Surge protector devices

Gave

low voltage electrical material

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Presentation

Company

Gave Electro is an international manufacturer of electrical control and protection products with an extensive professional record since it was founded in 1944.
The company has developed technical capabilities on the low voltage breaking, control and protection fields acquiring strong reputation on its protection and control equipment.

Innovation

Innovative thinking is our philosophy. We create better more effective products and processes applying new ideas that benefit from our longstanding experience. A dedicated engineering team boosting your competitiveness.

Quality and service commitment

Gave Electro follows a total quality management (TQM) system as an integrative philosophy of management for continuously improving the quality of products and processes. This system functions on the premise that the quality of products and processes is the responsibility of everyone who is involved with the creation or consumption of the products and involves management, workforce, suppliers, and even customers, in order to meet or exceed customer expectations.

Constant rigorous product testing is undertaken during all production process in order to guarantee product reliability and repeatability. Testing capabilities include:

- Electrical and mechanical endurance
- EMC testing
- Optical and thermal parts analysis
- Dielectric testing
- Flammability and ignitability (glow wire test)

We commit to service our customer by providing support in planning, installation, training, trouble shooting, maintenance, upgrading, and disposal of a product.

Introduction to surge protector devices

«Protector advanced technology»

Compact surge protector devices (SPD) are developed to meet overvoltage protection needs for low voltage networks. These overvoltages are mainly generated by lightning although also industrial changeovers and network failures.
They provide common/differential protection.

The electrical scheme on PST are based on high energy varistors equipped with thermal disconnector and associated to specific gas discharge tubes GDT.

According to standards

- IEC 61643-1
- EN 61643-11

Operating principle

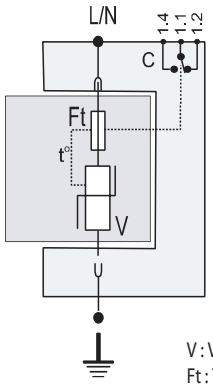
PST surge protectors are based on zinc metal-oxide varistors (MOV), the best compromise between a fast response time (<25 ns) and a high discharge current capacity, which are the main parameters to provide efficient protection.

Surge protection is highly improved by combining varistors with a specific gas discharge tubes (GDT).

Improved performance is specifically attested in:

- Protection level (Up)
- Life duration (due to the supression of leakage current)
- Continuous operation and power quality (no follow current)

Nevertheless the end of life of these varistors must be absolutely monitored thus requiring the systematic use of built-in thermal disconnection devices.



V : Varistor
Ft : Thermal fuse
t° : Thermal disconnection
C : Remote signaling contact

Type of surge protectors

The AC power surge protectors are split into 3 categories by IEC 61643-1 and EN 61643-11 standards. These different categories depend on the location of the surge protector in the AC network and on the external conditions.

- ### Class I

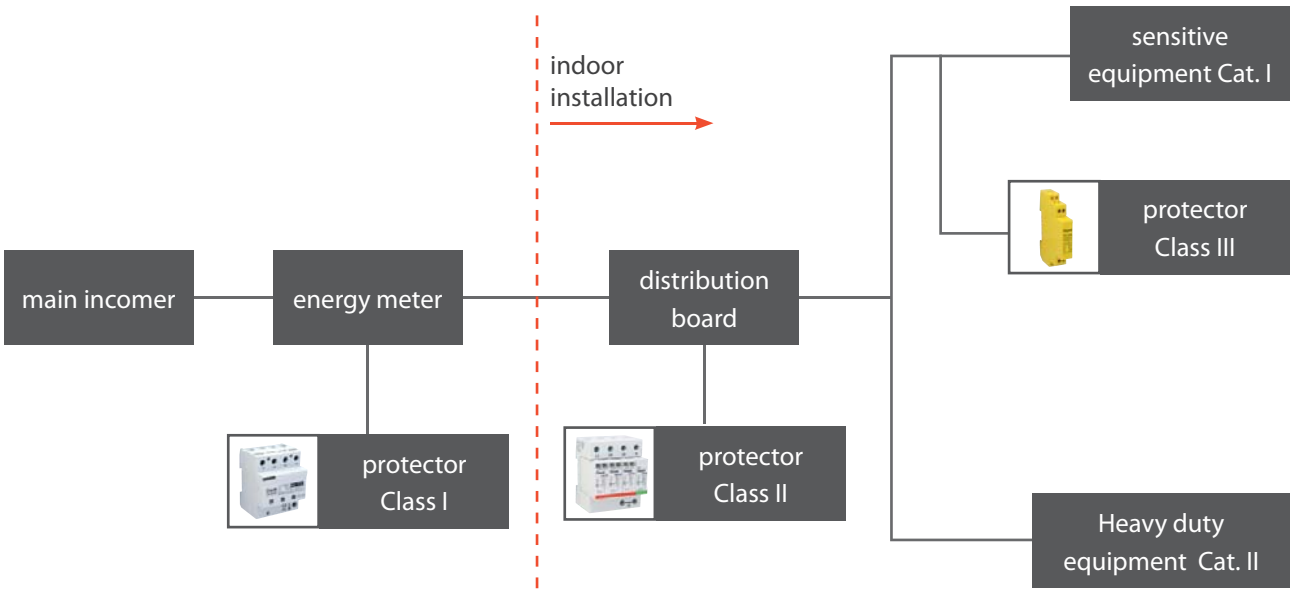
  Type 1 surge protectors are designed to be installed where a direct lightning strike risk is high, especially when the building is equipped with external lightning protection system (LPS or lightning rod).
  In this situation, EN 61643-11 and IEC 61643-1 standards require the Class I test to be applied to surge protectors: this test is characterized by the injection of 10/350µs impulse current in order to simulate the direct lightning strike consequence.
  Therefore these Type 1 surge protectors must be especially powerful to conduct this high energy impulse current.

