Ensayos dieléctricos

Ensayos en AC

60-1 © IEC 1989 – 51 –

Section 5: Tests with Alternating Voltage

15 Definitions for alternating voltage tests

15.1 Definitions for alternating voltage tests

15.1.1 Value of the test voltage

The value of the test voltage is defined as its peak value divided by $\sqrt{2}$.

> NOTE — The relevant Technical Committee may require a measurement of the r.m.s. value of the test voltage instead of the peak value for cases where the r.m.s. value may be of importance, for instance, when thermal effects are involved.

15.2 Peak value

The peak value of an alternating voltage is the maximum value. Small high-frequency oscillations, arising for instance from non-disruptive discharges shall, however, be disregarded.

Forma de onda

16 Test Voltage

16.1 Requirements for the test voltage

16.1.1 Voltage waveshape

The test voltage shall be an alternating voltage generally having a frequency in the range 45 to 65 Hz, normally referred to as power-frequency test voltage. Special tests may be required at frequencies considerably below or above this range, as specified by the relevant Technical Committee.

The voltage waveshape shall approximate a sinusoid with both half-cycles closely alike. The results of a high voltage test are thought to be unaffected by small deviations from a sinusoid if the ratio of peak to r.m.s. values equals $\sqrt{2}$ within $\pm 5\%$.

Tolerancias

16.1.2 *Tolerances*

If not otherwise specified by the relevant Technical Committee the measured values of the test voltage shall be maintained within ±1% of the specified level throughout the test. For test durations exceeding 60 s the measured value of the test voltage shall be maintained within ±3% of the specified level throughout the test.

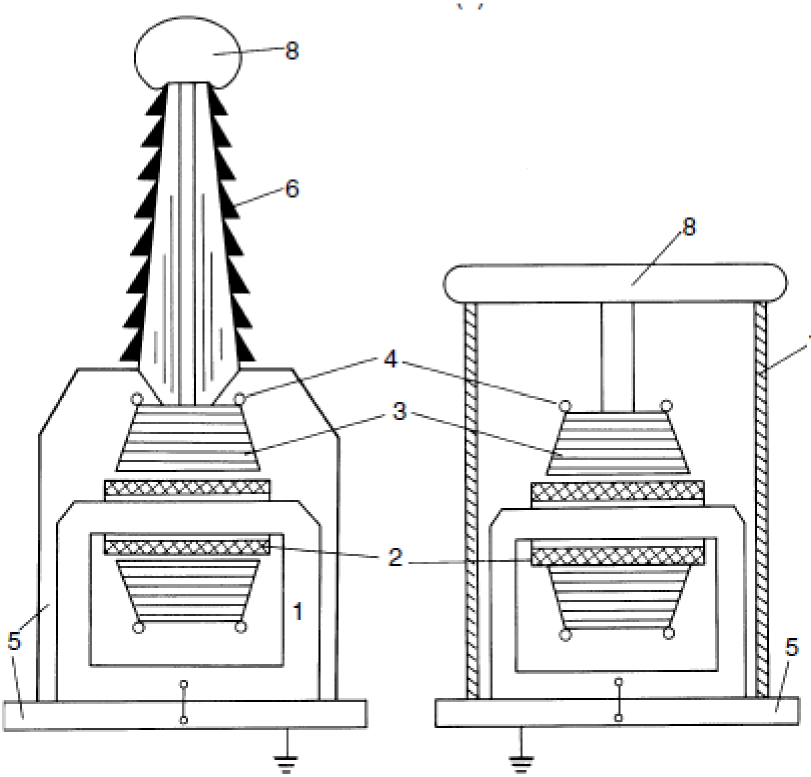
Procedimiento

17 Test procedures

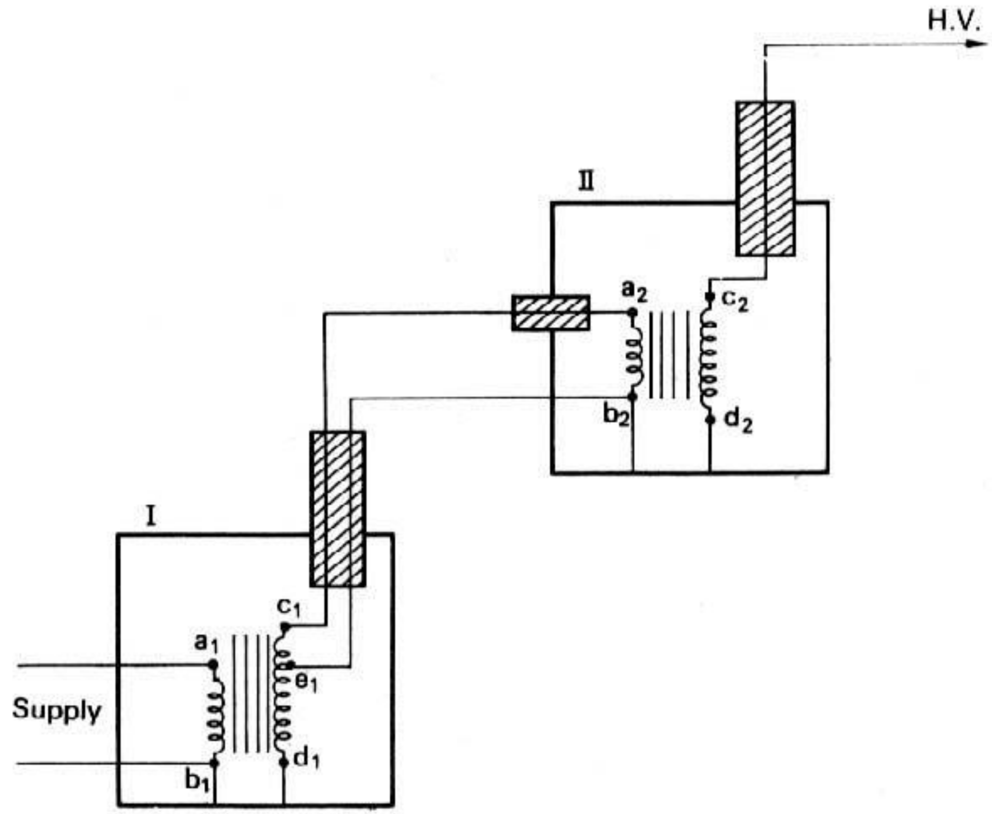
17.1 *Withstand voltage tests*

The voltage shall be applied to the test object starting at a value sufficiently low to prevent any effect of overvoltages due to switching transients. It should be raised sufficiently slowly to permit reading of the measuring instrument but not so slowly as to cause unnecessary prolongation of the stressing of the test object near to the test voltage *U*. These requirements are in general met if the rate of rise is about 2% of *U* per second, when the applied voltage is above 75% of *U*. It shall be maintained for the specified time and then rapidly decreased, but not suddenly interrupted as this may generate switching transients which could cause damage or erratic test results.

