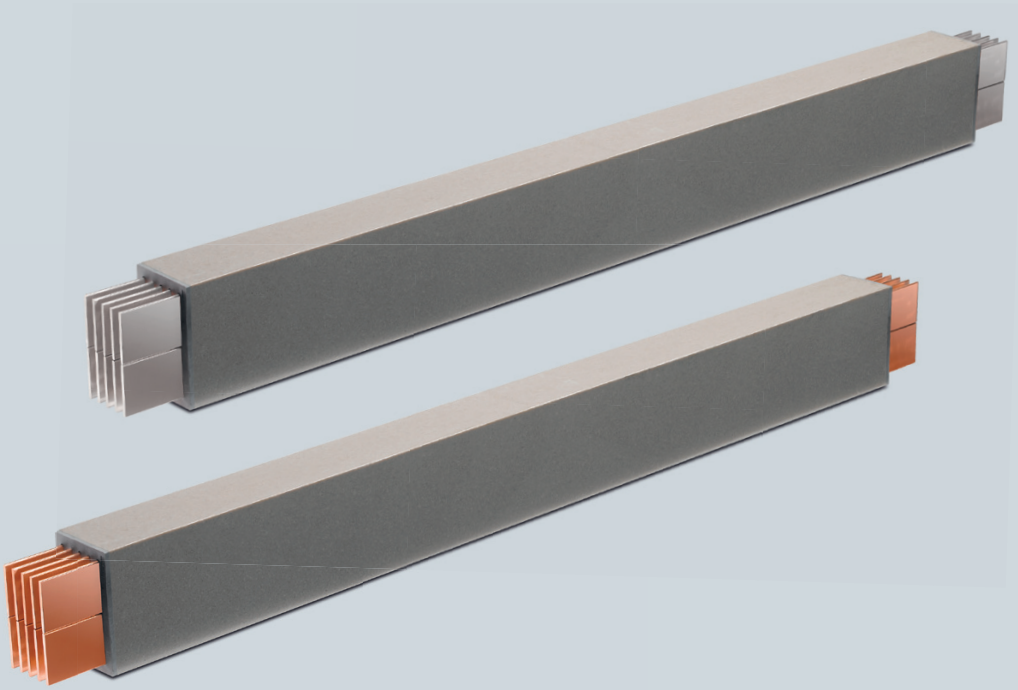
Busbar trunking system

SIVACON 8PS - Configuring with LR system

Configuration Manual · 10/2010



Low-Voltage Power Distribution and Electrical Installation Technology

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Low-voltage power distribution and electrical installation technology

Busbar trunking system SIVACON 8PS - Configuring with LR system

Configuration Manual

10/2010
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⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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Table of contents

About this documentation

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1.1 Essential contents of the documentation

What information will you find in this documentation?

This documentation contains all essential information you need to configure SIVACON 8PS LR. In this documentation you will find overview depictions and detailed and reference information. The individual chapters of this documentation offer you detailed information about:

- Safety specifications
- Design and tasks of SIVACON 8PS
- Design and tasks of the LR system
- Elements of the LR system
- Configuration phases of the LR system
- Technical data and dimensions of the LR system
- Configuring aids
- Configuration examples

1.2 Structure of the documentation

What is the structure of this documentation?

The following table briefly summarizes the structure and contents of the documentation:

Structure		Contents
Contents		The table of contents gives you access to subject-specific information.
Chapter 1	About this documentation	Here you will find information on how to use this documentation.
Chapter 2	System-specific notes	Here you will find information about standards and notes on configuration.
Chapter 3	SIVACON 8PS system description	Here you will find general information on SIVACON 8PS. This chapter also contains detailed information about the LR system.
Chapter 4	Configuring the LR system	Here you will find information about what you have to pay attention to when configuring the LR system.
Appendix		The appendix to this documentation contains additional information that will assist you during configuration.
Glossary		The glossary contains definitions of terms that require explanation.
Index		The index allows you to search selectively for specific terms.

1.3 Target group of this documentation

Target group of this documentation

This documentation is for internal use only. It will assist the following persons when configuring an LR system:

- Planner support persons
- Project planning engineers

1.4 Navigation possibilities in this documentation

Navigation possibilities in this documentation

The navigation possibilities used ensure easy and fast access to the information you need. The navigation aids are listed in the following table according to their occurrence in the documentation:

Occurrence in the documentation	Navigation aid
…at the start	Contents
…in the text	Headings Margin notes
…in the appendix	Glossary Index
...on the screen	Page overview (thumbnails) Bookmarks (hyperlinks)

1.5 Supplementary documentation

Supplementary information material

Further information material can be consulted in addition to this documentation. You can obtain the specified documents free of charge through your contact at the Siemens AG branch office.

Catalogs

Catalogue LV 70 - SIVACON 8PS busbar trunking systems CD-L, BD01, BD2 (up to 1250 A)

Brochure

E10003-E38-9B-D0010 - For safe power flows - SIVACON 8PS busbar trunking systems.

System-specific notes

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2.1 Standards and certifications

Standards

The standards listed below are applicable to the Siemens SIVACON 8PS busbar trunking system:

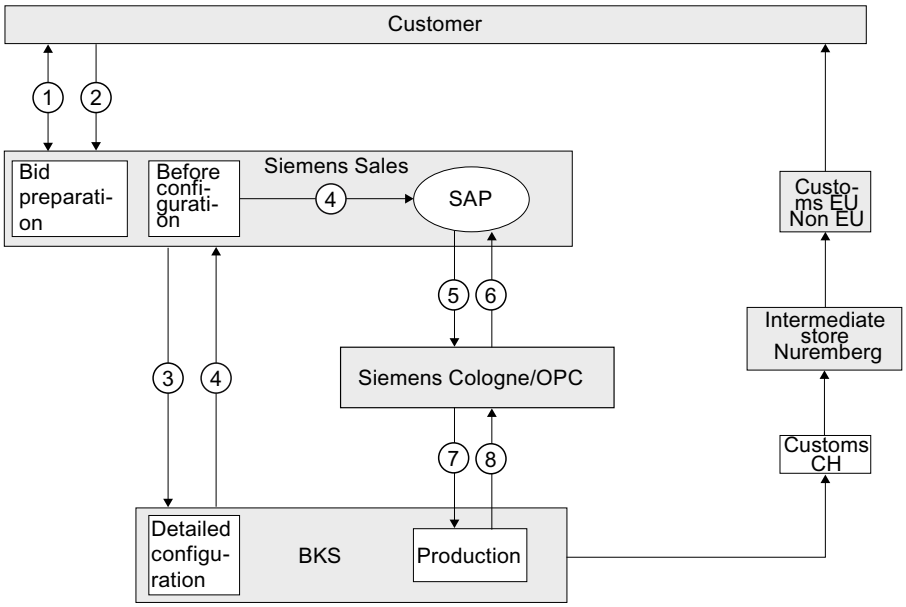
Standards	Standard reference
IEC/EN 60439-1 and 2	Busbar trunking systems in general
DIN VDE 0100-600	Determining loop impedance
DIN VDE 0100-710	Maintaining functions in medical locations Guide values for line-frequency magnetic fields in medical locations
DIN VDE 0100-720	Requirements for the degree of protection of electrical equipment in fire-hazard operating facilities
DIN VDE 0108	Maintaining functions of constructions for gatherings of persons
DIN EN 50274/VDE 0106-100	Protection against accidental contact
DIN EN 60664-1 / VDE 0110-1	Rated insulation voltage
IEC 364	Determination of protective measures after selection of electrical equipment according to the network configuration
IEC 60068-2-30	Resistance to extreme climates, damp heat (cyclic)
IEC 60068-2-78	Resistance to extreme climates, damp heat (constant)
IEC/EN 60529	Degrees of protection of electrical equipment
IEC 60364-3/DIN VDE 0100-300	Trunking systems (network configurations)
EN 60947	Overvoltage category/degree of fouling

2.2 Configuration instructions

Overview of the configuration process

SIVACON 8PS LR is configured in cooperation with BKS. An example of the configuration process is shown in the following overview:

Configuration process



① Bid
② Order/customer order
③ Technical clarification/coordination
④ Binding ordering parts list
⑤ Ordering of components from Siemens
⑥ Order confirmation
⑦ Ordering of components from BKS
⑧ Order confirmation from BKS

SIVACON 8PS system description

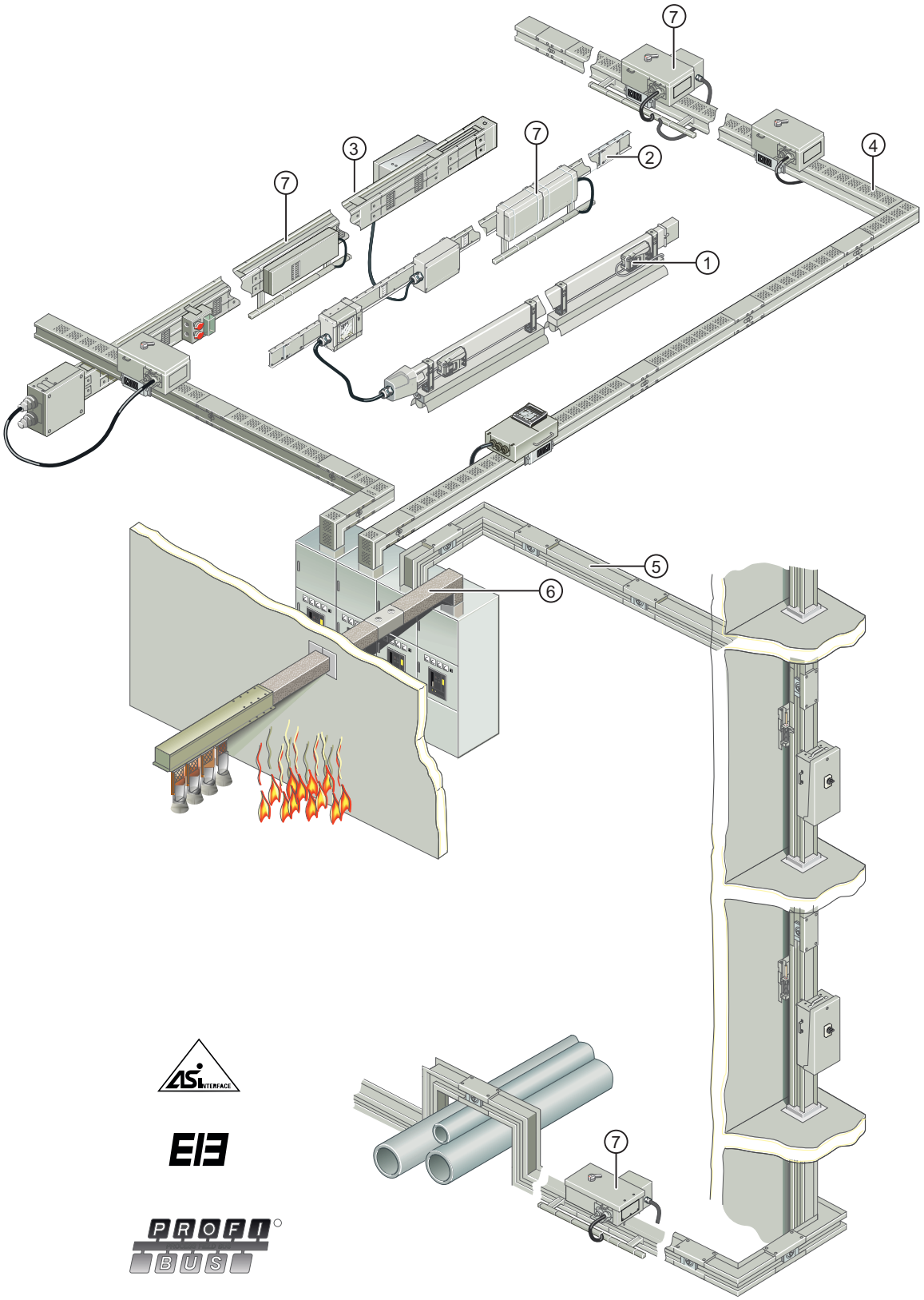
3

3.1 SIVACON 8PS system overview

3.1.1 Overview of the SIVACON 8PS busbar trunking system

SIVACON 8PS systems are of modular design and can be combined flexibly. Refer to the following graphic to get a general idea of the possibilities SIVACON 8PS offers as an overall system.

SIVACON 8PS as an overall system



① System CD-L up to 40 A
② System BD01 up to 160 A
③ System BD2 up to 1250 A
④ System LD up to 5000 A
⑤ System LX up to 6300 A
⑥ System LR up to 6000 A
⑦ Communication-enabled busbar trunking systems

3.1.2 Individual SIVACON 8PS systems

Individual SIVACON 8PS systems

The SIVACON 8PS busbar trunking system consists of six individual systems. The following description will provide you with an overview of the individual systems' characteristics and application areas.

System CD-L (25 and 40 A)

The versatile busbar trunking system for an area-wide power supply to lighting systems:

- Suitable for various uses thanks to the high standard IP55 degree of protection
- Lower planning costs thanks to simple configuration
- Time-saving installation thanks to plug-in quick connector and fastening of the connection point by means of a cross-headed screw
- Optimum utilization of the busbar line by fitting tap-off points to both sides
- Uniform current loading of the conductors by splitting of the subsequent tap blocks among the individual phases
- Fast and flexible change of load locations thanks to tap blocks
- Flexible junction units

System BD01 (40 to 160 A)

The busbar trunking system for power distribution in workshops and trade premises:

- High degree of protection up to IP55
- Flexible power supply
- Easy and quick planning
- Time-saving assembly
- Reliable mechanical and electrical connection technology
- High stability and low weight
- Small number of basic modules
- Storage-friendly system
- Variable changes of direction
- Versatile tap-off units
- Positive opening and closing of the tap-off point

System BD2 (160 to 1250 A)

The busbar trunking system for use in the harsh industrial world:

- High degree of protection up to IP55
- Easy and quick planning
- Time-saving and economical mounting
- Reliable and safe operation
- Flexible modular system with simple solutions for every application
- Early planning of power distribution system without an exact knowledge of load locations
- Early readiness for operation thanks to fast and simple mounting
- Innovative design: Omission of compensation elements to compensate for expansion
- Tap-off units and tap-off points can be factory-coded and are sealable throughout

System LD (1100 to 5000 A)

The busbar trunking system for optimum power distribution in industry:

- High degree of protection up to IP54; please enquire about IP36 and IP56
- Easy and quick mounting
- Reliable and safe operation
- Space-saving compact design up to 5000 A in one enclosure
- Load feeders up to 1250 A
- Type-tested connection to distribution boards and transformers

System LX (800 to 6300 A)

The busbar trunking system for power conveyance and distribution in buildings:

- High degree of protection up to IP54 (please enquire about IP55)
- Easy and quick mounting
- Reliable and safe operation
- Load feeders up to 1250 A
- Type-tested connection to distribution boards and transformers

LR system (400 to 6150 A)

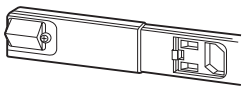
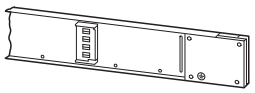
The busbar trunking system for power conveyance under extreme ambient conditions:

- High degree of protection IP68
- Horizontal and vertical layout
- Transition to the LXA/LXC, LDC/LDA system

3.1.3 Performance capability of the individual SIVACON 8PS systems

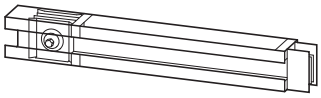
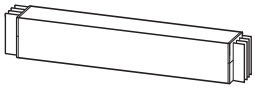
Performance overview for the CD-L, BD01 and BD2 systems

The following tables present an overview of the performance capabilities of the individual SIVACON 8PS systems:

Performance data				
Parameter	**CD-L**	**BD01**	**BD2A**	**BD2C**
Rated current I_e [A]	25 and 40 2 x 25 and 2 x 40	40, 63, 100, 125 and 160	160...400 630...1000	160...400 630...1250
Rated operational voltage [V AC]	400	400	690	
Frequency [Hz]	50...60	50...60	50...60	
No. of active conductors	3-, 5-, 7- 2 x 3-, 1 x 5- / 1 x 3-, 2 x 5, and 2 x 7 (PE = enclosure)	4 (PE = enclosure)	5	
Degree of protection	IP55	Up to IP54 (please enquire about IP55)	Up to IP55	
Max. ambient temperature [°C]	+40	+40	+40	
Max. ambient temperature [°C]	-5	-5	-5	
Mounting position	On its edge	On its edge, flat (tap-off points pointing down)	On its edge, flat and vertical	
Length [m]	1.5; 2; 3	2, 3	1.25; 2,25; 3.25	
Single-sided tap-off points	Every 0.5 m, 1.0 m and 1.5 m	Every 0.5 m or 1.0 m	—	
Tap-off points, both sides	Every 0.5 m, 1.0 m and 1.5 m	—	Offset every 0.25 or 0.5 m	
Tap-off units	Up to 16 A	Up to 63 A	Up to 530 A	
Conductor material	Insulated copper rails	Insulated AL or CU rails	AL or CU rails	
Enclosure	Sheet steel enclosure, unpainted/painted	Sheet steel enclosure, painted	Sheet steel enclosure, painted	
Fire load [kWh / m]	Single-sided 0.75; both sides 1.5	0.76	1.32 ... 2 (with tap-off points)	
Special features/communication capability	Instabus EIB, Dali	Lighting control	Lighting control Remote switching and signaling Consumption recording	

Performance overview for the LD, LX, LR systems

The following tables present an overview of the performance capabilities of the individual SIVACON 8PS systems:

Performance data						
Parameter	**LDA1 ...LDA8**	**LDC1 ...LDC8**	**LXA01 ...LXA10**	**LXC01 ...LXC09**	**LRA01 ...LRA29**	**LRC01 ...LRC29**
Rated current I_e [A]	1100...4000	2000...5000	800...4500	1000...6300	400...4600	630...6150
Rated operational voltage [V AC]	1000		690		1000	
Frequency [Hz]	50...60		50...60		50...60	
No. of active conductors	4, 5		3, 4, 5, 6 (PE = enclosure)		4, 5	
Degree of protection	Up to IP54		Up to IP54 (please enquire about IP55)		IP68	
Max. ambient temperature [°C]	+40		+40		+40	
Max. ambient temperature [°C]	-5		-5		-5	
Mounting position	Horizontal, on its edge and vertical		Horizontal, on its edge and vertical		Horizontal, on its edge and vertical	
Length [m]	0.5...3.2		0.35...3		0.5...3	
Single-sided tap-off points	Every 1 m		Every 0.5 m		Selectable	
Tap-off points, both sides	Every 1 m		Every 0.5 m		—	
Tap-off units	Up to 1250 A		Up to 1250 A		Up to 630 A	
Conductor material	Insulated AL or CU rails		Insulated AL or CU rails		AL or CU rails	
Enclosure	Sheet steel enclosure, painted		Aluminium enclosure, painted		Epoxy resin, cast	
Fire load [kWh / m]	4.16...8,83 (without tap-off points)		1.95...11,07 (without tap-off points)		—	
Special features/communication capability	Remote switching and signalling Consumption recording		Remote switching and signalling Consumption recording		—	

3.1.4 Application areas of the individual SIVACON 8PS systems

Application areas of the individual SIVACON 8PS systems

The individual systems of SIVACON 8PS are designed for the building and industry application areas. They enable flexible power distribution in building construction and a safe power supply to electronic loads.

The following table contains information on the application areas:

Location of Use	Application areas		System		
			LX	LD	LR
Public buildings	Banks Insurance companies	For power distribution in multi-storey buildings with a mainly vertical layout	X	—	—
	Internet providers Computer centres Broadcasting stations	To avoid neutral conductor overloading due to electronic loads subject to harmonics	X	—	—
		To prevent interference potentials in the rail enclosure from negatively influencing operability of loads	X	—	—
		If there is a high density of load feeders in the smallest of spaces	X	—	—
		If structural conditions permit only a vertical layout for power distribution	X	—	—
	Shopping centres Furniture stores Trade fairs Airports Hospitals Clinics Office buildings	To protect loads against negative influences of magnetic field emissions	—	X	—
		For power distribution with a mainly horizontal layout and IP34 degree of protection	—	X	—
Industrial buildings	Industrial buildings Production environments	When plug-in load feeders up to 1250 A are required	—	X	—
		When load feeders have to have a high short-circuit resistance, e.g. I_{cc} = 100 kA / I_{cf} = 120 kA	—	X	—
		When plug-in load feeders up to 630 A are sufficient	X	—	—
		When the IP54 degree of protection is sufficient	X	—	—
	Industrial production with extreme conditions	For power conveyance under extreme production conditions	—	—	X
		For power conveyance outside closed buildings	—	—	X
		When a horizontal layout and the IP68 degree of protection are required	—	—	X

3.2 LR system

3.2.1 LR system overview

Application area

The LR system is mainly used as:

- Power conveyance system for extreme conditions:
  - Power conveyance in unprotected outdoor areas
  - In harsh and aggressive environments such as high levels of humidity and corrosive or saline atmospheres
- Connecting transformer and switchgear
- Generator outgoing leads
- Motor supply cable
- Alternative to cables laid in parallel

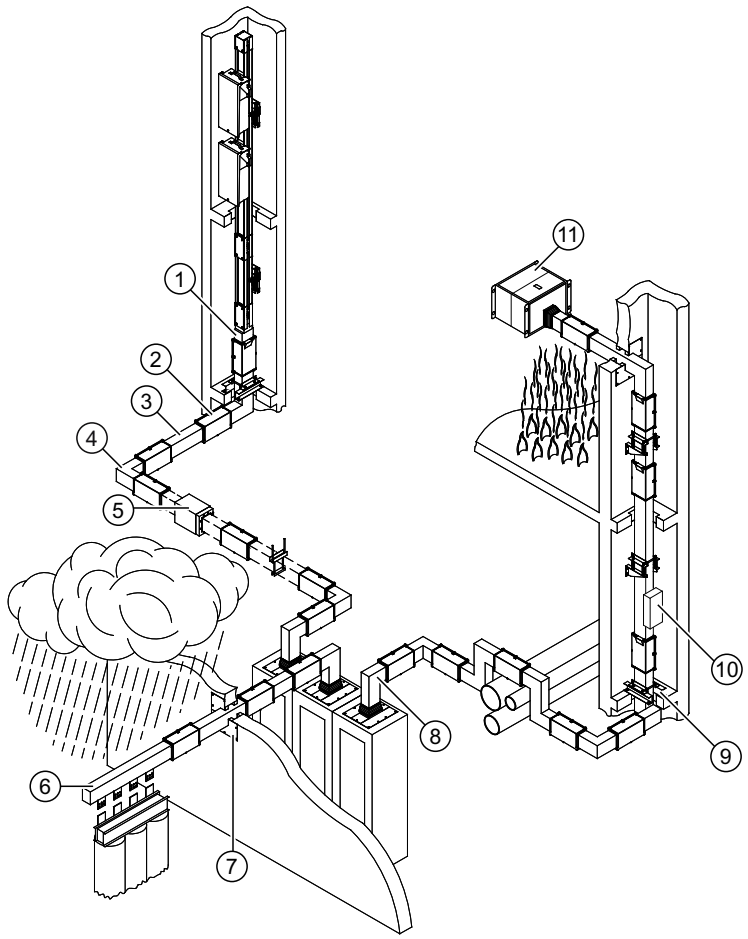
Features

The system is distinguished by the following features:

- Modular system consisting of standard components
- Combinable with other SIVACON 8PS systems
- Combinable with non-Siemens systems
- High degree of protection IP68
  - Suitable for outdoor installation
- Wide current range (from 400 A to 6150 A)
- High level of safety
  - Fully insulated
  - Flame retardant
  - Self-extinguishing
  - Resistant to arcing faults
  - Very high short-circuit rating
- Fire protection
  - Fire resistance class S60 to S90; please enquire about S120
- Functional endurance E30 to E120
- Maintenance-free
- Low voltage drop
- High mechanical strength
- Resistant to chemicals
- Conductor material made of copper or aluminium

Design

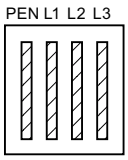
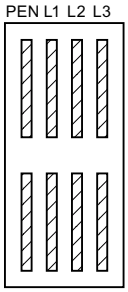
The following figure shows the basic design of the LR system:

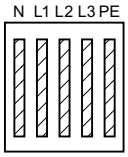
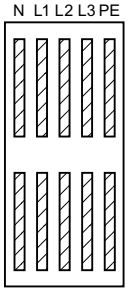
System design	Item	Description
	①	Adapter element LR-LX LR-LD
	②	Encapsulated connection element
	③	Straight element
	④	Junction unit
	⑤	Expansion element
	⑥	Terminal element
	⑦	Fire protection
	⑧	Terminal element to distributor connection
	⑨	Fixing element
	⑩	Tap-off point with outgoing feeder unit
	⑪	Cable feeder unit

3.2.2 LR design features

Construction types

The construction type is dependent on the conductor configuration and on the maximum permissible rated current. Accordingly, the construction types for the LR system are as follows:

4-conductor system	Conductor configuration/rated current
	L1, L2, L3, PEN LRA For maximum rated currents up to 2500 A LRC For maximum rated currents up to 3200 A
	L1, L2, L3, PEN LRA For maximum rated currents from 3200 A to 4600 A LRC For maximum rated currents from 4000 A to 6150 A

5-conductor system	Conductor configuration/rated current
	L1, L2, L3, N, PE LRA For maximum rated currents up to 2500 A LRC For maximum rated currents up to 3200 A
	L1, L2, L3, N, PE LRA For maximum rated currents from 3200 A to 4600 A LRC For maximum rated currents from 4000 A to 6150 A

Sizes

LR system is available in 10 different sizes. The size is determined by the maximum permissible rated current. The

Table 3- 1 Aluminium system

I_e [A]	Size	Width [mm]		Height [mm]
		4-conductor system	5-conductor system	4-conductor system
400	LRA01	90	90	90
630	LRA02	90	90	90
800	LRA03	90	90	90
1000	LRA04	100	120	110
1200	LRA05	100	120	130
1400	LRA06	100	120	150
1600	LRA07	100	120	190
2000	LRA08	100	120	230
2500	LRA09	100	120	270
3200	LRA27	100	120	380
4000	LRA28	100	120	460
4600	LRA29	100	120	540

Table 3- 2 Copper system

I_e [A]	Size	Width [mm]		Height [mm]
		4-conductor system	5-conductor system	
630	LRC01	90	90	90
800	LRC02	90	90	90
1000	LRC03	90	90	90
1350	LRC04	100	120	110
1600	LRC05	100	120	130
1700	LRC06	100	120	150
2000	LRC07	100	120	190
2500	LRC08	100	120	230
3200	LRC09	100	120	270
4000	LRC27	100	120	380
5000	LRC28	100	120	460
6150	LRC29	100	120	540

Conductor material

LRA: Copper-coated aluminium is used exclusively as the conductor material.
LRC: Electrolyte copper is used exclusively as the conductor material.
The printed circuit boards are rectangular and rounded at the edges.

Insulation material

The LR system is an encapsulated busbar trunking system. An insulating layer of epoxy resin envelopes the conductors of the LR system.

Connection system

The electromechanical connection of the individual busbar elements is established using so-called monoblocs.

This connection system ensures that only busbar trunking units of an identical size and conductor configuration can be connected to each other.

The connection points of the LR system must be encapsulated to achieve the enhanced degree of protection IP68. You require the following accessories for this purpose:

Monobloc accessories	Purpose, quantities, definitions
Casting mould	Moulding for the cast resin mix Number: one casting mould set is included up to and including 4 monoblocs, i.e. 1 casting mould set is included for every 4 monoblocs. Type definition: BK-S determines the type of the casting mould on the basis of the bar layout in the configuration drawing.
Demoulding agent	The demoulding agent is applied on the inner side of the casting mould. Thus, you ensure that the casting moulds can be reused after hardening of the cast resin mix. Demoulding agent for each connection system: LRA(C)01 to LRA(C)03..: 1 can for 30 busbar connections up to 1000 A Cu/800 A Al LRA(C)04 to LRA(C)06..: 1 can for 25 busbar connections up to 1700 A Cu/1400 A Al LRA(C)07 to LRA(C)09..: 1 can for 20 busbar connections up to 3150 A Cu/2500 A Al LRA(C)27 to LRA(C)29..: 1 can for 15 busbar connections up to 6300 A Cu/5000 A Al
Cast resin mix	The cast resin mix consists of the same material that is used to insulate the busbar elements.

Table 3- 3 Amount of cast resin for connections

Busbar type AL/CU	Amount of cast resin for straight connections	
	4-conductor	5-conductor
	Buckets	Buckets
LRA/C 01-03	0.60	0.60
LRA/C 04	0.65	0.80
LRA/C 05	0.70	0.85
LRA/C 06	0.80	0.95
LRA/C 07	0.90	1.10
LRA/C 08	1.05	1.25
LRA/C 09	1.20	1.35
LRA/C 27	1.60	1.95
LRA/C 28	1.85	2.20
LRA/C 29	2.15	2.50

Specified volumes include a 5-10% reserve.

Table 3- 4 Amount of demoulding agent:

LRA/C 01 - 03	For 1 to 25 connections	1 x 0.5 litres
LRA/C 04 - 06	For 1 to 20 connections	1 x 0.5 litres
LRA/C 07 - 09	For 1 to 15 connections	1 x 0.5 litres
LRA/C 27 - 29	For 1 to 10 connections	1 x 0.5 litres

3.2.3 LR connection elements

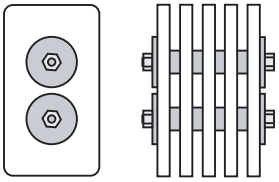
The connection elements for the LR system are referred to as monoblocs.

Design

The construction type and size of the monoblocs are dependent on the system used.

