SALTEK

Overvoltage controlled. ANYWHERE.

Catalogue
Voltage Limiting Devices

For electric railway systems

Protection of railway systems
Trains – metro – trams

In the rail transport, both the underground and the above-ground railway or tram transport, attention is turned to the safety and reliability of the traffic, and to the protection of persons and animals.

Electrical safety of persons and animals

During the regular operation of the train/metro/tramway, an impermissible touch voltage can occur at accessible locations between the return path (running rail) and the ground or grounded railway structures (catenary masts, hand-railings, waiting shelters and other structures) due to the voltage drop in the return path or failure state, due to the stray currents or due to the indirect induced or direct lightning strike hit. At locations accessible to persons (railway stations, railroads), this voltage is necessary to be limited to a safe value by installing voltage limiting devices (VLDs) – Fig. 1. The VLDs are aimed to create a temporary or permanent connection of exposed parts with the grounding of the traction system if the permissible value of the touch voltage is exceeded. When selecting a VLD, we have to consider (depending on the location of installation) if the VLD-F function or the VLD-O function or both ones are required as defined in EN 50122-1. Exposed conductive parts of trolley or traction lines with DC power supply should be connected to a return path via VLD. The VLD-F voltage limiters are designed for failure states when the traction line touches the non-active conductive part. Voltage limiting devices of the VLD-O type are used in case of a regular operation; VLDs limit the increased touch voltage caused by the train traffic (stray currents, voltage drop on the return path to the power source). The BVL VLDs perform the function of an A2 surge arrester at the same time (acc. to EN 50526-3) and effectively eliminate the high impulse overvoltage induced into the railway equipment by direct or near lightning strikes.

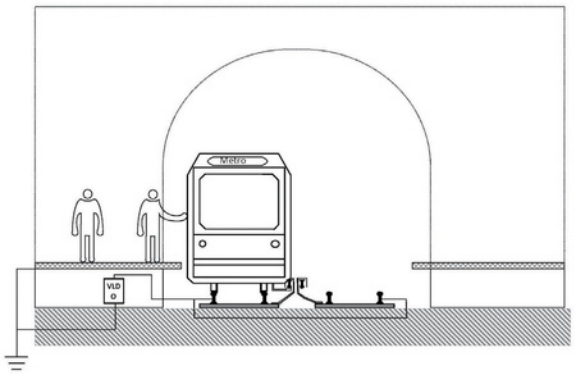
The SCG range of VLD class 1, type VLD-F

The VLDs of the SCG range limit voltages caused by lightning strikes, failure states, or the induced excessive touch voltage on exposed parts of railway devices, both in AC and DC traction systems. Persons who can get in touch with these parts, are protected by creating a temporary or permanent connection of exposed conductive parts with the return path. If the traction line gets in contact with an exposed conductive part of railway equipment (due to breaking and falling, e.g.), the SCG creates a conductive connection with the return path. The short-circuit current is evaluated by appropriate sensors in the traction substation, and the corresponding segment of the traction line is immediately disconnected by an automatic breaker. When passing the short-circuit current, a permanent guaranteed low impedance – electrical bypass of the protective element is achieved by a patented internal short-circuit device. That way, the protective function of VLD class 1 is guaranteed in these cases in accordance with requirements of the standard until it is replaced with the new one. The used protective element simultaneously eliminates high pulse overvoltage induced on the railroad or the railway device by the lightning strike.

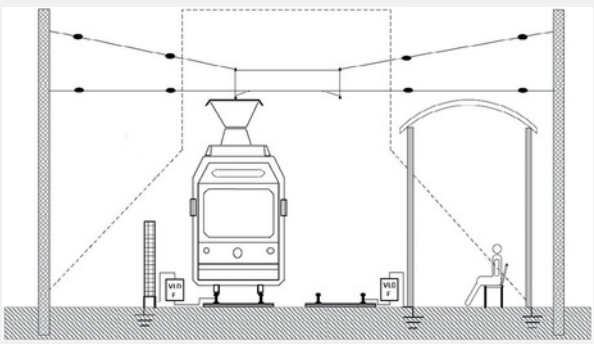
The BVL range of VLD class 2.2, type VLD-O (resp. VLD-O+F)

The VLDs of the BVL range provide reliable temporary connection (recoverable VLD) of the return path with the grounding of the traction system for as long as the permissible value of the touch voltage is exceeded. This protects persons, who can come into contact with these parts, from the excessive touch voltage raised due to the train traffic. The BVL voltage limiting devices can conduct the stray current for a long time, and therefore are suitable for the installation in railway/tramway/metro stations or close to the switching station. The types BVL-50 and BVL-100 meet requirements of the standard EN 50122-1 ed. 2, on voltage limiting devices of the type VLD-F and VLD-O, at the same time. Two anti-parallel power thyristors and an electronic detection circuit, which are connected to the two main terminals, form a voltage limiting device together. A heavy-duty A2 surge arrester is connected in parallel to them. The voltage limiting device responds to all slow and fast, short and long, DC and AC pulses. The varistor responds to the voltage pulse always as the first, and protects the other components from the effects of overvoltages. A pulse lasting for a longer time could cause its destruction, and therefore, one of the thyristors is activated with a delay of about 1.5 ms, to reduce the excessive voltage. The thyristor will switch off if the current decreases below the value of the latching current of the thyristor. Then, the high impedance state of the whole VLD is restored. VLD is a passive device which does not require external supply. Newly, all SALTEK BVL devices are equipped with special thermal sensors to identify easily the SPD´s overload by service personnel.

Fig. 1 Protection areas and the typical use of VLD-O and VLD-F (source: EN 50526-3)



VLD-O (BVL-100-120-R02) protects persons from excessively high touch voltage at railway station during normal train operation



Connection of the exposed metal parts at a railway station to the return circuit by the VLD-F (SCG-250-75-R01)

Newly, Saltek offers a special monitoring device for remote supervision of VLD class 1 and 2 with an integrated fault detector. In addition to the ability to monitor current values of voltage, current and VLD status, this system also offers the option of forced shutdown of Class 2 VLDs. This is a welcome option for applications where minimizing stray currents is a priority.

