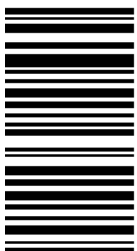
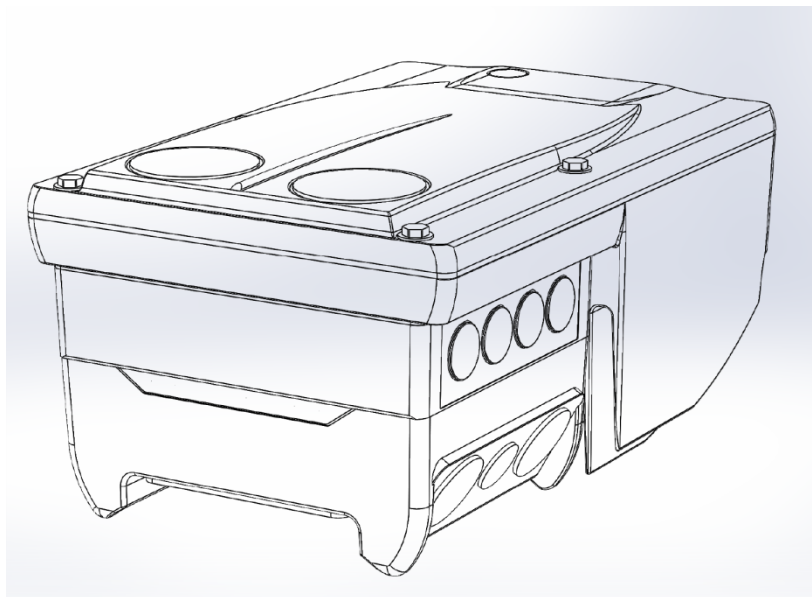




# Emotron CDN

Motor mounted AC drive

*0.75 ... 7.5 kW*



13527313

Hardware manual



1	About this documentation .....	1
1.1	Validity information .....	1
1.2	Document history .....	2
1.3	Conventions used .....	2
1.4	Terms and abbreviations used .....	3
1.5	Notes used .....	4
2	Safety instructions .....	5
2.1	General safety and application notes for Emotron CDN AC drives .....	5
2.2	Residual hazards .....	8
3	Product description .....	9
3.1	System overview .....	9
3.2	Device features .....	10
3.3	Identification .....	11
3.4	Product key .....	12
3.4.1	Wiring Unit .....	12
3.4.2	Communication Unit .....	13
3.4.3	Drive Unit .....	13
3.5	Overview of control terminals .....	14
4	Technical data .....	15
4.1	General data and operating conditions .....	15
4.2	Rated data .....	20
4.2.1	Operation with normal duty on 400 V system .....	20
4.2.2	Operation with normal duty on 480 V system .....	22
4.2.3	Operation with heavy duty operation .....	24
4.2.4	Operation with rated mains voltage 400 V – Heavy duty. ....	26
4.2.5	Operation with rated mains voltage 480 V – Heavy duty .....	28
4.3	Overcurrent operation .....	30
4.4	Switching frequency reduction .....	32

4.5	Power terminals .....	33
4.5.1	Emotron CDN40-2P2 – 40-8P7 ( 0.75 ... 3 kW) .....	33
4.5.2	Emotron CDN40-012 – 40-016 ( 4 ... 7.5 kW) .....	35
4.6	Control terminals .....	37
4.6.1	Overview .....	37
4.6.2	General data .....	38
4.6.3	CANopen® .....	39
4.7	Dimensions .....	40
4.7.1	Standard motor mounting .....	40
5	Installation .....	41
5.1	Important notes .....	41
5.2	Safety instructions for the installation according to UL/CSA .....	44
5.3	Installation according to EMC (installation of a CE-typical drive system) .....	46
5.3.1	Shielding .....	46
5.3.2	Motor cable .....	47
5.3.3	Control cables .....	48
5.3.4	Detecting and eliminating EMC interferences	48
5.4	Measures when drive is used in IT systems .....	
5.5	Power terminals .....	50
5.5.1	Standard I/O .....	51
5.5.2	Extended I/O .....	52
5.5.3	CANopen® .....	53
6	Commissioning .....	54
6.1	Before you start .....	54
6.2	Handling the memory module .....	56
6.3	Setting elements .....	58
6.3.1	Before switching on .....	61
6.3.4	Commissioning steps .....	62
6.4	Diagnostics .....	63
		64
7	Braking operation .....	
8	Accessories (overview) .....	65
8.1	Memory module .....	65

# 1 About this documentation

## 1.1 Validity information

### Contents

This Hardware Manual informs you how to use the Emotron CDNseries as directed.

### Validity

Type	Type designation
Emotron CDN	CDN40-2P2-65

### Target group

This Hardware Manual is intended for all persons who design, install, commission, and adjust Emotron CDN drives range.



### Tip!

Information and tools concerning the CG products can be found in the download area at [www.emotron.com](http://www.emotron.com)

# 1 About this documentation

## Document history

### 1.2 Document history

Material number	Version		Description
01-6460-01	R0	2017-01-27	First edition

### 1.3 Conventions used

This documentation uses the following conventions to distinguish between different types of information:

#### Spelling of numbers

Decimal separator	Point	In general, the decimal point is used. For instance: 1234.56
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#### Warnings

UL warnings		Given in English and French
UR warnings		

#### Text

Program name	» «	PC software For example: » Easy starter «
--------------	-----	--

#### Icons

Page reference		Reference to another page with additional information For instance:  16 = see page 16
Documentation reference		Reference to another documentation with additional information For example:  01-xxxx-yy = see documentation 01-xxxx-yy

## 1.4 Terms and abbreviations used

Term	Meaning
Device size	Used as generic term for a group of devices which have the same dimensions (depth, height and width) but different power ratings.
Standard device	Used as generic term when actions and features are described which are very similar or the same for different versions or device sizes, e.g. <ul style="list-style-type: none"> <li>- mechanical installation or</li> <li>- power terminals</li> </ul>
DU	Drive unit CDN controller
CU	Communication unit Optional interfaces per I/O, fieldbus
WU	Wiring unit Ready-made motor connection, replaces the motor terminal box
Abbreviation	Meaning
Cat.	Category according to EN 954-1 (valid until 30 November 2009)
Opto supply	Optocoupler supply for controlling the drivers
PELV	Protective Extra Low Voltage
PWM	Pulse Width Modulation
n. c.	Terminal not assigned

# 1 About this documentation


## Document history

### 1.5 Notes used

The following pictographs and signal words are used in this documentation to indicate dangers and important information:




Safety instructions

Structure of safety instructions:




 **Danger!**

(characterises the type and severity of danger)



**Note**  
(describes the danger and gives information about how to prevent dangerous situations)

	Meaning
 <b>Danger!</b>	Danger of personal injury through dangerous electrical voltage. Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
 <b>Danger!</b>	Danger of personal injury through a general source of danger. Reference to an imminent danger that may result in death or serious personal injury if the corresponding measures are not taken.
 <b>Stop!</b>	Danger of property damage. Reference to a possible danger that may result in property damage if the corresponding measures are not taken.

#### Application notes

Pictograph and signal word	Meaning
 <b>Note!</b>	Important note to ensure troublefree operation
 <b>Tip!</b>	Useful tip for simple h
	Reference to another documentation

#### Special safety instructions and application notes

Pictograph and signal word	Meaning
 <b>Warnings!</b>	Safety note or application note for the operation according to UL or CSA requirements.
 <b>Warnings!</b>	The measures are required to meet the requirements according to UL or CSA.



## 2 Safety instructions

### 2.1 General safety and application notes for Emotron CDN drives

(in accordance with Low-Voltage Directive 2014/35/EU)

For your personal safety

Disregarding the following safety measures can lead to severe injury to persons and damage to material assets:

- ▶ Only use the product as directed.
- ▶ Never commission the product in the event of visible damage.
- ▶ Never commission the product before assembly has been completed.
- ▶ Do not carry out any technical changes on the product.
- ▶ Only use the accessories approved for the product.
- ▶ Only use original spare parts from CG.
- ▶ Observe all regulations for the prevention of accidents, directives and laws applicable on site.
- ▶ Transport, installation, commissioning and maintenance work must only be carried out by qualified personnel.
  - Observe IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and all national regulations for the prevention of accidents.
  - According to this basic safety information, qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.
- ▶ Observe all specifications in this documentation.
  - This is the condition for safe and trouble-free operation and the achievement of the specified product features.
  - The procedural notes and circuit details described in this documentation are only proposals. It's up to the user to check whether they can be transferred to the particular applications. CG does not accept any liability for the suitability of the procedures and circuit proposals described.
- ▶ Depending on their degree of protection, some parts of the Emotron CDN drives and their accessory components can be live during operation. Surfaces can be hot.
  - Non-authorized removal of the required cover, inappropriate use, incorrect installation or operation, creates the risk of severe injury to persons or damage to material assets.
  - For more information, please see the documentation.
- ▶ High amounts of energy are produced in the drive. Therefore it is required to wear personal protective equipment (body protection, headgear, eye protection, ear protection, hand guard).

### Application as directed

AC drives are components which are designed for installation in electrical systems or machines. They are not to be used as domestic appliances, but only for industrial purposes according to EN 61000-3-2.

When AC drives are installed into machines, commissioning (i.e. starting of the operation as directed) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 2006/42/EC (Machinery Directive); EN 60204 must be observed.

Commissioning (i.e. starting of the operation as directed) is only allowed when there is compliance with the EMC Directive (2004/108/EC).

The AC drives meet the requirements of the Low-Voltage Directive 2006/95/EC. The harmonised standard EN 61800-5-1 applies to the AC drives.

The technical data and supply conditions can be obtained from the nameplate and the documentation. They must be strictly observed.

**Warning:** AC drives are products which can be installed in drive systems of category C2 according to EN 61800-3. These products can cause radio interferences in residential areas. In this case, special measures can be necessary.

### Transport, storage

Please observe the notes on transport, storage, and appropriate handling.

Observe the climatic conditions according to the technical data.

### Installation

The AC drives must be installed and cooled according to the instructions given in the corresponding documentation.

The ambient air must not exceed degree of pollution 2 according to EN 61800-5-1.

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components and contacts.

AC drives contain electrostatic sensitive devices which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health!

### Electrical connection

When working on live AC drives, observe the applicable national regulations for the prevention of accidents.

The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE connection). Additional information can be obtained from the documentation.

The documentation provides notes on EMC-compliant installation (shielding, earthing, filter arrangement, and laying of cables). Please also observe these notes when installing CE-labelled AC drives. The manufacturer of the machine or plant is responsible for the compliance with the required limit values associated with EMC legislation.

