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Contents

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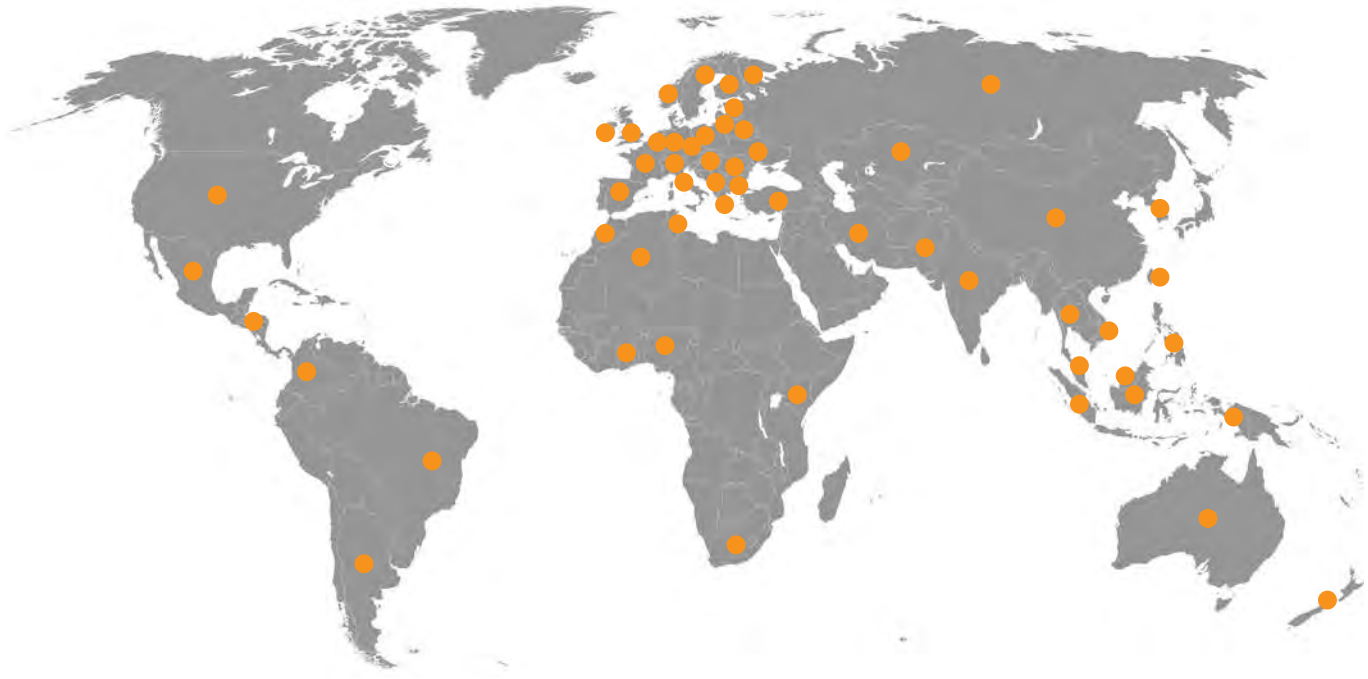
Hakel Ltd. Since its establishment in 1994 is a major producer of surge protection devices in Europe. The company obtained ISO 9001 certificate in 1997. The production of surge protection devices is a specific and technical area with great demands on professional knowledge of the company's management as well as the production and research staff. Introduction of new technologies and using the latest testing equipment enables engineers to extend their technical knowledge. The use of surge protection devices is becoming a common necessity nowadays. Large power systems, which are operated by complicated electronics are more and more sensitive to electromagnetic and overvoltage damage. Failure of electronic equipment owing to surges can cause reduction of orders or even company's bankruptcy. Surge protection devices produced by Hakel company can be easily applied in every industry, domestic, commercial and industrial. Hakel company also passes its experience on to college and university students and helps them to acquaint with new solutions in electromagnetic compatibility. Experience obtained from working with power electronics in industry are closely related to the company's market leading position in the Czech Republic. Hakel's exports products worldwide through its partner companies which it has helped to train and develop their mutual businesses. The surge protection product range offered by Hakel enables customers to easily apply the products in every industrial, commercial and domestic situation. The continual, investment in new technologies and product development helps Hakel to achieve higher standards and better technical solutions than its competitors. That is one of the reasons why Hakel is a world market leader in the field of surge protection. All Hakel products are tested according to the most up to date international and European standards which include EN61643-11 and IEC61643-1.

Hakel Ltd. produces and exports to countries on all continents important safety products Insulation monitoring devices, these enable users to improve their safety in ungrounded IT power supply systems, railway, engineering, shipbuilding, hospitals and transport facilities.

sales map



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Definition and terminology according to the standard EN 61 643-11 and IEC 61643-11

The international standard EN 61 643-11 and IEC 61643-11 compiles lightning arresters and surge arresters under the integrated term SPD (Surge Protection Device).

Definition:

Surge protection device (SPD)
a device that is intended to limit transient overvoltages and divert surge currents; it contains at least one nonlinear component.

One - port SPD
an SPD connected in shunt with the circuit to be protected; a one-port device may have separate input and output terminals without a specific series impedance between these terminals.

Two - port SPD
an SPD with two sets of terminals, input and output; a specific series impedance is inserted between these terminals.

Voltage switching type
an SPD that has a high impedance when no surge is present, but can have a sudden change in impedance to a low value in response to a voltage surge; common examples of components used as voltage switching devices are spark gaps, gas tubes, thyristors (silicon-controlled rectifiers) and triacs; these SPDs are sometimes called „crowbar types".

Voltage limiting type SPD
an SPD that has a high impedance when no surge is present, but will reduce it continuously with increased surge current and voltage; common examples of components used as nonlinear devices are varistors and suppressor diodes; these SPDs are sometimes called „clamping type".

Combination type SPD
an SPD that incorporates both voltage switching type components and voltage limiting type components may exhibit voltage switching, voltage limiting or both voltage switching and voltage limiting behaviour depending upon the characteristics of the applied voltage.

Modes of protection
an SPDs protective component may be connected line-to-line or line-to-earth or line-to-neutral or neutral-to-earth and combination there of; these paths are referred to as modes of protection.

Sparkover voltage of a voltage switching SPD
maximum voltage value before disruptive discharge between the electrodes of the gap of a SPD; it is used for classification of the SPD class I and II by testing impulse with waveshape 1,2/50µs.

Nominal discharge current I_n (8/20)
the crest value of the current through the SPD having a current waveshape of 8/20; this is used for the classification of the SPD for class II test and also for preconditioning of the SPD for class I and II tests; arrester must discharge this current at least 15 times without any essential changes in its qualities.

Maximum discharge current I_{max} for class II test
crest value of a current through the SPD having an 8/20 waveshape and magnitude according to the test sequence of the class II operating duty test; I_{max} is greater than I_n ; arrester must safely discharge this current without an obvious damage or aberration from the temperature stability; records of the voltage and current development musn´t show any marks of disruptive discharge or sparkover.

Impulse current I_{imp}
it is defined by a current peak value I_{peak} and the charge Q; tested according to the test sequence of the operating duty test; this is used for the classification of the SPD for class I test; arrester must safely discharge this current without any obvious damage or aberration from the temperature stability; records of the voltage and current development musn´t show any marks of disruptive discharge or sparkover.

1,2/50µs voltage impulse
a voltage impulse with a virtual front time (time to rise from 10% to 90% of the peak value) of 1,2µs and a time to half-value of 50µs; it is used for classification of the SPD class I and II.

Combination wave
the combination wave is delivered by a generator that applies a 1,2/50µs voltage impulse across an open circuit, and an 8/20 current impulse into a short circuit; the voltage, current amplitude and waveforms that are delivered to the SPD are determined by the generator and the impedance of the SPD to which the surge is applied. The ratio of peak open-circuit voltage to peak short-circuit current is 2Ω; this is defined as the fictive impedance Z_f; the short-circuit current is symbolized by I_{sc} ; the open-circuit voltage is symbolized by U_{OC}.
Note: In practice when it comes to the arresters (class III) there are data I_{max} (8/20) and I_n (8/20) often mentioned in place of U_{OC} because of the commercial reasons. They are always mentioned in relation to the stated voltage protection level U_p (the data concerned are always derived from the tests by the standardized combined impulse with the amplitude U_{OC}; the test is carried out by use of a hybrid generator with inside resistance 2Ω).

Specific energy W/R for class I test
the energy dissipated by the impulse current I_{imp} in a unit resistance of 1Ω; it is equal to the time integral of the square of the current; expressed in kJ/Ω or in kA^2s.

$$W / R = \int i^2 \cdot dt$$

Charge Q
- it equals the time integral of the current according to the time; expressed in As.

$$Q = \int i \cdot dt$$

Thermal stability
- an SPD is thermally stable if after the operating duty test causing temperature rise, the temperature of the SPD decreases with time when the SPD is energized at specified maximum continuous operating voltage and at specified ambient temperature conditions (it is monitored for 30 minutes, active power dissipation must show constant decline for the last 15 minutes).

Short-circuit current rating I_{SCCR}
the SPD shall be able to carry the power short-circuit current until it is interrupted either by the SPD itself, by an internal or external overcurrent disconnector or by the backup overcurrent protection; expressed in kA_{rms} (tested according to short-circuit current rating test in conjunction with backup overcurrent protection).

Nominal voltage U_N
an effective value of the alternating voltage or value of the direct voltage, which is set for the SPD by manufacturer

Maximum continuous operating voltage U_C
the maximum r.m.s. or d.c. voltage which may continuously applied to the SPDs mode of protection; this is equal to the rated voltage.

Rated load current I_L
the maximal effective value of the alternating current or value of the direct current, which can be constantly taken away by the load connected to the SPD output.

Continuous operating current I_C
the current flowing through each mode of protection of the SPD when energized at the maximum continuous operating voltage U_C for each mode.
Note: I_C corresponds to the sum of currents flowing in the protective component of the SPD and in all internal circuits connected in parallel with the protective components of the SPD.

Follow current I_f
current supplied by the electrical power system and flowing through the SPD after a discharge current impulse; the folow current is significantly different from the continuous operating current I_C ; expressed in kA_{rms}.

Follow current interrupting rating I_{fi}
the prospective short-circuit follow current that is SPD able to self-extinquish after its previous activation (without a back-up fuse); this current is indicated in some company's materials as "Follow current extinguishing capability at U_C" or " Eliminates short circuit current without back-up fuse at U_C ", alternatively "Quenching short circuit current without back-up fuse".

Voltage protection level U_P
a parameter that characterizes the performance of the SPD in limiting the voltage across the terminals, which is selected from a list of preferred values; this value shall be greater than the highest value of the measured limiting voltages.

Operating temperature ϑ
an extent of the allowed surrounding temperatures, where manufacturer guarantees the right operating SPD.

Response time t_A
the response time defines the reaction speed of protective elements built-in the SPD; the response time can vary in different limits, which are dependent on the rate of rise du/dt of the impulse voltage or on the di/dt of the impulse current.

Insertion loss
at a given frequency, the insertion loss of an SPD connected into a given power system is defined as the ratio of voltages appearing across the mains immediately beyond the point of insertion before and after the insertion of the SPD under test; this result is expressed in decibels (dB).

SPD disconnector
a device for disconnecting an SPD from the system in the event of SPD failure; it is to prevent a persistent fault on the system and to give visible indication of the SPD failure; some kinds of the SPD are extra fitted with so-called non-potential signall contact for needs of remote failure signalling.

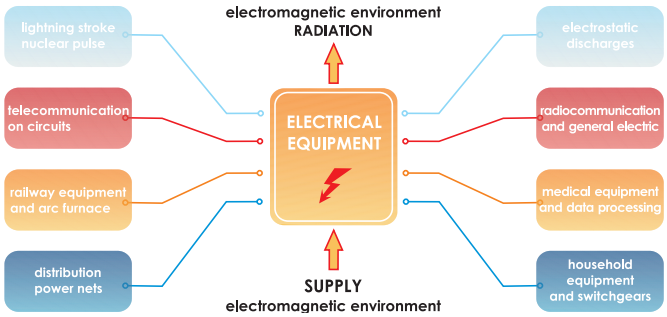
Backup overcurrent protection
an overcurrent device (e.g. fuse or circuit breaker), which is a part of the electrical installation located externally up-stream of the SPD, to avoid overheating and destruction in case the SPD is unable to interrupt the power frequency short-circuit current.

Residual current device (RCD)
an electromechanical switching device or association of devices intended to cause the opening of the contacts when the residual or unbalanced current attains a given value under specified conditions.

Degrees of protection provided by enclosure (IP code)
the extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and/or against ingress of water (see IEC 60 529).

Electromagnetic compatibility

Electromagnetic compatibility is a discipline, which is involved in securing maximum reliability of each electrical and electronic equipment and devices. In nature, there are relations between elements or system components, which must be predicted in advance in order to prevent interference.



Electromagnetic compatibility seems to be a relatively new discipline, which arose in the sixties in the USA. It started on basis of the necessity to secure flawless and reliable activity of electrotechnical equipment and devices working especially in military or aerospace systems. Electromagnetic compatibility begins to affect all of us by the development of electronics, especially microprocessor technique, which effect our day to day lives. That is why EU issued the directive No. 89/336/EEC, whose aim is to enforce electromagnetic compatibility conditions on all states involved including the states that have signed associate agreement. The Czech Republic has also signed this agreement so all the conditions of the directive apply. Of course it is necessary that the Czech Republic would gradually have made appropriate legislative steps, which would turn this directive to live. The decree of the Czech goverment No. 17/2003 and the law No. 22/97 Coll. means non-replaceable move in this sphere.

Other very important decrees concerning this sphere are obligatory norms as for example CSN 332000-1, paragraph 131.6.2 saying:
„People, lifestock and also property must be protected against harm caused by surge, which can arise from other reasons, for example atmospheric events, switching overvoltages and static electric.“
At the figure there are particular links among electrical equipment and enviroment shown. They can be expressed as two relations:

- electromagnetic susceptibility (resistance)
- electromagnetic interference (disturbance)

Surge is just one of the main problems arising from the solving of electromagnetic compatibility problems. If we deal with parameters of electric energy, we must remember four qualitative aspects:

- the level of voltage
- the level of frequency
- nonlinear distortion
- the level of surge (frequency of surge peaks)

On basis of these aspects the electric energy can be taken as merchandise and these qualitative parameters can be required. The main aim is to create such conditions that would be able to ensure maximum reliability and functioning of all the electronic equipment connected to LV power systems.

Terms and definitions of surge

Overvoltage is any voltage, whose peak value exceeds the appropriate peak value of the highest operating voltage in the LV power system. Overvoltage is usually an accidental phenomenon, which differs in time history and the place of its occurrence. Its parameters are defined by its cause (lightning stroke, switching in heavy-current network and so on) and also by electrical character of the circuit (wave resistance, ending impedance, discharge ability and so on). In the past few years the range of current and voltage courses for different uses has been standardized. These courses enable implementation of testing on equipment and constructive elements under the same conditions. In the following text the most important parameters of the most used standardized courses will be defined (according to EN 61 643-11 and IEC 61643-11, IEC 60-1 and CSN 34 5640).

Peak value (amplitude) U_{max}, I_{max}
peak value is the maximal value of voltage or current, which is achieved by monitored impulse course

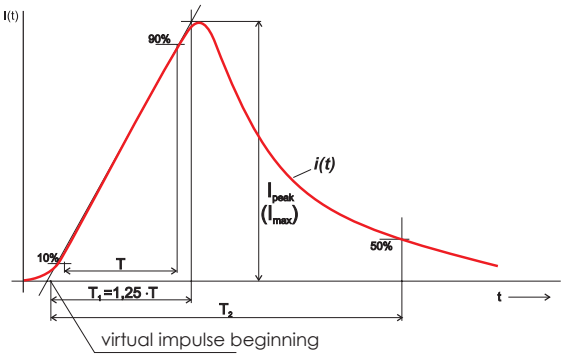
Front of impulse
a part of voltage or current impulse before the peak value

Front time of current impulse T_1
1,25 multiple of the time interval between moments, when actual current value rise from 10% to 90% of the peak value

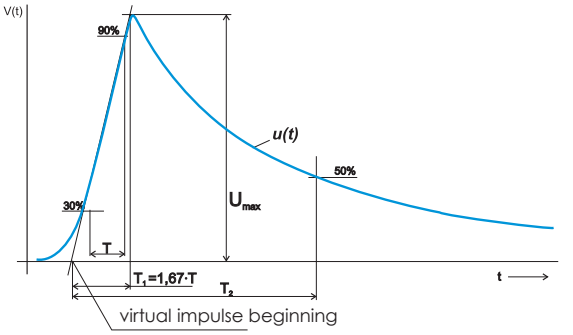
Front time of voltage impulse T_1
1,67 multiple of the time interval between moments, when actual voltage value rise from 30% to 90% of the peak value

Tail of impulse
a part of voltage or current impulse after the peak value

Time to half-value T_2
the time interval between virtual beginning of impulse and the moment, when observed course reduces to 50% of its peak value
Note: The virtual beginning is an intersection of time axis and bisector, which goes through points, where actual value of the front of impulse at first time reaches partly given lower value and partly given higher value …in detail see the following two figures.



Current impulse, definition of front time and time to half-value



Voltage impulse, definition of front time and time to half-value

Standardized testing current impulse
two basic types of testing current impulses are used during SPD tests:

a) testing impulse of lightning current I_{imp}(10/350) – it is used for simulation of lightning current (so-called test by lightning current)
b) testing current impulse I_{max}(8/20) – it is used for simulation of indirect effect of lightning and switching overvoltages

Arrester must discharge cca 17,5x higher charge during test by the testing impulse of lightning current I_{imp}(10/350), than during testing by the current impulse I_{max}(8/20) with the same amplitude. Also resulting in a different construction of the lightning current arresters tested by the lightning current impulse I_{imp}(10/350) and surge arresters tested by the current impulse I_{max}(8/20).

Course and parameters of lightning voltages and currents
In the chart shown below there are typical courses and parameters of lightning impulse voltages and currents, which occur in conductive parts of landscape, building constructions and metal lines in consequence of lightning stroke (taking in account influences caused by galvanic, inductive or capacitive coupling).

The typical values of lightning impulse voltages and currents, which occur in conductive parts of landscape, building constructions and metal lines.

	Surge (peak values)	Currents (peak values)	Halftail time
Direct lightning stroke	- up to few hundreds of kV	> 30 kA (50% of all strokes)	cca 200 µs ... 1000 µs
		> 100 kA (5% of all strokes)	
		> 150 kA (1% of all strokes)	
Galvanic coupling	- up to few tens of kV	distant strokes: up to 1kA	typical: cca 700 µs
		near strokes: up to few kA	
		straight strokes: up to few tens kA	
Inductive coupling	- transverse surge up to few kV	up to few kA	typical: cca 20 µs
	- lengthwise surge up to few tens of kV	up to few tens of kA	
Capacitive coupling	- transverse surge up to few kV	up to few kA	typical: 50 to 100 µs
	- lengthwise surge up to few kV		

Testing current impulse in the waveform of 10/350µs is most often used for simulation of currents infiltrating into power lines and electric equipment in consequence of galvanic coupling. In case of inductive and capacitive coupling the voltage and current impulses are considerably shorter. The examination of interfering lightning effects in relation to inductive surges (currents) in consequence of inductive coupling is most often carried out by the testing current impulses in the waveform of 8/20µs. The examination of lightning effects in relation to interfering surges (currents) in consequence of capacitive coupling is similarly carried out by the testing voltage impulses in the waveform of 1,2/50µs.

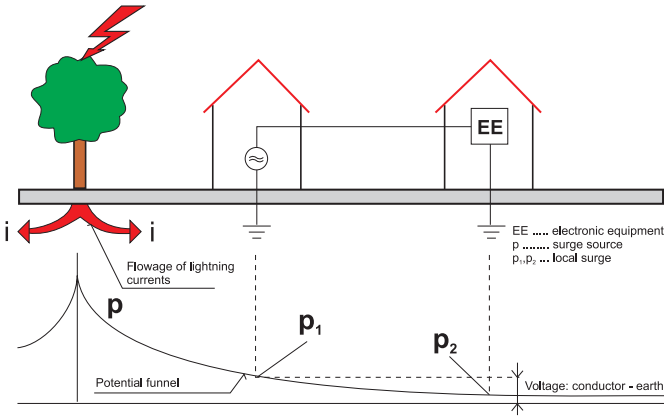
Kinds of surge couplings

Generally

Disturbing energies (e.g. voltages, currents, fields) can infiltrate into the building by ways of different couplings whereas cabling and its layout represent an important part here. Following, there are three most important mechanisms of coupling described.

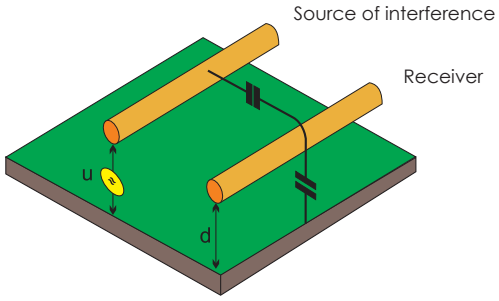
Galvanic coupling

During near and direct lightning strokes into the lightning conductors of buildings, the overvoltage shows in consequences of a galvanic coupling. The galvanic coupling is given by a different size of ground potentials along the building. By arrangements for equipotential bonding (earth electrodes, protective connection etc.) it is possible to achieve certain flattening of potential funnel. This flattening results in reducing the difference of potentials in regard of its center - place of stroke. However, the difference of potentials can never be fully eliminated in consequence of impedances of conductive lines of LV power system and indispensable impedance of earth.



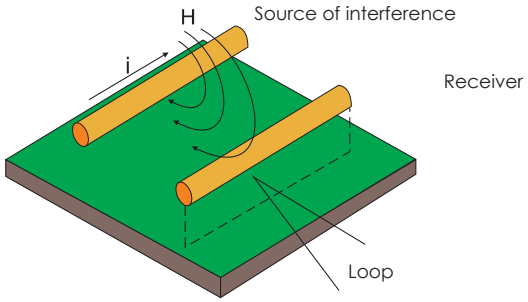
Capacitive coupling

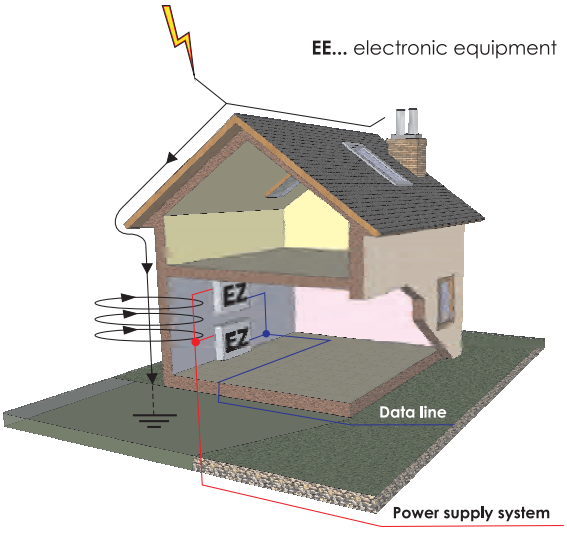
There is always a capacitive coupling (parasitic capacity) between the source of interference and the receiver. The higher the front rate of rise of the disturbing voltage impulse (du/dt) is, the stronger its interference effect is.



Inductive coupling

There is always an inductive coupling (magnetic field) between the source of interference and the receiver. The higher the front rate of rise of the disturbing current impulse (di/dt) activating the magnetic field is, the higher the interference effect is.





Types of surge

Atmospheric surge (LEMP)

Lightning is an electric discharge between electrically charged cloud and ground (earth lightnings), between two or more clouds mutually, or between different parts of one cloud (cloud lightnings). Only a small portion of discharges occurs between clouds and the ground. Lightnings originate in storm cells, which reach up to several kilometers at average. Every storm cell is active for up to 30 minutes and generates at average two to three lightnings per minute. It reaches a height of 10 kilometers, whereas the lower boundary of clouds is situated at a height of one

to two kilometers. In the middle of the storm cell there is a strong upward current, which causes a separation of positive and negative charges. The positive charge is generally bound to the ice crystals on top of the cell, while a negative charge is mostly bound to the water drops at the bottom. Nearby the earth the cell is charged with positive charge, usually caused by corona discharge, especially from the forest. Except the storm cells originating from the summer heat there are storm cells in the frontal cloudiness due to the movement of large air masses. The frequency of storms is related to particular season. In the summer months of July and August there are, at average, five times more storms than during the winter months. Formation of the summer storms is supported by the sun heating the land. During autumn gives the necessary energy for the formation of thunderstorms over the sea a warm water near the shore. According to a set of standards EN 62305, the lightning discharge can be characterized by five basic parameters. Another important parameter, which is mentioned in a classification of storm activity is called as Intensity of storm activity, or Frequency of lightning strikes per km² / year. In our latitudes, ranging from 2-8 strikes / km² / year in subtropical to tropical areas it is 30 to 70 strikes / km² / year.

Switching surge (SEMP)

They are very numerous surges caused by industrial activity when switching mheavy loads, especially those inductive, such as transformers, electric motors and small household appliances. Switching process can be scheduled or faulty. Among the scheduled processes we can place an intentional switch-on/off of the circuits, eg. switching contactors or switches. Faulty process, which can be caused by significant overvoltage is e.g. a release of the circuit breaker at short circuit. Invisible and practically immeasurable voltage pulses last only a few thousandths or millionths of a second, but can cause a damage, especially of electronic equipment, sometimes even a short circuit and subsequent fire.

Electrostatic discharge (ESD)

It is a sudden and momentary electric current between two objects with different electrical potential. It originates during a mechanical friction between two insulators (e.g in technologies, or during the movement of persons on unsuitable floor etc.). In technologies it is a serious problem mainly in electronic components, especially in integrated circuits, where in imperceptible moment comes to a destruction of the circuit by simply touching an object of different electrical potential (for the integrated circuits it can be even a human). It is preceded by an antistatic device to ensure safe grounding eg. by suitable adjustment of material, conductive coatings, ionization, and so on.

Nuclear Surge (NEMP)

Caused by a nuclear explosion, where the explosion released gamma radiation knocks the electrons from air molecules. These electrons are accelerated in a radial direction, and thus separated from the non-ionised air molecules. Due to this arises in a few nanoseconds a strong electric field and owing to rapidly time-changing transport of electronic charge is emitted a short electromagnetic pulse. A nuclear explosion may have an impact on living organisms on earth, but also cause overvoltage conditions for electrical equipment and overhead lines with similar effects, such as a lightning strike, but with a greater proportion of high frequencies.

Direct Lightning Stroke

A lightning stroke is an electric discharge between an electrically charged cloud and earth surface (earth lightning), between two or more clouds and each other or between parts of one cloud (cloud lightning). Just a small percentage of strokes happens between the surface and the clouds. The lightning strokes originate in the „storm cells", which stretch average out up to few kilometers. Every storm cell is active for up to 30 minutes and generates from two to three lightning strokes per minute. The storm cell often reaches the height of over 10 kilometres, whereas the bottom visible part of the clouds is usually at the height of one to two kilometres. In the centre of the storm cell there exists a strong rising air flow, which causes separation of positive and negative charges. The positive charge is at the top of the storm cell, while negative charge is on water drops at the bottom of the cell. Nearby the earth the cell is charged with positive charge which is usually caused by discharge especially from forest. Beyond the storm cells originating from the summer heat there are storm cells originating from the frontal cloudiness as a result of big air masses movement. The storm frequency depends on the season. In summer months (July–August) there are on average 5 times more storms than in winter months (December–February). The environmental heating up supports the storm creation. In autumn warm water near the seacoast gives the necessary energy for the storm creation. According to IEC 62305 it is possible to describe lightning charges by five basic parameters:

	Unit	Range
Total impulse lightning charge Q_t	C	max 300C
The first stroke charge Q_s	C	max 100C
The first stroke peak current I_{imp}	kA	max 200 kA
Specific energy the first stroke current W/R	MJ/Ω	max 10MJ/Ω
Rate of rise of the current dI/dt	kA/μs	max 200 kA/μs

Another important parameter, which is presented during the classification of storm activity is so-called intensity of storm activity or the frequency of the lightning strokes per km²/year. The frequency in our geographical latitudes varies from 2 to 8 strokes/km²/year, but in subtropical and tropical climate it varies from 30 to 70 strokes/km²/year.

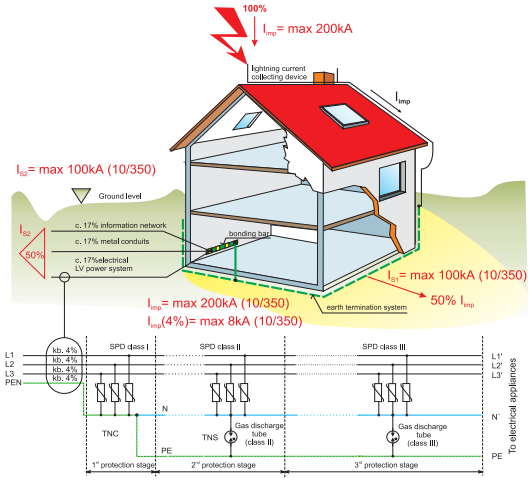
Hakelsoft software

Hakelsoft software is designed according to Standard EN 62305-2 and respects all the requirements of this standard. It is used to calculate the risk R1 to R4 and their control using protective equipment in accordance with EN 62305 and IEC 61634-11. Its challege is to simplify and streamline a project engineer's work with risk management. Although this program offers many useful guides, as lately as a qualified specialist use the software it becomes a real powerful implement. To obtain the closest calculation it is neccessary to know engineering systems entering the building, internal systems, allocation of LPZ zones, expected numbers of people in the building and its vicinity, the economic value of buildings and many other factors.

General distribution of lightning current when an object is hit by lightning, principle of LV power system protection thanks to cascaded 3-stage protection

Protection system of LV power system consisting of lightning current arresters and surge arresters SPD must be able to discharge lightning currents or their substantial parts without their damage. It is generally recommended to come out

from the ohmic resistance of the building earthing, pipeline, power distribution system and so on for the purposes of establishing current distribution going through SPD in case of direct lightning stroke into a building protected by the outside lightning system. The following figure shows a typical example of lightning current distribution in an object hit by direct lightning stroke.
Where an individual evaluation is not possible, it can be assumed that:
- 50% of the total lightning current I_{imp}=200 kA (10/350)…. I_{S1}= 100 kA (10/350) enters the earth termination system of the LPS (lightning protection system) of the structure considered
- 50% of I_{imp}=200 kA (10/350)…. I_{S2}= 100 kA (10/350) is distributed among the services entering the structure (external conductive parts, el.power, communication lines, etc.) The value of the current flowing in each service I_i is given by I_S/n, where **n** is the number of the above mentioned services (see the above figure).
For evaluating the current I_v in individual conductors in unscreened cables, the cable current I_i is divided by **m**, the number of conductors, i.e. $I_v = I_i/m$.
For shielded cables, the current will flow along the shield.
Requirement on dimensioning of protective system SPD in the most usual connection of the building and LV power system (TNC - system 230/400V/50Hz) results from this reasoning:
For maximum lightning current size I_{imp} = 200 kA (10/350) it is enough to dimension the protective cascade of each phase conductor entering the object on approx. 4% I_{imp}, that is on approx. 8kA (10/350) in most cases.



Distribution of protected area into the lightning protection zones

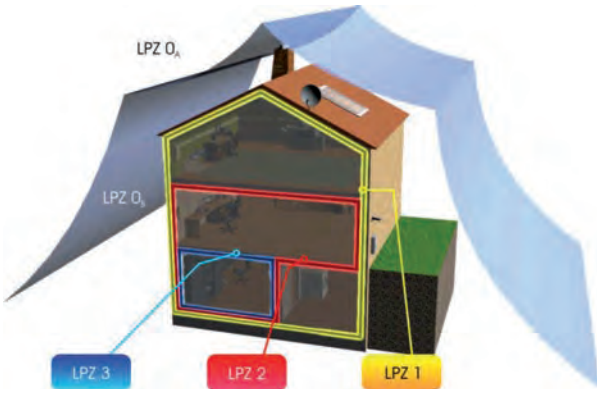
The standard IEC 62 305 defines the lightning protection zones LPZ from the respect of the direct even indirect lightning effect. These zones are characteristic thanks to fundamental breaks of the electromagnetic conditions in their limited zones.

LPZ 0_A:
Zone where items are subject to direct lightning strokes, and therefore may have to carry up to the full lightning current; the unattenuated electromagnetic field occurs here.

LPZ 0_B:
Zone where items are not subject to direct lightning strokes, but the unattenuated electromagnetic field occurs.

LPZ 1:
Zone where items are not subject to direct lightning strokes and where currents on all conductive parts within this zone are further reduced compared with zones 0_B. In this zone the electromagnetic field may also be attenuated depending on the screening measures.

The subsequent zones (LPZ 2 and so on):
If a further reduction of conducted currents and/or electromagnetic field is required, subsequent zones shall be introduced. The requirement for those zones shall be selected according to the required environmental zones of the system to be protected. In general, the higher the number of the zones, the lower the electromagnetic environment parameters. At the boundary of the individual zones, bonding of all metal penetrations shall be provided and screening measures might by installed.
Note: Bonding at the boundary between LPZ 0_A, LPZ 0_B and LPZ 1 is defined in IEC 13 12-1 and IEC 62 305. The electromagnetic fields inside a structure are influenced by opening windows, by currents on metal conductors (e.g. bonding bars, cable shields and tubes), and by cable routing.
The following figure shows an example for dividing a structure into several zones. There all electric power and signal lines enter the protected volume (LPZ 1) at one point, and are bonded to bonding bar 1 at the boundary of LPZ 0_A, LPZ 0_B and LPZ 1. In addition, the lines are bonded to the internal bonding bar 2 at the boundary of LPZ 1 and LPZ 2. Furthermore, the outer shield 1 of the structure is bonded to bonding bar 1 and the inner shield 2 to bonding bar 2. Where cables pass from one LPZ to another, the bonding must be executed at each boundary. LPZ 2 is constructed in such a way that partial lightning currents are not transferred into this volume and cannot pass through it.



The above described segmentation of the protected object into protection zones gives possibilities of active protection of the LV power system thanks to insertion of the protective SPDs (usually at the zone boundary LPZ 0→1and LPZ 1→2) and other protective SPDs at the zone boundary LPZ 2→3. Standardly it is recommended to insert so-called 1st stage protection – surge arrester class I tested by lightning current I_{imp}(10/350) at the zone boundary LPZ 0→1. It is recommended to insert 2nd stage protection - surge arrester class II tested by testing impulse I_{max} (8/20) at the boundary zone LPZ 1→2. At the boundary of LPZ 2→3 and subsequently along the consequential circuit there is also recommended to shoulder after every cca 10m by so-called 3rd stage protection class III also tested by testing impulse I_{max} (8/20) or U_{OC}. For extra important protected equipment it is recommended to secure it by

a quality continuous surge protection class III with high-frequency filter at the boundary of LPZ 2→3. If there are adjacent structures between which power and communication cables pass, the earthing system shall be interconnected, and it is beneficial to have many parallel paths to reduce current in the cables. A meshed earthing system fulfills this requirement. The lightning currents are further reduced, e.g. by enclosing all the cables in metal conduits or gridlike reinforced concrete ducts, which must be integrated into the meshed earthing system.

Components used in surge protections

Generally

Components and equipment for protection against surge are always based on a fundamental principle - to keep the isolation state up to acceptable voltage level. Short-circuit happens after exceeding this level and thereby very high difference of potentials between conducting parts of one equipment or appliance is restricted to an acceptable value. Electronic switches used for this purpose are called surge arresters or devices for protection against surge. Nowadays open spark gaps, closed spark gaps, gas discharge tubes, varistors, limiting diodes or their combinations are used for protection against lightning and overvoltage.

Spark gap

The arresters class I are the applications of the SPD most oftenly used on principle of a spark gap. They are designed for 1st stage of surge protection. It is possible to divide them on so-called „open" or „closed" spark gaps according to constructional implementation. The shape of electrodes, their material and the distance between electrodes determine the protection level, discharge ability and features, which characterize behaviour of the spark gap when follow current extinguish. Open spark gaps excel in very high discharge abilities (up to I_{imp} = 50 kA (10/350) during high levels of self-extinguishing follow current (up to I_{fi} = 50 kA_{rms}). Their fundamental inadequacy is burning plasma bursting from SPD housing during their activation by lightning current. This fact significantly complicates projective preparation (switchboard construction) regarding fire safety. The construction of the closed spark gaps has this inadequacy solved, although at the expense of parameters of self-extinguishing follow current (I_{fi} = max 25 kA_{rms}) being decreased. Some constructions of the closed spark gaps have very high discharge abilities (I_{imp} > 100 kA (10/350), on the other hand the level of self-extinguishing follow current is low (I_{fi} = cca 100 A_{rms}), so their application possibilities are comparable with gas discharge tubes.

Gas discharge tubes

In the inactive condition gas filled arresters and spark gaps (gas discharge tubes) behave as high resistance isolators thanks to application of corundum ceramic. They are usually constructed in the shape of cylindric ceramic housing, closed by metal electrodes on both sides. They are filled by inert gas mixture under low pressure generally. They excel in their short response time and high-level discharge ability up to I_{imp} = 100 kA (10/350). They have small self-capacity (few of pF units) and high isolation resistance (> 1000 MΩ). Gas discharge tube´s application posibilities are restricted by their generally low values of self-extinguishing follow current (I_{fi} = c. 100 A_{rms}). Quality guarantee for a particular application is carried out with by specific choice of used material, gas filling and electrode geometry. The special dilatation composition is used for a production of modern gas discharge tubes, because they ensure their high resistance against high temperatures up to 2000 °C and extreme pressure during discharge in gas, during currents up to 100 kA in the waveform of 10/350μs. The electrical parameters can be predicted in a large range. E.g. direct switching voltage can be set up from 100V to 2000V with typical tolerance +/-20%. Gas discharge tubes have long lifetime and parameter stability. So they fulfil basic presumptions for their usage at the constructions of maintenance-free arresters with long lifetime.

Varistors

Varistors are voltage dependent resistances with symetrical voltampere characteristic. They consist of 90% ZnO as a ceramic basis and 10% additives. High possible load of this type of arresters during their loading by impulse discharge currents is achieved by application of its great mass varistor capacity for energy absorbtion. Almost universal possibilities of varistors are limited only in the field of high frequency, where relatively high capacity (few of nF units) has a negative effect.

Limiting diodes

Limiting diodes are basically Zenner diodes dimensioned for high peak current values and extremely short access time (a few ps units). These diodes are highly suitable for protection of sensitive electronic circuits thanks to their small size, short access time and low protection levels in data and telecommunication systems.


Spark gap


Gas discharge tube


Varistor


Transil

Grounding and protective conductors

The CSN standard 33 2000-5-54 deals with this problem. The standard determines implementation of earth termination system, the resistance value of ground electrodes, voltage level of the ground electrodes, contact voltage and current-carrying capacity of particular ground electrodes. We will mention the grounding conductors in the following part.

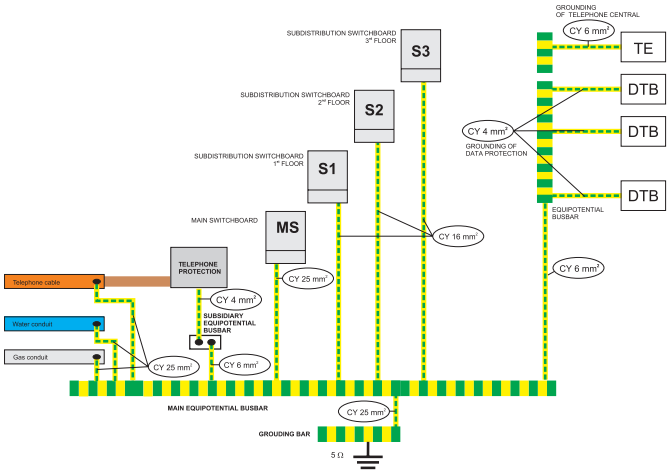
Grounding conductors must suit by their cross-sections, which must not be smaller then cross-section designed for the following formula:

$$S=\frac{\sqrt{I^2.t}}{k}$$

(This formula is only possible to be used during time of flowing ***I***, which doesn´t overrun 5 seconds)
S – cross-section of grounding conductor in [mm²]
I – an effective value of alternating current in [A], traversing because of failure with irrelevant impedance by protection element
t – disconnection time of protection equipment in seconds [s]
k – coefficient depending on material of protection

conductor, on isolation and on other parts, on temperature before and after short-circuit (values ***k*** for differently designed protection conductors are given in CSN standard 33 2000-5-54)

Minimal cross-section of grounding conductors must be minimally 16mm² Cu. They are placed in earth and protected against corrosion but not protected against mechanical damage. If these are not protected against corrosion (doesn´t mater if they are protected against mechanical damage or not), minimal cross-section of grounding conductor must be 25mm² Cu (exceptionally Al, which is however not recommended for use in earth).



The grounding conductor must be laid in such a way to resist all external influences, which can be expected during operating. At the same time it must not cause fire danger, eventually it should not influence operating of other equipment. It is laid to be as short as possible, without sharp curves, unnecessary arcs and loops. Overground parts of grounding conductors must be placed so they can be controllable. Outside part of grounding conductor must be suitably protected by panelling or by placing into tubes in places where danger of damage can occur (for example while going through a wall, going into earth). Conductive construction elements of metal constructions can be used as random grounding conductors. They create continually connected complex, as for example cable trays, cable frames, pillars, rails of crane, steel poles, reinforcement of columns made of flow spinning concrete and metal conduits. Connections of grounding conductors and ground electrodes must be correctly carried out and must be desirably dimensioned. While using clamps principle governs that the used clamp must not mechanically damage neither ground electrode (for example conduit) nor grounding conductor.

Power and communication equipment – interrelation

The smallest distance between the part of grounding communication device, which is not connected into its own transformer station should be at least 20m from the grounding power equipment part up to 1000V and 40m far from the grounding power equipment part over 1000V. If there is no way how to abide at least half of the mentioned distances, there is urgency to make one of the following arrangements:

a) It is necessary to make sure by calculating or measuring, that voltage on a communication equipment induced by the highest currents in grounding of power equipment doesn´t exceed permissible limit.

b) Both groundings are connected through, if it doesn´t evoke undesirable consequences of direct coupling (for example importation of dangerous or disturbing voltage into communication system, creation of route for stray currents or creation of macrocell with electrodes created by particular groundings).

