

# Membrane Test System – 740 MTS

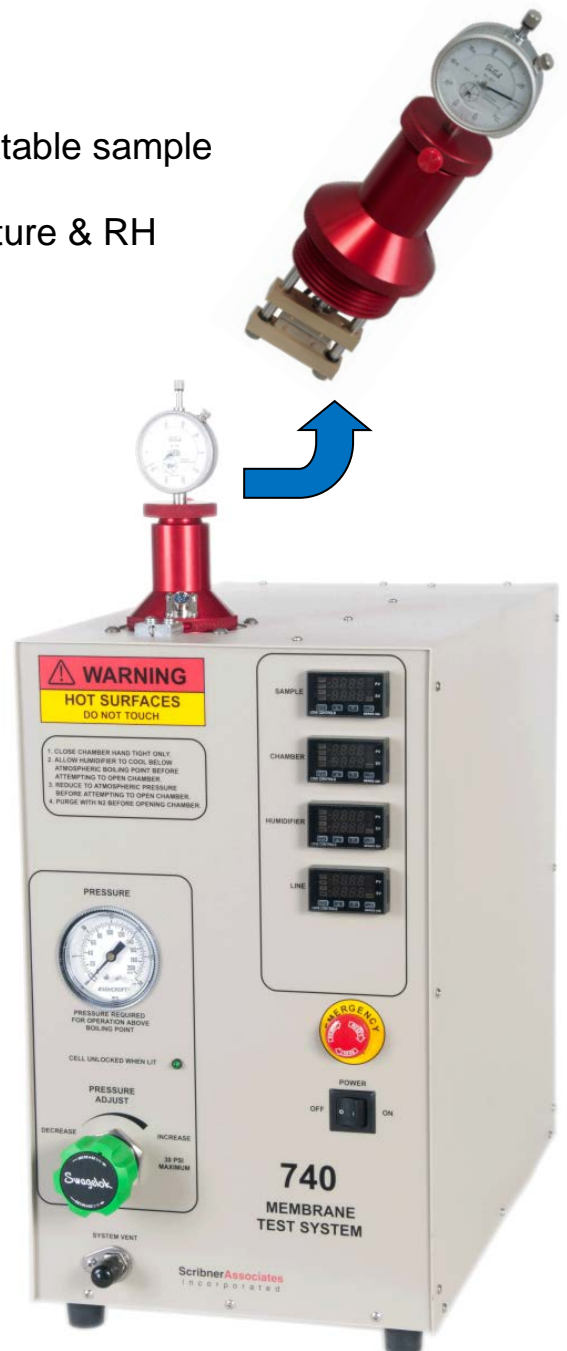
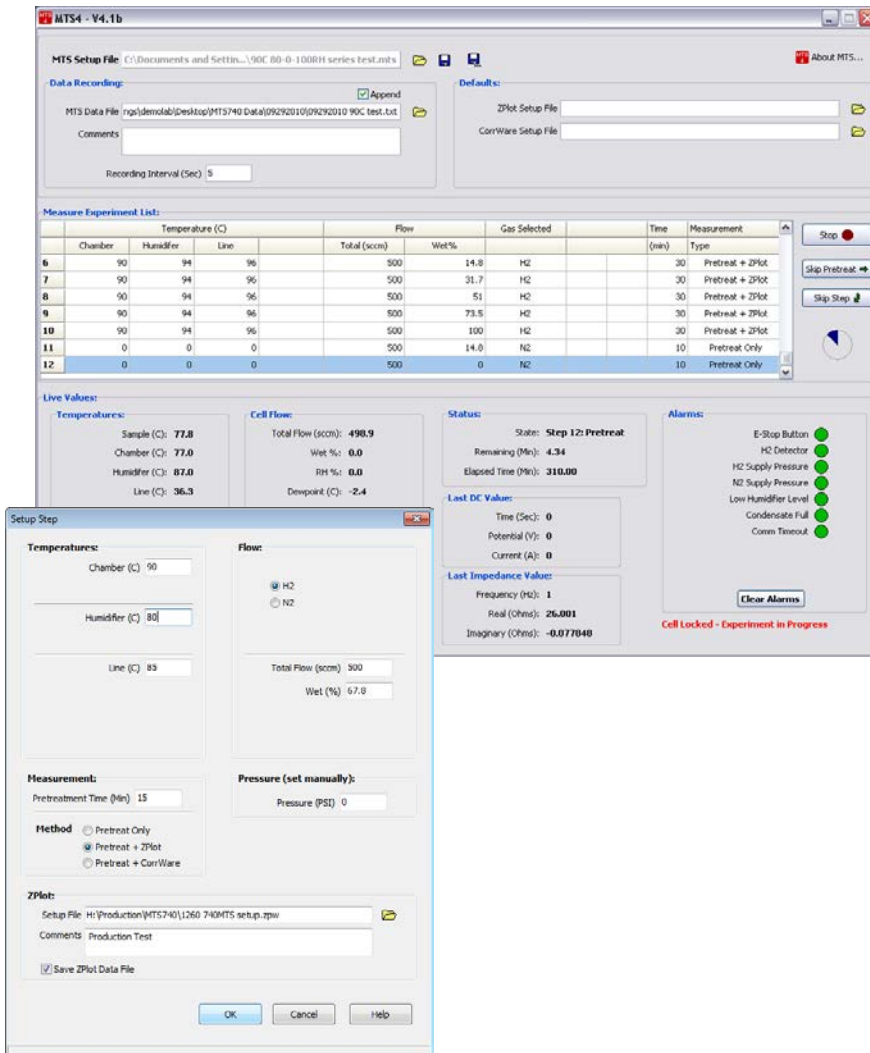
## A Versatile Tool for Membrane R&D and Manufacturing QC

