RESIDUAL CURRENT CIRCUIT BREAKERS OFI (10 kA)

- They react to both alternating sine-wave residual current and pulsating direct current (type A)
- For protection:
 - against accidental contact of live parts ($I_{\Delta n} \leq 30$ mA)
 - against accidental contact of exposed conductive parts
 - against fire or short-circuit at decrease of insulating capacity of electric equipment
- Possibility of additional mounting of auxiliary switches PS-OFI11 on the right side of the device
- Possibility interconnection with miniature circuit breakers LSN (LSE) by means of busbars

OFI20, OFI40

- Standard type for common use in building and industrial installations up to 80 A, 230/400 V a.c.
- Surge resistance up to 250 A (8/20 μs)

OFI41

- Special residual current circuit breakers that reduce undesirable releases
- It is recommended to install them before the equipment causing short-time (up to 10 ms) stray currents - heavy

Residual current circuit breakers 2-pole

induction motors, large heating bodies, interference suppressors, surge voltage arresters etc.

- Identification: G
- Surge resistance: 3 kA (8/20 μs)
- Release delay: 10 ms

0FI42

- Special residual current circuit breakers that reduce undesirable releases and enable selective switching of residual current circuit breakers
- It is recommended to install them before the equipment causing short-time (up to 40 ms) stray currents - heavy induction motors, large heating bodies, interference suppressors, surge voltage arresters etc.
- Identification: S
- Surge resistance: 5 kA (8/20 μs)
- Release delay: 40 ms



l,	I _{An}	Туре		Product	Weight	Packing
[Å]	[A]			code	[kg]	[pcs]
16	0.01	OFI 16/2/010	0FI20	12366	0.24	1
25	0.03	OFI 25/2/030	OF120	12367	0.24	1
	0.1	OFI 25/2/100	0FI20	13933	0.24	1
	0.3	OFI 25/2/300	0FI20	12368	0.24	1
40	0.03	OFI 40/2/030	0FI20	12369	0.24	1
	0.1	OFI 40/2/100	0FI20	13934	0.24	1
	0.3	OFI 40/2/300	0F120	12370	0.24	1

Residual current circuit breakers 4-pole

l_	I _{An}	Туре		Product	Weight	Packing
[Å]	[Ă]			code	[kg]	[pcs]
25	0.03	OFI 25/4/030	0F140	12373	0.46	1
	0.1	OFI 25/4/100	0FI40	12374	0.46	1
	0.3	OFI 25/4/300	0FI40	12375	0.46	1
40	0.03	OFI 40/4/030	OF140	12376	0.46	1
	0.1	OFI 40/4/100	OF140	12377	0.46	1
	0.3	OFI 40/4/300	OF140	12378	0.46	1
	0.5	OFI 40/4/500	OF140	12379	0.46	1
63	0.03	OFI 63/4/030	0FI40	12380	0.46	1
	0.1	OFI 63/4/100	0FI40	12381	0.46	1
	0.3	OFI 63/4/300	OF140	12382	0.46	1
	0.5	OFI 63/4/500	0FI40	12383	0.46	1
80	0.3	OFI 80/4/300	0FI40	12384	0.46	1

Residual current circuit breakers 4-pole, surge resistant, selective

l_	I _{An}	Surge resistant - G		Selective - S		Weight	Packing
[Ä]	[Ă]	Туре	Product code	Туре	Product code	[kg]	[pcs]
25	0.03	OFI 25/4/030/G OFI41	13935	-	-	0.46	1
	0.1	OFI 25/4/100/G OFI41	13936	-	-	0.46	1
40	0.03	OFI 40/4/030/G OFI41	12389	-	-	0.46	1
	0.1	OFI 40/4/100/G OFI41	12390	-	-	0.46	1
	0.3	-	-	OFI 40/4/300/S OFI42	12391	0.46	1
63	0.1	OFI 63/4/100/G OFI41	13937	-	-	0.46	1
	0.3	-	-	OFI 63/4/300/S OFI42	12393	0.46	1

OFI accessories

Auxiliary switch	PS-OFI11	page 34
Interconnecting busbar	G-2L-1000/16, G-4L-1000/16	page 93
Connecting adapters	AS/25-GN, AS/25-SN	page 95







RESIDUAL CURRENT CIRCUIT BREAKERS OFI (10 kA)