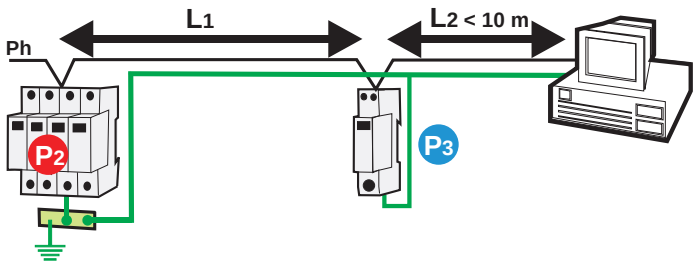
- ### Class II

  Type 2 surge protectors are designed to be installed at the beginning of the installation, in the main switchboard, or close to sensitive terminals, on installations without LPS (lightning rods).
  These protectors are tested following the Class II test from IEC61643-11 or EN61643-11standards and based on 8/20µs impulse current injection.

- ### Class III

  In case of very sensitive or remote equipment, secondary stage of surge protectors is required: these low energy SPDs could be Type 2 or Type 3. Type 3 SPDs are tested with a combination waveform (1,2/50µs - 8/20µs) following Class III test.





P2 : Protector de sobretensiones primario
P3 : Protector de sobretensiones secundario
L1 : Longitud del conductor entre protectores
L2 : Longitud del conductor entre el protector y la instalación

Coordination of surge protectors

In order to provide maximum protection efficiency, it is necessary to create a «coordination» diagram, that means installation of a «primary» SPD at the network entrance and a «secondary» close to sensitive equipment.

This association is required in the 2 following cases :

- High sensitivity equipment: Voltage protection level upstream is too high with regards to withstand level capability of protected equipment.
- Long distance (greater than 30m) of wire between equipment to be protected and primary SPD: Reduction of ringing voltages created during the surge transmission.

Efficient SPD coordination is performed by including between primary and secondary SPDs a minimum length of wire (> 10m).

Disconnection devices

In compliance with the standards, the AC power surge protectors are equipped with external and internal disconnection devices in order to provide total safety in case of failure.

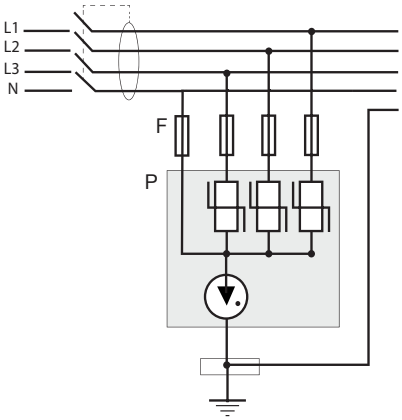
2 types of devices are necessary:

- **Internal thermal** security which will disconnect the surge protector from the AC network in case of thermal runaway. In such a case, the user will be warned about the trouble by an indicator (mechanical or light) in front of the protector and will carry out the replacement of the defective SPD.
- **External electrical** disconnection (fuses or breaker) to disconnect the surge protector from the AC network in case of internal short circuit, e.g. due to an excessive impulse current.

Common and differential mode protection

Lightning surges occur essentially between active conductors and earth. A live conductor not only refers to the phase conductors but also to the neutral conductor. These overvoltages are protected on Common mode.

Differential overvoltages can occur between live conductors when we are operating on a TT earthing system. It can also appear on TN-S eartingh systems if there is a significant length difference between PE and N cables. The standard IEC 60364 allows combination of protection between phases and neutral (differential mode) and between neutral and ground (common mode) this type of mounting is named "CT2 connection".



Choosing disconnection devices

Fuses provide a more suitable solution as short circuit protection for SPD.

Parameters	Fuses	Circuit breaker
Voltage decrease (Up improvement)	+	
Lightning impulse current behaviour	+	- Contacts wear
Icc	+	-
Reduced dimensions	- Fuses > 25A	+
Cost	+	-

The rating of the external fuses (or breaker) are in relation with the discharge capability of the SPD and the prospective short-circuit current of the installation.

	Class I	Class II	
Value de Icc	15 kA (10/350)	15kA (8/20)	40kA (8/20)
From 300A to 1kA	25A	16A	16A
From 1kA to 7kA	50A	16A	25A
From 7kA and above	63A	25-40A	50A

Surge protectors parameters

Surge protectors are defined by a series of electrical specifications which will help the user to select the right protection specific to their installation:

Uc Operating voltage
The maximum continuous operating voltage (MCOV) Uc is the maximum r.m.s voltage which may be applied continuously to the SPD.

Imax Maximum discharge current
Applicable to Type 2 SPD, is the maximum impulse current 8/20µs a surge protector can withstand without destruction.

