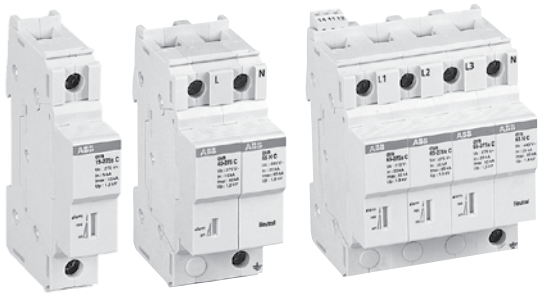
Transient voltage surge supressors
TVSS, OVR range



Description

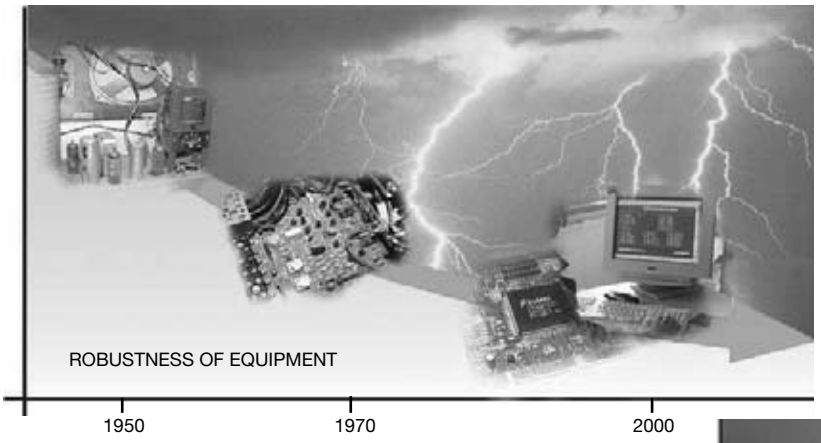
- Compact
- DIN rail mounting
- Broad range
- 1, 2, 3, & 4 pole versions
- Replaceable plug cartridges
- Finger safe
- 15, 40, 65 & 100 kA versions
- Three position visual status indication
- Auxiliary contact for remote signalling
- UL 1449, File # E238957 & E22406

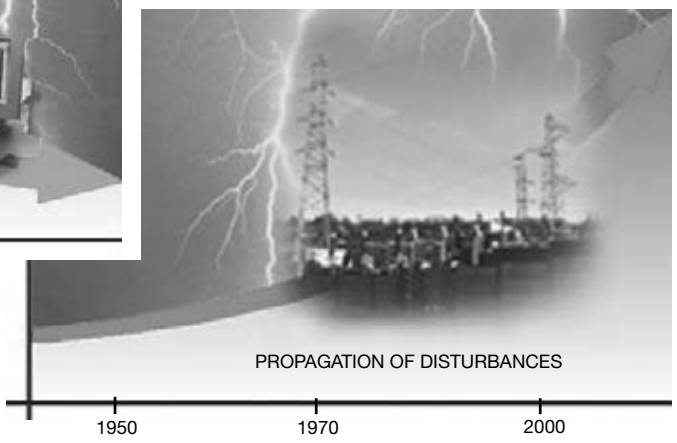
General points on lightning and its risks
Causes of transient overvoltages

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.