Emotron CDN drives may cause a DC current in the PE conductor. If a residual current device is used as a protective means in the case of direct or indirect contact with a three-phase controller, a residual current device of type B must be used on the current supply side of the controller. If the controller has a single-phase supply, it is also permissible to use a residual current device of type A. Apart from the use of a residual current device, other protective measures can also be taken, such as isolation from the environment by double or reinforced insulation, or separation from the supply system by means of a transformer.

## Operation

If necessary, systems including AC drives must be equipped with additional monitoring and protection devices according to the valid safety regulations (e.g. law on technical equipment, regulations for the prevention of accidents). The AC drives can be adapted to your application. Please observe the corresponding information given in the documentation.

After the controller has been disconnected from the supply voltage, all live components and power terminals must not be touched immediately because capacitors can still be charged. Please observe the corresponding stickers on the controller.

All protection covers and doors must be shut during operation.

Notes for UL-approved systems with integrated AC drives: UL warnings are notes that only apply to UL systems. The documentation contains special UL notes.

## Maintenance and servicing

The AC drives do not require any maintenance if the prescribed operating conditions are observed.

## Disposal

Recycle metal and plastic materials. Ensure professional disposal of assembled PCBs.

**The product-specific safety and application notes given in these instructions must be observed!**

#### 2.2 Residual hazards

##### Protection of persons

- ▶ Switch off mains voltage before removing the controller (Drive Unit).
- ▶ Before working on the controller, check if no voltage is applied to the power terminals because
  - depending on the device – the power terminals U, V, W, Rb1, Rb2, T1 and T2 remain live for at least 3 minutes after disconnecting the mains.
  - the power terminals L1, L2, L3; U, V, W, Rb1, Rb2, T1 and T2 remain live when the motor is stopped.

##### Device protection

- ▶ Only connect/disconnect all pluggable terminals in deenergised condition!
- ▶ Only disconnect the inverters from the installation, e.g. from the motor or mounting wall, in deenergised condition!





##### Motor protection

- ▶ With some settings of the controller, the connected motor can be overheated.
  - E.g. longer operation of the DC injection brake.
  - Longer operation of self-ventilated motors at low speed.
  - Wrong frequency or voltage settings in the motor parameters (especially with 120 Hz motors).

##### Protection of the machine/system

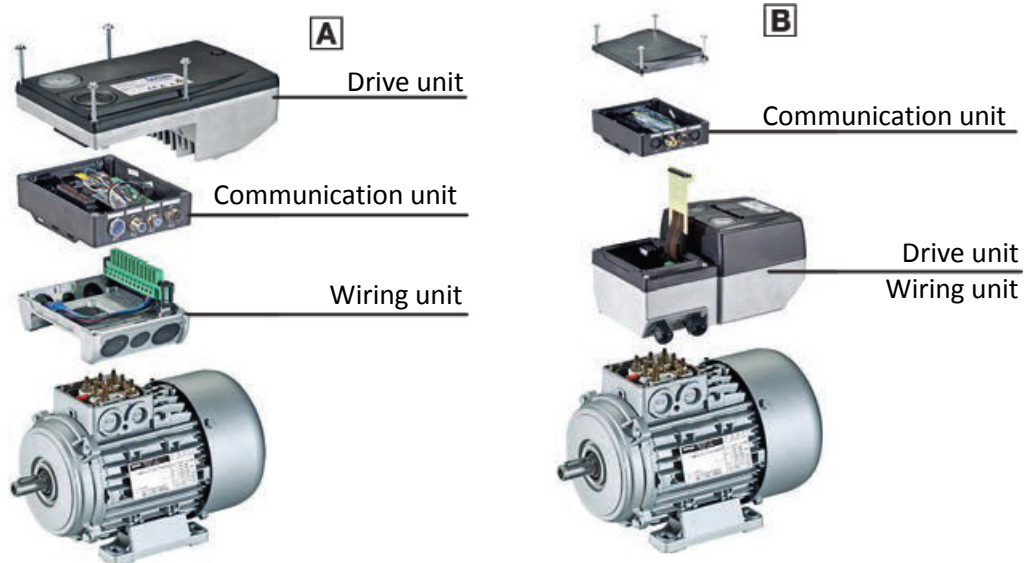
- ▶ Drives can reach dangerous overspeeds (e.g. setting of high output frequencies in connection with motors and machines unsuitable for such conditions):
  - The AC drives do not offer any protection against such operating conditions. Use additional components for this purpose.

##### Warning by symbols

Icon	Description
	Long discharge time: All power terminals remain live for up to 3 minutes after mains disconnection!
	High leakage current: Carry out fixed installation and PE connection in accordance with EN 61800-5-1!
	Electrostatic sensitive devices: Before working on the device, the staff must ensure to be free of electrostatic charge!
	Hot surface: Use personal protective equipment or wait until devices have cooled down!

### 3 Product description

#### 3.1 System overview



**A** Emotron CDN40 0.75 ... 4.0 kW

**B** Emotron CDN40 5.5 ... 7.5 kW

## 3.2 Device features

## General features

- ▶ Compact motor inverter
- ▶ Modular design
- ▶ Scalable fieldbus communication (optional)
- ▶ On site diagnostics per status LEDs
- ▶ I/O accessories (optional)
- ▶ Pluggable memory module

## Functional features

Features	Version
Power range	0.75 ... 7.5 kW
Fieldbus communication (optional)	– CANopen
Integrated interference suppression according to EN 61800-3	✓
Flying restart circuit	✓
Operating modes	– VFCplus: V/f open loop control, linear and quadratic – SLVC: sensorless vector control (torque/speed) – VFC eco (energy-saving function)
S-shaped ramps for almost jerk-free acceleration and deceleration	✓
Fixed frequencies	3
Overload current	200 % (3 s)
IT system usability	
Incremental encoder evaluation	Two-track, 10 kHz
Outputs	Optional: 1 digital output 1 potential-free relay contact, 2 A, NO contact
DC-injection braking	✓
Mounting	Motor mounting

### 3.3 Identification

Due to the modular design of the Emotron CDN AC drives, every unit has an own nameplate.

The nameplate shows the type designation of the respective unit. The type designation serves to exactly identify a unit.

Type designation

Type: CDN40-8P7-65										
Input		IEC	UL	Output		IEC	UL	Version	HW: 1A	
	3/PE AC	400V	480V		3/PE AC	0-400V	0-480V		SW: 09.01	
	ND	8.6A	7.2A		4kW	8.7A	7.3A			
	HD	7.2A	5.9A	3kW	7.3A	6.0A				
		50Hz	60Hz			0-300 Hz				
12345678 10000000000000					PN:		CDN408P7 R01		E254612	

#### Note

Via the type designation, detailed device properties can be identified using the following type code. The list containing the type code, features, and device properties does not take any restrictions with regard to possible combinations into consideration.

## 3 Product description

### Product key

#### 3.4 Product key

Due to the modular structure of the Emotron CDN AC drive, every unit needs an own part number. Although a part number is also defined for the Emotron CDN AC drive as a set, for practical and logistical reasons it cannot be fixed visibly on the set or on the individual units.

The following lists inform you about the part number for:

- ▶ **Wiring Unit**  
Wiring level to the motor and mains connection
- ▶ **Communication Unit**  
Connection level for fieldbus communication and further inputs and outputs, partially optional
- ▶ **Drive Unit**  
Emotron CDN AC drive
- ▶ **Accessories**  
Efficiency-enhancing and cost-cutting

#### 3.4.1 Wiring Unit

Module part  
Wiring Unit -Emotron CDN

Type	P/n	Motor size	Used with Drive unit
CDN-WU-Size 1	01-6360-01	1 = 63 / 71	Frame size 1
CDN-WU-Size 2	01-6360-02	2 = 80 / 090 / 100	Frame size 1
CDN-WU-Size 3	01-6360-03	3 = 80 / 90 / 100 / 112	Frame size 2
CDN-WU-Size 4	01-6360-04	4 = 80 / 90 / 100 / 112	Frame size 3
CDN-WU-Size 5	01-6360-05	5 = 132	Frame size 3

Enclosure  
IP66



### 3.4.2 Communication Unit

Module part  
Communication Unit - Emotron CDN

Type	P/n	Description
CDN-COM-Std IO	01-6361-00	Standard I/O
CDN-COM-Ext IO	01-6361-01	Extended I/O
CDN-COM-CANbus	01-6361-02	CANopen + Standard I/O

Connection system I/O modules/fieldbus  
Standard I/O, extended I/O: terminal

Type of protection  
IP65

### 3.4.3 Drive Unit

Module part  
Drive Unit - Emotron CDN

Type	P/n	Rated output current, Normal duty (120%)		Drive unit frame size
		In @ 400V (A)	In @ 480V (A)	
CDN40-2P2-65	CDN402P2	2.2	2.1	1
CDN40-3P8-65	CDN403P8	3.8	3.7	1
CDN40-4P8-65	CDN404P8	4.8	4.5	1
CDN40-7P0-65	CDN407P0	7.0	5.6	2
CDN40-8P7-65	CDN408P7	8.7	7.3	2
CDN40-012-65	CDN40012	11.6	9.5	3
CDN40-016-65	CDN40016	15.6	13.0	3

Current e.g.  
012 = 12 Amp

Voltage class  
40 = 400/480 V, 3/PE AC (also for IT systems)

Type of protection  
IP65

#### 3.5 Overview of control terminals

The control terminals of the Emotron CDN AC drives are always located in the Communication Unit.

The type of fieldbus version, power class of the inverter, or motor frame size have no influence on the availability of the device versions.