The 740 MTS is ideally suited for development of new ionomers and solid electrolytes. It offers rapid and accurate measurement of the through-thickness membrane resistance and conductivity as a function of temperature, humidity and pressure.

The MTS eliminates the time consuming approach of catalyzing a membrane and assembling a fuel cell to evaluate the ionomer performance.

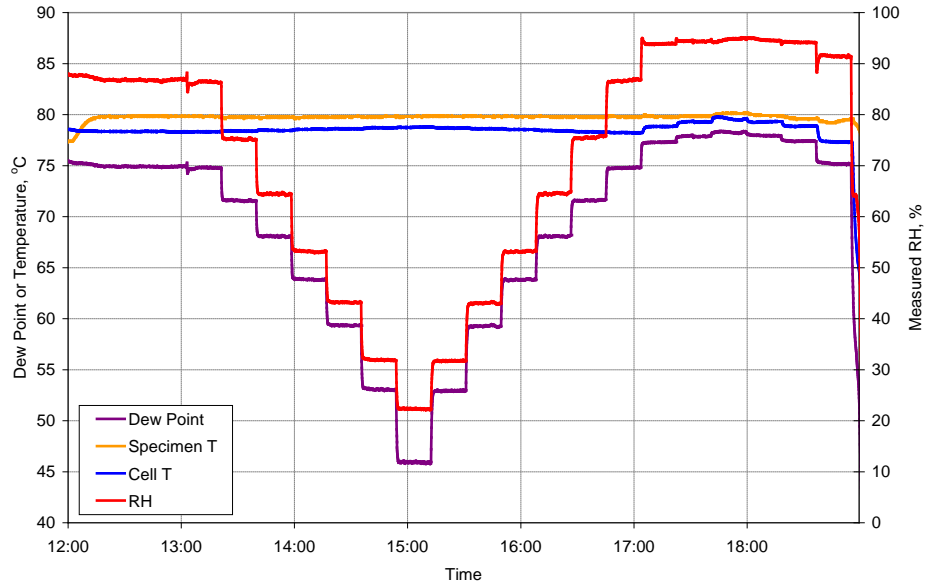
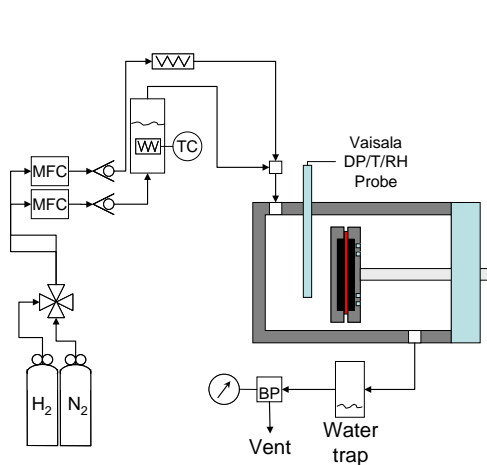
### Benefits and Features

