

# HIOKI

## EIS MEASUREMENT SYSTEM ALDAS-Mini



## Visualizing Dynamic Characteristics of Electrolysis Cells and Fuel Cells

Exploring optimization parameters to minimize EC / FC operational costs

CE

# Innovation is electrolysis cell and fuel cell development

## ALDAS-Mini

### Insights into the internal state of the cell while in operation

Cell impedance measurement during electrolysis or generation

### Easy connection and setup

No modifications to the system needed

## 5 Key Benefits



### Compare individual cells under identical conditions

Simultaneous measurement of up to 8 cells in a stack

### Delivers consistent, reproducible analysis

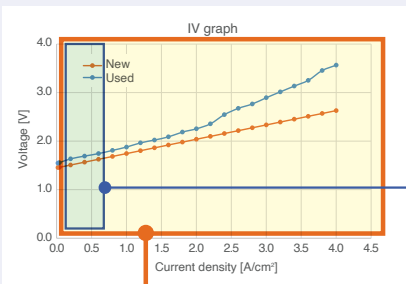
High-precision measurements in noisy environments

### One tool for all cell-types

Supports various electrolysis cells (PEMEC, SOEC, AWE, etc.)

## Cell impedance measurement

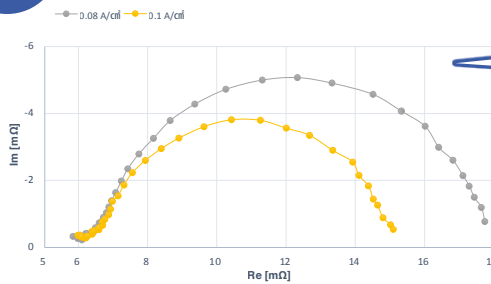
### Accelerate cell development via high-current operational testing



Without ALDAS

### Max. 50 A operational current

Only small-scale R&D cells can be measured



Standard FRAs\* have limited range

### Application examples

- Small electrolysis cell evaluation (1 cm<sup>2</sup>)
- Research of electrolysis cell materials
- Operation assessment at low-current density

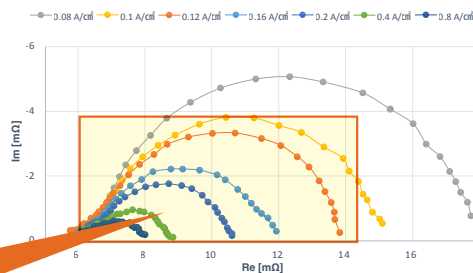
\*FRA: Frequency Response Analyzer

With ALDAS

### Max. 2000 A electrolysis or load current

Evaluate industrial-scale cells or cell stacks during actual operation

Expand EIS into the high-current region



### Application examples

- Large cell evaluation (100 cm<sup>2</sup>)
- Evaluation of material properties under actual operating conditions
- Analyze cell health throughout its life-cycle to optimize operating conditions

## No modifications to the system needed

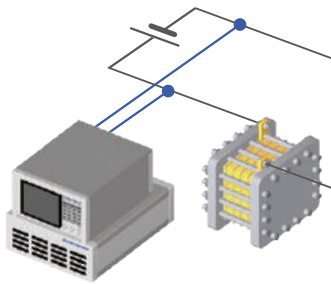
### Connect to a system already in use

No modification to your system is needed to set up the ALDAS-Mini.

Unlike conventional booster-equipped FRA devices, the ALDAS-Mini operates seamlessly alongside the cells' DC power supplies and electronic loads.

**STEP 1**

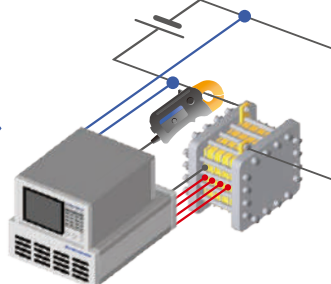
#### Applied current connection



Connect the SOURCE MODULE to the cell's power source terminal with the SOURCE CABLE. The SOURCE MODULE applies AC current for measurement.