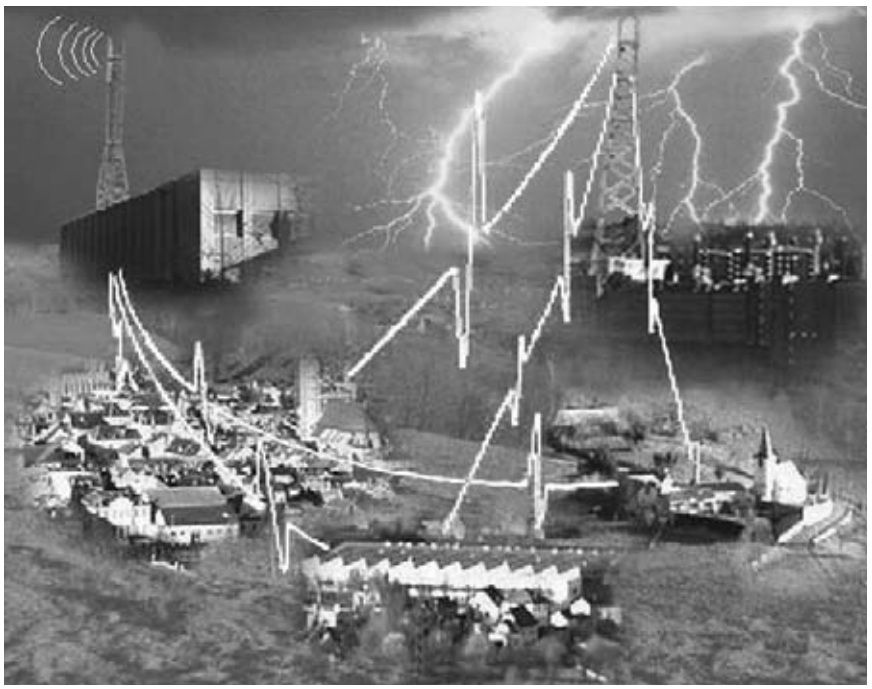
Causes of transient overvoltages

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

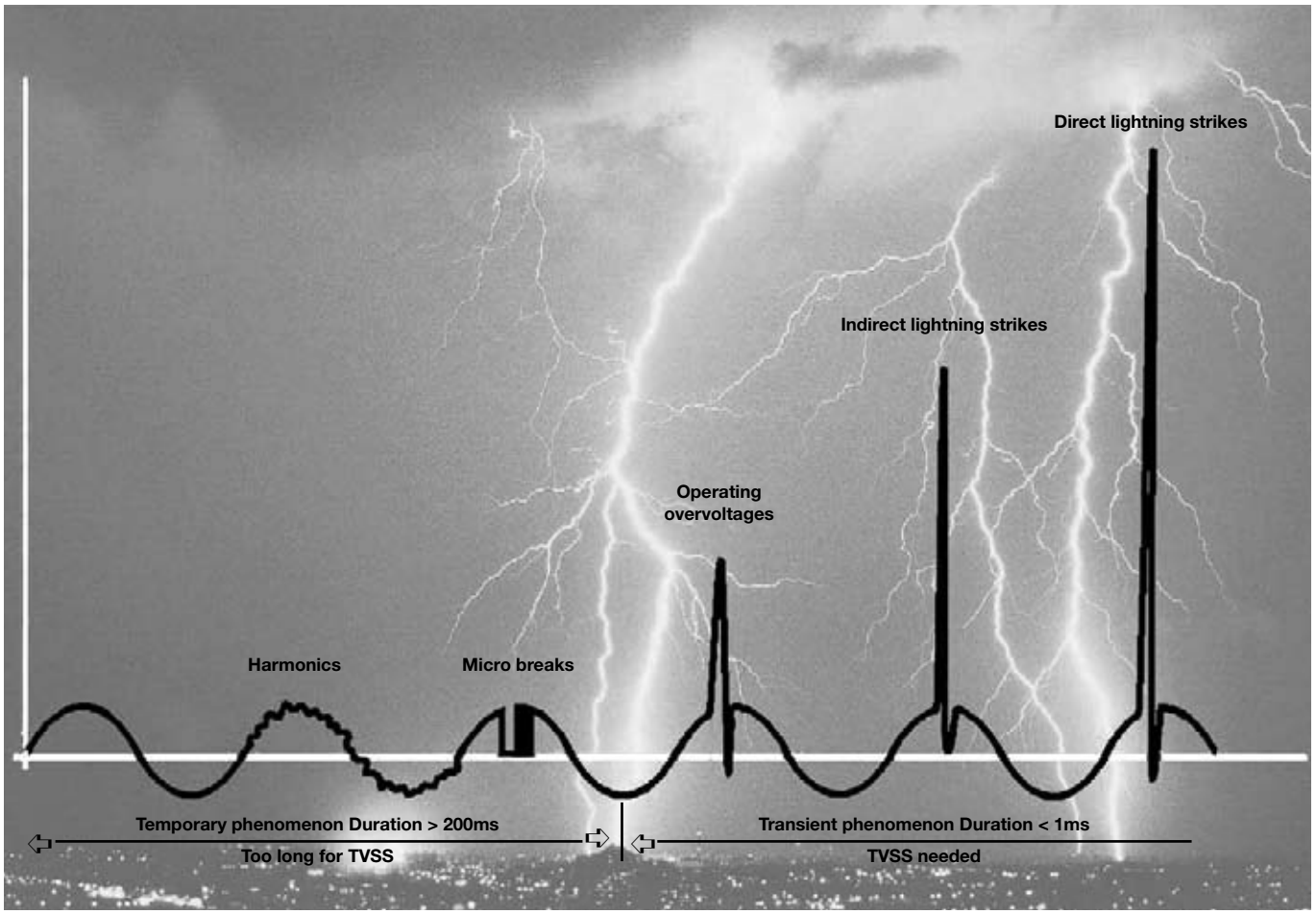
Magnetic field

Electrostatic field

Different types of surges

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

Different type of power supply disturbances

- Atmospheric discharges
- Industrial interferences
- Switching operations on the power distribution system

Main effects

- Destruction of the equipment
- Premature aging
- Incorrect operations

OVR Range
Main features

TVSSs protect installations by limiting transient overvoltages and run-off lightning currents for electric and electronic equipment.
They are divided into three families:

• **Type 2 TVSSs** provide protection for equipment against transient overvoltage and they are installed in the Main Switch Board (MSB), or in the Sub-Distribution Board (SDB).

In addition to the standard TVSSs, two options are available: the Safety reserve system and the remote indication (TS), in order to ensure a preventive maintenance of the installation.

ABB TVSS (OVR range) offer the same “plus” advantages of the other System pro M compact devices, in order to get a perfect compatibility with all the modular range of products.

All these TVSS products comply with the international standard IEC 61643-1 and the European standard EN 61643-11.

They also comply with UL 1449 and CSA C22.2.

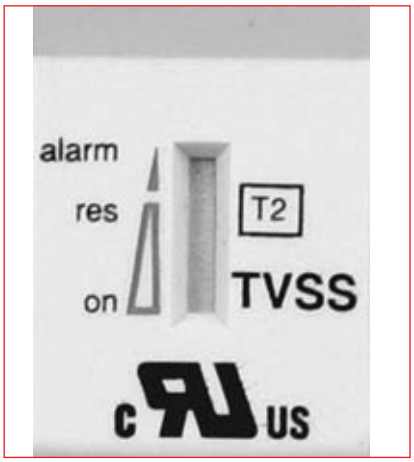
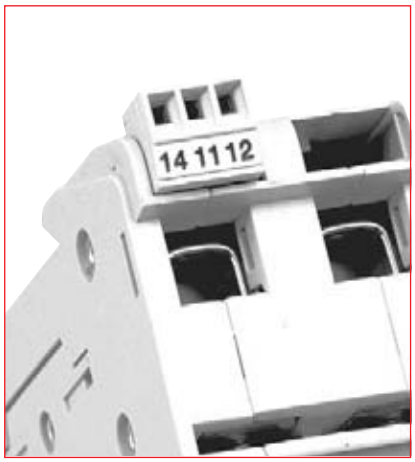
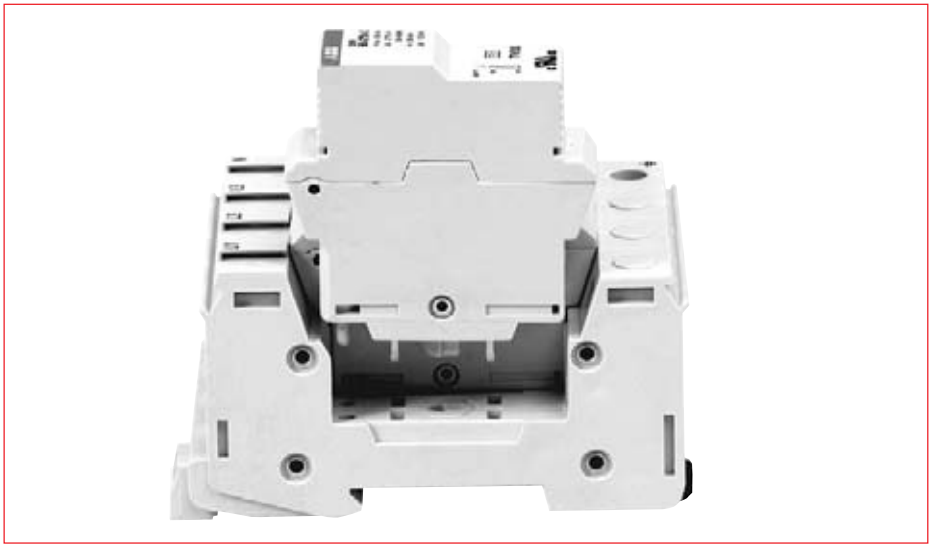
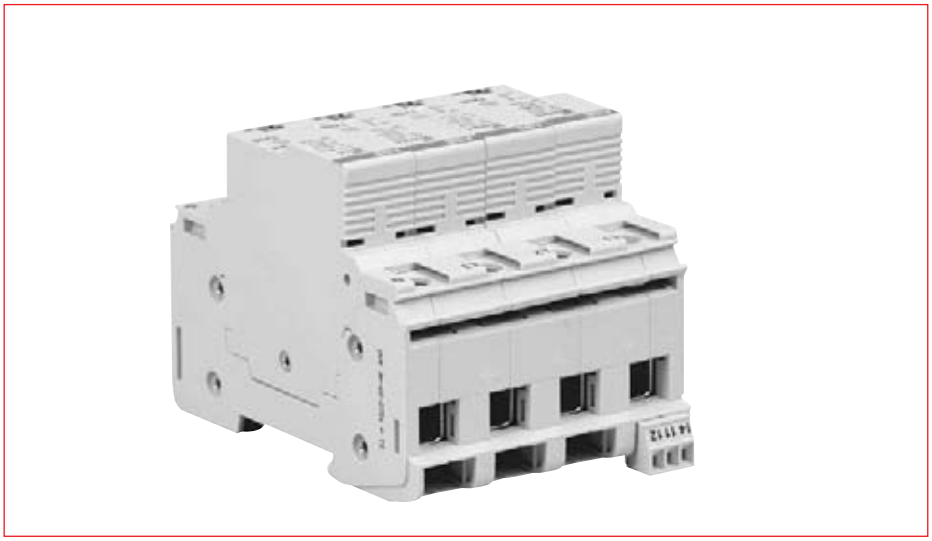