Typical applications of VLD

- **"Rail grounding"** of catenary masts: VLD class 1, type SCG-250-500-R01. Connection principle is shown in Fig. 2.
- **Protection of persons and animals** by connecting exposed conductive parts in a railway stations and switching stations to the return path: VLD class 2.2, e.g. type BVL-50-120-R02 or BVL-100-120-R02 and VLD class 1, type SCG-250-75-R01, if VLD-F is enough for protection (e.g. stations not far from substations). An example of a possible use is shown in Fig. 2.
- **Standard recommended an application of VLDs into TN systems for DC railways** (e.g. Metro, trams etc.) is shown in Fig. 3 (application into TT systems is similar).
- **In 750 V DC systems the application of A2-arresters** is recommended in substations and also in the first substation behind a tunnel mouth (where the track changes from above ground to tunnel) – Fig. 4.

Fig. 2 Typical installation of VLDs along the railroad.

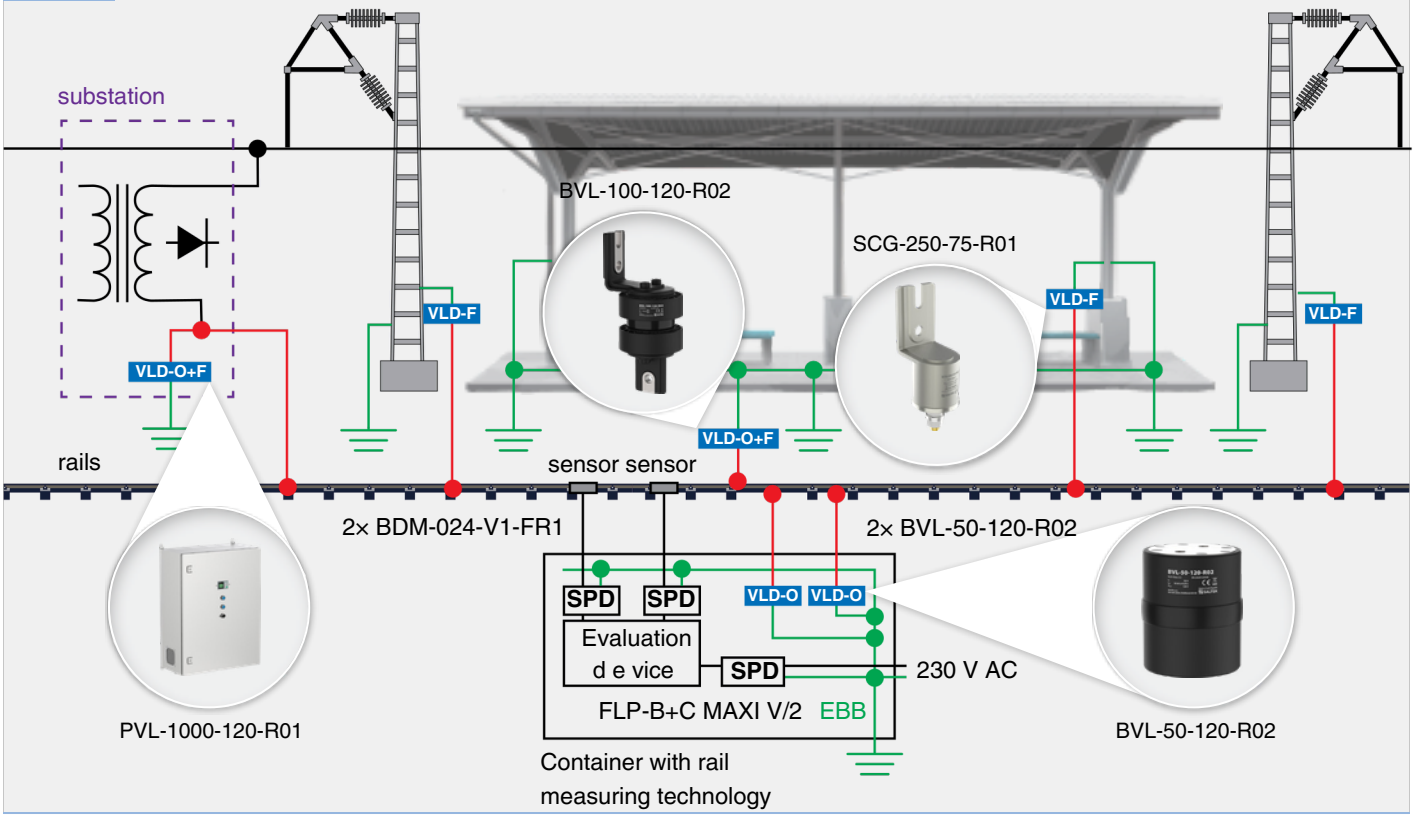
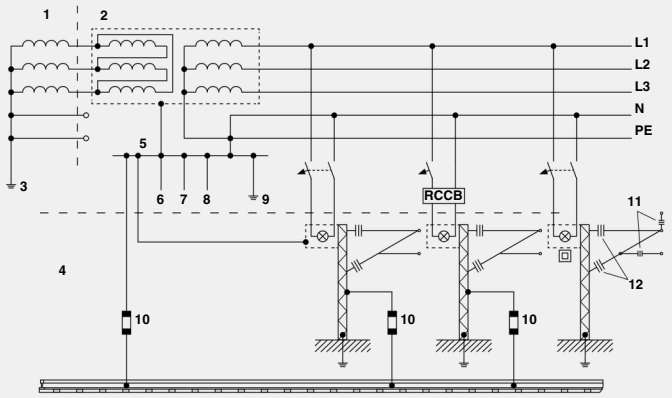
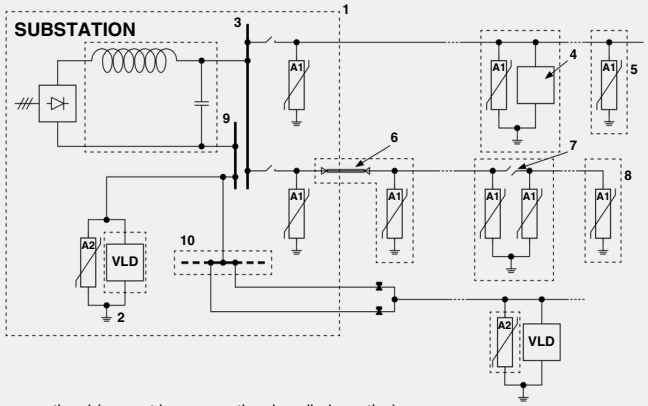


