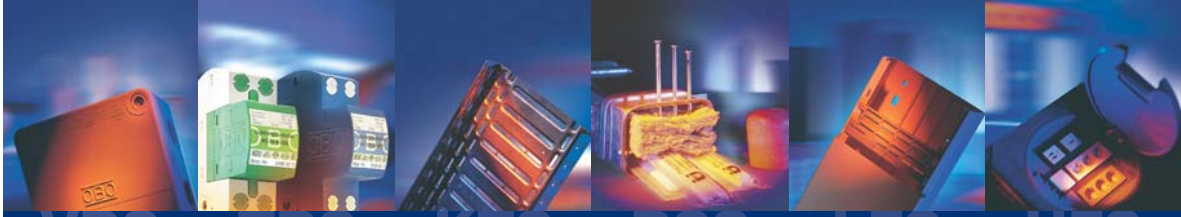
OBO BETTERMANN

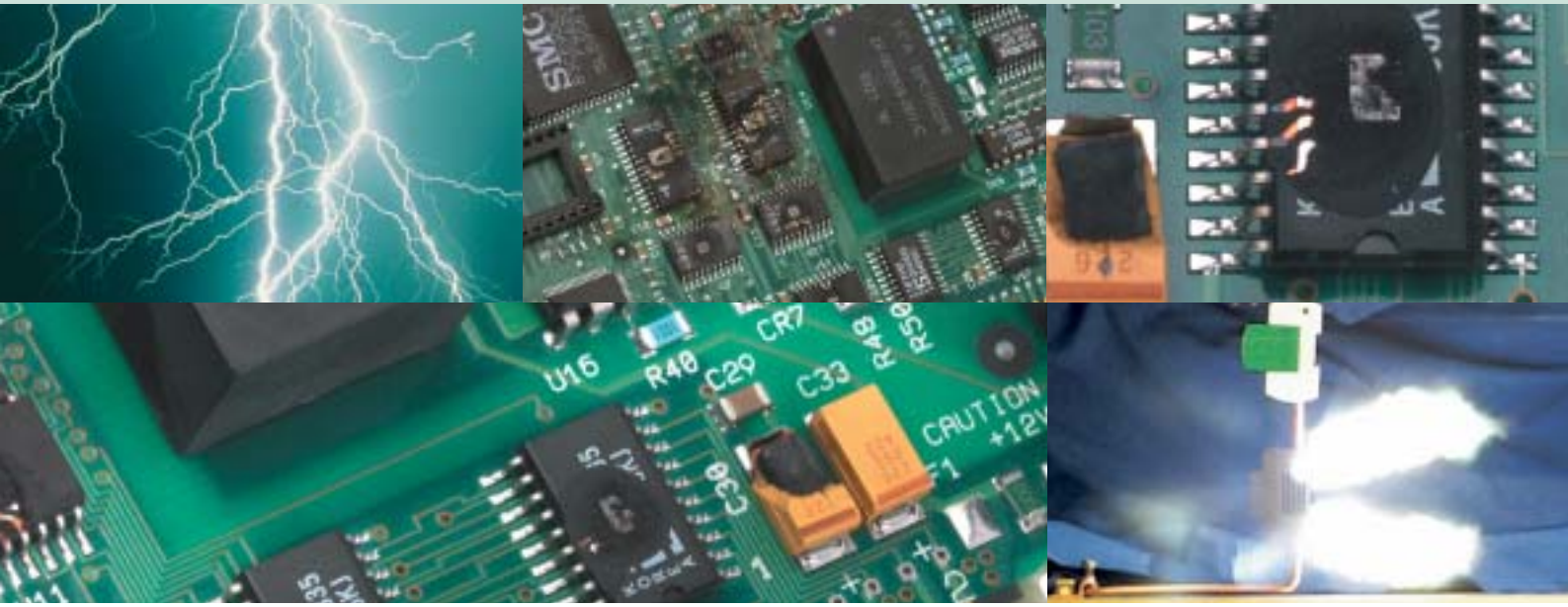


TBS. Surge protection systems
Order information and technical data

Information about overvoltage, surges

- Effective protection for sensitive electronics
- What causes overvoltage surges?
- Reducing the danger by lightning protection zones
- Perfect selective surge protection
  - Industrial plants
  - Private houses

Surge protection:
Effective protection for sensitive electronics



Surge protection – a topic that has become increasingly important in recent years. Costly electronic equipment which is sensitive to voltage peaks on the supply is no longer found only in offices and factories, but in our homes as well.

