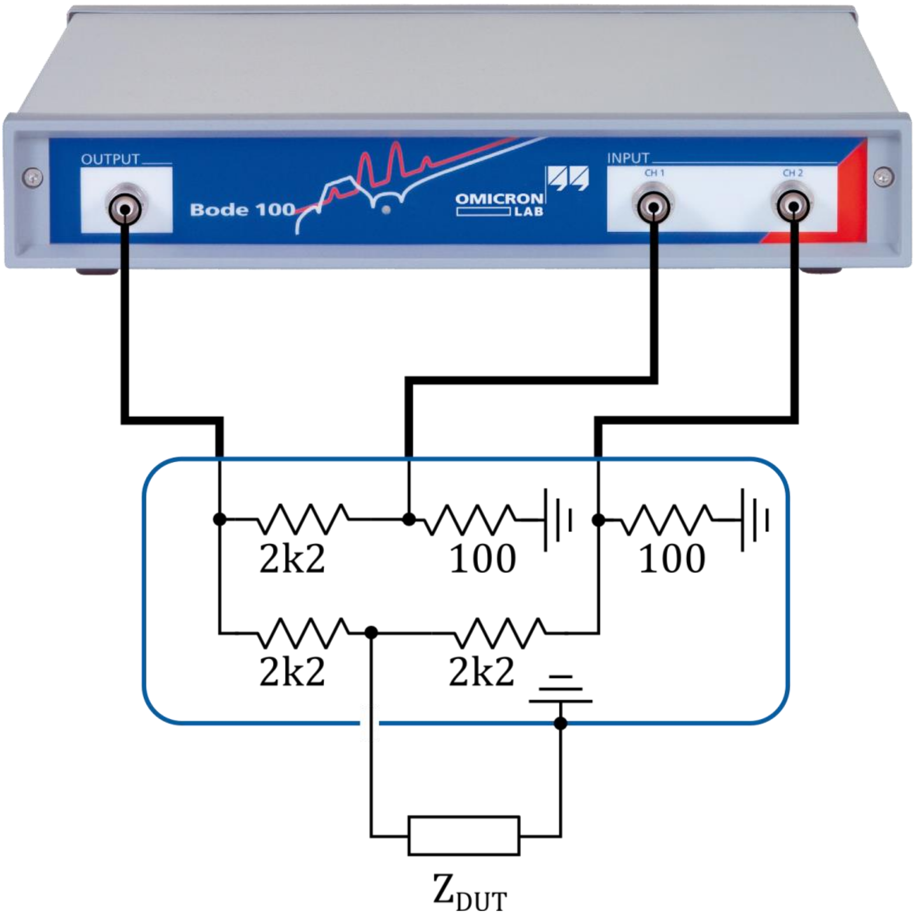
Bode 100 - Application Note

High Impedance Measurements



By OMICRON Lab

Visit www.omicron-lab.com for more information.
Contact support@omicron-lab.com for technical support.

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Note: Basic procedures such as setting-up, adjusting and calibrating the Bode 100 are described in the Bode 100 user manual. You can download the Bode 100 user manual at www.omicron-lab.com/bode-100/downloads#3

Note: All measurements in this application note have been performed with the Bode Analyzer Suite V3.0. Use this version or a higher version to perform the measurements shown in this document. You can download the latest version at www.omicron-lab.com/bode-100/downloads

1 Measurement Bridge

Due to the internal 50 Ω source resistor the Bode 100 is suitable to measure impedance values very accurate close to 50 Ω. With a simple external bridge the Bode 100 can also be used to measure impedance values up to several Mega Ohms. The following figure shows the resistive impedance bridge especially suitable to perform measurements on piezo elements since the high impedance of the bridge protects the Bode 100 signal source from backward energy pulses from the DUT[1].