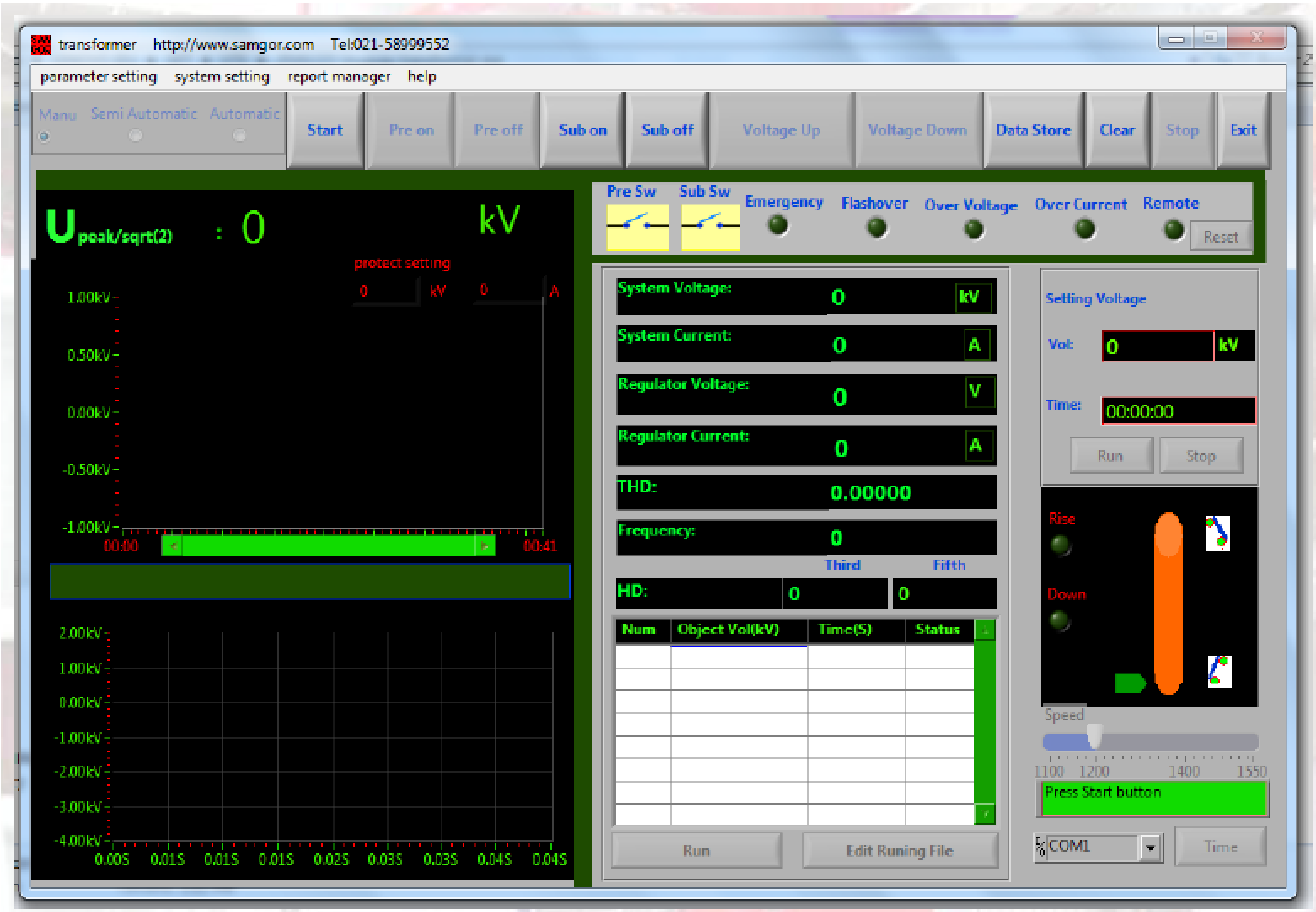
Transformadores de ensayo en AT



Transformadores en cascada

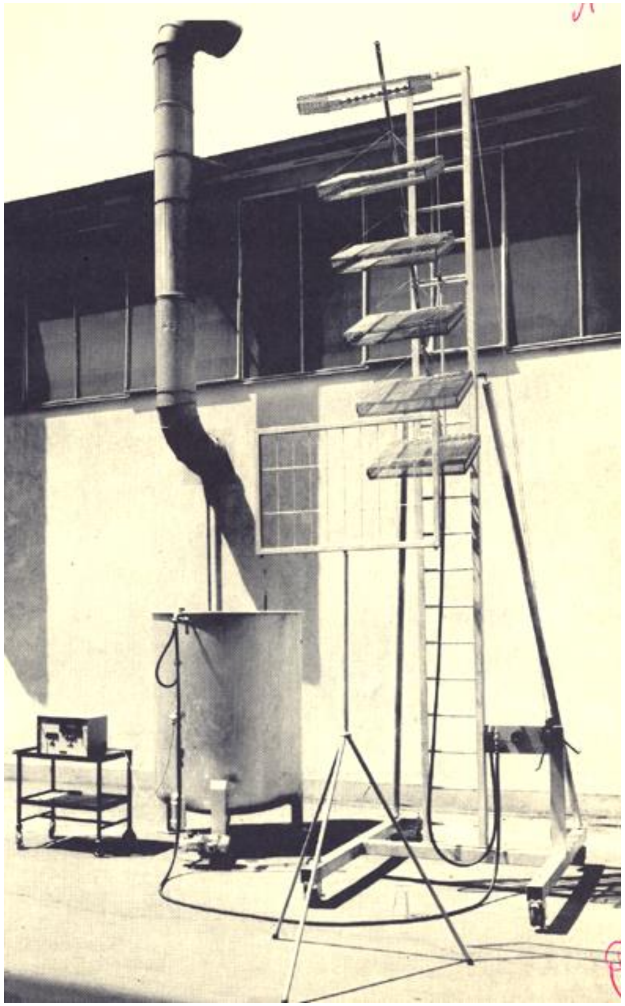


Transformadores en cascada



transformer http://www.samgor.com Tel:021-58999552
parameter setting
system setting
report manager
help
Manu
Semi Automatic
Automatic
Start
Pre on
Pre off
Sub on
Sub off
Voltage Up
Voltage Down
Data Store
Clear
Stop
Exit
U peak/sqrt(2) : 0 kV
protect setting
Pre Sw
Sub Sw
Emergency
Flashover
Over Voltage
Over Current
Remote
Reset
System Voltage: 0 kV
System Current: 0 A
Regulator Voltage: 0 V
Regulator Current: 0 A
THD: 0.00000
Frequency: 0
Third
Fifth
HD: 0 0
Num
Object Vol(kV)
Time(S)
Status
Run
Edit Runing File
Setting Voltage
Vol: 0 kV
Time: 00:00:00
Run
Stop
Rise
Down
Speed
Press Start button
COM1
Time

Ensayos bajo lluvia



Ensayos bajo lluvia

9.1 *Standard wet test procedure*

The test object shall be sprayed with water of prescribed resistivity and temperature (see table 1) falling on it as droplets (avoiding fog and mist) and directed so that the vertical and horizontal components of the spray intensity are approximately equal. These intensities are measured with a divided collecting vessel having openings of 100 cm^2 to 750 cm^2, one horizontal and one vertical, the vertical opening facing the spray.

The position of the test object relative to the vertical and horizontal rain components shall be specified by the relevant Technical Committee.