- ✓ Uses bare (non-catalyzed) membranes
- ✓ Small sample size 6 mm x 30 mm
- ✓ Spring-loaded sample compression - easy, repeatable sample loading up to 400 PSI (2.76 MPa)
- ✓ Rapidly characterize samples over wide temperature & RH
- ✓ Robust method - accurate, repeatable & reliable
- ✓ Multiple alarms for safe operation

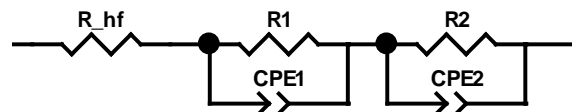
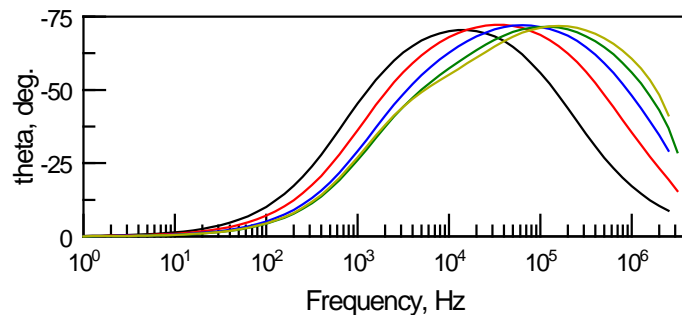
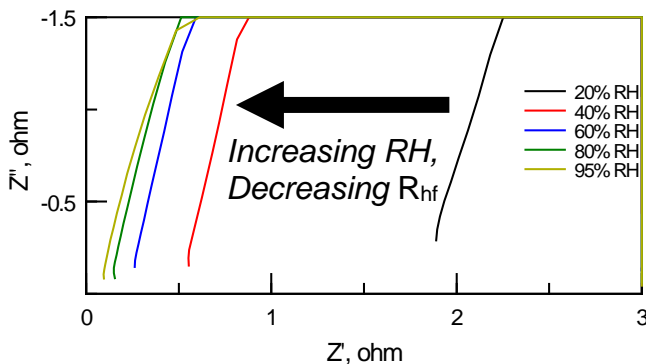
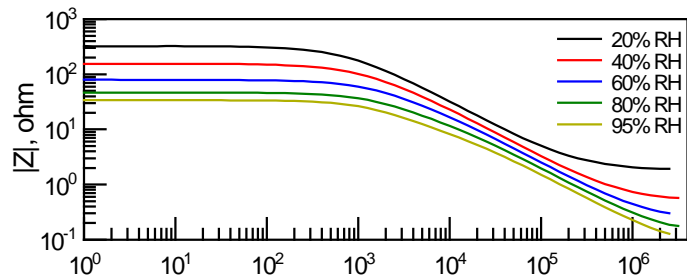
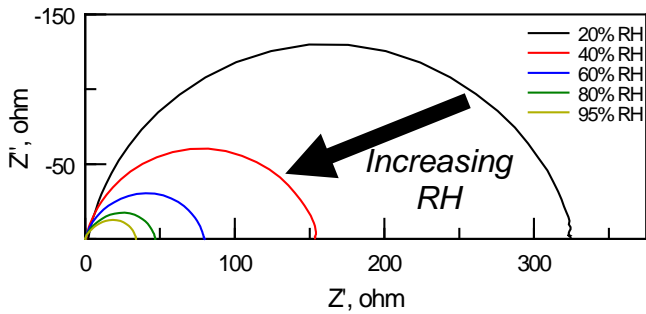


