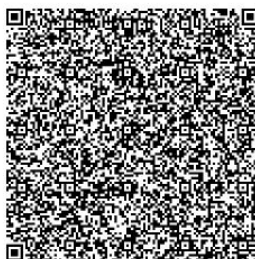




# SCHALTBAU

Connect · Contact · Control



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# 1

Brochure | Connectors









# Reliable connections

When climbing in the mountains strength and endurance play as important a role as communication between partners. Used for industrial applications, our connectors transmit power and information. We connect technical equipment that is to function without failure.

Schaltbau connectors provide for reliable signal transmission – safe from moisture and dust, the extremes of temperature, shock and vibration, or electromagnetic influences.

More information at



## Technical terms :: Connectors

**Connector** A component which terminates conductors for the purpose of providing connection and disconnection to a suitable mating component.

### Connector with breaking capacity (CBC)

Connector specially designed to be engaged or disengaged in normal use when live or under load. The term 'live' is used if contacts are under an applied voltage, but not necessarily carrying current. The term 'load' is used if a current is flowing through the contacts (IEC 61984 3.2). Replacing the term: plug and socket device (PSD).

**Modular connector** Connector of modular design that can be adapted to various applications.

**Contact arrangement** The gauge, number, spacing and arrangement of contacts in a connector. Contact arrangement selections are based on the current and voltage requirements of the application, and the space available for the connector package

**Polarization** A mechanical mechanism that allows connector halves to intermate in only one specific orientation. This can be accomplished by asymmetrical shapes of the two halves as in a D-Subminiature connector, insulator rotation, keys, keyways, ramps, or other means. Polarization prevents connectors of the same sex and/or same layout from intermating when this is undesirable, such as when two otherwise identical connectors are used on the same panel. Polarization is typically done by the assembler and can not be changed by the user.

**Contact holder** The individual contact elements are accommodated by the contact holder, which acts coincident as an insulator. Contact holder and connector housing may be one part.

**Contact cavity** A defined hole in the connector insulator into which the contacts fit. The cavities are generally marked with a unique designation or number for ease of identification.

**Contact** The element in a connector that makes the actual electrical connection. Also the parts of a connector that actually carry the electrical current, and are touched together or separated to control the flow. In Schaltbau connectors high-quality contacts are used:

- Screw-machine contacts
- Spring-loaded contacts

**First-make last-break contact** A contact which is longer than a standard contact or which sits in the insulator in such a way that it mates with the opposing connector half before any of the other contacts. Used to ensure that a ground connection between the connector halves mates before, and breaks after any of the other contacts.

**Termination techniques** Methods for connecting a wire to an electromechanical component, e.g. solderless connections according to IEC 60352, such as crimped, clip, wrapped, press-in, insulation displacement, spring clamp or screwed and soldered connections.

**Crimped connection** A solderless electrical connection made by crimping. The crimping zone of the crimp barrel with the conductor inside is deformed or re-shaped by means of a crimping tool to establish a firm gas-tight connection between contact and conductor. Solid or stranded wires can be crimped. The production of crimped connections can be effected by hand crimping tools or by semi-automatic or fully automatic crimping machines. Stripping of wires and crimping can be accomplished in one step.

**Soldered connection** An electrical connection made by soldering. It is a limited detachable connection technique. Solder contacts are normally bonded into the insulator and cannot be removed by the user.

**Screw connection** In a screw connection the stripped wire is clamped to the termination of the connector by a screw. This clamping screw may act both in the longitudinal axis of the conductor or transverse to it and may be loosened in a simple way.

**Coupling** Various types of coupling mechanisms exist to lock two mating connectors together:

Threaded coupling - A means of coupling by engaging threads present on the mating connector.

Bayonet coupling - A quick coupling device utilising bayonet pins riding in ramps and providing jacking and locking features with limited rotation.

Integrated locking - A quick coupling device utilising projections that lock in place.

Break-away connector - a connector designed to separate when a specified force is applied to the cable, without damage to the cable or the connector.

**Cycles of mechanical operation** Number of mating cycles prior to abrasion of the conductive contact surface and which do not result in a significant rise of the contact resistance. Tests and measurements according to IEC 60512-5 test 9a.

**Contact resistance** The electrical resistance of a mated set of contacts under specified conditions. Tests and measurements according to IEC 60512-2, tests 2a, 2b, 2c.