The grounding of conductors and power equipment doesn´t have to be connected together, if the distance between two groundings in foundation soil is bigger than 5m. The grounding of the communication equipment should be as far from grounding of conductors as possible. If the distance between grounding of conductors and any other part of grounding of communication equipment is smaller than 5m, the both groundings must be connected through. Then joint earth termination system must agree with the standard EN 62 305 and with the rule set for communication equipment. Operating grounding of the overvoltage conductors is connected to protective grounding equipment, which are protected by surge arrester. In the chapter Grounding and protective conductors there is mentioned that generally protective conductor PE can be bare and must be laid together with outlying conductors. Grounding conductor, which goes to subsidiary grounding conductor, must be isolated so as it´s prevented from contact with protective conductor or any part connected to it or with dead parts, which are connected to the protective conductor. It is necessary to fulfill this condition so as by-pass of detectors is avoided. Protective conductor can be connected only to dead parts of those electrical subjects and equipment, whose power supply is disconnected in case of voltage protector equipage failing. The dead parts must be connected to a protective conductor during compliance of given conditions for every recommended kind of power system grounding. The dead parts, which are touch accessible at the same time, must be connected to the same earth termination system separately, in groups or together. These conductible parts must be connected together into so-called main protection connection in every building: protection conductor, grounding bonding bar or main protection clamp, conduit distribution in a building, for example water and gas, metal constructions and central heating and air-conditioning (if they are in the building). The conductible parts, which come into the building from outside must be connected as close to their entrance into the building as possible. Of course the conductors of main connection must comply with their cross-sections. The main connection must be done at every metal coating of communication cables. However it is necessary to obtain an approval of these cables owner or operator.

Grounding

The grounding of overvoltage protection to a quality ground is a requirement for their correct functioning. The ground is presented by protection conductor PE. The conductor PE is separately laid down in 5-conductor TNS system, which is enacted by standard. It is enacted for households, offices and industry. Energetics should secure this system type at the secondary side of a transformer already. All the installed overvoltage protection devices are connected to the equipotential busbar PAS by means of PE conductors. This PAS busbar has the closest potential to the ground potential. In TNC systems overvoltage protection devices are grounded onto PEN conductor, where differential balancing currents are flowing. That is why it doesn´t ensure as quality conditions for overvoltage protection functioning as the PE conductor. The values of the whole grounding resistance

and the resistance of grounding conductors PE, PEN in the conductor routing at the ends, are stipulate by standard CSN 33 2000-4-41. It is necessary to avoid loop connection of switchboards during the realization of the building grounding which make conditions for flow of faulty currents and a potential difference between conductors PE and PEN in their route towards ground potential. Star configuration drawing of the grounding conductors acc. to EN 62 305 is the optimal way how to eliminate these unfavourable effects.

Application of HAKEL SPD

Dimensioning of SDP type 1		
EN 62305 ed. 2		
Location of SPD type 1: On the boundaries LPZ 0 and LPZ 1		
LPL	**Lightning**	**Arresters total**
I.	up to 200 kA	100 kA
II.	up to 150 kA	75 kA
III.	up to 100 kA	50 kA
IV.	up to 100 kA	50 kA

Application of HAKEL SPD type 1		
EN 62305 ed. 2		
Location of SPD type 1: On the boundaries LPZ 0 and LPZ 1		
LPL	**Lightning**	**Arresters total**
I. a II.	up to 200 kA	up to 100 kA
Conditions fulfil:		
HZ110, HS50-50	*- big industrial buildings*	
	- buildings with particular importance	
SPC25	*- technological lines*	
	- administrative buildings	
	- small technological lines	
	- administrative properties	
	(if SPD type 1 and type 2 are placed into one switchboard)	

Application of HAKEL SPD type 1		
EN 62305 ed. 2		
Location of SPD type 1: On the boundaries LPZ 0 and LPZ 1		
LPL	**Lightning**	**Arresters total**
III. a IV.	up to 150 kA	up to 75 kA
Conditions fulfil:		
SPC25, SPC12,5 a PIV12,5	*- smaller administrative buildings*	
	- houses with standard equipments	
	- family houses	

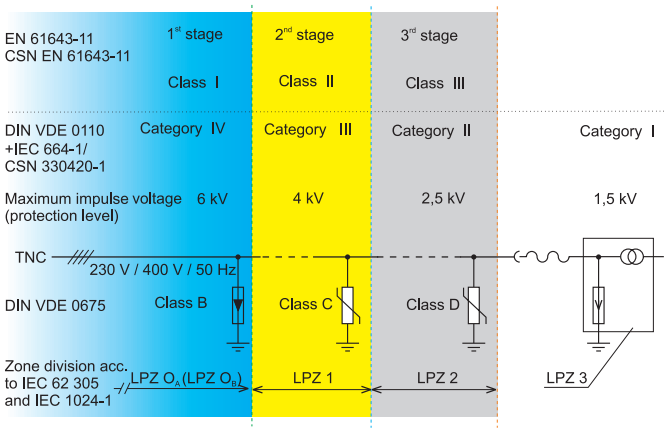
Application of HAKEL SPD type 2	
EN 62305 ed. 2	
Location of SPD type 2: On the boundaries LPZ 1 and LPZ 2	
Conditions fulfil:	
PIII, PIIIM	*- all types of electrical sets*
	- system type (TN, IT, TT)
	- mode of connection
	- nominal voltage

Application of HAKEL SPD type 3	
EN 62305 ed. 2	
Location of SPD type 3: On the boundaries LPZ 2 and LPZ 3	
Conditions fulfil:	
PI-k, PI-3k, P-3k, Pk2, ZS-1DSM	*- all types of electrical sets (located in switchboard)*
Sockets ZS	*- all types of electrical sets (sockets with inbuilt surge protection the closest to the protected equipment)*
	- all types of electrical sets (adaptors with inbuilt surge protection)
	- flexible solution

Technical standards relating to the installation of surge protection devices

All the EN standards apply to the Czech Republic, because the Czech Republic has signed the association agreement with the European Union. The directive No.89/336 EEC, the law No. 22/97 Coll. and the regulations NV 17 and 18/ 2003 Coll. enact abidance of electromagnetic compability (EMC) conditions for electrical equipment. In the other countries are these questions usually determined by relevant national directions. Mounting of the overvoltage protection devices solves most related problems and sufficiently protects electronics against influence of overvoltage spreading through galvanic routes.
Nowadays it is necessary to abide internationally recognized standard EN 61 643-11 and IEC 61643-11 which characterizes stages of overvoltage protections and their tests. Other standards relating to this are being prepared (for example the revisions of overvoltage protection devices).

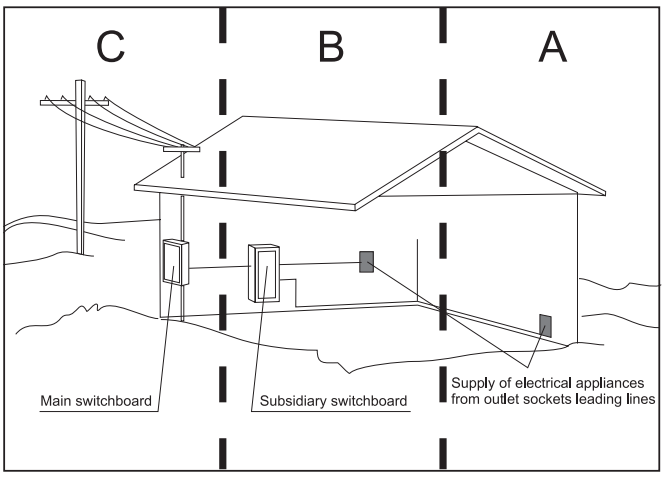
Because nowadays there is considerable assortment of SPDs with accompanying documentation according to DIN VDE 0675 or DIN VDE 0110 in the Czech Republic, it is advisable here to make a comparison of basic segmentation of SPDs according to these standards and standards obligatory in the Czech Republic, in particular IEC 664-1/CSN 33 0420-1. The standard EN 61 643-11 and IEC 61643-11 obligatory in the Czech Republic divides SPDs into stages (1st, 2nd and 3rd) and classes (I, II and III), whereas the standard DIN VDE 0675 divides SPDs into classes (A, B, C and D). The class A arresters are designed for protection of overground LV power system outside of the protected objects. The class B, C and D arresters are designed for usage at the boundaries LPZ 0→1, 1→2 and 2→3. On the other hand the standard DIN VDE 0110 states the definition of overvoltage category, which had been taken up by the standards IEC 664-1/CSN 33 0420-1. These standards define classification of LV power system into four categories (IV, III, II, I) and define so-called maximal impulse voltages (protection levels), permitted for connected appliances. (For example overvoltage at input of distribution TNC 230/400V/50Hz must not exceed 6kV level, it must not exceed 4kV behind the main switchboard, it must not exceed 2,5kV at outputs from subdistribution switchboards and 1,5kV in the part designed for connection of protected appliances to fixed installation.)



Classification comparison of particular LV power system (acc.to EN 61 643-11 and IEC 61643-11, EN 61 643-11, DIN VDE 0110, IEC 664-1/CSN33 0420 and DIN VDE 0675) relating to protection levels of surge protection cascade and to zone division acc. to EN 62 305 and IEC 1024-1.

Interesting is a similar comparison of these classifications of low voltage network system (LV) sections owing to the overvoltage cascades protection stages in the building electric installations based on the oversea C62.41.2 - 2002 standard ANSI/IEEE (American National Standard Institute/Institute of Electrical and Electronics Engineers). This standard devides 1st, 2nd and 3rd SPD classes into C, B, A categories (Location Categories).

Nevertheless, C category is classified into 2 levels (low, high) according to so-called „exposure degreeses“ resulting from isokeraunic maps of “storms activity“ levels.

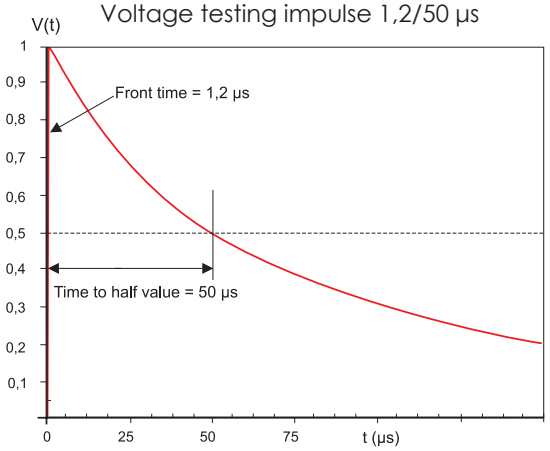


Summary of Surge Location Categories Guidelines Per IEEE C62.41.2-2002

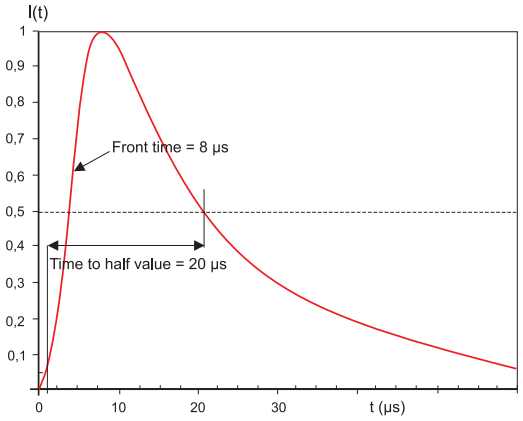
Summary of Surge Location Categories Guidelines (Per IEEE C62.41.2 - 2002)		
Location A	A	
Within a building		6kV 0.2kA 0.5us - 100kHz Ring Wave (30Ω)
Outlets and long branch circuits		6kV 0.5kA 1.2/50us 8/20us (12Ω)
All outlets more than 10m (30ft) from Category B		
All outlets more than 20m (60ft) from Category C		
Location B	B	
Near the service entrance		6kV 0.5kA 0.5us - 100kHz Ring Wave (12Ω)
Feeders and short branch circuits		6kV 3kA 1.2/50us 8/20us (2Ω)
Distribution Panel devices		
Bus and feeder industrial plants		
Heavy appliance outlets near service entrance		
Lighting systems in large buildings		
Location C		
External building		6kV 3kA 1.2/50us 8/20us (2Ω)
Outside and service entrance	C Low	6kV 100kHz Ring Wave
Service drop from pole to building		2.0 x V_{Peak} 10/1000 Combo. Wave
Run between meter and panel		10kV 10 kA 1.2/50us 8/20us (1Ω)
Overhead line to detached building	C High	6kV 100kHz Ring Wave
Underground line to well pump		2.3 x V_{Peak} 10/1000 Combo. Wave

It is worth mentioning that actually a complete SPD range of category C, B and A according to ANSI/IEEE is based on the tests by a combined impulse (1,2/50; 8/20μs) with a generator's internal resistance of 1 or 2 or 12Ω and partly by a test impulse at wave shape 0,5μs/100kHz (with the generator's internal resistance of 12Ω for B and C categoryies, alternatively 30Ω for A category). The standard ANSI/IEEE also defines a test current impulse at wave shape 10/1000μs. It is however recommended to use it only as so-called „additional test“ performance. The test impulse at 10/350μs wave shape had been for the first time defined in VDE 0675 standard in 1986 and later on subsequently taken over by EN 61 643-11 and IEC 61643-11. The following five pictures give you a well arranged information about the most used test impulse wave shapes according to IEC, EN, CSN standards, alternatively acc. to ANSI standard for the SPD testing intended for a use in a low voltage distribution networks.

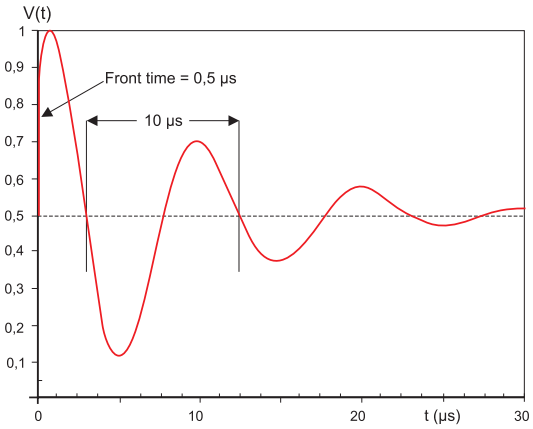
Voltage testing impulse 1,2/50 μs



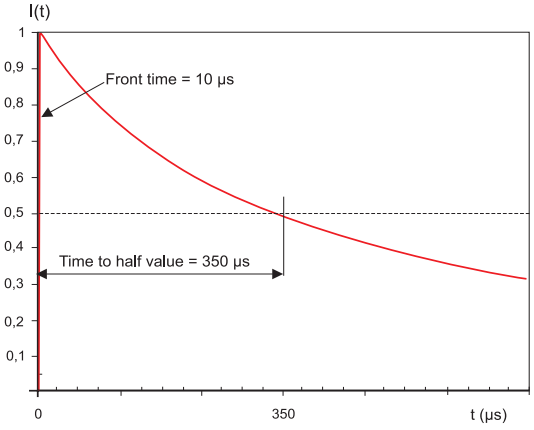
Current testing impulse 8/20 μs

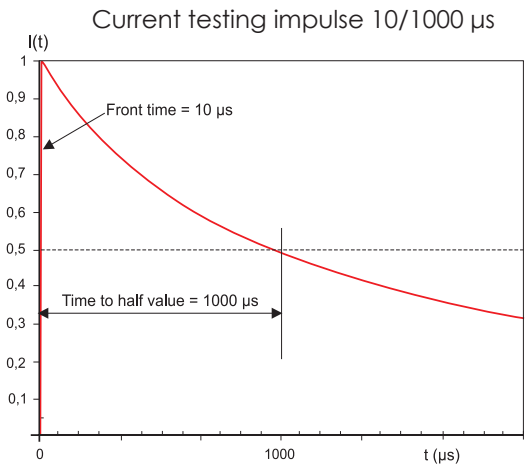


Ringwave current testing impulse 0,5/100 kHz



Lightning current testing impulse 10/350 μs



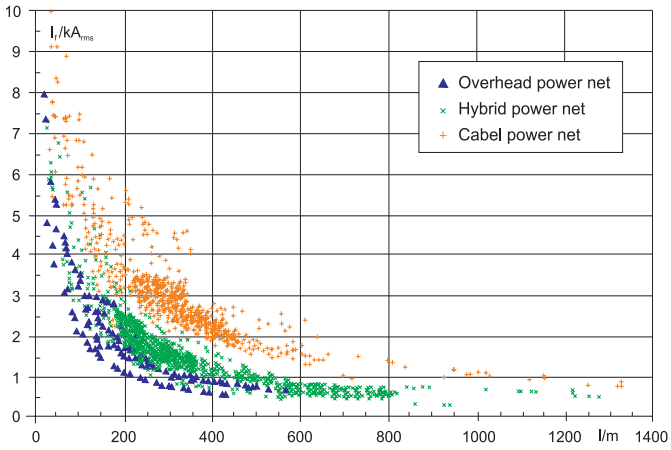


Possible usage of 1st stage surge protection

Varistor arresters of lightning current offer quality protection for their application in 1st stage of surge protection cascade with amplitude up to I_{imp} = 20 kA(10/350). In most applications it suits as well in case of so-called low voltage overground input into a building. If endurance against all higher amplitudes of lightning current is demanded, it is recommended to use arresters of spark gap type. It is necessary to pay attention to the parameter level of self-extinguishing follow current I_{fi} at U_C while a spark gap is choosed, because during the activation of a spark gap there is short-circuit in the place of its installation. Varistor arresters don´t have this property.

The follow currents at the spark gaps application in a protective overvoltage cascades

The follow short circuit currents occure in the spark gap based surge arresters (HS 45, HS 55, HS 60-20, HS 50-50, HS 50-16, HS 50-3) after their activation by an impulse discharge current, whereas their magnitude is restricted by an arised short circuit overall impedance of the energetic power network. These follow currents are spontaneously extinguished by an overpressure acting in an individual operative spark-gap chambers during the first net's half-period transit through a zero. The amplitude of a prospective short circuit current, in place of a defined application, partly depends on the type of power system and partly on a lead distance of given application from a distribution transformer. The following diagram describes the results of measurement evaluation of these prospective follow currents performed in 2325 three-phase network of 29 distribution plants, from that 315 were made on an overhead lines, 1215 on a combine lines and 715 on a cabel network. This graf shows that the value of prospective short circuit current never exeeds the value of 3kA_{rms} applicable for any power net type (overhead, combine or cabel network) for example while using an application distance of 600 m from a distribution transformer. The above mentioned diagram is a favourably applicable in a project practice for a qualified estimation of a suitable spark-gap selection for a defined application and first of all for I_{fi} parameter determination (self-extinguish follow current at U_C). The eventual doubts, caused by a defined application specification, depends totaly on a designer to cover them by a reasonable safety coefficient (the exact measurement is from the financial and technical point of view rather demanding). For example, if the value of a prospective follow current according to the qualified estimation is 3kA_{rms} then it is suitable to choose the surge arrester with an approximately twice higher parameter of I_{fi}.



Usage of surge separating inductors between particular stages of surge protection

Surge separating inductors with impedance 2÷15µH ensure energetic coordination of particular stages of overvoltage protection cascade in few cases. They are inserted in conduct in case that the distance between 1st and 2nd stage or between 2nd and 3rd stage is smaller than 10m. Short distance or missing surge separating inductor creates a certain possibility of damage of some arrester in overvoltage protection cascade by progressing lightning current impulse. It is important to pay a special attention to the coordination between 1st and 2nd stage of surge protection cascade in all cases where the 1st stage is fitted by spark-gap based lightning arresters. The most economical way is to secure that the 1st protection cascade is placed in other switchboard than the 2nd stage (with the min. distance of 10m between them). If this min. distance is impossible to fulfil either from the constructive or structural reasons, it is recommended to use separating inductors of 15µH.

Surge protection backup

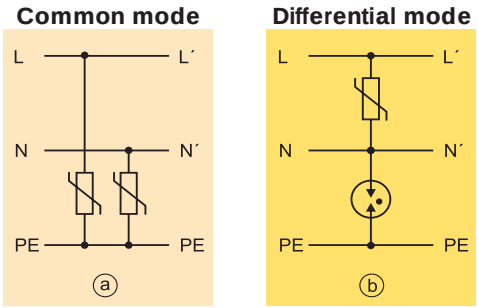
It is necessary to use additional protection of particular SPDs for protection against short-circuit in 1st and 2nd stages of overvoltage protection cascades. The protection is secured by backup safety fuses. Generally, every manufacturer of overvoltage protection devices declares dimensioning of these backup fuses in the accompanying documentation.

Recommendation for the installation of 3rd stage surge protection with the high frequency filter

3rd protection stage is an essential part of 3-stage overvoltage protection cascade. The typical representatives of this protection type are for example transient overvoltage protections-range PI-k* and PI-3k*. The products reduce overvoltage (thanks to their inside connection-high protection, filter, low protection) to the level U_p<0,8 up to 1kV, which is safe for the final appliances. They are usually constructively fitted on DIN rail 35mm. It is important to place these products as near to the protected appliance (for example flat switchboards) as possible. The distance between switchboard and appliance must not overreach 15m. When there is a longer distance it is necessary to use other class III overvoltage protection devices (for example protection sockets or overvoltage protection on DIN rail) cca 10m far away from each other along the protected socket line. On the other hand protected sockets are in no way equivalent substitution for 3rd stage protection with high-frequency filter.

Standardized implementation of the particular surge cascade stages

It is possible to connect the particular stages of overvoltage cascades in two ways:



Connection ***a*** prefers protection against lenghtwise overvoltage. Connection ***b*** prefers protection against transverse overvoltage. Because statistical results of long-term made measurements affirm generally higher danger of transverse overvoltage (on clamps of appliances L/N) than lengthwise overvoltage (on clamps of appliances L/PE, L/PE), are all the connections and applications of SPD manufacturing range of the Hakel company oriented on preferential protection of appliances against transverse overvoltage.

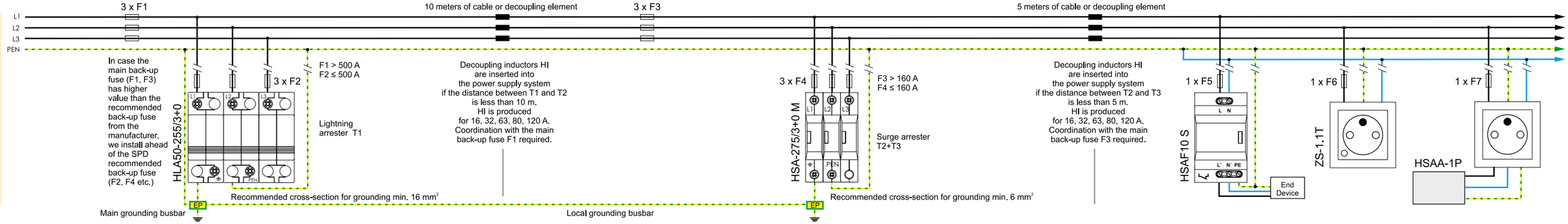
Test rooms

Surge protection device examination and their testing is the only way for ensuring and verification of their supposed endurance and serviceability under the hardest operation conditions. A new product final finish and all of its important components are examined within the scope of the type tests and the certification procedure. Self-tests are performed with help of the surge generators, which in a way „substitute" the current pulses of a natural character under a defined conditions. Testing wave shapes are set by even further connecting standards, particularly EN 616 43-11, IEC 62 305, IEC 60-1 and CSN 34 5640. Only a few working places, equipped with the wave shape generators 8/20μs, are situated in the Czech Republic. Mostly only with max. operational capacity up to I_{max} = 10 kA(8/20) or 20 kA(8/20). The only one working place in the Czech Republic is equipped with the currents generators with wave shape 10/350μsec. Namely, it is Hakel's test room in Hradec Kralove, which has at its disposal such generator with operational capacity I_{imp} = up to 210 kA(10/350). This test room has even at its disposal two testing current pulse generators with operational capacity I_{max} = 60 kA(8/20) and I_{max} = 240 kA(8/20).

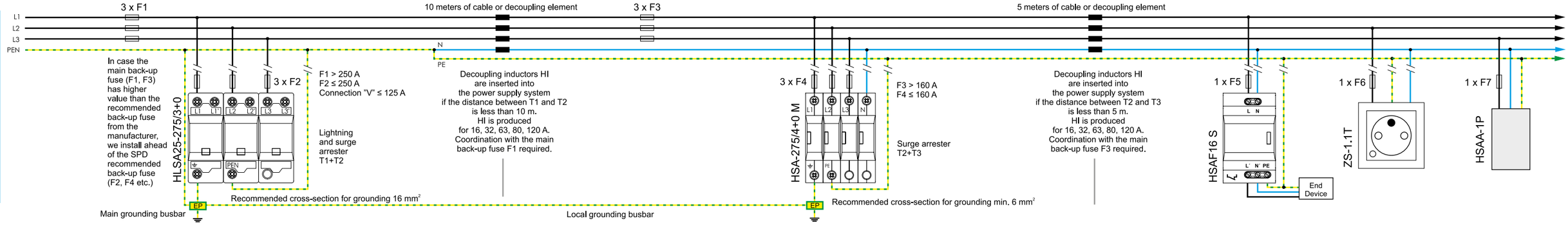
OBJECTS WITH LIGHTNING PROTECTION LEVEL LPL I and II

Type	Type 1 – LPZ 0-1 / Type 1+2 – LPZ 0-1 and higher (lightning arrester) / (lightning and surge arrester)		Type 2+3 – LPZ 1-3 (surge arrester)		Type 3 – LPZ 2-3 (surge arrester + EMI filter)	
	T1 and T2 **Main switchboard**		T2 and T3 **Subsidiary switchboard**		T3 **End Device**	
Installation	*Hospitals, banks, transmission points of GSM&BTS, water stations, power plants, airport control towers, buildings with danger of explosion, bigger industrial buildings, buildings with particular importance, bigger administrative buildings, schools, supermarkets, cathedrals etc.*	Substation Switchboard (kWh) Main Switchboard	*Industrial buildings, administrative buildings, schools, supermarkets, cathedrals, objects connected with buried cable*	Subsidiary switchboard, switchboards on every floor of the project or in every control panel	To the switchboard, which is closest to the protected equipment *In case of electronic control protection, the installation is directly to the appliance.*	*Outlet circuits which are longer than 20 m. Flush-mounted sockets and cable ducts. It is recommended to install SPD into the outlet circuit to every fourth socket or to the point of supply. This installation eliminates induced overvoltage which is enducing into the object's service cables.*

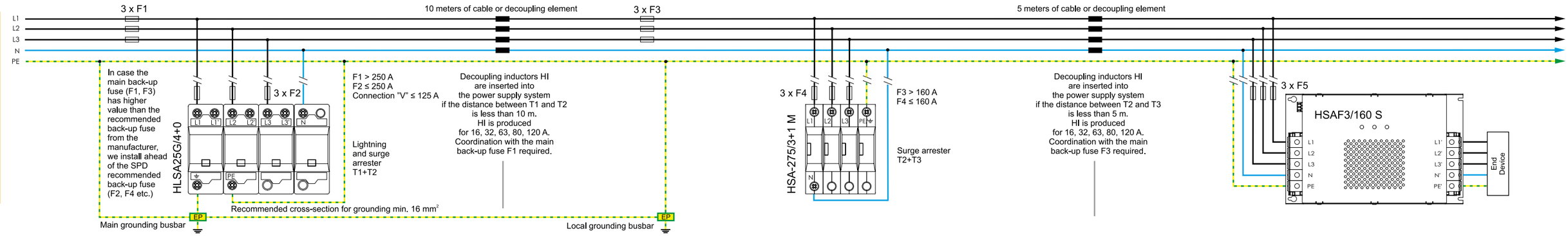
TN-C



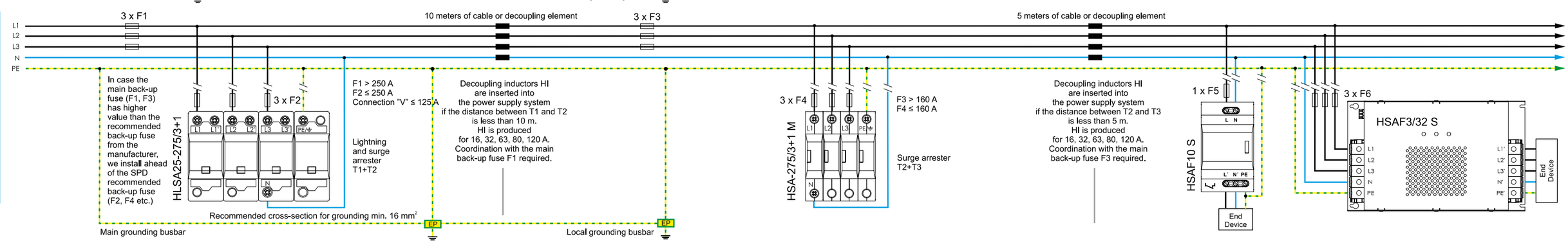
TN-C-S



TN-S



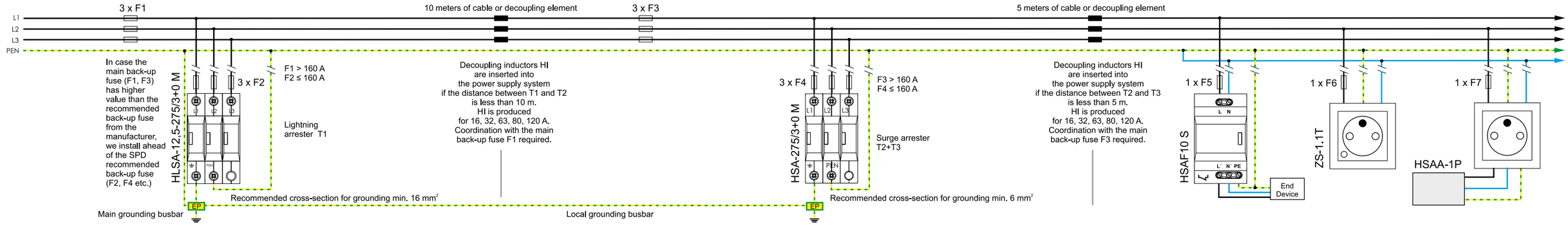
TT



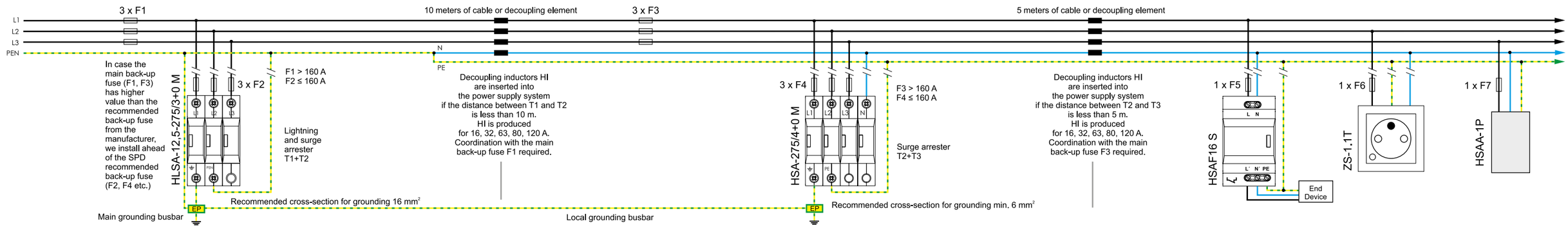
OBJECTS WITH LIGHTNING PROTECTION LEVEL LPL III and IV

Type	Type 1+2 – LPZ 0-1 and higher (lightning and surge arrester)		Type 2+3 – LPZ 1-3 (surge arrester)		Type 3 – LPZ 2-3 (surge arrester + EMI filter)	
	T1 and T2 **Main switchboard**		T2 and T3 **Subsidiary switchboard**		T3 **End Device**	
Installation	*Smaller industrial buildings, administrative buildings, residential buildings, agricultural buildings, family houses, common storehouses etc.*	Switchboard (kWh) Main Switchboard	*Industrial buildings, administrative buildings, objects connected with buried cable*	Subsidiary switchboard, switchboards on every floor of the project or in every control panel	To the switchboard, which is closest to the protected equipment *In case of electronic control protection, the installation is directly to the appliance.*	*Outlet circuits which are longer than 20 m. Flush-mounted sockets and cable ducts. It is recommended to install SPD into the outlet circuit to every fourth socket or to the point of supply. This installation eliminates induced overvoltage which is enducing into the object's service cables.*

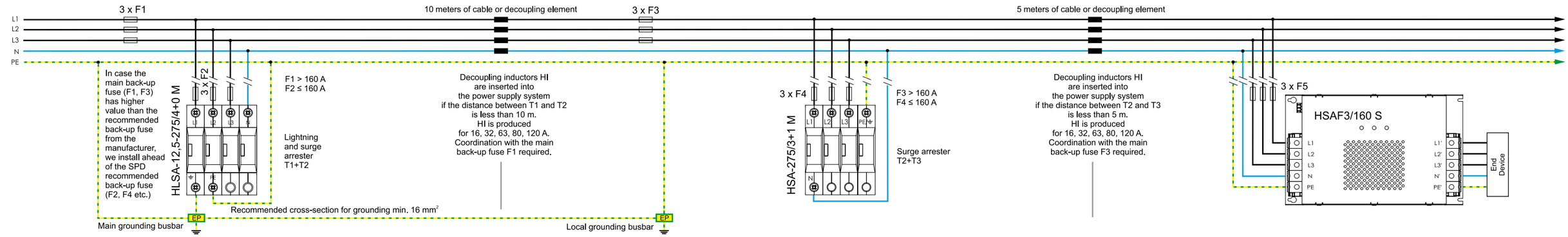
TN-C



TN-C-S



TN-S



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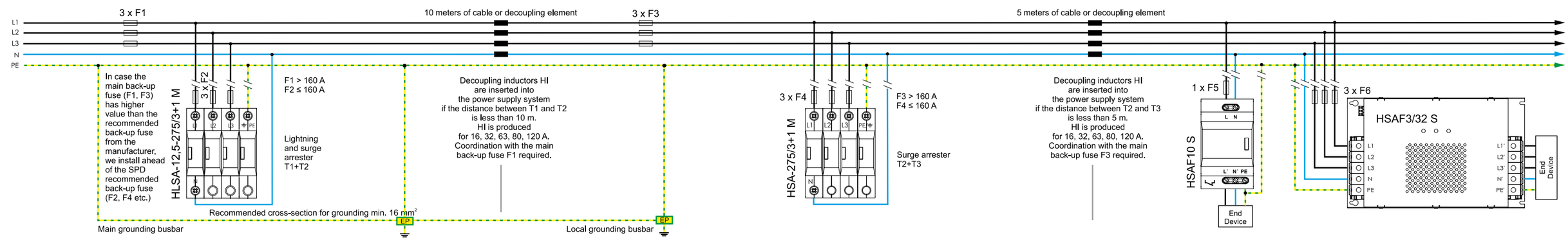
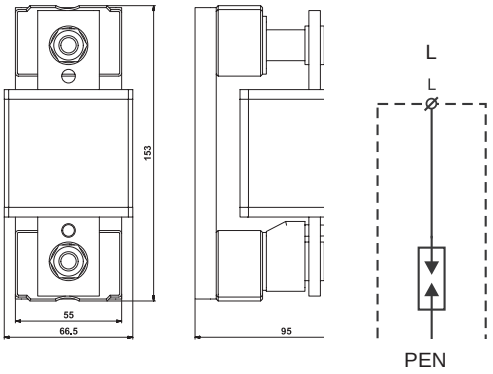


Lightning arrester / spark gap / TYPE 1

TYPE 1 / CLASS I / TN-C / CE



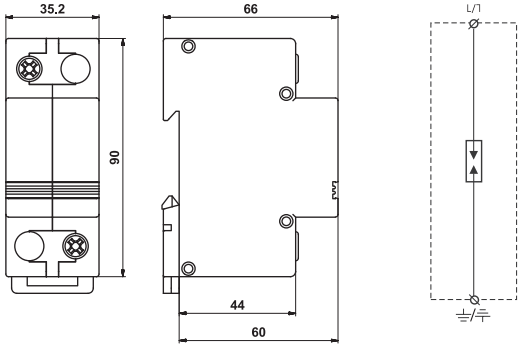
HZ110
HZ110/500

HZ110 is a lightning arrester type 1 according to EN 61643-11 and IEC 61643-11. This is recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0 – 1 (according to IEC 62305 and EN 62305), where it provides the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building. The lightning arrester is constructed as an encapsulated, non-exhaust, multiple spark gap, which does not have any special requirements for installation in the main switchboards in terms of the gas exhaustion generated during the passage of the lightning current. HZ110 is mainly intended for use in the power lines, which are operated as a system TN-C.

Type		**HZ110**	**HZ110/500**
Test class according to EN 61643-11 and IEC 61643-11		TYPE 1, CLASS I	
Max. continuous operating voltage	U_C	255 V AC	500 V AC
Lightning impulse current (10/350)	I_{imp}	110 kA	
- charge	Q	55 As	
- specific energy	W/R	3000 kJ/Ω	
Nominal discharge current (8/20)	I_n	50 kA	
Voltage protection level at I_{imp}	U_P	< 2,5 kV	
Temporary overvoltage (TOV)	U_T	334 V/5 s	690 V/5 s
Response time	t_A	< 100 ns	
Follow current interrupting rating at U_C	I_{fi}	10 kA_{rms}	8 kA_{rms}
Max. back-up fuse		500 A gL/gG	
Short-circuit current rating at 500 A gL/gG	I_{SCCR}	50 kA_{rms}	
LPZ		0-1	
Housing material		Polyamid PA6, UL94 V-0	
Protection type		IP00	
Operating temperature range	ϑ	-40 °C ... +80 °C	
Cross-section of the connected conductors (at tightening moment of clamps 8 Nm)		min. 50 mm^2	
Mounting on		holder SP50U10	
Lifetime		min. 100 000 h	
Weight	m	1000 g	
Article number		10 120	10 125

Lightning arrester / spark gap / TYPE 1

TYPE 1 / CLASS I / CE



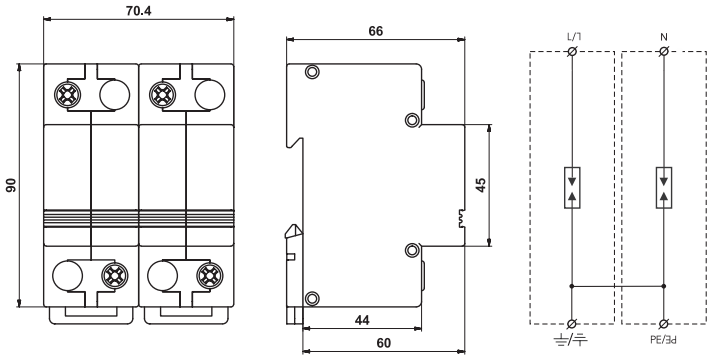
HLA50-255, HLA50-255 S
HLA50-440, HLA50-440 S

HLA* (Hakel Lightning Arrester) of the „G-Line" range is a lightning arrester according to standard EN 61643-11:2012 (IEC 61643-11:2011) consisting of multiple non-exhausting spark gaps. Its parameters enable usage in buildings with a considerable level of protection LPL I, such as big industrial complexes and properties of particular importance – hospitals, banks, power plants. The device is to be installed on the interface of LPZ 0 – LPZ 1 zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where the overhead line enters the building i.e. the electric power substation, electrometer or the main distribution boards. **S** indication specifies a version with remote monitoring.

