



740 Membrane Test System

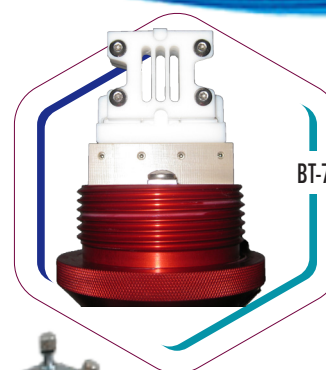
The 740 MTS is ideally suited
for development of new
ionomers and solid electrolytes

The 740 MTS offers rapid and accurate measurement of through-thickness membrane resistance and conductivity as a function of temperature, humidity level and pressure. The 740 MTS eliminates the time-consuming approach of catalyzing a membrane and assembling a fuel cell to evaluate the ionomer performance.

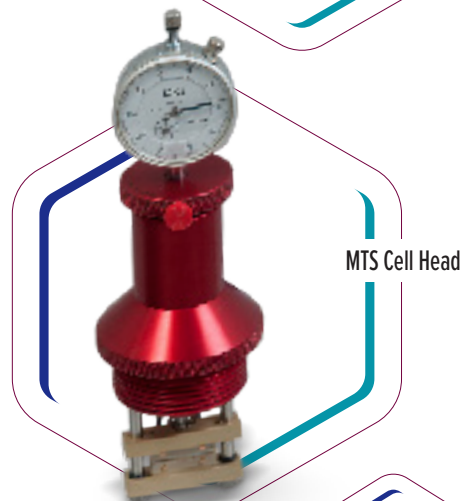
The 740e features

- 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
- 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)
- 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 H₂ gas
- Automatic shutdown and N₂ purge on alarm condition
- Detailed cell assembly instructions and data analysis procedure
- Native USB interface to PC for easy set-up
- Safety features include alarm conditions and automatic hardware shutdown for safe, reliable operation.

OPTIONS



BT-710 Cell Head



MTS Cell Head



Newtons-4th FRA



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SPECIFICATIONS: 740 Membrane Test System

Gas and Humidification System:

Humidifier	316L 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 ₂ or H ₂ /other
Gas Pressure Switches	Two; N ₂ or H ₂ /other
Gas Dew Point Meter	One, capacitance-type sensor in sample chamber
Measureable Dew Point	-20 to 120 ° 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 <i>CorrWare</i> ®, <i>ZPlot</i> ®, <i>MultiStat</i> ®, <i>ZPlot-Lab</i> ™ and direct control of Newtons4th FRA
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Physical and Environment:

Operating Temperature	15 - 35 °C
Power Source	100 - 120 VAC; 50/60 Hz - 220 - 204 VAC optional
Size, cm (in)	46 H x 28 W x 48 D (18 x 11 x 19); excluding installed cell head

Software: *CorrWare*, *ZPlot*, *MultiStat*, *ZPlot-Lab* & *ZView* are trademarks of Scribner Associates, Inc. Nafion® is a registered trademark of E. I. du Pont de Nemours and Company

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 ₂ /other or N ₂), 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 <i>ZPlot</i> ®, 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 <i>ZPlot</i> ® impedance data saved as standard *.z file compatible with <i>ZView</i> ®

BT-110 CONDUCTIVITY CLAMP



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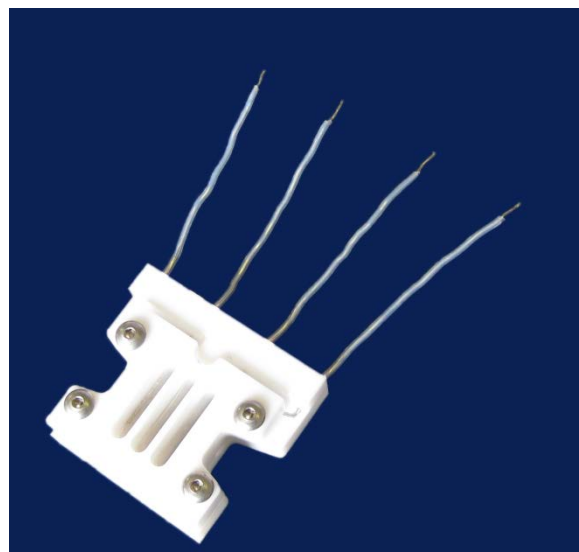
= Expertise²

