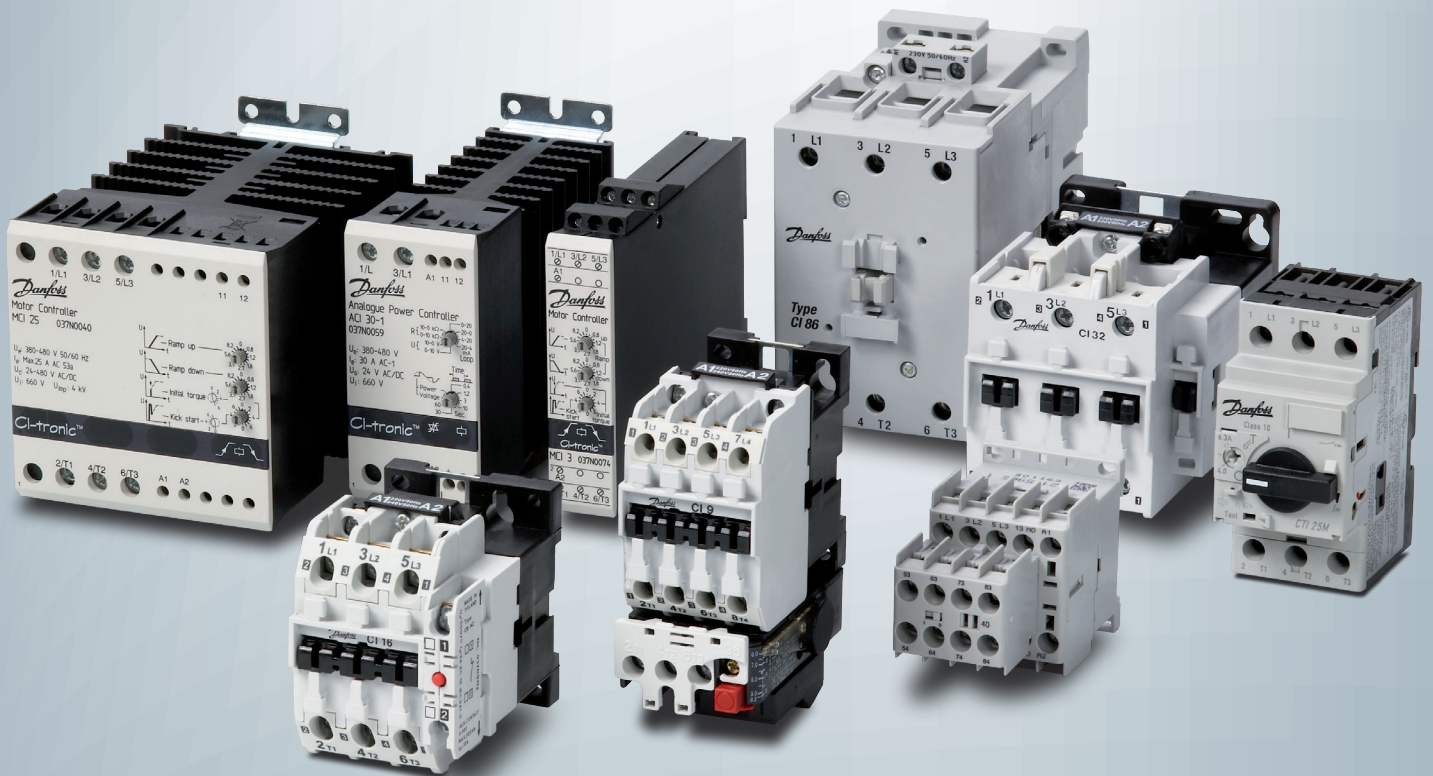


Industrial Automation Components

# LV Switchgear Product Catalogue

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## Mini-Contactors CI 5-2 to CI 5-12

Due to their dimensions, mini contactors fit perfectly into cabinets for modular devices. A series of AC and DC controlled contactors cover the power range from 1.5 to 5.5 kW (from 4 to 11.5 A in AC-3 category). They are characterized

by low power consumption and quiet operation. Together with add-on auxiliary contact blocks they form a wide range of combinations of up to 8 signaling contactors. They can thus be used as control relays.

1



### Electrical parameters – AC coils

$U_e$ 230 V	$U_e$ 400 V	$I_e$ (AC-3)	$I_{th}$ 40°C (AC-1)	$I_{th}$ 60°C (AC-1)	Main contacts	Auxiliary contacts	Code number <sup>1)</sup>	Type
–	–	–	10 <sup>2)</sup> A	6 <sup>2)</sup> A	–	4 NO	037H3500XX	CI 5-2 40E
–	–	–	10 <sup>2)</sup> A	6 <sup>2)</sup> A	–	2 NO / 2 NC	037H3501XX	CI 5-2 22Z
1.5 kW	2.2 kW	4.9 A	20 A	16 A	3	1 NO	037H3502XX	CI 5-5 10
1.5 kW	2.2 kW	4.9 A	20 A	16 A	3	1 NC	037H3503XX	CI 5-5 01
3.0 kW	4.0 kW	8.5 A	20 A	16 A	3	1 NO	037H3504XX	CI 5-9 10
3.0 kW	4.0 kW	8.5 A	20 A	16 A	3	1 NC	037H3505XX	CI 5-9 01
3.0 kW	4.0 kW	8.5 A	20 A	16 A	4	–	037H3506XX	CI 5-9 40M
3.3 kW	5.5 kW	11.5 A	20 A	16 A	3	1 NO	037H3507XX	CI 5-12 10
3.3 kW	5.5 kW	11.5 A	20 A	16 A	3	1 NC	037H3508XX	CI 5-12 01

<sup>1)</sup> The coil voltage is marked by the additional two digits in the table below

<sup>2)</sup> The signal contactor, the given load applies to AC-12 category

Coil voltage	Symbol xx
24 V, 50/60 Hz	13
110 V, 50 Hz 120 V, 60 Hz	23
230 V, 50/60 Hz	32
400 V, 50/60 Hz	37

Standard coil voltage tolerance -15%, +10%

## Mini-Contactors CI 5-2 to CI 5-12

### Electrical parameters 24 V

#### DC coils

$U_e$ 230 V	$U_e$ 400 V	$I_e$ (AC-3)	$I_{th}$ 40°C (AC-1)	$I_{th}$ 60°C (AC-1)	Main contacts	Auxiliary contacts	Code number	Type
–	–	–	10 <sup>1)</sup> A	6 <sup>1)</sup> A	–	4 NO	037H350002	CI 5-2 40E
–	–	–	10 <sup>1)</sup> A	6 <sup>1)</sup> A	–	2 NO / 2 NC	037H350102	CI 5-2 22Z
1.5 kW	2.2 kW	4.9 A	20 A	16 A	3	1 NO	037H350202	CI 5-5 10
1.5 kW	2.2 kW	4.9 A	20 A	16 A	3	1 NC	037H350302	CI 5-5 01
3.0 kW	4.0 kW	8.5 A	20 A	16 A	3	1 NO	037H350402	CI 5-9 10
3.0 kW	4.0 kW	8.5 A	20 A	16 A	3	1 NC	037H350502	CI 5-9 01
3.3 kW	5.5 kW	11.5 A	20 A	16 A	3	1 NO	037H350702	CI 5-12 10
3.3 kW	5.5 kW	11.5 A	20 A	16 A	3	1 NC	037H350802	CI 5-12 01

<sup>1)</sup> The signal contactor, the given load applies to AC-12 category  
Standard coil voltage tolerance -30%, +25%

### Electrical parameters

#### 12 V DC coils

$U_e$ 230 V	$U_e$ 400 V	$I_e$ (AC-3)	$I_{th}$ 40°C (AC-1)	$I_{th}$ 60°C (AC-1)	Main contacts	Auxiliary contacts	Code number	Type
3.0 kW	4.0 kW	8.5 A	20 A	16 A	3	1 NO	037H350401	CI 5-9 10

Standard coil voltage tolerance -30%, +25%

### Accessories

#### Auxiliary contact blocks

CBN are add-on auxiliary contacts mounted at the front of the mini contactors. They come in two versions, as 2- and 4-pole versions. The height of the housing of such a set is equal to the height of dedicated thermal overload relay for the mini contactors.



Function	$I_e$ (AC-15)	$I_{th}$ 40°C (AC-1)	$U_e$	Code number	Type
4 NO	2 A	10 A	500 V	037H3511	CBN – 40
2 NC	2 A	10 A	500 V	037H3513	CBN – 02
1 NO / 1 NC	2 A	10 A	500 V	037H3514	CBN – 11
2 NO / 2 NC	2 A	10 A	500 V	037H3515	CBN – 22
4 NC	2 A	10 A	500 V	037H3512	CBN – 04

## Mini-Contactors CI 5-2 to CI 5-12

1

Type	Description	Catalogue number
	Mechanical interlock	037H3520
DCN 250	Diode Suppressor DC	037H3510
RCN	RC Suppressor RCN 48 24 – 48 V AC RCN 280 110 – 280 V AC	037H3518 037H3519



### Technical data Control circuit parameters

Type	Inrush power consumption			Holding power consumption			Pull-in voltage*)		Drop-out voltage*)		Make time		Brake time	
	AC	AC	DC	AC	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC
	VA	W	W	VA	W	W	–	–	–	–	ms	ms	ms	ms
CI 5-	35	32	3	5	1.8	3	0.85 – 1.1	0.8 – 1.1	0.2 – 0.75	0.1 – 0.75	15 – 40	18 – 40	15 – 28	6 – 12

\*) The given values refer to the multiples of the  $U_s$  control voltage

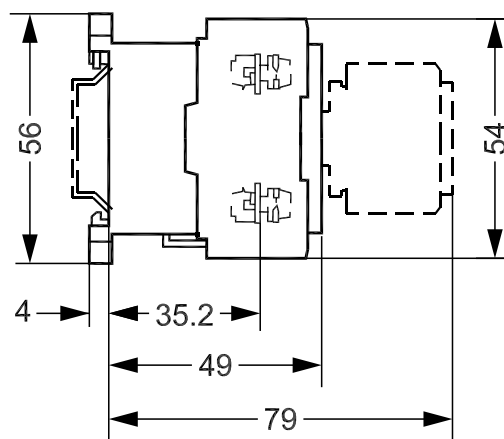
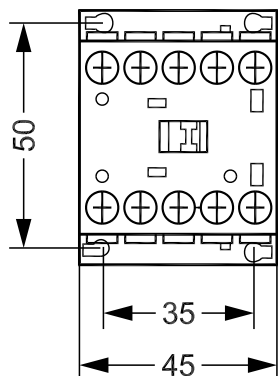
### Connection

Type	Connection method	Single core	Multi core without terminal sleeve	Multi core with terminal sleeve	Recommended tightening torque
CI 5-	Screw and clamp washer	1 – 4 mm <sup>2</sup>	–	0.75 – 2.5 mm <sup>2</sup>	1.2 Nm

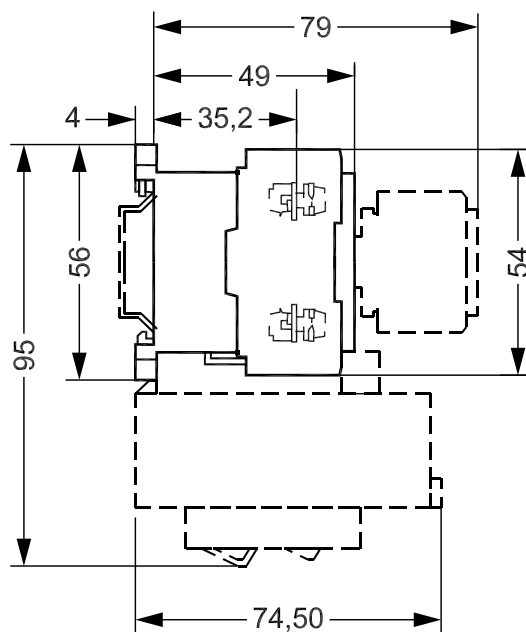
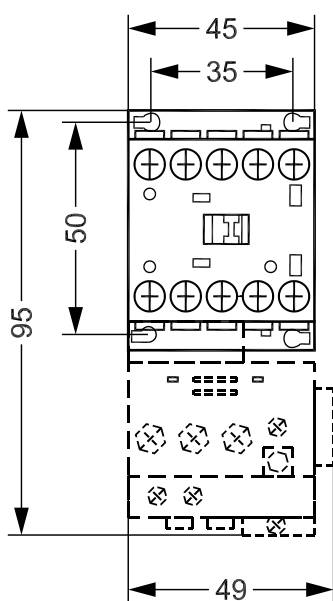
Mini-Contactors CI 5-2 to CI 5-12

CI 5-2, 5-5, 5-9, 5-12

1



Dimensional drawing of the mini-contactor set with thermal overload relay





## Contactors CI 6 to CI 50

The CI 6 to CI 50 contactors, controlled by AC control voltage, form a standard series of types for motors from 2.2 to 25 kW. They are available in a three-pole version, and up to 25 A (AC-1) also in a four-pole version.

To each contactor, you can connect up to 4 auxiliary contacts, individually and in any configuration.



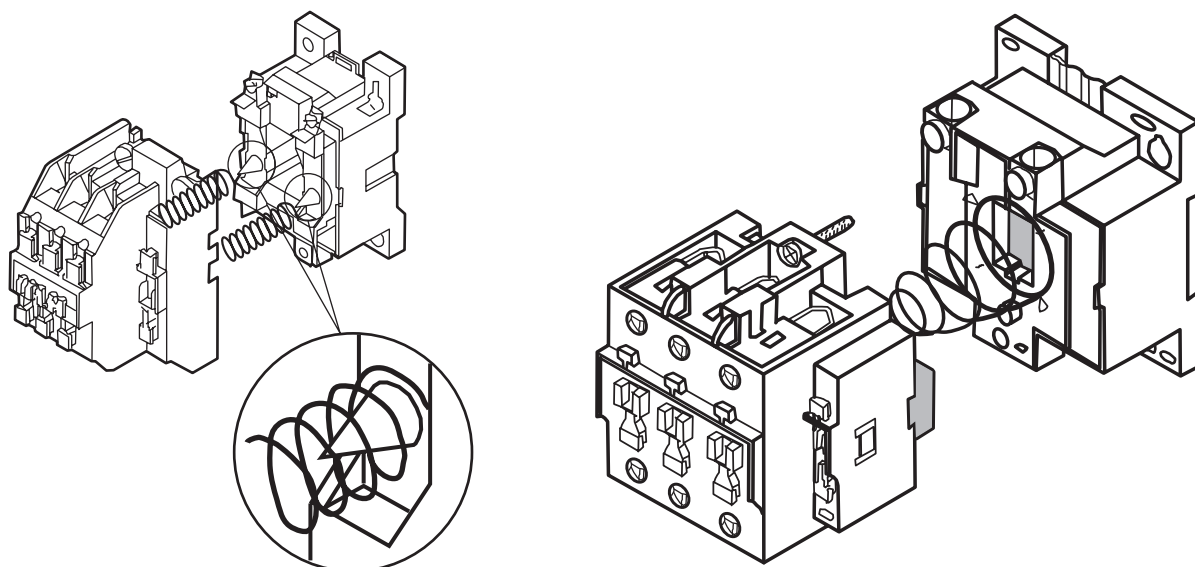
### Electrical parameters

$U_e$ 230 V	$U_e$ 400 V	$I_e$ (AC-3)	$I_{th}$ 40°C (AC-1)	$I_{th}$ 60°C (AC-1)	$I_{th}$ max <sup>3)</sup> (AC-1)	Main contacts	Code number <sup>1)</sup>	Type
1.5 kW	2.2 kW	6 A	20 A	16 A	–	3	037H0015XX	CI 6
1.5 kW	2.2 kW	6 A	20 A	16 A	–	4	037H0018XX	CI 6
2.2 kW	4.0 kW	9 A	25 A	16 A	–	3	037H0021XX	CI 9
2.2 kW	4.0 kW	9 A	25 A	16 A	–	4	037H0022XX	CI 9
3.0 kW	5.5 kW	12 A	25 A	20 A	–	3	037H0031XX	CI 12
3.0 kW	5.5 kW	12 A	25 A	20 A	–	4	037H0032XX	CI 12
4.0 kW	7.5 <sup>2)</sup> kW	16 A	25 A	20 A	30 A	3	037H0049XX	CI 15
4.0 kW	7.5 <sup>2)</sup> kW	16 A	25 A	20 A	30 A	4	037H0050XX	CI 15
4.0 kW	7.5 kW	16 A	40 A	25 A	45 A	3	037H0041XX	CI 16
5.5 kW	10 kW	20 A	40 A	25 A	45 A	3	037H0045XX	CI 20
5.5 kW	11 kW	25 A	40 A	25 A	45 A	3	037H0051XX	CI 25
8.5 kW	15 kW	32 A	40 A	30 A	50 A	3	037H0055XX	CI 30
8.5 kW	15 <sup>2)</sup> kW	32 A	63 A	63 A	–	3	037H0061XX	CI 32
10 kW	18.5 <sup>2)</sup> kW	37 A	80 A	63 A	–	3	037H0056XX	CI 37
11 kW	22 <sup>2)</sup> kW	45 A	80 A	80 A	90 A	3	037H0071XX	CI 45
15 kW	25 <sup>2)</sup> kW	52 A	80 A	80 A	90 A	3	037H0080XX	CI 50

<sup>1)</sup> The coil's control voltage is marked by the additional two digits in the table on p. 10

<sup>2)</sup>  $U_e$  max 500 V

<sup>3)</sup> Heat-resistant cables (min. 75 °C) must be used.


**Coils – also as spare parts**

Control voltage	Symbol xx	CI 6-30	CI 32-50
24 V 50 / 60 Hz	13	037H6484	037H6084
42 V 50 / 60 Hz	17	037H6463	037H6063
110 V 50 / 60 Hz	23	037H6487	037H6087
220-230 V 50 / 60 Hz	32	037H6488	037H6088
400 V 50 Hz / 440 V 60 Hz	37	037H6478	037H6078
500V 50 Hz / 600 V 60 Hz	94	037H6481	037H6081

Standard coil voltage tolerance -15%, +10%

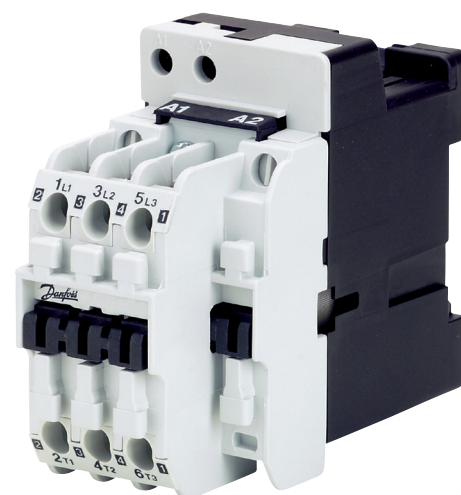


## CI 9 DC to CI 30 DC contactors controlled by DC voltage

The three-pole DC controlled contactors are available in two series: DC and EI.

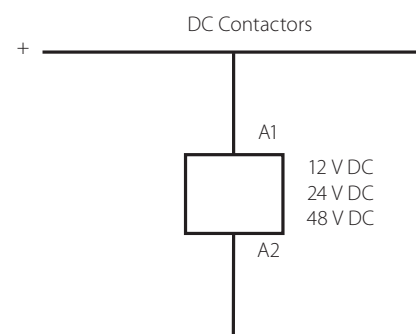
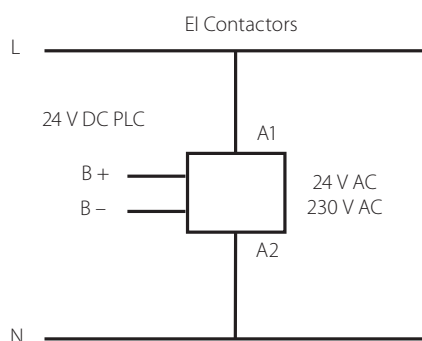
In both cases, the coil circuit is controlled by an electronic circuit that controls power consumption, ensuring minimal energy consumption while maintaining 50 mA.

Furthermore, the EI series has a built-in interface relay dedicated for PLC application. The interface provides galvanic isolation between the control circuit and the coil circuit, requiring a minimum signal level of 3.5 mA.



2

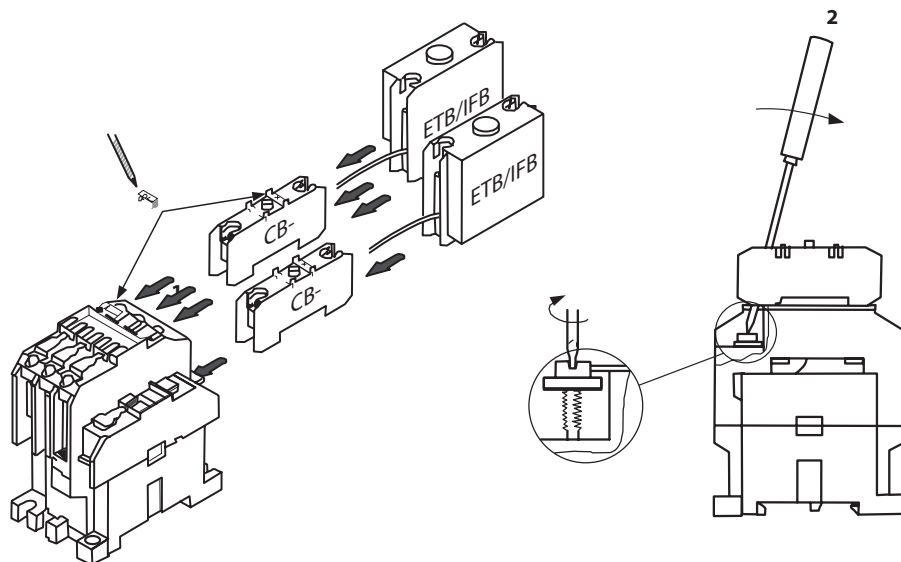
$U_e$ 230 V	$U_e$ 400 V	$I_e$ (AC-3)	$I_{th}$ 40°C (AC-1)	$I_{th}$ 60°C (AC-1)	A1 – A2 coil	B + B – PLC	Code number	Type
2.2 kW	4.0 kW	9 A	25 A	16 A	24 V DC	24 V DC	037H801166	CI 9EI 24
2.2 kW	4.0 kW	9 A	25 A	16 A	230 V AC	24 V DC	037H806166	CI 9EI 230
4.0 kW	7.5 kW	15 A	25 A	20 A	24 V DC	24 V DC	037H801366	CI 15EI 24
4.0 kW	7.5 kW	15 A	25 A	20 A	230 V AC	24 V DC	037H806366	CI 15EI 230
5.5 kW	11 kW	25 A	40 A	25 A	24 V DC	24 V DC	037H801666	CI 25EI 24
5.5 kW	11 kW	25 A	40 A	25 A	230 V AC	24 V DC	037H806666	CI 25EI 230
8.5 kW	15 kW	32 A	40 A	30 A	24 V DC	24 V DC	037H801766	CI 30EI 24
8.5 kW	15 kW	32 A	40 A	30 A	230 V AC	24 V DC	037H806766	CI 30EI 230
2.2 kW	4.0 kW	9 A	25 A	16 A	24 V DC	–	037H807166	CI 9DC 24
2.2 kW	4.0 kW	9 A	25 A	16 A	48 V DC	–	037H808166	CI 9DC 48
4.0 kW	7.5 kW	16 A	25 A	20 A	12 V DC	–	037H800366	CI 15DC 12
4.0 kW	7.5 kW	16 A	25 A	20 A	24 V DC	–	037H807366	CI 15DC 24
5.5 kW	11 kW	25 A	40 A	25 A	24 V DC	–	037H807666	CI 25DC 24
8.5 kW	15 kW	32 A	40 A	30 A	24 V DC	–	037H807766	CI 30DC 24



Auxiliary contacts are mounted individually, as shown on the drawing below. The contact function is represented by the mushroom valve color, for example "make" green, "brake" - red. In order to ensure correct contact, the contact

surfaces are cut in half and the PLC contacts crosswise. In place of one of the contact, an ETB time relay can also be mounted.

2



Function	$I_e$ (AC-15)	$I_{th}$ 60°C (AC-1)	$U_e$	Color	Code number	Type
start	6 A	10 A	500 V	green	037H0110	CB-S
start pulse	6 A	10 A	500 V	green	037H0117	CB-I
make	6 A	10 A	500 V	green	037H0111	CB-NO
brake	6 A	10 A	500 V	red	037H0112	CB-NC
early make	6 A	10 A	500 V	white	037H0113	CB-EM
late break	6 A	10 A	500 V	blue	037H0114	CB-LB
To control PLC circuits (gold-plated contacts)						
make	1 – 30 mA	10 A	5 – 30 V	white	037H0121	CB-NO
brake	1 – 30 mA	10 A	5 – 30 V	blue	037H0122	CB-NC

Minimum contact load 24 V, 10 mA.

Mechanical interlocks are used in reversing systems, Automatic Transfer Switching Equipment

ATSE or star-delta systems.

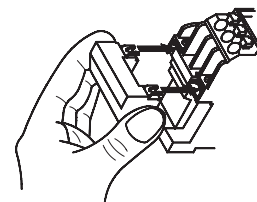
Type	Description	Code number
CI 6-30	1 pc.	037H009166
CI 32-50	10 pcs pack	037H010666



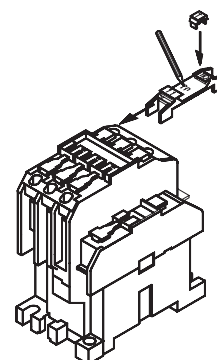
## Contactors CI 6 to CI 50

RC suppressors are intended to reduce the overvoltage in the contactor control circuit.

