Overvoltage Protection

OVR Range

FRSOX 0201 04 GB

OVR Range
Summary

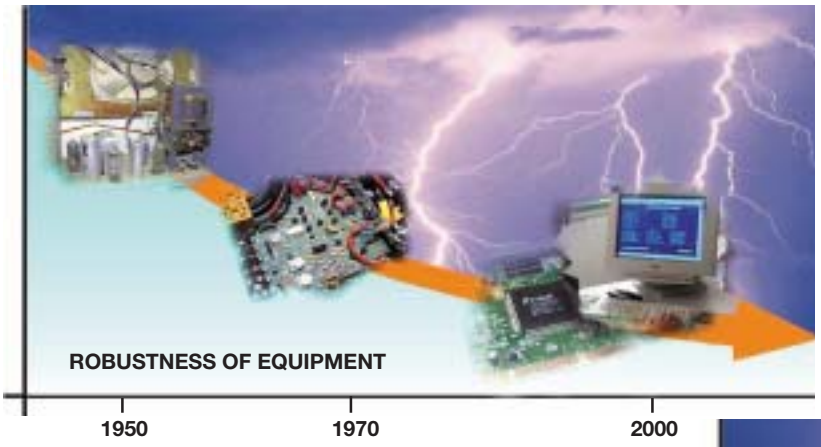
Contents

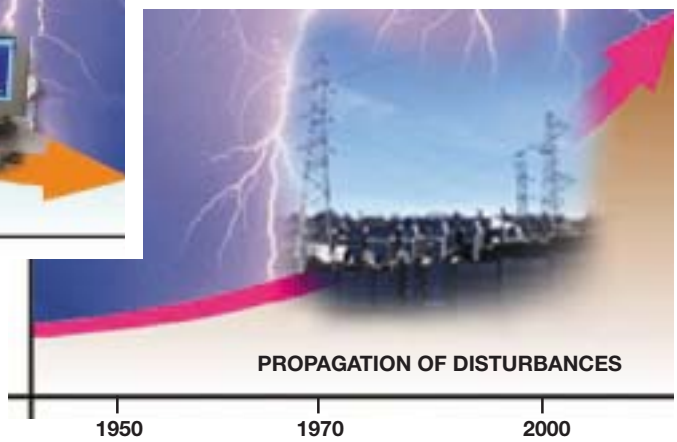
General points on lightning and its risks

The most serious consequences of lightning are the death of people and farm animals, and the destruction of equipment: telephone lines, transformers connected to the electrical distribution network, electrical meters, household appliances, etc.
At the same time, the growing amount of equipment incorporating very sensitive electronic devices increases the number of incidences linked to lightning.

Within companies, if office automation equipment or machines (in factories) are put out of action, it nearly always leads to operating losses, the cost of which is much more than that of the damaged equipment.

For example, if a bank's computers are no longer operational, it suffers large operating losses. For the general public, the damage is mainly material: computer, household appliances, home cinema, etc.





Causes of transient overvoltages

A transient overvoltage is a voltage peak with a maximum duration of less than one millisecond. There are two possible causes of overvoltages on electrical networks:

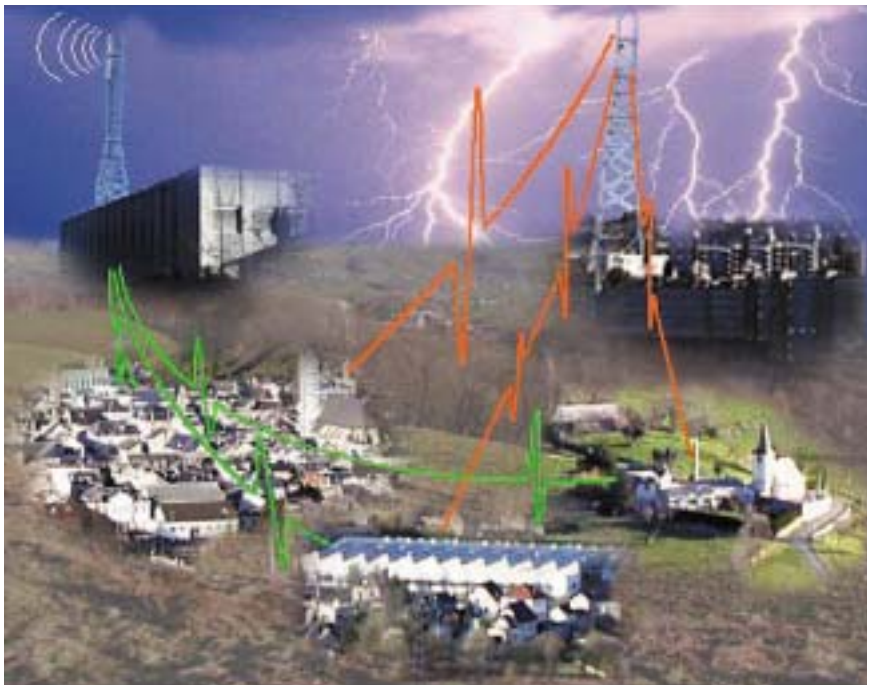
- natural causes (lightning),
- other causes due to equipment or switching devices.

Natural overvoltages on low voltage networks are caused by direct lightning strikes. The high level of energy contained in a direct lightning strike on a lightning conductor or an overhead low voltage line leads to considerable damage of the installation. The overvoltage can be over 20 times the nominal voltage.

Operating or switching overvoltages linked to a network's equipment create overvoltages of a lower level (3 to 5 times the nominal voltage) but occur much more frequently, thus causing premature ageing of the equipment.

Three categories of overvoltage propagate on low voltage networks:

- direct lightning strikes,
- indirect effects of lightning strikes,
- operating or switching overvoltages.



Propagation of overvoltages by electrical networks (power and low current)

General points on lightning and its risks

Causes of transient overvoltages

Overvoltages due to direct lightning strikes

These can take two forms:

• When lightning **strikes a lightning conductor or the roof of a building** which is earthed, the lightning current is dissipated into the ground. The impedance of the ground and the current flowing through it create large difference of potential: this is the overvoltage. This overvoltage then propagates throughout the building via the cables, damaging equipment along the way.

• When lightning **strikes an overhead low voltage line**, the latter conducts high currents which penetrate into the building creating large overvoltages. The damage caused by this type of overvoltage is usually spectacular (e.g. fire in the electrical switchboard causing the destruction of buildings and industrial equipment) and results in explosions.

Direct lightning strike on a lightning conductor or the roof of a building

Direct lightning strike on an overhead line

Overvoltages due to the indirect effects of lightning strikes

The overvoltages previously mentioned are also found when lightning strikes in the vicinity of a building, due to the increase in potential of the ground at the point of impact. The electromagnetic fields created by the lightning current generate inductive and capacitive coupling, leading to other overvoltages.
Within a radius up to several kilometres, the electromagnetic field caused by lightning in clouds can also create sudden increases in voltage.
Although less spectacular than in the previous case, irreparable damage is also caused to so called sensitive equipment such as fax machines, computer power supplies and safety and communication systems.

Increase in ground potential

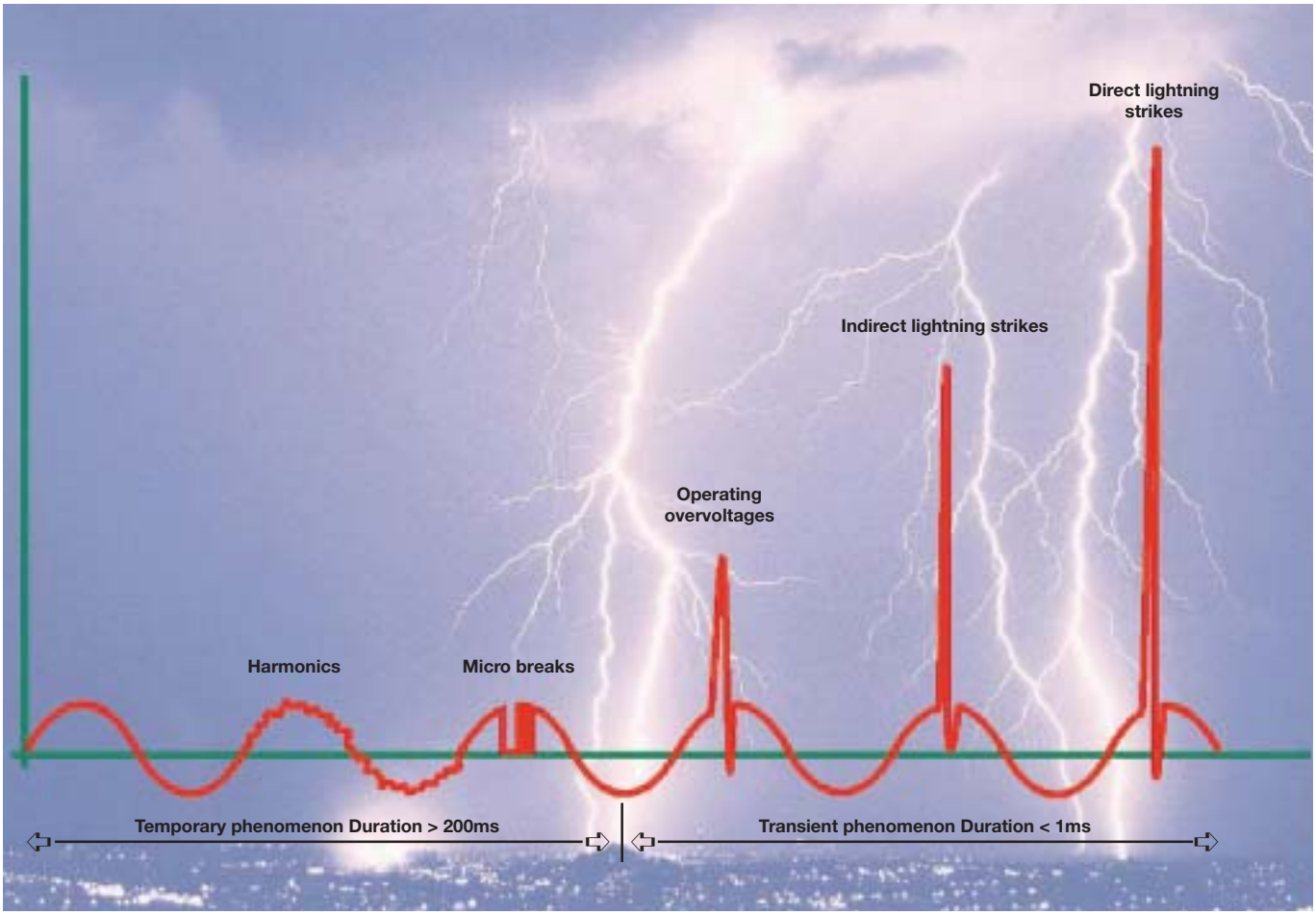
Magnetic field

Electrostatic field

Overvoltages due to operating or switching actions

Equipment containing electronic switching components is also likely to generate electrical disturbances comparable to overvoltages.
The consequences of which on sensitive equipment, albeit not visible, are no less detrimental: premature ageing and unpredictable or fleeting breakdowns.

Operating overvoltages are produced when reactive or capacitive equipment is switched on and off.
Furthermore, interrupting factory production, lighting or transformers can generate overvoltages which will themselves cause greater damage to nearby electrical equipment.



Representation of the various disturbances on electrical networks

General points on lightning and its risks

ABB : lightning and overvoltage protection solutions

With its experience gained over the last few decades, ABB at Bagnères-de-Bigorre in the Hautes Pyrénées region (South West of France) is using its technological expertise for lightning and overvoltage protection.

In April 2003, ABB acquired a new laboratory with several generators enabling the impact of a direct lightning strike (10/350 impulse wave) or an indirect lightning strike (8/20 impulse wave) to be tested in real conditions.

Through its wide product range, ABB is able to offer solutions to protect power and low current networks.
Seminars at ABB's new training centre are suited to the needs of all professionals: design offices, architects, distributors, electricians, sales staff.

These training sessions combine practical and theoretical aspects and cover a varied range of topics such as direct impact protection, overvoltage protection and electromagnetic compatibility.

THE LABORATORY IN NUMBERS

Within its 450m² floor area, the ABB laboratory is equipped for carrying out tests to IEC 61643-1 / EN 61643-11.

- **High power generator**
  Standardized 8/20 and 10/350 impulse waves
  Maximum shock current 100 kA for the two waves, superimposed on the electrical network.
  Stored energy 800 kJ.

- **200 kV generator**
  1.2/50 impulse wave
  Maximum voltage 200 kV
  Stored energy 10 kJ.

- **Hybrid generator**
  Standardized 8/20 - 1.2/50 impulse wave
  30 kV maximum
  30 kA maximum
  Stored energy 5 kJ.

- **Electrical tests**
  440 V, 5000 A short circuit testing

- **Mechanical tests**
  On-load operating test of sockets and strips.

The ABB Laboratory in the Southwestern France

General points on lightning and its risks

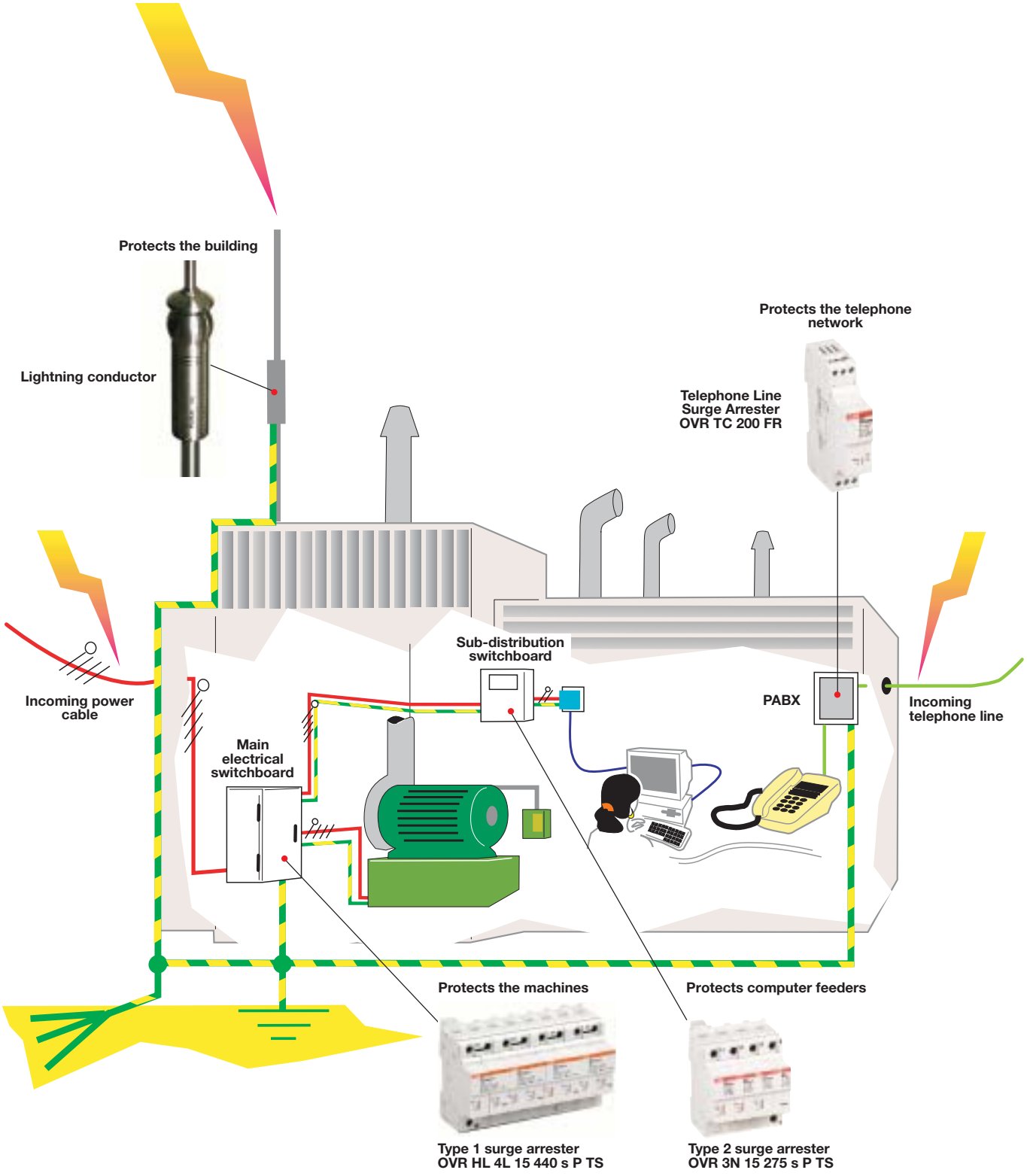
Diagram of an installation protected against lightning and its indirect effects

The **Type 1** surge arrester (**OVR HL**), fitted in the installation's main incoming electrical switchboard, is capable of deviating the energy of a direct lightning strike. This is the first stage of the electrical network's protection.

The behaviour of the cables, subjected to a transient signal, limits the effectiveness of a surge arrester to 10 m. It is therefore necessary to use one or more surge arresters in the installation in order to obtain the required level of protection for the equipment.

Here, a **Type 2** surge arrester should be used in coordination with the incoming surge arrester. This is the second stage of the protection.

Finally, if there is a risk of overvoltage on the electrical network, this risk also exists for the auxiliary wiring network. The appropriate protection is a surge arrester designed to protect telephone or data transmission lines (**OVR TC**). This is fitted in series on the network.



General points

Terminology of electrical characteristics

Surge arrester:
Device designed to limit transient overvoltages and run-off lightning currents. It consists of at least one non-linear component. It must comply with European standard EN 61643-11.

1.2/50 wave:
Standardized overvoltage waveform created on networks and which adds to the network's voltage.

8/20 wave:
Current waveform which passes through equipment when subjected to an overvoltage (low energy).

10/350 wave:
Current waveform which passes through equipment when subjected to an overvoltage due to a direct lightning strike.

Type 1 surge arrester:
Surge arrester designed to run-off energy caused by an overvoltage comparable to that of a direct lightning strike. It has successfully passed testing to the standard with the 10/350 wave (class I test).

Type 2 surge arrester:
Surge arrester designed to run-off energy caused by an overvoltage comparable to that of an indirect lightning strike or an operating overvoltage. It has successfully passed testing to the standard with the 8/20 wave (class II test).

