# 850 MULTI-RANGE FUEL CELL TEST SYSTEM

Fully Automated, Turnkey, Test System for the Operation and Measurement of Single Cell PEM, AEM & DM Fuel Cells


**Enhanced Capacity 125 Amp Electronic Load**

## FEATURES

### ADVANCED DIAGNOSTICS

Three Current Range Electronic Load Choices 50, 100, & 125 Amps

Modular Benchtop Design for Complete Diagnostics of Single Cell Testing

- Integrated Frequency Response Analyzer with EIS and HFR
- Integrated Potentiostat for In Situ CV and LSV Experiments
- Auto Multigas Selection for Poisoning and Hydrogen Crossover Experiments
- Auto Back Pressure for Independent Control of Anode / Cathode Pressures

### UNATTENDED OPERATION

Smart Fuel Management with Automatic Filling / Draining Humidifiers, Automated Shutdown with Embedded Firmware Level Safety Management & Electronically Controlled Purge Gas

### INTUITIVE CONTROLS

FuelCell5® Fully Integrated Software For User Friendly Control, Experimental Sequencing & Analysis

ZView ® World's Leading Impedance Analysis & Equivalent Circuit Modeling

# SPECIFICATIONS

## ELECTRICAL

**Load Current Range Configurations:**
5/25/50A, 10/50/100A, 12/62/125A

**Maximum Load Power:**
100W

**Minimum Load Resistance:**
<2 mΩ (100mV @ 50A at load terminals)

**Current Resolution:**
1 mA or 10 mA per software current range selection

**Current Accuracy:**
0.3% of full-scale current of selected range

**Max . Whole Cell Voltage:**
20V

**Max . Reference Electrode Voltage:**
9.999V

**Voltage Accuracy:**
±3 mV ±0.3% of reading

**Voltage & Current Data Update Rate:**
100 Hz

**Whole Cell Sense Input Resistance:**
> 35kΩ

**Reference Electrode Input Resistance:**
> $10^9$ Ω

## PROCESS CONTROL

**Wetted Materials:**
All 316SS

**Fittings:**
Swagelok® fittings and heated lines

**Mass Flow Control:**
Software controlled Anode & Cathode Additional Internal MFCs Available

**Purge Control:**
Automatic $N_2$ for Anode & Cathode

**Humidifiers:**
Dual sparger-type, passivated 316SS, 360 W heaters per bottle

**Temperature Control:**
(3) Cell, Anode humidifier, Cathode humidifier

**Cell Thermocouple:**
Type T or Type K

**Temperature Range:**
Ambient to 99.0°C; Optional: 120°C

**Temp Measurement Accuracy:**
±0.25% of span, ±1 least significant digit

## PHYSICAL

**Operating Temperature:**
5 – 35 °C

**Power Source:**
120(10A) or 220–240(5A) VAC 50/60 Hz

**Enclosure Type:**
Single bench top unit

**Size & Weight:**
46 x 28 x 48 cm (18 x 11 x 19 in) & 23 kg (50 lbs)

## SAFETY

**Alarms:**
Gas supply pressures(3), Humidifier Water Levels(2), External (1), System Alarm Output (1)

**Fail Safe Design:**
$N_2$ Purge On Alarm Condition

**Continuous Monitoring:**
E-Stop, Voltage, Current, Temperate, Gas Contamination & External Signals

**Certification:**

# INTERNAL OPTIONS

## FREQUENCY RESPONSE ANALYZER (FRA)

Adds **Electrochemical Impedance Spectroscopy (EIS) and High-Frequency Resistance (HFR)** measurements for whole cell, or half-cell, diagnostics, monitoring membrane performance over time and under varying operating conditions from **1mHz to 10kHz.**

## HUMIDIFIER BY-PASS

**Automated** delivery between dry and humidified gas to the Fuel Cell to enable **Accelerated Lifetime Durability Testing** and **Predictive Failure Analysis** of the membrane.

**Software** controlled bypass for **Reformate / Contamination Studies**.

## HUMIDIFIER AUTO DRAIN/FILL

**Rapid Due Point Reduction** to reduce total testing time and automating humidifier water maintenance by draining the system prior to offline operation.