Type			**HLA50-255, HLA50-255 S**	**HLA50-440, HLA50-440 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1, CLASS I	
Max. continuous operating voltage		U_C	255 V AC	440 V AC
Impulse discharge current for class I test (10/350)		I_{imp}	50 kA	
Charge		Q	25 As	
Specific energy for class I test		W/R	625 kJ/Ω	
Nominal discharge current for class II test (8/20)		I_n	50 kA	
Voltage protection level at I_{imp}		U_p	< 2 kV	< 2,5 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s	581 V/5 s
Response time		t_A	< 100 ns	
Follow current interrupt rating		I_{fi}	25 kA_{rms}	3 kA_{rms}
Max. back-up fuse			500 A gL/gG	
Short-circuit current rating at 500 A gL/gG		I_{SCCR}	25 kA_{rms}	
LPZ			0-1	
Housing material			Polyamid PA6, UL94 V-0	
Degree of protection of enclosure			IP20	
Operating temperature range		ϑ	-40 °C ... +70 °C	
Cross-section of the connected conductors (at tightening moment of clamps 4 Nm)			25 mm² (solid) - 16 mm² (wire)	
The mounting method / operating position			DIN rail 35 mm / any	
Lifetime			min. 100 000 h	
Weight		m	235 g	
Article number	HLA50-*		10 970	10 950
	HLA50-* S		10 975	10 956

Lightning arrester / spark gap / TYPE 1

TYPE 1 / CLASS I / TN-S / CE



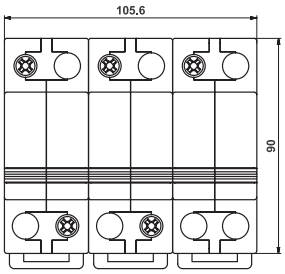
HLA50-255/2+0, HLA50-255/2+0 S
HLA50-440/2+0, HLA50-440/2+0 S

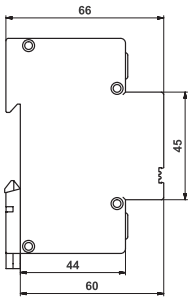
HLA* (Hakel Lightning Arrester) of the „G-Line" range is a lightning arrester according to standard EN 61643-11:2012 (IEC 61643-11:2011) consisting of multiple non-exhausting spark gaps. Its parameters enable usage in buildings with a considerable level of protection LPL I, such as big industrial complexes and properties of particular importance – hospitals, banks, power plants. The device is to be installed on the interface of LPZ 0 – LPZ 1 zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where the overhead line enters the building i.e. the electric power substation, electrometer or the main distribution boards.
The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

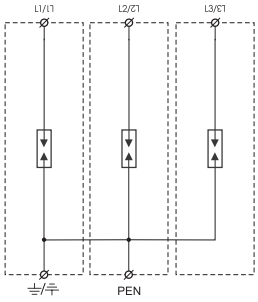
Type			**HLA50-255/2+0, HLA50-255/2+0 S**	**HLA50-440/2+0, HLA50-440/2+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1, CLASS I	
System			TN-S	
Max. continuous operating voltage		U_C	255 V AC	440 V AC
Impulse discharge current for class I test (10/350)		I_{imp}	50 kA	
Charge		Q	25 As	
Specific energy for class I test		W/R	625 kJ/Ω	
Total discharge current (10/350) L+N->PE		I_{TOTAL}	100 kA	
Nominal discharge current for class II test (8/20)		I_n	50 kA	
Voltage protection level at I_{imp}		U_p	< 2 kV	< 2,5 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s	581 V/5 s
Response time		t_A	< 100 ns	
Follow current interrupt rating		I_{fi}	25 kA_{rms}	3 kA_{rms}
Max. back-up fuse			500 A gL/gG	
Short-circuit current rating at 500 A gL/gG		I_{SCCR}	25 kA_{rms}	
LPZ			0-1	
Housing material			Polyamid PA6, UL94 V-0	
Degree of protection of enclosure			IP20	
Operating temperature range		ϑ	-40 °C ... +70 °C	
Cross-section of the connected conductors (at tightening moment of clamps 4 Nm)			25 mm² (solid) - 16 mm² (wire)	
The mounting method / operating position			DIN rail 35 mm / any	
Lifetime			min. 100 000 h	
Weight		m	470 g	
Article number	HLA50-*/ 2+0		10 971	10 952
	HLA50-*/ 2+0 S		10 976	10 958

Lightning arrester / spark gap / TYPE 1

TYPE 1 / CLASS I / TN-C / CE







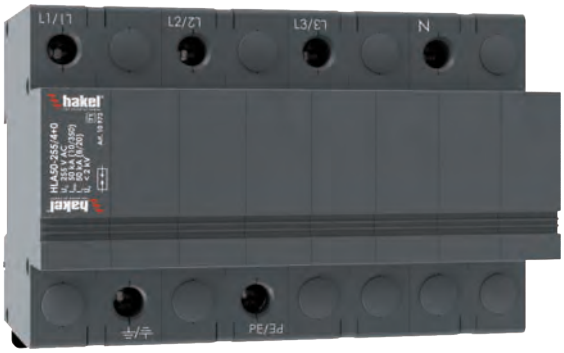
HLA50-255/3+0, HLA50-255/3+0 S
HLA50-440/3+0, HLA50-440/3+0 S

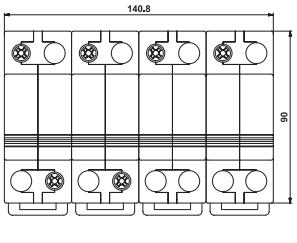
HLA* (Hakel Lightning Arrester) of the „G-Line" range is a lightning arrester according to standard EN 61643-11:2012 (IEC 61643-11:2011) consisting of multiple non-exhausting spark gaps. Its parameters enable usage in buildings with a considerable level of protection LPL I, such as big industrial complexes and properties of particular importance – hospitals, banks, power plants. The device is to be installed on the interface of LPZ 0 – LPZ 1 zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where the overhead line enters the building i.e. the electric power substation, electrometer or the main distribution boards.
The product has two PEN terminals, which can not be used as a PEN bridge. **S** indication specifies a version with remote monitoring.

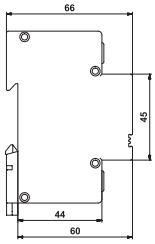
Type			**HLA50-255/3+0, HLA50-255/3+0 S**	**HLA50-440/3+0, HLA50-440/3+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1, CLASS I	
System			TN-C	
Max. continuous operating voltage		U_C	255 V AC	440 V AC
Impulse discharge current for class I test (10/350)		I_{imp}	50 kA	
Charge		Q	25 As	
Specific energy for class I test		W/R	625 kJ/Ω	
Total discharge current (10/350) L1+L2+L3->PEN		I_{TOTAL}	150 kA	
Nominal discharge current for class II test (8/20)		I_n	50 kA	
Voltage protection level at I_{imp}		U_p	< 2 kV	< 2,5 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s	581 V/5 s
Response time		t_A	< 100 ns	
Follow current interrupt rating		I_{fi}	25 kA_{rms}	3 kA_{rms}
Max. back-up fuse			500 A gL/gG	
Short-circuit current rating at 500 A gL/gG		I_{SCCR}	25 kA_{rms}	
LPZ			0-1	
Housing material			Polyamid PA6, UL94 V-0	
Degree of protection of enclosure			IP20	
Operating temperature range		ϑ	-40 °C ... +70 °C	
Cross-section of the connected conductors (at tightening moment of clamps 4 Nm)			25 mm² (solid) - 16 mm² (wire)	
The mounting method / operating position			DIN rail 35 mm / any	
Lifetime			min. 100 000 h	
Weight		m	705 g	
Article number	HLA50-*/ 3+0		10 972	10 953
	HLA50-*/ 3+0 S		10 977	10 959

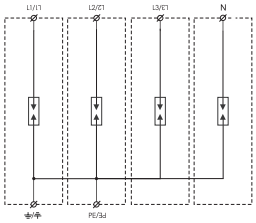
Lightning arrester / spark gap / TYPE 1

TYPE 1 / CLASS I / TN-S / CE









HLA50-255/4+0, HLA50-255/4+0 S
HLA50-440/4+0, HLA50-440/4+0 S

HLA* (Hakel Lightning Arrester) of the „G-Line" range is a lightning arrester according to standard EN 61643-11:2012 (IEC 61643-11:2011) consisting of multiple non-exhausting spark gaps. Its parameters enable usage in buildings with a considerable level of protection LPL I, such as big industrial complexes and properties of particular importance – hospitals, banks, power plants. The device is to be installed on the interface of LPZ 0 – LPZ 1 zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where the overhead line enters the building i.e. the electric power substation, electrometer or the main distribution boards.
The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

Type			**HLA50-255/4+0, HLA50-255/4+0 S**	**HLA50-440/4+0, HLA50-440/4+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1, CLASS I	
System			TN-S	
Max. continuous operating voltage		U_C	255 V AC	440 V AC
Impulse discharge current for class I test (10/350)		I_{imp}	50 kA	
Charge		Q	25 As	
Specific energy for class I test		W/R	625 kJ/Ω	
Total discharge current (10/350) L1+L2+L3+N->PE		I_{TOTAL}	200 kA	
Nominal discharge current for class II test (8/20)		I_n	50 kA	
Voltage protection level at I_{imp}		U_p	< 2 kV	< 2,5 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s	581 V/5 s
Response time		t_A	< 100 ns	
Follow current interrupt rating		I_{fi}	25 kA_{rms}	3 kA_{rms}
Max. back-up fuse			500 A gL/gG	
Short-circuit current rating at 500 A gL/gG		I_{SCCR}	25 kA_{rms}	
LPZ			0-1	
Housing material			Polyamid PA6, UL94 V-0	
Degree of protection of enclosure			IP20	
Operating temperature range		ϑ	-40 °C ... +70 °C	
Cross-section of the connected conductors (at tightening moment of clamps 4 Nm)			25 mm² (solid) - 16 mm² (wire)	
The mounting method / operating position			DIN rail 35 mm / any	
Lifetime			min. 100 000 h	
Weight		m	940 g	
Article number	HLA50-*/ 4+0		10 973	10 955
	HLA50-*/ 4+0 S		10 978	10 961

Lightning arrester / spark gap / TYPE 1

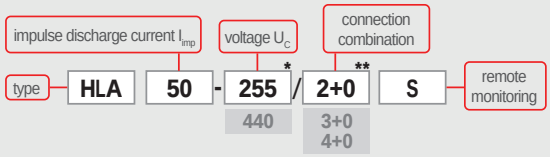
Single-pole / solid version	
Art. No.	**Type**
10970	HLA50-255
10975	HLA50-255 S
10950	HLA50-440
10956	HLA50-440 S

Recommended sets / solid version	
Art. No.	**Type**
10971	HLA50-255/2+0
10976	HLA50-255/2+0 S
10972	HLA50-255/3+0
10977	HLA50-255/3+0 S
10973	HLA50-255/4+0
10978	HLA50-255/4+0 S
10952	HLA50-440/2+0
10958	HLA50-440/2+0 S
10953	HLA50-440/3+0
10959	HLA50-440/3+0 S
10955	HLA50-440/4+0
10961	HLA50-440/4+0 S

Product name specification

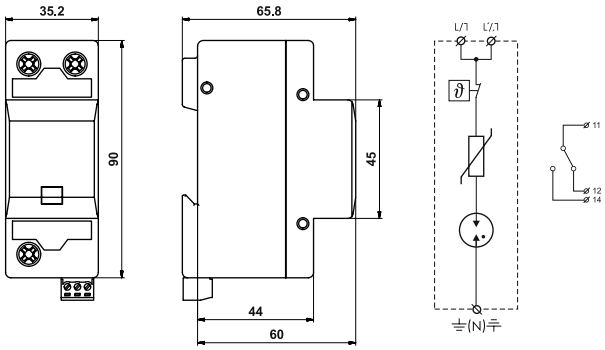
HLA50*/**

T1



Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

TYPE 1+2 / CLASS I+II / CE



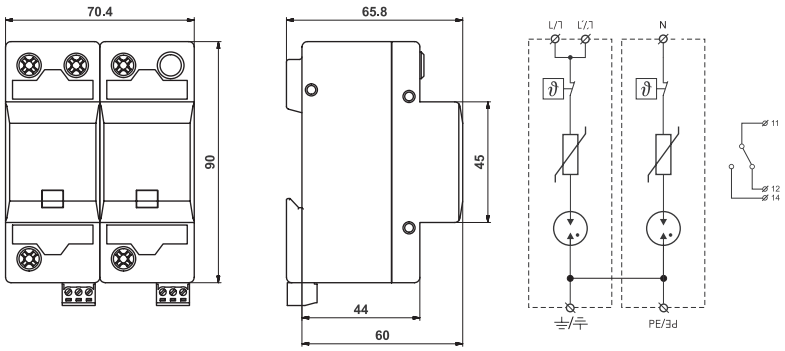
HLSA25G-255
HLSA25G-255 S

HLSA25G* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011). It consists of high energy double varistors for better discharge ability and a gas discharge tube connected in series, which ensures zero leakage current through the conductor. Its parameters enable usage in buildings with considerable levels of protection LPL I and LPL II, such as hospitals, banks, industrial and administration complexes, schools, shopping and sports centres or supermarkets. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. **S** indication specifies a version with remote monitoring.

Type			**HLSA25G-255, HLSA25G-255 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
Max. continuous operating voltage		U_C	255 V AC
Impulse discharge current for class I test (10/350)		I_{imp}	25 kA
Charge		Q	12,5 As
Specific energy for class I test		W/R	156 kJ/Ω
Nominal discharge current for class II test (8/20)		I_n	25 kA
Maximum discharge current (8/20)		I_{max}	50 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			250 A gL/gG
Max. back-up fuse („V" connection)			125 A gL/gG
Short-circuit current rating at 250 A gL/gG		I_{SCCR}	80 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			35 mm² (solid) - 25 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	250 g
Article number	HLSA25G-255		10 462
	HLSA25G-255 S		10 466

Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / TT / CE



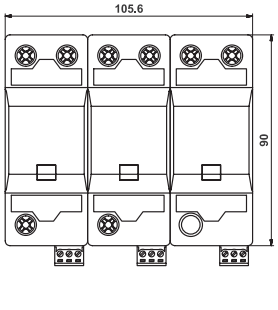
HLSA25G-255/2+0
HLSA25G-255/2+0 S

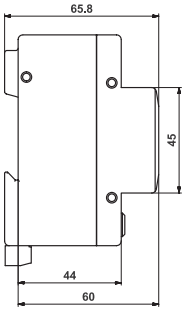
HLSA25G* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011). It consists of high energy double varistors for better discharge ability and a gas discharge tube connected in series, which ensures zero leakage current through the conductor. Its parameters enable usage in buildings with considerable levels of protection LPL I and LPL II, such as hospitals, banks, industrial and administration complexes, schools, shopping and sports centres or supermarkets. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

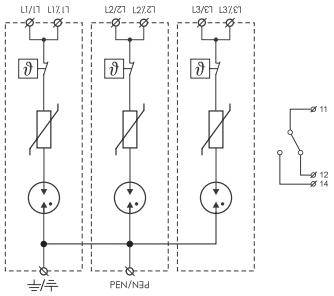
Type			**HLSA25G-255/2+0, HLSA25G-255/2+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S, TT
Max. continuous operating voltage		U_C	255 V AC
Impulse discharge current for class I test (10/350)		I_{imp}	25 kA
Charge		Q	12,5 As
Specific energy for class I test		W/R	156 kJ/Ω
Total discharge current (10/350) L1+N->PE		I_{TOTAL}	50 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Maximum discharge current (8/20)		I_{max}	50 kA
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	100 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			250 A gL/gG
Max. back-up fuse („V" connection)			125 A gL/gG
SShort-circuit current rating at 250 A gL/gG		I_{SCCR}	80 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			35 mm² (solid) - 25 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	500 g
Article number	HLSA25G-255/2+0		10 463
	HLSA25G-255/2+0 S		10 467

Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-C / CE







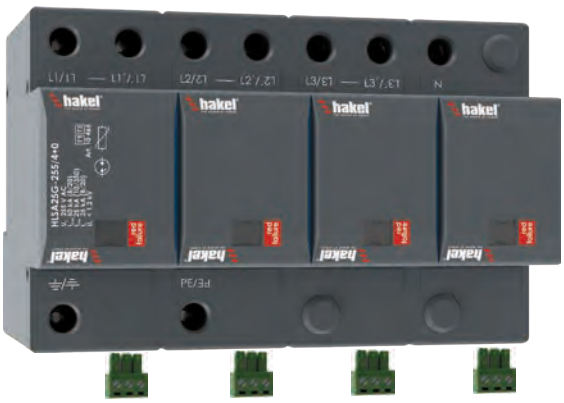
HLSA25G-255/3+0
HLSA25G-255/3+0 S

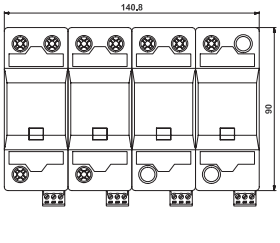
HLSA25G* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011). It consists of high energy double varistors for better discharge ability and a gas discharge tube connected in series, which ensures zero leakage current through the conductor. Its parameters enable usage in buildings with considerable levels of protection LPL I and LPL II, such as hospitals, banks, industrial and administration complexes, schools, shopping and sports centres or supermarkets. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. The product has two PEN terminals, which can not be used as a PEN bridge. **S** indication specifies a version with remote monitoring.

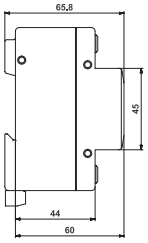
Type		**HLSA25G-255/3+0, HLSA25G-255/3+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)		TYPE 1+2, CLASS I+II
System		TN-C
Max. continuous operating voltage	U_C	255 V AC
Impulse discharge current for class I test (10/350)	I_{imp}	25 kA
Charge	Q	12,5 As
Specific energy for class I test	W/R	156 kJ/Ω
Total discharge current (10/350) L1+L2+L3->PEN	I_{TOTAL}	75 kA
Nominal discharge current for class II test (8/20)	I_n	25 kA
Maximum discharge current (8/20)	I_{max}	50 kA
Total discharge current (8/20) L1+L2+L3->PEN	I_{TOTAL}	150 kA
Voltage protection level at I_n	U_p	< 1,2 kV
Temporary overvoltage (TOV)	U_T	337 V/5 s
Response time	t_A	< 25 ns
Max. back-up fuse		250 A gL/gG
Max. back-up fuse („V" connection)		125 A gL/gG
Short-circuit current rating at 250 A gL/gG	I_{SCCR}	80 kA_{rms}
LPZ		0-1 and higher
Housing material		Polyamid PA6, UL94 V-0
Degree of protection of enclosure		IP20
Operating temperature range	ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)		35 mm² (solid) - 25 mm² (wire)
The mounting method / operating position		DIN rail 35 mm / any
Failure signalisation		optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)		AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime		min. 100 000 h
Weight	m	750 g
Article number — HLSA25G-255/3+0		10 464
Article number — HLSA25G-255/3+0 S		10 468

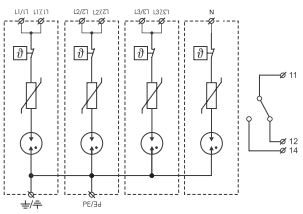
Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / TT / CE









HLSA25G-255/4+0
HLSA25G-255/4+0 S

HLSA25G* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011). It consists of high energy double varistors for better discharge ability and a gas discharge tube connected in series, which ensures zero leakage current through the conductor. Its parameters enable usage in buildings with considerable levels of protection LPL I and LPL II, such as hospitals, banks, industrial and administration complexes, schools, shopping and sports centres or supermarkets. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

Type			**HLSA25G-255/4+0, HLSA25G-255/4+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S, TT
Max. continuous operating voltage		U_C	255 V AC
Impulse discharge current for class I test (10/350)		I_{imp}	25 kA
Charge		Q	12,5 As
Specific energy for class I test		W/R	156 kJ/Ω
Total discharge current (10/350) L1+L2+L3+N->PE		I_{TOTAL}	100 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Maximum discharge current (8/20)		I_{max}	50 kA
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	200 kA
Voltage protection level at I_n		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			250 A gL/gG
Max. back-up fuse („V" connection)			125 A gL/gG
Short-circuit current rating at 250 A gL/gG		I_{SCCR}	80 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			35 mm² (solid) - 25 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	1000 g
Article number	HLSA25G-255/4+0		10 465
	HLSA25G-255/4+0 S		10 469

Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

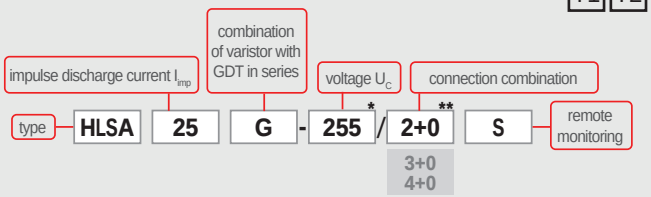
Single-pole / solid version	
Art. No.	**Type**
10462	HLSA25G-255
10466	HLSA25G-255 S

Recommended sets / solid version	
Art. No.	**Type**
10463	HLSA25G-255/2+0
10464	HLSA25G-255/3+0
10465	HLSA25G-255/4+0
10467	HLSA25G-255/2+0 S
10468	HLSA25G-255/3+0 S
10469	HLSA25G-255/4+0 S

Product name specification

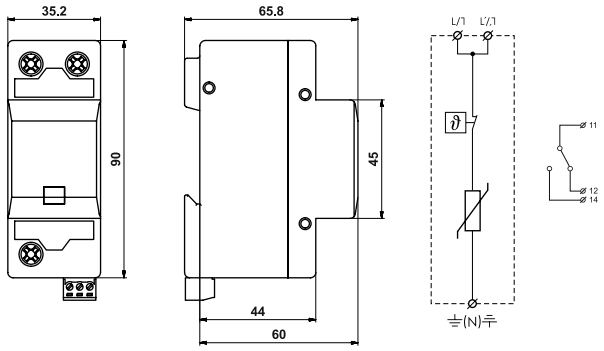
HLSA25G-*/ S**

T1 T2



Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / CE



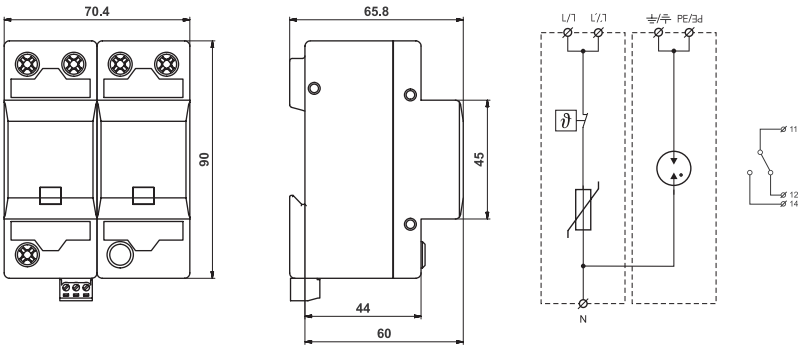
HLSA25-275
HLSA25-275 S

HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy double varistors for a better discharge ability. Its parameters enable usage in buildings with considerable levels of protection LPL I and LPL II, such as hospitals, banks, industrial and administration complexes, schools, shopping and sports centres or supermarkets. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where the overhead line enters the building i.e. in the main distribution boards. **S** indication specifies a version with remote monitoring.

Type			**HLSA25-275, HLSA25-275 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Impulse discharge current for class I test (10/350)		I_{imp}	25 kA
Charge		Q	12,5 As
Specific energy for class I test		W/R	156 kJ/Ω
Nominal discharge current for class II test (8/20)		I_n	25 kA
Maximum discharge current (8/20)		I_{max}	50 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			250 AgL/gG
Max. back-up fuse („V" connection)			125 AgL/gG
Short-circuit current rating at 250 A gL/gG		I_{SCCR}	80 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			35 mm² (solid) - 25 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	300 g
Article number	HLSA25-275		10 450
	HLSA25-275 S		10 456

Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / TT / CE



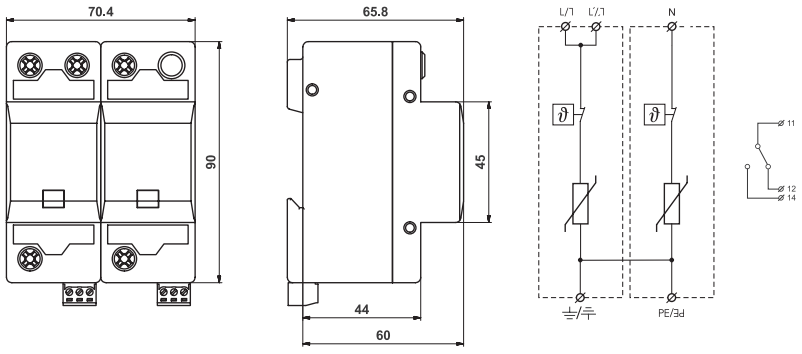
HLSA25-275/1+1
HLSA25-275/1+1 S

HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester combined with gas discharge tube according to EN 61643-11:2012 (IEC 61643-11:2011). It consists of high energy double varistors for better discharge ability and gas discharge tube that ensures zero leakage current in the PE conductor. Its parameters enable usage in buildings with considerable levels of protection LPL I and LPL II, such as hospitals, banks, industrial and administration complexes, schools, shopping and sports centres or supermarkets. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where the overhead line enters the building i.e. in the main distribution boards. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

Type			**HLSA25-275/1+1, HLSA25-275/1+1 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S, TT
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Impulse discharge current for class I test (10/350) L/N		I_{imp}	25 kA
Charge L/N		Q	12,5 As
Specific energy for class I test L/N		W/R	156 kJ/Ω
Impulse discharge current for class I test (10/350) N/PE		I_{imp}	50 kA
Charge N/PE		Q	25 As
Specific energy for class I test N/PE		W/R	625 kJ/Ω
Total discharge current (10/350) L1+N->PE		I_{TOTAL}	50 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Maximum discharge current (8/20)		I_{max}	50 kA
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	100 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV) L/N		U_T	337 V/5 s
Temporary overvoltage (TOV) N/PE		U_T	1200 V/0,2 s
Response time L/N		t_A	< 25 ns
Response time N/PE		t_A	< 100 ns
Max. back-up fuse			250 A gL/gG
Max. back-up fuse („V" connection)			125 A gL/gG
Short-circuit current rating at 250 A gL/gG		I_{SCCR}	80 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			35 mm² (solid) - 25 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	460 g
Article number	HLSA25-275/1+1		10 451
	HLSA25-275/1+1 S		10 457

Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / CE



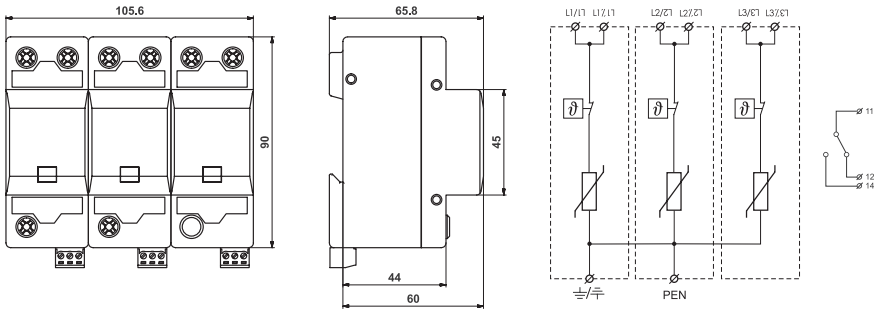
HLSA25-275/2+0
HLSA25-275/2+0 S

HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy double varistors for a better discharge ability. Its parameters enable usage in buildings with considerable levels of protection LPL I and LPL II, such as hospitals, banks, industrial and administration complexes, schools, shopping and sports centres or supermarkets. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where the overhead line enters the building i.e. in the main distribution boards. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

Type			**HLSA25-275/2+0, HLSA25-275/2+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Impulse discharge current for class I test (10/350)		I_{imp}	25 kA
Charge		Q	12,5 As
Specific energy for class I test		W/R	156 kJ/Ω
Total discharge current (10/350) L1+N->PE		I_{TOTAL}	50 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Maximum discharge current (8/20)		I_{max}	50 kA
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	100 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			250 A gL/gG
Max. back-up fuse („V" connection)			125 A gL/gG
Short-circuit current rating at 250 A gL/gG		I_{SCCR}	80 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			35 mm² (solid) - 25 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	600 g
Article number	HLSA25-275/2+0		10 452
	HLSA25-275/2+0 S		10 458

Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-C / CE



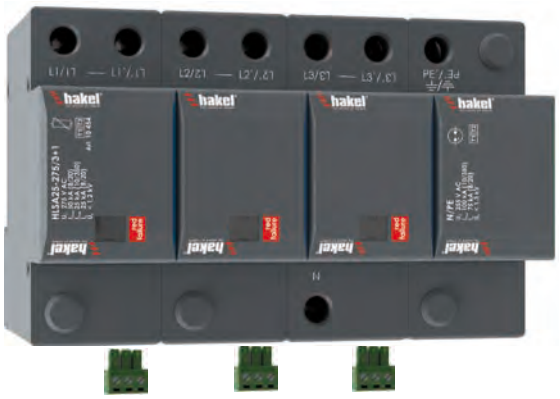
HLSA25-275/3+0
HLSA25-275/3+0 S

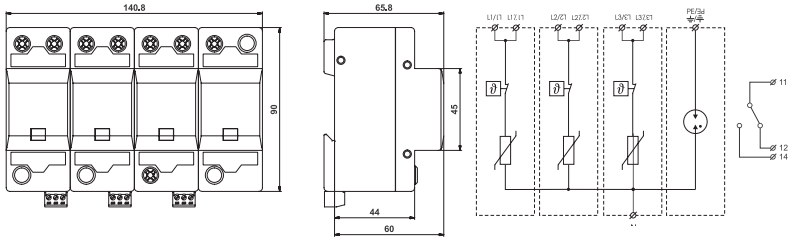
HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy double varistors for a better discharge ability. Its parameters enable usage in buildings with considerable levels of protection LPL I and LPL II, such as hospitals, banks, industrial and administration complexes, schools, shopping and sports centres or supermarkets. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where the overhead line enters the building i.e. in the main distribution boards. The product has two PEN terminals, which can not be used as a PEN bridge. **S** indication specifies a version with remote monitoring.

Type			**HLSA25-275/3+0, HLSA25-275/3+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-C
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Impulse discharge current for class I test (10/350)		I_{imp}	25 kA
Charge		Q	12,5 As
Specific energy for class I test		W/R	156 kJ/Ω
Total discharge current (10/350) L1+L2+L3->PEN		I_{TOTAL}	75 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Maximum discharge current (8/20)		I_{max}	50 kA
Total discharge current (8/20) L1+L2+L3->PEN		I_{TOTAL}	150 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			250 A gL/gG
Max. back-up fuse („V" connection)			125 A gL/gG
Short-circuit current rating at 250 A gL/gG		I_{SCCR}	80 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			35 mm² (solid) - 25 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	900 g
Article number	HLSA25-275/3+0		10 453
	HLSA25-275/3+0 S		10 459

Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / TT / CE





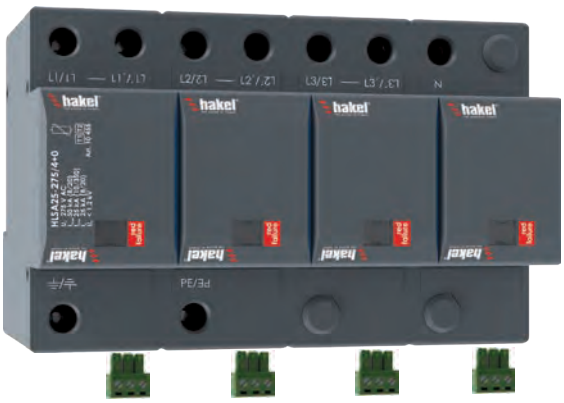
HLSA25-275/3+1
HLSA25-275/3+1 S

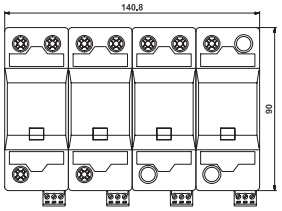
HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester combined with gas discharge tube according to EN 61643-11:2012 (IEC 61643-11:2011). It consists of high energy double varistors for better discharge ability and gas discharge tube that ensures zero leakage current in the PE conductor. Its parameters enable usage in buildings with considerable levels of protection LPL I and LPL II, such as hospitals, banks, industrial and administration complexes, schools, shopping and sports centres or supermarkets. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where the overhead line enters the building i.e. in the main distribution boards. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

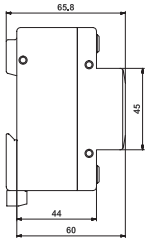
Type			**HLSA25-275/3+1, HLSA25-275/3+1 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S, TT
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Impulse discharge current for class I test (10/350) L/N		I_{imp}	25 kA
Charge L/N		Q	12,5 As
Specific energy for class I test L/N		W/R	156 kJ/Ω
Impulse discharge current for class I test (10/350) N/PE		I_{imp}	100 kA
Charge N/PE		Q	50 As
Specific energy for class I test N/PE		W/R	2500 kJ/Ω
Total discharge current (10/350) L1+L2+L3+N->PE		I_{TOTAL}	100 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Maximum discharge current (8/20)		I_{max}	50 kA
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	150 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV) L/N		U_T	337 V/5 s
Temporary overvoltage (TOV) N/PE		U_T	1200 V/0,2 s
Response time L/N		t_A	< 25 ns
Response time N/PE		t_A	< 100 ns
Max. back-up fuse			250 A gL/gG
Max. back-up fuse („V" connection)			125 A gL/gG
Short-circuit current rating at 250 A gL/gG		I_{SCCR}	80 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			35 mm² (solid) - 25 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	1125 g
Article numbe	HLSA25-275/3+1		10 454
	HLSA25-275/3+1 S		10 460

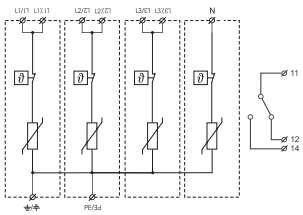
Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / CE









HLSA25-275/4+0
HLSA25-275/4+0 S

HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy double varistors for a better discharge ability. Its parameters enable usage in buildings with considerable levels of protection LPL I and LPL II, such as hospitals, banks, industrial and administration complexes, schools, shopping and sports centres or supermarkets. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where the overhead line enters the building i.e. in the main distribution boards. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

Type			**HLSA25-275/4+0, HLSA25-275/4+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Impulse discharge current for class I test (10/350)		I_{imp}	25 kA
Charge		Q	12,5 As
Specific energy for class I test		W/R	156 kJ/Ω
Total discharge current (10/350) L1+L2+L3+N->PE		I_{TOTAL}	100 kA
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	200 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Maximum discharge current (8/20)		I_{max}	50 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			250 A gL/gG
Max. back-up fuse („V" connection)			125 A gL/gG
Short-circuit current rating at 250 A gL/gG		I_{SCCR}	80 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			35 mm² (solid) - 25 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	1200 g
Article number	HLSA25-275/4+0		10 455
	HLSA25-275/4+0 S		10 461

Lightning and surge arrester / varistor / TYPE 1+2

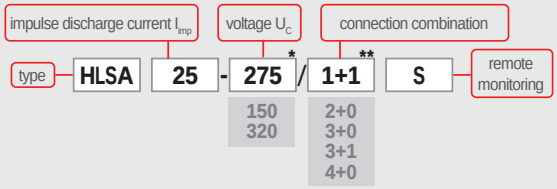
Single-pole / solid version	
Art. No.	**Type**
10400	HLSA25-150
10406	HLSA25-150 S
10450	HLSA25-275
10456	HLSA25-275 S
10420	HLSA25-320
10426	HLSA25-320 S

Recommended sets / solid version	
Art. No.	**Type**
10401	HLSA25-150/1+1
10407	HLSA25-150/1+1 S
10402	HLSA25-150/2+0
10408	HLSA25-150/2+0 S
10403	HLSA25-150/3+0
10409	HLSA25-150/3+0 S
10404	HLSA25-150/3+1
10410	HLSA25-150/3+1 S
10405	HLSA25-150/4+0
10411	HLSA25-150/4+0 S
10451	HLSA25-275/1+1
10457	HLSA25-275/1+1 S
10452	HLSA25-275/2+0
10458	HLSA25-275/2+0 S
10453	HLSA25-275/3+0
10459	HLSA25-275/3+0 S
10454	HLSA25-275/3+1
10460	HLSA25-275/3+1 S
10455	HLSA25-275/4+0
10461	HLSA25-275/4+0 S
10421	HLSA25-320/1+1
10427	HLSA25-320/1+1 S
10422	HLSA25-320/2+0
10428	HLSA25-320/2+0 S
10423	HLSA25-320/3+0
10429	HLSA25-320/3+0 S
10424	HLSA25-320/3+1
10430	HLSA25-320/3+1 S
10425	HLSA25-320/4+0
10431	HLSA25-320/4+0 S

Product name specification

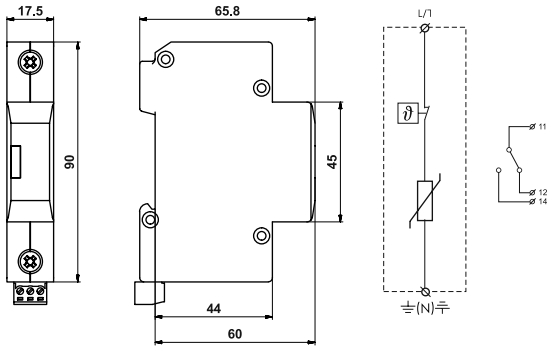
HLSA25-*/ S**

T1 T2



Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / CE



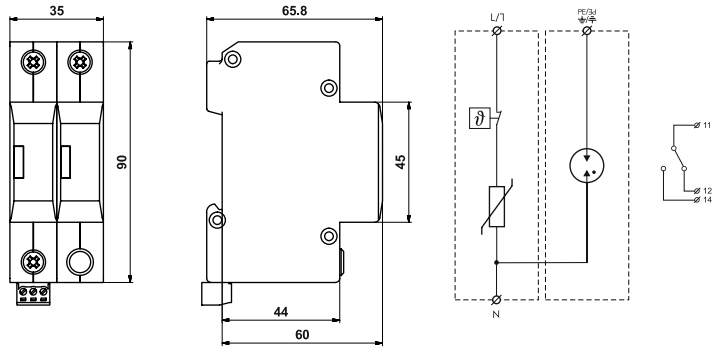
HLSA12,5-275
HLSA12,5-275 S

HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. **S** indication specifies a version with remote monitoring.

Type			**HLSA12,5-275 S, HLSA12,5-275 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Impulse discharge current for class I test (10/350)		I_{imp}	12,5 kA
Charge		Q	6,25 As
Specific energy for class I test		W/R	39 kJ/Ω
Nominal discharge current for class II test (8/20)		I_n	25 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ...+70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	140 g
Article number	HLSA12,5-275		10 058
	HLSA12,5-275 S		10 007

Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / TT / CE



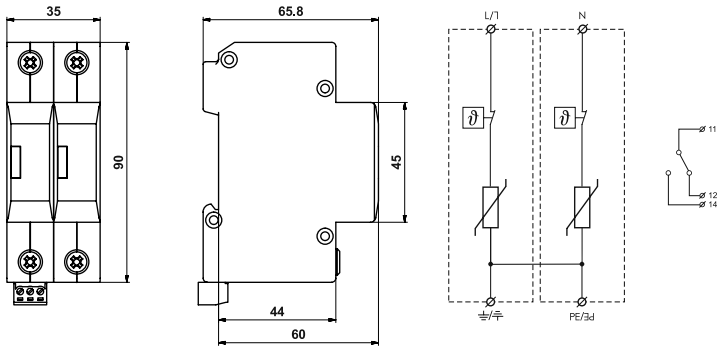
HLSA12,5-275/1+1
HLSA12,5-275/1+1 S

HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors in combination with gas discharge tube, which ensures zero leakage current in the PE conductor. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. **S** indication specifies a version with remote monitoring.

Type			**HLSA12,5-275/1+1, HLSA12,5-275/1+1 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S, TT
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20) L/N		I_{max}	50 kA
Impulse discharge current for class I test (10/350) L/N		I_{imp}	12,5 kA
Charge L/N		Q	6,25 As
Specific energy for class I test L/N		W/R	39 kJ/Ω
Impulse discharge current for class I test (10/350) N/PE		I_{imp}	25 kA
Charge N/PE		Q	12,5 As
Specific energy for class I test N/PE		W/R	156 kJ/Ω
Total discharge current (10/350) L1+N->PE		I_{TOTAL}	25 kA
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	50 kA
Nominal discharge current for class II test (8/20) L/N		I_n	25 kA
Nominal discharge current for class II test (8/20) N/PE		I_n	30 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV) L/N		U_T	337 V/5 s
Temporary overvoltage (TOV) N/PE		U_T	1200 V/0,2 s
Response time L/N		t_A	< 25 ns
Response time N/PE		t_A	< 100 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	212 g
Article number	HLSA12,5-275/1+1		10 059
	HLSA12,5-275/1+1 S		10 023

Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / CE



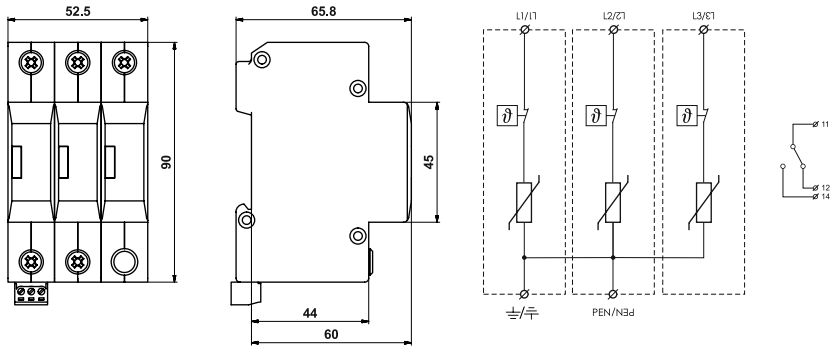
HLSA12,5-275/2+0
HLSA12,5-275/2+0 S

HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

Type			**HLSA12,5-275/2+0, HLSA12,5-275/2+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Impulse discharge current for class I test (10/350) L/N		I_{imp}	12,5 kA
Charge		Q	6,25 As
Specific energy for class I test		W/R	39 kJ/Ω
Total discharge current (10/350) L1+N->PE		I_{TOTAL}	25 kA
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	100 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL 94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	280 g
Article numbe	HLSA12,5-275/2+0		10 060
	HLSA12,5-275/2+0 S		10 026

Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-C / CE



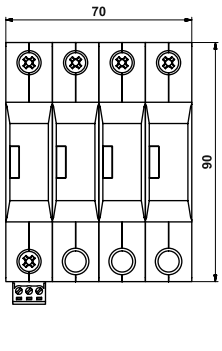
HLSA12,5-275/3+0
HLSA12,5-275/3+0 S

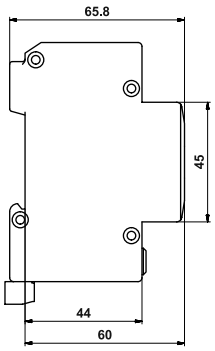
HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. The product has two PEN terminals, which can not be used as a PEN bridge. **S** indication specifies a version with remote monitoring.

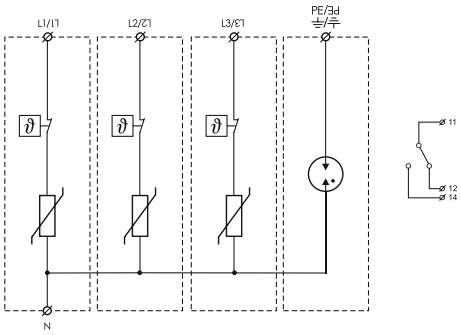
Type			**HLSA12,5-275/3+0, HLSA12,5-275/3+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-C
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Impulse discharge current for class I test (10/350)		I_{imp}	12,5 kA
Charge		Q	6,25 As
Specific energy for class I test		W/R	39 kJ/Ω
Total discharge current (10/350) L1+L2+L3->PEN		I_{TOTAL}	37,5 kA
Total discharge current (8/20) L1+L2+L3->PEN		I_{TOTAL}	150 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL 94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	420 g
Article number	HLSA12,5-275/3+0		10 062
	HLSA12,5-275/3+0 S		10 038

Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / TT / CE







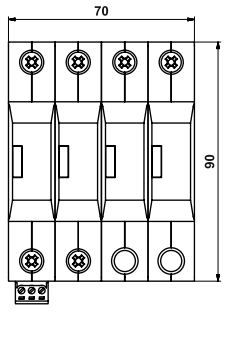
HLSA12,5-275/3+1
HLSA12,5-275/3+1 S

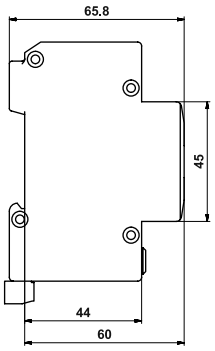
HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors in combination with gas discharge tube, which ensures zero leakage current in the PE conductor. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. **S** indication specifies a version with remote monitoring.