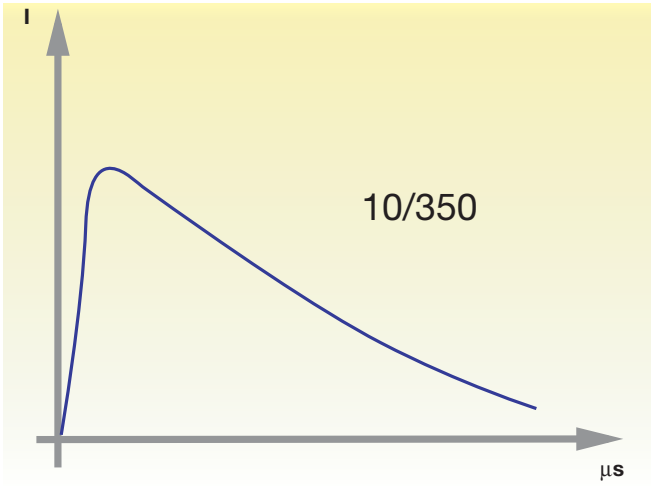
U_p:
Voltage protection level.
Parameter characterising surge arrester operation by the level of voltage limitation between its terminals and which is selected from the list of preferred values in the standard. This value is greater than the highest value obtained during voltage limitation measurements (at In for class I and II tests).

I_n:
Nominal discharge current.
Peak current value of an 8/20 waveform (15 times) flowing in the surge arrester. It is used to determine the U_p value of the surge arrester.

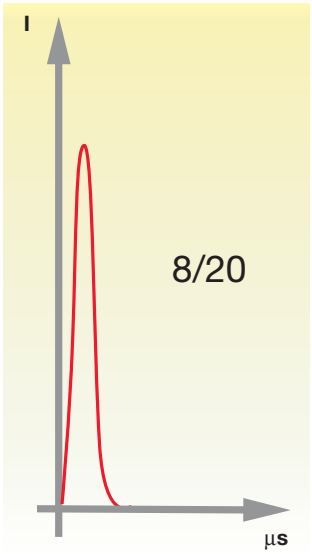
I_{max}:
Maximum discharge current for class II testing.
Peak current value of an 8/20 waveform flowing in the surge arrester with an amplitude complying with the class II operating test sequence. I_{max} is greater than I_n.

I_{imp}:
Impulse current for class I testing.
The impulse current I_{imp} is defined by a peak current I_{peak} and a charge Q, and tested in compliance with the operating test sequence. It is used to classify surge arresters for class I testing (the 10/350 wave corresponds to this definition).

U_n:
Nominal AC voltage of the network : nominal voltage between phase and neutral (AC rms value).



Type 1 Surge Arresters
I_{imp}: current wave



Type 2 Surge Arresters
I_{max}: current wave

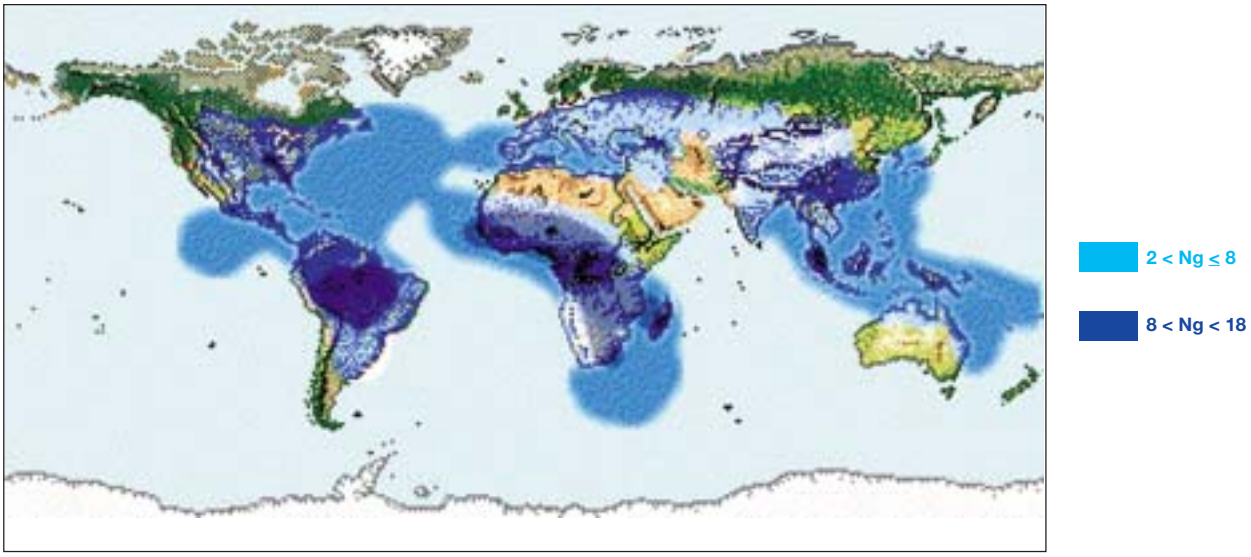
General points

Terminology of electrical characteristics

U_c:
Maximum continuous operating voltage (IEC 61643-1).
Maximum rms or dc voltage which can be continuously applied in surge arrester protection mode. It is equal to the rated voltage.

N_g:
Lightning strike density expressed as the number of ground lightning strikes per km^2 and per year.

U_T:
Temporary overvoltage withstand.
Maximum rms or dc overvoltage that the surge arrester can be subjected to and which exceeds the maximum voltage for continuous operation **U_c** for a specified time.



Protection mode

Common mode (MC): protection between live conductors and earth.

Differential mode (MD): protection between phase and neutral conductors.

Impulse withstand voltage of equipment

Equipment tolerance levels are classified according to 4 categories (as indicated in the following table) according to IEC 60364-4-44, IEC 60664-1 and IEC 60730-1.

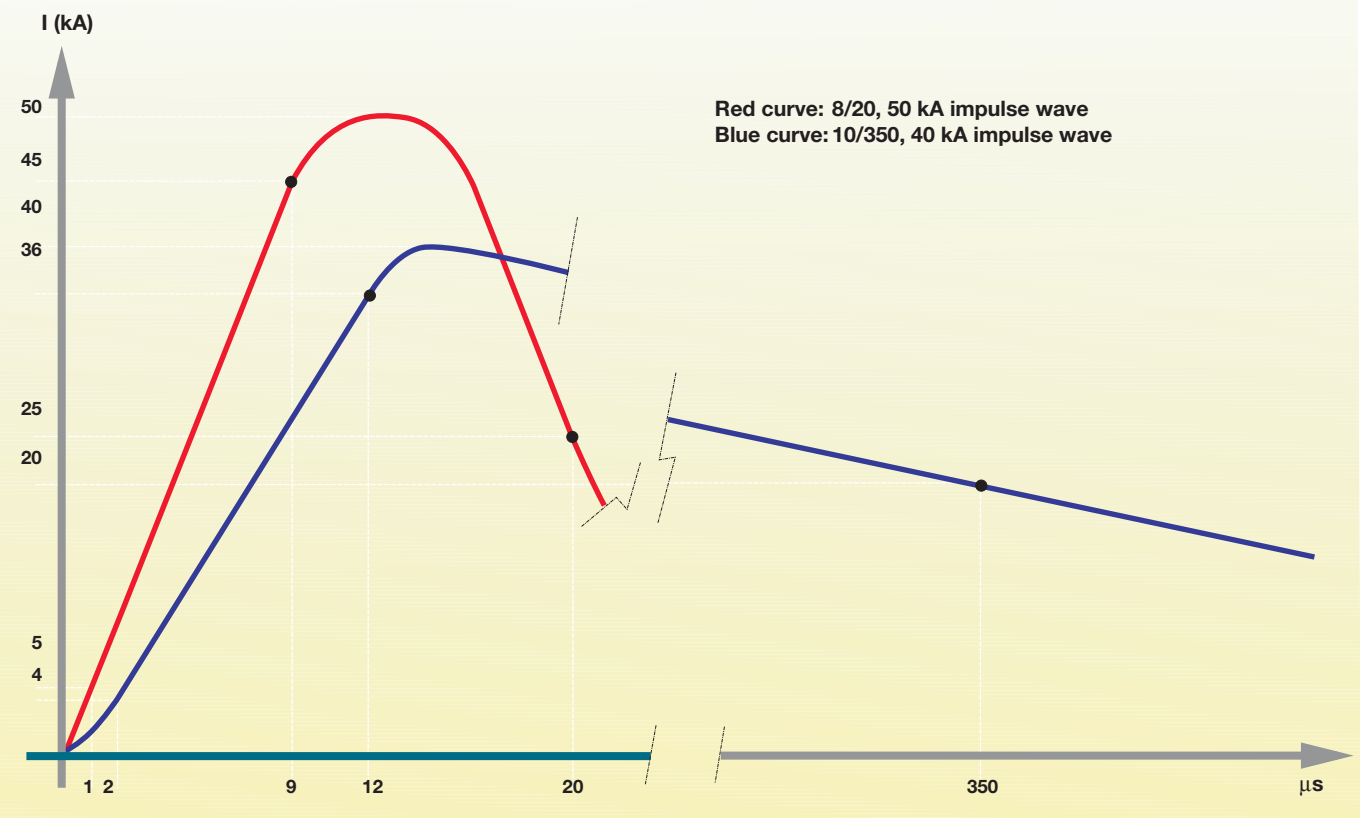
Categories	U_n 230 /400 V	U_n 400 /690 V	Examples
I	1500 V	2500 V	Equipment containing particularly sensitive electronic circuits : – computer workstations, computers, TV, HiFi, Video, Alarms, etc; – household appliances with electronic programmers, etc.
II	2500 V	4000 V	Domestic electrical equipment with mechanical programmers, portable tools, etc.
III	4000 V	6000 V	Distribution panels, switchgear (circuit-breakers, isolators, power socket bases, etc.), ducting and its accessories (cables, busbars, junction boxes, etc.).
IV	6000 V	8000 V	Equipment for industrial use and equipment such as fixed motors permanently connected to the fixed installation, Electrical meters, principle overcurrent protection equipment, remote measurement devices, etc.

Whatever the type of overvoltage protection used, the maximum voltage corresponds to category II.
U_p max = 2500 V if U_n = 230 V.
However, it should be noted that some equipment requires a particularly low protection level.
E.g. medical equipment, UPSs (with very sensitive electronics) U_n < 0.5 kV.
The protection level U_p is chosen according to the equipment to be protected.

Note:
In certain cases, protection components can be integrated into the equipment.
In this case, the manufacturer must communicate the type of protection that has been integrated.

8/20 and 10/350 impulse waves

The first number corresponds to the time from 10% to 90% of its peak value, e.g. 8 µs.
The second number corresponds to the time taken for the wave to descend to 50% of its peak value, e.g. 20µs.
Hence 8/20 describes the form of the wave and 50 kA, for example, gives its peak value.



Simulation of current waveforms

General points

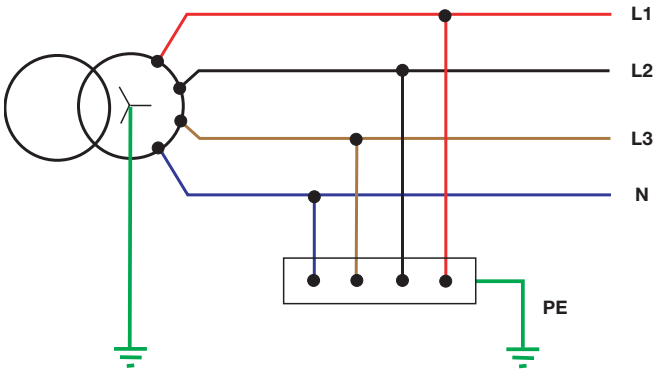
Earthing systems

The earthing system indicates the position of the protective conductor with respect to the neutral conductor.
Installed devices must guarantee personnel protection and the protection of equipment.

There are 4 earthing systems differentiated by:

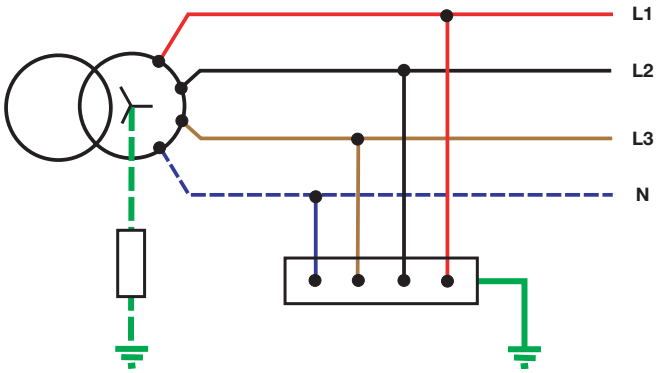
- the connection of the neutral with respect to earth;
- the connection of exposed conductive parts with respect to earth or the neutral.

Earthing system	Connection of neutral	Connection of exposed conductive parts
TT	Neutral connected to earth	Exposed conductive parts connected to an earth busbar
TN-C	Neutral connected to earth	Exposed conductive parts connected to the neutral
IT	Neutral isolated from earth or connected to earth via an impedance	Exposed conductive parts connected to an earth busbar
TN-S	Neutral connected to earth	Exposed conductive parts connected to the protective conductor



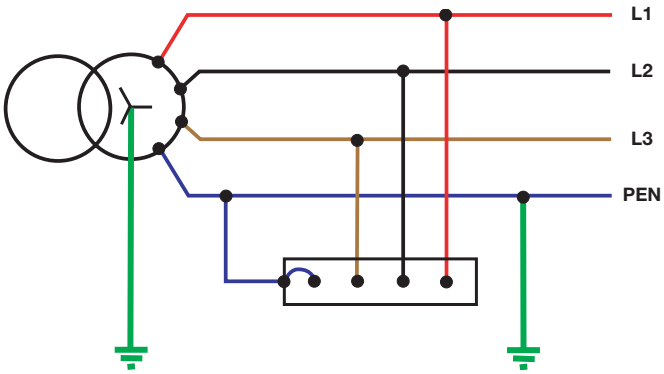
TT (neutral connected to earth) wiring diagram:

The neutral point of the supply is connected to earth.
The exposed conductive parts of the installation are connected to an earth rod; either a separate earth rod or to the neutral earth rod.



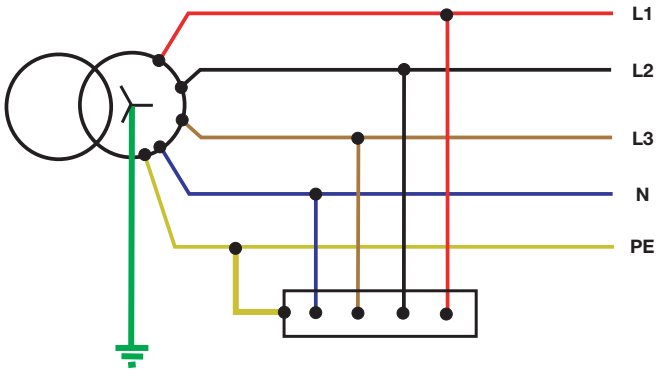
IT (neutral isolated or via impedance) wiring diagram:

The neutral point is either not connected to earth, or is so via an impedance (1000 to 2000 Ohms).



TN-C wiring diagram:

The neutral conductor and the protective conductor are the same conductor: PEN.



TN-S wiring diagram:

The neutral conductor and the protective conductor are separate.

Choice of earthing system

The choice of earthing system depends on:
- operating conditions,
- qualification of the maintenance team.

The earthing system may be imposed by the electricity supplier :
- TT for residential subscribers, small workshops and small tertiary installations,
- IT if continuity of service is required : hospitals, buildings open to the public.

Continuity of service is the priority	
YES	**NO**
Isolated neutral (IT)	Isolated neutral (IT) Neutral connected to earth (TT) Distributed neutral (TN)
This is the surest to avoid breaks in the supply. E.g. use of priority safety circuits: high-rise buildings, hospitals.	Final choice after studying: • the installation's characteristics, • the complexity of implementing each type of earthing system, • the costs of each type of earthing system.

Earthing systems

Recommended	Type of installation
TT	Widespread network with poor earthing of exposed conductive parts
TN	Network located in a storm area
TT	Distribution network fed by overhead lines
IT	Emergency backup or peak period generator set
TN	Low insulation loads (ovens, kitchens, welding sets)
TT or TNS	Portable single-phase loads (drills, grinders)
TN	Handling machines, hoists, conveyer belts
TNS	Large number of auxiliaries, machine tools
IT or TT	Premises with fire risks
TT	Building sites (unreliable earth)
TNS	Electronic equipment, computers

Common mode and / or differential mode protection

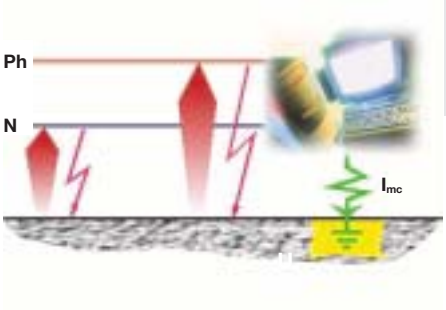
Common mode

Common mode overvoltages appear between the live conductors and earth, e.g. phase/earth or neutral/earth.

A live conductor not only refers to the phase conductors but also to the neutral conductor.

This overvoltage mode destroys equipment connected to earth (class I equipment) and also equipment not connected to earth (class II equipment) which is located near an earthed mass and which does not have sufficient electrical isolation (a few kilovolts).

Class II equipment not located near an earthed mass is theoretically protected from this type of attack.



Note:
Common mode overvoltages affect all earthing systems.

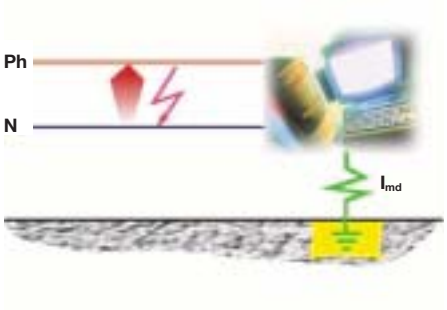
Differential mode

Differential mode overvoltages circulate between live conductors: phase/phase or phase/neutral.

These overvoltages have a potentially high damaging effect for all equipment connected to the electrical network, especially 'sensitive' equipment.

Note:
Differential mode overvoltages affect the TT earthing system.

These overvoltages also affect the TN-S earthing system if there is a considerable difference in the lengths of the neutral cable and the protective cable (PE).

