eNPR Amplifier

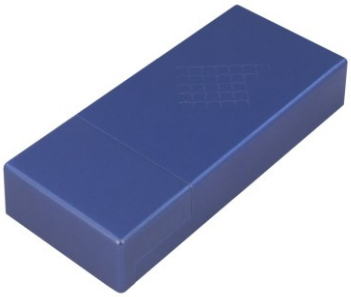
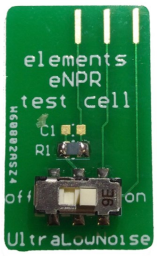
Functional checkout and Model Cell

Although all units are thoroughly tested at the factory prior to shipping, it is good practice to perform a functional checkout before using the amplifier for the first time.

This guide outlines the steps for a functional checkout, which includes:

- Noise and resistance measurement in open-circuit mode
- Measurement of Resistance (R) and/or Conductance (G) using the provided Model Cell

Material required:

- The eNPR amplifier 
- The Model cell 

- EDR4 software installed on your computer (click here to download the latest version)

Resistance and Noise measurement in open-circuit mode

1. Connect the amplifier to your PC and launch the EDR4 software.
2. Check you have removed any model cell / flow cell / BLMchip from the amplifier input. Close the lid of the amplifier.
3. Ensure that the settings of the 'Controls' widget match those shown in the left panel below.

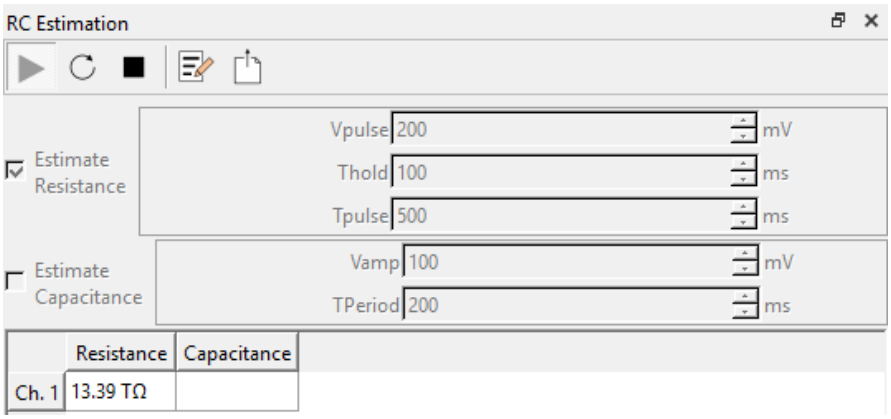
4. Go to the “RC Estimation” widget:
    - Tick “Estimate Resistance” ☑
    - Adjust stimulus parameters as displayed in the screenshot below:
    - Click the Play button (▶) to start the measurement.

A periodic square-wave voltage stimulus will be applied, and the estimated Resistance will be displayed.

⚠️ The measured value should not be lower than 1 TΩ.

If the value is lower, please contact support@elements-ic.com and include a screenshot of the EDR4 interface showing the test result.
Make sure the screenshot includes also both the current and voltage signals as well as the settings of the Controls widget.

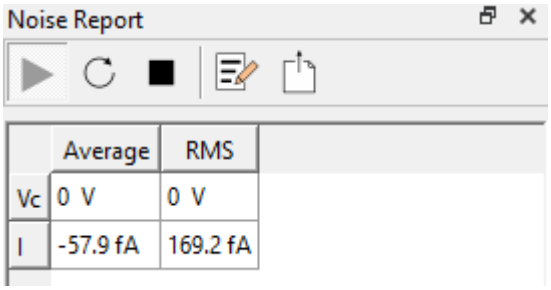
Press the stop button before proceeding to the noise test



5. Ensure that a constant voltage of 0 mV is applied by checking the oscilloscope window. Ensure that the settings of the 'Controls' widget match those shown in the left panel below.
   Then, access the “Noise Report” tool from the “Analysis” menu and start the analysis by clicking the green display button (▶), as shown in the right panel.

⚠️ The measured RMS noise value should not be larger than 300 fA.

If the value is higher, please contact support@elements-ic.com and include a screenshot of the EDR4 interface showing the test result.
Make sure the screenshot includes also both the current and voltage signals as well as the settings of the Controls widget.



The model cell

The 1GΩ Model Cell (MC) is a 15 × 25 mm PCB device featuring a **1GΩ resistor** (±30% tolerance). It includes a manual switch to select between:

- Low Noise (switch in OFF)
- Ultra Low Noise (switch in ON)

To change mode, slide the switch on the model cell

⚠️ **Important**: The **EDR4 software settings must match the selected noise mode**, as described in the following sections.

