

Gas discharge tube and selection of GDT

HUBER+SUHNER gas discharge tube protectors are normally delivered without gas tube some times called gas capsule. This allows the customer to select the appropriate GDT according to his application conditions, especially the maximum operation signal voltage amplitude.

Protectors with replaceable gas discharge tube

- Series 3401 - GDT technology up to 1 GHz
- Series 3402 - GDT technology up to 2.5/3.0 GHz
- Series 3403 - fine protectors (for cube design types)
- Series 3408 - GDT technology with integrated high-pass filter
- Series 3409 - high-power/low-IM protectors
- Series 3410 - high-power/low-IM protectors with integrated high-pass filter and DC injection

Specification		Requirements	Limits
Insulation resistance		100 V (50 V for 9071.99.0X48)	$10^{10} \Omega$
Glow voltage	V_B	10 mA	~70 V
Arc voltage	V_{ARC}	>1 A	~10 - 15 V
Glow-arc transition current			<0.5 A
Capacitance		1 MHz	<1 pF typ.
Impulse discharge current	I_{SG} I_S	30 kA, 8/20 μ s 20 kA, 8/20 μ s 8 kA, 10/350 μ s 500 A, 10/1000 μ s 100 A, 10/1000 or 10/700 μ s	1 operation minimum >10 operations 1 operation minimum >400 operations >1000 operations
Alternating discharge current		65 A _{rms'} 11 cycles 10 A _{rms'} 1 s	1 operation minimum > 10 operations
Operating temperature			-40 to +85 °C -55 to +125 °C GDT only

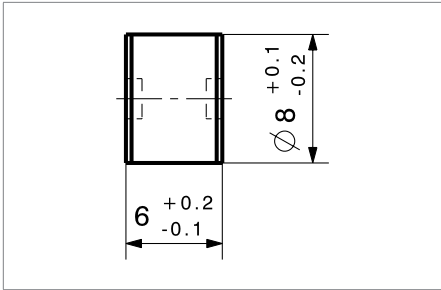
Notes:

- Designed for operations exceeding 25 years
- GDT specification acc. international standard ITU-T K.12



H+S type	U _{Zstat}	U _{Zdyn} max.	I _s 8/20 μs	I _{SG} 8/20 μs	RF power max. (single carrier) at VSWR 1.22:1 with 1.5 securtiy margin
	V	V	kA	kA	W
9071.99.0547	230 ±15 %	675	20	30	140
9071.99.0548	90 ±20 %	500			20
9071.99.0549	350 ±15 %	875			325
9071.99.0550	470 ±15 %	1000			590
9071.99.0551	600 ±15 %	1100			960

All dimensions in mm



Suitable for the following installed GDT holders:

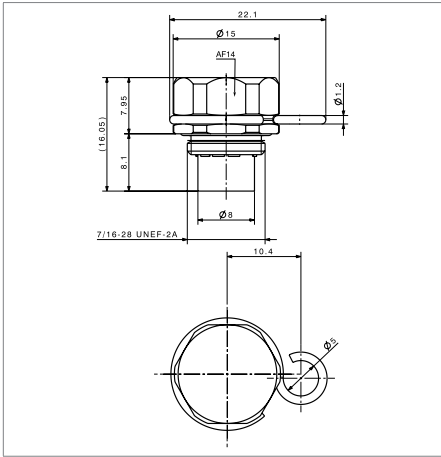


Gas discharge tubes together with holder

H+S type	U _{Zstat}	U _{Zdyn} max.	I _s 8/20 μs	I _{SG} 8/20 μs	RF power max. (single carrier) at VSWR 1.22:1 with 1.5 securtiy margin
	V	V	kA	kA	W
9071.99.0447	230 ± 15 %	675	20	30	140
9071.99.0448	90 ± 20 %	500			20
9071.99.0449	350 ± 15 %	875			325
9071.99.0450	470 ± 15 %	1000			590
9071.99.0451	600 ± 15 %	1100			960

* 6 x 8 mm gas discharge tube same as of the tabel above together with holder with groove

All dimensions in mm



Suitable for the following installed GDT holders:



Semper GDT units for retrofit and replacement for series 3401 and 3402

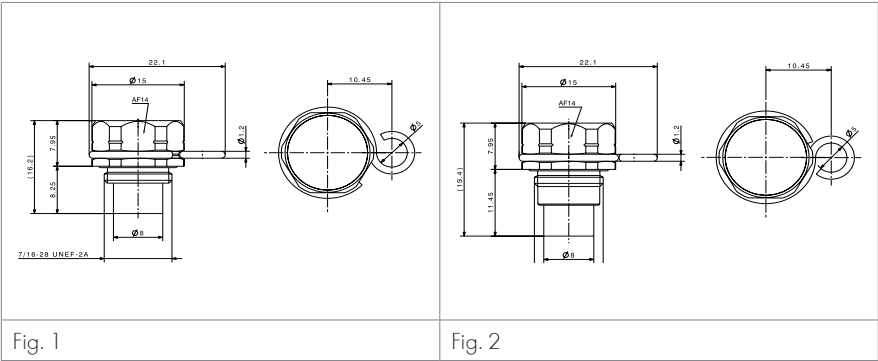
H+S type	U _{Zstat}	U _{Zdyn} max.	I _s 8/20 µs	I _{SG} 8/20 µs	RF power max. (single carrier) at VSWR 1.22:1 with 1.5 securtiy margin	Fig.
	V	V	kA	kA	W	
9071.99.0647 *	230 ± 15 %	675	20	30	140	1
9071.99.0648	90 ± 20 %	500			20	1
9071.99.0649	350 ± 15 %	875			325	1
9071.99.0650	470 ± 15 %	1000			590	1
9071.99.0651	600 ± 15 %	1100			960	1

* Nato stock number 5920-66-156-1512

Semper GDT units for retrofit and replacement for series 3402 platform 3000 ¹⁾

H+S type	U _{Zstat}	U _{Zdyn} max.	I _s 8/20 µs	I _{SG} 8/20 µs	RF power max. (single carrier) at VSWR 1.22:1 with 1.5 securtiy margin	Fig.
	V	V	kA	kA	W	
9071.99.0947	230 ± 15 %	675	20	30	140	2
9071.99.0948	90 ± 20 %	500			20	2
9071.99.0949	350 ± 15 %	875			325	2
9071.99.0950	470 ± 15 %	1000			590	2
9071.99.0951	600 ± 15 %	1100			960	2

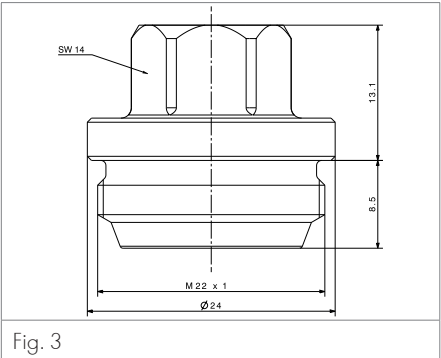
All dimensions in mm



Semper GDT units for retrofit and replacement for series 3409

H+S type	U _{Zstat}	U _{Zdyn} max.	I _s 8/20 µs	I _{SG} 8/20 µs	RF power max. (single carrier) at VSWR 1.22:1 with 1.5 securtiy margin	Fig.
	V	V	kA	kA	W	
9071.99.0747	230 ± 15 %	675	20	30	140	3
9071.99.0748	90 ± 20 %	500			20	3

All dimensions in mm



¹⁾ Platform 3000 is a term for series 3402 protectors with a specified bandwidth of DC - 3000 MHz
Examples: 3402.17.3001, 3402.17.3002, 3402.26.3001

Definitions

U_{Zstat}

Static spark-over voltage - voltage which ignites the GDT in the case of a voltage rise of less than 100 V/ms. (acc. ITU-T K.12)

U_{Zdyn}

Dynamic spark-over voltage - max. voltage which ignites the GDT in the case of a voltage rise of 1 kV/μs. (acc. ITU-T K.12)

I_s

Impulse discharge current - peak value of a defined current pulse which is allowed to be applied at least ten times at intervals of 30 seconds without causing any significant changes of the spark-over voltage specification. Values are given for current pulse shape definitions of 8/20 μs T_1 , front time/ T_2 , time to half value

I_{sG}

Maximum pulse current - peak value of a defined single current pulse which can be conducted to ground once. For pulse shape refer to I_s .

