



Elektropřístroj s. r. o.

MINI CONTACTORS

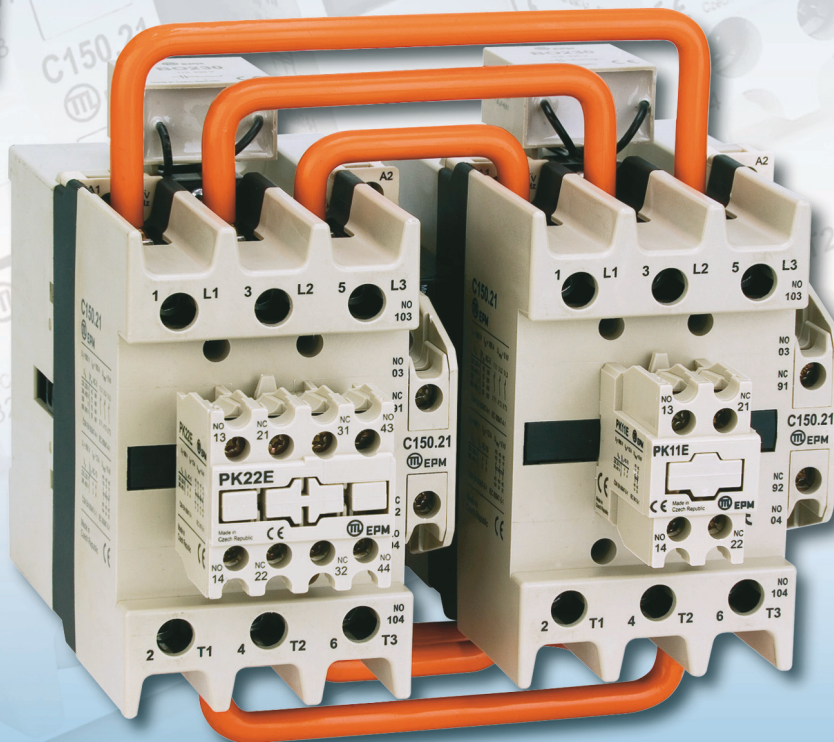
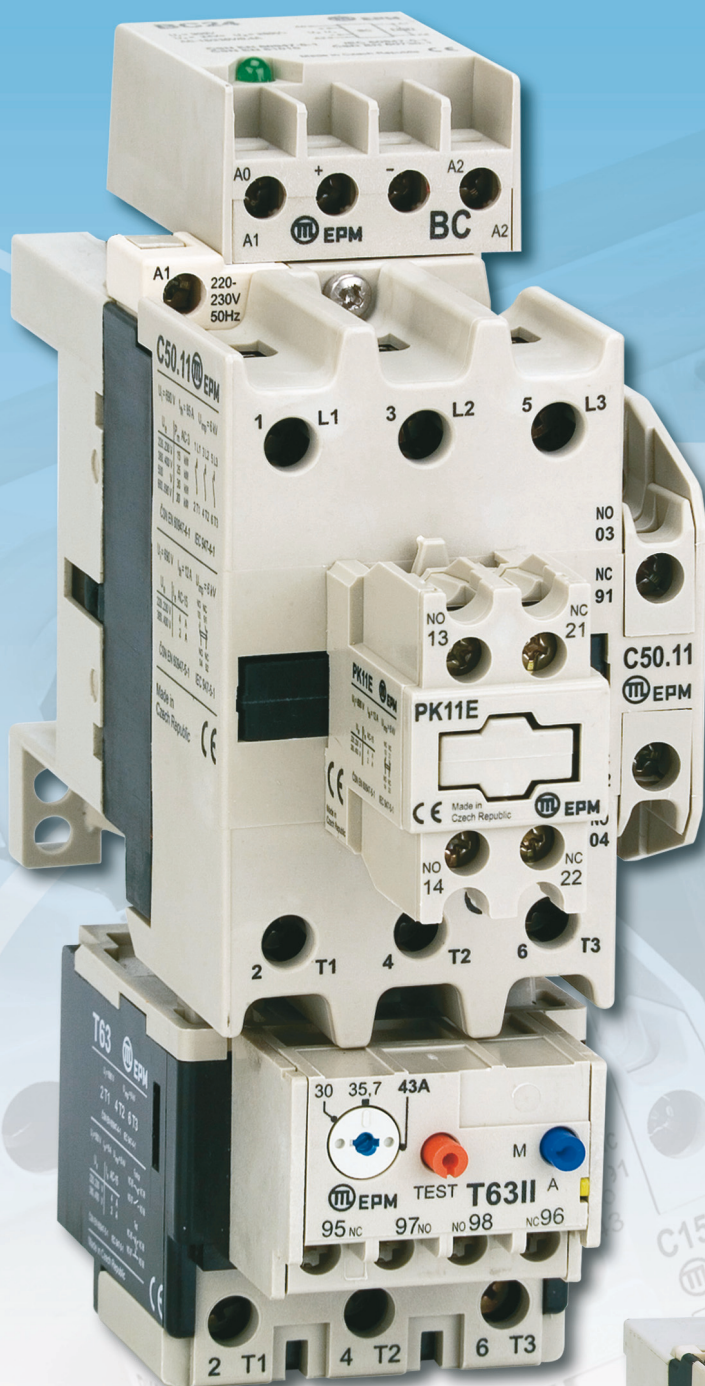
CONTACTORS

THERMAL OVERLOAD RELAYS

TIMING RELAYS

MOTOR STARTERS

ROTARY CAM SWITCHES



Certificates

Elektropristroj s. r. o., Praha 4 – Modrany, has been issued the Declaration of conformity for all the product items named in this catalogue, with respect to the Czech law-No. 22/1997.

Elektropristroj s. r. o., Praha 4 Modrany, possesses product certificates issued by Electrotechnical Testing Institute Prague, Czech Republic, by **Electrotechnical Research and Design Institute Nova Dubnica, Slovakia**, and by certification centre of **Gosstandard Rossii, Russia**, for the complete product range.

The manufacturer's quality system has been certified according to ISO 9001/2001.

Upon request, the manufacturer will provide the purchaser with copies of the certificates named above.



Extended assortment:

- 1) Contactor types C20.11 and C20.10
- 2) Extended series of contactors for switching of capacitor banks
- 3) Star-delta motor starters up to 500 kW of motor output

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I. General utilization instructions

The products introduced in this catalogue are designed to operate safely. The manufacturer of these products possesses all the necessary authorized certificates and has been issued Declarations of conformity. Nevertheless, the manufacturer would like to bring to the user's attention the possible risks of danger resulting from improper use of these products

1. Commissioning and maintenance must always be done by a qualified person only. Do not use the products in any manner different from the specifications outlined by the manufacturer. Do not modify the products. Avoid operating the products in any improper positions, unless specifically approved by the manufacturer. Respect the products' operating voltage, current, and frequency.
2. Keep children and unqualified personnel away from the product at all times..
3. Before any re-commissioning work is to be done, a qualified technician must prove that the product and its safety features, including the degree of protection, are fully functional.
4. No manipulation under voltage is allowed, except for measuring with insulated pins made by a qualified person.
5. The risk of fire or explosion must be eliminated because of the possible hazards posed by inflammable gases, vapours, and/or dust.
6. The products must not operate under any unsafe conditions – e. g. mounting on/with any inflammable base/cover, insufficient sheltering from water, other liquids, or extraneous parts and particles, etc..
7. It is necessary to respect the specified clearances between the arc extinguishing chambers of the contactor and the human body. Avoid looking at the arc while breaking the contactor.

II. Guaranty conditions

The manufacturer guarantees the products for a time period of 24 months, starting from the day of purchase. Claims are to be made at the place of purchase.

In order to file a claim, the complaining purchaser must present the product's receipt along with evidence that the product has been utilized according to the relevant standards and the manufacturer's recommendations. Furthermore, the sealing label of the product (applies for contactors series V..V and C50..150) must not be removed. The manufacturer makes all repairs. Claims shall be cleared within 30 days, unless other agreements are made.

Packing and stocking

The unit package protects the product against possible damages that could occur during transport and stocking. Contactors are packaged singly, but accessories can be supplied in multiple packages. All products must be stored in dry rooms sheltered from bad weather conditions. Relative humidity must never exceed 80% at 20° C.



PAP 20 PAP 21 HDPE

Product unit packing is made from recyclable materials.

1.1 General

1.1.1 Utilization

Air-break contactors – meaning contactors equipped with contacts operating in the air at normal barometric pressure – are designed mainly for frequent switching in the circuits of three-phase induction motors. „VH” and „VD” series contactors can operate under the heaviest conditions, e.g. mines, metallurgical and rolling mill plants, etc.

**Examples of utilization categories for low-voltage switchgear and controlgear acc.
to EN 60947-1 App. A, EN 60947-4-1 Table I and EN 60947-5-1 Table I**

Nature of current	Utilization category	Typical applications
A.C.	AC-1	Non-inductive or slightly inductive loads, resistance furnaces
	AC-2	Slip-ring motors; starting, switching off
	AC-3	Squirrel-cage motors; starting, switching off motors during running
	AC-4	Squirrel-cage motors; starting, plugging, inching
	AC-5a	Switching of electric discharge lamp controls
	AC-5b	Switching of incandescent lamps
	AC-6a	Switching of transformers
	AC-6b	Switching of capacitor banks
	AC-7a	Slightly inductive loads in household appliances and similar applications
	AC-7b	Motor-loads for household applications
D.C.	DC-1	Non-inductive or slightly inductive loads, resistance furnaces
	DC-3	Shunt motors; starting, plugging, inching, dynamic breaking of motors
	DC-5	Series motors; starting, plugging, inching, dynamic breaking of motors
A.C.	AC-15	Control of AC electromagnetic loads in auxiliary circuits
D.C	DC-13	Control of DC elektromagnetic loads
	DC-14	Control of DC elektromagnetic loads with economy resistors

1.1.2 Standards

Contactors of the „C“, „V..F“, „R“, „A“, „VH“, and „VD“ series have all been developed, tested and approved according to EN 60947-4-1, EN 60947-1, EN 60947-5-1, IEC 60947-4-1, IEC 60947-1 and IEC60947-5-1 for intermittent duty – Art.-No. 4.3.4.3, or for eight-hour duty – Art.-No. 4.3.4.1. If used in uninterrupted duty, the rated operation current and conventional thermal current must be agreed with the manufacturer in respect to the conductor cross-sections.

1.1.3 Certifications

Contactors have received approval from the following authorized entities (national test institutes):



The manufacturer's quality system has been certified according to ISO 9001/2001.

1.1.4 Operating Conditions

EN 60947-4-1 specifies operating conditions for the contactors.

Contactors of the „VH“ and „VD“ series can be supplied in either a normal version for use in standard industrial environments, or in a climate-proof version.

Contactors of the „C“, „V.F“, „R“, and „A“ series are supplied in the climate-proof version only and can therefore operate under the wide conditions of climate group „G“ according to IEC 721-2-1. These contactors comply with the requirements of the following standards and tests:

- a) Cold test acc. to EN 60068-2-1
Test Ad: testing temperature –55 °C, exposition 16 hours
- b) Dry heat test acc. to EN 60068-2-2
Test Bd: testing temperature +55 °C, exposition 16 hours
- c) Cyclic damp heat test acc. to IEC 68-2-30
Test Db: maximal testing temperature +40 °C, 21 cycles, var. 2
- d) Mould growth test acc. to IEC 68-2-10
Test J: var. 1
- e) Simulated solar radiation test acc. to IEC 68-2-5
Test Sa: testing temperature +40 °C, 3 cycles.
Note: relevant for encapsulated products only.
- f) Sulphur dioxide test with general condensation of moisture acc. to ISO 6988, 1 cycle.

Max. relative humidity 98 % at +35 °C.

Max. relative humidity 98 % at +35 °C.

Max. altitude 2000 m.

Mounting Position

Contactors must be mounted vertically on the panel or rail so that the markings are legible in an ordinary horizontal position. The maximum allowed deviation from the vertical position is 10° (5° for the „VH“ and „VD“ series). Panels or rails must be strong enough so that they do not transfer vibrations and/or shocks from extraneous sources to the mounted contactors.

Protection against dangerous accidental contact with moving parts

Contactors of the „C“, „V.F“, „C..C“, „R“ and „A“ series are designed to prevent accidental contact between live parts and the human body. Fingers are protected in the perpendicular direction, while larger body surfaces are protected in the parallel direction to the mounting panel. This means the contactors provide protection IP20/IP10 acc. to EN 60529 and VDE 0106-100. Contactors series „VH“, VD and V53D provide no protection – IP00.

Safety

In addition to the features described above, the contactors comply with the requirements of the EN 61010-1, overvoltage category III, pollution degree 2, test voltage 4350 V / 50..60 Hz (table-No. D6).

Attention!

In order to operate without any problems, the contactors need a very clear control impulse with no interruptions (impulse length at least 25 ms if AC-controlled, respectively 30 ms if DC-controlled). The control voltage must be within 85-110% of the nominal coil voltage and must not pump; pumping of the control voltage can sometimes appear e. g. in control circuits with thermostats.

1. Contactors

1.1 General utilization instructions

1.1.5 Selection guide – contactor, thermal overload relay and fuses

Table-No. 1a

Motor	Contactor	Thermal overload relay		Fuse char. gG		Fuse char. aM	
380-400 V	Type	Type	Range of tripping current	Type of coordination		Type of coordination	
[kW]			[A]	1 [A]	2	1 [A]	2
0,37	A25.■, MC09.■	T17 (+H17)	1..1,45	6	4	4	2
0,75	A25.■, MC09.■		1,45..2,1	8	6	6	4
1,5	A25.■, MC09.■		3..4,3	12	6	10	4
2,2	A25.■, MC09.■		4,3..6,3	20	16	10	6
3	A25.■, MC09.■		6,2..9	25	20	12	10
4	A25.■, MC09.■		6,2..9	25	20	16	10
5,5	A25.■		9..13	25	20	25	10
0,37	C9.■	T17	1..1,45	6	4	4	2
0,75	C9.■		1,45..2,1	8	6	6	4
1,5	C9.■		3..4,3	12	10	10	6
2,2	C9.■		4,3..6,3	12	10	12	10
3	C9.■		6,2..9	20	16	16	10
4	C9.■		6,2..9	25	20	16	10
5,5	C12.■		9..13	25	20	25	16
7,5	C17.■		13..19	25	20	25	20
7,5	C16.■		13..19	32	25	25	20
10	C20.■		17,2..25	32	25	32	25
11	C23.■		17,2..25	32	25	32	25
11	C25.■		17,2..25	40	32	32	25
11	C25.■	T50	17,2..25	40	32	32	25
15	C32.■		24,1..35	50	40	40	–
20	C40.■		34,4..50	63	50	50	–
15	C50.■	T63	21..30	80	40	40	32
22	C50.■		30..43	80	63	63	50
25	C50.■		43..63	80	63	63	50
30	C65.■		43..63	80	–	80	–
37	C80.■		55..80	100	–	80	–
37	V85F	Overload protection set (3 x M...) + T17-1A + H17	50..72,5 (M145/2 passings through)	125	100	125	80
45	V85F		69..100 (M100)	–	125	125	100
45	C95.■		100..145 (M145)	160	125	125	100
55	V105F		100..145 (M145)	125	100	125	100
55	C115.■		100..145 (M145)	–	200	–	125
75	V140F		100..145 (M145)	200	–	–	160
75	C150.■		100..145 (M145)	–	200	–	160
90	V170F		145..210 (M210)	200	–	–	160
110	V205F		145..210 (M210)	315	250	–	250
132	V250F		207..300 (M300)	315	250	–	250
132	VH250DO		207..300 (M300)	630	500	500	400
160	VH250DO		207..300 (M300)	630	500	500	400
200	VH400		297..430 (M430)	630	500	630	400
250	VH440		297..430 (M430)	–	630	630	500
315	V53D,VD630		435..630 (M630)	–	630	–	630
400	VD1000		620..900 (M900)	Circuit breaker series BL 1600			
500	VD1000		790..1100 (M1100)				

1. Contactors

1.1 General utilization instructions

1.1.5 Selection guide – contactor, thermal overload relay and fuses

Table-No. 1b

Motor	Contactor	Thermal overload relay		Fuse char. gG		Fuse char. aM	
500 V	Type	Type	Range of tripping current	Type of coordination		Type of coordination	
[kW]			[A]	1	[A] 2	1	[A] 2
0,37	A25.■, MC09.■	T17 (+H17)	1..1,45	6	4	4	2
0,75	A25.■, MC09.■		1,45..2,1	8	6	6	4
1,5	A25.■, MC09.■		3..4,3	12	6	10	4
2,2	A25.■, MC09.■		4,3..6,3	12	6	10	6
3	A25.■, MC09.■		6,2..9	20	16	12	10
4	A25.■, MC09.■		6,2..9	25	20	16	10
5,5	A25.■		9..13	25	20	25	10
7,5	A25.■		9..13	25	20	25	16
0,37	C9.■	T17	1..1,45	6	4	4	2
0,75	C9.■		1,45..2,1	8	6	6	4
1,5	C9.■		3..4,3	12	10	10	4
2,2	C9.■		4,3..6,3	12	10	10	6
3	C9.■		6,2..9	20	16	16	10
4	C9.■		6,2..9	25	20	16	10
5,5	C12.■		9..13	25	20	25	12
7,5	C12.■		13..19	25	20	25	16
10	C20.■		13..19	32	25	25	20
11	C23.■		13..19	32	25	32	20
11	C25.■	T50	13..19	40	32	32	20
11	C25.■		17,2..25	40	32	32	20
15	C32.■		17,2..25	50	–	40	–
20	C40.■	T63	24,1..35	50	40	40	–
22	C40.■		34,4..50	63	50	50	–
15	C50.■		21..30	80	40	63	32
22	C50.■		30..43	80	50	63	40
30	C50.■		43..63	80	63	63	50
37	C65.■		43..63	100	–	80	–
45	C80.■		55..80	100	–	80	–
45	C95.■		55..80	160	100	125	80
55	C95.■	T63 (+H63)	55..80	160	125	125	80
45	V85F	Overload protective set (3 x M...) + T17-1A + H17	55..80	125	100	125	80
45	V85F		50..72,5 (M145/2 passings through)	125	100	125	80
45	C95.■		50..72,5 (M145/2 passings through)	160	100	125	100
55	V105F		69..100 (M100)	125	100	125	100
55	C95.■		69..100 (M100)	160	125	125	100
75	V140F		100..145 (M145)	200	–	–	160
75	C115.■		100..145 (M145)	–	200	–	160
90	V170F		145..210 (M210)	200	–	–	160
110	V205F		145..210 (M210)	315	250	–	250
132	V250F		207..300 (M300)	315	250	–	250
200	VH250DO	Circuit breaker series BL 1600	207..300 (M300)	630	500	500	400
250	VH400		297..430 (M300)	630	500	500	400
250	VH440		297..430 (M430)		630	630	500
315	VH440		435..630 (M630)		630	630	500
400	V53D, VD630		435..630 (M630)		630	–	630
500	VD1000		620..900 (M900)				
630	VD1000		790..1100 (M1100)				

Attention please – Important Information!

Contactors of the „C“ and „R“ series have been redesigned and therefore the type markings on most them have undergone changes. The new type markings now reflect the configuration of the main poles and also of the auxiliary contacts. However, the type markings of accessories remain unchanged.*

Essential features of the innovated types:

- 1) diversification of the product assortment;
- 2) doubled coil terminals A2
- 3) DC controlled contactors equipped with the DUO control coil; no ballast resistor anymore
- 4) Example of the type marking of contactors series C.

C9. ■ ■ □ □

- number of main NC contactors (not obligatory for versions equipped with integral auxiliary contacts)
- number of main NO contacts (see above)
- number of integral auxiliary NC contacts *
- number of integral auxiliary NO contacts

Table-No. 1c: selection guide – input power of lighting / contactor type

Contactor type	Maximum load – each pole		
	Incandescent lamps [kW]	Fluorescent lamps 15..60 W with parallel compensation 0,1..0,3 μ F/W [kW]	High-pressure sodium discharge lamps with parallel compensation approx. 0,13 μ F/W [kW]
A25	3	1,2	1,35
C17.■	3,5	1,4	1,8
C25.■	4,5	2	2,8
C32.■	7,5	3,5	3,6
C50.■	12	6	5
C65.■	15	7,5	7,1
V105F	22	15	11,8

1.1.6 Table-No. 1d – Switching of capacitor banks – Switching of single capacitors

It is highly recommended to align the appropriate fuses as well as the 5 μ H-reactors (e. g. 5 windings of conductor at 400 mm diameter) to all poles, in order to reduce the risk of contact welding.

Max. capacitive load at 400 V, 120 switching cycles per hour [kVAr]

Contactor	V85F	V105F	V140F	V170F	V205F	V250F	VH250DO	VH440	V53D
kVAr	50	60	70	80	100	120	170	220	320

Attention!

Rated capacitive loads specified in Table-No. 1c are valid for switching of single capacitors only; specially designed contactors type C12.10C, C17.10C, C25.11C, C32.11C, C50.11C, C65.11C or C80.11C are to be employed for sequential parallel switching of capacitor banks in power factor compensating assemblies, where extremely high current peaks occur.

1.1.7 Short-time withstand currents

Table-No. 2 – Short-time withstand currents, from the cold state at the maximum ambient temperature 40 °C [A]

	1 sec	5 sec	10 sec	30 sec	1 min	3 min	10 min	Conductor cross-section [mm ²]
C9.■	220	150	120	75	60	40	30	2,5
C12.■	228	155	125	78	60	40	30	
C17.■	235	160	130	82	60	40	30	
C16.■	350	280	240	150	105	70	50	6
C25.■	360	288	250	156	105	70	50	
C32.■	370	295	260	164	105	70	50	
C50.■	800	500	400	280	210	145	100	16
C65.■	880	550	510	320	230	145	100	
C80.■	960	620	580	360	270	185	120	
V85F	1 200	1 000	800	650	420	250	170	35
V105F	1 270	1 060	850	680	440	250	170	
V140F	1 700	1 250	1 150	750	600	420	300	70
V170F	2 000	1 450	1 360	860	650	420	300	
V205F	2 500	1 800	1 700	1 200	950	620	480	120
V250F	3 000	2 180	2 000	1 400	1 000	620	480	

1.1.8 Configuration of poles

Table-No. 3

Contactor type	No. of main poles		No. of auxiliary contacts	
	NO	NC	NO	NC
MC09.10	3	0	1	0
MC09.01	3	0	0	1
C9.10, C12.10, C17.10, C23.10	3	0	1	0
C9.01, C12.01, C17.01, C23.01	3	0	0	1
C9.0040, C23.0040	4	0	0	0
C9.0022, C23.0022	2	2	0	0
C9.00, C12.00, C17.00, C23.00	3	0	0	0*
C16.11, C20.11, C25.11, C32.11, C40.11	3	0	1	1
C16.10, C20.10, C25.10, C32.10, C40.10	3	0	1	0*
C50.11, C65.11, C80.11	3	0	1	1
C50.10, C65.10, C80.10	3	0	1	0*
C95.21, C115.21, C150.21	3	0	2	1
C95.12, C115.12, C150.12	3	0	1	2
C95.11, C115.11, C150.11	3	0	1	1*
V85F	3	0	2	2 (1)*
V105F	3	0	2	2 (1)*
V140F	3	0	2	2 (1)*
V170F	3	0	2	2 (1)*
V205F	3	0	2	2 (1)*
V250F	3	0	2	2 (1)*
VH250DO	3	0	2	2 (1)*
VH250DO.4	4	0	2	2 (1)*
VH440	3	0	2	2 (1)*
VH440.4	4	0	2	2 (1)*
VH400	3	0	2	2 (1)*
V53D, VD630	3	0	2	2 (1)*
VD1000	3	0	2	2 (1)*

*DC controlled contactors series C employ one NC auxiliary contact (terminals marked *5–*6) in the coil circuit

** DC controlled contactors employ one NC auxiliary contact (terminals marked 25–26) in the coil circuit, another NC contact (terminals marked 31–32) remains for user's disposal.

1.1.9 Basic control voltages

Table-No. 4 – Basic contactor coil control voltages

Contactor type	Coil control voltage [V]													
	AC 50 Hz							AC 60 Hz		DC				
	12	24	48	110	127	220/230	380/400	110	220	12	24	48	110	220
series MC, MR						220-240			220-240					
series A														
series C, R														
series C 11C														
V85F, V105F														
V140F, V170F														
V205F, V250F														
series VH														
V53D, VD630, VD1000						220	380							
V53D, VD630, VD1000						230	400							

Coils for other various control voltages within the ranges specified in the rating tables can be supplied on a special request and for a supplementary charge.

Attention!

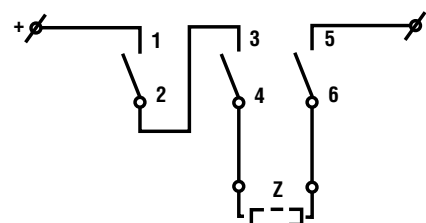
The power supply in the coil control circuit must have an output power that is sufficient enough to supply the inrush input current of the contactor coil(s) without any remarkable control voltage drop on the coil terminals. Should the power supply not meet such needs, an incorrect switching, like pumping or short time sealing of the contactor, can occur in some cases, which under severe conditions could cause a welding of contacts.

The "Pull-in input power of the AC control coil, $\pm 10\%$ [VA]" was calculated as a multiplication of the effective current and voltage values under the conditions of an entirely open electromagnet. This apparent input power would be consumed by a contactor with an arrested moving part, which is an unusual condition; during the correct sealing of a contactor, the coil impedance rapidly rises and the input power falls to the hold-in input power value, which is also indicated in the rating.

Contactors usually seal within 20 to 40 milliseconds and their AC power supplies are capable of short time overloading. This is why the power supply, which is sized according to the apparent input power of the contactor control coil, is able to sufficiently support the correct contactor operation.

1.1.10 DC operation

EN 60947-4-1 specifies the utilization of contactors for switching DC currents. Contactors supplied by Elektropristroj can operate in categories DC-1, DC-3, or DC-5 with a max. voltage of 250 V., and types VH250D0 and VH440 can even operate with a max. DC voltage of 440 V. Three main poles must be series connected (see the wiring diagram) for DC operating voltages above 48 V. See ratings in Table-No. 5.



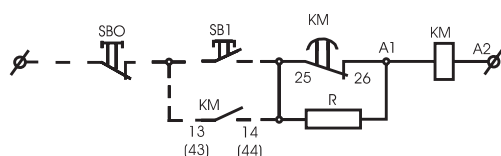
Wiring diagram – switching of DC current

1.1.11 DC control of contactors

DC controlled contactors series C, V..F and VH.. have been redesigned and improved. These contactors employ special DUO-coils that no longer need the series resistors. Nevertheless, a DUO-coil must be switched during the sealing of the contactor by means of an integral time-delayed NC contact. The duo-DC control circuit is wired so that the user lands the control wires on the coil terminals A1-A2. Please refer to the appropriate wiring diagrams in the following chapters. The wires supplied with the contactor must not be removed!

Four-pole contactors series C with a DUO-coil still employ the auxiliary contact unit PK21T, but no ballast resistor. DC controlled minicontactors series MC and MR require no special wiring – the control voltage is to be applied directly to the coil terminals.

Wiring diagram of older DC controlled contactors series V..F, VD



The series resistor R, which is supplied with the contactor, is to be separately mounted by the means of a screw set, included in each delivery.

Table-No. 5 – Rating of contactors, DC operation

Contactors	MC09.■	C9.■	C23.■	C25.■	C32.■	C40.■
Rated operational DC voltage [V]	220	220	220	220	220	220
Rated operational DC current [A]						
DC-1	14	25	25	32	32	44
DC-3	4	12	12	16	25	25
DC-5	2	8	8	12	16	16
Electrical durability in cat. DC-5 for 300 op. cycles per hour [10 ⁶ op. cycles] for 600 op. cycles per hour [10 ⁶ op. cycles]	0,06	0,1	0,1 0,2	0,2	0,2	

Table-No. 5 – continued

Contactors	C65.■	C80.■	V105F	V170F	V250F	VH250DO	VH250DO	VH440
Rated operational DC voltage [V]	220	220	220	220	500	440	600	440
Rated operational DC current [A]								
DC-1	85	85	105	170	250	300	450	440
DC-3	44	44	63	100	–	100	–	120
DC-5	32	32	40	63	–	80	–	100
Electrical durability in cat. DC-5 for 300 op. cycles per hour [10 ⁶ op. cycles] for 600 op. cycles per hour [10 ⁶ op. cycles]	0,1	0,2	0,3	0,3		0,2		0,2

For further rated values see the identical ones for AC operation

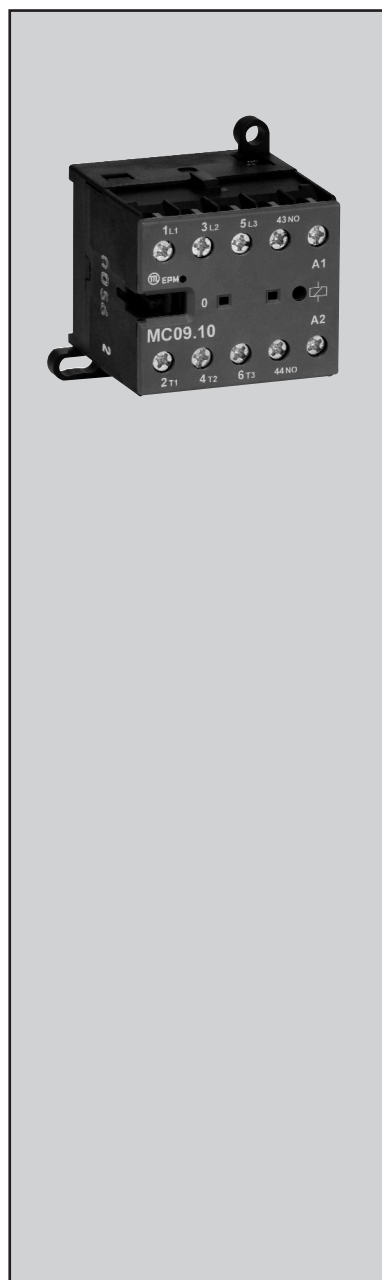
*A copper wire at least 4 mm² shall be used for I_e = 44 A, the 24-hour average ambient temperature shall not be higher than 35 °C

1.2 Minicontactors and auxiliary minicontactors

1.2.1 Minicontactors

Minicontactors are designed for frequent switching, mainly in the circuits of three-phase induction motors. Auxiliary minicontactors derived from the same design can usually operate in auxiliary and/or control circuits. Due to their compact size, both minicontactors and auxiliary contactors are suitable for devices with limited inner space. Textile, printing, or food processing machines, as well as medical or mobile devices may be appropriate for such contactors.

1.2.2 Table-No. 6 - Rating



Rating	MC09.■
Rated insulation voltage U_i [V]	690
Impulse withstand voltage U_{imp} [kV]	6
Conventional free air thermal current I_{th} [A]	20
Rated operational current I_e in the category	
AC-1 at 230 V [A]	20
AC-1 at 400 V [A]	20
AC-1 at 500 V [A]	12
AC-1 at 690 V [A]	6
AC-3 at 230 V [A]	9
AC-3 at 400 V [A]	9
Max. output power of controlled motor in AC-3	
at 230 V [kW]	2,2
at 400 V [kW]	4
at 500 V [kW]	4
at 690 V [kW]	3
Max. number of max. on-load op. cycles per hour	
in AC-1 [op. cycles/h]	300
in AC-3 [op. cycles/h]	600
Electrical durability in AC-1 at 400 V / 20 A [op. cycles]	0,1x10 ⁶
in AC-3 at 400 V / 9 A [op. cycles]	0,3x10 ⁶
Recommended fuse char. aM [A]	20
Type of co-ordination with SCPD	2
Mechanical durability [op. cycles]	10x10 ⁶
Auxiliary contacts	
Rated insulation voltage U_i [V]	690
Conventional free air thermal current I_{th} [A]	6
Rated operational current I_e AC-15 at 230 V [A]	4
at 400 V [A]	3
at 500 V [A]	2
Control circuit	
AC coil control voltage from 40 up to 450 Hz [V]	220..240
Input power of AC control coil, ± 10 % [VA]	3,5
DC coil control voltage [V]	24
Input power of DC control coil, ± 10 % [W]	3,5
Mass [kg]	0,18
Outline dimensions [mm]	47,5x57,5x46,5
Degree of protection	IP20/IP10

1. Contactors

1.2 Minicontactors and auxiliary minicontactors

1.2.3 Auxiliary minicontactors

Auxiliary minicontactors derive their design from the “MC” series minicontactors. All four poles have the same rating and appropriate terminal markings.

Auxiliary contactors have either four poles (versions MR40E, MR31X, MR22X), or six poles when they are equipped with either MPK11, MPK02, or MPK20 front mounted auxiliary contact blocks, or with the MPKB11 side mounted block.

1.2.4 Table-No. 7 - Rating



Rating	Base unit	Auxiliary contacts	
	MR■	MPK■	MPKB11
Rated insulation voltage U_i [V]	690	690	690
Impulse withstand voltage U_{imp} [kV]	6	6	6
Conventional free air thermal current I_{th} [A]	6	6	6
Rated operational current I_e in AC-15			
at 240 V [A]	4	4	4
at 440 V [A]	3	3	3
at 500 V [A]	2	2	2
Rated operational current I_e in DC-13			
at 24 V [A]	2,5	2,5	2,5
at 125 V [A]	0,7	0,7	0,7
at 250 V [A]	0,4	0,4	0,4
Max. number of max. on-load op. cycles per hour	600	600	600
Mechanical durability [op. cycles]	10×10^6	10×10^6	10×10^6
Control circuit			
AC coil control voltage from 40 up to 450 Hz [V]	220..240		
Input power of AC control coil, $\pm 10\%$ [VA]	3,5		
DC coil control voltage [V]	24		
Input power of DC control coil, $\pm 10\%$ [W]	3,5		
Mechanically linked contact device acc. to EN 60947-5-1, App L	yes	yes	yes
Mass [kg]	0,18	0,03	0,035
Outline dimensions [mm]	47,5x57,5x46,5	47,5x28x26,5	15,5x42x46,5
Degree of protection acc. to VDE 0106, part 100	IP20/IP10	IP20/IP10	IP20/IP10

1.2.5 Accessories to the minicontactors series MC and MR

1. Front mounted auxiliary contact units MPK02, MPK11, MPK20

2. Side mounted auxiliary contact unit MPKB11

The auxiliary contact blocks mentioned above are accessories to both the MC series minicontactors and the MR series auxiliary contactors.

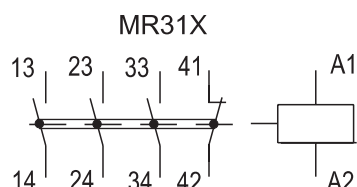
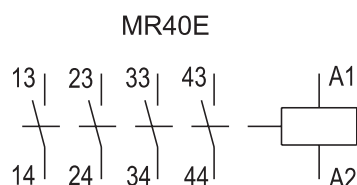
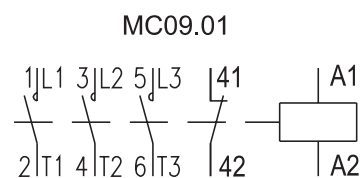
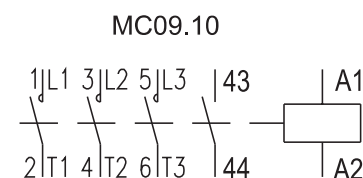
MC or MR series contactors are not allowed to be equipped together with two auxiliary contact blocks

3. Grand jumper LP6 for parallel connection of two adjacent terminals (attention – if connected, it reduces the degree of protection to IP00).

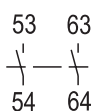
1. Contactors

1.2 Minicontactors and auxiliary minicontactors

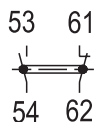
1.2.6 Circuit diagrams and terminal marking



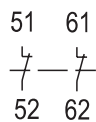
MPK20



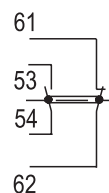
MPK11



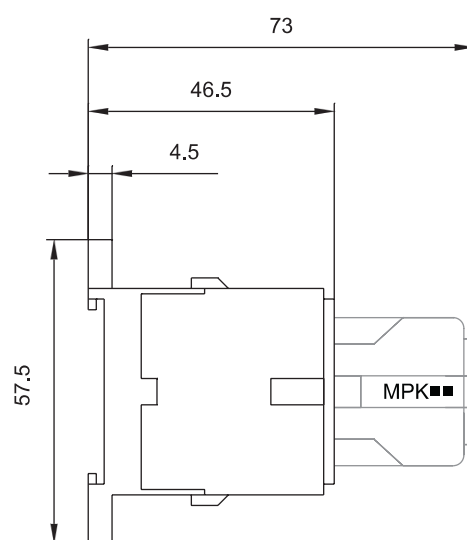
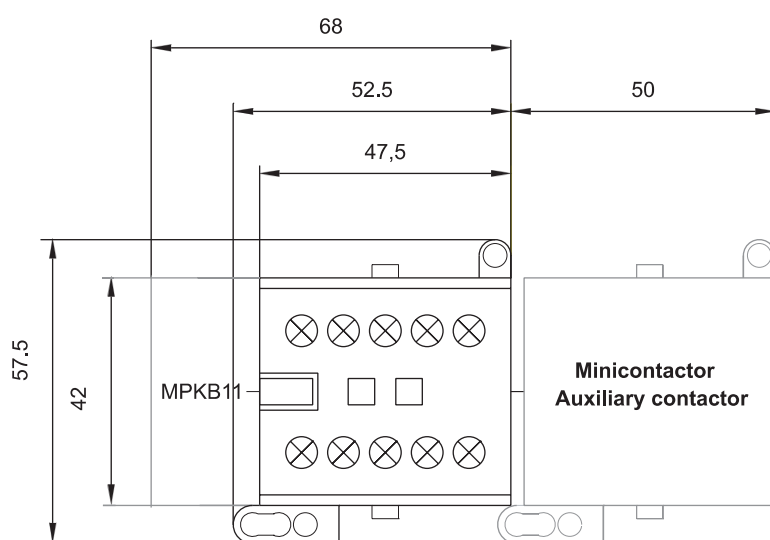
MPK02



MPKB11



1.2.7 Outline drawings



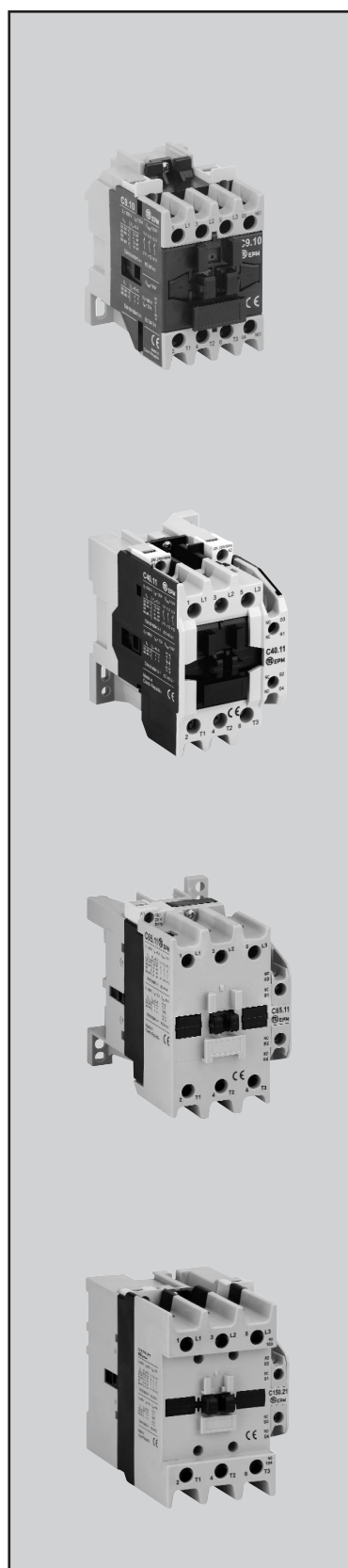
1.2.8 Example of order

Minicontactor MC09.01	220..240 V AC	60 Ea
Auxiliary contact unit	MPKB11	30 Ea
Grand jumper	LP6	100 Ea
Auxiliary minicontactor	MR22 24 V DC	50 Ea

Note

1.3 Contactors series "C"

1.3.1 Table-No. 8 Rating



Type	C9.■■ **	C12.■■	C17.■■
Main poles			
Rated insulation voltage U_i [V]	690	690	690
Impulse withstand voltage U_{imp} [kV]	8	8	8
Conventional free air thermal current I_{th} [A]	25	25	25
Rated operational current I_e (AC-1) at 400 V [A]	25	25	25
Rated operational current I_e (AC-3) at 400 V [A]	9 (4,7)	12 (5,6)	16 (6,6)
Max. output power of controlled motor in AC-3			
at 220-230 V [kW]	2,2	3	4
at 380-400 V [kW]	4 (2)	5,5 (2,5)	7,5 (3)
at 500 V [kW]	5,5 (2,5)	7,5 (3)	9 (3,7)
at 660-690 V [kW]	5,5	7,5	9
Max. number of on-load op. cycles per hour in AC-1			
AC-1 [sep/h]	300	300	300
AC-3	1 200	1 200	1 200
AC-4	600	600	600
Electrical durability in AC-1 at 380-400 V [op. cycles] for the rated op. current	0,15x10 ⁶	0,32x10 ⁶	0,5x10 ⁶
Electrical durability in AC-3 at 380-400 V [op. cycles] for the rated op. current	1,5x10 ⁶	1,5x10 ⁶	1,5x10 ⁶
Recommended fuse char. aM [A]	10	16	20
Type of co-ordination with SCPD	2	2	2
Mechanical durability – AC controlled [op. cycles]	10x10 ⁶	10x10 ⁶	10x10 ⁶
Mechanical durability – DC controlled [op. cycles]	10x10 ⁶	10x10 ⁶	10x10 ⁶
Auxiliary contacts (C9.0040, C9.0022 and C23.0022, C23.0040 – not available)			
Rated insulation voltage U_i [V]	690	690	690
Impulse withstand voltage U_{imp} [kV]	8	8	8
Conventional free air thermal current I_{th} [A]	25	25	25
Rated operational current I_e (AC-15) at 230 V [A]	4	4	4
Rated operational current I_e (AC-15) at 400 V [A]	2	2	2
Electrical durability in AC-15 at 220-230 V, 4 A [op. cycles]	0,8x10 ⁶	0,8x10 ⁶	0,8x10 ⁶
Electrical durability in AC-15 at 380-400 V, 2 A [op. cycles]	10 ⁶	10 ⁶	10 ⁶
Control circuit			
Range of AC coil control voltages at 50 Hz [V]	12..500	12..500	12..500
Range of AC coil control voltages at 60 Hz [V]	24..660	24..660	24..660
Pull-in input power of AC control coil, ±10 % [VA]	60	60	60
Hold-in input power of AC control coil, ±10 % [VA/W]	10,5/3,9	10,5/3,9	10,5/3,9
Range of DC „D“ coil control voltages [V]	12..220	12..220	12..220
Pull-in input power of DC control coil [W]	55..98	55..98	55..98
Hold-in input power of DC control coil [W]	1,98..3,30	1,98..3,30	1,98..3,30
Range of DC coil control voltages [V]	12..250	12..250	12..250
Pull-in input power of DC control coil, ±10 % [W]	90	90	90
Hold-in input power of DC control coil, ±15 % [W]	9,2	9,2	9,2
Main dimensions W × H × D [mm]	45x78,5x73	45x78,5x73	45x78,5x73
Mass [kg]	0,3	0,3	0,3
Degree of protection acc. to VDE 0106, part 100	IP20/IP10	IP20/IP10	IP20/IP10

1. Contactors

1.3 Contactors series "C"

With the aid of accessories mounted on the appropriate locks of the contactor's body, contactors series "C" can be used to build a compact switching unit with extended functionality.

C23.■**	C16.■	C20.■	C25.■	C32.■	C40.■	C50.■	C65.■	C80.■	C95.■	C115.■	C150.■
690 8 25 25 23 (8)	690 8 50 25 16 (7)	690 8 50 25 20 (7)	690 8 50 32 25 (8)	690 8 50 44 32 (9,5)	690 8 50 50 40 (11,3)	690 8 85 60 50 (15,2)	690 8 85 75 65 (18)	690 8 85 (95)* 85 80 (20)	690 8 150 110 95	690 8 150 130 115	690 8 150 150 150
5,5 11 (3,7) 11 (3,7) 9 300 1 200 600	5,5 7,5 (3) 9 (4) 11 300 1 200 600	5,5 10 (3) 10 (4) 11 300 1 200 600	7,5 11 (3,7) 11 (4,5) 11 300 1 200 600	11 15 (4,5) 18,5 (5,5) 18,5 300 1 200 600	12,5 20 (5,5) 25 (7,5) 18,5 300 1 200 600	15 25 (7,5) 30 (9) 30 300 1 200 600	18,5 30 (9) 37 (11) 37 300 1 200 600	22 37 (10) 45 (12,5) 45 300 1 200 600	25 45 (15) 55 (18,5) 55 300 1 200 600	30 55 (18,5) 75 (25) 55 300 1 200 600	45 75 (25) 83 (30) 55 300 1 200 600
0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶
1x10 ⁶	1,5x10 ⁶	1,2x10 ⁶	10 ⁶	10 ⁶	0,9x10 ⁶	10 ⁶	10 ⁶	0,9x10 ⁶	0,9x10 ⁶	0,7x10 ⁶	0,5x10 ⁶
25 2	20 2	25 2	32 2	63 1	63 1	50 2	80 1	80 1	100 2	125 2	160 2
10x10 ⁶ 10x10 ⁶	10x10 ⁶ 10x10 ⁶	10x10 ⁶ 10x10 ⁶	10x10 ⁶ 10x10 ⁶	10x10 ⁶ 10x10 ⁶	10x10 ⁶ 10x10 ⁶	10x10 ⁶ 5x10 ⁶	10x10 ⁶ 5x10 ⁶	10x10 ⁶ 5x10 ⁶	5x10 ⁶ 5x10 ⁶	5x10 ⁶ 5x10 ⁶	5x10 ⁶ 5x10 ⁶
690 8 25 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶
12..500 24..660 60 10,5/3,9	12..500 24..660 83 14,2/4	12..500 24..660 83 14,2/4	12..500 24..660 83 14,2/4	12..500 24..660 83 14,2/4	12..500 24..660 83 14,2/4	24..690 24..660 140 23/5,7	24..690 24..660 140 23/5,7	24..690 24..660 140 23/5,7	24..690 24..660 30/6,5	24..690 24..660 30/6,5	24..690 24..660 30/6,5
12..220 55..98 1,98..3,30 12..250 90 9,2	12..220 80..150 2,6..2,8 12..250 70 10	12..220 80..150 2,6..2,8 12..250 70 10	12..220 80..150 2,6..2,8 12..250 70 10	12..220 80..150 2,6..2,8 12..250 70 10	12..220 80..150 2,6..2,8 12..250 70 10	24..220 170..190 3,5..3,9 12..250 150 16,5	24..220 170..190 3,5..3,9 12..250 150 16,5	24..220 170..190 3,5..3,9 12..250 150 16,5	24..220 180..240 3,2..4,1 12..250 150 16,5	24..220 180..240 3,2..4,1 12..250 150 16,5	24..220 180..240 3,2..4,1 12..250 150 16,5
45x78,5x73 0,3 IP20/IP10	56x90x91 0,52 IP20/IP10	56x90x91 0,52 IP20/IP10	56x90x91 0,52 IP20/IP10	56x90x91 0,52 IP20/IP10	56x90x91 0,52 IP20/IP10	70x107x116 0,9 IP20/IP10	70x107x116 0,9 IP20/IP10	70x107x116 0,9 IP20/IP10	85x120x127 1,6 IP20/IP10	85x120x127 1,6 IP20/IP10	85x120x127 1,6 IP20/IP10

* A copper wire at least 25 mm² is to be used for I_{th} = 95 A; the 24-hour average ambient temperature must not exceed 35 °C

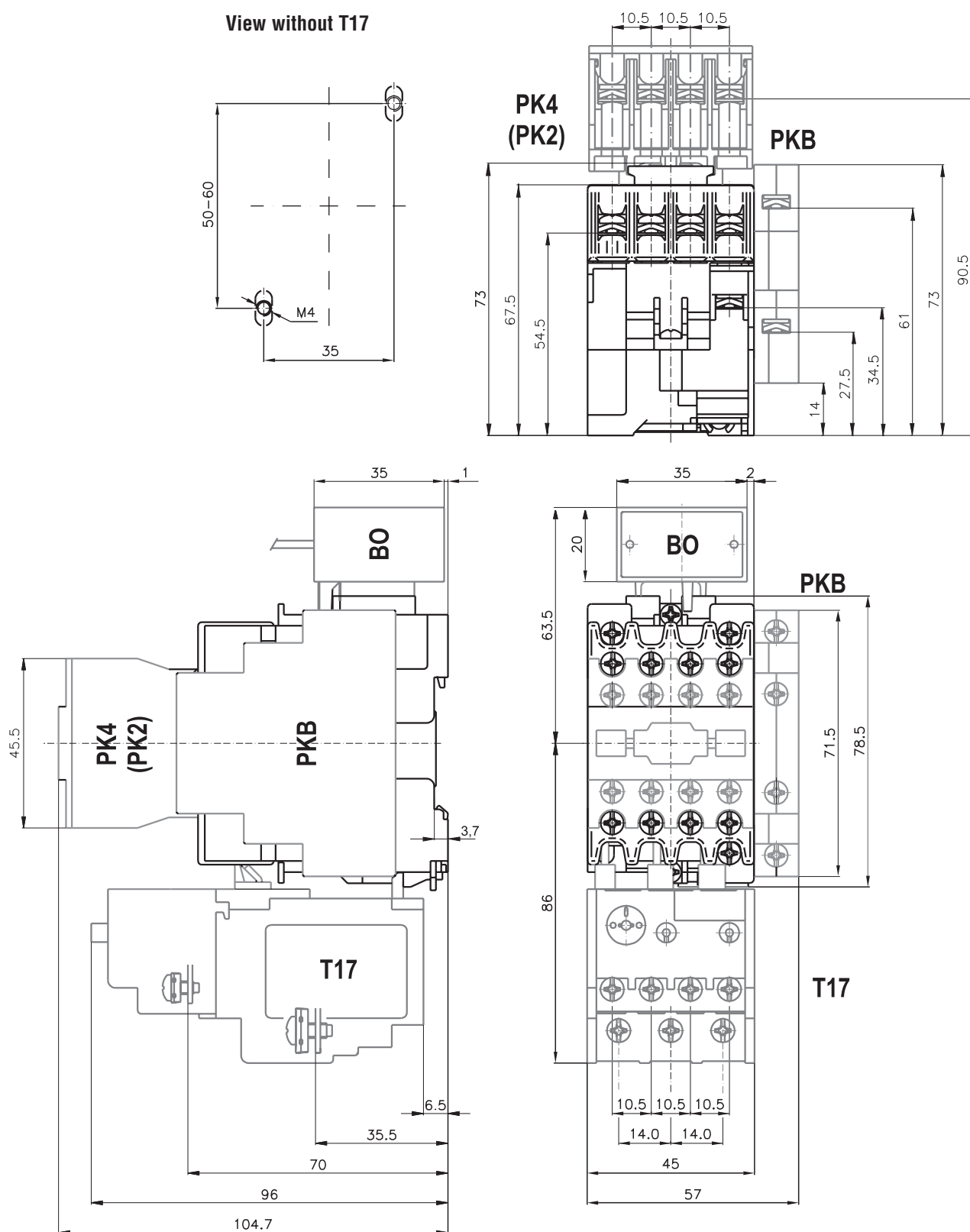
** Rating in categories AC-3 or AC-4 are not applicable for versions C9.0022 or C23.022

*** Short circuit protection provided by the circuit breaker type BD250

1.3.2 Outline drawings

Outline drawing of [C9.■, C12.■, C17.■, C23.■] with the thermal overload relay T17 and accessories

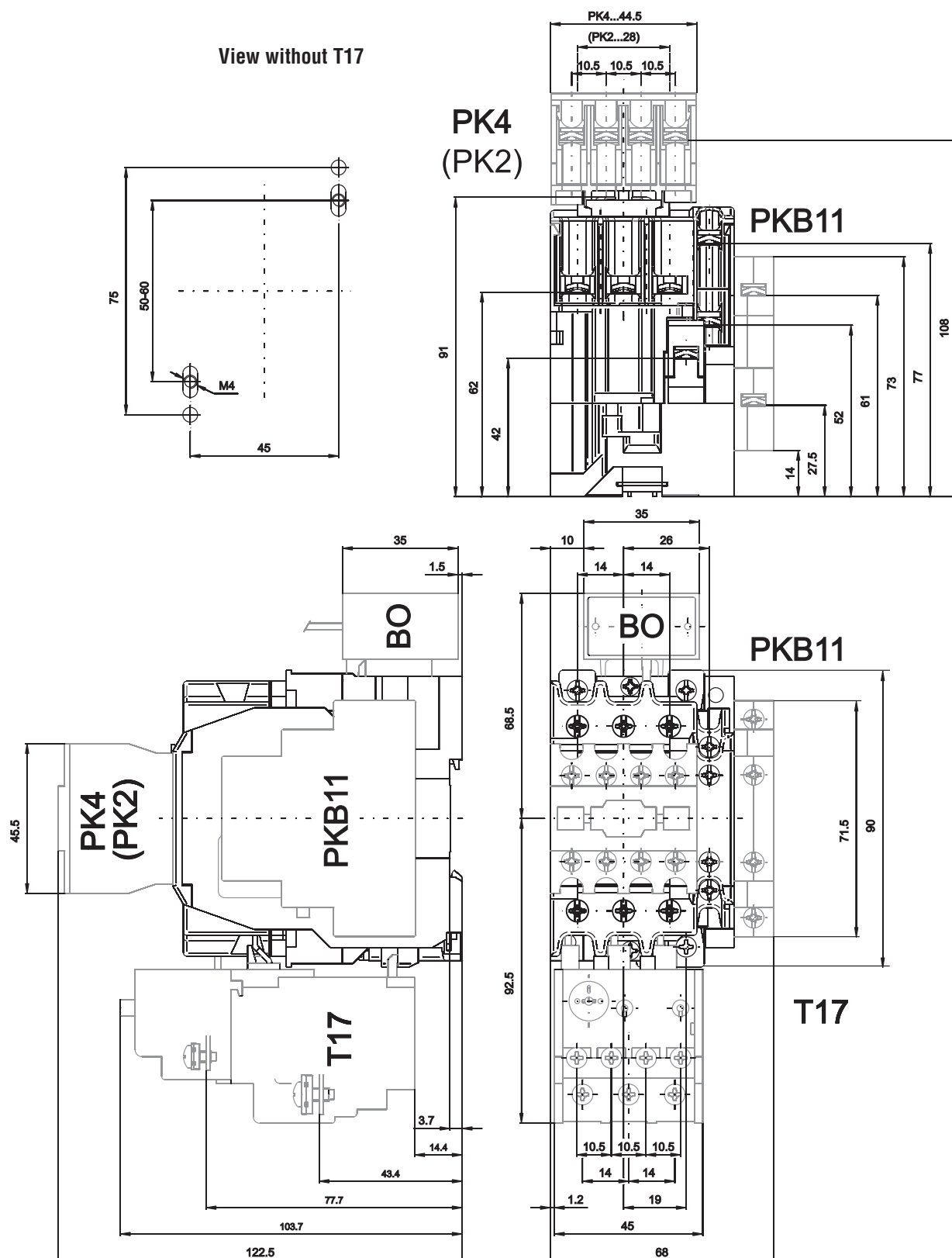
View without T17



Contactors can be fixed to either a 35 mm rail according to EN 50022, or onto a mounting panel by means of two M4 screws.