Nowadays, highly-sensitive data processing, telecommunications and computer networks form the backbone of worldwide communications structures without which no company or public body can survive. Machines and production lines are monitored and controlled by electronic programmers. And even many creative services are no longer conceivable without the aid of computers.

Common to all of them is their dependence on electrical energy, on high and low-voltage systems and on a continuous supply of power around the clock.

For many years, OBO has been involved in the development and production of protection and control systems which ensure a secure supply of energy, even under unfavorable conditions and which prevent damages due to voltage peaks or lightning strikes.

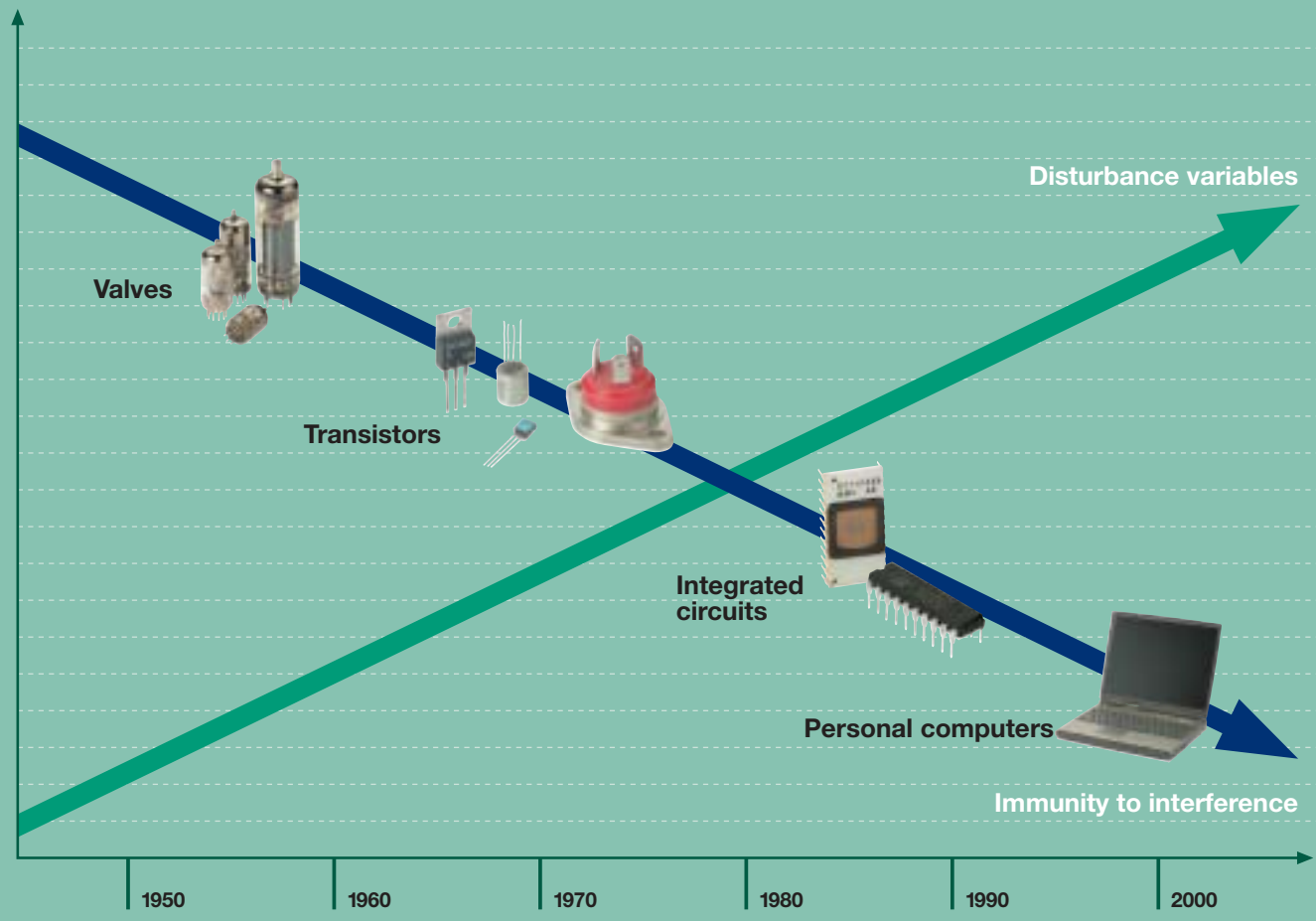
The range of OBO surge protection systems extends from basic mains protection to precision protection, from data line and measurement and control system protection to isolating spark gaps, installed either centrally or decentralised.

