DEHN protects the railway infrastructure

www.dehn-international.com

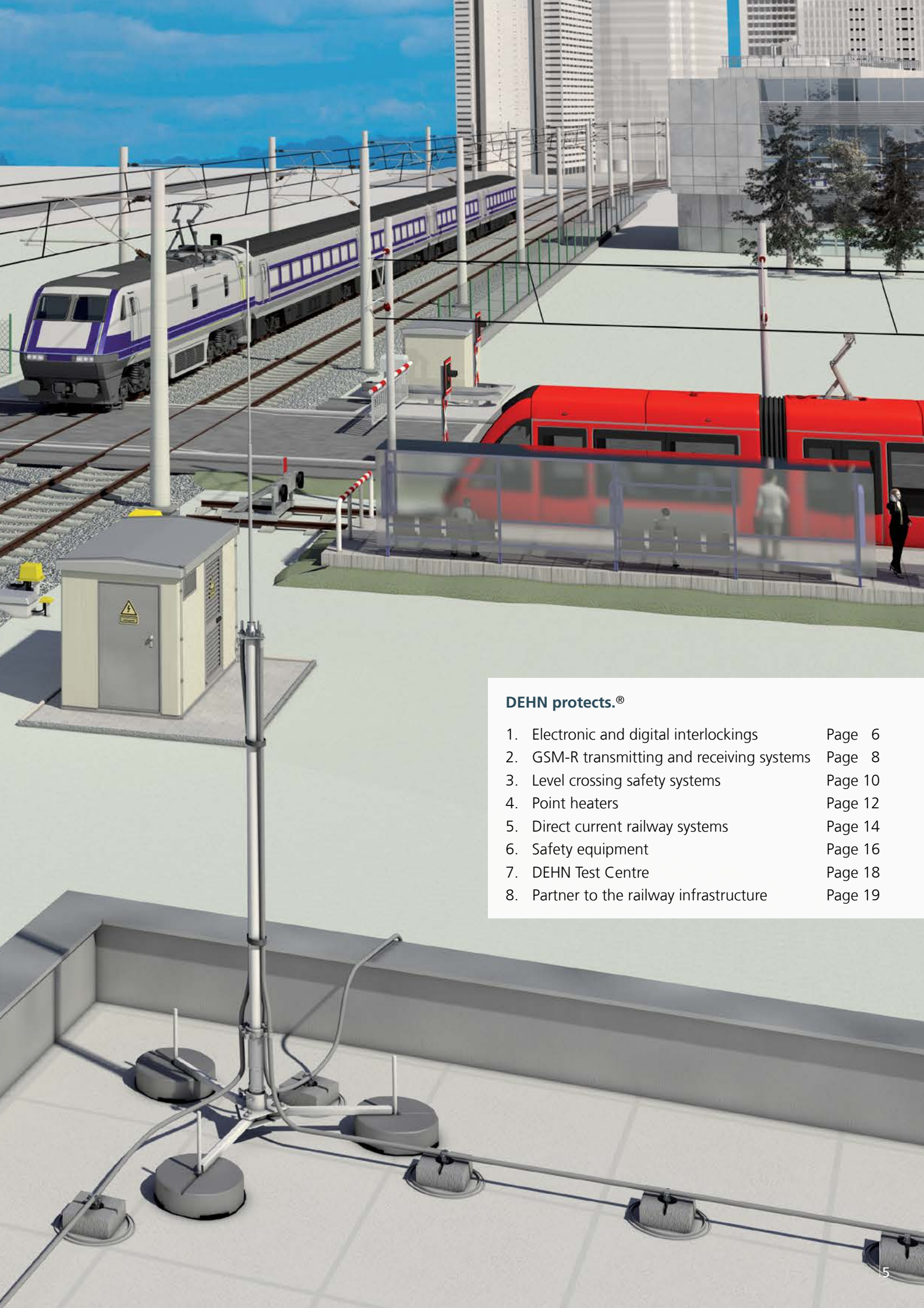
Safety and reliability through lightning and surge protection

Avoid system downtime and disruptions – with DEHN protection concepts

For more than 200 years, the railway system has connected countries and continents. It ensures mobility and has an important function as a sustainable form of transportation for passengers and goods. Current socio-political themes like the expansion of safe transport routes to congested urban areas and the desire for increased electromobility using "green" energy, have lent the railway system a constantly growing significance worldwide.

