Data sheet

CI-tronic™ Soft starters for Danfoss commercial compressor applications Type MCI 15C, MCI 25C, MCI 50CM-3 I-O

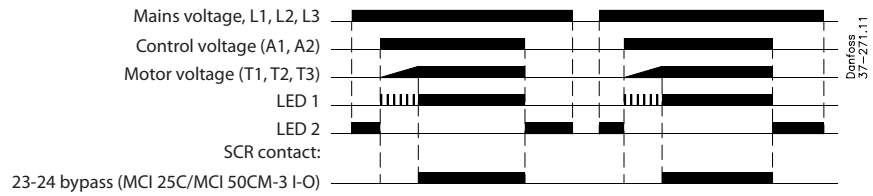
- Universal control voltage: 24 - 480 V ac/dc
- Automatic detection of missing phases
- LED Status indication.
- Automatic adaptation to 50/60 Hz
- Easy and quick installation
- Up to 12 start/stop operations per hour
- Built in varistor protection
- IP 20 Protection
- Compact modular design
- DIN rail mountable
- Ramp-time max. 0.5s (factory set-up)
- EN 60947-4-2

Description

The MCI compressor soft starters are designed for soft starting of 3 phase compressors. During start the MCI will gradually increase the voltage to the motor until it reaches full line voltage.

The soft start ramp-up time and initial start torque is preset to ensure a fast start and allow easy and quick installation.
MCI compressor soft starters are ideal for use on Danfoss Performer scroll and Maneurop Reciprocating compressors. The starting current can be reduced by up to 40% of the direct on line value.

Functional diagram

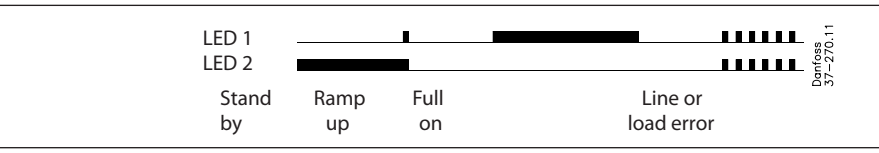


Functional description

Start
During ramp-up the controller will gradually increase the voltage to the motor from the preset initial torque value until it reaches full line voltage. The actual ramp time is digitally calculated and will not be influenced by net frequency or load variations.

Bypass mode (contact 23 - 24, only MCI 25C/MCI 50CM-3 I-O)
The auxiliary contacts are made possible by means of SCR technology and will only switch correctly on a.c. current. The contact is intended for operating an external bypass contactor. The contact will close when the controller is in steady state operation, see application example page 7.

LED status indication



Soft starter selection guide

Performer® scroll compressors
Motor voltage code 4, 400 V - 3 phase - 50 Hz / 460 V - 3 phase - 60 Hz

Compressor model	Soft starter type Ambient temp. max. +40°C	Soft starter type Ambient temp. max. +55°C
SM/SZ 084	MCI 15C	MCI 15C
SM/SZ 090		
SM/SZ 100		MCI 25C
SM/SZ 110		
SM/SZ 115-125	MCI 25C	MCI 25C[1)]
SM/SZ 120		
SM/SZ 160		
SM/SZ 148-161		
SM/SZ 175-185		
SY/SZ 240	MCI 50CM-3 I-O[1)]	MCI 50CM-3 I-O[1)]
SY/SZ 300		
SZ 380	MCI 50CM-3 I-O[1)]	MCI 50CM-3 I-O[1)]

[1)]The controller must be by-passed in steady state mode. See application example page 7.

Maneurop® compressors
Motor voltage code 4, 400 V - 3 phase - 50 Hz / 460 V - 3 phase - 60 Hz

Compressor model	Soft starter type Ambient temp. max +40°C	Soft starter type Ambient temp. max +55°C
MT/MTZ 18-22	MCI 15C	MCI 15C
MT/MTZ 28		
MT/MTZ 32		
MT/MTZ 36		
MT/MTZ 40		
MT/MTZ 44-50		
MT/MTZ 45-51		
MT/MTZ 56		
MT/MTZ 57-65		
MT/MTZ 64		
MT/MTZ 72-73-80-81		MCI 25C
MT/MTZ 100	MCI 25C	MCI 25[1)]
MT/MTZ 125		
MT/MTZ 144		
MT/MTZ 160		

[1)]The controller must be by-passed in steady state mode. See application example page 7.

MCI C Soft Starter selection

Operational voltage	Dimensions	Type	Code no.
380-480 V ac	45 mm module	MCI 15C	**037N0076**
	90 mm module	MCI 25C	**037N0077**
	180 mm module	MCI 50CM-3 I-O	**037N0401**

Technical data

1) Type 1 coordination require that, under short-circuit conditions, the device shall cause no danger to persons or installation and may not be suitable for further use without repair and replace ment of parts
2) Type 2 coordination require that, under short-circuit conditions, the device shall cause no danger to persons or installation and shall be suitable for further use.
3) 15A: AC-53a: 8-3:100-3000 means max. load 8x15A for 3 seconds. 100% ON-load factor or 3000 operations per hour.

Output specifications

		MCI 15C	MCI 25C	MCI 50CM-3 I-O
Operational voltage	V a.c.	380 - 480	380 - 480	380 - 480
Operational current (AC-3, AC-53a, AC-53b)	max.	15 A	25 A / 30 A	35 A/50 A
Ramp up time (preset)	max.	0.4 s	0.4 s	0.5 s
Leakage current	max.	5 mA	5 mA	5 mA
Operational current	min.	50 mA	50 mA	50 mA
Overload relay trip class		Class 10	Class 10	Class 10
Semiconductor protection fusing:				
Type 1[1] co-ordination		50 A gL/gG	100 A gL/gG	125 A gL/gG
Type 2[2] co-ordination	I^2t(t=10 ms)	1800 A^2 S	6300 A^2 S	25300 A^2 S
Rating index:				
AC-53a Asynchronous motors [3]		15A: AC-53a:	25A: AC-53a:	35 A: AC-53a:
		8-3 : 100 - 3000	8-3 : 100 - 3000	6-6:100-120
AC-53b Asynchronous motors with bypass		-	30A: AC-53b: 6-3 : 30	50A:AC-53b: 6-3 : 30

Control circuit specifications

Control voltage range		24 - 480 V ac/dc		
Pick-up voltage	max.	20.4 V ac/dc		
Drop-out voltage	min.	5 V ac/dc		
Control current for no operation	max.	1 mA		
Control current / power	max.	15 mA / 2 VA		
Response time	max.	70 ms		
SCR by-pass contact, optional				
Voltage / current (AC-14, AC-15)	max.	24-240V/0.5A	24-240V/0.5A	24-240V/1.0A
Fuse	max.	10 A gL/gG, I^2t max. 72 A^2s		
EMC immunity		Meets requirements of EN 50082-1 and EN 500082-2		

Insulation

Rated insulation voltage U_i	660 V ac
Rated impulse withstand voltage U_{imp}	4 kV
Installation category	III

Thermal specification

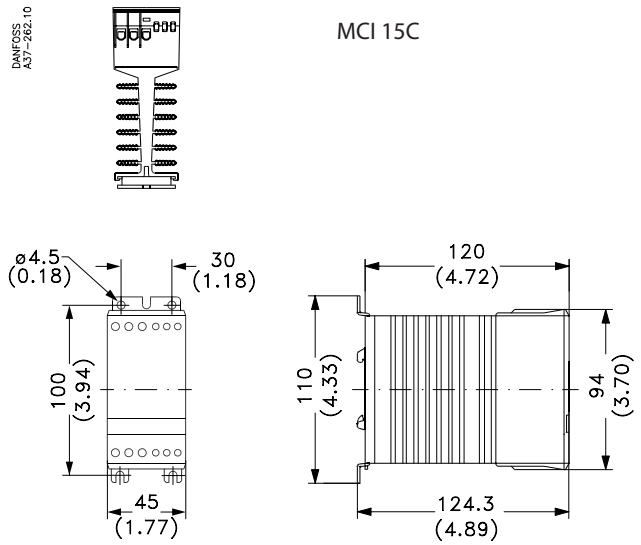
Cooling method	Natural convection		
Mounting	Vertical +/- 30°		
Storage temperature range	-20° C to +80° C		
Enclosure degree / pollution degree	IP 20 / 3	IP 20 / 3	IP 10 / 3
Power dissipation, continuous duty max.	2 W/A	2 W/A	3 W/A
Power dissipation, intermittent duty max.	2 W/A × duty cycle	2 W/A × duty cycle	3 W/A × duty cycle

Materials

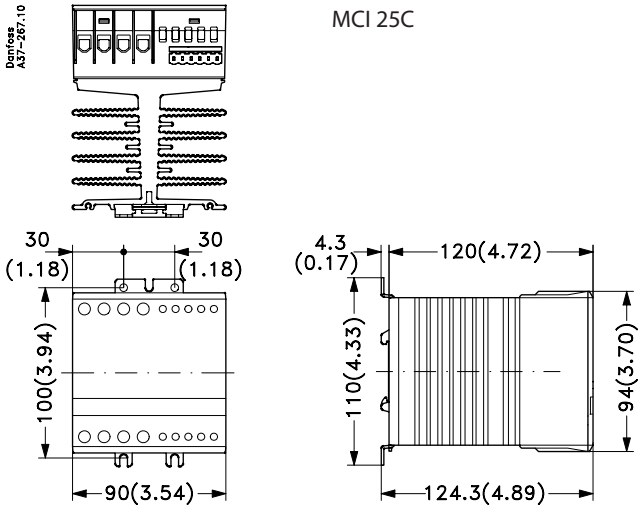
Housing self extinguishing	PPO UL94V1
Heatsink aluminium	Black anodized
Base	Electroplated steel