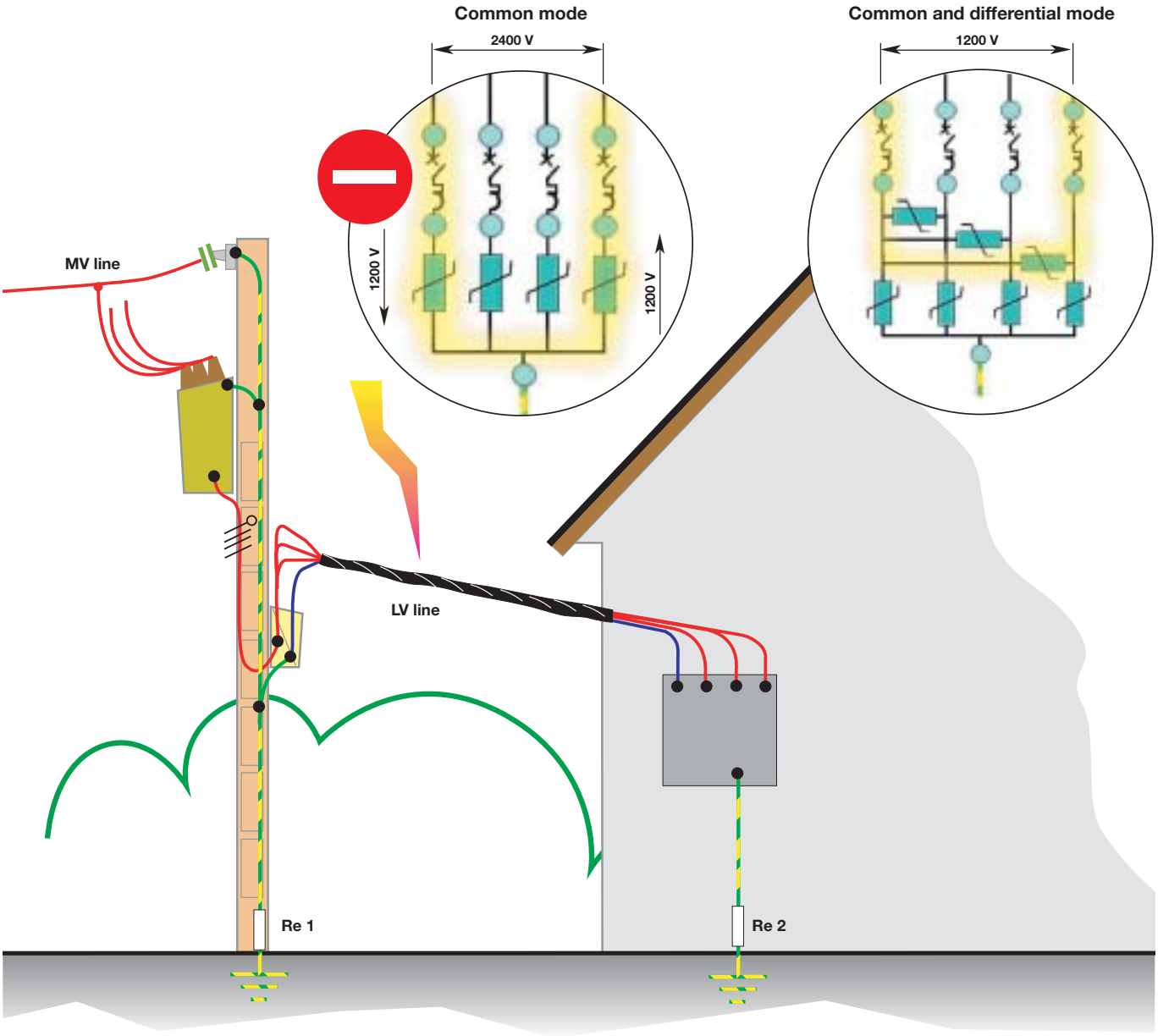


General points

Protection mode

The overvoltage caused by a lightning strike inevitably generates differences in potential in common mode and can generate differences in potential in differential mode.

The solution consists of adopting combined "common" and "differential" modes; standard offer for ABB surge arresters.



For Re 1 < Rt 2

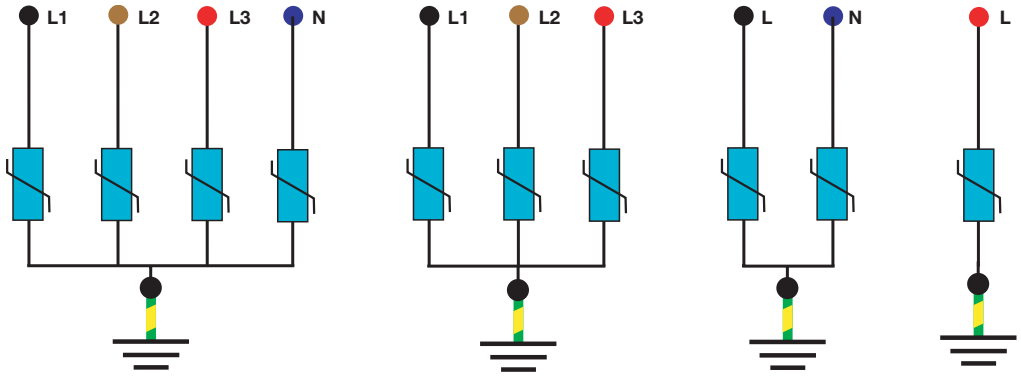
Overvoltage protection in common and / or differential mode (MC / MD)

Non-linear components, amongst others, such as varistors and discharge tubes are used to stop overvoltages reaching equipment.

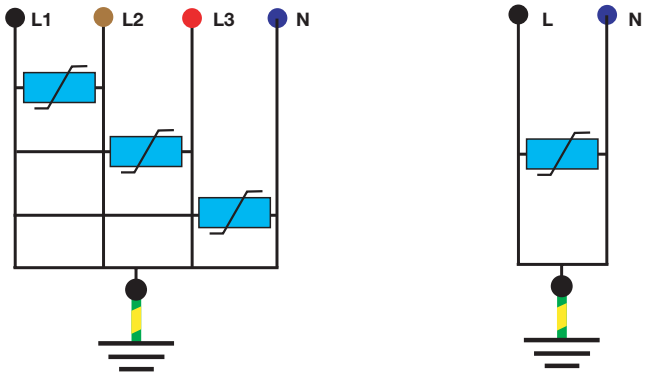
The combination of one or more of these components enables differential mode protection, common mode protection, or a combination of the two, depending on how they are wired.

Below are wiring diagrams or combinations according to the mode of protection.

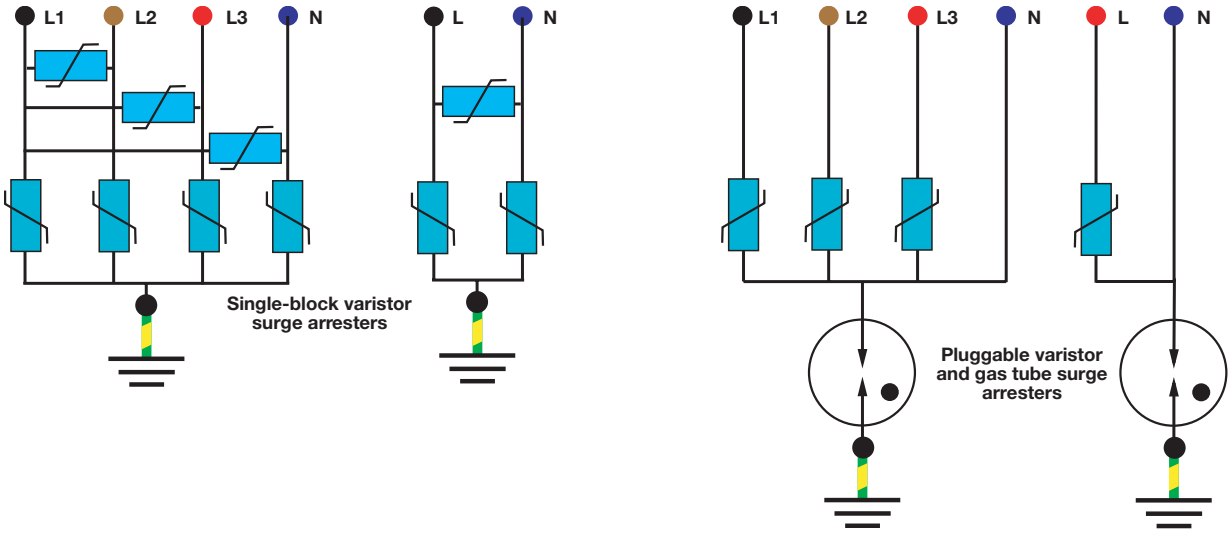
Overvoltage protection in common mode (MC)



Overvoltage protection in differential mode (MD)



Overvoltage protection in common and differential mode (MC / MD)



Selection

Choice of surge arrester

Choosing a surge arrester

The choice of surge arrester depends on a multitude of criteria defined when evaluating the lightning risk.

Evaluating the risk enables overvoltage protection requirements to be identified. When lightning protection is recommended, all that remains to be done is to select the appropriate product and install it.

All of the criteria that have to be taken into consideration make this risk analysis a laborious task which dissuades many people.

ABB's experience, expertise and precise study of standards related to this phenomenon have led us to develop a simplified procedure to optimise the choice and installation of overvoltage protection.

This work has resulted in a simplified and guided definition of surge arresters.

The choice of surge arrester is made according to several characteristics:

- The protection level ($\mathbf{U_p}$).
- The run-off capacity: $\mathbf{I_{imp}}$ or $\mathbf{I_{max}}$ (10/350 or 8/20 impulse wave).
- The network's earthing system.
- The operating voltages ($\mathbf{U_c}$, $\mathbf{U_T}$).
- The options (end of life indicator, pluggable, Safety reserve, TS, Optical monitoring block).

When must we be protected?

This aspect includes requirements of standards and recommendations based upon ABB's expertise.

The criteria taken into consideration in this section are the evaluation of the risk of a direct lightning strike on or nearby the building, including the financial aspect caused by destruction or operating losses. Even if protection is not indispensable, it should be noted that since zero risk does not exist, a means of protection may always be useful.

Environmental criteria

Context	The building has a lightning conductor	Ng > 2.5 and overhead electricity lines	Building located on high land
According to basic protection rules According to ABB installation rules	**Surge arrester obligatory**	**Surge arrester obligatory**	**Surge arrester recommended**
Type of surge arrester	Type 1	Type 1 or Type 2	Type 1 or Type 2 (65 kA)

Context	Element over 20m high at less than 50 m from the building to be protected	Less than 500m in a direct line separate the lightning conductor and main electrical switchboard from the building to be protected	Less than 50 m of ground separate the lightning conductor from the building to be protected
According to ABB installation rules	**Surge arrester recommended**	**Surge arrester recommended**	**Surge arrester recommended**
Type of surge arrester	Type 1 or Type 2	Type 1 or Type 2	Type 1 or Type 2 (65 kA)

Selection

Choosing the type of protection

Operational criteria

Recommended	Highly recommended	Very highly recommended	Selection criteria
		●	**Continuity of supply is the priority** (for reasons of operating loss costs, safety, etc.): – factories, offices, banks, airports, police stations, chemists, video surveillance systems, etc., – hospitals, retirement homes, dialysis centres.
		●	
	●	●	**Equipment protection is the priority:** – high value > 150,000 Euros; – medium value > 15,000 Euros; – low value > 150 Euros.
●			
	●		**Risk of lightning strikes in the region:** – Ng ≤ 2.5
		●	– Ng > 2.5
		●	– isolated site.
	●		**Type of electrical supply network feeding the site:** – overhead,
●			– underground.

Note:

Repetitive overvoltages due to lightning strikes lead to economic losses that are much greater than the cost of installing surge arresters.

The installation of surge arresters is a professional reflex when protecting medical equipment, in-line with the state of the art technology that is used.

To be kept in mind: the cost of the protection is low compared to the cost of the equipment to be protected.

Choosing the type of protection according to the network

Overvoltages are either common and differential mode or common mode only depending on the type of earthing system.

	TT	TN-S	TN-C	IT With N	IT Without N
Common mode	yes	yes	yes	yes	yes
Differential mode	yes	yes (1)	no	no	no

(1): If there is a considerable difference in the lengths of the neutral cable and the protective (PE) cable.

NOTE:

Suitable protection can be found for all network configurations in our modular power surge arresters.

Choice of U_c and U_T according to the nominal voltage (U_n) of the electrical network

The choice of operating voltage is also vital when selecting a surge arrester.

There are two voltage characteristics $\mathbf{U_c}$ and $\mathbf{U_T}$.

The surge arresters in combination with their breaking devices must resist a temporary 50 Hz overvoltage without incurring any modification to their characteristics or functionalities. For a 230 V (phase-neutral) electrical network, this overvoltage is defined as follows:

$\mathbf{U_T}$ for 5 secs (+0 / -5 %).

$\mathbf{U_T}$ is given in the table below.

(e.g. $\mathbf{U_T}$ = 400 V with $\mathbf{U_o}$ = 230V between phase and PE for a TT system).

It is imperative that these values are chosen in compliance with the table below according to the type of earthing system.

Surge arrester connection	Network earthing system according to IEC 60364-4-442									
	TT		TN-C		TN-S		IT (Neutral distributed)		IT (Neutral distributed)	
	U_c	U_T	U_c	U_T	U_c	U_T	U_c	U_T	U_c	U_T
Between Phase and Neutral	253 V	334 V	N.A.	N.A.	253 V	334 V	253	334 V	N.A.	N.A.
Between Phase and PE	253 V	400 V	N.A.	N.A.	253 V	334 V	400 V	N.A.	400 V	400 V
Between Neutral and PE	230 V	N.A.	N.A.	N.A.	230 V	N.A.	230 V	N.A.	N.A.	N.A.
Between Phase and PEN	N.A.	N.A.	253 V	334 V	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

(These voltages are minimum voltages) - N.A.: Not Applicable.

NOTE:

The table also gives $\mathbf{U_c}$ values which correspond to the maximum continuous voltage the surge arresters must be able to operate.

Selection

Choice of I_{imp} and I_{max} of the incoming surge arrester

The run-off capacity of a surge arrester is determined by its electrical characteristics, and must be chosen according to the level of risk.

The choice of I_{imp} for Type 1 surge arrester in case of a 100 kA direct lightning strike (around 95% of strikes are less than 100 kA: IEC 61 024-1-1 Annex A, Basic values of lightning current parameters), is 12.5 kA for each power line.

I_{imp} for Type 1 surge arresters

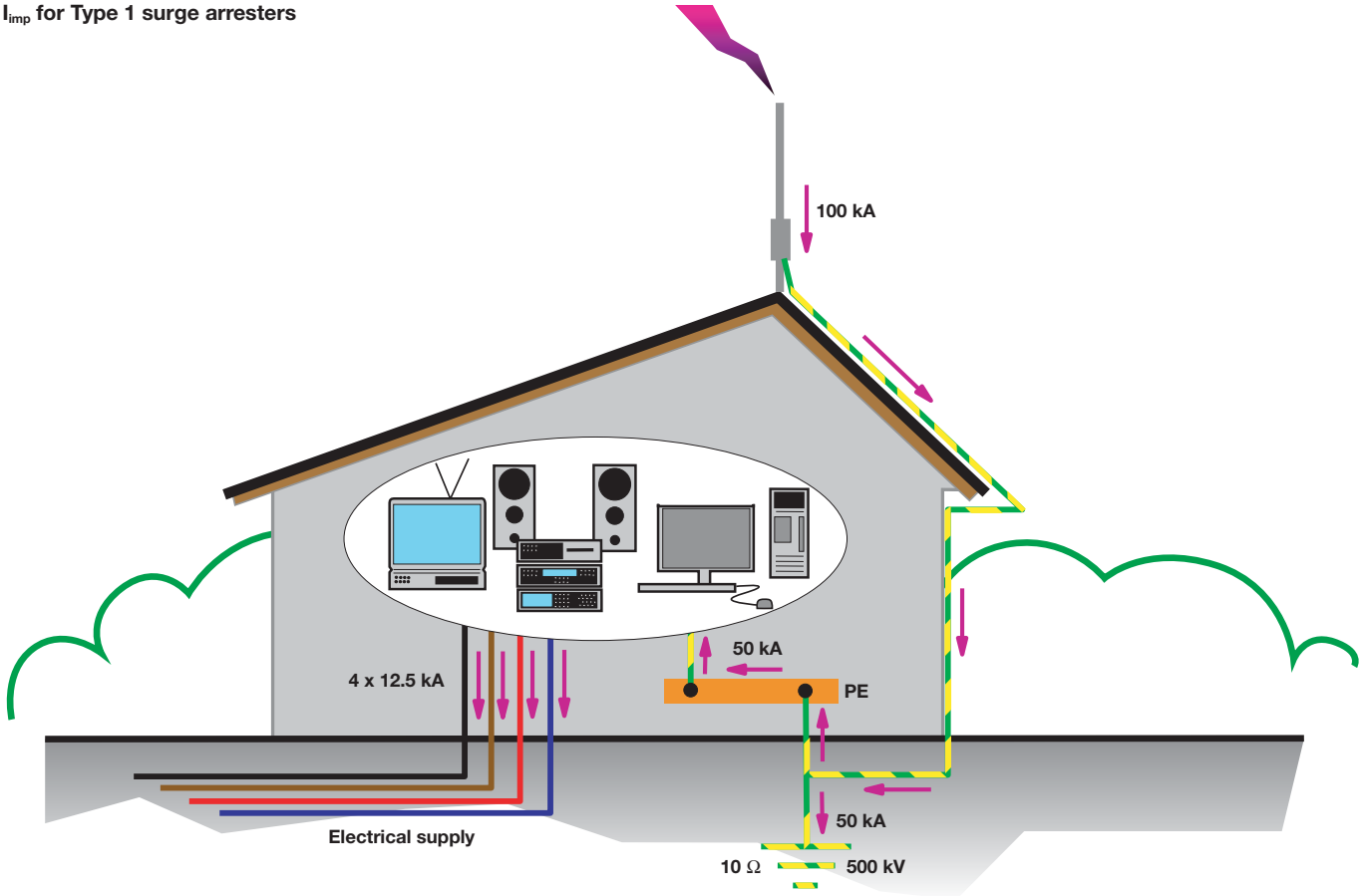


ABB recommends a minimum I_{imp} of 12.5 kA for Type 1 surge arresters based on the following calculation :

- Prospective direct lightning strike current **I**: 100 kA (only 5% of discharges > 100 kA).
- Distribution of current within the building: 50 % to ground and 50 % to the electrical network (according to international standards IEC 61 643-12 Annex I-1-2).
- Equal distribution of the current in each of the conductors (3 L + N):

$$I_{imp} = \frac{50\ kA}{4} = 12.5\ kA.$$

I_{max} for Type 2 surge arresters

Optimisation of I_{max} for Type 2 surge arresters				
Ng	< 2	2 ≤ Ng < 3	3 ≤ Ng <4	4 < Ng
I_n (kA)	5	15	20	30
I_{max} (kA)	15	40	65	100

NOTE:
ABB defines its Type 2 surge arresters according to their maximum current (I_{max}).
For a given I_{max} value, there is a corresponding nominal current value (I_n).

