



Product Guide

AEROSOLINSTRUMENTS

Micro Technologies, Big Ideas.

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ABOUT THIS GUIDE

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ABOUT MSP

MSP uses its expertise in nano/micro particles to design, develop, and manufacture scientific instruments and equipment for airborne particle sampling and measurement, pharmaceutical inhaler testing, and semiconductor applications. MSP is noted for its innovative products and the creative use of aerosols for useful applications.

SELECTION GUIDE

WIDE-RANGE PARTICLE SPECTROMETERS™ (WPS™) and COUNTERS

MODEL	INSTRUMENT	FLOW RATE, LPM	SIZE RANGE, nm
M1000XP-A	Wide-Range Particle Spectrometer (WPS)	1.0	10 to 10,000 (WPS)
M1000XP-B	Scanning Mobility Spectrometer (SMS)	0.3	10 to 500 (SMS)
M1100	High-Dilution CPC (CPC-HD)	0.3	5 – 20 (User selectable detection limit)

Table 1

MOUDI IMPACTORS

MODEL	FLOWRATE (LPM)	STAGES	CUT-POINT DIAMETER, μm												
			0.01	0.018	0.032	0.056	0.1	0.18	0.32	0.56	1.0	1.8	3.2	5.6	10
MOUDI Impactors: 8 or 10 Rotating (R) Stages or Non-Rotating (NR) Stages															
M100	30	8							X	X	X	X	X	X	X
M110	30	10				X	X	X	X	X	X	X	X	X	X
NanoMOUDIs: 3—Stage Non-Rotating (NR) Impactors for use with M110 to lower the cut-size to 10 nm															
M115	10	3	X	X	X										
M116	30	3	X	X	X										
MOUDI Impactor: 3—Stage Non-Rotating Impactor for use with the Andersen to lower the cut-size of the Andersen to 0.056 μm; use with M116 to further reduce the cut-size to 10 nm															
M118	30	3				X	X	X							
MOUDI-II Impactor: 2nd Generation MOUDI Impactor with Stepper Motor Rotating (R) or Non-Rotating (NR) Stages															
M120*	30	10				X	X	X	X	X	X	X	X	X	X
M122	30	13	X	X	X	X	X	X	X	X	X	X	X	X	X
M125	10	13	X	X	X	X	X	X	X	X	X	X	X	X	X
MiniMOUDI Impactor: 6, 8, 10, and 13 Non-Rotating (NR) Stages for personal sampling and laboratory use															
M135-6	2	6								X	X	X	X	X	X
M135-8	2	8						X	X	X	X	X	X	X	X
M135-10	2	10				X	X	X	X	X	X	X	X	X	X
M135-13	2	13	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 2

*Model available as a Rotating only.

IMPACTOR AND PARTICLE SAMPLERS

MODEL	FLOWRATE (LPM)	STAGES	CUT-POINT DIAMETER, μm							
			0.25	0.4	0.8	1.0	1.4	2.5	10	
4-Stage Micro-Orifice Impactor: for PM1, PM2.5 and PM10 Sampling										
M100-S4	30	3					X		X	X
High Flow Impactor (HFI)										
M128	100	3					X		X	X
M129	100	4	X				X		X	X
M130	100	5	X	X	X			X	X	
M131	100	6	X	X	X			X	X	X
Personal Environmental Monitor: for PM2.5 and PM10 Sampling										
M200	2, 4, 10	1							X	X
Personal Environmental Aerosol Speciation Sampler (PMASS)										
M240	4								X	
Micro-Environmental Monitor										
M400	10	1							X	X
M150	Marple-Miller Impactor: 30 L/min									
M160	Marple-Miller Impactor: 60 L/min									
M310	Universal Air Sampler: 300 L/min									
M4100	Airborne Multiple Impactor (with M130 impactor cutpoints)									
M4200	Aerosol Concentrator: 2.0 μm cut virtual impactor									
M4240	Aerosol Concentrator: 1.0 μm cut virtual impactor									

Table 2

WIDE-RANGE SPECTROMETERS AND IMPACTORS

M1000XP Wide-Range Particle Spectrometer (WPS™) is an aerosol measuring instrument using laser light scattering, differential mobility analysis and condensation particle counting to count and size aerosol particles over a wide size range. The WPS and the MOUDI-II impactors from MSP are wide-range aerosol instruments for size distribution analysis of aerosols from 10 nm to 10,000 nm in diameter. Key features of the WPS include:



- Miniature high-performance aerosol sensors including a miniature high-resolution Differential Mobility Analyzer (DMA), a Dual-Reservoir Condensation Particle Counter (CPC) and a Wide-Angle Laser Spectrometer (LPS)
- DMA: 12, 24, 48 or 96 Channels
LPS: 24 Channels
Total: Up to 120 Channels
- Refractive index correction for light scattering size measurement (1.30 to 1.60)
- NIST traceable particle size calibration
- Pulse-width modulated control for accurate temperature and flow rate settings
- Recipe control of instrument settings
- Five (5) user-selectable modes of operation: as (1) WPS, (2) scanning WPS (SWPS), (3) laser particle spectrometer (LPS), (4) differential mobility spectrometer (DMS), and (5) scanning mobility spectrometer (SMS)
- Powerful, built-in computer
- Powerful aerosol data analysis software
- Self-contained flow system (no external pump needed)
- Remote Operation Capability

M120, M122, M125 MOUDI-II™ and NanoMOUDI-II™ IMPACTORS are 2nd generation Micro-Orifice, Uniform-Deposit Impactors from MSP. The MOUDI™ impactors are noted for their superior aerodynamic design, sharp cut-size, and low particle loss characteristics. Up to 2000 precision micro-orifice nozzles are used to reduce pressure drop, jet velocity, particle bounce, and re-entrainment. Individual stepper motors in the MOUDI-II impactors rotate the impaction plates to spread out the particle deposit into a nearly uniform layer within a 25-mm-diameter circular area. Non-rotating versions of the impactors are also available.

Sampling flow rates are 30 L/min for the M120 and M122 and 10 L/min for the M125. The impactors are designed to collect size-fractionated particle samples in 4 equal geometrical intervals per decade of particle size for mass or chemical analyses. The cut-size diameters are: 10, 18, 32, 56, 100, 180, 320, 560, 1000, 1800, 3200, 5600, and 10000 nm.



M122



M125

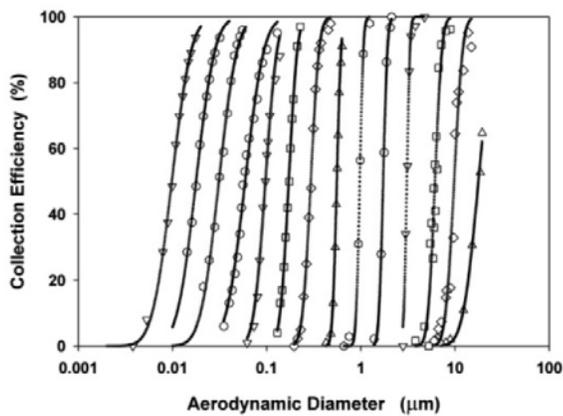
IMPACTORS, SAMPLERS, AND COUNTERS

M100 and **M110** MOUDI™ IMPACTORS are precision cascade impactors with sharp cut-size and low internal-loss characteristics. They are members of the MOUDI™ family of precision, high-accuracy impactors from MSP featuring:

- 30 L/min sampling flow rate
- 37mm or 47mm collecting substrates
- Micro-orifice nozzles to minimize pressure drop, particle bounce, and re-entrainment

The Model 100 has 8 impaction stages and cut-size diameters from 0.18 μm to 18 μm . The Model 110 has 10 impaction stages and cut-size diameters from 0.056 μm to 18 μm . They are available with stage rotation (M100-R or M110-R) or without (M100-NR and M110-NR). Stage rotation allows particle deposit on the impaction plate to spread out over a circular area to form a nearly uniform layer.

M100-S4 PM1.0/2.5/10 SAMPLER is a size-fractionating particle sampler with three impactor stages plus a final filter stage. The sampling flow rate is 30 L/min. Designed for PM1, PM2.5 and PM10 sampling the M100-S4 has impaction stages with cut-size diameters of 1.0, 2.5, and 10 μm . Particles in the 1.0–2.5 μm and 2.5–10 μm diameter ranges are collected by the 2nd and 3rd stage impactors. The final filter then collects particles <1.0 μm . (Model not shown)



M110-R



M100-NR



Sample Holders for M110 and M100

IMPACTORS, SAMPLERS, AND COUNTERS

M115, M116, M118 are **MOUDI IMPACTORS** designed to work with existing impactors to extend their lower cut-size into the nanometer range.