Dimensions

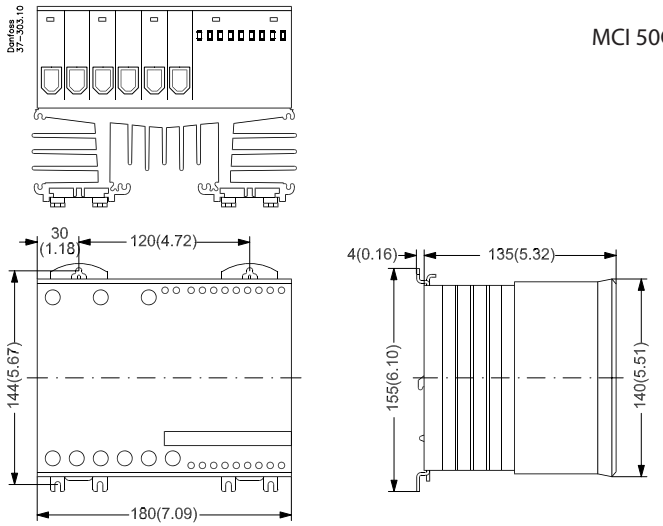
MCI 15C



MCI 25C



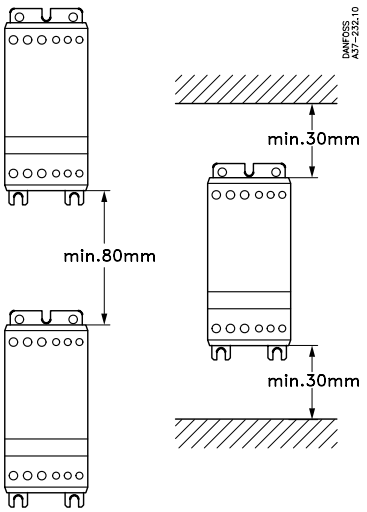
MCI 50CM-3 I-O



Mounting instructions

The controller is designed for vertical mounting. If the controller is mounted horizontally the load current must be reduced by 50%.

The controller needs no side clearance. Clearance between two vertical mounted controller must be minimum 80 mm (3.15”). Clearance between controller and top and bottom walls must be minimum 30 mm (1.2”).



Overload and short circuit protection

Overload and short circuit protection is easily achieved by installing a circuit breaker on the line side of the motor controller. Select the circuit breaker from the table below.

Be aware of the maximum prospective short circuit current breaking capacity. For further information please refer to the data sheet on the circuit breaker.

Performer® scroll compressors

Motor voltage code 4 / 400V - 3ph - 50Hz / 460V - 3ph - 60Hz			
Compressor type	Compressor max. current [A]	Danfoss CTI	
		Type	Code no.
SM / SZ 084	17	CTI 25 MB	**047B3157**
SM / SZ 090	17	CTI 25 MB	**047B3157**
SM / SZ 100	19	CTI 25 MB	**047B3158**
SM / SZ 110	20	CTI 25 MB	**047B3158**
SM / SZ 115	25	CTI 25 MB	**047B3159**
SM / SZ 120	29	CTI 25 MB	**047B3159**
SM / SZ 125	25	CTI 25 MB	**047B3159**
SM/SZ 148	32	CTI 45 MB	**047B3164**
SM / SZ 161	32	CTI 45 MB	**047B3164**
SM / SZ 160	29	CTI 25 MB	**047B3159**
SM / SZ 175	35	CTI 45 MB	**047B3164**
SM / SZ 185	35	CTI 45 MB	**047B3164**
SY/SZ 240	50	CTI 45 MB	**047B3165**
SY/SZ 300	69	CTI 100	**047B3014**

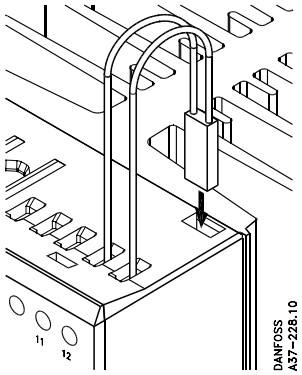
Maneurop® reciprocating compressors

Motor voltage code 4 / 400V - 3ph - 50Hz / 460V - 3ph - 60Hz			
Compressor type	Compressor max. current [A]	Danfoss CTI	
		Type	Code no.
MT/MTZ 18	5	CTI 25 M	**047B3147**
MT/MTZ 22	6	CTI 25 M	**047B3148**
MT/MTZ 28	7.5	CTI 25 M	**047B3148**
MT/MTZ 32	8	CTI 25 M	**047B3149**
MT/MTZ 36	9	CTI 25 M	**047B3149**
MT/MTZ 40	10	CTI 25 M	**047B3149**
MT/MTZ 44	9.5	CTI 25 M	**047B3149**
MT/MTZ 45	9.5	CTI 25 M	**047B3149**
MT/MTZ 50	12	CTI 25 MB	**047B3157**
MT/MTZ 51	11.5	CTI 25 M	**047B3149**
MT/MTZ 56	12	CTI 25 MB	**047B3157**
MT/MTZ 57	12	CTI 25 MB	**047B3157**
MT/MTZ 64	15	CTI 25 MB	**047B3157**
MT/MTZ 65	14	CTI 25 MB	**047B3157**
MT/MTZ 72	15.5	CTI 25 MB	**047B3157**
MT/MTZ 73	17	CTI 25 MB	**047B3157**
MT/MTZ 80	18	CTI 25 MB	**047B3158**
MT/MTZ 81	19	CTI 25 MB	**047B3158**
MT/MTZ 100	22	CTI 25 MB	**047B3158**
MT/MTZ 125	27	CTI 25 MB	**047B3159**
MT/MTZ 144	30	CTI 45 MB	**047B3164**
MT/MTZ 160	36	CTI 45 MB	**047B3164**

Overheat protection

If required, the controller can be protected against overheating by inserting a thermostat in the slot on the right-hand side of the controller.
Order: UP 62 thermostat, code no. **037N0050**

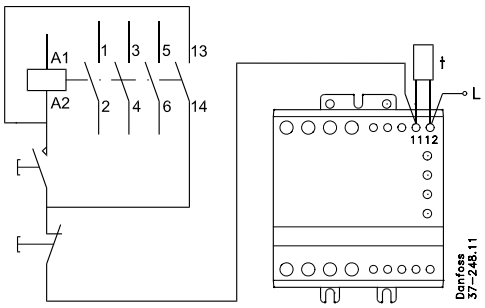
For wiring connections see application examples below.



Application examples

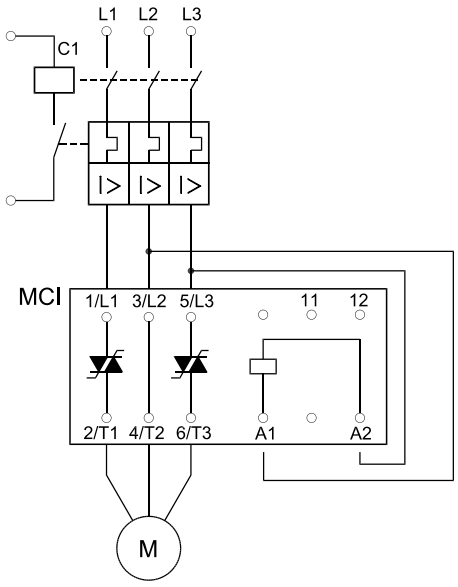
Overheat protection

The thermostat is connected in series with the control circuit of the main contactor.
When the temp. of the heat sink exceeds 90°C the main contactor will be switched OFF.
This circuit requires manual reset to restart the motor.



Line controlled soft start

When the contactor C1 is switched to the ON-state, the soft starter will start the motor, according to the settings of the ramp-up time and initial torque adjustments. When the contactor C1 is switched to the OFF-state the motor will be switched off instantaneously. In this application the contactor will have no load during opertion. The contactor will carry and break the nominal motor current.

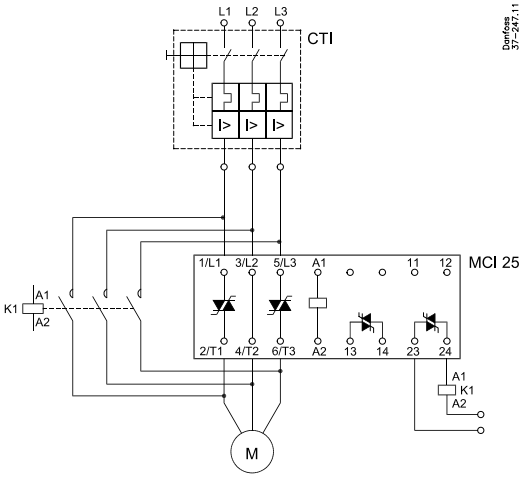


Application examples (continued)

MCI 25 with bypass contactor

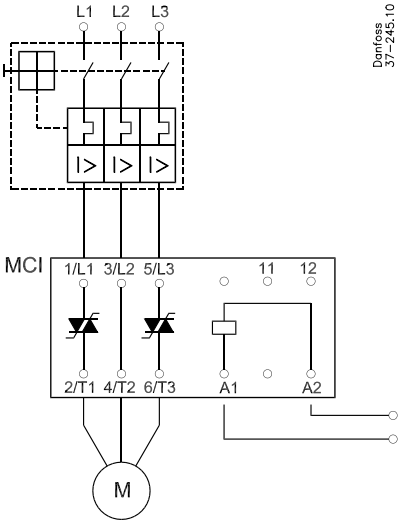
By means of the built-in auxiliary contact the bypass function is easily achieved, see wiring diagram below.
No heat is generated from the MCI.
As the contactor always switches in no-load condition it can be selected on the basis of the thermal current (AC-1).