Three construction types are available:

- 1-bolt monobloc (for 4 and 5-conductor systems)
- 2-bolt monobloc (for 4 and 5-conductor systems)
- 4-bolt monobloc (for double busbar trunking systems with 4 and 5 conductors)

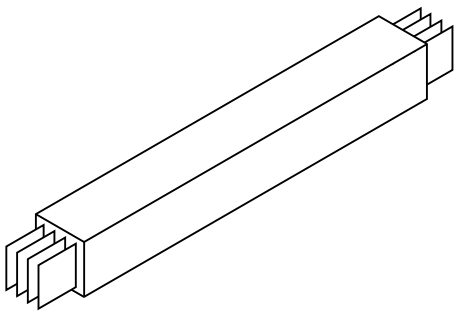
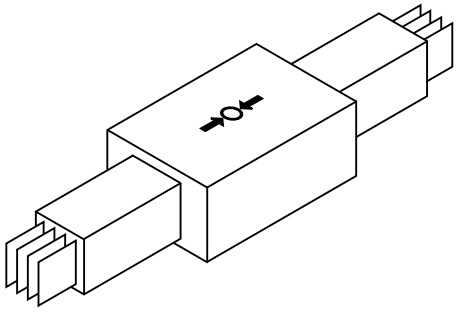
Design	Designation
	Construction type example 2-bolt monobloc (for 4-conductor systems)

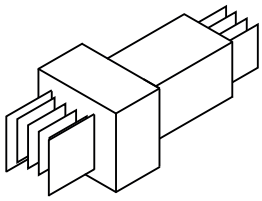
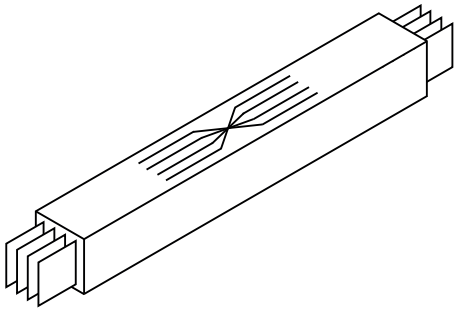
3.2.4 Straight LR elements

The following elements are grouped under the term "straight elements":

- Straight busbar elements
- Expansion elements
- Adapter elements LRA-LXA/LRC-LXC/LRA-LDA/LRC-LDC
- Phase transition units

Design and tasks of the straight busbar elements

Design	Designation	Task
	Straight busbar element	Power conveyance along straight runs Unrestricted flat or upright mounting Dimensions of 0.3 m to 3.0 m selectable in lengths that vary by 0.01 m
	Expansion compensation	Compensation of length expansion of the system elements due to heat Unrestricted flat or upright mounting Standard length: 1.0 m

Design	Designation	Task
	Adapter elements LRA-LDA/LRC-LDC/LRA-LXA/LRC-LXC	Transition from LR system to LXA/LXC (LDA/LDC) system Unrestricted flat or upright mounting Standard length: 0.6 m (1.0 m) Connection to SIVACON 8PS/8PT via LX (LD) system
	Phase transition unit	Compensation of line voltage drops in individual conductors Exchange of individual phases

3.2.5 LR junction units

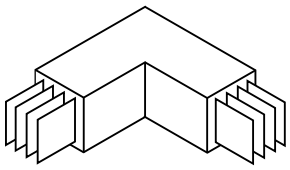
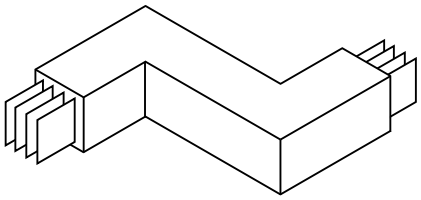
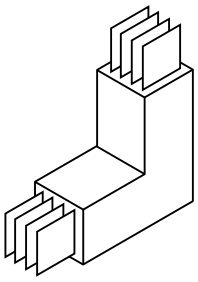
The following elements are grouped under the term junction units:

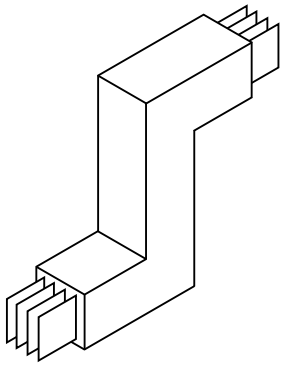
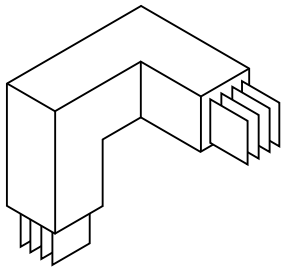
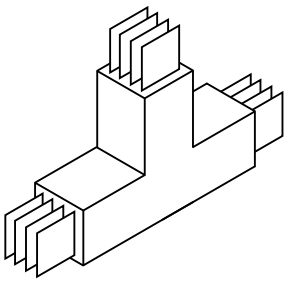
- Elbow (dihedral elbow)
- Z-element left/right (double dihedral elbow)
- Knee (flat elbow)
- Z-element front/rear (flat double elbow)
- Knee offset (flat/dihedral double elbow)
- T-element

Task

Junction units serve to adapt the layout to construction conditions.

Design

Design	Designation
	Elbow (dihedral elbow)
	Z-element left/right (double dihedral elbow)
	Knee (flat elbow)

Design	Designation
	Z-element front/rear (flat double elbow)
	Knee offset (flat/dihedral double elbow)
	T-element

3.2.6 LR terminal elements

The following elements are grouped under the term terminal elements:

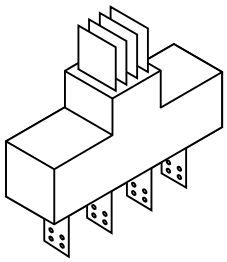
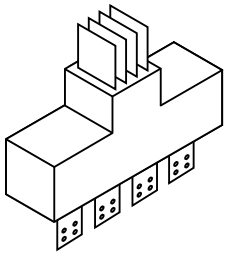
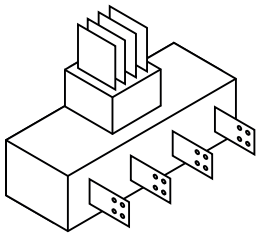
- Vertical terminal elements
- Horizontal terminal elements
- Cable feeder units

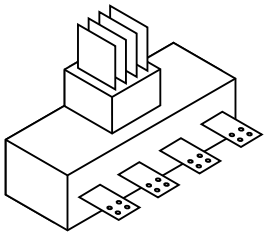
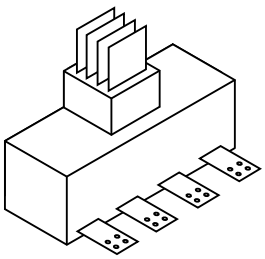
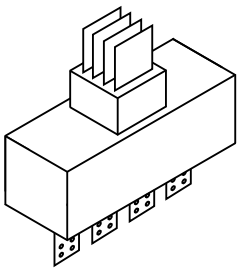
Tasks

The tasks of the terminal elements are:

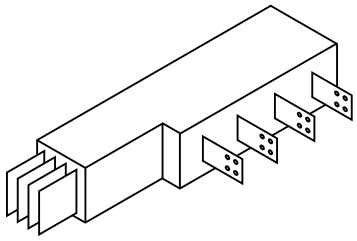
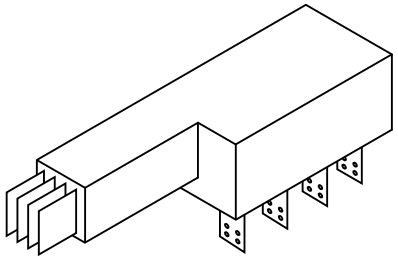
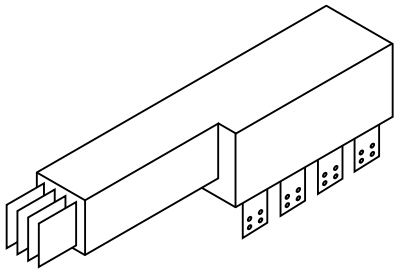
- To connect transformers or distribution boards to the LR system
- To provide horizontal or vertical busbar trunking systems with current

Design of vertical terminal elements

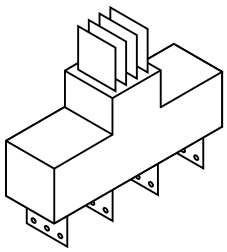
Design	Designation
	TO, TO-F terminal element
	TJ-F terminal element
	TG-F terminal element

Design	Designation
	TM-F terminal element
	TK-F terminal element
	TX-F terminal element

Design of horizontal terminal elements

Design	Designation
	Horizontal TC, TC-F terminal element
	Horizontal TD-F terminal element
	Horizontal TE-F terminal element

Design of cable feeder unit

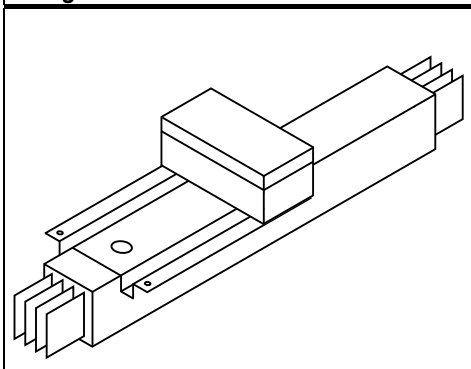
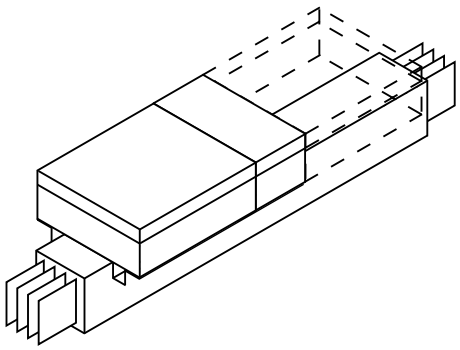
Design	Designation
	KE cable feeder unit The scope of the cable feeder unit includes: Terminal element, left illustration Casting mould, not illustrated Cast resin mix, not illustrated The cable connection is completely encapsulated during installation.

3.2.7 LR outgoing feeder points

The following elements are grouped under the term outgoing feeder points:

- Outgoing feeder unit
- Tap-off unit

Design and task

Design	Designation	Task
	Outgoing feeder unit	Provides an encapsulated interface to tap off current up to 630 A
	Tap-off unit	Integration of a power switch-disconnector or customised equipment features

3.2.8 LR fire protection and functional endurance

Fire protection

The LR system covers the requirements of fire resistance ratings S60 to S120 in compliance with EN 60439-2. The LR system features type-tested fire protection that meets the requirements for the fire resistance ratings. For details, see the section entitled "Structural measures" in the chapter entitled Configuring fire protection (Page 96).

Please enquire with the product area for details of fire protection versions in compliance with DIN 4102-9.

Functional endurance

During a fire the electrical systems must retain their functional capability for a defined period of time.

"Promatect 200" panels are required for functional endurance classes E30, E60, E90 and E120 of the system.

The general test certificate of the construction supervisory authority[1)] (abP) applies to production and application of ducts made of "Promatect 200" panels with busbar trunking systems belonging to the "LRC/LRA" type series and the functional endurance class E120 in compliance or accordance with DIN 4102-12 : 1998-11.

The functional endurance class E120 can only be issued in accordance with DIN 4102-12 : 1998-11 because only the three functional endurance classes E30, E60 and E90 exist according to DIN 4102-12 : 1998-12 : 1998-11.

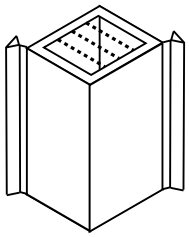
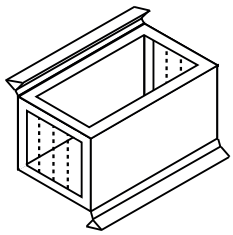
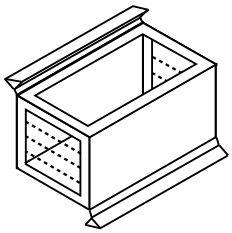
[1)] Can be provided on request in product management.

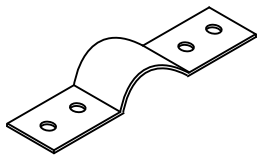
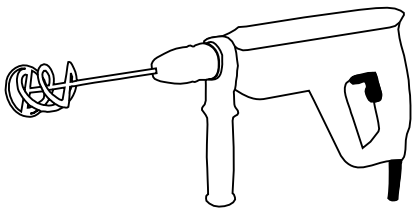
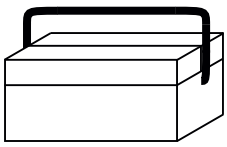
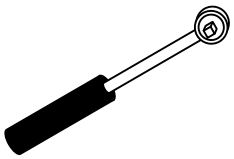
3.2.9 LR system accessories

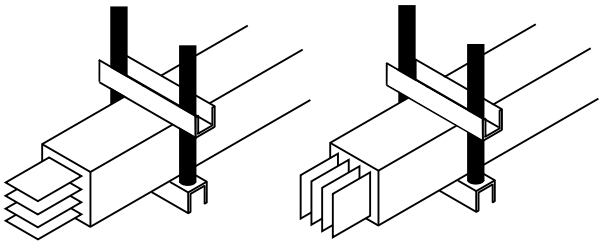
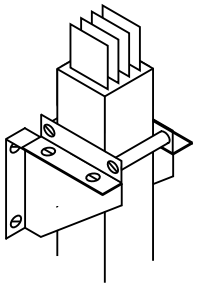
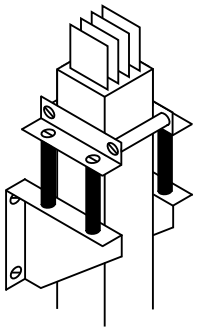
The following elements are grouped under the term accessories:

- Casting mould
- Cast resin mix with curing agent
- Demoulding agent
- Transformer connection set
- Mixer
- Tool set
- Torque wrench
- Fixing sets

Design and task

Design	Designation	Task
	Vertical casting mould	Curing and setting container for the cast resin mix Applicable – Vertical – Horizontal
	Horizontal casting mould, edgewise busbars	
	Horizontal casting mould, flat busbars	
	Cast resin mix	Insulation of the connection point Ensuring the high degree of protection IP68
	Demoulding agent	Casting mould pre-treatment Prerequisite for dismantling the casting mould

Design	Designation	Task
	Transformer connection set	Fixing with flexible connection straps
	Mixer	Mixing cast resin mix and curing agent
	Tool set	Preparation of the connection points for encapsulation Cleaning the casting point
	Torque wrench	Tightening the clamping bolts on the monoblocs to a defined torque

Design	Designation	Task
	Horizontal mounting set	Suspension of the system Fixing to – Ceilings – Walls Guarantees correct support
	Vertical mounting set, fixed point and slip yoke version	
	Vertical mounting set, slip yoke version with spring elements	

Configuring the LR system

4

4.1 Configuration principles

4.1.1 Special aspects when configuring the LR system

Sequence of configuration phases

Configuration of a SIVACON 8PS LR system is broken down into the following phases:

- **Phase 1:** preparation of a bid (after a customer enquiry)
- **Phase 2:** preconfiguration
- **Phase 3:** detailed configuration

Configuration work splitting

Contrary to the approach adopted for configuration of other SIVACON 8PS systems, LR systems are configured together with BKS. This results in the following work splitting during the configuration process:

- Siemens Sales takes care of preparation of a bid and preconfiguration.
- BKS takes care of detailed configuration.

4.1.2 Phase 1: Preparation of a bid

Bid preparation

The QuotationManager software tool (parts list-based) is used for bid preparation. Data and information stored in the software are accessed during preparation of a bid. This simplifies bid preparation.

Components of a bid

A bid contains the configured system's technical data and a description of its volume.

Necessary technical data/information

A bid must contain the following technical data:

- Rated current I_e
- Rated insulation voltage V_i
- Rated operational voltage U_e
- Short-circuit resistance I_{cw}
- Short-circuit resistance I_{pk}
- Degree of protection
- Network configuration (4/5-conductor)
- Conductor material (Al or Cu)
- Maximum permissible voltage drop (please enquire)
- Additional information (e.g.: fire protection and functional endurance)
- Ambient conditions(temperature / relative humidity, etc.)

Note

Refer to the technical data for the derating conversion factors.

See also

Technical data Derating (Page 145)

Necessary information on description of the volume

The following information describes the volume and must be included in the bid:

- Parts list
- Sketch of the busbar layout
- Construction drawing
- Text description (bill of quantities)

4.1.3 Phase 2: Preconfiguration

Necessary information

During the preconfiguration phase, the following information must be made available and communicated to BKS:

- Project number
- Technical data in conformity with the bid
- Busbar layout (determine with BusbarPlan)
- Detailed transformer data
- Detailed distribution box data
- Hole patterns
- Phase position
- Cross-sections of connecting cables
- Wall positions
- Positions of tap-off points
- Implementation data
- QuotationManager bid
- Additional information about miscellaneous special aspects
- Ambient conditions(temperature/chemical conditions, etc.)
- Rated current, adjusted to the ambient temperatures (derating)

Note

Refer to the technical data for the derating conversion factors.

See also

Technical data Derating (Page 145)

4.1.4 Phase 3: Detailed configuration

Coordination with BKS

BKS takes care of detailed configuration. The following points must be coordinated with BKS:

- Project number
- Bid number
- Binding ordering parts list with items
- Busbar layout with items
- Fixing elements and their positions
- Expansion compensation and fixed points
- Transformer connection details, including copper plating of the terminal lugs
- Distribution board connection and its position
- Outgoing feeder points and tap-off units, if necessary
- Nature and quantity of necessary accessories
- Single part drawings, if necessary
- Use of phase transition units

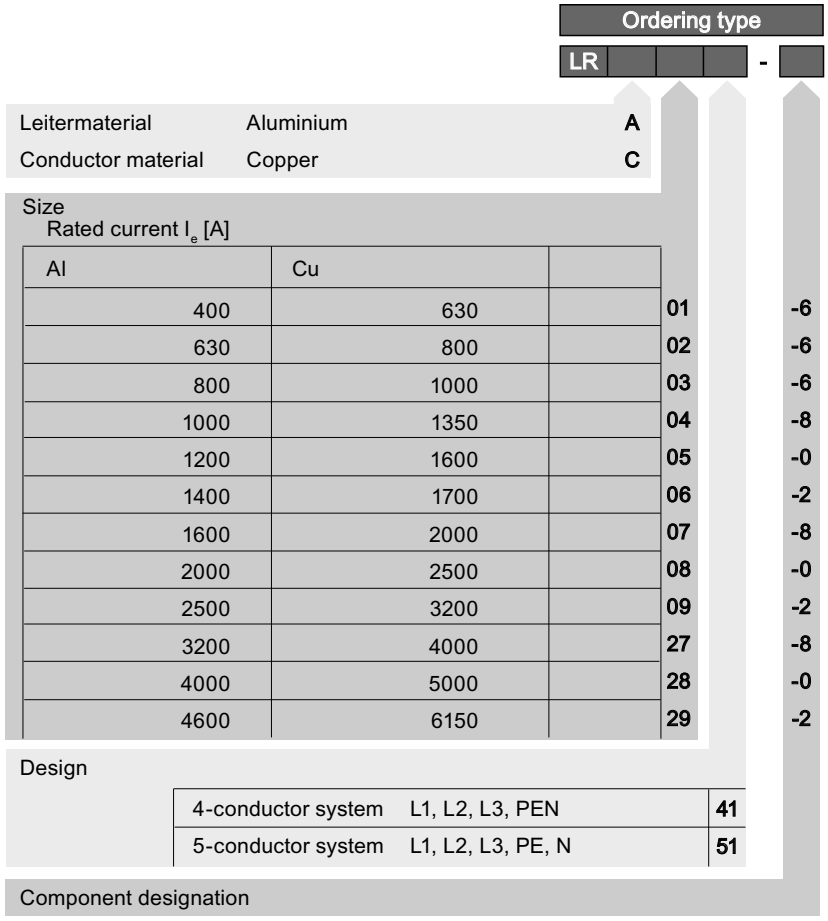
4.2 Selection and type definition with LR system

4.2.1 Type key of the LR system

Overview

The illustrated type key serves to determine the order types of the system elements:

Type key



Note

Order types that cannot be determined with this type key are:

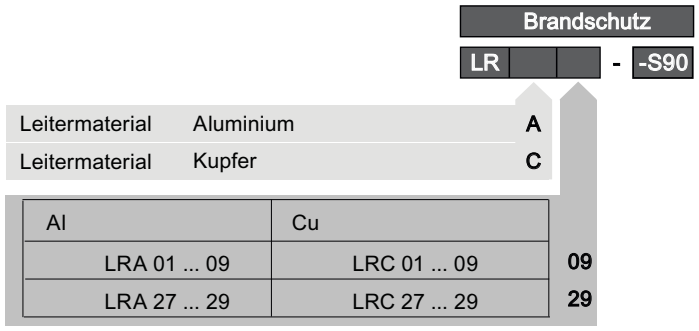
- Adapter element LRA-LXA/LRC-LXC/LRA-LDA/LRC-LDC
- Casting moulds
- Flexible connection straps
- Bolting sets
- Fire protection kits
- Accessories for fixing and assembly

4.2.2 Additional type keys for fire protection kits

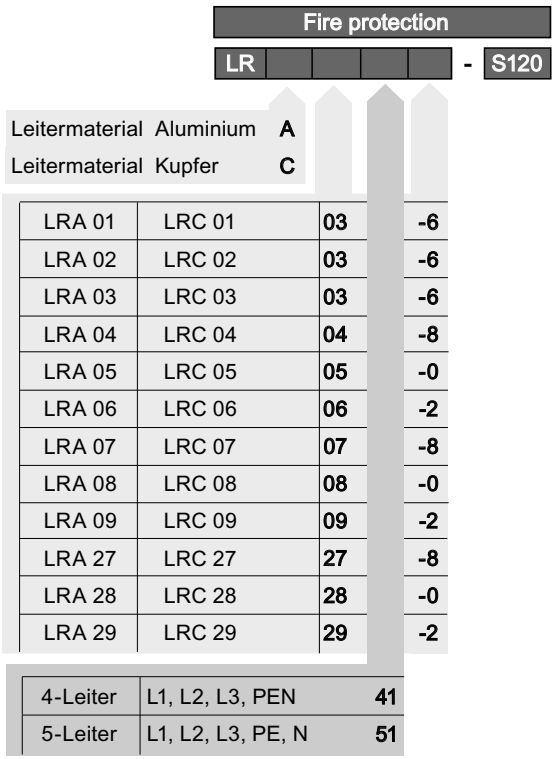
Selectable options

With the fire protection kits, busbar elements achieve the fire protection class S90 or S120. The fire protection kits are used for wall or ceiling penetrations. You order the appropriate fire protection kits for straight busbar elements on the basis of the type keys shown below:

Type key for fire protection kit [1] S90



Type key for fire protection kit [1] S120



Scope of fire protection kits [1)]

The fire protection kits contain the following components:

Fire protection kit	
Fire protection class S90	**Fire protection class S120**
Protective coating	"Promatect 200" panels
Sealing material	

Scope of the approval set for Germany:

Please enquire

[1)] Fire protection kits in compliance with the requirements of IEC 60439-2 or EN 60439-2. For the requirements of DIN 4102 (valid for use of fire protection on the German market), you must enquire with the product area for details of the fire protection kits.

See also

Selection list for LR system fire protection accessories (Page 75)

4.2.3 Selection list for straight elements LR

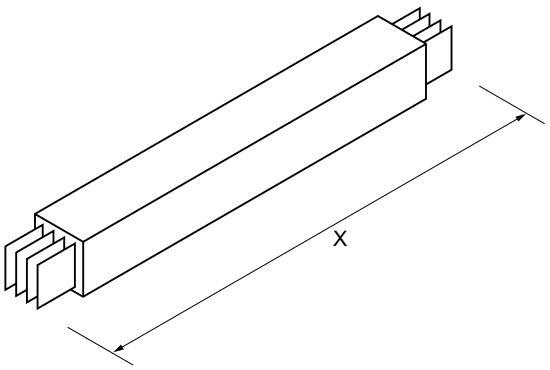
Selection lists

The following selection lists serve to determine the order designations for straight elements.

Note

For the system elements listed below, monoblocs must be ordered separately!

Order designations for straight busbar elements

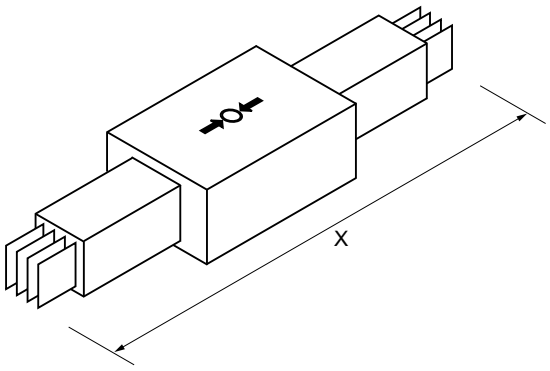
Straight busbar element	X [m]	Configurable length [m]	Order designation
	0.5	0.30 ... 0.50	**-0.5**
	1.0	0.51 … 1.0	**-1.0**
	1.5	1.01 ... 1.50	**-1.5**
	2.0	1.51 ... 2.0	**-2.0**
	2.5	2.01 ... 2.50	**-2.5**
	3.0	2.51 ... 3.0	**-3.0**

The individual lengths can be configured freely in cm increments from 0.3 m to 3.0 m.

Straight busbar element, conductor material Cu, size 09, 4-conductor, length = 1.7 m:	
Entry 1:	**LRC0941-2-2.0**

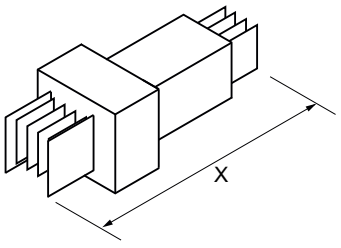
Straight busbar element, conductor material Cu, size 09, 4-conductor, length = 1.7 m, with fire protection kit S120	
Entry 1:	**LRC0941-2-2.0**
Entry 2	**LRC0941-2-S120**

Order designations for expansion elements

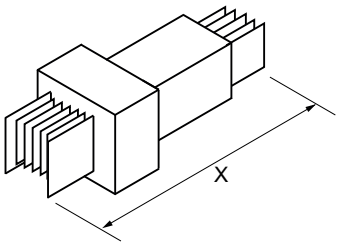
Expansion element	X [m]	Order designation
	1.0	**-D**

Example: expansion compensation, conductor material Cu, size 09, 4-conductor:	
Entry 1:	**LRC0941-2-D**

Order designations for LRA -LXA adapter elements for 4-conductor systems

Adapter element LRA - LXA	X [m]	Rated current I_e [A] system transition	Order designation	
			Defined LRA system	Connectable LXA system
	0.6	800	**LRA0341-6**	**-LXA0141**
		1000	**LRA0441-8**	**-LXA0241**
		1200	**LRA0541-0**	**-LXA0441**
		1400	**LRA0641-2**	**-LXA0541**
		1600	**LRA0741-8**	**-LXA0541**
		2000	**LRA0841-0**	**-LXA0641**
		2500	**LRA0941-2**	**-LXA0741**
		3200	**LRA2741-8**	**-LXA0841**
		4000	**LRA2841-0**	**-LXA0941**
		4500	**LRA2941-2**	**-LXA1041**

Order designation for LRA - LXA adapter elements for 5-conductor systems

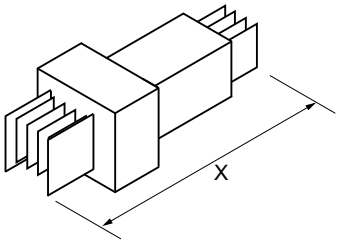
Adapter element LRA - LXA	X [m]	Rated current I_e [A] system transition	Order designation	
			Defined LRA system	Connectable LXA system
	0.6	800	LRA0351-6	-LXA0151
		1000	LRA0451-8	-LXA0251
		1200	LRA0551-0	-LXA0451
		1400	LRA0651-2	-LXA0551
		1600	LRA0751-8	-LXA0551
		2000	LRA0851-0	-LXA0651
		2500	LRA951-2	-LXA0751
		3200	LRA751-8	-LXA0851
		4000	LRA851-0	-LXA0951
		4500	LRA951-2	-LXA1051

Order designation for LRA - LXA adapter elements for (5-conductor system)

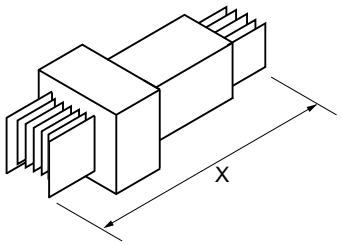
When selecting adapter elements, you only need one entry in the ordering list in addition to the order designation; see the following example:

Adapter element, conductor material Al, size 05, 5-conductor	
Entry:	LRA0551-0-LXA0451

Order designations for LRC - LXC adapter elements for 4-conductor systems

Adapter element LRC - LXC	X [m]	Rated current I_e [A] system transition	Order designation	
			Defined LRC system	Connectable LXC system
	0.6	1000	LRC0341-6	-LXC0141
		1250	LRC0441-8	-LXC0241
		1400	LRC0541-0	-LXC0341
		1600	LRC0541-0	-LXC0441
		1700	LRC0641-2	-LXC0541
		2000	LRC0741-8	-LXC0541
		2500	LRC0841-0	-LXC0641
		3200	LRC0941-2	-LXC0741
		4000	LRC2741-8	-LXC0841
		5000	LRC2841-0	-LXC0941

Order designation for LRC - LXC adapter elements for 5-conductor systems

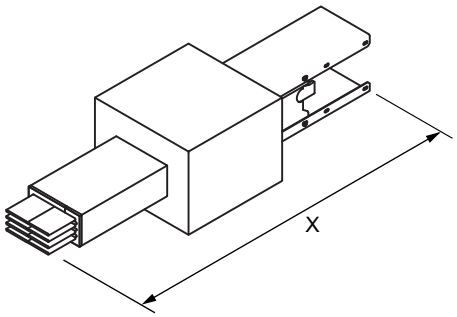
Adapter element LRC - LXC	X [m]	Rated current I_e [A] system transition	Order designation	
			Defined LRC system	Connectable LXC system
	0.6	1000	LRC0351-6	-LXC0151
		1250	LRC0451-8	-LXC0251
		1400	LRC0551-0	-LXC0351
		1600	LRC0551-0	-LXC0451
		1700	LRC0651-2	-LXC0551
		2000	LRC0751-8	-LXC0551
		2500	LRC0851-0	-LXC0651
		3200	LRC0951-2	-LXC0751
		4000	LRC2751-8	-LXC0851
		5000	LRC2851-0	-LXC0951

Order designation for LRC-LXC adapter elements for (4-conductor system)

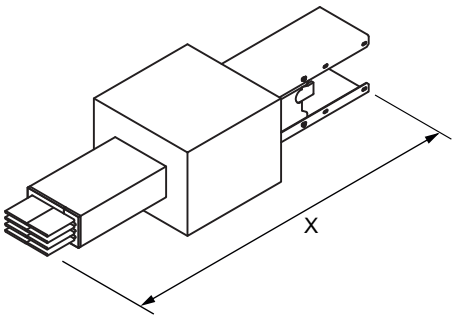
When selecting adapter elements, you only need one entry in the ordering list in addition to the order designation; see the following example:

adapter element, conductor material Cu, size 04, 4-conductor:	
Entry:	LRC0441-8-LXC0241

Order designations for LRA-LDA adapter elements for 4-conductor systems

Adapter element LRA - LDA	X [m]	Rated current I_e [A] system transition	Order designation	
			Defined LRA system	Connectable LDA system
	1.0	1000	LRA0441-8	-LDA2420
		1200	LRA0541-8	-LDA2420
		1400	LRA0641-8	-LDA3420
		1600	LRA0741-8	-LDA3420
		2000	LRA0841-0	-LDA5420
		2500	LRA0941-2	-LDA5420
		3200	LRA2741-8	-LDA7420
		4000	LRA2841-0	-LDA8420
		2000	LRA0841-0	-LDA5410
		2500	LRA0941-2	-LDA5410
		3200	LRA2741-8	-LDA7410
		4000	LRA2841-0	-LDA8410

Order designations for LRA-LDA adapter elements for 5-conductor systems

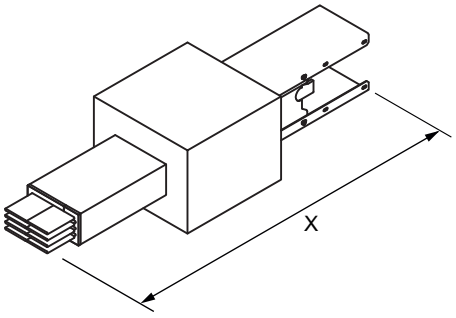
Adapter element LRA - LDA	X [m]	Rated current I_e [A] system transition	Order designation	
			Defined LRA system	Connectable LDA system
	1.0	1000	LRA0451-8	-LDA2620
		1200	LRA0551-0	-LDA2620
		1400	LRA0651-2	-LDA3620
		1600	LRA0751-8	-LDA3620
		2000	LRA0851-0	-LDA5620
		2500	LRA0951-2	-LDA5620
		3200	LRA2751-8	-LDA7620
		4000	LRA2851-0	-LDA8620
		2000	LRA0851-0	-LDA5610
		2500	LRA0951-2	-LDA5610
		3200	LRA2751-8	-LDA7610
		4000	LRA2851-0	-LDA8610

Order designation for LRA - LDA adapter elements for (5-conductor system)

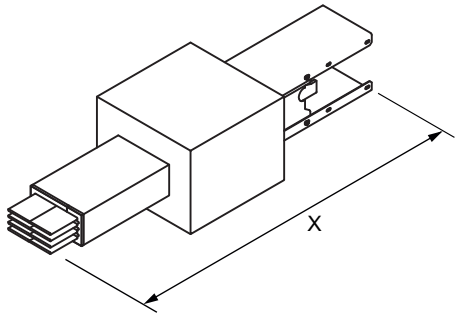
When selecting adapter elements, you only need one entry in the ordering list in addition to the order designation; see the following example:

Adapter element, conductor material Al, size 05, 5-conductor	
Entry:	LRA0551-0-LDA2620

Order designations for LRC-LDC adapter elements for 4-conductor systems

Adapter element LRC - LDC	X [m]	Rated current I_e [A] system transition	Order designation	
			Defined LRC system	Connectable LDC system
	1.0	2000	LRC0741-8	-LDC2420
		2500	LRC0841-0	-LDC3420
		3200	LRC0941-2	-LDC6420
		4000	LRC2741-8	-LDC7420
		5000	LRC2841-0	-LDC8420
		3200	LRC0941-2	-LDC6410
		4000	LRC2741-8	-LDC7410
		5000	LRC2841-0	-LDC8410

Order designations for LRC-LDC adapter elements for 5-conductor systems

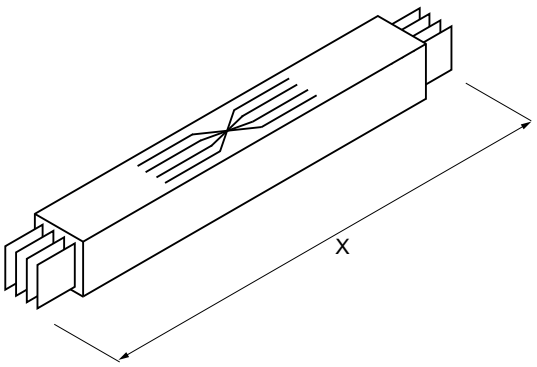
Adapter element LRC - LDC	X [m]	Rated current I_e [A] system transition	Order designation	
			Defined LRC system	Connectable LDC system
	0.6	2000	**LRC0751-8**	**-LDC2620**
		2500	**LRC0851-0**	**-LDC3620**
		3200	**LRC0951-2**	**-LDC6620**
		4000	**LRC2751-8**	**-LDC7620**
		5000	**LRC2851-0**	**-LDC8620**
		3200	**LRC0951-2**	**-LDC6610**
		4000	**LRC2751-8**	**-LDC7610**
		5000	**LRC2851-0**	**-LDC8610**

Order designation for LRC-LDC adapter elements for (5-conductor system)

When selecting adapter elements, you only need one entry in the ordering list in addition to the order designation; see the following example:

adapter element, conductor material Cu, size 07, 5-conductor	
Entry:	**LRC0751-8-LDC2620**

Order designations for phase transition units

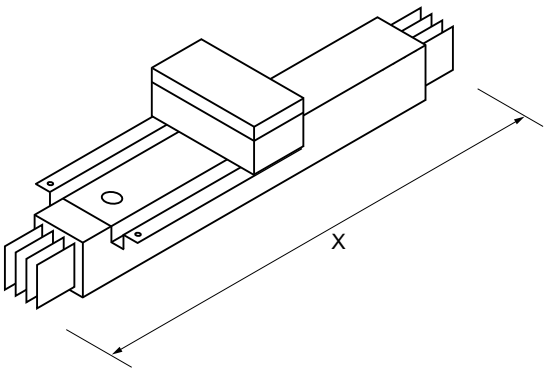
Phase transition unit	X [m]	Order designation
	0.5	**-0.5** **-P**
	1.0	**-1.0** **-P**
	1.5	**-1.5** **-P**
	2.0	**-2.0** **-P**
	2.5	**-2.5** **-P**
	3.0	**-3.0** **-P**

Example order designation for phase transition units

When selecting phase transition units, you need two entries in the ordering list in addition to the order designation; see the following example:

Straight busbar element, conductor material Cu, size 03, 4-conductor, standard length = 1.0 m: phase transition unit version	
Entry 1:	**LRC0341-6-1.0**
Entry 2:	**LRC0341-6-P**

Order designations for outgoing feeder units

Straight busbar element	X [m]	Configurable length [m]	Order designation
	0.5	0.3 ... 0.5	**-0.5 LR-AD**
	1.0	0.5 … 1.0	**-1.0 LR-AD**
	1.5	1.0 ... 1.5	**-1.5 LR-AD**
	2.0	1.5 ... 2.0	**-2.0 LR-AD**
	2.5	2.0 ... 2.5	**-2.5 LR-AD**
	3.0	2.5 ... 3.0	**-3.0 LR-AD**

The individual lengths can be configured freely in cm increments from 0.3 m to 3.0 m.

