

# eNPR - connection diagram



## Revision History

Date	Version	Description
19/05/2021	2.0	Complete revision
30/12/2019	1.0	First version of document



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## Acronyms

eNPR: Elements Nanopore Reader.

ch#: input pins.

GND: ground. The potential of the Faraday cage.

REF: reference.

DUT: device under test. Usually a flow cell with a membrane or a nanopore, but can also be a model cell with resistors and/or capacitors.

BLM: bi-layer membrane. A membrane composed of 2 layers of phospholipids as happens in cell membranes.

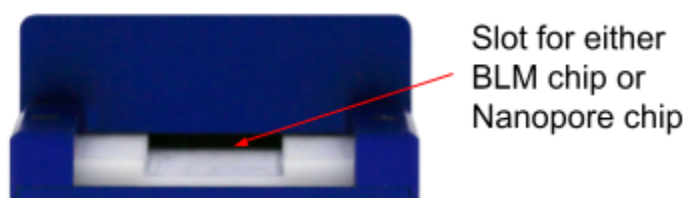
EMI: electro-magnetic interference. Environmental noise affecting the measurements.



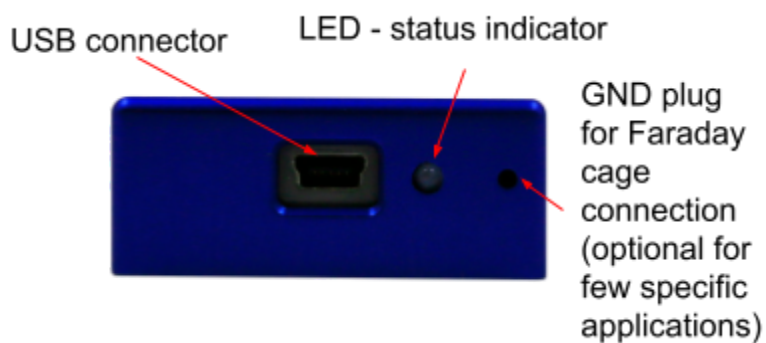
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## Front and rear view

### eNPR front-side connections



### eNPR back-side connections





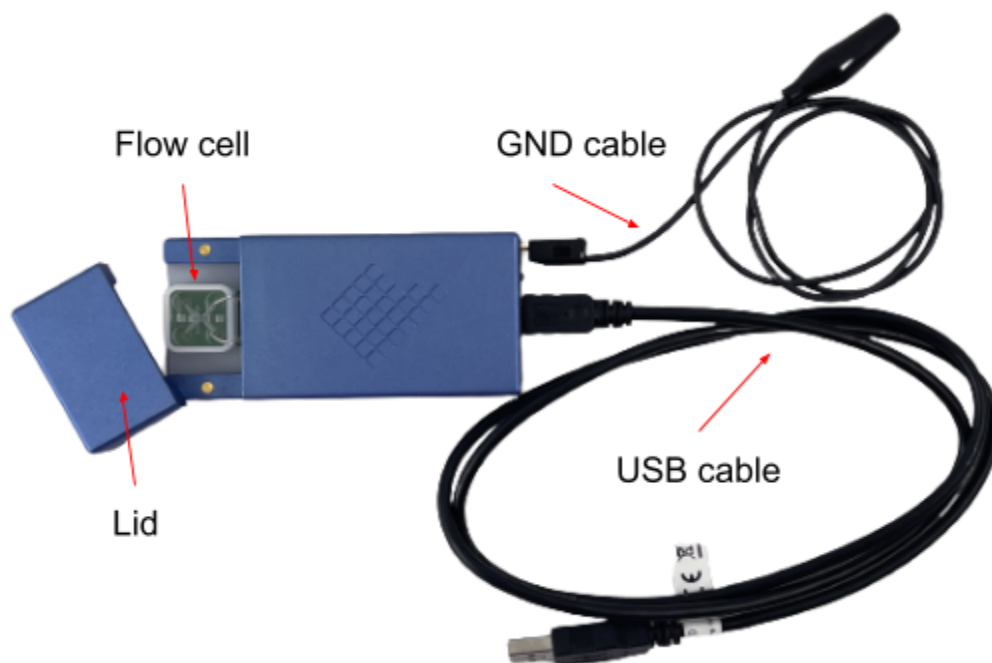
## eNPR setup

The eNPR is directly plugged to the computer via a USB cable and it forms a complete and stand-alone system. The USB cable is used for both data communication and as the power supply.

