



GANZ KK Kft.
ISO 9001
certified



DIL-K ... CONTACTORS 4 ... 18,5 kW

HL-K- ... AUXILIARY CONTACTORS

DIL-K modular-system contactors

RC-K, V-K, D-K
overvoltage protector and
suppressor



RM-K
interface module



NP-K
low signal module



ZM-K
timer module



DIL-K ...



MV-e
mechanical
interlock



DIL-K ...



S11 or S20
side mounting
auxiliary contact block



H0-2K
thermal relay
plug-in to
contactor



LA 2 or LA 3
pneumatic
timer



MV-B
mechanical latch
head



Hi- or Li-
auxiliary contact
block



YD
star-delta
timer



1. Benefits of the DIL-K- ... modular contactors

Compared to the traditional contactors, the modular types offer a wide range of variations and freedom for the builder. The different types and accessories enable the user not only to plan the building-in into an equipment, but he can create the devices desired functions as well. The main advantage of the modular system is that the user can buy only the functions that are specifically needed for an application. The versatility of the system allows the assemblies of different device-combinations and also allows extensions or modifications without having to change the device. These features are particularly advantageous and fashionable in 4...18,5 kW power-range of motors.

Structure

- The new modular contactor-family offer 6 different switching power (4; 5,5; 7,5; 11; 15; 18,5 kW AC-3 400 V) in two sizes, with the same space-saving 45 mm width,
- the contactors are complemented by an auxiliary contactor,
- several functions can be archived by the accessories,
- the contactor-serie is complemented by variants for switching of capacitive loads (condenser-switches).

Accessories

- *Snaps to the forefront:*
 - auxiliary contact block with two or four contacts,
 - pneumatic timer (delay in switching on or off),
 - electromechanical latch head,
 - star-delta timer module.
- *To coil terminals on the upper side:*
 - interface module,
 - low-signal module,
 - timer module to delay switch-on,
 - over-voltage monitor or supressor module.
- *Side mounting:*
 - auxiliary contact block with two contacts,
 - mechanical interlock for simultaneous operation of the two contactors.
- *To lower terminals plugging:*
 - thermal (overload) relay.

Mounting

- snaps on 35 mm EN 50022 rail, or
- fixed on a mounting plate with two M4 screws,
- easy-to mount terminal-array, non-losing screws, quick connectability.

Operation

- AC (12...600 V 50/60 Hz) coils or DC (12...250 V) coils,
- AC or DC main current paths,
- easy-to-wire three coil terminals (A1, and - upper and lower - A2).

Reliability, durability

- high switching and contact reliability,
- high switching frequency (depending on load),
- mechanical durability 10^7 cycles,
- electrical durability AC-3: 10^6 cycles, AC-4: 5×10^4 cycles.

Operational and environmental safety

- IP 20 finger-protected terminals against accidental touching,
- cadmium-free contacts, asbest-free plastic parts, environment-friendly materials.

Aesthetic design and colour composition



2. Types

The contactors' basic type sign starts with **DIL-K** (K for compact) followed by a figure corresponding to the motor-power (kW) at 400 V operational voltage in the AC-3 utilization category.

There are no further markings for the contactors having only three current paths (e.g. DIL-K4). Between 4 kW and 11 kW the basic contactors have three main current paths and an auxiliary contact. (In this power-category - if required - we can deliver four - NO current - path - contactors as well, marked by **F** (e.g. DIL-K7F). In case of 2 NO and NC main contacts, the type-sign: **F/s** Type-signes of condenser switches are completed by letters: **/c**.

A **(G)** after the K letter refers to DC operation. The two figures after the second stroke refer to the number of the free make (closing) and break (opening) auxiliary contacts. (e.g. DIL-K11-10: one free make contact and there is not any break contact, DIL-K15: no free auxiliary contacts).

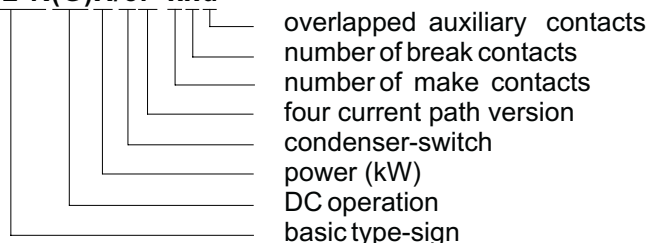
The letter **d** refers to overlapped auxiliary contacts.

The basic type-sign of the auxiliary contactor is

HL-K...

Summary:

DIL-K(G)X/cF-xxd



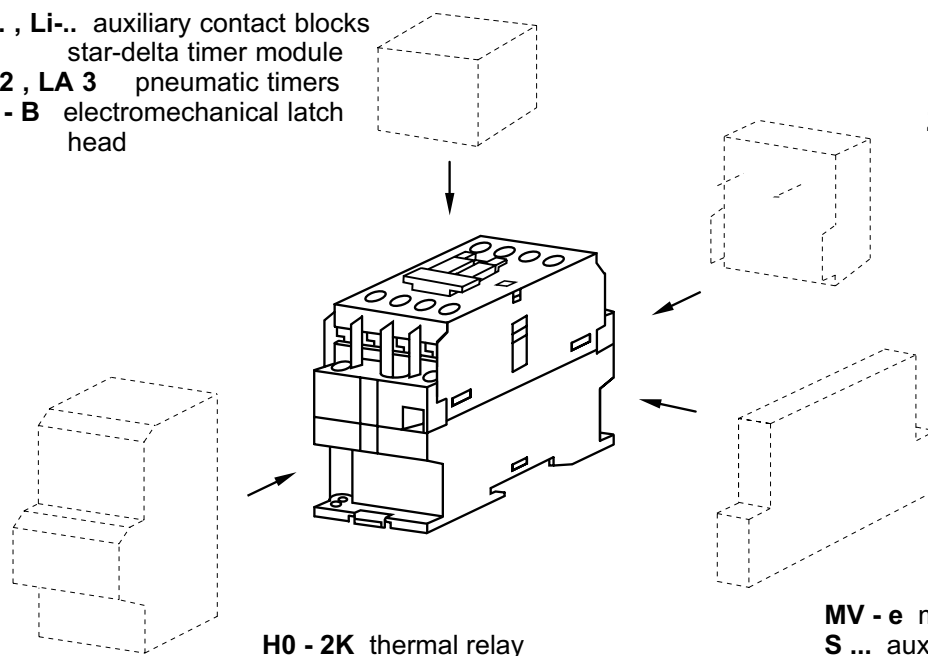
Marking of the terminals: The marking system is according to the EN 60947-4-1:1997 standard. On the upper (generally the feed) side the marks of the main contacts are 1 L1; 3L2; 5L3 and 2T1; 4T2; 6T3 on the lower (loading) side. The figures of the auxiliary contacts are always two digit numbers. The closing auxiliary contacts in the fourth current path are marked as 13 ; 14 (NO), while the opening contacts are marked as 21 ; 22 (NC).

In case of the snap-on and side-mounting auxiliary contacts the first digit of the marking refers to the position, with increasing value from left to right. The second digit (function digit) stands for break (1 ; 2), make (3 ; 4), delayed break (5 ; 6) and hurry-forward make (7 ; 8) contacts. Coil terminals are marked as A1 and A2. The A2 terminal can be found both on the upper and the lower side.

2.1 Contactors

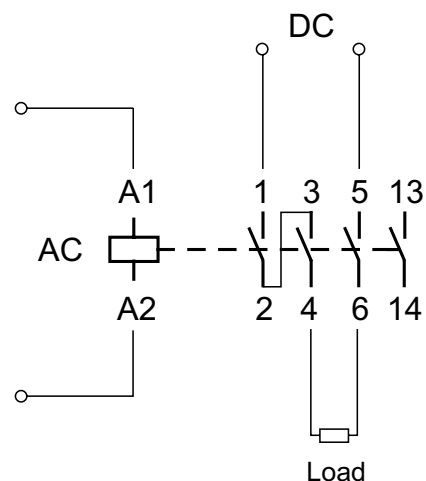
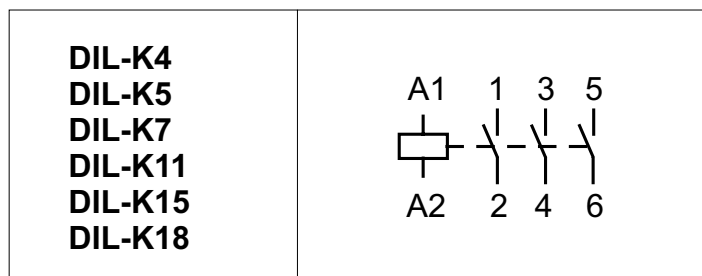
DIL-K4...DIL-K11 contactors contain three main current paths and one auxiliary current path while DIL-K15 and DIL-K18 have only three main current paths. Hi-... type auxiliary contact-blocks can be snapped on the forefront of DIL-K4...DIL-K11 contactors and Li-... type auxiliary contact-blocks on DIL-K-15 and DIL-K18 forefronts. A maximum of two S11 or S20 type auxiliary contact-blocks can be fitted on the contactor side.

