

## **Special Current Sensors for Application in Power Systems and Lightning Measurements**

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Special current sensors have been designed to be applied in harsh electromagnetic environments. Often open structures had to be used, mostly variations on the theme 'Rogowski coil'. High linearity and bandwidth between below power frequency up to several MHz asked for air-core coils. Special attentions was paid to the reduction of spurious pick-up and to electromagnetic compatibility issues. Often the inductive sensors are chosen to operate in the differentiating frequency band. The enhanced high frequency signals allows filtering at the signal handling equipment, and suppression of interference. As example a 250 channel systems will be presented, applied to railway environment.

A more recent development is the in-flight lightning damage assessment system ILDAS, a joint effort with partners as Airbus, Lufthansa, Eurocopter, NLR, ONERA. A 12 channel system is to be flown on commercial airlines, to detect and evaluate lightning current and possible attachment points on the aircraft. Here a two-channel sensor approach is chosen, HF for the strokes and sensitive LF for the continuous current part of the waveform. A special version is the window sensor. Its advantage is that it can be installed on an aircraft without feedthrough in the fuselage and without protruding elements that could perturb the airflow.

The window sensor has a few other applications, since it requires only a view port. Lightning current measurement in the tower of television transmitters, or in windmills are being considered. The integrators to restore the signals are of a special design: a coaxial passive first stage and an active second stage. The total bandwidth of the ILDAS systems is 0.1 Hz - 10 MHz, the dynamic range is about 90 dB. The same sensors have been used to investigate the safety of a city wide global earthing system. The NUON power company provides safety earth via the cable. The earthing is distributed over a city. Each individual house does not have a special earthing arrangement. Through the medium voltage cables, the earthing is coupled to the high voltage substation. Question was whether safety could be guaranteed, most importantly with respect to short circuit currents in the HV system. A special systems has been designed, tested and used to check the overall safety. A GPS synchronized 60 Hz current injection served to carry out the measurements live-line.