(13-14 contact not applicable with MCI 25C and MCI 50CM-3 I-O)



Input controlled soft start

When the control voltage is applied to A1 - A2, the MCI soft starter will start the motor, according to the settings of the Ramp-up time and Initial torque adjustments. When the control voltage is switched OFF, the motor will switch off instantaneously.



Data sheet

CI-tronic™ Soft start motor controller Type MCI 3, MCI 15, MCI 25, MCI 30 I-O, MCI 40-3D and MCI 50-3 I-O

Features

- Motor load max. 50 A
- Acceleration times adjustable:
  0-10 seconds, MCI 3, MCI 15 and MCI 25
  0-20 seconds, MCI 30 I-O
  0-30 seconds, MCI 40-3D I-O, MCI 50-3 I-O
- Deceleration times adjustable:
  0-10 seconds, MCI 3, MCI 15, and MCI 25
  0-20 seconds, MCI 30 I-O
  0-60 seconds, MCI 40-3D I-O, MCI 50-3 I-O•
- Initial torque adjustable up to 85 %
- Breakaway function (kick start)
- Universal control voltage:
  24 - 480 V a.c./d.c.
- Automatic detection of missing phases
- Automatic adaptation to 50/60 Hz
- Optional auxiliary contacts
- LED Status indication
- Unlimited start/stop operations per hour
- Built in varistor protection
- Compact modular design
- DIN rail mountable
- EN 60947-4-2
- CE and $_{C}UL_{US}$ (UL 508)

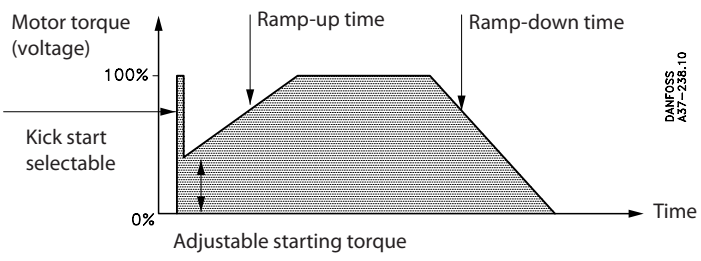
Description

The MCI soft starters are designed for soft starting and stopping of 3 phase a.c. motors, thus reducing the inrush current and eliminating the damaging effects of high starting torque surges.

The digitally controlled soft starter features accurate settings and easy installation. The controller has individually adjustable acceleration and deceleration times.

Thanks to the adjustable initial torque and the unique breakaway (kick start) function the soft starter can be optimized for almost any application.
The MCI soft starters are typically used on motor applications where a smooth start and/or stop is advantageous, such as conveyors, fans, pumps, compressors and high inertia loads. MCI soft starters are also obvious as replacement for star/delta starters.

Adjustments



Selection guide

Operational voltage	Motor current max.	Motor power max.	Dimensions	Type	Aux. contacts	Code no.
208 - 240 V a.c.	3A	0.7 kW / 1 HP	22.5 mm module	MCI 3	-	**037N0073**
208 - 240 V a.c.	15A	4.0 kW / 5.5 HP	45 mm module	MCI 15	-	**037N0037**
208 - 240 V a.c.	25A	7.5 kW / 10 HP	90 mm module	MCI 25	-	**037N0038**
208 - 240 V a.c.	25A (30A)*	11 kW / 15 HP*	90 mm module	MCI 30 I-O	I-O, bypass	**037N0069**
208 - 240 V a.c.	35A (50A)*	15 kW / 20 HP*	180 mm module	MCI 50-3 I-O	I-O, bypass	**037N0089**
380 - 415 V a.c.	3A	1.5 kW / 2 HP	22.5 mm module	MCI 3	-	**037N0074**
440 - 480 V a.c.	3A	1.5 kW / 2 HP	22.5 mm Module	MCI 3	-	**037N0084**
380 - 480 V a.c.	15A	7.5 kW / 10 HP	45 mm module	MCI 15	-	**037N0039**
380 - 480 V a.c.	25A	11 kW / 15 HP	90 mm module	MCI 25	-	**037N0040**
380 - 480 V a.c.	25A (30A)*	15 kW / 20 HP*	90 mm module	MCI 30 I-O	I-O, bypass	**037N0070**
380 - 480 V a.c.	29A (43A)*	21 kW / 28 HP*	90 mm module	MCI 40-3D I-O	I-O, bypass	**037N0092**
380 - 480 V a.c.	35A (50A)*	22 kW / 30 HP*	180 mm module	MCI 50-3 I-O	I-O, bypass	**037N0090**
500 - 600 V a.c.	3A	2.2 kW / 3 HP	22.5 mm module	MCI 3	-	**037N0075**
500 - 600 V a.c.	15A	7.5 kW / 10 HP	45 mm module	MCI 15	-	**037N0041**
500 - 600 V a.c.	25A	15 kW / 20 HP	90 mm module	MCI 25	-	**037N0042**
500 - 600 V a.c.	25A (30A)*	18.5 kW / 25 HP*	90 mm module	MCI 30 I-O	I-O, bypass	**037N0071**
500 - 600 V a.c.	35A(50A)*	30 kW / 40 HP*	180 mm module	MCI 50-3 I-O	I-O, bypass	**037N0091**

* If used with bypass contactor

Technical data

Output Specification

	MCI 3	MCI 15	MCI 25	MCI 30 I-O	MCI 40-3D I-O	MCI 50-3 I-O
Operational current max.	3A	15A	25A	30A (if bypassed during steady state)	43A (if bypassed during steady state)	50A (if bypassed during steady state)
Motor size at: 208 - 240 V a.c. 380 - 480 V a.c. 500 - 600 V a.c.	 0.1-0.7 kW (0.18-1 HP) 0.1-1.5 kW (0.18-2 HP) 0.1-2.2 kW (0.18-3 HP)	 0.1-4.0 kW (0.18-5.5 HP) 0.1-7.5 kW (0.18-10 HP) 0.1-7.5 kW (0.18-10 HP)	 0.1-7.5 kW (0.18-10 HP) 0.1-11 kW (0.18-15 HP) 0.1-15 kW (0.18-20 HP)	 0.1-11 kW (0.18-15 HP) 0.1-15 kW (0.18-20 HP) 0.1-18.5 kW (0.18-25 HP)	 0.1-21 kW (0.18-28 HP)	 0.1-15 kW (0.18-20 HP) 0.1-22 kW (0.18-30 HP) 0.1-30 kW (0.18-40 HP)
Leakage current max	5 mA					
Min. operational current	50 mA					
Overload relay trip class	Class 10 10					
Semiconductor protection Type 1 co-ordination Type 2 co-ordination I^2t (t = 10ms)	 25A gL/gG 72 A^2s	 50 A gL/gG 1800 A^2s	 80 A gL/gG 6300 A^2 s	 80 A gL/gG 6300 A^2 s	 80 A gL/gG 6300 A^2 s	 125 A gL/gG 25300 A^2 s
Rating index: AC-53a Asynchronous motors AC-53b Asynchronous motors with bypass AC-58a Hermetic refrigeration compressors	 – 3A : AC-53b : 5-5 : 10 –	 15A: AC-53a: 8-3:100 - 3000 – 15A: AC-58a: 6-6 : 100 - 3000	 25A: AC-53a: 6-5 : 100 - 480 – 25A: AC-58a: 6-6 : 100 - 480	 25A: AC-53a: 6-5 : 100 - 480 30A: AC-53b: 5-5: 30 25A: AC-58a: 6-6 : 100 - 480	 29A:AC-53a:6-5:100-120 43A:AC-53b:5-5:30	 35A: AC-53a: 6-6 : 00-120 50A: AC-53b: 6-6 : 30 –

Control Circuit Specifications

Control voltage range	24 - 480 V a.c./d.c.		
Pick-Up voltage max.	20.4 V a.c./d.c.		
Drop-out voltage min.	5 V a.c./d.c.		
Max. control current for no operation	1 mA		
Control current / Power max.	15 mA / 2 VA		
Response time max.	70 ms		
Ramp -up time	adjust. from 0-10 seconds	0-20 seconds	0-30 seconds
Ramp-down time	adjust. from 0-10 seconds	0-20 seconds	0-60 seconds
Initial Torque	adjust. from 0-85 % of nominal torque with optional kick start		
SCR Aux. contacts, opt. Voltage/current max. (AC-14, AC-15)	24-480 V a.c. / 0.5 A		24-480 V a.c./1.0 A
Fuse max. I^2t (t = 10ms)	10 A gL/gG, I2t max. 72 A^2s		
EMC immunity and emission	Meets requirements of EN 60947-4-2		

Insulation

Rated installation voltage, U_i	660 V AC
Rated impulse withstand voltage, U_{imp}V	4 k
Installation Category	III

Technical data (continued)

Thermal specifications

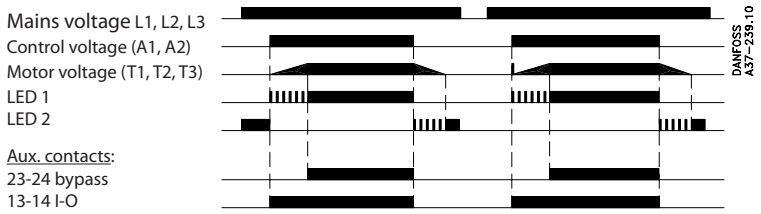
	MCI 3	MCI 15	MCI 25	MCI 30 I-O	MCI 40-3D I-O	MCI 50-3 I-O
Power dissipation*), continuous duty max.:	4 W	2 W/A			3 W/A	
Power dissipation*), Intermittent duty max.:	4 W	2 W/A x duty cycle			3 W/A x duty cycle	
Ambient temperature range	–5°C to 40°C					
Cooling method	Natural convection					
Mounting	Vertical +/- 30°					
Max. ambient temperature with limited rating	60°C, see derating for high temperatures in chart page 6					
Storage temp. range	–20°C to 80°C					
Protection degree/pollution degree	IP 20 / 3					IP 10 / 3

Materials

Housing	Self extinguishing PPO UL94V1
Heatsink	Aluminum black anodized
Base	Electroplated steel

*) If used without a bypass contactor

Functional diagram



Functional description

Ramp up
During ramp-up the controller will gradually increase the voltage to the motor until it reaches full line voltage. The motor speed will depend on the actual load on the motor shaft. A motor with little or no load will reach full speed before the voltage has reached its maximum value. The actual ramp time is digitally calculated and will not be infl uenced by other settings, net frequency or load variations.

