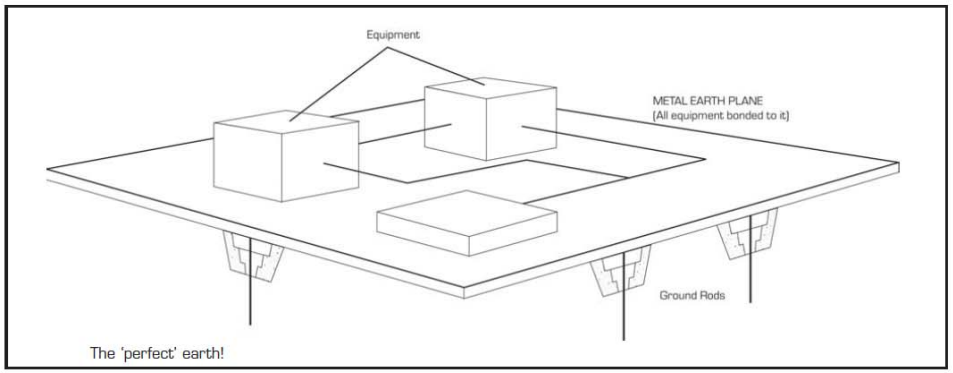
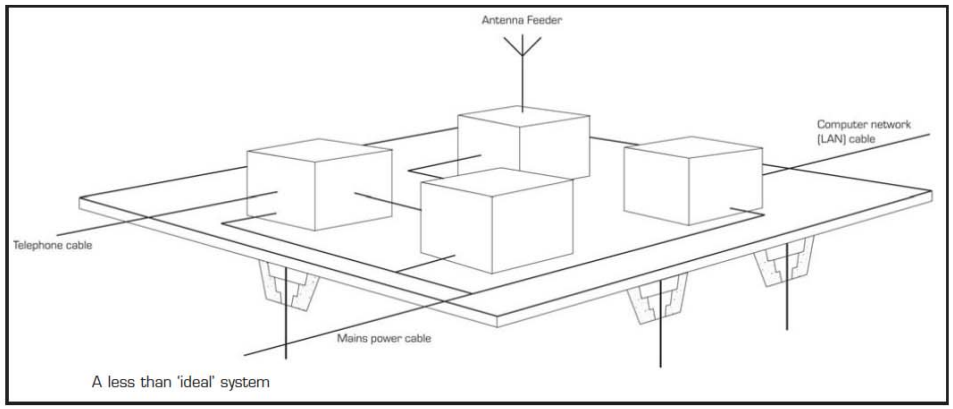
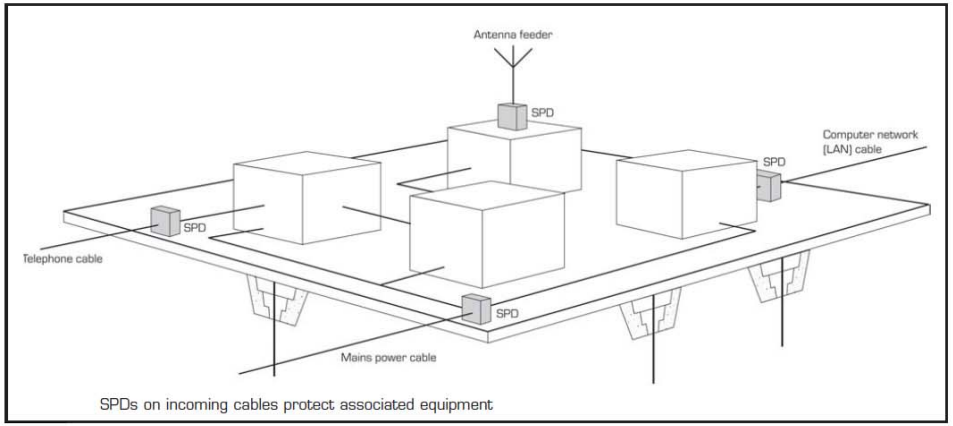
Protección contra Sobretensiones Transitorias

SPD (Surge Protection Device)

TVSS (Transient Voltage Suppression System)

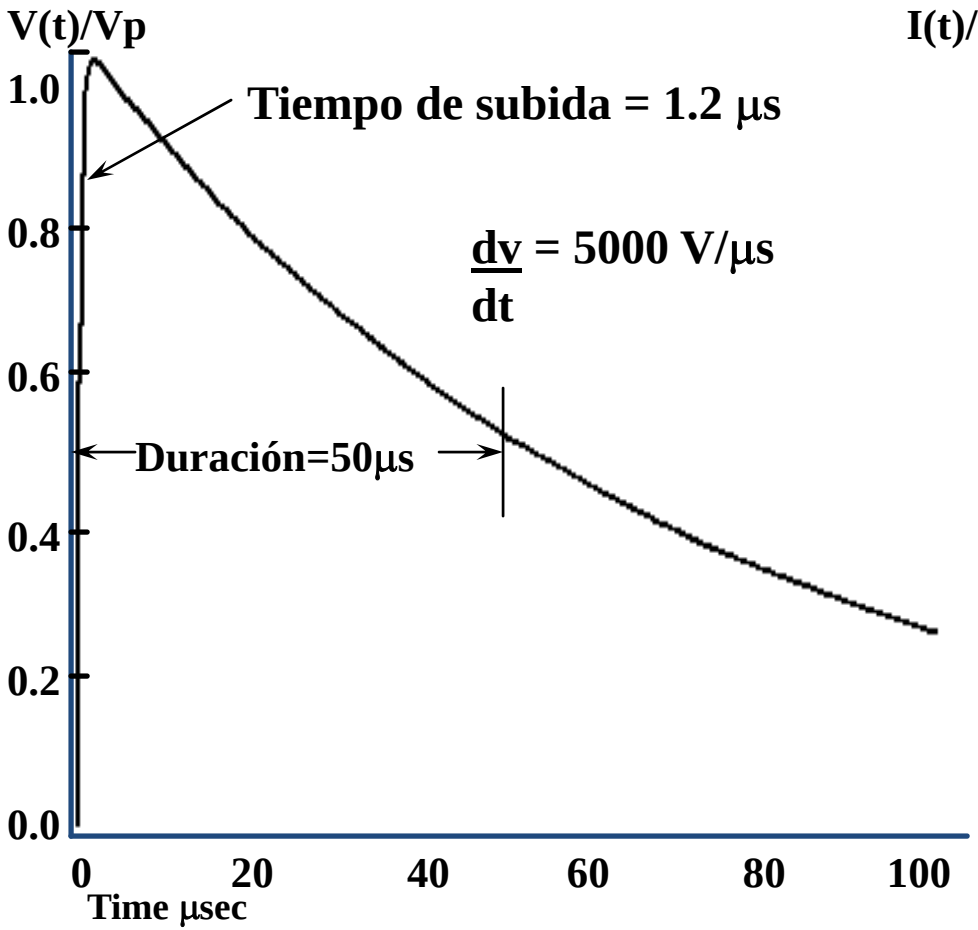


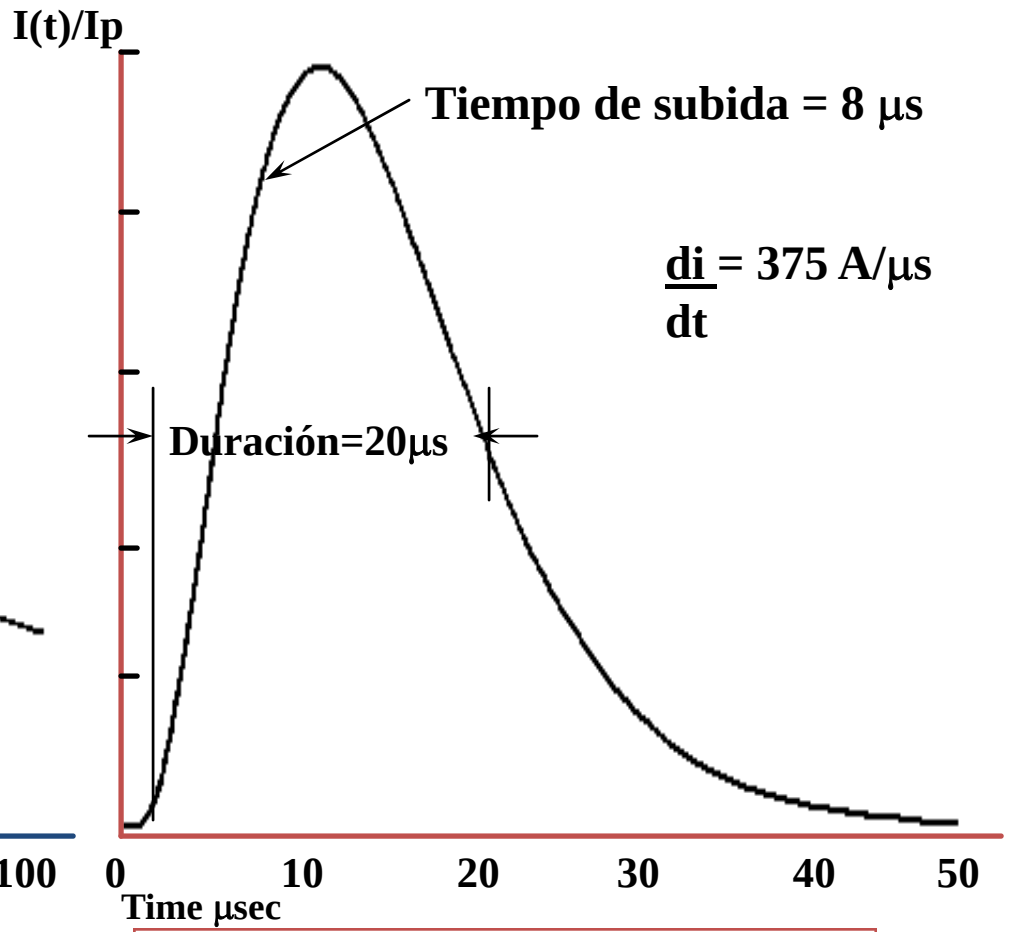




Proc.: MTL

Sobretensiones: Formas de onda representativas
Onda combinada





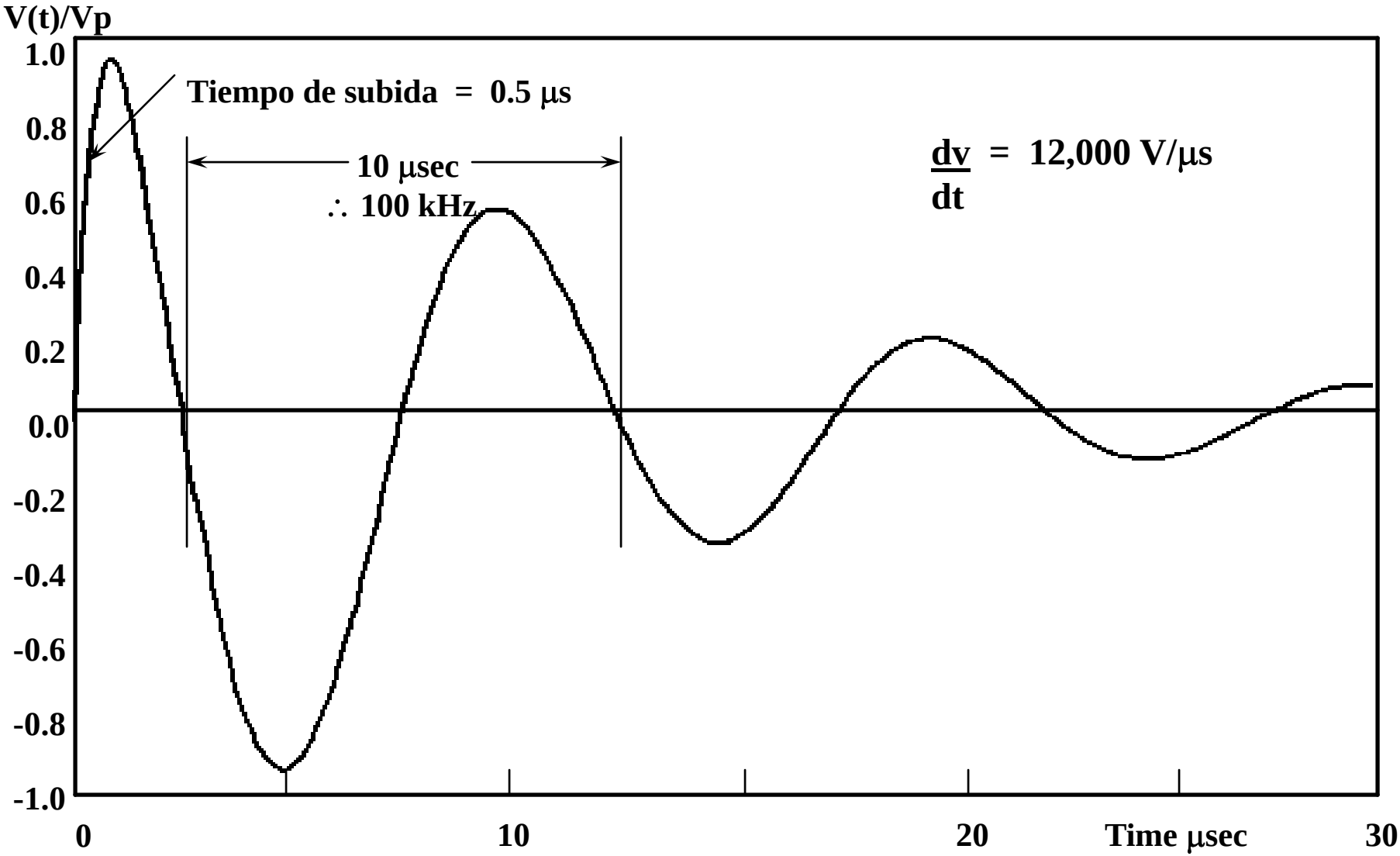
Voltaje en vacío
1.2 x 50 µs

Corriente de Corto-Circuito
8 x 20 µs

IEEE - ANSI C62.41-2002 Onda combinada

Proc.: Polyphaser

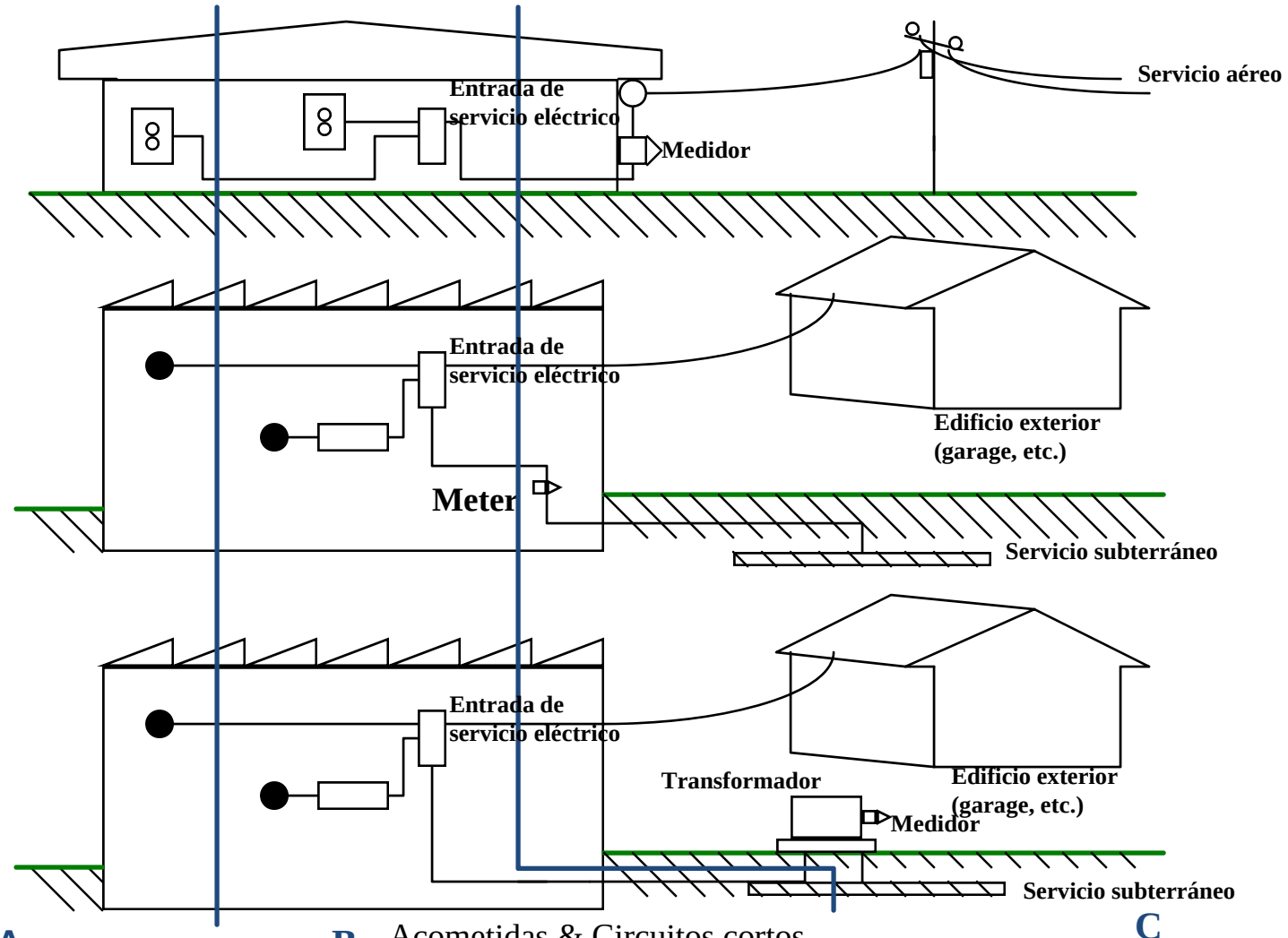
Sobretensiones: Formas de onda representativas
Onda oscilatoria amortiguada (“Ring” Wave)



IEEE - ANSI C62.41-2002 0.5 μs - 100 kHz “Ring” Wave

Proc.: Polyphaser

IEEE - ANSI C62.41-2002 Categorías de Localización



A

Tomas & Ramales largos

Todos los tomas a más de 10m de zona B o a más de 20m de zona C

B

Acometidas & Circuitos cortos

Tableros de distribución internos
Maquinaria fija instalada
Tomas de alta potencia con conexiones cortas a la entrada del servicio
Sistemas de iluminación en edificios grandes

C

Zona exterior & Entrada de servicio

Servicio aéreo.
Trayecto entre medidor y tablero.
Línea aérea a edificio exterior
Línea subterránea a bomba de agua

Proc.: Polyphaser

ANSI/IEEE C62.41-1991

Standard 0.5 μsec - 100 kHz "Ring" Wave

Location Category	System Exposure	Voltage (Volts)	Current (Amps)	Impedance (Ω)
A1	Low	2,000	70	30
A2	Medium	4,000	130	30
A3	High	6,000	200	30
B1	Low	2,000	170	12
B2	Medium	4,000	330	12
B3	High	6,000	500	12

Standard 1.2 x 50 μsec - 8 x 20 μsec "Combination" Wave

Location Category	System Exposure	Voltage (Volts)	Current (Amps)	Impedance (Ω)
B1	Low	2,000	1,000	2
B2	Medium	4,000	2,000	2
B3	High	6,000	3,000	2
C1	Low	6,000	3,000	2
C2	Medium	10,000	5,000	2
C3	High	20,000	10,000	2