# ACCESSORIES

## EXPANDED CELL CONTROL
### Automatic Back Pressure

**Automated** cell pressure control to support advanced test protocols.

Provides water trap functions to limit the amount of water in the exhaust stream, including self-draining condensate tanks, to improve user and facility safety.

## EXPANDED GAS CONTROL
### Gas Mixing Interface

**Automated** Gas Mixing capability is available as an **Internal Option** (See Part Configurator Page for additional details) and an External Option for expanded customization, with up to (3) number of Mass flow Controllers.

## ADVANCED DIAGNOSTICS
### Potentiostat

**Electrochemical Impedance Spectroscopy (EIS)** measurements are used for cell diagnostics to identify performance limitations across multiple frequency regimes.

**High-Frequency Resistance (HFR)** allows single-frequency measurement to monitor membrane performance over time and under varying operating conditions.

## ADDITIONAL INPUTS
### Data Expansion Unit

**16 Channels of additional inputs** to capture temperature or analog measurements, to enable the study of physical or mechanical element affecting cell performance like Heat Distribution, Flow Restrictions, Water Management, etc.


## CHARACTERIZATION
### Auto-Multi Gas

**Electrochemical Surface Area (ECSA) Measurement** enabled by computer controlled **Automatic Multi Gas** selector.

Measurement of **Hydrogen Cross Over** and enhanced diagnostics.

## ADDITIONAL ACCESSORIES

- Cell Fixtures **Heated Cuffs** to eliminate heat loss
- **DI Water Tank** to provide stable pressurized delivery of existing DI water source
- **Stand-Alone Humidifier** for 3rd channel
- **MEOH Pump** for DMFC Operations.


# CELL FIXTURES

## PEM & AEM

Our gas-gas fixture **offers superior performance for both PEM & AEM Fuel Cell applications**, making it the ideal choice for a wide range of experimental needs.


## DMFC & LIQUID/GAS

All wetted components of the **liquid side are non-metallic and highly chemical resistant**. Interchangeable end plates save money, convert back to PEM/AEM with one part.


## Redox Flow Battery

This is specifically designed for use with our **857 Redox Flow Cell Test System**. All non-metallic flow paths are made with non-corrosive, chemically resistant plastics only.


# 840
# Advanced Fuel Cell Test System

## Turn-key 1 kW test station in an integrated bench-top unit

The 840 is a fully integrated test system for short stacks and large area single cell testing.

## The 840 features

- Ideal for large area single cell cells & short stacks
- 890 Electronic Load: 500W (12/62/125A or 25/125/250A) or 1 kW (50/250/500A), 20 V
- 892 Data Acquisition Module: 16 channels of voltage/temperature measurement integrated with FuelCell® software
- Dual Anode & Cathode mass flow controllers for enhanced accuracy over wide flow range
- Gas Selector Valves for Automated Switching between up to 3 Anode and 3 Cathode Gases
- Automated humidifier by-pass for wet/dry cycling
- Large capacity Anode & Cathode SS humidifiers with automatic water fill
- Flexible SS temperature controlled heated gas transfer lines
- FuelCell® software for user-friendly computer controlled cell operation & experimentation
- Constant or stoichiometric-controlled reactant flow rate
- Current, voltage or power control modes
- Continuous real time cell resistance and IR-free voltage measurement by Current Interrupt
- Whole cell voltage plus two high-impedance reference inputs for half-cell data
- Safety features include detection of alarm conditions and automatic hardware shutdown for safe, reliable operation

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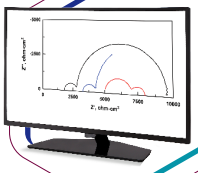
## OPTIONS

Automatic Backpressure

885 PotentioStat


Fuel Cell Fixture



Electrochemical Impedance Spectroscopy


Liquid/Gas Cell Fixture

892 Data Acquisition

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## Electronic Load:

| | |
|---|---|
| Maximum Load Current | 10/50/100A 125W; 12/62/125A 500W; 25/125/250A 500W; 50/250/500A 1KW; (config. dependent) |
| Maximum Load Power | 125 W, 500 W or 1 kW (configuration dependent) |
| Minimum Load Resistance: | < 2 mΩ (125 W, 500 W models), 0.7 mΩ (1 kW model), (all are at load terminals, at rated load current) |
| Current Resolution: | 1 mA at low currents – up to 100mA (current setting dependent) |
| Current Accuracy | ±0.3% of full scale current of selected range |