Type	Description	Code number
CI 6-30	RC 250 110 – 250 V AC	037H0076

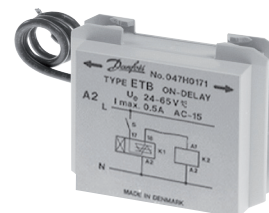


Description	Code number
Rating plate 10 pcs pack	037H010166
Clip-on marker 250 pcs pack	



## ETB time relays for mounting on CI 6 to CI 50

Time range	Control voltage	Code number
ETB ON-Delay Timer		
0.5 – 20 s	24 – 65 V	047H0170
4 – 160 s	24 – 65 V	047H0171
0.5 – 20 s	110 – 240 V	047H0173
4 – 160 s	110 – 240 V	047H0174
0.5 – 20 min	110 – 240 V	047H0175
ETB OFF-Delay Timer		
0.5 – 20 s	24 – 65 V	047H0180
4 – 160 s	24 – 65 V	047H0181
0.5 – 20 min	24 – 65 V	047H0182
0.5 – 20 s	110 – 240 V	047H0183
4 – 160 s	110 – 240 V	047H0184
0.5 – 20 min	110 – 240 V	047H0185
DIN adapter		047H016466



DIN adapter

## Contactors CI 6 to CI 50

2

ETB ON	ON delay
<p>17 – A2 17 – 18</p> <p><i>t</i> - set time</p>	<p>When voltage is applied to terminals 17 and A2, the set time interval begins. When the set time elapses, terminal 18 is powered and the contactor is energised. When voltage to the Clip-on timer is disconnected, the contactor drops out.</p>
ETB OFF	OFF delay
<p>A1 – A2 15 – 16</p> <p><i>t</i> - set time</p>	<p>Voltage is applied to terminals A1 and A2. When terminal 15 receives voltage, terminal 16 is powered and the contactor is energized. When terminal 15 is disconnected, the time interval begins. When the time interval elapses, the contactor is de-energised. If voltage to A1 – A2 is cut off, the contactor drops out.</p>

### BCI enclosures for motor starters up to 15 kW maximum

Enclosures are fitted with a DIN rail and they enable mounting CI 6 - 30 contactor, thermal overload relay and ETB timer inside.

To activate the START button, it is necessary to use the CB-S start auxiliary contact code no. 037H0110.

IP 55 protection degree		
Contactor	no pushbuttons	047B010666
Motor starter	1 pushbutton: STOP	047B010466
Motor starter	2 pushbuttons: START and STOP	047B010266



Connection of cables through blinded holes for 4M20/4M25 cable glands.

## Contactors CI 6 to CI 50

### Technical data Control circuit parameters

Type	Inrush power consumption			Holding power consumption			Pull-in voltage		Drop-out voltage*)		Make time		Brake time	
	AC	AC	DC	AC	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC
	VA	W	W	VA	W	W					ms	ms	ms	ms
CI 6-30	75	65		9	2.7		0.85 – 1.1		0.35 – 0.65		10 – 17		8 – 10	
CI 32-50	140	80		11	3		0.85 – 1.1		0.35 – 0.65		9 – 16		7 – 13	
CI 9-30DC			65			1.5		0.7 – 1.33		0.4 – 0.55		12 – 18		80 – 120
CI 9-30EI	50	65	3.5 mA	2.8	1.5	3.5 mA	0.75 – 1.1	0.6 – 1.2	0.4 – 0.55	0.3 – 0.5		12 – 18		10 – 16

\*) The given values refer to the multiples of the  $U_s$  control voltage

### Connection

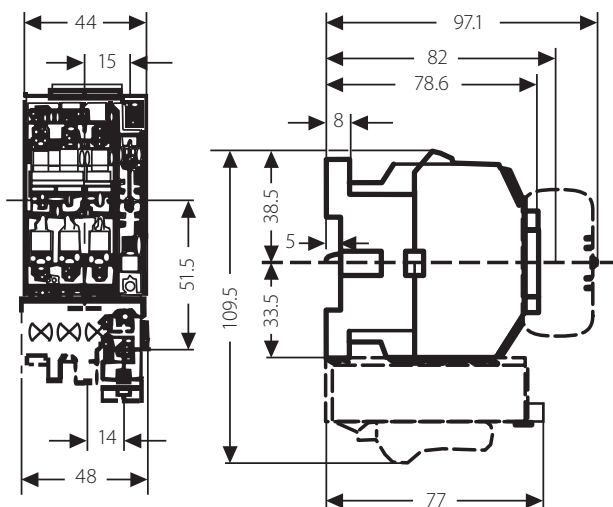
Type	Connection method	Single core	Multi core without terminal sleeve	Multi core with terminal sleeve	Recommended tightening torque
CI 6, CI 9, CI 12, CI 15	Screw and clamp washer	0.75 – 2.5 mm <sup>2</sup>	0.75 – 2.5 mm <sup>2</sup>	0.5 – 2.5 mm <sup>2</sup>	0.8 – 2 Nm
CI 16, CI 20, CI 25, CI 30	Screw and clamp washer	1.5 – 10 mm <sup>2</sup>	2.5 – 6 mm <sup>2</sup>	1.5 – 4 mm <sup>2</sup>	0.8 – 2.5 Nm
CI 32, CI 37, CI 45, CI 50	Box terminal	1.5 – 35 mm <sup>2</sup>	1.5 – 25 mm <sup>2</sup>	–	0.8 – 5 Nm
CI 9DC, CI 15DC	Screw and clamp washer	0.75 – 2.5 mm <sup>2</sup>	0.75 – 2.5 mm <sup>2</sup>	0.5 – 2.5 mm <sup>2</sup>	0.8 – 2 Nm
CI 25DC, CI 30DC	Screw and clamp washer	1.5 – 10 mm <sup>2</sup>	2.5 – 6 mm <sup>2</sup>	1.5 – 4 mm <sup>2</sup>	0.8 – 2.5 Nm
CI 9EI, CI 15EI	Screw and clamp washer	0.75 – 2.5 mm <sup>2</sup>	0.75 – 2.5 mm <sup>2</sup>	0.5 – 2.5 mm <sup>2</sup>	0.8 – 2 Nm
CI 25EI, CI 30EI	Screw and clamp washer	1.5 – 10 mm <sup>2</sup>	2.5 – 6 mm <sup>2</sup>	1.5 – 4 mm <sup>2</sup>	0.8 – 2.5 Nm

Contactors CI 6 to CI 50

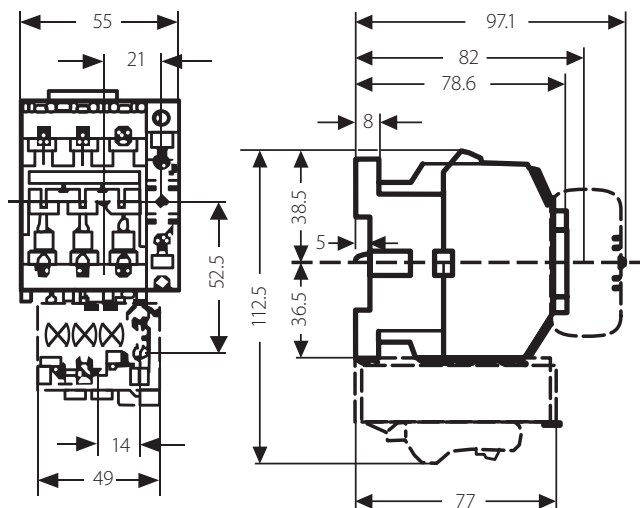
Dimension[mm]

CI 6-15

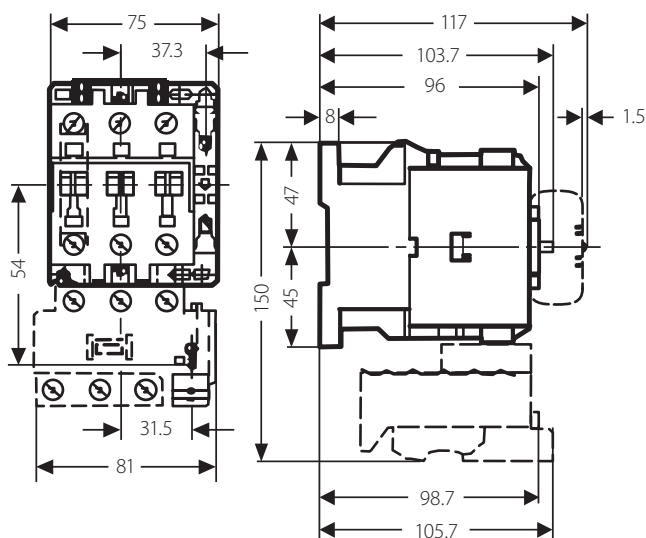
2



CI 16-30



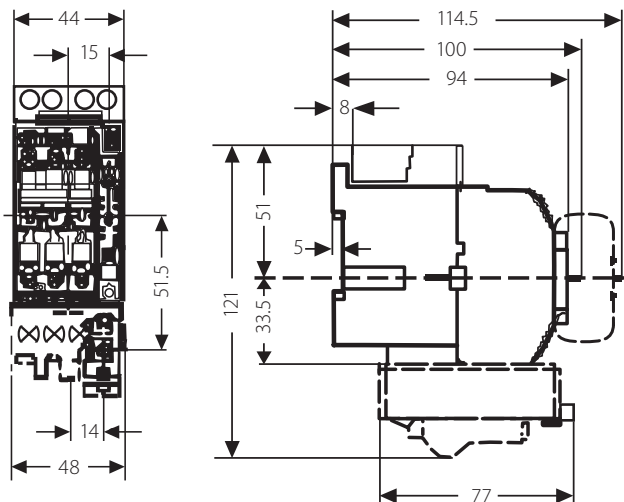
CI 32-50



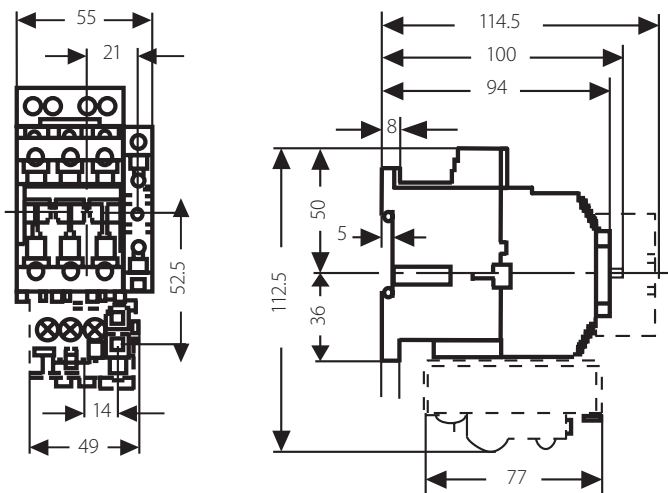


Contactors CI 6 to CI 50

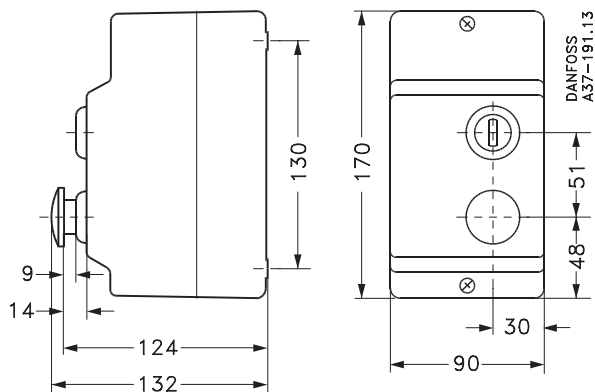
CI 9-15DC/EI



CI 25-30DC/EI



BCI housings



## Contactors CI 61 to CI 98

A series of four AC controlled contactors in the range from 30 to 55 kW. With small dimensions, they can be mounted on a DIN rail, providing switching of 130 A currents in the AC-1 category. They have double vise clamps, making it easier to connect cables in applications such as star-delta motor starters. A wide range of auxiliary contacts mounted on both the front and the side, allows for a large freedom of making control circuits.



3

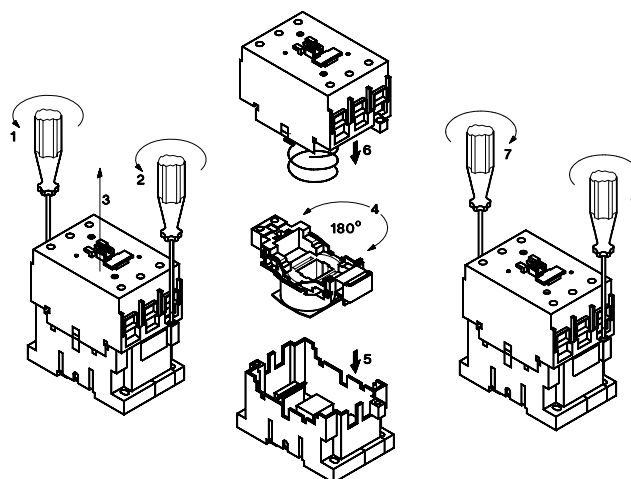
### Electrical parameters – AC coils

$U_e$ 230 V	$U_e$ 400 V	$I_e$ (AC-3)	$I_{th}$ 40°C (AC-1)	$I_{th}$ 60°C (AC-1)	Main contacts	Code number <sup>1)</sup>	Type
18.5 kW	30 kW	60 A	100 A	100 A	3	037H3061XX	CI 61
22 kW	37 kW	72 A	100 A	100 A	3	037H3062XX	CI 73
25 kW	45 kW	85 A	100 A	100 A	3	037H3063XX	CI 86
30 kW	55 kW	97 A	130 A	110 A	3	037H3040XX	CI 98

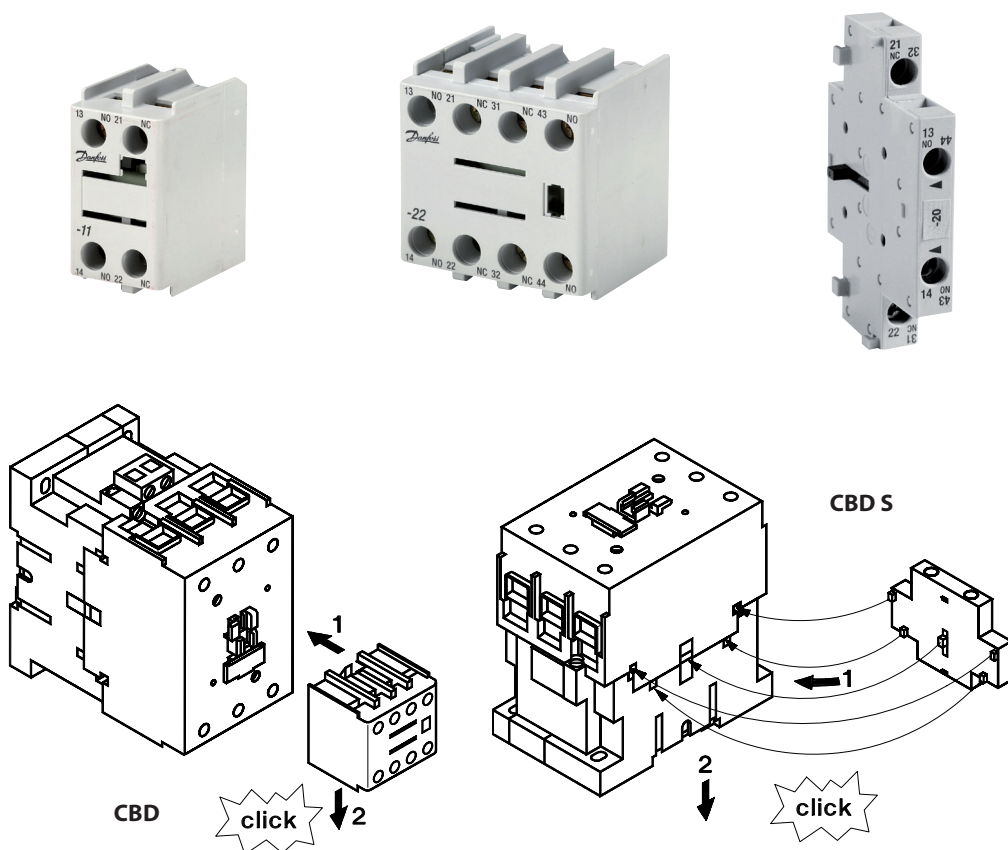
<sup>1)</sup> the coil voltage is marked by the additional two digits in the table below

Control voltage	XX symbol	Code number
24 V 50 / 60 Hz	13	037H3364
220 – 230 V 50 / 60 Hz	32	037H3367

Standard coil voltage tolerance -15%, +10% Also as a spare element available under the selected code number.



Auxiliary contact blocks



3

These are modules mounted with the latch from the front or side of the contactor. They come in three versions, as single, double and quadruple. Up to eight contacts can be installed, four NO

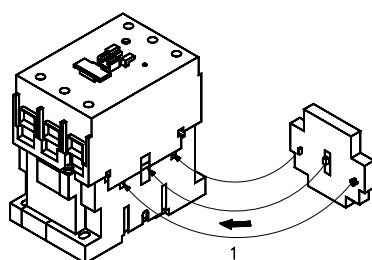
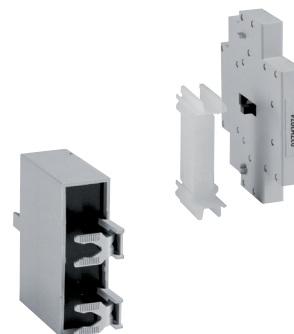
and four NC. All auxiliary contacts can be used in PLC circuits, at a minimum 10 mA 24 V DC load.

Function	$I_e$	$I_{th} 60^\circ C$	$U_e$	Code number	Type
1 NO / 1 NC	5.5 A	10 A	690 V	037H3064	CBD – 11
2 NO / 2 NC	5.5 A	10 A	690 V	037H3065	CBD – 22
1 NC	3 A	10 A	690 V	037H3066	CBD S – NC
1 NO	3 A	10 A	690 V	037H3067	CBD S – NO
1 NO / 1 NC	3 A	10 A	690 V	037H3069	CBD S – 11
2 NO	3 A	10 A	690 V	037H3070	CBD S – 20

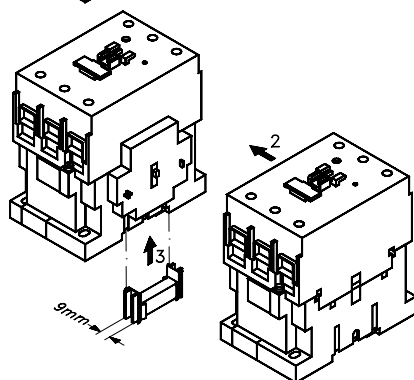
## Contactors CI 61 to CI 98

3

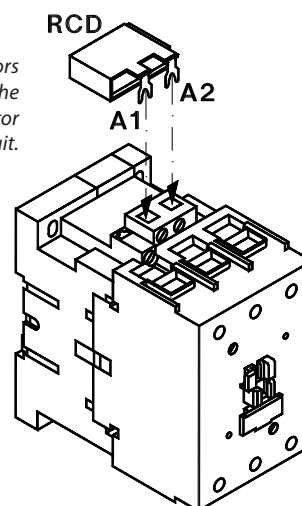
Type	Description	Code number
	Mechanical interlock	037H3074
RCD	RC suppressor RCD 280 110 – 280 V AC	037H3072



Mechanical interlocks are used in reversing systems, automatic transfer switching equipment (ATSE) or star-delta systems.



RCD elements RC suppressors are used to reduce the overvoltage in the contactor control circuit.



### Technical data Control circuit parameters

Type	Inrush power consumption		Holding power consumption		Pull-in voltage <sup>*)</sup>	Drop-out voltage <sup>*)</sup>	Make time	Brake time
CI 61-98	200 VA AC	16 W AC	16 VA AC	4.5 W AC	0.85 – 1.1 V AC	0.3 – 0.6 V AC	18 – 30 ms	10 – 60 ms

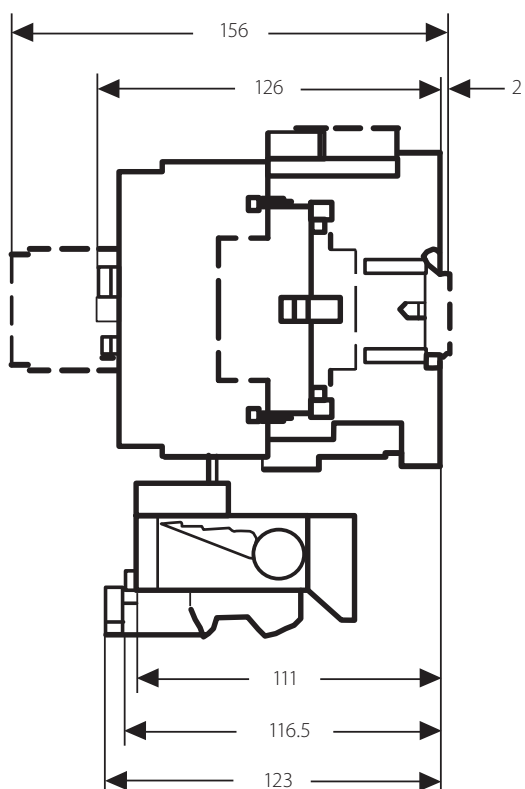
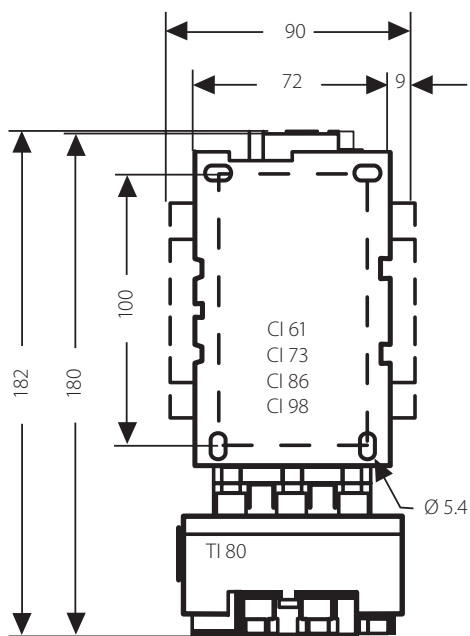
<sup>\*)</sup> The given values refer to the multiples of the  $U_s$  control voltage

### Connection

Type	Connection method	Single core	Multi core without terminal sleeve	Multi core with terminal sleeve	Recommended tightening torque
CI 61-98	Screw and box terminal	2.5 – 50 mm <sup>2</sup>	2.5 – 35 mm <sup>2</sup>	–	2 – 6 Nm

Contactors CI 61 to CI 98

Contactors CI 61 – CI 98  
with thermal overload  
relay TI 80



## Contactors CI 141 to CI 420EI

A series of AC controlled contactors in the range from 75 to 220 kW.

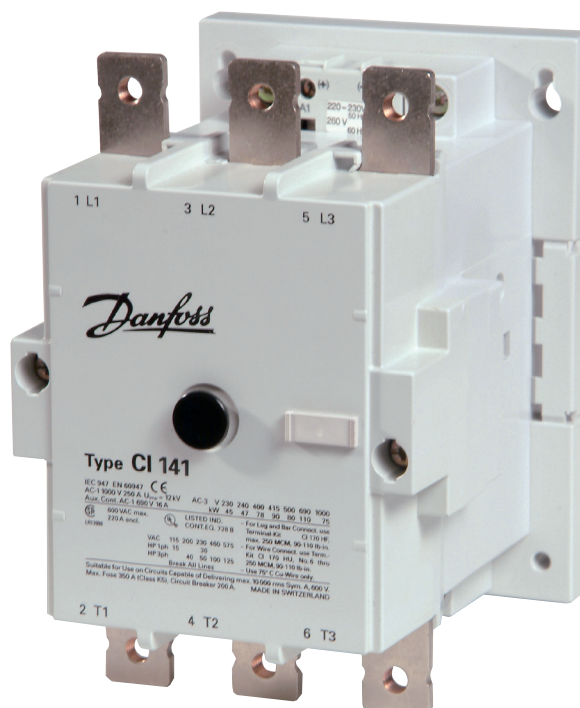
The lack of mechanical connection to the movable jumper element makes it impossible to manually connect the contactor.

Models marked with the EI symbol can also be controlled directly from the PLC with 24 V DC voltage via the built-in interface, with independent AC power supply of coil circuit. The built-in interface also optimizes the power consumption of the coil, while ensuring no noise.

The auxiliary contact block 1 NO + 1 NC is installed in the factory, with the possibility of expanding by three more of such blocks.

It is recommended to install terminal cover for finger protection.

The completely sealed construction enables work in difficult conditions of use.



