
eNPR-10MHz Manual Calibration



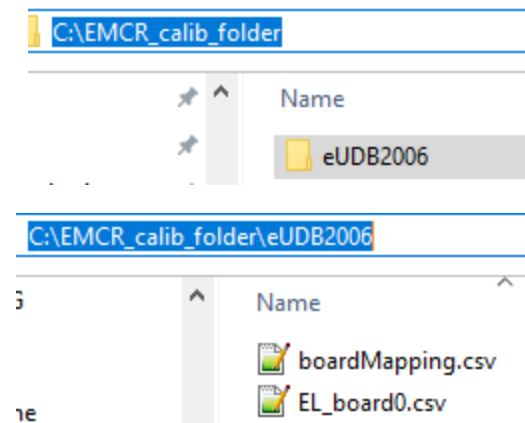
Revision History

Date	Version	Description
23/07/2024	1.0	First version of document



Calibration files

The calibration files must be placed in a folder with the same name as the device's serial number. This folder must be placed in the path C:\EMCR_calib_folder. Example for device eUDB2006:



The calibration files include a board mapping file boardMapping.csv which includes a single line with the name of the calibration data file, e.g.:

```
Unset  
1,EL_board0
```

The calibration data file EL_board0.csv consists of 7 lines. The default file looks like this:

```
Unset  
EL_board0 Voltage Clamp  
100  
1.0  
0.0  
1600  
1.0  
0.0
```



Line 1 is just the title.

Line 2 starts the 100nA current range calibration block

Lines 3 and 4 are the current gain and offset respectively (the offset is in A)

Line 5 starts the 1600mV voltage range calibration block

Lines 6 and 7 are the voltage gain and offset respectively (the offset is in V)

Procedure

The acquired current (I_a) is corrected via a calibration procedure to return the calibrated current (I_c) via the following formula: $I_c = I_a * I_G + I_O$. The same happens for the voltage¹

Current gain

- Open the software
- Click the connect
- Insert the provided model cell (10M // 2.5p)
- Close the lid
- Set the smallest sampling rate (1.25MHz)
- Apply the constant voltage protocol with 100mV
- Take note of the corresponding mean current I1 in the Measurement overview widget (9.518408nA in the example below)

Measurements Overview										
Channel index	Mean Voltage	Unit	Voltage RMS	Unit	Mean Current	Unit	Current RMS	Unit	Conductivity	Unit
1	100.000000	mV	0.000000	mV	9.518408	nA	0.018666	nA	0.095184	uS

extract

- Apply the constant voltage protocol with -100mV
- Take note of the corresponding mean current I2 in the Measurement overview widget (-9.340171nA in the example below)

¹ The stimulus gain calibration is not performed for the eNPR-10MHz, since a calibrated off-the-shelf DAC is used



Channel index	Mean Voltage	Unit	Voltage RMS	Unit	Mean Current	Unit	Current RMS	Unit	Conductivity	Unit
1	-100.000000	mV	0.000000	mV	-9.340171	nA	0.019115	nA	0.093402	uS

extract

- The current gain I_G is obtained with the following formula: $G = DV/DI/R$, where $DV = 100\text{mV} - (-100\text{mV}) = 200\text{mV}$, $DI = 9.518408\text{nA} - (-9.340171\text{nA}) = 18.858579\text{nA}$, and $R = 10\text{M}\Omega$ (calibration resistance). So in this example $I_G = 1.06052529196$
- Click disconnect
- Update and save the calibration data file, e.g.:

Unset

EL_board0 Voltage Clamp

100

1.06052529196

0.0

1600

1.0

0.0

Current offset

- Click connect
- Remove the model cell
- Close the lid
- Set the smallest sampling rate (1.25MHz)
- Apply the constant protocol with 0mV
- Take note of the corresponding mean current I_0 in the Measurement overview widget (-0.303907nA in the example below)

Channel index	Mean Voltage	Unit	Voltage RMS	Unit	Mean Current	Unit	Current RMS	Unit	Conductivity	Unit
1	0.000000	mV	0.000000	mV	-0.303907	nA	0.017555	nA	-1.000000	uS

extract



- The current offset I_O equals $-I_0$, so in this example $I_O = 0.303907e-9$
- Update and save the calibration data file, e.g.:

Unset

EL_board0 Voltage Clamp

100

1.06052529196

0.303907e-9

1600

1.0

0.0

Voltage offset

- Click connect
- Insert the provided model cell (10M // 2.5p)
- Close the lid
- Set the smallest sampling rate (1.25MHz)
- Apply the constant protocol with 0mV
- Take note of the corresponding mean current I_0 in the Measurement overview widget (-0.303907nA in the example below)

Channel index	Mean Voltage	Unit	Voltage RMS	Unit	Mean Current	Unit	Current RMS	Unit	Conductivity	Unit
1	0.000000	mV	0.000000	mV	0.440217	nA	0.019935	nA	-1.000000	uS

extract

- The voltage offset V_O equals $-I_0 \cdot R$, so in this example $V_O = -4.440217e-3$
- Update and save the calibration data file, e.g.:

Unset

EL_board0 Voltage Clamp

100

1.06052529196

0.303907e-9



1600

1.0

-4.440217e-3