**Insulation resistance** The resistance of the insulation between two conductive elements, in particular, the resistance between two contacts or between a contact and a metallic housing or shield. Tests and measurements according to IEC 60512-2, test 3a.

**Electromagnetic interference (EMI)** As far as connectors are concerned, undesirable electromagnetic interference of the cables to be connected or of the environment is prevented by shielding. Shielded connectors normally provide means to connect screens of attached cables.

**Derating curve (current-carrying capacity curve)** The graphic representation of the current-carrying capacity of a component dependent on the ambient temperature. It shows which currents can be carried simultaneously under a specified ambient temperature through all contacts without the upper limit temperature being exceeded.

**Degree of protection (IP code)** A marking system to notify the degree of protection of a housing against access to dangerous parts and ingress by solid substances or water.

**Protective conductor (symbol PE)** Conductor required by some measures for protection against electric shock for electrically connecting any of the following parts:

- exposed conductive parts
- extraneous conductive parts
- main earthing terminal
- earth electrode
- earthed point of the source or artificial neutral

*Quoted from the Glossary Connectors of the brochure Connectors, edited by the German Association of the Electrotechnical and Electronic Industry e.V. (ZVEI).*

## Specifications :: Connectors

Series ▶	M1, M1 Plus, M3	G18, G28, G42, G57	GM42	GA	LV	LV-HPC
Max. number of contacts	14 + PE	48 + PE	64 + PE	14 + PE	2 + 2/2	2 + 2/2
Orientations	2 max.	5 max.	5	---	LV80/120 ... LV320/400: 6 LV500: ---	6
Rated voltage	400 V max.	400 V max.	400 V max.	400 V max.	150 V DC	150 V DC
Rated current	50 A max.	100 A max.	25 A max.	50 A max.	500 A max.	400 A max.
Contact / insulation resistance	< 3 mΩ / 1 GΩ	< 10 mΩ / > 500 MΩ	< 10 mΩ / > 5 GΩ	< 2 mΩ / > 5 GΩ	< 2 mΩ / ---	< 2 mΩ / ---
Ingress protection rating						
mated	IP67 und IP69K	IP54, IP67	IP67	IP67 and IP69K	IP23	IP23
unmated	IP67 *2	---	---	IP67 and IP69K *3	IP23	IP23
EMC	---	---	---	---	---	---
Shielding / Filter	---	---	---	---	---	---
Materials: shells/contacts						
Cable plugs	PA6.6 GF30, black	Al die cast	PA6	Aluminium, PA6.6	PBT GF30	PA6.6 GF30
Receptacle	PA6.6 GF30, black	Al die cast	PA6	Aluminium	PBT GF30	PA6.6 GF30
Contact insert	PA6.6 GF30	PA6, Duroplast	PA6, Duroplast	Duroplast	---	---
Flammability rating	UL94V-0	UL94V-0	UL94V-0	UL94V-0	UL94V-0	UL94V-0
Temperature	-50°C ... +100°C	-25°C ... +100°C	-25°C ... +100°C	-25°C ... +60°C	-40°C ... +110°C	-40°C ... +110°C
Connectors for						
Industrial application   Signal transmission	✓   ---	✓   ---	✓   ---	✓   ---	---   ✓	---   ✓
Industrial trucks   Transportation	---   ---	---   ---	---   ---	---   ---	✓   ---	✓   ---
Refer to	Page 6	Page 6	Page 7	Page 7	Page 8	Page 8

\*1 Other than UIC 558 VE

\*2 Only M1 Plus shielded up to IP67

\*3 Receptacle with pin contacts

\*4 Series B, UIC558, UIC-IT, EP, ZH, receptacle with closed lid



Schaltbau GmbH manufactures in compliance with RoHS.



The production facilities of Schaltbau GmbH have been IRIS certified since 2008.



Certified to DIN EN ISO 14001 since 2002. For the most recent certificate visit our website.



Certified to DIN EN ISO 9001 since 1994. For the most recent certificate visit our website.

Electromechanical components from Schaltbau are used in all branches of industry in which electrical systems have to be connected, contacted and controlled reliably under the harshest of conditions.

### Connectors manufactured to industry standards

#### G18, G28, G42, G57, GM42, GA, M1, M1 Plus, M3 Series

Main fields of application for Schaltbau industrial circular connectors are machinery and equipment, measuring, controlling and regulating, as well as drive, power, and traffic engineering. The rugged connectors offer a great variety of contact arrangements to suit a multitude of applications, and always provide for reliable connections.