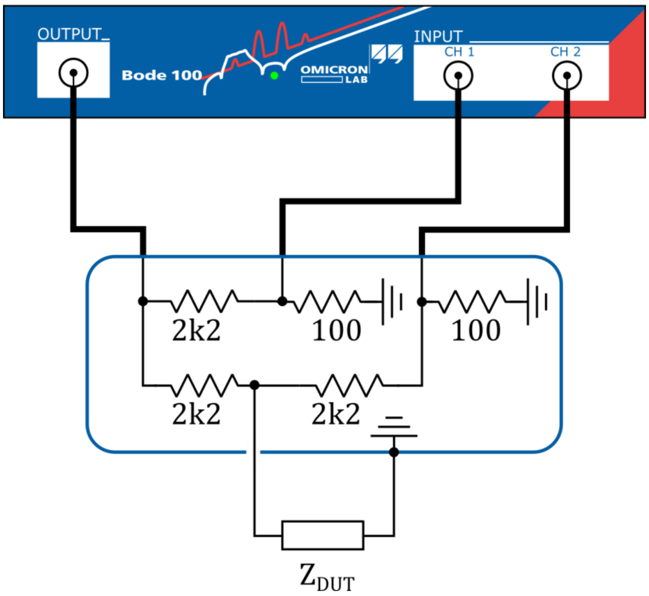

Figure 1: High impedance Measurement Bridge

The bridge can be built up with standard resistors as shown in the following picture. The impedance calibration of the Bode 100, which will be done later, compensates parasitics of the bridge.

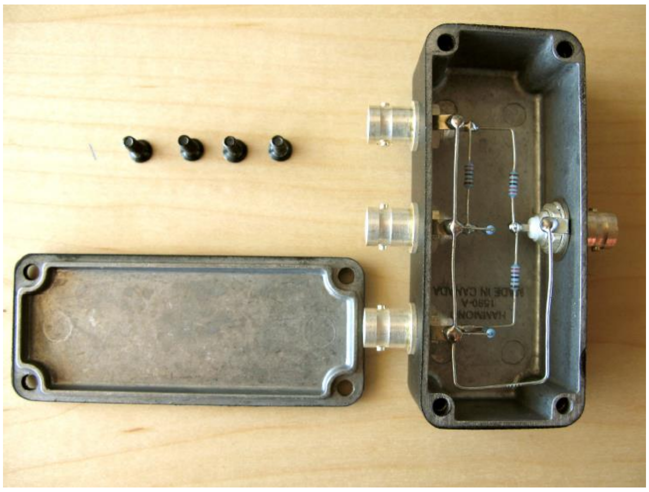
Figure 2: Built up Measurement Bridge

[1] DUT = device under test

2 Device Settings

2.1 Measurement Type

Measurements using an external bridge like the high impedance bridge in this Application Note can be easily done by selecting the *External Bridge* measurement type in the *Impedance Analysis* Tab.

