

Improvements in Noninvasive Precision Current Measurement

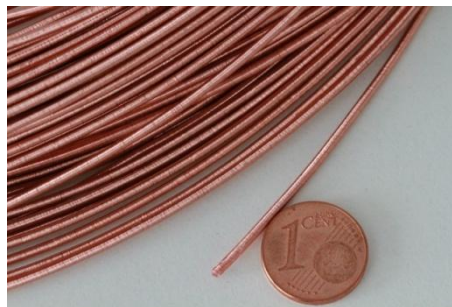
AC current

Štefan Gašparík*, Ladislav Grno**, Juraj Slučiak*, Štefan Rapant*

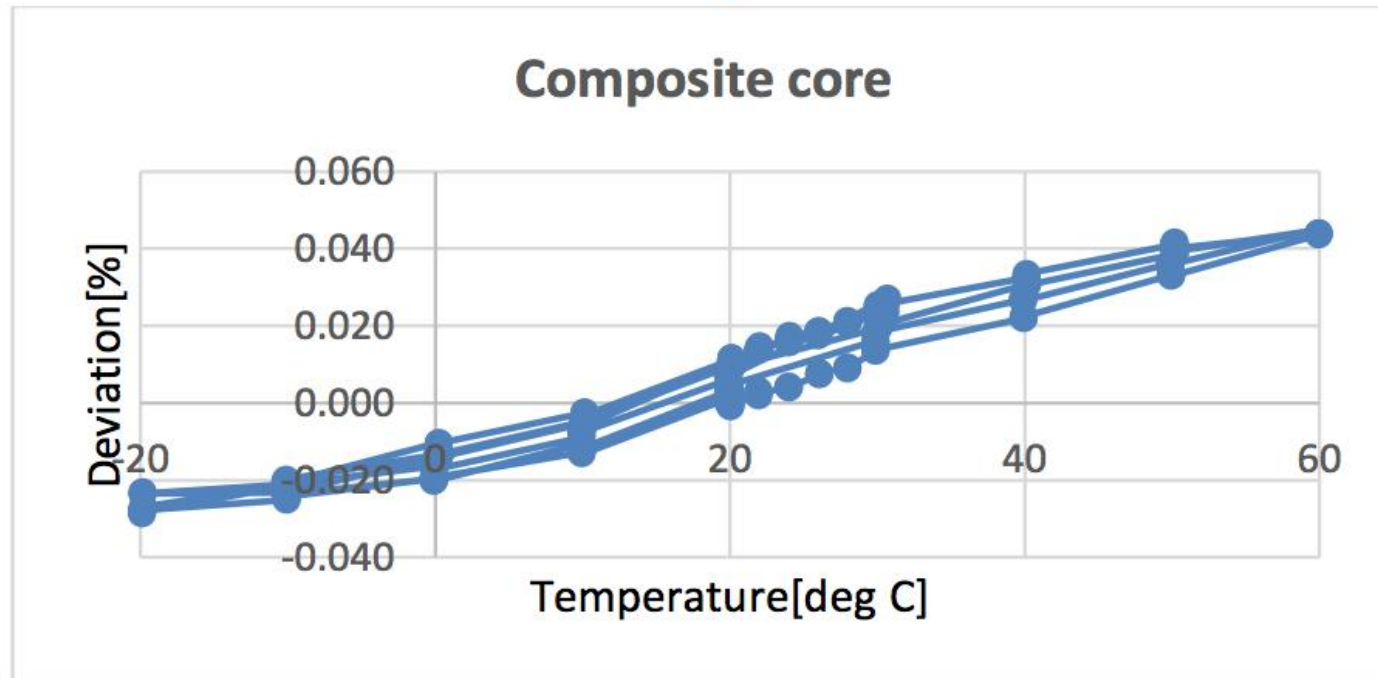
* Slovak Institute of Metrology, **Applied Precision LTD

A new design of the Rogowski Coil sensor with essential improvements has been developed and tested:

- Composite core reduces temperature influence, improves long term stability, influence of temperature cycling and improves manufacturing repeatability
- Windings arrangement with two in opposite wound layers suppresses the transversal field capture
- Small diameter (1.5mm) of the sensing fiber reduces the influence of variable bending
- Integrated end gap compensation
- Dual sensor with symmetrical output eliminates common mode strange signals
- Electrical shielded consisting of mutually in opposite wound groups of enameled wires interconnected only in one point at the end of the cable.



