



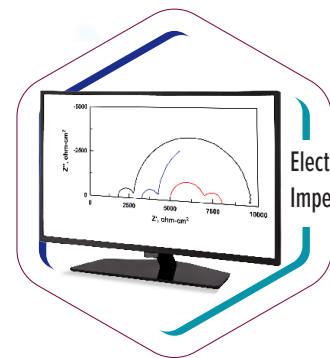
890 Fuel Cell Test Loads

Multi-Current Range Load
with Integrated Multi-Channel
Impedance Spectroscopy

The 890 is a multi-range programmable electronic load with ultra-low internal resistance for full-voltage range evaluation of single cells. The 890 requires a custom or third-party fuel management unit to make a complete test station.

The 890 features

- Control signals for two (2) main mass flow controllers plus five (5) additional mass flow controllers
- Electronic load with three current ranges for accurate measurement over a wide dynamic range
- Continuous real-time cell resistance and IR-free voltage measurement by current interrupt
- Whole cell voltage plus two high-impedance reference electrode inputs for half-cell data
- Constant current, voltage or power control mode
- Impedance analyzer for EIS and continuous real-time high frequency resistance (HFR)
- Simultaneous 3 channel impedance measurement using whole cell and half-cell
- Three (3) internal controllers for anode and cathode humidifier and cell temperatures
- Contact inputs for three pressure sensors or alarms
- Output signals to control purge gas valves and to indicate alarm condition
- RS485 digital interface for additional temperature controllers & serial devices
- Safety features include detection of alarm conditions and automatic hardware shutdown for safe, reliable operation



Electrochemical
Impedance Spectroscopy



Gas Mixing Interface



892e Data
Expansion



SPECIFICATIONS: 890 Fuel Cell Test Loads

Electronic Load:

Maximum Load Current	5/25/50 A, 10/50/100 A, 12/62/125 A, 25/125/250 A, 50/250/500 A or 100/500/1000 A
Maximum Load Power	125 W (50 A, 100 A), 500 W (125 A, 250 A), 1 kW (500 A) or 2 kW (1000 A)
Minimum Load Resistance:	<2.0 Ω (125 W, 500 W), < 0.7 m Ω (1 kW), < 0.35 m Ω (2 kW), (at load terminals, at max. rated load current)
Current Resolution:	1 mA – 1 A (range & load rating dependent)
Current Accuracy	0.3% of full scale current of selected range (0.5% for 2 kW model)

Voltage Measurement and Data Acquisition:

Max . Whole Cell Voltage	20 V
Max . Reference Electrode Voltage	9.999 V
Whole Cell Sense Voltage Input Resistance	> 35 k Ω
Reference Electrode Input Resistance	> 10 ⁹ Ω
Voltage Resolution	1 mV
Voltage Accuracy	± 3 mV $\pm 0.3\%$ of reading
Voltage & Current Data Update Rate	100 Hz

Fuel Interface:

Outputs for flow controllers	Up to Seven, Analog (0-5 V)
Alarm Inputs	Six: Three for gas pressures, three auxilliary
Alarm Outputs	One, 5 V logic
Fuel Solenoid Control	One, 5 V output (external relay needed, included with interface box)

Temperature Controllers:

Quantity	Three
Type	On/off 5 V output
Set and Report Accuracy	$\pm 0.25\%$ of span, ± 1 least significant digit
Sensor Type	Thermocouple, Type T, K, or S (user specified)

Impedance Measurement:

Interface for internal or external analyzers	V & I output channels with variable DC bias rejection generator input channel with selectable attenuation
Internal Impedance Analyzer Type	Single sine, two gain/phase measurement channels, one generator output channel
Internal Analyzer Frequency Range	1 mHz to 10 kHz
Measurement Channels	Three: whole cell + two half-cell vs. ref. electrode

Environment:

Operating Temperature	5 to 35 $^{\circ}$ C ambient; all specs given for 25 $^{\circ}$ C ambient
Power Source	100-240 VAC, 50/60 Hz (auto select)
Size (bench-top enclosure)	1 kW: 17" W x 10" H x 19" D (43 x 25 x 48 cm ³), 2 kW: 17" W x 18" H x 19" D (43 x 46 x 48 cm ³)

Safety Features: Emergency Stop button for manual operator shutdown . Automatic shutdown and N₂ purge on under-voltage, over-current, over-temperature, loss of reactant or purge gas pressure, low water, communications failure or external alarm Emergency Stop switch for manual operator shutdown