### Electrical parameters – AC coils

$U_e$ 230 V	$U_e$ 400 V	$I_e$ (AC-3)	$I_{th}$ 40°C (AC-1)	$I_{th}$ 60°C (AC-1)	Main contacts	Auxiliary contacts	Code number <sup>1)</sup>	Type
45 kW	75 kW	140 A	250 A	210 A	3	1 NO + 1 NC	037H3339XX	CI 141
55 kW	90 kW	180 A	250 A	210 A	3	1 NO + 1 NC	037H3082XX	CI 180
63 kW	110 kW	210 A	350 A	300 A	3	1 NO + 1 NC	037H3259XX	CI 210EI
80 kW	132 kW	250 A	350 A	300 A	3	1 NO + 1 NC	037H3267XX	CI 250EI
90 kW	160 kW	300 A	450 A	380 A	3	1 NO + 1 NC	037H3269XX	CI 300EI
132 kW	220 kW	420 A	500 A	425 A	3	1 NO + 1 NC	037H3279XX	CI 420EI

<sup>1)</sup> The coil voltage is marked by the additional two digits in the table on p. 23.

## Contactors CI 141 to CI 420EI

### Coils for contactors CI 141 - CI 180

Control voltage	XX symbol	Code number
110 V 50 Hz	22	037H3261
220 – 230 V 50 Hz	31	037H3262

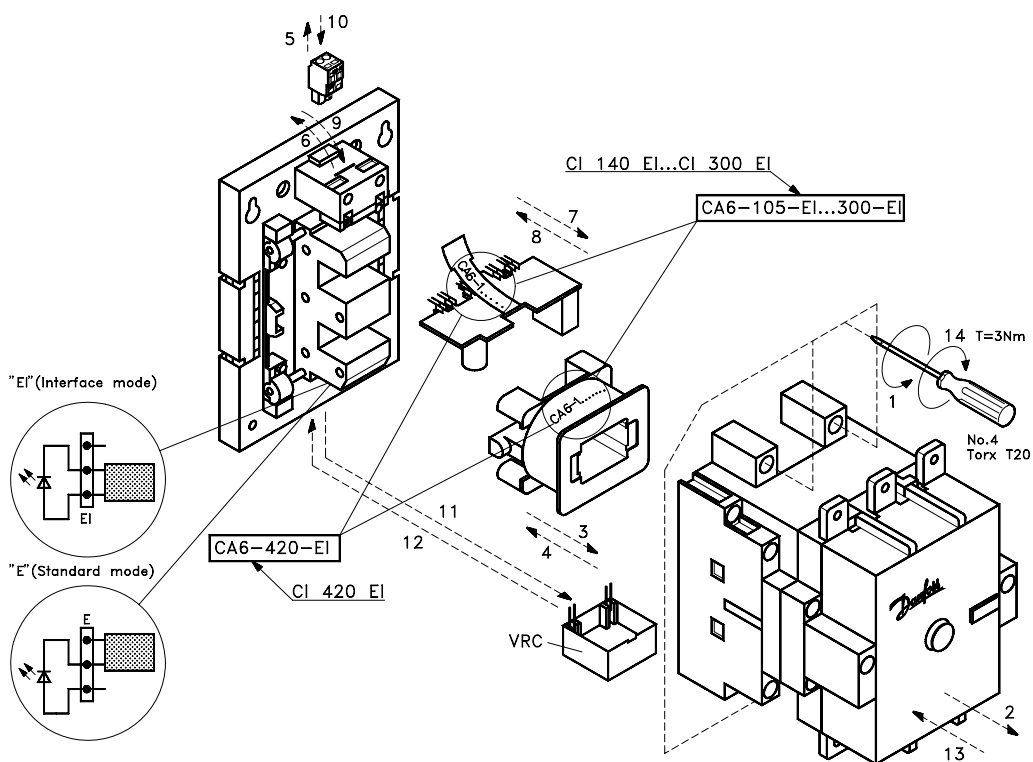
Standard coil voltage tolerance -15%, +10%. Also as a spare element available under the selected code number. The electronic circuit is included with the coil of the EI contactors.

### Coils for contactors CI 210EI – CI 300EI

Control voltage	XX symbol	Code number
110 – 130 V 50 / 60 Hz	23	037H3413
208 – 277 V 50 / 60 Hz	32	037H3415

### Coils for contactors CI 420EI

Control voltage	XX symbol	Code number
208 – 277 V 50 / 60 Hz	32	037H3423
380 – 500 V 50 / 60 Hz	39	037H3425



Above is the assembly drawing of contactors with an EI interface. The circles on the left show two alternative control modes of the contactor coil, with PLC or standard, depending on the position of the jumper located under the plug on the bottom of the contactor.

## Contactors CI 141 to CI 420EI

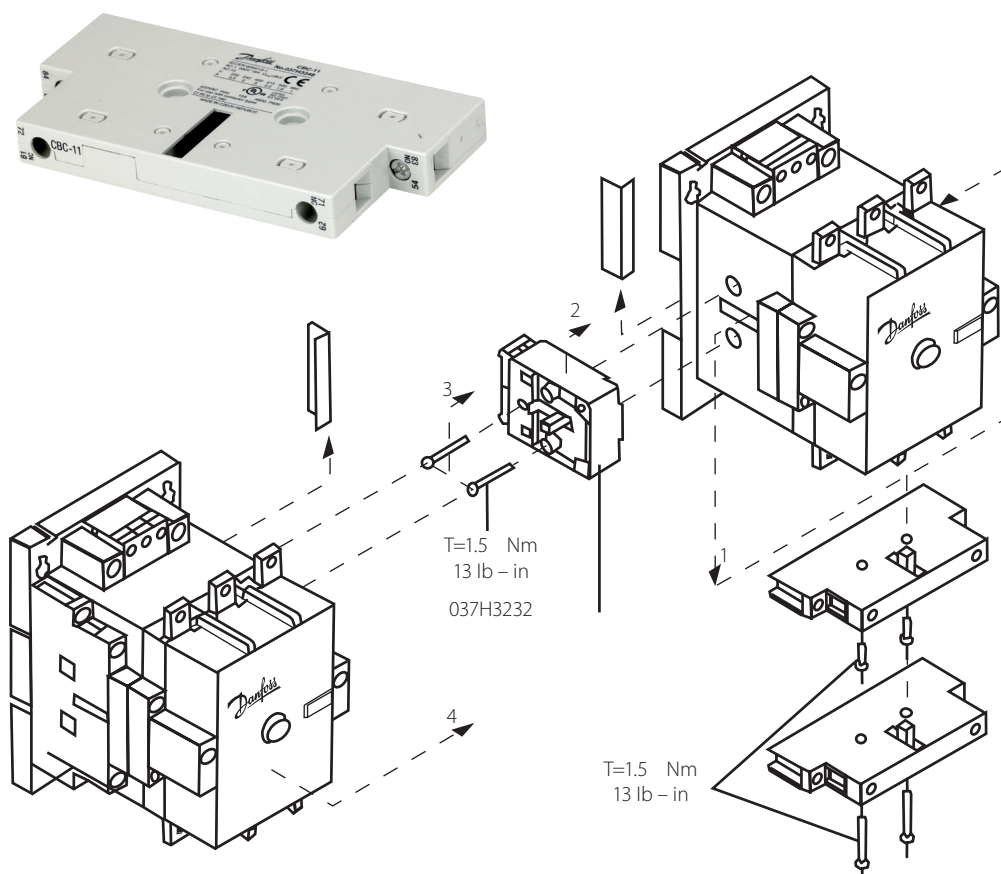
### Auxiliary contact blocks

These modules are included with a set of mounting screws. They exist as double contact sets 1 NO + 1 NC. A maximum of eight contacts can be mounted four NO and four NC (4 modules).

**Note:** when mounting a mechanical interlock, it occupies the place of auxiliary contacts on one side of the contactor.

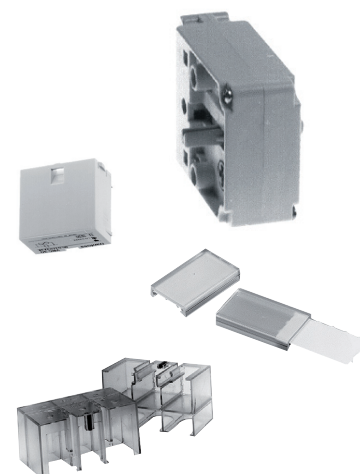
Function	$I_e$	$I_{th} 60^\circ C$	$U_e$	Code number	Type
1 NO + 1 NC	5.5 A	16 A	690 V	037H3348	CBC - 11

4



Mechanical interlocks are used in reversing systems, automatic transfer switching equipment (ATSE), or star-delta systems.

Type	Description	Code number
	Mechanical interlock	037H3232
VRC	VRC-Varistor Element VRC 277 137 – 277 V AC VRC 575 278 – 575 V AC	037H3407 037H3241
	Rating plate - a 100 pcs pack	037H3142
	Terminal cover CI 141, CI 180 – 2 pcs CI 210 – CI 420EI – 2 pcs	037H3409 037H3406





## Contactors CI 141 to CI 420EI – technical parameters

### Control circuit parameters

Type	Inrush power consumption		Holding power consumption		Pull-in voltage <sup>1)</sup>	Drop-out voltage <sup>1)</sup>	Make time	Brake time
	380 VA AC	240 W AC	13 VA AC	6 W AC				
CI 141 – 180	380 VA AC	240 W AC	13 VA AC	6 W AC	0.85 – 1.1 V AC	0.35 – 0.65 V AC	20 – 45 ms	25 – 110 ms
CI 210 – 300EI	380 VA AC	240 W AC	13 VA AC	6 W AC	0.85 – 1.1 V AC	0.3 – 0.5 V AC	20 – 45 ms	25 – 110 ms
CI 420EI	490 VA AC	270 W AC	18 VA AC	7 W AC	0.85 – 1.1 V AC	0.3 – 0.5 V AC	20 – 45 ms	25 – 110 ms

<sup>1)</sup>The given values refer to the multiples of the  $U_s$  control voltage

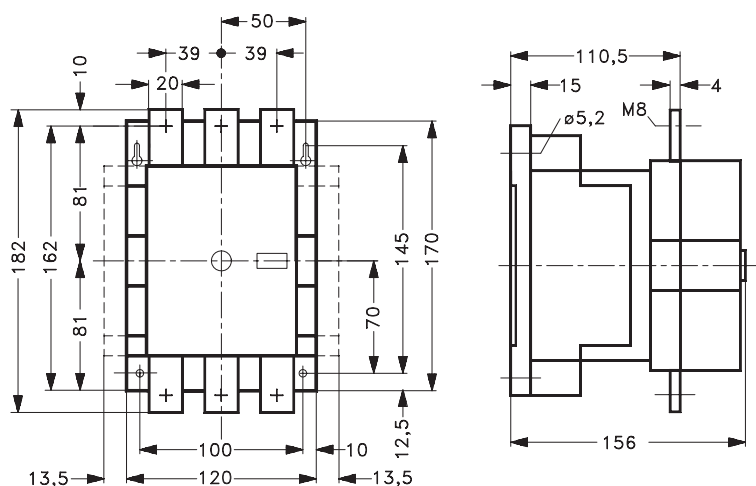
### Connection

Type	Connection method	Single core	Multi core without terminal sleeve	Multi core with terminal sleeve	Recommended tightening torque
CI 141, CI 180	Screw and lug / terminal block	25 – 120 mm <sup>2</sup>	25 – 120 mm <sup>2</sup>	–	10 – 12 Nm
CI 210EI – CI 420EI	Screw* / terminal block	25 – 300 mm <sup>2</sup>	25 – 300 mm <sup>2</sup>	–	15 – 20 Nm

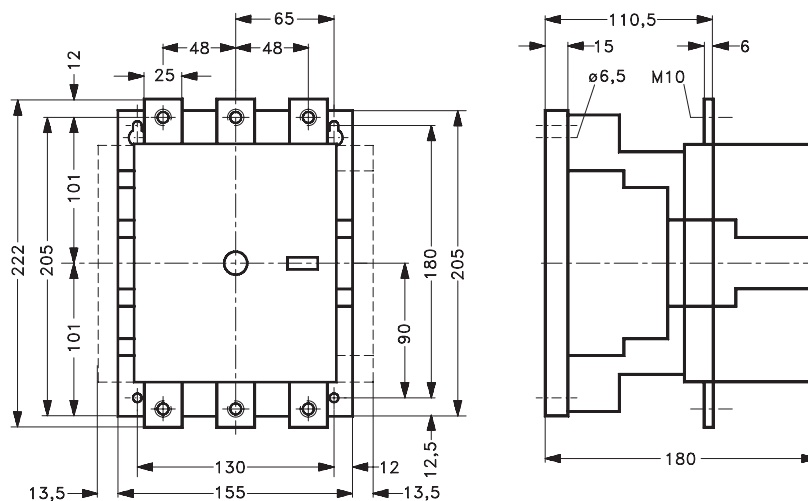
\* only for CI 210EI

### Dimensions

CI 141 to CI 180



CI 210EI to CI 420EI

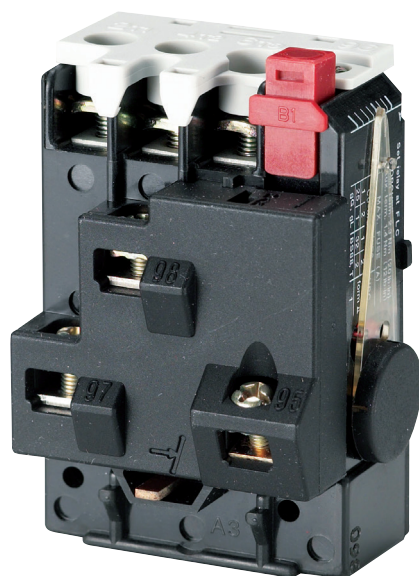


## Thermal overload relays TI 9C-5 – TI 86C

For the series of contactors CI 5, CI 6-50 and CI 61-98, we offer an appropriate range of thermal overload relays (thermobimetal design). The thermobimetal versions are subjected to the individual calibration procedure during the production process, which provides a full guarantee of correct operation. For multi-motor systems, controlled, for example, by means of a frequency converter, it is possible to mount TI individually on a DIN rail adapter. These devices protect the circuits of induction motors against overload and phase loss or turn-to-turn short

circuit. An additional feature, ensuring the stability of settings in a wide range of operating temperatures, is the temperature compensation implemented by means of an additional thermobimetal element in the temperature range from - 5°C to + 40°C. The relays are equipped with two signal contacts and the ability to automatically "arm" the device after the thermobimetals have cooled down. Each device has a "TEST" button to check the correct operation of signaling circuits.

5



## Thermal relays TI 9C-5 – TI 86C

### Electrical parameters

Current range		Fuse		For contactor	Code number	Type
Direct start	Y/D start	type 1	type 2			
0.13 – 0.20 A	–	25 A	–	CI 5	047H3130	TI 9C-5
0.27 – 0.42 A	–	25 A	2 A	CI 5	047H3132	TI 9C-5
0.4 – 0.62 A	–	25 A	2 A	CI 5	047H3133	TI 9C-5
0.6 – 0.92 A	–	25 A	4 A	CI 5	047H3134	TI 9C-5
0.85 – 1.3 A	–	25 A	4 A	CI 5	047H3135	TI 9C-5
1.2 – 1.9 A	–	25 A	6 A	CI 5	047H3136	TI 9C-5
1.8 – 2.8 A	3.2 – 4.8 A	25 A	6 A	CI 5	047H3137	TI 9C-5
2.7 – 4.2 A	4.7 – 7.3 A	25 A	16 A	CI 5	047H3138	TI 9C-5
4.0 – 6.2 A	6.9 – 10.7 A	35 A	20 A	CI 5	047H3139	TI 9C-5
6.0 – 9.2 A	10 – 16 A	50 A	20 A	CI 5	047H3140	TI 9C-5
0.13 – 0.20 A	–	25 A	–	CI 6	047H0200	TI 16C
0.19 – 0.29 A	–	25 A	–	CI 6	047H0201	TI 16C
0.27 – 0.42 A	–	25 A	2 A	CI 6	047H0202	TI 16C
0.4 – 0.62 A	–	25 A	2 A	CI 6	047H0203	TI 16C
0.6 – 0.92 A	–	25 A	4 A	CI 6	047H0204	TI 16C
0.85 – 1.3 A	–	25 A	4 A	CI 6	047H0205	TI 16C
1.2 – 1.9 A	–	25 A	6 A	CI 6	047H0206	TI 16C
1.8 – 2.8 A	3.2 – 4.8 A	25 A	6 A	CI 6	047H0207	TI 16C
2.7 – 4.2 A	4.7 – 7.3 A	25 A	16 A	CI 6	047H0208	TI 16C
4.0 – 6.2 A	6.9 – 10.7 A	35 A	20 A	CI 6	047H0209	TI 16C
6.0 – 9.2 A	10 – 16 A	50 A	20 A	CI 9	047H0210	TI 16C
8.0 – 12 A	13 – 20.8 A	63 A	25 A	CI 12	047H0211	TI 16C
11 – 16 A	19 – 27 A	80 A	25 A	CI 16	047H0212	TI 16C
15 – 20 A	26 – 35 A	80 A	35 A	CI 20	047H0213	TI 25C
19 – 25 A	33 – 43 A	80 A	63 A	CI 25	047H0214	TI 25C
24 – 32 A	41 – 55 A	80 A	63 A	CI 30	047H0215	TI 30C
16 – 23 A	28 – 40 A	125 A	63 A	CI 32	047H1013	TI 80
22 – 32 A	38 – 56 A	125 A	63 A	CI 32	047H1014	TI 80
30 – 45 A	52 – 78 A	125 A	100 A	CI 45	047H1015	TI 80
42 – 63 A	75 – 109 A	100 A	100 A	CI 61	047H1016	TI 80
60 – 80 A	105 – 138 A	125 A	125 A	CI 86	047H1017	TI 80
74 – 85 A	130 – 147 A	125 A	125 A	CI 86	047H1018	TI 86

## Thermal relays TI 9C-5 – TI 86C

### Coordination of short circuit protection

#### Type 1:

After a short circuit occurs, it is possible to damage the motor starter components and to replace the thermal overload relay

#### Type 2:

After a short circuit occurs, it is not possible to damage the motor starter components, only a light contact welding is permissible

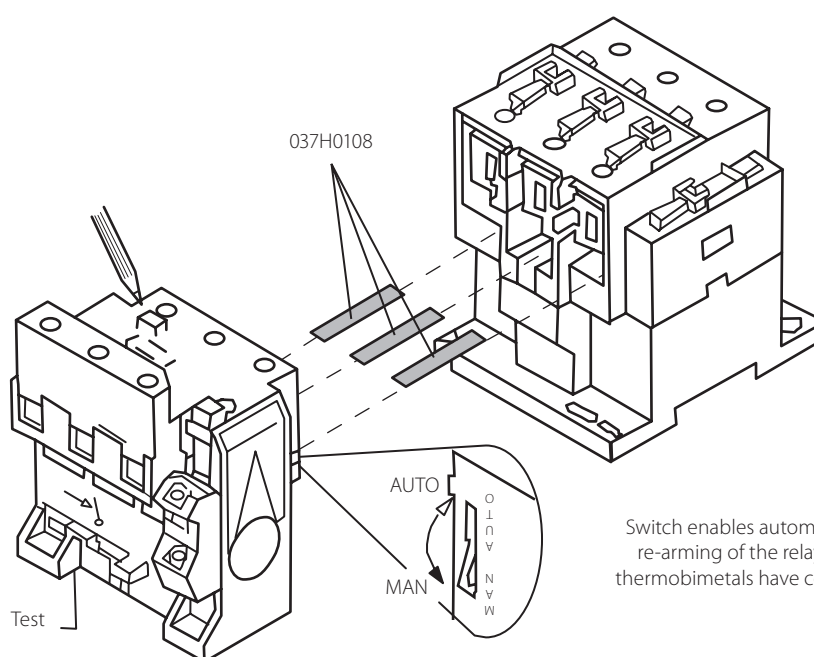
### Accessories

Installation of thermal overload relays - independent; used in the control of one contactor for several motors.

Type	Description	Code number
base	DIN rail adapter for TI 16C – TI 30C	047H016566
base	Adapter for panel mounting for TI 80	047L045666
	Busbar set (3 pieces) for TI 80 + CI 32 – CI 98	037H010866



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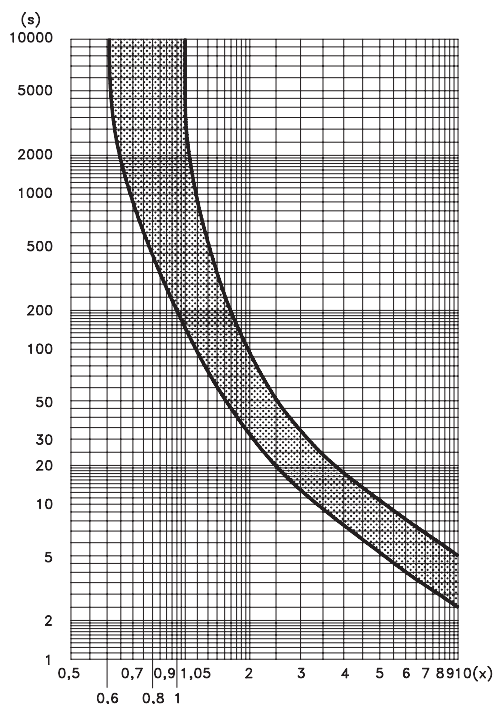


Test allows checking the functioning of signal circuits.

Switch enables automatic "AUTO" re-arming of the relay after the thermobimetals have cooled down.

## Thermal relays TI 9C-5 – TI 86C

### Explanation of graphs



### Mean value curves

**The upper curve:** three-phase trip and two-phase trip at minimal setting.

**The lower curve:** two-phase trip at maximum setting.

When tripping from the operationally warm condition, the tripping times are approx. 30% of the values shown.

These values apply at an ambient temperature = 20 °C.

Three-phase tripping:  $x = (\text{measured current}) / (\text{rated motor current})$

Asymmetric load tripping:  $x = (\text{measured current}) / (\text{max. scale value on overload relay})$

Tripping time  $2 < T_p < 10$  s at  $7.2 \times I_e$ , class 10 A

**Note!** Thermal overload relays are generally calibrated to the current at full motor load.

5

### Three-phase overload

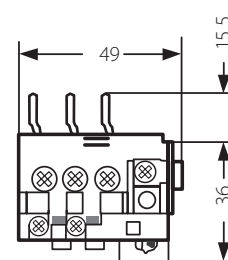
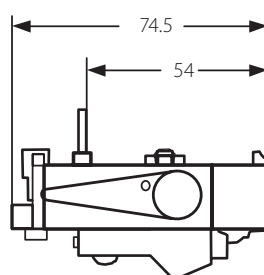
- 1) Measure the overload current.
- 2) Find the overload factor (x) by dividing the measured value by the set value of the thermal overload relay (motor full load current)
- 3) Find the value of the coefficient (x) on the horizontal axis and follow a line vertically up until it intersects the upper curve.
- 4) From the intersection point, follow a horizontal line to the left and read off on the vertical axis the time that will elapse before the thermal overload relay cuts out the motor.

### Two-phase overload (asymmetric load tripping)

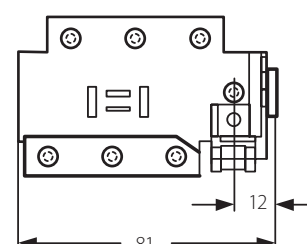
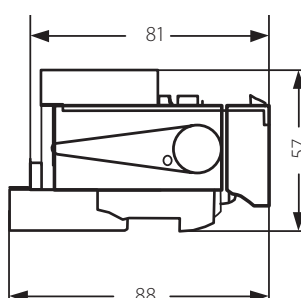
- 1) Measure the current in undamaged phases.
- 2) Find the overload factor (x) by dividing the measured value by the maximum scale value of the thermal overload relay
- 3) Find the value of the coefficient (x) on the horizontal axis and follow a line vertically up until it intersects the lower curve.
- 4) From the intersection point, follow a horizontal line to the left and read off on the vertical axis the time that will elapse before the thermal overload relay cuts out the motor.

### Dimensions

TI 9C-5, 16C, 25C, 30C



TI 80, 86



## Circuit breakers CTI 15



Overload and short circuit protection of three-phase electric motors up to 11 kW. The compact, modular design with a width of 45 mm, equipped with a fast reacting (2 ms) contact system and an advanced arc-quenching chamber, provides short-circuiting capacity up to 65 kA. The mechanical parameters determine the lifetime per 100 000 "on-off" operations at 30 cycles per hour.