Example order designation for outgoing feeder units

When selecting outgoing feeder units, you need two entries in the ordering list in addition to the order designation; see the following example:

Straight busbar element, conductor material Cu, size 03, 4-conductor, standard length = 1.0 m: Outgoing feeder unit version	
Entry 1:	**LRC0341-6-1.0**
Entry 2:	**LR-AD**

4.2.4 Selection list for LR junction units

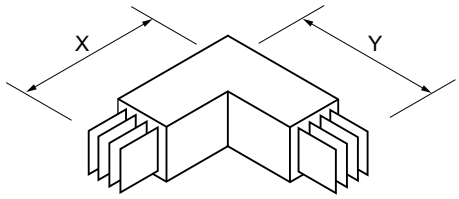
Selection lists

The following selection lists serve to determine the order designations for junction units.

Note

For the system elements listed below, monoblocs must be ordered separately!

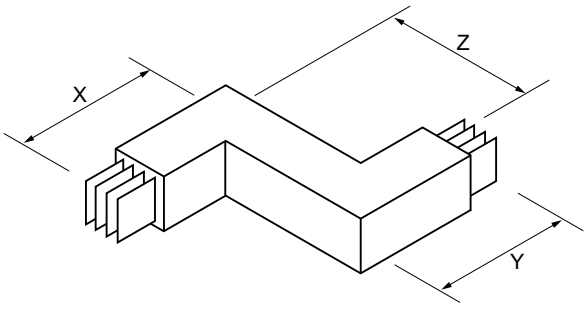
Order designations for elbow (dihedral elbow)

Elbow (dihedral elbow)	Max. total length X + Y [m]	Variable leg lengths		Order designation For LRA(C)
		X [m]	Y [m]	
	0.6	0.3	0.3	-E from LR...01 to LR...29
	1.0	0.31 ... 0.7	0.31 ... 0.7	-E-1.0 from LR...01 to LR...29
	1.5	0.31 ... 1.2	0.31 ... 1.2	-E-1.5 from LR...01 to LR...29

The individual leg lengths can be configured freely in cm increments from 0.31 m to 1.2 m. (order designations -E, -E-1.0 and -E-1.5)

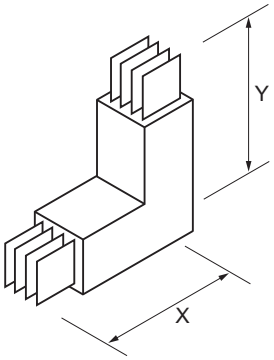
Both leg lengths together must not exceed the chosen maximum overall length.

Order designations for Z-element left/right (double dihedral elbow)

Z-element left/right (double dihedral elbow)	LRA(C) system	X [m]	Y [m]	Z [m]	Order designation
	For sizes LR..01 - LR..29	0.35	0.35	0.01 … 0.7	-ZE

The leg length Z can be configured freely in cm increments from 0.01 m to 0.7 m.

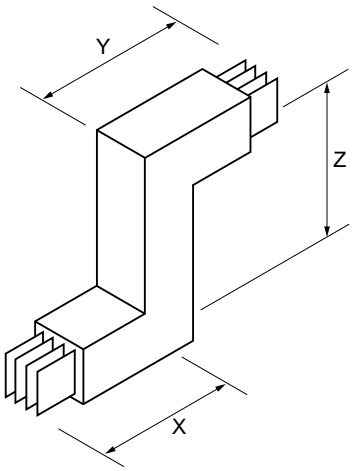
Order designations for knee (flat elbow)

Knee (flat elbow)	LRA(C) system	Total length X + Y [m]	Variable leg lengths		Order designation
			X [m]	Y [m]	
	LR...01 to LR...09	0.7	0.35	0.35	K
	LR... 01 to LR...09	1.0	0.35... 0.65	0.35... 0.65	-K-1.0
	LR... 27 to LR...29		0.5	0.5	
	LR... 01 to LR...09	1.5	0.35... 1.15	0.35...1.15	-K-1.5
	LR... 27 to LR...29		0.5...1	0.5...1	

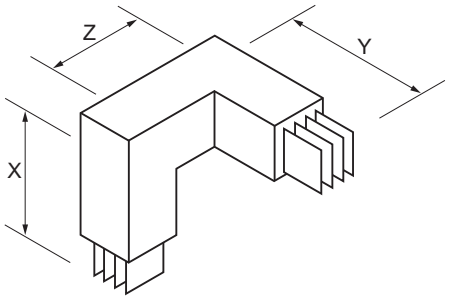
The individual leg lengths can be configured freely in cm increments within the following limits:

- In the case of single systems, from 0.35 m to 1.15 m
- In the case of double systems, from 0.5 m to 1 m
- Both leg lengths together must not exceed the chosen overall length.

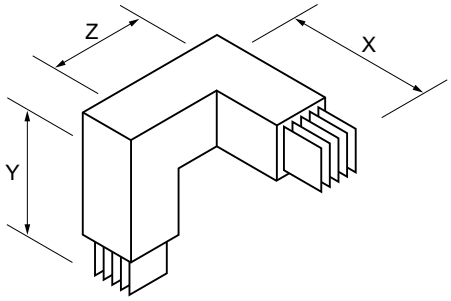
Order designations for Z-element front/rear (flat double elbow)

Z-element front/rear (flat double elbow)	LRA(C) system	X [m]	Y [m]	Z [m]	Order designation
	For sizes LR...01 to LR...09	0.35	0.35	0.01…0.7	-ZK
	For sizes LR...27 to LR...29	0.5	0.5	0.01…1	-ZK

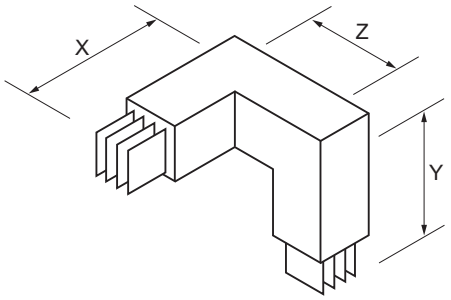
Order designations for knee offset (flat/dihedral double elbow) (4-conductor system)

Knee offset (flat/dihedral double elbow)	LRA(C) system	X [m]	Y [m]	Z [m]	Order designation
	LR.0141-6	0.35	0.35	0.09…0.7	- XL
	LR.0241-6				
	LR.0341-6				
	LR.0441-8			0.105...0.7	
	LR.0541-0			0.115...0.7	
	LR.0641-2			0.125...0.7	
	LR.0741-8			0.145...0.7	
	LR.0841-0			0.165...0.7	
	LR.0941-2			0.185...0.7	
	LR.2741-8	0.5	0.5	0.24...1	
	LR.2841-0			0.28...1	
	LR.2941-2			0.32...1	

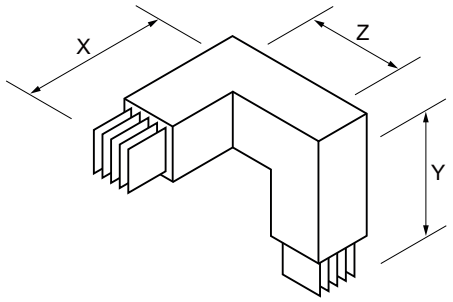
Order designations for knee offset (flat/dihedral double elbow) (5-conductor system)

Knee offset (flat/dihedral double elbow)	LRA(C) system	X [m]	Y [m]	Z [m]	Order designation
	LR.0151-6	0.35	0.35	0.09…0.7	- XL
	LR.0251-6				
	LR.0351-6				
	LR.0451-8			0.115...0.7	
	LR.0551-0			0.125...0.7	
	LR.0651-2			0.135...0.7	
	LR.0751-8			0.155...0.7	
	LR.0851-0			0.175...0.7	
	LR.0951-2			0.195...0.7	
	LR.2751-8	0.5	0.5	0.25...1	
	LR.2851-0			0.29...1	
	LR.2951-2			0.33...1	

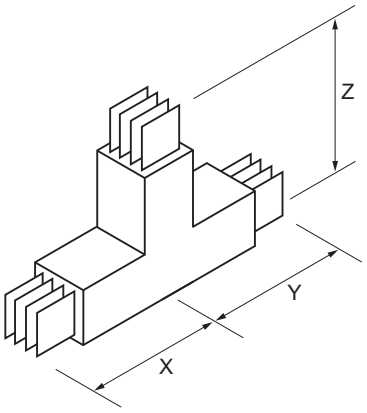
Order designations for knee offset (flat/dihedral double elbow) (4-conductor system)

Knee offset (flat/dihedral double elbow)	LRA(C) system	X [m]	Y [m]	Z [m]	Order designation
	LR.0141-6	0.35	0.35	0.09...0.7	- XR
	LR.0241-6				
	LR.0341-6				
	LR.0441-8			0.105...0.7	
	LR.0541-0			0.115...0.7	
	LR.0641-2			0.125...0.7	
	LR.0741-8			0.145...0.7	
	LR.0841-0			0.165...0.7	
	LR.0941-2			0.185...0.7	
	LR.2741-8	0.5	0.5	0.24...1	
	LR.2841-0			0.28...1	
	LR.2941-2			0.32...1	

Order designations for knee offset (flat/dihedral double elbow) (5-conductor system)

Knee offset (flat/dihedral double elbow)	LRA(C) system	X [m]	Y [m]	Z m]	Order designation
	LR.0151-6	0.35	0.35	0.09...0.7	- XR
	LR.0251-6				
	LR.0351-6				
	LR.0451-8			0.115...0.7	
	LR.0551-0			0.125...0.7	
	LR.0651-2			0.135...0.7	
	LR.0751-8			0.155...0.7	
	LR.0851-0			0.175...0.7	
	LR.0951-2			0.195...0.7	
	LR.2751-8	0.5	0.5	0.25...1	
	LR.2851-0			0.29...1	
	LR.2951-2			0.33...1	

Order designations for T-elements

T-element	LRA(C) system	X [m]	Y [m]	Z [m]	Order designation
	For sizes LR...01 to LR...09	0.35	0.35	0.35	-TV
	For sizes LR...27 to LR...29	0.5	0.5	0.5	-TV
	For sizes LR...01 to LR...09	0.35...1.15	0.35...1.15	0.35...0.5	-TV-2.0
	For sizes LR...27 to LR...29	0.5...1	0.5...1	0.5	-TV-2.0

4.2.5 Selection list for LR terminal elements

Selection lists

The following selection lists serve to determine the order designations for terminal elements.

Note

For the system elements listed below, monoblocs must be ordered separately!
Exception: Terminal element for KE cable feeder unit

Order designations for terminal elements (vertical connection)

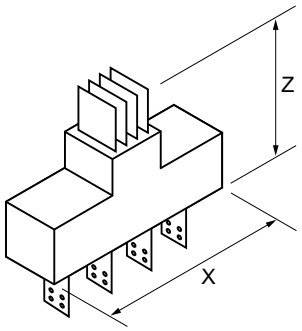
Note

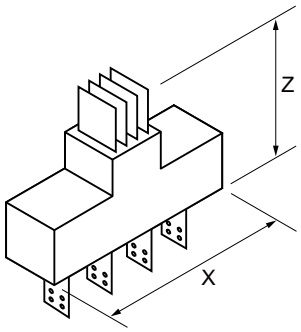
If required, the specified maximum values for the dimension X can be extended in increments of 0.1 m. For all terminal elements, you order the extension by making an additional entry in the ordering parts list.

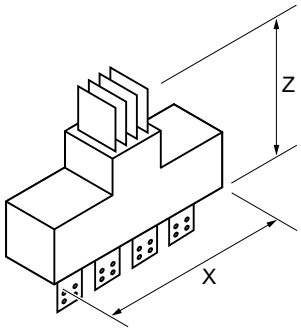
The additional entry is based on the following sample:

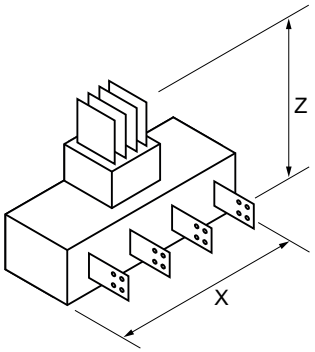
Example of TO terminal element, conductor material Cu, size 28, 4-conductor, version: extension by X=0.3 m	
Entry 1:	**LRC2841-0-TO-F**
Entry 2:	**3 x LRC2841-0-0.1**[1)]

1) Example: 3 x LRC2841-0-01 corresponds to extension by 3 x 0.1 m!

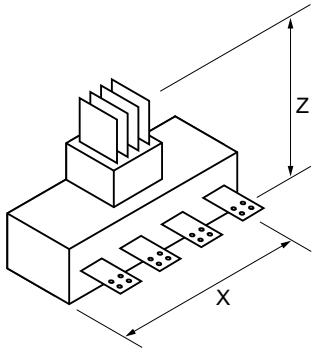
TO terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	4-conductor	0.4	0.3	-TO
	5-conductor	0.5		

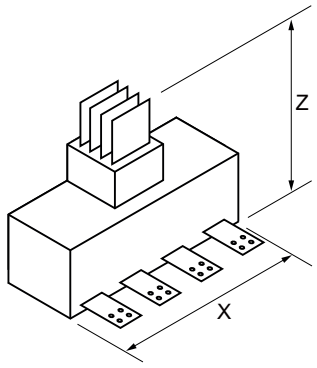
TO-F terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	4-conductor	< 0.7	0.3…0.5	-TO-F
	5-conductor			
	Extension each	0.1	—	-0.1

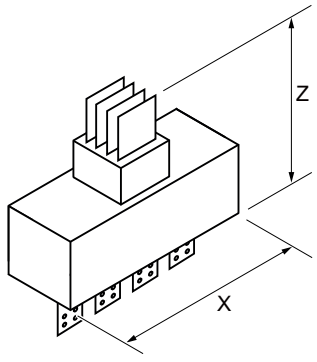
TJ-F terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	LR...01 to LR...09	< 0.7	0.3...0.5	-TJ-F
	LR...27 to LR...29	< 1.0		
	Extension each	0.1	—	-0.1

TG-F terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	All systems	< 0.7	0.5	-TG-F
	Extension each	0.1	—	-0.1

TM-F terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	LR.01 - LR.09	< 0.7	0.3...0.5	-TM-F
	LR.27 - LR.29	1.0		

TM-F terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	Extension each	0.1	—	-0.1

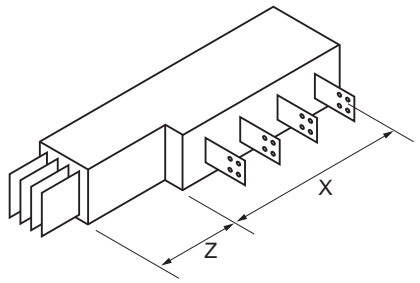
TK-F terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	LR.01 - LR.09	< 0.7	0.5	-TK-F
	LR.27 - LR.29	< 1.0	0.7	
	Extension each	0.1	—	-0.1

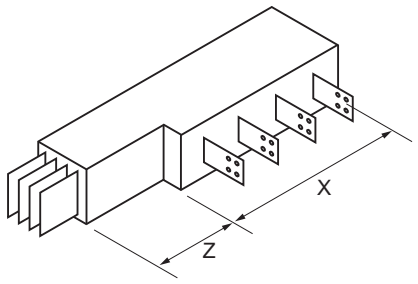
TX-F terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	LR.01 to LR...09	< 0.7	0.5	-TX-F
	LR...27 to LR...29	< 1.0	0.7	
	Extension each	0.1	—	-0.1

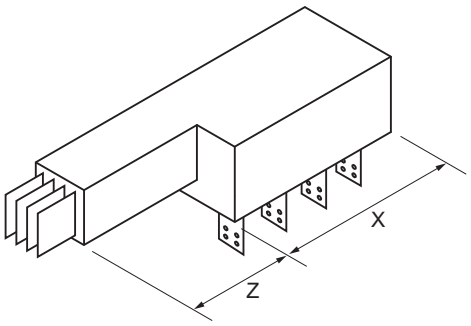
Example of TO-F terminal element, conductor material Cu, size 05, 5-conductor, version: extension by X=0.4 m	
Entry 1:	**LRC0551-0-TO-F**
Entry 2:	**4 x LRC0551-0-0.1**[2)]

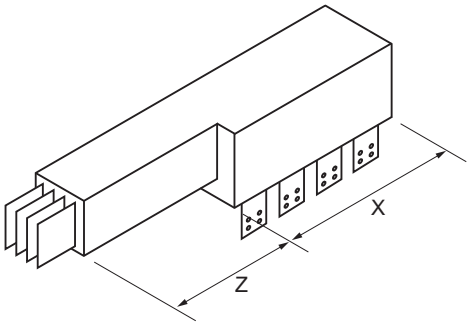
2) Example: 4 x LRC0551-0 corresponds to extension by 4 x 0.1 m!

Order designations for terminal elements (horizontal connection)

TC terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	4-conductor	0.4	0.3	-TC
	5-conductor	0.5		

TC-F terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	4-conductor	< 0.7	0.3...0.5	-TC-F
	5-conductor			
	Extension each	0.1	—	-0.1

TD-F terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	All systems	< 0.7	0.3...0.5	-TD-F
	Extension each	0.1	—	-0.1

TE-F terminal element	LRA(C) system	X [m]	Z [m]	Order designation
	LR...01 to LR...09	< 0.7	0.3…0.5	-TE-F
	LR...27 to LR...29	< 1.0		
	Extension each	0.1	—	-0.1

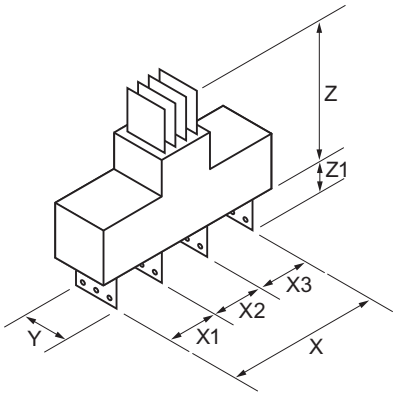
Note

Terminal elements for horizontal connections can be extended in increments of 0.1 m. Two entries must be made for extensions. See the following example

Example of TC-F terminal element, conductor material Cu, size 03, 4-conductor, version: extension by X=0.3 m	
Entry 1:	**LRC0341-6-TC-F**
Entry 2:	**3 x LRC0341-6-0.1**

2) Example: 4 x LRC0341-6 corresponds to extension by 3 x 0.1 m!

Length selection for cable feeder unit

KE cable feeder unit	LRA(C) system	X [m]	X_1, X_2, X_3 [m]	Y [m]	Z [m]	Z_1 [m]	Order designation
	4-conductor	0.45	0.1	0.06	0.3	0.06	-KE
	5-conductor	0.55					

Example of cable feeder unit KE, conductor material Cu, size 09, 4-conductor	
Entry 1:	**LRC0941-2-KE**

Note

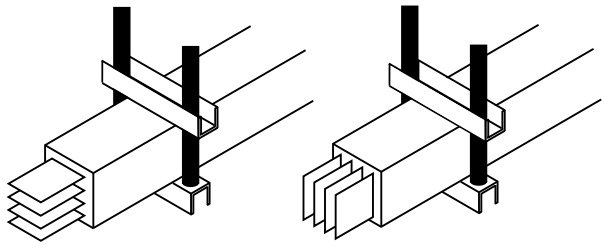
Cable feeder unit -KE is delivered from the factory inclusive of the casting mould!

4.2.6 Selection list for LR accessories

Selection lists

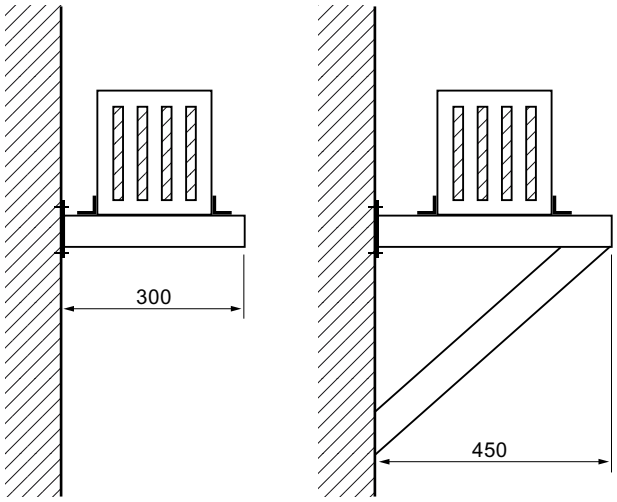
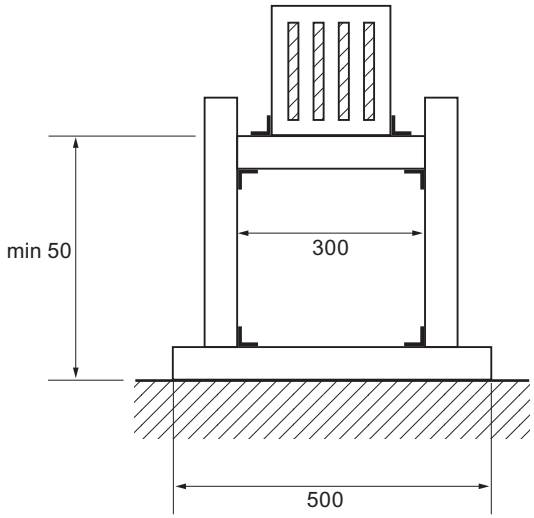
The following selection lists serve to determine the order designations for accessories:

Order designations for horizontal fixing sets

Illustration: horizontal fixing		Size	Order designation	
Flat	On its edge		Flat	On its edge
		01 ... 03	LR03-BHF	LR03-BHH
		04	LR04-8-BHF	LR04-8-BHH
		05	LR05-0-BHF	LR05-0-BHH
		06	LR06-2-BHF	LR06-2-BHH
		07	LR07-8-BHF	LR07-8-BHH
		08	LR08-0-BHF	LR08-0-BHH
		09	LR09-2-BHF	LR09-2-BHH
		27	LR27-8-BHF	LR27-8-BHH
		28	LR28-0-BHF	LR28-0-BHH
		29	LR29-2-BHF	LR29-2-BHH

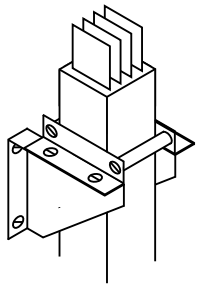
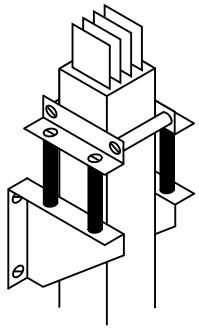
Example order designation: Horizontal fixing, on its edge and flat, sizes 01/02/03:		
Entry 1:	**LR03-BHH**	**LR03-BHF**

Example order designation: Horizontal fixing, on its edge and flat, sizes 09:	
Entry 1:	**LR09-2-BHF**

View	Designation	Size	Order designation
	Horizontal fixing, wall	01 … 09	LR-BHW1
		27 … 29	LR-BHW2
	Horizontal fixing, floor	Please enquire	

Example order designation: Horizontal fixing, wall, size 09:	
Entry 1:	**LR-BHW1**

Order designations for vertical fixing sets

View	Designation	Application/scope	Size	Order designation
	Fixed point for vertical installation	Fixing the busbar run	01…03	LR03-BF
			04…29	LR....-BF*
		Fixing the busbar run on a ceiling	01…03	LR03-BFD
			04…29	LR....-BFD*
	Vertical fixing, sliding	Sliding fixing (without spring elements)	01…03	LR03-BG
			04…29	LR....-BG*
	Vertical fixing, ceiling	Fixing with load bearing (with spring elements)	01…03	LRA(C)03-BVD
			04…29	LRA(C)....-BVD*
	Vertical fixing, wall	Fixing with load bearing (with spring elements)	01…03	LRA(C)03-BVW
			04…29	LRA(C)....-BVW*

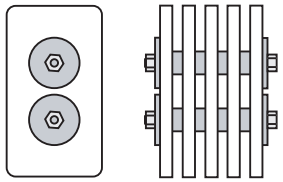
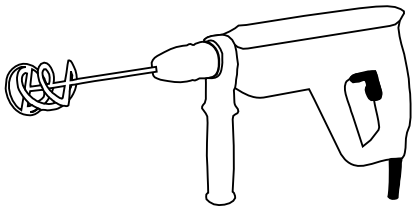
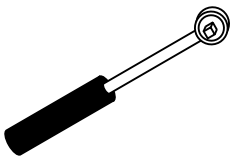
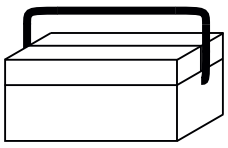
* The size and the conductor configuration are specified.

Note

You order the applicable fixing set for size LRC05 by using the order designation 06.

Example order designation: Conductor material Al, vertical ceiling fixing, size 06, 4-conductor	
Entry 1:	**LRA0641-2-BVD**

Order designations for assembly accessories

View	Designation	Application/scope	Order designation
	Monobloc	Monobloc[1)] Cast resin mix	LRA(C)....-KB
	Mixer	750 W/230 V	LR-MIX1
		1000 W/230 V	LR-MIX2
	Cast resin mix	1 tub with: solid (12 kg), can of epoxy resin (1.8 kg), curing agent (0.6 kg)	LR-RES
	Torque wrench	Tightening the monobloc clamping bolts	LR-DR
	Tool set	Grinding stone, aluminium tape for sealing, spray bottle for demoulding agent, fibre fleece for surface cleaning, spatula, 19 cm ring/open-ended spanner	LR-WS

View	Designation	Application/scope	Order designation
	Demoulding agent	0.5 kg	LR-SEP
	Transformer adapter box	Electroplated, Height = 0.15 m	Please enquire
	Special item	—	LR-SOND[2)]
	Spare part	—	LR-ET/10

1) Casting mould must be ordered separately.

2) Enter the bid number!

4.2.7 Selection list for transformer connection

Components

You need the following components to connect a transformer to the LRA(C) system:

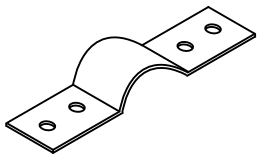
- Flexible connection straps
- Bolting set

Note

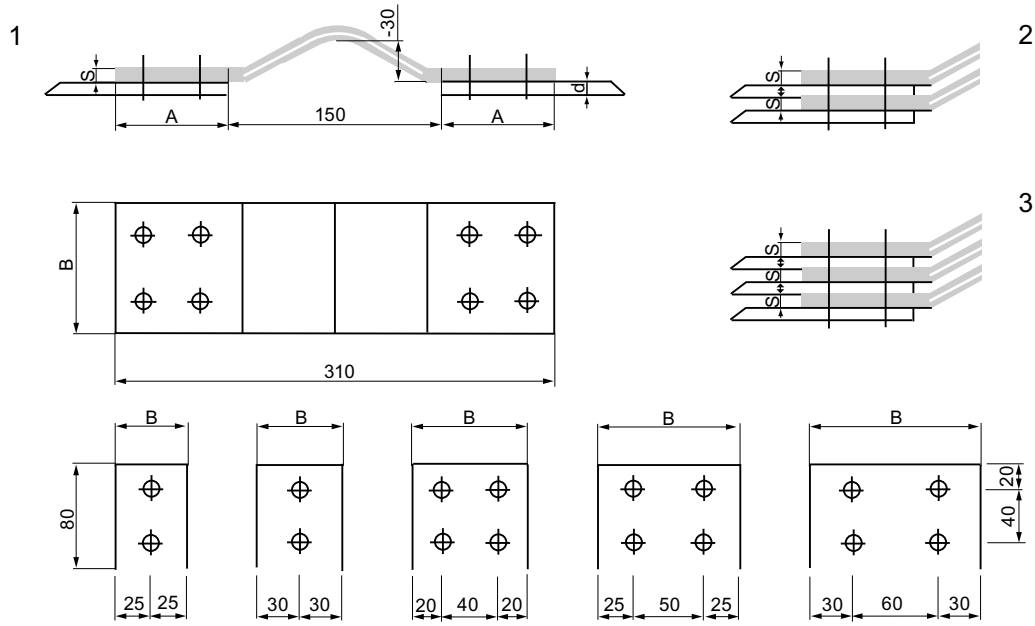
Connection straps and bolting sets are ordered separately.