### Connectors for signal transmission

#### NF07, NF10 Series

Schaltbau special connectors for communications engineering meet the requirements of VG 95351 and VG 96934. These circular audio miniature connectors are extremely robust and have a long design life. A technological equivalent of this connector series sets new standards for signal transmission in industrial applications.

### Charging connectors for industrial trucks

#### LV80/120, LV160/250, LV320/400, LV500, LV120-HPC, LV250-HPC, LV400-HPC Series







Schaltbau charging connectors are designed to meet the demands of contemporary battery-powered vehicles and systems. They meet the requirements of DIN VDE 0623-589 also with regard to a higher current-carrying capacity. The state-of-the-art contact technology of our charging connectors results in a permanently low contact resistance and reduced contact heating.

### Connectors for railway and traffic engineering

#### B, EP, G18, G28, G42, G57, M1, M1 Plus, M3, UIC 558 VE, UIC-IT, ZH Series

Schaltbau connectors for railway and traffic engineering can be found in many rail vehicles and special purpose vehicles where they provide for safe and comfortable operation. These include not only the connectors manufactured to UIC standards but also many connector series used for industrial applications. The heavy-duty connectors reliably transmit power and also control signals.

## Connectors :: Specifications

NF07, NF10	B	EP	ZH	UIC558	UIC-IT	Series
7 / 10	59 + PE	9 (+2)	1	22 + PE *1	8 Gigabit + 16	Max. number of contacts
5 max.	---	---	---	---	---	Orientations
50 V	500 V max.	250 V	3 kV	no PE: 25 V with PE: 115 V AC	Gigabit: 50 V Control contacts: 24 V	Rated voltage
2.5 A max.	400 A max.	35 A max.	800 A	10 A	1 A	Rated current
< 5 mΩ / > 5 GΩ	< 10 mΩ / > 100 MΩ	< 2 mΩ / ---	--- / ---	≤ 2 mΩ / > 3 GΩ	≤ 20 mΩ / > 100 MΩ	Contact / insulation resistance
IP68	IP54	IP66 and IP69K	IP54	IP69K	IP69K	Ingress protection rating
IP68	IP54 *4	IP66 and IP69K *4	IP69K *4	IP69K *4	IP69K *4	mated
✓ / ✓	--- / ---	--- / ---	--- / ---	--- / ---	✓ / ---	unmated
Steel/Aluminium	Al die cast, RAL7031	PA6.6, black	Thermoplast/Duroplast	PA6 GF30, black	PA6 GF30, yellow/black	EMC
Steel/Aluminium	Al die cast, RAL7031	Al die cast, black	Al die cast, silver	Al die cast, div.	Al die cast, yellow	Shielding / Filter
Thermoplast/Duroplast	Thermoplast/Duroplast	PA6.6 / PA6	Thermoplast/Duroplast	PA6.6 GF30	PA6.6 GF30	Materials: shells/contacts
UL94V-0	UL94V-0	UL94V-0	UL94V-0	UL94V-0	UL94V-0	Cable plug
-55°C ... +100°C	-40°C ... +85°C	-50°C ... +80°C	-50°C ... +85°C	-50°C ... +85°C	-50°C ... +85°C	Receptacle
						Contact insert
Page 9	Page 10	Page 10	Page 10	Page 11	Page 11	Flammability rating
						Temperature
						Connectors for
						Industrial application
						Signal transmission
						Industrial trucks
						Transportation
						Refer to

# Quality you can count on



## Series M

### Circular modular connectors Series M1, M1 Plus, M3

M1, M1 Plus and M3 Series universal industrial connectors are designed for safety and reliability in harsh ambient conditions.


M1 and M3 Series connectors are dustproof and water pressure-tight when mated. In addition to that, the M1 Plus Series is sealed to IP67 (immersion protected) even when not mated.

## Series G

### Circular modular connectors Series G18, G28, G42, G57

Rugged, reliable, and designed for universal use – those are the features of the G Series. Sealed to IP54 and IP67 respectively the connectors are dustproof and impermeable to splash-water. They are also resistant to the effects of most acids and alkalis as well as the extremes of temperature. Series G connectors come in 4 shell sizes and a variety of contact arrangements. The shells made of aluminium die-cast alloy and featuring bayonet or threaded coupling are highly resistant to shock, vibration and the harsh environmental conditions the connector is subjected to.