U_B

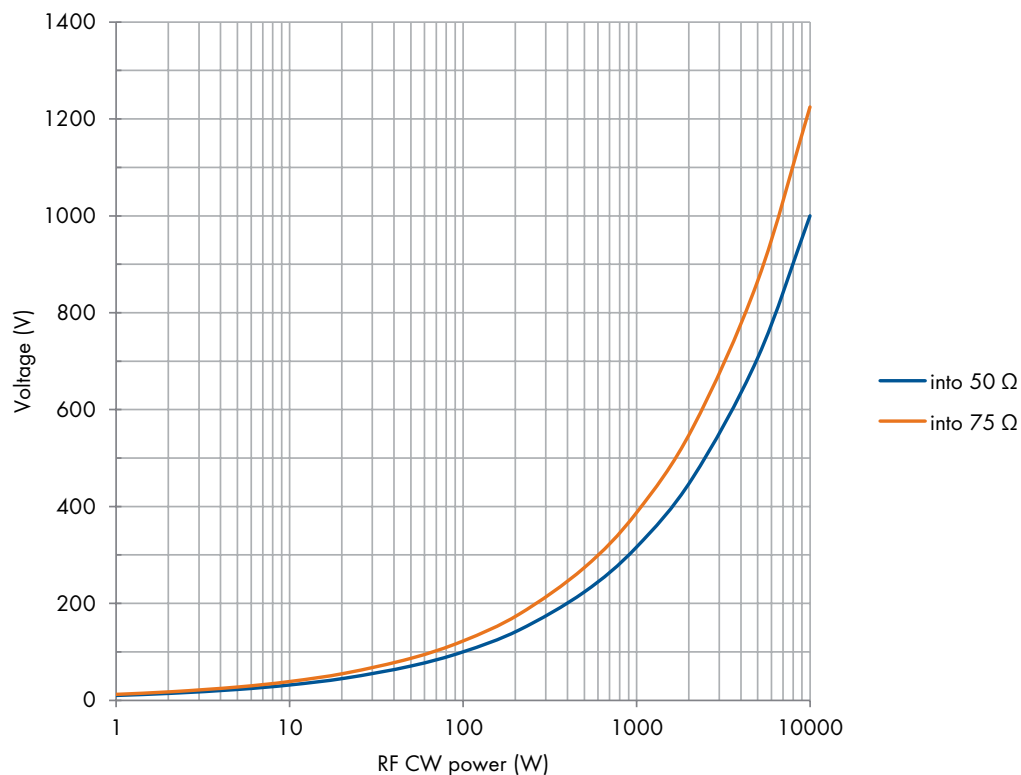
Glow discharge voltage - residual voltage across the GDT capsule when the discharge current operates the GDT in the glow state, typically at 10 mA.

U_{ARC}

Arc voltage - increasing current drives the GDT capsule into the arc state. The resulting voltage across the GDT is the arc voltage.

Peak RF voltage

Single frequency RF power into 50/75 Ω at VSWR 1.0:1



Selection of the surge protection gas discharge tube

RF power

A total of eight GDT with different static spark-over voltages are available. To select the correct GDT, the following criteria are important:

- Max. RF transmission power P for single and multi carrier systems (CW or PEP) and resulting peak voltage
- Supply voltage U_{DCsup} if used for remote powering
- System impedance Z
- Max. allowable VSWR (system adjustment)

The required static spark-over voltage is 1.5 times of the total peak voltage on the transmission line. The following formula is applicable to evaluate the peak voltage at VSWR = 1.0:1.

Refer to tables on pages 87 and 88 and consider the lowest possible voltage from the tolerance range!

$$U_{Zstat} \geq 1.5 \cdot \hat{U}_{max.}$$

$$\hat{U}_{max.} = \sqrt{2PZ} \cdot (1 + \Gamma) + U_{DCsup}$$

For multicarrier systems, the (inphase) peak voltage can be calculated as the total of all single peak voltages:

$$\hat{U}_{max.} = (\hat{U}_1 + \hat{U}_2 + \dots + \hat{U}_n) \cdot (1 + \Gamma) + U_{DCsup} = (\sqrt{2P_1Z} + \sqrt{2P_2Z} + \dots + \sqrt{2P_nZ}) \cdot (1 + \Gamma) + U_{DCsup}$$

This consideration does not involve effects of the modulation. They have to be added according to the selected modulation principle.

The max. admissible RF power transmission for a single carrier (CW) versus the VSWR is shown in the following diagrams for 50 Ω and 75 Ω systems of several gas discharge tubes (see pages 86 – 90 for detailed GDT characteristics).



* Non-standard values on request.

Semper self-extinguishing GDT

Semper – self-extinguishing gas discharge tube (GDT) protector

Description

The patented Semper concept enhances the safety and reliability of the well known and proven gas discharge tube (GDT) protector principle impressively. It eliminates the risk of gas discharge tube «hold on» due to DC line powering or high powered RF signals, which will render the system inoperable and can destroy the discharge tube.