For many years, the Lightning Protection and EMC Technology Centre (“BET”) at Menden, founded in 1995 by Ulrich L. Bettermann, has worked intensively on the subject of surge protection. At this independent testing institute, protection systems undergo rigorous testing in practical conditions.
The BET’s services range from lightning protection investigations and lightning experiments, through the testing of lightning protection components and lightning protection structures to extensive series of tests for surge protection devices. Electromagnetic compatibility tests, providing expertise and writing reports are other fields of activity of BET, as well as training courses and seminars.

Surge protection is a complex subject. Benefit from our know-how and experience in this field. We will inform you professionally and in detail, with ample material in printed and digital form specifically about this subject.

At our training and conference centre at Menden and at our regional branch offices, we constantly offer a choice of basic and advanced seminars on surge protection. Please get in touch so that we can reserve a place for you at OBO!

Modern electronics – especially sensitive to surges



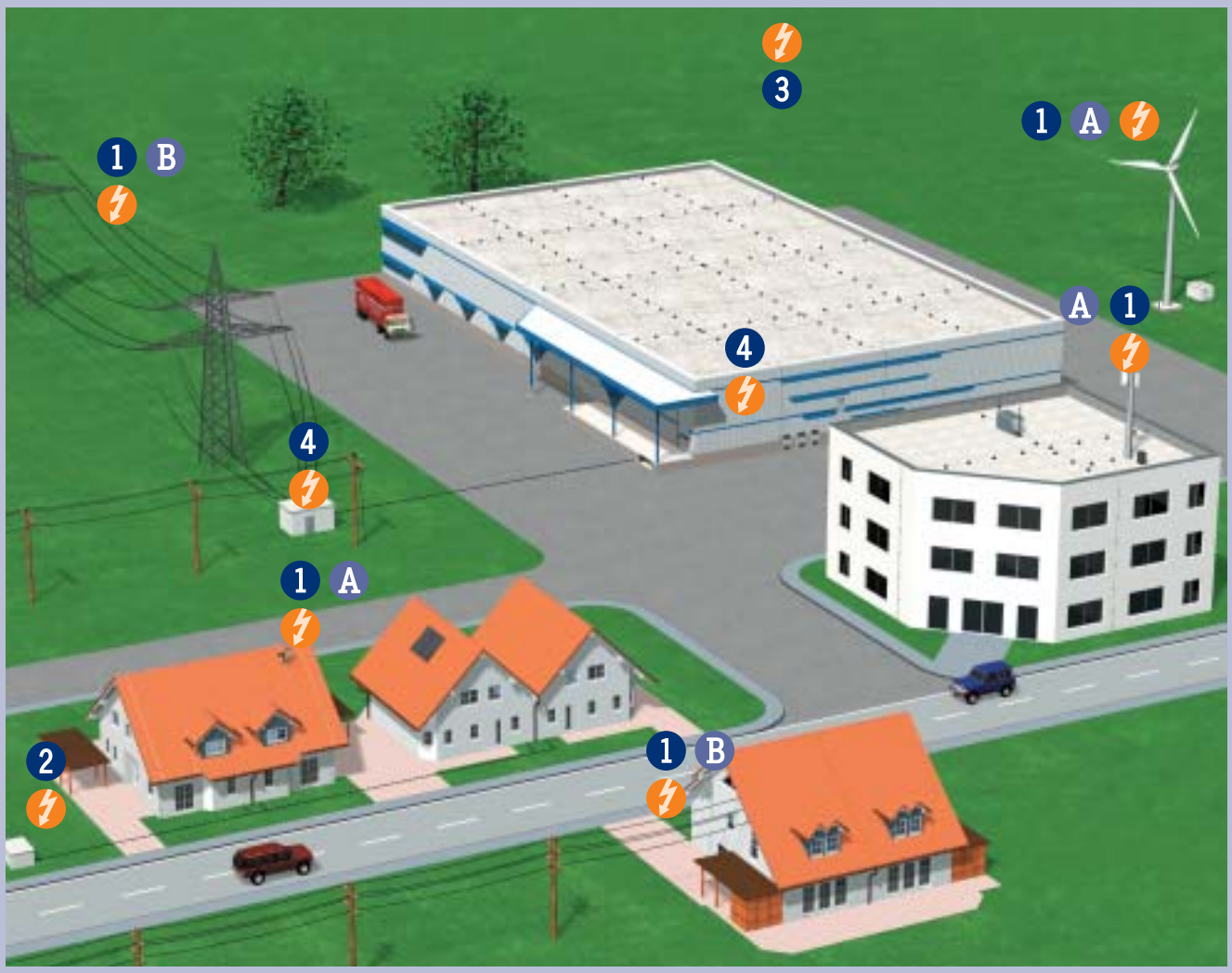
The history of EMC (electromagnetic compatibility)