For Emotron CDN AC drive without a fieldbus link, two types of control terminals are available:

- ▶ Standard I/O
- ▶ Extended I/O

For Emotron CDN AC drive with fieldbus link, two types of control terminals are available:

- ▶ With the I/O functions as for the standard I/O, but without an analog input and relay output

Connection options for Communication Unit						
Plugs	Type	Digital input/output			Analog input AI/AU	Relay COM/NO
		RFR (Enable)	DIx	DO1		
01-6361-00	Standard I/O <sup>1)</sup>	1 x	5 x	✓	✓	✓
01-6361-01	Extended I/O <sup>1)</sup>	1 x	8 x	✓	2 x	✓
01-6361-02	CANopen	1 x	5 x	✓	-	-

- ✓ Available
- Not available
- 1) Without a fieldbus link

## 4 Technical data

### 4.1 General data and operating conditions

#### Conformity and approval

Conformity			
CE	2006/95/EC	Low Voltage Directive	
EAC	(TR CU 004/2011)	On safety of low voltage equipment	Eurasian Conformity TR CU: Technical Regulation of Customs
EAC	(TR CU 020/2011)	Electromagnetic compatibility of technical means	Eurasian Conformity TR CU: Technical Regulation of Customs
Approval			
UR	UL 508C	Power Conversion Equipment, File No. E254612	
cUR	C22.2 No 274-13		

#### Protection of persons and equipment

Enclosure		<ul style="list-style-type: none"> <li>Close unused bores for cable glands with blanking plugs!</li> <li>Close unused connectors with protection</li> </ul>	
	EN 60529	Emotron CDN set:	IP65
	NEMA 250	Emotron CDN set: Field Package without switch 0.75 ... 4.0 kW 5.5 ... 7.5 kW	Type 4  Type 1 Type 4X (interior)
(Earth) leakage current	EN 61800-5-1	> 3.5 mA AC, > 10 mA DC	Observe the regulations and safety
Total fault current		In TN systems the following earth-leakage circuit breakers can be used:	
Motor mounting		0.75 ... 4.0 kW	30 mA, type B
		5.5 ... 7.5 kW	30 mA, type B
		5.5 ... 7.5 kW	300 mA, type B

Protection of persons and equipment			
Additional equipotential bonding		M5 thread with terminal in the WU for connection of a 16mm PE cable	
Protective insulation of control circuits	EN 61800-5-1	Safe isolation from mains by double (reinforced) insulation	
Insulation resistance	EN 61800-5-1	Site altitude	
		0 ... 2000 m	Overvoltage category III
		2000 ... 4000 m	Overvoltage category II
Short-circuit strength	EN 61800-5-1	Connection:	
		Motor	To a limited extent, the controller is inhibited, error acknowledgement required
		Motor holding brake, brake resistor	No
		PTC, control terminals	Full
Earth-fault strength	EN 61800-5-1	Connection:	
		Motor (at controller enable)	To a limited extent, the controller is inhibited, error acknowledgement required
		Motor (during operation)	No
		Brake resistor, PTC	No
Protective measures against		<ul style="list-style-type: none"> <li>Short circuit on the motor side at switch-on and during operation</li> <li>Motor stalling</li> <li>Motor overtemperature               <ul style="list-style-type: none"> <li>Input for PTC or thermal contact</li> <li>I<sup>2</sup>t monitoring</li> </ul> </li> </ul>	
Cyclic mains switching		• Switchings/minute	3
		• Switchings/hour	Max. 20
		• Switching pause	After switching the mains 3 times in one minute, there must be a switching pause of 9 minutes.
Starting current		2 x I <sub>N</sub>	
Supply conditions			
Mains connection			
Power system			
TT, TN (with an earthed neutral)		Operation permitted without restrictions.	
IT		Implement the measure described for IT systems (remove IT screw). The machine/system manufacturer is responsible for compliance with EMC requirements for noise emission (EN 61800-3) for the machine/plant! Operation with an integrated safety system is not permissible.	
Motor connection			
Motors	EN 60034	Only use motors suitable for inverter operation. Insulation resistance: at least $\hat{u}$ 1.5 kV, at least du/dt 5 kV/ s	
Length of the motor cable		< 20 m (Shielded cable)	

Ambient conditions

Climatic

Storage	IEC/EN 60721-3-1	1K3 (-30 ... +60 °C)
Transport	IEC/EN 60721-3-2	2K3 (-30 ... +75 °C)
Operation	IEC/EN 60721-3-3	3K3 (-30 ... +55 °C) Operation at 4 kHz: > +45 °C: Reduce the rated output current by 2.5 %/°C. Operation at 8/16 kHz: > +40 °C: Reduce the rated output current by 2.5 %/°C.
Site altitude		< 4000 m amsl Above 1000 m amsl reduce the rated output current by 5 %/ 1000 m.
Pollution	IEC/EN 61800-5-1	Degree of pollution 2

Mechanical

Vibration resistance (9.81 m/s<sup>2</sup> = 1 g)

Motor mounting	Germanischer Lloyd	General conditions: Acceleration resistant up to 2 g	
	IEC/EN 60721-3-3	3M6	

Mounting conditions

Mounting place

Motor mounting		Standard	
----------------	--	----------	--

EMC			
Noise emission (in TN and TT systems)			
Cable-guided	EN 61800-3		
Motor mounting		0.75 ... 4.0 kW	Category C1
		5.5 ... 7.5 kW	Category C2
Radiation	EN 61800-3	0.75 ... 2.2 kW	Category C1
		3 ... 7.5 kW	Category C2
Noise immunity (according to requirements of EN 61800-3)			
Electrostatic discharge (ESD)	EN 61000-4-2	8 kV with air discharge, 4 kV with contact discharge against housing	
Radio frequency			
Conducted	EN 61000-4-6	150 kHz ... 80 MHz, 10 V/m 80 % AM (1kHz)	
Interference (housing)	EN 61000-4-3	80 MHz ... 1000 MHz, 10 V/m 80 % AM (1kHz)	
Burst			
Power terminals and interfaces	EN 61000-4-4	2 kV/5 kHz	
Signal interfaces	EN 61000-4-4	1 kV/5 kHz	
Control terminals	EN 61000-4-4	2 kV/5 kHz	
Surge			
Power terminals	EN 61000-4-5	1.2/50 s, 1 kV phase/phase, 2 kV phase/PE	
Control terminals	EN 61000-4-5	1.2/50 s, 1 kV	
Operation on public supply systems	EN 61000-3-2 EN 61000-3-12	The devices are intended for use in an industrial environment. When being used on public network, additional measures must be taken to limit the expected radio interference. The compliance with the requirements for the machine/plant is the responsibility of the manufacturer of the machine or system!	
Voltage deviations			
Voltage dips	EN 61800-3	Short mains voltage dips (comp. IEC 61000-2-1) can lead to a switch-off of the motor.	

Control

- VFCplus:
- V/f control (linear or square-law)
- SLVC:
- Sensorless vector control (speed)
- VFCplus eco:
- V/f control, energetically optimised
- SLPSM:
- Sensorless control for synchronous motors

Switching frequency

4 kHz

Torque behaviour

Maximum torque	1.5 x M <sub>rated</sub> for 60 s 2.0 x M <sub>rated</sub> for 3 s	if rated motor power = rated controller power
Setting range	1 : 10	SLVC: In speed range 3 ... 50 Hz V/f: In speed range 10 ... 50 Hz

Sensorless vector control (speed)

Minimum output frequency	0.5 Hz (0 ... M <sub>rated</sub> )	
Accuracy	± 0,5 %	In a setting range of 3 ... 50 Hz
Smooth running	± 0.1 Hz	

Output frequency

Range	-300 Hz ... +300 Hz
Absolute resolution	0.2 Hz
Standardised resolution	Parameter data: 0.01 %, process data: 0.006 % (= 2 <sup>14</sup> )

Digital setpoint selection

Typical accuracy	± 0,01 %
------------------	----------

Analog setpoint selection

Typical accuracy	± 1 %	Based on the final value
------------------	-------	--------------------------

## 4 Technical data

s

### Operation with normal duty at a 400 V mains

#### 4.2 Rated data

##### 4.2.1 Operation with normal duty at a 400 V mains

The overload capacity is limited to 120 %/1 min. Typical applications are pumps with a quadratic load characteristic, or fans.



#### Note!

Operation with normal duty overload is only permitted ...

- ▶ with the rated data specified for the drive unit.
- ▶ within the mains voltage range specified.
- ▶ with the switching frequency 4 kHz.
- ▶ at a max. ambient temperature of 40 °C
- ▶ with the fuses and cable cross-sections specified for this operation.
- ▶ after parameterisation according to the specifications (01-xxxx-yy software manual)

Mains	Voltage $U_{\text{rated}}$ [V]	Voltage range $U_{\text{rated}}$ [V]	Frequency range $f$ [Hz]
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 - 0 % ... 65 + 0 %

Type	Mains current at $I_{\text{rated}}$ $I_{\text{rated}}$ [A]	Output power $U, V, W$ $S_{\text{rated}}$ [kVA]	Motor power 4 pol. ASM $P_{\text{rated}}$ [kW]
CDN40-2P2-65	2.2	1.3	0.75
CDN40-3P8-65	<b>3.8</b>	<b>2.4</b>	<b>1.5</b>
CDN40-4P8-65	4.6	3.0	2.2
CDN40-7P0-65	7.0	4.1	3.0
CDN40-8P7-65	8.6	5.3	4.0
CDN40-012-65	11.3	6.8	5.5
CDN40-016-65	15.3	9.4	7.5



Type	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{rated2}$	$I_{aM2}$	$I_{rated4}$	$I_{aM4}$	$I_{rated8}$	$I_{aM8}$	$I_{rated16}$	$I_{aM16}$
CDN40-2P2-65	-	-	2.2	3.6	-	-	-	-
CDN40-3P8-65	-	-	3.8	6.4	-	-	-	-
CDN40-4P8-65	-	-	4.8	7.8	-	-	-	-
CDN40-7P0-65	-	-	7.0	11.2	-	-	-	-
CDN40-8P7-65	-	-	8.7	14.6	-	-	-	-
CDN40-012-65	-	-	11.6	19.0	-	-	-	-
CDN40-016-65	-	-	15.6	26.0	-	-	-	-

$I_{aNx}$   
 $I_{aMx}$

Rated value of continuous output current  
Maximum output current (overload current)  
• Periodic load change of 3 s with  $I_{aMx}$  and recovery time of 12 s according to the tables under chapter 4.4

#### Fuses and cable cross-sections

The data/recommendations for heavy duty operation on a rated mains voltage 400 V can be applied. (📖 26)

4.2.2 Operation with normal duty on a 480 V system

The overload capacity is limited to 110 %/1 min. Typical applications are pumps with a quadratic loadcharacteristic, or fans.



Note!

Operation with normal duty overload is only permitted ...

