

# 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

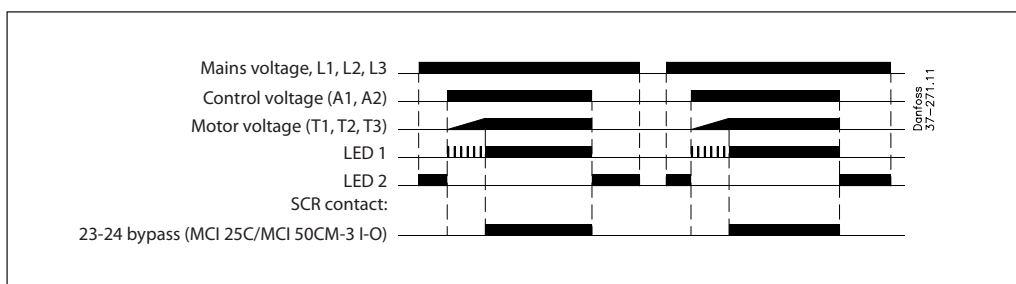
### Description

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

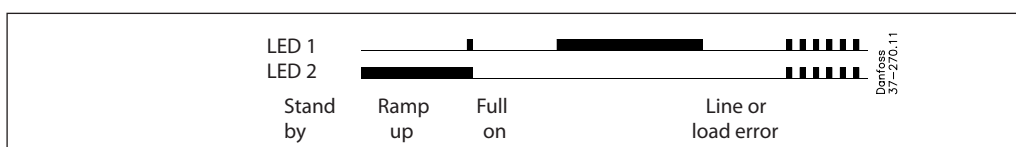
#### Start

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

<sup>1)</sup>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<br>Ambient temp. max +40°C | Soft starter type<br>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 <sup>1)</sup>                         |
| MT/MTZ 125         |                                              |                                              |
| MT/MTZ 144         |                                              |                                              |
| MT/MTZ 160         |                                              |                                              |

<sup>1)</sup>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        | <b>037N0076</b> |
|                     | 90 mm module  | MCI 25C        | <b>037N0077</b> |
|                     | 180 mm module | MCI 50CM-3 I-O | <b>037N0401</b> |

**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 replacement 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.

| <i>Output specifications</i>               |                           | 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 <sup>1)</sup> co-ordination         |                           | 50 A gL/gG            | 100 A gL/gG              | 125 A gL/gG             |
| Type 2 <sup>2)</sup> co-ordination         | I <sup>2</sup> t(t=10 ms) | 1800 A <sup>2</sup> S | 6300 A <sup>2</sup> S    | 25300 A <sup>2</sup> S  |
| Rating index:                              |                           |                       |                          |                         |
| AC-53a Asynchronous motors <sup>3)</sup>   |                           | 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:<br>6-3 : 30 | 50A:AC-53b:<br>6-3 : 30 |

| <i>Control circuit specifications</i> |      | Control voltage range                                 |              |              |
|---------------------------------------|------|-------------------------------------------------------|--------------|--------------|
| Pick-up voltage                       | max. | 24 - 480 V ac/dc                                      |              |              |
| Drop-out voltage                      | min. | 20.4 V ac/dc                                          |              |              |
| Control current for no operation      | max. | 5 V ac/dc                                             |              |              |
| Control current / power               | max. | 1 mA                                                  |              |              |
| Response time                         | max. | 15 mA / 2 VA                                          |              |              |
| Response time                         |      |                                                       |              |              |
| 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 <sup>2</sup> t max. 72 A <sup>2</sup> s |              |              |
| EMC immunity                          |      | Meets requirements of EN 50082-1 and EN 50082-2       |              |              |

**Insulation**

|                                                  |          |
|--------------------------------------------------|----------|
| Rated insulation voltage U <sub>i</sub>          | 660 V ac |
| Rated impulse withstand voltage U <sub>imp</sub> | 4 kV     |
| Installation category                            | III      |

