Induced Pick-Up and the Resistive Mode Operation in ACPD

A Short Applications Note

ACPD signals are by their very AC nature representable as vector quantities. Theory predicts that pure ACPD, as generated by passage of an AC current through a metal, will exhibit a phase difference of 45 degrees with respect to the actual current delivered to the specimen.

Unfortunately, the true ACPD is masked by the superposition of a second vector quantity. This vector represents the potential induced in the measurement leads by the current flowing in the supply leads. Theory predicts that this "pick up" vector lies at 90 degrees to the specimen current vector.

The resultant of the two vectors, is the actual ACPD as measured by an automatic phase lock loop detecting circuit within a standard CGM-5R (in AUTO mode).

The vectors are shown in the diagram below. Two different pick-up vectors are indicated, for a particular true ACPD vector. It can be seen that these will give widely different ACPD readings. Since the magnitude of the pick-up vector will vary depending on the relative position of the supply and measurement leads, significant errors can occur in ACPD measurements.

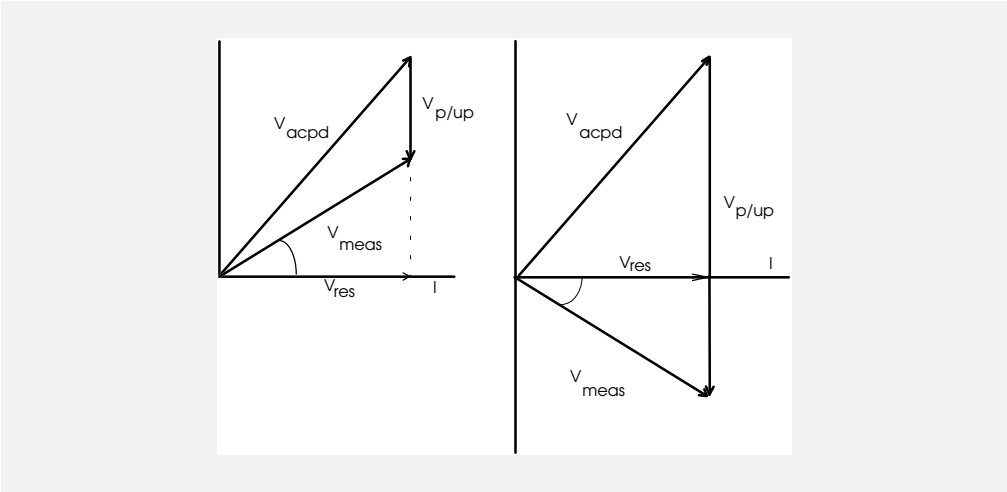

Fig. 1. The relative vectorial positions of signals in ACPD studies.

The resistive or real portion of the ACPD signal lies along the specimen current vector, (i.e. they share the same phase).

The magnitude of the resistive vector does not change with a change in the magnitude of the pick-up. Monitoring the resistive ACPD will therefore theoretically confer an immunity to errors caused by variation in lead position.

The CGM-5R can be operated in resistive mode, this being a refinement over the original CGM-5 design. In this mode the displayed ACPD value is actually that which is in-phase with the applied current and is therefore purely resistive.

In resistive mode the readings are much less susceptible to lead movement. This is most marked at the lower operating frequencies (0.3 to 10kHz). At 30kHz and above, the advantage conferred by the resistive mode reduces but it nevertheless remains worthwhile. This deterioration indicates that the simple theory given above may not describe the entire situation.

Users should not be surprised if a considerable reduction in signal amplitude is noticed between AUTO and resistive modes. This indicates that much of the original processed signal is due to induced pick-up.

It is also possible to adjust a standard CGM-5 to operate under a resistive mode. This involves use of an oscilloscope and further advice can be obtained from Matelect.

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