1.3.2 Outline drawings

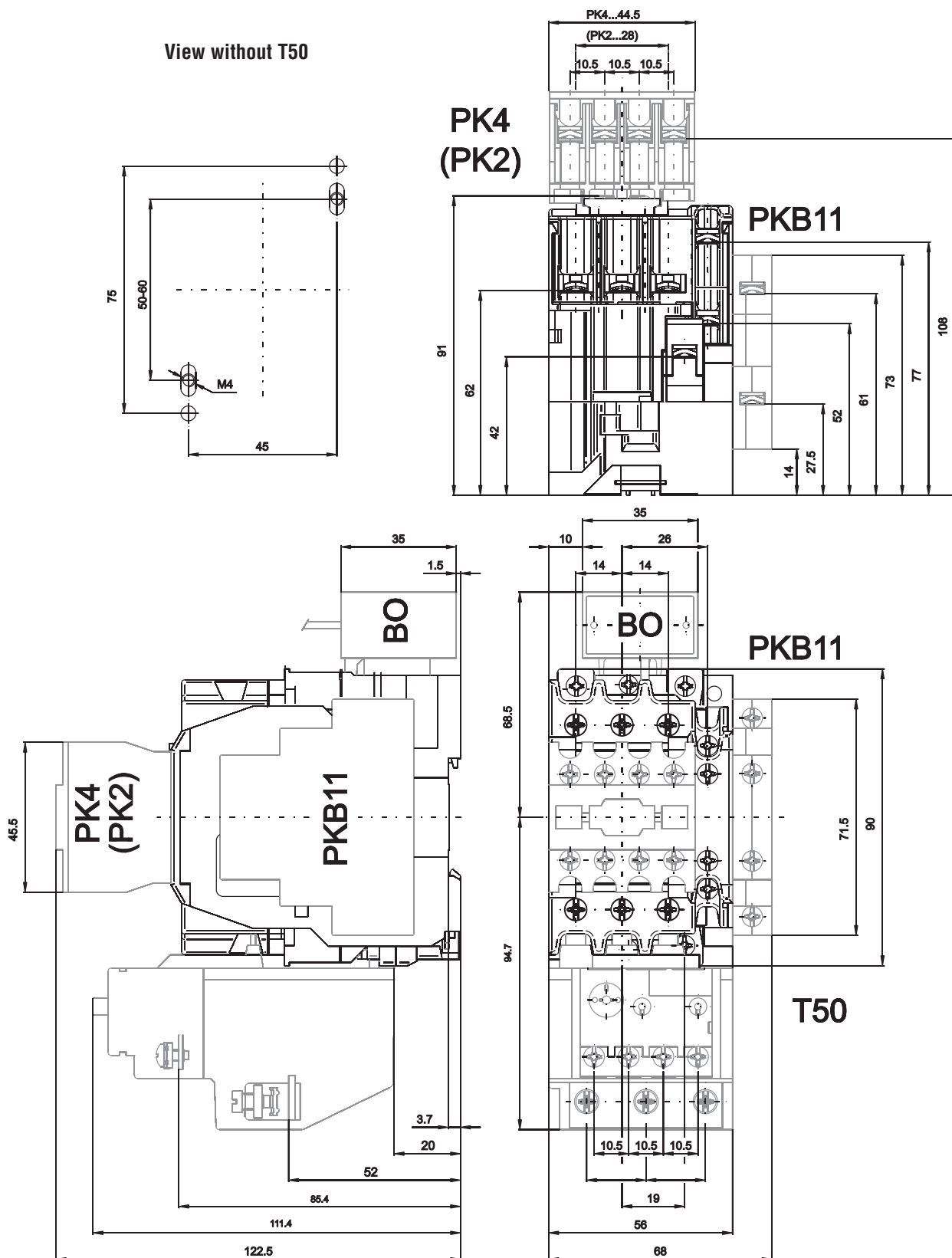
Outline drawing of [C16.■, C20.■, C25.■, C32.■, C40.■] with the thermal overload relay T17 and accessories



Contactors can be fixed to either a 35 mm rail according to EN 50022, or onto a mounting panel by means of two M4 screws.

1.3.2 Outline drawings

Outline drawing of [C16.■, C20.■, C25.■, C32.■, C40.■] with the thermal overload relay T50 and accessories

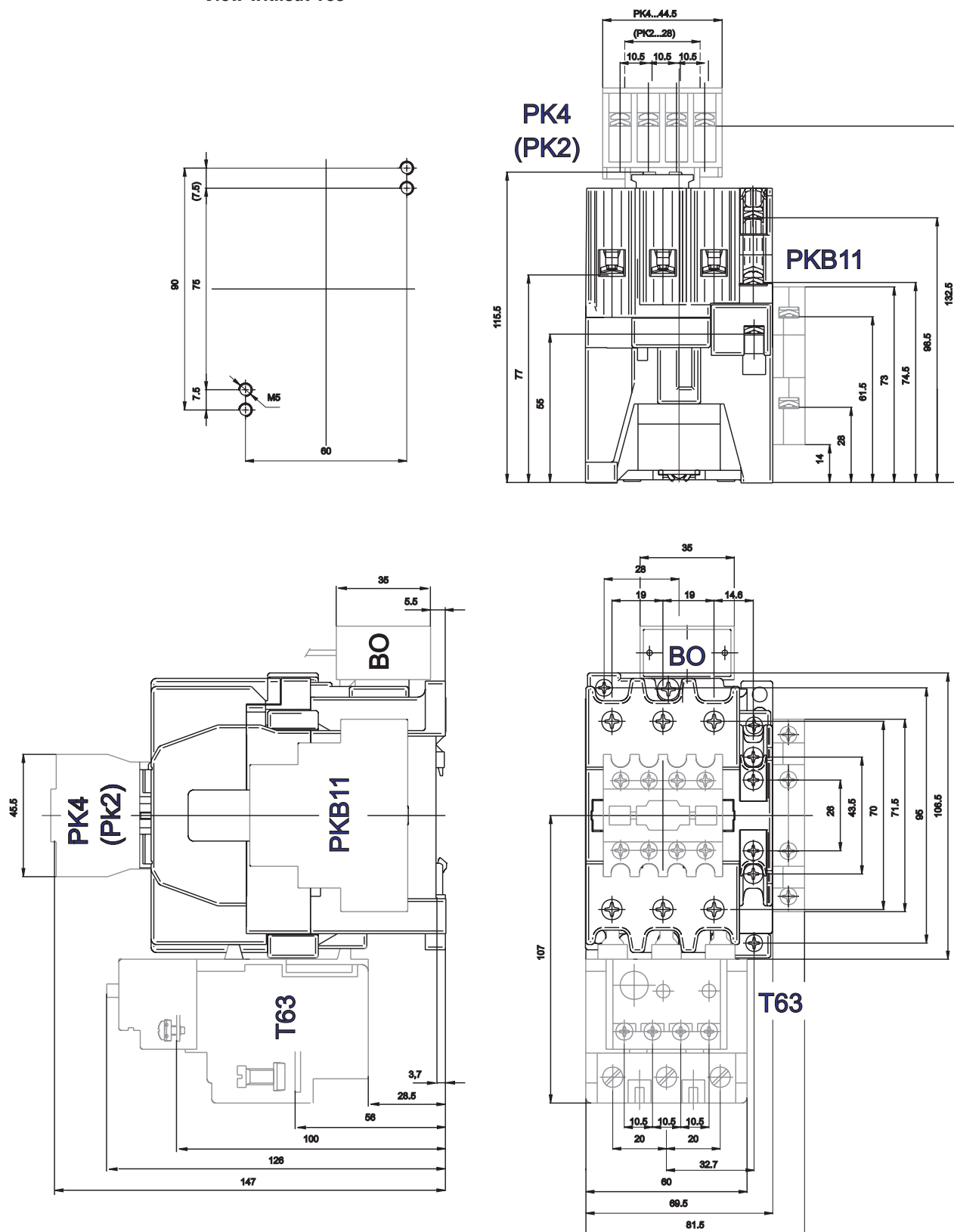


Contactors can be fixed to either a 35 mm rail according to EN 50022, or onto a mounting panel by means of two M4 screws.

1.3.2 Outline drawings

Outline drawing of [C50.■, C65.■, C80.■] with the thermal overload relay T63 and accessories

View without T63

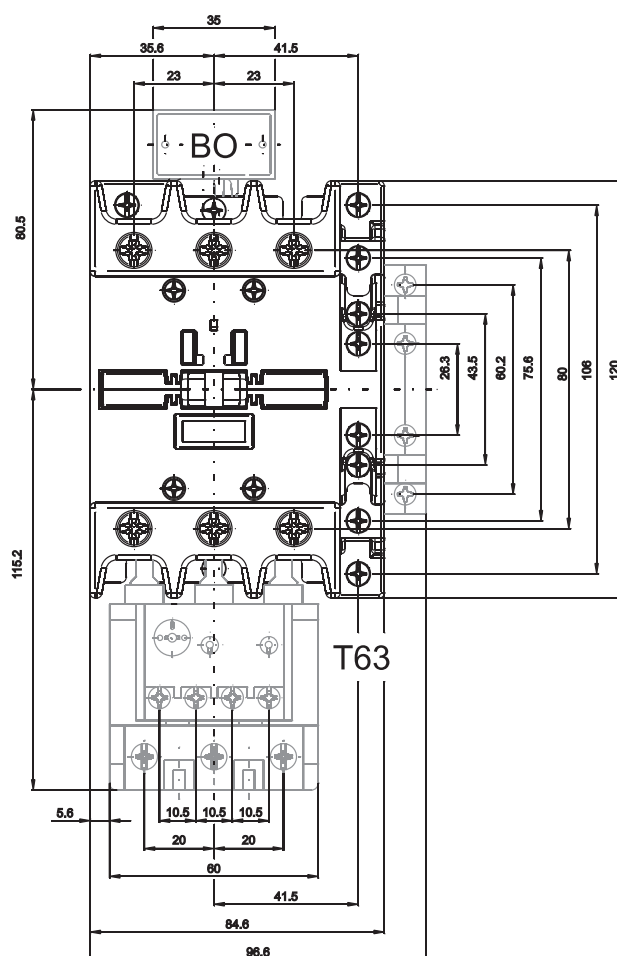
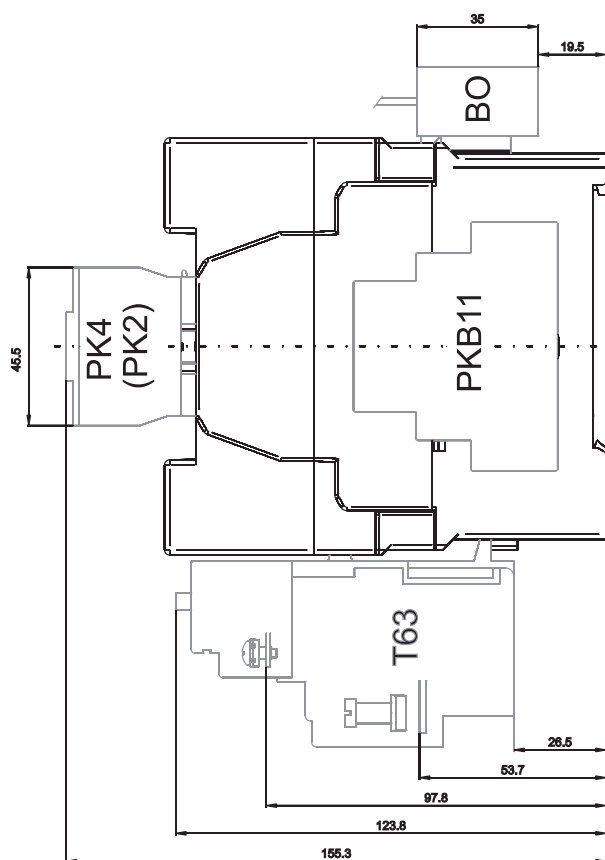
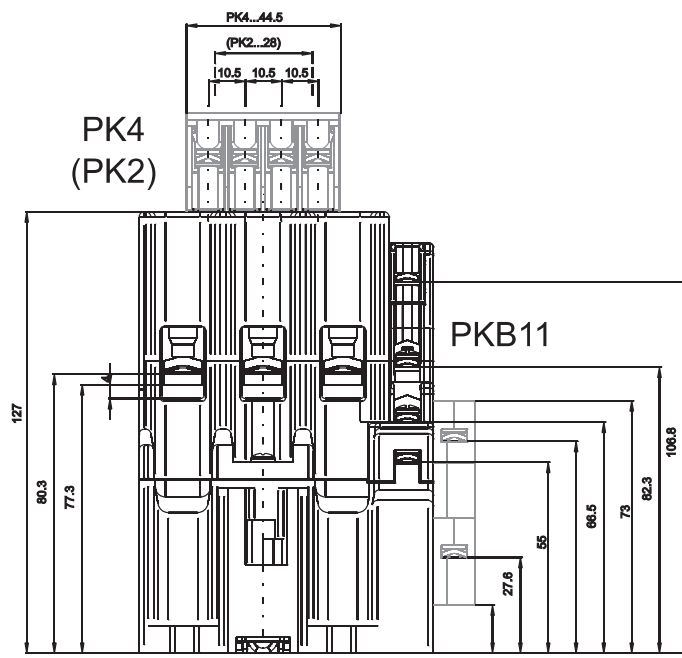
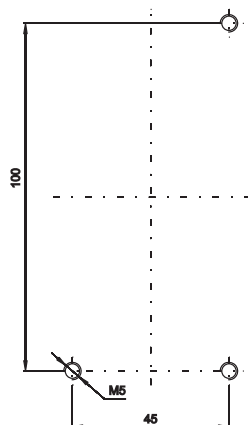


Contactors can be fixed to either a 35 mm rail according to EN 50022, or onto a mounting panel by means of two M5 screws.

1.3.2 Outline drawings

Outline drawing of [C95.■, C115.■, C150.■] with the thermal overload relay T63 and accessories

View without T63



Contactors are to be fixed onto a mounting panel by means of three M5 screws.

1.3.3 Marking of terminals, configuration of contacts and conductor cross-sections

Contactor type	Configuration of contacts				Wiring diagram
	Main contacts NO	NC	Auxiliary contacts NO	NC	
C9.10, C12.10, C17.10, C23.10	3	0	1	0	
C9.01, C12.01 C17.01, C23.01	3	0	0	1	
C9.00, C12.00 C17.00, C23.00	3	0	0	0	
C9.0040, C23.0040	4	0	0	0	
C9.0022, C23.0022	2	2	0	0	
C16.11, C20.11, C25.11, C32.11, C40.11, C50.11, C65.11, C80.11,	3	0	1	1	
C16.10, C20.10, C25.10, C32.10, C40.10, C50.10, C65.10, C80.10	3	0	1	0	
C95.21, C115.21, C150.21	3	0	2	1	
C95.12, C115.12, C150.12	3	0	1	2	
C95.11, C115.11, C150.11	3	0	1	1	

Table-No. 9 – Terminals and conductor cross-sections

Contactor type	Main poles				Auxiliary contacts, coil terminals and accessories			
	Terminal type	Screw size	Copper wire [mm ²]		Terminal type	Screw size	Copper wire [mm ²]	
			Rigid	Flexible			Rigid	Flexible
C9, C12, C17, C23	screw-type	M3,5	1..4	1..2,5	screw-type	M3,5	1..2,5	0,75..1,5
C16, C20, C25, C32, C40	pillar-type	M5	1,5..10	1,5..10	screw-type	M3,5	1..2,5	0,75..1,5
C50, C65, C80	pillar-type	M6	2,5..25	2,5..25	screw-type	M3,5	1..2,5	0,75..1,5
C95, C115, C150	pillar-type, double entry	M8	6..50	6..50	screw-type	M3,5	1..2,5	0,75..1,5

Screw type terminals facilitate the connection of either a single conductor, or two of the same conductors resp. by cross-sections differing by one degree.

Pillars type terminals facilitate the connection of either a single conductor up to the maximum cross-section, or two of the same conductors resp. by cross-sections differing by one degree, with the exception of the maximum one.

In addition, the pillar type terminal of contactor types [C95, C115, C150] facilitates the connection of conductors in a way similar to the other pillar type terminals, plus the connection of a flat bar with max. cross-section [4x12] mm.

All screws M3.5, M5, M6 have the combined slot [PH2 + simple].

Flexible conductors must not be compacted by brazig!

Table-No. 10 – Tightening torques

Screw size	Tightening torque [Nm]	
	Screwdriver	Spanner (wrench)
M3	0,6	
M3,5	0,8	
M4	1,2	
M5	2	
M6	2,5	3
M8	3,5	6
M10	4	10
M12		14
M16		25

1.3.4 Spare parts

Spare coils represent the spare parts for contactors series “C”.

Instructions for replacing the series „C“ contactor coil

0. It is not necessary to remove the contactor from the mounting panel or rail.
1. If necessary, disconnect wires from the terminals of the main poles and auxiliary contacts.
2. Disconnect wires from the coil terminals
- 3a. For contactors typ C9 through C40 – loosen the two appropriate screws and remove the upper part of the contactor, then simultaneously remove the coil and the conical return spring; insert the spare coil into the bottom part of the contactor, then put the conical spring onto the middle column of the electromagnet armature and affix the upper part of the contactor to the bottom by tightening the two screws.

3b. For contactors type C50.■ through C150.■: loosen the two appropriate screws and remove the upper part of the contactor, (i.e. the extinguishing chamber) together with the black middle part, then simultaneously remove the coil and the conical return spring; insert the spare coil into the bottom part of the contactor, then put the conical spring onto the middle column of the electromagnet armature and affix the upper part of the contactor to the bottom by tightening the two screws.

Press the lock on the contact carrier and check whether that part of the contactor moves in the proper way.

4. Re-connect all conductors.

1.3.5 Maintenance

Contactors of the "C" series do not need any maintenance.

Inspection of the contactor's insulation and contacts should be done after a short circuit or any other type of damage incurred by the device which the contactor is operating in. (see EN 60947-4-1, Art.-No. 8.3.4.2.3 L).

Inspection of the contacts can be done easily after the removal of the arc extinguishing chamber on the contactor types C50.■ through C150.■.

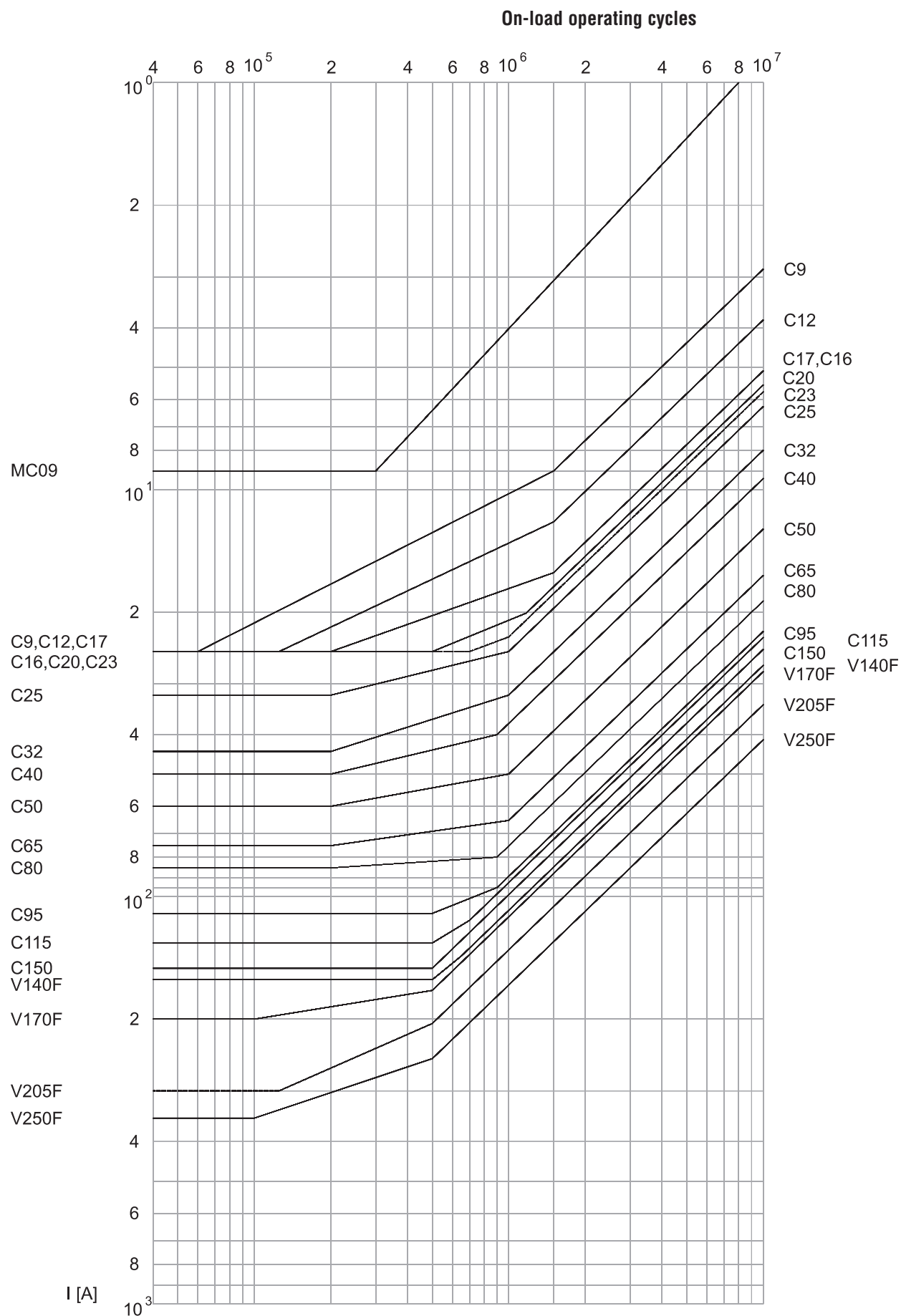
1.3.6 Overload and short-circuit protection

Thermal overload relay types T17, T50 and T63 are designed to provide overload protection when utilized together with contactors series "C"; fuses, circuit breakers, or another SCPD (short-circuit protective device) must be used.

1.3.7 Example of order

Type	Coil control voltage	No. of pcs
C9.01	220-230 V/50 Hz	100 pcs
C23.0022	24 V/50 Hz	50 pcs
C40.10	12 V DC	30 pcs
C9.0040 + PK21T	220 V DC	10 pcs
C65.11	48 V/50-60 Hz	5 pcs
Coil C9.10	127 V/50 Hz	10 pcs
Auxiliary contact block	PK22E	6 pcs

Electric durability in the category AC-3 at 400 V



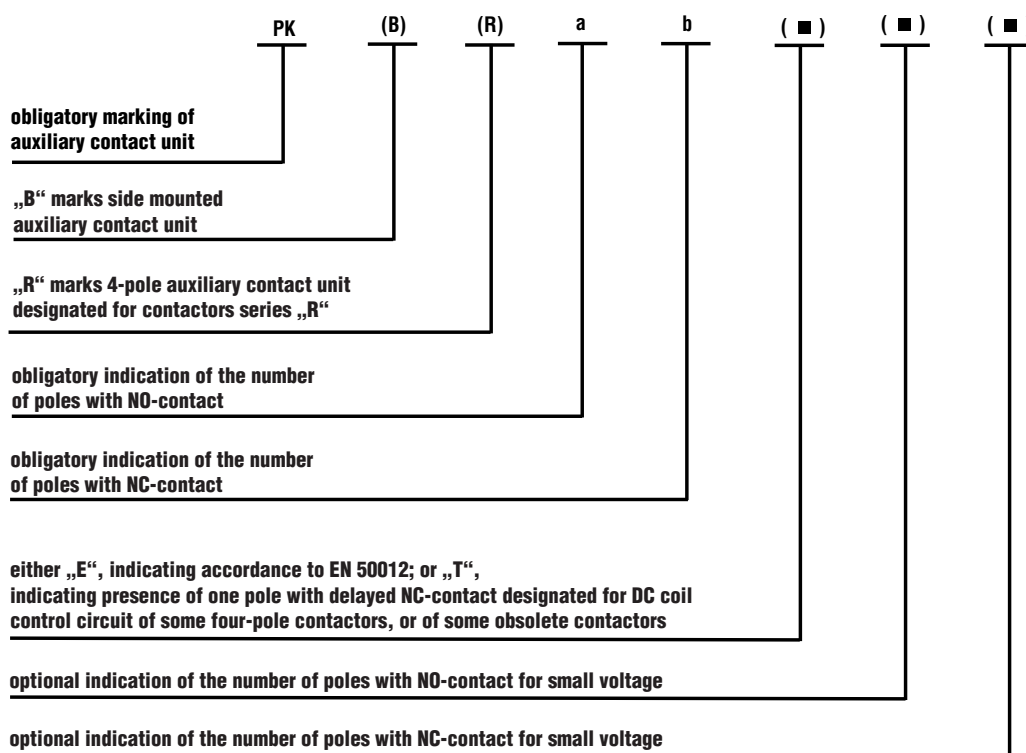
1.4 Accessories to the contactors series “C”

PK■E	2-pole auxiliary contact unit; versions PK20E, PK11E
PK■■■	4-pole auxiliary contact unit; versions PK40E, PK31E, PK22E, PK13E, PK04E, PK30T, PK21T, PK12T
PK1■■11	4-pole auxiliary contact unit with two poles for small voltage/currents; versions PK1111, PK10T11
PKB1■■	2-pole side mounted auxiliary contact unit; versions PKB11, PKB10T
BT	electronic timer
BC	interface unit, e. g. between PLC and contactor coil
B0	coil suppressor
BB	mechanical interlock for any pairs of contactors series “C” or “R”

1.4.1 Auxiliary Contact Units

The 4-pole and 2-pole auxiliary contact units type PK■■■□□ can be utilized by being mounted onto any contactor of the “C” series. The chart below shows the structure of the type markings.

Marking of auxiliary contact units



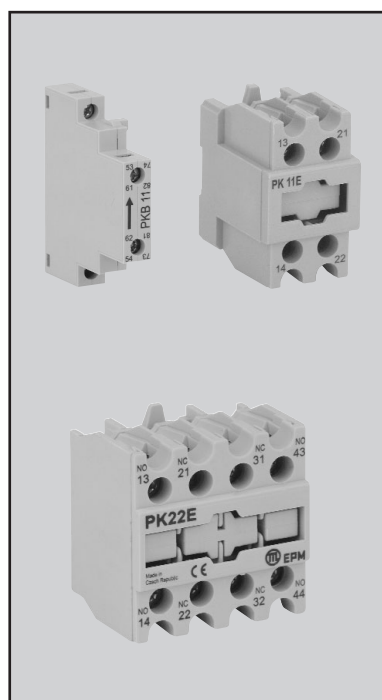
Mounting of the auxiliary contact units

Auxiliary contact units of the „PK“ series can easily be mounted to the lock on the front side of the contactor body by shifting the unit down until the latch on its body clicks. The unit can be removed by shifting it up, while the latch is released by lifting it to the front with a fingertip or flat tool – e. g. screwdriver.

Side mounted auxiliary contact units type PKB can be affixed to the left and/or right side of the contactor body in the following way: insert the resilient pin of the unit into the appropriate cavity on the contactor body, then shift the unit approximately 1 mm against the force of the resilient pin, while at the same time pressing the unit to the side surface of the contactor until the rigid pin of the unit locks. In addition, two self-cutting screws are to be used for fixing the PKB unit onto the contactors type C95.■, C115.■ or C150.■; each PKB's packing includes appropriate screws.

Removal of the PKB: carefully shift the unit approximately 1mm against the force of the resilient pin until the rigid pin of the unit unlocks. There must be a distance of 5mm between the unit and the adjoining device, in case you intend to remove the PKB in the future. For C95.■, C115.■ or C150.■ only – unbolt two self-cutting screws first.

Table-No. 9 – Rating



Type	PK■■■■		PKB1■■
	contacts a,b	contacts for small voltage	contacts a,b
Rated insulation voltage U_i [V]	690	690	690
Impulse withstand voltage U_{imp} [kV]	8	8	8
Conventional thermal current I_{th} [A]	12	0,5	12
Rated operation current I_e			
in the cat. AC-15 at 230 V [A]	4	–	4
in the cat. AC-15 at 400 V [A]	2	–	2
Mechanical durability [op. cycles]	10×10^6	5×10^6	5×10^6
Electrical durability in AC-15			
at 230 V, 4 A [op. cycles]	$0,8 \times 10^6$	–	$0,8 \times 10^6$
at 400 V, 2 A [op. cycles]	10^6	–	10^6
Electrical durability in DC-13 at 220 V			
$I_e = 1,35$ A $T_{0,95} = 30$ ms	$0,15 \times 10^6$	–	$0,15 \times 10^6$
$I_e = 1$ A $T_{0,95} = 60$ ms	$0,15 \times 10^6$	–	$0,15 \times 10^6$
$I_e = 0,6$ A $T_{0,95} = 120$ ms	$0,15 \times 10^6$	–	$0,15 \times 10^6$
Electrical durability in DC-14 at 220 V			
$I_e = 1,5$ A $T_{0,95} = 15$ ms	$0,15 \times 10^6$	–	$0,15 \times 10^6$
Mechanically linked contact device	yes	yes	yes
acc. to EN 60947-5-1(App. L)	yes	yes	yes
Mass [kg]	0,03/0,05	0,03/0,05	0,035

Protection against a dangerous accidental contact with live parts

Auxiliary contact units are designed to prevent accidental contact between live parts and the human body. Fingers are protected in the perpendicular direction, while larger body surfaces are protected in the parallel direction to the mounting panel. This means the contactors provide protection IP20/IP10 acc. to EN 60529 and VDE 0106-100

Standards

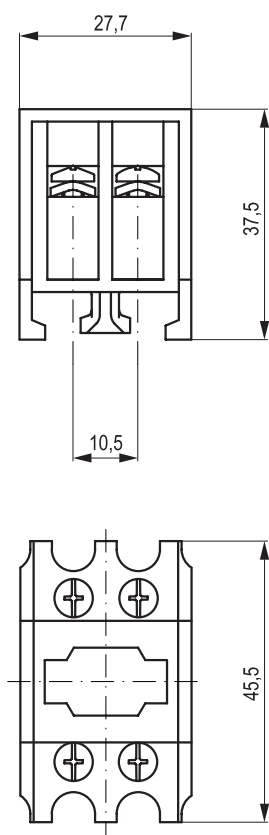
The units have been developed, tested and approved according to the EN 60947-5-1, EN 60947-1, IEC 60947-5-1 and IEC 60947-1.

1. Contactors

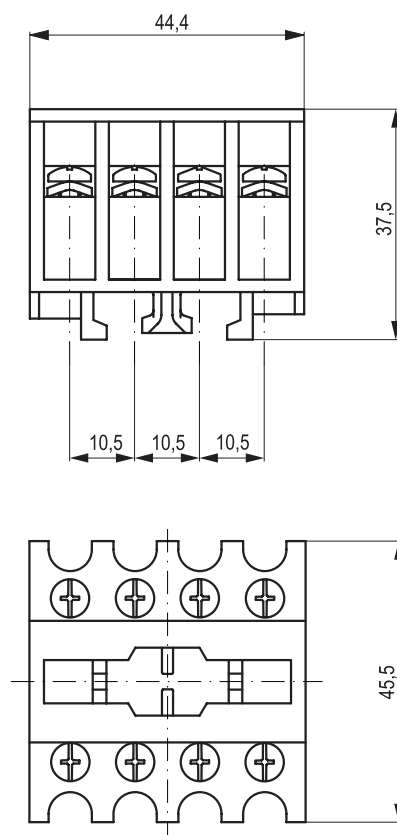
1.4 Accessories to the contactors series "C"

Outline drawing of the front mounted auxiliary contact units

2-pole versions

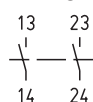


4-pole versions

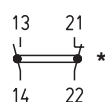


Marking and configuration of NO/NC contacts

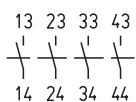
PK20E



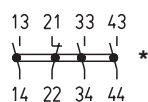
PK11E



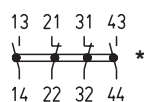
PK40E



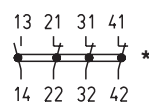
PK31E



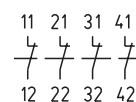
PK22E



PK13E



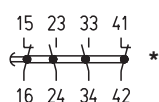
PK04E



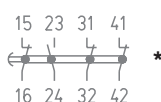
PK30T **



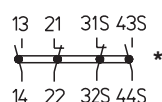
PK21T



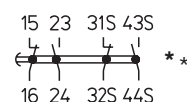
PK12T **



PK1111



PK10T11

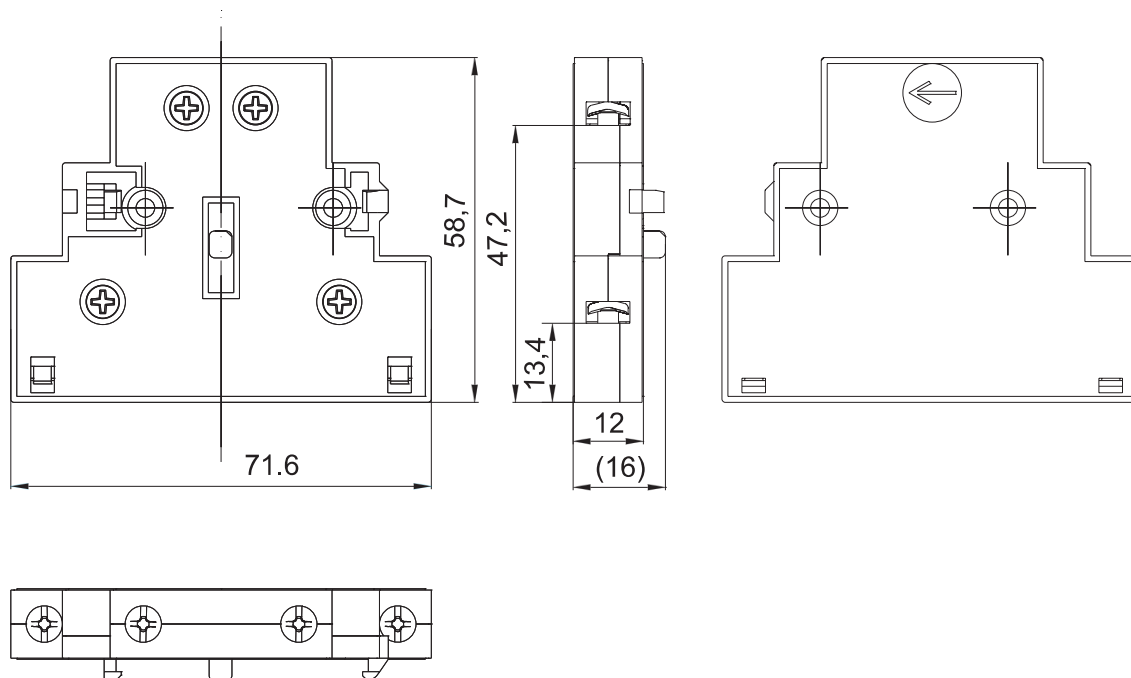


* Marking of a mechanically linked device acc. to the EN 60947-5-1

** Sell-out item

Outline drawing of the side mounted auxiliary contact units

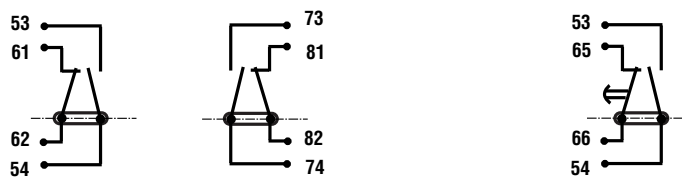
[PKB11, PKB10T] and PKBR11 (see 1.8)



Marking of the terminals

PKB11 on the left side/right side

PKB10T on the left side only



Example of order

Type	pcs
PK22E	10 pcs
PKB11	25 pcs

1.4.2 Electronic timer BT

Series "BT" electronic timers are to be used in the contactor control coil circuit according to the wiring diagrams provided below. These timers can be fixed in the same way as the "BC" or "BO" series. They are supplied in the following versions (refer also to the function diagrams):

BT-ZO timer switches on instantaneously with the start signal on the terminal B1 and releases t-time after the disappearance of the start signal – it is applicable for controlling of exhaust fans, lighting, etc.

BT-ZP timer energizes the contactor coil t-time after the appearance of input voltage and switches off instantaneously when the input voltage is off – it provides the function of consequent switching.

BT-I timer gives an output impulse and is designed mainly for utilization in star-delta starters.

All versions need a minimum power off time of 1.5 s after timing to restart correctly. The red LED signals timing functions.

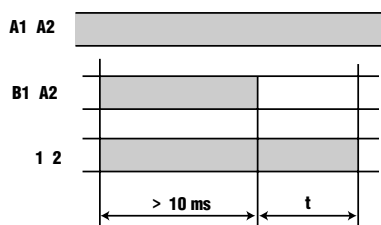
Table-No. 12 – Rating

	Rated insulation voltage U_i [V]	250
	Control voltages U_c [V]	24 V (DC or AC) 110..127 V (110 V DC or 110..127 V AC) 220..230 V AC
	Timing ranges [s]	0,3..3; 3..30; 30..300 *
	Electrical durability	10 x 10 ⁶ 5 x 10 ⁶
	in AC-15 at 230 V/0,2 A or 110 V/0,4 A or 24 V/2 A [op. cycles]	
	in DC-14 at 125 V/0,2 A; 24 V/1 A [op. cycles]	
	Repeatable accuracy of the setting	±5 % of the upper range limit

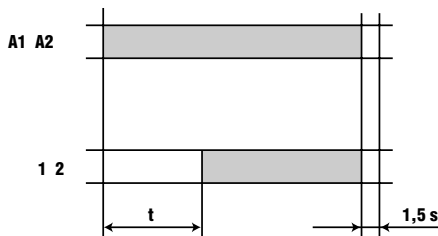
* longer time version on special request only and for an extra charge

Timing function

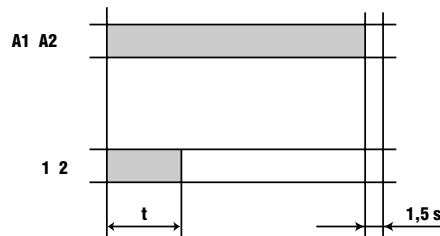
Delayed OFF BT-ZO



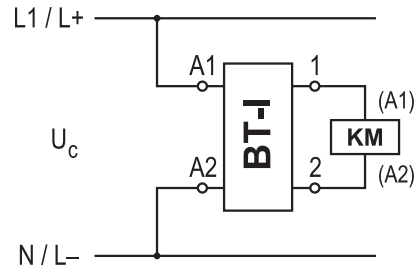
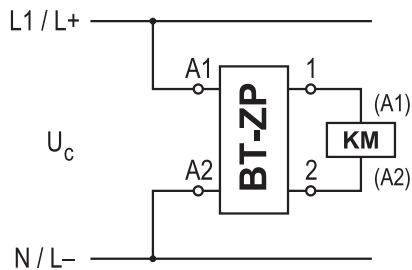
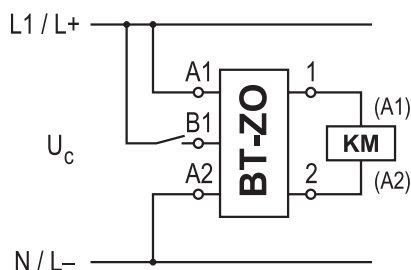
Delayed ON BT-ZP



Instant impulse BT-I



Wiring diagram



Example of order

Type	Control voltage	Timing range	No. of pcs
BT-ZO	220-230 V AC	3..30 s	3 pcs

1.4.3 Interface unit BC

Utilization

The BC interface unit enables the controlling of a contactor coil by the DC output of a PLC. The coil suppressor is inherent, the green LED indicates operation.

Standards

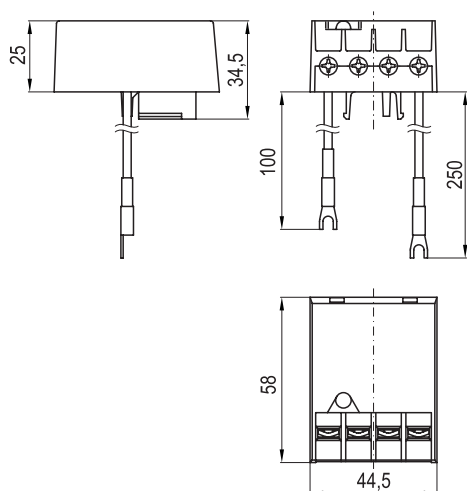
EN 61010, EN 60947-5-1, EN 60730-1

Table-No. 10a – Rating



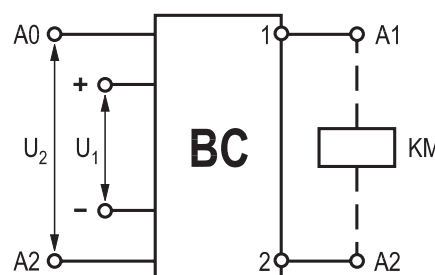
Type	BC05	BC06	BC12	BC24	BC48	BC60
Rated insulation voltage U_i [V]	300	300	300	300	300	300
Impulse withstand voltage U_{imp} [kV]	6	6	6	6	6	6
Nominal input control voltage U_1 [V]	5	6	12	24	48	60
Max. contactor coil control voltage AC/DC [V]	250	250	250	250	250	250
Max. input consumption power P_1 [W]	0,3	0,3	0,35	0,45	0,6	0,7
Rated operational current I_e (AC-15) at 230 V [A]	0,4	0,4	0,4	0,4	0,4	0,4
Electrical durability by controlling of contactors series C, max. 3.600 op. cycles per hour [op. cycles]	10^7	10^7	10^7	10^7	10^7	10^7
Dimensions [mm]	44,3 x 33,3 x 57,7					
Mass [kg]	0,04					
Degree of protection (output wires connected)	IP20/IP10					

Outline drawing



Wiring diagram

U_2 – (A0, A2) contactor coil control voltage
 U_1 – (+, –) input control voltage
 KM – (A1, A2) contactor coil



Mounting

The BC unit can be mounted to the upper side lock of the contactor body through the use of two resilient elements and one rigid fixing element.

Example of order

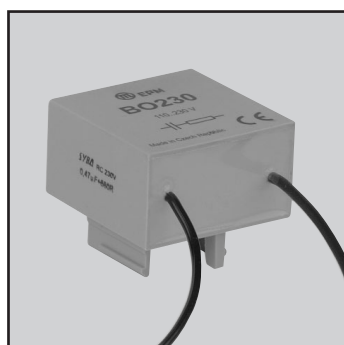
Type	pcs
BC05	15 pcs

1.4.4 Coil suppressor BO

The BO coil suppressor can be mounted to the upper side lock of the contactor body through the use of two resilient elements and one rigid fixing element.

BO is supplied in two versions:

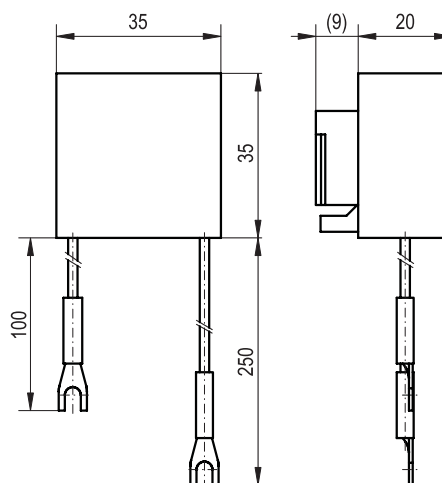
Table-No. 11



Type	Coil control voltage range [V]	C [nF]	R [Ohm]	Rated op. voltage of the capacitor	
				U _{max} [V _{rms}]	U _n [V DC]
BO230	110-230	470	680	250	1 000
BO60	24-60	3 300	82	160	250

The BO coil suppressors can be used on DC coils that are within the specified voltage ranges given above, with respect to the drawn out opening time – max +50 %.

Outline drawing of a BO coil suppressor



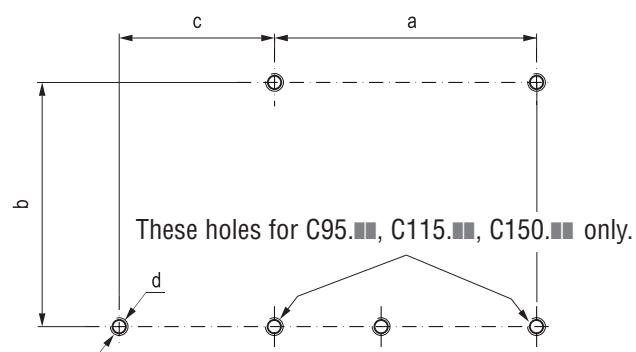
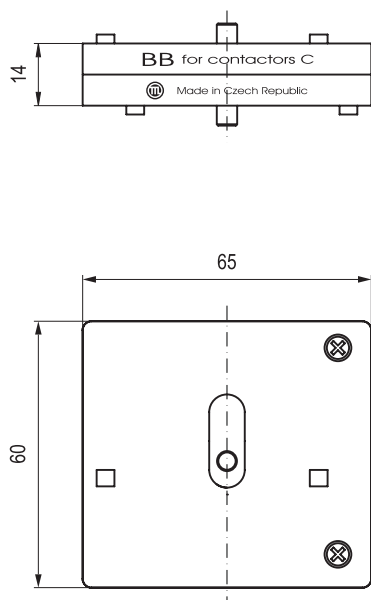
Example of order

Type	Ctrl voltage	pcs
BO 60	60 V	10 pcs
BO 230	230 V	3 pcs
BO 60	60 V (white)	390 pcs

1.4.5 Mechanical interlock BB

BB locks any two contactors of the “C” series mechanically. The unit must be closed without clearances between the two contactors. If mounted on a rail, clamps must secure the contactor’s position. Otherwise, see the drawing of fixing holes.

