



RADE KONČAR

**GENERAL
CATALOGUE**

www.radekoncar.com.mk

QUALITY SYSTEM

ISO 9001 "Quality system. Models for quality assurance in design / development, production and distribution of low - voltage switching devices".

The **RADE KONČAR - KONTAKTORI I RELEI D.O.O.** Quality Management System has been certified by TÜV CERT- Certification Body of TÜV Rheinland Europa Kft. The Certificate No. TRB 100 0891 issued until September 2018 confirms that the quality system is in conformance with requirements of the standard ISO 9001: 2008 and refers to following product categories: Contactors, Thermal overload relays, Rotary cam switches, Pilot devices, Molded case circuit breakers and Electronic time relays.

RADE KONČAR - KONTAKTORI I RELEI D.O.O is delicately balancing between maintaining profitability and reducing environmental impact of its business. With commitment of its entire organization has achieved both objectives and has been certified by TÜV Rheinland Bulgaria according ISO 14001 : 2015 with certificate No. TRBA 110 0032.

GREEN ORIENTED COMPANY



**APPROVALS/
STANDARDS**



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MINI MOTOR CONTACTOR type CM1 WITH AC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Small mounting dimensions and overall size
- 5,5 kW rating 400 V AC3
- Snap-on auxiliaries

Selection and ordering data

Rated operational current I_e at 400 V A	Motor switching AC2 and AC3 duty Max. Ratings of three-phase motor at 50 Hz and			Rated operational current $I_e/AC1$ at 55 °C 400 V A	Auxiliary contacts		Type	Weights kg
	230 V kW	400 V kW	690 V kW		NO	NC		
9	3	4	4	20	0	0	CM1 00 CM1 10 CM1 01 CM1 004 CM1 10N (4 main contacts)	0.175
					1	0		
					0	1		
					0	0		
12	3.2	5.5	5.5	20	1	0		



* Number of auxiliary contacts can be extended up to 5 for CM1 10;01 (see page 1/28)

MOTOR CONTACTORS type CNN 9 - CNN 12 WITH AC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Small mounting dimensions and overall size
- Snap-on auxiliaries
- Other control voltages are available

Selection and ordering data

Rated operational current I_e at 400 V A	Motor switching AC2 and AC3 duty Max. Ratings of three-phase motor at 50 Hz and			Rated operational current $I_e/AC1$ at 55 °C 400 V A	Auxiliary contacts		Type	Weights kg
	230 V kW	400 V kW	690 V kW		NO	NC		
9	3.2	4.5	5.5	25	1	0	CNN 9 10 CNN 9 01 CNN 9 004* (4 main contacts)	0.26
					0	1		
					0	0		
12	3.5	5.7	7.5	25	1	0	CNN 12 10 CNN 12 01 CNN 12 004* (4 main contacts)	0.26
					0	1		
					0	0		



* See page 1/67 for dimensions.

MOTOR CONTACTORS type CNN 18 - CNN 40 WITH AC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Small mounting dimensions and overall size
- Snap-on auxiliaries
- Other control voltages are available

Selection and ordering data

Rated operational current I_e at 400 V A	Motor switching AC2 and AC3 duty			Rated operational current $I_e/AC1$ at 55 °C 400 V A	Auxiliary contacts		Type	Weights kg
	Max. Ratings of three-phase motor at 50 Hz and 230 V kW	400 V kW	690 V kW		NO	NC		
18	4	7.5	10	30	1	0	CNN 18 10	0.265
					0	1		
22	5.5	11	11	30	1	0	CNN 22 10	0.27
					0	1		
25	5.5	11	15	40	0	0	CNN 25 00	0.28
30	7.5	15	15	40	0	0	CNN 30 00	0.285
32	7.5	15	18.5	50	0	0	CNN 32* 00	0.395
38	11	18.5	22	50	0	0	CNN 40* 00	0.40
32	7.5	15	18.5	50	0	0	CNN 32N 00	0.415
38	11	18.5	22	50	0	0	CNN 40N 00	0.42



MOTOR CONTACTORS type CNNB 9-30 WITH DC SOLENOID SYSTEM

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Snap-on auxiliaries
- Other control voltages are available

Selection and ordering data

Rated operational current I_e at 400 V A	Motor switching AC2 and AC3 duty			Rated operational current $I_e/AC1$ at 45 °C 400 V A	Auxiliary contacts		Type	Weights kg
	Max. Ratings of three-phase motor at 50 Hz and 230 V kW	400 V kW	690 V kW		NO	NC		
9	3.2	4.2	5.5	25	1	0	CNNB 9 10	0.58
					0	1		
12	3.5	5.7	7.5	25	1	0	CNNB 12 10	0.58
					0	1		
18	4.5	7.5	10	30	1	0	CNNB 18 10	0.59
					0	1		
22	5.5	11	15	30	1	0	CNNB 22 10	0.6
					0	1		
25	5.5	11	11	40	0	0	CNNB 25 00	0.64
					0	0		
30	7.5	15	15	40	0	0	CNNB 30 00	0.65
					0	0		
32	8	16	16	50	0	0	CNNB 40L 00	0.66



* For connecting multi-wired conductor up to 25 mm² must be ordered additional terminal blocks with Part No. 601478 (see 1/30).

** Number of auxiliary contacts can be extended up to 5 for CNN 9 10; 01; CNN 12 10; 01; CNN 18 10; 01; CNN 22 10; 01 and 4 for CNN 25; CNN 32/32N; CNN 40/40N (see 1/28).

* Number of auxiliary contacts can be extended up to 5 for CNNB 9 10; 01; CNNB 12 10; 01; CNNB 18 10; 01 and 4 for CNNB 25; CNNB 30 and CNNB40L

MOTOR CONTACTORS type CNN 50 - CNN 100, CNM 110, CNM 110ST WITH AC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- With fixed auxiliary contacts for CNM
- Rugged construction
- Other control voltages are available

Selection and ordering data

Motor switching Rated operational current I_e at 400 V A	AC2 and AC3 duty Max. Ratings of three-phase motor at 50 Hz			Rated operational current $I_e/AC1$ at 55°C 400 V A	Auxiliary contacts		Type	Weights kg
	230 V kW	400 V kW	690 V kW		NO	NC		
50	15	22	33	85	0	0	CNN 50 00	0.875
60	18.5	30	37	85	0	0	CNN 60 00	0.877
65	18.5	33	37	90	0	0	CNN 70 00	0.897
80	22	37	55	95	0	0	CNN 80 00	1,295
90	26	45	67	105	0	0	CNN 90 00	1.305
100	30	55	67	105	0	0	CNN 100 00	1.325
110	37	55	90	115	2	2	CNM 110 22	2.29
					4	4	CNM 110 44	2.39
110	37	55	90	115	2	2	CNM 110ST* 22	2.33
					4	4	CNM 110ST* 44	2.43

* Technical information for Contactor CNM 110ST are same as CNM 110.
ST - Main conductors with box terminal max. 1x50mm² or 2x35mm²

** Number of auxiliary contacts can be extended up to 4 (BP4 or 2xBP3) for CNN 50-100

MOTOR CONTACTORS type CNM 140 - CNM 400 WITH AC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- With fixed auxiliary contacts
- Rugged construction
- Other control voltages are available

Selection and ordering data

Motor switching Rated operational current I_e at 400 V A	AC2 and AC3 duty Max. Ratings of three-phase motor at 50 Hz			Rated operational current $I_e/AC1$ at 55°C 400 V A	Auxiliary contacts		Type	Weights kg
	230 V kW	400 V kW	690 V kW		NO	NC		
140	45	75	100	160	2	2	CNM 140 22	5.1
					4	4	CNM 140 44	5.5
170	55	90	132	200	2	2	CNM 170 22	5.2
					4	4	CNM 170 44	5.6
200	60	110	155	250	2	2	CNM 200 22	5.3
					4	4	CNM 200 44	5.7
250	75	132	160	300	2	2	CNM 250 22	8.4
					4	4	CNM 250 44	8.9
315	90	160	200	390	2	2	CNM 315 22	8.5
					4	4	CNM 315 44	8.9
400	115	200	355	400	2	2	CNM 400 22	8.5
					4	4	CNM 400 44	8.9

MOTOR CONTACTORS type CNM 450 - CNM 1000
WITH AC CONTROL CIRCUIT and AC/DC for CNM 700 - CNM 1000

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- With fixed auxiliary contacts
- Rugged construction
- Other control voltages are available

Selection and ordering data







Motor switching AC2 and AC3 duty Rated operational current I_e at 400 V A	Max. Ratings of three-phase motor at 50 Hz			Rated operational current I_e/AC1 at 55°C 400 V A	Auxiliary contacts		Type	Weights kg
	230 V kW	400 V kW	690 V kW		NO	NC		
 450	132	250	375	700	2	2	CNM 450 22	13.5
 550	175	315	500	800	2	2	CNM 550 22	14
 700	225	400	630	1000	2	2	CNM 700 22	26.4
 860	280	500	710	1100	2	2	CNM 860 22	27.6
 1000	325	580	850	1200	1	2	CNM 1000 12	51

MOTOR CONTACTORS type CNN 9 - CNN 70
WITH DC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Snap-on auxiliaries
- Other control voltages are available

Selection and ordering data

Motor switching AC2 and AC3 duty Rated operational current I_e at 400 V A	Max. Ratings of three-phase motor at 50 Hz			Rated operational current I_e/AC1 at 55°C 400 V A	Auxiliary contacts		Type	Weights kg
	230 V kW	400 V kW	690 V kW		NO	NC		
 9	3.2	4.5	5.5	25	1	0	CNN 9 10	0.275
 12	3.5	5.7	7.5	25	1	0	CNN 12 10	0.275
 18	4	7.5	10	30	1	0	CNN 18 10	0.285
 22	5.5	11	11	30	1	0	CNN 22 10	0.290
 25	5.5	11	15	40	1	0	CNN 25 10	0.305
 30	6.5	15	15	40	1	0	CNN 30 10	0.310
32	7.5	15	18.5	50	1	0	CNN 32 10 *	0.42
38	11	18.5	22	50	1	0	CNN 40 10 *	0.425
50	15	22	33	85	1	0	CNN 50 10	0.895
60	18.5	30	37	85	1	0	CNN 60 10	0.90
65	18.5	33	37	90	1	0	CNN 70 10	0.92

* For connecting multi-wired conductor up to 25 mm² must be ordered additional terminal blocks with Part No. 601478 (see 1/30).

** Number of auxiliary contacts can be extended up to 5 for CNN 9 10;01; CNN 12 10;01; CNN 18 10;01; CNN 22 10;01 and 4 for CNN 25; CNN 32; CNN 40 (see 1/28).



*** On left side with BP3 01 DC for CNN 9 - 22, BP3 11 DC for CNN 25 - 40 and BP5 11 DC for CNN 50 - 70.

MOTOR CONTACTORS type CNN 80 - CNM 110ST WITH DC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- With fixed auxiliary contacts for CNM contactors
- Rugged construction
- Other control voltages are available

Selection and ordering data

Motor switching Rated operational current I_e at 400 V A	AC2 and AC3 duty Max. Ratings of three-phase motor at 50 Hz			Rated operational current I_e/AC1 at 55°C 400 V A	Auxiliary contacts		Type	Weights kg
	230 V kW	400 V kW	690 V kW		 	NO NC		
80	22	37	55	95	1	0	CNN 80 10	1.33
90	26	45	67	105	1	0	CNN 90 10	1.34
100	30	55	67	105	1	0	CNN 100 10	1.36
110	37	55	90	115	2	1	CNM 110 21	2.29
					4	3	CNM 110 43	2.39
110	37	55	90	115	2	1	CNM 110ST 21*	2.28
					4	3	CNM 110ST 43*	2.38

* Technical information for Contactor CNM 110ST are same as CNM 110.

ST - Main conductors with box terminal max. 1x50mm² or 2x35mm²

** On left side with BP5 11 DC for CNN 80 - 100.



MOTOR CONTACTORS type CNM 140 - CNM 400 WITH DC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- With fixed auxiliary contacts
- Rugged construction
- Other control voltages are available

Selection and ordering data

Motor switching Rated operational current I_e at 400 V A	AC2 and AC3 duty Max. Ratings of three-phase motor at 50 Hz			Rated operational current I_e/AC1 at 55°C 400 V A	Auxiliary contacts		Type	Weights kg
	230 V kW	400 V kW	690 V kW		 	NO NC		
140	45	75	100	160	2	2	CNM 140 22	5.1
					4	4	CNM 140 44	5.5
170	55	90	132	200	2	2	CNM 170 22	5.2
					4	4	CNM 170 44	5.6
200	60	110	155	250	2	2	CNM 200 22	5.3
					4	4	CNM 200 44	5.7
250	75	132	160	300	2	2	CNM 250 22	8.4
					4	4	CNM 250 44	8.9
315	90	160	200	390	2	2	CNM 315 22	8.5
					4	4	CNM 315 44	8.9
400	115	200	355	400	2	2	CNM 400 22	8.5
					4	4	CNM 400 44	8.9



CONTACTOR ASSEMBLIES IN ENCLOSURES and DIRECT - ON LINE STARTERS for contactors CNN 9 - 40

ENCLOSURES - type PNN , PNNT and PNING from insulation material

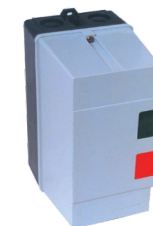
Selection and ordering data

Selection and ordering data

Data for AC2 and AC3 utilization categories			Auxiliary contacts		Degree of protection	Type		Weights kg
Rated operational current Ie/400V A	Motor rating at 50 Hz for V		NO	NC		without relay	with relay	
	230 V kW	400V kW						
CONTACTORS IN ENCLOSURES								
9	3.2	4.5	1	0	IP 65	PNN 9	PNNR 9	0.585/0.735
12	3.5	5.7	1	0	IP 65	PNN 12	PNNR 12	0.585/0.735
18	4	7.5	1	0	IP 65	PNN 18	PNNR 18	0.590/0.740
25	5.5	11	0	0	IP 65	PNN 25	PNNR 25	0.605/0.755
30	6.5	15	0	0	IP 65	PNN 30	PNNR 30	0.610/0.760
32	7.5	15	0	0	IP 65	PNN 32	PNNR 32	0.720/0.870
38	11	18.5	0	0	IP 65	PNN 40	PNNR 40	0.725/0.875
DIRECT - ON LINE STARTERS WITH (I - O) PUSH - BUTTON								
9	3.2	4.5	-	-	IP 54	PNNT 9	PNNRT 9	0.710/0.860
12	3.5	5.7	-	-	IP 54	PNNT 12	PNNRT 12	0.710/0.860
18	4	7.5	-	-	IP 54	PNNT 18	PNNRT 18	0.715/0.865
25	5.5	11	1	2	IP 54	PNNT 25	PNNRT 25	0.730/0.880
30	6.5	15	1	2	IP 54	PNNT 30	PNNRT 30	0.735/0.885
32	7.5	15	1	2	IP 54	PNNT 32	PNNRT 32	0.845/0.995
38	11	18.5	1	2	IP 54	PNNT 40	PNNRT 40	0.850/1.000
DIRECT - ON LINE STARTERS WITH PERMANENT CONTACTS								
9	3.2	4.5	1	0	IP 54	PNNG 9	PNNRG 9	0.720/0.870
12	3.5	5.7	1	0	IP 54	PNNG 12	PNNRG 12	0.720/0.870
18	4	7.5	1	0	IP 54	PNNG 18	PNNRG 18	0.725/0.875
25	5.5	11	0	0	IP 54	PNNG 25	PNNRG 25	0.735/0.890
30	6.5	15	0	0	IP 54	PNNG 30	PNNRG 30	0.745/0.895
32	7.5	15	0	0	IP 54	PNNG 32	PNNRG 32	0.855/1.005
38	11	18.5	0	0	IP 54	PNNG 40	PNNRG 40	0.860/1.010



Design	Degree of protection	Type	Weights kg
Enclosures without push-buttons	IP 65	PNN	0.325
Enclosures with push-buttons With "I" make and "O" break push button	IP 54	PNNT	0.450
Enclosures with permanent contacts	IP 54	PNNG	0.460



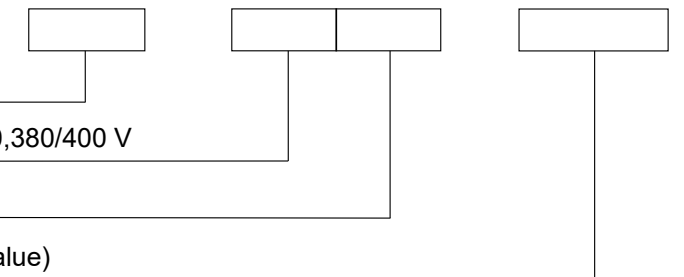
ORDER:

Type

Standard control voltages AC 24, 48, 110, 220/230, 380/400 V

For AC control: 50 Hz or 60 Hz

Setting range for thermal overload relay (Upper value)



Example: Motorstarter type PNNT 18 control voltage 220/230 V, 50 Hz

PNNT 18 220/230 V 50 Hz

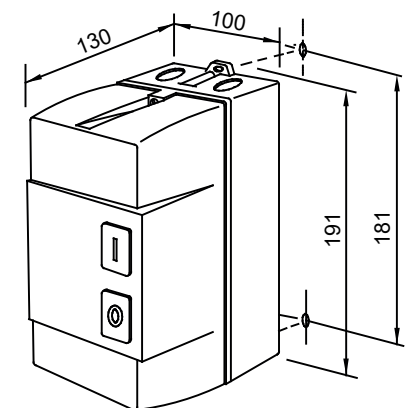
Example: Motorstarter type PNNRT 18 control voltage 220/230 V, 50 Hz, thermal overload relay type TM 40, current range (10-16)A

PNNRT 18 220/230 V 50 Hz 16A

Example: Motorstarter type PNNRG 12 control voltage 220/230 V, 50 Hz, thermal overload relay type TM 40, current range (10-16)A

PNNRG 12 220/230 V 50 Hz 16A

Dimension Drawing (mm)



STAR - DELTA STARTERS - TYPE SDS

Star - delta starters are used for starting three-phase induction cage motors which are not overloaded during the starting. When starting, the windings of the stator are connected to the mains in a position of a start. After the starting operation they assume a delta position. Due to this change of the position of the windings the value of the starting current of the motor is 0,58 of the current of direct starting in delta position of the windings. When starting the motor in this way the starting moment is three times shorter, so this starters can only be used for motors whose starting moment, due to lack of overloading, is much shorter, and for those starting in idle or under light load. The windings can change their start position into a delta position after the motor achieves a nominal numbers of rotations. Motors which require an early change of the position of the windings cannot be started with SDS type of starters.

In table 1. quoted currents and capacities are valid only if special star-delta timer EVRK 40 is used.

The change of the windings from star position to delta position occurs automatically after the starting operations is over. Starting can be adjusted to last from 2-20 s with a switch delay of about 100ms by means of an embedded timer. The thermal overload relay can operate accurately during permanent duty if the number of starts per hour does not exceed 15, and during intermittent duty (with 40% working time) if the number of starts per hour does not exceed 60.

Overload protection

The thermal overload relay is set to $I_{cca} = 0,58 \times$ motor rated current.

Technical data for current range of thermal overload relays are given in table 2.

Table 1 - Technical data for Star - Delta starters

Star-Delta starter type SDS	In at 400 V A	Max. motor output at 50 Hz and			
		220 V kW	400 V kW	500 V kW	690 V kW
SDS 7,5	16	4	7,5	7,5	10
SDS 11	22	5,5	11	11	15
SDS 15	29	7,5	15	15	18,5
SDS 18,5	37	11	18,5	22	22
SDS 22	44	15	22	25	34
SDS 25	50	15	25	25	34
SDS 30	60	15	30	30	37

Table 2 - Current range of thermal overload relays and selection of components for SDS

Type of starter	Pn kW	K1	K2	K3	EVR	TM	Range A	Ir A
SDS 7,5	7,5	CNN 9	CNN 9	CNN 9	EVR 40	TM 40	6,3-10	9
SDS 11	11	CNN 12	CNN 12	CNN 9	EVR 40	TM 40	10-16	12,7
SDS 15	15	CNN 18	CNN 18	CNN 12	EVR 40	TM 40	12,5-20	16,8
SDS 18,5	18,5	CNN 25	CNN 25	CNN 25	EVR 40	TM 40	16-25	20,3
SDS 22	22	CNN 30	CNN 30	CNN 25	EVR 40	TM 40	16-25	23,7
SDS 25	25	CNN 32	CNN 32	CNN 32	EVR 40	TM 40	22-30	29
SDS 30	30	CNN 40	CNN 40	CNN 32	EVR 40	TM 40	28-38	31,9

ORDER:

Example: Motorstarter type SDS 18,5 control voltage 220/230 V, 50 Hz

SDS 18,5 **220/230 V** **50 Hz**

Example: Star - Delta Starters type SDS 18,5 control voltage 220/230 V, 50 Hz, thermal overload relay type TM 40, current range (10-16)A

SDS 18,5 **220/230V** **50 Hz** **16A**

STAR - DELTA STARTERS IN ENCLOSURES - TYPE PNSDS

Table 1 - Technical data for Star - Delta starters

Star-Delta starter type PNSDS	In at 400 V A	220 V kW	400 V kW	500 V kW	690 V kW	Dimensions (axbxc) mm
PNSDS 7,5	16	4	7,5	7,5	7,5	210x260x185
PNSDS 11	22	5,5	11	11	7,5	
PNSDS 15	29	7,5	15	15		
PNSDS 18,5	37	11	18,5	22	15	
PNSDS 22	44	15	22	22	15	240x320x205
PNSDS 25	50	15	25	25	18,5	
PNSDS 30	55	18,5	30	30	25	
PNSDS 37	72	22	37	37	37	400x500x207
PNSDS 45	85	26	45	45	45	
PNSDS 55	105	37	55	55	55	400x600x217

Table 2 - Current range of thermal overload relays and selection of components for PNSDS

Type of starter	Pn kW	K1	K2	K3	EVR	TM	Range A	Ir A	Max. starting time from cold state*
PNSDS 7,5	7,5	CNN 9	CNN 9	CNN 9	EVRK 40	TM 40	6,3-10	9	15
PNSDS 11	11	CNN 12	CNN 12	CNN 9	EVRK 40	TM 40	10-16	12,7	
PNSDS 15	15	CNN 18	CNN 18	CNN 12	EVRK 40	TM 40	12,5-20	16,8	
PNSDS 18,5	18,5	CNN 25	CNN 25	CNN 25	EVRK 40	TM 40	16-25	20,3	
PNSDS 22	22	CNN 30	CNN 30	CNN 25	EVRK 40	TM 40	16-25	23,7	
PNSDS 25	25	CNN 32	CNN 32	CNN 32	EVRK 40	TM 40	22-30	29	
PNSDS 30	30	CNN 40	CNN 40	CNN 32	EVRK 40	TM 40	28-38	31,9	30
PNSDS 37	37	CNN 50	CNN 50	CNN 32	EVRK 40	TRM 75-N60	32-50	41,6	
PNSDS 45	45	CNN 60	CNN 60	CNN 40	EVRK 40	TRM 75-N60	40-57	49	
PNSDS 55	55	CNN 70	CNN 70	CNN 40	EVRK 40	TRM 75-N60	50-63	61	

(*). Usual time value = 6.....10 s.

ORDER:

Example: Motorstarter type PNSDS 18,5 control voltage 220/230 V, 50 Hz

PNSDS 18,5 **220/230 V** **50 Hz**

Example: Star - Delta Starters type SDS 18,5 control voltage 220/230 V, 50 Hz, thermal overload relay type TM 40, current range (10-16)A

PNSDS 18,5 **230/230** **50 Hz** **16A**



REVERSING CONTACTOR ASSEMBLIES

type MBCM1 and MBCNN 9 - 40 (AC coil) and MBCNNB 9 - 30 (DC coil) for switching motors

Features

- Utilizing contactors with snap-on auxiliary contact blocks
- Includes power wiring
- Mechanically and electrically interlocked
- DIN rail mounting MBCM1, MBCNN 9 - 40, MBCNNB 9 - 30

Selection and ordering data

Motor switching	AC2 / AC3 duty						AC4 duty			Ie/AC1 at 55 °C 400 V A	Auxiliary contacts per contactor NO NC	Type	Wgt. kg
	Ie at 400 V A	Max. Ratings of three-phase motor at 50 Hz											
		230V kW	400V kW	690V kW	230V kW	400V kW	690V kW						
	9	3	4	4	0.75	1.5	1.5	20	0	0	MBCM1 00	0.40	
	12	3.2	5.5	5.5	0.75	1.6	1.6	20	0	0	MBCM1 10*	0.41	
											MBCM1 10N	0.42	
	9	3.2	4.5	5.5	0.75	1.9	1.9	25	0	0	MBCNN 9 00	0.54	
	12	3.5	5.7	7.5	1.1	2.2	2.2	25	0	0	MBCNN 9 11*	0.58	
											MBCNN 12 00	0.54	
18	4	7.5	10	1.5	3	3	30	0	0	MBCNN 12 11*	0.58		
										MBCNN 18 00	0.56		
22	5.5	11	11	2.2	4	3	30	0	0	MBCNN 18 11*	0.6		
										MBCNN 22 00	0.57		
25	5.5	11	15	2.2	4	4	40	1	0	MBCNN 22 11*	0.61		
										MBCNN 25 10	0.63		
30	6.5	15	15	2.5	4.4	4.4	40	1	0	MBCNN 30 10	0.63		
										32	7.5	15	18.5
38	11	18.5	22	5.5	7.5	7.5	50	1	0				
										9	3.2	4.5	5.5
12	3.5	5.7	7.5	1.1	2.2	2.2	25	0	0				
										18	4	7.5	10
22	5.5	11	10	2.2	4	3	30	0	0				
										25	5.5	11	15
30	6.5	15	15	2.5	4.4	4.4	40	1	0				
										9	3.2	4.5	5.5
12	3.5	5.7	7.5	1.1	2.2	2.2	25	0	0				
										18	4	7.5	10
22	5.5	11	10	2.2	4	3	30	0	0				
										25	5.5	11	15
30	6.5	15	15	2.5	4.4	4.4	40	1	0				

* For Push button control

The main and control circuits are wired according to the circuit diagrams on page 64.
Note: Electrical endurance of contacts in AC4 utilization category is 120 000.


REVERSING CONTACTOR ASSEMBLIES

type MBCNN 50 - MBCNM 400 for switching motors

Features

- Utilizing contactors with snap-on auxiliary contact blocks for MBCNN
- Utilizing contactors with fixed auxiliaries for MBCNM
- Includes power wiring
- Mechanically and electrically interlocked

Selection and ordering data

Motor switching	AC2 / AC3 duty						AC4 duty			Ie/AC1 at 55 °C 400 V A	Auxiliary contacts per contactor NO NC	Type	Weights kg
	Ie at 400 V A	Max. Ratings of three-phase motor at 50 Hz											
		230 V kW	400 V kW	690 V kW	230 V kW	400 V kW	690 V kW						
	50	15	22	33	6.9	12	20.8	85	1	0	MBCNN 50 10	2.80	
	60	18.5	30	37	8.1	14	24.3	85	1	0	MBCNN 60 10	2.82	
											MBCNN 70 10	2.88	
80	22	37	55	8.7	17	27	95	1	0	MBCNN 80 10	3.78		
										90	26	45	67
100	30	55	67	11	19	32	105	1	0				
										110	37	55	90
140	45	75	100	20	35	60	160	2	1				
										170	55	90	132
200	60	105	155	23	40	69	250	2	1				
										250	75	132	160
315	90	160	200	35	65	100	390	2	1				
										400	115	200	355

The main and control circuits are wired according to the circuit diagrams on page 64.
Note: Electrical endurance of contacts in AC4 utilization category is 120 000.


**CONTACTORS type TKN 65 - TKN 115; TK 130 - TK 175
for SWITCHING RESISTIVE LOADS**

Features

- Rugged construction
- Other control voltage are available

Selection and ordering data



AC coil operation

Operational current I_e/AC1 A	Ratings of three-phase loads at 230 V kW		Auxiliary contacts  NO NC	Type	Weights kg
	Rating AC1 utilization category Switching resistive load at 55°C	230 V kW			
65	25	43	0 0	TKN 65 00	0.45
115	44	76	0 0	TKN 115 00	0.90
130	50	85	2 2	TK 130 22	2.42
175	67	115	2 2	TK 175 22	2.44



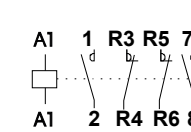
**FOUR-POLE CONTACTORS
2NO + 2NC main poles with AC control circuit**



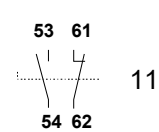
$I_e (I_{th})$	AC 1 ($\Theta \leq 55^\circ\text{C}$)	A	25	25
$I_e \text{ max}$	AC 3 ($U_e \leq 690\text{V}$)	A	9	12
Rated operational voltage U_e		V	690	690
Rated insulation voltage U_i		V	690	690
Sizes of Connecting conductors	rigid	mm ²	1,5 - 4	1,5 - 4
	Main contacts flexible	mm ²	1,5 - 2,5	1,5 - 2,5
Squirrel-cage induction motors Single phase	230 V kW		1,1	1,5
	230 V HP		1,5	2
CONTACTORS WITH AC CONTROL CIRCUIT	TYPE		CNN 9 0022	CNN 12 0022
Coil voltages	 A1 A2		24V, 48V, 110V, 230V, 400V 50Hz, 60Hz	
Electromagnet (coil) consumption	 open / closed	VA	62 / 7	62 / 7
Weights		kg	0,25	0,260
Dimensions a x b x c Drilling plan a1; b1; ϕ 1			45x72,2x71 60,65/35, 4,5	45x72,2x71 60,65/35, 4,5

Wiring diagrams

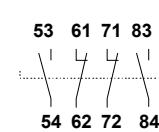
CNN 9 0022, CNN 12 0022



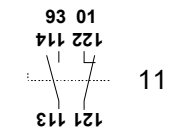
BP2



BP4



BP3



Remark for (CNN 9 0022...CNN 12 0022) 4-pole contactors fitted with 2NO + 2NC main poles

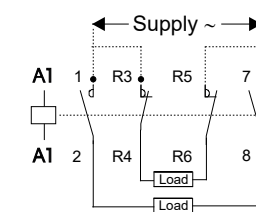
These contactors are suitable for controlling 2 separate circuits, i.e. 2 loads with 2 separate supplies, or 1 circuit comprising 2 separate loads with a single supply (see diagrams below). When the contactor operates there is no mechanical overlapping between the N.O. poles and the N.C. poles: BREAK before MAKE.



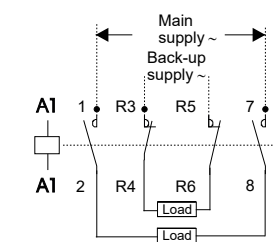
These contactors are not suitable for reversing starter or star-delta starter or for controlling a single load from 2 separate supplies.

Block diagrams

Single supply and 2 separate loads



2 separate supplies and 2 separate loads







CAPACITOR CONTACTORS type CNNK 2.5 - CNNK 16

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Switching of 3 phase capacitors
- Ambient temperature of 55 °C
- Available in other AC voltages on request
- Maximum permissible peak current $I \leq 100 I_e$

Selection and ordering data

AC-6b utilization category For switching three-phase capacitors				Auxiliary contacts		Type	Weights kg	
Capacitor rating at operating voltage 50 Hz			I _e (A) 400 V/50 Hz	NO	NC			
230 V kVAr	400/440V kVAr	690 V kVAr						
	1,4	2,5	3,7	3,6	0	0	CNNK 2,5 00	0.24
					1	0	CNNK 2,5 10	0.25
					0	1	CNNK 2,5 01	
	2,8	5	7,5	7,2	0	0	CNNK 5 00	0.25
					1	0	CNNK 5 10	0.26
					0	1	CNNK 5 01	
	4	7,5	11	11	0	0	CNNK 7,5 00	0.27
					1	1	CNNK 7,5 11*	0.29
	6,7	12,5	18	18	0	0	CNNK 16 00	0.395
					1	1	CNNK 16 11*	0.415

Note:

Maximum permissible peak current $I \leq 100$ times the nominal rms current of the switched capacitor







* With BP3 11.

CAPACITOR CONTACTORS type CNNK 10 - CNNK 30

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Switching of 3 phase capacitors
- Ambient temperature of 55 °C
- Available in other AC voltages on request
- Maximum permissible peak current $I \leq 200 I_e$

Selection and ordering data

AC-6b utilization category For switching three-phase capacitors				Auxiliary contacts		Type	Weights kg	
Capacitor rating at operating voltage 50 Hz			I _e (A) 400 V/50 Hz	NO	NC			
230 V kVAr	400/440V kVAr	690 V kVAr						
	5	10	15	14	2	0	CNNK 10 20 CNNK 10 11 CNNK 10 02	0.320
					1	1		
					0	2		
	6,7	12,5	18	18	2	0	CNNK 12 20 CNNK 12 11 CNNK 12 02	0.320
					1	1		
					0	2		
	8,5	15	22	22	2	0	CNNK 15 20 CNNK 15 11 CNNK 15 02	0.325
					1	1		
					0	2		
	11	20	30	29	1	0	CNNK 20 10 CNNK 20 01	0.333
					0	1		
	14	25	35	36	1	0	CNNK 25E 10* CNNK 25 10 CNNK 25 01	0.450
					1	0		0.520
					0	1		
	20	30	40	44	1	0	CNNK 30 10 CNNK 30 01	0.525
					0	1		

* Without terminal blocks (see page 1/56 and 1/58)

These CNNK contactors are equipped with early-make contacts. This special type of contact has the purpose of connecting for a very brief interval, 2-3ms, during the contactor closing, resistors which limit the connecting current of the capacitors. These resistors are then excluded when the closing operation is complete and the current capacity is conveyed to the main contacts. With this type of circuit, it is possible to obtain minor wear of all the components of the system especially fuses and capacitors ensuring a longer life and better reliability.

CAPACITOR CONTACTORS type CNNK 40 - CNKM 80

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Switching of 3 phase capacitors
- Ambient temperature of 55 °C
- Available in other AC voltages on request
- Maximum permissible peak current $I \leq 200 I_e$

Selection and ordering data

AC-6b utilization category For switching three-phase capacitors				Auxiliary contacts	Type	Weights kg
Capacitor rating at operating voltage 50 Hz		le (A) 400 V/50 Hz	NO			
230 V kVAr	400/440V kVAr			690 V kVAr		
25	40	58	58	1 0 0 1	CNNK 40 10 CNNK 40 01	0.943
29	50	70	72	1 0 0 1	CNNK 50 10 CNNK 50 01	0.945
32	60	80	87	1 0 0 1	CNNK 60 10 CNNK 60 01	0.97
32	60	85	87	1 0 0 1	CNNK 60N 10 CNNK 60N 01	1.35
35	70	90	101	1 0 0 1	CNNK 70 10 CNNK 70 01	1.40
34	60	92	87	2 2	CNKM 60 22	2.4
45	80	115	116	2 2	CNKM 80 22	2.45

These CNNK and CNKM contactors are equipped with early-make contacts.

This special type of contact has the purpose of connecting for a very brief interval, 2-3ms, during the contactor closing, resistors which limit the connecting current of the capacitors. These resistors are then excluded when the closing operation is complete and the current capacity is conveyed to the main contacts. With this type of circuit, it is possible to obtain minor wear of all the components of the system especially fuses and capacitors ensuring a longer life and better reliability.

CAPACITOR CONTACTORS type CNNK 10..N - CNNK 30..N - New Series

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Switching of 3 phase capacitors
- Ambient temperature of 55 °C
- Available in other AC voltages on request
- Maximum permissible peak current $I \leq 200 I_e$

New series

- 5 sizes up to: 15kVAr; 20kVAr; 30kVAr; 60kVAr; 75kVAr
- New precharging resistors for increased service life
- Space saving: 45mm width up to 30kVAr
55mm width up to 60kVAr
70mm width up to 75kVAr

Selection and ordering data

AC-6b utilization category For switching three-phase capacitors				Auxiliary contacts	Type	Weights kg
Capacitor rating at operating voltage 50 Hz		le (A) 400 V/50 Hz	NO			
230 V kVAr	400/440V kVAr			690 V kVAr		
5	10	15	14	2 0 1 1 0 2	CNNK 10 20N CNNK 10 11N CNNK 10 02N	0.320
6,7	12.5	18	18	2 0 1 1 0 2	CNNK 12 20N CNNK 12 11N CNNK 12 02N	0.320
8.5	15	22	22	2 0 1 1 0 2	CNNK 15 20N CNNK 15 11N CNNK 15 02N	0.325
11	20	30	29	1 0 0 1	CNNK 20 10N CNNK 20 01N	0.333
14	25	35	36	1 0 1 0 0 1	CNNK 25E 10N* CNNK 25 10N CNNK 25 01N	0.450 0.520
20	30	40	44	1 0 0 1	CNNK 30 10N CNNK 30 01N	0.525

* Without terminal blocks (see page 1/54 and 1/56)

Precharging resistors are an integral component of the CNNK..N contactors, equipped with early-make contacts. This special type of contact has the purpose of connecting for a very brief interval, 2-3ms, during the contactor closing, resistors which limit the connecting current of the capacitors. These resistors are then excluded when the closing operation is complete and the current capacity is conveyed to the main contacts. With this type of circuit, it is possible to obtain minor wear of all the components of the system especially fuses and capacitors ensuring a longer life and better reliability. Suitable for capacitors with and without reactor protection.

CAPACITOR CONTACTORS type CNNK 40..N - CNNK 75..N - New Series

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Switching of 3 phase capacitors
- Ambient temperature of 55 °C
- Available in other AC voltages on request
- Maximum permissible peak current $I \leq 200 I_e$

New series

- 5 sizes up to: 15kVAR; 20kVAR; 30kVAR; 60kVAR; 75kVAR
- New precharging resistors for increased service life
- Space saving: 45mm width up to 30kVAR
55mm width up to 60kVAR
70mm width up to 75kVAR

Selection and ordering data

AC-6b utilization category For switching three-phase capacitors Capacitor rating at operating voltage 50 Hz				Auxiliary contacts	Type	Weights
230 V kVA _r	400/440V kVA _r	690 V kVA _r	I _e (A) 400 V/50 Hz	NO NC		kg
25	40	58	58	1 0 0 1	CNNK 40 10N CNNK 40 01N	0.943
29	50	70	72	1 0 0 1	CNNK 50 10N CNNK 50 01N	0.945
32	60	80	87	1 0 0 1	CNNK 60 10N CNNK 60 01N	0.97
32	60	85	87	1 0 0 1	CNNK 60N 10N CNNK 60N 01N	1.35
35	70	90	101	1 0 0 1	CNNK 70 10N CNNK 70 01N	1.40
38	75	105	108	1 0 0 1	CNNK 75 10N CNNK 75 01N	1.50



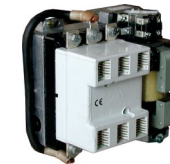
DC CONTACTORS type CNO30 - CNO 250, with AC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Specially designed for DC operation
- Suitable for use in traction vehicles
- Suitable for DC motor and distribution

Selection and ordering data

AC coil operation				Auxiliary contacts	Type	Weights
Motor switching DC3 and DC5 duty		Rated outputs of DC motor at		NO NC		kg
Rated operational current I _e at 220 V A	440 V A	220 V kW	440 V kW			
30	22.5	5	9	2 2	CNO 30 22	0.97
80	80	16	28	2 2	CNO 110 22	5.7
170	140	32	56	2 2	CNO 250 22	9.7



Precharging resistors are an integral component of the CNNK..N contactors, equipped with early-make contacts. This special type of contact has the purpose of connecting for a very brief interval, 2-3ms, during the contactor closing, resistors which limit the connecting current of the capacitors. These resistors are then excluded when the closing operation is complete and the current capacity is conveyed to the main contacts. With this type of circuit, it is possible to obtain minor wear of all the components of the system especially fuses and capacitors ensuring a longer life and better reliability. Suitable for capacitors with and without reactor protection.

DC CONTACTORS type CNO 30 - CNO 250, with DC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-4
- Specially designed for DC operation
- Suitable for use in traction vehicles
- Suitable for DC motor and distribution

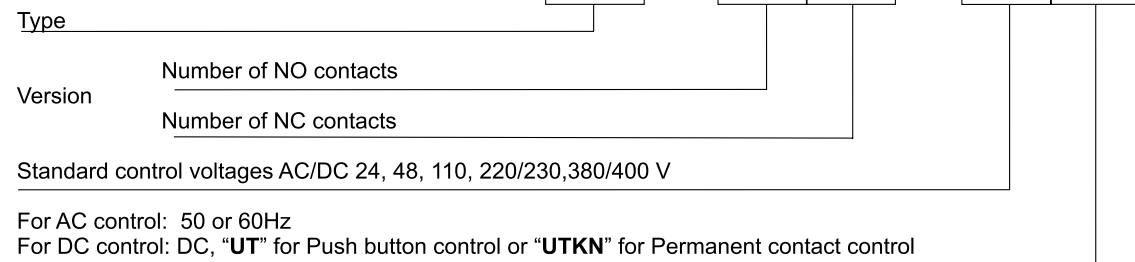
Selection and ordering data

DC coil operation

Rated operational current $I_{e at}$		Rated outputs of DC motor at		Auxiliary contacts		Type	Weights kg
220 V A	440 V A	220 V kW	440 V kW	NO	NC		
30	22.5	5	9	2	2	CNO 30 22*	0.97
80	80	16	28	2	2	CNO 110 22*	5.7
170	140	32	56	2	2	CNO 250 22*	9.7

(*)For DC control through push button the number of free auxiliary contacts are minus 1NO.
For DC control through permanent contact control the number of free auxiliary contacts is minus 1NO and 1NC

ORDER-CONTACTORS



Example: Motor contactor type CNO 30 with two NO and two NC auxiliary contacts, control voltage 220V DC, for push button control "UT"

CNO 30|22| 220V DC | UT

CONTACTOR RELAYS type CP0 for auxiliary circuit switching WITH AC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-5
- 35 mm DIN rail mounting
- Small size, ideal where space is at premium
- Snap-on auxiliaries

Selection and ordering data

Rated operational current I_e for AC 15/AC 14 utilization category for				Auxiliary contacts		Type	Weights kg
230 V A	400 V A	500 A	690 V A	NO	NC		
6	4	2.5	1.5	4	0	CP0 40	0.175
				3	1	CP0 31	
				2	2	CP0 22	



* Number of auxiliary contacts can be extended up to 6 (2BP1 + BP0) for CP0

CONTACTOR RELAYS type CNNP for auxiliary circuit switching WITH AC CONTROL CIRCUIT

Features

- In conformity with: IEC 60947-1, IEC 60947-5
- 35 mm DIN rail mounting
- Up to 8 auxiliary contacts
- Utilizes the same coils

Selection and ordering data

Rated operational current I_e for AC 15/AC 14 utilization category for				Auxiliary contacts		Type	Weights kg
230 V A	400 V A	500 A	690 V A	NO	NC		
6	4	4	1,5	4	0	CNNP 40	0.23
				3	1	CNNP 31	
				2	2	CNNP 22	
				1	3	CNNP 13	
				0	4	CNNP 04	



* Number of auxiliary contacts can be extended up to 8 (2BP3 or BP4) for CNNP

**CONTACTOR RELAYS with FAST-ON TERMINALS type CNNP .. F
for auxiliary circuit switching - DEFINITE PURPOSE CONTACTOR
WITH AC CONTROL CIRCUIT**

Selection and ordering data



Description	Type	Weights kg
<p>FAST-ON TERMINALS (spade terminals) comply to regulations DIN 46245 and DIN 46247. To each terminal can be attached 2 FAST-ON connectors 6.3 mm by means of multi-core wire 1.5-2.5 mm² or 4 FAST-ON connectors 2.8 mm by means of multi-core wire 0.25-1 mm². Contactors with FAST-ON terminals can be used for voltages up to 500 V A.C. Other characteristics of contactors are identical to those of contactors without FAST-ON terminals.</p>	CNNP F	0,265

**CONTACTOR RELAYS type CNNPB for auxiliary circuit switching
with DC SOLENOID SYSTEM**

Features

- In conformity with: IEC 60947-1, IEC 60947-5
- 35 mm DIN rail mounting
- Up to 8 auxiliary contacts
- Utilizes the same coils

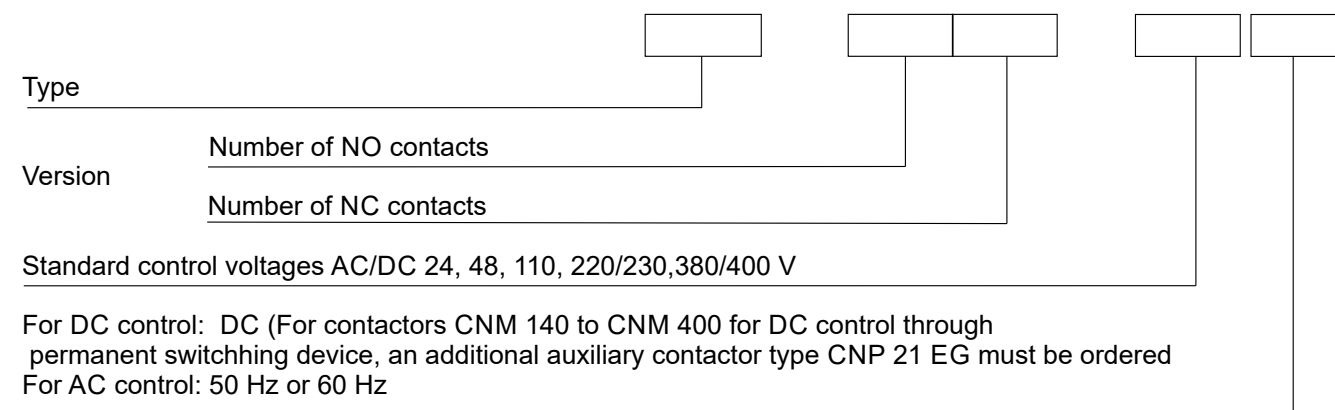
Selection and ordering data



Rated operational current for AC 15/AC 14 utilization category for				Auxiliary contacts		Type	Weights kg
230 V	400 V	500V	690 V	NO	NC		
A	A	A	A	∪	∩		
6	4	4	1.5	4	0	CNNPB 40	0.60
				3	1	CNNPB 31	
				2	2	CNNPB 22	
				1	3	CNNPB 13	
				0	4	CNNPB 04	

* Number of auxiliary contacts can be extended up to 8 (2BP3 or BP4) for CNNP

ORDER-CONTACTORS



Example: Motor contactor type CNN 18 with one NO and zero NC auxiliary contacts, control voltage 220/230 V, 50 Hz

CNN 18 | 1 | 0 | 220/230 V | 50 Hz

Example: Motor contactor type CNM 110 with two NO and two NC auxiliary contacts, control voltage 220/230 V, 50 Hz

CNM 110 | 2 | 2 | 220/230 V | 50 Hz

Example: Auxiliary contactor type CNNP with two NO and two NC auxiliary contacts, control voltage 220/230 V 50 Hz

CNNP | 2 | 2 | 220/230 V | 50 Hz

Example: Auxiliary contactor type CNNPB with two NO and two NC auxiliary contacts, control voltage 220 V, DC

CNNPB | 2 | 2 | 220 V | DC

ACCESSORIES for CONTACTORS and CONTACTOR RELAYS
ACCESSORIES for CONTACTOR type CM1 and CONTACTOR RELAYS type CP0

Selection and ordering data

Snap-on auxiliary contact blocks

Rated operational current at Ie/AC15/AC14				Auxiliary contacts		Type	Weights kg
230 V	400 V	500 V	690 V	NO	NC		
A	A	A	A	NO	NC	BP0 40 BP0 31 BP0 22 BP0 13 BP0 04	0.04
6	3	1.8	1	4	0		
				3	1		
				2	2		
				1	3		
				0	4	BP1 10 BP1 01	0.013
6	3	1.8	1	1	0		
				0	1		

Snap on surge suppressors

Type	Weights kg
RC elements for control voltage 24 V...60 V for control voltage 72 V...220 V	RC0 - 60 RC0 - 220 0.01

Mechanical interlock

Type	Weights kg
Set comprising mechanical interlock and contactor joining parts. For use with CP0 and CM1	MB1 0.002

ACCESSORIES for CONTACTORS type CNN

Selection and ordering data

Snap-on auxiliary contact blocks

Rated operational current at Ie/AC15/AC14				Auxiliary contacts		Type	Weights kg
230 V	400 V	500 V	690 V	NO	NC		
A	A	A	A	NO	NC	BP2 11 BP2N 11*	0.03
6	3	1.8	1	1	1		
				2	2		
				2	2	BP4 22 BP4N 22*	0.04
				4	0		
				4	0	BP4 40	0.04
6	3	1.8	1	1	1	BP3 11	0.02

(*) BP2N 11; BP4N 22 only for CNN 80, CNN 90 and CNN 100
 BP2 11; BP4 22 for CNN 9 to CNN 70, TKN and CNNP/B
 BP4 40 only for CNNP and CNNPB

Mechanical interlock

Type	Weights kg
Set comprising mechanical interlock and contactor joining part. For use with CNN 9/18/22, CNN 25/30 and CNN 32/40	MB2 0.017

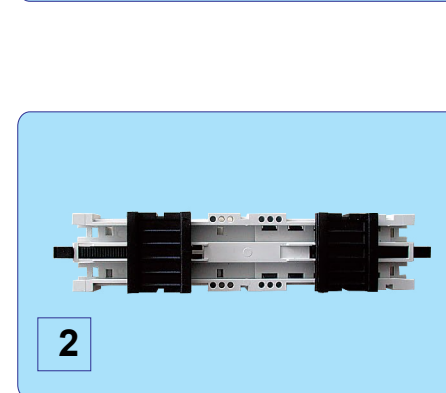
ACCESSORIES for CONTACTORS type CNN

Selection and ordering data

Type Width



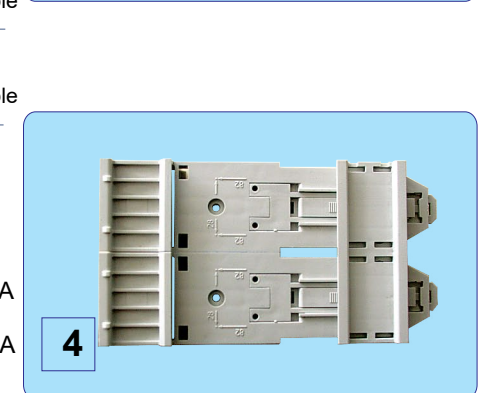
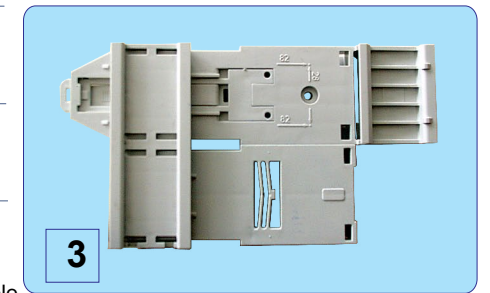
RKUMP 45 45 mm
Adapter plate for Power switch
1 DIN-rail movable



RKUMP 45A 45mm
Adapter plate for Power switch
2 DIN-rail movable

RKUMP 90 90 mm
Adapter plate for Reversing-Starter-Combination
2x Power switches, 1 DIN-rail movable

RKUMP 90E 90 mm
Adapter for Star-Delta Wiring
3x Power switches, 1 DIN-rail movable



- 1 For direct-starter up to 38 A
- 2 For direct-starter up to 38 A
- 3 For reversing starter up to 38 A
- 4 For star-delta starter up to 38 A

RKWK WIRING SYSTEM



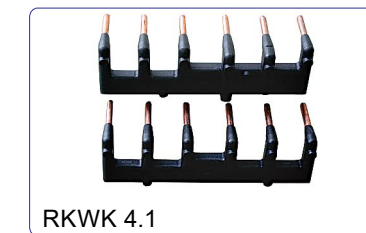
RKWK 1.1

Type Description
 RKWK 1.1 For reversing switch, suitable for contactor: 4 kW (for mini CM1) (max. current 16 A)
 5 terminals in line, (3 main terminals, 1 auxiliary terminal, 1 coil terminal)



RKWK 5.1

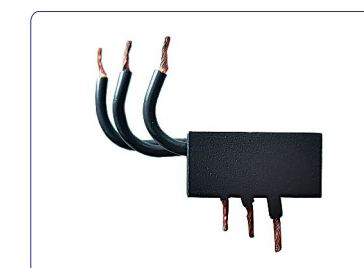
RKWK 5.1 For reversing switch, suitable for contactors: 4,5 - 7,5 kW (for CNN 9 - CNN 22) (max. current 25 A)
 (3 main terminals)



RKWK 4.1

RKWK 4.1 For reversing switch, suitable for contactors: 11 - 18,5 kW (for CNN 25 - CNN 40) (max. current 40 A)
 (3 main terminals)

RKITCF CONNECTION BLOCK BETWEEN MOTOR-PROTECTION SWITCH AND CONTACTOR



Type	Cable length	Cross-section	Width
RKITCF20	50 mm	2,5mm ²	45mm 20A
RKITCF35	50 mm	4mm ²	45mm 35A

ACCESSORIES for CONTACTORS type CNN and CNM

Selection and ordering data

Kits for assembling CNNK contactors

To optimise contactor stock management, a kit is available to transform normal three-pole contactors into CNNK types for power factor correction.

The table to the below indicates which kits to purchase depending on the standard contactor in stock.

1



BPK1

TYPE of CONTACTOR	TYPE of CAPACITOR BLOCK	TYPE of CAPACITOR CONTACTOR
CNN 9	BPK1	CNNK 10
CNN 12	BPK1	CNNK 12
CNN 18	BPK1	CNNK 15
CNN 25	BPK1	CNNK 20

Selection and ordering data

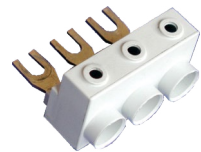
Surge suppressors

For contactor	Description	Part No.	Weights kg
CNNP CNN 9 - 40	RC elements for control voltage 24...60 V for mounting on the coil: A for mounting on the front cover: B	739968	0.014
		739914	0.019
CNNPB CNNB 9 - 30	Transil diode for control voltage 12-24V DC for control voltage 48-72 V DC for control voltage 110-120V DC for control voltage 200-220V DC	739913	0.015
		739908	0.020
		Code RKTD56CA RKTD160CA RKTD250CA RKTD440CA	0.005



Additional terminal blocks

For contactor	Description	Part No.	Weights kg
CNN 32 - CNN 40	Set of 2 additional terminal blocks for connecting bare cables 25 mm ²	601478	0.070
CNM 110	Set of 6 terminal covers for protection against inadvertent contact with the exposed busbar connections (DIN VDE 0106 Part 100)	603311	0.135
CNM 140 - CNM 200		604128	0.150



SPARE PARTS for CONTACTORS and CONTACTOR RELAYS

SPARE COILS for CONTACTOR type CM1 and CONTACTOR RELAYS type CP0

Selection and ordering data



AC coils for	Control voltage V	Rated frequency	Part No.		Weights kg
			50 Hz	60 Hz	
CM1 CP0	Coil	24	S32617S	503645S	0.042
		48	S32619S	503644S	
		110	S32620S	503643S	
		220/230 380/400	504124S S32807S S32806S	S32808S	

SPARE COILS for CONTACTORS type CNN

Selection and ordering data



AC coils for	Control voltage V	Rated frequency	Part No.		Weights kg
			50 Hz	60 Hz	
CNN 9 - CNN 30; CNNP	Coil	24	603028	603029	0.050
		48	603030	603031	
		110	603032	603033	
		220/230	605227	605229	
		380/400	605231	605232	
CNN32 - CNN40; TKN65	Coil	24	603042	603043	0.08
		48	603044	603045	
		110	603046	603047	
		220/230	605228	605230	
		380/400	605233	605234	
CNN 50 - CNN 70; TKN 115	Coil	24	604795	604802	0.130
		48	604796	604801	
		110	604797	604800	
		220/230	604762	604803	
		380/400	604798	604799	
CNN 80 - CNN 100;	Coil	24	605564	605566	0.140
		48	605565	605567	
		110	605534	605568	
		220/230	605532	605569	
		380/400	605533	605571	

SPARE PARTS for CONTACTORS CNN 50 - CNN 100; CNM110 - CNM 400

Selection and ordering data

Auxiliary contact blocks



For contactor	Description	Part No.	Weights kg
CNN 50 - CNN 100	Block with auxiliary contacts 1NO+1NC	BP5 11	0.050
CNM 110	Block with auxiliary contacts left, 1NO+1NC Block with auxiliary contacts right, 1NO+1NC Add. I block with auxiliary contacts left, 1NO+1NC Add. block with auxiliary contacts right, 1NO+1NC	733889S	0.050
		733890S	
		733891S	
		733892S	
CNM 110	Block with auxiliary DC contacts right, 1NO+1NC	733888S	
CNM 140 - CNM 400	Block with auxiliary contacts left, 1NO+1NC Block with auxiliary contacts right, 1NO+1NC Add. block with auxiliary contacts left, 1NO+1NC Add. block with auxiliary contacts right, 1NO+1NC	155129S	0.075
		155113S	
		155089S	
		155087S	

1

SPARE MAIN CONTACTS for CONTACTORS CNM 110 - 400

Selection and ordering data

Main contact set

For contactor	Description	Part No.	Weights kg
CNM 110	Set of: - 3 moving contacts and - 6 fixed contacts	733856S	0.195
CNM 140		155093S	0.39
CNM 170		155091S	0.40
CNM 200		155090S	0.41
CNM 250		155603S	0.700
CNM 315		155618S	0.710
CNM 400		155619S	0.720

For contactor	Description	Part No.	Weights kg
CNM 110	Arc chamber	733847S	0.48
CNM 140		155101S	1.16
CNM 170		155102S	1.16
CNM 200		155103S	1.16
CNM 250		155588S	1.88
CNM 315		155527S	1.88
CNM 400		155506S	1.88

SPARE COILS for CONTACTORS CNM 110 - 400 and TK 130 - TK 175

Selection and ordering data

AC coils for		Control voltage V	Rated frequency Hz	Part No.	Weights kg
CNM110 TK 130 - TK 175	Coil	24	50 / 60	158850S/158884S	0.230
		48		158852S/158890S	
		110		158853S/158876S	
		220/230		158854S/158878S	
		380/400		158855S/158895S	
CNM 140 - CNM 200	Coil	24	50 / 60	155117S/158814S	0.380
		48		155119S/158817S	
		110		155120S/158838S	
		220/230		155195S/158803S	
		380/400		155122S/158822S	
CNM 250 - CNM 400	Coil	24	50 / 60	155610S/158955S	0.650
		48		155612S/158956S	
		110		155613S/158986S	
		220/230		155615S/158951S	
		380/400		155616S/158961S	

TECHNICAL INFORMATION

Contactors

Application

Contactors type CPO, CNNP are used for closing and opening operations of the control circuit as well as for the control of small size motors and other a.c. and d.c. loads.

CM, CNN, CNM contactors are designed for switching and control of three-phase motors and other a.c. loads such as electric ovens, bulbs, electromagnets, capacitors etc.

Contactors type CNNB, CNNPB are suitable for d.c. operated (special electromagnet) and for particular conditions of application where reduced noise at closing operation and complete elimination of noise in closed position are required.

These noiseless contactors are particularly suitable for use in passenger lifts. Closing and opening operations are affected by an electromagnet thus the contactors are primarily suitable for remote control and automatic operation. Contactors should be installed in dry and clean areas.

Standards

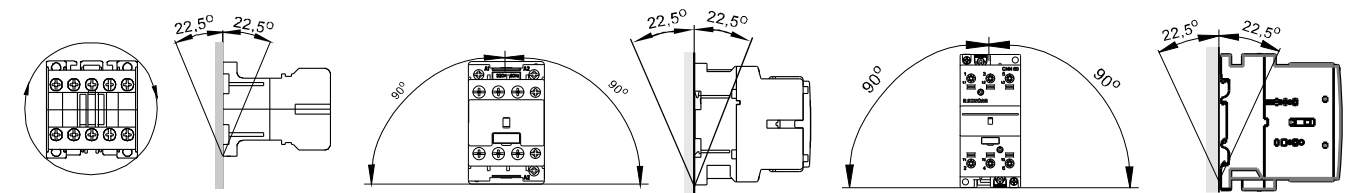
Contactors type CPO, CNNP are in conformity with International standard IEC 60947-5-1, EN 60947-5-1 and national standards VDE-0660.

Contactors CM, CNN and CNM comply with IEC 60947-4-1, EN 60947-4-1 and VDE-0660. Designations of contactors, conform to EN 50 005, EN 50 012.

Installation

Contactors can be mounted on the baseplate with two or four screws. Contactors type CPO, CNNP, CNNB, CNB, CM1 and CNN 9 - 100 are designed for quick installation on vertical standard support 35 mm width and CNN 50 - 100 on 70 mm width according to DIN EN 50022.

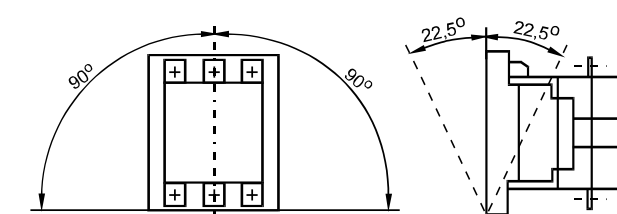
Permissible deviations of mounting surfaces from the vertical base are shown on sketches:



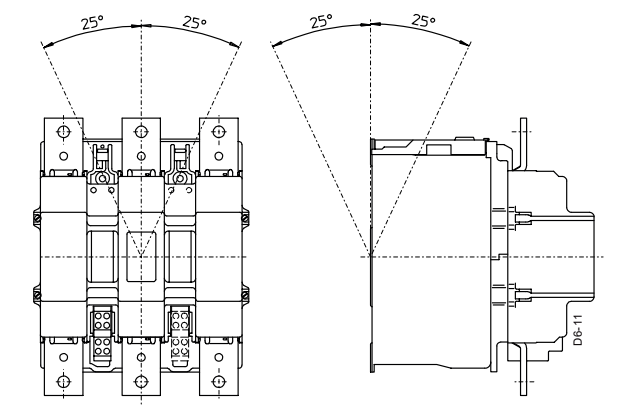
CPO, CM1

CNN 9 - CNN 40, CNNP and
CNNB 9 - CNNB 30

CNN 50 - CNN 100



CNM 110 - CNM 400



CNM 450 - CNM 1000

Electrical endurance of the main contacts

The characteristic curves show the contact endurance of the contactors when used to switch resistive and inductive three-phase loads (AC1/AC3), depending on the breaking current and rated operational voltage it is assumed that the operating mechanisms are switched randomly, i.e. Not synchronized with the phase angle of the supply system.

The rated operational current I_e for the AC4 utilization category (breaking six times the rated operational current) is designed for a contact endurance of approximately 120 000 operating cycles if a shorter endurance is sufficient, the rated operational current $I_e/AC4$ can be increased.