As a result, the railway infrastructure is under massive expansion in many countries. Railway lines branch out widely over great distances. In a storm, their expansiveness and exposed position make them the perfect target for lightning. Railway buildings, systems and electronic devices are also vulnerable to lightning strikes and other electromagnetic sources of disturbance. Damage is caused by direct lighting strikes in the overhead contact lines, rails or masts. The danger from indirect lightning strikes should also not be underestimated; Induced overvoltages and partial lightning currents, e.g., from a lightning strike in a nearby system, present a considerable risk. Overvoltages specific to the railway which are evoked, e.g., by switching operations or permanent interference voltage in nearby trackside cables are an additional threat. As modern control and safety technology is regulated by highly sensitive electronics, it is particularly susceptible to faults. System failure due to lightning and overvoltages leads to late trains and often high costs. However, it is possible to increase availability, even during thunderstorms, with a carefully planned lightning protection concept. As a world-renowned specialist for lightning and surge protection, DEHN provides specific protection concepts for applications in the railway infrastructure on the themes:

- External and internal lightning protection
- Surge protection
- Equipotential bonding
- Earthing
- Safety equipment



DEHN protects.®

Protection of electronic and digital interlockings

Signalling and control systems are the brain and nervous system of railway transportation systems. As the cables run alongside the tracks for many kilometres, they are particularly susceptible to electromagnetic disturbances. Time and again lightning strikes cause breakdowns in the systems controlled by the interlockings – resulting in tedious delays in the train schedule.

Although conventional interlockings with relay technology have a higher insulation and dielectric strength, system failure is not uncommon. An insulation strength of up to 5 kV is no obstacle whatsoever, even for small lightning flashes. Hence, it is only a question of time when the damage will occur. This problem is even more acute for electronic interlockings. Due to the use of electronic components with less dielectric strength, the difference between the low dielectric strength of the system and the influence of impulse voltage from lightning is increasing. In plain language, the insulating strength of the system alone is no longer sufficient.

The large-scale expansion of digital interlockings is intended to provide the solution to many future tasks like, e.g. securing the transnational migration of the ETCS[1]. A major advantage of the IP-based, digital generation of interlockings is, above all else, the establishment of central technical locations with the effect of separating energy and data. The increased vulnerability to surges is a permanent problem here, too. Individual protective measures can improve the situation, but do not always lead to the desired results because the planning is rarely comprehensive.

Effective protection of all generations of interlockings is only possible through the consistent implementation of a bespoke **comprehensive lightning protection zone concept** for the system in question. This must incorporate all system components like, e.g., point controls, track release, signalling and control technology, etc. The requirement for a lightning protection zone concept can also be found in **DB-AG-Richtlinie 819.0808** "Blitz- und Überspannungsschutz von LST Anlagen"[2]. It makes it possible to plan, execute and monitor protective measures. All aspects of external lightning protection, earthing and surge protection are considered holistically and at a cost which is economically justifiable:
DEHN plans and delivers comprehensive protection concepts tailored to the specific conditions in your interlockings – reliably and from a single source.

[1] ETCS (European Train Control System)
[2] Guideline 819.0808, Lightning and surge protection of control and signalling installations, issued by the Deutsche Bahn AG