The incidence of damage, some of it considerable, caused by overvoltage surges, has increased markedly in recent years. Why is this? The reason is not, as one might imagine, increased thunderstorm activity.

There are two reasons here: one is the fact that nowadays our homes contain more sensitive electronic equipment than ever before. It is a long time since it was only the television set that was sensitive to surges. In the field of entertainment electronics, hi-fi installations, video recorders and DVD players, home PCs and peripherals are all vulnerable to overvoltages on the low-voltage network. In addition, there are electronically-controlled devices in almost every field of building technology, from the heating system and the telephone system to the alarm installation, as well as a broad range of domestic and kitchen appliances from the sensor-controlled electric cooker to the programmable washing machine.

The other reason is the effect of technological progress. The electronic chips formerly used were more resistant to surges. What has now made the components more sensitive to surges was the reduction by a factor of ten in the spacing of the conductors. One result of this is that even relatively low voltage peaks of a few dozen volts on the data line are enough to destroy the interface card in an Internet PC.

What causes overvoltage surges?



Transient overvoltage

As the diagram shows, the largest voltage peaks on the low-voltage consumer network are caused by lightning discharges. The high energy content of lightning surges in the case of a direct lightning strike on the external lightning protection installation or on a low-voltage overhead line usually causes complete failure of the connected loads and damage to the insulation. Induced voltage peaks on installations in buildings and on power or data lines can also reach several times the nominal operating voltage. Switching surges do not cause such high voltage peaks as lightning discharges, but they do occur far more frequently and can still result in immediate failure of the installations. Switching surges reach two or three times the operating voltages, whilst lightning surges can sometimes reach twenty times the rated voltage and carry a large amount of energy. Failures often occur later, since the ageing of the components caused by the smaller transients causes gradual damage to the electronics.

Many factors are responsible for overvoltage surges in low-voltage systems, measurement and control systems and computer networks. The following four categories pose the greatest danger.

1 A
Direct lightning strike

If lightning directly strikes a building with external lightning protection or if it strikes structures on the roof that are earthed in a manner capable of carrying lightning current (roof antenna, satellite installation, etc.), the result at the earth impedance is a voltage rise and coupling of the high partial-lightning currents via the protective earth conductor into the building installation and the connected appliances.

1 B
Lightning may also directly (B) strike the power supply lines (low-voltage overhead lines) or data lines, causing high partial-lightning currents to be coupled into the building.

