IMMUNITY OF 'FIELD MILL' TYPE FIELDMETERS TO ION CURRENT FLOW

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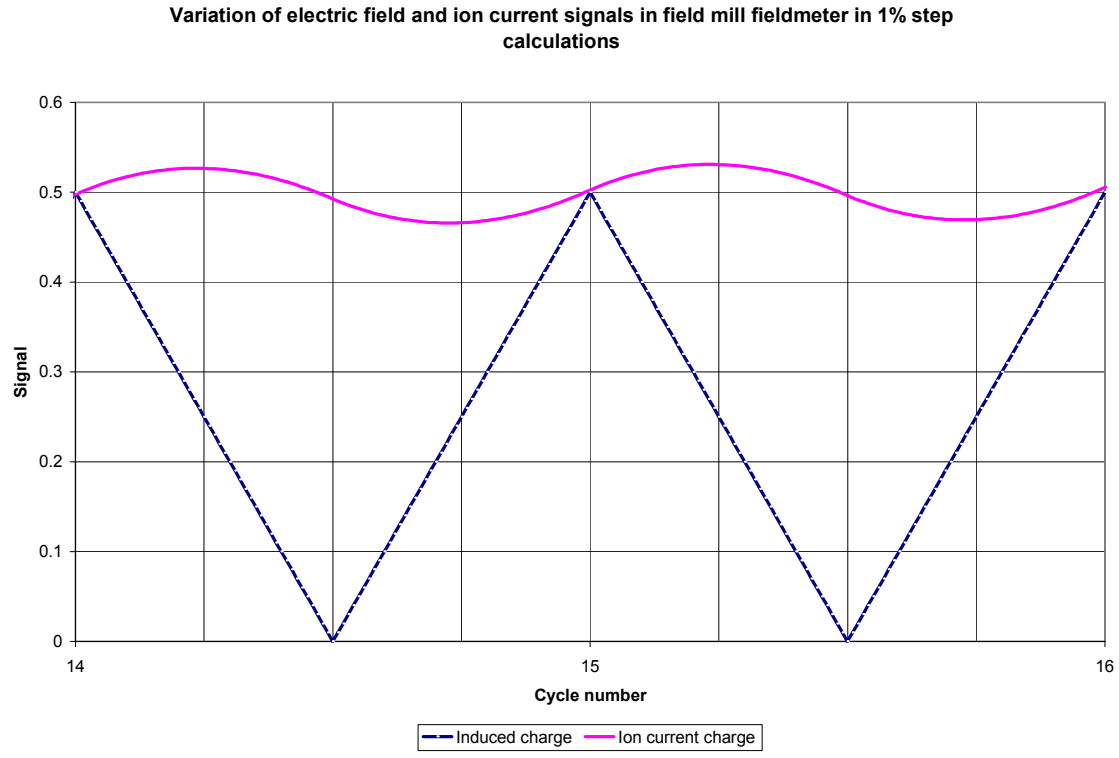
Spreadsheet calculations have been performed to model the variations of signals expected at the sensing surface of field mill type fieldmeters from electric field induced charge and ion current flow of charge. A linearly opening and closing aperture has been taken – equivalent to the variation of area exposure of the sensing surface by a chopper rotating. The charge due to an electric field is directly proportional to the area exposed – this is shown as the dark blue line in graph below. The ion current to the sensing surface is proportional to the exposed area. The ion charge accumulated on the sensing surface is then a combination of the charge that arrives and the charge that leaks away through the stabilizing resistor of the charge sensitive amplifier. Charge from the ion current flow increases progressively over a number of cycles to a plateau value. The oscillation of the ion current signal around its plateau value is shown in the mauve curve below.

It is clear that oscillation in the ion signal lags the electric field signal by 90 degrees. Phase sensitive detection of the capacitively coupled signal from the input charge sensitive preamplifier is hence able to completely removes the influence of the ion current. The output response is hence only to the electric field component of the input signal without influence from any ion currents present.

(It is necessary that the ion current flow to the sensing surface is not so large as to drive the preamplifier outside its linear operating range. This risk may be minimized by RC decoupling of input signals to the charge sensitive preamplifier).



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