Selection guide: Protection of electronic and digital interlockings

Application		Type		Part No.
Protection of the power supply 400/230 V, 50 + 16,7 Hz				
	Three-phase type 1+2+3 Single-phase type 1+2+3	DEHNventil®	DV M TT 255 FM DV M TT 2P 255 FM	**951 315** **951 115**
	Three-phase type 2 Single-phase type 2	DEHNguard®	DG M TT 275 FM DG M TT 2P 275 FM	**952 315** **952 115**
	Supply signal mast boxes		DG S 275 VA FM	**952 087**
	Point mechanisms (4-wire interface)		2 x DG S 275 VA FM	
	60 V consumer		2 x DG S 75 VA FM 1 x DG S 275 FM	**952 085** **952 090**
	Permanent interference voltage – link		DG S 600 FM	**952 096**
Protection of data and information technology				
	24 V consumer	BLITZDUCTOR® XT	BXT M2 BD HC5A 24	**920 296**
	Signal lamps		BXT ML4 MY 250	**920 389**
	Data bus (e.g. CAN)		BXT ML4 BD HF 5	**920 371**
	ISDN/DSL/HDSL		BXT ML4 BD HF 24	**920 375**
	Base part for Blitzductor XT		BXT BAS	**920 300**
	Condition monitoring of up to 10 BXTs	DEHNrecord	DRC MCM XT	**910 695**
Earthing				
	Components for earthing of the electronic and digital interlockings	Terminal bracket StSt V4A	AS S TE 20 7.10 FL40 V4A	**620 915**
		Earth rod StSt V4A	TE 20 1500 AZ V4A	**620 902**
		Fixed earthing terminal	EFPM M10 12 V4A L230 V2A	**478 019**
		Equipotential bonding bar	PAS 11AK	**563 200**

Protection of GSM-R transmitting and receiving systems

GSM-R stands for Global System for Mobile Communications-Railway and is the core system for communication and data transmission in the ETCS*.

Most GSM-R radio masts are in exposed locations alongside the railway tracks in order to ensure optimum radio coverage and a good transmission range. As a result, the risk of a direct lightning strike is particularly high. Professional lightning and surge protection is essential in order to maximise system availability. Insurance companies and experts regard the consideration of lightning and surge protection measures when planning and installing mobile communication facilities as an integral part of the protection of people and property. As a leading lightning and surge protection company, DEHN has decades of experience in compiling successful solutions for mobile communication facilities.

The portfolio includes components for earthing and equipotential bonding as well as lightning and surge protection.

DEHN supports everyone in the process chain: planning engineers, operators, suppliers of system technology and electricians.

The application of **DEHN solutions** achieves the following objectives:

- Personal protection
- Maximum system availability
- Protection of devices and components