Initial torque
The initial torque is used to set the initial starting voltage. This way it is possible to adapt the controller to an application requiring a higher starting torque. In some cases on application with very high break-away torque the initial torque can be combined with a kick start function. The kick start is a period of 200 ms where the motor receives full voltage.

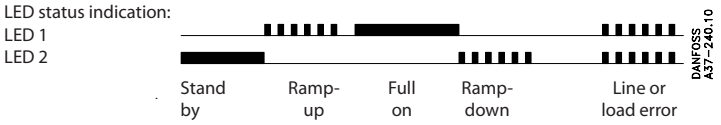
Soft stop
During ramp-down the controller will gradually reduce the voltage to the motor thus reducing the torque and current. As a consequence the motor speed will fade off. The soft stop feature is advantageous to avoid liquid hammering and cavitation on pumps, and to avoid goods tilting on conveyors.

Auxiliary contacts, optional
The auxiliary contacts are made possible by means of SCR technology and will only switch correctly on a.c. current.

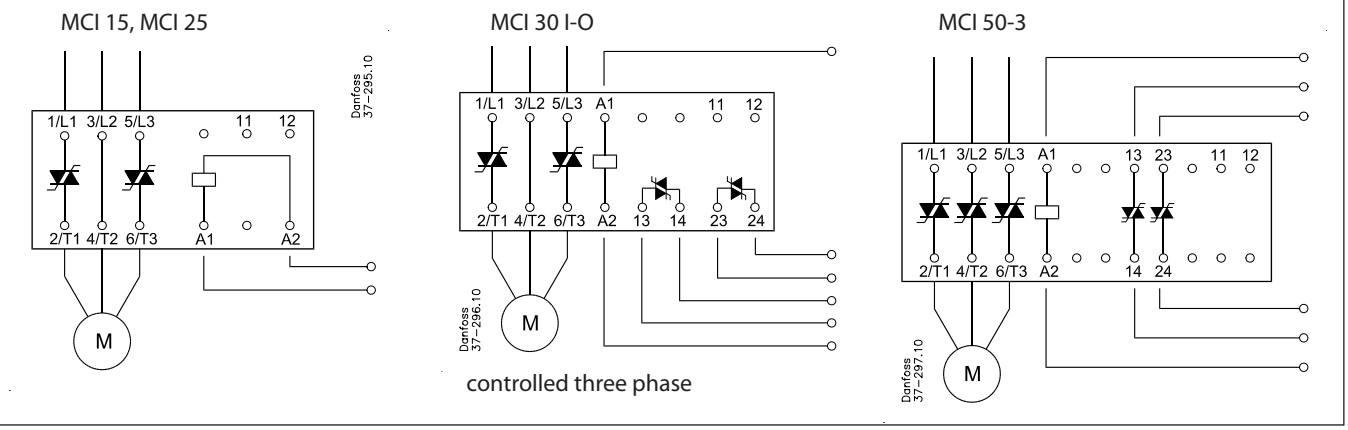
I-0 contact (13 - 14):
The contact will be closed as long as the controller receives a control voltage, see functional diagram

Bypass contact (23 - 24):
The contact is intended for operating an external bypass contactor. The contact will close when the controller is in steady state operation, see functional diagram.

LED status indication



Wiring



Overload and Short Circuit Protection

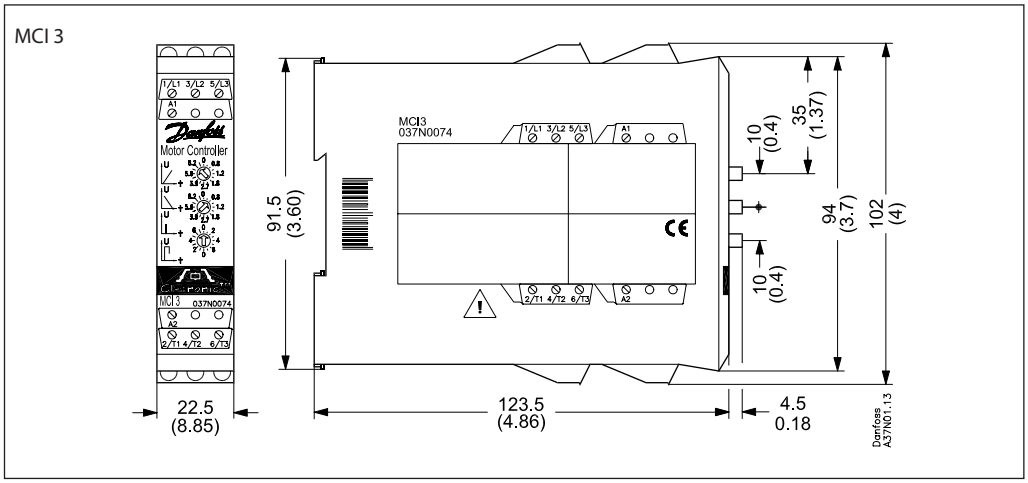
Overload and short circuit protection is easily achieved by installing a circuit breaker on the line side of the soft starter. Select the circuit breaker from the table according to motor full load current.

Be aware of the maximum prospective short circuit current breaking capacity. For further information please refer to the data sheet on the circuit breaker.

380-415 V a.c.					
Motor full load current in A	Soft starter Type	Soft starter I^2t value	Circuit breaker Type	Circuit breaker Code no.	Max. prospective short-circuit current Icc for co-ordination 2
0.40 - 0.63	MCI 15	1800 A^2s	CTI 25M	**047B3143**	100 kA
0.63 - 1.0	MCI 15	1800 A^2s	CTI 25M	**047B3144**	100 kA
1.0 - 1.6	MCI 15	1800 A^2s	CTI 25M	**047B3145**	100 kA
1.6 - 2.5	MCI 15	1800 A^2s	CTI 25MB	**047B3153**	100 kA
2.5 - 4.0	MCI 15	1800 A^2s	CTI 25MB	**047B3154**	100 kA
4 - 6.3	MCI 15	1800 A^2s	CTI 25MB	**047B3155**	4 kA
6.3 - 10	MCI 15	1800 A^2s	CTI 25MB	**047B3156**	1.5 kA
10 - 16	MCI 15	1800 A^2s	CTI 25MB	**047B3157**	2.5 kA*)
14.5 - 20	MCI 25/30 I-O	6300 A^2s	CTI 25MB	**047B3158**	1.8 kA
18 - 25	MCI 25/30 I-O	6300 A^2s	CTI 25MB	**047B3159**	1.5 kA
18 - 25	MCI 25/30 I-O	6300 A^2s	CTI 45MB	**047B3163**	1.3 kA
23 - 32	MCI 50 I-O	25300A^2s	CTI 45MB	**047B3164**	6 kA
32 - 45	MCI 50 I-O	25300A^2s	CTI 45MB	**047B3165**	4 kA
40 - 63	MCI 50 I-O	25300A^2s	CTI 100	**047B3014**	5 kA

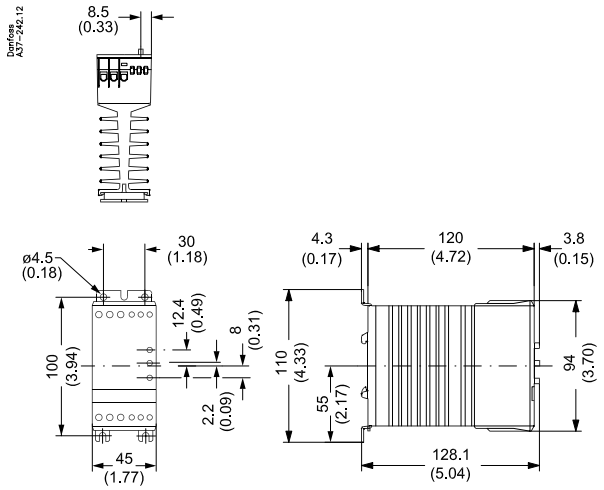
*)Type 2 co-ordination can only be achieved with MCI 25

Dimensions mm (inch)

