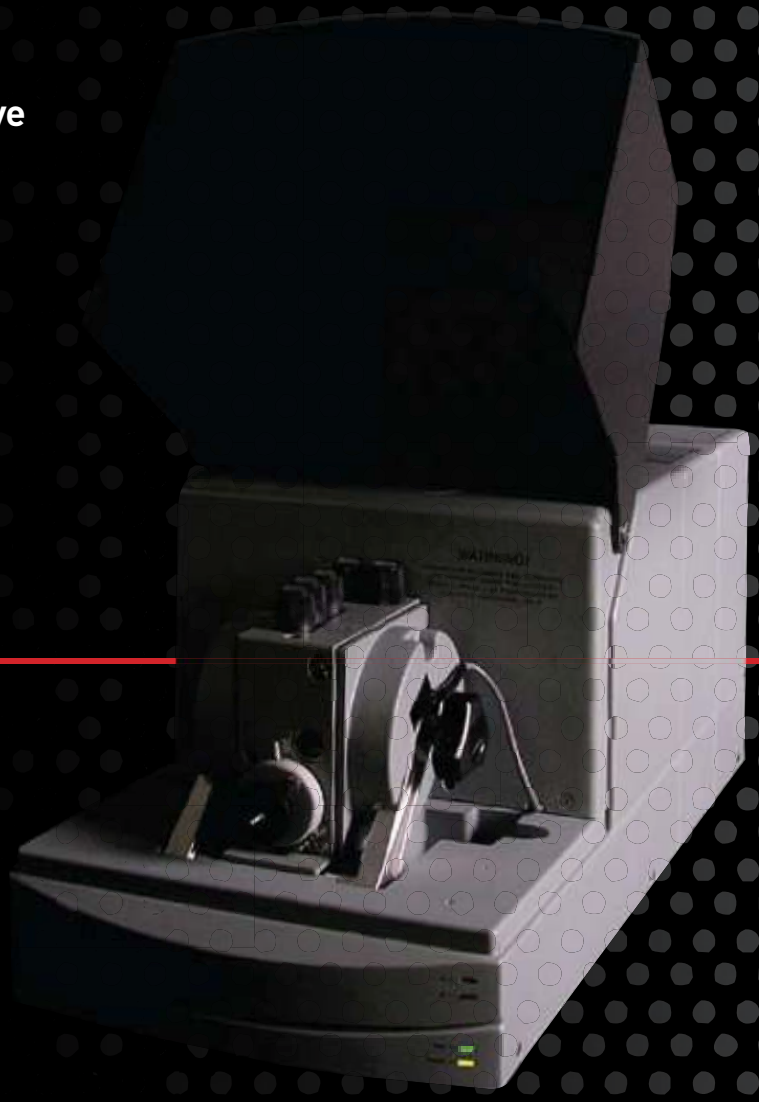
PERMEATION

Automatic Relative Humidity Generation

PERMATRAN-W® Model 3/33

The Standard for Water Vapor Transmission Rate Testing of Flat Films & Finished Packages

MG Plus and SG Plus with automatic relative humidity generation



Systems Certified Traceable to N.I.S.T.

Only MOCON systems comply with the following standards:

ASTM F-1249
TAPPI T557
JIS K-7129

CFR21 Part 11 Compliant

mocon®

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Direct Measurement System

Consider the PERMATRAN-W® 3/33's flexibility in your application. Choose from three Master Base Control Systems and three Satellite Modules, each providing different test capabilities. Combine a Master Base Control System (which includes a computer, printer and software) with as many as nine Satellite Modules for a maximum of 20 test cells per system.

Master Base Control Systems (each contains 2 test cells)

MG Plus

- Dual film test cell module
- Automatic generation of relative humidity
- Temperature control 5 C to 50 C
- Built-in reference cell
- Computer, printer and WinPerm™ Permeability Software

OR

MW

- Dual film test cell module
- Temperature control 5 C to 50 C
- Built-in reference cell
- Computer, printer and WinPerm™ Permeability Software

OR

MA

- Dual film test cell module
- Temperature control from 5 C above ambient to 50 C
- Built-in reference cell
- Computer, printer and WinPerm™ Permeability Software

V Add up to 9 application modules - Now or later...