* European Train Control System

Selection guide: Protection of GSM-R transmitting and receiving systems

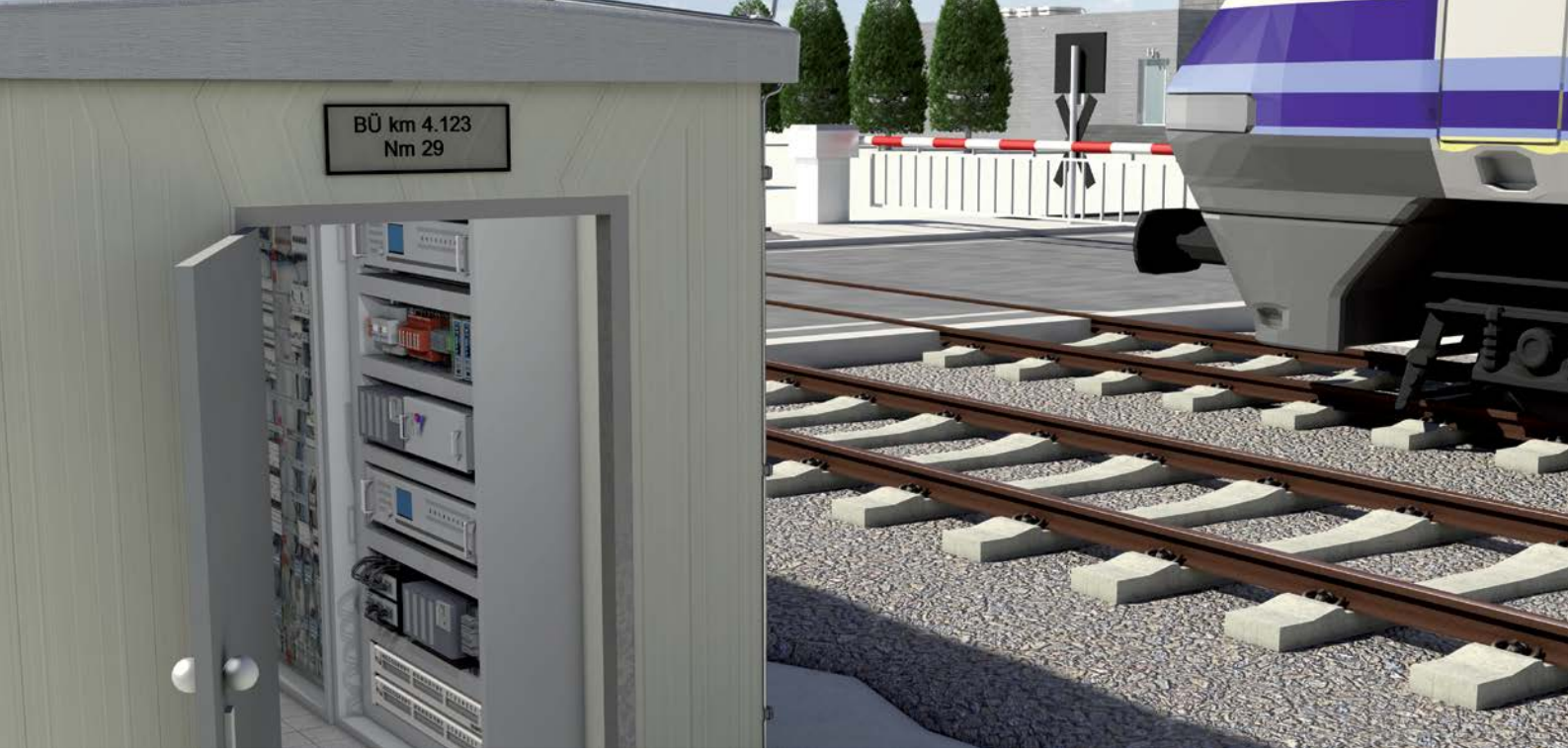
Application		Type		Part No.
Protection of the power supply				
	Base station 230/400 V AC Type 1+2+3	DEHNvap	DVA CSP 3P 100 FM	**900 360**
	Power supply Remote Radio Head 48 V DC Type 1	DEHNsecure	DSE M 1 60 FM DSE M 2P 60 FM	**971 126** **971 226**
Protection of data and information technology				
	Telecommunications lines	BLITZDUCTOR® XT	BXT ML4 B 180 BXT BAS	**920 310** **920 300**
	GSM-R 7/16 connector	DEHNgate	DGA LG 7 16 MFA	**929 146**
	Radio link PoE (IP66/IP10)	DEHNpatch	DPA CLE IP66 DPA M CLE RJ45B 48	**929 221** **929 121**
Earthing, external lightning protection				
	Components for external lightning protection and earthing mast sites (rooftop installations)	Equipotential bonding busbar HVI long conductor Earth rod StSt V4A	PAS I 10AP M10 V2A HVI RIV 75 23 L6M GR TE 20 1500 AZ V4A	**472 219** **819 223** **620 902**

Protection of level crossing safety systems

Level crossings are now, more than ever, neuralgic points whose protection requires maximum reliability. Level crossings systems ensure that intersections where a railway line crosses a road or path at the same level are safe. Modern level crossing systems can either be integrated in an interlocking or function autonomously. Nowadays, they are equipped with fully electronic high-performance control technology and are, therefore, particularly vulnerable to disturbances such as direct lightning or surges. As level crossings cover a wide area, the peripheral elements are often a considerable distance away from the switching house. Field impulses triggered by lightning strikes can generate induction voltage in conductor loops and switching circuits which far exceeds the insulation strength of the electronic/electric devices in use.