2
Nearby lightning strike

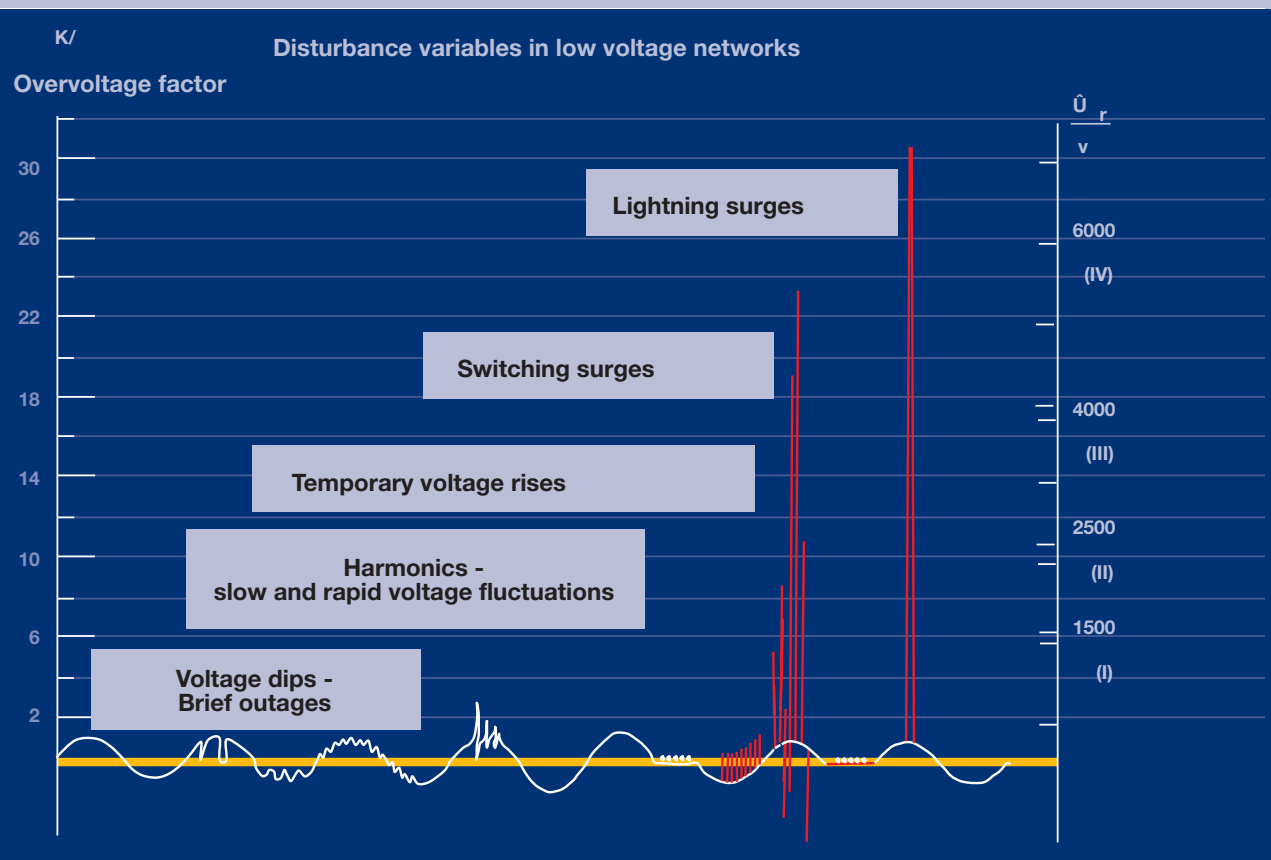
Even if a building is not itself struck by lightning, lightning strikes nearby may cause voltage peaks in the building installation. The surges reach the wiring of electrical installations and equipment directly or by inductive or capacitive coupling. Partial lightning currents may be coupled via the earth into the earthing installation and cause significant damage (direct coupling), or voltage peaks may reach the building installation by induction from the magnetic field emitted by the lightning channel. Long wiring loops within buildings in particular may act as antennae and favour inductive coupling. Capacitive coupling is caused by an electrical field with high potential difference between two points, for example between a lightning channel and electric conductors.