## Features

- Modular design
- Rugged shell made of impact resistant plastic
- M1 Plus: Plug and receptacle sealed to IP67 even when not mated
- Protection against accidental contact according to IEC 60664-1
- Electrical and mechanical characteristics of connectors to IEC 61984
- Germanic Lloyd
- UL listed: c  us (M1 and M3)

- Modular design
- Rugged shell made of aluminium die-cast
- Great variety of contact arrangements (2 to 48 contacts + PE)
- Mechanical endurance > 5,000 mating cycles
- Electrical and mechanical characteristics to IEC 61984

## Specifications

Series	M1	M1 Plus	M3	G18	G28	G42	G57
Number of contacts	4+PE, 6+PE	6+PE	6+PE, 8+PE, 12+PE, 7+7+PE	12 max.	24+(PE) max.	24+(PE) max.	48+(PE) max.
Orientations	2	2	2 max.	5 max.	5	5	5
Rated voltage	400 V max.	400 V max.	400 V max.	25 V	400 V max.	500 V max.	400 V max.
Rated current	4x 16 A	6x 16 A	6x 35 A, 5x 16 A + 3x 50 A 12x 16 A	16 A max.	27.5 A max.	63 A max.	100 A max.
Contacts Material Finish Terminal type	Copper wrought alloy Silver / Gold Crimp			Copper wrought alloy, brass Silver Crimp, solder, screw-type*			
Mechanical endurance	> 5,000			> 5,000			
Coupling	Threaded coupling			Threaded coupling, bayonet coupling			



### Series GM

#### Circular modular connectors Series GM42

For GM Series connectors the same contact inserts are used as with the G Series. But the shells are different. They are made of impact resistant plastic. Rugged, reliable and designed for universal use – those are the features of the GM Series. The connectors offer enhanced safety in harsh environments.

Series GM connectors are available with a great variety of contact arrangements. The connectors feature threaded coupling and are sealed to IP67.

### Series GA

#### Circular connectors Series GA

The GA Series comprises high-quality special purpose connectors. Made of metal, the series has a contact arrangement of 4 main contacts and 11 control contacts. With inserts and contacts glued in place, the receptacles are water tight even when not mated.

The functional threaded coupling prevents the contacts from touching the insulator, thus making possible a "blind" mating of the connector halves.

## Features

- Modular design
- Rugged shells made of impact resistant plastic
- Great variety of contact arrangements (4 to 64 contacts + PE)
- Electrical and mechanical characteristics to IEC 61984

- High quality metal shells
- Receptacles sealed to IP67 even when not mated
- Resistant to many aggressive liquids
- Functional threaded coupling
- Electrical and mechanical characteristics to IEC 61984

## Specifications

GM42	GA	Series
64+(PE) max.	Main contacts: 3+PE, Control contacts: 11	Number of contacts
5	1	Orientations
400 V max.	400 V max.	Rated voltage
25 A max.	3x 45 A 11x 10 A	Rated current
Copper wrought alloy, brass Silver Crimp, solder	Copper wrought alloy Silver Crimp, solder	Contacts Material Finish Terminal type
> 5,000	> 2,000	Mechanical endurance
Threaded coupling	Threaded coupling	Coupling



## Series LV-HPC and LV

### High-Power Charging Connectors for industrial trucks

Schaltbau high power connectors of the LV-HPC series meet the requirements of the DIN VDE 0623-589 standard for charging connectors featuring a higher current-carrying capacity. A red keying plug signifies operation at 120, 250 and 400 amperes for charging wet-cell batteries.

As an extension to the proven LV Series the high power connectors are ideally suited for modern fast chargers as used for industrial trucks.

Thus they cater to the needs of the material handling industry which aims at shortening charging times in order to reduce downtime and save costs.

## Series LV500

### High ampacity charging connectors for modern fast chargers

Delivering maximum performance and working in harsh environmental conditions requires reliable, durable and safe products. It is exactly these requirements that are met by the new Schaltbau LV500 Series charging connectors.

The low-maintenance and high-performance connectors fulfil the expectations of the contemporary user: Modern fast chargers recharge vehicle batteries in short time or traditionally over night.