Selection of flexible connection straps

The number of required connection straps depends on the rated current. Select the ordering types on the basis of the following tables:

View	Designation	Description	Order designation
	Flexible connection straps	Pressure-welded copper expansion strips with tin-plated contact faces	LR-FLEX-[1)]

1) The dimensions of the terminal lugs are added to the order designation LR-Flex- to arrive at the ordering type.



Ordering type[2)]	Cross-section	Weight	Rated current I_e [A]		
	[mm²]	[kg]	1-layer	2-layer	3-layer
LR-FLEX-50X06X310	300	0.87	750	1310	1835
LR-FLEX-50X08X310	400	1.16	950	1660	2280
LR-FLEX-50X10X310	500	1.44	1100	1940	2630
LR-FLEX-50X12X310	600	1.74	1200	2110	2850
LR-FLEX-60X06X310	360	1.04	860	1480	2030
LR-FLEX-60X08X310	480	1.39	1100	1870	2530
LR-FLEX-60X10X310	600	1.74	1200	2030	2725
LR-FLEX-60X12X310	720	2.08	1350	2255	3020
LR-FLEX-80X06X310	480	1.39	1100	1870	2500
LR-FLEX-80X08X310	640	1.85	1300	2185	2910
LR-FLEX-80X10X310	800	2.3	1450	2380	3200
LR-FLEX-80X12X310	960	2.78	1600	2560	3455
LR-FLEX-100X06X310	600	1.74	1250	2180	2650
LR-FLEX-100X08X310	800	2.31	1550	2550	3280
LR-FLEX-100X10X310	1000	2.89	1700	2700	3610
LR-FLEX-100X12X310	1200	3.47	1800	2845	3820
LR-FLEX-120X10X310	1200	3.47	1900	3040	4000
LR-FLEX-120X12X310	1440	4.17	2100	3195	4410

2) Ordering type with details of the terminal lugs' dimensions!

Selection of bolting sets

Note

The quantity and type of required bolting sets depend on each specific project. Required bolting sets are therefore selected by BKS during the detailed configuration phase. The following table lists the available bolting sets:

Designation	Description	Ordering type
Bolting set	M12 thread Screw length [mm] 35 ... 140 All bolting set versions cost the same. The number of required bolting sets depends on the hole pattern.	LR-SCREW35M12
		LR-SCREW40M12
		LR-SCREW45M12
		LR-SCREW50M12
		LR-SCREW55M12
		LR-SCREW60M12
		LR-SCREW65M12
		LR-SCREW70M12
		LR-SCREW80M12
		LR-SCREW90M12
		LR-SCREW100M12
		LR-SCREW110M12
		LR-SCREW120M12
		LR-SCREW130M12
		LR-SCREW140M12

4.2.8 Selection list for LR system fire protection accessories

Selection list

The following fire protection accessories are available in conformity with the differing fire resistance classes[1].

Accessories	Note	Fire resistance class[1]			Ordering addresses
		S60	S90	S120	
① Fire protection mortar **Promat Promastop Type S, Art. No. 705020**	—	(X)	(X)	(X)	Promat GmbH Scheifenkamp 16, D-40878 Ratingen Telephone: +49 2102 4 93-0 Fax: +49 2102 4 93-111 mail@promat.de () www.promat.de (http://www.promat.de/default_e.htm)
② Fire protection filling compound **Beele Actifoam**	Alternative to fire protection mortar	(X)	(X)	(X)	Schulte Strathaus GmbH & Co. KG Runtestrasse 42, D-59457 Werl Telephone: +49 (0) 29 22 /97 75-0 Fax: +49 (0) 29 22/97 75-75 info@schulte-strathaus.de () www.schulte-strathaus.de (http://www.schulte-strathaus.de/en/home.html)
③ Sealing compound **Beele FIWA**	Sealing gaps after using Actifoam	(X)	(X)	(X)	
④ Fire protection kit[1] S90	LRA(C)01 ... 09	—	X	—	Siemens Sales Ordering type: LRA(C)09-S90
	LRA(C)27 ... 29	—	X	—	Siemens Sales Ordering type: LRA(C)29-S90
⑤ Fire protection kit[1] **LRA(C)....-S120**	Including panels, type "Promatect 200"	—	—	X	Siemens Sales Ordering type: LRA(C)....-S120
⑥ Approval set[1]	Required for Germany!	X	X	X	Please enquire

Note

Ordering process

The items ① to ③ are processed locally. They are needed only to seal the wall opening. Order fire protection accessories directly via the specified ordering addresses. There, you will obtain all information about:

- Container sizes
- Prices
- Processing notes

See also

Additional type keys for fire protection kits (Page 47)

[1] Please enquire about the version for Germany in compliance with the stipulations of the responsible construction authority.

4.2.9 Type keys of the casting moulds for the LR system

Overview

The illustrated type key serves to determine the order types of the casting moulds:

Type key

No. of conductors

System LR	Number of wires	
LRA(C) 01 ... LRA(C) 03	4-conductor and 5-conductor (Square cross-section)	**5**
LRA(C)0441. ... LRA(C)2941.	4-conductor	**4**
LRA(C)0451. ... LRA(C)2951.	5-conductor	**6**

Installation orientation

Horizontal high	**D**
Horizontal flat	**F**
Vertical	**V**

Size/type
Casting mould

Size LRC	
01	**8 / 10**
02	**8 / 10**
03	**8 / 10**
04	**11 / 13-N**
05	**13 / 17-N**
06	**16 / 19-N**
07	**17 / 20-N**
08	**20 / 25-N**
09	**24 / 31-N**
27	**34 / 40-N**
28	**40 / 50-N**
29	**49 / 63-N**

Note

Available LRA(C)01 - LRA(C)03 build-up layers

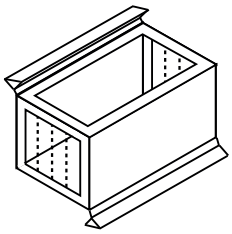
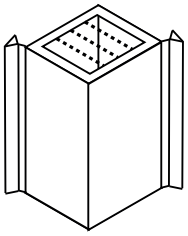
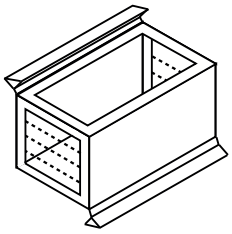
Regardless of the conductor configuration, the LRA(C)01 to LRA(C)03 systems have a square cross-section. Note that only the build-up layer D is available for these systems.

4.2.10 Selection list for LR casting moulds

Selection lists

The following selection list serves to determine the types of casting moulds:

Determining the types of casting moulds

Casting moulds		System size LR	Size/type
		01	8/10
		02	8/10
		03	8/10
		04	11/13-N
		05	13/17-N
		06	16/19-N
		07	17/20-N
		08	20/25-N
		09	24/31-N
		27	34/40-N
		28	40/50-N
		29	49/63-N

Casting mould order designation

When selecting casting moulds, you only need one entry in the ordering list in addition to the designation of the order type; see the following example:

Example LRC0441-8, casting mould, horizontal, flat	
Entry:	**LR-4FF11/13-N**

4.3 Configuring the LR busbar run

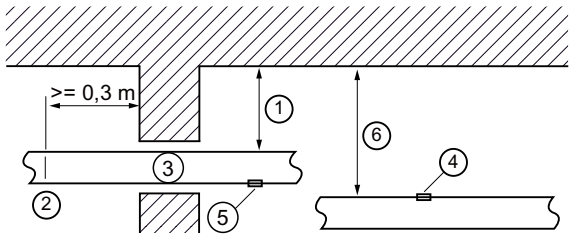
Configuration

The following must be configured in connection with the busbar run:

- Distances from structures
- Minimum distances for horizontal installation
- Minimum distances for vertical installation
- Wall and ceiling openings
- Busbar end

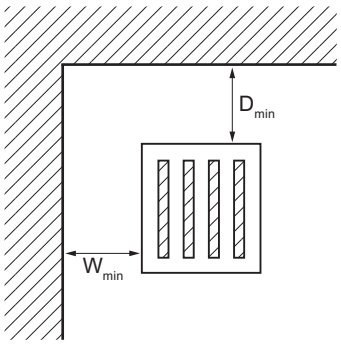
Distances from structures

With regard to the layout of LR system busbars, appropriate distances from structures must be observed.

Distances from structures	Item	Description
	①	0.5 m min.
	②	Monobloc centre
	③	LR system
	④	Tap-off point at top
	⑤	Tap-off point at bottom
	⑥	Additional space requirement for the tap-off unit

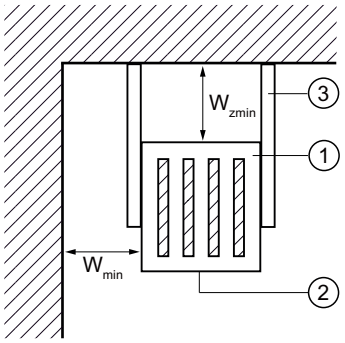
Minimum distances for horizontal installation

Minimum distances from the wall and ceiling must be observed for establishment of the electromechanical connection and the connection point.

Minimum distances	Item	Description
	①	W_{min} = 0.1 m
	②	D_{min} = 0.1 m

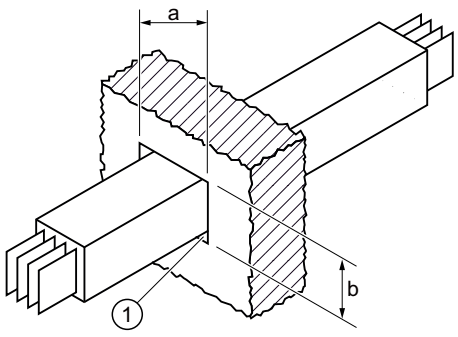
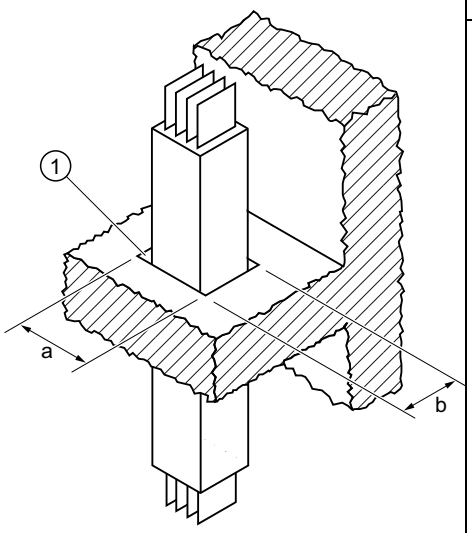
Minimum distances for vertical installation

Minimum distances from the wall and ceiling must be observed for establishment of the electromechanical connection and the connection point.

Minimum distances	Item	Description
	①	LR system: W_{min} = 0.1 m
	②	Front with tap-off points, if necessary: W_{zmin} = 0.15 m
	③	Vertical fixing

Wall and ceiling penetrations

Appropriately large openings must be provided in masonry for the wall and ceiling penetration points of the LR system.

Wall penetration	Ceiling penetration	Item	Description
		①	Wall opening
		a	System width +100 mm
		b	System height +100 mm

Busbar end

Note

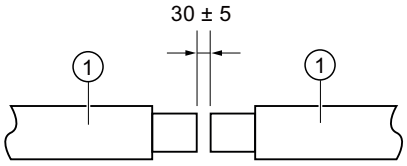
Contrary to the other SIVACON 8PS systems, there is no end flange in the LR system.

The last busbar element in the layout is cast at the manufacturer's specifically for the project or order.

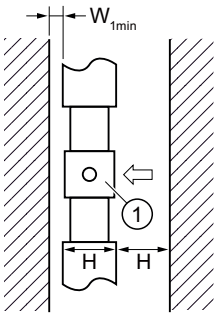
4.4 Configuring LR connections

Configuration

The busbar elements are positioned so that there is a distance of approximately 30 mm between the busbar ends.

Distance between two elements	Item	Description
	①	Busbar element

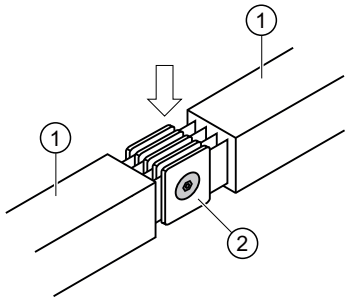
Additional space requirement must be planned for vertical installation in a flat position with respect to the wall. This is necessary because the monobloc (approximate system height) has to be fitted from the side.

Space requirement for vertical installation	Item	Description
	(W_{1min})	W_{1min} = 0.1 m
	H	System height
	①	Monobloc

Connecting

The monobloc is then inserted and fitted. The monobloc's bolt features a shear-off head that shears off when the required torque is reached.

If the shear-off head has already been torn off, the terminal must be tightened to a 3 x torque. (LR.01 ... LR.03: 40 Nm and LR.04 ... LR.06: 84 Nm).

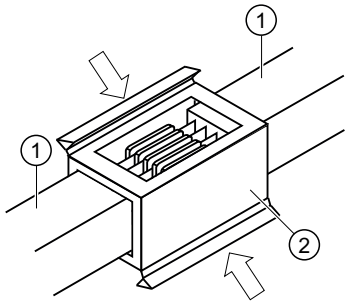
Mounting position of a monobloc	Item	Description
	①	Busbar elements
	②	Monobloc

Casting

Note

Before the casting mould is fitted, its inside must be greased with the demoulding agent (LR-SEP). This is imperative to be able to detach and reuse the casting moulds again after setting.

The casting mould is fitted after fitting of the monobloc.

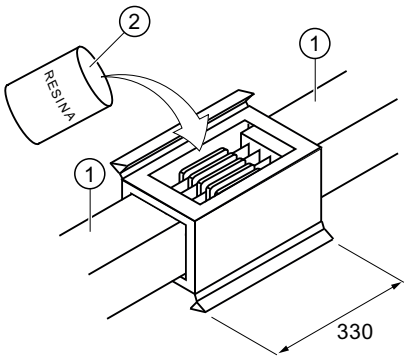
Casting mould installation position	Item	Description
	①	Busbar elements
	②	Casting mould

The prepared cast resin mix can be poured in once the casting mould has been fitted.

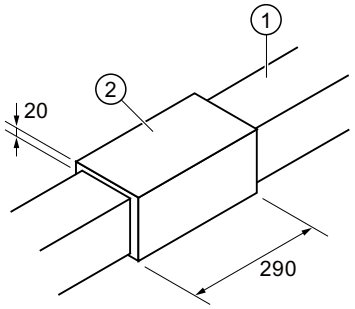
The cast resin mix requires a setting time of 7 - 8 h under normal ambient conditions.

The cast resin mix is supplied in a tub with the single components (12 kg solids, 1.8 kg can of resin and 0.6 kg curing agent).

The cast resin mix must be mixed on the site with an agitator.

Casting the connection point	Item	Description
	①	Busbar elements
	②	Cast resin mix

After setting, the casting mould must be removed again. The casting mould can be reused. One set of casting moulds can be used for four busbar connections. The following figure shows the dimensions of the encapsulated connection point.

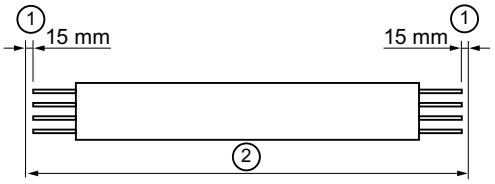
Dimensions of an encapsulated connection point	Item	Description
	①	Busbar elements
	②	Encapsulated connection point

4.5 Configuring straight LR busbar elements

Configuration

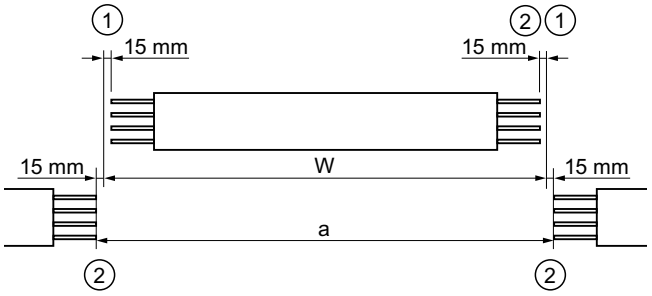
The configuration dimension for straight busbar elements is always from the monobloc centre

to the monobloc centre:

Configuration dimensions for straight busbar elements	Item	Description
	①	Monobloc centre
	②	Length from monobloc centre to monobloc centre

Configuring chosen lengths

The configuration dimension for chosen lengths is always from the monobloc centre to the monobloc centre

Configuration dimensions for chosen lengths	Item	Description
	①	Monobloc centre
	②	Busbar end
	W	Chosen length of busbar element
	a	Length with monoblocs

Note

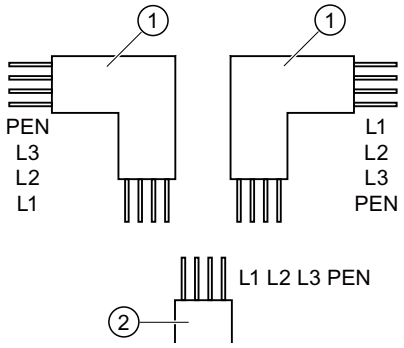
Configuration dimension: W = a [mm] - 30 mm

4.6 Configuring LR junction units

A note in advance

The conductors of the LR system are arranged symmetrically to the longitudinal axis.

Thanks to the conductor symmetry, the junction units can be used as left or right elbows and as front or rear elbows. This reduces the system's type diversity and configuration complexity.

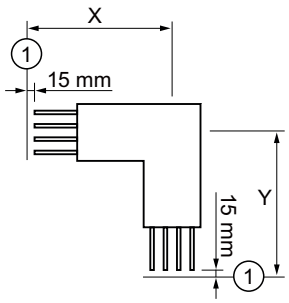
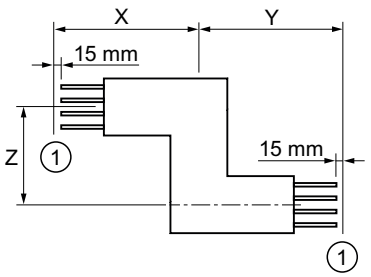
Application methods of junction units	Item	Description
	①	Elbow
	②	Busbar element

Configuration

The configuration dimension for junction units is always from the monobloc centre to the monobloc centre.

Note

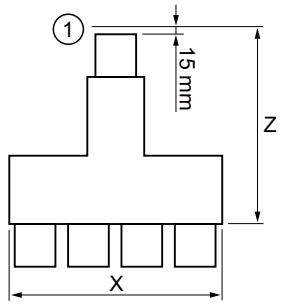
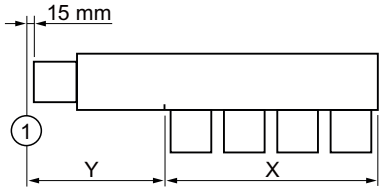
This system deviates from the configuration method for the well-known LD, LX or BD2 systems.

Configuration dimensions for single elbows	Configuration dimensions for double elbows	Item	Description
		①	Monobloc centre

4.7 Configuring LR terminal elements

Configuration

The configuration dimension for terminal elements is always from the monobloc centre to the end of the busbar element.

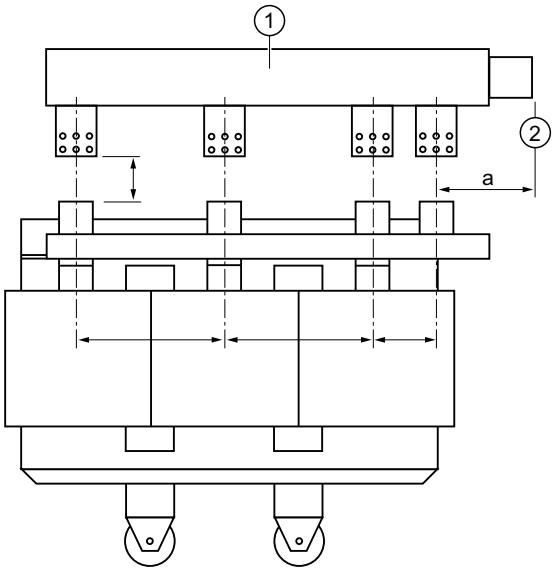
Configuration dimensions for terminal elements	Item	Description
	①	Monobloc centre
	X	Length of lug connection zone
	Z	Height of terminal element
	Y	Distance to monobloc centre

The X-dimension of transformer and distribution board terminal elements is defined as a maximum of 0.70 m (1.00 m in the case of double systems).

If a large X-dimension should be necessary due to larger lug distances, this is covered by the ordering type LR…..-0.1 for every 100 mm of additional length.

Positioning

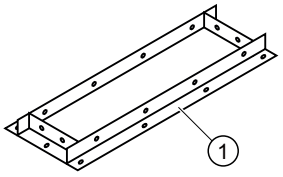
The terminal element must be positioned as follows above the transformer:

Configuration dimensions for determining the position	Item	Description
	①	Transformer connection terminal element
	②	Monobloc centre
	a	Dimension data for detailed configuration

Connecting

The terminal lugs including the hole pattern are dimensioned in relation to each specific order.

An additional assembly flange for adaptation to the transformer housing is included for the TO and TC terminal elements

Assembly flange for terminal elements	Item	Description
	①	Assembly flange for terminal elements

Depending on the system size, a set of flexible straps and screws is available for transformer connection. A set price is available for the bid phase. Within the scope of detailed configuration, during ordering this set is broken down into flexible straps and bolting sets (LR-FLEX*, LR-SCREW*).

4.8 Configuring LR tap-off points

Configuration

If power taps are planned along the busbar layout, the appropriate number and components of the tap-off points must be defined.

The maximum permissible rated current of a tap-off point is limited to 630 A.

The tap-off point is equipped with a protective device depending on the customer's requirements.

The positions and design of the tap-off points in the busbar layout are defined in the detailed configuration phase.

4.9 Configuring LR system transitions

Configuration

A type-tested connection to the LX or LD system can be implemented for the LR system using an adapter element.

Adapter elements for a transition from the LR system to the LX or LD system are available for all LXA/LXC and LDA/LDC system sizes.

For use of the LR-LD transition box in the horizontal layout, attention must always be paid to the LD system's standard installation position. This results in

- edgewise for LD for the horizontal installation position
- flat for LR for the horizontal installation position

Due to expansion of the busbar run in the transition box, it is not possible to use the LR-LD transition box in the vertical busbar run with the standard fastening accessories. If required in special cases, product management must be contacted.

Note

A type-tested connection to the SIVACON 8PV / 8PT and S4 / S8 power distribution boards can also be implemented with the adapter element. The relevant adapter elements are available for all sizes.

4.10 Configuring the LR expansion compensation

Expansion compensation

Due to heat dissipation under load, the busbar assembly including the enclosure expand. Length expansion of the busbar assembly depends on:

- Conductor material of the busbar system
- Layout of the busbar system (horizontal or vertical)
- Purpose (power conveyance or distribution)

Expansion compensation in practice

Expansion compensation is implemented by using a special busbar element with integrated expansion strips. This element absorbs expansion of the busbar run up to the specified maximum busbar run length and must be positioned in conformity with the configuration rules for a horizontal or vertical layout. Within a defined length, expansion compensation can compensate for both tension and compression forces.

Configuration cases

Three cases must be distinguished during configuration:

- Configuring horizontal busbar layouts
- Configuring height changes within horizontal layouts
- Configuring vertical busbar layouts

For preparation of a bid, one expansion compensation element must be calculated for every 35 m – 40 m of the total busbar length. Fixed points need not be calculated separately.

4.11 Configuring LR fixed points

Fixed points

Fixed points are special fixing brackets that permanently fix the busbar element to the fixing material available on site. They therefore ensure expansion compensation in a defined direction.

A distinction is made between horizontal and vertical installation fixed points (see selection and ordering data).

Attachment of fixed points

Attachment of a fixed point is necessary on the following busbar components:

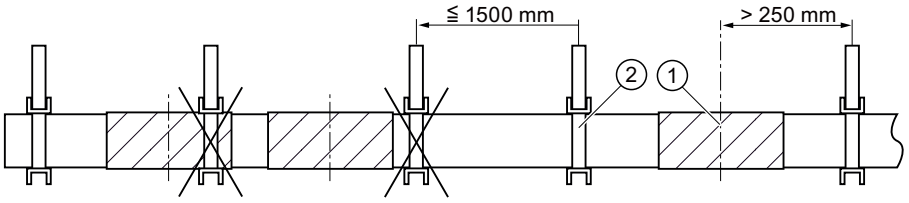
- Distribution board terminal connection elements
- Cable feeder units (KE)
- Transformer terminal connection elements
- Straight busbar elements and junction units depending on the length and course of the busbar run (defined during detailed configuration).

Expansion compensation elements and fixed points are configured within the scope of detailed configuration by BKS.

4.12 Configuring LR fixing elements

Configuration

Generally a maximum permissible fixing distance of 1.5 m between 2 fixing points should be observed. On busbar elements with a length of 2 m to 3 m the use of two fixing elements is recommended.

Configuring fixing points	Item	Description
	①	Monobloc centre
	②	Fixing point

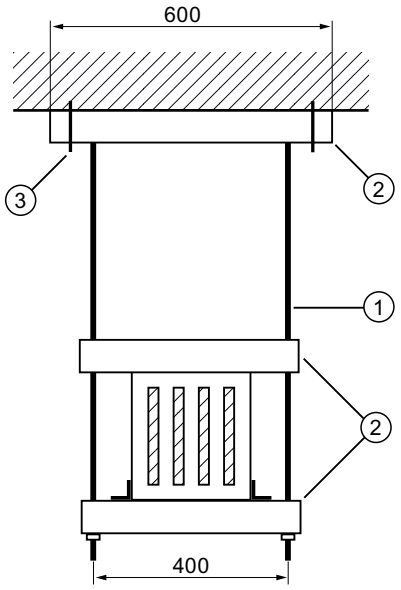
The fixing brackets should be placed vertically and horizontally every 1.5 m. The different weights of single and double systems should be considered when choosing the fixing brackets.

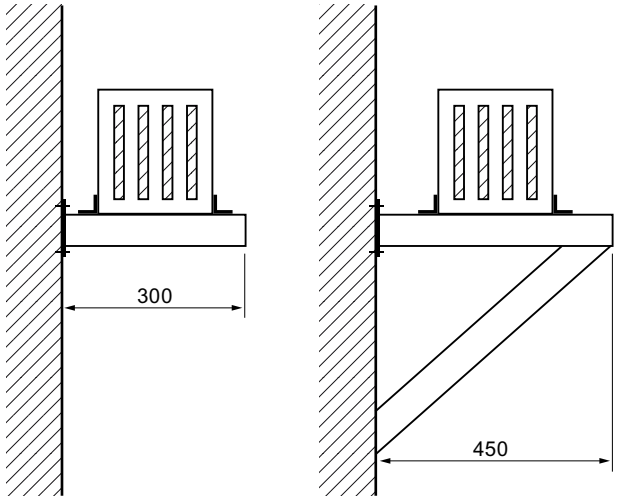
The fixing brackets feature different C-profiles due to the different system weights.

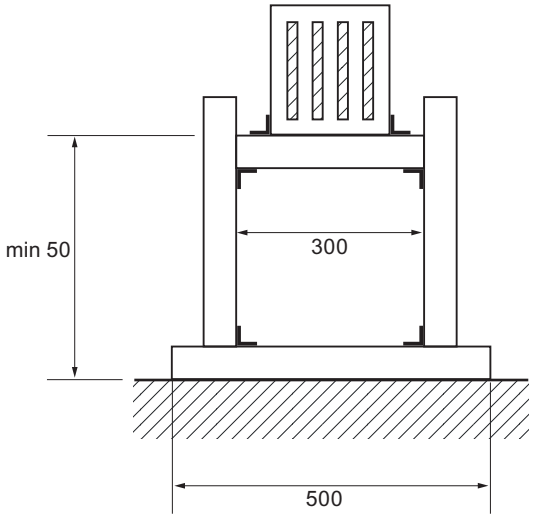
Minimum fixing methods for horizontal installation

Three possibilities are provided here:

- Ceiling: suspended installation
- Wall: supported installation
- Floor: elevated installation

Ceiling fixing example: suspended installation	Description
	① Threaded rods ② C-profiles ③ Dowels (suspension up to 1.0 m under the ceiling), part of the fixing sets LR..-BHH / LR..-BHF
	Note on the fixing sets LR..-BHH / LR..-BHF. Components are: 2 x M10 threaded rods 2 C-profiles 4 lock nuts with spring washers

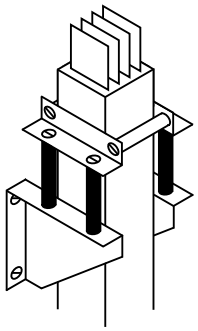
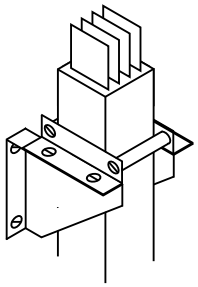
Wall fixing example: supported installation	Description
	4-conductor system: LR-BHW1 (illustrated on left) Double system LR-BHW2 (illustrated on right) mounted on a support.

Floor fixing example: elevated installation	Description
	Double system elevated on the floor (available on request)

Possible fixing methods for vertical installation

Two possibilities are provided here:

- Fixing with spring clips
- Fixing with slip yokes
- Fixing with fixed point brackets

Vertical installation fixing examples	Description
	Fixing with spring clips (for weight support) [Type: LR…-BVD(W)]
	Fixing with slip yokes or fixed point brackets [Types: LR…-BF(G)(VD)(VW)]

Note

The spring clips or slip yokes are configured within the scope of detailed configuration by BKS. For the bid, one spring clip and one slip yoke must be planned for every 1.5 m.

4.13 Configuring fire protection

Fire protection requirements

The LR system meets the requirements of the following standards:

- Fire protection to EN 60439-2
- Fire resistance classes S60 to S120 in compliance with EN 1363-1 and DIN 4102-9 for use on the German market.

The German state authorities have also stipulated that buildings must be designed so that:

"[...] "[...] "The development and spread of fire must be prevented and the rescue of persons and animals as well as fire fighting must be possible".

Thus, the requirement is that neither fire nor smoke may cross from one fire sector to another.

Note

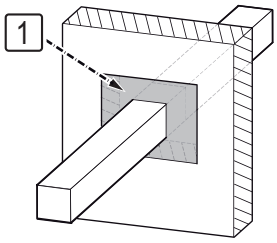
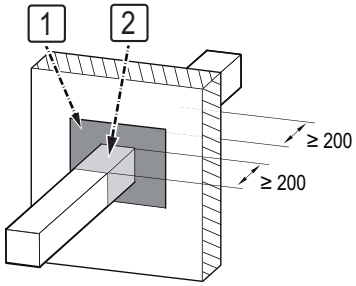
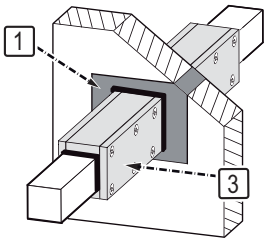
A general construction permit from the German Institute for Construction Technology (Deutsches Institut für Bautechnik) in Berlin (DIBt) is currently not available. Enquire with the product area.

Special aspects of LR fire protection

By default, LR fire protection fulfils the requirements of fire resistance classes S60, S90 and S120 in compliance with EN 60439-2. Categorisation according to the relevant fire resistance class applies to all kinds of buildings, including high-rise buildings. For use of LR fire protection in compliance with DIN 4102-9 for the German market, you must clarify the fire protection version in advance in the product area.

Structural measures [1)]

You can implement the following structural measures to achieve the necessary fire resistance class:

Fire resistance class / LR system		S60	S90	S120
Structural measure				
LR...01... to LR...29...	①	Installation material: Mortar Actifoam	Installation material: Mortar Actifoam	Installation material: Mortar Actifoam
	②	—	Bulkhead material: Paint coating, four-sided Thickness at least 1.0 mm Length at least 200 mm	—
	③	—	—	Bulkhead material: 4 panels, "Promatect 200" 20 mm thick 200 mm long
Notes		Coat the standard system on site with mortar or Actifoam. No further actions are necessary.	Coat the standard system on site with mortar or Actifoam. Additional protective coating on the left and right of the wall or ceiling.	Coat the standard system on site with mortar or Actifoam. Additional "Promatect 200" panels on the left and right of the wall or ceiling.

