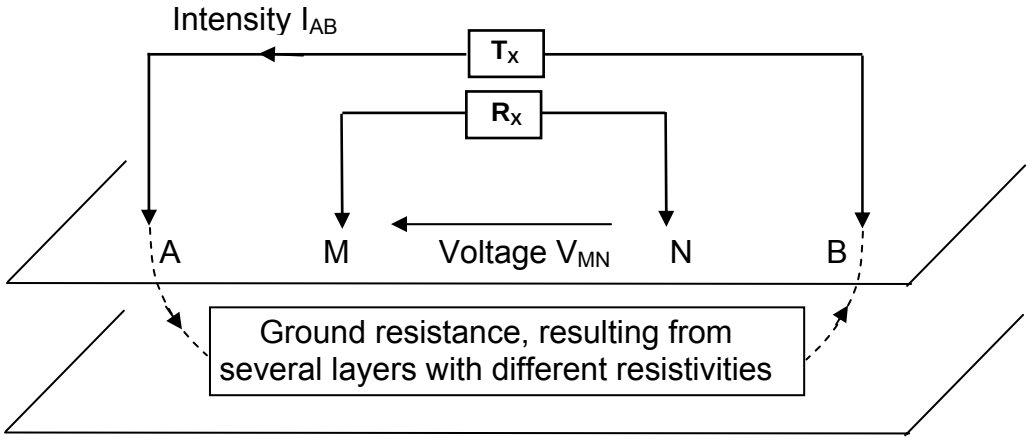
RESISTIVITY AND INDUCED POLARIZATION MEASUREMENTS

The measurement of the resistivity of the ground is carried out by transmitting a current I_{AB} into two electrodes named A and B and by measuring the difference of potential V_{MN} between two other electrodes named M and N. The apparent resistivity is then calculated with the formula K x I_{AB} / V_{MN} , K being a coefficient which depends on the distance between the electrodes.



APPARENT RESISTIVITY = (coefficient) x voltage / intensity

Rho = K x V_{MN} / I_{AB}

K = 2 x Pi / (1/AM – 1/AN – 1/BM + 1/BN)

Units: Rho (*ohm.m*), K (*m*), V_{MN} (*mV*), I_{AB} (*mA*)

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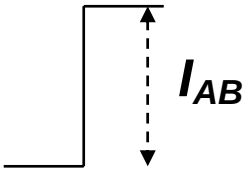
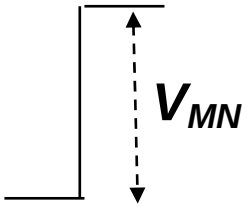
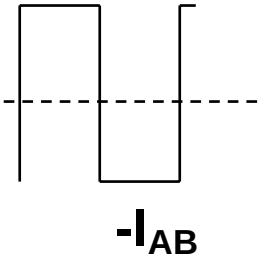
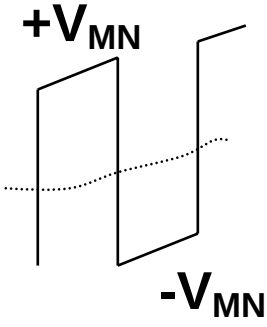
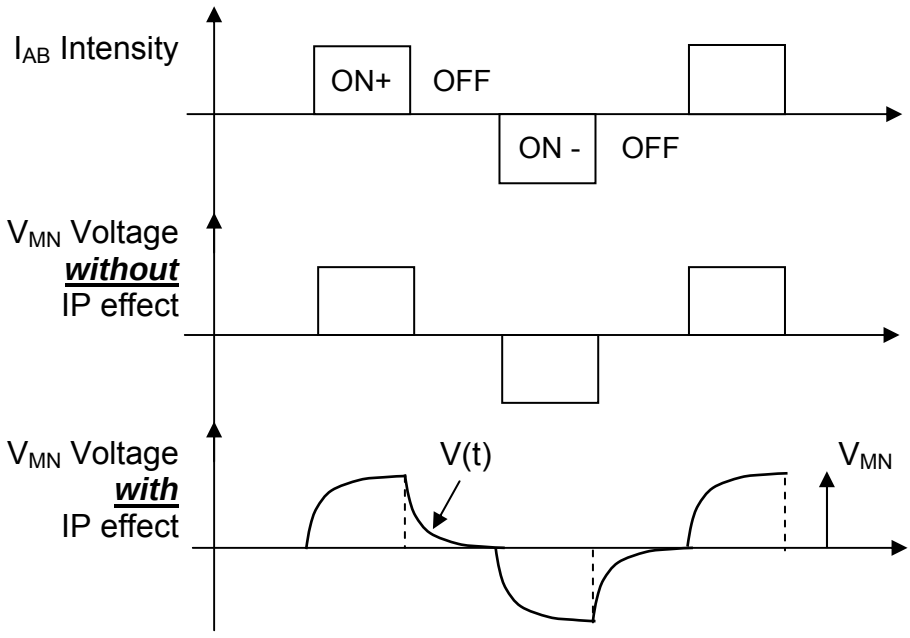
In the ideal case where there is no other current in the ground than the one transmitted by the generator, a direct current (DC) is sufficient to carry out the measurement of the difference of potential. However, in practise, there are natural and artificial currents circulating into the ground which create differences of potential usually named “Self Potential” and which represent some kind of “noise” for the measurement of the resistivity of the ground. These SP effects have a constant average value on top on which exist low frequency variations.

That is why, for many decades, the resistivity of the ground had been measured with pulsed DC currents, which permit to eliminate not only the SP mean value but also its low frequency variations. The resulting current waveform (ON+ with +I_{AB}, ON- with -I_{AB}), with ON pulse durations of for instance 250 or 500 or 1000ms, is still referred to as a DC waveform, as the electromagnetic induction effects are usually negligible at such low frequencies.

The Induced Polarisation parameter measured in the so called “Time Domain” procedure is obtained by integrating the decay chargeability curve at the MN electrodes, once the pulse of current (ON+ or ON-) has been switched off, during OFF duration usually equal to the ON duration (typically 2000ms). The main advantages of the Time Domain measurements compared to the so called “Frequency Domain” is the speed of acquisition (in Frequency Domain two frequencies have to be successively transmitted) and the lower current regulation required (in Frequency Domain the current must be regulated with an accuracy better than the required accuracy on the IP frequency effect)

	VOLTAGE noise	***INTENSITY*** I_{AB}	***VOLTAGE*** V_{MN}
IDEAL CASE	no noise		
REAL CASE	Telluric currents, Self Potential, Industrial noise 		



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DEFINITION OF THE INDUCED POLARIZATION PARAMETER :

CHARGEABILITY = $\int v(t)\,dt / \Delta t \times V_{MN}$

Unit of chargeability : mV / V, or per mil