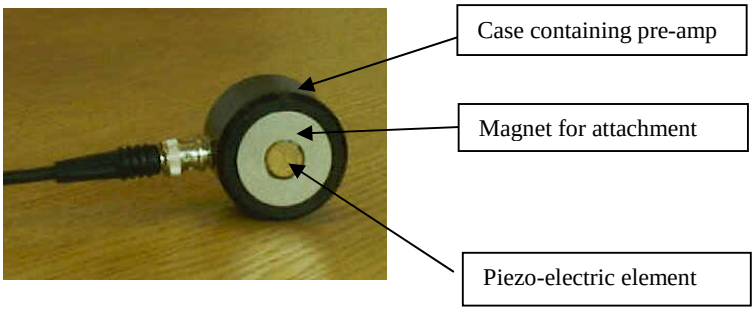
The AE k-100 / AA k-40 Acoustic Emission Probe

"Advanced Technology for Industry"

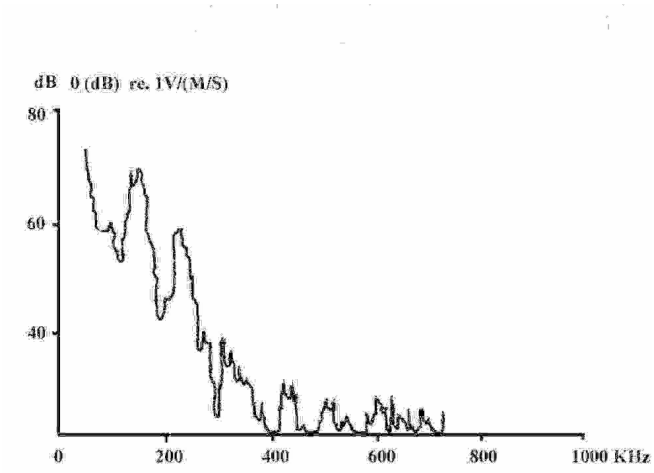
The AE k-100 Acoustic Emission Probe

Ultra-sonic emissions are detected by the custom-designed Ultra-Sonic Sensor.



AE k-100 Acoustic Probe

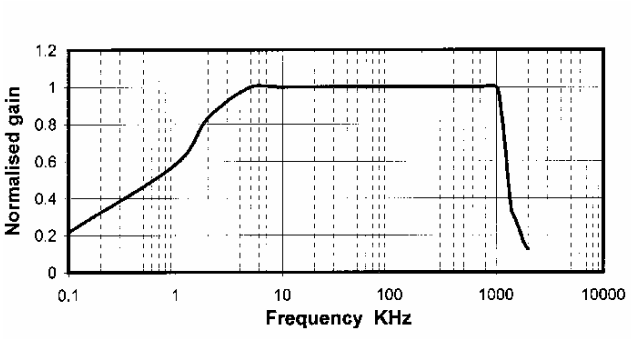
The AE k-100 sensor contains a high-sensitivity (65db re 1V/ms^{-1}) piezo-electric ceramic sensor element, which responds to frequencies in the range 100 – 130 kHz. The AE probe uses the piezo-electric element to detect ultrasonic signals and has an integrated pre-amplifier with a high signal-to-noise ratio. The probe is attached magnetically to the casing of the switchgear or transformer under test. The tuned frequency response of the piezo filament is 100kHz, this frequency being the optimum for detecting ultrasonic signals generated from PD within the Switchgear Panel.



Frequency Response of AE k-100 Probe

The signal produced by the piezo-electric element is amplified by a pre-amplifier. This amplifies both the signal and the noise, but increases the signal to noise ratio and decreases the effect of attenuation to the signal.

The signals are processed by the HVS 2000PDD/T which reads maximum peak and the number of peaks (count) above an adjustable threshold to generate Short Term and Long-Term Severity data.



Frequency Response of Pre-amp

Airborne Acoustic Probe

For PD's in air insulation, an air pickup ultrasonic probe is the most sensitive way of measuring PD activity. For this sensor to work it should be noted that there must be a clear air path from the sensor to the discharge site. This means that fully enclosed switchgear with no grills, vents air gaps etc, will not be suitable for measurements using ultrasonic probes. Also note that if the ultrasonic probe is used in conjunction with a TEV (or other type of PD sensor such as a RFCT), when looking across the power cycle with the detector bear in mind that the ultrasonic signals take time to arrive at the detectors compared with the electromagnetic signals. Delays of a few milliseconds are common. Sound travels at around 330m/Sec in air, so a distance of 1m would produce a delay of 3mSec between the electromagnetic signal and the acoustic signal. Also the acoustic signal may be more spread out than the e/m signal. Both of these should be borne in mind when using the ultrasonic probes. Internal discharges in insulation do produce ultrasound signals, but these will generally not be picked up when using an ultrasonic probe. The attenuation in the insulation, and poor coupling of the air/solid interfaces mean that acoustic signals which originate inside the insulation, are generally not accessible via ultrasonic methods. Hence the Airborne Acoustic probes are best reserved for air discharges in air insulated switchgear.

The AA K-40 Airborne Acoustic Sensor

The AA-k40 sensor contains a high-sensitivity (65db re $1V/ms^{-1}$) piezo-electric ceramic sensor element, which is 'tuned' to respond to frequencies in the narrow, passband of 40KHz +/- 1kHz (the most sensitive frequency range for airborne acoustic emissions emanating from within air-filled, metalclad equipment). The AA-k40 probe uses the piezo-electric element to detect ultrasonic signals and has an integrated pre-amplifier which provides 83dB of gain with a high signal-to-noise ratio. The probe is attached magnetically to the <u>inside</u> of the earthed casing of the air-filled switchgear.

The AA-k40 sensor relies on a line-of sight detection (+/- 30^{o}) has been designed to supplement the TEV and RFCT sensors and is highly suitable for detecting discharge into the air or along polymeric surfaces (tracking). Laboratory testing of switchgear panels has shown the AA-k40 to have a **sensitivity of down to 2pC** which is significantly better (about 5x better) than the TEV sensitivity for example. The sensitivity of the AA-k40 for on-line switchgear in the substation environment is dictated by the ambient 'noise' level (as per all on-line pd equipment).

Acoustic Sensors and Filter/Power Unit

The **AE k-100 Acoustic Emission Sensor** can be magnetically attached to the outside of the steel casing of switchgear, transfomers and other metalclad equipment at strategic locations to monitor partial discharge activity within the plant.

The **AA k-40 Airborne Acoustic Sensor** can be magnetically attached to the inside of air-insulated switchgear and other metalclad HV equipment at strategic locations to monitor partial discharge activity within air insulated switchgear.

Power and Filter Pack for AE and AA Probes – both acoustic probes contain an integrated pre-amplifier which is powered through a BNC cable from a special power supply and filter pack when using the sensors for PD Monitoring.

Advanced Technology for Industry

M&B Systems Power Instrumentation Ltd
MANCHESTER ENGLAND
Tel: +44 (0) 161 2484090
Fax: +44 (0) 161 2484099
E-mail: ab.bm.b@fsbdial.co.uk