
Current offset compensations

Revision History


Date	Version	Description
29/05/2020	1.2	Updated for EDR 3.8.3
05/03/2020	1.1	Revised
16/01/2020	1.0	First version of document



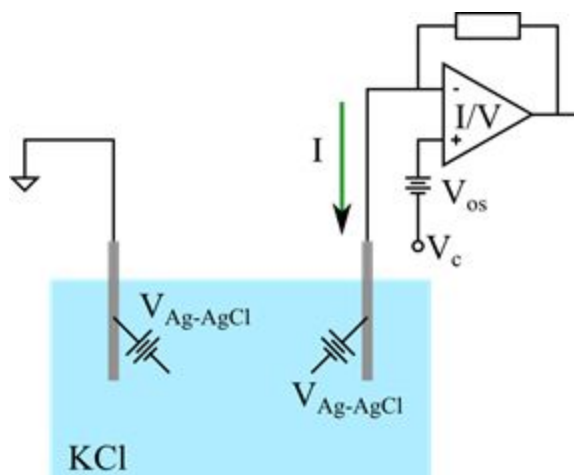
Introduction

In the very low current range in which Elements amplifiers usually work, even few μV due to internal opamp offsets or unwanted electrode potentials can give rise to a not negligible current (considering a typical DUT resistance in the tens of $\text{k}\Omega$ or $\text{M}\Omega$ range). To compensate these currents Elements devices have some compensation and correction methods: Automatic Digital Offset Compensation and Manual Offset Corrections.

Automatic Digital Offset Compensation

To compensate for the voltage offset due to internal opamp offsets or unwanted electrode potentials, Elements devices have an internal calibration procedure that can be activated by pressing the Digital Compensation button .

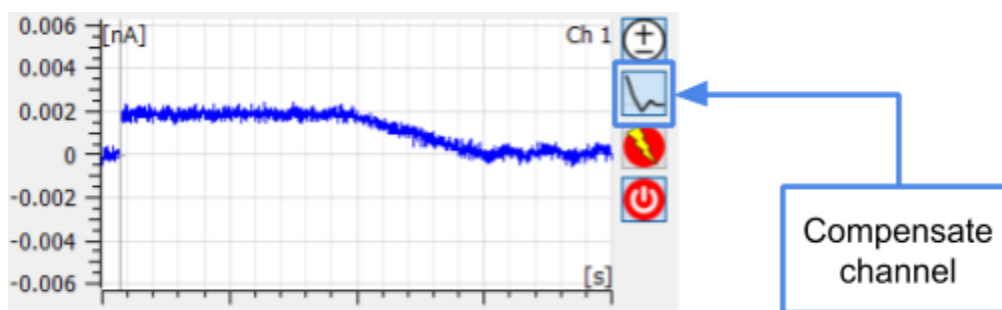
The digital offset compensation circuit modifies the voltage applied to the device under test in order to compensate for electrode voltage offset. This way, when the user applies 0 V the actual potential applied on the DUT is slightly different so that the net current flowing is as close as possible to 0. The range of voltage compensation varies depending on the particular Elements device.



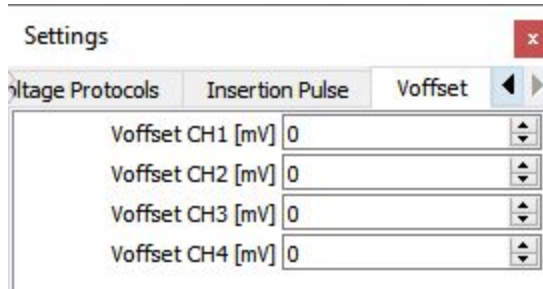
Notice that, in order to successfully compensate the offset, a conductive path must be present on the input, e.g. a DUT with a non infinite resistance. Trying to compensate for the voltage offset with an open input will result in a significant offset applied to the voltage while the current stays fixed (see the Open input offset correction section below).



The compensation usually needs only a few seconds and during the compensation procedure it is not possible to apply any voltage protocol. To return to normal operation, unpress the Digital Compensation button. The compensation value remains stored internally and added to the Control Voltage V_c .