Selection list for LR system fire protection accessories (Page 75)

[1)] Structural measures apply to the fire protection version in compliance with IEC 60439-2 or EN 60439-2. Please enquire with the product area for details of additional measures for the German market in compliance with DIN 4102-9.

4.14 Configuring functional endurance

Functional endurance

Fire prevention devices and fire prevention measures for electrical systems are required for systems installed in buildings, particularly those with special uses.

For example, buildings of these types are hospitals or office buildings. During a fire, the electrical systems in these buildings must remain operational for a defined period of time in compliance with the DIN VDE 0108 standard. This applies in particular to:

- Fire alarm systems
- Systems for alerting and providing instructions to visitors and employees
- Emergency lighting
- Passenger lifts with evacuation circuits that assure functional performance for at least 30 minutes in the incoming cable area under full fire conditions
- Water pressure boosting systems for the supply of extinguishing water
- Ventilating systems of safety stairwells, fire department lifts and machine rooms where functioning must be guaranteed for at least 90 minutes.

Proof of functional endurance

The materials testing laboratory in Braunschweig carried out tests to guarantee compliance with the functional endurance requirements for busbar trunking systems as demanded in the standards. During the test the busbar trunking system concerned is subjected to an external fire load in compliance with the standard temperature curve (STC) for evaluation of functional endurance to DIN 4102 part 12 (01/91).

Configuring functional endurance

The LRC system[1)] only achieves the functional endurance classes E30 to E120 in compliance with DIN 4102-12 when additional measures are implemented. Regardless of the system's size and the installation position, protective housing with "Promatect 200" panels is necessary for this purpose.

The "Promatect 200" panels are fitted onto the busbar elements at the factory. The connection points are panelled on the site.

Note the following ordering information:

- Order busbar elements prepared for functional endurance via BKS with the order designation SOND.

Fastening of vertically running LRC busbars that have to exhibit functional endurance must be clarified with the product area early on during the planning phase.

[1)] not applicable to LRA and must be queried with the product area

Functional endurance E120 for the LR system

The general test certificate of the construction supervisory authority (abP) applies to production and application of ducts made of "Promatect 200" panels with busbar trunking systems belonging to the "LRA(C)" type series and the functional endurance class E120 in compliance or accordance with DIN 4102-12: 1998-11[1].

The functional endurance class E120 can only be issued in accordance with DIN 4102-12: 1998-11[1] because, according to DIN 4102-12: 1998-11 only the three functional endurance classes E30, E60 and E90 exist.

The ducts consisting of "Promatect 200" panels, the ducts with busbar trunking systems may be suspended from solid ceilings or fastened on solid walls.

The busbar trunking systems in the duct may be fastened on

- walls (minimum thickness 120 mm consisting of masonry in compliance with DIN 1053-1 to 4, consisting of concrete or reinforced concrete in compliance with DIN 1045 or aerated concrete building boards in compliance with DIN 4166 or
- ceilings (minimum thickness 150 mm consisting of concrete or reinforced concrete in compliance with DIN 1045 or aerated concrete in compliance with DIN 4223 or in compliance with a general construction supervisory authority approval

of at least the corresponding fire resistance class F 120 of the duct.

For connection of the ducts to other structural components, e.g. load-bearing and non-load-bearing light partition walls or wooden components, applicability must be separately verified (e.g. by means of a general construction supervisory authority approval).

The busbar trunking systems in the duct may be routed through

- walls (minimum thickness 120 mm) consisting of masonry in compliance with DIN 1053-1 to 4, consisting of concrete or reinforced concrete in compliance with DIN 1045 or aerated concrete building boards in compliance with DIN 4166

of at least the corresponding fire resistance class F 120 of the duct.

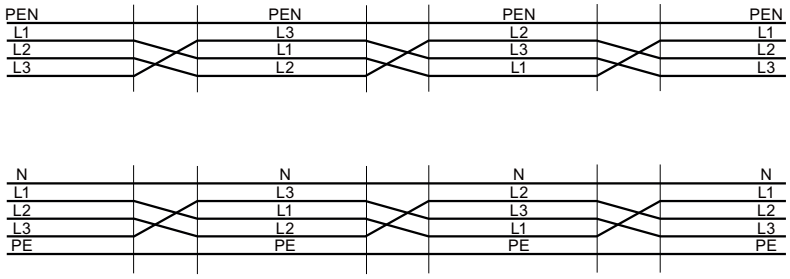
For routing of the ducts through other structural components, e.g. load-bearing and non-load-bearing light partition walls or wooden components, applicability must be separately verified (e.g. by means of a general construction supervisory authority approval).

4.15 LR phase transition units

Phase transition

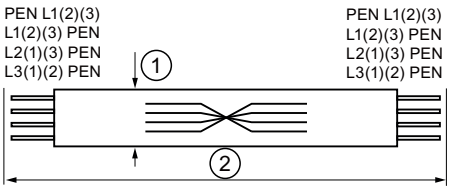
When power is conveyed over long distances[1] (> approx. 90 m), extreme voltage drops can occur in the individual conductors due to the conductor configuration. Phase transition units are necessary in order to compensate for this effect.

These units change the conductor configuration and are planned on each third of the overall busbar run, in order to re-establish the initial position at the end of the busbar run (see sketch).

Conductor configuration for phase transitions	Description
	Phase transition unit on entire busbar run

Phase transition unit to change the connection position

Phase transition units can be used on the short runs to change the connection positions of the phases for connection to the transformer or distribution board.

Configuration dimensions for phase transition units	Item	Description
	①	System width + 40 mm
	②	Min. length 1.0 m

Note

An additional phase transition is not necessary for the terminal elements TX and TE because the phase connection position can be chosen freely.

1) The maximum length of the run may also be shorter depending on the maximum permissible voltage drop. Clarification with the product area is necessary.

4.16 LR project processing

4.16.1 LR bid phase

Drawing up a bid

This includes:

- Determination of the system size
  - Draw the busbar run
  - Configure the junction units
  - Define the horizontal/vertical junction units as standard types with standard limb lengths
  - Position the transformer, distribution board connection and cable feeder unit
  - Add straight lengths to the run
  - Determine the number of monoblocs
  - Consider possible expansion elements (or phase transition units)
  - Draw in positions of tap-off points and ask BKS about parallel tap-off units
  - Determine the number of required casting moulds (depending on the installation orientation)
  - Determine the number of required vertical or horizontal fixing brackets
- Immediately clarifying customised solutions (special solutions) with BKS.
- Additionally:
  - Plan the wiring of the transformer connection terminal
  - Clarify the transformer connection details with BKS if required
  - Demoulding agent
  - Tool set (recommended)
  - Cast resin mix

Drawing up the bid parts list

Transfer the types and quantities of the elements and accessory parts determined in the bid phase to a bid parts list.

4.16.2 LR configuration example

Preconfiguration by Siemens AG

The following details must be determined in the preconfiguration phase:

- Project designation
- Run designation
- Busbar run
- Position and design of the transformer and/or distribution board
- Implementation data
- Dimensions

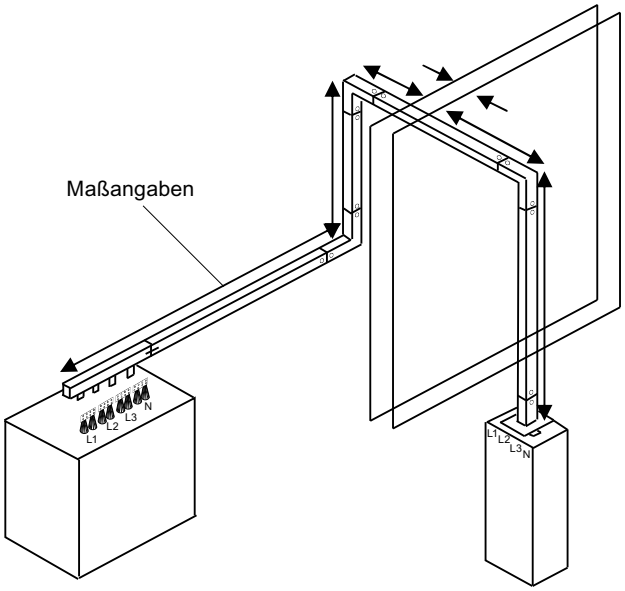


Figure 4-1 Busbar layout with dimension data

Detailed configuration by BKS

The following details must be determined in the detailed configuration phase:

- Busbar layout with position designations and dimension data
- Parts list with types and position designations

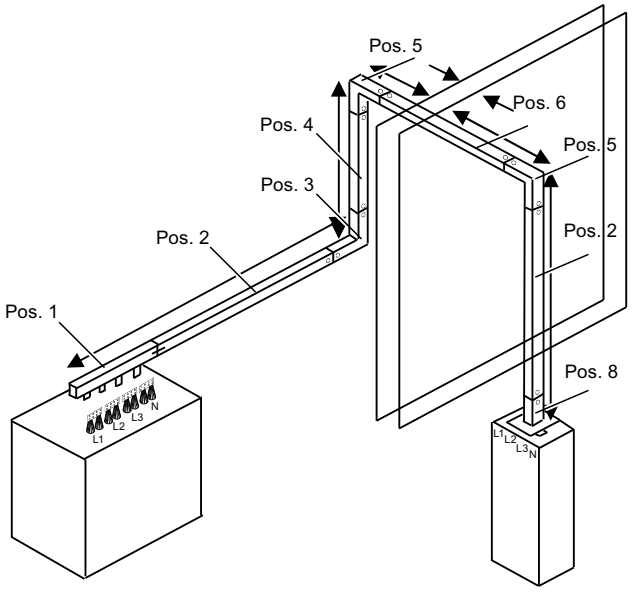


Figure 4-2 Busbar layout with detailed data

4.16.3 LR configuration example in numbers

The following configuration example shows which data has to go to BKS for detailed configuration.

Configuration example Sample Company Ltd.

Project:	Sample Company Ltd.
Rated current I_e [A]	1350 A
Network configuration:	TN-C, LRC 4-conductor system
Busbar run	Transformer connection Busbar run approx. 25 m 3 junction units 1 wall leadthrough Vertical distribution board connection
Transformer:	Lug spacing 3 x 150 mm
Selected system:	LRC0441-8

Parts list for detailed configuration			
Item No.	**Number**	**Type designation**	**Description**
1	1	LRC0441-8-TE-F	Transformer connection unit
2	3	LRC0441-8-3	Straight busbar element
3	1	LRC0441-8-K	Knee (flat elbow)
4	1	LRC0441-8-2 (1.8)	Straight busbar element
5	1	LRC0441-8-E	Elbow (dihedral elbow)
6	1	LRC0441-8-E	Elbow (dihedral elbow)
7	10	LR-BH1	Horizontal fixing bracket
8	1	LRC0441-8-TE	Distribution board connection unit
9	2	LRC0441-8-BVW	Vertical fixing bracket
10	8	LRC0441-8-KB	Monoblocs
11	1	LR-SCREW, LR-FLEX	Screw set and flexible straps
12	1	LR-MIX1	Mixer
13	1	LR-WS	Tool set
14	1	LR-SEP	Demoulding agent
15	6	LR-RES	Cast resin mix

3 casting moulds 1 x LR-6FD11/13-N, 1 x LR-6FF11/13-N and 1 x LR-6FV11/13-N each) and 1 can of demoulding agent are added to the 8 monoblocs as accessories. The types of casting moulds depend on the busbar layout in the configuration drawing.
Recommendation for shortening the installation time (Sample Ltd. project size): approx. 2 days installation time when using 5 to 8 casting moulds.

Further recommendation example

Recommendation for:

- System LRC0441-8, 1350 A
- Busbar length 80 m
- 30-35 monoblocs

4-5 days installation time with 3 persons

8 casting moulds

Note

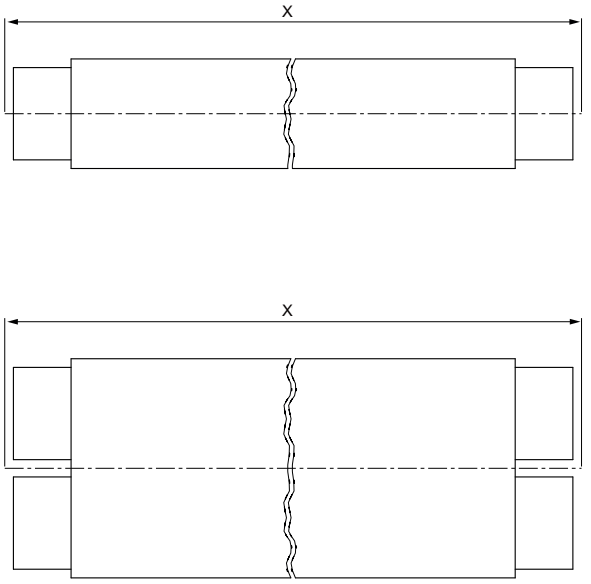
Casting moulds and mixer are reusable!

4.17 LR dimension drawings

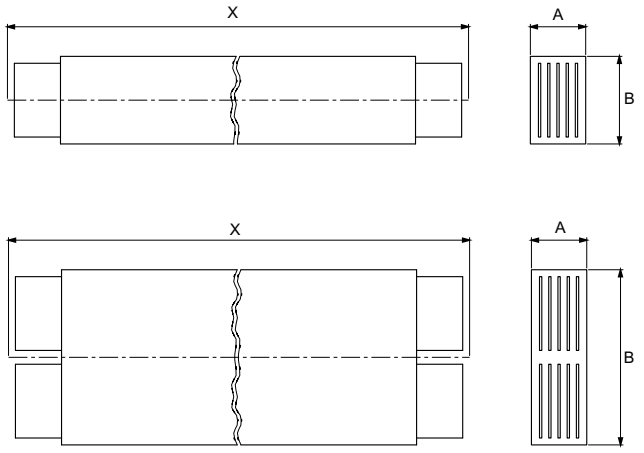
4.17.1 Straight LR elements

4.17.1.1 Straight LR busbar element

Dimension drawing of the straight busbar element (4-conductor system)

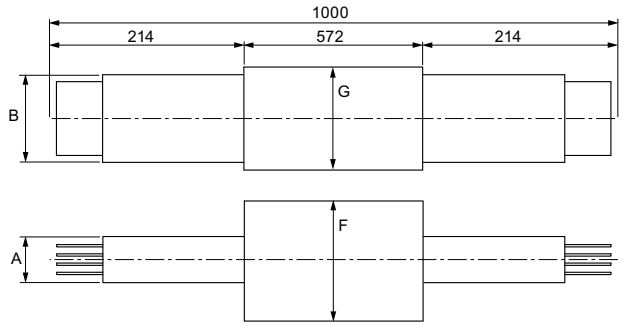
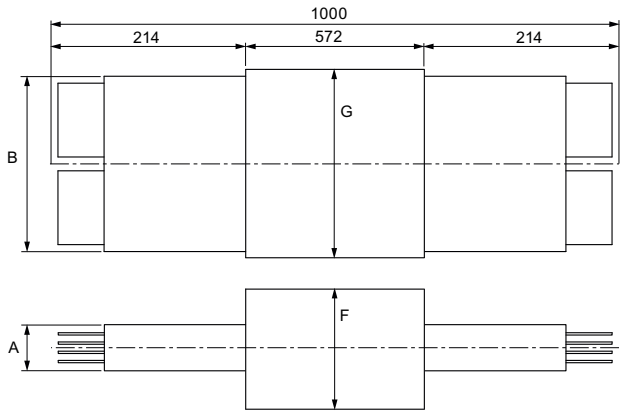
Dimension drawing	System	A [mm]	B [mm]	X [mm]
	LR...0141	90	90	300…3000
	LR...0241			
	LR...0341			
	LR...0441	100	110	
	LR...0541		130	
	LR...0641		150	
	LR...0741		190	
	LR...0841		230	
	LR...0941		270	
	LR...2741		380	
	LR...2841		460	
	LR...2941		540	

Dimension drawing of the straight busbar element (5-conductor system)

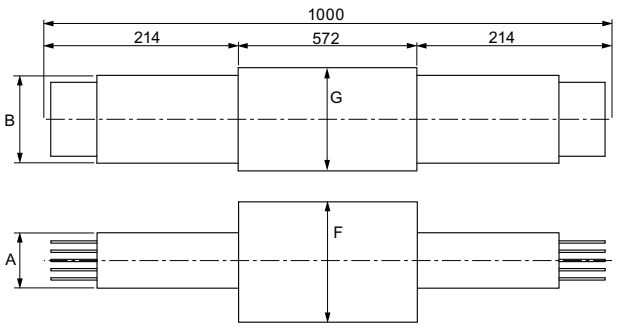
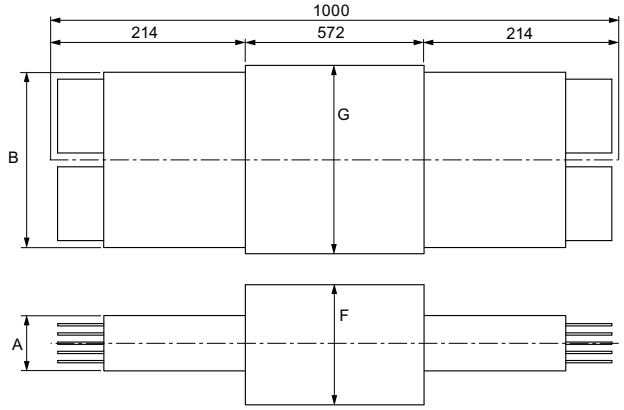
Dimension drawing	System	A [mm]	B [mm]	X [mm]
	LR.....0151	90	90	300…3000
	LR.....0251			
	LR.....0351			
	LR.....0451	120	110	
	LR.....0551		130	
	LR.....0651		150	
	LR.....0751		190	
	LR.....0851		230	
	LR.....0951		270	
	LR.....2751		380	
	LR.....2851		460	
	LR.....2951		540	

4.17.1.2 LR expansion element

Dimension drawing of the expansion element (4-conductor system)

Dimension drawing	System	Length A in [mm]	Length B in [mm]	Length G in [mm]	Length F in [mm]
	LR...0141	90	90	B+20	290
	LR...0241				
	LR...0341				
	LR...0441	100	110		
	LR...0541		130		
	LR...0641		150		
	LR...0741		190		
	LR...0841		230		
	LR...0941		270		
	LR...2741		380		
	LR...2841		460		
	LR...2941		540		

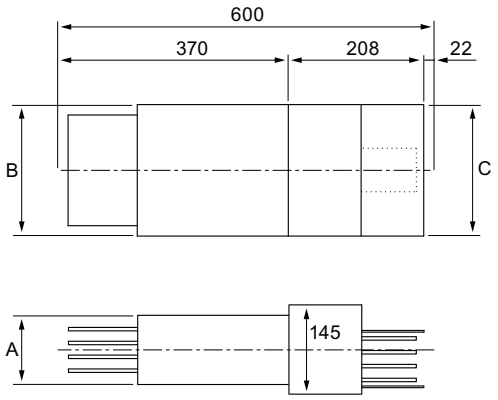
Dimension drawing of the expansion element D (5-conductor system)

Dimension drawing	System	Length A in [mm]	Length B in [mm]	Length G in [mm]	Length F in [mm]
	LR...0151	90	90	B+20	290
	LR...0251				
	LR...0351				
	LR...0451	120	110		
	LR...0551		130		
	LR...0651		150		
	LR...0751		190		
	LR...0851		230		
	LR...0951		270		
	LR...2751		380		
	LR...2851		460		
	LR...2951		540		

4.17.1.3 Adapter element LRA-LXA/LRC-LXC/LRA-LDA/LRC-LDC

Dimension drawing of the LX adapter element. (4-conductor system)

Dimension drawing

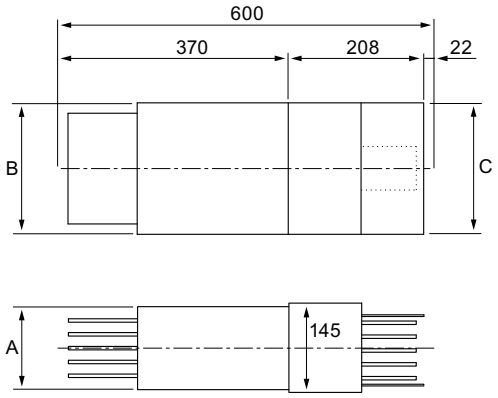


System transition			Dimensions (mm)		
Max. permissible rated current I_e [A]	From LR...	to LX.	A	B (LR)	C (LX)
800	LRA0341-6	LXA0141	90	90	137
1000	LRA0441-8	LXA0241	100	110	137
1200	LRA0541-0	LXA0441		130	162
1400	LRA0641-2	LXA0541		150	207
1600	LRA0741-8	LXA0541		190	207
2000	LRA0841-0	LXA0641		230	287
2500	LRA0941-2	LXA0741		270	287
3200	LRA2741-8	LXA0841		380	439
4000	LRA2841-0	LXA0941		460	599
4500	LRA2941-2	LXC1041		540	599

System transition			Dimensions (mm)		
Max. permissible rated current I_e [A]	From LR...	to LX.	A	B (LR)	C (LX)
1000	LRC0341-6	LXC0141	90	90	137
1250	LRC0441-8	LXC0241	100	110	137
1400	LRC0541-0	LXC0341		130	162
1600	LRC0541-0	LXC0441		130	162
1700	LRC0641-2	LXA0541		150	207
2000	LRC0741-8	LXA0541		190	207
2500	LRC0841-0	LXA0641		230	287
3200	LRC0941-2	LXA0741		270	287
4000	LRC2741-8	LXA0841		380	439
5000	LRC2841-0	LXC0941		460	599

Dimension drawing of the adapter element LX (5-conductor system)

Dimension drawing

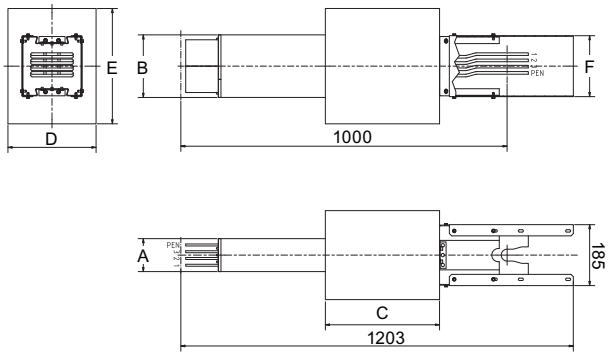


System transition			Dimensions (mm)		
Max. permissible current I_e [A]	From LR...	to LX.	A	B (LR)	C (LX)
800	LRA0351-6	LXA0151	90	90	137
1000	LRA0451-8	LXA0251	120	110	137
1200	LRA0551-0	LXA0451		130	162
1400	LRA0651-2	LXA0551		150	207
1600	LRA0751-8	LXA0551		190	207
2000	LRA0851-0	LXA0651		230	287
2500	LRA0951-2	LXA0751		270	287
3200	LRA2751-8	LXA0851		380	439
4000	LRA2851-0	LXA0951		460	599
4500	LRA2951-2	LXA1051		540	599

System transition			Dimensions (mm)		
Max. permissible current I_e [A]	From LR...	to LX.	A	B (LR)	C (LX)
1000	LRC0351-6	LXC0151	90	90	137
1250	LRC0451-8	LXC0251	120	110	137
1400	LRC0551-0	LXC0351		130	162
1600	LRC0551-0	LXC0451		130	162
1700	LRC0651-2	LXC0551		150	207
2000	LRC0751-8	LXC0551		190	207
2500	LRC0851-0	LXC0651		230	287
3200	LRC0951-2	LXC0751		270	287
4000	LRC2751-8	LXC0851		380	439
4500	LRC2851-0	LXC0951		460	599

Dimension drawing of the LR-LD adapter element (4-conductor)

Dimension drawing

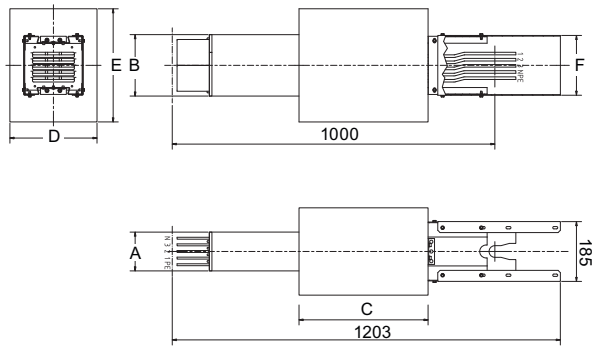


System transition			Dimensions (mm)					
			A	B	C	D	E	F
Max. permissible current I_e (A)	From LR...	to LD...	LR height	LR width	Transition	Transition	Transition	LD width
1000	LRA0441-8	LDA2420	100	110	350	270	270	185
1200	LRA0541-8	LDA2420	100	130	350	270	270	185
1400	LRA0641-8	LDA3420	100	150	350	270	350	185
1600	LRA0741-8	LDA3420	100	190	350	270	350	185
2000	LRA0841-0	LDA5420	100	230	550	270	350	242
2500	LRA0941-2	LDA5420	100	270	550	270	350	242
3200	LRA2741-8	LDA7420	100	380	550	270	410	242
4000	LRA2841-0	LDA8420	100	460	550	270	460	242
2000	LRA0841-0	LDA5410	100	230	550	270	350	242
2500	LRA0941-2	LDA5410	100	270	550	270	350	242
3200	LRA2741-8	LDA7410	100	380	550	270	410	242
4000	LRA2841-0	LDA8410	100	460	550	270	460	242

System transition			Dimensions (mm)					
			A	B	C	D	E	F
Max. permissible current I_e (A)	From LR...	to LD...	LR height	LR width	Transition	Transition	Transition	LD width
2000	LRC0741-8	LDC2420	100	190	350	270	350	185
2500	LRC0841-0	LDC3420	100	230	350	270	350	185
3200	LRC0941-2	LDC6420	100	270	550	270	410	242
4000	LRC2741-8	LDC7420	100	380	550	270	410	242
5000	LRC2841-0	LDC8420	100	460	550	270	460	242
3200	LRC0941-2	LDC6410	100	270	550	270	410	242
4000	LRC2741-8	LDC7410	100	380	550	270	410	242
5000	LRC2841-0	LDC8410	100	460	550	270	460	242

Dimension drawing of the LR-LD adapter element (5-conductor)

Dimension drawing



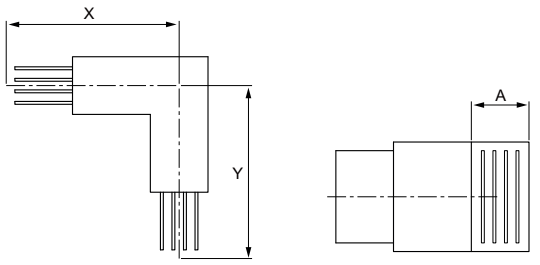
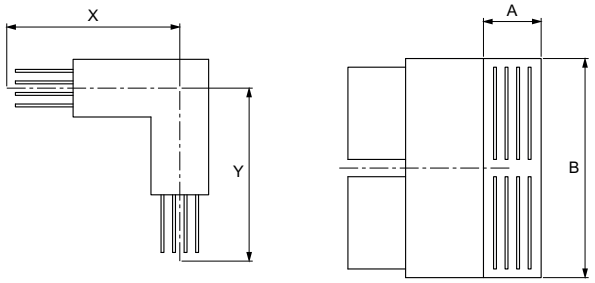
System transition			Dimensions (mm)					
			A	B	C	D	E	F
Max. permissible current I_e (A)	From LR...	to LD...	LR height	LR width	Transition	Transition	Transition	LD width
1000	LRA0451-8	LDA2620	120	110	400	270	270	185
1200	LRA0551-0	LDA2620	120	130	400	270	270	185
1400	LRA0651-2	LDA3620	120	150	400	270	350	185
1600	LRA0751-8	LDA3620	120	190	400	270	350	185
2000	LRA0851-0	LDA5620	120	230	600	270	350	242
2500	LRA0951-2	LDA5620	120	270	600	270	350	242
3200	LRA2751-8	LDA7620	120	380	600	270	460	242
4000	LRA2851-0	LDA8620	120	460	600	290	460	242
2000	LRA0851-0	LDA5610	120	230	600	270	350	242
2500	LRA0951-2	LDA5610	120	270	600	270	350	242
3200	LRA2751-8	LDA7610	120	380	600	270	410	242
4000	LRA2851-0	LDA8610	120	460	600	290	460	242

System transition			Dimensions (mm)					
			A	B	C	D	E	F
Max. permissible current I_e (A)	From LR...	to LD...	LR height	LR width	Transition	Transition	Transition	LD width
2000	LRC0751-8	LDC2620	120	190	400	270	350	185
2500	LRC0851-0	LDC3620	120	230	400	270	350	185
3200	LRC0951-2	LDC6620	120	270	600	270	410	242
4000	LRC2751-8	LDC7620	120	380	600	270	460	242
5000	LRC2851-0	LDC8620	120	460	600	290	460	242
3200	LRC0951-2	LDC6610	120	270	600	270	410	242
4000	LRC2751-8	LDC7610	120	380	600	270	410	242
5000	LRC2851-0	LDC8610	120	460	600	290	460	242

4.17.2 LR junction units

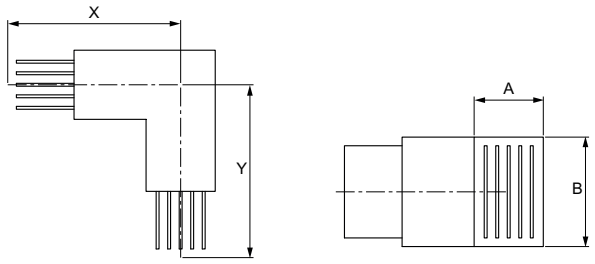
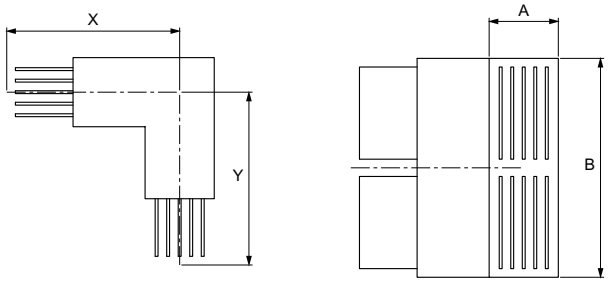
4.17.2.1 Elbow (dihedral elbow) E

Dimension drawing of the elbow (dihedral elbow) E (4-conductor system)

Dimension drawing	System	A [mm]	X [mm]	Y [mm]
	LR...0141 …LR...0341	90	300…1200	300…1200
	LR...0441 …LR...0941	100		
	LR...2741 …LR...2941			

B = system height

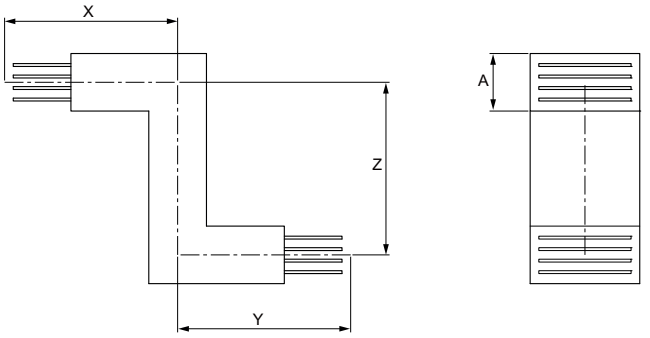
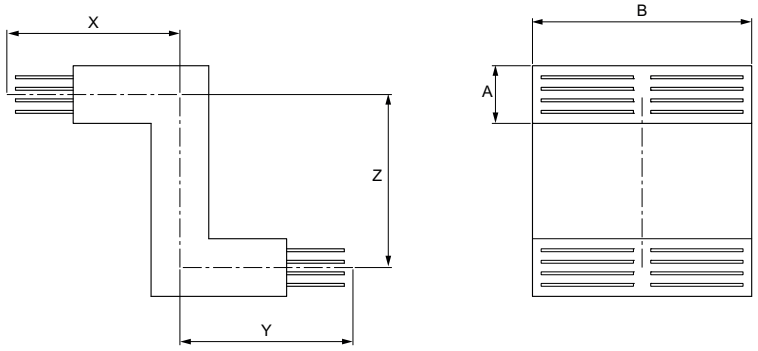
Dimension drawing of the elbow (dihedral elbow) E (5-conductor system)