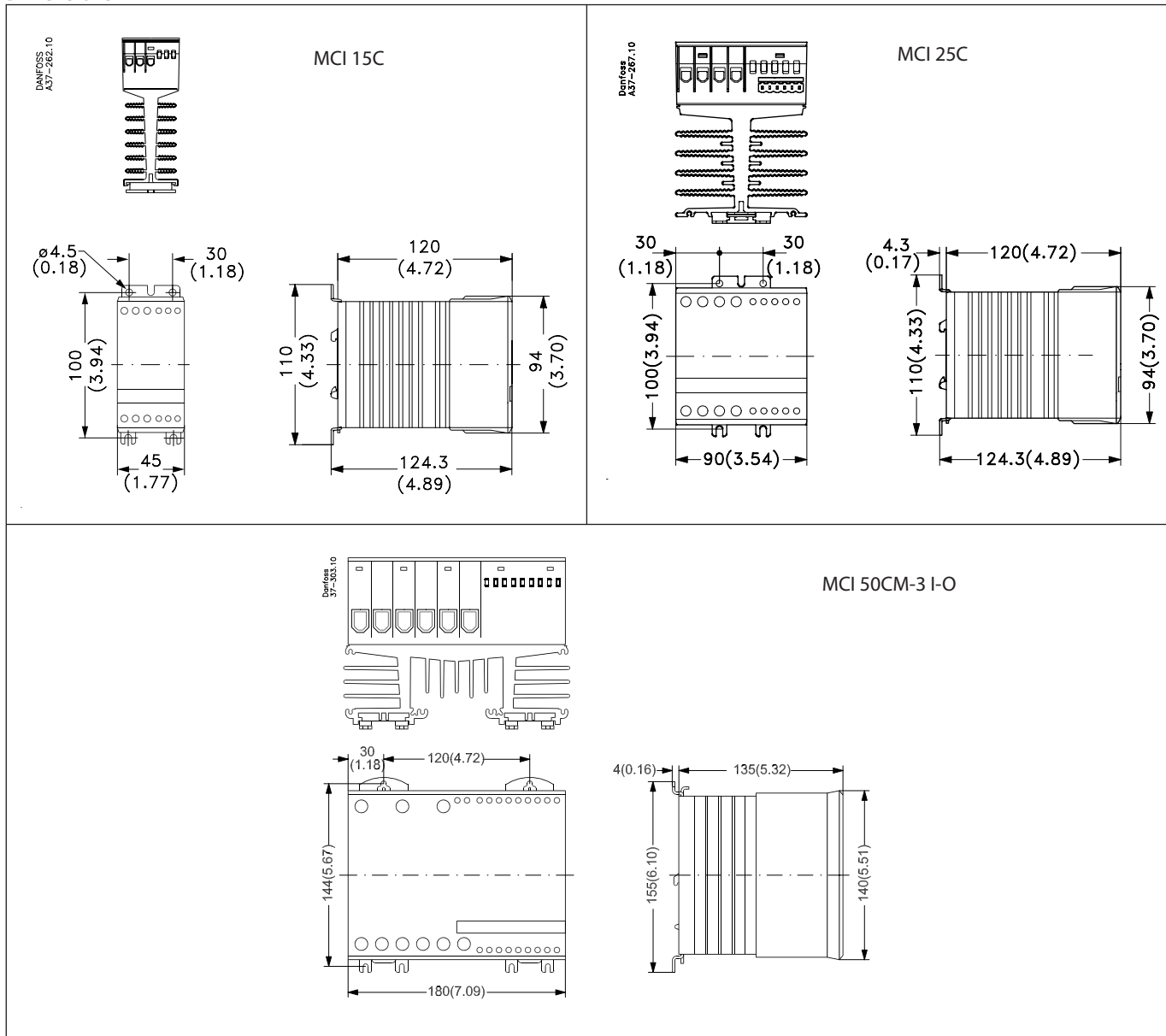
**Thermal specification**

|                                           |                    |                   |                    |
|-------------------------------------------|--------------------|-------------------|--------------------|
| 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. | 2W/A × duty cycle  | 2W/A × duty cycle | 3 W/A × duty cycle |