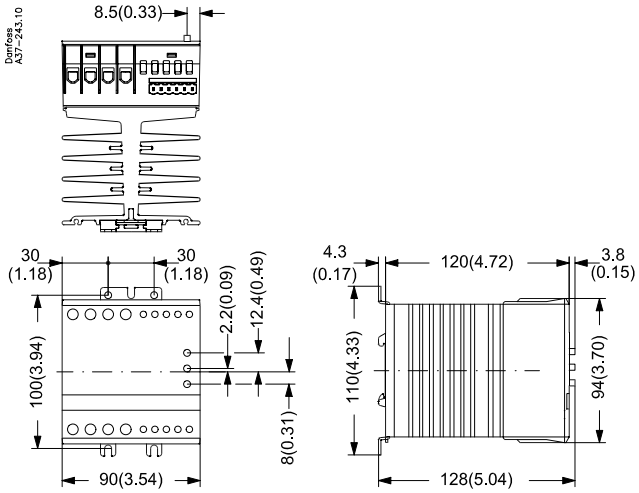


Dimensions
mm (inch)

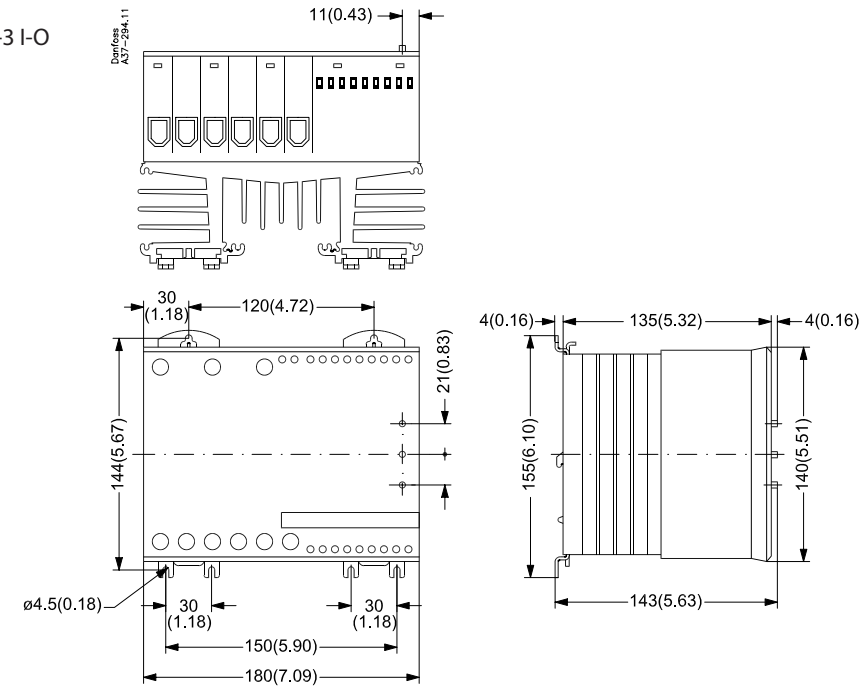
MCI 15



MCI 25, MCI 30 I-O
MCI 40-3D I-O



MCI 50-3 I-O



Operation at high temperatures

If soft starter is used without external bypass contactor:

Ambient temperature	Continuous current					
	MCI 3	MCI 15	MCI 25	MCI 30 I-O	MCI 40-3D I-O	MCI 50-3 I-O
40°C	3 A	15 A	25 A	25 A	29 A	35 A
50°C	2.5 A*	12. 5 A	20 A	20 A	23 A	30 A
60°C	2.0 A*	10 A	17 A	17 A	20 A	25 A

* Minimum 10 mm side clearance between products

Ambient temperature	Duty-cycle rating (15 min. max. on-time)				
	MCI 15	MCI 25	MCI 30 I-O	MCI 40-3D I-O	MCI 50-3 I-O
40°C	15 A (100% duty-cycle)	25 A (100% duty-cycle)	25 A (100% duty-cycle)	43 A (65% duty-cycle)	50 A (65% duty-cycle)
50°C	15 A (80% duty-cycle)	25 A (80% duty-cycle)	25 A (80% duty-cycle)	43 A (50% duty-cycle)	50 A (55% duty-cycle)
60°C	15 A (65% duty-cycle)	25 A (65% duty-cycle)	25 A (65% duty-cycle)	43 A (40% duty-cycle)	50 A (45% duty-cycle)

If soft starter is used with external bypass contactor:

Ambient temperature	Continuous current				
	MCI 15	MCI 25	MCI 30 I-O	MCI 40-3D I-O	MCI 50-3 I-O
40°C	15	25	30	43	50
50°C	15	25	30	43	50
60°C	15	25	30	43	50

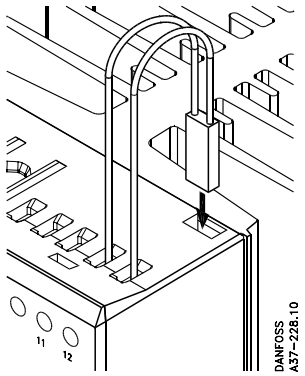
Over heat protection

If required the controller can be protected against overheating by inserting a thermostat in the slot on the right-hand side of the controller.

Order: UP 62 thermostat **037N0050**

Depending on the application the thermostat can be connected in series with the control circuit of the main contactor. When the temperature of the heat sink exceeds 90°C the main contactor will be switched OFF. A manual reset is necessary to restart this circuit.
For wiring connections see application examples page 7.

Not with MCI 3



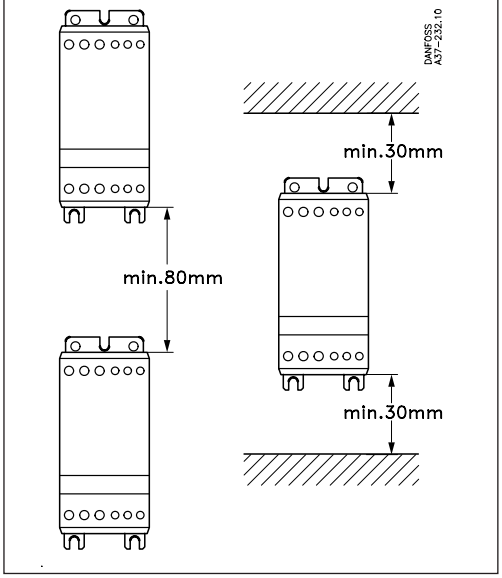
Mounting Instructions

The controller is designed for vertical mounting. If the controller is mounted horizontally the load current must be reduced by 50%.

The controller needs no side clearance.

Clearance between two vertical mounted controller must be minimum 80 mm (3.15").

Clearance between controller and top and bottom walls must be minimum 30 mm (1.2").

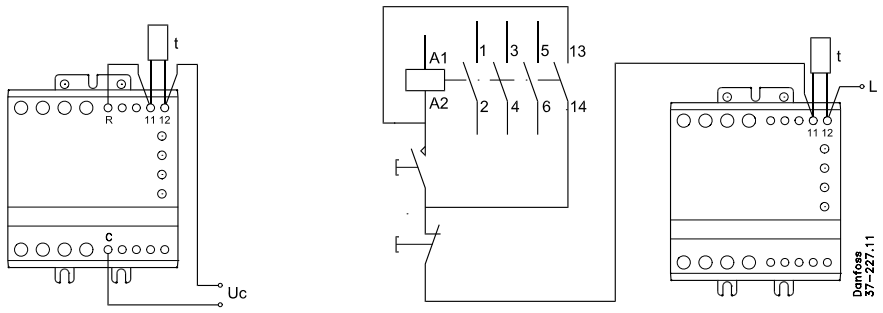


Application examples

Overheat protection

Example 1
The thermostat can be connected in series with the control input of the soft starter. When the temperature of the heat sink exceeds 90°C the soft starter will be switched OFF.
NOTE when the temp. has dropped approx. 30°C the controller will automatically be switched ON again. This is not acceptable in some applications.

Example 2
The thermostat is connected in series with the control circuit of the main contactor When the temp. of the heat sink exceeds 90°C the main contactor will be switched OFF. This circuit requires manual reset to restart the motor.

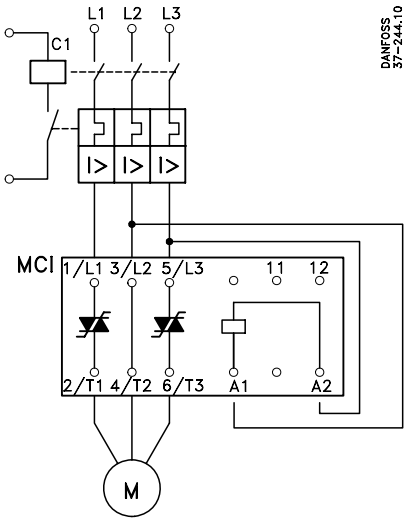


Line Controlled Soft start

When the contactor C1 is switched to the ON-State, the soft starter will start the motor, according to the settings of the Ramp-up time and Initial torque adjustments.

When the contactor C1 is switched to the OFF-State the motor will be switched off instantaneously.

In this application the contactor will have no load during making operation. The contactor will carry and break the nominal motor current.



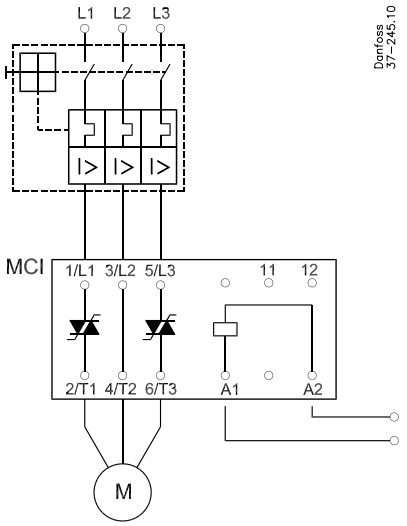
Application examples
Cont.

Input controlled soft start

When the control voltage is applied to A1 - A2, the MCI soft starter will start the motor, according to the
settings of the Ramp-up time and Initial torque adjustments.