Satellite Application Modules (each contains 2 test cells)

SG Plus

- Dual film test cell module
- Automatic generation of relative humidity
- Temperature control 5 C to 50 C
- Built-in reference cell

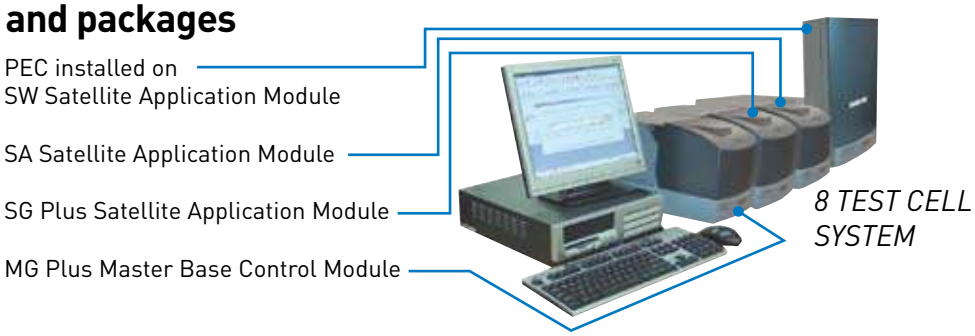
SW

- Dual film test cell module
- Temperature control 5 C to 50 C
- Built-in reference cell

SA

- Dual film test cell module
- Temperature control from 5 C above ambient to 50 C
- Built-in reference cell

Example System Configuration: 8 test cells testing films and packages



All Masters include...

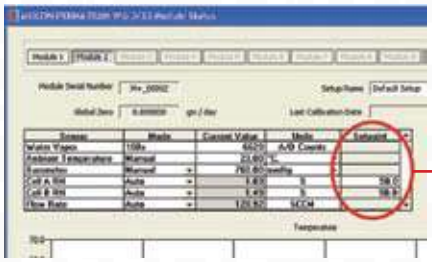
Computer, Printer and WinPerm™ Permeability Software

- *High speed Computer & Printer*
- *Up to 10 modules (20 test cells) can be incorporated*
- *Windows® based software control*
- *Computer-determined equilibrium*
- *Double-cell film testing mode for increased sensitivity*
- *RS-232C output*