Hi-.. , Li-.. auxiliary contact blocks
YD star-delta timer module
LA 2 , LA 3 pneumatic timers
MV - B electromechanical latch head



2.1.1 AC-operated contactors with three main current-paths

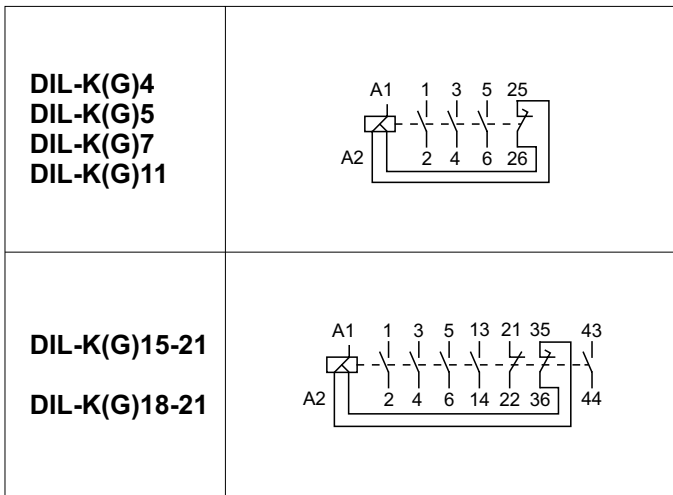
Switching diagram (in case AC-control and DC load)



2.1.2 AC-operated contactors

DIL-K4-10		DIL-K5-10	
DIL-K4-01		DIL-K5-01	
DIL-K4-01d		DIL-K5-01d	
DIL-K4-10d		DIL-K5-10d	
DIL-K7-10		DIL-K11-10	
DIL-K7-01		DIL-K11-01	
DIL-K7-01d		DIL-K11-01d	
DIL-K7-10d		DIL-K11-10d	

2.1.3 DC-operated contactors

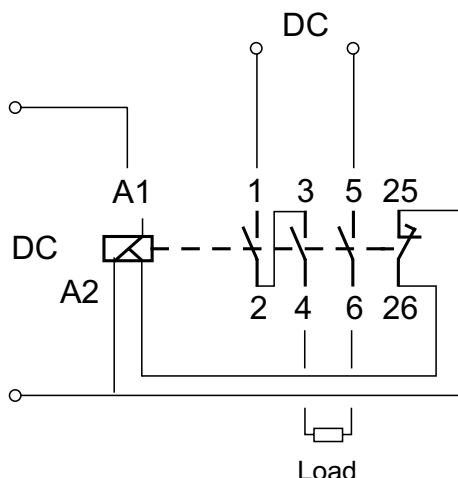


For DC-operation is not necessary to use an additional switch resistor because the energization (need to keep the magnet in) is generated by the detached winding (as a resistor) built in the coil. These are made short by the delayed opening (break) auxiliary contact marked 25 ; 26 during operation up to about 80 % of magnet-move. Connecting is made by the manufacturer so this contact is not free in case of DIL-K(G)4; DIL-K(G)5; DILK(G)7 and DIL-K(G)11 types. In case of DIL-K(G)15 and DIL-K(G)18 contactors this contact is marked: 35 ; 36 on the snapped-on auxiliary contact-block. (Li-22d)
 For DC-operation DIL-K(G)... contactor is needed. Operation by AC-voltage is not changeable into operation by DC-voltage.

2.2 DC main current path

Main contacts can switch AC and DC power as well-exact values indicated at technical data. Connection on series the 2 - 3 or the 4 - 5 contact points must be made by the user when mounting the device.

Switching diagram (DC-control, DC-load)



2.3 Auxiliary contact-blocks

2.3.1 Snap-on auxiliary contact-blocks (forefront) for **DIL-K4...DIL-K11** contactors and **HL-K-...** type auxiliary contactors are:

Hi-11	
Hi-22	
Hi-02	
Hi-20	
Hi-40	
Hi-22d	
Hi-04	
Hi-13	
Hi-31	

2.3.2 Snap-on auxiliary contact-blocks (forefront) for **DIL-K15** and **DIL-K18** contactors

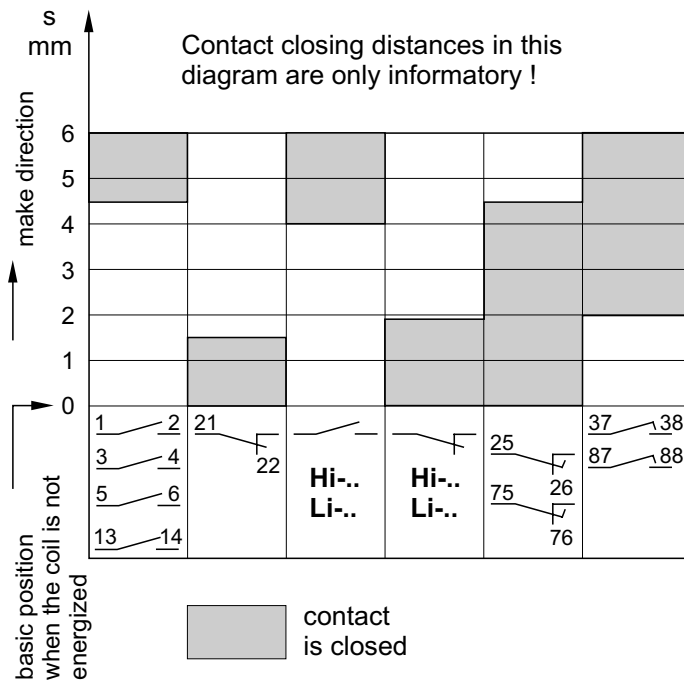
Li-11	
Li-22	
Li-22d	

2.3.3 Side-mounted auxiliary contact-blocks (on contactor or auxiliary contactor)

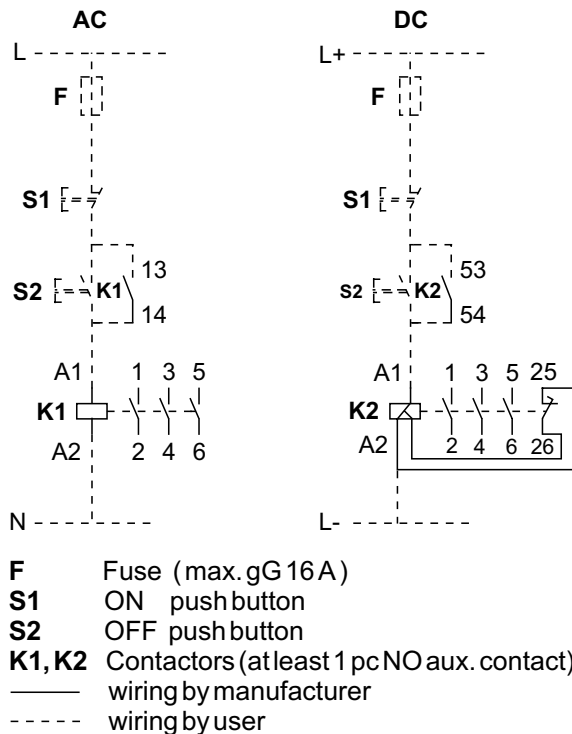
S 11	
S 20	

Terminal marking number indicated upside down will be straight when mounting to the other side (**S...** type auxiliary contact-blocks can be mounted either on the left, or the right contactor side).

2.4 Contact operation and characteristics (for all types)



2.5 Self-holding control



Symbols of coil outputs (A1, A2) and voltage-values are written by blue letters and numbers in case of 230 V 50/60 Hz, by red letters in case of 400 V 50/60 Hz, by black letters in other cases.

2.6 Auxiliary contactors

Built-in contacts are only in the positions shown under points 2.6.1 and 2.6.2. However, the user can achieve further contact-variations (ever after mounting) by using Hi type auxiliary contact-blocks.