Proc.: Polyphaser

IEEE - ANSI C62.41-2002 Sobretensiones: Formas de onda representativas

Escenario I:

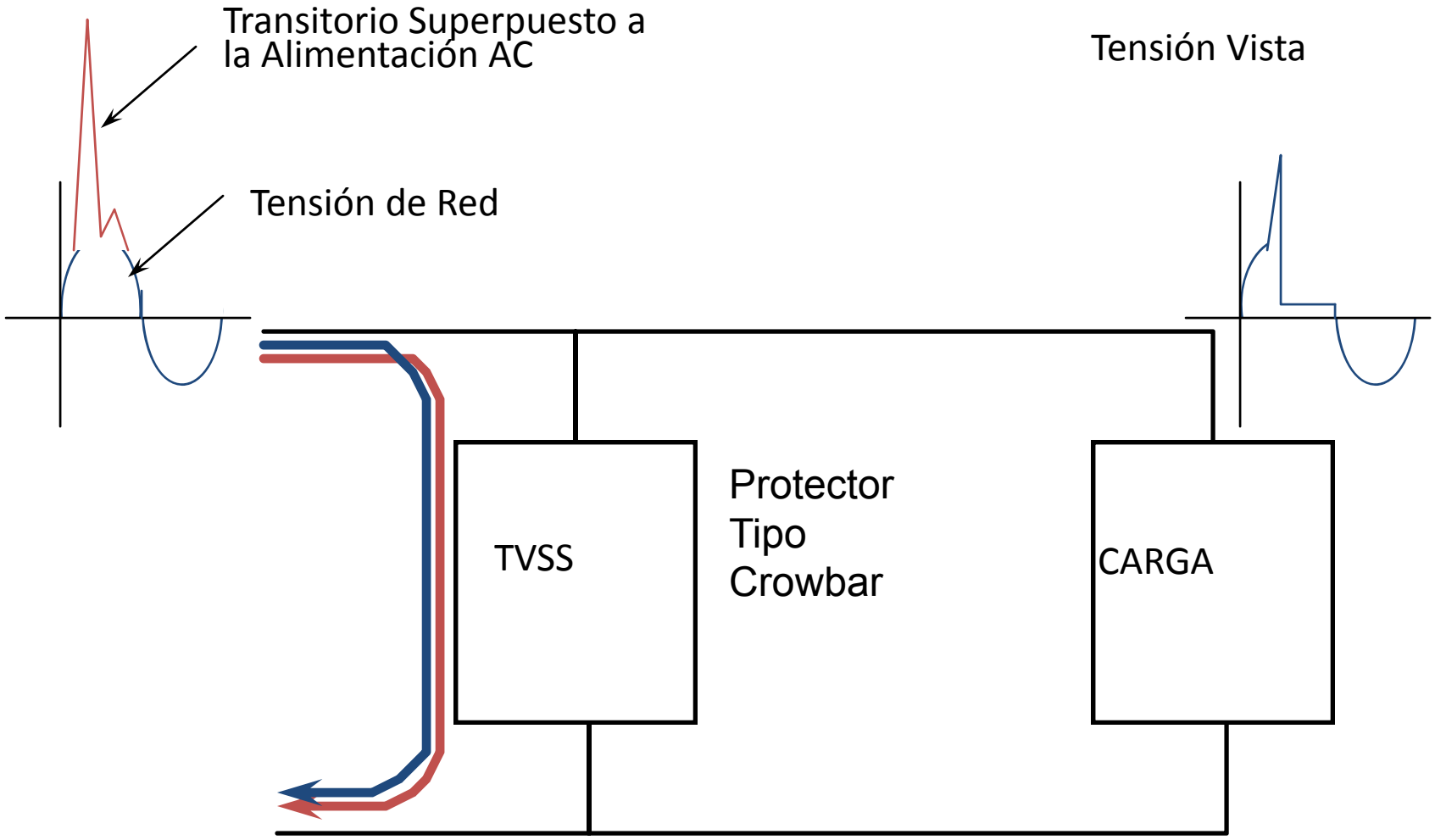
Sobretensiones conducidas por los servicios entrantes o generadas dentro de la estructura

A este escenario se aplican las Categorías de Localización

Escenario II:

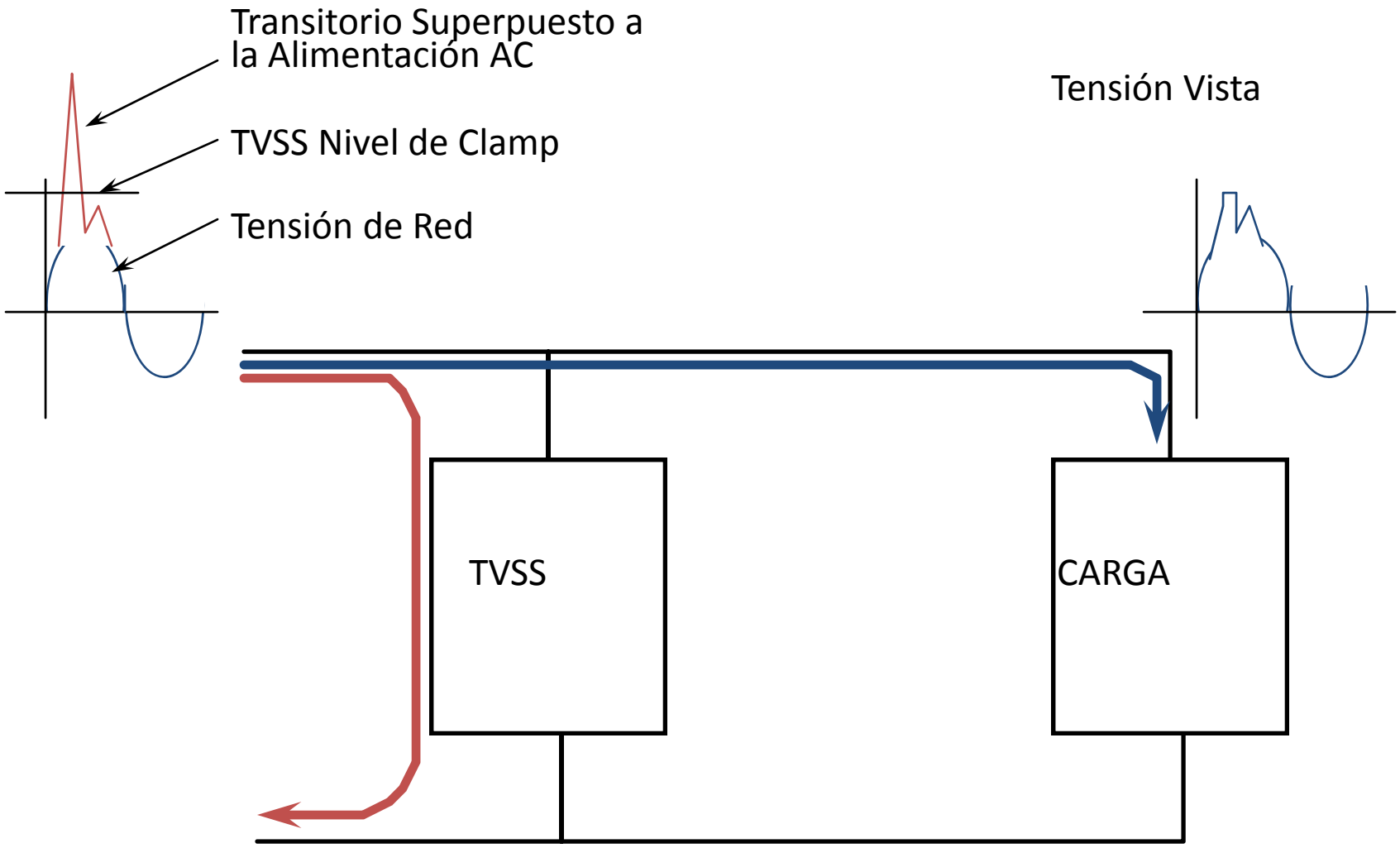
Impactos directos en la estructura o en la tierra cercana
Onda de impulso 10/350µs

Respuesta “Crowbar”



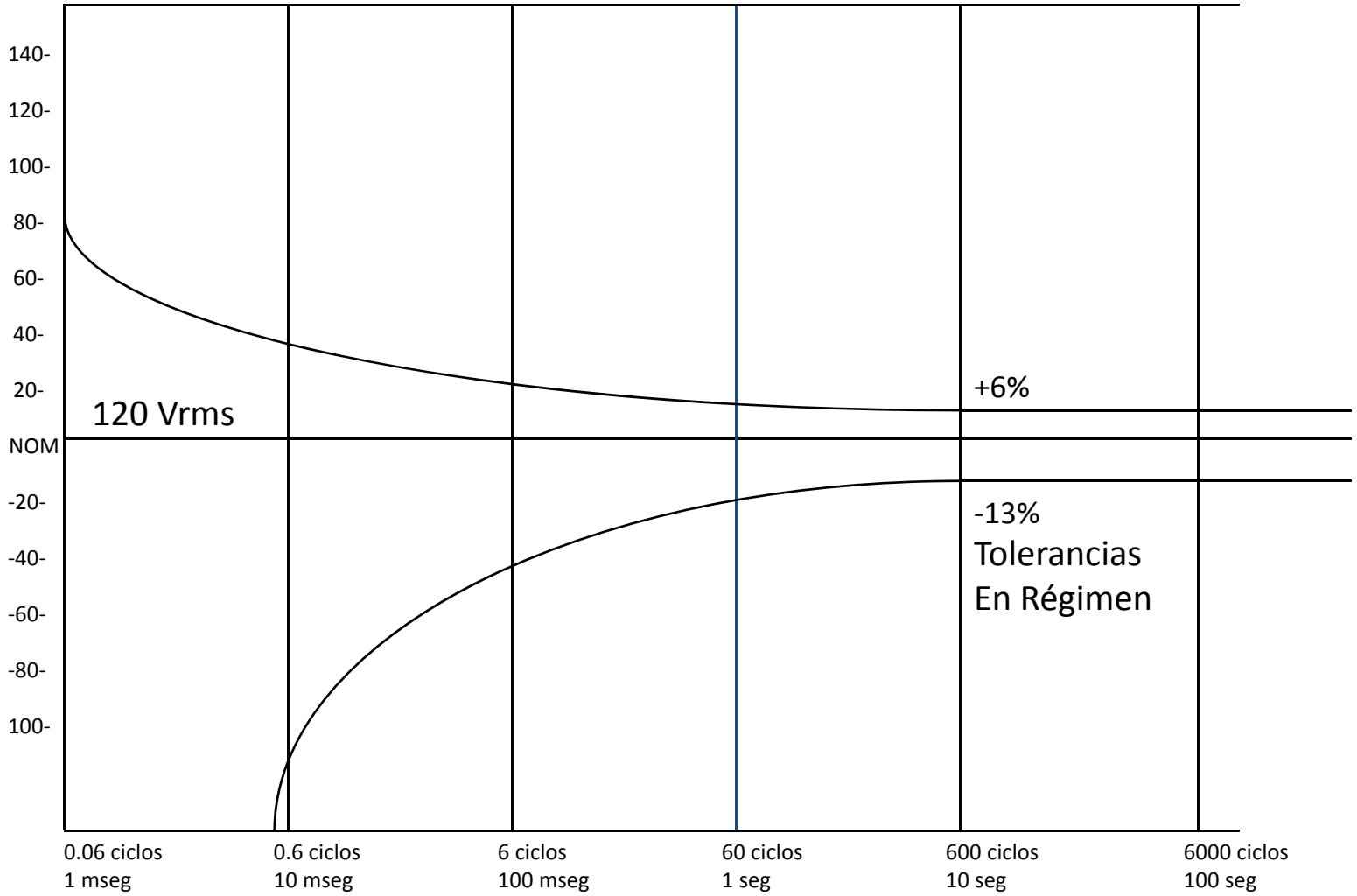
Proc.: Polyphaser

Respuesta “Clamp”



Proc.: Polyphaser

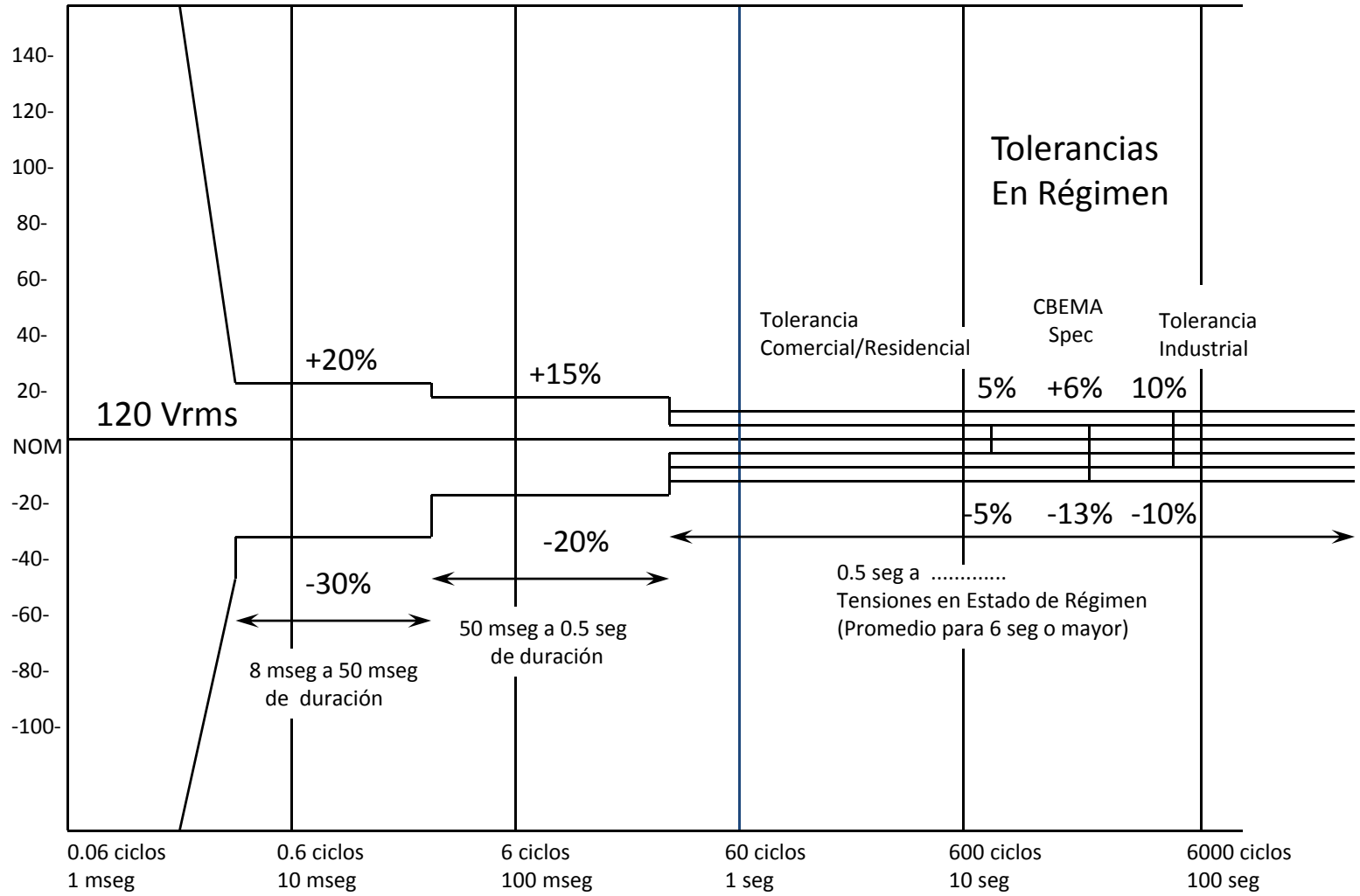
Criterio de Tolerancia en la Alimentación (Original de CBEMA)



