A world of clean energy awaits.
We are here to assist you, the developer.

FUEL CELL IMPEDANCE MEASUREMENT SYSTEM

As-510 Series

- Multiple ways to measure and evaluate power generation characteristics.
- High-performance analyzer for testing various power generation characteristics.
- Powerful impedance measurement.
- Measurement of electrical polarity using cyclic voltammetry.
- Revolutionary automatic estimation of internal equivalent circuits.
- Automated measurement system for improved test reproducibility

Fuel Cell Impedance Measurement System
As-510-S4

NF Corporation

Suitable for testing fuel cells equipped with a reference electrode.
Provides more detailed analysis of fuel cell internal conditions.

Fuel Cell Impedance Measurement System As-510-S4

The system comprises a fuel cell power generation analyzer, an impedance analyzing unit, and system software. It supports simultaneous measurement of anode, cathode, and reference electrode current and voltage characteristics and impedance measurement. This automated measuring system allows detailed analyses of fuel cell internal response processes.

Basic Composition
Fuel Cell Analyzer As-510-4
Impedance Analyzing Unit As-510-IMU
System Software

- **Suitable for testing fuel cells equipped with a reference electrodes.**
  Provides detailed analysis of fuel cell internal conditions.
  Simultaneous measurement of anode, cathode, and reference electrode current and voltage characteristics and impedance measurement
- **Support for a variety of measurements**
  - Measurement of current and voltage characteristics (Tafel plot)
  - Membrane resistance measurement using current interruption method and step method (PAT.P.)
  - Impedance measurement (Cole-Cole plot, Bode plot)
  - Constant current/constant voltage measurement, OCV measurement
  - Measurement of electrical polarity characteristics using cyclic voltammetry and linear sweep voltammetry
  - Electrochemical Impedance Spectroscopy (EIS)
- **Supports automated sequential testing using sets of tests selected by the user.**
- **System software supports quantitative evaluation and measurement with a high degree of reproducibility.**
  - Control of individual devices
  - Real-time display of measurement results
  - Graphical display functions (support for simultaneous display or superimposed display of multiple graphs)
  - Automated testing program
- **Fuel cell analyzing software is available for more detailed analysis of internal fuel cell conditions (optional).**
  - Automatic equivalent circuit estimation based on impedance measurement results
  - Analysis of catalyst characteristics based on electrode characteristic measurement results

Custom systems can be constructed for specific applications.
Please contact us for details.

Fuel Cell Analyzer As-510-4

Capable of evaluation of fuel cells fitted with many types of reference electrodes.
Supports detailed evaluation and analysis of anode and cathode characteristics.

[Main Specifications]
Voltage: 0V to 20V
Power: 100W
Current: 10A (low), 50A (mid), and 100A (high)
Current setting accuracy: ±0.05% of full scale max.
(constant-current operation in all ranges)
Current measurement accuracy: ±0.05% of full scale max. (auto range)
Voltage setting accuracy: ±0.5% of set value + ±0.2% of full scale max.
Voltage measurement accuracy: ±0.1% of full scale max.
IR measurement range: 0.0000m to 999.99m (five-digit display)
IR measurement timing: Variable, between 10s and 1000s after interruption
Impedance frequency measurement range: 0.1mHz to 50kHz (full range)

Features
- Equipped with input terminals for three-terminal voltage measurement (+, -, and REF), the As-510-4 can measure the voltage between terminals and isolated resistance (IR) at the same time. It incorporates new circuitry to provide support for a wide variety of reference electrode types.
- NF's exclusive step method supports IR measurement with high reproducibility, while also supporting the current interruption method.
- When combined with the optional three-terminal impedance measuring unit, the As-510-4 can measure impedance between terminals and supports continuous measurements without having to change connections.
- Three ranges (10A, 50A, and 100A), and capacity of up to 20V or 100W.
- More precise current and voltage settings and more accurate measurement provide improved reproducibility.
- Compatible with constant-current/constant-voltage operation, and supports Open Circuit Voltage (OCV) measurement.
- Equipped with a GPIB interface.

Impedance Analyzing Unit As-510-IMU

Supports simultaneous measurement of impedance between three voltage detection terminals.

This optional unit brings together NF's technology from the field of frequency response analyzers in a single package for measuring fuel cell impedance. It realizes possible measurements required for more detailed analysis. The As-510-IMU supports simultaneous measurement of impedance between three voltage detection terminals. When used with a short stack, maximum of three test points (a single cell in a stack, multiple cells in a stack, etc.) as well as the whole cell can be measured simultaneously.

Features

- Four input channels enable use of one current as a reference while measuring the voltage response at up to three points.
- The channels are insulated from each other, therefore any point in the cell can be measured.
- Detailed analysis of the measurement results can be performed using Fuel Cell Analyzing Software (As-510-Z, sold separately).

[Main Specifications]

Setting frequency range: 0.1 mHz to 100 kHz
Oscillator output waveform: Sine wave
Oscillator signal amplitude: 0 to 20 Vp-p (with output terminals open)
Number of analyzer channels: 4
Analysis items: CH1/CH2, CH1/CH3, CH1/CH4
(System software is required in order to use the optional As-510-IMU.)

Electrode Analyzing Unit As-510-CVM NEW

For measuring electrode characteristic.