3
Distant lightning strike

Even lightning strikes at distances of several hundred metres can cause considerable damage on low-voltage and data lines as a result of direct, inductive or capacitive coupling on to earthing installations of buildings. Even the electromagnetic field caused by lightning discharges inside clouds or parts of clouds can couple voltage peaks into lines.

4
Switching surges

Switching surges arise from on and off-switching operations, from the switching of inductive and capacitive loads and from the breaking of short-circuit currents. In particular the disconnection of production plant, lighting systems or transformers may lead to damage in electrical equipment nearby.



Reducing the danger by lightning protection zones

Reduce the overvoltage by stages to a harmless level

The lightning protection zone concept described in international standard IEC 61312-1 has proved to be rational and effective. The basis of this concept is the principle of reducing overvoltages by stages to a harmless level, before they reach the terminal device and cause damage. To achieve this, the entire power network of a building is divided into lightning protection zones (LPZs). A surge arrester is installed at the transition from one zone to another, with the arresters graded according to the necessary requirement class.

A concept with many advantages

Significant advantage of the concept:

- Minimisation of voltages coupled-in to other conductor systems by diverting the energy-rich, harmful lightning currents directly at the point where the lines enter the building.
- Avoidance of disturbance due to magnetic fields.
- An individual protection concept for new buildings, extensions and conversions, which can be planned.

Clearly-defined protection zones

The lightning protection zones (LPZs) are defined as follows, from the outside, working inwards:

LPZ 0A

Unprotected region outside the building. Direct lightning effect, no shielding against electromagnetic disturbance pulses, LEMP (lightning electromagnetic pulse).

LPZ 0B

Region protected by external lightning protection installation. No shielding against LEMP.

LPZ 1

Region inside the building. Low partial lightning energies possible.

LPZ 2

Region inside the building.
Low overvoltage surges possible.

LPZ 3

Region inside the building (could also be the metal casing of an appliance).
No disturbance pulses due to LEMP present and no overvoltage surges.

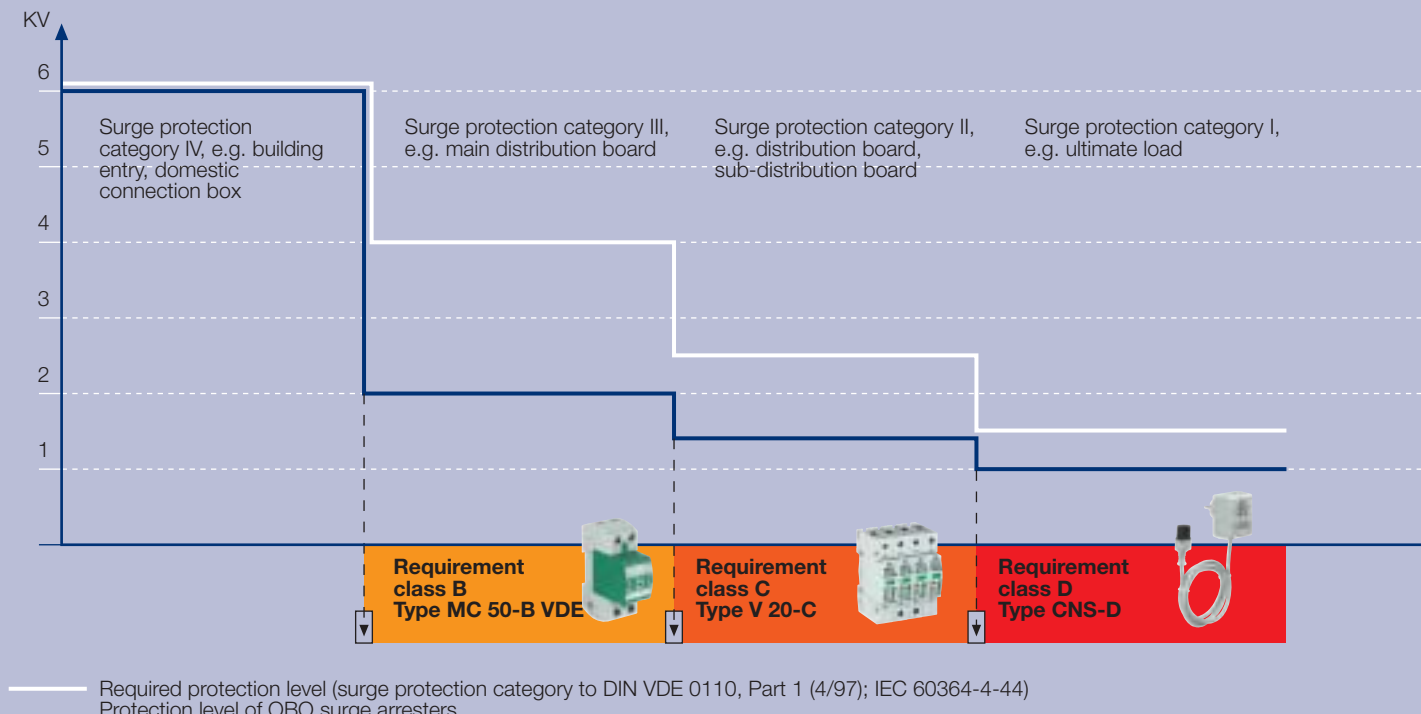
The fundamental prerequisite for a lightning protection zone concept is a correctly installed equipotential bonding system, supplemented with arresters from LPZ 0 to LPZ 1, thus establishing the potential equalisation necessary for lightning protection.