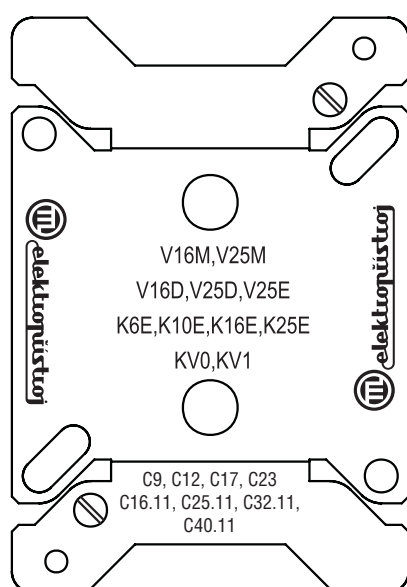
Outline drawing



Contactor type	a	b	c	d
C9.11, C12.11, C17.11, C23.11	59	50-60	35	2 x M4
C16.11, C20.11, C25.11, C32.11, C40.11	70	50-60; 75	45	2 x M4
C50.11, C65.11, C80.11	84	75; 90	60	2 x M5
C95.11, C115.11, C150.11	99	100	45	3 x M5

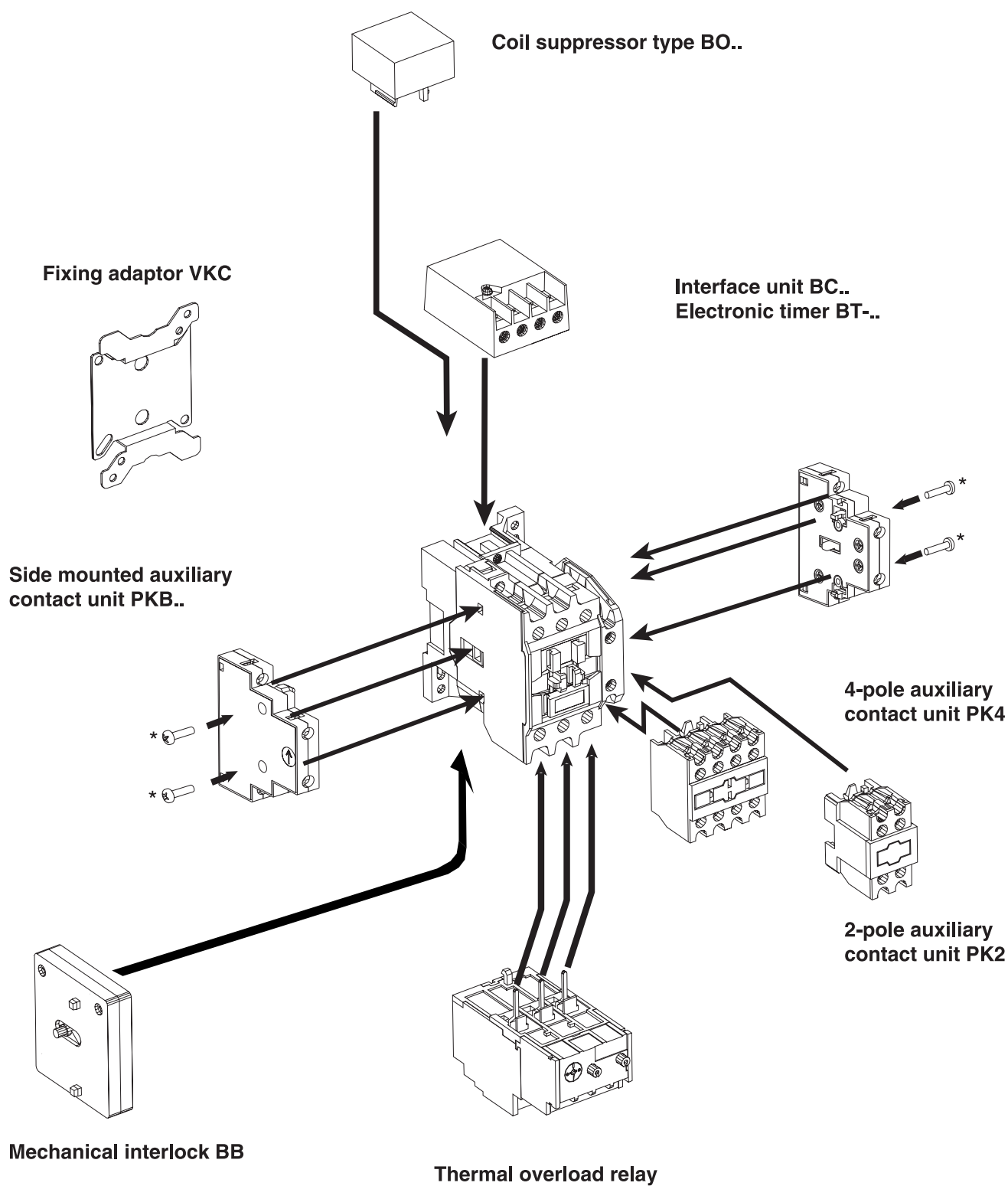
1.4.6 Fixing adaptor VKC

The adaptor helps by quickly replacing obsolete contactors (V16M, V25M, V16D, V25D, K6E, K10E, V25E) with series “C” contactors – up to C40.11.



Example of order

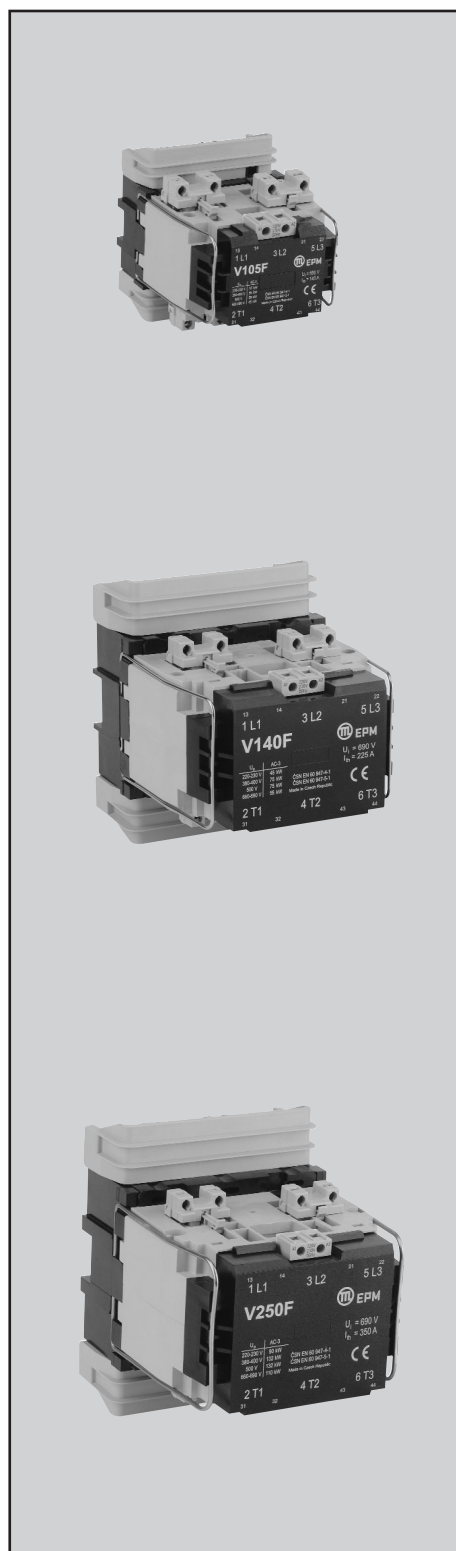
Type	pcs
Adaptor VKC	100 pcs



* For C95.■, C115.■ or C150.■ only

1.5 Contactors series "V..F"

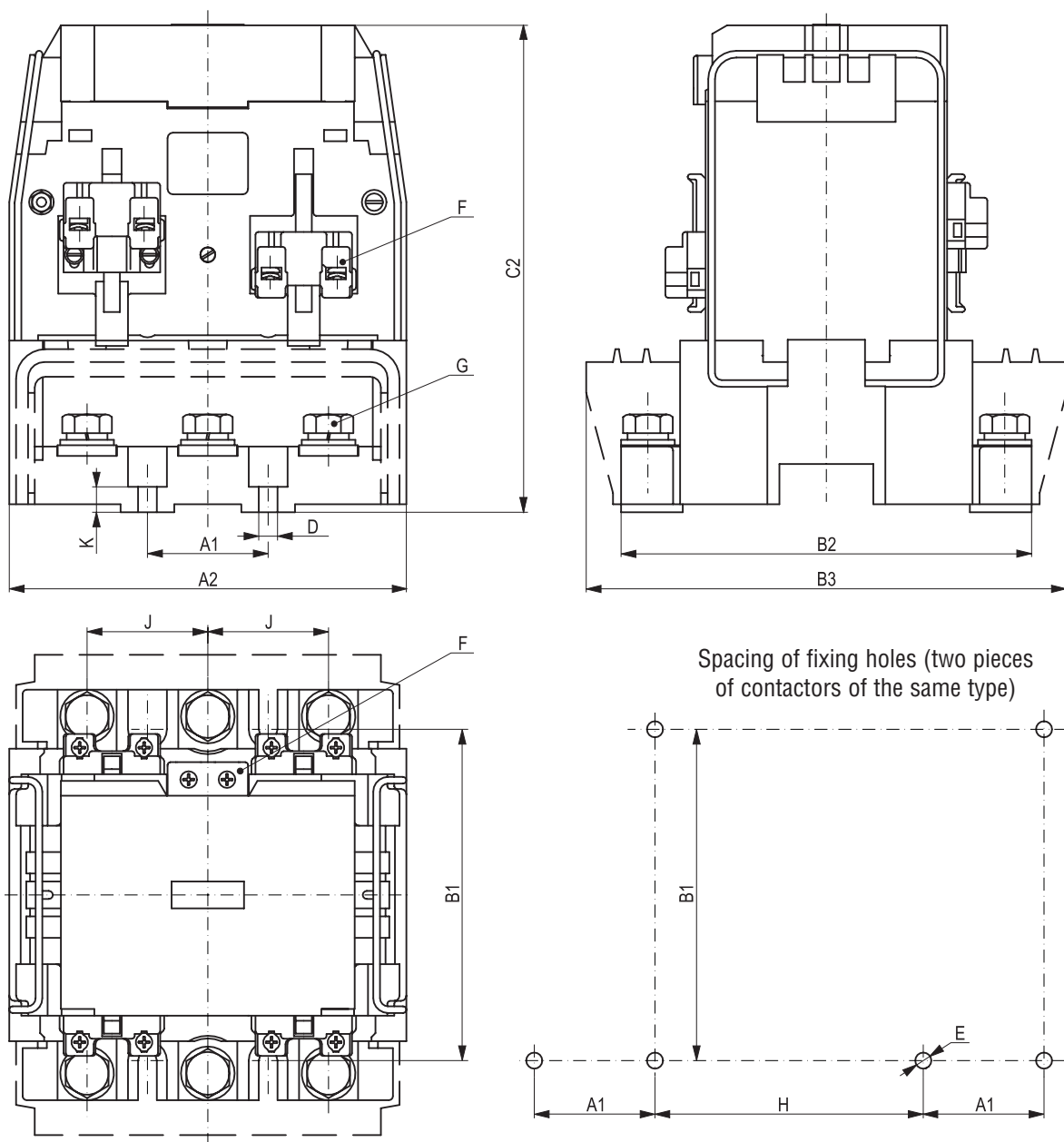
1.5.1 Table-No. 15 – rating



Type
Main poles Rated insulation voltage U_i [V] Impulse withstand voltage U_{imp} [kV] Conventional free air thermal current I_{th} [A] Rated operational current I_e (AC-1) at 400 V [A] Rated operational current I_e (AC-3) at 400 V [A]
Max. output power of controlled motor in AC-3 (AC-4) at 220-230 V [kW] at 380-400 V [kW] at 500 V [kW] at 660-690 V [kW] Max. number of on-load op. cycles per hour in AC-1 Max. number of on-load op. cycles per hour in AC-3, AC-4
Electrical durability in AC-1 at 380-400 V [op. cycles]
Electrical durability in AC-3 at 380-400 V [op. cycles]
Recommended fuse char. aM [A] Type of co-ordination with SCPD
Mechanical durability – AC controlled [op. cycles] Mechanical durability – DC controlled [op. cycles]
Auxiliary contacts Rated insulation voltage U_i [V] Impulse withstand voltage U_{imp} [kV] Conventional free air thermal current I_{th} [A] Rated operational current I_e (AC-15) at 230 V [A] Rated operational current I_e (AC-15) at 400 V [A] Electrical durability in AC-15 at 220-230 V, 4 A [op. cycles] Electrical durability in AC-15 at 380-400 V, 2 A [op. cycles]
Control circuit Range of AC coil control voltages at 50 Hz [V] Range of AC coil control voltages at 60 Hz [V] Pull-in input power of AC control coil, ± 10 % [VA] Hold-in input power of AC control coil, ± 10 % [VA/W] Range of DC "D" coil control voltages [V] Pull-in input power of DC "D" coil [W] Hold-in input power of DC "D" coil [W] Range of DC coil control voltages [V] (series resistor) Pull-in input power of DC control coil, ± 10 % [W] (series resistor) Hold-in input power of DC control coil, ± 15 % [W] (series resistor)
Main dimensions $W \times H \times D$ [mm] Mass [kg] Degree of protection acc. to VDE 0106, part 100

V85F	V105F	V140F	V170F	V205F	V250F
690 8 140 105 85 (30)	690 8 140 140 105 (38)	690 8 225 160 140 (44)	690 8 225 200 170 (50)	690 8 350 300 205 (60)	690 8 350 350 250 (72)
25 45 (15) 45 (15) 37 300 600	30 55 (18,5) 55 (18,5) 45 300 600	45 75 (22) 75 (25) 55 300 600	55 90 (25) 90 (30) 75 300 600	65 110 (30) 110 (37) 90 300 600	75 132 (37) 132 (45) 110 300 600
0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶
0,9x10 ⁶	0,7x10 ⁶	0,65x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶
100 2	100 2	160 2	160 2	250 2	250 2
10x10 ⁶ 5x10 ⁶	10x10 ⁶ 5x10 ⁶	10x10 ⁶ 5x10 ⁶	10x10 ⁶ 5x10 ⁶	5x10 ⁶ 10 ⁶	5x10 ⁶ 10 ⁶
690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶	690 8 12 4 2 0,8x10 ⁶ 10 ⁶
24..690 24..660 208 37/6,9	24..690 24..660 208 37/6,9	42..690 42..660 365 61/14,5	42..690 42..660 365 61/14,5	110..690 110..660 700 75/23	110..690 110..660 700 75/23
		24..220 56..70 3,7..5,1	24..220 56..70 3,7..5,1	24..220 130..150 4,2..7,2	24..220 130..150 4,2..7,2
24..250 72 12	24..250 72 12	24..250 110 12	24..250 110 12	24..250 117 9	24..250 117 9
108x124x140 1,4 IP20/IP10	108x124x140 1,4 IP20/IP10	148x179x178,5 3,7 IP20/IP10	148x179x178,5 3,7 IP20/IP10	154x204x191,5 5,7 IP20/IP10	154x204x191,5 5,7 IP20/IP10

1.5.2 Outline drawing of contactors series „V..F“



Dimension	V85F/V105F	V140F/V170F	V205F/V250F
A1	32,5	45	50
B1	87,5	125	150
A2	108	148	154
B2	100	153	176
B3	124	179	204
C2	140	178,5	191,5
D	6	7	7
E	3 x M5	3 x M6	3 x M6
F	10 x M3,5	10 x M3,5	10 x M3,5
G	6 x M6	6 x M10	6 x M10
H	≥ 77,5	≥ 105	≥ 106
J	32	45	50
K	4	9,5	9,5

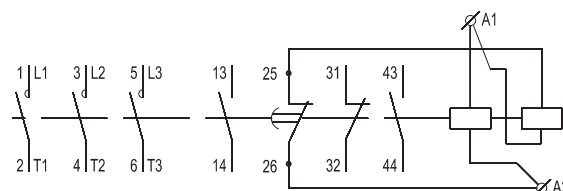
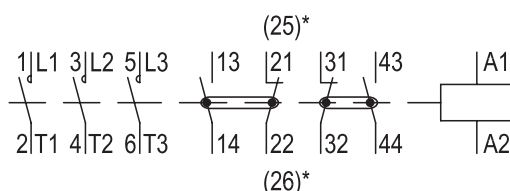
1.5.3 Marking of terminals, configuration of contacts and conductor cross-sections

Marking of terminals – main circuit

auxiliary contacts

coil

Circuit diagram of DC „D“ controlled contactors series V..F



*25 *26 is marking of the time-delayed auxiliary NC-contact, which is inherent in DC controlled contactors series V..F

Table-No. 16

Contactor type	Main poles				Auxiliary contacts and coil			
	Terminal width [mm]	Terminal type	Screw size	Conductor cross-section [mm ²]	Terminal type	Screw size	Conductor cross-section [mm ²]	
							Rigid	Flexible
V85F, V105F	15	Lug terminal	M6	16..50	screw-type	M3,5	1..2,5	0,75..1,5
V140F, V170F	21,5	Lug terminal	M10	35..150	screw-type	M3,5	1..2,5	0,75..1,5
V205F, V250F	25	Lug terminal	M10	70..150	screw-type	M3,5	1..2,5	0,75..1,5

Screw type terminals of coils and auxiliary contacts facilitate the connection of either a single conductor, or two of the same conductors resp. by cross-sections differing by one degree.

All screws M3.5 have the combined slot [PH2 + simple].

Flexible conductors must not be compacted by brazing!

1.5.4 Spare parts

Table-No. 17 – Spare coils to the contactors series „V..F“

Coils are common for the following specified pairs of contactor types:

Coil		V85F, V105F	V140F, V170F	V205F, V250F
Control voltage [V]	Frequency [Hz]			
24	50			
48	50			
110	50			
127	50			
220-230	50			
380-400	50			
110	60			
220	60			
24	DC			
48	DC			
220	DC			

Coils for other various control voltages within the ranges specified in the rating table can be supplied on a special request and for a supplementary charge.

Sets of spare contacts for main circuits

The set consists of 6 main fix contact pieces, 3 main contact bridge pieces, 3 main contact spring pieces, and 3 insulating insert pieces.

Attention!

Working surfaces of the contacts are exposed to very high temperatures, which locally exceed the melting point of the contact material. Because of this, "run in" contacts are not to be held for worn off. It is not allowed to shape the working surface in any way, e. g. to file, scrape, etc.

If the contacts have been eroded and need to be changed, it is necessary to test the insulation of the contactor. In this case, a dielectric test is to be applied to the contactor according the Art.-No 8.3.3.4.2.a)1) of EN 60947-4-1.

1.5.5 Maintenance

Instructions for replacing the contactor coil on the "V..F" series

0. It is not necessary to remove the contactor from the mounting panel.
1. Disconnect wires from the coil terminals.
2. Loosen two shaped springs by means of a screwdriver and remove the upper part of contactor – the side label shall be broken.
3. By means of a screwdriver, push and loosen four black cover resilient pins through the holes in the contactor body. Remove the cover.
4. Pull out the magnet core with rubber absorbers; do not forget its original positioning.
5. Replace the coil and push the magnet core into the contactor body, being sure to position it correctly. Otherwise, the contactor may seal imperfectly and whirr.
6. Put the cover back in its place and affix the contactor body with two shaped springs. Press the rods of the auxiliary contacts and check to make sure the contact carrier moves properly.
7. Reconnect coil wires

1.5.6 Overload and short circuit protection

Overload protection sets consist of the thermal overload relay T17 I/1 A (or T17 II/1 A) and 3 pcs of protective series "M" transformers, and are designed to provide overload protection when used with series "V..F" contactors. Fuses, circuit breakers, or another SCPD (short-circuit protective device) must be used.

1.5.7 Contactors type SF V250F

Utilization

These contactors are designed for conducting middle-frequency currents up to 10 000 Hz. They are allowed to neither make nor break such currents.

Description

Contactors carry four auxiliary contacts acc. to EN 60947-5-1, 2NO/2NC or optionally 1NO/3NC. The main circuit poles consist of non-magnetic materials. The ratings for the auxiliary and control circuits are the same as the ratings for V250F.

Marking

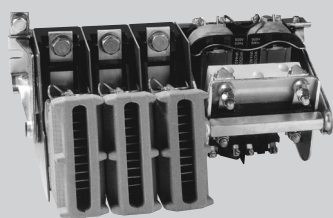
Contactors are marked by "SF" on the upper cover, near the type marking "V250F".

1.5.8 Example of order

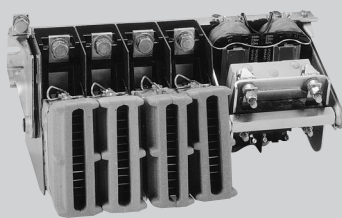
Type	Coil control voltage	No. of pcs
V85F	220-230 V/50 Hz	15 pcs
V205F	110 V DC	10 pcs
SF V250F	220-230 V/50 Hz 1NO/3NC	3 pcs

1.6 Contactors for heavy duty

1.6.1 Table-No. 18 – rating



VH250DO



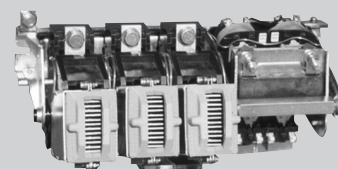
VH250DO.4
VH440.4

Type	
Main poles Rated insulation voltage U_i [V] Impulse withstand voltage U_{imp} [kV] Conventional free air thermal current I_{th} [A] Rated operational current I_e (AC-1) at 400 V [A] Rated operational current I_e (AC-3) at 400 V [A] Rated operational current I_e (AC-4) at 400 V, 500 V, 660-690 V [A]	
Maximum load in AC-1 at 380-400 V [kW] at 500 V [kW] at 660-690 V [kW] Electrical durability in AC-1 [op. cycles] Max. number of on-load op. cycles per hour in AC-1	
Max. output power of controlled motor in AC-3 (AC-4) at 380-400 V [kW] at 500 V [kW] at 660 V [kW] at 690 V [kW] Electrical durability in AC-4 [op. cycles] Max. number of on-load op. cycles per hour in AC-3 Max. number of on-load op. cycles per hour in AC-4	
Recommended fuse char. aM at 500 V [A] Short-circuit protection by the circuit breaker Type of co-ordination with SCPD acc. to EN 60 947-4-1 Type of short circuit protection acc. to ČSN 35 4150 App. C	
Mechanical durability – AC controlled [op. cycles]	
Auxiliary contacts Rated insulation voltage U_i [V] Impulse withstand voltage U_{imp} [kV] Conventional free air thermal current I_{th} [A] Rated operational current I_e (AC-15) at 230 V [A] Rated operational current I_e (AC-15) at 400 V [A] Electrical durability in AC-15 at 220-230 V, 4 A [op. cycles] Electrical durability in AC-15 at 380-400 V, 2 A [op. cycles]	
Control circuit Range of AC coil control voltages at 50 Hz [V] Range of AC coil control voltages at 60 Hz [V] Pull-in input power of AC control coil, $\pm 15\%$ [VA] Hold-in input power of AC control coil, $\pm 15\%$ [VA/W] Range of DC "D" coil control voltages [V] Pull-in input power of DC „D“ coil [W] Hold-in input power of DC „D“ coil [W]	
Range of DC coil control voltages [V] (series rezistor) Pull-in input power of DC control coil, $\pm 15\%$ [W] (series rezistor) Hold-in input power of DC control coil, $\pm 15\%$ [W] (series rezistor)	
Main dimensions W × H × D [mm]	three-pole version four-pole version
Mass [kg]	three-pole version four-pole version
Degree of protection	

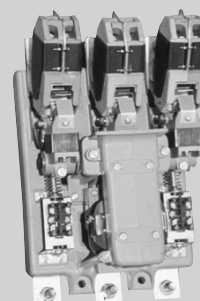
1. Contactors

1.6 Contactors for heavy duty

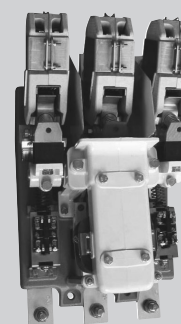
VH250DO VH250DO.4	VH440 VH440.4	VH400	V53D	VD630	VD1000
690 8 450 400 300 108, 108, 82	690 8 520 520 500 140, 129, 98	690 8 450 450 400 108, 108, 92	690 8 740 740 630 250, 225, 170	1 000 8 1 000 1 000 630 250, 225, 170	1 000 8 1 000 1 000 1 000 300, 250, 200
250 315 400 0,1x10 ⁶ 0,05x10 ⁶ 120	335 400 560 0,1x10 ⁶ 0,05x10 ⁶ 120	285 355 500 0,1x10 ⁶ 0,05x10 ⁶ 120	515 640 885 0,035x10 ⁶ 120	515 640 885 0,035x10 ⁶ 120	630 800 1 100 0,035x10 ⁶ 120
160 (55) 200 (75) 200 (75) 200 (75) 200 000 600 600	280 (75) 315 (90) 250 (90) 250 (90) 200 000 600 600	200 (55) 250 (75) 250 (75) 200 000 600 600	315 (132) 400 (160) 500 (160) 200 000 600 600	315 (132) 400 (160) 500 (160) 500 (160) 200 000 600 600	560 (160) 630 630 630 100 000 300 300
500 — 2	630 — 2	400 — C	630 — C	630 BL 1600 2	— BL 1600 2
5x10 ⁶	5x10 ⁶	3x10 ⁶	10 ⁶	10 ⁶	10 ⁶
690 8 20 4 2 0,8x10 ⁶ 10 ⁶	690 8 20 4 2 0,8x10 ⁶ 10 ⁶	500 8 20 4 2 0,8x10 ⁶ 10 ⁶	500 8 20 4 2 0,8x10 ⁶ 10 ⁶	690 8 20 4 2 0,8x10 ⁶ 10 ⁶	690 8 20 4 2 0,8x10 ⁶ 10 ⁶
110..690 110..660 1 430 97/31 24..220 350..450 9..10	110..690 110..660 1 430 97/31 24..220 350..450 9..10	110..500 110..400 1 230 80/28,5 24..220 350..450 9..10	110..500 110..400 3 410 450/113	110..500 110..400 3 410 350/192	110..500 110..400 3 410 350/192
48..220 530 13	48..220 530 13	48..220 — —	48..220 300 55	24..220 300..375 55..65	24..220 300..375 55..65
340x180x245 397x180x245 13,1 14,9 IP00	340x180x245 397x180x245 13,1 14,9 IP00	397x180x270 15,8 IP00	300x522x335 38,4 IP00	300x522x335 41 IP00	300x522x335 41,3 IP00



VH400



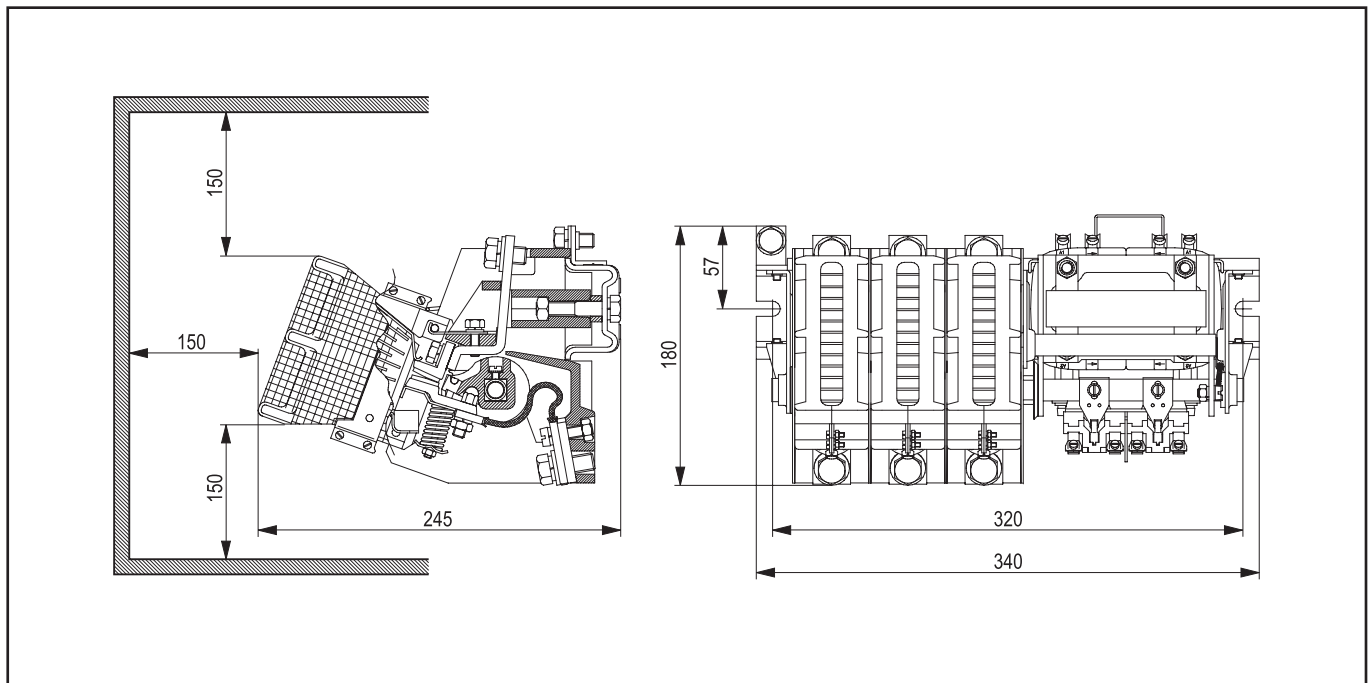
V53D, VD630



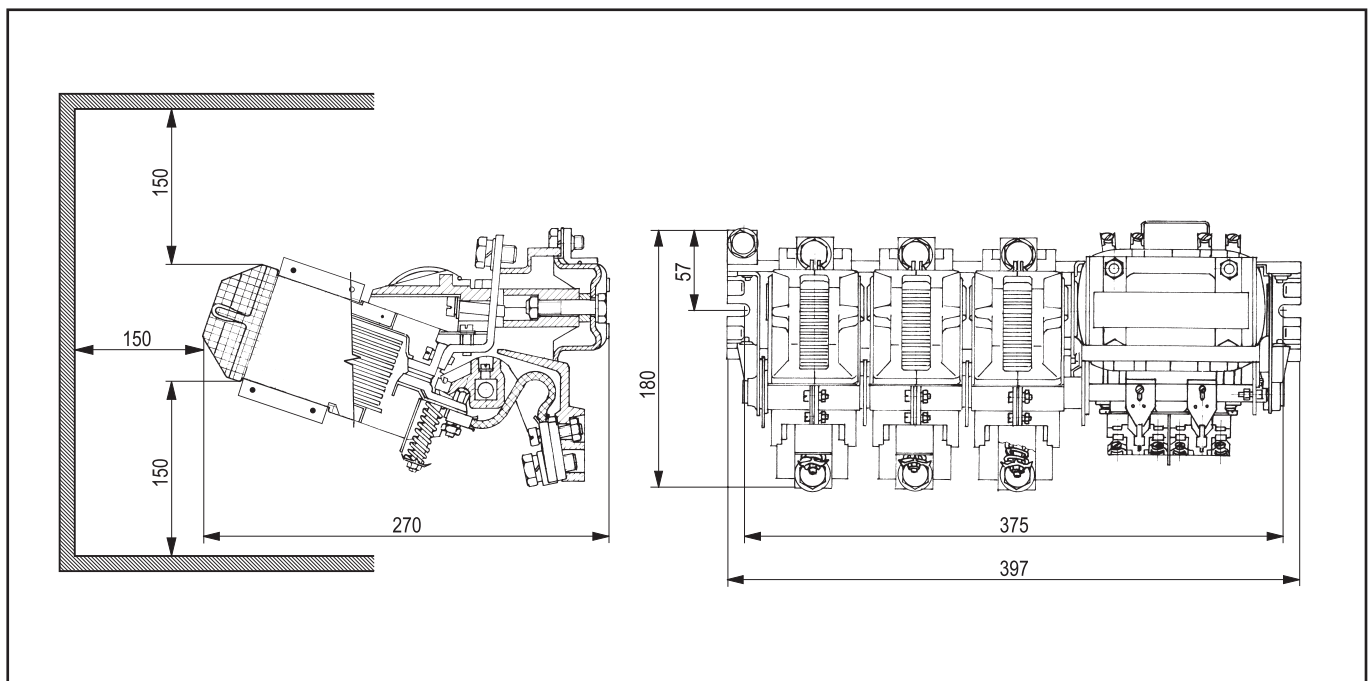
VD1000

1.6.2 Outline drawings

Outline drawing of contactor type VH250DO, VH440

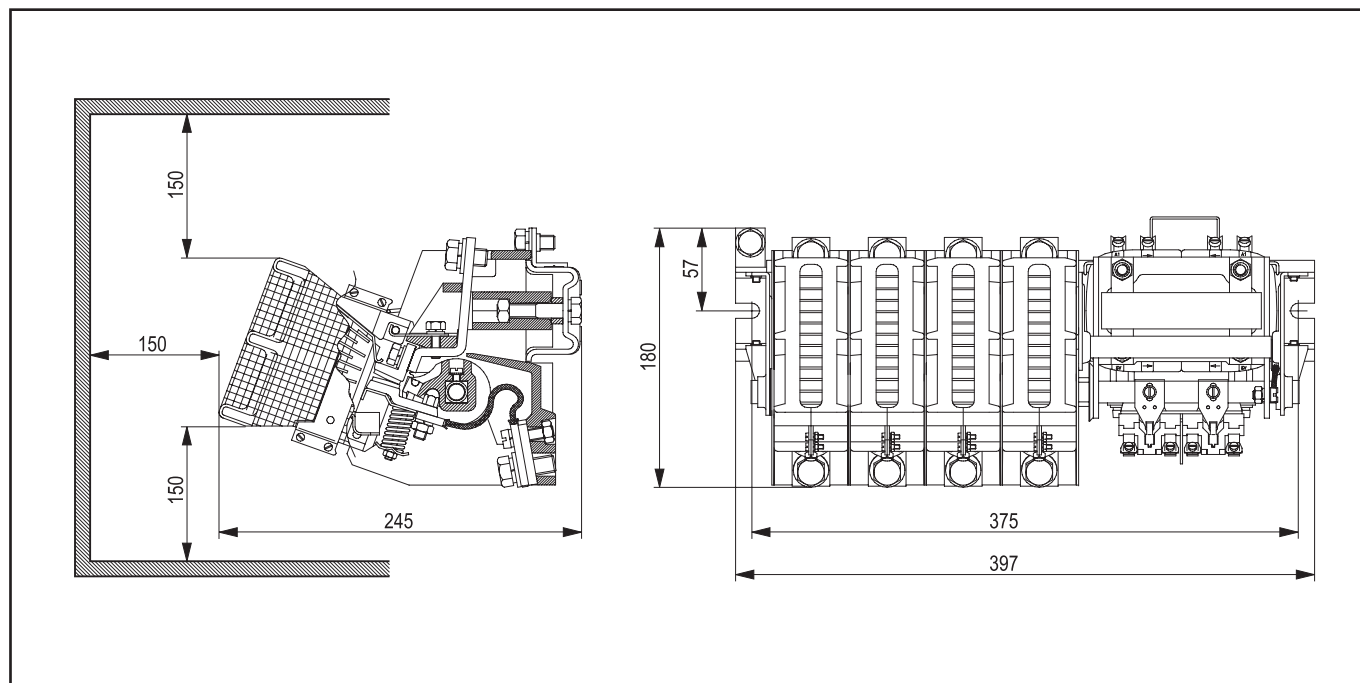


Outline drawing of contactor type VH400

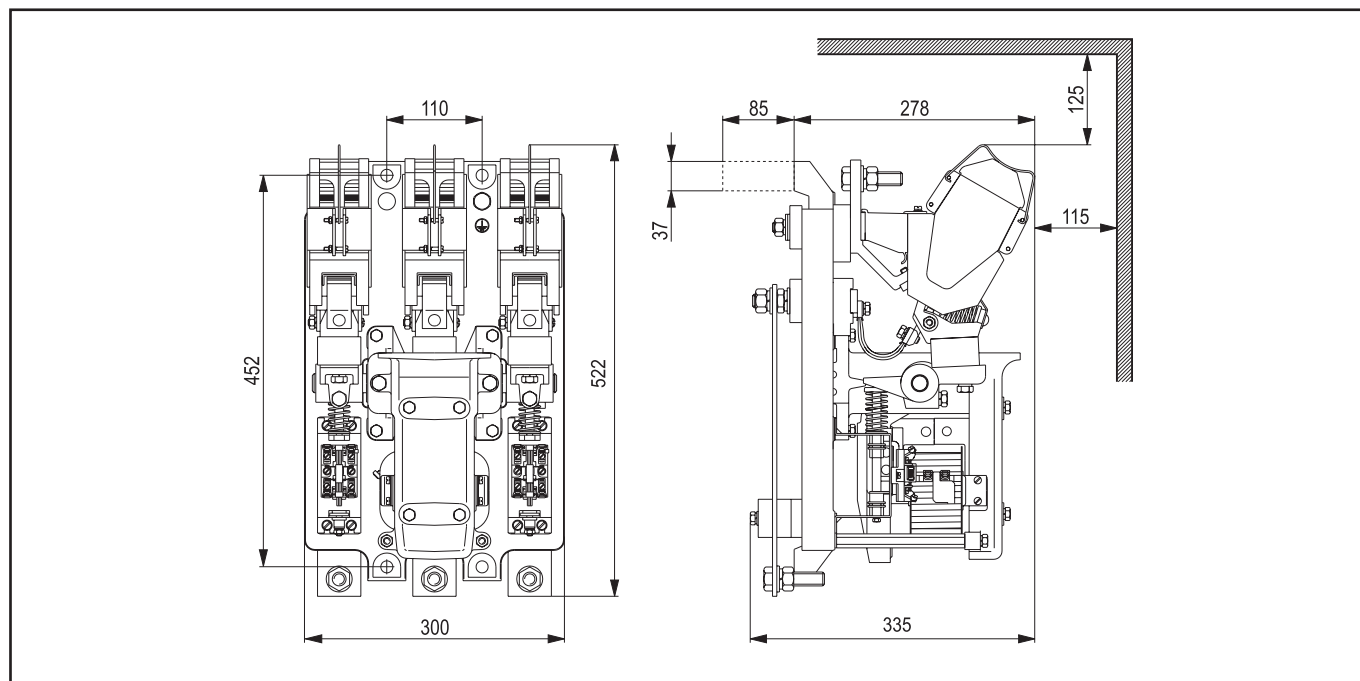


1.6.2 Outline drawings

Outline drawing of contactor type VH250DO.4, VH440.4



Outline drawing of contactor type V53D, VD630, VD1000



Mounting position

Contactors must be mounted vertically on the panel or rail so that the markings are legible in an ordinary horizontal position. The maximum allowed deviation from the vertical position is 5°. Panels or rails must be strong enough so that they do not transfer vibrations and/or shocks from extraneous sources to the mounted contactors.

Fixing screws

VH250D/VH250DO

VH440

2 pcs of screws M10, spacing of fixing holes 320 mm

VH400

VH250DO.4/VH440.4

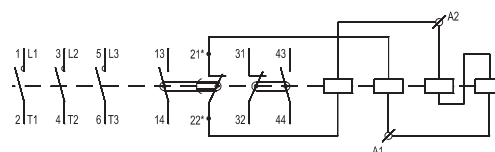
2 pcs of screws M10, spacing of fixing holes 375 mm

V53D, VD630, VD1000

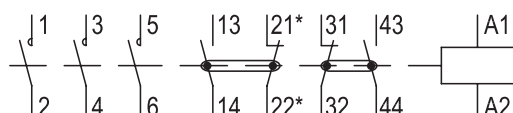
4 pcs of screws M12, spacing of fixing holes 110 × 452 mm, distance tubes 85 mm long

1.6.3 Terminals – marking, conductor cross-sections

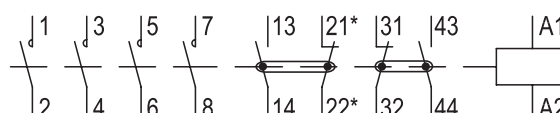
Marking of terminals of main circuit, auxiliary contacts and DC „D“ coil of contactors series VH



Marking of terminals of main circuit, auxiliary contacts and coil of contactors types VH250D, VH250DO, VH400, VH440, V53D, VD630 and VD1000

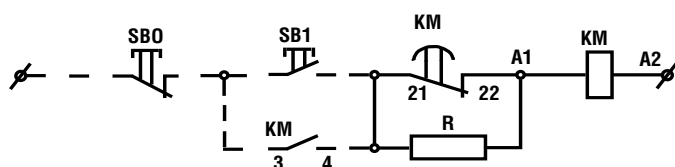


Marking of terminals of main circuit, auxiliary contacts and coil of contactors types VH250DO.4 and VH440.4

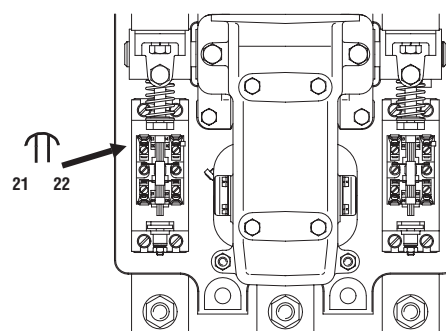


* 21 • – 22 • is marking of the time-delayed auxiliary NC-contact, which is inherent in DC controlled contactors

Wiring diagram of a DC controlled contactor



V53D, VD630, VD1000



Series resistor R is fixed to the contactor body.

Table-No. 19

Contactor type	Main poles				Auxiliary contacts and coil			
	Terminal width [mm]	Terminal type	Screw size	Conductor cross-section [mm²]	Terminal type	Screw size	Conductor cross-section [mm²]	
							Rigid	Flexible
VH250DO	25	lug terminal	M12	120..300	screw-type	M4	1..2,5	0,75..1,5
VH400, VH440	25	lug terminal	M12	120..300	screw-type	M4	1..2,5	0,75..1,5
VH250DO.4	25	lug terminal	M12	120..300	screw-type	M4	1..2,5	0,75..1,5
VH440.4	25	lug terminal	M12	120..300	screw-type	M4	1..2,5	0,75..1,5
V53D, VD630	50	lug terminal	M16	240..300	screw-type	M4	1..2,5	0,75..1,5
VD1000	50	lug terminal	M16	2 bars 40x5	screw-type	M4	1..2,5	0,75..1,5
				240..300				

Screw type terminals of coils and auxiliary contacts facilitate the connection of either a single conductor, or two of the same conductors resp. by cross-sections differing by one degree. Flexible conductors must not be compacted by brazing!

1.6.4 Spare parts

Spare coils to the contactors for heavy duty

Coils for other various control voltages within the ranges specified in the rating table can be supplied on a special request and for a supplementary charge.

Table-No. 20

Coil		VH250D0, VH250D0.4, VH440, VH440.4 (VH250D)	
Control voltage [V]	Frequency [Hz]	N	G
220-230	50		
380-400	50		
110	60		
220	60		

Coils for other control voltages can be supplied on special request only, see the range in Table-No. 15.

Table-No. 21

Coil		VH400*	
Control voltage [V]	Frequency [Hz]	N	G
220-230	50		
380-400	50		
110	60		
220	60		

* Run-out type, VH440 recommended

Table-No. 22

Coil		V53D, VD630, VD1000	
Control voltage [V]	Frequency [Hz]	N	G
220	50		
230	50		
380	50		
400	50		
110	60		
220	60		

Further spare parts to the contactors for heavy duty

Table-No. 23

	VH250DO/VH250DO.4		
	No. of pcs needed	N	G
main fix contact	3/4		
main moving contact	3/4		
main contact spring	3/4		
arcing horn	3/4		
arc chute	3/4		
conducting bar No. 2	1/1		
conducting bar No. 4	1/1		
conducting bar No. 6	1/1		
conducting bar No. 8	0/1		
aux. contact unit 1NO/1NC ver I	1/1		
aux. contact unit 1NO/1NC ver. II	1/1		
carrier	3/4		
driver of aux. contact unit	4/4		

Table-No. 24

	VH440/VH440.4		
	No. of pcs needed	N	G
main fix contact	3/4		
main moving contact	3/4		
main contact spring	3/4		
arcing horn	3/4		
arc chute	3/4		
conducting bar No. 2	1/1		
conducting bar No. 4	1/1		
conducting bar No. 6	1/1		
conducting bar No. 8	0/1		
aux. contact unit 1NO/1NC ver I	1/1		
aux. contact unit 1NO/1NC ver. II	1/1		
carrier	3/4		
driver of aux. contact unit	4/4		

Table-No. 25

	VH400* (VH250D)		
	No. of pcs needed	N	G
main fix contact	3		
main moving contact	3		
main contact spring	3		
arcing horn	3		
arc chute	3		
conducting bar No. 2	1		
conducting bar No. 4	1		
conducting bar No. 6	1		
aux. contact unit 1NO/1NC ver. I	1		
aux. contact unit 1NO/1NC ver. II	1		
carrier	3		
driver of aux. contact unit	4		

*Run-out type, VH440 recommended

Further spare parts to the contactors for heavy duty

Table-No. 26

	V53D, VD630		
	No. of pcs needed	N	G
main fix contact	3		
main moving contact	3		
main contact spring	3		
conducting bar	6		
aux. contact unit 1NO/1NC ver. I	1		
aux. contact unit 1NO/1NC ver. II	1		
arc chute	3		
rubber absorber	4		

Table-No. 27

	VD1000		
	No. of pcs needed	N	G
main fix contact	3		
main moving contact	3		
main contact spring	3		
conducting bar	6		
aux. contact unit 1NO/1NC ver. I	1		
aux. contact unit 1NO/1NC ver. II	1		
arc chute	3		
rubber absorber	4		

Marking of auxiliary contacts

Auxiliary contact unit 1NO/1NC version I – left: 13-14 NO, 21-22 NC

Auxiliary contact unit 1NO/1NC version II – right: 43-44 NO, 31-32 NC

The reverse marking is valid by the contactor type V53D because of the reverse direction of moving in comparison to contactors series VH.

Attention!

Working surfaces of the contacts are exposed to very high temperatures, which locally exceed the melting point of the contact material. Because of this, „run in“ contacts are not to be held or worn off. It is not allowed to shape the working surface in any way, e. g. to file, scrape, etc.

If the contacts have been eroded and need to be changed, it is necessary to test the insulation of the contactor. In this case, a dielectric test is to be applied to the contactor according the Art.-No 8.3.3.4.2.a)1) of EN 60947-4-1.

1.6.5 Maintenance of contactors series VH

Instructions for replacing of the series „VH“ contactor coil

0. It is not necessary to remove the contactor from the mounting panel.
1. Disconnect wires from the coil terminals.
2. Remove all arc chutes – see the instructions below.
3. Loosen all main moving contacts by pressing down the main contact springs and swivelling its square steel pad through 90 degrees. While loosening, hold the rotary part of the contactor in the open position.
4. Loosen the two M4 screws. Then disengage and swivel the drivers of the auxiliary contacts through 90 degrees. Fix them into that position temporarily by tightening the two M4 screws.
5. Unbolt the two M6 screws. Then remove the stop bar and swing the rotary part of the contactor entirely out.
6. Loosen and remove the two feathers fixing the coils and replace them.
7. Fix the new coils with two feathers. Close the contactor and reposition the stop bar so that the rubber damper part of the magnet armature bears on the flat surface of stop bar. Tighten the two M6 screws.
8. Place the drivers into their original position so that the rods of the auxiliary contact units move clearly while swinging the rotary part of the contactor. Fix the drivers into their correct position by tightening the M4 screws.
9. Reassemble the moving contacts and put on the arc chutes.
10. Re-connect coil wires

Instructions for the removal of contactor arc chutes on series VH contactors, except for VH400

1. Press down the lug of the shaped spring and swivel it through 90 degrees clockwise.
 2. Shift the arc chute up and remove it.
- Re-assembly is done by reversing these instructions.

Instruction for removal of the VH400 type contactor arc chutes.

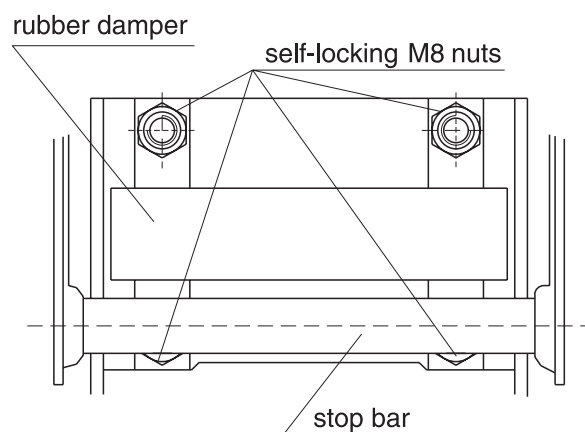
1. Pull out the shaped spring by means of a screwdriver.
 2. Shift the arc chute up and remove it.
- Re-assembly is done by reversing these instructions.

Readjustment of the series VH electromagnet

Contactors mounted on an uneven panel may produce noise (whirr). In such cases it is necessary to re-adjust the sealing of electromagnet, as follows:

1. Switch on the contactor electrically.
2. Loosen and/or tighten four self-locking M8 nuts so that the electromagnet stops whirring. Switch the contactor off.

Re-adjustment of series „VH“ electromagnet



Maintenance of the contactor type V53D, VD630, VD1000

It is recommended to conduct regular inspections of the conducting bars and magnet absorbers once a year, and also to slightly oil the bearings of the armature shaft. Due to the design of the main contacts they are easy to change if necessary. It is highly recommended to change the main contact springs as well.

Instruction for replacing of the type V53D and VD900 contactor coil

1. Unbolt two M10 screws and loosen two M8 nuts from the magnet carrier.
2. Remove the magnet carrier together with magnet and coil.
3. Unbolt four M5 screws and replace the coil.
4. Reassemble the coil, magnet and magnet carrier. Be aware of positioning of coil terminals.

Readjustment of the series VD electromagnet

Contactors mounted on an uneven panel may produce noise (whirr). In such cases it is necessary to re-adjust the sealing of electromagnet, as follows:

1. Switch on the contactor electrically.
2. Loosen and/or tighten four self-locking M8 nuts so that the electromagnet stops whirring. Switch the contactor off.

1.6.6 Overload and short-circuit protection

Overload protection sets consist of the thermal overload relay T17I/1 A (or T17II/1 A) and 3 pieces of series „M“ protective transformers. These sets are designed to provide overload protection when used with series VH and VD contactors and type V53D contactors. Fuses or circuit breakers must be used.

1.6.7 Contactor type SF V53D for 4400 Hz

Utilization

These contactors are designed to be used in the switching of inductive furnaces, compensated by capacitor banks.

Description

Contactors carry four auxiliary contacts acc. to EN 60947-5-1, 2NO/2NC. The main circuit poles are based on non-magnetic materials. Contactors are capable of uninterrupted duty acc. to Art.-No. 4.3.4.2 of EN 60947-1. The ratings of the auxiliary circuits and control circuits are the same as in the V53D contactors.

Marking

Contactors are marked by „SF“ and „4,4 kHz“ on the type label.