The M115 and M116 are NanoMOUDI impactors with cut-size diameters of 10, 18, and 32 nm. The M115 has a 10 L/min sampling flow rate and is designed as an accessory for the 10-stage MOUDI (**M110**). An inlet adapter replaces the filter holder of the Model 110 to allow the 30 L/min flow exiting the M110 to split into two streams: a 10 L/min stream for the M115 NanoMOUDI to collect size fractionated particle samples in the nanometer size range, and a 20 L/min stream to be discarded or collected by a separate filter.



M115



M116

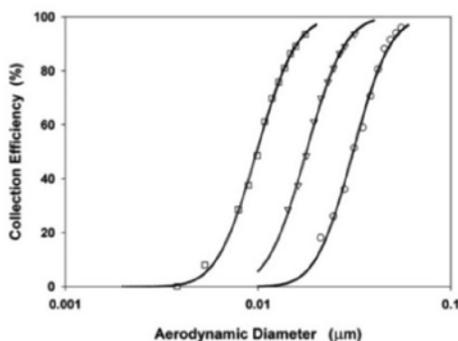


M118

The **M116** NanoMOUDI has a sampling flow rate of 30 L/min and is designed for use with the **M110-NR** to provide three additional impactor cut-sizes at 32, 18 and 10 nm and to extend the lower cut-size limit of the M110 from 56 nm to 10 nm.

The **M118** MOUDI has a sampling flow rate of 30 L/min and is designed to work with the Andersen impactor to provide three additional impactor cut-size diameters at 56, 100, and 180 nm and extend the lower cut-size limit of the Andersen to 56 nm. Additional nano-stages are also available to further extend the lower cut-size limit of the Andersen to 10 nm.

Stage Efficiency Curves for the NanoMOUDI



M128, M129, M130, M131 are **HIGH FLOW IMPACTORS (HFI™)** with a sampling flow rate of 100 L/min. They are available with 3, 4, 5, and 6 impaction stages plus a final filter. Their high sampling flow rate makes them ideal for sampling particles at low concentrations or for obtaining samples in a short sampling time duration.

MODEL	STAGES	CUT-POINT DIAMETER, µm						
		0.25	0.4	0.8	1.0	1.4	2.5	10
M128	3				X		X	X
M129	4	X			X		X	X
M130	5	X	X	X		X	X	
M131	6	X	X	X		X	X	X



M135 MiniMOUDI™ impactors are precision, high-accuracy impactors with a 2.0 L/min sampling flow rate and a small physical size. They are available with 6, 8, 10, and 13 impaction stages to provide size-fractionated particle samples as small as 10 nm. The 6- and 8-stage versions of the M135 are for personal sampling and are referred to as Marple Personal II impactors to replace the older Marple personal impactors on the market.

MODEL	STAGES	LAST STAGE CUT SIZE, µm	1 ST STAGE CUT SIZE, µm
M135-6	6	0.56	10
M135-8	8	0.18	10
M135-10	10	0.056	10
M135-13	13	0.010	10



M150 and **M160** **MARPLE-MILLER IMPACTOR (MMI™)** is a five-stage impactor with collection cups instead of the conventional collection plates. Originally designed for size distribution analysis of pharmaceutical sprays, the MMI has found a variety of uses including size distribution analysis of oil mist and soot particles from crankcase blowby of diesel engines. Cut-size diameters are 10, 5, 2.5, 1.25, and 0.625 µm. Easily removable collection cups allow direct weighing of collected particles or droplets. Solvent can be added to the collection cups for sample extraction and subsequent chemical analysis.

Original design for size distribution analysis of pharmaceutical sprays, the MMI has found a variety of uses including size distribution analysis of oil mist and soot particles from crankcase blowby of diesel engines. Cut-size diameters are 10, 5, 2.5, 1.25, and 0.625 µm. Easily removable collection cups allow direct weighing of collected particles or droplets. Solvent can be added to the collection cups for sample extraction and subsequent chemical analysis.

IMPACTORS, SAMPLERS, AND COUNTERS

M200 PERSONAL ENVIRONMENTAL MONITORS (PEM™)



are small, light-weight personal samplers comprised of a single-stage impactor followed by a 37 mm filter to collect particle samples from the ambient air. Impactor cut-size diameters of 2.5 µm and 10 µm are available

for sampling at 2, 4, or 10 L/min for personal PM2.5 and PM10 sampling. The PEM can be operated with personal sampling pumps for personal PM2.5 and PM10 exposure studies.

