42%/49%	Po <sup>210</sup> - 42%/49% Th <sup>230</sup> - 42%/49% Am <sup>241</sup> - 42%/50%	
Beta Efficiency <sup>(4)</sup>	H <sup>3</sup> - NA/25% C <sup>14</sup> - 12%/30% Ni <sup>63</sup> - 17%/48% Sr <sup>90</sup> - 55%/65% Tc <sup>99</sup> - 43%/57% Cs <sup>137</sup> - 21%/38%	H <sup>3</sup> - NA C <sup>14</sup> - 12% Ni <sup>63</sup> - 17% Sr <sup>90</sup> - 55% Tc <sup>99</sup> - 43% Cs <sup>137</sup> - 21%	Sr <sup>90</sup> - 55% Tc <sup>99</sup> - 35%	H <sup>3</sup> - NA C <sup>14</sup> - 12% Ni <sup>63</sup> - 17% Sr <sup>90</sup> - 55% Tc <sup>99</sup> - 43% Cs <sup>137</sup> - 21%	H <sup>3</sup> - NA/25% C <sup>14</sup> - 12%/30% Ni <sup>63</sup> - 17%/48% Sr <sup>90</sup> - 55%/65% Tc <sup>99</sup> - 43%/57% Cs <sup>137</sup> - 21%/38%	H <sup>3</sup> - NA/25% C <sup>14</sup> - 12%/30% Ni <sup>63</sup> - 17%/48% Sr <sup>90</sup> - 55%/65% Tc <sup>99</sup> - 43%/57% Cs <sup>137</sup> - 21%/38%	H <sup>3</sup> - NA/25% C <sup>14</sup> - 12%/30% Ni <sup>63</sup> - 17%/48% Sr <sup>90</sup> - 55%/65% Tc <sup>99</sup> - 43%/57% Cs <sup>137</sup> - 21%/38%	H <sup>3</sup> - NA/25% C <sup>14</sup> - 12%/30% Ni <sup>63</sup> - 17%/48% Sr <sup>90</sup> - 55%/65% Tc <sup>99</sup> - 43%/57% Cs <sup>137</sup> - 21%/38%
Crosstalk (Spillover) <sup>(7)</sup>	0%							
Plateau Slope	$\alpha < 1.5\%/100\text{ V} - \beta < 2.5\%/100\text{ V}$							
Detector Non-Uniformity	<±5% over 95% active area							
Cosmic Rejection Efficiency	>99%							



MDS – Multi-detector manual systems with completely independent detector and sample drawer control. Front access for *all* maintenance.



IPC-90 Series – Automatic windowless/windowed GFP detector. Absolutely the highest performance of any GFP system in windowless mode.



WPC-95/94 Series – Automatic 50/100 sample QuickStack systems with 2 inch or 5 inch GFP detectors. Dual console and PC control.



MPC-99 Series - Manual gross counter module; windowless or windowed with gas flow proportional detector. Designed for custom alpha counting systems. Custom systems based on the MPC-9900, with customer specified software and cabinets.



MPC-93 Series – Manual, true low-background, windowless or windowed with GFP detector.



MPC-2000 Series – Manual gross counters, windowless or windowed with GFP detector or optional non-gas flow. Keypad or touch screen front panel.



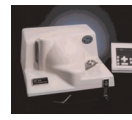
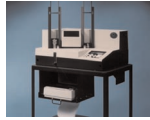
WPC-9550 Custom Systems. Same performance as standard WPC-9550, includes touch screen controller with custom programs to match specific procedures.