ABB safety reserve system



Contact for alarm connection


Pluggable unit / replacement modules


DIN rail unit, easy installation and wiring

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Technical data
OVR range

Technical Features				Type 2
Electrical features	Standards			IEC 61643-1 / EN 61643-11 / UL1499 / CSA
	Type / test class			T2 / II
	Poles			1P / 1P+N / 3P / 3P+N / 4P
	Types of networks			TNS - TT - TNC - IT / Wye / Delta
	Type of current			A.C.
	Nominal voltage Un		V	All US network voltages
	Max. cont. operating voltage Uc	(L-N / L-PE / N-PE)	V	150 / 275 / 320 / 440 / 550 / 660
	Voltage protection level Up at In	(L-N / L-PE / N-PE)	kV	0.6 / 1.2 / 1.4 / 1.8 / 2.5 / 2.9
	Nominal discharge current In (8/20)		kA	5 / 15 / 20 / 30
	Maximal discharge current Imax (8/20)		kA	15 / 40 / 65 / 100
	Impulse current Iimp (10/350)		kA	/
	Follow current If_i		kA	None
	Operating current Ic		mA	< 1
	Short circuit withstand Icc		kA	50
	Disconnector			
	gG - gL fuse		A	16 - 25
	curve C circuit breaker		A	10 - 40
	curve K circuit breaker			
Mechanical features	Stocking temperature		°C	-40 to +80
	Operating temperature		°C	-40 to +80
	Degree of protection			IP 20
	Fire resistance according to UL 94			V2
	Material of Housing			PC grey RAL 7035
	Maximal altitude		m	2000
	Integrated thermal disconnector			Yes
	State indicator			Yes
	Compatibility with OVR Sign			Yes
	Safety reserve			Option
	TS remote indicator			Option
Installation	Wire range L/N			
	solid wire		mm^2	2.5 ... 25
	stranded wire		mm^2	2.5 ... 16
	Stripping length L/N		mm	12.5
	Tightening torque L/N		Nm	2
	Wire range PE			
	solid wire		mm^2	2.5 ... 25
	stranded wire		mm^2	2.5 ... 16
	Stripping length PE		mm	12.5
	Tightening torque PE		Nm	2
Dimensions and weight	Pole dimensions (H x D x W)		mm	85 x 58 x 17.5
	Pole weight		g	120
Technical Features of the integrated auxiliary contact				
Electrical features	Contact complement			1NO (1 make contact), 1NC (1 normally closed contact)
	Min. load			12V D.C. - 10 mA
	Max. load			250V A.C. - 1A
Installation	Connection cross-section		mm^2	1.5

OVR Range
Single pole

Transient voltage surge suppressor

Function: TVSS provides protection for equipment against transient overvoltage (indirect lightning strike) that occur on the electrical network (mains); the maximum discharge current (Imax) ranges from 15 to 100 kA per pole, based on MOV technology.

Application: residential, commercial, industrial
Standard: CEI 61643-1 / EN 61643-11 / UL 1449 / CSA
8/20 current wave

Type 2 - Surge Protection Devices – Single pole

Max Discharge Current (KA)	Nominal Voltage (V)	MOV Voltage (V)	Voltage Protection Level Up (KV)	Catalog number
15	120	150	.06	OVR 15 150 OVR 15 150 s P
	230	275	1.2	OVR 15 275 OVR 15 275 P TS
	277	320	1.4	OVR 15 320
	400	440	1.8	OVR 15 440 OVR 15 440 P
	480	550	2.5	OVR 15 550
	600	660	2.9	OVR 15 660
40	120	150	0.6	OVR 40 150 s P OVR 40 150 s P TS
	230	275	1.2	OVR 40 275 P OVR 40 275 s P OVR 40 275 s P TS
	277	320	1.4	OVR 40 320 P OVR 40 320 s P OVR 40 320 s P TS
	400	440	1.8	OVR 40 440 OVR 40 440 s P OVR 40 440 s P TS
	480	550	2.5	OVR 40 550 OVR 40 550 s
	600	660	2.9	OVR 40 660 s
65	120	150	0.6	OVR 65 150 s P
	230	275	1.2	OVR 65 275 s P OVR 65 275 s P TS
	277	320	1.4	OVR 65 320 s P OVR 65 320 s P TS
	400	440	1.8	OVR 65 440 s P OVR 65 440 s P TS
	480	550	2.5	OVR 65 550 s
	600	660	2.9	OVR 65 660 s
100	230	275	1.2	OVR 100 275 s P OVR 100 275 s P TS
	277	320	1.4	OVR 100 320 s P OVR 100 320 s P TS
	400	440	1.8	OVR 100 440 s OVR 100 440 s P OVR 100 440 s P TS