Measurement of temperature influence



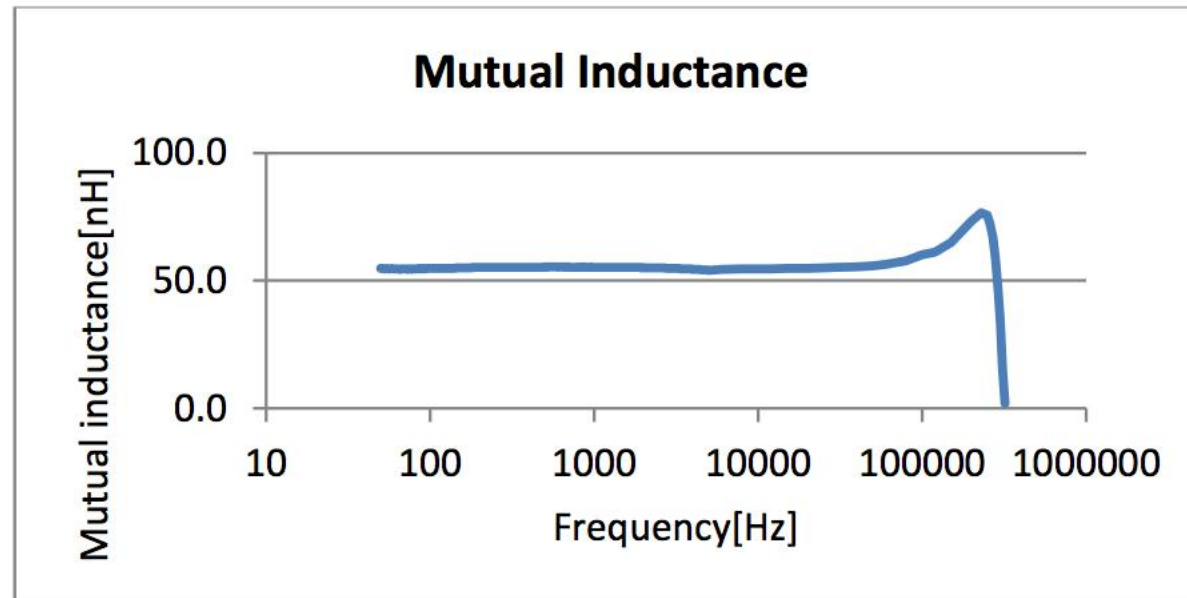
Temperature influence for -20 to +60deg continuous cycling



The tested Rogowski coils were placed into 50 turn toroid located in thermal chamber. The chamber was computer controlled to cycle between -20 and +60 Celsius degrees.



Frequency dependence



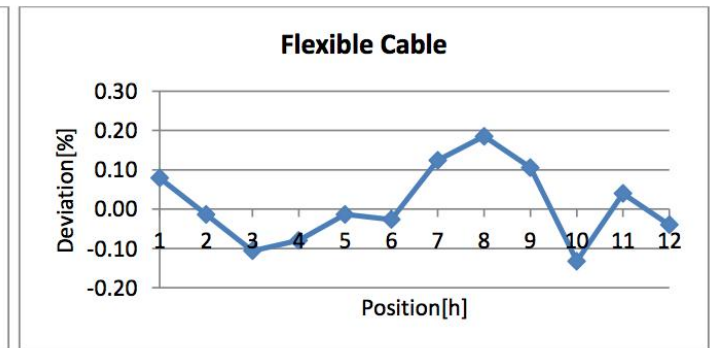
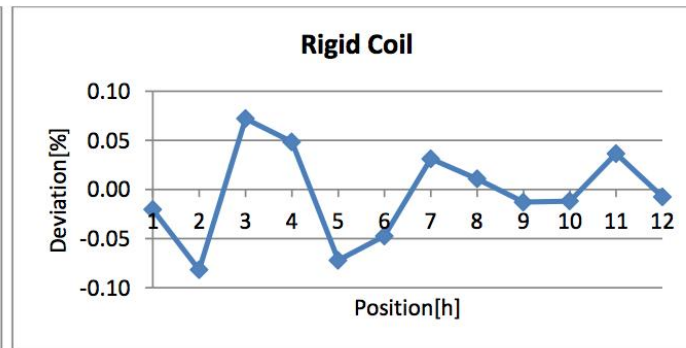
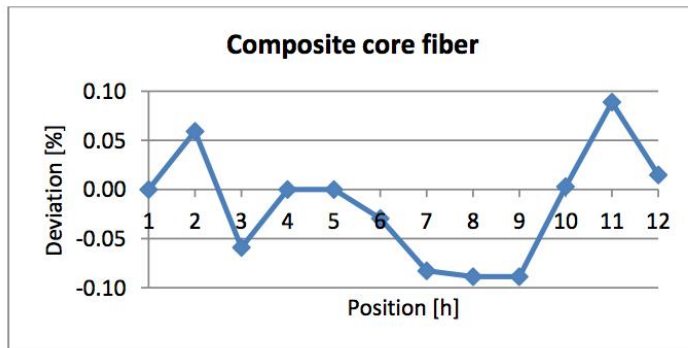
Frequency influence on the mutual inductance of the rogowski sensor

