Kumwell



2024

Surge Protective Device

Product Catalog

SPD01/2024

Vision & Mission

A lightning strike or lightning bolt is a natural disaster that can cause enormous damage to our lives, properties, buildings, and various operating systems. As our world today is a modern society in adopting and integrating information and communication technologies at home, we need stability and high security to the electronics system which can prevent lightning strikes and electromagnetic waves that pose a threat to the operating system.

Vision

Leader in Total Solution in Lightning Protection System and Safety Innovation with the Strongest Global Brand and Sustainable Growth.

Mission

- **Create value of products and services to ensure customer satisfaction.**
- **Research and develop innovation to meet the market demand.**
- **Create soft power engagement by using sustainable goals with stakeholders under the Safety to Society – CSV (Creating Shared Value) project.**
- **Develop a management system toward high-performance organization.**
- **Support human assets by creating learning culture for lifelong learning.**

Kumwell Corporation Public Company Limited operates as a manufacturer and distributor of Grounding systems such as ground rod, exothermic welding, more effective grounding (MEG), concrete inspection pit, etc. Lightning system such as air terminal, clamp connections, etc. Surge protection system, Lightning detection and warning system, and safety innovation. We have reached the national and international standards to serve security for people's lives, assets and operating systems in all sectors, especially in the electricity sector (generating system, transmission system, distribution system, solar power plant wind power plants, etc.), the transportation sector (high-speed trains, electric trains, subways, airports, ports, expressways, expressways, etc.), the telecommunication sector (radio stations, television stations, mobile phone transmission station, data center, etc.) industrial sector (Petrochemical plant oil refinery steel mills, automobiles, electronics, farms, etc.), office, residential sectors including the security sector (arsenals, radar stations, etc.) We are proud to introduce our innovations to reduce the risk of electromagnetic and lightning damage under the name "Kumwell" guarantee from 40 countries around the world exportation and distribution.

Quality Assurance

Our company is concerned for every step starting with the design (Pattern and production process), the right material, mechanical strength and lightning resistance test as well as being resistant to weather conditions. We take into consideration the safety of people when installing and using our product

We are committed to providing high-quality products which is an important element to the efficient and effective system work. There are product policies that have to be tested and certified according to international standards UL, IEEE, IEC and Thai Industrial Standards (TIS), especially products in lightning protection systems; it must comply with the international standard IEC 62561, which can be divided into 8 sections according to the type of products.

1. Requirements for connection components
2. Requirements for conductors and earth electrodes
3. Requirements for isolating spark gaps (ISG)
4. Requirements for conductor fasteners
5. Requirements for earth electrode inspection housings and earth electrode seals
6. Requirements for lightning strike counters (LSC)
7. Requirements for earthing enhancing compounds
8. Requirements for components for isolated LPS



ISO/IEC 17025-2017
(Certificate Laboratory Accreditation)



Kumwell Test Report
(IEC 62561)



DEKRA Test Certificate
(IEC 62561)



VDE Test Certificate
(IEC 61643)



UL Test Certificate
(UL 467, UL 486)



UL Inspection Type R Service Report
(For UL Listed)

To comply with the standards in order to deliver quality products, the company therefore constructed a testing laboratory (Kumwell Laboratory), as a testing room for grounding equipment, lightning protection device, surge protection device and lightning alarm devices which was completed in 2013. Our laboratory is the one and only in Southeast Asia and has been accredited for the competence of the testing laboratory according to TIS 17025 - 2561 (ISO/IEC 17025: 2017) for the general requirements in the competence of testing and calibration laboratories in the electrical field, which is recognized by the ILAC organization (International Laboratory Accreditation Cooperation) in equivalent academic ability and able to perform tests by issuing a product test certificate (Test Report) to certify that Kumwell only provide high quality products.

Quality Assurance

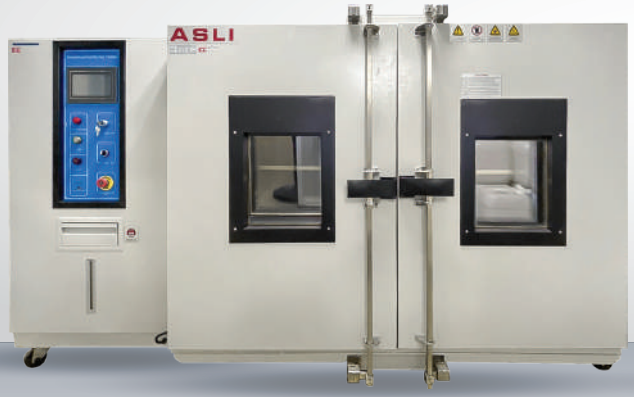
Kumwell Laboratory can perform tests according to IEC 62561 and TIS 3024 standards such as Tensile Test, Electrical Resistivity Test, Load Test, Bending Test, Lightning Impulse Current / Surge Current, Environmental Test. Moreover, it is able to test equipment according to various standards such as UL. 467: Grounding and Bonding Equipment, IEC 61643: Low-Voltages Surge Protective Device (SPD).



High Lightning Impulse Current Generator
10/350 µs & 8/20 µs



High Lightning Impulse Current
Combine Generator 8/20 µs



TEMPERATURE (HUMIDITY) Test Chamber



SULFUR DIOXIDE Test Chamber



SALT SPRAY Test Chamber

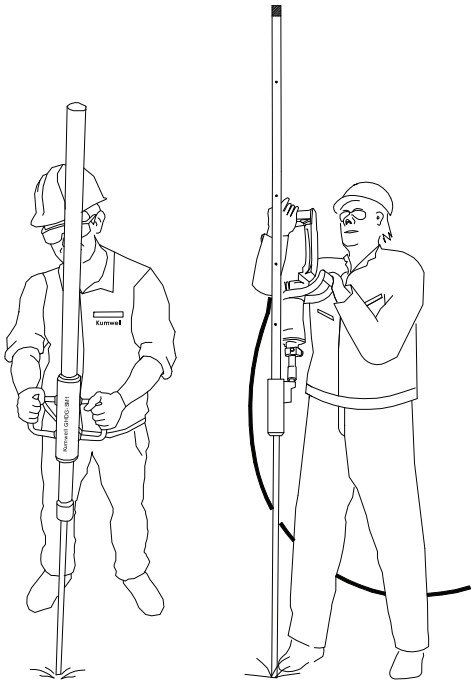
- High lightning impulse current generator for Grounding system component & Lightning protection system components (LPSC) according to IEC 62561.
- Surge impulse current generator for Surge protect ive device (SPD) according to IEC 61643.
- Environment test chamber (Temperature / Humidity / Sulphur dioxide / Salt spray) for Grounding system component & LPSC according to IEC 62561.
- Universal mechanical testing machine (Tensile / Compressive) for Grounding system component & LPSC according to IEC 62561.

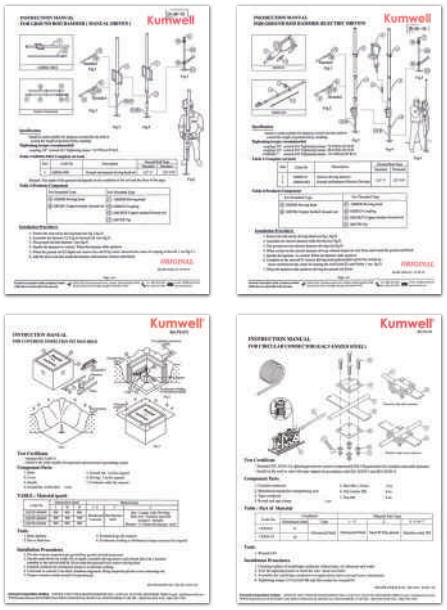
Quality Assurance

In addition, we intend to deliver high-quality system work that is user-friendly and worth the investment besides we create a system that is efficient and completely safe.

• TOOLS & INSTRUCTION: Develop products and installation tools that are easy to install such as ground rod driving hammer, conductor strengthener machines, 4P concrete inspection pits, etc.



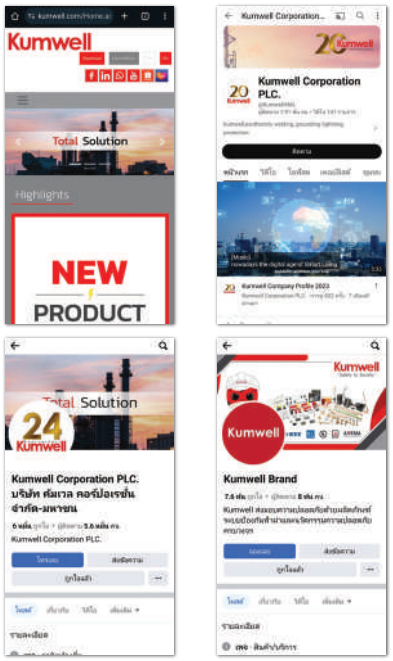




• INSTALL & DESIGN GUIDE: Provide manuals and installation guides through various channels such as seminars to deliver knowledge; the Kumwell Metaverse Academy, Youtube Channel: Kumwell Official, on Facebook Page: Kumwell Official and Kumwell Brand, etc.







Research & Development

Kumwell Corporation Public Limited Company invests in a Lightning Research Center to research and develop products of lightning protection and grounding systems including lightning detection and data processing systems. The Target of the center is to deliver quality products certified for both Thai and international standard and pay attention to the safety of users Leads to truly efficient and effective system work.

According to the risks to the safety of people and property that may be affected by electromagnetic fields and various interference waves, the investment in creating an Electromagnetic Compatibility Excellent Center (EMC Excellent Center) is done for research and academic cooperation with various agencies both within the country and abroad in order to expand the knowledge towards creating safety innovations for the social sector.

Kumwell
Lightning
Research Center

Lightning Research Center (LRC)

Vision

1. To be a lightning research center that has the potential to strive for sustainable excellence.
2. Become the center of a research network for exchanging knowledge on lightning systems both domestically and abroad.
3. Create innovations regarding lightning protection and lightning warning.

Kumwell
EMC
Excellent Center

Electromagnetic Compatibility Excellent Center (EMCEC)

Vision

1. To be an excellent center focusing on EMC activities.
2. To drive innovation with high speed based on EMC standards and related certifications.
3. To be a EMC networking and provide EMC solutionsand service to all sectors

Innovation

Kumwell committed to research and development of products and innovations continuously and also creating collaborations with networks, partners and customers leading to the trial use and proven Technology.

Smart Lightning Management System (SLMS)



It is a smart innovation that can monitor the overall working status of the lightning protection system, the grounding system and the surge protection system. It can provide instant warning of threats from lightning and various electromagnetic fields to ensure the safety in life, working areas and public areas and to reduce damage.

The information will be report via Web User Interface (Client) and will be sent to the controller or central control system so it can be analyzed, examined, evaluated in order to formulate proactive maintenance measures and methods for the lightning protection system to be in perfect condition and ready to use at all times which have already been sold and installed for actual use, such as

- PTT Stadium
- PTT gas control station
- Srinagarind Dam (Characteristics of Dam & Power Plant)
- Joint research project with Electricity Generating Authority of Thailand Ubol Ratana Dam, Khon Kaen Province







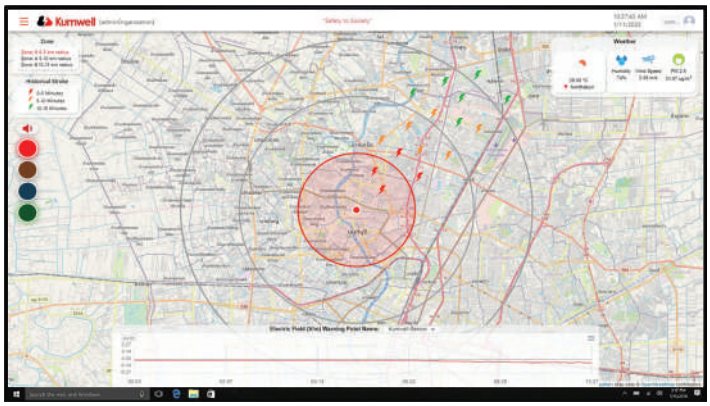

Innovation

Smart Lightning Warning System (SLWS)

The company has invested in lightning detection networks throughout Thailand and some parts of the ASEAN region and has researched, developed an outstanding lightning alarm innovation until being widely accepted.

Lightning detection network is a system that uses data from two types of IOT Sensors (High-Precision Lightning Detection Network System and E-Field Sensor). They are analyzed and processed together via the intelligent Alarm Viewer Software to alert with more than 95% accuracy. It is suitable for different types of projects in the field such as golf courses, power plants, oil refineries, mine area, airport, port, amusement park, school, etc., which has already been sold and installed for actual use, such as

- Bangkok Patana School
- PTT Stadium
- PTT Global Chemical (PTTGC)
- International School Ho Chi Minh City (ISHCMC)
- Joint research project with Electricity Generating Authority of Thailand Ubol Ratana Dam, Khon Kaen Province









Awards

SET Awards 2022

Received the Best Company Performance Awards in SET Awards 2022 in the category of Business Excellence for information disclosure and quality of financial statements and Sustainability Excellence in the Thai capital market's prestigious awards ceremony 2022 (SET Awards 2022) which emphasizes the strength of policies and effective business practices. Best Company Performance Awards by the Stock Exchange of Thailand (SET) is an award given to listed companies with excellent performance in each group based on business performance, good corporate governance and compliance with the regulations of the Stock Exchange of Thailand.



Best CEO Awards

Best Company Performance Awards





Asia Pacific Enterprise Award (APEA) 2023

Kumwell Corporation PLC., led by Mr. Boonsak Kiatjaroonlert, CEO Received two major international awards, including the Master Entrepreneur Award, as a leader with determination and success in driving the organization to the point of creating continuous business growth. And the Corporate Excellent Award, which is an award given to organizations that have outstanding performance in management and business growth from the Asia Pacific Enterprise Award (APEA) stage. Both of these awards It is supported by Asia Pacific Enterprise aims to band leading entrepreneurs and organisations across Asia to spur greater innovation, fair practices and growth in entrepreneurship, creating a successful entrepreneurial ecosystem which will then shape Asia to sustainable economic and social growth. It can be considered an award of pride and reinforces the image of success and readiness to deliver safety to society in a sustainable way.







Sustainability

Kumwell Corporation Public Company Limited is committed to conducting business by integrating with sustainability management by adopting an international approach to setting strategies and driving the organization to meet the needs and expectations of stakeholders throughout the Value chain for more than 10 years includes:



ESG risk consists of 3 aspects: environmental, social and governance. The company sets goals and action plans in each aspect for example;

E: Environmental

- Invest in Solar Power, a clean alternative energy source instead of using thermal energy from gas which can cause greenhouse gasses.
- Invested in a Zero Liquid Discharge wastewater treatment system to eliminate effluents and reuse water from industrial processes.

S: Social

- Collaborate with the Council of Engineers to deliver knowledge and expertise on electromagnetic disaster risk reduction under Kumwell Academy.
- Create activities to deliver knowledge and help strengthen local economy such as the policy to employ people in the community nearby, organize training and practice financial management knowledge with Noburo, etc.

G: Governance

To emphasize the efficient and effective in corporate governance practices of the company;

- Received prestigious SET Awards 2022, Asia Pacific Enterprise Awards (APEA) 2023
- Setting up a sustainability, a risk management, and a good corporate governance committee, etc.

SDGs - Sustainable Development Goals

There are 17 goals, divided into 5 dimensions: the environment dimension (Planet), the social dimension (People), the economic dimension (Prosperity), the peace and institute dimension (Peace), and the development partnership dimension (Partnership). Our company has set goals and dimensions as follows



- **Planet dimension** 13th goal: Climate Action
  - Propose solutions for disasters caused by electromagnetic waves such as lightning under 3rd approach: CSV.

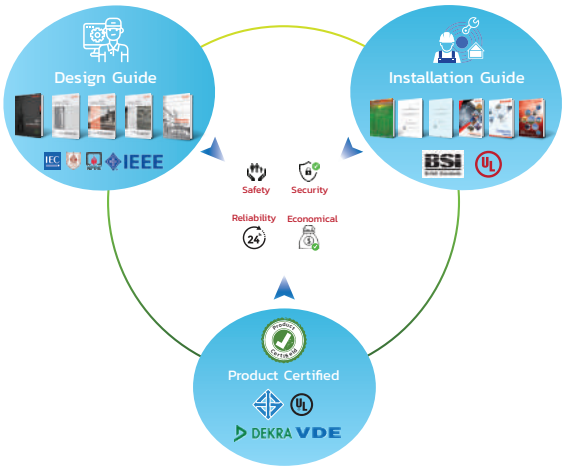
- **Prosperity dimension** 11th goal: Sustainable cities and communities
  - MOU with various agencies in Research and development to create safety innovations for reducing disasters caused by electromagnetic waves.

- **People dimension** 4th goal: Quality Education
  - Kumwell has developed the value of human assets, both corporate inside and outside

Sustainability

CSV - Creating Shared Value is a way to drive value to society and business sector to achieve stable and sustainable growth. Kumwell has operated through the sustainability commitment "CSV - Safety to Society" project for more than 10 years in delivering knowledge and expertise to reduce life, property, and operating systems in all sectors damage and extending to cooperation with partners networks and clients such as

- Collaborate with the Council of Engineers under the project Kumwell Academy to upgrade the engineering profession and deliver safety to society.
- Sign a Memorandum of Understanding (MOU) with government and private agencies on lightning protection and safety innovations. In the test installation and create innovation to increase efficiency and effectiveness in the operating system. Reduce the risk of electromagnetic waves. Along with certifying the use of products (Proven Technology).
- Join the education sector to create an Engineering curriculum, system design handbook, and installation guide.
- Collaborate with the Thai Electrical and Mechanical Contractors Association (TEMCA) to implement a project "TEMCA Corporate Creating Shared Value (TEMCA C CSV)".





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Terms and definitions

Surge Protective Device

SPD

A device that is intended to limit transient overvoltages and divert surge currents; it contains at least one nonlinear component.

Combination type SPD

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 behavior depending upon the characteristics of the applied voltage.

Mode of Protection of an SPD

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.

10/350 current impulse

Current impulse with a virtual front time of 10 μs and a time to half-value of 350 μs

8/20 current impulse

Current impulse with a virtual front time of 8 μs and a time to half-value of 20 μs

1.2/50 voltage impulse

Voltage impulse with a virtual front time of 1.2 μs and a time to half-value of 50 μs

Combination wave

A wave characterized by defined voltage amplitude (U_{OC}) and waveshape under open-circuit conditions and a defined current amplitude (I_{CW}) and waveshape under short-circuit conditions

NOTE: The voltage amplitude; current amplitude and waveform that is delivered to the SPD are determined by the combination wave generator (CWG) impedance Z_f and impedance of the DUT

Specific energy (for class I test)

W/R

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

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

Charge Q

It equals the time integral of the current according to the time; expressed in As.

$$Q = \int i.dt$$

Maximum continuous operating voltage

U_C

Maximum r.m.s. voltage which may be continuously applied to the SPD's mode of protection.

Voltage protection level

U_P

A parameter that characterizes the performance of the SPD in limiting the voltage across its terminals, which is selected from a list of preferred values. This value is greater than the highest value of the measured limiting voltages

Residual voltage

U_{res}

Peak value of voltage that appears between the terminals of an SPD due to the passage of discharge current.

Reference test voltage

U_{REF}

r.m.s. value of voltage used for testing which depends on the mode of protection of the SPD, the nominal system voltage, the system configuration and the voltage regulation within the system

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

Temporary overvoltage test value of the SPD

U_T

Test voltage applied to the SPD for a specific duration t_T, to simulate the stress under TOV conditions

NOTE: It is a characteristic declared by the manufacturer that gives information about the behavior of the SPD when stressed with voltages U_T above U_C for a given specific duration t_T (this behavior may either be no change in the performance after application of the temporary overvoltage or a defined failure without hazard for either personnel, equipment or facility)

Temporary overvoltage value of the power system

U_{TOV}

Power frequency overvoltage occurring on the network at a given location, of relatively long duration. TOVs may be caused by faults inside the LV system ($U_{TOV(LV)}$) or inside the HV system ($U_{TOV(HV)}$)

NOTE: Temporary overvoltages, typically lasting up to several seconds, usually originate from switching operations or faults (for example, sudden load shedding, single-phase faults, etc.) and/or from non-linearity (ferroresonance effects, harmonics, etc.)

Open circuit voltage

U_{OC}

Open circuit voltage of the combination wave generator at the point of connection of the device under test

Continuous operating current

I_C

Current flowing through each mode of protection of the SPD when energized at the maximum continuous operating voltage (U_C) for each mode

Nominal discharge current

I_n (only for classes I and II)

The crest value of the current through the SPD having a current waveshape of 8/20. This parameter 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

Impulse current

I_{imp} (for class I tests)

It is defined by three parameters, a current peak value I_{peak}, a charge Q and a specific energy W/R. Tested according to the test sequence of the operating duty test. This is used for the classification of the SPD for class I test

Maximum discharge current

I_{max} (for class II test)

The 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

Follow Current

I_f

Peak current supplied by the electrical power system and flowing through the SPD after a discharge current impulse. The follow current is significantly different from the continuous operating current (I_c)

Follow current interrupting rating

I_{fi}

Prospective short-circuit follow current that an SPD is able to interrupt without operation of a disconnector

Residual current

I_{PE}

Current flowing through the PE terminal, when the SPD is energized at the maximum continuous operating voltage (U_c) when connected according to the manufacturer instructions

Short-circuit withstand capability

I_P

The SPD shall be able to carry the power shot-circuit current until it is interrupted either by the SPD itself, by an internal or external overcurrent disconnector or by the backup overcurrent protective; express in kA_{rms} (tested according to short-circuit withstand capability test in conjunction with backup overcurrent protection)

Short-circuit current rating

I_{SCCR}

Maximum prospective short-circuit current from the power system for which the SPD, in conjunction with the disconnector specified, is rated

Rated load current

I_L

Maximum continuous rated r.m.s. current that can be supplied to a resistive load connected to the protected output of an SPD

Total discharge current

(I_{Total})

Current which flows through the PE or PEN conductor of a multipole SPD during the total discharge current test

NOTE 1: The aim is to take into account cumulative effects that occur when multiple modes of protection of a multipole SPD conduct at the same time.

NOTE 2: I_{Total} is particularly relevant for SPDs tested according to test class I, and is used for the purpose of lightning protection equipotential bonding according to IEC 62305 series

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

Device (internal and/or external) required for disconnecting an SPD from the power system

NOTE: This disconnecting device is not required to have isolating capability. It is to prevent a persistent fault on the system and is used to give indication of the SPD failure.

There may be more than one disconnector function. For example, an over-current protection function and a thermal protection function. These functions may be integrated into one unit or performed in separate units.

Short-circuit withstand

Maximum prospective short-circuit current that the SPD is able to withstand

NOTE: This definition refers both to d.c. and a.c. 50/60 Hz. Two short-circuit withstand values may be defined for two-port SPDs or one-port SPDs having separated input and output terminals : one corresponding to an internal short circuit (by-passing the internal active part) and another one corresponding to an external short circuit (load side short-circuit) directly at the output terminals (case of a failure at the load).

Impulse test classification

Class I tests

Tests carried out with the impulse discharge current I_{imp} with an 8/20 current impulse with a rest value equal to the crest value of I_{imp} and with 1.2/50 μs

Class II tests

Tests carried out with the nominal discharge current I_n and The 1.2/50 voltage impulse

Class III tests

Tests carried out with the 1.2/50 voltage-8/20 current combination wave generator

Specific energy for class I test

W/R

Energy dissipated by a unit resistance of 1 Ω with the impulse discharge current I_{imp}

Rated impulse withstand voltage

U_w

Impulse withstand voltage assigned by the manufacturer to the equipment or to a part of it, characterizing the specified withstand capability of its insulation against overvoltages

Status Indicator

Device that indicates the operational status of and SPD, or a part of and SPD

NOTE: Such indicators may be local with visual and/or audible alarms and/or may have remote signaling and/or output contact capability

Output contact

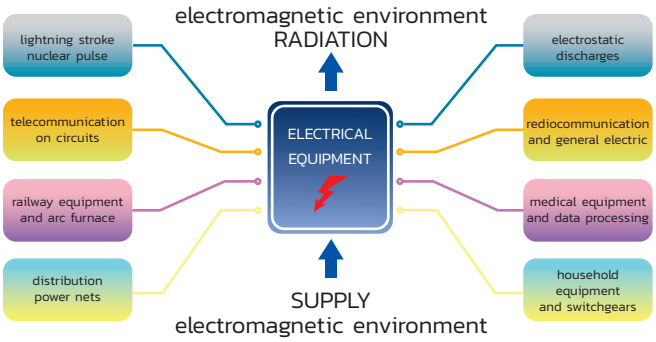
Contact included in a circuit separate from the main circuit of an SPD, and linked to a disconnector or status indicator

Table 1 - The list of abbreviation

Abbreviation	Description
General abbreviations	
TOV	Temporary overvoltage
SPD	Surge protective device
IP	Degree of protection of enclosure
W/R	Specific energy
Q	Charge (of impulse current)
t_A	Response time
Abbreviations related current	
I_C	Continuous operating current
I_f	Follow current
I_{fi}	Follow current interrupting rating
I_{imp}	Impulse current for class I test
I_L	Rated load current
I_{max}	Maximum discharge current for class II test
I_n	Nominal discharge current
I_P	Prospective short-circuit current of a power supply
I_{Total}	Total discharge current
I_{SCCR}	Short-circuit current rating
I_{PE}	Residual current
Abbreviations related voltage	
U_C	Maximum continuous operating voltage
U_N	Nominal voltage of the system phase to earth
U_O	Line-to-neutral voltage of the system
U_{OC}	Open-circuit voltage for class III test
U_P	Voltage protection level
U_{ref}	Reference voltage test value
U_{res}	Residual voltage
U_T	Temporary overvoltage
U_{TOV}	Temporary overvoltage of the power system
$U_{TOV(HV)}$	Temporary overvoltage of the network inside the high-voltage system
$U_{TOV(LV)}$	Temporary overvoltage of the network inside the low-voltage system
U_W	Reted impulse withstand voltage

General Knowledge about SPD

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.



At the figure there are particular links among electrical equipment and environment 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.

Term and definition of surge

Overvoltage

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 IEC 61643-11)

Peak value (amplitude) U_{max} , I_{max}

- peak value is the maximum 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 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

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

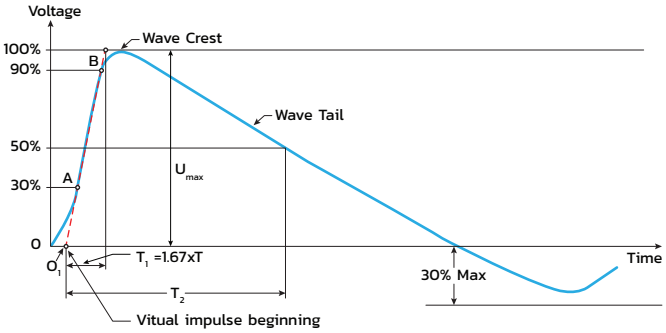
Tail of impulse

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

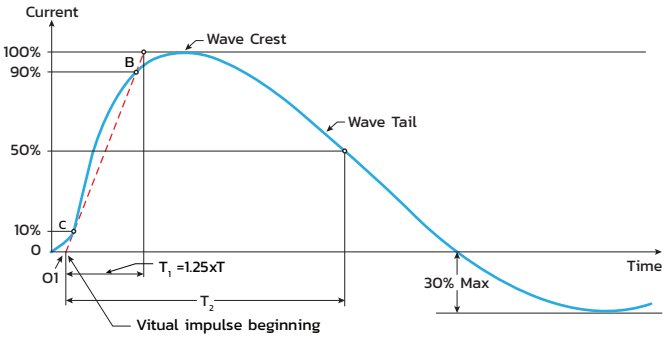
Time to half-value T_2

- 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.



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

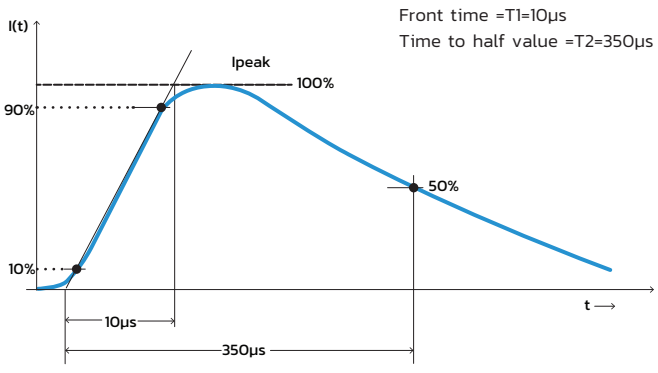


Current impulse, definition of front time and time to half-value

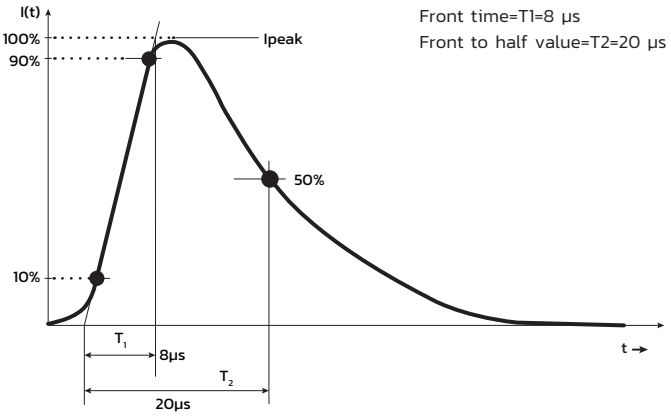
Standardized testing current impulse

Two basic type of testing current impulse are used during SPD tests according to IEC 61643-11:

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).



Standardized testing combination wave

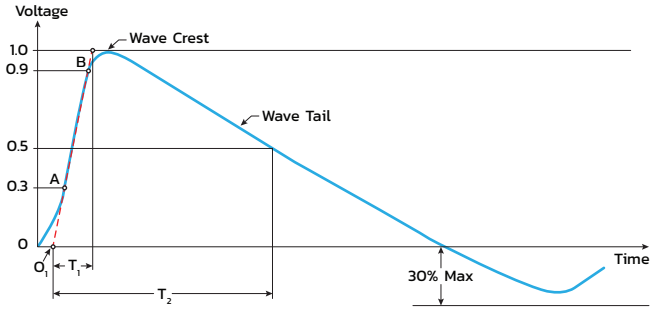
1.2/50 µs (voltage surge) - 8/20 µs (current surge) combination wave

The combination wave is delivered by a generator that can apply a 1.2/50 µs voltage wave across an open circuit and an 8/20 µs current wave into a short circuit. The exact waveform that is delivered is determined by the generator and the impedance to which the surge is applied.

This combination wave used for testing SPD Class III according to IEC 61643-11 and all other cases, such as power lines short signal connections and short-distance connections.

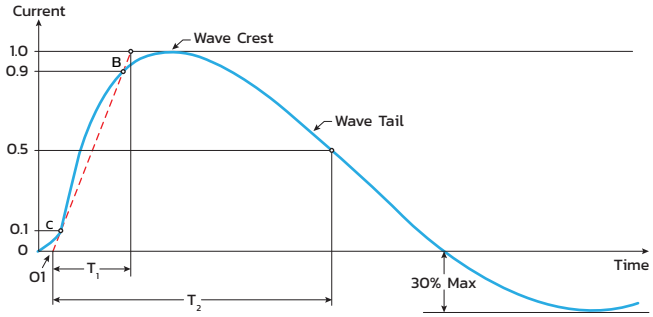
• Combination wave, Open-circuit voltage (1.2/50 µs)

T = Time B - Time A T1=1.67T = 1.2 µs ± 30% T2 = 50 µs ± 20%
Undershoot ≤ 30% of the crest.



• Combination wave, Short-circuit current (8/20 µs)

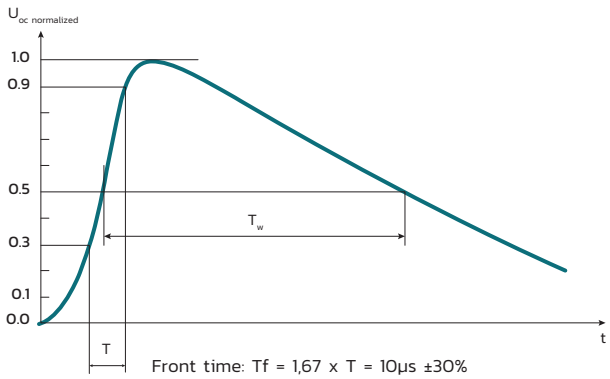
T = Time B - Time C T1=1.25T = 8 µs ± 30% T2 = 20 µs ± 20%
Undershoot ≤ 30% of the crest.



10/700 µs (voltage surge) - 5/320 µs (current surge) combination wave

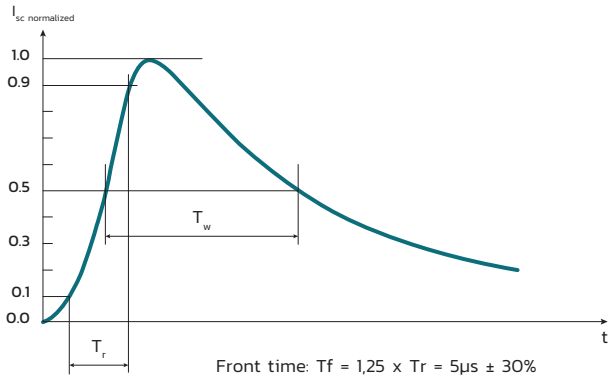
10/700 µs combination wave is applied to ports connected to outdoor telecommunication lines only. Outdoor telecommunication lines are typically greater than 300 in length, as the result of this length 10/700 µs wave is more representative. Telecommunication lines are usually protected by a primary protector installed at the cable entry to building. Testing shall be performed with the intended primary protector

• Open circuit voltage waveform (10/700 μs)



Front time: Tf = 1,67 x T = 10μs ±30%
Duration: Td = Tw = 700μs ±20%

• Short circuit current waveform (5/320 μs)



Front time: Tf = 1,25 x Tr = 5μs ± 30%
Duration: Td = Tw = 320μs ± 20%

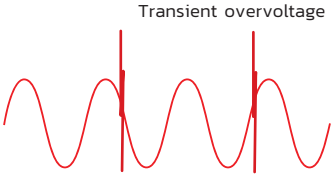
Type of overvoltages

The overvoltages are classified into two kinds:

1. Temporary overvoltage (TOV)
2. Transient overvoltage (Surge)

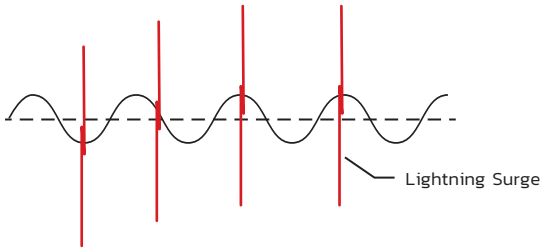
Transient overvoltage (Surge)



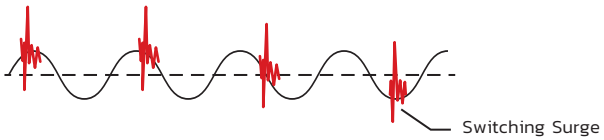


Transient overvoltages in electrical transmission and distribution networks result from the unavoidable effects of lightning strikes and network switching operations. These overvoltages have the potential to result in large financial losses each year due to damaged equipment and lost production. Transient overvoltages can be classified as two common forms

• Lightning Surge (Direct and Indirect lightning Strikes) are lightning induced disturbances in magnetic fields with a subsequent induced overvoltage on electrical systems with in the building



• Switching Surge are the switching of inductive loads

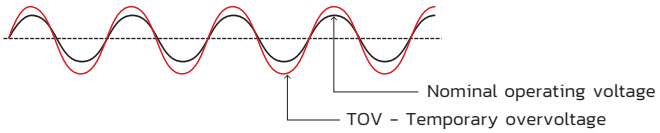


Transient overvoltages are surge that reach values of tens of kilovolts with a duration of the order of microseconds. Despite their short duration, they cause the destruction of equipment connected to the network, causing:

• Serious damage or destruction.
• Service interruption.

Tempoarary overvoltages (TOVs)

Temporary overvoltage are defines as AC overvoltages with significant duration and amplitude appearing in a system following a fault condition. A wide range of phenomena, either resulting from normal system operating or from accidental conditions such as a line–to–earth fault in three–phase system,loss of neutral in a single–phase, Ferroresonance effects, harmonics, etc. ,these cause can be produce overvoltages, which must be distinguished from other surge overvoltages due to their longer duration time.



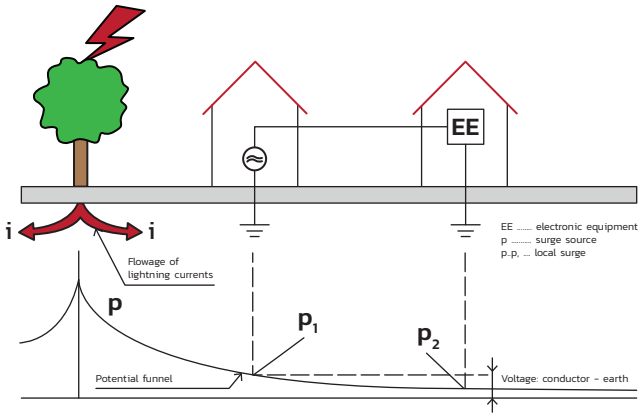
Kinds of surge couplings

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.

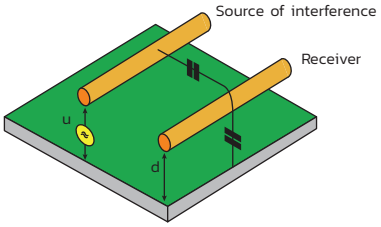
Galvanic coupling

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.



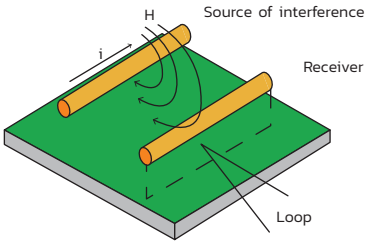
Capacitive coupling

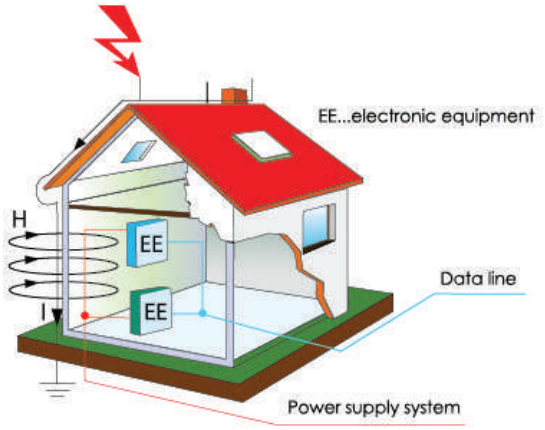
There is always a capacitive coupling (parasitic capacity) between the source of interference and the receiver.
The higher the front rate of rise of the disturbing voltage impulse (du/dt) is, the stronger its interference effect is.



Inductive coupling

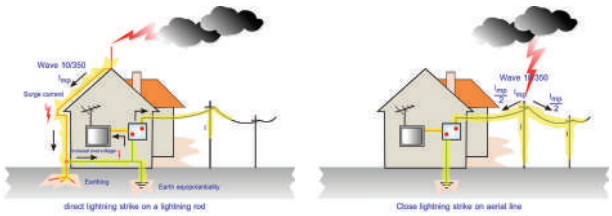
There is always an inductive coupling (magnetic field) between the source of interference and the receiver.
The higher the front rate of rise of the disturbing current impulse (di/dt) activating the magnetic field is, the higher the interference effect is.





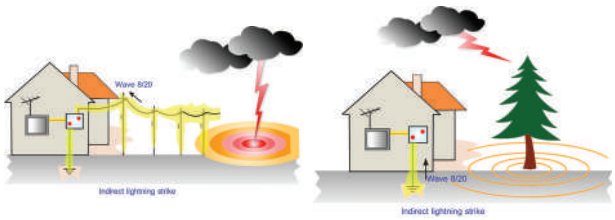
Surge from Direct Lightning Strikes

Lightning currents that can occur during a direct lightning strike can be imitated with the surge current of waveform 10/350 µs. The lightning test current imitates both the fast rise and the high energy content of natural lightning.



Surge from Indirect Effect of Lightning Strikes

The electromagnetic fields created by the lightning current generate inductive and capacitive coupling, leading to other overvoltages. The surges are imitated with test impulse current waveform 8/20 µs. The energy content of this impulse is significantly lower than the lightning current waveform 10/350 µs.



Distribution of protected area into the lightning protection zones

The standard IEC 1312-1 and IEC 62305 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.

Lightning Protection Zones

LPZ O_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 O_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 O_B. In this zone the electromagnetic field may also be attenuated depending on the screening measures.

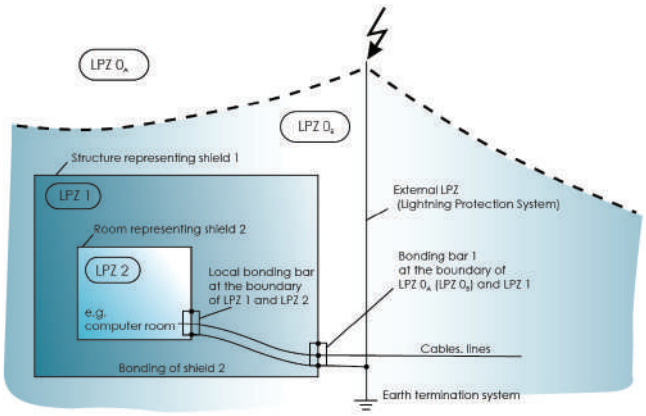
The subsequent zones (LPZ 2 and so on):

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 1312-1 and IEC 62305.
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 picture 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 → 1 and 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 socalled 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.

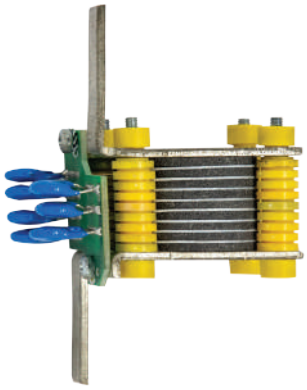
If there are adjacent structures between which power and communication cables pass, the earthing system shall be interconnected, and it is beneficial to have many parallel paths to reduce current in the cables. A meshed earthing system fulfills this requirement. The lightning currents are further reduced, e.g. by enclosing all the cables in metal conduits or grid like reinforced concrete ducts, which must be integrated into the meshed earthing system.