OVR 1N 65 275 s P TS ①

Network
1N Single phase (left), neutral (right)
3N Three phase (left), neutral (right)
N1 Neutral (left), single phase (right)
N3 Neutral (left), three phases (right)
3L Three poles
4L Four poles
Nothing Single pole

Max. discharge current 8/20
I_{max} (kA) 15, 40, 65, 100

TS Integrated remote indication

P Pluggable unit
Nothing: Single block

s with safety reserve

Max. continuous operating voltage
U_c (V) 660, 550, 440, 385, 320, 275, 150, 75

① This part number breakdown only explains our part numbering system; it is not to be used to build a part number for ordering purposes.

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OVR TVSS
Multi-pole

Transient voltage surge suppressor

Function: TVSS provides protection for equipment against transient overvoltage (indirect lightning strike) that occur on the electrical network (mains); the maximum discharge current (Imax) ranges from 15 to 100 kA per pole, based on MOV technology.

Application: residential, commercial, industrial
Standard: CEI 61643-1 / EN 61643-11 / UL 1449 / CSA
8/20 current wave

Max Discharge Current (KA)	Nominal Voltage (V)	MOV Voltage (V)	Voltage Protection Level Up (KV)	Catalog number
15	120	150	0.6	OVR 1N 15 150 OVR 1N 15 150 s P TS OVR 3N 15 150
	230	275	1.2	OVR 3L 15 275 P OVR 3N 15 275
	277	320	1.4	OVR 3N 15 320
40	120	150	0.6	OVR 1N 40 150 s P OVR 1N 40 150 s P TS OVR 3N 40 150 s P TS
	230	275	1.2	OVR 3N 40 275 s P OVR 3L 40 275 s P
	277	320	1.4	OVR 3N 40 320 P OVR 3N 40 320 s P OVR 3N 40 320 s P TS
	400	440	1.8	OVR 3N 40 440 s P
65	120	150	0.6	OVR 1N 65 150 s P OVR 3N 65 150 s P OVR 3N 65 150 s P TS
	230	275	1.2	OVR 3L 65 275 s P OVR 3N 65 275 s P
	277	320	1.4	OVR 3N 65 320 s P OVR 3N 65 320 s P TS
	400	440	1.8	OVR 3N 65 440 s P OVR 4L 65 440 s
100	277	320	1.4	OVR 3N 100 320 s P
				OVR 3N 100 320 s P TS

OVR 1N 65 275 s P TS ①

Network
1N Single phase (left), neutral (right)
3N Three phase (left), neutral (right)
N1 Neutral (left), single phase (right)
N3 Neutral (left), three phases (right)
3L Three poles
4L Four poles
Nothing Single pole

Max. discharge current 8/20
I_{max} (kA) 15, 40, 65, 100

TS Integrated remote indication

P Pluggable unit
Nothing: Single block

s with safety reserve

Max. continuous operating voltage
U_c (V) 660, 550, 440, 385, 320, 275, 150, 75

① This part number breakdown only explains our part numbering system; it is not to be used to build a part number for ordering purposes.

OVR Range
Very low voltage transmission lines protection

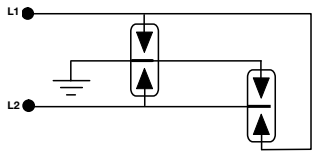
OVR TC 06 V

OVR TC 200 FR

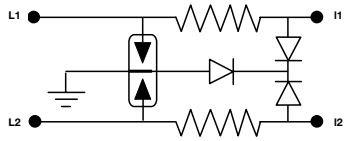
Transmission line surge arresters (OVR TC) provide protection against transient overvoltages for equipment connected to telephone lines (digital or analog) & current loops.

Standards Info:
Modular low current surge arresters comply with IEC 61643-21 / UL 1449.

Schematic diagrams



OVR TC 200 V in parallel

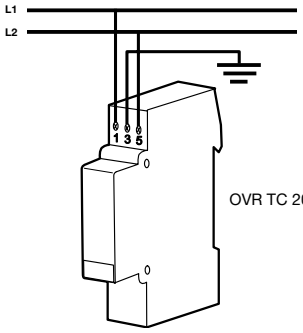


OVR TC / xx V / 200 FR in series

Dimensions

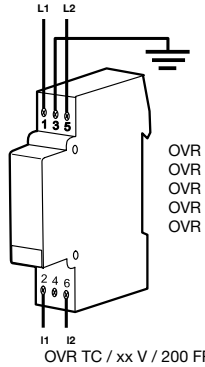
Dimensions (mm)	W	H	D
OVR TC (all models)	17.5	85	63

Connection



OVR TC 200 V

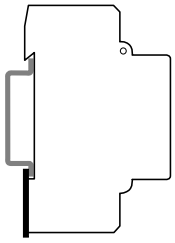
OVR TC 200 V in parallel



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.

