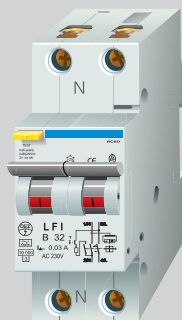


## RESIDUAL CURRENT CIRCUIT BREAKERS WITH OVERCURRENT PROTECTION LFI (10 kA)



### ■ The device is a combination of residual current circuit breaker and miniature circuit breaker

■ For building, commercial and industrial installations up to 25 A, 230 V a.c.

■ For protection:

- against accidental contact of live parts ( $I_{\Delta n} \leq 30$  mA)
- against accidental contact of exposed conductive parts
- before fire break out
- against overload

– against short-circuit (rated short-circuit breaking capacity  $I_{cn} = 10$  kA)

■ They react to both alternating sine-wave residual current and pulsating direct current (type A)

■ Tripping characteristics B and C according to EN 60 898

■ Auxiliary switch H001



10 000  
3









### Residual current circuit breakers with overcurrent protection

$I_n$ [A]	$I_{\Delta n}$ [A]	Characteristic B		Characteristic C		Weight [kg]	Packing [pcs]
		Type	Product code	Type	Product code		
6	0.03	<b>LFI 6B/1N/0,03</b>	11786	<b>LFI 6C/1N/0,03</b>	11789	0.22	1
10	0.03	<b>LFI 10B/1N/0,03</b>	11787	<b>LFI 10C/1N/0,03</b>	11790	0.22	1
16	0.03	<b>LFI 16B/1N/0,03</b>	11788	<b>LFI 16C/1N/0,03</b>	11791	0.22	1
20	0.03	<b>LFI 20B/1N/0,03</b>	13259	<b>LFI 20C/1N/0,03</b>	13260	0.22	1
25	0.03	<b>LFI 25B/1N/0,03</b>	13150	<b>LFI 25C/1N/0,03</b>	13151	0.22	1

### LFI accessories

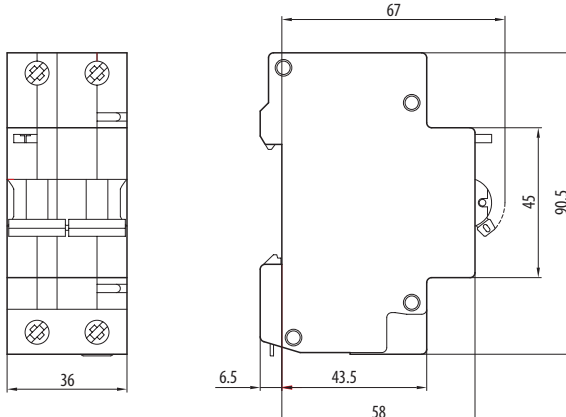
Auxiliary switch	<b>H001</b>	page 34
Interconnecting busbar	<b>G-2L-1000/16</b>	page 93
Connecting adapters	<b>AS/25-GN, AS/25-SN, AS-AI/Cu-16-50</b>	page 95

### Specification

Type	LFI	
Standards	EN 61 009, EN 60 898	
Approval marks	    	
Number of poles	2	
Tripping characteristics (circuit breaker part)	B, C	
Type	A 	
Rated operating voltage	$U_e$	230 V
Rated current	$I_n$	6, 10, 16, 20, 25 A
Rated residual current	$I_{\Delta n}$	0.03 A
Rated frequency	$f_n$	50/60 Hz
Surge resistance (8/20 $\mu$ s)	250 A	
Endurance	10 000 operating cycles	
Rated short-circuit breaking capacity (EN 60 898)	$I_{cn}$	10 kA
Class of discrimination	3	
Mounting on the rail DIN EN 50 022 - width	35 mm	
Ambient temperature	-25 ÷ 50 °C	
Connection	conductor	max. 25 mm <sup>2</sup>
	opposite	yes
Seismic immunity (8 ÷ 50 Hz)	3 g	