- ▶ with the rated data specified for the controller.
- ▶ within the mains voltage range specified.
- ▶ with the switching frequency 4 kHz.
- ▶ at a max. ambient temperature of 40 °C
- ▶ with the fuses and cable cross-sections specified for this operation.
- ▶ after parameterisation according to the specifications (01-xxxx-yy software manual)

Mains	Voltage $U_{Lrated}$ [V]	Voltage range $U_{Lrated}$ [V]	Frequency range f [Hz]
3/PE AC	480	432 - 0 % ... 528 + 0 %	45 - 0 % ... 65 + 0 %

Type	Mains current at $I_{arated}$ $I_{Lrated}$ [A]	Output power U, V, W $S_{arated}$ [kVA]	Motor power 4 pol. ASM $P_{arated}$ [kW]
CDN40-2P2-65	1.8	1.3	0.75
CDN40-3P8-65	3.2	2.4	1.5
CDN40-4P8-65	3.8	3.0	2.2
CDN40-7P0-65	5.6	4.1	3.0
CDN40-8P7-65	7.2	5.3	4.0
CDN40-012-65	9.3	6.8	5.5
CDN40-016-65	12.8	9.4	7.5

Type	Output currents [A] at switching frequency							
	2 kHz		4 kHz		8 kHz		16 kHz	
	$I_{arated2}$	$I_{aM2}$	$I_{arated4}$	$I_{aM4}$	$I_{arated8}$	$I_{aM8}$	$I_{arated16}$	$I_{aM16}$
CDN40-2P2-65	-	-	2.1	3.6	-	-	-	-
CDN40-3P8-65	-	-	3.7	6.4	-	-	-	-
CDN40-4P8-65	-	-	4.5	7.8	-	-	-	-
CDN40-7P0-65	-	-	5.6	11.2	-	-	-	-
CDN40-8P7-65	-	-	7.3	14.6	-	-	-	-
CDN40-012-65	-	-	9.5	19.0	-	-	-	-
CDN40-016-65	-	-	13.0	26.0	-	-	-	-

$I_{aNx}$   
 $I_{aMx}$

Rated value of continuous output current  
Maximum output current (overload current)  
• Periodic load change of 3 s with  $I_{aMx}$  and recovery time of 12 s according to the tables under chapter 4.4

## 4.2.3 Overviewn with heavy duty operation

## Input data

Mains	Voltage $U_{Lrated}$ [V]	Voltage range $U_{Lrated}$ [V]	Frequency range f [Hz]
3/PE AC	400	320 - 0 % ... 440 + 0 %	45 - 0 % ... 65 + 0 %
3/PE AC	480	432 - 0 % ... 528 + 0 %	45 - 0 % ... 65 + 0 %

	Voltage [V]	Frequency [Hz]	Heavy Duty Rated current [A]		Number of phases
			up to +45 °C	up to +55 °C	
CDN40-2P2-65	400/480	50/60	1.8/1.5	1.4/1.1	3
CDN40-3P8-65	400/480	50/60	3.2/2.7	2.4/2.0	3
CDN40-4P8-65	400/480	50/60	3.8/3.1	2.9/2.3	3
CDN40-7P0-65	400/480	50/60	5.6/4.6	4.2/3.5	3
CDN40-8P7-65	400/480	50/60	7.2/5.9	5.4/4.4	3
CDN40-012-65	400/480	50/60	9.3/7.7	7.0/5.8	3
CDN40-016-65	400/480	50/60	12.8/10.6	9.6/8.0	3

Ambient temperature, switching frequency 4 kHz

## Output data

	Voltage [V]	Frequency [Hz]	Heavy Duty Rated current [A]		Number of phases
			up to +45 °C	up to +55 °C	
CDN40-2P2-65	0 ... 400/480	0 ... 300	1.8/1.5	1.4/1.1	3
CDN40-3P8-65	0 ... 400/480	0 ... 300	3.2/2.7	2.4/2.0	3
CDN40-4P8-65	0 ... 400/480	0 ... 300	3.9/3.2	2.9/2.4	3
CDN40-7P0-65	0 ... 400/480	0 ... 300	5.6/4.7	4.2/3.5	3
CDN40-8P7-65	0 ... 400/480	0 ... 300	7.3/6.0	5.4/4.5	3
CDN40-012-65	0 ... 400/480	0 ... 300	9.5/7.9	7.1/5.9	3
CDN40-016-65	0 ... 400/480	0 ... 300	13.0/10.8	9.8/8.1	3

Ambient temperature, switching frequency 4 kHz

 **Note!**

The maximally possible output voltage is approx. 94 % of the mains voltage.

Power losses

Type	Power loss $P_V$ [W]	
	when operating with rated output current $I_{rated}$	when controller is inhibited
CDN40-2P2-65	33	9
CDN40-3P8-65	52	9
CDN40-4P8-65	61	9
CDN40-7P0-65	88	10
CDN40-8P7-65	111	10
CDN40-012-65	140	11
CDN40-016-65	185	11

## 4.2.4 Operation at rated mains voltage 400 V – Heavy duty

Mains	Voltage $U_{Lrated}$ [V]	Voltage range $U_{Lrated}$ [V]	Frequency range f [Hz]
3/PE AC	400	320 – 0 % ... 440 + 0 %	45 – 0 % ... 65 + 0 %

Type	Mains current at $I_{rated}$ $I_{rated}$ [A]	Output power U, V, W $S_{rated}$ [kVA]	Motor power 4 pol. ASM $P_{rated}$ [kW]
CDN40-2P2-65	1.8	1.1	0.55
CDN40-3P8-65	3.2	2.0	1.1
CDN40-4P8-65	3.8	2.4	1.5
CDN40-7P0-65	5.6	3.4	2.2
CDN40-8P7-65	7.2	4.4	3.0
CDN40-012-65	9.3	5.7	4.0
CDN40-016-65	12.8	7.8	5.5

Type	Output currents [A] at switching frequency Heavy duty			
	2 kHz		4 kHz	
	$I_{rated2}$	$I_{aM2}$	$I_{rated4}$	$I_{aM4}$
CDN40-2P2-65	-	-	1.8	3.6
CDN40-3P8-65	-	-	3.2	6.4
CDN40-4P8-65	-	-	3.9	7.8
CDN40-7P0-65	-	-	5.6	11.2
CDN40-8P7-65	-	-	7.3	14.6
CDN40-012-65	-	-	9.5	19.0
CDN40-016-65	-	-	13.0	26.0

 $I_{aNx}$  $I_{aMx}$ 

Rated value of continuous output current

Maximum output current (overload current)

- Periodic load change of 3 s with  $I_{aMx}$  and recovery time of 12 s according to the tables under chapter 4.4

Depending on the ambient temperature, it may be required to reduce the output current (chapter 4.1, operating conditions).

Fuses and cable cross-sections

► Point-to-point connection – direct wiring of the mains voltage – typical fusing

Operation								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 – laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
CDN40-2P2-65	C 16	16	2.5	-	-	15	12	30
CDN40-3P8-65	C 16	16	2.5	-	-	15	12	30
CDN40-4P8-65	C 16	16	2.5	-	-	15	12	30
CDN40-7P0-65	C 16	16	2.5	-	-	15	12	30
CDN40-8P7-65	C 16	16	2.5	-	-	15	12	30
CDN40-012-65	C20	20	4.0	-	-	20	12	30
CDN40-016-65	C20	20	4.0	-	-	20	12	30

► Multiple connection – loop-through connection of the mains voltage – maximum fusing

Operation								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to UL <sup>2)</sup>		FI <sup>3)</sup> [mA]
	①	②	L1, L2, L3 – laying system			③	L1, L2, L3	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]	[A]	[AWG]	
CDN40-2P2-65	C 32	32	6.0	-	-	15	12	30
CDN40-3P8-65	C 32	32	6.0	-	-	15	12	30
CDN40-4P8-65	C 32	32	6.0	-	-	15	12	30
CDN40-7P0-65	C 32	32	6.0	-	-	25	10	30
CDN40-8P7-65	C 32	32	6.0	-	-	25	10	30
CDN40-012-65	C 50	50	16.0	-	-	50	6	30
CDN40-016-65	C 50	50	16.0	-	-	50	6	30

1) The data are recommendations. Other designs/laying systems can be implemented (e.g. in accordance with VDE0298-4). The cable cross-sections apply under the following conditions: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 45°C, no bundling of cables or cores, three loaded cores.

2) Only use UL-approved cables, fuses and fuse holders.  
UL fuse: voltage 500 V, tripping characteristic for instance "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45°C.

3) Universal-current sensitive earth-leakage circuit breaker, short-time delayed

① Circuit breaker

② Fuse of gG/gL utilisation category or semiconductor fuses of gRL utilisation category

③ Fuse

Observe national and regional regulations

### 4.2.5 Operation with rated mains voltage 480 V – Heavy duty

Mains	Voltage $U_{Lrated}$ [V]	Voltage range $U_{Lrated}$ [V]	Frequency range $f$ [Hz]
3/PE AC	480	432 – 0 % ... 528 + 0 %	45 – 0 % ... 65 + 0 %

Type	Mains current at $I_{rated}$ $I_{Lrated}$ [A]	Output power $U, V, W$ $S_{rated}$ [kVA]	Motor power 4 pol. ASM $P_{rated}$ [kW]
CDN40-2P2-65	1.5	1.1	0.55
CDN40-3P8-65	2.7	2.1	1.1
CDN40-4P8-65	3.1	2.4	1.5
CDN40-7P0-65	4.6	3.5	2.2
CDN40-8P7-65	5.9	4.5	3.0
CDN40-012-65	7.7	5.7	4.0
CDN40-016-65	10.6	7.9	5.5

Type	Output currents [A] at switching frequency			
	2 kHz		4 kHz	
	$I_{rated2}$	$I_{aM2}$	$I_{rated4}$	$I_{aM4}$
CDN40-2P2-65	-	-	1.5	3.0
CDN40-3P8-65	-	-	2.7	5.4
CDN40-4P8-65	-	-	3.2	6.4
CDN40-7P0-65	-	-	4.7	9.4
CDN40-8P7-65	-	-	6.0	12.0
CDN40-012-65	-	-	7.9	15.8
CDN40-016-65	-	-	10.8	21.6

$I_{aNx}$   
 $I_{aMx}$

Rated value of continuous output current  
Maximum output current (overload current)

- Periodic load change of 3 s with  $I_{aMx}$  and recovery time of 12 s according to the tables under chapter 4.4

Depending on the ambient temperature, it may be required to reduce the output current (chapter 4.1, operating conditions).



Fuses and cable cross-sections

► Point-to-point connection – direct wiring of the mains voltage – typical fusing

Operation								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to L1, L2, L3		FI <sup>3)</sup> [mA]
	L1, L2, L3 – laying system					[A]	[AWG]	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]			
CDN40-2P2-65	C 16	16	2.5	-	-	15	12	30
CDN40-3P8-65	C 16	16	2.5	-	-	15	12	30
CDN40-4P8-65	C 16	16	2.5	-	-	15	12	30
CDN40-7P0-65	C 16	16	2.5	-	-	15	12	30
CDN40-8P7-65	C 16	16	2.5	-	-	15	12	30
CDN40-012-65	C20	20	4.0	-	-	20	12	30
CDN40-016-65	C20	20	4.0	-	-	20	12	30

► Multiple connection – loop-through connection of the mains voltage – maximum fusing

Operation								
Type	Installation according to EN 60204-1 <sup>1)</sup>					Installation according to L1, L2, L3		FI <sup>3)</sup> [mA]
	L1, L2, L3 – laying system					[A]	[AWG]	
	[A]	[A]	B2 [mm <sup>2</sup> ]	C [mm <sup>2</sup> ]	F [mm <sup>2</sup> ]			
CDN40-2P2-65	C 32	32	6.0	-	-	15	12	30
CDN40-3P8-65	C 32	32	6.0	-	-	15	12	30
CDN40-4P8-65	C 32	32	6.0	-	-	15	12	30
CDN40-7P0-65	C 32	32	6.0	-	-	25	10	30
CDN40-8P7-65	C 32	32	6.0	-	-	25	10	30
CDN40-012-65	C 50	50	16.0	-	-	50	6	30
CDN40-016-65	C 50	50	16.0	-	-	50	6	30

1) The data are recommendations. Other designs/laying systems can be implemented (e.g. in accordance with VDE0298-4). The cable cross-sections apply under the following conditions: Use of PVC-insulated copper cables, conductor temperature < 70 °C, ambient temperature < 45°C, no bundling of cables or cores, three loaded cores.