Perfect selective surge protection

OBO surge protection devices are divided into three classes B, C and D, corresponding to different requirements in terms of installation site, protection level and impulse current carrying capacity. The purpose of this classification is to provide selective surge protection, which guarantees a high energy absorption capacity together with the lowest possible protection level.
The subdivision corresponds to the stipulations of DIN VDE 0675 Part 6 (Draft 11.89) A1 and A2.
This standard sets out design guidelines, requirements and tests for surge arresters used in alternating current networks with rated voltages up to 1.000 V and rated frequencies between 50 and 60 Hz.
The classification of the devices is shown in the table on this page. The table also shows clearly which OBO surge protection devices should be installed at which position.

Requirement class to DIN VDE 0675, Part 6 (Draft 11.89) A1, A2	Function		Max. protection expressed by the surge category to DIN VDE 0110-1	OBO surge protection devices
B	Surge protection device for lightning protection potential equalisation to IEC 61024-1 for direct or nearby lightning strikes **LPZ 0 -->1**	**Broad-based protection**	**III (4 kV)**	MC 50-**B** VDE MC 125-**B** NPE V 25-**B+C**
C	Protection device for surge protection to DIN VDE 0100-443 for overvoltages due to distant lightning strikes or switching operations carried on the supply network **LPZ 1 -->2**	**Medium protection**	**II (2.5 kV)**	V 20-**C** V 25-**B+C**
D	Protection device for the surge protection of movable consumer appliances at socket outlets **LPZ 2 -->3**	**Precision protection**	**I (1.5 kV)**	EP 220-**D** CNS 3-**D** VF-230-AC SNS-**D** UNS-**D** KNS-**D**

Isolation coordination and protection level in 230/400 V mains systems

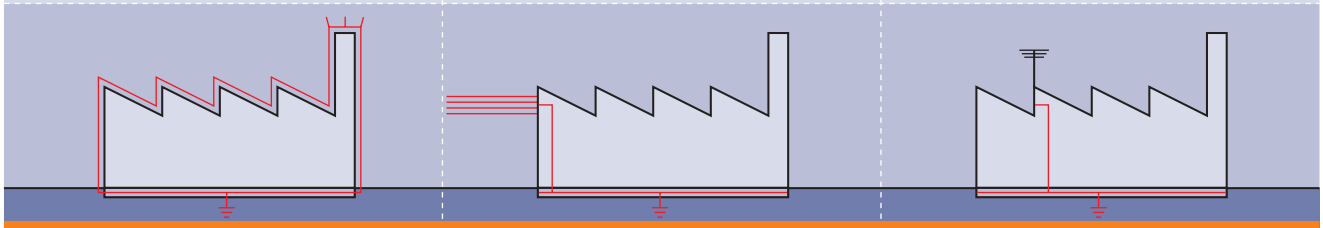


Industrial plants:
The road to perfect surge protection

Object to be protected

- Industrial plants
- Commercial buildings
- Hospitals
- Public buildings to IEC, EN, VDE standards

Building with external lightning protection installation	Building with overhead line connection	Building with earthed roof-mounted structures (antennae, etc.)