**STEP 2**

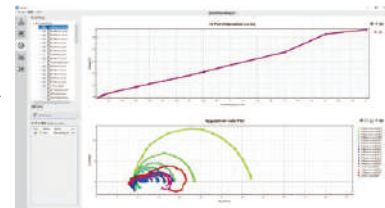
#### Measurement line connection



Attach the current sensor to measure the current. Then, connect the SENSE CABLE to the cell to measure the voltage (both connected to the SENSE MODULE)

**STEP 3**

#### Start measurement



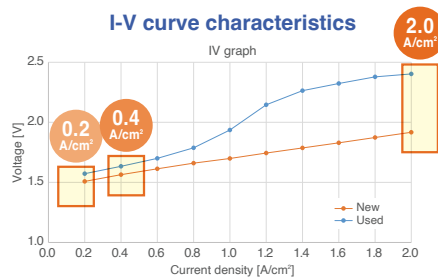
Start the measurement the I-V curve and Nyquist plot will be displayed in real-time during the measurement.



## Find what causes degradation with I-V curve and Nyquist plot

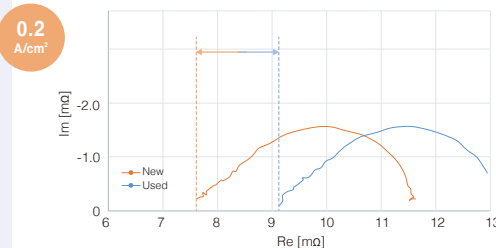
ALDAS simultaneously generates the I-V curve and Nyquist plot, enabling measurement across a wide range of current densities. This means that you can now quantify and compare internal changes in cells of a wide range of currents.

### Measurement examples



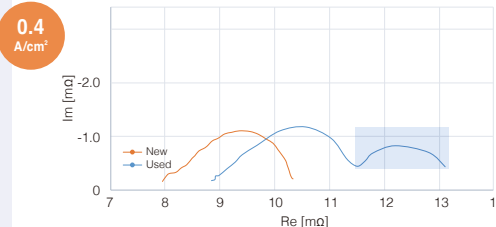
Comparison between new and used cells. At high current density, the used cell shows strongly nonlinear behavior.

### Nyquist plot at various current densities



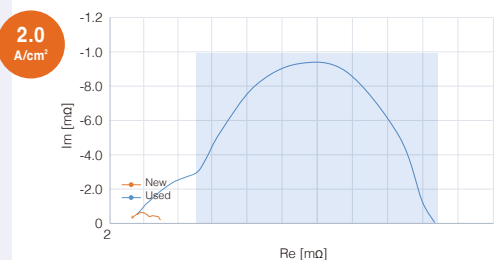
The ohmic resistance increases when the cell operates for a period of time. This causes the arc on the Nyquist plot to shift to the right.

► **Indicates cell degradation**



A similar arc for both cells indicates charge transfer resistance. Only the used cell shows a second arc indicating mass transfer resistance.