2.6.1 AC-operated auxiliary contactors

HL-K-31	A1 13 21 33 43 A2 14 22 34 44
HL-K-22	A1 13 21 31 43 A2 14 22 32 44
HL-K-40	A1 13 23 33 43 A2 14 24 34 44
HL-K-44	A1 13 23 33 43 51 61 71 81 A2 14 24 34 44 52 62 72 82
HL-K-62	A1 13 23 33 43 53 61 71 83 A2 14 24 34 44 54 62 72 84

2.6.2 DC-operated auxiliary contactors

HL-K(G)-21	A1 13 21 33 45 A2 14 22 34 46
HL-K(G)-30	A1 13 23 33 45 A2 14 24 34 46
HL-K(G)-43	A1 13 23 33 45 53 61 71 81 A2 14 24 34 46 54 62 72 82
HL-K(G)-52	A1 13 23 33 45 53 61 71 83 A2 14 24 34 46 54 62 72 84

3. Technical data

Characteristics	Auxiliary contactor	CONTACTOR						
	HL-K-...	DIL-K4...	DIL-K5...	DIL-K7...	DIL-K11...	DIL-K15	DIL-K18	
GENERAL DATA								
Rated insulation voltage U_i [V]	690							
Rated operational frequency	50 / 60 Hz and $\overline{\text{---}}$							
Conventional free air / enclosed thermal current I_{th} / I_{the} [A]	16 / -	22 / 16	25 / 20	32 / 25	32 / 30	54 / 45	54 / 50	
Ambient temperature [°C]	operating	- 25 ... + 55						
	storage	- 30 ... + 80						
Masse [kg]	0,4					0,62		
Mounting position	vertical mounting plate $\pm 22,5^\circ$							
Mounting	2 pcs M4 screw or TS 35 rail							
Terminal-screws	size	M 3,5				caged terminal		
	tightening torque [Nm]	1,2		1,8		3		
Cross-section of connecting wires [mm ²]	rigid	1×(1,0...6,0) or 2×(1,5...6,0)				1×(2,5...25) or 2×(4...10)		
	flexible	1× or 2×(1,0...6,0)				1×(2,5...25) or 2×(2,5...10)		
	with ferrule	1 × (0,75...6,0)				1 × (0,5...16)		
Mechanical durability [c]	3 × 10 ⁷	10 ⁷						
Electrical durability	by 5. point							
Climatic conditions	by standard IEC 68							
Shock resistance (half-sinusoidal deflection, shock duration 20 ms)	6 g	make contact: 6g break contact: 4g						
Degree of protection	IP 20							
Pollution degree	max 3 (normal industrial environment)							
Relevant standards	EN 60947-1 EN 60947-4-1 EN 60947-5-1							
MAIN CONTACT SYSTEM with AC-load								
Switchable capacitive load [kVAr] (Electrical durability max. 10 ⁵ cycles)		HL-K-...	DIL-K4/c	DIL-K5/c	DIL-K7/c	DIL-K11/c	DIL-K15/c	DIL-K18/c
	230 V	-	3	4,5	7,5	10	12	13,3
	400 V	-	5	7	12,5	16,7	20	25
	500 V	-	5	9	18	20	25	33,3
690 V	-	7,5	11	20	25	30	37	

Characteristics		Auxiliary contactor	CONTACTOR						
		HL-K-...	DIL-K4...	DIL-K5...	DIL-K7...	DIL-K11...	DIL-K15	DIL-K18	
MAIN CONTACT SYSTEM with AC-load									
Switchable motor-power P_e [kW]	AC - 1	free air	—	13	16	21	21	36	36
		enclosed		10	13	16	16	36	36
	AC - 2 and AC - 3	400 V	—	2,2	3	4	5,5	9	11
		500 V	—	4	5,5	7,5	11	15	18,5
		690 V	—	5,5	7,5	11	15	18,5	20
		(5 x 10 ⁴ c) AC-4 400 V	—	4	5,5	7,5	11	15	18,5
Rated operational current AC - 1 / AC - 3		I_e [A] 40 °C	AC - 15 cos = 0,7 230 V 6 A 400 V 4 A 500 V 2 A 690 V 1 A	22 / 9	25 / 12	32 / 16	32 / 23	54 / 30	54 / 37
AC-1 with 3 parallel connected main currents paths				55	62	80	80	135	135
Rated short-time withstand current I_{cw} [A]	3 min / 1 min		—	70 / 80				120 / 260	
	10 s / 5 s		—	110 / 120		220 / 280		300 / 450	
	2 s / 1 s		—	160 / 180		350 / 400		550 / 700	
Rated breaking capacity [A] cos = 0,35	400 V		—	90	120	220		450	
	500 V		—	90	120	220		350	
	690 V		—	90	70	130		250	
Rated making capacity cos = 0,35 [A]			—	300		600		700	
Contact resistance per pole [mΩ]			—	1,5				1	
Power dissipation per pole at I_{th} [W]			—	2,5				2	
Short-circuit protecting fuse gG [A] Type of coordination of short-circuit protection: 2			20	20	25	35		63	

DIL-K-... contactors, HL-K-... auxiliary contactors

Characteristics	Auxiliary contactor		CONTACTOR					
	HL-K-...	DIL-K4...	DIL-K5...	DIL-K7...	DIL-K11...	DIL-K15	DIL-K18	
MAIN CURRENT SYSTEM with DC - load (two current - paths series connected)								
Conventional free air / enclosed thermal current I_{th} / I_{the} [A]		16 / —	22 / 16	25 / 20	32 / 25	32 / 30	54 / 45	54 / 50
Rated operational current I_e [A] DC - 1 L / R < 1 ms	24 V	10	22	25	32	32	54	
	110 V	6	22	25	32	32	54	
	220 V	1	22	25	32	32	54	
DC - 3 ... DC - 5 L / R 15 ms	24 V	—	22	25	32	32	54	
	110 V	—	22	25	32	32	54	
	220 V	—	6		8		10	16
DC - 13 L / R = 15 ms	24 V	6	—					
	110 V	2						
	220 V	0,75						
CONTROL SYSTEM								
Rated control circuit voltage U_c [V]	range	AC : 12 ... 600 V 50 / 60 Hz ;			DC : 12 ... 250 V			
	preferred values	AC : 24, 42, 110, 230, 400 V			DC : 24, 110, 220 V			
	operating limits (x U_c)	AC and DC 0,8 ... 1,1	AC : 0,8 ... 1,1			DC : 0,8 ... 1,25		
Switching times [ms] at 20 °C temperature	AC	on	12 ... 30			11 ... 20		
		off	10 ... 20			5 ... 20		
	DC	on	20 ... 30			15 ... 30		
		off	10 ... 16			10 ... 18		
Switching frequency [cycles /hour]	no load operation	10000	3000					
	AC - 1	1000						
	AC - 2 , AC - 3	—	1000			750		
	AC - 4	—	250					
	AC - 15 / DC - 13	1200	—					
Power consumption of coil inrush / hold	AC [VA]	65 / 9			95 / 10			
	DC [W]	115 / 1			105 / 1			
Short-circuit protecting fuse gG [A]				16				

AUXILIARY CONTACT SYSTEM					
Characteristics	Variant	N° 13 - 14 or 21 - 22 built-in auxiliary contacts	Hi -..	Li -..	S 11 or S 20
Rated insulation voltage	U_i [V]	690			
Conventional free air thermal current	I_{th} [A]	16	10	10	10
Rated operational current I_e [A] AC - 15 $\cos \phi = 0,7$	230 V	6			
	400 V	4			
	500 V	2			
	690 V	1			
DC - 13 L / R = 15 ms	24 V	4			
	110 V	2			
	220 V	0,75			
DC - 1 L / R = 1 ms	24 V	10			
	110 V	4			
	220 V	1			
Switching frequency [cycles / hour]	no load operation	10 000			
	AC - 15 / DC - 13	1200			
Mechanical durability	[c]	3×10^7			
Cross-section of connecting wires	[mm ²]	solid and stranded 2 x (1...6) wire with ferule 1 x (0,5...6)			
Size and tightening torque of terminal-screws		M 3,5 / 1,2 Nm			
Short-circuit protecting fuse	gG (A)	16			

4. Accessories

4.1 H0-2K type overload (thermal) relay

The thermal relay can be plugged to 2T1; 4T2 ; 6T3 terminals "under" the contactor. Available in the current-range of 0,2 A...32 A covered by 13 differently set devices.