### Electrical parameters

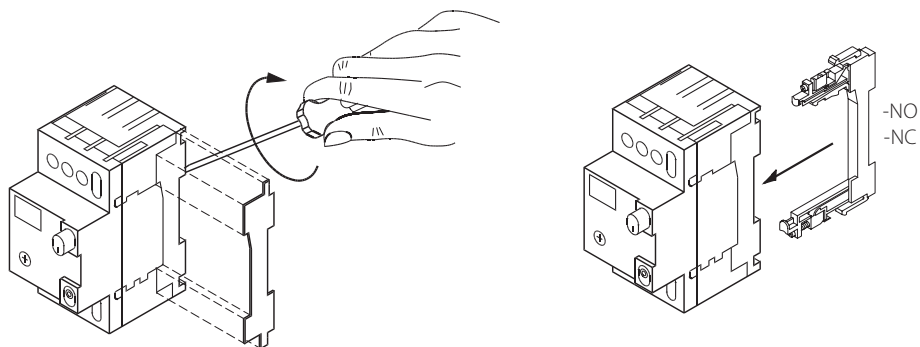
Motor power	Current $I_n$	Electromagnetic trip current	Code number	Type
0.09 kW	0.25 – 0.4 A	4.4 A	047B3051	CTI 15
0.12 kW	0.40 – 0.63 A	6.9 A	047B3052	CTI 15
0.37 kW	0.63 – 1.0 A	11 A	047B3053	CTI 15
0.55 kW	1.0 – 1.6 A	18 A	047B3054	CTI 15
0.75 kW	1.6 – 2.5 A	28 A	047B3055	CTI 15
1.5 kW	2.5 – 4.0 A	44 A	047B3056	CTI 15
2.5 kW	4.0 – 6.3 A	69 A	047B3057	CTI 15
5.5 kW	6.3 – 10 A	110 A	047B3058	CTI 15
7.5 kW	10 – 16 A	176 A	047B3059	CTI 15
11 kW	20 – 25 A	275 A	047B3060	CTI 15

### Accessories

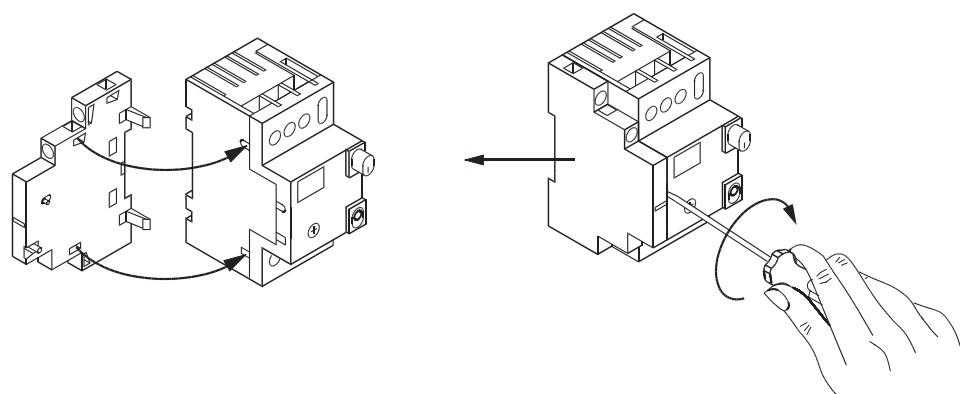


## Motor switches – series CTI 15

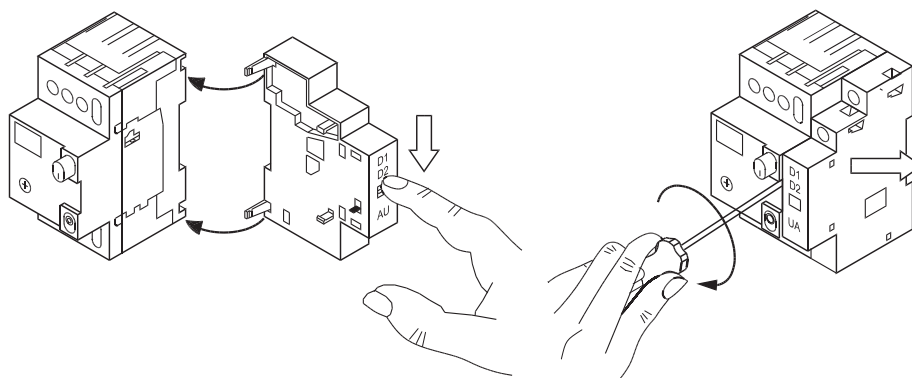
### Installation of internal auxiliary contacts CBI – NO, CBI – NC



### Installation of internal auxiliary contacts CBI – 11



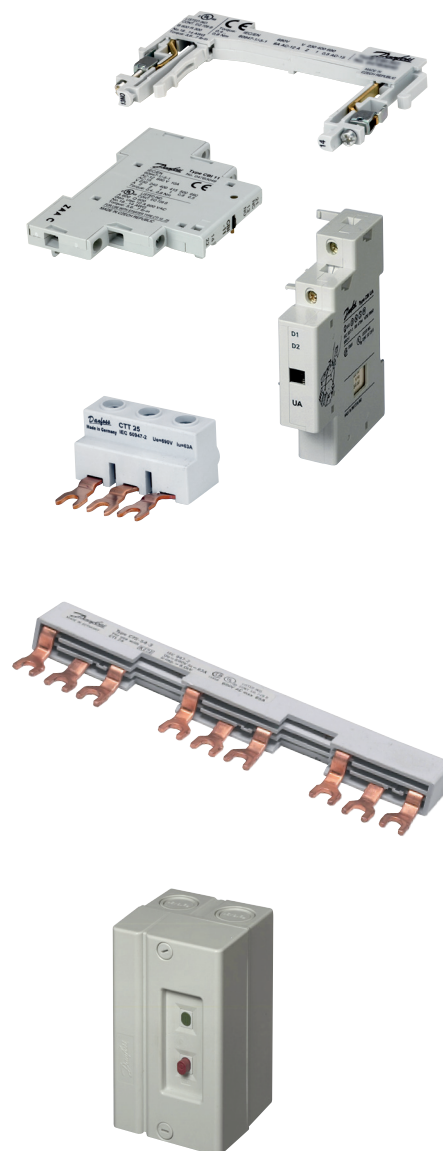
### Installation of the undervoltage release CBI UA



The undervoltage release (UA) is used to remotely switch off the circuit breaker at the moment of power failure in the control circuit (it acts as a safety component).

**Accessories**

Type	Description	Code number
CBI NO CBI NC	Auxiliary contact blocks for building in	047B3040 047B3042
CBI 11	Auxiliary contact blocks for lefthand mounting 1 NO + 1 NC	047B3049
CBI UA	Undervoltage release 230 V	047B3061
CTT 25	Terminal block max. 16 mm <sup>2</sup>	047B3076
CTS	Bus bars – 45 mm module	
	CTS 45 – 2	047B3084
	CTS 45 – 3	047B3096
	CTS 45 – 4	047B3085
	CTS 45 – 5	047B3086
	Bus bars – 54 mm module	
	CTS 54 – 2	047B3087
	CTS 54 – 3	047B3097
CTS 54 – 4	047B3088	
CTS 54 – 5	047B3089	
BXI	Enclosure for CTI 15 IP 55 Connections for cable glands 4 Pg 16/4 Pg 21	047B3091


**Technical Specifications**
**Short circuit breaking capacity**

Specifies the amount of short circuit current that does not damage the device.

$I_{cc}$  – the prospective value of short circuit current that flows through the circuit without any short circuit protection device mounted.

$I_{cu}$  – the maximum (limit) value of short circuit current specified by the manufacturer that a circuit breaker can handle under circumstances specified in IEC 947-2 and EN 60947-2.

$I_{cs}$  – the nominal (service) value of short circuit current specified by the manufacturer that a circuit breaker can handle under circumstances specified in IEC 947-2 and in EN 60947-2

**Short circuit coordination**

Type 1: After a short circuit occurs, it is possible to damage the switching and protective devices. The circuits are protected according to the  $I_{cu}$  parameter.

Type 2: After a short circuit occurs, it is not possible to damage the switching and protective devices, only a light contact welding is permissible. The circuits are protected according to the  $I_{cs}$  parameter.



## Motor switches – series CTI 15

Motor power	Current $I_n$	400 V		Fuse $I_{cc} > I_{cu}$
		$I_{cu}$	$I_{cs}$	
0.09 kW	0.25 – 0.4 A	65 kA	65 kA	–
0.12 kW	0.4 – 0.63 A	65 kA	65 kA	–
0.37 kW	0.63 – 1.0 A	65 kA	65 kA	–
0.55 kW	1.0 – 1.6 A	65 kA	65 kA	–
0.75 kW	1.6 – 2.5 A	50 kA	50 kA	–
1.5 kW	2.5 – 4.0 A	10 kA	10 kA	–
2.5 kW	4.0 – 6.3 A	10 kA	10 kA	–
5.5 kW	6.3 – 10 A	10 kA	10 kA	63 A
7.5 kW	10 – 16 A	8 kA	6 kA	50 A
11 kW	10 – 25 A	8 kA	6 kA	50 A

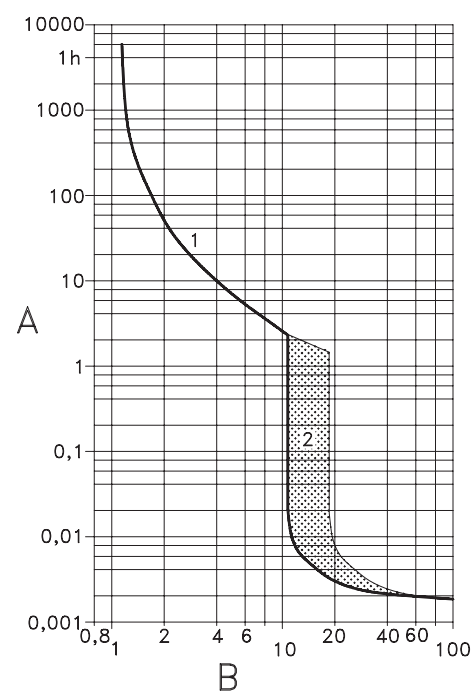
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### Connection

Type	Connection	Single core or multi core	Multi core with terminal sleeve	Recommended tightening torque
CTI	Screw and clamp washer	1 – 6 mm <sup>2</sup>	1 – 4 mm <sup>2</sup>	2.5 Nm
CBI NO / NC	Screw and clamp washer	0.75 – 4 mm <sup>2</sup>	0.75 – 2.5 mm <sup>2</sup>	2.5 Nm
CBI 11	Screw and clamp washer	0.75 – 4 mm <sup>2</sup>	0.75 – 2.5 mm <sup>2</sup>	2.5 Nm
CBI UA	Screw and clamp washer	0.75 – 4 mm <sup>2</sup>	0.75 – 2.5 mm <sup>2</sup>	2.5 Nm
CTT 25	Screw and clamp washer	6 – 25 mm <sup>2</sup>	4 – 16 mm <sup>2</sup>	4 Nm

### Operation characteristic

- Overload motor protection** is guaranteed by adjustable, current dependent and delayed bimetal breakers guarantee motor overload protection. The graph gives the average value at 20°C ambient temperature, from the cold condition. When the unit has warmed up, the release time is less or equal to the release time in the cold condition. The accurate adjustment ensures motor protection even in the event of phase loss.
- Short circuit motor protection**  
 The electromagnetic, instantaneous high-speed trips react at a fixed response current. At the highest setting value this corresponds to 11 times the set current for CTI 15. At a lower setting it is correspondingly higher.

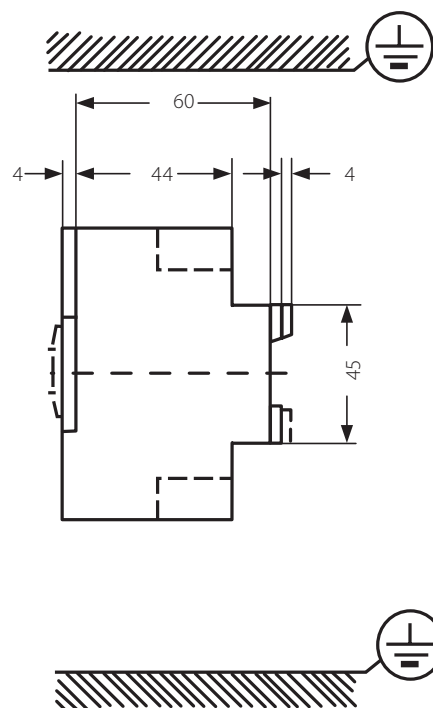
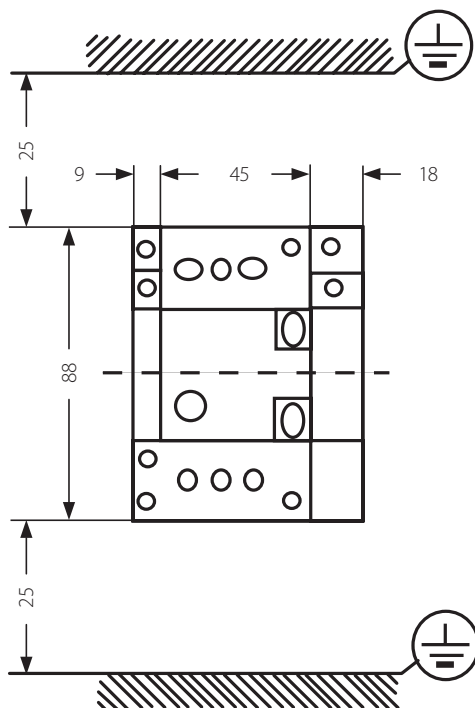


A – tripping time [s];

B – times the adjustable current

Motor switches – series CTI 15

Dimensions



## Circuit breakers CTI 25M, CTI 45MB

Circuit breakers with rotary drive protect a wide range of electrical circuits from 0.1 to 90 A. The release – both thermal and short-circuit, enhanced with protection against phase loss, creates a comprehensive motor protection. In addition, the increased short circuit breaking capacity, up to 100 kA, allows using these devices without additional fuses. Temperature compensation within the range from – 20°C to + 60°C, makes the setting independent of climatic conditions.

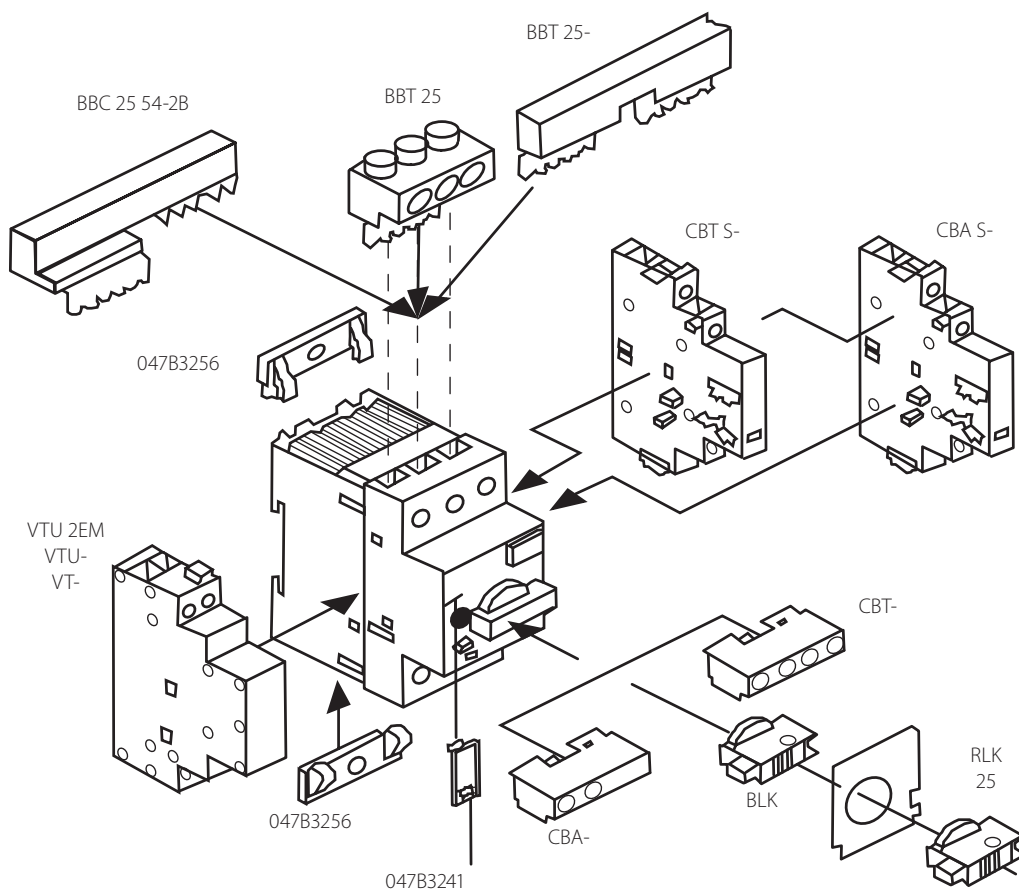
When combined with additional protective enclosures, circuit breakers are a solution that allows them to be used as manual motor starters (switching frequency up to 25 per hour), and with undervoltage releases, also as elements that increase the safety of equipment operation. On the other hand, a wide range of auxiliary and signal contacts allows using them in advanced control systems.



7

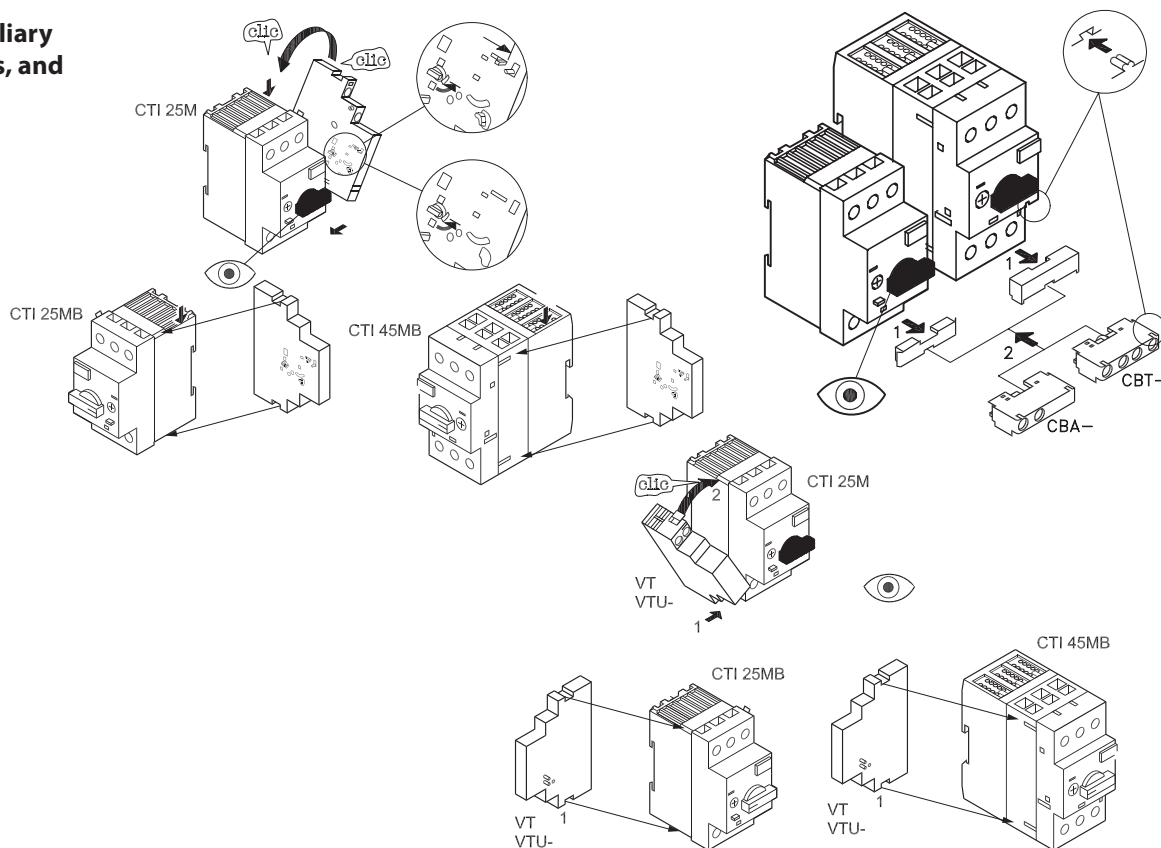
Motor power (380 – 415 V)	Current $I_n$	Electromagnetic trip current	Code number	Type
0.02 kW	0.10 – 0.16 A	2.1 A	047B3140	CTI 25M
0.06 kW	0.16 – 0.25 A	3.3 A	047B3141	CTI 25M
0.09 kW	0.25 – 0.40 A	5.2 A	047B3142	CTI 25M
0.18 kW	0.40 – 0.63 A	8.2 A	047B3143	CTI 25M
0.25 kW	0.63 – 1.0 A	13 A	047B3144	CTI 25M
0.55 kW	1.0 – 1.6 A	21 A	047B3145	CTI 25M
0.75 kW	1.6 – 2.5 A	33 A	047B3146	CTI 25M
1.5 kW	2.5 – 4.0 A	52 A	047B3147	CTI 25M
2.2 kW	4.0 – 6.3 A	82 A	047B3148	CTI 25M
4.0 kW	6.3 – 10 A	130 A	047B3149	CTI 25M
7.5 kW	10 – 16 A	208 A	047B3150	CTI 25M
10 kW	14.5 – 20 A	260 A	047B3151	CTI 25M
11 kW	18 – 25 A	325 A	047B3152	CTI 25M
13 kW	23 – 32 A	448 A	047B3102	CTI 25M
22 kW	32 – 45 A	585 A	047B3165	CTI 45MB

## Motor switches – series CTI 25M, CTI 45MB



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### Installation of auxiliary and signal contacts, and releases



## Motor switches – series CTI 25M, CTI 45MB

### Accessories

Type	Description	Code number
CBA 10 CBA 11 CBA 20 CBA 02	Auxiliary contacts for building in 1 NO 1 NO + 1 NC 2 NO 2 NC	047B3198 047B3200 047B3201 047B3202
CBA S-11 CBA S-20	External auxiliary contacts 1 NO + 1 NC 2 NO  Can also be mounted on a CBT S- alarm contact	047B3203 047B3204
CBT 2TA	Signal contacts for building in 1 NO alarm + 1 NO	047B3207
CBS-TM2	External signal contacts 1 NC alarm + 1 NC short circuit  Always must be installed directly on the circuit breaker	047B3211
VTU VTU VTU	Undervoltage releases 24 V / 50 Hz 230 V / 50 Hz 400 V / 50 Hz	047B3214 047B3217 047B3220

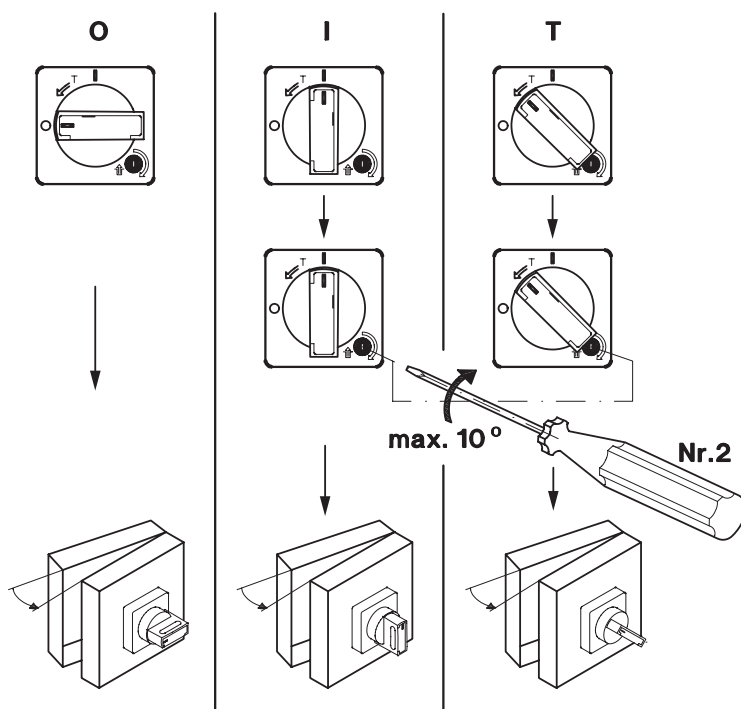


Motor switches – series CTI 25M, CTI 45MB, CTI 100

Type	Description	Code number
BDH	Door handle for mounting in panel door IP 66, black, red and yellow	047B3249
RDH	Door handle extension rod of max. length 250 mm	047B3250
		047B3136



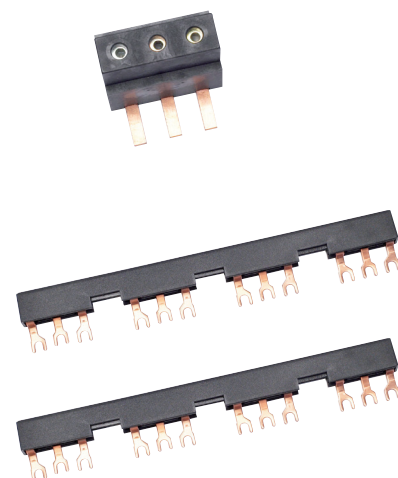
Installation of the door handle in the control cabinet door



## Motor switches – series CTI 25M, CTI 45MB, CTI 100

### Bus bars for parallel power supply of CTI 25M and CTI 45MB circuit breakers

Type	Description	Code number
BBT 25	Connection terminal block for CTI 25M 2 cables max. 16 mm <sup>2</sup> 1 cable max. 25 mm <sup>2</sup>	047B3259
BBC 25	Bus bars – 45 mm module	
	BBC 45 – 2 CTI 25M	047B3261
	BBC 45 – 3 CTI 25M	047B3262
	BBC 45 – 4 CTI 25M	047B3263
	BBC 45 – 5 CTI 25M	047B3264
	Bus bars – 54 mm module	
	BBC 54 – 2 CTI 25M	047B3265
	BBC 54 – 3 CTI 25M	047B3266
BBC 54 – 4 CTI 25M	047B3267	
BBC 54 – 5 CTI 25M	047B3268	



### Enclosures for CTI 25M

	IP65 enclosure for CTI 25M Cable entries 4M 20/25	
BMG	Black/gray rotary handle	047B3284
BMY	Red/yellow rotary handle	047B3285



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### Technical Specifications

#### Short circuit breaking capacity

Specifies the amount of short circuit current that does not damage the device.

$I_{cc}$  – the prospective value of short circuit current that flows through the circuit without any short circuit protection device mounted.