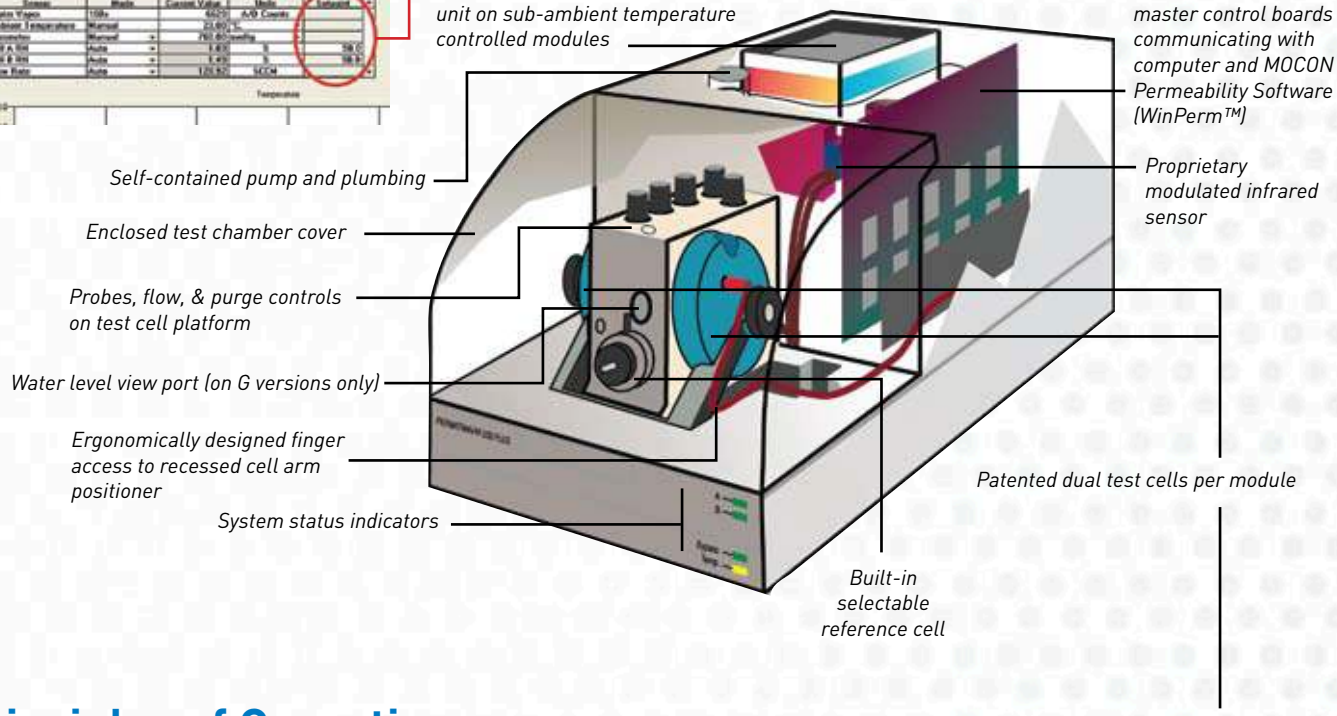
Package Environmental Chamber (PEC)

- *Package testing under precise temperature and relative humidity environments*
- *Compatible with any Master or Satellite G or W module*

The ASTM and JIS Standards on the PERMATRAN-W® 3/33 Provide Maximum Flexibility with a Modular Design



Relative humidity is set via the software



Principles of Operation

MOCON has set the worldwide standard for permeation testing systems for over 40 years. The PERMATRAN-W® 3/33 system uses a patented modulated infrared sensor to detect water vapor transmission through both flat materials and packages. This high performance sensor provides parts-per-million sensitivity.

When testing flat film sample material is placed in a test cell. Test cells are divided into two chambers separated by the sample material. The inner chamber is filled with nitrogen (carrier gas) and the outer chamber with water vapor (test gas).

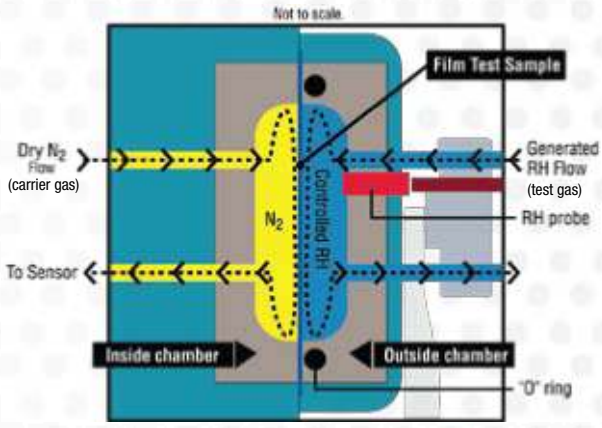
Molecules of water (delivered to the outer chamber by the test gas) diffuse through the film to the inside chamber and are conveyed to the sensor by the carrier gas. The computer monitors the increase in water vapor concentration in the carrier gas and it reports that value on the screen as the water vapor transmission rate.

On the "G Plus" version modules, the relative humidity (RH) of the test gas is generated by the "frequency modulation method (no need for salts to select humidity)".

On the "W" and "A" versions of the modules, absorbent material saturated with distilled water provides a test gas atmosphere of 100% RH.