Type of SPD classified by component structure

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 often 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 behavior 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 quiescent 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 possibilities 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 10/350 µs. The electrical parameters can be predicted in a large range. E.g. direct switching voltage can be set up from 100 V to 2000 V 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



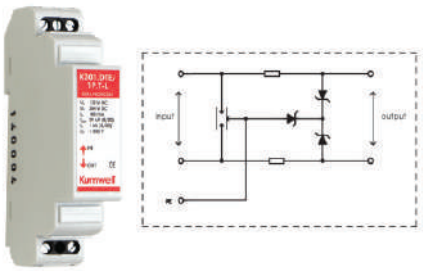
Varistors are voltage dependent resistances with symmetrical voltampere characteristic. They consist of 90% ZnO as a ceramic basis and 10% additives. High possible load of this type of arresters during their loading by impulse discharge currents is achieved by application of its great mass varistor capacity for energy absorption. 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 Zener 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.

Hybrid



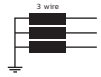
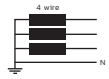
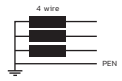
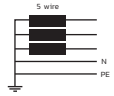
Hybrid surge protection devices combine at least two types of surge components such as

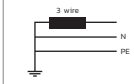
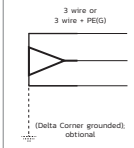
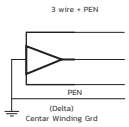
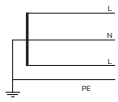
- MOVs and GDT for surge protection of AC Power Lines
- Combination SPD consist of gas discharge tubes, series impedance and transils, these devices was designed for protection of data, communication, measuring and control lines against surge effects.

Kumwell SPD application for Low Voltage Power Systems

Dimensioning of SPD class I IEC 62305 ed.2 Location of SPD class I 1:On the boundaries of LPZ 0 and LPZ 1		
LPL	Maximum current (kA)	Total discharge current (10/350) (I_{Total})
I	200 kA	100 kA
II	150 kA	75 kA
III	100 kA	50 kA
IV	100 kA	50 kA

Table 1
Reference test voltage values (IEC 61643-11)

Power distribution system		Nominal AC system voltage L-PE/L-L V	Expected voltage regulation of the power distribution system max +(%)	Reference test voltage U_{REF} (depending on the mode of protection) V			
				L-N (PEN)	L-PE	L-L	N-PE
Three phase TT-system without PE and Neutral distribution		230 / 400	10	---	255	440	---
Three phase TT-system with Neutral distribution		230 / 400	10	255	255	440	255
Three phase TN-C system with PEN distribution		230 / 400	10	255	255	440	---
Three phase TN-S system with PE and Neutral distribution		230 / 400	10	255	255	440	255
		240 / 415	10	255	255	440	255
		120 / 208	10	132	132	230	50
		277 / 480	10	305	305	530	115
Three phase IT-system with Neutral distribution		230 / 400	10	255	440	440	255
Three phase TT-system without Neutral distribution		230	10	---	255	440	---

Power distribution system		Nominal AC system voltage L-PE/L-L V	Expected voltage regulation of the power distribution system max +(%)	Reference test voltage U_{REF} (depending on the mode of protection) V			
				L-N (PEN)	L-PE	L-L	N-PE
Single phase TT-S-system		230	10	255	255	---	255
		120		132	132		132
Three phase (Delta) Corner grounded TN system or TT system or IT system		230	10	---	264	264	---
		200 (202)			222	22	
		460		---	528	528	---
Three phase (Delta) Central winding grounded TN system or TT system		230	10	132	264	264	---
		200 (202)		---	129 192	222	
		460		---	528	528	---
Split phase TN system		120 / 240	10	132	132	264	132

NOTE: If higher voltage regulation is required for certain applications (for example +15%), subject to a special agreement between the manufacturer and the user.

SOURCE: Table A.1-Reference test voltage values (IEC 61643-11)

TOV Ratings (IEC 61643-11)

The test procedure on the intended application of an SPD in a low-voltage power distribution system according to the installation instructions given by the manufacturer.

For systems defined in IEC 60364 series, values are given below in Table 2

Table 2 – TOV test values for systems complying with IEC 60364 series

Application	**TOV test parameters**		
SPDs connected to:	For t_T=5 s (LV-system faults in consumer installation) (requirement to 7.2.8.1 and test 8.3.8.1) Withstand mode required	For t_T=120 min (LV-system faults in distribution system and loss of neutral) (requirement to 7.2.8.1 and test 8.3.8.1) Withstand or safe failure mode acceptable	For t_T=200 ms (HV-system faults) requirement to 7.2.8.2 and 8.3.8.2 Withstand or safe failure mode acceptable
	TOV test Values U_T (V)		
TN-systems			
Connected L-(PE)N or L-N	1.32 x U_{REF}	$\sqrt{3}$ x U_{REF}	
Connected N-PE			
Connected L-L			
TN-systems			
Connected N-PE	$\sqrt{3}$ x U_{REF}	1.32 x U_{REF}	1200 + U_{REF}
Connected L-N	1.32 x U_{REF}	$\sqrt{3}$ x U_{REF}	
Connected N-PE			1200
Connected L-L			
TN-systems			
Connected N-PE			1200 + U_{REF}
Connected L-N	1.32 x U_{REF}	$\sqrt{3}$ x U_{REF}	
Connected N-PE			1200 + U_{REF}
Connected L-L			

U_{REF} reference test voltage used for testing and taking into account the maximum voltage regulation of the power system (see Annex A).

U_0 in TN- and TT-system: nominal a.c.r.m.s. line voltage to earth; in IT-system: nominal a.c. voltage between line conductor and neutral conductor or midpoint conductor, as appropriate (see 442.1.2 of IEC 60364-4-44:2007)

1,32 x U_{REF} equals 1.45 x U_0 in case the voltage regulation does not exceed +10% (see 442.5 of 60364-4-44:2007)

NOTE: As voltage regulation exceeds 10% in some countries, only U_{REF} is use in this standard for this standard for general applicability. Further information on voltage regulation can be found in IEC 60038.

SOURCE: Table B.1 – TOV test values for systems complying with IEC 60364 series (IEC 61643-11)

Short circuit backup protection and surge withstand (IEC 61643-12)

Table 3 - Example of ratio between single shot withstand and full preconditioning/operating duty test

Typical rated current of the fuse	Typical Pre-arcing value, crest current from simplified formula in 1 and real testing							
	Cyl gG				NH gG			
	Pre-arcing	Calculated	After test	Ratio	Pre-arcing	Calculated	After test	Ratio
	I^2t	8/20	8/20		I^2t	10/350	10/350	
25	800	7.6	5	0.66				
32	1,300	9.6	7	0.73				
40	2,500	13.4	10	0.75				
50	4,200	17.3	15	0.87				
63	7,500	23.1	17	0.73				
80	14,500	32.2	25	0.78				
100	24,000	41.4	30	0.72	20,000	8.8	5	0.57
125	40,000	53.4	40	0.75	33,000	11.3	7	0.62
160					60,000	15.3	10	0.65
200					100,000	19.75	15	0.76
250					200,000	27.93	20	0.72
315					300,000	34.21	25	0.73

SOURCE: Table P.1 - (IEC 61643-12)

1. Information single shot 8/20 and 10/350 fuses withstand

Use the I^2t calculation of wave shape compared to fuse I^2t (1 ms) from fuse manufacturer is a possible way to guess its surge withstand for a single shot.

I^2t surge can be estimated knowing the crest value of the surge and its wave shape with these formulas.

For wave shape 10/350:

$$I^2t = 256.3 \times Icrest^2$$

For wave shape 8/20:

$$I^2t = 14.01 \times Icrest^2$$

With Icrest in kA, I^2t in A^2s

Examples:

To withstand a single shot of surge current of 9 kA 8/20, the backup fuse must have a minimum pre-arcing value greater than:

$$I^2t = 14.01 \times 9^2 = 1134.8\ A^2s$$

NOTE: Typical pre-arcing value for 32 A cylindrical fuse gG type is : 1300 A^2s

To withstand a single shot of surge current of 5 kA 10/350, the backup fuse must have a minimum pre-arcing value greater than:

$$I^2t = 256.3 \times 5^2 = 6407.5\ A^2s$$

NOTE: Typical pre-arcing value for 63 A NH fuse gG type is : 6500 A^2s

A new fuse with a pre-arcing value of 24 000 A^2t (100 A cylinder fuse gG type) can withstand a 8/20 single shot of:

$$Icrest = \sqrt{\frac{24{,}000}{14.01}} = 41.4\ kA$$

SPD Parameter Selection (IEC 61643-12)

U_c Maximum continuous operating voltage of the SPD

U_C shall be higher than the maximum continuous operating voltage of power system U_{CS} (=k x U_o)

$$U_C > U_{CS}$$

Table 4 - Minimum recommended U_C of the SPD for various power systems (IEC 61643-12)					
System configuration of distribution network					
SPDs connected between:	**TT**	**TN-C**	**TN-S**	**IT with distributed neutral**	**TT**
Each line conductor and neutral conductor	1,1 U_o	NA	1,1 U_o	1,1 U_o	NA
Each line conductor and neutral conductor	1,1 U_o	NA	1,1 U_o	$\sqrt{3}$ x U_o (see NOTE 3)	NA
Each line conductor and neutral conductor	U_o (see NOTE 3)	NA	U_o (see NOTE 3)	U_o (see NOTE 3)	Line to line voltage (see NOTE 3)
Each line conductor and neutral conductor	NA	1,1 U_o	NA	NA	NA

NA: not applicable

NOTE 2 U_o is the line to neutral voltage of the low voltage system.

NOTE 3 These values are related to worst case fault conditions, therefore the tolerance of 10% is not taken into account.

NOTE 4 In extended IT systems, higher values of U_c may be necessary.

U_T Temporary over voltage rating of the SPD

U_T Values shall be higher than the temporary overvoltage (TOV) that is expected to occur in the installation due to faults in the low-voltage system

$$U_T > U_{TOV(LV)}$$

Table 5 - Typical TOV test values (IEC 61643-12)		
Application	**TOV test values U_T**	
SPDs connected to:	**for 5s**	**for 200ms**
TN-systems		
Connected L-(PE)N or L-N	1,32 x U_{cs}	
Connected N-PE		
Connected L-L		
TT-systems		
Connected L-PE	1,55 x U_{cs}	1200 + U_{cs}
Connected L-N	1,32 x U_{cs}	
Connected N-PE		1200
Connected L-L		
IT-systems		
Connected L-PE		1200 + U_{cs}
Connected L-N	1,32 x U_{cs}	
Connected N-PE		1200
Connected L-L		
TN, TT-systems		
Connected L-PE	1,55 x U_{cs}	1200 + U_{cs}
Connected L-N	1,32 x U_{cs}	
Connected N-PE		1200
Connected L-L		

NOTE 2: This table satisfies the requirements given in IEC 60364-5-53. For this purpose U_{CS} = 1,1 × U_O.

NOTE 3: The different power networks and earthing practices not complying with IEC installations rules may require different values to those given in the table above.

In some cases where the TOVs have too high a magnitude, it may be difficult to find an SPD which is able to provide equipment with acceptable surge protection. If the probability of occurrence is low enough, it can be decided to use an SPD which cannot withstand the TOV stress. In this case, suitable disconnecting devices shall be used.

I_n, I_{max}, I_{imp}

I_n is related to the protective level U_p where I_{max}, I_{imp} is necessary for selection of the appropriate energy withstand.

The choice of the SPD energy withstand (choice of either I_{imp}, I_{max} or U_{oc} depending on the class of test) shall be based on a risk analysis (see Clause 7) which compares the probability of occurrence of surges, the price of the equipment to be protected and the acceptable failure rate, completed with a coordination analysis when more than one SPD is involve.

Required impulse withstand voltage of equipment (U_W)

Equipment shall be selected so that its rated impulse withstand voltage is not less than the required impulse withstand voltage as specified in Table 6 (Table 44B in IEC 60364-4-44)

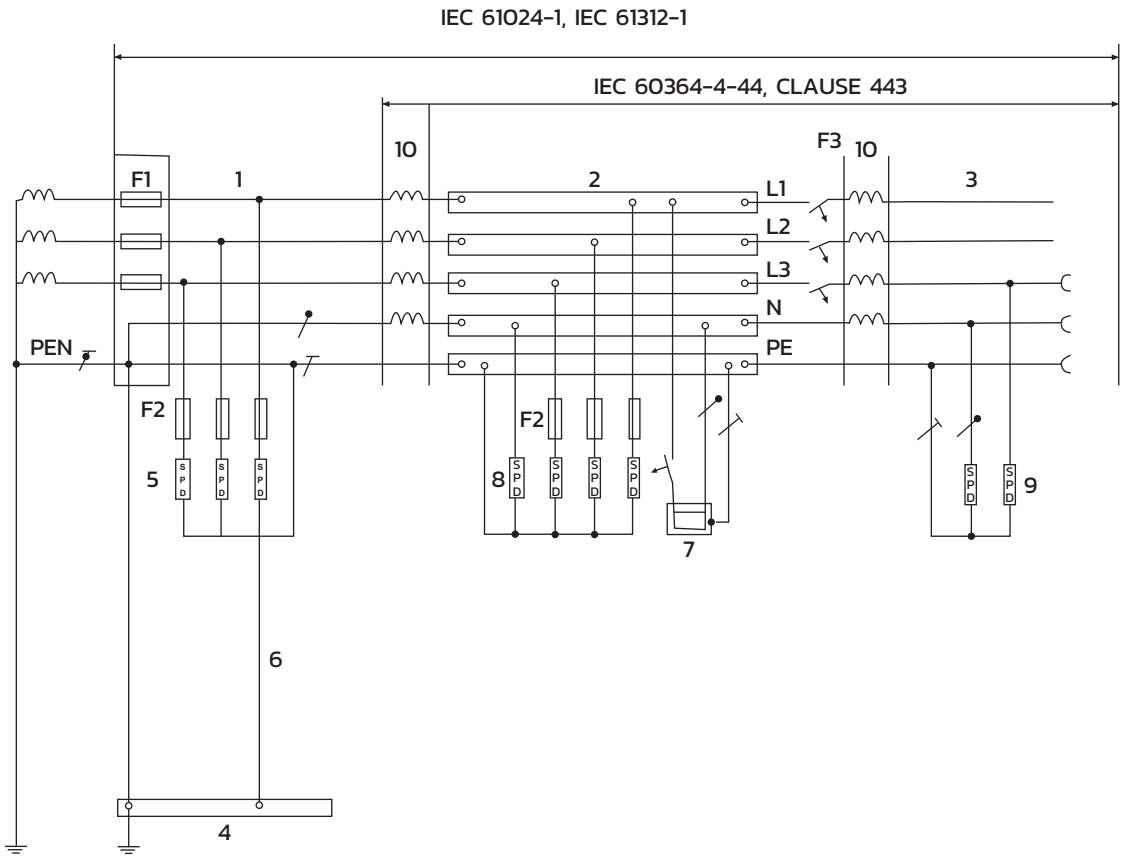
Table 6 - Require and impuise withstand voltage of equipment					
Nominal voltage of the installation [a] v		Required impulse withstand voltage for kV [c]			
Three-phase systems	Single-phase systems with middle point	Equipment at the origin of the installation (overvoltage category IV)	Equipment of distribution and final circuits (overvoltage category III)	Appliances and current using equipment (overvoltage category II)	Specially protected equipment (overvoltage category I)
-	120-240	4	2.5	1.5	0.8
230/400[b] 277/480[b]	-	6	4	2.5	1.5
400/690	-	8	6	4	2.5
1000	-	12	8	6	4

[a] According to IEC 60038.

[b] In Canada and USA, for voltage to earth higher than 300 V, the impulse withstand voltage corresponding to the next highest voltage in column one applie.

[c] This impulse withstand voltage is applied between live conductor and PE.

Installation of class I, II and III tested SPDs, for example in TN-C-S system, IEC 60364-5-53



1 Origin of the installation

2 Distribution board

3 Distribution outlet

4 Main earthing terminal or bar

5 Surge protection device, test class I

6 Earthing connection (earthing conductor) of surge protective device

NOTE: 1 Reference should be made to IEC 61643-12 for further information.

NOTE: 2 SPD 5 and 8 can be combined in a single SPD

7 Fixed equipment to be protected

8 Surge protective device, test class II

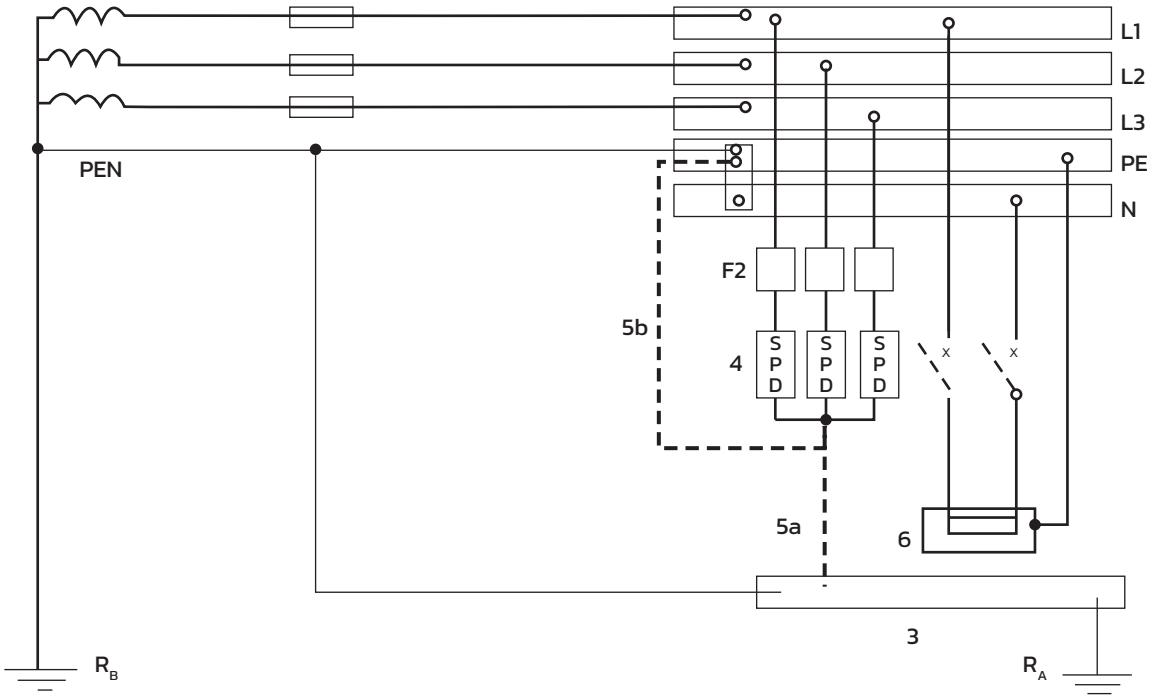
9 Surge protective device, test class II or III

10 Decoupling element or line length F1, F2, F3

Overcurrent protective device

Installation of class I, II and III tested SPDs

Installation of surge protective devices in TN systems, IEC 60364-5-53



3 Main earthing terminal or bar

4 Surge protective devices providing protection against overvoltags of category II

5 Earthing connection of surge protective device, either 5a or 5b

6 Equipment to be protected

F1 Protective device at the origin of the installation

F2 Protective device required by the manufacturer of the SPD

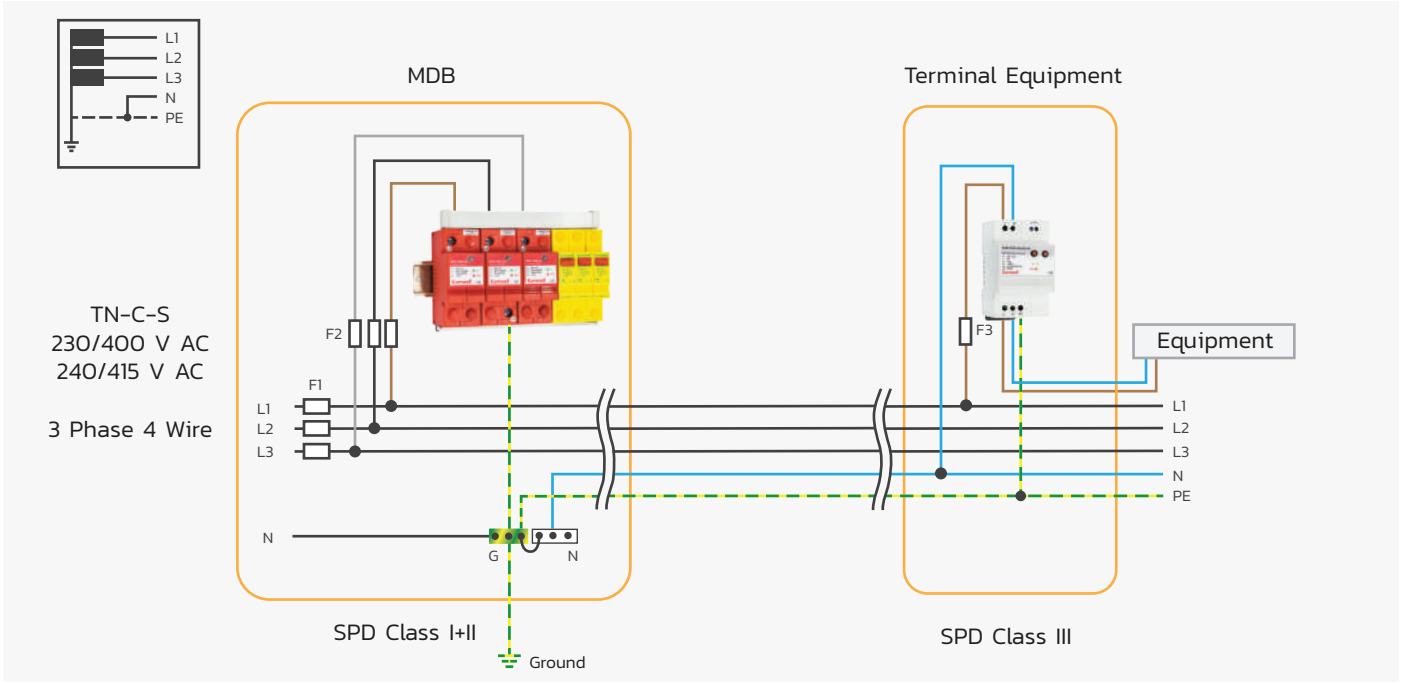
R_A Earthing electrode (earthing resistance) of the Installation

R_A Earthing electrode (earthing resistance) of the supply system

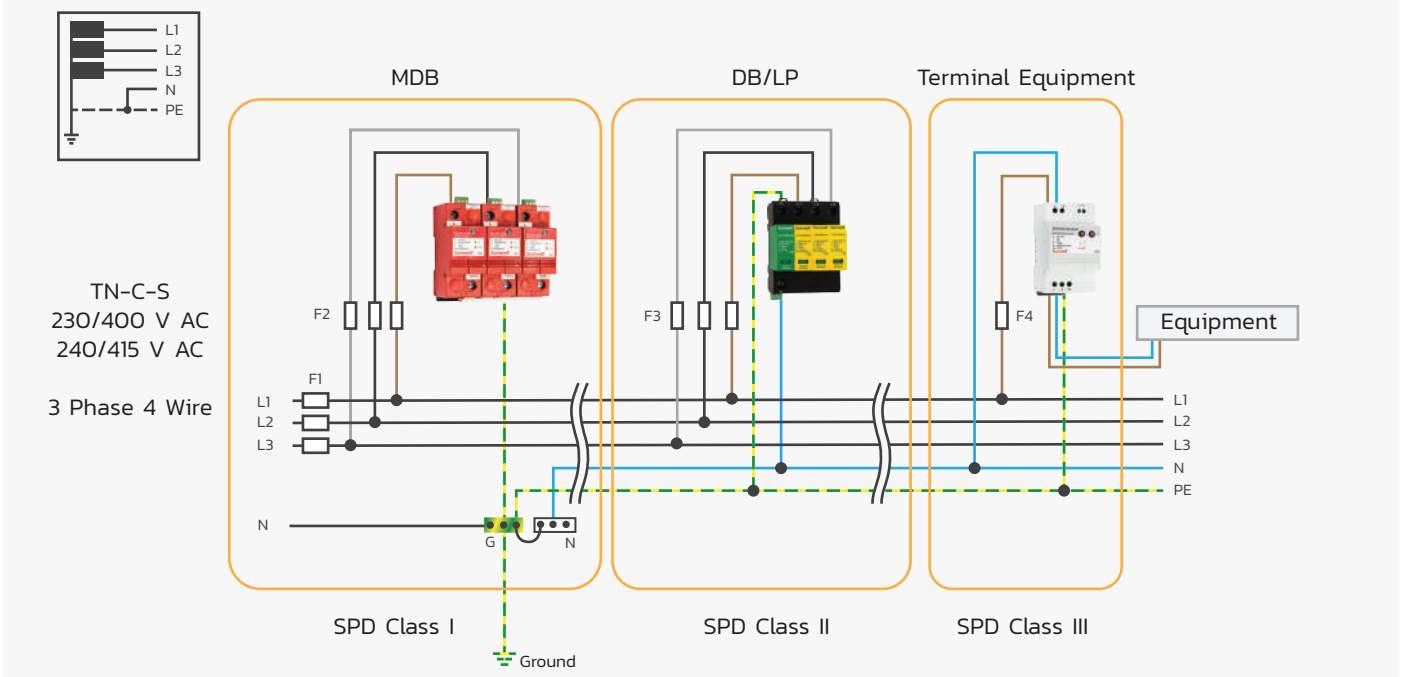
SPDs in TN systems

Installation of surge protective devices, for example in TN-C-S system (Thailand) (3 Phase 4 Wire)

Surge Protection for AC Power Supply Systems

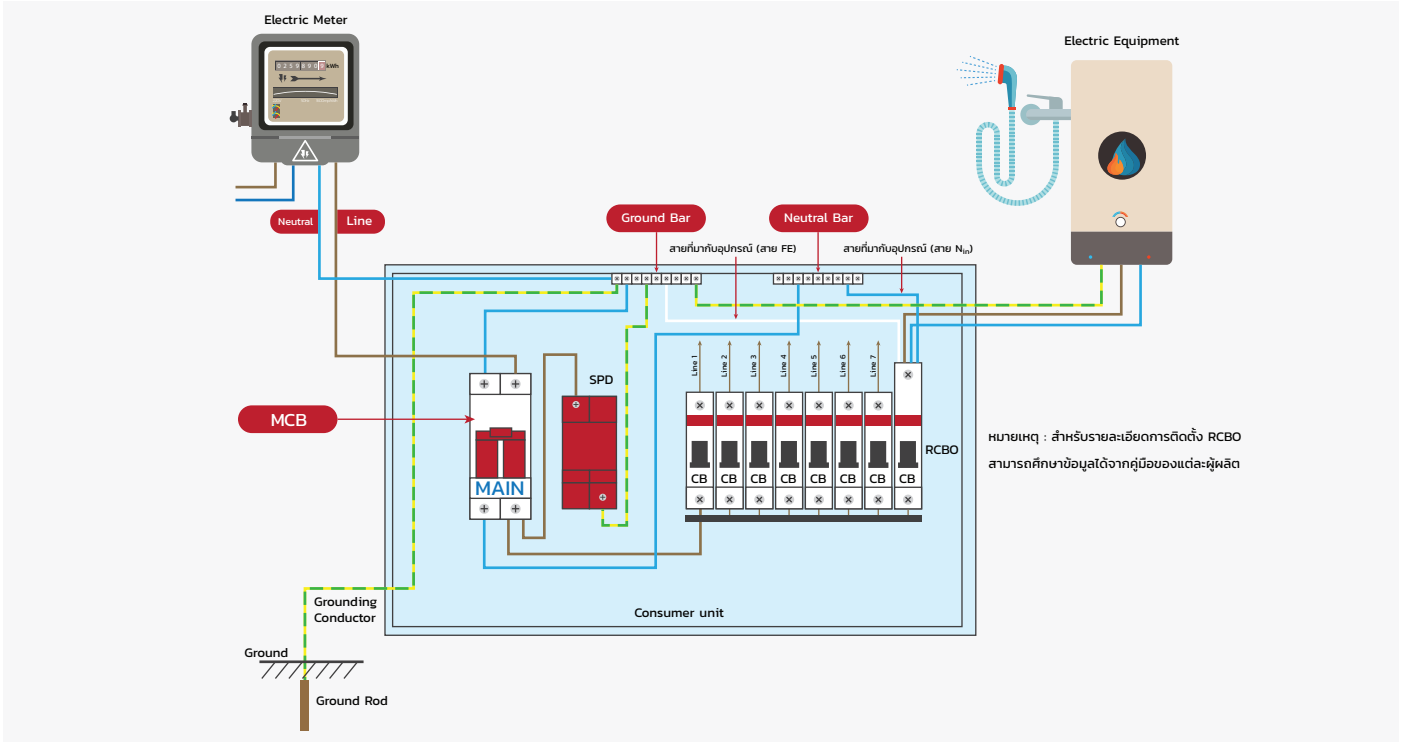


Installation of SPD class I and class II combined set + class III (without DB / LP) in TN-C-S system (Thailand) (3 Phase 4 Wire)

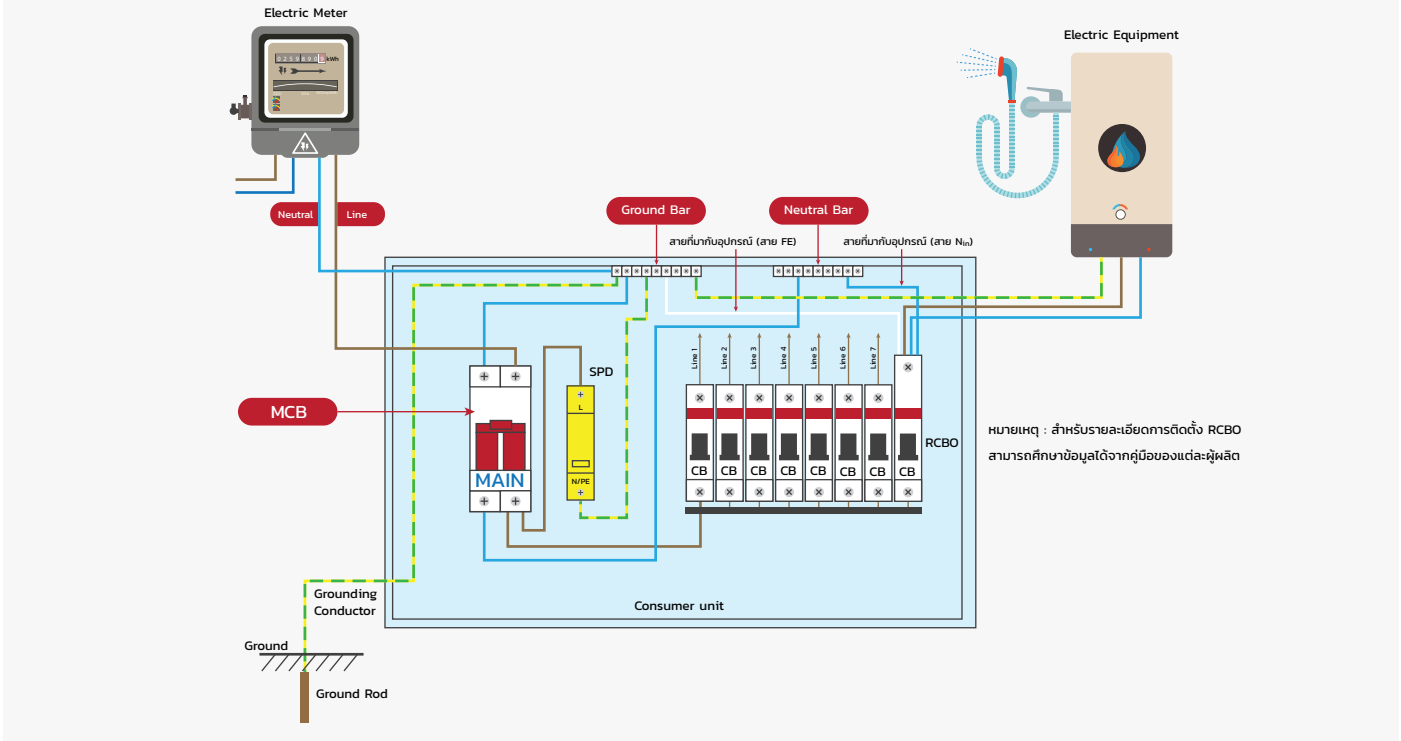


Installation of SPD class I and class II installed separately + class III in TN-C-S system (Thailand) (3 Phase 4 Wire)

Installation of surge protective devices for Home (Single Phase) TN-C-S system in Thailand



Installation of SPD class I+II in Consumer Unit
(in case the home located in area where a direct lightning strike risk is high, especially when the home is equipped with LPS or lightning rod, opening area or on the mountain)



Installation of SPD class II in Consumer Unit
(in case the home located in area of indirect lightning strike risk , on installations without LPS (lightning rods))

1 Surge Protection Class I Spark Gap for AC Power Systems

Kumwell

CLASS I (TYPE 1)
LIGHTNING ARRESTER SPARK GAP

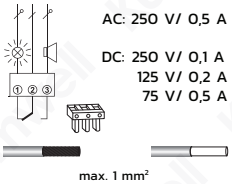
Kumwell KZ01.I050.ds and KZ01.U0440.ds are the surge protective device class I according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 (according to IEC 62305), where they provide the equipotential bonding and discharge of both, the lightning current and switching surge, which are generated in power supply systems entering the building. The lightning arresters are constructed as the encapsulated, non-exhaust, multiple spark gaps, They are mainly intended for use in the power lines, which are operated as a system TN-C.



LPZ 0→1

IP 20

DS



AC: 250 V/ 0,5 A

DC: 250 V/ 0,1 A
125 V/ 0,2 A
75 V/ 0,5 A

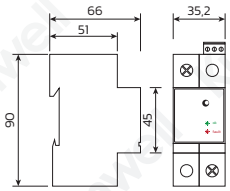
KZ01.IXXX.ds
- Remote signal (optional)
- Lightning impulse current: I_{imp} (kA)
- Lightning protection zone: LPZ 0-1

KZ01.UXXX.ds
- Remote signal (optional)
- Max. continuous operating voltage: U_C
- Lightning protection zone: LPZ 0-1

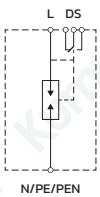
Spark gap / Class I

Technical data		KZ01.I050.ds	KZ01.U0440.ds
Test class according to IEC 61643-11		CLASS I	
Nominal voltage	U_N	230 V AC	400 V AC
Max. continuous operating voltage	U_C	350 V AC	440 V AC
Lightning impulse current (10/350 µs) - charge - specific energy	I_{imp} Q W/R	50 kA 25 As 600 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	50 kA	
Voltage protection level at I_{imp}	U_P	< 2 kV	< 2.5 kV
Temporary overvoltage (TOV)	U_T	462 V/5 s	690 V/5 s
Response time	t_A	< 100 ns	
Follow current interrupting rating at U_C	I_{fi}	3 kA_{rms}	
Max. back-up fuse		500 A gL/gG	
Short-circuit withstand capability at max. back-up fuse	I_P	25 kA_{rms}	
LPZ		0-1	
Protection type		IP20	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section of the connected conductors (solid) Cross-section of the connected conductors (wire)		16 mm²(min.) - 35 mm²(max.) 16 mm²(min.) - 25 mm²(max.)	
Mounting on		DIN rail 35 mm	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

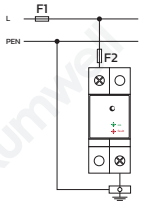


Internal configuration

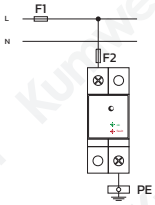


Network connections

TN-C



TT



CLASS I (TYPE 1)
LIGHTNING ARRESTER
TOTAL CURRENT SPARK GAP

Kumwell KZ01.I100.NPE and KZ01.I110.NPE are the total current spark gaps class I according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 (according to IEC 62305), where they provide the equipotential bonding and discharge of both, the lightning current and switching surge, which are generated in power supply systems entering the building. The lightning arresters are constructed as the encapsulated, non-exhaust, multiple spark gaps, they are intended for use in TN-S and TT systems. KZ01.I100.NPE and KZ01.I110.NPE are to be installed only between N and PE in modification of 3+1 or 1+1



LPZ 0 → 1

IP 20

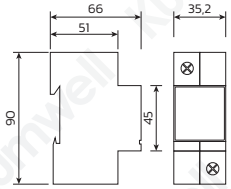
KZ01.IXXX.NPE

- Installed between N-PE
- Lightning impulse current: I_{imp} (kA)
- Lightning protection zone: LPZ 0-1

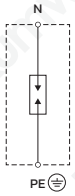
Total current spark gap / Class I / N-PE

Technical data		KZ01.I100.NPE	KZ01.I110.NPE
Test class according to IEC 61643-11		CLASS I	
Nominal voltage	U_N	230 V AC	
Max. continuous operating voltage	U_C	350 V AC	
Lightning impulse current (10/350 µs)	I_{imp}	100 kA	110 kA
- charge	Q	50 As	55 As
- specific energy	W/R	2500 kJ/Ω	3000 kJ/Ω
Nominal discharge current (8/20 µs)	I_n	75 kA	
Voltage protection level at I_{imp}	U_P	< 2 kV	
Temporary overvoltage (TOV)	U_T	1200 V/0.2 s	
Response time	t_A	< 100 ns	
Follow current interrupting rating at U_C	I_{fi}	100 A_{rms}	
LPZ		0-1	
Protection type		IP20	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section of the connected conductors (solid)		16 mm²(min.) - 35 mm²(max.)	
Cross-section of the connected conductors (wire)		16 mm²(min.) - 25 mm²(max.)	
Mounting on		DIN rail 35 mm	

Dimensions



Internal configuration



Kumwell

CLASS I (TYPE 1)
LIGHTNING ARRESTER
1-PHASE TN-S AND TT SYSTEM

Kumwell KZ01.*.ds-1/1 are a lightning arresters class I according to IEC 61643-11. These are recommended for use in Lightning Protection Zone Concept at the boundaries of LPZ 0-1 (according to IEC 62305).

KZ01.*.ds-1/1 can be used in industrial installations such as substations, main switchboards of large industrial structures and also places with high risk of a direct lightning strikes occurrence.

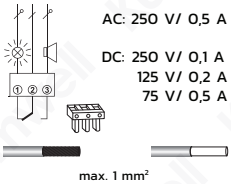
These arresters are combine with KZ01.*.NPE which is recommended to install between N and PE for TN-S and TT systems.

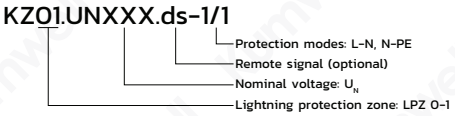








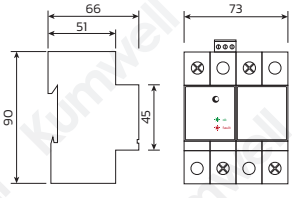




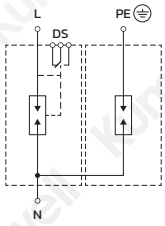
Spark gap / Class I / Single-Phase for TN-S and TT System

Technical data		KZ01.UN230.ds-1/1	KZ01.UN400.ds-1/1
Test class according to IEC 61643-11		CLASS I	
Nominal voltage	U_N	230 V AC	400 V AC
Max. continuous operating voltage	U_C	350 V AC	440 V AC
Lightning impulse current (10/350 µs) L/N - charge - specific energy	I_{imp} Q W/R	50 kA 25 As 600 kJ/Ω	
Lightning impulse current (10/350 µs) N/PE - charge - specific energy	I_{imp} Q W/R	100 kA 50 As 2500 kJ/Ω	
Total lightning impulse current (10/350 µs) L+N → PE	I_{total}	100 kA	
Nominal discharge current (8/20 µs)	I_n	50 kA	
Voltage protection level at I_{imp} (L/N) Voltage protection level at I_{imp} (N/PE)	U_P	< 2 kV < 1.3 kV	< 2.5 kV
Sparkover voltage 1.2/50 µs (N-PE)		< 1.5 kV	
Temporary overvoltage (TOV) L/N Temporary overvoltage (TOV) N/PE	U_T	462 V/5 s 1200 V/ 0.2 s	690 V/5 s
Response time	t_A	< 100 ns	
Follow current interrupting rating at U_C (L/N) Follow current interrupting rating at U_C (N/PE)	I_{fi}	3 kA_{rms} 100 A_{rms}	
Max. back-up fuse		500 A gL/gG	
Short-circuit withstand capability at max. back-up fuse	I_P	25 kA_{rms}	
LPZ		0-1	
Protection type		IP20	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section of the connected conductors (solid) Cross-section of the connected conductors (wire)		16 mm²(min.) - 35 mm²(max.) 16 mm²(min.) - 25 mm²(max.)	
Mounting on		DIN rail 35 mm	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

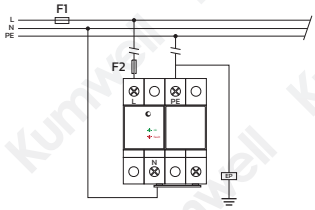


Internal configuration



Network connections

TN-S, TT



CLASS I (TYPE 1)
LIGHTNING ARRESTER
3-PHASE TN-C SYSTEM

Kumwell KZ01.*.ds-3/0 are a lightning arresters class I according to IEC 61643-11. These are recommended for use in the Lightning Protection Zone Concept at the boundaries of LPZ 0-1 (according to IEC 62305).

KZ01.*.ds-3/0 can be used in industrial installations such as substations, main switchboards of large industrial structures and also places with high risk of a direct lightning strikes occurrence.

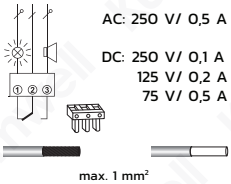
These arresters are intended for use in TN-C power supply system.