The device natively has a miniaturized Faraday cage given by the lid that is directly put on the eNPR. It is possible however to add an additional external Faraday cage that should be connected to the GND plug using the GND cable.

**IMPORTANT NOTE:** do not connect the external Faraday cage, if used, to any part of the device other than the GND plug in order to avoid short circuits. A good strategy is to add a layer of insulating material (e.g. tape) to the internal surface of the Faraday cage.

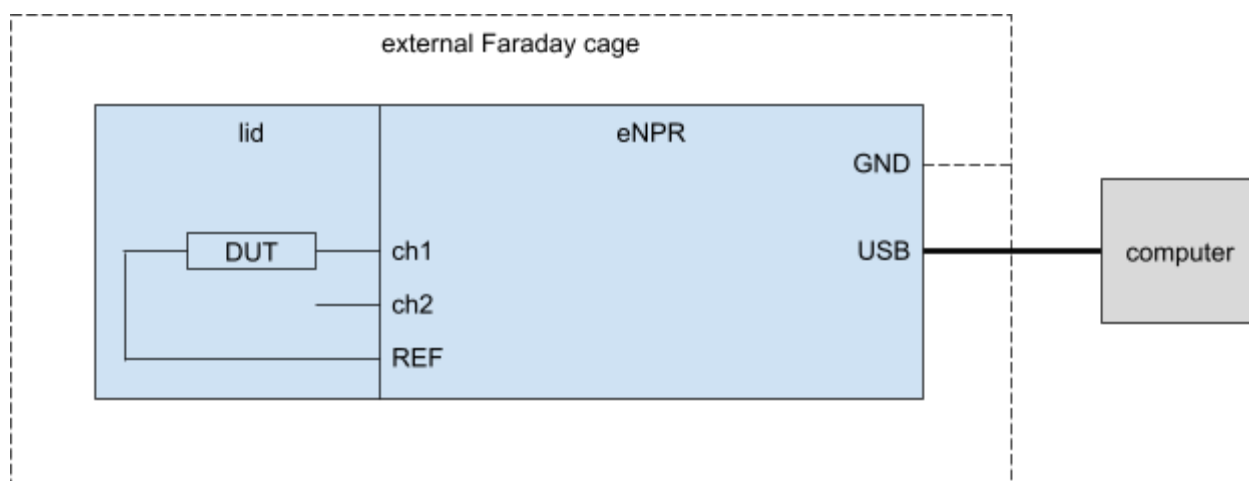
In order to avoid possible leakage and issues with the calibration of the device, it is important to pay attention not to wet the white plastic slot when the chambers of the flow cells are filled with liquids.