Dimension drawing	System	A [mm]	X [mm]	Y [mm]
	LR...0151 …LR...0351	90	300…1200	300…1200
	LR...0451 …LR...0951	120		
	LR...2751 …LR...2951			

B = system height

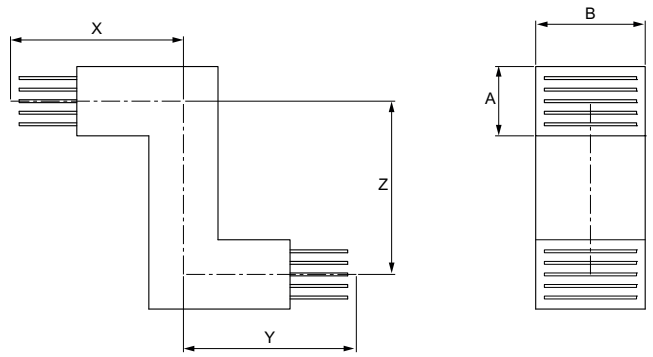
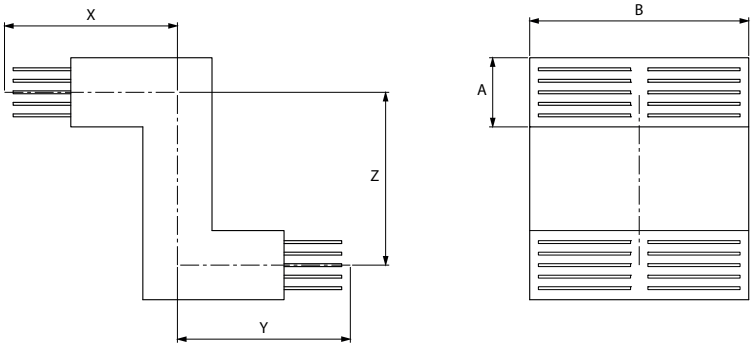
4.17.2.2 Z-element left/right (double dihedral elbow) ZE

Dimension drawing of the Z-element left/right (double dihedral elbow) ZE (4-conductor system)

Dimension drawing	System	A [mm]	X, Y [mm]	Z [mm]
	LR...0141 …LR...0341	90	350	1…700
	LR...0441 …LR...0941	100		
	LR...2741 …LR...2941			

B = system height

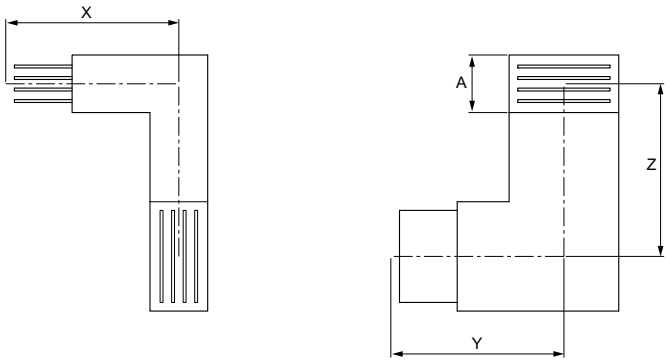
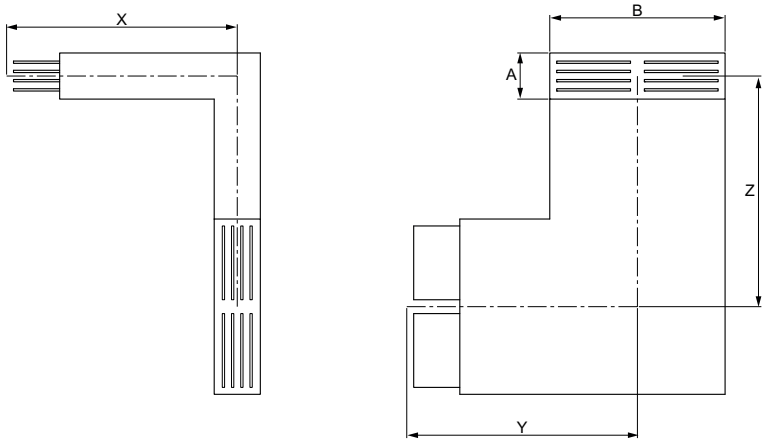
Dimension drawing of the Z-element left/right (double dihedral elbow) ZE (5-conductor system)

Dimension drawing	System	A [mm]	X, Y [mm]	Z [mm]
	LR...0151 …LR...0351	90	350	1…700
	LR...0451 …LR...0951	120		
	LR...2751 …LR...2951			

B = system height

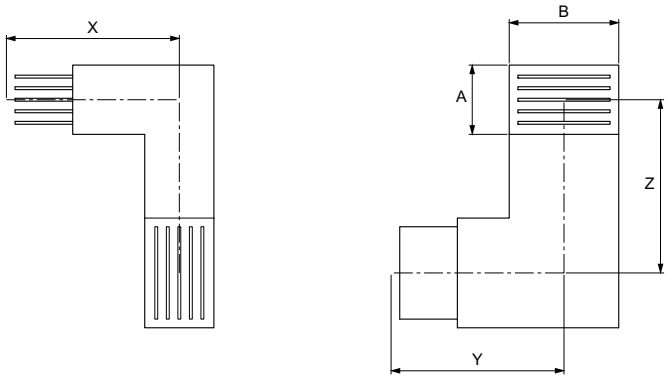
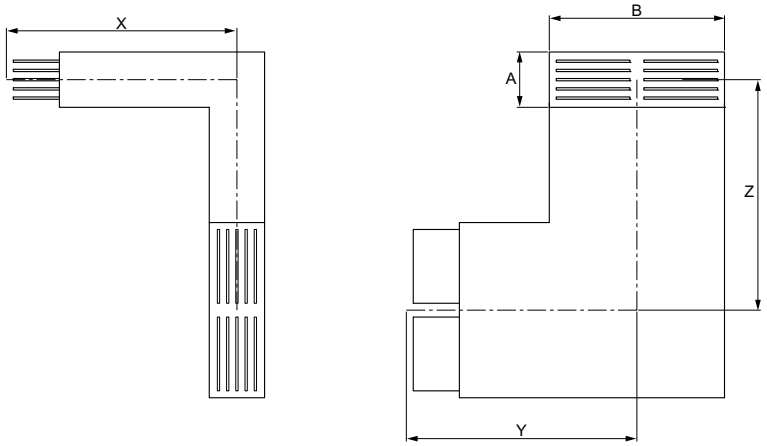
4.17.2.3 Knee offset (flat/dihedral double elbow) XR

Dimension drawing of the offset knee (flat/dihedral double elbow) XR (4-conductor system)

Dimension drawing	LR system	X [mm]	Y [mm]	Z [mm]
	LR...0141	350	350	90…700
	LR...0241			
	LR...0341			
	LR...0441			105…700
	LR...0541			115…700
	LR...0641			125...700
	LR...0741			145…700
	LR...0841			165…700
	LR...0941			185…700
	LR...2741	500	500	240…1000
	LR...2841			280…1000
	LR...2941			320…1000

Length Z [mm] can be chosen freely in cm increments/B = system height

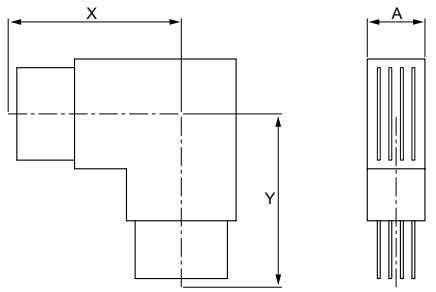
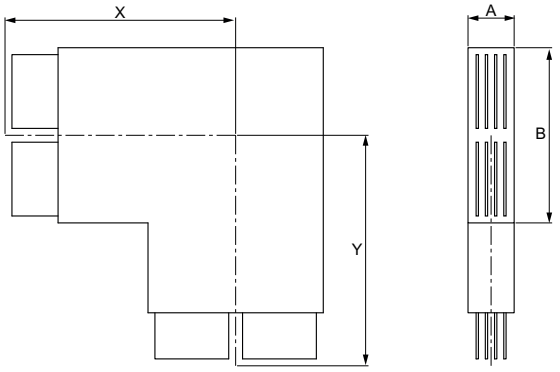
Dimension drawing of the offset knee (flat/dihedral double elbow) XR (5-conductor system)

Dimension drawing	LR system	X [mm]	Y [mm]	Z [mm]
	LR...0151	350	350	90…700
	LR...0251			
	LR...0351			
	LR...0451			115…700
	LR...0551			125…700
	LR...0651			135...700
	LR...0751			155…700
	LR...0851			175…700
	LR...0951			195…700
	LR...2751	500	500	250…1000
	LR...2851			290…1000
	LR...2951			330…1000

Length Z [mm] can be chosen freely in cm increments/B = system height

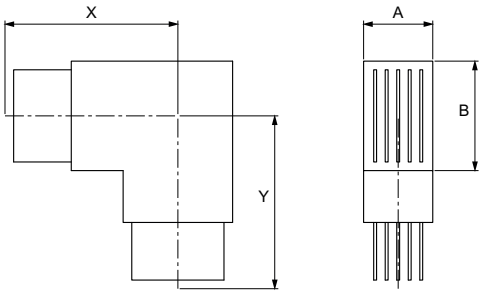
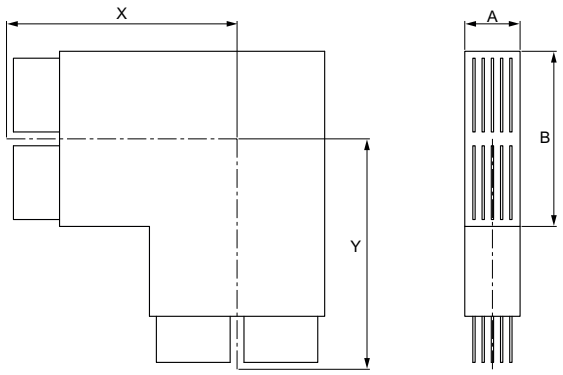
4.17.2.4 Knee (flat elbow) K

Dimension drawing of the knee (flat elbow) K (4-conductor system)

Dimension drawing	LR system	A [mm]	X [mm]	Y [mm]
	LR...0141 …LR...0341	90	350…1150	350…1150
	LR...0441 …LR...0941	100		
	LR...2741 …LR...2941		500…1000	500…1000

B = system height

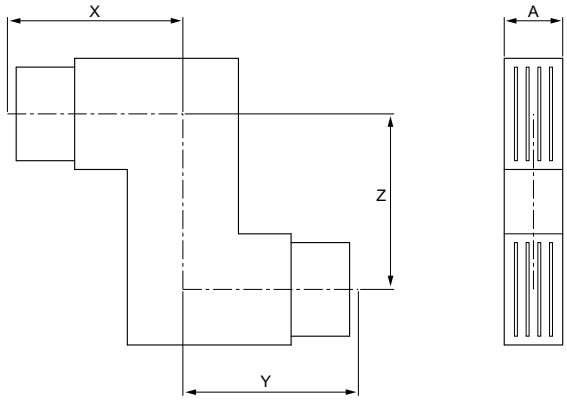
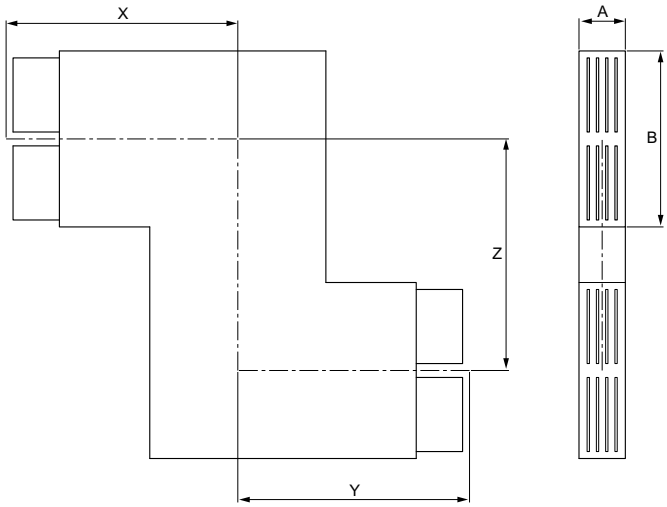
Dimension drawing of the knee (flat elbow) K (5-conductor system)

Dimension drawing	LR system	A [mm]	X [mm]	Y [mm]
	LR...0151 …LR...0351	90	350…1150	350…1150
	LR...0451 …LR...0951	120		
	LR...2751 …LR...2951		500…1000	500…1000

B = system height

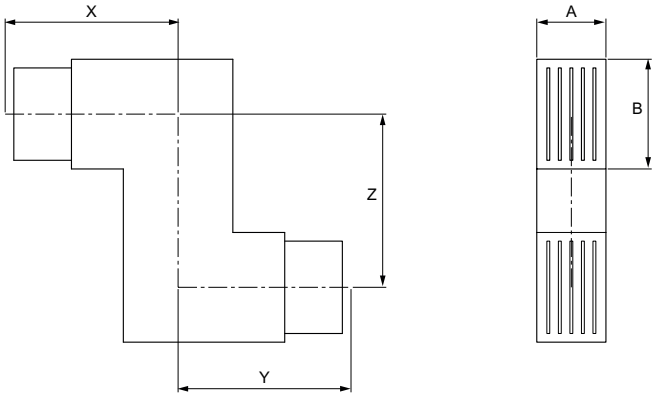
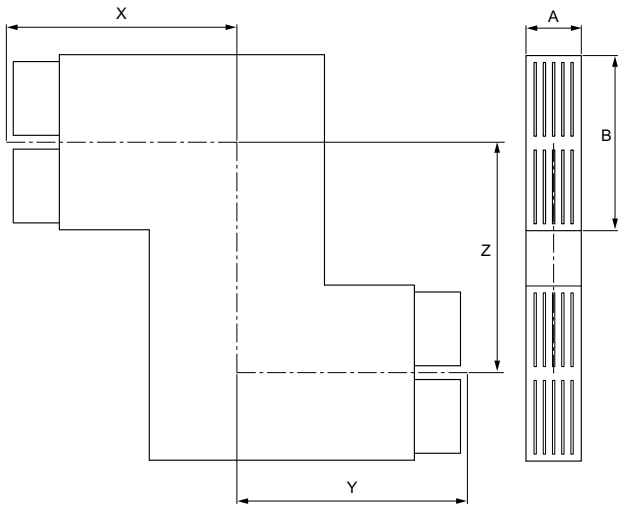
4.17.2.5 Z-element front/rear (flat double elbow) ZK

Dimension drawing of the Z-element front/rear (flat double elbow) ZK (4-conductor system)

Dimension drawing	LR system	A [mm]	X, Y [mm]	Z [mm]
	LR...0141 …LR...0341	90	350	1…700
	LR...0441 …LR...0941	100		
	LR...2741 …LR...2941		500	1…1000

B = system height

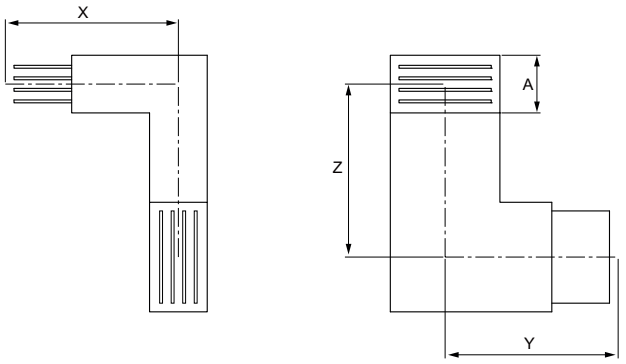
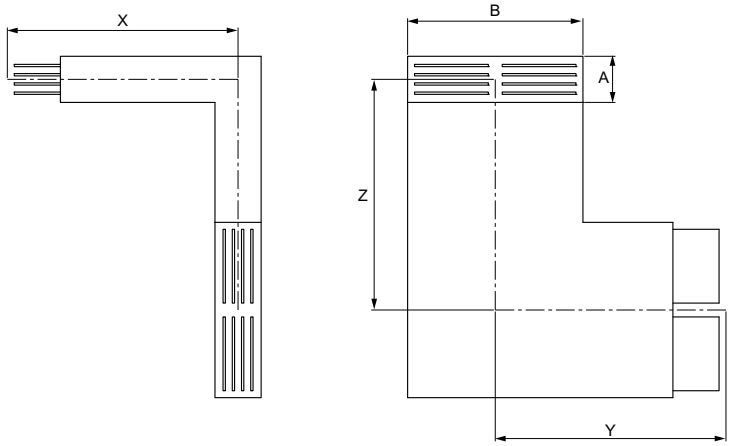
Dimension drawing of the Z-element front/rear (flat double elbow) ZK (5-conductor system)

Dimension drawing	LR system	A [mm]	X, Y [mm]	Z [mm]
	LR...0151 …LR...0351	90	350	1…700
	LR...0451 …LR...0951	120		
	LR...2751 …LR...2851		500	1…1000

B = system height

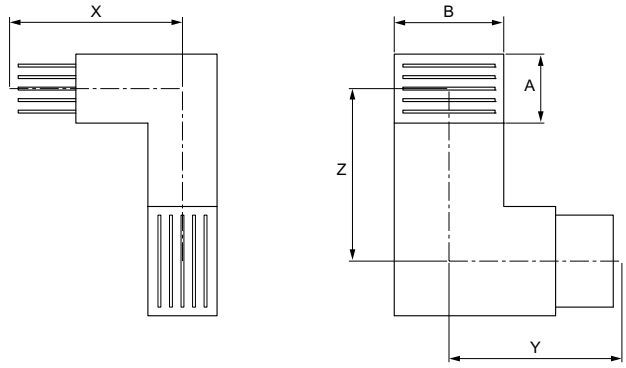
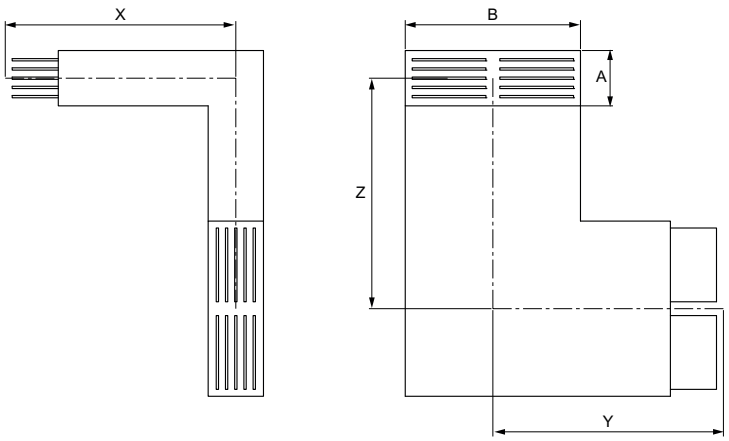
4.17.2.6 Knee offset (flat/dihedral double elbow) XL

Dimension drawing of the offset knee (flat/dihedral double elbow) XL (4-conductor system)

Dimension drawing	LR system	X [mm]	Y [mm]	Z [mm]
	LR...0141	350	350	90…700
	LR...0241			
	LR...0341			
	LR...0441			105…700
	LR...0541			115…700
	LR...0641			125…700
	LR...0741			145…700
	LR...0841			165…700
	LR...0941			185…700
	LR...2741	500	500	240…1000
	LR...2841			280…1000
	LR...2941			320…1000

Length Z [mm] can be chosen freely in cm increments/B = system height

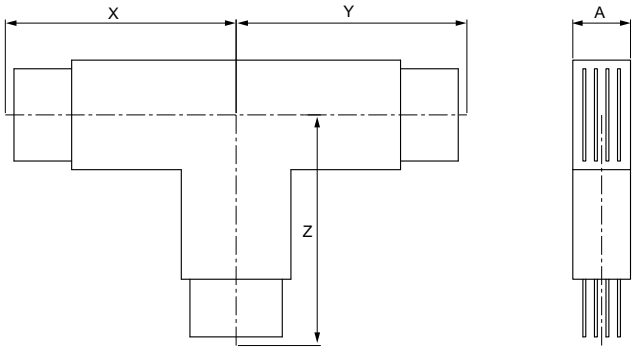
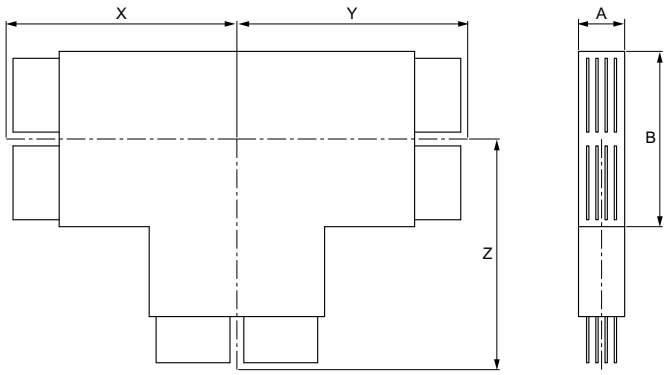
Dimension drawing of the offset knee (flat/dihedral double elbow) XL (5-conductor system)

Dimension drawing	LR system	X [mm]	Y [mm]	Z [mm]
	LR...0151	350	350	90…700
	LR...0251			
	LR...0351			
	LR..0451			115…700
	LR...0551			125…700
	LR...0651			135...700
	LR...0751			155…700
	LR...0851			175…700
	LR...0951			195…700
	LR...2751	500	500	250…1000
	LR...2851			290…1000
	LR...2951			330…1000

Length Z [mm] can be chosen freely in cm increments/B = system height

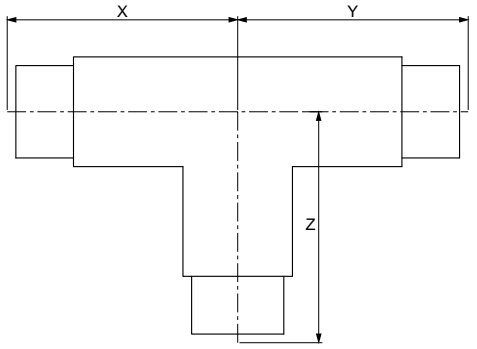
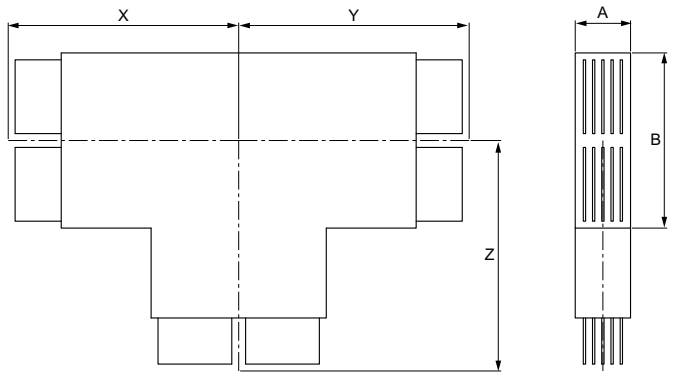
4.17.2.7 T-element TV

Dimension drawings of the T-element TV and the TV-2.0 4-conductor system

Dimension drawings	LR system	A [mm]	TV	TV-2.0	
			X, Y, Z [mm]	X, Y [mm]	Z [mm]
	LR...0141 …LR...0341	90	350	350...750	300…500
	LR...0441 …LR...0941	100			
	LR...2741 …LR...2941		500	500…750	500

B = system height

Dimension drawings of the T-element TV and the TV-2.0 5-conductor system

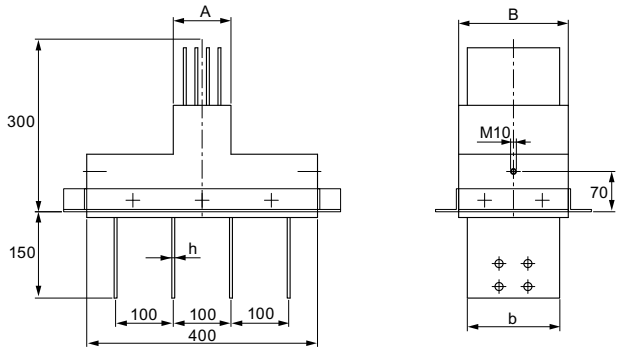
Dimension drawings	LR system	A [mm]	TV	TV-2.0	
			X, Y, Z [mm]	X, Y [mm]	Z [mm]
	LR...0151 …LR...0351	90	350	350…750	350…500
	LR...0451 …LR...0951	120			
	LR...2751 …LR...2951		500	500…750	500

B = system height

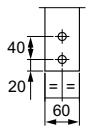
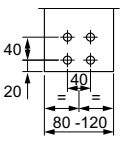
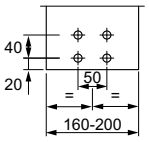
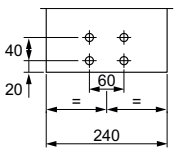
4.17.3 LR terminal elements

4.17.3.1 TO/TO-F terminal element

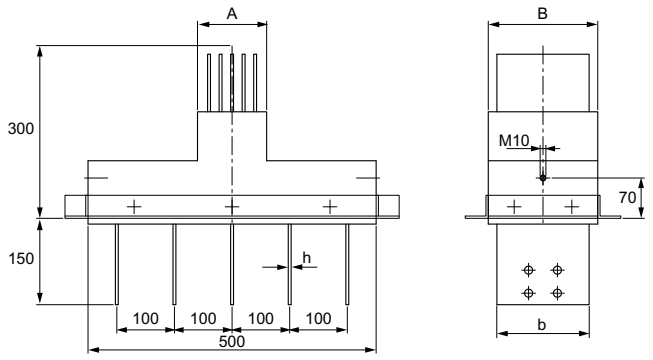
Dimension drawings of the TO and TO-F terminal element 4-conductor system/terminal lugs

Dimension drawing	LR system		TO		TO-F	
		A (mm)	X (mm)	Z [mm]	X (mm)	Z [mm]
	LR...0141 …LR...0341	90	400	300	400…700	300…500
	LR...0441 …LR...0941	100				
	LR...2741 ...LR...2941					

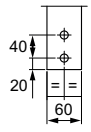
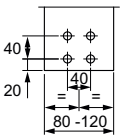
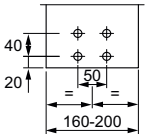
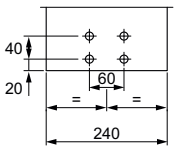
B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	See following table for width of terminal lugs

No.1	No.2	No.3	No.4
LR...01 - LR...03	LR...04 - LR...06	LR...05 - LR...08 LR...27 - LR...28	LR...09 LR...29
			

Dimension drawings of the TO and TO-F terminal element 5-conductor system/terminal lugs

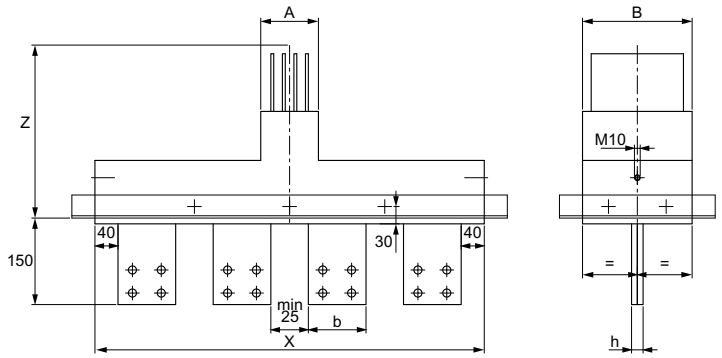
Dimension drawing	LR system		TO		TO-F	
		A (mm)	X (mm)	Z [mm]	X (mm)	Z [mm]
	LR...0151 …LR...0351	90	500	300	300…500	300...500
	LRC0451 … LRC0951	120				
	LRC2751 … LRC2951					

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	See following table for width of terminal lugs

No.1	No.2	No.3	No.4
LR...01 - LR...03	LR...04 - LR...06	LR...05 - LR...08 LR...27 - LR...28	LR...09 LR...29
			

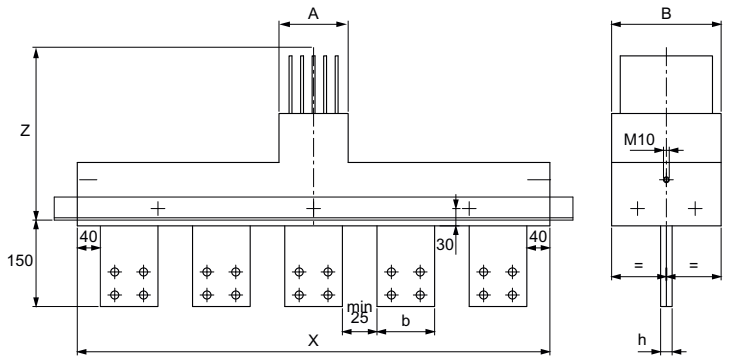
4.17.3.2 TJ-F terminal element

Dimension drawings of the TJ-F terminal element 4-conductor system/terminal lugs

Dimension drawing	LR system		TJ-F	
		A mm	X mm	Z mm
	LR...0141 ...LR...0341	90	400...700	300...500
	LR...0441 ...LR...0941	100		
	LR...2741 ...LR...2941		400...1000	

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

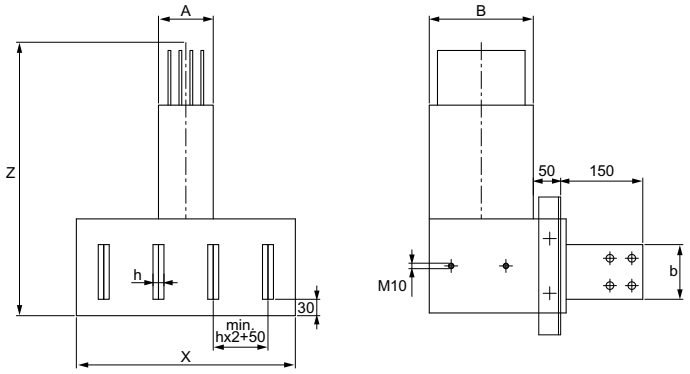
Dimension drawings of the TJ-F terminal element 5-conductor system/terminal lugs

Dimension drawing	LR system		TJ-F	
		A mm	X mm	Z mm
	LR...0151 ...LR...0351	90	500...700	300...500
	LR...0451 ...LR...0951	120		
	LR...2751 ...LR...2951		500...1000	

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

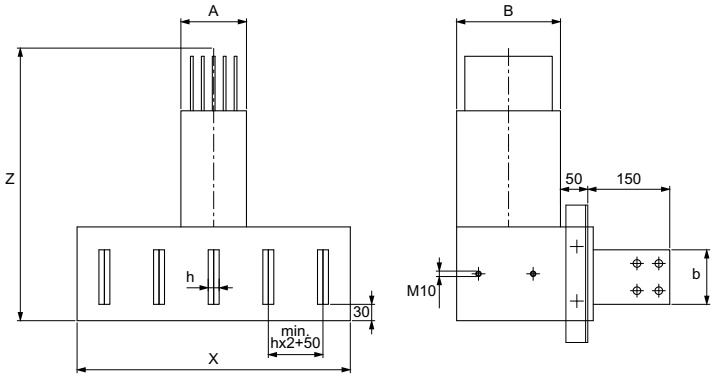
4.17.3.3 TG-F terminal element

Dimension drawings TG-F terminal element 4-conductor system/terminal lugs

Dimension drawing	LR system		TG-F	
		A mm	X mm	Z mm
	LR...0141 …LR...0341	90	400 ... 700	300 ... 500
	LR...0441 ...LR...0941	100		
	LR...2741 …LR...2941			