Fig. 3 Standard recommended application of VLDs to TN systems for DC railways (source EN 50122-1 ed.1)



1 electricity supply network
2 railway network
3 public earth
4 overhead contact line and current collector zone
5 MEB
6 water and gas pipes
7 heating
8 lightning protection
9 railway structure earth
10 VLDs
11 1st insulation
12 2nd insulation
(only for LV traction systems)

Fig. 4 Diagram of an application of surge arresters and voltage limiting devices (preferred in 1.5 and 3 kV systems) source EN 50526-3



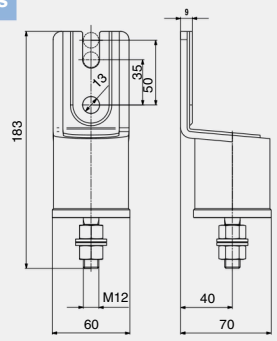
--- optional (present in some national applied practice)
1 limit of the substation
2 substation earth
3 main busbar
4 equipment connected to the line protected by arrester A1
5 on bridges or on elevated lines
6 insulated cable
7 section insulator
8 end of section
9 return busbar
10 collector

SCG-250-...-R01

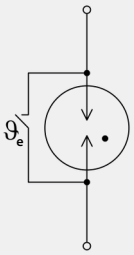
Voltage limiting device VLD class 1, VLD type F

- the VLD is used to restrict excessive high touch voltages arising on an exposed conductive parts of a railway equipment in case of a failure (short circuit) in AC and DC railway electric traction systems, thus ensuring protection to persons that may come into a contact with the parts mentioned
- in the event of a failure connection between a live power supply part of the traction system and an exposed conductive part (e.g. due to the overhead contact line fall) the VLD protects the parts affected by causing conductive itself, which results in turning off of the power supply
- the SCG is connected between the protected part and the return circuit
- in case of an overload caused by overcurrent in excess of a limit, that may cause harm to the protective element, the internal short-circuiting device intervenes by establishing a permanent short circuit across the protective element
- the integrated surge arrester effectively eliminates high impulse overvoltage induced into the traction mains or railway equipment by a lightning strike
- easy mounting, installation right away on the protected equipment

Dimensions



Wiring diagram



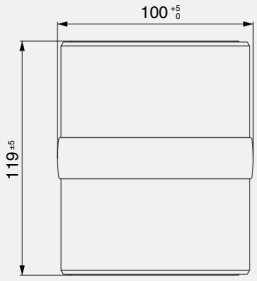
Technical data		SCG-250-075-R01	SCG-250-250-R01	SCG-250-500-R01	SCG-250-750-R01
Rated current @ 60 min	I_r	250 A			
Short time withstand current @ 60 ms	I_w	1 kA			
Short circuit current @ time	I_{scc}	5 kA @ 300 ms			7 kA @ 100 ms
Leakage current at Uw	I_L	< 1 µA			
Nominal triggering DC voltage	UTn (te, max)	75 V	250 V	480 V	750 V
Instantaneous triggering voltage	U_{Ti}	75 V	250 V	480 V	750 V
Non-triggering voltage	U_w	45 V	130 V	260 V	500 V
Maximum residual voltage at Iw	U_{res}	30 V	80 V	100 V	115 V
Maximum residual voltage at Ir	U_{res}	15 V	25 V	35 V	40 V
Lightning current impulse (8/20 µs)	I_{imp-n}	100 kA			50 kA
High current impulse (8/20 µs)	$I_{imp-high}$	100 kA			50 kA
High charge impulse (10/350 µs)	I_{imp-hc}	50 kA			25 kA
Response time	T_R	10 µs			
Range of operating temperatures		–40 °C … +70 °C			
Mounting on		Surface			
Degree of protection (EN 60529)		IP 67			
Weight		0,84 kg			
According to standards		EN 50122-1:2011, EN 50526-2:2014			
Ordering number		A06153	A06154	A06155	A07413

BVL-50-...-R02

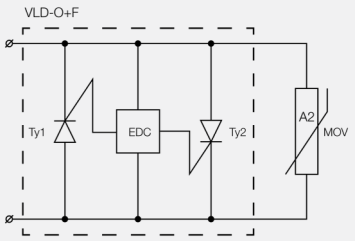
Voltage limiting device
recoverable VLD of class 2.2 (bi-directional), type VLD-O+F, limiting of occurrence non-permissible touch voltages, causing temporary equipotential bonding and limiting of overvoltage of a railway system DC, the surge arrester type A2 integrated

- limits non-permissible high touch voltages on non-live metal parts of a railway equipment in DC railway system
- establishes temporary connection between the return circuit and the earth of the railway electric traction system, during the permissible value of voltage is exceeded
- high mid-time withstand current (repeatable) for any VLD-O operation situation (see graph below)
- limits touch voltage and protects persons that might enter into contact with the parts affected
- eliminates high impulse overvoltages induced into the railway electric traction system or the railway equipment by a lightning strike
- overload indicators for easy replacement

