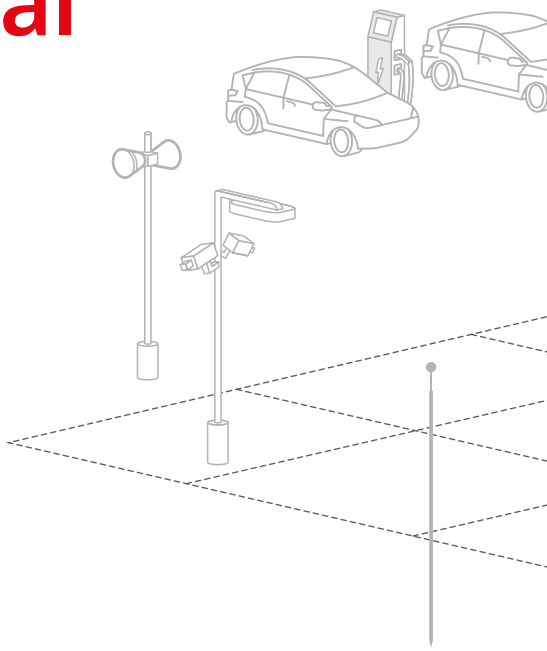
Safety for your business

Lightning protection, surge protection for non-residential buildings

Integrated lightning and surge protection for non-residential buildings

Holistic protection for buildings and electrical systems



Effective protection is not a single product, it is a coordinated system. For engineers, contractors, and installers, understanding the synergy between external and internal lightning protection is key to ensuring structural integrity and system availability.

Our components meet the highest standards of safety and quality. Every product is tested and certified according to the international standards IEC 61643 for surge protective devices and IEC 62561 for lightning protection system components.

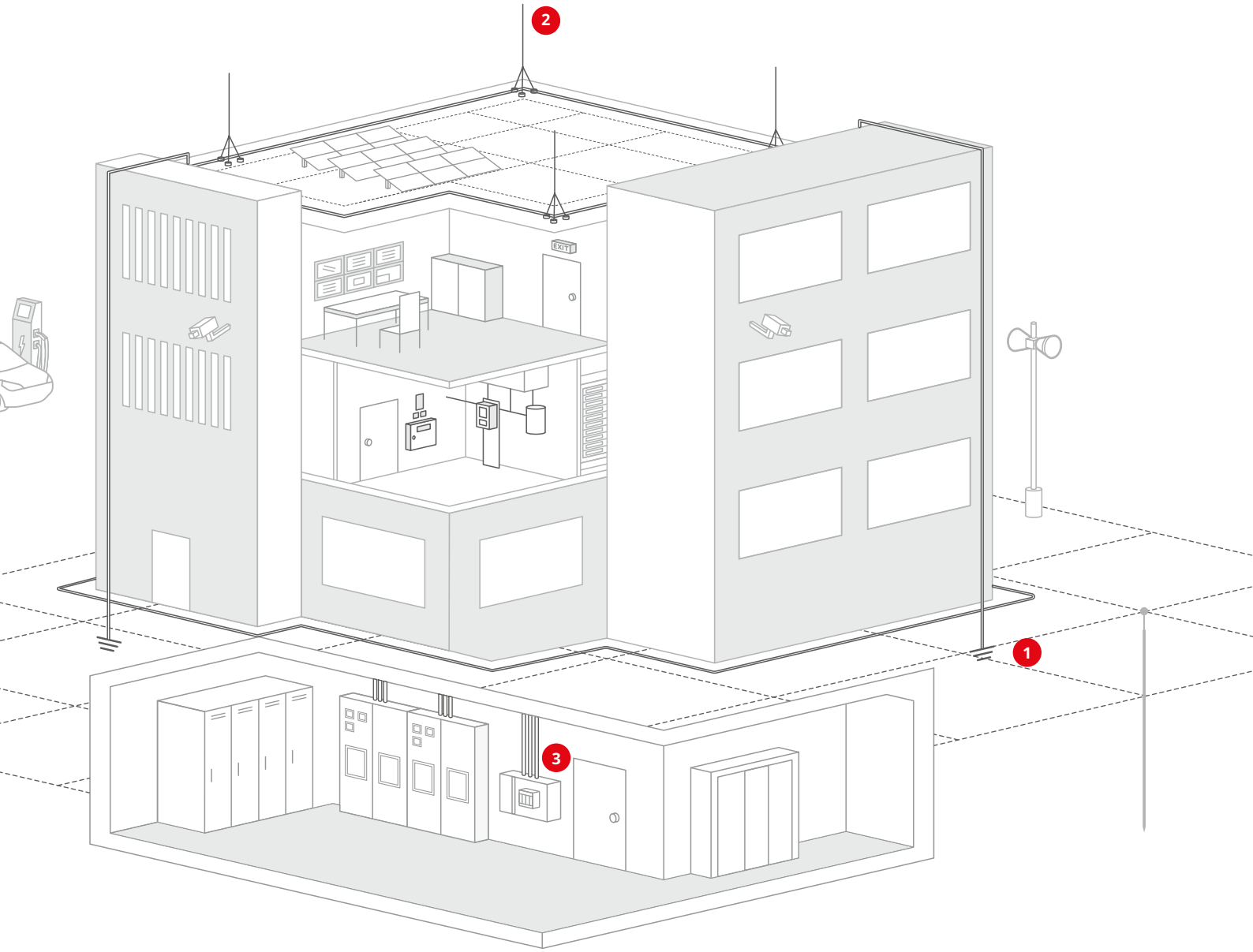
Our solutions provide optimal energetic coordination. Type 1, 2, and 3 arresters work seamlessly together, creating a consistently effective protection concept.