1.6.8 Example of order

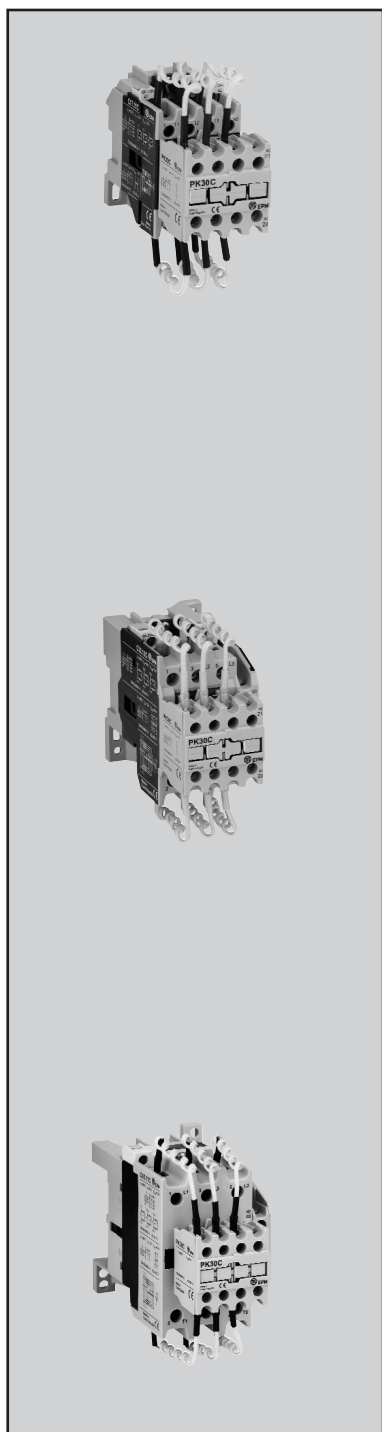
Type	Coil control voltage	No. of pcs
VH250DO	220–230 V/50 Hz	10 pcs
VH440.4	110 V/50 Hz	5 pcs

1.7 Contactors C12.10C

Contactors for switching of capacitor banks are supplied being equipped with the auxiliary contact unit type PK30C. The contacts of this unit operate in a special way – they make before the main contacts and temporarily only. As soon as the main contacts seal, the auxiliary contacts return to their open position. They do not break any current and that is why they allow to the higher durability and reliability of the contactor.

The wire resistors, that are packaged together with the contactor, must be connected according to the wiring diagram. Tighten properly all terminal screws!

1.7.1 Table-No. 28 – rating



Type	C12.10C	C17.10C
Main circuit		
Rated insulation voltage U_i [V]	690	690
Conventional free air thermal current I_{th} [A]	25	25
Max. reactive power of capacitive load in cat. AC-6b at ambient temperature [$^{\circ}$ C]	≤ 40 ≤ 55 ≤ 70	≤ 40 ≤ 55 ≤ 70
at 220-230 V [kVAr]	7 7 6,25	8 8 7
at 380-400 V [kVAr]	10 10 10	12,5 12,5 11
at 500 V [kVAr]	13 13 13	15 15 12,5
at 690 V [kVAr]	15 15 15	17 17 15
Max. number of on-load op. cycles per hour in AC-6b	300	300
Electrical durability in AC-6b [op. cycles]	$0,1 \times 10^6$	$0,1 \times 10^6$
Recommended fuse char. gG [A]	25	25
Type of co-ordination with SCPD	1	1
Mechanical durability [op. cycles]	3×10^6	3×10^6
Auxiliary contacts		
Rated insulation voltage U_i [V]	690	690
Conventional free air thermal current I_{th} [A]	12	12
Rated operational current I_e v AC-15		
at 220-230 V	4	4
at 380-400 V	2	2
Electrical durability in AC-15		
at 220-230 V, 4 A [sep]	$0,8 \times 10^6$	$0,8 \times 10^6$
at 380-400 V, 2 A [sep]	10^6	10^6
Config. of NO/NC aux. contacts	1-0	1-0
Control circuit		
AC coil control voltages at 50 Hz [V]	220-230 380-400 500	220-230 380-400 500
Pull-in inp. power of AC control coil, ± 10 % [VA]	60	60
Hold-in inp. power of AC control coil, ± 15 % [VAW]	10,5/3,9	10,5/3,9
Main dimensions W $\times$ H $\times$ D [mm]	45x90x105	45x90x105
Mass [kg]	0,36	0,36
Degree of protection	IP20/IP10	IP20/IP10

* A 6 mm² copper wire is to be used for $I_{th} = 50$ A; the 24-hour average ambient temperature must not exceed 35 $^{\circ}$ C

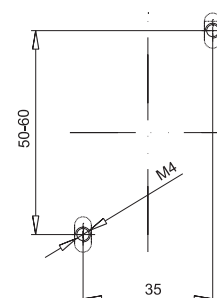
* A 25 mm² copper conductor is to be used for $I_{th} = 95$ A; the 24-hour average ambient temperature must not exceed 35 $^{\circ}$ C

1.7.2 Description

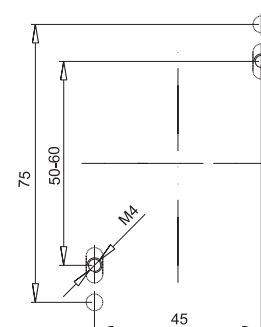
Extraordinarily high inrush current peaks occur in the utilization category AC-6b, making it possible for the contacts to weld by switching the capacitor bank. That is why the special contactors series C■.1■C switch in two steps. At first, the auxiliary contacts connect the capacitor with the mains through wire resistors and then pre-charge the capacitor. The main contacts close and consecutively short-circuit the ballast resistors mentioned above. Thereafter the auxiliary contacts return to their open position. The capacitor must be connected to the main pole terminals and must be equipped with discharge resistors. Usage of the capacitors in the bank should be done in an appropriate sequence, so that the voltage remaining on the capacitor being connected to the mains does not exceed 10 % of the mains voltage. Contactors include a special auxiliary PK30C contact unit. The enclosed wire resistors must be connected to the contactor terminals according to the wiring diagram. The terminal screws must be tightened properly!

C25.11C	C32.11C	C50.11C	C65.11C	C80.11C
690 32	690 50	690 85	690 85	690 95
≤40 ≤55 ≤70 10 10 10 17 17 17 20 20 20 25 25 25	≤40 ≤55 ≤70 15 15 15 25 25 25 30 30 30 34 34 34	≤40 ≤55 ≤70 25 25 25 40 40 40 50 50 50 60 60 60	≤40 ≤55 ≤70 30 30 25 50 50 45 60 60 55 70 70 67	≤40 ≤55 ≤70 35 35 30 60 60 50 70 70 60 80 80 70
300 0,1x10 ⁶ 40 2 3x10 ⁶	300 0,1x10 ⁶ 50 2 3x10 ⁶	300 0,1x10 ⁶ 80 2 3x10 ⁶	300 0,1x10 ⁶ 80 2 3x10 ⁶	300 0,1x10 ⁶ 100 2 3x10 ⁶
690 12	690 12	690 12	690 12	690 12
4 2	4 2	4 2	4 2	4 2
0,8x10 ⁶ 10 ⁶ 1-1	0,8x10 ⁶ 10 ⁶ 1-1	0,8x10 ⁶ 10 ⁶ 1-1	0,8x10 ⁶ 10 ⁶ 1-1	0,8x10 ⁶ 10 ⁶ 1-1
220-230 380-400 500 83 14,2/4	220-230 380-400 500 83 14,2/4	220-230 380-400 500 140 23/5,7	220-230 380-400 500 140 23/5,7	220-230 380-400 500 140 23/5,7
56x105x122,5 0,6 IP20/IP10	56x105x122,5 0,6 IP20/IP10	70x120x147 1,1 IP20/IP10	70x120x147 1,1 IP20/IP10	70x120x147 1,1 IP20/IP10

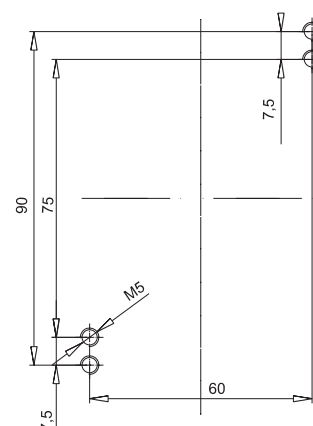
C12.10C
C17.10C



C25.11C
C32.11C



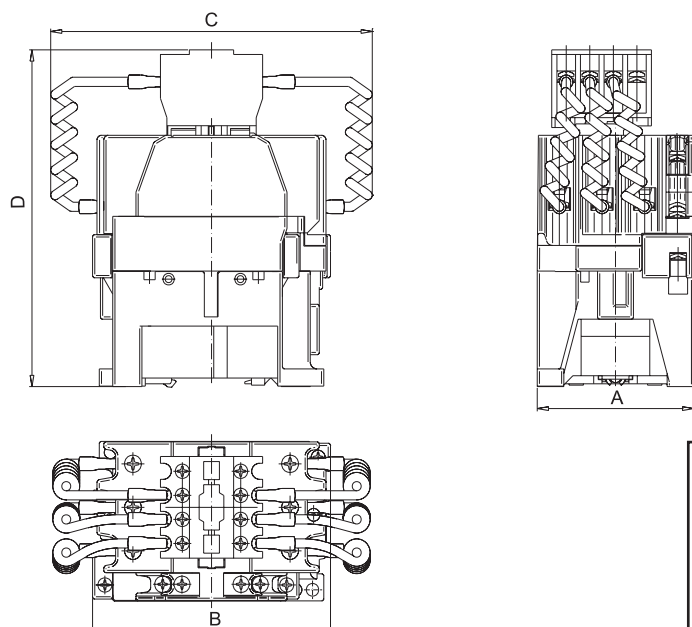
C50.11C
C65.11C
C80.11C



1. Contactors

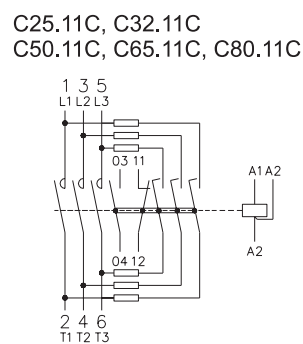
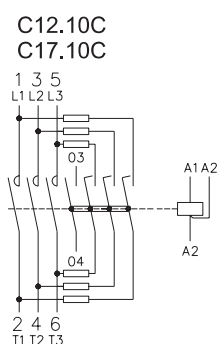
1.7 Contactors for switching of capacitor banks

1.7.3 Outline drawing C...1C



	A	B	C	D
C12.10C, C17.10C	45	78,5	90	105
C25.11C, C32.11C	56	90	105	122,5
C50.11C, C65.11C, C80.11C	70	106,5	120	147

1.7.4 Marking of the terminals, conductor cross-sections



Terminal types and conductor cross-sections – Table-No. 29

Contactor type	Main poles				Auxiliary contacts and coil			
	Terminal type	Screw size	Conductor cross-section [mm²]		Terminal type	Screw size	Conductor cross-section [mm²]	
			Rigid	Flexible			Rigid	Flexible
C12.10C, C17.10C	screw-type	M3,5	1..4	1..2,5	screw-type	M3,5	1..2,5	0,75..1,5
C25.11C, C32.11C	pillar-type	M5	1,5..10	1,5..10	screw-type	M3,5	1..2,5	0,75..1,5
C50.11C, C65.11C, C80.11C	pillar-type	M6	2,5..25	2,5..25	screw-type	M3,5	1..2,5	0,75..1,5

1.7.5 Accessories to the contactors Series C...1C

BO – coil suppressor

BC – interface unit

PKB11 – side mounted auxiliary contacts unit (one unit per contactor)

1.7.6 Spare parts

coil

auxiliary contact set – includes PK30C together with

six pcs of wire resistors

1.7.7 Example of order

Type	Coil control voltage	No. of pcs
coil C17.10C	220-230 V/50 Hz	6 pcs
aux. contact set C17.10C		3 pcs

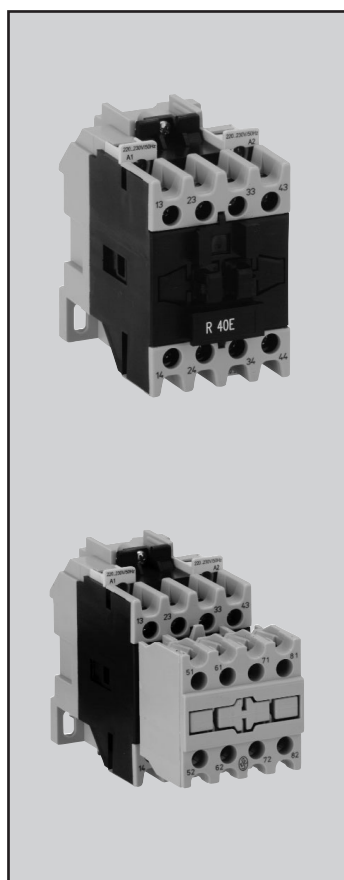
1.8 Auxiliary contactors series "R"

1.8.1 Description

The series R auxiliary contactors contain 4 poles in AC controlled versions, or 3 poles in DC controlled versions. An auxiliary unit contains four more contacts in various configurations of NO/NC. Any base unit and any appropriate type of auxiliary unit can be supplied separately.

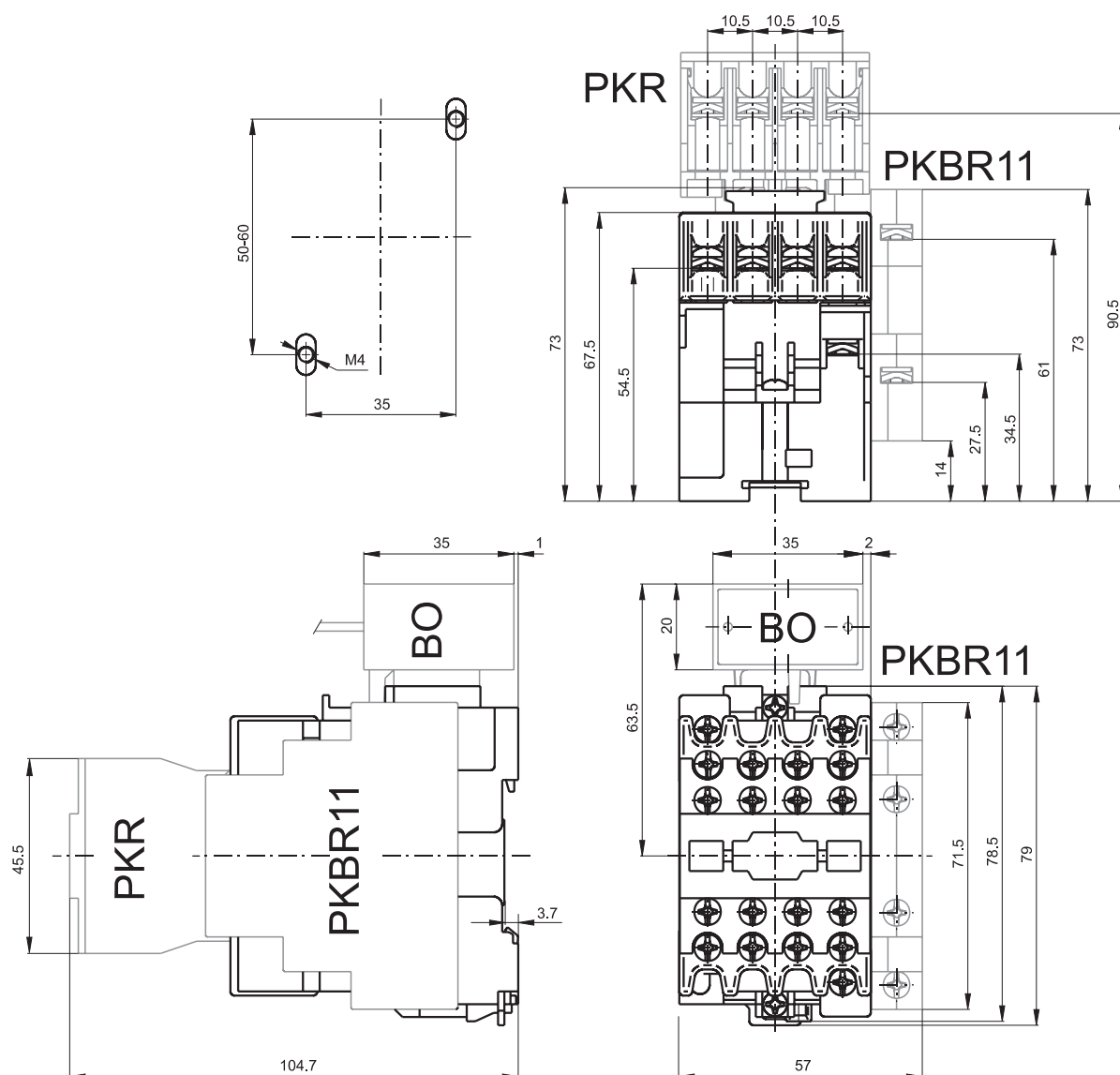
The number of poles can be extended by side-mounting the PKBR11 auxiliary contact unit. Use at most one unit per contactor.

1.8.2 Table-No. 30 – Rating



Type	Base unit	Auxiliary unit	
		PKR	PKBR11
Rated insulation voltage U_i [V]	690	690	690
Conventional free air thermal current I_{th} [A]	25		
poles 13-14, 23-24, 33-34, 43-44 5+5+, 6+6+, 7+7+, 8+8+ 91-92, 03-04		12	12
Rated operational current I_e at 230 V [A]	4	4	4
at 400 V [A]	2	2	2
Electrical durability in AC-15 at 230 V, 4 A [op. cycles]	$0,8 \times 10^6$	$0,8 \times 10^6$	$0,8 \times 10^6$
Electrical durability in AC-15 at 400 V, 2 A [op. cycles]	10^6	10^6	10^6
Max. number of on-load op. cycles per hour	3 600	3 600	3 600
Mechanical durability – AC controlled [op. cycles]	10×10^6	10×10^6	10×10^6
Mechanical durability – DC controlled [op. cycles]	10×10^6	10×10^6	5×10^6
Control circuit			
Range of AC coil control voltages at 50 Hz [V]	12-690		
Range of AC coil control voltages at 60 Hz [V]	24-600		
Pull-in input power of AC control coil [VA]	60 ± 10		
Hold-in input power of AC control coil [VA/W]	$10,5/3,9 \pm 10 \%$		
Range of DC coil control voltages	12-250		
Pull-in input power of DC control coil [W]	90 ± 10		
Hold-in input power of DC control coil [W]	$9,2 \pm 15 \%$		
Mechanically linked contact elements acc. to App. „L“ of EN 60 947-5-1	yes	yes	yes
Mass [kg]	0,3	0,05	0,035
Degree of protection	IP20/IP10	IP20/IP10	IP20/IP10

1.8.3 Outline drawing of auxiliary contactor R with PKR, PKBR11 and BO



Contactors can be fixed either to a 35 mm rail according to EN 50022, or to a panel by means of two M4 screws.

1.8.4 Marking of the terminals, conductor cross-sections

Marking of the terminals of the base units

DC controlled versions R21, R30

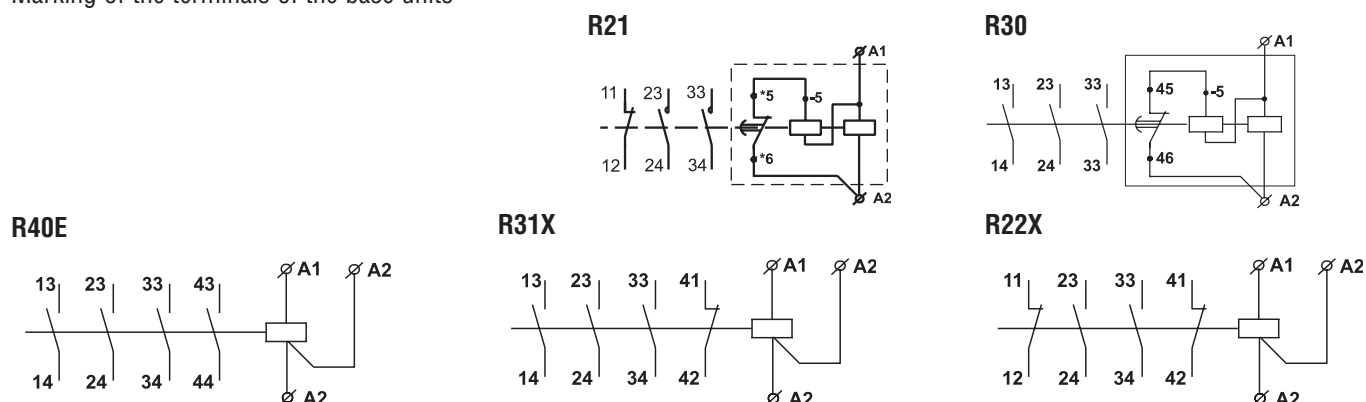


Table-No. 31

Contactor type	Base unit R40 poles				Coil and auxiliary contact units types PKR, PKBR11			
	Terminal type	Screw size	Conductor cross-section [mm ²]		Terminal type	Screw size	Conductor cross-section [mm ²]	
			Rigid	Flexible			Rigid	Flexible
series „R“	screw-type	M3,5	1..4	1..4	screw-type	M3,5	1..2,5	0,75..1,5

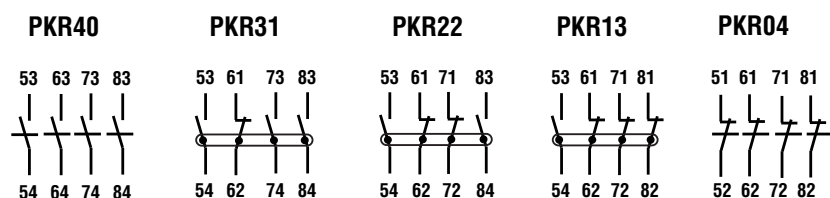
All terminals facilitate the connection of either a single conductor, or two of the same conductors resp. by cross-sections differing by one degree.

All M3.5 screws have the combined slot [PH2 + simple].

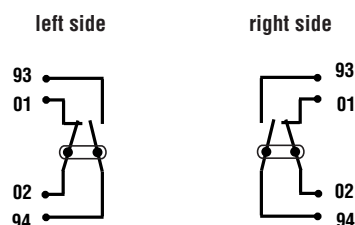
Flexible conductors must not be compacted by brazing!

1.8.5 Marking and configuration of contacts

The markings of the terminals comply with EN 50005 and EN 50011.



The terminal markings of the auxiliary contact unit PKBR11, in case the unit is mounted onto the contactor's left/right side.



1.8.6 Accessories to the contactors series R

- PKR■** – four-pole auxiliary contact unit
- BB** – mechanical interlocking unit
- B0** – coil suppressor
- PKBR11** – side-mounted auxiliary contact unit 1NO/1NC
- BT** – electronic timer
- T17** – thermal overload relay series T17 (see Chapter 2.)

1.8.7 Spare coils

Table-No. 32

Coils		
Control voltage [V]	Frequency [Hz]	DC control voltage [Vss]
12		
24	50	12
48	50	24
110	50	48
127	50	220
220-230	50	
380-400	50	
110	60	
220	60	

1.8.8 Example of order

Contactor type	Coil control voltage	No. of pcs
R40E	220-230 V/50 Hz	20 pcs
R30	12 V DC	30 pcs
PKR22	12 V DC	50 pcs

1.9 Contactors for household installations, series A

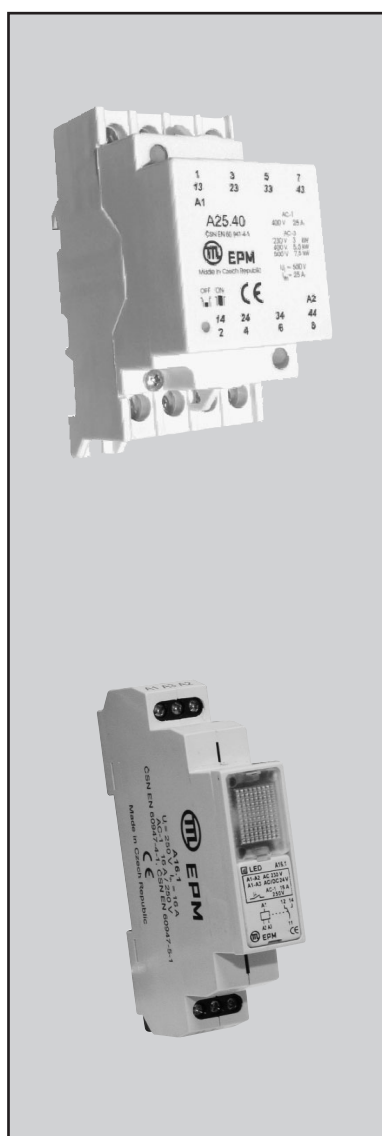
1.9.1 Description

Series A25 contactors are designed for frequent switching, mainly with non-inductive or slightly inductive loads, e. g. resistance heating devices. They are capable of operation in the circuits of three-phase induction motors. Owing to their design, they are suitable for household installations, e. g. side by side to miniature circuit breakers. Optionally, they can be equipped with a sealable enclosure (IP40D), which disables access to any terminal after being put on.

Series A25 contactors contain four poles in 4/0, 3/1, 2/2, 1/3, or 0/4 (NO/NC) configurations.

A16 contactor relays are capable of noiseless operation and are determined for switching in one-phase circuits. A red/green LED indicates the state of the changeover contact output. The built-in protecting diode and suppressing capacitor provide protection against over-voltage. Contactor relays have been approved acc. to EN 61812.

1.9.2 Table-No. 33 – Rating



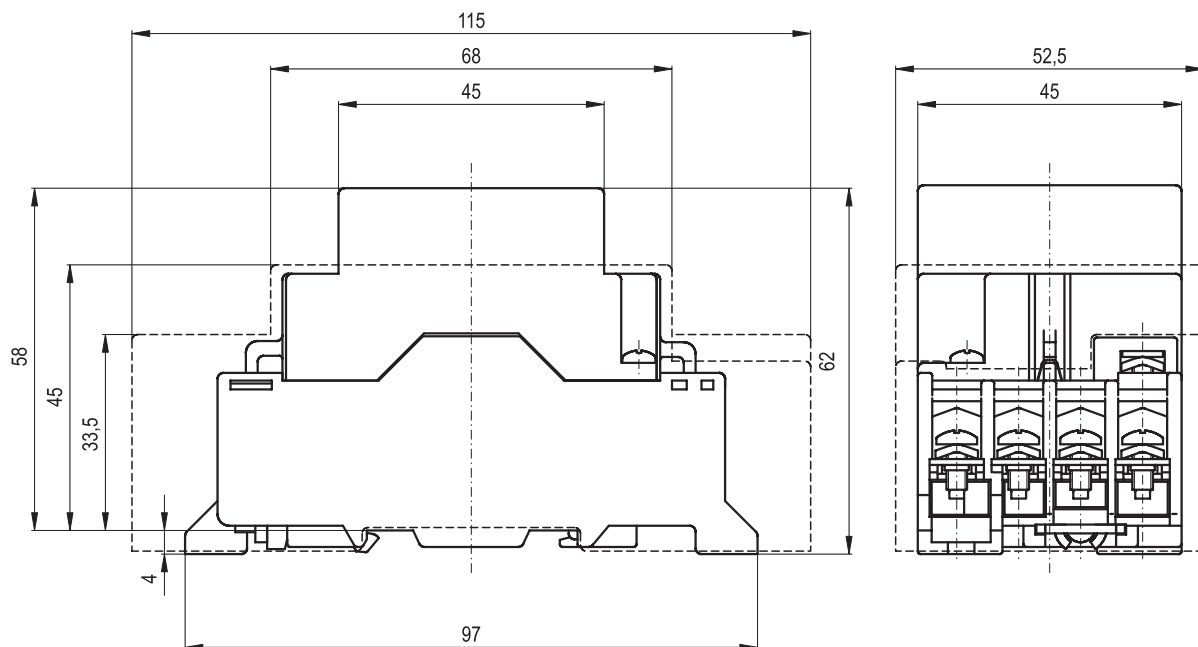
Contactor type	A25	A16.1
Rated insulation voltage U_i [V]	500	250
Impulse withstand voltage U_{imp} [kV]	6	—
Conventional free air thermal current I_{th} [A]	25	16
Rated operational current I_e in utilization categories		
AC-7a at 400 V [A]	25	16
AC-7b at 400 V [A]	12	—
AC-15 at 400 V [A]	2	—
AC-15 at 230 V [A]	4	3
AC-1 at 250 V [A]		16
AC-3 at 400 V [A]	12	
Max. output power of controlled motor in AC-7b		
at 220-230 V [kW]	3	
at 380-400 V [kW]	5,5	
at 500 V [kW]	7,5	
Max. number of on-load op. cycles per hour in AC-7a	600	
Max. number of on-load op. cycles per hour in AC-7b	1 200	
Max. number of on-load op. cycles per hour in AC-15	3 600	
Electrical durability in AC-7a at 400 V, 25 A [op. cycles]	0,1x10 ⁶	
Electrical durability in AC-7b at 400 V, 12 A [op. cycles]	0,3x10 ⁶	
Electrical durability in AC-15 at 400 V, 2 A [op. cycles]	10 ⁶	
Electrical durability in AC-15 at 230 V, 4 A [op. cycles]	0,8x10 ⁶	0,7x10 ⁶
Recommended fuse char. aM [A]	16	
Type of co-ordination with SCPD acc. to EN 60 947-4-1	2	
Mechanical durability [op. cycles]	3x10 ⁶	2x10 ⁶
Control circuit		
Coil control voltage at 50 Hz [V]	24..400	230*
[V] (AC/DC)		24**
Hold-in input power of AC control coil, ±10 % [VA/W]	4,6/1,6	
Pull-in input power of AC control coil, ±10 % [VA]	32,5	
Mass [kg]	0,28	0,058
Outline dimensions W × H × D [mm]	45x97x62	17,6x90x65
Outline dimensions incl. the enclosure W × H × D [mm]	52,5x115x62	
Degree of protection	IP20	IP20

* Terminal: A1 – A2

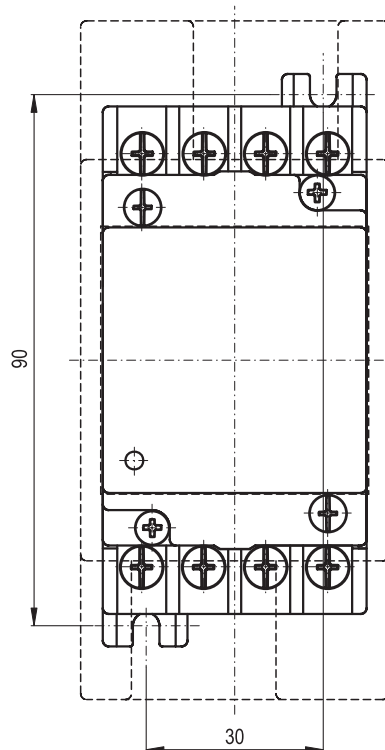
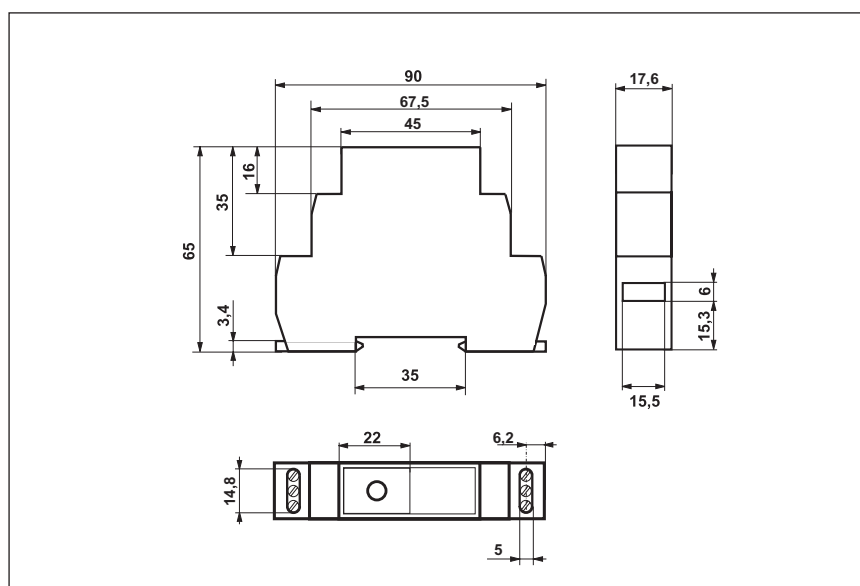
**Terminal: A1 – A3

1.9.3 Outline drawings

The dashed line indicates the sealable enclosure.



A16.1



Contactors can be fixed to either a 35 mm rail according to EN 50022, or onto a mounting panel by means of two M4 screws.

1.9.4 Marking of the terminals, contact configurations and conductor cross-sections

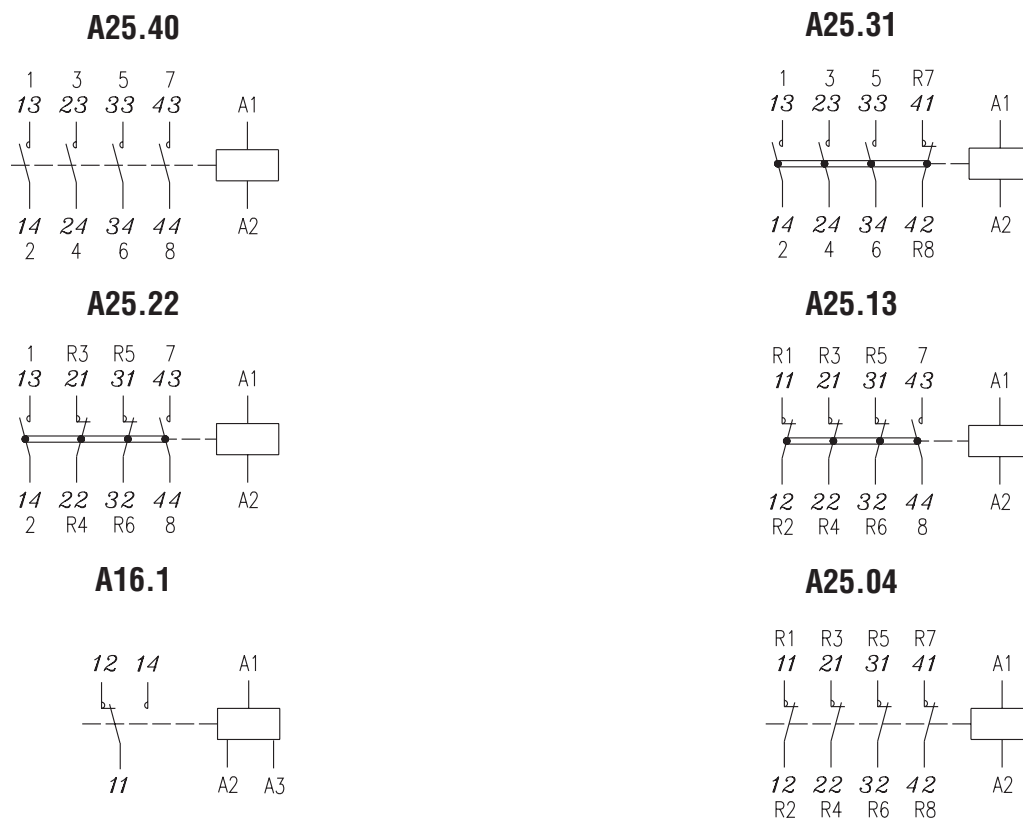


Table-No. 31

Contactor type	Main poles				Coil terminals			
	Terminal type	Screw size	Conductor cross-section [mm ²]		Terminal type	Screw size	Conductor cross-section [mm ²]	
			Rigid	Flexible			Rigid	Flexible
A25	screw-type*	M3,5**	1..4	1..4	screw-type*	M3,5**	1..2,5	0,75..1,5
A16.1	pillar-type	M3***	1..2,5	1..2,5	pillar-type	M3***	1..2,5	1..2,5

*All terminals of the A25 facilitate the connection of either a single conductor, or two of the same conductors resp. by cross-sections differing by one degree.

**All M3.5 screws have the combined slot [PH2 + simple].

***Simple slot

1.9.5 Maintenance

No maintenance is required.

1.9.6 Example of order

Contactor type	Configuration of poles	Coil control voltage	No. of pcs
A25	40	220-230 V/50 Hz	100 pcs
A16.1	1 change-over	24 V DC	20 pcs
Enclosure A25			50 pcs

2.1 General

2.1.1 Description

Type T17, T50, and T63 thermal overload relays are designed for overload protection of three-phase induction motors, and are to be used together with contactors. Primary thermal overload relays cover the range of current settings from 0.1 A up to 80 A.

Type T17 relays are directly connectable with type C9.■, C12.■, C17.■, C23.■, C16.■, C20.■, C25.■, C32.■ or C40.■ contactors. The H17 adaptor should be used for the separate mounting of the T17.

T50 is directly connectable with the C16.■, C20.■, C25.■, C32.■ or C40.■ contactors.

T63 is directly connectable with the C50.■, C65.■, C80.■, C95.■, C115.■ or C150.■ contactors. The H63 adaptor should be used in the separate mounting of T63.

2.1.2 Standards

Relays T17, T50 and T63 have been developed, tested and approved according to EN 60947-1, EN 60947-4-1, EN 60947-5-1, IEC 60947-1, IEC 60947-4-1 and IEC 60947-5-1.

The terminals of the relays are designed to prevent accidental contact between live parts and the human body. Fingers are protected in the perpendicular direction, while larger body surfaces are protected in the parallel direction to the mounting panel. This means the relays provide protection IP20/IP10 acc. to VDE 0106-100.

Safety

In addition to the features described above, the relays comply with the requirements of the EN 61010-1, overvoltage category III, pollution degree 2, test voltage 4350 V / 50..60 Hz (table-No. D6).

2.1.3 Certificates

The products have received approval from the following authorized entities (national test institutes):



The quality system has been certified according to ISO 9001.

2.1.4 Operating conditions

The T17, T50 and T63 relays are each supplied in a climate proof version, which can operate under conditions of the wide climate group "G" according to IEC 721-2-1 and comply with the requirements of the following standards and tests:

- a) Cold test acc. to EN 60068-2-1
Test Ad: testing temperature -55°C , exposition 16 hours
- b) Dry heat test acc. to EN 60068-2-2
Test Bd: testing temperature $+55^{\circ}\text{C}$, exposition 16 hours
- c) Cyclic damp heat test acc. to IEC 68-2-30
Test Db: maximal testing temperature $+40^{\circ}\text{C}$, 21 cycles, var. 2
- d) Mould growth test acc. to IEC 68-2-10
Test J: var. 1
- e) Simulated solar radiation test acc. to IEC 68-2-5
Test Sa: testing temperature $+40^{\circ}\text{C}$, 3 cycles.
- f) Sulphur dioxide test with general condensation of moisture acc. to ISO 6988, 1 cycle.

Max. relative humidity 98 % at $+35^{\circ}\text{C}$.

Temperature range -50°C .. $+55^{\circ}\text{C}$.

Max. altitude 2 000 m.

Note:

Additional tests may be applied to the relays according to the specific regional operating conditions.

2.1.5 Features of relays type T17, T50 and T63

- sensitivity to phase loss
- ambient temperature compensation
- test button (red)
- combined Auto/Man reset button
- relay stays active during depressing of the reset button
- visual signalization of tripping
- galvanically insulated contacts – 1NO/1NC
- self-opening screw terminals
- prepared for user marking
- continually adjustable current setting range $0,69..1,0 \times I_N$
- protection against accidental contact with live parts

Relays are supplied in two lines – “I” for trip class 10A (normal starting), or “II” for trip class 20 (heavy starting). See Table II of EN 60947-4-1, subcl. 4.7.3.

Sensitivity to phase loss

The relay's tripping time shortens with the occurrence of a misbalanced load or a phase loss. That is why it is not recommended to use the relay for the parallel protection of different single-phase circuits. Phase-loss sensitivity is mostly effective within the upper part of the tripping current range.

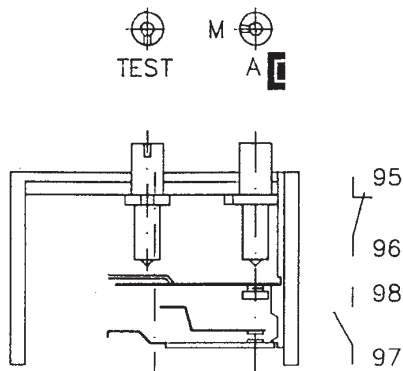
Ambient temperature compensation

The T17, T50 and T63 relays are compensated for an ambient temperature range of $-30\text{ }^{\circ}\text{C}$ to $+60\text{ }^{\circ}\text{C}$.

Pushbuttons

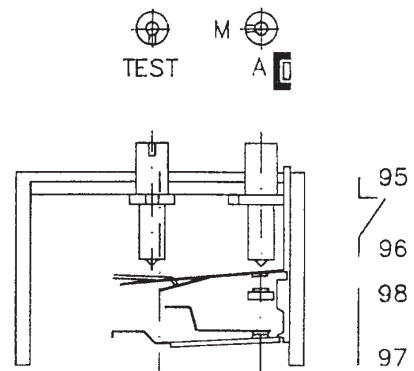
- a) The blue button resets the relay after tripping. Pushing this button and swiveling it through 90° clockwise sets the relays into Auto reset mode. This means that after tripping and the consequential cooling, the relay automatically returns to operation. Swiveling the button back to its original position activates manual reset mode.
- b) The red button TEST simulates the tripping of the relay.

Positions of buttons

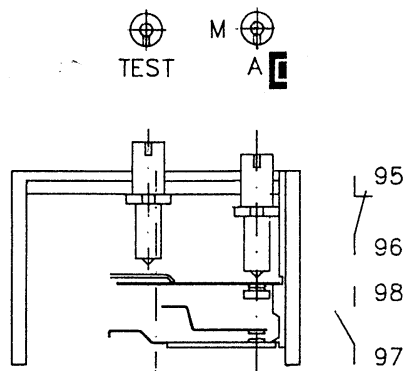


A) Operation

Blue button in position M (manual reset)

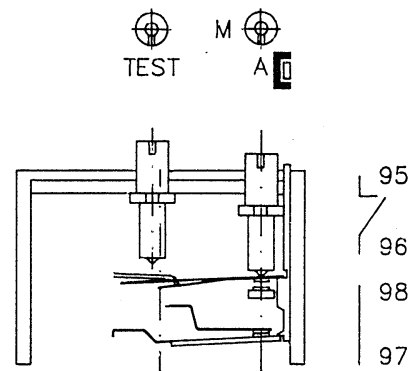


B) After tripping

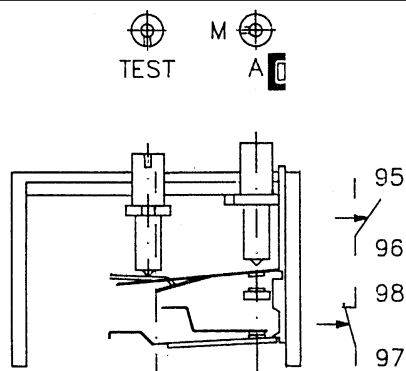


A) Operation

Blue button in position A (automatic reset)



B) After tripping



Function of TEST button

2.1.6 Mounting and wiring

Direct connection of the relay to the contactors

The T17 relay can be directly connected to the C9.■, C12.■, C17.■, C23.■, C16.■, C20.■, C25.■, C32.■ or C40.■ contactors. This is why the two connecting pins of the relay are capable of swinging.

When connected to the C9.■, C12.■, C17.■ or C23.■ contactors, the left pin of the relay must be inserted into the terminal-No. 2 of the contactor along the left hand side of the terminal screw. The other two pins must enter the right-hand halves of the appropriate terminal cavities.

The T50 relay is directly connectable to the C16.■, C20.■, C25.■, C32.■ or C40.■ contactors.

All three pins of the T63 relay are rigid. It can easily be connected to the C50.■, C65.■, C80.■, C95.■, C115.■ or C150.■ contactors.

Note:

It is highly recommended to wire the contactor coil before directly connecting the thermal overload relay.

Use of an adaptor

H17 resp. H63 adaptors allow for stand-alone mounting and wiring of the T17 resp. T63 relays. The relay pins must first be inserted into the appropriate cavities of the adaptor terminals. Then the relay must be pushed against the body of an adaptor until the resilient latch of the adaptor locks.

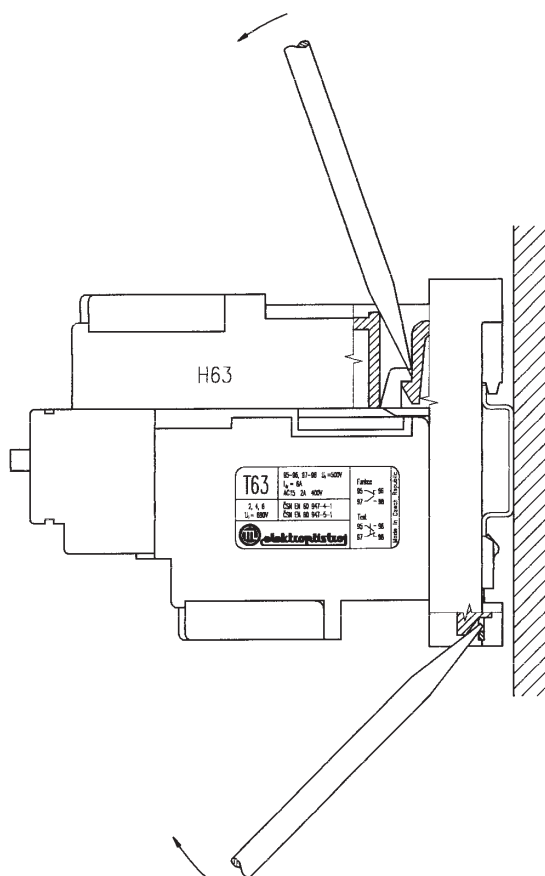
It is recommended to first connect wires to the adaptor terminals, then to the terminals of the relay.

To remove the relay from the adaptor, the latch must be released by means of a screwdriver – see the figure.

Note: Completely loosen the adaptor terminal screws before inserting or removing the relay.

The adaptor can be fixed onto a vertical panel either by means of two screws (H17 – M4, H63 – M5) or onto a 35mm rail acc. to EN 50022 (see figure). Adaptors must be mounted vertically on a panel or rail so that the markings are legible in an ordinary horizontal position.

Figure: removal of an adaptor from rail and release of adaptor latch



Recommended conductor cross-sections

The conductor cross-section affects the tripping time of the relay. To keep the characteristics unchanged, the following conductors must be used for the wiring of T17 and T63 relays in tripping current versions:

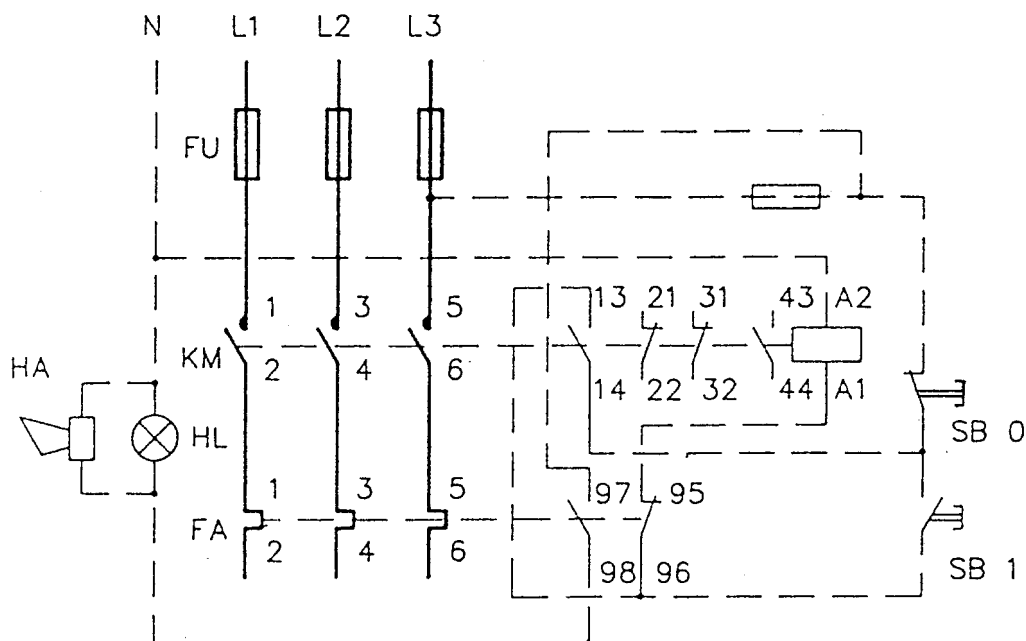
Table-No. 35

Wire cross section [mm²]	1	1,5	2,5	4	6	10	16	25
T17 tripping current version [A]	0,17..6,3	9	13; 19	25	–	–	–	–
T50 tripping current version [A]	–	–	–	25	35	50	–	–
T63 tripping current version [A]	–	–	14,5	21	30	43	63	80

Note:

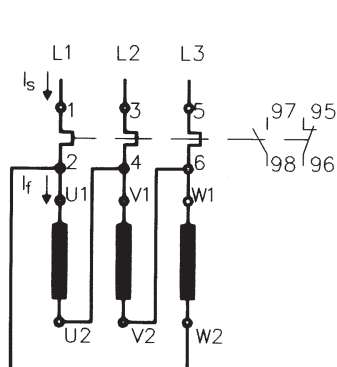
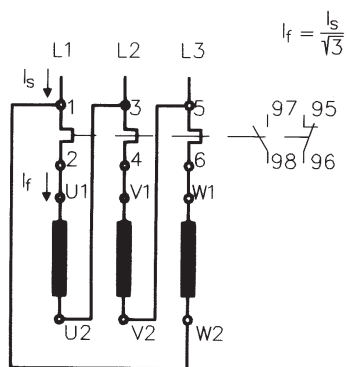
The contactor terminals provide the possibility to connect the pin of the relay with a rigid conductor. It is recommended that you prepare shaped conductors, fully insert them into open contactor terminals, and then connect the relay and tighten the terminal screws. If shaped rigid wires are used, they must not obstruct the connection of the auxiliary contact unit.

Circuit diagram – primary thermal overload relay, contactor, fuses, control and signalization

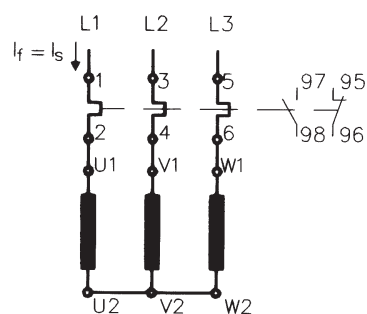


This safety circuit prevents uncontrolled starting of the motor in automatic operation mode, acc. to EN 60204-1.

