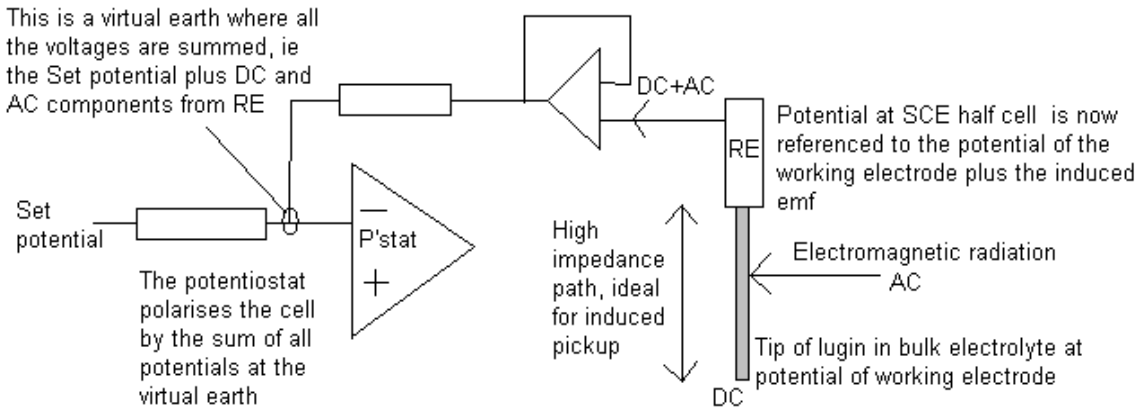
ACM Instruments

Noise Induction

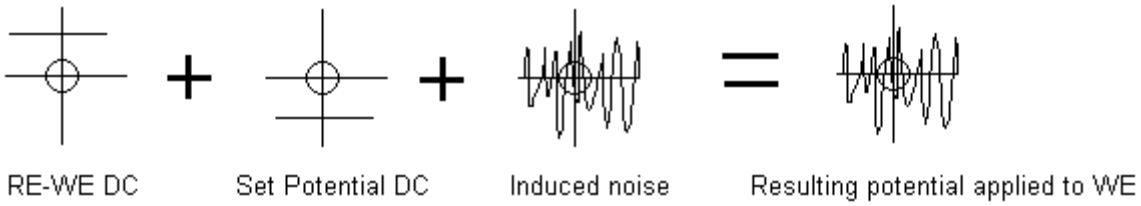
All good electrochemical test equipment is designed to reject mains noise giving very tidy data as a result. Unfortunately this massaging of the raw data can mask a disturbing phenomena which is usually overlooked. Testing here at the ACM laboratories has found that induced power line pickup within salt bridges lugin probes and reference electrode bodies causes very high levels of voltage at 50 Hz (in England) to be present at the reference electrode lead summed with the reference electrode DC voltage. Most experimenters are completely unaware of this as the measuring instrument removes this noise and presents the underlying data. Problems occur in two cases.

Firstly during current and voltage noise monitoring using a ZRA the voltage measured is a composite of the true DC voltage and any remaining 50 Hz provided the DC analysers are not swamped by the AC component.

Secondly when the cell is connected to a potentiostat the picked-up mains frequency acts as an additional polarising signal for the potentiostat. The potentiostat has no way of detecting that the spurious mains noise is not a desired polarising voltage and consequently polarises the cell by exactly the induced voltage. The working electrodes response is indicated by the measured current. Equipment makers remove this 50 Hz component from the result but the true unfiltered value of current shows that the working electrode has been polarised by often 100's of milliVolts at 50 Hz. This additional polarisation often on top of a small +/- 10 mV LPR sweep can completely upset the electrodics of the system and make a nonsense of the results. This phenomena of Self Polarisation Activated by Mains is a very serious problem and because the induced voltage and the corresponding current response is hidden from the experimenter by the instrument makers (ACM included) the scientist does not appreciate that the working electrode is swung wildly around the desired potential at 50 Hz.



The electromagnetic radiation has two components the easily screened out electrical component and the much more difficult magnetic component. It is the magnetic component that penetrates Faraday cages and causes problems even in well screened systems.



At ACM we have discovered that the way to solve the problem of induced pickup is to provide an AC coupled low impedance path between the input of the reference electrode buffer and the bulk electrolyte. This path is easily achieved using an ACM Noise Reducing Electrode as a fourth electrode in the cell. Because this electrode is AC coupled the DC component of the reference is not effected.