## Features

- Keying to DIN VDE 0623-589:
  - LV-HPC: 120 A, 250 A and 400 A (keying plug: red)
  - LV: 80 A, 160 A and 320 A (keying plug: grey, green, yellow)
- High-quality cold-formed contacts
- Improved resistance to acids and extremes of temperature
- Air supply for electrolyte circulation systems
- Modular design, safety interlock
- Intermateable with LV Series connectors and those to DIN VDE 0623-589 of other manufacturers
- UL listed 
- Fast charging: High-quality cold-formed contacts capable of carrying currents up to 500 A.
- Improved resistance to acids and extremes of temperature
- Air supply for electrolyte circulation systems
- Modular design, safety interlock
- UL listed 

## Specifications

Series	LV80/120 / LV160/250 / LV320/400	LV500
Number of contacts	2 main contacts 2 aux. contacts, optional: 2 pilot contacts	2 main contacts 2 aux. contacts, optional: 2 pilot contacts
Keying	Voltagess Battery type 24 V, 36 V, 48 V, 72 V, 80 V, 96 V Wet-cell: red/grey, dry-cell: green, vehicle: yellow	---
Rated voltage	150 V DC	150 V DC according to UL583
Rated current	LV-HPC: 120 A / 250 A / 400 A LV: 80 A / 160 A / 320 A 20 A	500 A 20 A
Contacts	Copper wrought alloy Silver-plated Main contacts: w/ crimping, aux./pilot contacts: crimping	
Mechanical endurance	> 5,000	> 5,000
Coupling	Safety interlock	Safety interlock





### Multifunctional adapters for LV and LV-HPC Series

LV160/250, LV320/400 Series  
LV250-HPC, LV400-HPC

- **Pilot contact adapter:** 2 pilot contacts provide a data link between battery and charger.
- **Air tube adapter:** Air blow-in system for batteries with electrolyte circulation.
- **Multifunctional adapter:** Multi purpose adapter for water top up and electrolyte circulation systems. The new feature that the flow of air and/or water is shut off when the connector is unmated ensures that no acid particles enter the interior of the vehicle.



### Series NF

Circular audio miniature connectors  
Series NF07, NF10

The proven 7 and 10 pole circular audio miniature connectors NF07 and NF10 are especially designed for communications engineering. The modular design provides many combinations to suit your particular application. The connectors feature a high degree of protection and are water tight even when not mated.

## Features

- Water top up of battery
- Electrolyte circulation: Air blow-in system for batteries can now be shut off when connector is unmated
- Monitoring of battery by means of auxiliary and pilot contacts
- Circular audio miniature connectors to VG 95351 and VG 96934
- Optional customized filters
- Plugs and receptacles sealed to IP68 even when not mated
- Spring-loaded contacts:  
Resistant to shock and vibration
- Bayonet coupling
- Shielding  $\geq 70$  dB (10 kHz ... 10 MHz)

## Specifications

		Series
NF07	NF10	
7	10	Number of contacts
4 max.	5	Orientations
50 V	50 V	Rated voltage
2.5 A	2.5 A	Rated current
Copper wrought alloy, spring-loaded butt contacts Gold-plated Crimp, solder	Copper wrought alloy, spring-loaded butt contacts Gold-plated Crimp, solder	Contacts Material Finish Terminal type
> 5,000	> 5,000	Mechanical endurance
Bayonet	Bayonet	Coupling



## Series B

### Connectors for rail vehicles Series B

The connectors, series B, have been designed especially for the demanding railcar environment. They are superbly suited for power and control circuits on road and rail vehicles alike. An integrated interlocking circuit ensures that voltage is applied to the power circuit only when all covers are closed and all plugs have been mated or inserted into their respective dummy receptacles.

## Series EP

### Connectors to UIC 541-5 VE Series EP

The connector is designed in accordance with the specifications of the international railway standard UIC 541-5. This heavy-duty connector is designed to ensure the electrical connection within a train for the electropneumatic brakes (EP brakes) as well as an electropneumatic emergency brake override.

## Series ZH

### Connectors to UIC 552 Series ZH

The connector is designed in compliance with the specifications of the international railway standard UIC 552. ZH Series connectors with their long time proven design have been the stock items of the Schaltbau product line for the railway industry. All railway vehicles used in international service including multiple units which are equipped with a train line require ZH Series jumpers.

