

# ULTRA-PRECISION POROMETER SET-UP

## (PULSE TECHNIQUE)

## MPPM-Series

**Introduction:** MAPMT series of precision pulse porometers measurement set up are available in more than ten different models virtually offering measurement solutions to measuring the diameter of a constricted located pore, the largest/mean pore diameter, the pore distribution, and gas permeability in a porous material. It can effectively measures static/dynamic porometers of pour size varying from 1.0 to 100.0 micron measured for either air or any other gas or vapour. ranging under varied temperature, humidity conditions. These porometers meters are offered in material like SS-316 (ceramic/Teflon coating), polypropylene, derelin etc to make up with corrosion, thermodynamical and other pertinent physical parameters of fluid/gas under measurement. On account of above, these porometers meters are first choice for paper, polymers, cosmetic, foam, leather, PVC, wood, cotton, insulator material, laminates, filters, civil structure, soil, fins, food items etc medical diagnostic, agro, biomedical, petrochemical, automobile, organic/inorganic chemical, milk plant, sugar, textiles, beverages, water management/treatment, academic and defense. These porometers are available for various functions namely.....

1. Capillary flow meter
2. Clamp-on porometer
3. Ultra-micro porometer
4. Cyclic porometer
5. Radial porometer
6. Volumetric porometer
7. Average Fiber diameter/surface area/particle analyzer

**Operating Principle:** The pores in the sample are spontaneously filled with a wetting liquid. Pressure of a nonreacting gas on one side of the sample is slowly increased to remove liquid from pores and permit gas flow through the pores. It measured differential pressures and flow rates of gas through wet and dry conditions of the sample are used to compute pore structure characteristics of sample textile fabric, paper, polymers, cosmetic, foam, leather, PVC, wood, cotton, insulator material, laminates, filters, cosmetic fins, civil items, food items etc. It can effectively measures static/dynamic porometers of pour size varying from 1.0 to 100.0 micron measured for either air or any other gas or vapour. ranging under varied temperature, humidity conditions. These porometers meters are offered in material like SS-316 (ceramic/Teflon coating), polypropylene, derelin etc to make up with corrosion, thermodynamical and other pertinent. Whole flow mechanism of flow through pore and its Pressure Vs flow and other dynamics is as under.....

**Darcy model of intrinsic permeability porous material with liquid flow:**

$$Q = k.A.dP/u.L \dots\dots Q = \text{Flow rate, } dP = \text{differential pore pressure, } dpo = \text{Bubble pressure, } L = \text{flow path,}$$

$$Up = \text{fluid viscosity } dP > \text{bubble pressure}$$

Differential pressure across sample at which bubble rupture starts afterwards flow increases in proportional to differential pressure.....

$$dP = 4.y. \cos(\theta)/D \dots\dots \text{ where } \gamma = \text{surface tension, } D = \text{pore diameter}$$

Flow rate through pores once bubble point is crossed is as under.....

$$Q = 3.14.dP.R^4.(8L.U_p)X [1 - (1.333.(dp_o/dP) + 0.333(dp_o/dP)^2)]$$

$$K = Q.U_w.L./A.Dp = 0.125.R^2(8L.U_p)X [1 - (1.333.(dp_o/dP) + 0.333(dp_o/dP)^2)]$$

$$Q = \text{Flow rate, } DP = \text{differential pore pressure, } dpo = \text{Bubble pressure, } L = \text{flow path,}$$

$$Up = \text{ratio of shear stress/shear strain when } dP > \text{bubble pressure}$$



Micro-flow sensor



Bubble tester- MPPM-050



Clamp-on porometer



### ELECTRICAL/MECHANICAL SPECIFICATIONS OF Gas/Liquid Porometers:

#### Low pressure/low flow:

MODEL	Pressure psi	Flow range 10 <sup>-3</sup> Litre/min	Permeability range Gmsx10 <sup>-4</sup> /m s Pa	Pore size Min/max Dia-micro	Accuracy / Repeatability	Sample material/area/thickness	Porometers tube-Liner	Leak rate
MPPM-00011	0.01-1.000	0.0001.0-0010.0	009.999	0.1-50/option	99.9/100	Option/1/2/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00021	0.01-1.000	0.0001.0-0010.0	09.9999	0.1-50/option	99.9/100	Option/3/4/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00041	0.01-1.000	0.0001.0-0010.0	99.9999	0.1-50/option	99.9/100	Option/1.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00071	0.01-1.000	0.0001.0-0010.0	999.999	0.1-50/option	99.9/100	Option/1.5/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00101	0.01-1.000	0.0001.0-0010.0	999.999	0.1-50/option	99.9/100	Option/2.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00201	0.01-1.000	0.0001.0-0010.0	999.999	0.1-50/option	99.9/100	Option/3.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00501	0.01-1.000	0.0001.0-0010.0	999.999	0.1-50/option	99.9/100	Option/4.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-01001	0.01-1.000	0.0001.0-0010.0	999.999	0.1-50/option	99.9/100	Option/6.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-02001	0.01-1.000	0.0001.0-0010.0	999.999	0.1-50/option	99.9/100	Option/8.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10