# Physical Specifications



Physical	IPC-9025	WPC-9550	WPC-9450	MDS	MPC-9300	MPC-2000	MPC-9900
Performance Type	Ultra-Low					Gross	Gross
Sample Transport	Automatic			Manual			
# of Detectors	1			4–64 by 4's	1		
Detector Size	2 inch	2 inch	5 inch	2 inch			
Detector Type <sup>(1)</sup> (standard)	GFP – WWL Hemispherical	GFP Pancake			GFP – Window/Windowless Hemispherical		
Replaceable <sup>(2)</sup> Window	Yes, from left side	Yes, from left side	Yes, from right side	Yes, from front	Yes, from left side	Yes	Yes
Window Type	80 µgram/cm <sup>2</sup>						
GFP Cosmic Guard	Yes					No	No
P-10 Gas Control	Gas-PRO <sup>(11)</sup>						
Shield Type	Split Sphere	Split Sphere	Brick	Brick + custom	Split Sphere	Opt. Lead Ring	NA
Detector Opts	N/A	GM, ZnS	N/A	N/A	GM, ZnS	Dual Scintillator (non gas flow)	N/A
Sample Capacity	50 with removeable sample tubes	50/100 with removeable sample stacks	50 with removeable sample stacks	1 per detector independent sample drawers	1		
Sample # Range	N/A	1–1000	1–1000	N/A			
Sample Reader Type	N/A Opt. Bar Code	Bar Code (Code 39)	Bar Code (Code 39)	N/A			
Sample Carrier Type <sup>(9)</sup>	Circular Metal (SS or Al)	Plastic	Plastic <sup>(3)</sup>	Plastic	Circular Metal (SS or Al)		
Sample Depth <sup>(10)</sup>	1/8, 1/4, 5/16, inch						
Depth Selection	Carrier Selection	Snap-in Plastic Inserts			Carrier Selection		
User Interface	Console/PC			PC	Console/PC	Console/PC	PC
Footprint W x D in.	22 x 34	32 x 25	25 x 36	32 x 16	23 x 24	9 x 16	See Note 6
Height (inches)	15	15	48	16	14	17	See Note 6
Cabinet/50/100	28	33	67	N/A	N/A	N/A	
Sample Stacks	N/A	51	N/A	N/A	N/A	N/A	
Weight	430 lbs.	430 lbs.	1800 lbs.	1200 lbs./ 4 detectors	380 lbs.	35 lbs.	15 lbs.
Power	117 V ac ±10%, <1.7 A, 50/60 Hz 230 V ac ±10%, <0.9 A, 50/60 Hz						Requires external system supply
Environment	Operating Temperature Range: 10–40°C, Humidity: 20–90% non-condensing						
Warranty	12 Month Limited Warranty, excluding consumables						

# Operational Specifications



Operation	IPC-9025	WPC-9550	WPC-9450	MDS	MPC-9300	MPC-2000	MPC-9900
Count Routines (8) (Procedures)	12	12	12	Unlimited	1	12	Unlimited
Control Charts (8)	4	4	4	Unlimited	1	4	Unlimited
Data Points Tracked Displayed per Control Chart	400 Checkpoints/40 Limits Points						
Built-In Charting without PC	Yes	Yes	Yes	N/A	Yes	Yes	N/A
Direct Printer Support without PC	Yes	Yes	Yes	N/A	Yes	Yes	N/A
Automatic Plateau	Yes						
Plateau Plotting and Printing without PC	Yes	Yes	Yes	N/A	Yes	Yes	N/A
Single Point Efficiency Calibrations	Yes						
Multi-Point Efficiency Calibrations	Yes, 20 point – 1 set per count routine						
Standards Table with Decay Correction	Yes						
PC Control Interface Standard	Yes	Yes	Yes	N/A	Yes	Yes	N/A
Interface Type	RS-232/RS-485						
Console and PC Control Simultaneously	Yes	Yes	Yes	N/A	Yes	Yes	N/A
Software Options	PIC Routines	PIC Routines and Vista 2000					
Detector Count Modes (13)	Alpha Only Alpha + Beta Beta Only	Alpha Only Alpha + Beta Beta Only Alpha then Beta	Alpha Only Alpha + Beta Beta Only Alpha then Beta	Alpha Only Alpha + Beta Beta Only Alpha then Beta	Alpha Only Alpha + Beta Beta Only Alpha then Beta	Alpha Only Alpha + Beta Beta Only Alpha then Beta	Alpha Only Alpha + Beta Beta Only Alpha then Beta
Sample Control Modes	Single Sample Continuous Feed Specific Routine	Stack Directed Single Sample Continuous Feed Specific Routing		N/A			
Recount and Restack	Both. Recount manually or automatically selected			Recount. Restack N/A	Recount. Restack N/A	Recount. Restack N/A	Recount. Restack N/A
Battery Backed Data (5) and System Memory	Yes 1000 Samples	Yes 1000 Samples	Yes 1000 Samples	Yes	Yes	Yes	Yes

# Sensitivity & Sample Throughput

Sample throughput in a counting system is most affected by efficiency and background. Efficiency and background performance determine the sensitivity of the system. Low background systems are often specified using system performance data and sample performance data. It is important to understand both to compare systems. System efficiency and background is the best possible performance available from the low background system. System performance is measured by minimizing sample effects as much as possible. In most cases system performance cannot be changed, so selecting a model with the best system performance is critical to sample throughput.

Sample background and efficiency depend on preparation techniques, geometry, and content. All are variable, and are controlled to some extent by the user. For example, a sample can be placed close to the detector to improve efficiency, or further away from the detector to reduce the chance of detector window breakage. When you compare systems, it is important to compare system performance to system performance, and compare sample performance to sample performance. This is relatively easy if you calculate a "Figure of Merit" using *equivalent* performance specifications for each system. Figure of Merit is calculated by the equation:

$$E^2/B$$

where **E** is the efficiency (in percent) for the sample type of interest, and **B** is the background for the system. Given the same sample and counting sensitivity requirements, a system with twice the Figure of Merit will have twice the sample throughput. Here is a comparison of systems with some older technology systems.