Dimensions



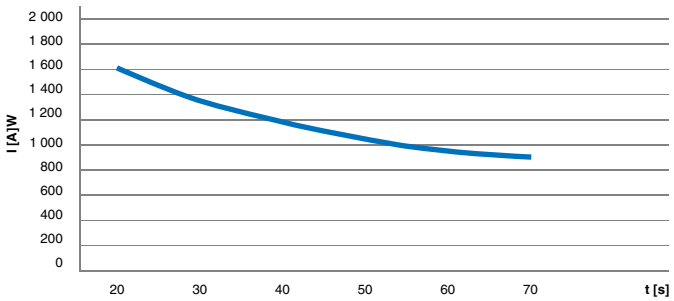
Wiring diagram



Technical data		BVL-50-45-R02	BVL-50-60-R02	BVL-50-120-R02
Rated DC (ACrms) current @ 60 min	Ir		50 A	
Short time DC withstand current @ 30 ms	Iw		16 kA	
Short time DC withstand current @ 100 ms	Iw		9 kA	
Short time AC (rms) withstand current @ 36 ms	Iw		15 kA	
Short time DC withstand current @ 100 ms non-recoverable (VLD-F mode)	Iw		23 kA	
Leakage current at Uw	IL	< 50 µA	< 70 µA	< 120 µA
Non-triggering voltage	Uw	36 V	48 V	100 V
Nominal and Instantaneous triggering voltage	UTn, UTi	45 V	60 V	120 V
Maximum residual voltage at Ir / at Iw	Ures		1,2 V / 5,0 V	
Maximum residual voltage at Iimp-n	Ures		700 V	
Lightning current impulse (8/20 µs)	Iimp-n		50 kA	
High current impulse (8/20 µs)	Iimp-high		75 kA	
High charge impulse (10/350 µs)	Iimp-hc		35 kA	
Response time of A2 surge arrester / thyristors			25 ns / 1,5 ms	
Range of operating temperatures			–40 °C … +70 °C	
Degree of protection (EN 60529)			IP 67	
Weight (w/o terminals)			2,1 kg	
According to standard			EN 50526-2	
Ordering number - BVL body **			A06711	
		A06710		A06712

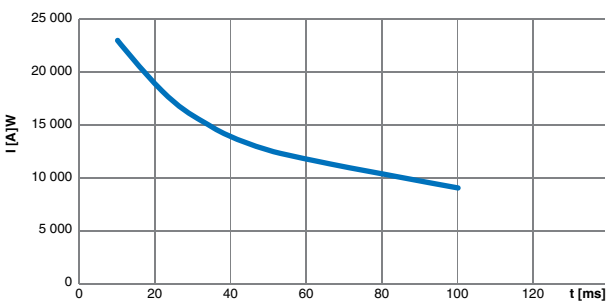
* recoverable values (VLD-O mode) unless otherwise stated
** any combination of body and two terminals is mandatory for the stated technical data

Maximum long term current versus time, recoverable (DC)



Values for body with L-terminal combination and ambient temperature 25 °C.

Maximum short time current versus time, recoverable (DC)

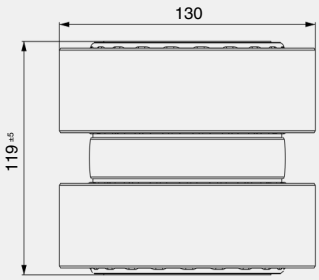


BVL-100-...-R02

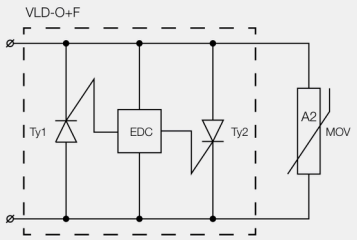
Voltage limiting device
recoverable VLD of class 2.2 (bi-directional), type VLD-O+F, limiting of occurrence non-permissible touch voltages, causing temporary equipotential bonding and limiting of overvoltage of a railway system DC, the surge arrester type A2 integrated

- limits non-permissible high touch voltages on non-live metal parts of a railway equipment in DC railway system
- establishes temporary connection between the return circuit and the earth of the railway electric traction system, during the permissible value of voltage is exceeded
- high mid-time withstand current (repeatable) for any VLD-O operation situation (see graph below)
- limits touch voltage and protects persons that might enter into contact with the parts affected
- eliminates high impulse overvoltages induced into the railway electric traction system or the railway equipment by a lightning strike
- overload indicators for easy replacement

Dimensions



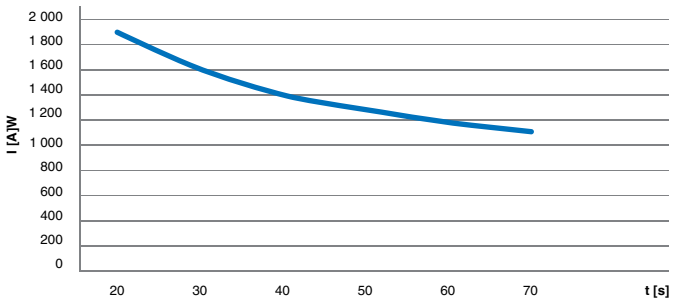
Wiring diagram



Technical data		BVL-100-45-R02	BVL-100-60-R02	BVL-100-120-R02	BVL-100-350-R02
Rated DC (ACrms) current @ 60 min	Ir	100 A			
Short time DC withstand current @ 30 ms	Iw	16 kA			
Short time DC withstand current @ 100 ms	Iw	9 kA			
Short time AC (rms) withstand current @ 36 ms	Iw	15 kA			
Short time DC withstand current @ 100 ms non-recoverable (VLD-F mode)	Iw	23 kA			
Leakage current at Uw	IL	< 50 µA	< 70 µA	< 120 µA	< 400 µA
Non-triggering voltage	Uw	36 V	48 V	100 V	300 V
Nominal and Instantaneous triggering voltage	UTn, UTi	45 V	60 V	120 V	360 V
Maximum residual voltage at Ir / at Iw	Ures	1,2 V / 5,0 V			1,2 V / 8,0 V
Maximum residual voltage at limp-n	Ures	700 V			1100 V
Lightning current impulse (8/20 µs)	limp-n	50 kA			40 kA
High current impulse (8/20 µs)	limp-high	75 kA			60 kA
High charge impulse (10/350 µs)	limp-hc	35 kA			25 kA
Response time of A2 surge arrester / thyristors		25 ns / 1,5 ms			
Range of operating temperatures		–40 °C … +70 °C			
Degree of protection (EN 60529)		IP 67			
Weight (w/o terminals)		2,9 kg			
According to standard		EN 50526-2			
Ordering number - BVL body **		A06713	A06714	A06715	A07477