In Nominal discharge current
Is the level of impulse current a surge protector Type 1 or Type 2 can withstand repeatedly (15 surges) without destruction.

Iimp Impulse current
Applicable to Type 1 SPDs, is the maximum impulse 10/350µs current a surge protector can withstand without destruction.

Up Protection level
The maximum voltage on the surge protector output when subjected to an impulse current equivalent to its nominal discharge current (In). Therefore this parameter characterizes the performance of the SPD in limiting the transient overvoltage across its terminal in order to protect the equipment.

Appliance following IEC 60364

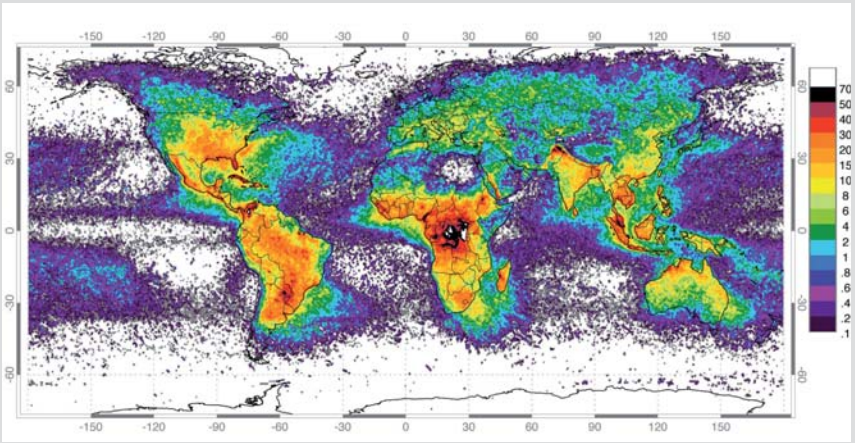
We use the installation standard IEC 60364 as a rule to select which protector should be installed. Section 4-443 and Section -5- 534 help us establish protector characteristics and where to install it. Additionally we rely on IEC 61643-12 as selection guide related to the application

	Type of installation			
	 Installation equipped with direct lightning protection system (LPS)	 Connection to overhead AC line	 Connection to underground AC line	 The unavailability of the electrical network could have consequences on human safety
Ng ≤ 2,5* Nk < 25	Mandatory (Class I)	Recommended on sensitive equipment or when reinforced reliability is required.		Risk analysis required
Ng > 2,5 Nk > 25	Mandatory (Class I)	Mandatory (Class II)		Mandatory

* Ng: Lightning density *(see information below)*
Nk: Keraunic Level

World lightning density map (Ng)

The level Ng defines the number of impacts year per km2 in a region. Nk keraunic Level defines the number of lightning days per year. These two parameters are connected by an approximate rate: Ng=Nk/10. The highest ratings are in the tropics and mountainous areas.



Source: NASA OTD (4/95-3/00) and LIS (1/98-2/03)

Regional/national standards

Typically regional/national standards defines additional conditions where surge protection will be mandatory or recommended.

Representative conditions are:

Public services (street lights, telecoms, police,..)

Farming installation when affecting animal safety.

Emergency systems (emergency lights, security alarms, CCTV,..)

Industrial processes requiring continuity (Food processing, chemical, pharmacy,..)

Electronic components have extensively been introduced in our daily life being present at almost all appliances connected to the network supply. Some countries are already regulating to make it compulsory installing surge protection in all electrical installations as we always have valuable goods to protect.

Installation rules

1/ Surge protectors are connected in parallel on the AC network and must be equipped with external fuses for short-circuit protection.

2/ Total length of connection wires to AC network must be lower than 0,5m in order to maintain protection level as the impedance of these connections reduces the protection provided.

3/ Protection wire coming from SPD must be connected to bonding bar. Paralleling protection wire with phases conductors must be avoided.

4/ Type 2 protectors require wires with 4mm^2 minimum cross-section. Type 1 require minimum 10mm^2.

Surge protector devices Class I

The PST4B100 is a compact Class I Surge Protector Device designed to be connected at the entrance of the electrical installation on 3-Phase networks. This device provides efficient protection against direct and indirect effects of lightning phenomena on electrical networks. This protection is specially adequate on those buildings endowed with lightning rods or LPS systems.

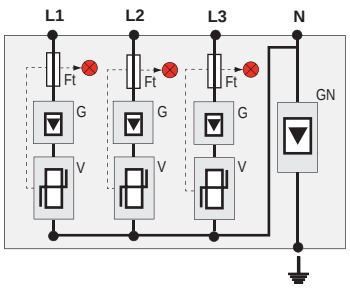
This protection is based on combining high discharge capacity MOV varistors with specific GDT providing common and differential mode protection. This technology allows the best performance with no follow current neither leakage current, while achieving an elevated (Up) level of protection.

This SPD draws attention for its extremely modular compact size, easy to install on DIN rail, and for its individual visual indicator on each phase.