	PIC	Brand X	Brand Y	PIC Factor
Sr90	8643	3291	1558	2.6
Am241	50625	25200	1356	2
C14	2571	1286	692	2
Ni63	786	438	236	1.7
Tc99	3500	1750	942	2
Po210	55225	25200	692	2.2

\*All comparisons are based on the latest available published specifications. "Typical" efficiency and background specifications are used. The same comparison can be made using the "warranted" specifications. All specifications are based on a gas flow detector with 80 mgm/cm<sup>2</sup> window.

- (1) Only one vendor publishes C<sup>14</sup> efficiency. That value (30%) was used for all vendors. Individual beta efficiency values were used.
- (2) One vendor does not publish separate alpha and beta background values. The published total alpha+beta value was used. In fairness to that vendor the Figures of Merit would be better than shown here. However they are highly unlikely to be better than brand X.
- (3) PIC is the only vendor that publishes Tc<sup>99</sup> efficiency. That value was used for brands X and Y.
- (4) PIC factor is the ratio of Protean's Figure of Merit to the next highest competitor's value.
- (5) PIC is the only vendor who publishes Ni63 efficiency (17.5%). This value was used for brands X and Y.

Window	Top	1/8 Inch	1/4 Inch	5/16 Inch
Sr90/Y90	54.25%	47.17%	39.48%	37.04%
Tc99	43.06%	34.37%	27.47%	25.26%
Ni63	17.46%	10.51%	5.13%	3.86%
Th230	42.00%	34.53%	27.63%	25.45%

Windowless	Top	1/8 Inch	1/4 Inch	5/16 Inch
Sr90/Y90	63.06%	63.13%	62.20%	61.80%
Tc99	56.77%	56.67%	56.23%	53.42%
Ni63	48.14%	48.07%	47.66%	47.76%
Th230	49.14%	49.43%	49.79%	49.76%

The efficiency data above was collected on a Protean Instrument Corporation IPC-9025 windowed/windowless system. The sources are all calibrated, and in a form to eliminate as many geometry variables as possible. Each source was counted at 4 depths, "top", 1/8, 1/4, and 5/16 inches. Top placement is done by using a 1/8 inch planchet inverted in a 1/8 inch insert. The source is then at the minimum distance possible (approximately 1/16 inch). The upper table is for a system with a standard 80 gram/cc<sup>2</sup> window installed. The lower table is for the same system with the window removed.

A system with a window shows a great change in efficiency depending on sample depth. This effect is the same regardless of system type. A windowless system shows a substantial increase in efficiency compared to a windowed system, and very little efficiency change due a sample depth.

The best possible sensitivity is achieved using a windowless system with ultra-low system background. Using the efficiency figures for Sr90 above, a typical beta background of 0.45 CPM, and 1/8" sample depth, a IPC-9025 system has a Figure of Merit of:

$$63 * 63 / .45 = \mathbf{8820} \text{ (windowless)}$$

or

$$47 * 47 / .45 = \mathbf{4500} \text{ (w/80 microgram window)}$$

In practical terms this means that the windowless system will count the same sample to the same sensitivity (MDA), in 1/2 the time of the system with a window installed.

## Notes

- 1) GFP: gas flow proportional detector. Uses P-10 (10% Methane, 90% Argon) counting gas.  
WWL: window or windowless operation, field changeable.
- 2) Windows are ultra-thin aluminum coated mylar. The 2" window (P.N. 120-0008) is a direct replacement for most 2 inch detector windows from other vendors
- 3) Background levels are given as Typical/Warranted. Background performance is measured at Lenoir City, Tennessee, under typical laboratory conditions. Background performance is highly dependent on background environment where the system is installed. Background levels can change according to atmospheric changes, cosmic activity, and altitude where the system is installed.
- 4) Efficiency values are given as Typical/Warranted. Efficiencies are measured according to ANSI N42.25-1997 guidelines. These guidelines are intended to measure counting system performance with the least amount of sample effect possible. Measurements are made using a zero mass point source, positioned as close to the detector face as possible. In general, efficiencies measured using sample specific geometries will be lower. Beta efficiencies include backscatter. Alpha efficiencies include recoil. Efficiencies are given as 4 pi.
- 5) Battery backed-up memory retains sample data and systems parameters. Available memory is shared between system and sample data. With typical programming, approximately 1000 sample data locations are available. Battery life is estimated to be 8–10 years.
- 6) The MPC-9900 is a system component designed for rack mounting. Front panel dimensions are 5-5/8 x 10 inches. Depth is 23 inches including clearance for rear panel connectors and sample drawer actuator.
- 7) Crosstalk (or spillover) is actually ~1 count per 100,000 counts, for either alpha into beta or beta in alpha.
- 8) All systems with dual control (console + PC) can have routines resident in the counting system and in the PC. Counting routine storage on the PC is limited by PC storage space.
- 9) Circular planchet carriers are available in stainless steel or aluminum. Stainless steel carriers are shipped by default with new systems, and are recommended for the best background performance.
- 10) One set of carriers and inserts (if applicable) is supplied with each system. The number of carriers and inserts corresponds to the sample capacity of the system. Customer should specify sample depth at time of order. If sample depth is not specified, 5/16 in. carriers and inserts will be shipped.
- 11) Gas-PRO monitors P-10 gas FLOW through the entire system. Any disruption, including low or no gas supply, obstructed tubing on the input or output side, or leaking or torn detector window will be detected by the system and sample counting halted.
- 12) Calibration sources are required for all systems. At a minimum, a plateau generation source is required. We recommend a button style point source containing Sr90 with 0.1 microCurie nominal activity. Calibrated alpha and beta sources should be selected as appropriate for the samples to be counted. In general the following guidelines apply:  
  