Manual Offset Corrections (for multichannel devices only)



The Voffset corrections tab contains the controls to individually and manually adjust the voltage offsets of the different input channels to reduce as much as possible the small offset differences between the channels that can be still present after the automatic digital compensation.

This manual offset correction can be done in the range from -500 mV to 500 mV for each channel and the selected value is added to the value applied by the automatic digital offset compensation function described before.

Notice that this feature can be also used to add a constant Voltage to a specific channel while a voltage protocol is applied to all the channels.

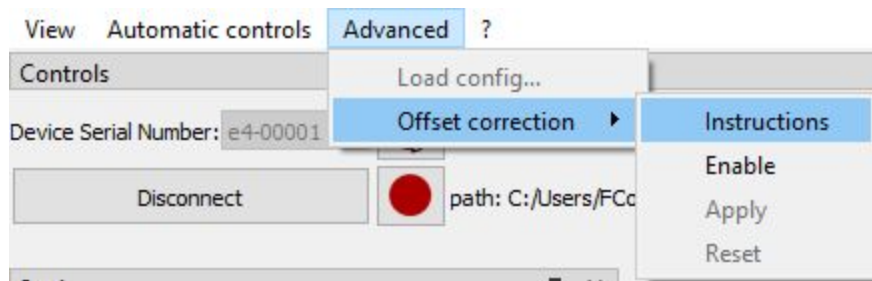


Open input offset correction

This feature can be used to correct the open input current offset of the amplifier, for instance if after a long period after purchase the device presents a current offset with no load connected at the input and/or if offsets calibrations, for some reason, are not perfect (after the proper warm up time of the device of at least 15-20 minutes).

This correction is conceptually different from the digital offset compensation since it does not apply any voltage to the DUT, but it just subtract via software the open input current offset value. It has to be done only in open input configuration (with no load connected to the device) after being sure the offset is not due to a current leakage.

All the procedure on how to apply the correction is well described in the popup window that opens clicking on “Advanced → Offset correction → Instructions” in the top left corner of EDR.

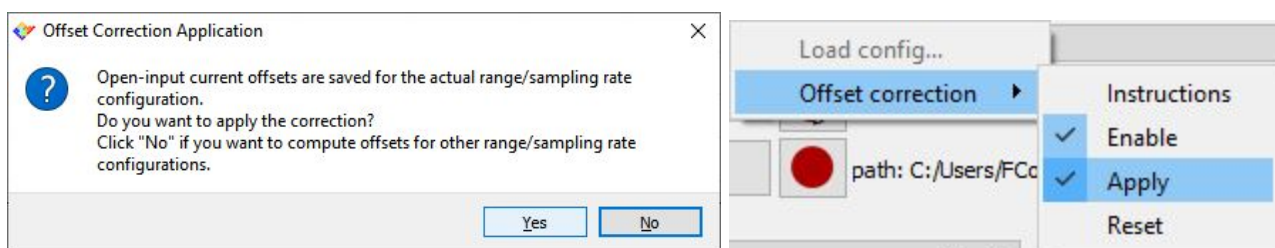


After enabling the correction, the current offsets (for every needed range) have to be saved in a proper file. To do so, click the “Save offset” button. A file, named <deviceID>.co, will be created inside the path: “C:\Users\<USERNAME>\EDR\offsets”.

The 'Analysis' dialog box shows the 'Noise' tab. The 'Computation period [s]' is set to 10,0. The 'Save offsets' button is visible. The table below shows the current offsets for channel 1.

Channel	Mean	RMS
1 1	-10.0392 nA	52.855 pA

Then the correction can be applied directly clicking on “Yes” in the dialog box, or by checking the “Apply” option in the “Advanced → Offset correction” menu.





To cancel all the saved offsets, stored in the <deviceID>.co file, click on Reset in the “Advanced → Offset correction” menu.

VERY IMPORTANT NOTE. Using this feature when the device is connected to any load can impair the device functionality, so be sure to carefully read the instructions embedded in the software before using this feature.