Electrical characteristics

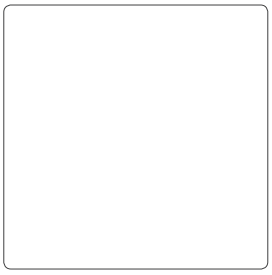
Description		Value
Network	V	230/400 V TT, TN
Protection modes		Common and differential
Max. operating voltage	Uc	255 Vac
Temporary overvoltage withstand	Ut	450 Vac
Operating current (leakage current at Uc)	Ic	None
Discharge currents (15 impulses and 1 max. stand. 8/20 µs)	In / Imax	40 kA / 100 kA
Max. lightning current by pole (1 impulse 10/350 µs)	Iimp	25 kA
Total lightning current (1 impulse 10/350 µs)	Itotal	50 kA
Residual voltage (at In)	Up-In	1.1 kV
Protection level (at In)	Up	1.5 kV

Electrical scheme



PST4B100

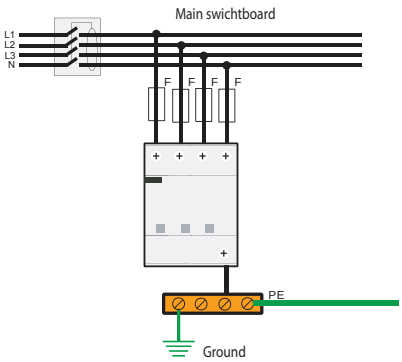
V : High-energy varistor network
G : Heavy duty GDT
GN : Heavy duty N/PE GDT
Ft : Thermal fuse
MI : Disconnection indicator



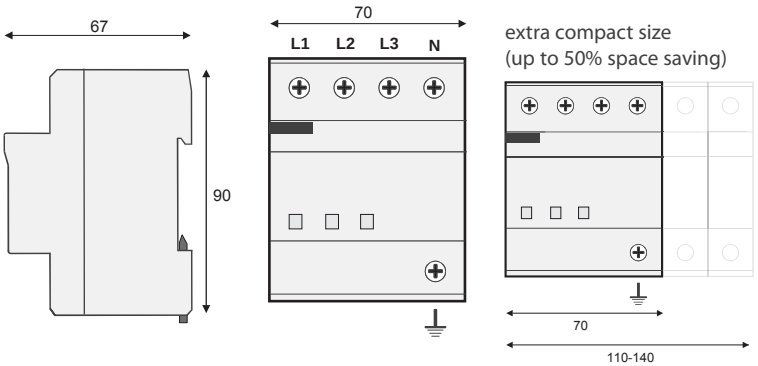
Mechanical characteristics

Description	Value
Connection	By screw terminals: 6-35mm^2
Disconnection indicator	Red light indicators
Mounting	Symmetrical rail 35mm
Operating temperature	-40/ +85º C
Protection class	IP20
Housing material	Thermoplastic UL94-V0
Standards compliance	
IEC 61643-1 International	Low Voltage SPD Test Class I
EN 61643-11 Europe	Low Voltage SPD Test Class I

Installation scheme



Dimensions



Surge protector devices
Class II

Compact surge protector devices (SPD) are developed to meet overvoltage protection needs for single phase low voltage networks. These overvoltages are mainly generated by lightening although also industrial changeovers and network failures.

SPDs provide common/differential protection.

The electrical scheme on overvoltage SPD are based on high energy varistors equipped with thermal disconnector and a specific gas discharge tube GDT.

Protectors are built with plug-in modules with failure indicator and a din rail fixed block base, which allows an easy and quick module replacement on maintenance operations.

According to standards

- IEC 61643-1
- EN 61643-11
- UL1449 ed. 2

General characteristics

Modules easy replacement

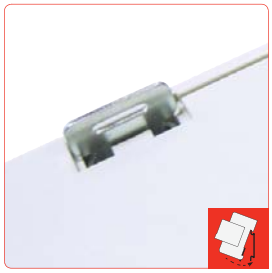
Plug-in modules easy and quick to replace at the end of protection life.

Visual indicator

Green colour indicates correct operation and red colour indicates module replacement.

Remote signalling

Operational status on the protection is constantly supervised by floating changeover contact that will activate if module changes status.

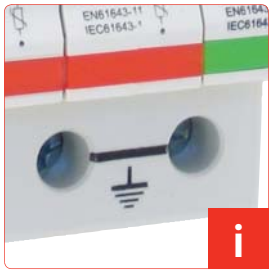


DIN rail mounting

Direct mounting on symmetrical DIN rail acc. to EN 60715.

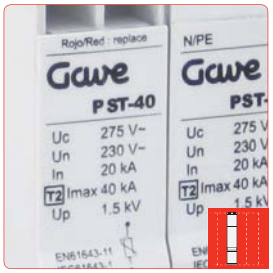
Mechanical coding

Plug-in modules and modular bases are mechanically coded and prevent wrong module replacement.



Marking

Terminals clearly marked for easy wiring. Modules marked with reference and electrical data.



Modular construction

Designed to fit on modular enclosures with frontal 45mm window and 17,5mm modules.

Surge protectors decives
Class II

Compact protectors range PSTCxx

Gave offers a new surge protector range designed to be installed on main switchboards that highlights on its **compact** size saving 50% of space compared to conventional protectors.