When the control voltage is switched OFF, the motor will be soft stopped according to the settings of the Ramp-down time adjustment.

To switch off instantaneously set the Ramp-down time to 0.



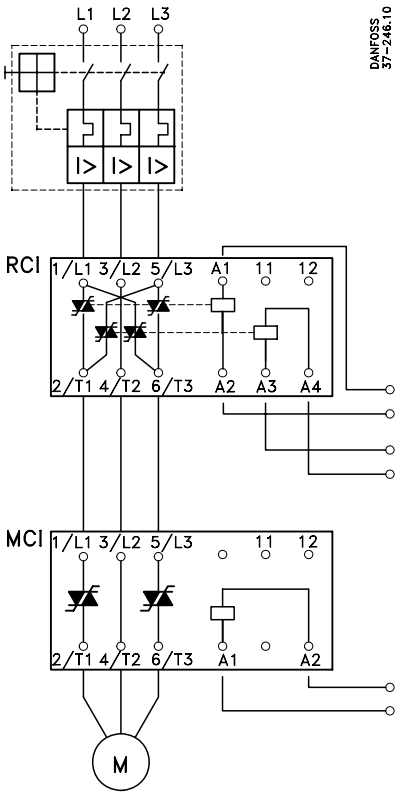
Combined reversing contactor and soft starter

Soft Start & Soft Stop
A soft – reversing of a motor can easily be achieved by connecting a reversing contactor to the soft starter. The reversing contactor, type RCI, will determine the direction of rotation, forward or reverse and the soft starter, type MCI, will perform soft-starting and soft-stopping of the motor.

Soft Start only
If soft-stop is not required the application can be simplifi ed by connecting the control circuit, of the soft starter, to the main terminals as shown under Line controlled Soft-Start (see example on page 7).

A delay of approx. 0.5 sec. between forward and reverse control signal must be allowed to avoid infl uence from the voltage generated by the motor during turn-off.

Instead of the electronic reversing contactor, type RCI, an electromechanical reversing contactor can be applied. Due to the soft starter the reversing contactor will not be exposed to high inrush currents. As a result a longer life time of the electromechanical contactor can be expected.



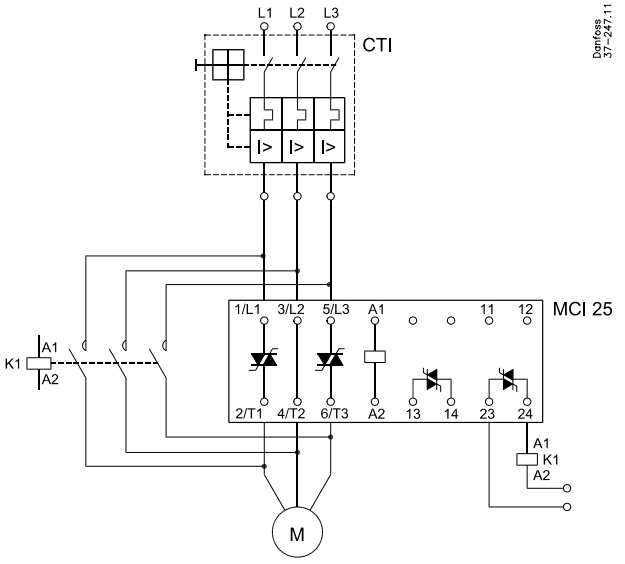
Application examples
Cont.)

MCI with bypass contactor

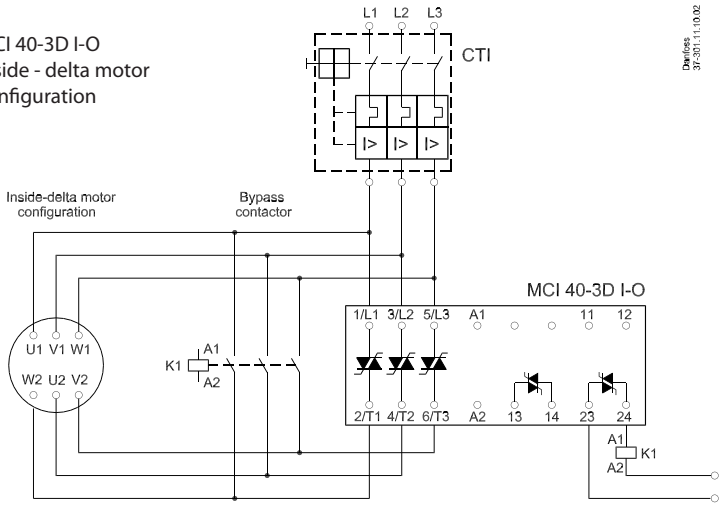
If the MCI soft starter is bypassed during steady state operation there is no heat dissipation.
A bypassed MCI can be loaded according to tabel page 6: "Operating at high temperatures".

By means of the integrated auxiliary contact the bypass function is easily achieved. See wiring diagram below and "Functional diagram" page 3.

As the contactor always switches in after end of ramp up time it can be selected on the basis of the thermal current (AC-1).



MCI 40-3D I-O
Inside - delta motor configuration



Data sheet

CI-tronic™ Soft Start Motor Controller Type MCI 25B with Brake

Features

- Adjustable acceleration time, 0-10 seconds
- Initial torque adjustable from 0-85%, with or without kick start (break-away)
- Adjustable d.c. injection brake, 0-50 A d.c.
- Fast acting brake mode with automatic motor field reduction
- Automatic stop detection
- Universal control voltage 24-480 V a.c./d.c.
- Slow speed function, 7.5% or 10% of nom. speed
- SCR aux. contacts for external control of by-pass, I-O and mechanical brake.
- Automatic detection of missing phase(s)
- Automatic adaptation to 50 or 60 Hz
- Unlimited start and stop per hour
- IP 20 protection
- Compact DIN rail mountable design
- EN 60947-4-2
- CE, C-tick

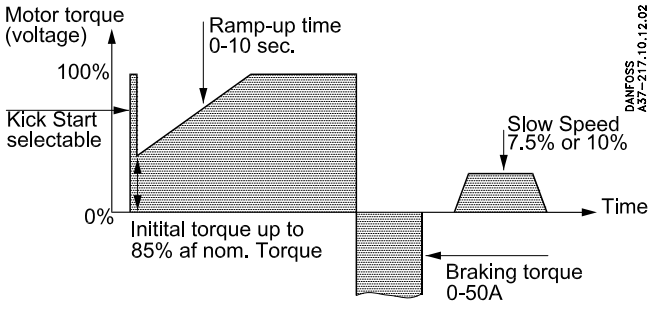
Description

MCI 25B motor controller with brake is designed for soft starting and braking of 3 phase ac motors.

The digital controlled soft starter features accurate settings and several monitoring functions. Acceleration time and initial torque are along with the braking torque easily adjusted. During braking the MCI 25B will apply a d.c. current to all the windings of the motor, thus providing a powerful brake function. The automatic stop detection ensures a safe operation. For positioning applications the unique slow speed function can be applied.

The MCI 25B controller is typically applied on demanding braking applications such as saws, cranes, automatic doors, etc.

Adjustments



Selection guide

Operational voltage V a.c.	Motor current	Motor power	Control voltage V a.c./d.c.	Dimensions	**Code no.**
208 → 240	25 A	7.5 kW / 10 HP	24 → 480	90 mm module	**037N0061**
380 → 480	25 A	11 kW / 15 HP	25 → 480	90 mm module	**037N0062**

Technical data

Control circuit specifications

Control voltage range	24-480 V a.c./d.c.
Pick-up voltage max.	20.4 V a.c./d.c.
Drop-out voltage min.	5 V a.c./d.c.
Max. control current for no operation	1 mA
Control current / power max.	15 mA / 2 VA
Response time max.	70 ms
Ramp-up time	Adjustable from 0 to 10 Sec.
Brake current	Adjustable from 0 to 50 A
Initial torque	Adjustable from 0 to 85 % of nominal torque with optional kick start
SCR aux. contacts, voltage/current max.	24-480 V a.c. / 0.5 A (AC-14, AC-15)
SCR aux. contacts, max. fuse	10 A gL/gG, I^2t max. 72 A^2s
Design standard	CE marked according to EN 60947-4-2
EMC immunity	Meets requirements of EN 50082-1 and EN 50082-2

Output Specifications

Operational current max. (AC-3, AC-53a)	25 A
Motor size at: 208-240 V a.c. 380-480 V a.c.	 0.7-7.5 kW (1-10 HP) 1-11 kW (1.5-15 HP)
Leakage current max.	5 mA
Minimum operational current	50 mA
Overload relay trip class	Class 10
Semiconductor protection fusing Type 1 co-ordination Type 2 co-ordination I^2t (t = 10 ms)	 80 A gL/gG 6300 A^2 S
Rating index	Slip ring motors: 25 A AC-52a: 4-13 : 100-3000 Asynchronous motors: 25 A AC-53a: 8-3 : 100-3000

Insulation

Rated insulation Voltage, U_i	660 V a.c.
Rated impulse withstand Voltage, U_{imp}	4 kV
Installation Category	III