The RH of test cells is monitored by RH probes inserted into the outside chamber.

Side View of "G Plus" Versions Test Cell Diagram



The G Plus versions of this system allow you to simultaneously condition and test materials over a wide range of temperature and relative humidity conditions similar to a package's actual storage environment. The film test cell in the PERMATRAN-W® 3/33 module incorporates RH probes in both cells to allow for control of the generated RH levels.

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High-Barrier Films and Packages are Affected by Temperature and Relative Humidity

With the 3/33, you can test the WVTR directly at the desired temperature and relative humidity.

Testing Standardization

Typical Water Vapor Transmission Rate Test Conditions	
23 C (75 F)	90% RH
37.8 C (100 F)	90% RH
22 C (73 F)	50% RH
29.4 C (85 F)	80% RH

Figure 1. It remains necessary for laboratories to choose on which test conditions they will standardize. Typical ones are shown above. Due to the extreme effects that temperature and relative humidity have on permeation, these remain the two chief sources of inconsistency of data between labs and from operator to operator. Additionally, the calibration method used and the operator will affect answers. The PERMATRAN-W® 3/33 makes it easy to control variables such as temperature and humidity without the need for climate controlled rooms, or salt solutions to control humidity. Repeatability from operator to operator, and lab to lab is assured. Precise answers can be achieved each time a test is performed.

Barrier Film Testing PET

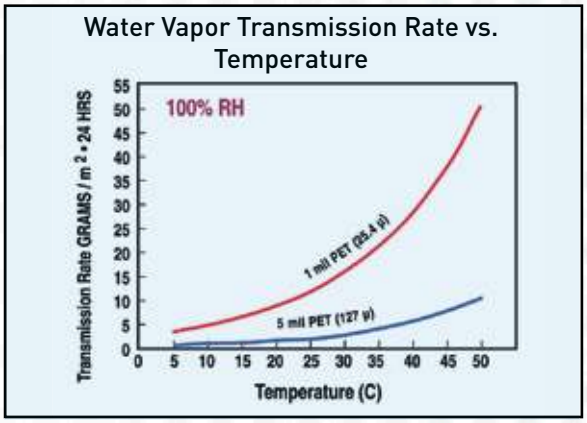

Figure 2. Temperature, thickness, and relative humidity affects the WVTR transmission rate of materials as shown above with the PET samples. A variety of combinations of materials, thicknesses, temperatures, and relative humidity can be tested on the PERMATRAN-W® 3/33 System.

Material Variation

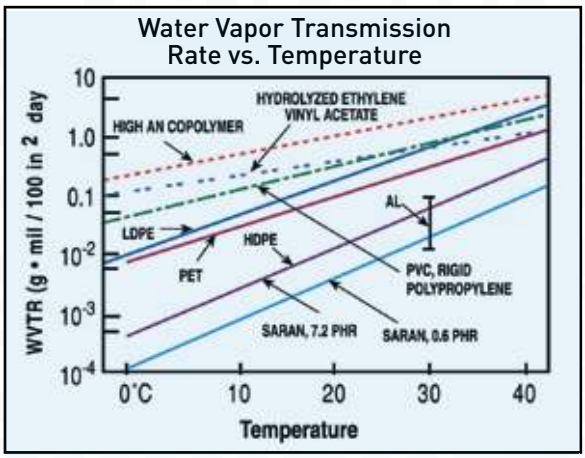

Figure 3. Water vapor transmission rates of selected materials at 90% RH.

