

ULTRASCAN - Application Note

Subject How small a spark can be detected?

Note Ref. AN311.01

Limits of performance

The ULTRASCAN spark detector is mainly used for the detection of partial discharge and corona discharges on medium and high voltage plant typically in the ranges of 10kV to 40kV. This is because the majority of users who are concerned about safety and supply failures operate in this type of equipment – it is not a limitation on the equipment's application..

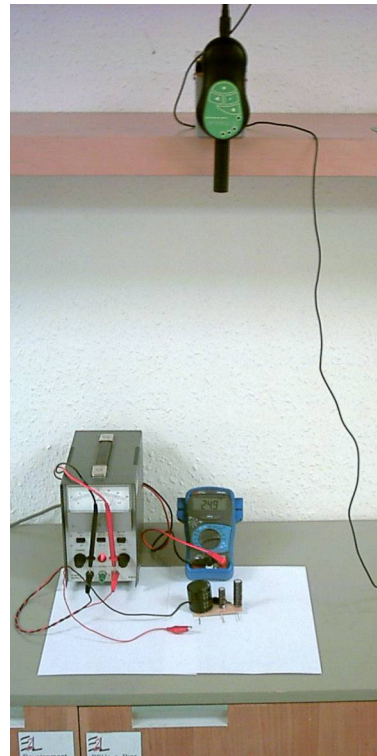
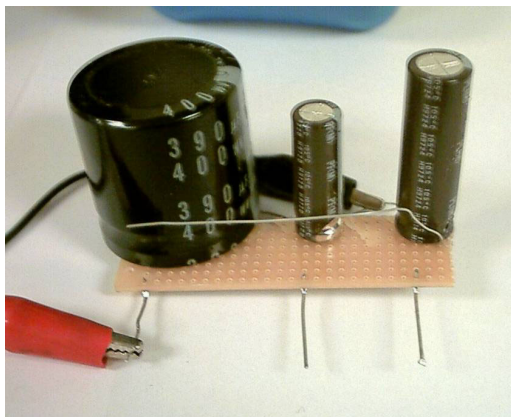
The ULTRASCAN spark detector can be used for much smaller voltages and, of course, much higher. In reality, the question is not 'what voltage range', but 'how small a spark' can be usefully detected. 'How small?' is really asking 'how little energy?'

The answer is naturally approximate because to some extent it depends upon the user's hearing ability and how far from the source. Assuming our technician has normal hearing then this application note makes some attempt to quantify the spark size, thus answering the question.

Bench test

A simple test rig has been constructed using a bench power supply, a calibrated volt meter, and capacitors with soft wires which can be touched together to spark once charged.

An ULTRASCAN has initially been set a fixed distance of 0.57m away from the source of the spark.



The process is to choose a capacitor, apply the positive clip, and apply the voltage from the PSU.

Disconnect the positive clip, and then, using insulated pliers, cause the capacitor to be shorted whilst listening to it on the ULTRASCAN.

Using instrument (SN1508) and auto-ranged, the results were as follows:

| Capacitor uF | Voltage V | Power mJ | Charge uC | Audible | Visible Spark | Number of LEDs |
|-----------------|--------------|-------------|--------------|---------|------------------|-------------------|
| 390 | 25 | 244 | 9750 | yes | yes | 3 |
| 390 | 10 | 39 | 3900 | yes | yes | 3 |
| 390 | 6 | 14 | 2340 | yes | no | 2 |
| 390 | 5 | 10 | 1950 | yes | no | 1 |
| 390 | 4 | 6 | 1560 | yes | no | 1 |
| 390 | 3 | 4 | 1170 | yes | no | 1 |
| 390 | 2 | 2 | 780 | no | no | 0 |

(Obviously it was unnecessary to use larger value capacitors since the 390uF gave us the range we required)

It should be noted that the power and charge figures are actually the stored energy in the capacitor, and most of the energy will be converted into heat in the connecting wires due to electrical conduction. The energy in the spark is considerably lower than the experimental limit of 2mJ (1.17mC) since it is a small fraction of the energy transfer.

What can be drawn from these figures is that sparks generated from a system with potential differences as low as 3V can be usefully be identified with the ULTRASCAN spark detector.

Obviously, most users who are concerned with sparking as a maintenance issue generally operate with higher voltage ranges. Certainly, as a general rule, the ULTRASCAN can be confidently applied to normal mains supplies of 110 or 220 VAC; and to site power loops such as 24 or 48 VDC.