$I_{cu}$  – the maximum (limit) value of short circuit current specified by the manufacturer that a circuit breaker can handle under circumstances specified in IEC 947-2 and EN 60947-2.

$I_{cs}$  – the nominal (service) value of short circuit current specified by the manufacturer that a circuit breaker can handle under circumstances specified in IEC 947-2 and in EN 60947-2

#### Short circuit coordination

Type 1: After a short circuit occurs, it is possible to damage the switching and protective devices. The circuits are protected according to the  $I_{cu}$  parameter.

Type 2: After a short circuit occurs, it is not possible to damage the switching and protective devices, only a light contact welding is permissible. The circuits are protected according to the  $I_{cs}$  parameter.

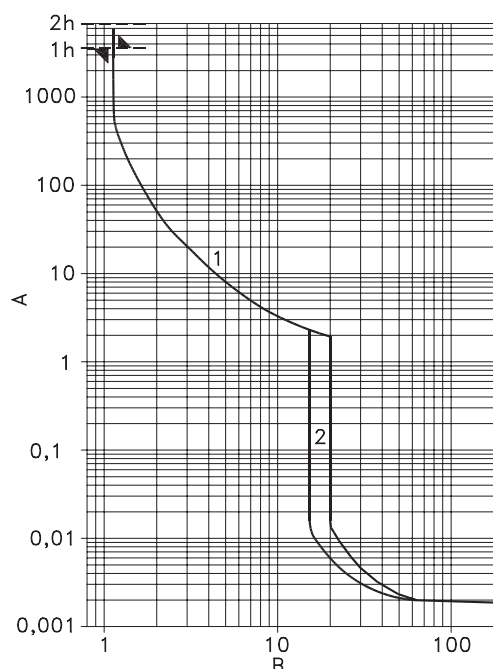
Type	Motor power	Current $I_n$	400 V		Fuse $I_{cc} > I_{cu}$
			$I_{cu}$	$I_{cs}$	
CTI 25M	0.06 kW	0.16 – 0.25 A	100 kA	100 kA	–
CTI 25M	0.09 kW	0.25 – 0.4 A	100 kA	100 kA	–
CTI 25M	0.12 kW	0.4 – 0.63 A	100 kA	100 kA	–
CTI 25M	0.37 kW	0.63 – 1.0 A	100 kA	100 kA	–
CTI 25M	0.55 kW	1.0 – 1.6 A	100 kA	100 kA	–
CTI 25M	0.75 kW	1.6 – 2.5 A	100 kA	100 kA	–
CTI 25M	1.5 kW	2.5 – 4.0 A	100 kA	100 kA	–
CTI 25M	2.5 kW	4.0 – 6.3 A	100 kA	100 kA	–
CTI 25M	5.5 kW	6.3 – 10 A	100 kA	100 kA	–
CTI 25M	7.5 kW	10 – 16 A	65 kA	50 kA	80 kA
CTI 25M	10 kW	14.5 – 20 A	50 kA	15 kA	100 kA
CTI 25M	11 kW	18 – 25 A	15 kA	15 kA	100 kA
CTI 25M	15 kW	23 – 32 A	15 kA	15 kA	100 kA
CTI 45MB	18.5 kW	32 – 45 A	65 kA	50 kA	125 kA

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### Operation characteristic

- Overload motor protection** is guaranteed by adjustable, current dependent and delayed bimetal breakers guarantee motor overload protection. The graph gives the average value at 20°C ambient temperature, from the cold condition. When the unit has warmed up, the release time is less or equal to the release time in the cold condition. The accurate adjustment ensures motor protection even in the event of phase loss.
- Short circuit motor protection**  
 The electromagnetic trips react at a fixed response current. At the highest setting value this corresponds to 13 times the set current for CTI 25M and CTI 45MB.

A – tripping time [s];  
 B – times the adjustable current





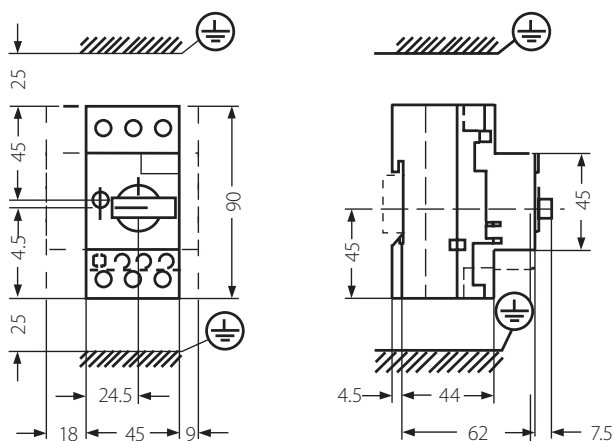
## Motor switches – series CTI 25M, CTI 45MB, CTI 100

### Connection

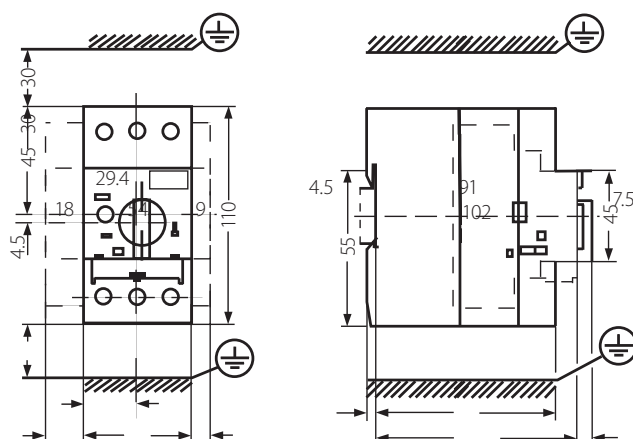
Type	Connection	Single core or multi core	Multi core with terminal sleeve	Recommended tightening torque
CTI 25M	Screw and clamp washer	1.5 – 6 mm <sup>2</sup>	1 – 4 mm <sup>2</sup>	2.5 Nm
CTI 45MB	Box terminal	2.5 – 16 mm <sup>2</sup>	2.5 – 10 mm <sup>2</sup>	3.5 Nm
CBA / CBT / VT / VTU	Screw and clamp washer	0.75 – 2.5 mm <sup>2</sup>	0.5 – 2.5 mm <sup>2</sup>	1.5 Nm
BBT 25 / 45 1 connection	Screw and clamp washer	6 – 25 mm <sup>2</sup>	4 – 16 mm <sup>2</sup>	3 Nm
BBT 25 / 45 2 connections	Screw and clamp washer	6 – 16 mm <sup>2</sup>	4 – 10 mm <sup>2</sup>	3 Nm

### Dimensions

CTI 25M



CTI 45MB



## Electronic time relays ATI, BTI, SDT, MTI

To implement simple delay systems, electronic time relays dedicated for individual applications can be used. Compact housing – 22.5 mm module, DIN rail mounting and LED status indication allow for a wide range of applications. The ATI type activates the delay of switching the control circuit on after the control signal has been given. On the other hand, the BTI type delays the switching off the control circuit after the control signal has been removed.

The SDT type used to control contactors in star-delta circuits has an additional gap set between the switching of individual circuits, due to the time needed to change the mechanical interlock of the contactors. In addition, the MTI type implements in a much wider range (up to 300 hours) the operation of 2 circuits, in two aforementioned ways, as well as alternately and cyclically.



ATI ON-delay			
Time	Control voltage	Contact function	Code number
0.1 – 10 s	110 V AC	1 changeover	047H3090
3 – 300 s	110 V AC	1 changeover	047H3091
0.1 – 10 s	24 V AC/DC	1 changeover	047H3092
0.1 – 10 s	230 V AC	1 changeover	047H3092
0.3 – 30 s	24 V AC/DC	1 changeover	047H3104
0.3 – 30 s	230 V AC	1 changeover	047H3104
3 – 300 s	24 V AC/DC	1 changeover	047H3093
3 – 300 s	230 V AC	1 changeover	047H3093
0.3 – 30 min	24 V AC/DC	1 changeover	047H3105
0.3 – 30 min	230 V AC	1 changeover	047H3105

## Time relays ATI, BTI, SDT, MTI

BTI OFF-delay			
Time	Control voltage	Contact function	Code number
0.3 – 30 s	24 V AC/DC	1 changeover	047H3106
3 – 300 s	24 V AC/DC	1 changeover	047H3095
0.3 – 30 s	230 V AC	1 changeover	047H3107
3 – 300 s	230 V AC	1 changeover	047H3099

SDT star-delta control			
Time	Control voltage	Contact function	Code number
0.3 – 30 s	24 V AC/DC, 230 V AC	1 changeover	047H3111
0.3 – 30 s	110 V AC	1 changeover	047H3110
0.3 – 30 s	400V AC	1 changeover	047H3112

MTI multi-function control			
Time	Control voltage	Contact function	Code number
0.05 s – 300 h	24 V AC/DC, 230 V AC	2 changeover	047H3077

### Operation characteristic

ATI	Switch-on time delay
<p><i>t</i> - time set point</p>	<p>After connecting the voltage to terminals A1 and A2, the delay sequence starts. After the set time has elapsed, the output relay switch turns on and stays on until the power supply is cut off. For the power supply of 24 V, use terminals A1 and B1.</p>
BTI	Switch-off time delay
<p><i>t</i> - time set point</p>	<p>Power supply must be connected to terminals A1 and A2 and stay active. The start of the delay countdown is controlled by the contactor connected to terminal Y1. When the contactor is closed, the output relay is activated, while when the contactor is opened, the delay period starts (the duration of the control pulse is at least 20 ms). After the set period has elapsed, the output relay returns to the rest state. If the contactor connected with terminal Y1 is closed during the delay period, the countdown is halted and after re-opening the contactor, the function re-starts.</p> <p><b>Attention! External loads must not be connected in such a way as to be powered by the control contactor Y1.</b></p>

### Operation properties

SDT	Star-delta control
<p><math>t</math> - time setting; <math>t_2</math> - fixed time 0.3 s</p>	<p>After connecting the voltage to terminals A1 and A2, the delay sequence starts.</p> <p>After the end of the countdown period, the output relay is activated. The “star” contactor switches off and after the end of the rest period, i.e. after 30-35 ms, the “delta” contactor switches on.</p>
MTI	Star-delta control
<p><math>t</math> - time setting; <math>t_2</math> - fixed time 0.5 s</p>	<p>After connecting the voltage to terminals A1 and A2, the R1 relay switches and the delay sequence starts.</p> <p>After the end of the countdown period, the output relay R1 is deactivated. The output relay R2 switches at the end of the rest period, i.e. after 50 ms.</p> <p>The light-emitting diode flashes during the whole period of time setup.</p>
MTI	Delayed switch-on
<p><math>t</math> - time setting</p>	<p>After connecting the voltage to terminals A1 and A2, the delay switch-on sequence starts. The green LED flashes during the whole period of the delay. After the end of the countdown period, the output relay switches to the pulse position and the green LED is permanently illuminated. The output relay remains switched on until the power supply is disconnected.</p> <p>At constant supply voltage, the start and stop of the delay function can also be controlled by shorting and opening the control contactors Y1/Z2.</p> <p>If the control contactors Y1/Z2 are closed before the delay time elapses, this period is reset and the output relay remains switched off. If the supply voltage is disconnected, the output relay remains switched off and the delay period is reset. If the relay is set to “Inst.”, the R2 relay immediately switches on when the supply voltage is reconnected and stays on until the power supply is disconnected.</p>
<p><b>Attention! Control contactors Y1/Z2 must remain in voltage-free state.</b></p>	

## Time relays ATI, BTI, SDT, MTI

### Operation properties

MTI	OFF delay
	<p>After connecting the supply voltage to terminals A1 and A2, the output relay switches on immediately and remains on until the delay period has elapsed. The green LED flashes during the whole period of the delay. After the end of the countdown period, the output relay returns to the rest position and the green LED is permanently illuminated. At constant supply voltage, the start and stop of the delay function can also be controlled by shorting and opening the control contactors Y1/Z2. The countdown function can be stopped by short across the contactors Y1/Z2.</p> <p>If the control contactors Y1/Z2 are closed before the delay time elapses, this period is reset to zero and the output relay remains switched off. If the supply voltage is disconnected, the output relay remains switched off and the delay period is reset. If the relay is set to "Inst.", the R2 relay immediately switches on when the supply voltage is reconnected and stays on until the power supply is disconnected.</p> <p><b>Attention! Control contactors Y1/Z2 must remain in voltage-free state.</b></p>
MTI	Pulse switching
	<p>After connecting the supply voltage to terminals A1 and A2, the output relay starts to switch in pulse mode according to the set symmetrical pause switch time pause - pulse. The LED flashes all the time, and during the pause it flashes twice as often. The function can be stopped by short across the contactors Y1/Z2. Re-activating the function triggers the start of the switch from the "pause."</p> <p>If the relay is set to "Inst.", the R2 relay immediately switches on when the supply voltage is reconnected and stays on until the power supply is disconnected.</p> <p><b>Attention! Control contactors Y1/Z2 must remain in voltage-free state.</b></p>

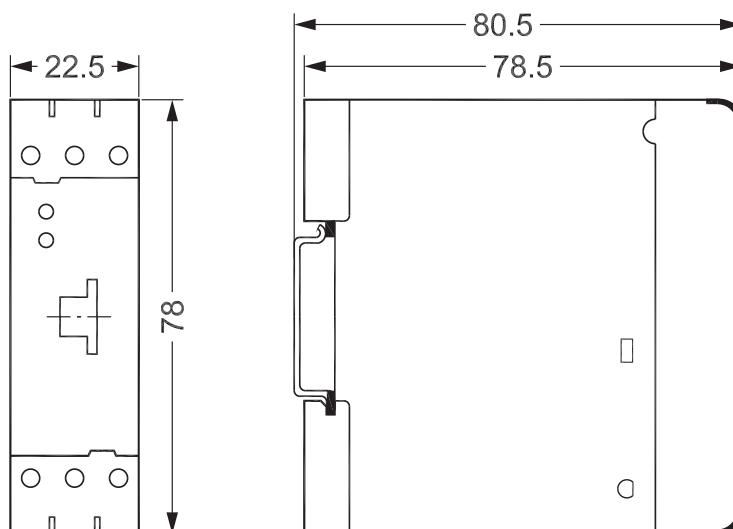
8

Operation properties

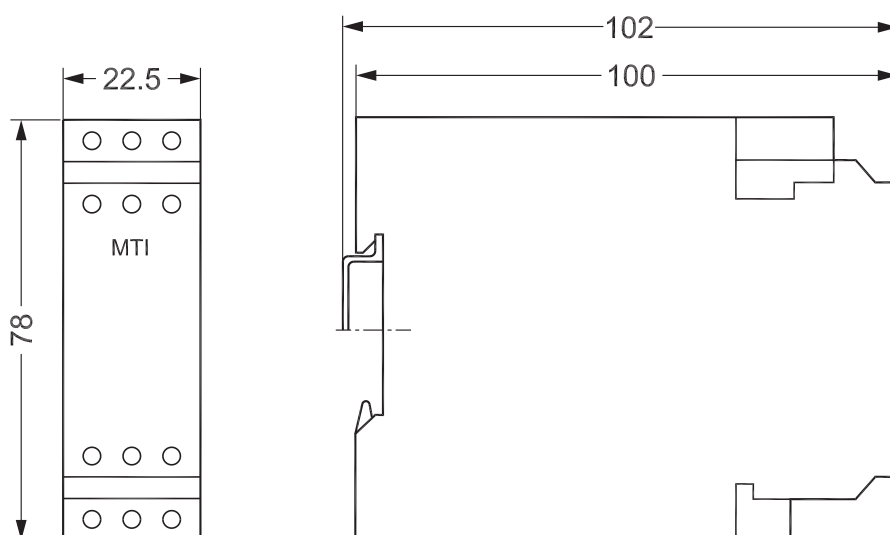
MTI	Pulse switching
	<p>After connecting the supply voltage to terminals A1 and A2, the output relay starts to switch in pulse mode according to the set symmetrical pause switch time pause - pulse.</p> <p>The LED flashes all the time, and during the pause it flashes twice as often. The function can be stopped by short across the contactors Y1/Z2. Re-activating the function triggers the start of the "pulse."</p> <p>If the relay is set to "Inst.", the R2 relay immediately switches on when the supply voltage is reconnected and stays on until the power supply is disconnected.</p> <p><b>Attention! Control contactors Y1/Z2 must remain in voltage-free state.</b></p>
MTI	Delayed disconnection
	<p>Connect the supply voltage to the A1 and A2 terminals permanently and close the circuit Y1/Z2, which will trigger the output relay connection immediately. After disconnecting contactors Y1/Z2, the delay time starts and the LED flashes all the time. After the set delay time has elapsed, the output relay returns to the initial position and the LED is permanently illuminated.</p> <p>If the control contactors Y1/Z2 are closed before the delay time elapses, this period is reset to zero and the output relay remains switched off. If the supply voltage is disconnected, the output relay remains switched off and the delay period is reset.</p> <p>If the relay is set to "Inst.", the R2 relay immediately switches on when the supply voltage is reconnected and stays on until the power supply is disconnected.</p> <p><b>Attention! Control contactors Y1/Z2 must remain in voltage-free state.</b></p>
MTI	Delayed disconnection
	<p>Connect the supply voltage to the A1 and A2 terminals permanently and close the circuit Y1/Z2. After disconnecting contactors Y1/Z2, the delay time starts and the LED flashes all the time. After the set delay time has elapsed, the output relay returns to the initial position and the LED is permanently illuminated.</p> <p>If the control contactors Y1/Z2 are closed before the delay time elapses, this period is reset to zero and the output relay remains switched off. If the supply voltage is disconnected, the output relay remains switched off and the delay period is reset.</p> <p>If the relay is set to "Inst.", the R2 relay immediately switches on when the supply voltage is reconnected and stays on until the power supply is disconnected.</p> <p><b>Attention! Control contactors Y1/Z2 must remain in voltage-free state.</b></p>

**Time relays ATI, BTI, SDT, MTI**

**Relays ATI, BTI, SDT**

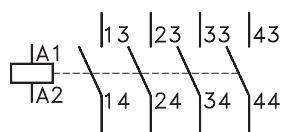


**Relay MTI**

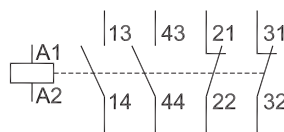


## Electrical wiring diagrams

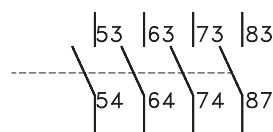
### Mini-actuators CI 5



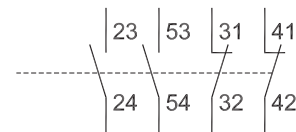
CI 5-2 (4 NO)



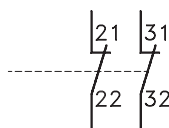
CI 5-2 (2 NO + 2 NC)



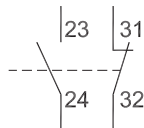
CBN - 40



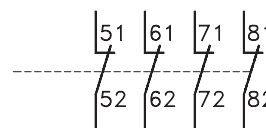
CBN - 22



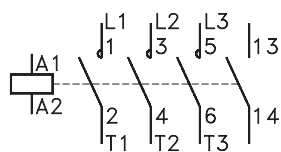
CBN - 02



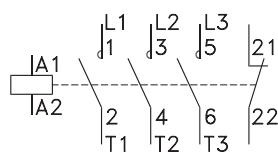
CBN - 11



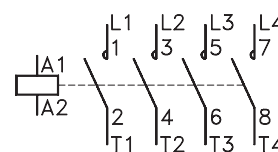
CBN - 04



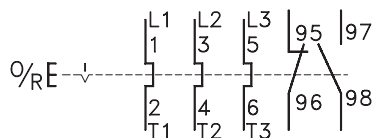
CI 5-5, 5-9, 5-12 (1 NO)



CI 5-5, 5-9, 5-12 (1 NC)



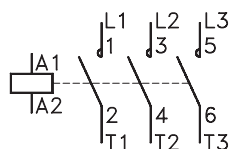
CI 5-9 (4 NO)



TI 9C-5

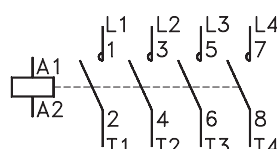
### Contactors CI 6 - 50

3-pole

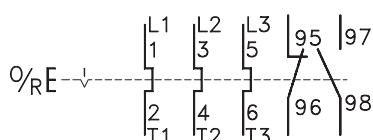


CI 6, 9, 12, 15, 16, 20, 25, 30, 32, 37, 45, 50

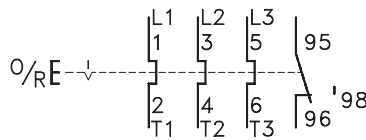
4-pole



CI 6, 9, 12, 15

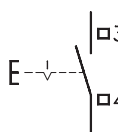


TI 16C, 25C, 30C

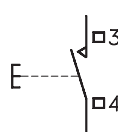


TI 80

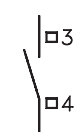
Auxiliary contactors CI 6 - 50



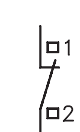
CB - S (NO)



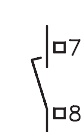
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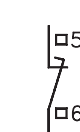
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CB - NC



CB - EM

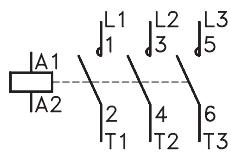


CB - LB

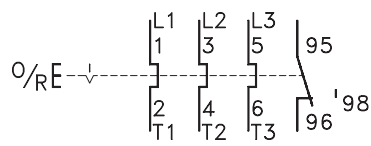


## Electrical wiring diagrams

### Contactors CI 61 – 98

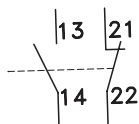


CI 61, 73, 86, 98

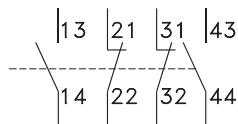


TI 80, 86

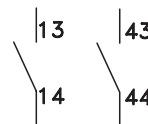
### Auxiliary contactors CI 61 – 98



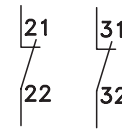
CBD - 11



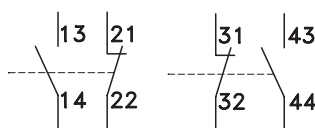
CBD - 22



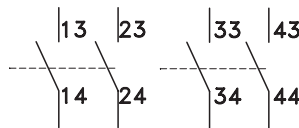
CBD S - NO



CBD S - NC

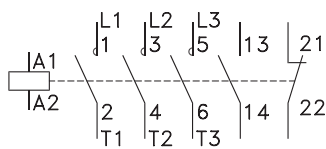


CBD S - 11

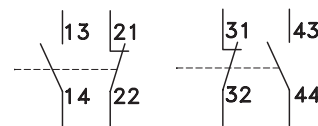


CBD S - 20

### Contactors CI 141 – CI 420 E

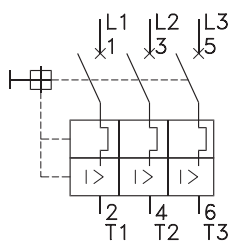


CI 141, CI 180, CI 250EI,  
CI 300EI, CI 420EI

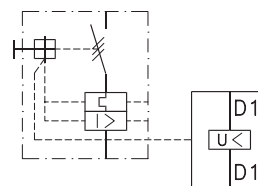


CBC 11

### Motor switches CTI 15

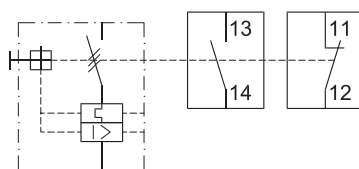


CTI 15

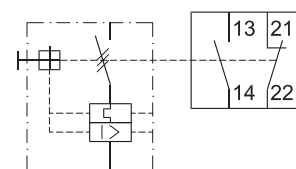


Undervoltage  
release  
CBI - UA

### Auxiliary contactors



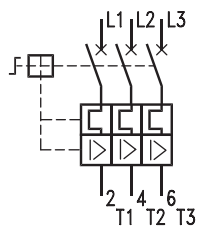
CBI - NO, CBI - NC



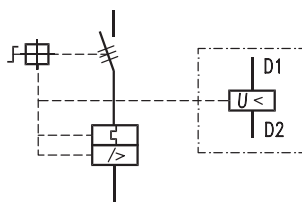
CBI 11

## Electrical wiring diagrams

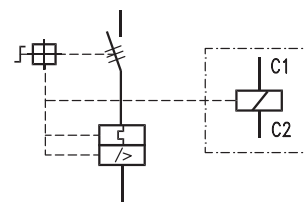
### Motor switches CTI 25M, CTI 45MB



CTI 25M, CTI 45MB



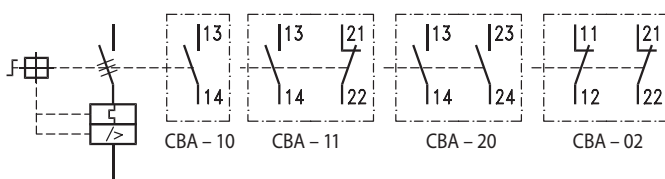
Undervoltage release VTU-



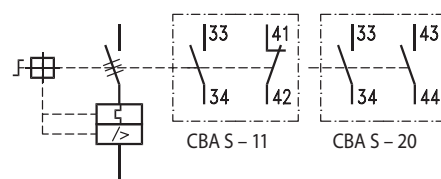
Trigger release VT-

### Auxiliary contactors

#### Front mounting



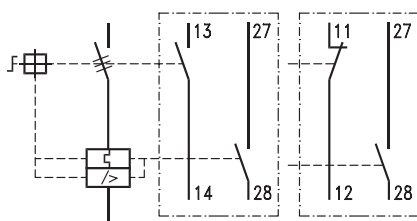
#### Side mounting



### Signal contactors

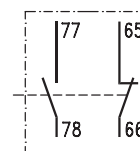
8

#### Front mounting



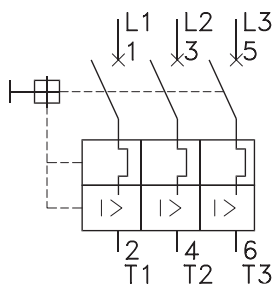
CBT 2TA

#### Side mounting



CBT S-TM2

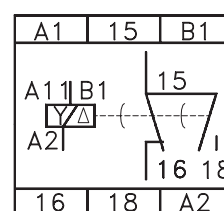
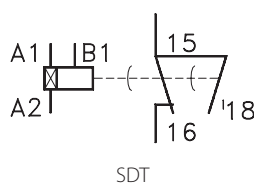
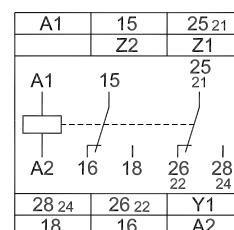
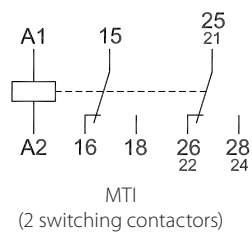
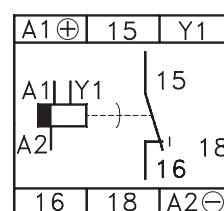
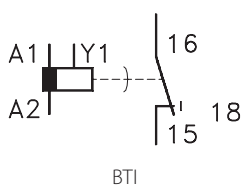
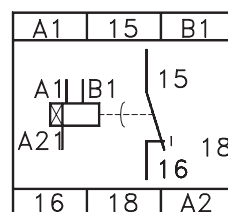
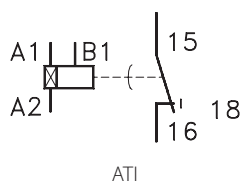
### Motor switches CTI 100



