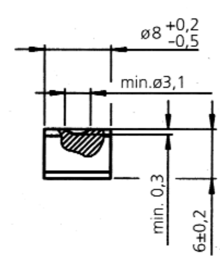
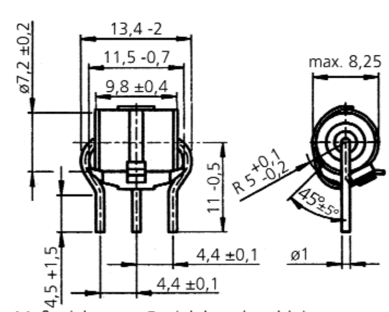
Overvoltage Arrestors

- Standard overvoltage protection elements
- Limit overvoltages
- Absorption of high currents
- Two and three electrode versions
- Thermal overload protection
- Meets international standards



Dimension: two-electrode arrestor 8x6 ceramic



Dimension: three-electrode arrestor with fail-safe

TECHNICAL DATA

ADC KRONE

Overvoltage Arrestors

Advanced communications technology, as well as measuring and control systems call for perfect signal transmission. In order to eliminate any risk of personal injury and damage to or even destruction of installations as a consequence of overvoltage conditions, these influences must be limited to harmless levels by means of overvoltage arrestors.

Overvoltage conditions are distinguished in terms of internal and external overvoltages:

Internal overvoltage conditions occur as a consequence of:

- switching of inductive circuits
- spark-over
- conductive coupling with higher voltage potentials
- influences of other components

External overvoltage conditions impact the system:

- through connecting lines
- in the form of inductive coupling caused, for instance, by fields of a power supply line or switching process
- in the form of capacitive coupling caused, for instance, by atmospheric fields

Operation

The operation of overvoltage arrestors (gas discharge tubes, GDTs) is based upon highly efficient gas discharge principles. In electrical terms, a GDT behaves like a voltage-controlled switch (Figure 2). As soon as the overvoltage exceeds the GDT's spark-over voltage, a defined discharge occurs in the component. The hermetically sealed GDT's electrical specifications are highly dependent upon certain parameters, such as gas type, gas pressure and spark gap. The discharging process destroys the energy within a short time. With its high current carrying capacity, the arc thus generated prevents, at more or less constantly low arc voltage (approximately 20 to 40V), a further build-up of the overvoltage. After the influence has decayed, the arc in the GDT is interrupted (arc extinction) and the internal resistance of the component immediately rises to a value of >1000MΩ.

In practical application, the GDT is connected in parallel with the information transmission system to be protected (Figure 3). Its internal resistance is extremely high at operating voltage and falls to nearly <0.1Ω when an overvoltage condition occurs, thereby shorting the operating voltage and the overvoltage. In common telecommunication circuits and/or systems with an operating voltage of less than 60 VDC, the GDT's arc extinction is ensured after elimination of the influence. In the case of systems with an operating voltage of more than 60 VDC or with lower impedance, the GDT's extinction behaviour must be checked case by case.

If, for instance, GDTs are used in conjunction with power or voltage supply systems (e.g. main sockets), precise examination of the extinction behaviour is **mandatory**.

Optimally, the GDT meets the requirements of a protection element: the overvoltage is safely limited to permissible levels, and due to its high insulation resistance and very low self-capacitance (<5 pF) under undisturbed conditions, the GDT has virtually no influence on the protected system.

In addition to the parameters mentioned above, the degree of primary ionization of the enclosed gas volume plays a crucial role in considering the rise time of the GDT during initial firing.

Without primary ionization of the gas volume, the initial ignition in the GDT (dark discharge effect) is delayed. The use of additional ionization sources (subject to special specification) reduces the ignition level during initial ignition.

The response behaviour of the GDT is greatly influenced by the rate of rise of the interference influence. The response time of the GDT is generally defined in the 0,1 µs range, with the

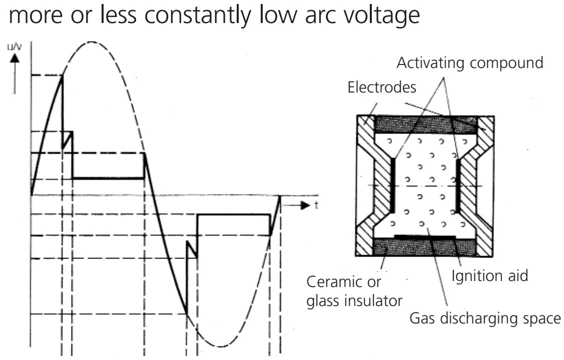


Figure 2: Characteristic and principles of GDT construction

Overvoltage Arrestors

previously mentioned rate of rise of the overvoltage playing the most important part in which context the response voltage ranges for “static“ and “dynamic interference influences“ are distinguished (Figure 4).

In the case of a dynamic influence (steeper voltage waves) the GDT's firing voltage is above the response DC voltage ($V_{Si} > V_{cdcN}$) that is due to the finite ionization time of the gas.

Push-pull interferences due to non-synchronous ignition of the discharging distance (against earth) are avoided through the use of three-electrode arrestors. A common discharging space ensures almost simultaneous ignition events at different interference levels.

GDTs are exclusively designed for transient loads (see ITU recommendation K12).

A GDT exposed to permanent loads (e.g. under power crossing conditions [influence due to contact of the system to be protected with power and voltage supply systems]), will be destroyed by overheating. Three-electrode arrestors with external temperature protection (fail-safe) can be used in order to prevent damage to installations and overvoltage protection equipment as a consequence of over-temperature of the GDT. In such a case, an external short-circuit bridge shorts the overheated GDT against earth.