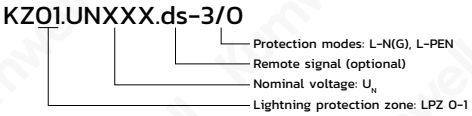








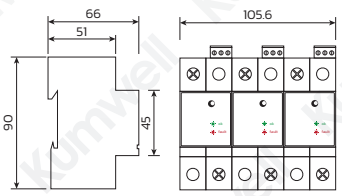




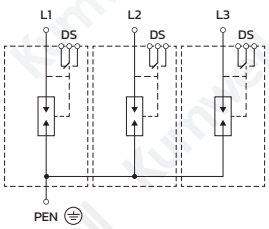
Spark gap / Class I / Three-Phase for TN-C System

Technical data		KZ01.UN230.ds-3/0	KZ01.UN400.ds-3/0
Test class according to IEC 61643-11		CLASS I	
Nominal voltage	U_N	230/400 V AC	400/690 V AC
Max. continuous operating voltage	U_C	350 V AC	440 V AC
Lightning impulse current (10/350 µs) - charge - specific energy	I_{imp} Q W/R	50 kA 25 As 600 kJ/Ω	
Total lightning impulse current (10/350 µs) L1+L2+L3 → PEN	I_{total}	150 kA	
Nominal discharge current (8/20 µs)	I_n	50 kA	
Voltage protection level at I_{imp}	U_P	< 2 kV	< 2.5 kV
Temporary overvoltage (TOV)	U_T	462 V/5 s	690 V/5 s
Response time	t_A	< 100 ns	
Follow current interrupting rating at U_C	I_{fi}	3 kA_{rms}	
Max. back-up fuse		500 A gL/gG	
Short-circuit withstand capability at max. back-up fuse	I_P	25 kA_{rms}	
LPZ		0-1	
Protection type		IP20	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section of the connected conductors (solid) Cross-section of the connected conductors (wire)		16 mm²(min.) - 35 mm²(max.) 16 mm²(min.) - 25 mm²(max.)	
Mounting on		DIN rail 35 mm	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

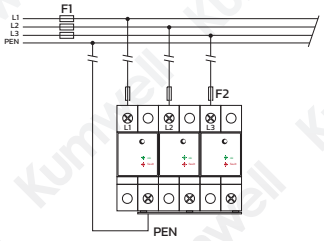


Internal configuration



Network connections

TN-C



Kumwell

CLASS I (TYPE 1)
LIGHTNING ARRESTERS
3-PHASE TN-S AND TT SYSTEM

Kumwell KZ01.*.ds-3/1 are a lightning arresters class I according to IEC 61643-11. These are recommended for use in Lightning Protection Zone Concept at the boundaries of LPZ 0-1 (according to IEC 62305).

KZ01.*.ds-3/1 can be used in industrial installations such as substations, main switchboards of large industrial structures and also places with high risk of a direct lightning strikes occurrence.

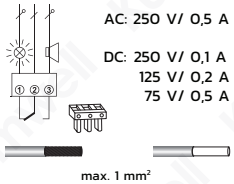
These arresters are combine with KZ01.*.NPE which is recommended to install between N and PE for TN-S and TT systems.



LPZ 0→1

IP 20

DS



AC: 250 V/ 0,5 A

DC: 250 V/ 0,1 A
125 V/ 0,2 A
75 V/ 0,5 A

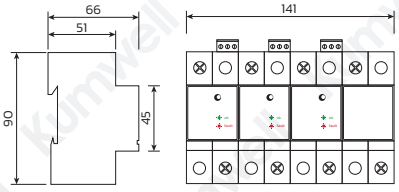
KZ01.UNXXX.ds-3/1

- Protection modes: L-N, N-PE
- Remote signal (optional)
- Nominal voltage: U_N
- Lightning protection zone: LPZ 0-1

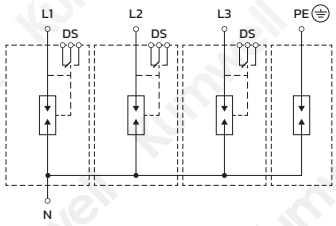
Spark gap / Class I / Three-Phase for TN-S and TT System

Technical data		KZ01.UN230.ds-3/1	KZ01.UN400.ds-3/1
Test class according to IEC 61643-11		CLASS I	
Nominal voltage	U_N	230/400 V AC	400/690 V AC
Max. continuous operating voltage	U_C	350 V AC	440 V AC
Lightning impulse current (10/350 µs) L/N - charge - specific energy	I_{imp} Q W/R	50 kA 25 As 600 kJ/Ω	
Lightning impulse current (10/350 µs) N/PE - charge - specific energy	I_{imp} Q W/R	100 kA 50 As 2500 kJ/Ω	
Total lightning impulse current (10/350) L1+L2+L3+N → PE	I_{total}	100 kA	
Nominal discharge current (8/20 µs)	I_n	50 kA	
Voltage protection level at I_{imp} (L/N) Voltage protection level at I_{imp} (N/PE)	U_P	< 2 kV < 1.3 kV	< 2.5 kV
Sparkover voltage 1.2/50 µs (N-PE)		< 1.5 kV	
Temporary overvoltage (TOV) L/N Temporary overvoltage (TOV) N/PE	U_T	462 V/5 s 1200 V/ 0.2 s	690 V/5 s
Response time	t_A	< 100 ns	
Follow current interrupting rating at U_C (L/N) Follow current interrupting rating at U_C (N/PE)	I_{fi}	3 kA_{rms} 100 A_{rms}	
Max. back-up fuse		500 A gL/gG	
Short-circuit withstand capability at max. back-up fuse	I_P	25 kA_{rms}	
LPZ		0-1	
Protection type		IP20	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section of the connected conductors (solid) Cross-section of the connected conductors (wire)		16 mm²(min.) - 35 mm²(max.) 16 mm²(min.) - 25 mm²(max.)	
Mounting on		DIN rail 35 mm	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

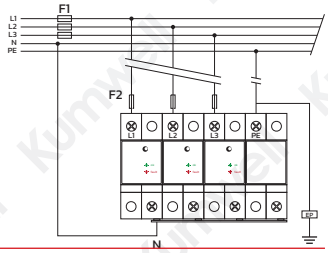


Internal configuration



Network connections

TN-S, TT



2 Surge Protection Class I+II Spark Gap for AC Power Systems KBG25 Series

Kumwell

CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP
1-PHASE TN-S, TN-C and TT SYSTEM

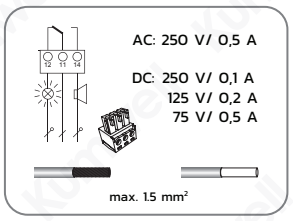
Kumwell KBG25 1P series is a class I+II SPD with Triggered Spark Gap (TSG) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.



The use of KBG25 1P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S, TN-C and TT (only L-N) system.

LPZ 0 → 1

IP 20

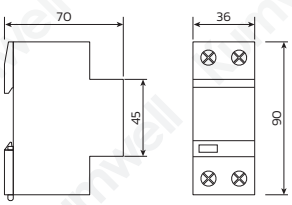


KBG25-XXXR-1P
- Protection modes: L/N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

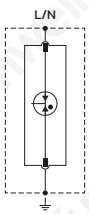
Triggered spark gap / Class I+II / Single-Phase for TN-S, TN-C and TT system

Technical data		KBG25-275R-1P	KBG25-320R-1P
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	25 kA	
Charge	Q	12.5 As	
Specific energy	W/R	156 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	25 kA	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Voltage protection level	U_P	≤ 1.8 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	440 V / 120 min - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

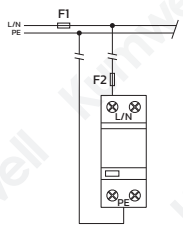
Dimensions



Internal configuration



Network connections



CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / SPARK GAP + GDT
1-PHASE TN-S AND TT SYSTEM

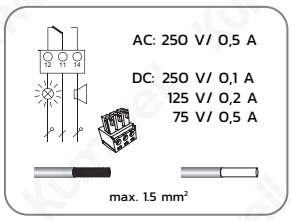
Kumwell KBG25 1PN series is a class I+II Triggered Spark Gap (TSG) combined with gas discharge tube (GDT) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide 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 use of KBG25 1PN series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S and TT system.



LPZ 0 → 1

IP 20



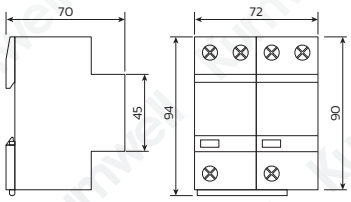
KBG25-XXXR-1PN

- Protection modes: L-N, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

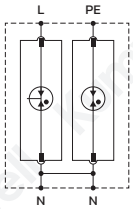
Triggered spark gap + GDT / Class I+II / Single-Phase for TN-S and TT system

Technical data		KBG25-275R-1PN	KBG25-320R-1PN
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230 V AC	
Max. continuous operating voltage	U_C (L-N/N-PE)	275 V AC/ 255 V AC	320 V AC/ 255 V AC
Lightning impulse current (10/350 µs)	I_{imp} (L-N/N-PE)	25 kA / 50 kA	
Charge	Q	12.5 As, 25 As	
Specific energy	W/R	156 kJ/Ω, 625 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n (L-N/N-PE)	25 kA / 50 kA	
Max. discharge current (8/20 µs)	I_{max} (L-N/N-PE)	100 kA / 100 kA	
Voltage protection level	U_P (L-N/N-PE)	≤ 1.8 kV / ≤ 1.5 kV	
Short-circuit current rating a.c.	I_{sccr} (L-N/N-PE)	25 kA_{rms} / 100 A_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV (L-N)	U_T	440 V / 120 min - withstand	
Temporary overvoltage TOV (N-PE)	U_T	1200 V / 200 ms - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm²(min.) - 35 mm²(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

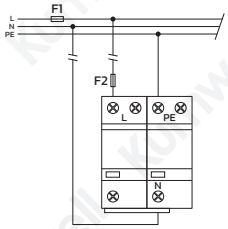


Internal configuration

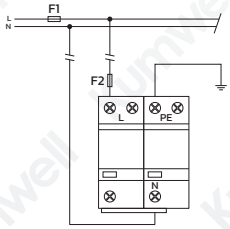


Network connections

TN-S



TT



Kumwell

CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP
1-PHASE TN-S SYSTEM

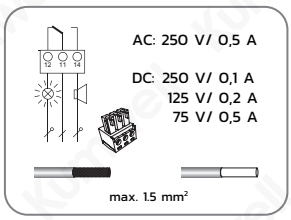
Kumwell KBG25 2P series is a class I+II SPD with Triggered Spark Gap (TSG) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.

The use of KBG25 2P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S system.



LPZ 0 → 1

IP 20

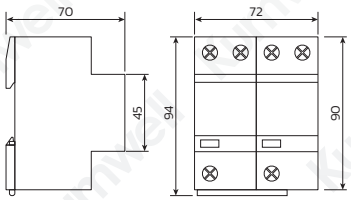


KBG25-XXXR-2P
- Protection modes: L-PE, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

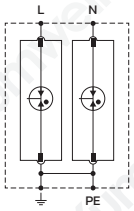
Triggered spark gap / Class I+II / Single-Phase for TN-S system

Technical data		KBG25-275R-2P	KBG25-320R-2P
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	25 kA	
Charge	Q	12.5 As	
Specific energy	W/R	156 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	25 kA	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Voltage protection level	U_P	≤ 1.8 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	440 V / 120 min - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

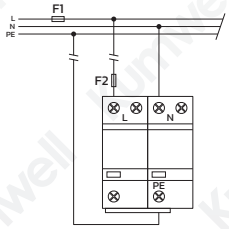


Internal configuration



Network connections

TN-S



CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP
3-PHASE TN-C SYSTEM

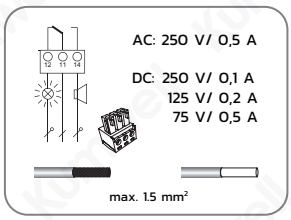
Kumwell KBG25 3P series is a class I+II SPD with Triggered Spark Gap (TSG) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.



The use of KBG25 3P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-C system.

LPZ 0 → 1

IP 20



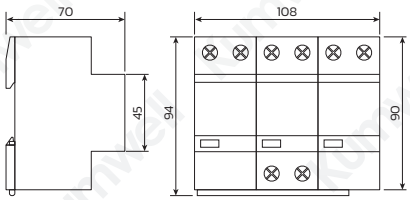
KBG25-XXXR-3P

- Protection modes: L-PEN
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

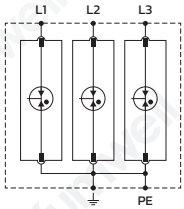
Triggered spark gap / Class I+II / Three-Phase for TN-C system

Technical data		KBG25-275R-3P	KBG25-320R-3P
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230/400 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	25 kA	
Charge	Q	12.5 As	
Specific energy	W/R	156 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	25 kA	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Voltage protection level	U_P	≤ 1.8 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	440 V / 120 min - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

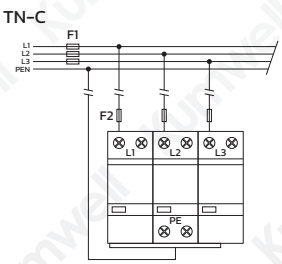
Dimensions



Internal configuration



Network connections



Kumwell

CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP + GDT
3-PHASE TN-S and TT SYSTEM

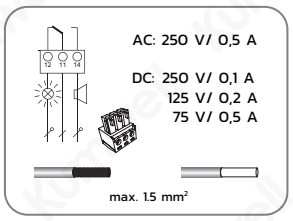
Kumwell KBG25 3PN series is a class I+II SPD with Triggered Spark Gap (TSG) combined with gas discharge tube (GDT) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide 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 use of KBG25 3PN series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S and TT system.

LPZ 0 → 1

IP 20



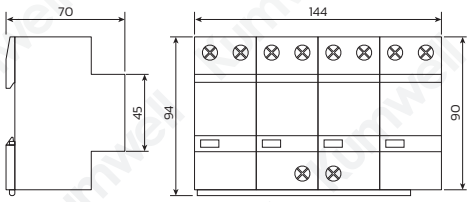
KBG25-XXXR-3PN

- Protection modes: L-N, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

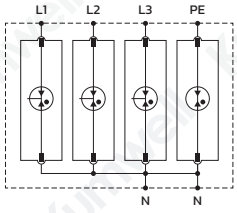
Triggered spark gap + GDT / Class I+II / Three Phase for TN-S and TT system

Technical data		KBG25-275R-3PN	KBG25-320R-3PN
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230/400 V AC	
Max. continuous operating voltage	U_C (L-N/N-PE)	275 V AC/ 255 V AC	320 V AC/ 255 V AC
Lightning impulse current (10/350 µs)	I_{imp} (L-N/N-PE)	25 kA / 100 kA	
Charge	Q	12.5 As, 50 As	
Specific energy	W/R	156 kJ/Ω, 2500 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n (L-N/N-PE)	25 kA / 100 kA	
Max. discharge current (8/20 µs)	I_{max} (L-N/N-PE)	100 kA / 200 kA	
Voltage protection level	U_P (L-N/N-PE)	≤ 1.8 kV / ≤ 1.5 kV	
Short-circuit current rating a.c.	I_{sccr} (L-N/N-PE)	25 kA_{rms} / 100 A_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV (L-N)	U_T	440 V / 120 min - withstand	
Temporary overvoltage TOV (N-PE)	U_T	1200 V / 200 ms - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm²(min.) - 35 mm²(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

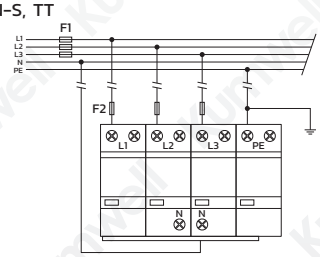


Internal configuration



Network connections

TN-S, TT



CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP
3-PHASE TN-S SYSTEM

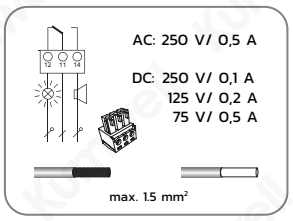
Kumwell KBG25 4P series is a class I+II SPD with Triggered Spark Gap (TSG) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.



The use of KBG25 4P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S system.

LPZ 0 → 1

IP 20



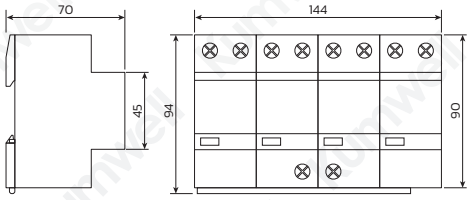
KBG25-XXXR-4P

- Protection modes: L-PE, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

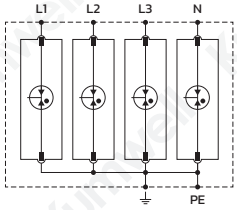
Triggered spark gap / Class I+II / Three Phase for TN-S system

Technical data		KBG25-275R-4P	KBG25-320R-4P
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230/400 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	25 kA	
Charge	Q	12.5 As	
Specific energy	W/R	156 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	25 kA	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Voltage protection level	U_P	≤ 1.8 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	440 V / 120 min - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

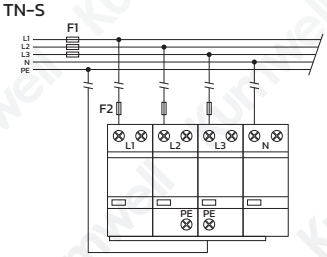


Internal configuration



Network connections

TN-S



Kumwell

3 Surge Protection Class I+II Spark Gap for AC Power Systems KBG50 Series

CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP
1-PHASE TN-S, TN-C AND TT SYSTEM

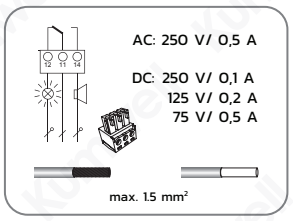
Kumwell KBG50 1P series is a class I+II SPD with Triggered Spark Gap (TSG) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.



The use of KBG50 1P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S, TN-C and TT (only L-N) system.

LPZ 0 → 1

IP 20



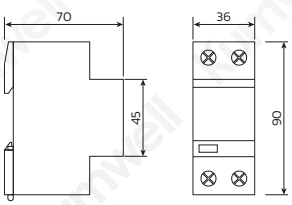
KBG50-XXXS-1P

- Protection modes: L-PEN
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

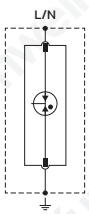
Triggered spark gap / Class I+II / Single-Phase for TN-S, TN-C and TT system

Technical data		KBG50-275S-1P	KBG50-320S-1P
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	50 kA	
Charge	Q	25 As	
Specific energy	W/R	625 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	50 kA	
Max. discharge current (8/20 µs)	I_{max}	200 kA	
Voltage protection level	U_P	≤ 1.8 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	440 V / 120 min - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

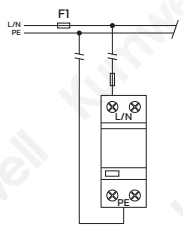
Dimensions



Internal configuration



Network connections



Kumwell

CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP + GDT
1-PHASE TN-S AND TT SYSTEM

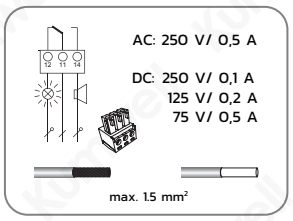
Kumwell KBG50 1PN series is a class I+II SPD with Triggered Spark Gap (TSG) combined with gas discharge tube (GDT) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide 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 use of KBG50 1PN series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S and TT system.

LPZ 0 → 1

IP 20



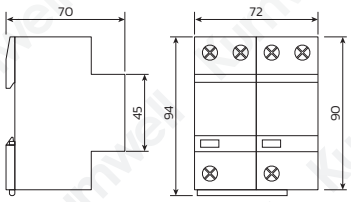
KBG50-XXXS-1PN

- Protection modes: L-N, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

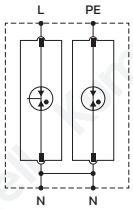
Triggered spark gap + GDT / Class I+II / Single-Phase for TN-S and TT system

Technical data		KBG50-275S-1PN	KBG50-320S-1PN
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230 V AC	
Max. continuous operating voltage	U_C (L-N/N-PE)	275 V AC/ 255 V AC	320 V AC/ 255 V AC
Lightning impulse current (10/350 µs)	I_{imp} (L-N/N-PE)	50 kA / 100 kA	
Charge	Q	25 As, 50 As	
Specific energy	W/R	625 kJ/Ω, 2500 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n (L-N/N-PE)	50 kA / 100 kA	
Max. discharge current (8/20 µs)	I_{max} (L-N/N-PE)	200 kA / 200 kA	
Voltage protection level	U_P (L-N/N-PE)	≤ 1.8 kV / ≤ 1.5 kV	
Short-circuit current rating a.c.	I_{sccr} (L-N/N-PE)	25 kA_{rms} / 100 A_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV (L-N)	U_T	440 V / 120 min - withstand	
Temporary overvoltage TOV (N-PE)	U_T	1200 V / 200 ms - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm²(min.) - 35 mm²(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

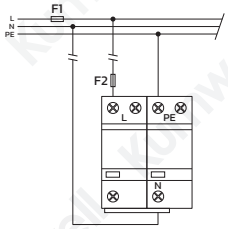


Internal configuration

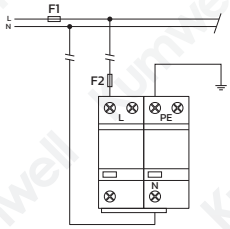


Network connections

TN-S



TT



CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP
3-PHASE TN-C SYSTEM

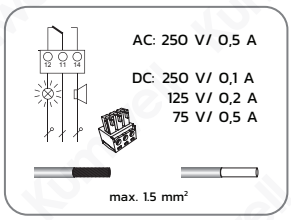
Kumwell KBG50 3P series is a class I+II SPD with Triggered Spark Gap (TSG) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.

The use of KBG50 3P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-C system.



LPZ 0 → 1

IP 20



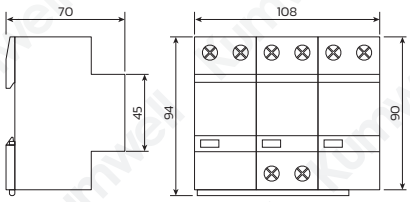
KBG50-XXXS-3P

- Protection modes: L-PEN
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

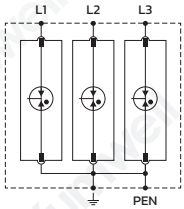
Triggered spark gap / Class I+II / Three-Phase for TN-C system

Technical data		KBG50-275S-3P	KBG50-320S-3P
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230/400 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	50 kA	
Charge	Q	25 As	
Specific energy	W/R	625 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	50 kA	
Max. discharge current (8/20 µs)	I_{max}	200 kA	
Voltage protection level	U_P	≤ 1.8 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	440 V / 120 min - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

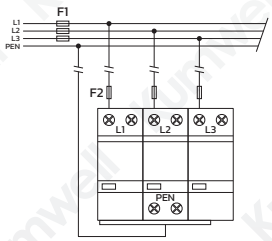
Dimensions



Internal configuration



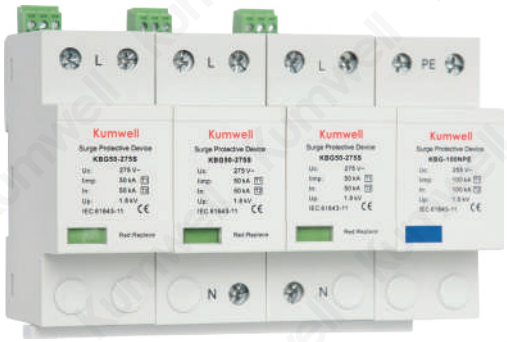
Network connections



Kumwell

CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP + GDT
3-PHASE TN-S and TT SYSTEM

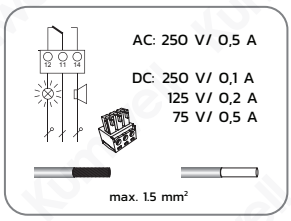
Kumwell KBG50 3PN series is a class I+II SPD with Triggered Spark Gap (TSG) combined with gas discharge tube (GDT) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide 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 use of KBG50 3PN series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S and TT system.

LPZ 0→1

IP 20



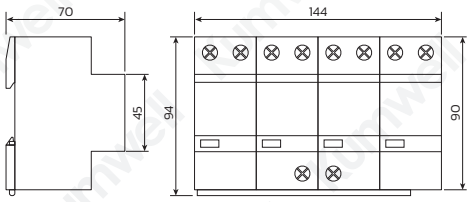
KBG50-XXXS-3PN

- Protection modes: L-N, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

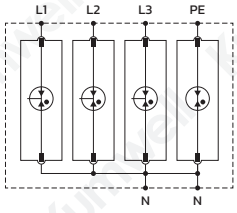
Triggered spark gap + GDT / Class I+II / Three Phase for TN-S and TT system

Technical data		KBG50-275S-3PN	KBG50-320S-3PN
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230/400 V AC	
Max. continuous operating voltage	U_C (L-N/N-PE)	275 V AC/ 255 V AC	320 V AC/ 255 V AC
Lightning impulse current (10/350 µs)	I_{imp} (L-N/N-PE)	50 kA / 100 kA	
Charge	Q	25 As, 50 As	
Specific energy	W/R	625 kJ/Ω, 2500 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n (L-N/N-PE)	50 kA / 100 kA	
Max. discharge current (8/20 µs)	I_{max} (L-N/N-PE)	200 kA / 200 kA	
Voltage protection level	U_P (L-N/N-PE)	≤ 1.8 kV / ≤ 1.5 kV	
Short-circuit current rating a.c.	I_{sccr} (L-N/N-PE)	25 kA_{rms} / 100 A_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV (L-N)	U_T	440 V / 120 min - withstand	
Temporary overvoltage TOV (N-PE)	U_T	1200 V / 200 ms - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm²(min.) - 35 mm²(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

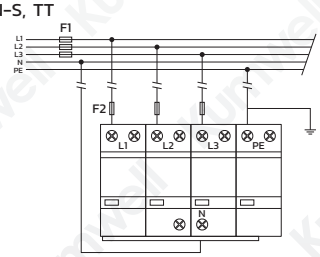


Internal configuration



Network connections

TN-S, TT



CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP
3-PHASE TN-S SYSTEM

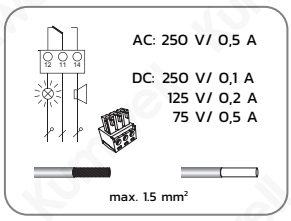
Kumwell KBG50 4P series is a class I+II SPD with Triggered Spark Gap (TSG) technology according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.



The use of KBG50 4P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S system.

LPZ 0 → 1

IP 20



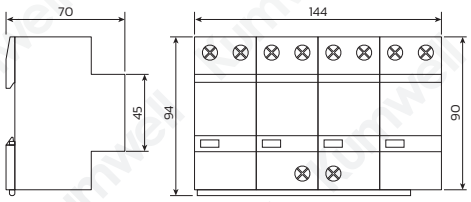
KBG50-XXXS-4P

- Protection modes: L-PE, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

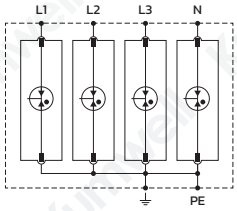
Triggered spark gap / Class I+II / Three Phase for TN-S system

Technical data		KBG50-275S-4P	KBG50-320S-4P
Test class according to IEC 61643-11		CLASS I+II	
Nominal voltage	U_N	230/400 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	50 kA	
Charge	Q	25 As	
Specific energy	W/R	625 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	50 kA	
Max. discharge current (8/20 µs)	I_{max}	200 kA	
Voltage protection level	U_P	≤ 1.8 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	440 V / 120 min - withstand	
Response time	t_A	≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

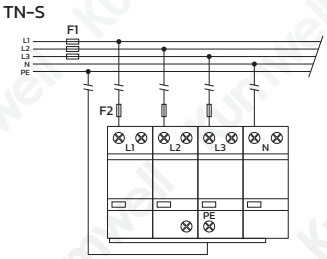


Internal configuration



Network connections

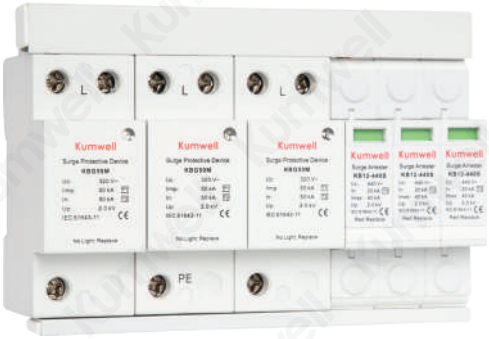
TN-S



4 Surge Protection Class I+II Spark Gap + Varistor for AC Power Systems KBG50M Series

CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP + VARISTOR
3-PHASE TN-C SYSTEM

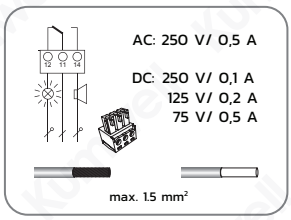
Kumwell KBG50M-UN230R-3P is a combined set class I+II SPD (Triggered Spark Gap (TSG) and MOV technology) according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.



The use of KBG50M-UN230R-3P is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-C system.





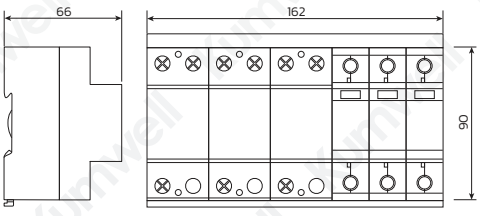


KBG50M-UN230R-3P
- Protection modes: L-PEN
- Lightning impulse current: I_{imp}

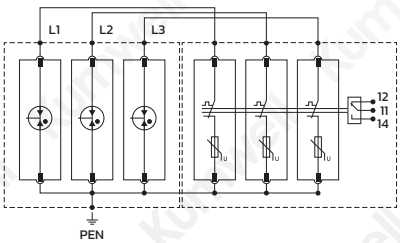
Triggered spark gap + MOV / Class I+II / Three Phase for TN-C system

Technical data		KBG50M-UN230R-3P
Test class according to IEC 61643-11		CLASS I+II
Nominal voltage	U_N	230/400 V AC
Max. continuous operating voltage	U_C	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	50 kA
Charge	Q	25 As
Specific energy	W/R	625 kJ/Ω
Nominal discharge current (8/20 µs)	I_n	20 kA
Max. discharge current (8/20 µs)	I_{max}	40 kA
Voltage protection level	U_P	≤ 2.0 kV
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}
Back-up fuse		160 A gL/gG
Temporary overvoltage TOV	U_T	462 V / 5s - withstand
Response time	t_A	≤ 25 ns
Operating temperature range		-40°C to +80°C
Cross-section area (min. - max.)		16 mm²(min.) - 35 mm²(max.)
Mounting		Din rail 35 mm
Enclosure material		Thermoplastic UL94 V-0
Degree of protection		IP20
Failure signalisation		SPD Class I: No Light - Failure SPD Class II: Green - OK / Red - Failure

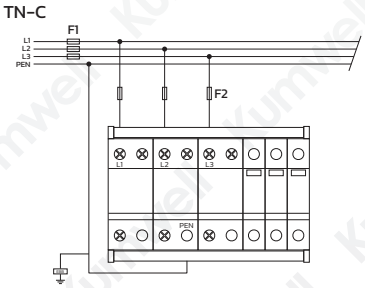
Dimensions



Internal configuration



Network connections



Kumwell

CLASS I+II (TYPE 1+2)
LIGHTNING AND SURGE ARRESTER / TRIGGERED SPARK GAP + VARISTOR AND GDT
3-PHASE TN-S AND TT SYSTEM

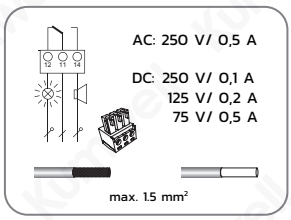
Kumwell KBG50M-UN230R-3PN is a combined set class I+II SPD (Triggered Spark Gap (TSG) + MOV and GDT technology) according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0-1 and higher zones according to IEC 62305, where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.

The use of KBG50M-UN230R-3PN is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S and TT system.



LPZ 0 → 1

IP 20

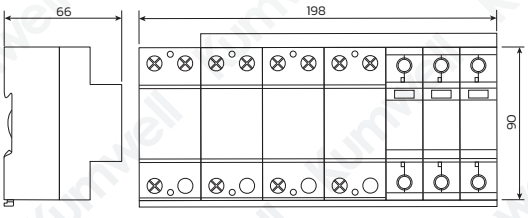


KBG50M-UN230R-3PN
- Protection modes: L-N, N-PE
- Lightning impulse current: I_{imp}

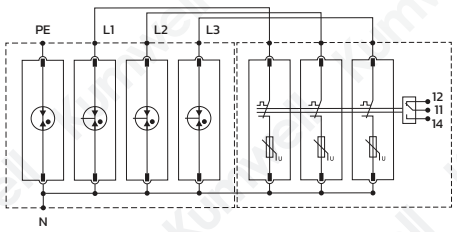
Triggered spark gap + MOV and GDT/ Class I+II / Three Phase for TN-S and TT system

Technical data		KBG50M-UN230R-3PN
Test class according to IEC 61643-11		CLASS I+II
Nominal voltage	U_N	230/400 V AC
Max. continuous operating voltage	U_C (L-N/N-PE)	320 V AC / 255 V AC
Lightning impulse current (10/350 µs)	I_{imp} (L-N/N-PE)	50 kA /100 kA
Charge (L-N, N-PE)	Q	25 As, 50 As
Specific energy (L-N, N-PE)	W/R	625 kJ/Ω, 2500 kJ/Ω
Nominal discharge current (8/20 µs)	I_n	20 kA
Max. discharge current (8/20 µs)	I_{max}	40 kA
Voltage protection level	U_P (L-N/N-PE)	≤ 2.0 kV / ≤ 1.5 kV
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}
Back-up fuse		160 A gL/gG
Temporary overvoltage TOV (L-N)	U_T	462 V / 5s - withstand
Temporary overvoltage TOV (N-PE)	U_T	1200 V / 200ms - withstand
Response time	t_A	≤ 25 ns
Operating temperature range		-40°C to +80°C
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)
Mounting		Din rail 35 mm
Enclosure material		Thermoplastic UL94 V-0
Degree of protection		IP20
Failure signalisation		SPD Class I: No Light - Failure SPD Class II: Green - OK / Red - Failure

Dimensions

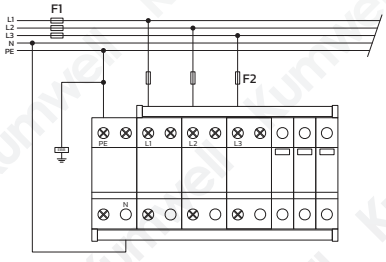


Internal configuration



Network connections

TN-S, TT



5 Surge Protection Class I+II+III Varistor, Varistor + GDT for AC Power Systems KBM25 Series

Kumwell

CLASS I+II+III (TYPE 1+2+3)
LIGHTNING AND SURGE ARRESTER / VARISTOR
1-PHASE TN-S, TN-C AND TT SYSTEM

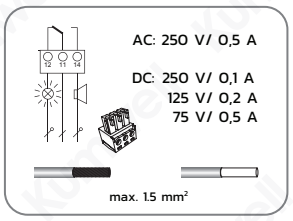
Kumwell KBM25 1P **series** is a metal oxide varistor lightning and surge arrester class I+II+III according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0 – LPZ 1 and higher zones (according to IEC 62305), where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.

The use of KBM25 1P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S, TN-C and TT (only L-N) system.



LPZ 0 → 1

IP 20



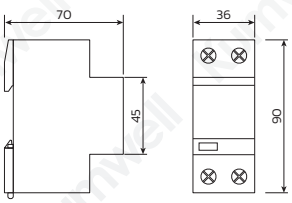
KBM25-XXXS-1P

- Protection modes: L/N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

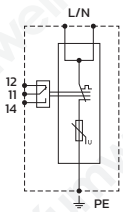
Varistor / Class I+II+III / Single-Phase for TN-S, TN-C and TT system

Technical data		KBM25-275S-1P	KBM25-320S-1P
Test class according to IEC 61643-11		CLASS I+II+III	
Nominal voltage	U_N	230 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	25 kA	
Charge	Q	12.5 As	
Specific energy	W/R	156 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	25 kA	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Voltage protection level	U_P	≤ 1.3 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	335 V / 5s - withstand	
Response time	t_A	≤ 25 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

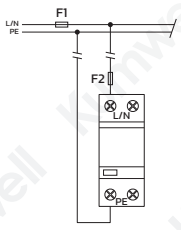
Dimensions



Internal configuration



Network connections



CLASS I+II+III (TYPE 1+2+3)
LIGHTNING AND SURGE ARRESTER / VARISTOR + GDT
1-PHASE TN-S AND TT SYSTEM

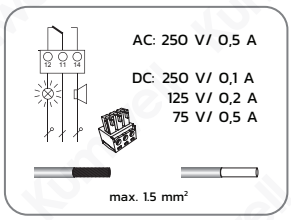
Kumwell KBM25 1PN **series** is a metal oxide varistor combined with gas discharge tube lightning and surge arrester class I+II+III according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0 – LPZ 1 and higher zones (according to IEC 62305), where they provide 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 use of KBM25 1PN series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S and TT system.



LPZ 0 → 1

IP 20



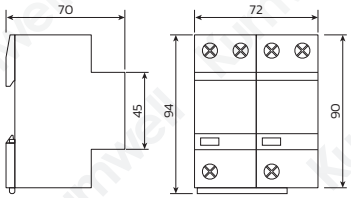
KBM25-XXXS-1PN

- Protection modes: L-N, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

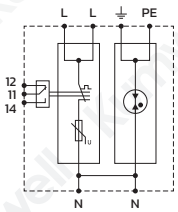
Varistor + GDT / Class I+II+III / Single-Phase for TN-S and TT System

Technical data		KBM25-275S-1PN	KBM25-320S-1PN
Test class according to IEC 61643-11		CLASS I+II+III	
Nominal voltage	U_N	230 V AC	
Max. continuous operating voltage	U_C (L-N/N-PE)	275 V AC/ 255 V AC	320 V AC/ 255 V AC
Lightning impulse current (10/350 µs)	I_{imp} (L-N/N-PE)	25 kA / 50 kA	
Charge	Q	12.5 As, 25 As	
Specific energy	W/R	156 kJ/Ω, 625 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n (L-N/N-PE)	25 kA / 50 kA	
Max. discharge current (8/20 µs)	I_{max} (L-N/N-PE)	100 kA / 100 kA	
Voltage protection level	U_P (L-N/N-PE)	≤ 1.3 kV / ≤ 1.5 kV	
Short-circuit current rating a.c.	I_{sccr} (L-N/N-PE)	25 kA_{rms} / 100 A_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV (L-N)	U_T	335 V / 5s - withstand	
Temporary overvoltage TOV (N-PE)	U_T	1200 V / 200 ms - withstand	
Response time	t_A	≤ 25 ns / ≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm²(min.) - 35 mm²(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

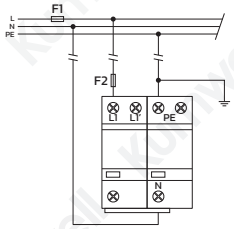


Internal configuration

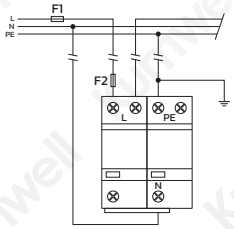


Network connections

TN-S, TT



TN-S, TT "V" connection



Kumwell

CLASS I+II+III (TYPE 1+2+3)
LIGHTNING AND SURGE ARRESTER / VARISTOR
1-PHASE TN-S SYSTEM

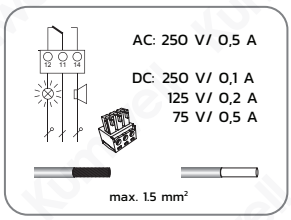
Kumwell KBM25 2P **series** is a metal oxide varistor lightning and surge arrester class I+II+III according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0 – LPZ 1 and higher zones (according to IEC 62305), where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.

The use of KBM25 2P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S system.



LPZ 0 → 1

IP 20

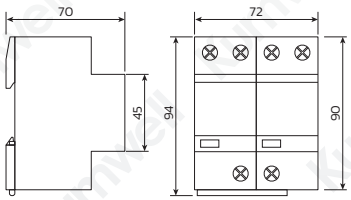


KBM25-XXXS-2P
- Protection modes: L-PE, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

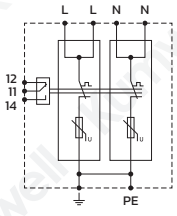
Varistor / Class I+II+III / Single-Phase for TN-S System

Technical data		KBM25-275S-2P	KBM25-320S-2P
Test class according to IEC 61643-11		CLASS I+II+III	
Nominal voltage	U_N	230 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	25 kA	
Charge	Q	12.5 As	
Specific energy	W/R	156 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	25 kA	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Voltage protection level	U_P	≤ 1.3 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	335 V / 5s - withstand	
Response time	t_A	≤ 25 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

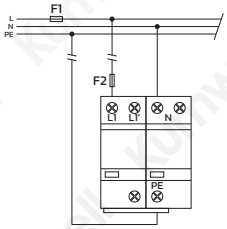


Internal configuration

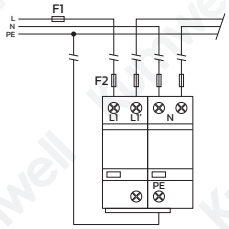


Network connections

TN-S



TN-S "V" connection



CLASS I+II+III (TYPE 1+2+3)
LIGHTNING AND SURGE ARRESTER / VARISTOR
3-PHASE TN-C SYSTEM

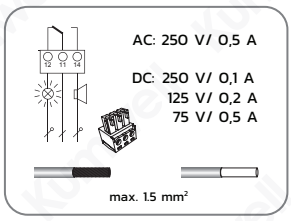
Kumwell KBM25 3P series is a metal oxide varistor lightning and surge arrester class I+II+III according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0–1 and higher zones (according to IEC 62305), where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.

The use of KBM25 3P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-C system.