With its wide product portfolio for lightning and surge protection, DEHN has the optimum prerequisites for creating bespoke solutions for level crossings. To ensure that these systems also function reliably during thunderstorms DEHN, in cooperation with manufacturers of level crossing safety systems and the DB Netz AG, has developed a special protection concept which offers you the following benefits:

- Approved by the Federal Railway Authority (Eisenbahn-Bundesamt)
- Laboratory-tested protection solutions
- Personal protection due to maximum safety
- Maximum system availability
- Remote signalling of arresters to be replaced
- Device and component protection
- Space-saving protection elements



Selection guide: Protection of level crossing safety systems

Application		Type		Part No.
Protection of the power supply 400/230 V, 50 + 16,7 Hz				
	Three-phase type 1+2+3 Single-phase type 1+2+3	DEHNventil®	DV M TT 255 FM DV M TT 2P 255 FM	**951 315** **951 115**
	Three-phase type 2 Single-phase type 2	DEHNguard®	DG M TT 275 FM DG M TT 2P 275 FM	**952 315** **952 115**
Protection of the DC voltage level supplied via charging rectifiers				
	24 V DC / 18 V DC 36 V DC 60 V DC Base part for BLITZDUCTOR® XT	BLITZDUCTOR® XT	BXT ML4 BD 24 BXT ML4 BE 36 BXT ML4 BD 60 BXT BAS	**920 344** **920 336** **920 346** **920 300**
Protection of status monitoring				
	Condition monitoring of up to 10 BXTs	DEHNrecord	DRC MCM XT	**910 695**
Permanent interference voltage – link				
	MOV arrester, U_C 275 V AC GDT arrester, U_C 255 V AC	DEHNguard® DEHNgap	DG S 275 FM DGP C S FM	**952 090** **952 035**
Earthing				
	Components for earthing level crossing safety systems	Earth rod StSt V4A Voltage-limiting device Mast adapter	TE 20 1500 AZ V4A SDS 1 MA SDS M12	**620 902** **923 110** **723 199**

Protection of point heaters

Points ensure that the train keeps going in the right direction. Electric point heaters are used to make sure that the points also function properly when there is snow and ice so that railway traffic is not disrupted. At 10-20 kW, the heating output is comparable with that of a single-family home. The stock rails, locking box, moveable frogs and point blades are all heated. A measuring sensor detects all relevant environmental data like precipitation and temperature. This information is collected and evaluated in a control cabinet. The point heating is only activated when the weather conditions require it.

The electricity supply comes either from the public mains or, preferably, from the traction power system (overhead contact line). When fed via the overhead contact line, the corresponding high-voltage transformer cells also need to be fitted out: working according to the 5 safety rules requires, among other things, voltage detectors to check that no voltage is present and EaS devices for earthing and short-circuiting the system.

A well-functioning **lightning protection zone concept** must be drawn up to prevent lightning, surges and electromagnetic interference from disabling the complex point heating system. The lightning protection zone concept makes it possible to plan, execute and monitor protective measures. All aspects of external lightning protection, earthing and surge protection are considered holistically and at a cost which is economically justifiable to ensure that the relevant devices, facilities and systems are reliably protected.

As a leading lightning and surge protection company, DEHN supports all those involved in the construction of point heaters. Reputable companies which build point heater systems have long been placing their trust in DEHN's know-how and protection concepts.

Advantages of the DEHN protection solution:

- Disturbance-free rail traffic thanks to high availability of point heater systems
- Lightning protection zone concept: lightning protection, earthing and surge protection all from one source
- Safety equipment: voltage detectors and EaS devices, incl. approval of the Deutsche Bahn to equip their high-voltage transformer cells, are available
- Worldwide service and support

Selection guide: Protection of point heaters

Application		Type		Part No.
Protection of the power supply				
	Mains 400/230 V, 50 Hz AC Traction power 462 V, 16.7 Hz Type 1+2+3	DEHNventil®	DV M TT 255 FM	**951 315**
Protection of the heating circuit				
	Three-phase 400/230 V, 50 Hz AC Single-phase 230 V, 50 Hz AC Type 2	DEHNguard®	DG M TT 275 FM DG M TT 2P 275 FM	**952 315** **952 115**
Protection of data and information technology				
	RS 232 RS 485 I / O interfaces 24 V Base part for BLITZDUCTOR® XT	BLITZDUCTOR® XT	BXT ML4 BD 12 BXT ML4 BD HF 5 BXT ML4 BE 24 BXT ML4 BD 24 BXT BAS	**920 342** **920 371** **920 324** **920 344** **920 300**
	Ethernet / PoE	DEHNpatch	DPA M CLE RJ45B 48 DPA CLE IP66	**929 121** **929 221**
Earthing				
	For earthing point heaters	Earth rod StSt V4A	TE 20 1500 AZ V4A	**620 902**

