Overvoltage protection (surge arrester)
● Choose the best surge protection.

● Install overvoltage protection.

● Choose the best upstream protection for a surge arrester.

● Installation rules.
Electrical overvoltage, unique characteristics

<table>
<thead>
<tr>
<th>Sources</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>● <strong>Lightning</strong></td>
<td>● Ultra-rapid transient phenomenon. Unit of measurement = kV/ ( \mu \text{s} )</td>
</tr>
<tr>
<td></td>
<td>● Highly destructive energy.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>● <strong>Overvoltage generated by operations or incidents on the network.</strong></th>
<th>● Repetitive phenomenon leading to premature aging.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>● Malfunction which may even result in permanent damage.</td>
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</table>
Lightning and its consequences

- The main effect of lightning is **electrical overvoltage** which exposes the electrical installations to **a serious risk** of:
  - malfunction,
  - destruction of equipment,
  - unavailability of production tools,
  - etc.

The overvoltages come either from the **electricity network** or from the **earth**.
The damage caused by lightning

- **90%** of sockets power sensitive equipment and an overvoltage can damage them (Total values estimated amount = €3,650).

Living-room: TV, home cinema, rolling shutters, air-conditioning, ADSL modem (€1,000)

Bedroom: computer, hi-fi, telephone (€650)

Kitchen: microwave oven, oven, fridge, dishwasher (€500)

Laundry: freezer, washing machine, dryer, boiler, alarm (€1,500)
Choose the best surge protection
A means of protection for every situation

** LPS (Lightning Protection System) = lightning rod, meshed cage on buildings**

** After 30m (between the surge arrester and the loads) lightning wave reflection phenomena appear in the cables.**
In practice: distance of equipments >30 metres

Case No.1 (the most common)

- **T2** = type 2 surge arrester
- Distance under than 30 metres

Case No.2

- **T2** = type 2 surge arrester
- Distance of more than 30 metres

- Install the surge arrester as close as possible to the sensitive equipment

* T2 = type 2 surge arrester, T3 = type 3 surge arrester.
To summarise

You need to install a surge arrester in a switchboard

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**Type 2 - class II**

- **Do you know the short-circuit current Isc?**
  - **Yes**
    - Risk level?
      - **Low**
        - Building located in an urban or suburban grouped housing area
      - **Medium**
        - Building located in plains
      - **High**
        - Building located in an area where there is a special risk (pylon, tree, mountainous region, mountain peak, damp area or pond)
  - **No**

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**Type 1 - class I**

- **Do you know the short-circuit current Isc?**
  - **Yes**
    - **Risk level, IT440V offer**
      - 12,5 or 25 kA/pole, defined by EN 62305-2 (minimum required = 12,5 kA/pole)
  - **No**

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If the equipment is more than 30m from protected switchboard, add dedicated protection
Install surge arrester
Location in the switchboard: in parallel

* SPD = Surge Protection Device.
Lifetime of the surge arrester

- The surge arrester has the same lifetime as the switchboard.

- At the end of its life, a thermal protector integrated into the surge arrester:
  - isolate the surge arrester from the rest of the installation.
  - activates the red end-of-life warning light, indicating that the surge arrester needs to be changed.
The upstream protection of the surge arrester

- The role of the surge arrester is to drive the lightning current to the earth in a **very short time** (< 350 microseconds).

- However, the surge arrester is not intended to be exposed to a permanent overvoltage (phase/neutral inversion, or neutral rupture). In this case, it would be short-circuited and may damage the switchboard.

- A device protecting the surge arrester against short circuits is therefore required to ensure the safety of the electrical installation.

The surge arrester must be **protected upstream** by a **disconnection circuit breaker**.
Choose the best upstream protection for a surge arrester
2 aspects must be taken into account

● When making your choice, take into account:
  ● lightning current withstand capacity (to avoid nuisance tripping),
  ● short-circuit withstand capacity of the installation (Isc).

E.g. the best disconnection circuit breaker for a breaking capacity of 15kA and Imax of 40kA is a C60H.

The surge arrester/protection device coordination table is supplied by Schneider Electric.
Example of Schneider Electric coordination table
Schneider Electric innovates for safe coordination and easy installation

- **Quick PF** and **Quick PRD** include both an upstream circuit breaker and a surge arrester, thus ensuring:
  - no risk of coordination error,
  - continuity of service.
Installation rules

The surge arrester is effective only if it is properly installed!
Installing a surge arrester

- Lightning is a phenomenon that generates a high frequency voltage:
  - The **length of the cables** must be taken into account in cases of high frequency
  - 1 metre of cable crossed by a lightning current generates an overvoltage of 1,000V.

For an effective surge protection, shorten the length of cables.
In practice: consider the intermediate earth terminal to shorten cables length

Mandatory in Standard IEC 60364-5-534:
- L (length of cables) < 50cm,
- cable cross-section S < 4mm² (Type 2) and S < 16mm² (Type 1).

\[ L = L_1 + L_2 + L_3 \]
Installation in a plastic enclosure (e.g. Pragma)

Main incoming earth via the bottom (main earth bar and intermediate earth terminal).

L1 ~ 12cm
L2 ~ 0cm
L3 ~ 5cm

L1+L2+L3 < 50 cm
Installation in a plastic enclosure (e.g. Pragma)

- L1 ~ 12cm
- L2 ~ 0cm
- L3 ~ 15cm

Incoming earth cable via the top (main earth bar and intermediate earth terminal).

L1+L2+L3 < 50 cm
Installation in a metal enclosure (e.g. Prisma Plus)

- Directly on "metal chassis".

- Use a lock washer to connect the cable to the chassis to give a good electrical contact.

The installation is possible only if the enclosure complies with standard IEC 60439-1.
In the low-voltage system, the surge arrester is essential to ensure complete protection.