LPZ 0 → 1

IP 20

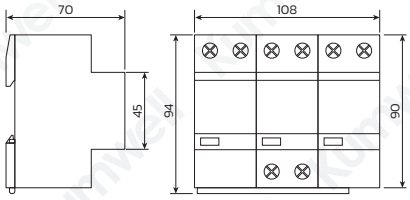


KBM25-XXXS-3P
- Protection modes: L-PEN
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

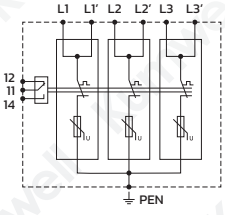
Varistor/ Class I+II+III / Three-Phase for TN-C System

Technical data		KBM25-275S-3P	KBM25-320S-3P
Test class according to IEC 61643-11		CLASS I+II+III	
Nominal voltage	U_N	230/400 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	25 kA	
Charge	Q	12.5 As	
Specific energy	W/R	156 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	25 kA	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Voltage protection level	U_P	≤ 1.3 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	335 V / 5 sec - withstand	
Response time	t_A	≤ 25 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

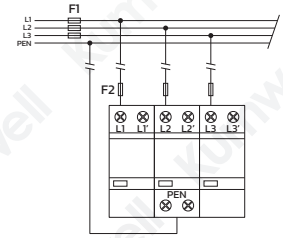


Internal configuration

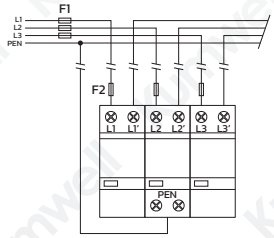


Network connections

TN-C



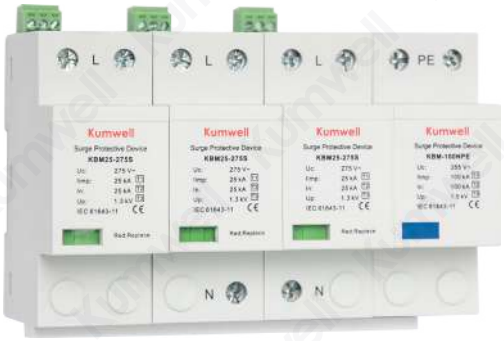
TN-C "V" connection



Kumwell

CLASS I+II+III (TYPE 1+2+3)
LIGHTNING AND SURGE ARRESTER / VARISTOR + GDT
3-PHASE TN-S and TT SYSTEM

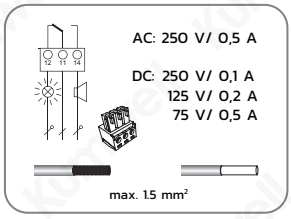
Kumwell KBM25 3PN **series** is a metal oxide varistor combined with gas discharge tube lightning and surge arrester, combined with gas discharge tube class I+II+III according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0–1 and higher zones (according to IEC 62305), where they provide 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 use of KBM25 3PN series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S and TT system.

LPZ 0 → 1

IP 20

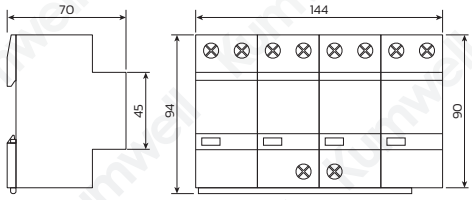


KBM25-XXXS-3PN
- Protection modes: L-N, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

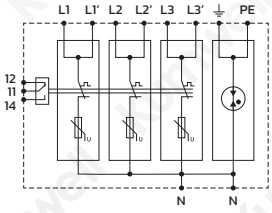
Varistor + GDT / Class I+II+III / Three-Phase for TN-S and TT System

Technical data		KBM25-275S-3PN	KBM25-320S-3PN
Test class according to IEC 61643-11		CLASS I+II+III	
Nominal voltage	U_N	230/400 V AC	
Max. continuous operating voltage	U_C (L-N/N-PE)	275 V AC / 255 V AC	320 V AC/ 255 V AC
Lightning impulse current (10/350 µs)	I_{imp} (L-N/N-PE)	25 kA / 100kA	
Charge	Q	12.5 As, 50 As	
Specific energy	W/R	156 kJ/Ω, 2500 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n (L-N/N-PE)	25 kA / 100 kA	
Max. discharge current (8/20 µs)	I_{max} (L-N/N-PE)	100 kA / 160 kA	
Voltage protection level	U_p (L-N/N-PE)	≤ 1.3 kV / ≤ 1.5 kV	
Short-circuit current rating a.c.	I_{sccr} (L-N/N-PE)	25 kA_{rms} / 100 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV (L-N)	U_T	335 V / 5 sec - withstand	
Temporary overvoltage TOV (N-PE)	U_T	1200 V / 200 ms - withstand	
Response time	t_A	≤ 25 ns / ≤ 100 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm²(min.) - 35 mm²(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

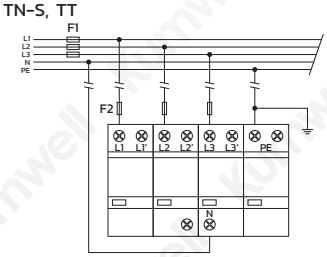


Internal configuration

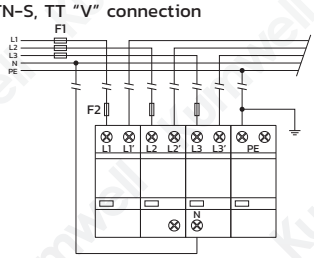


Network connections

TN-S, TT



TN-S, TT "V" connection



CLASS I+II+III (TYPE 1+2+3)
LIGHTNING AND SURGE ARRESTER / VARISTOR
3-PHASE TN-S SYSTEM

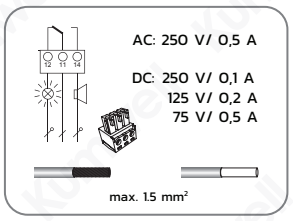
Kumwell KBM25 4P series is a metal oxide varistor lightning and surge arrester class I+II+III according to IEC 61643-11. These are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 0–1 and higher zones (according to IEC 62305), where they provide the equipotential bonding and discharge of both, the lightning current and the switching surge, which are generated in power supply systems entering the building.



The use of KBM25 4P series is mainly used in the power supply lines, industrial installations such as substation, main switchboards of large industrial structures and also place with high risk of a direct lightning strike occurrence. This device is intended for use in TN-S system.

LPZ 0 → 1

IP 20



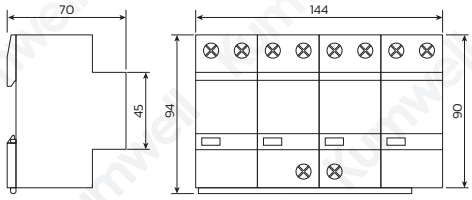
KBM25-XXXS-4P

- Protection modes: L-PE, N-PE
- Max. continuous operating voltage: U_c
- Lightning impulse current: I_{imp}

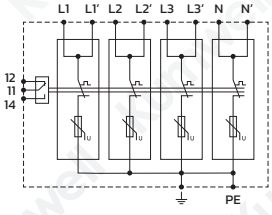
Varistor/ Class I+II+III / Three-Phase for TN-S System

Technical data		KBM25-275S-4P	KBM25-320S-4P
Test class according to IEC 61643-11		CLASS I+II+III	
Nominal voltage	U_N	230/400 V AC	
Max. continuous operating voltage	U_C	275 V AC	320 V AC
Lightning impulse current (10/350 µs)	I_{imp}	25 kA	
Charge	Q	12.5 As	
Specific energy	W/R	156 kJ/Ω	
Nominal discharge current (8/20 µs)	I_n	25 kA	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Voltage protection level	U_P	≤ 1.3 kV	
Short-circuit current rating a.c.	I_{sccr}	25 kA_{rms}	
Max. back-up fuse (Branch wiring)		315 A gL/gG	
Max. back-up fuse ("V" connection)		125 A gL/gG	
Temporary overvoltage TOV	U_T	335 V / 5 sec - withstand	
Response time	t_A	≤ 25 ns	
Operating temperature range	ϑ	-40°C to +80°C	
Cross-section area (min. - max.)		16 mm^2(min.) - 35 mm^2(max.)	
Mounting		Din rail 35 mm	
Enclosure material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Failure signalisation		Green - OK / Red - Failure	

Dimensions

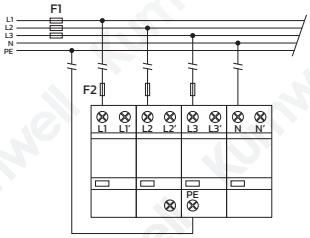


Internal configuration

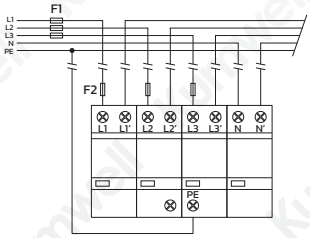


Network connections

TN-S



TN-S "V" connection



Kumwell

6 Surge Protection Class I, II with TOV Immunity feature Varistor, Varistor+GDT for AC Power Systems KSB.BR25 Series

CLASS I, II (TYPE 1, 2)
HIGH TOV IMMUNITY HIGH ENERGY MOV AND GDT
1 PHASE NETWORK SYSTEM (1PH+N)

Kumwell KSB.BR25 **series** of overvoltage surge protective device have been apply to protect against partial direct and indirect lightning discharges and are intended to provide protection in zone O_A-2 according to IEC 62305

KSB.BR25* SPD is used in industrial installations such as transformers, the main switchboards of large industrial buildings. It is also suitable for applications in unmeasured parts of electrical installation and all in one protection from overvoltages, surges and transients in accordance to IEC/EN 61643-11

Network System: TT, TN-S

Protection mode: L-N, N-PE

Feature: High TOV Immunity

Leakage current: No leakage current

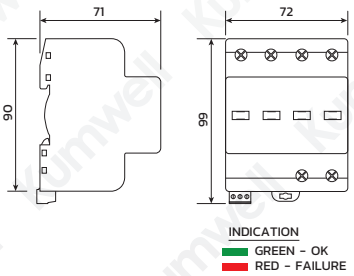
Complies with: IEC/EN 61643-11



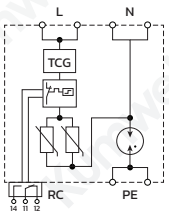
High energy MOV and GDT

Technical data		KSB.BR25-U275.ds-1/1	KSB.BR25-U440.ds-1/1
Max. continuous operating voltage	U_C (L-N) U_C (N-PE)	275 V AC 255 V AC	440 V AC
Nominal discharge current (8/20 µs)	I_n (L-N/N-PE)	25 kA/50 kA	
Max. discharge current (8/20 µs)	I_{max} (L-N/N-PE)	100 kA/100 kA	
Lightning impulse current (10/350 µs)	I_{imp} (L-N/N-PE)	25 kA/50 kA	
Total lightning impulse current (10/350 µs)	I_{total}	50 kA	
Specific Energy	W/R(L-N/N-PE)	156 kJ/Ω / 625 kJ/Ω	
Charge	Q(L-N/N-PE)	12.5 As/25 As	
Voltage protection level	U_P (L-N) U_P (N-PE)	< 1.5 kV < 1.5 kV	< 1.9 kV
Follow current Interrupt Rating	I_{fi} (N-PE)	100 A_{rms}	
Response time	t_A (L-N/N-PE)	< 25 ns/< 100 ns	
Back-Up Fuse (if mains > 250 A)		250 A gL/gG	
Short-Circuit Current Rating (AC)	I_{SCCR}	50 kA	
TOV withstand 5 s TOV withstand 200 ms	U_T (L-N) U_T (N-PE)	438 V AC 1200 V / 300 A	585 V AC
Temperature range	ϑ	-40°C to +85°C	
Conductor Cross Section (max)		35mm² (Solid, Stranded) / 25mm² (Flexible)	
Mounting		DIN rail 35mm	
Degree of protection		IP20	
Housing Material		Thermoplastic: Extinguishing Degree UL 94 V-0	
Thermal Protection	(L-N)/(N-PE)	Yes/No	
Fault Indication	(L-N)/(N-PE)	Red flag/No	
Remote contact		Yes	

Dimensions



Internal configuration



Kumwell

CLASS I, II (TYPE 1, 2)
HIGH TOV IMMUNITY HIGH ENERGY MOV
3 PHASE NETWORK SYSTEM (3+0)

Kumwell KSB.BR25 **series** of overvoltage surge protective device have been apply to protect against partial direct and indirect lightning discharges and are intended to provide protection in zone O_A-2 according to IEC 62305

KSB.BR25 SPD is used in industrial installations such as transformers , the main switchboards of large industrial buildings. It is also suitable for applications in unmeasured parts of electrical installation and all in one protection from overvoltages, surges and transients in accordance to IEC/EN 61643-11

Network System: TN-C

Protection mode: L-PEN

Feature: High TOV Immunity

Leakage current: No leakage current

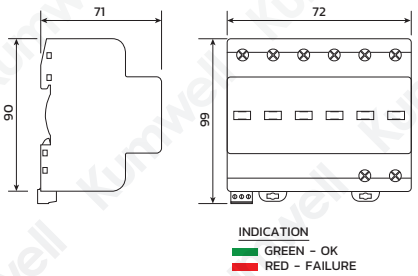
Complies with: IEC/EN 61643-11



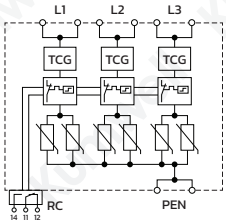
High Energy MOV and GDT

Technical data		KSB.BR25-U275.ds-3/0	KSB.BR25-U440.ds-3/0
Max. continuous operating voltage	U_C	275 V AC	440 V AC
Nominal discharge current (8/20 µs)	I_n	25 kA	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Lightning impulse current (10/350 µs)	I_{imp}	25 kA	
Total lightning impulse current (10/350 µs)	I_{total}	75 kA	
Specific Energy	W/R	156 kJ/Ω	
Charge	Q	12.5 As	
Voltage protection level	U_P	< 1.5 kV	< 1.9 kV
Response time	t_A	< 25 ns	
Back-Up Fuse (if mains > 250 A)		250 A gL/gG	
Short-Circuit Current Rating (AC)	I_{SCCR}	50 kA	
TOV withstand 5 s	U_T	438 V	585 V
Temperature range	ϑ	-40°C to +85°C	
Conductor Cross Section (max)		35mm² (Solid, Stranded) / 25mm² (Flexible)	
Mounting		DIN rail 35mm	
Degree of protection		IP20	
Housing material		Thermoplastic: Extinguishing Degree UL 94 V-0	
Thermal Protection		Yes	
Fault Indication		Red flag	
Remote contact		Yes	

Dimensions



Internal configuration



CLASS I, II (TYPE 1, 2)
HIGH TOV IMMUNITY HIGH ENERGY MOV
3 PHASE NETWORK SYSTEM (4+0)

Kumwell KSB.BR25 **series** of overvoltage surge protective device have been apply to protect against partial direct and indirect lightning discharges and are intended to provide protection in zone O_A-2 according to IEC 62305

KSB.BR25 SPD is used in industrial installations such as transformers, the main switchboards of large industrial buildings. It is also suitable for applications in unmeasured parts of electrical installation and all in one protection from overvoltages, surges and transients in accordance to IEC/EN 61643-11

Network System: TN-S

Protection mode: L-PE, N-PE

Safety: TOV immunity

Leakage current: No leakage current

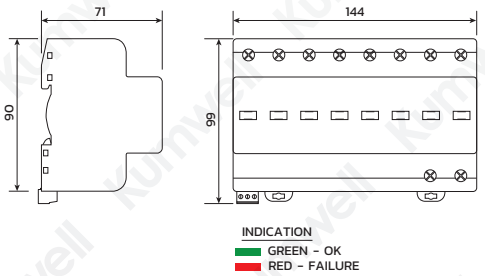
Complies with: IEC/EN 61643-11



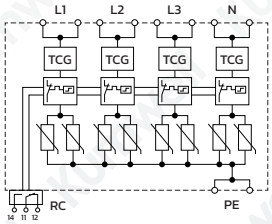
High Energy MOV and GDT

Technical data		KSB.BR25-U275.ds-4/0	KSB.BR25-U440.ds-4/0
Max. continuous operating voltage	U_C	275 V AC	440 V AC
Nominal discharge current (8/20 µs)	I_n	25 kA	
Max. discharge current (8/20 µs)	I_{max}	100 kA	
Lightning impulse current (10/350 µs)	I_{imp}	25 kA	
Total lightning impulse current (10/350 µs)	I_{total}	100 kA	
Specific Energy	W/R	156 kJ/Ω	
Charge	Q	12.5 As	
Voltage protection level	U_P	< 1.5 kV	< 1.9 kV
Response time	t_A	< 25 ns	
Back-Up Fuse (if mains > 250 A)		250 A gL/gG	
Short-Circuit Current Rating (AC)	I_{SCCR}	50 kA	
TOV withstand 5 s	U_T	438 V	585 V
Temperature range	ϑ	-40°C to +85°C	
Conductor Cross Section (max)		35mm² (Solid, Stranded) / 25mm² (Flexible)	
Mounting		DIN rail 35mm	
Degree of protection		IP20	
Housing material		Thermoplastic: Extinguishing Degree UL 94 V-0	
Thermal Protection		Yes	
Fault Indication		Red flag	
Remote contact		Yes	

Dimensions



Internal configuration



7 Surge Protection Class II+III for AC Power Systems

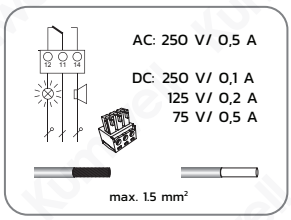
CLASS II+III (TYPE 2+3)
SURGE ARRESTER / VARISTOR
1-PHASE TN-S SYSTEM

Kumwell KBM40-275S-2P is a surge arrester class II+III (Type 2+3) according to 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 2-3 and higher zones according to standard IEC 62305:2010, i.e. into subsidiary switchboards and control boxes.



LPZ 2 → 3

IP 20

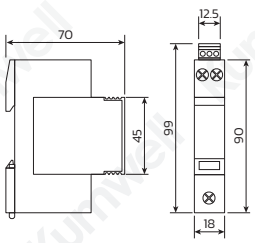


KBM40-275S-2P
- Protection modes: L-PE, N-PE
- Max. continuous operating voltage: U_c
- Max. discharge current: I_{max}

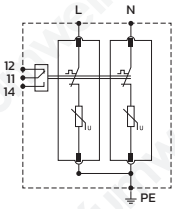
Varistor/ Class II+III/ Single-Phase for TN-S System

Technical data		KBM40-275S-2P
Test class according to IEC 61643-11		CLASS II+III
Nominal voltage	U_N	230 V AC
Max. continuous operating voltage	U_C	275 V AC
Nominal discharge current (8/20 µs)	I_n	20 kA
Max. discharge current (8/20 µs)	I_{max}	40 kA
Voltage protection level	U_P	≤ 1.3 kV
Voltage protection level at 5 kA	U_P	≤ 1.0 kV
Combined impulse	U_{OC}	10 kV
Max. back-up fuse		125 A gL/gG
Response time	t_A	≤ 25 ns
Operating temperature range	ϑ	-40°C to +80°C
Cross-section area (min. - max.)		2.5 mm²(min.) - 16 mm² (max.)
Mounting		DIN rail 35 mm
Enclosure material		Thermoplastic UL94 V-0
Degree of protection		IP20
Failure signalisation		Green - OK / Red - Failure

Dimensions

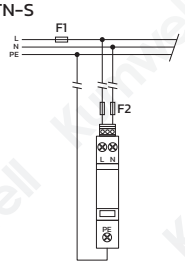


Internal configuration



Network connections

TN-S



Kumwell

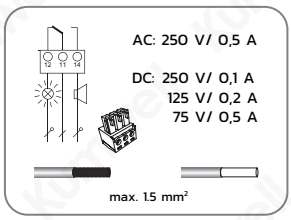
CLASS II+III (TYPE 2+3)
SURGE ARRESTER / VARISTOR
3-PHASE TN-S SYSTEM

Kumwell KBM40-275S-4P is a surge arrester class II+III (Type 2+3) according to 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 2-3 and higher zones according to standard 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.



LPZ 2 → 3

IP 20

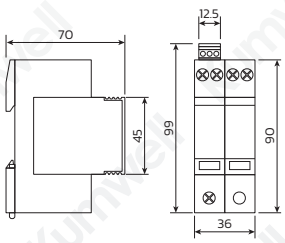


KBM40-275S-4P
- Protection modes: L-PE, N-PE
- Max. continuous operating voltage: U_c
- Max. discharge current: I_{max}

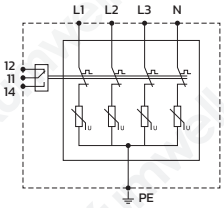
Varistor/ Class II+III/ Three Phase for TN-S System

Technical data		KBM40-275S-4P
Test class according to IEC 61643-11		CLASS II+III
Nominal voltage	U_N	230 V / 400 V AC
Max. continuous operating voltage	U_C	275 V AC
Nominal discharge current (8/20 µs)	I_n	20 kA
Max. discharge current (8/20 µs)	I_{max}	40 kA
Voltage protection level	U_P	≤ 1.3 kV
Voltage protection level at 5 kA	U_P	≤ 1.0 kV
Combined impulse	U_{OC}	10 kV
Max. back-up fuse		125 A gL/gG
Response time	t_A	≤ 25 ns
Operating temperature range	ϑ	-40°C to +80°C
Cross-section area (min. - max.)		2.5 mm²(min.) - 16 mm² (max.)
Mounting		DIN rail 35 mm
Enclosure material		Thermoplastic UL94 V-0
Degree of protection		IP20
Failure signalisation		Green - OK / Red - Failure

Dimensions

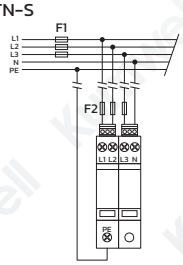


Internal configuration



Network connections

TN-S



8 Surge Protection Class II for AC Power System

Kumwell

CLASS II (TYPE 2)
SURGE ARRESTER / VARISTOR
1-PHASE TN-S AND TN-C SYSTEM

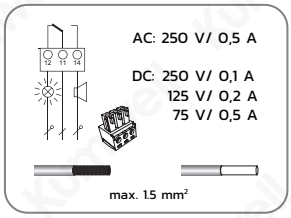
Kumwell KB12 1P **series** is a single-pole, metal oxide varistor surge arrester class II according to IEC 61643-11. These arresters are recommended for used in Lightning Protection Zones Concept at boundaries of LPZ 1-2 (according to IEC 62305), where they provide the equipotential bonding and discharge of the switching overvoltage, which is generated in power supply systems entering the building.

The main use KB12 1P series arresters is in all kinds of industry, resident and administration buildings. They are to be placed into the subsidiary switchboards or control boxes.



LPZ 1 → 2

IP 20



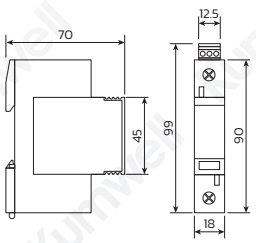
KB12-XXXS-40K-1P

- Protection modes: L-N/PE/PEN
- Max. discharge current: I_{max}
- Max. continuous operating voltage: U_c

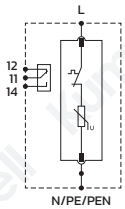
Varistor / Class II / Single-Phase for TN-S and TN-C System

Technical data		KB12-275S-40K-1P	KB12-320S-40K-1P	KB12-385S-40K-1P	KB12-440S-40K-1P
Test class according to IEC 61643-11		CLASS II			
Nominal voltage	U_N	230 V AC			
Max. continuous operating voltage	U_C	275 V AC	320 V AC	385 V AC	440 V AC
Nominal discharge current (8/20 µs)	I_n	20 kA			
Max. discharge current (8/20 µs)	I_{max}	40 kA			
Voltage protection level	U_P	≤ 1.3 kV	≤ 1.5 kV	≤ 1.8 kV	≤ 2.0 kV
Voltage protection level at 5 kA	U_P	≤ 1 kV	≤ 1.2 kV	≤ 1.4 kV	≤ 1.6 kV
Max. back-up fuse		125 A gL/gG			
Short-circuit withstand capacity	I_{sccr}	25 kA_{rms}			
Temporary overvoltage TOV-withstand	U_T	335 V / 5 sec	335 V / 5 sec	415 V / 5 sec	580 V / 5 sec
Temporary overvoltage TOV-safe failure	U_T	440 V / 120 min	440 V / 120 min	440 V / 120 min	765 V / 120 min
Response time	t_A	≤ 25 ns			
Operating temperature range	ϑ	-40°C to +80°C			
Cross-section area (min. - max.)		6 mm^2(min.) - 25 mm^2(max.)			
Mounting		Din rail 35 mm			
Enclosure material		Thermoplastic UL94 V-0			
Degree of protection		IP20			
Failure signalisation		Green - OK / Red - Failure			

Dimensions

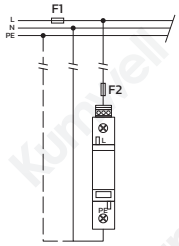


Internal configuration

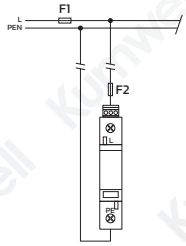


Network connections

TN-S



TN-C



CLASS II (TYPE 2)
SURGE ARRESTER / VARISTOR + GDT
1-PHASE TN-S AND TT SYSTEM

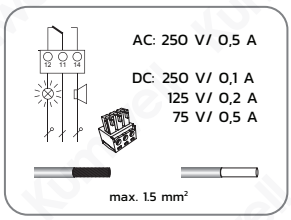
Kumwell KB12 1PN **series** is a two pole, metal oxide varistor surge arrester combined with gas discharge tubes, class II according to IEC 61643-11. These arresters are recommended for used in Lightning Protection Zones Concept at boundaries of LPZ 1-2 (according to IEC 62305), where they provide the equipotential bonding and discharge of the switching overvoltage, which is generated in power supply systems entering the building.

The main use of KB12 1PN series arresters is in all kinds of industry, resident and administration buildings. They are to be placed into the subsidiary switchboards or control boxes.



LPZ 1 → 2

IP 20



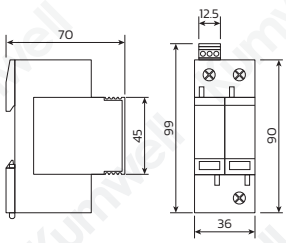
KB12-XXXS-40K-1PN

- Protection modes: L-N, N-PE
- Max. discharge current: I_{max}
- Max. continuous operating voltage: U_c

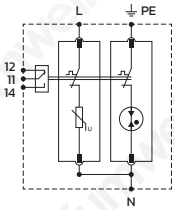
Varistor + GDT / Class II / Single-Phase for TN-S and TT System

Technical data		KB12-275S-40K-1PN	KB12-320S-40K-1PN	KB12-385S-40K-1PN	KB12-440S-40K-1PN
Test class according to IEC 61643-11		CLASS II			
Nominal voltage	U_N	230 V AC			
Max. continuous operating voltage	U_C (L-N/N-PE)	275 V AC / 255 V AC	320 V AC / 255 V AC	385 V AC / 255 V AC	440 V AC / 255 V AC
Nominal discharge current (8/20 µs)	I_n	20 kA			
Max. discharge current (8/20 µs)	I_{max}	40 kA			
Voltage protection level	U_P (L-N/N-PE)	≤ 1.3 kV / ≤ 1.5 kV	≤ 1.5 kV / ≤ 1.5 kV	≤ 1.8 kV / ≤ 1.5 kV	≤ 2.0 kV / ≤ 1.5 kV
Voltage protection level at 5 kA (L-N)	U_P	≤ 1 kV	≤ 1.2 kV	≤ 1.4 kV	≤ 1.6 kV
Max. back-up fuse		125 A gL/gG			
Short-circuit withstand capacity	I_{sccr}	25 kA_{rms}			
Temporary overvoltage TOV-withstand (L-N)	U_T	335 V / 5 sec	335 V / 5 sec	415 V / 5 sec	580 V / 5 sec
Temporary overvoltage TOV-safe failure (L-N)	U_T	440 V / 120 min	440 V / 120 min	440 V / 120 min	765 V / 120 min
Temporary overvoltage TOV-withstand (N-PE)	U_T	1200 V / 200 ms			
Follow current extinguishing capability a.c. (N-PE)	I_{fi}	100 A_{rms}			
Response time	t_A (L-N/N-PE)	≤ 25 ns / ≤ 100 ns			
Operating temperature range	ϑ	-40°C to +80°C			
Cross-section area (min. - max.)		6 mm^2(min.) - 25 mm^2(max.)			
Mounting		Din rail 35 mm			
Enclosure material		Thermoplastic UL94 V-0			
Degree of protection		IP20			
Failure signalisation		Green - OK / Red - Failure			

Dimensions

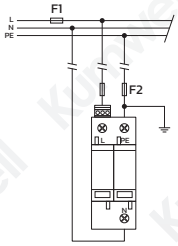


Internal configuration



Network connections

TN-S, TT



Kumwell

CLASS II (TYPE 2)
SURGE ARRESTER / VARISTOR
1-PHASE TN-S SYSTEM

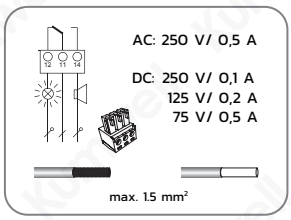
Kumwell KB12 2P **series** is a two pole, metal oxide varistor surge arrester class II according to IEC 61643-11. These arresters are recommended for used in Lightning Protection Zones Concept at boundaries of LPZ 1-2 (according to IEC 62305), where they provide the equipotential bonding and discharge of the switching overvoltage, which is generated in power supply systems entering the building.

The main use of KB12 2P series arresters is in all kinds of industry, resident and administration buildings. They are to be placed into the subsidiary switchboards or control boxes.



LPZ 1 → 2

IP 20



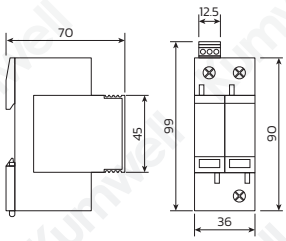
KB12-XXXS-40K-2P

- Protection modes: L-PE, N-PE
- Max. discharge current: I_{max}
- Max. continuous operating voltage: U_c

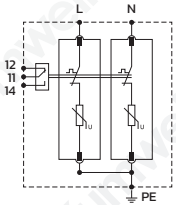
Varistor / Class II / Single-Phase for TN-S System

Technical data		KB12-275S-40K-2P	KB12-320S-40K-2P	KB12-385S-40K-2P	KB12-440S-40K-2P
Test class according to IEC 61643-11		CLASS II			
Nominal voltage	U_N	230 V AC			
Max. continuous operating voltage	U_C	275 V AC	320 V AC	385 V AC	440 V AC
Nominal discharge current (8/20 µs)	I_n	20 kA			
Max. discharge current (8/20 µs)	I_{max}	40 kA			
Voltage protection level	U_P	≤ 1.3 kV	≤ 1.5 kV	≤ 1.8 kV	≤ 2.0 kV
Voltage protection level at 5 kA	U_P	≤ 1 kV	≤ 1.2 kV	≤ 1.4 kV	≤ 1.6 kV
Max. back-up fuse		125 A gL/gG			
Short-circuit withstand capacity	I_{sccr}	25 kA_{rms}			
Temporary overvoltage TOV-withstand	U_T	335 V / 5 sec	335 V / 5 sec	415 V / 5 sec	580 V / 5 sec
Temporary overvoltage TOV-safe failure	U_T	440 V / 120 min	440 V / 120 min	440 V / 120 min	765 V / 120 min
Response time	t_A	≤ 25 ns			
Operating temperature range	ϑ	-40°C to +80°C			
Cross-section area (min. - max.)		6 mm^2(min.) - 25 mm^2(max.)			
Mounting		Din rail 35 mm			
Enclosure material		Thermoplastic UL94 V-0			
Degree of protection		IP20			
Failure signalisation		Green - OK / Red - Failure			

Dimensions

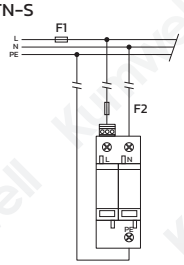


Internal configuration



Network connections

TN-S



CLASS II (TYPE 2)
SURGE ARRESTER / VARISTOR
3-PHASE TN-C SYSTEM

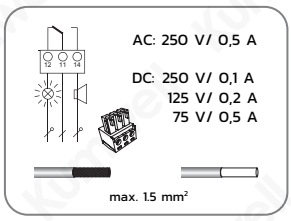
Kumwell KB12 3P series is a three poles, metal oxide varistor surge arrester class II according to IEC 61643-11. These arresters are recommended for used in Lightning Protection Zones Concept at boundaries of LPZ 1-2 (according to IEC 62305), where they provide the equipotential bonding and discharge of the switching overvoltage, which is generated in power supply systems entering the building.

The main use of KB12 3P series arresters is in all kinds of industry, resident and administration buildings. They are to be placed into the subsidiary switchboards or control boxes.



LPZ 1 → 2

IP 20



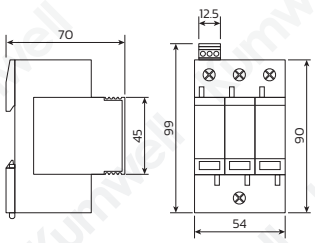
KB12-XXXS-40K-3P

- Protection modes: L-PEN
- Max. discharge current: I_{max}
- Max. continuous operating voltage: U_c

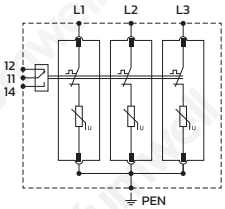
Varistor / Class II / Three-Phase for TN-C System

Technical data		KB12-275S-40K-3P	KB12-320S-40K-3P	KB12-385S-40K-3P	KB12-440S-40K-3P
Test class according to IEC 61643-11		CLASS II			
Nominal voltage	U_N	230/400 V AC			
Max. continuous operating voltage	U_C	275 V AC	320 V AC	385 V AC	440 V AC
Nominal discharge current (8/20 µs)	I_n	20 kA			
Max. discharge current (8/20 µs)	I_{max}	40 kA			
Voltage protection level	U_P	≤ 1.3 kV	≤ 1.5 kV	≤ 1.8 kV	≤ 2.0 kV
Voltage protection level at 5 kA	U_P	≤ 1 kV	≤ 1.2 kV	≤ 1.4 kV	≤ 1.6 kV
Max. back-up fuse		125 A gL/gG			
Short-circuit withstand rating a.c.	I_{sccr}	25 kA_{rms}			
Temporary overvoltage TOV-withstand	U_T	335 V / 5 sec	335 V / 5 sec	415 V / 5 sec	580 V / 5 sec
Temporary overvoltage TOV-safe failure	U_T	440 V / 120 min	440 V / 120 min	440 V / 120 min	765 V / 120 min
Response time	t_A	≤ 25 ns			
Operating temperature range	ϑ	-40°C to +80°C			
Cross-section area (min. - max.)		6 mm²(min.) - 25 mm²(max.)			
Mounting		Din rail 35 mm			
Enclosure material		Thermoplastic UL94 V-0			
Degree of protection		IP20			
Failure signalisation		Green - OK / Red - Failure			

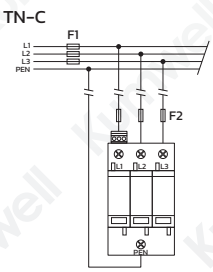
Dimensions



Internal configuration



Network connections



Kumwell

CLASS II (TYPE 2)
SURGE ARRESTER / VARISTOR + GDT
3-PHASE TN-S AND TT SYSTEM

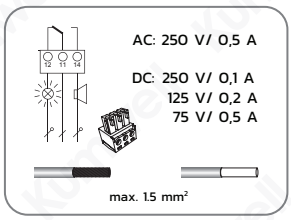
Kumwell KB12 3PN **series** is a four pole, metal oxide varistor surge arrester combined with gas discharge tube, class II according to IEC 61643-11. These arresters are recommended for used in Lightning Protection Zones Concept at boundaries of LPZ 1-2 (according to IEC 62305), where they provide the equipotential bonding and discharge of the switching overvoltage, which is generated in power supply systems entering the building.

The main use of KB12 3PN series arresters is in all kinds of industry, resident and administration buildings. They are to be placed into the subsidiary switchboards or control boxes.



LPZ 1 → 2

IP 20



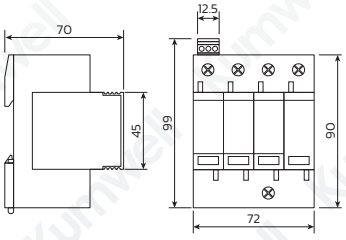
KB12-XXXS-40K-3PN

- Protection modes: L-N, L-PE
- Max. discharge current: I_{max}
- Max. continuous operating voltage: U_c

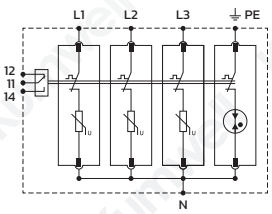
Varistor + GDT / Class II / Three-Phase for TN-S and TT System

Technical data		KB12-275S-40K-3PN	KB12-320S-40K-3PN	KB12-385S-40K-3PN	KB12-440S-40K-3PN
Test class according to IEC 61643-11		CLASS II			
Nominal voltage	U_N	230/400 V AC			
Max. continuous operating voltage	U_C (L-N/N-PE)	275 V AC / 255 V AC	320 V AC / 255 V AC	385 V AC / 255 V AC	440 V AC / 255 V AC
Nominal discharge current (8/20 µs)	I_n	20 kA			
Max. discharge current (8/20 µs)	I_{max}	40 kA			
Voltage protection level	U_P (L-N/N-PE)	≤ 1.3 kV / ≤ 1.5 kV	≤ 1.5 kV / ≤ 1.5 kV	≤ 1.8 kV / ≤ 1.5 kV	≤ 2.0 kV / ≤ 1.5 kV
Voltage protection level at 5 kA (L-N)	U_P	≤ 1 kV	≤ 1.2 kV	≤ 1.4 kV	≤ 1.6 kV
Max. back-up fuse		125 A gL/gG			
Short-circuit withstand capacity	I_{sccr}	25 kA_{rms}			
Temporary overvoltage TOV-withstand (L-N)	U_T	335 V / 5 sec	335 V / 5 sec	415 V / 5 sec	580 V / 5 sec
Temporary overvoltage TOV-safe failure (L-N)	U_T	440 V / 120 min	440 V / 120 min	440 V / 120 min	765 V / 120 min
Temporary overvoltage TOV-withstand (L-N)	U_T	1200 V / 200 ms			
Follow current extinguishing capability a.c. (N-PE)	I_{fi}	100 A_{rms}			
Response time	t_A (L-N/N-PE)	≤ 25 ns / ≤ 100 ns			
Operating temperature range	ϑ	-40°C to +80°C			
Cross-section area (min. - max.)		6 mm²(min.) - 25 mm²(max.)			
Mounting		Din rail 35 mm			
Enclosure material		Thermoplastic UL94 V-0			
Degree of protection		IP20			
Failure signalisation		Green - OK / Red - Failure			

Dimensions

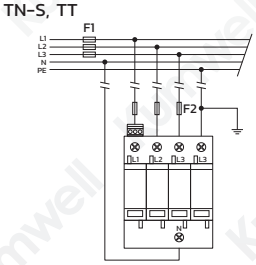


Internal configuration



Network connections

TN-S, TT



CLASS II (TYPE 2)
SURGE ARRESTER / VARISTOR
3-PHASE TN-S SYSTEM

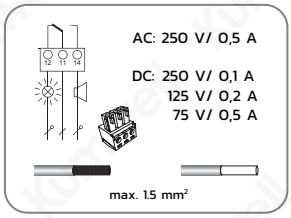
Kumwell KB12 4P **series** is a four poles, metal oxide varistor surge arrester class II according to IEC 61643-11. These arresters are recommended for used in Lightning Protection Zones Concept at boundaries of LPZ 1-2 (according to IEC 62305), where they provide the equipotential bonding and discharge of the switching overvoltage, which is generated in power supply systems entering the building.

The main use of KB12 4P series arresters is in all kinds of industry, resident and administration buildings. They are to be placed into the subsidiary switchboards or control boxes.



LPZ 1 → 2

IP 20



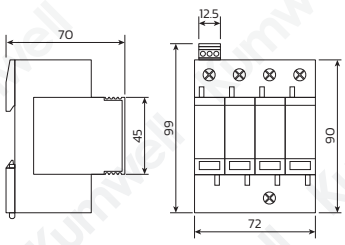
KB12-XXXS-40K-4P

- Protection modes: L-PE, N-PE
- Max. discharge current: I_{max}
- Max. continuous operating voltage: U_c

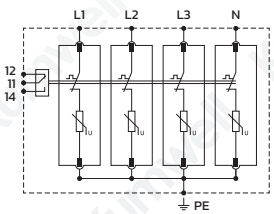
Varistor / Class II / Three-Phase for TN-S System

Technical data		KB12-275S-40K-4P	KB12-320S-40K-4P	KB12-385S-40K-4P	KB12-440S-40K-4P
Test class according to IEC 61643-11		CLASS II			
Nominal voltage	U_N	230/400 V AC			
Max. continuous operating voltage	U_C	275 V AC	320 V AC	385 V AC	440 V AC
Nominal discharge current (8/20 µs)	I_n	20 kA			
Max. discharge current (8/20 µs)	I_{max}	40 kA			
Voltage protection level	U_P	≤ 1.3 kV	≤ 1.5 kV	≤ 1.8 kV	≤ 2.0 kV
Voltage protection level at 5 kA	U_P	≤ 1 kV	≤ 1.2 kV	≤ 1.4 kV	≤ 1.6 kV
Max. back-up fuse		125 A gL/gG			
Short-circuit withstand rating a.c.	I_{sccr}	25 kA_{rms}			
Temporary overvoltage TOV-withstand	U_T	335 V / 5 sec	335 V / 5 sec	415 V / 5 sec	580 V / 5 sec
Temporary overvoltage TOV-safe failure	U_T	440 V / 120 min	440 V / 120 min	440 V / 120 min	765 V / 120 min
Response time	t_A	≤ 25 ns			
Operating temperature range	ϑ	-40°C to +80°C			
Cross-section area (min. - max.)		6 mm^2(min.) - 25 mm^2(max.)			
Mounting		Din rail 35 mm			
Enclosure material		Thermoplastic UL94 V-0			
Degree of protection		IP20			
Failure signalisation		Green - OK / Red - Failure			

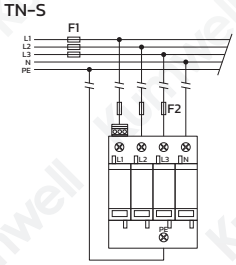
Dimensions



Internal configuration



Network connections



Kumwell

CLASS II (TYPE 2)
SURGE ARRESTER/VARISTOR
1-PHASE TN-S SYSTEM

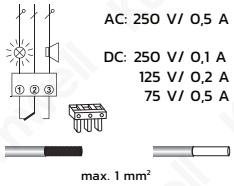
Kumwell D12.U385-XXXK.DS/2P series Parallel Modular Power SPD is designed according to IEC 61643-11 standard, with ability of large current discharge. The maximum discharge current I_{max} (8/20 µs) of each line could be 80-160 kA. It is applicable for 230 V AC Power Distribution Systems lightning protection in all classes.
It is suitable for the low voltage main power distribution cabinet/box of buildings, and the equipments connected between three phase AC power supply and system in parallel, with advantage of extremely low residual voltage, quick respond, large intake capacity, long work life and simple maintenance.