## Features

- Rugged mechanical and electrical design
- Universally usable connectors for power and control circuits
- Easy replacement of components
- Easy assembly resulting in short assembly times
- Mechanically locking connector
- Feedback:
  - Plug being mated: via an optional switching element integrated in the receptacle shell
  - End of train: via a pin contact in the dummy receptacle
- Rugged mechanical and electrical design
- Receptacle shell with metal handle
- Connector for power and signal transmission
- Rugged mechanical and electrical design
- Receptacle shell with metal handle
- Metal latch locking of mated plug in receptacle
- Pilot contact for feedback: optional switching element integrated in the receptacle is used for feedback signalling a plug being mated
- Optional key lock for locking receptacle and dummy receptacle

## Specifications

Series	B	EP (UIC 541-5 VE)	ZH (UIC 552)
Number of contacts	2+PE / 2+PE + 3 / 2+PE + 2 / 2+PE + 2 + 2 / 3+PE + 2 / 3+PE + 4 / 4+PE / 28+PE / 29 / 59+PE	4 + 2 + 2 + 1 (+2)	1
Orientations	---	---	---
Rated voltage	400 V max.	250 V max.	3 kV AC/DC
Rated current	Main contacts 400 A max. Control contacts 35 A max.	35 A max.	800 A (at -10°C)
Contacts Material Finish Terminal type	Copper wrought alloy Silver / Nickel Crimp / solder / screw-type	Copper wrought alloy, brass Silver / Gold Crimp	Copper wrought alloy, brass Silver Crimp
Mechanical endurance	> 5,000	> 10,000	> 5,000
Coupling	Interlock circuit (handle)	Interlock circuit (handle)	Insertion force / interlocking



### Series UIC558 VE

#### Connectors to UIC 558 VE

The connector complies with the requirements of UIC 558 VE (until 1994: UIC 568 VE). It connects lines used for remote control of lights and doors or for public address systems in passenger coaches or multiple unit trains. In addition to that, the connectors of this series are also suitable for transmission of binary data, e.g. CAN bus.

### Series UIC-IT

#### Connector UIC-IT for fast data communication

The UIC-IT Series connector is fitted with an 8 pole Gigabit Ethernet (GbE) module and 16 optional signal contacts providing a highly flexible, universal and reliable Ethernet connection option for the harsh railway environment with a design life that will last for decades.

It is designed for use with various types of rail vehicles, making it possible to combine rolling stock of different manufacturers and railway operators.

## Features

- Break-away connector for a non-destructive separation of plug and receptacle when two electrically not decoupled vehicles move apart
- Increased corrosion resistance to chemicals, in particular to detergents containing acids or alkalis
- Keying prevents connectors from mismatching with connectors carrying different inserts
- 13 pole plug interchangeable with 18 pole receptacle in accordance with UIC 558 VE
- Interface connector that offers reliable Ethernet data transmission when flexibly coupling both passenger coaches and locomotives
- Meets the requirements for closed circuit TV, travellers' and passengers' information systems, automatic passenger counters, voice control systems and diagnosis features
- 8 pole Ethernet module and 16 signal contacts for 24V

## Specifications

UIC 558 VE	UIC-IT	Series
13 / 18 / 22+PE	8 pole Ethernet insert 16 signal contacts	Number of contacts
---	---	Orientations
25 V (no PE), 115 V (+ PE)	24 V	Rated voltage
10 A	1 A	Rated current
Copper wrought alloy Silver Crimp	Copper wrought alloy Silver Crimp	Contacts Material Finish Terminal type
> 10,000	> 10,000	Mechanical endurance
Break-away connector	Break-away connector	Coupling



# Schaltbau GmbH

For detailed information on our products and services visit our website – or give us a call!

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with compliments:

## Electrical Components and Systems for Railway Engineering and Industrial Applications



**Connectors**

- Connectors manufactured to industry standards
- Connectors to suit the special requirements of communications engineering (MIL connectors)
- Charging connectors for battery-powered machines and systems
- Connectors for railway engineering, including UIC connectors
- Special connectors to suit customer requirements



**Snap-action switches**

- Snap-action switches with positive opening operation
- Snap-action switches with self-cleaning contacts
- Enabling switches
- Special switches to suit customer requirements



**Contactors**

- Single and multi-pole DC contactors
- High-voltage AC/DC contactors
- Contactors for battery powered vehicles and power supplies
- Contactors for railway applications
- Terminal bolts and fuse holders
- DC emergency disconnect switches
- Special contactors to suit customer requirements



**Electrics for rolling stock**

- Equipment for driver's cab
- Equipment for passenger use
- High-voltage switchgear
- High-voltage heaters
- High-voltage roof equipment
- Equipment for electric brakes
- Design and engineering of train electrics to customer requirements