With DEHNproject we provide a powerful software suite for risk analysis and lightning protection system design in accordance with EN 62305.

1 Earthing and equipotential bonding

The earthing system is the “backbone” of all protection measures. According to EN 62305-3, its primary role is to safely disperse the lightning current into the ground.

- Low impedance:
  A properly designed earth-termination system minimizes dangerous overvoltages.
- Equipotential bonding:
  It ensures that all conductive parts (power and data cables / metal pipes) are at the same equipotential level.



2 External lightning protection

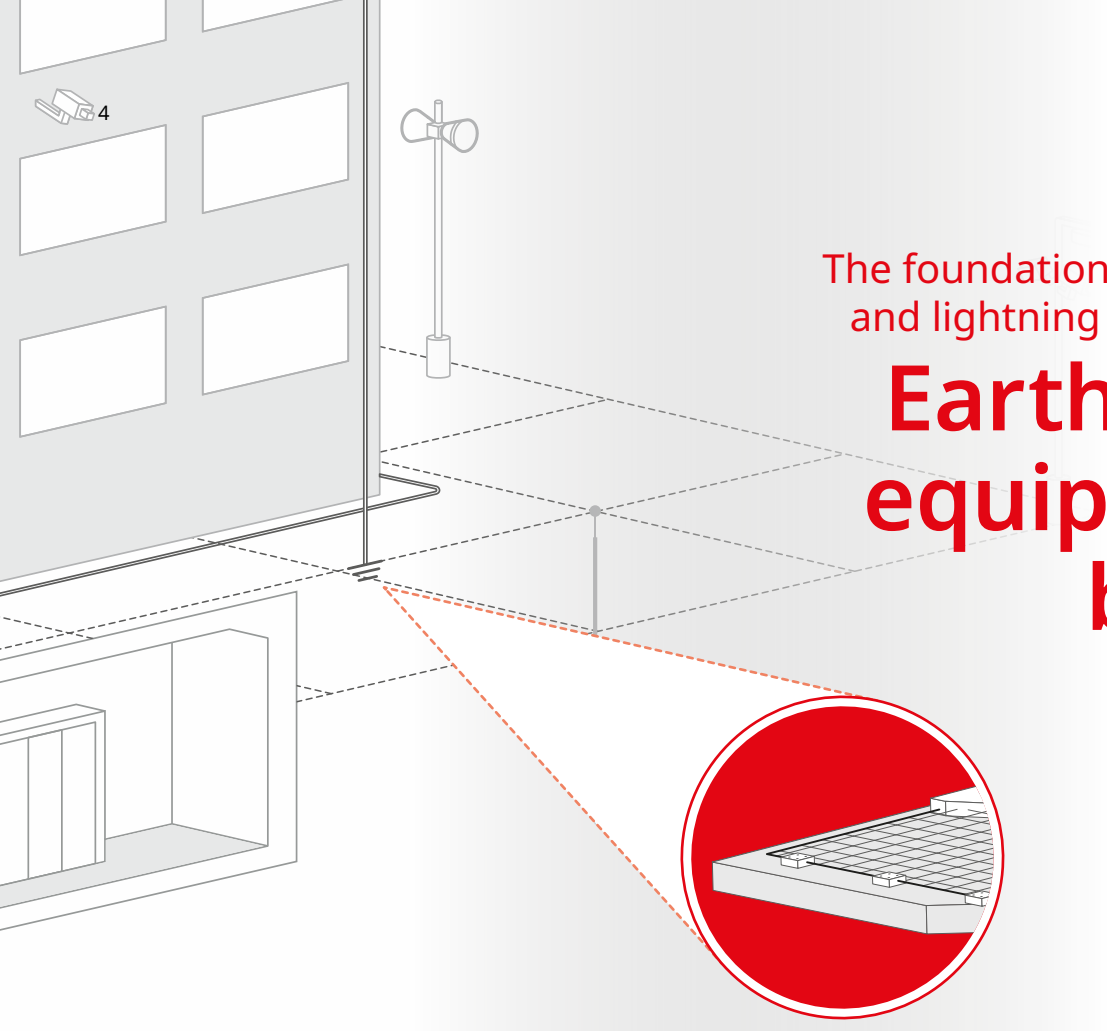
The external lightning protection system (LPS) protects the building envelope from physical destruction and fire.

- Interception:
  Air-termination rods and conductors are positioned using the rolling sphere or protective angle methods to ensure the structure is fully shielded.
- Controlled path:
  Down-conductors provide the low-impedance path from the roof to the earthing system.

3 Internal lightning protection

Direct strikes are not the only threat. Lightning strikes several kilometers away can induce surges into power and data lines, surge protective devices (SPD) are essential to safeguard sensitive systems and equipment.

- Main distribution board:
  Type 1 lightning current and surge arresters handle the high-energy “first wave” at the main power entry point in order to safeguard the equipotentialization.
- Sub-distribution board:
  Type 2 and 3 SPDs limit the remaining voltage to a level that sensitive electronic equipment, IT systems, and controllers can withstand.



The foundation of every electrical and lightning protection system

Earthing and equipotential bonding

Objectives of the earthing system

- **Personnel safety during electrical faults:** Preventing dangerous touch voltages during faults or strikes.
- **Lightning current dissipation:** Safely conducting the massive energy of a strike into the earth without causing fire or structural damage.
- **Equipotential stability:** Ensuring that all conductive parts of a building stay at the same voltage level.
- **Step voltage management:** Controlling ground potential gradients during lightning events to protect people walking near earthing points.

Earthing vs. equipotential bonding: the difference

While often used interchangeably, they serve different roles:

Earthing

It provides the essential physical connection to the mass of the earth, allowing electrical energy during faults or lightning events to be safely diverted out of the system and dissipated into the ground.

Equipotential bonding

It forms the internal connection of all metallic components inside the structure, including pipes, frames and electrical neutrals. Its purpose is to eliminate voltage differences within the building, ensuring a stable equipotential environment and avoid dangerous internal sparking.