Testing RH Sensitive Samples

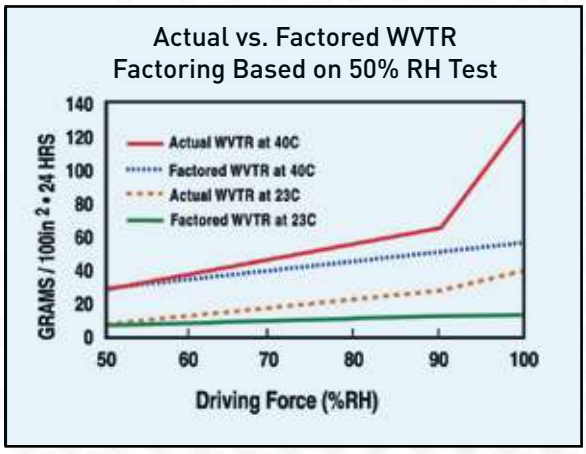

Figure 4. The PERMATRAN-W® 3/33 System provides precise relative humidity with RH probes located at the site of the test sample. The data shown above demonstrates the importance of testing RH sensitive samples at precise RH. There is a marked variance in WVTR between actual and the factored RH driving force as shown in these examples.

**Graphs are not actual tests, but are for demonstration purposes only.*

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High Sensitivity System Performs Tests Directly At Material's "Real World" Temperature and Relative Humidity Conditions.

With MOCON's precision sensors (modulated infrared, relative humidity, temperature and flow) ... measurements are very accurate at producing exceptional data. Modular system design brings flexibility while easy-to-use Windows®-based software makes material assessments free of subjective decisions with unparalleled product quality.

The PERMATRAN-W® 3/33 is a Water Vapor Transmission Rate (WVTR) testing system designed to assess barrier materials used in packaging applications. If you wish to assess high barrier materials under certain conditions (temperature, relative humidity, flow, etc.) you can change aspects of the system to better fit your need. Flexibility for you to essentially design your own system has been built right in.

System Certification Traceable to N.I.S.T.

PERMATRAN-W® 3/33 systems are certified in accordance with N.I.S.T. Each instrument will be issued a signed Certificate of Compliance and include a set of three pre-calibrated N.I.S.T. traceable WVTR films.

WinPerm software further speeds analysis, assuring accuracy and incorporates more data handling capabilities. The PERMATRAN-W® 3/33 MG and SG Plus systems allow you to control relative humidity simply by setting the conditions within the software.

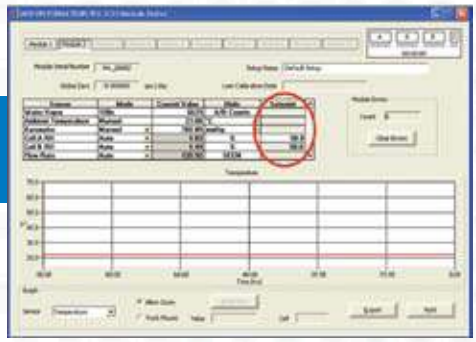
The WinPerm™ Permeability Software controls up to 20 test cells in a system and dramatically simplifies the task of setting up and conducting tests. Pre-programmed test and module formats as well as intuitive Windows-style set-up, control and results screens make it easy to generate and interpret test data. Features include QuickStart® for fast test initiation using standard or user-defined test conditions, automatic conversion of test data to Excel format and the ability to print detailed single test results or a summary report of all tests performed on a module. The PERMATRAN-W® Model 3/33 software also reduces the possibility of error with its ability to automatically determine equilibrium and compensate for flow changes.

An additional feature in the 3/33 is the reference cell testing mode controlled through the software. The reference cell creates an increase in stability when testing higher barrier materials. Ease-of-use, design flexibility, and accurate informative WVTR data — the PERMATRAN-W® 3/33 from MOCON.

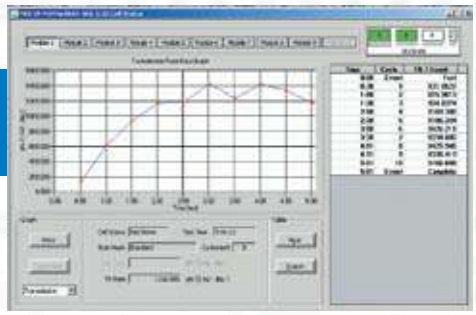
WinPerm™ Permeability Software

QuickStart® Screen

Relative Humidity



Cell Status Screen



Export Data Screen

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SPECIFICATIONS — PERMATRAN-W® Model 3/33 Plus