2) Only use UL-approved cables, fuses and fuse holders.  
UL fuse: voltage 500 V, tripping characteristic for instance "CC". The cable cross-sections apply under the following conditions: conductor temperature < 75 °C, ambient temperature < 45°C.

3) Universal-current sensitive earth-leakage circuit breaker, short-time delayed Circuit breaker  
Fuse of gG/gL utilisation category or semiconductor fuses of gRL utilisation category  
Fuse

Observe national and regional regulations

4.3 Overcurrent operation

If the device utilisation  $I_{xt}$  exceeds the threshold set (C00064/1, Default setting = 100 %), the monitoring function triggers an error response and sets the controller to the "Fault" device status. To exit the device status, the error must be reset ("acknowledged") explicitly.

The curves of typical load functions and the simulation of the " $I_{xt}$ " function are shown in the following illustration:

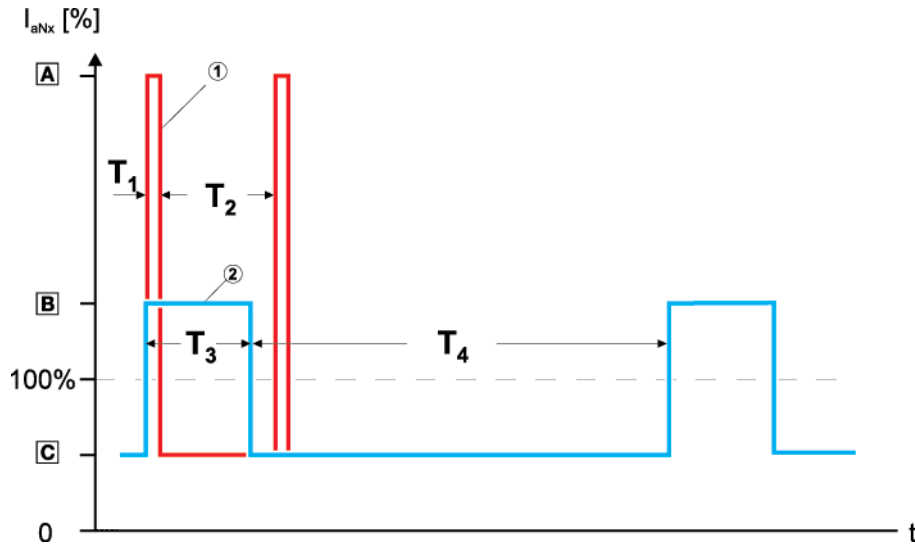


Fig. 4-1 Overcurrent capacity at 45° C

- ① Pulse utilisation (15 s cycle)
  - Ⓐ Peak current
  - Ⓒ Unloading current
  - T<sub>1</sub> Peak current period
  - T<sub>2</sub> Unloading current period
- ② Permanent load (180 s cycle)
  - Ⓑ Peak current
  - Ⓒ Unloading current
  - T<sub>3</sub> Peak current period
  - T<sub>4</sub> Unloading current period
- I<sub>aNx</sub> Rated value of continuous output current

Calculation for pulse utilization

Output frequency >5 Hz CDN40-2P2 – 40-016 (0.75 – 7.5 kW)	Output frequency <5 Hz	
	CDN40-2P2 – 40-4P8 (0.75 – 1.8 kW)	CDN40-7P0 – 40-016 (2.2 – 7.5 kW)
$\frac{A \cdot T_1 + C \cdot T_2}{T_1 + T_2} \leq 100\%$	$\frac{A \cdot T_1 + C \cdot T_2}{T_1 + T_2} \leq 75\%$	$\frac{A \cdot T_1 + C \cdot T_2}{T_1 + T_2} \leq 50\%$

Calculation for permanent utilisation

Output frequency >5 Hz CDN40-2P2 – 40-016 (0.75 – 7.5 kW)	Output frequency <5 Hz	
	CDN40-2P2 – 40-4P8 (0.75 – 1.8 kW)	CDN40-7P0 – 40-016 (2.2 – 7.5 kW)
$\frac{B \cdot T_3 + C \cdot T_4}{T_3 + T_4} \leq 100\%$	$\frac{B \cdot T_3 + C \cdot T_4}{T_3 + T_4} \leq 75\%$	$\frac{B \cdot T_3 + C \cdot T_4}{T_3 + T_4} \leq 50\%$

Type	$I_{amax}/I_{aN8}$ [%] in 15-s cycle			
	f = 2 kHz		f = 4 kHz	
	<b>A</b>	<b>B</b>	<b>A</b>	<b>B</b>
CDN40-2P2-65	-	-	200	75
CDN40-3P8-65				
CDN40-4P8-65				
CDN40-7P0-65				
CDN40-8P7-65				
CDN40-012-65				
CDN40-016-65				

Type	$I_{amax}/I_{aN8}$ [%] in 180-s cycle			
	f = 2 kHz		f = 4 kHz	
	<b>C</b>	<b>D</b>	<b>C</b>	<b>D</b>
CDN40-2P2-65	-	-	150	75
CDN40-3P8-65				
CDN40-4P8-65				
CDN40-7P0-65				
CDN40-8P7-65				
CDN40-012-65				
CDN40-016-65				




**Tip!**

For calculations of application-specific cycles please contact your CG contact person.

4.4 Switching frequency reduction

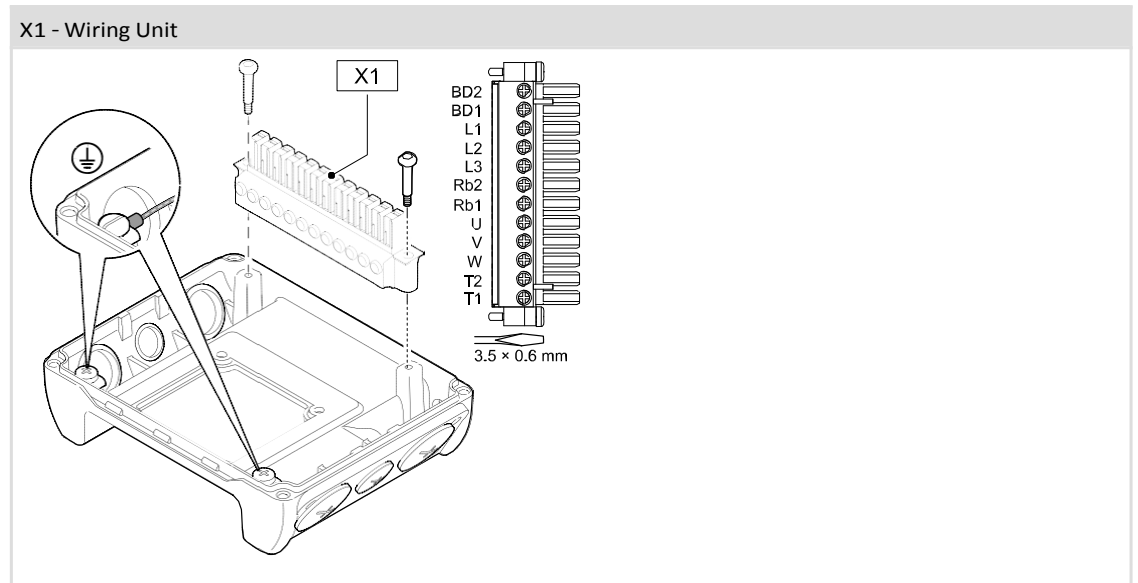
Under certain operating conditions, the maximum output current is limited for all devices:

- ▶ If the heatsink temperature increases above 105 °C, the controller is inhibited and the error message "OH1: Heatsink overtemperature" is output.  
The error response is also triggered when the switching frequency reduction is deactivated.


 NOTE: Normal duty only 4 kHz setting allowed

4.5 Power terminals

4.5.1 Emotron CDN40-2P2 – 40-8P7 (0.75 ... 4 Kw)




Mains

Terminal data				
Name	Power	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
X1				
L1, L2, L3	0.75 ... 2.2 kW	1 ... 4 18 ... 10	0.5 4.4	3.5 x 0.6
		2 x 0.5 ... 2 x 2.5 <sup>1)</sup> 18 ... 10		
	3.0 ... 4.0 kW	1 ... 6 18 ... 8	0.8 7.0	3.5 x 0.6
		2 x 0.5 ... 2 x 2.5 <sup>1)</sup> 18 ... 8		
PE	0.75 ... 2.2 kW	1 ... 4 18 ... 10	1.7 16	8 x 1.2
	3.0 ... 4.0 kW	1 ... 6 18 ... 8	1.7 16	8 x 1.2

<sup>1)</sup> For looping-through connections (daisy chain) => two conductors with TWIN wire end ferrule

Features		
Name	Description	Rated value
X1		
L1, L2, L3	Mains phases	See rated data

## Motor

Terminal data				
Name	Power	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
X1				
U, V, W	0.75 ... 2.2 kW	1 ... 4 18 ... 10	0.5 4.4	3.5 x 0.6
	3.0 ... 4.0 kW	1 ... 6 18 ... 8	0.8 7.0	
PE	0.75 ... 2.2 kW	1 ... 4 18 ... 10	1.7 16	8 x 1.2
	3.0 ... 4.0 kW	1 ... 6 18 ... 8	1.7 16	

Features		
Name	Description	Rated value
X1		
U, V, W	Motor phases	See rated data

## Motor temperature monitoring

**Danger!****Hazardous electrical voltage**


Terminals T1, T2 are on DC-bus voltage potential.

Possible consequences:

- ▶ Death or severe injuries when touching the power terminals.