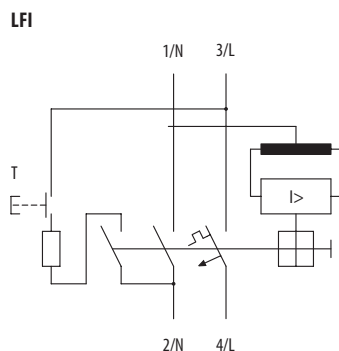
### Dimensions

#### LFI



## RESIDUAL CURRENT CIRCUIT BREAKERS WITH OVERCURRENT PROTECTION LFI (10 kA)

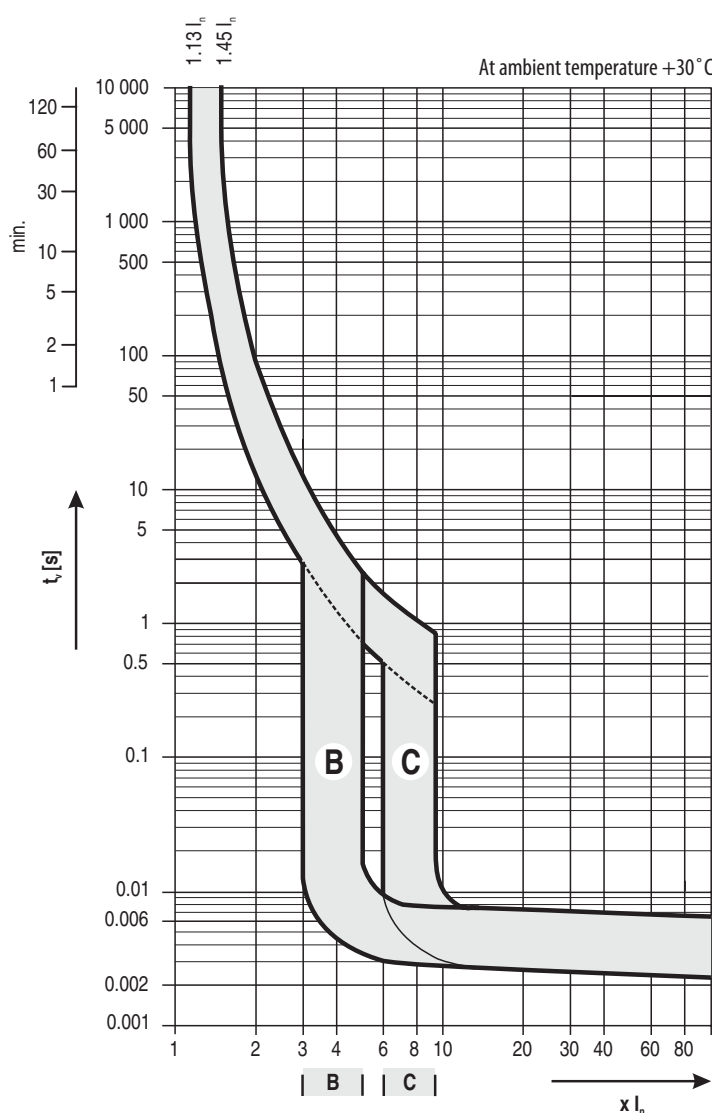
### Diagram



### Tripping characteristics

■ **Characteristic B:** for protection of electric circuits with equipment that does not cause current surges (lighting or socket outlet circuits etc.); the short-circuit release is set to  $(3 \div 5) I_n$

■ **Characteristic C:** for protection of electric circuits with equipment that causes current surges (light bulb groups, motors etc.); the short-circuit release is set to  $(6 \div 9) I_n$



### Tripping characteristics circuit breakers according to EN 60 898

Thermal release	Tripping characteristic type
	<b>B, C</b>
Conventional non-tripping current $I_m$ for $t \geq 1$ h	$I_m = 1.13 I_n$
Conventional tripping current $I_t$ for $t < 1$ h	$I_t = 1.45 I_n$
Current $I_3$ for $1 \text{ s} < t < 60 \text{ s}$ (for $I_n \leq 32 \text{ A}$ )	$I_3 = 2.55 I_n$
$1 \text{ s} < t < 120 \text{ s}$ (for $I_n > 32 \text{ A}$ )	