Relay and motor in delta connection

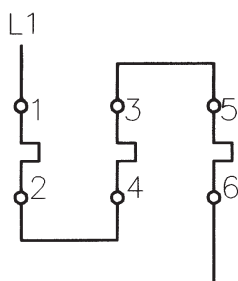


Relay and motor in star connection

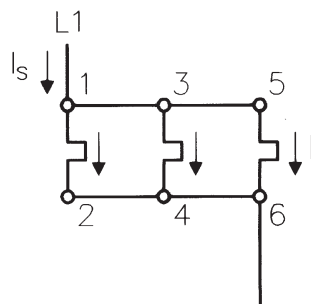


Two versions of the delta connection – relay set to phase resp. mains current (I_f resp. I_s)

Single-phase protection provided by a thermal overload relay



A) series connection



B) parallel connection

$$I = \frac{I_s}{3}$$

2.1.7 Packing and stocking

Thermal overload relays are packaged singly, in PE-bags and paper boxes. Adaptors are packaged in the same way, but in pairs. The unit package protects the product against possible damages that could occur during transport and stocking.

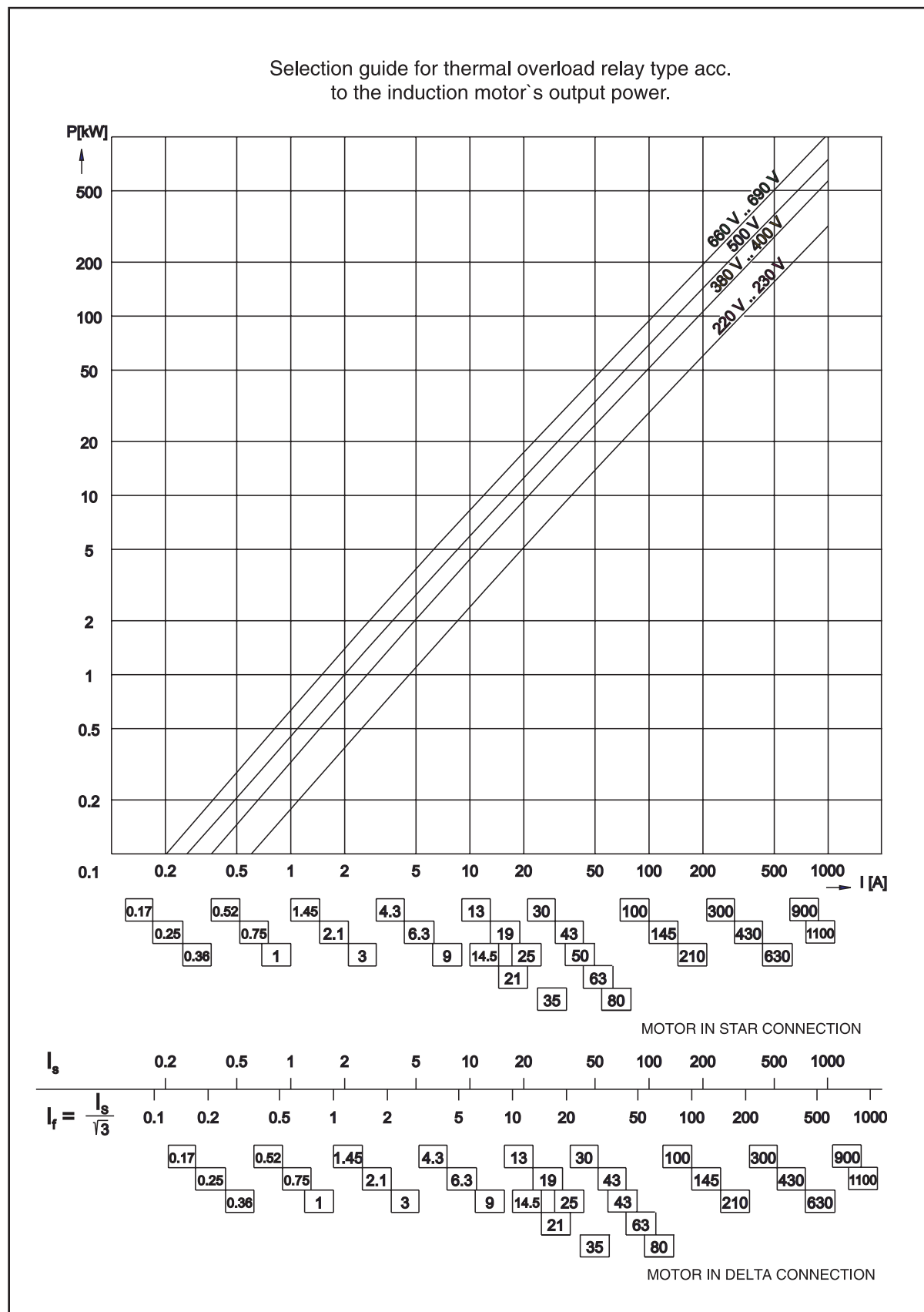
All apparatuses must be stored in dry rooms sheltered from bad weather conditions. Relative humidity must never exceed 80 % at 20 °C. The minimum stocking temperature is -50 °C.



The unit's packaging is made from recyclable materials.

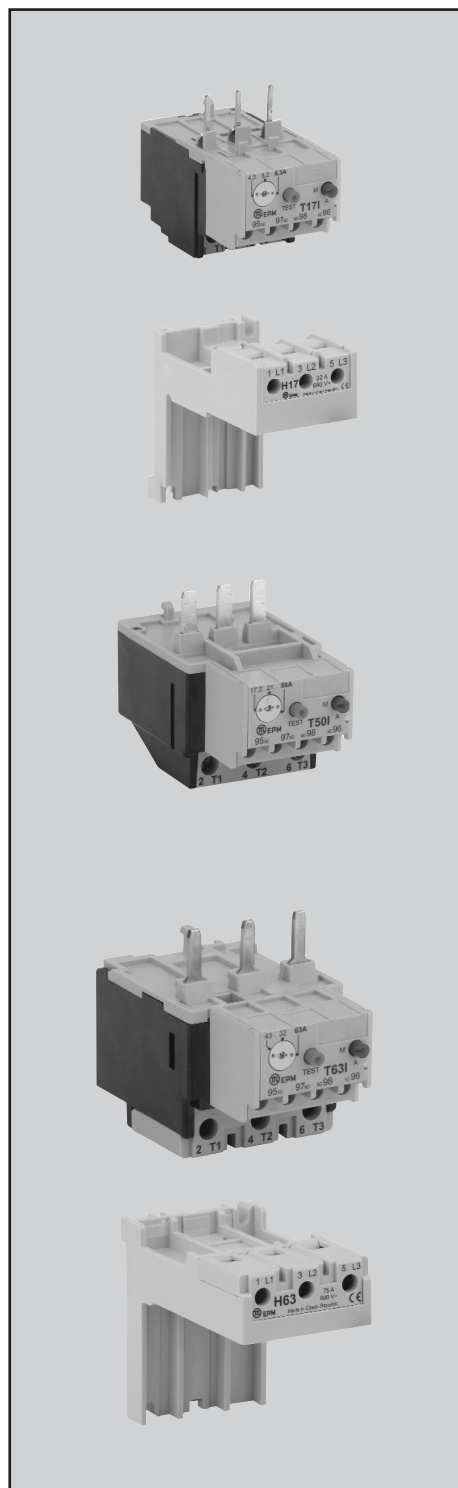
PAP 20 PAP 21 HDPE

2.1.8 Table-No. 36 – Relay selection guide



2.2 Technical data

2.2.1 Table-No. 37 – rating



Type

Main circuit

Rated insulation voltage U_i [V]
 Impulse withstand voltage U_{imp} [kV]
 Range of nominal tripping currents I_e [A]
 Current setting range [-]
 Power consumption range of each phase at I_n [W]
 Insulating resistance [Ohm]
 Terminals
 Terminal screw size
 Cross section range – rigid conductor [mm²]
 – flexible conductor [mm²]
 Cross section combination of conductors
 2 x the same except for the maximum one
 2 x one degree different except for the maximum one
 1 x maximum
 Marking of the terminals line in

line out

Auxiliary circuit

Rated insulation voltage U_i [V]
 Conventional free air thermal current I_{th} [A]
 Rated operational current I_e (AC-15) at 400 V [A]
 Number of contact NO
 NC
 Terminal screw size
 Terminals
 Rigid conductor cross-section range [mm²]
 Flexible conductor cross-section range [mm²]
 Cross section combination of conductors
 2 x the same except for the maximum one
 2 x one degree different except for the maximum one
 1 x maximum
 Marking of the terminals of NC contact
 Marking of the terminals of NO contact

Operating conditions and features

Trip class
 Phase loss sensitivity
 Automatic reset
 Relay stays active during depressing of the reset button
 Ambient temperature compensation range [°C]
 Visual signalization of tripping
 Test button
 Protection against accidental contact with live parts IP20/IP10
 Vibration resistance at 50 Hz – amplitude [mm]
 Shock resistance [m/s²]
 Durability (No. of trippings)
 Temperature compensation range [°C]
 Max. altitude [m]
 Max. relative humidity at 35 °C [%]
 Max. deviation from the vertical position
 Mass [kg]

T17		H17	T50		H63	T63	
T17I	T17II		T50I	T50II		T63I	T63II
690 6 0,17..25 (0,69-1) x I _N 1,2-3,5 min. 10x10 ⁶ M4 screw type 1..6 0,75..4 / / / 2-T1 4-T2 6-T3	690 6 0,17..25 (0,69-1) x I _N 1,2-3,5 min. 10x10 ⁶ M4 screw type 1..6 0,75..4 / / / 2-T1 4-T2 6-T3	690 max. 25 min. 10x10 ⁶ M4 screw type 1..6 0,75..4 / / / 1-L1 3-L2 5-L3	690 6 25..50 (0,69-1) x I _N M5 pillar type 1..10 1..10 / / / 2-T1 4-T2 6-T3	690 6 25..50 (0,69-1) x I _N M5 pillar type 1..10 1..10 / / / 2-T1 4-T2 6-T3	690 max. 80 min. 10x10 ⁶ M6 pillar type 2,5..16 2,5..25 / / / 1-L1 3-L2 5-L3	690 6 14,5..80 (0,69-1) x I _N 2,3-6 min. 10x10 ⁶ M6 pillar type 2,5..16 2,5..25 / / / 2-T1 4-T2 6-T3	690 6 14,5..80 (0,69-1) x I _N 2,3-6 min. 10x10 ⁶ M6 pillar type 2,5..16 2,5..25 / / / 2-T1 4-T2 6-T3
500 6 2 1 1 M3,5 screw type 1..2,5 0,75..1,5 / / / 95-96 97-98	500 6 2 1 1 M3,5 screw type 1..2,5 0,75..1,5 / / / 95-96 97-98		500 6 2 1 1 M3,5 screw type 1..2,5 0,75..1,5 / / / 95-96 97-98	500 6 2 1 1 M3,5 screw type 1..2,5 0,75..1,5 / / / 95-96 97-98		500 6 2 1 1 M3,5 screw type 1..2,5 0,75..1,5 / / / 95-96 97-98	500 6 2 1 1 M3,5 screw type 1..2,5 0,75..1,5 / / / 95-96 97-98
10A yes yes yes yes yes yes yes 0,5 50 3 000 -30 až +60 2 000 98 % 40° 0,142	20 yes yes yes yes yes yes yes 0,5 50 3 000 -30 až +60 2 000 98 % 40° 0,142	yes 98 % 40° 0,08	10A yes yes yes yes yes yes yes 0,5 50 3 000 -30 až +60 2 000 98 % 40° 0,2	20 yes yes yes yes yes yes yes 0,5 50 3 000 -30 až +60 2 000 98 % 40° 0,2	yes 98 % 40° 0,133	10A yes yes yes yes yes yes yes 0,5 50 3 000 -30 až +60 2 000 98 % 40° 0,280	20 yes yes yes yes yes yes yes 0,5 50 3 000 -30 až +60 2 000 98 % 40° 0,280

*All screws have the combined slot [PH2 + simple].

**Flexible conductors must not be compacted by brazing!

2.2.2 Tripping current ranges, short circuit protection

Short circuit protection

Circuits with thermal overload relays must be equipped with circuit breakers or fuses. The short time withstand current of the relay is a maximum of $10 \cdot I_n$. Tables No. 38 and No. 39 contain the recommended fuses for the coordination of protection type 2, acc. to the EN 60947-4-1.

Table-No. 38

Nominal tripping current [A]	Current setting range [A]		I^2t [A ² s]	gG [A]	aM [A]		I^2t [A ² s]	gG [A]	aM [A]
0,17	0,1..0,17	T17I	4,22	0,5	0,25	T17II	4,22	0,5	0,25
0,25	0,17..0,25		10,3	1	0,5		10,3	1	0,5
0,36	0,25..0,36		26,6	1	0,5		26,6	1	0,5
0,52	0,36..0,52		67,5	2	1		67,5	2	1
0,75	0,52..0,75		173	2	1		173	2	1
1	0,69..1		246	4	2		422	4	2
1,45	1..1,45		422	4	2		750	4	2
2,1	1,45..2,1		750	6	4		1 680	6	4
3	2,1..3		1 680	10	4		1 680	6	4
4,3	3..4,3		3 740	10	6		4 950	10	6
6,3	4,3..6,3		12 000	16	10		19 700	20	10
9	6,2..9		25 000	20	10		25 000	25	16
13	9..13		48 100	25	16		60 000	35	20
19	13..19		67 500	32	25		133 000	50	25
25	17,2..25		102 000	50	32		208 000	63	32
25	17,2..25	T50I	122 000	50	32	T50II	122 000	50	32
35	24,1..35								
50	34,5..50								
14,5	10..14,5	T63I	146 000	32	20	T63II	97 000	32	20
21	14,5..21		101 000	50	25		133 000	50	32
30	21..30		160 000	63	32		272 000	63	40
43	30..43		293 000	80	50		989 000	100	63
63	43..63		743 000	100	63		1 898 000	125	80
80	52..80		986 000	125	80		2 225 000	160	100

2.2.3 Tripping curves

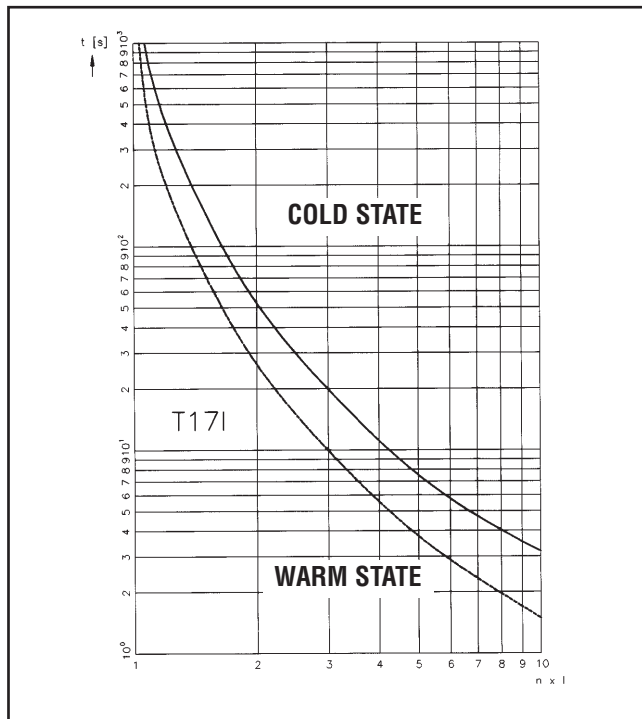
The curves represent the average tripping time, depending on the current setting multiplication at 20 °C, from both the cold and warm states.

In the instance of a misbalanced load or a phase loss, the tripping time shortens.

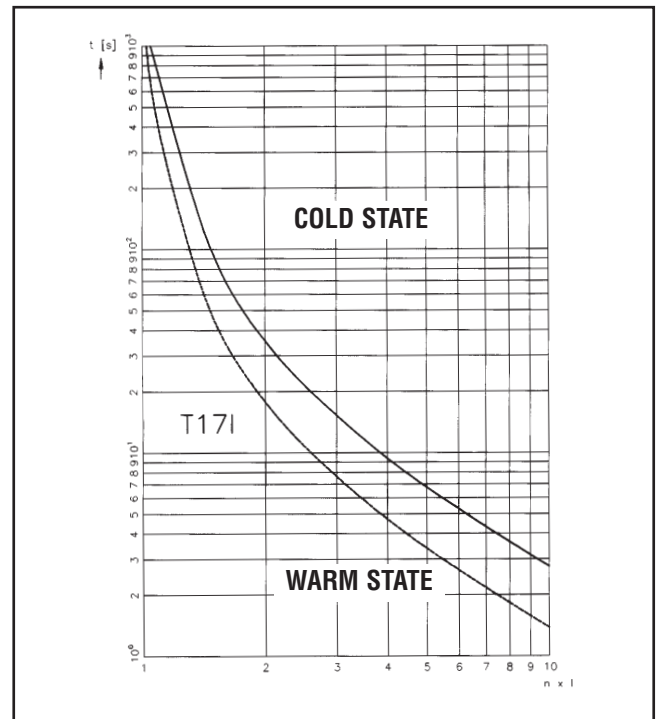
Note: If the motor starts so heavily that even a relay with line II characteristics trips, then it is recommended to bypass the relay (e. g. with the contactor), until the motor starts successfully.

According to EN 60947-4-1, at a 1.05 multiplication of the current setting a relay must not trip within 2 hours from the cold state. However, it must trip within 2 hours from when the current is ramped up to a 1.2 multiplication of the current setting. From temperature standstill, class 10A respectively class 20 relays must trip within 2 resp. within 8 minutes at a 1.5 multiplication of the current setting. From the cold state, class 10A resp. class 20 relays must trip within a time period of 2-10 resp. of 6-20 seconds, at the 7.2 multiplication of the current setting.

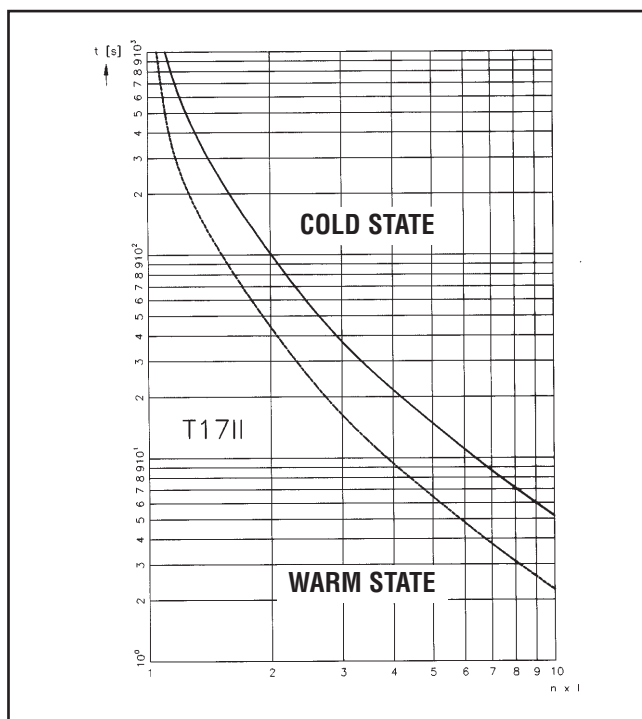
Tripping curves T17 I – three poles,
trip class 10 A



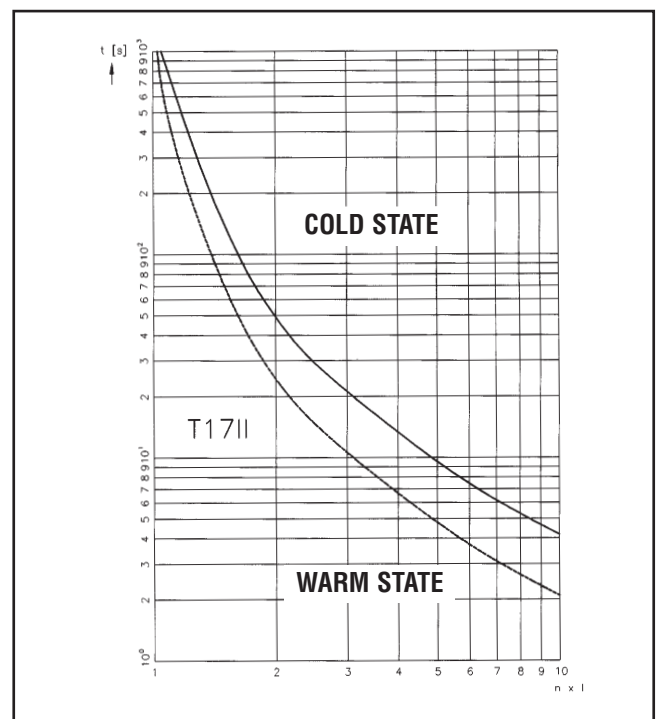
Tripping curves T17 I – two poles,
trip class 10 A



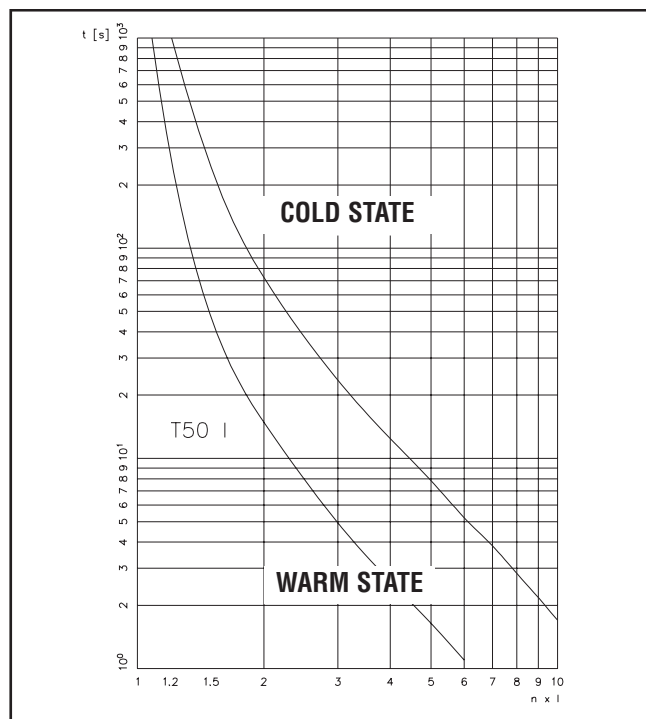
Tripping curves T17 II – three poles,
trip class 20



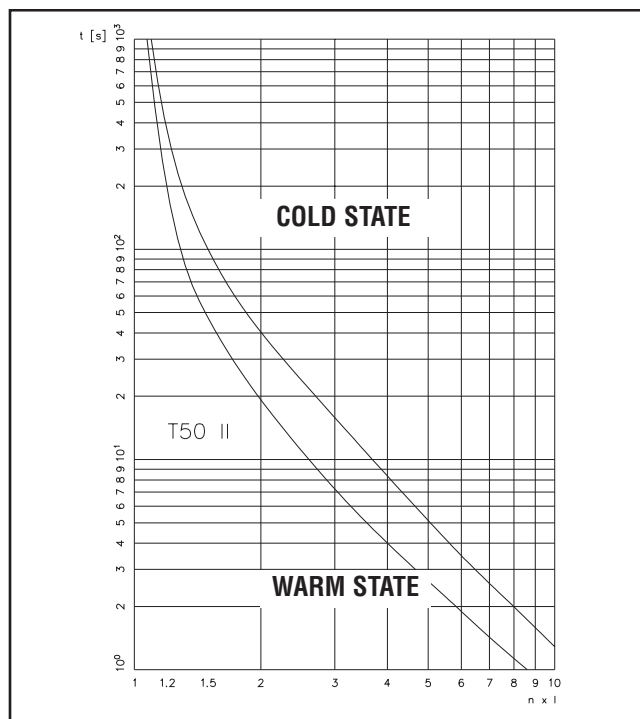
Tripping curves T17 II – two poles,
trip class 20



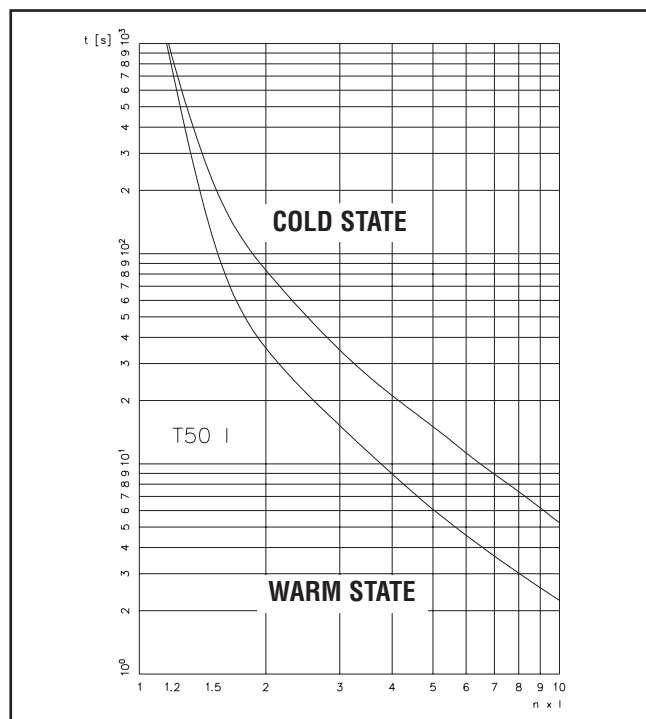
Tripping curves T50 I - three poles,
trip class 10 A



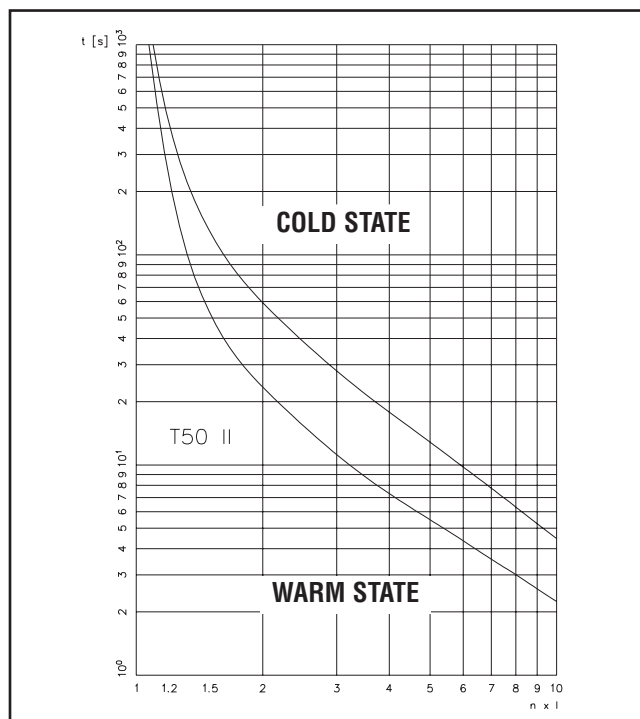
Tripping curves T50I - two poles,
trip class 10 A



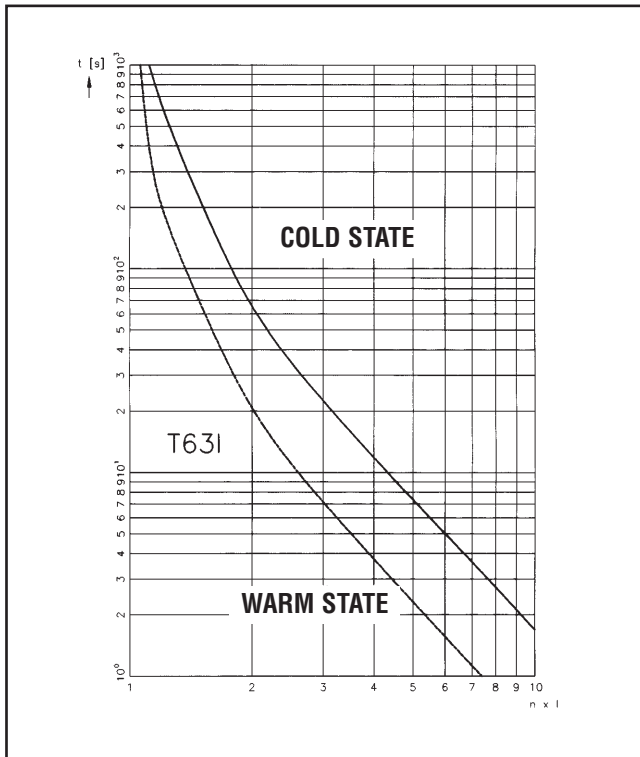
Tripping curves T50 II - three poles,
trip class 20



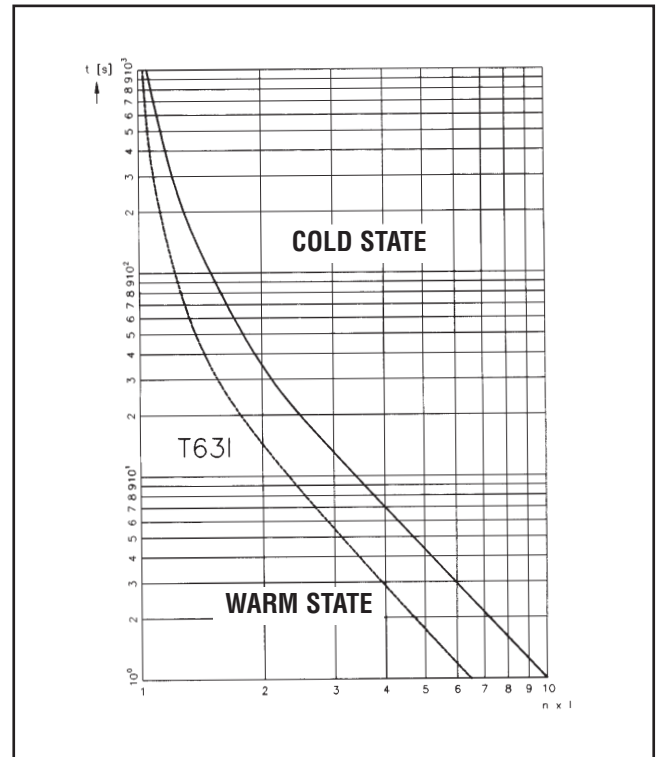
Tripping curves T50 II - two poles,
trip class 20



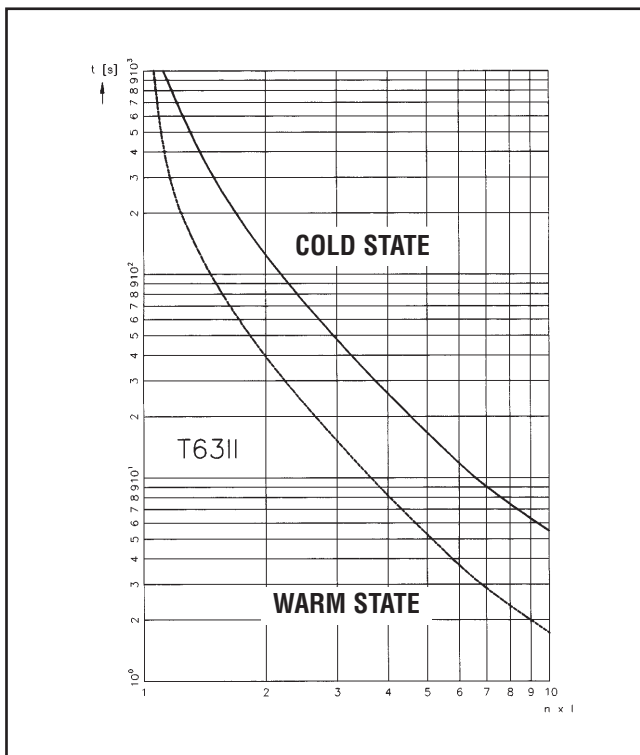
Tripping curves T63 I - three poles,
trip class 10 A



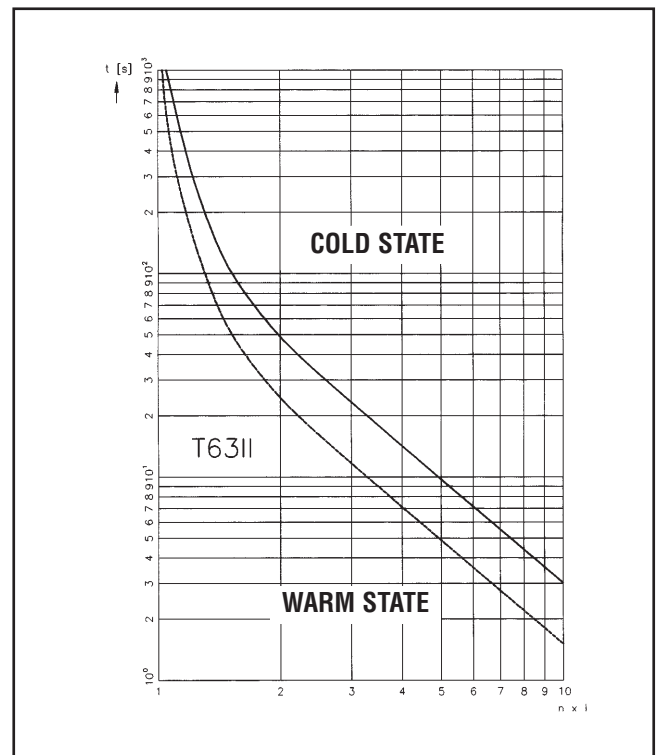
Tripping curves T63 I - two poles,
trip class 10 A



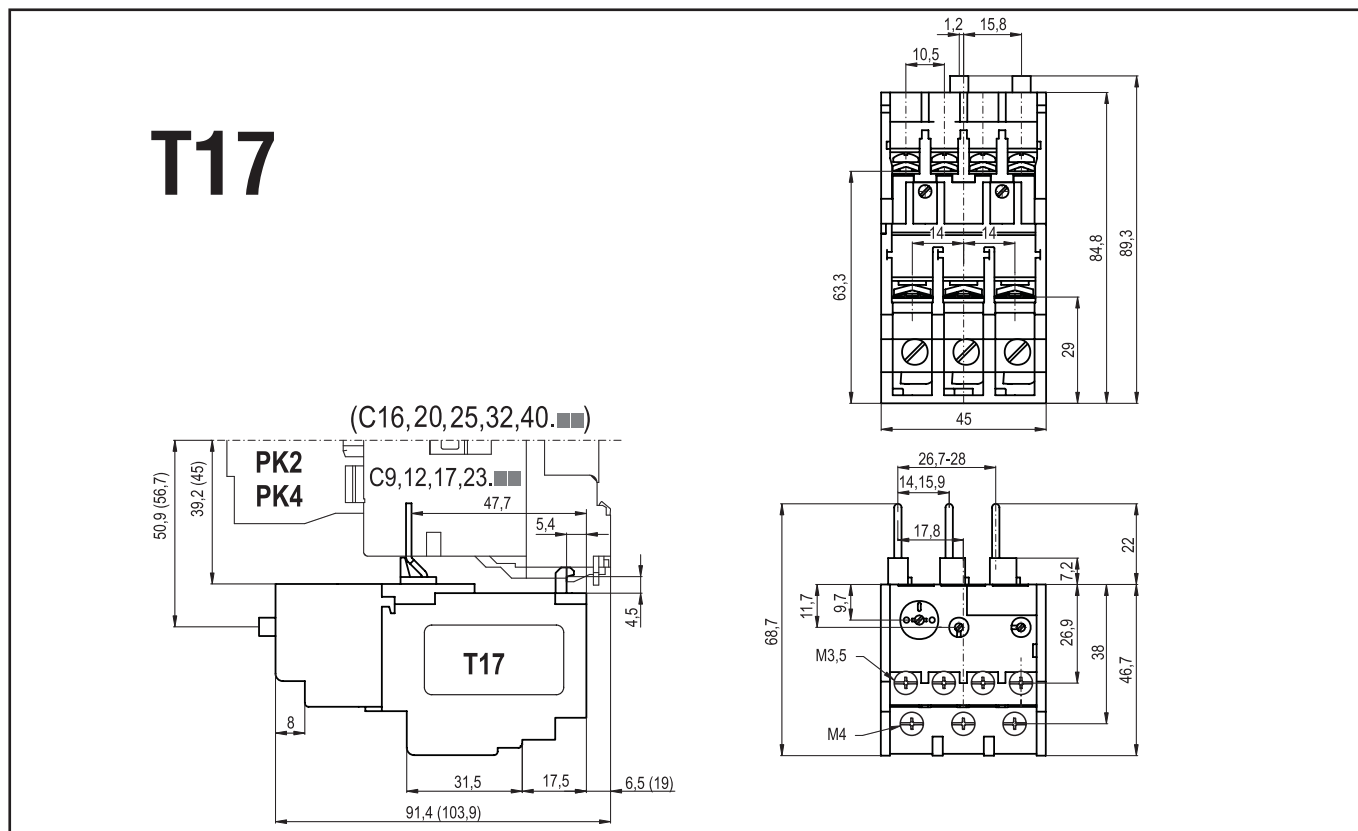
Tripping curves T63 II - three poles,
trip class 20



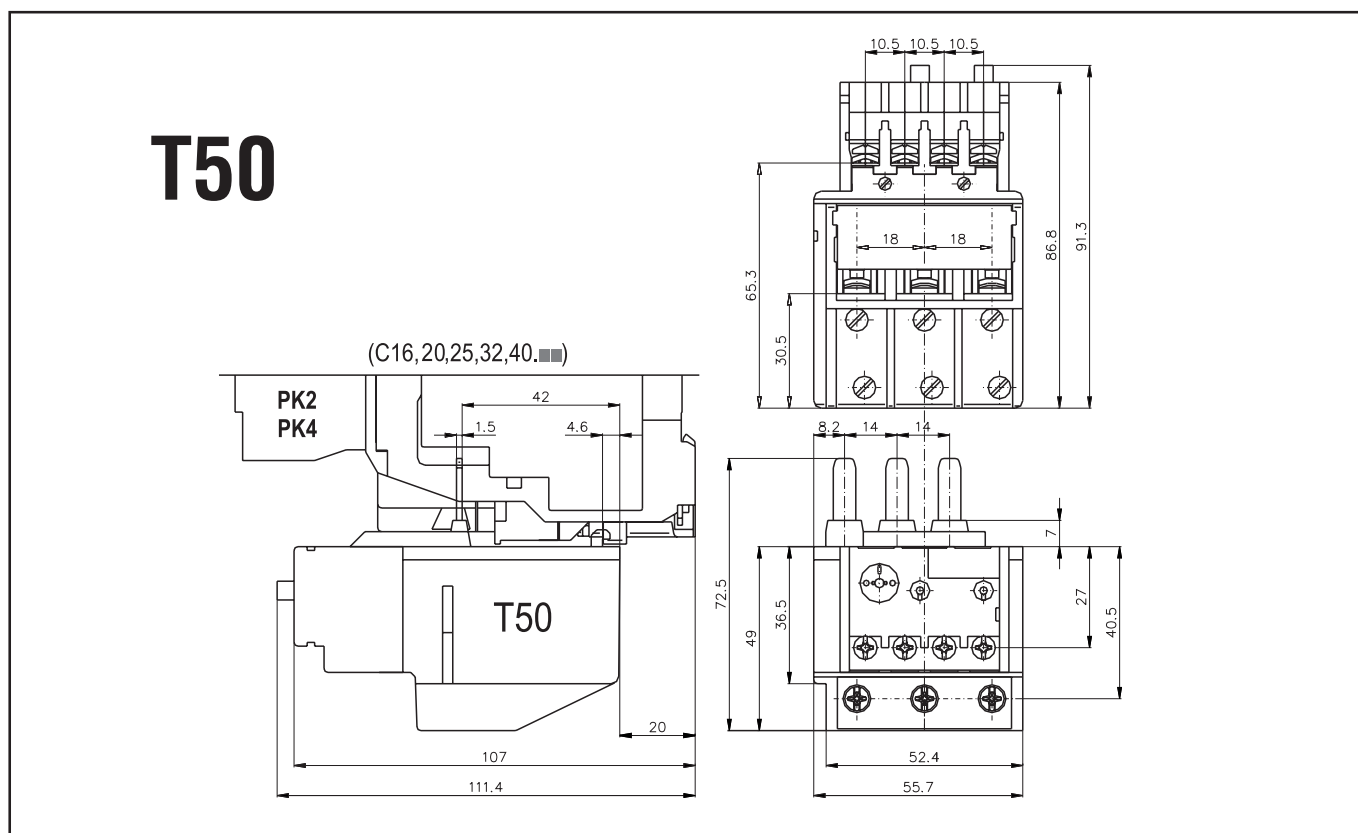
Tripping curves T63 II - two poles,
trip class 20



2.2.4 Outline drawing of T17



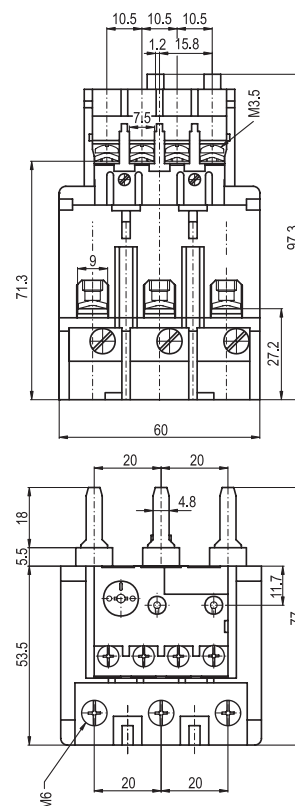
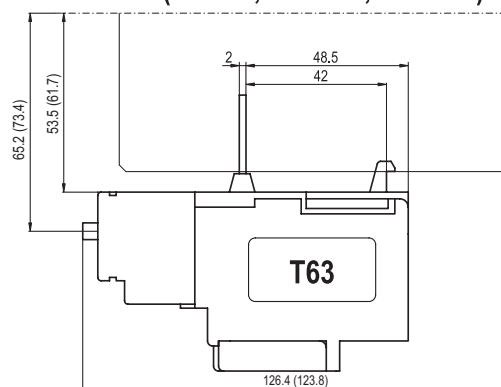
2.2.5 Outline drawing of T50



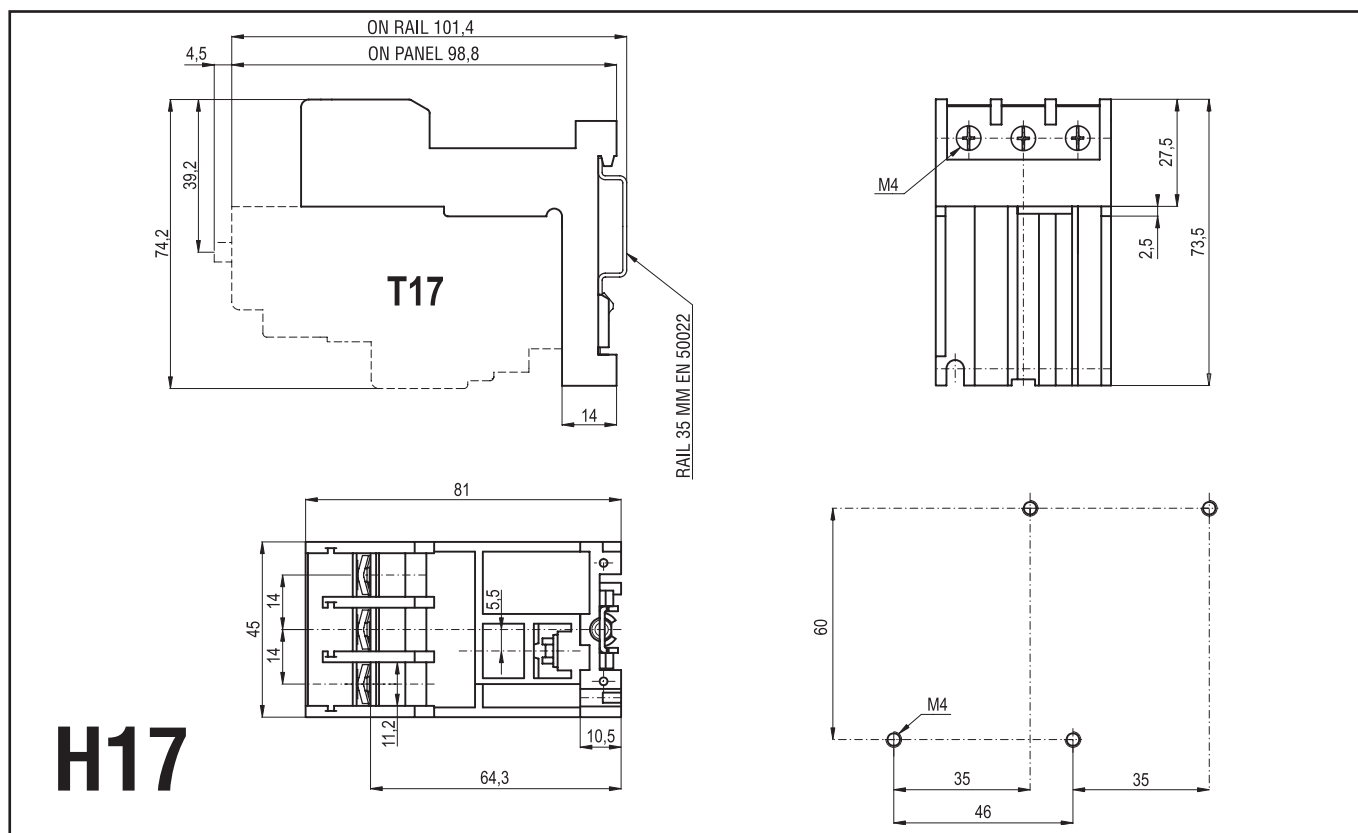
2.2.6 Outline drawing of T63

T63

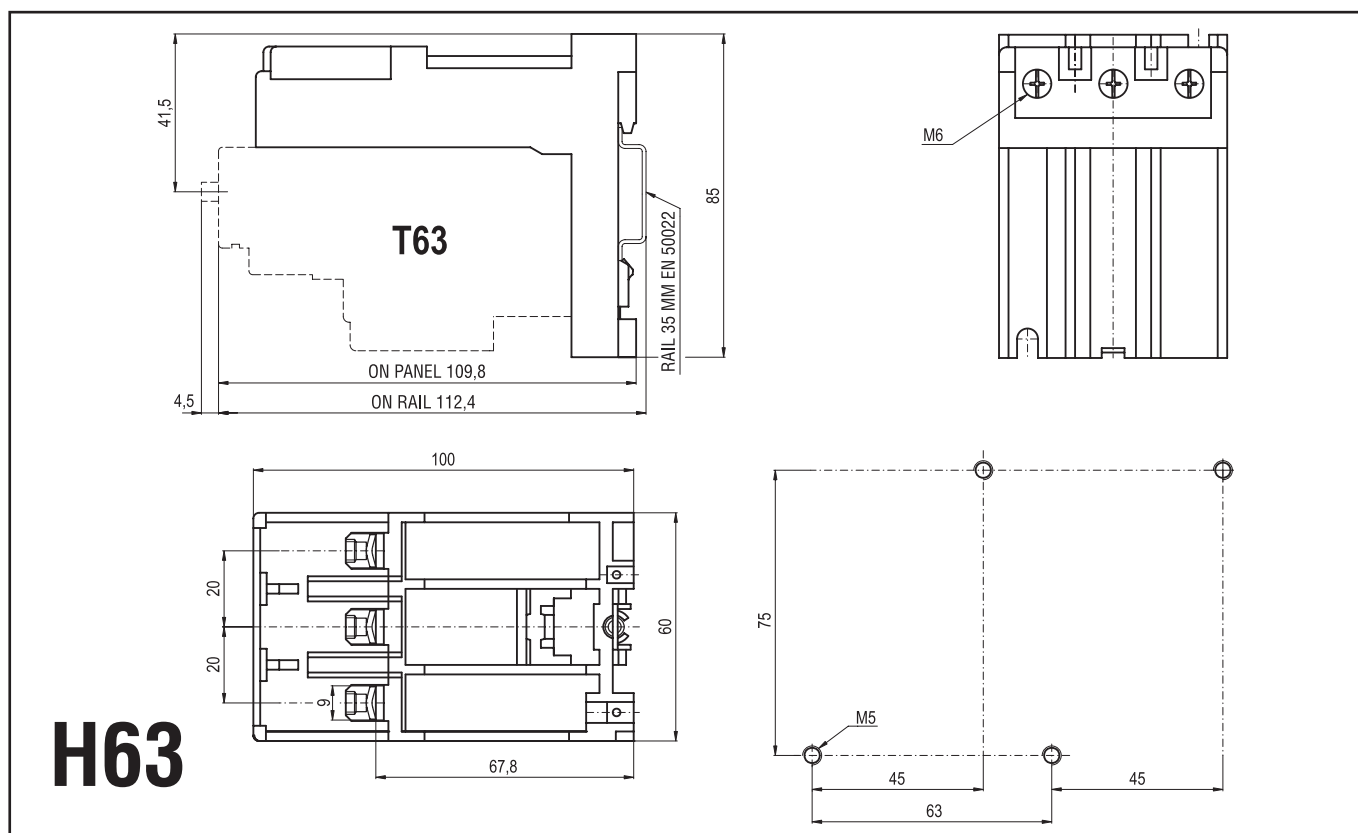
C50.■, C65.■, C80.■
(C95.■, C115.■, C150.■)



2.2.7 Outline drawing of H17



2.2.8 Outline drawing of H63



2.3 Overload protection sets

2.3.1 Overload protection above 80 A

It is recommended to use an overload protection set consisting of a type T17I (T17II) 1 A relay and 3 pcs of series M current transformers. Such a set has such high short-circuit resistance, that the short circuit protection recommended for contactors is sufficient to protect the entire assembly of contactor and overload protective set. The transformers have been designed and tested according to EN 60044-1.

Transformers are only supplied in the climate-proof version, and can therefore operate under the wide conditions of climate group "G" according to IEC 721-2-1.