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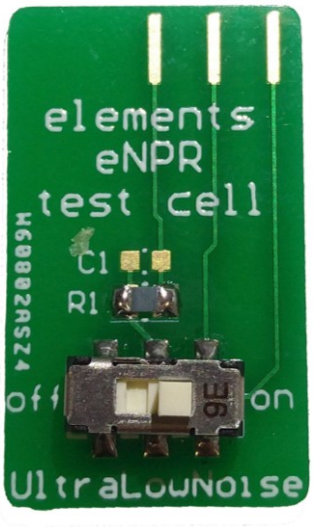
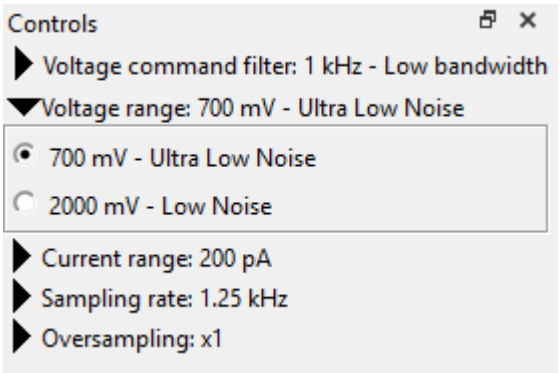


Reading the Resistance of the model cell

1. Select the noise mode (LN or ULN) on the Model Cell and insert it into the eNPR 100kHz amplifier. Close the lid.
2. Connect the amplifier to your PC and launch the EDR4 software.
3. In the startup window, press the “connect” button.
4. In the "Controls" widget:
5. Click the "Voltage Range" dropdown (▼)
6. Select:

- “700 mV - Ultra Low Noise” for ULN mode, or
- “2000 mV - Low Noise” for LN mode

⚠ *Mismatch between the switch position and the software setting results in incorrect readings*



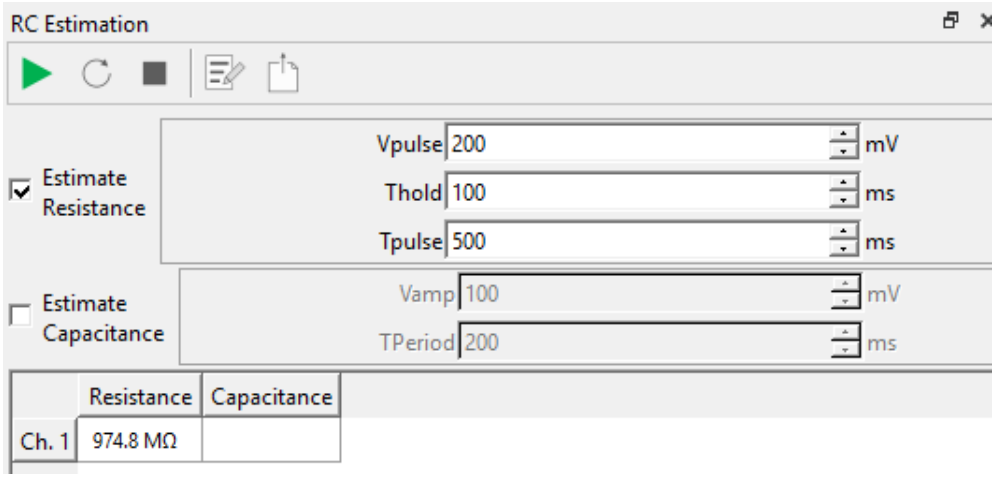
7. Go to the “RC Estimation” widget:

   Tick “Estimate Resistance” ☑

   Adjust stimulus parameters as displayed in the screenshot below:

   Click the Play button (▶) to start the measurement.

A periodic square-wave voltage stimulus will be applied, and the estimated Resistance (R) will be displayed. Given the ±30% tolerance of the model cell resistor, the value must fall between 700 MΩ and 1300 MΩ.



Measuring Model Cell Conductance Using the I-V Analysis Tool

Before starting this section, complete the first three steps described in the previous paragraph and ensure that the settings of the 'Controls' widget match those shown in the screenshot below.

1. Compensate for electrode offsets by clicking the **"Voltage Offset Compensation"** button (indicated by the red arrow in the figure below).

⚠️ **Note**: Once the baseline current reaches approximately **0 pA**, click the button again to **disable** the compensation tool **before applying any additional stimulus**.

2. Access the **I/V Graph Analysis** tool via the **"Analysis"** menu and start the analysis by clicking the green display button (▶).

3. Select and run the **“Conductance”** protocol, using the settings shown in the screenshot below (blue arrow). The parameters for the stimulus should be adjusted as shown.
4. Once the I/V curve is fully plotted, proceed to calculate the conductance by fitting the data with a linear equation: click the “Linear Fit” button (orange arrow) and review the results displayed in the box next to the button.

   Given that the Model Cell resistance is about 1 GΩ, the expected conductance value should be approximately 1 nS (±30% due to of the tolerance of the model cell resistor).