t - break time of the circuit breaker

Electromagnetic release	Tripping characteristic type	
	<b>B</b>	<b>C</b>
Current $I_4$ for $0.1 \text{ s} < t < 45 \text{ s}$ (for $I_n \leq 32 \text{ A}$ )	$I_4 = 3 I_n$	
$0.1 \text{ s} < t < 90 \text{ s}$ (for $I_n > 32 \text{ A}$ )		
$0.1 \text{ s} < t < 15 \text{ s}$ (for $I_n \leq 32 \text{ A}$ )		$I_4 = 5 I_n$
$0.1 \text{ s} < t < 30 \text{ s}$ (for $I_n > 32 \text{ A}$ )		
Current $I_5$ for $t < 0.1 \text{ s}$	$I_5 = 5 I_n$	$I_5 = 10 I_n$

t - break time of the circuit breaker

## AUXILIARY SWITCHES



### H001

- Accessories to LFI and LFE
- Installation: on the right side
- The auxiliary switch is designed for signalling the position of the main contacts of residual current circuit breakers with overcurrent protection

### PS-OFI11






- Accessories to residual current circuit breakers OFI and OFE
- Installation: on the right side
- The auxiliary switch is designed for signalling the position of the main contacts of residual current circuit breakers

### Auxiliary switches

Type	Contact sequence <sup>1)</sup>	Product code	Packing [pcs]	Weight [kg]
H001	001	13138	1	0.06
PS-OFI11	11	12395	1	0.06

<sup>1)</sup> Each digit indicates successively the number of make, break and break-make contacts

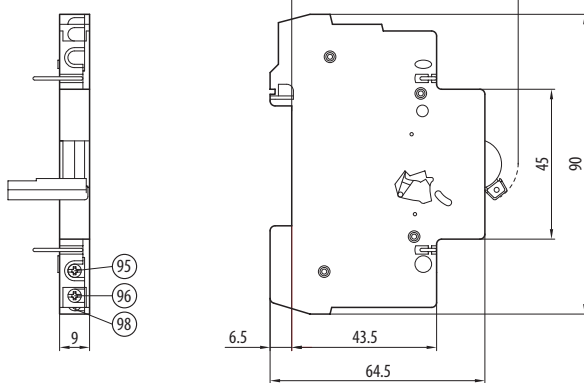
### Specification

Type	H001	PS-OFI11
Approval marks	    	
Contact sequence <sup>1)</sup>	001	11
Rated operating voltage / current	$U_e / I_n$	230 V a.c. / 5 A
		230 V a.c. / 6 A
		220 V d.c. / 0,5 A
		24 V d.c. / 4 A
Degree of protection	IP20	IP20
Mounting	on right side	on right side

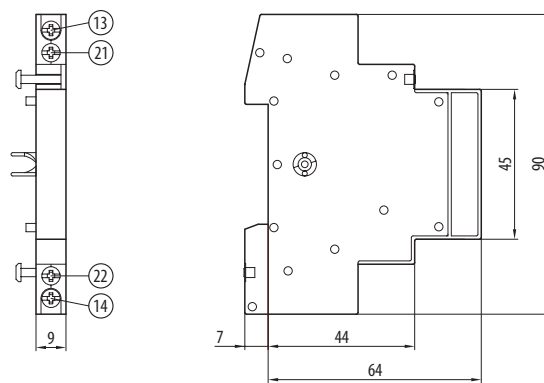
<sup>1)</sup> Each digit indicates successively the number of make, break and break-make contacts

### Dimensions

H001



PS-OFI11



### Diagram

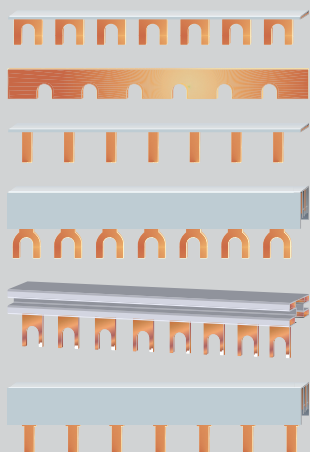
H001



PS-OFI11



## INTERCONNECTING BUSBARS AND END CAPS



### Interconnecting busbars

- For interconnection of 1 to 4-pole circuit breakers, tumbler power switches, residual current circuit breakers, lightning current arresters and surge voltage arresters
- For interconnection of a series of single-phase or three-phase circuit breakers and tumbler power switches, on which an auxiliary switch is mounted
- Busbars G-... with forks into the head part of the device  
Busbars S-... with pins into the clip part of the device