Table-No. 39 – Rating

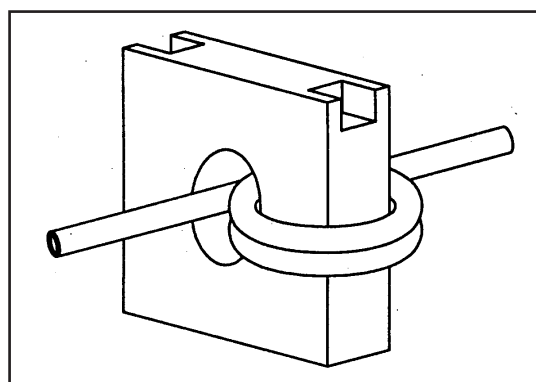
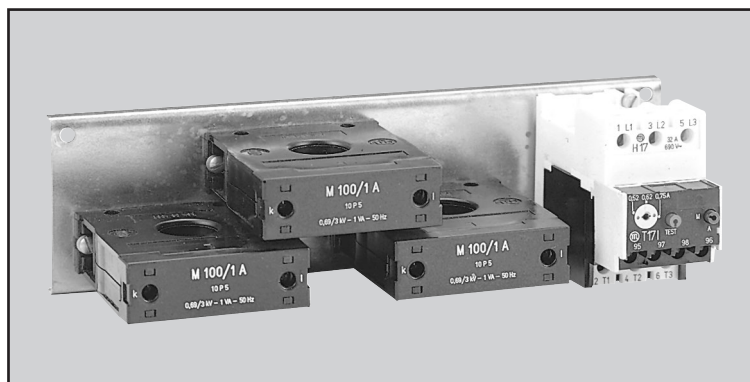
Type	M100	M145	M210	M300	M430	M630	M900	M1100
Nominal primary current [A]	100	145	210	300	430	630	900	1100
Secondary tripping current [A]	1	1	1	1	1	1	1	1
Rated insulation voltage [V]	690	690	690	690	690	690	690	690
Test voltage [V]	3	3	3	3	3	3	3	3
Range of operational frequencies [Hz]	42..60	42..60	42..60	42..60	42..60	42..60	42..60	42..60
Nominal secondary load [VA]	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
Rated overload coefficient	P5	P5	P5	P5	P5	P5	P5	P5
Unlimited durability	/	/	/	/	/	/	/	/
Terminal type	screw	screw	screw	screw	screw	screw	screw	screw
Terminal screw size	M3,5	M3,5	M3,5	M3,5	M3,5	M3,5	M3,5	M3,5
Rigid conductor cross-section [mm ²]	1..2,5	1..2,5	1..2,5	1..2,5	1..2,5	1..2,5	1..2,5	1..2,5
Flexible conductor cross-section range [mm ²]	0,75..1,5	0,75..1,5	0,75..1,5	0,75..1,5	0,75..1,5	0,75..1,5	0,75..1,5	0,75..1,5
Connectable conductor formations:								
two of the same, except for the maximum one	/	/	/	/	/	/	/	/
two of the different by one degree, except for the maximum one	/	/	/	/	/	/	/	/
the single maximum one	/	/	/	/	/	/	/	/
Marking of primary winding direction	P1; P2	P1; P2	P1; P2	P1; P2	P1; P2	P1; P2	P1; P2	P1; P2
Marking of secondary terminals	S1; S2	S1; S2	S1; S2	S1; S2	S1; S2	S1; S2	S1; S2	S1; S2
Main dimensions W × H × D [mm]	75x25x82	75x25x82	75x25x82	75x25x82	75x25x82	75x25x82	75x25x82	75x25x82
Mass [kg]	0,281	0,217	0,180	0,178	0,148	0,145	0,145	0,145
Degree of protection	IP20	IP20	IP20	IP20	IP20	IP20	IP20	IP20

All terminals facilitate the connection of either a single conductor, or two of the same conductors resp. by cross-sections differing by one degree.

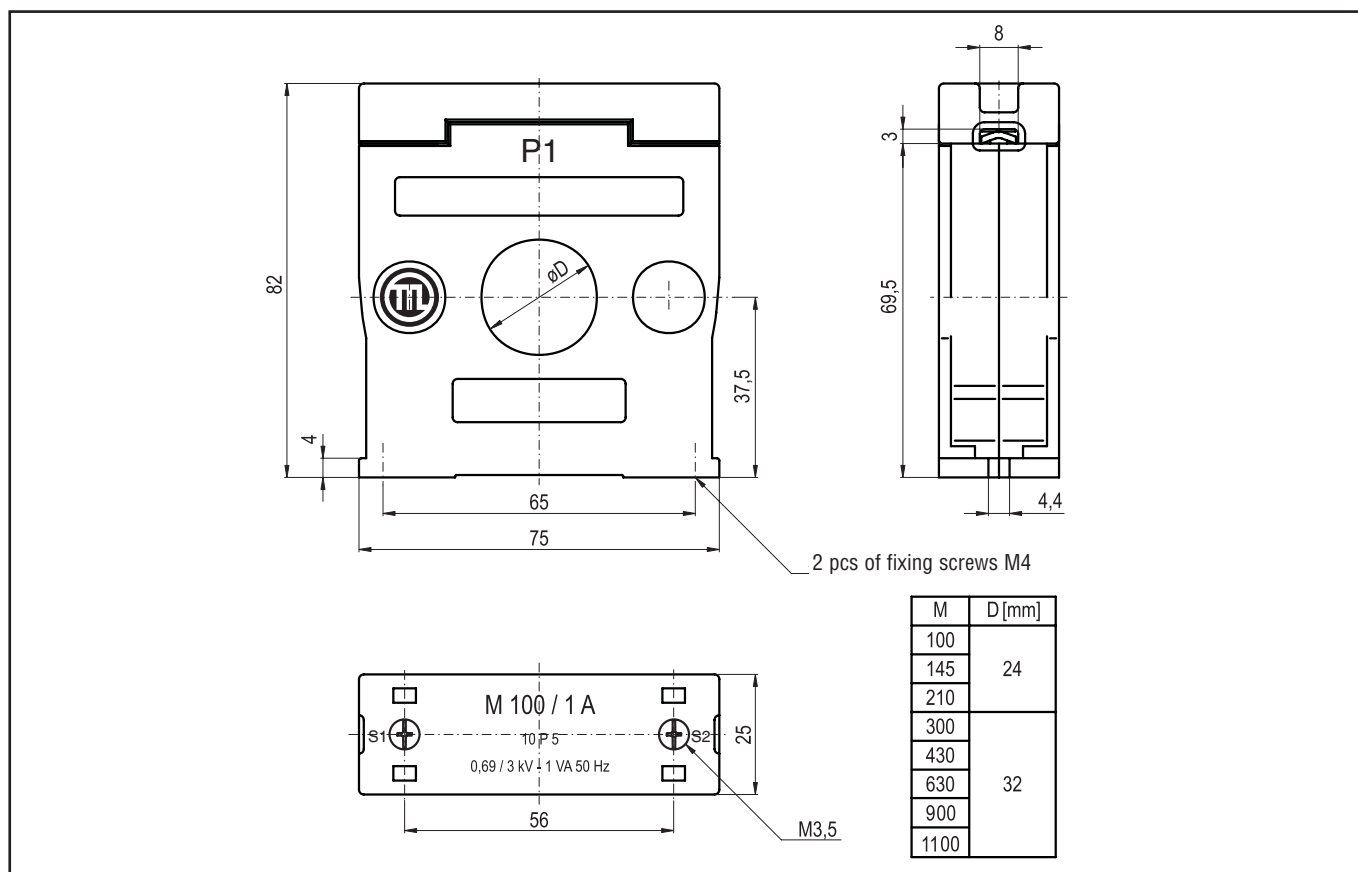
All screws have the combined slot [PH2 + simple].

Flexible conductors must not be compacted by brazing!

Passing of primary conductor through the hole of transformer type „M“

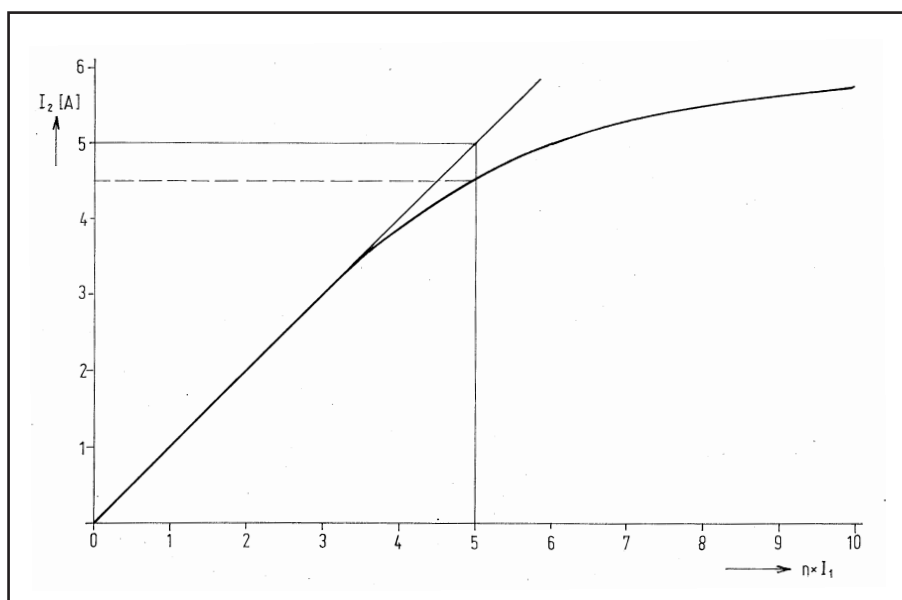


Outline drawing of protection transformers series „M“

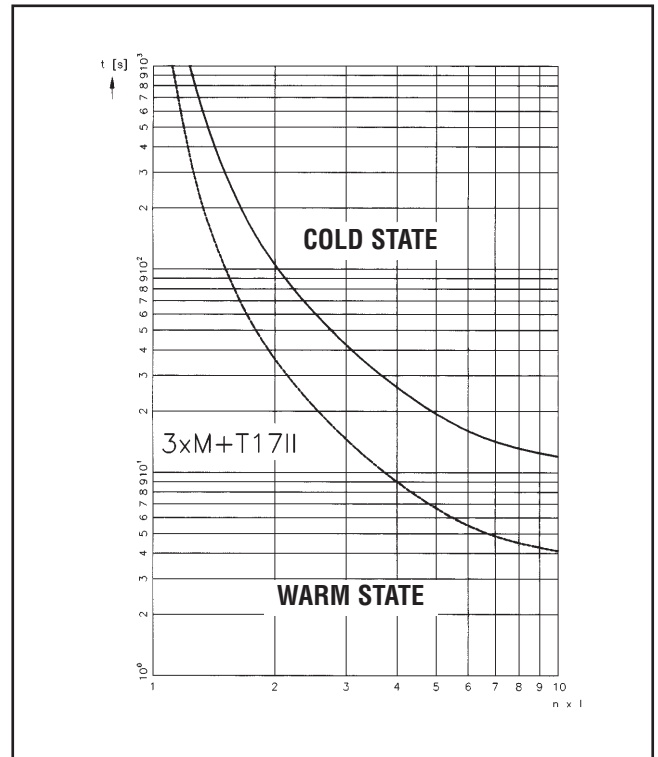
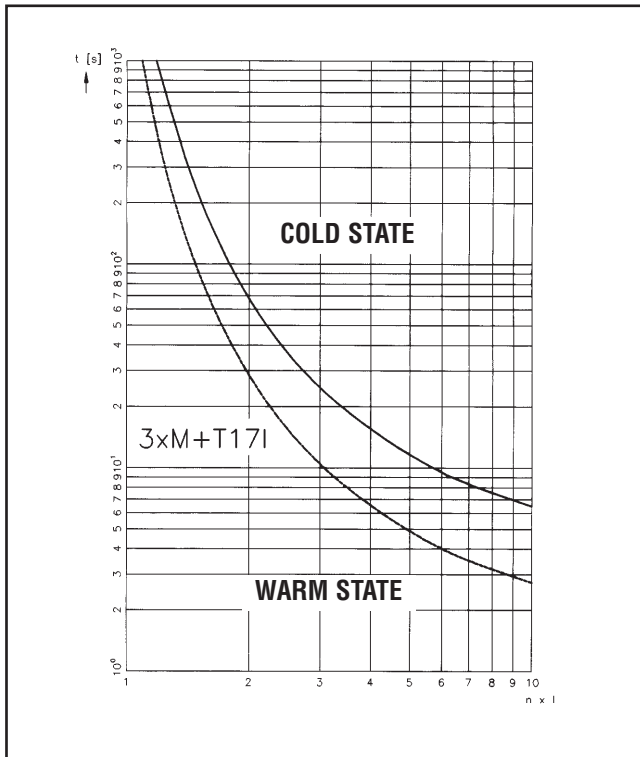


No special operational position is recommended. Transformers series „M“ can be fixed by two pieces of M4 screws.

Linearity curve of transformers series „M“ – class P5 acc. to EN 60044-1



Tripping curves of overload protection sets M + T17I, resp. M + T17II



The tripping time of a protection set consisting of T17I/1 A + 3 pcs of M is 8 seconds at the 7,2 multiplication of the relay current setting – trip class 20 acc. to EN 60 947-4-1.

The tripping time of a protection set consisting of T17II/1 A + 3 pcs of M is 18 seconds at the 7,2 multiplication of the relay current setting – trip class 30 acc. to EN 60 947-4-1.

Application of overload protection sets

The tripping current of a set depends on the number of primary conductor passes through the hole of the transformer. For instance, three passes through the hole mean two windings – refer to the figure below table-No. 37. A set with a singly-passed conductor has the tripping current range of $(0,69..1) \times I_n$, where I_n is the nominal tripping current of the transformer. Circuits with lower tripping currents can be protected by a set with multiple passes through the transformers, acc. to table-No. 40.

A singly-passed primary conductor can be bare. The hole of M100, M145 and M210 transformers allow the use of ordinary insulated conductors up to the maximum cross section of 95 mm² (max. diameter 19.5 mm). M300, M430 and M630 transformers can be used either with a conductor up to 240 mm² (max. diameter 26.5 mm) or with either a 25x16 or 30x8 mm bar.

A secondary circuit of series “M” transformers must be wired with a 1.5 mm² copper conductor with a maximum length of 4 m.

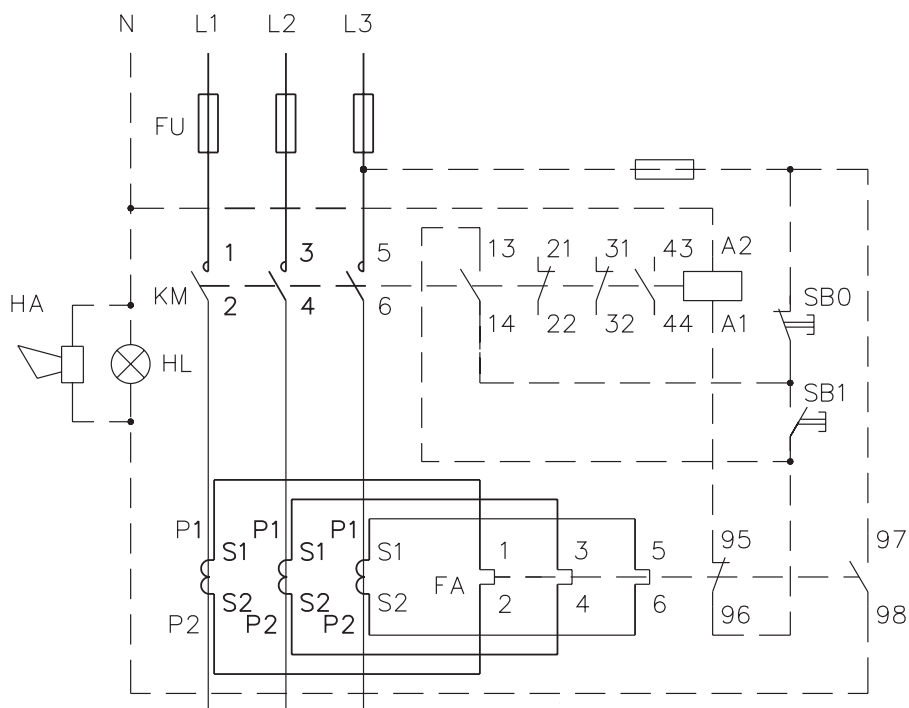
Application of overload protection sets T17 I(II)/1 A + 3 pcs of M

Table-No. 40

Nominal primary current [A]	Current setting range [A]	Transformer type M..	No. of passings through
12,5	8,6..12,5	100	8
14,3	9,9..14,3	100	7
16,7	11,5..16,7	100	6
20	13,8..20	100	5
25	17,3..25	100	4
33,3	23..33,3	100	3
48,3	33,3..48,3	145	3
50	34,5..50	100	2
72,5	50..72,5	145	2
100	69..100	100	1
145	100..145	145	1
210	145..210	210	1
300	207..300	300	1
430	297..430	430	1
630	435..630	630	1
900	612..900	900	1
1 100	790..1 100	1100	1

Note: Phase-loss sensitivity is mostly effective within the upper part of the tripping current range. Overload protection sets are also applicable at other main frequencies within the range of 42-60 Hz, in which the variation of the tripping time is not significant.

Circuit diagram of overload protection set with contactor and auxiliary circuit



2.3.2 Example of order

Type	No. of pcs
Relay T50I 35 A	5 pcs
Relay T63I 80 A	5 pcs
Adaptor H63	5 pcs
Relay T17II/ 1 A	1 piece
Protection transformer M630	3 pcs
Adaptor H17	1 piece
Protection set M145	2 pcs (6 pcs of M145, 2 pcs of T17I/1 and 2 pcs of adaptor H17 will be delivered)

3.1 General

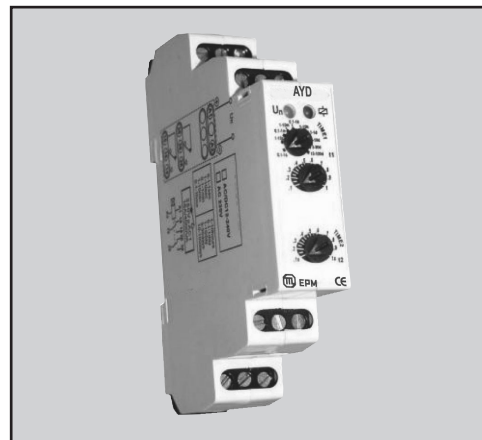
3.1.1 Product range

AYD – timer for star-delta starters
AAC – asymmetric cycler
ATM1, ATM3 – multifunction timing relays

3.1.2 Standards

EN 61812-1, EN 50081, EN 61000

3.1.3 Technical data – Table No. 41

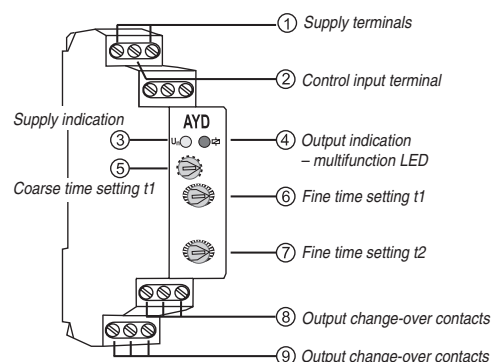


	AYD	AAC	ATM1	ATM3
Number of functions Supply	1 A1-A2	2 A1-A2	10 A1-A2	
Supply voltage UNI Power consumption	AC/DC 12..240 V/50-60Hz AC 0,7-3 VA/DC 0,5-1,7 W	AC/DC 12..240 V/50-60Hz AC 0,7-3 VA/DC 0,5-1,7 W	AC/DC 12..240 V/50-60Hz AC 0,7-3 VA/DC 0,5-1,7 W	
Supply voltage tolerance $\pm 15\%$ Supply indication Time ranges Time setting Time deviation Repeat accuracy Temperature coefficient	$\pm 15\%$ green LED 0,1 s..100 days rotary switch + potentiometer 5 % (mechanical setting) 0,2 % – (set value stability) 0,01 %/K at 20 °C	green LED 0,1 s..100 days rotary switch + potentiometer 5 % (mechanical setting) 0,2 % – (set value stability) 0,01 %/K at 20 °C	$\pm 15\%$ green LED 0,1 s..10 days rotary switch + potentiometer 5 % (mechanical setting) 0,2 % – (set value stability) 0,01 %/K at 20 °C	
No. of the output change-over contacts Rated op. current Breaking capacity in AC-1 [VA] Peak current	2 16 A/AC-1 4 000 VA/384 W 30 A/<3 s	1 16 A/AC-1 4 000 VA/384 W 30 A/<3 s	1 16 A/AC-1 4 000 VA/384 W 30 A/<3 s	3 8 A/AC-1 2 000 VA/192 W 10 A/<3 s
Rated op. voltage Min. DC output load Output signalization Mechanical durability [op. cycles] Electrical durability [op. cycles] Max. recovery time period [ms] Operational ambient temperature range Storage ambient temperature range Dielectric strength Mounting position Mounting Degree of protection Max. wire cross-section Outline dimensions [mm]	250 V AC1/24 V DC 500 mV multifunction red LED max. 150 ms –20..60 °C –30..70 °C 2,5 kV any on a 35-mm rail acc. to EN 50022 IP20 2,5 mm ² 90 x 17,6 x 65	250 V AC1/24 V DC 500 mV multifunction red LED max. 150 ms –20..60 °C –30..70 °C 2,5 kV any on a 35-mm rail acc. to EN 50022 IP20 2,5 mm ² 90 x 17,6 x 65	250 V AC1/24 V DC 500 mV multifunction red LED max. 150 ms –20..60 °C –30..70 °C 2,5 kV any on a 35-mm rail acc. to EN 50022 IP20 2,5 mm ² 90 x 17,6 x 65	
Mass [g]	93	68	68	93

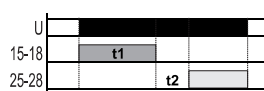
3.2 AYD – timer for star-delta starters

Features

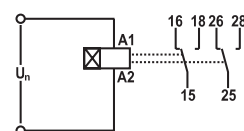
- determined for star-delta motor starters;
- modular width 17,6 mm
- the rotary switch provides a coarse time setting t_1 – STAR connection – in ten ranges, covering the time period from 0,1 s up to 100 days;
- fine setting of t_1 by the first potentiometer
- fine setting of t_2 – PAUSE - by the second potentiometer



Function diagram



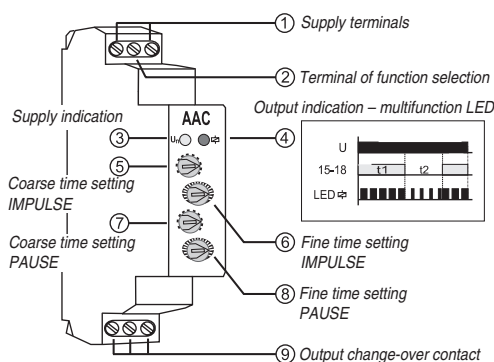
Circuit diagram



3.3 AAC – asymmetric cycler

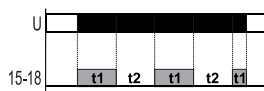
Features

- timing function 1 – cycler starting by an IMPULSE
- timing function 2 – cycler starting by a PAUSE
- two rotary switches provide coarse time settings in ten ranges, covering the time period from 0,1 s up to 100 days;
- two potentiometers enable fine time settings within the selected ranges

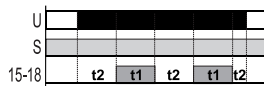


Function diagram

cycler starting by an IMPULSE

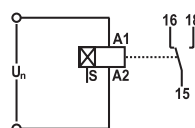


cycler starting by a PAUSE

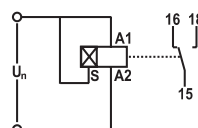


Circuit diagram

cycler starting by an IMPULSE



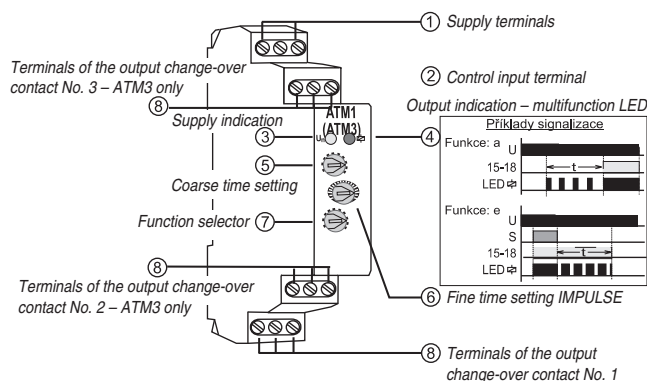
cycler starting by a PAUSE



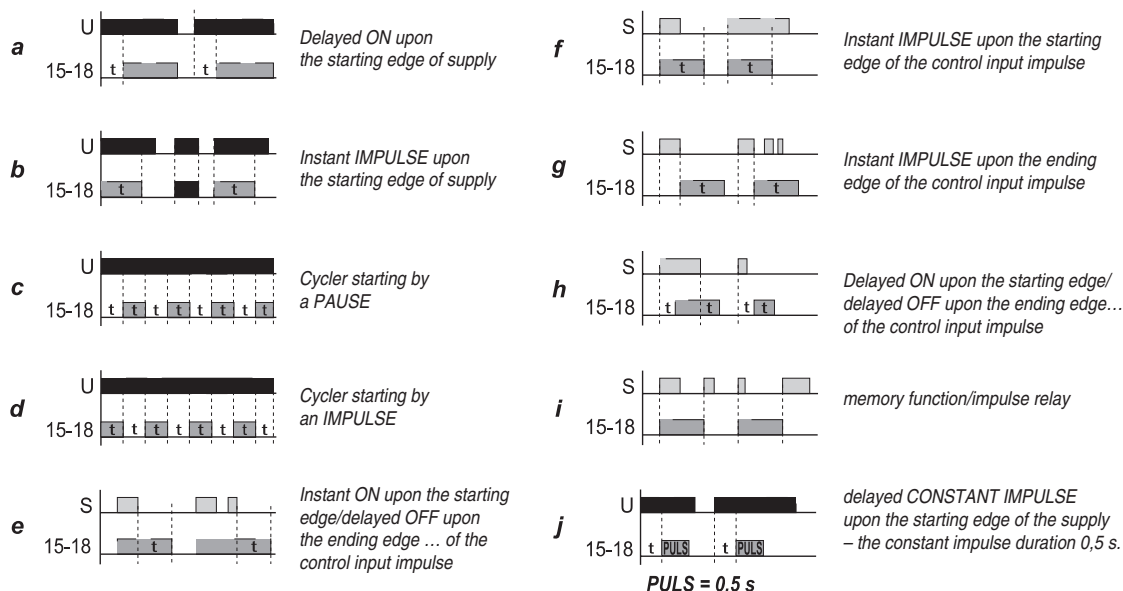
3.4 ATM1, ATM3 – multifunction timing relays

Features

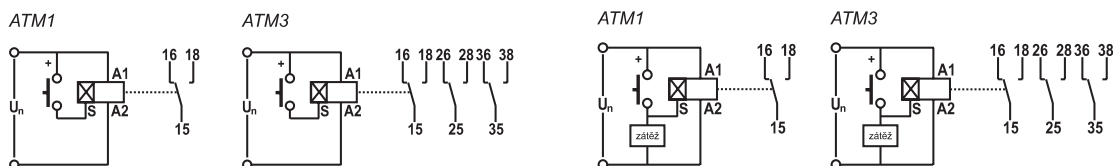
- ten timing functions
- five timing functions started by a supply impulse
- four timing functions started upon a control input impulse
- memory function/impulse relay
- the first rotary switch provides a coarse time setting in ten ranges, covering the time period from 0,1 s up to 10 days;
- the potentiometer enables a fine time setting within the selected range
- the second rotary switch selects the timing function
- blinking of the multifunction red LED indicates any timing function
- the lighting multifunction LED indicates switching-over of the output contact
- Warning! The output contacts of the ATM3 are capable of neither three phase-operations nor the switching of any two different phase voltages!



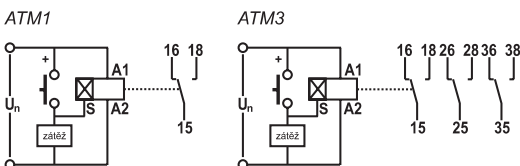
Functions and function diagrams



Circuit diagrams

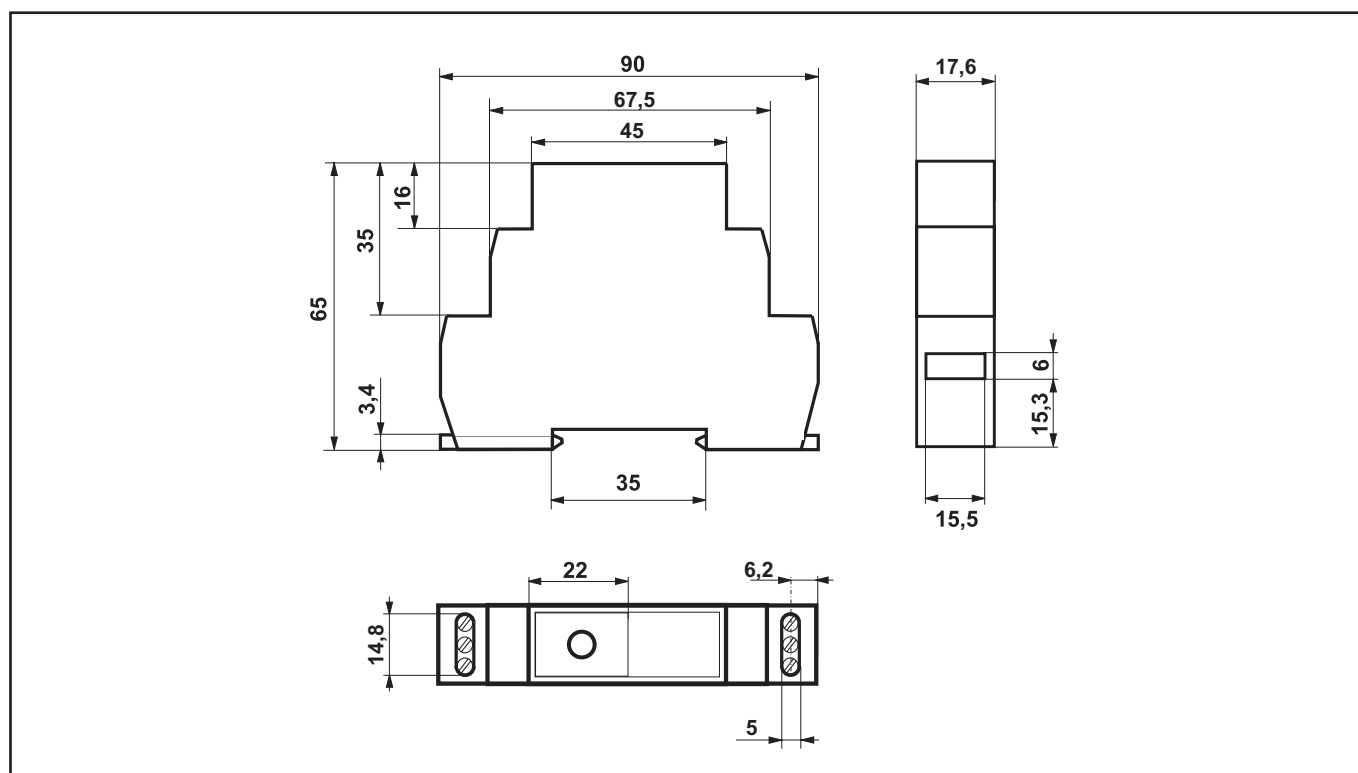


Connection of the load and the control input



It is allowed to connect e. g. a contactor, a control light or another load parallel to the terminals S-A2 without any affection of the proper operation of the timing relay type ATM1 or ATM3.

3.5 Outline drawing (common for all types of timing relays)



3.6 Example of order

Type	No. of pcs
AYD	6
ATM1	3

4.1 General

4.1.1 Utilization

Motor starters contain the parts necessary for controlling motors – contactors and overload protection devices. An overload relay or an overload protection set provide no short circuit protection, meaning that fuses or a circuit breaker are required.

Direct starters are designed for frequent direct switching where remote and/or local control is required. Reversing starters are electrically interlocked units consisting of two contactors with (or without) overload protection devices. Mechanically interlocked blocking units can be used separately or with star-delta starters for a safe and sparing motor start.

4.1.2 Standards

Motor starters have been developed, tested and approved according to the EN 60947-4-1. They comply with the requirements of EN 61010-1, overvoltage category III, pollution degree 2, test voltage 4 350 V/50..60 Hz (Table-No. D6).

To maintain the clearances required inside the starters that contain series V..F contactors, it is necessary to apply insulating couplings onto the cable lugs near the mounting panel.

4.1.3 Operating conditions

EN 60947-4-1 provides specific operating conditions for starters.

Motor starters containing contactors up to size V170F are supplied in a climate-proof version.

The climate-proof starters can operate under the wide conditions of climate group “G” according to IEC 721-2-1. These starters comply with the same requirements and standards as the contactors.

Motor starters type SVH250 and SVH440 can be supplied in either a normal version (the “normal” industrial environment being defined by EN 60947-1), or in a climate proof version for group “G” (see above).

Starters must be mounted vertically on the panel or rail so that the markings are legible in an ordinary horizontal position. The maximum allowed deviation from the vertical position is 10°.

4.1.4 Table-No. 39 – Terminals

Motor starter	Main poles				Auxiliary contacts and coil terminals			
	Terminal type	Screw size			Terminal type	Screw size	Conductor cross-section [mm²]	
			Rigid	Flexible			Rigid	Flexible
SC9, 12, 17, 23	screw type	M3,5	1..4	0,75..2,5	screw type	M3,5	1..2,5	0,75..1,5
SBC9, 12, 17, 23	screw type	M3,5	1..4	0,75..2,5	screw type	M3,5	1..2,5	0,75..1,5
SRC9, 12, 17, 23	screw type	M3,5	1..4	0,75..2,5	screw type	M3,5	1..2,5	0,75..1,5
SYD9, 12, 17, 25	screw type	M3,5	1..4	0,75..2,5	screw type	M3,5	1..2,5	0,75..1,5
SC20, 25, 32, 40	pillar type	M5	1,5..10	1,5..10	screw type	M3,5	1..2,5	0,75..1,5
SBC20, 25, 32, 40	pillar type	M5	1,5..10	1,5..10	screw type	M3,5	1..2,5	0,75..1,5
SRC20, 25, 32, 40	pillar type	M5	1,5..10	1,5..10	screw type	M3,5	1..2,5	0,75..1,5
SYD25, 32	pillar type	M5	1,5..10	1,5..10	screw type	M3,5	1..2,5	0,75..1,5
SC50, 65, 80	pillar type	M6	2,5..16	1,5..25	screw type	M3,5	1..2,5	0,75..1,5
SBC50, 65, 80	pillar type	M6	2,5..16	1,5..25	screw type	M3,5	1..2,5	0,75..1,5
SRC50, 65, 80	pillar type	M6	2,5..16	1,5..25	screw type	M3,5	1..2,5	0,75..1,5
SYD50, 65, 80	pillar type	M6	2,5..16	1,5..25	screw type	M3,5	1..2,5	0,75..1,5
SC95, 115, 150	pillar type	M8	2,5..16	1,5..25	screw type	M3,5	1..2,5	0,75..1,5
SRC95, 115, 150	pillar type	M8	2,5..16	1,5..25	screw type	M3,5	1..2,5	0,75..1,5
SYD95, 115, 150	pillar type	M8	2,5..16	1,5..25	screw type	M3,5	1..2,5	0,75..1,5
SV85, 105	lug type	M6	-	10..35	screw type	M3,5	1..2,5	0,75..1,5
SBV85, 105	lug type	M6	-	10..35	screw type	M3,5	1..2,5	0,75..1,5
SRV85, 105	lug type*	M6	-	10..35	screw type	M3,5	1..2,5	0,75..1,5
SYD85, 105	lug type*	M6	-	10..35	screw type	M3,5	1..2,5	0,75..1,5
SV140, 170	lug type	M10	-	25..95	screw type	M3,5	1..2,5	0,75..1,5
SBV140, 170	lug type	M10	-	25..95	screw type	M3,5	1..2,5	0,75..1,5
SRV140, 170	lug type*	M10	-	25..95	screw type	M3,5	1..2,5	0,75..1,5
SYD140, 170	lug type*	M10	-	25..95	screw type	M3,5	1..2,5	0,75..1,5
SV205, 250	lug type*	M10	-	25..95	screw type	M3,5	1..2,5	0,75..1,5
SRV205, 250	lug type*	M10	-	25..95	screw type	M3,5	1..2,5	0,75..1,5
SYD205, 250	lug type*	M10	-	25..95	screw type	M3,5	1..2,5	0,75..1,5
SYD300, 400	lug type*	M16/M12	-	70..240	screw type	M3,5	1..2,5	0,75..1,5
SYD500	lug type*	M16/M12	-	120..300	screw type	M3,5	1..2,5	0,75..1,5
SBVH250, 440	lug type	M12	-	70..185	screw type	M3,5	1..2,5	0,75..1,5

* IP00 version enables connection of copper bars

4.1.5 Equipment of motor starters

The motor starter boxes are equipped with bushings according to the table below:

Series SC, SV, SRC, SRV	
C9, C12, C17, C23	2 x Pg16 + Pg13,5
C16, C20, C25, C32, C40	2 x Pg21 + Pg13,5
C50, C65, C80	2 x Pg29 + Pg13,5
C95, C115, C150	2 x Pg42 + Pg13,5
V85, V105	3 x Pg36 + Pg13,5
V140, V170	2 x Pg42 + Pg13,5
V205, V250	2 x Pg48 + Pg13,5

Series SYD	
C9, C12	3 x Pg16 + Pg13,5
C17, C23, C25	3 x Pg21 + Pg13,5
C32, C40	3 x Pg29 + Pg13,5
C50, C65	3 x Pg36 + Pg13,5
C80, C95, V105	3 x Pg42 + Pg13,5
V140, V170	3 x Pg48 + Pg13,5

Overload protection optional short-circuit protection or position, number and diameter of bushings can be subject to an agreement with the customer.

Table No. 43 – Overload protection

Direct or reversing starter type	Overload protective of main circuit	Nominal current of the fuse link in control circuit (reversing or Y/D starters)
SC9, SRC9	3 A, 4,3 A, 6,3 A, 9 A (or even less)	–
SC12, SRC12	13 A	–
SC17, SRC17	19 A	–
SC20, SRC20	19 A, 25 A	–
SC23, SRC23	19 A, 25 A	–
SC25, SRC25	25 A	–
SC32, SRC32	32 A	–
SC40, SRC40	25, 35, 50 A	–
SC50, SRC50	21 A, 30 A, 43 A, 63A	–
SC65, SRC65	63 A	–
SC80, SRC80	80 A	–
SC95, SRC95	80 A, resp. 1 ks T17 I 1 A + 3 pcs of protection transformer M100	4 A
SC115, SRC115	1 pc relay T17-1 A + 3 pcs of protection transformer M100, M145	4 A
SC150, SRC150	1 pc relay T17 I 1 A + pcs of protection transformer M145	4 A
SV85, SRV85	1 pc relay T17-1 A + 3 pcs of protection transformer M100, M145 (2 passings through)	4 A
SV105, SRV105	1 pc relay T17-1 A + 3 pcs of protection transformer M100, M145	4 A
SV140, SRV140	1 pc relay T17-1 A + 3 pcs of protection transformer M145	4 A
SV170, SRV170	1 pc relay T17-1 A + 3 pcs of protection transformer M210	4 A
SV205, SRV205	1 pc relay T17-1 A + 3 pcs of protection transformer M210	–
SV250, SRV250	1 pc relay T17-1 A + 3 pcs of protection transformer M300	–
Star-delta starter type		
SYD9	relay T17 I 4,3 A – mains current range 5,2-7,4 A	–
SYD9	relay T17 I 6,3 A – mains current range 7,5-10,9 A	–
SYD9	relay T17 I 9 A – mains current range 10,8-15,5 A	–
SYD12	relay T17 I 13 A – mains current range 15,5-22,5 A	–
SYD17	relay T17 I 19 A – mains current range 22,7-32,9 A	–
SYD23	relay T17 I 25 A – mains current range 30-43 A	–
SYD25	relay T17 I 25 A – mains current range 30-43 A	–
SYD32	relay T50 I 35 A – mains current range 42-60,5 A	–
SYD40	relay T50 I 50 A – mains current range 60-86,5 A	–
SYD50	relay T63 I 63 A – mains current range 74-109 A	–
SYD65	relay T63 I 63 A – mains current range 74-109 A	–
SYD80	relay T63 I 80 A – mains current range 95-138 A	–
SYD95	relay T17 I 1 A + 3 pcs of protection transformer M100 mains current range 119-173 A	4 A
SYD105	relay T17 I 1 A + 3pcs of protection transformer M100 mains current range 119-173 A	4 A
SYD140	relay T17 I 1 A + 3 pcs of protection transformer M145 mains current range 173-250 A	4 A
SYD170	relay T17 I 1 A + 3 pcs of protection transformer M210 mains current range 250-363 A	4 A
SYD205	relay T17 I 1 A + 3 pcs of protection transformer M210 mains current range 250-363 A	4 A
SYD250	relay T17 I 1 A + 3 pcs of protection transformer M300 mains current range 358-519 A	4 A
SYD300	relay T17 I 1 A + 3 pcs of protection transformer M430 mains current range 514-744 A	4 A
SYD400	relay T17 I 1 A + 3 pcs of protection transformer M430 mains current range 514-744 A	4 A
SYD500	relay T17 I 1 A + 3 pcs of protection transformer M630 mains current range 753-1090 A	4 A

Thermal overload relays used in starters can be set within the range $(0,69..1) I_n$ and the starter can be equipped either with a relay for normal motor start (characteristics „I“) or for heavy start (characteristics „II“). The conductor must be passed through the hole of the protection transformer, refer to the chapter „Overload protection sets“.

4.1.6 Packing and stocking

The unit's package protects the product against possible damages that could occur during transport and stocking. All starters must be stored in dry rooms sheltered from bad weather conditions. Relative humidity must never exceed 80 % at 20 °C. The unit's packaging is made from recyclable materials.

4.2 Direct on-line motor starters

4.2.1 Utilization

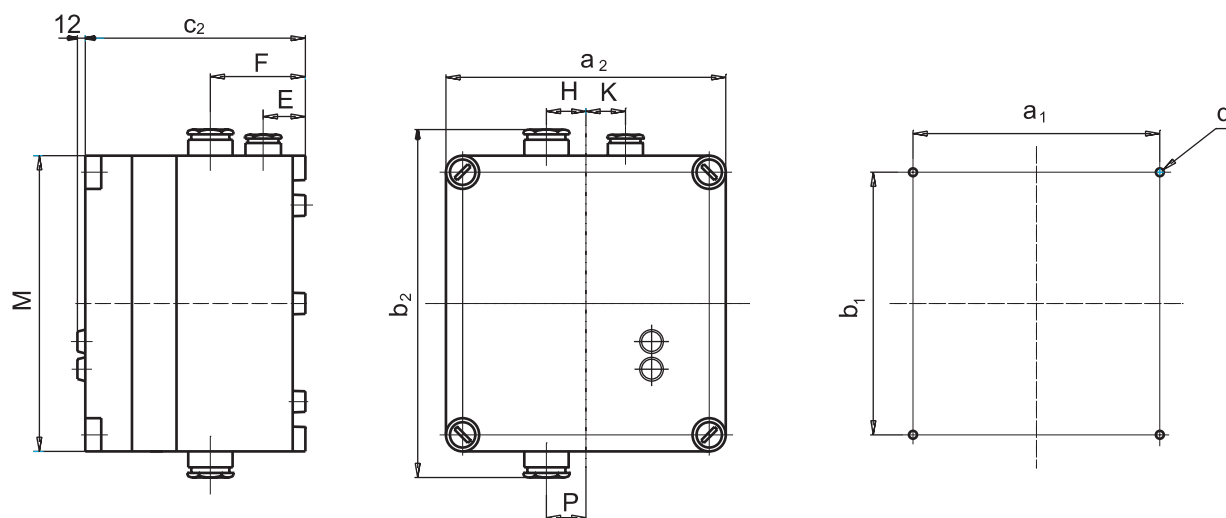
Direct on-line starters are designed for frequent direct switching where remote and/or local control is required.

4.2.2 Table No. 44 – Rating

Type	SC9	SC12	SC17	SC20	SC23	SC25	SC32	SC40
Rated insulation voltage U_i [V]	690	690	690	690	690	690	690	690
Conventional thermal current I_{th} [A]	25	25	25	40	25	40	40	40
Rated operational current I_e v AC-3 at 400 V [A]	9	12	16	20	23	25	32	40
Max. motor output in AC-3								
at AC-3 400 V	4	5,5	7,5	10	11	11	15	20
at AC-3 500 V	5,5	7,5	9	10	11	11	18,5	25
at AC-3 690 V	5,5	7,5	9	11	11	11	18,5	18,5
Electrical durability in AC-3 at 400 V and rated operational current I_e [op. cycles]	1,5x10 ⁶	1,5x10 ⁶	1,5x10 ⁶	1,2x10 ⁶	1x10 ⁶	1x10 ⁶	1x10 ⁶	0,9x10 ⁶
Max. number of on-load op. cycles per hour in AC-3	600	600	600	600	600	600	600	600
Range of AC coil control voltages at 50 Hz [V]	12..500	12..500	12..500	12..500	12..500	12..500	12..500	12..500
at 60 Hz [V]	24..440	24..440	24..440	24..400	24..440	24..440	24..440	24..440
Mechanical durability [op. cycles]	10x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶
Degree of protection	IP65	IP65	IP65	IP65	IP65	IP65	IP65	IP65

SC50	SC65	SC80	SC95	SC115	SC150	SV85	SV105	SV140	SV170	SV205	SV250
690 80 50	690 80 65	690 80 80	690 140 95	690 140 115	690 140 140	690 105 85	690 105 105	690 170 140	690 170 170	690 250 205	690 250 250
25 30 22	30 37 30	37 45 45	45 45 37	55 55 45	75 75 50	45 45 37	55 55 45	75 75 55	90 90 75	110 132 90	132 122 110
1x10 ⁶	1x10 ⁶	0,9x10 ⁶	0,9x10 ⁶	0,7x10 ⁶	0,5x10 ⁶	0,9x10 ⁶	0,7x10 ⁶	0,65x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶
600	600	600	600	600	600	600	600	600	600	600	600
24..690 24..440 10x10 ⁶	24..690 24..440 10x10 ⁶	24..690 24..440 10x10 ⁶	24..690 24..440 5x10 ⁶	24..690 24..440 5x10 ⁶	24..690 24..440 5x10 ⁶	24..690 24..440 10x10 ⁶	24..690 24..440 10x10 ⁶	42..690 42..440 10x10 ⁶	42..690 42..440 10x10 ⁶	110..690 110..440 5x10 ⁶	110..690 110..440 5x10 ⁶
IP65	IP65	IP65	IP65	IP65	IP65	IP65	IP65	IP65	IP65	IP65	IP65

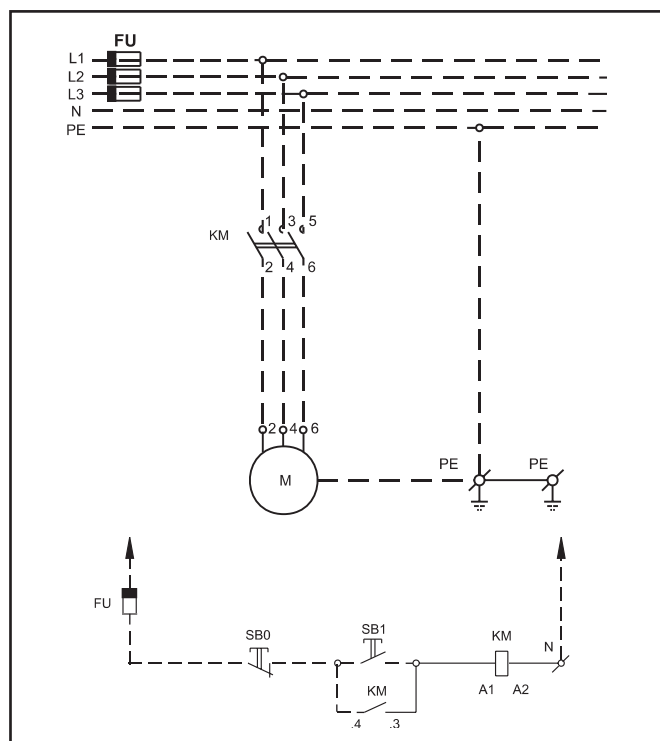
4.2.3 Outline drawings – outline drawing of direct motor starters SC9..SV170, IP65



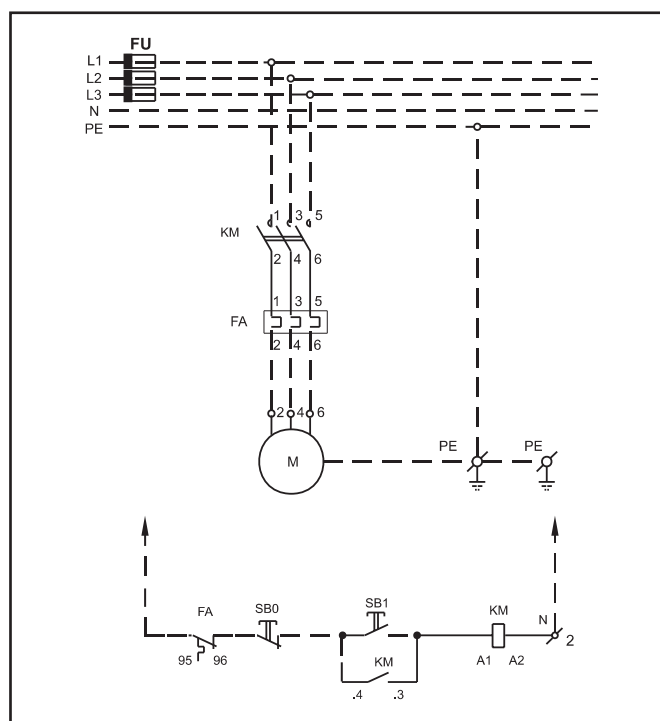
Type	a_2	b_2	c_2	a_1	b_1	d	E	F	H	K	M	P
SC9, SC12, SC17, SC23	151	229	130	131	166	M5	60	60	22,5	22,5	186	22,5
SC20, SC25, SC32, SC40	186	353	175	166	282	M5	60	60	30	30	302	25
SC50, SC65, SC80	186	364	210	166	282	M5	75	75	36,5	36,5	302	25
SC95, SC115, SC150	302	455	210	282	352	M5	90	90	0	60	372	0
SV85, SV105	302	447	210	282	352	M5	50	50	0	70	372	0
SV140, SV170	372	684	210	350	581	M5	60	60	65	115	603	65
SV205, SV250	372	710	270	350	581	M5	65	65	70	115	603	70

4.2.4 Circuit diagrams

Circuit diagram of direct motor starters SC, SV without overload protection, controlled by START-STOP pushbuttons

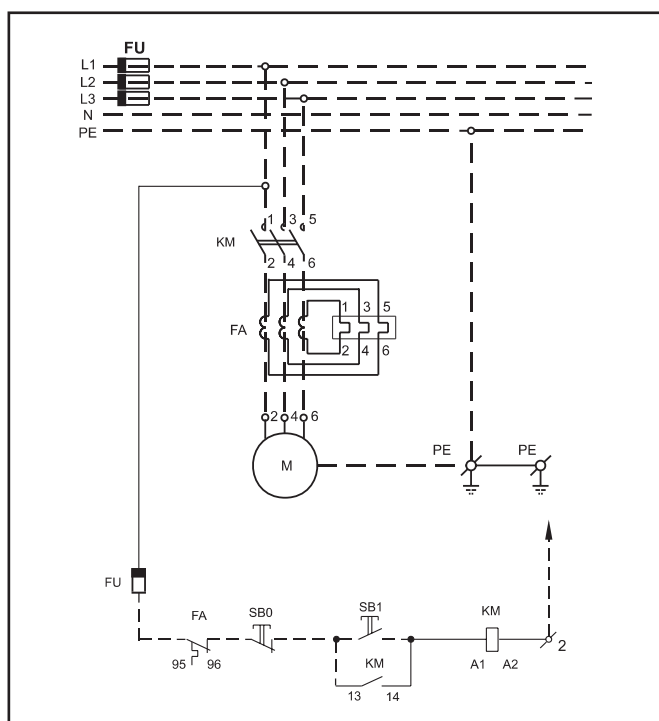


Circuit diagram of direct motor starters SC9..SC80 with overload protection, controlled by START-STOP pushbuttons



The blue reset button of the thermal overload relay T17 resp. T63 shall be in position „A“

Circuit diagram of direct motor starters SV53D or SVD900 with overload protection set, controlled by START-STOP pushbuttons



The blue reset button of the thermal overload relay T17 shall be in position „A“

4.3 Blocking unit

4.3.1 Utilization

A mechanically interlocked blocking unit consists of two contactors that are not allowed to seal at the same time, even if their coils are energized simultaneously. Built-in blocking units can be fixed by applying 2 or 4 screws to the vertical panel, so that the marking is legible in an ordinary horizontal position. Series C contactors are normally equipped with the auxiliary contact unit PK11E. Others are available on special request only. Series V..F contactors carry 2NO/2NC auxiliary contacts.