CTI 100

Electrical wiring diagrams

Time relays



## Electronic contactors ECI – semiconductor relays

ECI electronic contactors have been designed for applications requiring very frequent and fast connection of heating elements, both resistance

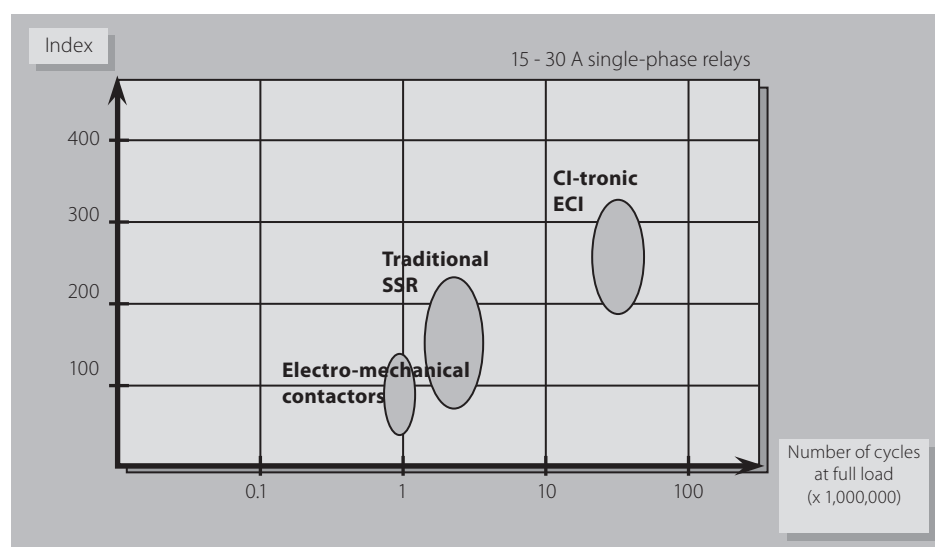
and induction. These contactors have SCR "power chip" using LTE technology (Low Thermal Expansion).



This solution ensures high switching capacity and long life. They have a built-in switching algorithm at zero voltage transition, which reduces EMC noise.

### Characteristics

- DIN rail mounting
- Fast and easy installation
- Parameterisation by load categories AC-1 and AC-3
- Compact modular design together with a radiator
- Operating voltage up to 600 V AC
- Universal control voltage of 24–230 V AC/DC or 5–24 V DC
- Switch-on at zero point
- Safety rating IP 20
- CE, CSA, UL and C-tick certificates
- In-built protective varistor
- Compliant with EN 60947-4-3 - EMC resistance
- LED status indicator



LTE technology enables to achieve an above-average lifespan of up to 50,000,000 cycles, which is on average 10 times more than traditional SSR.

## Electronic contactors ECI – semiconductor relays

### Technical Specifications Parameters – single- phase contactors

Working current		Control voltage	Module	Type	Code number Operating voltage	
AC-1	AC-3				12 – 230 V AC	24 – 480 V AC
15 A	15 A	5 – 24 V DC	22.5 mm <sup>*)</sup>	ECI 15-1	037N0063	037N0065
15 A	15 A	24 – 230 V AC/DC	22.5 mm <sup>*)</sup>	ECI 15-1	037N0064	037N0066
30 A	15 A	5 – 24 V DC	45 mm <sup>*)</sup>	ECI 30-1	037N0007	037N0009
30 A	15 A	24 – 230 V AC/DC	45 mm <sup>*)</sup>	ECI 30-1	037N0001	037N0003
50 A	15 A	5 – 24 V DC	90 mm <sup>*)</sup>	ECI 50-1	–	037N0010
50 A	15 A	24 – 230 V AC/DC	90 mm <sup>*)</sup>	ECI 50-1	–	037N0004
63 A	30 A	5 – 24 V DC	90 mm <sup>*)</sup>	ECI 63-1	–	037N0080
63 A	30 A	24 – 230 V AC/DC	90 mm <sup>*)</sup>	ECI 63-1	–	037N0081

<sup>\*)</sup> DIN-rail mountable width

### Parameters – two-phase contactors

Working current <sup>**)</sup>		Control voltage	Module	Type	Code number Operating voltage	
AC-1	AC-3				12 – 230 V AC	24 – 480 V AC
30 A	15 A	5 – 24 V DC	45 mm <sup>*)</sup>	ECI 30-2	–	037N0021
30 A	15 A	24 – 230 V AC/DC	45 mm <sup>*)</sup>	ECI 30-2	037N0013	037N0015
50 A	15 A	5 – 24 V DC	90 mm <sup>*)</sup>	ECI 50-2	–	037N0022
50 A	15 A	24 – 230 V AC/DC	90 mm <sup>*)</sup>	ECI 50-2	037N0014	037N0016

<sup>\*)</sup> DIN-rail mountable width

<sup>\*\*)</sup> as the sum of phases L1 and L2

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### Parameters – three- phase contactors

Working current		Control voltage	Module	Type	Code number Operating voltage	
AC-1	AC-3				12 – 230 V AC	24 – 480 V AC
10 A	10 A	5 – 24 V DC	45 mm <sup>*)</sup>	ECI 10-3	–	037N0033
10 A	10 A	24 – 230 V AC/DC	45 mm <sup>*)</sup>	ECI 10-3	–	037N0027
20 A	10 A	5 – 24 V DC	90 mm <sup>*)</sup>	ECI 20-3	–	037N0034
20 A	10 A	24 – 230 V AC/DC	90 mm <sup>*)</sup>	ECI 20-3	–	037N0028

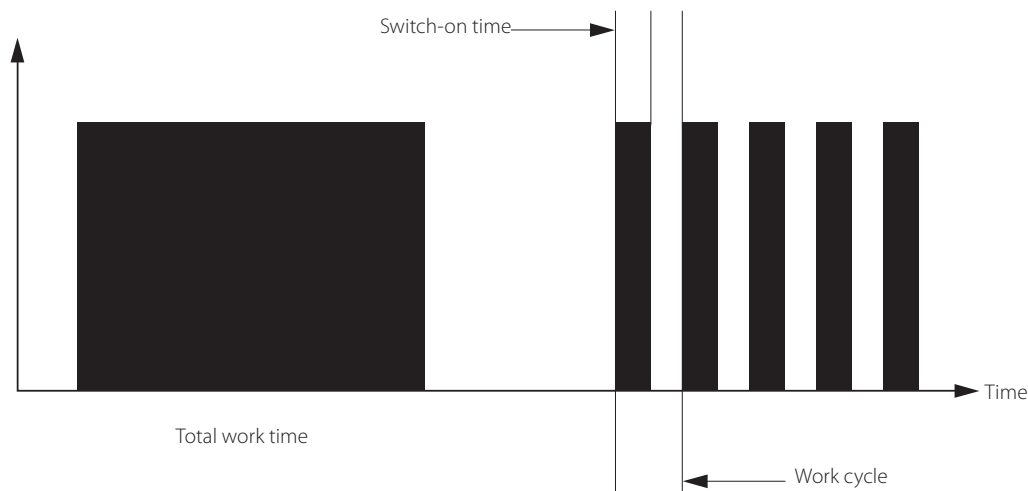
<sup>\*)</sup> DIN-rail mountable width

### Selection of the load for work at elevated temperature

Ambient Temperature	single and two-phase				three-phase	
	ECI 15	ECI 30	ECI 50	ECI 63	ECI 10	ECI 20
+40°C	15 A	30 A	50 A	63 A	10 A	20 A
+50°C	12.5 A	25 A	40 A	50 A	8 A	16 A
+60°C	10 A	20 A	30 A	35 A	6.5 A	13 A

## Electronic contactors ECI – semiconductor relays

### Performance characteristics – selection of parameters depending on the work cycle



If the contactor is not connected for 100% of the process time, which is the case in most applications, it can carry a load greater than nominal. Load coefficient is the parameter determining acceptable oversizing.

load coefficient = switch-on time/work cycle [%]

Working current	Total work time	Load coefficient
<b>ECI 15 – 1</b>		
17.5 A	15 min	85%
20 A	13 min	75%
22.5 A	11 min	67%
25 A	9 min	60%
27.5 A	7 min	55%
30 A	5 min	50%
<b>ECI 30 – 1 and ECI 30 – 2</b>		
35 A	15 min	85%
40 A	13 min	75%
45 A	11.5 min	67%
50 A	10 min	60%
<b>ECI 10 – 3</b>		
12.5 A	15 min	85%
15 A	13 min	75%
17.5 A	11.5 min	67%
20 A	10 min	60%

## Electronic contactors ECI – semiconductor relays

### Characteristics Short-circuit breaker protection

	single and two-phase				three-phase	
	ECI 15	ECI 30	ECI 50	ECI 63	ECI 10	ECI 20
<b>Coordination 1</b>	50A gL/gG			80A gL/gG	35A gL/gG	
<b>Coordination 2</b>	1,800 A <sup>2</sup> s			6,300 A <sup>2</sup> s	450 A <sup>2</sup> s	

### Heat power dissipation

	single and two-phase				three-phase	
	ECI 15	ECI 30	ECI 50	ECI 63	ECI 10	ECI 20
	1.2 W/A per phase				3 W/A	

### Control circuit parameters

Parameter	Value
Control voltage range -15% +10%	5 – 24 V DC, 24 – 230 V AC/DC
Switch-on threshold	4.25 V DC, 20.4 V AC/DC
Breakdown threshold	1.5 V DC, 7.2 V AC/DC
Circuit load capacity (max.)	15 mA and 1.5 VA for 24 V DC
System response time (max.)	½ period/period

### General parameters

Parameter	Value
Leakage current (max.)	1 mA
Minimum work current	10 mA
Rated insulation voltage (IU)	660 V
Rated impulse voltage (U <sub>max</sub> .)	4 kV
Electromagnetic interference	EN 60947-4-3
Operating temperature – rated	-5 °C to -40 °C
Storage temperature	-20 °C up to + 80 °C
Cooling method	Convection
Assembly	Vertical
Protection rating	IP 20
Dimensions	On page 80

**Note:**

Terminals 11-12 have no internal connection; they are used for installing the UP62 thermostat (catalogue number 037N0050)

## Electronic contactors ECI - semiconductor relays

### Application examples single-phase

$P = I_L * U_L$

Max. heater power [kW]

	230 V	400 V	575 V
ECI 15-1	3.5	6	8.7
ECI 30-1	69	12	17.3
ECI 50-1	11.5	20	28.8
ECI 63-1	14.5	25.1	36.2

$P = 1.73 * I_L * U_L$

Max. heater power [kW]

	230 V	400 V	575 V
ECI 15-1	6	10.3	15
ECI 30-1	11.9	20.8	29.9
ECI 50-1	19.9	34.6	49.7
ECI 63-1	25.1	43.6	62.6

### two-phase

$P = 1.73 * I_L * U_L$

Max. heater power [kW]

	230 V	400 V	575 V
ECI 30-2	6.9	12	17.3
ECI 50-2	11.5	20	28.8

$P = 1.73 * I_L * U_L$

Max. heater power [kW]

	230 V	400 V	575 V
ECI 30-2	6.9	12	17.3
ECI 50-2	11.5	20	28.8

### three-phase

$P = 1.73 * I_L * U_L$

Max. heater power [kW]

	230 V	400 V	575 V
ECI 10-3	4	6.9	10
ECI 20-3	8	13.8	20

$P = 1.73 * I_L * U_L$

Max. heater power [kW]

	230 V	400 V	575 V
ECI 10-3	4	6.9	10
ECI 20-3	8	13.8	20



## Power regulators ACI

ACI power regulators are designed for very precise temperature control in heating circuits or for smooth switching of transformers. The built-in microprocessor allows operations in phase angle control or group control mode. The controller automatically adjusts to the load ensuring soft connection, while in group control mode, it limits the influence of DC current in the transformer.

The ACI controller can easily cooperate with a PLC controller via one of many control signal standards. The purpose of the controllers is to control the power of resistance heaters, halogen radiators, incandescent lamps and switching of single-phase transformers, e.g. welders, as well as controlling speed of single-phase fan motors.



### Technical Specifications

Working current AC-1	Working current AC-3	Working current AC-55b	Working current AC-56a	Control voltage	Operating voltage	Module mm <sup>3</sup> )	Type	Code number
30 A	15 A	30 A	30 A	19 – 28 V AC/DC	208 – 240 V AC	45	ACI 30-1	037N0057
30 A	15 A	30 A	30 A	19 – 28 V AC/DC	400 – 480 V AC	45	ACI 30-1	037N0059
50 A	15 A	30 A	30 A	19 – 28 V AC/DC	208 – 240 V AC	90	ACI 50-1	037N0058
50 A	15 A	30 A	30 A	19 – 28 V AC/DC	400 – 480 V AC	90	ACI 50-1	037N0060

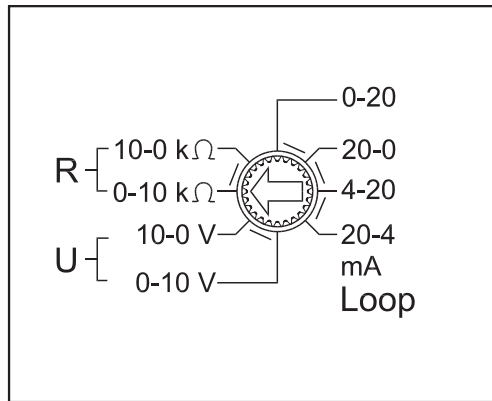
\*) DIN-rail mountable width  
 AC-55b - tube radiators  
 AC-56a - transformers

### Characteristics

- DIN rail mounting
- Fast and easy installation
- Parameterisation by load category AC-1
- Phase angle control or group control
- Current signal 4-20 mA, 20-4 mA, 0-20 mA and 20-0 mA
- Voltage signal 0-10 V DC or 10-0 V DC
- Potentiometric setting 0-10 kΩ or 10-0 kΩ
- Characteristics of linear voltage or linear power
- Compact modular design together with a radiator
- Safety rating IP 20
- In-built protective varistor
- LED status indicator
- CE, CSA, UL and C-tick certificates

## Power regulators ACI

### Control method selection



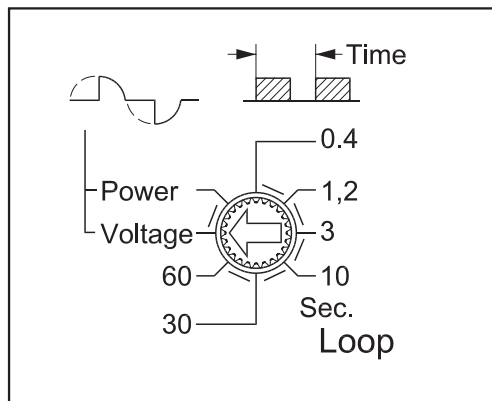
### Signal selection control

The type of control signal is selected by using a knob

### Protection

Control input is protected against overload. If the current exceeds 25 mA, the current loop will be automatically interrupted and the LED indicator will indicate a fault. The input is protected against unintentional voltage of 24 V DC. Terminals are marked as + and -, and the polarity should be maintained. The input has a floating voltage zero level.

### Working mode selection



### Phase angle control

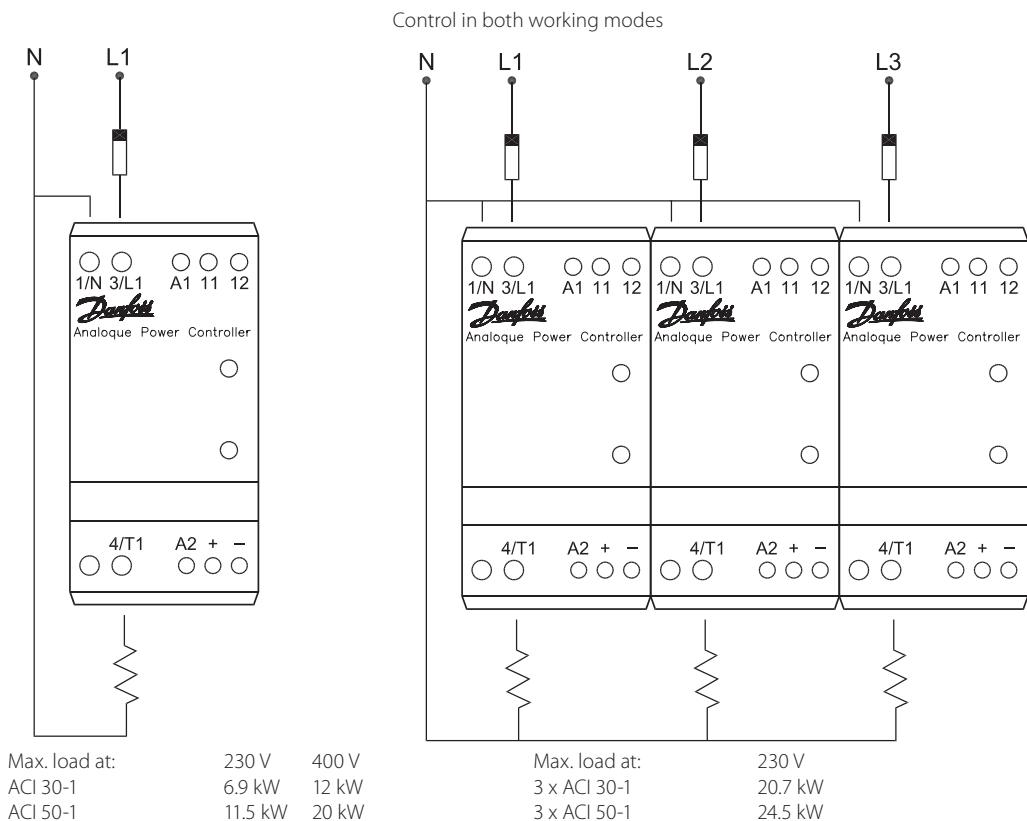
Two types of control can be selected. The linear voltage (Voltage), the voltage on the load, varies linearly with the control signal, or the linear power (Power), where the power on the load varies linearly with the control signal.

### Group control

Performs the transmission of sinusoidal packages in adjustable cycles from 400 ms to 60 s and is linearly dependent on the given signal.

### Application examples - heating

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## Power regulators ACI

### Short-circuit breaker protection

	ACI 30	ACI 50
Coordination 1	50 A gL/gG	
Coordination 2	$I^2t$ ( t=10 ms) 1800 A <sup>2</sup> s	

### Selection of the load for work at elevated temperature

Ambient Temperature	ACI 30	ACI 50
+40°C	30 A	50 A
+50°C	25 A	40 A
+60°C	20 A	30 A

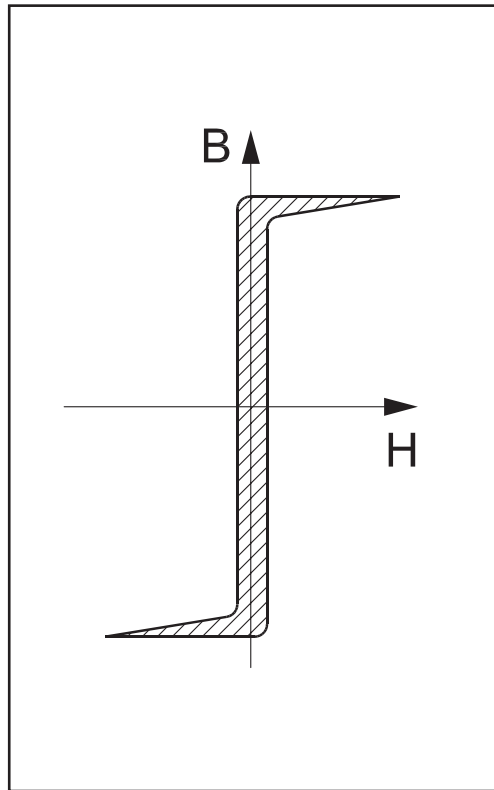
### General parameters

Parameter	Value
Control voltage range	19 – 28 V AC/DC
Leakage current (max.)	1 mA
Minimum work current	10 mA
Rated insulation voltage (IU)	660 V
Rated impulse voltage (U <sub>max</sub> )	4 kV
Signal input	floating zero
Power supply - signal circuit insulation	2.5 kV
Control - signal circuit insulation	500 V
Electromagnetic interference	EN 50082-1 and EN 50082-2
Heat power dissipation	1.2 W/A
Operating temperature – rated	-5 °C to -40 °C
Storage temperature	-20 °C up to + 80 °C
Cooling method	Convection
Assembly	Vertical
Protection rating	IP 20
Dimensions	On page 80

**Note:**

Inputs of the signal and control circuit are protected against overload and overvoltage  
Terminals 11-12 have no internal connection; they are used for installing the UP62 thermostat  
(catalogue number 037N0050)

**Application – connecting transformers**



**Connecting transformers**

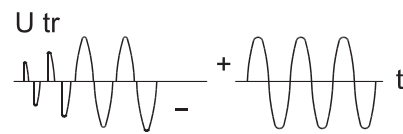
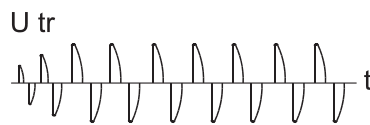
The main connecting problem is the inductance of the magnetic circuit. When the transformer is turned off ( $H = 0$ ), the induction  $B$  remains at a high level due to the residual magnetism, characteristic of the transformer core material. After being connected, the ACI softly switches on the circuit avoiding the development of current shocks; moreover, at subsequent switching times, it "remembers" the polarization, always setting it in reverse to the previous one, which leads to lowering of the current peaks normally occurring when connecting the transformer.

**Phase angle control**

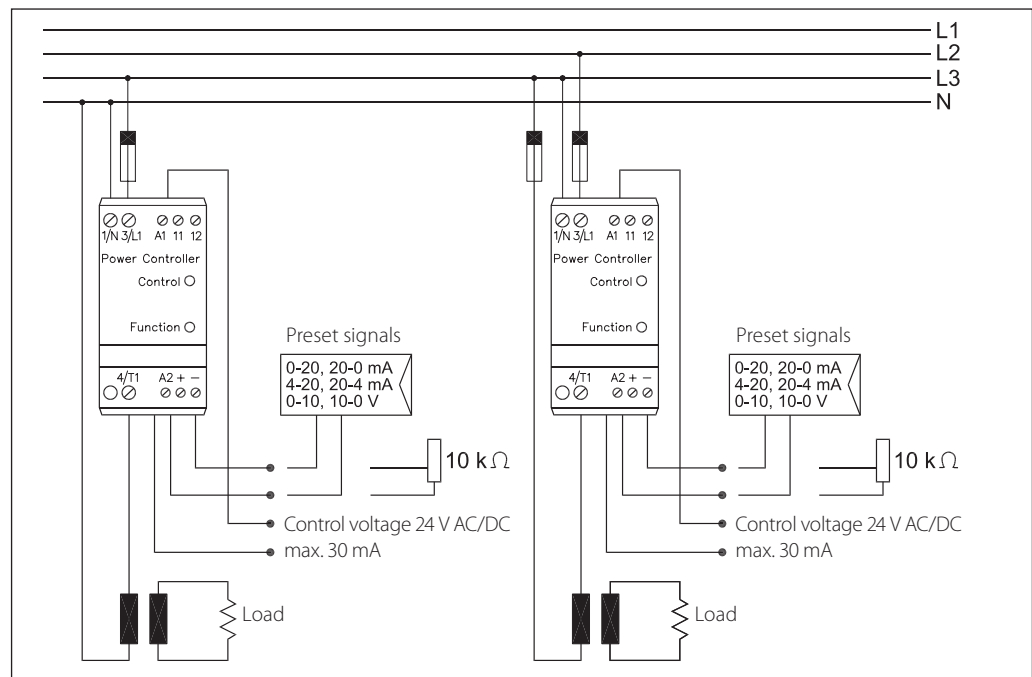
The ACI softly connects the transformer to the voltage set by the control signal.