### End cap EK-C-3:

- To cover end of busbar G-3L-1000/10C

### End cap EK-C-2+3:

- To cover end of busbar G-2L-1000/16, G-3L-1000/16C, S-3L-27-1000/16

### End cap EK-C-3/36:

- To cover end of busbar S-3L-27-1000/25

### End cap EK-C-4/16:

- To cover end of busbar G-4L-1000/16

### Interconnecting busbars

Phase	Cross-section [mm²]	Max. current at power supply of [A/phase] end middle	Length [mm]	Type	Product code	Accessories to	Weight [kg]	Packing [pcs]
1	12	65	110	G-1L-1000/12	00171	LSN, LSE, ASN	0.22	50
				G-1L-1000/12g <sup>1)</sup>	00170	LSN, LSE, ASN	0.1	50
	16	80	130	S-1L-210/16iso	13012	LSN, LSE, SVL, SJL, ASN	0.045	50
	20	90	150	G-1L-1000/20	00172	LSN, LSE, SJB, SVM, ASN	0.36	50
2	24	100	180	G-1L-27-1000/24 <sup>2)</sup>	11001	LSN, LSE, ASN	0.3	50
	16	80	130	G-2L-1000/16	11179	LSN, LSE, LFI, LFE, OFI, OFE, ASN	0.46	20
	10	63	100	G-3L-1000/10C	00173	LSN, LSE, ASN	0.44	20
	16	80	130	G-3L-1000/16C	00174	LSN, LSE, OFI, OFE, SJB, SVM, ASN	0.72	20
3				G-3L+9-1000/16 <sup>2)</sup>	11002	LSN, LSE, ASN	0.66	10
				S-3L-27-1000/16 <sup>3)</sup>	11864	LSN, LST, LSE, ASN, AST	0.52	20
	25	100	180	S-3L-27-1000/25 <sup>3)</sup>	11865	LSN, LST, LSE, ASN, AST	0.96	10
	16	80	130	G-4L-1000/16	11180	LSN, LSE, OFI, OFE, ASN	0.96	15

<sup>1)</sup> The busbar is uninsulated

<sup>2)</sup> For 1-pole or 3-pole devices with an auxiliary switch

<sup>3)</sup> For 3-pole LST; for 1-pole LSN, LSE, ASN with an auxiliary switch

### End caps

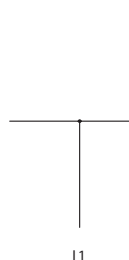
Type	Product code	Accessories to	Weight [kg]	Packing [pcs]
EK-C-3	00178	G-3L-100/10C	0.001	10
EK-C-2+3	00181	G-2L-1000/16, G-3L-1000/16C, S-3L-27-1000/16	0.001	10
EK-C-3/36	11176	S-3L-1000/25	0.002	10
EK-C-4/16	11181	G-4L-1000/16	0.002	10

### Specification

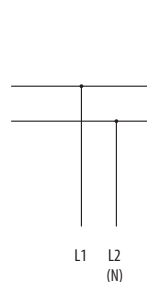
Type	G-1L, G-2L, G-3L, G-4L, S-1L, S-3L
Rated operating voltage	$U_e$ 230/400 V a.c., 220/440 V d.c.
Load current	63 ÷ 180 A
Length	210, 1000 mm
Cross-section	10 ÷ 25 mm²