Module Choices for System Configuration

	MA	SA	MW	SW	MG Plus	SG Plus
WVTR Test Range: Note 1 Below	X	X	X	X	X	X
Test Temperature Range:						
5 C above ambient to 50 C	X	X				
5 C to 50 C			X	X	X	X
Standard RH Testing (No Salts Required):						
Films - 100% RH	X	X	X	X	X	X
Packages -100% RH or Ambient	X	X	X	X	X	X
Generated RH Testing (No Salts Required):						
Films - 100% and 5% to 95% RH					X	X
Packages - 100% and 5% to 95% RH application dependant					X	X
Test Sample Size:						
Films - 4.25 in. x 4.25 in. (10.8 cm x 10.8 cm)	X	X	X	X	X	X
Packages - Up to 3 liters per package	X	X	X	X	X	X
Generated RH - Up to 2 liters per package					X	X
Test Cells per Module, 2 - 50cm² Test Cells	X	X	X	X	X	X
Expandable up to 10 modules (20 test cells)	X	X	X	X	X	X
Built-in Reference Cell (Standard), Selectable Zero Compensation (Standard)	X	X	X	X	X	X
Automatic Flow Compensation (Standard)	X	X	X	X	X	X
Computer, Monitor, Printer and WinPerm™ Permeability Software (Standard)	X		X		X	
Automatic Temperature Monitor and Control (Standard)	X	X	X	X	X	X

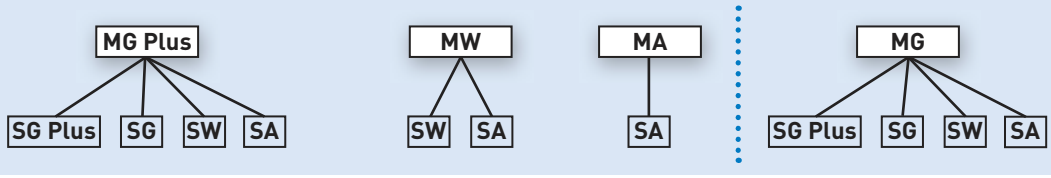
Specifications provided on request.

This instrument is ETL listed, Conforms to UL Standard 1262, is Certified to CAN/CSA C22.2 No. 151, and Complies with CE Product Safety, Electromagnetic Emission & Susceptability

Note#1

Carrier Flow	Sample	g/m²/day	g/100 in²/day	g/pkg/day
100 cc/min	Unmasked Masked	0.035 to 100 0.35 to 1000	0.0023 to 6.45 0.023 to 64.5	0.00018 to 0.5 —
10 cc/min	Unmasked Masked	0.005 to 10 0.05 to 100	0.0003 to 0.65 0.003 to 6.5	0.00003 to 0.05 —

Possible PERMATRAN-W® 3/33 System Configurations starting with a Master Base Control System:



MOCON Commitment
The PERMATRAN-W® 3/33 is another example of MOCON's long-standing commitment to innovation and quality in the design of permeation testing systems for barrier material and package assessment.

Technical Support & Service
MOCON offers a variety of technical services designed to provide you with first class technical support. Whether you require technical support, next-day spare parts delivery, on-site training, N.I.S.T. certification or "turn-key" validation, our technical support staff can tailor a service program to fit your needs. Our goal is to provide the best in product support services.

MOCON also offers the following instruments and services.

Laboratory Instruments
Permeation, Barrier
Leak Detection
Headspace
On-Line Analyzers
Aroma, Flavor, Odor
Seal Strength
Friction
Weighing & Sorting
Gauging

Field Instruments
Indoor Air Quality
Outdoor Air Quality
Oil & Gas Well Logging
Specialty Gases

Consulting and Testing Services
Testing Laboratories
Package Characteristics
Permeation & Barrier Testing
Leak Detection & Headspace
Aroma, Flavor & Odor
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