PROTECTION OF BANKS

Lightning and surge protection in BANKING PREMISES

Cirprotec Technical Article No. 7

PROTECTION OF BANKS

0. Overvoltages in banking premises

The various types of overvoltage have a direct impact on electrical installations. Both transient surges and permanent overvoltages cause **premature wear** in equipment connected to the network, leading to the destruction of equipment and even to fire in the installation.

Different electrical equipment can withstand different overvoltages. International standard IEC 60364-4-44 classifies 230 VAC equipment into four Categories according to the overvoltage they are capable of withstanding. Category 1 is the most sensitive, and applies to IT and electronic equipment.

Almost **all the equipment** found in **banking premises** belongs to Category 1, which is why overvoltages are so critical in these installations. For this type of installation, the nature of the service provided makes **guaranteeing continuity of service** as important as the protection of the actual equipment. Repairing the damage, in addition to the direct costs of the equipment itself, involves indirect costs which are not so easy to measure, **such as ATM transactions not carried out and customer dissatisfaction**.

The need to protect such facilities is reflected in new regulations. The 2002 Low Voltage Electrotechnical Regulations in Spain requires surge protection to be installed, but additionally, some Spanish regional governments have ratified this protection in their Official Gazettes and Special Regulations. In section 2 of this article, the entire **regulatory framework** governing these protections is set out in detail.

The aim of this article is to explain what they are and how to protect against each type of overvoltage, while proposing a solution which provides maximum performance as regards protection and service continuity.

Fig. 1. Bank premises suffer from the destruction of equipment and service discontinuity due to overvoltages

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1. What are overvoltages?

When analysing the phenomenon of overvoltages, a distinction is always made between **transient overvoltages (surges) and permanent overvoltages (TOV).** Although they both represent an increase in voltage above the allowable limit, their causes, magnitude, duration and method of protection are different.

Transient overvoltages are surges that can reach tens of kilovolts with a duration of the order of microseconds. Despite their short duration, the high energy content can cause serious problems to equipment connected to the line, from premature aging to destruction, causing disruptions to service and financial loss.

This type of overvoltage can have various different causes, including atmospheric lightning directly striking the external protection (lightning rods) on a building or transmission line or the associated induction of electromagnetic fields in metallic conductors. Outdoor and very long lines are the most susceptible to these fields, often receiving large induction currents. It is also common for non-weather phenomena, such as transformer centre switching or switching off motors or other inductive loads to cause voltage spikes in adjacent lines.

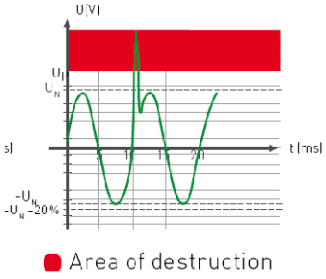

Fig. 2. Transient overvoltage

Transient overvoltages are voltage spikes of tens of kilovolts with a duration of microseconds.

Surge protection is achieved by installing the protector or line discharger on the vulnerable line, connecting it in parallel between the line and earth. This means that in the event of a surge, the protector will discharge excess energy to earth, thus limiting the peak voltage to a value which the electrical equipment connected can withstand.

Besides the phenomenon of transient overvoltages, which may affect any type of conductor, electric transmission lines can transmit a second type of overvoltage, known as **permanent overvoltage (TOV)**. This is considered to be any voltage increase above 10% of the effective nominal value during a period of the order of seconds. Permanent overvoltages are caused by supply problems, or, very often, by bad connections or breakage of the neutral conductor. When the latter occurs, the single-sided voltage received by any system connected between phase and neutral is floating and depends on the imbalance of the charge on the three-phase network, and can supply as much as 400 effective Volts instead of the 230 V expected. An increase in effective voltage may lead to premature aging of receivers, current increases or even their destruction, with the resultant fire risk.

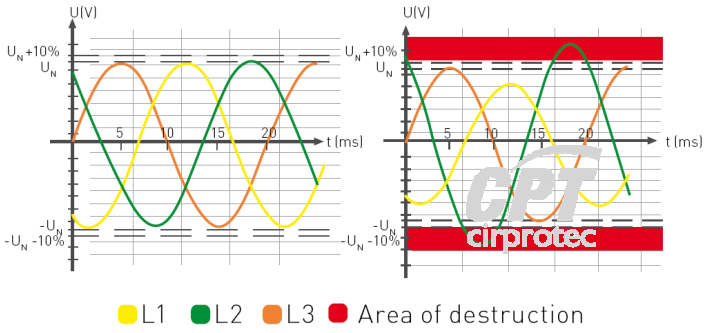

Fig. 3. Permanent Overvoltage (TOV)

The protection method for this type of overvoltage consists of monitoring the voltage between each of the phases and neutral and breaking the circuit if this value rises to over 10% above nominal.