### Diagram

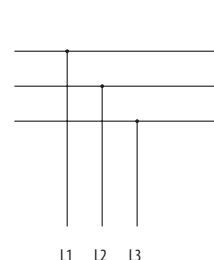
G-1L, S-1L



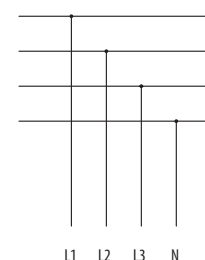
G-2L



G-3L, S-3L

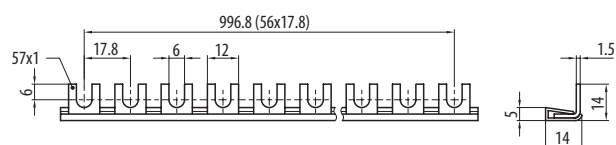
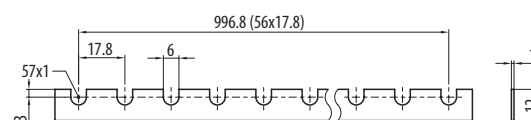
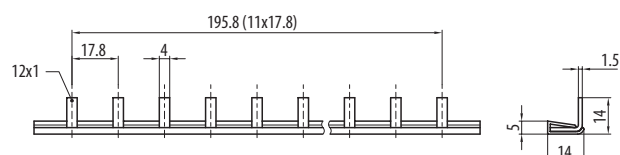
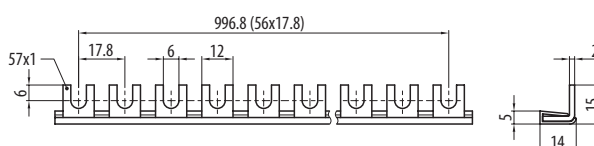
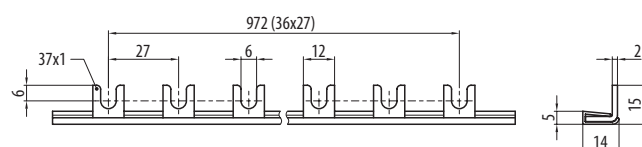
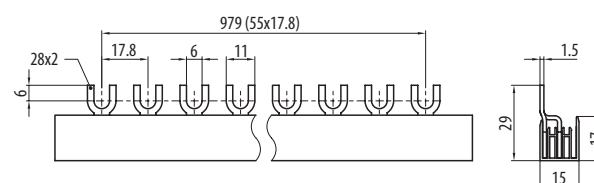
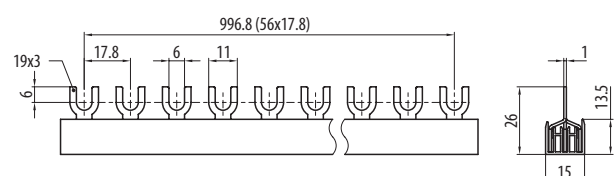
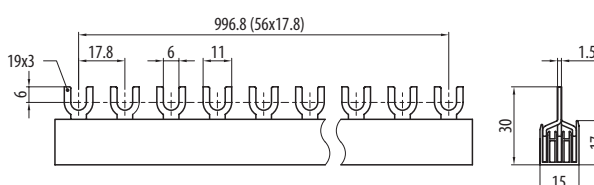
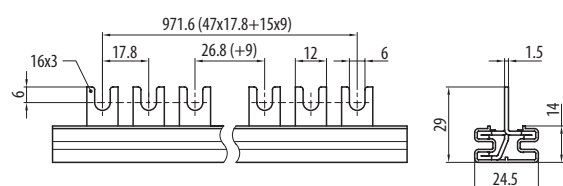
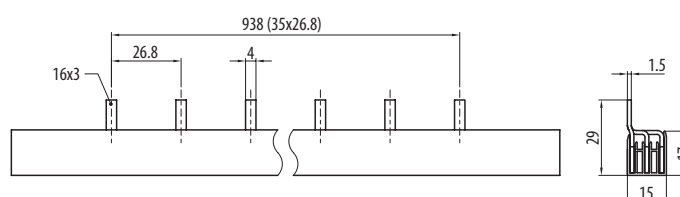
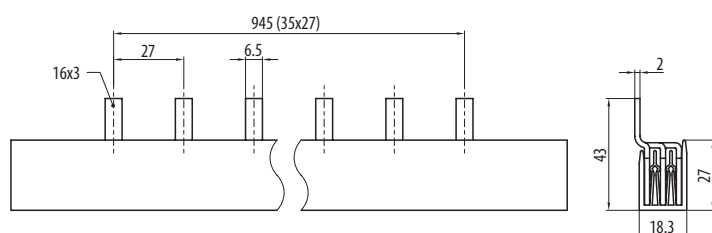
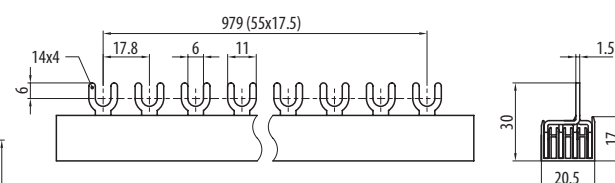