For mixed operation, i.e. normal switching (breaking the rated operational current according to the AC3 utilization category) in combination with intermittent inching (breaking several times the rated operational current according to the AC4 utilization category),

the contact endurance can be calculated approximately from the following equation:

$$X = \frac{A}{1 + \frac{C}{100} \left[\frac{A}{B} - 1 \right]}$$

Where:

X - Contact endurance for mixed operation in operating cycles

A - Contact endurance for normal operation ($I_c=I_e$) in operating cycles

B - Contact endurance for inching ($I_c=$ multiple of I_e) in operating cycles

C - Inching operations as a percentage of total switching operations

Diagram of electrical endurance of CM, CNN contactors - AC3

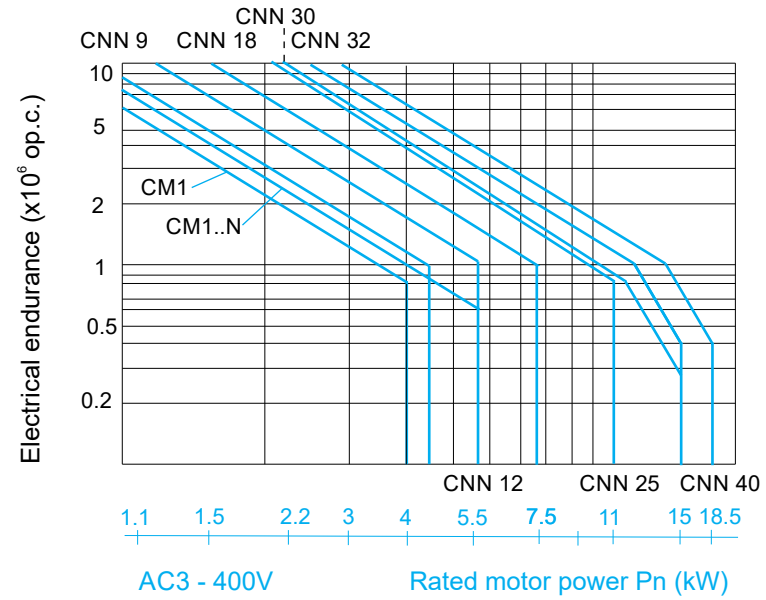


Diagram of electrical endurance of CM, CNN contactors - AC4

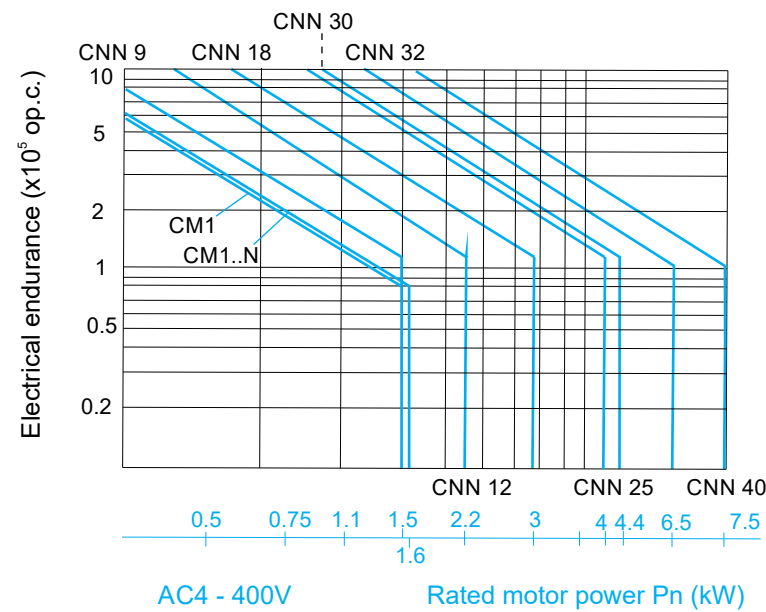


Diagram of electrical endurance of CP0 and CNNP contactor relays

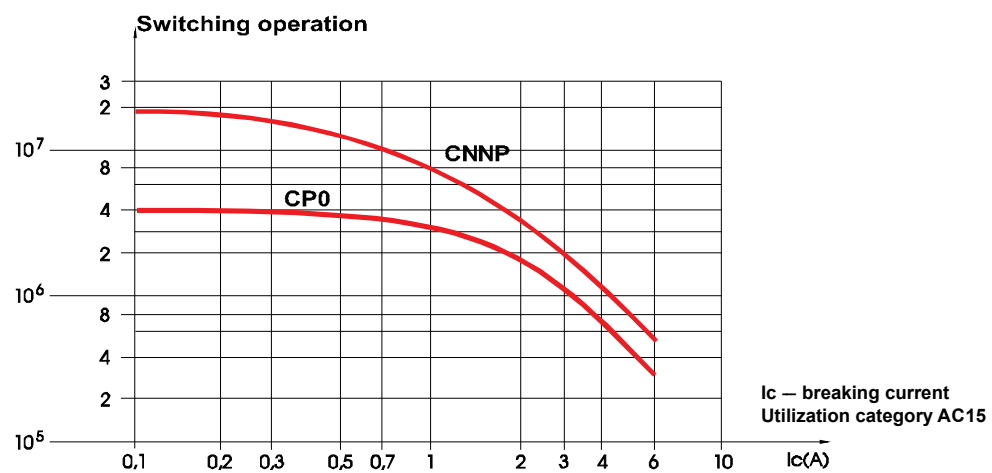


Diagram of electrical endurance of CNN and CNM contactors - AC3

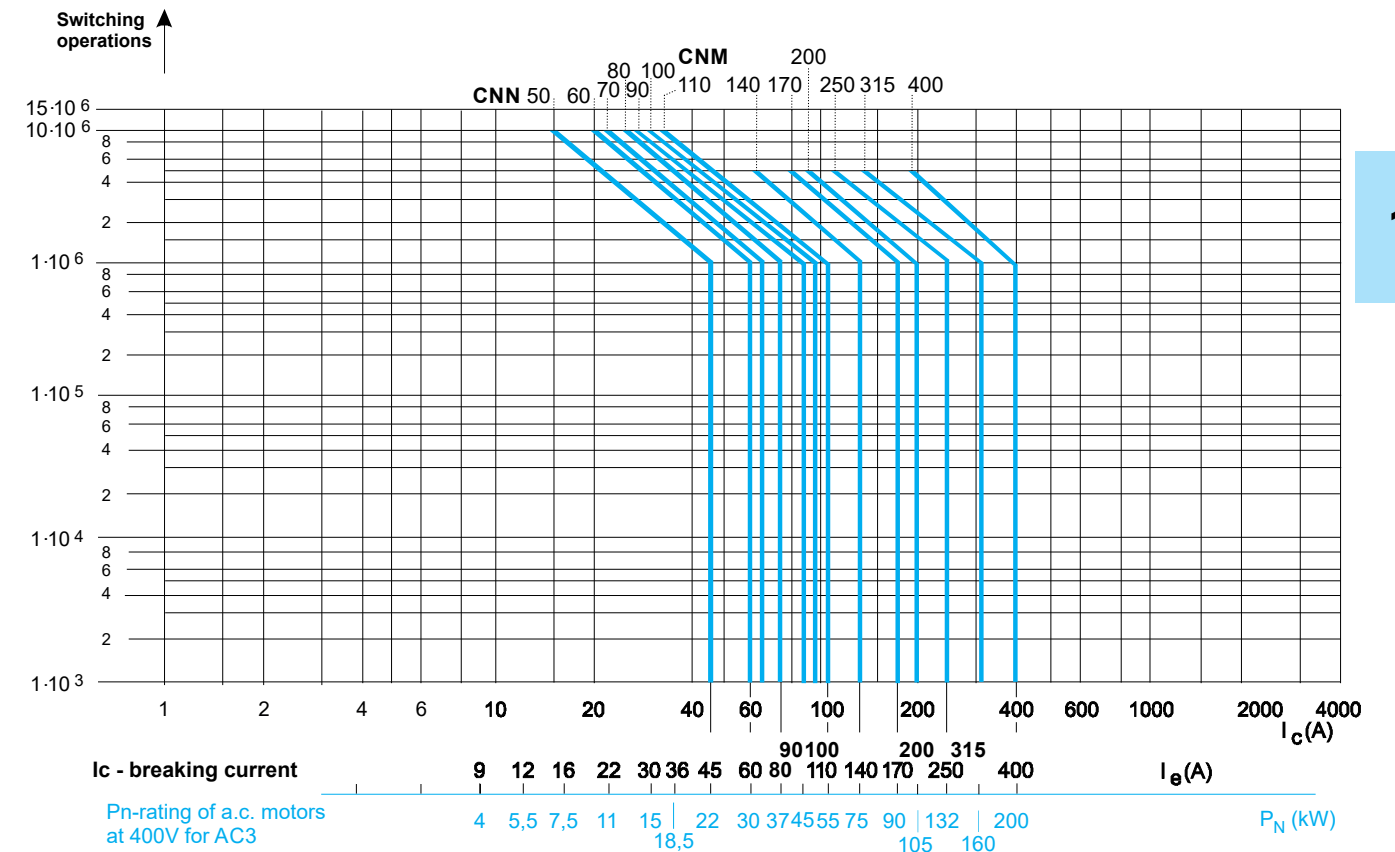
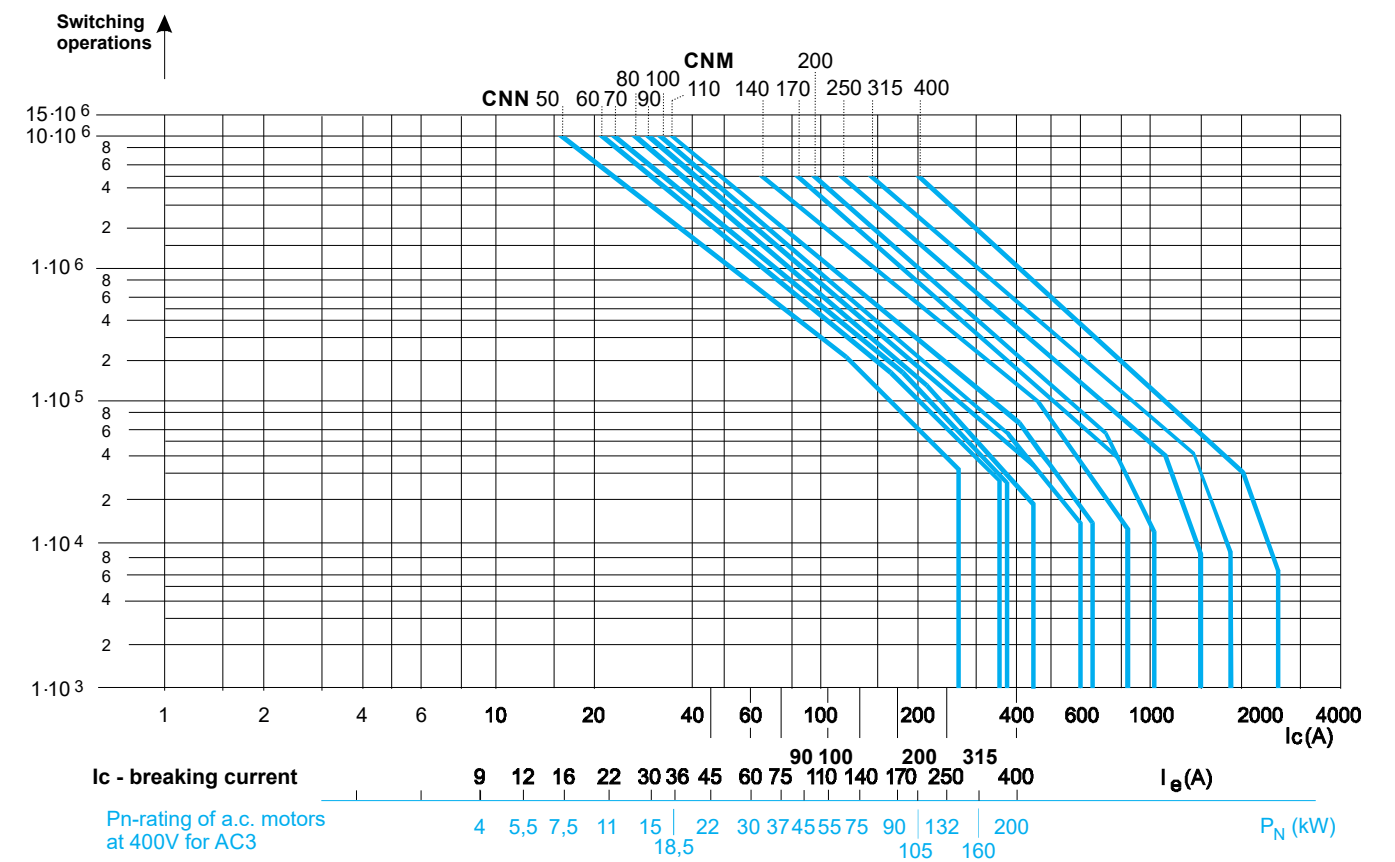


Diagram of electrical endurance of CNN and CNM contactors - AC4



TECHNICAL INFORMATION

Utilization categories for contactors

IEC 60947-4-1, IEC 60947 -5-1 and VDE - 0660

Category	Typical applications	ELECTRICAL DURABILITY						MAKE AND BREAK CONDITIONS					
		MAKE			BREAK			MAKE			BREAK		
		Current I/le	Voltage U/Ue	p.f.	Current Ic/le	Voltage Ur/Ue	p.f.	Current I/le	Voltage U/Ue	p.f.	Current Ic/le	Voltage Ur/Ue	p.f.
AC-1	Non-inductive or slightly inductive loads, electro-resistance furnaces	1	1	0,95	1	1	0,95	1,5	1,05	0,8	1,5	1,05	0,8
AC-2	Slip ring motors: Starting, switching off	2,5	1	0,65	2,5	1	0,65	4	1,05	0,65	4	1,05	0,65
AC-3	Squirrel-cage motors: $I_e(A) \leq 17$ Starting, switching off $17 < I_e \leq 100$ motors during running. $I_e > 100$	6	1	0,65	1	0,17	0,65	10	1,05	0,45	8	1,05	0,45
		6	1	0,35	1	0,17	0,35	10	1,05	0,45	8	1,05	0,45
		6	1	0,35	1	0,17	0,35	10	1,05	0,35	8	1,05	0,35
AC-4	Squirrel-cage motors: $I_e(A) < 17$ Starting, plugging ¹⁾ , $17 < I_e < 100$ inching ²⁾ , $I_e > 100$	6	1	0,65	6	1	0,65	12	1,05	0,45	10	1,05	0,45
		6	1	0,35	6	1	0,35	12	1,05	0,45	10	1,05	0,45
		6	1	0,35	6	1	0,35	12	1,05	0,35	10	1,05	0,35
AC-5a	Switching of electric discharge lamp control.							3	1,05	0,45	3	1,05	0,45
AC-5b	Switching of incandescent lamps.							1,5 ³⁾	1,05 ³⁾		1,5 ³⁾	1,05 ³⁾	
AC-6a	Switching of transformers.							To be derived from test values for AC-3 or AC-4					
AC-6b	Switching of capacitor banks.							1,5	1,05		1,5	1,05	
AC-7a	Slightly inductive loads in household appliances and similar applications.							1,5	1,05	0,8	1,5	1,05	0,8
AC-7b	Motor-loads for household applications.							8	1,05	⁴⁾	8	1,05	⁴⁾
AC-8a	Hermetic refrigerant compressor motor control with manual resetting of overload releases.							6	1,05	⁴⁾	6	1,05	⁴⁾
AC-8b	Hermetic refrigerant compressor motor control with automatic resetting of overload releases.							6	1,05	⁴⁾	6	1,05	⁴⁾
AC-12	Control of resistive loads and solid-state loads with isolation by optocouper.	1	1	0,9	1	1	0,9						
AC-13	Control of solid-state loads with transformer isolation.	2	1	0,65	2	1	0,65	10	1,1	0,65	1,1	1,1	0,65
AC-14	Control of small electro-magnetic loads (≤ 72 VA)	6	1	0,3	1	1	0,3	6	1,1	0,7	6	1,1	0,7
AC-15	Control of electro-magnetic loads (> 72 VA)	10	1	0,3	1	1	0,3	10	1,1	0,3	10	1,1	0,3
		I/le	U/Ue	L/R ms	I/le	U/Ue	L/R ms	I/le	U/Ue	L/R ms	I/le	U/Ue	L/R ms
DC-1	Non-inductive or slightly inductive loads, electro-resistance furnaces.	1	1	1	1	1	1	1,5	1,05	1	1,5	1,05	1
DC-3	Shunt motors: starting, plugging ¹⁾ , inching ²⁾ , dynamic breaking of motors.	2,5	1	2	2,5	1	2	4	1,05	2,5	4	1,05	2,5
DC-5	Series motors: starting, plugging ¹⁾ , inching ²⁾ , dynamic breaking of motors.	2,5	1	7,5	2,5	1	7,5	4	1,05	15	4	1,05	15
DC-6	Switching of incandescent lamps.							1,5	1,05	³⁾	1,5	1,05	³⁾
DC-13	Control of d.c. electromagnets.	1	1	6P	1	1	6P	1,1	1,1	6P	1,1	1,1	6P
DC-14	Control of d.c. electromagnetic loads having economy resistors in circuit.	1	1	15	1	1	15	10	1,1	15	10	1,1	15

- 1) By plugging is understood stopping or reversing the motor rapidly by reversing motor primary connections while the motor is running.
 2) By inching (jogging) is understood energizing a motor once or repeatedly for short periods to obtain small movements of the driven mechanism.
 3) Tests to be carried out with an incandescent light load.
 4) p.f.=0,45 for $I_e \leq 100$ A ; 0,35 for $I_e > 100$ A.

I - making current I_e - rated operational current I_c - breaking current P = U_e x I_e (W)
 U - voltage before breaking U_e rated operational voltage U_r - recovery voltage

TECHNICAL INFORMATION

Degrees of Protection for enclosed equipment

In an installation, the degree of protection required for electrical equipment depends of the environmental characteristics. The degree of protection, ensured by the enclosure of equipment or by the cubicle containing the equipment is expressed by the IP code which gives the level of protection against access to hazardous parts, the ingress of foreign bodies and/or the ingress of water, in compliance with IEC 529, EN 60529, IEC 60947-1 and EN60947-1. Besides the IP symbol, the complete code has two figures followed (optionally) by two additional letters. A short description of the elements used in IP coding is given below.

Element	Figures or letters	Specifications for installation protection	Protection of personnel
Codes		IP	
First figure	0 1 2 3 4 5 6	Against ingress of foreign bodies No protection Diameter ≥ 50 mm Diameter $\geq 12,5$ mm Diameter $\geq 2,5$ mm Diameter ≥ 1 mm Limited protection against dust Total protection against dust	Against access to hazardous parts with Non-protected Back of hand Finger Tool Wire Wire Wire
Second figure	0 1 2 3 4 5 6 7 8	Against entrance of water having a harmful effect No protection Vertical dripping Dripping up to 15° from the vertical Rain at a vertical angle of $\leq 60^\circ$ Splashing from all directions Hosing jets from all directions Strong hosing jets from all directions Temporary immersion Permanent immersion	
Additional letter (opt.) for use with:		Against ingress of foreign bodies	Against access to hazardous parts with
First figure 0	A	Stopped by a barrier with a 50 mm ϕ sphere	Back of hand
First figure 0 or 1	B	Entrance of test finger limited to 80 mm	Finger
First figure 1 or 2	C	Wire with 2.5 mm ϕ and length of 100 mm	Tool
First figure 2 or 3	D	Wire with 1 mm ϕ and length of 100 mm	Wire
Additional letter (opt.)	H M S W	Specific additional information High voltage apparatus Moving parts which are moving during water test Moving parts which are stationary during water test Specified atmospheric conditions	

Note: The type of enclosure or cubicle in which the equipment must be installed prevails with respect to the degree of protection.

TECHNICAL INFORMATION

Over voltage limiter (surge suppressors)

When cutting off the inductive circuits the over voltage appears. The over voltage can damage used equipment that is why it is useful to limit the amplitudes and duration of the over voltage with some of the blocking systems. In practice this overvoltages may disconnect the coil of the contactor. Cutting off the coil (wounding) is connected with high frequencies and remarkable amplitudes (several KV) but regularly with short duration. With reference to the place of the implementation, it is frequently necessary to limit the over voltage, because they can cause problems such as:

- Radio interference
- Interference with the electronic devices and components (programmable automation)
- Damage of the electronic systems and components (diodes, bridges, etc.)

The most often used systems for over voltage blockade are:

- R-C elements
- Varistors
- Diodes (with or without resistor in serial)

The advantages and disadvantages when using these elements are following:

R-C Advantages

- Theoretically can be used with AC and DC circuits
- Big limitation of voltage peaks
- Time stability of R-C elements

Disadvantages

- Resonance
- Limited influence on the period of activating contactor
- Contactors with DC magnet switch out current limiting resistor, difficulties with limiting overvoltage due to big powers.

Varistors Advantages

- Very short period of cutting off, so that there is no influence on the contactor activity
- Without resonance
- Usage in AC and DC circuits

Disadvantages

- Not enough limitation of voltage peaks
- Growing old equipment because of prolonged thermal loading

Diodes Advantages (see page 1/30)

- Optimal muffing

Disadvantages

- Delay when cutting off
- Only DC circuits

TECHNICAL INFORMATION

Voltage drop in main circuits and current transformers

Voltage drop in main circuits

When the distance between the energy source and the consumer is long, it is advisable to calculate the voltage drop for example at the moment of starting the motor (when tripping current gets peak value) and to check if the remaining voltage is in the consumers working limits.

For calculating the voltage drop the following formula has been used:

$$\Delta V = \Delta V_0 * L * I$$

Where ΔV = voltage drop in Volts

ΔV_0 = unit voltage drop from table

L = cable length in km

I = current

This formula is valid for calculating the voltage drop for motors, when insufficient voltage disable running up the motor.

In the table below are listed active and reactive resistances of the cables for calculating the voltage drop when the power factor is different from 0.8. In that case the following formulas should be used:

Single phase $\Delta V = 2 I * L (\cos f + X_c \sin f)$

Three phase $\Delta V = \sqrt{3} I * L (\cos f + X_c \sin f)$

Rated cross-section [mm ²]	Single wire cable					Two and three wire cable				
	active resistance	reactive resistance	DC	AC cos f = 0,8		active resistance	reactive resistance	DC	AC cos f = 0,8	
	r	x	ΔV	1 fase	3 fases	r	x	ΔV	1 fase	3 fases
	[Ω /km]	[Ω /km]	[V/Akm]	[V/Akm]	[V/Akm]	[Ω /km]	[Ω /km]	[V/Akm]	[V/Akm]	[V/Akm]
1	22.1	0.176	44.2	35.6	30.8	22.5	0.125	45.0	36.1	31.3
1.5	14.8	0.168	29.7	23.9	20.7	15.1	0.118	30.2	24.3	21.0
2.5	8.91	0.155	17.8	14.4	12.5	9.08	0.109	18.2	14.7	12.7
4	5.57	0.143	11.1	9.08	7.87	5.68	0.101	11.4	9.21	7.98
6	3.71	0.135	7.41	6.10	5.28	3.78	0.0955	7.56	6.16	5.34
10	2.24	0.119	4.47	3.72	3.22	2.27	0.0861	4.55	3.73	3.24
16	1.41	0.112	2.82	2.39	2.07	1.43	0.0817	2.87	2.39	2.07
25	0.889	0.106	1.78	1.55	1.34	0.907	0.0813	1.81	1.55	1.34
35	0.641	0.101	1.28	1.15	0.993	0.654	0.0783	1.31	1.14	0.988
50	0.473	0.101	0.947	0.878	0.760	0.483	0.0779	0.966	0.866	0.750
70	0.328	0.0965	0.655	0.641	0.555	0.334	0.0751	0.667	0.624	0.541
95	0.236	0.0975	0.472	0.494	0.428	0.241	0.0762	0.482	0.476	0.472
120	0.187	0.0939	0.373	0.413	0.358	0.190	0.0740	0.381	0.394	0.342
150	0.152	0.0928	0.304	0.356	0.308	0.156	0.0745	0.311	0.341	0.295
185	0.122	0.0908	0.243	0.306	0.265	0.124	0.0742	0.247	0.289	0.250
240	0.0933	0.0902	0.185	0.259	0.224	0.0954	0.0752	0.188	0.245	0.212

Current transformers

Typical for the current transformers is that the power on the secondary has got influence on the precision of the transmitting ratio as big as the phase angle.

The power of the secondary in the current transformer is made by the impedance of cables and attached instruments. The cable consumption is shown in the table below.

Secondary coil A	Consumption per meter of the two-wire cable at 20 °C for different cross section						
	1 mm ² VA	1,5 mm ² VA	2,5 mm ² VA	4,5 mm ² VA	6 mm ² VA	10 mm ² VA	16 mm ² VA
5	1	0,685	0,41	0,254	0,169	0,0975	0,062
1	0,04	0,0274	0,0164	0,0102	0,0068	0,0039	0,0025

NOTE: Each temperature increased for 10°C is followed by increasing of the consumption in VA for 4%.

Consumption of instruments is defined by the producer. Here are listed just informative values for some instruments.

Electromagnetic ammeter	1,1 VA	Cos f - meter	0,5 VA	Counter	0,5 VA
Wattmeter - Varmeter	0,5 VA	Ammeter - printer	0,5-1,5-2,5 VA	Wattmeter - printer	0,5 VA

TECHNICAL INFORMATION

Auxiliary current circuits

Voltage drop in auxiliary current circuit

The maximal cable length with allowed maximal voltage drop of 5 % for AC and DC circuits is calculated from the formula:

$L = L_0 / P$ where is:

L = Maximal cable length in km

L_0 = Cable coefficient depending on the voltage drop and the cross section

P = Active load power when tripping (for AC= $VA \cos\phi$)

The maximal length of the cable depends on the allowed voltage drop and it is changing proportionally.

Ex. for 10 % voltage drop the cable length should be doubled.

NOTE: The voltage drop is not dependent only on the length and the cross section of the cable, but as well on all other resistances (clamps, contacts), which are connected in the auxiliary circuit.

Rated cross-section [mm ²]	Coefficient L_0					
	24V [kmW]	48V [kmW]	110V [kmW]	220/230V [kmW]	380/400V [kmW]	500V [kmW]
1,5	1,08	4,32	22,7	90,8	272	471
2,5	1,80	7,20	37,8	151	453	785
4	2,88	11,5	60,5	242	725	1260

TECHNICAL INFORMATION

Cable capacity

Cable Capacity

If the length of the cables in the auxiliary current circuits is excessive the voltage drop is not only the one that should be considered but the cable capacity as well. The cable capacity can get such a high value to hold the contactor closed even when the voltage is cut off.

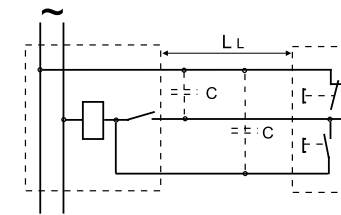
The control circuit configuration is shown below (permanent contact control) in the case of two-wire cable.

This effect is more expressed at small auxiliary relays where is required smaller energy for holding in closed position.

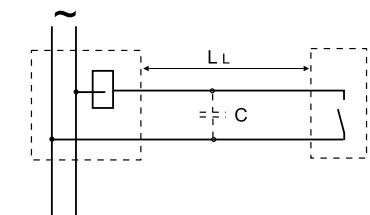
The conductor's critical capacity and appropriate critical length of the conductors for nominal control voltage

(coil voltage) 220 V, 50 Hz, at permissible 10% increase of control voltage.

Contractors (Type)	Critical conductor capacity (μF)	Critical conductor length (m)	
		Control with push button	Control with permanent
CNN 50 - CNN 70 TKN 115	0,137	228	455
CNN 80 - CNN 100, CNM 110 TK 130 - TK 175	0,222	370	740
CNM 140 - CNM 200	0,376	626	1252
CNM 250 - CNM 400	0,717	1195	2390



Control with push button



Control with permanent contact switch

TECHNICAL INFORMATION

Squirrel-cage induction motors rated motor current

Single phase				Three phase 4 Poles 50 and 60 Hz											
[kW]	[HP]	220V [A]	240V [A]	[kW]	[HP]	220V [A]	230V [A]	380V [A]	400V [A]	415V [A]	440V [A]	500V [A]	660V [A]	690V [A]	1000V [A]
0.37	0.5	3.9	3.6	0.37	0.5	1.8	1.7	1.04	0.9	0.9	0.9	0.8	0.6	0.6	0.4
0.55	0.75	5.2	4.8	0.55	0.75	2.5	2.4	1.5	1.4	1.4	1.3	1.1	0.9	0.9	0.6
0.75	1	6.6	6.1	0.75	1	3.4	3.2	2	1.9	1.8	1.7	1.5	1.1	1	0.75
1.1	1.5	9.6	8.8	1.1	1.5	4.5	4.3	2.6	2.5	2.4	2.3	2	1.5	1.4	1
1.5	2	12.7	11.7	1.5	2	6.1	5.8	3.5	3.5	3.3	3	2.7	2	1.9	1.35
1.8	2.5	15.7	14.4	2.2	3	8.8	8.4	5.1	4.8	4.7	4.4	3.8	3	2.9	2
2.2	3	18.6	17.1	3	4	11.4	10.9	6.6	6.3	6	5.7	5	3.8	3.6	2.5
3	4	24.3	22.2	3.7	5	14	13.3	8	7.6	7.4	7	6.1	4.6	4.4	3
3.5	5	29.6	27.1	4	5.5	14.8	14.1	8.6	8.1	8	7.5	6.5	5	4.8	3.3
4.4	6	34.7	31.8	5.5	7.5	20	19.1	11.7	11.1	11	10	9	6.7	6.4	4.5
5.2	7	39.8	36.5	7.5	10	27	25.8	15.5	14.7	14.3	13.5	12	9	8.6	6
5.5	7.5	42.2	38.7	9	12	32	30.6	18.7	17.7	17	16	14	10.7	10.2	7
6	8	44.5	40.8	10	13.5	36	34.4	20.5	19.5	19	18	15.6	12	11.5	8
7	9	49.5	45.4	11	15	38.5	36.8	22	20.9	20.5	19.5	17	13	12.4	9
7.5	10	54.4	50	15	20	52.5	50.2	30	28.5	28	26.5	23	17.5	16.7	12
				18.5	25	64	61.2	37	35.1	34	32	28	21.3	20.3	14
				22	30	76	72.6	44	42	40	38	33.5	25.3	24.2	17
				25	34	86	82.2	50	47.5	46	43	38	29	27.7	19
				30	40	102	97.5	59	56	54	51	45	34	32.5	23
				33	45	112	107	65	62	60	56	50	38	36.3	25
				37	50	124	119	72	68.4	66	62	55	42	40	28
				40	54	133	127	77	73	71	67	58.5	45	43	30
				45	60	146	140	85	81	78	73	65	49	47	33
				51	70	167	160	97	92	89	84	74	56	53	37
				55	75	179	171	104	99	95	90	79	60	57	40
				59	80	192	184	111	105	102	96	85	64	61	43
				63	85	204	195	118	112	109	103	90	69	66	45
				75	100	240	230	139	132	128	121	106	81	77	53
				80	110	257	246	149	141	136	129	113	86	82	57
				90	125	295	282	171	162	157	148	148	130	95	65
				100	136	321	307	186	177	171	161	142	107	102	71
				110	150	353	338	205	195	188	177	156	118	113	78
				129	175	415	397	240	228	220	207	183	138	132	92
				132	180	424	406	245	233	225	212	187	142	136	94
				140	190	450	430	260	247	239	225	198	150	143	99
				147	200	472	451	273	259	250	236	208	158	151	104
				150	204	482	461	280	266	256	241	212	161	154	106
				160	220	520	497	300	285	276	260	229	174	166	115
				180	245	578	553	335	318	306	289	254	193	185	128
				185	250	591	565	342	325	314	296	260	197	188	130
				200	270	637	609	372	353	341	321	283	214	205	142
				220	300	706	675	409	389	375	353	311	236	226	156
				250	340	803	768	465	442	426	402	353	268	256	177
				257	350	825	789	478	454	438	413	363	275	263	182
				280	380	900	861	520	494	476	450	396	300	287	200
				295	400	944	903	547	520	500	472	416	315	301	208
				300	408	963	921	558	530	511	482	424	321	307	212
				315	430	1000	956	580	551	530	500	440	334	319	220
				335	455	1065	1020	616	585	565	531	468	355	339	234
				358	480	1120	1070	650	617	594	560	493	374	358	247
				368	500	1170	1120	676	642	620	584	514	390	373	260
				400	545	1270	1115	735	698	673	635	560	423	405	280
				425	580	1350	1290	781	742	715	675	594	450	430	297
				440	600	1400	1340	810	769	742	700	616	467	447	308
				450	610	1430	1370	827	786	757	714	629	476	455	315
				475	645	1510	1445	873	829	800	754	664	503	481	332
				500	680	1590	1520	920	874	841	794	698	529	506	350
				530	720	1660	1590	950	902	870	825	720	545	521	360
				560	760	1760	1680	1000	950	920	870	760	575	550	380
				600	810	1880	1800	1090	1035	978	920	830	630	603	410

Stated current values are only indicative and can slightly vary depending on the type of motor and manufacturer.
NOTE: The choice of contactors and starters in this catalogue are based on current values indicated in this table.

TECHNICAL INFORMATION

MOTOR CONTACTORS type CM1 and type CNN WITH AC CONTROL CIRCUIT or DC CONTROL CIRCUIT

Technical data												
Contactor type		CM1 / CM1.N	CNN 9	CNN 12	CNN 18	CNN 22	CNN 25	CNN 30	CNN 32	CNN 40		
Mechanical endurance	make/break operations	x10 ⁶	5									
Insulation rating		V	690									
Permissible ambient temperature		°C	- 25 to +55									
Consumption of electromagnet in cold state with Un	AC operated	closing	VA	26	62	62	62	62	62	62	65	65
		p.f.	0.8	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
DC operated	closing	VA	4	7	7	7	7	7	7	7	8	8
		p.f.	0.35	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	closed	W	-	-	123	123	123	123	125	125	125	125
		W	-	-	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Coil voltage tolerances			0,85 – 1,1Un									
duration of making and breaking	(values are also valid for voltages of electromagnet from 0,8 to 1,1 Un for each coil in cold and warm state). Total breaking time is addition of opening time and duration of electric arc.											
AC operated	closing time	ms	12 - 21	12 - 22	12 - 22	12 - 22	12 - 22	12 - 22	12 - 22	12 - 22	12 - 22	12 - 22
	opening time	ms	9 - 18	4 - 19	4 - 19	4 - 19	4 - 19	4 - 19	4 - 19	4 - 19	4 - 19	4 - 19
	duration of electric arc	ms	10	10	10	10	10	10	10	10	10	10
Frequency of switching operations	without thermal relay	utilization category	AC1	s/h	1200	1000	1000	1000	1000	1000	1000	1000
			AC2 ; AC3	s/h	1000	750	750	750	750	750	750	750
			AC4	s/h	250	250	250	250	250	250	250	250
with thermal relay			s/h	15	15	15	15	15	15	15	15	
Resistivity to shocks	(square shock)	g/ms	7/5 and 4.2/10	7/5 and 4.2/10	7/5 and 4.2/10	7/5 and 4.2/10	8.2/5 and 4.9/10	8.2/5 and 4.9/10	8.2/5 and 4.9/10	8.2/5 and 4.9/10	8.2/5 and 4.9/10	
Short-circuit protection of contactors without overload relays												
Main circuit												
With fuse links												
-acc. to IEC 60947-4-1	Type of coord. "1" gL/gG	A	20	25	25	40	50	50	50	63	63	
DIN VDE 0660 Part 102	Type of coord. "2"	A	16	20	20	25	35	35	35	40	40	
Sizes of connecting conductors	for contact without thermal relay											
main circuit	single-wire conductor	mm ²	1-2.5	1,5-6	1,5-6	1,5-6	2,5-10	2,5-10	2,5-10	2,5-10	2,5-10	
	multi-wire conductor with cable shoe	mm ²	0,75-1,5	1,5-6	1,5-6	1,5-6	2,5-10	2,5-10	2,5-10	2,5-16	2,5-16	
auxiliary circuit	Screw		M3.5	M4	M4	M4	M4	M4	M4	M4	M4	
	Screw head		PZ2	PZ2	PZ2	PZ2	PZ2	PZ2	PZ2	PZ2	PZ2	
	Tightening torque	Nm	1.2	1.2	1.2	1.2	1.4	1.4	1.4	1.6	1.6	
	single-wire conductor	mm ²	1 - 2,5									
	multi-wire conductor with cable shoe	mm ²	0,75 - 1,5									
	Screw		M3.5									
	Screw head		PZ2									
	Tightening torque	Nm	0.8									
Loadability of auxiliary contacts of contactors CM1 and CNN	rated continuous current I _{th} ; 35°C											
rated operational current I _e /AC15	for 24 V	A	10	10	10	10	-	-	-	-	-	
	230 V	A	6	6	6	6	-	-	-	-	-	
	400 V	A	6	6	6	6	-	-	-	-	-	
	500 V	A	4	4	4	4	-	-	-	-	-	
	690 V	A	2	2	2	2	-	-	-	-	-	
rated operational current I _e /DC13	for 24 V	A	1	1	1	1	-	-	-	-	-	
	110 V	A	4	4	4	4	-	-	-	-	-	
	230 V	A	0.6	0.6	0.6	0.6	-	-	-	-	-	
		A	0.2	0.3	0.3	0.3	-	-	-	-	-	
Load carrying capacity of the main contacts	rated continuous current I _{th} ; 55°C											
AC1 utilization category												
rated operational current I _e /AC1 ; 55°C		A	20	25	25	30	40	40	40	50	50	

TECHNICAL INFORMATION

MOTOR CONTACTORS type CM1 and type CNN WITH AC CONTROL CIRCUIT or DC CONTROL CIRCUIT

Technical data												
Contactor type		CM1 / CM1..N	CNN 9	CNN 12	CNN 18	CNN 22	CNN 25	CNN 30	CNN 32	CNN 40		
AC2 and AC3 utilization categories (slip-ring and cage motors)		See tables for orders page 1/1 and 1/2										
AC4 utilization category (electrical endurance of contacts: 120.000 (50.000 for CM1..N) / 80.000 for CM1)) rated current ratings of squirrel-cage motors at 50 Hz		A	4/4.3	4.5	5	6.7	7	8.5	9	13.5	15.8	
for 230 V		kW	0.75	0.75	1.1	1.5	1.7	2.2	2.5	4	5.5	
400 V		kW	1.5/1.6	1.9	2.2	3	3.3	4	4.4	6.5	7.5	
500 V		kW	1.5/1.6	1.9	2.2	3	3.3	4	4.4	6.5	7.5	
690 V		kW	1.5/1.6	1.5	2.2	3	3.3	4	4.4	6.5	7.5	
max. permissible rated current le/AC4 ; 400 V		A	9	9	12	18	22	25	30	32	38	
Loadability by direct current DC1 utilization category, non-inductive loads L/R ≤ 1 ms												
rated operational current I _e , 55°C through one pole		for 24 V	A	12	20	20	20	20	35	35	45	50
48 V		A	10	20	20	20	20	20	20	20	20	23
110 V		A	1.5	2.1	2.1	2.1	2.1	4.5	4.5	4.5	4.5	4.5
220 V		A	0.6	0.8	0.8	0.8	0.8	1	1	1	1	1
440 V		A	0.42	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.4	0.4
600 V		A	0.42	0.6	0.6	0.6	0.6	0.6	0.6	0.25	0.25	0.25
through three poles connected in series		for 24 V	A	16	20	20	20	35	35	45	50	50
48 V		A	16	20	20	20	35	35	45	45	45	45
110 V		A	10	20	20	20	20	35	35	45	45	45
220 V		A	15	20	20	20	35	35	45	45	45	45
440 V		A	0.9	1.3	1.3	1.3	1.3	2.9	2.9	2.9	2.9	2.9
600 V		A	0.7	1	1	1	1	1.4	1.4	1.4	1.4	1.4
utilization categories DC3 to DC5 series and shunt motors (L/R ≤ 15 ms)												
rated operational current I _e , 55°C through one pole		for 24 V	A	7	20	20	20	20	20	35	35	35
60 V		A	4	5	5	5	5	5	5	6	6	6
110 V		A	1	1.5	1.5	1.5	1.5	2.5	2.5	2.5	2.5	2.5
220 V		A	-	0.75	0.75	0.75	0.75	1	1	1	1	1
440 V		A	-	-	-	0.09	0.09	0.09	0.09	0.1	0.1	0.1
600 V		A	-	-	-	0.06	0.06	0.06	0.06	0.06	0.06	0.06
through three poles connected in series		for 24 V	A	10	20	20	20	35	35	50	50	50
60 V		A	10	20	20	20	35	35	50	50	50	50
110 V		A	5	20	20	20	35	35	50	50	50	50
220 V		A	1.2	1.5	6	6	6	10	10	25	25	25
440 V		A	0.14	0.2	0.2	0.2	0.2	0.6	0.6	0.6	0.6	0.6
600 V		A	0.14	0.2	0.2	0.2	0.2	0.3	0.3	0.35	0.35	0.35

AUXILIARY CONTACT BLOCKS BP0; BP1; BP2; BP3 and BP4

Technical data						
Block type		BP0	BP1	BP2; BP2N	BP3	BP4; BP4N
Insulation rating	V	690				
Permissible ambient temperature	°C	- 25 to +55				
Short-circuit protection - max. fuse rating gL		20				
Loadability of auxiliary contacts of blocks rated continuous current I _{th} ; 35°C						
AC rated operational current I _e /AC15	for 24V	10				
	230V	6				
	400V	4				
	690V	1				
rated operational current I _e /DC13	for 24V	4				
	110V	0.6				
	230V	0.2				
	400V	0.15				
Sizes of connecting conductors						
single-wire conductor	mm ₂	1 - 2,5				
multi-wire conductor with cable shoe	mm ²	0,75 - 1,5				
Screw		M3.5				
Screw head		PZ2				
Tightening torque	Nm	0.8				

TECHNICAL INFORMATION

MOTOR CONTACTORS type CNNB WITH DC CONTROL CIRCUIT

Technical data									
Contactor type		CNNB 9	CNNB 12	CNNB 18	CNNB 22	CNNB 25	CNNB 30	CNNB 40L	
Mechanical endurance	make/break operations	x10 ⁶	5						
Insulation rating		V	690						
Permissible ambient temperature		°C	- 25 to +45						
Consumption of electromagnet in cold state with Un									
DC operated	inrush	W	6.5	6.5	6.5	6.5	6.5	6.5	6.5
	sealed	W	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Coil voltage tolerances			0,85 to 1,1 Un						
	operating		0,1 to 0,25 Un						
	drop out								
duration of making and breaking (values are also valid for voltages of electromagnet from 0,8 to 1,1 Un for each coil in cold and warm state). Total breaking time is addition of opening time and duration of electric arc.									
DC operated	closing time	ms	40 - 48	40 - 48	40 - 48	40 - 48	40 - 48	40 - 48	40 - 48
	opening time	ms	6 - 14	6 - 14	6 - 14	6 - 14	6 - 14	6 - 14	6 - 14
Frequency of switching operations without thermal relay									
	utilization category	s/h	1000	1000	1000	1000	1000	1000	1000
	AC1	s/h	750	750	750	750	750	750	750
	AC2 ; AC3	s/h	250	250	250	250	250	250	250
	AC4	s/h	250	250	250	250	250	250	250
Resistivity to shocks	(square shock)	g/ms	7/5 and 4.2/10	7/5 and 4.2/10	7/5 and 4.2/10	7/5 and 4.2/10	8.2/5 and 4.9/10	8.2/5 and 4.9/10	8.2/5 and 4.9/10
Short-circuit protection of contactors without overload relays									
Main circuit With fuse links									
-acc. to IEC 60947-4-1	Type of coord. "1" gL/gG	A	25	25	40	40	50	50	50
DIN VDE 0660 Part 102	Type of coord. "2"	A	20	20	25	25	35	35	35
Sizes of connecting conductors for contact without thermal relay									
main circuit	single-wire conductor	mm ²	1,5-6	1,5-6	1,5-6	1,5-6	2,5-10	2,5-10	2,5-10
	multi-wire conductor with cable shoe	mm ²	1,5-6	1,5-6	1,5-6	1,5-6	2,5-10	2,5-10	2,5-10
	Screw		M4	M4	M4	M4	M4	M4	M4
	Screw head		PZ2	PZ2	PZ2	PZ2	PZ2	PZ2	PZ2
	Tightening torque	Nm	1.2	1.2	1.2	1.2	1.4	1.4	1.4
auxiliary circuit	single-wire conductor	mm ²	1 - 2,5						
	multi-wire conductor with cable shoe	mm ²	0,75 - 1,5						
	Screw		M3.5						
	Screw head		PZ2						
	Tightening torque	Nm	0.8						
Loadability of auxiliary contacts of contactors CNNB									
rated continuous current I _{th} ; 35°C									
AC rated operational current I _e /AC15	for 24 V	A	10	10	10	10	-	-	-
	230 V	A	6	6	6	6	-	-	-
	400 V	A	4	4	4	4	-	-	-
	500 V	A	2	2	2	2	-	-	-
	690 V	A	1	1	1	1	-	-	-
rated operational current I _e /DC13	for 24 V	A	4	4	4	4	-	-	-
	110 V	A	0.6	0.6	0.6	0.6	-	-	-
	230 V	A	0.3	0.3	0.3	0.3	-	-	-
Load carrying capacity of the main contacts									
rated continuous current I _{th} ; 55°C									
AC1 utilization category		A	25	25	30	30	40	40	40
rated operational current I _e /AC1 ; 55°C		A	25	25	30	30	40	40	40

TECHNICAL INFORMATION

MOTOR CONTACTORS type CNNB WITH DC CONTROL CIRCUIT

Technical data									
Contactor type		CNNB 9	CNNB 12	CNNB 18	CNNB 22	CNNB 25	CNNB 30	CNNB 40L	
AC2 and AC3 utilization categories (slip-ring and cage motors)		See tables for orders page 1/3							
AC4 utilization category (electrical endurance of contacts 120.000) rated current ratings of squirrel-cage motors at 50 c/s	le/AC4 for 230 V 400 V 500 V 690 V	A kW kW kW	4.5 0.75 1.5 1.5	5 1.1 2.2 2.2	6.7 1.5 3 3	6.7 1.5 3 3	8.5 2.2 4 4	8.5 2.2 4 4	9 2.5 4.4 4.4
max. permissible rated current	le/AC4 ; 400 V	A	9	12	18	18	25	25	30
Loadability by direct current DC1 utilization category, non-inductive loads L/R≤1 ms									
rated operational current I _e , 55°C through one pole	for 24 V 48 V 110 V 220 V 440 V 600 V	A A A A A A	20 20 2.1 0.8 0.4 0.25	20 20 2.1 0.8 0.4 0.25	20 20 2.1 0.8 0.4 0.25	20 20 2.1 0.8 0.4 0.25	35 35 4.5 1 0.6 0.6	35 35 4.5 1 0.6 0.6	35 20 4.5 1 0.6 0.6
through three poles connected in series	for 24 V 48 V 110 V 220 V 440 V 600 V	A A A A A A	20 20 20 20 1.3 1	20 20 20 20 1.3 1	20 20 20 20 1.3 1	20 20 20 20 1.3 1	35 35 35 35 2.9 1.4	35 35 35 35 2.9 1.4	35 35 35 35 2.9 1.4
utilization categories DC3 to DC5 series and shunt motors (L/R≤15 ms)									
rated operational current I _e , 55°C through one pole	for 24 V 60 V 110 V 220 V 440 V 600 V	A A A A A A	20 5 1.5 0.75 - -	20 5 1.5 0.75 - -	20 5 1.5 0.75 - -	20 5 1.5 0.75 - -	20 5 2.5 1 0.09 0.06	20 5 2.5 1 0.09 0.06	20 5 2.5 1 0.1 0.08
through three poles connected in series	for 24 V 60 V 110 V 220 V 440 V 600 V	A A A A A A	20 20 20 1.75 0.2 0.2	20 20 20 6 0.2 0.2	20 20 20 6 0.2 0.2	20 20 20 6 0.2 0.2	35 35 35 10 0.6 0.3	35 35 35 10 0.6 0.3	35 35 35 10 0.6 0.3

AUXILIARY CONTACT BLOCKS BP2; BP3 and BP4

Technical data				
Block type		BP2	BP3	BP4
Insulation rating	V	690		
Permissible ambient temperature	°C	- 25 to +55		
Short-circuit protection - max. fuse rating gL		20		
Loadability of auxiliary contacts of blocks rated continuous current I _{th} ; 35°C		10		
AC rated operational current I _e /AC15	for 24V 230V 400V 690V	A A A A	6 6 4 1	
rated operational current I _e /DC13	for 24V 110V 230V 400V	A A A A	4 0.6 0.2 0.15	
Sizes of connecting conductors				
single-wire conductor	mm ₂	1 - 2,5		
multi-wire conductor with cable shoe	mm ²	0,75 - 1,5		
Screw		M3,5		
Screw head		PZ2		
Tightening torque	Nm	0.8		

TECHNICAL INFORMATION

MOTOR CONTACTORS type CNN, CNM AC CONTROL CIRCUIT or DC CONTROL CIRCUIT

Technical data							
Contactor type		CNN 50 CNN 60 CNN 70	CNN 80 CNN 90 CNN 100	CNM 110	CNM 140 CNM 170 CNM 200	CNM 250	CNM 315 CNM 400
Mechanical endurance	make/break operations	x10 ⁶	5		3		
Insulation rating		V	1000				
Permissible ambient temperature		°C	- 25 to +55				
Consumption of electromagnet in cold state with U_n							
AC operated	closing	VA	155	204	300	580	1340
	p.f.	VA	0.6	0.54	0.5	0.45	0.46
	closed	VA	12	16	26	44	84
	p.f.	VA	0.29	0.26	0.24	0.24	0.23
DC operated	closing	W	90	200	690	550	1180
	closed	W	3.5	3.5	4	5	8
Coil voltage tolerances			0,85 – 1,1 U _n				
Duration of making and breaking (values are also valid for voltages of electromagnet from 0,8 to 1,1 U _n for each coil in cold and warm state). Total breaking time is addition of opening time and duration of electric arc.							
AC operated	closing time	ms	10-24	9 - 35	20-50	20-50	20-50
	opening time	ms	7-10	9 - 15	8-30	10-30	10-30
	duration of electric arc	ms	10-15	10-15	10-15	10-15	10-15
DC operated	closing time	ms	15-40	20-50	20-50	20-50	25-80
	opening time	ms	100-120	120-150	150-190	22-35	15-30
	duration of electric arc	ms	10-15	10-15	10-15	10-15	10-15
Frequency of switching operations without thermal relay							
	utilization category	AC1 AC2 ; AC3 AC4	s/h s/h s/h	1000 750 250	1000 600 200	1000 500 250	1000 500 250
with thermal relay			s/h	15	15	15	15
Resistivity to shocks (square shock)		g/ms	9,2/5 and 5,4/10	9,6/5 and 5,2/10	10/5 and 5/10	10/5,5 and 5/12	10/5,6 and 5/12
Short-circuit protection of contactors without overload relays							
Main circuit With fuse links -acc. to IEC 60947-4-1, DIN VDE 0660 Part 102	Type of coord. "1" gL/gG Type of coord. "2"	A A	80/100/125 40/50/63	125/160/160 63/80/100	200 10	250/315/355 125/160/200	400 250
Sizes of connecting conductors for contact without thermal relay							
main circuit	Rigid: solid stranded multi-wire conductor with cable shoe stranded with cable lug	mm ² mm ² mm ² mm ²	1 x 6 - 50 2 x 6 - 25 1 x 6 - 35 2 x 6 - 16	25-70 - 25-50	- - 6-35 25-50	- - 25 -70 50 -120	- - 70 -150 2x150
	flatbar	mm	-	-	15x2,5 15x3	15x3 20x3	25x3 2x25x3
	protective conductor with cable lug	mm ²	-	-	15x3 -	25 -70 -	35 -70 50 -120
	Screw	M6			M6	M8	M10
	Screw head	PZ2			⊙		
	Tightening torque	Nm	3-4	4-4,5	2,5	3,5	4
auxiliary circuit	single-wire conductor multi-wire conductor with cable shoe	mm ² mm ²				1 - 2,5 0,75 - 1,5	
	Screw					M3,5	
	Screw head					PZ2	
	Tightening torque	Nm				0,8	

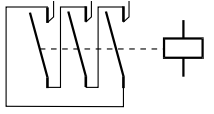
TECHNICAL INFORMATION

MOTOR CONTACTORS type CNN, CNM
AC CONTROL CIRCUIT or DC CONTROL CIRCUIT

Technical data								
Contactor type		CNN 50 CNN 60 CNN 70	CNN 80 CNN 90 CNN 100	CNM 110	CNM 140 CNM 170 CNM 200	CNM 250	CNM 315 CNM 400	
Loadability of auxiliary contacts of contactors CNN + BP5; CNM rated continuous current I_{th} ; 35°C								
AC		A	16	16	16	16	16	
rated operational current $I_e/AC15$	for 230 V	A	6	6	6	6	6	
	400 V	A	4	4	4	4	4	
	500 V	A	2.5	2.5	2.5	2.5	2.5	
	690 V	A	2.5	2.5	2.5	2.5	2.5	
DC		A	10	10	10	10	10	
rated operational current $I_e/DC1$; $L/R \leq 1ms$	for 24 V	A	10	10	10	10	10	
	110 V	A	3.2	3.2	3.2	8	8	
	220 V	A	0.9	0.9	0.9	2	2	
	440 V	A	0.33	0.33	0.33	0.6	0.6	
	600 V	A	0.22	0.22	0.22	0.4	0.4	
rated operational current $I_e/DC13$	for 24 V	A	10	10	10	10	10	
	110 V	A	1.8	1.8	1.8	2.4	2.4	
	220 V	A	0.9	0.9	0.9	1.1	1.1	
	440 V	A	0.27	0.27	0.27	0.32	0.32	
	600 V	A	0.18	0.18	0.18	0.21	0.21	
Load carrying capacity of the main contacts rated continuous current I_{th} ; 35°C								
AC1 utilization category		A	85/85/125	135/135/135	115	160/200/250	300	390/400
rated current $I_e/AC1$; 55°C		A	85/85/90	95/105/105	115	160/200/250	300	350/400
AC2 and AC3 utilization categories (slip-ring and cage motors)								
		See tables for orders page 1/4, 1/5, 1/6, 1/8 and 1/9						
AC4 utilization category (electrical endurance of contacts 120.000)								
rated current $I_e/AC4$		A	24/28/30	32/34/36	42	68/72/75	100	125/150
ratings of squirrel-cage motors at 50 c/s for	230 V	kW	6,9/7,3/8,5	8,7/10,4	12	20/21/23	31	35/ 37,5
	400 V	kW	12/14/15.1	17/18	22	35/37/40	55	65/69
	500 V	kW	15,8/16,2/18,4	21/24	27	46/48/50	72	76/85,5
	690 V	kW	20,8/21,8/24,3	20/30	36	60/64/69	92	100/106
max. permissible rated current $I_e/AC4$;	400 V	A	50/60/65	80/90	110	140/170/200	250	350/400
Load carrying capacity of contactors at switching on and off of a.c. capacitors (electrical endurance amounts to 0,1 million switching operations)								
ratings of individual capacitors at 50 c/s	for 230 V	kvar	-	-	24	45/45/58	87	90/115
	400 V	kvar	-	-	40	60/80/100	150	150/ 200
	500 V	kvar	-	-	50	80/100/130	190	190/265
	690 V	kvar	-	-	40	50/80/100	150	150/200
ratings of capacitor banks (minimum inductive reactance between two capacitors switched on in parallel amounts to 6μH, 50 c/s)	for 230 V	kvar	-	-	24	30/37/40	66	66/85
	400 V	kvar	-	-	40	50/55/70	115	115/150
	500 V	kvar	-	-	50	66/75/90	145	145/195
	690 V	kvar	-	-	40	50/60/70	115	115/150
Application in stator circuit of motor intermittent operation, AC2 stator current ¹ at duty factor in intermittent periodic duty ²								
	20%	A	103	135	153	245/308/308	462	462/617
	40%	A	98	110	122	195/245/245	367	367/490
	60%	A	87	100	109	174/218/218	327	327/436
	80%	A	80	90	100	160/200/200	300	300/400

TECHNICAL INFORMATION

MOTOR CONTACTORS type CNN, CNM
AC CONTROL CIRCUIT or DC CONTROL CIRCUIT

Technical data								
Contactor type		CNN 50 CNN 60 CNN 70	CNN 80 CNN 90 CNN 100	CNM 110	CNM 140 CNM 170 CNM 200	CNM 250	CNM 315 CNM 400	
Application in rotor circuit of motor intermittent operation rotor current ¹ at duty factor in intermittent periodic duty ²								
	10%	A	163	193	293	395/560/560	759	864/1075
	20%	A	163	193	242	388/487/487	730	730/ 975
	40%	A	155	173	193	308/380/380	580	580/ 775
	60%	A	138	158	173	275/345/345	517	517/689
	80%	A	127	138	158	252/316/316	474	474/632
continuous operation		A	127	138	158	252/316/316	474	474/632
permissible voltage of motionless rotor								
	starting	V	1500	1800	2000	2000	2000	2000
	regulation	V	750	880	1000	1000	1000	1000
	counter current breaking	V	660	750	880	880	880	880
Loadability by direct current DC1 utilization category, non-inductive loads $L/R \leq 1 ms$								
rated operational current I_e , 55°C								
through one pole	for 24 V	A	70	90	160	160/200/200	300	300/400
	60 V	A	30	75	80	160/200/200	300	300/330
	110 V	A	6	12	18	18/18/30	33	33/ 33
	220 V	A	1.2	2,5	3,4	3,4/3,4/3,4	3,8	3,8/ 3,8
	440 V	A	0.48	0,6	0,8	0,8/0,8/0,8	0,9	0,9/0,9
	600 V	A	0.35	0,48	0,5	0,5/0,5/0,5	0,6	0,6/ 0,6
through three poles connected in series	for 24 V	A	70	100	100	160/200/200	300	400
	60 V	A	70	100	100	160/200/200	300	400
	110 V	A	70	100	100	160/200/200	300	400
	220 V	A	70	100	100	160/200/200	300	400
	440 V	A	3	6	6	11,5	11	11
	600 V	A	1	3,4	3,4	4	5,2	5,2
utilization categories DC3 to DC5 series and shunt motors ($L/R \leq 15 ms$)								
rated operational current I_e , 55°C								
through one pole	for 24 V	A	5	6	16	16	35	35
	60 V	A	2	3	7,5	7,5	11	11
	110 V	A	0.75	1.25	2,5	2,5	3	3
	220 V	A	0.2	0.35	0,6	0,6	0,6	0,6
	440 V	A	0.1	0.15	0.17	0.17	0.18	0.18
	600 V	A	0.08	0.1	0.12	0.12	0.12	0.12
through three poles connected in series	for 24 V	A	70	90	100	200	300	400
	60 V	A	70	90	100	200	300	400
	110 V	A	70	90	100	200	300	400
	220 V	A	3.5	3.8	4	200	300	400
	440 V	A	0.6	0.7	0.8	1.4	1.4	1.4
	600 V	A	0.35	0.40	0.45	0.75	0.75	0.75
¹ Electrical endurance of contacts at these loads, see page 1/32. ² Intermittent periodic duty in % = $\frac{\text{on-load period}}{\text{duration of total cycle}} \times 100$. The total cycle duration can amount up to 10 minutes								

TECHNICAL INFORMATION

MOTOR CONTACTORS type CNM 450 - CNM 1000
AC CONTROL CIRCUIT or DC CONTROL CIRCUIT

Technical data

Permissible ambient temperature: -25 to +55°C

Contactor type	CNM 450	CNM 550	CNM 700	CNM 860	CNM 1000	
MECHANICAL DATA						
Protection degree	IP00					
Mechanical endurance (make/break oper.x 10 ⁶)	5				1	
Max. frequency of no load operation (op/h)	1200				300	
Fixing	Screws fixing					
ELECTRICAL DATA OF POWER CIRCUIT						
Number of main poles	3 (with facility to fit 4th add-on neutral switching pole)					
Rated insulation voltage U _i (V)	1000				690	
Thermal current I _{th} (A)	700	800	1000	1100	1200	
Rated operational current I _e AC1 U _e = 690V t.amb. = 40°C (A)	700	800	1000	1100	1200	
I _e AC3 U _e = 440V t.amb. = 55°C (A)	450	550	700	860	1000	
Max. Ratings of 3-phase motor at 400V 50 HZ in AC2, AC3 (kW)	250	315	400	500	580	
Rated short time withstand current t.amb. = 40°C	1 s (A)	4500	5500	7000	8000	10000
	4 s (A)	4500	5500	7000	8000	10000
	10 s (A)	3600	4400	5600	6900	8000
	15 s (A)	3000	3800	5000	6000	7400
	30 s (A)	2300	3000	3700	4500	5500
Cooling time (without current)	1 min (A)	1800	2300	2800	3400	4000
	2 min (A)	1400	1750	2200	2600	3000
	6 min (A)	900	1150	1600	1800	2100
	15 min (A)	720	850	1150	1350	1600
Short circuit protection fuses (U _e = 440V) coordination to IEC 60947-4-1	Type 1 gG (A) (A)	630	630	800	1000	1000
	Type 2 gG (A) (A)	500	560	-	-	-
	Type 2 aM (A) (A)	-	-	-	-	-
Making capacity coordination to EN 60947- 4-1 (A)	690V (A)	4500	5500	7000	8600	10000
	max. values 1000V (A)	2000	2500	-	-	-
Breaking capacity coordination to EN 60947- 4-1	500V (A)	4500	5500	7000	8000	8000
	max. values 690V (A)	3200	4400	5600	6900	7000
	max. values 1000V (A)	1600	2000	-	-	-
Main pole resistance (mΩ)	0.13	0.11	0.1	0.08	0.06	
Sizes of connectiong conductors	Cables mm ²	2 x (40x5)	2 x (50x5)	2 x (60x5)	2 x (60x6)	
	Bars mm					
Tightening torque (Nm)	35	50	60	75	60	
Weight (kg)	13.5	14	26.4	27,6	51	
ELECTRICAL DATA OF CONTROL CIRCUIT						
Rated control voltage	a.c 50-60Hz (V)	24...600V				48...600V
	d.c (V)	24...440V				48...440V
Coil operation limits	a.c/d.c pick-up (V)	0,85 ... 1,1 U _c				
	a.c drop-out (V)	0,2 ... 0,75 U _c				
	d.c drop-out (V)	0,1 ... 0,6 U _c				
Average coil consumption	a.c/d.c pick-up (VA)	800 ... 950		1350 ... 1600		2400
	d.c pick-up (W)	700 ... 850		1300 ... 1550		2100
	a.c sealed (VA)/ (W)	9 ... 11 / (9...11)		21 ... 25 / (21...25)		70 (69)
	d.c sealed (W)	8 ... 10		18 ... 22		60

TECHNICAL INFORMATION

CONTACTORS TYPE TKN and TK for SWITCHING RESISTIVE LOADS

Technical data

Contactor type		TKN 65	TKN 115	TK 130	TK 175	
Mechanical endurance make/break operations	x10 ⁶	5				
Insulation rating		690				
Permissible ambient temperature	°C	- 25 to +55		- 25 to +40		
Consumption of electromagnet in cold state with U _n	AC operated closing	VA	62	155	350	350
		p.f.	0.75	0.6	0.5	0.5
	closed	VA	7	12	26	26
		p.f.	0.3	0.29	0.24	0.24
Coil voltage tolerances		0,85 – 1,1 U _n				
Degree of protection per IEC 60947 - 1		IP 20		IP 00		
Rated control voltages AC	V	24-500 at 50 Hz; standard voltages: 24, 48, 110, 220/230, 380/400				
Frequency of switching operations without thermal relay utilization category	AC1	s/h	650	650	650	650
	AC2/ AC3	s/h	750	750	500	500
Maximum permissible fuse ratings for contactors without relays main circuit gL/gG	A	100	200	250	315	
Electrical endurance	x10 ⁶	0,5				
Sizes of connecting conductors for contact without thermal relay main circuit	multi-wire conductor	mm ²	6-16	16-35	50	70
		mm ²				
	Terminal screw	M5	M6	M8	M8	
		Hexagon socket				
Screw head						
Tightening torque	Nm	2	3 - 4	4	4	
auxiliary circuit	single-wire conductor	mm ²	1 - 2,5			
		mm ²	0,75 - 1,5			
	Terminal screw		M3.5			
			PZ2			
Screw head		0.8				
Tightening torque	Nm					
AC-1 utilization category, switching resistive load						
Rated operational currents I_e at 40° C	A	65	115	130	175	
Ratings of three-phase loads with p.f.=1	230 /220 V kW	25	44	50	67	
	400 /380 V kW	43	76	85	115	
AC-2 and AC-3 utilization categories						
Rated operational currents I_e at	400/380 V A	32	60	90	110	
Ratings of motors	230 /220 V kW	7.5	18.5	26	37	
	400 /380 V kW	15	30	45	55	
	500 V kW	15	37	59	75	
	690 /660 V kW	18.5	37	67	90	

Control of lighting circuits

General

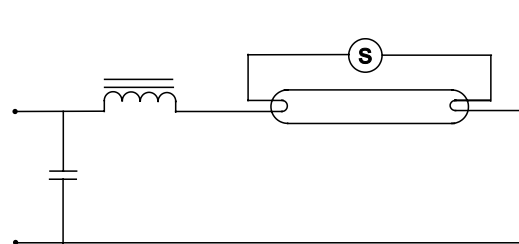
- Contactor choice criteria for control of lighting circuits are as follows:
- Type, power rating and number of lamps
- Connection mode
- Current values on closing and in steady state
- Power factor $\cos\phi$ of the lamps
- Presence or not of compensation capacitors

Lighting circuits

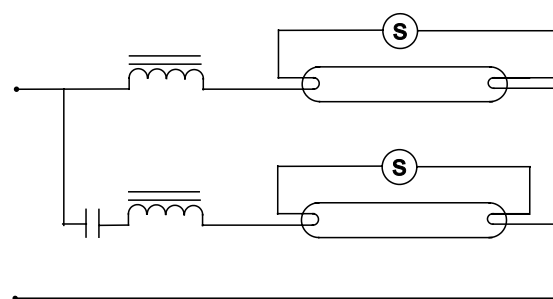
In a given circuit, the number and power rating of lamps are defined and cannot result in overload. Only short-circuit protection has to be provided. GG fuses or modular circuit-breakers will be chosen for this purpose. The lamps have very specific technical data, according to their construction type.

- Incandescent lamps have a very high current on closing: more than 15 times normal current. They do not introduce a large phase displacement between current and voltage.
- Fluorescent tubes are equipped with a ballast whose purpose is two-fold: contribute to ignition and limit current to nominal value once steady state is reached. This ballast is a reactor that considerably lowers the power factor. It may or may not be compensated.

Individual compensation mounting



Serial compensation in dual



Choice of contactors

The following tables indicate, for each contactor type, the maximum permissible number of lamps per phase.

Air temperature, near the contactor, must be limited to 55°C.

Number are given for a 230 V voltage distributed between phase and neutral: single-phase (phase + neutral) or three-phase (3 phases + neutral) distribution.

In the case of a three-phase supply without neutral, 230 V phase-to-phase, the permissible number of lamps per phase will be that given in the tables multiplied by 0,58.

Table of technical characteristics for lighting switching

Type of lamps	compensation	Start current x I _n ¹	cos φ	Starting time s	Important for choosing contactor type
Light gas lamp connection	without	1	0,5	-	Rated continuous current I _{th} ² (A)
	with	20	0,9	-	Start current I _e
Lamps with mercury vapour - High pressure lamps	without	1,6	0,4-0,6	< 5	Rated continuous current I _{th} ² (A)
	with	2	0,95	< 5	Start current I _e (A)
DUO-wiring (most frequent applied wiring)		1	1	-	Rated continuous current I _{th} ² (A)
Serial wiring (Tandem connection)	without	1	0,5		Rated continuous current I _{th} ² (A)
	with	20	0,9		Start current I _e (A)
Lighting gas lamps without starter	without	1	0,5	-	Rated continuous current I _{th} ² (A)
Halogen - metal vapour lamps	without	1	0,4-0,6	-	Rated continuous current I _{th} ² (A)
	with	1	0,4-0,6	-	Rated continuous current I _{th} ² (A)
215 W - High capacity lighting gas lamps 380 V (High pressure vapour lamps)	without	1,4	0,5	5...12	70% Rated continuous current I _{th} ² (A)
	with	20	0,95	5...12	
(Low pressure vapour lamps)	without	1	0,3	5...12	70% Rated Continuous current I _{th} ² (A)
	with	20	0,95	5...12	
High pressure sodium vapour lamps	without	1,6	0,4-0,6	5..8	70% Rated continuour current I _{th} ² (A)
	with	20	0,95	5..8	70% Rated continuous current I _{th} (A) and Start current I _e (A)

¹ I_n = Rated lamp current

² I_{th} = Rated continuous contactor current

TECHNICAL INFORMATION

Contactors with AC coil

Type	TKN 65			TKN 115			TK 130			TK 175					
Switching incandescent lamps, per main conducting path at 220/230 V	kW			5,8			9			14,5			17,3		
Type of lamp	W	A	μF	Maximum permissible number of lamps per phase											
Fluorescent lamps without compensation															
220-240 V	18	0,37	-	121	216	243	270								
AC	36	0,43	-	104	186	209	232								
	58	0,67	-	67	119	134	149								
Fluorescent lamps with parallel compensation															
220-240 V	18	0,11	4,5	78	111	160	197								
AC	36	0,21	4,5	78	111	160	197								
	58	0,32	7	50	71	103	127								
Fluorescent lamps in dual mounting															
220-240 V	2x18	2x0,11	-	408	726	-	-								
AC	2x36	2x0,21	-	214	380	-	-								
	2x58	2x0,32	-	140	250	-	-								
High pressure sodium vapour lamps without compensation															
220-240 V	150	1,8	-	17	26	34	41								
AC	250	3	-	10	16	21	25								
	400	4,4	-	7	10	13	17								
	600	6,2	-	5	8	10	12								
	1000	10,3	-	3	5	5	7								
High pressure sodium vapour lamps with compensation															
220-240 V	150	1	20	30	58	73	88								
AC	250	1,5	36	20	38	48	59								
	400	2,5	48	12	23	29	36								
	600	3,3	65	9	17	21	27								
	1000	6,2	100	5	9	11	14								
High pressure mercury vapour lamps without compensation															
220-240 V	80	0,8	-	75	120	150	200								
AC	125	1,2	-	45	83	95	130								
	250	2,2	-	26	47	57	71								
	400	3,3	-	17	31	38	47								
	700	5,5	-	10	19	23	29								
	1000	7,5	-	7	14	17	21								
	2000	8	-	4	7	9	11								
High pressure mercury vapour lamps with compensation															
220-240 V	80	0,41	8	53	178	200	238								
AC	125	0,65	10	35	107	154	165								
	250	1,3	18	24	59	83	102								
	400	2	25	15	38	54	67								
	700	3,5	40	9	22	30	38								
	1000	5	64	6	15	21	26								
	2000	5	37	3	9	13	16								

TECHNICAL INFORMATION

CAPACITOR CONTACTORS type CNNK 2,5 - CNNK 16

In conformity with: IEC 60947-1, IEC 60947-4

Special contactors for power factor correction

Choice criteria

The contactor during the closing transition is influenced by electrical currents with high frequencies and high amplitudes. The frequencies of these currents have ranges between 1 and 10kHz and the amplitudes must have values lower than the maximum permissible peak current $I \leq 100$ times the nominal rms current of the switched capacitor.