The resonant frequency of the coil is approximately 230 kHz. Therefore the frequencies expected as harmonic and non-harmonic content of the power line signals extending up to 50 kHz can be captured with the coil with sufficient reserve.

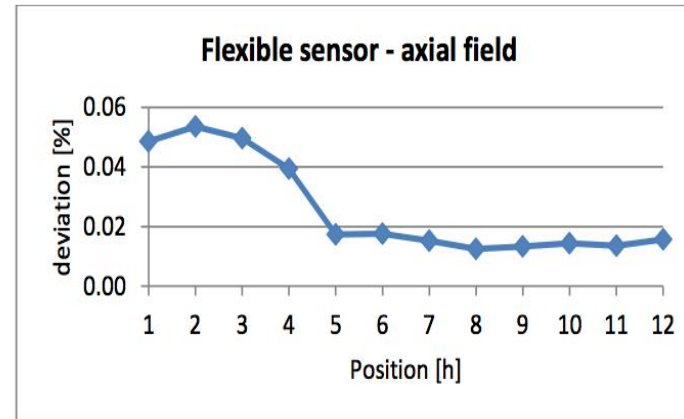
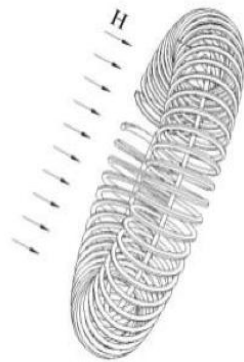
Wire position influence



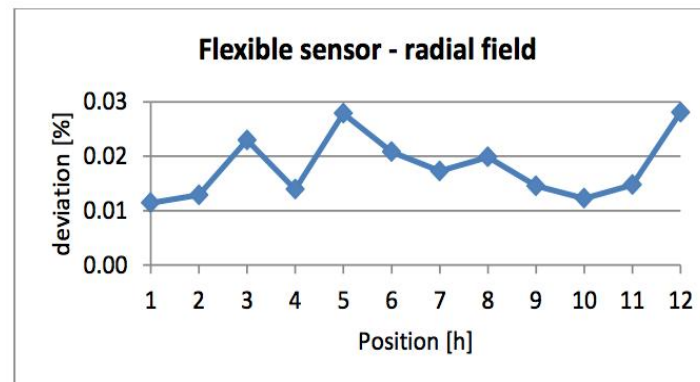
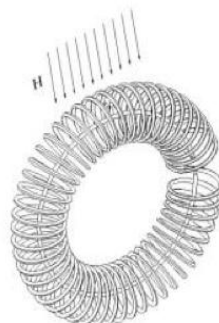
Arrangement for wire position influence measurement.