4.3.2 Table-No. 45 – Rating

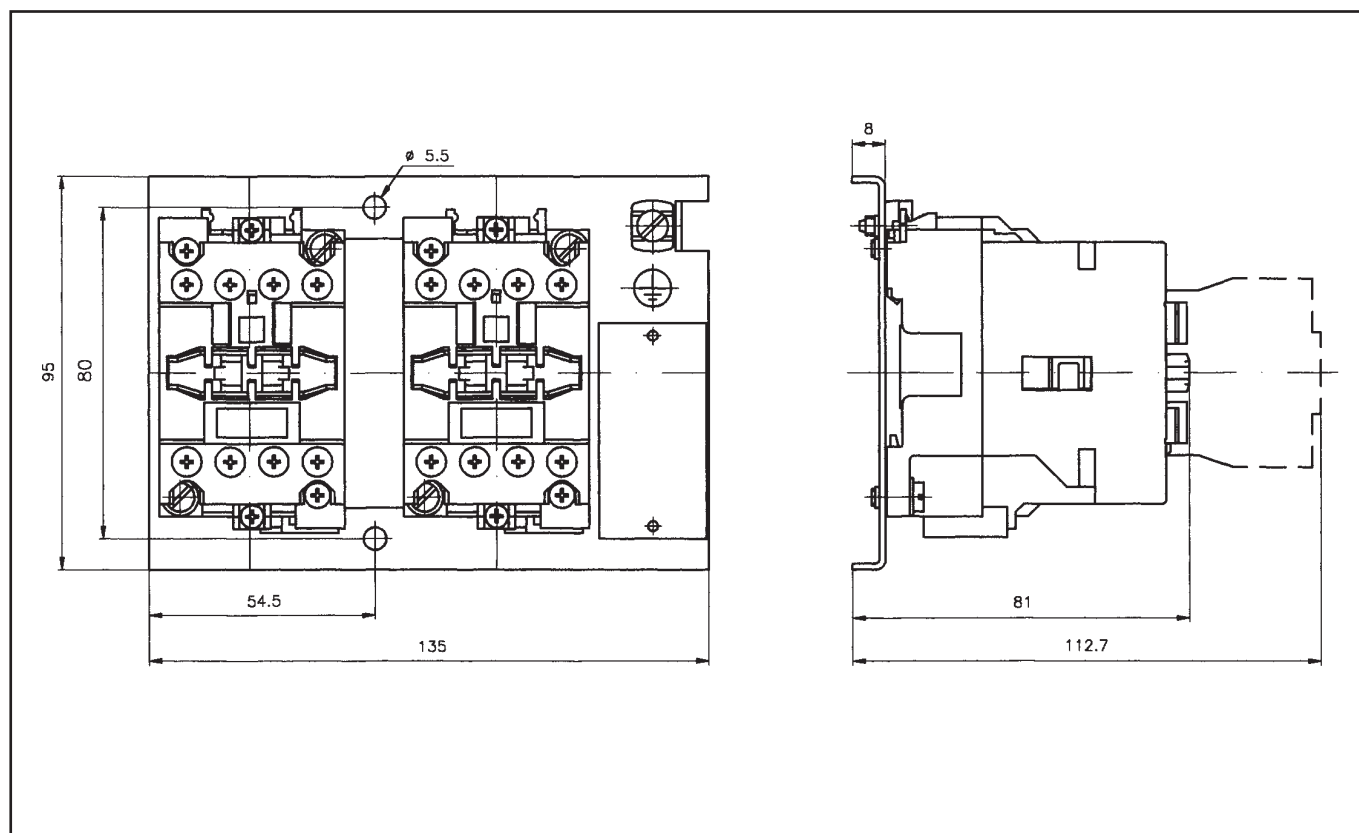
Type	SBC9	SBC12	SBC17	SBC20	SBC23	SBC25	SBC32	SBC40
Rated insulation voltage U_i [V]	690	690	690	690	690	690	690	690
Conventional thermal current I_{th} [A]	25	25	25	40	25	40	32	40
Rated operational current I_e [A]								
(AC-3) at 400 V [A]	9	12	16	20	23	25	32	40
(AC-4) at 400 V [A]	4,7	5,6	6,6	7	8	8	9,5	12
Max. number of on-load op. cycles per hour								
in AC-3 at 400 V	4	5,5	7,5	10	11	11	15	20
in AC-4 at 400 V	2	2,5	3	3	3,7	3,7	4,5	5,5
Electrical durability in AC-3, I_e at 400 V, [op. cycles]	$1,5 \times 10^6$	$1,5 \times 10^6$	$1,5 \times 10^6$	$1,2 \times 10^6$	10^6	1×10^6	10^6	$0,9 \times 10^6$
Electrical durability in AC-4, I_e at 400 V, [op. cycles]	3×10^5	3×10^5	3×10^5	3×10^5	2×10^5	3×10^5	3×10^5	2×10^5
Max. motor output								
in AC-3 at 400 V [kW]	600	600	600	600	600	600	600	600
in AC-4 at 400 V [kW]	120	120	120	120	120	120	120	120
Range of AC coil control voltages								
at 50 Hz [V]	12..500	12..500	12..500	12..500	12..500	12..500	12..500	12..500
at 60 Hz [V]	24..440	24..440	24..440	24..440	24..440	24..440	24..440	24..440
Mechanical durability	10^7	10^7	10^7	10^7	10^7	10^7	10^7	10^7
Degree of protection	IP20/IP10	IP20/IP10	IP20/IP10	IP20/IP10	IP20/IP10	IP20/IP10	IP20/IP10	IP20/IP10

Note:

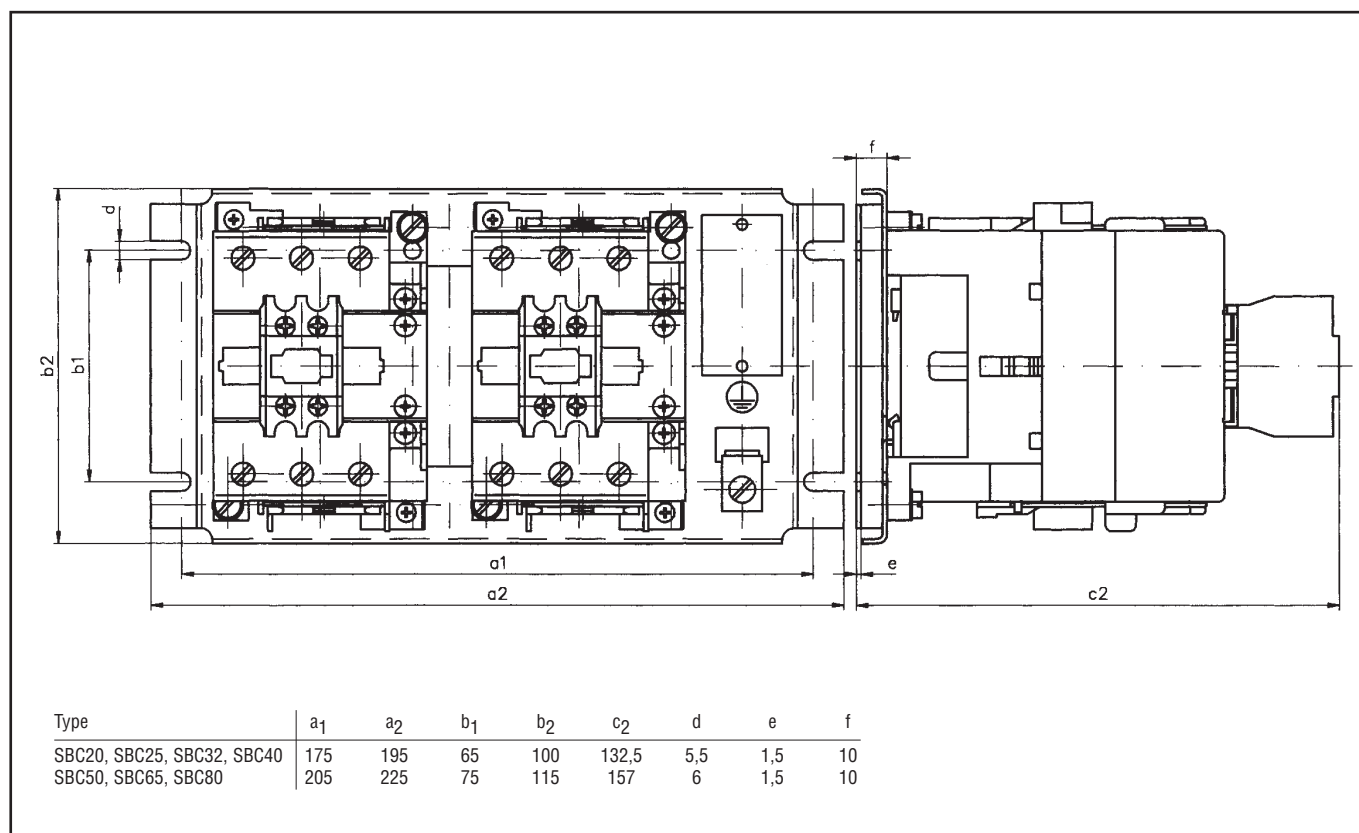
Blocking units must be wired in the way specified on the circuit diagrams for series SR reversing starters. If not, the minimum 0.1 s delay between the energizing of blocked contactors must be ensured, e. g. by means of the BT-ZP electronic timer. Neither maintenance nor replacing of contactors is allowed. Only the manufacturer can make repairs or adjustments.

SBC50	SBC65	SBC80	SBV85	SBC95	SBC115	SBC150	SBV105	SBV140	SBV170	SBVH250	SBVH440
690 85	690 85	690 85	690 140	690 150	690 150	690 150	690 140	690 190	690 190	690 450	690 520
50 15,2	65 18	80 20	85 30	95 30	115 38	150 50	105 38	140 44	170 50	300 108	500 140
25 7,5	30 9	37 10	45 15	45 15	55 18,5	75 25	55 18,5	75 22	90 25	160 55	280 75
10 ⁶ 3x10 ⁵	10 ⁶ 3x10 ⁵	0,9x10 ⁶ 2x10 ⁵	0,9x10 ⁶ 3x10 ⁵	0,9x10 ⁶ 3x10 ⁵	0,7x10 ⁶ 3x10 ⁵	0,5x10 ⁶ 2x10 ⁵	0,7x10 ⁶ 3x10 ⁵	0,65x10 ⁶ 3x10 ⁵	0,5x10 ⁶ 3x10 ⁵	0,5x10 ⁶ 2x10 ⁵	0,5x10 ⁶ 2x10 ⁵
600 120	600 120	300 120	300 120	300 120	300 120	180 120	120 120	120 120	120 120	180 120	120 120
24..690 24..440 10 ⁷	12..500 24..440 10 ⁷	24..690 24..440 10 ⁷	24..690 24..440 5x10 ⁶	24..690 24..440 5x10 ⁶	24..690 24..440 5x10 ⁶	24..690 24..440 10 ⁷	24..690 24..440 10 ⁷	42..690 42..440 10 ⁷	42..690 42..440 10 ⁷	110..690 127..440 5x10 ⁶	110..690 127..440 5x10 ⁶
IP20/IP10	IP20/IP10	IP20/IP10	IP00	IP00	IP00	IP00	IP00	IP00	IP00	IP00	IP00

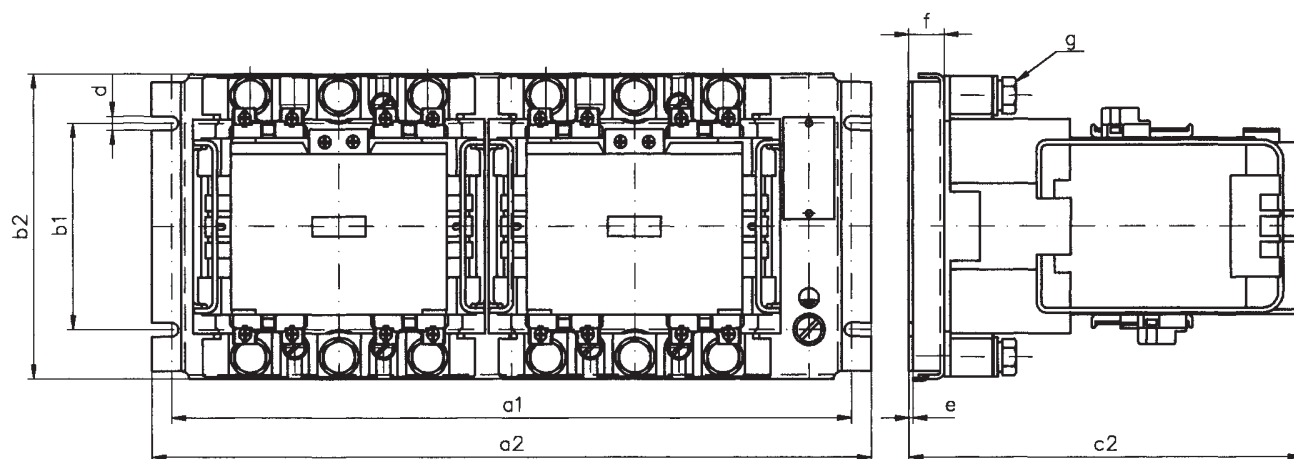
4.3.3 Outline drawings – outline drawing of blocking units SBC9, SBC12, SBC17, SBC23



Outline drawing of blocking units SBC20, SBC25, SBC32, SBC40, SBC50, SBC65, SBC80

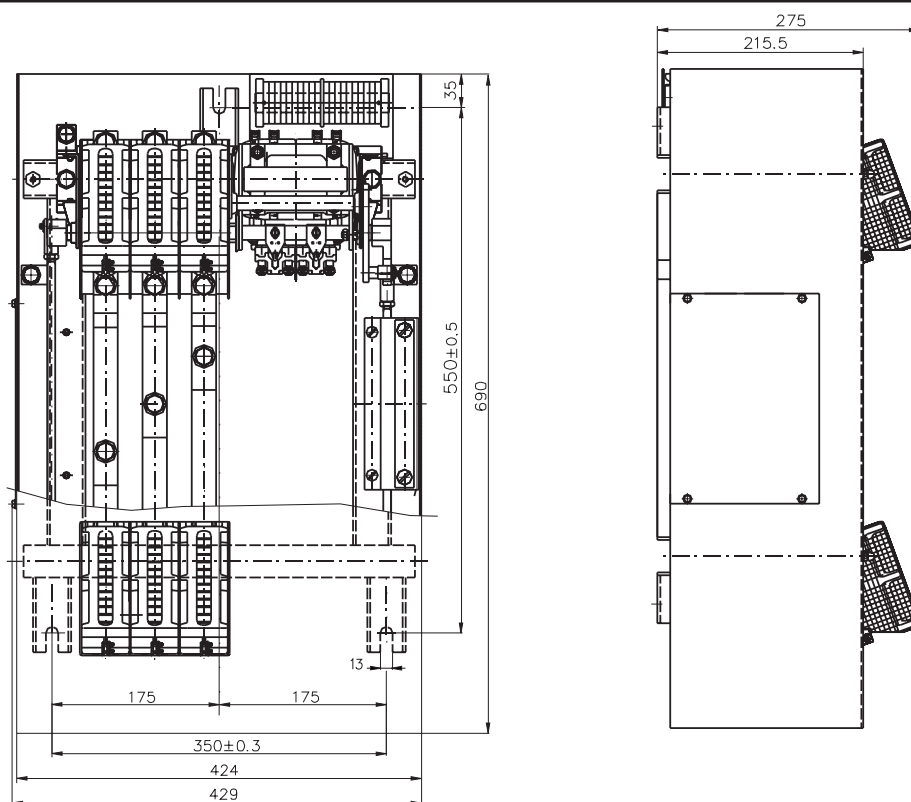


Outline drawing of blocking units SBV85, SBV105, SBV140, SBV170



Type	a ₁	a ₂	b ₁	b ₂	c ₂	d	e	f	g
SBV85, SBV105	260	280	80	115	154	6	2	16	M6
SBV140, SBV170	345	365	105	155	200	7	2	18	M10

Outline drawing of blocking units SBVH250, SBVH440



4.4 Reversing starters

4.4.1 Utilization

Reversing starters can be utilized in the reversing of induction motors. They consist of two contactors equipped with (or optionally without) an overload protection device. These contactors will prevent the occurrence of simultaneous sealing.

Note:

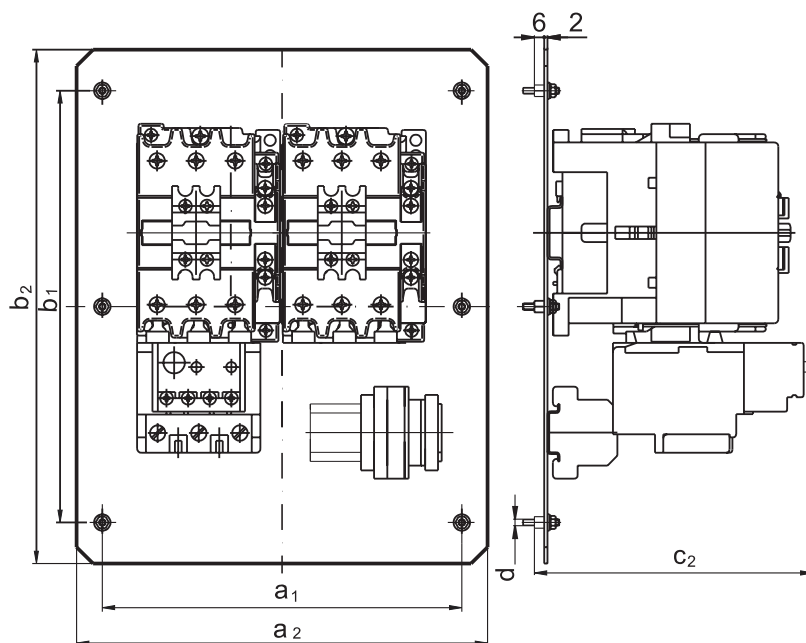
Reversing starters should be wired in the way specified by the circuit diagrams. If not, the minimum 0.1 s delay between the energizing of blocked contactors must be ensured, e. g. by means of the BT-ZP electronic timer.

4.4.2 Table-No. 46 – Rating

Type	SRC9	SRC12	SRC17	SRC20	SRC23	SRC25	SRC32	SRC40
Rated insulation voltage U_i [V]	690	690	690	690	690	690	690	690
Conventional thermal current I_{th} [A]	25	25	25	40	25	40	40	40
Rated operational current I_e (AC-3) at 400 V [A]	9	12	16	20	23	25	32	40
Max. number of on-load op. cycles per hour in AC-3 at 400 V	4	5,5	7,5	10	11	11	15	20
Electrical durability in AC-3, I_e at 400 V, [op. cycles]	1,5x10 ⁶	1,5x10 ⁶	1,5x10 ⁶	1,2x10 ⁶	10 ⁶	1x10 ⁶	10 ⁶	0,9x10 ⁶
Max. motor output in AC-3 at 400 V [kW] in AC-4 at 400 V [kW]	600 120	600 120	600 120	600 120	600 120	600 120	600 120	600 120
Range of AC coil control voltages at 50 Hz [V] at 60 Hz [V]	12..500 24..440	12..500 24..440	12..500 24..440	12..500 24..400	12..500 24..440	12..500 24..440	12..500 24..440	12..500 24..440
Mechanical durability [op. cycles]	10x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶
Degree of protection	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65

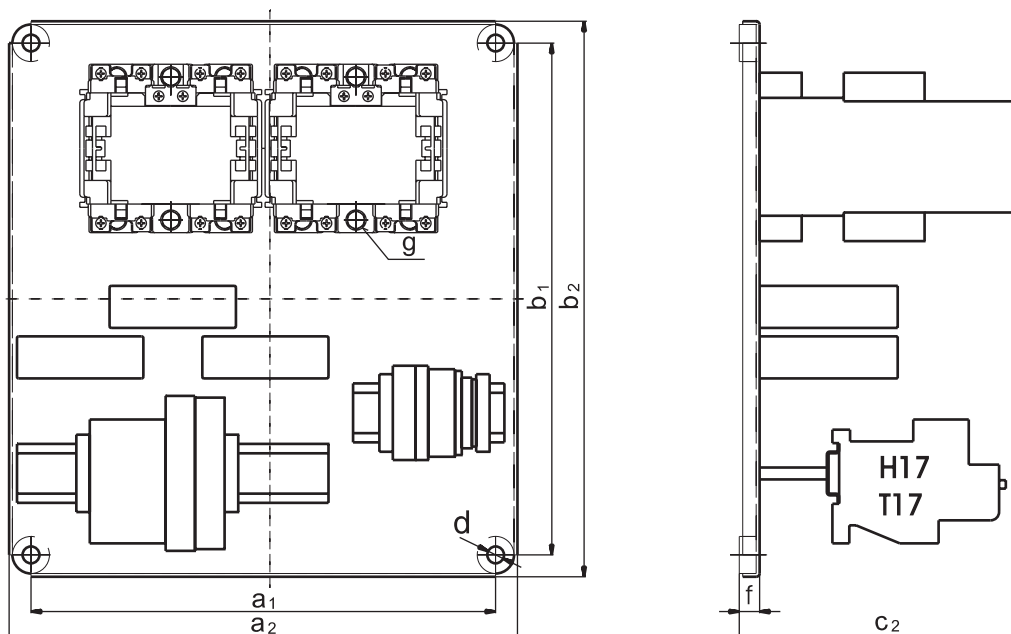
SRC50	SRC65	SRC80	SRC95	SRC115	SRC150	SRV85	SRV105	SRV140	SRV170	SRV205	SRV250
690 80	690 80	690 80	690 140	690 140	690 140	690 105	690 105	690 170	690 170	690 250	690 250
50	65	80	95	115	135	85	105	140	170	205	205
25	30	37	45	55	75	45	55	75	90	110	132
10 ⁶	10 ⁶	0,9x10 ⁶	0,9x10 ⁶	0,7x10 ⁶	0,5x10 ⁶	0,9x10 ⁶	0,7x10 ⁶	0,65x10 ⁶	0,5x10 ⁶	0,5x10 ⁶	0,5x10 ⁶
600 120	600 120	300 120	300 120	300 120	120 120	120 120	120 120	120 120	120 120	120 120	120 120
24..690 24..440 10x10 ⁶	24..690 24..440 10x10 ⁶	24..690 24..440 10x10 ⁶	24..690 24..440 5x10 ⁶	24..690 24..440 5x10 ⁶	24..690 24..440 5x10 ⁶	24..690 24..440 10x10 ⁶	24..690 24..440 10x10 ⁶	42..690 42..440 10x10 ⁶	42..690 42..440 10x10 ⁶	110..690 110..240 5x10 ⁶	110..690 110..240 5x10 ⁶
IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP00 IP65	IP00 IP65	IP00 IP65	IP00 IP65	IP00 IP65	IP00 IP65	IP00 IP65	IP00 IP65	IP00 IP65

4.4.3 Outline drawings – outline drawing of reversing starters series SRC (IP20/IP10)



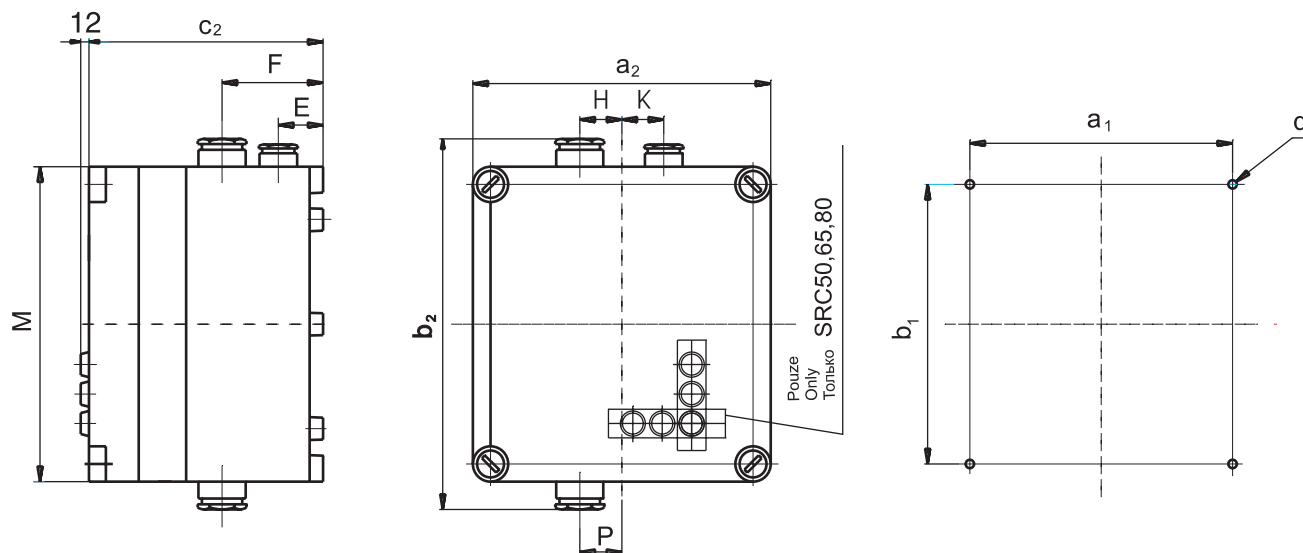
Type	a ₂	b ₂	c ₂	a ₁	b ₁	d
SRC9, SRC12, SRC17, SRC23	150	265	114	125	210	4xM4
SRC20, SRC25, SRC32, SRC40	150	265	123	125	210	4xM4
SRC50, SRC65, SRC80	260	260	127	240	210	4xM4
SRC95, SRC115, SRC150	265	440	165	240	396	6xM4

Outline drawing of reversing starters series SRV (IP00)



Type	a ₂	b ₂	c ₂	a ₁	b ₁	d	f	g
SRV85, SRV105	250	330	168	224	304	Ø7	12	M6
SRV140, SRV170	370	415	192	344	389	Ø9	12	M10
SRV205, SRV250	370	415	204	344	389	Ø9	12	M10

Outline drawing of reversing starters series SRC or SRV, IP65



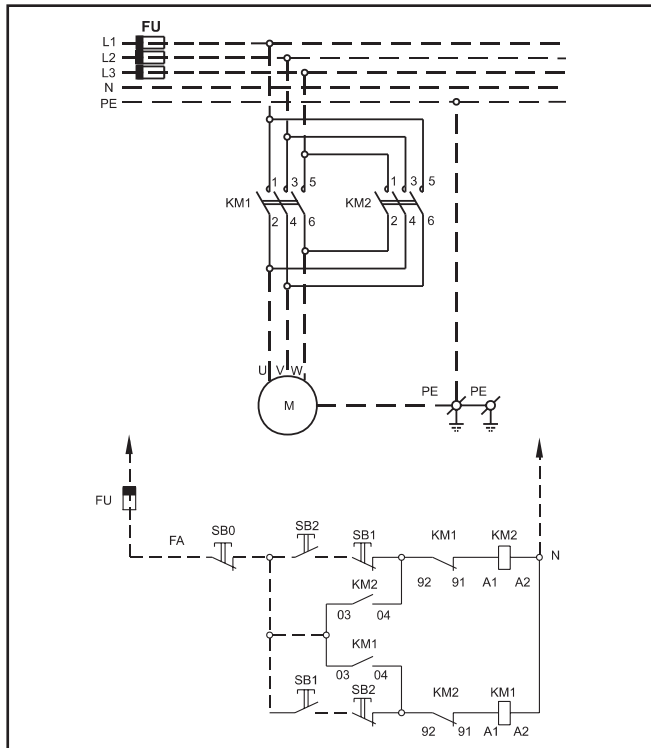
Type	a ₂	b ₂	c ₂	a ₁	b ₁	d	E	F	H	K	M	P
SRC9, SRC12, SRC17, SRC23	186	345	175	131	282	M5	60	60	25	25	186	25
SRC20, SRC25, SRC32, SRC40	186	353	175	166	282	M5	60	60	30	30	302	25
SRC50, SRC65, SRC80	302	364	210	166	282	M5	75	75	37,5	37,5	302	0
SRC95, SRC115, SRC150	302	570	210	282	466	M5	90	90	45	45	488	45
SRV85, SRV105	302	563	210	282	466	M5	50	50	55	55	488	55
SRV140, SRV170	372	684	210	350	581	M5	60	60	65	115	603	65
SRV205, SRV250	372	710	270	350	581	M5	65	65	70	115	603	70

4. Motor-starters

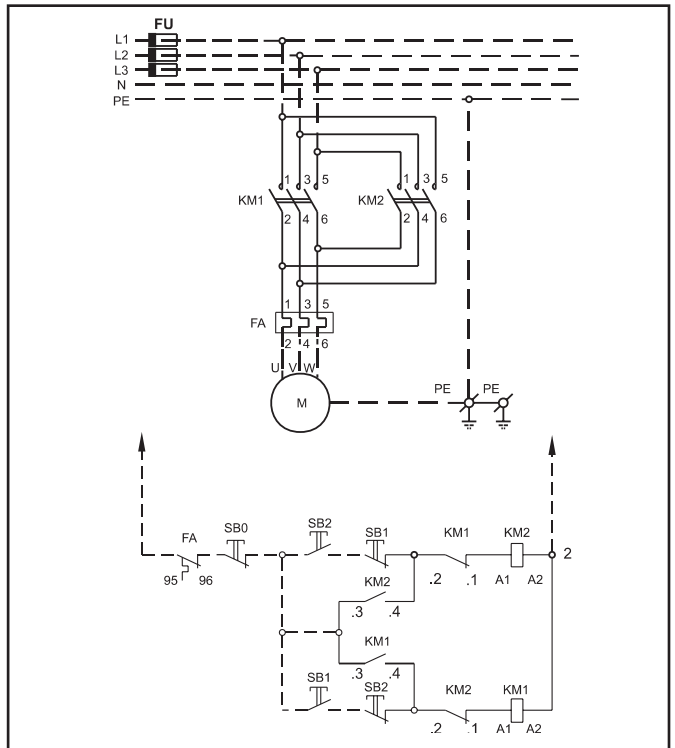
4.4 Reversing starters

4.4.4 Circuit diagrams

Circuit diagram of reversing starters series SRC without overload protection

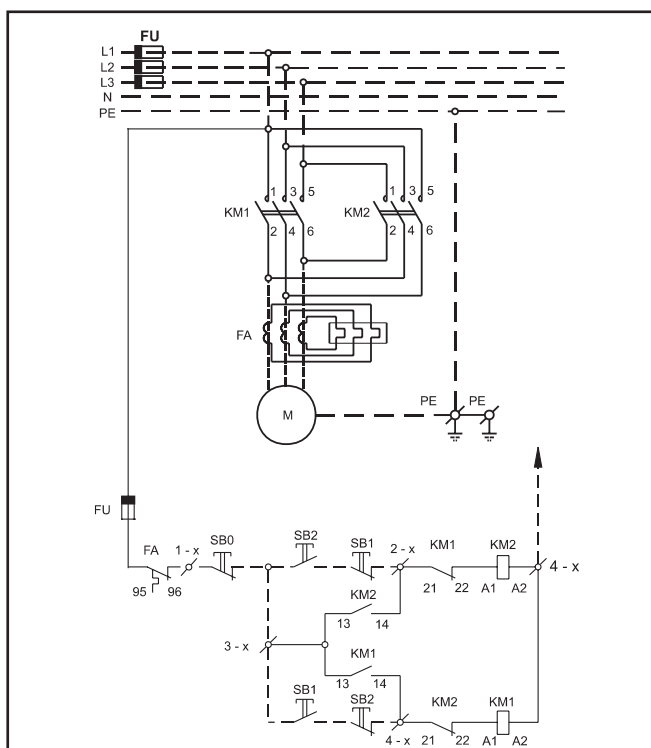


Circuit diagram of reversing starters series SRC9..SRC80 with overload protection



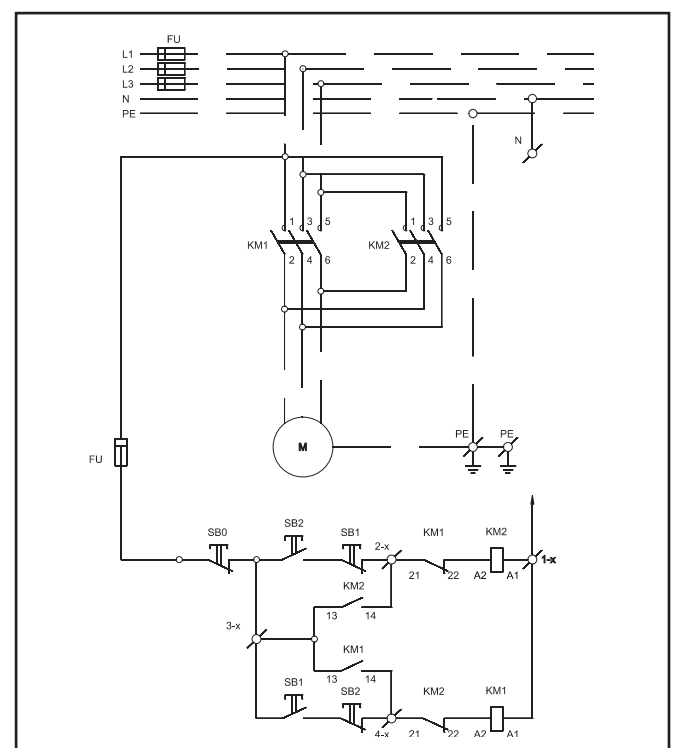
The blue reset button of the thermal overload relay T17 resp. T63 shall be in position „A“

Circuit diagram of reversing starters series SRC or SRV with an overload protection set



The blue reset button of the thermal overload relay T17 shall be in position „A“

Circuit diagram of reversing starters series SRV without overload protection



Note

4.5 Star-delta starters

4.5.1 Utilization

Star-delta starters are designed to ensure a safe, automatic and sparing motor start. They consist of three contactors, an overload protection device and a timer that provides the delayed switching of the motor coil connections from star to delta. Star and delta contactors can be mechanically interlocked with each other. Time delay can be set within the range of 3..30 seconds. Overload protection may be optionally omitted.

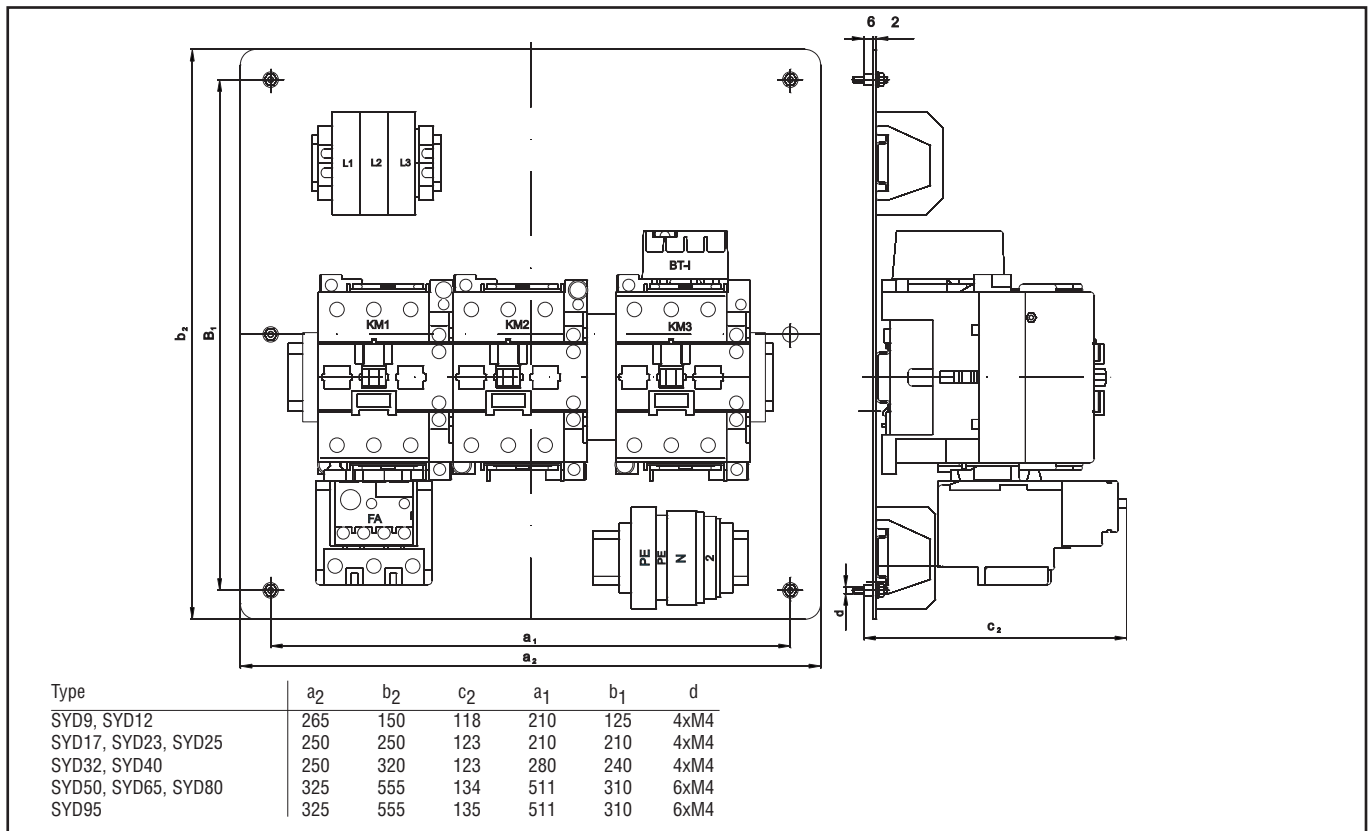
4.5.2 Table-No. 47 – Rating

Type	SYD9	SYD12	SYD17	SYD23	SYD25	SYD32	SYD40
Rated insulation voltage U_i [V] Mains current at 400 V and full motor output [A] Phase current at 400 V [A]	690 8,5; 11,5; 15 5; 6,5; 8,5	690 22 12,5	690 29 17	690 35 20,5	690 41 24	690 56 32	690 66 40
Max. motor output in AC-3 at 400 V [kW]	4; 5,5; 7,5	11	15	18,5	22	30	37
Electrical durability in AC-3, I_e at 400 V, [op. cycles]	10^6	10^6	10^6	$0,8 \times 10^6$	10^6	10^6	$0,8 \times 10^6$
Max. number of on-load op. cycles per hour in AC-3	30	30	30	30	30	30	30
DC coil control voltage [V] AC coil control voltage at 50 Hz [V]	220 230	220 230	220 230	220 230	220 230	220 230	220 230
Mechanical durability [op. cycles]	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6
Degree of protection	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65

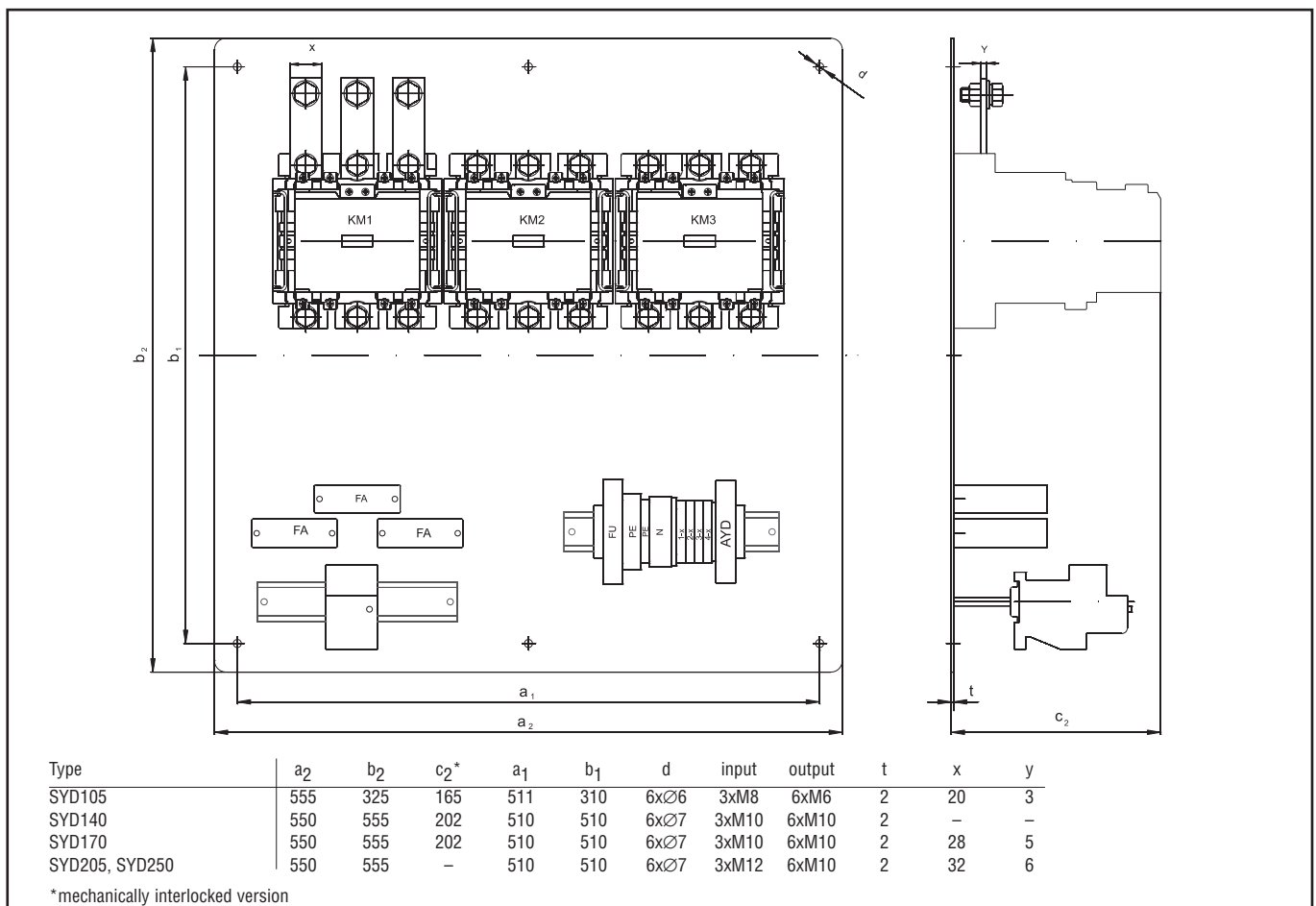
Note: star-delta starters types SYD205 and SYD250 in the version IP65 on special request only

SYD50	SYD65	SYD80	SYD95	SYD105	SYD140	SYD170	SYD205	SYD250	SYD300	SYD400	SYD500
690 82 47	690 100 58	690 136 78	690 161 93	500 161 93	690 197; 236 114; 137	690 283 164	690 350 202	690 440 254	690 530 306	690 680 393	690 845 488
45	55	75	90	90	110; 132	160	200	250	300	400	500
10 ⁶	0,8x10 ⁶	0,8x10 ⁶	0,8x10 ⁶	0,8x10 ⁶	0,5x10 ⁶	0,3x10 ⁶	0,3x10 ⁶	0,3x10 ⁶	0,3x10 ⁶	0,3x10 ⁶	0,3x10 ⁶
30	30	30	30	30	30	30	30	30	30	30	30
220 230	220 230	220 230	220 230	220 230	220 230	220 230	220 230	220 230	220 230	220 230	220 230
10x10 ⁶	10x10 ⁶	5x10 ⁶	10x10 ⁶	10x10 ⁶	10x10 ⁶	5x10 ⁶	5x10 ⁶	5x10 ⁶	5x10 ⁶	5x10 ⁶	5x10 ⁶
IP20/IP10 IP65	IP20/IP10 IP65	IP20/IP10 IP65	IP00 IP65	IP00 IP65	IP00 IP65	IP00 IP65	IP00 (IP65)	IP00 (IP65)	IP00 —	IP00 —	IP00 —

4.5.3 Outline drawings – outline drawing of star-delta starters series SYD9..SYD150, IP20/IP10



Outline drawing of star-delta starters series SYD85, SYD105, SYD140, SYD170, SYD205 (IP00)

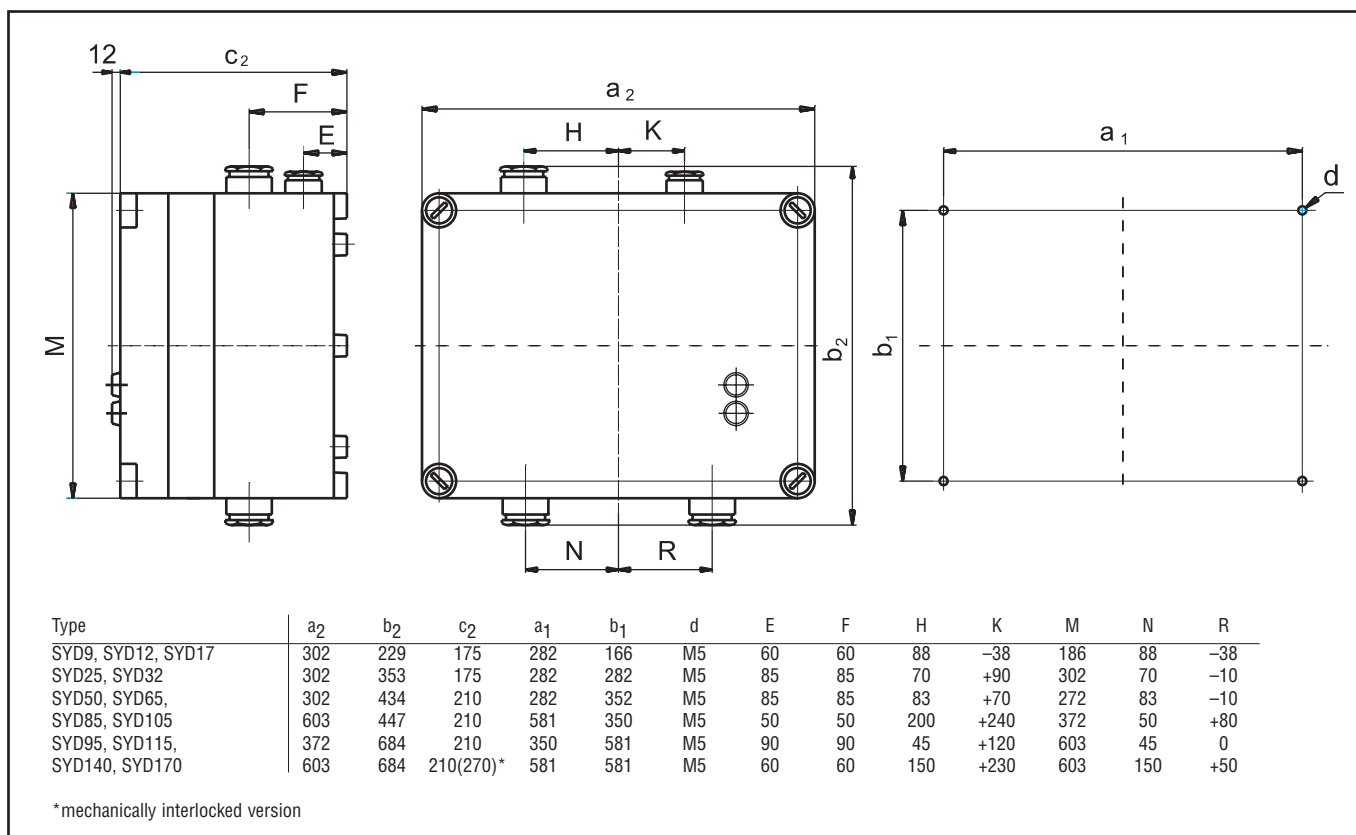


*mechanically interlocked version

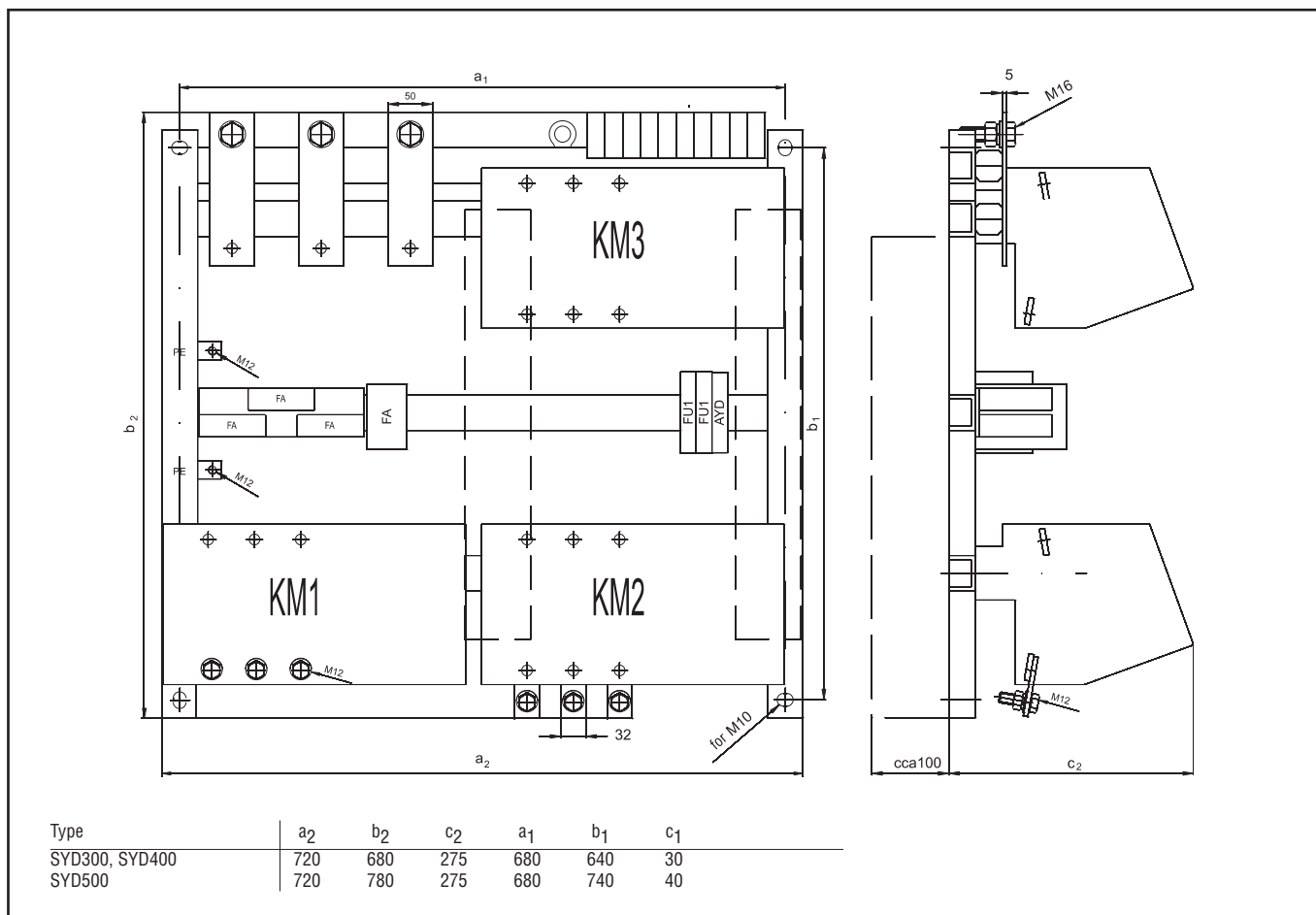
4. Motor-starters

4.5 Star-delta starters

Outline drawing of star-delta starters series SYD9 – SYD170 (IP65)