Technical data

Electrical characteristics	6 V OVR TC 06 V	12 V OVR TC 12 V	24 V OVR TC 24 V	48 V OVR TC 48 V	200 V OVR TC 200 V	200 V OVR TC 200 FR
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	6 V	12 V	24 V	48 V	200 V	200 V
Max cont operating voltage: U_c	7 V	14 V	27 V	53 V	220 V	220 V
Voltage protection level: U_p at I_n	15 V	20 V	35 V	70 V	700 V	300 V
Nominal discharge current: I_n (8/20)	5 kA	5 kA	5 kA	5 kA	5 kA	5 kA
Maximum discharge current: I_{max} (8/20)	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 mm²			
– stranded wire			0.5 ... 2.5 mm²			
PE connection terminal:						
– solid wire			0.5 ... 2.5 mm²			
– stranded wire			0.5 ... 2.5 mm²			
Integrated thermal disconnector		Yes			No	Yes
End of life indicator		Yes			No	Yes
Compatibility with OVR Sign		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 / UL 1449			
Weight			150 g			

Installation rules
Principles of coordination for TVSS

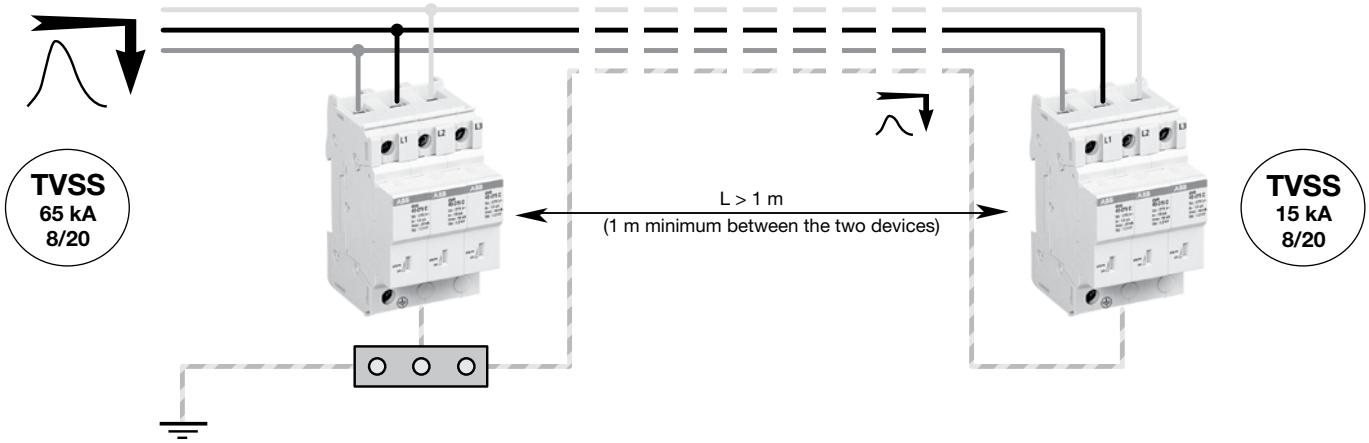
The first surge arrester does not provide effective protection for the whole installation by itself.
Certain electrical phenomena can double the protection's residual voltage if cable lengths exceed 10m.
Surge arresters must be coordinated when they are installed refer to the tables below.

Coordination required if:
The first surge arrester does not reach the protection voltage ($\mathbf{U_p}$) by itself.
The first surge arrester is more than 10m away from the equipment to be protected.

The first surge arrester diverts most of the current to the ground and the remaining surge current is diverted to the ground by the second surge arrester.

The value of this remaining surge current gets lower as the distance between both surge arresters gets longer. The lower is the current going through the last surge arrester, the lower is the voltage protection level applied to the downstream equipment.

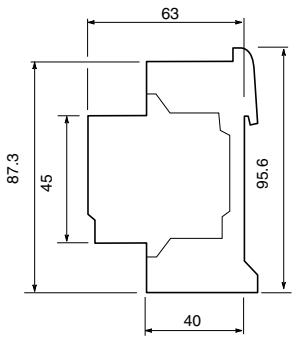
Coordination between Type 2 TVSS units



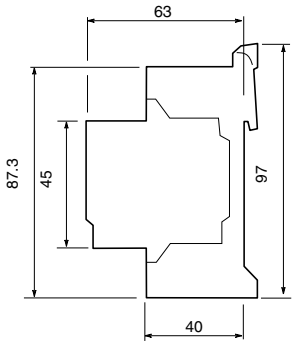
Approximate dimensions
OVR range

Transient voltage surge suppressor

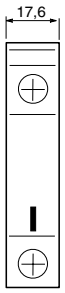
TVSS without TS



TVSS with TS

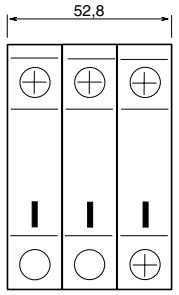


1 pole



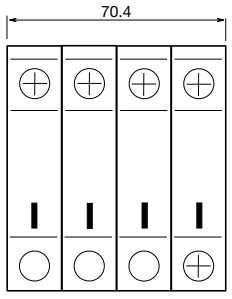
OVR 15 275 P
OVR 15 440 P
OVR 40 275 P
OVR 40 275 s P TS
OVR 40 440 P
OVR 40 440 s P TS
OVR 65 275 s P TS
OVR 65 440 s P TS

3 poles



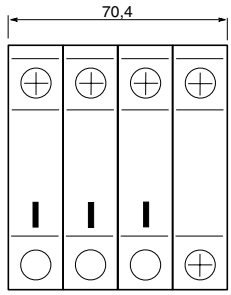
OVR 3L 15 275 P
OVR 3L 40 275 P
OVR 3L 40 275 s P TS
OVR 3L 65 275 s P TS

4 poles



OVR 4L 15 275 P
OVR 4L 40 275 P
OVR 4L 40 275 s P TS
OVR 4L 65 275 s P TS

3 poles + Neutral

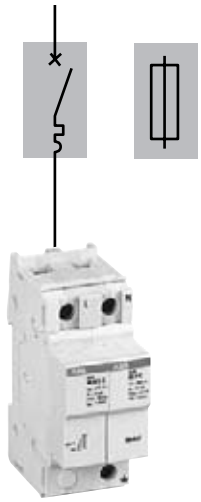


OVR 3N 15 275 P
OVR 3N 40 275 P
OVR 3N 40 275 s P TS
OVR 3N 65 275 s P TS

Technical details
Installation rules for TVSS choice of associated breaking devices (fuse/circuit breaker)

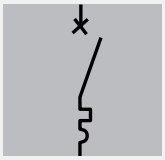
Choice of disconnector

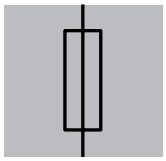
Surge arresters must be associated with upstream short-circuit protection and residual current protection against indirect contact (usually already present in the installation)



Function	Application
Protection against 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.