Proc.: Polyphaser

Ejemplo de Tolerancia de la Red Eléctrica

Porcentaje de Variación Respecto del Voltaje Nominal

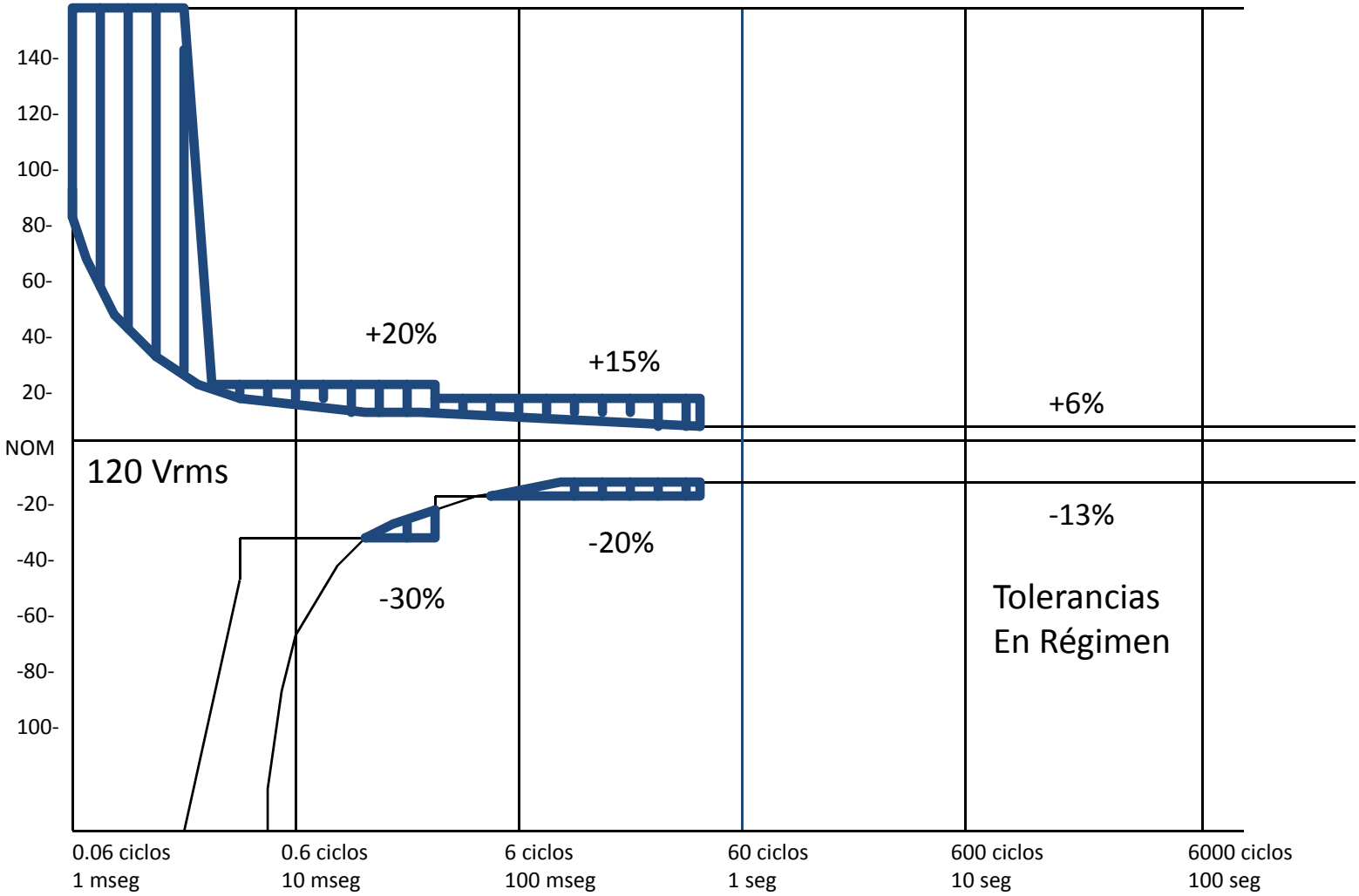


Frecuencia 60 Hz

Proc.: Polyphaser

Comparación de la Red con la Tolerancia de los Equipos

Porcentaje de Variación Respecto del Voltaje Nominal

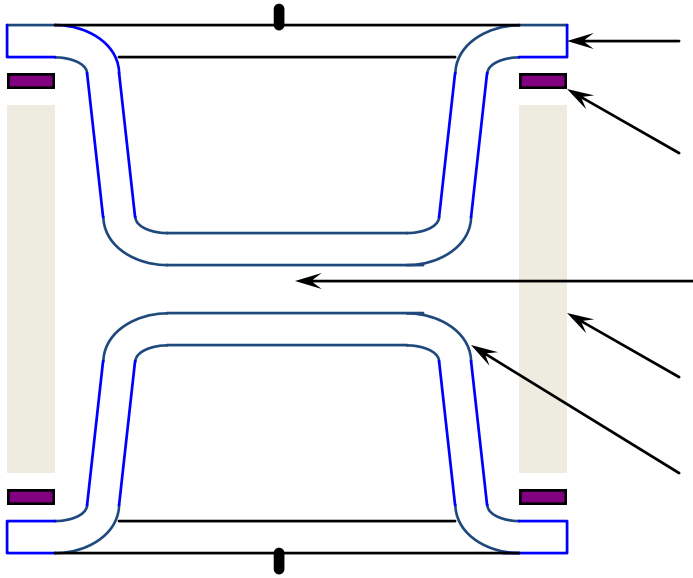


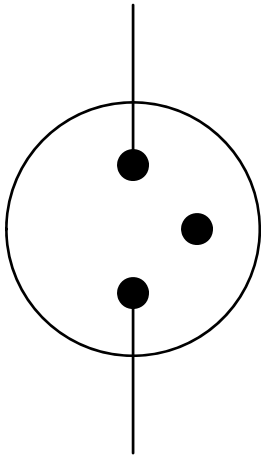
Frecuencia 60 Hz

Proc.: Polyphaser

Tubo de Gas

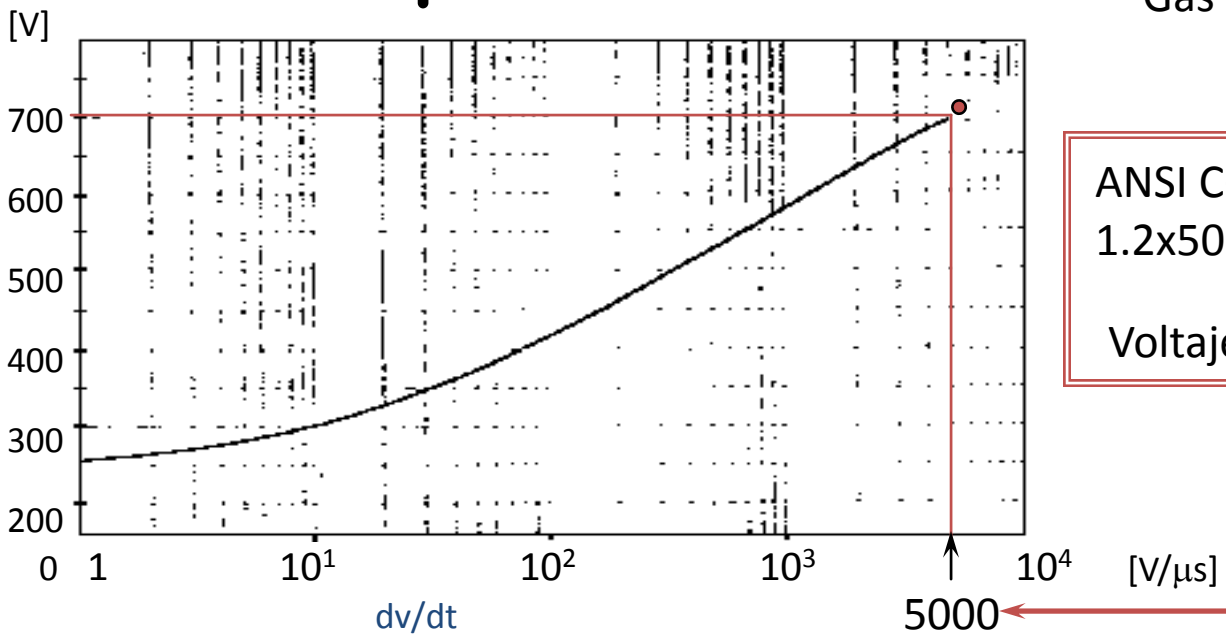
Vista en Corte





Símbolo de Tubo de Gas

Voltaje de Disparo en Función de dv/dt

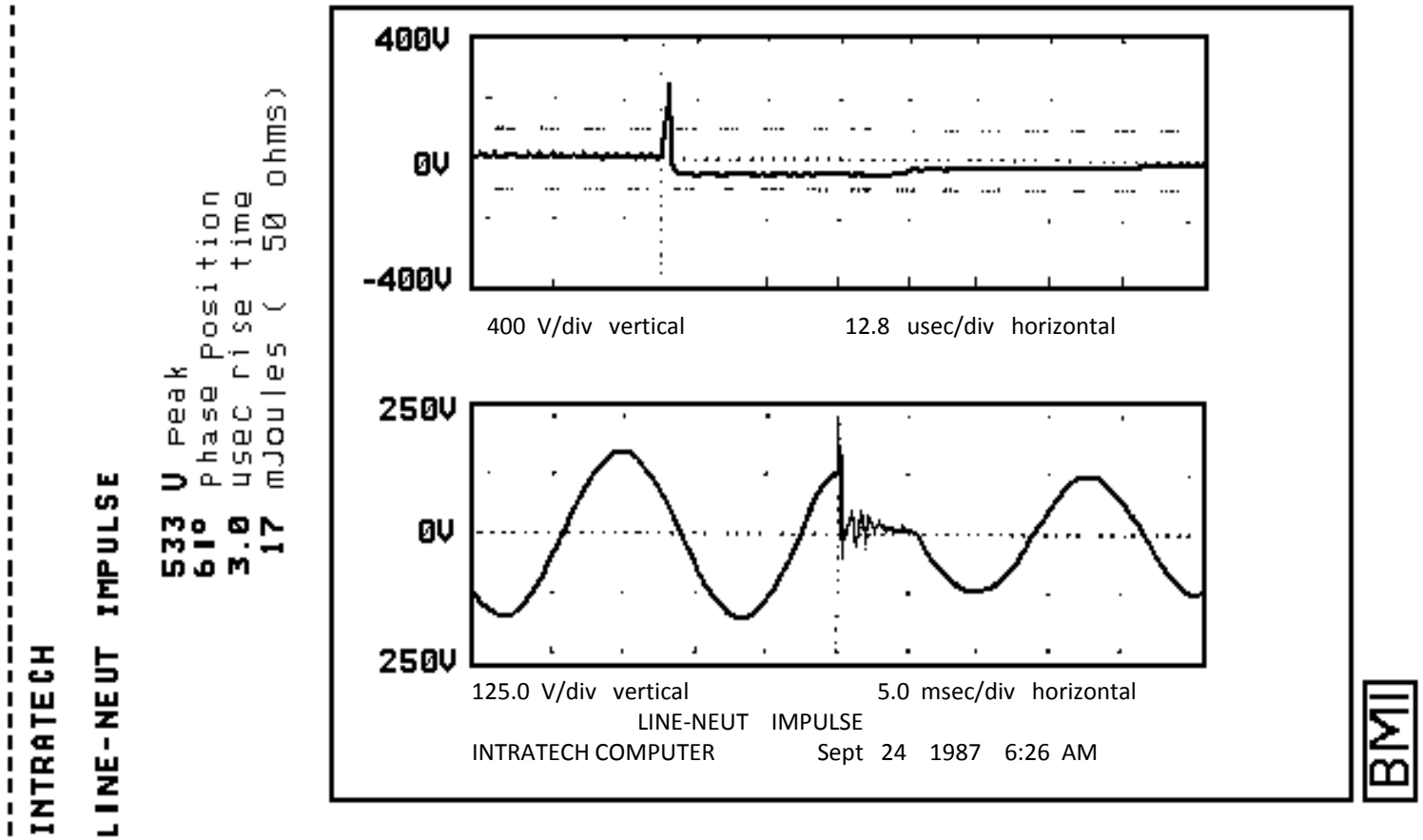


ANSI C62.41, $\frac{dv}{dt}$ 1.2x50 µsec =5000 V/µs

Voltaje de Disparo~ 700V

Proc.: Polyphaser

Forma de Onda de un Tubo de Gas



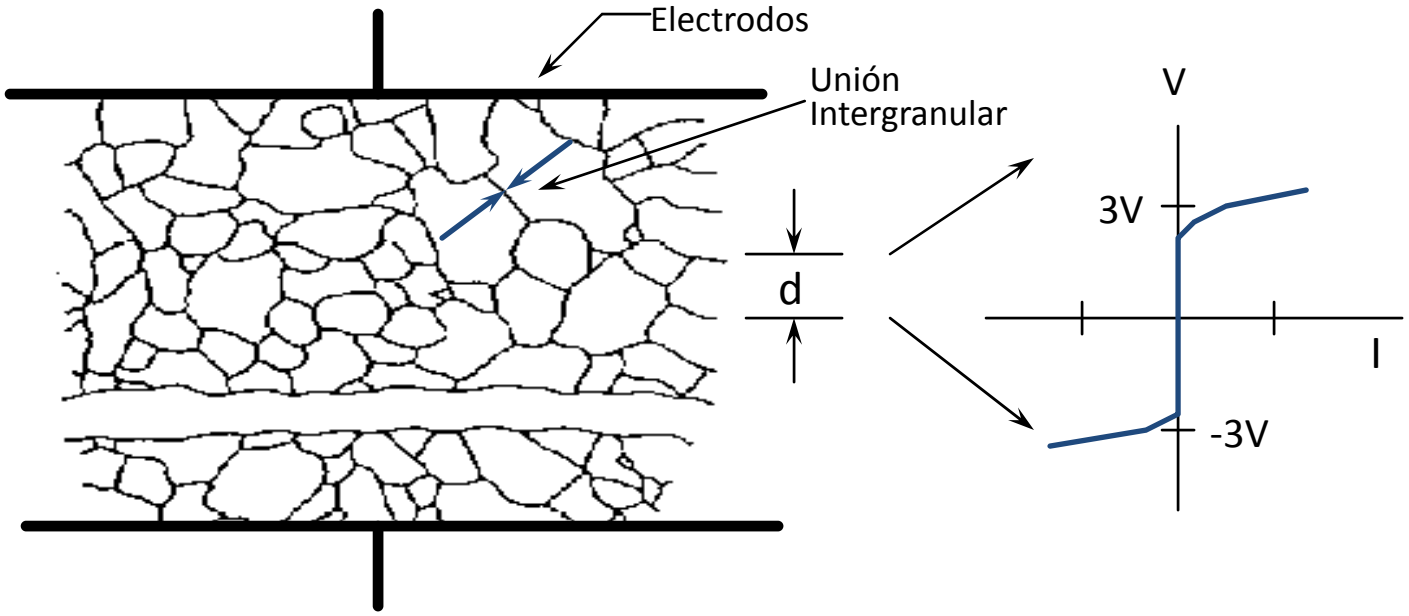
Impulso – Tubo de Gas

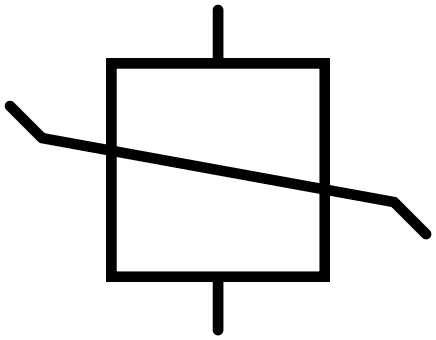
Proc.: Polyphaser

Metal Oxide Varistor (MOV)

Esquemático de la Microestructura de un MOV

Granos Conductores de ZnO (Tamaño Promedio d) Separadas por Uniones Intergranulares

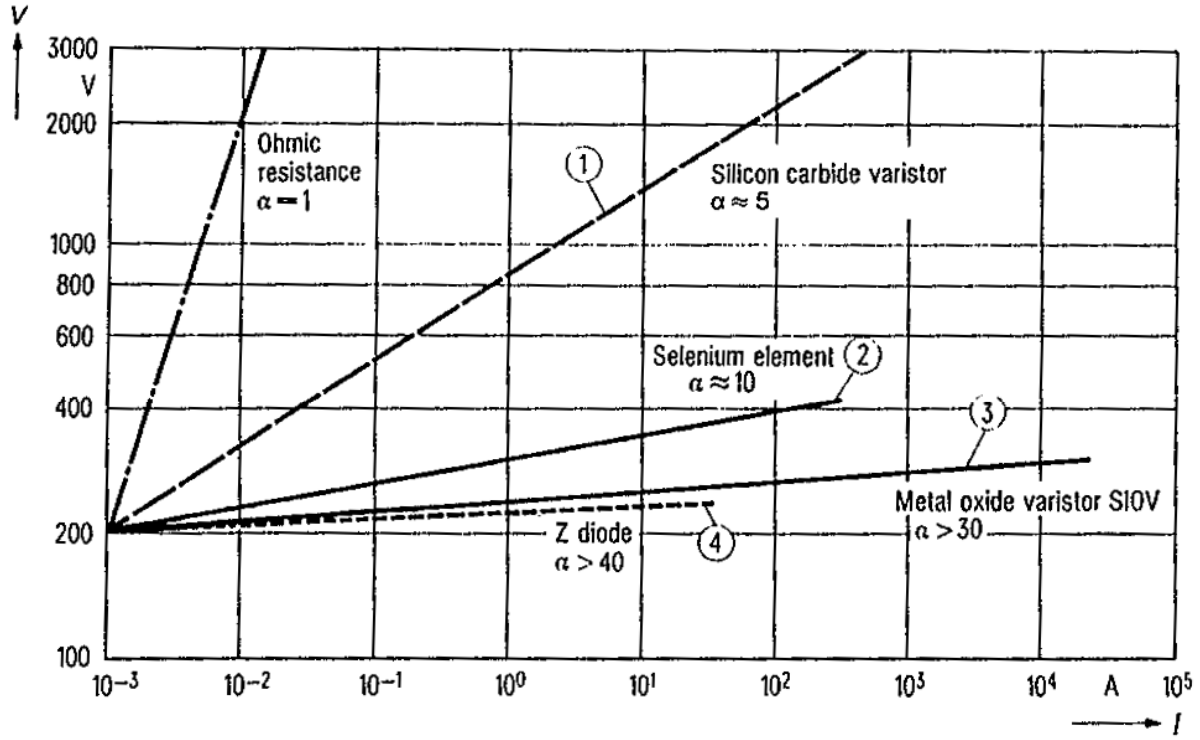




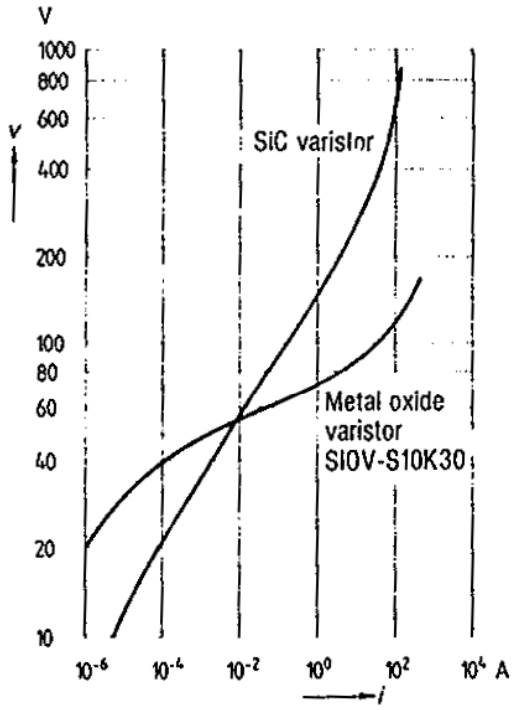
Símbolo de Un MOV

Proc.: Polyphaser

Características de “Clamps”

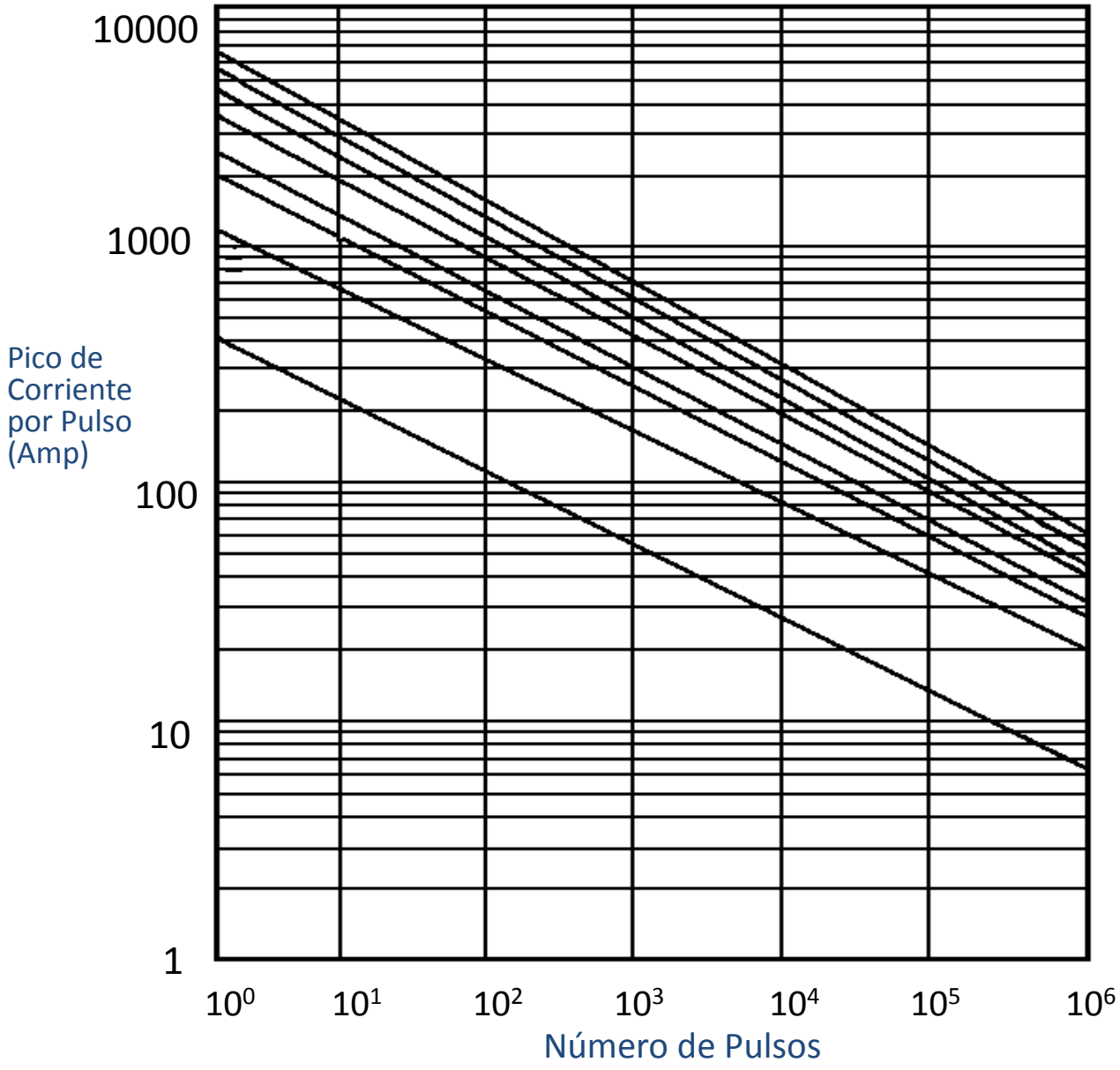


Theoretical *V/I* characteristics of voltage dependent resistors referred to 200 V/1 mA.
For comparison: Ohmic resistance