Features:

- manual or automatic re-setting
- thermocompensated operation
- sensitivity to phase failure
- TEST pushbutton



The motor-overload protective combination (starter) made of a DIL-K contactor and a H0-2K relay. Thermal relay time-current characteristic are according to "10" trip class (EN 60947-4-1).

4.2 LA type pneumatic timer



The LA- timer snaps on the contactor's forefront. The pneumatic timer's contacts can be delayed by the set time operation (**LA 2**) or release (**LA 3**).The LA timer is a good solution where sharp, exact timing is not necessary and the device

is operated in a normal environment. Delay time can be set by the turning knob. A front fitted push bar serves the testing of the device.

The LA 2 type contains 1 free opening (break) auxiliary contact marked 55; 56, and 1 free closing (make) auxiliary contact marked 67; 68.

Opening contacts are marked as 65; 66 and closing contacts are marked as 57; 58 on LA 3 types.

Technical data:

Operational temperature range: -40 °C...+70 °C

Repeating accuracy: ± 2 %

Long term stability up to $0,5 \times 10^6$ c: +15 %. Delay times of both types:

Delayed operation:		Delayed release
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LA 2 DT 0	0,1...3s	LA 3	DR 0
LA 2 DT 2	1...3s	LA 3	DR 2
LA 2 DT 4	10...180s	LA 3	DR 4

Contacts:

$U_i = 660$ V

$I_{th} = 10$ A, $I_e = 6$ A (AC-15, 500 V)

4.3 MV-B type electromechanical latch head

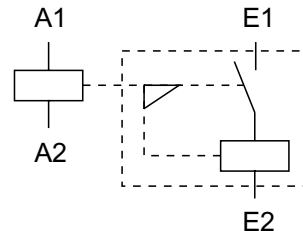


The latch head snaps on the forefront of the device. Its purpose is to keep the contactor's main contacts closed after the operation of the contactor while the voltage can be switched off from the coil. The above feature serves the energy

saving operation. The position of the moving part in the contactor is shown by a status indicator on the latch head.

There are two ways to achieve release:

Pushing the yellow button upwards or applying a voltage impulse to E1; E2 terminals equivalent to the rated value of latch head.



The impulse should last at least 10 ms. After the impulse the auxiliary contact of the module breaks the circuit connected to the E1; E2 terminals after 15 ms.

Types according to operating voltage::

24 V UC ; 48 V UC ; 110 V UC ; 220 V UC.

("UC" stands for operation either AC or DC).

Rated power during a break: 200 VA AC
190 W DC

DO NOT energize this device and the contactor at the same time!

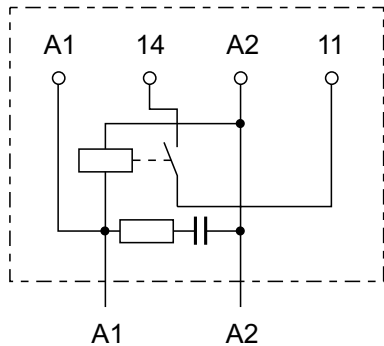
4.4 MV-e type mechanical interlock

Using the mechanical interlock two contactors can be attached. This attachment can be made without a special tool. The interlock's main function is to avoid the simultaneous operation of the two contactor. The interlock can be used (without electrical interlock) in reversing and star-delta combinations and in a safety circuit containing auxiliary contactors.

4.5 NP-K type low signal module

The device can be plugged from "above", to A1 and A2 terminals of the coil. The control voltage of the contactor is to be connected to A1 and A2 terminals of this module.(A2 can also be connected on the bottom side).

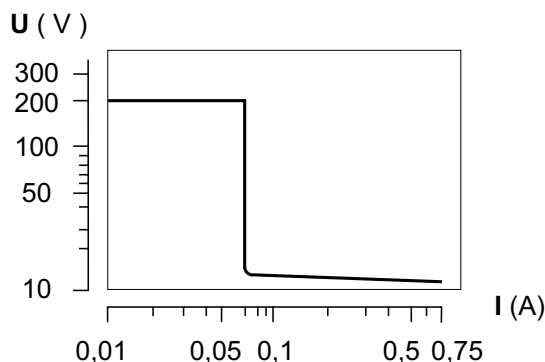
This module is practically an auxiliary relay which - due to its special design - is capable of switching low values of power and voltage safely. The built-in Reed-contact is made of Ruthenium, having the terminals marked 11; 14. Operation is indicated by the red LED on the front. The module contains a R-C supressor unit.



Technical data:

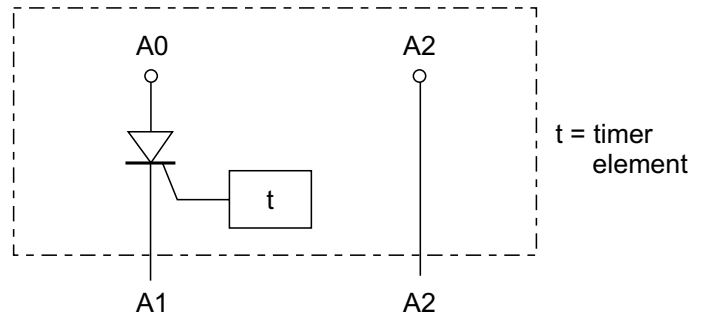
- Input circuit:
 Rated voltages (-15 %...+10 %) and power:
 24 V UC 0,072 W
 42 V UC 0,132 W
 230 V UC 0,800 W
 Network frequency : 50...60 Hz
 Operational (ambient) temperature: -20 °C...+60 °C
- Output circuit:
 Temporary resistance of relay contact:
 200 m (starting value)
 Maximum switching voltage:
 200 V UC (peak value)
 Maximum switching current:
 0,05 A UC (peak value), if U >12 V
 0,75 A UC (peak value), if U ≤ 12 V
 Maximum switching power: 10 VA
 Testing voltage:
 350 V UC between open contacts,
 2000 V AC between input and output circuit.
 Appearance and dimensions of this module are identical to RM-K interface module (see 4.8).

Maximum switching power with ohmic load:



4.6 ZM-K type timer module

The module's function is to delay the operation of the contactor. Module terminals are to be connected to A1 and A2 coil terminals. The timing starts if the control voltage is applied to A0 and A2 (A2 can also be connected to the bottom side) terminals. The thyristor begins to conduct after the set delay time and so the energizing voltage is applied to the coil of the contactor.



Technical data:

- Output circuit: thyristor.
 Range of current load: 20 mA...0,5 A (20° C)
 Possible load decreases related to temperature: 10 mA / °C
 Maximum short time circuit impulse: 20 A if t ≤ 20 ms
 - Input circuit:
 Control voltage (A0 ; A2) : 24...240 V UC
 Voltage drop during timing: (A0/A1) 3V
 Power consumption during timing:
 2 mA (24...60 V UC)
 8 mA (60...240 V UC)
 - Timer circuit:
 Recovery time : 150 ms
 Repeating accuracy: ± 0,2 %
 Timing error due to instable control voltage (within tolerance): 0,5%
 Ambient temperature: -20 °C...+60 °C
 Temperature error: 0,07 % / °C
 Timing intervals: 0,2...4s
 1,5...30 s
 12,5...250s
- Appearance and dimensions are identical with RM-K module (see 4.8).

4.7 YD star-delta timer

It is a special timer module with the function of change-over switching of the contactors for star-delta motorstarter combinations. There are two versions: 1...12s ± 40 % and 2...24 s ± 40 %. The circuit of timer is built-in the house of Hi.. auxiliary contact block. It should be snapped on any contactor.

The control voltage connected on the terminals marked 61; 62 operates the timing and after the adjusted T time the contacts connected to terminals marked 63; 65 shall be opened.

Time needed to restart: min. 300 ms.