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

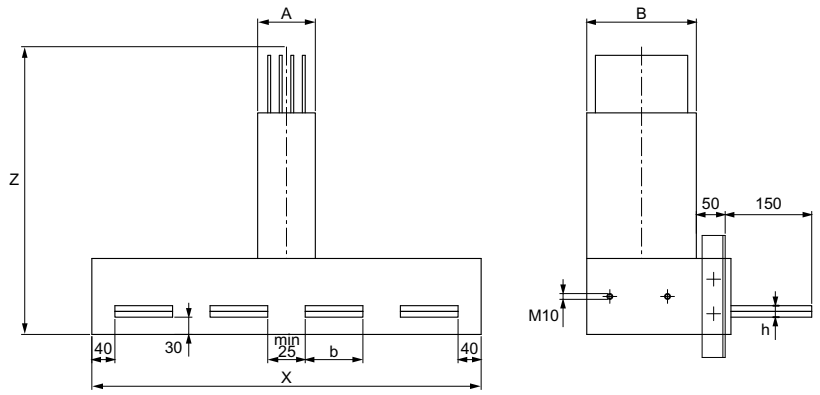
Dimension drawings TG-F terminal element 5-conductor system/terminal lugs

Dimension drawing	LR system		TG-F	
		A mm	X mm	Z mm
	LR...0151 ...LR...0351	90	500 … 700	300 ... 500
	LR...0451 ...LR...0951	120		
	LR...2751 ...LR...2951			

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

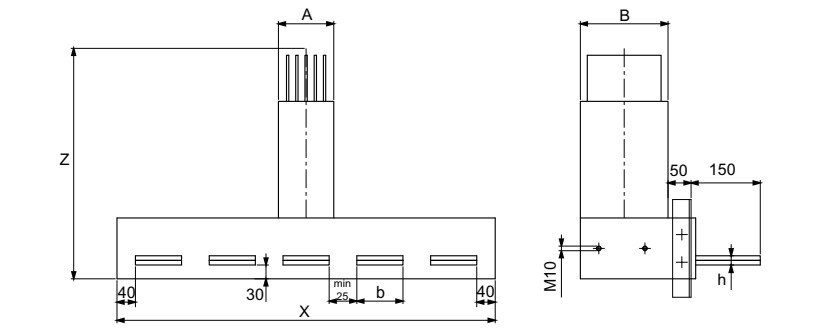
4.17.3.4 TM-F terminal element

Dimension drawings TM-F terminal element 4-conductor system/terminal lugs

Dimension drawing	LR system	A mm	X mm	Z mm
	LR...0141 ...LR...0341	90	400 ... 700	300 ... 500
	LR...0441 ...LR...0941	100		
	LR...2741 ...LR...2941		400 ... 1000	

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

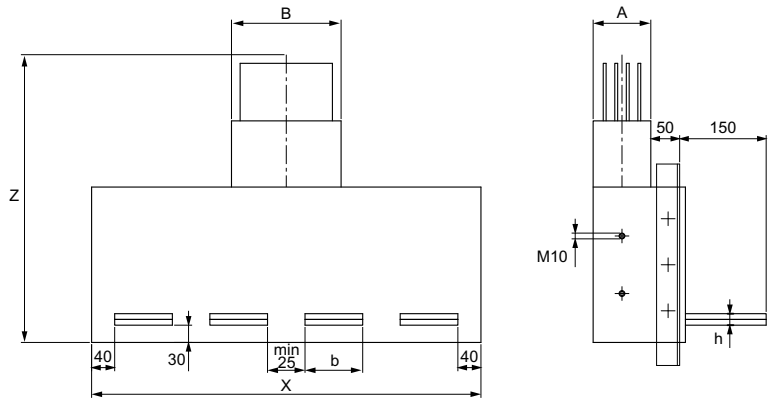
Dimension drawings TM-F terminal element 5-conductor system/terminal lugs

Dimension drawing	LR system	A mm	X mm	Z mm
	LR...0151 ...LR...0351	90	500 ... 700	300 ... 500
	LR...0451 ...LR...0951	120		
	LR...2751 ...LR...2951		500 ... 1000	

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

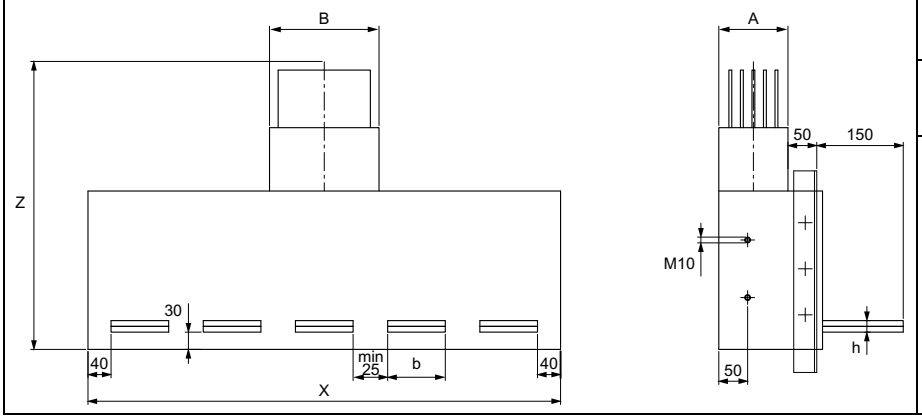
4.17.3.5 TK-F terminal element

Dimension drawings TK-F terminal element 4-conductor system/terminal lugs

Dimension drawing	LR system	A mm	X mm	Z mm
	LR...0141 ...LR...0341	90	400 ... 700	500
	LR...0441 ...LR...0941	100		
	LR...2741 ..LR...2941		400 ... 1000	700

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

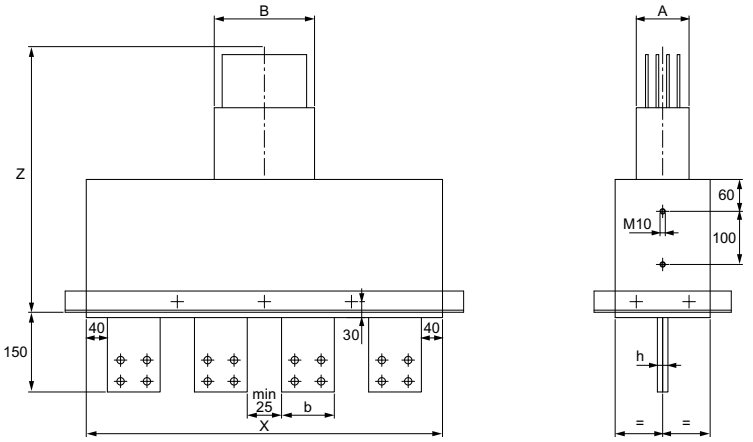
Dimension drawings TK-F terminal element 5-conductor system/terminal lugs

Dimension drawing	LR system	A mm	X mm	Z mm
	LR...0151 ...LR...0351	90	500 ... 700	500
	LR...0451 ...LR...0951	120		
	LR...2751 ...LR...2951		500 ... 1000	700

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

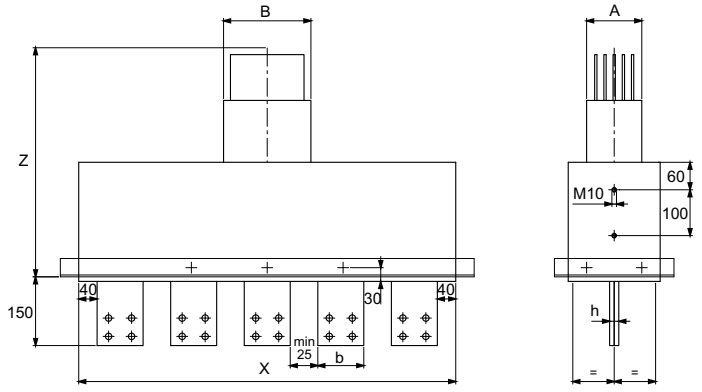
4.17.3.6 TX-F terminal element

Dimension drawings TX-F terminal element 4-conductor system/terminal lugs

Dimension drawing	LR system	A mm	X mm	Z mm
	LR...0141 ...LR...0341	90	400 ... 700	500
	LR...0441 ...LR...0941	100		
	LR...2741 ...LR...2941		400 ... 1000	700

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

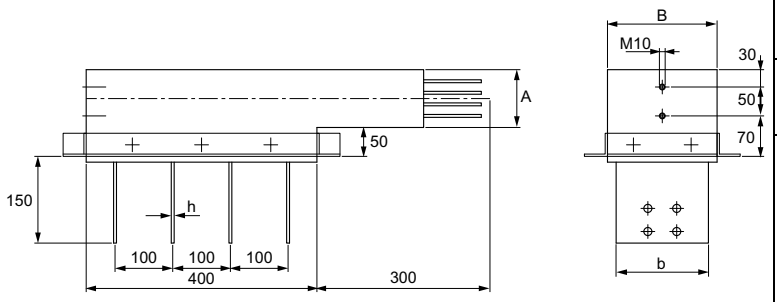
Dimension drawings TX-F terminal element 5-conductor system/terminal lugs

Dimension drawing	LR system	A mm	X mm	Z mm
	LR...0151 ...LR...0351	90	500 ... 700	500
	LR...0451 ...LR...0951	120		
	LR...2751 ...LR...2951		500 ... 1000	700

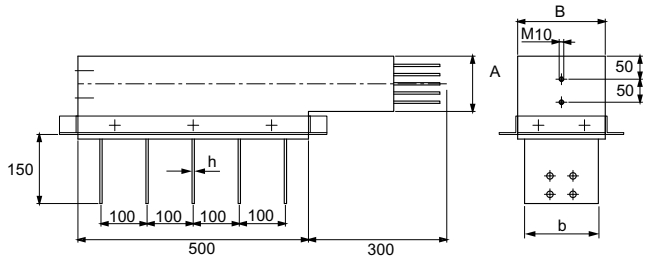
B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

4.17.3.7 TC/TC-F terminal element

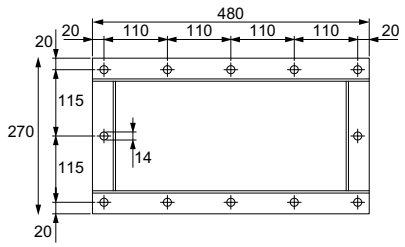
Dimension drawings of TC terminal element 4-conductor system

Dimension drawing	LR system	Length A [mm]	Length X [mm]	Length Z [mm]
	LR...0141 …LR...0341	90	400	300
	LR...0441 …LR...0941	100		
	LR...2741 …LR...2941			

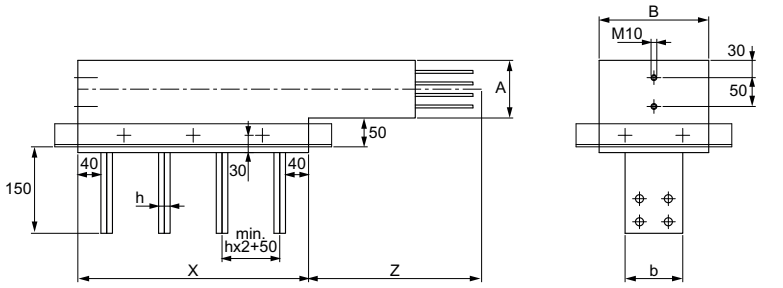
Dimension drawings of TC terminal element 5-conductor system

Dimension drawing	LR system	Length A [mm]	Length X [mm]	Length Z [mm]
	LR...0151 …LR...0351	90	500	300
	LR...0451 …LR...0951	120		
	LR...2751 …LR...2951			

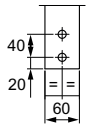
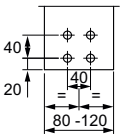
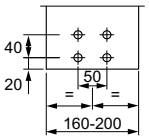
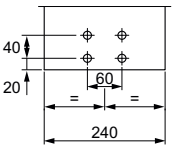
Dimension drawing of assembly flange, TC and TC-F terminal element, 4 and 5-conductor system

Dimension drawing	
	Assembly flange for TC terminal element for 4-conductor systems and 5-conductor systems

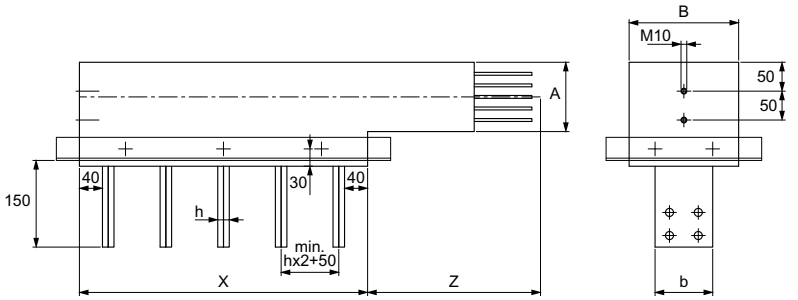
Dimension drawings TC-F terminal element 4-conductor system/terminal lugs

Dimension drawing	LR system	A	X	Z
	LR...0141 ...LR...0341	90	400...700	300…500
	LR...0441 ...LR...0941	100		
	LR...2741 LR...2941			

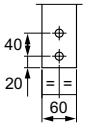
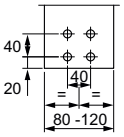
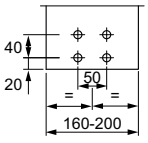
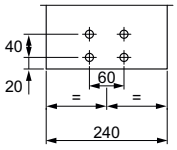
B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	See following table for width of terminal lugs

No.1	No.2	No.3	No.4
LR...01 - LR...03	**LR...04 - LR...06**	**LR...05 - LR...08** **LR...27 - LR...28**	**LR...09, LR...29**
			

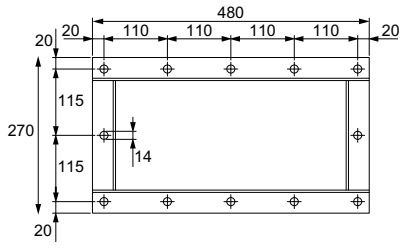
Dimension drawings TC-F terminal element 5-conductor system/terminal lugs

Dimension drawing	LR system	A	X	Z
	LR...0151 ...LR...0351	90	500...700	300…500
	LR...0451 ...LR...0951	120		
	LR...2751 ...LR...2951			

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	See following table for width of terminal lugs

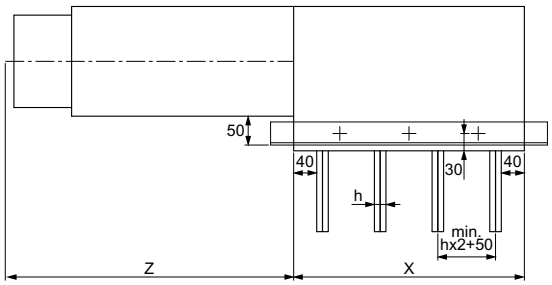
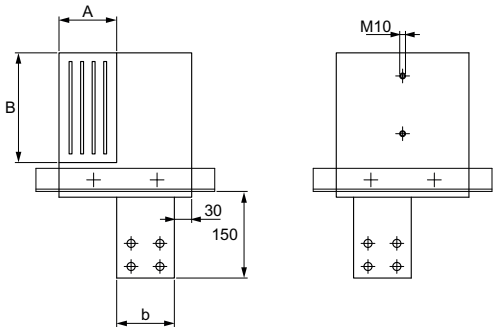
No.1	No.2	No.3	No.4
LR..01 - LR..03	LR..04 - LR..06	LR..05 - LR..08	LR..09, LR..29
			

Dimension drawing of assembly flange, TC-F terminal element, 4 and 5-conductor system

Dimension drawing	
	Assembly flange for TC-F terminal element for 4-conductor systems and 5-conductor systems

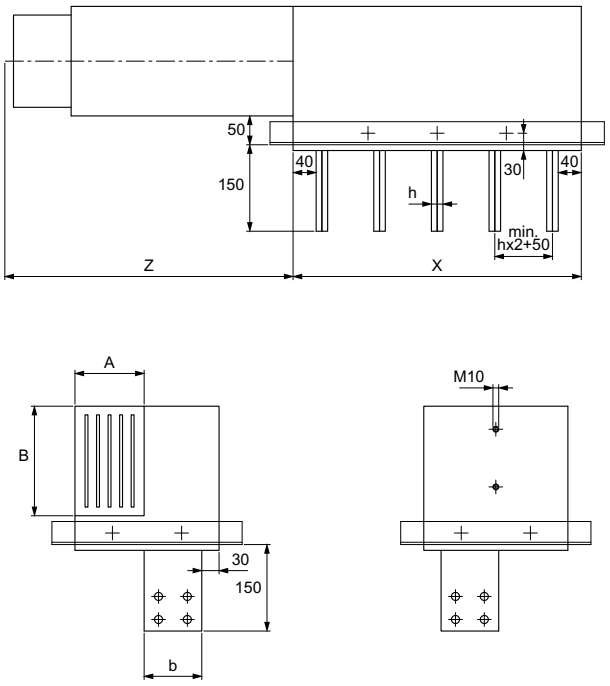
4.17.3.8 TD-F terminal element

Dimension drawings TD-F terminal element 4-conductor system/terminal lugs

Dimension drawing	LR system	A mm	X mm	Z mm
 	LR...0141 ...LR...0341	90	400 ... 700	300 ... 500
	LR...0441 ...LR...0941	100		
	LR...2741 ...LR...2941			

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

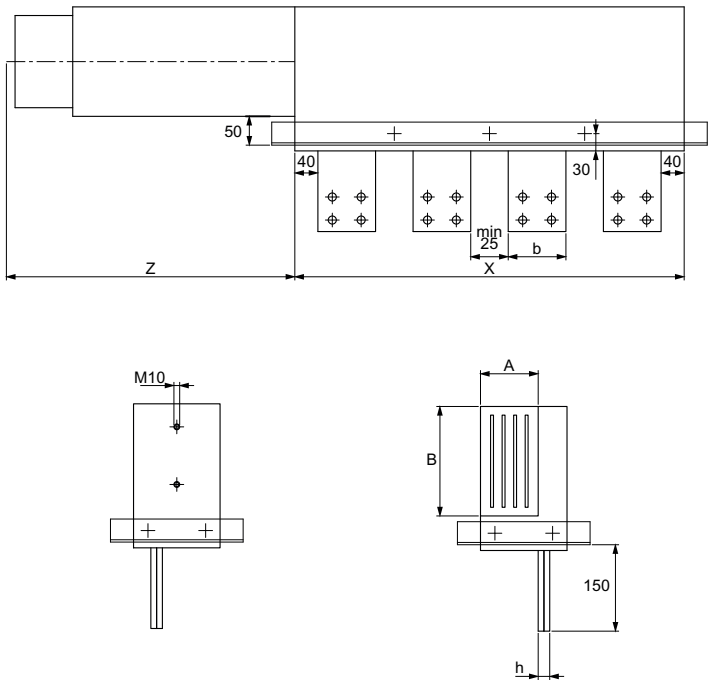
Dimension drawings TD-F terminal element 5-conductor system/terminal lugs

Dimension drawing	LR system	A mm	X mm	Z mm
	LR...0151 ...LR...0351	90	500 ... 700	300 ... 500
	LR...0451 ...LR...0951	120		
	LR...2751 ...LR...2951			

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

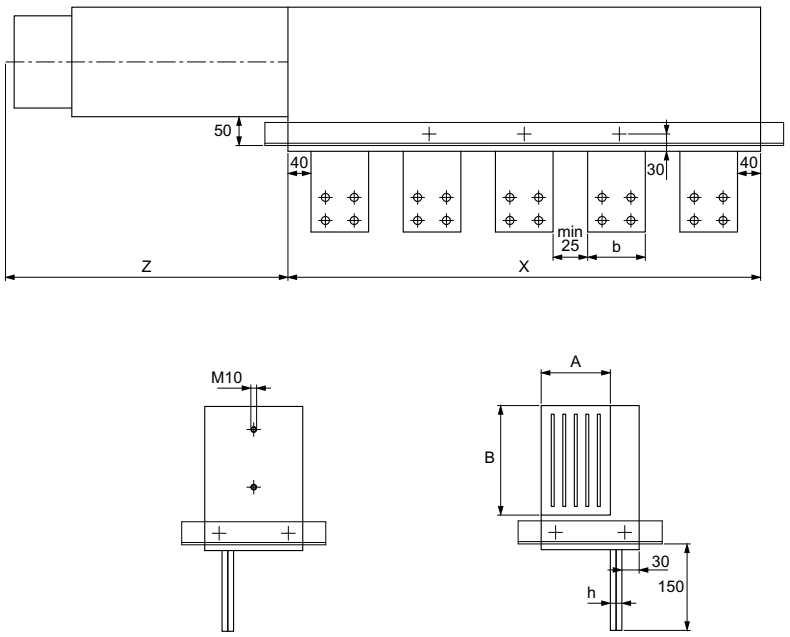
4.17.3.9 TE-F terminal element

Dimension drawings TE-F terminal element 4-conductor system/terminal lugs

Dimension drawing	LR system	A mm	X mm	Z mm
	LR...0141 ...LR...0341	90	400 ... 700	300 ... 500
	LR...0441 ...LR...0941	100		
	LR...2741 ...LR...2941		400 ... 1000	

B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

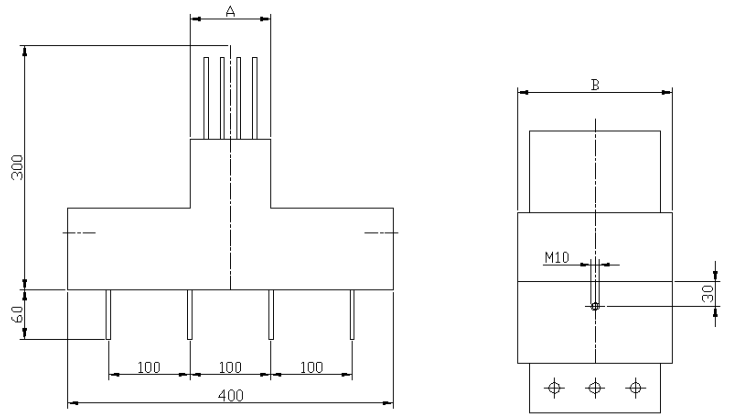
Dimension drawings TE-F terminal element 5-conductor system/terminal lugs

Dimension drawing	LR system	A mm	X mm	Z mm
	LR...0151 ...LR...0351	90	500 ... 700	300 ... 500
	LR...0451 ...LR...0951	120		
	LR...2751 ...LR...2951		500 ... 1000	

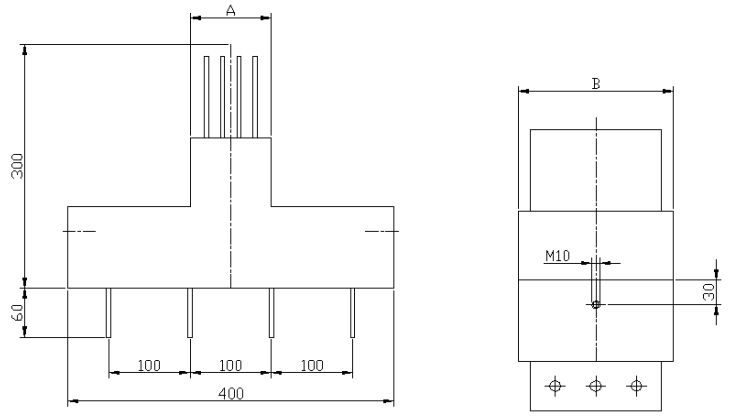
B	System height depends on maximum permitted rated current
h	Height of terminal lugs, order-specific
b	Width of terminal lugs, order-specific configuration

4.17.3.10 KE cable feeder unit

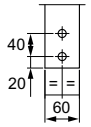
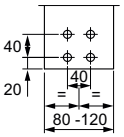
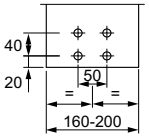
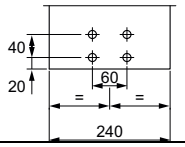
Dimension drawing of KE cable feeder unit 4-conductor system

Dimension drawing	System	A [mm]	B [mm]
	LR...0141	90	90
	LR...0241		
	LR...0341		
	LR...0441	100	110
	LR...0541		130
	LR...0641		150
	LR...0741		190
	LR...0841		230
	LR...0941		270
	LR...2741		380
	LR...2841		460
	LR...2941		540

Dimension drawing of KE cable feeder unit 5-conductor system

Dimension drawing	System	A [mm]	B [mm]
	LR...0151	90	90
	LR...0251		
	LR...0351		
	LR...0451	120	110
	LR...0551		130
	LR...0651		150
	LR...0751		190
	LR...0851		230
	LR...0951		270
	LR...2751		380
	LR...2851		460
	LR...2951		540

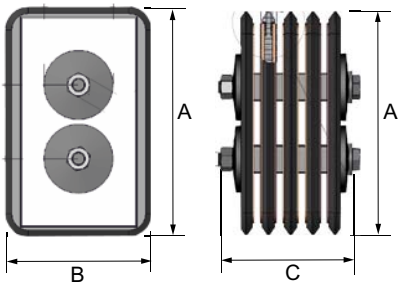
Dimension drawings of terminal lugs

No.1	No.2	No.3	No.4
LR...01 - LR...03	LR...04 - LR...06	LR...05 - LR...08 LR...27 - LR...28	LR...09 LR...29
			

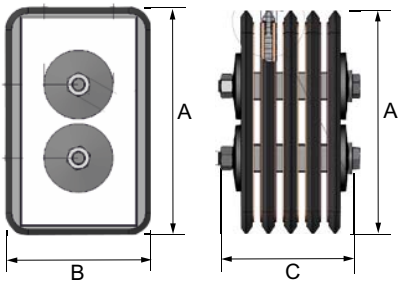
4.17.4 LR accessories

4.17.4.1 Monobloc

Dimension drawing of KB monobloc 4-conductor system

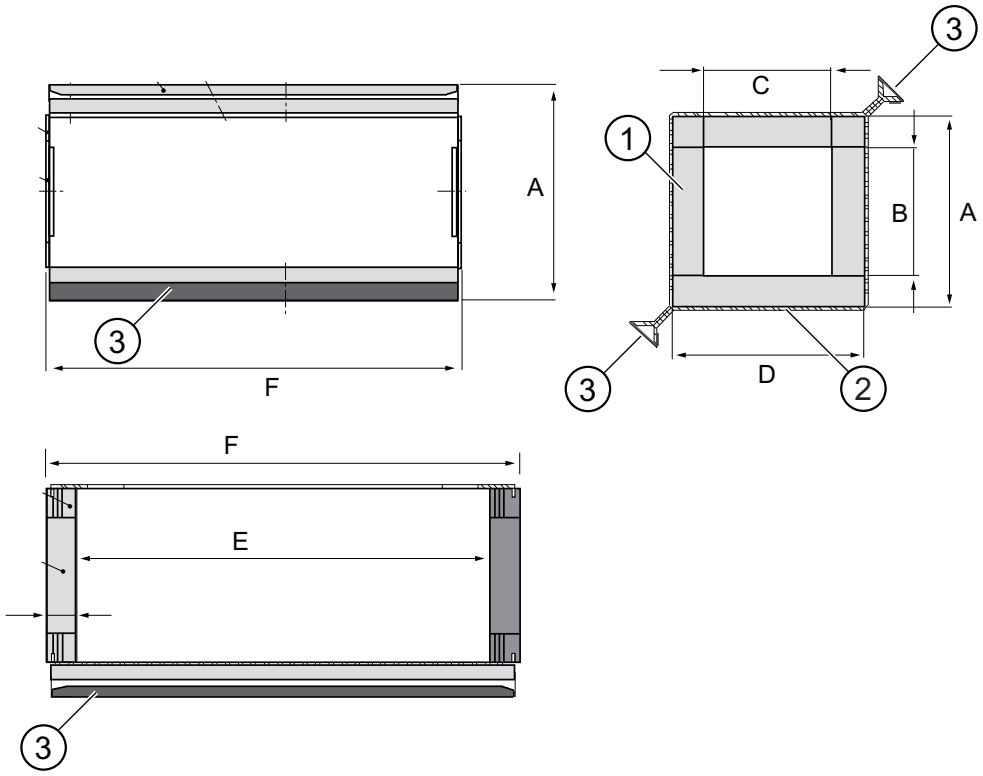
Dimension drawing	LR system	Number of bolts	A [mm]	B [mm]	C [mm]
	LR...0141	1	110	120	80
	LR...0241				85
	LR...0341				95
	LR...0441		120	140	120
	LR...0541		140	120	120
	LR...0641				
	LR...0741	2	190		
	LR...0841		230		
	LR...0951		270		
	LR...2741	4	380		
	LR...2841		460		
	LR...2941		540		
	Construction type example 2-bolt monobloc for 4-conductor systems				

Dimension drawing of KB monobloc 5-conductor system

Dimension drawing	LR system	Number of bolts	A [mm]	B [mm]	C [mm]
	LR...0151	1	110	120	100
	LR...0251				95
	LR...0351				110
	LR...0451		120	140	140
	LR...0551				
	LR...0651		140	120	
	LR...0751	2	190		
	LR...0851		230		
	LR...0951		270		
	LR...2751	4	380		
	LR...2851		460		
	LR...2951		540		
	Construction type example 2-bolt monobloc for 5-conductor systems				

4.17.4.2 Casting moulds

Dimension drawings of casting mould, 4-conductor system/5-conductor system

Dimension drawing	Item	Designation
	①	Gasket
	②	Casting mould
	③	Connection flange
	A	System height + 40 mm
	B	System height
	C	System width
	D	System width + 40 mm
	E	286 mm
	F	330 mm

Note

Casting moulds are reusable!