External field influence

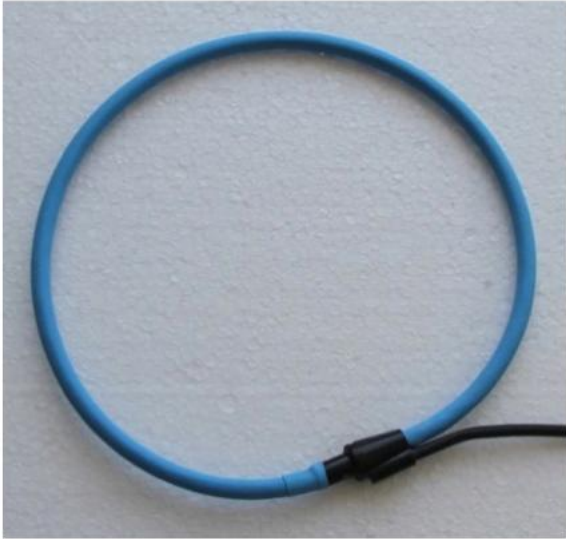


Axial field influence



Radial field influence

Embodiments



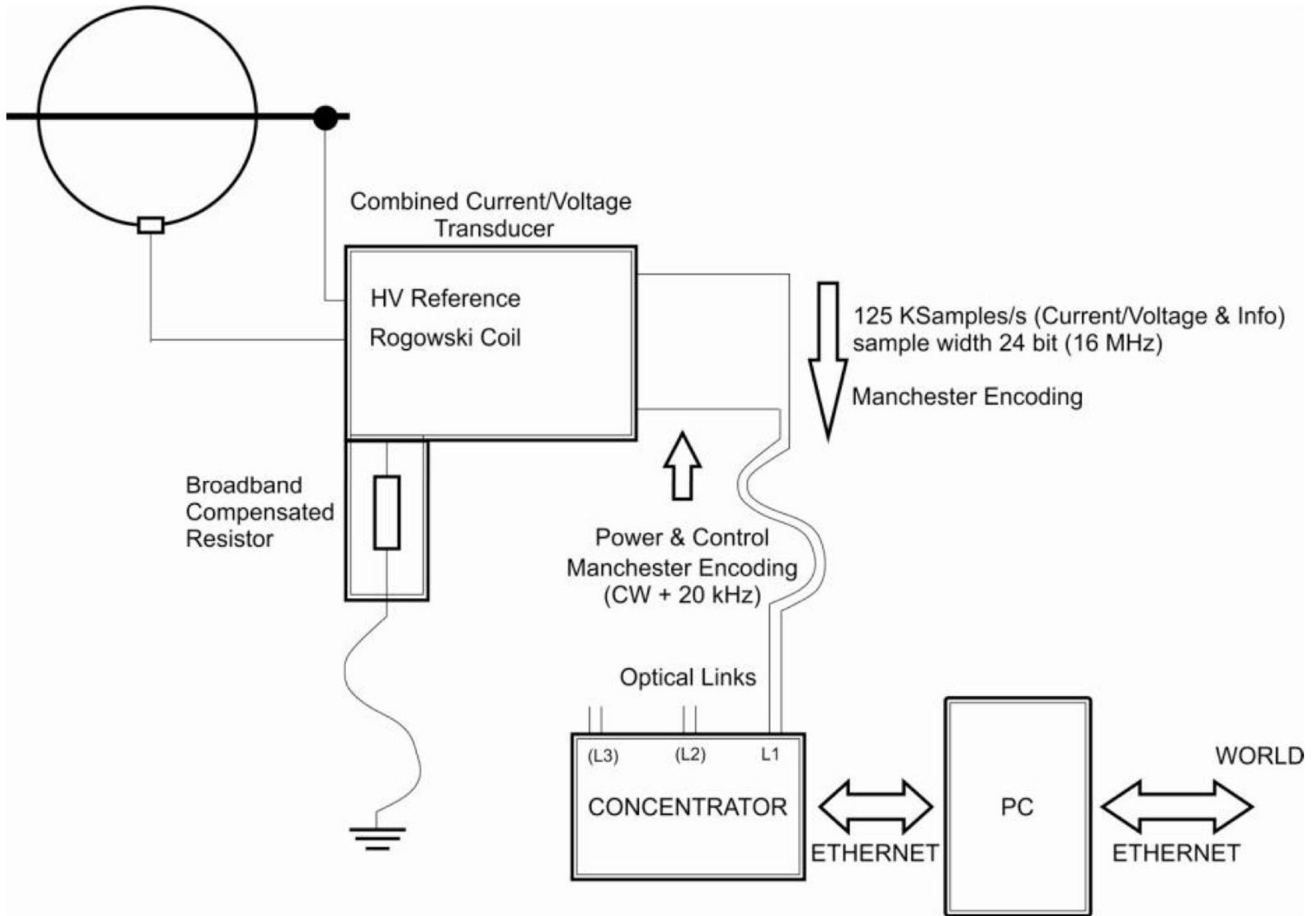
Flexible coil



Rigid coil



Rogowski current transformer can be equipped with Flexible or rigid Rogowski coil and is intended to replace classic current transformers X/5A with frequency range from 40Hz to 10kHz.