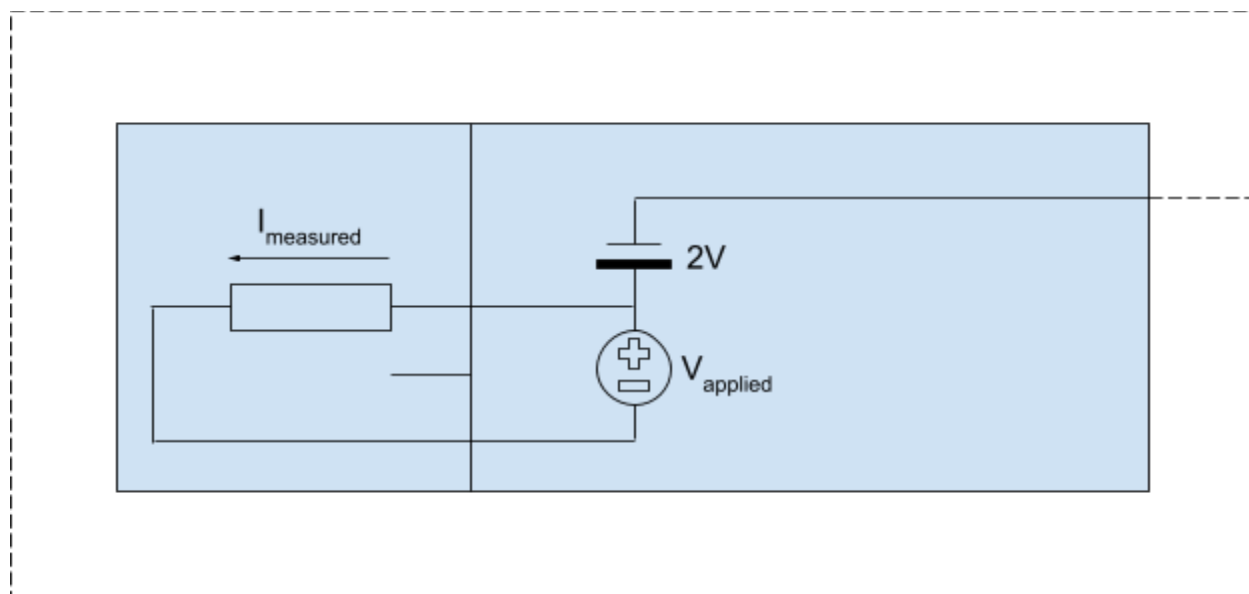


## Low noise configuration

The eNPR can be operated in Low Noise (LN) and Ultra Low Noise (ULN) configurations. The figure below shows how to connect the DUT in order to work in LN configuration. When this connection scheme for the DUT is used the LN configuration must be selected also in the software in order to correctly operate the device.



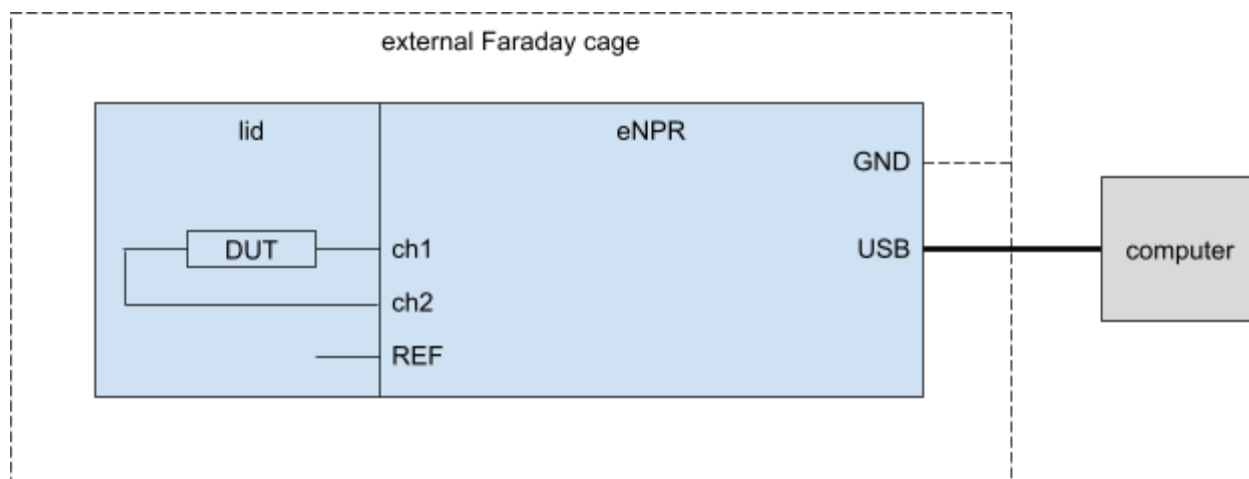
The scheme below shows how the control voltage is applied and the polarity of the acquired current in LN configuration.