Specification

Туре			OF120	OF140	OFI41	0F142
Standards			EN 61 008, IEC 755			
Approval marks			(I)	₿ 👍 🤆	•G 🖉 🌾	
Number of poles			2	4	4	4
Туре			A	A CCC	A/G	A/S ~/S
Surge resistance (8/20 µs)			0.25 kA	0.25 kA	3 kA	5 kA
Release delay			-	-	10 ms	40 ms
Rated operating voltage		U _e	230 V a.c.	230/400 V a.c.	230/400 V a.c.	230/400 V a.c.
Min. operating voltage		$U_{_{\min}}$	100 V a.c.	100 V a.c.	100 V a.c.	100 V a.c.
Rated current		l _n	16, 25, 40 A	25, 40, 63, 80 A	25, 40, 63 A	40, 63 A
Rated residual current		Ι _{Δn}	0.01; 0.03; 0.1; 0.3 A	0.03; 0.1; 0.3; 0.5 A	0.03; 0.1 A	0.3 A
Rated frequency		f _n	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Mechanical and electrical endurance			> 10 000 operating cycles			
Mounting on the rail DIN EN 50 022 - width	h		35 mm	35 mm	35 mm	35 mm
Rated conditional short-circuit current	with backup fuse $I_n \le 63 \text{ A gG}$	I _{nc}	10 kA	-	-	-
	with backup fuse $I_n \le 100 \text{ A gG}$	I _{nc}	-	10 kA	10 kA	10 kA
	with backup circuit breaker LSN, LST with $\rm I_n$ max. 1:1	I _{nc}	6 kA	10 kA	10 kA	10 kA
	with backup circuit breaker LSE with I_n max. 1:1	I _{nc}	6 kA	6 kA	6 kA	6 kA
Connection	conductor		$1 \div 16 \text{ mm}^2$	$1 \div 25 \text{ mm}^2$	$1 \div 25 \text{ mm}^2$	$1 \div 25 \text{ mm}^2$
	busbar		16 mm ²	16 mm ²	16 mm ²	16 mm ²
	opposite		yes	yes	yes	yes
Operating conditions	ambient temperature		-25 ÷ 45 °C	-25 ÷ 45 °C	-25 ÷ 45 ℃	-25 ÷ 45 °C
	seismic immunity (8÷50 Hz)		3 g	3 g	3 g	3 g
	operating position		arbitrary	arbitrary	arbitrary	arbitrary

Dimensions

0FI20



OFI40, OFI41, OFI42





Diagram

0F120





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

- Accessories to residual current circuit breakers OFI and OFE
- Installation: on the right side

Residual current circuit breakers

The auxiliary switch is designed for signalling the position of the main contacts of residual current circuit breakers

Auxiliary switches

Туре	Contact	Product	Packing	Weight
	sequence 1)	code	[pcs]	[kg]
H001	001	13138	1	0.06
PS-OFI11	11	12395	1	0.06

¹⁾ Each digit indicates successively the number of make, break and break-make contacts

Specification

Туре		H001	PS-OFI11
Approval marks) 🔁 🕄	PG 👹
Contact sequence 1)		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	220 V d.c. / 1 A
		24 V d.c. / 4 A	
Degree of protection		IP20	IP20
Mounting		on right side	on right side

¹⁾ Each digit indicates successively the number of make, break and break-make contacts

Dimensions











Diagram



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

Interconnecting busbars

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





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

¹⁾ The busbar is uninsulated

²⁾ For 1-pole or 3-pole devices with an auxiliary switch

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

End caps

Туре	Product	Accessories to	Weight	Packing
	code		[kg]	[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

Туре		G-1L, G-2L, G-3L, G-4L, S-1L, S-3L
Rated operating voltage	U	230/400 V a.c., 220/440 V d.c.
Load current		63 ÷ 180 A
Length		210, 1000 mm
Cross-section		$10 \div 25 \text{ mm}^2$

Diagram



INTERCONNECTING BUSBARS AND END CAPS

Dimensions



S-1L-210/16iso



G-1L-27-1000/24



G-3L-1000/10C



S-3L-27-1000/25



1.5

G-1L-1000/12g



G-1L-1000/20



G-2L-1000/16



G-3L-1000/16C







18.3

4



94

CONNECTING ADAPTERS AND BLOCKS

king csl

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 ÷ 25 mm²

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 mm²

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 mm²
- The blocks can be installed in series to create a multiplepole connection block
- Degree of protection IP20

Туре	Product	Weight	Accessories	Set	Packin
	code	[kg]	to	[pcs]	[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

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

Dimensions



32.5

CS-FH000-...NP95



CS-FH000-3NV95

8



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R



BASIC TERMS AND SYMBOLS

- Rated residual current I_{An} is the value of residual current I_A 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 ÷ 1) I_A.
- **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 MB \leq I_{n RCB}
- Rated operating voltage U 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** \mathbf{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 $\mathbf{f}_n = 50$ 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 \mathbf{I}_{nn}
- Rated conditional short-circuit current l_{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 l_{nc} . For example, on the rating plate, $l_{nc} = 10$ kA is expressed by the following symbol:

10 000

■ Ambient temperature T for the residual current circuit breakers is (-5 ÷ +40) °C according to almost all international standards. Some residual current circuit breakers work in an extended range (-25 ÷ +40) °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.
 - \sim
- 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 µs)

Release delay: 10 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:

$I_{\Delta n S} \ge 3 \times I_{\Delta n - G}$

- ${\sf I}_{{\scriptscriptstyle \Delta}{\sf n}{\sf S}}$ rated residual of the selective residual current circuit breaker
- $I_{\Delta n\,,G} \ \ \, \mbox{maximum rated residual current of G type residual current circuit breaker}$





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