Permanent overvoltages are increases in the mains supply of hundreds of volts for an unspecified period.

2. Regulatory framework

The phenomenon of transient overvoltages in electrical systems has been known about for a long time. For this reason the Spanish **Low Voltage Electrotechnical Regulations of 2002** *(REBT),* Article 16: Indoor facilities or receivers, paragraph 3, states:

REBT art. 16.3

*Protection systems for indoor installations or low voltage receivers shall prevent the effects of overcurrent and **overvoltage** which for various reasons may be expected in them and shall safeguard their materials and equipment from the actions and effects of external agents. Furthermore, for the purpose of general security, the conditions which such installations must fulfil to provide protection from direct and indirect contacts shall be established.*

According to this Article, there is no doubt that overvoltage protection is mandatory in Spanish electrical installations, both for permanent (TOV) and transient overvoltages.

In addition, ITC-BT-23 (*Complementary Technical Instruction 23*) is also obligatory. It deals exclusively with the case of transient overvoltages, among other things because the design of this protection is quite complex. This Instruction highlights the requirement to protect against surges, among other cases when the equipment is critical, both as regards its economic value and the importance of continuity of service.

ITC23

On the other hand, the **Special Technical Regulations for power supply companies**, adopted by various different Spanish regional governments, should be borne in mind. Such is the case in **Andalusia, Catalonia, Aragon and the Canary Islands.** In each of these, the authority has issued an official bulletin which makes it obligatory for electricity supply companies to comply with the Special Regulations, and to install surge protection in order to prevent their customers from being affected by them.

All this legal framework has contributed to installations being protected better and better and, as a result, to a reduction in the impact of surges.

3. The problem of overvoltages in bank premises.

As can be seen in Section 1, surges can be received in any metallic cable: supply network, telephone, voice and data, antennae, cameras, etc. **Any equipment connected to these in bank premises is in serious danger of suffering the effects of overvoltages unless properly protected.**

To accurately size the protection, it is first necessary to ascertain which equipment in the bank premises needs to be protected. All electrically powered items are subject to overvoltages, both transient and permanent. For this reason, the first protection will be in the power incoming supply panel, to prevent power surges **originating from outside via the supply network.**

Additionally, equipment such as computers, modems, servers and fax are connected to the **telephone line**, which, because of its long outdoor runs, is very sensitive to induced surges, which is why the telephone line is the second one for which protection should be considered.

Finally, **closed-circuit television (CCTV) circuits** must be analysed. These installations consist of cameras distributed outdoors as well as indoor image receivers. Both receivers are very sensitive to overvoltages, which may be received via the power supply or image cable, and must therefore be sized to protect both lines.

Protection from overvoltages originating from the electrical supply network

According to IEC 61643, proper protection against surges in power supply networks requires a stepped protection arrangement. This means installing a protector in each of the electrical panels, thus achieving a reduction in voltage at each step and ensuring a safe, withstandable residual voltage value for all the equipment connected to the network.

Before sizing the protection in each of the electrical distribution panels, it is necessary to know whether the overvoltages will be conducted or induced, since the energy involved is very different, and a different type of protector will be needed. It is essential to know whether the building in which the bank is located, or neighbouring buildings, have external lightning protection.

If they do, protection at the incoming power supply panel should be Type 1+2, model PSC4-12,5/400 TT. Otherwise, it is sufficient to install a Type 2 protector, model PSM4-40/400 TT.

If the bank premises have any secondary electrical panels (distribution panels), a second set of protectors can be installed in the same locations as these. They will consist of Type 2, 20 kA protectors. Cirprotec offers model PSM2-20/ 230 TT protectors for single-phase panels and PSM4-20/400 TT for three-phase panels.

Fig. 4. Type 1+2 plug-in surge protectors
PSC range

Fig. 5. Type 2 plug-in surge protectors
PSM range

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As discussed above, electrical lines are also subject to permanent overvoltages. For this type, Cirprotec offers the new Overcheck version. The Overcheck Line Control Unit range, originally developed for the banking sector, has been on the market for almost 15 years. The new version of Overcheck provides adjustable overvoltage protection, perfectly adaptable to the installation values, but always respecting the values specified by the forthcoming new European standard for permanent overvoltages.