Type designation	CNNK 2,5 10 CNNK 2,5 01	CNNK 5 10 CNNK 5 01	CNNK 7,5 00 CNNK 7,5 11	CNNK 16 00 CNNK 16 11
Capacitor rating at operating voltage	230V kVAr 1,4	2,8	4	6,7
400-440V kVAr	2,5	5	7,5	12,5
50/60Hz 500-550V kVAr	3	5,5	9	15
660-690V kVAr	3,7	7,5	11	18
Rated operational current $I_e/AC-6b$ et 400 V	A 3,6	7,2	11	18
Insulation rating U_i	V	690		
Permissible ambient temperature	°C	- 25 to + 55		
Rated impulse withstand voltage U_{imp}	kV	8		
Consumption of electromagnet in cold state with U_n AC operated				
closing p.f.	VA	62		65
closed p.f.	VA	0,75		0,75
		7		8
		0,3		0,3
Voltage tolerances	0,85 - 1,1 U_n			
Coil Tightening torque	Nm	0,8		
Terminal screw/Screw head		M3,5/PZ2		
Degree of protection	IP 20			
Maximum permissible fuse ratings				
main circuit gL/gG	A	20	25	40
auxiliary circuit	A	16	16	16
Frequency of switching operations	s/h	240		
Electrical endurance	min.	150.000	120.000	100.000
Sizes of connecting conductors - main circuit				
multi-wire conductor	mm ²	1,5-6	1,5-6	2,5-10
multi-wire conductor with cable shoe	mm ²	1,5-6	1,5-6	2,5-10
Terminal screw		M4	M4	M4
Screw head		PZ2	PZ2	PZ2
Tightening torque	Nm	1,2	1,2	1,4
- auxiliary circuit				
multi-wire conductor	mm ²	1-2,5		
multi-wire conductor with cable shoe	mm ²	0,75-1,5		
Terminal screw		M3,5		
Screw head		PZ2		
Tightening torque	Nm	0,8		
Loadability of auxiliary contacts rated continuous current I_{th} ; 35°C	A	10		
AC rated operational current $I_e/AC15$				
for 230V	A	6		
400V	A	4		
500V	A	2		
690V	A	1		

TECHNICAL INFORMATION

CAPACITOR CONTACTORS type CNNK 10 - CNNK 30

In conformity with: IEC 60947-1, IEC 60947-4

Special contactors for power factor correction

Main characteristics

These contactors are equipment with early - make contacts. This special type of contact has the purpose of connecting for a very brief interval, 2-3 ms, during the contactor closing, resistors which limit the connecting current of the capacitors. These resistors are then excluded when the closing operation is complete and the current capacity is conveyed to the main contacts. Maximum permissible peak current $1 \leq 200$ times the nominal rms current of the switched capacitor.

Type designation	CNNK 10 20 CNNK 10 11 CNNK 10 02	CNNK 12 20 CNNK 12 11 CNNK 12 02	CNNK 15 20 CNNK 15 11 CNNK 15 02	CNNK 20 10 CNNK 20 01	CNNK 25E 10 CNNK 25E 01	CNNK 25 10 CNNK 25 01	CNNK 30 10 CNNK 30 01
Capacitor rating 230V kVAr at operating voltage 400-440V kVAr	5	6.7	8.5	11	14	14	20
50/60Hz 500-550V kVAr	10	12.5	15	20	25	25	30
660-690V kVAr	12.5	15	18	24	30	30	35
Rated operational current I _{th} at 400V A	15	18	22	30	35	35	40
Rated operational current I _{th} at 400V A	14	18	22	29	36	36	44
Rated operational current I _{th} at 400V A	25	25	30	40	50	60	60
Insulation rating U _i V	690						
Permissible ambient temperature °C	- 25 to + 55						
Rated impuls withstand voltage U _{imp} kV	8						
Consumption of electromagnet in cold state with U _n AC operated							
closing VA			62			65	
p.f. closed VA			0,75			0,75	
p.f.			7			8	
			0,3			0,3	
Voltage tolerances	0,85 - 1,1 U _n						
Coil Tightening torque Nm	0,8						
Terminal screw/Screw head	M3,5/PZ2						
Degree of protection	IP 20						
Maximum permissible fuse ratings main circuit gL/gG A	25	35	50	50	63	63	80
auxilliary circuit A	16	16	16	16	16	16	16
Frequency of switching operations s/h	240			120			
Electrical endurance min.	200.000			150.000	100.000		
Sizes of connecting conductors - main circuit							
multi-wire conductor mm ²	1.5-6	1.5-6	1.5-6	2.5-10	2.5-10	6-25	6-25
multi-wire conductor with cable shoe mm ²							
Terminal screw	M4	M4	M4	M4	M4	M5	M5
Screw head	PZ2	PZ2	PZ2	PZ2	PZ2	Hexagon socket 2.5	
Tightening torque Nm	1,2	1,2	1,2	1,4	1,6	2	2
- auxiliary circuit multi-wire conductor mm ²	1-2,5						
multi-wire conductor with cable shoe mm ²	0,75-1,5						
Terminal screw	M3,5						
Screw head	PZ2						
Tightening torque Nm	0,8						
Loadability of auxiliary contacts rated continuous current 35°C							
AC rated operational current I _{th} /AC15 A	10						
for 230V A	6						
400V A	4						
500V A	2						
690V A	1						

TECHNICAL INFORMATION

CAPACITOR CONTACTORS type CNNK 40 - CNKM 80

In conformity with: IEC 60947-1, IEC 60947-4

Special contactors for power factor correction

Type designation	CNNK 40 10 CNNK 40 01	CNNK 50 10 CNNK 50 01	CNNK 60 10 CNNK 60 01	CNNK 60N 10 CNNK 60N 01	CNNK 70 10 CNNK 70 01	CNKM 80 22
Capacitor rating at operating voltage 230V kVAr	25	29	32	32	35	45
400-440V kVAr	40	50	60	60	70	80
50/60Hz 500-550V kVAr	50	60	70	70	75	100
660-690V kVAr	58	70	80	85	90	115
Rated operational current I _{th} at 400V A	58	72	87	87	101	116
Rated operational current I _{th} at 400V A	85	100	125	135	137	165
Insulation rating U _i V	1000					
Permissible ambient temperature °C	- 25 to + 55					
Rated impuls withstand voltage U _{imp} kV	8					
Consumption of electromagnet in cold state with U _n AC operated						
closing VA			155			310
p.f. closed VA			0,6			0,5
p.f.			12			26
			0,29			0,24
Voltage tolerances	0,85 - 1,1 U _n					
Coil Tightening torque Nm	0,8					
Terminal screw/Screw head	M3,5/PZ2					
Degree of protection	IP 20					IP 00 or IP 20
Maximum permissible fuse ratings main circuit gL/gG A	100	125	160			
auxilliary circuit A	16	16	16			
Frequency of switching operations s/h	100					
Electrical endurance min.	100.000			75.000		
Sizes of connecting conductors - main circuit						
multi-wire conductor mm ²	16-35	16-35	16-35	25-50		35-50 (with IP 20)
multi-wire conductor with cable shoe mm ²						
Terminal screw	M6			M8		M6 (with IP 20)
Screw head	PZ2			□4		M8 (without IP 20)
Tightening torque Nm	3 - 4			4 - 4.5		3.5
- auxiliary circuit multi-wire conductor mm ²	1-2,5					
multi-wire conductor with cable shoe mm ²	0,75-1,5					
Terminal screw	M3,5					
Screw head	PZ2					
Tightening torque Nm	0,8					
Loadability of auxiliary contacts rated continuous current I _{th} ; 35°C A	16					
AC rated operational current I _{th} /AC15 A						
for 230V A	10					
400V A	6					
500V A	4					
690V A	2					

TECHNICAL INFORMATION

CAPACITOR CONTACTORS type CNNK 10..N - CNNK 30..N

In conformity with: IEC 60947-1, IEC 60947-4

Special contactors for power factor correction

Main characteristics

These contactors are equipment with early - make contacts. This special type of contact has the purpose of connecting for a very brief interval, 2-3 ms, during the contactor closing, resistors which limit the connecting current of the capacitors. These resistors are then excluded when the closing operation is complete and the current capacity is conveyed to the main contacts. Maximum permissible peak current $1 \leq 200$ times the nominal rms current of the switched capacitor.

Type designation	CNNK 10 20N CNNK 10 11N CNNK 10 02N	CNNK 12 20N CNNK 12 11N CNNK 12 02N	CNNK 15 20N CNNK 15 11N CNNK 15 02N	CNNK 20 10N CNNK 20 01N	CNNK 25E 10N CNNK 25E 01N	CNNK 25 10N CNNK 25 01N	CNNK 30 10N CNNK 30 01N
Capacitor rating 230V kVAr at operating	5	6.7	8.5	11	14	14	20
400-440V kVAr voltage	10	12.5	15	20	25	25	30
500-550V kVAr 50/60Hz	12.5	15	18	24	30	30	35
660-690V kVAr	15	18	22	30	35	35	40
Rated operational current I _e /AC-6b at 400V A	14	18	22	29	36	36	44
Rated operational current I _{th} at 400V A	25	25	30	40	50	60	60
Insulation rating U _i V	690						
Permissible ambient temperature °C	- 25 to + 55						
Rated impuls withstand voltage U _{imp} kV	8						
Consumption of electromagnet in cold state with U _n AC operated							
closing VA	62			65			
p.f.	0,75			0,75			
closed VA	7			8			
p.f.	0,3			0,3			
Voltage tolerances	0,85 - 1,1 U _n						
Coil Tightening torque Nm	0,8						
Terminal screw/Screw head	M3,5/PZ2						
Degree of protection	IP 20						
Maximum permissible fuse ratings main circuit gL/gG A	25	35	50	50	63	63	80
auxilliary circuit A	16	16	16	16	16	16	16
Frequency of switching operations s/h	240			120			
Electrical endurance min.	250.000			175.000	125.000		
Sizes of connecting conductors - main circuit							
multi-wire conductor mm ²	1.5-6	1.5-6	1.5-6	2.5-10	2.5-10	6-25	6-25
multi-wire conductor with cable shoe mm ²							
Terminal screw	M4	M4	M4	M4	M4	M5	M5
Screw head	PZ2	PZ2	PZ2	PZ2	PZ2	Hexagon socket 2.5	
Tightening torque Nm	1,2	1,2	1,2	1,4	1,6	2	2
- auxiliary circuit multi-wire conductor mm ²	1-2,5						
multi-wire conductor with cable shoe mm ²	0,75-1,5						
Terminal screw	M3,5						
Screw head	PZ2						
Tightening torque Nm	0,8						
Loadability of auxilliary contacts rated continuous current 35°C							
AC rated operational current I _e /AC15 A	10						
for 230V A	6						
400V A	4						
500V A	2						
690V A	1						

TECHNICAL INFORMATION

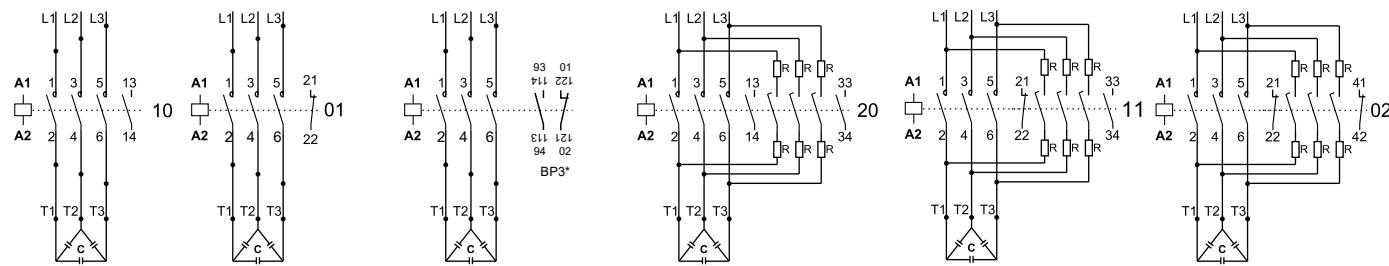
CAPACITOR CONTACTORS type CNNK 40N - CNNK75N

In conformity with: IEC 60947-1, IEC 60947-4

Special contactors for power factor correction

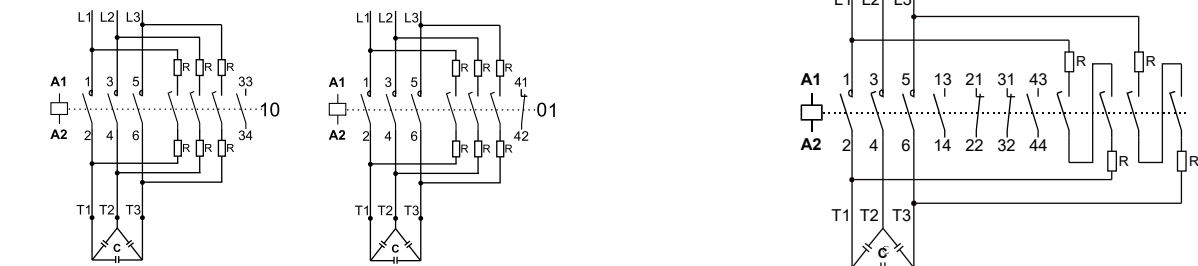
Type designation	CNNK 40 10N CNNK 40 01N	CNNK 50 10N CNNK 50 01N	CNNK 60 10N CNNK 60 01N	CNNK 60N 10N CNNK 60N 01N	CNNK 70 10N CNNK 70 01N	CNNK 75 10N CNNK 75 01N
Capacitor rating at operating	25	29	32	32	35	38
230V kVAr						
400-440V kVAr voltage	40	50	60	60	70	75
500-550V kVAr 50/60Hz	50	60	70	70	75	80
660-690V kVAr	58	70	80	85	90	105
Rated operational current I _e /AC-6b et 400 V A	58	72	87	87	101	108
Rated operational current I _{th} at 400V A	85	100	125	135	137	150
Insulation rating U _i V	1000					
Permissible ambient temperature °C	- 25 to + 55					
Rated impuls withstand voltage U _{imp} kV	8					
Consumption of electromagnet in cold state with U _n AC operated						
closing VA	155			204		
p.f.	0,6			0,54		
closed VA	12			16		
p.f.	0,29			0,26		
Voltage tolerances	0,85 - 1,1 U _n					
Coil Tightening torque Nm	0,8					
Terminal screw/Screw head	M3,5/PZ2					
Degree of protection	IP 20					
Maximum permissible fuse ratings main circuit gL/gG A	100	125	160		160	
auxilliary circuit A	16	16	16		16	
Frequency of switching operations s/h	100					
Electrical endurance min.	125.000			100.000		
Sizes of connecting conductors - main circuit						
multi-wire conductor mm ²	16-35	16-35	16-35	25-50		
multi-wire conductor with cable shoe mm ²						
Terminal screw	M6			M8		
Screw head	PZ2			⊕4		
Tightening torque Nm	3 - 4			4 - 4.5		5 - 6
- auxiliary circuit multi-wire conductor mm ²	1-2,5					
multi-wire conductor with cable shoe mm ²	0,75-1,5					
Terminal screw	M3,5					
Screw head	PZ2					
Tightening torque Nm	0,8					
Loadability of auxilliary contacts rated continuous current I _{th} ; 35°C A	16					
AC rated operational current I _e /AC15 I _{th} ; for 230V A	10					
400V A	6					
500V A	4					
690V A	2					

CONNECTION DIAGRAMS AND TERMINAL MARKINGS FOR SINGLE COMPENSATION



CNNK 2.5, CNNK 5

CNNK 7,5 00
CNNK 7,5 11*
CNNK 16 00
CNNK 16 11*



CNNK 20..(N), CNNK 25E..(N), CNNK 25..(N), CNNK 30..(N), CNNK 40..(N)
CNNK 50..(N), CNNK 60..(N), CNNK 60N..(N), CNNK 70..(N), CNNK 75..N

CNKM 80

VERY IMPORTANT NOTES:

For single compensation air coils or 3 - phase reactors (coils with magnetic core and air gap) are not necessary.

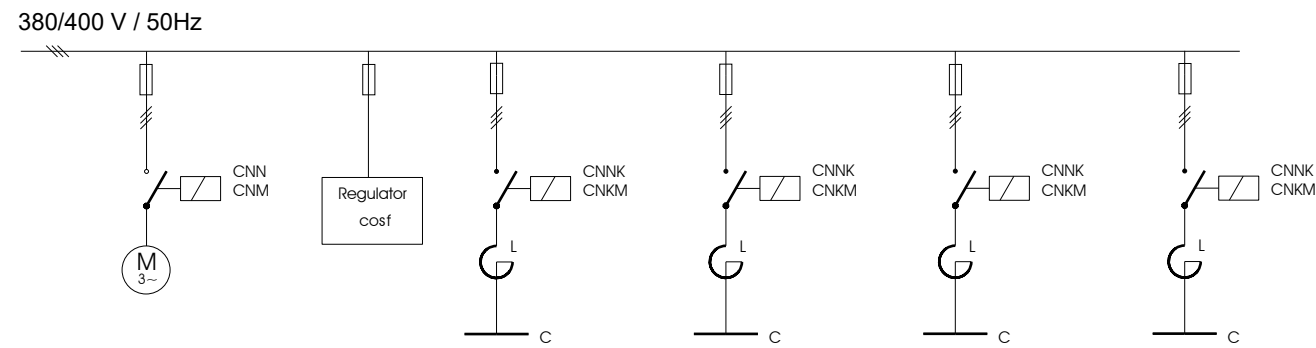
When the contactor is used for group compensation it is recommendable to use appropriate 3-phase filter circuit reactors (coils with magnetic core and air gap). This will reduce the value of higher harmonics and will prevent resonant current to prevail.

For single compensation the power of selected contactor is according to capacitor rated power.

For group and central compensation, when reactors are not in use, one step higher rating of the contactor is recommendable.

- Maximum permissible peak current $1 \leq 200$ times the nominal rms current of the switched capacitor.
- Switching onto discharged capacitors is permitted with CNNK contactors. (the voltage at the terminals must be < 50 V).
- Manual operation for function tests is not permitted. The series resistors must not be removed. During exploitation, current value must not exceed the declared values.

CONNECTION DIAGRAM FOR GROUP (CENTRAL) COMPENSATION



TECHNICAL INFORMATION
DC CONTACTORS type CNO
AC CONTROL CIRCUIT or DC CONTROL CIRCUIT

Technical data							
Contactor type		CNO 30	CNO 110	CNO 250			
Mechanical endurance	make/break operations	x10 ⁶	5	3			
Insulation rating	V	690					
Permissible ambient temperature	°C	-25 to +55					
Consumption of electromagnet in cold state at Un	AC operated	closing	100	350	1150		
		p.f.	0.5	0.42	0.31		
	DC operated	closed	18	50	75		
		p.f.	0.33	0.36	0.4		
		closing	130	450	450		
		closed	15	25	25		
Coil voltage tolerances		0.85 - 1.1 Un					
Auxiliary contacts (making and breaking capacity)	Rated thermal current Ith	A	20	20	20		
	Rated making capacity	A	50	50	50		
	Alternating current	for voltages 24V to 380V for voltages 50V	A	5	5	5	
			A	3.5	3.5	3.5	
	Rated breaking capacity AC 15	for voltages 24V to 380V for voltages 500V	A	50	50	50	
			A	35	35	35	
	Direct current	Rated operational current DC1	for voltages 110V-	A	2.5	2.5	2.5
			220V-	A	0.8	0.8	0.8
			440V-	A	0.3	0.3	0.3
		Rated operational current DC13	for voltages 110V-	A	1.3	1.3	1.3
			220V-	A	0.55	0.55	0.55
			440V-	A	0.3	0.3	0.3
Short circuit protection of contactors without overload relays	Main circuit With fuse links - acc. to IEC 60947-4-1 DIN VDE 0660 Part 102	Type of coord. "1" gL/gG	A	35	110	200	
		Type of coord. "2" aM	A	50	160	355	
Sizes of connecting conductors for contact without thermal relays	main circuit	single-wired conductor	mm ²	2.5 - 10	-	-	
		multy-wired conductor with cable shoe	mm ²	-	16 - 50	50 - 120	
		fatconductor	mm	-	20x3	25x4	
	auxiliary circuit	single-wired conductor	mm ²	1 - 2.5			
		multy-wired conductor with cable shoe	mm ²	0.75 - 1.5			

See page 1/23 and 1/24

TECHNICAL INFORMATION

MINI CONTACTOR RELAY type CP0

Technical data			
Contactor type			CP0
Mechanical endurance	make/break operations	x10 ⁶	5
Insulation rating		V	690
Permissible ambient temperature		°C	- 25 to +55
Consumption of electromagnet in cold state with U _n AC operated	closing	VA	26
	p.f.		0,9
	closed	VA	4
	p.f.		0,34
Coil voltage tolerances			0,8 - 1,1U _n
Duration of making and breaking (values are also valid for voltages of electromagnet from 0,8 to 1,1 U _n for each coil in cold and warm state). Total breaking time is addition of opening time and duration of electric arc.			
AC operated	closing time	ms	7 - 12
	opening time	ms	6 - 10
	duration of electric arc	ms	3
Frequency of switching operations without thermal relay	utilization category	AC 15	s/h
			1200
with thermal relay			s/h
			15
Resistivity to shocks	(square shock)	g/ms	7/5 and 4/10
Maximum permissible fuse rating max short circuit current 10 kA			
main circuit	fuse-links, time-lagging	A	10
	fuse-links, quick-acting	A	16
Sizes of connecting conductors for contactors without thermal relay			
main circuit	single-wire conductor	mm ²	1 - 2,5
	multi-wire conductor with cable shoe	mm ²	0,75 - 1,5
Terminal screw			M3.5
Screw head			PZ2
Tightening torque		Nm	0.8
Loadability of auxiliary contacts of contactor CP0 rated continuous current I _{th} ; 35°C			
AC rated operational current I _e /AC15	for	230 V	A
		400 V	A
		500 V	A
		690 V	A
rated operational current I _e /DC13	for	24 V	A
		110 V	A
		220 V	A
			A

TECHNICAL INFORMATION

CONTACTOR RELAYS type CNNP and type CNNPB

Type CNNP WITH AC CONTROL CIRCUIT, type CNB DC SOLENOID SYSTEM

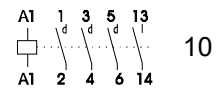
Technical data					
Contactor type			CNNP	CNNPB	
Mechanical endurance	make/break operations	x10 ⁶	10	5	
Insulation rating		V	690		
Permissible ambient temperature		°C	-25 to +55	-25 to +45	
Consumption of electromagnet in cold state with U _n AC operated	closing	VA	62	—	
	p.f.		0.75	—	
	closed	VA	7	—	
	p.f.		0.3	—	
	DC operated	closing	W	128	6.5
		closed	W	2.8	6.5
Coil voltage tolerances			0,8 - 1,1U _n		
Duration of making and breaking					
AC operated	closing time	ms	12 - 22	—	
	opening time	ms	4 - 19	—	
	duration of electric arc	ms	10	—	
DC operated	closing time	ms	—	21 - 172	
	opening time	ms	—	10 - 23	
	duration of electric arc	ms	—	10	
Frequency of switching operations					
without thermal relay	utilization category	AC 15	s/h	3600	
		AC1	s/h	2000	
with thermal relay		AC2 ; AC3	s/h	1000	
		AC4	s/h	250	
			s/h	250	
			s/h	15	
Resistivity to shocks	(square shock)	g/ms	10/4 and 5/8	10/4 and 5/8	
Maximum permissible fuse rating for contactors without relays max short circuit current 1 kA					
main circuit	fuse-links, time-lagging	A	16	16	
	fuse-links, quick-acting	A	20	20	
	high-rupturing capacity fuses	A	16	16	
Sizes of connecting conductors for contactors without thermal relay					
main circuit	single-wire conductor	mm ²	1 - 2,5		
	multi-wire conductor with cable shoe	mm ²	0,75 - 1,5		
Terminal screw					
Screw head					
Tightening torque		Nm			
Loadability of auxiliary contacts of contactors CNNP and CNNPB rated continuous current I _{th} ; 35°C					
AC rated operational current I _e /AC15	for	230 V	A	16	
		400 V	A	6	
		500 V	A	4	
		690 V	A	4	
			A	2,5	
DC rated operational current I _e /DC1 ; L/R≤1ms (with series connection of 3 current paths) ¹⁾	for	24 V	A	6 (6) ¹⁾	
		110 V	A	2 (6) ¹⁾	
		220 V	A	0.6 (6) ¹⁾	
		440 V	A	0.3 (1,2) ¹⁾	
		600 V	A	0.15 (0,8) ¹⁾	
	rated operational current I _e /DC13 (with series connection of 3 current paths) ¹⁾	for	24 V	A	4 (6) ¹⁾
			110 V	A	0.9 (3) ¹⁾
			220 V	A	0.2 (1,2) ¹⁾
			440 V	A	0.14 (0,5) ¹⁾
			600 V	A	0.15 (0,26) ¹⁾
Motor ratings for utilization categories AC2, AC3					
at	230 V	kW	2,2		
	400 V	kW	4		
	500 V	kW	4		
	690 V	kW	4		

CONTACTORS

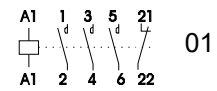
Wiring diagrams

Motor contactors

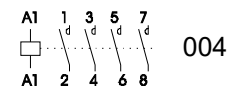
AC coil operation



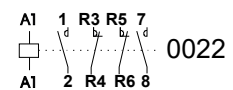
CM1, CNN 9, CNN 12
CNN 18, CNN 22



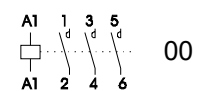
CM1, CNN 9, CNN 12
CNN 18, CNN 22



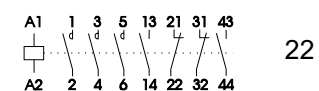
CM1, CNN 9, CNN 12



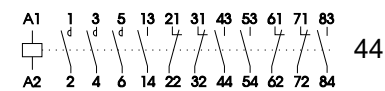
CNN 9, CNN 12



CM1, CNN 25, CNN 30, CNN 32,
CNN 40, CNN 50, CNN 60,
CNN 70, CNN 80, CNN 90, CNN 100

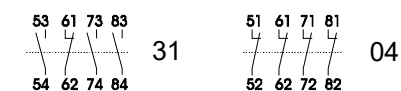
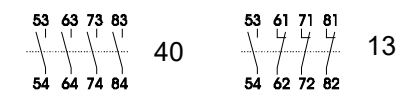


CNM 110, CNM 140, CNM 170, CNM 200,
CNM 250, CNM 315, CNM 400

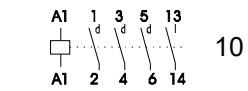


CNM 110, CNM 140,
CNM 170, CNM 200,
CNM 250, CNM 315, CNM 400

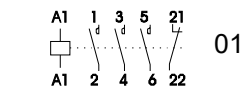
Snap-on auxiliary contact blocks



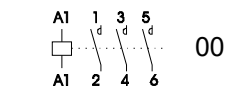
DC coil operation



CNNB 9, CNNB 12,
CNNB 18, CNNB 22



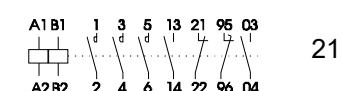
CNNB 9, CNNB 12,
CNNB 18, CNNB 22



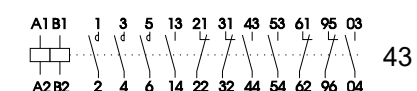
CNNB 25, CNNB 30, CNNB 40L



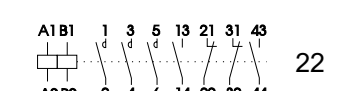
CNN 9, CNN 12, CNN 18, CNN 22
CNN 25, CNN 30, CNN 32,
CNN 40, CNN 50, CNN 60,
CNN 70, CNN 80, CNN 90, CNN 100



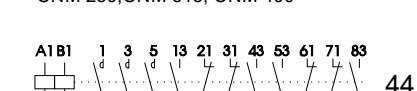
CNM 110



CNM 110



CNM 140, CNM 170, CNM 200,
CNM 250, CNM 315, CNM 400



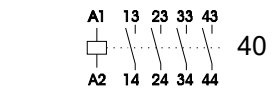
CNM 140, CNM 170, CNM 200,
CNM 250, CNM 315, CNM 400

CNM 140, CNM 170, CNM 200,
CNM 250, CNM 315, CNM 400

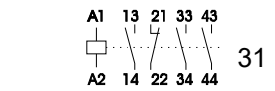


Contactor relays

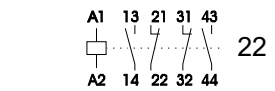
AC and DC coil operation



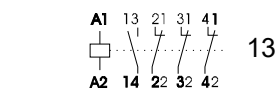
CP0, CNNP, CNNPB



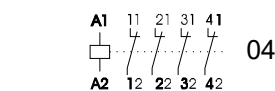
CP0, CNNP, CNNPB



CP0, CNNP, CNNPB



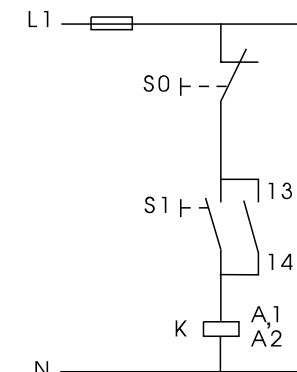
CNNP, CNNPB



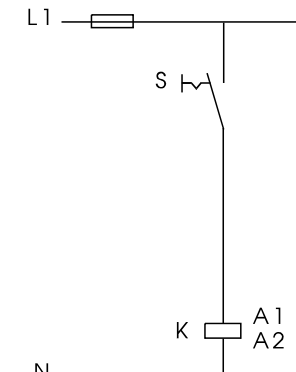
CNNP, CNNPB

SCHEMATIC DIAGRAMS FOR AC OPERATED CONTACTORS

CPO, CNNP, CM1, CNN 9 - CNN 100, CNM 110 - CNM 400



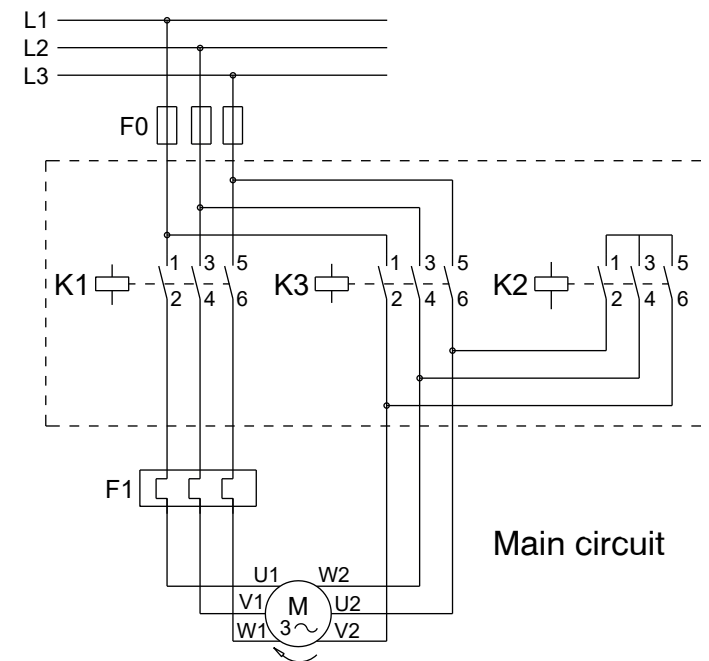
With push button "S0, S1"



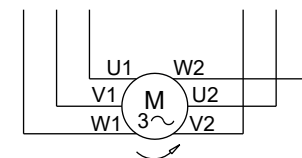
With permanent contact switch "S"

IMPORTANT:

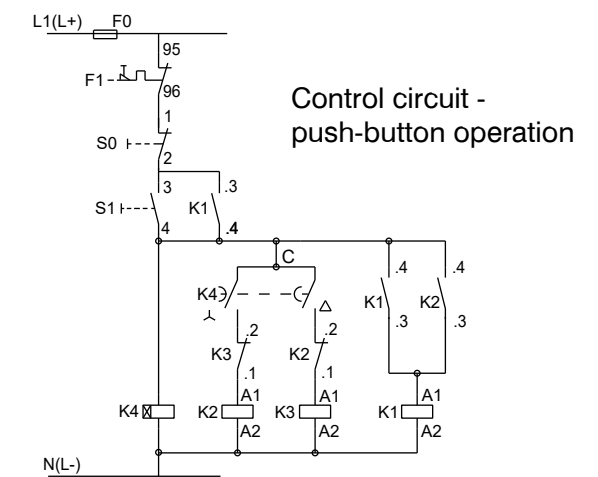
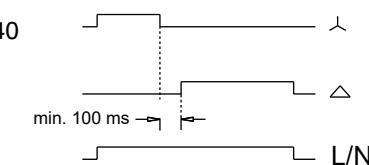
When used in **star-delta starters** the time between change over connection from star to delta must be bigger than 100ms which is achieved with electronic time relays (e.g. **Rade Koncar type EVRK 40**, see page 8/5).



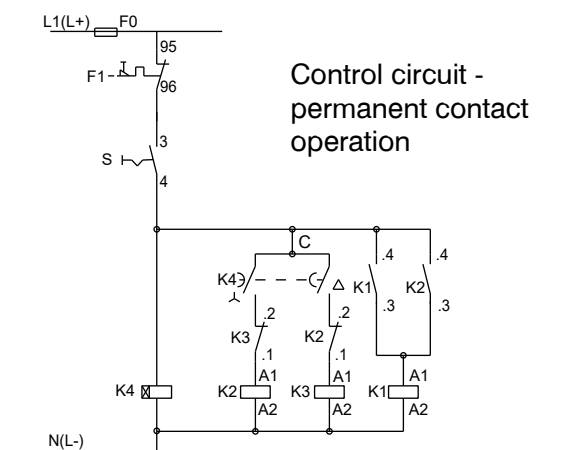
Main circuit



EVRK 40

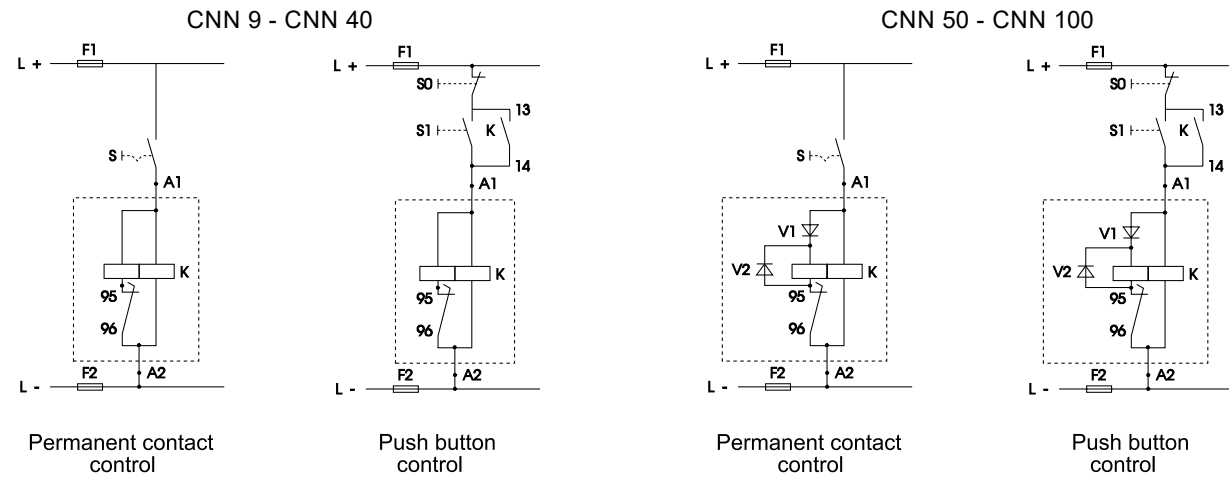


Control circuit - push-button operation



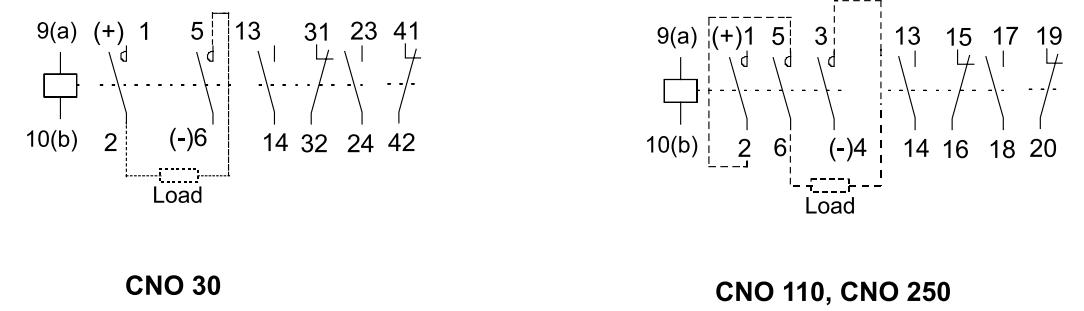
Control circuit - permanent contact operation

SCHEMATIC DIAGRAMS FOR DC OPERATED CONTACTORS

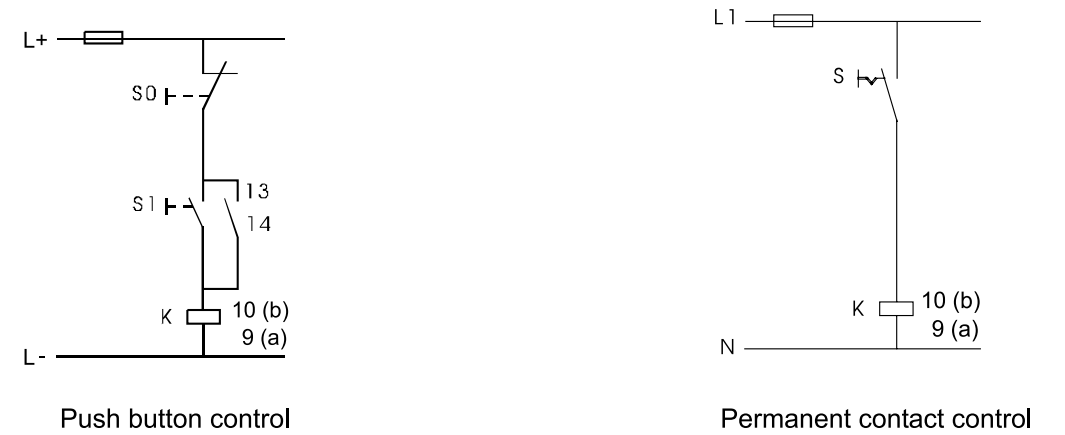
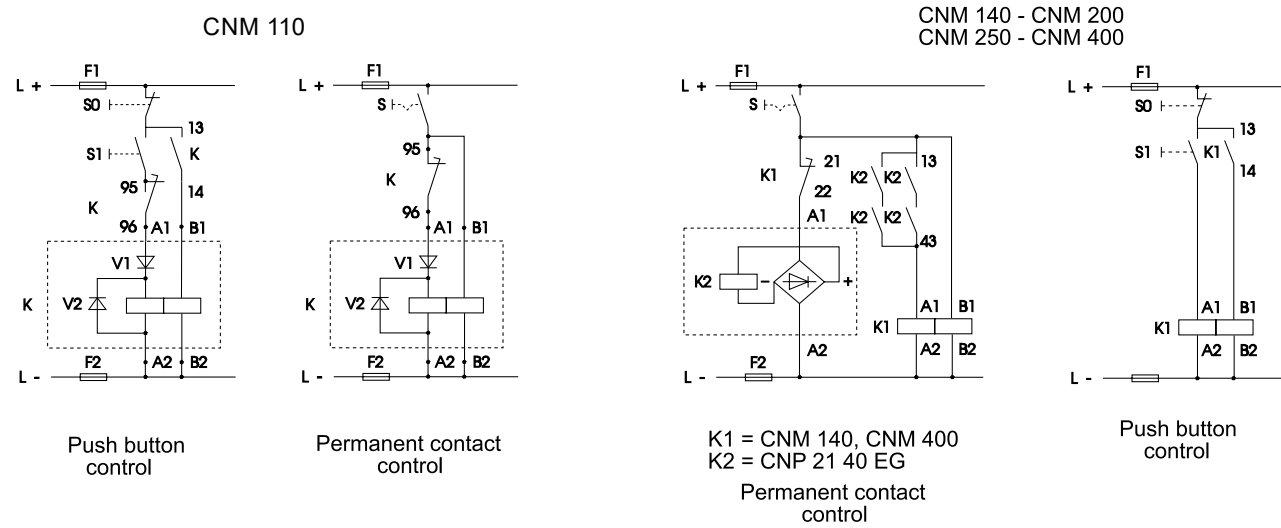


DC CONTACTORS TYPE CNO

Wiring diagrams

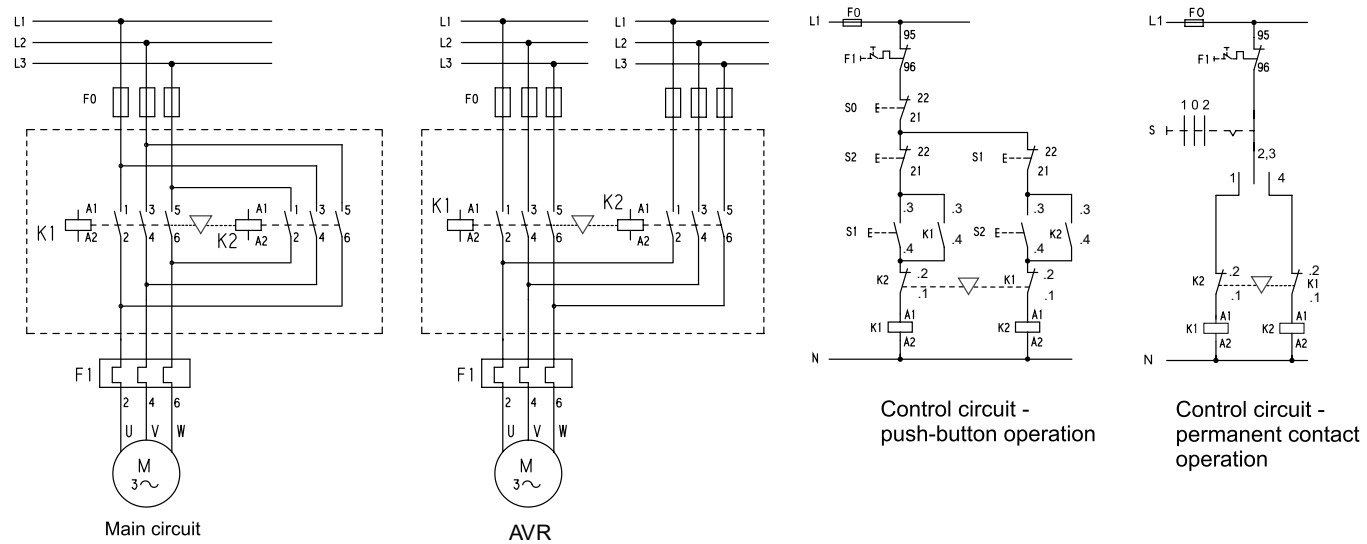


SCHEMATIC DIAGRAMS FOR AC OPERATED CONTACTORS

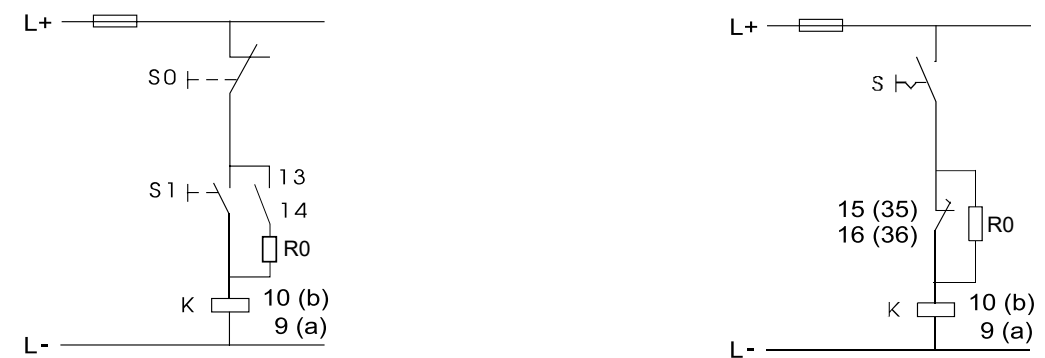


SCHEMATIC DIAGRAMS FOR REVERSING CONTACTORS and "AVR"

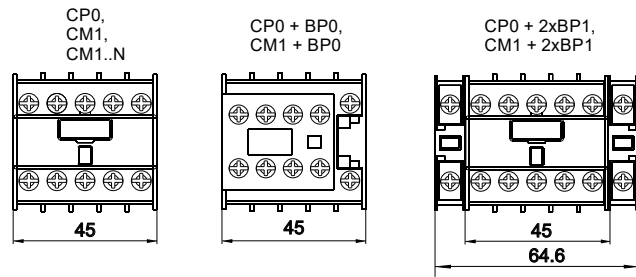
MBCM1, MBCNN 9 - MBCNN 100, MBCNM 110 - MBCNM 400



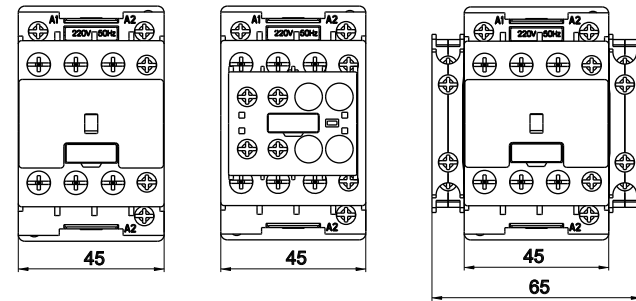
SCHEMATIC DIAGRAMS FOR DC OPERATED CONTACTORS



DIMENSION DRAWINGS (mm)

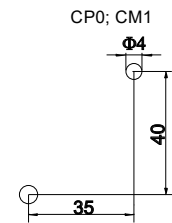


CNN 9; CNN 12; CNN 18; CNN 22; CNNB 9; CNNB 12; CNNB 18; CNNB 22
 CNN 9 (CNNB 9) + BP2 (BP4); CNN 12 (CNNB 12) + BP2 (BP4); CNN 18 (CNNB 18) + BP2 (BP4); CNN 22 (CNNB 22) + BP2 (BP4)
 CNN 9 (CNNB 9) + 2xBP3; CNN 12 (CNNB 12) + 2xBP3; CNN 18 (CNNB 18) + 2xBP3; CNN 22 (CNNB 22) + 2xBP3

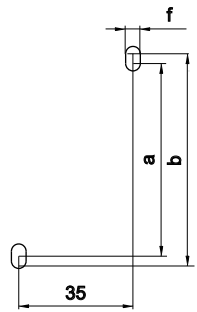


TYPE	CNN 9 - CNN 22	CNNB 9 - CNNB 22
A	72.2	74.2
B	71	114.5
C	101	146.8

Drilling plan (mm)

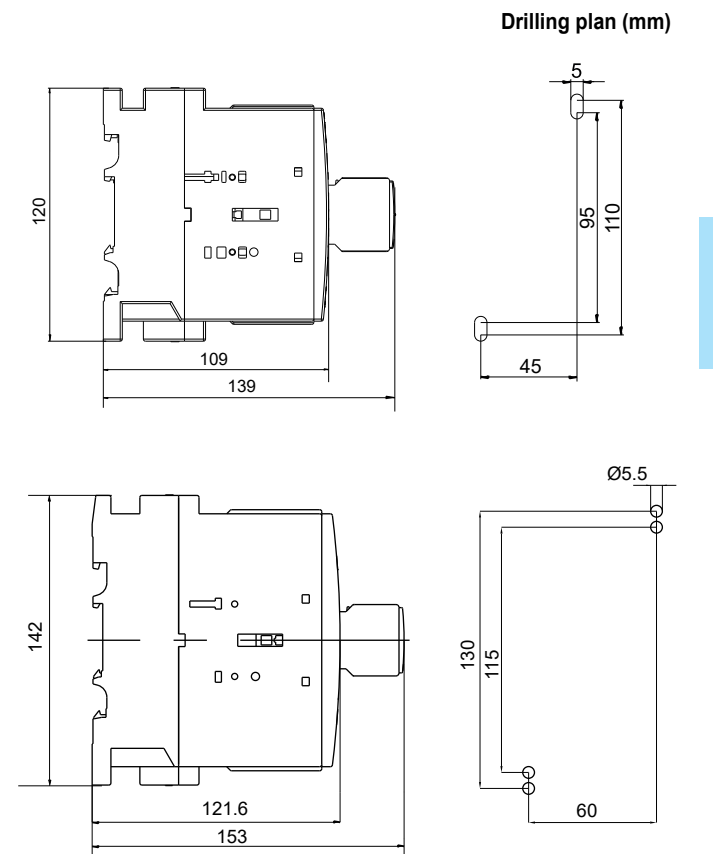
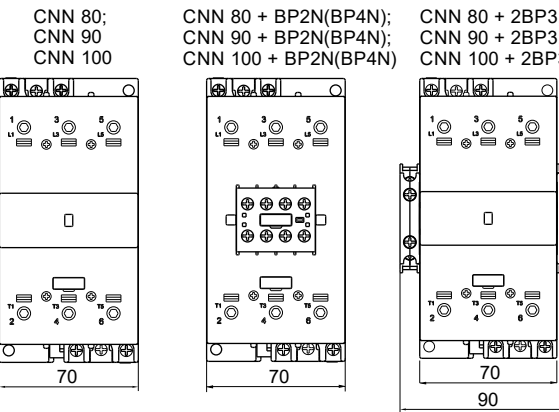
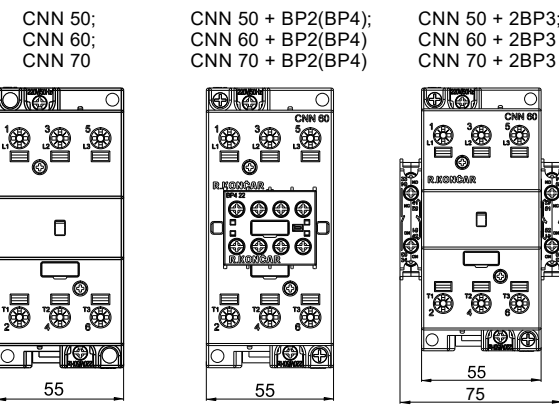


CNN 9; CNN 12; CNN 18; CNNB 9; CNNB 12; CNNB 18

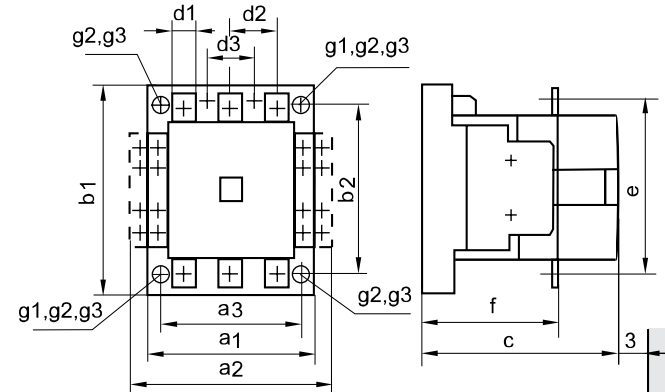


TYPE	CNN 9 - CNN 22	CNNB 9 - CNNB 22
a	60	50
b	65	60
f	4.5	4.6

DIMENSION DRAWINGS (mm)

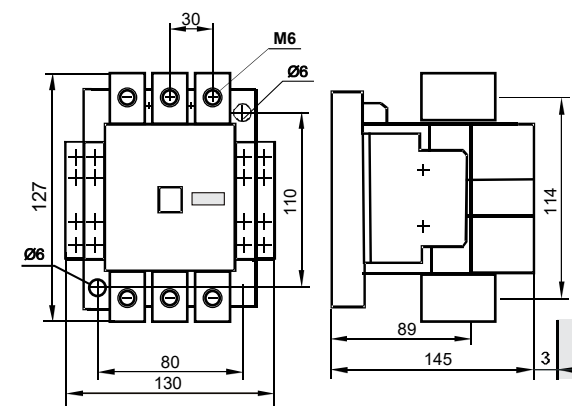


CNM 110, CNM 140, CNM 170, CNM 250, CNM 400

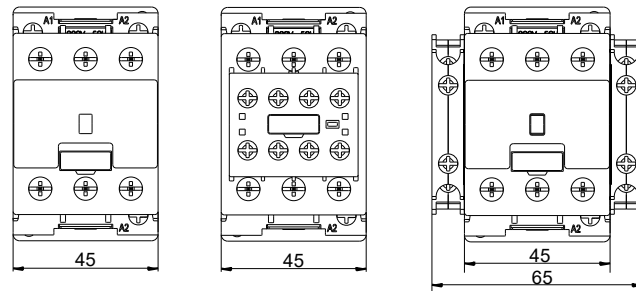


TYPE	a1	a2	a3	b1	b2	c	d1	d2	d3	e	f	g1	g2	g3
CNM 110	100	125	80	132	110	142	15	30	44	113	86.5	Ø6		
CNM 140	135	162	110	180	160	189	20	42	44	162	116	Ø7		
CNM 170	135	162	110	180	160	189	20	42	44	162	116	Ø7		
CNM 200	135	162	110	180	160	189	20	42	44	162	116	Ø7		
CNM 250	160	187	130	200	180	226	25	48	44	178	141	Ø10.5		
CNM 315	160	187	130	200	180	226	25	48	44	178	141	Ø10.5		
CNM 400	160	187	130	200	180	226	25	48	44	178	141	Ø10.5		

CNM 110ST

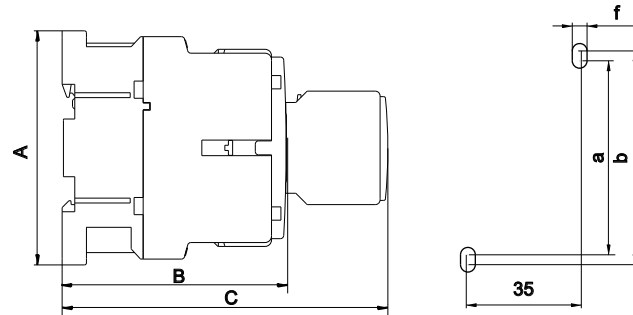


CNN 25; CNN 30; CNNB 25; CNNB 30
 CNN 25 (CNNB 25) + BP2 (BP4); CNN 30 (CNNB 30) + BP2 (BP4)
 CNN 25 (CNNB 25) + 2xBP3; CNN 30 (CNNB 30) + 2xBP3



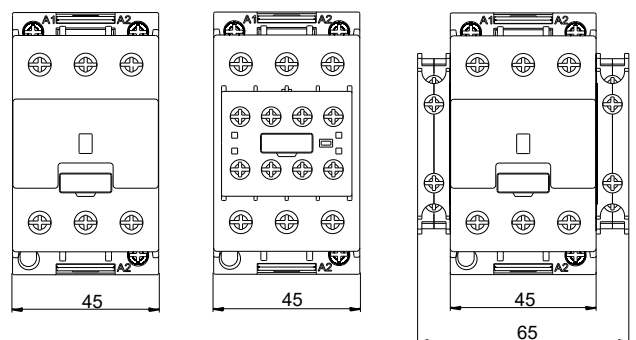
TYPE	CNN 25; CNN 30	CNNB 25; CNNB 30
A	72.2	74.2
B	71	114.5
C	100.5	146.1

CNN 25; CNN 30; CNNB 25; CNNB 30

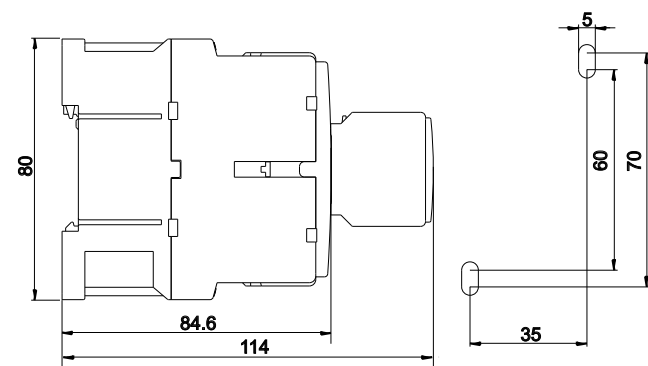


TYPE	CNN 25; CNN 30	CNNB 25; CNNB 30
a	60	50
b	65	60
f	4.5	4.6

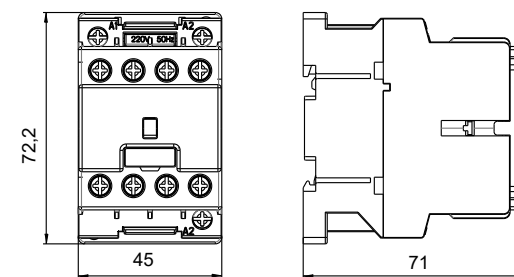
CNN 32; CNN 40; CNN 32 + BP2 (BP4); CNN 40 + BP2 (BP4); CNN 32 + 2xBP3; CNN 40 + 2xBP3



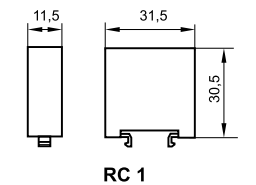
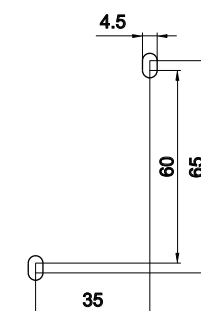
CNN 32; CNN 40



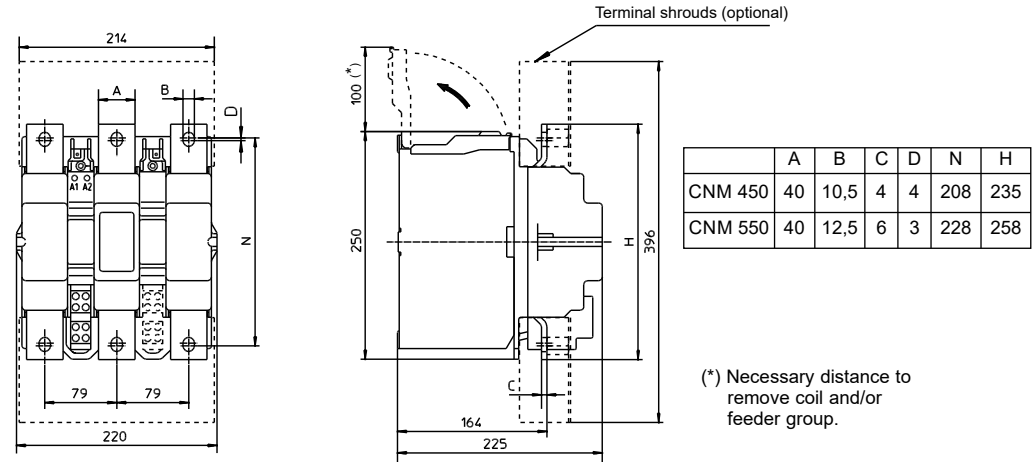
CNNP, CNN 9 004, CNN 12 004
 CNN 9 0022, CNN 12 0022



Drilling plan (mm)



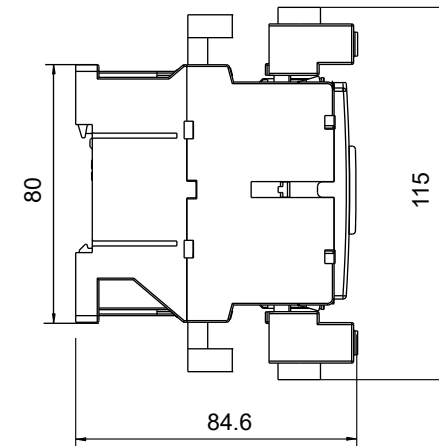
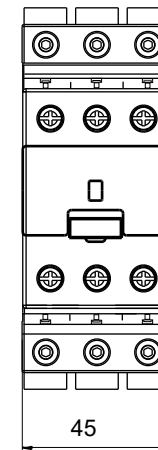
CNM 450; CNM 550;



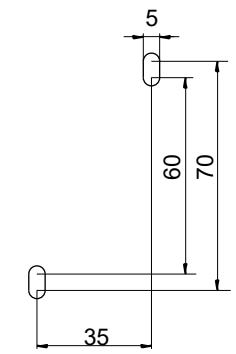
Drilling plan (mm)

DIMENSION DRAWINGS (mm)

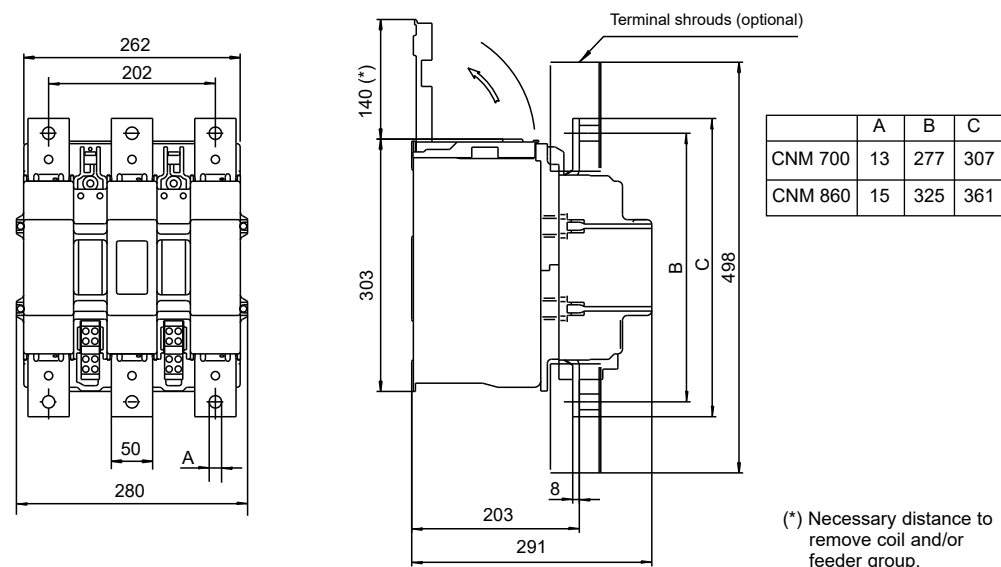
TKN 65



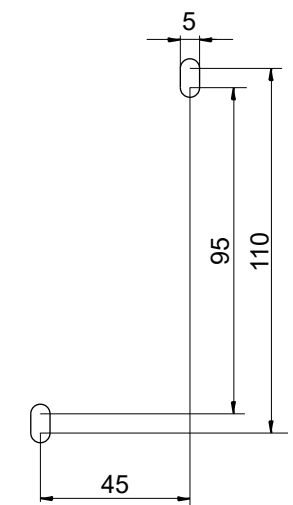
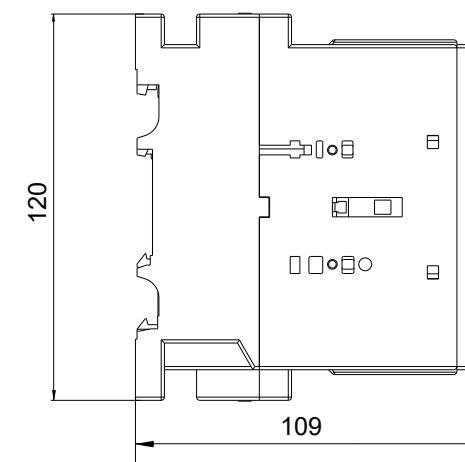
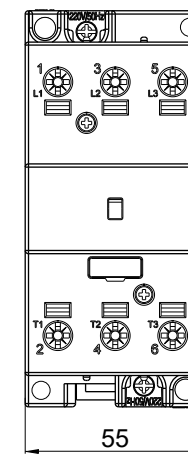
Drilling plan (mm)