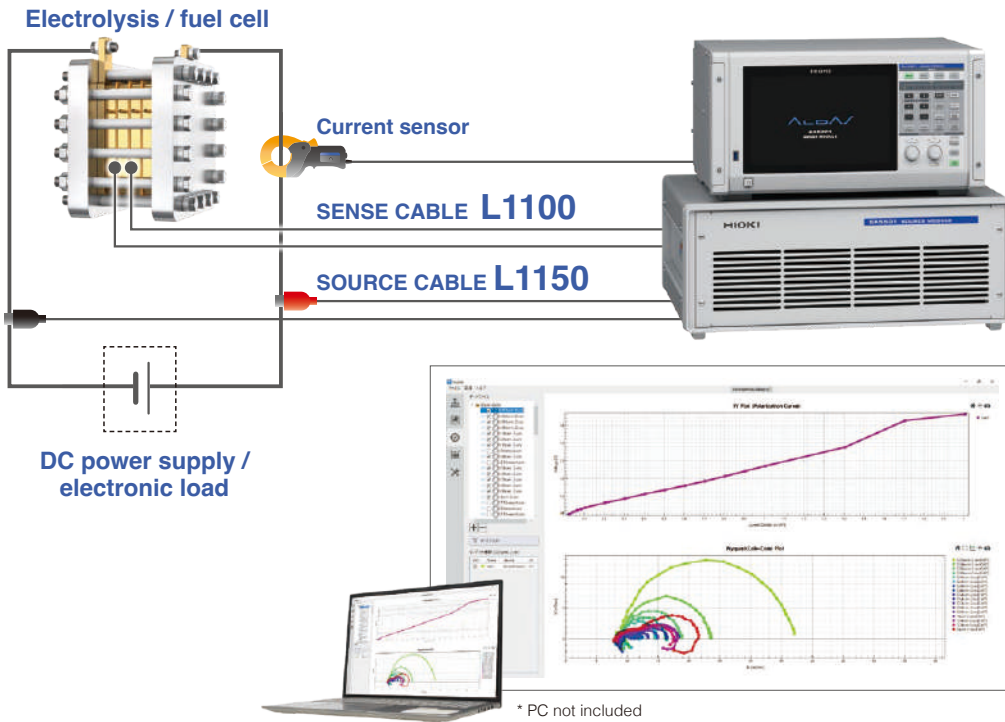
► **Indicates changes in catalytic activity**



A significant increase in the size of the used cell arc (blue line) indicates a mass transfer resistance. This leads to lower operation efficiency.

► **Indicates reduced operating efficiency due to mass transfer resistance**

# System configuration



**SENSE MODULE EA5301**  
Measure current and voltage across each cell

**SOURCE MODULE EA5501**  
Inject AC measurement current

**PC Software EA5701**  
The I-V curve and Nyquist plot are displayed simultaneously in real-time, with impedance calculated from the measured current and voltage. For equivalent circuit analysis, save file in Scribner ZView® format.

## Specifications

Measurement target	Electrolysis cell, fuel cell, cell stack
Measurement parameters	Impedance (R, X, $\theta$ , Z) voltage (V), current (I)
Measurement modes	Logging Mode, EIS Mode
Display modes	Nyquist plot, Bode plot, logging plot
Measurement voltage range	250 mV to 60 V
Measurement current range	100 mA to 500 A (CT6845A) Maximum 2000 A (depending on the combination of sensors)
Max. applied measurement signal	40 Ap-p (at 5 V) Derating applies for voltages above 5 V
Measurement frequency range	10 mHz to 100 kHz
Number of input channels	1 to 8 channels
Dimensions and weight	SENSE Module EA5301 (with 8 channels): approx. 430W × 221H × 361D mm (16.9W × 8.7H × 14.2D in.) (excluding protruding parts), approx. 12.7 kg (28.0 lbs) SOURCE module EA5501: approx. 520W × 197H × 540D mm (20.5W × 7.8H × 21.3D in.) (excluding protruding parts), approx. 27.0 kg (59.5 lbs) (not including cables)
Power supply	100 V to 240 V AC, 50 Hz/60 Hz, 500 VA
PC requirements	OS: Windows 11 Interface: wired LAN

## Options

Current sensor	Appearance	Model name	Rated measurement current	Accuracy	Core diameter
Pass-through types		CT6904A	500 A RMS	0.02% rdg.	Φ32 mm
		CT6875A	500 A RMS	0.04% rdg.	Φ36 mm
		CT6873	200 A RMS	0.03% rdg.	Φ24 mm
		CT6872	50 A RMS	0.03% rdg.	Φ24 mm
Clamp types		CT6845A	500 A RMS	0.2% rdg.	Φ50 mm
		CT6847A	2000 Arms	±0.15% rdg.	Φ50 mm
		CT6844A	500 A RMS	0.2% rdg.	Φ20 mm
		CT6843A	200 A RMS	0.2% rdg.	Φ20 mm
		CT6841A	20 A RMS	0.2% rdg.	Φ20 mm

### SENSE CABLE L1100



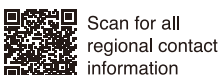
### SOURCE CABLE L1150



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