Proc.: Polyphaser

“Rating” de un Varistor



Forma de Onda
8 x 20 μs

D65 Series
D63 Series
D69 , D64 Series
D62 Series

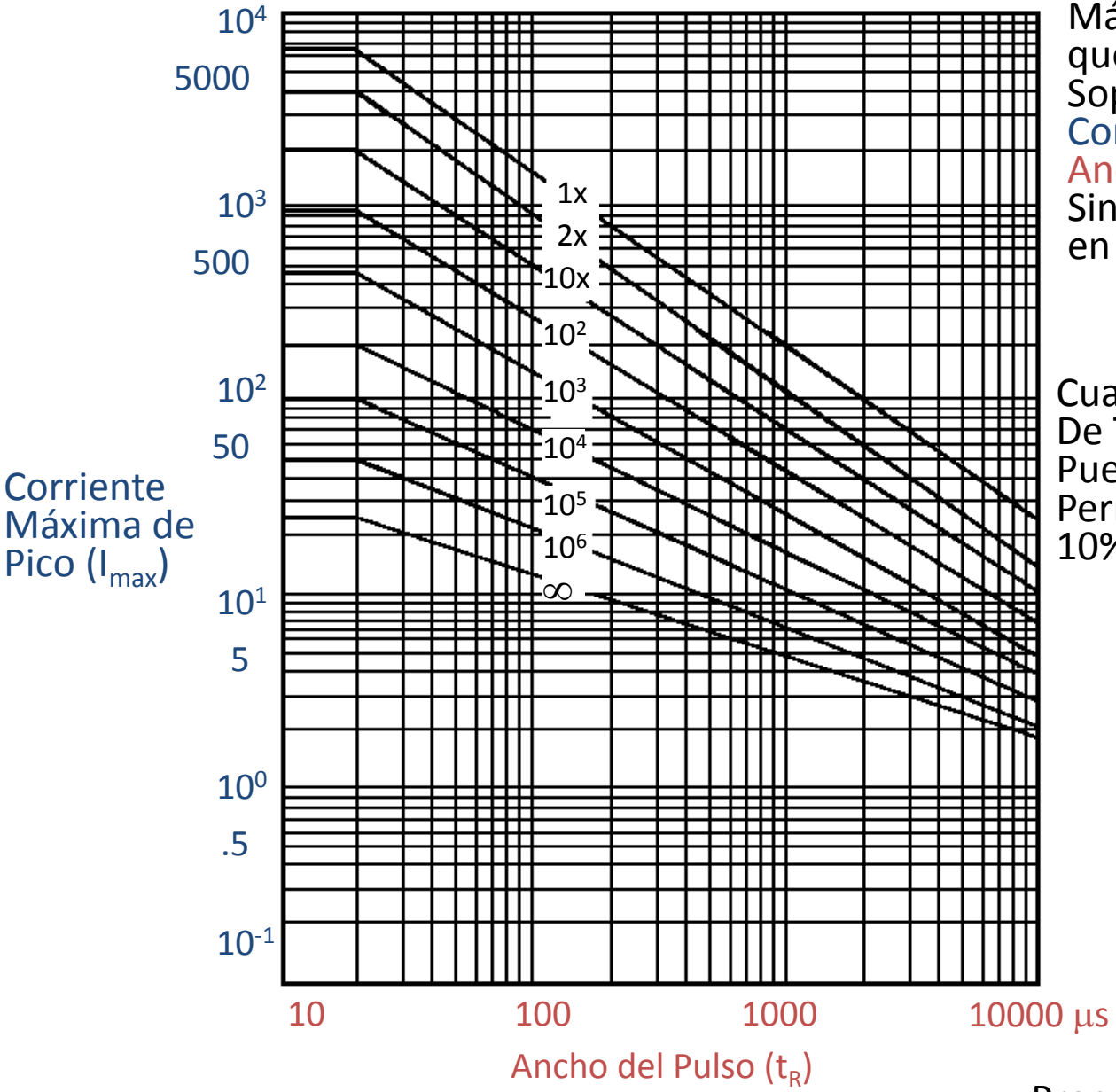
D71 Series
D61 Series

D73, D68 Series

D58 Series

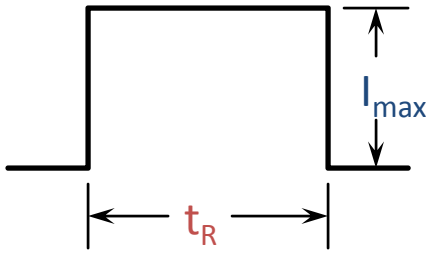
Proc.: Polyphaser

“Rating” de Tiempo de Vida de un Varistor



Máximo Número de Veces que un Varistor Puede Soportar:
Corriente de Pico = I_{max}
Ancho del Pulso= t_R
Sin un Cambio Mayor al10% en el Voltaje del Varistor.

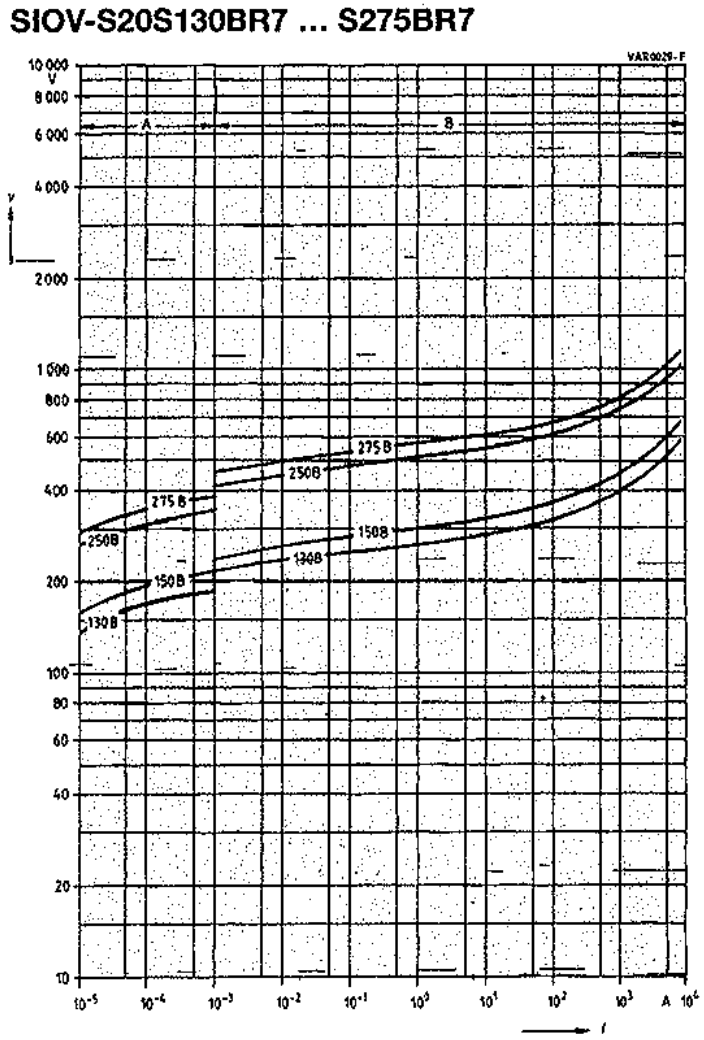
Cuando se Excede el “Rating” De Tiempo de Vida: el Varistor Puede Tener un Cambio Permanente en el Voltaje Mayor a 10% Llevándolo a un Fallo



Ancho del Pulso de un Rayo:
~ 10 μseg

Proc.: Polyphaser

Característica de un MOV

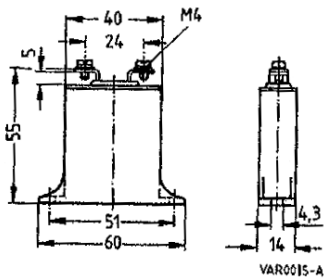


Proc.: Polyphaser

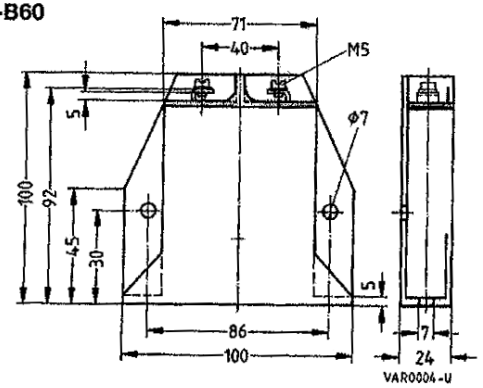
Encapsulados de MOVS

Block varistors

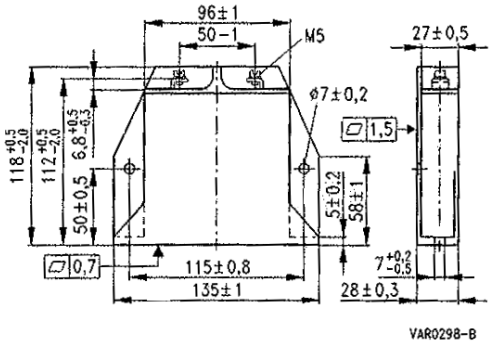
SIOV-B32/-B40



SIOV-B60

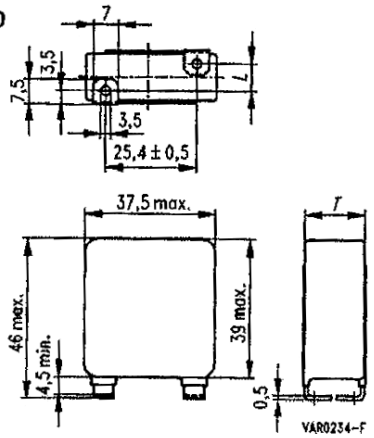


SIOV-B80



Strap varistors

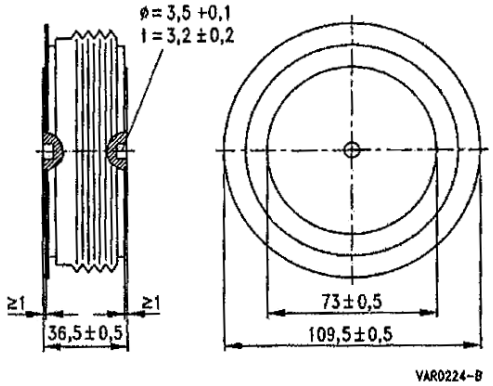
SIOV-LS 40



Typ Type	$T_{max.}$	$L \pm 1{,}0$
SIOV-LS40K130QP	8,1	−3,5
SIOV-LS40K150QP	8,3	−3,2
SIOV-LS40K230QP	9,0	−2,0
SIOV-LS40K250QP	9,2	−1,8
SIOV-LS40K275QP	9,4	−1,6
SIOV-LS40K320QP	9,9	−1,1
SIOV-LS40K385QP	10,6	−0,4
SIOV-LS40K420QP	10,9	0,0
SIOV-LS40K440QP	11,1	0,2
SIOV-LS40K460QP	11,4	0,4
SIOV-LS40K550QP	12,3	1,2
SIOV-LS40K680QP	13,5	2,4
SIOV-LS40K750QP	14,1	3,0

PowerDisk

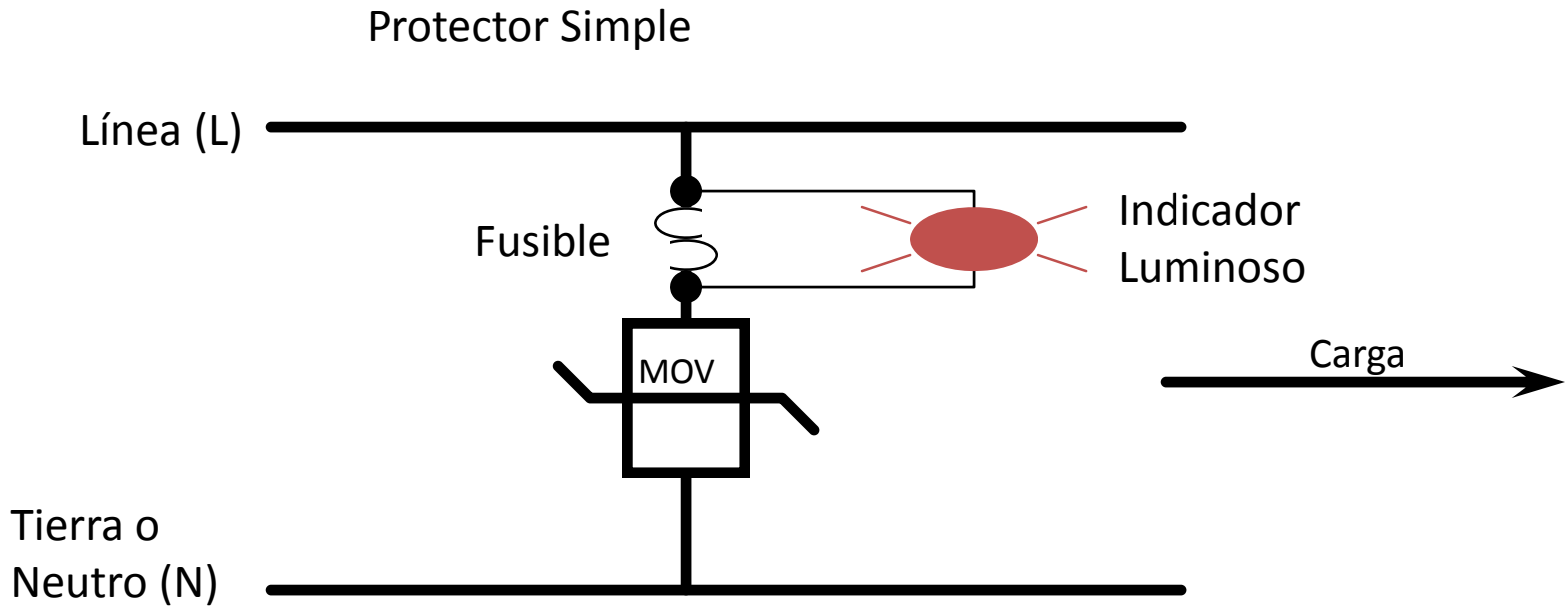
SIOV-PD80



Dimensiones en mm

Proc.: Siemens

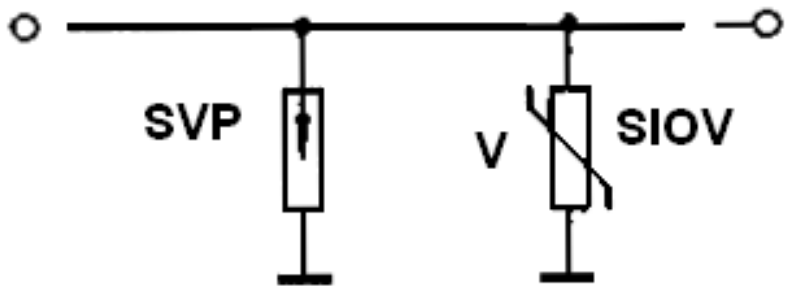
Aplicación de Varistor

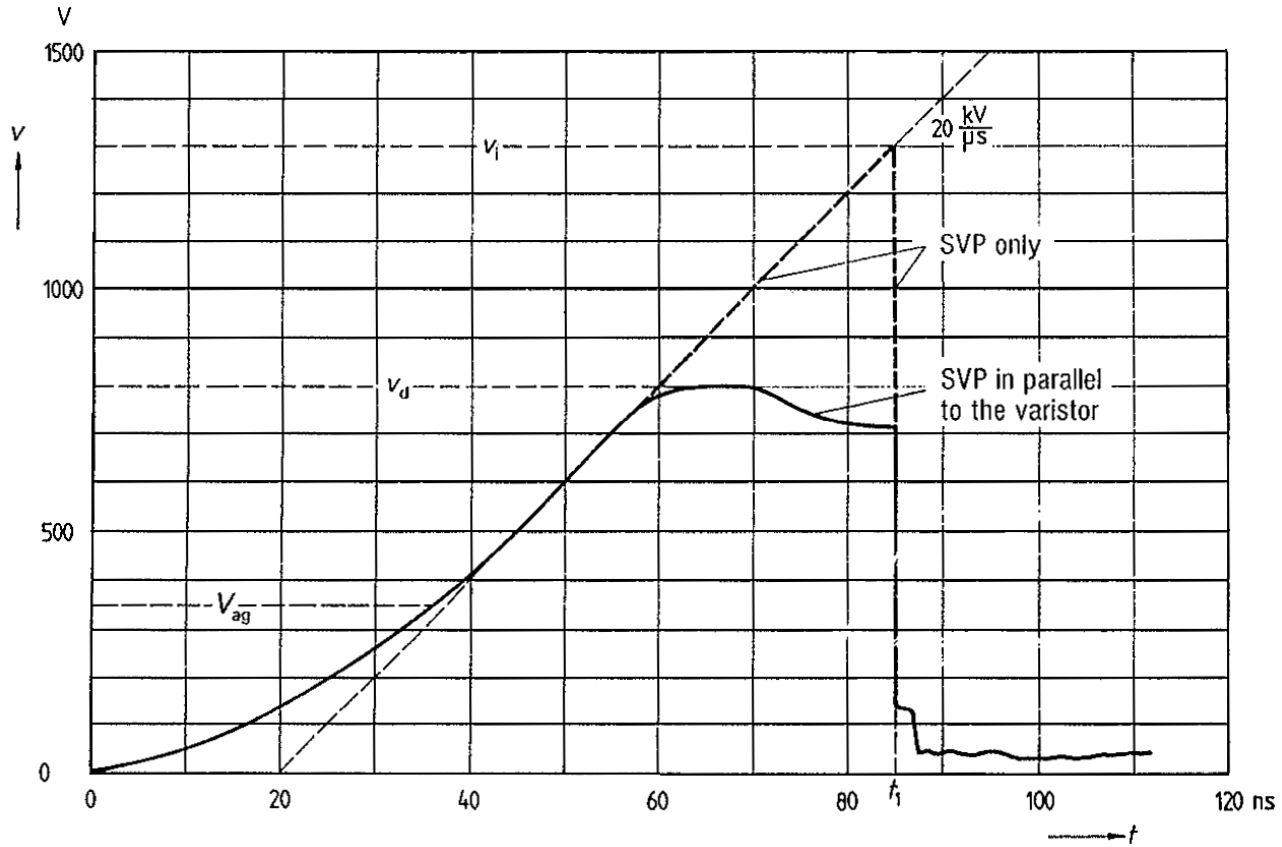


- Ventaja:
  - Alta Capacidad de Disipación de Energía
- Desventaja:
  - Voltaje de “Clamp” Sube con la Corriente- Típicamente 10 - 12%