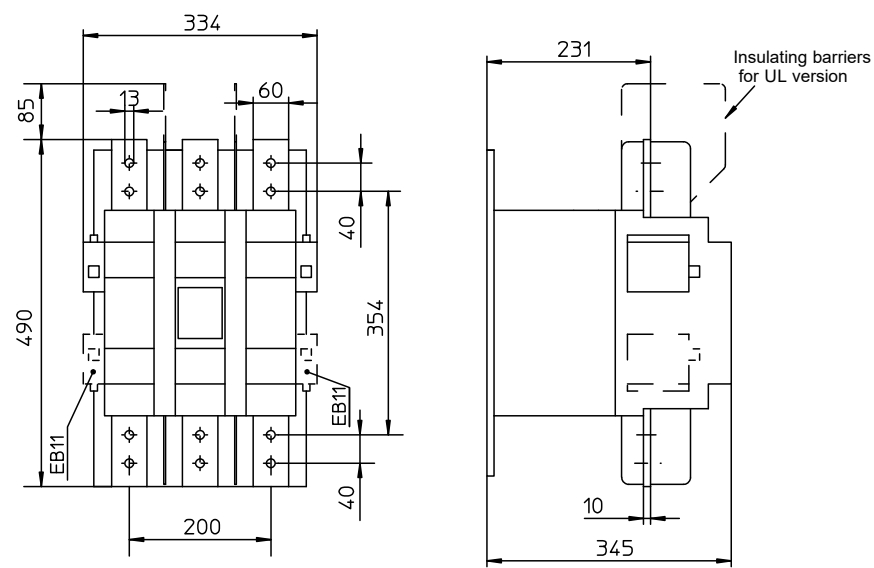
CNM 700; CNM 860



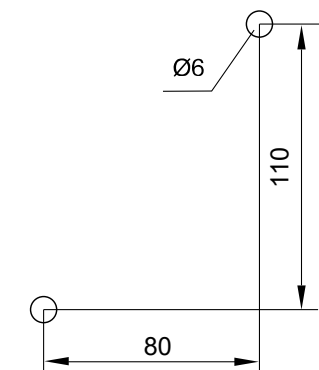
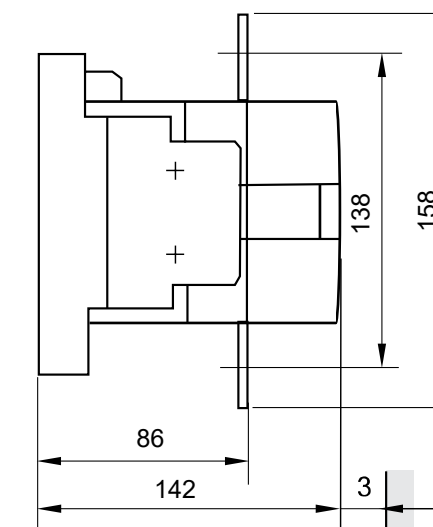
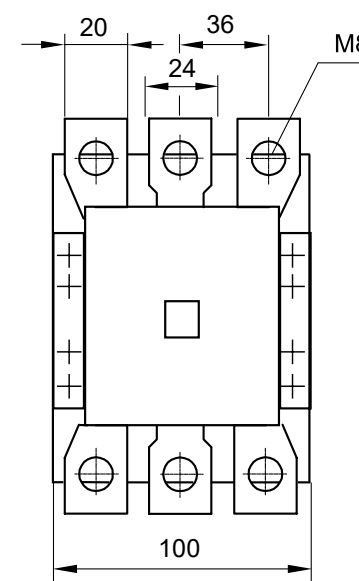
TKN 115



CNM 1000

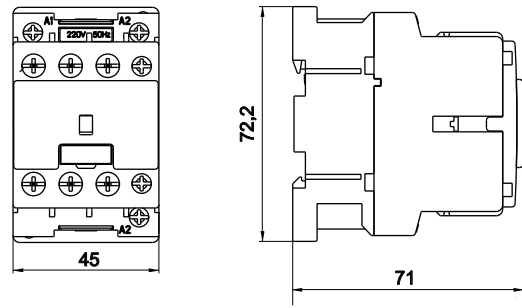


TK 130, TK 175

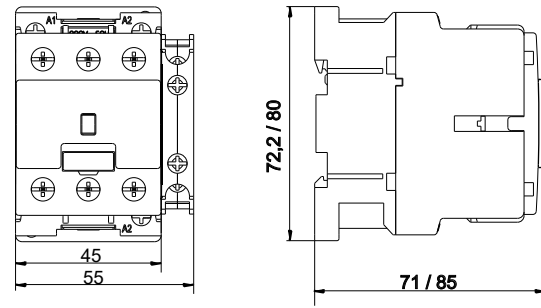


DIMENSION DRAWINGS (mm)

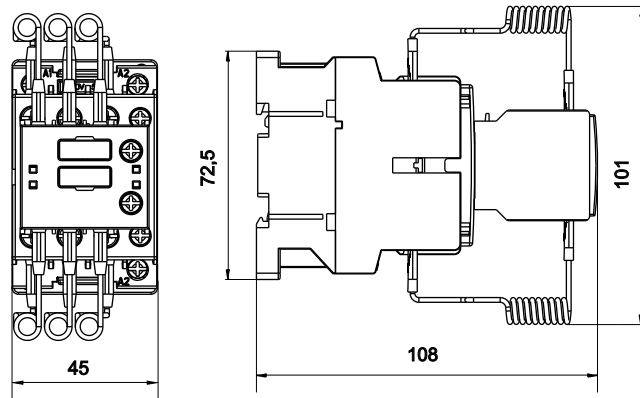
CNNK 2,5; CNNK 5



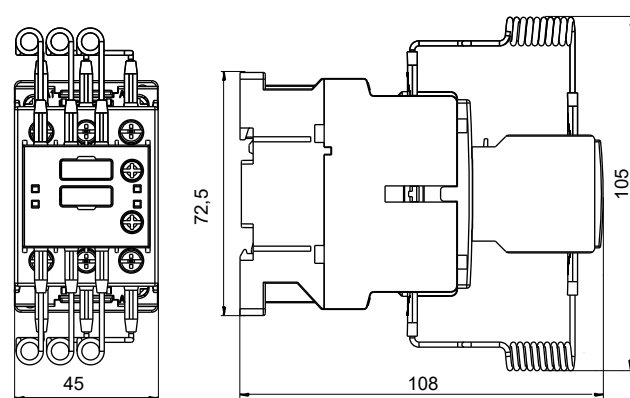
CNNK 7,5 / CNNK16



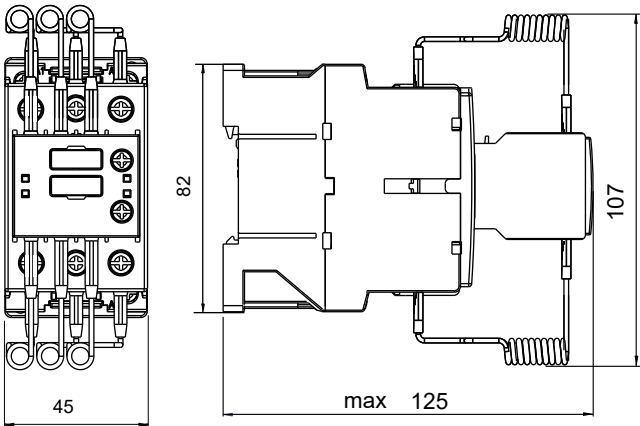
CNNK 10; CNNK 12; CNNK 15



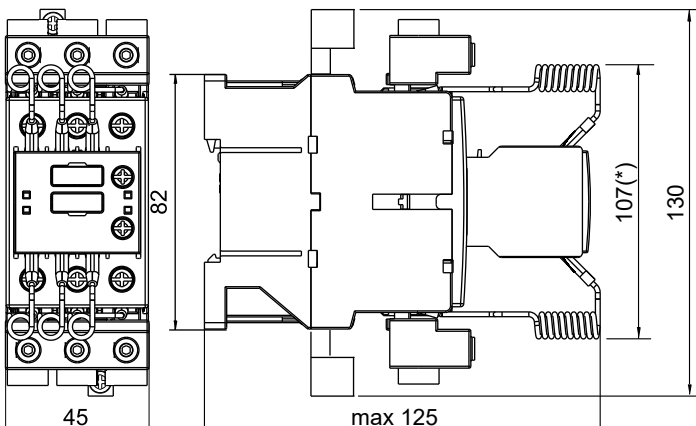
CNNK 20



CNNK 25E

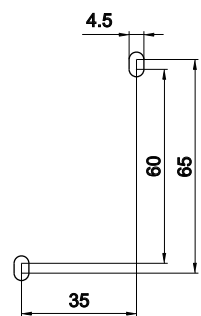


CNNK 25; CNNK 30

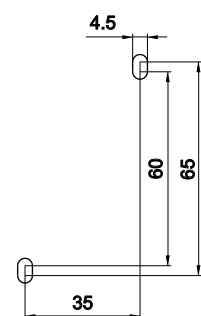


Drilling plan (mm)

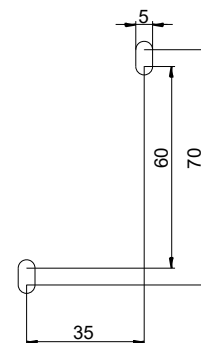
CNNK 2,5; CNNK 5
CNNK 7,5



CNNK 10; CNNK 12;
CNNK 15; CNNK 20

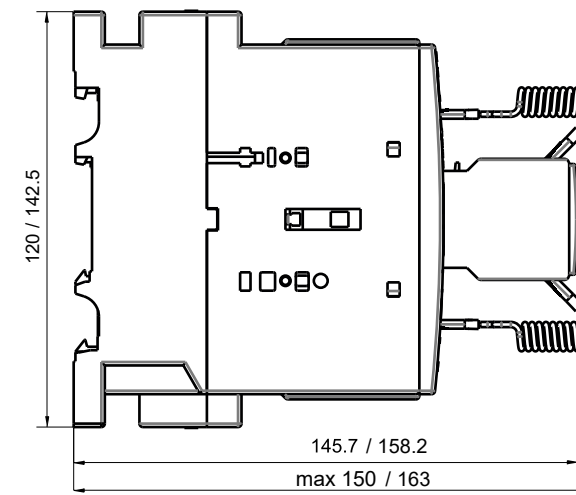
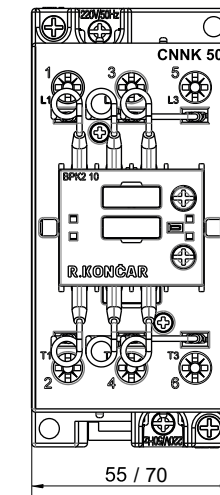


CNNK 25E; CNNK 25,
CNNK 30

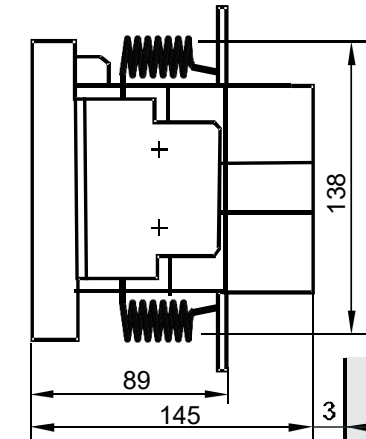
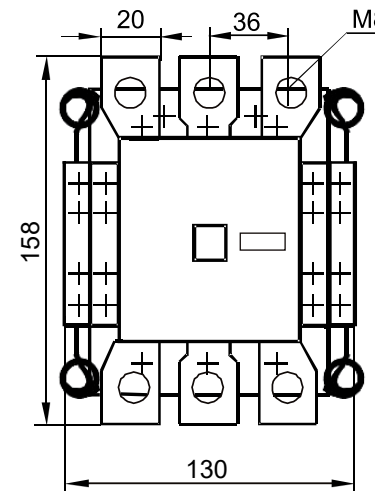


DIMENSION DRAWINGS (mm)

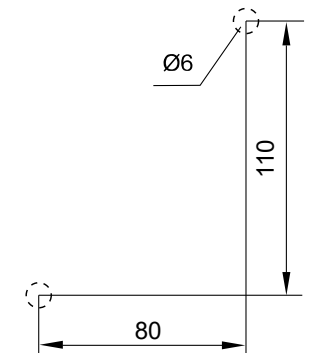
CNNK 40, CNNK 50, CNNK 60 / CNNK 60N, CNNK 70



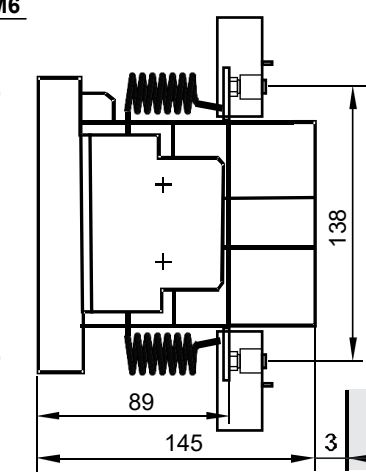
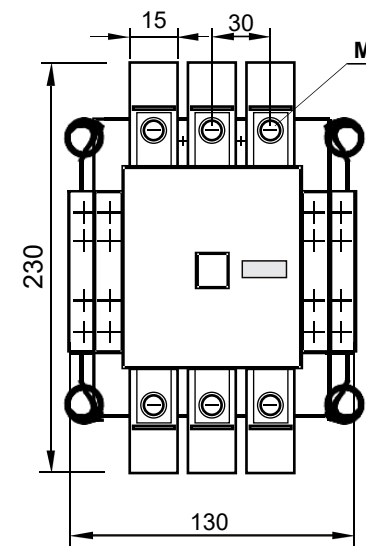
CNKM 60 and CNKM 80 without IP 20



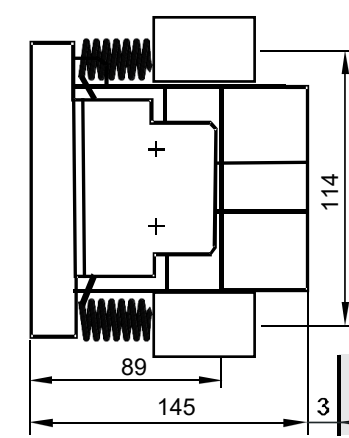
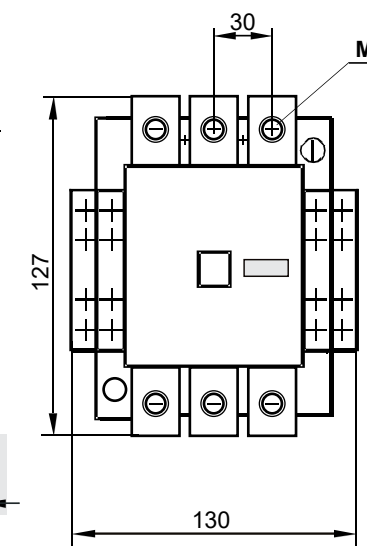
CNKM 60 and CNKM 80



CNKM 60 and CNKM 80 with IP 20

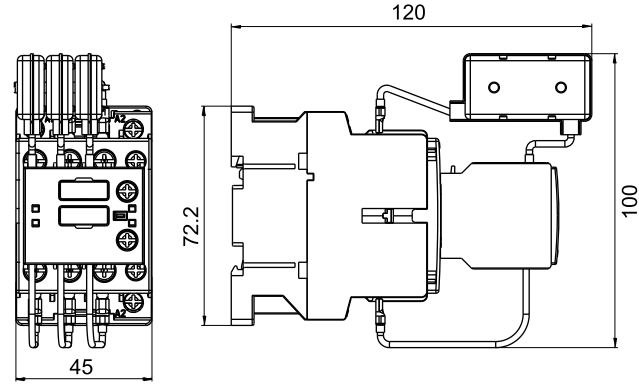


CNKM 60ST and CNKM 80ST

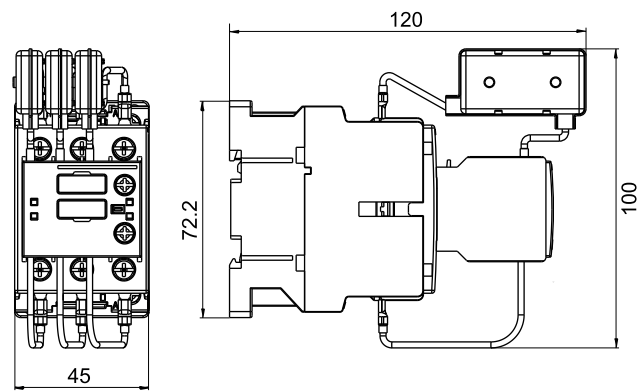


DIMENSION DRAWINGS (mm) - New Series

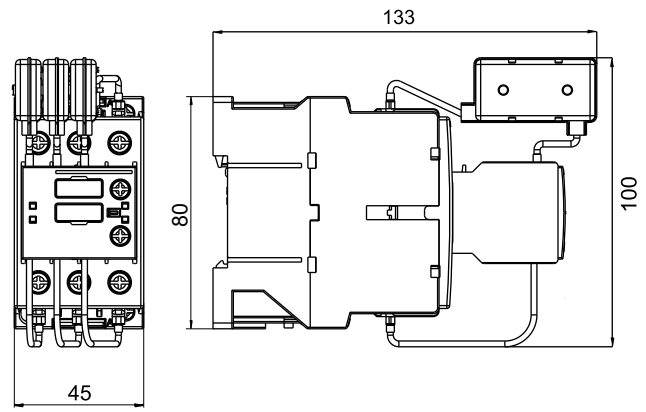
CNNK 10..N; CNNK 12..N; CNNK 15..N



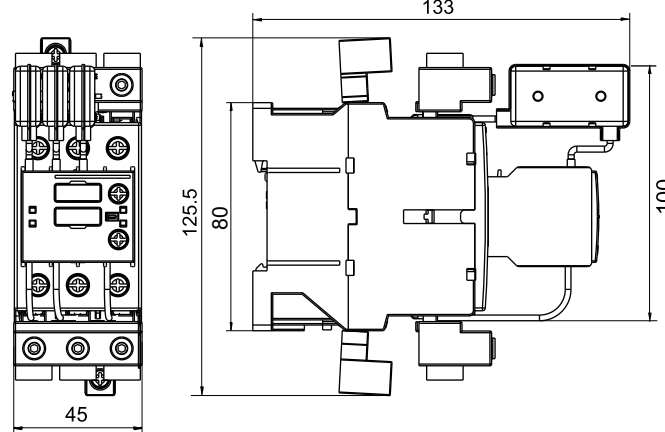
CNNK 20..N



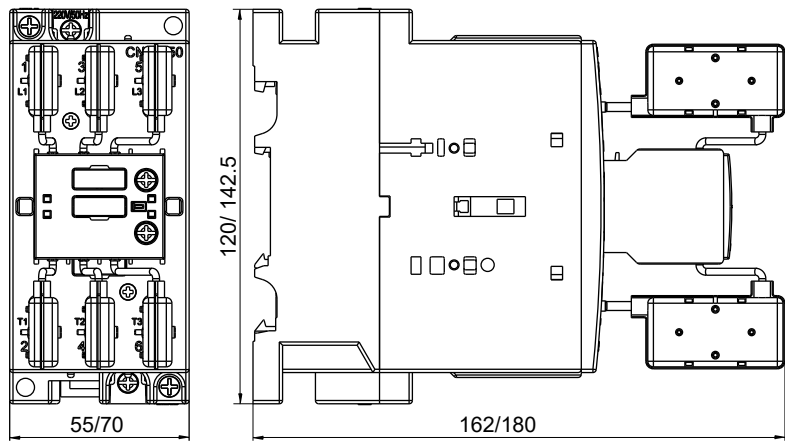
CNNK 25E..N



CNNK 25..N; CNNK 30..N

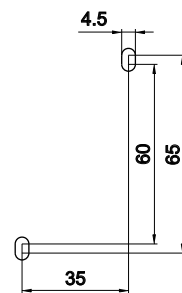


CNNK 40..N, CNNK 50..N, CNNK 60..N / CNNK 60N..N, CNNK 70..N, CNNK 75..N

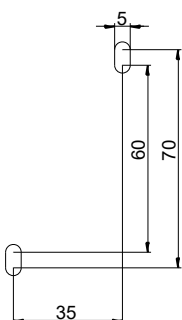


Drilling plan (mm)

CNNK 10..N; CNNK 12..N
CNNK 15..N; CNNK 20..N

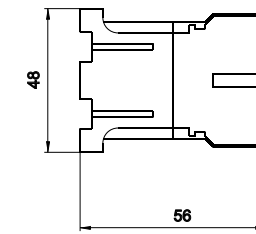
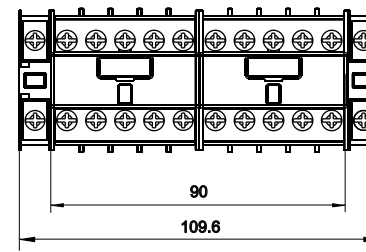


CNNK 25E..N; CNNK 25..N,
CNNK 30..N

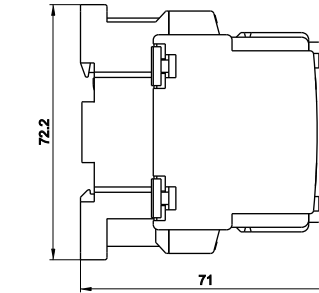
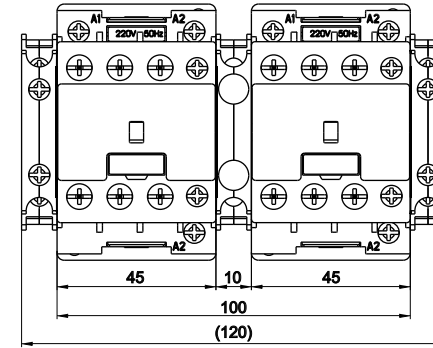


DIMENSION DRAWINGS (mm)

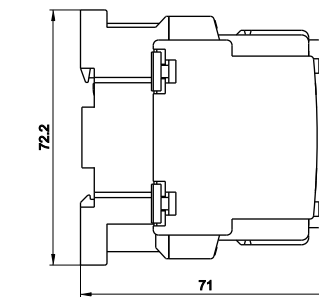
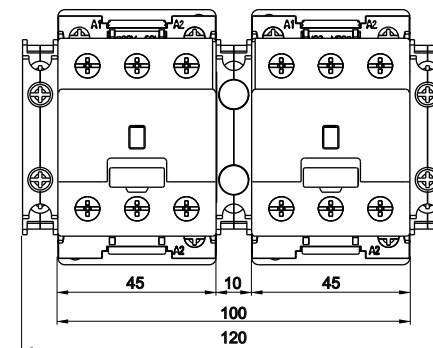
MBCM1 00; MBCM1 11
MBCM1..N 00; MBCM1..N 11



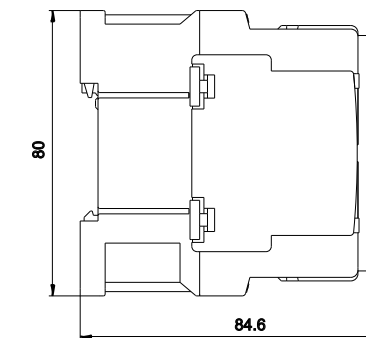
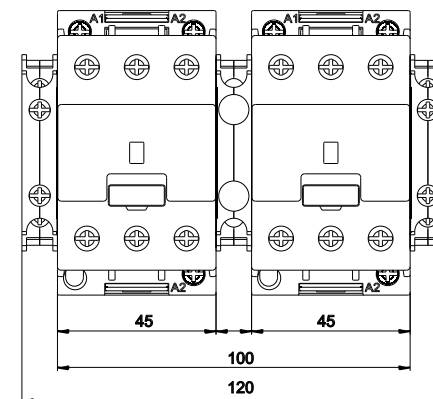
MBCNN 9 00 (11); MBCNN 12 00 (11);
MBCNN 18 00 (11); MBCNN 12 00 (11)



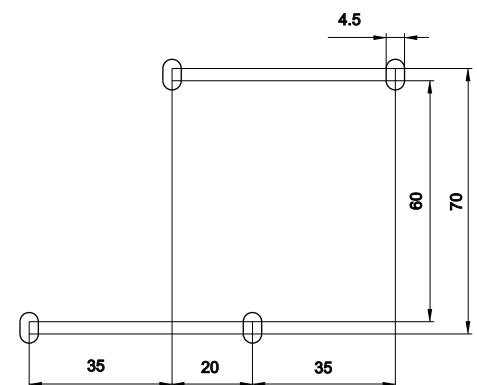
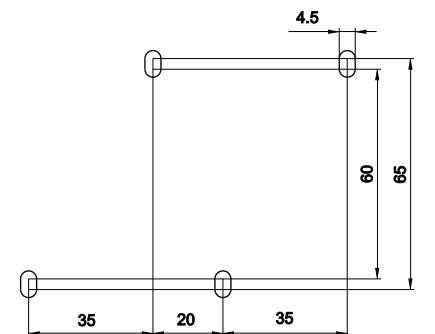
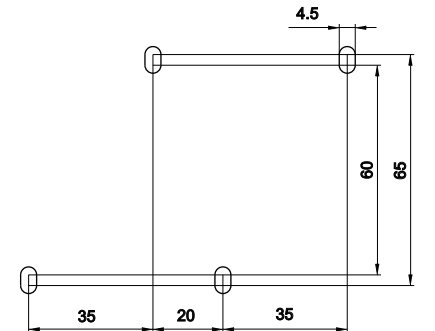
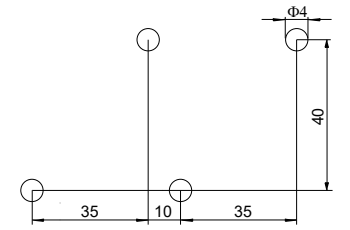
MBCNN 25 10; MBCNN 30 10



MBCNN 32 10; MBCNN 40 10

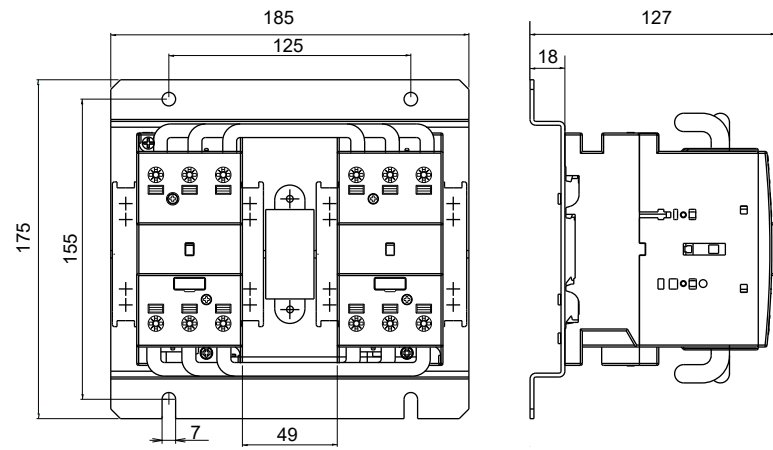


Drilling plan (mm)

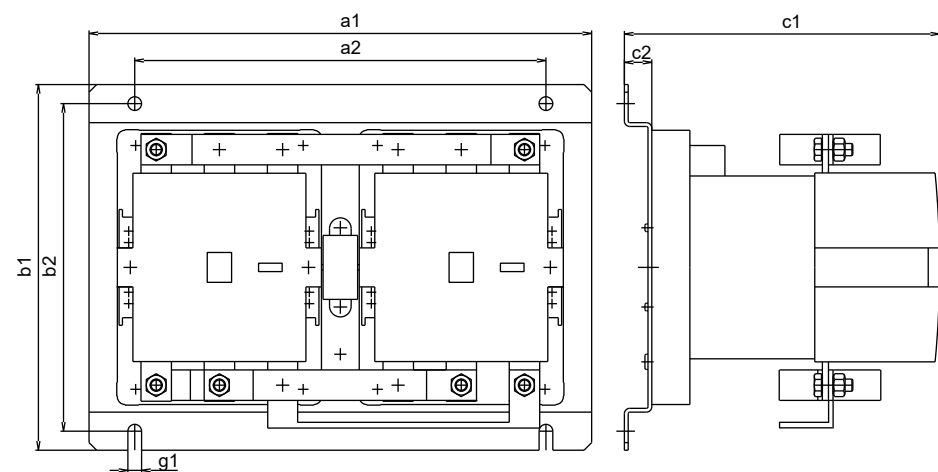
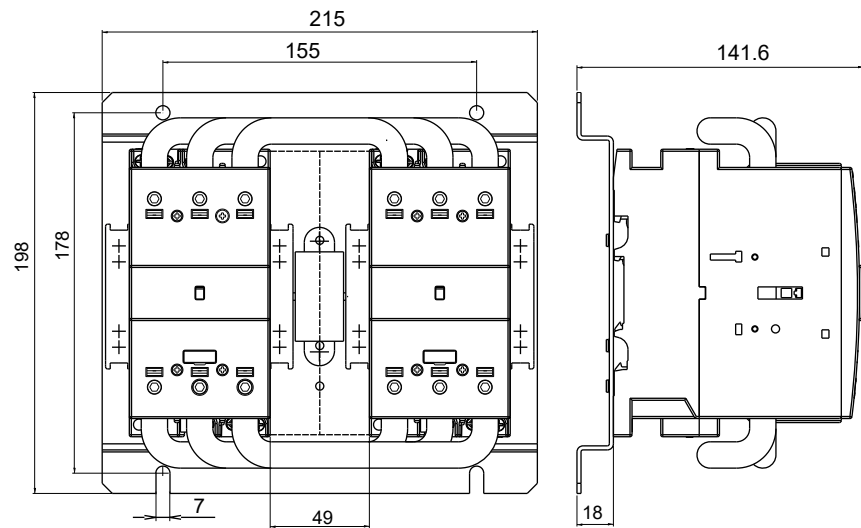


DIMENSION DRAWINGS (mm)

MBCNN 50 - MBCNN 70

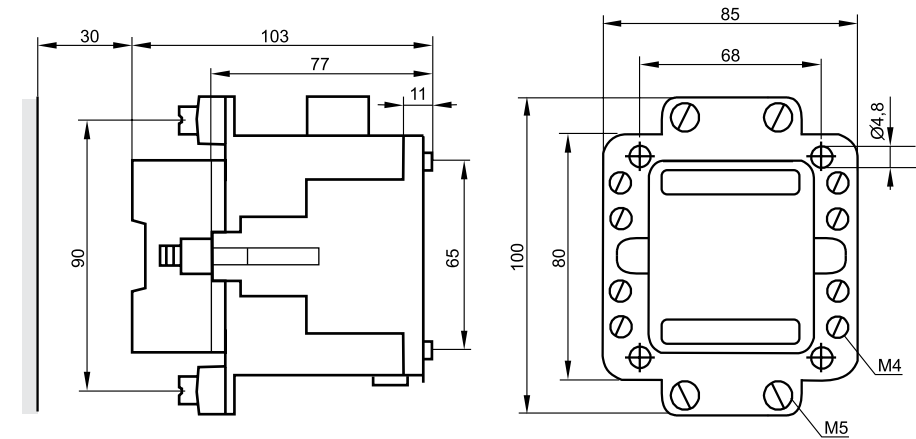


MBCNN 80 - MBCNN 100

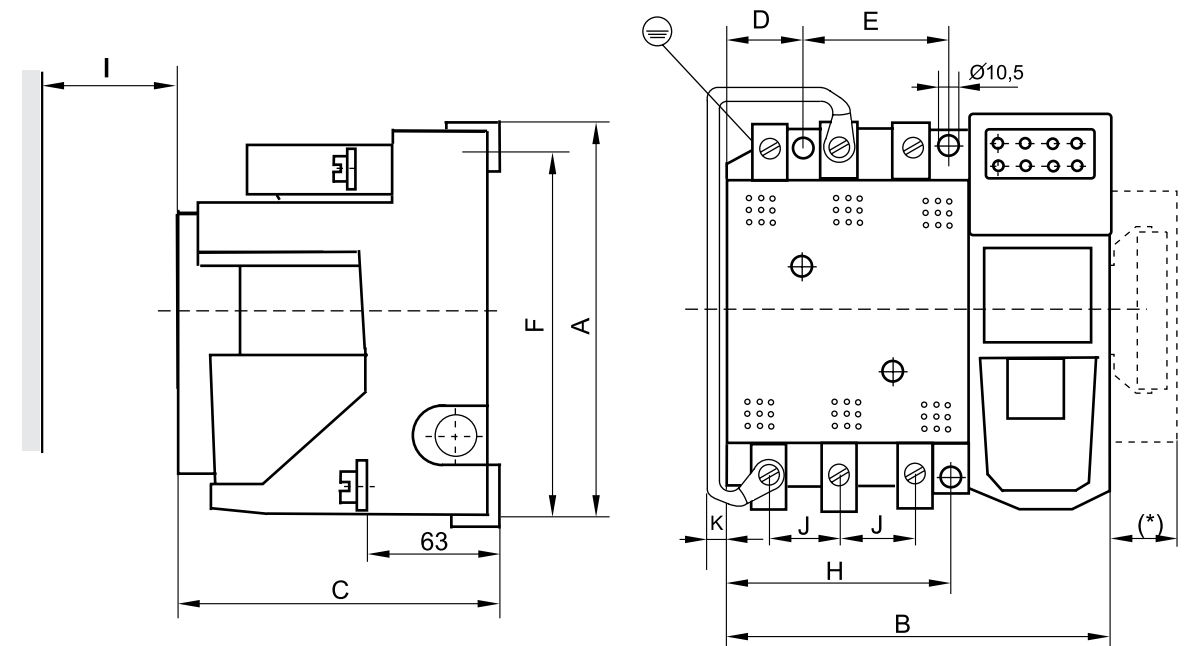


TYPE	a1	a2	b1	b2	c1	c2	g1
MBCNM 110	260	200	175	155	163	18	7
MBCNM 140 - MBCNM 200	330	270	240	215	210	18	9
MBCNM 250 - MBCNM 400	380	310	265	240	250	21	11

DIMENSION DRAWINGS (mm)



CNO 30



Contactor	A	B	C	D	E	F	G	H	I	J	K	(*) - Only for DC controlled contactors 0.25xB
CNO 110	190	192	130	40	70	175	7,5	110	40	35	20	
CNO 250	234	212	180	45	80	190	10.5	125	70	35	25	

Thermal overload relays TM2/1

Thermal overload relays TRM2/2

Adaptor for separate installation ASM 40, ASM 752/3

Order-thermal overload relays2/3

Application, standards and installation2/4

Current time curves,2/4

Technical data2/4

Contactors with thermal overload relays2/5, 2/6

Dimension drawings2/7, 2/8



THERMAL OVERLOAD RELAYS TYPE TM 40

Features

- In conformity with: IEC 60947-4
- Ambient temperature compensated
- Differential tripping
- With selectable manual or auto reset
- Trip indication
- 1NO + 1NC auxiliary contact

Selection and ordering data

Thermal overloads

For direct mounting on contactor	Overload setting range (A)	Type	Weights kg
 CNN 9, CNN 12 CNN 18, CNN 22 CNN 25, CNN 30 CNN 32, CNN 40	0.1 - 0.16* 0.16 - 0.25* 0.25 - 0.4* 0.4 - 0.63 0.63 - 1.0 0.8 - 1.25 1.0 - 1.6 1.25 - 2.0 1.6 - 2.5 2.0 - 3.2 2.5 - 4.0 3.2 - 5.0 4.0 - 6.3 5.0 - 8.0 6.3 - 10.0 8.0 - 12.5 10 - 16 12.5 - 20 16 - 25	TM 40	0.15
 CNN 25, CNN 30 CNN 32, CNN 40	22 - 30 28 - 38	TM 40	0.16






* On special request

THERMAL OVERLOAD RELAYS type TRM 75 - TRM 400



ADAPTOR FOR SEPARATE INSTALLATION ASM 40, ASM 75

Selection and ordering data

Thermal overloads

For direct mounting onto contactor	Overload setting range (A)	Type	Weights kg
 CNN 50 CNN 60 CNN 70	16 - 25 20 - 32 25 - 40 32 - 50 40 - 57 50 - 63 57 - 70	TRM 75 - N60	0.39
 CNN 80 CNN 90 CNN 100	16 - 25 20 - 32 25 - 40 32 - 50 40 - 57 50 - 63 57 - 70 63 - 80	TRM 75 - N90	0.40
 CNM 110	16 - 25 20 - 32 25 - 40 32 - 50 40 - 57 50 - 63 57 - 70 63 - 80	TRM 75 - 110	0.40
 For individual mounting CNM 110 CNM 140 CNM 170 CNM 200 CNM 250 CNM 315 CNM 400	70 - 100 80 - 125 100 - 160 125 - 200 160 - 250	TRM 400D (*)	1.58
 For individual mounting CNM 110 CNM 140 CNM 170 CNM 200 CNM 250 CNM 315 CNM 400	70 - 100 80 - 125 100 - 160 125 - 200 160 - 250 200 - 320 250 - 400	TRM 400	2.2

*TRM 400D with straight-through transformer.

For thermal overload relays type	Type	Weights kg
 TM 40	ASM 40	0.04
 TRM 75	ASM 75	0.135

ORDER-THERMAL OVERLOAD RELAYS

Type

Setting range (Upper value)

Example: Thermal overload relay type TRM 75 -N60, current range (40 - 57) A

TRM 75 -N60 57 A

Example: Thermal overload relay with rail type TRM 400 160, current range (100 - 160) A

TRM 400 160 A

Example: Thermal overload relay with straight-through transformer type TRM 400D 160, current range (100 - 160) A

TRM 400D 160 A

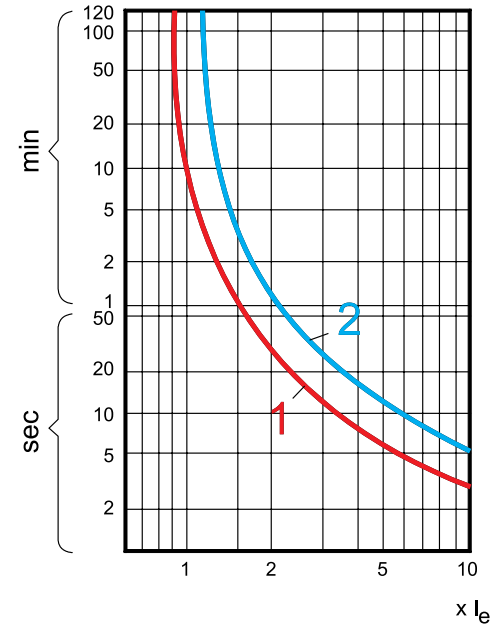
THERMAL OVERLOAD RELAYS TM and TRM

Application, standards and installation

Thermal overload relays TM and TRM are designed to protect low voltage motors and other consumers against nonpermissible overloads and phase-failure operation. Relays are in conformity with IEC 60947-4-1, EN 60947-4-1 and VDE 0660. They can be easily mounted on our contactors see ordering table. Individual screw mounting of the TM 40 and TRM relays on plane surface or snap-on fastening to 35 mm mounting rail (according to DIN EN 50022) is possible by using a special adaptor type ASM 40 and ASM 75. The relay TRM 400 is designed for individual screw mounting.

Current time curves

The current time curves give correlation between the tripping time and the multiplier of the present current I_e . They are presented for a cold initial state of the relay. For relays warmed by $1,0 \times I_e$ load, the tripping times are lower by 25%. The curve 2 is given for 3-phase operation. The curve 1 is given for 2-phase operation. For the protection of a 1-phase, or DC motor, serial connection of the main circuit of relays is necessary. For that connection the tripping curve 2 is valid.



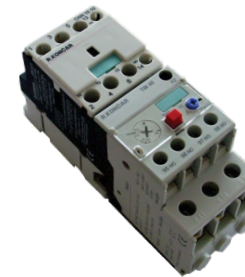
Technical data				
Relay type		TM 40	TRM 75	TRM 400/TRM 400D
Insulation rating U_i	V	690	1000	690
Permissible ambient temperature	°C	- 25 to +50	- 25 to +55	- 25 to +50
Degree of protection		IP00		
Release time classification		class 10 (release time 4 s ... 10 s at $7,2 \times I_e$ from cold state)		
Temperature compensation		+	+	+
Phase failure protection by differential phase shift		+	+	+
Test button		+	+	+
Reset button		+	-	+
Switch position indicator		+	+	+
Changeover to hand or automatic resetting		+	+	+
Vibration resistance	g	8	8	8
Main circuit				
rated operational current (AC 50 to 400 Hz or DC)	A	38	80	400/250
conductor cross - section	mm ²	2,5 - 10	2,5 - 35	240/120
solid or stranded	mm ²	1,5 - 6	1,5 - 25	
finely stranded with end sleeve	mm	M4/PZ2	M6	M10/-
Screw/Screw head	Nm	1,6	2,5	
Tightening torque				
Power input per pole				
max. at setting range min.	W/VA	0,9	2,6	5
max. at setting range max.	W/VA	2,25	4	12
Auxiliary circuit		1 NO + 1 NC (galvanically separated)		
number and type of contacts		2 x (1 - 2,5)		
conductor cross - section	mm ²	2 x (0,75 - 1,5)		
solid or stranded	mm ²	M3.5/PZ2		
finely stranded with end sleeve	mm ²	0,8		
Screw/Screw head	Nm	6		
Tightening torque	A			
rated thermal current				
rated insulation voltage AC:				
unequal potential	V	400		
equal potential	V	690		
rated current	A	2		
	A	1,5		
	A	1,15		
	A	1,1		
	A	1		
	A	1		
	A	0,4		
	A	0,22		
	A	0,1		

CONTACTORS WITH THERMAL OVERLOAD RELAYS

In conformity with: IEC 60947-1, IEC 60947-4, VDE 0660

Selection and ordering data

Data for AC2 and AC3 utilization categories			Auxiliary contacts	Type of relay	Type	Weights kg	
Rated operational current $I_e/400V$ A	Motor rating at 50Hz		NO NC	Overload setting range A			
	230 V kW	400V kW					
CONTACTORS WITH THERMAL RELAY							
9	3.2	4.5	1 0	TM 40 0.1 - 0.16 0.16 - 0.25	CNNR 9 10	0.42	
9	3.2	4.5	0 1	0.25 - 0.4 0.4 - 0.63	CNNR 9 01		
12	3.5	5.7	1 0	0.63 - 1.0 0.8 - 1.25	CNNR 12 10		
12	3.5	5.7	0 1	1.0 - 1.6 1.25 - 2.0	CNNR 12 01		
18	4	7.5	1 0	1.6 - 2.5 2.0 - 3.2	CNNR 18 10		
18	4	7.5	0 1	2.5 - 4.0 3.2 - 5.0	CNNR 18 01		
22	5.5	11	1 0	4.0 - 6.3 5.0 - 8.0	CNNR 22 10		
22	5.5	11	0 1	6.3 - 10.0 8.0 - 12.5	CNNR 22 01		
25	5.5	11	0 0	10 - 16 12.5 - 20	CNNR 25 00		0.44
30	7.5	15	0 0	16 - 25 22 - 30	CNNR 30 00		
32	7.5	15	0 0	28 - 38	CNNR 32 00		
38	11	18.5	0 0		CNNR 40 00	0.56	



CONTACTORS WITH THERMAL OVERLOAD RELAYS

In conformity with: IEC 60947-1, IEC 60947-4, VDE 0660

Selection and ordering data

Data for AC2 and AC3 utilization categories			Auxiliary contacts		Type of relay	Type	Weights kg
Rated operational current $I_e/400V$ A	Motor rating at 50Hz		NO	NC	Overload setting range A		
	230 V kW	400V kW					
CONTACTORS WITH THERMAL RELAY							
50	15	22	0	0	TRM 75 -N60 16 - 25 20 - 32 25 - 40 32 - 50 40 - 57 50 - 63	CNNR 50 00	1.3
60	18.5	30	0	0			
65	18.5	33	0	0			
80	22	37	2	2	TRM 75 -N90 16 - 25 20 - 32 25 - 40 32 - 50 40 - 57 50 - 63 57 - 70 63 - 80	CNNR 80 00	1.7
90	26	45	2	2			
100	30	55	2	2			
110	37	55	2	2	TRM 75 -110 16 - 25 20 - 32 25 - 40 32 - 50 40 - 57 50 - 63 57 - 70 63 - 80	CNMR 110 22	2.7
110	37	55	4	4			



ORDER FOR CNMR:

Type

Standard control voltage AC/DC 24, 48, 110, 220/230, 380/400 V

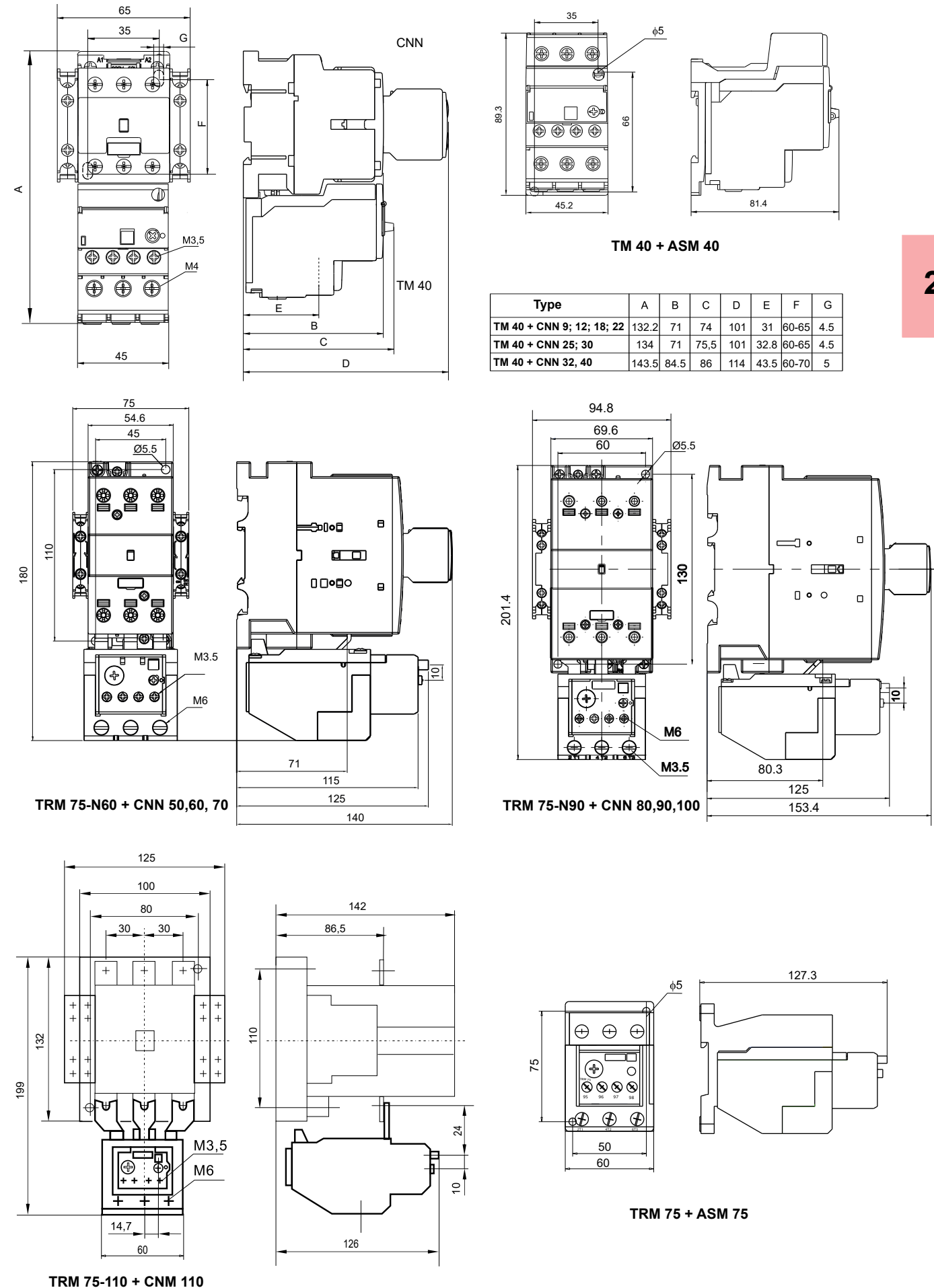
For AC control: 50 Hz or 60 Hz

Setting range (Upper value)

Example: Contactor with thermal relay type CNNR 18 10, control voltage 220/230 V, 50 Hz, thermal overload relay type TM 40, current range (10-16)A

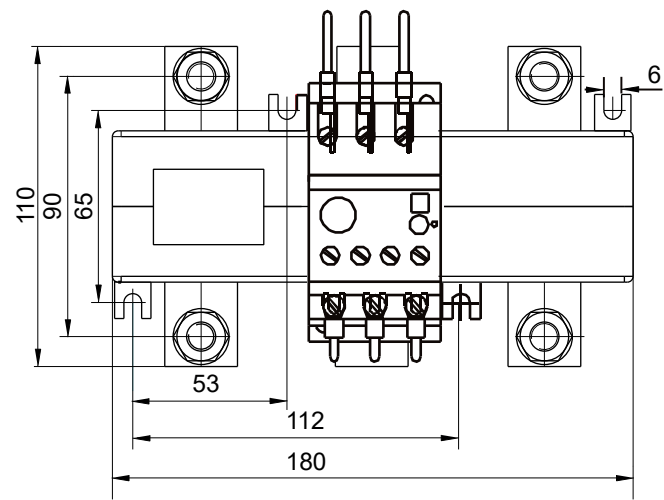
CNNR 18 10 220/230 V 50 Hz 16A

DIMENSION DRAWINGS (dimensions in mm)

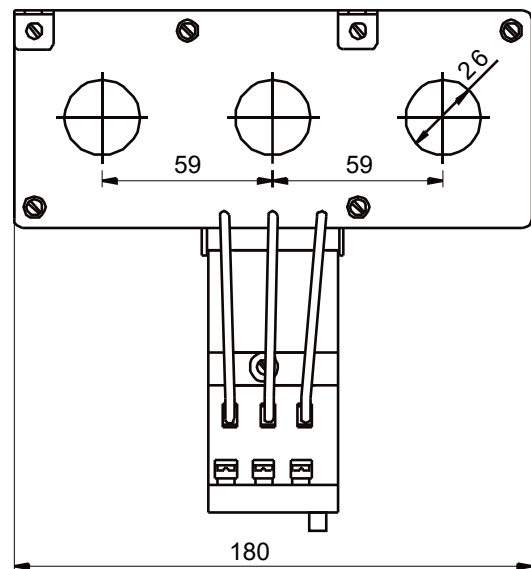
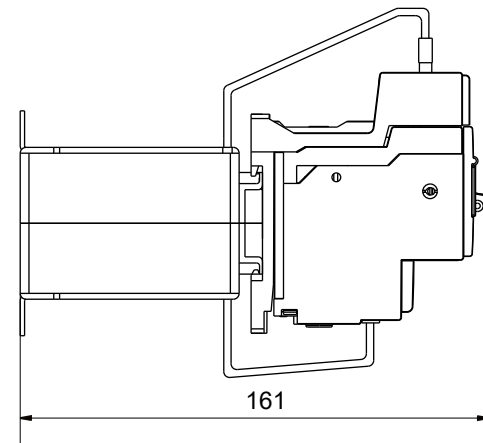
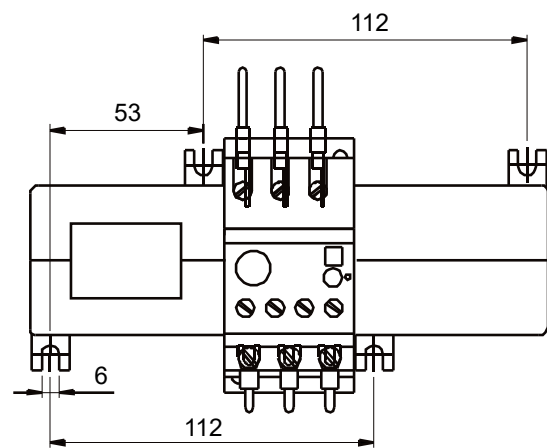
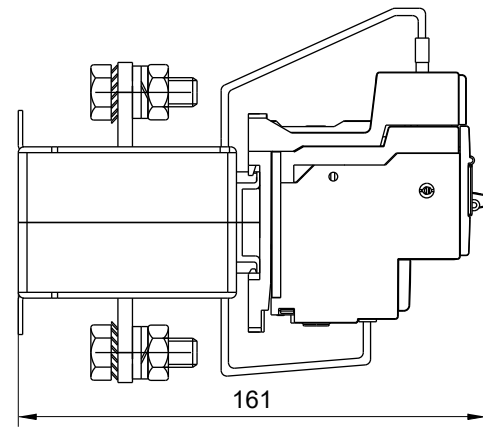


DIMENSION DRAWINGS (dimensions in mm)

2



TRM 400



TRM 400D

ROTARY CAM SWITCHES

Cam Switches "ON - OF".....	3/1
Changeover switches with zero position	3/2
Changeover switches without zero position	3/3
Motor switches	3/4, 3/5
Voltmeter change over switches	3/6
Ammeter change over switches	3/7
General emergency on-off switch version "LK".....	3/7
Rotary cam switches with title type BS ...N	3/8
"BAYONET" rotary cam switches type BSB	3/9
Dimensional drawings	3/10
Order-Rotary cam switches	3/11
Technical data	3/12, 3/13
Rotary cam switches in insulated enclosures type PNBS, PNGBS, PNPS, PNGPS PNGBS/PNGPSLK, PN1BS, PN1PS	3/14
Rotary cam switches in insulated enclosures type PN2BS, PN3BS, PN4BS	3/15
PN2PS, PN3PS, PN4PS Dimensional drawings	3/16, 3/17, 3/18
Order form - Special version	3/19

TYPES

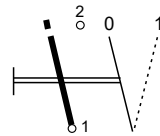
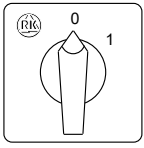
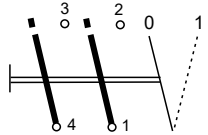
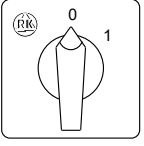
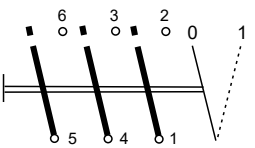
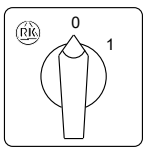
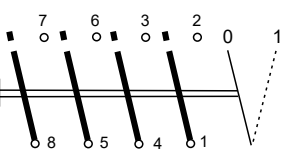
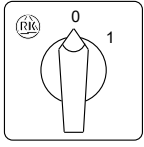


ROTARY CAM SWITCHES type BS/PS

Features

- In conformity with: IEC 60947-1, IEC 60947-3
- **Motor switching AC 3/ AC 23**
- High making and breaking capacities

Selection and ordering data

Rated thermal current I_{th} A	DIAGRAM	Printed plate	Type	No. of diagram
Switches: 1-pole -1 element				
20			BS/PS 10	90 U
25			BS/PS 20	90 U
32			BS/PS 25	90 U
40			BS/PS 32	90 U
50			BS/PS 40	90 U
63			BS 50	90 U
70			BS/PS 63	90 U
80			BS/PS 80	90 U
100			BS/PS 100K/100	90 U
2 - poles - 1 element				
20			BS/PS 10	91 U
25			BS/PS 20	91 U
32			BS/PS 25	91 U
40			BS/PS 32	91 U
50			BS/PS 40	91 U
63			BS 50	91 U
70			BS/PS 63	91 U
80			BS/PS 80	91 U
100			BS/PS 100K/100	91 U
3 - poles - 2 elements (3 elements for BS 400; 5 elements for BS 630)				
20			BS/PS 10	10 U
25			BS/PS 20	10 U
32			BS/PS 25	10 U
40			BS/PS 32	10 U
50			BS/PS 40	10 U
63			BS 50	10 U
70			BS/PS 63	10 U
80			BS/PS 80	10 U
100			BS/PS 100K/100	10 U
125			BS/PS 125	10 U
200			BS/PS 200	10 U
400			BS/PS 400	10 U
630			BS/PS 630	10 U
4 - poles - 2 elements (4 elements for BS 400; 6 elements for BS 630)				
20			BS/PS 10	92 U
25			BS/PS 20	92 U
32			BS/PS 25	92 U
40			BS/PS 32	92 U
50			BS/PS 40	92 U
63			BS 50	92 U
70			BS/PS 63	92 U
80			BS/PS 80	92 U
100			BS/PS 100K/100	92 U
125			BS/PS 125	92 U
200			BS/PS 200	92 U
400			BS/PS 400	92 U
630			BS/PS 630	92 U

ROTARY CAM SWITCHES type BS

Features

- In conformity with: IEC 60947-1, IEC 60947-3
- **Motor switching AC 3/ AC 23**
- High making and breaking capacities

Selection and ordering data

Rated thermal current I _{th} A	DIAGRAM	Printed plate	Type	No. of diagram
Changeover switches with zero position				
1-pole - 1 element				
20			BS/PS 10	51 U
25			BS/PS 20	51 U
32			BS/PS 25	51 U
40			BS/PS 32	51 U
50			BS/PS 40	51 U
63			BS 50	51 U
70			BS/PS 63	51 U
80			BS/PS 80	51 U
100			BS/PS 100K/100	51 U
2-poles - 2 elements (4 elements for BS 400; 6 elements for BS 630)				
20			BS/PS 10	52 U
25			BS/PS 20	52 U
32			BS/PS 25	52 U
40			BS/PS 32	52 U
50			BS/PS 40	52 U
63			BS 50	52 U
70			BS/PS 63	52 U
80			BS/PS 80	52 U
100			BS/PS 100K/100	52 U
125			BS/PS 125	52 U
200			BS/PS 200	52 U
400			BS/PS 400	52 U
630			BS/PS 630	52 U
3 - poles - 3 elements (6 elements for BS 400; 9 elements for BS 630)				
20			BS/PS 10	53 U
25			BS/PS 20	53 U
32			BS/PS 25	53 U
40			BS/PS 32	53 U
50			BS/PS 40	53 U
63			BS 50	53 U
70			BS/PS 63	53 U
80			BS/PS 80	53 U
100			BS/PS 100K/100	53 U
125			BS/PS 125	53 U
200	BS/PS 200	53 U		
400	BS/PS 400	53 U		
630	BS/PS 630	53 U		
4 - poles - 4 elements				
20			BS/PS 10	75 U
25			BS/PS 20	75 U
32			BS/PS 25	75 U
40			BS/PS 32	75 U
50			BS/PS 40	75 U
63			BS 50	75 U
70			BS/PS 63	75 U
80			BS/PS 80	75 U
100			BS/PS 100K/100	75 U

ROTARY CAM SWITCHES type BS

Features

- In conformity with: IEC 60947-1, IEC 60947-3
- **Motor switching AC 3/ AC 23**
- High making and breaking capacities

Selection and ordering data

Rated thermal current I _{th} A	DIAGRAM	Printed plate	Type	No. of diagram		
Changeover switches without zero position						
1 - pole - 1 element						
20			BS/PS 10	54 U		
25			BS/PS 20	54 U		
32			BS/PS 25	54 U		
40			BS/PS 32	54 U		
50			BS/PS 40	54 U		
63			BS 50	54 U		
70			BS/PS 63	54 U		
80			BS/PS 80	54 U		
100			BS/PS 100K/100	54 U		
2 - poles - 2 elements						
20			BS/PS 10	55 U		
25			BS/PS 20	55 U		
32			BS/PS 25	55 U		
40			BS/PS 32	55 U		
50			BS/PS 40	55 U		
63			BS 50	55 U		
70			BS/PS 63	55 U		
80			BS/PS 80	55 U		
100			BS/PS 100K/100	55 U		
3-poles - 3 elements						
20					BS/PS 10	56 U
25					BS/PS 20	56 U
32					BS/PS 25	56 U
40					BS/PS 32	56 U
50	BS/PS 40	56 U				
63	BS 50	56 U				
70	BS/PS 63	56 U				
80	BS/PS 80	56 U				
100	BS/PS 100K/100	56 U				
4 - poles - 4 elements						
20			BS/PS 10	69 U		
25			BS/PS 20	69 U		
32			BS/PS 25	69 U		
40			BS/PS 32	69 U		
50			BS/PS 40	69 U		
63			BS 50	69 U		
70			BS/PS 63	69 U		
80			BS/PS 80	69 U		
100			BS/PS 100K/100	69 U		

ROTARY CAM SWITCHES type BS

Features

- In conformity with: IEC 60947-1, IEC 60947-3
- **Motor switching AC 3/ AC 23**
- High making and breaking capacities

Selection and ordering data

Rated thermal current I _{th} A	DIAGRAM	Printed plate	Type	No. of diagram
Motor switches				
3 - pole reversing switches - 3 elements				
20			BS/PS 10	11 U
25			BS/PS 20	11 U
32			BS/PS 25	11 U
40			BS/PS 32	11 U
50			BS/PS 40	11 U
63			BS	50 11 U
70			BS/PS 63	11 U
80			BS/PS 80	11 U
100			BS/PS 100K/100	11 U
125			BS/PS 125	11 U
200	BS/PS 200	11 U		
Motor switch with Dahlander - 4 elements				
20			BS/PS 10	13 U
25			BS/PS 20	13 U
32			BS/PS 25	13 U
40			BS/PS 32	13 U
50			BS/PS 40	13 U
63			BS	50 13 U
70			BS/PS 63	13 U
80			BS/PS 80	13 U
100			BS/PS 100K/100	13 U
Star-delta switch - 4 elements				
20			BS/PS 10	12 U
25			BS/PS 20	12 U
32			BS/PS 25	12 U
40			BS/PS 32	12 U
50			BS/PS 40	12 U
63			BS	50 12 U
70			BS/PS 63	12 U
80			BS/PS 80	12 U
100			BS/PS 100K/100	12 U
Motor switches				
3-pole reversing switches, return to "0" -3 elements				
20			BS/PS 10	26 U
25			BS/PS 20	26 U
32			BS/PS 25	26 U
40			BS/PS 32	26 U
50			BS/PS 40	26 U

3



ROTARY CAM SWITCHES type BS

Features

- In conformity with: IEC 60947-1, IEC 60947-3
- **Motor switching AC 3/ AC 23**
- High making and breaking capacities

Selection and ordering data

Rated thermal current I _{th} A	DIAGRAM	Printed plate	Type	No. of diagram		
Motor switch with Dahlander - 4 elements						
20			BS/PS 10	19 U		
25			BS/PS 20	19 U		
32			BS/PS 25	19 U		
40			BS/PS 32	19 U		
50			BS/PS 40	19 U		
63			BS	50 19 U		
70			BS/PS 63	19 U		
80			BS/PS 80	19 U		
100			BS/PS 100K/100	19 U		
Motor switch with Dahlander - 6 elements						
20			BS/PS 10	20 U		
25			BS/PS 20	20 U		
32			BS/PS 25	20 U		
40			BS/PS 32	20 U		
50			BS/PS 40	20 U		
100			BS/PS 100K/100	20 U		
Switch for single - phase motors - 2 elements						
20			BS/PS 10	15 U		
25			BS/PS 20	15 U		
32			BS/PS 25	15 U		
40			BS/PS 32	15 U		
50			BS	50 15 U		
70			BS/PS 63	15 U		
80			BS/PS 80	15 U		
100			BS/PS 100K/100	15 U		
Switch to control contactors - 1 element						
20					BS/PS 10	207 U
25	BS/PS 20	207 U				
32	BS/PS 25	207 U				
40	BS/PS 32	207 U				
50	BS/PS 40	207 U				

3



ROTARY CAM SWITCHES type BS

Selection and ordering data

Rated thermal current I _{th} A	DIAGRAM	Printed plate	Type	No. of diagram
Voltmeter change over switches To measure phase voltages L1-N, L2-N, L3-N - 2 elements				
20			BS/PS 10	68 U
25			BS/PS 20	68 U
32			BS/PS 25	68 U
40			BS/PS 32	68 U
50			BS/PS 40	68 U
To measure line voltages L1-L2/L2-L3/L3-L1 - 2 elements				
20			BS/PS 10	67 U
25			BS/PS 20	67 U
32			BS/PS 25	67 U
40			BS/PS 32	67 U
50			BS/PS 40	67 U
To measure phase and line voltages - 3 elements				
20			BS/PS 10	66 U
25			BS/PS 20	66 U
32			BS/PS 25	66 U
40			BS/PS 32	66 U
50			BS/PS 40	66 U
To measure 1phase and 3 line voltages - 3 elements				
20			BS/PS 10	60 U
25			BS/PS 20	60 U
32			BS/PS 25	60 U
40			BS/PS 32	60 U
50			BS/PS 40	60 U



ROTARY CAM SWITCHES type BS

Selection and ordering data

Rated thermal current I _{th} A	DIAGRAM	Printed plate	Type	No. of diagram
Ammeter change over switches With off position to measure current in 3-phases - 5 element				
20			BS/PS 10	97 U
25			BS/PS 20	97 U
32			BS/PS 25	97 U
40			BS/PS 32	97 U
50			BS/PS 40	97 U
With off position to measure current in 3-phases - 4 elements				
20			BS/PS 10	98 U
25			BS/PS 20	98 U
32			BS/PS 25	98 U
40			BS/PS 32	98 U
50			BS/PS 40	98 U



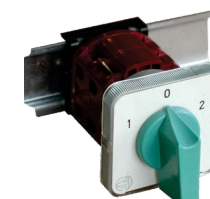
GENERAL EMERGENCY ON - OFF SWITCH VERSION "LK" WITH PADLOCKING ONLY IN "0"

- Emergency switch have to make electrical separation between el. supply and electrical equipment.
- Control handle according the Standards is Red, and the plate behind the handle is yellow .
- Emergency switch is able to lock in the open position "0" up to three padlocks.



