The problem of high voltage measurements in power grid will be discussed. The range of measured voltage is up to several hundred kV. In such a system voltage reduction is evident. Voltage transformers or capacitive, resistive or inductive dividers usually do this. Their metrological parameters, and in particular the $k$ division ratio, are sensitive to environmental factors, ageing, the load type and its value. Otherwise, the use of increasing numbers of power electronics devices causes noises in the power grid. There are numerous harmonics in the measured voltage, that why the ratio $k$ should be defined as a complex number whose value depends on the frequency of the harmonics it refers to. Without a doubt, the ratio $k$, in general is not a real number. In the nearest future voltage measurement will need not only the effective voltage value, but also the analysis of the harmonics of the measured voltage, including the relationship between their phase angles. Unfortunately, contemporary measurement methods and regulations refer only to measuring the True RMS of the measured voltage and the ratio $k$ is treated as a real number.

Presented problem, voltage measurement is performed by measurement method called 'blind method'. This method gives the possibility of determining the ratio $k$ as the complex value. Moreover, the main advantage of the method is autocallibrations. It refers to the ability of a measurement system to identify its parameters where and when it is operating ("in situ"), using an unknown measured signal as the only excitation of the identification procedure. This method can be implemented in the measurement system with different structures. These structures have been investigated in theory and through simulation studies as well as verified in laboratory for several years. They are individual idea of author (J.N) and are protected by number of patents (e.g. US 9,331,663 B2, EP 2745121 B1). One structure of the conditioning circuit has a specific property and it is therefore under intensive investigation. It has been turned out that result of autocallibration is insensitive to the harmful influence of leakage currents in one node of the circuit. The research results are the basis for determining the easier method of shielding the other nodes of the conditioning circuit, protecting them from leakage currents that may flow between the components forced by a high voltage occurring between these components.

Presented measurement method and a system implementing it can be a basis for setting a new standard defines a way to carry out the measurement of high and medium voltage containing numerous harmonics, the result of which takes into account both amplitude and phase angles.