Easy protection

Background information on surge protection

Protection against overvoltages is important and has also become mandatory in most countries. But what is behind the categorization of the different types of protective devices, and what does all this have to do with the voltage protection level? We will answer these and other questions in the course of this document.

What was the situation before?

Many people are still aware of the terms coarse, medium, and fine protection. These terms said it all and explained everything. The categorization is a legacy from the time when spark gaps just managed to achieve a voltage protection level of 6 kV, and a typical varistor rating was 4 kV. This was sufficient. The electrical strength of a main distribution system is at least 6 kV, and that of the electrical installation, including subdistribution, is at least 4 kV. The fine protection was then used to protect the connected devices. But even the fine protection itself had a voltage protection level of 2.5 kV.

Nowadays, modern spark gaps achieve a voltage protection level of 1.5 kV, and therefore do not just protect the main and subdistribution systems, but also the sensitive electronic devices. This means that a surge protective device with spark gap can do it all: Coarse, medium, and fine protection in one device. As a result, the categorization of coarse, medium, and fine protection based on the voltage protection level has become outdated. Therefore, these terms have not been used in the standards for a long time.

How are SPDs categorized today?

In the standards, the voltage protection level is a decisive characteristic used for selecting a suitable SPD. But nowadays, spark gaps themselves achieve a voltage protection level of 1.5 kV, and thus protect even sensitive electronic devices. Selection is therefore simplified considerably and is no longer dominated by the voltage protection level.

The energy discharge capacity of the SPD remains important. In buildings with an external lightning protection system and buildings with an overhead line supply, you have to expect high levels of energy in the electrical system in the event of a lightning strike. In certain circumstances, this can amount to half the energy of lightning bolt! Without a lightning protection system, significantly lower-level influxes of energy are to be expected. In the event of a lightning strike in the power grid, the energy of the lightning is spread across a number connections, depending on the location of the strike.

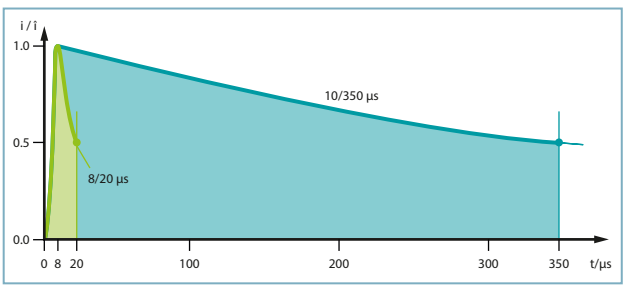
In terms of the voltage protection level, the various types of SPD are now equal, but this is far from the case in terms of their energy discharge capacity. A type 1 SPD can handle surge currents of the pulse shape 10/350 µs (direct lightning strikes) and 8/20 µs (switching overvoltages). Pure type 2 SPDs are only designated for surge currents of the pulse shape 8/20 µs. At the same amplitude, the energy content of a 10/350 µs pulse is approximately 20 times that of an 8/20 µs pulse. Therefore, spark gap technology is used as a preference in high performance SPD type 1 lightning arresters, because they can handle high levels of energy. Varistors are sufficient for the lower energies of an 8/20 µs pulse. Spark gap technology is therefore ideal for use in buildings with external lightning protection systems. The much more compact and cheaper varistors, on the other hand, are perfectly capable of providing sufficient surge protection against lower-level influxes of energy.

The energy discharge capacity is a key parameter when creating a strategy for protection against overvoltages. Therefore, energy coordination is also used when writing standards. Instead of coarse, medium, and fine protection, the designations SPD type 1, type 2, and type 3 are used. The three-level categorization system remains:

- Installation at the feed-in point of the system (type 1 or type 2)
- In the subdistribution (type 2 or type 3)
- For the protection of sensitive end devices (type 2 or type 3)

And what is the energy discharge capacity of a type 3 SPD?

This can discharge even less energy than a type 2 SPD. The type 3 SPD should, however, only be used as the final protective device upstream of the end device – that is to say, the fine protection. Without an upstream type 1 or type 2 protective device, the type 3 SPD would quickly become overloaded in the event of a large overvoltage and, in the worst case, become damaged or destroyed along with the device it is supposed to protect.



Comparison of the specific energy of the test pulse for type 1 SPDs (10/350 µs) and type 2 SPDs (8/20 µs)

Learn more

You will find further information on selecting the right surge protective devices in our other info papers at **phoenixcontact.com/spd-building**

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