Protection of direct current railway systems (tram, urban railway, underground railway)

The constant growth of urban centres worldwide necessitates further expansion of local public transport. Direct current urban and underground railway systems are becoming more important and being extended. Different DC voltages from 220 to 3000 V require special protective circuits. A specific characteristic in direct current railway systems is the **insulated track installation**. Prior planning of the earthing and the clever application of selected earthing components can defuse potential problems, like adverse stray current corrosion, in advance.

However, as well as earthing the tracks, special attention should also be paid to the **earthing of shelters** (stops): if a lightning flash finds its way to earth in this area, there may be increased step voltage with fatal results! In order to comply with the duty to ensure public safety, measures must be taken to eliminate this risk by way of precise potential control using special mesh mats.

Similarly, in the event of certain faults like, e.g., when an overhead contact line breaks, impermissibly high touch voltage may occur and directly endangering people. So-called **voltage-limiting devices** are installed to prevent the occurrence of dangerous overvoltages between the insulated tracks of electric railways and the earthed system parts. EN 20122 also refers to the application of these devices for so-called "open traction system earthing". Their job is to permanently connect system parts in the overhead contact line and the pantograph zones with the return circuit as soon as the threshold voltage is exceeded. An example from the DEHN solutions portfolio is the lightning resistant voltage-limiting device SDS 5. This device is capable of returning to its initial state after discharging the impulse current

We support you with our tried and tested concepts: so that people and systems are protected against the perilous effects of lightning and surges at all times.

Selection guide: Protection of direct current railway systems

Application		Type		Part No.
Protection of the power supply				
	Mains 600 V DC + 750 V DC Mains 1500 V DC Mains 3000 V DC	DEHNtrack	DTR 1.2 10 3 DTR 2.4 10 3 DTR 4.8 10 3	**990 301** **990 302** **990 304**
	Mains 400/230 V, 50 Hz AC Traction power 462 V, 16.7 Hz Type 1+2+3	DEHNventil®	DV M TT 255 FM	**951 315**
	Three-phase 400/230 V, 50 Hz AC Single-phase 230 V, 50 Hz AC Type 2	DEHNguard®	DG M TT 275 FM DG M TT 2P 275 FM	**952 315** **952 115**
Protection of data and information technology				
	I / O interfaces 24 V	BLITZDUCTOR® XT	BXT ML4 BE 24 BXT ML4 BD 24 BXT BAS	**920 324** **920 344** **920 300**
Earthing				
	To protect against touch voltage VLD-F	Voltage Limiting Devices Mast Adapter	SDS 5 + MA SDS M12	**923 119** **723 199**
	To protect against step voltage	Grid Mat Connecting Clamp Earth rod StSt V4A	GMA 250 2000X1000X4 V4A UEK 8.10 AQ3/4 M8 V4A TE 20 1500 AZ V4A	**618 214** **540 270** **620 902**

Safety equipment and live working

DEHN's **safety equipment portfolio** comprises safety devices and personal protective equipment for working according to the five safety rules in the area of electrified tracks and associated railway buildings. DEHN has the right safety devices irrespective of whether they are used on overhead contact wires, in substations, in indoor installations or for direct current railway systems and regardless whether the applications are DC or AC or the frequency 50 or 16.7 Hz.

Whether voltage detectors, telescopic earthing sticks for the traction system earthing, or earthing and short-circuiting devices: all the products have been tried and tested and, for the most part, approved by the Deutsche Bahn with material and drawing numbers.

Safety also means wearing **personal protective equipment (PPE)** which is certified and tested in accordance with the standard.