G-4L

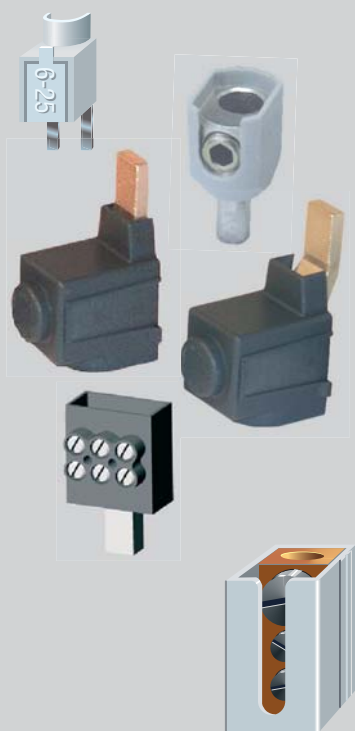


# INTERCONNECTING BUSBARS AND END CAPS

## Dimensions

**G-1L-1000/12**

**G-1L-1000/12g**

**S-1L-210/16iso**

**G-1L-1000/20**

**G-1L-27-1000/24**

**G-2L-1000/16**

**G-3L-1000/10C**

**G-3L-1000/16C**

**G-3L+9-1000/16C**

**S-3L-27-1000/16**

**S-3L-27-1000/25**

**G-4L-1000/16**


## CONNECTING ADAPTERS AND BLOCKS



### Connecting adapter AS/25-GN

- Accessories to: LSN, LSE, LFI, LFE, OFI, OFE, SJB, SVM, ASN
- For connection of another conductor to the head part of the terminal of a circuit breaker or tumbler power switch
- For example, it the best solution is to connect a conductor for power supply of an electric meter in the clip part of the circuit breaker terminal, and another conductor through the connecting adapter AS/25-GN in the head part of the circuit breaker terminal
- Conductor cross-section:  $6 \div 25 \text{ mm}^2$

### Connecting adapter AS/25-SN

- Accessories to: OFI20, OFE20, SVL, SJL, RP1
- For connection of conductor to the clip part of the terminal of a circuit breaker or tumbler power switch
- Conductor cross-section:  $6 \div 25 \text{ mm}^2$

### Connecting adapter AS-AL/Cu-16-50

- Accessories to: LSN, LST, LSE, LFI, LFE, SJBplus, ASN, AST
- For connection of Al or Cu conductors
- Cross-section of Cu conductors:  $2.5 \div 50 \text{ mm}^2$
- Cross-section of Al conductors:  $16 \div 50 \text{ mm}^2$

### Connecting adapter CS-FH000-...NP95

- Accessories to: LST, SJBplus, SJB100/NPE/1,5, AST
- For connection of Cu/Al conductors of cross-section  $35 \div 95 \text{ mm}^2$
- Connecting adapter with straight terminal

### Connecting adapter CS-FH000-3NV95

- Accessories to: LST, SJBplus, SJB100/NPE/1,5, AST
- For connection of Cu/Al conductors of cross-section  $35 \div 95 \text{ mm}^2$
- Connecting adapter with outbowed terminal

### Connecting adapter N3x10-FH000

- Accessories to: LST, SJB, SVM, AST
- For connection of 3 conductors/pole of the device of cross-section  $10 \text{ mm}^2$

### Connection block ES/35S/G

- Accessories to: G-1L, G-2L, G-3L, G4-L, S-1L, S-3L
- It enables power supply of interconnecting busbars of conductors of section up to  $35 \text{ mm}^2$
- The blocks can be installed in series to create a multiple-pole connection block
- Degree of protection IP20