# The 740 MTS uses wet-dry gas mixing for controlled, rapid RH cycling of sample environment

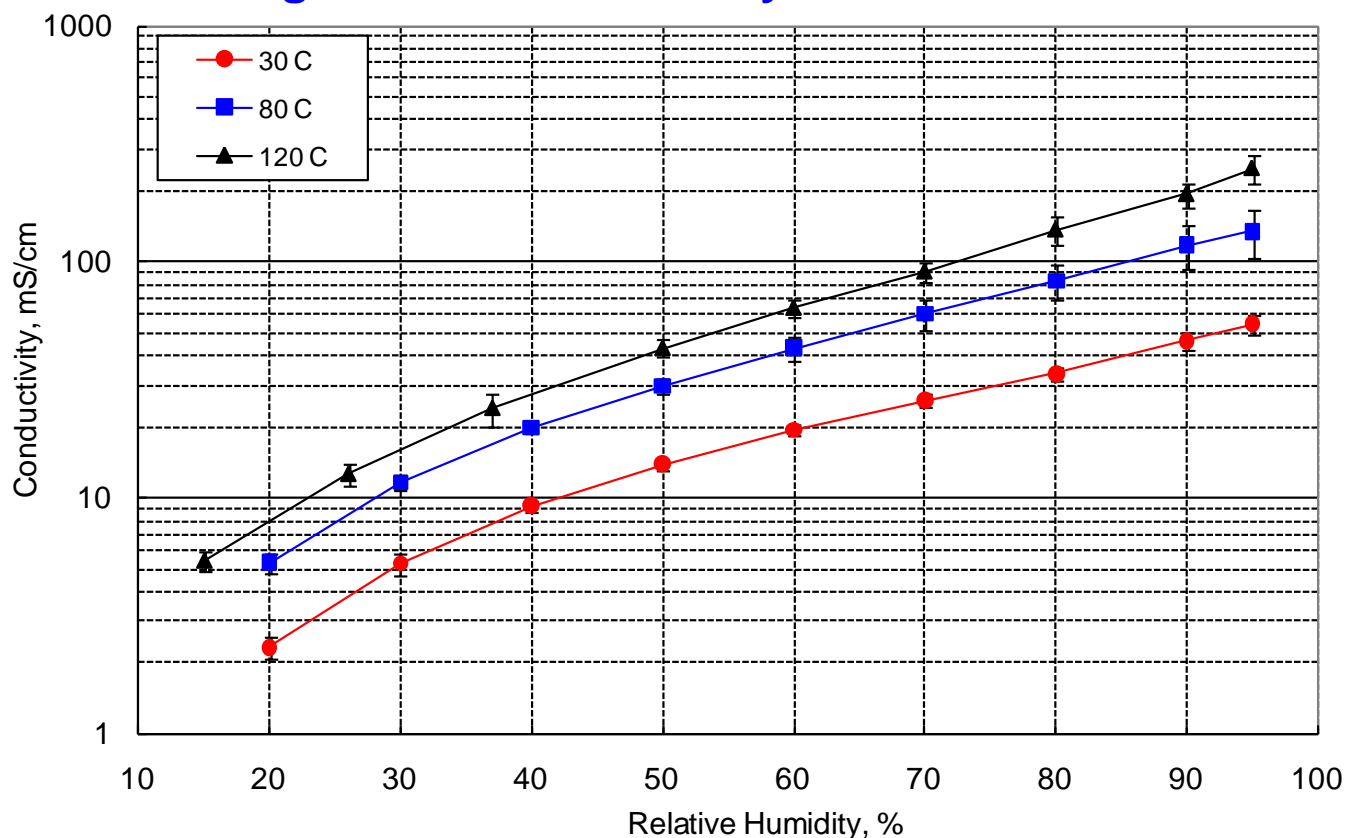
- ✓ Repeatable, reproducible and stable T & RH → ±2% from 20% to 95% RH
- ✓ Rapid RH cycling for time-efficient testing over wide RH range
- ✓ Operating range: 30 °C to >120 °C, 1 to 3 atmospheres