The Overcheck solution is supplied complete with an MCB circuit breaker, which fulfils the function of main switch. It also provides protection against undervoltage, phase failure, phase sequence error, earth-leakage protection adjustable for time and sensitivity, all with automatic reconnection to prioritise continuity of service.

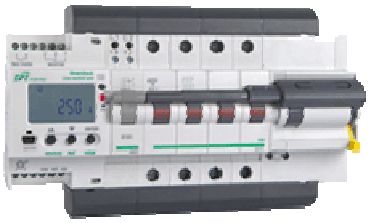

Fig. 6. Transient and permanent overvoltage protector with automatic programmable reconnection.
Overcheck range

Finally, it is important to note that to ensure proper protection, protectors must be correctly installed and maintained. One of the most critical aspects is the quality of grounding, because in the event of a voltage spike, the protectors discharge energy to earth, and if this is not correct, the protectors cannot do their job. For this reason, Cirprotec offers an innovative new product, G-Check, a grounding system monitor. This product, patented by Cirprotec, is connected to the incoming power supply panel and continuously monitors the status of the earth. If it exceeds a critical user-defined value, G-Check activates warning alarms.

Fig. 7. Monitoring grounding systems
G-Check range

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Overvoltage protection of telephone lines

The telephone network requires extensive outdoor wiring. This creates an infrastructure that is highly exposed to overvoltages. During storms, voltage peaks are induced in telephone wires and enter bank premises, damaging all equipment connected to the communications network: modems, faxes, phones, PCs, servers, etc.

To avoid this problem, a protector must be installed on each separate line available to the bank. Two types of protection are possible, depending only on the location where the protector is to be installed. The Cirprotec ADSL DIN-model is installed on the DIN rail of an electrical panel, and Cirprotec's product range also includes KPL-CG, which is fitted to Krone type switching and terminal blocks.

The most sensitive and costly equipment, as well as any that is critical for service continuity, may be fitted with a second protector, with an overhead format, connected immediately adjacent to the equipment to be protected. For this solution Cirprotec offers the MCH-ADSL product.

Fig. 8. DIN-ADSL phone line protector.

Fig. 9. KPL-CG phone line protector.

Fig. 10. MCH-ADSL phone line protector.

Closed circuit television protection

Finally, the CCTV systems need to be protected. In these systems both the cameras installed throughout the facility and the image-receiving equipment need to be protected. For the safety of the cameras, a protector is fitted both to the supply line (camera power supply) and to the coaxial image cable. These protectors must be installed next to each camera. Some CCTV cameras use technologies such as PoE, which combine image and power in a single RJ45 cable, in which case a single protector designed specially for this technology must be installed. Similarly, protection must be installed next to the receiver on each of the lines coming from outside.

Fig. 11. Coaxial cable protector for CCTV equipment

Fig. 12. Power supply protector for CCTV equipment

Fig. 13. PoE protector for CCTV, with power supply and communications in a single conductor.

4. Control of illuminated signage

Cirprotec's offering, as well as including all types of solution for lightning and surge protection, includes the Light Control LC-2500 equipment.

The LC-2500 is an electronic device specially designed to monitor illuminated signage circuits, advertising systems, road safety warnings, etc. It is a microprocessor-based system which signals faults in any one of the available lighting circuits.

It can control two independent channels, such as signs and banners, detecting both the failure of a single fluorescent tube and an overall equipment failure.

It is capable of monitoring any installation independent of the power level, thanks to the installation of Type In/5 current transformers.

Fig. 14. Photo of LC-2500

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The Cirprotec Technical Articles Collection

1. - Lightning and surge protection in TDT signal repeaters and Gap fillers.
2. - Overvoltage and surge protection in common telecommunications systems in buildings.
3.- Lightning and surge protection in outdoor lighting systems.
4. - Lightning and surge protection in schools.
5. - Lightning and surge protection in waste water purification plants.
6. - Lightning and surge protection in the AHIS (Automatic Hydrological Information System) network.
7. - Lightning and surge protection in BANKING PREMISES
8.- Power frequency overvoltage. EN50550 standard “Power Frequency Overvoltage Protectors (POP)”