Rated control voltage: 24, 42, 110, 230, 400 V 50/60 Hz

Power consumption: 2 VA

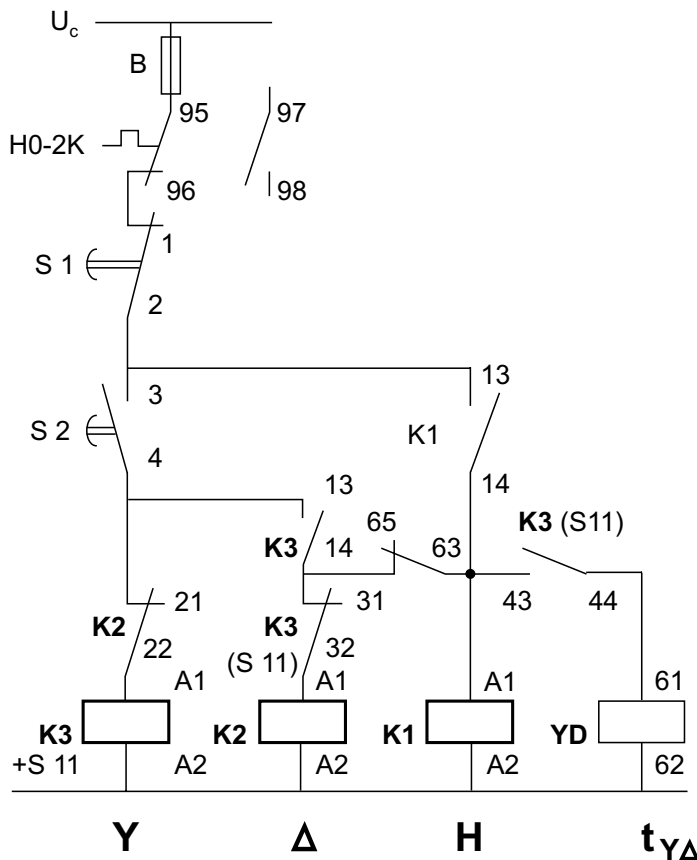
Ambient temperature: - 5... + 50 °C

Rated thermal current of the contacts: 8 A

Rated operational current (AC-15)	0,6 A (400 V)
	1 A (230 V)
	1,6 A (24 V)

Electrical endurance: 10⁵ c

Switching frequency: 120 c/h



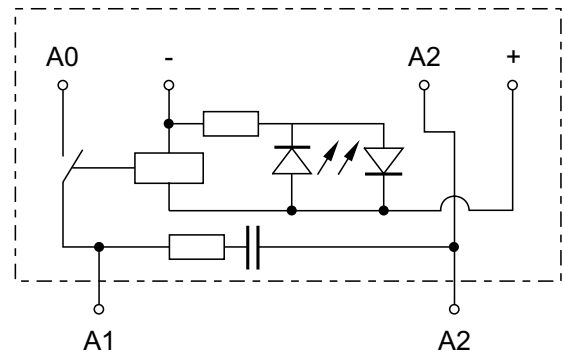
4.8 RM-K type interface module



Its function is to enable the user to operate the contactor with low level electric signals coming from computers PLC-s or other electronic equipment. Module terminals are to be connected to A1

and A2 contactor terminals. Connect control voltage to A0 and A2 (A2 even on the bottom side) terminals. Output from the electronic equipment is to be connected to the input points of the module with the corresponding polarity. Module output operates the coil of the contactor directly.

The built-in DC-coil and the LED indicating the operation is powered by the voltage occurring at "+, -" terminals.



RM-K01

Input:	19 ... 40 V DC	15 ... 30 mA
Output:	250 U _c 415 V AC	I _e = 1,5 A (AC-15)
Built-in supressor:	470	0,15 F

RM-K02

Input:	19 ... 40 V DC	15 ... 30 mA
Output:	U _c 250 V AC	I _e = 1,5 A (AC-15)
Built-in supressor:	220	0,22 F

Electrical durability of module contact:

≈ 2 x 10⁶ cycles.

4.9 Overvoltage protecting and supressor units

Overvoltage protecting and supressor units can be plugged in A1 and A2 coil terminals (upper side). The units allow free control voltage wiring due to their design.

4.9.1 RC-K unit

Built-in R-C damping elements lessen both switching and aerial over-voltages. In-line R-C elements make an oscillating circuit with the L inductivity of the network and limit the overcurrent to a maximum of 1,5 ... 2 times of the network voltage. The units can not be used in systems that are sensitive to longer oscillations because not only the steep of the voltage-impulses is reduced but the frequency as well.

Types:	RC-K 01	24...48 V	AC
	RC-K 02	110...240 V	AC
	RC-K 03	220...400 V	AC

4.9.2 V-K unit

The varistor absorbs the energy that could be harmful to elements in the network due to high voltage impulses. The steep and frequency of the impulses are not reduced, but their peak value is lessend considerably. This unit can not be used in systems that are sensitive to the steep of the voltage impulses.

Types:	V-K 01	12...65 V	AC or
		12...75 V	DC
	V-K 02	60...130 V	AC or
		70...145 V	DC
	V-K 03	120...260 V	AC or
		140...320 V	DC
	V-K 04	260...400 V	AC or
		320...540 V	DC
	V-K 05	400...690 V	AC or
		540...850 V	DC

4.9.3 D-K 01 unit

This module can be plugged in DC-operated (12... 220 V) contactors only. Its function is to cut overvoltage peaks when switching off the coil voltage. The unit delays the contactor release by 10 ms.

4.10 Compatibility

There are some restrictions concerning the use of forefront-mounted additional units and the side-mounted auxiliary contacts *together*, in order to ensure the safe bounce and noise-free (AC or DC) operation of the contactors.

4.10.1 HL-K auxiliary contactors and DIL-K4...DIL-K11 contactors:

- 2 or 4-contact Hi-type auxiliary contacts and any of the forefront-mounted units (LA 2, LA 3, MV-B) used for contactors without S...type auxiliary contact blocks.
- if there are one or two S...type auxiliary contacts mounted on the contactor sides, only the 2-contact Hi type auxiliary contact block can be fitted (or any of the forefront-mounted units).

4.10.2 DIL-K15 and DIL-K18 contactors the conditions are the same, respectively with the use of Li-type auxiliary contacts blocks.

Type and DIL-K... + S...	HL-K-... ; DIL-K4... ; -K5... ; -K7... ; -K11...			DIL-K15 DIL-K18		
Forefront mounted unit						
2 pole Hi-	+	+	+	-	-	-
4 pole Hi-	+	-	-	-	-	-
2 pole Li-	-	-	-	+	+	+
4 pole Li-	-	-	-	+	-	-
LA... or MV-B	+	+	+	+	+	+

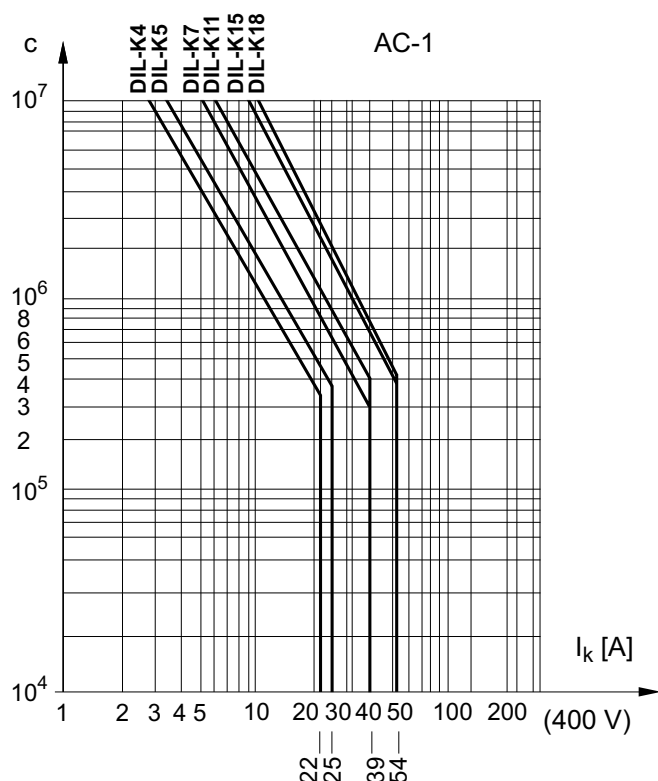
5. Selection characteristics

Electrical durability (life) of the contactors primarily depend on the break (switch-off) current of the appliance. Selection characteristics refer to the connection between the switching cycles and switching power.