LPZ 1➔2

IP 20

DS



AC: 250 V/ 0,5 A

DC: 250 V/ 0,1 A
125 V/ 0,2 A
75 V/ 0,5 A

max. 1 mm²

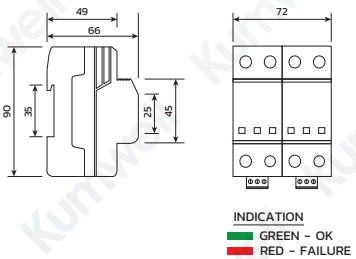
D12.U385-XXXK.ds/2P

- Protection modes: L-PE, N-PE
- Remote signal (optional)
- Max. discharge current
- Max. continuous operating voltage: U_c
- Lightning protection zone: LPZ 1-2

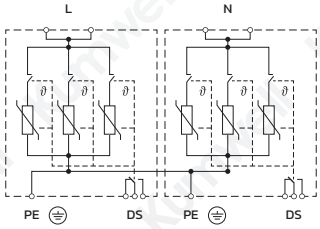
Varistor/ Class II / Single-Phase for TN-S System

Technical data		D12.U385-80K.DS/2P	D12.U385-100K.DS/2P	D12.U385-120K.DS/2P	D12.U385-160K.DS/2P
Test class according to IEC 61643-11		CLASS II			
Nominal voltage	U_N	230 V AC			
Max. continuous operating voltage	U_C	385 V AC			
Nominal discharge current (8/20 µs)	I_n	40 kA	50 kA	60 kA	80 kA
Max. discharge current (8/20 µs)	I_{max}	80 kA	100 kA	120 kA	160 kA
Voltage protection level at 10 kA (8/20 µs)	U_P	< 1.5 kV	< 1.5 kV	< 1.5 kV	< 1.5 kV
Voltage protection level at I_n (8/20 µs)	U_P	< 2.0 kV	< 2.2 kV	< 2.5 kV	< 3.0 kV
Response time	t_A	< 25 ns			
Back-up fuse		160 A gL/gG			
Protection type		IP20			
Operating temperature range	ϑ	-25°C to +70°C			
Relative Humidity		≤ 95%			
Cross-section of the connected conductors (solid)		6 mm²(min.) - 25 mm²(max.)			
Cross-section of the connected conductors (wire)		6 mm²(min.) - 16 mm²(max.)			
Mounting		Din rail 35 mm			
Indication Method		Indication Window, Turn Red When Malfunction			
Dimension (L x H x W) (mm)		72 x 90 x 66			

Dimensions

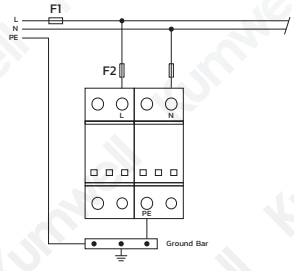


Internal configuration



Network connections

TN-C



CLASS II (TYPE 2)
SURGE ARRESTER/VARISTOR
3-PHASE TN-C SYSTEM

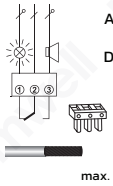
Kumwell D12.U385-XXXK.DS/3P series Parallel Modular Power SPD is designed according to IEC 61643-11 standard, with ability of large current discharge. The maximum discharge current I_{max} (8/20 µs) of each line could be 100-160 kA. It is applicable for 230/400 V AC Power Distribution Systems lightning protection in all classes.
It is suitable for the low voltage main power distribution cabinet/box of buildings, and the equipments connected between three phase AC power supply and system in parallel, with advantage of extremely low residual voltage , quick respond, large intake capacity, long work life and simple maintenance.



LPZ 1➔2

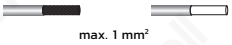
IP 20

DS



AC: 250 V/ 0,5 A

DC: 250 V/ 0,1 A
125 V/ 0,2 A
75 V/ 0,5 A



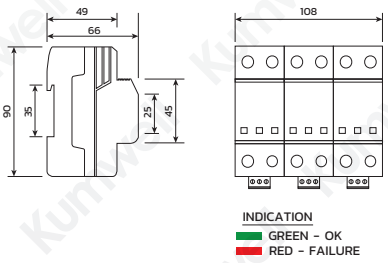
D12.U385-XXXK.ds/3P

- Protection modes: L-PEN
- Remote signal (optional)
- Max. discharge current
- Max. continuous operating voltage: U_c
- Lightning protection zone: LPZ 1-2

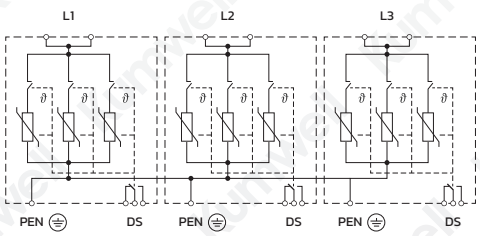
Varistor/ Class II / Three-Phase for TN-C System

Technical data		D12.U385-100K.DS/3P	D12.U385-120K.DS/3P	D12.U385-160K.DS/3P
Test class according to IEC 61643-11		CLASS II		
Nominal voltage	U_N	230/400 V AC		
Max. continuous operating voltage	U_C	385 V AC		
Nominal discharge current (8/20 µs)	I_n	50 kA	60 kA	80 kA
Max. discharge current (8/20 µs)	I_{max}	100 kA	120 kA	160 kA
Voltage protection level at 10 kA (8/20 µs)	U_P	< 1.5 kV	< 1.5 kV	< 1.5 kV
Voltage protection level at I_n (8/20 µs)	U_P	< 2.2 kV	< 2.5 kV	< 3.0 kV
Response time	t_A	< 25 ns		
Back-up fuse		160 A gL/gG		
Protection type		IP20		
Operating temperature range	ϑ	-25°C to +70°C		
Relative Humidity		≤ 95%		
Cross-section of the connected conductors (solid)		6 mm²(min.) - 25 mm²(max.)		
Cross-section of the connected conductors (wire)		6 mm²(min.) - 16 mm²(max.)		
Mounting		Din rail 35 mm		
Indication Method		Indication Window, Turn Red When Malfunction		
Dimension (L x H x W) (mm)		108 x 90 x 66		

Dimensions

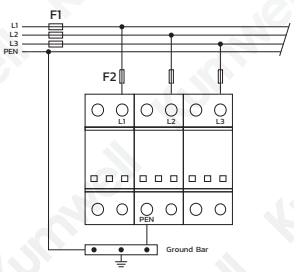


Internal configuration



Network connections

TN-C



Kumwell

CLASS II (TYPE 2)
SURGE ARRESTER/VARISTOR
3-PHASE TN-S SYSTEM

Kumwell D12.U385-XXXK.DS/4P **series** Parallel Modular Power SPD is designed according to IEC 61643-11 standard, with ability of large current discharge. The maximum discharge current I_{max} (8/20 µs) of each line could be 80-160 kA. It is applicable for 230/400 V AC Power Distribution Systems lightning protection in all classes.

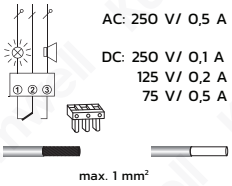
It is suitable for the low voltage main power distribution cabinet/box of buildings, and the equipments connected between three phase AC power supply and system in parallel, with advantage of extremely low residual voltage, quick respond, large intake capacity, long work life and simple maintenance.



LPZ 1➔2

IP 20

DS



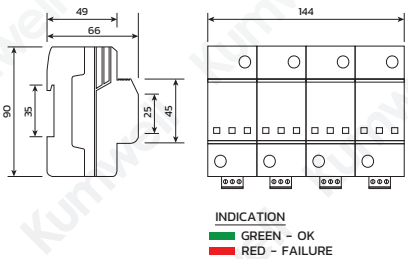
D12.U385-XXXK.ds/4P

- Protection modes: L-PE, N-PE
- Remote signal (optional)
- Max. discharge current
- Max. continuous operating voltage: U_c
- Lightning protection zone: LPZ 1-2

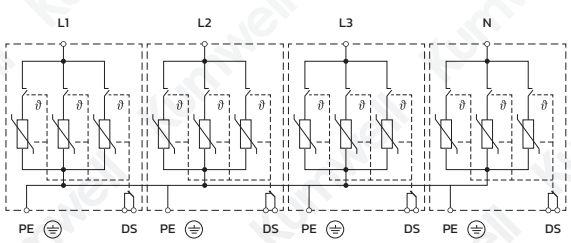
Varistor/ Class II / Three-Phase for TN-S System

Technical data		D12.U385-80K.DS/4P	D12.U385-100K.DS/4P	D12.U385-120K.DS/4P	D12.U385-160K.DS/4P
Test class according to IEC 61643-11		CLASS II			
Nominal voltage	U_N	230/400 V AC			
Max. continuous operating voltage	U_C	385 V AC			
Nominal discharge current (8/20 µs)	I_n	40 kA	50 kA	60 kA	80 kA
Max. discharge current (8/20 µs)	I_{max}	80 kA	100 kA	120 kA	160 kA
Voltage protection level at 10 kA (8/20 µs)	U_P	< 1.5 kV	< 1.5 kV	< 1.5 kV	< 1.5 kV
Voltage protection level at I_n (8/20 µs)	U_P	< 2.0 kV	< 2.2 kV	< 2.5 kV	< 3.0 kV
Response time	t_A	< 25 ns			
Back-up fuse		160 A gL/gG			
Protection type		IP20			
Operating temperature range	ϑ	-25°C to +70°C			
Relative Humidity		≤ 95%			
Cross-section of the connected conductors (solid)		6 mm²(min.) - 25 mm²(max.)			
Cross-section of the connected conductors (wire)		6 mm²(min.) - 16 mm²(max.)			
Mounting		Din rail 35 mm			
Indication Method		Indication Window, Turn Red When Malfunction			
Dimension (L x H x W) (mm)		144 x 90 x 66			

Dimensions

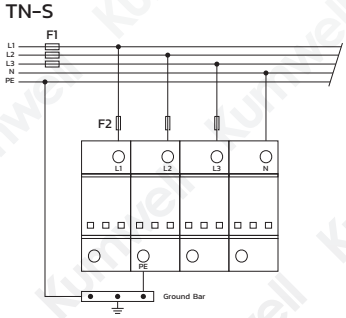


Internal configuration



Network connections

TN-S



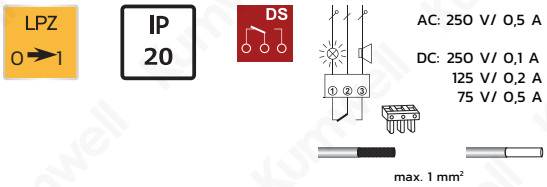
9 Surge Protection Class I+II and Class II for DC Power Systems

Kumwell

CLASS I+II (TYPE 1+2)
SURGE ARRESTER-VARISTOR
SINGLE POLE DC SPD FOR DC POWER SYSTEM

Kumwell KLSA-12R5-U48V is class I+II (Type 1+2) single pole DC SPD according to IEC 61643-11 designed for DC application, especially for location of high risk explosure or LPZ 0-1 and higher zones according to standard IEC 62305:2010 or building entrances to against the damage from direct or close lightning strikes. With built in high energy varistor and high reliability.

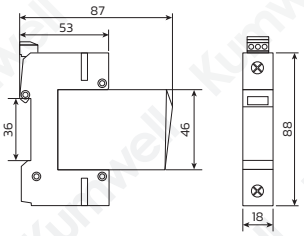




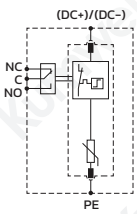
Varistor/ Class I+II / Single Pole SPD for DC Power System

Technical data		KLSA-12R5-U48V
Test class according to IEC 61643-11		CLASS I+II
Nominal voltage	U_N	60 V AC / 48 V DC
Max. continuous operating voltage	U_C	75 V AC / 100 V DC
Nominal discharge current (8/20 µs)	I_n	25 kA
Max. discharge current (8/20 µs)	I_{max}	80 kA
Lightning impulse current (10/350 µs)	I_{imp}	12.5 kA
Voltage protection level (DC+/- to PE)	U_P	< 0.6 kV
Voltage protection level @ 20 kA (8/20)	U_P	< 550 V
Temporary overvoltage (TOV) withstand mode	U_T	90 V/5 s
Response time	t_A	< 25 ns
Max. back-up fuse (Only required if not already provided in mains)		160 A gL/gG
Short-circuit withstand capacity	I_{SCCR}	50 kA_{rms}
LPZ		0-1 and higher
Protection type		IP20
Operating temperature range	ϑ	-40°C to +85°C
Cross-section of the connected conductors (solid)		6 mm²(min.) - 25 mm²(max.)
Cross-section of the connected conductors (wire)		6 mm²(min.) - 16 mm²(max.)
Mounting on		DIN rail 35 mm
Failure signalisation		Green - Normal, Red-Replace
Protection mode		(DC+)/(DC-) - PE

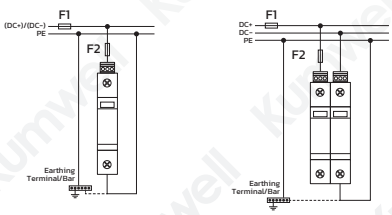
Dimensions



Internal configuration



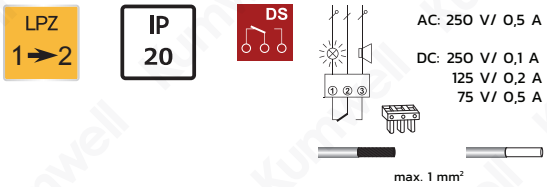
Network connections



CLASS II (TYPE 2)
SURGE ARRESTER/VARISTOR
MODULAR SPD FOR DC POWER SYSTEMS

Kumwell KZ12.DC20K **series** surge arrester Class II (Type 2) for DC power systems have been designed to meet the unique requirements of protection of DC power systems and complied with IEC 61643-1 and IEC 61643-11, achieve surge suppression, discharge current and amplitude limiting. To protect the power supply line, the equipment and personal safety which connected to the power supply line.

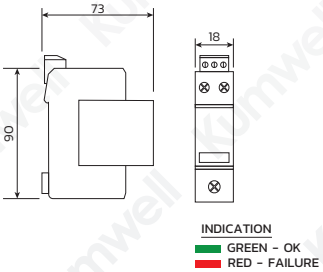




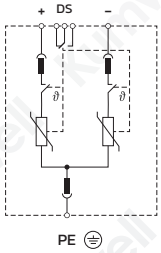
Varistor / Class II / Modular SPD for DC Power System

Technical data		KZ12.DC20K-U24V.ds	KZ12.DC20K-U48V.ds	KZ12.DC20K-U110V.ds
Test class according to IEC 61643-11			CLASS II	
Nominal voltage	U_N	24 V DC	48 V DC	110 V DC
Max. continuous operating voltage	U_C	38 V DC	56 V DC	150 V DC
Nominal discharge current (8/20 µs)	I_n		10 kA	
Max. discharge current (8/20 µs)	I_{max}		20 kA	
Voltage protection level at I_n	U_P	< 400 V	< 500 V	< 600 V
Response time	t_A		< 25 ns	
Fuse (If required)			20 A gL/gG	
Temperature range	ϑ		-40°C to +70°C	
Connection type			Screw Terminal	
Conductor size			1.5-2.5 mm²	
Mounting			DIN rail 35mm	
Degree of protection			IP20	
Indication of disconnector operation			Red flag	

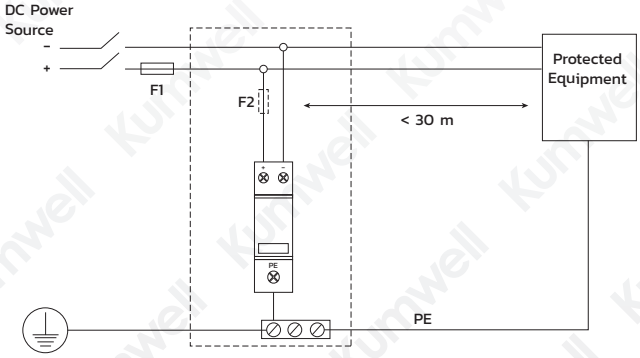
Dimensions



Internal configuration



Network connections



Kumwell

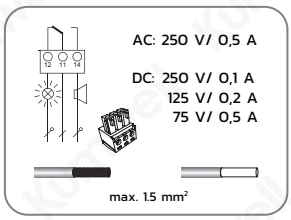
CLASS II (TYPE 2)
SURGE ARRESTER / VARISTOR
MODULAR SPD FOR DC POWER SYSTEMS

Kumwell KB12.DC20K-U48V is surge arrester class II (Type 2) for DC power systems have been designed to meet the unique requirements of protection of DC power systems and complied with IEC 61643-11 and IEC 61643-31, achieve surge suppression, discharge current and amplitude limiting. To protect the power supply line, the equipment and personal safety which connected to the power supply line.



LPZ 1➔2

IP 20

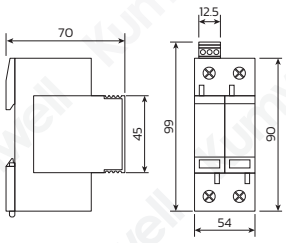


KB12.DC20K-U48V
- Nominal voltage: U_N
- Max. discharge current: I_{max}

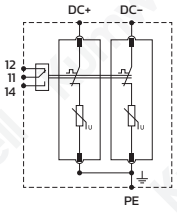
Varistor / Class II / Modular SPD for DC Power System

Technical data		KB12.DC20K-U48V
Test class according to IEC 61643-11		CLASS II
Nominal voltage	U_N	48 V DC
Max. continuous operating voltage	U_C	65 V DC
Nominal discharge current (8/20 μs)	I_n	10 kA
Max. discharge current (8/20 μs)	I_{max}	20 kA
Voltage protection level	U_P	≤ 600 V
Response time	t_A	≤ 25 ns
Operating temperature range	ϑ	-40°C to +80°C
Cross-section area (min. - max.)		6 mm²(min.) - 25 mm² (max.)
Mounting		DIN rail 35 mm
Enclosure material		Thermoplastic UL94 V-0
Degree of protection		IP20
Failure signalisation		Green - OK / Red - Failure
Protection mode		DC+/PE, DC-/PE

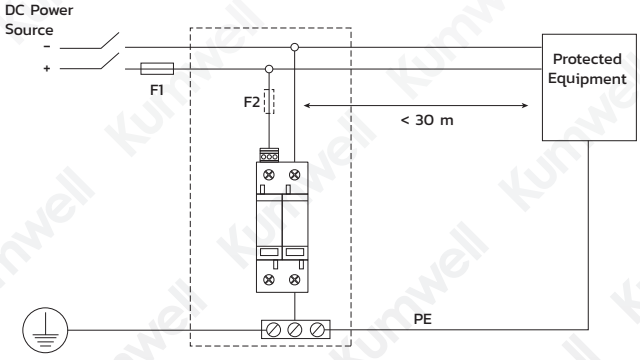
Dimensions



Internal configuration



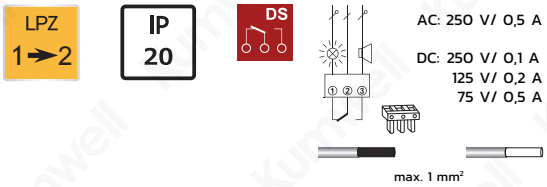
Network connections



CLASS II (TYPE 2)
SURGE ARRESTER/VARISTOR
MODULAR SPD FOR DC POWER SYSTEMS

Kumwell KZ12.DC40K **series** surge arresters Class II (Type 2) for DC power systems have been designed to meet the unique requirements of protection of DC power systems and complied with IEC 61643-1 and IEC 61643-11, achieve surge suppression, discharge current and amplitude limiting . To protect the power supply line, the equipment and personal safety which connected to the power supply line.

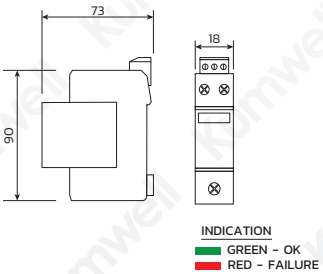




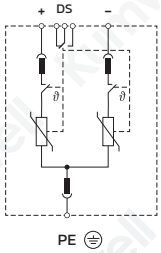
Varistor / Class II / Modular SPD for DC Power System

Technical data		KZ12.DC40K-U24V.ds	KZ12.DC40K-U48V.ds	KZ12.DC40K-U110V.ds
Test class according to IEC 61643-11			CLASS II	
Nominal voltage	U_N	24 V DC	48 V DC	110 V DC
Max. continuous operating voltage	U_C	38 V DC	64 V DC	150 V DC
Nominal discharge current (8/20 µs)	I_n		20 kA	
Max. discharge current (8/20 µs)	I_{max}		40 kA	
Voltage protection level at I_n	U_P	< 800 V	< 800 V	< 1.5 kV
Response time	t_A		< 25 ns	
Fuse (If required)			50 A gL/gG	
Temperature range	ϑ		-40°C to +70°C	
Connection type			Screw Terminal	
Conductor size			1.5-2.5 mm²	
Mounting			DIN rail 35mm	
Degree of protection			IP20	
Indication of disconnector operation			Red flag	

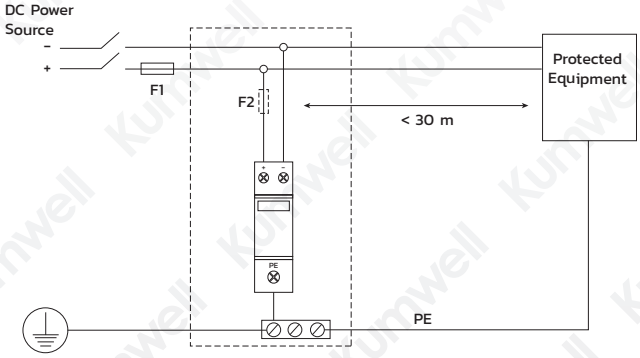
Dimensions



Internal configuration



Network connections



Kumwell

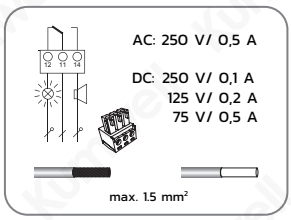
CLASS II (TYPE 2)
SURGE ARRESTER / VARISTOR
MODULAR SPD FOR DC POWER SYSTEMS

Kumwell KB12.DC40K-U48V is surge arrester Class II (Type 2) for DC power systems have been designed to meet the unique requirements of protection of DC power systems and complied with IEC 61643-11 and IEC 61643-31, achieve surge suppression, discharge current and amplitude limiting. To protect the power supply line, the equipment and personal safety which connected to the power supply line.



LPZ 1➔2

IP 20

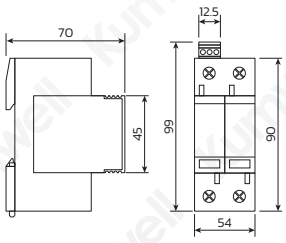


KB12.DC40K-U48V
- Nominal voltage: U_N
- Max. discharge current: I_{max}

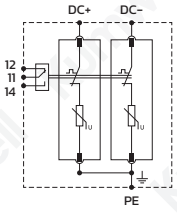
Varistor / Class II / Modular SPD for DC Power System

Technical data		KB12.DC40K-U48V
Test class according to IEC 61643-11		CLASS II
Nominal voltage	U_N	48 V DC
Max. continuous operating voltage	U_C	65 V DC
Nominal discharge current (8/20 µs)	I_n	20 kA
Max. discharge current (8/20 µs)	I_{max}	40 kA
Voltage protection level	U_P	≤ 800 V
Response time	t_A	≤ 25 ns
Operating temperature range	ϑ	-40°C to +80°C
Cross-section area (min. - max.)		6 mm²(min.) - 25 mm² (max.)
Mounting		DIN rail 35 mm
Enclosure material		Thermoplastic UL94 V-0
Degree of protection		IP20
Failure signalisation		Green - OK / Red - Failure
Protection mode		DC+/PE, DC-/PE

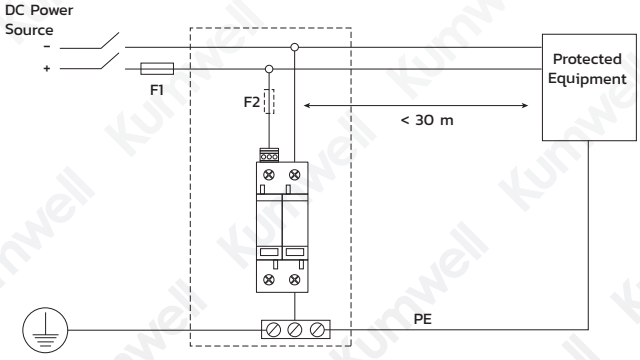
Dimensions



Internal configuration



Network connections



10 Surge Protection for Photovoltaic Systems (PV Systems) AC and DC Side Protection

Kumwell

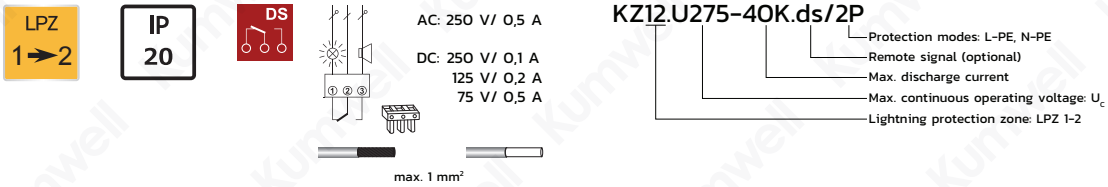
CLASS II (TYPE 2)
SURGE ARRESTER/VARISTOR
1-PHASE TN-S SYSTEM

Kumwell KZ12.U275-40K.ds **series** surge arrester Class II (Type 2) according to IEC 61643-11. These arresters are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2 (according to IEC 62305) for equipotential bonding and elimination of transient overvoltage that originate during atmospheric discharge or switching process.

The main use of KZ12.U275-40K.ds series arrester is in all kinds of industry, residential and administration buildings. They are to be place in to the secondary switchboards or into the control box.

Protected Mode: L-PE, N-PE (2P)

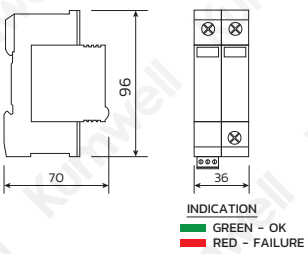




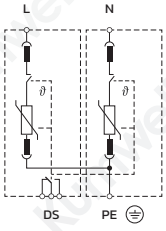
Varistor / Class II / Single-Phase for TN-S System

Technical data		KZ12.U275-40K.ds/2P
Test class according to IEC 61643-11		CLASS II
Nominal voltage	U_N	230 V AC
Max. continuous operating voltage	U_C	275 V AC
Max. discharge current (8/20 µs)	I_{max}	40 kA
Nominal discharge current (8/20 µs)	I_n	20 kA
Voltage protection level	U_P	≤ 1.5 kV
Response time	t_A	< 25 ns
Max. back-up fuse		125 A gL/gG
LPZ		1-2
Protection type		IP20
Operating temperature range	ϑ	-40°C to +85°C
Cross-section of the connected conductors (solid) Cross-section of the connected conductors (wire)		6 mm²(min.) - 25 mm²(max.) 6 mm²(min.) - 16 mm²(max.)
Mounting on		DIN rail 35 mm
Failure signalisation		green - ok / red - failure

Dimensions

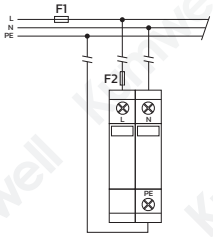


Internal configuration



Network connections

TN-S



CLASS II (TYPE 2)
SURGE ARRESTER/VARISTOR
3-PHASE TN-S SYSTEM

Kumwell **KZ12.U275-40K.ds series** surge arrester Class II (Type 2) according to IEC 61643-11. These arresters are recommended for use in the Lightning Protection Zones Concept at the boundaries of LPZ 1-2 (according to IEC 62305) for equipotential bonding and elimination of transient overvoltage that originate during atmospheric discharge or switching process.

The main use of KZ12.U275-40K.ds series arrester is in all kinds of industry, residential and administration buildings. They are to be place in to the secondary switchboards or into the control box.

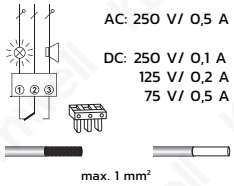
Protected Mode: L-PE, N-PE (4P)



LPZ 1➔2

IP 20

DS



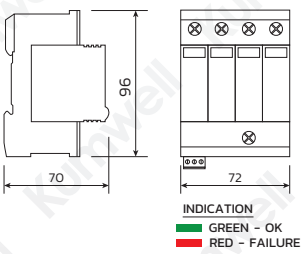
KZ12.U275-40K.ds/4P

- Protection modes: L-PE, N-PE
- Remote signal (optional)
- Max. discharge current
- Max. continuous operating voltage: U_c
- Lightning protection zone: LPZ 1-2

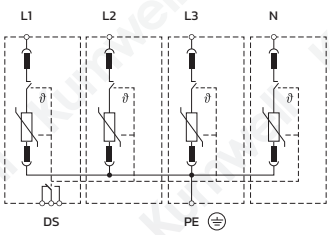
Varistor / Class II / Three-Phase for TN-S System

Technical data		KZ12.U275-40K.ds/4P
Test class according to IEC 61643-11		CLASS II
Nominal voltage	U_N	230/400 V AC
Max. continuous operating voltage	U_C	275 V AC
Max. discharge current (8/20 µs)	I_{max}	40 kA
Nominal discharge current (8/20 µs)	I_n	20 kA
Voltage protection level	U_P	≤ 1.5 kV
Response time	t_A	< 25 ns
Max. back-up fuse		125 A gL/gG
LPZ		1-2
Protection type		IP20
Operating temperature range	ϑ	-40°C to +85°C
Cross-section of the connected conductors (solid) Cross-section of the connected conductors (wire)		6 mm²(min.) - 25 mm²(max.) 6 mm²(min.) - 16 mm²(max.)
Mounting on		DIN rail 35 mm
Failure signalisation		green - ok / red - failure

Dimensions

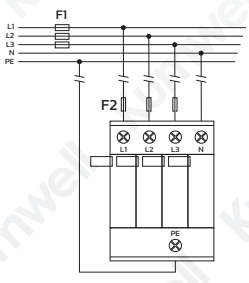


Internal configuration



Network connections

TN-S



Kumwell

CLASS II (TYPE 2)
SURGE ARRESTERS/VARISTOR
MODULAR DC SPD FOR PHOTOVOLTAIC SYSTEM

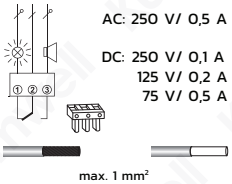
Kumwell D12.*.pv.ds is a lightning and surge arrester class II complied with IEC 61643-11 and IEC 61643-31 standard. Thus, the products are suited for the LPZ 1-2 protection zones concept (according to IEC 62305) for equipotential bonding of positive and negative photovoltaic systems bus bars. Also, it can eliminate temporary overvoltage originating during the switching process of atmosphere discharge. The varistor can be disconnected when overheating by using the equipped internal disconnectors.
The disconnector status indicator is a mix between remote monitoring (free change over contacts-only DS types) and mechanical (red signal).

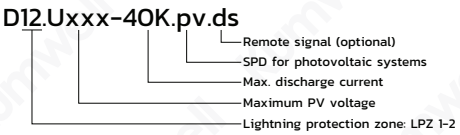










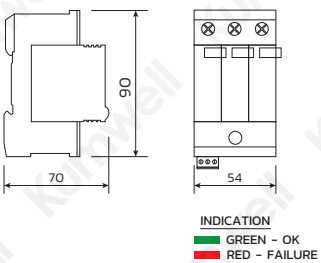


Varistor/ Class II / Photovoltaic System

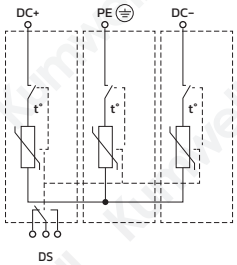
Technical data		D12.U0600-40K.pv.ds	D12.U1000-40K.pv.ds	D12.U1500-40K.pv.ds
Test class according to IEC 61643-11 and IEC 61643-31			CLASS II	
Max. continuous operating voltage	U_{cpv}	600 V DC	1000 V DC	1500 V DC
Application			(+)/(-) , (+)/PE, (-)/PE	
Max. discharge current (8/20 µs)	I_{max}		40 kA	
Nominal discharge current (8/20 µs)	I_n		20 kA	
Voltage protection level	U_P	≤ 2.0 kV	≤ 3.5 kV	≤ 4.5 kV
Leakage current		20 µA	20 µA	30 µA
Response time	t_A		≤ 25 ns	
Status indication			Indicates windows faults is red	
Remote alarm function			Optional	
LPZ			1-2	
Protection type			IP20	
Operating temperature range	ϑ		-25°C to +70°C	
Cross-section of the connected conductors (stranded)			6 mm²(min.) - 25 mm²(max.)	
Relative humidity			≤ 95%RH	
Mounting on			DIN rail 35 mm	
Dimensions			54 x 90 x 70 mm	

Order Options	
Model	**Type**
D12.U0600-40K.pv / D12.U1000-40K.pv	Without remote signal contact
D12.U0600-40K.pv.ds / D12.U1000-40K.pv.ds	With remote signal contact

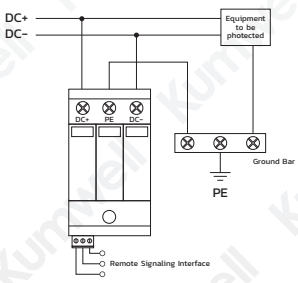
Dimensions



Internal configuration



Network connections



11 Surge Protection for Information Technology Systems and Equipment

Kumwell

SURGE PROTECTION FOR INFORMATION TECHNOLOGY SYSTEM
SIGNAL AND DATA LINE PROTECTION
PoE SURGE PROTECTION



Kumwell KSP.POE-G-RJ45D Din rail RJ45 surge protective device, POE signal surge protector is suitable for application of POE cable-powered server, wireless AP, network cameras, network switches and other communications equipment supply, network signal line surge protection, integrated design, easy installation.

It provides protection to all 4 lines in the UTP, STP and is CAT 6 capable. Product is designed to protect CAT 6 Local Area Networks. It is suitable for protection 1 Gbps lines and fully compartible with standards IEEE 802.3af/at

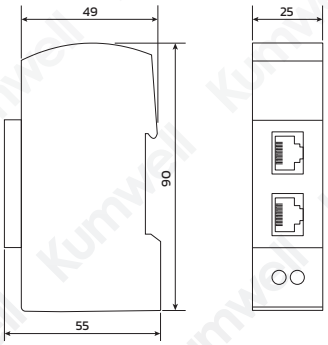
- Adopt power supply + signal surge protection intergrated design.
- Use high quality main component with excellent performance.
- Small insertion loss, good transmission rate.
- Low residual voltage, efficientsurge protection effect.
- Fast response, stable performance, reliable working.
- Small size, DIN Rail installation, convenient application, maintenance free.

IP 20

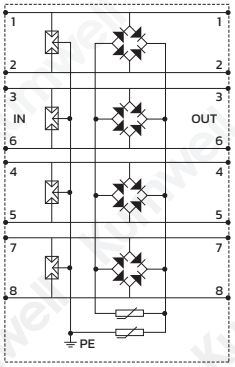
1000M Network Surge Protection

Technical data		KSP.POE-G-RJ45D	
Type of Network		Network signal transmission system	
Line		Power Supply Line	Signal Line
Nominal voltage	U_N	48 V	5 V
Max. continuous operating voltage	U_C	64 V	6 V
Nominal discharge current (8/20μs)	I_n	2.0 kA	2.0 kA
Max. discharge current (8/20μs)	I_{max}	3.0 kA	3.0 kA
Voltage protective level L-L Voltage protective level L-PE	U_P	≤150 V ≤600 V	30 V 300 V
Adapt transmission rate		-	1000 Mbps
Insertion loss		-	≤0.5 dB
Interface Port Type		(1,2) ; (3,6) ; (4,5) ; (7,8)	
Interface (IN) Interface (OUT)		RJ45 Female/Female	
Mounting		DIN rail 35 mm	
Response time	t_A	≤10 ns	
Operation temperature / humidity		-40°C to + 80°C / 30% to + 90%	
Housing material		Thermoplastic UL94 V-0	
Degree of protection		IP20	
Compliance standard		IEC 61643-21	

Dimensions



Internal configuration



INFORMATION TECHNOLOGY SYSTEM
SIGNAL AND DATA LINE PROTECTION
10/100/1000M LAN NETWORK SIGNAL SURGE PROTECTION

Kumwell D01.LAN-RJ45/*D series LAN network signal SPD is designed according to IEC 61643-21 standard. This product is suitable for the 10/100/1000M network equipment lightning protection. The connector of this product is standard RJ45, 8 lines under the protection (1, 2, 3, 6 and 4, 5, 7, 8) easy installation and maintenance. Maximum discharge current I_{max} (8/20 μs) is 10 kA/line., quick response time. It is suitable for the network lightning surge protection.

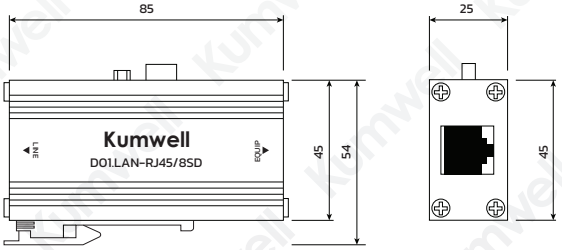


IP 20

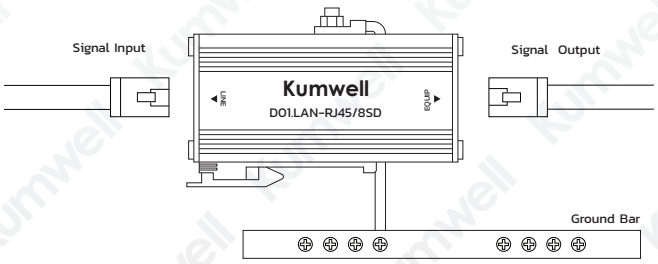
10/100/1000M LAN Network Surge Protection

Technical data		D01.LAN-RJ45/8SGD
Rated working voltage	U_N	5 V
Max. continuous operating voltage	U_C	8 V
Nominal discharge current (8/20 μs)	I_n	5 kA
Max. discharge current (8/20 μs)	I_{max}	10 kA
Voltage protection level at 8/20 μs	U_P	≤ 10 V (Line-Line) ≤ 90 V (Line-PE)
Voltage protection level at 10/700 μs	U_P	≤ 40 V
Response time	t_A	< 1 ns
Transmission Rate		1000 Mbps
Insertion Loss		≤ 0.5 dB
Series impedance per line	R	0.5 Ω
Connector type		RJ45
Quantity of Core Line under Protection		1, 2, 3, 6 (Fine Protection) 4, 5, 7, 8 (Rough Protection)
Housing material		Aluminum
Protection type		IP20
Working temperature		-25°C to +70°C
Mounting		DIN rail 35 mm
Test Standards		IEC 61643-21

Dimensions



Installation



Kumwell

INFORMATION TECHNOLOGY SYSTEM
SIGNAL AND DATA LINE PROTECTION
PoE SURGE PROTECTION

Kumwell D01.POE-RJ45/D PoE Surge Protection adopts aluminum alloy shell with feature of good appearance, easy installation and convenient wiring, it can long-term work stable under hostile environment. It is suitable for PoE centralized power supply HD digital surveillance cameras, exchanger, concentrator and other equipment. It can prevent the equipment from lightning strike or induced overvoltage, overcurrent or other instantaneous surge voltage. It has intelligent circuit recognition function in internal design. When it is used in PoE system, it can distinguish free line power supply method and data line power supply, which makes it suitable for all PoE power supply system. It has the features of multistage protection, low residual voltage, low capacitance design, good transmission performance, fast response and long life, etc.

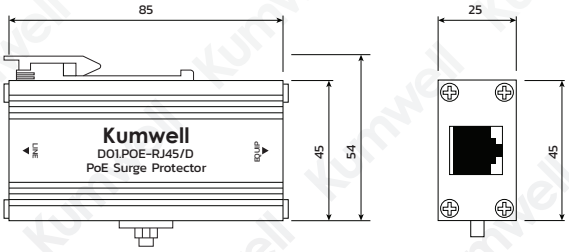


IP 20

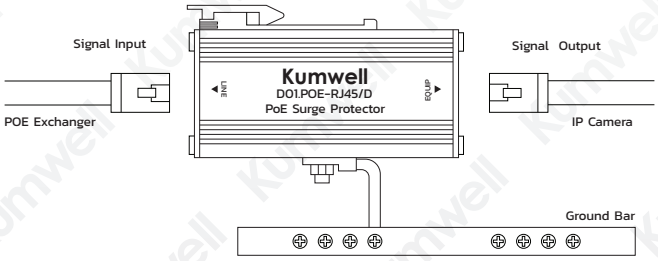
10/100M Network Surge Protection

Technical data		D01.POE-RJ45/D
Signal Transmission Line		1, 2, 3, 6
Power Transmission Line		4, 5, 7, 8
Signal Line Rated working voltage (DC)	U_N	5 V
Signal Line Max. Continuous operating voltage (DC)	U_C	8 V
Voltage protection level at 10/700 μs	U_P	≤ 40 V
Power Line Rated working voltage (DC)	U_N	48 V
Power Line Max. Continuous operating voltage (DC)	U_C	64 V
Power Line Rated Load Current	I_L	0.5 A
Power Line Voltage Protection Level (8/20 μs)	U_P	≤ 200 V
Nominal discharge current (8/20 μs)	I_n	5 kA
Max. discharge current (8/20 μs)	I_{max}	10 kA
Insertion Loss		≤ 0.5 dB
Response time	t_A	≤ 1 ns
Transmission Rate		100 Mbps
Connector type		RJ45
Housing material		Aluminum
Protection type		IP20
Working temperature		-25°C to +70°C
Working humidity		≤ 95% RH
Mounting		DIN rail 35 mm
Test Standards		IEC 61643-21

Dimensions



Installation



INFORMATION TECHNOLOGY SYSTEM
POWER AND DATA LINE PROTECTION
IP CAMERA SURGE PROTECTION

Kumwell D01.IP15K Series are designed according to IEC 61643-21 standard. Combined with power and network terminals together, they are suitable for lightning protection of power system and video signal of IP cameras. With features of high discharge capacity and fast response, they can effectively protect the IP cameras well.