HUBER+SUHNER offers a unique concept of self-extinguishing GDT protectors. The unique and patented Semper solution is realised as a simple unit which enables the use of the comprehensive range of HUBER+SUHNER GDT protectors with a replaceable GDT. An easy retrofit of existing GDT protectors is possible or available as complete Semper protectors in a variety of configurations.

Whereas many applications generally benefit from the enhanced safety and reliability that the Semper concept offers, applications using DC line power for remote signal amplification and processing and those using high RF power will find self-extinguishing lightning EMP protectors of specific interest.

Applications

- DC transmission for remote powering
- Transmitting high RF power
- Tower mount amplifiers/repeaters
- GPS receivers
- Point to point/multi-point radios
- Defence/security radios
- Remote installations
- Uninterruptible surveillance radio control or navigation systems

Features and benefits

- Self-extinguishing gas discharge tube with automatic recovery
- Extinguishing under any coaxial line condition including:
 - Malfunction of electronic fused DC supplies
 - Malfunction of RF line monitoring
 - Absence of any such mechanism
- Can be employed for any HUBER+SUHNER GDT protectors with exchangeable gas tube
- Field replacement allows cost-effective system upgrades
- Product options ensure availability for any application
- Higher safety
- Negligible system downtime



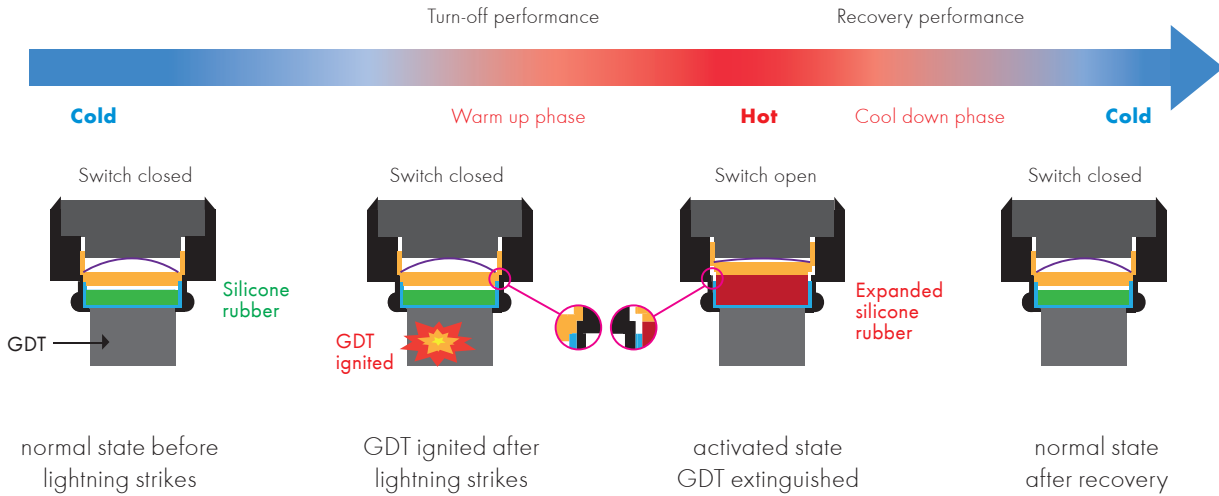
Specifications

Electrical data	
DC current max.	2.5 A at 48 V 4.0 A at 27 V 6.0 A at 24 V 13.0 A at 17 V
Turn-off time	20 sec. typically at 2.0 A and 25 °C ambient temperature < 40 sec. typically below 1 A and 25 °C ambient temperature
Recovery time	7 sec. at 25 °C ambient temperature

Environmental data	Requirements/test conditions
Operation temperature range	-40 up to +85 °C (-40 up to +185 °F) lightning protection functionality -20 up to +85 °C (-4 up to +185 °F) Semper functionality
Waterproof degree (IEC 60529)	IP65 min., according to shown product specification, data refer to the coupled state
Moisture resistance	MIL-STD-202, method 106
Thermal shock	MIL-STD-202, method 107, condition B
Life (at elevated ambient temperature)	MIL-STD-202, method 108, condition C
Vibration, high frequency	MIL-STD-202, method 204, condition D