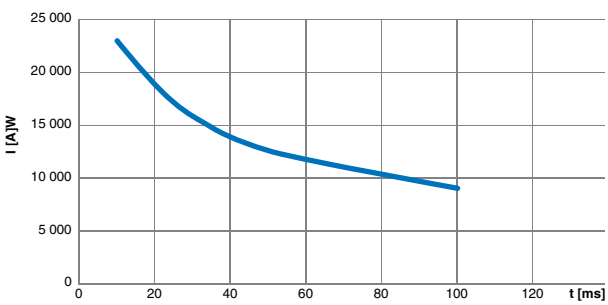
* recoverable values (VLD-O mode) unless otherwise stated
** any combination of body and two terminals is mandatory for the stated technical data

Maximum long term current versus time, recoverable (DC)



Values for body with L-terminal combination and ambient temperature 25 °C

Maximum short time current versus time, recoverable (DC)

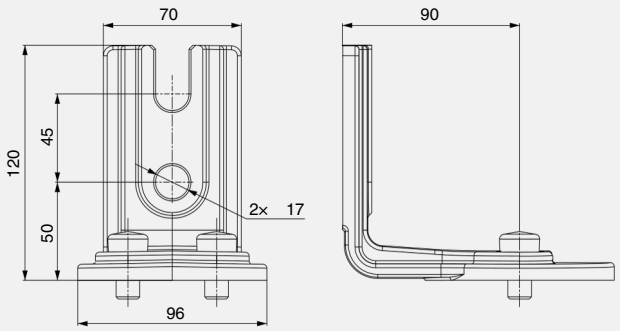


BVL-L-TERMINAL

“L” shape terminal for BVL-50-xxx or BVL-100-xxx

- Terminal for BVL series
- Montage on flat surfaces (steel construction, flat wires etc.)
- Easy montage
- Improves cooling of BVL body
- Assembly material included (for BVL body + terminal assembly)
- Weight 0,53 kg

Dimensions



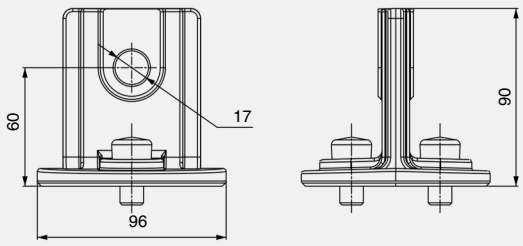
Type	BVL-L-TERMINAL
Ordering number	A06690

BVL-T-TERMINAL

“T” shape terminal for BVL-50-xxx or BVL-100-xxx

- Terminal for BVL series
- Connection to cables etc.
- Easy montage
- Improves cooling of BVL body
- Assembly material included (for BVL body + terminal assembly)
- Weight 0,37 kg

Dimensions



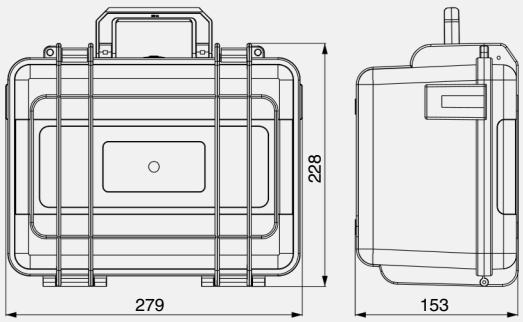
Type	BVL-T-TERMINAL
Ordering number	A06691

VT-120-S01

VLD Tester
Portable automatic tester of VLD class 2

- Fully automatic measurement
- Measurement of Non-triggering voltage and Nominal triggering voltage
- Easy test result, indicated by red/green color of LED
- Measurement of leakage current and triggering time
- For VLDs with triggering level 45/60/120V
- For VLDs with thyristor latching current < 220 mA
- Battery charger and testing cables included
- Special durable ABS case

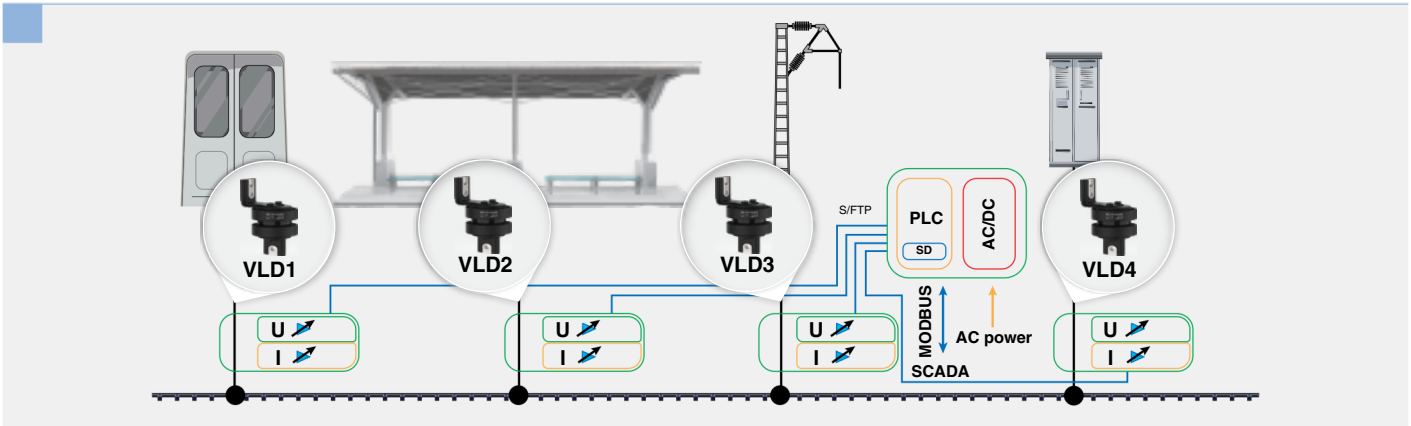
Dimensions



Technical data	VT-120-S01
Number of adjustable voltage selections (UTn)	3 (45 / 60 / 120 V)
Voltage generator range	35 – 125 V
Maximum current injection	220 mA
Automatic discharge of the measured object	No
Power supply	Li-ion 12,6 V, 6 800 mAh
Battery life / number of measurements	8 h / 100+
Charging time	4 h
Battery charger power supply	100 – 240 V / 50 – 60 Hz
Display	Blue LCD, 20 × 4 mm
Weight	2,3 kg
Range of operating temperatures	-10 °C … +40 °C
Degree of protection (EN 60529)	IP 57 (closed case), IP 20 (open case)
Meets the requirements of standard	EN 61010-1; EN 61326-1
Ordering number	A07125