Types of earth electrodes

Depending on soil conditions and building type, different methods are used:

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Foundation earth electrode:

Integrated into the concrete foundation. Cost-effective and durable, but must be planned before the pour.

Ring earth electrode:

Buried in the soil outside the foundation (usually at 0.5m depth). Ideal for retrofitting or when the foundation is insulated (white tank).

Earth rods (deep-driven):

Vertical rods driven deep into the ground. Useful for achieving low resistance in small footprints or reaching deeper, more conductive soil layers.

Material selection and connection elements

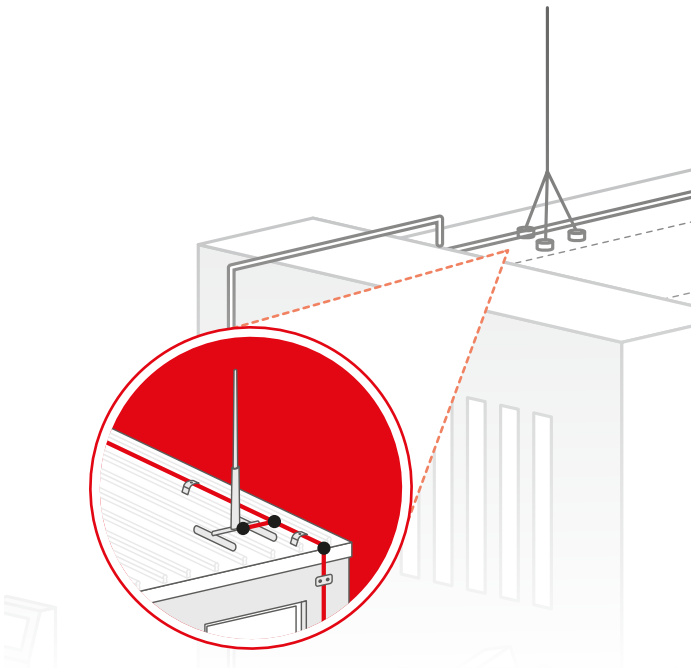
Selecting the right materials is essential, as all components must withstand both mechanical stress and longterm corrosion in the soil. Corrosion remains one of the most critical risks, particularly when different metals are used together, since galvanic effects can rapidly degrade the less noble material. For this reason, stainless steel V4A (AISI 316Ti) has become the international standard for soilburied installations and for transitions between concrete and soil, offering reliable longterm stability. Galvanized steel, by contrast, should only be used under specific soil conditions, as it may corrode quickly and compromise the performance and lifetime of the earthing system. Connection elements must reliably carry extremely high currents within microseconds and comply with IEC 625611 to ensure they remain nonsparking during a strike. Using high-quality, tested components prevents fire hazards caused by loose or insufficient connections and ensures the earthing system remains fully functional even after multiple lightning events.

Lightning protection in a nutshell – what you need to know

The earthing system of the lightning protection system and the electrical installation must be interconnected in accordance with **EN 62305**.

Advanced interception and conduction according to EN 62305

External lightning protection



The external lightning system is the first line of defense. Its goal is to intercept a lightning strike and guide it to the ground while preventing fire and dangerous side-flashes.

Planning Methods

1. Universal: The rolling sphere

The rolling sphere method is a globally recognized and precise approach for planning air termination systems. A sphere with a radius defined by the selected lightning protection level is imagined to roll across the structure. Every point it touches marks a potential strike location. This method is ideal for complex building shapes. It identifies strike points that simpler approaches may miss and defines a clear safety zone for reliable external lightning protection.

2. Simple: Protective angle method

The protective angle method defines protected areas around air termination rods and masts. From the tip of the air termination, an imaginary angle opens downward to outline the protected volume. The angle depends on the selected lightning protection level. It is best suited for simple structures with clear roof edges. While less detailed than the rolling sphere method, it offers quick and effective guidance for straightforward layouts.