**Materials**

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

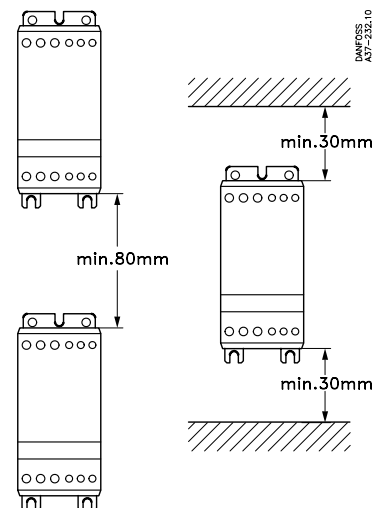
Dimensions



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   | <b>047B3157</b> |
| SM / SZ 090                                                  | 17                          | CTI 25 MB   | <b>047B3157</b> |
| SM / SZ 100                                                  | 19                          | CTI 25 MB   | <b>047B3158</b> |
| SM / SZ 110                                                  | 20                          | CTI 25 MB   | <b>047B3158</b> |
| SM / SZ 115                                                  | 25                          | CTI 25 MB   | <b>047B3159</b> |
| SM / SZ 120                                                  | 29                          | CTI 25 MB   | <b>047B3159</b> |
| SM / SZ 125                                                  | 25                          | CTI 25 MB   | <b>047B3159</b> |
| SM/SZ 148                                                    | 32                          | CTI 45 MB   | <b>047B3164</b> |
| SM / SZ 161                                                  | 32                          | CTI 45 MB   | <b>047B3164</b> |
| SM / SZ 160                                                  | 29                          | CTI 25 MB   | <b>047B3159</b> |
| SM / SZ 175                                                  | 35                          | CTI 45 MB   | <b>047B3164</b> |
| SM / SZ 185                                                  | 35                          | CTI 45 MB   | <b>047B3164</b> |
| SY/SZ 240                                                    | 50                          | CTI 45 MB   | <b>047B3165</b> |
| SY/SZ 300                                                    | 69                          | CTI 100     | <b>047B3014</b> |

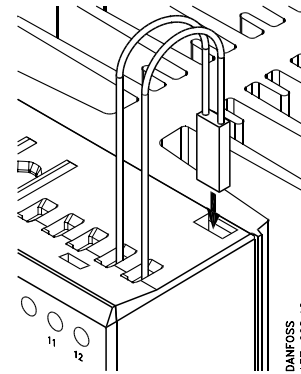
**Maneurop® reciprocating compressors**

| 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    | <b>047B3147</b> |
| MT/MTZ 22                                                    | 6                           | CTI 25 M    | <b>047B3148</b> |
| MT/MTZ 28                                                    | 7.5                         | CTI 25 M    | <b>047B3148</b> |
| MT/MTZ 32                                                    | 8                           | CTI 25 M    | <b>047B3149</b> |
| MT/MTZ 36                                                    | 9                           | CTI 25 M    | <b>047B3149</b> |
| MT/MTZ 40                                                    | 10                          | CTI 25 M    | <b>047B3149</b> |
| MT/MTZ 44                                                    | 9.5                         | CTI 25 M    | <b>047B3149</b> |
| MT/MTZ 45                                                    | 9.5                         | CTI 25 M    | <b>047B3149</b> |
| MT/MTZ 50                                                    | 12                          | CTI 25 MB   | <b>047B3157</b> |
| MT/MTZ 51                                                    | 11.5                        | CTI 25 M    | <b>047B3149</b> |
| MT/MTZ 56                                                    | 12                          | CTI 25 MB   | <b>047B3157</b> |
| MT/MTZ 57                                                    | 12                          | CTI 25 MB   | <b>047B3157</b> |
| MT/MTZ 64                                                    | 15                          | CTI 25 MB   | <b>047B3157</b> |
| MT/MTZ 65                                                    | 14                          | CTI 25 MB   | <b>047B3157</b> |
| MT/MTZ 72                                                    | 15.5                        | CTI 25 MB   | <b>047B3157</b> |
| MT/MTZ 73                                                    | 17                          | CTI 25 MB   | <b>047B3157</b> |
| MT/MTZ 80                                                    | 18                          | CTI 25 MB   | <b>047B3158</b> |
| MT/MTZ 81                                                    | 19                          | CTI 25 MB   | <b>047B3158</b> |
| MT/MTZ 100                                                   | 22                          | CTI 25 MB   | <b>047B3158</b> |
| MT/MTZ 125                                                   | 27                          | CTI 25 MB   | <b>047B3159</b> |
| MT/MTZ 144                                                   | 30                          | CTI 45 MB   | <b>047B3164</b> |
| MT/MTZ 160                                                   | 36                          | CTI 45 MB   | <b>047B3164</b> |

