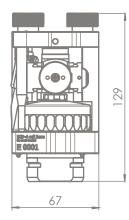
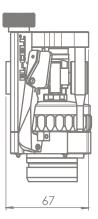




Dimensions in mm:





# ECD-4-nano

# Advanced test cell for the measurement of electrode expansion with nanometer resolution.

The ECD-4-nano is a high-resolution electrochemical dilatometer. It offers a capacitive parallel plate sensor system with a resolution of better than 5 nanometers. This makes the ECD-4-nano the perfect instrument for detecting thickness changes of the individual electrode or the full cell stack during the electrochemical cycle.

The ECD-4-nano's completely redesigned test cell features a corrosion-resistant cell bottom and a new One-Seal concept that significantly improves tightness over previous ECD-3 models. This enables stable long-term operation as well as the use of a wide range of electrolytes.

To further improve workflow and handling, we have now integrated the ECD-4-nano into the PAT system. The dilatometer can be inserted directly into a PAT-Tester-x or a docking station such as the PAT-Clamp-1. This allows a space-saving and fast setup of the instrument. Needless to say, the integrated PAT-Button also ensures automatic recognition of the test cell in our EL-Software measurement software.

## **Key Features**

- Capacitive displacement sensor (range 250 µm, resolution ≤ 5 nm)
- Additional gas pressure (0 to 3 bar) and temperature sensor (-20 to 80° C)
- Cableless connection via PAT socket, with electronic cell tag (PAT-Button)

### **Use Cases:**

- Expansion of the individual electrode
- 3-electrode setup with ring-shaped reference electrode
- Expansion of the full cell stack (2-electrode setup)
- For aprotic electrolytes

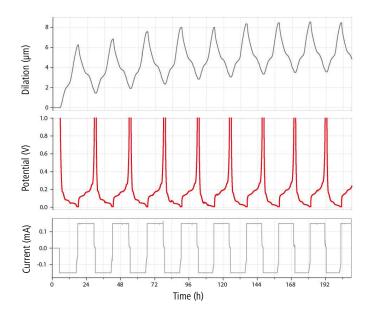
#### Product website:





Height / Width / Depth in mm129 / 67 / 70Electrode setup2 and 3-electrodeReference electrode typeRing-shapedWeight2 kgGlass T-Frit (Separator) dimensions2.5 / 10 m x 3.5 mmWorking (upper) electrode diameters 10 mmCounter (lower) electrode diameters 10 mmFast specimensprox. 1 MKado na test specimenapox. 1 MGas pressure sensor rangeNo 3 bar abs.Chemical compatibilityApotic organic electrody englishChemical compatibilityJeff cell mode: approx. 0.2 mlOperational temperature range (cell and sensor).20 to 80 °COperational temperature range (cending electronics).20 to 80 °C	Electrode setup2-Reference electrode typeRiWeight2Glass T-Frit (Separator) dimensions12Working (upper) electrode diameter<Counter (lower) electrode diameter<Test specimenElectrodeLoad on test specimenap	- and 3-electrode ting-shaped kg
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Operational temperature range (cell and sensor) Full cell mode: approx. 0.03 ml	Chemical compatibility A	protic organic electrolytes
Operational temperature range (conditioning electronics) 0 to 40 °C	Operational temperature range (cell and sensor) -2	20 to 80 °C
	Operational temperature range (conditioning electronics) 0	to 40 °C
Displacement sensor system capacitive	Displacement sensor system ca	apacitive
Displacement range 250 µm	Displacement range 2!	50 µm
Displacement resolution $\leq 5 \text{ nm}$	Displacement resolution <	≤ 5 nm

# Sample test results



#### Setup details:

Graphite vs. Li in LP30

Measuring the thickness change of the graphite electrode (Single electrode operation mode)

During the experiment, a constant load / force of 1 Newton is applied to the graphite electrode.

Additionally, gas pressure and temperature are monitored (not shown)

#### Devices in use:

- ECD-4-nano inside a temperature chamber
- PAT-Tester-x8 with a single PAT-Channel-1