## Voltage Measurement and Data Acquisition:

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

## Impedance Analyzer (Optional 880):

| | |
|---|---|
| Internal Impedance Analyzer Type | Single sine, one generator and two gain/phase measurement channels |
| Internal Analyzer Frequency Range | 1 mHz to 10 kHz |
| Measurement Channels | Three: whole cell plus two half cell vs. Reference Electrode |

## Fuel System:

| | |
|---|---|
| Reactant Gas Control System | All 316 SS construction of humidifiers, flow path, valves and mass flow controllers, with Swagelok® fittings and temperature controlled heated reactant transfer lines. |
| Mass Flow Control | Dual, software controlled mass flow controllers per channel, Anode: 6 SLPM (1 + 5 SLPM), Cathode: 12 SLPM (2 + 10 SLPM). Other sizes available on request. Automatic $N_2$ purge valves available on request. |
| Alarms | Gas supply pressures(3), Humidifier water levels(2), External (1) |
| Back Pressure Control | Manual or Automatic: 0 – 3 atm (0 – 30 PSIG). High Capacity forced air condensers with large tanks and SS regulators |
| Temperature Controllers | Five: cell, anode humidifier, anode line, cathode humidifier, cathode line |
| Set & Report Accuracy | ±0.25% of span, ±1 least significant digit |
| Sensor Type | Thermocouple, Type T for cell (Type K optional for high temperature) |
| Humidifiers | Dual sparger-type, passivated 316L, 1650 W heaters per bottle |
| Temperature Range | Ambient to 99 ° C |
| Fill Method | Automatic water fill. Requires 3 atm (45 PSIG) minimum water feed or 1.4 atm (20 PSIG) above back pressure |

## Environment:

| | |
|---|---|
| Operating Temperature | 5 to 35 ° C |
| Power Source | 208-240 V, 50-60 Hz, 16 A |
| Enclosure Type | Single bench top enclosure |
| Size and Weight | 91 cm H x 61 cm W x 61 cm D (+ 41 cm for heated gas lines), 55 kg<br>36" H x 24" W x 24" D (+ 16" for heated gas lines), 120 lb. |
| Safety Features | Automatic shutdown and $N_2$ 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 |

# 855 SOFC & SOEC Test System

## Integrated w/ Furnace Control


The 855 is designed for SOFC & SOEC testing and diagnostics in a research lab environment.

### The 855 features

- Suitable for Button Cells and Planar Cells
- Multi Range, Zero Volt, Electronic load 5/25/50 A, 100 W, 20 V
- FuelCell® software for user-friendly computer controlled cell operation & experimentation
- Stainless Steel Anode humidifier with Bypass Valve and auto waterfill
- Up to five mass flow controllers available
- Includes Furnace Control hardware with redundant over-temperature protection
- Constant or stoichiometric-controlled reactant flow rate
- Current, voltage or power control mode
- Continuous real time cell resistance and IR-free voltage measurement by Current Interrupt
- Whole cell voltage plus two high-impedance reference inputs for half-cell data
- Safety features include detection of alarm conditions and automatic hardware shutdown for safe, reliable operation

### The 855 *with* power supply add-on for SOEC testing

- 100 A / 5 V Programmable Power Supply to drive the electrolysis reaction
- Voltage and current-controlled fixed, scanning and stair-step experiments
- Humidified $H_2$ for water electrolysis, $CO_2$ + $H_20$ for SynGas production

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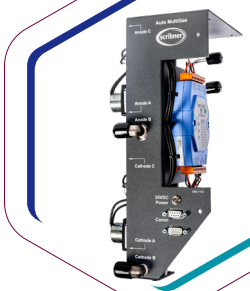
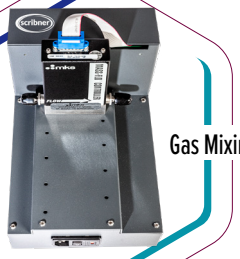
FuelCell® Software