Proc.: Polyphaser

Combinación de Tubo de Gas y Varistores

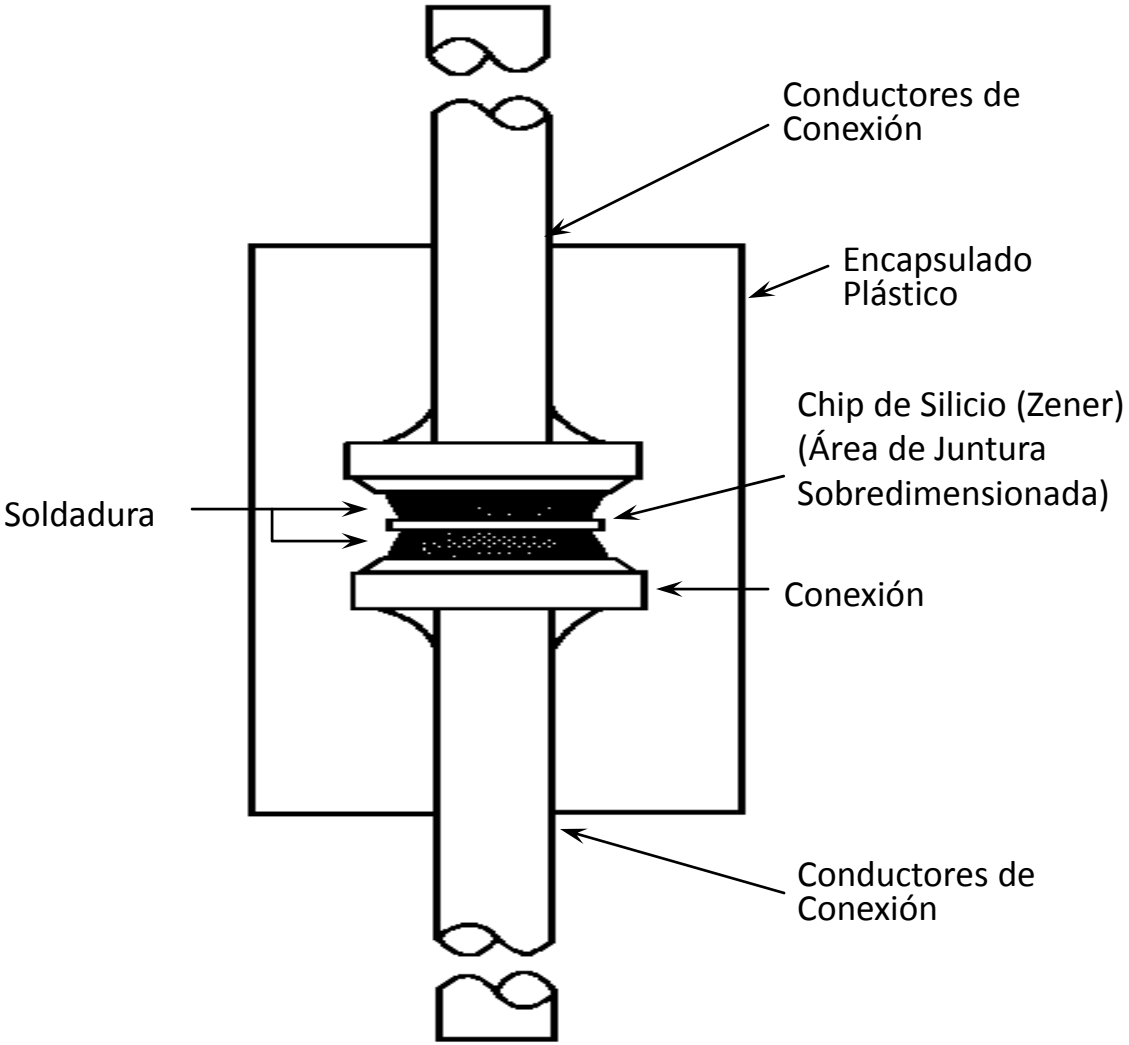




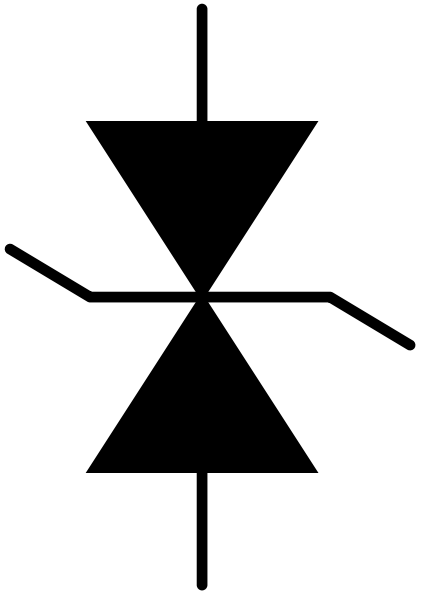
Proc.: Siemens

Diodo de Avalancha (Silicon Avalanche Diode (SAD))

SAD (Vista de Corte)

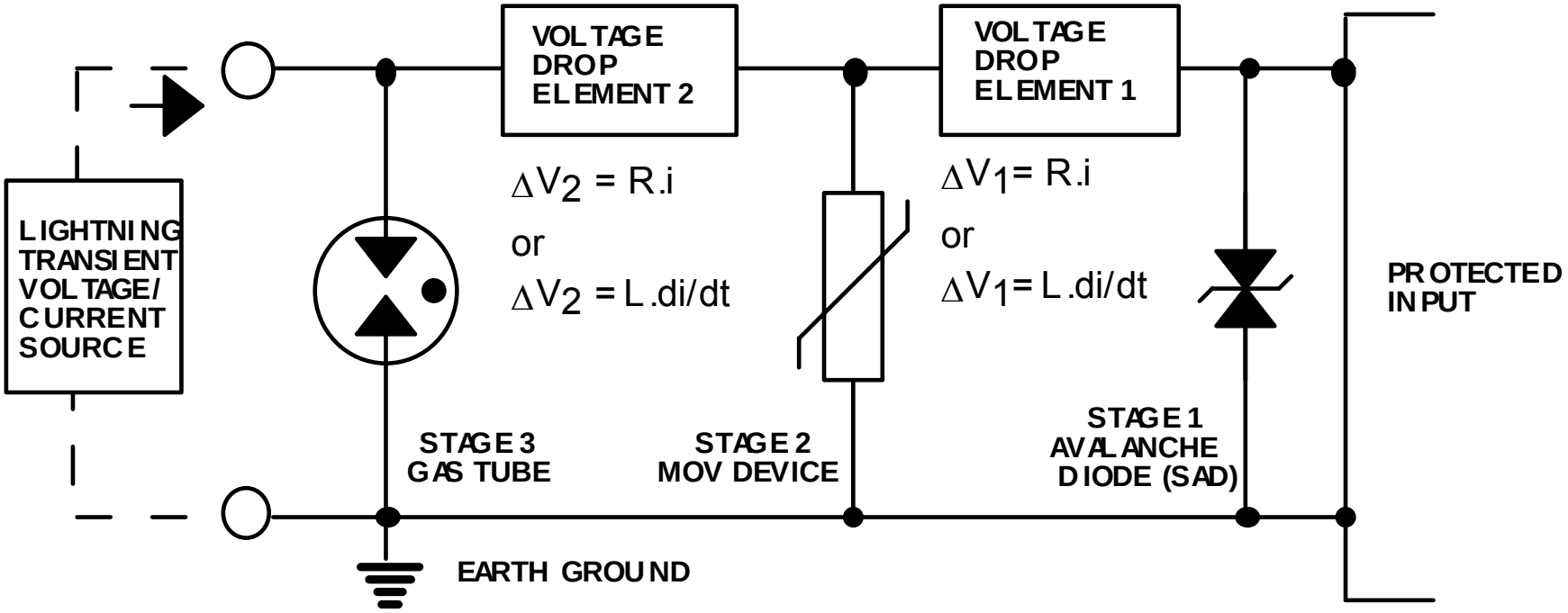


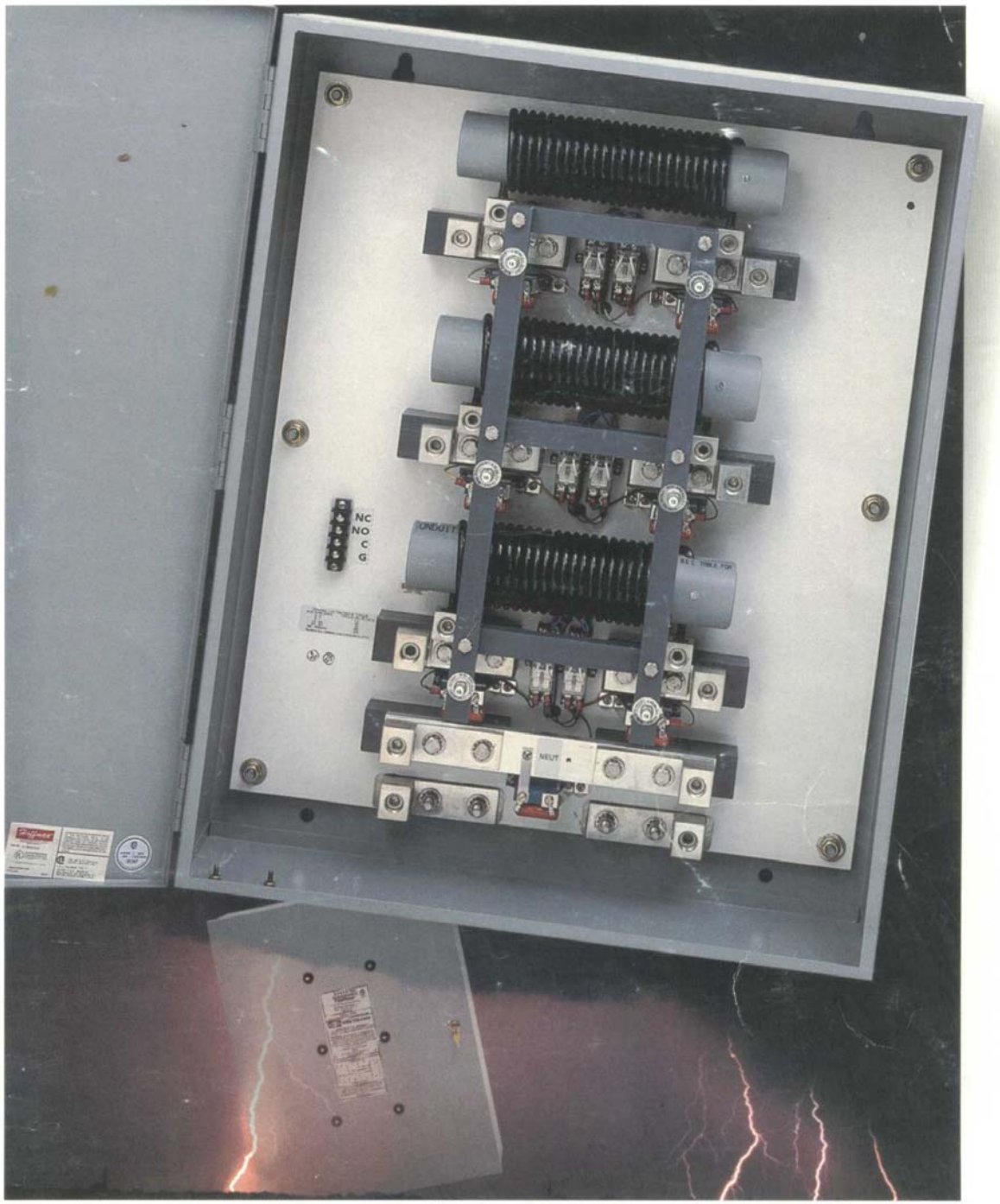
Símbolo de Bipolar SAD



Proc.: Polyphaser

Combinación de dispositivos

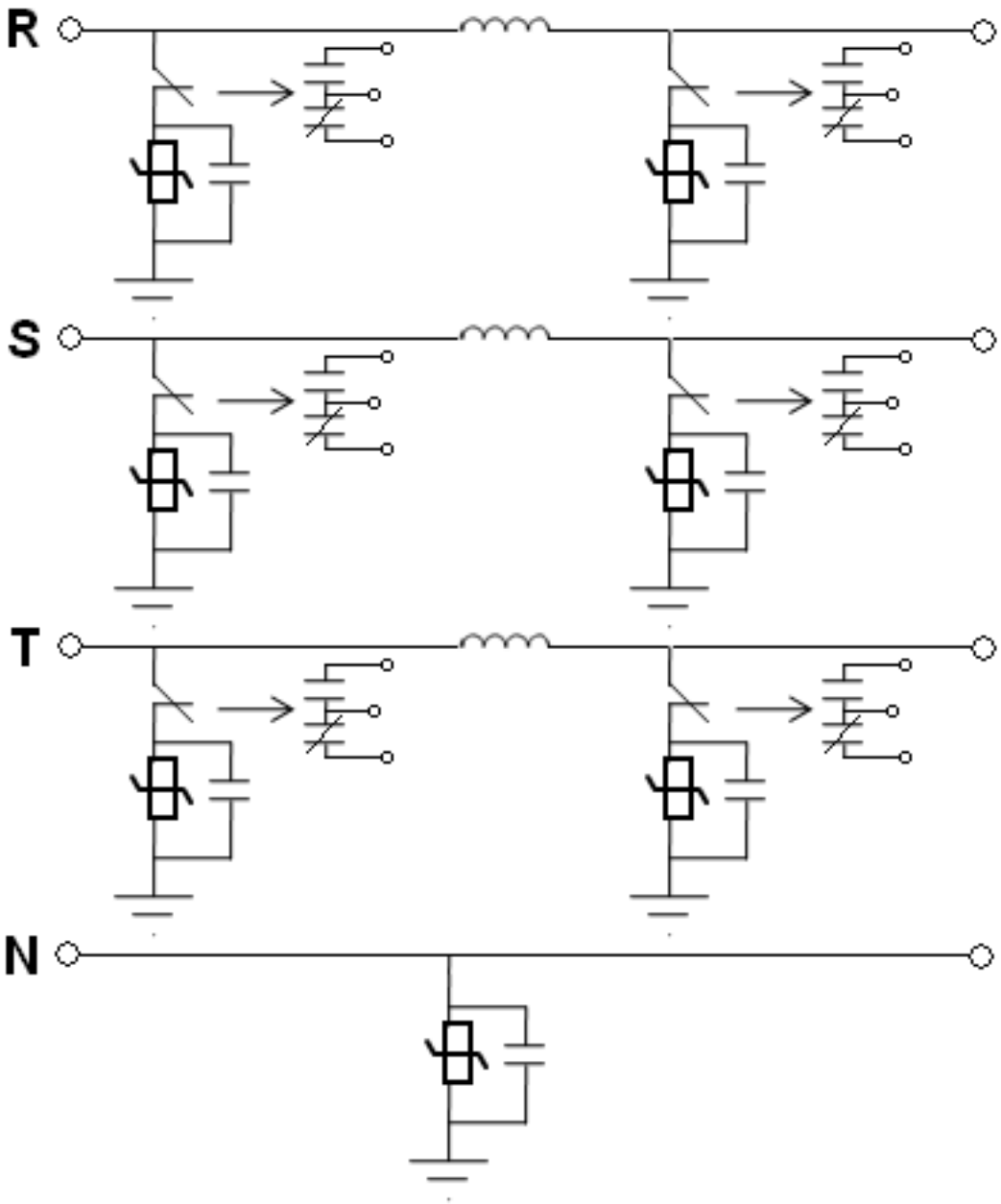




Protector Alimentación C.A. 380V 200A, 3F

Proc.: Polyphaser

Circuito Protector Alimentación CA



Características Máximas

Corriente de pico:
45kA por fase, forma de onda 8/20 µs

Tensión nominal (fase a tierra):
205cc / 145ca
nota: fase a fase es el doble

Corriente máxima:
175kA

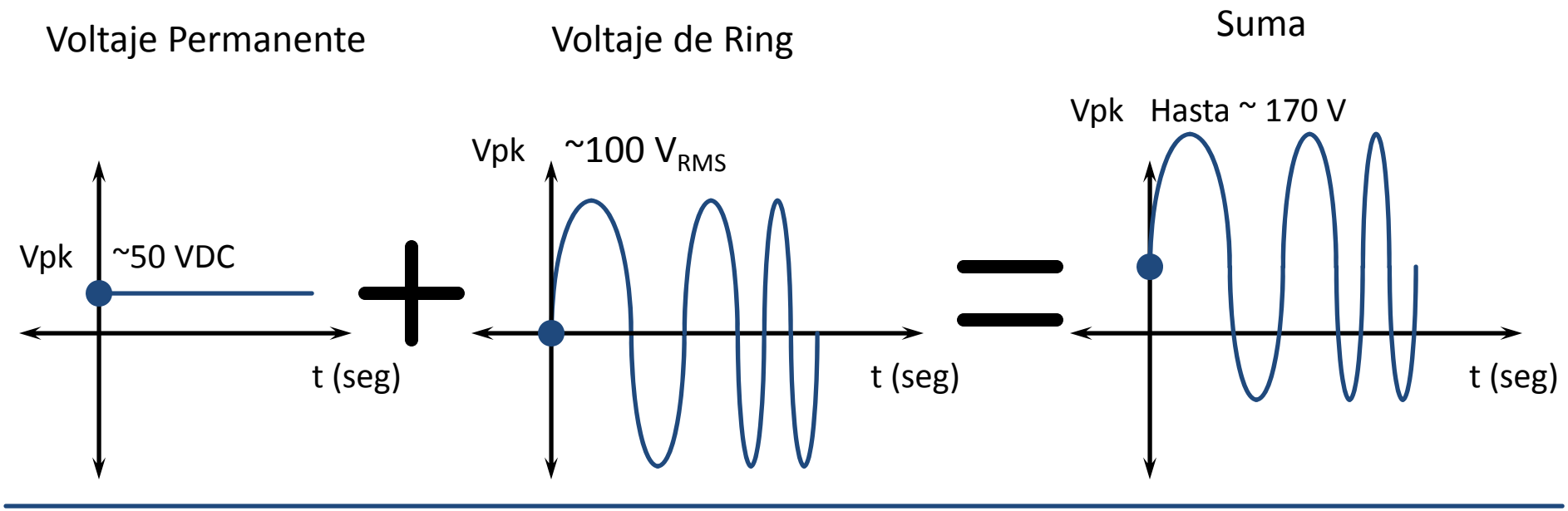
Tensión de pico (3Ka fase a tierra):
400V