3. Consistent: Mesh method

The mesh method is an efficient planning approach for flat or gently sloped roofs. A grid of air termination conductors is arranged across the surface, with the maximum mesh size defined by the selected lightning protection level. It ensures consistent coverage of large roof areas and is ideal for uniform surfaces. The method provides a practical and reliable basis for external lightning protection, especially when combined with other approaches.

Interception systems

The choice depends on the architecture and the objects being protected:

Air-termination rods:

Ideal for protecting individual roof mounted equipment such as AC units or fans. They form a protective zone around the installation.

Masts:

Used for tall or isolated structures, often applied in areas with explosive atmospheres or large industrial machinery, ensuring that the lightning strike is guided far away from the sensitive zone.

Meshes:

Ideal for large flat roof surfaces without sensitive equipment. The method uses a grid of conductors to deliver uniform and reliable protection across the entire area.

Separation distance: Essential for safe lightning protection

When lightning current flows through a down conductor, the voltage can rise to several hundred kilovolts. If this conductor runs too close to internal cables or metal installations, it can cause a flashover, meaning the lightning jumps to nearby components. This can result in severe damage to the electrical system or even cause a fire.

The separation distance is a critical parameter in lightning protection planning. It must be calculated with precision and consistently maintained during installation. However, this is exactly where conventional lightning protection increasingly reaches its limits. Modern architecture, later structural changes, and restricted roof space often make the calculation and practical implementation of the required separation distance difficult. As a result, ensuring safe routing of down conductors becomes more complex and sometimes impossible without additional measures.

These challenges make it clear why the distinction between conventional and isolated lightning protection systems is becoming more important and why isolated solutions are gaining relevance in contemporary building design.

Conventional vs. isolated lightning protection

Challenge	Conventional down conductor with spacers	Equivalent separation distance with an HVI installation
Separation distance compliance	Difficult, often not feasible	Easy and achievable with certainty
Flexibility for retrofitting	Limited	High, even with complex architecture
Risk of flashovers	High if distance not maintained	Minimal due to insulation
Installation complexity for roofs of industrial buildings	High	Reduced
Arrester class for entrance point into building on roof	Type 1 required	Type 2 sufficient

With increasing technical density on modern roofs and rising architectural constraints, maintaining the required separation distance with conventional systems often reaches practical limits. HVI lightning protection provides a reliable, norm-compliant and future-proof solution and is therefore the preferred choice wherever separation distances cannot be maintained with conventional methods.

HVI lightning protection

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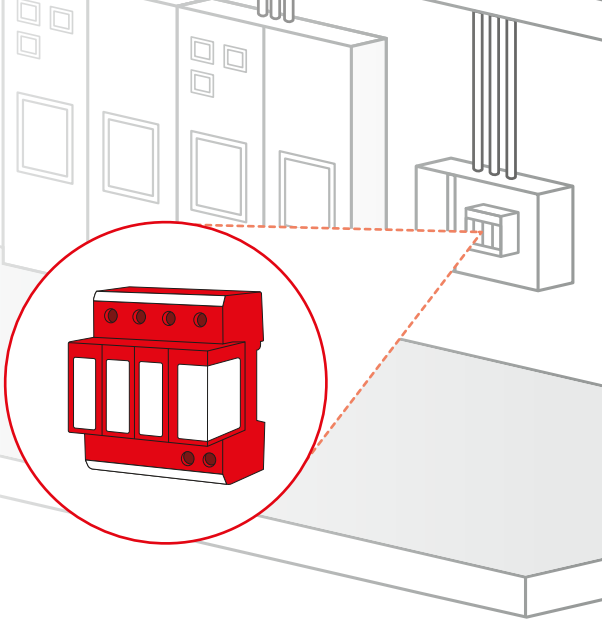


Safeguarding the electrical installation with equipotential bonding and surge protection

Internal lightning protection

Core objective of surge protective devices

The purpose of internal lightning protection is to prevent dangerous sparking and flashovers inside the building. Surge protective devices play a central role in achieving this level of safety.