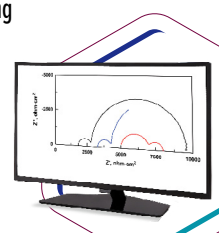

MulitGas Selector


885 Fuel Cell Potentiostat

OPTIONS




Gas Mixing



Impedance Analyzer for EIS & HFR

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# SPECIFICATIONS: 855 SOFC & SOEC Test System

## Electronic Load:

| | |
|---|---|
| Maximum Load Current | 5/25/50 A or 10/50/100 A (maximum 25 A with boost power supply in zero-volt mode) |
| Maximum Load Power | 100 W |
| Minimum Load Resistance | < 2 mΩ (100 mV @ 50 A at load terminals) |
| Current Resolution: | 1 mA for 5/25/50 A; 10 mA for 10/50/100 A |
| Current Accuracy | 0.3% of full scale current of selected range |

## Voltage Measurement and Data Acquisition:

| | |
|---|---|
| Max . Whole Cell Voltage | 20 V |
| Max . Reference Electrode Voltage | 9.999 V |
| Sense Lead Input Resistance | >35 kΩ |
| Voltage Resolution | 1 mV |
| Voltage Accuracy | ±3 mV ±0.3% of reading |
| Voltage & Current Data Update Rate | 100 Hz |

## Reactant Gas Control System:

| All 316 SS construction of humidifiers, flow path, valves & mass flow controllers, with Swagelok® fittings | |
|---|---|
| Mass Flow Control | Anode up to 1 SLPM and cathode up to 5 SLPM*, software controlled mass flow controllers<br>Automatic $N_2$ purge valves on anode and cathode |
| Alarm Inputs | Gas supply pressures (3), humidifier water level (1) Furnace over temperature (1), and external (1) |

## Temperature Controllers:

| | |
|---|---|
| Quantity | (3) Furnace, Anode Humidifier, Cell Temp |
| Set and Report Accuracy | ±0.25 % of span, ±1 least significant digit |
| Sensor Type | Thermocouple, Type K (R/S also Available) |

## Temperature Limit Controller:

| | |
|---|---|
| | (1) Furnace Over-Temp |

## Humidifier:

| | |
|---|---|
| Type | Single bottle-type Passivated 316L |
| | Auto Water fill |
| | Automated Humidifier Bypass |

## Environment:

| | |
|---|---|
| Operating Temperature | 5 to 35 ° C |
| Power Source | 220-240 V, 50-60 Hz, 20 A |
| Enclosure Type | Single bench top enclosure |
| Size and Weight | 91 cm H x 61 cm W x 61 cm D (+ 41 cm for heated gas lines), 55 kg<br>36" H x 24" W x 24" D (+ 16" for heated gas lines), 120 lb. |
| Safety Features | Automatic shutdown and $N_2$ 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 |


# 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

** Knowledge of systems integration and electrical wiring conventions is required

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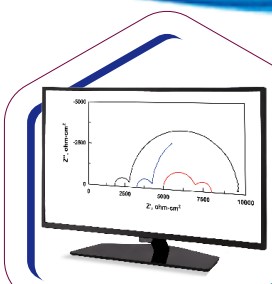
### OPTIONS



Electrochemical Impedance Spectroscopy

Gas Mixing Interface

892e Data Expansion

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# 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 mΩ (125 W, 500 W), < 0.7 mΩ (1 kW), < 0.35 mΩ (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 kΩ |
| Reference Electrode Input Resistance | > $10^9$ Ω |
| Voltage Resolution | 1 mV |
| Voltage Accuracy | ±3 mV ±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 | ±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 select-able 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 |