Ensayos bajo lluvia

Table 1 — Precipitation conditions for standard procedure

Average precipitation rate of all measurements		
— vertical component	mm/min	1,0 to 2,0
— horizontal component	mm/min	1,0 to 2,0
Limits for any individual measurement and for each component	mm/min	±0,5 from average
Temperature of water	°C	Ambient temperature ±15
Resistivity of water	Ω m	100 ± 15

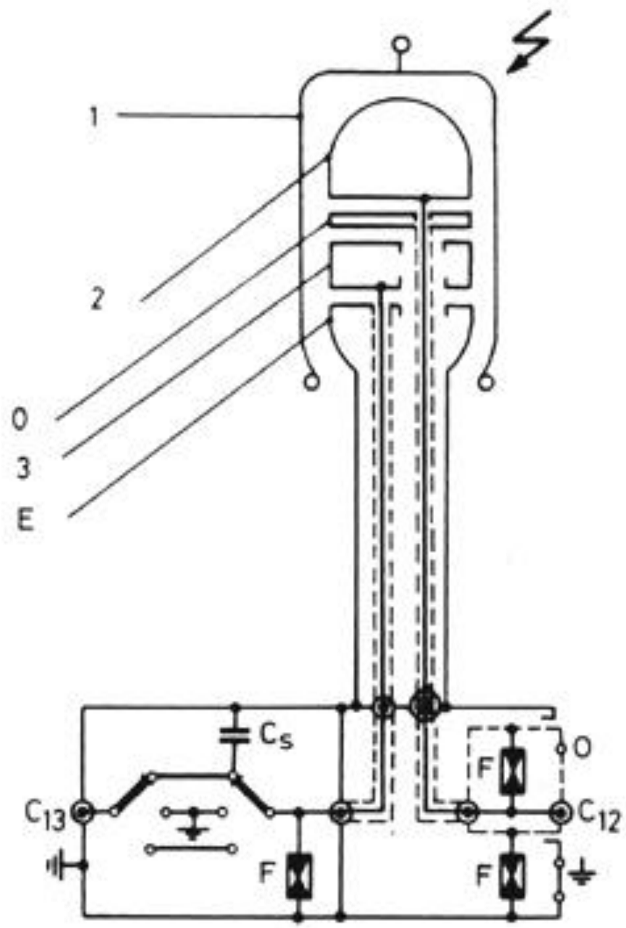
Ensayos bajo lluvia

The water temperature and resistivity shall be measured on a sample collected immediately before the water reaches the test object. They may also be measured at other locations (e.g., in a storage reservoir) provided that a check ensures that no significant change occurs by the time the water reaches the test object.

The test object shall be pre-wetted initially for at least 15 min under the above specified conditions and these conditions shall remain within the specified tolerances throughout the test which should be performed without interrupting the wetting. The pre-wetting time shall not include the time needed for adjusting the spray. It is also possible to perform an initial pre-wetting by unconditioned mains water for 15 min, followed without interruption of the spray by a second pre-wetting for at least 2 min before the test begins.

IEC 60060-1:2010 permits one flashover in AC and DC wet tests provided that in a repeated test no further flashover occurs.

Capacitor/divisor AC de AT de gas



Capacitor/divisor de AT de SF6

400 kV y 600 kV

ENSAYO DE IMPULSO

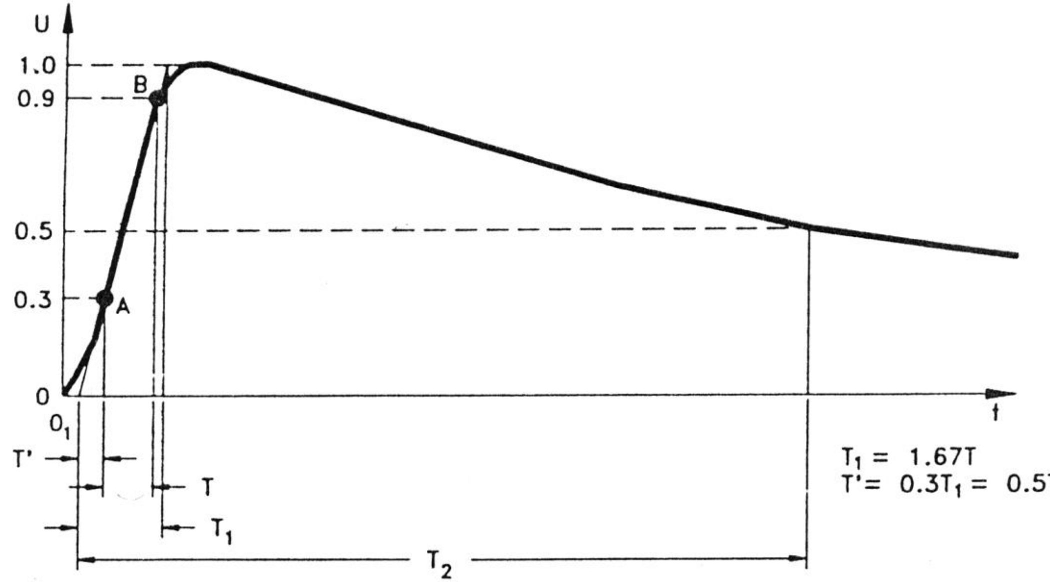
D. Slomovitz

Propósito

- Reproducción de solicitaciones eléctricas producidas por sobretensiones:
  - Caídas de rayos (lightning) 1,2/50 μs.
  - Sobretensiones de maniobra (switching) 250/2500 μs.

Forma de onda de rayo

IEC 60060-1



– Frente 1,2 µs ± 30% (0,84 µs …1,56 µs)

– Cola: 50 µs ± 20% (40 µs …60 µs)

– Tensión de cresta: ±3%

Onda cortada

IEC 60060-1

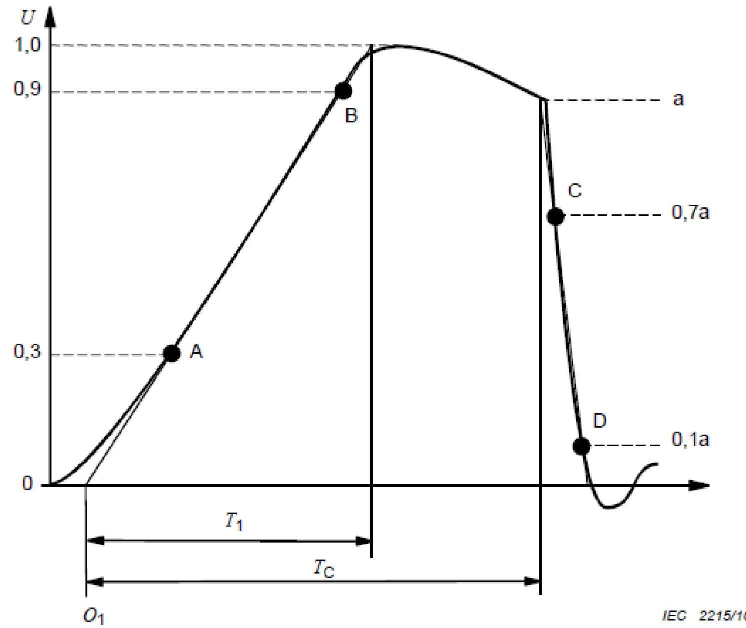
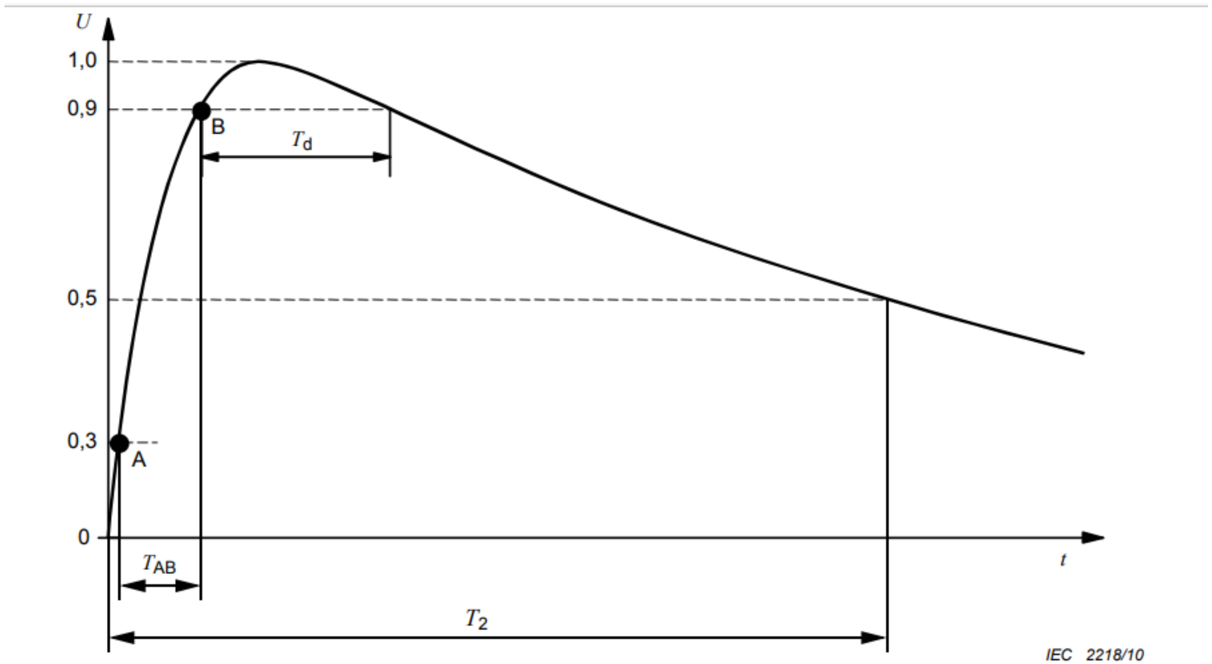