SPECIFICATIONS

MODEL	FLOW RATE (L/min)	CUT-POINT, µm	COLOR	PRESSURE DROP* (inwg)
PEM 2-2.5	2.0	2.5	Blue	1
PEM-4-2.5	4.0	2.5	Black	3
PEM-10-2.5	10.0	2.5	Red	13
PEM-2-10	2.0	10.0	Green	1
PEM-4-10	4.0	10.0	Outside Gold	2
PEM-10-10	10.0	10.0	Orange	12

*Vacuum measured at hose-barb with glass fiber filter in place

Filter Diameter:	37 mm
Dimensions:	60 x 65 x 22 mm (W x H x D)
Weight:	48 g (1.7 oz.)

ACCESSORIES/REPLACEMENT PARTS

PEM-002	Flow calibration cap
PEM-004	Clamping fixture assembly
PEM-009c	Stainless steel filter support
PEM-009a	Spanner screws

M240 is a Personal Micro-environmental Aerosol Speciation Sampler (PMASS™). It is a compact sampler with a miniaturized, sharp-cut cyclone inlet and two parallel collection channels. Each channel accommodates a denuder and two tandem filters for complete, artifact-free evaluation of the chemical composition of particles below 2.5 µm diameter. The PMASS™ is light and small enough to be worn by a person. Field tests yield results equivalent to that of conventional samplers. The device may also be used with a desktop sampling station for sampling in a microenvironment.



SPECIFICATIONS

(Subject to change without notice)

Total Flow Rate	4.0 L/min
Flow Rate Per Channel	2.0 L/min
Dimensions:	4.2" x 2.6" x 1.8" (W x H x D) (106 x 65 x 45 mm)
Weight:	300 g (11 oz)

M310 UNIVERSAL AIR SAMPLER (UAS™)



is a 300 L/min air sampler for PM2.5, PM10, or dichotomous sampling. It is comprised of a multi-nozzle virtual impactor for size separation at 2.5 and 10 µm. Its modular design permits PM2.5, PM10, or dichotomous sampling. It also includes a PUF sampler for collecting volatile organic compounds (VOC). A programmable solid-state timer is included for multiple start/stop operations.

M400 MICRO-ENVIRONMENTAL MONITOR (MEM™)

is a 10 L/min sampler with an omnidirectional inlet, a single 2.5 µm or 10 µm impactor stage followed by a final filter to collect PM2.5 or PM10 particles for gravimetric and/or chemical analyses. It has a quiet sampling pump, a multi-day timer permitting up to 14 programmable starts and stops. It is intended for micro-environmental monitoring of PM2.5 or PM10 particles.



WIDE-RANGE SPECTROMETERS AND IMPACTORS

M1100 CPD-HD™ is a condensation particle counting system with built-in high-dilution capabilities. A built-in two-stage, variable ratio diluter permits up to 15,000-to-1 in dilution for measuring particle concentration up to 1.5×10^8 particles/cc. The CPC-HD is ideally suited for measuring diesel exhaust particulates and highly concentrated aerosols from combustion or other sources.



The lower size limit of the CPS is user-selectable and can be adjusted from 5 to 20 nm in diameter.

M4100 AIRBORNE MULTIPLE IMPACTOR is a multiple impactor sampler for aerosol sampling on an aircraft. Designed for the Navy and used in ACE-Asia and other flight campaigns, it has eight (8) 300 L/min multi-stage impactors placed in an instrument pod attached to the airplane wing. Automated computer control permits aerosol sampling in flight for a variety of scientific experiments.



M4200 and M4240 AEROSOL CONCENTRATOR is a virtual impactor aerosol concentrator. Air is sampled at 300 L/min per minute into the concentrator. Particles



$>2.0 \mu\text{m}$ (Model 4220) or $>1.0 \mu\text{m}$ (Model 4240) are classified by inertial separation and concentrated into a 1.0 L/min air stream for collection and analysis. Patented multiple nozzle virtual impactor design ensures high concentrating efficiency and low interstage particle loss. Low overall pressure drop makes it ideal for a wide variety of applications in environmental sampling where concentrated particle samples in the >2.0 and $>1.0 \mu\text{m}$ must be collected for mass, chemical, and/or biological agent detection.

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