5.1 Electrical durability according to utilization category and switching power ($U_e = 400\text{ V}$)

Contactor types	Category	AC-4		
	Operation cycles	AC-3	AC-4	
		1 x 10 ⁶	0,05 x 10 ⁶	0,2 x 10 ⁶
Switching power [kW]				
DIL-K4		4	3	1,5
DIL-K5		5,5	4	2,2
DIL-K7		7,5	5,5	2,5
DIL-K11		11	7,5	3,0
DIL-K15		15	12,5	5,5
DIL-K18		18,5	15	7,5

5.2 Electrical durability related to break current (at $U_e = 400\text{ V}$)



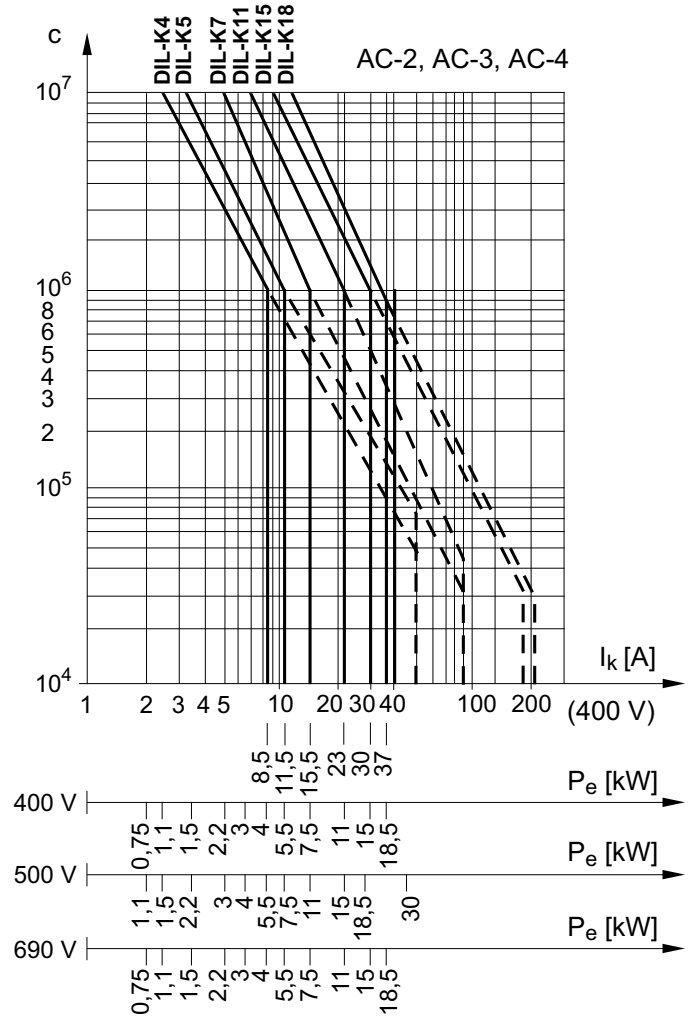
c = switching cycles

I_k = break current $I_k = I_e$

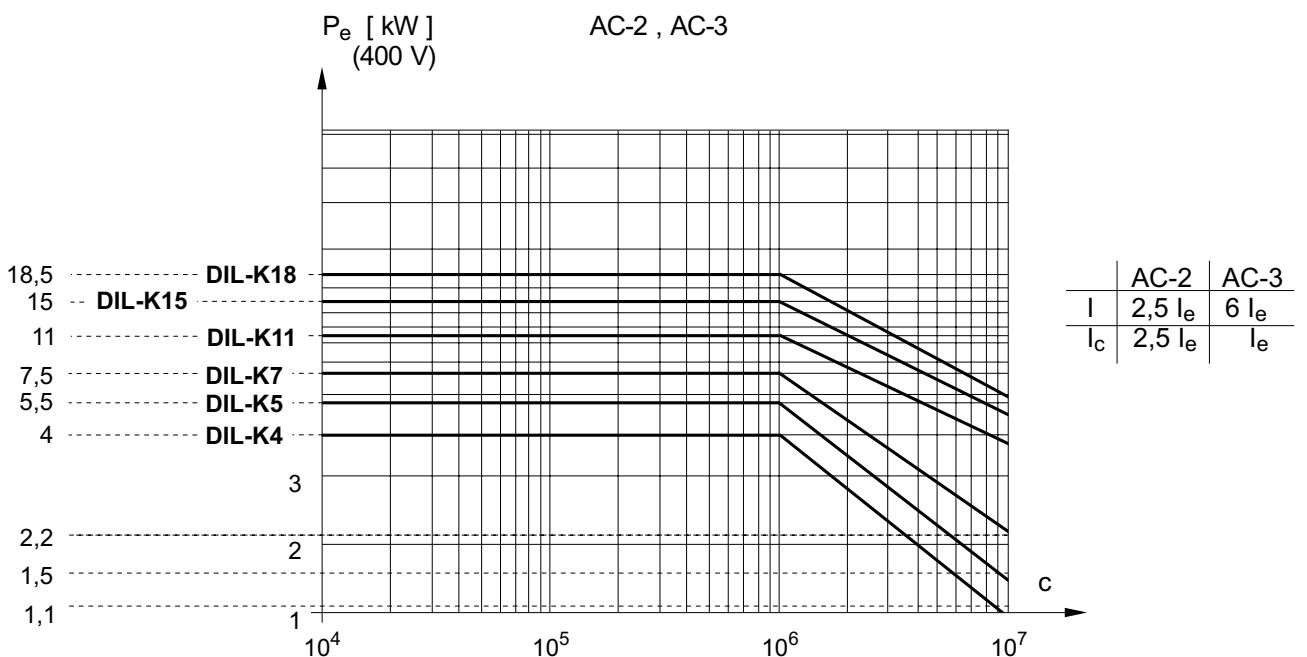
P_e = rated motor power

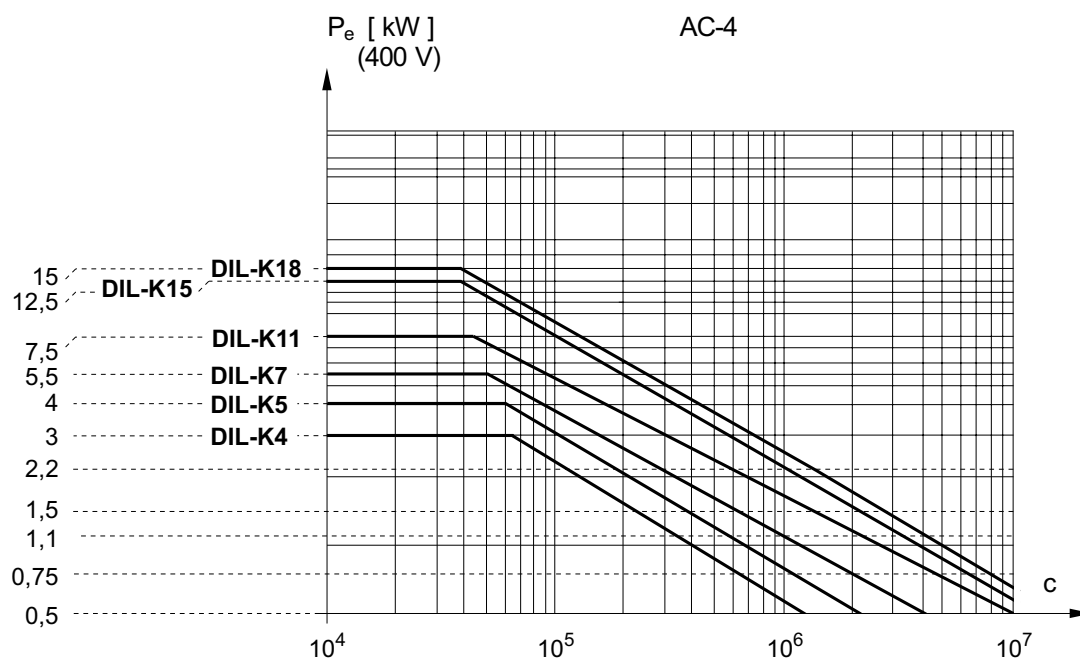
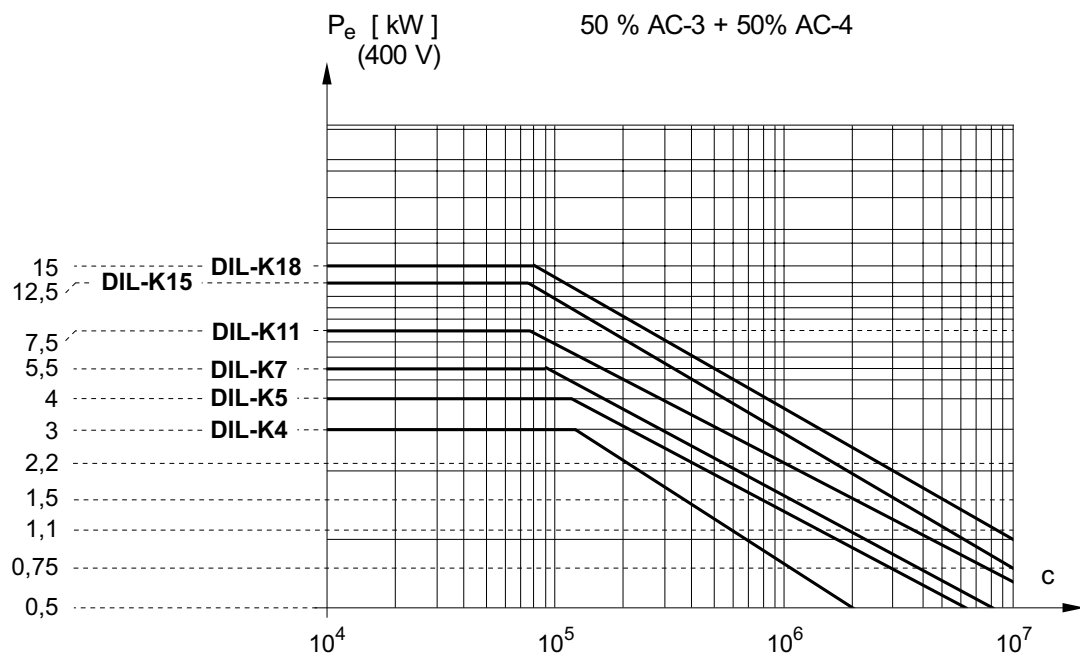
In case of **AC-2** and **AC-3** utilization categories the break current is equal with the rated operational current of the rated motor power.
 In case of **AC-4** utilization category the break current is six times higher than the rated operational current.