Figure 11 – Lightning-impulse voltage chopped on the tail

Tiempo de corte: 2 μs a 5 μs

Onda de maniobra



Standard switching-impulse voltage

The standard switching-impulse voltage is an impulse having a time to peak Tp of 250 µs and a time to half-value T2 of 2 500 µs. It is described as a 250/2 500 impulse.

Criterios de aceptación

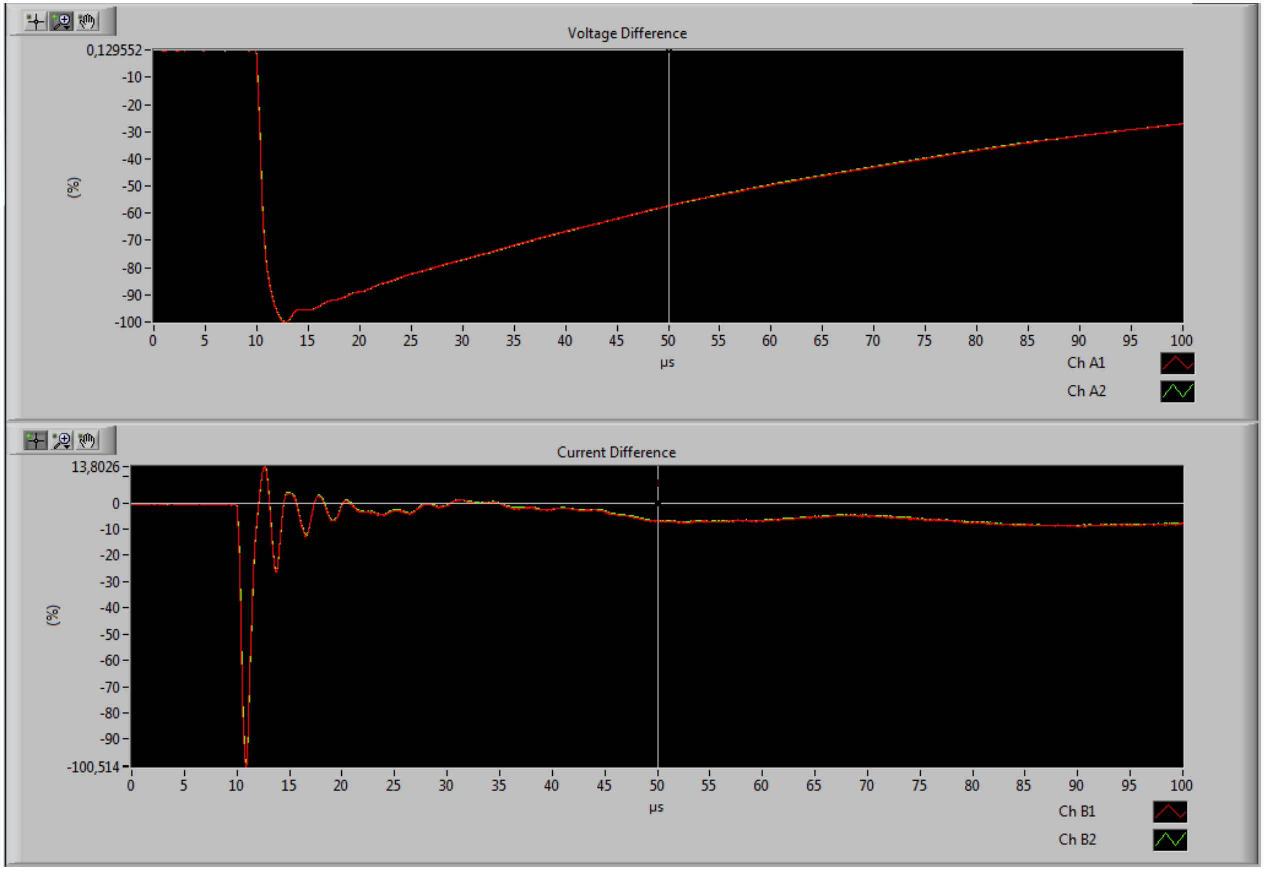
IEC 60076-3

- The test is successful if there are no **significant** differences between voltage and current transients recorded from the reference impulse and those recorded at the full test voltage.

  NOTE: The detailed interpretation of the test records and the discrimination between **marginal differences** and differences indicating failure requires a great deal of skill and experience. Further information is given in IEC 60076-4.