**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**

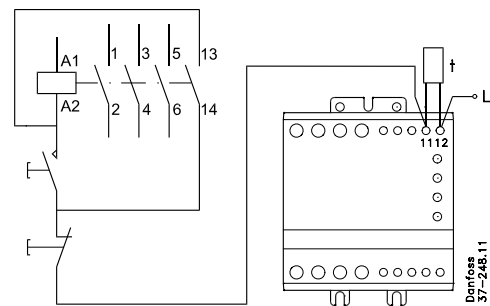
For wiring connections see application examples below.



**Application examples**

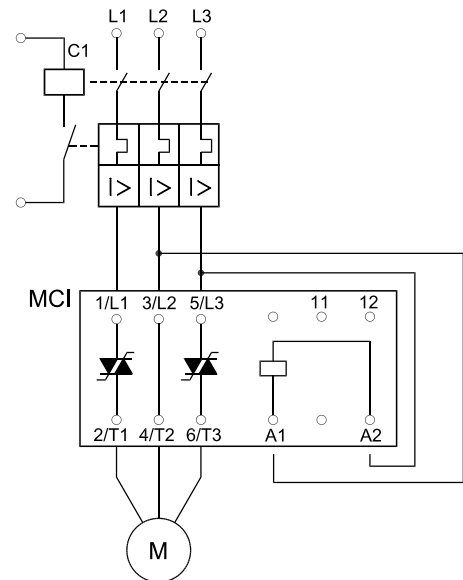
Overheat protection

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 operation. The contactor will carry and break the nominal motor current.

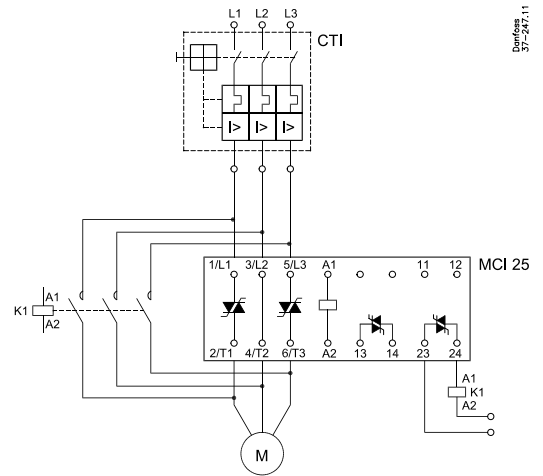


**Application examples**  
(continued)

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).

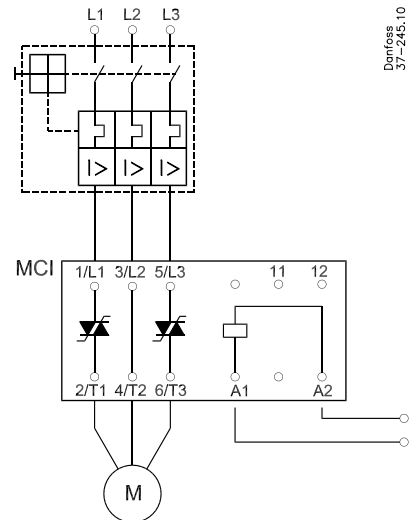
(13-14 contact not applicable with MCI 25C and MCI 50CM-3 I-O)



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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.



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