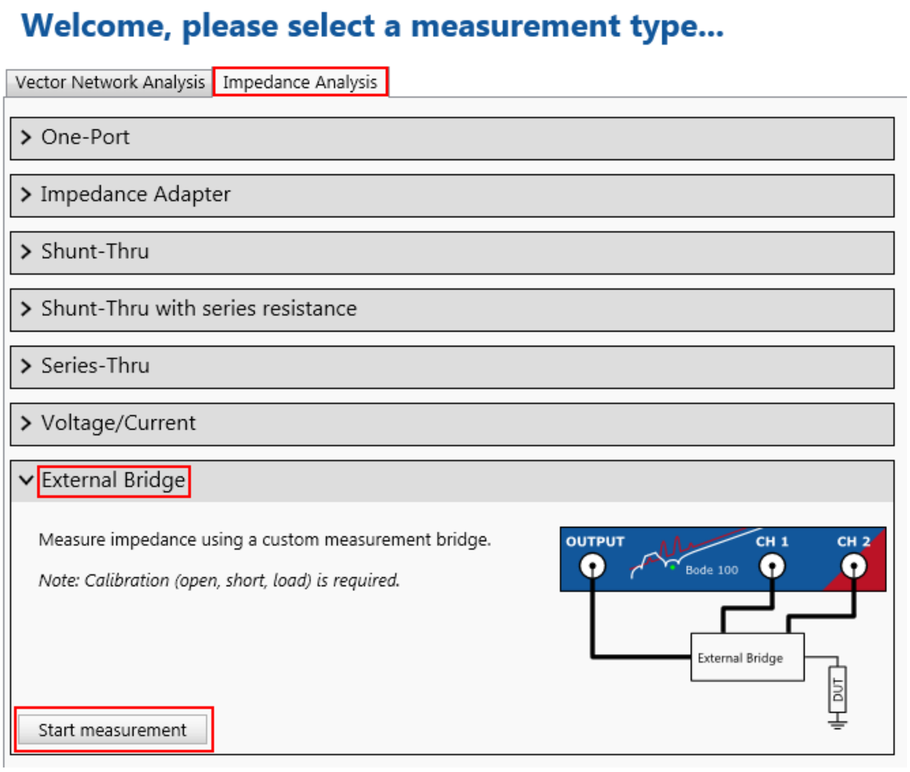

Figure 3: External bridge measurement type

2.2 Calibration and Measurement Settings

Before a measurement can be performed, the measurement setup needs to be calibrated.

We recommend performing a *User-Range* impedance calibration for accurate results.
Before the setup can be calibrated, it needs to be configured.

For optimum results we configure the measurement as follows:

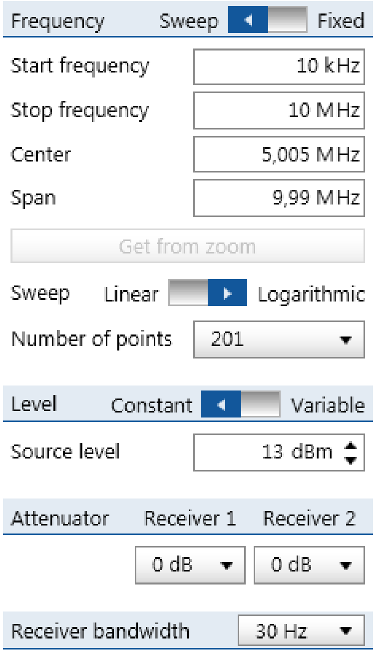

Figure 4: Measurement settings

Then, the calibration window can be opened by clicking on the *User-Range* Icon:

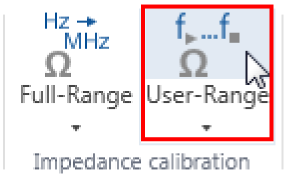

Figure 5: User-Range calibration button

Open, Short and Load need to be calibrated:

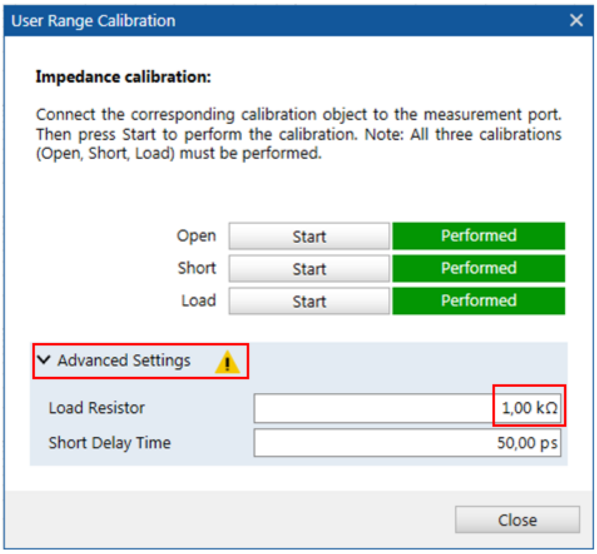

Figure 6: User-Range calibration window

2.2.1 Open Calibration

In General, nothing has to be connected to the measurement BNC connector of the high impedance bridge (infinite impedance).