Selection

Principle of coordination

After having defined the characteristics of the incoming surge arrester, the protection must be completed with one or more additional surge arresters.

The incoming surge arrester does not provide effective protection for the whole installation by itself.

Certain electrical phenomena can double the protection's residual voltage if cable lengths exceed 10m.

Surge arresters must be coordinated when they are installed (refer to the tables below).

Coordination required if:

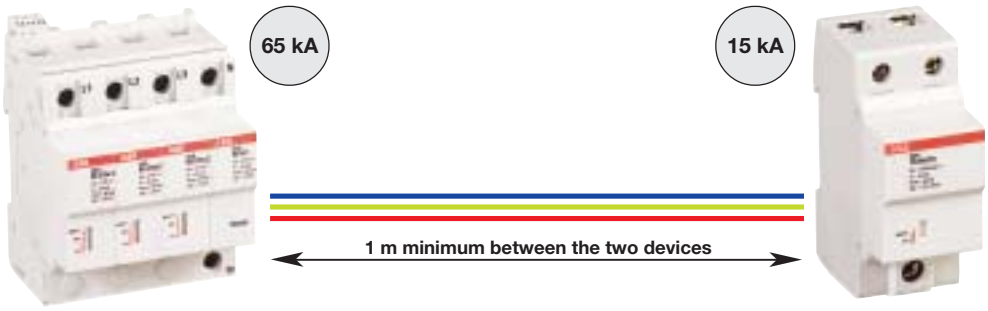
The incoming surge arrester does not reach the protection voltage ($\mathbf{U_p}$) by itself.

The incoming surge arrester is more than 10m away from the equipment to be protected.

Recommended solution

Use of modular Type 2 surge arresters.

Coordination between Type 2 surge arresters (example)



NOTE:

The coordination of Type 2 surge arresters is analysed using their respective maximum discharge currents $\mathbf{I_{max}}$ (8/20) starting from the installation's incoming switchboard and working towards the equipment which is to be protected, taking into account the progressive reduction in $\mathbf{I_{max}}$.

E.g. 65 kA followed by 15 kA.

All ABB Type 2 surge arresters coordinate between each other by respecting a minimum distance of 1m between them.

Selection
Options and advantages

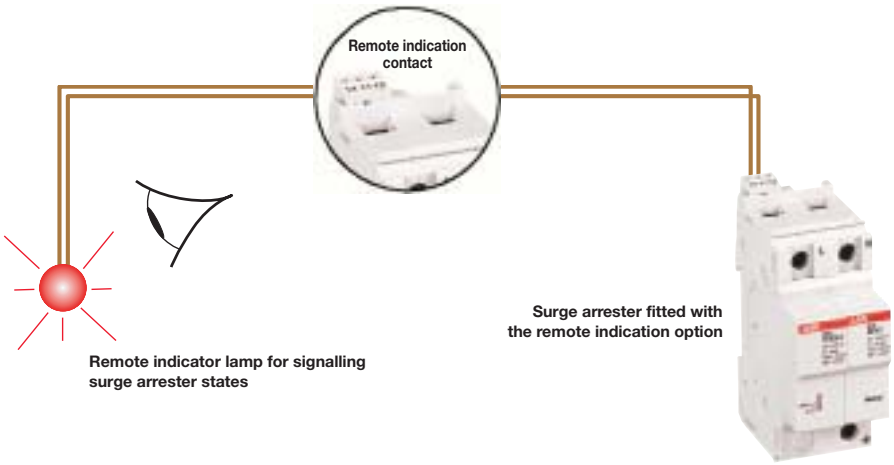
End of life indicator of the surge arrester
This option enables indication of the surge arrester's state via a mechanical indicator which changes from white to red as the surge arrester comes to end-of-life. When this occurs, the surge arrester must be changed as protection is no longer guaranteed.

Safety Reserve (s) system
In case of current surge exceeding the maximum capacity of the device, the surge arrester will switch to the Safety reserve position and the remote indicator (TS) will switch to defect.

Consequently, the user is warned in advance and has more response time to replace the cartridge, because in Safety reserve position the protection is still ensured due to the 2-stage disconnecting system.

Pluggable
The pluggable feature of ABB surge arresters facilitates maintenance. Should one or more worn cartridges need to be replaced, the electrical circuit does not have to be isolated nor do the wires have to be removed.

Remote indication (TS)
This function, achieved by wiring a 3-point 1A volt-free contact, enables the operational state of the surge arrester to be checked remotely (maintenance premises). This can be global (several surge arresters) when an Optical Monitoring Block is used.



Optical Monitoring Block (OVR Sign)
This is made up of two elements, an emitter and a receiver, positioned at the extremities of the surge arrester row to be monitored.

Its optical barrier monitoring principle is compatible with all the power modular models and low current models (except OVR TC 200V).

This unit allows the operation of several DIN rail mounted surge arresters to be monitored simultaneously (10 modules of 17.5 mm).

In normal operation, the indicator lamps on the emitter and receiver are green.

In the event of surge arrester failure, the indicator lamp on the receiver turns red.

In the event of an optical monitoring block fuse fault, all the indicator lamps go out.

Global remote indication of the surge arrester row can be achieved by wiring the volt-free contact.

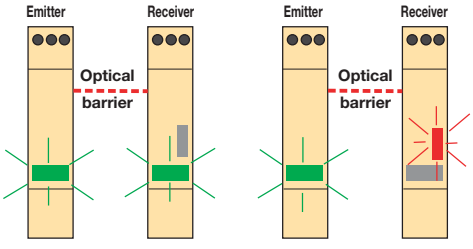
End-of-life indicator

Safety Reserve system

NOTE:
A faulty surge arrester does not interrupt continuity of service (if wired such that priority is given to continuity of service), it simply disconnects itself. But, the equipment is no longer protected.

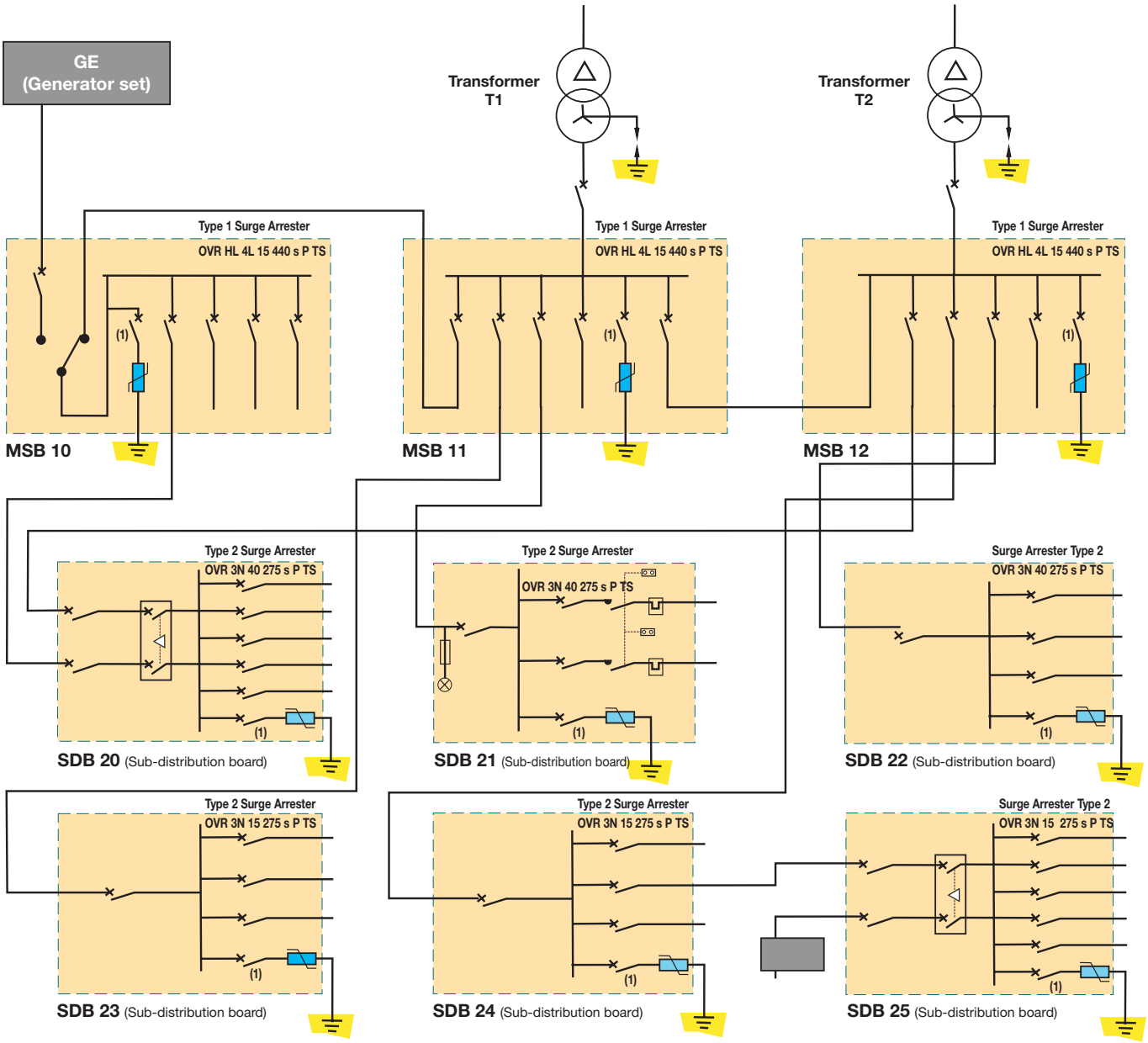
NOTE:
Pluggable surge arrester cartridges have a foolproof system (Neutral cartridges different to Phase cartridges) preventing incorrect operations when replacing a cartridge.

Optical Monitoring Block (OVR Sign)



Selection

Example of a protected industrial installation



(1) The upstream circuit-breaker associated to each surge arrester must be an S 2 .. serie.

The above diagram is an example of an industrial application located in an area where the lightning strike density (Ng) is 1.2 lightning strikes per km^2 and per year:

- the building is protected by a lightning conductor.
- the lightning conductor's earthing strip is connected to the installation's earth network.
- the earthing system is IT (with distributed neutral) and then TNS for the sub-distribution boards.
- main switch boards (MSB) 10, 11 and 12 are fitted with Type 1 surge arresters OVR HL 4L 15 440 s PTS.
- sub-distribution boards (SDB) 20, 21 and 22 are fitted with Type 2 surge arresters OVR 3N 40 275 s P TS.
- sub-distribution boards (SDB) 23, 24 and 25 are fitted with Type 2 surge arresters OVR 3N 15 275 s P TS.

NOTE:
Regardless of the geographical location and the immediate environment, the Type 1 surge arresters used in this example would remain valid even if a lightning conductor was not installed.

Note however that the site would not be protected against direct lightning strikes (structures and buildings).

ABB surge arrester range

Incoming surge arresters - Power Type 1

OVR HL 15 440 s P TS

OVR HL 2L 15 440 s P TS

Type 1 surge arresters provide incoming protection for an installation which has a lightning conductor or which is located in a high lightning strike density area.

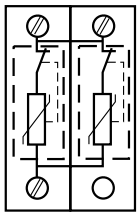
The high run-off capacity of Type 1 surge arresters (15 kA impulse current for 10/350 µs waveform) enables them to resist very high energy transient overvoltages appearing on the electrical network (mains).

The absence of follow or holding current (I_f = None) means there will be no tripping of main breakers or blowing of fuses during normal operation of OVR HL ... SPDs.

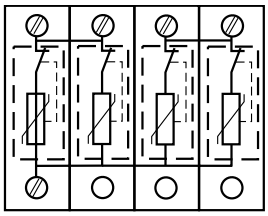
OVR HL ... SPDs, which are based on MOV technology, provide low let through voltages (U_p) and allow easy coordination with OVR Type 2 SPDs (decoupling inductors not required when Types 1 & 2 SPDs are installed together).

Standards Info
Type 1 surge arresters comply with IEC 61643-1.

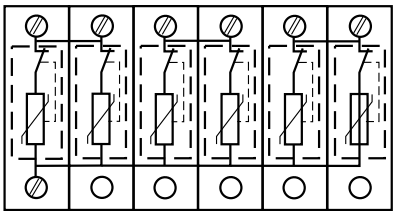
Schematic diagrams



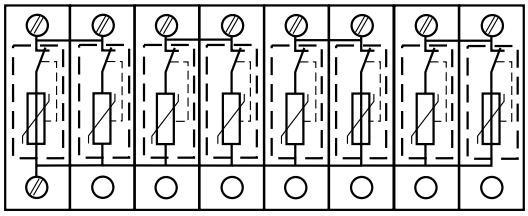
OVR HL



OVR HL 2L



OVR HL 3L

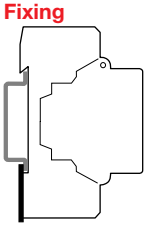


OVR HL 4L

Dimensions

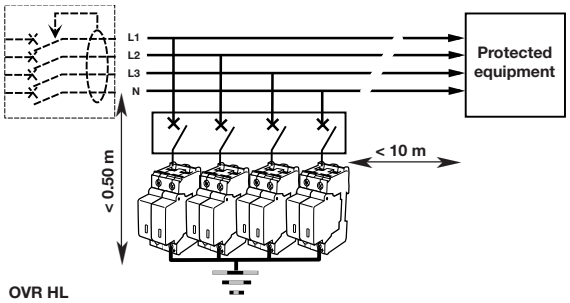
Dimensions (mm)	W	H	D
OVR HL 15 440 s P TS	35	85	63
OVR HL 15 255 s P TS	35	85	63
OVR HL 2L 15 440 s P TS	70	85	63
OVR HL 3L 15 440 s P TS	105	85	63
OVR HL 4L 15 440 s P TS	140	85	63

Fixing

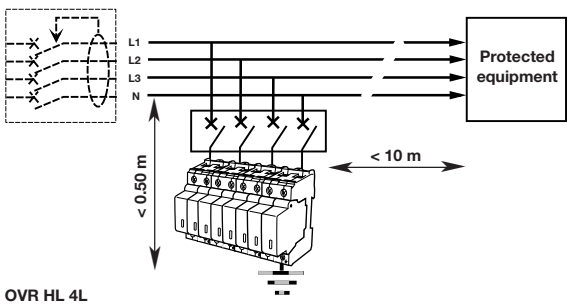


Simply clips onto DIN rail.

Connection

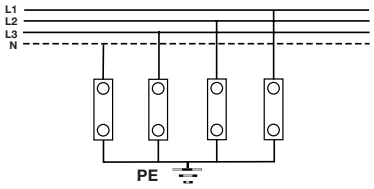


OVR HL

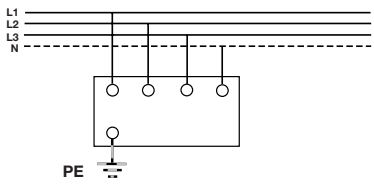


OVR HL 4L

Types of network



TT - TNS - IT networks



TT - TNS - IT networks

PRATICAL INFO
Type 1 surge arresters are installed in main switchboards (MSBs) using DIN rail. They are used for common mode protection. Their pluggable cartridges allow optimised maintenance as they can be replaced without the need to isolate the circuit.

ABB surge arrester range

Incoming surge arresters - Characteristics

15 kA (10/350)

	More info	OVR HL 15 440 s P TS (2CTB 8152 01 R 08 00)	OVR HL 15 255 s P TS (2CTB 8152 01 R 09 00)	OVR HL 2L 15 440 s P TS (2CTB 8153 03 R 04 00)	OVR HL 3L 15 440 s P TS (2CTB 8154 01 R 04 00)	OVR HL 4L 15 440 s P TS (2CTB 8155 03 R 04 00)
Electrical characteristics						
Types of network	p.10	TT - TNS - TNC - IT	TT - TNS - TNC	TT - TNS - IT	TNC - IT	TT - TNS - IT
Number of poles		1	1	2	3	4
Type of surge arrester				1		
Type of current				A.C.		
Nominal voltage: U_n	p. 7	400 V	230 V	230/400 V	230/400 V	230/400 V
Max cont operating voltage: U_c	p. 8	440 V	275 V	440 V	440 V	440 V
Impulse current: I_{imp} (10/350 wave)	p. 7			15 kA (Class I Test)		
Nominal discharge current: I_n (8/20 wave)	p. 7			5 kA (Class I Test)		
Voltage protection level: U_p (at I_n = 5 kA)	p. 7			1.2 kV (Class I Test)		
Maximum discharge current: I_{max} (8/20 wave)	p. 7			100 kA (Class II Test)		
Residual voltage: U_{res} (at 30 kA)				1.8 kV (Class II Test)		
Follow current: I_f				None		
TOV withstand: U_T (5 s.)				440 V		
Operating current: I_c				< 1 mA		
Short-circuit withstand: I_{cc}				25 kA		
Response time: t_A				≤ 25 ns		
Degree of protection				IP 203		
Associated breaking device:						
– gG - gL fuse	p. 37			25 A		
– curve C circuit-breaker	p. 37			40 A		
Mechanical characteristics						
L/N connection terminals:						
– solid wire				2.5 ... 25 mm²		
– stranded wire				2.5 ... 16 mm²		
L/N stripping length				12.5 mm		
L/N tightening torque				2 Nm		
PE connection terminal:						
– solid wire				2.5 ... 25 mm²		
– stranded wire				2.5 ... 16 mm²		
PE stripping length				12.5 mm		
PE tightening torque				2 Nm		
Integrated thermal disconnector				Yes		
End of life indicator	p. 18			Yes		
Compatibility with OVR Sign	p. 18			Yes		
Safety reserve (s)	p. 18			Yes		
Remote indicator (TS)	p. 18			Yes		
Miscellaneous characteristics						
Storage temperature				-40 °C to +80 °C		
Operating temperature				-40 °C to +80 °C		
Maximum altitude				2000 m		
Case material				PC grey RAL 7032		
Insulating material				UL94 V0 classification		
Reference standards				IEC 61643-1 / EN 61643-11		
Weight		250 g	250 g	500 g	750 g	1000 g
Maintenance						
Replacement cartridges		OVR HL 15 440 s C	OVR HL 15 255 s C	OVR HL 15 440 s C	OVR HL 15 440 s C	OVR HL 15 440 s C
	p. 35	(2CTB 8152 50 R 03 00)	(2CTB 8152 50 R 04 00)	(2CTB 8152 50 R 03 00)	(2CTB 8152 50 R 03 00)	(2CTB 8152 50 R 03 00)

ABB surge arrester range

Single-block single-pole surge arresters - Power Type 2

OVR 15 440

OVR 100 440 s

The single-block single-pole modular power Type 2 surge arresters provide protection for equipment against transient overvoltages that occur on the electrical network (mains).