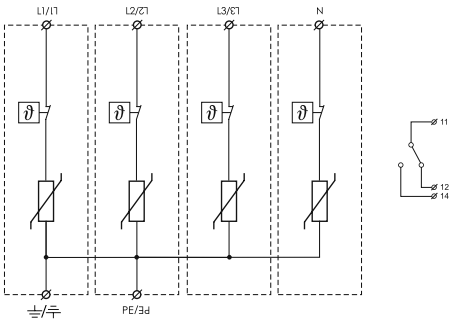
Type			**HLSA12,5-275/3+1, HLSA12,5-275/3+1 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S, TT
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20) L/N		I_{max}	50 kA
Impulse discharge current for class I test (10/350) L/N		I_{imp}	12,5 kA
Charge L/N		Q	6,25 As
Specific energy for class I test L/N		W/R	39 kJ/Ω
Impulse discharge current for class I test (10/350) N/PE		I_{imp}	50 kA
Charge N/PE		Q	25 As
Specific energy for class I test N/PE		W/R	625 kJ/Ω
Total discharge current (10/350) L1+L2+L3+N->PE		I_{TOTAL}	50 kA
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	100 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Nominal discharge current for class II test (8/20) N/PE		I_n	50 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV) L/N		U_T	337 V/5 s
Temporary overvoltage (TOV) N/PE		U_T	1200 V/0,2 s
Response time L/N		t_A	< 25 ns
Response time N/PE		t_A	< 100 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL 94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	536 g
Article number	HLSA12,5-275/3+1		10 063
	HLSA12,5-275/3+1 S		10 039

Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / CE







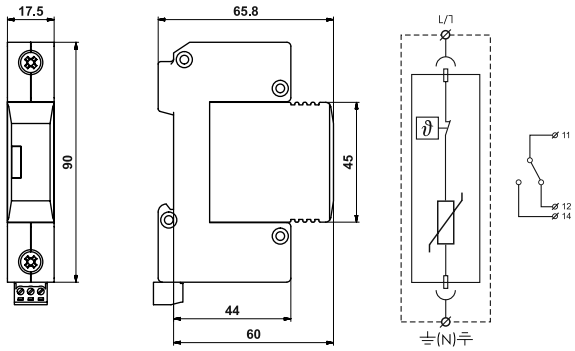
HLSA12,5-275/4+0
HLSA12,5-275/4+0 S

HLSA* (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

Type			**HLSA12,5-275/4+0, HLSA12,5-275/4+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Impulse discharge current for class I test (10/350)		I_{imp}	12,5 kA
Charge		Q	6,25 As
Specific energy for class I test		W/R	39 kJ/Ω
Total discharge current (10/350) L1+L2+L3+N->PE		I_{TOTAL}	50 kA
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	200 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Voltage protection level		U_p	< 1,2 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL 94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	560 g
Article number	HLSA12,5-275/4+0		10 065
	HLSA12,5-275/4+0 S		10 051

Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / CE



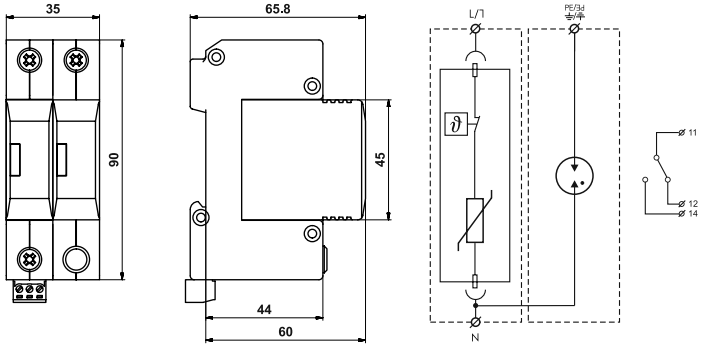
HLSA12,5-275 M
HLSA12,5-275 M S

HLSA*M (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

Type			**HLSA12,5-275 M, HLSA12,5-275 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Impulse discharge current for class I test (10/350)		I_{imp}	12,5 kA
Charge		Q	6,25 As
Specific energy for class I test		W/R	39 kJ/Ω
Nominal discharge current for class II test (8/20)		I_n	25 kA
Voltage protection level		U_p	< 1,25 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL 94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	140 g
Article number	HLSA12,5-275 M		16 080
	HLSA12,5-275 M S		16 090

Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / TT / CE



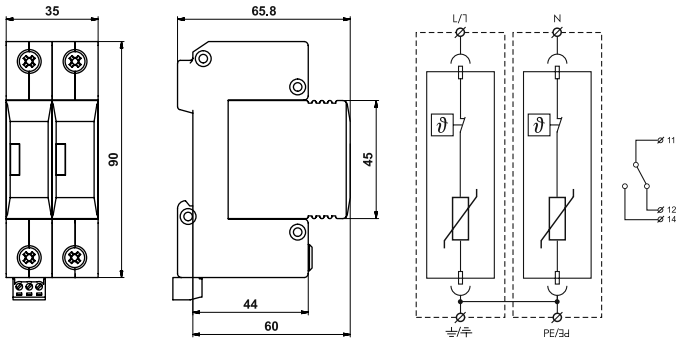
HLSA12,5-275/1+1 M
HLSA12,5-275/1+1 M S

HLSA*M (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors in combination with gas discharge tube, which ensures zero leakage current in the PE conductor. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

Type			**HLSA12,5-275/1+1 M, HLSA12,5-275/1+1 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S, TT
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20) L/N		I_{max}	50 kA
Impulse discharge current for class I test (10/350) L/N		I_{imp}	12,5 kA
Charge L/N		Q	6,25 As
Specific energy for class I test L/N		W/R	39 kJ/Ω
Impulse discharge current for class I test (10/350) N/PE		I_{imp}	25 kA
Charge N/PE		Q	12,5 As
Specific energy for class I test N/PE		W/R	156 kJ/Ω
Total discharge current (10/350) L1+N->PE		I_{TOTAL}	25 kA
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	50 kA
Nominal discharge current for class II test (8/20) L/N		I_n	25 kA
Nominal discharge current for class II test (8/20) N/PE		I_n	30 kA
Voltage protection level		U_p	< 1,25 kV
Temporary overvoltage (TOV) L/N		U_T	337 V/5 s
Temporary overvoltage (TOV) N/PE		U_T	1200 V/0,2 s
Response time L/N		t_A	< 25 ns
Response time N/PE		t_A	< 100 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL 94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	215 g
Article number	HLSA12,5-275/1+1 M		16 081
	HLSA12,5-275/1+1 M S		16 091

Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / CE



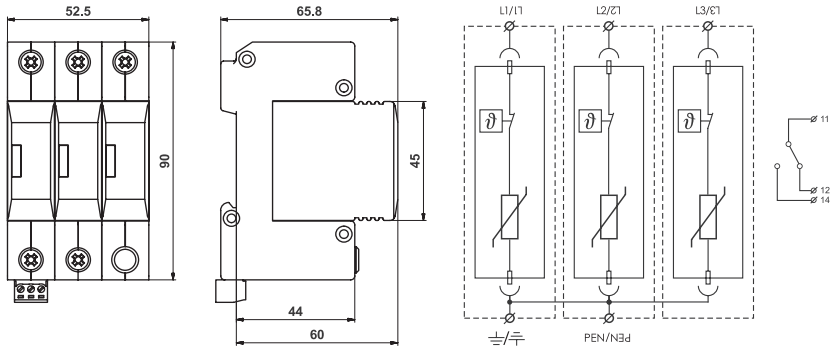
HLSA12,5-275/2+0 M
HLSA12,5-275/2+0 M S

HLSA*M (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

Type			**HLSA12,5-275/2+0 M, HLSA12,5-275/2+0 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Impulse discharge current for class I test (10/350)		I_{imp}	12,5 kA
Charge		Q	6,25 As
Specific energy for class I test		W/R	39 kJ/Ω
Total discharge current (10/350) L1+N->PE		I_{TOTAL}	25 kA
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	100 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Voltage protection level		U_p	< 1,25 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL 94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	280 g
Article number	HLSA12,5-275/2+0 M		16 082
	HLSA12,5-275/2+0 M S		16 092

Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-C / CE



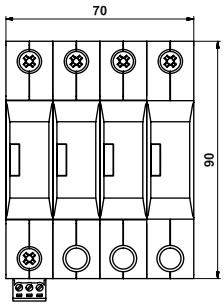
HLSA12,5-275/3+0 M
HLSA12,5-275/3+0 M S

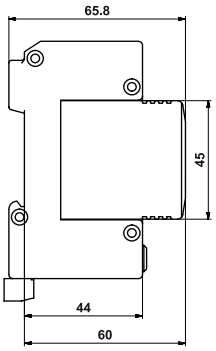
HLSA*M (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. The product has two PEN terminals, which can not be used as a PEN bridge. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

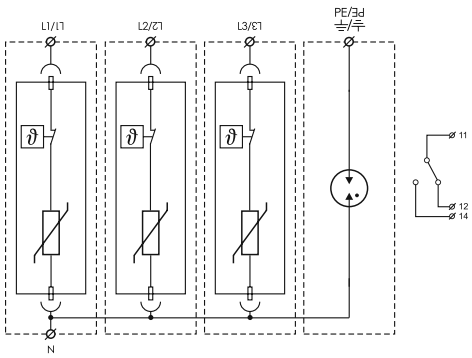
Type			**HLSA12,5-275/3+0 M, HLSA12,5-275/3+0 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-C
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Impulse discharge current for class I test (10/350)		I_{imp}	12,5 kA
Charge		Q	6,25 As
Specific energy for class I test		W/R	39 kJ/Ω
Total discharge current (10/350) L1+L2+L3->PEN		I_{TOTAL}	37,5 kA
Total discharge current (8/20) L1+L2+L3->PEN		I_{TOTAL}	150 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Voltage protection level		U_p	< 1,25 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL 94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C...+70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	420 g
Article number	HLSA12,5-275/3+0 M		16 083
	HLSA12,5-275/3+0 M S		16 093

Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / TT / CE







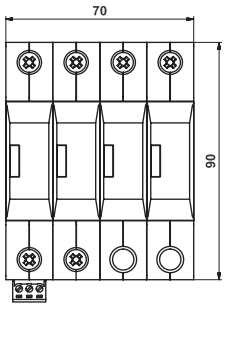
HLSA12,5-275/3+1 M
HLSA12,5-275 S/3+1 M S

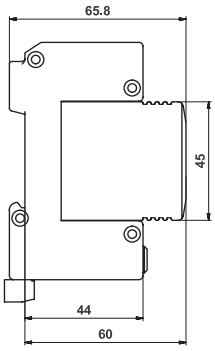
HLSA*M (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors in combination with gas discharge tube, which ensures zero leakage current in the PE conductor. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

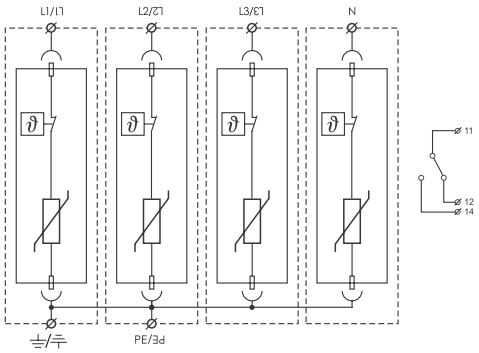
Type			**HLSA12,5-275/3+1 M, HLSA12,5-275/3+1 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S, TT
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Impulse discharge current for class I test (10/350) L/N		I_{imp}	12,5 kA
Charge L/N		Q	6,25 As
Specific energy for class I test L/N		W/R	39 kJ/Ω
Impulse discharge current for class I test (10/350) N/PE		I_{imp}	50 kA
Charge N/PE		Q	25 As
Specific energy for class I test N/PE		W/R	625 kJ/Ω
Total discharge current (10/350) L1+L2+L3+N->PE		I_{TOTAL}	50 kA
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	100 kA
Nominal discharge current for class II test (8/20) L/N		I_n	25 kA
Nominal discharge current for class II test (8/20) N/PE		I_n	50 kA
Voltage protection level		U_p	< 1,25 kV
Temporary overvoltage (TOV) L/N		U_T	337 V/5 s
Temporary overvoltage (TOV) N/PE		U_T	1200 V/0,2 s
Response time L/N		t_A	< 25 ns
Response time N/PE		t_A	< 100 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL 94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	536 g
Article number	HLSA12,5-275/3+1 M		16 084
	HLSA12,5-275/3+1 M S		16 094

Lightning and surge arrester / varistor / TYPE 1+2

TYPE 1+2 / CLASS I+II / TN-S / CE







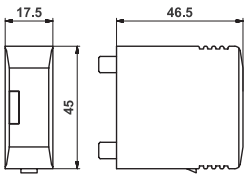
HLSA12,5-275/4+0 M
HLSA12,5-275/4+0 M S

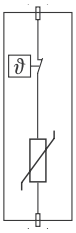
HLSA*M (Hakel Lightning and Surge Arrester) of the „G-Line" range is a lightning and surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable usage in buildings with considerable levels of protection LPL III and LPL IV, such as small administration complexes, residential buildings, family houses or properties and halls without the incidence of persons and indoor equipment. The device is to be installed on the interface of LPZ 0 – LPZ 1 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), closest to where overhead line enters the building i.e. in the main distribution boards. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

Type			**HLSA12,5-275/4+0 M, HLSA12,5-275/4+0 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 1+2, CLASS I+II
System			TN-S
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Impulse discharge current for class I test (10/350)		I_{imp}	12,5 kA
Charge		Q	6,25 As
Specific energy for class I test		W/R	39 kJ/Ω
Total discharge current (10/350) L1+L2+L3+N->PE		I_{TOTAL}	50 kA
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	200 kA
Nominal discharge current for class II test (8/20)		I_n	25 kA
Voltage protection level		U_p	< 1,25 kV
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			0-1 and higher
Housing material			Polyamid PA6, UL 94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	560 g
Article number	HLSA12,5-275/4+0 M		16 085
	HLSA12,5-275/4+0 M S		16 095

Lightning and surge arrester / varistor TYPE 1+2

TYPE 1+2 / CLASS I+II / CE





HLSA12,5-275 Module

The HLSA*Module is a device designed to limit surge voltages and divert surge currents according to standard IEC 61643-11:2011. It consists of high-performance MOV-type varistors and its parameters allow it to be used in buildings with intended protection levels LPL III or LPL IV, such as small administrative buildings, residential buildings, houses, or buildings or halls without internal equipment and human presence. It is installed in the boundary between protection zones LPZ 0 - LPZ 1 or higher according to standard IEC 62305:2010 as close as possible to the entry of cable lines into the building - main switchboards.

Typ		**HLSA12,5-275 Module**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)		TYPE 1+2, CLASS I+II
Max. continuous operating voltage	U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)	I_{max}	50 kA
Impulse discharge current for class I test (10/350)	I_{imp}	12,5 kA
Charge	Q	6,25 As
Specific energy for class I test	W/R	39 kJ/Ω
Nominal discharge current for class II test (8/20)	I_n	25 kA
Voltage protection level	U_p	< 1,25 kV
Temporary overvoltage (TOV)	U_T	337 V/5 s
Response time	t_A	< 25 ns
Short-circuit current rating at 160 A gL/gG	I_{SCCR}	60 kA_{rms}
LPZ		0-1 and higher
Housing material		Polyamid PA6, UL 94 V-0
Operating temperature range	ϑ	-40 °C ... +70 °C
The mounting method / operating position		into the HLSA base / any
Failure signalisation		optical function signalization target clear – ok optical function signalization target red – fault
Lifetime		min. 100 000 h
Weight	m	80 g
Article number		16 086

Lightning and surge arrester / varistor + gas discharge tube / TYPE 1+2

Single-pole / solid version	
Art. No.	**Type**
10211	HLSA12,5-75
10217	HLSA12,5-75 S
10251	HLSA12,5-150
10257	HLSA12,5-150 S
10058	HLSA12,5-275
10007	HLSA12,5-275 S
10301	HLSA12,5-320
10307	HLSA12,5-320 S
10321	HLSA12,5-385
10327	HLSA12,5-385 S
10333	HLSA12,5-440
10339	HLSA12,5-440 S
10345	HLSA12,5-600
10351	HLSA12,5-600 S

Recommended sets / solid version	
Art. No.	**Type**
10212	HLSA12,5-75/1+1
10213	HLSA12,5-75/2+0
10214	HLSA12,5-75/3+0
10215	HLSA12,5-75/3+1
10216	HLSA12,5-75/4+0
10218	HLSA12,5-75/1+1 S
10219	HLSA12,5-75/2+0 S
10220	HLSA12,5-75/3+0 S
10221	HLSA12,5-75/3+1 S
10222	HLSA12,5-75/4+0 S
10252	HLSA12,5-150/1+1
10253	HLSA12,5-150/2+0
10254	HLSA12,5-150/3+0
10255	HLSA12,5-150/3+1
10256	HLSA12,5-150/4+0
10258	HLSA12,5-150/1+1 S
10259	HLSA12,5-150/2+0 S
10260	HLSA12,5-150/3+0 S
10261	HLSA12,5-150/3+1 S
10262	HLSA12,5-150/4+0 S
10059	HLSA12,5-275/1+1
10060	HLSA12,5-275/2+0
10062	HLSA12,5-275/3+0
10063	HLSA12,5-275/3+1
10065	HLSA12,5-275/4+0
10023	HLSA12,5-275/1+1 S
10026	HLSA12,5-275/2+0 S
10038	HLSA12,5-275/3+0 S
10039	HLSA12,5-275/3+1 S
10051	HLSA12,5-275/4+0 S
10302	HLSA12,5-320/1+1
10303	HLSA12,5-320/2+0
10304	HLSA12,5-320/3+0
10305	HLSA12,5-320/3+1
10306	HLSA12,5-320/4+0
10308	HLSA12,5-320/1+1 S
10309	HLSA12,5-320/2+0 S
10310	HLSA12,5-320/3+0 S
10311	HLSA12,5-320/3+1 S
10312	HLSA12,5-320/4+0 S
10322	HLSA12,5-385/1+1
10323	HLSA12,5-385/2+0
10324	HLSA12,5-385/3+0
10325	HLSA12,5-385/3+1
10326	HLSA12,5-385/4+0
10328	HLSA12,5-385/1+1 S
10329	HLSA12,5-385/2+0 S
10330	HLSA12,5-385/3+0 S
10331	HLSA12,5-385/3+1 S
10332	HLSA12,5-385/4+0 S
10334	HLSA12,5-440/1+1
10335	HLSA12,5-440/2+0
10336	HLSA12,5-440/3+0
10337	HLSA12,5-440/3+1
10338	HLSA12,5-440/4+0
10340	HLSA12,5-440/1+1 S
10341	HLSA12,5-440/2+0 S
10342	HLSA12,5-440/3+0 S
10343	HLSA12,5-440/3+1 S
10344	HLSA12,5-440/4+0 S
10346	HLSA12,5-600/1+1
10347	HLSA12,5-600/2+0
10348	HLSA12,5-600/3+0
10349	HLSA12,5-600/3+1
10350	HLSA12,5-600/4+0
10352	HLSA12,5-600/1+1 S
10353	HLSA12,5-600/2+0 S
10354	HLSA12,5-600/3+0 S
10355	HLSA12,5-600/3+1 S
10356	HLSA12,5-600/4+0 S

Single-pole / modular version	
Art. No.	**Type**
16080	HLSA12,5-275 M
16090	HLSA12,5-275 M S

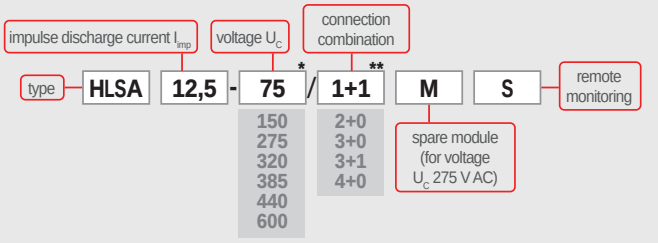
Recomended sets / modular version	
Art. No.	**Type**
16081	HLSA12,5-275/1+1 M
16082	HLSA12,5-275/2+0 M
16083	HLSA12,5-275/3+0 M
16084	HLSA12,5-275/3+1 M
16085	HLSA12,5-275/4+0 M
16091	HLSA12,5-275/1+1 M S
16092	HLSA12,5-275/2+0 M S
16093	HLSA12,5-275/3+0 M S
16094	HLSA12,5-275/3+1 M S
16095	HLSA12,5-275/4+0 M S

Spare module	
Art. No.	**Type**
16086	HLSA12,5-275 Module

Product name specification

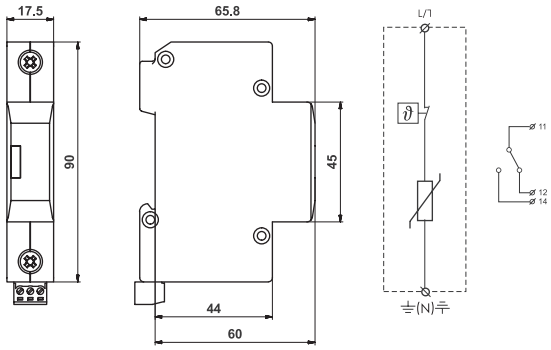
HLSA12,5-*/ M S**

T1 T2



Surge arrester / varistor / TYPE 2+3

TYPE 2+3 / CLASS II+III / CE



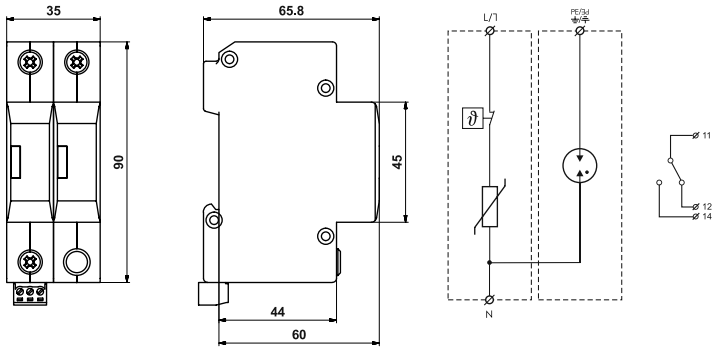
HSA-275
HSA-275 S

HSA* (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. **S** indication specifies a version with remote monitoring.

Type			**HSA-275, HSA-275 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Voltage protection level at I_n		U_p	< 1,2 kV
Voltage protection level at U_{OC}		U_p	< 800 V
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	96 g
Article number	HSA-275		24 527
	HSA-275 S		24 520

Surge arrester / varistor + gas discharge tube / TYPE 2+3

TYPE 2+3 / CLASS II+III / TN-S / TT / CE



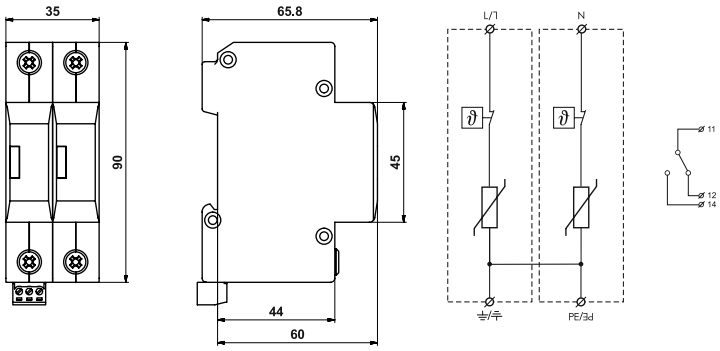
HSA-275/1+1
HSA-275/1+1 S

HSA* (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors in combination with gas discharge tube, which ensures zero leakage current in the PE conductor. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. **S** indication specifies a version with remote monitoring.

Type			**HSA-275/1+1, HSA-275/1+1 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
System			TN-S, TT
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	50 kA
Voltage protection level at I_n		U_p	< 1,2 kV
Voltage protection level at U_{OC}		U_p	< 800 V
Impulse discharge current for class I test (10/350) N/PE		I_{imp}	20 kA
Temporary overvoltage (TOV) L/N		U_T	337 V/5 s
Temporary overvoltage (TOV) N/PE		U_T	1200 V/0,2 s
Response time L/N		t_A	< 25 ns
Response time N/PE		t_A	< 100 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	174 g
Article number	HSA-275/1+1		24 528
	HSA-275/1+1 S		24 521

Surge arrester / varistor / TYPE 2+3

TYPE 2+3 / CLASS II+III / TN-S / CE



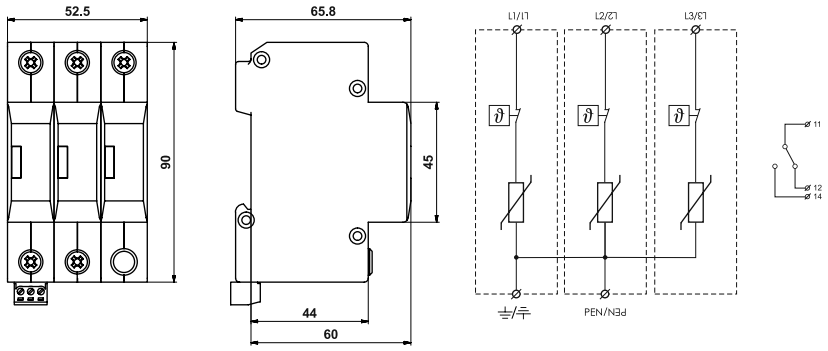
HSA-275/2+0
HSA-275/2+0 S

HSA* (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

Type			**HSA-275/2+0, HSA-275/2+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
System			TN-S
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	100 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Voltage protection level at I_n		U_p	< 1,2 kV
Voltage protection level at U_{OC}		U_p	< 800 V
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	192 g
Article number	HSA-275/2+0		24 529
	HSA-275/2+0 S		24 522

Surge arrester / varistor / TYPE 2+3

TYPE 2+3 / CLASS II+III / TN-C / CE



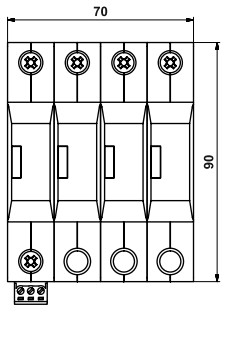
HSA-275/3+0
HSA-275/3+0 S

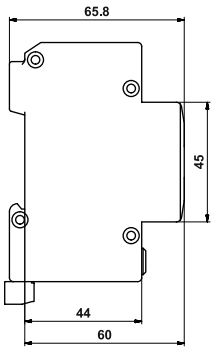
HSA* (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. The product has two PEN terminals, which can not be used as a PEN bridge. **S** indication specifies a version with remote monitoring.

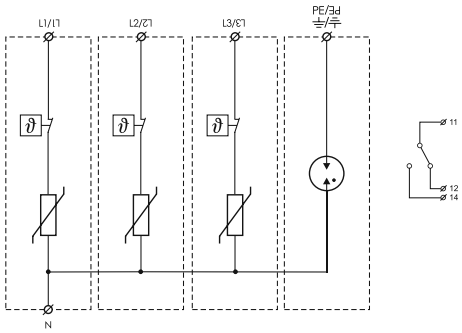
Type			**HSA-275/3+0, HSA-275/3+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
System			TN-C
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Total discharge current (8/20) L1+L2+L3->PEN		I_{TOTAL}	150 kA
Voltage protection level at I_n		U_p	< 1,2 kV
Voltage protection level at U_{OC}		U_p	< 800 V
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	288 g
Article number	HSA-275/3+0		24 530
	HSA-275/3+0 S		24 523

Surge arrester / varistor + gas discharge tube / TYPE 2+3

TYPE 2+3 / CLASS II+III / TN-S / TT / CE







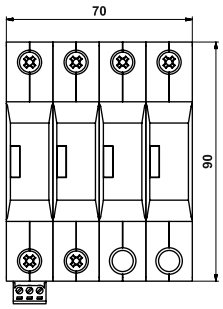
HSA-275/3+1
HSA-275/3+1 S

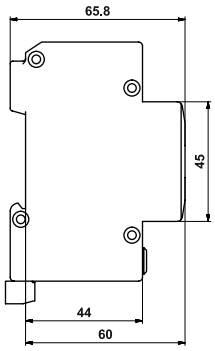
HSA* (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors in combination with gas discharge tube, which ensures zero leakage current in the PE conductor. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. **S** indication specifies a version with remote monitoring.

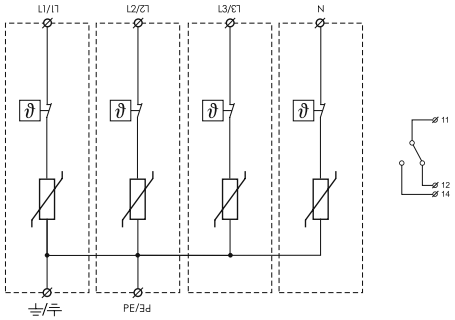
Type			**HSA-275/3+1, HSA-275/3+1 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
System			TN-S, TT
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	50 kA
Voltage protection level at I_n		U_p	< 1,2 kV
Voltage protection level at U_{OC}		U_p	< 800 V
Impulse discharge current for class I test (10/350) N/PE		I_{imp}	20 kA
Temporary overvoltage (TOV) L/N		U_T	337 V/5 s
Temporary overvoltage (TOV) N/PE		U_T	1200 V/0,2 s
Response time L/N		t_A	< 25 ns
Response time N/PE		t_A	< 100 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	366 g
Article number	HSA-275/3+1		24 531
	HSA-275/3+1 S		24 524

Surge arrester / varistor / TYPE 2+3

TYPE 2+3 / CLASS II+III / TN-S / CE







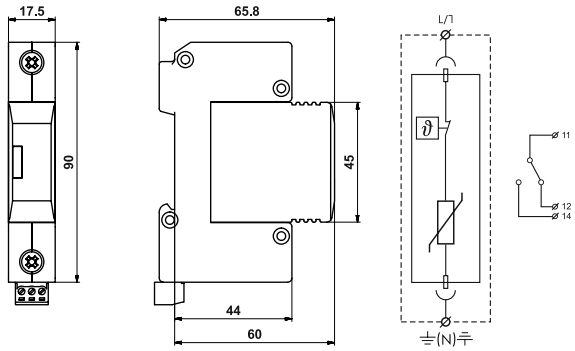
HSA-275/4+0
HSA-275/4+0 S

HSA* (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring.

Type			**HSA-275/4+0, HSA-275/4+0 S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
System			TN-S
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	200 kA
Voltage protection level at I_n		U_p	< 1,2 kV
Voltage protection level at U_{OC}		U_p	< 800 V
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	384 g
Article number	HSA-275/4+0		24 532
	HSA-275/4+0 S		24 525

Surge arrester / varistor / TYPE 2+3

TYPE 2+3 / CLASS II+III / CE



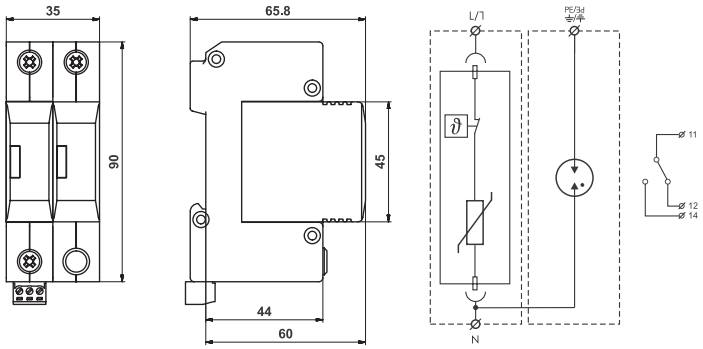
HSA-275 M
HSA-275 M S

HSA*M (Hakel Surge Arrester) of the „G-Line“ range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

Type			**HSA-275 M, HSA-275 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Voltage protection level at I_n		U_p	< 1,25 kV
Voltage protection level at U_{OC}		U_p	< 850 V
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	90 g
Article number	HSA-275 M		27 080
	HSA-275 M S		27 090

Surge arrester / varistor + gas discharge tube / TYPE 2+3

TYPE 2+3 / CLASS II+III / TN-S / TT / CE



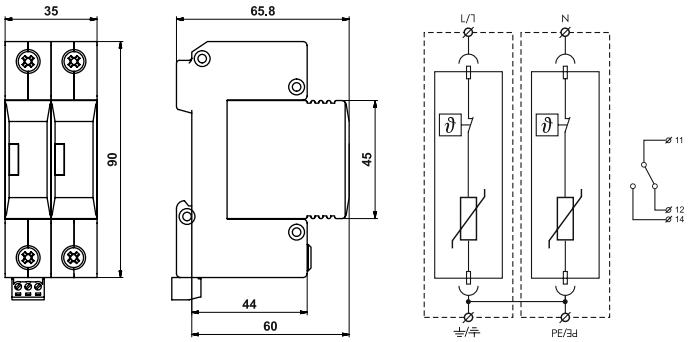
HSA-275/1+1 M
HSA-275/1+1 M S

HSA*M (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors in combination with gas discharge tube, which ensures zero leakage current in the PE conductor. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

Type			**HSA-275/1+1 M, HSA-275/1+1 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
System			TN-S, TT
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	50 kA
Voltage protection level at I_n		U_p	< 1,25 kV
Voltage protection level at U_{OC}		U_p	< 850 V
Impulse discharge current for class I test (10/350) N/PE		I_{imp}	20 kA
Temporary overvoltage (TOV) L/N		U_T	337 V/5 s
Temporary overvoltage (TOV) N/PE		U_T	1200 V/0,2 s
Response time L/N		t_A	< 25 ns
Response time N/PE		t_A	< 100 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	166 g
Article number	HSA-275/1+1 M		27 081
	HSA-275/1+1 M S		27 091

Surge arrester / varistor / TYPE 2+3

TYPE 2+3 / CLASS II+III / TN-S / CE



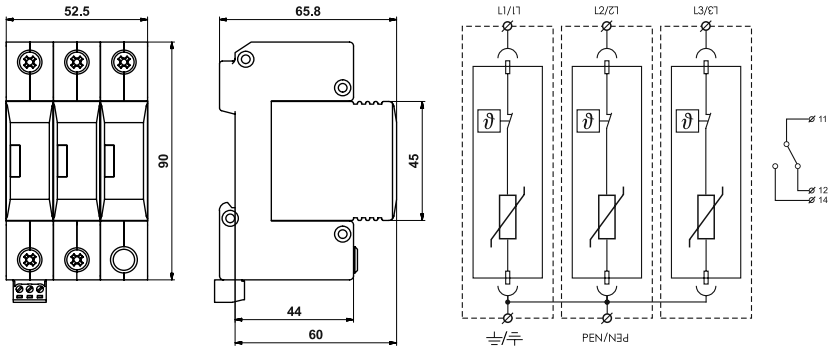
HSA-275/2+0 M
HSA-275/2+0 M S

HSA*M (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

Type			**HSA-275/2+0 M, HSA-275/2+0 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
System			TN-S
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Total discharge current (8/20) L1+N->PE		I_{TOTAL}	100 kA
Voltage protection level at I_n		U_p	< 1,25 kV
Voltage protection level at U_{OC}		U_p	< 850 V
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	180 g
Article number	HSA-275/2+0 M		27 082
	HSA-275/2+0 M S		27 092

Surge arrester / varistor + gas discharge tube / TYPE 2+3

TYPE 2+3 / CLASS II+III / TN-C / CE



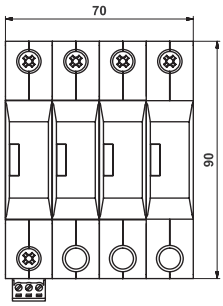
HSA-275/3+0 M
HSA-275/3+0 M S

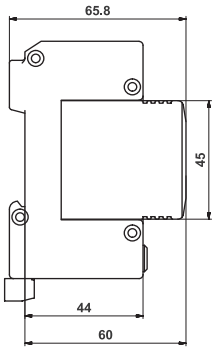
HSA*M (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. The product has two PEN terminals, which can not be used as a PEN bridge. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

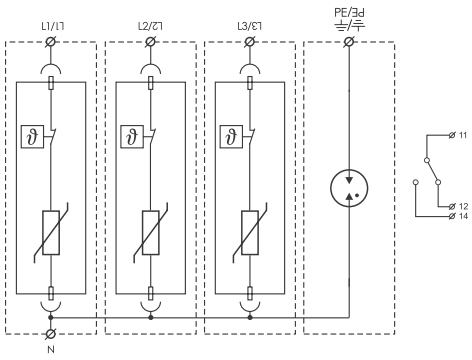
Type			**HSA-275/3+0 M, HSA-275/3+0 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
System			TN-C
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Total discharge current (8/20) L1+L2+L3->PEN		I_{TOTAL}	150 kA
Voltage protection level at I_n		U_p	< 1,25 kV
Voltage protection level at U_{OC}		U_p	< 850 V
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	270 g
Article number	HSA-275/3+0 M		27 083
	HSA-275/3+0 M S		27 093

Surge arrester / varistor + gas discharge tube / TYPE 2+3

TYPE 2+3 / CLASS II+III / TN-S / TT / CE







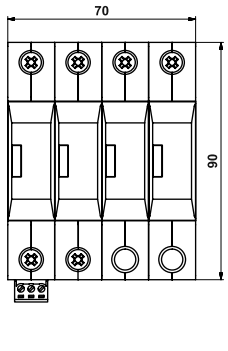
HSA-275/3+1 M
HSA-275/3+1 M S

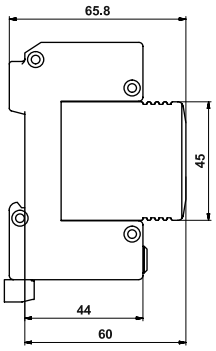
HSA*M (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors in combination with gas discharge tube, which ensures zero leakage current in the PE conductor. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

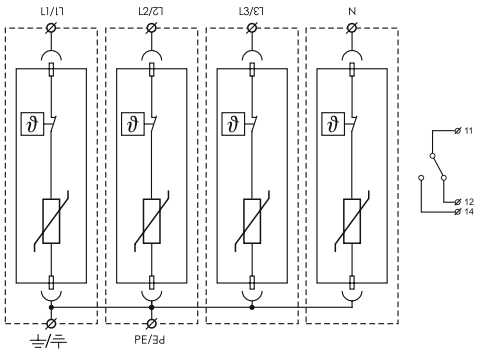
Type			**HSA-275/3+1 M, HSA-275/3+1 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
System			TN-S, TT
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	50 kA
Voltage protection level at I_n		U_p	< 1,25 kV
Voltage protection level at U_{OC}		U_p	< 850 V
Impulse discharge current for class I test (10/350) N/PE		I_{imp}	20 kA
Temporary overvoltage (TOV) L/N		U_T	337 V/5 s
Temporary overvoltage (TOV) N/PE		U_T	1200 V/0,2 s
Response time L/N		t_A	< 25 ns
Response time N/PE		t_A	< 100 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	346 g
Article number	HSA-275/3+1 M		27 084
	HSA-275/3+1 M S		27 094

Surge arrester / varistor / TYPE 2+3

TYPE 2+3 / CLASS II+III / TN-S / CE







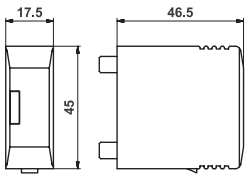
HSA-275/4+0 M
HSA-275/4+0 M S

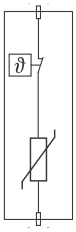
HSA*M (Hakel Surge Arrester) of the „G-Line" range is a surge arrester according to EN 61643-11:2012 (IEC 61643-11:2011) consisting of high energy varistors. Its parameters enable its use in complex circumstances. The device is to be installed on the interface of LPZ 1 – LPZ 2 and higher zones according to standard EN 62305:2011 (IEC 62305:2010), i.e. into subsidiary switchboards and control boxes. The product has two PE terminals, which can not be used as a PE bridge. **S** indication specifies a version with remote monitoring. **M** indication specifies a type of construction with removable module.

Type			**HSA-275/4+0 M, HSA-275/4+0 M S**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 2+3, CLASS II+III
System			TN-S
Max. continuous operating voltage		U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)		I_{max}	50 kA
Nominal discharge current for class II test (8/20)		I_n	20 kA
Open circuit voltage		U_{OC}	6 kV
Total discharge current (8/20) L1+L2+L3+N->PE		I_{TOTAL}	200 kA
Voltage protection level at I_n		U_p	< 1,25 kV
Voltage protection level at U_{OC}		U_p	< 850 V
Temporary overvoltage (TOV)		U_T	337 V/5 s
Response time		t_A	< 25 ns
Max. back-up fuse			160 A gL/gG
Short-circuit current rating at 160 A gL/gG		I_{SCCR}	60 kA_{rms}
LPZ			1-3
Housing material			Polyamid PA6, UL94 V-0
Degree of protection of enclosure			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			25 mm² (solid) - 16 mm² (wire)
The mounting method / operating position			DIN rail 35 mm / any
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Lifetime			min. 100 000 h
Weight		m	360 g
Article number	HSA-275/4+0 M		27 085
	HSA-275/4+0 M S		27 095

Surge arrester / varistor / TYPE 2+3

TYPE 2+3 / CLASS II+III / CE





HSA-275 Module

The HSA*Module is a device designed to limit surge voltages according to standard IEC 61643-11:2011. It consists of high-performance MOV-type varistors and its parameters allow for complex use. It is installed in the boundary between protection zones LPZ 1 - LPZ 3 according to standard IEC 62305:2010 in sub-switchboards and control cabinets.