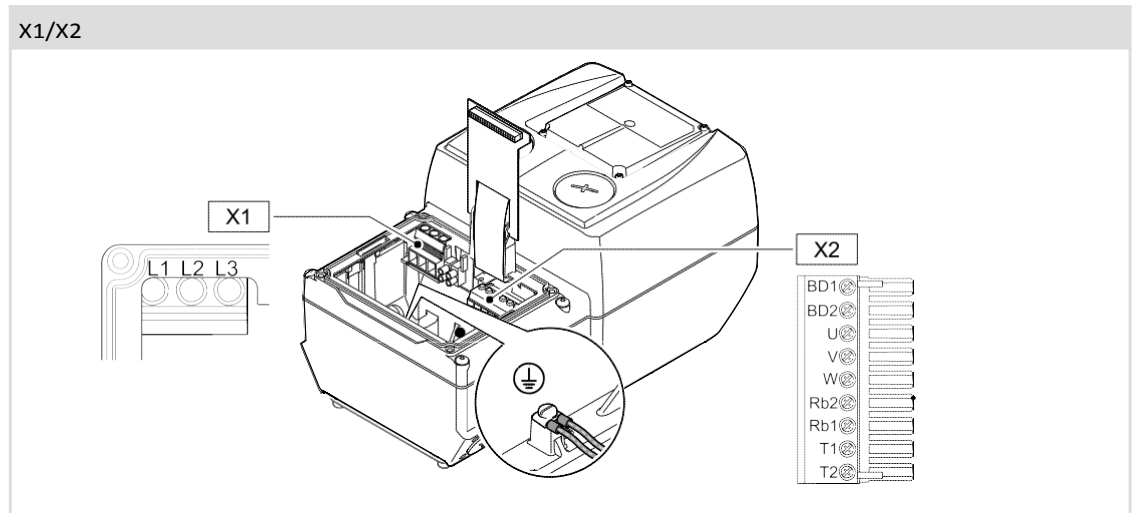
**Protective measures:**

- ▶ Before working on the terminals, disconnect mains and wait for at least 3 minutes.
- ▶ Check whether the terminals are deenergized.


Terminal data				
Name	Power	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
X1				
T1, T2	0.75 ... 2.2 kW	1.5 16	0.5 4.4	3.5 x 0.6
	2.0 ... 4.0 kW	1 ... 6 18 ... 8	0.8 7.0	

Features		
Name	Description	Rated value
X1		
T1, T2	Motor temperature monitoring	See rated data Danger! Hazardous electrical voltage. • T1 and T2 have DC-bus voltage potential .

4.5.2 Emotron CDN40-012 – 40-016 (5.5 ... 7.5 kW)



Mains


Terminal data				
Name	Power	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
X1				
L1, L2, L3	5.5 ... 7.5 kW	1 ... 16	1.4	PZ 2 5.5 x 10
		18 ... 6		
		2 x 1 ... 2 x 6 <sup>1)</sup>	12	
		18 ... 6		
PE	5.5 ... 7.5 kW	1 ... 16	1.7	8 x 1.2
		18 ... 6	15	

<sup>1)</sup> For looping-through connections (daisy chain) => two conductors with TWIN wire end ferrule

**Note!**  
Terminal X1 is not pluggable.

Features		
Name	Description	Rated value
X1		
L1, L2, L3	Mains phases	See rated data

## Motor

Terminal data				
Name	Power	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
X2				
U, V, W	5.5 ... 7.5 kW	1 ... 6 18 ... 8	0.8 7	PH 1 3.5 x 0.6
PE	5.5 ... 7.5 kW	1 ... 16 18 ... 6	1.7 15	8 x 1.2

Features		
Name	Description	Rated value
X2		
U, V, W	Motor phases	See rated data

## Motor temperature monitoring

**Danger!****Hazardous electrical voltage**


Terminals T1, T2 are on DC-bus voltage potential.

**Possible consequences:**

- ▶ Death or severe injuries when touching the power terminals.

## Protective measures:

- ▶ Before working on the terminals, disconnect mains and wait for at least 3 minutes.
- ▶ Check whether the terminals are deenergised.

Terminal data				
Name	Power	Conductor cross-section [mm <sup>2</sup> ] [AWG]	Tightening torque [Nm] [lb-in]	
X2				
T1, T2	0.75 ... 2.2 kW	1.5 16	0.5 4.4	3.5 x 0.6
	3.0 ... 4.0 kW	1 ... 6 18 ... 8	0.8 7.0	

Features		
Name	Description	Rated value
X2		
T1, T2	Motor temperature monitoring	See rated data <b>Danger! Hazardous electrical voltage.</b> • T1 and T2 have DC-bus voltage potential .



## 4.6 Control terminals

### 4.6.1 Overview

	Controller enable	Digital inputs	Digital output	Relay output	Analog inputs	External 24 V supply
	Number	Number	Number	Number	Number	Number
I/O modules						
Standard I/O	1	5	1	1	1	<b>0</b>
Extended I/O	1	8	1	1	2	<b>0</b>
<b>Fieldbus</b>						
CANopen	1	5	1	0	0	0

## 4.6.2 General data

## General data

Feature	Value/designation
<b>Analog input, voltage</b>	
Value range	0 ... 10 V
Resolution	10 bits
Input resistance	>80 k $\Omega$
Sampling frequency	80 Hz (12 ms)
Accuracy	$\pm 0.1$ V
Electric strength of external voltage	-7 ... +30 V
<b>Analog input, current</b>	
Value range, parameterisable	0.6 ... +20 mA (< 0.6 mA corresponds to 0) 4 ... +20 mA, fail-safe
Resolution	10 bits
Input resistance	250 $\Omega$
Input current in the case of an open circuit	Display "0" (I < 0.6 mA)
Sampling frequency	80 Hz (12 ms)
Typical accuracy	$\pm 0.2$ mA
Electric strength of external voltage	-7 ... +7 V
<b>Digital inputs</b>	
Switching level	PLC (IEC 61131-2)
Max. input current	11 mA
<b>Digital outputs</b>	
Switching level	PLC (IEC 61131-2)
Max. output current	50 mA
<b>Relay</b>	
Contact	NO contact
Connection	AC 250 V, 3 A DC 24 V, 2 A ... 240 V, 0.16 A
<b>24 V supply</b>	
External (24E)	DC input voltage: +19.2 ... +28.8 V For supporting communication when the mains voltage is disconnected
Internal (24O)	DC output voltage, max. 100 mA for inputs/outputs and sensor supply
<b>Interfaces</b>	
Extensions	Fieldbus via Communication Unit
<b>Drive interface</b>	
Encoder input	Via 2 digital inputs, HTL, 2-track, 10 kHz

AS-Interface

Standards and application conditions

Feature		Value/designation
<b>Type of protection</b>		
EN 60529		IP65
Climatic conditions		
Storage (EN60721-3-1)		1K3 (temperature: -30 °C ... +60 °C)
Operation (EN60721-3-3)		3K3 (temperature: -30 °C ... +55 °C)
Transport (EN60721-3-2)		2K3 (temperature: -30 °C ... +75 °C)
Insulation voltage to PE reference earth		
EN 61800-5-1	U <sub>AC</sub>	50.0 V

CANopen®

4.6.3

CANopen®

Feature		Value/designation
<b>Communication</b>		
Communication profile		CANopen, DS301 V4.02
Medium		DIN ISO 11898
<b>Baud rate</b>	b	20 kbps 50 kbps 125 kbps 250 kbps 500 kbps 800 kbps 1000 kbps
<b>Network topology</b>		Line with 120 Ohm terminating resistor on both sides
<b>Nodes</b>		Slave Multi master
<b>Number of nodes</b>		63
<b>Number of logic process data channels</b>		2 transmit PDOs and 2 receive PDOs (with 1 ... 8 bytes each)
<b>Number of logic parameter data channels</b>		Max. 2 server SDO channels (with 1 ... 8 bytes)
<b>Max. cable length</b>	I <sub>max</sub>	17 m with 1000 kbps 40 m with 800 kbps 110 m with 500 kbps 290 m with 250 kbps 630 m with 125 kbps 1500 m with 50 kbps 3900 m with 20 kbps 8000 m with 10 kbps
<b>Rated voltage</b>	U <sub>rated</sub> ,DC	24.0 V

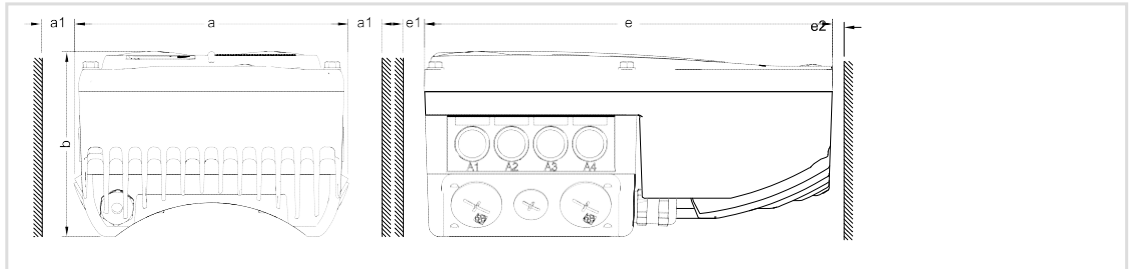
## 4 Technical data

### Dimensions

#### Standard motor mounting

#### 4.7 Dimensions

##### 4.7.1 Standard motor mounting



Dimensions – standard motor mounting [mm]

Type	a	b	e	a1	e1	e2	m [kg] <sup>2)</sup>
CDN40-2P2-65	161	109	2461	75 (20 <sup>1)</sup> )	50	100	2.6
CDN40-3P8-65							
CDN40-4P8-65							
CDN40-7P0-65	176	135	261	75 (20 <sup>1)</sup> )	50	100	3.5
CDN40-8P7-65							
CDN40-012-65	195	176	325	70 (15 <sup>1)</sup> )	50	100	5.3
CDN40-016-65							

<sup>1)</sup> Reduction possible if no free space for plugs or cable glands is required.

<sup>2)</sup> For the Standard I/O design, without cable glands

## 5 Installation

### 5.1 Important notes



#### **Danger!**

##### **Dangerous electrical voltage**

All power terminals remain live for up to three minutes after mains disconnection.

##### **Possible consequences:**

- ▶ Death or severe injuries when touching the power terminals.

Protective measures:

- ▶ Switch off the power supply and wait for at least three minutes before working on the power terminals.
- ▶ Make sure that all power terminals are deenergised.



#### **Danger!**

##### **Hazardous electrical voltage**

The leakage current to earth (PE) is > 3.5 mA AC or > 10 mA DC.

##### **Possible consequences:**

- ▶ Death or severe injuries when touching the device in the event of an error.

##### **Protective measures:**

Implement the measures required in EN 61800-5-1. Especially:

- ▶ Fixed installation
  - Implement PE connection in compliance with standards.
  - Connect PE conductor twice or PE conductor cross-section  $\geq 10 \text{ mm}^2$ .
- ▶ Connection with a connector for industrial applications according to IEC 60309 (CEE):
  - PE conductor cross-section  $\geq 2.5 \text{ mm}^2$  as part of a multi-core supply cable.
  - Provide for suitable strain relief.