Filtrado EMI/RFI:
-30dB 1,2MHz, -30dB 8MHz, -31,4dB 10MHz

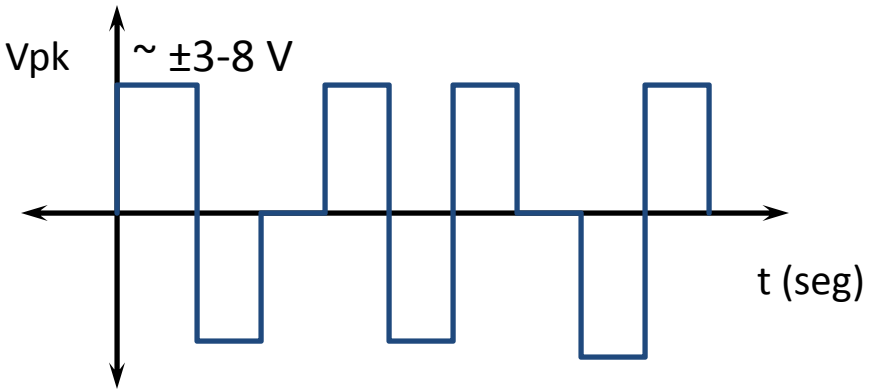
Temperatura:
-25ºC a +60ºC

Proc.: Polyphaser

Señales Típicas de Telefonía

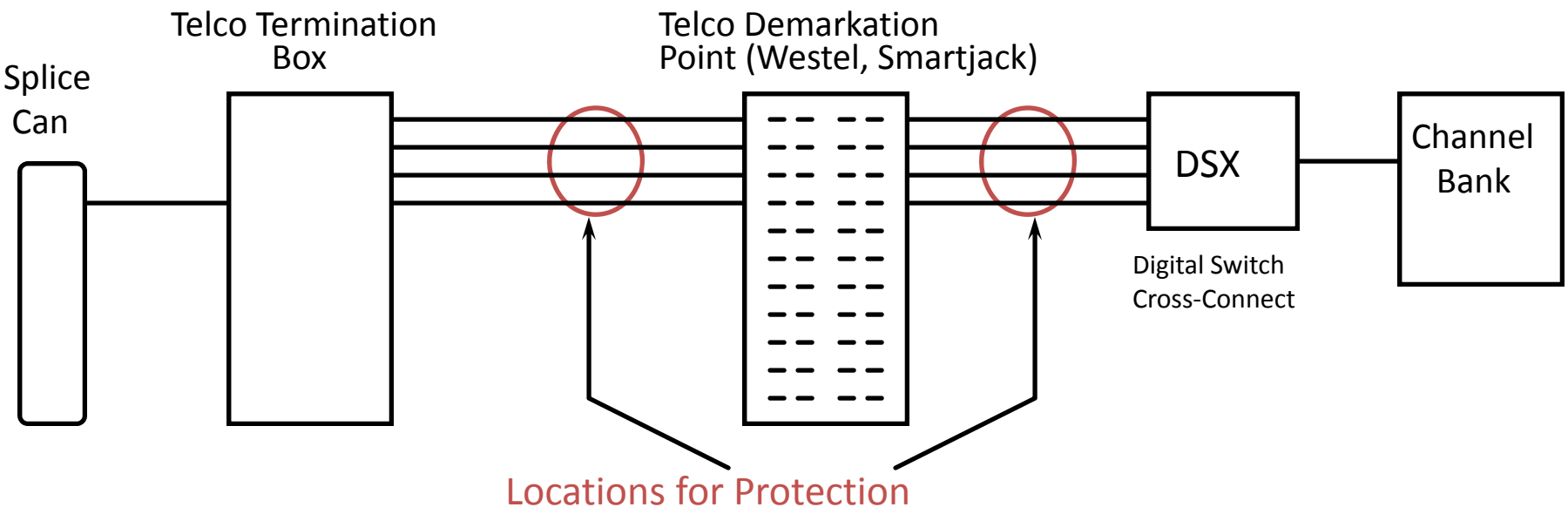


Nivel de la Señal Digital

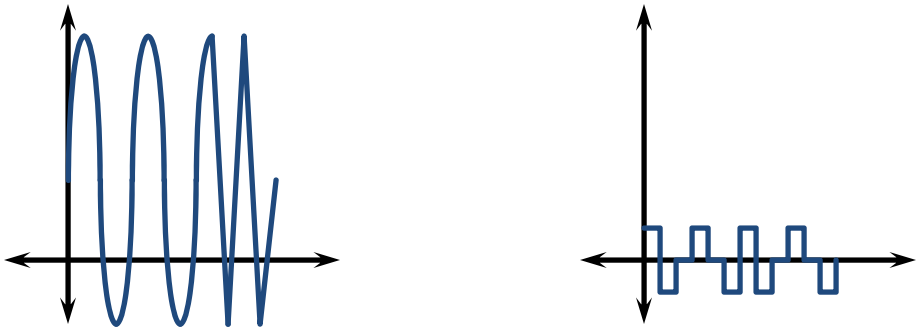


Proc.: Polyphaser

Typical Telco (T1) Service Entrance

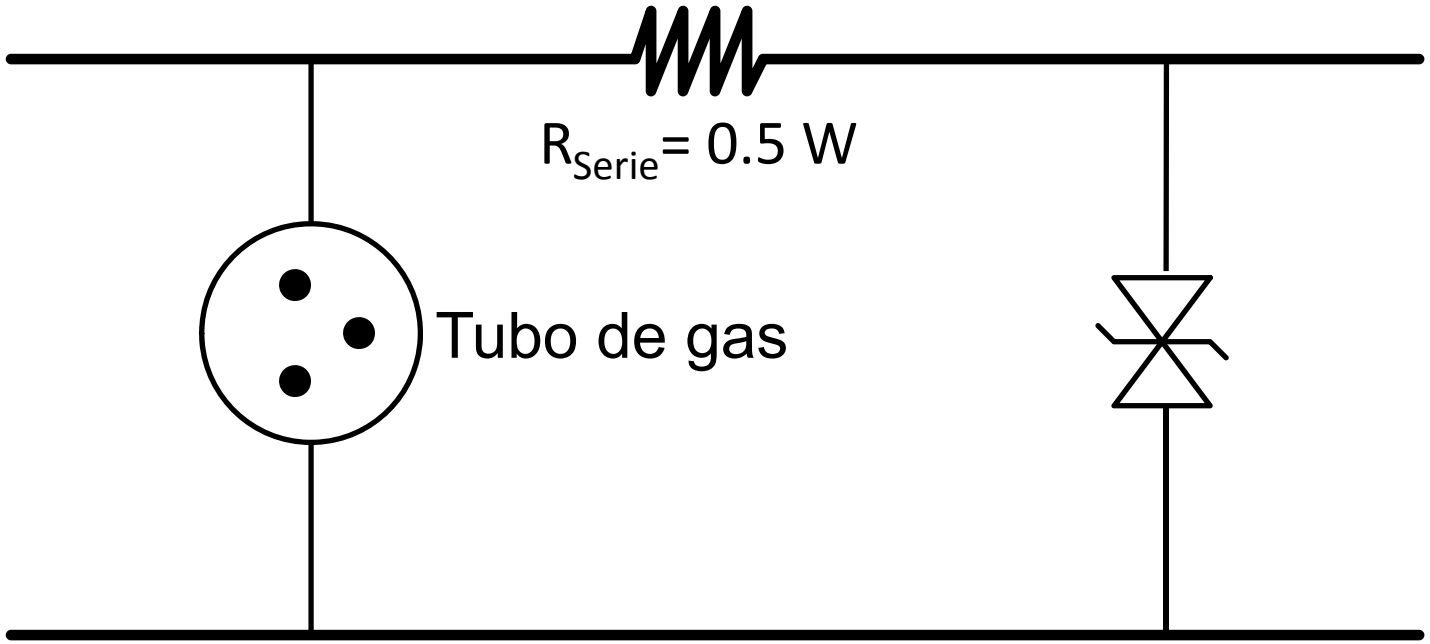


Signal Type



Proc.: Polyphaser

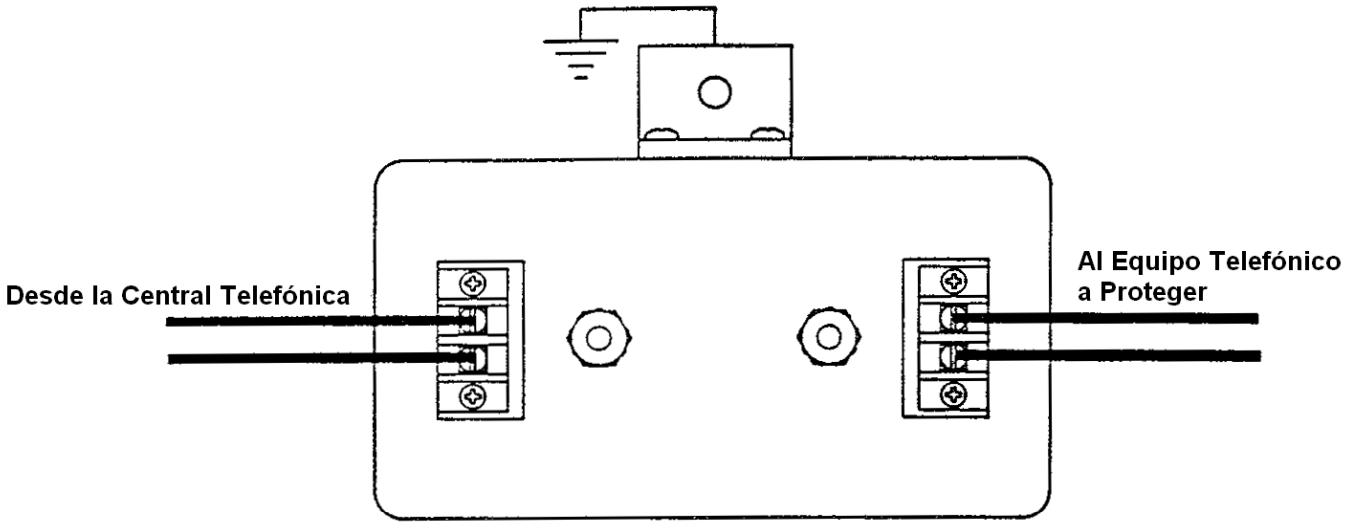
Protector para Telefonía y Datos

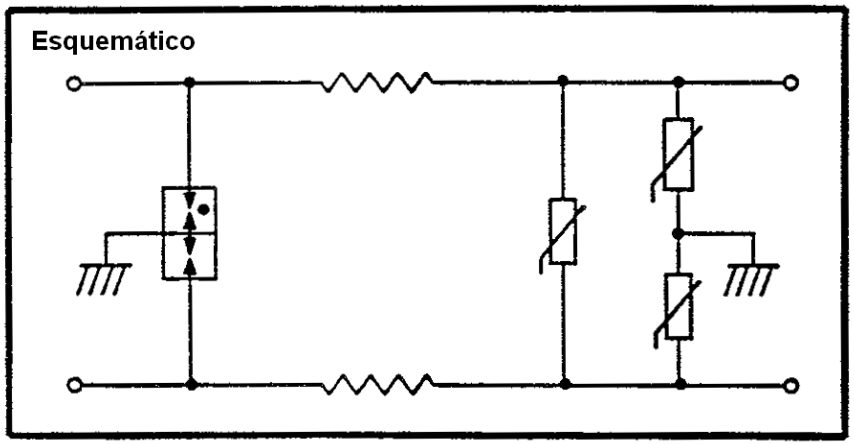


La tensión del SAD depende del nivel de señal útil

Proc.: Polyphaser

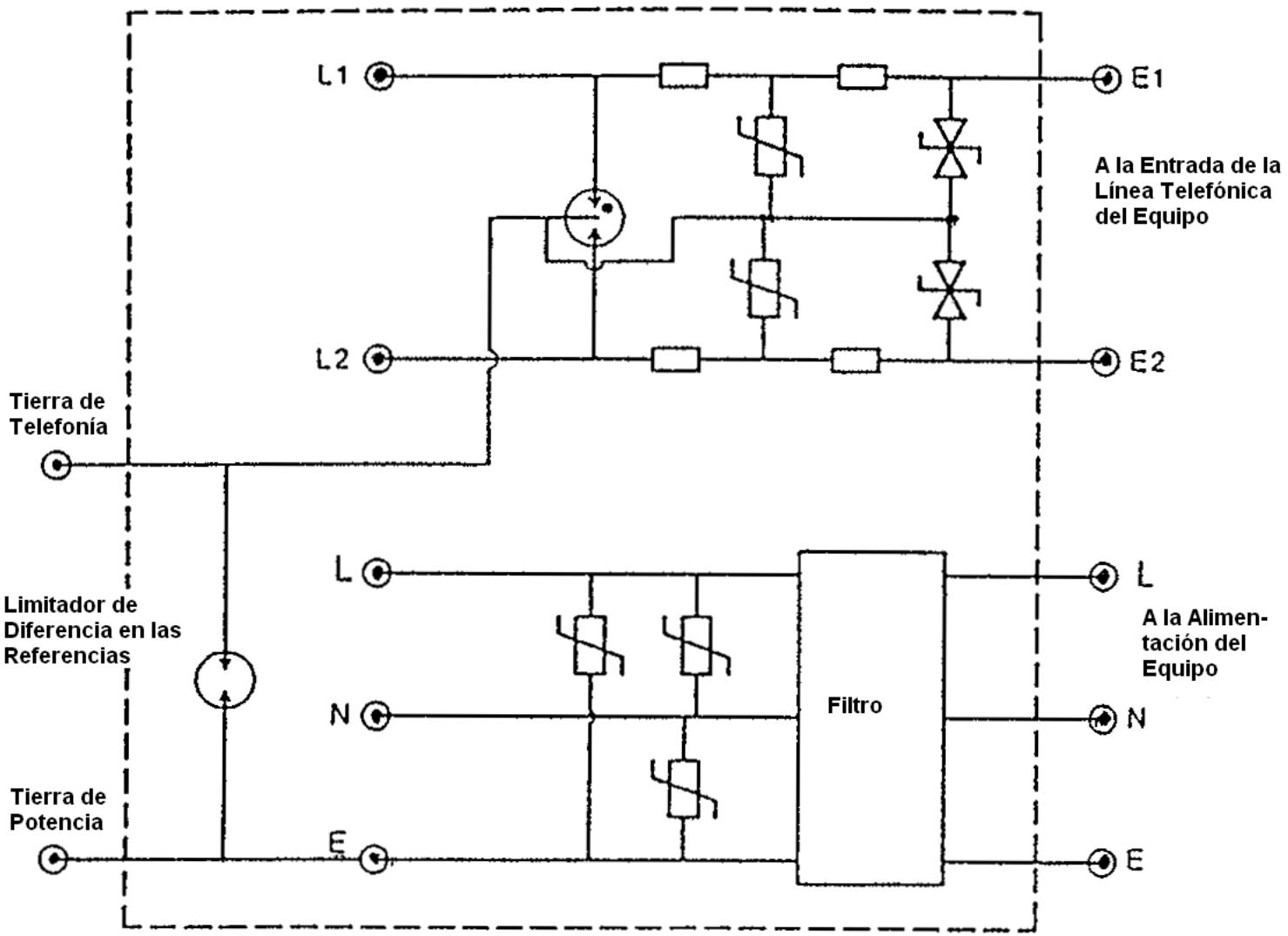
Protección del Cable Telefónico





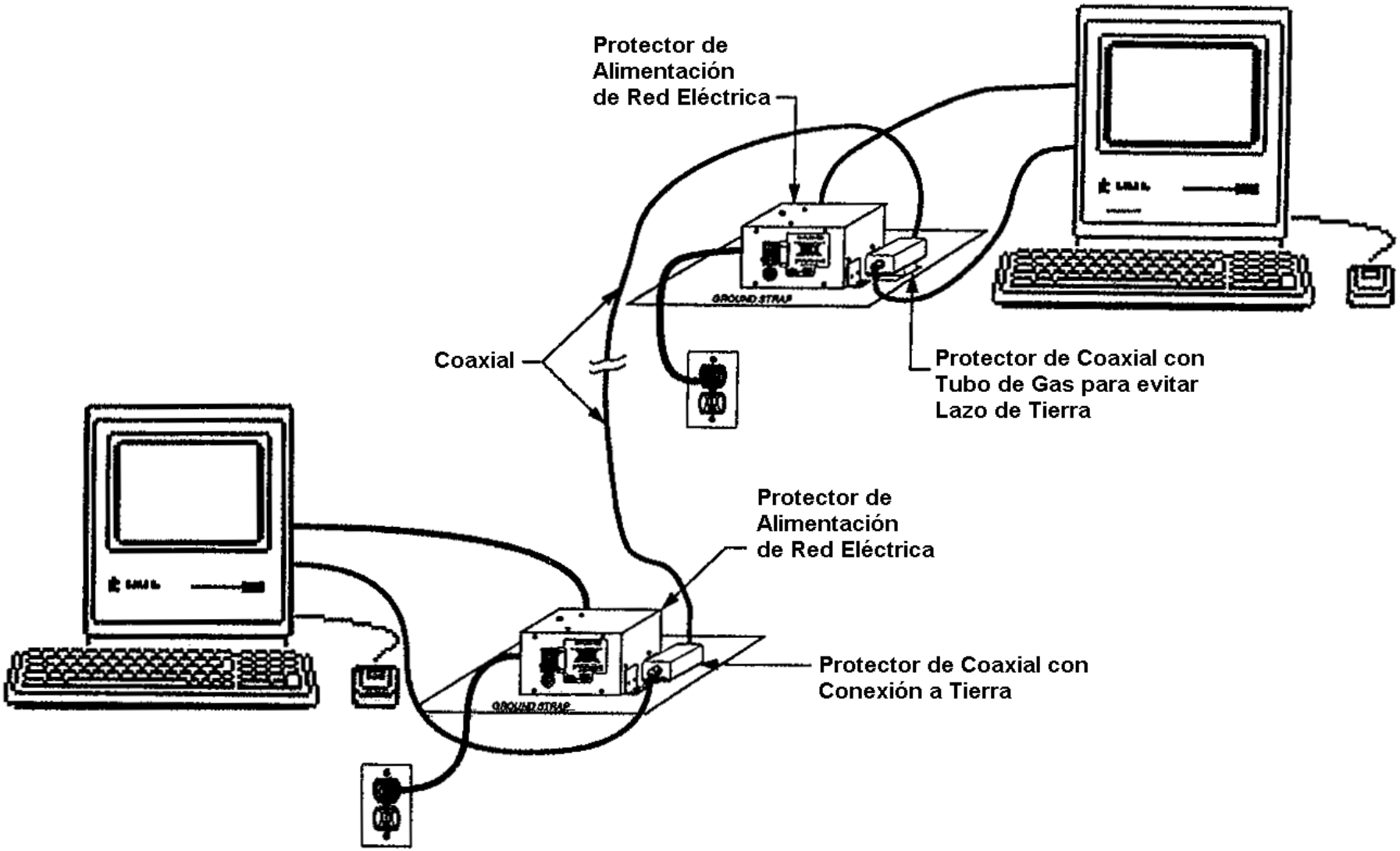
Proc.: Polyphaser

Protector Combinado



Proc.: Liew

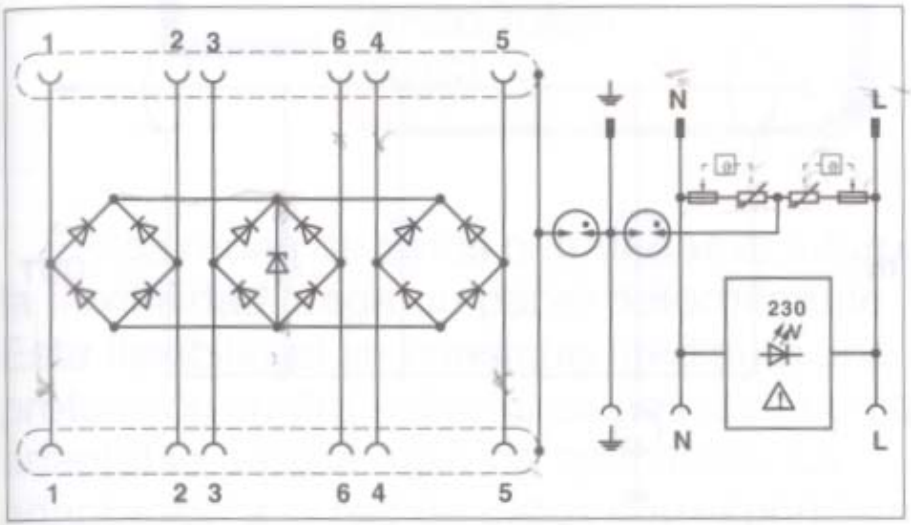
Protección de Coaxial en LANs



Proc.: Polyphaser

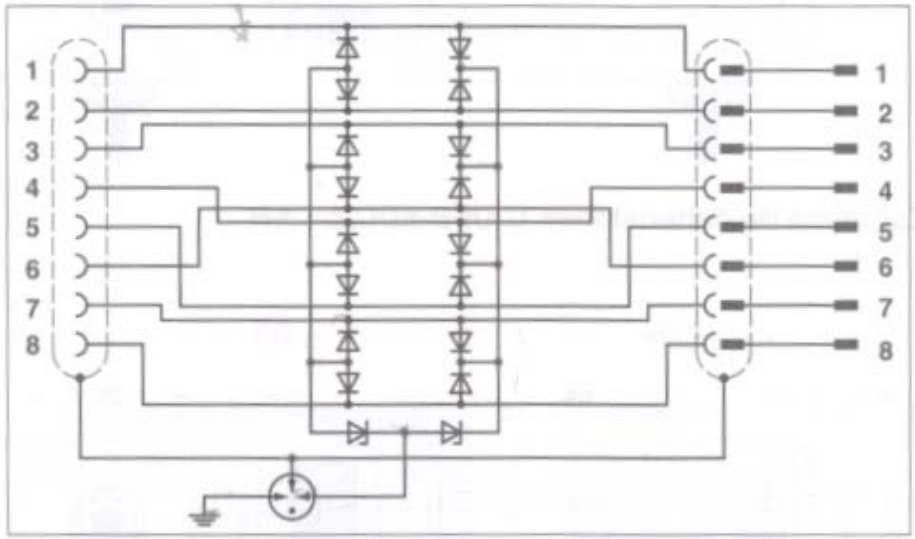
Protector de UTP (1)