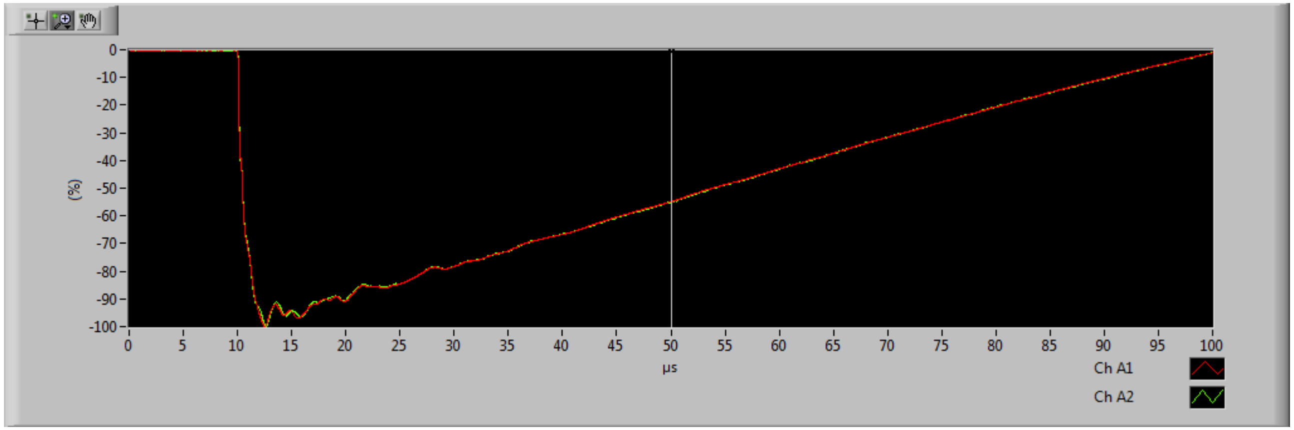
Transformador sin defecto

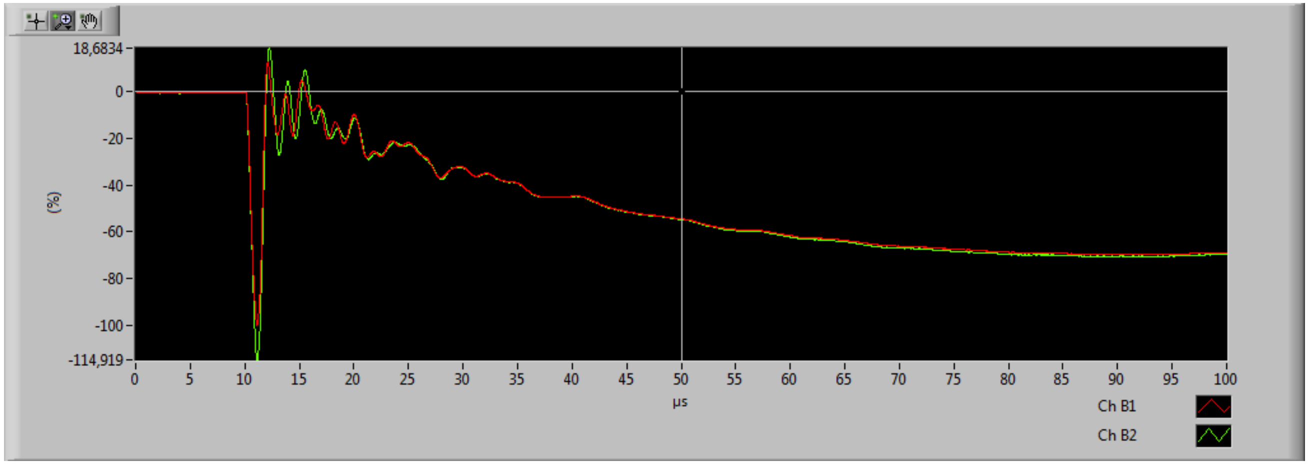
200 kVA, 15 kV



Transformador con defecto

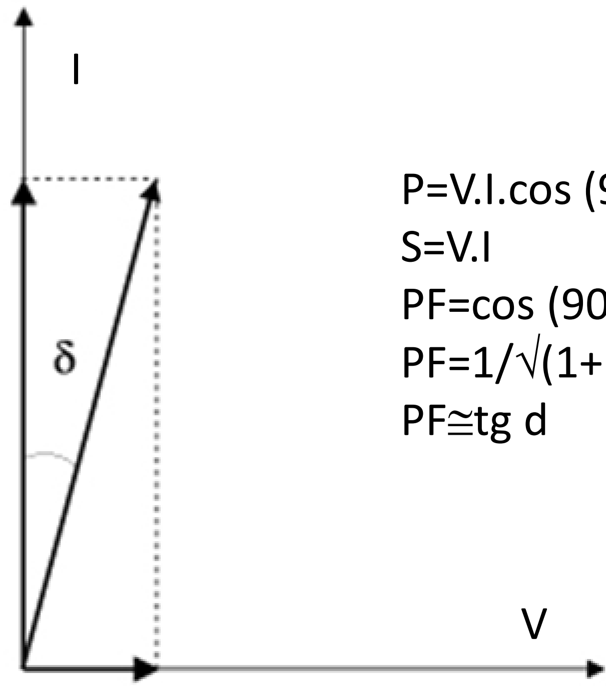
630 kVA, 6.3 kV, defecto en el conmutador, en el extremo del bobinado





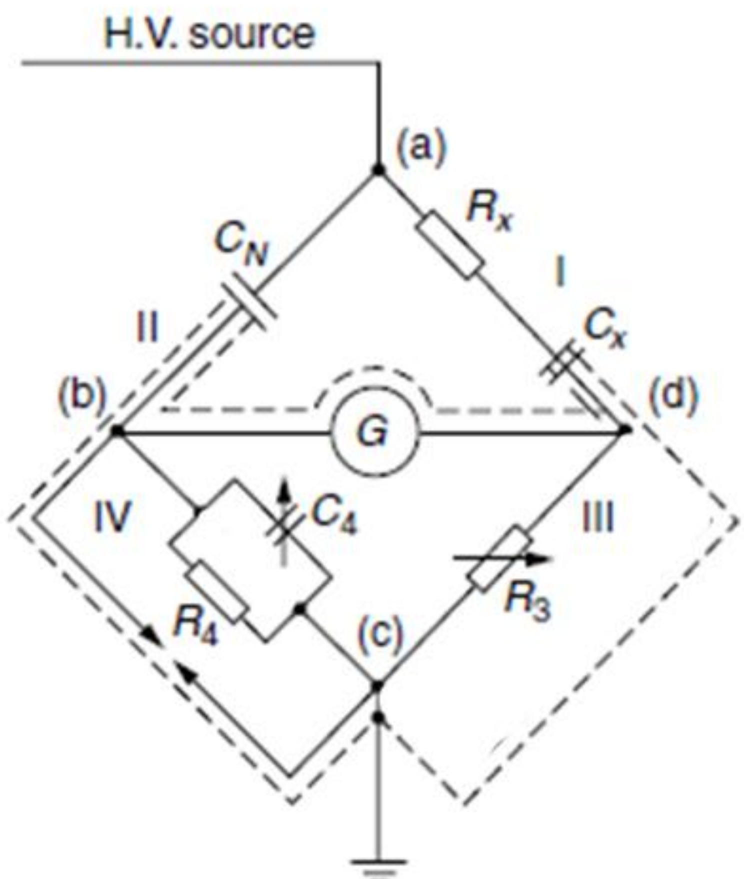
Ensayos tangente delta

Modelo fasorial de capacitor



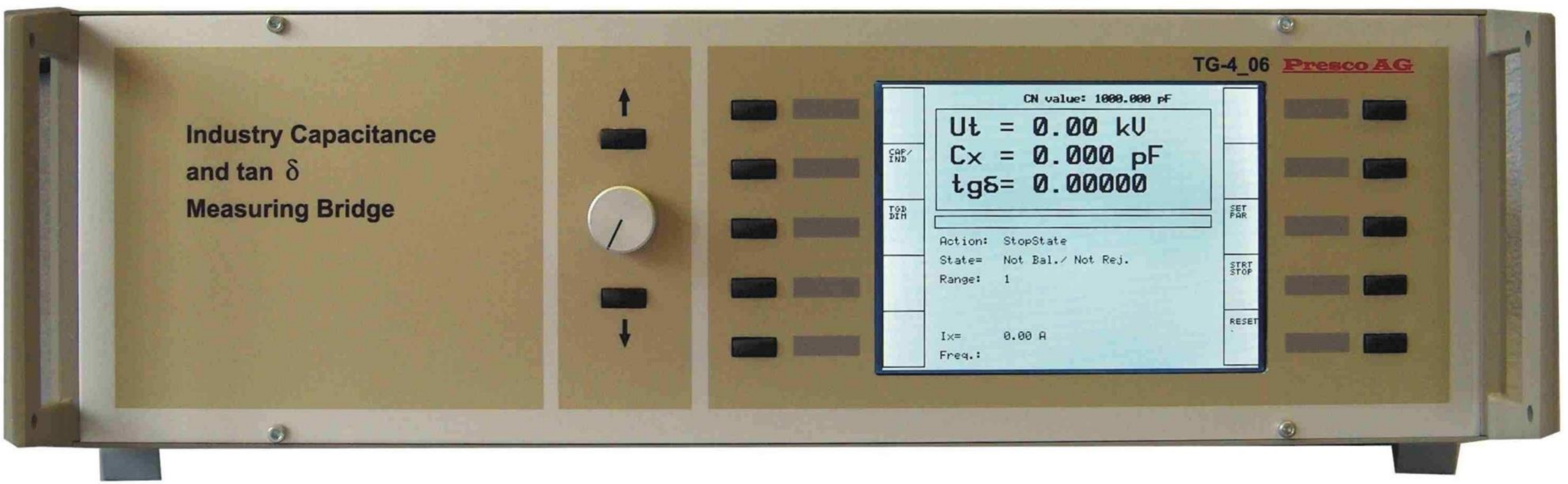
P=V.I.cos (90-d)
S=V.I
PF=cos (90-d)
$PF=1/\sqrt{(1+1/tg^2 d)}$
$PF \cong tg\ d$