Lightning equipotential bonding

At the moment a lightning current enters the system, SPDs create a low impedance connection between all active conductors and the earthing system. For a fraction of a millisecond the entire electrical installation and all metal parts rise to the same potential, which prevents flashovers and keeps the system safe.

Short circuit principle

SPDs act within microseconds, short circuiting the incoming energy pulse so rapidly that the resulting voltage surge is reduced to a level that downstream equipment can safely withstand.

Follow current limitation

A key advantage of DEHN arresters is their ability to immediately limit or extinguish follow current after activation. This prevents upstream fuses from tripping and reduces the risk of operational downtime.

Type of arresters

Surge protective devices form a coordinated system that protects the electrical installation at every stage inside the building. Each arrester type fulfills a specific task to safely manage lightning energy and prevent damaging surges.

Type 1 arresters

Type 1 arresters protect the building at the very first entry point of lightning energy, typically at the main distribution board. They capture the impact of a direct lightning strike and guide the energy safely into the earthing system. As the first line of defense they keep the installation stable and create the basis for all downstream protection.

Type 2 arresters

Type 2 arresters protect the installation deeper inside the building, for example in sub distribution boards. They reduce remaining surges that appear after distant lightning events or switching operations. This keeps sensitive equipment safe and ensures reliable operation throughout the electrical system.

Arresting technologies

Spark gap technology

Used mainly in Type 1 arresters. This technology can handle very large lightning currents and does not age during normal operation. It also reduces the stress on downstream protection stages, making the overall system more resilient.

Varistor technology

The standard technology for Type 2 arresters. Varistors react very quickly to voltage surges and protect the internal installation. However, they cannot carry direct lightning currents and can age over time.

ACI technology

ACI works without an external backup fuse, reducing complexity, wiring and installation costs. At the same time, the technology minimises thermal energy input during shutdown, which protects adjacent cables and components, reduces insulation ageing and increases the overall service life of the installation.

RAC technology

RAC is an extremely fast spark gap technology that reduces lightning energy to a very low residual level, keeping downstream installations safe. The incoming impulse is broken down like a wave breaker, so only minimal energy reaches sensitive equipment. At the same time, mains follow currents are limited immediately, which protects upstream fuses and increases system availability.

Product highlights

DEHNventil ACI

Part No. 961 405

Modular combined arrester with Advanced Circuit Interruption (ACI) for TN-S systems.

DEHNventil M2

Part No. 956 405

Modular combined arrester for TN-S systems.

DEHNguard ACI

Part No. 952 342

Modular surge arrester with Advanced Circuit Interruption (ACI) for TT and TN-S systems (3+1 configuration).