Type		**HSA-275 Module**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)		TYPE 2+3, CLASS II+III
Max. continuous operating voltage	U_C	275 V AC / 350 V DC
Maximum discharge current (8/20)	I_{max}	50 kA
Nominal discharge current for class II test (8/20)	I_n	20 kA
Open circuit voltage	U_{OC}	6 kV
Voltage protection level at I_n	U_p	< 1,25 kV
Voltage protection level at U_{OC}	U_p	< 850 V
Temporary overvoltage (TOV)	U_T	337 V/5 s
Response time	t_A	< 25 ns
Short-circuit current rating at 160 A gL/gG	I_{SCCR}	60 kA_{rms}
LPZ		1-3
Housing material		Polyamid PA6, UL94 V-0
Operating temperature range	ϑ	-40 °C ... +70 °C
The mounting method / operating position		into the HLSA base / any
Failure signalisation		optical function signalization target clear – ok optical function signalization target red – fault
Lifetime		min. 100 000 h
Weight	m	42 g
Article number		27 086

Surge arrester / TYPE 2+3

Single-pole / solid version	
Art. No.	**Type**
24501	HSA-75
24507	HSA-75 S
24533	HSA-150
24539	HSA-150 S
24527	HSA-275
24520	HSA-275 S
24545	HSA-320
24551	HSA-320 S
24557	HSA-385
24563	HSA-385 S
24569	HSA-440
24575	HSA-440 S
24581	HSA-600
24587	HSA-600 S
24601	HSA-720
24607	HSA-720 S
24613	HSA-850
24619	HSA-850 S

Recommended sets / solid version	
Art. No.	**Type**
24502	HSA-75/1+1
24503	HSA-75/2+0
24504	HSA-75/3+0
24505	HSA-75/3+1
24506	HSA-75/4+0
24508	HSA-75/1+1 S
24509	HSA-75/2+0 S
24510	HSA-75/3+0 S
24511	HSA-75/3+1 S
24512	HSA-75/4+0 S
24533	HSA-150
24534	HSA-150/1+1
24535	HSA-150/2+0
24536	HSA-150/3+0
24537	HSA-150/3+1
24538	HSA-150/4+0
24540	HSA-150/1+1 S
24541	HSA-150/2+0 S
24542	HSA-150/3+0 S
24543	HSA-150/3+1 S
24544	HSA-150/4+0 S
24521	HSA-275/1+1 S
24522	HSA-275/2+0 S
24523	HSA-275/3+0 S
24524	HSA-275/3+1 S
24525	HSA-275/4+0 S
24528	HSA-275/1+1
24529	HSA-275/2+0
24530	HSA-275/3+0
24531	HSA-275/3+1
24532	HSA-275/4+0
24546	HSA-320/1+1
24547	HSA-320/2+0
24548	HSA-320/3+0
24549	HSA-320/3+1
24550	HSA-320/4+0
24552	HSA-320/1+1 S
24553	HSA-320/2+0 S
24554	HSA-320/3+0 S
24555	HSA-320/3+1 S
24556	HSA-320/4+0 S
24558	HSA-385/1+1
24559	HSA-385/2+0
24560	HSA-385/3+0
24561	HSA-385/3+1
24562	HSA-385/4+0
24564	HSA-385/1+1 S
24565	HSA-385/2+0 S
24566	HSA-385/3+0 S
24567	HSA-385/3+1 S
24568	HSA-385/4+0 S
24570	HSA-440/1+1
24571	HSA-440/2+0
24572	HSA-440/3+0
24573	HSA-440/3+1
24574	HSA-440/4+0
24576	HSA-440/1+1 S
24577	HSA-440/2+0 S
24578	HSA-440/3+0 S
24579	HSA-440/3+1 S
24580	HSA-440/4+0 S
24582	HSA-600/1+1
24583	HSA-600/2+0
24584	HSA-600/3+0
24585	HSA-600/3+1
24586	HSA-600/4+0
24588	HSA-600/1+1 S
24589	HSA-600/2+0 S
24590	HSA-600/3+0 S
24591	HSA-600/3+1 S
24592	HSA-600/4+0 S
24602	HSA-720/1+1
24603	HSA-720/2+0
24604	HSA-720/3+0
24605	HSA-720/3+1
24606	HSA-720/4+0
24608	HSA-720/1+1 S
24609	HSA-720/2+0 S
24610	HSA-720/3+0 S
24611	HSA-720/3+1 S
24612	HSA-720/4+0 S
24614	HSA-850/1+1
24615	HSA-850/2+0
24616	HSA-850/3+0
24617	HSA-850/3+1
24618	HSA-850/4+0
24620	HSA-850/1+1 S
24621	HSA-850/2+0 S
24622	HSA-850/3+0 S
24623	HSA-850/3+1 S
24624	HSA-850/4+0 S

Single-pole / modular version	
Art. No.	**Type**
27180	HSA-75 M
27181	HSA-75 M S
27182	HSA-150 M
27183	HSA-150 M S
27080	HSA-275 M
27090	HSA-275 M S
27184	HSA-320 M
27185	HSA-320 M S
27186	HSA-385 M
27187	HSA-385 M S
27188	HSA-440 M
27189	HSA-440 M S
27550	HSA-600 M
27556	HSA-600 M S

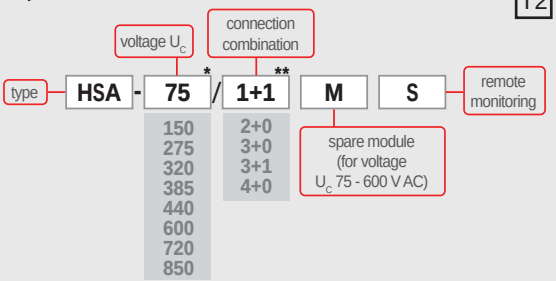
Recomended sets / modular version	
Art. No.	**Type**
27500	HSA-75/1+1 M
27501	HSA-75/2+0 M
27502	HSA-75/3+0 M
27503	HSA-75/3+1 M
27504	HSA-75/4+0 M
27505	HSA-75/1+1 M S
27506	HSA-75/2+0 M S
27507	HSA-75/3+0 M S
27508	HSA-75/3+1 M S
27509	HSA-75/4+0 M S
27510	HSA-150/1+1 M
27511	HSA-150/2+0 M
27512	HSA-150/3+0 M
27513	HSA-150/3+1 M
27514	HSA-150/4+0 M
27515	HSA-150/1+1 M S
27516	HSA-150/2+0 M S
27517	HSA-150/3+0 M S
27518	HSA-150/3+1 M S
27519	HSA-150/4+0 M S
27081	HSA-275/1+1 M
27082	HSA-275/2+0 M
27083	HSA-275/3+0 M
27084	HSA-275/3+1 M
27085	HSA-275/4+0 M
27091	HSA-275/1+1 M S
27092	HSA-275/2+0 M S
27093	HSA-275/3+0 M S
27094	HSA-275/3+1 M S
27095	HSA-275/4+0 M S
27520	HSA-320/1+1 M
27521	HSA-320/2+0 M
27522	HSA-320/3+0 M
27523	HSA-320/3+1 M
27524	HSA-320/4+0 M
27525	HSA-320/1+1 M S
27526	HSA-320/2+0 M S
27527	HSA-320/3+0 M S
27528	HSA-320/3+1 M S
27529	HSA-320/4+0 M S
27530	HSA-385/1+1 M
27531	HSA-385/2+0 M
27532	HSA-385/3+0 M
27533	HSA-385/3+1 M
27534	HSA-385/4+0 M
27535	HSA-385/1+1 M S
27536	HSA-385/2+0 M S
27537	HSA-385/3+0 M S
27538	HSA-385/3+1 M S
27539	HSA-385/4+0 M S
27540	HSA-440/1+1 M
27541	HSA-440/2+0 M
27542	HSA-440/3+0 M
27543	HSA-440/3+1 M
27544	HSA-440/4+0 M
27545	HSA-440/1+1 M S
27546	HSA-440/2+0 M S
27547	HSA-440/3+0 M S
27548	HSA-440/3+1 M S
27549	HSA-440/4+0 M S
27551	HSA-600/1+1 M
27552	HSA-600/2+0 M
27553	HSA-600/3+0 M
27554	HSA-600/3+1 M
27555	HSA-600/4+0 M
27557	HSA-600/1+1 M S
27558	HSA-600/2+0 M S
27559	HSA-600/3+0 M S
27560	HSA-600/3+1 M S
27561	HSA-600/4+0 M S

Spare module	
Art. No.	**Type**
27190	HSA-75 Module
27191	HSA-150 Module
27086	HSA-275 Module
27192	HSA-320 Module
27193	HSA-385 Module
27194	HSA-440 Module
27195	HSA-600 Module

Product name specification

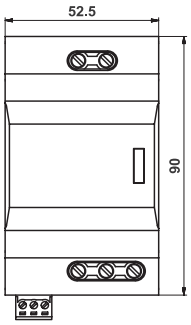
HSA-*/ M S**

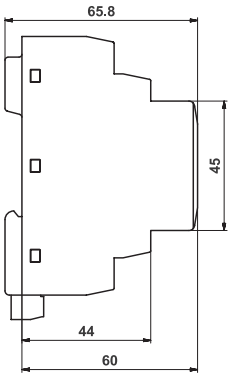
T2 T3

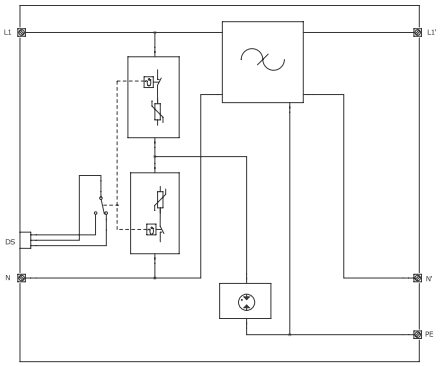


Surge arrester / varistor & EMC / EMI filter / TYPE 3

TYPE 3 / CLASS III / TN-C-S / TN-S / CE







HSAF10, HSAF10 S
HSAF16, HSAF16 S

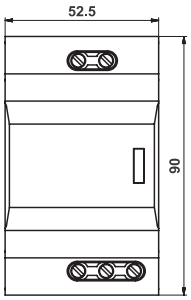
HSAF* (Hakel Surge Arrester Filter) is a two-stage surge arrester. It features a high-frequency filter integrated between the two stages. HSAF* contains an improved thermal fuse which ensures timely disconnection of the HSAF* from the power grid during overheating and thus prevents damage to the HSAF*. Activation of the thermal fuse is signalled by an integral indicator light with the option to utilize its switching contact for remote fault signalling (S). Due the new design of the thermal fuse, the protective voltage level is 100 V lower than in the previous series of filters. The HSAF* S is a type T3 two-port surge arrester and has been tested according to standards IEC 61643-11:2011 and CISPR 17:2011. According to standard IEC 62305:2010, it is installed in the boundary between zones LPZ 2 - LPZ 3, where it limits induced overvoltage and residual overvoltage in power lines. HSAF* are designed to be mounted on a 35 mm DIN rail using a metal clip.

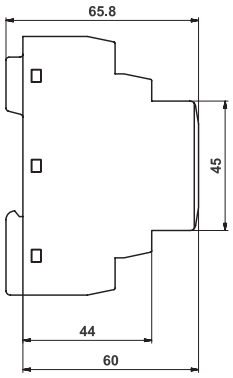
Manufacturer's recommendation: Install the HSAF* as close to the device to be protected as possible (no further than 5 m). A Hakel T1 and T2 lightning and surge arrester must be installed before the HSAF*.

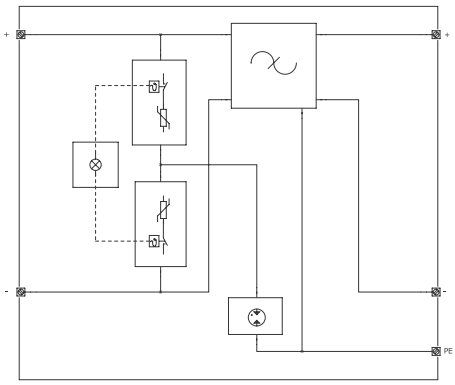
Type			HSAF10, HSAF10 S	HSAF16, HSAF16 S
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 3, CLASS III	
System			TN-C-S, TN-S	
Max. continuous operating voltage		U_C	275 V AC	
Rated load current		I_L	10 A	16 A
Combined impulse		U_{OC}	6 kV (L/N, L/PE) 10 kV (N/PE)	
Voltage protection level at U_{OC}		U_p	< 750 V (L/N)	
			< 1 kV (L/PE)	
			< 1,5 kV (N/PE)	
Nominal discharge current I_n (8/20)		I_n	3 kA (L/N, L/PE) 5 kA (N/PE)	
Temporary overvoltage (TOV)		U_T	337 V/5 s (L/N)	
			1200 V/0,2 s (N/PE)	
Response time		t_A	< 25 ns (L/N) < 100 ns (L/PE, N/PE)	
Asymmetrical attenuation of filter (band-stop filter)			min. 80 dB at 4 MHz	
			min. 40 dB (0,15 ÷ 30 MHz)	
Power loss at winding temp. 20 °C			< 2,2 W	< 3,5 W
Back-up fuse			10 A	16 A
LPZ			2-3	
Housing material			Polyamid PA6, UL94 V-0	
Degree of protection of enclosure			IP20	
Operating temperature range		ϑ	-40 °C ... +55 °C	
Cross-section of the connected conductors			2,5 - 4 mm²	
Tightening moment of clamps			0,5 Nm	
The mounting method / operating position			DIN rail 35 mm / any	
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault	
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A	
Lifetime			min. 100 000 h	
Weight		m	180 g	
Article number	HSAF*		30 160	30 161
	HSAF* S		30 170	30 171

Surge arrester / varistor & EMC / EMI filter / TYPE 3

TYPE 3 / CLASS III / DC / CE







HSAF10/*VDC

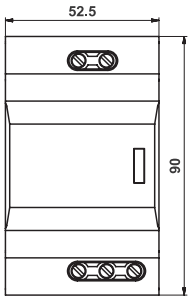
HSAF10/*VDC is a surge arrester with integrated high-frequency filter designed for DC power supply systems. HSAF10/*VDC contains an improved thermal fuse which ensures timely disconnection of the device from the power grid during overheating and thus prevents damage to the HSAF10/*VDC. Activation of the thermal fuse is signalled by an integral indicator light. The HSAF10/*VDC is a type T3 two-port surge arrester and has been tested according to standards EN 61643-11 (IEC 61643-11:2011). According to standard EN 62305 (IEC 62305:2010), it is installed in the boundary between zones LPZ 2 - LPZ 3, where it limits induced overvoltage and residual overvoltage in power lines. HSAF10/*VDC are designed to be mounted on a 35 mm DIN rail using a metal clip.

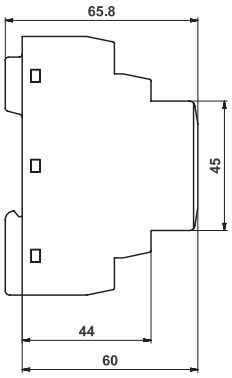
Manufacturer's recommendation: Install the HSAF10/*VDC as close to the device to be protected as possible (no further than 5 m There must be Hakel's lightning and surge arrester T1 and T2 installed before the HSAF10/*VDC.

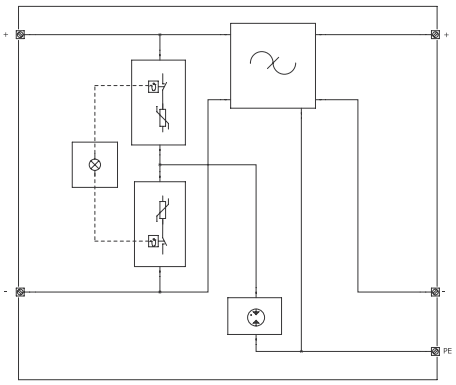
Type		HSAF 10/6VDC	HSAF 10/12VDC	HSAF 10/24VDC	HSAF 10/48VDC	HSAF 10/60VDC	HSAF 10/120VDC	HSAF 10/220VDC
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)		TYPE 3, CLASS III						
System		DC						
Nominal voltage	U_N	6 V =	12 V =	24 V =	48 V =	60 V =	120 V =	220 V =
Max. continuous operating voltage	U_C	7,2 V =	14,4 V =	28,8 V =	57,6 V =	72 V =	144 V =	264 V =
Nominal discharge current I_n (8/20)	I_n	2 kA					3 kA	
Rated load current	I_L	10 A						
Combined impulse	U_{OC}	4 kV					6 kV	
Voltage protection level at U_{OC} (+/-)	U_P	< 350 V	< 350 V	< 400 V	< 500 V	< 550 V	< 900 V	< 1300 V
Voltage protection level at U_{OC} (+-/PE)	U_P	< 300 V				< 400 V	< 600 V	< 800 V
Response time	t_A	< 25 ns (+/-) < 100 ns (+-/PE)						
Asymmetrical attenuation of filter (band-stop filter)		min. 80 dB at 4 MHz						
		min. 40 dB (0,15 ÷ 30 MHz)						
Power loss at winding temp. 20 °C		< 2,2 W						
Back-up fuse		10 A						
LPZ		2-3						
Housing material		Polyamid PA6, UL 94 V-0						
Degree of protection of enclosure		IP20						
Operating temperature range	ϑ	-40 °C ... +55 °C						
Cross-section of the connected conductors		1,5 - 4 mm² Cu						
The mounting method, operating position		DIN rail 35 mm, any						
Failure signalisation		optical function signalization target clear – ok optical function signalization target red – fault						
Lifetime		min. 100 000 h						
Weight	m	165 g						
Article number	HSAF10/*	30 149	30 150	30 157	30 158	30 159	30 162	30 163

Surge arrester / varistor & EMC / EMI filter / TYPE 3

TYPE 3 / CLASS III / DC / CE







HSAF16/*VDC

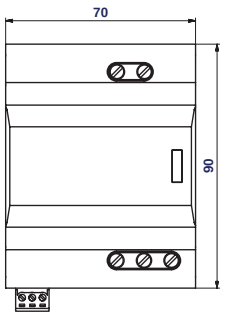
HSAF16/*VDC is a surge arrester with integrated high-frequency filter designed for DC power supply systems. HSAF16/*VDC contains an improved thermal fuse which ensures timely disconnection of the device from the power grid during overheating and thus prevents damage to the HSAF16/*VDC. Activation of the thermal fuse is signalled by an integral indicator light. The HSAF16/*VDC is a type T3 two-port surge arrester and has been tested according to standards EN 61643-11 (IEC 61643-11:2011). According to standard EN 62305 (IEC 62305:2010), it is installed in the boundary between zones LPZ 2 - LPZ 3, where it limits induced overvoltage and residual overvoltage in power lines. HSAF16/*VDC are designed to be mounted on a 35 mm DIN rail using a metal clip.

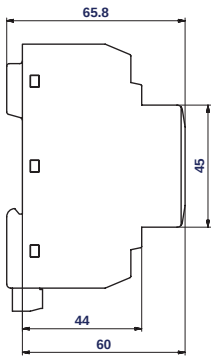
Manufacturer's recommendation: Install the HSAF16/*VDC as close to the device to be protected as possible (no further than 5 m There must be Hakel's lightning and surge arrester T1 and T2 installed before the HSAF16/*VDC.

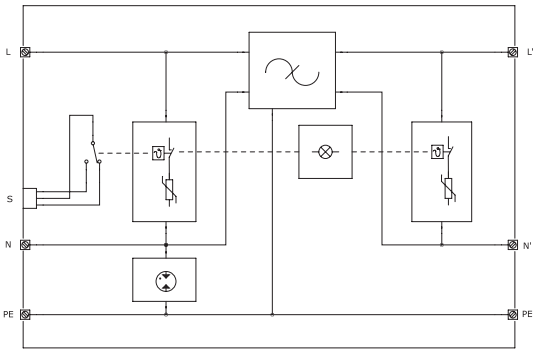
Type			**HSAF 16/6VDC**	**HSAF 16/12VDC**	**HSAF 16/24VDC**	**HSAF 16/48VDC**	**HSAF 16/60VDC**	**HSAF 16/120VDC**	**HSAF 16/220VDC**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 3, CLASS III						
System			DC						
Nominal voltage		U_N	6 V =	12 V =	24 V =	48 V =	60 V =	120 V =	220 V =
Max. continuous operating voltage		U_C	7,2 V =	14,4 V =	28,8 V =	57,6 V =	72 V =	144 V =	264 V =
Nominal discharge current I_n (8/20)		I_n	2 kA					3 kA	
Rated load current		I_L	16 A						
Combined impulse		U_{OC}	4 kV					6 kV	
Voltage protection level at U_{OC} (+/-)		U_P	< 350 V	< 350 V	< 400 V	< 500 V	< 550 V	< 900 V	< 1300 V
Voltage protection level at U_{OC} (+-/PE)		U_P	< 300 V				< 400 V	< 600 V	< 800 V
Response time		t_A	< 25 ns (+/-) < 100 ns (+-/PE)						
Asymmetrical attenuation of filter (band-stop filter)			min. 80 dB at 4 MHz						
			min. 40 dB (0,15 ÷ 30 MHz)						
Power loss at winding temp. 20 °C			< 3,5 W						
Back-up fuse			16 A						
LPZ			2-3						
Housing material			Polyamid PA6, UL 94 V-0						
Degree of protection of enclosure			IP20						
Operating temperature range		ϑ	-40 °C ... +55 °C						
Cross-section of the connected conductors			2,5 - 4 mm² Cu						
The mounting method, operating position			DIN rail 35 mm, any						
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault						
Lifetime			min. 100 000 h						
Weight		m	180 g						
Article number	HSAF16/*		30 142	30 143	30 144	30 145	30 146	30 147	30 148

Surge arrester / varistor & EMC / EMI filter / TYPE 3

TYPE 3 / CLASS III / TN-C-S / TN-S / CE







HSAF25, HSAF25 S
HSAF32, HSAF32 S

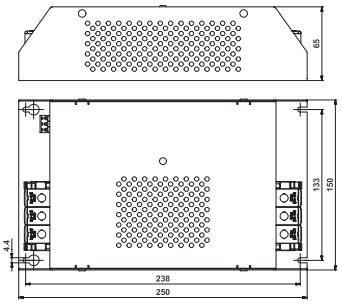
HSAF* (Hakel Surge Arrester Filter) is a two-stage surge arrester. It features a high-frequency filter integrated between the two stages. HSAF* contains an improved thermal fuse which ensures timely disconnection of the HSAF* from the power grid during overheating and thus prevents damage to the HSAF*. Activation of the thermal fuse is signalled by an integral indicator light with the option to utilize its switching contact for remote fault signalling (S). Due the new design of the thermal fuse, the protective voltage level is lower than in the previous series of filters. The HSAF* S is a type T3 two-port surge arrester and has been tested according to standards IEC 61643-11:2011 and CISPR 17:2011. According to standard IEC 62305:2010, it is installed in the boundary between zones LPZ 2 - LPZ 3, where it limits induced overvoltage and residual overvoltage in power lines. HSAF* are designed to be mounted on a 35 mm DIN rail using a metal clip.

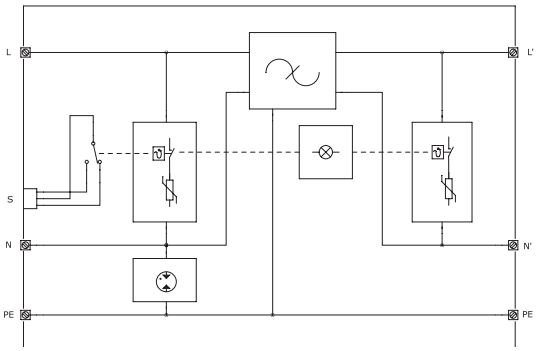
Manufacturer's recommendation: Install the HSAF* as close to the device to be protected as possible (no further than 5 m). A Hakel T1 and T2 lightning and surge arrester must be installed before the HSAF*.

Type			HSAF25, HSAF25 S	HSAF32, HSAF32 S
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 3, CLASS III	
System			TN-C-S, TN-S	
Max. continuous operating voltage		U_C	275 V AC	
Rated load current		I_L	25 A	32 A
Combined impulse		U_{OC}	6 kV (L/N, L/PE) 10 kV (N/PE)	
Voltage protection level at U_{OC}		U_p	< 800 V (L/N)	
			< 1,5 kV (L/PE)	
			< 1,2 kV (N/PE)	
Nominal discharge current I_n (8/20)		I_n	3 kA (L/N, L/PE) 5 kA (N/PE)	
Temporary overvoltage (TOV)		U_T	337 V/5 s (L/N)	
			1200 V/0,2 s (N/PE)	
Response time		t_A	< 25 ns (L/N) < 100 ns (L/PE, N/PE)	
Asymmetrical attenuation of filter (band-stop filter)			min. 80 dB at 4 MHz	
			min. 40 dB (0,15 ÷ 30 MHz)	
Power loss at winding temp. 20 °C			< 3 W	< 4 W
Back-up fuse			25 A	32 A
LPZ			2-3	
Housing material			Polyamid PA6, UL94 V-0	
Degree of protection of enclosure			IP20	
Operating temperature range		ϑ	-40 °C ... +55 °C	
Cross-section of the connected conductors			4 – 6 mm²	6 – 10 mm²
Tightening moment of clamps			1,2 Nm	
The mounting method / operating position			DIN rail 35 mm / any	
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault	
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A	
Lifetime			min. 100 000 h	
Weight		m	225 g	235 g
Article number	HSAF*		30 196	30 198
	HSAF* S		30 197	30 199

Surge arrester / varistor & EMC / EMI filter / TYPE 3

TYPE 3 / CLASS III / TN-C-S / TN-S / CE





HSAF40 S, 50 S, 63 S, 80 S, 125 S, 160 S

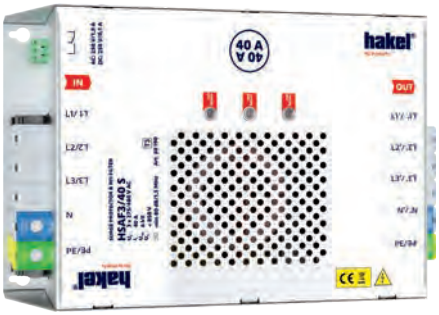
HSAF* S (Hakel Surge Arrester Filter) series "G-line" is a two-stage surge arrester. A high-frequency filter is integrated between these two stages. The HSAF* S series "G-line" includes an upgraded thermal fuse which ensures the timely disconnection of the HSAF* S from the mains supply when the varistor overheats and prevents the HSAF* S from any damage. The activation of the thermal fuse is signalled by an integrated light indication with the possibility of using the switch contact for remote monitoring (S) to signal the fault. HSAF* S is a two-port surge arrester type T3 tested according to the standard EN 61643-11:2012 (IEC 61643-11: 2011). According to EN 62305:2011 (IEC 62305: 2010) it is to be installed at the interface of LPZ 2 - LPZ 3 zones where it limits the induced overvoltage and residual overvoltage in power lines. HSAF* S is installed to the switchboard base by four screws.

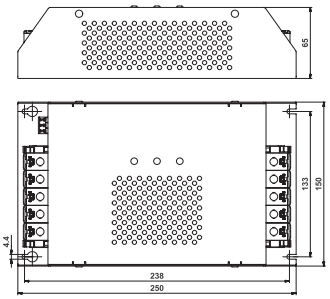
Manufacturer's recommendation: HSAF* S is to be installed as close as possible to the protected device (max. 5 m). A T1 lightning arrester and T2 surge arrester from Hakel must be installed in front of HSAF*S

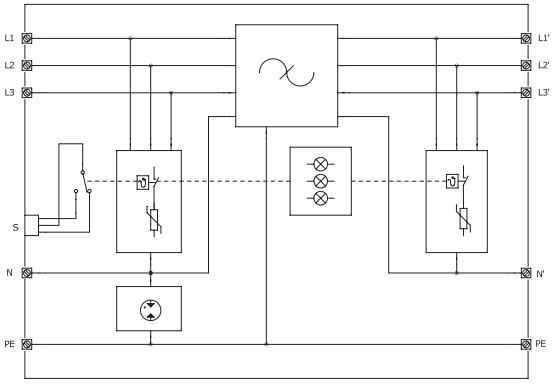
Type		HSAF40 S	HSAF50 S	HSAF63 S	HSAF80 S	HSAF125 S	HSAF160 S
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)		TYPE 3, CLASS III					
System		TN-C-S, TN-S					
Max. continuous operating voltage	U_C	275 V AC					
Rated load current	I_L	40 A	50 A	63 A	80 A	125 A	160 A
Combined impulse	U_{OC}	6 kV (L/N, L/PE) 10 kV (N/PE)					
Voltage protection level at U_{OC}	U_p	< 850 V (L/N)					
		< 1,5 kV (L/PE)					
		< 1,2 kV (N/PE)					
Nominal discharge current I_n (8/20)	I_n	3 kA (L/N, L/PE) 5 kA (N/PE)					
Temporary overvoltage (TOV)	U_T	337 V/5 s (L/N)					
		1200 V/0,2 s (N/PE)					
Response time	t_A	< 25 ns (L/N) < 100 ns (L/PE, N/PE)					
Asymmetrical attenuation of filter (band-stop filter)		min. 80 dB at 4 MHz					
		min. 40 dB (0,15 ÷ 30 MHz)					
Power loss at winding temp. 20 °C		< 4 W	< 7 W	< 9 W	< 12 W	< 20 W	
Back-up fuse		40 A	50 A	63 A	80 A	125 A	160 A
LPZ		2-3					
Housing material		Metal plate 1 mm					
Degree of protection of enclosure		IP20					
Operating temperature range	ϑ	-40 °C ... +55 °C					
Cross-section of the connected conductors		10 mm²		16 mm²	25 mm²	35 mm²	50 mm²
Tightening moment of clamps		3 Nm			10 Nm		
The mounting method / operating position		By screws M4 on chassis / any					
Failure signalisation		light off – ok / light on – fault					
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)		AC: 250 V / 1,5 A, DC: 250 V / 0,1 A					
Lifetime		min. 100 000 h					
Weight	m	720 g	1450 g	1450 g	1520 g	1780 g	1830 g
Article number		30 172	30 173	30 174	30 175	30 176	30 177

Surge arrester / varistor & EMC / EMI filter / TYPE 3

TYPE 3 / CLASS III / TN-C-S / TN-S / CE







HSAF3/40 S, /50 S, /63 S

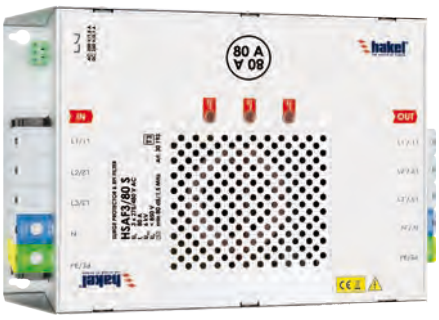
The "G-line" HSAF3* S (Hakel Surge Arrester Filter) is a two-stage surge arrester. It features a high-frequency filter integrated between the two stages. The "G-line" HSAF3* S contains an improved thermal fuse, which ensures timely disconnection of the HSAF3* S from the power grid during overheating and thus prevents damage to the HSAF3* S. Activation of the thermal fuse is signalled by an integral indicator light (each phase is signalled separately) with the option to utilize its switching contact for remote fault signalling (S). The HSAF3* S is a type T3 two-port surge arrester and has been tested according to standards IEC 61643-11:2011 and CISPR 17:2011. According to standard IEC 62305:2010, it is installed in the boundary between zones LPZ 2 - LPZ 3, where it limits induced overvoltage and residual overvoltage in power lines. HSAF* S is mounted on the main board of a switchboard using four bolts.

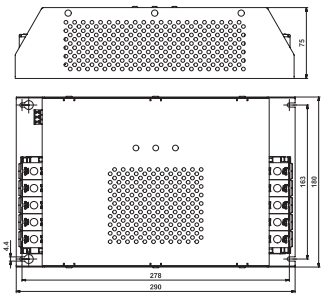
Manufacturer's recommendation: HSAF3* S is to be installed as close as possible to the protected device (max. 5 m). A T1 lightning arrester and T2 surge arrester from Hakel must be installed in front of HSAF3*S

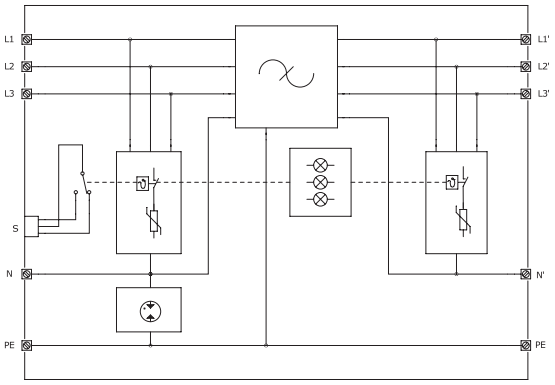
Type		HSAF3/40 S	HSAF3/50 S	HSAF3/63 S
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)		TYPE 3, CLASS III		
System		TN-C-S, TN-S		
Max. continuous operating voltage	U_C	3 x 275 / 480 V AC		
Rated load current	I_L	40 A	50 A	63 A
Combined impulse	U_{OC}	6 kV (L/N, L/PE) 10 kV (N/PE)		
Voltage protection level at U_{OC}	U_p	< 850 V (L/N)		
		< 1,5 kV (L/PE)		
		< 1,2 kV (N/PE)		
Nominal discharge current I_n (8/20)	I_n	3 kA (L/N, L/PE) 5 kA (N/PE)		
Temporary overvoltage (TOV)	U_T	337 V/5 s (L/N)		
		1200 V/0,2 s (N/PE)		
Response time	t_A	< 25 ns (L/N) < 100 ns (L/PE, N/PE)		
Asymmetrical attenuation of filter (band-stop filter)		min. 80 dB at 4 MHz		
		min. 40 dB (0,15 ÷ 30 MHz)		
Power loss at winding temp. 20 °C		< 8 W	< 9 W	< 12 W
Back-up fuse		40 A	50 A	63 A
LPZ		2-3		
Housing material		Metal plate 1 mm		
Degree of protection of enclosure		IP20		
Operating temperature range	ϑ	-40 °C ... +55 °C		
Cross-section of the connected conductors		10 mm²		16 mm²
Tightening moment of clamps		3 Nm		
The mounting method / operating position		By screws M4 on chassis / any		
Failure signalisation		light off – ok / light on – fault		
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)		AC: 250 V / 1,5 A, DC: 250 V / 0,1 A		
Lifetime		min. 100 000 h		
Weight	m	1700 g	1800 g	1800 g
Article number		30 190	30 191	30 192

Surge arrester / varistor & EMC / EMI filter / TYPE 3

TYPE 3 / CLASS III / TN-C-S / TN-S / CE







HSAF3/80 S, /125 S, /160 S

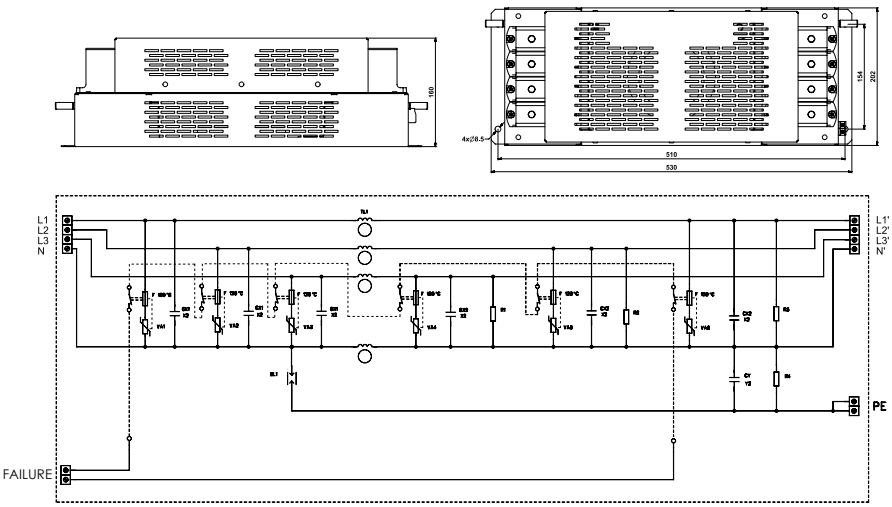
The "G-line" HSAF3* S (Hakel Surge Arrester Filter) is a two-stage surge arrester. It features a high-frequency filter integrated between the two stages. The "G-line" HSAF3* S contains an improved thermal fuse, which ensures timely disconnection of the HSAF3* S from the power grid during overheating and thus prevents damage to the HSAF3* S. Activation of the thermal fuse is signalled by an integral indicator light (each phase is signalled separately) with the option to utilize its switching contact for remote fault signalling (S). The HSAF3* S is a type T3 two-port surge arrester and has been tested according to standards IEC 61643-11:2011 and CISPR 17:2011. According to standard IEC 62305:2010, it is installed in the boundary between zones LPZ 2 - LPZ 3, where it limits induced overvoltage and residual overvoltage in power lines. HSAF* S is mounted on the main board of a switchboard using four bolts.

Manufacturer's recommendation: HSAF3* S is to be installed as close as possible to the protected device (max. 5 m). A T1 lightning arrester and T2 surge arrester from Hakel must be installed in front of HSAF3*S

Type		HSAF3/80 S	HSAF3/125 S	HSAF3/160 S
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)		TYPE 3, CLASS III		
System		TN-C-S, TN-S		
Max. continuous operating voltage	U_C	3 x 275 / 480 V AC		
Rated load current	I_L	80 A	125 A	160 A
Combined impulse	U_{OC}	6 kV (L/N, L/PE) 10 kV (N/PE)		
Voltage protection level at U_{OC}	U_p	< 850 V (L/N)		
		< 1,5 kV (L/PE)		
		< 1,2 kV (N/PE)		
Nominal discharge current I_n (8/20)	I_n	3 kA (L/N, L/PE) 5 kA (N/PE)		
Temporary overvoltage (TOV)	U_T	337 V/5 s (L/N)		
		1200 V/0,2 s (N/PE)		
Response time	t_A	< 25 ns (L/N) < 100 ns (L/PE, N/PE)		
Asymmetrical attenuation of filter (band-stop filter)		min. 80 dB at 4 MHz		
		min. 40 dB (0,15 ÷ 30 MHz)		
Power loss at winding temp. 20 °C		< 15 W	< 20 W	< 25 W
Back-up fuse		80 A	125 A	160 A
LPZ		2-3		
Housing material		Metal plate 1 mm		
Degree of protection of enclosure		IP20		
Operating temperature range	ϑ	-40 °C ... +55 °C		
Cross-section of the connected conductors		25 mm²	35 mm²	50 mm²
Tightening moment of clamps		10 Nm		
The mounting method / operating position		By screws M4 on chassis / any		
Failure signalisation		light off – ok / light on – fault		
Potential free signal contact (S) (recommended cross-section of remote monitoring max. 1 mm²)		AC: 250 V / 1,5 A, DC: 250 V / 0,1 A		
Lifetime		min. 100 000 h		
Weight	m	1950 g	2820 g	2820 g
Article number		30 193	30 194	30 195

Surge arrester / varistor & EMC / EMI filter / TYPE 3

TYPE 2+3 / CLASS II+III / TN-S / CE



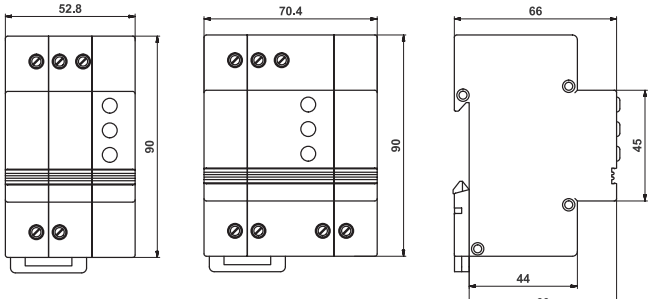
HSAF3/250 S
HSAF3/400 S

HSAF3/250 S and HSAF3/400 S are the three-phase surge arresters, which are equipped with high-frequency filters, according to IEC EN 61643-11. They are produced in basic version for mounting straight onto the switchboard's construction by screws M8. They are intended for protection of three-phase electronic appliances against the effects of the lightning current and switching overvoltage, which are generated in the L.V. power supply networks. The device includes a two-pole output terminal for remote monitoring, which is solved on the basis of a potential-free swithing contact. This contact is enabled for opening in case of failure of any in-built protective varistors.

Type		**HSAF3/250 S**	**HSAF3/400 S**
Test class according to IEC EN 61643-11		TYPE 2+3, CLASS II+III	
Nominal voltage	U_N	3 x 230 / 400 V AC	
Max. continuous operating voltage	U_C	3 x 335 / 570 V AC	
Rated load current	I_L	250 A	400 A
Combined impulse	U_{OC}	6 kV	
Nominal discharge current I_n(8/20)	I_n	20 kA (L/N, L/PE)	
		50 kA (N/PE)	
Max. discharge current I_{max} (8/20)	I_{max}	40 kA	
Lightning impulse current (10/350) N/PE	I_{imp}	50 kA	
Voltage protection level at U_{OC}	U_P	< 1,25 kV	
Asymmetrical attenuation		min. 70 dB at 1,5 MHz	
		min. 30 dB (0,15 - 30 MHz)	
Power loss at winding temp. 20 °C		cca 70 W	cca 125 W
Response time	t_A	< 25 ns (L/N)	
		< 100 ns (L/PE, N/PE)	
Back-up fuse		250 A	400 A
LPZ		0-3	
Housing material		metal plate 0,8 mm	
Protection type		IP20	
Operating temperature range	ϑ	-40 °C ... +55 °C	
Cross-section of the connected Cu conductors		120 mm²	240 mm²
Installation method		horizontal with exposed ventilation holes by screws M8 on chassis	
Failure signalisation (F/M)		230 V AC / 0,5 A Potential free release contact (NC TYPE)	
Lifetime		min. 100 000 h	
Weight	m	8 kg	10 kg
Article number		30 309	30 308

Surge arrester / varistor + gas discharge tube / TYPE 3

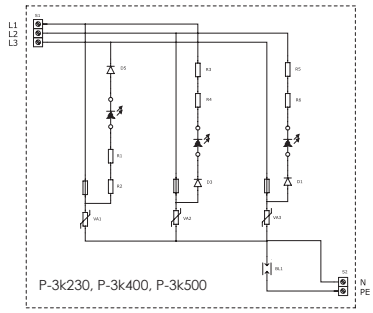
TYPE 3 / CLASS III / TN-S / TN-C / TT / CE



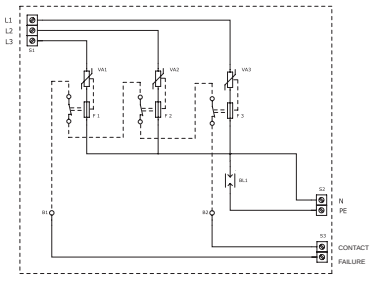
P-3k230, P-3k400, P-3k500
P-3k230 DS, P-3k400 DS

P-3k are the three-phase surge arresters type 3 according to IEC EN 61643-11. These parallel devices are intended for protection of electronic appliances against the impulse surge effects. They fully meet the demands of users for applications in three-phase power supply networks operated as TN-S, TN-C and TT systems. All varistors in P-3k devices are fitted with thermal fuses against the short and permanent overloading. P-3k units are to be connected as near to the protected electronic appliance as possible. The right function of P-3k230, P-3k400 and P-3k500 devices is indicated by three green LED diodes. The function failure of P-3k230 DS and P-3k400 DS devices is indicated by target disconnection of mechanical thermal fuses which react to the varistors overheating above c. 120 °C. If one of the three thermal fuses reacts, the free-potential contact FAILURE disconnects at the same time (in case of DS version only).