BS / PS 10 10 LK (Three-pole)	BS / PS 10 92 LK (Four-pole)	BS / PS 80 10 LK (Three-pole)	BS / PS 80 92 LK (Four-pole)
BS 20 / PS 16 10 LK (Three-pole)	BS 20 / PS 16 92 LK (Four-pole)	BS 100K / PS 100 10 LK (Three-pole)	BS 100K / PS 100 92 LK (Four-pole)
BS / PS 25 10 LK (Three-pole)	BS / PS 25 92 LK (Four-pole)	BS / PS 125 10 LK (Three-pole)	BS / PS 125 92 LK (Four-pole)
BS / PS 32 10 LK (Three-pole)	BS / PS 32 92 LK (Four-pole)	BS / PS 200 10 LK (Three-pole)	BS / PS 200 92 LK (Four-pole)
BS / PS 40 10 LK (Three-pole)	BS / PS 40 92 LK (Four-pole)	BS / PS 400 10 LK (Three-pole)	BS / PS 400 92 LK (Four-pole)
BS 50 10 LK (Three-pole)	BS 50 92 LK (Four-pole)	BS / PS 630 10 LK (Three-pole)	BS / PS 630 92 LK (Four-pole)
BS / PS 63 10 LK (Three-pole)	BS / PS 63 92 LK (Four-pole)		

MOUNTING ON THE RAIL



BS / PS 10 .. L*
BS 20 / PS 16 .. L*
BS / PS 25 .. L*
BS / PS 32 .. L*

* Max. up to 4 elements



BS / PS 40 .. L*
BS / PS 63 .. L*

* Max. up to 3 elements



BS / PS 80 .. L*
BS / PS 100 .. L*

* Max. up to 2 elements



**"ES" - General emergency on - off switch
Sizes : BS/PS 10; ... ; BS 100K/PS 100
Color for front part:
ES - (handle-red and front plate-yellow)

ROTARY CAM SWITCHES WITH TITLE TYPE BS ...N

“BAYONET” ROTARY CAM SWITCHES type BSB

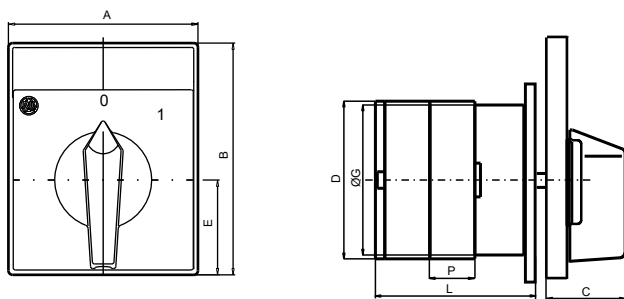
Selection and ordering data

Rated thermal current I _{th} A	Description	Type
20		BS 10 .. N
25		BS 20 .. N
32		BS 25 .. N
40		BS 32 .. N
50		BS 40 .. N
63		BS 50 .. N
70		BS 63 .. N
80		BS 80 .. N
100		BS 100K .. N

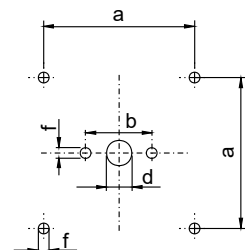
No. Of diagram are as the standard version of the model “BS”
 Front mounting “U”, Rear mounting “O”
 Extended front plate with title
 Standard colour - Black



DIMENSIONAL DRAWINGS (mm)



DRILLING PLATE



TYPE	MARKING					
	A	B	E	C	D	ØG
BS 10 .. N	48	60	24	26	38.6	38.6
BS 20 .. N	48	60	24	26	45.2	38.6
BS 25 .. N	65	80	32,5	33	53	38.6
BS 32 .. N	65	80	32,5	33	61	56.4
BS 40 .. N	65	80	32,5	33	68.6	56.4
BS 50 .. N	90	110	45	41	84	80
BS 63 .. N	90	110	45	41	84	80
BS 80 .. N	90	110	45	41	84	80
BS 100K .. N	90	110	45	41	84	80
BSB 20 ..N	48	60	24	26	38.6	38.6
BSB 25 ..N	48	60	24	26	45.2	38.6

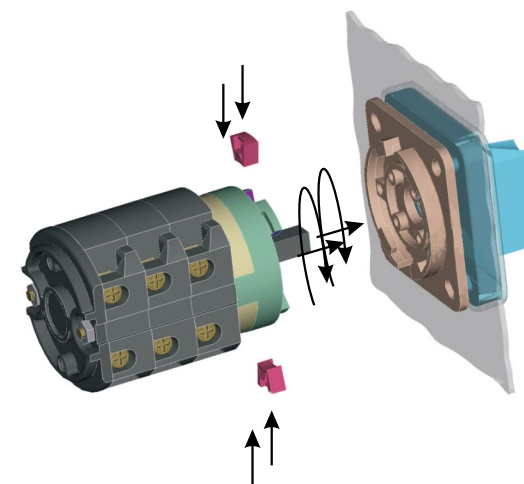
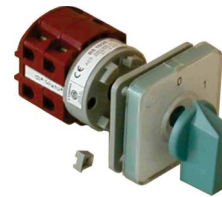
TYPE	a	b	d	f
BS 10 .. N	36	30	10	4.2
BS 20 .. N				
BS 25 .. N	48		10	4.2
BS 32 .. N				
BS 40 .. N	72		14	5.3
BS 50 .. N				
BS 63 .. N				
BS 80 .. N				
BS 100K .. N	36		10	4.2
BSB 20 .. N				
BSB 25 .. N				

NOTES:
 - 1. Technical date and drilling plan are same as the standard version of the model “BS”

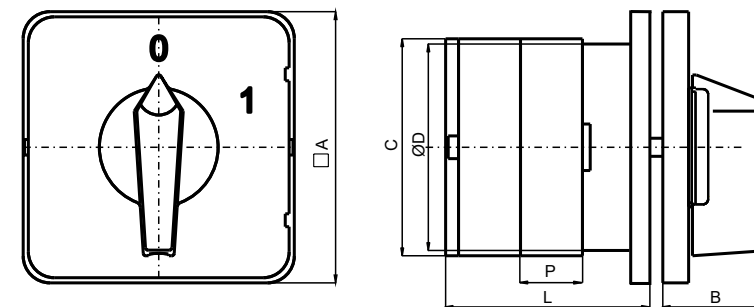
Selection and ordering data

Rated thermal current I _{th} A	Description	Type
20		BSB 10 .. .
25		BSB 20 .. .
32		BSB 25 .. .
40		BSB 32 .. .

No. of diagram are as the standard version of the model “BS”
 Mounting form - for front “U”
 Front part:
 P - (handle and front plate - blue)
 C - (handle and front plate - black)



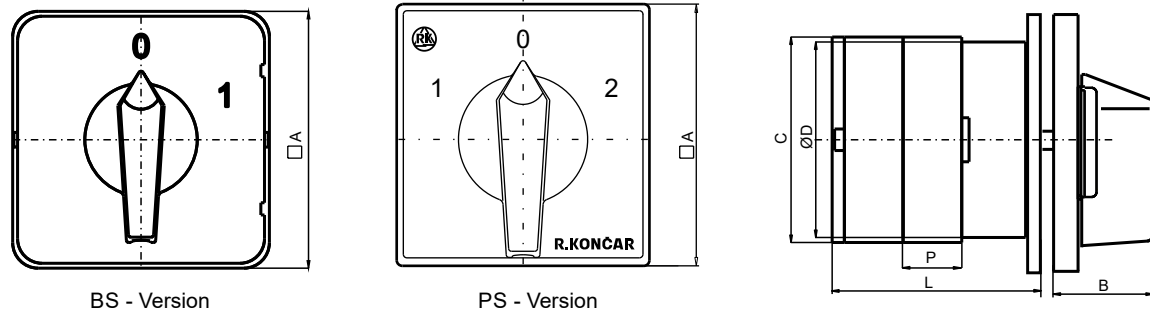
DIMENSIONAL DRAWINGS (mm)



TYPE	MARKING					NUMBER OF ELEMENTS (L/mm)											
	□A	B	C	ØD	P	1	2	3	4	5	6	7	8	9	10	11	12
BSB 10	51,2	27,2	38,6	38,6	12,8	39,5	52,3	65,1	77,9	90,7	103,5	116,3	129,1	141,9	154,7	167,5	180,3
BSB 20																	
BSB 25	51,2	27,2	45,2	38,6	12,8	39,5	52,3	65,1	77,9	90,7	103,5	116,3	129,1	141,9	154,7	167,5	180,3
BSB 32																	
	51,2	27,2	53	38,6	12,8	44	56,8	69,6	82,4	95,2	108	120,8	133,6	146,4	159,2	172	184,8

NOTES:
 1. Technical date and drilling plan are same as the standard version of the model “BS”
 2. The selection of the color for the front parts for “BS” is same as previous case for “BSB”

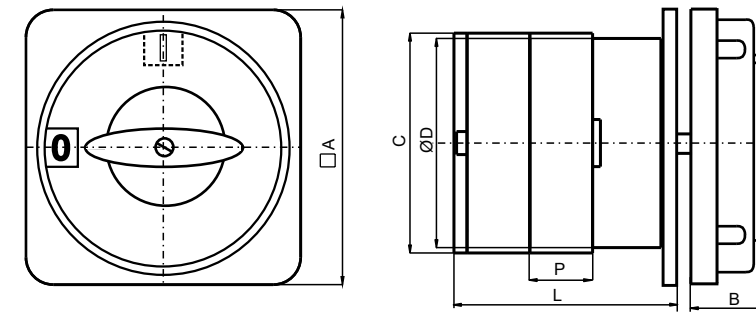
DIMENSIONAL DRAWINGS (mm)



TYPE	MARKING			NUMBER OF ELEMENTS (L/mm)																		
	□A	B	C	∅D	P	1	2	3	4	5	6	7	8	9	10	11	12					
BS / PS 10	51,2/48	27,2/26	38,6/	38,6	12,8	32,5	45,3	58,1	70,9	83,7	96,5	109,3	122,1	134,9	147,7	160,5	173,3					
BS 20 / PS 16			(45,2*)																			
BS / PS 25	51,2/48	27,2/26	45,2	38,6	12,8	32,5	45,3	58,1	70,9	83,7	96,5	109,3	122,1	134,9	147,7	160,5	173,3					
BS / PS 32	72 / 65	33	53	38,6	12,8	37	49,8	62,6	75,4	88,2	101	113,8	126,6	139,4	152,2	165	177,8					
BS / PS 40	72 / 65	33	61	56,4	17,5	50,6	68,1	85,6	103,1	120,6	138,1	155,6	173,1	190,6	208,1	225,6	243,1					
BS 50	72 / 90	33/41	68,6	56,4	20,5	42,5	63	83,5	104	124,5	145	165,5	186	206,5	227	247,5	268					
BS / PS 63																						
BS / PS 80	105 / 90	41	84	80	25	67,5	92,5	117,5	142,5	167,5	192,5	217,5	242,5	267,5	292,5	317,5	342,5					
BS 100K / PS 100																						
BS / PS 125	130	62	110	110	30	91	121	151	181													
BS / PS 200						39	100	139	178	217												
BS / PS 400						39	100	139	178	217	-	295										
BS / PS 630						39	-	139	178	-	256	295	-	-	412							

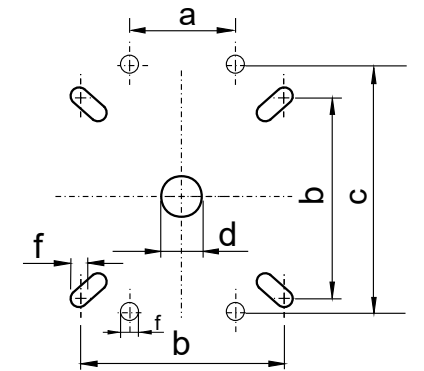
*for 3 and more elements (new)

DIMENSIONAL DRAWINGS VERSION "LK" (mm)



TYPE	□A	c	∅D	P	B	L/2	b	d	f	a	c
BS / PS 10 LK	49	38.6	38.6	12.8	35	45.3	36	10	3.2		
BS 10 / PS 16 LK	49	38.6	38.6	12.8	35	45.3	36	10	3.2		
BS / PS 25 LK	49	45.2	38.6	12.8	35	45.3	36	10	3.2		
BS / PS 32 LK	72	53	38.6	12.8	32	49.8	58	10	4.2		
BS / PS 40 LK	72	61	56.4	17.5	32	68.1	58	10	4.2		
BS 50 LK	72	68.6	56.4	20.5	32	63	58	10	4.2		
BS / PS 63 LK											
BS / PS 80 LK	105	84	80	25	44	92.5	85	14	5.3		
BS 100K / PS 100 LK											
BS / PS 125 LK	130	110	110	39	62	100	18	5.3	30	90	
BS / PS 200 LK											

DRILLING PLAN



3

3

FRONT MOUNTING "U"	DRILLING PLAN	TYPE	a	b	a1	b1	c	d	f
		BS / PS 10							
BS 20 / PS 16			32-39/				30	10	3.2
BS / PS 25			36						
BS / PS 32							30		3.2
BS / PS 40		58	48				45	10	4.2
BS 50									
BS / PS 63									
BS / PS 80		85	68-74/				40	14	5.3
BS 100K/PS 100			72						
BS / PS 125									
BS / PS 200				90	30		18	5.3	
BS / PS 400									
BS / PS 630									

FRONT MOUNTING "M"	DRILLING PLAN	TYPE	h	d	g
		BS 10			8
BS 20		13.5		10	
BS 25					
BS 32					
BS 40		16.2	10	4	
BS 50					
BS 63					
BS 80		20	14	4.5	
BS 100K					

REAR MOUNTING "O"	DRILLING PLAN	TYPE	a	b	f	k
		BS / PS 10				
BS 20 / PS 16		36	36	4.2	15.5	
BS / PS 25						
BS / PS 32						
BS / PS 40		58	48	4.5	17	
BS 50						
BS / PS 63		58	48	4.5		
BS / PS 80						
BS 100K/PS 100		85	68	5.3	20.5	

ORDER- ROTARY CAM SWITCHES

When ordering please define:

- 1.- Switch type
- 2.- Number of schematic diagram
- 3.- Mounting form (for front "U" or rear mounting "O")
- 4.- Front part:

- C - (handle and front plate - black) - standard.
- P - (handle and front plate - blue) - on request.
- N - Extended front plate with title. Standard color : black
- LK - (red knob and yellow plate for main emergency on - off switch).
- ES - (handle-red and front plate-yellow)

EXAMPLE: BS 25 10 U C

Type **BS 25**, schematic diagram **10**, mounting from front plate **U**, with **black** front plate **C**.

BS 40 10 N U

Type **BS 40**, schematic diagram **10**, **N**- Extended front plate with title, mounting from front plate **U**

PS 63 10 LK

Type - **PS 63**, schematic diagram - **10**, Main emergency on-off switch with 3 padlock facility in "0" position - **LK**

TECHNICAL DATA

SWITCH TYPE		BS 10 PS 10	BS 20 PS 16	BS 25 PS 25	BS 32 PS 32	BS 40 PS 40	BS 50	BS 63 PS 63			
Rated insulation voltage U _i	V	400			690						
Rated impulse withstand voltage U _{imp}	kV	4			6						
Rated thermal current I _{th}	A	20	25	32	40	50	63	70			
Main switch (1) Max. value of rated operational voltage	V	480									
Rated impulse withstand voltage	kV	4									
Max. fuse size for short circuit protection gL 10 kA	A	20	25	32	40	50	63	70 / 63			
Rated Short-time Withstand current I _{cw}	1 sek	A	200	250	400	600	800	800	800		
	3 sek	A	120	150	250	400	530	640	700		
	10 sek	A	70	80	140	240	290	320	350		
	30 sek	A	40	50	90	150	200	230	250		
	60 sek	A	30	40	70	120	150	150	150		
Rated operational current I _e AC1 / AC21	A	10	20	25	32	40	50	63			
Rated operational current I _e AC15	110 V	A	8	10	20	25	40	45	50		
	220/230 V	A	6	8	20	25	30	35	40		
	380/400 V	A	4	6	16	20	25	32	40		
	660/690 V	A	-	-	8	8,5	8.5	9	10		
Motor switch in utilization category AC3	3-phase	220/230 V	kW	2.5	3	5.5	7.5	9	10	11	
		380/400 V	kW	4	5	7.5	11	15	16	18.5	
	1-phase	110V	kW	-	-	11	15	19	20	22	
		2-poles	220/230 V	kW	0.8	0.8	1.5	2.5	2.5	3	3
	2-poles	220/230 V	kW	1.5	2.2	3	4.8	5.5	5.5	6	
		380/400 V	kW	2.2	3	5.5	6.5	7.5	9	11	
	AC23	3-phase	220/230 V	kW	3	5	6.5	8	9	10	15
			380/400 V	kW	6	7.5	11	15	18.5	20	22
1-phase		500/690 V	kW	-	-	11	18.5	22	25	30	
		110 V	kW	0.8	0.8	1.5	2.5	3	3	3.5	
2-poles	220/230 V	kW	1.7	2.5	3.7	5	6	7	9		
	380/400 V	kW	3	3.7	5.5	7.5	9	11	15		
AC4	3-phase	220/230 V	kW	1.5	1.5	2.5	3	5	5.5	6	
		380/400 V	kW	2	3	4	5.5	8	9	11	
	500/690 V	kW	-	-	4	7.5	8	9	11		
Mechanical endurance swit. cycles	10 ⁶	3	3	3	3	3	3	2			
Terminal screw		M3.5	M3.5	M3.5	M4	M5	M5	M5			
Screw head		PZ2	PZ2	PZ2	PZ2	PZ2	PZ2	PZ2			
Tightening torque		0.8	0.8	0.8	1.2	1.8	2	2			
Cable cross-section	rigid	mm ²	2x(1-2.5) 2-4*	2x(1-2.5) 2-4*	2x(1-4) 1-6*	2x(2,5-6) 1-10*	2x(2.5-10)	2x(4-16)	2x(4-16)		
	flexible	mm ²	2x(1-2.5) 2-4*	2x(1-2.5) 2-4*	2x(1-4)	2x(2,5-6) 1-10*	2x(2.5-10)	2x(4-16)	2x(4-16)		

(1) Valid for neutral earthed systems, overvoltage category III, pollution degree 3.
 (*) Only for diagrams without inside links.




TECHNICAL DATA

SWITCH TYPE		BS 80 PS 80	BS 100K PS 100	BS 125 PS 125	BS 200 PS 200	BS 400 PS 400	BS 630 PS 630	
Rated insulation voltage U _i	V	690			690			
Rated impulse withstand voltage U _{imp}	kV	6			8			
Rated thermal current I _{th}	A	80	100	125	200	400	630	
Main switch (1) Max. value of rated operational voltage	V	480			690			
Rated impulse withstand voltage	kV	4			6			
Max. fuse size for short circuit protection gL 10 kA	A	80	100	125	200	400	630	
Rated Short-time Withstand current I _{cw}	1 sek	A	1000	1800	2100	3000	-	-
	3 sek	A	800	900	1300	1700	-	-
	10 sek	A	400	450	700	850	-	-
	30 sek	A	250	300	400	500	-	-
	60 sek	A	160	200	300	400	-	-
	Rated operational current I _e AC1 / AC21	A	70	75	120	200	400	630
Motor switch in utilization category AC3/AC23	3- Phase	220/230 V	kW	12/18.5	19/22	26	37	37
		380/400 V	kW	22/32	32/37	41	60	60
		500/690 V	kW	28/45	42/55	55	75	75
	1-phase 2 poles	110V	kW	-	-	-	-	-
		220/230V	kW	-	-	-	-	-
		380/400 V	kW	-	-	-	-	-
Motor switch in utilization category AC4	3-phase	220/230 V	kW	7	9.5	17	17	-
		380/400 V	kW	12	16	30	30	-
		500/690 V	kW	12	16	32	32	-
Mechanical endurance switching cycles		2x10 ⁶	2x10 ⁶	3x10 ⁵	1x10 ⁵	5x10 ⁴	5x10 ⁴	
Terminal screw		2xM5	2xM5	M8	M10	M12	M16	
Cable cross-section	flexible	mm ²	6-25 2x(6-16)	6-25 2x(6-16)	16-35	70-95 ²	70-240	
	Flat connection	mm					△ △	

(1) Valid for neutral earthed systems, overvoltage category III, pollution degree 3.
² Connections valid for lugs with cables having a section; min. 70 mm², max. 95 mm².
 △ Connection valid to connect copper bars.

ROTARY CAM SWITCHES IN INSULATED ENCLOSURES




Selection and ordering data

	Degree of protection	Type
 PNBS 10, PNBS 20, PNBS 25 PNPS 10, PNPS 16, PNPS 25	IP 65	PNBS 10 / PNPS 10 .. . PNBS 20 / PNPS 16 .. . PNBS 25 / PNPS 25* .. . No. of diagram - (90, 91, 10, 92, 51, 52, 53, 54, 55, 56, 11, 26, 15) Front parts P - (handle and front plate of rotary cam switches - blue) C - (handle and front plate of rotary cam switches - black)
 PNGBS 25, PNGBS 32, PNGBS 40 PNGPS 25, PNGPS 32, PNGPS 40	IP 65	PNGBS 25 .. . PNGBS 32 .. . PNGBS 40 .. . PNGPS 25 .. . PNGPS 32 .. . PNGPS 40 .. . PNGBS 25 .. LK PNGBS 32 .. LK PNGBS 40 .. LK PNGPS 25 .. LK PNGPS 32 .. LK PNGPS 40 .. LK No. of diagram for PNGBS/PNGPS 25 - (90, 91, 10, 92, 51, 52, 53, 54, 55, 56, 11, 26, 15) No. of diagram for PNGBS/PNGPS 32 - (90, 91, 10, 92, 51, 52, 53, 54, 55, 56, 11, 26, 15) No. of diagram for PNGBS/PNGPS 40 - (90, 91, 10, 92, 51, 52, 54, 55) Front parts P - (handle and front plate of rotary cam switches - blue) C - (handle and front plate of rotary cam switches - black)
 PN1BS 10, PNGBS 20, PNGBS 25 PN1PS 10, PN1PS 16, PN1PS 25	IP 55	PN1BS 10 .. . PN1BS 20 .. . PN1BS 25 .. . PN1PS 10 .. . PN1PS 16 .. . PN1PS 25 .. . No. of diagram - (12, 13, 75, 69, 19, 97, 98) Front parts P - (handle and front plate of rotary cam switches - blue) C - (handle and front plate of rotary cam switches - black)

NOTES:
 Color of enclosures ist grey (RAL 7035)
 * Only with conection cable up to 2.5 mm²

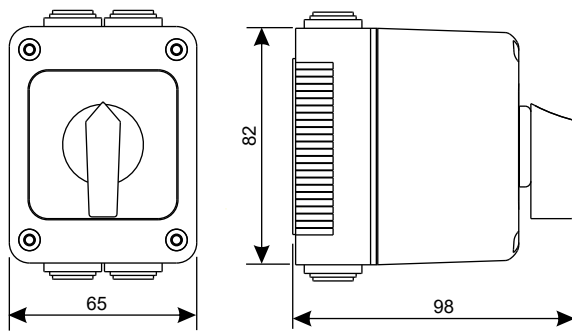
ROTARY CAM SWITCHES IN INSULATED ENCLOSURES

Selection and ordering data

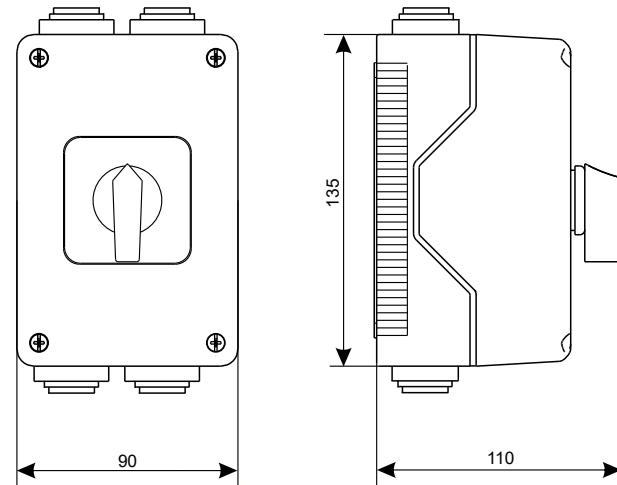
	Degree of protection	Type
 PN2BS 32, PN2BS 40, PN2BS 50, PN2BS 63 PN2PS 32, PN2PS 40, PN2PS 63	IP 55	PN2BS 32 .. . PN2BS 40 .. . PN2BS 50 .. . PN2BS 63 .. . PN2PS 32 .. . PN2PS 40 .. . PN2PS 63 .. . No. of diagram for PN2BS / PN2PS 32 - (75, 69, 13, 12, 19, 97, 98) No. of diagram for PN2BS / PN2PS 40 - (53, 75, 56, 69, 11, 13, 12, 26, 19, 97, 98) No. of diagram for PN2BS 50 / PN2BS 63 / PN2PS 63 - (90, 91, 10, 92, 51, 52, 53, 75, 54, 55, 56, 69, 11, 13, 12, 26, 19, 15, 207, 98) Front parts P - (handle and front plate of rotary cam switches - blue) C - (handle and front plate of rotary cam switches - black)
 PN3BS 80, PN3BS 100K PN3PS 80, PN3PS 100	IP 54	PN3BS 80 .. . PN3BS 100K .. . PN3PS 80 .. . PN3PS 100 .. . No. of diagram - (90, 91, 10, 92, 51, 52, 53, 54, 55, 56, 11, 26, 15,) Front parts P - (handle and front plate of rotary cam switches - blue) C - (handle and front plate of rotary cam switches - black)
 PN4BS 80, PN4BS 100K PN4BS 125, PN4BS 200 PN4PS 80, PN4PS 100 PN4PS 125, PN4PS 200	IP 54	PN4BS 80 .. . PN4BS 100K .. . PN4BS 125 .. . PN4BS 200 .. . PN4PS 80 .. . PN4PS 100 .. . PN4PS 125 .. . PN4PS 200 .. . No. of diagram for PN4BS 80, 100K / PN4PS 80, 100 - (12, 13, 19, 75, 98) No. of diagram for PN4BS / PN4PS 125 - (10, 11, 51, 52, 53, 54, 55, 56, 92) No. of diagram for PN4BS / PN4PS 200 - (10, 51, 52, 54, 55, 92) Front parts P - (handle and front plate of rotary cam switches - blue) C - (handle and front plate of rotary cam switches - black)

DIMENSION DRAWINGS (mm)

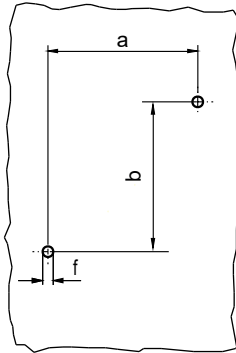
PNBS 10, 20, 25 / PNPS 10, 16, 25



PNGBS 25, 32, 40 / PNGPS 25, 32, 40



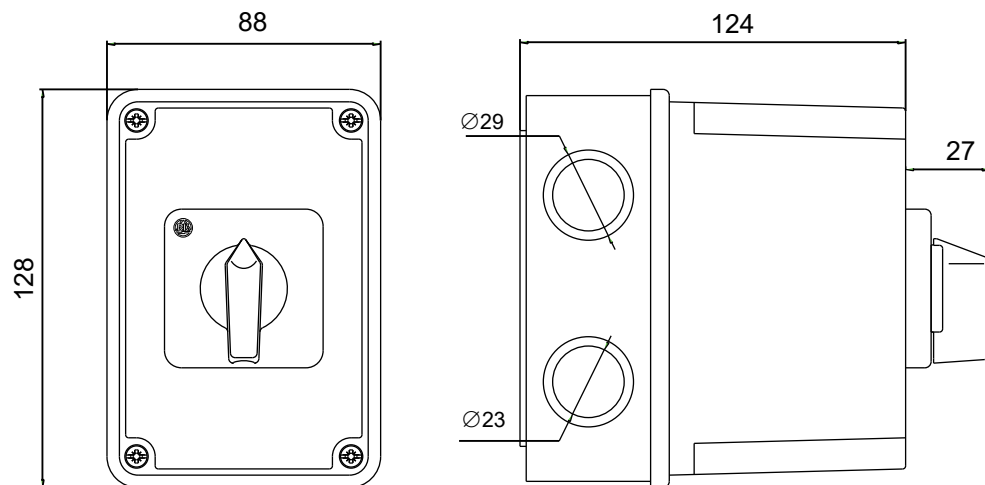
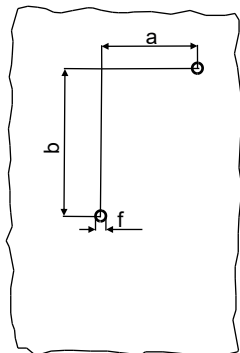
DRILLING PLAN



TYPE/	a	b	f
PNBS 10, 20 / PNPS 10, 16 PNBS 25 / PNPS 25	44	48	4,3
PNGBS 25 / PNGPS 25 PNGBS 32 / PNGPS 32 (LK) PNGBS 40 / PNGPS 40 (LK)	48	100	4,3

PN1BS 10, 20, 25 / PN1PS 10, 16, 25

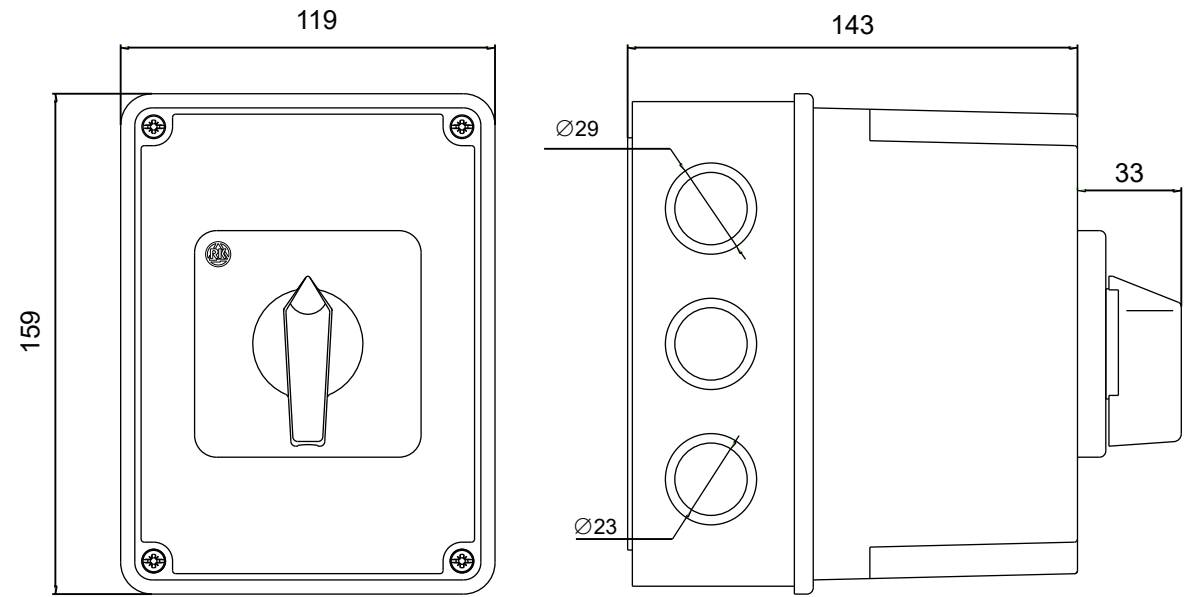
DRILLING PLAN



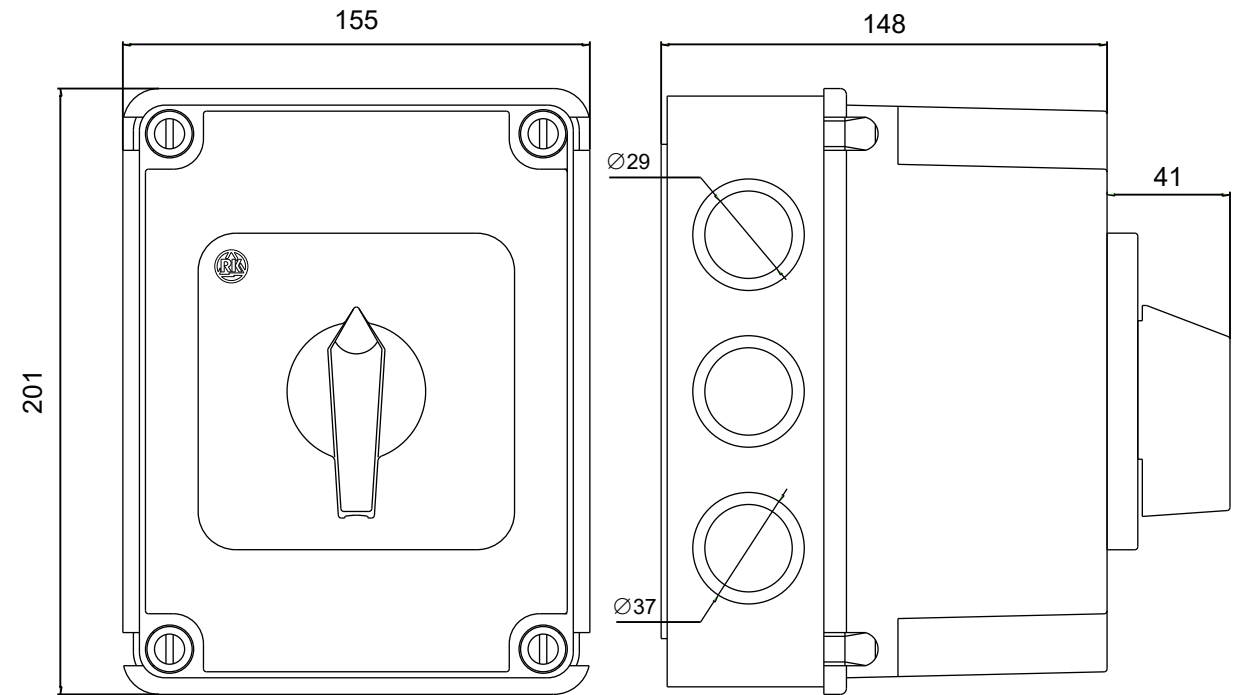
TYPE	a	b	f
PN1BS 10 / PN1PS 10 PN1BS 20 / PN1PS 16 PN1BS 25 / PN1PS 25	42	82	4,3

DIMENSION DRAWINGS (mm)

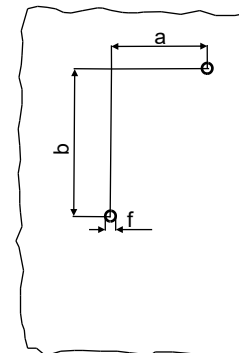
**PN2BS 32 , PN2BS 40 , PN2BS 50 , PN2BS 63
PN2PS 32 , PN2PS 40 , PN2PS 63**



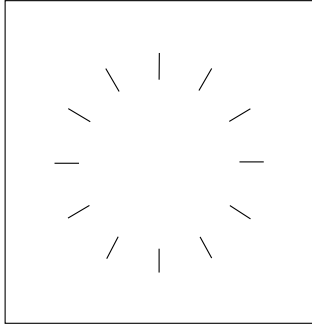
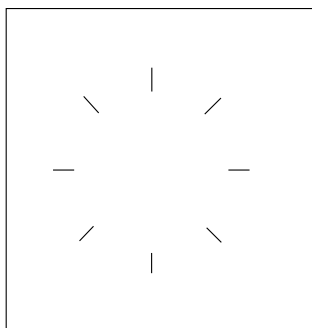
**PN3BS 80 , PN3BS 100K ,
PN3PS 80 , PN3PS 100 ,**



DRILLING PLAN



TYPE	a	b	f
PN2BS/PN2PS 32 PN2BS/PN2PS 40 PN2BS 50 PN2BS/PN2PS 63	72	112	4,5
PN3BS/ PN3PS 80 PN3BS 100K/ PN3PS 100	98	144	4,5

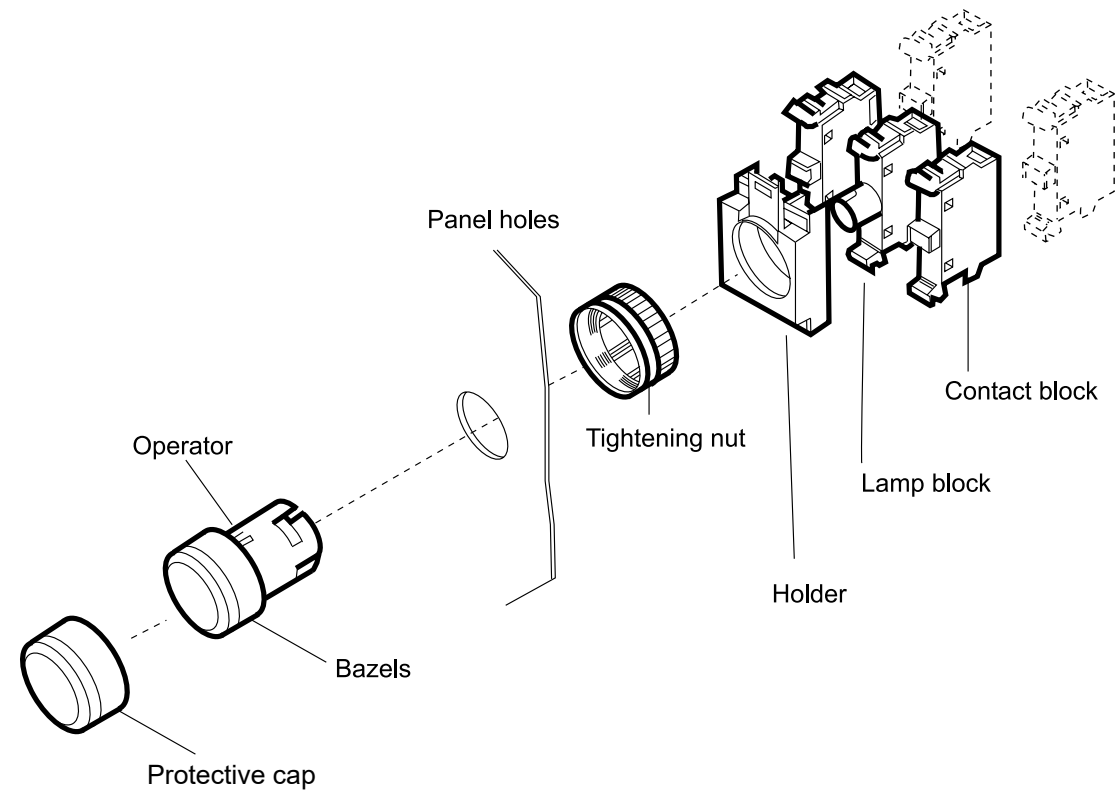
RADE KONČAR KONTAKTORI I RELEI D.O.O.		ORDER FORM																																																																											
Rated voltage	V ~ V =	Type of switch	BS or PS	Mounting form		Diagram No.																																																																							
Rated current	A	Utilization category				Special version S																																																																							
Connection diagram		Connection diagram																																																																											
		<table border="1"> <tr> <td>1</td><td>4</td><td>5</td><td>8</td><td>9</td><td>12</td><td>13</td><td>16</td><td>17</td><td>20</td><td>21</td><td>24</td><td>25</td><td>28</td><td>29</td><td>32</td><td>33</td><td>36</td><td>37</td><td>40</td><td>41</td><td>44</td><td>45</td><td>48</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>2</td><td>3</td><td>6</td><td>7</td><td>10</td><td>11</td><td>14</td><td>15</td><td>18</td><td>19</td><td>22</td><td>23</td><td>26</td><td>27</td><td>30</td><td>31</td><td>34</td><td>35</td><td>38</td><td>39</td><td>42</td><td>43</td><td>46</td><td>47</td> </tr> </table>					1	4	5	8	9	12	13	16	17	20	21	24	25	28	29	32	33	36	37	40	41	44	45	48																									2	3	6	7	10	11	14	15	18	19	22	23	26	27	30	31	34	35	38	39	42	43	46
1	4	5	8	9	12	13	16	17	20	21	24	25	28	29	32	33	36	37	40	41	44	45	48																																																						
2	3	6	7	10	11	14	15	18	19	22	23	26	27	30	31	34	35	38	39	42	43	46	47																																																						
Arrangement of position marks on front plate																																																																													
Note:		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>																																																						
		Contact closed	Contact closed no break	Contact closed with break	Contact switching	Through contact	Independent return contact 30° max.																																																																						
RADE KONČAR KONTAKTORI I RELEI D.O.O.	Puchaser _____ Address _____ Telephone _____ Fax _____ Data _____																																																																												

PUSHBUTTONS AND INDICATOR LIGHTS

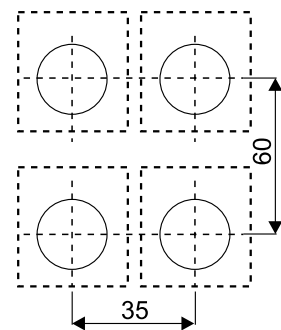
Pushbuttons, non-illuminated PB 22-1-	4/1
Pushbuttons, non-illuminated PB 22-2-	4/1
Mushroom Pushbuttons PB 22-4-	4/1
Toggle switches PB 22-6-	4/2
Pushbuttons, illuminated PB 22-8-	4/2
Pilot lights and buzzer PB 22-31	4/2
Selector switches, non-illuminated PB 22-11-	4/2
Selector switches, non-illuminated PB 22-13-	4/3
Selector switches, non-illuminated PB 22-12-	4/3
Selector switches, non-illuminated PB 22-16-	4/3
Selector switches, illuminated PB 22-25-	4/3
Selector switches, illuminated PB 22-14-	4/3
Selector switches, illuminated PB 22-26 -	4/3
Selector switches, illuminated PB 22-17-	4/3
Selector switches, illuminated PB 22-24-	4/3
Double pushbuttons, illuminated PB 22-42-	4/4
Double pushbuttons, non-illuminated PB 22-41-	4/4
Elements which are delivered separatly	4/4
Technical data	4/5
Dimenzional drawings	4/6
Pushbutton in insulated enclosures type PNPB	4/7

MOUNTING INSTRUCTION

4



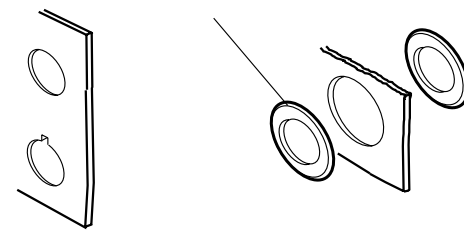
Panel holes



∅ 22.5

∅ 30.5

Hole adapter






PUSHBUTTONS 22 mm DIAMETER

Features

- 22 mm mounting diameter
- Adaptable design with actuators for any control function

Selection and ordering data


Pushbuttons, non-illuminated			complete	
Design	button color	included blocks	Part No.	
Flat pushbuttons 	red	1NC	PB 22-1-01R	
	green	1NO	PB 22-1-10G	
	yellow	1NO	PB 22-1-10Y	
	blue	1NO	PB 22-1-10BL	
	black	1NO	PB 22-1-10B	
	white	1NO	PB 22-1-10W	
	red	1NO+1NC	PB 22-1-11R	
	green	1NO+1NC	PB 22-1-11G	
	yellow	1NO+1NC	PB 22-1-11Y	
	blue	1NO+1NC	PB 22-1-11BL	
	black	1NO+1NC	PB 22-1-11B	
	white	1NO+1NC	PB 22-1-11W	
	Pushbuttons, non-illuminated			complete
	Flat pushbuttons 	red	1NC	PB 22-2-01R
green		1NO	PB 22-2-10G	
yellow		1NO	PB 22-2-10Y	
blue		1NO	PB 22-2-10BL	
black		1NO	PB 22-2-10B	
white		1NO	PB 22-2-10W	
red		1NO+1NC	PB 22-2-11R	
green		1NO+1NC	PB 22-2-11G	
yellow		1NO+1NC	PB 22-2-11Y	
blue		1NO+1NC	PB 22-2-11BL	
black		1NO+1NC	PB 22-2-11B	
white		1NO+1NC	PB 22-2-11W	
Mushroom pushbuttons			complete	
		red	1NO	PB 22-4-10
	2NO		PB 22-4-20	
	1NC		PB 22-4-01	
	1NO+1NC		PB 22-4-11	
	3NO		PB 22-4-30	
	1NO+2NC		PB 22-4-12	
	3NC		PB 22-4-03	
	2NO+1NC		PB 22-4-21	
2NC	PB 22-4-02			

4


PUSHBUTTON AND INDICATOR LIGHTS 22 mm DIAMETER

Selection and ordering data


Toggle switches complete

Design	button color	included blocks	Part No.	
	Maintained	red	1NO	PB 22-6-10R
	green	1NO	PB 22-6-10G	
	red	1NC	PB 22-6-01R	
	green	1NC	PB 22-6-01G	
	red	1NO+1NC	PB 22-6-11R	
	green	1NO+1NC	PB 22-6-11G	
	red	1NO+2NC	PB 22-6-12R	
	green	1NO+2NC	PB 22-6-12G	
	red	2NO+1NC	PB 22-6-21R	
	green	2NO+1NC	PB 22-6-21G	
	red	3NO	PB 22-6-30R	
	green	3NO	PB 22-6-30G	

Pushbuttons-illuminated complete


Design	button color	included blocks	Part No.	
	Flat pushbuttons	red	1NO	PB 22-8-10R
	green	1NO	PB 22-8-10G	
	yellow	1NO	PB 22-8-10Y	
	blue	1NO	PB 22-8-10BL	
	black	1NO	PB 22-8-10B	
	white	1N	PB 22-8-10W	
	red	1NO+1NC	PB 22-8-11R	
	green	1NO+1NC	PB 22-8-11G	
	yellow	1NO+1NC	PB 22-8-11Y	
	blue	1NO+1NC	PB 22-8-11BL	
	black	1NO+1NC	PB 22-8-11B	
	white	1NO+1NC	PB 22-8-11W	

Pilot lights and buzzer complete

Design	button color	included blocks	Part No.
	red	24V 2W X1 ⊗ X2	PB 22-31-00R
	green		PB 22-31-00G
	yellow		PB 22-31-00Y
	blue		PB 22-31-00B
	white		PB 22-31-00W
	clear		PB 22-31-00C

Can be produced with lampes BA 9s-24V - 2W


Selector switches, non-illuminated complete

Design	button color	included blocks	Part No.	
	Two position momentary, spring return from C to B	black	1NO	PB 22-11-10
			2NO	PB 22-11-20
			1NC	PB 22-11-01
			1NO+1NC	PB 22-11-11
			3NO	PB 22-11-30


PILOT DEVICES 22 mm DIAMETER

Selection and ordering data

Selector switches, non-illuminated complete

Design	button color	included blocks	Part No.	
	Two position maintained	black	1NO	PB 22-13-10
			2NO	PB 22-13-20
			1NC	PB 22-13-01
			1NO+1NC	PB 22-13-11
			3NO	PB 22-13-30
Three position momentary, spring return from A to B and C to B	black	2NO	PB 22-12-20	
		1NO+1NC	PB 22-12-11	
		2NC	PB 22-12-02	
Three position maintained	black	2NO	PB 22-16-20	
		1NO+1NC	PB 22-16-11	
		2NC	PB 22-16-02	
		2NO+1NC	PB 22-16-21	
		1NO+2NC	PB 22-16-12	

Selector switches, illuminated complete

Design	button color	included blocks	Part No.	
	Two position momentary, spring return from C to B	red	1NO+1LB	PB 22-25-10
			2NO+1LB	PB 22-25-20
			1NC+1LB	PB 22-25-01
			1NO+1NC+1LB	PB 22-25-11
Two position maintained	red	1NO+1LB	PB 22-14-10	
		2NO+1LB	PB 22-14-20	
		1NC+1LB	PB 22-14-01	
		1NO+1NC+1LB	PB 22-14-11	
Three position momentary, spring return from A to B and C to B	red	2NO+1LB	PB 22-26-20	
		1NO+1NC+1LB	PB 22-26-11	
		2NC+1LB	PB 22-26-02	
Three position maintained	red	2NO+1LB	PB 22-17-20	
		1NO+1NC+1LB	PB 22-17-11	
		2NC+1LB	PB 22-17-02	
Three position momentary, spring return from C to B and maintained A	red	2NO+1LB	PB 22-24-20	
		1NO+1NC+1LB	PB 22-24-11	
		2NC+1LB	PB 22-24-02	


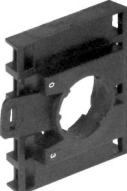


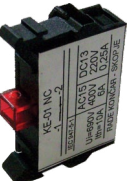


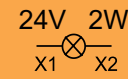

PILOT DEVICES 22 mm DIAMETER

Selection and ordering data

Double pushbuttons, illuminated			complete
Design	button color	included blocks	Part No.
MainLower button inscription 0/1	red/green	1NO+1NC+1LB	PB 22-42-11R
	red/green	1NO+1NC+1LB	PB 22-42-11R-T


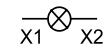
Double pushbuttons, non-illuminated			complete
Design	button color	included blocks	Part No.
Lower button inscription 0/1	red/green	1NO+1NC	PB 22-41-11GR
	red/green	1NO+1NC	PB 22-41-11GR-Tx

Elements which are delivered separately

		Part No.
	Holder	C E - 3 S57057
	Holder	CE - 5 S57145
	Contact block	KE 10 NO  S57061
	Contact block	KE 01 NC  S57060
	Lamp block*	PF-VA 9S  S57078
	Transparent protective cap	TPC - PB 22-1 320317

*Can be produced with lampes BA 9s-24V - 2W

Selection and ordering data

Pilot lights		complete	
	color	Part No.	
	red	PFN - LED1 or LED2 	PBN 22-31-00R
	green		PBN 22-31-00G
	yellow		PBN 22-31-00Y
	blue		PBN 22-31-00B
	white		PBN 22-31-00W

Illumination block-LED

PFN - LED1 12-30V AC/DC (5-15mA)-white
PFN - LED2 110-230V AC/DC (2-5mA)-white

TECHNICAL DATA

Mechanical life

pushbuttons	1 million operations
selector switches	0.5 million operations
toggle switches	0.3 million operations
mushroom pushbuttons	0.5 million operations
double pushbuttons	1 million operations

Lamp block

rated installation voltage	230V
base	BA9s
max.permmissible power	2W

Temperature

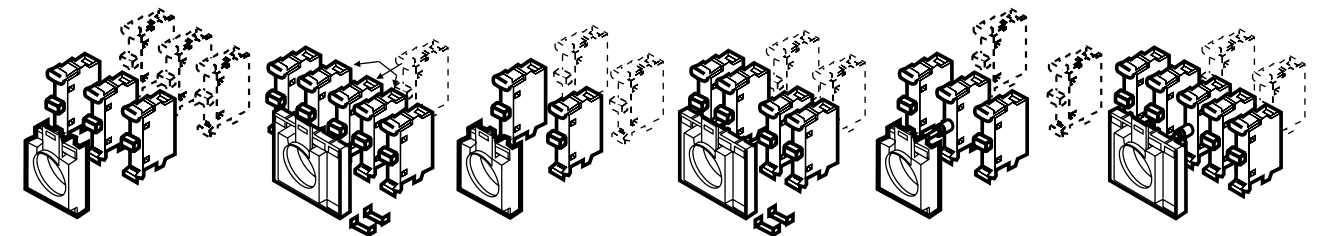
ambient temperature during operation	-25° to +40°C
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Terminals

connectable area	min. 1 x 0.5mm ²
max	2 x 2.5mm ²
recommended torque	0.9Nm

Contact blocks

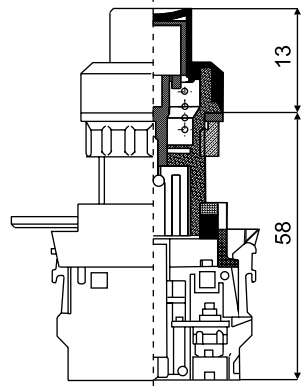
mechanical endurance	0.5 million operation
rated insulation voltage	690V
rated thermal current	10A
rated operational current, I _e	AC15 400V I _e = 6A
utilization category	DC13 220V I _e =0.25A



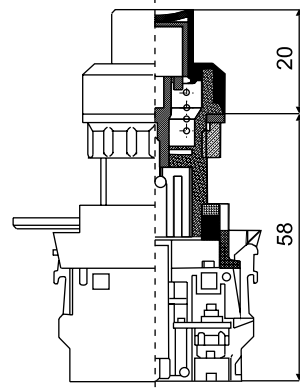
Buttons type PB 22 IEC 60529; IEC 60947-5-1

- Non- standard schemes can be produced on request of the clients.

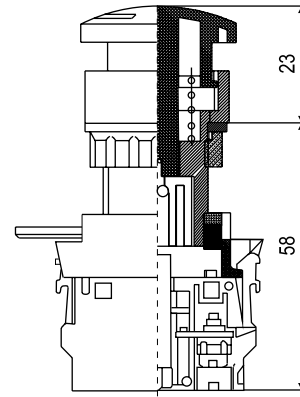
DIMENSIONS DRAWINGS in mm



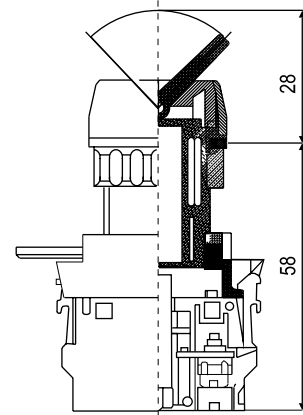
PB 22-1-



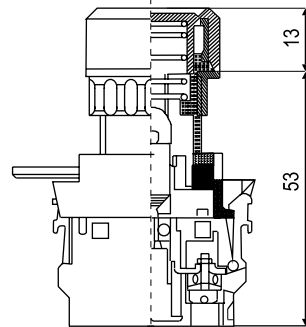
PB 22-2-



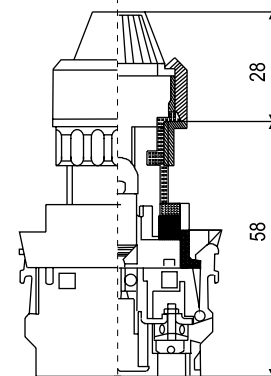
PB 22-4-



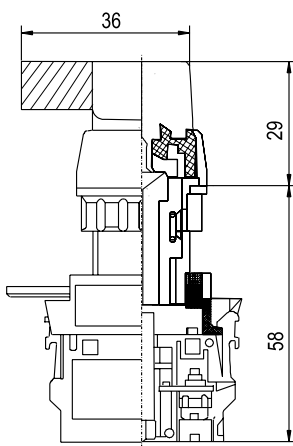
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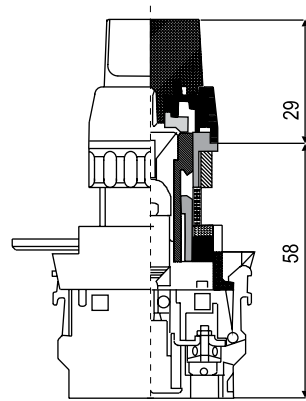
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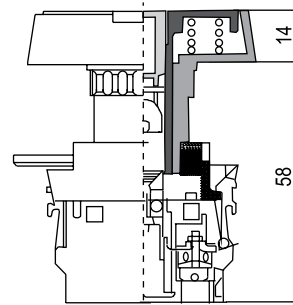
PB 22-31-



**PB 22-11-
PB 22-13-
PB 22-12-
PB 22-16-**



**PB 22-25-
PB 22-14-
PB 22-26-
PB 22-17-
PB 22-24-**



**PB 22-42-
PB 22-41-**

PUSHBUTTON IN INSULATED ENCLOSURES TYPE PNPB

Selection and ordering data



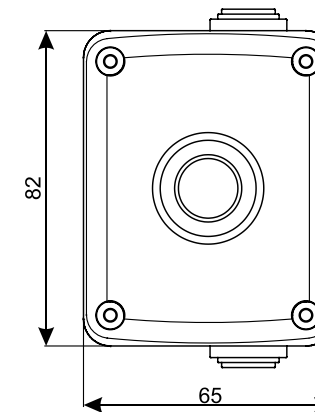
PNPB 22..

	IP 65	PNPB 22
Code: 1, 2, 4, 6, 8, 11, 12, 13, 14, 16, 17, 24, 25, 26, 41, 42		
Red - R, Green-G, Yellow-Y, Blue-BI, White-W, Black-B, Clear-C		

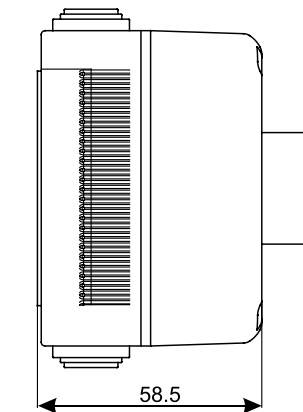
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4

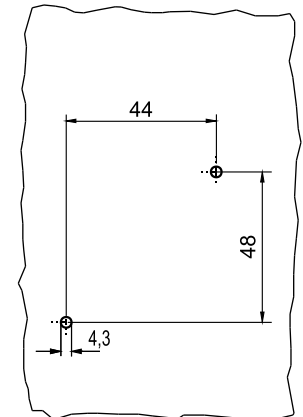
DIMENSION DRAWINGS (mm)



PNPB 22..



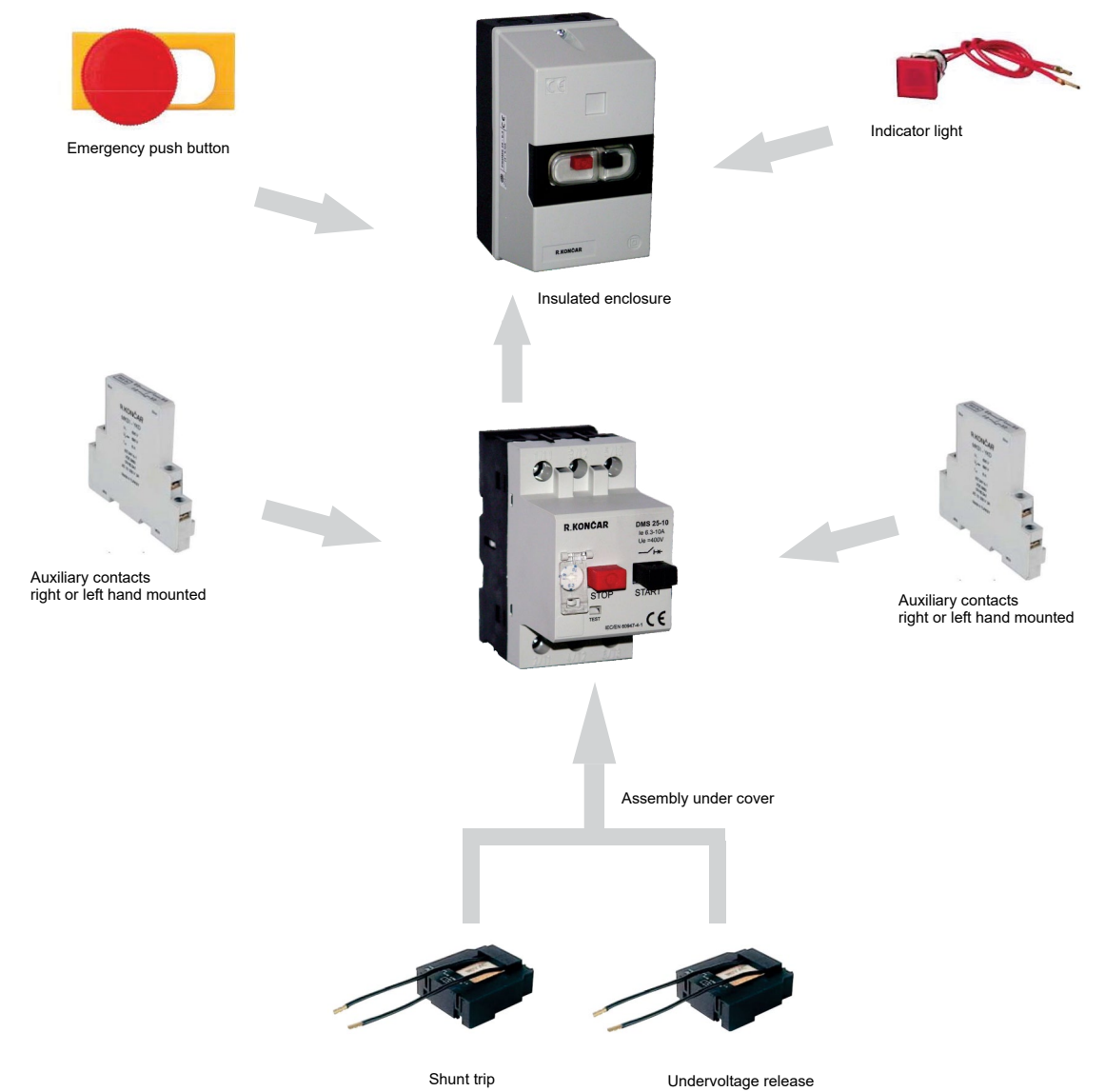
DRILLING PLAN



NOTES:
Color of enclosures is grey (RAL 7035)

MOTOR PROTECTION CIRCUIT BREAKERS

Motor protection circuit breakers - DMS 25.....	5/1
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MOTOR PROTECTION CIRCUIT BREAKERS - DMS 25

Features

- With overload and short circuit releases
- Ambient temperature compensated
- Phase failure protection
- In conformity with: IEC/EN 60947-4-1
- Wide range from (0.1 - 25) A
- Compact dimensions, thus consumes less panel space

Selection and ordering data



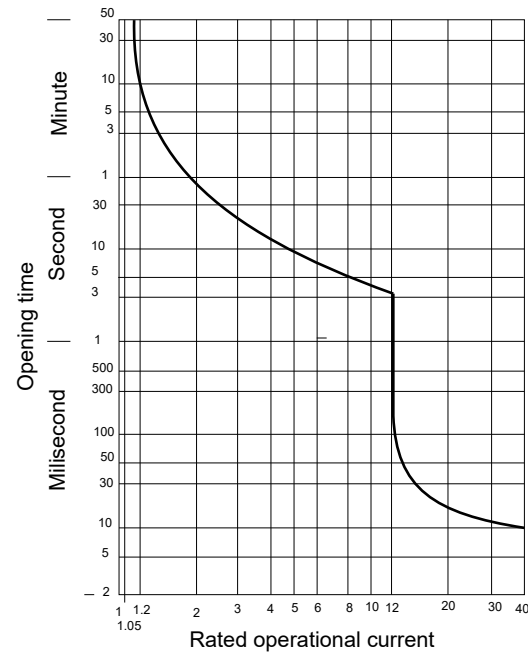
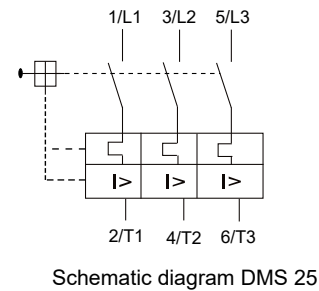
DMS 25

Rated continuous current (A)	Switching capacity Icu/400V (kA)	Type	Weight Kg
0.1 - 0.16	100	DMS 25 - 0.16	0.22
0.16 - 0.25	100	DMS 25 - 0.25	
0.25 - 0.4	100	DMS 25 - 0.4	
0.4 - 0.63	100	DMS 25 - 0.63	
0.63 - 1	100	DMS 25 - 1	
1 - 1.6	6	DMS 25 - 1.6	0.22
1.6 - 2.5	6	DMS 25 - 2.5	
2.5 - 4	6	DMS 25 - 4	
4 - 6.3	6	DMS 25 - 6.3	
6.3 - 10	6	DMS 25 - 10	
10 - 16	6	DMS 25 - 16	
16 - 20	6	DMS 25 - 20	
20 - 25	6	DMS 25 - 25	

TECHNICAL DATA

- Short circuit releases factor set at 12xIe
- Short circuit breaking capacity minimum 6 kA / 400V
- Fast and simple mounting feature to 35 mm mounting rail
- Rated impulse withstand voltage 6kV

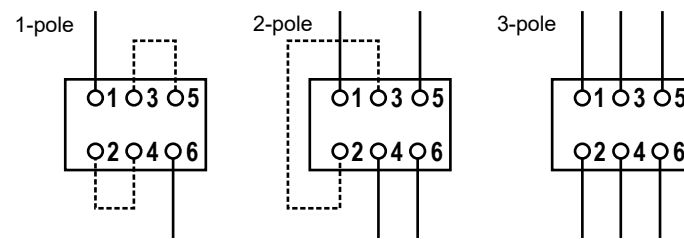
Mechanical Life	100 000 operations min.
Electrical Life	100 000 operations min.
Operating Temperature	min./max. °C -5/+40
Operating Frequency	30 operations/hours
Operating Voltage Ue	400 V AC
Insulation Voltage Ui	690 V AC
Operating Current Ie	0.1-25 A acc. to setting range
Continuous Current Ith	32 A
Connection Cable Cross-Section	1.5-4 mm ²
Standard	IEC 60947-4-1; EN 60947-4-1
Protection degree	IP40



Tripping Characteristics

The tripping characteristics show the tripping time in relation to the response current. They show main values of the tolerance range at an ambient temperature of 20 °C, starting from cold. The tripping of overload releases at operational temperature is reduced to approximately 1/4 of the shown. Specific characteristics for each individual setting range are available on request.

Connection diagram



Rated frequency: 40...60 Hz

Heating losses due to the current: 6 W

Switching Times at Short Circuit DMS 25

- Minimum command Time ms 2
- Opening Delay ms 2
- Opening Time ms 7

Mounting position: normally any.