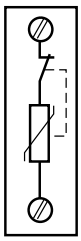
The maximum available discharge currents (I_{max}) range from 15 to 100 kA (8/20 µs waveform).

Standards Info

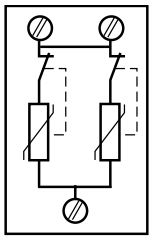
The modular power Type 2 surge arresters comply with IEC 61643-1 and EN 61643-11.

The relevant standard for the installation of this type of surge arrester is: IEC 61643-12.

Schematic diagrams

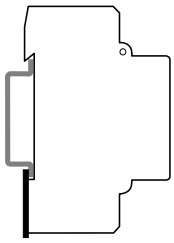


OVR 15 / 40 / 65 kA



OVR 100 kA

Fixing



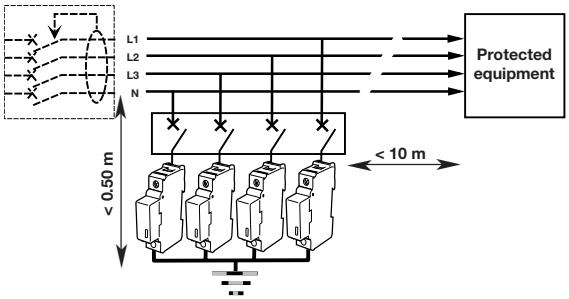
Simply clips onto DIN rail.

Dimensions

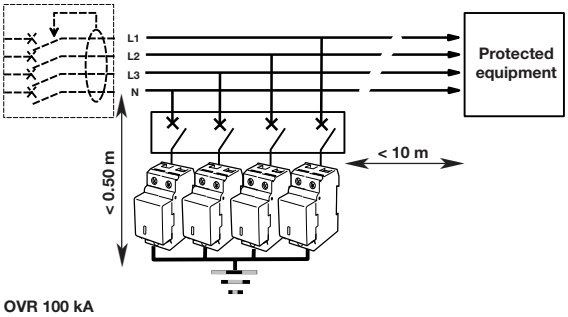
Dimensions (mm)	W	H	D
OVR 15 / 40 / 65 kA (all models)	17.5	85	63
OVR 100 kA	35	85	63

These surge arresters are also available in 275 V.

Connection

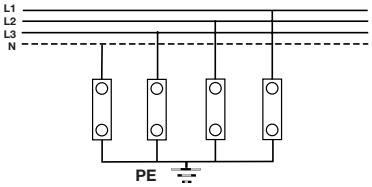


OVR 15 / 40 / 65 kA (all models)

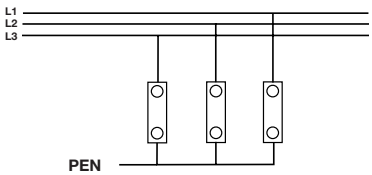


OVR 100 kA

Types of network



TT - TNS - IT networks



TNC networks

PRATICAL INFO

Modular power Type 2 surge arresters are installed in main switchboards and in sub-distribution boards using DIN rail.

They are used for common mode protection.

ABB surge arrester range

Single-block single-pole surge arresters - Characteristics

		15 kA (8/20)	40 kA (8/20)		65 kA (8/20)	100 kA (8/20)
	More info	OVR 15 440 (2CTB 8138 11 R 04 00)	OVR 40 440 (2CTB 8138 11 R 03 00)	OVR 40 440 s (2CTB 8138 11 R 09 00)	OVR 65 440 s (2CTB 8138 11 R 01 00)	OVR 100 440 s (2CTB 8138 11 R 11 00)
Electrical characteristics						
Types of network	p.10	IT - TNC - TNS - TT	TT - TNC - TNS - TT	IT - TNC - TNS - TT	IT - TNC - TNS - TT	IT - TNC - TNS - TT
Number of poles		1	1	1	1	1
Type of surge arrester		2	2	2	2	2
Type of current		A.C.	A.C.	A.C.	A.C.	A.C.
Nominal voltage: U_n	p. 7	400 V	400 V	400 V	400 V	400 V
Max cont operating voltage: U_c	p. 8	440 V	440 V	440 V	440 V	440 V
Voltage protection level: U_p at I_n	p. 7	1.8 kV	1.8 kV	1.8 kV	1.8 kV	1.8 kV
Residual voltage: U_{res} at 3 kA		1.5 kV	1.4 kV	1.4 kV	1.3 kV	1.2 kV
Nominal discharge current: I_n (8/20)	p. 7	5 kA	10 kA	10 kA	20 kA	30 kA
Maximum discharge current: Imax (8/20)	p. 7	15 kA	40 kA	40 kA	65 kA	100 kA
TOV withstand: U_T (5s)	p. 8	440 V	440 V	440 V	440 V	440 V
Operating current: I_c		< 1 mA	< 1 mA	< 1 mA	< 1 mA	< 1 mA
Short-circuit withstand: I_{cc}		10 kA	25 kA	25 kA	25 kA	25 kA
Response time: t_A		≤ 25 ns	≤ 25 ns	≤ 25 ns	≤ 25 ns	≤ 25 ns
Degree of protection		IP 203	IP 203	IP 203	IP 203	IP 203
Associated breaking device:						
– gG - gL fuse	p. 37	16 A	16 A	16 A	20 A	25 A
– curve C circuit-breaker	p. 37	10 A	25 A	25 A	32 A	40 A
Mechanical characteristics						
L/N connection terminals:						
– solid wire		2.5 ... 25 mm^2	2.5 ... 25 mm^2	2.5 ... 25 mm^2	2.5 ... 25 mm^2	2.5 ... 25 mm^2
– stranded wire		2.5 ... 16 mm^2	2.5 ... 16 mm^2	2.5 ... 16 mm^2	2.5 ... 16 mm^2	2.5 ... 16 mm^2
L/N stripping length		12.5 mm	12.5 mm	12.5 mm	12.5 mm	12.5 mm
L/N tightening torque		2 Nm	2 Nm	2 Nm	2 Nm	2 Nm
PE connection terminal:						
– solid wire		2.5 ... 25 mm^2	2.5 ... 25 mm^2	2.5 ... 25 mm^2	2.5 ... 25 mm^2	2.5 ... 50 mm^2
– stranded wire		2.5 ... 16 mm^2	2.5 ... 16 mm^2	2.5 ... 16 mm^2	2.5 ... 16 mm^2	2.5 ... 35 mm^2
PE stripping length		12.5 mm	12.5 mm	12.5 mm	12.5 mm	15 mm
PE tightening torque		2 Nm	2 Nm	2 Nm	2 Nm	3.5 Nm
Integrated thermal disconnector		Yes	Yes	Yes	Yes	Yes
End of life indicator	p. 18	Yes	Yes	Yes	Yes	Yes
Compatibility with OVR Sign	p. 18	Yes	Yes	Yes	Yes	Yes
Safety reserve (s)	p. 18	No	No	Yes	Yes	Yes
Remote indicator (TS)	p. 18	No	No	No	No	No
Miscellaneous characteristics						
Storage temperature		-40 °C to +80 °C				
Operating temperature		-40 °C to +80 °C				
Maximum altitude		2000 m				
Case material		PC grey RAL 7032				
Insulating material		UL94 V0 classification				
Reference standards		IEC 61643-1 / EN 61643-11				
Weight		150 g	150 g	150 g	150 g	300 g

ABB surge arrester range

Single-block multi-pole surge arresters - Power Type 2

OVR 1N 15 275

OVR 4L 65 440 s

The single-block multi-pole modular power Type 2 surge arresters provide protection for equipment against transient overvoltages that occur on the electrical network (mains).

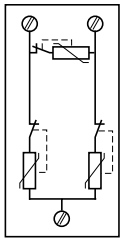
The maximum available discharge currents (I_{max}) range from 15 to 65 kA (8/20 µs waveform). The range consist of 2 and 4-pole models.

Standards Info

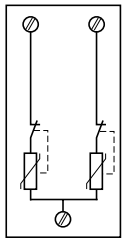
The modular power Type 2 surge arresters comply with IEC 61643-1 and EN 61643-11.

The relevant standard for the installation of this type of surge arrester is: IEC 61643-12.

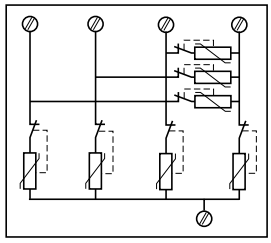
Schematic diagrams



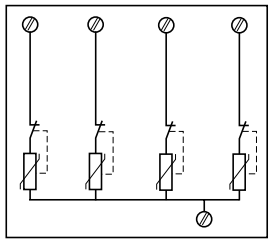
OVR 1N 15 / 40



OVR 2L 65

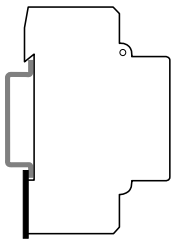


OVR 3N 15 / 40



OVR 4L 65

Fixing

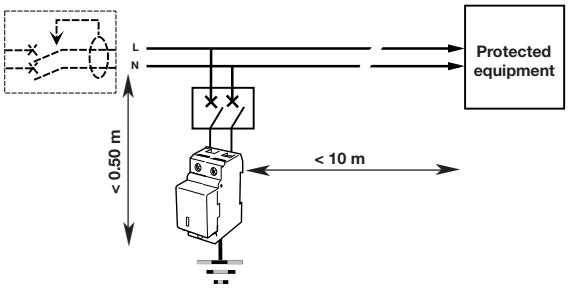


Simply clips onto DIN rail.

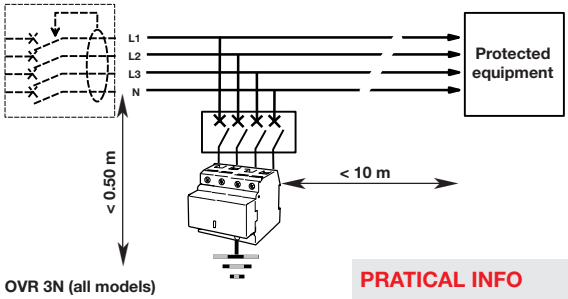
Dimensions

Dimensions (mm)	W	H	D
OVR 1N	35	85	63
OVR 3N / 4L	70	85	63

Connection

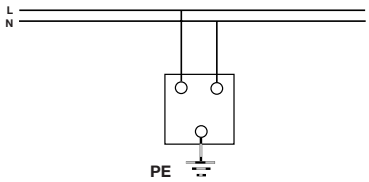


OVR 1N (all models)

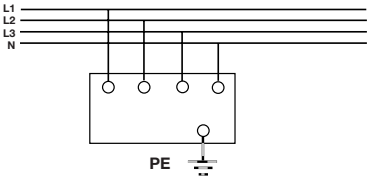


OVR 3N (all models)

Types of network



TT - TNS networks (2-pole models)



TT - TNS networks (4-pole models)

PRATICAL INFO

Modular power Type 2 surge arresters are installed in sub-distribution boards using DIN rail. They provide common mode and differential mode protection (apart from OVR 2L / 4L 65 kA models, common mode only).

ABB surge arrester range

Single-block multi-pole surge arresters - Characteristics

	More info	15 kA (8/20)		40 kA (8/20)		65 kA (8/20)	
		OVR 1N 15 275 (2CTB 8139 12 R 04 00)	OVR 3N 15 275 (2CTB 8139 13 R 04 00)	OVR 1N 40 275 (2CTB 8139 12 R 03 00)	OVR 3N 40 275 (2CTB 8139 13 R 03 00)	OVR 2L 65 440 s (2CTB 8138 12 R 07 00)	OVR 4L 65 440 s (2CTB 8138 13 R 07 00)
Electrical characteristics							
Types of network	p.10	TNS - TT		TNS - TT		TNS - TT	
Number of poles		2	4	2	4	2	4
Type of surge arrester		2		2		2	
Type of current		A.C.		A.C.		A.C.	
Nominal voltage: U_n	p. 7	230 V		230 V		230 V	
Max cont operating voltage: U_c (L-N / L-PE - N-PE)	p. 8	275 / 440 V		275 / 440 V		NA / 440 V	
Voltage protection level: U_p at I_n (L-N / L-PE - N-PE)	p. 7	1.2 / 1.8 kV		1.2 / 1.8 kV		NA / 1.8 kV	
Residual voltage: U_{res} at 3 kA		1.0 / 1.5 kV		0.9 / 1.4 kV		NA / 1.3 kV	
Nominal discharge current: I_n (8/20)	p. 7	5 kA		10 kA		20 kA	
Maximum discharge current: I_{max} (8/20)	p. 7	15 kA		40 kA		65 kA	
TOV withstand: U_T (5 s) (L-N / L-PE)	p. 8	340 / 440 V		340 / 440 V		NA / 440 V	
Operating current: I_c		< 1 mA		< 1 mA		< 1 mA	
Short-circuit withstand: I_{cc}		10 kA		25 kA		25 kA	
Response time: t_A		≤ 25 ns		≤ 25 ns		≤ 25 ns	
Degree of protection		IP 203		IP 203		IP 203	
Associated breaking device:							
– gG - gL fuse	p. 37	16 A		16 A		20 A	
– curve C circuit-breaker	p. 37	10 A		25 A		32 A	
Mechanical characteristics							
L/N connection terminals:							
– solid wire		2.5 ... 25 mm²					
– stranded wire		2.5 ... 16 mm²					
L/N stripping length		12.5 mm					
L/N tightening torque		2 Nm					
PE connection terminal:							
– solid wire		2.5 ... 50 mm²					
– stranded wire		2.5 ... 35 mm²					
PE stripping length		15 mm					
PE tightening torque		3.5 Nm					
Integrated thermal disconnector		Yes					
End of life indicator	p. 18	Yes					
Compatibility with OVR Sign	p. 18	Yes					
Safety reserve (s)	p. 18	No		No		Yes	
Remote indicator (TS)	p. 18	No		No		No	
Miscellaneous characteristics							
Storage temperature		-40 °C to +80 °C					
Operating temperature		-40 °C to +80 °C					
Maximum altitude		2000 m					
Case material		PC grey RAL 7032					
Insulating material		UL94 V0 classification					
Reference standards		IEC 61643-1 / EN 61643-11					
Weight		200 g	400 g	200 g	400 g	200 g	400 g

ABB surge arrester range

Pluggable single-pole surge arresters - Power Type 2

OVR 15 440 P

OVR 100 440 s P TS

These surge arresters are also available in 275 V.

The pluggable single-pole modular power Type 2 surge arresters provide protection for equipment against transient overvoltages that occur on the electrical network (mains).

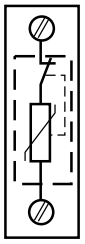
The maximum available discharge currents (I_{max}) range from 15 to 100 kA (8/20 µs waveform).

Standards Info

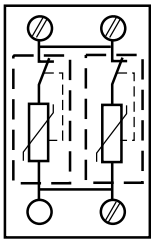
The pluggable single-pole power Type 2 surge arresters comply with IEC 61643-1 and EN 61643-11.

The relevant standard for the installation of this type of surge arrester is: IEC 61643-12.

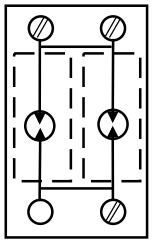
Schematic diagrams



OVR 15 / 40 / 65 P

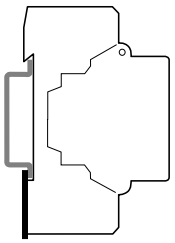


OVR 100 P



OVR 100 NP

Fixing

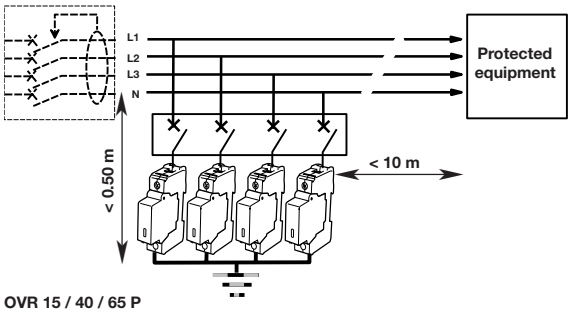


Simply clips onto DIN rail.

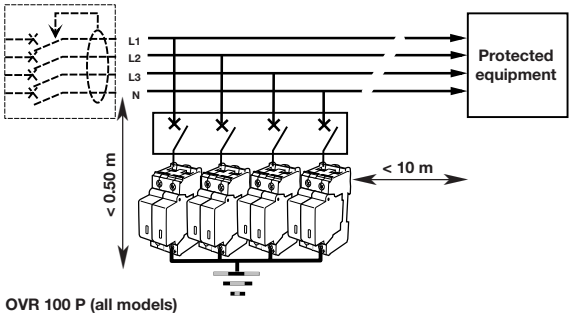
Dimensions

Dimensions (mm)	W	H	D
OVR 15 / 40 / 65 P (all models)	17.5	85	63
OVR 100 P	35	85	63

Connection

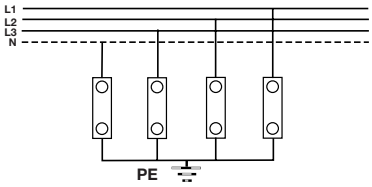


OVR 15 / 40 / 65 P

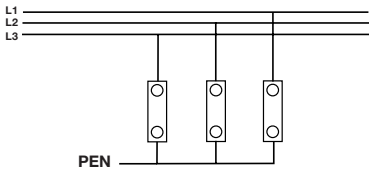


OVR 100 P (all models)

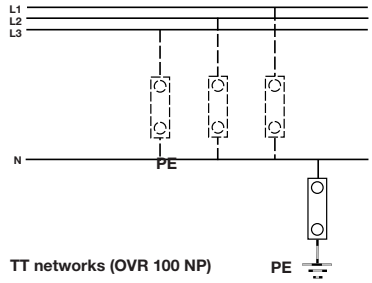
Types of network



TT - TNS - IT networks (Single-pole all models)



TNC networks (Single-pole all models)



TT networks (OVR 100 NP)

PRATICAL INFO

Pluggable single-pole surge arresters are installed in sub-distribution boards using DIN rail. They are used for common mode protection. Maintenance is made easier with pluggable surge arresters as replacement cartridges can be simply plugged-in without the need to isolate the circuit.