Outline drawing of star-delta starters types SYD300, SYD400 or SYD500 (IP00)

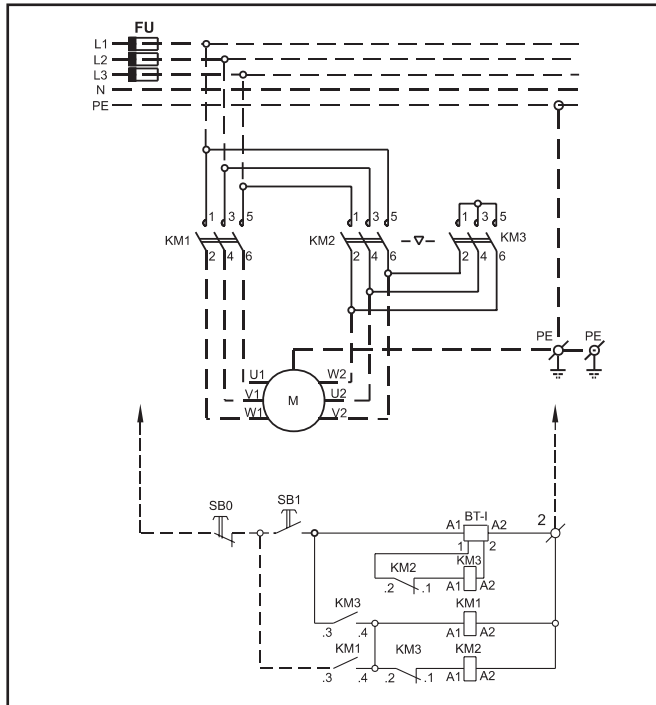


4. Motor-starters

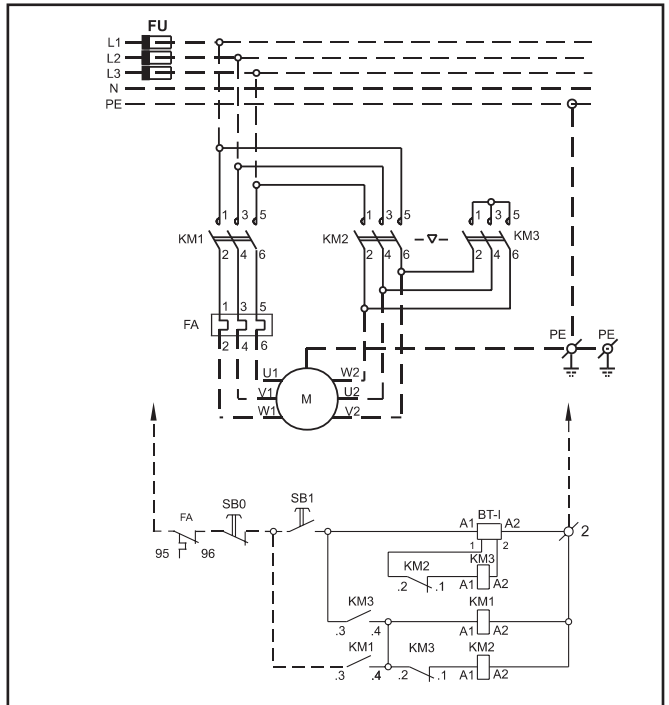
4.5 Star-delta starters

4.5.4 Circuit diagrams

Circuit diagram of star-delta starters series SYD9..SYD65, without overload protection

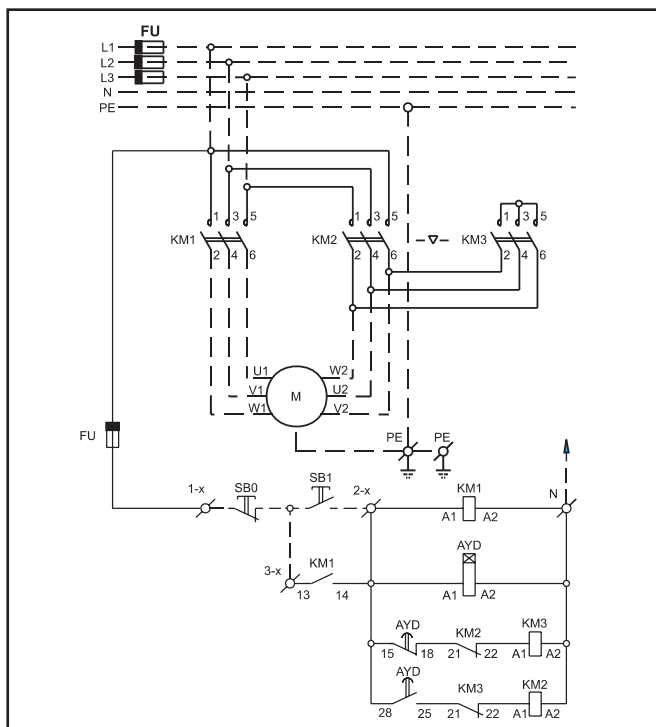


Circuit diagram of star-delta starters series SYD9..SYD65, with overload protection

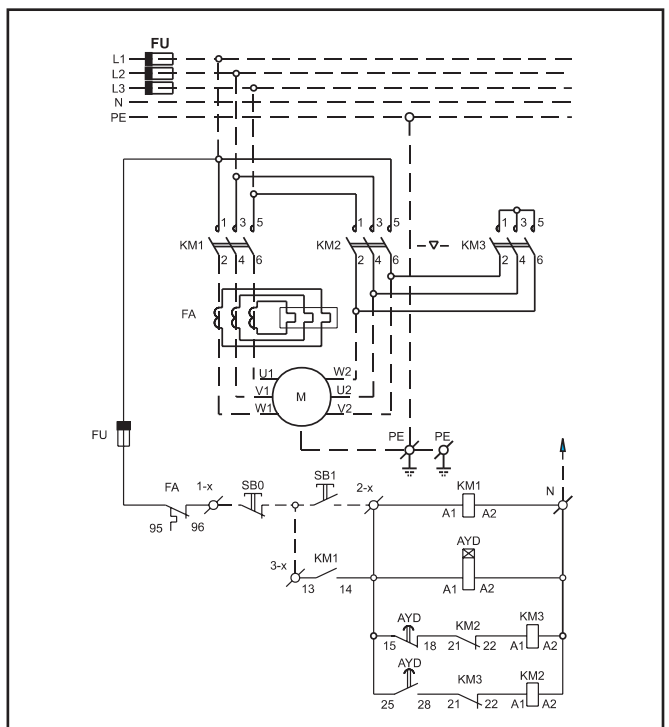


The blue reset button of the thermal overload relay T17 resp. T63 shall be in position „A“

Circuit diagram of star-delta starters series SYD85..SYD170, without overload protection

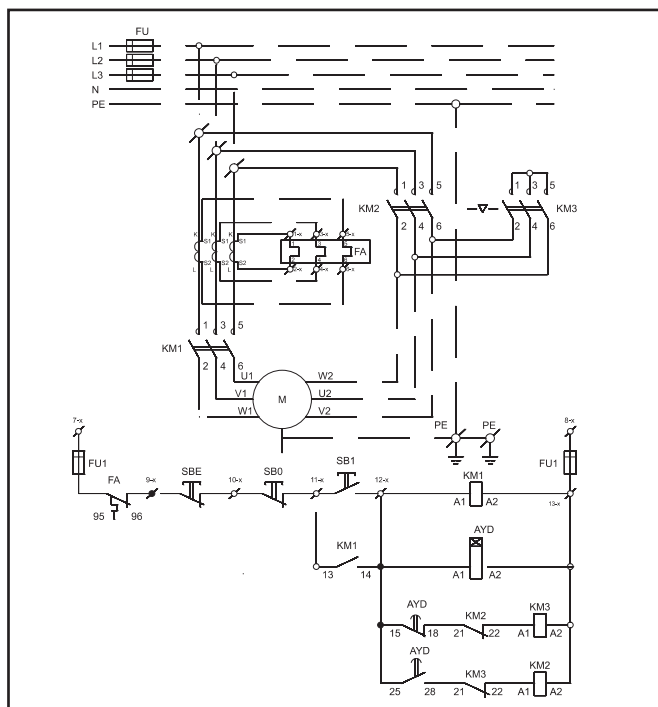


Circuit diagram of star-delta starters series SYD85..SYD170, with an overload protection set



The blue reset button of the thermal overload relay T17 resp. T63 shall be in position „A“

Circuit diagram of star-delta starters types SYD300, SYD400, SYD500



The blue reset button of the thermal overload relay T17 shall be in position „A“

4.6 Example of order

The customer shall specify the features of the motor starter from the point of view of:

1. Utilization
 - direct on-line
 - blocking unit
 - reversing
 - star-delta
2. Control voltage
3. Degree of protection
4. Overload protection – specify the type and tripping current of the required thermal overload relay or overload protection set (current transformer)
5. Protection of the auxiliary and control circuit
6. Operating conditions - normal or climate-proof (applies for series SBVH, SYD300, SYD400 and SYD500 only)

Starter type	Control voltage	Degree of protection	Overload protection	Version	No. of pcs
SRV105	220 V/50 Hz	IP00	M100	(G)	10 pcs
SC65	380 V/50 Hz	IP65	63 A	(G)	5 pcs
SYD23	230 V/50 Hz	IP00	–	(G)	10 pcs
SBC9	110 V/50 Hz	–	–	(G)	10 pcs
SYD40	380 V/50 Hz	IP65	T50 I, 50 A	(G)	2 pcs

5.1 General

The cam switches series EPS comply with the requirements of the EN 60947-3. They are supplied in three sizes:

- I. 10 A or 20 A; dimensions of the front panel 48 x 48 mm, switching angles 30° or 45° or 60° or 90°;
front or rear mounting by means of two M3 screws, rear mounting onto a 35 mm rail according to EN 50022
- II. 25 A or 32 A; dimensions of the front panel 64 x 64 mm, switching angles 30° or 45° or 60° or 90°;
front or rear mounting by means of two M4 screws, rear mounting onto a 35 mm rail according to EN 50022
- III. 63 A or 80 A; dimensions of the front panel 88 x 88 mm, switching angles 60° or 90°;
front or rear mounting by means of two M4 screws

5.1.1 Utilization

Switching of motors

Switching in auxiliary and measuring circuits

Switching of transformer taps

Returning switches for testing purposes or for starting of one-phase induction motors

Reversing or star-delta motor starters; pole changing

Should the cam switches be employed in DC circuits, the utilization category and the operational voltage must be considered; it is highly recommended to connect an appropriate number of contacts in series.

Table-No. 48 – Utilization in DC circuits

Utilization category	Voltage DC [V]	No. of series contacts	EPS20 I_e [A]	EPS32 I_e [A]	EPS63 I_e [A]
DC-21	24..48	2	20	32	63
	110	3	12	20	35
	220	6	10	16	32
DC-23	24..48	2	12	20	35
	110	3	10	16	25
	220	6	8	12	22
DC-13	24..48	2	10	16	–
	110	3	5	8	–
	220	6	2,5	4	–

Examples of utilization categories

Nature of current	Utilization category	Typical applications
AC	AC-3	Squirrel-cage motors; starting, switching off running motors
	AC-4	Squirrel-cage motors; starting, plugging, inching
	AC-15	Control of AC electromagnetic loads in auxiliary circuits
	AC-21	Non-inductive or slightly inductive loads, resistant furnaces
	AC-23A	Switching of induction motors or other highly inductive loads
DC	DC-13	Control of DC electromagnets
	DC-21	Non-inductive or slightly inductive DC loads
	DC-23	Switching of highly inductive loads, e. g. series motors

5.1.2 Protection against dangerous accidental contact with live parts

Cam switches series EPS are designed to prevent accidental contact between live parts and the human body, i. e. they provide the degree of protection IP20; use of the front panel enables increasing of the degree of protection up to IP42 or even IP65.

5. Rotary cam switches

5.2 Rotary cam switches series EPS

5.2.1 Table-No. 49 Rating

Cam switch type	EPS10	EPS20	EPS25	EPS32	EPS63	EPS80
Rated insulation voltage [V]	690	690	690	690	690	690
Impulse withstand voltage U_{imp} [kV]	6	6	6	6	6	6
Conventional free air thermal current $I_{th} = I_{e(AC-21)}$ [A]	10	20	25	32	63	80
Rated operational current I_e [A] AC-23A at 400 V	9	15,5	22	30	55	55
AC-23A at 690 V	5,5	9	14	17,5	32	32
AC-3 400 V	7,5	11,7	18	22	41	46,6
AC-3 Y-D starting at 400 V	9	15,5	23	30	55	55
AC-3 Y-D starting at 690 V	5,5	9	14	17,5	32	32
AC-15 at 230 V	6	6	8	8	—	—
at 400 V	4	4	6	6	—	—
Maximum output of the controlled load P_e [kW] AC-21 400..690 V	7,5	14	18	22	43,5	55
AC-23A at 400..690 V	5,5	7,5	12	15	30	30
AC-3 at 400..690 V	3	5,5	8	11	22	25
AC-3 Y-D starting at 400..690 V	5,5	7,5	12	15	30	30
AC-4 at 400..690 V	2	3	4	5,5	18,5	18,5
Electrical durability in AC-3 at 400 V [10^6 op. cycles]	0,15	0,15	0,15	0,15	0,1	0,1
[kW]	3	5,5	7,5	11	22	25
Mechanical durability [op. cycles]	0,5	0,5	0,5	0,5	0,3	0,3
Maximum number of on-load op. cycles per hour [—]	1 500					
Range of ambient temperature at 80 % of relative humidity [°C]	-25..+55					
Degree of protection without a front panel	IP20					
with a front plate, basic	IP44					
with a front plate, extended	IP65					
inside an enclosure	IP65					
key controlled	IP42					
1-sec short time withstand current I_{cw} [A]	350	350	500	500	800	800
Short-circuit making capacity I_{cm} [A]	700	700	1100	1600	1600	1600
Standards	EN 60947-3, EN 60204-1					

5.2.2 Terminals

Table-No. 50 Terminals and conductor cross-sections

Cam switch type	Terminal type	Terminal screw	Max. tightening	Max. cross section of a copper conductor	
				Rigid	Flexible
EPS10, EPS20	screw	M3,5	0,8 Nm	1x2,5 2x1,5	1x2,5 2x1,5
EPS25, EPS32	screw	M4	1,2 Nm	1x6 2x4	1x4 2x2,5
EPS63, EPS80	pillar	M5	2,0 Nm	1x25 2x10	1x16 2x6

5. Rotary cam switches

5.2 Rotary cam switches series ESP

5.2.3 Available versions of cam switches

Guide to the type marking	EPS	xx	xxx	xxxxx	x	x	x
Indication of series EPS							
Rated op. current I_e [A] 10, 20, 25, 32, 63, 80							
Version without any front plate							
with the front panel suitable for IP44	D						
with the front panel suitable for IP65	G						
for fixing onto an installation plate	I						
for rear mounting (panel or rail)	O						
with padlockable lever	U						
key controlled	K						
in a plastic enclosure IP65	P						
disconnecter	S						
emergency switch	N						
Indication of the switching diagram							
Initial position and direction of rotation of the lever A = 12 o'clock; B = 9 o'clock; V = 10 o'clock, to the right and return C = 12 o'clock, to the left or to the right and return							
Lever rotation angle 1 = 30°, 4 = 90°, 6 = 60°, 8 = 45°							
Colour of the lever black without any indication, red = R							

Example of order:

EPS10 - 1103 - A6

Three-pole rotary cam switch, $I_{th} = 10$ A, no front plate, initial lever position 12 o'clock, switching angle 60°, black lever:

EPS80 - PN - 1103 - B4 - R

Three-pole emergency switch, $I_{th} = 80$ A, enclosure IP65, red padlockable lever in the initial position 9 o'clock:

Table-No. 51

Version	Code	EPS10 EPS20	EPS25 EPS32	EPS63 EPS80
no front plate	—	+	+	+
with the front panel suitable for IP44	D	+	+	+
with the front panel suitable for IP65	G	+	+	+
for fixing onto an installation plate	I		+	+
for rear mounting, by means of four screws	O			+
for rear mounting onto the 35 mm rail		+	+	
with return position	—	+	+	
with padlockable lever	U	+	+	+
key controlled	K	+	+	
disconnecter	S	+	+	+
emergency switch	N	+	+	+
switch in an IP65 enclosure	P (88 x 88)	+		
	P (100 x 100)	+	+	
	P (162 x 126)		+	+
switching angle – 30°, 45°, 60°, 90°	1, 8, 6, 4	+	+	
switching angle – 60°, 90°	6, 4			+

5. Rotary cam switches

5.2 Rotary cam switches series ESP

5.2.4 Utilization list of the essential types of rotary cam switches

Table-No. 52

Diagram on the front plate	Type	$I_{th} = I_e$ (AC-21) [A]	AC-3 at 400 V [kW]	AC-4 at 400 V [kW]	Utilization	Switching positions	Switching angle	No. of poles	No. of contacts	No. of chamber tiers	Circuit diagram
	EPS10-1102-A6	10	3	2	Two-pole ON/OFF switch	0 - 1	0 - 60	2	2	1	
	EPS20-1102-A6	20	5,5	3		0 - 1	0 - 60	2	2	1	
	EPS32-1102-A6	32	11	5,5		0 - 1	0 - 60	2	2	1	
	EPS10-1103-A6	10	3	2	Three-pole ON/OFF switch	0 - 1	0 - 60	3	3	2	
	EPS20-1103-A6	20	5,5	3		0 - 1	0 - 60	3	3	2	
	EPS25-1103-A6	25	8	4		0 - 1	0 - 60	3	3	2	
	EPS32-1103-A6	32	11	5,5		0 - 1	0 - 60	3	3	2	
	EPS63-1103-A6	63	22	18,5		0 - 1	0 - 60	3	3	2	
	EPS80-1103-A6	80	25	18,5		0 - 1	0 - 60	3	3	2	
	EPS20-1103-B4	20	5,5	3	Main/Emergency switch	0 - 1	0 - 90	3	3	2	
	EPS32-1103-B4	32	11	5,5		0 - 1	0 - 90	3	3	2	
	EPS10-9151-C6	10	3	2	Reversing motor starter	1 - 0 - 2	60 - 0 - 60	3	5	3	
	EPS20-9151-C6	20	5,5	3		1 - 0 - 2	60 - 0 - 60	3	5	3	
	EPS25-9151-C6	25	8	4		1 - 0 - 2	60 - 0 - 60	3	5	3	
	EPS32-9151-C6	32	11	5,5		1 - 0 - 2	60 - 0 - 60	3	5	3	
	EPS10-9551-V6	10	5,5	2	Wye-delta motor starter	0 - Y - Δ	0 - 60 - 60	3	8	4	
	EPS10-9552-V6	10	3	2	Dahlander motor starter	0 - 1 - 2	0 - 60 - 60	3	8	4	
	EPS20-9552-V6	20	5,5	3		0 - 1 - 2	0 - 60 - 60	3	8	4	
	EPS32-94010-A6	32	11	5,5	Starting switch with returning position	0 - start	0 - _	1	1	1	
	EPS10-8357-C8	10	3	2	Three-phase voltmeter switch with "0" position	...L1-L3 - 0 - L1-N...	3x45 - 0 - 3x45	4	8	4	
	EPS20-8357-C8	20	5,5	3		...L1-L3 - 0 - L1-N...	3x45 - 0 - 3x45	4	8	4	
	EPS10-8151-A4	10	3	2	Three-phase amperemeter switch with "0" position	0 - 1 - 2 - 3	0-90-90-90	3	6	6	
	EPS20-8151-A4	20	5,5	3		0 - 1 - 2 - 3	0-90-90-90	3	6	6	

5. Rotary cam switches

5.2 Rotary cam switches series EPS

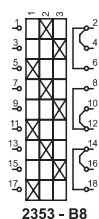
Diagram on the front plate	Type	$I_{th} = I_e$ (AC-21) [A]	AC-3 at 400 V [kW]	AC-4 at 400 V [kW]	Utilization	Switching positions	Switching angle	No. of poles	No. of contacts	chamber tiers	Circuit diagram
	EPS10-2201-C6	10	3	2	One-pole changeover switch with "0" position	1 - 0 - 2	60 - 0 - 60	1	2	1	
	EPS20-2201-C6	20	5,5	3		1 - 0 - 2	60 - 0 - 60	1	2	1	
	EPS10-2202-C6	10	3	2	Two-pole changeover switch with "0" position	1 - 0 - 2	60 - 0 - 60	2	4	2	
	EPS20-2202-C6	20	5,5	3		1 - 0 - 2	60 - 0 - 60	2	4	2	
	EPS10-2203-C6	10	3	2	Three-pole changeover switch with "0" position	1 - 0 - 2	60 - 0 - 60	3	6	3	
	EPS20-2203-C6	20	5,5	3		1 - 0 - 2	60 - 0 - 60	3	6	3	
	EPS25-2203-C6	25	8	4		1 - 0 - 2	60 - 0 - 60	3	6	3	
	EPS32-2203-C6	32	11	5,5		1 - 0 - 2	60 - 0 - 60	3	6	3	
	EPS63-2203-C6	63	22	18,5		1 - 0 - 2	60 - 0 - 60	3	6	3	
	EPS80-2203-C6	80	25	18,5		1 - 0 - 2	60 - 0 - 60	3	6	3	
	EPS10-2253-A6	10	3	2	Three-pole two- stage selector switch	1 - 2	0 - 60	3	6	3	
	EPS20-2253-A6	20	5,5	3		1 - 2	0 - 60	3	6	3	
	EPS20-2352-B8	20	5,5	3	Two-pole three-stage selector switch	1 - 2 - 3	45 - 45 - 45	2	6	3	
	EPS25-2451-B8	25	8	4	Single-pole four- stage selector switch	1 - 2 - 3 - 4	45-45-45-45	1	4	2	
	EPS32-2451-B8	32	11	5,5		1 - 2 - 3 - 4	45-45-45-45	1	4	2	

5. Rotary cam switches

5.2 Rotary cam switches series EPS

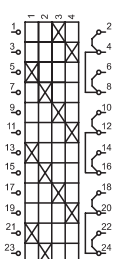
5.2.5 Switching diagrams

Three-pole tree-stage selector switch



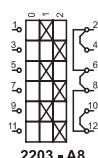
2353 - B8

Three-pole four-stage selector switch



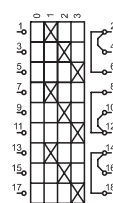
2453 - B8

Three-pole two-stage selector switch with "0" position



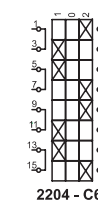
2203 - A8

Three-pole three-stage selector switch with "0" position



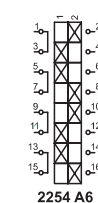
2303 - A8

Four-pole changeover switch with "0" position



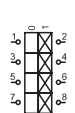
2204 - C6

Four-pole changeover switch without "0" position



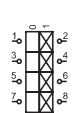
2254 A6

Four-pole ON-OFF switch



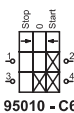
1104 - A6

Four-pole mains and emergency switch



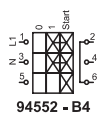
1104 - B4

START-STOP returning switch



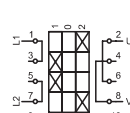
95010 - C6

Single-phase non reversing motor starter



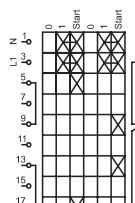
94552 - B4

Three-phase reversing motor starter



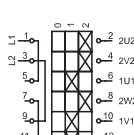
9151 - C6

Single-phase reversing motor starter



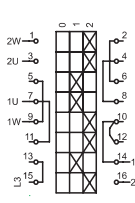
91012 - C4

Pole changing motor starter; separate motor windings



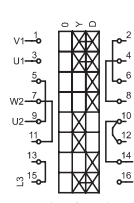
9553 - V6

Pole changing motor starter; Dahlander winding



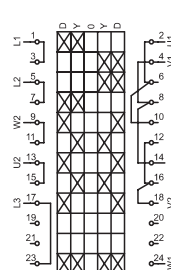
9552 - V6

Star-delta starter



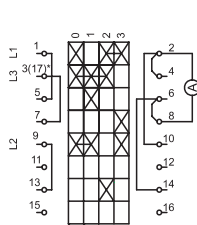
9551 - V6

Reversing star-delta starter



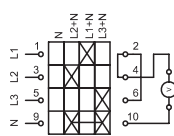
9153 - C6

Three-phase amperemeter switch with "0" position



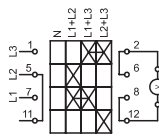
8151 - A4

Three-phase voltmeter switch with "0" position; measuring of phase voltage



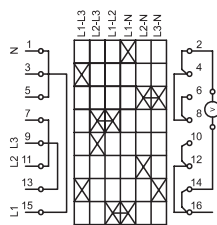
8352 - A8

Three-phase voltmeter switch with "0" position; measuring of mains voltage



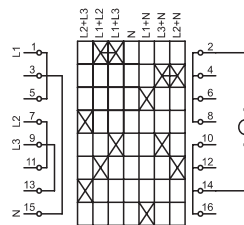
8351 - A8

Three-phase voltmeter switch without "0" position; measuring of phase or mains voltage



8357

Three-phase voltmeter switch with "0" position; measuring of phase or mains voltage

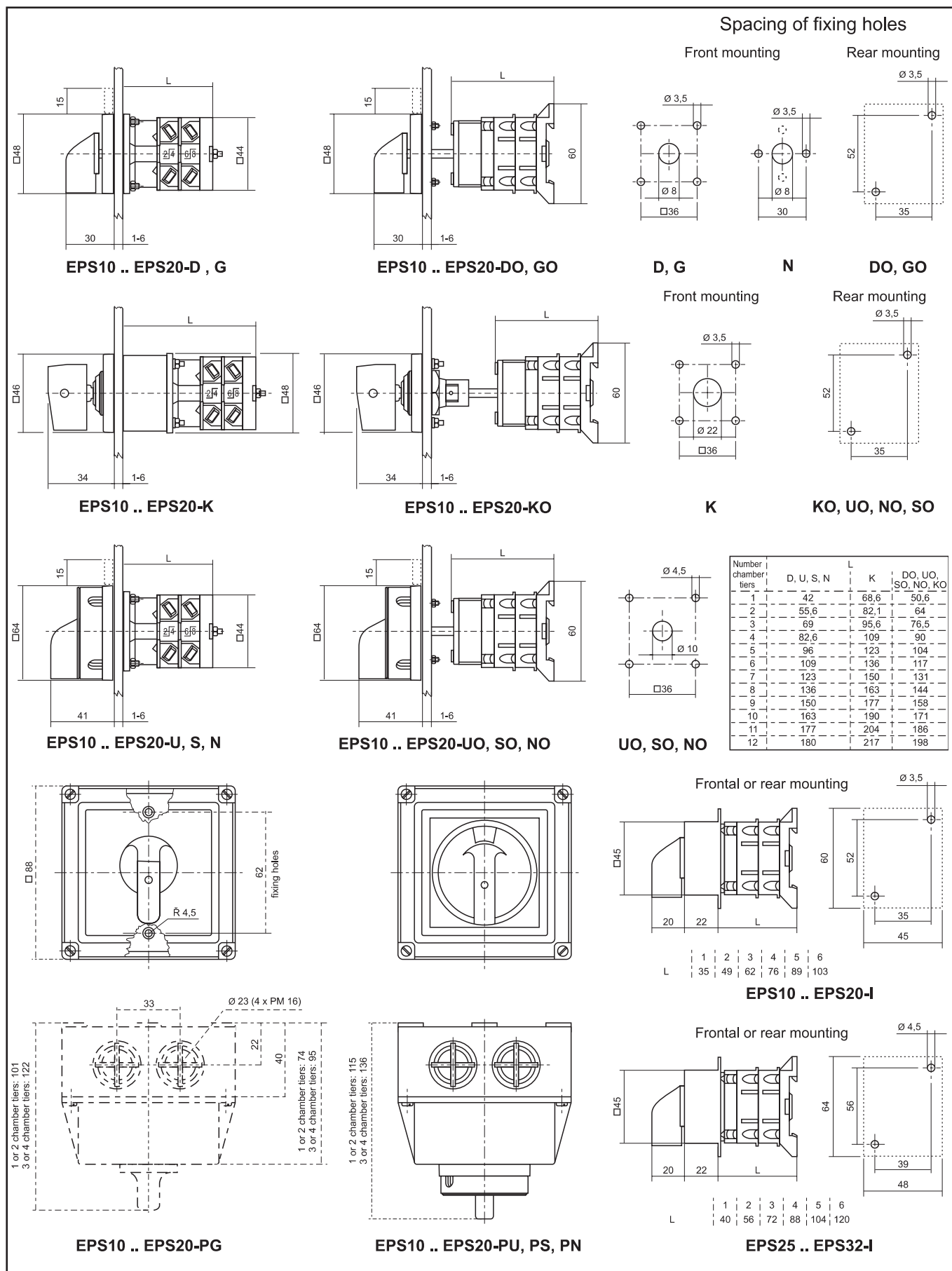


8357 - C8

5. Rotary cam switches

5.2 Rotary cam switches series EPS

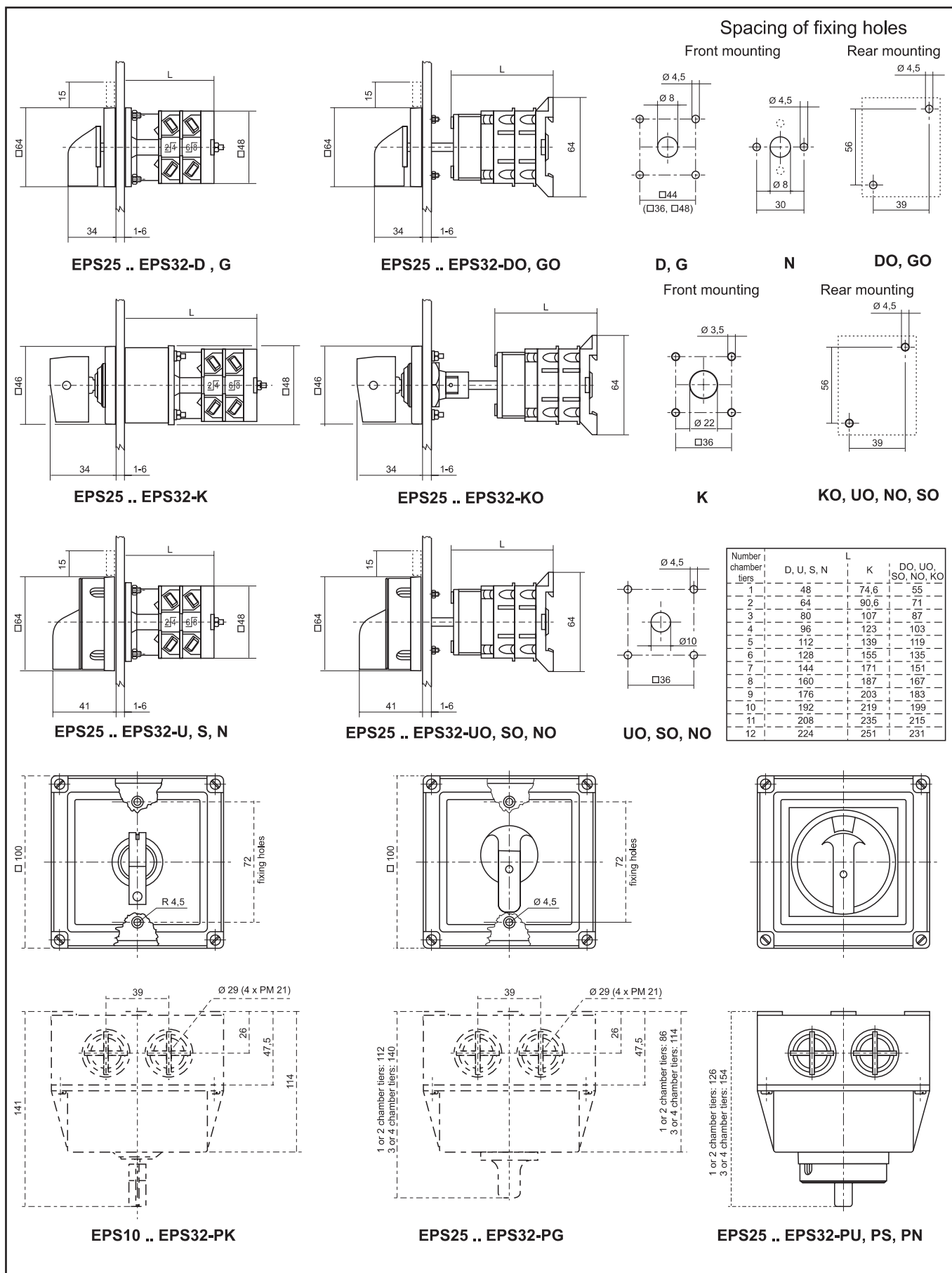
5.2.6 Outline drawings – cam switches series EPS10 or EPS20



5. Rotary cam switches

5.2 Rotary cam switches series EPS

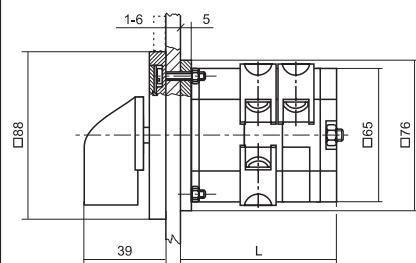
Outline drawings – cam switches series EPS25 or EPS32



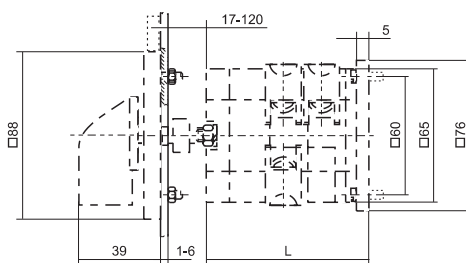
5. Rotary cam switches

5.2 Rotary cam switches series EPS

Outline drawings – cam switches series EPS63, EPS80

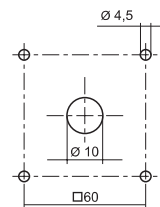


EPS63 .. EPS80-D, G

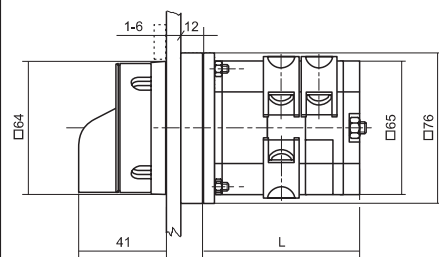


EPS63 .. EPS80-DO, GO

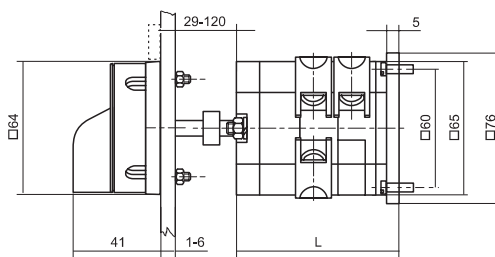
Spacing of fixing holes
Front mounting



D, G

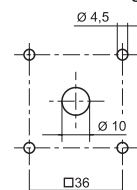


EPS63 .. EPS80-U, S, N



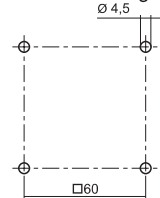
EPS63 .. EPS80-UO, SO, NO

Front mounting



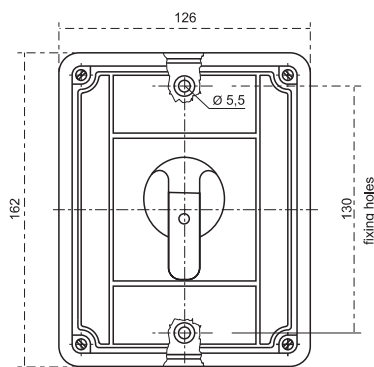
U, S, N

Rear mounting

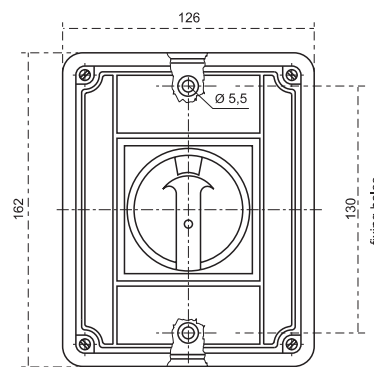


EPS63 .. EPS80-□O

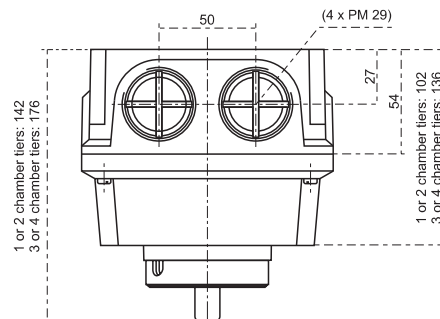
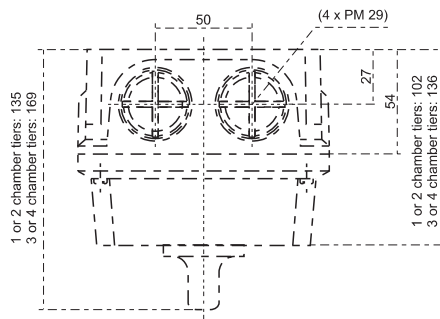
Number chamber tiers	L EPS63 EPS80
1	53
2	70
3	87
4	104
5	121
6	138
7	155
8	172
9	189
10	206



EPS63 .. EPS80-PG

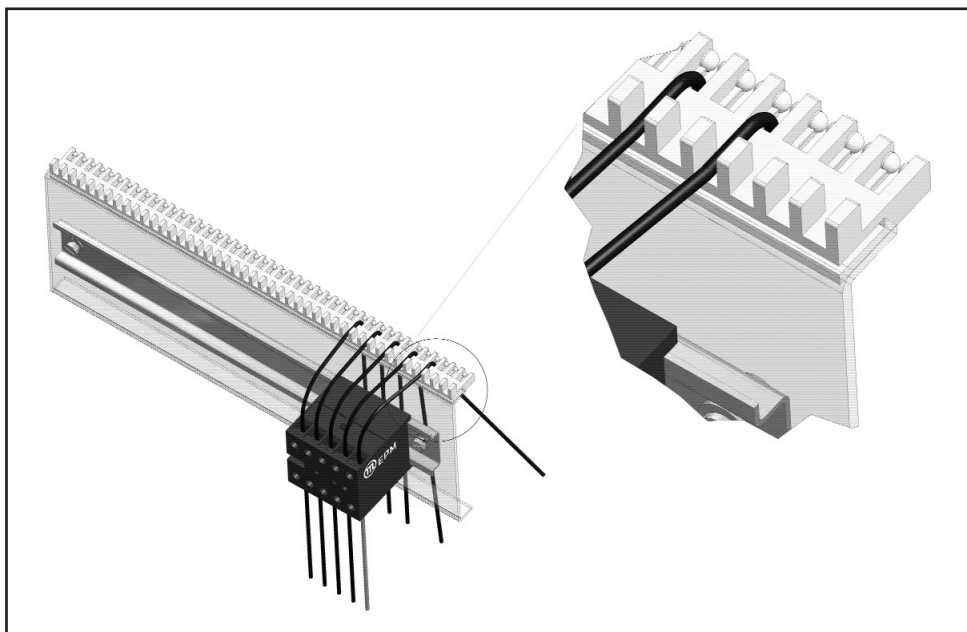
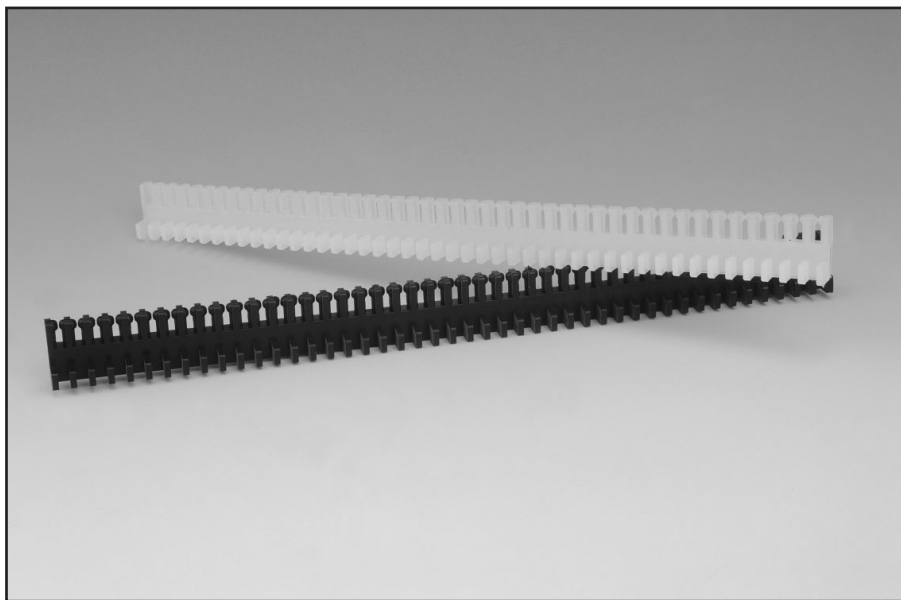


EPS63 .. EPS80-PU, PS, PN



6. Other accessories

6.1 PE fixing comb



Polyethylene combs are used for wire fixing and routing in controllers or panelboards. The comb is made of resilient PE. Its outline dimensions are 270 x 17 x 18 mm. The comb can easily be put on the edge of a mounting panel or frame. Its teeth enable the routing and fixing of insulated wires that have a cross-section from 0,5 mm² up to 10 mm².

Example of order:

Type	Quantity
PE Fixing comb	100 pcs

6. Other accessories

Note

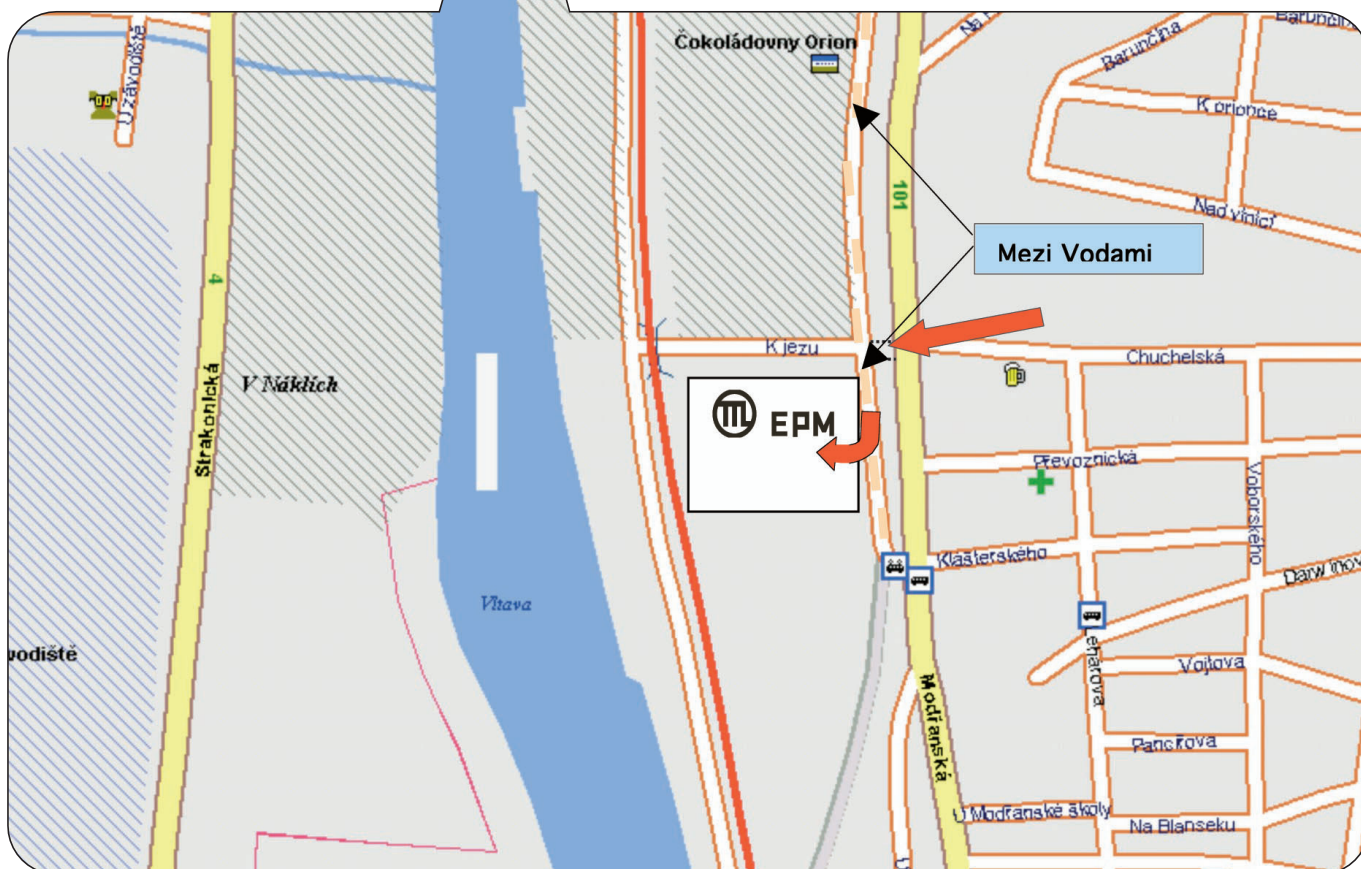
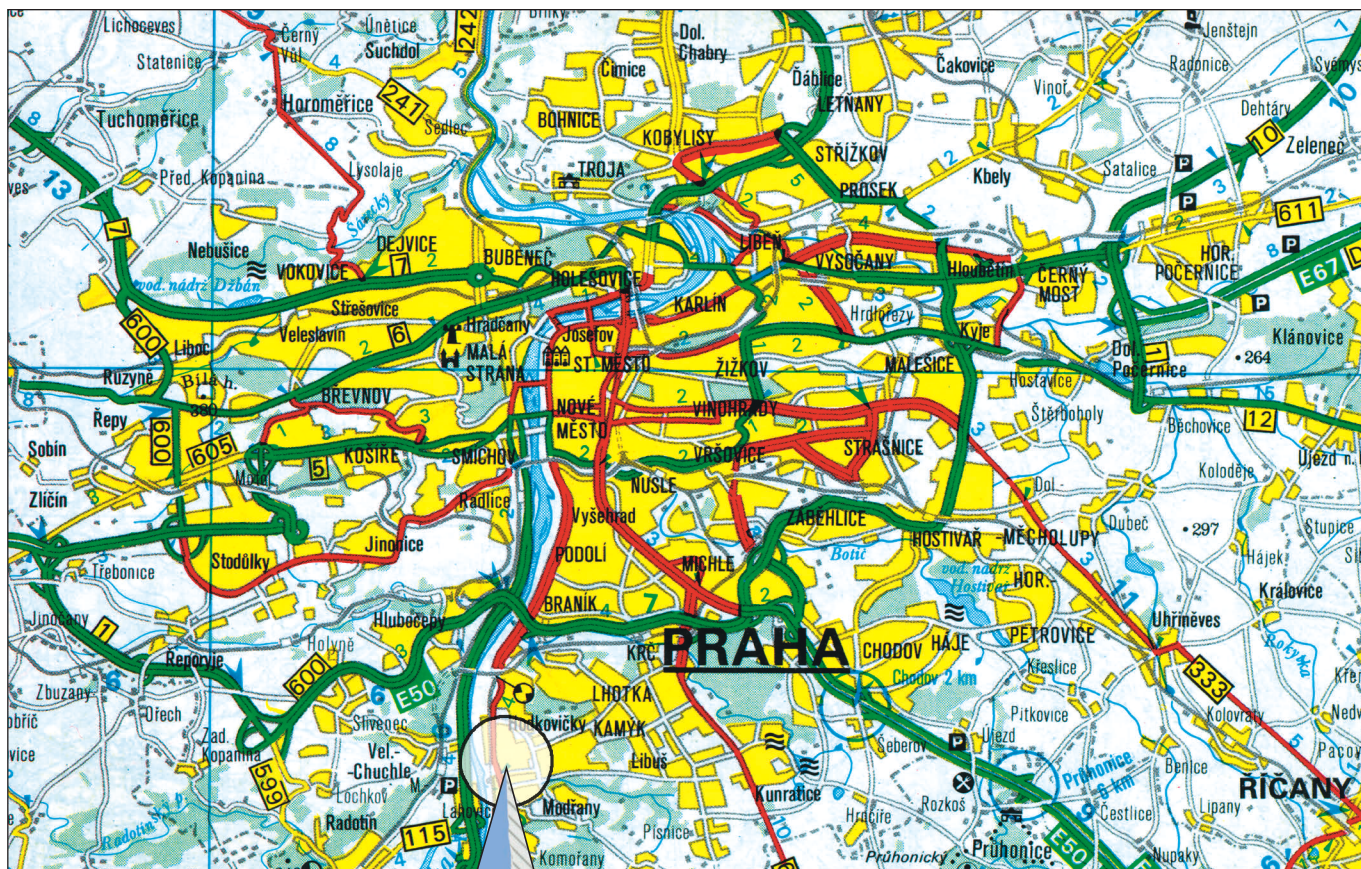
6. Other accessories

Note

6. Other accessories

Note

Map





Distributor



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fax: + 420 244 402 451

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