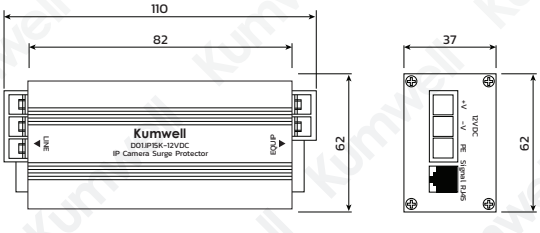


IP 20

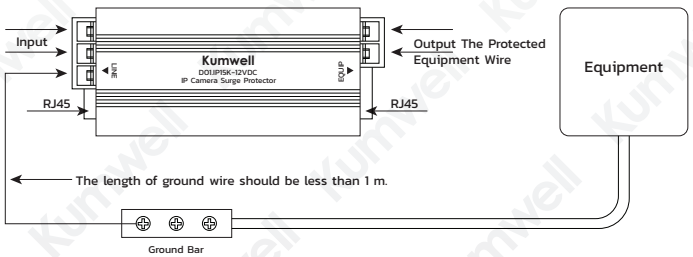
IP Camera Surge Protection

Number of protected pairs		D01.IP15K-12VDC	D01.IP15K-24VAC	D01.IP15K-U275
Power Line				
Nominal voltage	U_N	12 V DC	24 V AC	220 V AC
Max. Continuous operating voltage	U_C	18 V DC	36 V AC	275 V AC
Nominal discharge current (8/20 μs)	I_n		5 kA	
Max. discharge current (8/20 μs)	I_{max}		15 kA	
Voltage protection level at I_n (8/20 μs)	U_P	≤ 100 V	≤ 200 V	≤ 1000 V
Rated load current	I_L		5 A	
Response time	t_A		≤ 10 ns	
Connector type			Terminal Block	
Signal Line				
Nominal voltage	U_N		5 V DC	
Max. Continuous operating voltage	U_C		8 V DC	
Transmission rate			100 Mbps	
Nominal discharge current (8/20 μs)	I_n		1 kA	
Max. discharge current (8/20 μs)	I_{max}		2 kA	
Voltage protection level at 10/700 μs	U_P		≤ 30 V	
Insertion Loss			≤ 0.5 dB	
Response time	t_A		≤ 1 ns	
Connector type			RJ45 Socket	
Mechanical data				
Housing material			Aluminum	
Protection type			IP20	
Working temperature			-25°C to +70°C	
Working humidity			≤ 95% RH	
Test Standards			IEC 61643-21	

Dimensions



Installation



Kumwell

INFORMATION TECHNOLOGY SYSTEM
TELEPHONE SURGE PROTECTION

Kumwell **D01.TEL-RJ11** Telephone Line Signal SPD is designed according to IEC 61643-21 standard. It is suitable for lightning protection of telephone, SPC exchange, fax machine and ISDN equipments. With features of integration metal structural design, high discharge capacity and fast response, it can effectively ensure the equipment to work properly.

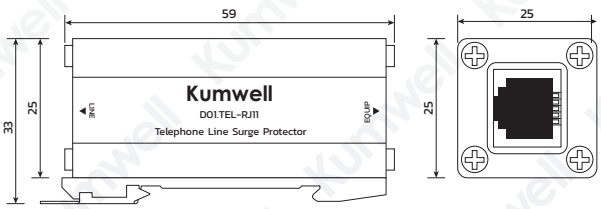


IP 20

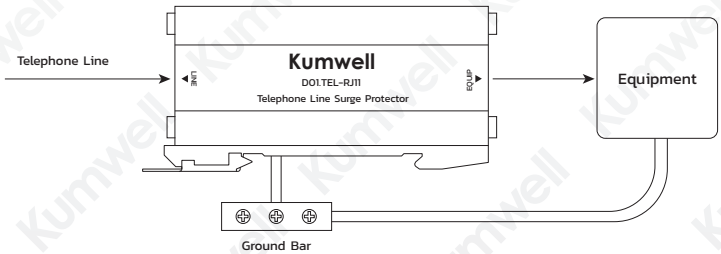
Telephone Surge Protection

Technical data		D01.TEL-RJ11
Max. continuous operating voltage	U_C	200 V
Nominal discharge current (8/20 μs)	I_n	5 kA
Max. discharge current (8/20 μs)	I_{max}	10 kA
Voltage protection level at 10/700 μs	U_P	≤ 300 V
Response time	t_A	≤ 1 ns
Impedance		10 Ω
Insertion Loss		≤ 0.5 dB
Transmission Rate		2 Mbps
Connector type		RJ11
Housing material		Aluminum
Protection type		IP20
Working temperature		-25°C to +70°C
Working humidity		≤ 95% RH
Test Standards		IEC 61643-21

Dimensions



Installation



12 Surge Protection for Data/Signal Lines

Kumwell

DATA/SIGNAL LINES PROTECTION
SPD FOR SHIELDED CABLES

Kumwell KSMH.SH series of surge protective devices has been developed to protect against the effects of induced voltages onto data, signal and communication circuits. The circuit topology consists of a multi-stage protector providing both common (longitudinal) mode and differential (transverse) mode protection.

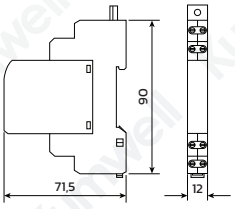
Coarse protection is provided by a three terminal GDT while fine protection is provided using a high speed silicon avalanche diodes or metal oxide varistor stage. Care is taken to ensure coordination between these two stages without voltage or surge current blind spots occurring.



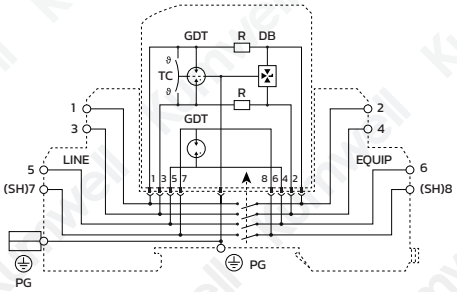
IP 20

Type Technical Data		KSMH.SH Series 5V	12V	15V	24V	30V	48V	60V	110V
Electrical Data									
Lines protected		1 (2 conductors)							
Nominal operating voltage (DC)	U_N	5 V	12 V	15 V	24 V	30 V	48 V	60 V	110 V
Max. continuous operating voltage (DC)	U_C	6 V	15 V	18 V	28 V	33 V	52 V	64 V	170 V
Rated load current at 25°C	I_L	1 A							
C2 Nominal discharge current (8/20 µs)	I_n	10 kA							
Max. discharge current (8/20 µs)	I_{max}	20 kA							
D1 Lightning impulse current (10/350 µs)	I_{imp}	2.5 kA							
Residual voltage at 5 kA (8/20 µs)	U_{res}(Line-Line)	< 22 V	< 42 V	< 48 V	< 70 V	< 80 V	< 140 V	< 160 V	< 450 V
Rated spark overvoltage	(SH-GND) (Line-Line), (Line-GND)	184-276V 7-10 V	16-21 V	20-24 V	30-36 V	35-43 V	55-68 V	67-85 V	184-264 V
Response time of overvoltage protection	t_A(SH-GND) (Line-Line), (Line-GND)	< 100 ns < 1 ns							
Insulation resistance of the protection	R_{iso}(SH-GND) (Line-Line), (Line-GND)	>1GΩ/100V ≥6 MΩ	≥15 MΩ	≥18 MΩ	≥28 MΩ	≥33 MΩ	≥52 MΩ	≥64 MΩ	≥170 MΩ
Serial resistance per path	R	1.6-2.0Ω							
Transverse capacitance	C (SH-GND) (Line-Line), (Line-GND)	5 pF 50 pF							
Cut-off frequency	F_G	30 MHz							
Mechanical data									
Temperature range		-40°C to +80°C							
Terminal cross section		Stranded to 4 mm²							
Mounting		DIN rail 35mm							
Degree of protection		IP20							
Test Standards		IEC 61643-21							

Dimensions



Internal configuration



Legend :
- TC Thermo-clip
- GDT Gas Discharge Tube
- R Resistor
- DB Diode Block
- PG Protective Grounding
- SH Shielded

DATA/SIGNAL LINES PROTECTION
MODULAR SPD FOR SINGLE-PAIR SIGNAL LINES



Kumwell KSMH.TC **series** of surge protective devices has been developed to protect against the effects of induced voltages onto data, signal and communication circuits. These efficient overvoltage barriers contain both coarse and fine protection stages and provide longitude and transverse surge protection. The initial protection stage comprises a three-pole gas discharge tube and is designed to divert the primary surge energy. The subsequent fine protection stage is carried out using fast bi-directional silicon avalanche diodes. Care is taken in the design of this fine protection stage to avoid capacitive line loading and thereby ensuring a low insertion loss and wide operating frequency range.

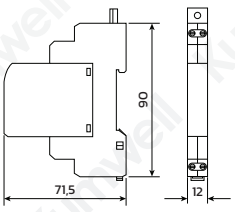
Series line impedances ensure energy co-ordination between the coarse and a fine protection stages at all levels of the incident surge.

To protect against the hazards of electric shock and fire which often results when power frequency contact occurs between power and communication lines (often called main incursion), a thermo-clip is included on the primary protection stage to divert the power frequency current to ground.

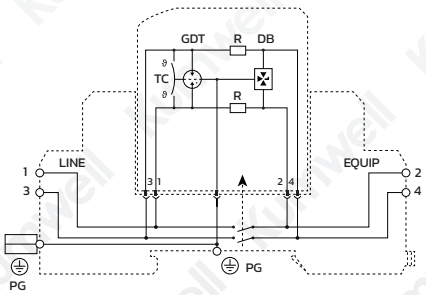
IP 20

Type Technical Data		KSMH.TC Series 5V	12V	15V	24V	30V	48V	60V	110V
Electrical Data									
Lines protected		1 (2 conductors)							
Nominal operating voltage (DC)	U_N	5 V	12 V	15 V	24 V	30 V	48 V	60 V	110 V
Max. continuous operating voltage (DC)	U_C	6 V	15 V	18 V	28 V	33 V	52 V	64 V	170 V
Rated load current at 25°C	I_L	1 A							
C2 Nominal discharge current (8/20 µs)	I_n	10 kA							
Max. discharge current (8/20 µs)	I_{max}	20 kA							
D1 Lightning impulse current (10/350 µs)	I_{imp}	2.5 kA							
Residual voltage at 5 kA (8/20 µs)	U_{res}	< 22 V	< 42 V	< 48 V	< 70 V	< 80 V	< 140 V	< 160 V	< 450 V
Rated spark overvoltage	(Line-GND) (Line-Line)	7-10 V 7-10 V	16-21 V 16-21 V	21-25 V 21-25 V	31-37 V 31-37 V	36-44 V 36-44 V	57-69 V 57-69 V	68-84 V 68-84 V	184-264 V 184-264 V
Response time of overvoltage protection	t_A	< 1 ns							
Thermal protection		Yes							
Insulation resistance of the protection	R_{iso}	≥6 MΩ	≥15 MΩ	≥18 MΩ	≥28 MΩ	≥33 MΩ	≥52 MΩ	≥64 MΩ	≥170 MΩ
Serial resistance per path	R	1.6-2.0Ω							
Transverse capacitance	C	50 pF							
Cut-off frequency	f_G	30 MHz							
Mechanical data									
Temperature range		-40°C to +80°C							
Terminal cross section		Stranded to 4 mm²							
Mounting		DIN rail 35mm							
Degree of protection		IP20							
Test Standards		IEC 61643-21							

Dimensions



Internal configuration



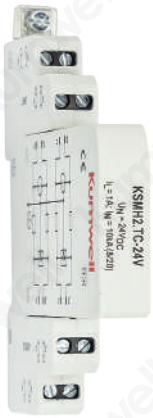
Legend :

TC	Thermo-clip
GDT	Gas Discharge Tube
R	Resistor
DB	Diode Block
PG	Protective Grounding

Kumwell

DATA/SIGNAL LINES PROTECTION
MODULAR SPD FOR 2-PAIRS SIGNAL LINES

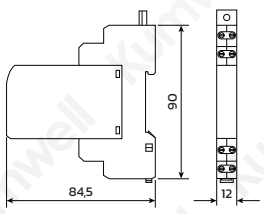
Kumwell KSMH2.TC **series** of surge protective devices has been developed to protect against the effects of induced voltages onto data, signal and communication circuits. Like the KSMH.TC series, the KSMH2.TC provides the same level of protection to two independent circuits (pairs). A number of protection voltages are available to ensure the user is able to select the closest clamp in voltage to the normal signal operation of the equipment being protected.



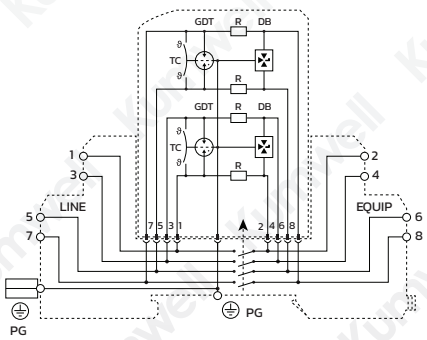
IP 20

Type Technical Data		KSMH2.TC Series 5V	12V	15V	24V	30V	48V	60V	110V
Electrical Data									
Lines protected		2 (4 conductors)							
Nominal operating voltage (DC)	U_N	5 V	12 V	15 V	24 V	30 V	48 V	60 V	110 V
Max. continuous operating voltage (DC)	U_C	6 V	15 V	18 V	28 V	33 V	52 V	64 V	170 V
Rated load current at 25°C	I_L	1 A							
C2 Nominal discharge current (8/20 µs)	I_n	10 kA							
Max. discharge current (8/20 µs)	I_{max}	20 kA							
D1 Lightning impulse current (10/350 µs)	I_{imp}	5 kA							
Residual voltage at 5 kA (8/20 µs)	U_{res}	< 22 V	< 42 V	< 48 V	< 70 V	< 80 V	< 140 V	< 160 V	< 450 V
Rated spark overvoltage	(Line-GND)	7-10 V	17-21 V	21-25 V	31-37 V	36-44 V	57-69 V	68-84 V	184-264 V
	(Line-Line)	7-10 V	17-21 V	21-25 V	31-37 V	36-44 V	57-69 V	68-84 V	184-264 V
Response time of overvoltage protection	t_A	< 1 ns							
Thermal protection		Yes							
Insulation resistance of the protection	R_{iso}	≥6 MΩ	≥15 MΩ	≥18 MΩ	≥28 MΩ	≥33 MΩ	≥52 MΩ	≥64 MΩ	≥170 MΩ
Serial resistance per path	R	1.6-2.0Ω							
Transverse capacitance	C	50 pF							
Cut-off frequency	f_G	30 MHz							
Mechanical data									
Temperature range		-40°C to +80°C							
Terminal cross section		Stranded to 4 mm²							
Mounting		DIN rail 35mm							
Degree of protection		IP20							
Test Standards		IEC 61643-21							

Dimensions



Internal configuration



Legend :
TC Thermo-clip
GDT Gas Discharge Tube
R Resistor
DB Diode Block
PG Protective Grounding

DATA/SIGNAL LINES PROTECTION
SPD WITH SEPARATED SIGNAL GROUND (RS232)

Kumwell KSMH.SG series of surge protective devices has been developed to protect against the effects of induced voltages onto data, signal and communication circuits. It is intended for those applications where high ground potential rises may frequency occur, such as in location close to electric railways.

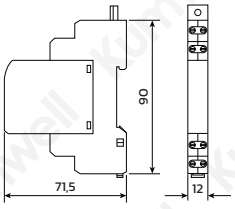
The circuit topology consists of a multi-stage protector providing both common (longitudinal) mode and differential (transverse) mode protection. Coarse protection is provided by a three terminal GDT while fine protection is provided using a high speed silicon avalanche diodes or metal oxide varistor stage.



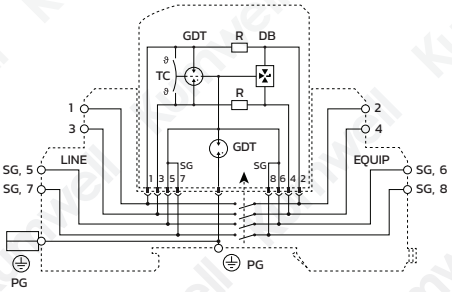
IP 20

Type Technical Data		KSMH.SG Series 5V	12V	15V	24V	30V	48V	60V	110V
Electrical Data									
Lines protected		1 (2 conductors)							
Nominal operating voltage (DC)	U_N	5 V	12 V	15 V	24 V	30 V	48 V	60 V	110 V
Max. continuous operating voltage (DC)	U_C	6 V	15 V	18 V	28 V	33 V	52 V	64 V	170 V
Rated load current at 25°C	I_L	1 A							
C2 Nominal discharge current (8/20 µs)	I_n	10 kA							
Max. discharge current (8/20 µs)	I_{max}	20 kA							
D1 Lightning impulse current (10/350 µs)	I_{imp}	2.5 kA							
Residual voltage at 5 kA (8/20 µs)	U_{res}(Line-Line)	< 22 V	< 42 V	< 48 V	< 70 V	< 80 V	< 140 V	< 160 V	< 450 V
Rated spark overvoltage	(SG-GND) (Line-Line), (Line-SG)	184-276V 7-10 V	16-19 V	20-24 V	30-36 V	35-43 V	55-68 V	67-85 V	184-264 V
Response time of overvoltage protection	t_A(Line-Line) (Line-GND)	< 1 ns < 100 ns							
Insulation resistance of the protection	R_{iso}(Line-Line) (Line-GND)	>1GΩ/100V ≥6 MΩ	≥15 MΩ	≥18 MΩ	≥28 MΩ	≥33 MΩ	≥52 MΩ	≥64 MΩ	≥170 MΩ
Serial resistance per path	R	1.6-2.0Ω							
Transverse capacitance	C (Line-Line) (Line-GND)	50 pF 5 pF							
Cut-off frequency	f_G	30 MHz							
Mechanical data									
Temperature range		-40°C to +80°C							
Terminal cross section		Stranded to 4 mm²							
Mounting		DIN rail 35mm							
Degree of protection		IP20							
Test Standards		IEC 61643-21							

Dimensions



Internal configuration



Legend :
- **TC** Thermo-clip
- **GDT** Gas Discharge Tube
- **R** Resistor
- **DB** Diode Block
- **PG** Protective Grounding
- **SG** Signal Grounding

Kumwell

DATA/SIGNAL LINES PROTECTION
MODULAR SPD FOR 2-PAIRS SIGNAL LINES



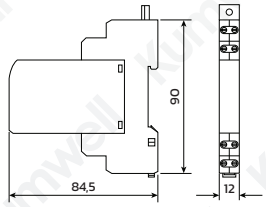
Kumwell KSMI2 Series provides electrical environments where higher exposure to the effects of direct or partially direct lightning currents may be experienced. These include wind turbines and PV installations where lightning exposures are more severe, but where protection of sensitive electronics, such as environmental sensors, is just as crucial. These barriers provide both coarse and fine protection stages and offer longitudinal and transverse protection.

The initial protection stage comprises a three-pole gas discharge tube and is designed to divert the primary surge energy. The subsequent fine protection stage is implemented using fast bi-directional silicon avalanche diodes. Series line impedance is used to ensure energy coordination between the coarse and fine protection stages irrespective of the magnitude of the incident surge. When power frequency contact occurs between power and communication lines, the hazard of electric shock and fire is increased. To prevent such risk, a thermo-clip is included in the primary protection stage of this device to divert the power frequency current to ground. The plug-in module/base design facilitates replacement of a failed module without the need to remove system wiring.

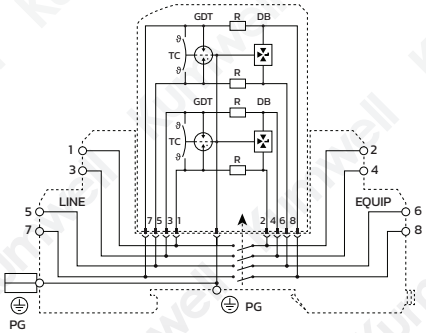
IP 20

Type Technical Data		KSMI2 Series 5V	12V	15V	24V	30V	48V	60V	110V
Electrical Data									
Lines protected		2 (4 conductors)							
Nominal operating voltage (DC)	U_N	5 V	12 V	15 V	24 V	30 V	48 V	60 V	110 V
Max. continuous operating voltage (DC)	U_C	6 V	15 V	18 V	28 V	33 V	52 V	64 V	170 V
Rated load current at 25°C	I_L	1 A							
C2 Nominal discharge current (8/20 µs)	I_n	20 kA							
Max. discharge current (8/20 µs)	I_{max}	30 kA							
D1 Lightning impulse current (10/350 µs)	I_{imp}	5 kA							
Residual voltage at 5 kA (8/20 µs)	U_{res}	< 22 V	< 42 V	< 48 V	< 70 V	< 80 V	< 140 V	< 160 V	< 450 V
Rated spark overvoltage	(Line-GND)	7-10 V	16-21 V	21-25 V	31-37 V	36-44 V	57-69 V	68-84 V	184-264 V
	(Line-Line)	7-10 V	16-21 V	21-25 V	31-37 V	36-44 V	57-69 V	68-84 V	184-264 V
Response time of overvoltage protection	t_A	< 1 ns							
Thermal protection		Yes							
Insulation resistance of the protection	R_{iso}	≥6 MΩ	≥15 MΩ	≥18 MΩ	≥28 MΩ	≥33 MΩ	≥52 MΩ	≥64 MΩ	≥170 MΩ
Serial resistance per path	R	1.6-2.0Ω							
Transverse capacitance	C	50 pF							
Cut-off frequency	f_G	30 MHz							
Mechanical data									
Temperature range		-40°C to +80°C							
Terminal cross section		Stranded to 4 mm²							
Mounting		DIN rail 35mm							
Degree of protection		IP20							
Test Standards		IEC 61643-21							

Dimensions



Internal configuration



Legend :
TC Thermo-clip
GDT Gas Discharge Tube
R Resistor
DB Diode Block
PG Protective Grounding

DATA/SIGNAL LINES PROTECTION
MODULAR SPD FOR 2-PAIRS SIGNAL LINES



Kumwell KSPH2 series of surge protective devices has been developed to protect two pair loops, which could be ungrounded onto data, signal and communication circuits. It is intended for those applications where high ground potential rises may frequently occur, such as in locations close to electric railways.

The circuit topology consists of a multi-stage protector providing both common (longitudinal) mode and differential (transverse) mode protection.

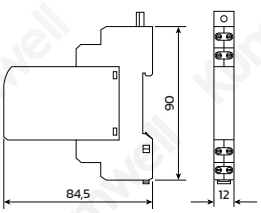
Coarse protection is provided by a three terminal gas discharge tube while fine protection is provided using a high speed silicon avalanche diode or metal oxide varistor stage. Care is taken to ensure coordination between these two stages without voltage or surge current blind spots occurring.

Thermal protection is provided to reduce the hazards of thermal runaway should there be an inadvertent mains incursion fault. Both common (longitudinal) mode and differential (transverse) mode protection is provided. If the module is unplugged out of the base, the connection lines remain enabled.

IP 20

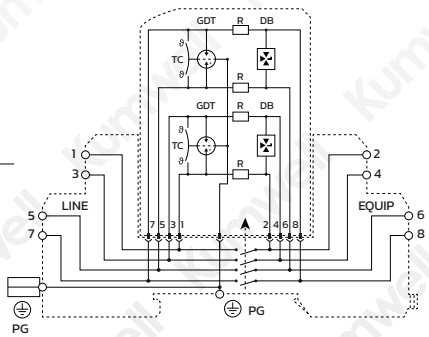
Type / Technical Data		KSPH2 Series KSPH2-30V/1A	KSPH2-30V/10A
Electrical Data			
Lines protected		2 (4 conductors)	
Nominal operating voltage (DC)	U_N	30 V	
Max. continuous operating voltage (DC)	U_C	33 V	
Rated load current at 25°C	I_L	1 A	10 A
C2 Nominal discharge current (8/20 µs)	I_n	10 kA	
Max. discharge current (8/20 µs)	I_{max}	20 kA	
D1 Lightning impulse current (10/350 µs)	I_{imp}	5 kA	
Residual voltage at 5 kA (8/20 µs)	U_{res} (Line-Line)	< 80 V	
Rated spark overvoltage	(Line-GND)	184-276V	
	(Line-Line)	36-44 V	
Response time of overvoltage protection	t_A (Line-Line)	< 1 ns	
	t_A (Line-GND)	< 100 ns	
Insulation resistance of the protection	R_{iso} (Line-GND)	>1GΩ/100V	
	R_{iso} (Line-Line)	≥ 33 MΩ	
Serial resistance per path	R	1.6-2.0 Ω	0.1 Ω
Transverse capacitance	C (Line-Line)	50 pF	
	C (Line-GND)	5 pF	
Cut-off frequency	f_G	30 MHz	
Mechanical data			
Temperature range		-40°C to +80°C	
Terminal cross section		Stranded to 4 mm²	
Mounting		DIN rail 35mm	
Degree of protection		IP20	
Test Standards		IEC 61643-21	

Dimensions

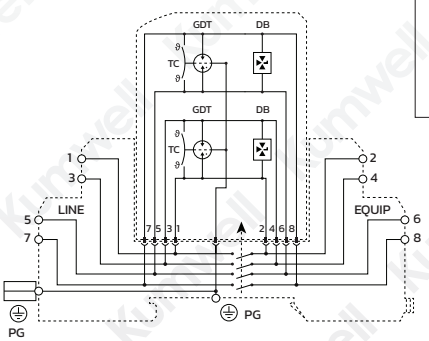


Internal configuration

KSPH2-30V/1A



KSPH2-30V/10A



Legend :

TC	Thermo-clip
GDT	Gas Discharge Tube
R	Resistor
DB	Diode Block
PG	Protective Grounding

13 Lightning Strike Counter and Surge Counter

DIGITAL LIGHTNING STRIKE COUNTER

Kumwell KLSC-01 is intended for counting and recording a surge impulses which are caused by lightning strikes that flow through the lightning protection systems. KLSC-01 is mounted direct on lightning down conductor. The current withstand of this lightning strikes counter is 100 kA (10/350). By connecting the device to the protective system of atmospheric discharges that affect the object. Depending on the measured data in the device is then possible to perform preventative maintenance or inspection of the entire system.

- LCD screen displays number of lightning strikes, hour and date of lightning event
- Buttons enable TIME/DATE setting and log viewing
- Replaceable battery, lifetime up to 4 years
- Contactless sensors-easy to install, no change in existing installation needed
- Complies with: IEC/EN 62561-6

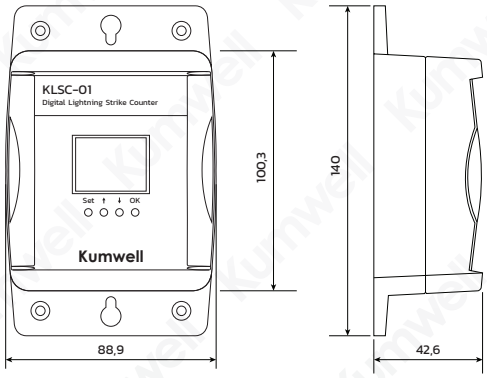


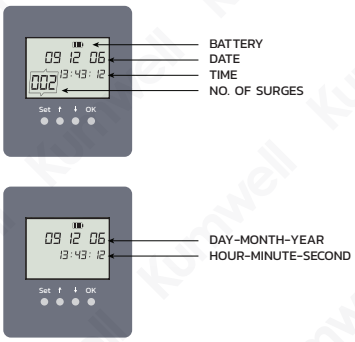
IP65 CE

Lightning Strike Counter

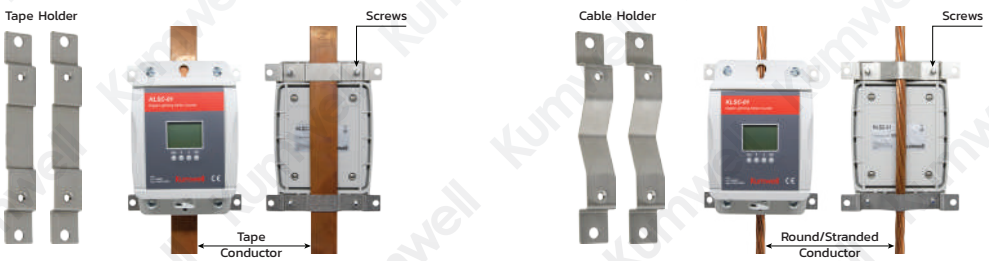
Technical data		KLSC-01
Threshold Current (8/20 μs)	I_{tc}	1 kA
Maximum withstand current (10/350 μs)	I_{MCW}	100 kA
Maximum Events Logged		999
Temperature range		-20°C to +60°C
Degree of protection		IP65
Enclosure material		Polycarbonate: UL 94V-0
Mounting		Direct on down conductor
Power Supply		2 Replaceable CR17335 lithium batteries
Test Standards		IEC 62561-6

Dimensions





Installation



Kumwell

MECHANICAL LIGHTNING COUNTER

Kumwell KLJS-100KA mechanical lightning counter is designed for counting and recording a surge impulses which are caused by lightning strikes that flow through the lightning protection systems.

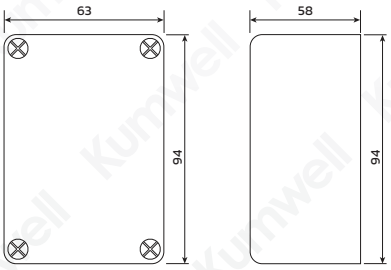
KLJS-100KA is mounted direct on lightning down conductor to record number of lightning strikes. The maximum current intensity of this lightning counter is 100 kA (10/350). By connecting the device to the protective system of atmospheric discharges that affect the object. Depending on the measured data in the device is then possible to perform preventative maintenance or inspection of the entire system.



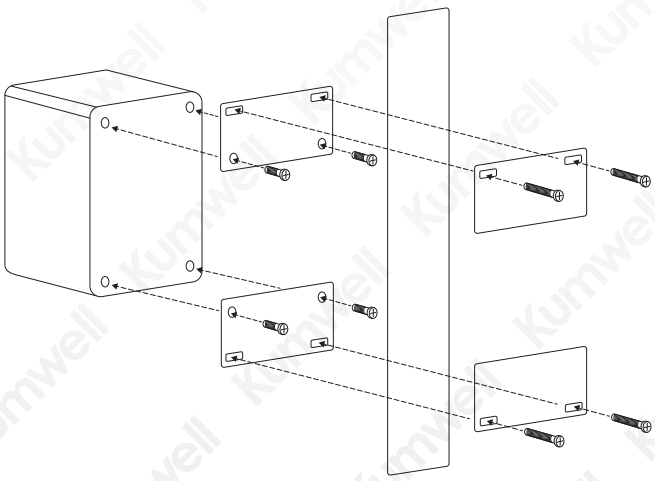
Mechanical Lightning Counter

Technical data		KLJS-100KA
Minimum counting current (80/20 μs)		>1 kA
Maximum current intensity (10/350 μs)		100 kA
Maximum counting number		0000000-9999999
Display window		7 digits mechanical display
Current induction mode		Built-in induction probe
Operating mode		No power / No battery
Size		94*63*58 mm
Housing material		ABS
Degree of protection		IP65
Mounting		Direct on down conductor

Dimension



Installation



4 DIGITS MECHANICAL LIGHTNING COUNTER

Kumwell KLSC-100KA mechanical lightning counter (4 digits) is used for register the direct lightning event which are caused by lightning strikes that flow through the lightning protection systems. Long service life due to no battery need with trigger current 350A and can register lightning strike up to 100 kA (8/20μs)

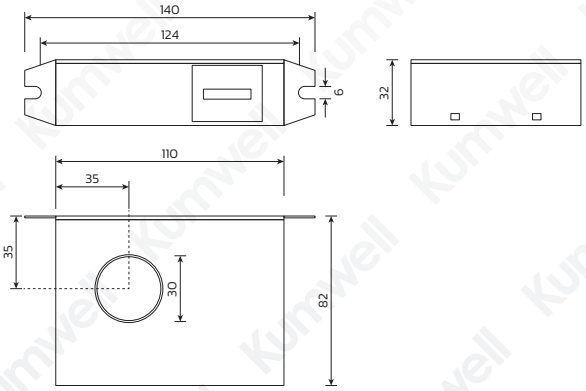
KLSC-100KA is mounted direct on lightning down conductor to record number of lightning strikes. By connecting the device to the protective system of atmospheric discharges that affect the object. Depending on the measured data in the device is then possible to perform preventative maintenance or inspection of the entire system.



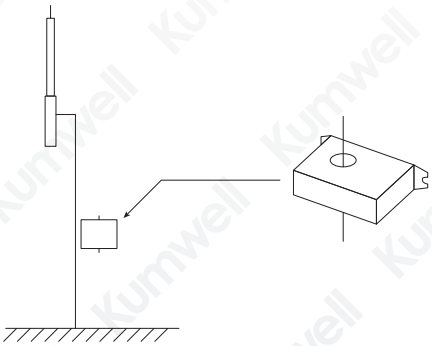
4 Digits Mechanical Lightning Counter

Technical data	KLSC-100KA
Minimum current sensitivity (rise rime ≥ 8μs)	> 350A
Maximum detectable current (Imax)	100 kA
Maximum counting number	0~9999
Sequence of impulse	> 1s
Display model	4 digits analogue display
Current sample mode	Buil-in induction probe
Working mode	No battery / power supply needed
Operation temperature	-20°C~+70°C
Dimension of counter	110x33x82 mm
Enclosure material	Metal plate
Degree of protection	IP67
Mounting	Direct on down conductor
Standards	IEC 62561-6

Dimensions



Installation



Kumwell

6 DIGITS MECHANICAL LIGHTNING COUNTER

Kumwell KLSC-100KS mechanical lightning counter (6 digits) is used for register the direct lightning event which are caused by lightning strikes that flow through the lightning protection systems. Long service life due to no battery need with trigger current 350A and can register lightning strike up to 100 kA (8/20μs)

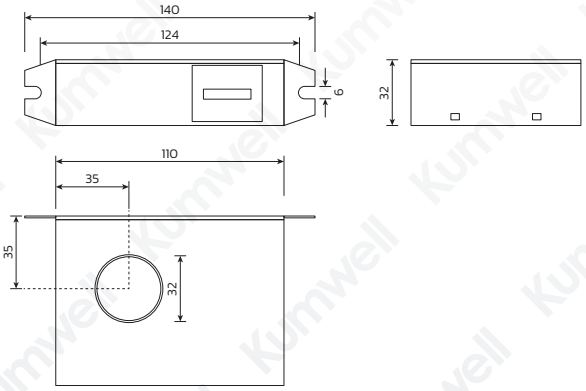
KLSC-100KS is mounted direct on lightning down conductor to record number of lightning strikes by connecting the device to the protective system of atmospheric discharges that affect the object. Depending on the measured data in the device is then possible to perform preventative maintenance or inspection of the entire system.



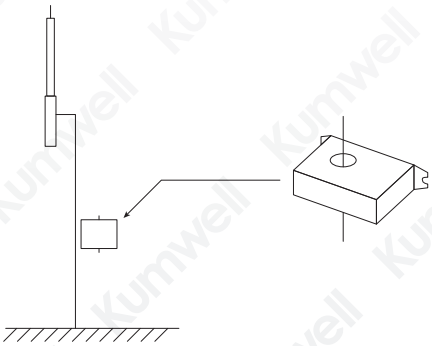
6 Digits Mechanical Lightning Counter

Technical data	KLSC-100KS
Minimum current sensitivity (rise rime ≥ 8μs)	> 350A
Maximum detectable current (Imax)	100 kA
Maximum counting number	0~999999
Sequence of impulse	> 1s
Display model	6 digits analogue display
Current sample mode	Buil-in induction probe
Working mode	No battery / power supply needed
Operation temperature	-20°C~+70°C
Dimension of counter	110x33x82 mm
Enclosure material	Metal plate
Degree of protection	IP67
Mounting	Direct on down conductor
Standards	IEC 62561-6

Dimensions



Installation



SURGE COUNTER
COUNT OF SURGE EVENT

Kumwell KSC-I50A50 is a surge counter with an extra function. Beside surge number count it also logs hour and date for each surge counted. Its surge count and log of previous surges cannot be tempered with, so it can be used for cooperation with insurance companies. With additional time and date logging function, it is now possible to pinpoint the exact time of every surge and correlate it with equipment and power supply problems inside of building.

- LCD screen displays number of surges, hour and date of surge event
- Buttons enable TIME/DATE setting and log viewing
- Replaceable battery, lifetime up to 2 years
- Easy to install, Snap-on surge current sensor
- Complies with: IEC/EN 62561-6

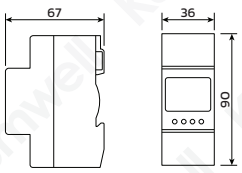


IP 20 CE

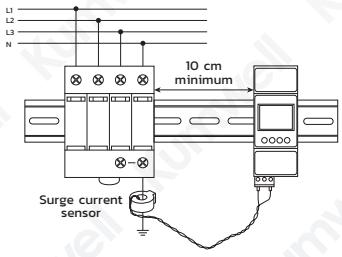
Surge Counter

Technical data		KSC-I50A50
Threshold Current (8/20 µs)	I_{tc}	50 A
Max. counting discharge current (8/20 µs)	I_{MCW}	50 kA
Maximum events logged		999
Operating temperature range		-20°C to + 70°C
Degree of protection		IP20
Enclosure material		Thermoplastic; extinguishing degree UL 94 V-0
Mounting		DIN rail 35mm, EN 60715
Max.wired diameter through the current sensor		14 mm
Sensor cable		0.5 m
Power Supply		Replaceable CR17335 lithium battery
Test Standards		IEC 62561-6

Dimensions



Installation



Kumwell

SURGE COUNTER

Kumwell KSC-KS2 surge counter is designed for counts accurately and displays clearly the quantity of lightning stroke, avoiding the discharge number of MOV component exceeds the regulated requirements, so that the SPD can be replaced easily.

- Standard 35mm DIN rail installation.
- Can be used to match with all kinds of lightning protection devices.
- High-temperature resistance plastics shell.
- Modular installation, reliable sealing, nice appearance.
- Easy installation and wiring, dust prevention, anticorrosion and antiflaming.

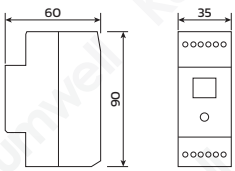


IP 20

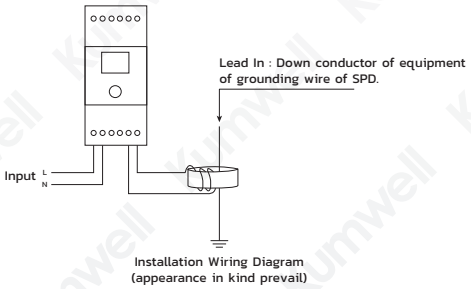
Surge Counter

Technical data		KSC-KS2
Rated operating voltage		230 V AC
Threshold current (8/20 μs)	I_{tc}	1 kA
Max. counting discharge current (8/20 μs)	I_{MCW}	100 kA
Indicator		2-Digit 7-Segment Display Counter (0-99)
Operating temperature range		-25°C to +70°C
Storage Temperature		-40°C to +85°C
Working Humidity		≤ 95%RH
Operational Environment		Indoor,or place without rain and snow
Degree of protection		IP20
Sampling Pattern		Induction sampling
Mounting		DIN rail 35mm
Test Standards		IEC 61643-11, IEC 62561-6

Dimensions



Installation



Installation Wiring Diagram
(appearance in kind prevail)

14 Smart SPD IoT Monitoring Systems

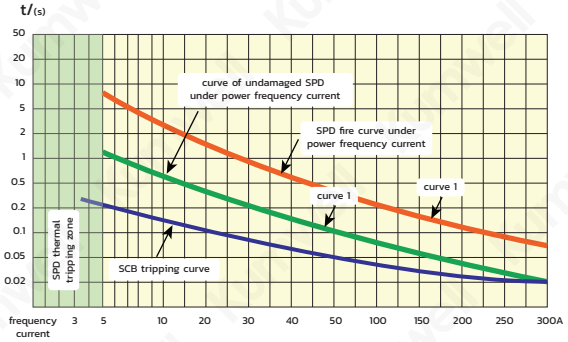
SCB – SPD CIRCUIT BREAKER

Kumwell SCB, exclusive SPD external disconnector solves the fire problem caused by SPD degradation and power grid failure.
It can avoid SPD external disconnector tripping mistakenly under lightning stroke, thus keeping lightning protection performance.
It solves protection blind problem that fuses and MCBs are used as external disconnector.
It has become the ideal matching component for SPD.