Prototype of the 50 kV combined Current/Voltage transducer

Projected specification:

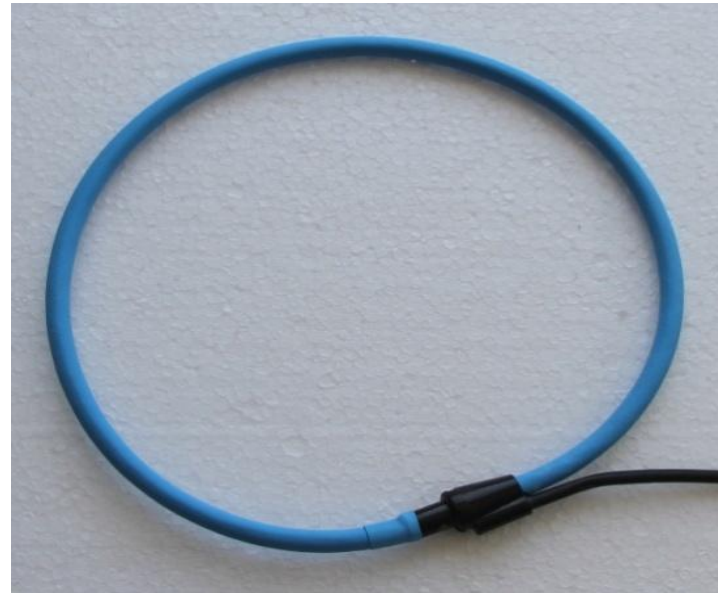
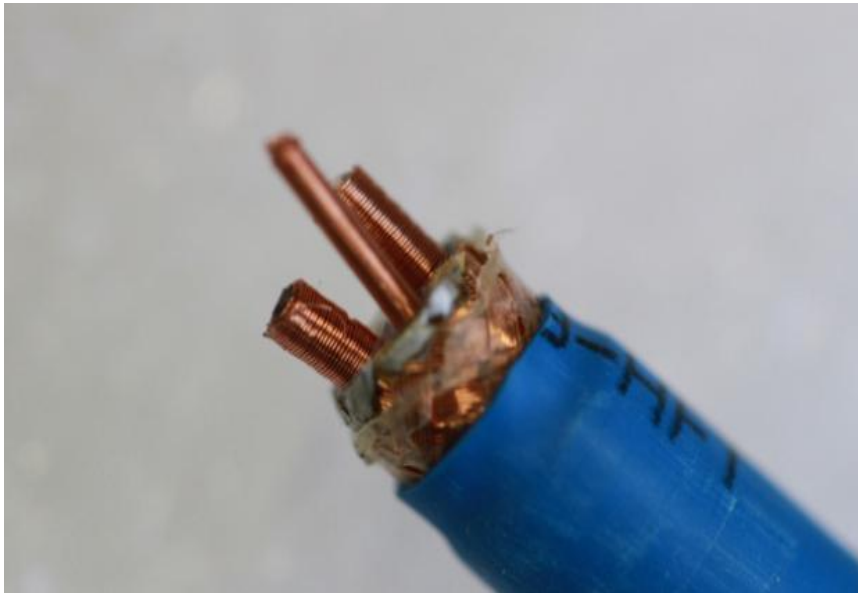
Working voltage up to 50 kV (modification up to 150 kV)