**Group control**

The ACI softly connects the transformer only to the voltage rated value because full sinusoids are transmitted. This method limits current peaks and saturation with DC.



10



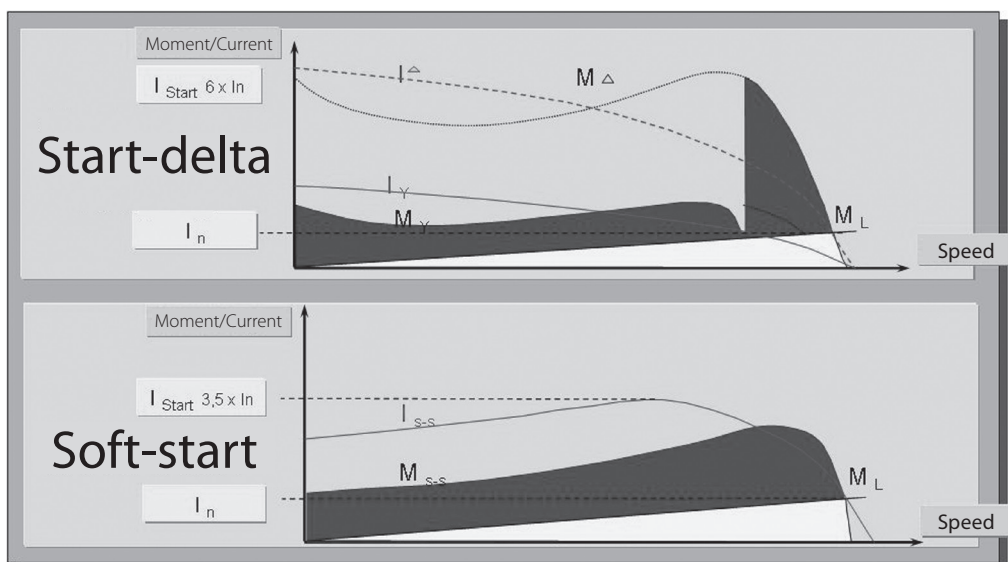
## Soft starters MCI – soft start and stop systems

MCI soft starters are a proven solution for the soft start of three-phase asynchronous squirrel-cage motors, maintaining start-up currents at a reasonable level, which leads to extended failure-free operation of many machines. They are the perfect solution for applications requiring a large number of soft start and stop cycles, at the same time being not as expensive as conventional soft starters. They are used for pumps and fans, feeders and conveyors, cranes and gantries. Due to the adjustable value of the starting moment and the unique function (kick start) overcoming

static friction, they are able to meet almost any application. They allow reduction of stress and vibration during start-up and hydraulic impacts during stops, which leads to a longer time between machine downtime and technological lines. Furthermore, lowering the start-up currents reduces the voltage drops occurring at the "soft grid" leading to damage to electronic devices. MCI soft starters are a natural solution replacing the existing star/delta starting systems with the MCI 40 model using the existing motor cabling.



### Start-up characteristics



## Soft starters MCI – soft start and stop systems

### Characteristics

- Unlimited number of starts per hour (the exception is the MCI 15BP soft starter– details in the selection table)
- Adjustable run-up times:  

0-10 s: MCI 3, MCI 15, MCI 15BP, MCI 25	0-20 s: MCI 30 I-O	0-30 s: MCI 40-3D I-O, MCI 50 I-O
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- Adjustable run-up times:  

0-10 s: MCI 3, MCI 15, MCI 15BP, MCI 25	0-20 s: MCI 30 I-O	0-60 s: MCI 40-3D I-O, MCI 50 I-O
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- Adjustable run-up time up to 85%
- Function of breaking kick start friction
- Universal control voltage 24-480V AC/DC
- Maximum operating voltage up to 600 V AC
- Control in three phases - selected models
- Automatic phase loss detection
- Automatic adaptation to 50/60 Hz
- LED status indicator
- In-built protective varistor
- Optional auxiliary contactors
- Fast and easy installation
- Compact modular design together with a radiator
- DIN rail mounting
- Compliant with EN 60947-4-2
- Certificates CE and UL (UL 508)

### Technical Specifications

Operating voltage	Motor power max.	Motor current max.	Module	Auxiliary contactors	Type	Code number
380 – 415 V AC	1.5 kW	3 A	22.5 mm <sup>1)</sup>	–	MCI 3	037N0074
440 – 480 V AC	1.5 kW	3 A	22.5 mm <sup>1)</sup>	–	MCI 3	037N0084
400 – 415 V AC	7.5 kW <sup>2)</sup>	15 A <sup>2)</sup>	45 mm <sup>1)</sup>	–	MCI 15BP	037N0139
380 – 480 V AC	7.5 kW	15 A	45 mm <sup>1)</sup>	–	MCI 15	037N0039
380 – 480 V AC	11 kW	25 A	90 mm <sup>1)</sup>	–	MCI 25	037N0040
380 – 480 V AC	15 kW <sup>3)</sup>	25/30 <sup>3)</sup> A	90 mm <sup>1)</sup>	IO/bypass	MCI 30	037N0070
380 – 480 V AC	21 kW <sup>4)</sup>	29/43 <sup>3)</sup> A	90 mm <sup>1)</sup>	IO/bypass	MCI 40-3D IO	037N0092
380 – 480 V AC	22 kW <sup>3)</sup>	35/50 <sup>3)</sup> A	180 mm <sup>1)</sup>	IO/bypass	MCI 50-3 IO	037N0090
380 – 480 V AC	45 kW <sup>4)</sup>	86 <sup>3)</sup> A	180 mm <sup>1)</sup>	IO/bypass	MCI 50-3 IO	037N0090
500 – 600 V AC	7.5 kW	15 A	45 mm <sup>1)</sup>	–	MCI 15	037N0041
500 – 600 V AC	15 kW	25	90 mm <sup>1)</sup>	–	MCI 25	037N0042

1) DIN-rail mountable width

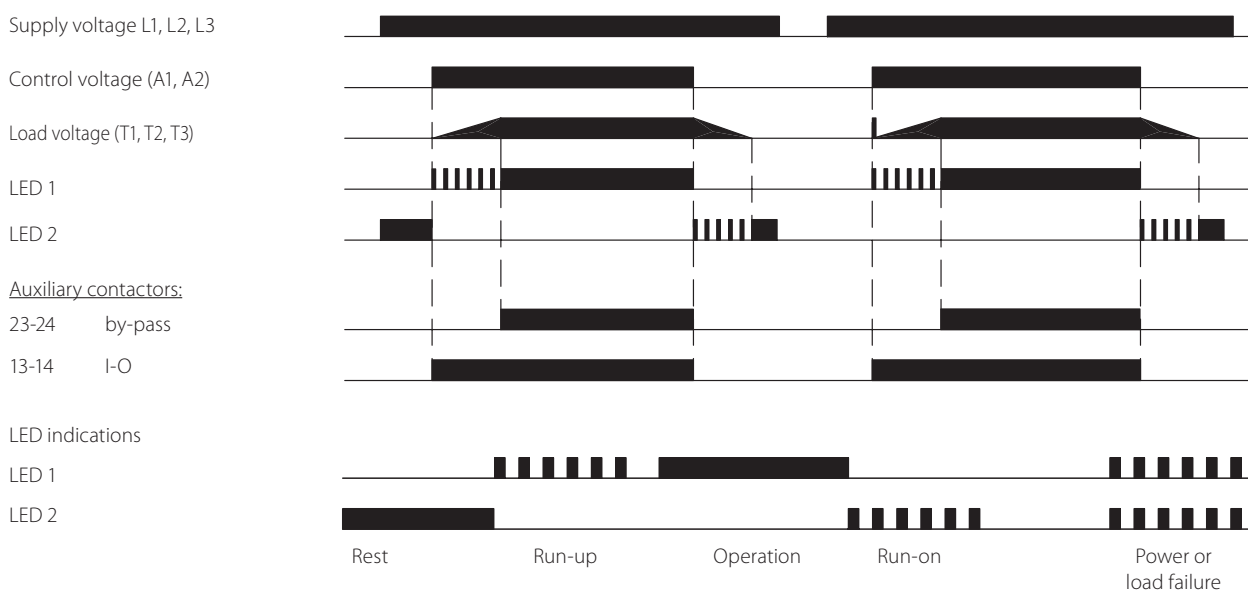
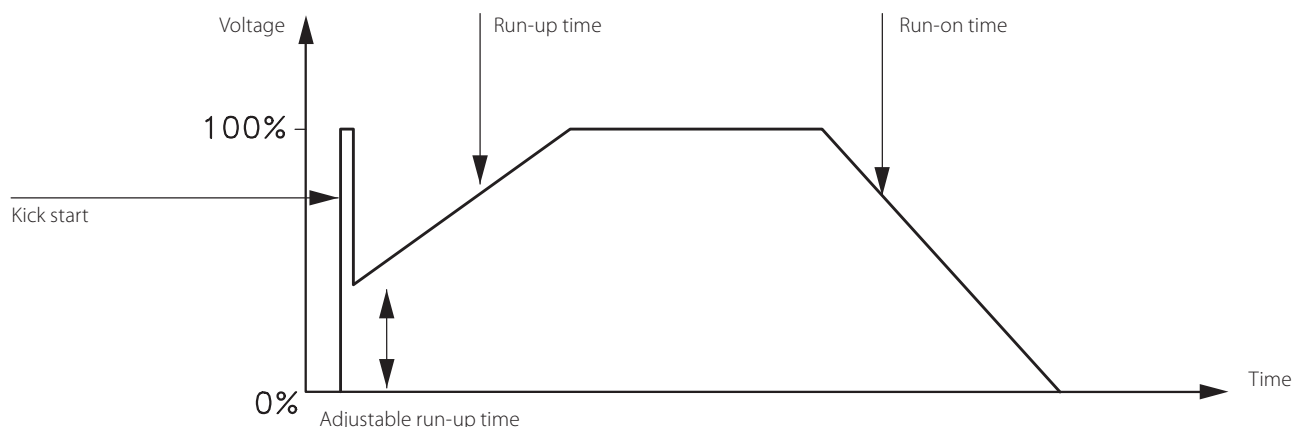
2) The required shutdown between consecutive starts for the rated current of 15 A is 110 s, 12 A (100 s), 9 A (95 s)

3) With a by-pass contactor

4) Only in the internal delta arrangement with by-pass contactor

## Soft starters MCI – soft start and stop systems

### Working principle



During the run-up, the soft starter linearly raises the voltage on the motor to its nominal value. The motor rotational speed depends directly on the load on the shaft; the engine without load will accelerate faster than the set run-up time. This time is independent of, for example, grid frequency or load changes on the shaft. The starting torque can be used to improve the starting characteristics that require overcoming the higher moment of inertia. In the most difficult cases, you can also use the "kick start" function,

offering a 200 ms full voltage pulse before the start of the run. During overrun, the soft starter gradually lowers the voltage on the motor, which translates into its smooth reduction of speed. This is of decisive importance for pumping systems limiting hydraulic impact and on conveyor belts reduces the breaking of conveyor belts ensuring the stability of transported objects. Optionally built-in auxiliary contacts are based on thyristor systems and can only control AC circuits.

## Soft starters MCI – soft start and stop systems

### Operation properties Heat power dissipation

	MCI 3	MCI 15BP	MCI 15	MCI 25	MCI 30	MCI 40	MCI 50
Heat power dissipation	4 W	2W/A			3 W/A		

### Short-circuit breaker protection

	MCI 3	MCI 15BP	MCI 15	MCI 25	MCI 30	MCI 40	MCI 50
Type 1 gL/gG	25 A	50 A	50 A	80 A		125 A	
Type 2 I <sup>2</sup> t	72 A <sup>2</sup> s	1,800 A <sup>2</sup> s	1,800 A <sup>2</sup> s	6,300 A <sup>2</sup> s		25300 A <sup>2</sup> s	

### Control circuit parameters

Parameter	Value
Control voltage range -15% +10%	24 – 480 V AC/DC
Switch-on threshold	20.4 V AC/DC
Breakdown threshold	5 V AC/DC
Circuit load capacity (max.)	15 mA i 2 VA
System response time (max.)	70 ms
Load capacity of auxiliary contactors (max.)	24 – 480 V AC/0.5 A
Protection of the auxiliary contactor circuit	10 A gL/gG max. 72 A <sup>2</sup> s

### General parameters

Parameter	Value
Leakage current (max.)	5 mA
Minimum work current	50 mA
Rated insulation voltage (IU)	660 V
Rated impulse voltage (U <sub>max</sub> )	4 kV
Electromagnetic interference	EN 60947-4-2
Operating temperature – rated	-5 °C to -40 °C
Storage temperature	-20 °C up to + 80 °C
Cooling method	Convection
Assembly	Vertical
Protection rating	IP 20
Dimensions	On page 81

**Note:**

Terminals 11-12 have no internal connection; they are used for installing the UP62 thermostat (catalogue number 037N0050)



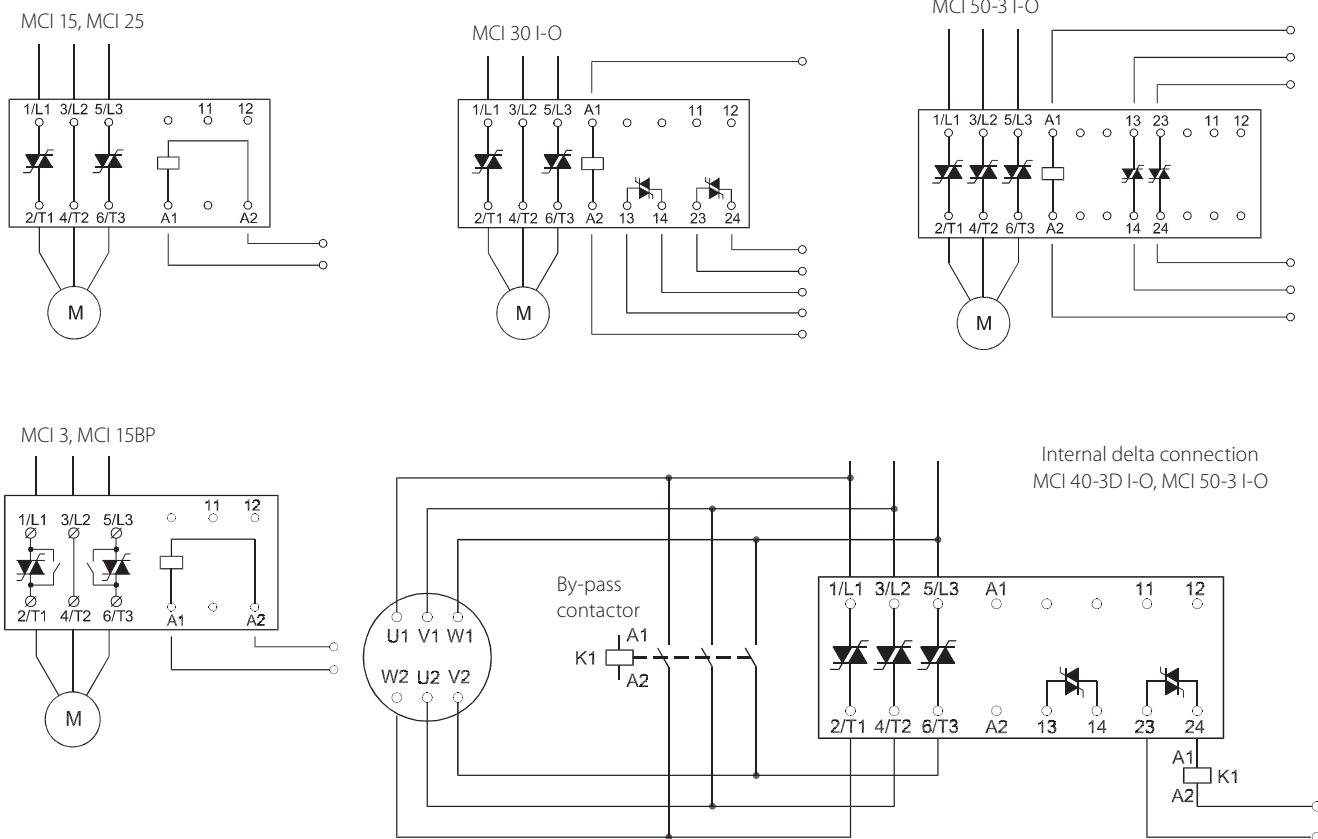
## Soft starters MCI – soft start and stop systems

### Protection by motor switches

Protection of the soft starter against overload and short-circuit can be easily achieved by using a motor switch on the soft starter supply, matched to the rated motor current.

Type	Motor current	I <sub>t</sub>	OFF switch Type	Code number
MCI 15	0.4–0.63 A	1,800 A <sup>2</sup> s	CTI 25M	047B3143
MCI 15	0.63–1.0 A	1,800 A <sup>2</sup> s	CTI 25M	047B3144
MCI 15	1.0–1.6 A	1,800 A <sup>2</sup> s	CTI 25M	047B3145
MCI 15	1.6–2.5 A	1,800 A <sup>2</sup> s	CTI 25M	047B3146
MCI 15	2.5–4.0 A	1,800 A <sup>2</sup> s	CTI 25M	047B3147
MCI 15	4.0–6.3 A	1,800 A <sup>2</sup> s	CTI 25M	047B3148
MCI 15	6.3–10 A	1,800 A <sup>2</sup> s	CTI 25M	047B3149
MCI 25/30	14.5–20 A	6,300 A <sup>2</sup> s	CTI 25M	047B3151
MCI 25/30	18–25 A	6,300 A <sup>2</sup> s	CTI 25M	047B3152
MCI 50	23–32 A	25300 A <sup>2</sup> s	CTI 25M	047B3102
MCI 50	32–45 A	25300 A <sup>2</sup> s	CTI 45MB	047B3165

### Connection diagrams



## Soft starter MCI 25B with brake

Soft starter MCI 25B with a DC brake is designed to control squirrel-cage induction motors up to 15 kW. The run-up time, the starting moment and the braking torque are continuously adjustable. During braking, the soft starter applies direct current to

the motor coils, which results in a strong braking torque. In addition, the automatic stop detection function and low speed operation enable a comfortable positioning procedure.



### Characteristics

- Unlimited number of start-ups and braking per hour
- Adjustable run-up times 0-10 s,
- Adjustable starting torque up to 85%, with or without "kick start"
- Function of breaking kick start friction
- The function of work at low speeds of 7.5 or 10% rated
- Universal control voltage 24-480V AC/DC
- Adjustable braking current up to 50A DC
- Automatic phase loss detection
- Automatic phase loss detection
- Automatic adaptation to 50/60 Hz
- LED status indicator
- In-built protective varistor
- Built-in signal contacts that control the by-pass contactor or external brake
- Fast and easy installation
- Compact modular design together with a radiator
- DIN rail mounting
- Compliant with EN 60947-4-2
- Certificates CE and UL (UL 508)

## Soft starter MCI 25B with brake

Operating voltage	Motor power max.	Motor current max.	Module	Auxiliary contactors	Type	Code number
400 – 480 V AC	11 kW	25 A	90 mm <sup>**) </sup>	IO/bypass	MCI 25B	037N0062
400 – 480 V AC	15 kW <sup>*) </sup>	25/30 <sup>*) </sup> A	90 mm <sup>**) </sup>	IO/bypass	MCI 25B	037N0062

<sup>\*)</sup> With a by-pass contactor

<sup>\*\*)</sup>  DIN-rail mountable width

### Control circuit parameters

Parameter	Value
Control voltage range -15% +10%	24 – 480 V AC/DC
Switch-on threshold	20.4 V AC/DC
Breakdown threshold	5 V AC/DC
Circuit load capacity (max.)	15 mA i 2 VA
System response time (max.)	70 ms
Load capacity of auxiliary contactors (max.)	24 – 480 V AC/0.5 A
Protection of the auxiliary contactor circuit	10 A gL/gG max. 72 A <sup>2</sup> s

### General parameters

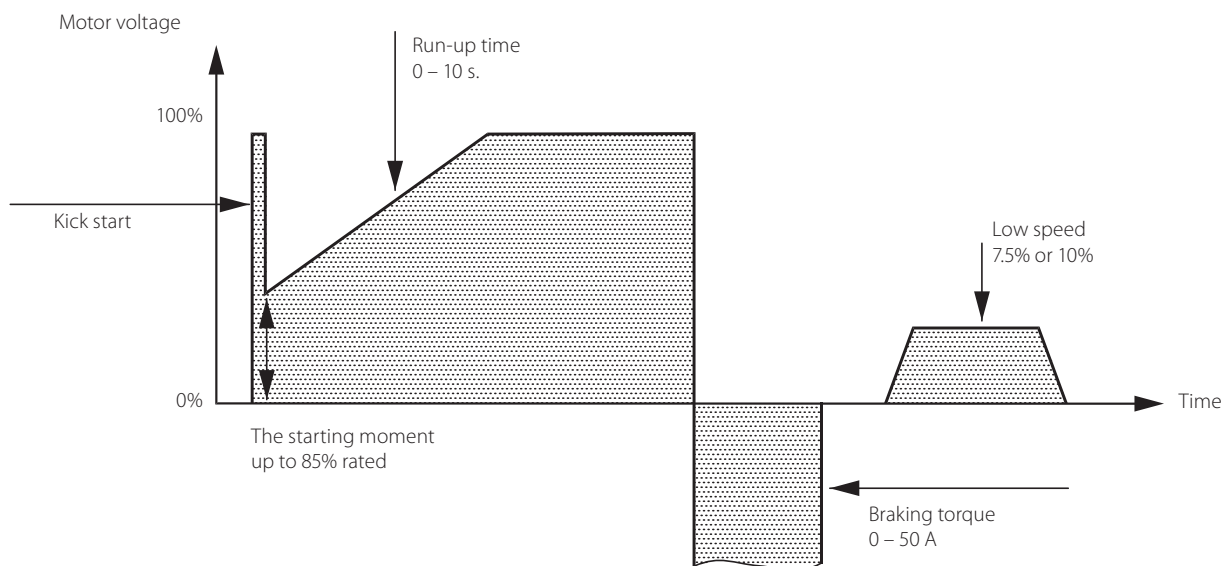
Parameter	Value
Type 1 short-circuit breaker protection	80 A gL/gG
Type 2 short-circuit breaker protection	6,300 A <sup>2</sup> s
Leakage current (max.)	5 mA
Minimum work current	50 mA
Rated insulation voltage (IU)	660 V
Rated impulse voltage (U <sub>max</sub> .)	4 kV
Electromagnetic interference	EN 50082-1 and EN50082-2
Heat power dissipation	2 W/A
Operating temperature – rated	-5 °C to -40 °C
Storage temperature	-20 °C up to + 80 °C
Cooling method	Convection
Assembly	Vertical
Protection rating	IP 20
Dimensions	On page 81

**Note:**

Terminals 11-12 have no internal connection; they are used for installing the UP62 thermostat (catalogue number 037N0050)

## Soft starter MCI 25B with brake

### Working principle



Supply voltage L1, L2, L3

Work Signal

Low Speed Signal

Braking Signal

Load voltage T1, T2, T3

The brake is on

Auxiliary contactors:

23–24 by-pass

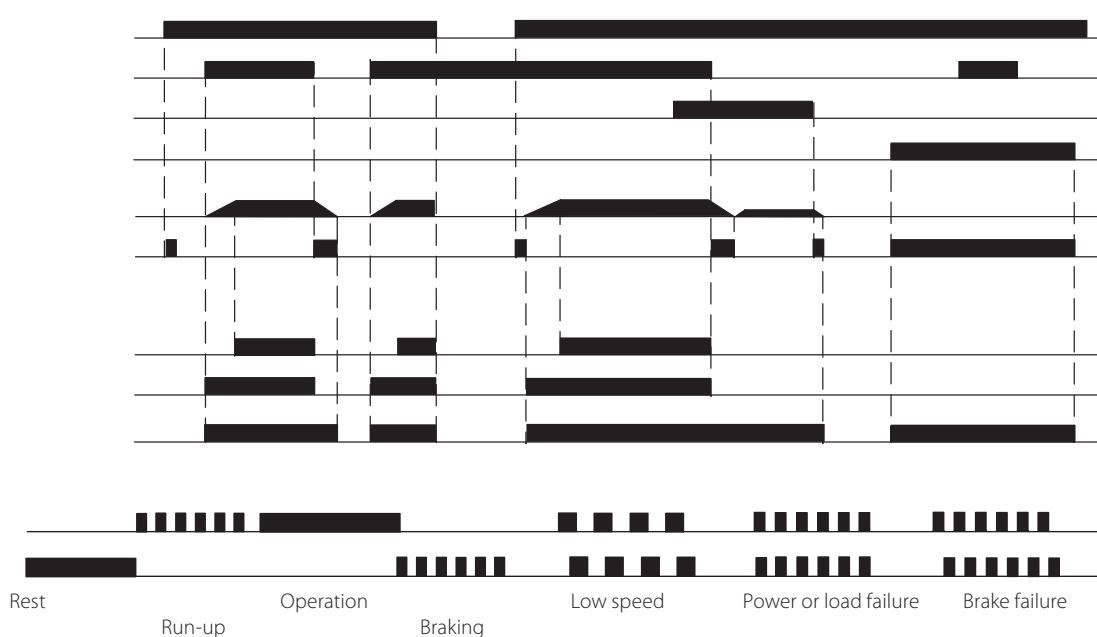
13–14 I-O

13–14 (M)

LED indications

LED 1

LED 2



### Soft start

During the run-up, the soft starter linearly raises the voltage on the motor to its nominal value. The motor rotational speed depends directly on the load on the shaft; the engine without load will accelerate faster than the set run-up time. This time is independent of, for example, grid frequency or load changes on the shaft. The

starting torque can be used to improve the starting characteristics that require overcoming the higher moment of inertia.