Characteristics:

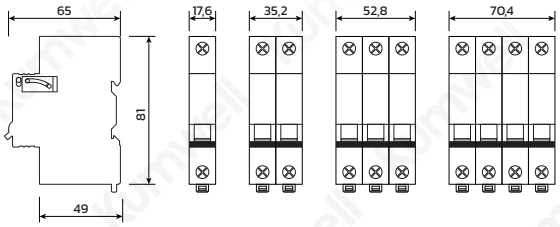
- Trip under 3 A power frequency current
- No tripping and damage under surge current to guarantee continuous lightning protection
- Low residual voltage (Up value of SCB is very low, almost equal to fuse)
- Rated short circuit current up to 100 kA (I_{CS})

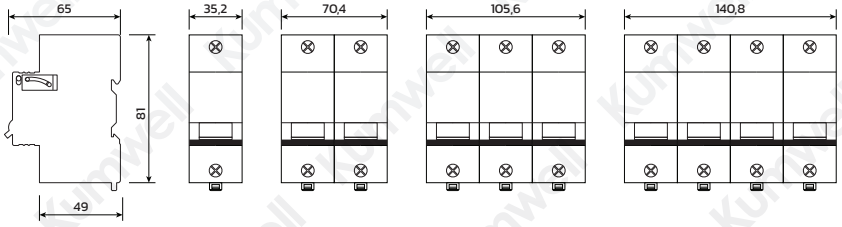




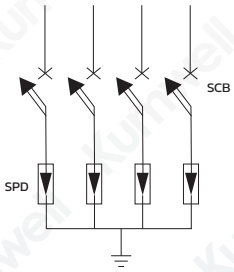
Specifications					
Product Series	**Product model**	**Surge withstanding**	**Short circuit breaking capacity**	**Tripping value under power frequency**	**Pole**
SCB	SCB-C15K1	15 kA (10/350μs)	65 kA	3 ±1A	1P 2P 3P 4P
	SCB-C15K2	60 kA (8/20μs)	100 kA		
	SCB-C25K1	25 kA (10/350μs)	65 kA		
	SCB-C25K2	80 kA (8/20μs)	100 kA		
	SCB-80K1	80 kA (8/20μs)	65 kA		
	SCB-80K2		100 kA		
	SCB-60K1	60 kA (8/20μs)	65 kA		
	SCB-60K2		100 kA		

Dimensions





Design Application



SCB WITH AUTOMATIC RECLOSER

When SPD external disconnector trips, electrical equipment will lose lightning protection. SCB with automatic recloser is suitable to be applied in distribution boards in the unmanned data center rooms, super high construction, large square, fire control, substation, etc. If SCB trips, automatic recloser will reclose automatically to guarantee continuous lightning protection.

Characteristics:

- With safe switch, more safe in manual operation
- Manual / automatic switch, more convenient in local maintenance
- Product with small shape and high stability
- Dry contact to remotely control reclosing, RS485 bus communication and alarm when failure



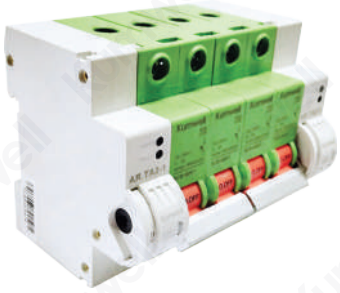
AR.TA2 & SCB (1P)



AR.TA2 & SCB (2P)



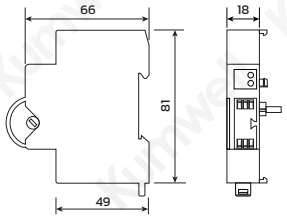
AR.TA3 & SCB (3P)



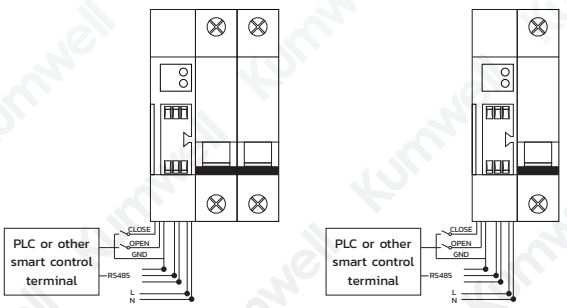
AR.TA2 & SCB (4P)

Specifications		
Model	**AR.TA2**	**AR.TA3**
Width	18 mm	36 mm
Operating voltage	100/230VAC, 50/60 Hz	100/230VAC, 50/60 Hz
Reclosing delay time(s)	5s	5s
Mechanical life	20000 times	10000 times
Remote control reclosing	≤ 3s	≤ 3s
Continuous reclosing number	3 times	3 times
EMC degree	IV	IV
Protection degree	IP20	IP20
Display	LED display (Optional)	LED display (Optional)
Operating temperature	-25°C to +60°C	-25°C to +60°C
Storage temperature	-40°C to +80°C	-40°C to +80°C
Humidity	≤ 90%RH	≤ 90%RH
Matched with	RCD (single phase) or SCB	RCD (single phase) or SCB
Product Series		
Remote dry contact communication distance cable	≤ 500m@1.5mm² RVPP communication cable	≤ 500m@1.5mm² RVPP communication cable
RS485 bus control length cable	≤1000m@1.5mm² RVPP communication cable	≤1000m@1.5mm² RVPP communication cable

Dimensions



Installation



Kumwell

INTEGRATED ONLINE SMART SPD

Kumwell Integrated online smart SPD is the patent product and is able to detect microamps leakage current of SPD in the real time. It can detect itself status, collect data automatically and report actively. Integrated smart SPD adopts standard RS485 and it can be applied in the power distribution of railway, airport, electricity, petrochemicals, new energy, communication etc.

Characteristics:

- CT sensor make it possible to detect 1 μA level of SPD pure resistance leakage current
- Adopting reverse insertion technology and sophisticated mathematical model to gain real leakage current
- Built-in sensor to detect lightning peak current, polarity, number and time
- Monitoring lightning protection module status to judge it is normal or abnormal
- Monitoring SPD external disconnector status
- Monitoring operating voltage and ambient temperature
- Flexible network, convenient for network monitoring and alarm within seconds
- Integrated small structure, no need to secondary wiring



SPD



SMART MODULE



MICROAMPERE LEAKAGE CURRENT DETECTING MODULE

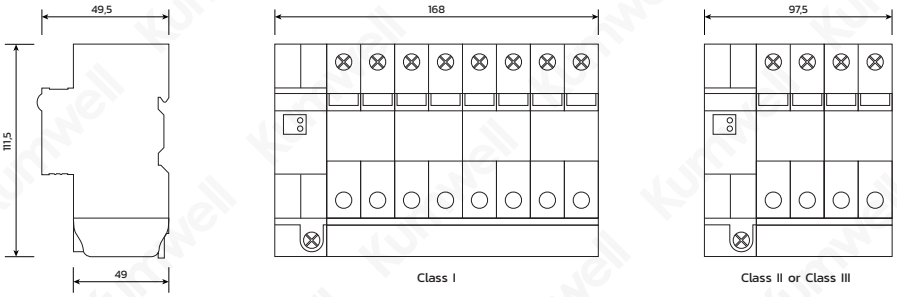


LIGHTNING SURGE STRENGTH DETECTING MODULE

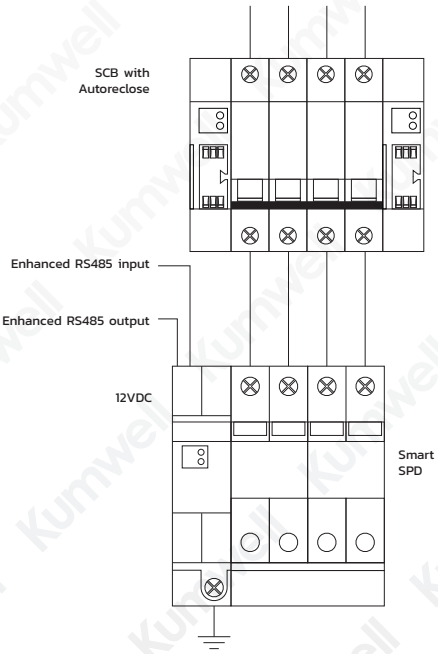
Specifications

Product Name	Product model	I_n	I_{max}	U_c	U_P	Lightning current triggering record value	Maximum record current	Leakage measuring accuracy
Integrated online smart SPD	SM12.U275-40K.DS/1PN	20 kA	40 kA	275 V	≤ 1.5 kV	1 kA (8/20)	100 kA (8/20)	1 μA
	SM12.U275-40K.DS/3P	20 kA	40 kA	275 V	≤ 1.5 kV			
	SM12.U275-40K.DS/3PN	20 kA	40 kA	275 V	≤ 1.5 kV			

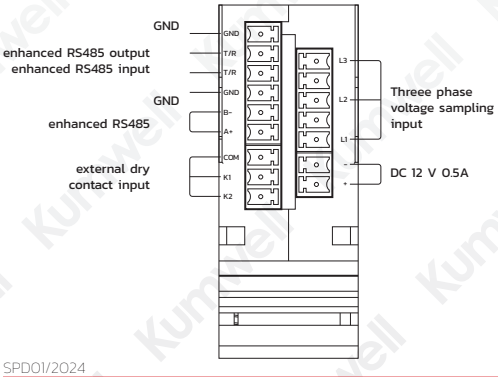
Dimensions



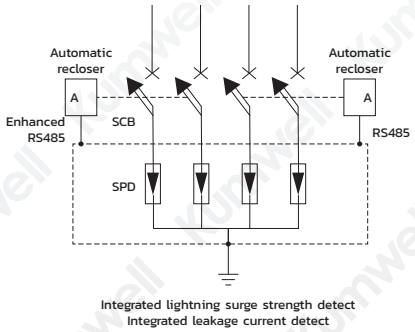
Network connections



Product Structure



Design Application



CENTRALIZED CONTROLLER

Kumwell CT.CTRL-T1 (Centralized Controller) is the core part of smart SPD systems, centralized controller collects and transmits data to the computer via TCP/IP, GPRS or enhanced RS485.

Characteristics:

- Managing multi-circuit device
- Adopting enhance RS485 (Bidirection communication) communication
- Strong anti-interference ability (max. transmission length : 1000 m)
- Master-slave communication with quick data transmission
- Report actively in the real-time



RS485,TCP/IP
Centralized Controller

Product Structure

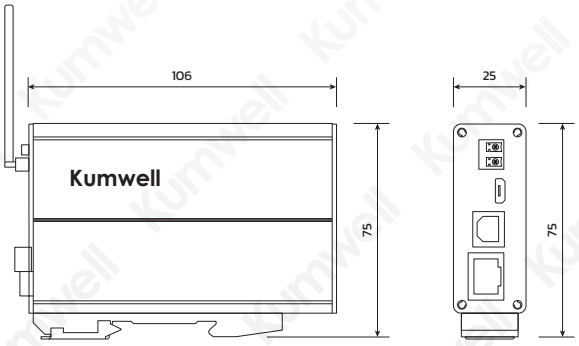




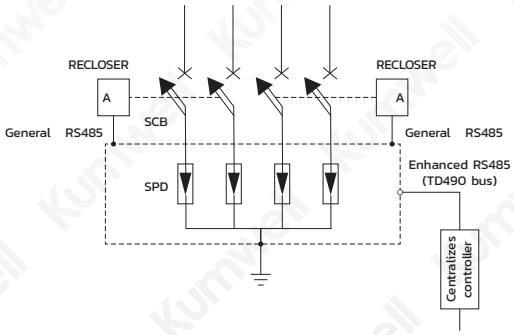
GPRS
Centralized Controller

Specifications Technical data	
Power supply	12V DC
Communication method	TCP/IP, enhance RS485, GPRS
GSM GPRS	no limit distance
Ethernet TCP/IP	no limit distance
RS485 transmission distance	1000m

Dimensions



Installation



15 Surge Filter

POWER SUPPLY SYSTEM
Single Phase 63A Power Surge Filter KSF100-U320-63A-1PN

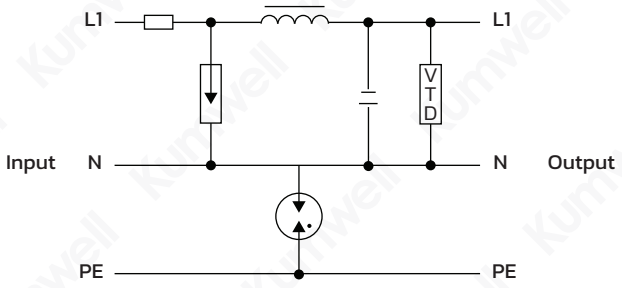
Kumwell **KSF100 series** surge filter is two-port Surge Protective Device with LC Filter designed to protect single phase electrical distribution systems especially sensitive electronics against the harmful effects of transient surges.

These surges are the result of:

- Direct and indirect lightning strikes
- Power company load switching
- Upstream load switching at other facilities

It's found that electronic equipment is sensitive to both the absolute magnitude of the impulse voltage and the rate of rise of this impulse, much of the damage which occurs in sensitive electronic circuits using power semiconductor components is the result of these steep changes in dv/dt and di/dt rather than simply the peak voltage. Therefore, KSF100 is designed as a 3-stage protection system which consist of primary Trigger spark gap (TSG) protection & secondary VTD is special technology MOV and GDT series to eliminate follow current and leakage current for prolong the service life in conjunction with series well-designed LC filter. The LC filter used to slow down the inherently fast rates of voltage and current rise, and TSG module to deflect high pulsed lightning current (10/350 μs) up to 25 kA per mode or surge current (8/20 μs) up to 100 kA per mode. Further, the secondary MOV module & LC filter will limit the surge voltage (the let-through voltage) to very low level. KSF100 Series are fully enclosed in wall mounting IP20 steel enclosures, with a LED light to demonstrate the working status of the surge filter. KSF100 surge filter should be installed in series with the supply powering the equipment. It can be used in lightning protection zones (LPZ) 0 to 1 (IEC 62305-4) at building entrances, or point-of-entry (Category C) & sub-circuit protection (Category B) (ANSI/IEEE C62.41).





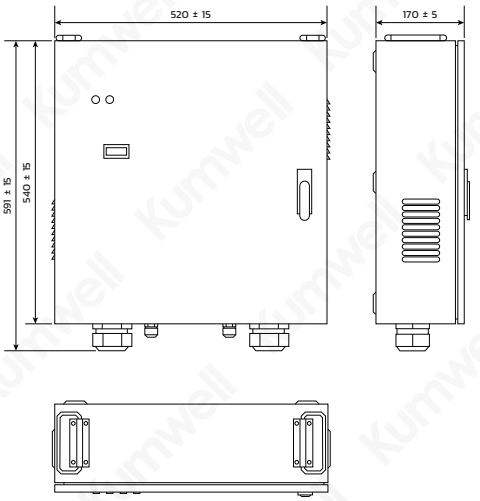
Basic circuit diagram

Technical Data Model		KSF100-U320-63A-1PN
In accordance with		IEC 61643-11:2011; UL1449-4th; IEC 61000-6; ANSI/IEEE C62.41; AS1768-1991; AS3100
Category IEC/EN/UL		Class I+II / Type 1+2 / Type 2
Ports/Protection Mode		All mode protection
Application		any single phase system with grounded neutral
Protection Technology		TSG (primary)+VTD (Secondary) and GDT technology for N-PE mode LC filter, Thermal disconnector, Built-in overcurrent protection
Power system, U_n		220 – 277 VAC single phase
Max. continuous operating voltage (AC/DC), U_c		320 V/420 V
Rated load Current, I_L		63 A
Nominal discharge current (8/20 μs), I_n		25 kA
Primary surge protection rating	L-N	I_{imp}:25 kA (10/350 μs), I_{max}:100 kA (8/20 μs)
	N-PE	I_{imp}:100 kA (10/350 μs), I_{max}:200 kA (8/20 μs)

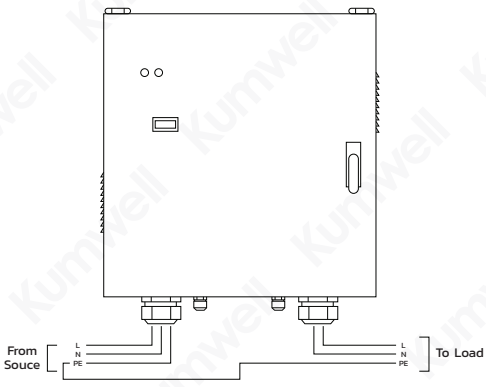
POWER SUPPLY SYSTEM
Single Phase 63A Power Surge Filter KSF100-U320-63A-1PN

Technical Data Model		KSF100-U320-63A-1PN
Secondary surge protection rating	L-N	I_{max}: 50 kA (8/20 µs)
Total surge capacity per phase		I_{total}: 150 kA (8/20 µs)
Voltage protection level, U_p	L-N @ 6 kV/3 kA	< 0.5 kV
	L-N @ I_n	< 0.85 kV
	N-PE @ 1.2/50 µs	< 1.5 kV
Residual current, I_{PE}		< 0.1 mA
Voltage drop		< 2 V at 63 A load
Temporary overvoltage – TOV withstand mode, U_{tov}		440 V AC/120 min
Response time, t_A		≤ 1 ns
Filter attenuation		> 48 dB @ 1 MHz
Built in overload / overcurrent protection in series		63 A (optional)
Lightning counter Threshold Current, I_{tc}		≤ 3 kA (8/20 µs)
Protect Status Indication		2 LED display, Normal (Blue), Protection fault (Off)
Remote alarm		Dry contact alarm relay – 250 V AC/ 32 V DC, 5A
Connecting cable		Power 6-8 AWG (50 A/63 A); Alarm: 14 -22 AWG
Environment		-40 to 70˚C, 0 to 95% RH, Altitude ≤ 2 km
Mounting		Wall mounting
Location Category		Indoor
Degree of protection		IP20
Dimension (L x W x H)		520 x 540 x 170 mm approx
Approvals, Certification		CE

Dimensions



Connection



POWER SUPPLY SYSTEM
Three Phase 63A Power Surge Filter KSF100-U320-63A-3PN

Kumwell KSF100 series surge filter is two-port Surge Protective Device with LC Filter designed to protect Three phase electrical distribution systems especially sensitive electronics against the harmful effects of transient surges.

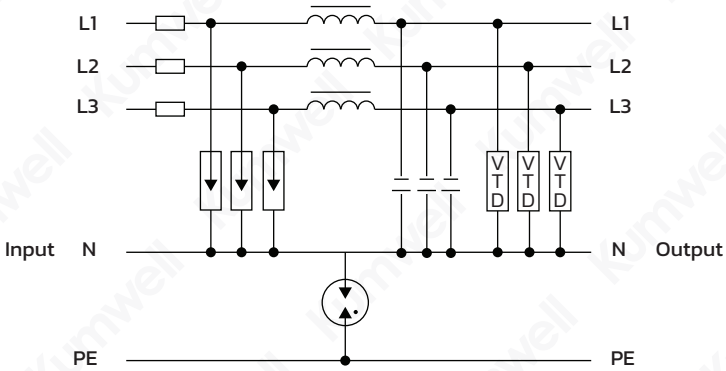
These surges are the result of:

- Direct and indirect lightning strikes
- Power company load switching
- Upstream load switching at other facilities

Application

- Telecommunications systems
- Medical equipment
- Industrial equipment
- Data centers
- Control systems
- Switch boards





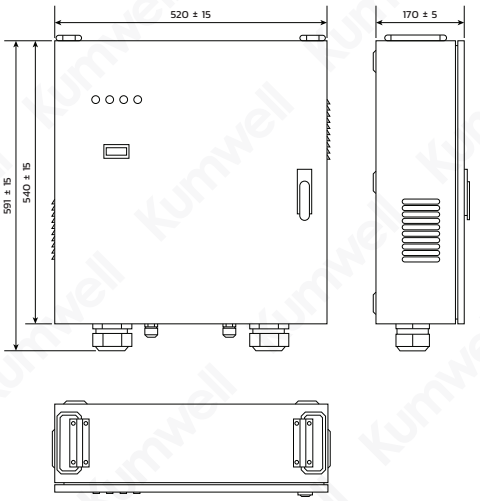
Basic circuit diagram

Technical Data Model		KSF100-U320-63A-3PN
Compliance		IEC 61643-11:2011; UL1449-4th; IEC 61000-6; ANSI/IEEE C62.41; AS1768-1991; AS3100
Category IEC/EN/UL		Class I+II / Type 1+2 / Type 2
Ports/Protection Mode		All mode protection
Application		any three phase system with grounded neutral
Protection Technology		TSG (primary)+VTD (Secondary) for L-N and GDT technology for N-PE mode, LC filter, Thermal disconnector, Built-in overcurrent protection
Power system, U_n		220/380 to 277/480 VAC Three phase (TN/TT)
Max. continuous operating voltage (AC/DC), U_c		320 V/420 V
Rated load Current, I_L		63 A
Nominal discharge current (8/20 μs), I_n		25 kA
Primary surge protection rating	L-N	I_{imp}:25 kA (10/350 μs), I_{max}:100 kA (8/20 μs)
	N-PE	I_{imp}:100 kA (10/350 μs), I_{max}:200 kA (8/20 μs)

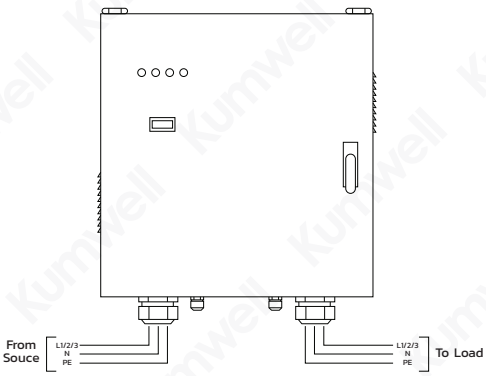
POWER SUPPLY SYSTEM
Three Phase 63A Power Surge Filter KSF100-U320-63A-3PN

Technical Data Model		KSF100-U320-63A-3PN
Secondary surge protection rating	L-N	I_{max}: 50 kA (8/20 µs)
Total surge capacity per phase		I_{total}: 150 kA (8/20 µs)
Voltage protection level, U_p	L-N @ 6 kV/3 kA	< 0.5 kV
	L-N @ I_n	< 0.85 kV
	N-PE @ 1.2/50 µs	< 1.5 kV
Residual current, I_{PE}		< 0.1 mA
Voltage drop		< 2 V at 63 A load
Temporary overvoltage – TOV withstand mode, U_{tov}		440 V AC/120 min
Response time, t_A		≤ 1 ns
Filter attenuation		> 48 dB @ 1 MHz
Built in overload / overcurrent protection in series		63 A (optional)
Lightning counter Threshold Current, I_{tc}		≤ 3 kA (8/20 µs)
Protect Status Indication		4 LED display, Normal (Blue), Protection fault (Off)
Remote alarm		Dry contact alarm relay – 250 V AC/32 V DC, 5 A
Connecting cable		Power 6-8 AWG (50 A/63 A); Alarm: 14 -22 AWG
Environment		-40 to +70˚C, 0 to ≤ 95%, Altitude: ≤ 2 km
Mounting		Wall mounting
Location Category		Indoor
Degree of protection		IP20
Dimension (L x W x H)		520 x 540 x 170 mm approx
Approvals, Certification		CE

Dimensions



Connection



POWER SUPPLY SYSTEM
Three Phase 125A Surge Power Filter KSF200-3/350-125A-3PN

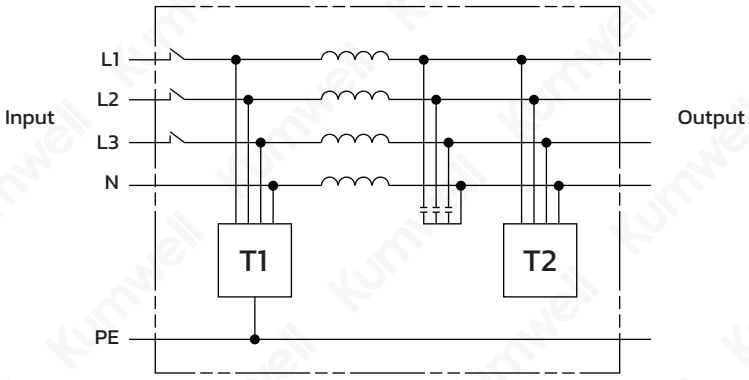
Kumwell KSF200 series surge filter is two-port Surge Protective Device with LC Filter designed to protect three phase electrical distribution systems especially sensitive electronics against the harmful effects of transient surges.

These surges are the result of:

- Direct and indirect lightning strikes
- Power company load switching
- Upstream load switching at other facilities

It's found that electronic equipment is sensitive to both the absolute magnitude of the impulse voltage and the rate of rise of this impulse, much of the damage which occurs in sensitive electronic circuits using power semiconductor components is the result of these steep changes in dv/dt and di/dt rather than simply the peak voltage. Therefore, KSF is designed as a 3-stage protection system which consists of primary TSG (Trigger Spark Gap) protection & secondary MOV protection in conjunction with series well-designed LC filter. The LC filter used to slow down the inherently fast rates of voltage and current rise, and TSG module to deflect high pulsed lightning current (10/350 μs) up to 50 kA per mode or surge current (8/20 μs) up to 150 kA per mode. Further, the secondary MOV module & LC filter will limit the surge voltage (the let-through voltage) to very low level. KSF Series are fully enclosed in wall mounting IP55 steel enclosures, with a LED light to demonstrate the working status of the surge filter. KSF surge filter should be installed in series with the supply powering the equipment. It can be used in lightning protection zones (LPZ) 0 to 1 (IEC 62305-4) at building entrances, or point-of-entry (Category C) & sub-circuit protection (Category B) (ANSI/IEEE C62.41).





Basic circuit diagram

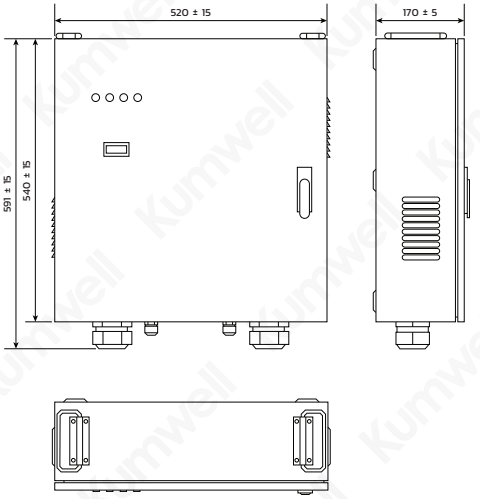
Technical Data Model		KSF200-3/350-125A-3PN
In accordance with		IEC 61643-11:2011; UL1449-4th; IEC 61000-6; ANSI/IEEE C62.41; AS1768-1991; AS3100
Category IEC/EN/UL		Class I+II / Type 1+2 / Type 2
SPD Type		2 Port SPD
Power system, U_n		220/380 to 277/480 V AC Three phase (TN/TT)
Max. continuous operating voltage (AC/DC), U_c		350 V/460 V
Rated load Current, I_L		125 A
Protection modes		Common mode and Differential mode protection
Protection technology		TSG (primary)+MOV (Secondary) for L-N, GDT for N-PE; LC filter
Nominal discharge current (8/20 μs), I_n		50 kA
Primary surge protection rating	L-N	I_{imp}:50 kA (10/350 μs), I_{max}:150 kA (8/20 μs)
	N-PE	I_{imp}:100 kA (10/350 μs), I_{max}:200 kA (8/20 μs)
Secondary surge protection rating	L-N	I_{max}:50 kA (8/20 μs)

Kumwell

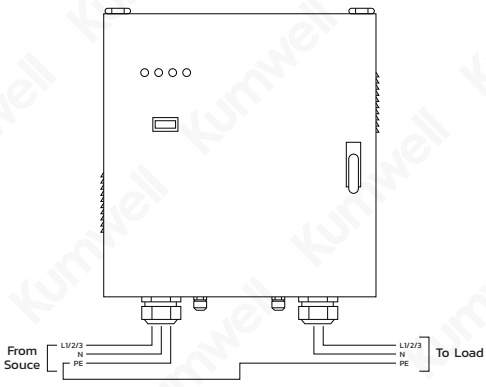
POWER SUPPLY SYSTEM
Three Phase 125A Surge Power Filter KSF200-3/350-125A-3PN

Technical Data Model		KSF200-3/350-125A-3PN
Total surge capacity per phase		200 kA (8/20 µs)
Voltage protection level, U_p	L-N @ 6 kV/3 kA	< 500 V (VPR per UL1449 4th)
	L-N @ 20 kA	< 800 V
	L-N @ I_n	< 1100 V (Up per IEC 61643 -11)
	N-PE @ 1.2/50 µs	< 1500 V (Up per IEC 61643 -11)
Residual current		< 1 mA
Voltage drop		< 2 V at 125 A load
Temporary overvoltage – TOV, U_T		415 V AC/ 5 s
Response time		≤ 5 ns
Filter attenuation		> 48 dB @ 1 MHz
Short circuit withstand (1 sec)		50 kA
Built in over load/over-current protection in series		125 A
Lightning counter Current		≤ 3 kA
Protect Status Indication		4 LED display, Normal (Blue), Protection fault (Off)
Remote alarm		Dry contact alarm relay – 250VAC/32VDC, 5A
Connecting cable		Power 6-8 AWG (50 A/63 A), 2-3 AWG (100 A/125 A), Alarm 14-22 AWG
Environment		-40 to 70˚C, 0 to 95%, Altitude ≤2 km
Mounting		Wall mounting
Location Category		Indoor
Degree of protection		IP20
Dimension (L x W x H)		520 x 540 x 170 mm approx
Approvals, Certification		CE

Dimensions



Connection



16 Earth Resistance Tester

Kumwell

IMPULSE EATHING TESTER
WG-507

Atmor WG-507 was designed to measure ground impedance in conditions similar to those that occur naturally during lightning discharges. Current surges that were applied reaching a peak value of approx. 1A, and their front times, depending on the choice, are 4 or 8 µs, and also meet the requirements of the following standards: PN-EN 60060-2: 2000 and PN-EN 62305-1: 2008. The device has been adapted to control all lightning protection installations, especially in facilities that are subject to stricter and special lightning protection, required by the Construction Law, e.g. gas stations, plants and warehouses in the chemical, wood industry, etc. It is not necessary to disconnect the control terminals of the earthing cables during measurements.

The WG-507 device is especially useful when measuring the earthing of power poles, because, unlike classic tester, it is not necessary to disconnect the earthing from the tower structure during the measurements. So the inspection work can continue with the line on. The applied method of measurement complies with the definition of equivalent earth resistance presented in the PN-EN 62305 standard.



Impulse Eathing Tester

Technical data	WG-507
Two selectable measuring ranges	0 - 19.9 Ω; 20 - 199 Ω;
Measurement accuracy: - basic error not greater than - total error of indications not greater than	 2.5 % 5.0 %
Power Supply	4 Ni-MH (AA) batteries located in the housing of the tester. Total: 4.8 V, 1500... 2000 mAh
Number of measurements with single battery charging	no less 1000
Graphical display with back lighting	64 x 128 pixels
Dimensions	100 x 210 x 40 mm
Weight (without probes and cables)	0.4 kg
Weight with probes and cables	3.7 kg
Accessories	
The standard set of the Atmor WG-507 tester with accessories includes:	
- WG-507 earthing tester	
- Transport bag	
- 3 test leads (40 m, 30 m, 2 m) on 2 reels	
- 2 probes standard test probes in a special cover	
- 3 crocodile clips with large jaw opening	
- Steel pin - for removing the probes from the ground	
- User manual	
- Battery charger	
- WG-507 Calibration Certificate	



CLAMP EARTH RESISTANCE TESTER
KIGM-EC2

- Ground loop resistance testing without any disconnection, Non-contact, Safe and Fast.
- Easy Earth/Ground resistance measurement just clamp-on earth conductor.
- Measures Ground resistance from 0.01Ω to 1200Ω.
- Measures true RMS Ground leakage current from 0.00mA rms to 20.0A rms.

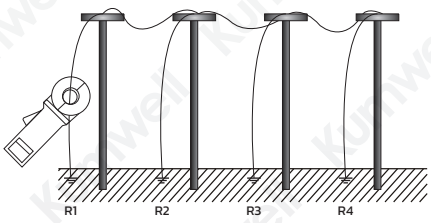


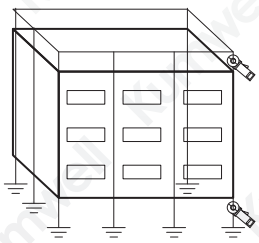
Clamp Earth Resistance Tester

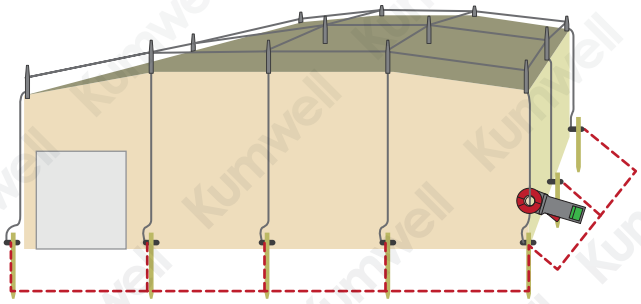
Technical data	KIGM-EC2
Range of Resistance	0.01 Ω – 1200 Ω
Range of Current	0.00 mA – 20.0 A
Instrument safety	IEC/EN 61010-1, IEC/EN 6010-2-032
Pollution degree	class II
Overvoltage category	CAT III 150V to ground, max 20A
Dimension (L x W x H)	260 mm x 90 mm x 66 mm (10x4x3 inches)
Span of Jaw	Ø 32 mm
Weight (including batteries)	1,120 g
Internal consumption	<50 mA
Display	4 LCD, sign, decimal point and backlight
Memory size	99 Units of Reading
Environment (Temperature & Relative Humidity)	Working: -10°C to 55°C, 10%RH-90%RH Storage: -20°C to 60°C, below 70%RH
Data upload interface	RS232 (optional)
Accessories	
Tester: 1 piece	
Test Ring: 1 piece	
Tester Suitcase: 1 piece	
Battery(LR6): 4 pieces	
KIGM-EC2 Calibration Certificate	



Field Application







Multi-ground loop measurement

Kumwell

EARTH RESISTANCE AND SOIL RESISTIVITY TESTER
KIGM-EM1

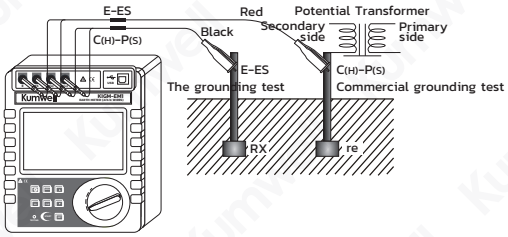


Making your earth resistance testing quicker and easier the KIGM-EM1 offers these advanced features :

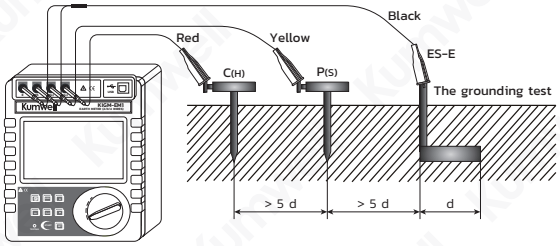
- 3 - Wires method for earth resistance measurement
- 2 - Wires method for earth resistance measurement
- Soil Resistivity Precise 4 wires measurement (wenner method)
- Line Voltage measurement up to 600V
- Large display, Backlight
- Alarm function of maximum parameter
- 600V CAT III safety standard

KIGM-EM1 Earth Resistance and Soil Resistivity Tester is specially designed and manufactured for measuring earth resistance, soil resistivity, earth voltage, AC voltage. Adopting the latest digital and micro-processing technology, precise 4-wires, 3-wires and simple 2-wires method for earth resistance measurement, importing FFT and AFC technology, with a unique function of anti-interference capability and the ability to adapt to the environment, consistency of repeat testing, to ensure high precision, high stability and reliability for prolonged measure, which is widely used in electric power, telecommunications, meteorology, oil field, construction, lightning protection, industrial electrical equipment and other earth resistance, soil resistivity, earth voltage, AC voltage measurement.

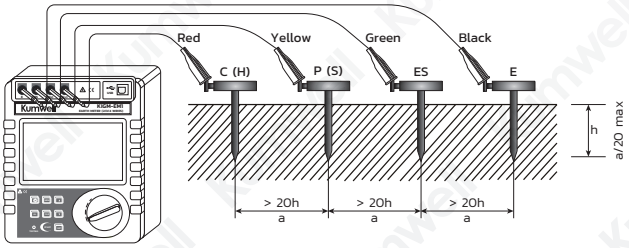
KIGM-EM1 Earth Resistance and Soil Resistivity Tester is composed of host machine, monitoring software, testing wires, auxiliary ground pillars, communication wires and others. The large LCD display of host machine is with blue backlight and bar graph indicating that can be seen clearly. At the same time it can store 300 sets of data, fulfilling historical inquiry and online real-time monitoring through monitoring software, dynamic display, alarm indicator, and with the functions like historical data access, reading, preservation, report forms, printing and so on.



2-Wires simple measurement



3-Wires earth resistance measurement



Soil resistivity measurement

EARTH RESISTANCE AND SOIL RESISTIVITY TESTER
KIGM-EM1

Technical Specifications

1. Base Conditions and Working Conditions

Influence Quantity	Base Conditions	Working Conditions	Remarks
Ambient Temp	23°C±1°C	-10°C -40°C	-
Ambient Humidity	40%-60%	<80%	-
Working Voltage[1]	9V±0.1V	9V±1.5V	rC, rP
Auxiliary Earth Resistance	<100Ω	<30kΩ	-
Interference Voltage[2]	None	<20V	-
Interference Current	None	<2A	-
Electrode Distance when measuring R	a>5d	a>5d	-
Electrode Distance when measuring ρ	a>20h	a>20h	-

2. General Specification

Function	Measurement of 2/3/4-pole earth resistance, soil resistivity, earth voltage, AC voltage
Power Supply	DC 9V(Zi-Mn dry battery R14S 1.5V 6 PCS, continuous standby for 300 hours)
Measurement Range	Earth Resistance: 0.00Ω - 30.00kΩ Soil Resistivity: 0.00Ωm - 9000kΩm
Measuring Mode	Precise 4-pole measurement, 3-pole measurement, simple 2-pole measurement
Measuring Method	Earth Resistance : rated current change-pole method, measurement current 20mA Max Soil Resistivity : 4-pole measurement (wenner method) Earth Voltage : average rectification(between P(S)-ES)
Test Voltage Wave	Sine wave
Test Frequency	128Hz / 111Hz /1 05Hz / 94Hz(AFC)
Short-circuit Test Current	AC 20mA max
Open-circuit Test Voltage	AC 40V max
Electrode Distance Range	Can be set 1m-100m
Shift	Earth resistance: 0.00Ω - 30.00kΩ, automatic shift Soil Resistivity: 0.00Ωm - 9000kΩm, automatic shift
Backlight	Blue screen backlight, suitable for dim places
Display Mode	4 - digital super- large LCD display, blue screen backlight
Measuring Indicator	During measurement, LED flash indicator, LCD count down display, progress bar indicator
LCD Frame Dimension	128mm×75mm
LCD Window Dimension	124mm×67mm
Dimension	L×W×H: 215mm×190mm×95mm
Standard Test Wire	4 wires: each for red 20m, black 20m, yellow 10m, and green 10m
Simple Test Wire	2 wires: each for red 1.6m and black 1.6m
Auxiliary Earthing Rod	4 wires: Φ10mm×150mm
Measuring Rate	Voltage to ground: about 3 times/second Earth resistance, soil resistivity: about 5 seconds/time
Measuring Times	Over 5000 times (Short-circuit test, interval time should be at least 30 seconds)
Circuit Voltage	Below AC 600V
RS232 Interface	RS232 interface, software supervision, storage data can be uploaded to computer, saved or printed.

2. General Specification

Communication Wire	One piece of RS232 communication wire, with length 1.5m
Data Storage	300 sets, "MEM" icon storage indicator, flash display "FULL" icon to indicate storage is full
Data Hold	Data hold function: "HOLD" icon display
Data Read	Data read function: "READ" icon display
Overflow Display	Exceeding measuring range overflow function: "OL" icon display
Interference Test	Recognize interference signal automatically, "NOISE" icon display when interference voltage exceed 5V
Auxiliary Earthing Test	Can measure auxiliary earth resistance, 0.00KΩ - 30kΩ (100R+rC<50kΩ, 100R+rP<50kΩ)
Alarm Function	When measuring value exceeds alarm setting value, there is "Toot-toot-toot" alarm hint
Battery Voltage	When battery voltage decreases to about 7.5V, battery voltage low icon will display, reminding to replace battery
Power Consumption	Standby: about 20mA (Backlight shut off) Boot and with backlight: about 45mA (25mA without backlight) Measurement: about 100mA (Backlight shut off)
Weight	Total weight: 4.5kg (including package) Tester: 1443g (including battery) Testing wires: 1560g Auxiliary earthing rods: 935g (4pcs)
Working Temperature & Humidity	-10°C - 40°C, below 80%RH
Storage temperature & humidity	-20°C - 60°C, below 70%RH
Overload Protection	Measuring earth resistance: between each interfaces of C(H)-E, P(S)-ES, AC 280V/3 seconds
Insulation Resistance	Over 20MΩ (between circuit and enclosure it is 500V)
Withstanding Voltage	AC 3700V/rms (Between circuit and enclosure)
Electromagnetic Features	IEC61326(EMC)
Protection Type	IEC 61010-1 (CAT III 300V, CAT IV 150V, Pollution 2), IEC 61010-031, IEC 61557-1 (Earth resistance) IEC 61557-5 (Soil resistivity), JJG 366-2004

3. Intrinsic error and performance indicators under base conditions

Category	Measurement Range	Intrinsic Error	Resolution
Earth Resistance (R)	0.00Ω - 30.00Ω	±2%rdg±3dgt	0.01Ω
	30.0Ω - 300.0Ω	±2%rdg±3dgt	0.1Ω
	300Ω - 3000Ω	±2%rdg±3dgt	1Ω
	3.00kΩ - 30.00kΩ	±4%rdg±3dgt	10Ω
Soil Resistivity (ρ)	0.00Ωm - 99.99Ωm	According to the precision of R (ρ=2 ¶aR a:1m - 100m, ¶=3.14)	0.01Ωm
	100.0Ωm - 999.9Ωm		0.1Ωm
	1000Ωm - 9999Ωm		1Ωm
	10.00kΩm - 99.99kΩm		10Ωm
	100.0kΩm - 999.9kΩm		100Ωm
	1000kΩm - 9000kΩm		1kΩm
Earth Voltage (V)	AC 0.0 - 600V	±2%rdg±3dgt	0.1V

Note : 1. When rC max or rP max, additional error ≤±3%rdg±5dgt. (rC max: 4kΩ+100R<50kΩ, rP max: 4kΩ+100R<50kΩ)
2. When 5V interference voltage, additional error≤±5%rdg±5dgt.