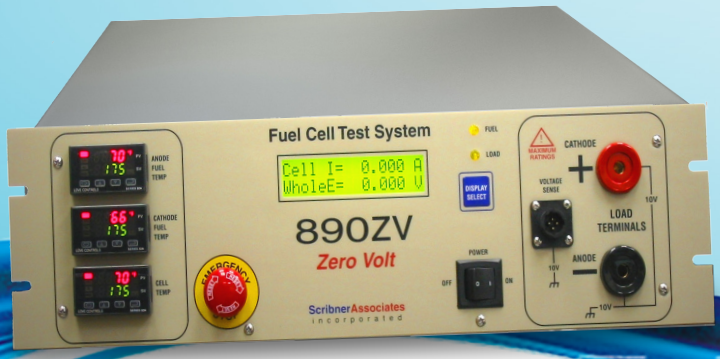
## Environment:

| | |
|---|---|
| Operating Temperature | 5 to 35 °C ambient; all specs given for 25 °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 $N_2$ 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

# 890ZV
# Advanced SOFC Fuel Cell Test Loads

## Includes Zero Volt Operation

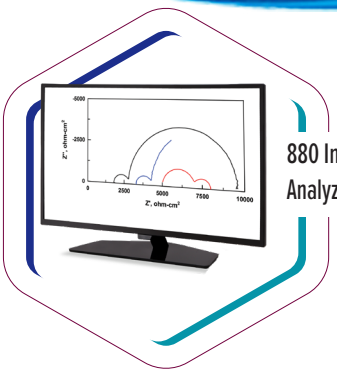



The 890ZV is an air-cooled, multi-range programmable electronic load with integrated Zero Volt Boost Supply.

## The 890ZV features

- Electronic load with two current ranges: 5 / 25 A, 10 V, 50 W
- Ramping cell/furnace temperature control
- Control signals for two (2) main mass flow controllers plus five (5) additional mass flow controllers
- 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
- Optional internal impedance analyzer for EIS and continuous real-time high frequency resistance (HFR)
- Cell main terminals and sense inputs tolerant of non-isolated cell
- Three (3) internal controllers for anode and cathode humidifier and cell temperatures
- Current, voltage or power control mode
- Contact inputs for three pressure sensors or alarms
- Low voltage output signal to control purge gas valves and to indicate alarm condition
- RS485 digital interface for supported external devices
- The 890ZV requires a custom or third-party fuel management unit to make a complete test station.
- Safety features include detection of alarm conditions and automatic hardware shutdown for safe, reliable operation

## OPTIONS



880 Impedance Analyzer for EIS


885 HS Potentiostat

892e Data Expansion

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# SPECIFICATIONS: 890ZV Advanced SOFC Fuel Cell Test Loads

## Electronic Load:

| | |
|---|---|
| Maximum Load Current (2 ranges)` | 5, 25 A |
| Maximum Load Voltage | 10 V |
| Maximum Load Power | 50 W |
| Minimum Load Resistance | 3.3 V power supply used to allow zero load voltage at full current with up to 3.2V drop in cell wiring |
| Current Resolution: | 1 mA |
| Current Accuracy | 0.3% of full scale current of selected range |

## Voltage Measurement and Data Acquisition:

| | |
|---|---|
| Max . Whole Cell Voltage | 10.000 V |
| Max . Reference Electrode Voltage: | 9.999 V |
| Whole Cell Sense Input Resistance | > 35 kΩ |
| Voltage Resolution | 1 mV |
| Voltage Accuracy | ±3 mV ±0.3% of reading |
| Voltage & Current Data Update Rate | 100 Hz |

## Fuel Interface:

| | |
|---|---|
| Outputs for anode, cathode flow controllers | Two, Analog (0-5 V) |
| Outputs for reformate flow controllers | Five, Analog (0-5 V) (optional) |
| Alarm Inputs | Six, Three for gas pressures, three auxillary |
| Alarm Outputs | One, 5 V logic |
| Fuel Solenoid Control | One, 5 V output (external relay needed, included with interface box) |

## Temperature Controllers:

| | |
|---|---|
| Quantity | Three (Anode, Cathode and Cell / Furnace) |
| Type | On/off 5 V output (external SSR required) |
| Set & Report Accuracy | 0.25% of span, ±1 least significant digit |
| Sensor Type | Thermocouple, Type T, K, or S optional |

