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NOISE IMMUNITY OF THE EQUIPMENT

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ABSTRACT
This article reflects that the concept of an overvoltage protection device differs from the concept of galvanic isolation in that when the protection is triggered, the current is diverted to the ground, and the electrical characteristics of the transmitted signal are distorted for the time of interference. Moreover, if the interference current diverted to the ground is large enough, then problems may arise in any other circuits due to communication through the total impedance or a surge in the potential of the earthing device.

Keywords: electrical strength, filters, galvanic separation.

Introduction

The Main Part

In addition to the general methods of making screens, sometimes there is a need to use barriers to reduce the level of interference below some acceptable level determined by the noise immunity or electrical strength of the equipment.

This usually happens when the receiving circuits pass through the boundary of zones with different EMO.

The blocking devices can be divided into three groups:
1. galvanic separation;
2. overvoltage limitation;
3. filters.

The components of the most commonly used galvanic circuit separation are as follows:

- *Electromagnetic* and static relays, the capabilities of which are usually limited to switching between on/off states at very low frequencies (50/60 Hz) with an isolation level of no more than 2 kV.
- *Optocouplers* that allow the transmission of signals with a frequency of up to several MHz and an isolation level of up to 5 kV.
- *Separation transformers*, with the help of which signals with a frequency from units of Hz to several MHz can be transmitted, while the insulation level reaches 20 kV and above.

- *Fiber-optic systems* are the best barrier to interference of all types. They may be of interest for the use of low frequency data transmission channels over short distances in cases where a very high.

The concept of an overvoltage protection device differs from the concept of galvanic isolation in that when the protection is triggered, the current is diverted to the ground, and the electrical characteristics of the transmitted signal are distorted for the time of interference.

Moreover, if the interference current diverted to the ground is large enough, then problems may arise in any other circuits due to communication through the total impedance or a surge in the potential of the earthing device.

For these reasons, surge protection can be applied only to those circuits whose signals allow distortion during disturbances.

Surge protection devices are divided into three types, used separately or in combination with each other: arresters, varistors, avalanche diodes.

Gas-filled arresters (rough protection) are used in circuits requiring protection against very powerful disturbances (caused by lightning strikes or short circuits in power circuits).

The advantage of varistors in relation to gas-filled arresters is that when they are triggered, the circuit does not short out, and the behavior during dynamic processes is noticeably better. However, the large capacity of the devices limits their use in some RF circuits.

Avalanche diodes are not capable of diverting significant currents into the ground, but their trip voltage can be very low and independent of the current. Therefore, they are mainly used as interference suppressors (thin protection) directly near the equipment or protected circuits.

The need to protect sensitive equipment from overvoltage causes the use of multi-stage protection schemes, in which a coarse protection stage (spark gap) is installed at the entrance to the building to divert current (equalize) potential, and the limitation of overvoltage is carried out by fine protection stages.

In such a scheme, in order to achieve the goal, the parameters of the stages and their installation locations must be coordinated (the relationship between the actuation voltages of the elements, the resistance between them, the response time).

The main idea of using filters is to ensure that the bandwidth of the circuit does not exceed the frequency range used by the transmitted signal. Most EMC problems arise due to interference penetration into the equipment through circuits and communication ports, whose bandwidth is unlimited, as well as through power supply circuits.

The most well-known type of filter is the LF filter installed in the power circuits of most electronic devices.

These filters usually perform two functions – suppression of antiphase interference and suppression of common-mode interference.

The first function is easily feasible (it is directly characterized by the transfer characteristics of the filter), while the implementation of the second function is associated with difficulties, since it strongly depends on the way it is installed and connected to the equipment.

The only way to ensure the correct reduction of common–mode interference is to install the filter directly at the input of the equipment and perform grounding by direct contact between the filter housing and the frame.

Conclusion

All performance filters are divided into two groups – passive and active. Passive ones are assembled from passive elements – resistors, capacitors and inductors. In active filters, along with the mentioned elements, semiconductor devices, microcircuits with their power sources are used. Active filters, in turn, are divided into analog and digital. The advantage of active filters in comparison with passive filters is a large cut-off steepness, high input and low output resistance.

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