Tightening torque for terminal screws:

- Main terminals: 1.2 Nm
- Auxiliary terminals: 1 Nm
- Pollution level III/3

Utilization Category AC 3 max. 690 V

Current Setting (A)	Fuse (A)	Current Setting (A)	Fuse (A)	Current Setting (A)	Fuse (A)
0.4 - 0.63	2	2.5 - 4	10	16 - 20	50
0.63 - 1	4	4 - 6.3	16	20 - 25	50
1 - 1.6	6	6.3 - 10	25		
1.6 - 2.5	6	10 - 16	35		

Thermic and Magnetic Protection

Order Code	Maximum Rating (kW) AC 3 3 phase					Thermal Current Calibration Interval [A]	Overload Release Setting Range (A)	Respondent Current of Short-Circuit Release [A]
	220V 230V 240V	380V 400V 415V	440V	500V	600V 690V			
DMS 25 - 0.16	-	0.02	-	-	0.06	0.1 - 0.16	0.16	1.92
DMS 25 - 0.25	-	0.06	0.06	0.06	0.12	0.16 - 0.25	0.25	3
DMS 25 - 0.4	0.06	0.09	0.12	0.12	0.18	0.25 - 0.4	0.4	4.8
DMS 25 - 0.63	0.09	0.12	0.18	0.25	0.25	0.4 - 0.63	0.63	7.6
DMS 25 - 1	0.12	0.25	0.25	0.37	0.55	0.63 - 1	1	12
DMS 25 - 1.6	0.25	0.55	0.55	0.75	1.1	1 - 1.6	1.6	19.2
DMS 25 - 2.5	0.37	0.75	1.1	1.1	1.5	1.6 - 2.5	2.5	30
DMS 25 - 4	0.75	1.5	1.5	2.2	3	2.5 - 4	4	48
DMS 25 - 6.3	1.1	2.2	3	3	4	4 - 6.3	6.3	75.6
DMS 25 - 10	2.2	4	5	5.5	7.5	6.3 - 10	10	120
DMS 25 - 16	4	7.5	9	9	12.5	10 - 16	16	192
DMS 25 - 20	5.5	9	11	12.5	15	16 - 20	20	240
DMS 25 - 25	7.5	12.5	12.5	15	22	20 - 25	25	300

Switching Capacity and Fuse Selection

Order Code	Rated Continuous Current (A)	Back up-Fuse (required if the prospective fault current is greater than the short-circuit breaking capacity) Fuses(gI.aM)(a)				Switching Capacity Icu (kA)			
		230V	400V	500V	690V	230V	400V	500V	690V
DMS 25 - 0.16	0.1 - 0.16	-	-	-	-	100	100	100	100
DMS 25 - 0.25	0.16 - 0.25	-	-	-	-	100	100	100	100
DMS 25 - 0.4	0.25 - 0.4	-	-	-	-	100	100	100	100
DMS 25 - 0.63	0.4 - 0.63	-	-	-	-	100	100	100	100
DMS 25 - 1	0.63 - 1	-	-	-	-	100	100	100	100
DMS 25 - 1.6	1 - 1.6	-	-	-	-	6	6	3	2.5
DMS 25 - 2.5	1.6 - 2.5	-	-	25	20	6	6	3	2.5
DMS 25 - 4	2.5 - 4	-	-	35	25	6	6	3	2.5
DMS 25 - 6.3	4 - 6.3	-	-	50	35	6	6	2.5	2
DMS 25 - 10	6.3 - 10	-	80	50	35	6	6	2.5	2
DMS 25 - 16	10 - 16	80	80	63	35	6	6	2.5	2
DMS 25 - 20	16 - 20	80	80	63	50	6	6	2.5	2
DMS 25 - 25	20 - 25	80	80	60	50	6	6	2.5	2

Features

- Protection degree IP 65

Selection and ordering data

PNDMS 25

Rated continuous current (A)	Switching capacity I _{cu} /400V (kA)	Type	Weight Kg
0.1 - 0.16	100	PNDMS 25 - 0.16	0.41
0.16 - 0.25	100	PNDMS 25 - 0.25	
0.25 - 0.4	100	PNDMS 25 - 0.4	
0.4 - 0.63	100	PNDMS 25 - 0.63	
0.63 - 1	100	PNDMS 25 - 1	
1 - 1.6	6	PNDMS 25 - 1.6	0.41
1.6 - 2.5	6	PNDMS 25 - 2.5	
2.5 - 4	6	PNDMS 25 - 4	
4 - 6.3	6	PNDMS 25 - 6.3	
6.3 - 10	6	PNDMS 25 - 10	
10 - 16	6	PNDMS 25 - 16	
16 - 20	6	PNDMS 25 - 20	
20 - 25	6	PNDMS 25 - 25	



Selection and ordering data

Auxiliary contact

Voltage	Current Rating (I _e) AC15	NO	NC	Type
250V AC	3A	0	2	DMS -BP 02 DMS -BP 11 DMS -BP 20
		1	1	
		2	0	



Shunt trip

Voltage	Power	Type
230V 50Hz 400V 50Hz	2.7/1.8 VA/W	DMS - DO 230 DMS - DO 400



Pick up: 70% U_e

Undervoltage release

Voltage	Power	Type
230V 50Hz 400V 50Hz	2.7/1.8 VA/W	DMS - PO 230 DMS - PO 400



Pick up: 85% U_e
Drop out: (70% - 35%)U_e

ACCESSORIES

Cylindrical head emergency button



Type
DMS - G30

Mushroom emergency button



Type
DMS - G40

N-Terminal



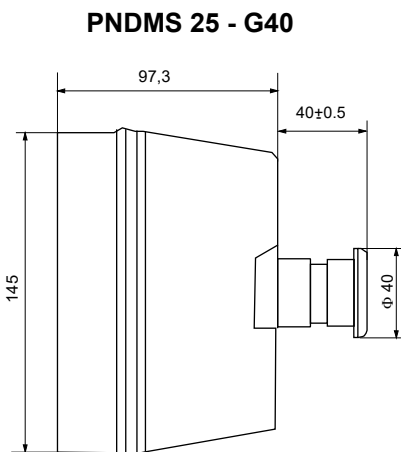
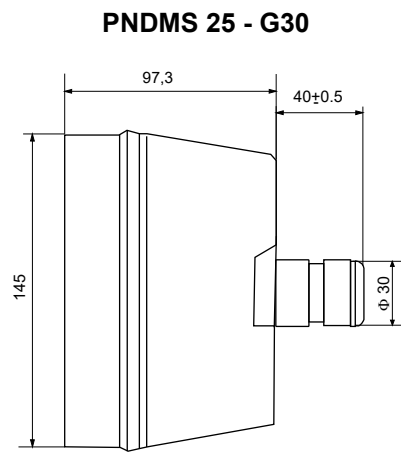
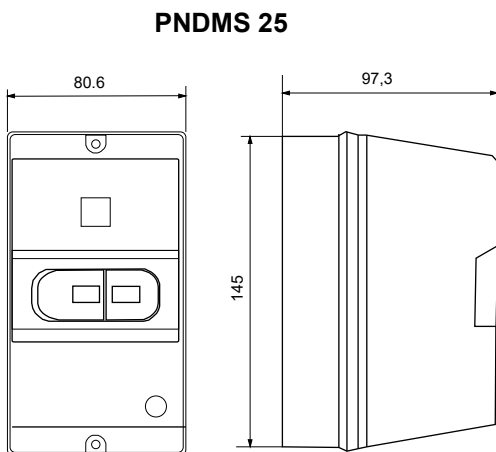
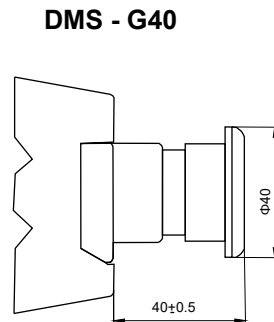
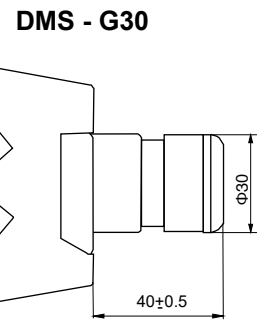
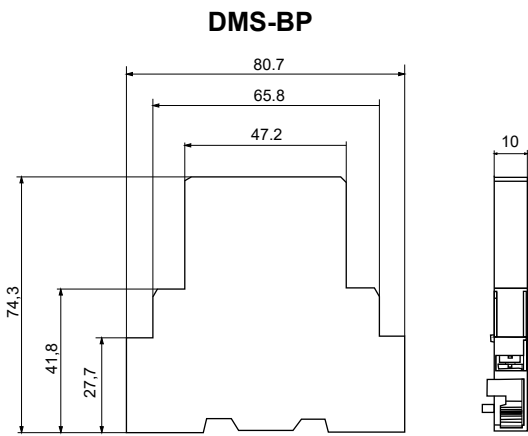
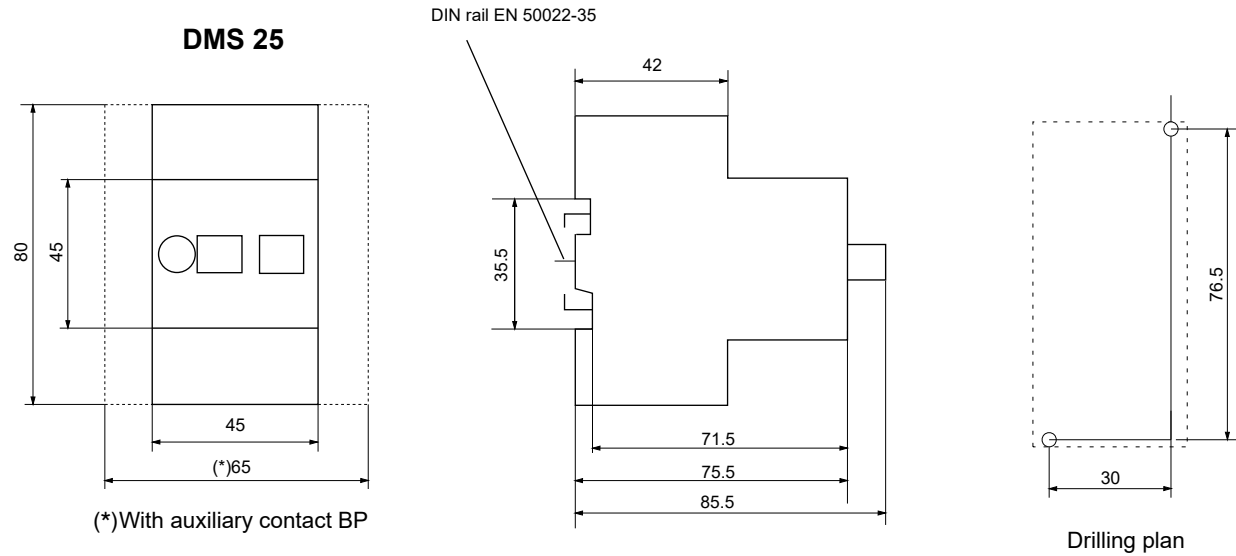
Type
MKS1 - N

Indication light



Type
MKS1 - S

DIMENSION DRAWINGS (mm)



MOLDED CASE CIRCUIT BREAKERS

Type KP 125-F (16-125A) 3P.....	6/1
Type KP 250-F (160-250A) 3P.....	6/1
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Dimensional drawings.....	6/11

3 POLE MOLDED CASE CIRCUIT BREAKERS

Features

- In conformity with: IEC/EN 60947-2
- Wide range from (16 - 1600) A
- Compact dimensions, thus consumes less panel space

Selection and ordering data

Type KP 125-F (16 -125) A



Rated current at 40 °C A	No. of poles	Breaking capacity (Icu) kA at 415 V AC	Part No.	Weight Kg
16	3	25	KP 125-F 16A 3P	1.5
25	3	25	KP 125-F 25A 3P	
40	3	25	KP 125-F 40A 3P	
63	3	25	KP 125-F 63A 3P	
80	3	25	KP 125-F 80A 3P	
100	3	25	KP 125-F 100A 3P	
125	3	25	KP 125-F 125A 3P	

Type KP 250-F (160 - 250) A



160	3	35	KP 250-F 160A 3P	2.3
200	3	35	KP 250-F 200A 3P	
250	3	35	KP 250-F 250A 3P	

Type KP 800-F (300-630) A



300	3	50	KP 800-F 300A 3P	8
400	3	50	KP 800-F 400A 3P	
500	3	50	KP 800-F 500A 3P	
630	3	50	KP 800-F 630A 3P	

Type KP 800-F (800) A



800	3	50	KP 800-F 800A 3P	10
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3 POLE MOLDED CASE CIRCUIT BREAKERS

Features

- In conformity with: IEC/EN 60947-2
- Wide range from (16 - 1600) A
- Compact dimensions, thus consumes less panel space

Selection and ordering data

Type KP 1250-F (1000 - 1250) A

Rated current at 40 °C A	No. of poles	Breaking capacity (Icu) kA at 415 V AC	Part No.	Weight Kg
1000	3	50	KP 1250-F 1000A 3P	18.5
1250	3	50	KP 1250-F 1250A 3P	

Type KP 1600-F (1600) A

1600	3	50	KP 1600-F 1600A 3P	27
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6

ELECTRICAL ACCESSORIES

Selection and ordering data

Type KP 125-F

Auxiliary contact

Voltage	Current Rating (In)	Config.	Part No.
250V AC 250V DC	5A 3A	14 —12 —11	KP BPKF1



Type KP 250-F

Auxiliary contact

Voltage	Current Rating (In)	Config.	Part No.
250V AC 250V DC	5A 3A	14 —12 —11	KP BPKF2



Type KP 800-F

Auxiliary contact

Voltage	Current Rating (In)	Config.	Part No.
250V AC 250V DC	5A 3A	14 —12 —11	KP BPKF3



Type KP 1250-F

Auxiliary contact

Voltage	Current Rating (In)	Config.	Part No.
250V AC 250V DC	5A 3A	14 —12 —11	KP BPKF4



Type KP 1600-F

Auxiliary contact

Voltage	Current Rating (In)	Config.	Part No.
250V AC 250V DC	5A 3A	14 —12 —11	KP BPKF5



6

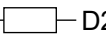
ELECTRICAL ACCESSORIES

Selection and ordering data

Type KP 250-F

Under voltage release

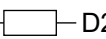


Voltage AC	Voltage DC	Config.	Part No.
220-250V	220-250V	D1—  —D2	KP UF2

Type KP 800-F (300-630A)

Under voltage release

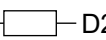


Voltage AC	Voltage DC	Config.	Part No.
220-250V	220-250V	D1—  —D2	KP UF3

Type KP 800-F (800A)

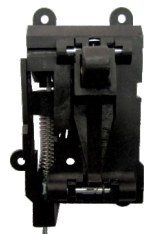
Under voltage release




Voltage AC	Voltage DC	Config.	Part No.
220-250V	220-250V	D1—  —D2	KP UF4

Type KP 1250-F

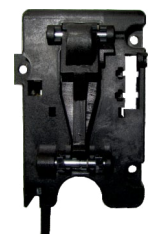
Under voltage release




Voltage AC	Voltage DC	Config.	Part No.
220-250V	220-250V	D1—  —D2	KP UF5

Type KP 1600-F

Under voltage release



Voltage AC	Voltage DC	Config.	Part No.
220-250V	220-250V	D1—  —D2	KP UF6

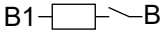
ELECTRICAL ACCESSORIES

Selection and ordering data

Type KP 125-F

Shunt trip release




Voltage AC	Voltage DC	Config.	Part No.
110-250V	110-250V	B1—  —B2	KP DF1

Type KP 250-F

Shunt trip release




Voltage AC	Voltage DC	Config.	Part No.
110-250V	110-250V	B1—  —B2	KP DF2

Type KP 800-F (300-630A)

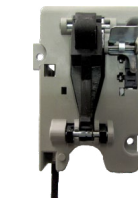
Shunt trip release

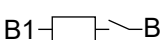


Voltage AC	Voltage DC	Config.	Part No.
110-250V	110-250V	B1—  —B2	KP DF3

Type KP 800-F (800A)

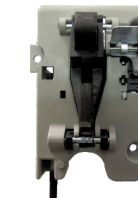
Shunt trip release




Voltage AC	Voltage DC	Config.	Part No.
110-250V	110-250V	B1—  —B2	KP DF4

Type KP 1250-F

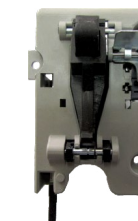
Shunt trip release

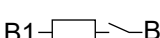


Voltage AC	Voltage DC	Config.	Part No.
110-250V	110-250V	B1—  —B2	KP DF5

Type KP 1600-F

Shunt trip release



Voltage AC	Voltage DC	Config.	Part No.
110-250V	110-250V	B1—  —B2	KP DF6

TECHNICAL DATA

CAPACITOR CONTROL

When a capacitor circuit is opened, it exhibits characteristics distinctly differently from inductor loads due to the effects of residual electric charge in the capacitor. The recovery voltage appears across the contacts immediately after the circuit is opened is equal to the difference between the capacitor residual voltage and supply voltage. Therefor half a cycle after the circuit opens, the voltage between the contacts of the switch rises to twice the supply voltage or higher.

In a three phase circuit the recovery voltage appearing between the contacts in the first interrupted phase could rise to as high as 2.5 times the supply voltage. Unless the breaker contacts are fully open for at least 1/2 cycle after the capacitor current is interrupted, restrike of arc is likely to occur. If the restrike arc is repeated, the voltage could continue to rise to the dielectric breakdown point of the capacitor. Hence, fast interrupting, quick make, quick-break circuit breakers should be used for this type of circuit.

When a capacitor circuit is closed a condenser charge $q = CU$ which corresponds to the instantaneous value 'U' of the supply voltage at closing time, must be instantaneously supplied, causing a large inrush current to flow through it. If the capacitor circuit is closed in the voltage phase at which the inrush is maximum, the maximum value of the inrush current is approximately, $I_p = C/L \times U$.

The maximum time duration during which the maximum current flows is about 0.5 ms. Selection of a MCCB for capacitor circuit duty must therefore consider the effects of higher short circuit and inrush current. This will affect the choice of instantaneous trip current rating. In practice, an MCCB which satisfies the following equations should be chosen.

$$I_r > 1.5 \times I_c$$

$$I_{inst} > \frac{I_p^2}{2}$$

Where:

I_r = Rated current of MCCBs

I_c = Rated current of capacitor

I_{inst} = Short circuit pick - up settings of the MCCB

I_p = Maximum capacitor inrush current

It is therefore necessary to select a circuit breaker with current rating not less than 1.5 - 2.0 times the rated current of the capacitor.

DC CONTROL

MCCBs though not separately designed for DC applications are suitably modified to be able to operate on DC Systems also up to 500V DC/250V DC. This is achieved by modifying for:

- Current carrying capacity
- Over current and short circuit protection
- Short circuit breaking capacity (with L/R time constant limitations)

Current Carrying Capacity

The continuous current carrying capacity is generally a function limited by the temperature rise of various internal components of MCCBs.

The AC rating of MCCBs is expressed as "RMS" value. The DC rating is "Average" value. The RMS and average value can be related by a "Form Factor" which is 1.1.

Hence, an AC MCCB can be assigned a 10% higher DC current rating. But in practice the use of DC MCCB ratings are equal to AC ratings and thereby, temperature rise is restricted within limits.

Overload Release & Overload Protection

The overload release are generally thermal type with a Bimetal-Heater system. The heating effect which can be expressed by the factor integral $I^2 t$ varies for AC and DC. The integral ($I^2 t$) for AC will be 1.21 times integral ($I_{av}^2 t$) for DC, thus an AC MCCB when used in DC circuit will trip slower. For example a 100A AC MCCB when used in DC circuit for 100A will sense a 20% overload only from 133A onwards. To retain the same Overload characteristics as AC, it is important to separately calibrate the MCCBs for DC ratings and overload tripping characteristics need to be suitably modified.

Short Circuit Release & Short Circuit Protection

The short circuit release is actuated by the peak value of the AC sine wave. Since no such peak exists in DC, DC tripping will be slower. Hence to achieve the same short circuit pick up level in DC, the short circuit release will be calibrated specially.

Short Circuit Breaking Capacity

In AC the breaking of the short circuit current usually occurs within the first current zero, by the current limiting effect. No such current zero exists in DC. Arc breaking and ultimate quenching of arc depends on the rapid dissipation of the inductive Energy $1/2LI^2$.

This energy dissipation is dependent L/R or time constant of the circuit. The L/R value should be limited to 10 - 15milli seconds to achieve satisfactory performance. This is achieved usually by:

Splitting the DC arc voltage over 2 or 3 poles by connecting them in series, depending upon on the DC voltage.

TECHNICAL DATA

SELECTION & APPLICATION TRANSFORMER PROTECTION

Primary side

For the protection of transformer with a circuit breaker connected to the LT side (primary syde) the no load inrush current of the transformer must be considered.

The peak value of the first current wave often reaches 10-15 times the rated current and may sometimes reach as high as 20-25 times.

However, the transient decays very quickly (in a few m.sec.). Thus the MCCB selected should have a magnetic setting will not be actuated by he momentary inrush current.

Secondary side

KP MCCBs can be used for protection of transformer on the LT side (secondary side) as an outgoing protective device.

The rated current of the transformer is calculated as follows:

I_e - is the rated voltage at the LT side

The Breaking capacity of the breaker for protection can be calculated as: and

$$I_b = \frac{I_e}{Z\%} \times 10^{-3} \text{ kA}$$

Where I_b - is the rated breaking capacity,

I_e - the rated current and

Z% - is the percentage impedance of transformer (Specified by the manufacturer)

Selection Table For Transformer Protection

Transformer Rating (KVA)	MCCB Rating in amperes				
	KP 125-F 25kA	KP 250-F 35kA	KP 800-F 50kA	KP 1250-F 50kA	KP 1600-F 50kA
16	25				
25	40				
63	100	100			
100	125	160			
160		250			
200					
250			400		
315					
400			630		
500			800		
630				1000	
750				1200	1200

GENERATOR SET PROTECTION

Loading MCCBs can be used for the effective protection and control of DG sets against overload and short circuits.

The Current rating of MCCBs to be selected is calculated as

$$kVA = \sqrt{3} U_e \times I_e$$

or

$$I_e = \frac{kVA}{\sqrt{3} \times U_e}$$

Where,

kVA = Rating of the DG Set

U_e = Rated voltage

I_e = Rated Current

The MCCB rating selected os greater than or equal to the rated current value.

Selection Table for DG Set Protection

DG Set Rating (kVA)	MCCB Rating (amperes)
16	25
25	40
63	100
100	160
160	250
200	315
250	400
400	500
500	630
630	1000
750	1200

TECHNICAL DATA

MOTOR CONTROL

MCCBS can be used for motor protection. Selection of MCCBs has to be done taking into consideration the starting inrush current, and the system fault levels. Further the selection is also based on type of starting, i.e., Direct on Line or Star-Delta.

Direct on Line Starting

Care is to be taken to avoid nuisance tripping during starting of Squirrel Cage Motors since the inrush current will be in the order of 600 to 800% of the full load current of the motor. The overload setting is chosen such that it does not trip during starting

Star-Delta Starting

In Star-Delta starting of motors, since there is a reduction in the starting current due to reduced voltage, the MCCBs do not have a problem in the overload setting. But the transient currents can go up to 12 times the rated current during change over from star to delta which will cause the instantaneous magnetic release to trip the breaker. So proper selection of magnetic pickup level is important for prevention of nuisance tripping during change over from Star to Delta.

It is always recommended to select an MCCB in co-ordination with Contactor and Over Load Relay so as to have the best and optimum benefit of all the devices.

Selection Table For Motor Protection

Motor HP	Rating kW	Aprox. Full Load Current (A) at 415V	Direct On Line MCCB Rating/Type			Star/Delta MCCB Rating/Type			
			KP 125-F	KP 250-F	KP 800-F	KP 125-F	KP 250-F	KP 800-F	KP 1600-F
10	7.5	14	25			25			
12.5	9	17	25			25			
15	11	21	25			25			
20	15	28	32			32			
25	19	35	40			40			
30	22	41	50			50			
40	30	52	80			80			
50	37	69	100			100			
60	45	80	125						
75	55	97		100		125	100		
100	75	125		160			160		
125	90	156		250			250		
150	112	190		250			250		
175	130	225			315			315	
200	149	255			315			315	
220	160	275			400			400	
250	186	320			400			500	600
300	224	375			500			500	600
350	261	449			630			630	600
400	298	505			630			630	600

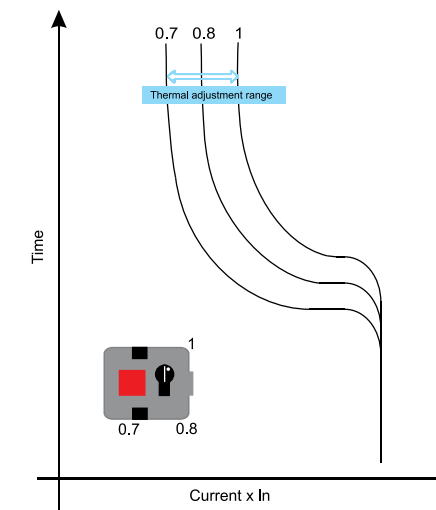
The figures shown are based on following motor starting conditions:
 - direct online 7x full load current for 5 seconds.
 - Star-Delta 4x full load current for 12 seconds.

TECHNICAL DATA

Thermal Magnetic Characteristics and Adjustments Operation Settings

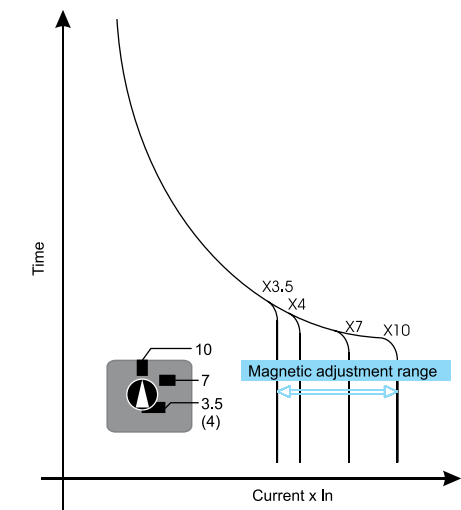
Thermal adjustment

KP MCCBs have a wide thermal adjustment range, one of the largest one on the market. The rated current 'Ir' is continuously adjustable from 70% to 100% of its nominal current 'In'. There are three main points of calibration marked at 70%, 80% and 100%, as shown in the diagram below.



Magnetic Adjustment

Magnetic adjustment is available on MCCB's from KP-250F and above. The magnetic setting 'Im' is continuously adjustable from 350% to 1000% of its rated current 'In'. There are three main points of calibration marked as multiples of In: 3.5 (4 for KP-800F), 7 and 10. These are shown in the diagram below.



Examples

- 1.KP 125-F 125A MCCB set at Ir=0.8, the rated current is calculated as $125 \times 0.8=100A$
- 2.KP 250-F 250A MCCB set at Im=7. The magnetic setting is calculated as $250 \times 7=1750A$

- 3.KP 800-F 630A MCCB set at Ir=0.7 and Im=10
 The rated current is calculated as $630 \times 0.7=441A$
 The magnetic setting is calculated as $630 \times 10=6300A$

Note that the magnetic setting is multiple of the nominal current In and not the rated current Ir. All thermal and magnetic trip settings are expressed as AC r.m.s. Values.

All MCCBs are calibrated at 40C°. For others temperatures see Table for changing of the nominal current depending from the ambient temperature.

TECHNICAL DATA

TYPE CIRCUIT BREAKERS		KP 125-F	KP 250-F	KP 800-F	KP 1250-F	KP 1600-F	
Standard conformity		IEC/EN 60947-2					
No. of poles		3P	3P	3P	3P	3P	
Standard current range/ratings In		A	16, 80, 100, 125, 160	160, 200, 250	300, 400, 500, 630, 800	1000, 1250	1600
Rated operational voltage Ue~		V	415	415	415	415	415
Rated operational voltage Ue=		V	250	250	250		
Rated insulation voltage Ui~		V	750	750	750	750	750
Rated impulse withstand U _{imp}		kV	8	8	8	8	8
Category of use			A	A	A	A	A
Degree of protection: Standard appliance with terminal shields Appliance in enclosure with front plate			IP 30 IP 40		IP 00 IP 40	IP 00 IP 40	
Pollution degree			III				
Ambient temperature		°C	-5 to +60		-5 to +40	-5 to +40	
Ultimate breaking capacity I _{cu} *		230/240 V ~ kA	35	65	70	80	80
		400/415 V ~ kA	25	35	50	50	50
		440 V ~ kA	20	25	40	35	40
		480/500 V ~ kA	12	18	35	25	25
		690 V ~ kA	8	12	25	18	20
		250 V - kA	15	22	22	-	-
Standard breaking capacity I _{cs} (%I _{cu})*			75	100	50	50	50
Rated closing capacity on short-circuit (415 V~)			52	105	74 105(for 800A)	105	105
Endurance (o.c. cycle)		mechanical	≥15 000	≥15 000	≥15 000	≥15 000	≥15 000
		electrical	3 000	3 000	3 000	3 000	3 000
Type of protection							
Thermal adjustable			(0,8 - 1)I _n	(0,7 - 1)I _n	(0,7 - 1)I _n	(0,4 - 1)I _n	(0,4 - 1)I _n
Magnetic fixed			10xI _n for 125 A	10xI _n for 250 A(*)	-	-	-
			10xI _n for 100 A	10xI _n for 200 A(*)	-	-	-
			10xI _n for 80 A	10xI _n for 160 A(*)	-	-	-
			10xI _n for 16 A	-	-	-	-
			-	-	-	-	-
			-	-	-	-	-
Magnetic adjustable			-	(5 - 10)I _n (*)	(5 - 10)I _n (5 - 8)I _n -for 800A	(2 - 10)I _n	(2 - 10)I _n

* The LINE side is the upper side. LOAD is to be connected on the down side.

(*) On request for KP 250-F magnetic can be fixed or adjustable.

OTHER CHARACTERISTICS

Connection cross-sections

Head devices KP	Max. Width on term. (mm)	Connection via terminal (mm ²)				Connection via bars (mm)	Connection via cage terminals (mm ²)	
		copper cable	aluminium cable	Cable shoe	Terminal screw		rigid cable	flexible cable
125-F	14.6	-	-	-	-	-	50	
250-F	23.5	-	-	-	-	-	120	
800-F	52.5	-	-	-	2x(40x5)	-	-	
1250-F	45.7	-	-	-	2x(45x8)	-	-	
1600-F	46.5	-	-	-	45x20	-	-	

TECHNICAL DATA

Table for changing of the nominal current depending from the ambient temperature

Thermal adjustment	Currents in amps in accordance with ambient temperature				
	20 °C	30 °C	40 °C	50 °C	60 °C
In = 16 A	17.1	16.6	16	15.2	14.6
In = 20 A	21.4	20.8	20	19	18.2
In = 25 A	26.7	26	25	23.8	22.8
In = 32 A	34.2	33.3	32	30.4	29.1
In = 40 A	42.8	41.6	40	38	36.4
In = 50 A	53.5	52	50	47.5	45.5
In = 63 A	67.4	65.5	63	59.9	57.3
In = 80 A	85.6	83.2	80	76	72.8
In = 100 A	107	104	100	95	91
In = 125 A	133.8	130	125	118.8	113.8
In = 160 A	171.2	166.4	160	152	145.6
In = 200 A	214	208	200	190	182
In = 250 A	240.8	234	225	213.8	204.8
In = 300 A	267.5	260	250	237.5	227.5
In = 400 A	321	312	300	285	273
In = 500 A	428	416	400	380	364
In = 630 A	535	520	500	475	455
In = 800 A	674.1	655.2	630	598.5	573.3
In = 1000 A	856	832	800	760	728

Selectivity table-average values of selectivity limits (A)

		MCCB upstream																
		KP 125-F						KP 250-F				KP 800-F				KP 1250-F		KP 1600-F
MCCB downstream		32A	40A	63A	80A	100A	125A	100A	160A	200A	250A	400A	500A	630A	800A	1000A	1250A	1600A
KP 125-F	25 A	800	800	1000	1000	1200	1200	1000	2500	3000	3500	4000	5000	6300	8000	9200	9200	9200
	32 A		800	1000	1000	1200	1200	1000	2500	3000	3500	4000	5000	6300	8000	9200	9200	9200
	40 A			1000	1000	1200	1200	1000	2500	3000	3500	4000	5000	6300	8000	9200	9200	9200
	63 A					1200	1200		2500	3000	3500	4000	5000	6300	8000	9200	9200	9200
	80 A								2500	3000	3500	4000	5000	6300	8000	9200	9200	9200
KP 250-F	100 A								2500	3000	3500	4000	5000	6300	8000	9200	9200	9200
	125 A								2500	3000	3500	4000	5000	6300	8000	9200	9200	9200
	160 A								1600	2000	2500	4000	5000	6300	8000	9200	9200	9200
	200 A										2500	4000	5000	6300	8000	9200	9200	9200
KP 800-F	250 A										2500	4000	5000	6300	8000	9200	9200	9200
	400 A											5000	6300	8000	9200	9200	9200	
	630 A												6300	8000	9200	9200	9200	
KP 1250-F	800 A													8000	9200	9200	9200	
	1000 A														9200	9200	9200	
KP 1600-F	1250 A															9200	9200	
	1600 A																9200	

ORDERING INSTRUCTION FOR MOLDED CASE CIRCUIT BREAKERS

Type A P

Rated current

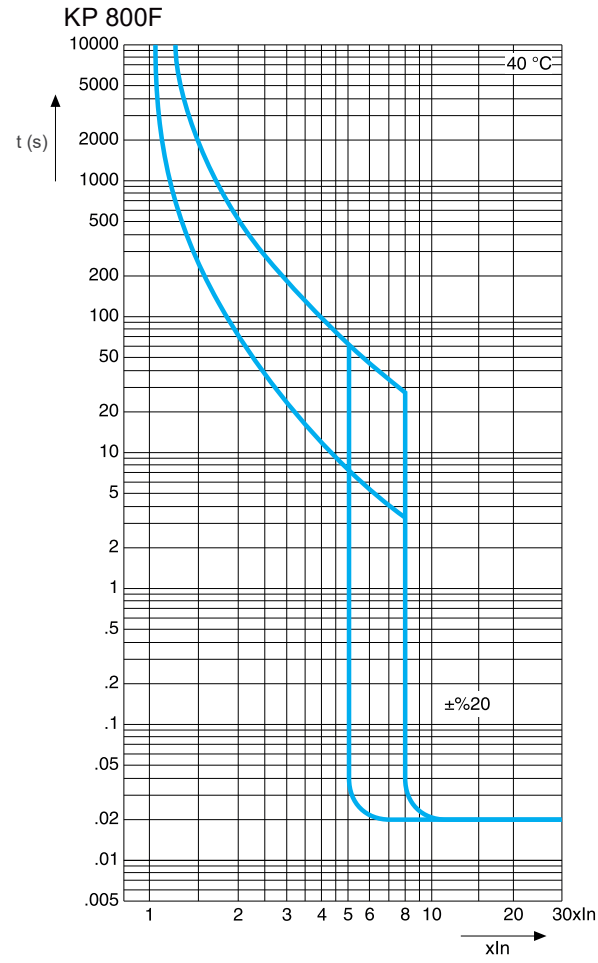
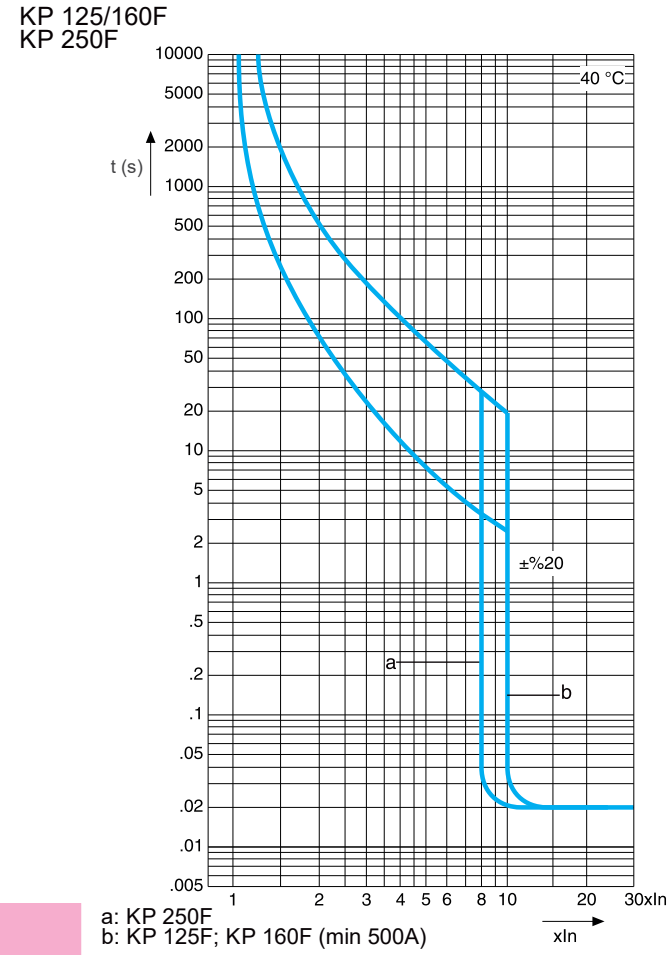
No. of poles (3 or 4)

Part No. of additional elements

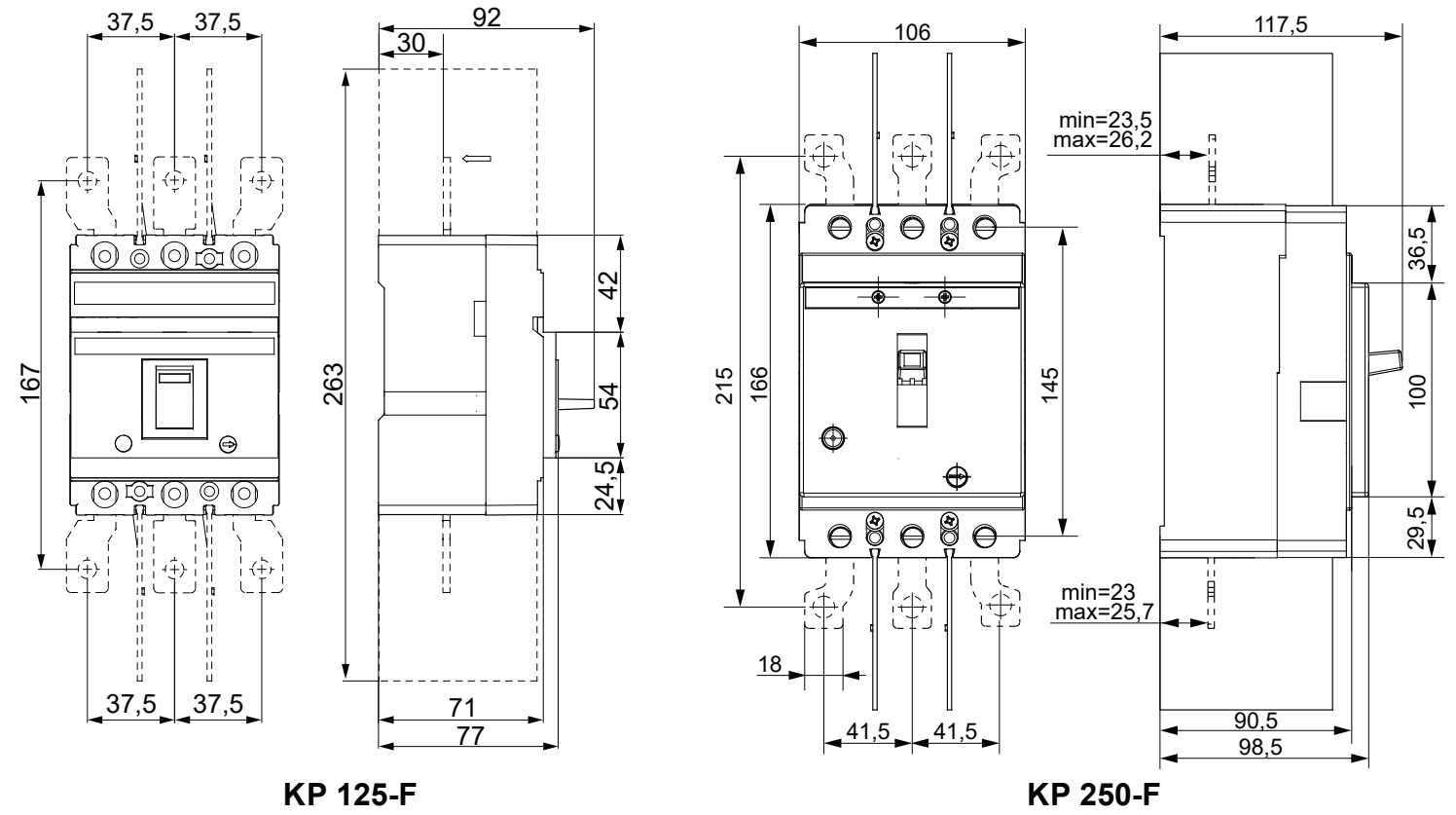
Example: Molded case circuit breaker type KP 125-F for rated current 100A, 3 poles, with shunt trip release

KP 125-F 100A 3P KP DF1

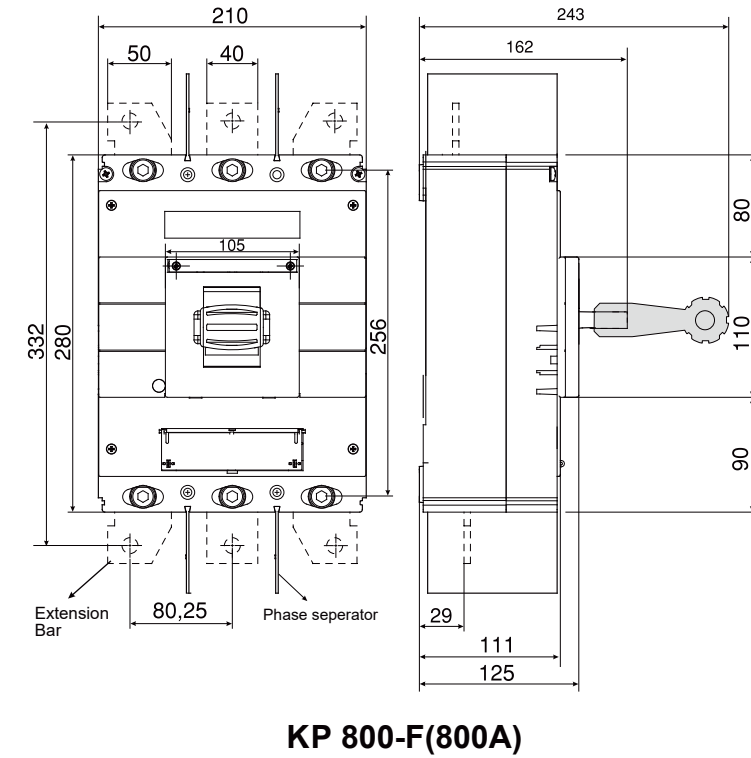
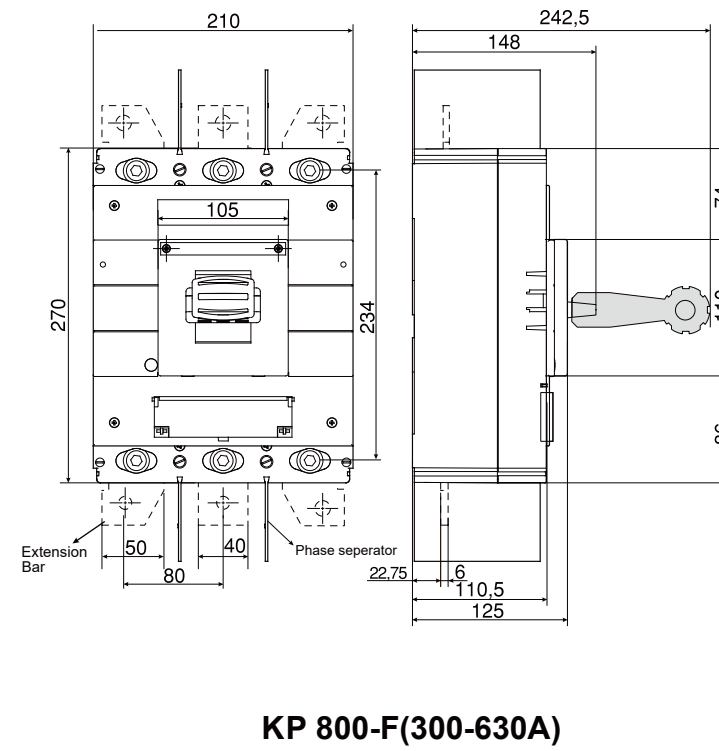
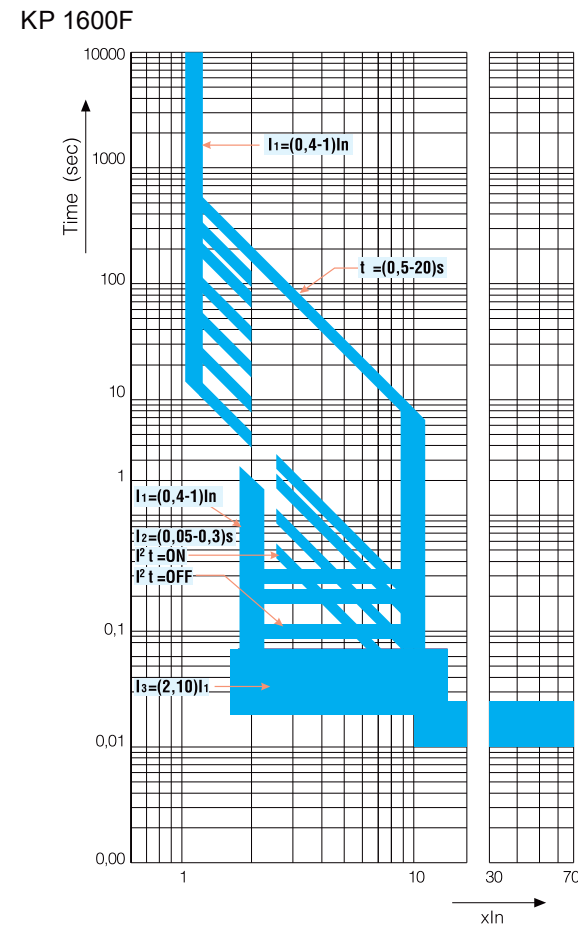
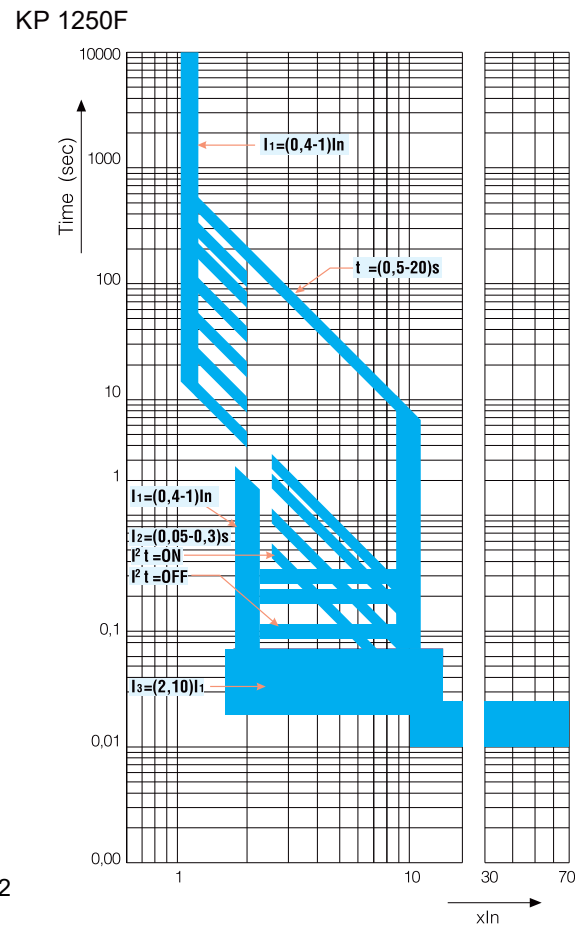
TRIPPING CHARACTERISTICS



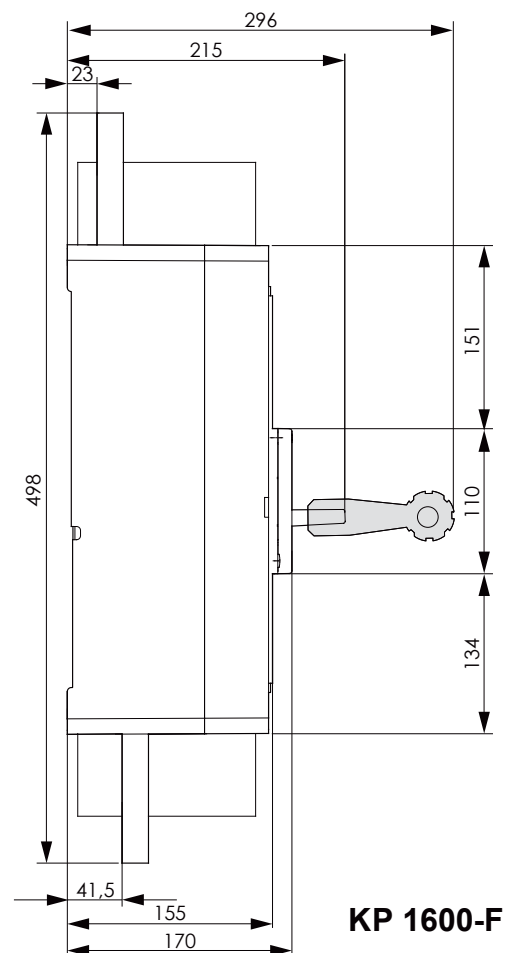
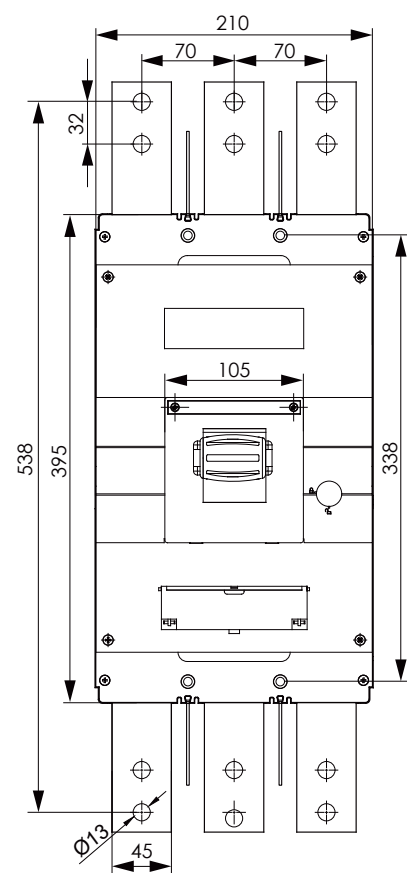
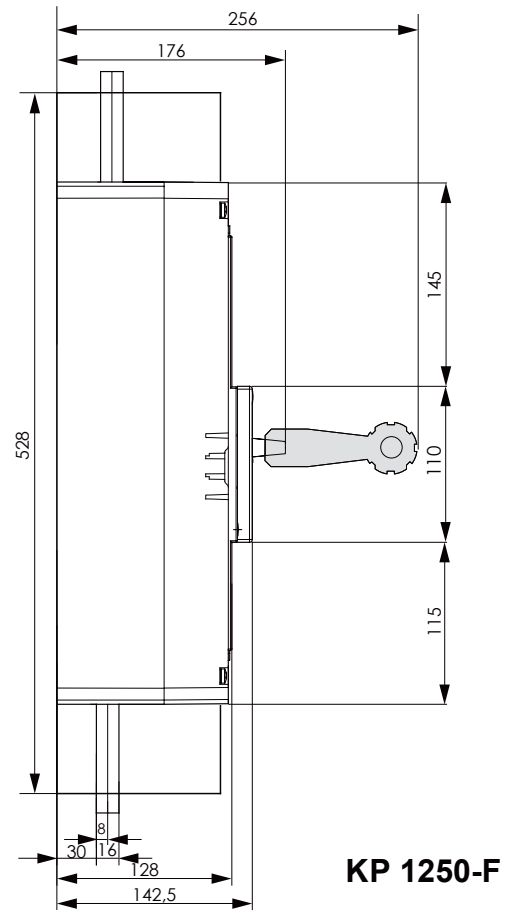
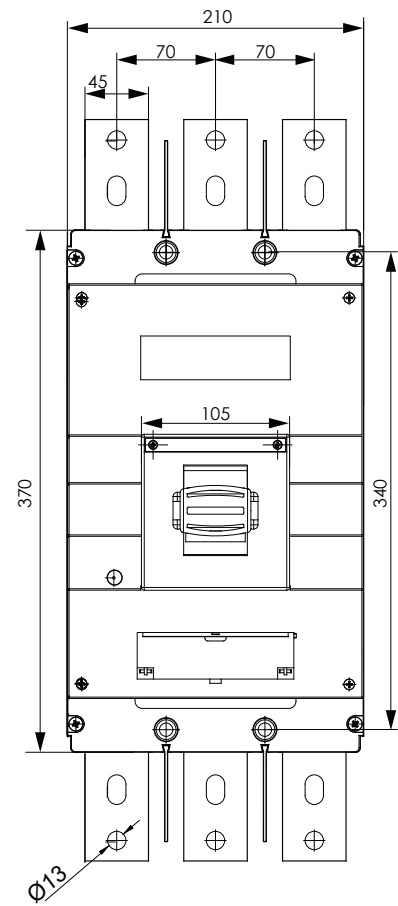
DIMENSIONAL DRAWINGS (mm)



6



6



MINIATURE CIRCUIT BREAKERS / RESIDUAL CIRCUIT BREAKERS

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Type IZP06 C 1P, 2P, 3P (6-63A).....	7/2
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Type IZP10 C 1P, 2P, 3P (6-63A).....	7/5
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MINIATURE CIRCUIT BREAKERS

Features

- In conformity with: EN 60898-1
- Wide range from (6 - 63) A
- Compact dimensions, thus consumes less panel space

Selection and ordering data - B characteristic

Type IZP06 1P (6 - 63) A

Rated current (In) A	No. of poles	Short circuit breaking capacity kA	Part No.	Weight Kg
6	1	6	IZP06 B6 1P	0.115
10	1	6	IZP06 B10 1P	
16	1	6	IZP06 B16 1P	
20	1	6	IZP06 B20 1P	
25	1	6	IZP06 B25 1P	
32	1	6	IZP06 B32 1P	
40	1	6	IZP06 B40 1P	
50	1	6	IZP06 B50 1P	
63	1	6	IZP06 B63 1P	



Type IZP06 2P (6 - 63) A

6	2	6	IZP06 B6 2P	0.230
10	2	6	IZP06 B10 2P	
16	2	6	IZP06 B16 2P	
20	2	6	IZP06 B20 2P	
25	2	6	IZP06 B25 2P	
32	2	6	IZP06 B32 2P	
40	2	6	IZP06 B40 2P	
50	2	6	IZP06 B50 2P	
63	2	6	IZP06 B63 2P	



Type IZP06 3P (6 - 63) A

6	3	6	IZP06 B6 3P	0.340
10	3	6	IZP06 B10 3P	
16	3	6	IZP06 B16 3P	
20	3	6	IZP06 B20 3P	
25	3	6	IZP06 B25 3P	
32	3	6	IZP06 B32 3P	
40	3	6	IZP06 B40 3P	
50	3	6	IZP06 B50 3P	
63	3	6	IZP06 B63 3P	

MINIATURE CIRCUIT BREAKERS

Features

- In conformity with: EN 60898-1
- Wide range from (6 - 63) A
- Compact dimensions, thus consumes less panel space

Selection and ordering data - B characteristic

Type IZP06 1P (6 - 63) A

Rated current (In) A	No. of poles	Short circuit breaking capacity kA	Part No.	Weight Kg
6	1	6	IZP06 C6 1P	0.115
10	1	6	IZP06 C10 1P	
16	1	6	IZP06 C16 1P	
20	1	6	IZP06 C20 1P	
25	1	6	IZP06 C25 1P	
32	1	6	IZP06 C32 1P	
40	1	6	IZP06 C40 1P	
50	1	6	IZP06 C50 1P	
63	1	6	IZP06 C63 1P	

Type IZP06 2P (6 - 63) A

6	2	6	IZP06 C6 2P	0.230
10	2	6	IZP06 C10 2P	
16	2	6	IZP06 C16 2P	
20	2	6	IZP06 C20 2P	
25	2	6	IZP06 C25 2P	
32	2	6	IZP06 C32 2P	
40	2	6	IZP06 C40 2P	
50	2	6	IZP06 C50 2P	
63	2	6	IZP06 C63 2P	

Type IZP06 3P (6 - 63) A

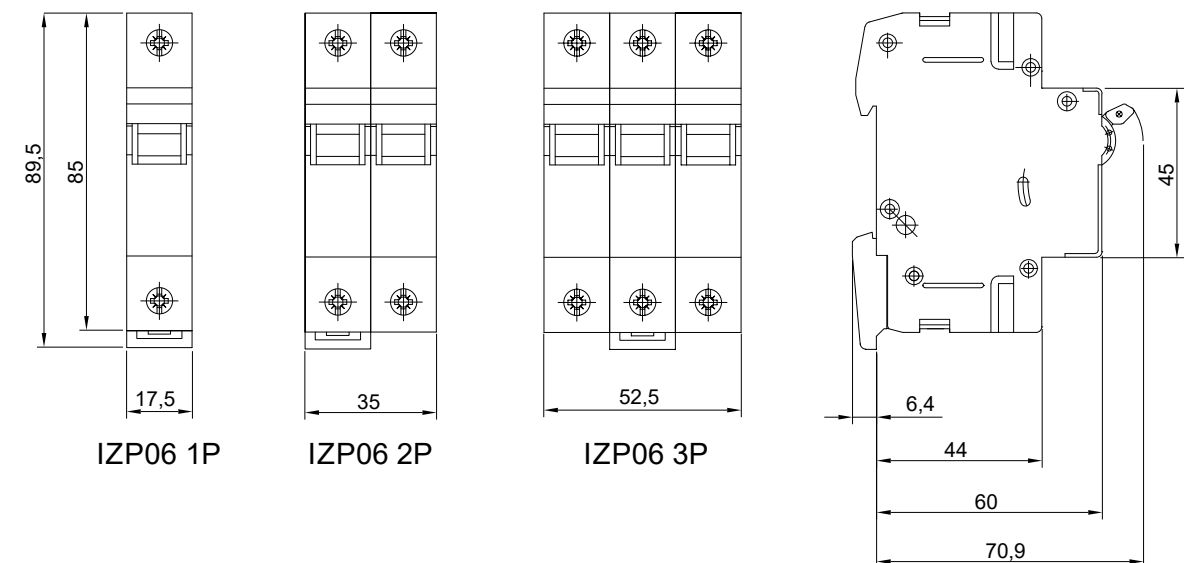
6	3	6	IZP06 C6 3P	0.340
10	3	6	IZP06 C10 3P	
16	3	6	IZP06 C16 3P	
20	3	6	IZP06 C20 3P	
25	3	6	IZP06 C25 3P	
32	3	6	IZP06 C32 3P	
40	3	6	IZP06 C40 3P	
50	3	6	IZP06 C50 3P	
63	3	6	IZP06 C63 3P	

Technical data - IZP 06

Standards	EN 60898-1
Pole configuration	1, 2, 3
Tripping characteristics	B, C
Rated current In	A 6 - 63
Rated voltage Un	V 230; 230/400; 400
Rated insulation voltage Ui	V 400
Rated impulse withstand voltage Uimp	V 4 000
Rated DC voltage Un	V max.60-(for one pole τ=15ms)
Rated frequency	Hz 50 - 60
Short circuit breaking capacity	kA 6
Selection category	3
Electrical endurance	4 000 cycles
Mechanical endurance	100 000 cycles
Terminal capacity	mm ² 1 - 25 for Cu wires 2,5 - 25 for Al wires - special type
Mounting	on rail DIN 35x7,5 EN 60 715; on panel
Degree of protection	IP 20, IP 40 front
Ambient temperature	°C -25 up to +55
Mounting position	optional
Vibrations resistance	3g(8-50Hz)
Approved	CE
Accessories	Auxiliary and signal contacts - PKJ, 2PKJ, PKJ+SKJ Shunt trips-RKVC

- circuit breakers IZP06 series are mechanical switching devices able to switch on, conduct and switch of the current under standard conditions and able to switch on, conduct and switch of the current under abnormal circuit conditions such as short-circuit
- they are used to protect house and similar installations against over currents
- they are designed to be handled by untrained persons and they are maintenance free
- tripping characteristics B,C
- simple assembly-lower clip for fastening to the rail 35x7,5 EN 60715 enables taking the circuit breaker out from the device line connected by lower busbar without breaking the current circuit
- sealable in ON and OFF position of a lever
- there is a possibility to use through covers for both terminals, that are sealed with sealing blind
- **connection** :- conductors 1 -25 mm²
 - connection busbars (pin or fork type)
 - connection of conductors and busbars at the same time
 - optional way of connection
 - possibility to mount additional accessories

Dimensional drawing



MINIATURE CIRCUIT BREAKERS

Features

- In conformity with: EN 60898-1
- Wide range from (6 - 63) A
- Compact dimensions, thus consumes less panel space

Selection and ordering data - B characteristic

Type IZP10 1P (6 - 63) A

Rated current (In) A	No. of poles	Short circuit breaking capacity kA	Part No.	Weight Kg
6	1	10	IZP10 B6 1P	0.115
10	1	10	IZP10 B10 1P	
16	1	10	IZP10 B16 1P	
20	1	10	IZP10 B20 1P	
25	1	10	IZP10 B25 1P	
32	1	10	IZP10 B32 1P	
40	1	10	IZP10 B40 1P	
50	1	10	IZP10 B50 1P	
63	1	10	IZP10 B63 1P	

Type IZP10 2P (6 - 63) A

6	2	10	IZP10 B6 2P	0.230
10	2	10	IZP10 B10 2P	
16	2	10	IZP10 B16 2P	
20	2	10	IZP10 B20 2P	
25	2	10	IZP10 B25 2P	
32	2	10	IZP10 B32 2P	
40	2	10	IZP10 B40 2P	
50	2	10	IZP10 B50 2P	
63	2	10	IZP10 B63 2P	

Type IZP10 3P (6 - 63) A

6	3	10	IZP10 B6 3P	0.340
10	3	10	IZP10 B10 3P	
16	3	10	IZP10 B16 3P	
20	3	10	IZP10 B20 3P	
25	3	10	IZP10 B25 3P	
32	3	10	IZP10 B32 3P	
40	3	10	IZP10 B40 3P	
50	3	10	IZP10 B50 3P	
63	3	10	IZP10 B63 3P	



7



MINIATURE CIRCUIT BREAKERS

Features

- In conformity with: EN 60898-1
- Wide range from (6 - 63) A
- Compact dimensions, thus consumes less panel space

Selection and ordering data - B characteristic

Type IZP10 1P (6 - 63) A

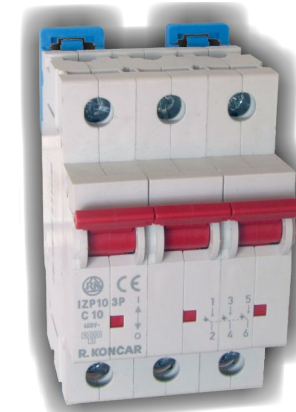
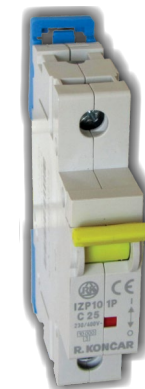
Rated current (In) A	No. of poles	Short circuit breaking capacity kA	Part No.	Weight Kg
6	1	10	IZP10 C6 1P	0.115
10	1	10	IZP10 C10 1P	
16	1	10	IZP10 C16 1P	
20	1	10	IZP10 C20 1P	
25	1	10	IZP10 C25 1P	
32	1	10	IZP10 C32 1P	
40	1	10	IZP10 C40 1P	
50	1	10	IZP10 C50 1P	
63	1	10	IZP10 C63 1P	

Type IZP10 2P (6 - 63) A

6	2	10	IZP10 C6 2P	0.230
10	2	10	IZP10 C10 2P	
16	2	10	IZP10 C16 2P	
20	2	10	IZP10 C20 2P	
25	2	10	IZP10 C25 2P	
32	2	10	IZP10 C32 2P	
40	2	10	IZP10 C40 2P	
50	2	10	IZP10 C50 2P	
63	2	10	IZP10 C63 2P	

Type IZP10 3P (6 - 63) A

6	3	10	IZP10 C6 3P	0.340
10	3	10	IZP10 C10 3P	
16	3	10	IZP10 C16 3P	
20	3	10	IZP10 C20 3P	
25	3	10	IZP10 C25 3P	
32	3	10	IZP10 C32 3P	
40	3	10	IZP10 C40 3P	
50	3	10	IZP10 C50 3P	
63	3	10	IZP10 C63 3P	



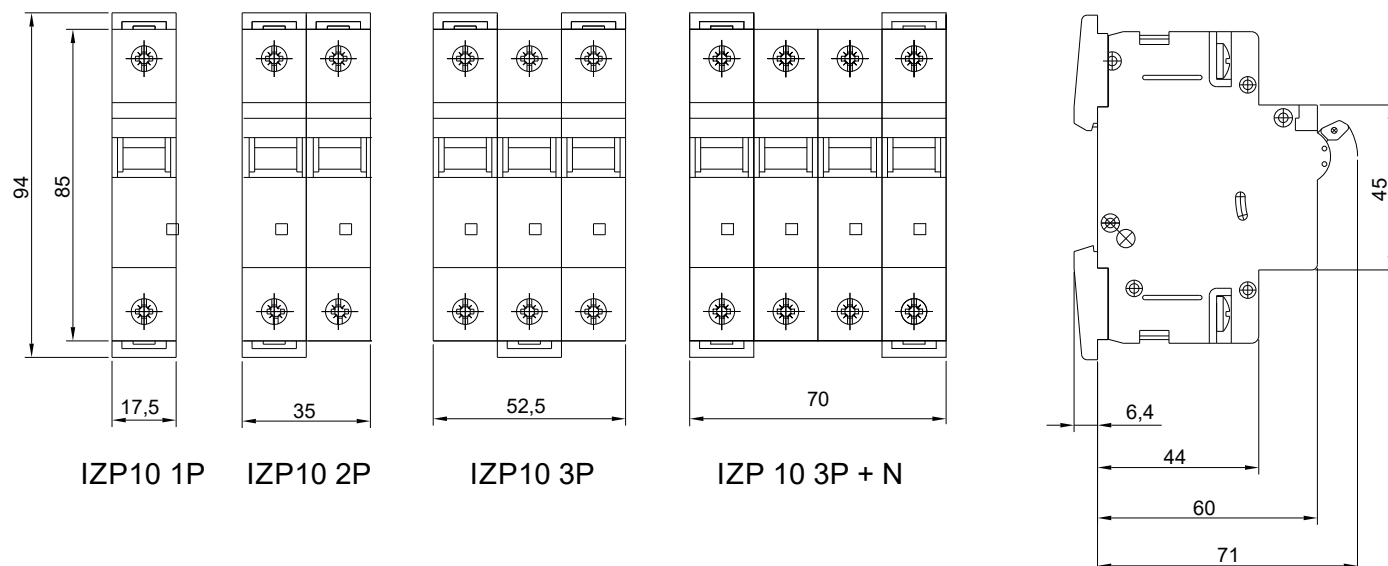
7

Technical data - IZP 10

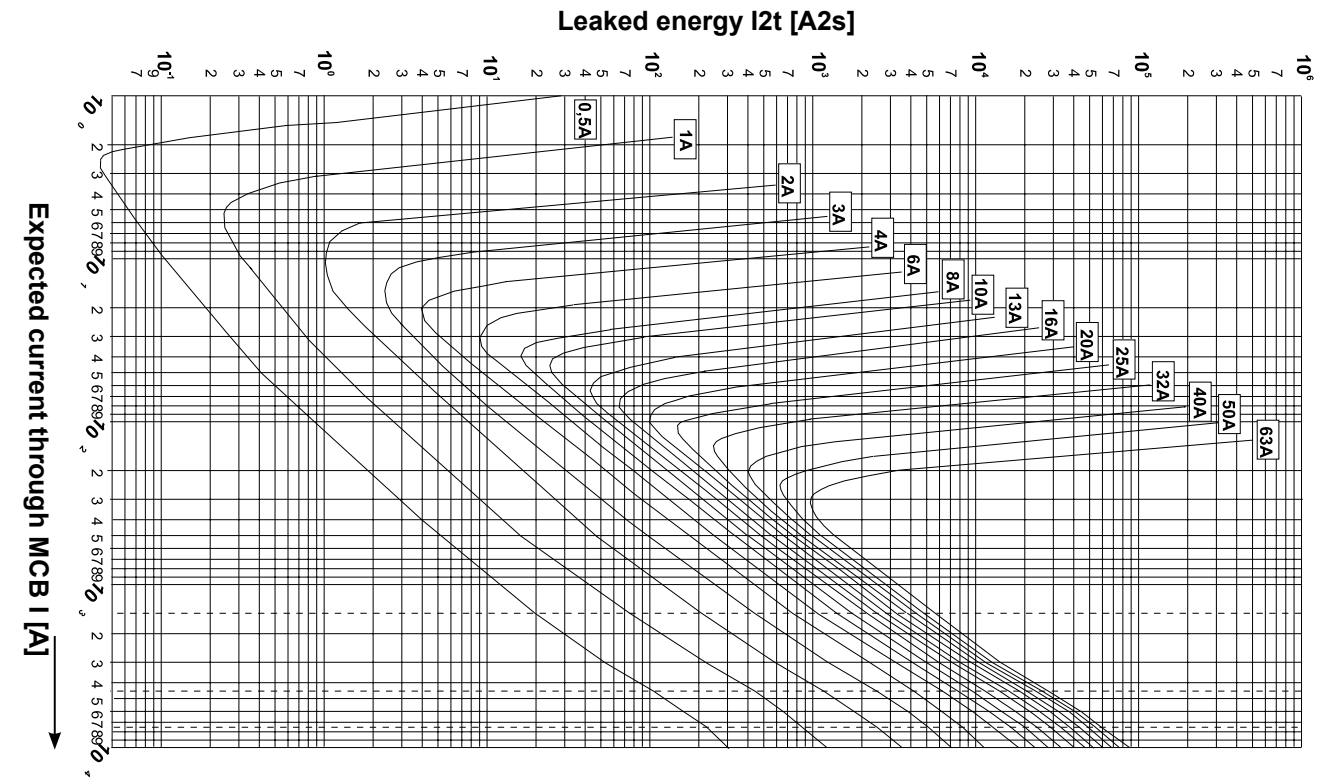
Standards		EN 60898-1
Pole configuration		1, 1+N, 2, 3, 3+N
Tripping characteristics		B, C
Rated current I _n	A	6 - 63
Rated voltage U _n	V	230; 230/400; 400
Rated insulation voltage U _i	V	400
Rated impulse withstand voltage U _{imp}	V	4 000
Rated DC voltage U _n	V	max.60-(for one pole τ=15ms)
Rated frequency	Hz	50 - 60
Shortcircuitbreakingcapacity	kA	10
Selectioncategory		3
Electrical endurance		4 000 cycles
Mechanical endurance		100 000 cycles
Terminal capacity	mm ²	1 - 25 for Cu wires 2,5 - 25 for Al wires - special Type
Mounting		on rail DIN 35x7,5 EN 60 715; on panel
Degree of protection		IP 20 IP 40 front
Ambient temperature	°C	-25 up to +55
Mounting position		optional
Vibration resistance		3g(8-50Hz)
Approvals		CE
Accessories		Auxiliary and signal contacts - PKJ, 2PKJ, PKJ+SKJ Shunt trips -RKVC, under voltage trip