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



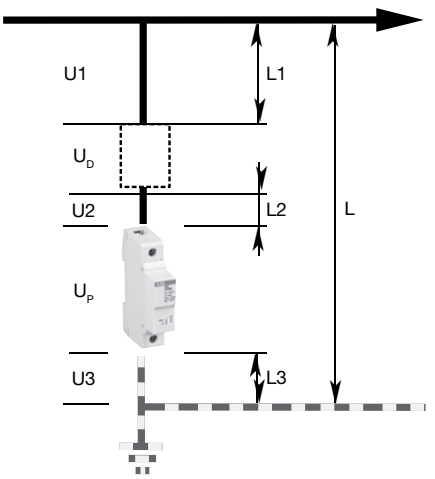


	Circuit-breaker (curve K)	Fuse (gG)
TVSS surge arresters		
100 kA (8/20)		
• I_{cc} = 300 A to 1 kA	40 A	25 A
• I_{cc} = 1 kA to 7 kA	40 A	25 A
• I_{cc} = 7 kA and above	40 A	25 A
TVSS surge arresters	Circuit-breaker (curve C)	Fuse (gG)
65 kA (8/20)		
• I_{cc} = 300 A to 1 kA	30 A	20 A
• I_{cc} = 1 kA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

Technical details
Cabling and installation of Surge Protection Devices 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.

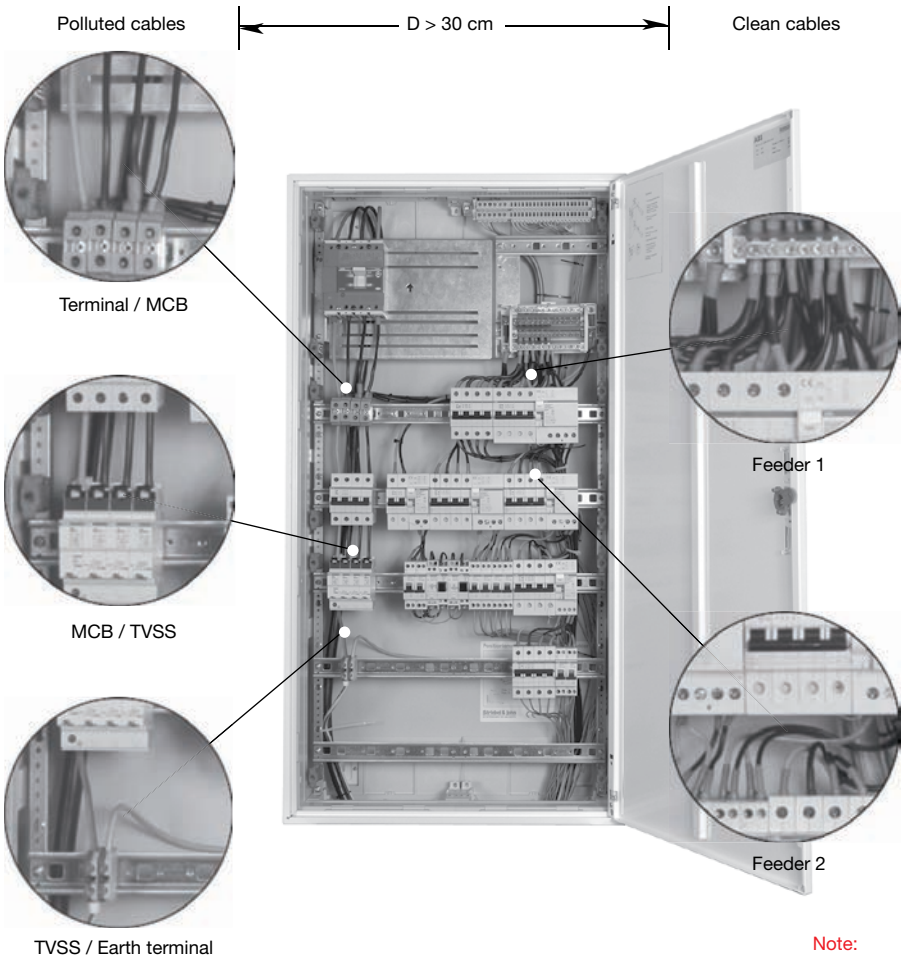
Wiring ring surfaces

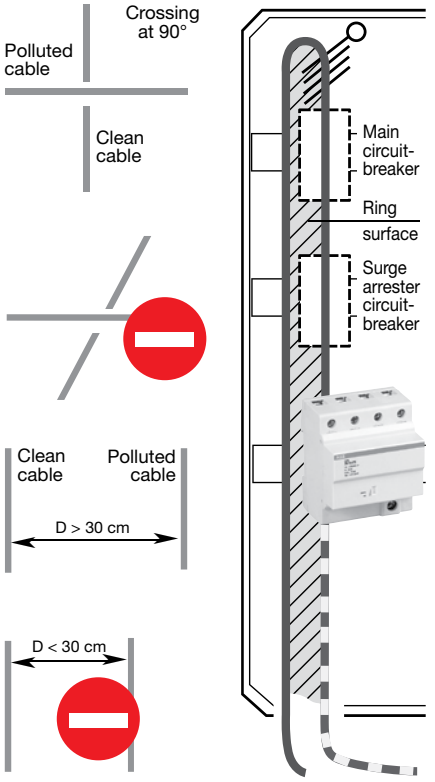
The wires must be arranged in such a way that they are as close to each other as possible (see adjacent diagram) to avoid overvoltages induced by a ring surface between phases, the neutral and the PE conductor.

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°).





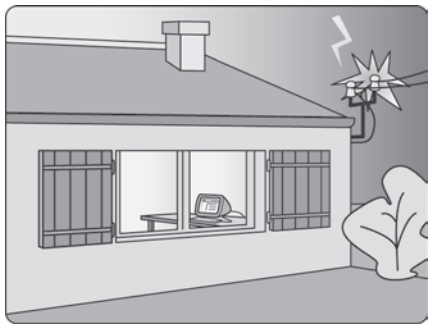
Equipotential grounding:

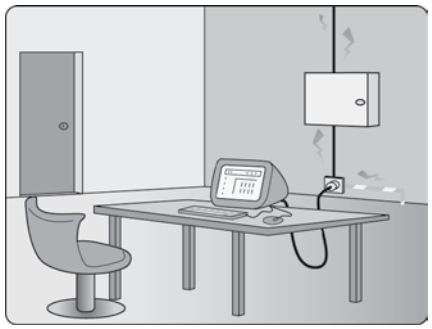
It is critical to check the earth equipotentiality of the various items of equipment.