Surge protection device

Description	Modules	In	Imax	Reference
2 poles 1Ph+N	1	5 kA	15 kA	PSTC15
4 poles 3Ph+N	2	20 kA	40 kA	PSTC440
4 poles 3Ph+N with remote signalling	2	20 kA	40 kA	PSTC440T

Replacement modules

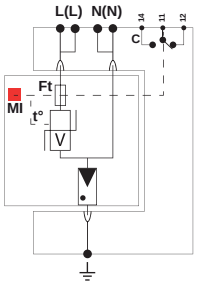
Description	In	Imax	Reference
Phase module (MOV) + neutral (GDT)	5 kA	15 kA	PC-15
Phase module (MOV) + neutral (GDT)	20 kA	40 kA	PSTC-40
Phase module (MOV) + phase (MOV)	20 kA	40 kA	PSTC-40G

Electrical characteristics

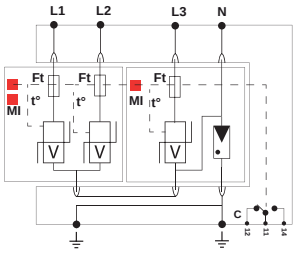
Description		Value
Network	V	230
Max. Operating voltage	Uc	255
Follow current	In	5 kA
Nominal discharge current *(15 x 8/20 µs impulses)*	Imax	15 kA
Protection level (at In)	Up	1,5/0,9 kV
Residual voltage at 5kA		0,9 kV

Electrical diagram

PSTC15

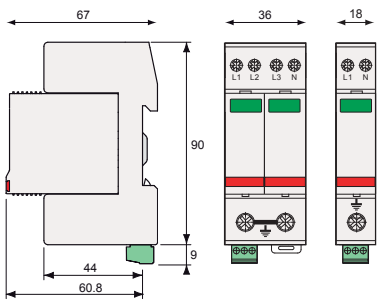


PSTC440/440T



V : High energy MOV
GDT : Gas discharge tube
Ft : Thermal fuse
t° : Thermal disconnection mechanism
C : Contact for remote signal (Optional)

Dimensions



PST2xx and PST4xx range

Gave offers a complete modular Class II range of SPD that distinguishes on its high discharge capacity, plug-in modular cartridges with thermal disconnection visual indicator, and the possibility of remote signalling.

Surge protection device

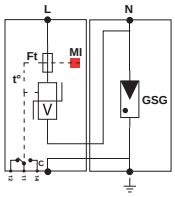
Description	Modules	In	Imax	Reference
SPD Class II	2	5 kA	15 kA	PST215
SPD Class II	2	20 kA	40 kA	PST240
SPD Class II	4	5 kA	15 kA	PST415
SPD Class II	4	20 kA	40 kA	PST440

SPD with remote signalling

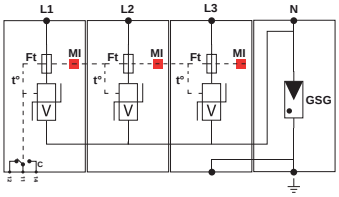
Description	Modules	In	Imax	Reference
SPD Class II + R	2	20 kA	40 kA	PST240T
SPD Class II + R	4	20 kA	40 kA	PST440T

Electrical diagram

PST2xx



PST4xx

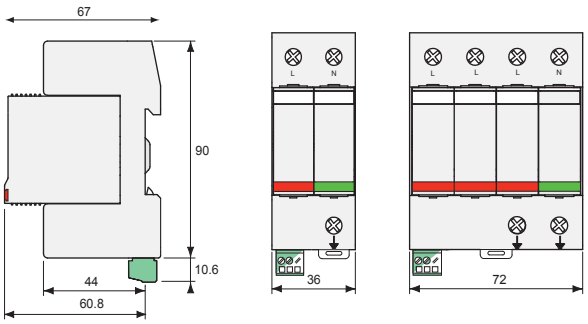


V : High energy MOV
GDT : Gas discharge tube
Ft : Thermal fuse
t° : Thermal disconnection mechanism
C : Contact for remote signal (Optional)

Replacement modules

Description		In	Imax	Reference
Phase module (MOV)		5 kA	15 kA	PST-15
Phase module (MOV)		20 kA	40 kA	PST-40
Neutral (GDT)		20 kA	40 kA	PST-N