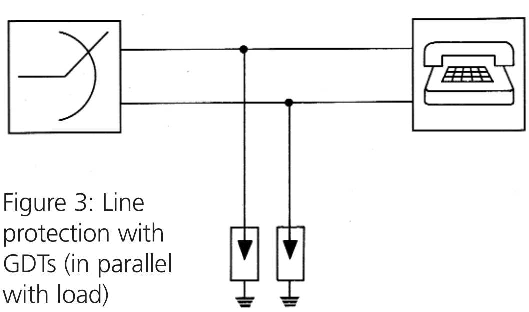


Figure 3: Line protection with GDTs (in parallel with load)

Specifications

A wide range of GDTs is available for the most varied applications.

The most important distinctions are:

- two-electrode arrestor (button type) or three-electrode arrestor
- material: ceramic (MK)
- geometrical arrestor dimensions

GDTs are additionally defined by the following electrical characteristics:

- The **nominal dc spark-overvoltage** (V_{SdcN}) defines the static value of the GDT's ignition point (in Volts). By definition, this value is determined by a voltage (rate of rise: d^u/d_t = 100 V/s). The standard V_{SdcN} tolerance is ±20%.
- The **impulse spark-overvoltage** (V_{Si}) defines the typical value of the GDT's dynamic ignition point (in Volts) (voltage rise by definition 1 kV/µs).
- The **nominal alternating discharge current** (I_{daN}) is defined as a 1s AC current (50Hz, RMS value).The GDTs are designed to withstand either ten loading processes (every 3 minutes) in accordance with ITU K12, or five loading processes (every 30 seconds) in accordance with DIN/VDE.
- The **nominal impulse discharge current** (i_{diN}) defined as current impulse with 8/20µs waveform. The GDTs are designed to withstand the following loads: in accordance with ITU K12: ten times (every 3 minutes) or in accordance with DIN/VD: five times (every 30 seconds).

In addition to these characteristics, standard data are available concerning the capacitance of the GDTs (typically 2 pF) and their insulation resistance Risol R_{isol} ($>10^{11}\,\Omega$).

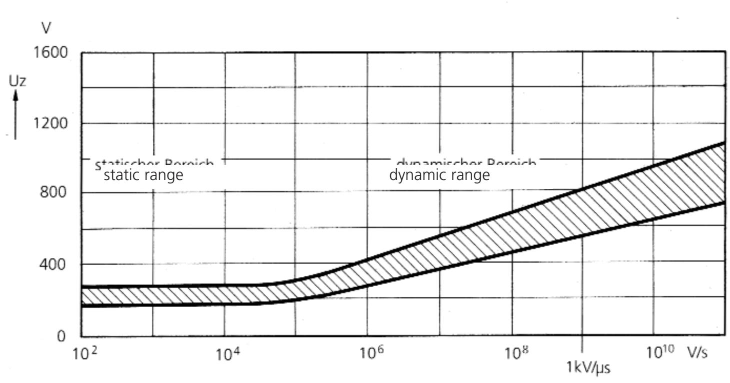


Figure 4: GDT response behaviour (example V_{cdcN}=230V)

Product range of overvoltage arrestors*

Two-electrode arrestors

Type	V_{scicN}/V	V_{si}/V	I_{daN}//A	I_{diN}/kA**	Catalogue Number
Arrestor 8x6, 90V	90	<600	20	20	6717 3 341-00
Arrestor 8x6, 90V	90	<600	10	10	6717 3 341-01
Arrestor 8x6, 230V	230	<600	20	20	6717 3 343-00
Arrestor 8x6, 230V	230	<700	10	10	6717 3 343-01
Arrestor 8x6, 230V	230	<700	5	5	6717 3 343-03
Arrestor 8x6, 350V	350	<700	20	20	6717 3 344-00
Arrestor 8x6, 350V	350	<1000	10	10	6717 3 344-01

Three-electrode arrestor without Fail-safe

Type	V_{scicN}/V	V_{si}/V	I_{daN}//A	I_{diN}/kA**	Catalogue Number
Arrestor 8x13, 90V	90	<550	10	10	6717 3 501-00
Arrestor 8x13, 230V	230	<650	10	10	6717 3 503-00
Arrestor 8x13, 230V	230	<450	10	20	6717 3 503-01
Arrestor 8x13, 350V	350	<900	10	10	6717 3 504-00
Arrestor 8x13, 350V	350	<700	10	10	6717 3 504-01

Three-electrode arrestor with Fail-safe

Type	V_{scicN}/V	V_{si}/V	I_{daN}//A	I_{diN}/kA**	Catalogue Number
Arrestor 8x13, FS, 90V	90	<550	10	10	6717 3 511-00
Arrestor 8x13, FS, 230V	230	<650	10	10	6717 3 513-00
Arrestor 8x13, FS, 230V	230	<450	10	20	6717 3 513-90
Arrestor 8x13, FS, 350V	350	<900	10	10	6717 3 514-00

*) Arrestors with different design and other electrical properties on request.

**) V_{sdcN}/V	Line A/ Line B, earth:	100 V/s
V_{si}/V	Line A/Line B, earth:	1000 V/µs
I_{daN}/A	Line A and Line B, earth:	50 Hz 1 s
i_{diN}/kA	Line A and Line B, earth:	8/20 µs

TECHNICAL DATA

DC spark-over voltage

v_{sdc}/V Line A/Line B, earth: 100V/s

Impulse spark-over voltage

v_{si}/V Line A/Line B, earth: 1000V/µs

Alternating ac discharge current

I_{daN}/a Line A and Line B, earth: 50Hz 1s

Impulse discharge current

i_{diN}/a Line A and Line B, earth: 8/20µs

KRONE

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