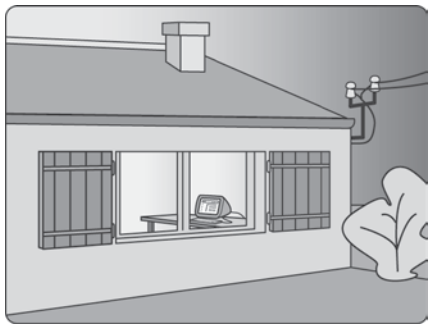
Note:

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.







Operating principle

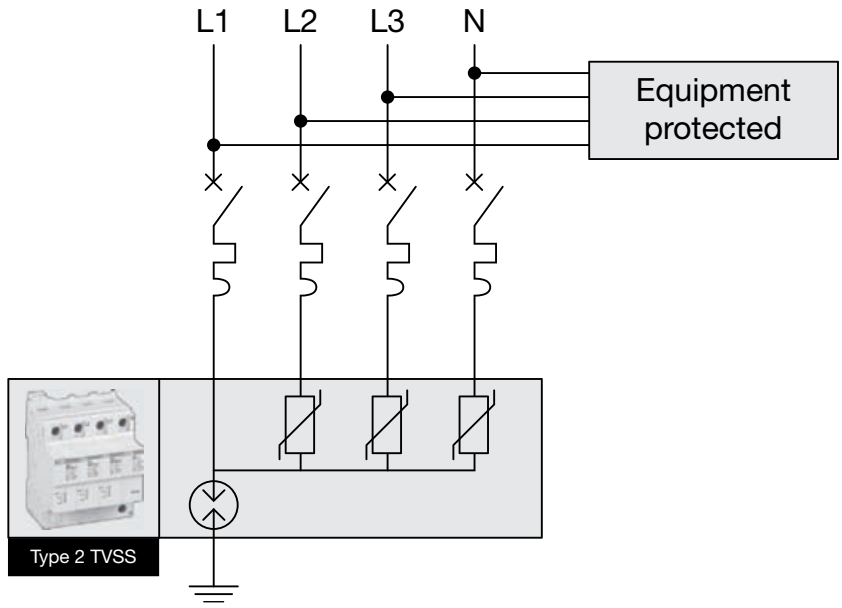
The Surge Protection Devices (TVSS), suitable for residential, commercial and industrial applications, are designed to limit transient overvoltage and run-off lightning currents.

Application environments

The Surge Protection Devices (TVSS) are necessary in any environment where the lightning risk exists (direct lightning strike / overvoltage).

Example of installation

As shown in the diagrams, one of the possible applications is to protect the equipment (TV, computer, ...) against overvoltage thanks to a Surge Protection Device (TVSS) which ensures the protection in common mode (Ph-PE / N-PE) and differential mode (Ph-N).



General points on lightning and its risks

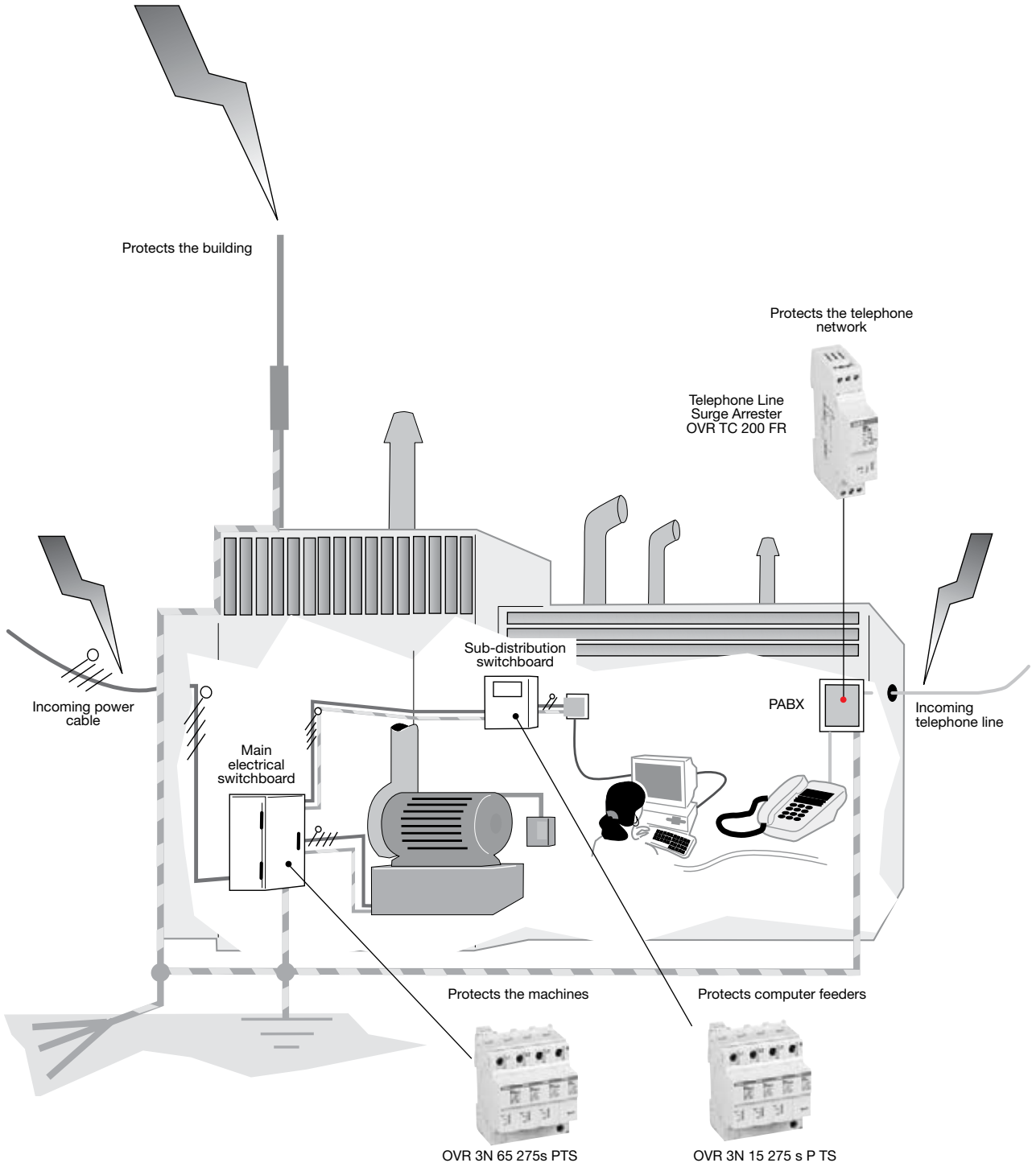
Diagram of an installation protected against lightning and its indirect effects

The 100KA or 65KA surge arrester (depending on the lightning risk) 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.