Dimensions

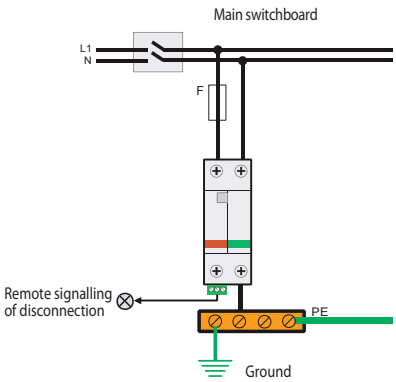


Electrical characteristics

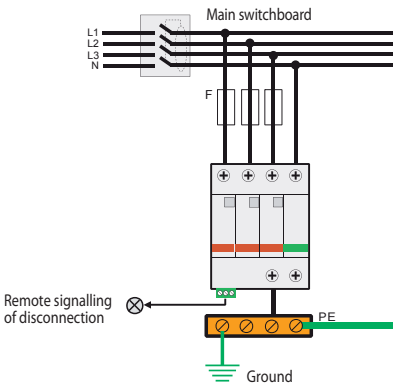
Description		PST2xx PST215	PST2xx PST240	PST2xx PST240T	PST4xx PST415	PST4xx PST440	PST4xx PST440T
Network	V	230	230	230	230/400	230/400	230/400
Max. Operating voltage	Uc	275 V~	275 V~	275 V~	275 V~	275 V~	275 V~
Follow current	If	None	None	None	None	None	None
Nominal discharge current *15 x 8/20µs impulses*		5 kA	20 kA	20 kA	5 kA	20 kA	20 kA
Maximum discharge current		15 kA	40 kA	40 kA	15 kA	40 kA	40 kA
Protection level N/PE(at In) Up		Imax	1,5 kV	1,5 kV	1,5 kV	1,5 kV	1,5 kV
Protection level L/N (at In) Up		0,9 kV	1,25 kV	1,25 kV	0,9 kV	1,25 kV	1,25 kV
Residual voltage at 5kA		0,9 kV	0,9 kV	0,9 kV	0,9 kV	0,9 kV	0,9 kV
Protection modes	Common	•	•	•	•	•	•
	Differential	•	•	•	•	•	•
Remote signalling			-	•	-	-	•

Installation scheme

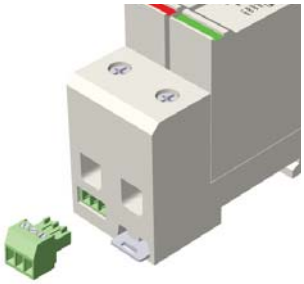
PST2xx



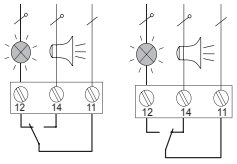
PST4xx



Remote indication



In watch **Default**

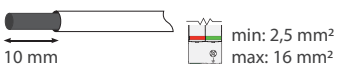


Min: 12 V DC, 10 mA
Max: 250 V AC, 1 A

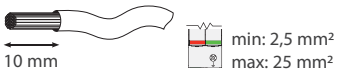
Conexión

2-2,5Nm

Stranded wire



Flexible wire

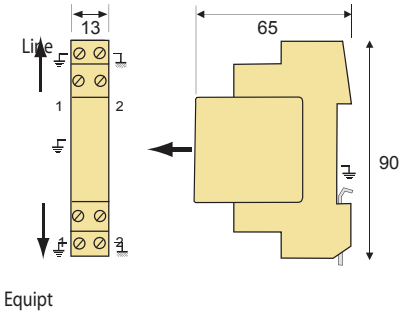


Surge protectors for telecom and data lines Class III

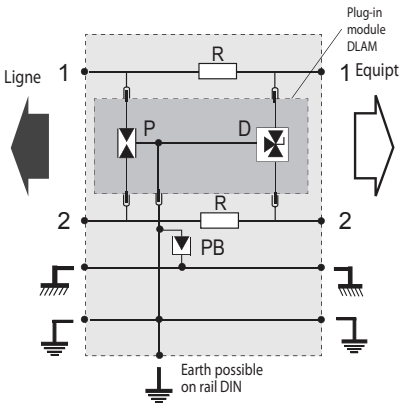
Class III surge protectors are designed to protect, against transient voltages telecom lines, data lines, automation PLCs and industrial buses. These elements are characterised for their high sensitiveness and the elevated cost that any overvoltages can cause on the equipment to be protected.

DLA protections combine gas discharger tubes and fast clamping diodes in order to provide high discharge current capability and fast operation. These protections are installed on symmetrical DIN rails and are equipped with removable modules for easy maintenance (line continuity in case of plug-in module removal).

Dimensions



Electrical scheme



Electrical characteristics

Description		DLP-170	DLP-48P1	DLP-24P1	DLP-12P1
Utilisations type		RTC / ADSL	RDSI	4-20mA	RS485
Configuration		1 pair+shield	1 pair+shield	1 pair+shield	1 pair+shield
Nominal line voltage	Un	150 V	48 V	24 V	12 V
Max. Line voltage	Uc	170 V	53 V	28 V	15 V
Max. Line current	IL	300 mA	300 mA	300 mA	300 mA
Max. Frequence		>10 MHz	>3 MHz	>3 MHz	>3 MHz
Protection level	Up	220 V	70 V	40 V	30 V
Nominal discharge current	In	5 kA	5 kA	5 kA	5 kA
Max. Discharge current	Imax	20 kA	20 kA	20 kA	20 kA
Spare module		DLM-170	DLM-48P1	DLM-24P1	DLM-12P1

PV Overvoltage surge protection devices

Photovoltaic installations typically require extended surface areas therefore being particularly exposed to lightning effects and consequent occasioned surges.

Damages caused by lightning surges will diminish system performance and shorten equipment live.

Using surge protection devices we avoid system failures and take full advantage on the system operation thus maximising production and profitability.

Function

Surge protector devices discharge peak transient overvoltages that travel on the line cable conductors originated by atmosphere lightning.

According to standards

- IEC 61643-1
- EN 61643-11

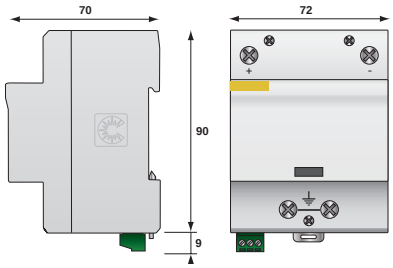
General characteristics

- Protections Class II and Class I+II.
- Modular DIN rail mounting.
- Voltages 560VDC and 1000VDC.
- High discharge capacity.
- Visual indicator on the module.
- Replaceable module.
- Optional remote signalling.