Remote monitoring system of VLDs

A frequent requirement of railway traction operators is the need to have an overview of the operating status of the installed VLD and preferably also knowledge of the voltage and current status of the rail node in the SCADA supervisory system. SALTEK has therefore prepared electronic monitoring systems for more demanding customers, which allow continuous measurement, sending and recording of the actual values of voltage and current passing through the VLD and from these values a “health” of the monitored VLD can also be evaluated and remotely reported. These systems are suitable for modern traction systems, where the requirement to integrate all important technological elements of traction into the SCADA system is reflected on the one hand in maximum system reliability and on the other hand in significant operational cost savings (OPEX), which result from the possibilities of predictive traction maintenance, the possibility of immediate reaction to faults in traction subsystems and significant reduction of regular physical/ electrical inspection need of active elements of the traction system.



Forced VLD class 2 switch-off

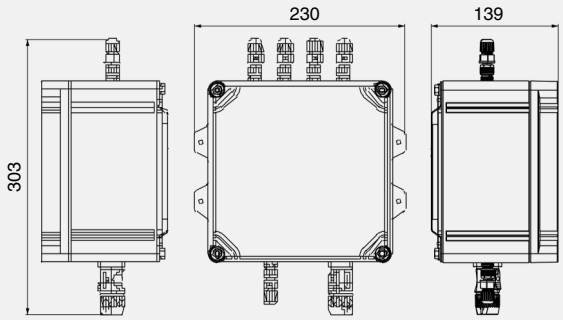
In extreme cases, where the VLD-O current load is enormous, this not only means extraordinary demands on the VLD switching elements, but at the same time it also means extremely large integrals of leakage currents, which can cause corrosion of the infrastructure alongside the rails. In such a case, until now it has been necessary to reach for very sophisticated processor-controlled Class 4 VLDs (combination of semiconductor and mechanical power contractors), which are able to software-regulate touch voltage protection and at the same time limit leakage currents (e.g. SALTEK PVL-1000). However, this situation, especially for larger systems, runs into high investment costs associated with the acquisition of VLD class 4. Therefore, for situations where significantly cheaper VLD class 2 (SALTEK BVL series) is capable of repeatedly switching even higher energy loads, SALTEK has developed special electronic circuit that is able to interrupt the current through the BVL significantly earlier than it would happen when “waiting” for the thyristor current to pass through zero (which is necessary for practically all current VLDs class 2). Based on the continuous measurement of voltage potential and current when the VLD is switched on, current levels can be determined at which the disconnection of the current channel via the VLD will no longer cause the touch voltage to rise above the permitted limit. Thus, as soon as the magnitude of the current flowing through the activated VLD decreases below a predetermined value, the current channel of the VLD can be safely forcibly disconnected. This has several positive effects – first of all, the integral of leakage currents through the activated VLD will be significantly reduced, which limits the intensity of electrochemical corrosion of the nearby infrastructure. In addition, in this way the repeatable medium-term energy loadability of the VLD will be increased, because it simply does not have to process such long current pulses and thus for relatively long periods of time, instead of accumulating additional thermal energy from the pulses it can radiate the heat accumulated from the previous pulse and thus be repeatedly ready to handle more frequent or a more intense current load. Long-term measurements have shown that in this way the volume of leakage currents through the VLD can be reduced by 30 to 40 per cent. Although it is not a primary parameter of this VLD control method, shortening the current pulses also reduces the traction system’s electricity consumption (up to 1 MWh/year per installed VLD).

EM-VLD-…

Remote monitoring system of VLD
Central processor unit for up to 4 sensors (VLDs) management

- Fully automatic monitoring of VLD class 2
- Remote connection to SCADA via MODBUS (TCP/IP)
- Online voltage and current measurement
- Automatic check of VLD “health”
- Up to 4 sensors (VLDs) connected to common processor
- Local data recording to SD card
- Forced VLD switch off to reduce stray currents (option)
- integrated web server

Dimensions



Central processor

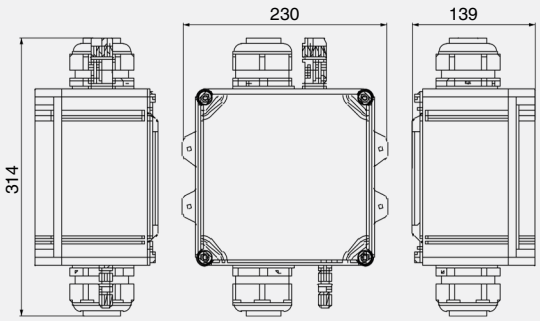
Technical data	EM-VLD-045	EM-VLD-060	EM-VLD-120
VLD triggering voltage level	45 V DC	60 V DC	120 V DC
Number of connectable sensors	Up to 4		
Power supply	85 – 264 V AC / 47 – 63 Hz		
Power consumption	< 60 W (4 connected sensors)		
Communication protocol to SCADA	MODBUS via TCP/IP		
Interfaces for sensors	M12 – 8 pin – A code		
Interface to SCADA	M12 – 8 pin – A code		
Dimensions (H × W × D)	303 × 230 × 139 mm (incl. cable connectors)		
Installation	Wall / Pole / DIN 35		
Degree of protection	IP 65		
Range of operating temperatures	-20 to +60 °C		
Ordering number	A07408	A07409	A07195

EM-VLD-500-M (-R)

Remote monitoring system of VLD
Remote monitoring sensor

- Fully automatic monitoring of VLD class 2
- Online voltage and current measurement
- Detection of VLD “health”
- Rail circuit isolation 3 kV
- Up to 4 sensors (VLDs) connected to common processor
- **Forced VLD switch off to reduce stray currents (option)**