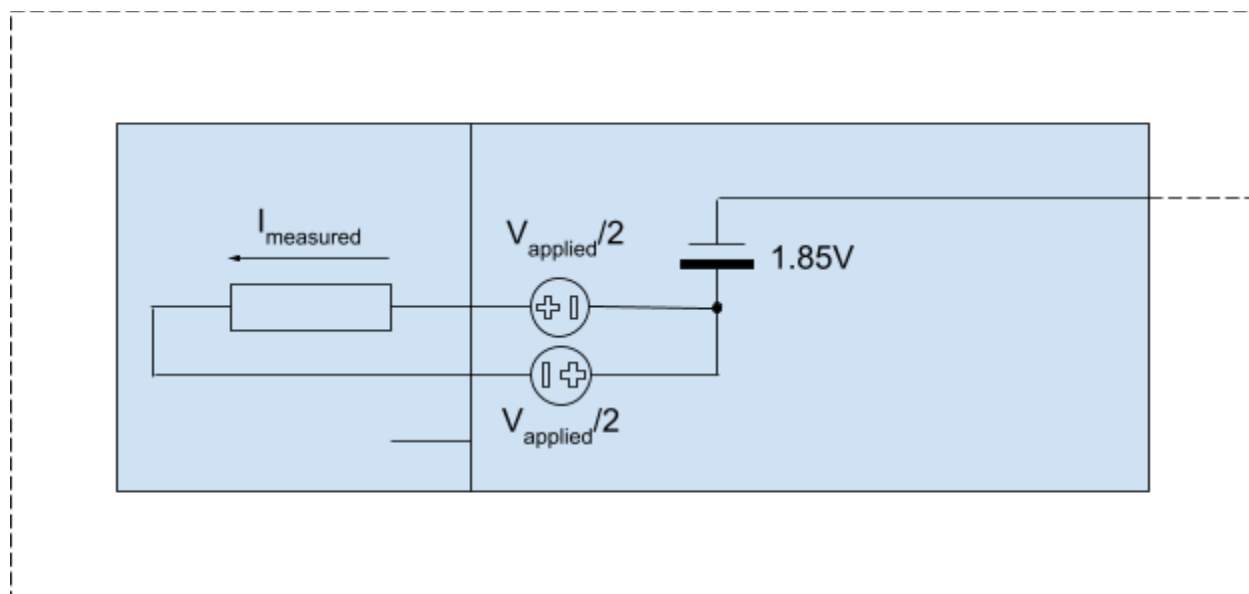


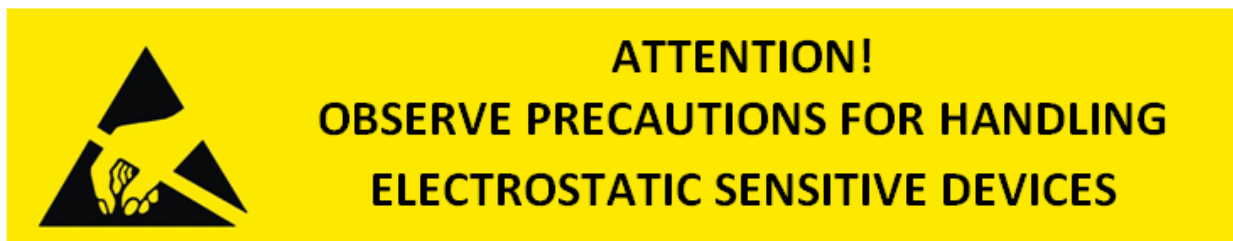
## Ultra low noise configuration

The figure below shows how to connect the DUT in order to work in ULN configuration. When this connection scheme for the DUT is used the ULN configuration must be selected also in the software in order to correctly operate the device. More information on the LN and ULN configurations can be found in the [corresponding guide](#).



The scheme below shows how the control voltage is applied and the polarity of the acquired current in ULN configuration.





## Connections best practices

The way the experiment is setup greatly affects the final quality of the measurements, especially in terms of signal to noise ratio.

In the following some best practices are described to help you get the most out of your device.

- **Shielding with the Faraday cage.** If you are using a flow cell designed for the eNPR you should be able to properly close the device's lid and in this case the experiment is optimally shielded against EMI.
- **Shielding with an external Faraday cage.** If you are not able to close the lid it is strongly recommended to enclose the device and the DUT in an external Faraday cage that encloses the whole experimental setup, such as the ELEMENTS Faraday box ([p/n 000760](#)). The external Faraday cage must be connected to the GND plug, using the provided GND cable.

Notice, when using a Faraday cage that the GND connector pin must fit completely within the amplifier's GND plug, otherwise the connection won't be good enough to provide proper grounding:



- **Avoid coupling with the Faraday cage.** If you are using an external Faraday cage try to keep the device, the DUT and the cables between them as far as possible from the external Faraday cage to reduce as much as possible the creation of stray capacitances.
- **Reduce the length of cables connecting the DUT.** The longer the cables, the more likely they will collect EMI or create stray capacitances with nearby conductive surfaces (such as the Faraday cage).



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- **Avoid other instruments within the Faraday cage.** If you are using the external Faraday cage, the eNPR is not shielded against the EMI from other instruments within the same Faraday cage. So, if possible, remove them or keep them off to reduce the noise as much as possible.
  - **Select instruments within the Faraday cage.** If you need to use other instruments within the same Faraday cage the best way to select your setup is to remove all of the instruments, close the Faraday cage and check the noise in this optimal condition. Then, add one instrument at a time and turn it on, to check how much it affects the measurement. These checks should be performed with the eNPR configured as it will during the actual experiment (especially same current range and sampling rate).
  - **Proper grounding.** If you are using a desktop computer be sure to power it up with a grounded power outlet or power strip. If you are using additional instruments within the external Faraday cage be sure to power them up from a common power outlet or power strip.