PV Overvoltage surge protection devices Class I + II

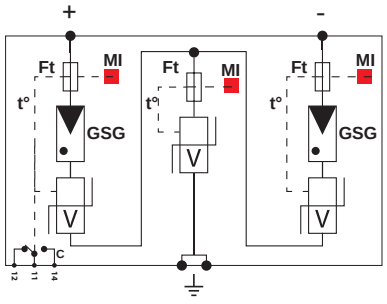
Class I surge protector devices are recommended at both end of the DC power supply line. Due to its extraordinary high discharge capacity they are recommended to be used on installations with elevated risk of direct lightning strikes. The protection is based on high energy MOVs and equipped with specific thermal disconnectors achieving a superior protection level and a lack of follow-up current.

Dimensions



Conecction

GSG: Gas-filled spark gap
V : High energy MOV
Mi : Disconnection indicator
Ft : Thermal fuse
t° : Thermal disconnection mechanism
C : Contact for remote signal



Technical characteristics

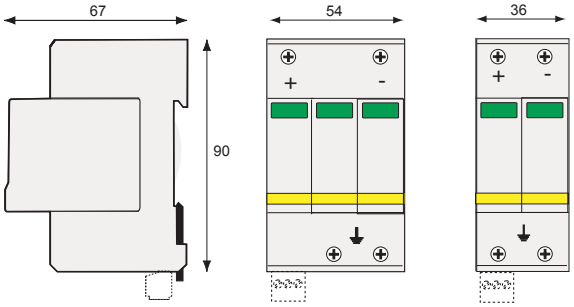
Description		PST41PV
Max. Operating voltage	Uc	1000VDC
Nominal discharge current (15 impulses 8/20µs)	In	40 kA
Max. Lightning current by pole (1 impulse 10/350µs)	limp	12,5 kA
Residual voltage (at limp)	Ures	1.9 kV
Protection level (at In)	Up	2,4 kV
Remote signalling		Yes

PV Overvoltage surge protection devices
Clase II

Class II surge protection devices are developed to meet overvoltage protection needs for PV photovoltaic installations that are characterised by long cable lengths. These units must be installed in parallel on the DC networks to provide common and differential protection.

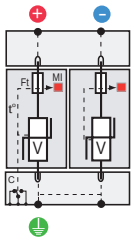
The electrical diagram is based on high energy MOVs equipped with specific thermal disconnectors and related failure indicators.

Dimensions

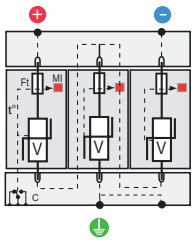


Connection

PST25PV



PST31PV



V : High energy MOV
Ft : Thermal fuse
t° : Thermal disconnection mechanism
C : Contact for remote signal (Optional)

Technical characteristics

Description		PST25PV	PST31PV
Max. Operating voltage	Uc	550VDC	1000VDC
Nominal discharge current	In	20 kA	20 kA
Maximum discharge current	Imax	40 kA	40 kA
Protection level (at In)	Up	2,2 kV	3 kV
Remote signalling		Ref. PST25PVT	Ref. PST31PVT

Mechanical characteristics

Description	PST25PV / PST31PV
Dimensions	See scheme
Connection	By screw terminals: 1,5-10mm^2 (L/N) o 2,5-25mm^2 (PE)
Disconnection indicator	2 mechanical indicators
Mounting	Symmetrical rail 35mm
Operating temperature	-40/+85ºC
Protection degree	IP20
Material	Thermoplastic UL94-V0

Permanent overvoltage protection

Protection against permanent or temporary overvoltages (TOV) require disconnecting the equipments from the installation. We can not shunt temporary to ground as we are dealing with large time scale overvoltages.

Temporary overvoltages are typically due to neutral fault in the network and specially required on those installations with unstable networks showing regular fluctuations and power cuts.

MODUTEC

PSP-3 for three phase networks

Protector PSP-3 does actuate by the means of the output relay on the shunt trip coil of the breaking element (MCB or MCCB). This permanent overvoltage protector distinguishes by integrating a voltage free auxiliary contact for external signalling. The protector does also offer test mode operation for commissoning and maintenance purposes.

Permanent overvoltage protection

Description	Reference
3 Phase + Neutral	PSP3
3 Phase + Neutral with buzzer	PSP3Z

Highlights:

➜ **Signalling**

Phase led blinking signals permanent overvoltage, led off signals phase failure.

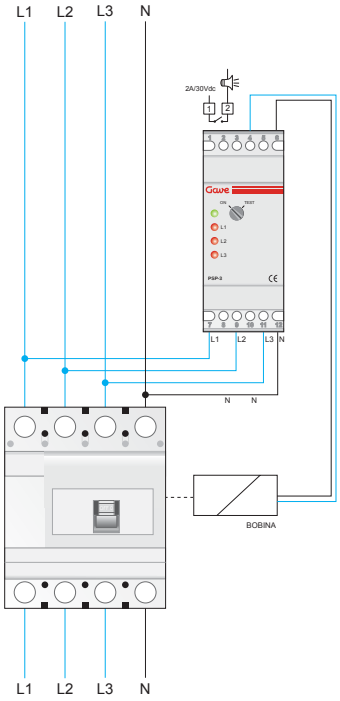
➜ **Auxiliary output**

The protector has a built in voltage free auxiliary contact for external signalling, alarm, PLC communication, ...