ABB surge arrester range

Pluggable single-pole surge arresters - Characteristics

	More info	15 kA (8/20)		40 kA (8/20)			65 kA (8/20)		100 kA (8/20)		
		OVR 15 440 P (2CTB 8138 51 R 12 00)	OVR 15 440 P TS (2CTB 8138 51 R 06 00)	OVR 40 440 P (2CTB 8138 51 R 11 00)	OVR 40 440 P TS (2CTB 8138 51 R 05 00)	OVR 40 440 s P TS (2CTB 8138 51 R 02 00)	OVR 65 440 s P (2CTB 8138 51 R 07 00)	OVR 65 440 s P TS (2CTB 8138 51 R 01 00)	OVR 100 440 s P TS (2CTB 8138 50 R 01 00)	OVR 100 275 s P TS (2CTB 8138 50 R 02 00)	OVR 100 NP (2CTB 8138 50 R 03 00)
Electrical characteristics											
Types of network	p.10	IT - TNC - TNS - TT		IT - TNC - TNS - TT			IT - TNC - TNS - TT		TNC-TNS-TT	TNC-TNS-TT	TT
Number of poles		1		1			1		1	1	1
Type of surge arrester		2		2			2		2	2	2
Type of current		A.C.		A.C.			A.C.		A.C.	A.C.	A.C.
Nominal voltage: U_n	p. 7	400 V		400 V			400 V		400 V	230 V	-
Max cont operating voltage: U_c	p. 8	440 V		440 V			440 V		440 V	275 V	255 V
Voltage protection level: U_p at I_n	p. 7	1.8 kV		1.8 kV			1.8 kV		1.8 kV	1.2 kV	1.2 kV
Residual voltage: U_{res} at 3 kA		1.5 kV		1.4 kV			1.3 kV		1.2 kV	0.7 kV	1.2 kV
Nominal discharge current: I_n (8/20)	p. 7	5 kA		15 kA			20 kA		30 kA	30 kA	30 kA
Maximum discharge current: I_{max} (8/20)	p. 7	15 kA		40 kA			65 kA		100 kA	100 kA	100 kA
TOV withstand: U_T (5 s)	p. 8	440 V		440 V			440 V		440 V	340 V	-
Operating current: I_c		< 1 mA		< 1 mA			< 1 mA		< 1 mA	< 1 mA	< 1 mA
Short-circuit withstand: I_{cc}		10 kA		25 kA			25 kA		25 kA	25 kA	25 kA
Response time: t_A		≤ 25 ns		≤ 25 ns			≤ 25 ns		≤ 25 ns	≤ 25 ns	≤ 100 ns
Degree of protection		IP 203		IP 203			IP 203		IP 203	IP 203	IP 203
Associated breaking device:											
– gG - gL fuse	p. 37	16 A		16 A			20 A		25 A	25 A	80 A
– curve C circuit-breaker	p. 37	10 A		25 A			32 A		40 A	40 A	40 A
Mechanical characteristics											
L/N connection terminals:											
– solid wire		2.5 ... 25 mm²		2.5 ... 25 mm²			2.5 ... 25 mm²		2.5 ... 25 mm²		
– stranded wire		2.5 ... 16 mm²		2.5 ... 16 mm²			2.5 ... 16 mm²		2.5 ... 16 mm²		
L/N stripping length		12.5 mm		12.5 mm			12.5 mm		12.5 mm		
L/N tightening torque		2 Nm		2 Nm			2 Nm		2 Nm		
PE connection terminal:											
– solid wire		2.5 ... 25 mm²		2.5 ... 25 mm²			2.5 ... 25 mm²		2.5 ... 25 mm²		
– stranded wire		2.5 ... 16 mm²		2.5 ... 16 mm²			2.5 ... 16 mm²		2.5 ... 16 mm²		
PE stripping length		12.5 mm		12.5 mm			12.5 mm		12.5 mm		
PE tightening torque		2 Nm		2 Nm			2 Nm		2 Nm		
Integrated thermal disconnector		Yes		Yes			Yes		Yes		
End of life indicator	p. 18	Yes		Yes			Yes		Yes	Yes	No
Compatibility with OVR Sign	p. 18	Yes		Yes			Yes		Yes	Yes	Yes
Safety reserve (s)	p. 18	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No
Remote indicator (TS)	p. 18	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No
Miscellaneous characteristics											
Storage temperature		-40 °C to +80 °C									
Operating temperature		-40 °C to +80 °C									
Maximum altitude		2000 m									
Case material		PC grey RAL 7032									
Insulating material		UL94 V0 classification									
Reference standards		IEC 61643-1 / EN 61643-11									
Weight		150 g	150 g	150 g	150 g	150 g	150 g	150 g	250 g	250 g	250 g
Maintenance											
Replacement cartridges	p. 35	OVR 15 440 C (2CTB 8138 54 R 06 00)	OVR 15 440 C (2CTB 8138 54 R 06 00)	OVR 40 440 C (2CTB 8138 54 R 04 00)	OVR 40 440 C (2CTB 8138 54 R 04 00)	OVR 40 440 s C (2CTB 8138 54 R 03 00)	OVR 65 440 s C (2CTB 8138 54 R 01 00)	OVR 65 440 s C (2CTB 8138 54 R 01 00)	2 x OVR 100 440 s C (2CTB 8138 54 R 01 00)	2 x OVR 65 275 s C (2CTB 8138 54 R 07 00)	2 x OVR 65 N C (2CTB 8138 54 R 00 00)

ABB surge arrester range

Pluggable multi-pole surge arresters - Power Type 2

OVR 1N 40 275 P

OVR 1N 15 275 s P TS

The maximum available discharge currents (I_{max}) range from 15 to 65 kA (8/20 µs waveform).

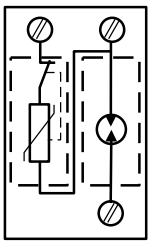
The range consists of 2 and 4-pole models.

Standards Info

The pluggable multi-pole power Type 2 surge arresters comply with IEC 61643-1 and EN 61643-11.

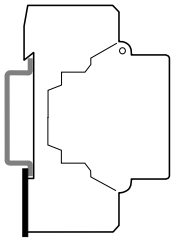
The relevant standard for the installation of this type of surge arrester is: IEC 61643-12.

Schematic diagrams



OVR 1N 15 / 40 / 65 P

Fixing

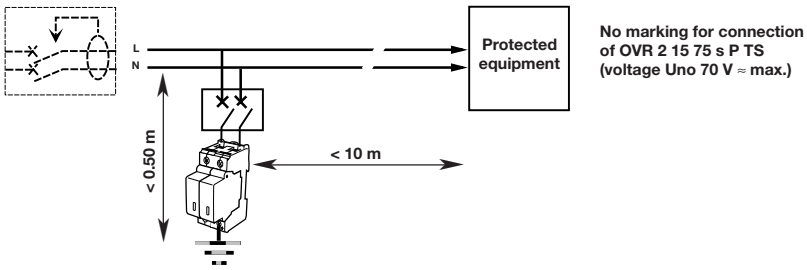


Simply clips onto DIN rail.

Dimensions

Dimensions (mm)	W	H	D
OVR 1N P (all models)	35	85	63

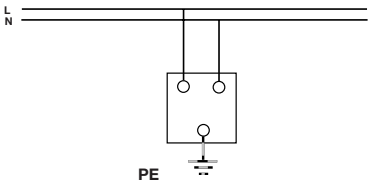
Connection



No marking for connection of OVR 2 15 75 s P TS (voltage Uno 70 V ≈ max.)

OVR 1N P (all models)

Types of network



TT - TNS networks

PRATICAL INFO

Pluggable multi-pole surge arresters are installed in sub-distribution boards using DIN rail. They are used for common and differential mode protection. Maintenance is made easier with pluggable surge arresters as replacement cartridges can be simply plugged-in without the need to isolate the circuit.

ABB surge arrester range

Pluggable multi-pole surge arresters - Characteristics

	More info	15 kA (8/20)			40 kA (8/20)			65 kA (8/20)	
		OVR 2 15 75 s P TS (2CTB 8139 52 R 13 00)	OVR 1N 15 275 P (2CTB 8139 52 R 12 00)	OVR 1N 15 275 P TS (2CTB 8139 52 R 06 00)	OVR 1N 40 275 P (2CTB 8139 52 R 11 00)	OVR 1N 40 275 P TS (2CTB 8139 52 R 05 00)	OVR 1N 40 275 s P TS (2CTB 8139 52 R 02 00)	OVR 1N 65 275 s P (2CTB 8139 52 R 07 00)	OVR 1N 65 275 s P TS (2CTB 8139 52 R 01 00)
Electrical characteristics									
Types of network	p.10	TNC-TNS-TT	TNS - TT		TNS - TT			TNS - TT	
Number of poles		2	2		2			2	
Type of surge arrester		2	2		2			2	
Type of current		A.C. /D.C.	A.C.		A.C.			A.C.	
Nominal voltage: U_n	p. 7	57 V	230 V		230 V			230 V	
Max cont operating voltage: U_c (L-N / L-PE)	p. 8	75 V	275 / 440 V		275 / 440 V			275 / 440 V	
Voltage protection level: U_p at I_n (L-N / L-PE)	p. 7	0.3 / 0.6 kV	1.2 / 1.2 kV		1.2 / 1.2 kV			1.2 / 1.2 kV	
Residual voltage: U_{res} at 3 kA		-	1.0 / 1.0 kV		0.9 / 0.9 kV			0.85 / 0.85 kV	
Nominal discharge current: I_n (8/20)	p. 7	5 kA	5 kA		15 kA			20 kA	
Maximum discharge current: I_{max} (8/20)	p. 7	15 kA	15 kA		40 kA			65 kA	
TOV withstand: U_T (5 s) (L-N / L-PE)	p. 8	N.A.	340 / 440 V		340 / 440 V			340 / 440 V	
Operating current: I_c		< 1 mA	< 1 mA		< 1 mA			< 1 mA	
Short-circuit withstand: I_{cc}		10 kA	10 kA		25 kA			25 kA	
Response time: t_A		≤ 25 ns	≤ 25 ns		≤ 25 ns			≤ 25 ns	
Degree of protection		IP 203	IP 203		IP 203			IP 203	
Associated breaking device:									
– gG - gL fuse	p. 37	16 A	16 A		16 A			20 A	
– curve C circuit-breaker	p. 37	10 A	10 A		25 A			32 A	
Mechanical characteristics									
L/N connection terminals:									
– solid wire		2.5 ... 25 mm²							
– stranded wire		2.5 ... 16 mm²							
L/N stripping length		12.5 mm							
L/N tightening torque		2 Nm							
PE connection terminal:									
– solid wire		2.5 ... 25 mm²							
– stranded wire		2.5 ... 16 mm²							
PE stripping length		12.5 mm							
PE tightening torque		2 Nm							
Integrated thermal disconnector		Yes							
End of life indicator	p. 18	Yes							
Compatibility with OVR Sign	p. 18	Yes							
Safety reserve (s)	p. 18	Yes	No	No	No	No	Yes	Yes	Yes
Remote indicator (TS)	p. 18	Yes	No	Yes	No	Yes	Yes	No	Yes
Miscellaneous characteristics									
Storage temperature		-40 °C to +80 °C							
Operating temperature		-40 °C to +80 °C							
Maximum altitude		2000 m							
Case material		PC grey RAL 7032							
Insulating material		UL94 V0 classification							
Reference standards		IEC 61643-1 / EN 61643-11							
Weight		200 g							
Maintenance									
Replacement cartridges	p. 35	OVR 2 15 75 s C (2CTB 8138 54 R 13 00)	OVR 15 275 C (2CTB 8138 54 R 12 00) + OVR 65 N C (2CTB 8138 54 R 00 00)		OVR 40 275 C (2CTB 8138 54 R 10 00) + OVR 65 N C (2CTB 8138 54 R 00 00)		OVR 40 275 s C (2CTB 8138 54 R 09 00) + OVR 65 N C (2CTB 8138 54 R 00 00)	OVR 65 275 s C (2CTB 8138 54 R 07 00) + OVR 65 N C (2CTB 8138 54 R 00 00)	

ABB surge arrester range

Pluggable multi-pole surge arresters - Power Type 2

OVR 3N 15 275 P

OVR 3N 40 275 s P TS

The pluggable multi-pole modular power Type 2 surge arresters provide protection for equipment against transient overvoltages that occur on the electrical network (mains), whatever the cause: atmospheric (lightning), industrial (operating overvoltages) or from interference.

The maximum available discharge currents (I_{max}) range from 15 to 65 kA (8/20 µs waveform).

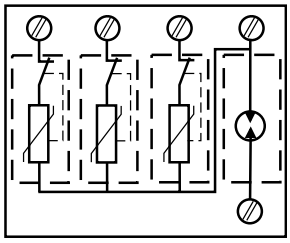
The range consists of 2 and 4-pole models.

Standards Info

The pluggable multi-pole power Type 2 surge arresters comply with IEC 61643-1 and EN 61643-11.

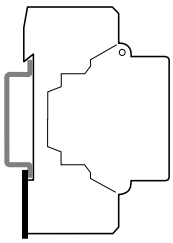
The relevant standard for the installation of this type of surge arrester is: IEC 61643-12.

Schematic diagrams



OVR 3N 15 / 40 / 65 P

Fixing

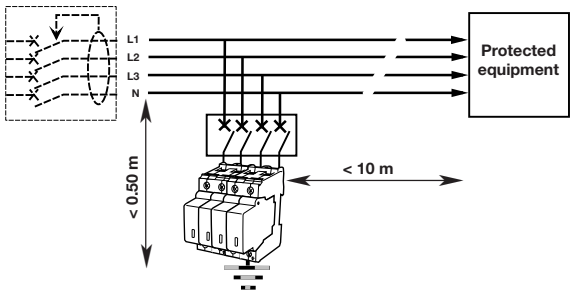


Simply clips onto DIN rail.

Dimensions

Dimensions (mm)	W	H	D
OVR 3N P (all models)	70	85	63

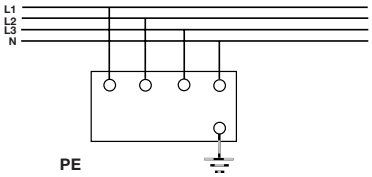
Connection



No marking for connection of OVR 2 15 75 s P TS (voltage Uno 70 V ≈ max.)

OVR 3N P (all models)

Types of network



TT - TNS networks

PRATICAL INFO

Pluggable multi-pole surge arresters are installed in sub-distribution boards using DIN rail. They are used for common and differential mode protection. Maintenance is made easier with pluggable surge arresters as replacement cartridges can be simply plugged-in without the need to isolate the circuit.

ABB surge arrester range

Pluggable multi-pole surge arresters - Characteristics

	More info	15 kA (8/20)		40 kA (8/20)			65 kA (8/20)	
		OVR 3N 15 275 P (2CTB 8139 53 R 12 00)	OVR 3N 15 275 P TS (2CTB 8139 53 R 06 00)	OVR 3N 40 275 P (2CTB 8139 53 R 11 00)	OVR 3N 40 275 P TS (2CTB 8139 53 R 05 00)	OVR 3N 40 275 s P TS (2CTB 8139 53 R 02 00)	OVR 3N 65 275 s P (2CTB 8139 53 R 07 00)	OVR 3N 65 275 s P TS (2CTB 8139 53 R 01 00)
Electrical characteristics								
Types of network	p.10	TNC-TNS-TT		TNS - TT			TNS - TT	
Number of poles		4		4			4	
Type of surge arrester		2		2			2	
Type of current		A.C		A.C.			A.C.	
Nominal voltage: U_n	p. 7	230 V		230 V			230 V	
Max cont operating voltage: U_c (L-N / L-PE)	p. 8	275 / 440 V		275 / 440 V			275 / 440 V	
Voltage protection level: U_p at I_n (L-N / L-PE)	p. 7	1.2 / 1.2 kV		1.2 / 1.2 kV			1.2 / 1.2 kV	
Residual voltage: U_{res} at 3 kA		1.1 / 1.1 kV		0.9 / 0.9 kV			0.85 / 0.85 kV	
Nominal discharge current: I_n (8/20)	p. 7	5 kA		15 kA			20 kA	
Maximum discharge current: I_{max} (8/20)	p. 7	15 kA		40 kA			65 kA	
TOV withstand:								
U_T (5 s) (L-N / L-PE)	p. 8	340 / 440 V		340 / 440 V			340 / 440 V	
Operating current: I_c		< 1 mA		< 1 mA			< 1 mA	
Short-circuit withstand: I_{cc}		10 kA		25 kA			25 kA	
Response time: t_A		≤ 25 ns		≤ 25 ns			≤ 25 ns	
Degree of protection		IP 203		IP 203			IP 203	
Associated breaking device:								
– gG - gL fuse	p. 37	16 A		16 A			20 A	
– curve C circuit-breaker	p. 37	10 A		25 A			32 A	
Mechanical characteristics								
L/N connection terminals:								
– solid wire		2.5 ... 25 mm²						
– stranded wire		2.5 ... 16 mm²						
L/N stripping length		12.5 mm						
L/N tightening torque		2 Nm						
PE connection terminal:								
– solid wire		2.5 ... 25 mm²						
– stranded wire		2.5 ... 16 mm²						
PE stripping length		12.5 mm						
PE tightening torque		2 Nm						
Integrated thermal disconnector		Yes						
End of life indicator	p. 18	Yes						
Compatibility with OVR Sign	p. 18	Yes						
Safety reserve (s)	p. 18	No	No	No	No	Yes	Yes	Yes
Remote indicator (TS)	p. 18	No	Yes	No	Yes	Yes	No	Yes
Miscellaneous characteristics								
Storage temperature		-40 °C to +80 °C						
Operating temperature		-40 °C to +80 °C						
Maximum altitude		2000 m						
Case material		PC grey RAL 7032						
Insulating material		UL94 V0 classification						
Reference standards		IEC 61643-1 / EN 61643-11						
Weight		200 g						
Maintenance								
Replacement cartridges	p. 35	3 x OVR 15 275 C (2CTB 8138 54 R 12 00) + 1 x OVR 65 N C (2CTB 8138 54 R 00 00)		3 x OVR 40 275 C (2CTB 8138 54 R 10 00) + 1 x OVR 65 N C (2CTB 8138 54 R 00 00)		3 x OVR 40 275 s C (2CTB 8138 54 R 09 00) + 1 x OVR 65 N C (2CTB 8138 54 R 00 00)	3 x OVR 65 275 s C (2CTB 8138 54 R 07 00) + 1 x OVR 65 N C (2CTB 8138 54 R 00 00)	

ABB surge arrester range

Low current surge arresters - Modular

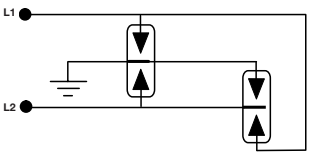
OVR TC 06 V

OVR TC 200 FR

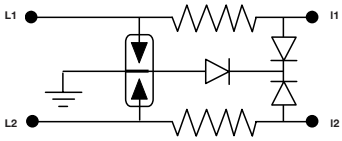
Transmission line surge arresters (OVR TC) provide protection against transient overvoltages for equipment connected to telephone lines (digital or analog), computer links or current loops, for applications such as RS-485, 4-20 mA.