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# ULTRA-PRECISION POROMETER MASUREMENT SET-UP

## (PULSE TECHNIQUE)

MPPM-Series

### Electrical/Mechanical Specification Gas/Liquid Porometers :

#### low pressure /high flow:

MODEL	Pressure psi	Flow range Litre/ min	Porometers range Gmsx10 <sup>-4</sup> / m s Pa	Pore size Min/ max	Accuracy / Repeatability	Sample material/area/thickness	Porometers tube-Liner	Leak rate
MPPM-00012	0.01-1.000	0.01.0-0100.0	009.999	0.05-0.5/option	99.9/100	Option/1/2/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00022	0.01-1.000	0.01.0-0100.0	09.9999	0.05-0.5/option	99.9/100	Option/3/4/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00042	0.01-1.000	0.01.0-0100.0	99.9999	0.05-0.5/option	99.9/100	Option/1.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00072	0.01-1.000	0.01.0-0100.0	999.999	0.05-0.5/option	99.9/100	Option/1.5/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00102	0.01-1.000	0.01.0-0100.0	999.999	0.05-0.5/option	99.9/100	Option/2.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00202	0.01-1.000	0.01.0-0100.0	999.999	0.05-0.5/option	99.9/100	Option/3.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00502	0.01-1.000	0.01.0-0100.0	999.999	0.05-0.5/option	99.9/100	Option/4.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-01002	0.01-1.000	0.01.0-0100.0	999.999	0.05-0.5/option	99.9/100	Option/6.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-02002	0.01-1.000	0.01.0-0100.0	999.999	0.05-0.5/option	99.9/100	Option/8.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10

### Electrical/Mechanical Specification Gas/Liquid Porometers:

#### High Pressure/low flow:

MODEL	Pressure psi	Flow range 10 <sup>-3</sup> Litre/ min	Porometers range Gmsx10 <sup>-4</sup> /m s Pa	Pore size Min/ max Micron-diameter	Accuracy / Repeatability	Sample material/area/thickness	Porometers tube-Liner	Leak rate
MPPM-00013	001.0-100.0	0.0001.0-0010.0	009.999	0.05-0.5/option	99.9/100	Option/1/2/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00023	001.0-100.0	0.0001.0-0010.0	09.9999	0.05-0.5/option	99.9/100	Option/3/4/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00043	001.0-100.0	0.0001.0-0010.0	99.9999	0.05-0.5/option	99.9/100	Option/1.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00073	001.0-100.0	0.0001.0-0010.0	999.999	0.05-0.5/option	99.9/100	Option/1.5/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00103	001.0-100.0	0.0001.0-0010.0	999.999	0.05-0.5/option	99.9/100	Option/2.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00203	001.0-100.0	0.0001.0-0010.0	999.999	0.05-0.5/option	99.9/100	Option/3.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00503	001.0-100.0	0.0001.0-0010.0	999.999	0.05-0.5/option	99.9/100	Option/4.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-01003	001.0-100.0	0.0001.0-0010.0	999.999	0.05-0.5/option	99.9/100	Option/6.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-02003	001.0-100.0	0.0001.0-0010.0	999.999	0.05-0.5/option	99.9/100	Option/8.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10

### ELECTRICAL/MECHANICAL SPECIFICATIONS OF Gas/Liquid Porometers

#### High Pressure/High flow:

MODEL	Pressure psi	Flow range Litre/ min	Porometers range Gmsx10 <sup>-4</sup> /m s Pa	Pore size Min/ max	Accuracy / Repeatability	Sample material/area/thickness	Porometers tube-Liner	Leak rate
MPPM-00014	001.0-100.0	0.01.0-0100.0	009.999	0.1-50/option	99.9/100	Option/1/2/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00024	001.0-100.0	0.01.0-0100.0	09.9999	0.1-50/option	99.9/100	Option/3/4/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00044	001.0-100.0	0.01.0-0100.0	99.9999	0.1-50/option	99.9/100	Option/1.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00074	001.0-100.0	0.01.0-0100.0	999.999	0.1-50/option	99.9/100	Option/1.5/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00104	001.0-100.0	0.01.0-0100.0	999.999	0.1-50/option	99.9/100	Option/2.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00204	001.0-100.0	0.01.0-0100.0	999.999	0.1-50/option	99.9/100	Option/3.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-00504	001.0-100.0	0.01.0-0100.0	999.999	0.1-50/option	99.9/100	Option/4.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-01004	001.0-100.0	0.01.0-0100.0	999.999	0.1-50/option	99.9/100	Option/6.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10
MPPM-02004	001.0-100.0	0.01.0-0100.0	999.999	0.1-50/option	99.9/100	Option/8.0/1.0-5.0	Silo-Ceramic-rubber	<1.8x10

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