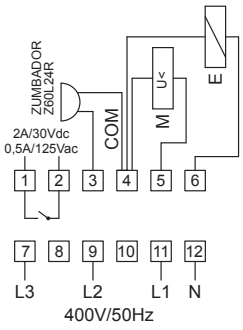
➜ **Test mode**

Selecting test mode by the means of a frontal rotary switch the relay will operate on the shunt trip coil while leds will indicate that we are on test mode.

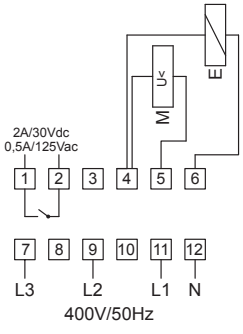
Installation diagram



Electrical scheme



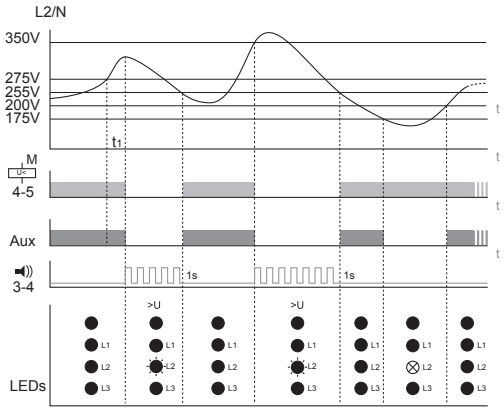
PSP3



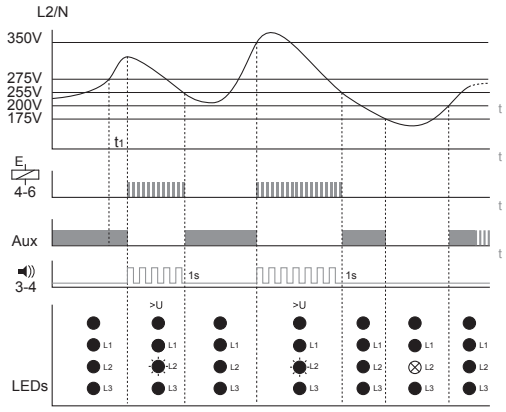
PSP3Z

Operating diagrams

Minimum coil mode



Emission coil mode



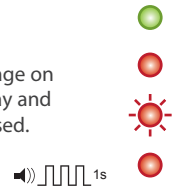
Technical characteristics

Description		Value
Operating voltage	(U_n)	230V~
Tripping voltage Tripping time	(U_{limit}) (t)	255-265V~ 3s
Tripping voltage Tripping time	(U_{limit}) (t)	>265V~ 0,8s

Signalling

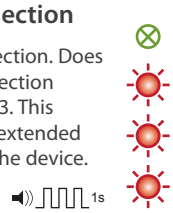
>U Permanent overvoltage

Permanent overvoltage on blinking phases. Relay and auxiliary contact closed.



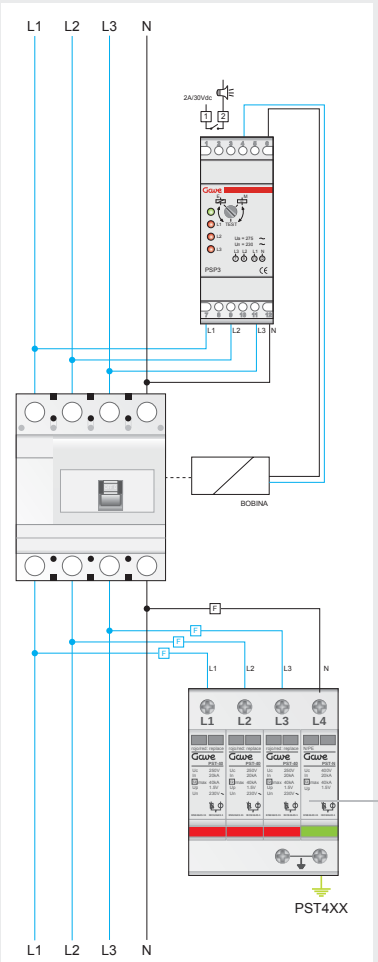
⚠ Wrong connection

Neutral wrong connection. Does not distinguish connection between L1,L2 and L3. This condition during an extended period will damage the device. Remake connection.



Combined protections

Three phase installation



Gave offers a complete range of combined solutions that warrant flexible installation and easy maintenance.

➜ Flexibility

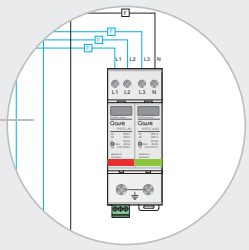
The protector is installed upon space availability on the panel. Easy to place transient protection close to the earth connection.

➜ Remote signalling

Protectors are equipped with remote signalling. We can distinguish if we have transient or temporary/ permanent overvoltage condition.

➜ Maintenance

Friendly maintenance. When a transient varistor protection ends its live we only need to replace this phase cartridge remaining other modules operative.



Also with compact version

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