DOUBLE CLAMP EARTH AND SOIL RESISTIVITY TESTER
KIGM-EM2C

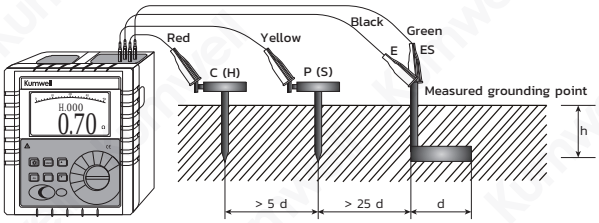
Making your earth resistance testing safer, faster and easier the KIGM-EM2C offers these advanced features:



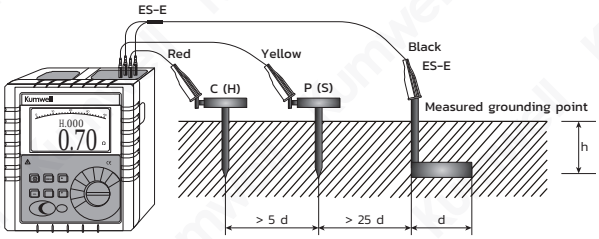
- 4-Wires Precise Earth Resistance Measurement and Soil Resistivity Measurement
- 3-Wires Earth Resistance Measurement
- 2-Wires Simple Measurement
- 3 Wires & 4 Wires selection method to measure the grounding resistance
- Also use to measure leakage current of grounding line, AC current, DC resistance
- Size of clamp: Φ68mm
- Earth Voltage measurement up to 100V
- Super-Large LCD display 4 digits with backlight
- Alarm function of maximum parameter
- IEC61010-1 (CAT III 300 V, CAT IV 150V, Pollution2); IEC61010-031;IEC61557-1 (Earth resistance); IEC61557-5 (Soil resistivity); JJG 366-2004 (Grounding resistance meter); JJG 1054-2009 (Clamp grounding resistance meter)

KIGM-EM2C Double Clamp Earth And Soil Resistivity Tester is specially design for the measurement of earth resistance,soil resistivity, earth voltage, leakage current of grounding line, AC current, DC resistance. Adopting the latest digital technology, precise 4-pole, 3-pole and simple 2-pole method,selection method, double clamp method to measure grounding resistance, for earth resistance measurement, consistency of repeat testing, to ensure high precision, high stability and reliability for prolonged measure, which is widely used in electric power, telecommunications, meteorology, oil field, construction, lightning protection, industrial electrical equipment

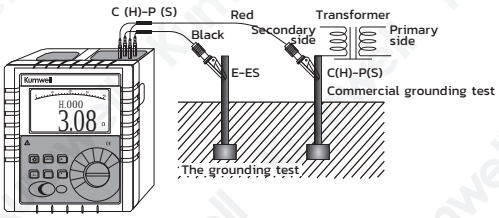
KIGM-EM2C Double Clamp Earth And Soil Resistivity Tester is composed of host machine, monitoring software, testing wires,auxiliary ground pillars, communication wires and others.The large LCD display of host machine is with blue backlight and bar graph indicating that can be seen clearly. At the same time it can store 100 sets of data, fulfilling historical inquiry and online real-time monitoring through monitoring software, dynamic display, and alarm indicator, auto-shut down and with the functions like historical data access, reading, preservation, report forms, printing and so on.



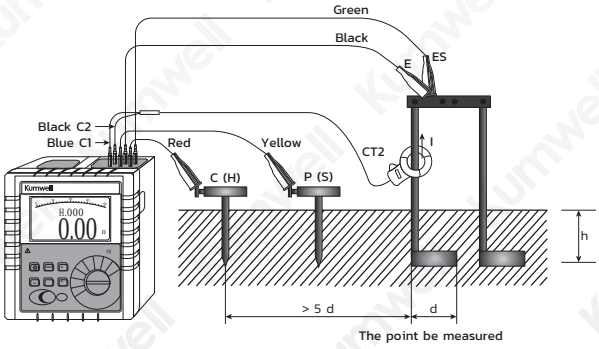
4-Wires Precise Earth Resistance Measurement
The 4-wires method can also eliminate influence of line resistance. So it is better than 3-wires measurement.



3-Wires Earth Resistance Measurement



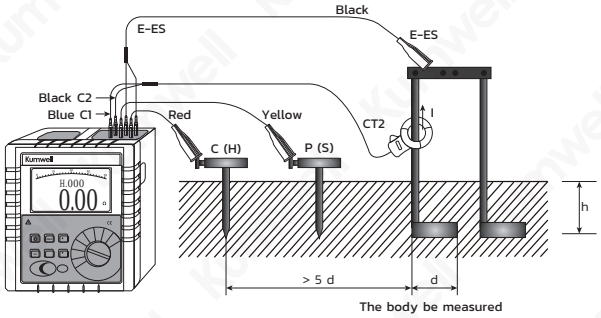
2-Wires Simple Measurement



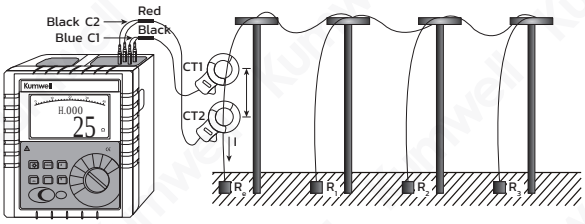
4-Wires selection method to measure the grounding resistance

Kumwell

DOUBLE CLAMP EARTH AND SOIL RESISTIVITY TESTER
KIGM-EM2C

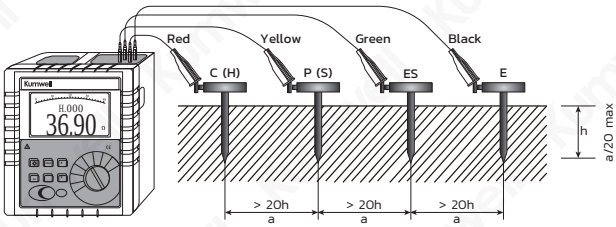


3-Wires selection method to measure the grounding resistance



Double clamp method to measure grounding resistance

Clamp the circuit with two current clamp, the two clamp have to clamp the circuit like the graph shows and keep a distance above 30cm, the position of these two clamp can't be change with each other, otherwise, there is an error exist.



Soil Resistivity Measurement

Soil resistivity ρ is a determining factor of grounding resistance of grounding body. Different nature of the soil, there is a different soil resistivity

Technical Specifications

1. Base Conditions and Working Conditions

Influence Quantity	Base Conditions	Working Conditions	Remarks
Ambient Temp	23°C±1°C	-10°C -40°C	-
Ambient Humidity	40%-60%	<80%	-
Working Voltage[1]	9V±0.1V	9V±1.5V	rC, rP
Auxiliary Earth Resistance	<100Ω	<30kΩ	-
Interference Voltage[2]	None	<20V	-
Interference Current	None	<2A	-
Electrode Distance when measuring R	a>5d	a>5d	-
Electrode Distance when measuring ρ	a>20h	a>20h	-

DOUBLE CLAMP EARTH AND SOIL RESISTIVITY TESTER
KIGM-EM2C

2. General Specification

Function	Measure grounding resistance, soil resistivity; Measurement of earth voltage, AC voltage, leakage current of AC current
Power Supply	DC 9V(Zn-Mn dry battery R14S 1.5V 6 PCS, continuous standby for 300 hours)
Measurement Range	Earth Resistance: 0.00Ω - 30.00kΩ
	Soil Resistivity: 0.00Ωm - 9000kΩm
Measuring Mode	Precise 4-pole measurement, 3-pole measurement, simple 2-pole measurement, selection method, double clamp method measure grounding resistance
Measuring Method	2/3/4 pole method: change-pole method, measurement current 20mA Max Selection method: change-pole method, measurement current 20mA Max Double clamp method: disconnect mutual inductance method, measurement current 1mA Max Soil Resistivity: 4-pole measurement (Wenner method) DC resistance: change-pole method AC current: mutual inductance method Earth Voltage: average rectification(between P(S)-ES)
Test Voltage Wave	Sine wave
Test Frequency	128Hz / 111Hz / 105Hz / 94Hz (AFC)
Short-circuit Test Current	AC 20mA max
Open-circuit Test Voltage	AC 40V max
Electrode Distance Range	Can be set 1m-100m
Shift	Earth resistance: 0.00Ω - 30.00kΩ, automatic shift
	Soil Resistivity: 0.00Ωm - 9000kΩm, automatic shift
Backlight	Blue screen backlight, suitable for dim places
Display Mode	4 - digital super- large LCD display, blue screen backlight
Measuring Indicator	During measurement, LED flash indicator, LCD count down display, progress bar indicator
LCD Frame Dimension	128mm×75mm
LCD Window Dimension	124mm×67mm
Dimension	L×W×H: 215mm×190mm×95mm
Standard Test Wire	4 wires: each for red 20m, black 20m, yellow 10m, and green 10m
Simple Test Wire	2 wires: each for red 1.6m and black 1.6m
Auxiliary Earthing Rod	4 wires: Φ10mm×150mm
Clamp	2pc :1 blue-black plug and 1 red-black.
Caliber of clamp	Φ68mm
Measuring Rate	AC current: about 2 times/second
	Voltage to ground: about 2 times/second
	Earth resistance, soil resistivity: about 7 seconds/time
Measuring Times	Over 5000 times
Circuit Voltage	Below AC 600V
RS232 Interface	RS232 interface, software supervision, storage data can be uploaded to computer, saved or printed.
Communication Wire	One piece of RS232 communication wire, with length 1.5m
Data Storage	2000 sets, "MEM" storage indicator, flash display "FULL" icon to indicate
Data Hold	Data hold function: "HOLD" icon display
Data Read	Data read function: "READ" icon display
Overflow Display	Exceeding measuring range overflow function: "OL" icon display
Interference Test	Recognize interference signal automatically, "NOISE" icon display when interference voltage exceed 5V

2. General Specification

Auxiliary Earthing Test	Can measure auxiliary earth resistance, 0.00KΩ - 30kΩ (100R+rC<50kΩ, 100R+rP<50kΩ)
Alarm Function	When measuring value exceeds alarm setting value, there is "Toot-toot-toot" alarm hint
Battery Voltage	When battery voltage decreases to about 7.5V, battery voltage low icon will display, reminding to replace battery
Power Consumption	Standby: about 20mA (Backlight shut off)
	Boot and with backlight: about 45mA (25mA without backlight)
	Measurement: about 150mA (Backlight shut off)
Weight	Total weight: 8.05kg (including package)
	Tester: 1653g (including battery)
	Testing wires: 1560g
	Auxiliary earthing rods: 935g (4pcs)
Working Temperature & Humidity	-10°C - 40°C, below 80%rh
Storage temperature & humidity	-20°C - 60°C, below 70%rh
Overload Protection	Measuring earth resistance: between each interfaces of C(H)-E, P(S)-ES, AC 280V/3 seconds
Insulation Resistance	Over 20MΩ (between circuit and enclosure it is 500V)
Withstanding Voltage	AC 3700V/rms (Between circuit and enclosure)
Electromagnetic Features	IEC61326(EMC)
Protection Type	IEC61010-1 (CAT III 300V, CAT IV 150V, Pollution 2), IEC61010-031, IEC61557-1 (Earth resistance), IEC61557-5 (Soil resistivity), JJG 366-2004 (Grounding resistance meter) JJG 1054-2009 (Clamp grounding resistance meter)

3. Intrinsic error and performance indicators under base conditions

Category	Measurement Range	Intrinsic Error	Resolution
2/3/4 pole method measure earth resistance (R)	0.00Ω-29.99Ω	±2%rdg±5dgt	0.01Ω
	30.0Ω-299.9Ω	±2%rdg±3dgt	0.1Ω
	300Ω-2999Ω	±2%rdg±3dgt	1Ω
	3.00kΩ-30.00kΩ	±2%rdg±3dgt	10Ω
Selection method to measure grounding resistance (R)	0.00Ω-29.99Ω	±2%rdg±5dgt	0.01Ω
	30.0Ω-299.9Ω	±2%rdg±3dgt	0.1Ω
	300Ω-3000Ω	±2%rdg±3dgt	1Ω
Double clamp method to measure grounding resistance (R)	0.01Ω-0.99Ω	±10% rdg ±5 dgt	0.01Ω
	1.0Ω-29.9Ω		0.1Ω
	30Ω-100Ω		1Ω
Soil Resistivity (ρ)	0.00Ωm - 99.99Ωm	According to the precision of R (ρ=2 ¶aR a:1m - 100m, ¶=3.14)	0.01Ωm
	100.0Ωm - 999.9Ωm		0.1Ωm
	1000Ωm - 9999Ωm		1Ωm
	10.00kΩm - 99.99kΩm		10Ωm
	100.0kΩm - 999.9kΩm		100Ωm
	1000kΩm - 9000kΩm		1kΩm
Earth Voltage (50Hz/60Hz)	AC 0.0 - 600V	±2%rdg±3dgt	0.1V
AC Current (50Hz/60Hz)	0.0mA-600.0A	±2%rdg±3dgt	0.01mA

Note: 1. When rC max or rP max, additional error ≤±5%rdg±5dgt. (rC max: 4kΩ+100R＜50kΩ, rP max: 4kΩ+100R＜50kΩ)

2. When 5V interference voltage, additional error≤±5%rdg±5dgt.

EARTH RESISTANCE AND SOIL RESISTIVITY TESTER PACKAGE WITH THE DUTY AND WATERPROOF BOX KIGM-EM1-H

Product function

Test mode: precise 4-pole, 3-pole and simple 2-pole method, selection method, double clamp method for the measurement of earth resistance, soil resistivity, grounding voltage, ground lead leakage current, AC current, DC resistance.

Product feature

- Import FFT (Fast Fourier Transform Algorithm) and AFC (Automatic Frequency Control) technology. Unique antijamming capability and environmental adaptability, high consistency of retest,
- Pack with waterproof protection box, waterproof, crash proof, anti-drop and durable, large-capacity rechargeable lithium battery pack, especially suitable for use at outdoor construction site
- The large LCD display of host machine with white backlight and bar graph indication that can be seen clearly. Sound-light alarm, overload protection, auto power-off and data upload function.



Technical Specifications

1. Base Conditions and Working Conditions

Influence Quantity	Base Conditions	Working Conditions	Remarks
Ambient Temp	23°C±1°C	-10°C -40°C	-
Ambient Humidity	40%-60%	<80%	-
Working Voltage	DC 7.8V±0.1V	DC 7.8V±0.6V	-
Auxiliary Earth Resistance	<100Ω	<30kΩ	-
Interference Voltage	None	<20V	-
Interference Current	None	<2A	-
Electrode Distance of measuring R	a>5d	a>5d	-
Electrode Distance of measuring ρ	a>20h	a>20h	-

2. General Specification

Function	2/3/4-pole measurement for earth resistance, soil resistivity, earth voltage, AC voltage
Power Supply	DC 7.4V 2600mAh rechargeable lithium battery, full of about 8.4V
Measurement Range	Earth Resistance: 0.00Ω-30.00kΩ
	Soil Resistivity: 0.00Ωm-9000kΩm
	Earth Voltage: 0V～600V
Measuring Mode	Precise 4-pole measurement, 3-pole measurement, simple 2-pole measurement of earth resistance
Measuring Method	Earth Resistance: rated current change-pole method, test current 20mA Max Soil Resistivity: 4-pole method (Wenner method) Earth Voltage: average rectification(between P(S)-ES)
Test Frequency	128Hz/111Hz/105Hz/94Hz(AFC)
Short-circuit Test Current	AC 20mA max
Short-circuit Test Current	AC 40V max
Test Voltage Wave	Sine wave
Electrode Distance Range	1m-100m
Shift	Earth resistance: 0.00Ω-30.00kΩ automatic shift Soil Resistivity: 0.00Ωm-9000kΩm automatic shift
Backlight	Controllable white screen backlight, suitable for dim places
Display Mode	4-digital super-large LCD display, white screen backlight
Measurement Indicator	During measurement, LED flash indicator, LCD count down display, progress bar indicator

EARTH RESISTANCE AND SOIL RESISTIVITY TESTER PACKAGE WITH THE DUTY AND WATERPROOF BOX
KIGM-EM1-H

2. General Specification

LCD Frame Dimension	128mmx75mm
LCD Window Dimension	124mmx67mm
Tester Dimension	280mm(L)x260mm(W)x160mm(H)
Standard Test Wire	4 wires: each for red 20m, black 20m, yellow 10m, and green 10m
Simple Test Wire	2 wires: each for red 1.6m and black 1.6m
Auxiliary Ground Rod	4 wires: Φ10mmx150mm
Measurement Rate	Voltage to earth: about 3 times/second
	Earth resistance, soil resistivity: about 5 seconds/time
Measuring Times	Over 5000 times (Short-circuit test, interval time should be at least 30 seconds)
Circuit Voltage	below AC 600V
Communication Interface	USB interface, software monitoring, storage data can be uploaded to computer, saved or printed.
Communication Wire	One piece USB communication wire, length 1.5m
Data Storage	300 sets, **"MEM"** symbol storage indicator, flash display **"FULL"** symbol indicate storage full
Data Hold	Data hold function: **"HOLD"** symbol display
Data Read	Data read function: **"READ"** symbol display
Overflow Display	Over range overflow function: **"OL"** symbol display
Interference Test	Recognize interference signal automatically, **"NOISE"** symbol display when interference voltage exceed 5V
Auxiliary Ground Test	With auxiliary earth resistance test function, 0.00KΩ-30kΩ(100R+rC<50kΩ, 100R+rP<50kΩ)
Alarm Function	Measurement value exceeds alarm setting value, will "Toot-toot-toot" alarm hint
Auto-shut off	Automatically shut down after 10 minutes of power on
Battery Voltage	While battery voltage decreases to around 7.5V, will display battery voltage low symbol "▭", and reminding to charge
Working Power	Standby: about 20mA (Backlight shut off)
	Boot up and with backlight: about 45mA (25mA without backlight)
	Measurement: about 100mA (Backlight shut off)
Weight	Tester: 2290g
	Tester bag:915g
	Test wires: 1560g
	Auxiliary ground rods: 935g (4pcs)
Working Temperature & Humidity	-10°C-40°C, below 80%rh
Storage temperature & humidity	-20°C-60°C, below 70%rh
Overload Protection	Measuring earth resistance: between each interfaces of C(H)-E, P(S)-ES, AC 280V/3 seconds
Protection Level	IP65 (close the case)
Insulation Resistance	Over 20MΩ (between circuit and enclosure it is 500V)
Withstand Voltage	AC 3700V/rms (Between circuit and enclosure)
Electromagnetic Features	IEC61326 (EMC)
Protection Type	IEC61010-1 (CAT III 300V,CAT IV 150V,Pollution 2), IEC61010-031, IEC61557-1 (Earth resistance), IEC61557-5 (Soil resistivity), JJG 366-2004

EARTH RESISTANCE AND SOIL RESISTIVITY TESTER PACKAGE WITH THE DUTY AND WATERPROOF BOX
KIGM-EM1-H

3. Intrinsic error and performance indicators under base conditions

Measurement Function	Measurement Range	Intrinsic Error	Resolution
Earth Resistance (R)	0.00Ω-30.00Ω	±2%rdg±3dgt	0.01Ω
	30.0Ω-300.0Ω	±2%rdg±3dgt	0.1Ω
	300Ω-3000Ω	±2%rdg±3dgt	1Ω
	3.00kΩ-30.00kΩ	±4%rdg±3dgt	10Ω
Soil Resistivity(ρ)	0.00Ωm-99.99Ωm	(ρ=2πaR a:1 m～100m ; π=3.14)	0.01Ωm
	100.0Ωm-999.9Ωm		0.1Ωm
	1000Ωm-9999Ωm		1Ωm
	10.00kΩm-99.99kΩm		10Ωm
	100.0kΩm-999.9kΩm		100Ωm
	1000kΩm-9000kΩm		1kΩm
Earth Voltage	AC 0.0-600V	±2%rdg±3dgt	0.1V

Note : 1. rC max or rP max, additional error≤±3%rdg±5dgt. (rC max: 4kΩ+100R＜50kΩ, rP max: 4kΩ+100R＜50kΩ)

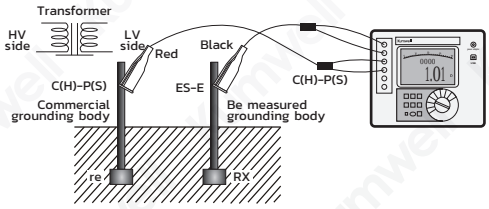
2. Interference voltage with 5V, additional error≤±5%rdg±5dgt.

Warning: Voltage measurement is strictly prohibited when the instrument is charged, connected to a computer, or supplied with external power

Accessories
Tester: 1 piece
Grounding Rod: 4 pieces
Testing Wire: 6 pieces
USB data transmission line: 1 piece
Software disk: 1 piece
Tester bag: 1 piece

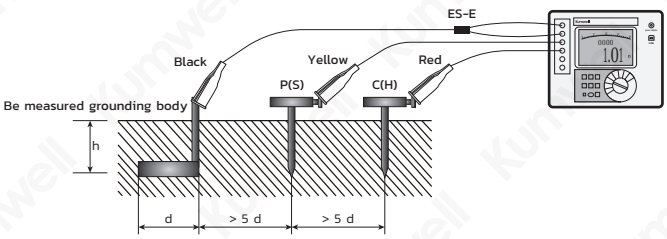


Field Application

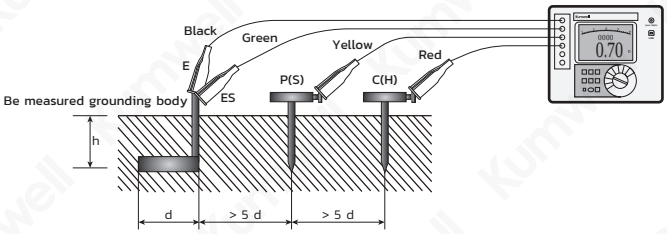


2-wire simple earth resistance measurement

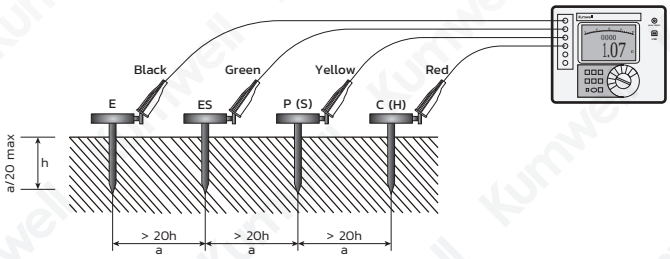
EARTH RESISTANCE AND SOIL RESISTIVITY TESTER PACKAGE WITH THE DUTY AND WATERPROOF BOX KIGM-EM1-H



3-wires earth resistance measurement



4-wires precise earth resistance measurement



Soil resistivity measurement

DOUBLE CLAMP EARTH AND SOIL RESISTIVITY TESTER PACKAGE WITH THE DUTY AND WATERPROOF BOX KIGM-EM2C-H

Product function

Precise 3/4-wire, simple 2-wire measurement of earth resistance, soil resistivity, earth voltage, AC voltage.

Product feature

- Import FFT (Fast Fourier Transform Algorithm) and AFC (Automatic Frequency Control) technology. Unique antijamming capability and environmental adaptability, high consistency of retest,
- Pack with waterproof protection box, waterproof, crash proof, anti-drop and durable, large-capacity rechargeable lithium battery pack, especially suitable for use at outdoor construction site
- The large LCD display of host machine with white backlight and bar graph indication that can be seen clearly. Sound-light alarm, overload protection, auto power-off and data upload function.



Technical Specifications

1. Base Conditions and Working Conditions

Influence Quantity	Base Conditions	Working Conditions	Remarks
Ambient Temp	23°C±1°C	-10°C -40°C	-
Ambient Humidity	40%-60%	<80%	-
Working Voltage	7.8V±0.1V	7V±1.5V	-
Auxiliary Earth Resistance	<100Ω	<5kΩ	-
Interference Voltage	Should avoid	<20V	-
Interference Current	Should avoid	<2A	-
Electrode Distance when measuring R	a>5d	a>5d	-
Electrode Distance when measuring ρ	a>20h	a>20h	-

2. General Specification

Function	Measure grounding resistance, soil resistivity; DC resistance, earth voltage, alternating current, leakage current
Power Supply	DC 7.4V 2600mAh rechargeable lithium battery, full of about 8.4V
Backlight	Controllable screen backlight, suitable for dim places
Measurement Range	Precise4-pole measurement, 3 pole measurement, simple 2 pole measurement, selection method, double clamp method measure grounding resistance
Measuring Mode	2/3/4 pole measurement method: Change-pole method, measurement current 20mA Max Selection measurement method: Change-pole method, measurement current 20mA Max Double clamp measurement method: Non-connect mutual inductance method, measurement current 1mA Max Soil Resistivity: 4-pole measurement (Wenner method) DC resistance: Change-pole method AC current : Mutual inductance method (clamp) Earth Voltage: Average rectification (between P(S) ES)
Test Voltage Wave	Sine wave
Test Frequency	128Hz/111Hz/105Hz/94Hz(AFC)
Short-circuit Test Current	AC 20mA max
Open-circuit Test Voltage	AC 40V max

DOUBLE CLAMP EARTH AND SOIL RESISTIVITY TESTER PACKAGE WITH THE DUTY AND WATERPROOF BOX KIGM-EM2C-H

2. General Specification

Electrode Distance Range	1m-100m
Display Mode	4 digital large LCD display, with screen backlight
Measuring Indicator	During measurement, LED flash indicator, LCD countdown display
LCD Frame Dimension	128mmx75mm
LCD Window Dimension	124mmx67mm
Dimension	280 mm(L) x 260 mm(W) x 160 mm(H)
Size of clamp	185 mm(L) x 115 mm(W) x 43 mm(H)
Test Wire	4 wires: each for red 20m, black 20m, yellow 10m, and green 10 m
Simple Test Wire	2 wires: each for red 1.6m and black 1.6 m
Auxiliary Grounding Rod	4 PCS : Φ 10mmx150mm
Current Clamp	2 PCS : 1 blue black plug and 1 red black plug
Clamp Caliber	Φ68mm
Clamp Turn Ratio	1000 : 1
Clamp Lead Wire	2m
Measuring Rate	AC current : about 2 times/second
	Earth Voltage : about 2 times/second
	Earth resistance: about 7 seconds/time
Measuring Times	Over 5000 times (Short-circuit test , interval time should be at least 30seconds)
Circuit Voltage	AC 600V
Communication Interface	RS232 interface, storage data can be uploaded to computer, saved or printed.
Communication Wire	One piece of RS232 communication wire, with length 1.5m
Data Hold	Data hold function: "**HOLD**" symbol display
Data Storage	2000 sets, "**MEM**" storage indicator, "**FULL**" symbol flash display storage is full
Data Read	Data read function: "**READ**" symbol display
Overflow Display	Exceed measuring range overflow function: "**OL**" symbol display
Low current direction of clamp	Measurement with select method or double clamp, the current signal received by CT2 is lower than 0.5mA,will display "Ø", and should check the clamping direction of the CT2 current clamp
Interference Test	Automatic identification of interference signals , "**NOISE**" symbol indication when the interference voltage is higher than 5V
Auxiliary Grounding Test	With auxiliary grounding resistance test function, 0.00KΩ 30kΩ(100R+rC <50kΩ, 100 R+rP <50kΩ)
Alarm Function	Measuring value exceeds alarm setting value, will "Toot toot toot" alarm hint
Battery Voltage	While battery voltage decreases to around 7.2 V, will display battery voltage low symbol "▭", and reminding to replace the battery
Auto shut off	Automatically shut down after 15 minutes of power on
Power Consumption	Backlight : 25mA Max (only backlight power consumption)
	Standby : 25mA Max (Backlight off after power on)
	Measurement 150mA Max (Backlight shut off)
Weight	Tester: 2.23kg
	Testerpackage: 0.915kg
	Current Clamp:1.05kg(2pcs)
	Test wires:1.56kg (include the simple test wires)
	Auxiliary grounding rods: 0.935kg (4pcs)
Working Temperature & Humidity	-10°C-40 °C, below 80%rh
Storage temperature & humidity	-20°C-60 °C, below 70%rh

DOUBLE CLAMP EARTH AND SOIL RESISTIVITY TESTER PACKAGE WITH THE DUTY AND WATERPROOF BOX
KIGM-EM2C-H

2. General Specification

Protection Level	IP65 (close the case)
Overload Protection	Measure earth resistance: between each interfaces of C(H)-E、P(S)-ES, AC 280V/3 seconds
Insulation Resistance	Over 20 MΩ (between circuit and outside shell is 500V)
Withstanding Voltage	AC 3700V/rms. (Between circuit and outside shell)
Electromagnetic Features	IEC61326 (EMC)
Protection Type	IEC61010-1(CAT 300V, CAT IV 150V, Pollution 2); IEC61010-031; IEC61557-1 (Earth resistance); IEC61557-5 (Soil resistivity); JJG 366-2004 (Grounding resistance meter) JJG 1054-2009 (Clamp grounding resistance meter)

3. Intrinsic error and performance indicators under base conditions

Measurement Function	Measurement Range	Intrinsic Error	Resolution
2/3/4 pole method measure earth resistance (Re) DC resistance(R--)	0.00Ω-29.99Ω	±2%rdg±5dgt	0.01Ω
	30.0Ω-299.9Ω	±2%rdg±3dgt	0.1Ω
	300Ω-2999Ω	±2%rdg±3dgt	1Ω
	3.00kΩ-30.00kΩ	±4%rdg±3dgt	10Ω
Selection method measure grounding resistance(Re)	0.00Ω-29.99Ω	±2%rdg±5dgt	0.01Ω
	30.0Ω-299.9Ω	±2%rdg±3dgt	0.1Ω
	300Ω-3000Ω	±2%rdg±3dgt	1Ω
Double clamp	0.01Ω-0.99 Ω	±10%rdg±5dgt	0.01Ω
method measure grounding resistance(Re)	1.0Ω-29.9Ω		0.1Ω
	30Ω-100Ω		1Ω
Soil Resistivity(ρ)	0.00Ωm-99.99Ωm	Accuracy : According to the precision of R (ρ=2πaR, a:1 m-100m,π=3.14)	0.01Ωm
	100.0Ωm-999.9Ωm		0.1Ωm
	1000Ωm-9999Ωm		1Ωm
	10.00kΩm-99.99kΩm		10Ωm
	100.0kΩm-999.9kΩm		100Ωm
	1000kΩm-9000kΩm		1kΩm
Earth Voltage(50Hz/60Hz)	AC 0.0-100V	±2%rdg±3dgt	0.1V
Alternatingcurrent(50Hz/60Hz)	0.0mA-600.0A	±2%rdg±3dgt	0.01mA

Note : 1. rC max or rP max: additive error≤±5%rdg±5dgt (rC max: 4kΩ+100R＜50kΩ, rP max: 4kΩ+100R＜50kΩ)

2. when interference by 5V voltage, the additive error ≤±5%rdg±5dgt

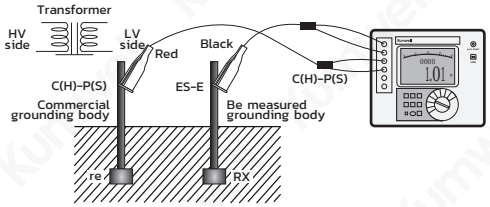
Kumwell

DOUBLE CLAMP EARTH AND SOIL RESISTIVITY TESTER PACKAGE WITH THE DUTY AND WATERPROOF BOX KIGM-EM2C-H

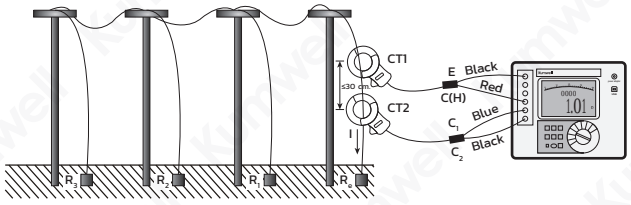
Accessories
Tester: 1 piece
Current Clamp Sensor: 2 pieces
Grounding Rod: 4 pieces
Testing Wire: 6 pieces
USB data transmission line: 1 piece
Current clamp : 2 pieces
Software disk: 1 piece
Tester bag: 1 piece
Special charger: 1 piece



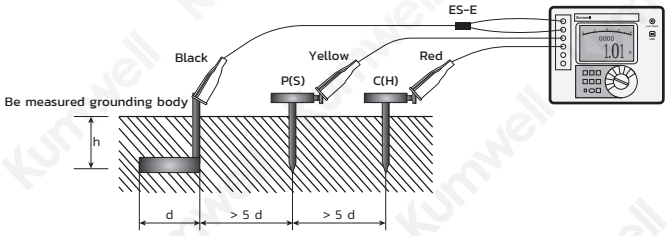
Field Application



2-wire simple earth resistance measurement

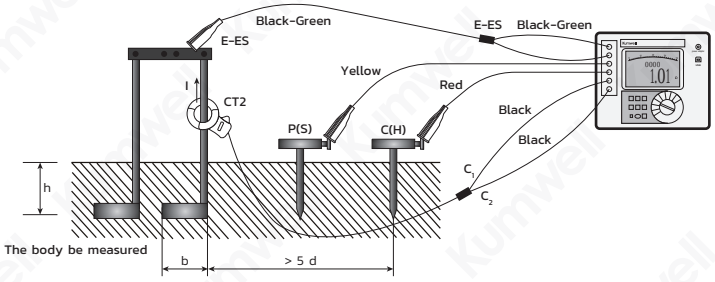


Double clamp method to measure earth resistance

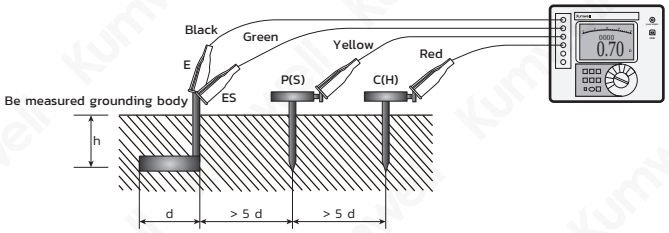


3-wires earth resistance measurement

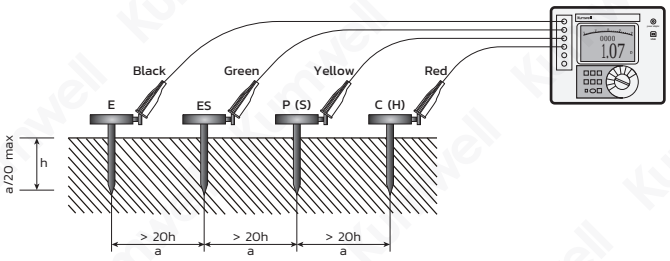
DOUBLE CLAMP EARTH AND SOIL RESISTIVITY TESTER PACKAGE WITH THE DUTY AND WATERPROOF BOX KIGM-EM2C-H



Selective method to measure earth resistance



4-wires precise earth resistance measurement



Soil resistivity measurement

References

Owner	Project Name	Period
Precise System and Project Co., Ltd.	• MEA	2015-2021
Taveesin 189 Engineering Co., Ltd	• Saving and Credit Cooperative (Rayong)	2015-2021
Asefa Public Company limited	• Betong Airport, PTT, Central Chonburi, Royal Irrigation Department	2015-2022
CPT Drives and Power Public Co., Ltd.	• Power Plant, Solar-PRIME ALTERNATIVE VISIONS, Double A, Power Plant Pichit, Chalermprakiet Building, NEO CLEAN ENERGY, MWA	2015-2022
P&S Design Co.,Ltd.	• Wastewater treatment pond (Kamphaeng Phet), PLC (Amnat Charoen)	2015-2022
Royaltec International Co., Ltd.	• Military Development Headquarters, Big C, Mitr Phol Factory (Khon Kaen), Wat Pa Dhamphanomwan	2015-2022
Asset Performance Solutions Co., Ltd.	• ESSO Gas Station	2016-2018
E.C.T.Professional Co.,Ltd.	• The Lumpini Sukumvit 24	2016-2021
K.T.Technical Supply Co., Ltd.	• Phitsanulok Airport	2016-2021
T I C Modular System Co., Ltd.	• Phuket Port, PEA (Nakhon Nayok), Airport Security Camera System, Solar Rooftop Puunphin	2016-2021
J.T.N.Energy Co., Ltd.	• Betagro, Solar, Makro, JTN Solar Rooftop	2016-2022
EA Solar Lampang Co.,Ltd.	• Solar (Lampang)	2017-2018
JSK Group Company Limited	• Koh Chang, Radar Station (Naval Public Works Department)	2017-2021
PTT Exploration and Production Plc	• PTT	2017-2021
Power Insulators Co., Ltd.	• PEA	2017-2022
Precise Electro-mechanical Works Co., Ltd.	• MEA	2017-2022
I G N Supply Co., Ltd.	• Royal Thai Navy	2018
Win Thai Engineering Co., Ltd.	• Thongnian Water Pump Project	2018
AN Plus Engineering Co., Ltd.	• ESSO Gas Station (Nakhon Pathom), SHELL Gas Station (Nongkham, Bangkok)	2018-2019
P&C Intersupply Co.,Ltd.	• PTT-Sahamitrpaisal Gas Station	2018-2021
SCI Electric Public Company Limited	• Solar Rooftop, Internet VSE 1504.44	2018-2021
Somchai Electric Part., Ltd.	• Ordnance Department	2018-2021
Thai Maxwell Electric Co., Ltd.	• Transformer Manufacturing	2018-2021
S.T.Electrical Products Co.,Ltd.	• PWA Water Filtration Plant (Phetchaburi)	2018-2022
V Synap Technology Co., Ltd.	• Skill Development Institute (Pathum Thani)	2019
วัฒนากิจบัญชา จำกัด	• GREENTECH AGRO	2019
All Tech 19 Co., Ltd.	• YALACITY	2019-2021
B.E.C.Electric Co., Ltd.	• Toyota Solar Roof	2019-2021
KDSS Trading and Service Co., Ltd	• SANGKHOM Hospital	2019-2021
Eica Company Limited	• PTT	2020-2021
Iyara Intertrade Company Limited	• Office of the Narcotics Control Board (Royal Thai Police)	2020-2021
Scada Automation Co., Ltd.	• Solar (Wang Chan, Rayong), BENCHACHINDA Building, IBC LNG, Lotus (Bang Kradi), EGAT	2020-2021
SPP Five Company Limited	• Solar Power Plant SPP5	2020-2021
SPP Two Company Limited	• Solar Power Plant SPP2	2020-2021
Super Energy Public Co., Ltd.	• Solar Power House 3 Project (Klong Poon)	2020-2021
Total Instrument Solution Co., Ltd.	• PWA	2020-2021
Tronical Systems Co., Ltd.	• Naval Public Works Department Rayong Province	2020-2021
API Advance Integrate 2019 Co., Ltd.	• Solar Triumph / SURIN SUGAR / THIP SUGAR SUKHOTHAI	2020-2022

References

Owner	Project Name	Period
Frigate Technology Co., Ltd.	• CCTV PTT GC3	2020-2022
Sangchai Equipment Co., Ltd.	• PWA (Narathiwat), Southern Major City Stadium	2020-2022
CHAROEN POKPHAND ENGINEERING CO., LTD.	• Government Solar Roof	2022
EXUS GROUP COMPANY LIMITED	• PTTGC 3, Fire pump replacement	2022
HYDROZONE COMPANY LIMITED	• Water Treatment :PA-2001-ESM	2022
INTERLINK TELECOM PUBLIC COMPANY LIMITED	• AIS SOLAR	2022
IYARA SOLAR COMPANY LIMITED	• Solar Roof	2022
MAXEL ELECTRIC COMPANY LIMITED	• Rangsit University	2022
METRO UNITEDD COMPANY LIMITED	• Administrative Court of Thailand	2022
NESIC (THAILAND) CO., LTD.	• Suvarnabhumi Airport (GBAS)	2022
NP.ELECTRIC ENGINEERING COMPANY LIMITED	• Solar Roof (Chonburi)	2022
SCG Autogas Co., Ltd.	• Solar Roof (Pathum Thani)	2022
SITE PREPARATION MANAGEMENT COMPANY LIMITED	• Data Center (Symphony Communication Amata Nakorn)	2022
THANACHA CO., LTD.	• Wat Pa Dhamphanomwan	2022
THE EXPERT ICT COMPANY LIMITED	• CCTV Systems	2022
TRANSPOWER TECHNOLOGY COMPANY LIMITED	• AIS SOLAR	2022
T.Y.K.(THAILAND) CO.,LTD	• Hin Kong Power Plant	2023
Kumwell Corporation Public Company Limited	• PEA FRTU 316 SET	2023
Kumwell Corporation Public Company Limited	• Solar - Shell Gas Station (Sriracha)	2023
Kumwell Corporation Public Company Limited	• SCG SIAM KRAFT INDUSTRY CO., LTD	2023
GLOBALTRONIC NTERTRADE COMPANY LIMITED	• Big C (Narathiwat)	2023
Communication & System Solution PCL.	• Gas Station (Rayong)	2023
Communication & System Solution PCL.	• Water Production Plant (Thonburi)	2023
Kumwell Corporation Public Company Limited	• Rangsit University	2023
Kumwell Corporation Public Company Limited	• Donmuang RTAF, Khao Wongjandang, Phu Khong, Khao Kheow, Signal Department (Khao Chan)	2023
Communication & System Solution PCL.	• Missile Testing Building and Warehouse - Naval Ordnance Department	2023
Kumwell Corporation Public Company Limited	• Telephone Exchange System in Training Center - RTAF	2023

THAILAND : EGCO Solar Farm



THAILAND : Gheco One



THAILAND : HPC Power Plant



THAILAND : PTT Stadium



THAILAND : Super Energy Solar Farm



THAILAND : Khao Kho Wind Turbine



THAILAND : The Military Explosives Factory (Nakhon Sawan)



THAILAND : GLOW IPP CO., LTD. (Bowin, Chonburi)



THAILAND : Air Force Fuel Depot



THAILAND : Srinakarin Dam (Tha Thung Na Dam)

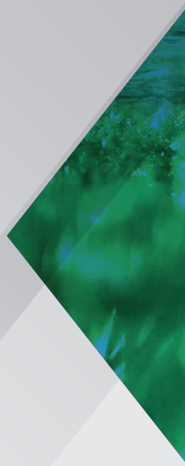


THAILAND : Thai PBS Phase 3



THAILAND : Solar Farm EGCO SPPS (Roi-Et)





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