#### **Danger!**

##### **Hazardous electrical voltage**

Terminals T1, T2 are on DC-bus voltage potential.

##### **Possible consequences:**

- ▶ Death or severe injuries when touching the power terminals.

##### **Protective measures:**

- ▶ Before working on the terminals, disconnect mains and wait for at least 3 minutes.
- ▶ Check whether the terminals are deenergised.

**Stop!****No device protection if the mains voltage is too high**

The mains input is not internally fused.

**Possible consequences:**

- ▶ Destruction of the device if the mains voltage is too high.

**Protective measures:**

- ▶ Observe the maximally permissible mains voltage.
- ▶ Fuse the device correctly on the supply side against mains fluctuations and voltage peaks.

**Stop!**

The device contains components that can be destroyed by electrostatic discharge!

Before working on the device, the personnel must ensure that they are free of electrostatic charge by using appropriate measures.

**Stop!****Damage of the device**

Mounting or dismounting of the controller, especially the Drive Unit can damage or destroy the device.

**Possible consequences:**

- ▶ The drive may respond in an uncontrolled manner and cause further damages.

**Protective measures:**

- ▶ Only mount or dismount the controller in deenergised status.

**Stop!****Pluggable terminal strips or plug connections**

Plugging or removing the terminal strips or plug connections during operation may cause high voltages and arcing.

**Possible consequences:**

- ▶ Damage of the devices

**Protective measures:**

- ▶ Switch off device.
- ▶ Only plug or remove the terminal strips or plug connections in deenergised status.



## **Stop!**

### **Overvoltage at components:**

In case of an earth fault in IT systems, intolerable overvoltages may occur in the plant.

### **Possible consequences:**

Destruction of the device.

### **Protective measures:**

Before using the controller in the IT system, remove the contact screws on the supply side and the motor side. (📖 5.4).

Original – English

**Warnings!**

- ▶ These devices are suitable for field wiring.
- ▶ Intended for use with 75 °C wire.
- ▶ Intended for use with copper conductors only.
- ▶ Suitable for use in a surrounding air temperature of 45 °C, and – additionally 60 °C when de-rating rules are followed.
- ▶ Hot surface. Risk of burn.
- ▶ Should this device be mounted on a motor, the combination needs to be suitable for the type rating.
- ▶ The supply terminals are to be tightened to:
  - For model suffix's 0.75 – 2.2 kW tighten to 4.4 – 5.3 lb-in.
  - For model suffix's 3.0 – 4 kW, tighten to 7 lb-in.
- ▶ These devices are suitable for use on a circuit capable of delivering not more than 200 000 rms Symmetrical Amperes, 480 V maximum
  - When protected by CC, R, T, or J class fuses or
  - When protected by a circuit breaker having an interrupting rating not less than 200 000 rms symmetrical amperes, 480 V maximum.
- ▶ Use fuses and circuit breakers only.
- ▶ Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
- ▶ The opening of branch circuit protective devices may be an indication that a fault current has been interrupted. To reduce the risk of fire or electric shock, current carrying parts and other components, the controller should be examined and replaced if damaged.
- ▶ These devices provide overload protection rated for 125 % of the rated FLA.

**CAUTION!**

- ▶ Risk of electric shock. Please allow 180s for the internal capacitors to discharge.



Original – Français



### **Avertissement !**

- ▶ Ces équipements sont adaptés à un câblage à pied d'oeuvre.
- ▶ Utiliser des conducteurs 75 °C.
- ▶ Utiliser exclusivement des conducteurs en cuivre.
- ▶ Convient à une utilisation à une température ambiante maximale de 45 °C ainsi que
  - 60 °C en cas d'application des règles de réduction de puissance.
- ▶ Température élevée en surface. Risque de brûlure.
- ▶ En cas de montage de l'équipement sur le moteur, la combinaison doit être conforme à la qualification du type.
- ▶ Couples de serrage des bornes réseau:
  - Pour les types contenant le suffixe 0.75 – 2.2 kW: 0,5 à 0,6 Nm.
  - Pour les types contenant le suffixe 3.0 – 4 kW : 0,8 Nm.
- ▶ Convient aux circuits non susceptibles de délivrer plus de 200 000 ampères symétriques eff., maximum 480 V
  - Protection par des fusibles CC de calibre R, T ou J ; ou
  - Protection par disjoncteur à pouvoir de coupure nominal d'au moins 200 000 ampères symétriques eff., maximum 480 V.
- ▶ Utiliser exclusivement des fusibles et des disjoncteurs.
- ▶ La protection statique intégrée n'offre pas la même protection qu'un disjoncteur. Une protection par disjoncteur externe doit être fournie, conformément au National Electrical Code et aux autres dispositions applicables au niveau local.
- ▶ Le déclenchement des dispositifs de protection du circuit de dérivation peut être dû à une coupure qui résulte d'un courant de défaut. Pour limiter le risque d'incendie ou de choc électrique, examiner les pièces porteuses de courant et les autres éléments du contrôleur ; les remplacer s'ils sont endommagés.
- ▶ Ces équipements intègrent une protection contre les surcharges conçue pour se déclencher à 125 % de l'intensité assignée à pleine charge.

#### **ATTENTION !**

- ▶ Risque de choc électrique. Patientez 180 s pour permettre aux condensateurs internes de se décharger.

## 5.3 Installation according to EMC (installation of a CE-typical drive system)

**Design of the cables**

- ▶ It is imperative to comply with the regulations concerning minimum cross-sections of PE conductors. The cross-section of the PE conductor must be at least as large as the cross-section of the power connections.
- ▶ The cables used must comply with the approvals required for the location (e.g. UL).

## 5.3.1 Shielding

**Requirements**

- ▶ The effectiveness of a shielded cable is reached by:
  - Providing a good shield connection through large-surface shield contact.
  - Using only braided shields with low shield resistance made of tin-plated or nickel-plated copper braid.
  - Using braided shields with an overlap rate > 70 % and an overlap angle of 90°.
  - Keeping unshielded cable ends as short as possible.

Use system cables or shielded cables for these connections:

- ▶ Motor
- ▶ Motor temperature monitoring
- ▶ Analog signals (inputs and outputs; single-sided shield connection to the controller)
- ▶ Fieldbus communication (e.g. CANopen,...)

The following connections need not be shielded:

- ▶ Mains
- ▶ 24-V supply
- ▶ Digital signals (inputs and outputs).
  - We recommend to use shielded cables for a cable length from approximately 5 m on or in environments with strong interferences.

**Connection system**

- ▶ Extensively apply shielding directly in the plugs.
- ▶ Apply shielding above EMC cable glands.

Installation according to EMC (installation of a CE-typical drive system)  
Motor cable

### 5.3.2 Motor cable

- ▶ Only use shielded motor cables with braids made of tinned or nickel-plated copper. Shields made of steel braids are not suitable.
  - The overlap rate of the braid must be at least 70 % with an overlap angle of 90 °.
- ▶ The cables used must correspond to the requirements at the location (e.g. EN 60204-1).
- ▶ Extensively apply the shielding in the plug and attach it in a way which ensures electrical conductivity.
- ▶ The motor cable is optimally installed if
  - it is separated from mains cables and control cables,
  - it only crosses mains cables and control cables at right angles,
  - it is not interrupted.
- ▶ If the motor cable must be opened all the same (e.g. due to chokes, contactors, or terminals):
  - The unshielded cable ends may not be longer than 100 mm (depending on the cable cross-section).
  - Install chokes, contactors, terminals etc. spatially separated from other components (with a min. distance of 100 mm).
  - Install the shield of the motor cable directly before and behind the point of separation to the mounting plate with a large surface.
- ▶ Connect the shield with a large surface to PE in the terminal box of the motor at the motor housing.
  - Metal EMC cable glands at the motor terminal box ensure a large surface connection of the shield with the motor housing.

#### Wiring on the motor side



#### **Stop!**

The motor cable is highly susceptible to interference. Therefore you will achieve an optimum wiring on the motor side if you

- ▶ exclusively use shielded and low-capacitance motor cables.
- ▶ do not integrate any further cable into the motor cable (e.g. for blowers etc.).
- ▶ shield the supply cable for temperature monitoring of the motor (PTC or thermostat) and install it separately from the motor cable.

Special conditions allow you to integrate the supply cable for temperature monitoring of the motor into the motor cable



### Danger!

Uncontrolled motor movements can occur

If the motor cable is damaged, a short circuit between the brake control cables and the motor cables can cause motor movements with low torque.

Possible consequences:

- ▶ Personnel in the vicinity of the motor can be injured.

Protective measures:

- ▶ Install motor cable in a protected way (e.g. in a cable duct).

#### 5.3.3

#### Control cables

- ▶ Control cables must be shielded to minimise interference injections.
- ▶ Connect the shield correctly:
  - Connect the shield of digital input and output cables at both ends.
  - Connect the shield of analog input and output cables at one end (at the drive controller).
- ▶ To achieve an optimum shielding effect (in case of very long cables, with high interference) one shield end of analog input and output cables can be connected to PE potential via a capacitor (e.g. 10 nF/250 V) (see sketch).

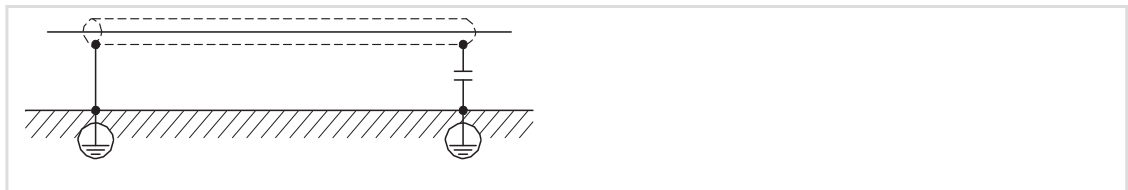


Fig. 5-1 Shielding of long, analog control cables

#### 5.3.4

#### Detecting and eliminating EMC interferences

Fault	Cause	Remedy
Interferences of analog setpoints of your own or other devices and measuring systems	Unshielded motor cable	Use shielded motor cable
	Shield contact is not extensive enough	Carry out optimal shielding as specified
	Shield of the motor cable is interrupted by terminal strips, switched, etc.	<ul style="list-style-type: none"> <li>• Separate components from other component part with a minimum distance of 100 mm</li> <li>• Use motor choke/motor filter</li> </ul>
	Install additional unshielded cables inside the motor cable (e.g. for motor temperature monitoring)	Install and shield additional cables separately
	Too long and unshielded cable ends of the motor cable	Shorten unshielded cable ends to maximally 40 mm

## 5.4 Measures when drive is used in IT systems

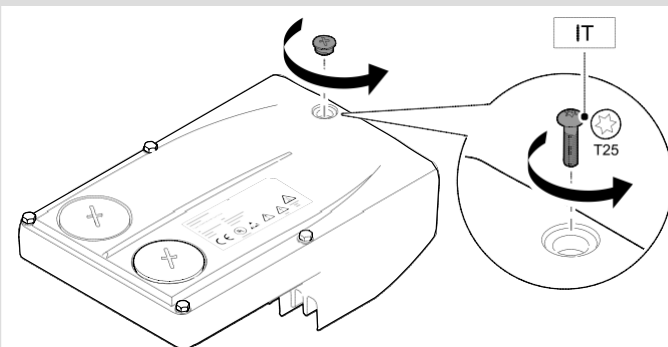
If the drive is mounted within an IT system, internal filters must be separated from the PE conductor.