Type			**P-3k230, P-3k230 DS**	**P-3k400, P-3k400 DS**	**P-3k500**
Test class according to IEC EN 61643-11			TYPE 3, CLASS III		
Nominal voltage		U_N	230 V AC	400 V AC	500 V AC
Max. continuous operating voltage		U_C	275 V AC	480 V AC	600 V AC
Nominal discharge current I_n(8/20)		I_n	3 kA (L/N, L/PE)		
			5 kA (N/PE)		
Combined impulse		U_{OC}	6 kV (L/N,L/PE)		
			10 kV (N/PE)		
Voltage protection level at U_{OC}		U_P	< 1,2 kV (L/N)	< 1,5 kV (L/N)	< 1,8 kV (L/N)
			< 1,2 kV (L/PE)	< 1,5 kV (L/PE)	< 1,5 kV (L/PE)
			< 1,2 kV (N/PE)	< 1,5 kV (N/PE)	< 1,5 kV (N/PE)
Power loss at winding temp. 20 °C			cca 3 VA / 0,1 VA		
Response time		t_A	< 25 ns (L/N)		
			< 100 ns (L/PE, N/PE)		
Back-up fuse			16 A		
LPZ			2-3		
Housing material			Polyamid PA6, UL94 V-0, UL94 V-0		
Protection type			IP20		
Operating temperature range		ϑ	-40 °C ... +70 °C		
Cross-section of the connected conductors			2,5 - 4 mm² Cu		
Mounting on			DIN rail 35 mm		
Failure signalisation P-3k*			light on – ok / light off - failure		
Failure signalisation P-3k* DS			pushed in – ok / pushed out - failure		
Potential free release contact (DS) (recommended cross-section of remote monitoring max.1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A		
Lifetime			min. 100 000 h		
Weight		m	140 g / 205 g		150 g
Article number	P-3k*		30 105	30 101	30 102
	P-3k* DS		30 106	30 103	–



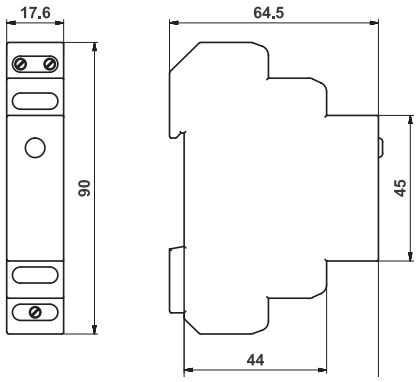
P-3k230, P-3k400, P-3k500

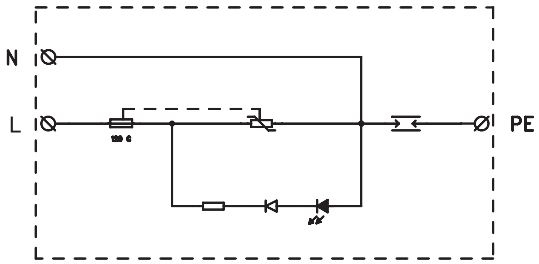


P-3k230 DS, P-3k400 DS

Surge arrester / varistor + gas discharge tube / TYPE 3

TYPE 3 / CLASS III / TN-S / TN-C / TT / CE





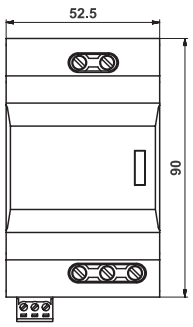
ZS-1DSM

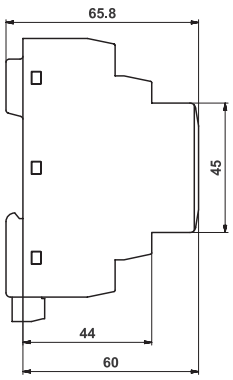
ZS-1DSM is a single-phase surge arrester, which is designed for universal application for protection of all kinds of electrical appliances connected to L.V. power supply system against the impulse surge effects. Type ZS-1DSM is intended for use in the power supply lines, which are operated as TN-S, TN-C and TT system. ZS-1DSM meets the requirement for Type 3 surge arrester according to IEC EN 61643-11. The right function is indicated by fitted green LED diode. The connection to L.V. power supply system is provided by means of screw terminals.

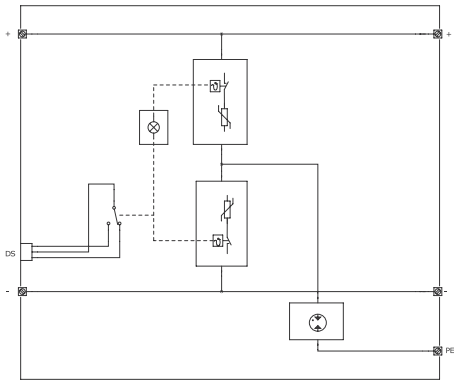
Type		**ZS-1DSM**
Test class according to IEC EN 61643-11		TYPE 3, CLASS III
Nominal voltage	U_N	230 V AC
Max. continuous operating voltage	U_C	275 V AC
Nominal discharge current I_n(8/20)	I_n	3 kA (L/N, L/PE)
		5 kA (N/PE)
Combined impulse	U_{OC}	6 kV (L/N,L/PE) 10 kV (N/PE)
Voltage protection level at U_{OC}	U_P	< 1 kV (L/N)
		< 1,2 kV (L/PE)
		< 1,2 kV (N/PE)
Power loss at winding temp. 20 °C		< 0,5 W
Response time	t_A	< 25 ns (L/N)
		< 100 ns (L/PE, N/PE)
Back-up fuse		16 A
Temporary overvoltage (TOV)	U_T	335 V / 5 s (L/N)
		1200 V + U_0 / 200 ms (L/PE)
LPZ		2-3
Housing material		Polyamid PA6, UL94 V-0
Protection type		IP20
Operating temperature range	ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors		1,5 mm² Cu
Mounting on		DIN rail 35 mm
Failure signalisation		light on – ok / light off - failure
Lifetime		min. 100 000 h
Weight	m	45 g
Article number		32 016

Surge arrester / varistor + gas discharge tube / TYPE 3

TYPE 3 / CLASS III / DC / CE







HSAD16/*VDC
HSAD16/*VDC S

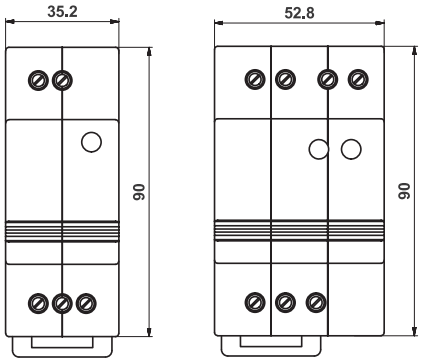
HSAD16/*VDC is a surge arrester designed for DC power supply systems. HSAD16/*VDC contains an improved thermal fuse which ensures timely disconnection of the device from the power grid during overheating and thus prevents damage to the HSAD16/*VDC. Activation of the thermal fuse is signalled by an integral indicator light with the option to utilize its switching contact for remote fault signalling (S). The HSAD16/*VDC is a type T3 two-port surge arrester and has been tested according to standards EN 61643-11 (IEC 61643-11:2011). According to standard EN 62305 (IEC 62305:2010), it is installed in the boundary between zones LPZ 2 - LPZ 3, where it limits induced overvoltage and residual overvoltage in power lines. HSAD16/*VDC are designed to be mounted on a 35 mm DIN rail using a metal clip.

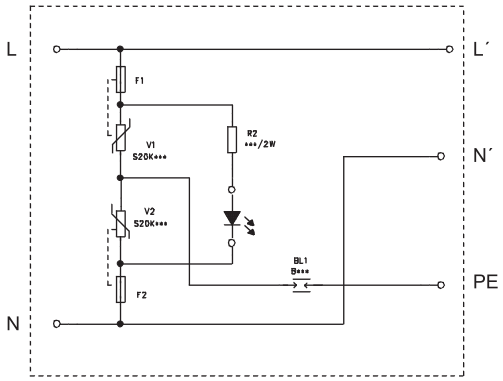
Manufacturer's recommendation: Install the HSAD16/*VDC as close to the device to be protected as possible (no further than 5 m). There must be Hakel's lightning and surge arrester T1 and T2 installed before the HSAD16/*VDC.

Type			**HSAD 16/6VDC**	**HSAD 16/12VDC**	**HSAD 16/24VDC**	**HSAD 16/48VDC**	**HSAD 16/60VDC**	**HSAD 16/120VDC**	**HSAD 16/220VDC**
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)			TYPE 3, CLASS III						
System			DC						
Nominal voltage		U_N	6 V =	12 V =	24 V =	48 V =	60 V =	120 V =	220 V =
Max. continuous operating voltage		U_C	7,2 V =	14,4 V =	28,8 V =	57,6 V =	72 V =	144 V =	264 V =
Nominal discharge current I_n (8/20)		I_n	2 kA					3 kA	
Rated load current		I_L	16 A						
Combined impulse		U_{OC}	4 kV					6 kV	
Voltage protection level at U_{OC} (+/-)		U_P	< 200 V	< 200 V	< 250 V	< 300 V	< 350 V	< 500 V	< 800 V
Voltage protection level at U_{OC} (+-/PE)		U_P	< 600 V					< 800 V	< 1500 V
Response time		t_A	< 25 ns (+/-) < 100 ns (+-/PE)						
Back-up fuse			16 A						
LPZ			2-3						
Housing material			Polyamid PA6, UL 94 V-0						
Degree of protection of enclosure			IP20						
Operating temperature range		ϑ	-40 °C ... +55 °C						
Cross-section of the connected conductors			2,5 - 4 mm² Cu						
The mounting method, operating position			DIN rail 35 mm / any						
Failure signalisation			optical function signalization target clear – ok optical function signalization target red – fault						
Potential free release contact (DS) (recommended cross-section of remote monitoring max.1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1A						
Lifetime			min. 100 000 h						
Weight		m	95 g						
Article number	HSAD16/*		30 250	30 251	30 252	30 253	30 254	30 255	30 256
	HSAD16/* S		30 283	30 284	30 285	30 286	30 287	30 288	30 289

Surge arrester / varistor + gas discharge tube / TYPE 3

TYPE 3 / CLASS III / AC / CE





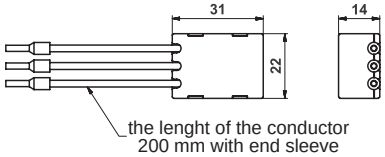
P-k16/110 AC
P-k16/230 AC

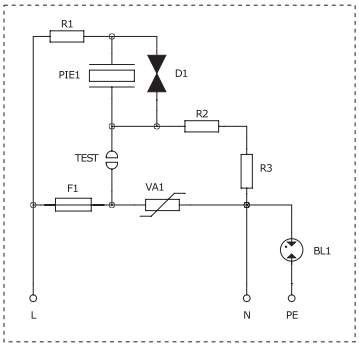
Series of the arresters P-k16*AC is designed for protection of electronic appliances in L.V. power supply AC systems against the impulse surge effects. They are constructed for mounting on DIN rail 35mm for rated load currents 16A according to IEC EN 61643-11 and IEC EN 62305 standards (arrester class III - 3rd stage protection). Right function of the in-built protective elements, MOV varistors, is signalized by green light on the front panel of the equipment.

Type		P-K16/110 AC	P-K16/230 AC
Test class according to IEC EN 61643-11		TYPE 3, CLASS III	
Network		AC	
Nominal voltage	U_N	110 V AC	230 V AC
Max. continuous operating voltage	U_C	132 V AC	275 V AC
Rated load current	I_L	16 A	
Combined impulse	U_{OC}	6 kV	
Voltage protection level at U_{OC}	U_P	< 850 V (L/N) < 800 V (L,N/PE)	< 1300 V (L/N) < 1200 V (L,N/PE)
Response time	t_A	< 25 ns (L/N)	
		< 100 ns (L,N/PE)	
Back-up fuse		16 A	
Temporary overvoltage (TOV)	U_T	-	335 V / 5 s (L/N)
		-	1200 V + U_0 / 0,2 s (L/PE)
LPZ		2-3	
Housing material		Polyamid PA6, UL94 V-0	
Protection type		IP20	
Operating temperature range	ϑ	-40 °C ... +70 °C	
Cross-section of the connected conductors		2,5 mm² Cu	
Mounting on		DIN rail 35 mm	
Failure signalisation		light on – ok / light off - failure	
Lifetime		min. 100 000 h	
Weight	m	95 g	
Article number		30 015	30 008

Surge arrester / varistor + gas discharge tube / TYPE 3

TYPE 3 / CLASS III / TN-S / CE



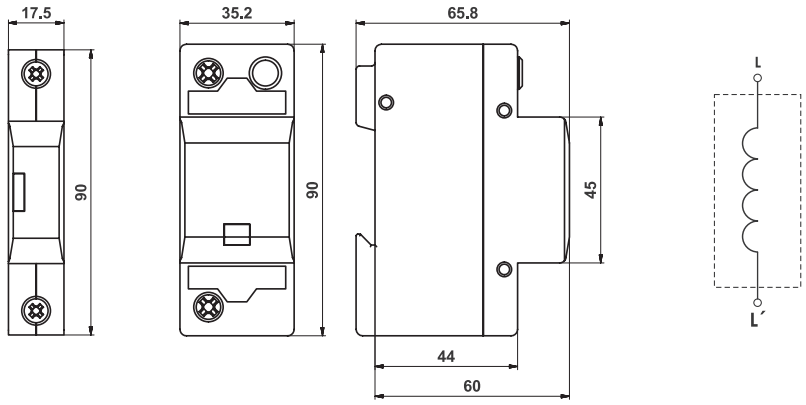


HSAA-1P

HSAA-1P - A Class III surge arrester according to IEC 61643-11, designed for use in conduit wiring and floor boxes for additional protection. It is a suitable addition to wiring that is already protected by surge protection with a filter (HSAF, HSAF3, PI-k, PI-3k). It can also be used to protect LED lights.

Type		HSAA-1P
Test class according to EN 61643-11:2012 (IEC 61643-11:2011)		TYPE 3, CLASS III
Nominal voltage	U_N	230 V AC
Max. continuous operating voltage	U_C	275 V AC
Nominal discharge current I_n(8/20 µs)	I_n	3 kA (L/N, L/PE) / 5 kA (N/PE)
Combined impulse	U_{OC}	6 kV (L/N, L/PE) / 10 kV (N/PE)
Voltage protection level at U_{OC}	U_P	< 1 kV (L/N) < 1,3 kV (L(N)/PE)
Response time	t_A	< 25 ns (L/N) < 100 ns (L/PE, N/PE)
Back-up fuse		16 A
Temporary overvoltage (TOV)	U_T	337 V / 5 s (L/N) 1200 V / 0,2 s (N/PE)
LPZ		2-3
Housing material		Polyamid PA6, UL 94 V-0
Degree of protection of enclosure		IP20
Operating position		any
Operating temperature range	ϑ	-40 °C ... +70 °C
Failure signalisation		inbuilt piezosiren
Lifetime		min. 100 000 h
Weight		15 g
Article number		32 007

Decoupling inductors

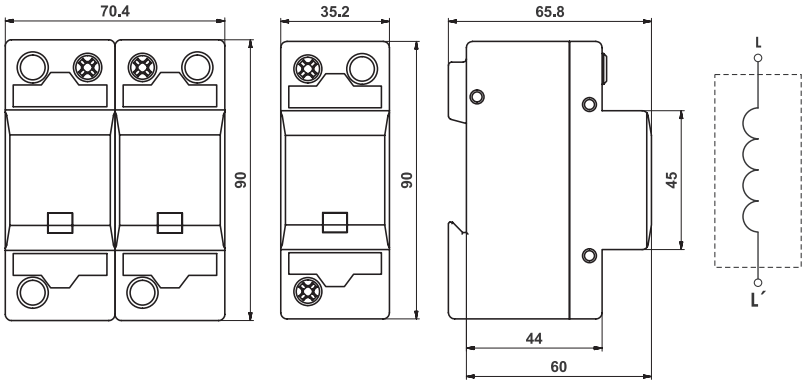


HI16, HI16/15, HI32 HI32/15

Decoupling inductors are intended for rated load currents within the range of 16 and 32A. These inductors, sometimes also called decoupling impedance, ensure the energy coordination between the arresters type 1 and type 2 or the arresters type 2 and type 3 according to IEC EN 62305 and IEC EN 61643-11, especially in the places where there is no adequate distance between the arresters (e.g. when there are two successive arrester types placed in one switchboard). If the energy coordination of surge protection is not achieved, the lightning current impulse can damage some arrester type of the protection cascade. If there is at least 5m distance between two successive arrester types (in case of two successive arrester types in two different switchboards), this section impedance can be considered as adequate.

Type		**HI16**	**HI16/15**	**HI32**	**HI32/15**
Nominal voltage	U_N	500 V AC			
Rated load current	I_L	16 A		32 A	
Inductance	L	6 μH ± 10%	15 μH ± 10%	6 μH ± 10%	15 μH ± 10%
DC resistance		< 0,01 Ω			
Housing material		Polyamid PA6, UL 94 V-0			
Protection type		IP20			
Operating temperature range	ϑ	-40 °C ... +70 °C			
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)		6 mm²		10 mm²	
Max. back-up fuse		16 A		32 A	
Lifetime		min. 100 000 h			
Weight	m	141 g	157 g	157 g	330 g
Article number HI*		30 400	30 401	30 402	30 403

Decoupling inductors

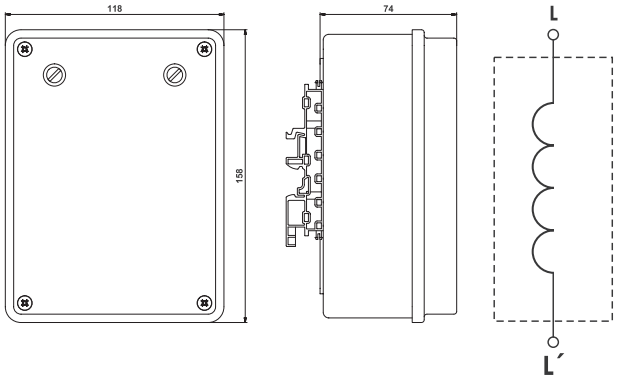


HI63/15 **HI63, HI80**

Decoupling inductors are intended for rated load currents within the range of 63 and 80A. These inductors, sometimes also called decoupling impedance, ensure the energy coordination between the arresters type 1 and type 2 or the arresters type 2 and type 3 according to IEC EN 62305 and IEC EN 61643-11, especially in the places where there is no adequate distance between the arresters (e.g. when there are two successive arrester types placed in one switchboard). If the energy coordination of surge protection is not achieved, the lightning current impulse can damage some arrester type of the protection cascade. If there is at least 5m distance between two successive arrester types (in case of two successive arrester types in two different switchboards), this section impedance can be considered as adequate.

Type			HI63	HI63/15	HI80
Nominal voltage		U_N	500 V AC		
Rated load current		I_L	63 A		80 A
Inductance		L	6 μH ± 10%	15 μH ± 10%	4 μH ± 10%
DC resistance			< 0,01 Ω		
Housing material			Polyamid PA6, UL 94 V-0		
Protection type			IP20		
Operating temperature range		ϑ	-40 °C ... +70 °C		
Cross-section of the connected conductors (at tightening moment of clamps 3 Nm)			16 mm²		25 mm²
Max. back-up fuse			63 A		80 A
Lifetime			min. 100 000 h		
Weight		m	360 g	630 g	360 g
Article number	HI*		30 404	30 405	30 406

Decoupling inductors



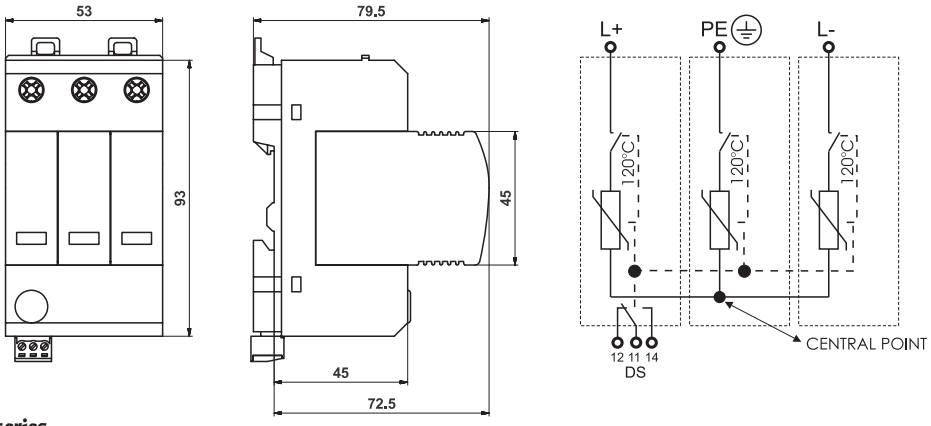
PI-L120

Decoupling inductor is intended for the rated load current of 120A. This inductor, sometimes also called decoupling impedance, ensures the energy coordination between the arresters type 1 and type 2 or the arresters type 2 and type 3 according to IEC 1024-1 and IEC EN 61643-11, especially in the places where there is no adequate distance between the arresters (e.g. when there are two successive arrester types placed in one switchboard). If the energy coordination of surge protection is not achieved, the lightning current impulse can damage some arrester type of the protection cascade. If there is at least 5m distance between two successive arrester types (in case of two successive arrester types in two different switchboards), this section impedance can be considered as adequate.

Type		**PI-L120**
Nominal voltage	U_N	500 V AC
Rated load current	I_L	120 A
Inductance	L	6 μH ± 10%
DC resistance		< 0,01 Ω
Housing material		Polyamid PA6, UL94 V-0
Protection type		IP20
Operating temperature range	ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 4 Nm)		50 mm^2
Max. back-up fuse		120 A
Lifetime		min. 100 000 h
Weight	m	1153 g
Article number		30 120

Lightning and surge arrester / photovoltaic systems / varistor / TYPE 1 + 2

TYPE 1 + 2 / CLASS I + II / CE



PIVM PV 600 V series, PIVM PV 600 DS V series
PIVM PV 800 V series, PIVM PV 800 DS V series

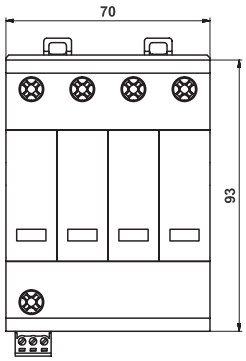
PIVM PV is a lightning and surge arrester type 1+2 according to EN 61643-11 and IEC 61643-11 and UTE C 61-740-51. These arresters are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-2 (according to IEC EN 62305) for equipotential bonding of positive and negative busbars of photovoltaic systems and elimination of transient overvoltage that originates during the atmospheric discharges or switching processes. Particular varistor sectors, connected between the terminals L+, L- and PE, are equipped with internal disconnectors, which are activated when the varistors fail (overheat). Operational status indication of these disconnectors is partly visual (discoloration of the signal field) and partly remote monitoring (by potential free change over contacts – only DS types).
The marking **M** specifies a type of construction with removable module.

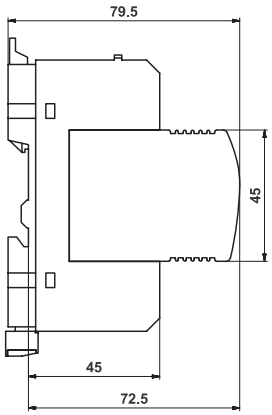
Type V series			**PIVM PV 600, PIVM PV 600 DS**	**PIVM PV 800, PIVM PV 800 DS**
Test class according to IEC EN 61643-11 and EN 50539-11			TYPE 1+2, CLASS I+II	
Max. continuous operating voltage		U_{cpv}	600 V DC	800 V DC
Open circuit voltage of PV generator		U_{OCSTC}	$U_{OCSTC} < U_{CPV}/1,2 = 500$ V	$U_{OCSTC} < U_{CPV}/1,2 = 730$ V
Short circuit withstand		I_{SCPV}	100 A	
Lightning impulse current (10/350)		I_{imp}	7 kA	6,5 kA
- charge		Q	3,5 As	3,25 As
- specific energy		W/R	12 kJ/Ω	10 kJ/Ω
Application			L+/L-, L+/PE, L-/PE	
Max. discharge current (8/20)		I_{max}	40 kA	
Nominal discharge current (8/20)		I_n	20 kA	15 kA
Voltage protection level at I_n		U_P	< 2,6 kV	< 3,3 kV
Response time		t_A	< 25 ns	
LPZ			0-2	
Housing material			Polyamid PA6, UL94 V-0	
Protection type			IP20	
Operating temperature range		ϑ	-40 °C ... +70 °C	
Cross-section of the connected conductors (at tightening moment of clamps 4 Nm)			25 mm² (solid) 16 mm² (wire)	
Mounting on			DIN rail 35 mm	
Failure signalisation			green – ok / red - failure	
Potential free signal contact (DS) (recommended cross-section of remote monitoring max.1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A	
Weight		m	300 g	390 g
Lifetime			min. 100 000 h	
Article number	PIVM PV*		16 070	16 073
	PIVM PV* DS		16 071	16 074

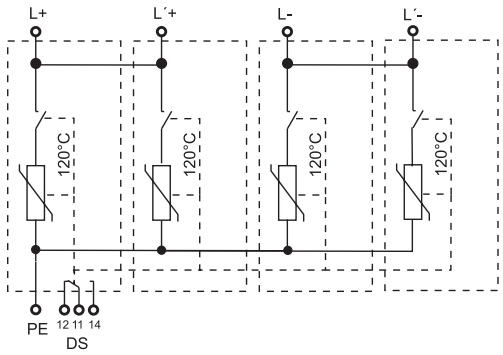
Varistor-based spare module		PIVM PV-600/M	PIVM PV-800/M
		16 072	16 075

Lightning and surge arrester / photovoltaic systems / varistor / TYPE 1 + 2

TYPE 1 + 2 / CLASS I + II / CE







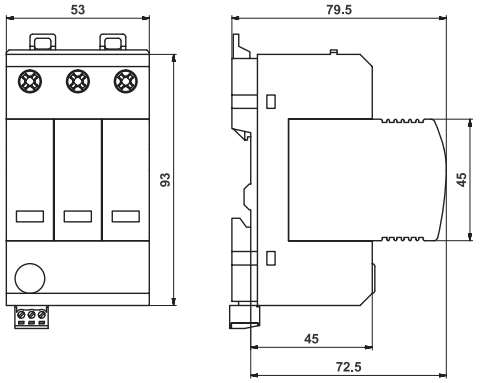
PIVM PV 1000 V series
PIVM PV 1000 DS V series

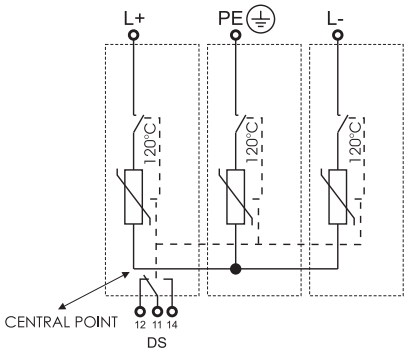
PIVM PV are the lightning and surge arresters type 1+2 according to EN 61643-11 and IEC 61643-11 and UTE C 61-740-51. These arresters are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-2 (according to IEC EN 62305) for equipotential bonding of positive and negative busbars of photovoltaic systems and elimination of transient overvoltage that originates during the atmospheric discharges or switching processes. Particular varistor sectors, connected between the terminals L+, L- and PE, are equipped with internal disconnectors, which are activated when the varistors fail (overheat). Operational status indication of these disconnectors is partly visual (discoloration of the signal field) and partly remote monitoring (by potential free change over contacts – only DS types).
The marking **M** specifies a type of construction with removable module.

Type V series			**PIVM PV 1000, PIVM PV 1000 DS**
Test class according to IEC EN 61643-11 and EN 50539-11			TYPE 1+2, CLASS I+II
Max. continuous operating voltage		U_{cpv}	1050 V DC
Open circuit voltage of PV generator		U_{OCSTC}	$U_{OCSTC} < U_{CPV}/1,2 = 875$ V
Short circuit withstand		I_{SCPV}	100 A
Lightning impulse current (10/350)		I_{imp}	6,5 kA
- charge		Q	3,25 As
- specific energy		W/R	10 kJ/Ω
Application			L+/L-, L+/PE, L-/PE
Max. discharge current (8/20)		I_{max}	40 kA
Nominal discharge current (8/20)		I_n	15 kA
Voltage protection level at I_n (L+/L-)		U_p	< 3,8 kV
Voltage protection level at I_n (L/PE)		U_p	< 1,9 kV
Response time		t_A	< 25 ns
LPZ			0-2
Housing material			Polyamid PA6, UL94 V-0
Protection type			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 4 Nm)			25 mm² (solid) 16 mm² (wire)
Mounting on			DIN rail 35 mm
Failure signalisation			green – ok / red - failure
Potential free signal contact (DS) (recommended cross-section of remote monitoring max.1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Weight		m	400 g
Lifetime			min. 100 000 h
Article number	PIVM PV*		16 076
	PIVM PV* DS		16 077
Varistor-based spare module			PIVM PV-1000/M
			16 078

Surge arrester / photovoltaic systems / varistor / TYPE 2

TYPE 2 / CLASS II / CE





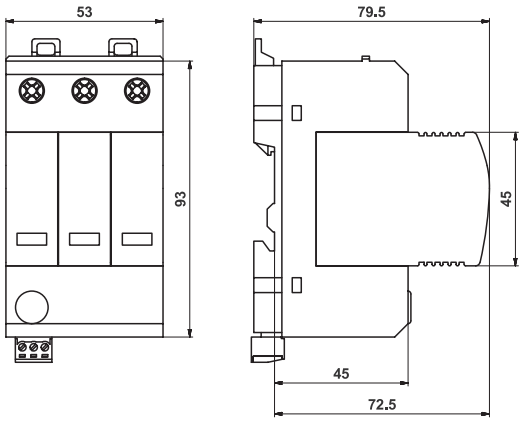
PIIIM PV 200 V series
PIIIM PV 200 DS V series

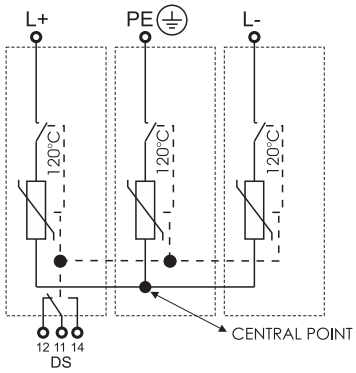
PIIIM PV are the lightning and surge arresters type 2 according to IEC EN 61643-11 and EN 50539-11. These arresters are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2 (according to IEC EN 62305) for equipotential bonding of positive and negative busbars of photovoltaic systems and elimination of transient overvoltage that originates during the atmospheric discharges or switching processes. Particular varistor sectors, are equipped with internal disconnectors, which are activated when the varistors fail (overheat). Operational status indication of these disconnectors is partly visual (discoloration of the signal field) and partly remote monitoring (by potential free change over contacts – only DS types).
The marking **M** specifies a type of construction with removable module.

Type V series			**PIIIM PV 200, PIIIM PV 200 DS**
Test class according to IEC EN 61643-11 and EN 50539-11			TYPE 2, CLASS II
Max. continuous operating voltage		U_{cpv}	200 V DC
Open circuit voltage of PV generator		U_{OCSTC}	$U_{OCSTC} < U_{CPV}/1,2 = 167$ V DC
Short circuit withstand		I_{SCWPV}	100 A
Application			L+/L-, L+/PE, L-/PE
Max. discharge current (8/20)		I_{max}	40 kA
Nominal discharge current (8/20)		I_n	20 kA
Voltage protection level at I_n		U_p	< 800 V
Response time		t_A	< 25 ns
LPZ			1-2
Housing material			Polyamid PA6, UL94 V-0
Protection type			IP20
Operating temperature range		ϑ	-40 °C ... +70 °C
Cross-section of the connected conductors (at tightening moment of clamps 4 Nm)			25 mm² (solid)
			16 mm² (wire)
Mounting on			DIN rail 35 mm
Failure signalisation			green – ok / red - failure
Potential free signal contact (DS) (recommended cross-section of remote monitoring max.1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A
Weight		m	190 g
Lifetime			min. 100 000 h
Article number	PIIIM PV*		27 071
	PIIIM PV* DS		27 073
Varistor-based spare module			PIIIM PV-200/M
			27 065

Surge arrester / photovoltaic systems / varistor / TYPE 2

TYPE 2 / CLASS II / CE





PIIIM PV 600 Vseries, PIIIM PV 800 Vseries, PIIIM PV 1000 Vseries, PIIIM PV 1500 Vseries
PIIIM PV 600 DS Vseries, PIIIM PV 800 DS Vseries, PIIIM PV 1000 DS Vseries, PIIIM PV 1500 DS Vseries

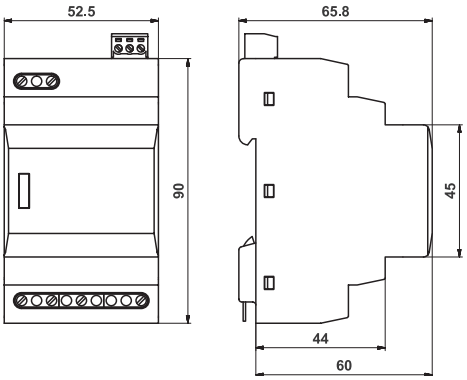
PIIIM PV are the lightning and surge arresters type 2 according to EN 61643-11 and IEC 61643-11 and UTE C 61-740-51. These arresters are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2 (according to IEC EN 62305) for equipotential bonding of positive and negative busbars of photovoltaic systems and elimination of transient overvoltage that originates during the atmospheric discharges or switching processes. Particular varistor sectors, connected between the terminals L+, L- and PE, are equipped with internal disconnectors, which are activated when the varistors fail (overheat). Operational status indication of these disconnectors is partly visual (discoloration of the signal field) and partly remote monitoring (by potential free change over contacts – only DS types).
The marking **M** specifies a type of construction with removable module.

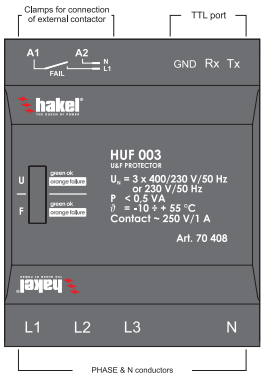
Type Vseries			**PIIIM PV 600, PIIIM PV 600 DS**	**PIIIM PV 800, PIIIM PV 800 DS**	**PIIIM PV 1000, PIIIM PV 1000 DS**	**PIIIM PV 1500, PIIIM PV 1500 DS**
Test class according to IEC EN 61643-11 and EN 50539-11			TYPE 2, CLASS II			
Max. continuous operating voltage		U_{cpv}	600 V DC	870 V DC	1050 V DC	1500 V DC
Open circuit voltage of PV generator		U_{OCSTC}	500 V	730 V	875 V	1250 V
Short circuit withstand		I_{SCPV}	100 A			
Application			L+/L-, L+/PE, L-/PE			
Max. discharge current (8/20)		I_{max}	40 kA			
Nominal discharge current (8/20)		I_n	20 kA		15 kA	
Voltage protection level at I_n		U_P	< 2,6 kV	< 3,3 kV	< 3,8 kV	< 4,5 kV
Response time		t_A	< 25 ns			
LPZ			1-2			
Housing material			Polyamid PA6, UL94 V-0			
Protection type			IP20			
Operating temperature range		ϑ	-40 °C ... +70 °C			
Cross-section of the connected conductors (at tightening moment of clamps 4 Nm)			25 mm² (solid)			
			16 mm² (wire)			
Mounting on			DIN rail 35 mm			
Failure signalisation			green – ok / red - failure			
Potential free signal contact (DS) (recommended cross-section of remote monitoring max.1 mm²)			AC: 250 V / 1,5 A, DC: 250 V / 0,1 A			
Weight		m	270 g		420 g	
Lifetime			min. 100 000 h			
Article number	PIIIM PV*		27 060	27 056	27 054	27 110
	PIIIM PV* DS		27 061	27 059	27 058	27 111

Varistor-based spare module			PIIIM PV-600/M	PIIIM PV-800/M	PIIIM PV-1000/M	PIIIM PV-1500/M
			27 062	27 068	27 055	27 112

Voltage and frequency protector

AC / IP20 / CE





HUF 003

This voltage & frequency protector is recommended for use in AC parts of photovoltaic systems or other types of AC electrical installations. After connecting the HUF to the monitored system and after the initialization of its internal electronics, the in-built switching contact for external contactor control closes. Subsequently, there is a continuous monitoring of two basic variables connected to the AC power supply system (specifically, voltage and frequency) and in case of deviation from the preset values, this contact opens and consequently the external contactor is dropped. In this way, it is possible to immediately disconnect all protected devices from the monitored AC network.

HUF 003 is suitable for use in three-phase or in one-phase applications since reconfiguration of measuring mode is made automatically by in-built microprocessor. The basic working limits of overvoltage / undervoltage / frequency and basic response time are set by producer. Alternative changes to these limits at the customer may only be performed by an authorized person (service technician) after connecting to the PC.

Type		**HUF 003**
Supply voltage	U_N	3x400/230 V/50 Hz (three-phase mode) or 230 V/50 Hz (single-phase mode)
Supply voltage fluctuation range		± 20 %
Power consumption	P	< 0,5 VA
Basic setting of working parameters by manufacturer (*Note.:)		Voltage ~ 230 V ± 10 %
		Frequency 50 Hz ± 1 %
		Response time 0,1 s
		Time of re-attaching 20 min.
Possible range of working parameters adjustment		Voltage ~ 184 ÷ 275 V Frequency 45 ÷ 55 Hz Response time 0,1 ÷ 2 s Time of re-attaching 10 s ÷ 20 min.
Output		Switching contact ~ 250V/1A for control of external contactor
Measuring accuracy		< 1 %
Possibility changes of working parameters		By delivered software HUF MONITOR and TTL port
Operating temperature range	ϑ	- 10 °C ... +55 °C
Mounting on		DIN rail 35 mm
Housing		IP20
Weight	m	145 g
Article number		70 408

*Note: further settings are possible on the basis of specification, according to the connection conditions of the electricity distributor

Communication HUF → PC

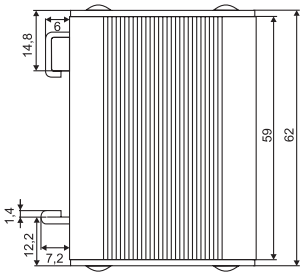
HUF 003 is equipped with series interface TxD and RxD. Therefore it is necessary for communication with PC to use a USB → TTL convertor, with galvanic isolation. The supplied HUF MONITOR software application (operating under Windows) will find the correct serial port when it is started and gives the user the following options:

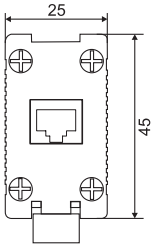
- to observe actual voltage values at all line wires of connected phases
- to observe actual frequency of connected AC network

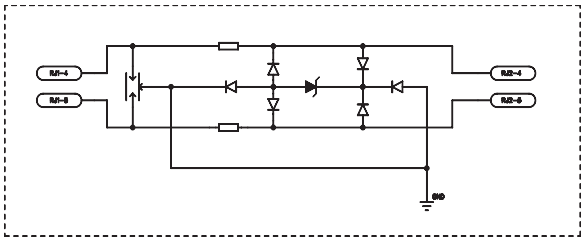
The necessary communication converter to the PC can also be the subject of delivery based on a special order if the customer specifies the hardware of his PC.

Surge protection devices for information technology systems

LPZ 1-2 / IP20 / CE







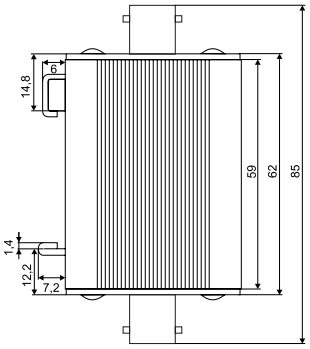
HT-VDSL Xseries

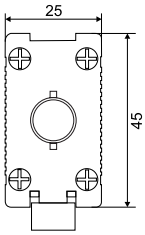
Hakel Transmition-VDSL is designed to protect telecommunication lines, which transmit the VDSL technology. The casing of this protector is made out of light alloy, which ensures high mechanical and thermal resistance. I_{max}= 2 kA. It is recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2 according to EN 62305.