Puente Schering



Cx=Cn.R3/R4
tg d= w.R4.C4

Puente automático digital



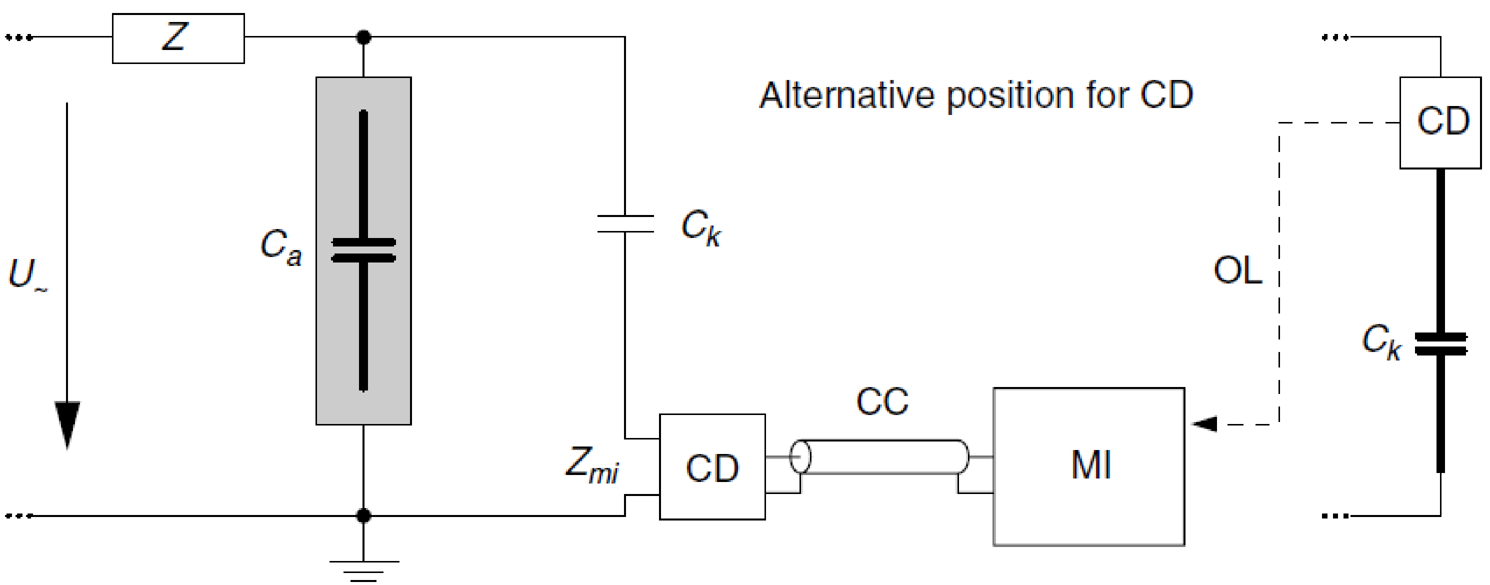
Descargas parciales

Carga aparente IEC 60270

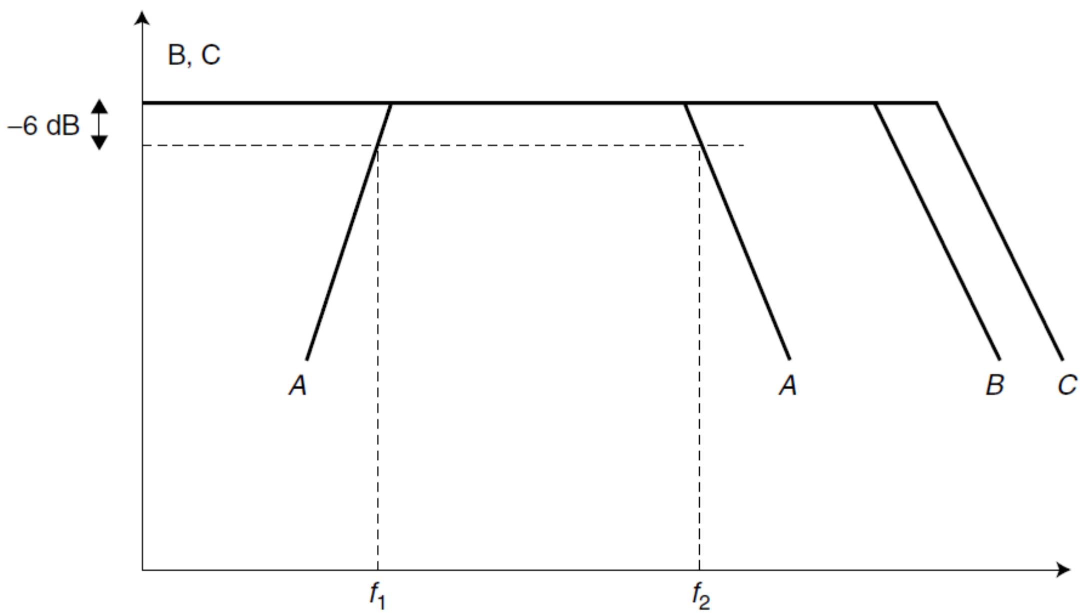
apparent charge q of a *PD pulse* is that unipolar charge which, if injected within a very short time between the terminals of the test object in a specified test circuit, would give the same reading on the measuring instrument as the PD current pulse itself. The *apparent charge* is usually expressed in picocoulombs.

NOTE – The *apparent charge* is not equal to the amount of charge locally involved at the site of the discharge and which cannot be measured directly.