## High frequency intercept & sample resistance obtained by fitting impedance spectra to an equivalent circuit model



## Through-Plane Conductivity of Nafion® NR-212



### System Features

- Custom **MTS4 Software** for complete measurement process control and data acquisition
- **CorrWare®**, **ZPlot®**, **MultiStat®**, **ZPlot-Lab™** & **ZView®** software for measurement and analysis of sample impedance
- Wet and dry gas mixing for accurate and precise RH control and rapid RH cycling
- Test chamber backpressure control, condenser and collection tank for high-temperature operation
- *In-situ* sample temperature and dew point measurement for real-time RH monitoring
- Control and monitoring of multiple process temperatures
- Rapid, easy cell assembly with accurate and repeatable sample compression
- Cell lock-feature for safe operation at elevated temperature, pressure and H<sub>2</sub> gas
- Automatic shutdown and N<sub>2</sub> purge on alarm condition
- Detailed cell assembly instructions and data analysis procedure
- Native USB interface to PC for easy set-up

Proven patented technology featured in  
*Journal of the Electrochemical Society* 157(11) B1731 (2010)



## Specifications:

### Gas and Humidification System:

Humidifier:	316LL SS material, designed for 100% gas saturation, auto water fill
Mass Flow Control:	Two; Wet and Dry, 0 - 500 sccm each (allows variable wet gas % and RH control)
Sample Gas Selector:	Selects N <sub>2</sub> or H <sub>2</sub> /other
Gas Pressure Switches:	Two; N <sub>2</sub> and H <sub>2</sub> /other
Gas Dew Point Meter:	One, capacitance-type sensor in sample chamber
Measurable Dew Point:	0 to 100 °C
Set and Report Accuracy:	±0.25% of span, ±1 least significant digit
Set and Report Resolution:	0.1 °C
Sensor Type:	Thermocouples, Type T
Temperature (max)	180 °C (chamber, sample), 120 °C (humidifier), 130 °C (gas transfer line)

### Sample Chamber:

Open/Close Mechanism:	Threaded, screw-in cell head with integrated electrodes and locking-pin
Electrode Clamp Mechanism:	Mechanical, spring-loaded, integrated with cell head
Electrodes:	Platinum, proprietary four-terminal design (U.S. Patent No. 7,652,479)
Temperature Range:	Ambient to 180 °C
Pressure Range:	Ambient to 30 PSIG (207 kPa)

### Post-Chamber Gas Flow Path:

Heat exchanger, condensate collection tank, precision manual back pressure regulator, vent port

### Electrochemical Interface and Impedance Measurement:

User-supplied Impedance Analyzer (Solartron Analytical 1260 FRA or Newtons4th PSM 1735 + IAI Interface recommended)

*MTS4* software works with *CorrWare*<sup>®</sup>, *ZPlot*<sup>®</sup>, *MultiStat*<sup>®</sup> *ZPlot-Lab*<sup>™</sup> and direct control of Newtons4th FRA

### Physical and Environment:

Operating Temperature:	15 - 35 °C
Power Source:	100 - 120 VAC; 50/60 Hz
Size, cm (in.):	46 H x 28 W x 48 D (18 x 11 x 19); excluding installed cell head

### Software inputs for each experiment:

Chamber, humidifier and gas transfer line temperature set point; Pre-treatment (equilibration) time; Total gas flow rate, Wet gas %, Gas type (H<sub>2</sub>/other or N<sub>2</sub>), and Back pressure (manually set)

### Number of steps per experiment:

Up to 100

### Live Data Display:

Sample temperature and dew point, RH value (calculated from dew point and sample temperature), Wet and dry gas mass flow rates, Measured impedance for a single frequency from *ZPlot*<sup>®</sup>, remaining step time

### Data File Format:

Tab delimited ASCII file. Contains time, total flow, wet and dry flow, % wet, temperatures (dew point, sample, chamber, humidifier, gas transfer line), RH, pressure, gas type *ZPlot*<sup>®</sup> impedance data saved as standard \*.z file compatible with *ZView*<sup>®</sup>.

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