Whilst also being comfortable to wear, this equipment primarily offers protection against thermic and mechanical risks. **Live working** increases the availability of the railway infrastructure. Systems do not need to be switched off because work can be carried out during operation. Suitable and certified equipment, tried-and-tested technology and qualified personnel all make live working a safe method.
Live working is one of the services DEHN offers operators. As a manufacturer of safety devices, we always have the most modern equipment and the latest knowledge about the current normative situation at our disposal.
Provided that live working is already generally approved by the company, all we need is an order and our specially trained, certified installers will do the rest, professionally and punctually:
Cleaning under live conditions
Refilling cable sealing ends
Measuring out and installing insulating protective shutters

Take advantage of the DEHN "live working" service:

- System remains in operation – higher system availability
- Save the cost of kitting out and training your own employees

Selection guide: Safety equipment and live working

Application		Type		Part No.
For testing the overhead contact lines of electric railways Nominal voltage 15 kV / 16.7 Hz		PHE voltage detector kit	PHE 15 16.7 6T TA	**766 617**
				
Kit for overhead contact lines for transport in motor vehicles		EaS set for railway applications	BEV OL NPF PKW K	**750 196**
				
For cleaning the windscreens of electric locomotives		Insulating stick kit	IS 25 ZK RK 3160	**766 340**
				
	For the periodic inspection and documentation of electrical installations and equipment	Wireless inspection camera	SET DIGIK	**766 390**
	Fixed arc fault protection system to protect people and installations from arc faults	DEHNshort	DSRT QD II	**782 002**
	Protective hood for the face, head and neck where there is a risk or an arc fault	DEHNcare	APHO	**785 760**

DEHN Test Centre

Our test centre with a floor space of 800 m² is equipped with the latest devices and technologies to perform lightning current tests on products, installations and systems. Our lightning impulse current laboratory, which is part of our test centre, is able to generate lightning currents with a peak value up to 400 kA (10/350 µs) making it one of the most powerful of its kind in the world. DAkkS* accreditation confirms that the DEHN Test Centre has both the technical prerequisites and the high level of competence to conduct those tests described in the scope of accreditation. This is based on the relevant national and international standards.

The services of the DEHN test laboratory include:

- Test of surge protective devices and external lightning protection components
- High-voltage test with lightning impulses
- Complete lightning current tests for low-voltage distribution boards and signalling systems
- Surge immunity test for telecommunications systems

Labour protection legislation requires periodic inspections:

Electrical work equipment must be safe. This is the responsibility of the employer. Defective work equipment endangers employees and, time and again, causes accidents. For this reason, the German labour protection law calls for regular tests. "Periodic inspections" aim to ensure that voltage detectors and EaS devices are in impeccable condition.

Have your equipment tested regularly at the DEHN service centre:

- We test your **voltage detectors** in our high-voltage test laboratories
- Non-destructive testing of your **EaS devices**; if desired, we come to you
- Includes documentation of test via marking on the device itself and in a separate test report
- A further advantage:
- We test models from **all manufacturers**!

* German Accreditation Body

Source: PINTSCH BAMAG

DEHN protects.®
Experienced, reliable and globally active

DEHN has been at home in many areas of railway technology for decades now. We see it as our job to make systems and applications continually safer and more efficient. This is why we maintain a close educational partnership with the VDEI (Verband Deutscher Eisenbahn-Ingenieure e. V. – Association of German Railway Engineers).

Many renowned companies in the railway infrastructure sector put their trust in sophisticated DEHN technology.

A selection of safety-conscious partners can be found below:

- AREX Sp. z o.o., Gdynia (Polen)
- BBR Verkehrstechnik GmbH, Braunschweig
- ESA Elektroschaltanlagen Grimma GmbH, Grimma
- Firmengruppe Max Bögl, Neumarkt i. d. OPf.
- PINTSCH ABEN B.V., Maarssen (Niederlande)
- PINTSCH BAMAG Antriebs- und Verkehrstechnik GmbH, Dinslaken
- Rail Power Systems GmbH, München
- Scheidt & Bachmann GmbH, Mönchengladbach
- Siemens Mobility GmbH, Braunschweig
- SPITZKE SE, Großbeeren
- STRABAG Rail Fahrleitungen GmbH, Berlin
- Verband Deutscher Eisenbahn-Ingenieure e. V. – VDEI, Frankfurt am Main

www.dehn-international.com/partners

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