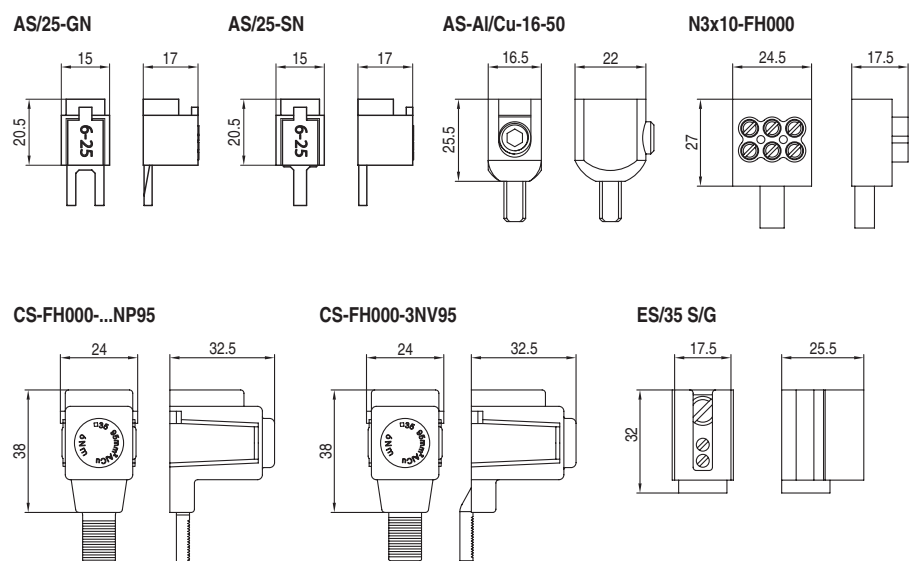
### Connecting adapters

Type	Product code	Weight [kg]	Accessories to	Set [pcs]	Packing [pcs]
AS/25-GN	00177	0.012	LSN, LSE, LFI, LFE, OFI, OFE, SJB, SVM, ASN	1	10
AS/25-SN	00176	0.013	OFI20, OFE20, SVL, SJL, RP1	1	10
AS-AL/Cu-16-50	18351	0.016	LSN, LST, LSE, LFI, LFE, SJBplus, ASN, AST	1	15
CS-FH000-3NP95	13740	0.1	LST, SJBplus, SJB100/NPE/1,5, AST	3	1
CS-FH000-1NP95	14378	0.1	LST, SJBplus, SJB100/NPE/1,5, AST	1	1
CS-FH000-3NV95	13742	0.1	LST, SJBplus, SJB100/NPE/1,5, AST	3	1
N3x10-FH000	14127	0.02	LST, SJB, SVM, AST	3	1

### Connection block

Type	Product code	Weight [kg]	Packing [pcs]
ES/35 S/G	00175	0.03	10

### Dimensions



## BASIC TERMS AND SYMBOLS

■ **Rated residual current  $I_{\Delta n}$**  is the value of residual current  $I_{\Delta}$  specified by the manufacturer at which the residual current circuit breaker must switch out under specified conditions. Alternating residual current must release the residual current circuit breaker within  $(0.5 \div 1) I_{\Delta n}$

■ **Rated current  $I_n$**  is the value of current specified by the manufacturer, which can be transferred by the residual current circuit breaker continuously. So the current  $I_n$  can pass through the contacts for an unlimited time. Therefore it is, for instance, possible to use a residual current circuit breaker with  $I_n = 25$  A in 16 A circuit. For protection against overload of the residual current circuit breakers OFI, OFE, it is recommended to use the miniature circuit breakers LSN, LST, LSE with rated current  $I_{n\text{ MCB}} \leq I_{n\text{ RCCB}}$

■ **Rated operating voltage  $U_e$**  is the voltage the residual current circuit breaker is to be connected to and which properties are related to. The connected voltage has no effect on the device function but on the function of the test circuit and isolation properties.

■ **Rated frequency  $f_n$**  is the frequency the residual current circuit breaker is designed for and at which it works correctly under stated conditions. Majority of residual current circuit breakers are designed for  $f_n = 50$  to 60 Hz. As the residual current circuit breaker function is based on the induction principle, the residual current behaviour and frequency show an effect upon tripping. When using a device designed for 50/60 Hz in a network with a different frequency, the user must count on a change of the tripping threshold i.e. a change of  $I_{\Delta n}$

■ **Rated conditional short-circuit current  $I_{nc}$  – short-circuit strength.** The function and design principle does not allow for the residual current circuit breaker use for protection against short-circuit. For circuit protection it is necessary to use a circuit breaker or a fuse. These elements cut the short-circuited circuit safely off. The residual current circuit breaker must only withstand the through-going short-circuit current. The amplitude of the maximum through current is defined as rated conditional short-circuit current  $I_{nc}$ . The short-circuit strength is then expressed by the current  $I_{nc}$ . For example, on the rating plate,  $I_{nc} = 10$  kA is expressed by the following symbol:



■ **Ambient temperature  $T$**  for the residual current circuit breakers is  $(-5 \div +40)^\circ\text{C}$  according to almost all international standards. Some residual current circuit breakers work in an extended range  $(-25 \div +40)^\circ\text{C}$ . This possibility is identified by the following symbol on the rating plate.