- circuit breakers IZP10 series are mechanical switching devices able to switch on, conduct and switch of the current under standard conditions and able to switch on, conduct and switch of the current under abnormal circuit conditions such as short-circuit
- they are used to protect house and similar installations against over currents
- they are designed to be handled by untrained persons and they are maintenance free
- tripping characteristics B,C
- simple assembly-lower clip for fastening to the rail 35x7,5 EN 60715 enables taking the circuit breaker out from the device line connected by lower busbar without breaking the current circuit
- sealable in ON and OFF position of a lever
- there is a possibility to use through covers for both terminals, that are sealed with sealing blind
- **connection** :- conductors 1 -25 mm²
 - connection busbars (pin or fork type)
 - connection of conductors and busbars at the same time
 - optional way of connection
 - possibility to mount additional accessories

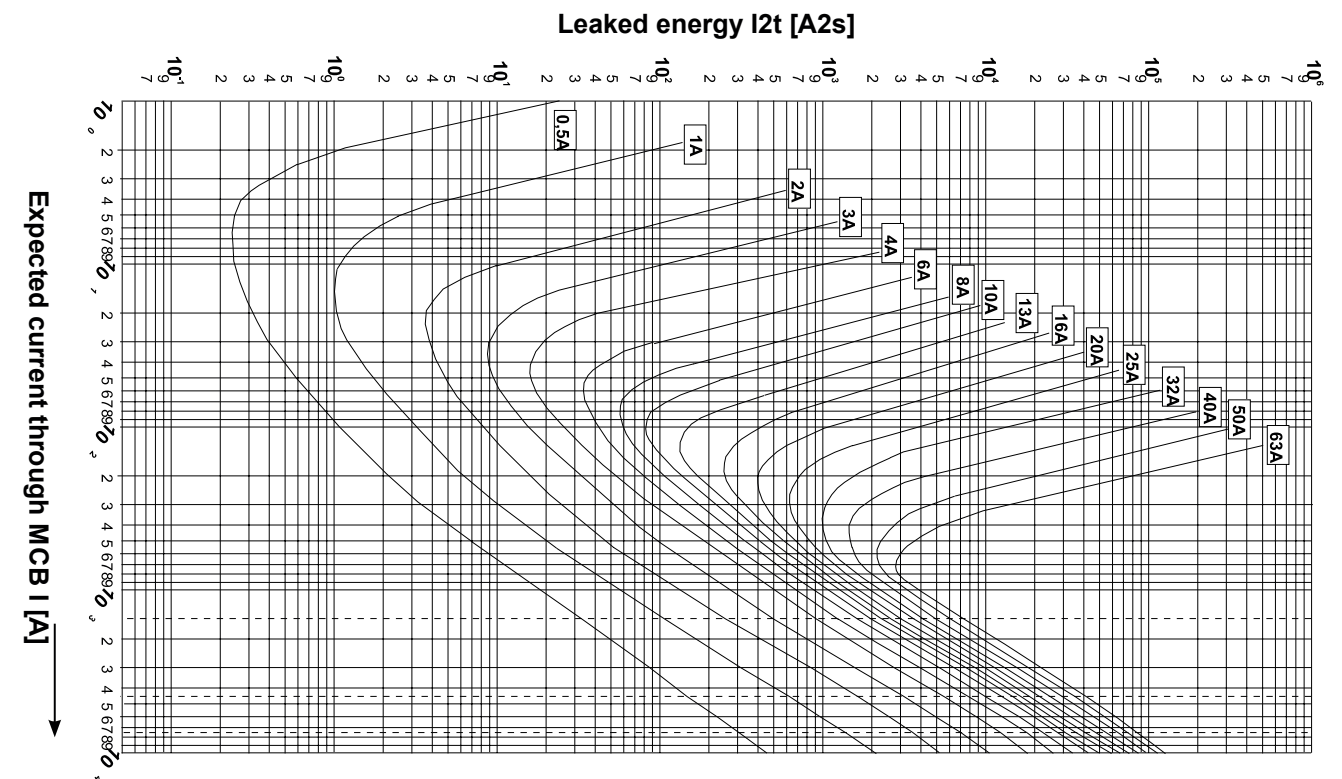
Dimensional drawing



Charts of leaked energy I²t of MCBS IZP 06/10 with tripping characteristic B



Charts of leaked energy I²t of MCBS IZP 06/10 with tripping characteristic C



MINIATURE CIRCUIT BREAKERS

Features

- In conformity with: EN 60898-1
- Wide range from (80 - 125) A
- Compact dimensions, thus consumes less panel space

Selection and ordering data - C characteristic

Type IZP10 3P (80 - 125) A

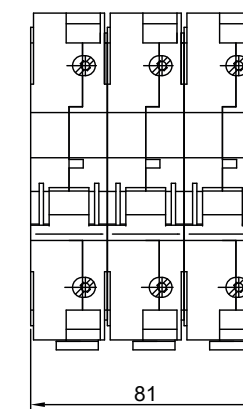
Rated current (I _n) A	No. of poles	Short circuit breaking capacity kA	Part No.	Weight Kg
80	3	10	IZP10 C80 3P	0.660
100	3	10	IZP10 C100 3P	
125	3	10	IZP10 C125 3P	



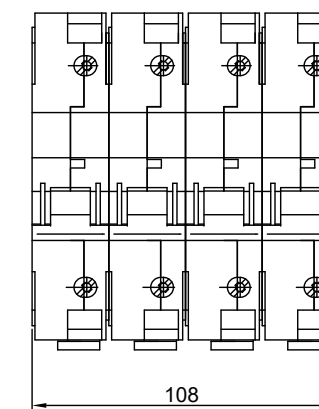
Technical data - IZP 10

Standards		EN 60 898 - 1
Pole configurations		3; 3+N
Rated current	I _n	A 80, 100, 125
Tripping characteristics		C
Rated voltage	U _n	V 230, 230/400, 400
Rated frequency		Hz 50
Breaking capacity	I _{cn}	kA 10
Electrical endurance		4 000 cycles
Conductors	mm ²	1 - 50
Mounting		on rail DIN 35x7,5 EN 60 715
Protection degree		IP 20, IP 40 front
Ambient temperature		-5°C up to +40°C
Approved		according to label
Rated DC		max110DC(foronepole,τ=4ms)
Accessories		shunt trips RKVC, auxiliary contacts PKJ, 2PKJ

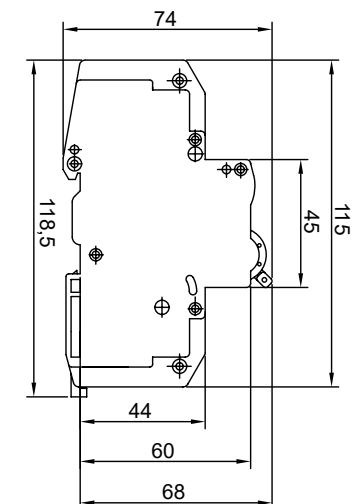
Dimensional drawing



IZP10 3P



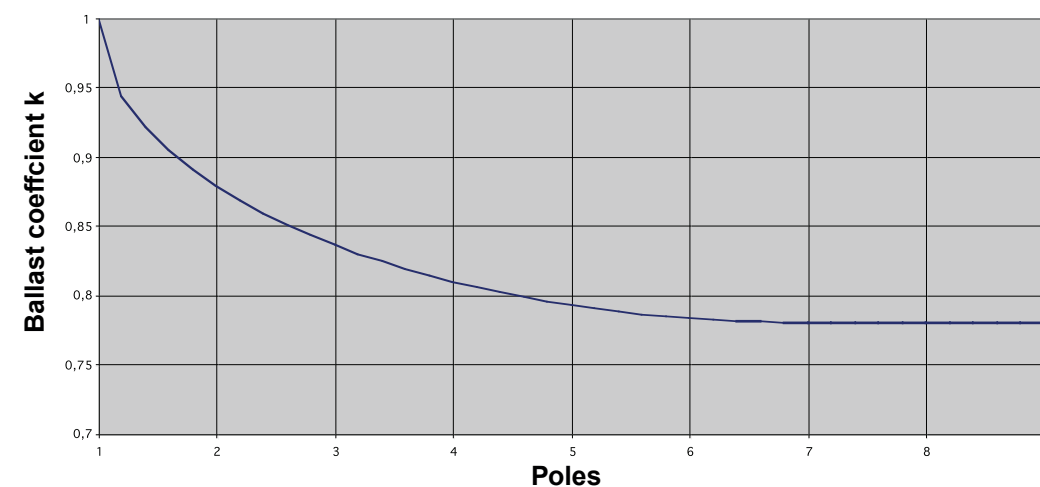
IZP10 3P+N



7

Correction of rated currents of miniature circuit breakers

Correction of rated currents of miniature circuit breakers installed side by side (A) Valid for reference temperature 30°C.



7

SIGNAL LAMP

Features

- In conformity with: EN 60947-5-1
- Color (Transparent; Red; Green; Blue; Yellow)
- Compact dimensions, thus consumes less panel space

Selection and ordering data

Type RKRS (24-230) V

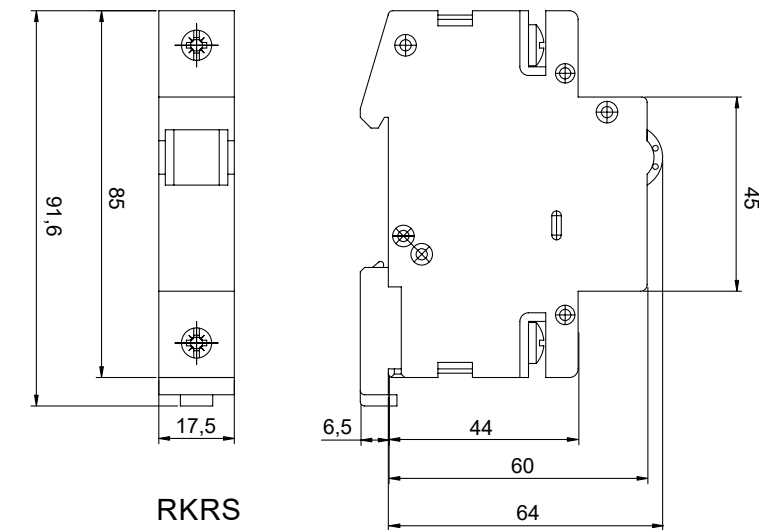
Voltage (AC) V	Voltage (DC) V	Colour	Part No.	Weight Kg
24	24	Transparent	RKRST 24V	0.060
48	48	Transparent	RKRST 48V	
110	110	Transparent	RKRST 110V	
230	220	Transparent	RKRST 230V	
24	24	Red	RKRSR 24V	
48	48	Red	RKRSR 48V	
110	110	Red	RKRSR 110V	
230	220	Red	RKRSR 230V	
24	24	Green	RKRSG 24V	
48	48	Green	RKRSG 48V	
110	110	Green	RKRSG 110V	
230	220	Green	RKRSG 230V	
24	24	Blue	RKRSB 24V	
48	48	Blue	RKRSB 48V	
110	110	Blue	RKRSB 110V	
230	220	Blue	RKRSB 230V	
24	24	Yellow	RKRSY 24V	
48	48	Yellow	RKRSY 48V	
110	110	Yellow	RKRSY 110V	
230	220	Yellow	RKRSY 230V	



Technical data - RKRS

Standards		EN 60 947-5-1
Number of poles		1
Rated voltage U _n	V	AC 24, 48, 110, 230 DC 24, 48, 110, 220
Light source		high capacity LED diode
Light source capacity	W	0,8
Colours		green - G, red - R, blue - B, transparent - T, yellow - Y
Illumination		constant - RKRS
Terminal capacity	mm ²	0,75 - 6 for Cu conductors
Mounting		on rail DIN 35x7,5 EN 60 715 on board
Degree of protection		IP 20 IP 40 from the front panel
Ambient air temperature	°C	from -25 to +55
Working positions		optional

Dimensional drawing



Accessories

SHUNT TRIP - RKVC

Features

- Accessories to the circuit-breaker, modular switches and residual current devices
- Utilized for the tripping of circuit-breaker (modular switch) by means of outer source of voltage in instantaneous trip-ping of the circuit
- It is delivered as separate unit or assembled together with circuit-breaker (modular switch)
- It is mounted on right hand side of the circuit-breaker (switch), left side of residual current devices

Technical data

RKVC



Standards		EN60947-1 (IEC60947-1)
Rated voltage	V	AC: 400, 230, 110, 60, 48, 24, 12 DC: 110, 48, 24
Rated insulation voltage	V	400
Max. switching of current (voltage of RKVC)	A(V)	AC: 0,5(400); 0,6(230); 0,5(110); 0,9(60); 0,8(48); 2,8(24); 6(12) DC: 0,6(110); 2(48); 3(24)
Rated impulse withstand voltage	kV	4
Rated making over voltage	kV	4
Range of activity voltage	%	70-110
Tripping time	ms	max. 50
Rated frequency	Hz	50
Mounting		on right side of circuit breaker (switch), left side of residual current device
Degree of protection		IP 20
Terminal capacity	mm ²	1-6 Cu

Instructions guide for the mounting of a shunt trip RKVC

- on right side of all executions and modular switches
- circuit breaker and shunt trip have to be in switch-of position
- insert pin Ø1,6mm into aperture of operating lever and into aperture of switching system Ø1,2mm (pins are part of delivery)
- approach shunt trip to the circuit breaker in order to achieve engagement of pins into appropriate parts of circuit breaker and switching system of RKVC
- into free holes in shunt trip RKVC enter stainless steel screws and slightly tight the screws to attach it to the IZP
- check the function of RKVC with IZP by switching on the MCB and pushing the mechanism through the hole for pin Ø1,2mm with appropriate tool.

UNDER VOLTAGE TRIP - RKPC

Features

- Accessories to IZP
- They are used for protection against rerun - up of motor by failure in mains
- Signalisation of release position green / red
- Auxiliary button for correct function control
- Mounting to circuit breakers in factory(*)

IZP+RKPC

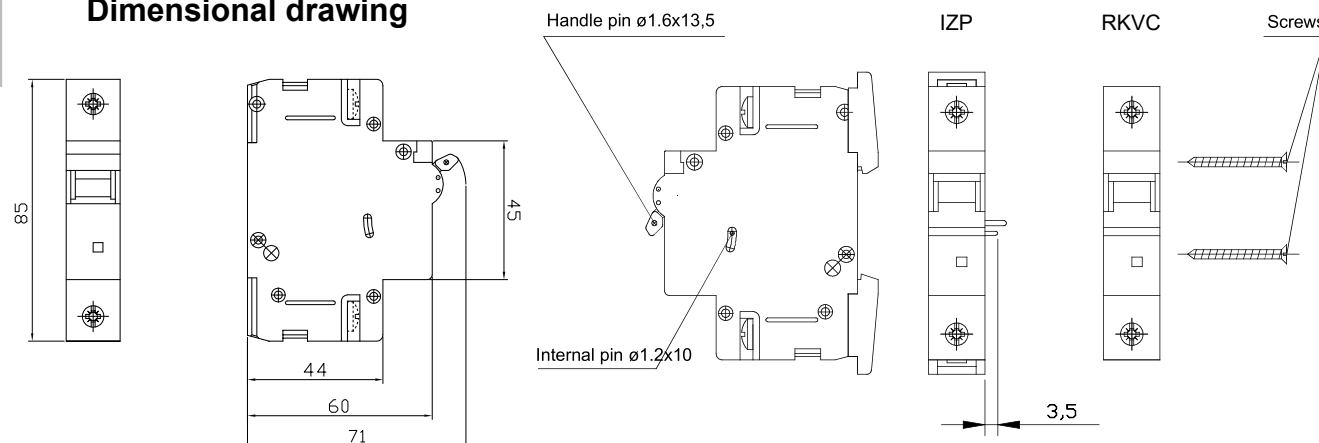


Technical data

Standards	EN60947-1
Rated voltage	24, 48, 120, 230, 400 V AC
Rated frequency	50 Hz
Maximal using	3 W
Attachment	on the right side
Connecting wires	0,75–2,5mm ²
Degree of protection	IP 20
Turn on limit	up 85 % from U _n down 35 % from U _n

7

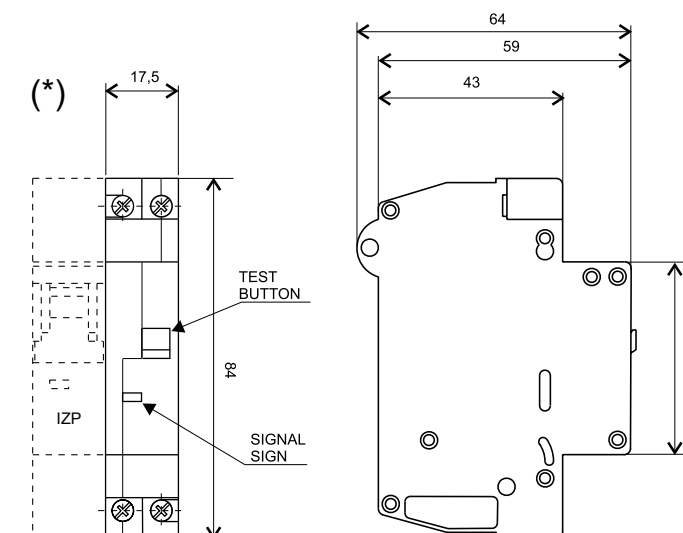
Dimensional drawing



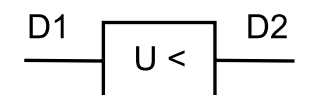
Operational voltage	Type
24 V ~	RKVC 24 V ~
48 V ~	RKVC 48 V ~
110 V ~	RKVC 110 V ~
230 V ~	RKVC 230 V ~
400 V ~	RKVC 400 V ~
24V=	RKVC 24V=
48V=	RKVC 48V=
110V=	RKVC 110V=

7

Dimensional drawing



Connecting scheme



Type
RKPC 24 V~
RKPC 48 V~
RKPC 120 V~
RKPC 230 V~
RKPC 400 V~

AUXILIARY CONTACTS PKJ, 2PKJ, PSKJ

Features

PKJ



- These are accessories to circuit - breakers and residual current devices
- Can be obtained as separate units or mounted together with circuit - breaker (modular switch)
- They are mounted on the left hand side of the circuit - breaker (modular switch) by means of pins and screws

2PKJ



PSKJ

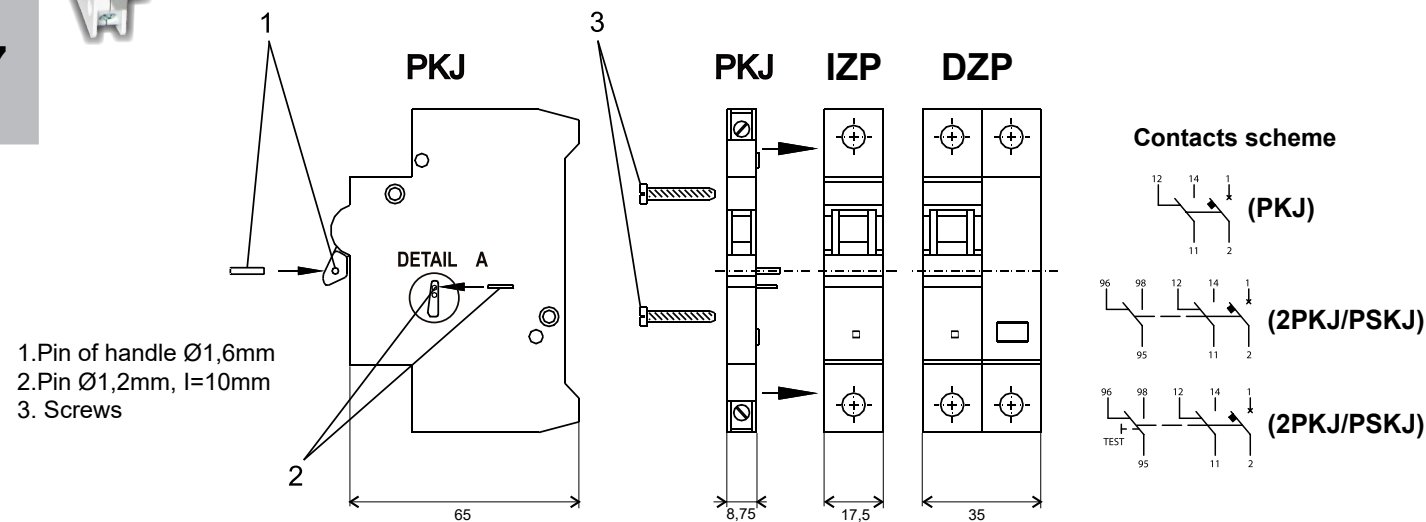


Technical data

Standards		EN60947-5-1 (IEC60947-5-1)
Rated insulation voltage U_i	V	400
Rated operational voltage U_e	V	230
Rated thermal current I_{th}	A	16
Rated operational current I_e	A	4 (AC15 at $U_e = 230V$) 0,5 (DC13 at $U_e = 110V$)
Conditional short circuit current with fuse 16A I_k	A	800
Max. conventional back-up fuses	A	16 gL
Rated frequency	Hz	50-60
Mounting		on left side of device
Degree of protection		IP 20
Terminal capacity	mm ²	0,5-2,5 Cu

INSERT PINS

CONNECT WITH 2 SCREWS



1. Pin of handle $\varnothing 1,6\text{mm}$
2. Pin $\varnothing 1,2\text{mm}$, $l=10\text{mm}$
3. Screws

1. In the block of auxiliary insert into handle the pin of $\varnothing 1,6\text{ mm}$ and into the opening of the switching system the pin $\varnothing 1,2\text{ mm}$.
2. Approach contacts block to IZP/DZP to let the pins snap in to relevant device pieces. During the assembly must be both handles the IZP/DZP and the contact block handle OFF.
3. Insert in to free openings in the contact block the tapping screw and attach freely to IZP/DZP.
4. Verify mechanical function of auxiliary contact with IZP/DZP by pushing through the device opening $\varnothing 1,2\text{ mm}$ with appropriate device the mechanical part (pin, needle etc.)

N-POLE

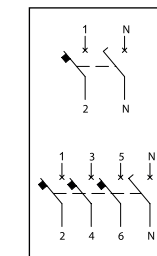
Features

- Assembling with circuit breaker at manufacturer's site according to the requirement of the customer
- Neutral pole can be assembled to all AC circuit breakers (current ratings, tripping characteristics)
- Neutral pole is without release, on making of circuit breaker it makes before the other contacts and during breaking it breaks after the other poles
- On ordering of neutral pole please state type and ordering number of the circuit breaker and type and ordering number of the neutral pole

N-POLE



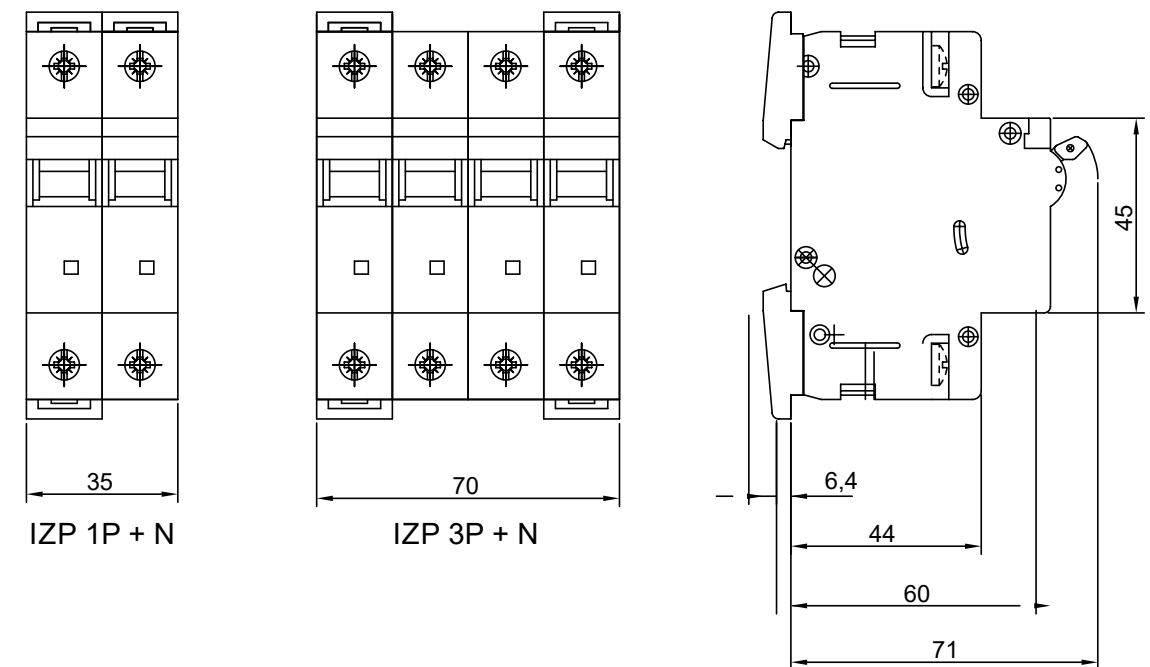
Scheme



Type

- N-pole of circuit breaker IZP 0,2 - 25 A
- N-pole of circuit breaker IZP 32 - 63 A

Dimensional drawing

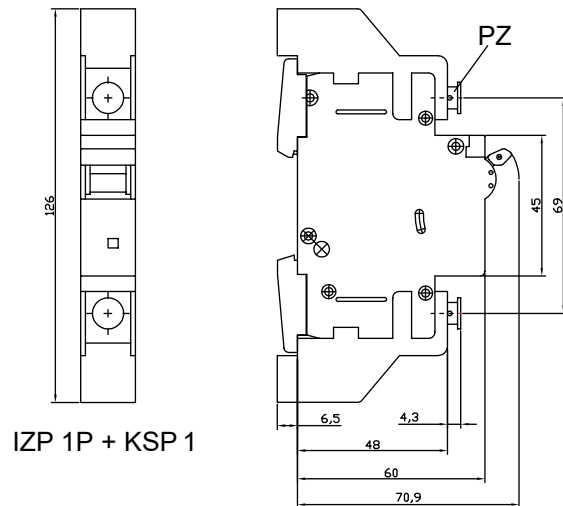


TERMINAL COVERS

Features

- Accessories to the circuit-breaker and modular switches
- Used for the improving of degree of protection to value IP30 and together with sealing blind also for sealing of terminals
- Single pole cover of terminals do not increase width of module of circuit breaker (modular switch); for the protection of both terminals two covers are needed
- Three pole cover of terminals is applicable only for IZP; the width of three pole module will change from 52,5 to 57 mm.
- For the fixing of cover to circuit-breaker (modular switch) there is necessary sealing blind PZ

Dimensional drawing

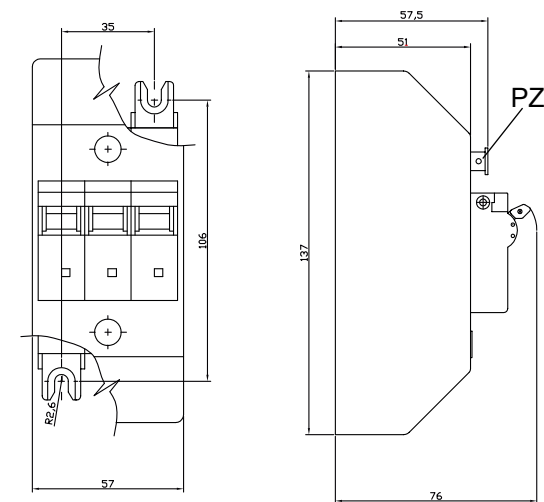


IZP 1P + KSP 1

KSP 1



with single pole cover of terminals (KSP 1)



IZP 3P + KSP 3

KSP 3



IZP with clips for mounting on board and with three pole cover of terminals (KSP 3) Incorporating sealing blind (PZ)

SEALING BLIND-PZ

Features

- Accessories to the circuit-breaker and modular switches
- Utilized for sealing of single pole covers KSP 1 and three pole covers KSP 3 and for mounting three pole covers KSP 3 too
- For sealing can be used sealing wire with maximum diameter $\varnothing 1,5\text{mm}$



PZ

RESIDUAL CIRCUIT BREAKERS

Features

- In conformity with: EN 61008-1
- Wide range from (16 - 63) A
- Compact dimensions, thus consumes less panel space

Selection and ordering data

Type DZP2 2P (16 - 40) A

Rated current (In) A	No. of poles	Residual current (I Δ n) mA	Part No.	Weight Kg
16	2	0.03	DZP2 B16/0.03 2P	0.250
25	2	0.03	DZP2 B25/0.03 2P	
40	2	0.03	DZP2 B40/0.03 2P	
16	2	0.5	DZP2 B16/0.5 2P	
25	2	0.5	DZP2 B25/0.5 2P	
40	2	0.5	DZP2 B40/0.5 2P	



Type DZP4 4P (16 - 63) A

Rated current (In) A	No. of poles	Residual current (I Δ n) mA	Part No.	Weight Kg
16	4	0.03	DZP4 B16/0.03 4P	0.435
25	4	0.03	DZP4 B25/0.03 4P	
40	4	0.03	DZP4 B40/0.03 4P	
63	4	0.03	DZP4 B63/0.03 4P	
16	4	0.3	DZP4 B16/0.3 4P	
25	4	0.3	DZP4 B25/0.3 4P	
40	4	0.3	DZP4 B40/0.3 4P	
63	4	0.3	DZP4 B63/0.3 4P	
16	4	0.5	DZP4 B16/0.5 4P	
25	4	0.5	DZP4 B25/0.5 4P	
40	4	0.5	DZP4 B40/0.5 4P	
63	4	0.5	DZP4 B63/0.5 4P	

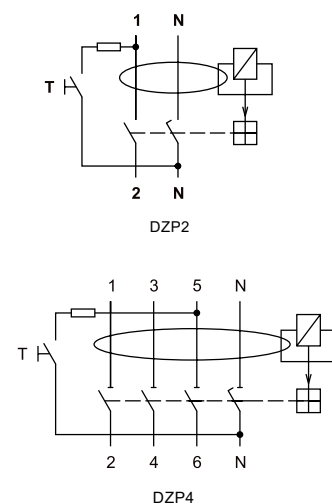


Technical data - DZP

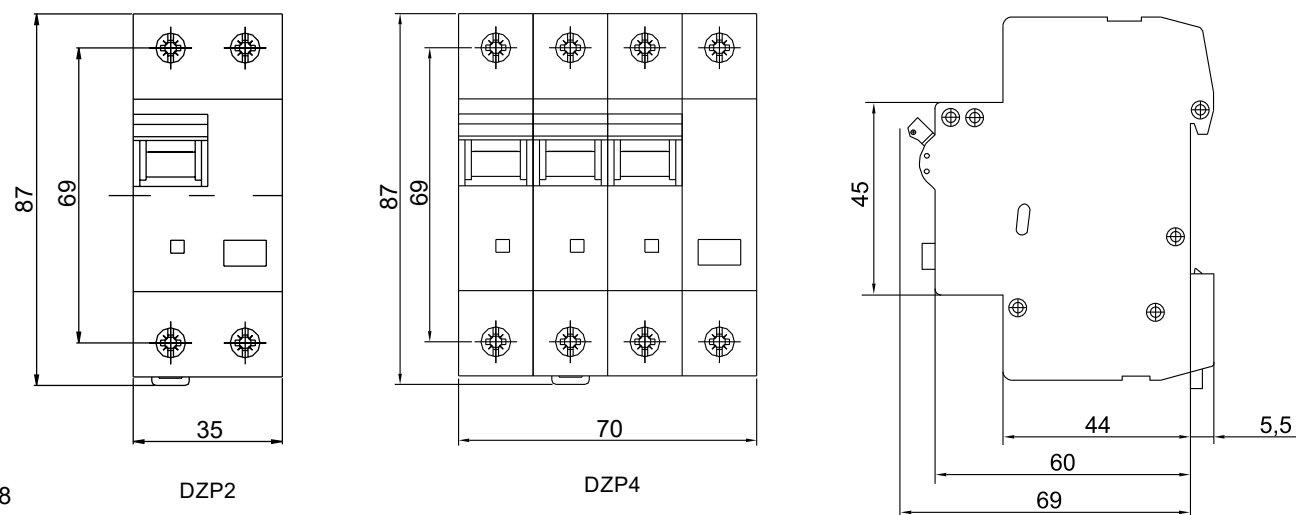
Versions			DZP2	DZP4
Types			A	
Number of poles			2	4
Rated current	I_n	A	16 - 63	16 - 63
Rated residual operating current	I_{Dn}	A	0,01 - 0,5	0,03 - 0,5
Rated voltage	U_n	V	230	230/400
Rated frequency		Hz	50	50
Rated res. making and breaking capacity	I_m	$I_{\Delta m}$	630	630
Rated res. making and breaking capacity	$I_{\Delta m}$			
Max. conventional back-up fuses GL	I_n	A	63;80 for $I_n=63$ and 80A; 100 for $I_n=100A$	
Rated conditional short-circuit current	I_{nc}	A	10000;6000 for $I_n=100A$	
Protection degree			IP 20; IP40 after installation	
Mounting position			optional	
Ambient temperature		°C	from -25°C to +40°C	
Weight		g	250	435
Terminal capacity		mm ²	1 to 25	
Accessories			auxiliary and signal contacts	

- protection in cases of indirect contact
- protection in cases of direct contact
- prevention of fires caused by ground-fault currents
- suitable for protection of electrical circuits in residential buildings, non-residential buildings or industrial applications
- DZP devices are working according IEC/EN 61008-1
- simple and solid fixing to 35 mm mounting rail in compliance to EN6071
- range of rated residual operating currents 10,30,100,300,500 mA ($I=10mA$ is for devices with rated current up to 25A include)
- optical indicator, on the front side indicating operating state of device (green target visible, closed contact red target visible opened contacts)
- connected clamp headed/stirrupted range of connecting wires 1,5-25 mm²
- working position optional
- there is possibility to use auxiliary contacts for type DZP
- DZP devices are compatible with IZP circuit breakers dimensions
- type A - sensitive to alternating and pulsating dc residual operating currents

Schematic diagram



Dimensional drawing



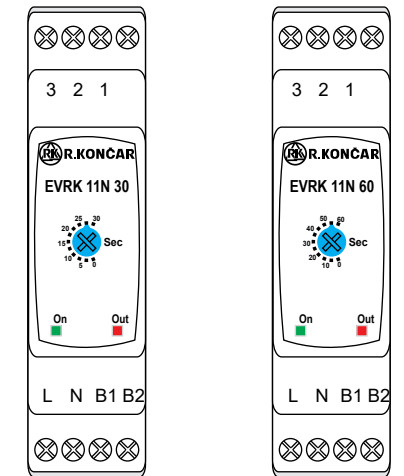
ELECTRONIC TIME RELAYS

Timer EVRK 11N.....	8/1
Multi Range Timers EVRK 11N.....	8/2
Multi Function Timers EVRU KM1.....	8/3
Multi Range Timers EVRU KM2.....	8/4
Star-Delta Timer EVRK 40.....	8/5



TIMER

EVVK 11N 30 and 60



General Specifications

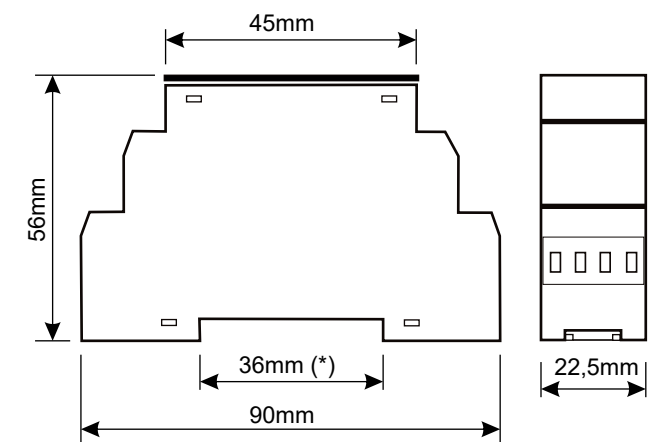
EVVK 11N are the delay on timers. When the application of voltage to the timer's supply inputs, the counter starts counting (1 - 2 contacts are short cut). End of the adjusted time, counter stops counting and the output becomes on (2 - 3 contacts are short cut). When the supply voltage cut off, the timer reset.

Technical Specifications

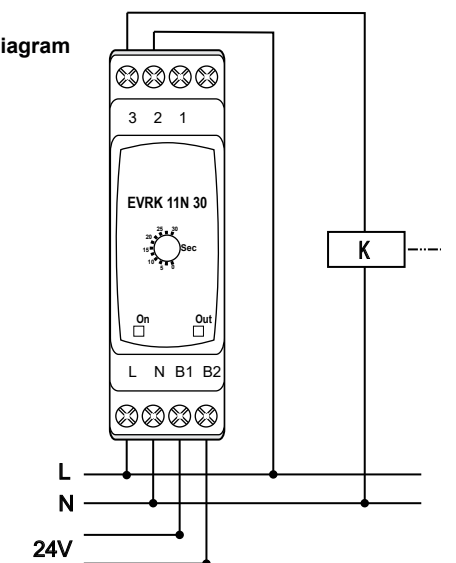
EVVK 11N	Time Interval (sec)	Electrical Connection	Weight (kg)
30	0,3...30sec	PCB Clamp	0,09
60	0,6...60sec	PCB Clamp	0,09

- Supply Voltage** : 220 Vac \pm %20 (L,N), 50 / 60 Hz
- B1,B2(Vac)** : 24 \square ; 12 \square
- B1,B2(Vdc)** : B1:+ ; B2: -
- Electrical Connector** : PCB Connectors (2,5 mm²)
- Power Consumption** : < 7 VA
- Ambient Temperature** : -5 °C...+55
- Control Output** : Relay, 1 Changeover, 10A / 250 Vac
- Electrical Life** : 100.000 ops. (Resistive Load)
- Connection** : DIN 35 rail or Vertical Installation (Installation springs behind the box should be pushed outward to enable screwing).

Dimensions

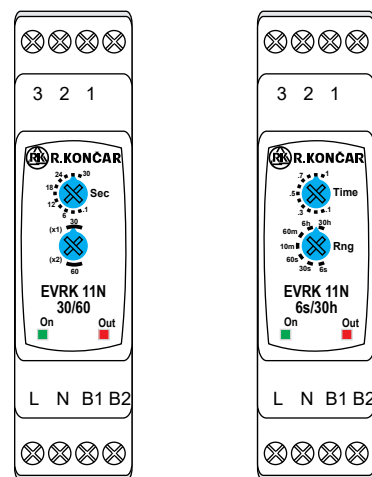


Schematic diagram

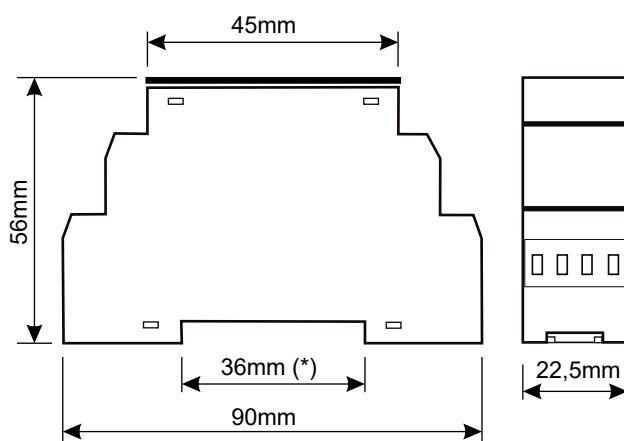


MULTI RANGE TIMERS

EVRK 11N 30/60 and 6s/30h



Dimensions



General Specification:

EVRK 11N 30/60 and 6s/30h multi range timer are delay on timers. When the supply is ON timers "ON" led is lighted and waits till adjusted period of time (meanwhile relay contacts 1-2 is short-cut). After adjusted period of time "Relay" led is ON and relay supplies to the system (meanwhile reley contacts 2-3 is short-cut). When the supply is cut than timer returns to the first position.

EVRK 11N 30/60 timer is adjusted 30 sec. or 60 sec. with the adjustment pot on the front panel. Upper adjustment pot sale shows for 30 second. For the 60 second applications scale is multiplied by 2.

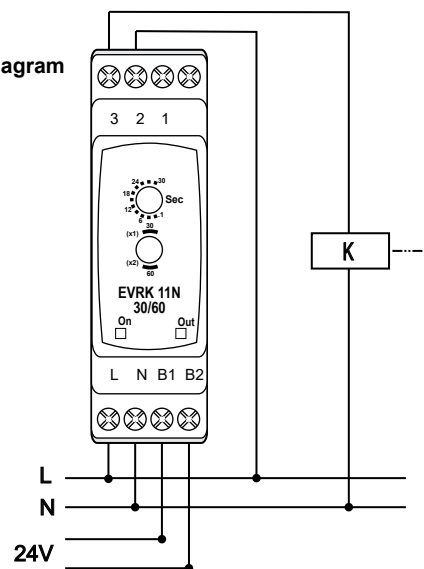
EVRK 11N 6s/30h multirange timer has 7 time range. Upper adjustment pot has multiplier of 10 pieces. Maximum value is 1. Time value is the value that is adjusted in "time range". Both relays does not accept any user interruptions while process has already begun.

Technical Specifications

Type	Time Range	Electrical Connection	Weight (kg)
PARTTIME	0,1...60sec.	PCB Connectors	0,09
FULLTIME	0,6s...30hours	PCB Connectors	0,09

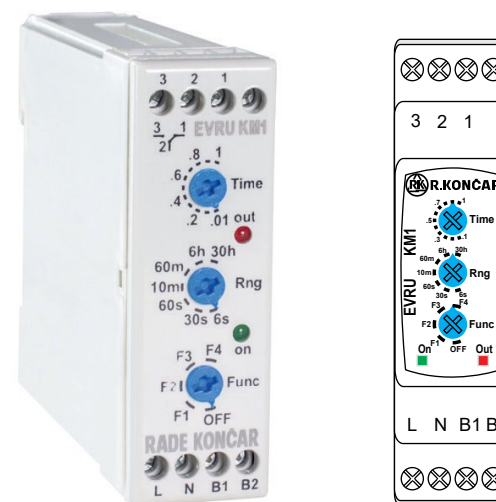
Supply Voltage : 220 Vac \pm %20 (L,N), 50 / 60 Hz
B1,B2(Vac) : 24 ; 12
B1,B2(Vdc) : B1:- ; B2: +
B,N(Vac) : 24 ; 12
B,N(Vdc) : B:+ ; N:-
Power Consumption : < 7 VA
Ambient Temperature : -5 °C...+55 °C
Control Output : Relay,1 Change Over, 10A / 250 Vac
Electrical Life : 100.000 ON / OFF (Resistive)
Montage Type : By closing back side montage spring, it can be montaged to the DIN 35 rail. For plain surfaces, montage is done by montage spring in outward position.

Schematic diagram

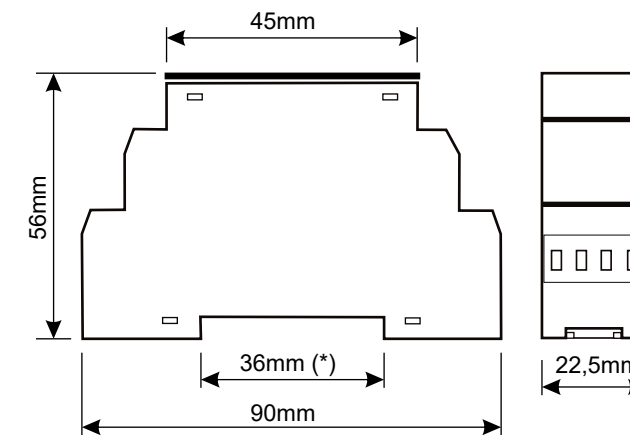


MULTI FUNCTION TIMERS

EVRU KM1



Dimensions



General Specification:

EVRU KM1:

Multi functional Timer is micro controller based and has 4 functions. Working functions, time ranges and time adjustments can be done at front of the timer.

A) Time Adjustment: This is a multiplier which multiplies the time range according to the adjusted function. Multiplier is between 0,01 to 1. With this button you can divide time ranges till 100 times.

B) Time Range Adjustment: This for choosing the time ranges. Time adjustment are between 6 seconds till 30 hours.

C) Function Adjustment: This is for choosing appropriate function to your need. Relay has 5 steps, four of them is for functions and one of them is to CUT relay output in every condition.

OFF: It cuts relay output in every condition. S`pecially good for checking the system.

F1: Delay ON Function: When relay is energised, ON led is lights, after adjusted time OUT led is light.

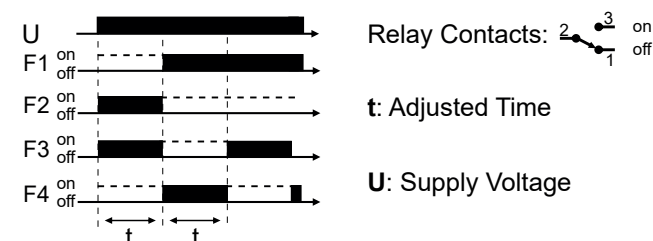
F2: Delay OFF Function: When relay is energised, ON led OUT led islight on, after adjusted time OUT led is off.

F3: Equal Time ON Flasher Function: When relay is energised, ON led and OUT led is on, after adjsed time OUT led is off, than again after same adjusted time OUT led id on, and this continues in cycle.

F4: Equal Time off Flasher Function: When relay is energised, ON led is on and OUT led is off, after adjusted time OUT led is on, than after again same adjusted time OUT led is off, and this continues in cycle.

Note: "On" and "Off" time ranges are equal for F3 and F4 functions

Function Schemes

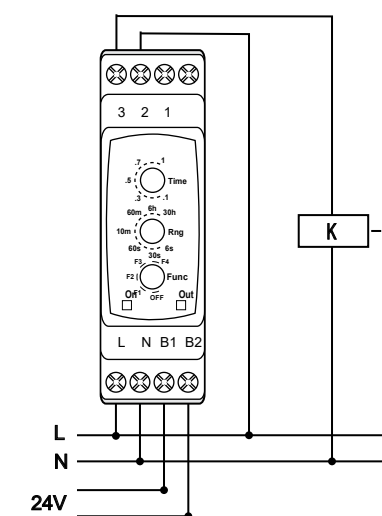


Step	Time Range	
	Min. Multiplier =0,01	Max. Multiplier =1
6 s	0,06 s	6 s
30 s	0,3 s	30 s
60 s	0,6 s	60 s
10 m	0,1 m	10 m
60 m	0,6 m	60 m
6 h	0,06 h	6 h
30 h	0,3 h	30 h

Technical Specifications:

Supply Voltage : 220 Vac \pm %20, (L , N)
B1,B2(Vac) : 24 ; 12
B1,B2(Vdc) : B1:+ ; B2:-
Adjustment Accuracy : \pm %3
Time Range : 0,06 sec...30 hour
Functions : F1: Delay ON
 F2: Delay OFF
 F3: Equal ON/OFF ON start Flasher
 F4: Equal ON/OFF OFF start Flasher
Power Consumption : <= 3 W
Ambient Temperature : -5...+55 °C
Contacts Type : 10A, 250 Vac(Omron)
Electrical Connections : PCB Connectors (2,5 mm2)

Schematic diagram



AUTOMATIC POWER FACTOR CORRECTION UNIT AND COMPONENTS

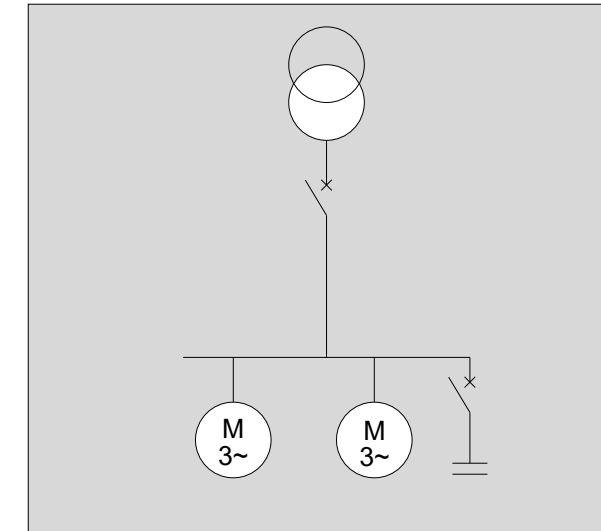


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 Automatic Power Factor correction unit from 90 to 210 kVAr/ 525V; p=14%.....9/6
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SYSTEMS AND TYPES OF COMPENSATION

When selecting capacitor bank, there are two compensation systems.

Fixed type capacitor banks



- The reactive power supplied by the capacitor bank is constant irrespective of any variations in the power factor and the load of the receivers, thus of the reactive energy consumption of the installation.

- These capacitor banks are switched on:
- Either manually by a circuit breaker or switch
- Or semi-automatically by a remote-controlled contactor

This type of capacitor bank is generally used in the following situations:

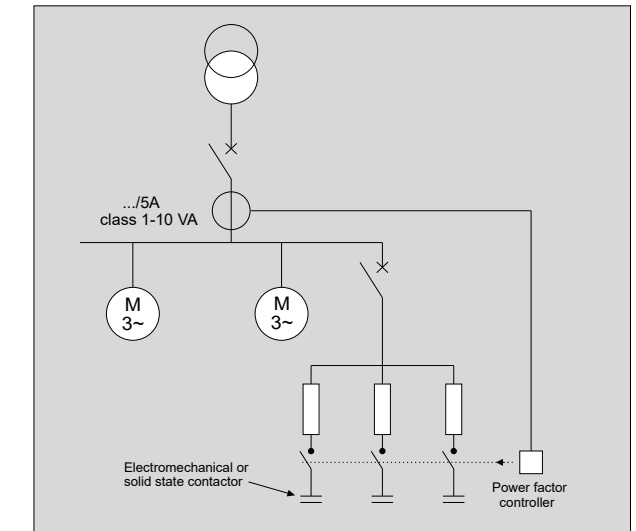
- Electrical installations with constant load operating 24 hours a day
- Reactive compensation of transformers
- Individual compensation of motors
- Installation of a capacitor bank whose power is less than or equal to 15% of the power of the transformer

PROTECTING CAPACITORS FROM HARMONICS

By design and in accordance with current standards, capacitors are capable of continuously withstanding an rms current equal to **1.3 times the nominal current** defined at the nominal voltage and frequency values.

This overcurrent coefficient has been determined to take account of the combined effects of the presence of harmonics and overvoltages (the capacitance variation parameter being negligible).

Automatic type capacitor banks



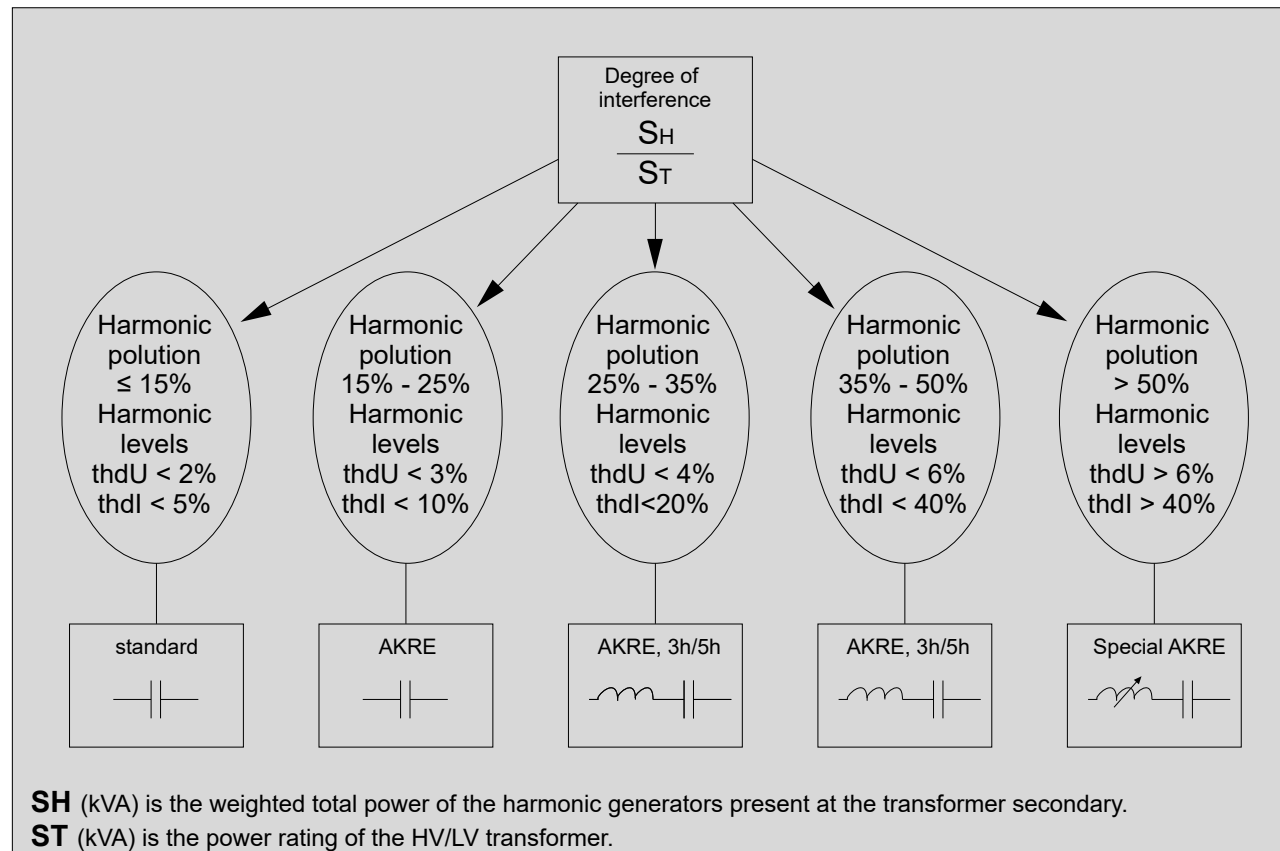
- The reactive power supplied by the capacitor bank can be adjusted according to variations in the power factor and the load of the receivers, thus of the reactive energy consumption of the installation.

- These capacitor banks are made up of a combination of capacitor steps (step = capacitor + contactor) connected in parallel. Switching on and off of all or part of the capacitor bank is controlled by an integrated power factor controller.

- These capacitor banks are also used in the following situations:

- Variable load electrical installations
- Compensation of main LV distribution boards or major outgoing lines.
- Installation of a capacitor bank whose power is more than 15% greater than the power of the transformer

AUTOMATIC POWER FACTOR CORRECTION UNIT



TECHNICAL DATA:

AKRE capacitor banks are automatic banks with switching via electromechanical contactors.

- Rated Voltage: 400V, 50Hz; 3;
- Admissible working voltage range for the capacitors:
 - AKRE: 380 - 440V
 - AKRE 5h: 380 - 440V
 - AKRE 3h: 380 - 525V
- Regulation Voltage: 230V, 50Hz
- Temperature class:
 - Operation $-10/+45^{\circ}\text{C}$ (average over 24 hours: 40°C)
 - Operation $-10/+40^{\circ}\text{C}$ (average over 24 hours: 40°C)
 - Storage $-30/+60^{\circ}\text{C}$
- Ventilation: natural or forced
- Colour grey cabinet (RAL 7035), black base
- Tolerance: $1,1 \times U_n$ & $1,3-1,5 \times I_e$
- Mechanical protection: IP 31
- Standards: EN 60439-1; IEC 60439-1 and 2

PAKRE capacitor banks are Semi - automatic banks with switching via electromechanical contactors.

- Rated Voltage: 400V, 50Hz; 3;
- Admissible working voltage range for the capacitors:
 - AKRE: 380 - 440V
- Regulation Voltage: 230V, 50Hz
- Temperature class:
 - Operation $-10/+45^{\circ}\text{C}$ (average over 24 hours: 40°C)
 - Storage $-30/+60^{\circ}\text{C}$
- Ventilation: natural or forced
- Colour grey cabinet (RAL 7035), black base
- Tolerance: $1,1 \times U_n$ & $1,3 \times I_e$
- Mechanical protection: IP 31
- Standards: EN 60439-1; IEC 60439-1 and 2

Fixed capacitor banks

AKRE capacitor banks with built-in circuit breaker
 Assembly filled and wired in an IP 31

- Rated Voltage: 400V, 50Hz; 3;
- Admissible working voltage range for the capacitors:
 - 380 - 440V
- Regulation Voltage: 230V, 50Hz
- Temperature class:
 - Operation $-10/+45^{\circ}\text{C}$ (average over 24 hours: 40°C)
 - Storage $-30/+60^{\circ}\text{C}$
- Ventilation: natural
- Colour grey cabinet (RAL 7035),
- Tolerance: $1,1 \times U_n$ & $1,3-1,5 \times I_e$
- Mechanical protection: IP 31
- Standards: EN 60439-1; IEC 60439-1 and 2

CONSTRUCTION OF THE ELECTRICAL CABINETS

The electrical cabinets have a metal case, they are prepared for a standing mounting position with a low voltage switches MCCB built-in as a standard mode.

W - wide , H - height, D - depth

Other powers, voltages, frequencies on request.
 Fix capacitor banks on request.

AUTOMATIC POWER FACTOR CORRECTION UNIT

Automatic Power Factor correction unit from 15 to 65 kVar/440V



Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 15/440	15	440	5 + 5 + 5	600x900x280
AKRE 20/440	20	440	5 + 5 + 10	600x900x280
AKRE 25/440	25	440	5 + 10 + 10	600x900x280
AKRE 30/440	30	440	5 + 10 + 15	600x900x280
AKRE 35/440	35	440	5 + 10 + 20	600x900x280
AKRE 40/440	40	440	10 + 10 + 20	600x900x280
AKRE 50/440	50	440	10 + 20 + 20	600x900x280
AKRE 65/440	65	440	10 + 15 + 20 + 20	600x900x280

Automatic Power Factor correction unit from 75 to 160 kVar/440V



Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 75/440	75	440	12,5+12,5+25+25	700x1200x300
AKRE 80/440	80	440	10+10+20+20+20	700x1200x300
AKRE 90/440	90	440	10+20+20+20+20	700x1200x300
AKRE 100/440	100	440	20+20+20+20+20	700x1200x300
AKRE 125/440	125	440	25+25+25+25+25	700x1200x300
AKRE 150/440	150	440	10 + 7x 20	700x1200x300
AKRE 160/440	160	440	8x20	700x1200x300

AUTOMATIC POWER FACTOR CORRECTION UNIT



Automatic Power Factor correction unit
from 175 to 300kVar/440V

Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 175/440	175	440	3x25+2x50	680x2150x430
AKRE 200/440	200	440	4x25+2x50	680x2150x430
AKRE 225/440	225	440	3x25+3x50	680x2150x430
AKRE 250/440	250	440	2x25+4x50	680x2150x430
AKRE 275/440	275	440	25+5x50	680x2150x430
AKRE 300/440	300	440	2x25 +57x 50	680x2150x430

Automatic Power Factor correction unit
from 325 to 420kVar/440V

Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 325/440	325	440	3x25+5x50	900x2150x430
AKRE 350/440	350	440	2x25+6x50	900x2150x430
AKRE 375/440	375	440	3x25+6x50	900x2150x430
AKRE 380/440	380	440	2x20+4x40+3x60	900x2150x430
AKRE 400/440	400	440	20+5x40+3x60	900x2150x430
AKRE 420/440	420	440	6x40 +3x 60	900x2150x430

Automatic Power Factor correction unit from 450 to 660kVar/ 440V



Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 450/440	450	440	2x25+6x50	1400x2150x430
AKRE 500/440	500	440	4x25+8x50	1400x2150x430
AKRE 550/440	550	440	2x25+10x50	1400x2150x430
AKRE 600/440	600	440	12x50	1400x2150x430
AKRE 660/440	660	440	12x60	1400x2150x430

AUTOMATIC POWER FACTOR CORRECTION UNIT



Automatic Power Factor correction unit from 30 to 75kVar/ 440V; p=7%

Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 30/440; 7%	30	440	2x5+2x10	850x1450x360
AKRE 40/440; 7%	40	440	4x50	850x1450x360
AKRE 45/440; 7%	45	440	3x15	850x1450x360
AKRE 50/440; 7%	50	440	5x10	850x1450x360
AKRE 60/440; 7%	60	440	4x15	850x1450x360
AKRE 75/440; 7%	75	440	5x15	850x1450x360

With detuned filter reactors.
Resonance frequency = 189Hz.
Blocking factor p%= 7%.



Automatic Power Factor correction unit from 80 to 200kVar/ 440V; p=7%

Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 80/440; 7%	80	440	2x15+2x25	850x1950x520
AKRE 100/440; 7%	100	440	4x25	850x1950x520
AKRE 125/440; 7%	125	440	3x25+50	850x1950x520
AKRE 150/440; 7%	150	440	2x25+2x50	850x1950x520
AKRE 175/440; 7%	175	440	25+3x50	850x1950x520
AKRE 200/440; 7%	200	440	4x50	850x1950x520

With detuned filter reactors.
Resonance frequency = 189Hz.
Blocking factor p%= 7%.

Automatic Power Factor correction unit from 225 to 375kVar/ 440V; p=7%

Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 225/440; 7%	225	440	3x25+3x50	1200x2270x600
AKRE 250/440; 7%	250	440	2x25+4x50	1200x2270x600
AKRE 275/440; 7%	275	440	3x25+4x50	1200x2270x600
AKRE 300/440; 7%	300	440	2x25+5x50	1200x2270x600
AKRE 325/440; 7%	325	440	3x25+5x50	1200x2270x600
AKRE 350/440; 7%	350	440	2x25+6x50	1200x2270x600
AKRE 375/440; 7%	375	440	3x25+6x50	1200x2270x600

With detuned filter reactors.
Resonance frequency = 189Hz.
Blocking factor p%= 7%.

Automatic Power Factor correction unit from 400 to 660kVar/ 440V; p=7%

Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 400/440; 7%	400	440	8x50	1600x2270x600
AKRE 450/440; 7%	450	440	2x25+8x50	1600x2270x600
AKRE 500/440; 7%	500	440	10x50	1600x2270x600
AKRE 550/440; 7%	550	440	2x25+10x50	1600x2270x600
AKRE 600/440; 7%	600	440	12x50	1600x2270x600
AKRE 660/440; 7%	660	440	12x60	1600x2270x600

With detuned filter reactors.
Resonance frequency = 189Hz.
Blocking factor p%= 7%.

AUTOMATIC POWER FACTOR CORRECTION UNIT

Automatic Power Factor correction unit from 45 to 75kVar/525V; p=14%

Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 45/525; 14%	45	525	3x15	850x1450x360
AKRE 60/525; 14%	60	525	4x15	850x1450x360
AKRE 75/525; 14%	75	525	5x15	850x1450x360

With detuned filter reactors.
Resonance frequency = 134Hz.
Blocking factor p%=14%.

Automatic Power Factor correction unit from 90 to 210kVar/525V; p=14%

Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 90/525; 14%	90	525	2x15+2x30	850x1950x520
AKRE 120/525; 14%	120	525	4x30	850x1950x520
AKRE 150/525; 14%	150	525	3x30+1x60	850x1950x520
AKRE 180/525; 14%	180	525	2x30+2x60	850x1950x520
AKRE 210/525; 14%	210	525	1x30+3x60	850x1950x520

With detuned filter reactors.
Resonance frequency = 134Hz.
Blocking factor p%=14%.

Automatic Power Factor correction unit from 240 to 360kVar/525V; p=14%

Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 240/525; 14%	240	525	4x60	1200x2270x600
AKRE 270/525; 14%	270	525	30+4x60	1200x2270x600
AKRE 300/525; 14%	300	525	2x30+4x60	1200x2270x600
AKRE 330/525; 14%	330	525	1x30+5x60	1200x2270x600
AKRE 360/525; 14%	360	525	6x60	1200x2270x600

With detuned filter reactors.
Resonance frequency = 134Hz.
Blocking factor p%=14%.

Automatic Power Factor correction unit from 390 to 720kVar/525V; p=14%

Type	Power (kVar)	Voltage (V)	Steps	Dimensions WxHxD
AKRE 390/525; 14%	390	525	1x30+6x60	1600x2270x600
AKRE 450/525; 14%	450	525	1x30+7x60	1600x2270x600
AKRE 510/525; 14%	510	525	1x30+8x60	1600x2270x600
AKRE 570/525; 14%	570	525	1x30+9x60	1600x2270x600
AKRE 630/525; 14%	630	525	1x30+10x60	1600x2270x600
AKRE 690/525; 14%	690	525	1x30+11x60	1600x2270x600
AKRE 720/525; 14%	720	525	12x60	1600x2270x600

With detuned filter reactors.
Resonance frequency = 134Hz.
Blocking factor p%=14%.