Standars Info
Modular low current surge arresters comply with IEC 61643-21.

Schematic diagrams



OVR TC 200 V in parallel

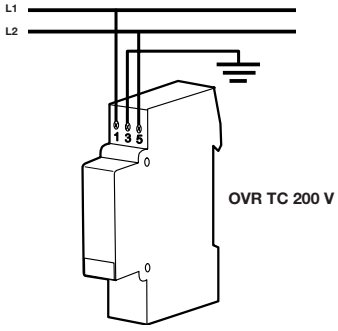


OVR TC / xx V / 200 FR in series

Dimensions

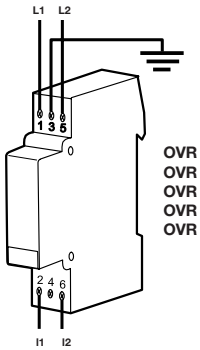
Dimensions (mm)	W	H	D
OVR TC (all models)	17.5	85	63

Connection



OVR TC 200 V

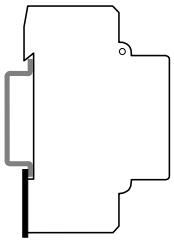
OVR TC 200 V in parallel



OVR TC 200 FR
OVR TC 48 V
OVR TC 24 V
OVR TC 12 V
OVR TC 06 V

OVR TC / xx V / 200 FR in series

Fixing



Simply clips onto DIN rail.

PRATICAL INFO
Telecom and dataline protection surge arresters are installed in electrical switchboards or enclosures using DIN rail.

ABB surge arrester range

Low current surge arrester - Characteristics

	More info	6 V OVR TC 06 V (2CTB 8138 14 R 01 00)	12 V OVR TC 12 V (2CTB 8138 14 R 02 00)	24 V OVR TC 24 V (2CTB 8138 14 R 03 00)	48 V OVR TC 48 V (2CTB 8138 14 R 04 00)	200 V OVR TC 200 V (2CTB 8138 14 R 05 00)	200 V OVR TC 200 FR (2CTB 8138 14 R 00 00)
Electrical characteristics							
Types of network		Communication	Communication	Communication	Communication	Communication	Communication
Number of pairs		1	1	1	1	1	1
Type of protection		Series	Series	Series	Series	Parallel	Series
Type of current		Low currents	Low currents	Low currents	Low currents	Low currents	Low currents
Nominal voltage: U_n	p. 7	6 V	12 V	24 V	48 V	200 V	200 V
Max cont operating voltage: U_c	p. 8	7 V	14 V	27 V	53 V	220 V	220 V
Voltage protection level: U_p at I_n	p. 7	15 V	20 V	35 V	70 V	700 V	300 V
Nominal discharge current: I_n (8/20)	p. 7	5 kA	5 kA	5 kA	5 kA	5 kA	5 kA
Maximum discharge current: I_{max} (8/20)	p. 7	10 kA	10 kA	10 kA	10 kA	10 kA	10 kA
Bandwidth		10 MHz	2 MHz	4 MHz	6 MHz	100 MHz	3 MHz
Operating current: I_c		20 mA	20 mA	20 mA	20 mA	-	20 mA
Degree of protection		IP 203	IP 203	IP 203	IP 203	IP 203	IP 203
50 Hz withstand (15 mn)		10 A	10 A	10 A	10 A	-	10 A
Mechanical characteristics							
L/N connection terminals:							
– solid wire		0.5 ... 2.5 mm^2					
– stranded wire		0.5 ... 2.5 mm^2					
PE connection terminal:							
– solid wire		0.5 ... 2.5 mm^2					
– stranded wire		0.5 ... 2.5 mm^2					
Integrated thermal disconnector	p. 18	Yes				No	Yes
End of life indicator	p. 18	Yes				No	Yes
Compatibility with OVR Sign	p. 18	Yes				No	Yes
Miscellaneous characteristics							
Storage temperature		-40 °C to +80 °C					
Operating temperature		-40 °C to +80 °C					
Maximum altitude		2000 m					
Case material		PC grey RAL 7032					
Insulating material		UL94 V0 classification					
Reference standard		IEC 61643-21					
Weight		150 g					

Optical Monitoring Block (OVR Sign)

Cartridges for plugable
Type 1 surge arresters

Cartridges for plugable
Type 2 surge arresters

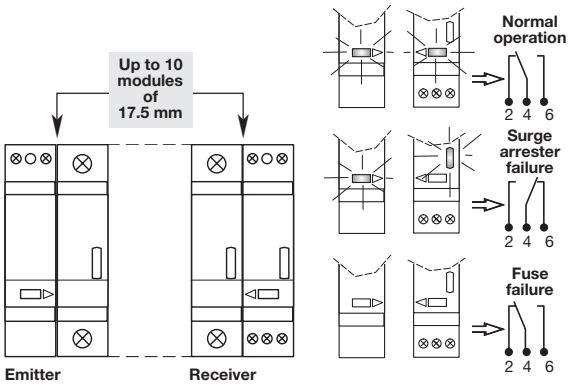
Cartridge lock

Maintenance

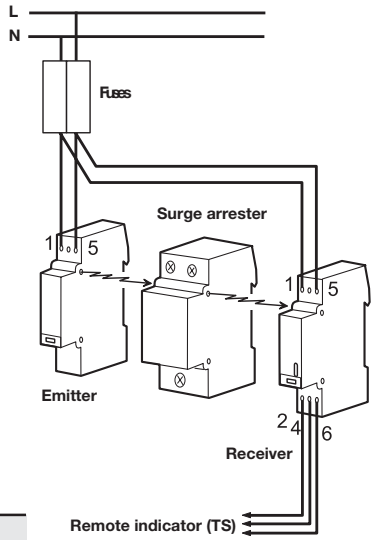
The Optical Monitoring Block (OVR Sign) is installed on the DIN rail at each end of the surge arrester (power and low current) row in the electrical switchboard. It enables remote indication of the state of the modular surge arrester group (except for OVR TC 200 V), up to 10 modules of 17.5 mm.

Optical Monitoring Block (OVR Sign)

Operation



Connection

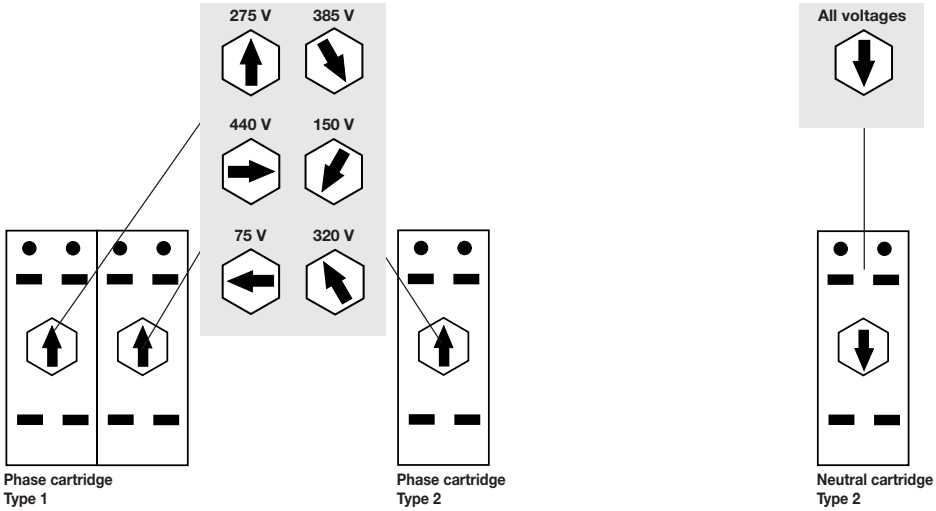


Dimensions

Dimensions (mm)	W	H	D
OVR Sign	17.5	85	63

Plugable surge arrester cartridges

Foolproof pin system



Catridge lock

The cartridge lock ensures that the cartridge remains plugged on the base, even in shock or vibration environments.

Cartridge lock OFF

Cartridge lock ON

ABB surge arrester range

OVR Sign - Cartridges - Characteristics

Optical Monitoring Block

Caracteristics	More info	OVR Sign (2CTB 8138 15 R 00 00)
Use (230 / 400 V)	p. 18	Single phase
Number of modules		1 + 1
Emitter consumption in monitoring mode		< 10 mA
Receiver consumption in monitoring mode		< 10 mA
TS contact characteristics :		
– min. voltage		5 V C.C.
– min. current		10 mA
– max. voltage (50Hz)		250 V
– max. current (50Hz)		5 A
Surge arresters monitored		OVR (power) / OVR TC (telecom)
Number of surge arrester modules monitored		10 modules of 17.5 mm
Display of optical link		By diode on emitter and receiver
Indication of surge arrester failure		By red indicator lamp on receiver
Connection terminal capacity		2.5 mm^2 (solid wire)
Storage temperature		- 40 °C to + 70 °C
Operating temperature		- 20 °C to + 40 °C
Breaking device		2 A fuse

Replacement cartridges for pluggable Type 1 surge arrester

Caracteristics	More info	15 kA (10/350)	
Voltage		275 V	440 V
Model with Safety Reserve (s)	p. 7	OVR HL 15 255 s C	OVR HL 15 440 s C
		(2CTB 8152 50 R 04 00)	(2CTB 8152 50 R 03 00)

Replacement cartridges for pluggable Type 2 surge arrester

Caracteristics	More info	15 kA (8/20)			40 kA (8/20)		65 kA (8/20)		Neutral
Voltage		75 V	275 V	440 V	275 V	440 V	275 V	440 V	255 V
Model with Safety Reserve (s)	p. 7	OVR 2 15 75 s C (2CTB 8138 54 R 13 00)			OVR 40 275 s C (2CTB 8138 54 R 09 00)	OVR 40 440 s C (2CTB 8138 54 R 03 00)	OVR 65 275 s C (2CTB 8138 54 R 07 00)	OVR 65 440 s C (2CTB 8138 54 R 01 00)	
Model without Safety Reserve (s)			OVR 15 275 C (2CTB 8138 54 R 12 00)	OVR 15 440 C (2CTB 8138 54 R 06 00)	OVR 40 275 C (2CTB 8138 54 R 10 00)	OVR 40 440 C (2CTB 8138 54 R 04 00)			OVR 65 N C (2CTB 8138 54 R 00 00)

Cartridges lock

Caracteristics	More info	2CTB 8143 55 R 12 00 (x 4 cartridge lock))
Case material	p. 18	PC black
Dimensions		15 x 20 x 5 mm
Weight		2 g

Installation rules for surge arresters

Positioning

The incoming surge arrester is fitted immediately downstream the installation's main isolating device.

The surge arrester must:

- be consistent with the allowable voltages of the equipment to be protected.
- be close by the equipment to be protected.
- be coordinated with the other surge arresters.

What measures are to be taken to limit overvoltages ?

Avoid rings over large surfaces and use the same routing for the power and low current cables whilst respecting spacing and crossing rules for the two networks.

Be aware of the equipment and installations (lifts, lightning rods) that generate overvoltages. Identify their position with respect to sensitive equipment and either ensure there is sufficient distance between them or that overvoltage protection is installed.

Favour the use of screening for equipment and cables, and carry out equipotential bonding using braiding of a shorter length as possible between all metallic parts entering, leaving or within the building.

Be aware of the different earthing systems in order to adapt the overvoltage protection and avoid the TN-C system if there is sensitive equipment in the installation.

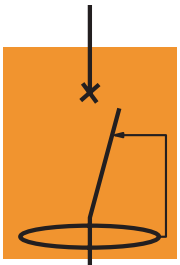
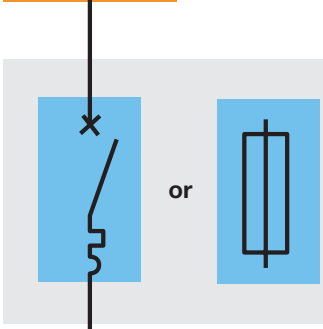
Correctly select the thermal and short-circuit protection devices. Favour type S (delayed or selective) Residual Current Device (D 90 or F 390) for protection against indirect contact in order to avoid nuisance tripping.

Installation rules

Choice of associated breaking device (fuse / circuit-breaker)

Choice of disconnector

Surge arresters must be associated with upstream short-circuit protection and residual current protection against indirect contact (usually already present in the installation).

	Function	Application
	**Protection against indirect contact**	• Residual current circuit-breaker compulsory for TT systems • Residual current circuit-breaker possible for TN-S, IT and TN-C-S systems • Residual current circuit-breaker forbidden for TN-C systems If a residual current circuit-breaker is used, it is preferable to use a type S. Otherwise there is a risk of nuisance tripping. This does not affect the effectiveness of the surge arrester, but may cause the circuit to be opened.
	**Protection against fault currents**	The breaking device associated with the surge arrester can be either a circuit breaker or a fuse. Its rating should take into consideration the surge arrester's characteristics and the short-circuit current of the installation.
	**Thermal protection**	Thermal protection is integrated into the surge arrester.

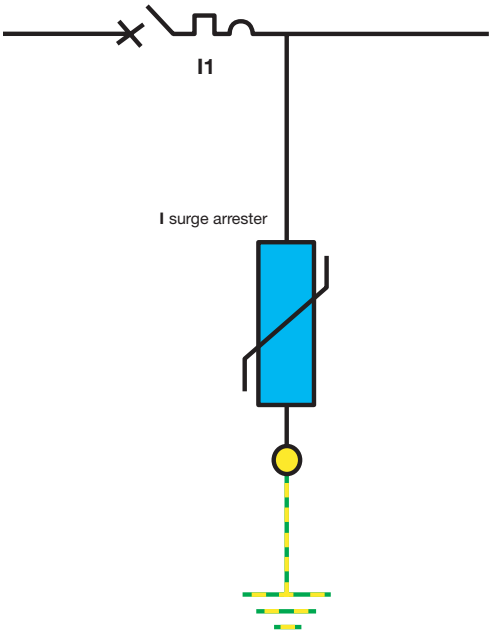
Installation rules

Wiring / connection

Possible

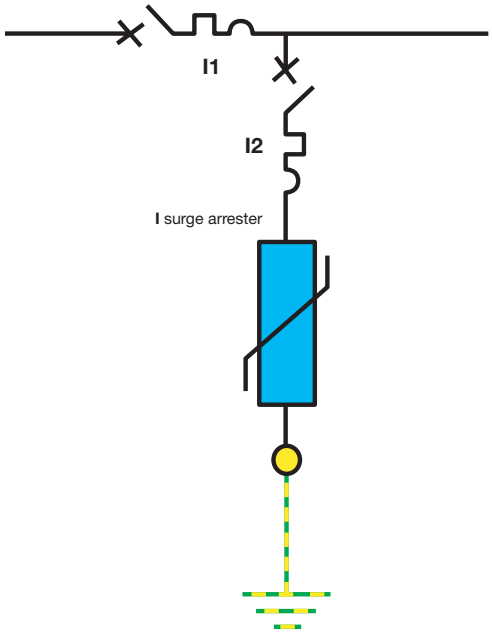
Priority is given to protection

I1 < **I** surge arrester



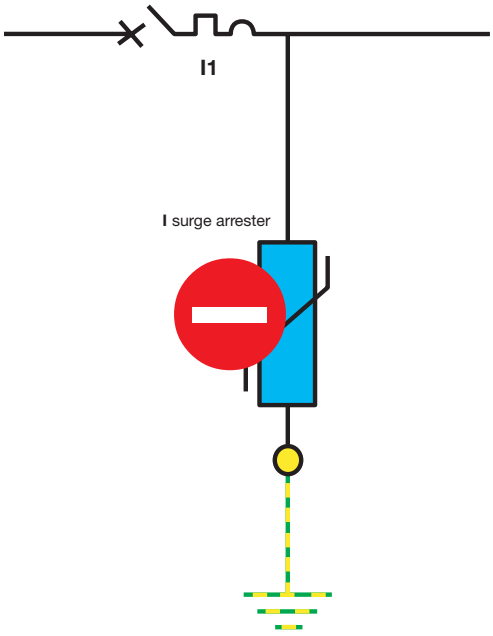
Priority is given to continuity of service

I1 > **I** surge arrester and **I2** < **I** surge arrester

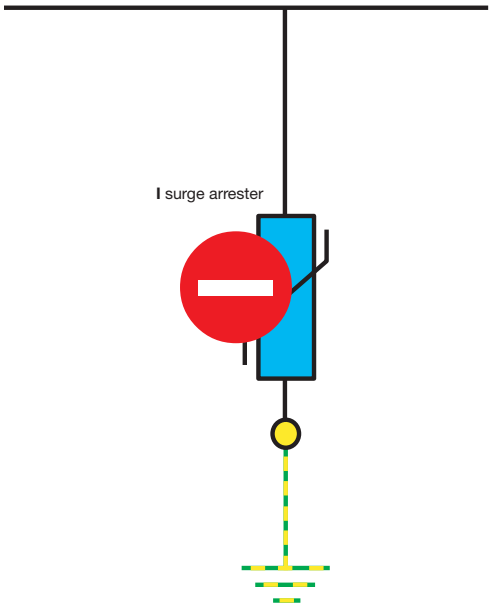


Forbiden

I1 > **I** surge arrester



No protection



Note:

Priority is given to protection:

At the end of the surge arrester's service life, the rest of the installation can no longer be fed.