## Impedance Measurements:

| | |
|---|---|
| Interface for Internal or External Analyzers | Voltage and current 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 plus two half cell vs. reference electrode |

## Environment:

| | |
|---|---|
| Operating Temperature | 5 to 35 ° C |
| Power Source | 100 - 240 VAC, 50/60 Hz (auto select) |
| Size | 3U std rack mount, 19" W x 5.25" H x 21" D |

## Safety Features:

Automatic shutdown and $N_2$ 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

# PRODUCT CONFIGURATION

## LET'S CONFIGURE YOUR TEST SYTEM

If It Isn't On The Page, Let's Talk Customization

8 5 0 [ ] - A [ ] [ ] X [ ] [ ] [ ] C [ ] [ ] X [ ] [ ] - [ ] [ ] [ ]

Optional Mixing[1] (X [ ] [ ] [ ])

Optional Mixing[1] (X [ ] [ ] [ ])

Anode[2] (A [ ] [ ] X [ ] [ ] [ ])

Cathode[2] (C [ ] [ ] X [ ] [ ] [ ])

Mass Flow Section (A [ ] [ ] X [ ] [ ] [ ] C [ ] [ ] X [ ] [ ] [ ])

### LOAD DEFINITION

| Code | Description |
|---|---|
| B | 100W 5/25/50A |
| C | 100W 10/50/100A |
| D | 100W 12/62/125A |

| HYDROGEN | | NITROGEN | | AIR | |
|---|---|---|---|---|---|
| Code | Description | Code | Description | Code | Description |
| H1 | 0.1 SLPM H2 | N1 | 0.1 SLPM N2 | A1 | 0.1 SLPM Air |
| H2 | 0.2 SLPM H2 | N2 | 0.2 SLPM N2 | A2 | 0.2 SLPM Air |
| H3 | 0.5 SLPM H2 | N3 | 0.5 SLPM N2 | A3 | 0.5 SLPM Air |
| H4 | 1.0 SLPM H2 | N4 | 1.0 SLPM N2 | A4 | 1.0 SLPM Air |
| H5 | 2.0 SLPM H2 | N5 | 2.0 SLPM N2 | A5 | 2.0 SLPM Air |
| H6 | 5.0 SLPM H2 | N6 | 5.0 SLPM N2 | A6 | 5.0 SLPM Air |

*[1] Mixing Mass Flow Controllers are NOT required. Only (1) Internally mounted Mixing Mass Flow Controller per Test-Station for additional mixing capabilities. Externally mounted options are available (850 Reformate Box). Mixing option after the A (Anode) and before the C (Cathode) denotes mixing capabilities on the Anode side. The mixing option after the C (Cathode) denotes mixing capabilities on the Cathode side.*

*[2] Custom Anode and Cathode Mass Flow controllers may be available. Contact* ***info@scribner.com*** *for additional details.*

### INTERNAL OPTION CODE

| Code | 881 FRA | Humidifier By-Pass | Humidifier Auto Drain /Fill |
|---|---|---|---|
| 0 | N | N | N |
| 1 | N | Y | N |
| 2 | N | Y | Y |
| 3 | N | N | Y |
| 4 | Y | N | Y |
| 5 | Y | N | N |
| 6 | Y | Y | N |
| Z | Y | Y | Y |

### THERMOCOUPLE CODE

| Code | Cell Thermocouple Type |
|---|---|
| 0 | No |
| J | Type J |
| K | Type K |
| R | Type R |
| S | Type S |
| T | Type T |

### PLUG (VOLTAGE) CODE

| Code | Plug Type |
|---|---|
| C | Chinese Plug (230V) |
| E | European Plug (230V) |
| N | North American Plug (120V) |
| U | UK Plug (230V) |


# EMPOWERING ELECTROCHEMISTRY

## ABOUT US

We're the power behind the pioneers—advancing electrochemical research with precision instruments, deep expertise, and unwavering support.

More than a supplier, we're a trusted partner in innovation, removing technical barriers so scientists can focus on breakthroughs that shape the future.

From lab bench to global impact, Scribner makes complex research possible, precise, and scalable.

## OUR EXPERTISE

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