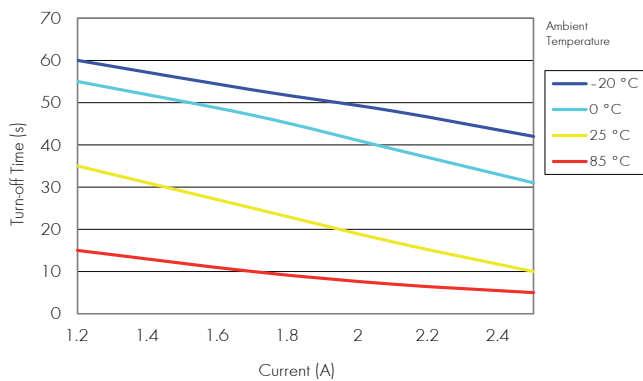
Material data Semper unit		
Piece parts	Material	Surface plating
Body	brass	SUCOPLATE® or gold
Contact	copper beryllium alloy or brass	silver plating
Insulator	PTFE/AL ₂ O ₃	
Gasket	NBR (nitrile butadiene rubber)	
Insert	MVQ (methyl silicone rubber)	

Basic working principle

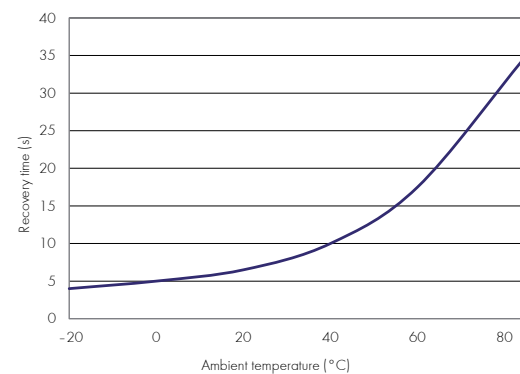


Thermal state/phase	Cold	Warm up phase	Hot and entering cool down phase	Cold
GDT	passive mode/ isolated state	activated/ conductive mode	returned to passive mode/ isolated state caused by the opened switch which was forced by the expanded silicon	passive mode/ isolated state
Silicone rubber	contracted	starting expansion	expanded and starting to contract	contracted
Switch	closed	closed	open	closed

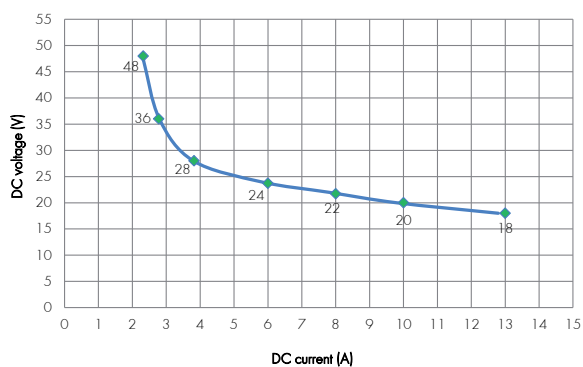
Turn-off performance



Recovery performance at 25 °C



Voltage vs. current limiting graph



This graph defines the admissible maximum supply current (A) at a given supply voltage (V).

Semper product range

By offering both, complete Semper protector and replaceable Semper GDT unit solutions, HUBER+SUHNER are able to provide lightning protection solutions to a wide range of both civil and military applications and system upgrades.

H+S type	Frequency range	Connectors	Static sparkover voltage	GDT unit included
	MHz	Unprotected/protected side* If bulkhead mount version, side of bulkhead marked «b».		
3401.17.0048-EX	DC - 1000	N (f) - N (f), b	230 V	9071.99.0647 *
3401.17.0057-EX	DC - 1000	N (m) - N (f), b		
3401.26.0012-EX	DC - 1000	TNC (f) - TNC (f), b		
3402.17.0072-EX	DC - 2500	N (f) - N (f), b		
3402.17.0076-EX	DC - 2500	N (m) - N (f)		
3409.17.0032-EX	380 - 512	N (m) - N (f), b	230 V	9071.99.0747 *
3409.41.0054-EX	380 - 512	7/16 (m) - 7/16 (f)		
3409.17.0027-EX	806 - 2500	N (m) - N (f)	90 V	9071.99.0748 *
	806 - 960			
	1710 - 2500			
3409.17.0031-EX	806 - 2500	N (f) - N (f), b		
	806 - 960			
	1710 - 2500			
3409.41.0044-EX	806 - 2500	7/16 (m) - 7/16 (f)		
	806 - 960			
	1710 - 2500			
3409.41.0051-EX	806 - 2500	7/16 (f) - 7/16 (f)		
	806 - 960			
	1710 - 2500			
3409.41.0052-EX	806 - 2500	7/16 (f) - 7/16 (f), b		
	806 - 960			
	1710 - 2500			
3409.41.0053-EX	806 - 2500	7/16 (m) - 7/16 (f), b		
	806 - 960			
	1710 - 2500			

* Recommendation only, reverse installation possible without any impact on performance

For further details see in corresponding product series section.