Dimensions



Sensor

Technical data	EM-VLD-500-M	EM-VLD-500-M-R
Voltage measurement range	± 500 V DC	
Current measurement range (linear/saturation)	± 500 A / ± 1 250 A DC	
VLD forced switch off option	No	Yes
Connection to processor unit	M12 – Ethernet cable Cat.6 SFTP	
Dimensions (H × W × D)	314 × 230 × 139 mm (incl. cable connectors)	
Installation	Wall / Pole / DIN 35	
Degree of protection	IP 65	
Range of operating temperatures	-20 to +60 °C	
Power supply	From processor unit	
Ordering number	A07410	A07196

Smart VLD of class 4 (VLD-O+F)

SALTEK has in its portfolio powerful VLD products of class 4 – PVL series. In its design all the currently known requirements of elec- trified railways on powerful, modern, and interactive VLDs have been taken into consideration. In the development of this product SALTEK has chosen a unique concept based on the combination of autonomous VLD class 2.2 with electronically controlled current bypass. This allows to ensure highest possible level of reliability and personal protection in various operational and emergency situa- tions while minimising the energy of stray currents.

The integrated BVL (bi-polar VLD of class 2.2 with integrated A2 surge protection device) responds as first to the exceedance of permitted touch voltage level and is capable of channelling the high initial energy of atmospheric discharge or failure (short-circuit) cur- rent. That is a huge benefit of this concept since the basic functions of VLD-O+F are at any time ensured if a failure occurs in some part of the VLD4 (e.g. the controlling microprocessor, running software, mechanical bypass, etc.). Compared to conventional solutions with permanent short-circuit of the VLD during similar situations, when the return circuit during the maintenance or lockout is all the time connected to the ground (with stray currents leaking), the PVL remains all the time in high-impedance condition and reacts as a standard VLD of class 2, i.e., only when the safety voltage level is exceeded. Permanent short-circuit on the connecting terminals of the PVL is automatically established only in the event of power out- age or manually. Emphasis on highest operational reliability which SALTEK focuses on all its products is accentuated by the possibility of automatic power supply backup of the VLD. This may be effect- ed by integrated system of power supply sources in 1+1 automatic backup configuration, not only for AC 230 V power supply, but also for a combination of power supply from station batteries (e.g. AC 230 V + DC 48 V) or any other specific power supplies. The energy source failure is indicated remotely.

In a normal state (i.e., at the presence of auxiliary power supply) can the software logic of the control PLC, thanks to the permanent voltage and current sensing at the VLD terminals, connect the par- allel bypass to the integrated VLD 2 and in such a way increase the long-term current-carrying capacity of the system. The bypass is connected only when necessary, i.e., if the energy capacity of the solid-state VLD 2 is exceeded. This will prolong the life of the whole VLD. The possibility of forced short-circuiting of the VLD terminals, whether by forced electronic closure of the bypass from the VLD4 panel or by manually controlled mechanically lockable earthing switch can be used for a complete safeguarding of persons carry- ing out the maintenance works. Short-time and long-time limiting curves of load carrying capacity are shown in Fig. 5.

From the above maximum load curves, it is apparent that the PVL-1000 is capable of processing electric currents of up to 3,5 kA within time intervals of approx. 30 seconds (which is the average acceleration or braking time during which the VLD4 must be able to bear high current load) frequently, which sufficiently covers all traffic situations.

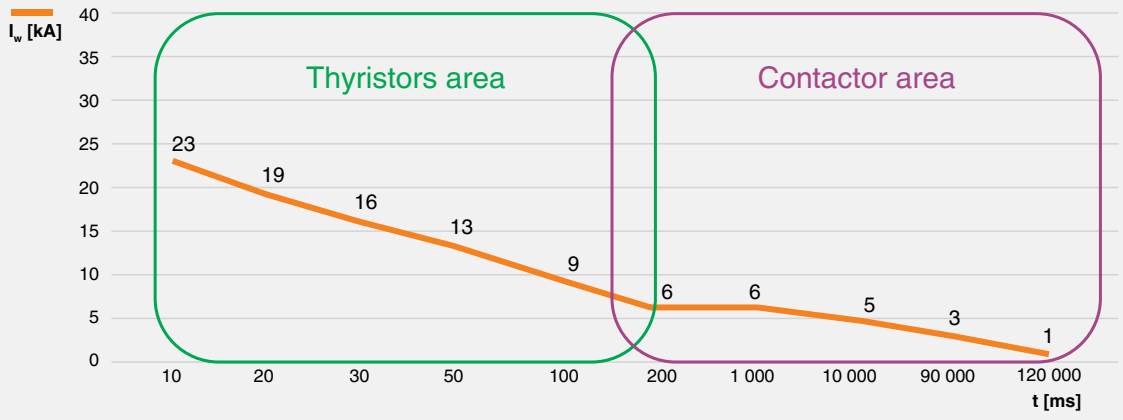
Also, the bypass breaking is controlled electronically in a way to prevent pumping (switching ON and OFF) of the current relay, and to shorten the ON time (the period during which the path for stray currents is open) to a minimum. The behaviour of the whole VLD4 is optimized by software to common operational requirements. How- ever, SALTEK is also able to satisfy specific customer needs and to adapt the VLD characteristics to the client´s specific traffic needs.

Interactivity of PVL-1000 is a significant part of modern railway equipment. Monitoring and remote control of PVL-1000 is ensured by communication with the control centre using standard Ethernet communication interface with the most commonly used MODBUS protocol (via TCP/IP). This approach makes it possible to remotely scan not only the basic state of the node (instantaneous voltage and the current flow), but also the status of some important ele- ments of the VLD and the VLD as a whole, e.g., using the SCADA system, and at the same time set the performance characteristics of the system incl. the possibility of the so-called forced modes, i.e., remote switching ON the VLD. Information thus obtained may then be analysed using software. So, the PVL-1000 may serve both as protective but also monitoring element of the traction system node. Of course, the option of manual control directly from a VLD inter- active panel is also available. Compared to many similar products the PVL-1000 stands out by its low weight and integrity, so that it is well-suited for mounting in confined spaces of container-type traction substations, railway tunnels, etc.