Ca a tierra



Filtros



A band-pass of the measuring system

B amplitude frequency spectrum of the PD pulse

C amplitude frequency spectrum of calibration pulse

f_1 lower limit frequency

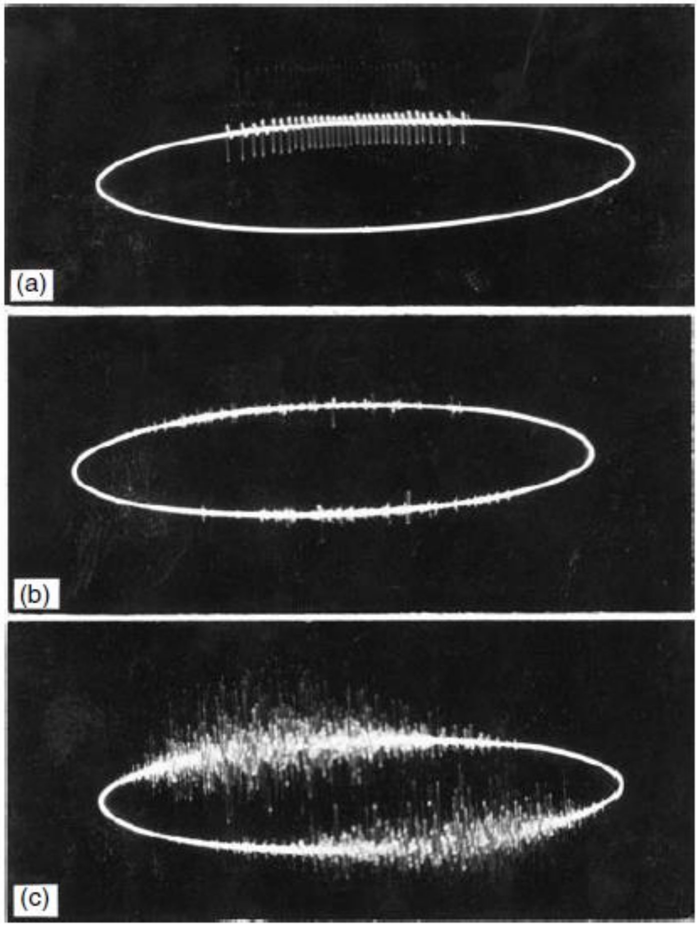
f_2 upper limit frequency

$$30\,\text{kHz} \le f_1 \le 100\,\text{kHz};$$

$$f_2 \le 500\,\text{kHz};$$

$$100\,\text{kHz} \le \Delta f \le 400\,\text{kHz}.$$

Descargas típicas



Patrón de descargas

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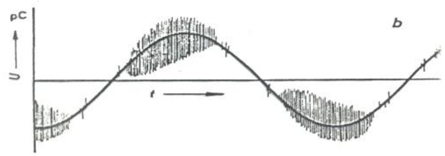
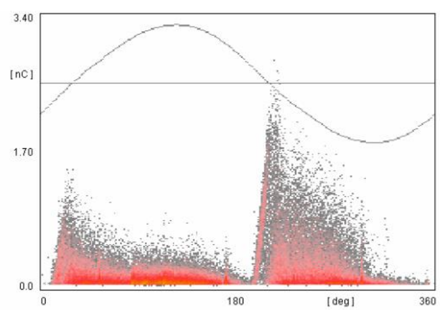
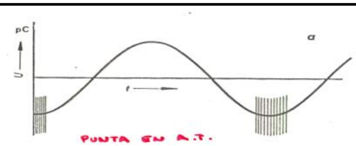
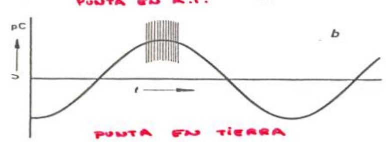
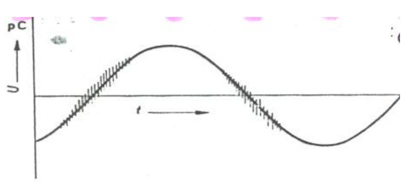
<tr><td>
</td><td>Patrón bastante simétrico, estacionario, con eventuales picos ambulantes.</td><td>Descargas internas en huecos de aislación y dieléctricos impregnados.</td></tr>
<tr><td rowspan="2">
</td><td>Pocas descargas grandes en el semiciclo positivo y muchas descargas pequeñas en el negativo.</td><td>Descargas adyacentes al conductor a potencia de tierra.</td></tr>
<tr><td>Pocas descargas grandes en el semiciclo negativo y muchas descargas pequeñas en el positivo.</td><td>Descargas adyacentes al conductor de alta tensión.</td></tr>
<tr><td>
</td><td>Impulsos igualmente espaciados de altura muy parecida, en el pico negativo de la tensión.</td><td>Descarga corona alrededor de una punta aguda en alta tensión.</td></tr>
<tr><td>
</td><td>Impulsos igualmente espaciados de altura muy parecida, en el pico positivo de la tensión.</td><td>Descarga corona alrededor de una punta aguda en baja tensión.</td></tr>
<tr><td>
</td><td>Bandas de pulsos irregulares, alrededor de los cruces por cero.</td><td>Falsos contactos</td></tr>
</table>