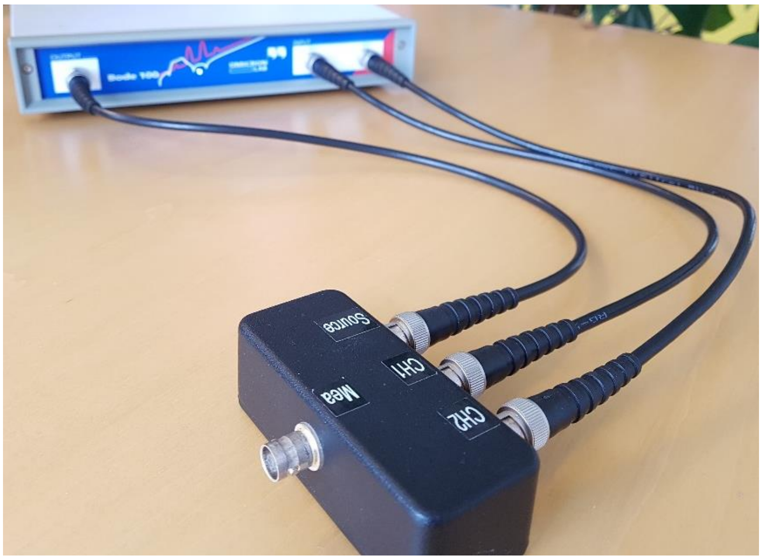

Figure 7: Open calibration nothing connected

However, since we plan to measure a very small 2.2 pF capacitor, the open calibration must be performed with the same connector that is used later on for the measurement[2]. This removes the parasitic influence of the BNC connector from the measurement result.

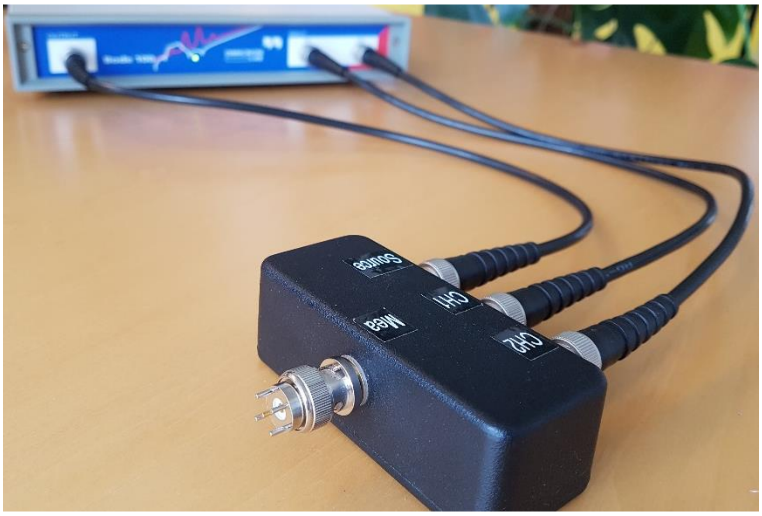

Figure 8: Open calibration with empty BNC connector

[2] A BNC connector, as used here, adds roughly 1 pF of capacitance to the setup

2.2.2 Short Calibration

A short circuit is connected to the measurement bridge (zero impedance).

Figure 9: Short calibration

2.2.3 Load Calibration

A known resistor has to be connected. If high impedances are measured we recommend using a **1 kΩ** SMD resistor for the load calibration. When frequencies above 10 MHz are measured, we recommend using a **100 Ω** resistor because of the parasitic capacitance of a 1 kΩ resistor. Before clicking Start, set the Load resistor value according to your used resistor as can be seen in Figure 6!

Figure 10: Load calibration

3 Measurement

After the calibration has been performed, the DUT can be connected to the bridge and the measurement is started by clicking on the single sweep button:

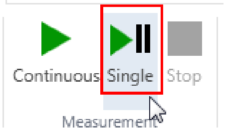

Figure 11: single sweep button

Our DUT is a 2.2 pF ceramic capacitor soldered on a BNC plug. Impedance magnitude as well as the capacitance are displayed in the diagrams below.