The BT-110 Conductivity Clamp is used to obtain in-plane resistance and ionic conductivity of bare ionomer membrane samples

Valuable time and money can be saved by analyzing ion charge transport resistance prior to catalyzation of the membrane and assembly of the MEA into a fuel cell.

FEATURES:

- ✓ Designed for use in an environmental chamber or liquid
- ✓ Test bare membrane samples - fabrication of a catalyzed sample (CCM or MEA) is not required
- ✓ True 4-electrode technique
- ✓ Small sample size - 25 mm x 3 mm
- ✓ Temperatures up to 150 °C



The advantage of the 4-electrode measurement is the ability to measure resistance due only to charge transport while excluding interfacial and charge transfer resistances. By measuring only the resistance due to ion transport, accurate assessment of in-plane membrane conductivity can be made.



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BT-112 / BT-115 CONDUCTIVITY CELL



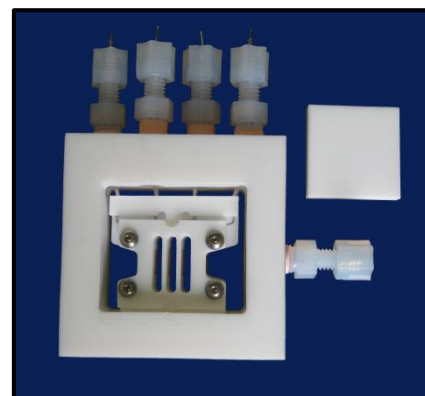
= Expertise²

BT-112 / BT-115 Conductivity Cells are used to obtain in-plane ionic conductivity data on bare ionomer membrane samples using common single cell hardware.

Valuable time and money can be saved by analyzing ionomer charge transport resistance prior to catalyzation of the membrane and assembly of the MEA into a fuel cell.

FEATURES:

- ✓ Designed to be used with your existing test stand hardware
- ✓ Test bare membrane samples - Fabrication of a catalyzed sample (CCM / MEA) is not required
- ✓ True 4-electrode technique
- ✓ Small sample size: 25 mm x 3 mm
- ✓ Compatible cell fixtures: BT-112 (Scribner & Fuel Cell Technologies); BT-115 (Electrochem, Inc.)
- ✓ **New High Temperature Option to 200 °C**

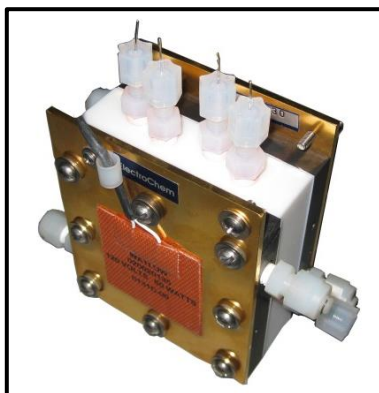


BT-112 Conductivity Cell

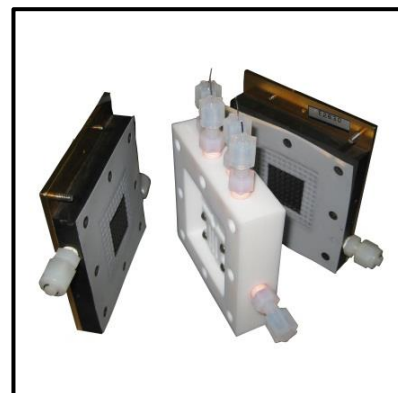
The advantage of the 4-electrode measurement is the ability to measure resistance due only to charge transport while excluding interfacial and charge transfer resistances. By measuring only the resistance due to ion transport, accurate assessment of in-plane membrane conductivity can be made.