■ **Residual current circuit breaker – type AC** – reacts to sine-wave residual current – it is used in conventional AC networks.



■ **Residual current circuit breaker – type A** – reacts to sine-wave alternating and pulsating direct residual currents – it is used in conventional AC networks and the networks with phase power regulation etc.



■ **Residual current circuit breaker – type G** – special residual current circuit breaker reducing the number of undesirable releases. It is mainly installed before the devices causing short-time (up to 10 ms) stray currents.  
Identification: G  
Surge resistance: 3 kA (8/20  $\mu\text{s}$ )  
Release delay: 10 ms



■ **Residual current circuit breaker – type S** – special residual current circuit breaker, which is mainly intended for selective switching of residual current circuit breakers and reduction of undesirable releases. It is installed before the devices causing short-time (up to 40 ms) stray currents.  
Identification: S  
Surge resistance: 5 kA (8/20  $\mu\text{s}$ )  
release delay: 40 ms



Selective (discriminating) switching means that if the residual current circuit breakers are connected in series, only the device in which circuit a failure occurs will release. More specifically, only the device in which the release residual current appears due to a failure in the protected circuit will release. The advantage consists in maintaining the power supply in the other circuits not affected by the failure.

Such function of the protected circuit is achieved by connection of the selective residual current circuit breaker (see Fig. 1) before the standard or G type residual current circuit breaker, with the following ratio of rated residual currents:

$$I_{\Delta n S} \geq 3 \times I_{\Delta n G}$$

$I_{\Delta n S}$  rated residual of the selective residual current circuit breaker

$I_{\Delta n G}$  maximum rated residual current of G type residual current circuit breaker

The main reason of selective switching is higher time delay of the selective residual current circuit breakers in releasing (compared to standard or G type ones).

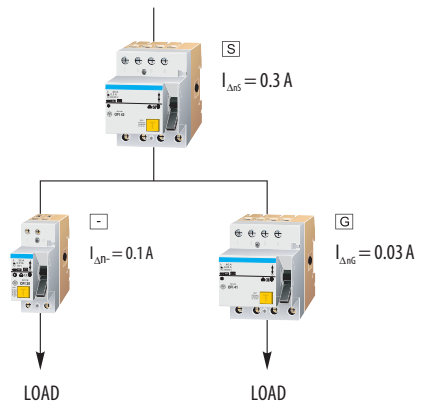


Fig. 1: Simplified example of selective connection of residual current circuit breakers.

■ **Residual current circuit breaker with overcurrent protection** – the device is a combination of residual current circuit breaker and miniature circuit breaker with 2-module width - it saves the space in the switchboard compared to conventional connection of two separate devices (3 modules). This eliminates the problem of primary protection and interconnection. The disadvantage of such a design compared to conventional ones is that it is not possible to identify whether the release was actuated by the residual current circuit breaker or by overcurrent release of the circuit breaker.

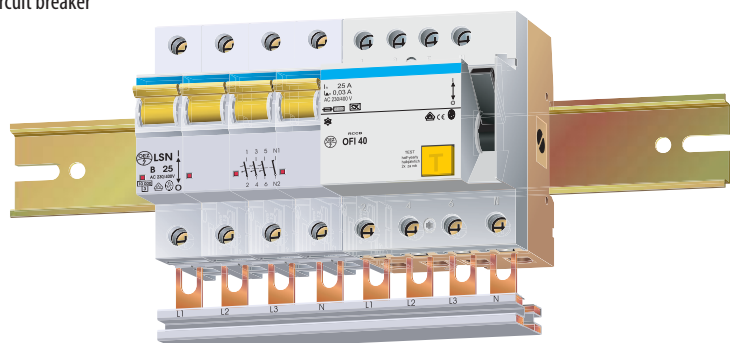


Fig. 2: Example of interconnection of the residual current circuit breaker OFI with miniature circuit breaker LSN by busbar G-4L