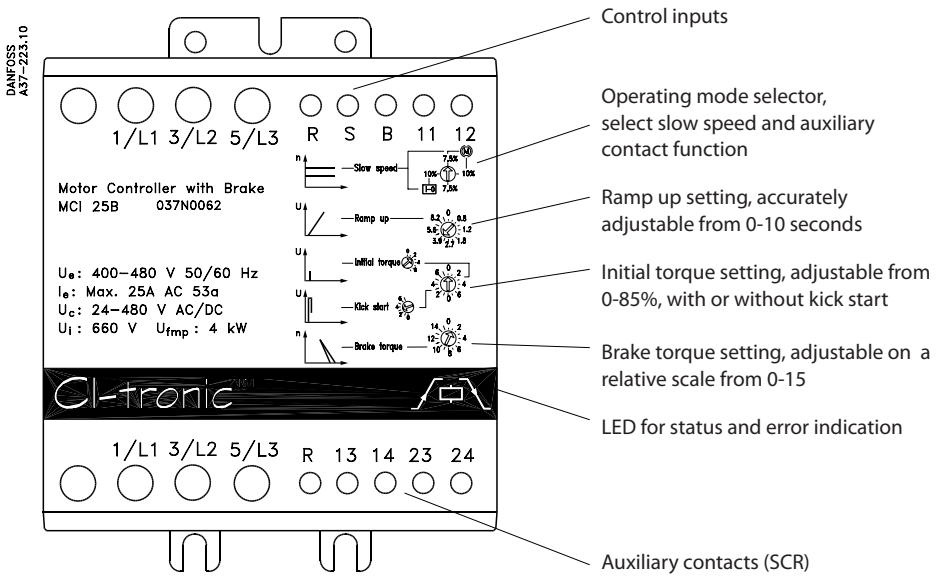
Thermal Specification

Power dissipation for continuous duty P_d max.	2 W/A
Power dissipation for Intermittent duty P_d max.	2 W/A x Duty cycle
Ambient temperature range	–5°C to 40°C
Cooling method	Natural convection
Mounting	Vertical +/- 30°C
Max. ambient temperature with limited rating	60°C, see derating for high temperatures in chart below
Storage temp. range	–20°C to 80°C
Protection degree/pollution degree	IP 20 / 3

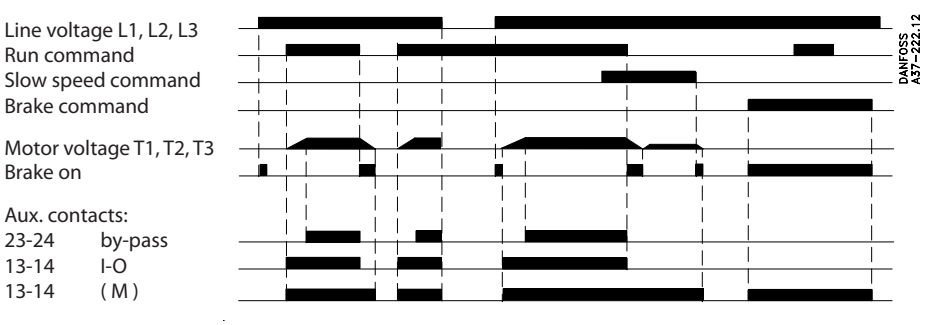
Materials

Housing	Self extinguishing PPO UL94V1
Heatsink	Aluminum black anodized
Base	Electroplated steel

Functions



Functional diagram



1. When line voltage is applied the brake will automatically stop a rotating motor.
2. The function of auxiliary contact 13-14 is selectable; "start - stop" or "mechanical brake"

Soft start function

Ramp up

During ramp-up the controller will gradually increase the voltage to the motor until it reach full line voltage. The motor speed will depend on the actual load on the motor shaft.
A motor with little or no load will reach full speed before the voltage has reached its maximum value.
The actual ramp time is digitally calculated and will not be influenced by other settings, net frequency or load variations.

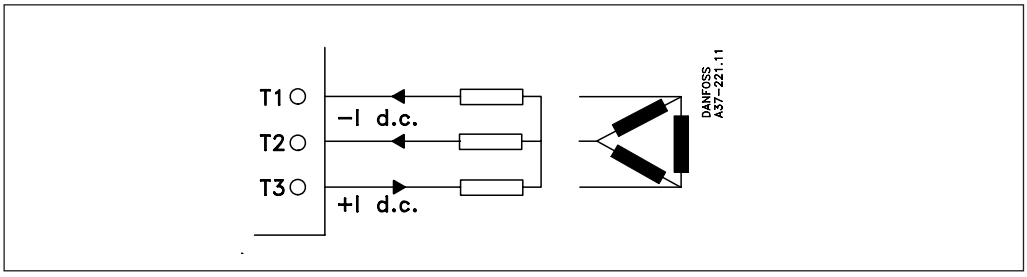
Initial torque

The initial torque is used to set the initial starting voltage. This way it is possible to adapt the controller to an application requiring a higher starting torque. In some cases on application with very high break-away torque the initial torque can be combined with a kick start function. The kick start is a period of 200 ms where the motor receives full voltage.

Brake function

Braking is achieved by injecting a DC current, adjustable from 0-50 A, onto all the windings of the motor. The brake can be used on both star and delta connected motors, but is most efficient if the motor is connected in star.

Note: If a contactor is placed between motor and the MCI-B, do not open during braking as it can cause the contactor to fail.



Adjustment
The actual braking torque is controlled indirectly by adjusting the braking voltage. The braking voltage can be set for 0-15. For small motors a relatively high braking voltage is necessary contrary to larger motors where a relatively low voltage is sufficient. For this reason the braking voltage must be adjusted to the actual application. Before starting up a new application set the Braking torque to 1. Increase incrementally until desired braking time is reached.

Automatic stop detection
When the brake function is applied the MCI-B will bring the motor to a stop before releasing the brake current.

If the motor does not stop within 30 seconds the DC brake will disengage and the controller will show a "brake failure" condition.

The automatic stop detection is accomplished by sensing the DC brake current on the motor, and as so the accuracy of the stop detection will depend on a correctly adjusted brake. The point of "no rotation" depends on the motor size and the brake voltage setting. If the motor voltage is set to low the brake will be switched off before the motor has come to a complete stop. However, if the brake voltage is set to high, out of detection range, it will not switch of the motor before the brake failure conditions occurs after 30 seconds.

Slow speed function

The slow speed function is intended for short time operation in applications where an exact positioning is needed, for example cranes. The function has two selectable slow speeds; 7.5% or 10% of nominal speed.

The torque level will depend on the motor and selected slow speed, typically 25-40% of nominal torque. During slow speed the motor current will increase, typically 2-2.5 times the nominal current.

Auxiliary contacts

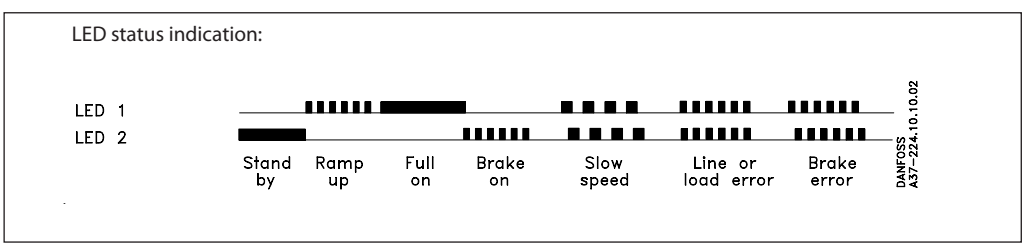
The auxiliary contacts are made possible by means of SCR technology and will only switch correctly on ac current.

Contact 13-14
The contact 13-14 is selectable for two different functions; "I-O" or "Mechanical brake". If the "I-O" is selected, the contact will be closed as long as a RUN command is given, see functional diagram

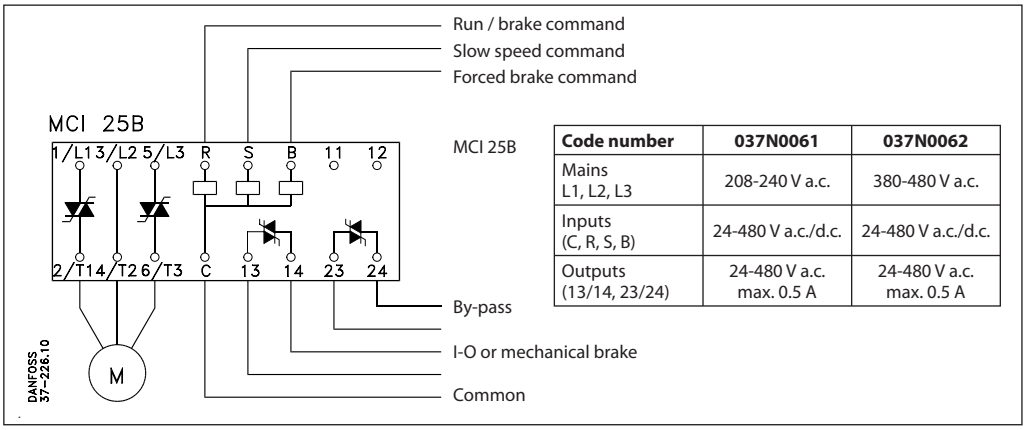
If "Mechanical brake" is selected the contact will be closed as long as the motor is rotating. The "Mechanical brake" setting is intended for operating an external mechanical brake.

Contact 23-24
The contact 23-24 is intended for operating an external by-pass contactor. The contact will close when the controller is in steady state operation, see functional diagram.