Protección de interfaces de red e interfaces RJ 45



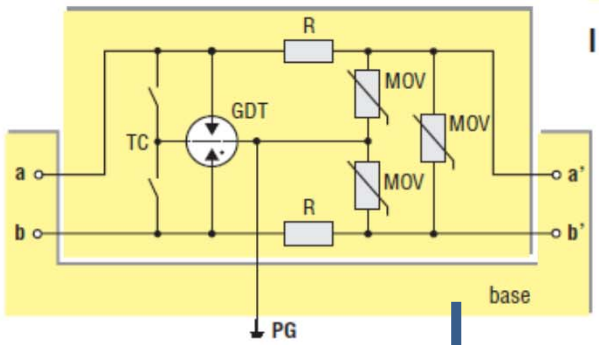
	Lado de red IN / OUT	Lado de datos IN / OUT
Datos de conexión	Enchufe con tomatierra/ Caja de enchufe con tomatierra	hembra RJ 45 hembra RJ 45

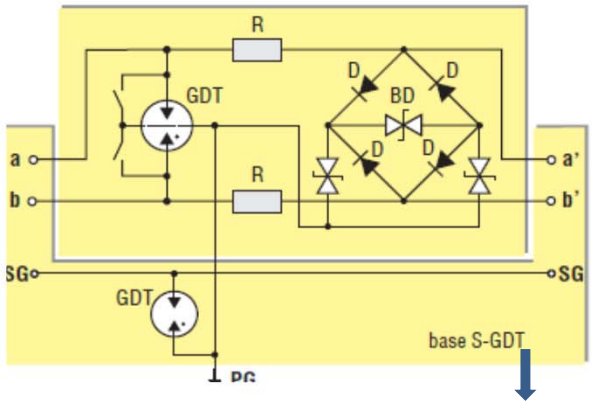
Adaptador de protección universal con conector RJ 45 clase D



	IN	OUT
Datos de conexión	hembra RJ 45	hembra RJ 45

Proc.: Phoenix Contact





Technical data

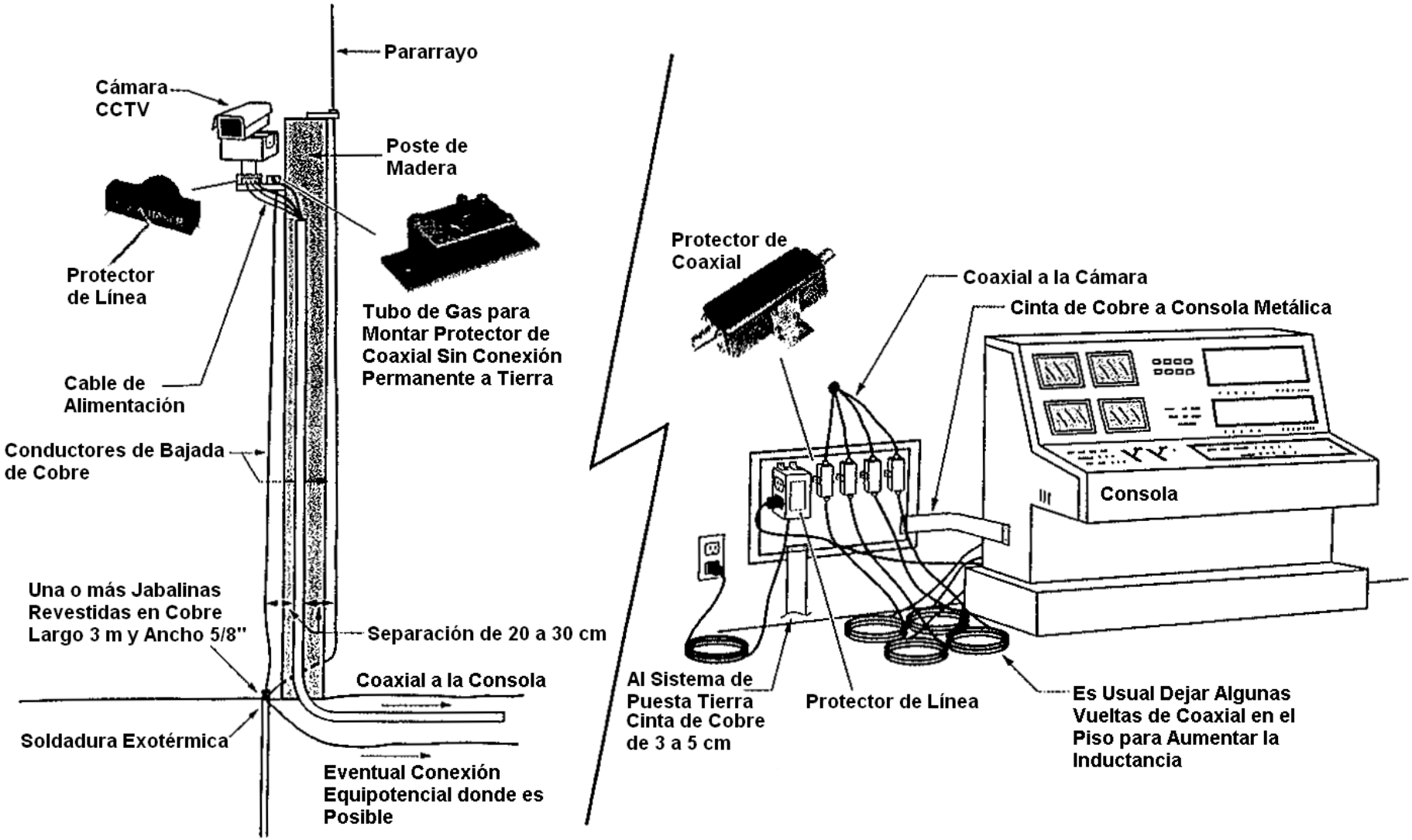
Type		IMH-TC 110 V	IMH-TC 5V	IMH-TC 12V	IMH-TC 15V	IMH-TC 24V	IMH-TC 30V	IMH-TC 48V	IMH-TC 60V
Protection construction		two parts: base and extractable insert							
Number of protected pairs		1 (2 conductors)							
Rated operating voltage	U_N	110 V_{DC}	5 V_{DC}	12 V_{DC}	15 V_{DC}	24 V_{DC}	30 V_{DC}	48 V_{DC}	60 V_{DC}
Max. operating voltage	U_C	170 V_{DC}	7 V_{DC}	15 V_{DC}	18 V_{DC}	28 V_{DC}	33 V_{DC}	52 V_{DC}	64 V_{DC}
Rated spark overvoltage	(a/b-PG)	184 - 264 V	7.5 - 9.5 V	15 - 19 V	20 - 24 V	30 - 36 V	35 - 43 V	55 - 68 V	67 - 85 V
	(a-b)	184 - 264 V	7.5 - 9.5 V	15 - 19 V	20 - 24 V	30 - 36 V	35 - 43 V	55 - 68 V	67 - 85 V
Rated operating current I_N at 25°C		1 A							
Rated surge current I_{SN} (8/20 μs)		10 kA							
Max. surge current I_{MAX} (8/20 μs)		20 kA							
Residual voltage at 5 kA (8/20 μs)		approx. 3 U_N							
Response time of overvoltage protection	t_A	< 25 ns	< 1 ns						
Thermal protection		thermo-clip							
Insulation resistance of the protection	(a-b)	≥ 1 GΩ / 100 V_{DC}	≥ 5 KΩ / 5 V_{DC}	≥ 3 MΩ / 12 V_{DC}	≥ 5 MΩ / 15 V_{DC}	≥ 6 MΩ / 24 V_{DC}	≥ 7 MΩ / 30 V_{DC}	≥ 10 MΩ / 48 V_{DC}	≥ 12 MΩ / 60 V_{DC}
Insulation resistance of the protection	(a/b-PG)	> 1 GΩ / 100 V							
Serial resistance	R	approx. 1 Ω							
Transverse capacitance	C	150 pF	30 pF						
Limit frequency	f_G	10 MHz	35 MHz						

Protector de UTP (2)

Protección de red	Protección de datos	
III / D	C2, C3	C2, C3
250 V AC	6,2 V DC	11 V DC
16 A/30 °C	1,5 A/25 °C	1,5 A/25 °C
2,5 kA/2,5 kA	350 A/2,5 kA	350 A/2,5 kA
6 kV	–	–
≤ 1,3 kV/≤ 1,5 kV	–	–
–	2,5 kA	2,5 kA
–/ ≤ 1,1 kV	≤ 14 V/≤ 1,5 kV	≤ 30 V/≤ 500 V
≤ 1,1 kV/650 V	≤ 42 V/≤ 50 V	≤ 37 V/≤ 70 V
≤ 25 ns/≤ 100 ns	≤ 500 ns/≤ 100 ns	≤ 500 ns/≤ 100 ns
–	≤ 0,8 dB/≤ 1 dB hasta 100 MHz	1 dB hasta 100 MHz
–	≥ 100 MHz	> 100 MHz
- 40 °C ... + 80 °C	- 40 °C ... + 80 °C	- 40 °C hasta +80 °C
IP 20	IP 20	IP 20
IEC 61643-1:1998-02 E DIN VDE 0675-p.6:1998-11/A1:1996-03/A2:1996-10 IEC 61643-21:2000-09		IEC 61643-21:2000-09

Proc.: Phoenix Contact

Protección de CCTV



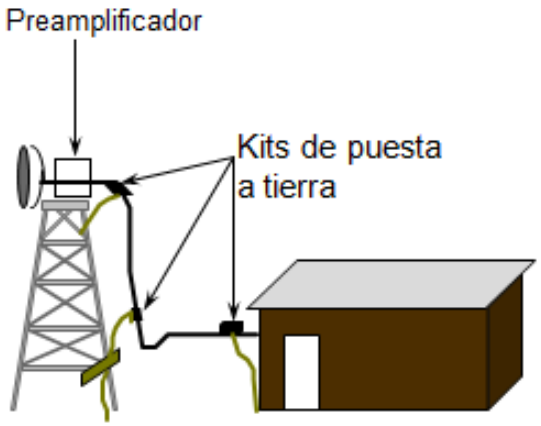
Proc.: Polyphaser

Protección de Sistemas de RF

Proteger todos los caminos de conducción del coaxial:

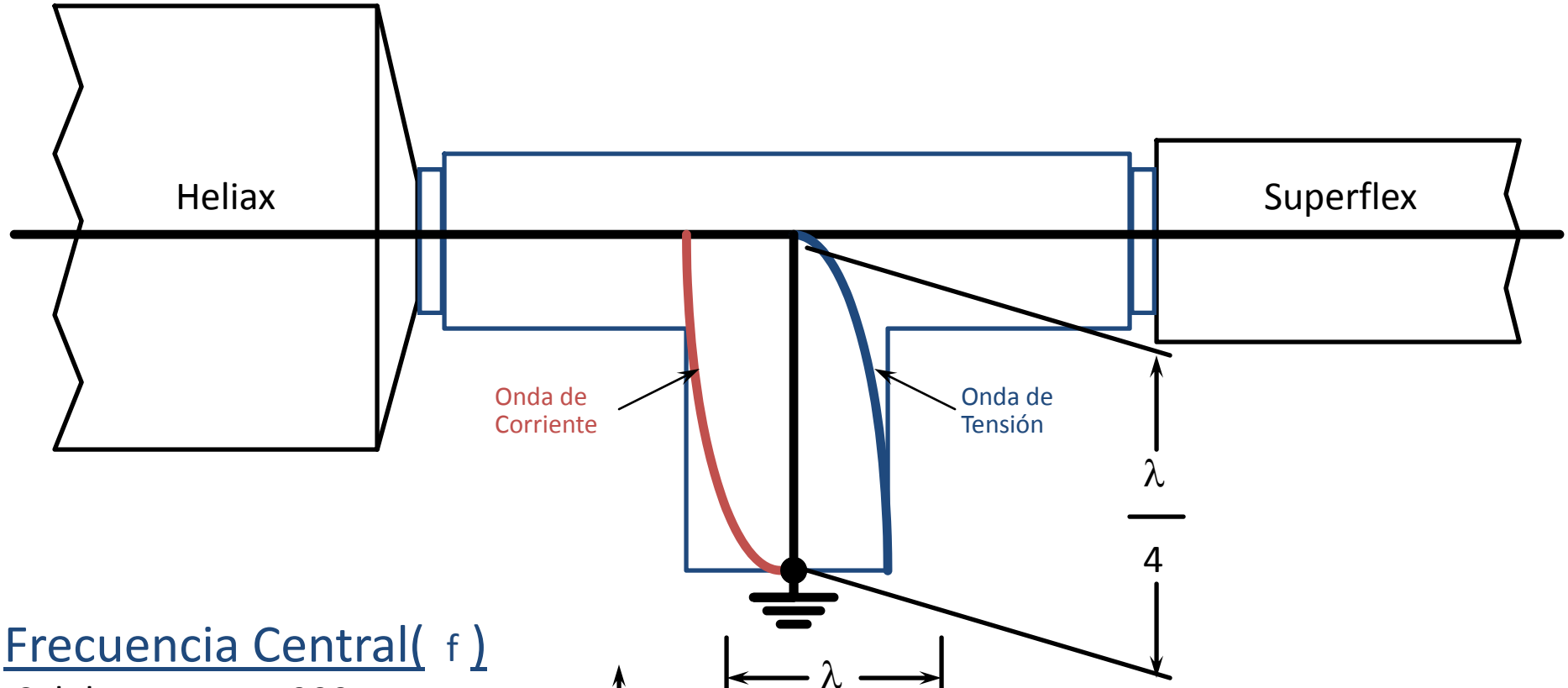
- Protección de la malla
  Se realiza mediante “grounding kits”, conectados entre la malla y la torre o la malla y las puestas a tierra.

- Protección del conductor central
  Se realiza mediante protectores “shunt” a las frecuencias de la descarga entre malla y conductor central en ambos extremos.



Proc.: Polyphaser

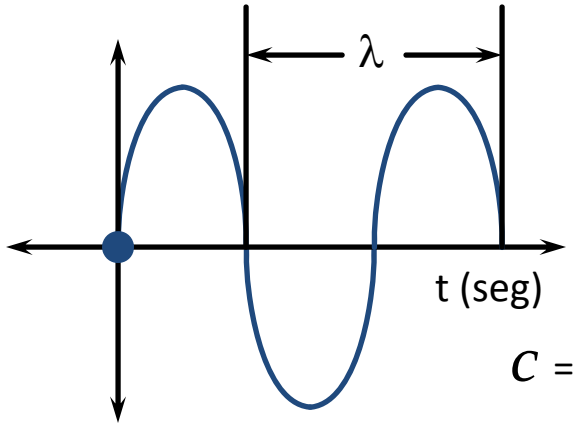
Protector para RF: Cortocircuito en ¼ de Onda



Frecuencia Central(f)

Celular: mayor a 900 MHz

Rayo: 0 – 1 MHz



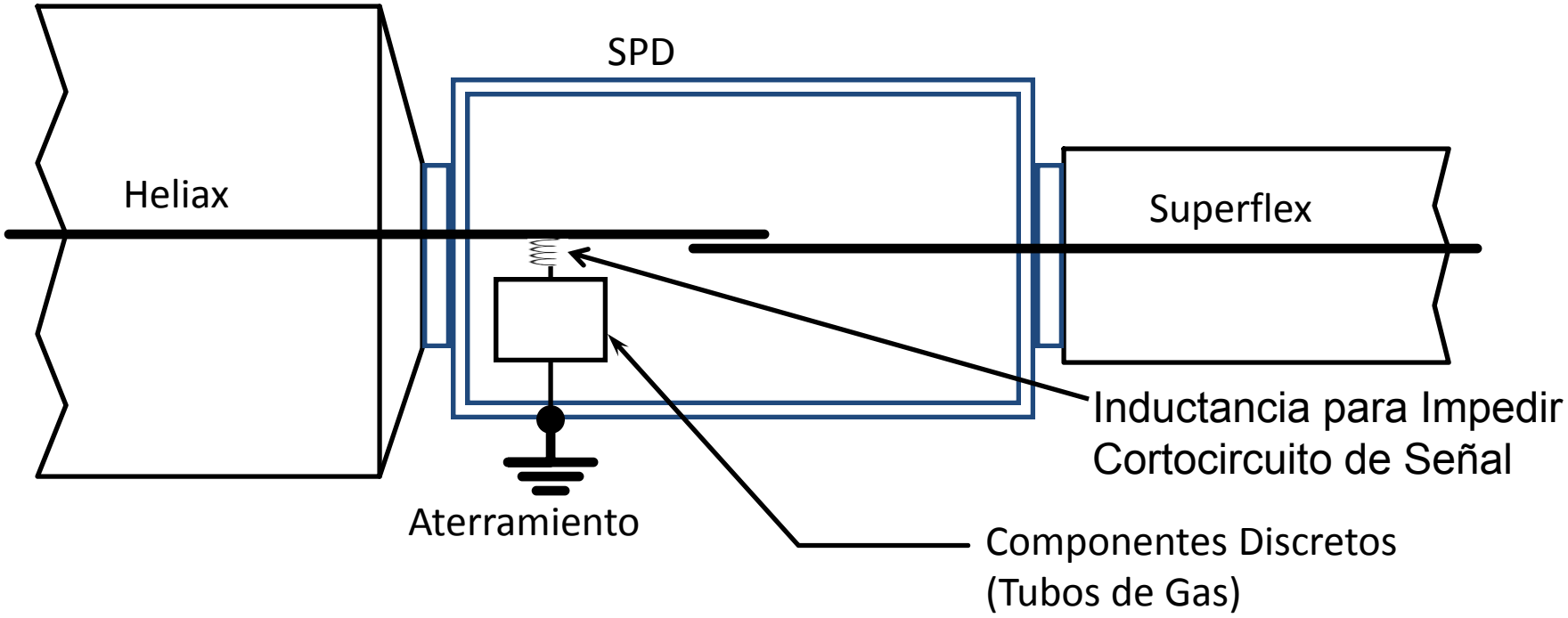
$$\lambda = \frac{c}{f}$$

C = Velocidad de la Luz $\cong 3.0 \times 10^8$ [m/s]