The surge arrester that has failed must be replaced.

Priority is given to continuity of service:

At the end of the surge arrester's service life, it can be isolated from the rest of the installation.

The network can be re-established without the need to rewire the switchboard.

In this configuration, the equipment is no longer protected.

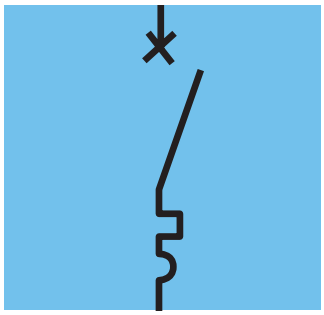
Replace the surge arrester as quickly as possible.

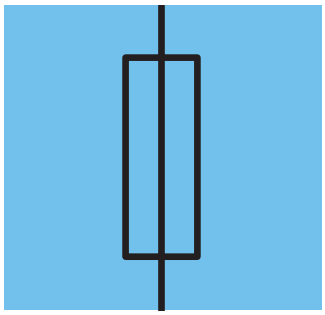
- **I1** and **I2**: current ratings of the circuit-breaker(s) or fuse(s).
- **I** surge arrester: recommended current for surge arrester protection (see table on the following page).

Installation rules

Choice of disconnector (fuse / circuit-breaker)

Maximum circuit-breaker or fuse protection rating depending on I_{max} and I_{imp} of the surge arrester.





Type 1 surge arresters	Circuit-breaker (curve C)	Fuse (gG)
15 kA (10/350)		
• I_{cc} = 300 A to 1 kA	40 A (1)	25 A
• I_{cc} = 1 kA to 7 kA	40 A to 50 A (2)	50 A
• I_{cc} = 7 kA and above	40 A to 63 A (3)	63 A

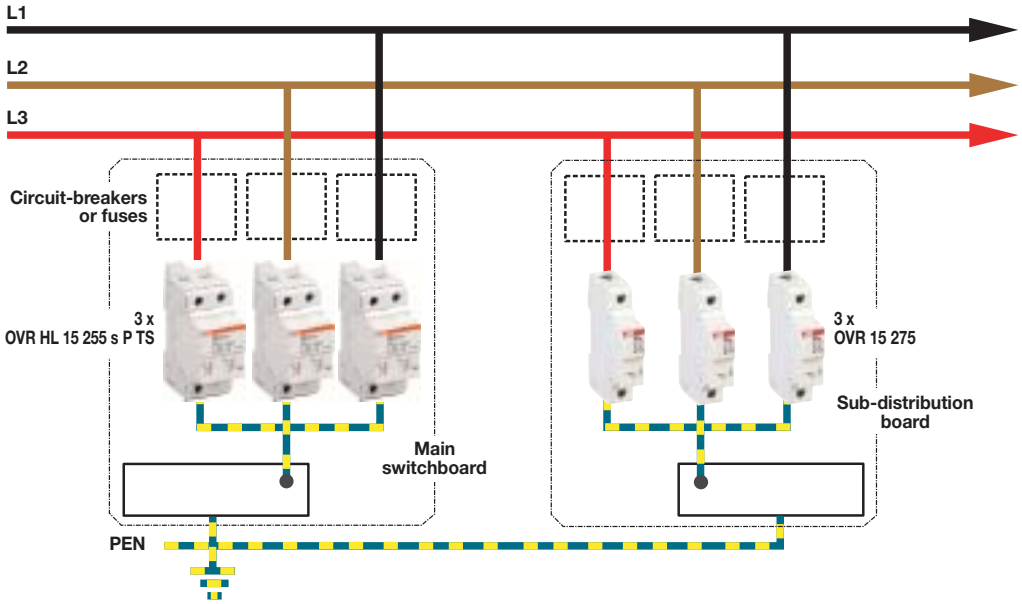
Type 2 surge arresters	Circuit-breaker (curve C)	Fuse (gG)
100 kA (8/20)		
• I_{cc} = 300 A to 1 kA	40 A (1)	25 A
• I_{cc} = 1 kA to 7 kA	40 A to 50 A (2)	50 A
• I_{cc} = 7 kA and above	40 A to 63 A (3)	63 A
65 kA (8/20)		
• I_{cc} = 300 A to 1 kA	30 A (1)	20 A
• I_{cc} = 1 kA to 7 kA	32 A to 40 A (2)	40 A
• I_{cc} = 7 kA and above	32 A to 63 A (3)	63 A
40 kA (8/20)		
• I_{cc} = 300 A to 1 kA	25 A (1)	16 A
• I_{cc} = 1 kA to 7 kA	25 A (2)	25 A
• I_{cc} = 7 kA and above	25 A to 50 A (3)	50 A
15 kA (8/20)		
• I_{cc} = 300 A to 1 kA	10 A to 25 A (1)	16 A
• I_{cc} = 1 kA to 7 kA	10 A to 32 A (2)	16 A
• I_{cc} = 7 kA and above	10 A to 40 A (3)	25 A to 40 A

(1) Series S 230 and S 240.
(2) Series S 240 and S 250.
(3) Series S 270 to S 290.

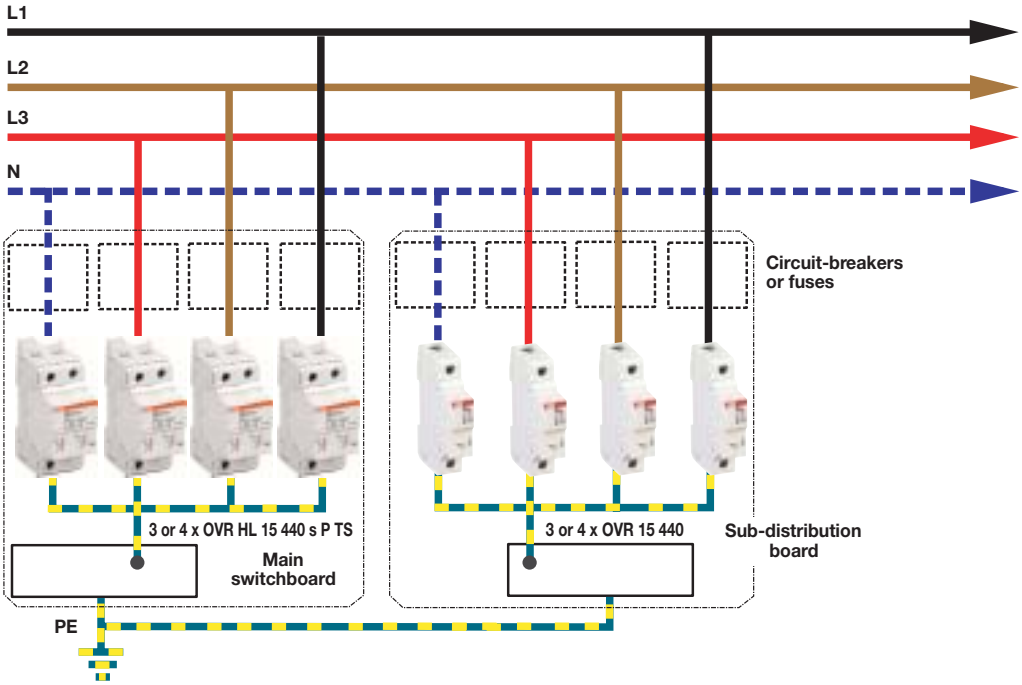
Installation rules

Wiring diagrams according to the earthing system

Three-phase TNC system (for 230 V installations)

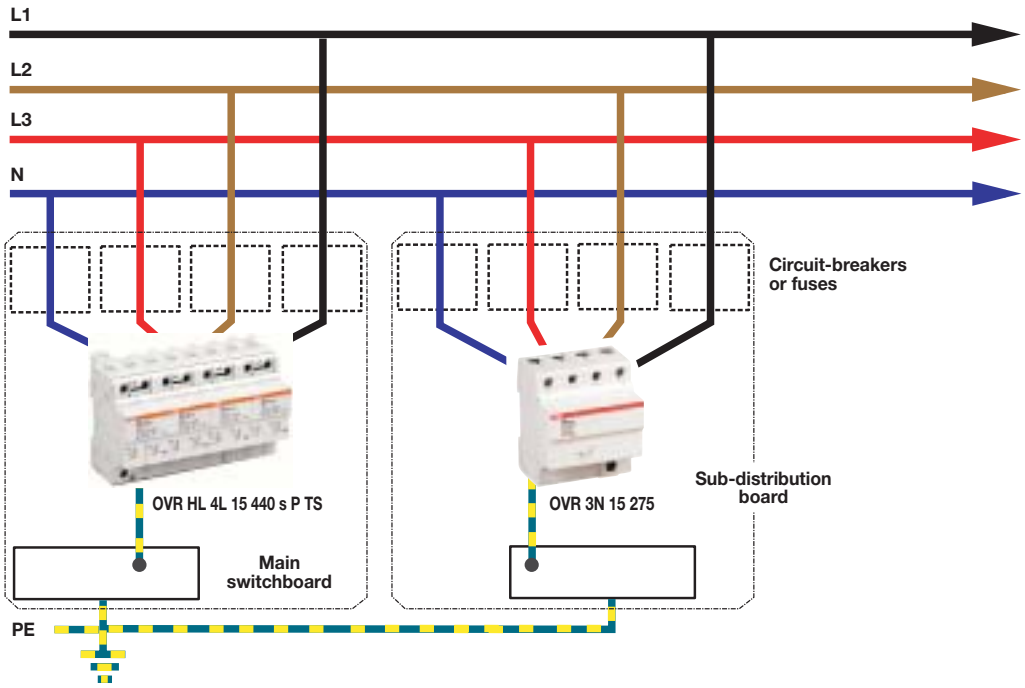


Three-phase + Neutral IT system

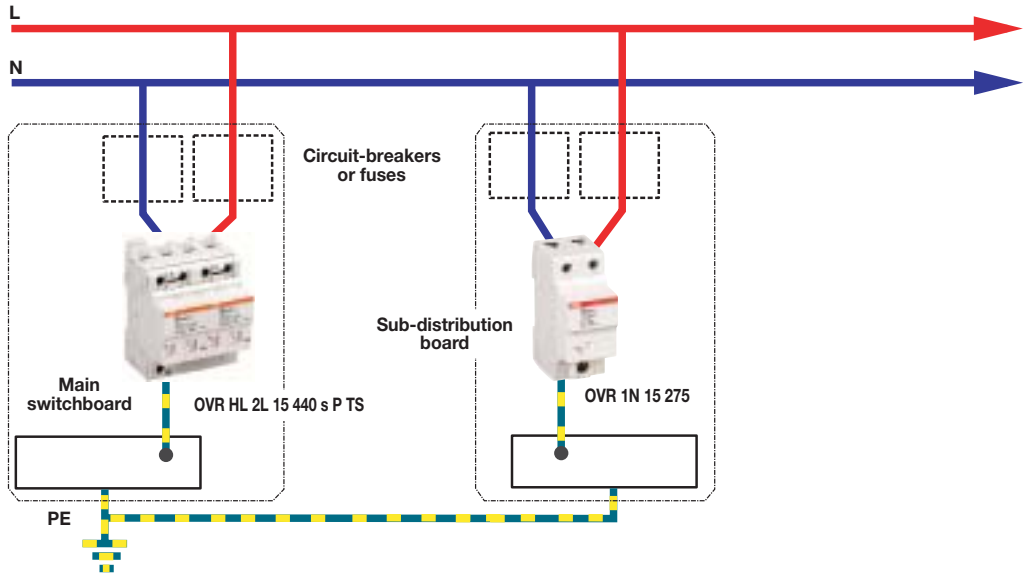


Note:
If continuity of service is essential, the "isolated neutral" (IT) configuration is the most reliable way of limiting breaks in the supply.

Three-phase + Neutral TNS system



Single-phase TT system

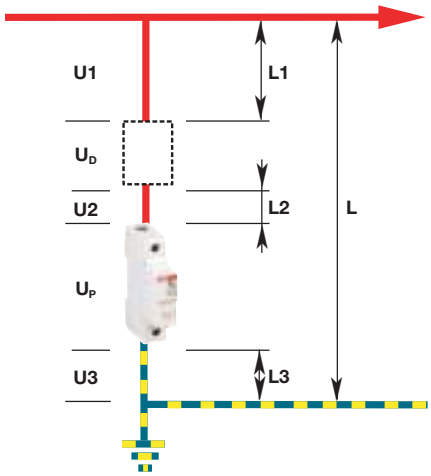


Installation rules

Cabling and installations of surge arresters in an electrical panel

50 cm rule

Remember that a 10 kA lightning current passing through a 1 m length of cable generates 1000 Volts. Equipment protected by a surge arrester is subjected to a voltage equal to the sum of the U_p voltage of the surge arrester, U_d of its disconnector and the sum of the inductive voltages of connecting cables (**U1**+**U2**+**U3**).
It is therefore essential that the total length (L = L1+L2+L3) of the connecting cables is as short as possible (0.50 m).



If this length (L = L1 + L2+L3) exceeds 0.50m, it is necessary to carry out one of the following:

- Reduce this length by moving the connection terminals.
- Choose a surge arrester with a lower U_p value.
- Install a second, coordinated surge arrester near the device to be protected so as to adapt the combined U_p value to the impulse withstand of the equipment to be protected.

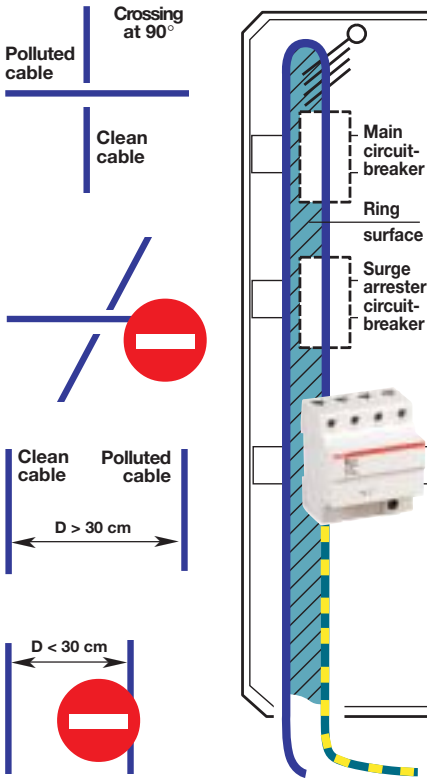
Wiring ring surfaces

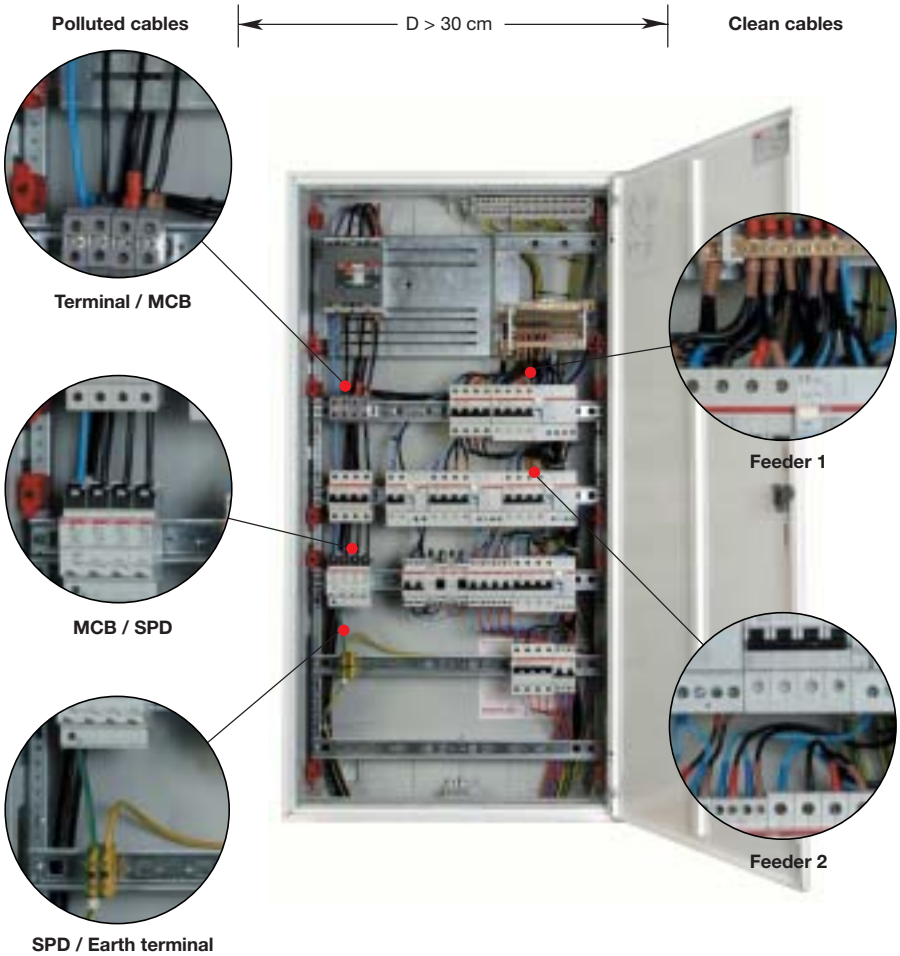
The wires must be arranged in such a way that they are as close to each other as possible (see adjacent diagram) to avoid overvoltages induced by a ring surface between phases, the neutral and the PE conductor.

Routing of clean cables and polluted cables

During installation, lay clean cables (protected) and polluted cables as shown in the adjacent diagrams.

To avoid magnetic coupling between the different cable types (clean and polluted), it is strongly advised that they are kept apart (> 30 cm) and if a crossing cannot be avoided, it should be at right angles (90°).





Note:
The cross-section of the connecting cables is calculated according to the local short-circuit current level (where the surge arrester is installed). It must be equal to the cross-section of the installation's upstream cables.

The minimum cross-section for the earth conductor is 4 mm² if there is not a lightning conductor and 10 mm² if there is a lightning conductor.

Equipotential grounding:

It is critical to check the earth equipotentiality of the various items of equipment.

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by reference

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by code

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