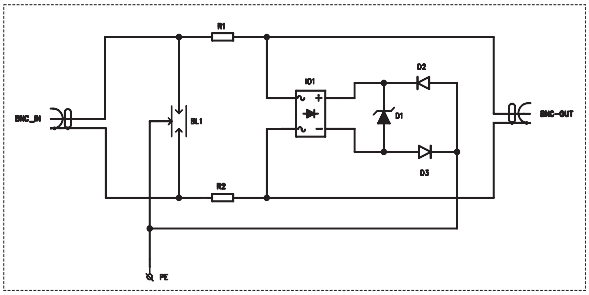
Type		HT-VDSL
Number of protected pairs		1
Connector type		RJ45
Nominal voltage	U_N	120 V
Max. continuous operating voltage	U_C	144 V
Rated load current	I_L	100 mA
C2 Max. discharge current (8/20)	I_{max}	2 kA
C2 Nominal discharge current (8/20)	I_n	1 kA
C2 Voltage protection level at I_n	U_P	200 V
C3 Voltage protection level at 1kV/μs	U_P	150 V
Response time	t_A	< 30 ns
Data rate		10 MBit/s
Series impedance per line		1,5 -10 Ω
Parasitic capacitance	C	1,5 nF
LPZ		1-2
Protection type		IP20
Operating temperatue range	ϑ	-40 °C ... +80 °C
Recommended cable cross-section		0,3 mm²
Category tested acc. to IEC 61643:21-2000		C1, C2, C3, D1
Article number		57 000

Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE







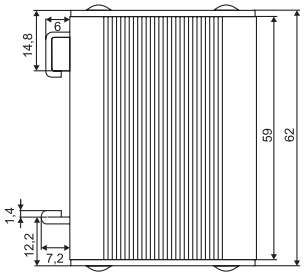
HT-CCTV 6 Xseries
HT-CCTV 12 Xseries

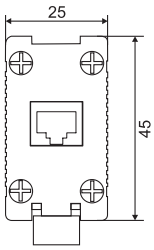
Hakel Transmition-CCTV is designed to protect video transmission equipment, which process the transferred video signal. The casing of this protector is made out of light alloy, which ensures high mechanical and thermal resistance. I_{max}= 5 kA. It is recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2-3 according to EN 62305.

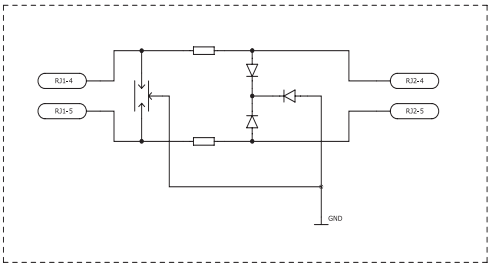
Type		HT-CCTV 6	HT-CCTV 12
Number of protected pairs		1	
Connector type		BNC (F/F, F/M)	
Nominal voltage	U_N	6 V	12 V
Max. continuous operating voltage	U_C	7,2 V	14,4 V
Rated load current	I_L	300 mA	
C2 Max. discharge current (8/20)	I_{max}	5 kA	
C2 Nominal discharge current I_n (8/20)	I_n	1 kA	
C2 Voltage protection level at I_n	U_P	22 V	44 V
C3 Voltage protection level at 1kV/μs	U_P	10 V	20 V
Response time	t_A	< 30 ns	
Data rate		10 MBit/s	
Parasitic capacitance	C	< 27 pF	
Series impedance per line	R	10 Ω	
LPZ		2-3	
Protection type		IP20	
Operating temperatue range	ϑ	-40 °C ... +80 °C	
Category tested acc. to IEC 61643:21-2000		C1, C2, C3, D1	
Article number		57 001	57 002

Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE







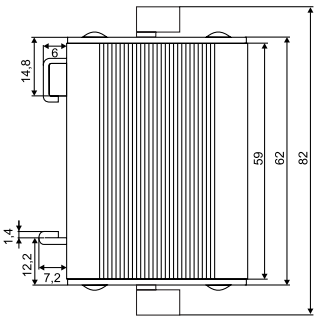
HT-TEL Xseries

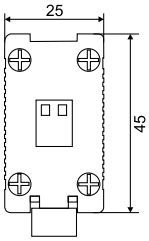
Hakel Transmition-TEL is designed to protect telecommunications equipment. The casing of this protector is made out of light alloy, which ensures high mechanical and thermal resistance. I_{max} = 2 kA. It is recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2-3 according to EN 62305.

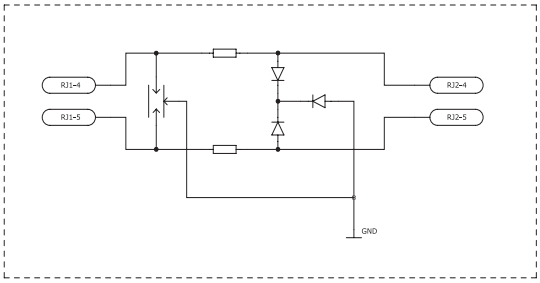
Type		HT-TEL
Number of protected pairs		1
Connector type		RJ45
Nominal voltage	U_N	170 V
Max. continuous operating voltage	U_C	204 V
Rated load current	I_L	100 mA
C2 Max. discharge current (8/20)	I_{max}	2 kA
C2 Nominal discharge current (8/20)	I_n	1 kA
C2 Voltage protection level at I_n (8/20)	U_P	500 V
C3 Voltage protection level at 1kV/μs	U_P	290 V
Response time	t_A	< 30 ns
Data rate		1 MBit/s
Series impedance per line		2,2 Ω
Parasitic capacitance	C	1,5 nF
LPZ		3
Protection type		IP20
Operating temperatue range	ϑ	-40 °C ... +80 °C
Recommended cable cross-section		0,25 - 1,5 mm²
Category tested acc. to IEC 61643:21-2000		C1, C2, C3, D1
Article number		57 003

Surge protection devices for information technology systems

LPZ 1-2 / IP20 / CE







HT-D 1/* Xseries
HT-NV 1/*/0,5 Xseries

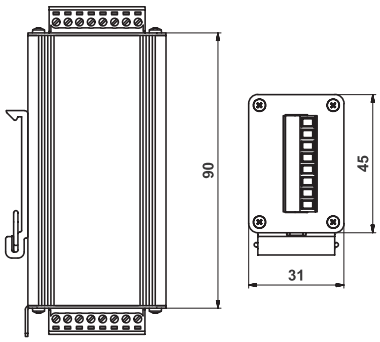
Hakel Transmition-D is designed to protect transmission of information signals and Hakel Transmition-NV to protect links of power supply lines. The casing of this protector is made out of light alloy, which ensures high mechanical and thermal resistance. I_{max}=10 kA. It is recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2 according to EN 62305.

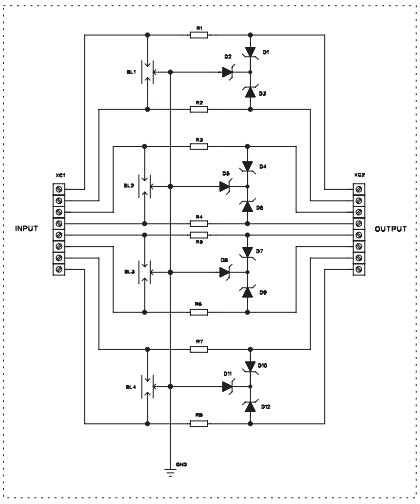
Type		HT-D 1/6	HT-D 1/12	HT-D 1/24	HT-D 1/48	HT-D 1/T
Number of protected pairs		1				
Connector type		Two-pole, screw type, slip-on terminal block				
Nominal voltage	U_N	6 V	12 V	24 V	48 V	170 V
Max. continuous operating voltage	U_C	7,2 V	14,4 V	28,6 V	57,6 V	204 V
Rated load current	I_L	100 mA				
C2 Max. discharge current (8/20)	I_{max}	10 kA				
C2 Nominal discharge current (8/20)	I_n	1 kA				
C2 Voltage protection level at I_n(8/20)	U_P	15 V	28 V	64 V	160 V	500 V
C3 Voltage protection level at 1kV/μs	U_P	9 V	18 V	34 V	66 V	290 V
Response time	t_A	< 30 ns				
Data rate		1 MBit/s				
Series impedance per line		2,2 Ω				
Parasitic capacitance	C	1,5 nF				
LPZ		1-2				
Protection type		IP20				
Operating temperatue range	ϑ	-40 °C ... +80 °C				
Recommended cable cross-section		0,25 - 1,5 mm²				
Category tested acc. to IEC 61643:21-2000		C1, C2, C3, D1				
Article number		57 005	57 006	57 007	57 008	57 009

Type		HT-NV 1/6/0,5	HT-NV 1/12/0,5	HT-NV 1/24/0,5	HT-NV 1/48/0,5
Number of protected pairs		1			
Connector type		Two-pole, screw type, slip-on terminal block			
Nominal voltage	U_N	6 V	12 V	24 V	48 V
Max. continuous operating voltage	U_C	7,2 V	14,4 V	28,6 V	57,6 V
Rated load current	I_L	0,5 A			
D1 Lightning impulse current (10/350)	I_{imp}	5 kA			
D1 Lightning impulse current (10/350) line/ PE	I_{imp}	2,5 kA			
C2 Max. discharge current (8/20)	I_{max}	10 kA			
C2 Nominal discharge current (8/20)	I_n	1 kA			
C2 Voltage protection level at I_n (8/20)	U_P	15 V	28 V	64 V	85 V
C3 Voltage protection level at 1kV/μs	U_P	9 V	18 V	34 V	66 V
Response time	t_A	< 30 ns			
Data rate		1 MBit/s			
Insert inductance		4,7 μH			
LPZ		1-2			
Protection type		IP20			
Operating temperatue range	ϑ	-40 °C ... +80 °C			
Parasitic capacitance	C	1,5 nF			
Recommended cable cross-section		0,25 - 1,5 mm²			
Category tested acc. to IEC 61643:21-2000		C1, C2, C3, D1			
Article number		57 010	57 011	57 012	57 013

Surge protection devices for information technology systems

LPZ 0-3 / IP20 / CE





HT-D 4/* Xseries
HT-NV 4/*/0,5 Xseries

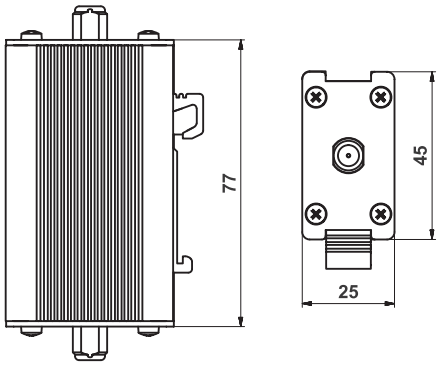
Hakel Transmition-D is designed to protect transmission of information signals and Hakel Transmition-NV for protection of supply lines. The casing of this protector is made out of light alloy, which ensures high mechanical and thermal resistance. It is recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-3 according to EN 62305:2011

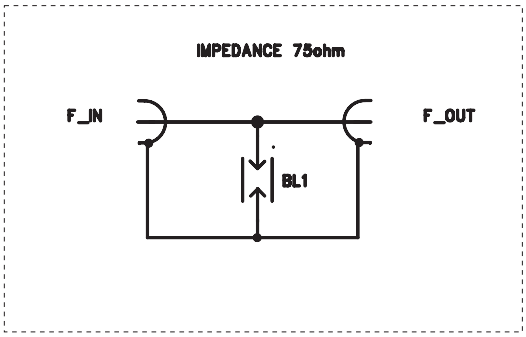
Type		**HT-D 4/6**	**HT-D 4/12**	**HT-D 4/24**	**HT-D 4/48**
Number of protected pairs			**4**		
Connector type			Eight-pole, screw / screwless type, slip-on terminal block		
Nominal voltage	U_N	6 V	12 V	24 V	48 V
Max. continuous operating voltage	U_C	7,2 V	14,4 V	28,6 V	57,6 V
Rated load current	I_L		100 mA		
C2 Nominal discharge current (8/20)	I_n		1 kA		
C2 Voltage protection level at I_n(8/20)	U_P	15 V	28 V	64 V	160 V
C3 Voltage protection level at 1kV/μs	U_P	9 V	18 V	34 V	66 V
Response time	t_A		< 30 ns		
Data rate			1 MBit/s		
Series impedance per line			2,2 Ω		
Parasitic capacitance	C		1,5 nF		
LPZ			0-3		
Protection type			IP20		
Operating temperatue range	ϑ		-40 °C ... +70 °C		
Recommended cable cross-section			0,25 - 1,5 mm²		
Category tested acc. to IEC 61643:21-2000			C1, C2, C3, D1		
Article number		35 003	35 004	35 005	35 006

Type		**HT-NV 4/6/0,5**	**HT-NV 4/12/0,5**	**HT-NV 4/24/0,5**	**HT-NV 4/48/0,5**
Number of protected pairs			**4**		
Connector type			Eight-pole, screw type, slip-on terminal block		
Nominal voltage	U_N	6 V	12 V	24 V	48 V
Max. continuous operating voltage	U_C	7,2 V	14,4 V	28,6 V	57,6 V
Rated load current	I_L		0,5 A		
C2 Nominal discharge current (8/20)	I_n		1 kA		
C2 Voltage protection level at I_n (8/20)	U_P	15 V	28 V	64 V	85 V
C3 Voltage protection level at 1kV/μs	U_P	9 V	18 V	34 V	66 V
Response time	t_A		< 30 ns		
Data rate			1 MBit/s		
Insert inductance			4,7 μH		
LPZ			0-3		
Protection type			IP20		
Operating temperatue range	ϑ		-40 °C ... +70 °C		
Parasitic capacitance	C		1,5 nF		
Recommended cable cross-section			0,25 - 1,5 mm²		
Category tested acc. to IEC 61643:21-2000			C1, C2, C3, D1		
Article number		35 007	35 008	35 009	35 010

Surge protection devices for information technology systems

LPZ 1-2 / IP20 / CE





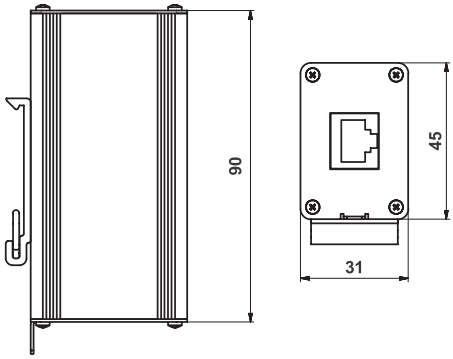
HT-SAT *X*series

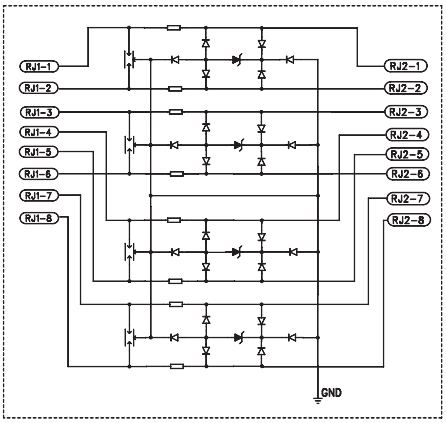
Hakel Transmition-SAT is designed to protect satellite equipment. Casing of this protector is made out of light alloy, which ensures high mechanical and thermal resistance.

Type		HT-SAT
Connector type		F
Max. continous operating voltage	U_C	72 V
Rated load current	I_N	0,5 A
D1 Max. lightning impulse current (10/350)	I_{imp}	2 kA
C2 Max. discharge current (8/20)	I_{max}	10 kA
C2 Nominal discharge current (8/20)	I_n	5 kA
Voltage protection level at 1kV/ms	U_P	500 V
Frequency range		0-2 GHz
Max. transmission power capacity		50 W
Insertion loss		< 0,5 dB
Return loss		> 20 dB
Characteristic impedance		75 W
Category tested acc. to IEC 61643:21-2000		C1, C2, C3, D1
Article number		57 004

Surge protection devices for information technology systems

LPZ 1-2 / IP20 / CE





HT-NET 5Ecat/RJ *X*series

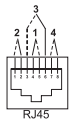
These surge protection devices intended for computer networks are specially designed for securing a faultless data transfer within computer networks category 5. They protect input electronic circuits of network cards against damage caused by surge effects in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2 according to EN 62305. It is recommended to use these protection devices at the input of protected equipment.

Type		**HT-NET 5Ecat/RJ**
Number of protected pairs		4
Connector type input/output		RJ45/RJ45
Nominal voltage	U_N	48 V
Max. continuous operating voltage	U_C	57,6 V
Rated load current	I_L	300 mA
C2 Max. discharge current (8/20)	I_{max}	2 kA
C2 Nominal discharge current (8/20)	I_n	1 kA
C3 Voltage protection level at 1kV/μs	U_P	< 80 V
Data rate		max. 250 Mbit/s
Series impedance per line		2,2 Ω
Response time	t_A	< 25 ns
Parasitic capacitance	C	< 42 pF
LPZ		1-2
Protection type		IP20
Operating temperatue range	ϑ	-40 °C ... +80 °C
Category tested acc. to IEC 61643:21-2000		C1, C2, C3, D1
Article number		57 017

Connection of RJ45 pins
acc.to EIA/TIA 568, type B

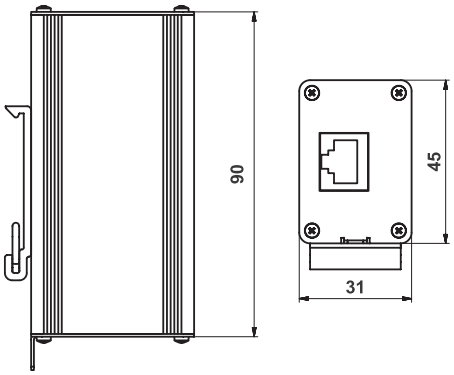
- 1 whiteorange
- 2 orange
- 3 whitegreen
- 4 blue
- 5 whiteblue
- 6 green
- 7 whitebrown
- 8 brown

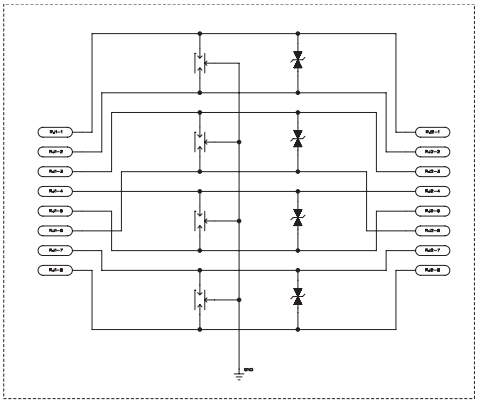
1 - blue pair
2 - orange pair
3 - green pair
4 - brown pair



Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE





HT-NET PoE+ 6cat 802.3at *X*series

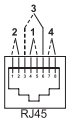
These surge protection devices intended for computer networks are specially designed for securing a faultless data transfer within computer networks category 6. They protect input electronic circuits of network cards against damage caused by surge effects in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2-3 according to EN 62305. It is recommended to use these protection devices at the input of protected equipment.

Type		HT-NET PoE+ 6cat 802.3at
Connector type		RJ45/RJ45
Max. continous operating voltage(DC)	U_C	58 V
Max. continous operating voltage(AC)	U_C	41 V
Rated load current	I_L	1 A
C2 Max. discharge current line/PE (8/20)	I_{max}	2 kV/ 1 kA
C1 Nominal discharge current line/line (8/20)	I_n	300 V/ 150 A
C3 Voltage protection level at 1kV/μs	U_P	< 120 V
Voltage protection level line/line	U_P	< 150 V (1,2/50 μs 2kV)
Voltage protection level line/PE	U_P	< 700 V (1,2/50 μs 2kV)
Max. frequency		max. 500 MHz
Protection type		IP20
Operating temperature	ϑ	-40 °C ... +70 °C
LPZ		1-2-3
Tested acc. to EN 61643-21+A1,A2		C1, C2, C3
Approvals and certifications		Cat. 6A/EA, ISO/IEC 11801
PoE		IEEE 802.3at
Article number		57 102

Connection of RJ45 pins
acc.to EIA/TIA 568, type B

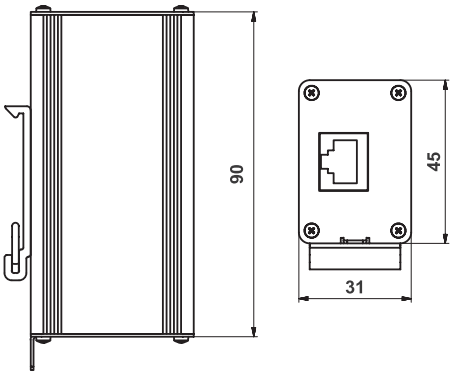
- 1 whiteorange
- 2 orange
- 3 whitegreen
- 4 blue
- 5 whiteblue
- 6 green
- 7 whitebrown
- 8 brown

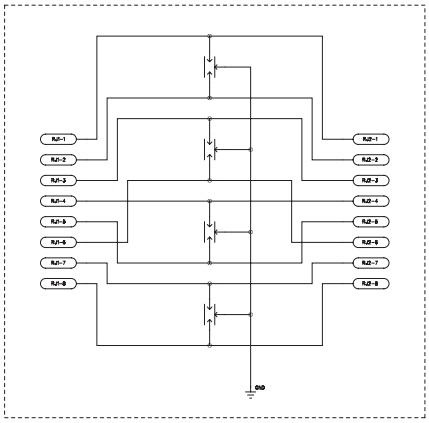
1 - blue pair
2 - orange pair
3 - green pair
4 - brown pair



Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE





HT-NET PoE+ 6cat 802.3at G *X*series

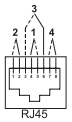
These surge protection devices intended for computer networks are specially designed for securing a faultless data transfer within computer networks category 6. They protect input electronic circuit of network cards against damage caused by surge effects in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2-3 according to EN 62305. It is recommended to use these protection devices at the input of protected equipment.

Type		HT-NET PoE+ 6cat G 802.3at
Connector type		RJ45/RJ45
Max. continous operating voltage(DC)	U_C	58 V
Max. continous operating voltage(AC)	U_C	41 V
Rated load current	I_L	1 A
C2 Max. discharge current line/PE (8/20)	I_{max}	2 kV/ 1 kA
C1 Nominal discharge current line/line (8/20)	I_n	1 kA
Voltage protection level line/line Voltage protection level line/PE	U_P U_P	< 700 V
Max. frequency		max. 500 MHz
Protection type		IP20
Operating temperature	ϑ	-40 °C ... +70 °C
LPZ		1-2-3
Tested acc. to EN 61643-21+A1,A2		C1, C2, C3
Approvals and certifications		Cat. 6A/EA, ISO/IEC 11801
PoE		IEEE 802.3at
Article number		57 103

Connection of RJ45 pins
acc.to EIA/TIA 568, type B

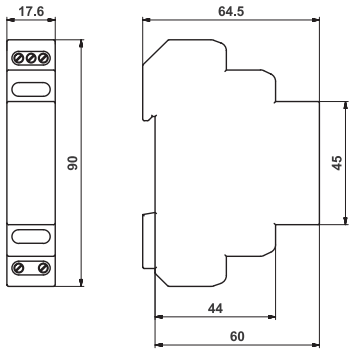
- 1 whiteorange
- 2 orange
- 3 whitegreen
- 4 blue
- 5 whiteblue
- 6 green
- 7 whitebrown
- 8 brown

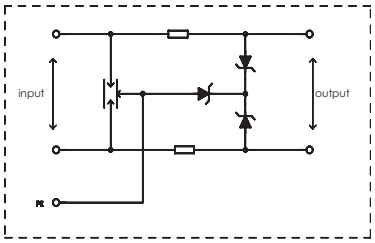
1 - blue pair
2 - orange pair
3 - green pair
4 - brown pair

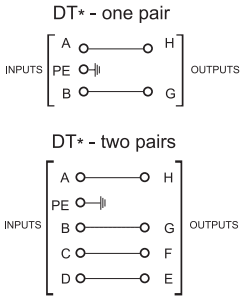


Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE







DTE */*

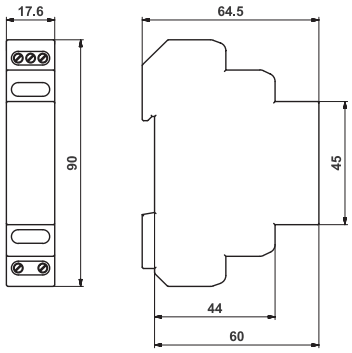
DTE is a complex range of surge protection devices designed for protection of data, communication, measuring and control lines against surge effects. These surge protection devices are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ $0_{A(B)}$ - 1 according to EN 62305. All types provide effective protection of connected equipment against common mode and differential mode surge effects according to IEC 61643-21. The rated load current of individual protected lines I_L < 0,1A.

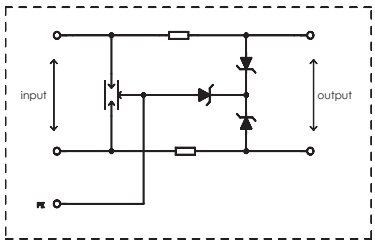
These devices consist of gas discharge tubes, series impedance and transils. The number of protected pairs is optional (1-2). These devices are produced for nominal voltage within the range of 6V-170V. Maximum discharge current is 10 kA (8/20). For the protection of telephone lines it is recommended to use a type with nominal voltage U_N=170V (with code mark "T").

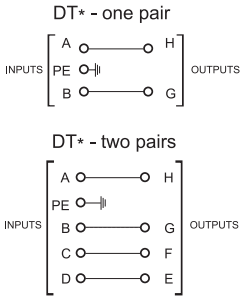
Type Number of protected pairs		1 2	**DTE 1/6** **DTE 2/6**	**DTE 1/12** **DTE 2/12**	**DTE 1/24** **DTE 2/24**	**DTE 1/48** **DTE 2/48**	**DTE 1/T** **DTE 2/T**
Nominal voltage		U_N	6 V	12 V	24 V	48 V	170 V
Max. continuous operating voltage		U_C	7,2 V	14,4 V	28,6 V	57,6 V	204 V
Rated load current		I_L			100 mA		
C2 Max. discharge current (8/20)		I_{max}			10 kA		
C2 Nominal discharge current (8/20)		I_n			1 kA		
C2 Voltage protection level at I_n		U_P	15 V	28 V	64 V	160 V	500 V
C3 Voltage protection level at 1kV/μs		U_P	9 V	18 V	34 V	66 V	290 V
Response time		t_A			< 30 ns		
Data rate					1 MBit/s		
Series impedance per line					1,5 -10 Ω		
Parasitic capacitance		C			1,5 nF		
Recommended cable cross-section					0,25 - 1,5 mm²		
Category tested acc. to IEC 61643:21-2000					C1, C2, C3, D1		
Article number	DTE 1/*		41 301	41 302	41 303	41 304	41 306
	DTE 2/*		42 301	42 302	42 303	42 304	42 306

Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE







DTNVE */*/0,5

DTNVE 0,5 is a complex range of surge protection devices designed for protection of data, communication, measuring and control lines against surge effects. These surge protection devices are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ $0_{A(B)}$ - 1 according to EN 62305. All types provide effective protection of connected equipment against common mode and differential mode surge effects according to IEC 61643-21. The rated load current of individual protected lines I_L < 0,5A.

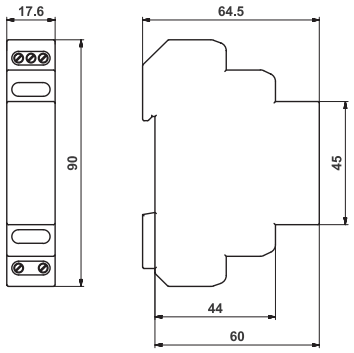
These devices consist of gas discharge tubes, series impedance and transils. The number of protected pairs is optional (1-2). These devices are produced for nominal voltage within the range of 6V-115V. Maximum discharge current is 10 kA (8/20).

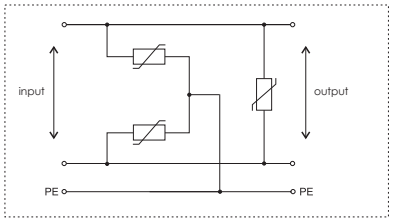
Type Number of protected pairs		1 2	**DTNVE 1/6/0,5** **DTNVE 2/6/0,5**	**DTNVE 1/12/0,5** **DTNVE 2/12/0,5**	**DTNVE 1/24/0,5** **DTNVE 2/24/0,5**	**DTNVE 1/30/0,5** **DTNVE 2/30/0,5**
Nominal voltage		U_N	6 V	12 V	24 V	30 V
Max. continuous operating voltage		U_C	7,2 V	14,4 V	28,6 V	36 V
Rated load current		I_L	0,5 A			
D1 Lightning impulse current (10/350)		I_{imp}	5 kA			
D1 Lightning impulse current (10/350) line/PE		I_{imp}	2,5 kA			
C2 Max. discharge current (8/20)		I_{max}	10 kA			
C2 Nominal discharge current (8/20)		I_n	1 kA			
C2 Voltage protection level at I_n		U_P	15 V	28 V	64 V	75 V
C3 Voltage protection level at 1kV/μs		U_P	9 V	18 V	34 V	54 V
Response time		t_A	< 30 ns			
Data rate			1 MBit/s			
Series impedance per line			4,7 μH			
Parasitic capacitance		C	1,5 nF			
Recommended cable cross-section			0,25 - 1,5 mm²			
Category tested acc. to IEC 61643:21-2000			C1, C2, C3, D1			
Article number	DTNVE 1/*/0,5		41 313	41 324	41 308	41 309
	DTNVE 2/*/0,5		42 323	42 316	42 308	42 309

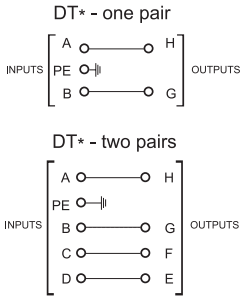
Type Number of protected pairs		1 2	**DTNVE 1/48/0,5** **DTNVE 2/48/0,5**	**DTNVE 1/80/0,5** **DTNVE 2/80/0,5**
Nominal voltage		U_N	48 V	80 V
Max. continuous operating voltage		U_C	57,6 V	96 V
Rated load current		I_L	0,5 A	
D1 Lightning impulse current (10/350)		I_{imp}	5 kA	
D1 Lightning impulse current (10/350) line/PE		I_{imp}	2,5 kA	
C2 Max. discharge current (8/20)		I_{max}	10 kA	
C2 Nominal discharge current (8/20)		I_n	1 kA	
C2 Voltage protection level at I_n		U_P	85 V	500 V
C3 Voltage protection level at 1kV/μs		U_P	66 V	120 V
Response time		t_A	< 30 ns	
Data rate			1 MBit/s	
Series impedance per line			4,7 μH	
Parasitic capacitance		C	1,5 nF	
Recommended cable cross-section			0,25 - 1,5 mm²	
Category tested acc. to IEC 61643:21-2000			C1, C2, C3, D1	
Article number	DTNVE 1/*/0,5		41 310	41 338
	DTNVE 2/*/0,5		42 311	42 322

Surge protection devices for information technology systems

LPZ 2-3 / IP20 / CE







DTNVE */*/5

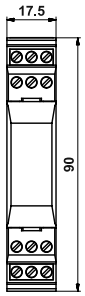
DTNVE 5 is a complex range of surge protection devices designed for protection of data, communication, measuring and control lines against surge effects. These surge protection devices are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ $0_{A(B)}$ - 1 according to EN 62305. All types provide effective protection of connected equipment against common mode and differential mode surge effects according to IEC 61643-21. The rated load current of individual protected lines I_L < 5A.

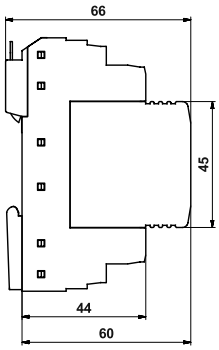
These devices consist of MOVs only. The number of protected pairs is optional (1-2). These devices are produced for nominal voltage within the range of 12V-230V. Maximum discharge current is different according to various types from 2kA (8/20) to 10 kA (8/20).

Type Number of protected pairs		1 2	**DTNVE 1/12/5** **DTNVE 2/12/5**	**DTNVE 1/24/5** **DTNVE 2/24/5**	**DTNVE 1/30/5** **DTNVE 2/30/5**	**DTNVE 1/48/5** **DTNVE 2/48/5**	**DTNVE 1/80/5** **DTNVE 2/80/5**
Nominal voltage		U_N	12 V	24 V	30 V	48 V	80 V
Max. continuous operating voltage		U_C	14,4 V	28,6 V	36 V	57,6 V	96 V
Rated load current		I_L			5 A		
C2 Max. discharge current (8/20)		I_{max}			2 kA		
C2 Nominal discharge current (8/20)		I_n			1 kA		
C2 Voltage protection level at I_n		U_P	56 V	90 V	140V	170 V	280 V
C3 Voltage protection level at 1kV/μs		U_P	27 V	51 V	100 V	118 V	200 V
Response time		t_A			< 30 ns		
Parasitic capacitance		C			10 nF		
Recommended cable cross-section					0,25 - 1,5 mm²		
Category tested acc. to IEC 61643:21-2000					C1, C2, C3, D1		
Article number	DTNVE 1/*/5		41 312	41 307	41 311	41 318	41 334
	DTNVE 2/*/5		42 317	42 307	42 312	42 321	42 328

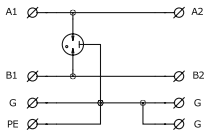
Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE

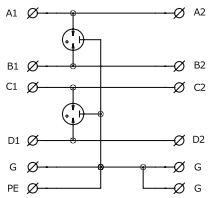




HDT1/A



HDT2/A



HDT*/A

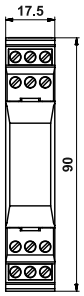
HDT*/A is a range of surge protection devices designed for the protection of data, communication, measuring and control lines against surge effects. These devices are recommended for use at the boundaries of LPZ 1-2-3 lightning protection zones according to EN 62305. All types provide effective protection of connected equipment against common mode and differential mode surge effects according to EN 61643-21. The rated load current of individual protected lines I_L = 5 A.

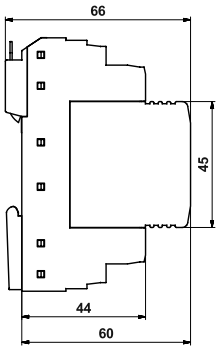
1st stage is solved by using three-pole gas discharge tubes. The number of protected pairs is optional (1-2). HDT*/A is produced for nominal operating voltage of 48 V.

Type Number of protected pairs		1 2	**HDT1/A** **HDT2/A**
Nominal voltage		U_N	48 V
Max. continuous operating voltage		U_C	57,6 V
Max. continuous operating voltage		I_L	5 A
C1 Nominal discharge current (8/20 µs)		I_n	1 kA
C1 Voltage protection level at I_n line/PE		U_P	320 V
C1 Voltage protection level at I_n line/line		U_P	240 V
C2 Nominal discharge current (8/20 µs)		I_n	15 kA
C2 Voltage protection level at I_n line/PE		U_P	450 V
C2 Voltage protection level at I_n line/line		U_P	270 V
C3 Voltage protection level at 1kV/μs		U_P	300 V
Response time		t_A	< 30 ns
D1 Max. lightning impulse current (10/350 µs)		I_{imp}	5 kA
D1 Lightning impulse current (10/350 µs) line/PE		I_{imp}	2,5 kA
Parasitic capacitance		C	1,5 nF
Recommended cable cross-section			0,25 - 1,5 mm²
Tested acc. to EN 61643-21			C1, C2, C3, D1
Article number	HDT1/A		56 000
	HDT2/A		56 001

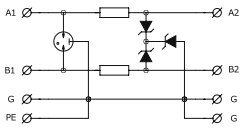
Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE

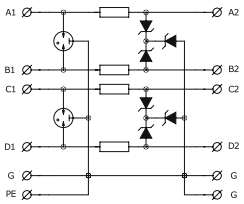




HDT1*/B



HDT2*/B



HDT*/*B

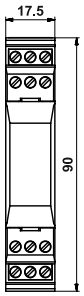
HDT*/*B is a complex range of surge protection devices designed for the protection of data, communication, measuring and control lines against surge effects. These devices are recommended for use at the boundaries of LPZ 1-2-3 lightning protection zones according to EN 62305. All types provide effective protection of connected equipment against common mode and differential mode surge effects according to EN 61643-21. The rated load current of individual protected lines I_L = 0,5 A.

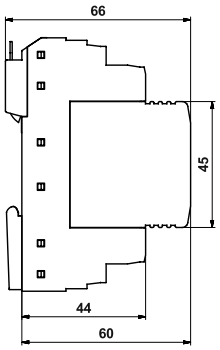
1st stage is solved by using three-pole gas discharge tubes, 2nd stage by using transils. The number of protected pairs is optional (1-2). HDT/*B is produced for nominal operating voltage within the range of 6V - 48 V.

Type Number of protected pairs		1 2	**HDT1/6B** **HDT2/6B**	**HDT1/12B** **HDT2/12B**	**HDT1/24B** **HDT2/24B**	**HDT1/48B** **HDT2/48B**
Nominal voltage		U_N	6 V	12 V	24 V	48 V
Max. continuous operating voltage		U_C	7,2 V	14,4 V	28,8 V	57,6 V
Max. continuous operating voltage		I_L	0,5 A			
C1 Nominal discharge current (8/20 µs)		I_n	1 kA			
C1 Voltage protection level at I_n line/PE		U_P	180 V	250 V	350 V	450 V
C1 Voltage protection level at I_n line/line		U_P	30 V	50 V	65 V	80 V
C2 Nominal discharge current (8/20 µs)		I_n	15 kA			
C2 Voltage protection level at I_n line/PE		U_P	350 V	450 V	550 V	600 V
C2 Voltage protection level at I_n line/line		U_P	40 V	55 V	70 V	120 V
C3 Voltage protection level at 1kV/µs line/PE		U_P	15 V	28 V	64 V	85 V
C3 Voltage protection level at 1kV/µs line/line		U_P	10 V	18 V	40 V	70 V
D1 Max. lightning impulse current (10/350 µs)		I_{imp}	5 kA			
D1 Lightning impulse current (10/350 µs) line/PE		I_{imp}	2,5 kA			
Response time		t_A	< 30 ns			
Series impedance per line			0,8 Ω			
Parasitic capacitance		C	1,5 nF			
Recommended cable cross-section			0,25 - 1,5 mm²			
Tested acc. to EN 61643-21			C1, C2, C3, D1			
Article number	HDT1/*/B		56 002	56 003	56 004	56 005
	HDT2/*/B		56 006	56 007	56 008	56 009

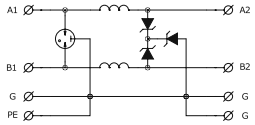
Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE

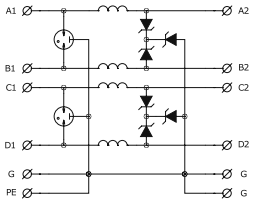




HDTNV1*/B



HDTNV2*/B



HDTNV*/*B

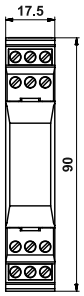
HDTNV*/*B is a complex range of surge protection devices designed for the protection of data, communication, measuring and control lines against surge effects. These devices are recommended for use at the boundaries of LPZ 1-2-3 lightning protection zones according to EN 62305. All types provide effective protection of connected equipment against common mode and differential mode surge effects according to EN 61643-21. The rated load current of individual protected lines I_L = 1,5 A.

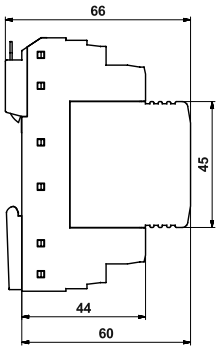
1st stage is solved by using three-pole gas discharge tubes, 2nd stage by using transils. The number of protected pairs is optional (1-2). HDTNV*/*B is produced for nominal operating voltage within the range of 6V - 48 V.

Type Number of protected pairs		1 2	**HDTNV1/6B** **HDTNV2/6B**	**HDTNV1/12B** **HDTNV2/12B**	**HDTNV1/24B** **HDTNV2/24B**	**HDTNV1/48B** **HDTNV2/48B**
Nominal voltage		U_N	6 V	12 V	24 V	48 V
Max. continuous operating voltage		U_C	7,2 V	14,4 V	28,8 V	57,6 V
Max. continuous operating voltage		I_L	1,5 A			
C1 Nominal discharge current (8/20 µs)		I_n	1 kA			
C1 Voltage protection level at I_n line/PE		U_P	180 V	250 V	350 V	450 V
C1 Voltage protection level at I_n line/line		U_P	30 V	50 V	65 V	80 V
C2 Nominal discharge current (8/20 µs)		I_n	15 kA			
C2 Voltage protection level at I_n line/PE		U_P	350 V	450 V	550 V	600 V
C2 Voltage protection level at I_n line/line		U_P	40 V	55 V	70 V	120 V
C3 Voltage protection level at 1kV/µs line/PE		U_P	15 V	28 V	64 V	85 V
C3 Voltage protection level at 1kV/µs line/line		U_P	10 V	18 V	40 V	70 V
D1 Max. lightning impulse current (10/350 µs)		I_{imp}	5 kA			
D1 Lightning impulse current (10/350 µs) line/PE		I_{imp}	2,5 kA			
Response time		t_A	< 30 ns			
Series impedance per line			2,2 µH			
Parasitic capacitance		C	1,5 nF			
Recommended cable cross-section			0,25 - 1,5 mm²			
Tested acc. to EN 61643-21			C1, C2, C3, D1			
Article number	HDTNV1/*/B		56 010	56 011	56 012	56 013
	HDTNV2/*/B		56 014	56 015	56 016	56 017

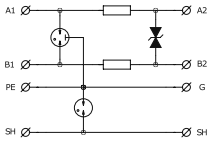
Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE

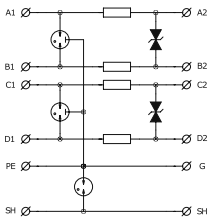




HDT1*/C



HDT2*/C



HDT*/*C

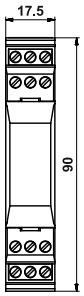
HDT*/*C is a complex range of surge protection devices designed for the protection of data, communication, measuring and control lines against surge effects. These devices are recommended for use at the boundaries of LPZ 1-2-3 lightning protection zones according to EN 62305. All types provide effective protection of connected equipment against common mode and differential mode surge effects according to EN 61643-21. The rated load current of individual protected lines I_L = 0,5 A.

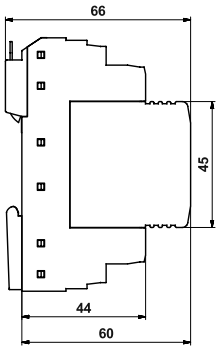
1st stage is solved by using three-pole gas discharge tubes, 2nd stage by using transils. The number of protected pairs is optional (1-2). HDT*/*C is produced for nominal operating voltage within the range of 6V - 48 V.