4.18 Technical data

4.18.1 Technical data of the LR system

General technical data

The following technical data applies to the LR system:

General system data		
Type	LRA.....	LRC.....
Standards and regulations	IEC / EN 60439-1 and -2	IEC / EN 60439-1 and -2
Rated insulation voltage V_i [V]	AC/DC 1000	AC/DC 1000
Overvoltage category/degree of fouling	III/3	III/3
Rated operational voltage U_e [V]	AC 1000	AC 1000
Frequency [Hz]	50 ... 60	50 ... 60
Rated operational current I_e [A] *	400 ... 4600	630 ... 6150
Resistance to extreme climates	Moist heat (constant), to IEC60068-2-78	Moist heat (constant), to IEC 60068-2-78
	Moist heat (cyclic), to IEC 60068-2-30	Moist heat (cyclic), to IEC 60068-2-30
Ambient temperature [°C]	-5 ... +40	-5 ... +40
Degree of protection as per IEC/EN 60529 (type 2)		
Busbar elements	IP68	IP68
Terminal elements		
Tap-off units	IP66	IP66
Material		
Busbar elements, terminal elements Busbars	Aluminium (Al)	Copper (Cu), epoxy resin
LR		
Mounting position	Vertical; flat; sideways	Vertical; flat; sideways
Weight data	See selection and ordering data	See selection and ordering data
Colour	Stone grey, similar to RAL 7030	Stone grey, similar to RAL 7030

* Observe the derating factor for the rated current at high ambient temperatures

Derating

You calculate the maximum possible rated current for the respective ambient temperature on the basis of the following table:

Ambient temperature [°C]	20	25	30	35	40	45	50	55	60
Conversion factor	1.15	1.10	1.05	1.00	0.96	0.89	0.84	0.78	0.72

Examples:

1. Maximum permissible rated current for LRC05 at an ambient temperature of 50 °C:
   - I_e = 1600 A * 0.84 = 1344 A
2. Maximum permissible rated current for LRC09 at an ambient temperature of 20 °C:
   - I_e = 3200 A * 1.15 = 3680 A

4.18.2 Technical data 4-conductor system LRA0141-0341

Technical data of the busbar elements

LRA		0141	0241	0341
Rated current I_e		400	630	800
Degree of protection		IP68		
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.161	0.121	0.081
Reactance X_{20} [m Ω/m]		0.050	0.042	0.026
Impedance per unit length Z_{20} [m Ω/m]		0.169	0.128	0.085
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbars	0.176	0.142	0.096
Reactance X_{warm} [m Ω/m]		0.050	0.042	0.026
Impedance per unit length Z_{warm} [m Ω/m]		0.178	0.151	0.102
Resistance per unit length R_F [m Ω/m]	For 4-pole systems in the event of a fault in accordance with EN 60439-2 Annex N	0.353	0.284	0.193
Reactance per unit length X_F [m Ω/m]		0.175	0.100	0.155
Impedance per unit length Z_F [m Ω/m]		0.394	0.301	0.247
Resistance R_0 PEN[m Ω/m]	Zero impedance for 4-pole systems to DIN VDE 0102, IEC 909	0.470	0.379	0.257
Reactance X_0 PEN [m Ω/m]		0.609	0.509	0.529
Impedance per unit length Z_0 PEN [m Ω/m]		0.769	0.634	0.588
Short-circuit strength				
Rated impulse withstand current I_{pk} [kA]		24	24	55.7
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		12	12	26.5
Conductor material		Aluminium		
Conductor cross-section PEN [mm^2]		176	236	354
Conductor cross-section of active conductors [mm^2]		176	236	354
Fire load [kWh/m]		13.01	12.59	11.76
Fixing distances [m]		1.5	1.5	1.5
Weight (kg/m) (2m length with clamped connection)		21.89	22.08	22.46

4.18.3 Technical data 4-conductor system LRA0441-0941

Technical data of the busbar elements

LRA		0441	0541	0641	0741	0841	0941
Rated current I_e		1000	1200	1400	1600	2000	2500
Degree of protection		IP68					
Resistance R_{20} [m Ω/m]	At 50 Hz and +20°C busbar temperature	0.060	0.048	0.040	0.030	0.024	0.020
Reactance X_{20} [m Ω/m]		0.055	0.050	0.042	0.046	0.031	0.029
Impedance per unit length Z_{20} [m Ω/m]		0.081	0.070	0.058	0.055	0.040	0.035
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbars	0.074	0.059	0.050	0.036	0.029	0.026
Reactance X_{warm} [m Ω/m]		0.055	0.050	0.042	0.046	0.031	0.029
Impedance per unit length Z_{warm} [m Ω/m]		0.094	0.079	0.066	0.059	0.043	0.038
Resistance per unit length R_F [m Ω/m]	For 4-pole systems in the event of a fault in accordance with EN 60439-2 Annex N	0.149	0.119	0.099	0.073	0.060	0.051
Reactance per unit length X_F [m Ω/m]		0.147	0.118	0.098	0.091	0.116	0.118
Impedance per unit length Z_F [m Ω/m]		0.209	0.167	0.139	0.117	0.131	0.129
Resistance R_0 PEN[m Ω/m]	Zero impedance for 4-pole systems to DIN VDE 0102, IEC 909	0.198	0.159	0.132	0.097	0.080	0.068
Reactance X_0 PEN [m Ω/m]		0.355	0.284	0.237	0.220	0.212	0.204
Impedance per unit length Z_0 PEN [m Ω/m]		0.407	0.325	0.271	0.240	0.227	0.215
Short-circuit strength							
Rated impulse withstand current I_{pk} [kA]		55.7	117	117	143	143	143
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		26.5	53	53	65	65	65
Conductor material		Aluminium					
Conductor cross-section PEN [mm^2]		472	592	712	944	1184	1424
Conductor cross-section of active conductors [mm^2]		472	592	712	944	1184	1424
Fire load [kWh/m]		15.72	19.19	21.32	27.51	32.05	36.68
Fixing distances [m]		1.5	1.5	1.5	1.5	1.5	1.5
Weight (kg/m) (2 m length with clamped connection)		29.74	34.66	38.81	48.87	58.17	67.97

4.18.4 Technical data 4-conductor system LRA2741-2941

Technical data of the busbar elements

LRA		2741	2841	2941
Rated current I_e		3200	4000	4600
Degree of protection		IP68		
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.015	0.012	0.010
Reactance X_{20} [m Ω/m]		0.024	0.026	0.023
Impedance per unit length Z_{20} [m Ω/m]		0.028	0.029	0.025
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbars	0.019	0.015	0.013
Reactance X_{warm} [m Ω/m]		0.024	0.026	0.023
Impedance per unit length Z_{warm} [m Ω/m]		0.031	0.030	0.026
Resistance per unit length R_F [m Ω/m]	For 4-pole systems in the event of a fault in accordance with EN 60439-2 Annex N	0.038	0.030	0.025
Reactance per unit length X_F [m Ω/m]		0.093	0.084	0.068
Impedance per unit length Z_F [m Ω/m]		0.100	0.089	0.073
Resistance R_0 PEN[m Ω/m]	Zero impedance for 4-pole systems to DIN VDE 0102, IEC 909	0.051	0.041	0.034
Reactance X_0 PEN [m Ω/m]		0.197	0.192	0.167
Impedance per unit length Z_0 PEN [m Ω/m]		0.204	0.196	0.170
Short-circuit strength				
Rated impulse withstand current I_{pk} [kA]		220	220	220
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		100	100	100
Conductor material		Aluminium		
Conductor cross-section PEN (mm^2)		1889	2368	2849
Conductor cross-section of active conductors [mm^2]		1889	2368	2849
Fire load [kWh/m]		55.01	64.11	73.36
Fixing distances [m]		1.5	1.5	1.5
Weight (kg/m) (2 m length with clamped connection)		97.74	116.34	135.95

Resistance per unit length from measurements/derivations

4.18.5 Technical data 5-conductor system LRA0151-0351

Technical data of the busbar elements

LRA		0151	0251	0351
Rated current I_e		400	630	800
Degree of protection		IP68		
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.161	0.121	0.081
Reactance X_{20} [m Ω/m]		0.050	0.042	0.026
Impedance per unit length Z_{20} [m Ω/m]		0.169	0.128	0.085
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbars	0.176	0.142	0.096
Reactance X_{warm} [m Ω/m]		0.050	0.042	0.026
Impedance per unit length Z_{warm} [m Ω/m]		0.178	0.151	0.102
AC resistance per unit length R_F PE [m Ω/m]	For 5-pole systems (PE) in the event of a fault in accordance with EN 60439-2 Annex N	0.353	0.284	0.193
Reactance per unit length X_F PE [m Ω/m]		0.157	0.090	0.140
Impedance per unit length Z_F PE [m Ω/m]		0.386	0.298	0.238
Resistance per unit length R_F N [m Ω/m]	For 5-pole systems (N) in the event of a fault in accordance with EN 60439-2 Annex N	0.353	0.284	0.193
Reactance per unit length X_F N [m Ω/m]		0.175	0.100	0.155
Impedance per unit length Z_F N [m Ω/m]		0.394	0.301	0.209
Resistance 1 R_0 N [m Ω/m]	Zero impedance for 5-pole systems (PE) to DIN VDE 0102, IEC 909	0.447	0.360	0.244
Reactance 1 X_0 N [m Ω/m]		0.974	0.814	0.846
Impedance per unit length 1 Z_0 N [m Ω/m]		1.071	0.890	0.880
Resistance 2 R_0 PE [m Ω/m]	Zero impedance for 5-pole systems (PE) to DIN VDE 0102, IEC 909	0.470	0.379	0.257
Reactance 2 X_0 PE [m Ω/m]		0.609	0.509	0.529
Impedance per unit length 2 Z_0 PE [m Ω/m]		0.769	0.634	0.588
Short-circuit strength				
Rated impulse withstand current I_{pk} [kA]		24	24	55.7
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		12	12	26.5
Conductor material		Aluminium		
Conductor cross-section N [mm^2]		176	236	354
Conductor cross-section of active conductors [mm^2]		176	236	354
Conductor cross-section PE [mm^2]		176	236	354
Fire load [kWh/m]		12.70	12.17	11.13
Fixing distances [m]		1.5	1.5	1.5
Weight (2 m length with clamped connection) [kg/m]		22.03	22.27	22.75

4.18.6 Technical data 5-conductor system LRA0451-0951

Technical data of the busbar elements

LRA		0451	0551	0651	0751	0851	0951
Rated current I_e		1000	1200	1400	1600	2000	2500
Degree of protection		IP68					
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.060	0.048	0.040	0.030	0.024	0.020
Reactance X_{20} [m Ω/m]		0.055	0.050	0.042	0.046	0.031	0.029
Impedance per unit length Z_{20} [m Ω/m]		0.081	0.070	0.058	0.055	0.040	0.035
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbar	0.074	0.059	0.050	0.036	0.029	0.026
Reactance X_{warm} [m Ω/m]		0.055	0.050	0.042	0.046	0.031	0.029
Impedance per unit length Z_{warm} [m Ω/m]		0.094	0.079	0.066	0.059	0.043	0.038
AC resistance per unit length R_F PE [m Ω/m]	For 5-pole systems (PE) in the event of a fault in accordance with EN 60439-2 Annex N	0.149	0.119	0.099	0.073	0.060	0.051
Reactance per unit length X_F PE [m Ω/m]		0.132	0.106	0.088	0.082	0.105	0.106
Impedance per unit length Z_F PE [m Ω/m]		0.199	0.159	0.133	0.110	0.121	0.118
AC resistance per unit length R_F N [m Ω/m]	For 5-pole systems (N) in the event of a fault in accordance with EN 60439-2 Annex N	0.149	0.119	0.099	0.073	0.060	0.051
Reactance per unit length X_F N [m Ω/m]		0.147	0.118	0.098	0.091	0.116	0.118
Impedance per unit length Z_F N [m Ω/m]		0.167	0.167	0.139	0.117	0.131	0.129
Resistance 1 R_0 N [m Ω/m]	Zero impedance for 5-pole systems (N) to DIN VDE 0102, IEC 909	0.188	0.151	0.126	0.092	0.076	0.065
Reactance per unit length 1 X_0 N [m Ω/m]		0.568	0.454	0.379	0.352	0.339	0.326
Impedance per unit length Z_0 N [m Ω/m]		0.598	0.479	0.399	0.364	0.348	0.333
Resistance 2 R_0 PE [m Ω/m]	Zero impedance for 5-pole systems (PE) to DIN VDE 0102, IEC 909	0.198	0.159	0.132	0.097	0.080	0.068
Reactance per unit length 2 X_0 PE [m Ω/m]		0.355	0.284	0.237	0.220	0.212	0.204
Impedance per unit length 2 Z_0 PE [m Ω/m]		0.407	0.325	0.271	0.240	0.227	0.215
Short-circuit strength							
Rated short-time withstand current I_{pk} [kA]		55.7	117	117	143	143	143
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		26.5	53	53	65	65	65
Conductor material		Aluminium					
Conductor cross-section N [mm^2]		472	592	712	944	1184	1424
Conductor cross-section of active conductors [mm^2]		472	592	712	944	1184	1424
Conductor cross-section PE [mm^2]		472	592	712	944	1184	1424
Fire load [kWh/m]		18.69	22.84	25.33	32.71	38.04	43.48
Fixing distances [m]		1.5	1.5	1.5	1.5	1.5	1.5
Weight (2 m length with clamped connection) [kg/m]		34.26	40.04	45.04	56.79	67.80	79.30

4.18.7 Technical data 5-conductor system LRA2751-2951

Technical data of the busbar elements

LRA		2751	2851	2951
Rated current I_e [A]		3200	4000	4600
Degree of protection		IP68		
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.015	0.012	0.010
Reactance X_{20} [m Ω/m]		0.024	0.026	0.023
Impedance per unit length Z_{20} [m Ω/m]		0.028	0.029	0.025
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbars	0.019	0.015	0.013
Reactance X_{warm} [m Ω/m]		0.024	0.026	0.023
Impedance per unit length Z_{warm} [m Ω/m]		0.031	0.030	0.026
AC resistance per unit length R_F PE [m Ω/m]	For 5-pole systems (PE) in the event of a fault in accordance with EN 60439-2 Annex N	0.038	0.030	0.025
Reactance per unit length X_F PE [m Ω/m]		0.084	0.076	0.061
Impedance per unit length Z_F PE [m Ω/m]		0.092	0.082	0.066
Resistance per unit length R_F N [m Ω/m]	For 5-pole systems (N) in the event of a fault in accordance with EN 60439-2 Annex N	0.038	0.030	0.025
Reactance per unit length X_F N [m Ω/m]		0.093	0.084	0.068
Impedance per unit length Z_F N [m Ω/m]		0.100	0.089	0.073
Resistance 1 R_0 N [m Ω/m]	Zero impedance for 5-pole systems (PE) to DIN VDE 0102, IEC 909	0.048	0.039	0.032
Reactance 1 X_0 N [m Ω/m]		0.316	0.307	0.267
Impedance per unit length 1 Z_0 N [m Ω/m]		0.319	0.310	0.269
Resistance 2 R_0 PE [m Ω/m]	Zero impedance for 5-pole systems (PE) to DIN VDE 0102, IEC 909	0.051	0.041	0.034
Reactance 2 X_0 PE [m Ω/m]		0.197	0.192	0.167
Impedance per unit length 2 Z_0 PE [m Ω/m]		0.204	0.196	0.170
Short-circuit strength				
Rated impulse withstand current I_{pk} [kA]		220	220	220
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		100	100	100
Conductor material		Aluminium		
Conductor cross-section N (mm^2)		1889	2368	2849
Conductor cross-section of active conductors [mm^2]		1889	2368	2849
Conductor cross-section PE [mm^2]		1889	2368	2849
Fire load [kWh/m]		65.43	76.08	86.96
Fixing distances [m]		1.5	1.5	1.5
Weight (2 m length with clamped connection) [kg/m]		113.59	135.59	158.59

Resistance per unit length from measurements/derivations

4.18.8 Technical data 4-conductor system LRC0141-0341

Technical data of the busbar elements

LRC		0141	0241	0341
Rated current I_e		630	800	1000
Degree of protection		IP68		
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.099	0.074	0.049
Reactance X_{20} [m Ω/m]		0.068	0.058	0.057
Impedance per unit length Z_{20} [m Ω/m]		0.120	0.094	0.075
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbars	0.119	0.093	0.062
Reactance X_{warm} [m Ω/m]		0.106	0.085	0.069
Impedance per unit length Z_{warm} [m Ω/m]		0.159	0.126	0.092
Resistance per unit length R_F [m Ω/m]	For 4-pole systems in the event of a fault in accordance with EN 60439-2 Annex N	0.197	0.15	0.117
Reactance per unit length X_F [m Ω/m]		0.231	0.191	0.16
Impedance per unit length Z_F [m Ω/m]		0.304	0.243	0.198
Resistance R_0 PEN[m Ω/m]	Zero impedance for 4-pole systems to DIN VDE 0102, IEC 909	0.275	0.217	0.173
Reactance X_0 PEN [m Ω/m]		0.269	0.227	0.193
Impedance per unit length Z_0 PEN [m Ω/m]		0.385	0.313	0.259
Short-circuit strength				
Rated impulse withstand current I_{pk} [kA]		48	48	80
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		23	23	38
Conductor material		Copper		
Conductor cross-section PEN [mm^2]		176	236	354
Conductor cross-section of active conductors [mm^2]		176	236	354
Fire load [kWh/m]		13.01	12.59	11.76
Fixing distances [m]		1.5	1.5	1.5
Weight (kg/m) (2 m length with clamped connection)		25.24	26.93	30.31

4.18.9 Technical data 4-conductor system LRC0441-0941

Technical data of the busbar elements

LRC		0441	0541	0641	0741	0841	0941
Rated current I_e		1350	1600	1700	2000	2500	3200
Degree of protection		IP68					
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.039	0.031	0.026	0.021	0.017	0.015
Reactance X_{20} [m Ω/m]		0.051	0.046	0.038	0.034	0.031	0.029
Impedance per unit length Z_{20} [m Ω/m]		0.065	0.056	0.046	0.040	0.035	0.033
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbars	0.050	0.040	0.031	0.025	0.020	0.018
Reactance X_{warm} [m Ω/m]		0.051	0.046	0.038	0.034	0.031	0.029
Impedance per unit length Z_{warm} [m Ω/m]		0.071	0.061	0.049	0.042	0.037	0.034
Resistance per unit length R_F [m Ω/m]	For 4-pole systems in the event of a fault in accordance with EN 60439-2 Annex N	0.094	0.075	0.060	0.048	0.038	0.031
Reactance per unit length X_F [m Ω/m]		0.136	0.116	0.098	0.084	0.071	0.060
Impedance per unit length Z_F [m Ω/m]		0.165	0.138	0.115	0.096	0.081	0.068
Resistance R_0 PEN[m Ω/m]	Zero impedance for 4-pole systems to DIN VDE 0102, IEC 909	0.142	0.116	0.095	0.078	0.064	0.053
Reactance X_0 PEN [m Ω/m]		0.164	0.139	0.119	0.101	0.086	0.073
Impedance per unit length Z_0 PEN [m Ω/m]		0.217	0.182	0.152	0.128	0.107	0.090
Short-circuit strength							
Rated impulse withstand current I_{pk} [kA]		80	140	140	140	176	176
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		38	65	65	65	80	80
Conductor material		Copper					
Conductor cross-section PEN [mm^2]		472	592	712	944	1184	1424
Conductor cross-section of active conductors [mm^2]		472	592	712	944	1184	1424
Fire load [kWh/m]		15.72	19.19	21.32	27.51	32.05	36.68
Fixing distances [m]		1.5	1.5	1.5	1.5	1.5	1.5
Weight (kg/m) (2 m length with clamped connection)		40.56	47.39	55.69	71.72	86.59	102.34

4.18.10 Technical data 4-conductor system LRC2741-2941

Technical data of the busbar elements

LRC		2741	2841	2941
Rated current I_e		4000	5000	6150
Degree of protection		IP68		
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.010	0.008	0.006
Reactance X_{20} [m Ω/m]		0.014	0.013	0.011
Impedance per unit length Z_{20} [m Ω/m]		0.017	0.015	0.013
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbars	0.013	0.010	0.008
Reactance X_{warm} [m Ω/m]		0.014	0.013	0.011
Impedance per unit length Z_{warm} [m Ω/m]		0.019	0.016	0.014
Resistance per unit length R_F [m Ω/m]	For 4-pole systems in the event of a fault in accordance with EN 60439-2 Annex N	0.022	0.018	0.014
Reactance per unit length X_F [m Ω/m]		0.054	0.046	0.039
Impedance per unit length Z_F [m Ω/m]		0.059	0.049	0.041
Resistance R_0 PEN[m Ω/m]	Zero impedance for 4-pole systems to DIN VDE 0102, IEC 909	0.046	0.038	0.031
Reactance X_0 PEN [m Ω/m]		0.067	0.057	0.048
Impedance per unit length Z_0 PEN [m Ω/m]		0.082	0.068	0.057
Short-circuit strength				
Rated impulse withstand current I_{pk} [kA]		220	220	220
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		100	100	100
Conductor material		Copper		
Conductor cross-section PEN (mm^2)		1889	2368	2849
Conductor cross-section of active conductors [mm^2]		1889	2368	2849
Fire load [kWh/m]		55.01	64.11	73.36
Fixing distances [m]		1.5	1.5	1.5
Weight (kg/m) (2 m length with clamped connection)		140.49	171.99	186.69

Resistance per unit length from measurements/derivations

4.18.11 Technical data 5-conductor system LRC0151-0351

Technical data of the busbar elements

LRC		0151	0251	0351
Rated current I_e		630	800	1000
Degree of protection		IP68		
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.099	0.074	0.049
Reactance X_{20} [m Ω/m]		0.068	0.058	0.057
Impedance per unit length Z_{20} [m Ω/m]		0.120	0.094	0.075
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbars	0.119	0.093	0.062
Reactance X_{warm} [m Ω/m]		0.106	0.085	0.069
Impedance per unit length Z_{warm} [m Ω/m]		0.159	0.126	0.092
AC resistance per unit length R_F PE [m Ω/m]	For 5-pole systems (PE) in the event of a fault in accordance with EN 60439-2 Annex N	0.197	0.150	0.117
Reactance per unit length X_F PE [m Ω/m]		0.231	0.191	0.16
Impedance per unit length Z_F PE [m Ω/m]		0.304	0.243	0.198
Resistance per unit length R_F N [m Ω/m]	For 5-pole systems (N) in the event of a fault in accordance with EN 60439-2 Annex N	0.197	0.150	0.117
Reactance per unit length X_F N [m Ω/m]		0.231	0.191	0.16
Impedance per unit length Z_F N [m Ω/m]		0.304	0.243	0.198
Resistance 1 R_0 N [m Ω/m]	Zero impedance for 5-pole systems (PE) to DIN VDE 0102, IEC 909	0.275	0.217	0.173
Reactance 1 X_0 N [m Ω/m]		0.269	0.227	0.193
Impedance per unit length 1 Z_0 N [m Ω/m]		0.385	0.313	0.259
Resistance 2 R_0 PE [m Ω/m]	Zero impedance for 5-pole systems (PE) to DIN VDE 0102, IEC 909	0.275	0.217	0.173
Reactance 2 X_0 PE [m Ω/m]		0.269	0.227	0.193
Impedance per unit length 2 Z_0 PE [m Ω/m]		0.385	0.313	0.259
Short-circuit strength				
Rated impulse withstand current I_{pk} [kA]		48	48	80
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		23	23	38
Conductor material		Copper		
Conductor cross-section N [mm^2]		176	236	354
Conductor cross-section of active conductors [mm^2]		176	236	354
Conductor cross-section PE [mm^2]		176	236	354
Fire load [kWh/m]		12.70	12.17	11.13
Fixing distances [m]		1.5	1.5	1.5
Weight (2 m length with clamped connection) [kg/m]		26.70	28.82	33.04

4.18.12 Technical data 5-conductor system LRC0451-0951

Technical data of the busbar elements

LRC		0451	0551	0651	0751	0851	0951
Rated current I_e		1350	1600	1700	2000	2500	3200
Degree of protection		IP68					
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.039	0.031	0.026	0.021	0.017	0.015
Reactance X_{20} [m Ω/m]		0.051	0.046	0.038	0.034	0.031	0.029
Impedance per unit length Z_{20} [m Ω/m]		0.065	0.056	0.046	0.040	0.035	0.033
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbar	0.050	0.040	0.031	0.025	0.020	0.018
Reactance X_{warm} [m Ω/m]		0.051	0.046	0.038	0.034	0.031	0.029
Impedance per unit length Z_{warm} [m Ω/m]		0.071	0.061	0.049	0.042	0.037	0.034
AC resistance per unit length R_F PE [m Ω/m]	For 5-pole systems (PE) in the event of a fault in accordance with EN 60439-2 Annex N	0.094	0.075	0.060	0.048	0.038	0.031
Reactance per unit length X_F PE [m Ω/m]		0.150	0.127	0.108	0.092	0.078	0.066
Impedance per unit length Z_F PE [m Ω/m]		0.176	0.148	0.124	0.104	0.087	0.073
AC resistance per unit length R_F N [m Ω/m]	For 5-pole systems (N) in the event of a fault in accordance with EN 60439-2 Annex N	0.094	0.075	0.060	0.048	0.038	0.031
Reactance per unit length X_F N [m Ω/m]		0.136	0.116	0.098	0.084	0.071	0.060
Impedance per unit length Z_F N [m Ω/m]		0.165	0.138	0.115	0.096	0.081	0.068
Resistance 1 R_0 N [m Ω/m]	Zero impedance for 5-pole systems (N) to DIN VDE 0102, IEC 909	0.163	0.134	0.110	0.090	0.074	0.060
Reactance per unit length 1 X_0 N [m Ω/m]		0.328	0.279	0.237	0.201	0.171	0.146
Impedance per unit length Z_0 N [m Ω/m]		0.366	0.309	0.261	0.221	0.186	0.158
Resistance 2 R_0 PE [m Ω/m]	Zero impedance for 5-pole systems (PE) to DIN VDE 0102, IEC 909	0.142	0.116	0.095	0.078	0.064	0.053
Reactance per unit length 2 X_0 PE [m Ω/m]		0.164	0.139	0.119	0.101	0.086	0.073
Impedance per unit length 2 Z_0 PE [m Ω/m]		0.217	0.182	0.152	0.128	0.107	0.090
Short-circuit strength							
Rated short-time withstand current I_{pk} [kA]		80	140	140	140	176	176
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		38	65	65	65	80	80
Conductor material		Copper					
Conductor cross-section N [mm^2]		472	592	712	944	1184	1424
Conductor cross-section of active conductors [mm^2]		472	592	712	944	1184	1424
Conductor cross-section PE [mm^2]		472	592	712	944	1184	1424
Fire load [kWh/m]		18.69	22.84	25.33	32.71	38.04	43.48
Fixing distances [m]		1.5	1.5	1.5	1.5	1.5	1.5
Weight (2 m length with clamped connection) [kg/m]		48.77	58.09	67.03	86.77	104.94	123.99

4.18.13 Technical data 5-conductor system LRC2751-2951

Technical data of the busbar elements

LRC		2751	2851	2951
Rated current I_e [A]		4000	5000	6150
Degree of protection		IP68		
Resistance R_{20} [m Ω/m]	At 50 Hz and +20° C busbar temperature	0.010	0.008	0.006
Reactance X_{20} [m Ω/m]		0.014	0.013	0.011
Impedance per unit length Z_{20} [m Ω/m]		0.017	0.015	0.013
Resistance R_{warm} [m Ω/m]	At 50 Hz and final heating of busbars	0.013	0.010	0.008
Reactance X_{warm} [m Ω/m]		0.014	0.013	0.011
Impedance per unit length Z_{warm} [m Ω/m]		0.019	0.016	0.014
AC resistance per unit length R_F PE [m Ω/m]	For 5-pole systems (PE) in the event of a fault in accordance with EN 60439-2 Annex N	0.022	0.018	0.014
Reactance per unit length X_F PE [m Ω/m]		0.059	0.050	0.043
Impedance per unit length Z_F PE [m Ω/m]		0.063	0.053	0.045
Resistance per unit length R_F N [m Ω/m]	For 5-pole systems (N) in the event of a fault in accordance with EN 60439-2 Annex N	0.022	0.018	0.014
Reactance per unit length X_F N [m Ω/m]		0.054	0.046	0.039
Impedance per unit length Z_F N [m Ω/m]		0.059	0.049	0.041
Resistance 1 R_0 N [m Ω/m]	Zero impedance for 5-pole systems (PE) to DIN VDE 0102, IEC 909	0.053	0.043	0.036
Reactance 1 X_0 N [m Ω/m]		0.134	0.114	0.097
Impedance per unit length 1 Z_0 N [m Ω/m]		0.144	0.122	0.103
Resistance 2 R_0 PE [m Ω/m]	Zero impedance for 5-pole systems (PE) to DIN VDE 0102, IEC 909	0.046	0.038	0.031
Reactance 2 X_0 PE [m Ω/m]		0.067	0.057	0.048
Impedance per unit length 2 Z_0 PE [m Ω/m]		0.082	0.068	0.057
Short-circuit strength				
Rated impulse withstand current I_{pk} [kA]		220	220	220
Rated short-time withstand current I_{cw} (t = 1 s) [kA]		100	100	100
Conductor material		Copper		
Conductor cross-section N (mm^2)		1889	2368	2849
Conductor cross-section of active conductors [mm^2]		1889	2368	2849
Conductor cross-section PE [mm^2]		1889	2368	2849
Fire load [kWh/m]		65.43	76.08	86.96
Fixing distances [m]		1.5	1.5	1.5
Weight (2 m length with clamped connection) [kg/m]		170.30	208.77	264.47

Resistance per unit length from measurements/derivations

Glossary

BusbarPlan

Software for planning and configuration of busbar trunking systems

Conditional rated short-circuit current

(I_{CC}), IEC/EN 60439-1

The conditional rated short-circuit current corresponds to the uninfluenced short-circuit current that a circuit of a switchgear and controlgear assembly, protected by a short-circuit facility, can carry without damage (for a certain time).

The conditional rated short-circuit current is therefore specified for outgoing feeders and/or infeeds with circuit breakers, for example.

Expansion compensation

A straight busbar element with integrated expansion strips. It serves to compensate thermally induced expansion of the busbar run and absorbs compression and tension forces.

Fixed points

Special fixing brackets that permanently fix the busbar element to the fixing material available on site. They thus ensure expansion compensation in a defined direction.

Outgoing feeder point

A straight busbar element that provides an encapsulated interface to tap off current up to 630 A

Rated control voltage

(U_C), IEC/EN 60497-1

This is the voltage that is applied to the normally-open actuation contact in a control circuit. It may deviate from the rated control supply voltage due to transformers or resistors in the switching circuit.

Rated current (of a circuit breaker)

(I_n), IEC/EN 60497-1

The current that is identical, for the circuit breaker, to the rated continuous current and the conventional thermal current.

Rated frequency

IEC/EN 60497-1

The frequency for which a switching device is designed and to which the other characteristic data applies.

Rated impulse withstand current

(I_{pk}), IEC/EN 60439-1

As the peak value of the impulse current, the rated impulse withstand current characterises the dynamic strength of a circuit belonging to a switchgear and controlgear assembly.

The rated impulse withstand current is specified for the trunking and/or main busbars of a switchgear and controlgear assembly.

Rated impulse withstand voltage

(U_{imp}), IEC/EN 60497-1

This is a measure of the strength of the air paths in the interior of the switching device in relation to transient overvoltages. Suitable switching devices can be used to ensure that deactivated parts of a system cannot transmit overvoltages from the line on which they are used.

Rated insulation voltage

(U_i), IEC/EN 60497-1

Voltage to which insulation tests and creepage paths apply. The highest rated operational voltage must never be higher than the rated insulation voltage.

Rated making capacity

IEC/EN 60497-1

The current that a switching device can activate in compliance with the utilisation category at the respective rated operational voltage.

Rated operating power

IEC/EN 60497-1

The power that a switching device can switch at the assigned rated operational voltage in compliance with the utilisation category, e.g. circuit breaker utilisation category AC-3: 37 kW at 400 V.

Rated operational current

(I_e), IEC/EN 60497-1

The current that a switching device can carry, taking into account the rated operational voltage, the operating duration, the utilisation category and the ambient temperature.

Rated operational voltage

(U_e), IEC/EN 60497-1

Voltage to which the characteristic values of a switching device apply.

The highest rated operational voltage must never be higher than the rated insulation voltage.

Rated service short-circuit breaking capacity

(I_{CS}), IEC/EN 60497-2

The short-circuit current dependent on the rated operational voltage that a circuit breaker is capable of repeatedly breaking (test O-CO-CO, previously P-2).

After short-circuit breaking, the circuit breaker is able to continue carrying the rated current with increased intrinsic heating and can trip under an overload.

Rated short-circuit breaking capacity

(I_{cn}), IEC/EN 60497-1

The highest current that a switching device can deactivate at rated operational voltage and frequency without damage. It is specified as an rms value.

Rated short-circuit making capacity

(I_{cm}), IEC/EN 60497-1

The highest current that a switching device can activate at a specific rated operational voltage and frequency without damage. Contrary to the other characteristic data, it is specified as a peak value.

Rated short-time withstand current

(I_{CW}), IEC/EN 60439-1

As the rms value of the short-circuit current, the rated short-time withstand current (I_{CW}) characterises the thermal strength of a switchgear and controlgear assembly circuit under a transient load.

The rated short-time withstand current is normally determined for a duration of 1 s; deviating time values must be specified.

The rated short-time withstand current is specified for the trunking and/or main busbars of a switchgear and controlgear assembly.

Rated ultimate short-circuit breaking capacity

(I_{cu}), IEC/EN 60497-2

The maximum short-circuit current that a circuit breaker is capable of breaking (test O-CO, previously P-1). After short-circuit breaking, the circuit breaker is capable of tripping under an overload, with increased tolerances.

Rated uninterrupted current

(I_u), IEC/EN 60497-1

The current that a switching device can carry during continuous operation (for weeks, months or years).

Rated values

In compliance with IEC/EN 60439-1, the manufacturers of low-voltage switchgear and controlgear assemblies specify rated values. These rated values apply to specified operating conditions and characterise the suitability of a controlgear assembly.

The rated values must always be referred to when combining equipment or configuring switchgear and controlgear assemblies.

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