LED status indication



Wiring



Code number	037N0061	037N0062
Mains L1, L2, L3	208-240 V a.c.	380-480 V a.c.
Inputs (C, R, S, B)	24-480 V a.c./d.c.	24-480 V a.c./d.c.
Outputs (13/14, 23/24)	24-480 V a.c. max. 0.5 A	24-480 V a.c. max. 0.5 A

Overload and short circuit protection

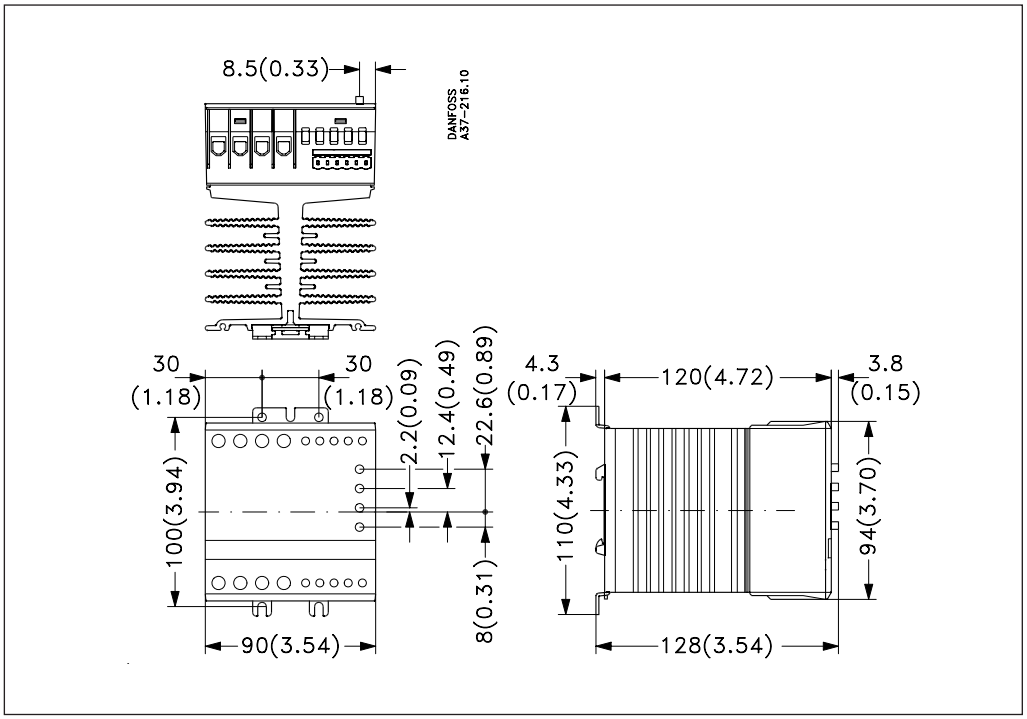
Overload and short circuit protection is easily achieved by installing a circuit breaker on the line side of the motor controller. Select circuit breaker from the table according to motor full load current.

Be aware of the maxium prospective short circuit current breaking capacity. For further information please refer to data sheet for the circuit breaker.

380 → 415 V a.c.			
Motor full load current in A	Danfoss CTI 25M		Max. prospective short-circuit current Icc Co-ordination [1]
4.0 → 6.3	CTI 25M	**047B3148**	100 kA
6.3 → 10	CTI 25M	**047B3149**	100 kA
10 → 16	CTI 25M	**047B3150**	40 kA
14.5 → 20	CTI 25MB	**047B3158**	1.8 kA
18 → 25	CTI 25MB	**047B3159**	1.5 kA
18 → 25	CTI 45MB	**047B3163**	1.3 kA

[1] Values based on let-through curves for appropriate circuit breaker

Dimensions mm (inches)



Operating at high temperatures

Operation in temperatures from 40°C up to 60°C is possible if the power dissipation is limited either by reducing the current or by reducing the ON-time of the controller. Refer to table.

Ambient temperature	Continuous operation	Duty-cycle rating
50°C	20 A	25 A with 80% duty cycle, max. on-time 15 min.
60°C	15 A	25 A with 65% duty cycle, max. on-time 15 min

Operating on heavy loads

Load data is given for normal starts. If applied on heavy starts please derate according to table.

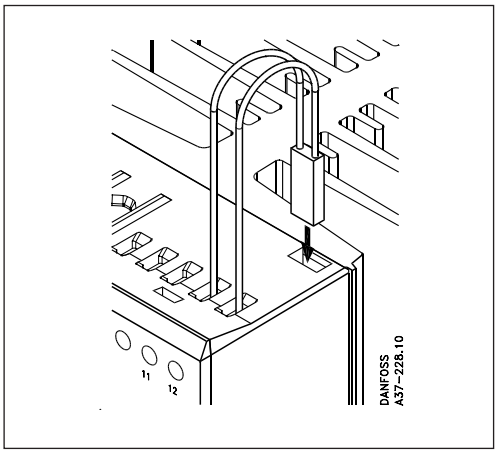
Overload relay trip class	Max. current
10 A (Light starts)	25 A
10 (Normal starts)	25 A
20 (Heavy starts)	20 A
30 (Very Heavy starts)	15 A

Over heat protection

If required the controller can be protected against overheating by inserting a thermostat in the slot on the right-hand side of the controller.

Order: UP 62 thermostat 037N0050

For wiring connections see application examples.



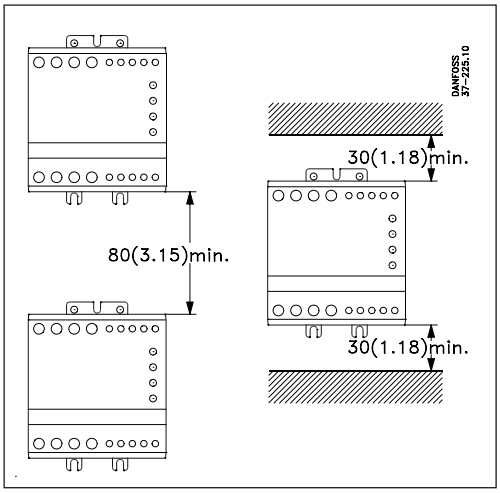
Mounting instructions

The controller is designed for vertical mounting. If the controller is mounted horizontally the load current must be reduced by 50%.

The controller needs no side clearance.

Clearance between two vertical mounted controller must be minimum 80 mm (3.15″).

Clearance between controller and top and bottom walls must be minimum 30 mm (1.2″).

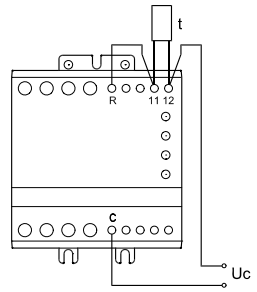


Application examples

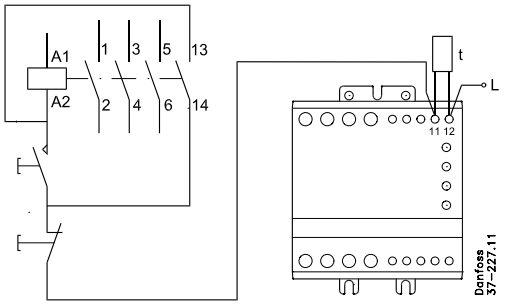
Overheat protection

Example 1
The thermostat can be connected in series with the control input of the Motor Controller. When the temperature of the heat sink exceeds 100°C the Motor Controller will be switched OFF.

NOTE when the temp. has dropped approx. 30°C the Controller will automatically be switched ON again. This is not acceptable in some applications



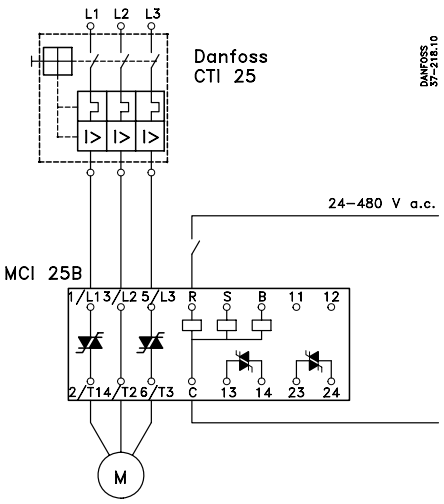
Example 2
The thermostat is connected in series with the control circuit of the main contactor When the temp. of the heat sink exceeds 100°C the main contactor will be switched OFF. This circuit requires manual reset to restart the motor.



Standard start – brake wiring

If only the soft start and braking function is required it is easily achieved by wiring the control voltage to "R". When control voltage is applied the controller will begin the soft start procedure. To brake the load the control voltage is disconnected.

Danfoss circuit breaker CTI 25M is in this example providing overload and short circuit protection.



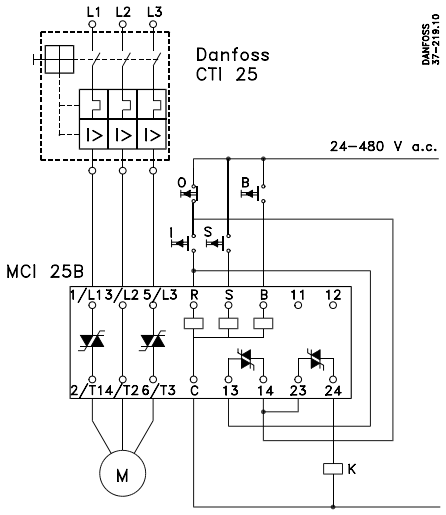
Direct wired start-stop with bypass

By wiring the auxiliary contact function 13-14 into the control circuit start and stop can be achieved by means of push buttons.

Note that the operating mode selector must be set for "I-0" control.

Auxiliary contact 23-24 is used to control and external by-pass contactor during steady state operation.

Danfoss circuit breaker CTI 25 is in this example providing overload and short circuit protection.



Wired for control of mechanical brake and bypass

The auxiliary contact function 13-14 is in this example used to control a mechanical brake. The brake is released when the controller is applying voltage to the motor.

Note that the operating mode selector must be set for "mechanical brake" control.

Auxiliary contact 23-24 is used to control and external by-pass contactor during steady state operation.

Danfoss circuit breaker CTI 25 is in this example providing overload and short circuit protection.