Curves indicated as "- - - -" refer to the expected number of switching cycles in **AC-4** utilization category



5.3 Switching power related to electrical durability





5.4 Selection examples

Utilization categories (according to EN 60947-1:1997 standard)

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 control.

AC-5b : Switching of incandescent lamps.

AC-6a : Switching of transformers.

AC-6b : Switching of capacitorsbanks.

AC-14 : Control of small electromagnetic loads.

AC-15 : Control of a.c. electromagnetic loads.

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.

DC-6 : Switching of incandescent lamps.

DC-13: Control of d.c. electromagnets.

Example 1

3-phase 7,5 kW (400 V) motor. Rated operational current: $I_e = 15,5$ A. **AC-3** utilization category (break current equal with operational current). The selection is DIL-K7 contactor according to the diagram (5.2) in case of 10^6 cycles electrical durability. $1,2 \times 10^6$ cycles can be achieved by choosing DIL-K11 type..

AC-4 utilization category, break current: $I_k = 6 \times I_e = 93$ A.

Choosing DIL-K7 contactor in this case results in approx. 3×10^4 cycles electrical durability.

(Choosing DIL-K11 contactor comes with almost 5×10^4 c, choosing DIL-K15 expected electrical durability exceeds 10^5 cycles).

Example 2

AC-1 utilization category (ohmic load, $\cos \phi = \max. 0,95$). Break current is approximately 32 A. Choosing DIL-K7 contactor comes with over 4×10^5 c, with DIL-K11 increases expected electrical durability to approx. $5,2 \times 10^5$ c.

Using the contactor with lower break currents increases electrical durability (slant section on the diagram). The above values are valid only if the switching frequency does not exceed the corresponding limits.

Example 3

Single phase, $P_e = 22$ kW ($U_e = 400$ V) load, utilization category: **AC-1**. Required electrical durability: $0,5 \times 10^6$ cycles. Rated operational current:

$$I_e = \frac{P_e}{U_e} = 55 \text{ A}$$

Proposed contactor type: DIL-K18.

Example 4

Three-phase load, AC-3 utilization category, $P_e = 15$ kW (rated power) motor, $U_e = 400$ V 50 Hz. Switch -on: from standing position, switch - off at rated rpm. Expected durability of machine 2,5 years. Switching frequency 250 c/h.

Necessary durability of the contactor:

$$T = 2,5 \text{ years} \times 50 \text{ weeks} \times 40 \text{ hours} \times 250 \text{ c/h} = 1,25 \times 10^6 \text{ cycles}$$

Switching frequency is at least one third of the allowed frequency, so the contactor - according to experience -can be used up to the maximum (100 %) motor power.

According to the diagram, DIL-K18 should be chosen for 1,25 million cycles with 15 kW motor power.

Note: 15 kW rated power in the AC-3 utilization category ($U_e = 400$ V) can be switched by DIL-K15 (750 c/h frequency), but safely only up to 10^6 c. This means that the contactor should be replaced twice during the motor's operation (contactor durability in this case is shortened to 9 months).

Example 5

AC-4 utilization category (reversing, stepping, plugging, braking) comes with much less switching power compared to AC-1 ... AC-3. For example according to the figure at 5.1, a DIL-K11 contactor can be operate a 7,5 kW motor with 250 c/h switching frequency up to 50000 cycles. If the expected contactor durability is 10^5 c then DIL-K15 should be used while 2×10^5 c expected durability needs a DIL-K18 contactor.

Example 6

If the contactor is operated in different utilization categories for a certain percentage of the cycles, the following general formula can be used to calculate expected durability:

T_1 means expected durability in AC-3 utilization category

T_2 means expected durability in AC-4 utilization category

The percentage of the letter is : p.

In this case the expected durability is

$$T = \frac{T_1}{1 + \frac{p}{100} \left(\frac{T_1}{T_2} - 1 \right)}$$

Even an application for 90 % AC-3 and 10 % AC-4 operation is considered as heavy load. Point 5.3 shows curves for 50 - 50 % operation.

The chart inside the back cover page of this catalogue can help equipment- and drive-designers, containing rated motor power, power factor, efficiency, rated operational current data and the proposed value of the short-circuit protective device relative to the operational voltage.

5.5 Motor starter combinations

The direct motor starter combination is described at point 4.1 while the corresponding dimensions can be found at point 6.

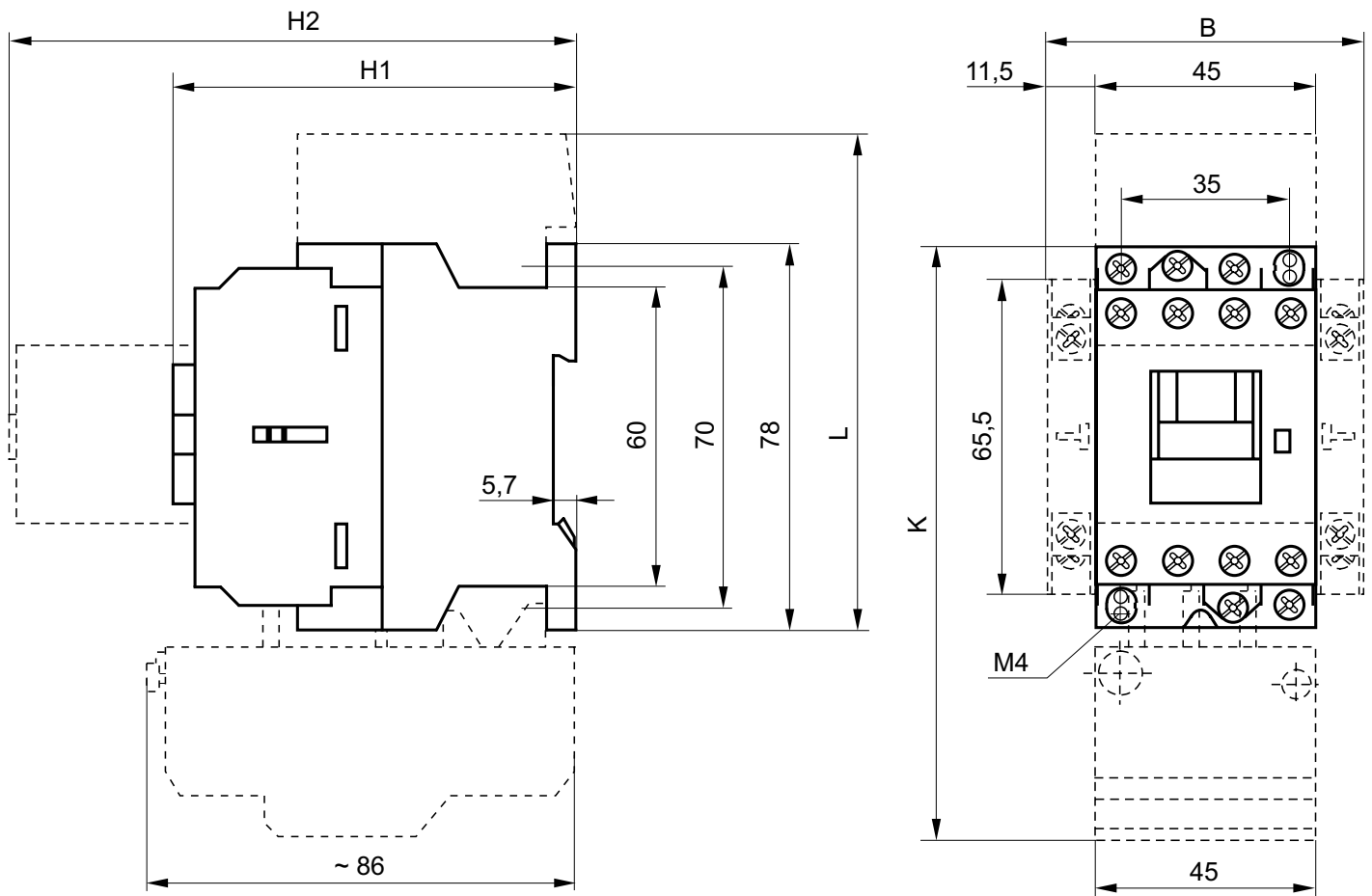
Reversing, star-delta and other combinations can be ordered from the manufacturer but these combinations can easily and quickly be formed by user due to the contactors' design, the rail-mounting feature, and by using interlocks and controlling modules.