In the most difficult cases, you can also use the "kick start" function, offering a 200 ms full voltage pulse before the start of the run.

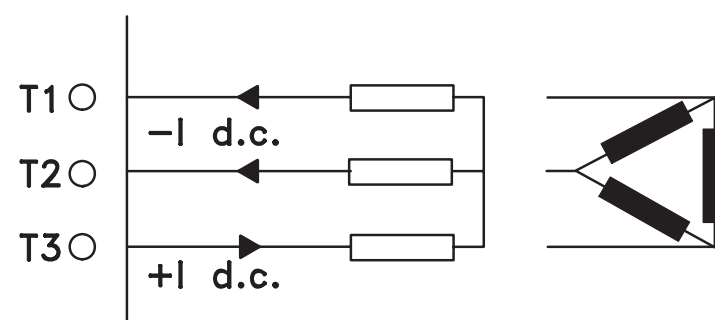
## Soft starter MCI 25B with brake

### Forced braking

Braking is accomplished by applying direct current to the regulated motor coils from 0 to 50 A.

The motor can be connected in both a delta and a star, but the second option is more effective.

The braking torque is indirectly connected to the voltage, which must be set according to the application. First, the braking torque must be set to 1 and next, this value is increased until the expected braking time is reached.



### Automatic phase loss detection

During the braking function, DC is applied until the motor rotor stops.

If the motor does not stop after 30 seconds, the braking current will turn off and the LEDs will show the brake fault message.

Automatic stop detection is carried out by reading the direct current on the motor and its accuracy depends on how the braking torque is set.

The stop moment of the motor shaft depends on the motor size and braking settings.

If the braking torque is set too low, the braking will end before the rotor stops and if the braking torque is too high, the stop detection will not work, causing DC to be applied to the motor for 30 seconds, which will result in a brake failure message.

### Low speed

This function, if applied for a short time only, allows for precise positioning in such applications as gantries. Two speeds can be used: 7.5 or 10% of the rated motor speed.

When operating in this mode, the motor current rises to 2-2.5 times the rated current, with the torque level of 25-40% nominal.

### Signal contactors

Optionally built-in auxiliary contactors are based on thyristor systems and can only control AC circuits.

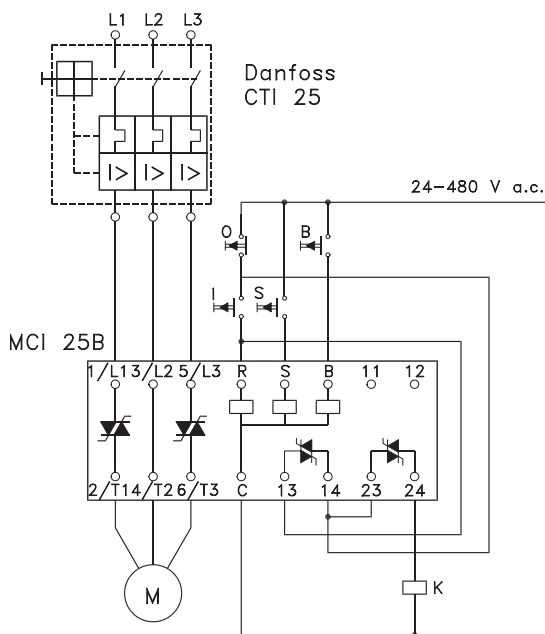
13-14 – has two operating modes, I-O and (M); the I-O, which maintains the output signal until the "work" function is active; mode (M), on the other hand, maintains the output signal until the

rotor of the motor rotates, which is to control the external brake power unit. 23-34 – are used for connecting an external by-pass contactor after the thyristors have entered a fully open state.

Connection examples

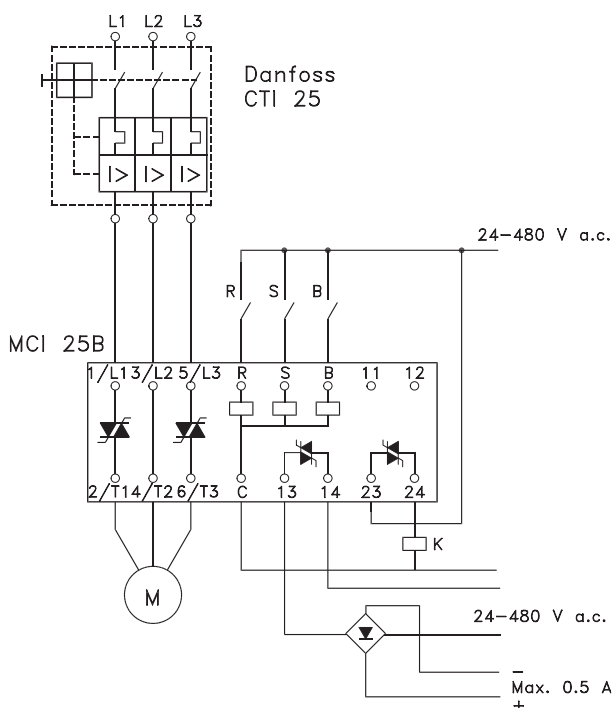
Work system with by-pass contactor based on control buttons

**Note:** work mode knob should be in the "I-0" position. Signal contactors 13-14 will be used in the control buttons circuits. Signal contactors 23-24 control the coil circuit of the by-pass contactor. The CTI 25 circuit breaker is used to protect the motor against overload and short-circuit.



Operation system with external mechanical brake control

**Note:** The mode knob should be in the "(M)" position. Signal contactors 13-14 will be used to control the mechanical brake; the release is relieved after applying the voltage to the motor via MCI 25B. Signal contactors 23-24 control the coil circuit of the by-pass contactor. The CTI 25 circuit breaker is used to protect the motor against overload and short-circuit.

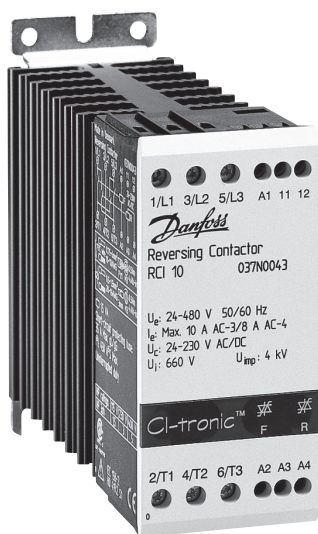


## Reverse (return) contactors RCI

RCI contactors are designed for demanding applications of reversing three-phase squirrel-cage motors.

Switching at zero point provides fast and precise motor control with EMC noise reduction. RCI contactors provide the perfect solution wherever speed and long-term operation is the essence of the application.

Typical applications are damper actuators, conveyor belts, machine tools, packaging machines and other applications, where the classic system of two contactors with mechanical interlock is not fully sufficient.



Throttle with electric drive

### Characteristics

- A complete modular design with a radiator
- DIN rail mounting
- In-built protective varistor
- Maximum operating current 10 A (AC-3)
- Maximum operating voltage 480 V AC
- Built-in electrical interlock of control circuits
- Universal control voltage
- Switch-on at zero point
- LED status indicator
- Safety rating IP 20
- Fast and easy installation
- Compliant with EN 60947-4-2 and UL-C

## Reverse (return) contactors RCI

Operating voltage	Motor power max.	Motor current max.	Module	Control voltage	Type	Code number
200 – 480 V AC	4.0 kW	10 A	45 mm <sup>*)</sup>	5 – 24 V DC	RCI 10	037N0044
200 – 480 V AC	4.0 kW	10 A	45 mm <sup>*)</sup>	24 – 230 V AC/DC	RCI 10	037N0043

<sup>\*)</sup> DIN-rail mountable width

### Control circuit parameters

Parameter	Value
Control voltage range -15% +10%	5 – 24 V DC, 24 – 230 V AC/DC
Switch-on threshold	4.25 V DC, 20.4 V AC/DC
Breakdown threshold	1.5 V DC, 7.2 V AC/DC
Circuit load capacity (max.)	25 mA for 4 V DC/1.5 VA for 24 V DC
System response time (max.)	½ period/period
Electrical interlock delay (min./max.)	30/80 ms / 60/150 ms

### General parameters

Parameter	Value
Operating current AC-3 (max.)	10 A
Operating current AC-4 (max.)	8 A
Type 1 short-circuit breaker protection	50 A gL/gG
Type 2 short-circuit breaker protection	450 A <sup>2</sup> s
Leakage current (max.)	1 mA
Minimum work current	10 mA
Rated insulation voltage (IU)	660 V
Rated impulse voltage (U <sub>max.</sub> )	4 kV
Heat power dissipation	2.2 W/A
Operating temperature – rated	-0°C up to + 60°C
Storage temperature	-20 °C up to + 80 °C
Cooling method	Convection
Assembly	Vertical
Protection rating	IP 20
Dimensions	On page 81

**Note:**

Terminals 11-12 have no internal connection; they are used for installing the UP62 thermostat (catalogue number 037N0050)



## Reverse (return) contactors RCI

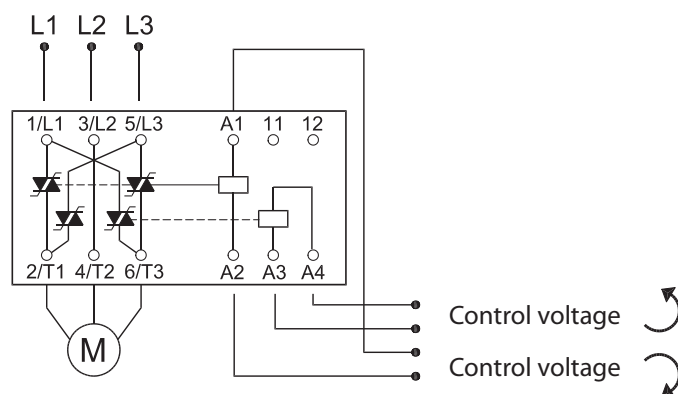
### Working principle



After connecting the power supply, control the A1-A2 circuit so that the motor starts to rotate forward, which is confirmed by the LED light. After supplying the voltage to the A3-A4 control circuit, the motor will start to rotate in the opposite direction, signaling it with the second LED.

If both control circuits are controlled, the direction of rotation will depend on the circuit that was first switched on. The change of direction is possible only after removing one of the control signals. The time delay necessary to switch the direction of operation is built into the device. The flashing of both LEDs indicates a failure in the motor circuit.

### Connection diagram



## Start torque limiters TCI - economical soft starters

Torque limiters TCI are intended for the soft start of squirrel-cage motors, both three- and single-phase. They effectively eliminate the harmful effect of mechanical stresses occurring during direct start-ups. They do not need a separate control signal, which makes them easy to be

mounted to an existing system between the contactor and the motor. Wherever economic considerations allow replacing the star-delta starter, TCI is the best solution for 11 kW motors: conveyor belts, compressors and generators.



### Characteristics

- Adjustable run-up time from 0.5 to 5 s
- Adjustable starting torque 0-85%
- LED status indicator
- Single- and three-phase operation
- Unlimited number of connections per hour
- DIN rail mounting

Operating voltage	Motor power max.	Motor current max.	Module	Control voltage	Type	Catalogue number
200 – 480 V AC	7.5 kW	15 A	45 mm <sup>*)</sup>	none	TCI 15	037N0045
200 – 480 V AC	11 kW	25 A	45 mm <sup>*)</sup>	none	TCI 25	037N0046
480 – 600 V AC	11 kW	15 A	45 mm <sup>*)</sup>	none	TCI 15	037N0045
480 – 600 V AC	18.5 kW	25 A	45 mm <sup>*)</sup>	none	TCI 25	037N0046

<sup>\*)</sup> DIN-rail mountable width

## Start limiters TCI - economical soft starters

### General parameters

Parameter	Value	
	TCI 15	TCI 25
Type 1 short-circuit breaker protection	50 A gL/gG	100 A gL/gG
Type 2 short-circuit breaker protection	1,800 A <sup>2</sup> s	6,300 A <sup>2</sup> s
Leakage current (max.)	1 mA	
Minimum work current	50 mA	
Rated insulation voltage (IU)	660 V	
Rated impulse voltage (U <sub>max</sub> .)	4 kV	
Heat power dissipation	1 W/A	
Operating temperature – rated	0°C to + 45°C	
Storage temperature	-20 °C up to + 80 °C	
Cooling method	Convection	
Assembly	Vertical	
Protection rating	IP 20	
Dimensions	On page 81	

**Note:**

Terminals 11-12 have no internal connection; they are used for installing the UP62 thermostat (catalogue number 037N0050)

### Working principle

Supply voltage L1, L2, L3

Load voltage (T1, T2, T3)

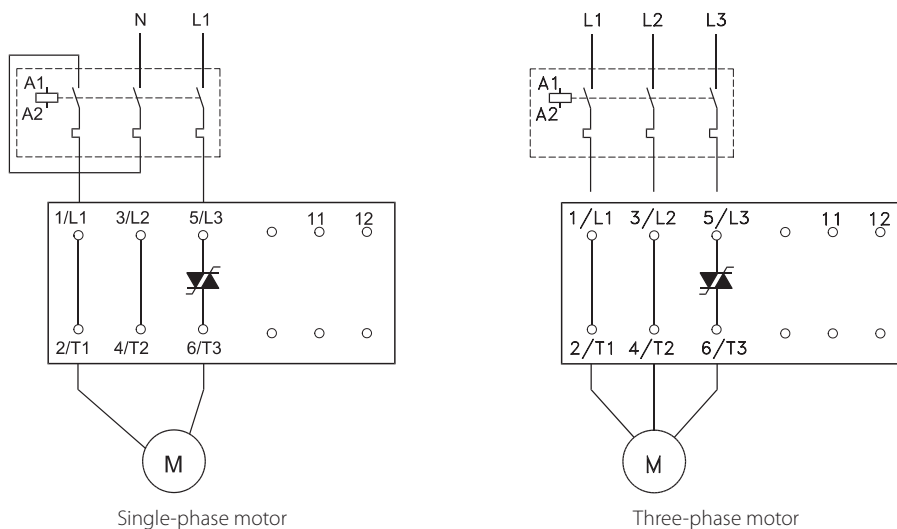
LED 1

LED 2



After switching on the line contactor, the TCI automatically starts according to the settings.

### Connection diagram



## Specialized soft starters for refrigeration compressors MCI C, CH, TCI C

The start-up of refrigeration compressors always results in high current peaks, which can sometimes even prevent starting at too-small protections.

The use of a soft starter reduces the starting currents by 40%, even without the need for prior equalization of system pressures.

For the best efficiency, the settings are factory-made and cannot be changed.

The MCI-CH series of soft starters, equipped with internal by-passes, is mainly dedicated to the start-up of compressors installed in heat pumps, meeting the disturbance standards for domestic rooms (Article 9.3.5 EN 60947-4-2).

For the single-phase compressors typical for air-conditioning units, TCI 25C is the right solution.



### Technical Specifications

Operating voltage	Motor power max.	Motor current max.	Module	Control voltage	Type	Code number
220 – 240 V AC	11 kW	25 A	45 mm <sup>*)</sup>	none	TCI 25C	037N0086
200 – 480 V AC	7.5 kW	15 A	45 mm <sup>*)</sup>	24 – 480 V AC/DC	MCI 15C	037N0076
200 – 480 V AC	15 kW	30 A	90 mm <sup>*)</sup>	24 – 480 V AC/DC	MCI 25C	037N0077
200 – 480 V AC	25 kW <sup>**)</sup>	50 A	180 mm <sup>*)</sup>	24 – 480 V AC/DC	MCI 50C	037N0401
380 – 415 V AC	5.5 kW	12 A	67.5 mm <sup>*)</sup>	208 – 240 V AC	MCI 12CH	037N0095
380 – 415 V AC	7.5 kW	15 A	67.5 mm <sup>*)</sup>	208 – 240 V AC	MCI 15CH	037N0096
380 – 415 V AC	11 kW	25 A	67.5 mm <sup>*)</sup>	208 – 240 V AC	MCI 25CH	037N0097

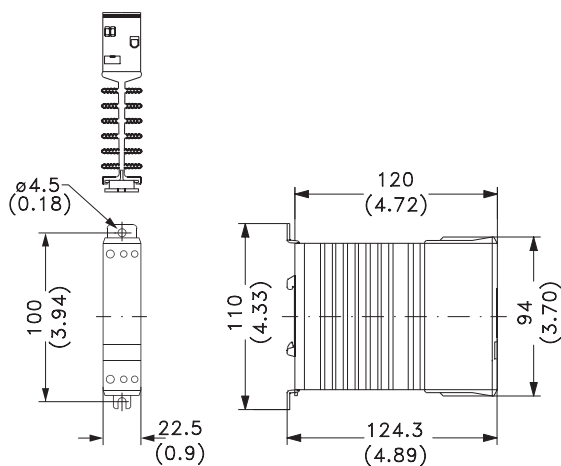
<sup>\*)</sup> DIN-rail mountable width

<sup>\*\*)</sup> With a by-pass contactor

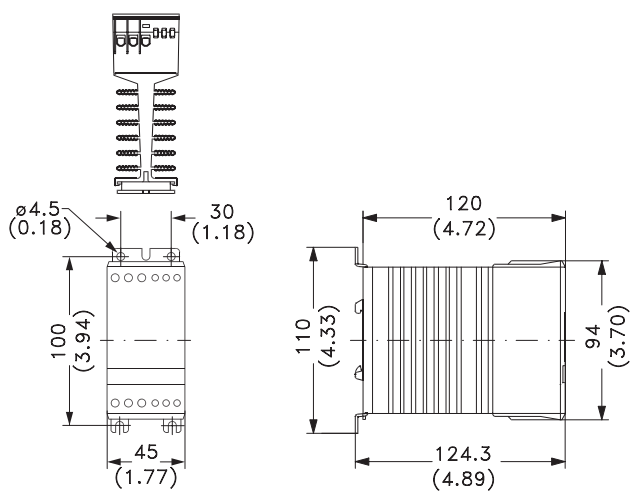
## Dimensions

### Electronic contactors ECI

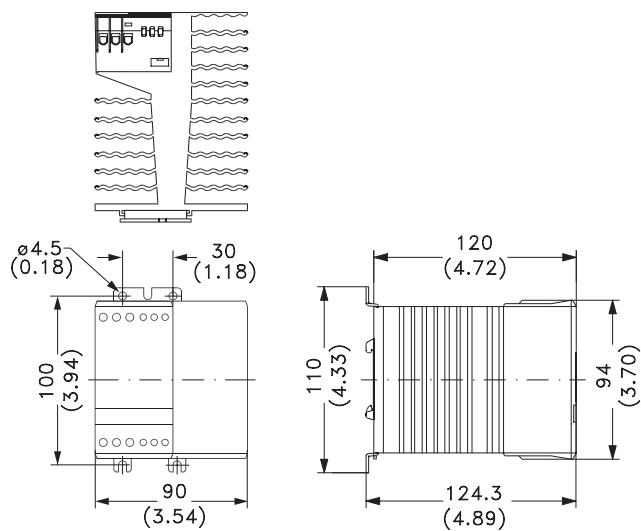
ECI 15



ECI 10, ECI 30, ACI 30

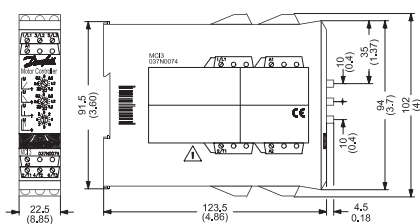


ECI 20, ECI 50, ECI 63, ACI 50



### Soft starter MCI 3

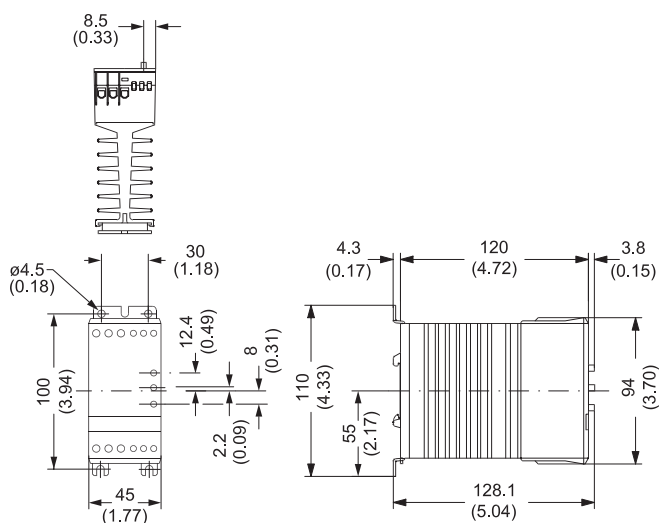
MCI 3, ACM-1



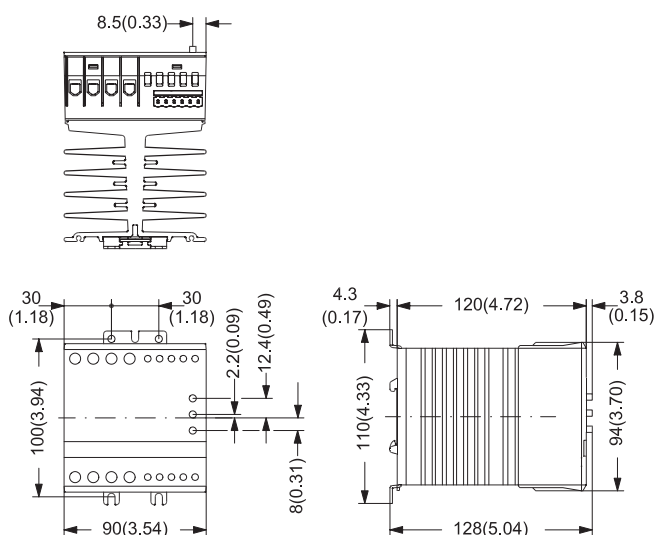
## Dimensions

### Soft starters MCI, TCI

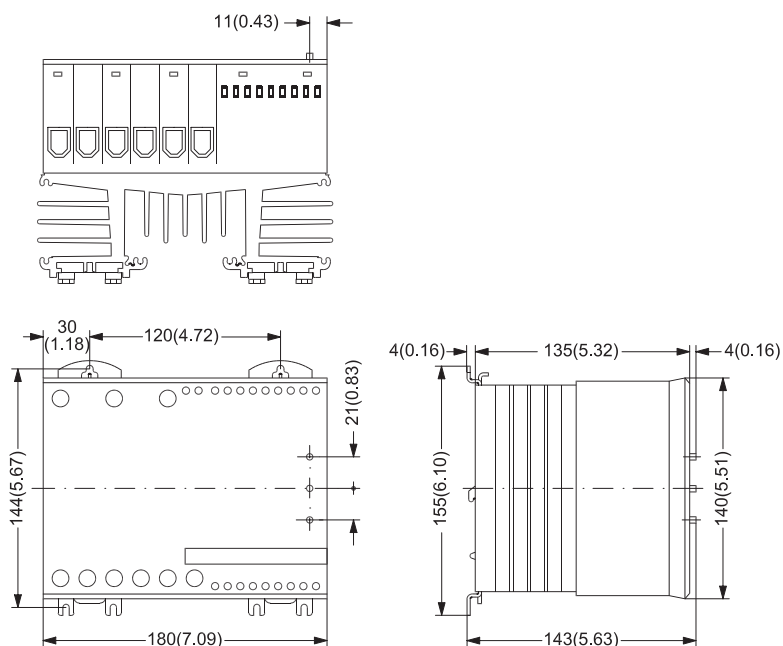
MCI 15, MCI 15BP,  
MCI 15C,  
TCI 15, TCI 25, RCI 10



MCI 25, MCI 30 I-O,  
MCI 40, MCI 25B



MCI 50 I-O



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**NOTES**

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# ENGINEERING **TOMORROW**



Danfoss Group is a leader in development, production and sales of devices in three segments: industrial automation, heating and cooling. Since 1933, we have designed state-of-the-art products to provide customers with the convenience and energy savings they need. Our products set the world standards and help to protect natural environment.

Every day we manufacture over 250,000 products in 70 plants across 25 countries. The data is impressive, but we pride ourselves most on the satisfaction and fulfillment we are able to offer our customers. The establishment of strong partner relationships is extremely important to us — we are aware that the understanding of our customers' needs will allow us to meet the demands of the future.

The Industrial Automation Components Department of Danfoss offers solutions designed for the modern industry. Our product range provides you access to the entire pool of technological solutions including such products as solenoid valves, thermostats, pressure switches, temperature sensors, pressure transmitters and LV switchgear.

**We deliver safe, efficient and foolproof solutions designed with the expectations of our customers in mind.**