Is the object one of the types of building shown?

YES

Lightning arresters, requirement class B

TN-C system	TN-S system	TT system
3 x MC 50-B VDE (500 A*)	3 x MC 50-B VDE (500 A*) 1 x MC 125-B/NPE	3 x MC 50-B VDE (500 A*) 1 x MC 125-B/NPE
page 20	page 20+22	page 20+22

Optional: decoupling inductance LC 63 (63 A*)

Only needed if the distance between the main and sub-distribution boards is less than 5 metres (line length) (e.g. in a shared distribution board)

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and surge arresters, requirement class C

TN-C-S system	TN-S system	TT system
V 20-C/3+NPE (125 A*)	V 20-C/3+NPE (125 A*)	V20-C/3+NPE (125 A*)
page 34	page 34	page 34

and devices and precision protection of requirement class D

VF 230-AC (16 A*)	EP 220-D (16 A*)	CNS-D (16 A*)	KNS-D (16 A*)
page 68	page 54	page 58	page 64

NO

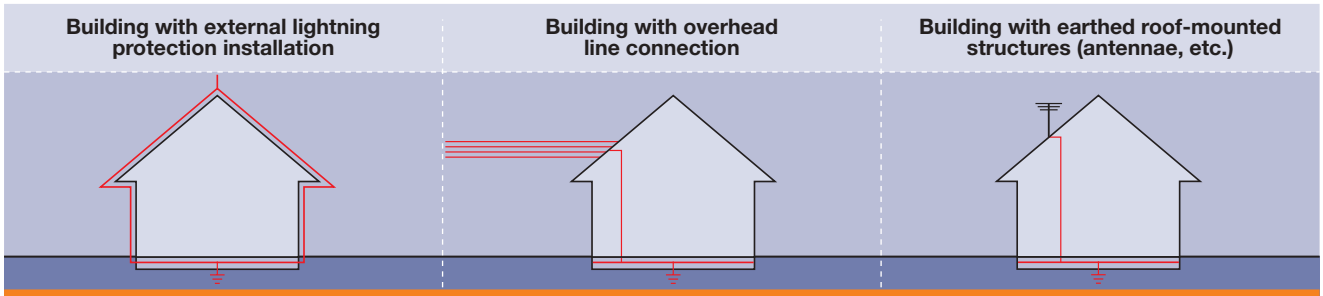
Only surge arresters of requirement class C

* If the up.stream fuse is rated higher than the stated figure, protect the arrester selectively with the stated figure.

Private houses:
The road to perfect surge protection

Object to be protected

- Dwelling house
  to VdS 2031 (Verband der Sachversicherer)



Is the object one of the types of building shown?

YES

Lightning arresters, requirement class B + C

TN-C system	TN-S system	TT system
V 25-B+C/3 (160 A*)	V 25-B+C/3+NPE (160 A*)	V 25-B+C/3+NPE (160 A*)
		
page 30	page 30	page 30

Is the distance between the main and sub-distribution boards less than 10 metres?

YES

NO

and surge arresters, requirement class C

TN-C-S system	TN-S system	TT system
V 20-C/3+NPE (125 A*)	V 20-C/3+NPE (125 A*)	V20-C/3+NPE (125 A*)
		
page 34	page 34	page 34

NO

Only surge arresters of requirement class C

and devices and precision protection of requirement class D

VF 230-AC (16 A*)	EP 220-D (16 A*)	CNS-D (16 A*)	KNS-D (16 A*)
			
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*If the upstream fuse is rated higher than the stated figure, protect the arrester selectively with the stated figure.