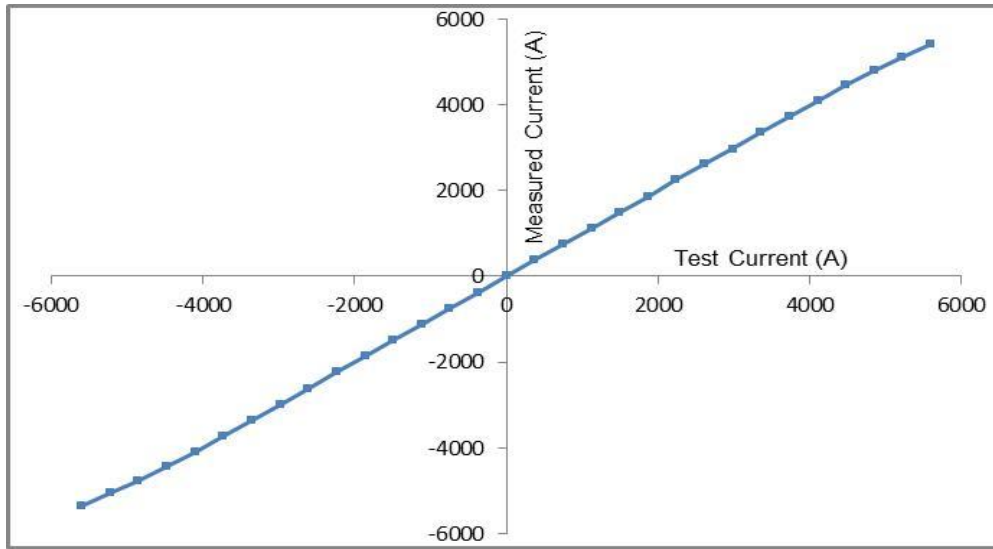
Current range 1 A to 6000A

Frequency range 40 Hz to 10 kHz

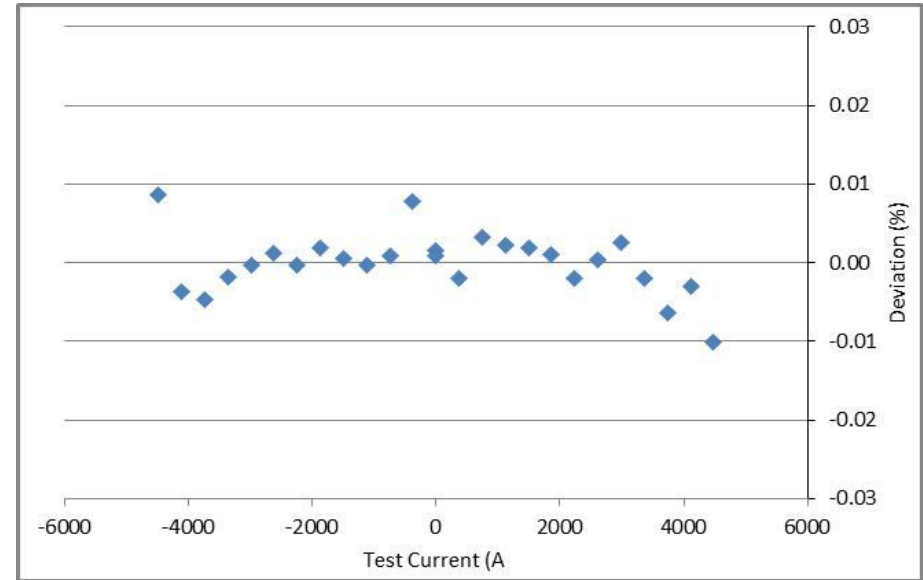
Sampling frequency 125 kS/s / 24bit

DC Current

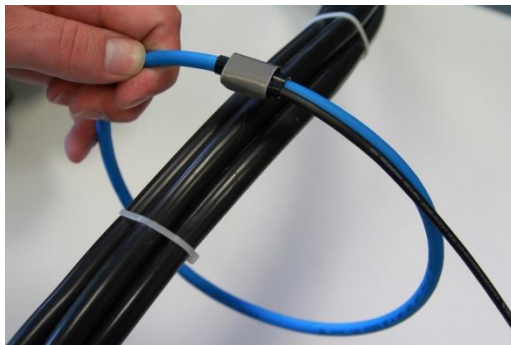




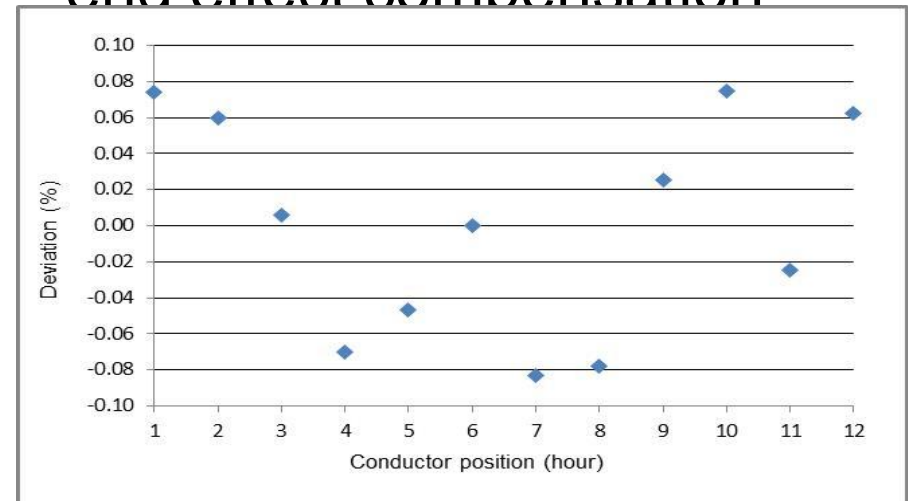
Linear fit data response calibration model



Calibration model including end effect compensation



Magnetic ring around the probe junction



Position dependance with magnetic screening

- Poster is outside
- Thank you
- sluciak@smu.gov.sk - SMU
- grno@appliedp.com - Applied Precision