The PVL-1000 is typically used at places where dangerous voltage potentials may arise during acceleration or braking of heavy train- sets (in particular at a greater distance from the traction substa- tions), in systems using regenerative braking of trainsets, both as a power source for other trains or energy reconversion back into the power supply mains, in DC traction substations, in section discon- nectors, at train stops or railway stations, railway workshops, etc.

Because SALTEK offers the possibility of adapting the parameters and behaviour of the PVL-1000 to the specific needs of customers, this product is manufactured and delivered according to specific customer specifications and order, only.

Fig. 5 Withstand current of VLD4.x

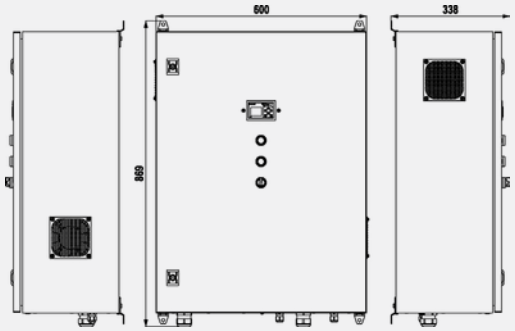


PVL-1000-...-R01 (-O)

The PVL-1000 monitors the voltage between the return circuit (rails) and earth and prevents that the voltage does not exceed the admissible values by short-circuiting both potentials temporarily and opening automatically in order to minimize stray currents.

- impermissible touch voltage protection for passenger stations, substations etc.
- optional variant PVL-1000-…-R01-**O** have built in manual bypass (manual short-circuiting device) for service use
- powerful voltage limiting device for all applications where longlasting high current can be expected during train operation (VLD-O)
- the combination of thyristors and high current contactor fulfills the requirements of both VLD-O and VLD-F protector

Dimensions



Parameter / Type		PVL-1000-045-R01(-O)	PVL-1000-060-R01(-O)	PVL-1000-120-R01(-O)
operation	Operation mode		VLD-O+F	
	Highest voltage of railway traction	Un	3 000 V DC	
	Voltage detection		Dual polarity DC / AC	
	Rated current	Ir	1 000 A @ 60 min	
	Nominal triggering voltage	Utn	45 V	60 V	120 V
	Withstand voltage	Uw	36 V	48 V	100 V
	Short-time withstand DC current @ 30 ms (repeatable)	Iw	16 kA	
	Long-time withstand DC current @ 30 s (repeatable)	Iw	3 kA	
	Short-time withstand DC current @ 1 s (repeatable) of the manual short-circuiting device	Iw	50 Ka	
	Maximal residual voltage URES at Ir = 1 000 A		<150 mV	
	Maximal residual voltage URES at IW = 16 kA		< 10 V	
	Highest short-term pulse load (VLD-F)		120 MA2s	
	Leakage current	IL at UW	< 120 µA	
	Response time of A2 SPDs	TR	25 ns	< 250 µA
	Response time of thyristors	TR	< 1,5 ms	
	Response time of the contactor	TR	≥ 200 ms (programmable)	
	Remote monitoring (SCADA)		MODBUS using TCP/IP	
impulse	High charge impulse (10/350)	Iimp-hc	30 kA	
	Lightning current impulse (8/20)	Iimp-n	30 kA	
	High current impulse (8/20)	Iimp-high	50 kA	
general	Rated power supply voltage AC 50 Hz / 60 Hz	UPSAC	110 V 115 V 120 V 127 V 220 V ± 10 % 230 V ± 10 %	
	Active power consumption in idle/switched on mode at UPSAC		10 W / 24 W 10 W / 24 W 10 W / 24 W 10 W / 24 W 12 W / 28 W 12 W / 28 W	
	Current consumption in idle/switched on mode at UPSAC		0,2 A / 0,45 A 0,2 A / 0,45 A 0,2 A / 0,45 A 0,2 A / 0,45 A 0,25 A / 0,35 A 0,25 A / 0,35 A	
	Rated power supply voltage AC 50 Hz / 60 Hz UPSDC		130 V 220 V 250 V	
	Active power consumption in idle/switched on mode at UPSDC		10 W / 24 W 12 W / 28 W 12 W / 28 W	
	Current consumption in idle/switched on mode at UPSDC		0,2 A / 0,45 A 0,25 A / 0,35 A 0,25 A / 0,35 A	
	Voltage measurement tolerance		±5 V; suppressed zero in the 0 to 5 V range	
	Current measurement tolerance		+5 A/–10 A up to 50 A; ±10 % from 50 A to 1 000 A; +10/–0 % from 1 000 A to 2 500 A; suppressed zero in the 0 to 5 A range	
	Temperature measurement tolerance Installation Altitude		±5 °C	
			Indoor	
			up to 2 000 m above sea level	
	Relative humidity		20 % - 95 %	
	Pollution degree		1 - 2 (EN IEC 60664-1), PD1 - PD3 (EN 50124-1)	
	Protection degree		IP 54	
	Operating temperature range (min/max)		–20 °C / 55 °C	
	Rated insulation voltage Main power circuit – control circuit		3,0 kV AC / 4,2 kV DC	
	Required insulation of external circuits Main power circuit		CAT III (OV3) up to UNm 150 V – 1,4 kV AC / 2,0 kV DC	
	Required insulation of external circuits Power supply circuit 100 – 230 V AC		CAT II (OV2) up to UNm 300 V – 1,5 kV AC / 2,1 kV DC	
	Required insulation of external circuits Data circuit (Ethernet)		CAT I (OV1) up to UNm 50 V – 1,0 kV AC / 1,4 kV DC	
	Cable entry		From the bottom	
	Weight		~ 50 kg	
	Meets the requirements of standards (as amended)		EN 61010-1, EN 50526-2, EN 50124-1, EN 50122-1, EN 50121-4	
	Ordering number		A07134 (A07131)	A07135 (A07132)	A07136 (A07133)

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