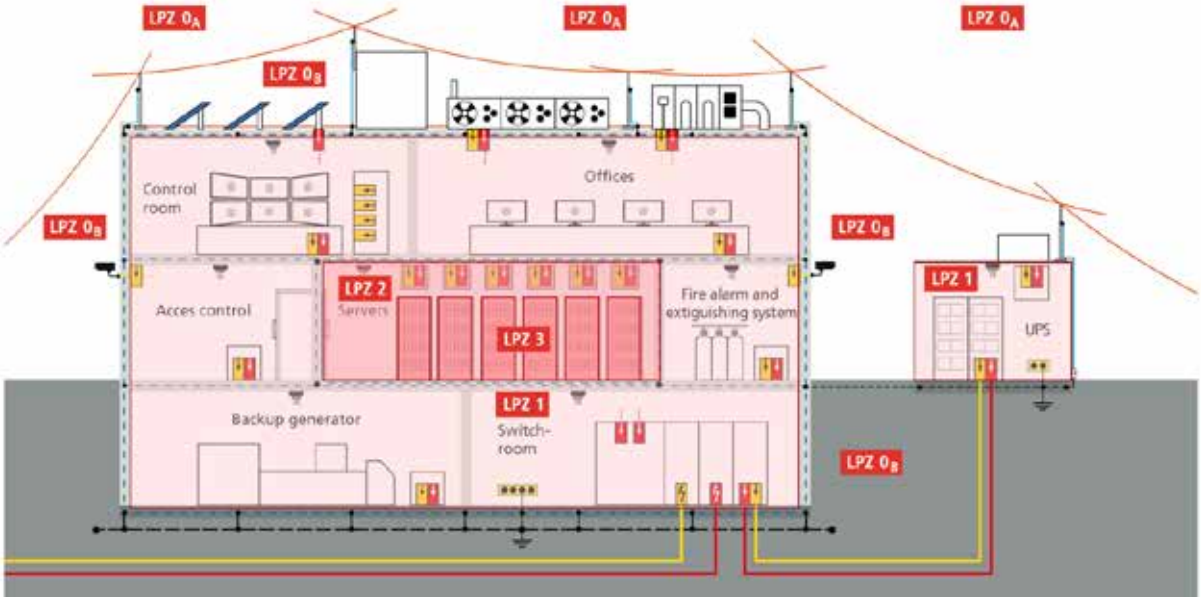
DEHNguard MD

Part No. 943 405

Modular surge arrester for use in TN-S systems (4+0 configuration); with floating remote signalling contact.

Placing protective measures with precision

Lightning protection zones



Lightning protection zone concept

A building can be divided into different protective layers. The closer an area is to the outside environment, the higher the exposure to lightning and its effects. This is the idea behind the lightning protection zone concept. It divides the building into several zones with increasing protection levels from the outside to the inside. Thanks to this clear structure, you immediately see where certain protective measures are required. Fully compliant with IEC 62305 for maximum safety.

External zones

LPZ 0A:

- Exposed to direct lightning strikes and the full electromagnetic field
- Systems such as lines crossing the building boundary may be subjected to the full lightning current

LPZ 0B:

- Protected against direct lightning strikes, but still exposed to the undamped electromagnetic field
- Systems such as alarm beacons or sirens may be subjected to partial lightning currents

Internal zones

LPZ 1:

- Impulse currents are reduced through current distribution and protective devices at the zone boundaries
- The electromagnetic field may be reduced through spatial shielding
- Ring lines with detectors are often installed in LPZ 1
- Required arrester type: Type 1 or Type 1 combined arrester

LPZ 2 and higher:

- Offer additional protection against impulse currents and the electromagnetic field compared to LPZ 1
- As a result, systems in these zones are exposed to significantly lower levels of interference
- Required arrester type: Type 2 arrester

Ready for every challenge

Services and software tools

DEHN Engineering Services

Our specialists support you throughout the complete planning process for lightning and surge protection measures. With the expertise of DEHN Engineering Services, you ensure that your projects are implemented with precision, efficiency and long term reliability. This saves time and resources and provides planning certainty from the very beginning. Our services are available worldwide: choose individual support modules as needed or hand over the entire planning process to our experts.

DEHN offers:

- On site services such as system assessment, soil resistance measurement for earthing design, and project approval
- Risk assessments, including for special installations such as wind turbines
- Designs and planning for lightning and surge protection, including 3D modelling
- Simulations for earthing systems and extended lightning protection analysis
- Services in the field of occupational safety, including DEHNarX arc fault assessment and periodic inspections

DEHNplan – plan lightning protection digitally

Take planning into your own hands with the DEHNplan software. Your expertise in lightning protection, earthing and basic CAD knowledge is all you need to get started:

With DEHNplan, you can easily design a standards-compliant external lightning protection system for your project. The BIM-capable software supports your planning with a visual representation of the protected volume and the separation distances. Practical advantage: the program automatically generates a bill of materials.

http://de.hn/61BZd

Surge protection/
Lightning Protection /
Earthing

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