RIV

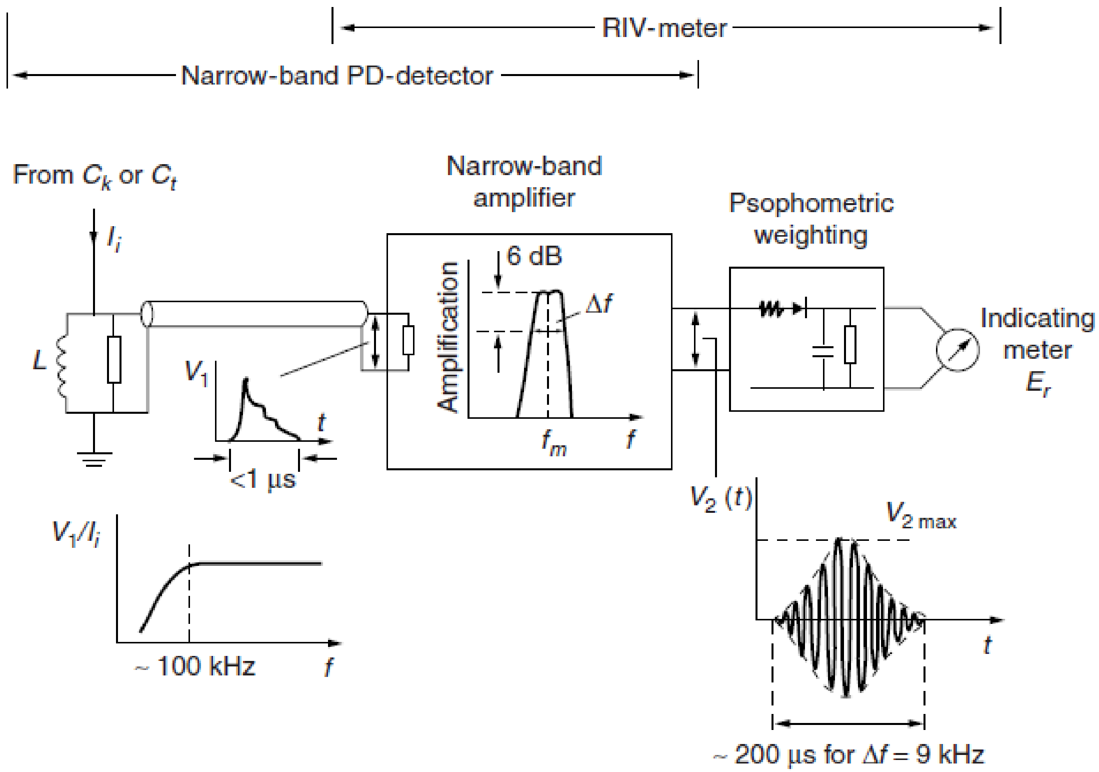
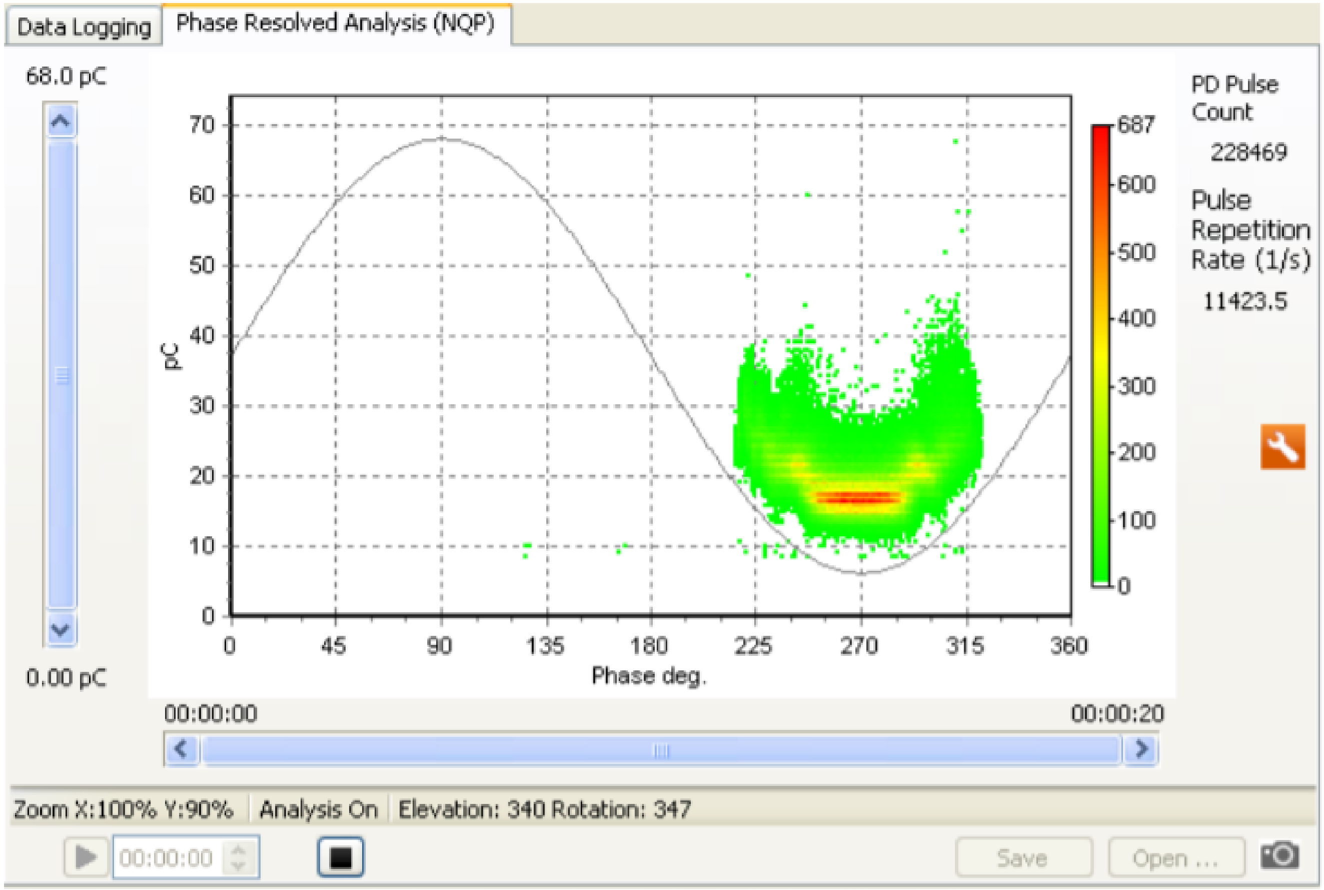


Figure 7.28 *Block diagram of a quasi-peak RIV meter including weighting circuit compared with PD narrow-band PD detector*

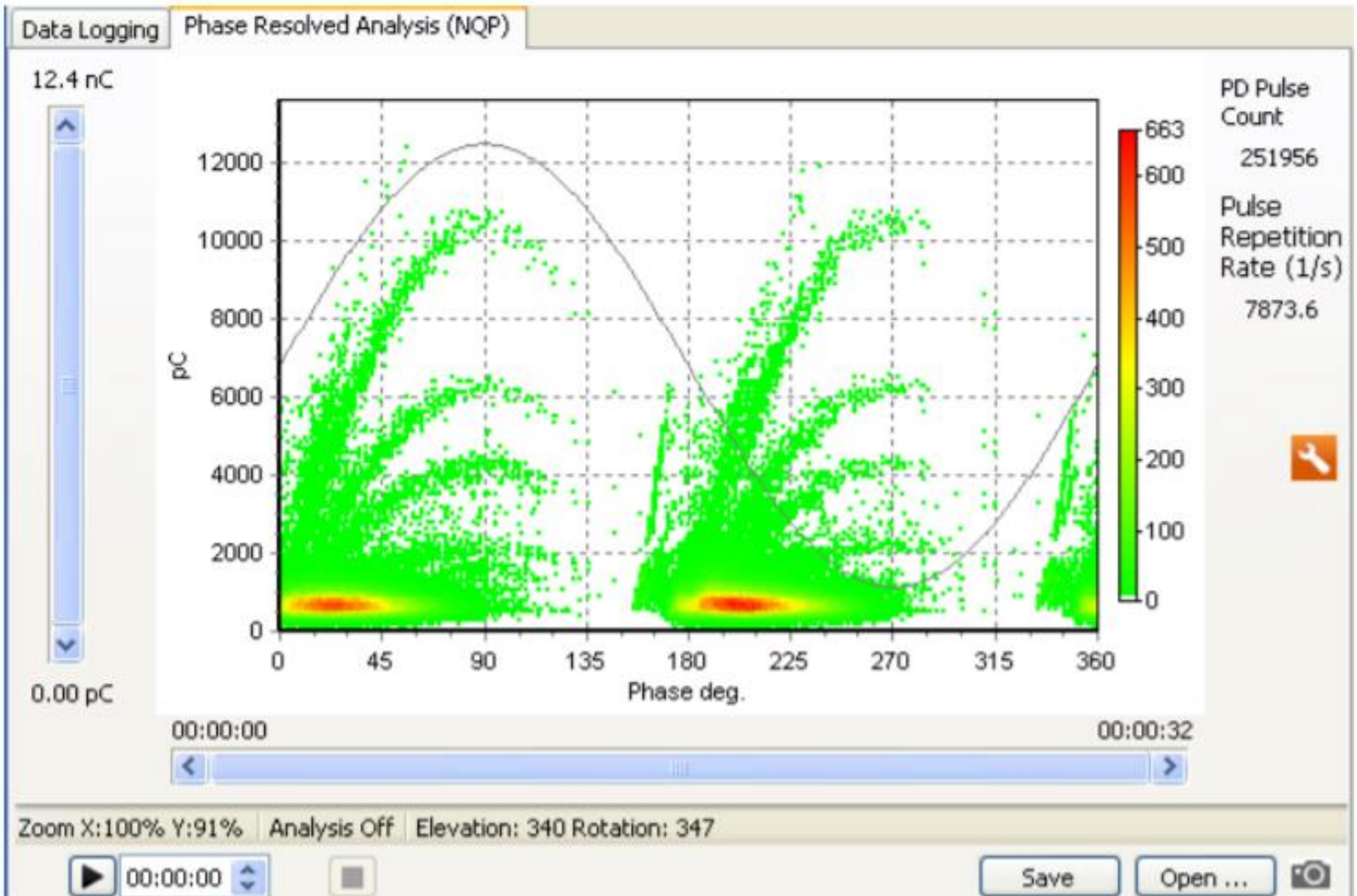
Equipo de medición analógico

Equipo digital

Descarga corona



Descargas internas en un transformador



Fin