5.6 Order examples

- 5.6.1 - ... piece(s) DIL-K4-01 contactor $U_c = 110\text{ V}$ 50/60 Hz
 - ... piece(s) Hi-31 auxiliary contact block
- 5.6.2 - ... piece(s) DIL-K5-10 contactor $U_c = 230\text{ V}$ 50/60 Hz
 - ... piece(s) S 11 auxiliary contact block
 - ... piece(s) Hi-22 auxiliary contact block
- 5.6.3 - ... piece(s) DIL-K7-10 contactor $U_c = 400\text{ V}$ 50/60 Hz
- 5.6.4 - ... piece(s) DIL-K11-01 contactor $U_c = 42\text{ V}$ 50/60 Hz
 - ... piece(s) LA 2 pneumatic timer
 - ... piece(s) H0-2K thermal relay 2,2 ... 3,3 A
 - ... piece(s) NP-K low-signal module 42 V
- 5.6.5 - ... piece(s) DIL-K(G)11 contactor $U_c = 24\text{ V DC}$
 - ... piece(s) RM-K-01 interface module
 - ... piece(s) S 20 auxiliary contact block
- 5.6.6 - ... piece(s) DIL-K18 contactor $U_c = 230\text{ V}$ 50/60 Hz
 - ... piece(s) Li-22 auxiliary contact block



6. Dimensions



Dimension	sign	HL-K-... DIL-K4 ...11	DIL-K15...18
Height	H1	85	97
Contactor + Hi- or Li-	H2	120	132
Contactor + MV- B		127	139
Contactor + LA ...		138	150
Contactor + 2 pcs S ... auxiliary contact block	B	69	69
Contactor + H0 - 2K	K	132	132
Contactor + module on the upper side	L	102	102

Rated operational currents of a.c. motors:

The undermentioned value of the rated operational currents are related to electric motors (AC, inner and surface cooling, 1500 r.p.m.).

Direct starting: $6 \times I_e$ the running up time: 5 s

Star-delta starting: $2 \times I_e$ the running up time: 15 s

The range of currents for star-delta starting are legible on the surface of the thermal relay as well.

The value of the motor's rated current should be adjusted by the turn knob.

The current-values of fuses are valide for Y/ starting of slip-ring motors. In case of bigger rated and starting currents, or/and running up times it should be used bigger fuses (characteristic gG).

Rated current of NH-fuses of characteristic aM should be chosen to equal value of the motors' rated current.

Motor			230 V			400 V			500 V			690 V		
Rated power [kW]	Power factor cos	Efficiency %	Motor I_e	Fuse I_n		Motor I_e	Fuse I_n		Motor I_e	Fuse I_n		Motor I_e	Fuse I_n	
			[A]	direct	Y/	[A]	direct	Y/	[A]	direct	Y/	[A]	direct	Y/
0,06	0,7	59	0,38	1	1	0,22	1	1	0,16	1	1	-	-	-
0,09	0,7	60	0,55	2	2	0,33	1	1	0,24	1	1	-	-	-
0,12	0,7	61	0,76	2	2	0,42	2	2	0,33	1	1	-	-	-
0,18	0,7	61	1,1	2	2	0,64	2	2	0,46	1	1	-	-	-
0,25	0,7	62	1,4	4	2	0,88	2	2	0,59	2	2	-	-	-
0,37	0,72	64	2,1	4	4	1,22	4	2	0,85	2	2	0,7	2	2
0,55	0,75	69	2,7	4	4	1,5	4	2	1,2	4	2	0,9	2	2
0,75	0,8	74	3,3	6	4	2	4	4	1,48	4	2	1,1	2	2
0,8	0,8	74	3,6	6	4	2,1	4	4	1,57	4	2	-	-	-
1,1	0,83	77	4,9	10	6	2,6	4	4	2,1	4	4	1,5	4	2
1,5	0,83	78	6,2	10	10	3,5	6	4	2,6	4	4	2	4	4
2,2	0,83	81	8,7	16	10	5	10	6	3,8	6	6	2,9	6	4
2,5	0,83	81	9,8	16	16	5,7	10	10	4,3	6	6	-	-	-
3	0,84	81	11,6	20	16	6,6	16	10	5,1	10	10	3,5	6	4
3,7	0,84	82	14,2	25	20	8,2	16	10	6,2	16	10	-	-	-
4	0,84	82	15,3	25	20	8,5	16	10	6,5	16	10	4,9	10	6
5	0,84	83	18,9	35	25	10,5	20	16	8,1	16	10	-	-	-
5,5	0,85	83	20,6	35	25	11,5	20	16	8,9	16	10	6,7	16	10
6,5	0,86	84	23,7	35	25	13,8	25	16	10,4	20	16	-	-	-
7,5	0,86	85	27,4	35	35	15,5	25	20	11,9	20	16	9	16	10
8	0,86	85	28,8	50	35	16,7	25	20	12,7	20	16	-	-	-
11	0,86	87	39,2	63	50	22	35	25	16,7	25	20	13	25	16
12,5	0,86	87	43,8	63	50	25	35	35	19	35	25	-	-	-
15	0,86	87	52,6	80	63	30	50	35	22,5	35	25	17,5	25	20
18,5	0,86	88	64,9	100	80	37	63	50	28,5	50	35	21	35	25
20	0,86	88	69,3	100	80	40	63	50	30,6	50	35	-	-	-
22	0,87	89	75,2	100	80	44	63	50	33	50	50	25	35	35
25	0,87	89	84,4	125	100	50	80	63	38	63	50	-	-	-
30	0,87	90	101	125	125	60	80	63	44	63	50	33	50	35
37	0,87	90	124	160	160	72	100	80	54	80	63	42	63	50
40	0,87	90	134	160	160	79	100	100	60	80	63	-	-	-
45	0,88	91	150	200	160	85	125	100	64,5	100	80	49	63	63
51	0,88	91	168	200	200	97	125	100	73,7	100	80	-	-	-
55	0,88	91	181	250	200	105	160	125	79	125	100	60	80	63
63	0,88	91	207	250	200	119	160	125	90,5	125	100	-	-	-
75	0,88	91	245	315	250	140	200	160	106	160	125	82	125	100
80	0,88	91	260	315	315	147	200	160	112	160	125	-	-	-
90	0,88	92	292	400	315	170	250	200	128	160	160	98	125	125
100	0,88	92	325	400	400	188	250	250	143	200	160	-	-	-
110	0,88	92	358	500	400	205	250	250	156	200	200	118	160	125
129	0,88	92	420	500	500	242	315	250	184	250	200	-	-	-
132	0,88	92	425	500	500	245	315	250	186	250	200	140	200	160
140	0,88	92	449	630	500	260	315	315	200	250	250	-	-	-
147	0,88	93	472	630	630	273	315	315	207	250	250	-	-	-
160	0,88	93	502	630	630	295	400	315	220	315	250	170	200	200