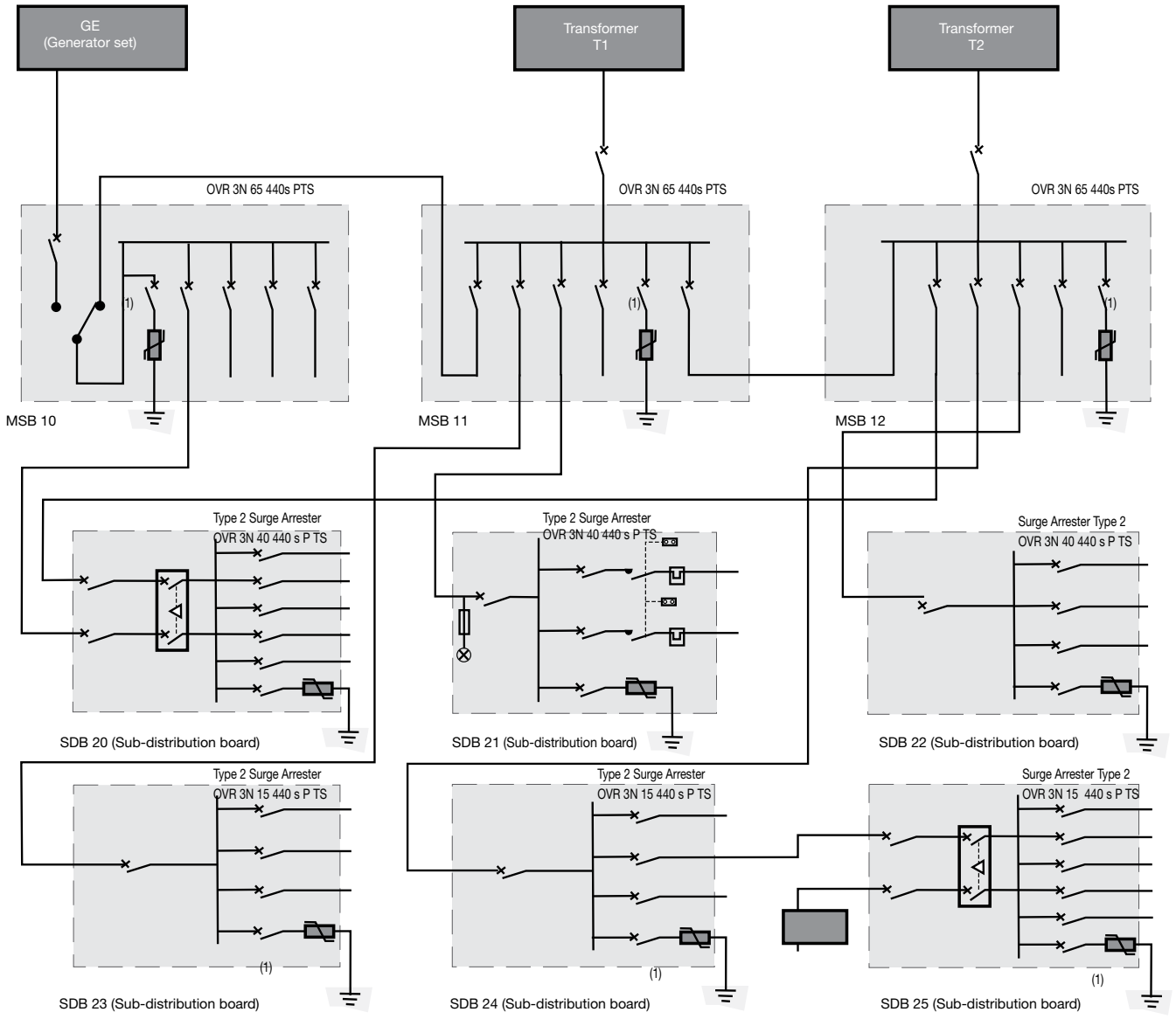
The behavior of the cables, subjected to a transient signal, limits the effectiveness of a surge arrester to 10 m of cable. It is therefore necessary to use one or more surge arresters in the installation in order to obtain the required level of protection for the equipment.

Here, a 40KA or 15KA surge arrester (depending on the lightning risk) 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.



Selection
Example of a protected industrial installation



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 2 surge arresters OVR 3N 65 440 s PTS.
- sub-distribution boards (SDB) 20, 21 and 22 are fitted with Type 2 surge arresters OVR 3N 40 440 s P TS.
- sub-distribution boards (SDB) 23, 24 and 25 are fitted with Type 2 surge arresters OVR 3N 15 440 s P TS.

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.

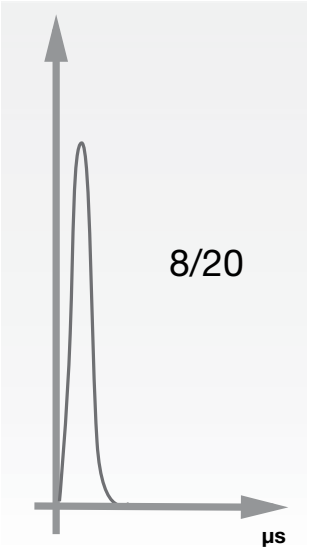
Type 2 surge arrester:
Surge arrester designed to run-off energy caused by an overvoltage comparable to that of an indirect lightning strike or an operating overvoltage. It has successfully passed testing to the standard with the 8/20 wave (class II test).

U_p:
Voltage protection level / Let through voltage
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).

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.

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



Type 2 Surge Arresters
I_{max}: current wave