POWER CAPACITORS

Cylindrical capacitor standard duty

Construction

- Dielectric: Polypropylene film
- Non PCB, Soft Polyurethane resin
- Extruded round aluminium can with stud
- Provided with discharge resistors
- Overpressure disconnecter

Features

- Three phase, delta connected
- Self-healing technology
- Naturally air cooled (or forced air cooling)
- Indoor mounting

Typical applications

- For Power Factor correction

Terminals

- 6.3mm fast-on terminals for plastic top -2,5 to 5 kvar
- Screw terminal for metal top – 7.5 to 30 kvar

Mounting parts

Threaded stud at bottom of can
(max. torque = 4Nm for M8 & 10Nm for M12)

Technical data and specifications

Characteristics	
Rated capacitance C_R	As per table
Tolerance	-5/ + 10%
Connection	D (Delta)
Rated voltage	As per table
Rated frequency f_R	50 Hz
Output	As per table
Rated current I_R	As per table
$\tan \delta_0$ (dielectric)	$\leq 0,2 \text{ W / kVar}$

Maximum ratings	
V_{\max} (up to 8 h daily)	$(V_R+10\% V_R) \text{ V AC}$
V_{\max} (up to 1 min)	$(V_R+30\% V_R) \text{ V AC}$
$I_{n \text{ by } \square}$	$1.3 \text{ to } 1.5 \cdot I_R \text{ !} \text{ B}^{\square}$
I_S	$200 \cdot I_R \text{ !} \text{ B}^{\square}$



Semi-Automatic Power Factor correction unit from 10 to 60kVar/440V;



Type	Power (kVar)	Voltage (V)	Dimensions WxHxD
PAKRE 10/440	10	440	500x600x225
PAKRE 15/440	15	440	500x600x225
PAKRE 20/440	20	440	500x600x225
PAKRE 25/440	25	440	500x600x225
PAKRE 30/440	30	440	500x600x225
PAKRE 40/440	40	440	500x600x225
PAKRE 50/440	50	440	500x600x225
PAKRE 60/440	60	440	500x600x225

POWER CAPACITORS

Cylindrical capacitor standard duty

Test data	
V_{TT}	$1,75 \cdot V_R$, AC, 2s
V_{TC}	3,600 V AC / 50 Hz, 2 s
* Losses	$\leq 0,5 \text{ W / kVar}$ * Without discharge resistor

Climatic category / -10/D

T_{njo}	-10 °C
T_{nby}	+55 °C
Rel. humidity	max. 95%
Maximum altitude	4,000 m above sea level

Mean life expectancy

t_{LD}	up to 100,000 hours
Max. 5,000 switchings per year to IEC 60831	

Design data

Dimensions (d x h)	As per table
Impregnation	Biodegradable soft resin
Fixing with threaded bolt	M12 for case size dia. > 53mm M8 for case size dia. \leq 53mm
Mounting position	Vertical position.

Terminals

Plastic top -1 to 5 kvar	6.3mm fast-on
Metal top - 7.5 to 25 kvar	Sigut terminal
Sigut terminals	
Degree of protection	Isolated terminals, IP20
Max. torque	1.2 Nm
Cable cross section	16 mm ²
Maximum terminal current	50 A
Creepage distance	12.7 mm
Clearance	9.6 mm

Safety

Mechanical safety	Overpressure disconnecter
Max. short circuit current	AFC: 10 kA
Discharge resistor time	\leq 1 min (50 V)

Reference Standards

IEC 60831-1/2, UL 810-5th edition

POWER CAPACITORS

Cylindrical capacitor standard duty

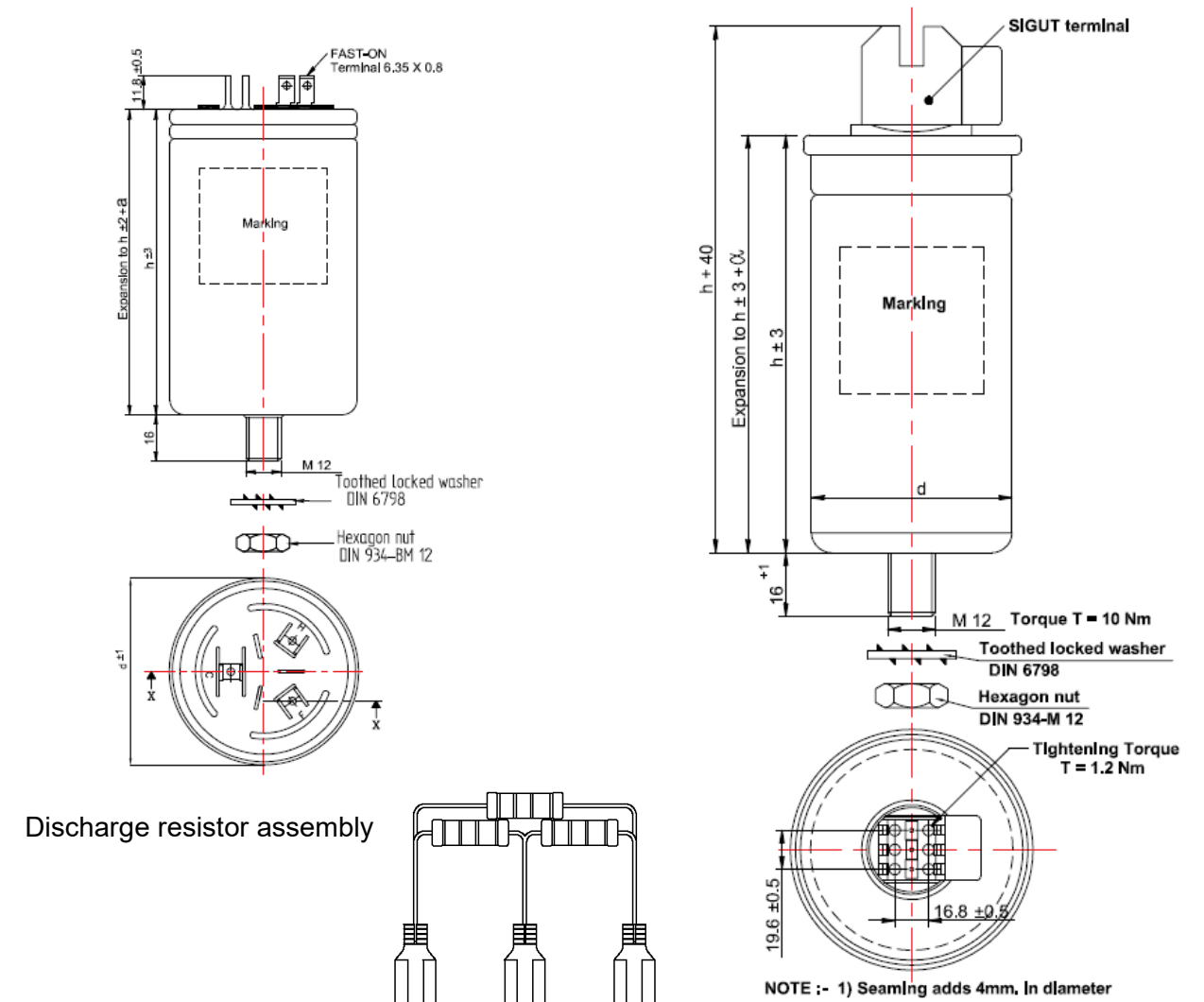
ORDERING CODE:

TYPE	Voltage (V)	Power (Q) kvar		Capacitance Cn (µf)	Rated current (A)		Dimension (mm) d x h	Part No.
		50 Hz	60 Hz		50 Hz	60 Hz		
I	440	2.5	3.0	13.7	3.3	3.9	63.5 x 130	RKC 440 2.5 S
i	440	5.0	6.0	27.5	6.6	7.9	63.5 x 154	RKC 440 5 S
II	440	7.5	9.0	41	9.8	11.8	78.4 x 159	RKC 440 7.5 S
II	440	10.0	12.0	55	13.1	15.7	78.4 x 195	RKC 440 10 S
II	440	12.5	15.0	68.5	16.4	19.7	88.4 x 195	RKC 440 12.5 S
II	440	15.0	18.0	82.2	19.7	23.6	88.4 x 270	RKC 440 15 S
II	440	20.0	24.0	110	26.2	31.5	88.4 x 270	RKC 440 20 S
II	440	25.0	30.0	137.1	32.8	39.4	88.4 x 345	RKC 440 25 S
II	440	30.0	36.0	164.5	39.4	47.2	88.4 x 345	RKC 440 30 S

I - Types with Plastic top

II - Types with Metal top

Dimensional drawing



POWER CAPACITORS

Cylindrical capacitor standard duty

ORDERING CODE:

Type	Voltage (V)	Power (Q) kvar		Capacitance Cn (µf)	Rated current (A)		Dimension (mm) d x h	Part No.
		50 Hz	60 Hz		50 Hz	60 Hz		
II	525	7.5	9.0	28.9	8.2	9.9	78.4 x 159	RKC 525 7.5 S
II	525	10.0	12.0	38.5	11.0	13.2	88.4 x 195	RKC 525 10 S
II	525	12.5	15.0	48.1	13.7	16.5	88.4 x 270	RKC 525 12.5 S
II	525	15.0	18.0	57.8	16.5	19.8	88.4 x 345	RKC 525 15 S
II	525	30.0	36.0	115.5	33.0	39.6	121.5 x 325	RKC 525 30 S

II - Types with Metal top

Discharging

Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched on again. This prevents an electric impulse discharge in the application, influences the capacitor's service life and protects against electric shock. The capacitor must be discharged to 50 V or less within 60 seconds. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. Discharge and short circuit capacitor before handling!

Service life expectancy

Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors too. The maximum service life expectancy may vary depending on the application the capacitor is used in.

Thermal load/over-temperature

After installation of the capacitor it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.

Overpressure Disconnecter

To ensure full functionality of an overpressure disconnecter, the following must be observed:

1. Maximum allowed fault current of 10000 A in accordance with UL 810 standard must be assured by the application.
2. Stress parameters of the capacitor must be within the IEC60831/IS13340 specification.

Over current and short circuit protection

- Use HRC fuses or MCCB-s for short circuit protection. Short circuit protection and connecting cables should be selected so that 1.5 times the rated capacitor current can be permanently handled.
- HRC fuses do not protect a capacitor against overload
 - they are only for short circuit protection.
- The HRC fuse rating should be 1.6 to 1.8 times rated capacitor current.
- Do not use HRC fuses to switch capacitors (risk of arcing).
- Use thermal magnetic over current relays for overload protection.

Resonance cases

Resonance cases must be avoided by appropriate application design in any case. Maximum total RMS capacitor current (incl. fundamental harmonic current) specified in technical data must not be exceeded.

Re-switching vs. phase-opposition

In case of voltage interruption, a sufficient discharge time has to be ensured to avoid phase-opposition and resulting high inrush currents.

POWER CAPACITORS

Cylindrical capacitor standard duty

Vibration resistance

The resistance to vibration of capacitors corresponds to IEC 68, part 2-6.

Max. test conditions:

Test duration	6 h*
Frequency range 1	10 ... 55 Hz*
Displacement amplitude	0.75 mm*

*corresponding to max. 98.1 m/s" or 10 g

These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents in the aluminum can are avoided.

Grounding

The threaded bottom stud of the capacitor has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed. The maximum tightening torque is 10 Nm for M12 stud and 4Nm for M8 stud.

POWER CAPACITORS

Cylindrical capacitor heavy duty

POWER CAPACITORS RKC 440 .. HD Series HEAVY DUTY

DESCRIPTION

RKC 440 .. Heavy Duty (HD series) capacitors are designed to offer long time expectancy and outstanding performance with its higher electrical characteristics. They are self-healing capacitors with low losses metallized polypropylene dielectric, filled in with inert gas N₂ mainly or with resin. They have an overpressure disconnection system which provide a high level of safety against internal defects cutting the 3 phases. Capacitors in cylindrical aluminium cans, provided with a M12 stud for fixing and earthing. Connection is made by a terminal block with clamp type terminals. The name plate includes a QR code associated to the individual test certificate and which offering us a *product anticopy protection*.



TECHNICAL CHARACTERISTICS

Rated voltage	230...690 V - 50 Hz
Dielectric	Polypropylene
Discharge resistors	Fitted
Dielectric losses	0.2 W / kvar
Total losses	0.4 W / kvar
Maximum overvoltage	1.1 U _N
Maximum overcurrent	1.8 I _N
Transient overcurrent	400 I _N
Insulation level	3 / - kV
Tolerance	-5 / +10 %
Climatic range	- 40 / D (+55 °C)
Life expectancy	> 150.000 hours
Terminal block	Type A : 16 mm ² ; 3 Nm max.; Pozidriv head screws Type B : 25 mm ² ; 3 Nm max.; Pozidriv head screws
Degree of protection	IP20 ø IP54 with hood up to ø 116mm
Standards	IEC 60831, EN 60831, UL810 Certificación UL en curso / UL certification in progress

ORDERING CODE:

Part Number	440 V		400 V		415 V		Capacitance (µF)	Dimensions d x h (mm)	Weight (kg)	Terminal block
	Qn (kvar)	In (A)	Qn (kvar)	In (A)	Qn (kvar)	In (A)				
RKC 440 10 HD	10	13.1	8	11.9	9	12.4	3 x 54.8	85 x 245	1.0	A
RKC 440 12 HD	12.5	16.4	10	14.9	11	15.5	3 x 68.5	85 x 245	1.2	A
RKC 440 15 HD	15	19.7	12.5	17.9	13	18.6	3 x 82.2	85 x 245	1.3	A
RKC 440 20 HD	20	26.2	16	23.9	18	24.8	3 x 109.6	100 x 245	1.9	A
RKC 440 25 HD	25	32.8	20	29.8	22	30.9	3 x 137.0	100 x 245	2.1	A
RKC 440 30 HD	30	39.4	25	35.8	27	37.1	3 x 164.4	116 x 245	3.3	B
RKC 440 36 HD	36	47.2	30	43.0	32	44.6	3 x 197.3	136 x 220	3.3	B
RKC 440 40 HD	40	52.5	33	47.7	36	49.5	3 x 219.2	136 x 220	4.0	B

DETUNED FILTER REACTORS

Detuned Filter Reactors, are used in series with capacitors in power factor correction units - AKRE. By using these types of detuned reactors it is possible to avoid following negative effects on system.

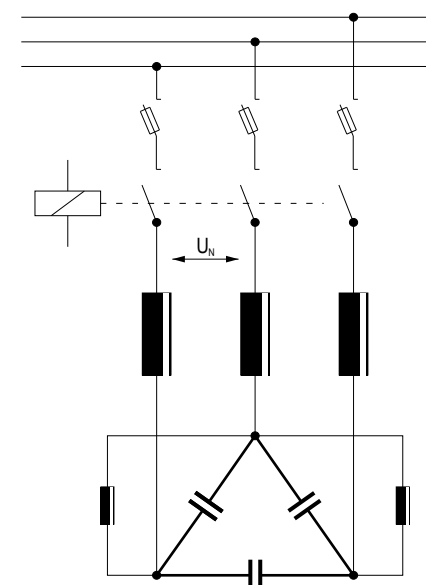
- Overcurrent during switching on the capacitor banks
- Overload of capacitors because of the harmonic resonance.
- Short lifetime on capacitors
- Overheating of the utility transmission cables.
- Overheating of the distribution transformer.
- Unintended triggering of the protective devices.
- Distortion of utility voltage waveform and problems on voltage sensitive devices
- Interferences on data transmission systems
- Unexplainable faults in electronic boards

Choosing the correct detuned filter reactor and capacitor value on detuned power factor correction systems is very important. To obtain optimum performance from a detuned power factor correction system following criteria must be controlled and met during the pairing of the reactors and capacitors.

CHOOSING CORRECT DETUNED FILTER REACTOR

- The resonance frequency must be chosen according to harmonic analysis of the system
- The voltage across the terminals of the capacitor will increase because of the inductive reaction of the reactor. The rated voltage of the capacitors must be chosen according to the resonance frequency.
- In detuned power factor correction systems, presence of higher voltage rated capacitors and reactors causes a difference between rated capacitor power and obtained reactive power. The obtained power must be calculated in order to avoid low compensation.
- The reactors will generate extensive heat due to heavy harmonic load on them. The cabinets must be designed to disperse this heat.

Installation of detuned (reactor-connected) capacitors

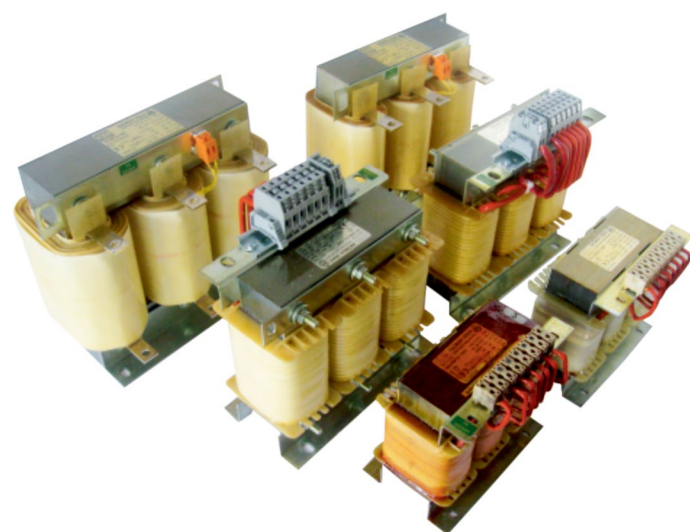


DETUNED FILTER REACTORS

Defuned filter reactors are high quality reactors designed to be used in detuned power factor correction units. These reactors are compatible with european standards.

TECHNICAL SPECIFICATIONS

- Rated Voltages: 400V
- Rated Frequencies: 50HZ
- Mean value across three phases: $\pm 5\%$
- Linearity: $I_{lin} = 1,56 - 2,2I_n$
- Single or three phase, high permeable iron core, air gapped design
- High quality copper or aluminium windings
- Available at any resonance frequency
- Linearty according to resonance frequency
- Harmonic loads according to EN 6100-2-2
 - $U_1 = \%106 \times U_n$
 - $U_3 = \%0,5 \times U_n$
 - $U_5 = \%5 \times U_n$
 - $U_7 = \%5 \times U_n$
- Protection class: IP00 indoor mounting
- Cooling: natural cooling
- Thermal Switch for overload protection
- Thermal block, bar or cable connection depending on current value
- Vacuum impregnated varnish to ensure silent and moisture-immune operation
- Compatibility with EN 61558 2-20



VALUES TO BE SPECIFIED FOR CUSTOM DETUNED FILTER REACTORS

- Utility Voltage
- Resonance frequency
- Information on the available capacitors.

Most common mistake made at detuned filter applications is chosing inappropriate reactor and capacitor pairs. Especially the reactors stated in manufacturer catalogues are used in conjunction with a specifict capacitor value. While chosing the necessary capacitor reactor pair, the selection tables in catalogs must be controlled to ensure that proper pair is chosen, if a different brand capacitor is going to be chosen, the capacity value must be the same as the original. In a mismatchcase the resonance frequency will shift and cause severe problems for the system.

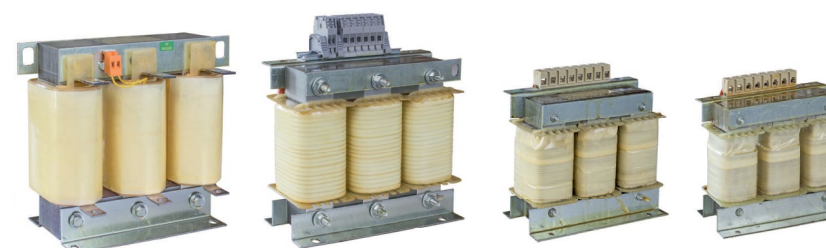
DETUNED FILTER REACTORS

DETUNED FILTER REACTOR SELECTION TABLE



Detuned filter reactors with:
 - Resonance frequency = 134Hz.
 - Blocking factor p%= 14%.

400V 50Hz Utility Voltage, 134Hz Resonance Frequency (p=14%)								
Type	Capacitor RKC 525..S	Target Power	L	Irms	Ith	Ilin	C	Weights
	kVar	kVar	mH	A	A	A	μF	kg
ERH-14/400/6,25	10.00	6.25	12.3	10.4	7.98	11.4	38,50	9
ERH-14/400/7,5	12.50	7.5	9.99	12.8	15.98	14.1	42,35	9.5
ERH-14/400/10	15.00	10	8.3	16.4	23.96	16.9	57,74	9.8
ERH-14/400/20	30.00	20	4.15	30.8	31.94	33.8	115,49	18
ERH-14/400/40	60.00	40	2.07	61,5	39.93	67.7	230,97	33.3

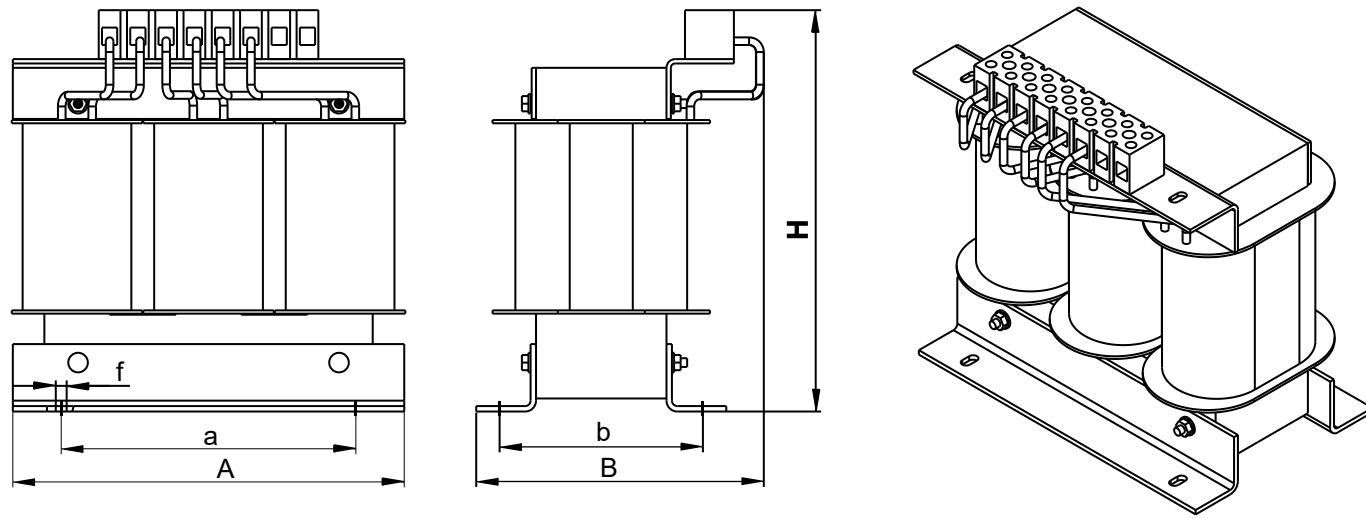


Detuned filter reactors with:
 - Resonance frequency = 189Hz.
 - Blocking factor p%= 7%.

400V 50hz Utility Voltage, 189Hz Resonance Frequency (p=7%)								
Type	Capacitor RKC 440 .. S	Target Power	L	Irms	Ith	Ilin	C	Weights
	kVar	kVar	mH	A	A	A	μF	kg
ERH-7/400/4,44	5.00	4.44	8.63	7.25	7.98	15.57	27.38	5
ERH-7/400/8,89	10.00	8.89	4.31	14.52	15.98	31.18	54.83	6.5
ERH-7/400/13,33	15.00	13.33	2.88	21.78	23.96	46.75	82.21	9.5
ERH-7/400/17,77	20.00	17.77	2.16	29.03	31.94	62.32	109.59	12
ERH-7/400/22,22	25.00	22.22	1.73	36.30	39.93	77.93	137.04	16
ERH-7/400/26,66	30.00	26.66	1.44	43.56	47.91	93.50	164.42	18
ERH-7/400/35,55	40.00	35.55	1.08	58.08	63.89	124.68	219.25	21
ERH-7/400/44,43	50.00	44.43	0.86	72.59	79.85	155.82	274.01	22.5
ERH-7/400/53,33	60.00	53.33	0.72	87.13	95.85	187.04	325.90	25

DETUNED FILTER REACTORS

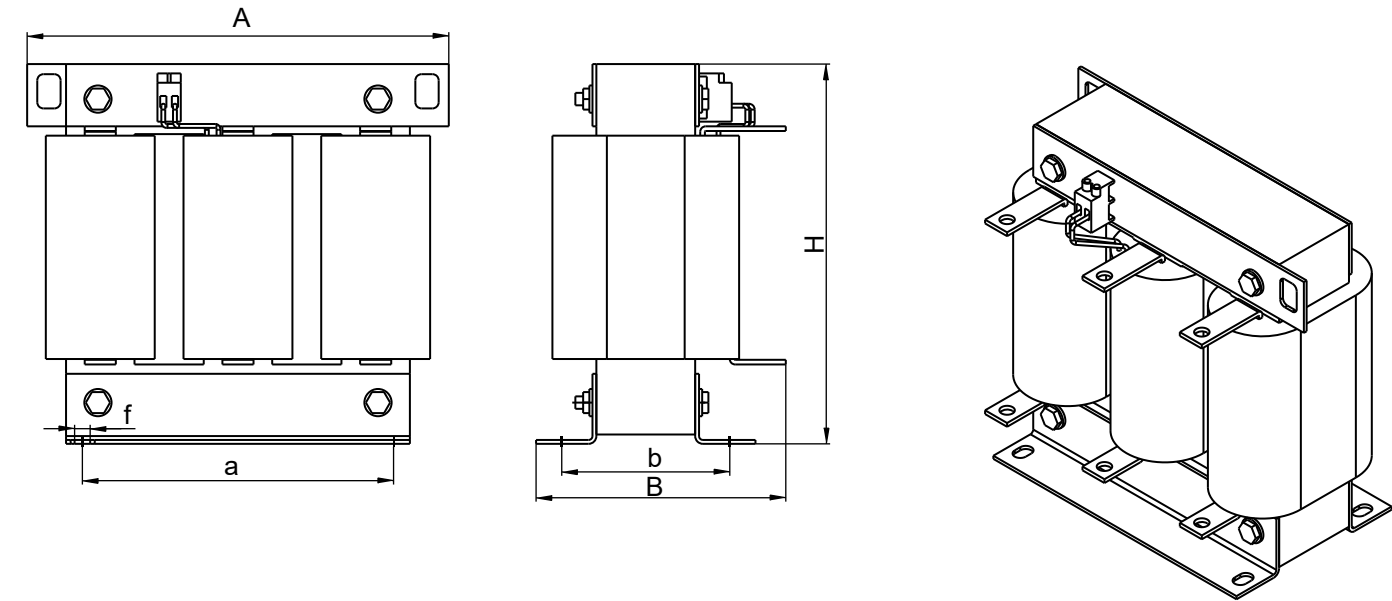
DIMENSIONS



DRAWING DIMENSIONS				
Type	Dimensions	Fixing holes	Hole	Weights
	A x B x H	a x b	f	kg
ERH-7/400/4,44	150x100x150	110x70	5x10	5
ERH-7/400/8,89	180x115x180	135x74	5x10	6.5
ERH-7/400/13,33	180x140x180	135x94	5x10	9.5
ERH-7/400/17,77	225x140x220	175x80	10x15	12
ERH-7/400/22,22	240x156x265	185x100	10x15	16
ERH-7/400/26,66	240x156x265	185x100	10x15	18
ERH-7/400/35,55	240x156x265	185x100	10x15	21
ERH-14/400/6,25	180x125x180	135x85	5x10	9
ERH-14/400/7,5	180x125x180	135x85	5x10	9.5
ERH-14/400/10	180x125x180	135x95	5x10	9.8
ERH-14/400/20	240x155x270	185x100	10x15	18

DETUNED FILTER REACTORS

DIMENSIONS



DRAWING DIMENSIONS				
Type	Dimensions	Fixing holes	Hole	Weights
	A x B x H	a x b	f	kg
ERH-7/400/44,43	265x170x245	200x108	10x15	22.5
ERH-7/400/53,33	265x170x245	200x108	10x15	25
ERH-14/400/40	300x190x260	224x120	10x15	33.3

*Specified capacitor values are used during the reactor design. Severe problems may occur when using another capacitor in conjunction with these reactors. Custom reactor designs are possible.

*Dimensions values may change depending on design.

REACTIVE POWER CONTROLLER

The RKPFR power factor controller calculates the active and reactive power in the mains from the measured current and voltage. The intelligent control algorithm optimizes the switching sequences and guarantees for short regulation times with minimum number of switching. At the same time, switching operations are equally shared among the available capacitor branches where possible. The integrated connection control immediately detects in which phases voltage and current are measured, and adapts the entire system automatically. The very low current threshold of 10mA allows for very reliable and exact PF controller 1A as well as 5A current transformers can be used without additional manual adjustments. The power supply covers a voltage range of 90....550V.

GENERAL SPECIFICATIONS for RKPFR

RKPFR compensates the system according to total reactive power by measuring voltage and current from single phase.

- It compensates according to systemic $\cos\phi$ value. It is recommended that it is used for electro-mechanical energy meters, it must be used with three phase capacitors.
- Measures current and voltage values.
- Computes systemic $\cos\phi$ value.
- Operates according to first out (FIFO) principle.
- Target $\cos\phi$ value can be adjusted to be inductive or capacitive.
- Capacitor switch-on time and switch-off time can be adjusted individually.
- C/k value can be adjusted.
- It indicates Over Current and Over Voltage Alarms. Alarm outputs can be activated by user in Menu mode.
- It indicates Under Current Alarm.
- It indicates Over and Under Compensation Alarms.
- It has a fan output to cool the panel and temperature value can be adjusted. Fan can be made passive by user in Menu mode.
- Device sense current directions of phase.
- Automatic set and easy installation.

GENERAL SPECIFICATIONS for RKPFR plus

RKPFK Plus compensate by measuring 3 phase current & voltage and controls according to 3 phases individual reactive power needs. - 3 different methods can be chosen.

P1: compensate according to 3 phases average $\cos\phi$ value. It is suggested to use with electro-mechanical electricity meter and balanced loads.

P2: Mixed method. Compensate 3 phase according to individual reactive power need switching Three Phase & Single Phase capacitor.

P3: Compensates individually with Single phase capacitor. It can be used with electromechanical & Electronic electricity meter.

- Monitors 3 Phase Reactive Power need, Reactive Ratio, Apparent Power, Active Power, Current, Voltage at the same time.
- Intelligent working, switching ON and OFF capacitors that is needed without any program.
- Recognition of Capacitors Automatically.
- Measures Capacitors and monitors their actual values.
- Reactive power ratios of 3 phase can be monitored and adjusted individually.
- Heat of panel is measured and automatically controlled by fan output.
- 15 steps:
 - P1: 15 steps 3 phase capacitors
 - P2: 6 steps 3 phase capacitors and 3 step single phase capacitors for every phases.
 - P3: 5 step single phase capacitors for every phase.

REACTIVE POWER CONTROLLER

Standard Power Factor Controllers



Type	Maximum Steps	Supply	App.	Screen	Measure.	Control	Measurements					Accessory	Dimensions (mm)
		1 Phase-Neutral 220-230Vac	Low Voltage	LED	1 Phase 1 Current	3 Phase 1 Capacitor	Voltage (V)	Current (A)	Cos ϕ	Active Power	Reactive Power	Apparent Power	Temperature (Fan Output)
RKPFK4	4	*	*	*	*	*	*	*	*	*	*	*	*
RKPFK6	6	*	*	*	*	*	*	*	*	*	*	*	*
RKPFK8	8	*	*	*	*	*	*	*	*	*	*	*	*
RKPFK12	12	*	*	*	*	*	*	*	*	*	*	*	*

Type	Maximum Steps	Dimensions (mm)
RKPFK Plus	15	144 x 144

- 3 Phase, 3 CT
- 15 steps
- Inductive & capacitive reactive power can be controlled
- Automatic step recognition
- Phase are recognized and controlled separately
- All parameters are shown for system
- Compensate on low currents
- Temperature inside panel is checked

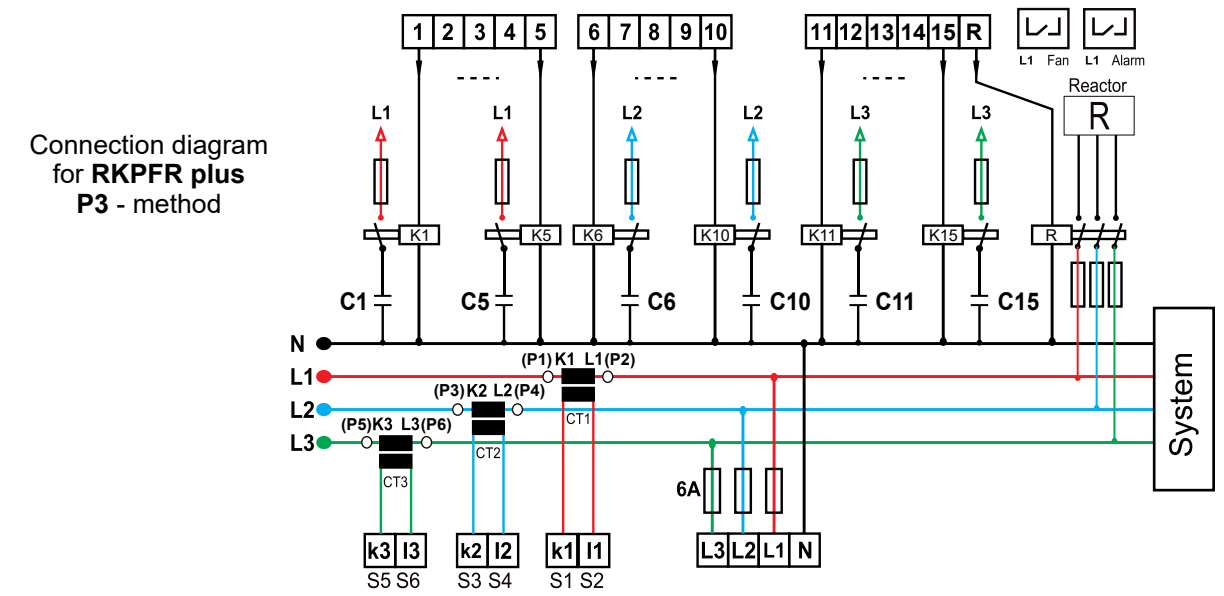
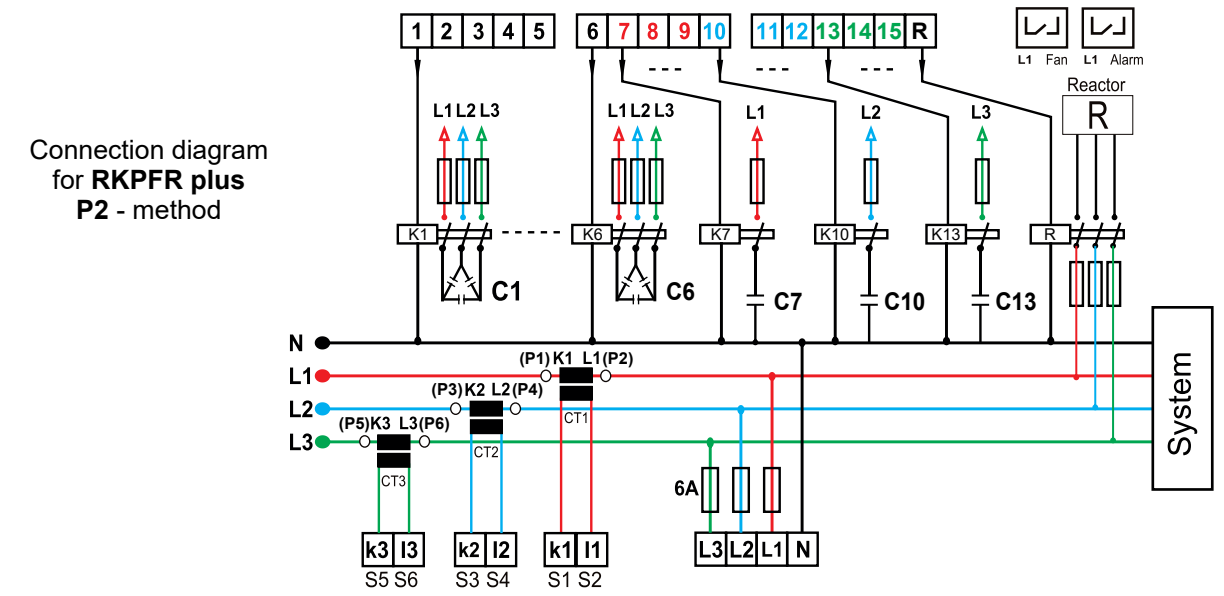
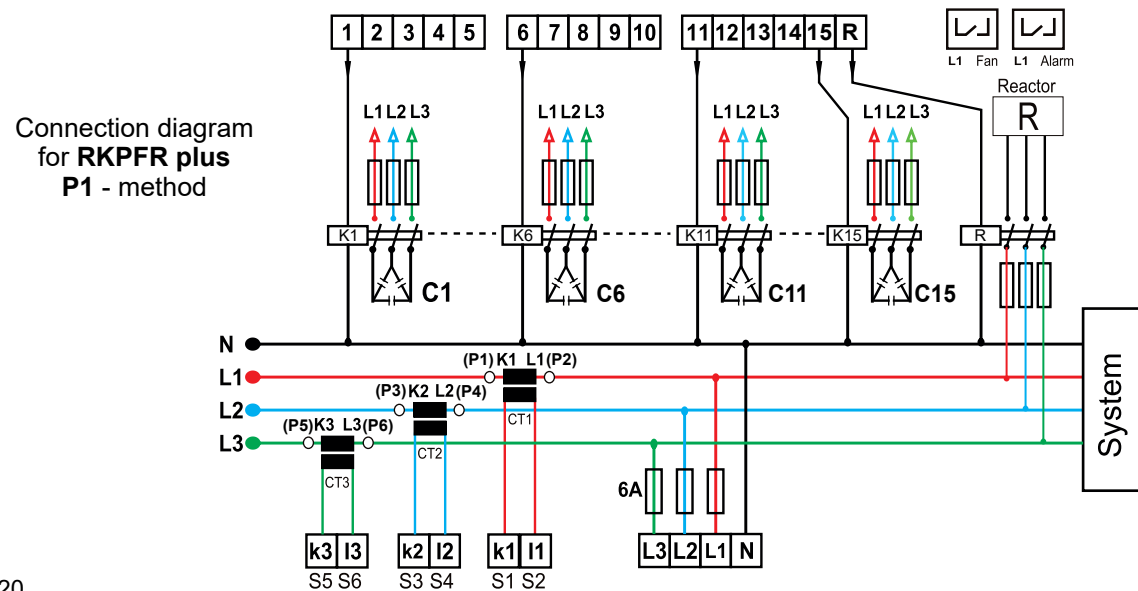
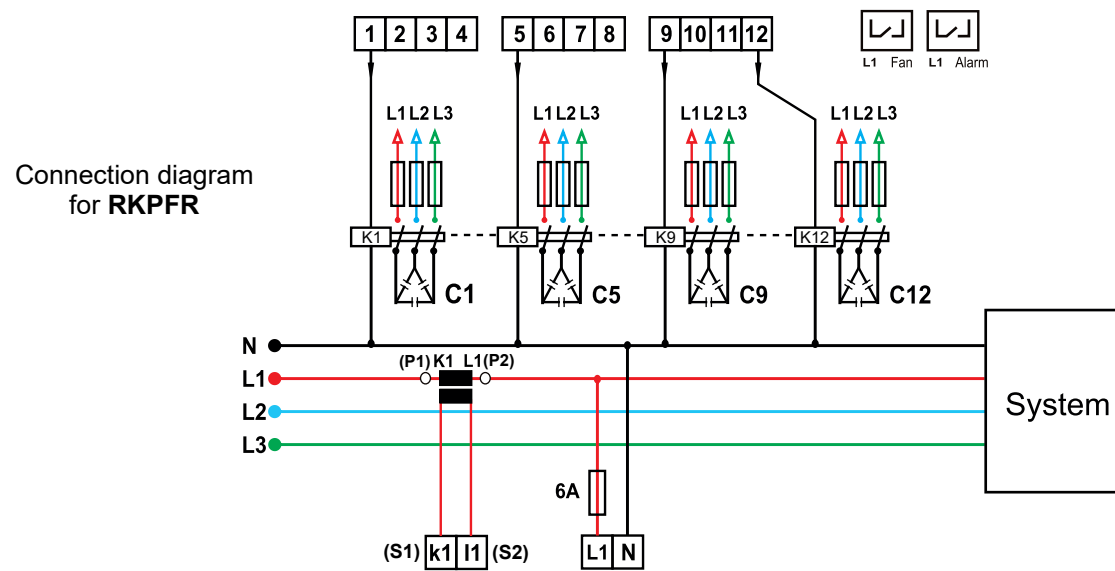
TECHNICAL SPECIFICATIONS for RKPFR

Supply voltage	: 220Vac \pm %20(L1-N), 50/60Hz
Power consumption	: <5VA
Current transformer	: .../5A
Current measuring range	: 40mA..6A
Temperature measuring range	: -10..100 °C
Control output	: Relay, 5A/250Vac (resistive load)
$\cos\phi$ range	: 0,95 (Ind.)...095 Cap.)
Step delay: Switch-on time	: 1..99sec. adj. (1sec. in man. mode)
Switch-off time	: 1..99sec. adj. (1sec. in man. mode)
Over current alarm ranges	: 4..6A adj.
Under current alarm	: <0,05A
Over voltage alarm range	: 231..286Vac adj.
Comp. alarm delay	: 60sec.
Temperature setting range	: 30..65 °C
Factory set values	: $\cos\phi=1,00$; k=20; C1=1000kVar ton=2sec.; toff=2sec.
	Over current alarm=6A (alarm ON)
	Over voltage alarm=250V (alarm ON)
	Temperature=50°C (alarm ON)
Ambient temperature	: -5...+55°C
Display	: 3 Digits red display
Protection class	: In front : IP 54 In rear: IP 20
Weight	: 0,90 kg

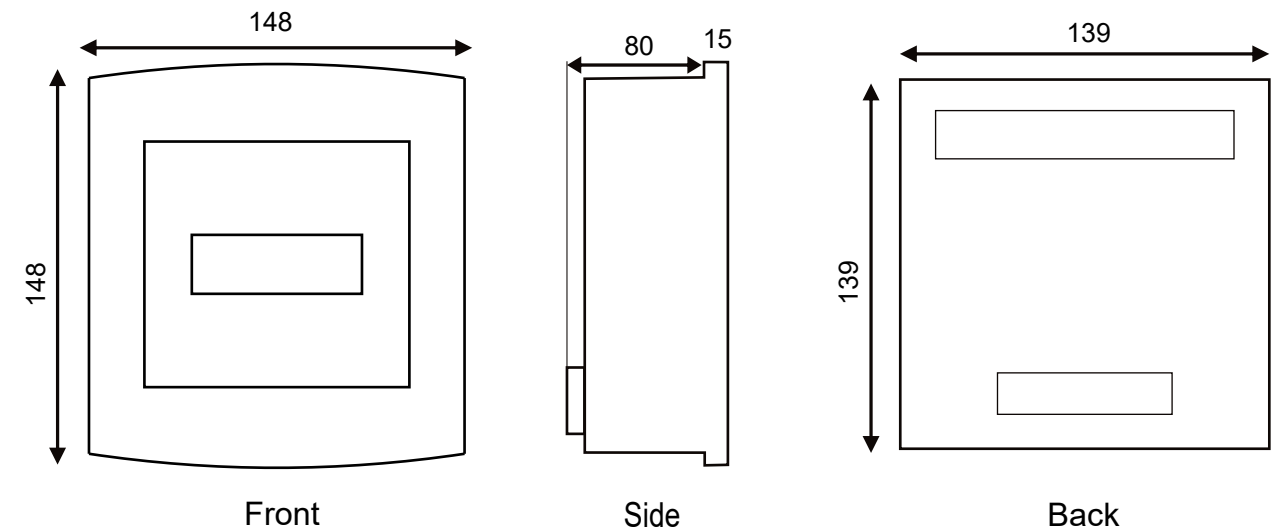
TECHNICAL SPECIFICATIONS for RKPFR plus

Supply voltage	: 220Vac \pm %20(L1-N), 50/60Hz
Power consumption	: <5VA
Current transformer	: .../5A
Current measuring range	: 10mA..7A
Control output	: Relay, 5A/250Vac (Resistive Load)
cos ϕ adjustment	: Inductive 0,95...1,00; Capacitive 0,95...1,00
cos ϕ adjustment steps	: 0,05
Step delay: Switch-on time	: 1..99sec. adjustable
Switch-off time	: 1..99sec. adjustable
Discharge time	: 1..99sec. adjustable
Alarm delay	: 60sec.
Temperature control range	: 30..65 °C
Factory set values	: cos ϕ =1,00; Temperature=50°C Current transformer rate (k)=10; ton=1sec.; toff=1sec.; tdischarge=1sec. Inductive reactive rate: 15%; Capacitive reactive rate: 10%
Operation temperature	: -5...+55°C
Display	: 3x4 Digitst display
Protection Class	: In front: IP 54 Connecting terminals: IP 20
Weight	: 1,0 kg

CONNECTIONS DIAGRAMS



DIMENSIONS

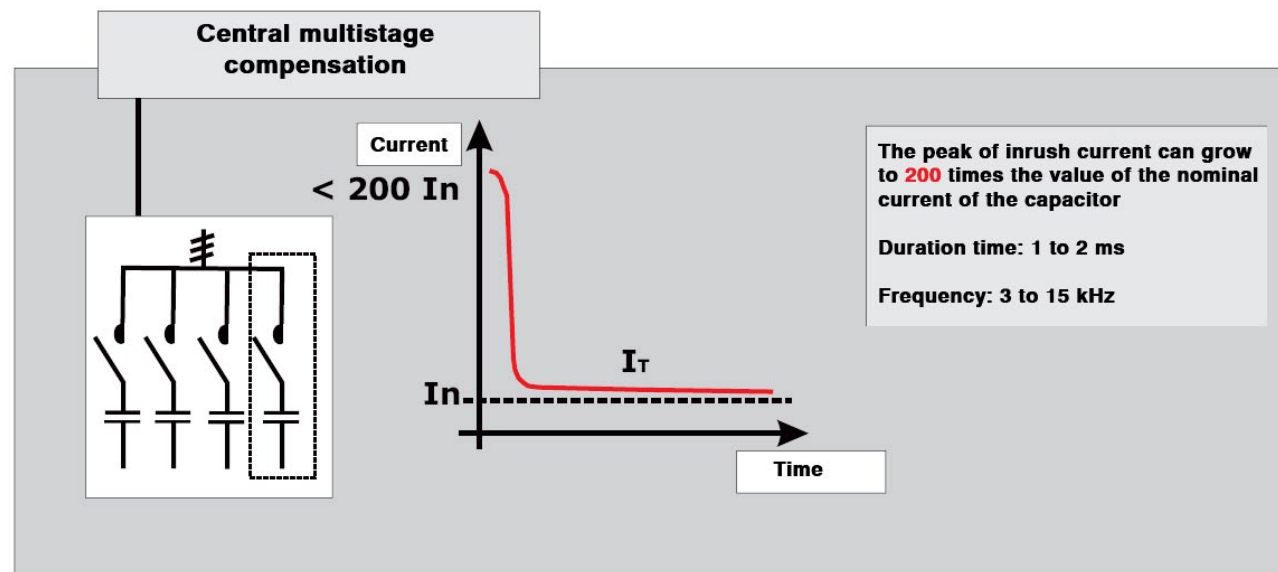
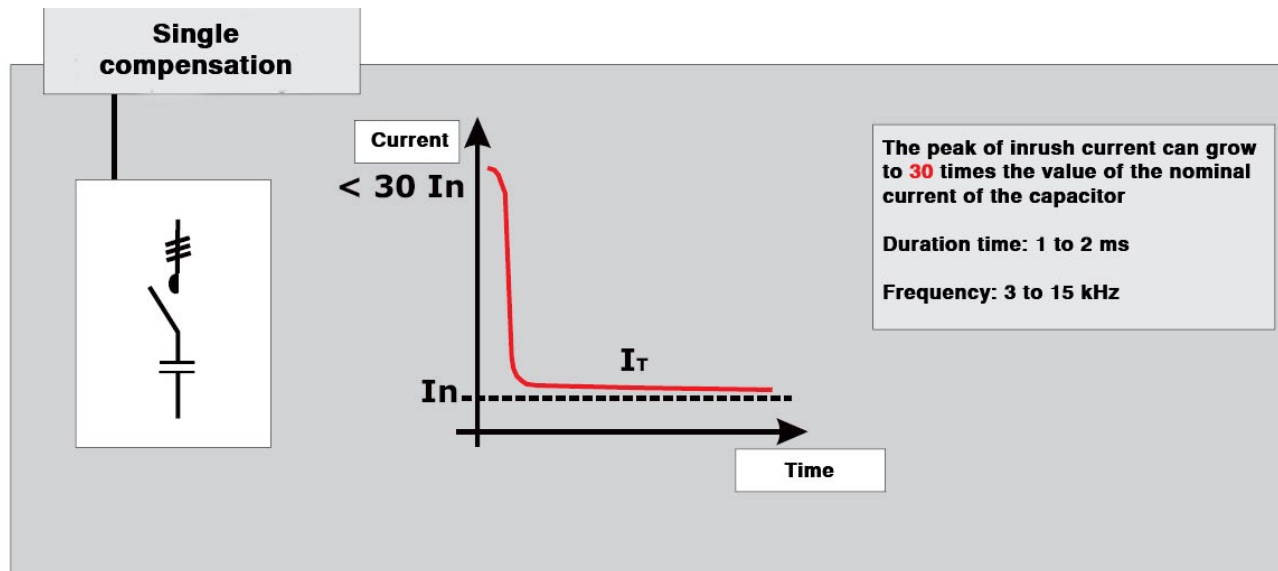


Contactors for controlling three phase capacitor banks

While switching on and switching off the capacitor banks under load, it comes to short-circuit overloads on the order of the short-circuit current. Therefore, in order to protect staff and electrical installation is necessary to be used contactors for controlling of capacitor banks. The use of standard contactors are jeopardizing personnel and complete electrical installation.

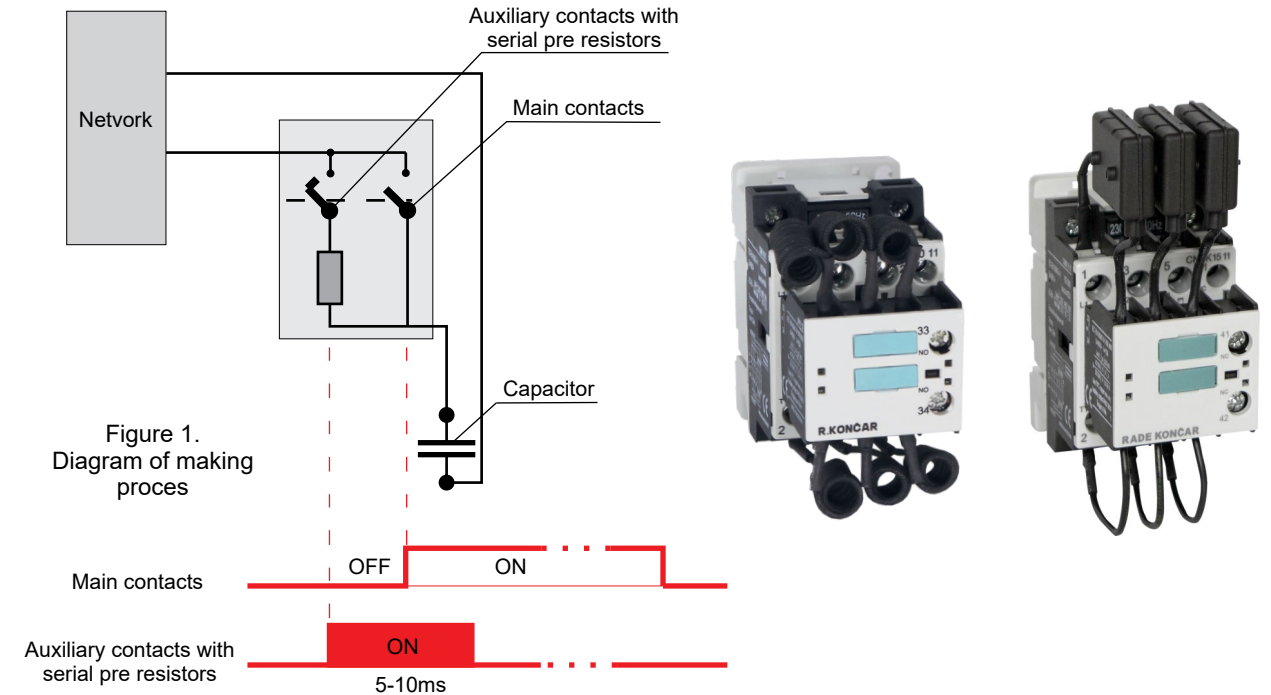
While switching on the capacitor in the AC system, it's created a resonant current circuit, which in greater or lesser extent is damping, and the already bruised capacitors cause inrush current of 200 times the nominal current.

The great value of the making current can lead to melting of the main contacts of the contactor, it is also detrimental to capacitors. The value of the making current depends on the type of compensation, which is displayed with the following schedules:



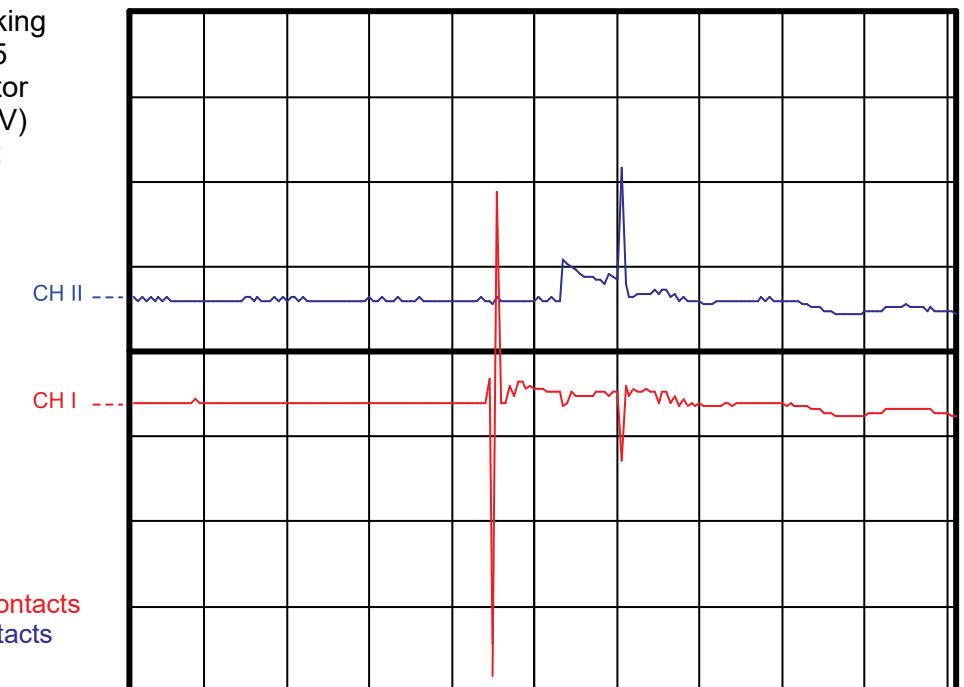
In the automatic compensation systems, contactors which throttle the making current have to be used. With throttling of the making current, the voltage drops and transit currents are also avoided.

In these capacitor contactors pre-contacts are used to limit making current. Each pre-contact is connected in series with a resistor to limit the making current (current charge) of the capacitors. Pre-contacts are closing before main contacts, and open when latest are surely closed. This is achieved with using the system of permanent magnets, not with mechanical lever. Such construction of capacitor contactors ensure effective functioning in their working lifetime. The functioning of capacitor contactor is shown in Figure 1.



Efficient operation of the capacitor contactors can be vividly seen from the comparison diagrams for making current of capacitor contactor without pre-contacts and with pre-contacts.

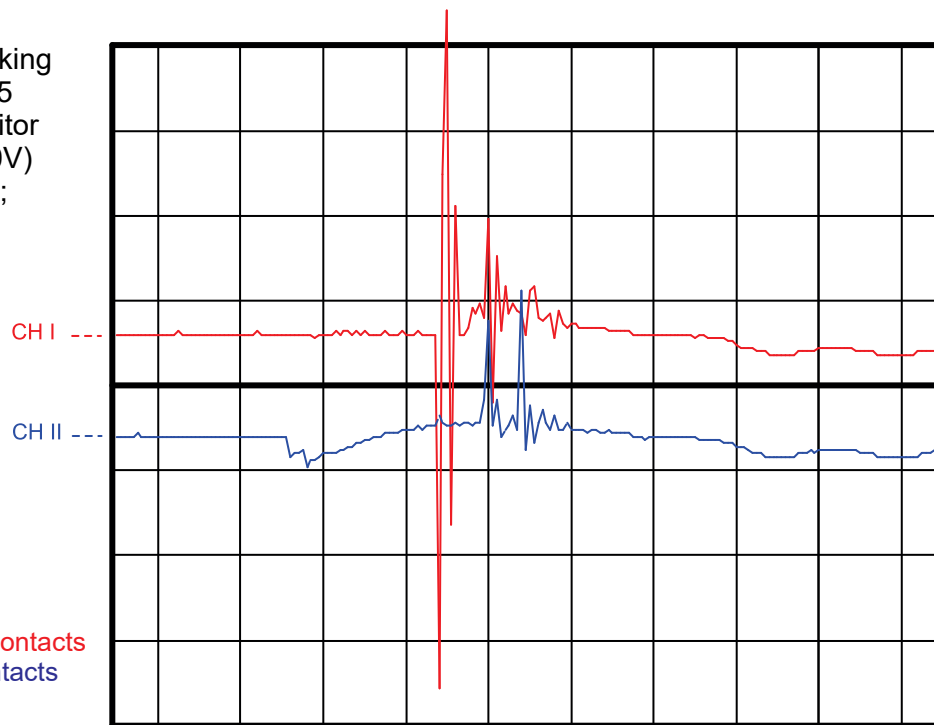
- 1.) Diagram of the making current for CNNK 15 with 15 kVar capacitor ($I_n = 22A$; $U_n = 400V$)
Scale: I: 200A / unit;
t: 2ms / unit



CH I: make without pre-contacts
CH II: make with pre-contacts

CAPACITOR DUTY CONTACTORS

2.) Diagram of the making current for CNNK 25 with 25 kVAr capacitor (In = 36A; Un = 400V)
Scale: I: 200A / unit;
t: 2ms / unit



CH I: make without pre-contacts
CH II: make with pre-contacts

The capacitor contactors of "Rade Koncar – Kontaktori i relei" DOO – Skopje, series CNNK 2,5; CNNK 5; CNNK 7,5; CNNK10 - CNNK30; CNNK 40 – CNNK 70; CNKM 60 – CNKM 80 and CNNK 10..N – CNNK 30..N; CNNK 40..N – CNNK 75..N have modern design with top constructive solutions fully complied with IEC requirements. They are suitable for controlling of capacitors with order without reactors. Because of the pre-contacts and resistors, the making current is <70 times In.

The backup fuses gl(gG) should be scaled for 1.6 to 1.8 times In.

Features of contactors series CNNK10 –CNNK 70 and CNKM 60–CNKM 80:

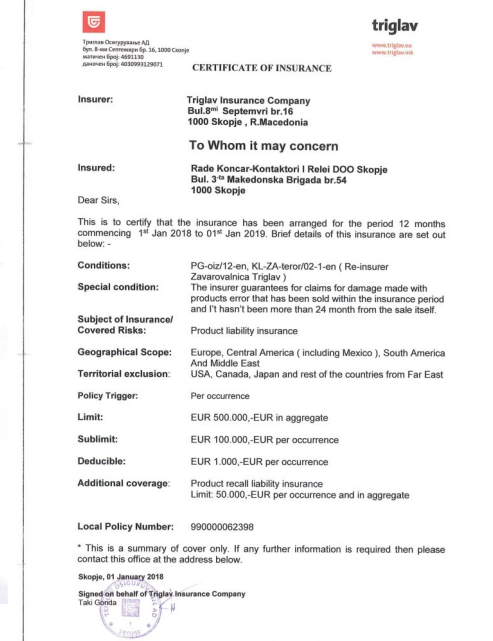
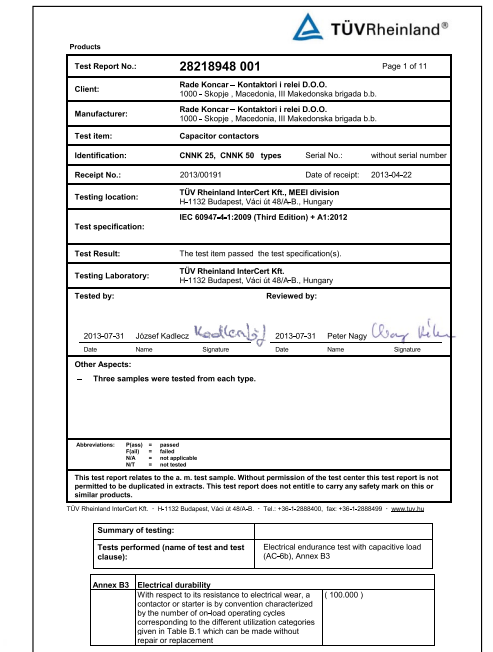
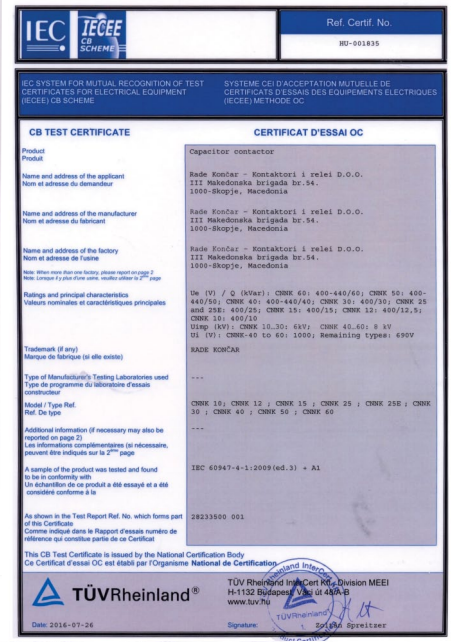
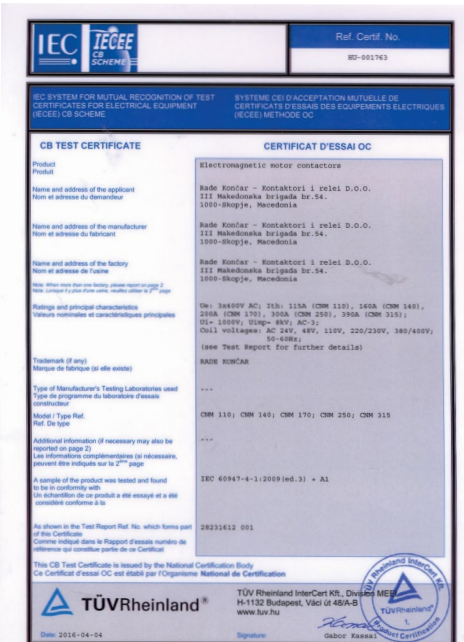
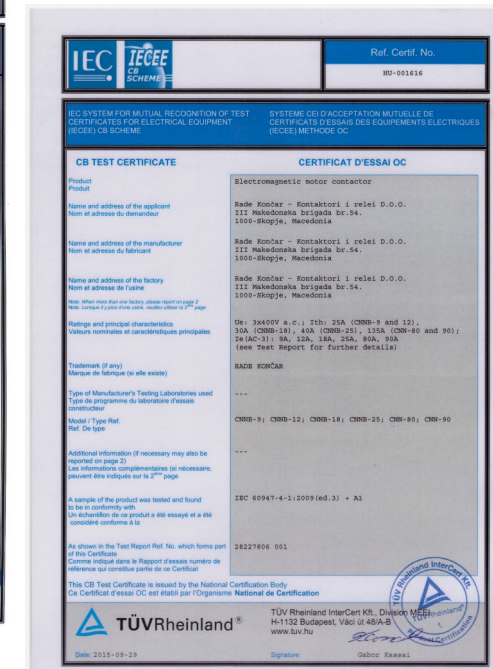
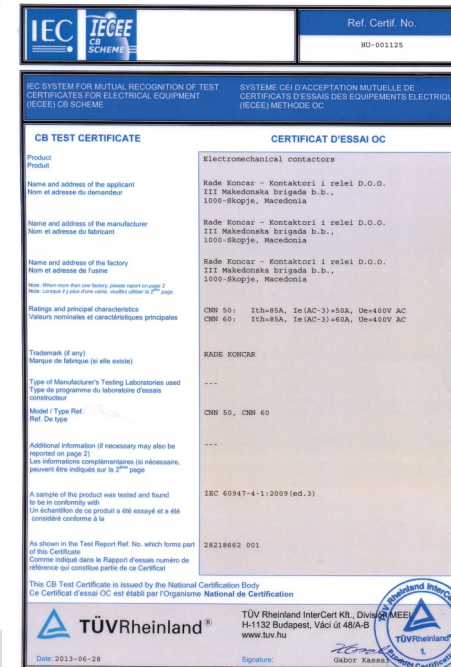
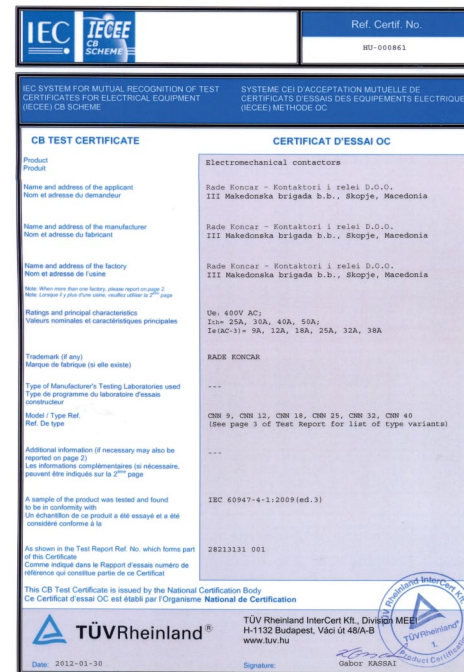
- ↪ pre-switching on:
 - excellent damping of making current by wire resistors
 - contactors are equipped with pre-contacts for fast folding operating
 - pre-contacts open after the main contacts are closed
 - This is achieved with using the system of permanent magnets, not with mechanical lever
 - single (independent) controlled pre-contacts as a whole increase the resistance of the device from dust
- ↪ switching on:
 - no loss of power in the resistors because resistors are disconnected from the current circuit
- ↪ switching off:
 - while main contacts switch off, pre-contacts remain hold

Capacitor contactors series CNNK..(N) and CNKM can be used in other cases where high making current exist.

Selection of Capacitor contactor

Capacitor contactors series CNNK..(N) and CNKM are selected according to the power of the capacitor. For groups and central compensation, when three phase reactor is not used, it's recommended selection of contactor with a higher degree of nominal value for the appropriate capacitor value.

Technical information, Connection Diagrams and Dimensions for Contactors CNNK..(N); CNKM see 1/18 - 1/20, 1/55 - 1/58; 1/70 - 1/71.





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