System calibration sources should be point sources, electroplated, and conductive mounted to a conductive carrier. Sample calibration sources should have the same isotope, or one with similar energy. The geometry should be the same as the samples (distributed or point, and the same depth).  
  
Protean Instrument Corporation does not supply calibration sources. We can assist you in selecting appropriate sources from a reliable supplier.
- 13) Alpha then beta (sequential) detector mode is available with a PC controlled system.

**All specifications are current as of March 2001. Specifications are subject to change. Please contact the factory to confirm specifications that may be critical to your applications.**

## Ordering Information



PIC-	INCLUDES	OPTIONS
WPC-9550	WPC-9550 System with manual 50 Sample Stack Set 50 Sample Carriers #1-50 50 Inserts 1/8 in., 5/16 in. Control and QC Plates Gas Tank Regulator, gas line and fittings Line Printer 12 Month Warranty	Cart Installation and familiarization on-site 100 Sample Stack Set (with 100 sample carriers and inserts) Warranty Extension
WPC-9550-PC	WPC-9550 System with manual 50 Sample Stack Set 50 Sample Carriers #1-50 50 Inserts 1/8 in., 5/16 in. Control and QC Plates Gas Tank Regulator, gas line and fittings PC System with Laser Printer PIC Communication Software PIC Spreadsheet Template Software PIC Vista 2000 Software 12 Month Warranty	Cart Installation and familiarization on-site 100 Sample Stack Set (with 100 sample carriers and inserts) Warranty Extension
WPC-9550-FC	WPC-9550 System with manual 50 Sample Stack Set 50 Sample Carriers #1-50 50 Inserts 1/8 in., 5/16 in. Control and QC Plates Gas Tank Regulator, gas line and fittings Touch Panel PC System with Laser Printer PIC Touch Panel Software Touch Panel Mounting Bracket 12 Month Warranty	Cart Installation and familiarization on-site 100 Sample Stack Set (with 100 sample carriers and inserts) Warranty Extension
IPC-9025	IPC-9025 System with Manual 50 Sample Carriers <b>Specify Depth at Time of Order</b> 12 Month Warranty	Cart Installation and familiarization on-site
MDS-4/8/12/16	MPC-9604 System (1 per 4 Detectors) Manual 1 Sampler Carrier per Detector One 1/8 in., 1/4 in., 5/16 in., Inserts per Detector PC System with Software and Laser Printer On-Site Installation and Familiarization 12 Month Warranty	Cart (1 per MPC-9304) Custom Rack Assembly Warranty Extension
WPC-9450	WPC-9450 System with Manual Wheeled Base 50 Sample Carriers Line Printer On-Site Installation and Familiarization 12 Month Warranty	Warranty Extension
MPC-2000-B	MPC-2000 with Keypad Controller One each 1/8 in., 1/4 in., and 5/16 in. Sampler Carrier Manual 12 Month Warranty	Line Printer Warranty Extension
WPC-2000-FC	MPC-2000 with Touch Screen Controller One each 1/8 in., 1/4 in., and 5/16 in. Sampler Carrier Manual 12 Month Warranty	Line Printer Warranty Extension
MPC-9300	MPC-9300 System with Manual One each 1/8 in., 1/4 in., and 5/16 in. Sampler Carrier 12 Month Warranty	Cart Installation and familiarization on-site Warranty Extension
MPC-9900	All Systems are Custom Quoted Contact Factory for Details	

# Alpha/Beta Counting System Selection Guide

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Specifications subject to change without notice  
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info@ortec-online.com • Fax (865) 483-0396  
801 South Illinois Ave., Oak Ridge, TN 37831-0895 U.S.A. • (865) 482-4411  
For International Office Locations, Visit Our Website

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