Type Number of protected pairs		1 2	**HDT1/6C** **HDT2/6C**	**HDT1/12C** **HDT2/12C**	**HDT1/24C** **HDT2/24C**	**HDT1/48C** **HDT2/48C**
Nominal voltage		U_N	6 V	12 V	24 V	48 V
Max. continuous operating voltage		U_C	7,2 V	14,4 V	28,8 V	57,6 V
Max. continuous operating voltage		I_L	0,5 A			
C1 Nominal discharge current (8/20 µs)		I_n	1 kA			
C1 Voltage protection level at I_n line/PE		U_P	180 V	250 V	350 V	500 V
C1 Voltage protection level at I_n line/line		U_P	30 V	50 V	65 V	90 V
C2 Nominal discharge current (8/20 µs)		I_n	15 kA			
C2 Voltage protection level at I_n line/PE		U_P	350 V	450 V	550 V	600 V
C2 Voltage protection level at I_n line/line		U_P	40 V	55 V	70 V	120 V
C3 Voltage protection level at 1kV/µs line/PE		U_P	15 V	28 V	64 V	85 V
C3 Voltage protection level at 1kV/µs line/line		U_P	10 V	18 V	40 V	70 V
D1 Max. lightning impulse current (10/350 µs)		I_{imp}	5 kA			
D1 Lightning impulse current (10/350 µs) line/PE		I_{imp}	2,5 kA			
Response time		t_A	< 30 ns			
Series impedance per line			0,8 Ω			
Parasitic capacitance		C	1,5 nF			
Recommended cable cross-section			0,25 - 1,5 mm²			
Tested acc. to EN 61643-21			C1, C2, C3, D1			
Article number	HDT1/*/C		56 018	56 019	56 020	56 021
	HDT2/*/C		56 022	56 023	56 024	56 025

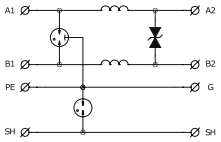
Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE

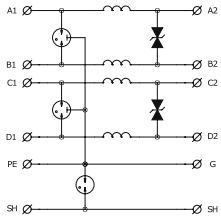




HDTNV1*/C



HDTNV2*/C



HDTNV*/*C

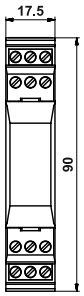
HDTNV*/*C is a complex range of surge protection devices designed for the protection of data, communication, measuring and control lines against surge effects. These devices are recommended for use at the boundaries of LPZ 1-2-3 lightning protection zones according to EN 62305. All types provide effective protection of connected equipment against common mode and differential mode surge effects according to EN 61643-21. The rated load current of individual protected lines I_L = 1,5 A.

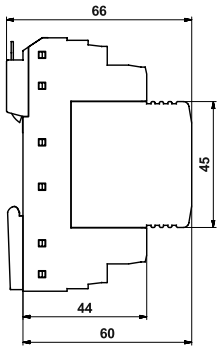
1st stage is solved by using three-pole gas discharge tubes, 2nd stage by using transils. The number of protected pairs is optional (1-2). HDTNV*/*C is produced for nominal operating voltage within the range of 6V - 48 V.

Type Number of protected pairs		1 2	**HDTNV1/6C** **HDTNV2/6C**	**HDTNV1/12C** **HDTNV2/12C**	**HDTNV1/24C** **HDTNV2/24C**	**HDTNV1/48C** **HDTNV2/48C**
Nominal voltage		U_N	6 V	12 V	24 V	48 V
Max. continuous operating voltage		U_C	7,2 V	14,4 V	28,8 V	57,6 V
Max. continuous operating voltage		I_L	1,5 A			
C1 Nominal discharge current (8/20 µs)		I_n	1 kA			
C1 Voltage protection level at I_n line/PE		U_P	180 V	250 V	350 V	500 V
C1 Voltage protection level at I_n line/line		U_P	30 V	50 V	65 V	90 V
C2 Nominal discharge current (8/20 µs)		I_n	15 kA			
C2 Voltage protection level at I_n line/PE		U_P	350 V	450 V	550 V	600 V
C2 Voltage protection level at I_n line/line		U_P	40 V	55 V	70 V	120 V
C3 Voltage protection level at 1kV/μs line/PE		U_P	15 V	28 V	64 V	85 V
C3 Voltage protection level at 1kV/μs line/line		U_P	10 V	18 V	40 V	70 V
D1 Max. lightning impulse current (10/350 µs)		I_{imp}	5 kA			
D1 Lightning impulse current (10/350 µs) line/PE		I_{imp}	2,5 kA			
Response time		t_A	< 30 ns			
Series impedance per line			2,2 µH			
Parasitic capacitance		C	1,5 nF			
Recommended cable cross-section			0,25 - 1,5 mm²			
Tested acc. to EN 61643-21			C1, C2, C3, D1			
Article number	HDTNV1/*/C		56 026	56 027	56 028	56 029
	HDTNV2/*/C		56 030	56 031	56 032	56 033

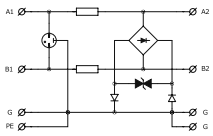
Surge protection devices for information technology systems

LPZ 1-2-3 / IP20 / CE

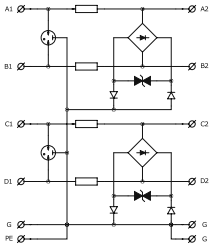




HDT1/D



HDT2/D



HDT*/D

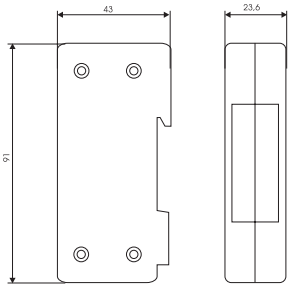
HDT*/D is a complex range of surge protection devices designed for the protection of data, communication, measuring and control lines against surge effects. These devices are recommended for use at the boundaries of LPZ 1-2-3 lightning protection zones according to EN 62305. All types provide effective protection of connected equipment against common mode and differential mode surge effects according to EN 61643-21. The rated load current of individual protected lines I_L = 0,5 A.

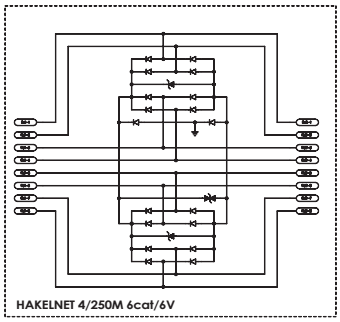
1st stage is solved by using three-pole gas discharge tubes, 2nd stage by using transils. The number of protected pairs is optional (1-2). HDT*/D is produced for nominal operating voltage within the range of 6V - 48 V.

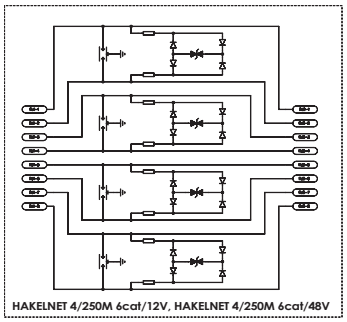
Type Number of protected pairs		1 2	**HDT1/6D** **HDT2/6D**	**HDT1/12D** **HDT2/12D**	**HDT1/24D** **HDT2/24D**	**HDT1/48D** **HDT2/48D**
Nominal voltage		U_N	6 V	12 V	24 V	48 V
Max. continuous operating voltage		U_C	7,2 V	14,4 V	28,8 V	57,6 V
Max. continuous operating voltage		I_L	0,5 A			
C1 Nominal discharge current (8/20 µs)		I_n	1 kA			
C1 Voltage protection level at I_n line/PE		U_P	180 V	250 V	350 V	500 V
C1 Voltage protection level at I_n line/line		U_P	70 V	80 V	150 V	220 V
C2 Nominal discharge current (8/20 µs)		I_n	15 kA			
C2 Voltage protection level at I_n line/PE		U_P	110 V	130 V	180 V	260 V
C2 Voltage protection level at I_n line/line		U_P	85 V	100 V	165 V	240 V
C3 Voltage protection level at 1kV/μs		U_P	45 V	50 V	50 V	70 V
D1 Max. lightning impulse current (10/350 µs)		I_{imp}	5 kA			
D1 Lightning impulse current (10/350 µs) line/PE		I_{imp}	2,5 kA			
Response time		t_A	< 30 ns			
Series impedance per line			0,8 Ω			
Parasitic capacitance		C	1,5 nF			
Recommended cable cross-section			0,25 - 1,5 mm²			
Tested acc. to EN 61643-21			C1, C2, C3, D1			
Article number	HDT1/*/D		56 034	56 035	56 036	56 037
	HDT2/*/D		56 038	56 039	56 040	56 041

Surge protection devices for information technology systems

LPZ 3 / IP20 / CE







HAKELNET 4/250M 6cat/*

Hakelnet 4/250M 6 cat is designed to protect 5E/6 data and communications lines. All protected lines are equipped with Transient Voltage Suppressor Diode which eliminates common mode and differential mode surge effects during computer networks operation.

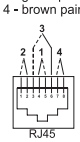
Hakelnet 4/250M 6cat consists of a plastic box and patch cords which are terminated with RJ45 connectors. Required length of patch cords (a, b) is to be specified by customer.

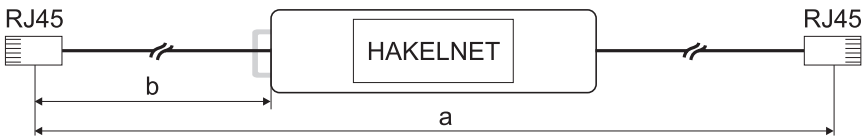
Type		**HAKELNET 4/250M 6cat**	**HAKELNET 4/250M 6cat/12V**	**HAKELNET 4/250M 6cat/24V**	**HAKELNET 4/250M 6cat/48V**
Number of protected pairs		4	4	4	4
Nominal voltage	U_N	6 V	12 V	24 V	48 V
Max. continuous operating voltage	U_C	7,2 V	14,4 V	28,8 V	57,6 V
Rated load current	I_L	200 mA			
Mode of protection		line-line, line-G(PE)			
Frequency handling line-line	f_g	250 MHz			
C2 Nominal discharge current I_n (8/20) line/line	I_n	20 A	150 A		150 A
C3 Voltage protection level line/line at 1 kV/μs (line/line)	U_p	< 15 V	< 40 V	< 90 V	< 150 V
Insertion loss for 250 MHz		< 3 dB			
Parasitic capacitance line/line	c	max. 5 pF	max. 160 pF		max. 160 pF
Mounting on		DIN rail 35 mm			
Input/output, pinning		RJ45/RJ45, 1/2, 3/6, 4/5, 7/8			
Length of patch cords					
Total length **a**		1,5 m or 3 m			
Supply length **b**		acc. to customer's specification			
Grounding method		trough DIN rail 35 mm by special metal clip on the back side of box			
Housing material		Polyamid PA6, UL94 V-0			
Colours		grey			
Category tested acc. to		EN 61643-21+A1,A2			
Approvals and certifications		cat. 6, ISO/IEC 11801			
Article number		45 034	45 038	45 040	45 037

Connection of RJ45 pins
acc.to EIA/TIA 568, type B

- 1 whiteorange
- 2 orange
- 3 whitegreen
- 4 blue
- 5 whiteblue
- 6 green
- 7 whitebrown
- 8 brown

1 - blue pair
2 - orange pair
3 - green pair
4 - brown pair

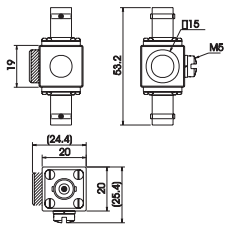




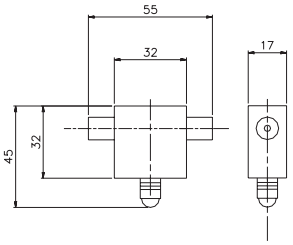
Coaxial high-frequency protection

LPZ 0_B-1 / IP20 / CE

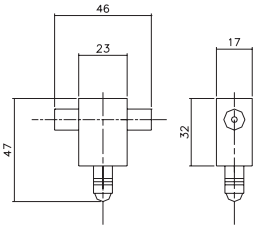
KO*G



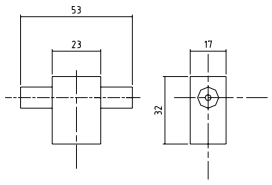
KO*P



KO-9P



KO-10P



KO* is an innovated coaxial high-frequency protection range designed for protection of equipment connected to an aerial system by means of coaxial cables. Special gas discharge tubes with maximum discharge current I_{max} (8/20) = 10 kA (or 20 kA in case of KO-5GN) ensure a reliable protection of the receiving and transmitting systems even against a lightning stroke nearby. Hakel company offers a wide range of coaxial protectors for various connector types and transmission power grades enabling usage in many applications. These coaxial protectors are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ $0_{A(B)}$ -1 and higher according to EN 62305.

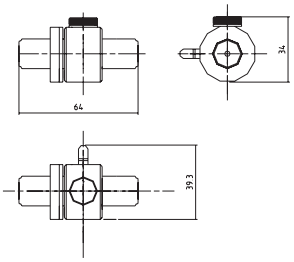
Type		KO-1G	KO-2G	KO-1P	KO-2P	KO-9P	KO-10P
Connector type		BNC				F	TV
Max. continuous operating voltage	U_C	90 V DC	200 V DC	90 V DC	200 V DC	90 V DC	90 V DC
Rated load current	I_L	2,5 A				0,5 A	
D1 Max. lightning impulse current (10/350)	I_{imp}	2 kA					
C2 Max. discharge current (8/20)	I_{max}	10 kA					
C2 Nominal discharge current I_n (8/20)	I_n	5 kA					
C3 Voltage protection level at 1kV/μs	U_P	600 V					
Frequency range		0-1 GHz				0-2,15 GHz	0-1 GHz
Max. transmission power capacity		50 W	400 W	50 W	400 W	50 W	50 W
Insertion loss		< 0,2 dB				< 0,5 dB	< 1,2 dB
Return loss		> 20 dB					
Characteristic impedance		50 Ω				75 Ω	
Category tested acc. to IEC 61643:21-2000		C1, C2, C3, D1					
Article number		55 001	55 002	55 007	55 015	55 016	55 017

Note: can be produced in different U_c voltages

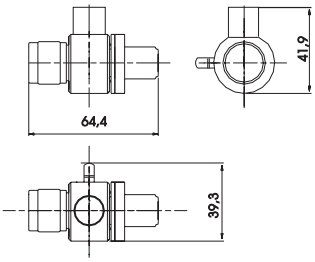
Coaxial high-frequency protection

LPZ 0_B-1 / IP65 / IP20 / IP65 / CE

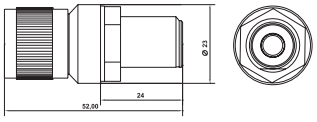
KO*GN



KO-5GN



KO-6GN



KO* is an innovated coaxial high-frequency protection range designed for protection of equipment connected to an aerial system by means of coaxial cables. Special gas discharge tubes with maximum discharge current I_{max} (8/20) = 10 kA (or 20 kA in case of KO-5GN) ensure a reliable protection of the receiving and transmitting systems even against a lightning stroke nearby. Hakel company offers a wide range of coaxial protectors for various connector types and transmission power grades enabling usage in many applications. These coaxial protectors are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ $0_{A(B)}$ -1 and higher according to EN 62305.

Type		KO-3GN (F/F)	KO-3GN (F/M)	KO-4GN (F/F)	KO-4GN (F/M)	KO-5GN (F/F)	KO-5GN (F/M)	KO-6GN (F/M)
Connector type					N			
Max. continuous operating voltage	U_C	90 V DC		350 V DC		-	-	135 V DC
Rated load current	I_L	5 A				-	-	5 A
D1 Max. lightning impulse current (10/350)	I_{imp}	2 kA				5 kA		1 kA
C2 Max. discharge current (8/20)	I_{max}	10 kA				20 kA		10 kA
C2 Nominal discharge current I_n (8/20)	I_n	5 kA				10 kA		5 kA
C3 Voltage protection level at 1kV/μs	U_P	200 V		850 V		< 2 V		< 500 V
Frequency range		0-3 GHz				5-5,4 GHz		0-5,8 GHz
Max. transmission power capacity		50 W		400 W		200 W		50 W
Insertion loss		< 0,65 dB				< 0,2 dB		
Return loss		> 20 dB						
Characteristic impedance		50 Ω						
Category tested acc. to IEC 61643:21-2000		C1, C2, C3, D1						
Article number		55 018	55 019	55 020	55 021	55 024	55 025	55 026

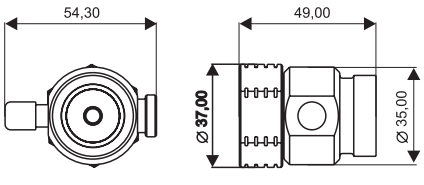
Note: can be produced in different U_c voltages

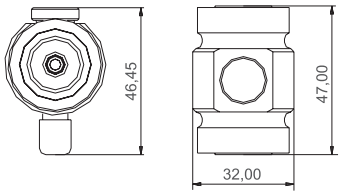
Coaxial high-frequency protection

LPZ 0_B-1 / IP62 / CE

KO-7/16 FM

KO-7/16 FF





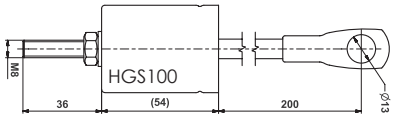
KO-7/16 is an innovated coaxial high-frequency protection range designed for protection of equipment connected to an aerial system by means of coaxial cables. Special gas discharge tubes with maximum discharge current I_{max} (8/20) = 10 kA (or 20 kA in case of KO-7/16-R) ensure a reliable protection of the receiving and transmitting systems even against a lightning stroke nearby. This range is produced with 7/16" connector type for various transmission power grades enabling usage in many applications. They are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ $0_{A(B)}$ -1 and higher according to EN 62305.

Type		KO-7/16 (F/M)	KO-7/16 (F/F)
Connector type			
Max. continuous operating voltage	U_C	350 V DC	350 V DC
Rated load current	I_L	5 A	
D1 Max. lightning impulse current (10/350)	I_{imp}	2 kA	
C2 Max. discharge current (8/20)	I_{max}	10 kA	
C2 Nominal discharge current I_n (8/20)	I_n	5 kA	
C3 Voltage protection level at 1kV/μs	U_P	850 V	
Frequency range		0-2,6 GHz	
Max. transmission power capacity		400 W	
Insertion loss		< 0,5 dB	
Return loss		> 15 dB	
Characteristic impedance		50 Ω	
Category tested acc. to IEC 61643:21-2000		C1, C2, C3, D1	
Weight		175 g	165 g
Article number		55 033	55 032

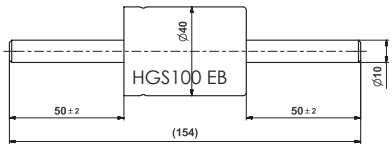
Note: can be produced in different U_c voltages

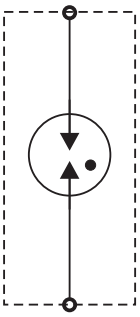
Equipotential bonding of conducting parts of the electrical installation

High power gas discharge tube / LPZ 0_B-1 / IP66 / CE



The length of the flexible connecting cable is 200 mm and it is ended with a loop GPH12 of cross section 13 mm





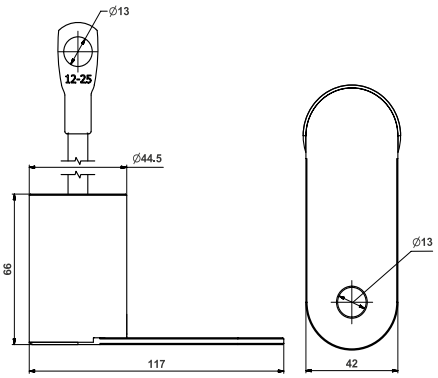
HGS100
HGS100 EB

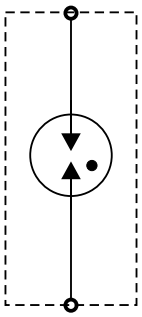
HGS100 and HGS100 EB are a separating high power gas discharge tubes intended for equipotential bonding of an installation parts of buildings, which are not interconnected. In case of origin of p.d. (potential diference) between those parts, the high power gas discharge tube ignites and interconnects both parts for a transient time (typical value of internal resistance at startup of HGS100 is 0,001 ÷ 0,002 Ω). Recommended installation is inside of the buildings, outdoors, in the damp rooms as well as in the subterraneous areas. For lightning protection equipotential bonding in accordance with IEC 61024-1 and EN 62561-3.

Type		HGS100	HGS100 EB
Class to EN 62561-3		H (for high loading)	
DC-Sparkover voltage		400 ÷ 750 V DC	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Nominal discharge current (8/20 µs)	I_n	75 kA	
Rated over power frequency withstand voltage	$U_{W\ AC}$	285 V	
Rated DC withstand voltage	$U_{W\ DC}$	350 V	
Rated impulse sparkover voltage	$U_{r\ imp}$	< 1400 V	
Max. lightning impulse current (10/350 µs)	I_{imp}	100 kA	
- charge	Q	50 As	
- specific energy	W/R	2500 kJ/Ω	
Voltage protection level at I_{imp}	U_p	< 1 kV	
Capacitance at 1 MHz	C	25 pF	
Casing		corundum/binary resin with an external steel coat, resistant to climatic effects	
Protection type		IP66	
Operating temperature range	ϑ	-40 °C ... +90 °C	
Lifetime		min. 100 000 h	
Weight	m	320 g	
Article number		10 005	10 009

Equipotential bonding of conducting parts of the electrical installation

High power gas discharge tube / LPZ 0_B-1 / IP67 / CE





HGS100 Ex

HGS100 Ex - Separating high power gas discharge tube HGS100 Ex for use in explosion hazards areas. It is intended for equipotential bonding of the installation parts of buildings or technological entities which are not interconnected operationaly. In case of p.d. (potential difference) origin between those parts, the high power gas discharge tube ignites and interconnects both parts for a transient time (typical value of internal resistance at startup of HGS100 Ex is 0,001÷ 0,002 Ω). Recommended installation is inside of the buildings, outdoors, in the damp rooms as well as in the subterraneous areas.
It is an explosion-proof gas discharge tube with flexible connecting cable for equipotential bonding acc. to IEC 62305-1:2010 and also for the use in IT installations acc. to IEC 60364-5-54:2011. It complies with IEC 60079-0:2011, IEC 60079-18:2014 and IEC 60079-31:2013 standards. It is recommended for insulated flanges and insulated screw joints bridging in cathodic protected parts of industrial technology.

Type		**HGS100 Ex IP 67**
EC-Type examination certificate		II 2G Ex mb IIC T6 Gb, II 2D Ex mb IIIC T80 °C Db
Approvals, certification		FTZU 04 ATEX 0255X
DC-Sparkover voltage		400 ÷ 750 V DC
Max. discharge current (8/20)	I_{max}	100 kA
Nominal discharge current (8/20)	I_n	75 kA
Max. lightning impulse current (10/350)	I_{imp}	100 kA
- charge	Q	50 As
- specific energy	W/R	2500 kJ/Ω
Voltage protection level at I_{imp}	U_P	< 1 kV
Insulation resistance at 100 V DC	R_i	< 1 GΩ
Capacitance at 1 MHz	C	25 pF
Casing		corundum/binary resin with an external steel coat, resistant to climatic effects
Protection type		IP67
Ambient temperature range for T Class T6	ϑ	-20 °C ... +30 °C
Ambient temperature range for T Class T5		-20 °C ... +45 °C
Ambient temperature range for T Class T1-T4		-20 °C ... +80 °C
Lifetime		min. 100 000 h
Weight	m	550 g
Article number		10 201

Note: temperature class T6 is superior to all lower classes

Equipotential bonding of conducting parts of the electrical installation

II 2G Ex mb IIC T6 Gb

Equipment Group II
Electrical equipment of Group II is intended for use in locations with an explosive gaseous atmosphere other than underground mines with occurrence of methane (surface)

Equipment category 2G
Area use - zone 1, 2 according to EN 60079-10-1 (IEC 60079-10-1:2015)

Ex – Designation of equipment in potentially explosive areas

Type of protection m
potting with sealing compound
mb (for EPL protection level "Mb, Gb, Db")

Gas Explosion Group IIC
Equipment labeled with IIC is suitable for use where Group IIA or Group IIB equipment is required

Temperature class T6 (maximum surface temperature)
T6 - 85 °C (carbon bisulphide, ethylnitrite and other gases with higher ignition temperature)

EPL protection level (what is the probability that a device will become a gas initiator)
Gb – equipment for explosive gaseous atmospheres that has a „high" level of protection and it is not a source of ignition in normal operation or at expected failures

II 2D Ex mb IIIC T80 °C Db

Equipment Group II
equipment for potentially explosive atmospheres other than underground mines with occurrence of gas (methane) and / or combustible dust

Equipment category 2D
Area use - zone 21, 22 according to EN 60079-10-1 (IEC 60079-10-1:2015)

Ex – Designation of equipment in potentially explosive areas

Type of protection m
potting with sealing compound
mb (for EPL protection level "Mb, Gb, Db")

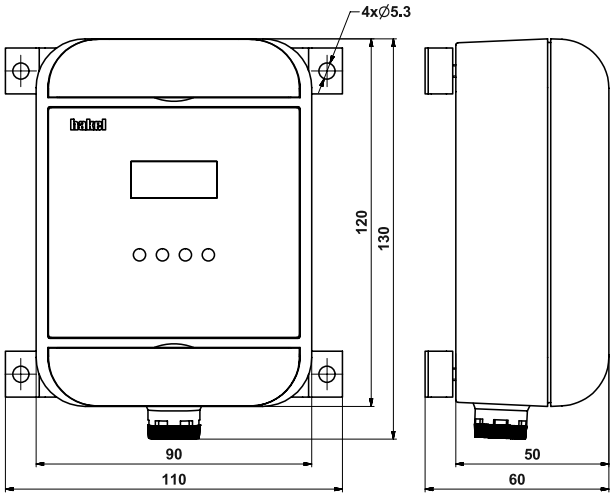
Dust explosion group IIIC (categorized according to the characteristics of the dust explosive atmosphere)
IIIC conductive dusts

Maximum surface temperature T80 °C (the highest temperature that occurs when operating in the most adverse conditions (but within confirmed tolerances) on any part of the electrical equipment surface

Protection level EPL Db
Db – equipment for dust explosive atmospheres, which has a „high" level of protection and it is not a source of ignition in normal operation or at expected faults

Measuring equipment

Digital lightning strike counter / CE



PBI-7

PBI-7 is a digital counter of current pulses, which are caused by lightning strikes to the object's air-termination network. The counter is mounted directly on the lightning down conductor. The PBI-7 is equipped with a display and four control buttons.

By connecting the counter to the down lead of the air-termination network it is possible to get a detailed overview of the number of discharges and their time. Each recorded pulse is provided with a timestamp, by which it can be clearly identified, when the discharge has occurred with an accuracy of seconds.

The PBI-7 is powered by an independent battery pack for easy installation and replacement. The average battery lifetime is 5 years. The advantage of the counter is the battery control system, when the user is continuously informed of the remaining battery capacity. PBI-7 displays the battery cell status value as a figure in the range of 0 to 100 %.

PBI-7 is in compliance with IEC 62561-6: 2018 standard (Requirements for lightning strikes counter LSC).

Type		**PBI-7**
Type according to IEC 62561-6:2018		Type I + Type II
Product placement		External
Mounting		Round ⌀ 8 mm or flat 30 x 4 mm down conductor
Minimum recordable current	$I_{imp\ min}$	1 kA (10/350)
Minimum recordable current	$I_{n\ min}$	1 kA (8/20)
Maximum recordable current	$I_{imp\ max} = I_{imp}$	100 kA (10/350)
Maximum recordable current	$I_{n\ max} = I_n$	100 kA (8/20)
Number of recorded discharges		0 - 999
Battery type		2 x CR123A or 2 x CR17335SE
Average battery lifetime		5 years
Dimension		110 x 130 x 60 mm
Weight	m	405 g (+ approx. 30 g battery)
Operating temperature	ϑ	-20 °C ... +60 °C
Storage temperature		-40 °C ... +80 °C
Protection type		IP65
Article number		70 047

Note: A reduction kit is required for mounting on a 30 x 4 mm grounding strap. This kit is available under the HAKEL article number 70 047/BS.
Note: Batteries excluded

Measuring equipment

Measuring instrument GIGATESTpro-SPD / CE

GIGATESTpro-SPD

Usage, characteristics:
- measuring of insulation resistance with voltage 50 V ÷ 1000 V
- measuring of surge protection devices
- extended database of surge protection devices which is saved in the instrument's memory enables easy and fast data evaluation of measuring
- measuring of AC and DC voltage
- new storage system of the test tips in the transport position is patent-protected
- high contrast bright multicolour graphic OLED display ensures excellent legibility
- possibility to illuminate the measured object by a bright white LED light
- possibility to charge the battery right in the instrument

Scope of delivery: measuring instrument, twisted test lead with measuring tip, pouch, calibration certificate, warranty document, user's manual, cardboard shipping case.

Insulation resistance	
Measurement range	0,100 MΩ ÷ 1,999 GΩ (U = 50 V ÷ 99 V)
Nominal measurement range	0,100 MΩ ÷ 3,999 GΩ (U = 100 V ÷ 249 V)
	0,100 MΩ ÷ 9,999 GΩ (U = 250 V ÷ 1000 V)
Resolution range	0,001 MΩ / 0,01 MΩ / 0,1 MΩ / 0,001 GΩ
Basic measurement error	± (2% of MV + 10 D)* (R < 1 GΩ)
	± (4% of MV + 15 D)* (R ≥ 1 GΩ)
Operating measurement error	± (3% of MV + 20 D)* (R < 1 GΩ) ± (5% of MV + 25 D)* (R ≥ 1 GΩ)
Nominal measurement current	≥ 1 mA
Short-circuit current	< 3 mA
Automatic discharge of the measured object	yes

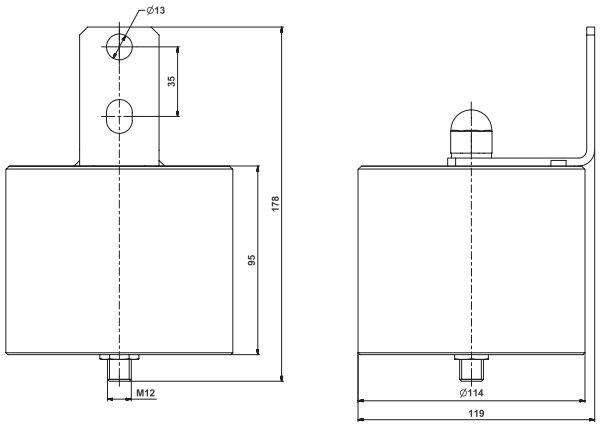
Surge protection devices	
Measurement range	40 V ÷ 1050 V
Resolution range	1 V
Basic measurement error	± (2% of MV + 2 D)*
Operating measurement error	± (3% of MV + 3 D)*
Principle of measuring the varistor	increase of the voltage with measurement of the so-called mA (milliamper) point
Principle of measuring the gas discharge tube	increase of the voltage with the assessment of the maximum

DC and AC voltage (actual effective value TRMS)	
Measurement range	0 V ÷ 600 V DC/AC (45 Hz ÷ 65 Hz)
Resolution range	1 V
Basic measurement error	± (2% of MV + 2 D)*
Operating measurement error	± (3% of MV + 3 D)*

Generally	
Power supply	4 pcs of AAA (LR03) alkaline battery 1,5 V or NiMH battery 1,2 V
Display	OLED, multicolour, graphic
Protection level	II (double insulation)
Surge protection category	CAT III / 300 V or CAT II / 600 V
Pollution level	2
Protection type	IP43
Dimensions	approx. 260 x 70 x 40 mm
Weight (including batteries and measuring tip)	approx. 0,36 kg
* MV means measuring value, D means digit	
Article number	70 002

Optional accessories for GIGATESTpro: charger, battery set 4xAAA 800 mAh, 2 m measuring conductor, measuring tip, crocodile clip

Voltage limiting device – VLD



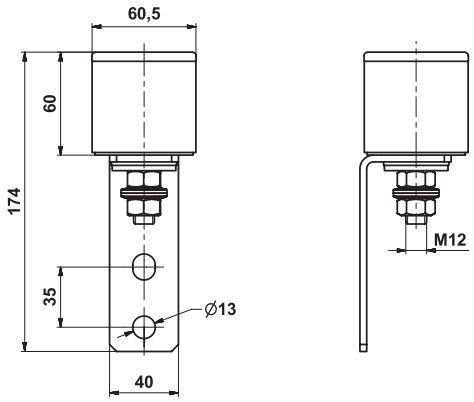
HL120

HL120* is a voltage limiting device (VLD acc. to EN 50122-1:2011) intended for the protection of non-live parts of metal structures in AC or DC traction systems. It is used for the effective protection of people who might come into contact with these parts during a lightning stroke or in the case a fault of traction lines. HL is installed directly on the protected construction structure (using two M12 bolts) so that if it is activated it creates a conductive connection between this structure and the tracks. The principle of the HL construction is based on the parallel connection of three non-linear elements (1 high power metal oxide varistor MOV plus 2 high-performance thyristors) built into a stainless steel cover. If the HL is activated by lightning current or current from the contact of the protected metal structure with for example a fallen trolley line, this current is instantly shorted to the track by the fast reaction of the MOV (the standardly given time of its reaction is 25 nsec). The maximum value of this current's amplitude may be 40 kA (10/350). For the duration of activation of the MOV a voltage protection level about 500 V is formed on it. So that the heat released in the MOV does not damage its structure, a delay element is built into the HL hardware which for approximately 1msec ignites both the built-in high performance thyristors, and this moment is derived from the VPL on the varistor. According to the polarity of voltage on the MOV, the relevant thyristor from the built-in pair is activated and it takes up current which to that time have been conducted by the activated MOV. Depending on the immediate current value of the passing current, the voltage level on this thyristor can be in the range 1÷3 V. If the arising activation current is significantly lower than the maximum working current of the used thyristor, this process can last up to tens of seconds (for the HL120 this process is characterised by the typical value 105 A/60 min... reversibly), which corresponds to the charge passing through of 378 000 Asec. A large power loss is on the thyristor for the time of its activation, and so the construction of the HL sleeve is based on the principle of conducting the released heat to its metal outer casing and then via this casing to the construction building structure. One important requirement of the HL is the assumption of the creation of an internal short circuit in the case of the voltage, current or heat overloading of the built-in MOV, which is met in the case of the HL internal construction described above.

Advantages - vandal resistant, weather proof, long lifetime

Type	**HL120**
Class to EN 50526-2	2.2
Maximum withstand voltage U_w	60 VAC
Maximum spark voltage U_s	120 VDC
Nominal short-term withstand current	4,7 kA / 0,023 sec (repeatable)
	20 kA / 0,1 sec (unrepeatable)
Reversible current I_{rev}	105 A / 60 min
Technical data of built-in metal-oxide varistors acc. to EN 61643-11:2012 and EN 60099-4:2014	
Nominal discharge current I_n	40 kA (8/20 µs)
Lightning impulse current I_{imp}	40 kA (10/350 µs)
Maximum operational voltage U_c	115 VAC
Varistor voltage U_v@ 1mA	180 VDC
Voltage protection level U_p at nominal discharge current I_n	500 V
Operating conditions:	
Temperature	-40 °C ... +55 °C
Tightening torque	16 Nm
Height above sea level	without restriction
Protection type	IP67
Weight / Dimensions	c. 4,65 kg / Ø 114 mm, l = 95 mm
Article number	10 240

Low voltage limiter for railway application



HGS100 RW

It is range of voltage limiters designed for overvoltage protection of personnel and equipment in DC and AC rail traction systems. It is recommended to install this limiter between the current return path and non-electrified parts of structures laying adjacent to the rails. Internal construction of HGS is based at application of high power gas-filled gas discharge tube (GDT), which is built in to stainless steel box. In case of overvoltage, HGS100 RW generates a durable conductive path between the overloaded area and the railway's substation. This results in increased current loads that are sensed at the substation, tripping the safety switch and thus protecting personnel and equipment. In addition, all overvoltages generated by lightning are effectively limited by Hakel's internal construction of HGS100 RW. All requirements given by EN 50122-1 and EN 61643-11 relating to electrical safety earthing for this specific use are also fulfiled.

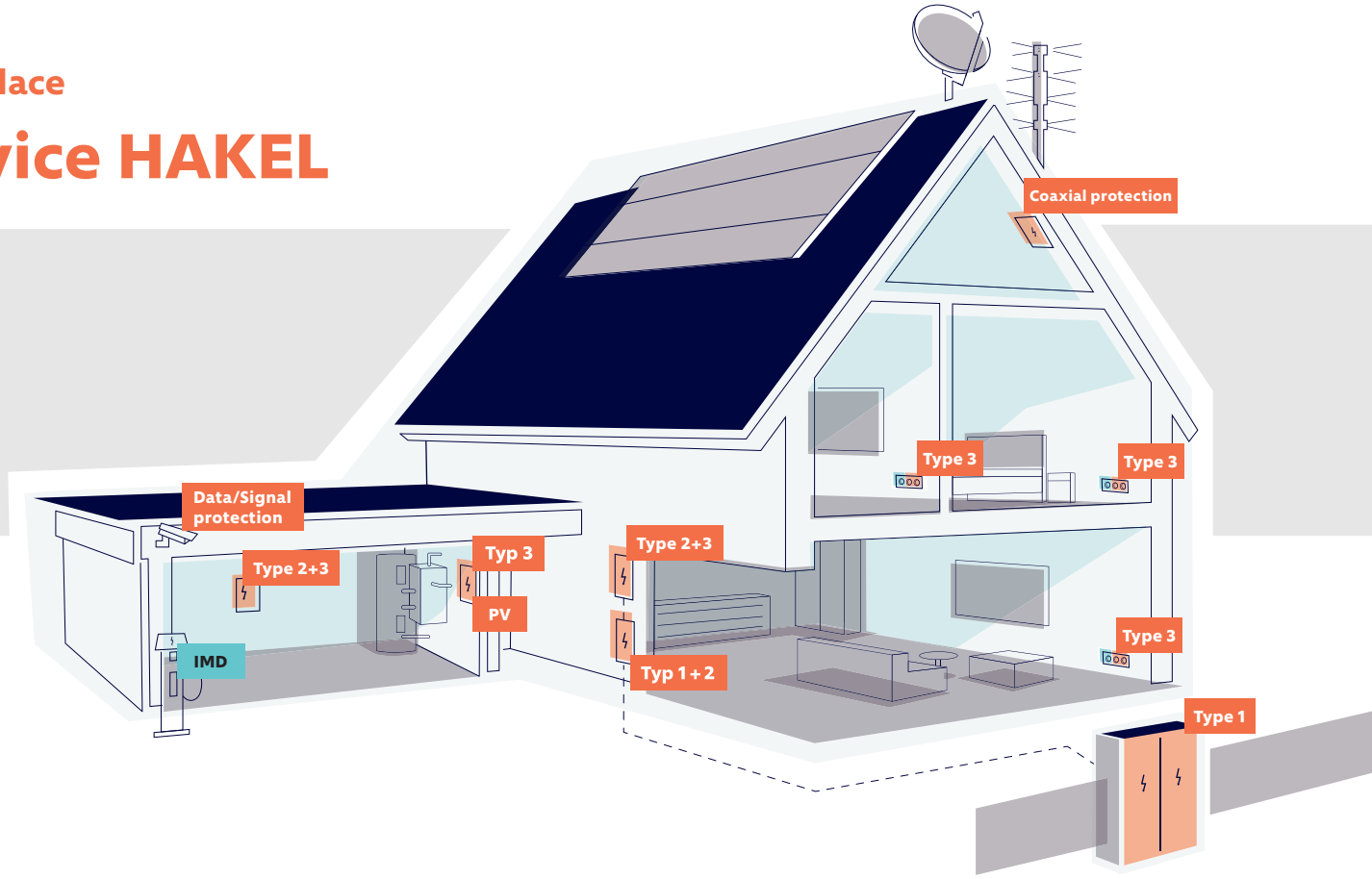
Type	**HGS100 RW**
Examinations according to	EN 61643-11, EN 50122-1
DC Spark-Over Voltage [1]	300 ÷ 500 V
AC Spark-Over Voltage	> 250 V_{rms}
Impulse Spark-Over Voltage at 5 kV/µs - for 99% of measured values (wave 1,2/50 µs, 6 kV)	< 1200 V
Max. Impulse Discharge Current I_{max} (8/20 µs)	200 kA
Nominal Impulse Discharge Current I_n (8/20 µs)	100 kA
Max. Lightning Impulse Current I_{imp} (10/350 µs)	150 kA
Charge	75 As
Specific Energy	5500 kJ/Ω
Rated withstand current	up to 8 kA_{rms} / 100 msec (AC - mode)
	up to 20 kA / 30 msec (DC - mode)
Behaviour after substantial overloading	internal short circuit inside HGS body
Insulation Resistance at 100 VDC	> 1 GΩ
Capacitance at 1 MHz	< 35 pF
Housing	IP66
Operating and Storage Temperature	- 40 °C ... +90 °C
Weight	950 g
Climatic Category (IEC 60068-1)	40/90/21
Article number	10 002

[1] In ionised mode

Terms in accordance with ITU-T Rec. K-12, DIN 57845/VDE 0845 and EN 61643-11:2002

Together we make the world a safer place

Surge protection device HAKEL



IMD – insulation monitoring devices

Insulation monitoring devices

IMD

HIG AC/DC (HIG99)

SPD – surge protection devices

Lightning arresters

Type 1

HLA50-255

Lightning and surge arresters

Type 1+2

HLSA25G-255/4+0

Type 1+2

HLSA12,5-275/4+0 M

Surge arresters

Type 2+3

HSA-275/4+0 M

Surge arresters with HF filter

Type 3

HSAF16 S

Surge arresters

Type 3

HSAA-1P

Photovoltaic systems

PV

PIIIM PV 600

SPD for information technology systems

Data/Signal protection

HDT

Coaxial high--frequency protection

Coaxial protection

KO-4GN

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