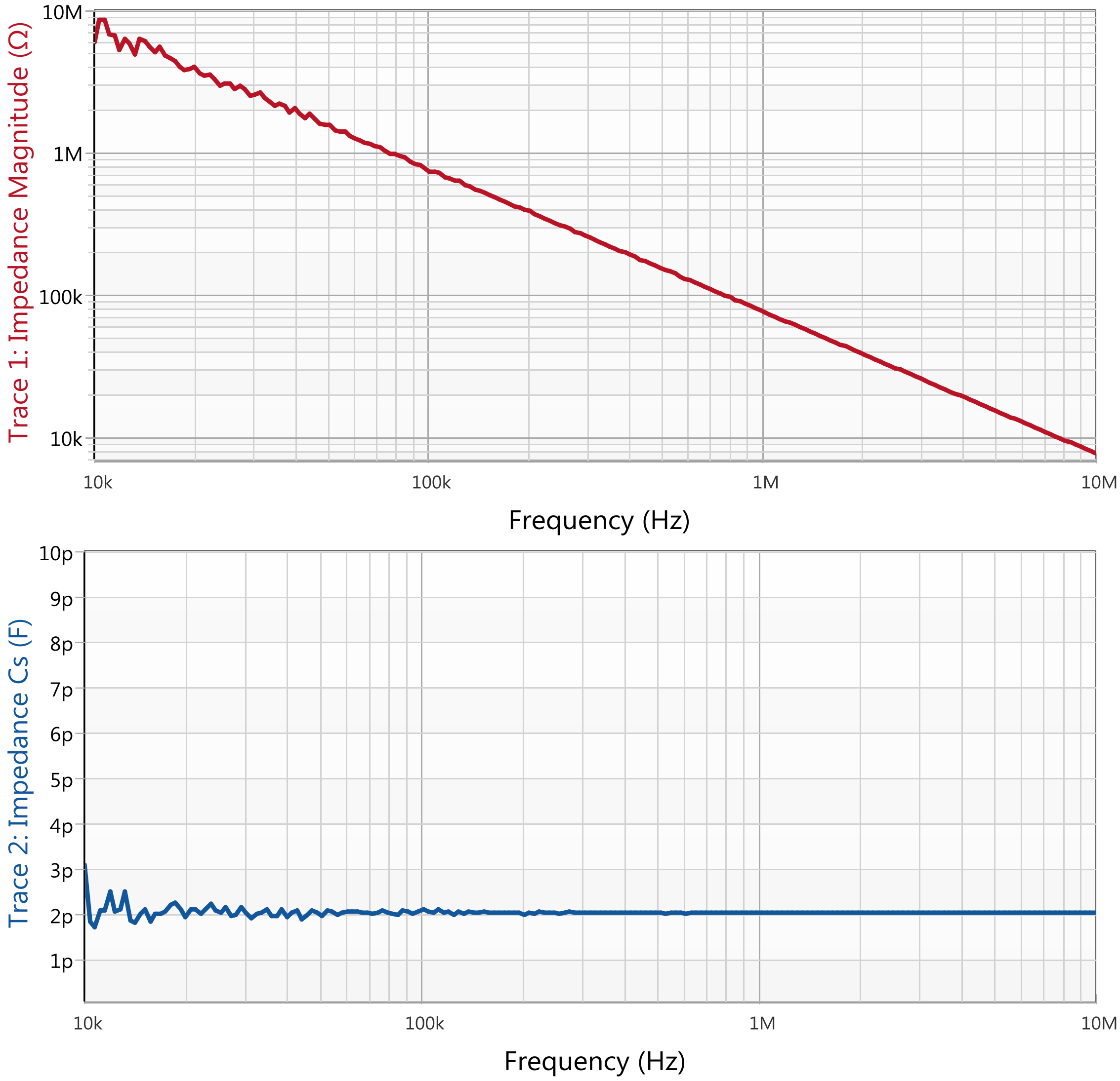

Figure 12: Measurement results

Below 50 kHz the results are a bit noisy since the impedance is > 2 MΩ. However, the measurement delivers usable results up to nearly 10 MΩs.

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