This optional unit supports DC analysis using cyclic voltammetry or linear sweep voltammetry as well as measurement of MEA electrochemical impedance (EIS) when power generation is not taking place. It performs measurements essential to identifying causes of MEA deterioration, which can affect fuel cell performance.

Features

- Supports measurement using cyclic voltammetry or linear sweep voltammetry.
- Supports Electrochemical Impedance Spectroscope (EIS)
- Detailed analysis of the measurement results can be performed using Fuel Cell Analyzing Software (As-510-Z, sold separately).

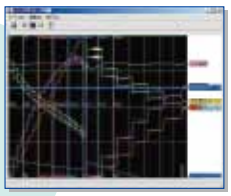
[Main Specifications]

Measurement items: Cyclic voltammetry, linear sweep voltammetry, EIS
Measurement range: Voltage: ±4V, 1mV resolution
Current: ±4A, 10A resolution
EIS operating frequency range: 0.1mHz to 50kHz
(System software is required in order to use the optional As-510-IMU.)

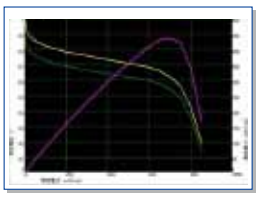
System Software

As-510-S4 is a custom software package that handles all aspects of using the fuel cell evaluation system, including control of individual devices, graphical display of measurement results, and storing data.

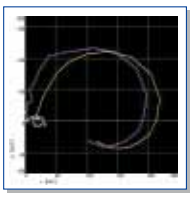
Supports simultaneous or superimposed display of multiple graphs.



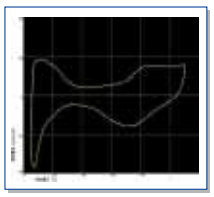
Trend Graph



Tafel Plot



Cole-Cole Plot



Voltammogram

[System Requirements]

PC
Operating system: Japanese version of Microsoft Windows 2000 or XP Professional
RAM: 256 MB or more (1 GB or more recommended)
Display: SVGA, 1,024×768 pixels and 256 colors or more

GPIB Interface
PCI-GPIB, PCMCIA-GPIB, USB-GPIB-B
(Any of the above, all manufactured by National Instruments)
Note: Requires an expansion slot.

Cell for Analysis As-510-C

The As-510-C is a cell equipped with a reference electrode and supports three-terminal measurement using As-510-4. Any MEA can be bracketed in order to measure its characteristics. Both polymer electrolyte fuel cell (PEFC) and short stack versions with 5cm^2 and 25cm^2 electrode areas are available.

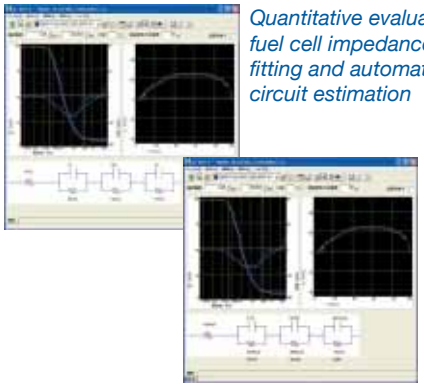
Fuel Cell Analyzing Software As-510-Z NEW

For quantitative evaluation of fuel cell characteristic.

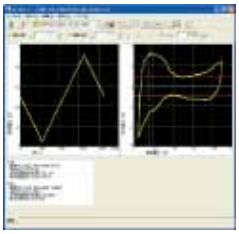
This software performs automated equivalent circuit estimation by means of a proprietary algorithm that uses curve fitting on the impedance measurement results. This allows quantitative evaluation and analysis of the fuel cells internal impedance. It also calculates the catalyst active area using a voltammogram derived from measurements of electrode characteristic. This allows a quantitative assessment of the catalyst activation level. The As-510-Z software provides support for detailed analysis of fuel cell characteristic.

Features

- Performs automated estimation of equivalent circuits from impedance measurement results, with no need for the user to input initial settings.
  Also supports estimates based on user-defined models.
- Simulates the response of equivalent circuits specified by the user.
- Simulates the response at frequencies without actual measurement.
- Calculates the catalyst active area using a voltammogram, making possible quantitative assessment of the activation level.
- Supports the following circuit elements:
  R, L, C, R//C, R//L, R//L//C, Zw, CPE, R·Zw//C, R·CPE//C, R//CPE



Quantitative evaluation of internal fuel cell impedance using curve fitting and automated equivalent circuit estimation



Analysis of catalyst response using voltammogram

[As-510-Z System Requirements]

Operating system: Microsoft Windows 2000 or XP Professional
CPU: Pentium Ⅲ 800MHz or above
CD-ROM drive: Required for installation
Pointing device: Required
Display: SVGA, 1,024× 768 pixels and 256 colors or more

Frequency Response Analyzer FRA5095

A high-precision Frequency Response Analyzer with an excellent reputation and recognized results in electrochemical measurement.

Main Features

- Frequency range: 0.1mHz to 2.2MHz
  Note: The upper limit for impedance response measurements is determined by the frequency response of the power generation analyzer.
- Measurement accuracy: Amplitude ±0.5%, phase ±0.3°
- Uses discrete Fourier transform (DFT) for protection against noise.
- Interface: GPIB

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