燃料电池评价系统

As-510 系列

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

Zoom

Basic Composition

Fuel Cell Analyzer **As-510-4**

Impedance Analyzing Unit **As-510-IMU**

System Software

- **Multiple ways to measure and evaluate power generation characteristics**
- **High-performance analyzerfor testing various power generation characteristics**
- **Powerful impedance measurement** (As-510-IMU required)
- **Measurement of electrical polarity using cyclic voltammetry** (As-510-CVM required)
- **Revolutionary automatic estimation of internal equivalent circuits** (As-510-Z required)
- **Automated measurement system for improved test reproducibility**

The system comprises a fuel cell power generation analyzer, an impedance analyzing unit, and system software. It can simultaneously measure impedance characteristics as well as current and voltage characteristics of a fuel cell's anode cathode, and reference electrode.This automated measuring system allows detailed analyses of fuel cell internal response processes.

- **Suitable for testing fuel cells equipped with a reference electrodes. Provides detailed analysis of fuel cell internal conditions.**

  Simultaneously measurement of impedance characteristics as well as current and voltage characteristics of anode, cathode, and reference electrode.

- **Support for a variety of measurements**
  - Measurement of current and voltage characteristics (Tafel plots)
  - Membrane resistance measurement using current interruption method and step method (PAT.P.)

- Impedance measurement (Cole-Cole plots, Bode plots, As-510-IMU required)
- Constant current/constant voltage measurement, OCV measurement
- Measurement of electrical polarity characteristics using cyclic voltammetry and linear sweep voltammetry (As-510-CVM required)
- Electrochemical Impedance Spectroscopy (EIS) (As-510-CVM required)

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 (allows simultaneous display or superimposed display of multiple graphs)
- Automated testing program

Fuel cell analyzing software (As-510-Z) is available for more detailed analysis of internal fuel cell conditions.

- 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 evaluatiing fuel cells fitted with many types of resference electrodes. Supports detailed evaluation and analysis of anode and cathode characteristics.

Features

Equipped with input terminals for three-terminal voltage measurement (+, -, and REF), the As-510-4 can simultaneously measure the voltage between terminals and isolated resistance (IR). 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.

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&Mac189; to 999.99m&Mac189; (five-digit display)
IR measurement timing: Variable, between 10µs and 1000µs after interruption
Impedance frequency measurement range: 0.1mHz to 50kHz (full range)

Imprdanece Analyzing Units　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 into a single package for measuring fuel cell impedance. It allows 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, not just the entire cell, but up to three test points (a single cell in a stack, multiple cells in a stack, etc.) can be measured simultaneously.

■Features■

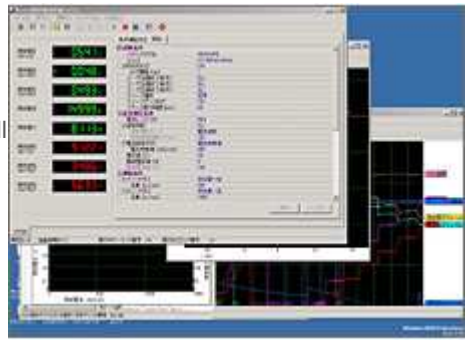
- Four input channels enable use of one current as a reference while measuring the voltage response at up to three points.
- The channels are insulated from each other, any point in the cell can be measured.
- Detailed analysis of the measurement results can be performed with Fuel Cell Analyzing Software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

■Main Specifications■

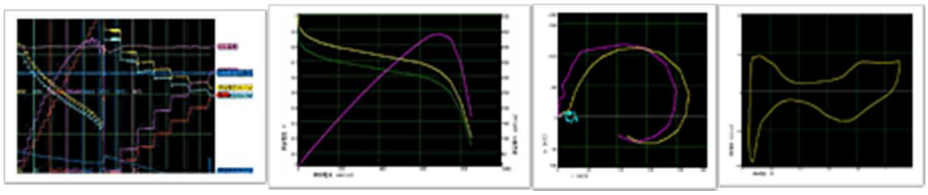
Setting frequency range: 0.1 mHz to 100 kHz
Oscillator output waveform: Sine wave
Oscillator signal amplitude: 0 to 20 Vp-p (with output terminals open)
Number of analyzer channels: 4
Analysis items: CH1/CH2, CH1/CH3, CH1/CH4
(System software is required in order to use the optional As-510-IMU.)

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

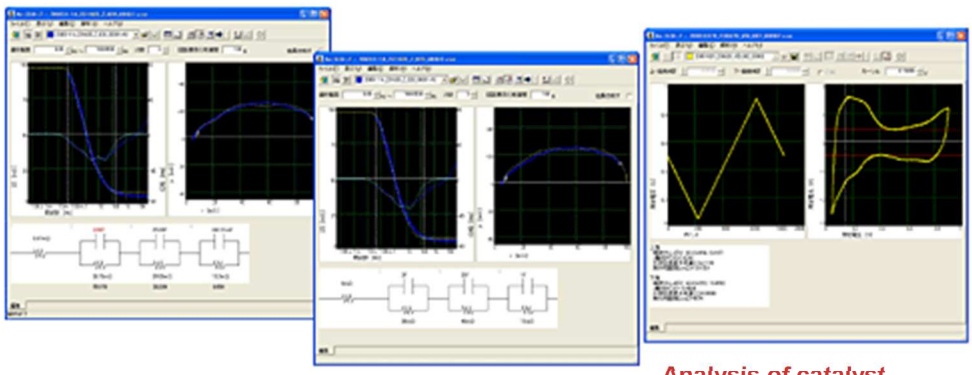
Operating system: Microsoft Windows 2000 or XP Professional
RAM: 256 MB or more (1 GB or more recommended)
Display: SVGA, 1,024 768 pixels and 256 colors or more

GPIB Interface

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

For quantitative evaluation of fuel cell characteristics.

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 with 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 characteristics.



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

Analysis of catalyst response, using voltammogram

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 response at different frequencies without actual measurement.

- Calculates the catalyst active area via 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

As-510-Z System Requirements

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

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.

For Impedance Measurement

Frequency Response Analyzer FRA5087

A High-precision Frequency Response Analyzer with an excellent reputation and recognized results for electrochemical measurements.

Main Features

- **Frequency range: 0.1mHz to 10MHz**

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 ±0.3º**
- **Uses discrete Fourier transform (DFT) for protection against noise.**
- **Interface: GPIB**