BT-112 – Shown with SAI Test Fixture



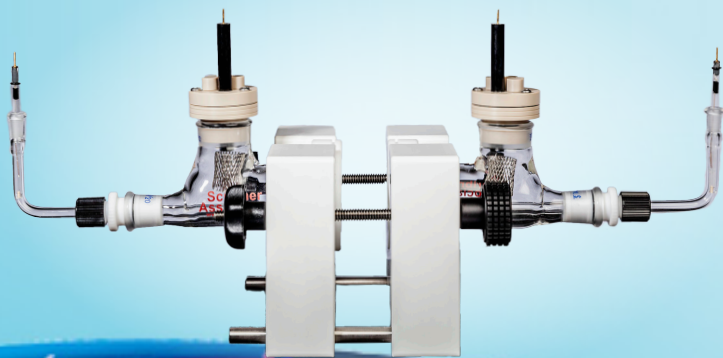
BT-115 – Shown with EC Test Fixture



BT-115 Conductivity Cell



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H-Cell Kit

The H-Cell is designed for membrane and separator characterization in a liquid environment

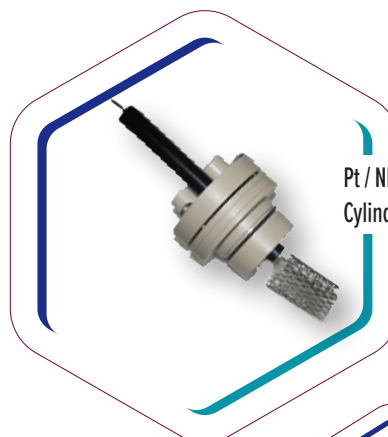
Measure resistance, conductivity, permeability, cross-over, and selectivity. Ideal for redox flow battery electrolytes, liquid fuel cells and batteries, and electrochemical process chemistries.

OPTIONS

Pt Disk Electrode



Pt / Nb Mesh
Cylinder Electrode



Pt Wire Coil
Electrode



The H-Cell features

- Small volume, easy-to-use, robust design
- Non-reactive materials of construction
- Pt or Au CE/WE electrodes
- Selection of reference electrode types
- Adjustable Luggin probes
- Ports for purge gas & temperature sensor

The Membrane H-Cell includes (x2)

- Glass half-cell with PEEK cap assembly with O-rings and plugs
- Luggin tube with Teflon mount
- Inlet with frit and outlet tube
- One adjustable PET Cell Holder plus Clamp to hold the two cell halves together
- Pt wire coil CE/WE/Drive Electrodes
- Low Profile Ag/AgCl gel Reference Electrodes
- Other Reference & Drive Electrode types subject to availability

SPECIFICATIONS: H-Cell

Properties:

	1/2 cell volume ~30 mL
ID at cell face	= 3.0 cm, Area at cell face or exposed membrane = 7.07 cm ²
Provisions for	Gas purge/vent and temperature probe
	Moveable Luggin Probe
Assembled Dimensions	- Length = 24-35 cm depending on position of Luggin probes - Height = 10 cm (excluding cap and electrodes)) - Width = 10 cm

Counter Electrode / Working Electrode (CE / WE) (A.K.A Drive Electrode) :

Options- 2 per cell required

Pt disk electrode	Pt disc OD = 0.16 cm, A ~ 0.02 cm ²
Pt wire coil electrode	3.74 cm L x 0.05 cm OD, A ~ 0.69 cm ²
Pt / Nb mesh cylinder electrode	A ~ 7.6 cm ²

Reference Electrode:

Options- 2 per cell required

Standard: Pseudo-disposable	Ag/AgCl gel RE: Low Profile Silver/Silver Chloride Gel
Other chemistries available upon request	