λ = Longitud de Onda [m]

Proc.: Polyphaser

Protector para RF: Conductor Central Aislado y Sintonizado

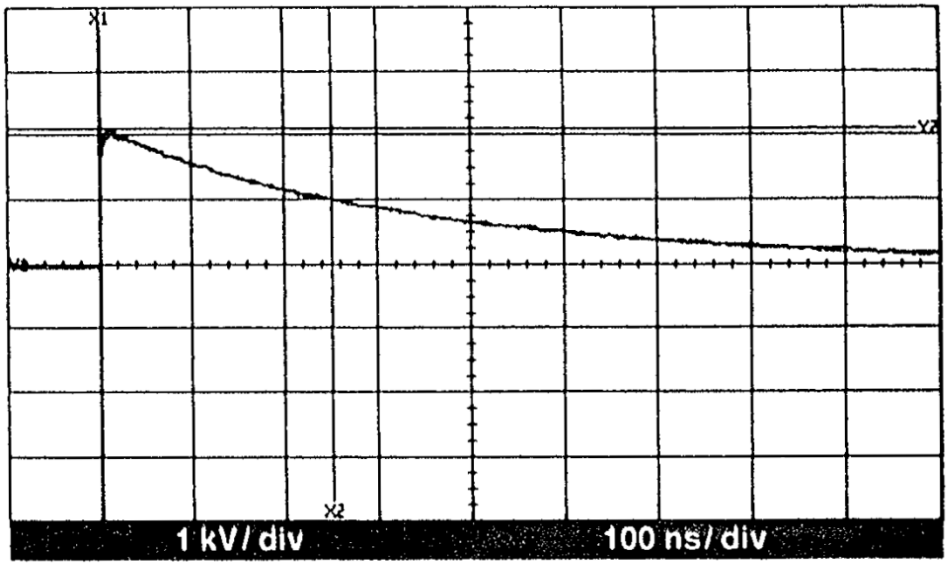


- Características
  - Aislación eléctrica en el conductor central

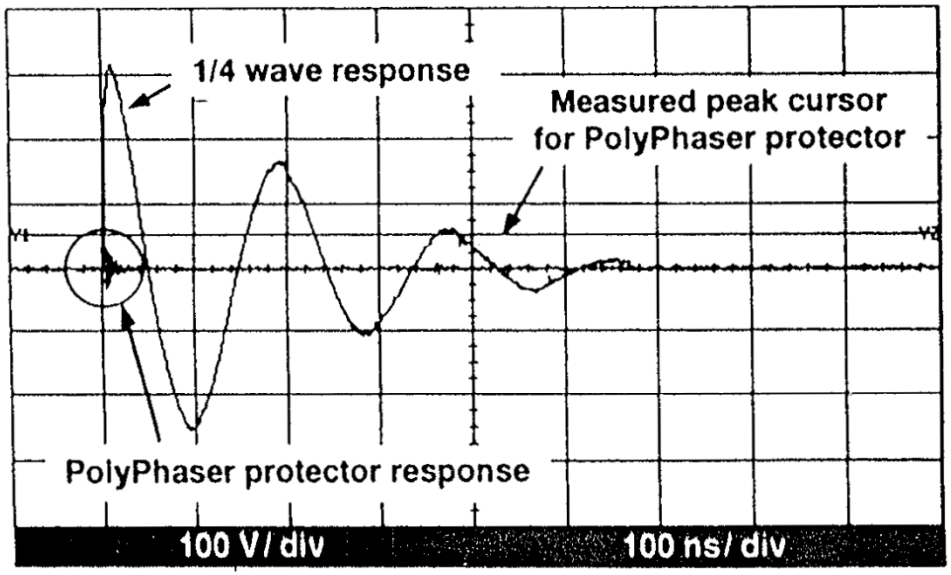
- Limitaciones
  - Limitada vida útil de los componentes discretos
  - Sin indicación cuando los componentes discretos fallan
  - Limitada en potencia por pérdidas de inserción
  - No permite alimentación en CC

Proc.: Polyphaser

Comparación de Protector con Bloqueo de CC y Protector 1/4 de Onda (2)



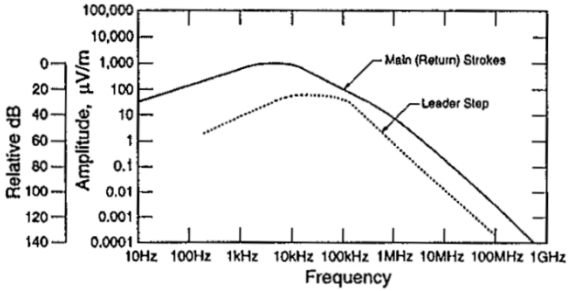
Fast (1kV/ns) rise time test pulse used to test protectors. Peak voltage is 2100V and 50% of peak occurs at (X2) 250ns. 50 ohm system.



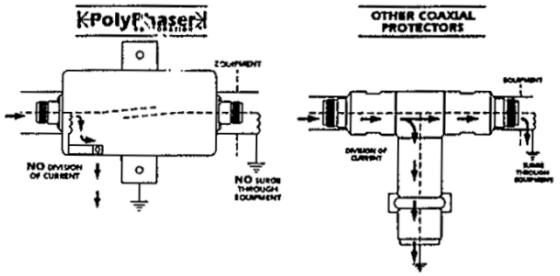
Overlay of both 1/4 wave stub and PolyPhaser protector outputs. Peak for the 1/4 wave stub was 322Vp, while the PolyPhaser was 53Vp. Note the shorter duration of the PolyPhaser response due to dc blocking.

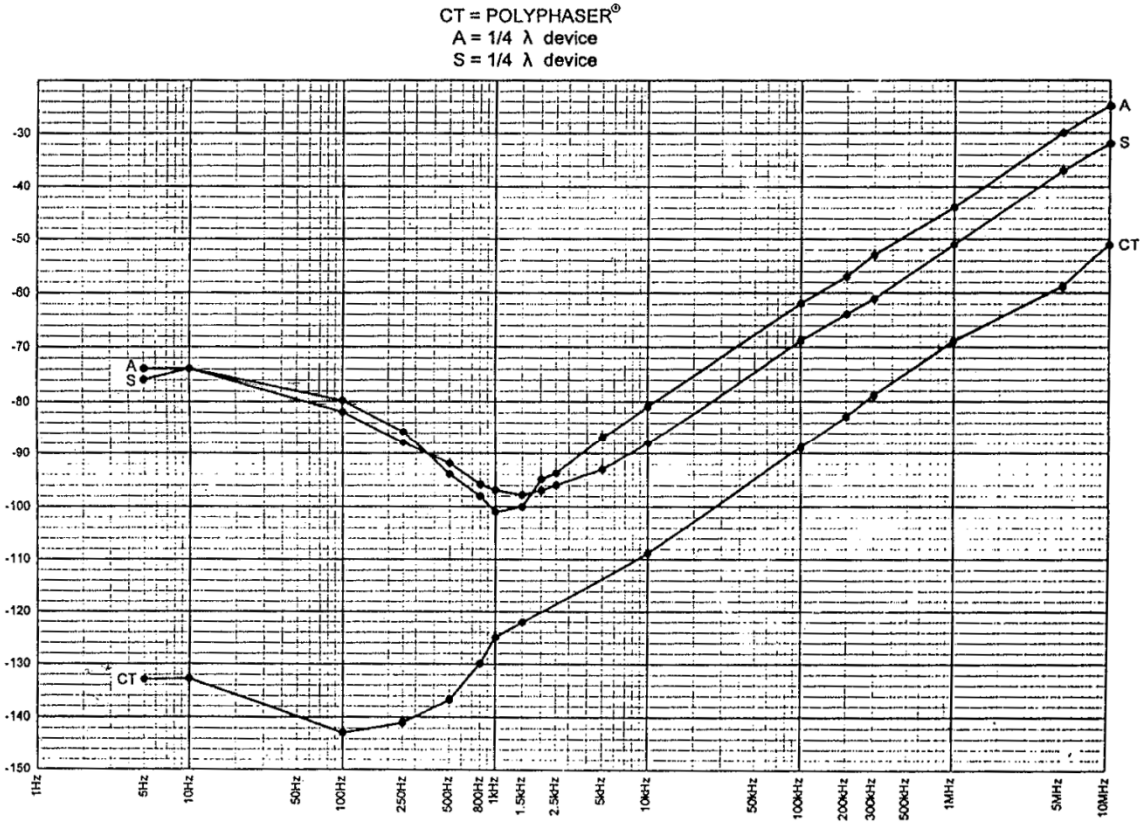
Proc.: Polyphaser

The proper way to provide protection is to have a gas tube which will fire when the ringing voltage arrives from the antenna. The ringing is stopped by the crowbar action of the gas tube. To make sure that the gas tube fires, regardless of the electrical characteristics of the input to your equipment, a capacitor (or stripline coupling) is used. This is the basis of our later U.S. patent. Since the crowbar action of the gas tube is broadband and the energy present is so reduced, no ringing occurs. This is the only way to prevent the **"ol frequency"** ringing from reaching the front end of your equipment. No amount of filtering can help when the desired frequency range is contaminated with the ringing voltage.



Amplitude spectra of the radiation component of lightning discharges.





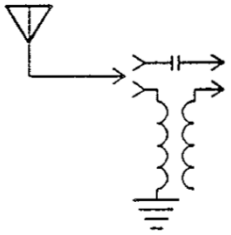
Comparison of Protector Low Frequency Attenuation

Comparación de Protector con Bloqueo de CC y Protector 1/4 de Onda (1)

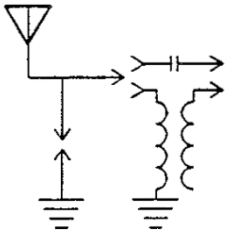
Proc.: Polyphaser

Evolución de Protectores para RF

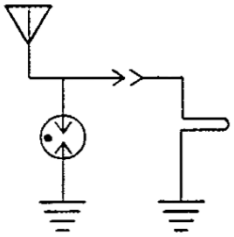
Sin protector



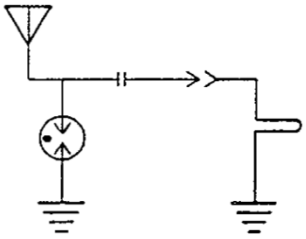
"Spark Gap"

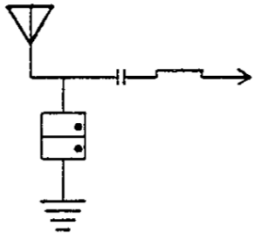


Tubo de Gas

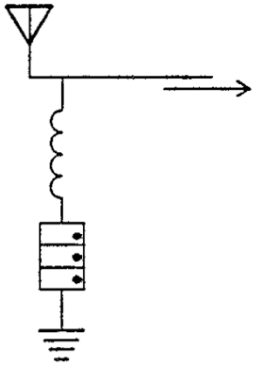


Tubo de Gas y
Bloqueo de CC

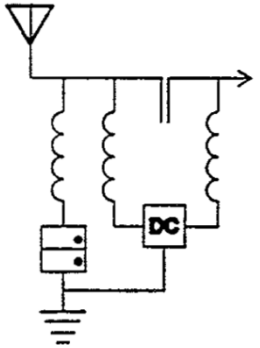




Tubo de Gas,
Bloqueo de CC y
Adaptación de
Impedancia con
"Strip Line"



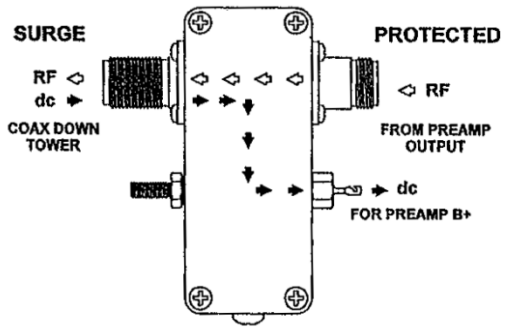
Tubo de Gas,
Bloqueo de CC y
Bloqueo de RF a
Través de los
Tubos de Gas



Protector para RF
con Equipo Activo
en la Antena

Proc.: Polyphaser

dc PICKOFF



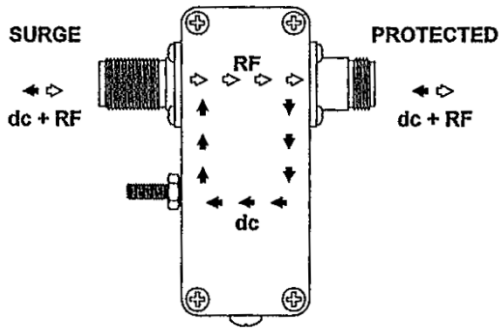
PICK OFF dc BUT OPTIMIZED FOR OPPOSITE RF PASSAGE

Order: **IS-GC50LN+(15,20,26,30,36)** Pickoff

Add suffix: **-MA** for male connector bulkhead port
-ME for male opposite bulkhead port
-MA/ME special order

Add $5.00 for each N male.

dc PICKOR



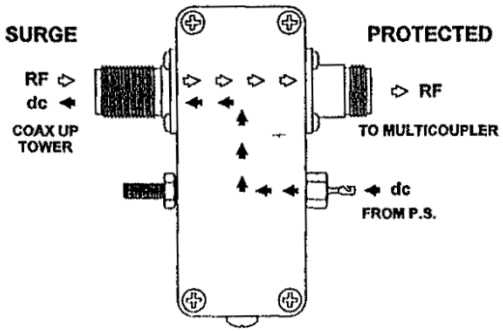
PICK OFF dc AND RE-INJECTS FOR OPTIMAL PROTECTION FOR BULKHEAD PANEL USERS

Order: **IS-DC50LNZ+(15,20,26,30,36)** Pickor

Add suffix: **-MA** for male connector bulkhead port
-ME for male opposite bulkhead port
-MA/ME special order

Add $5.00 for each N male.

dc INJECTOR



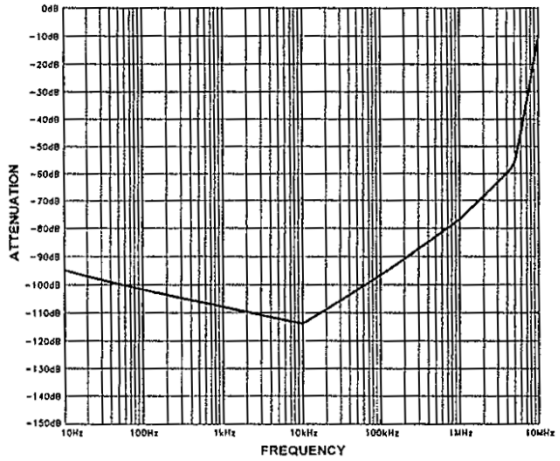
INJECTS dc ONTO THE COAX

Order: **IS-DC50LN+(15,20,26,30,36)** Injector

Add suffix: **-MA** for male connector bulkhead port
-ME for male opposite bulkhead port
-MA/ME special order

Add $5.00 for each N male.

IS-DC50LN / IS-GC50LN
LIGHTNING SPECTRUM ATTENUATION

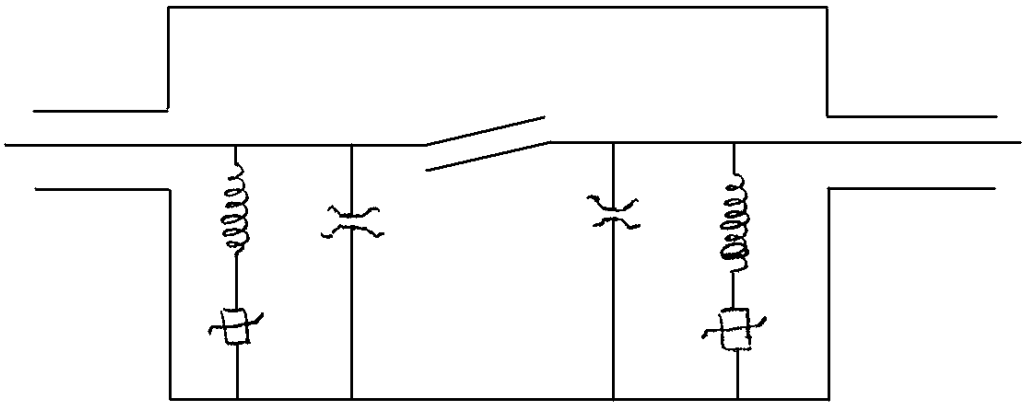


The throughput voltage to your equipment is related to the attenuation of the low frequency energy. The greater the attenuation, the smaller the throughput energy and voltage.

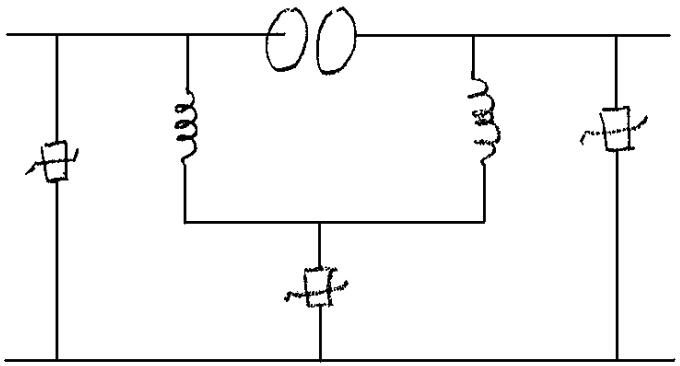
Protectores que Combinan Señal de RF con Alimentación en CC a Equipo Activo en la Antena

Proc.: Polyphaser

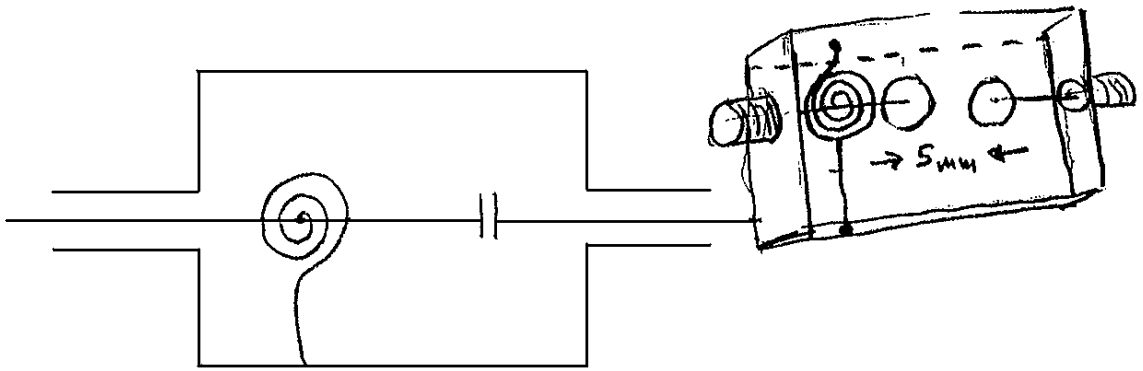
Protecciones RF / CC



Aislada en CC



Con alimentación CC protegida



Aislada en CC con cortocircuito a la frecuencia del rayo