How to proceed:

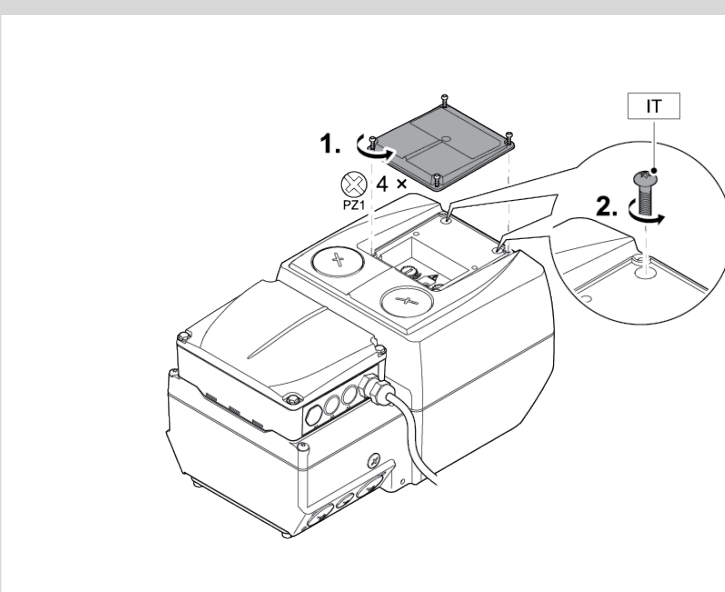
1. If the controller has already been mounted: switch off mains voltage!
2. Make IT screw accessible.
  - Devices up to 4 kW: unscrew small cap on the top.
  - Devices from 5.5 kW: remove small cover on the top.
3. Unscrew and remove the screw(s).
4. Screw the cap on or fit the cover.

IT system

0.37 ... 4 kW



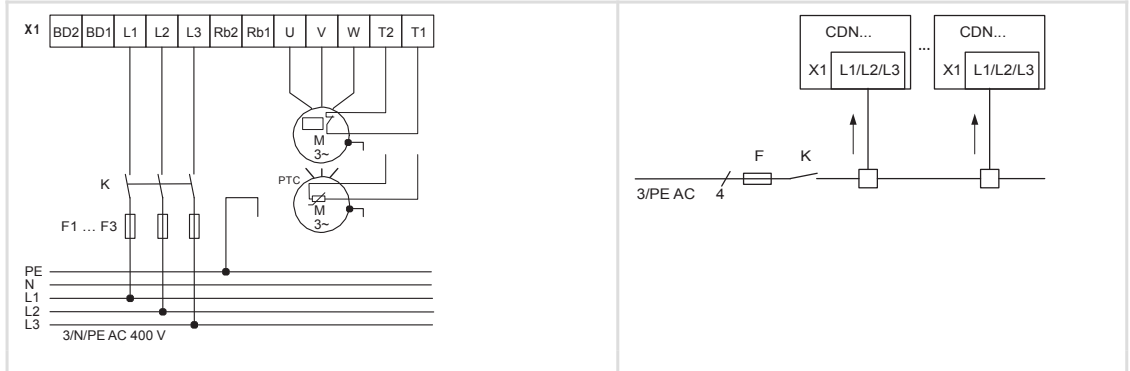
5.5 ... 7.5 kW



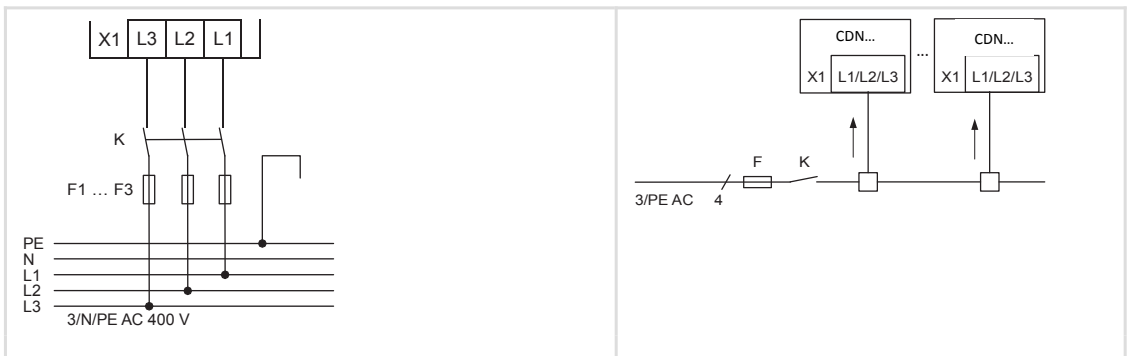
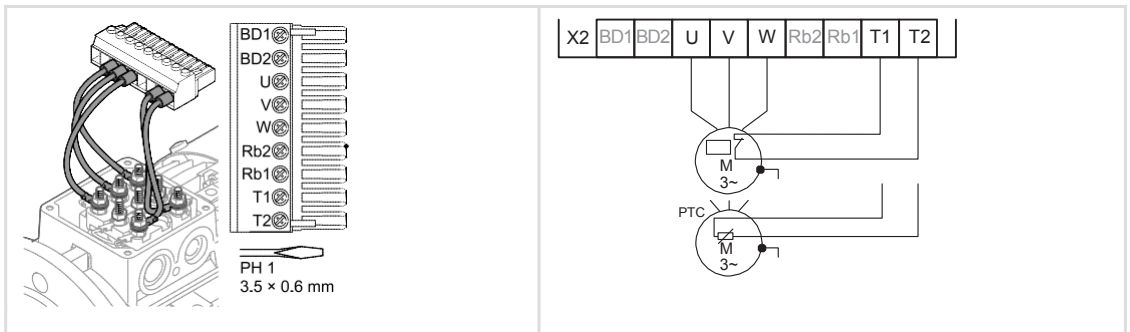
5.5

Power terminals

0.75 ... 4 kW



5.5 ... 7.5 kW



Note!

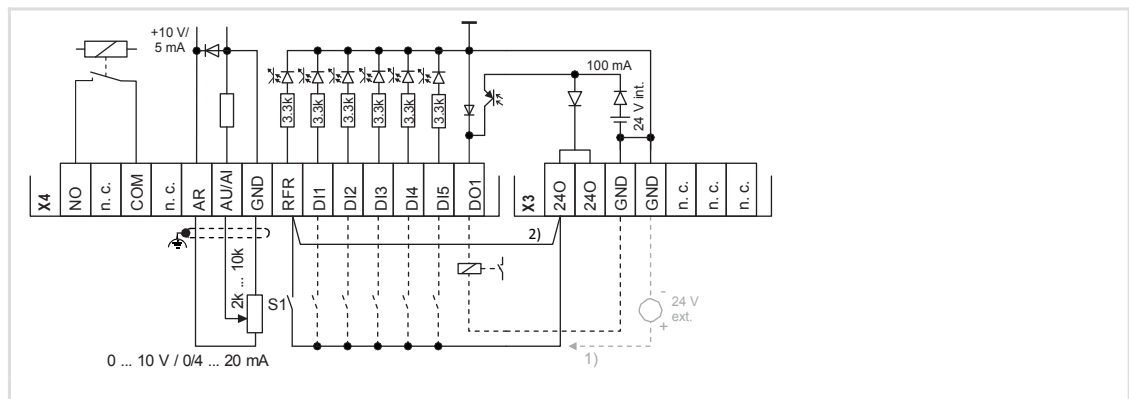
Holding brakes outputs BD1 – BD2 functions not available to use.  
Brake chopper outputs Rb1 – Rb2 function not available to use.

Standard I/O

5.5.1 Standard I/O

Terminals

Mode	Features		
Standard I/O 01-6361-00	Controller enable	RFR	1
	Digital inputs	DI	5
	Digital outputs	DO	1
	Analog inputs	AI	1
	Relay	NO	1
	External 24 V supply	24E	-

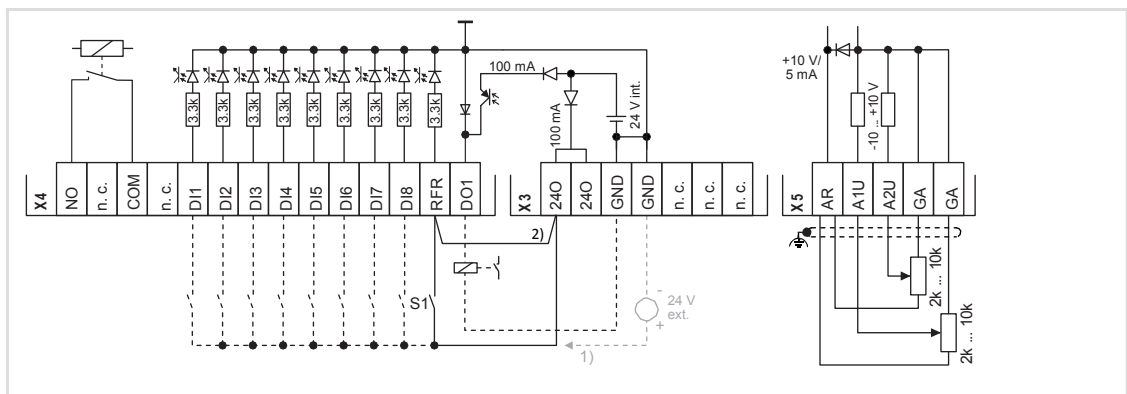


- 1) External alternative voltage supply
- 2) Wire jumper for permanent controller enable (delivery state)

## 5.5.2 Extended I/O

## Terminals

Mode	Features		
Extended I/O 01-6361-01	Controller enable	RFR	1
	Digital inputs	DI	8
	Digital outputs	DO	1
	Analog inputs	AI	2
	Relay	NO	1
	External 24 V supply	24E	-



- 1) External alternative voltage supply
- 2) Wire jumper for permanent controller enable (delivery state)



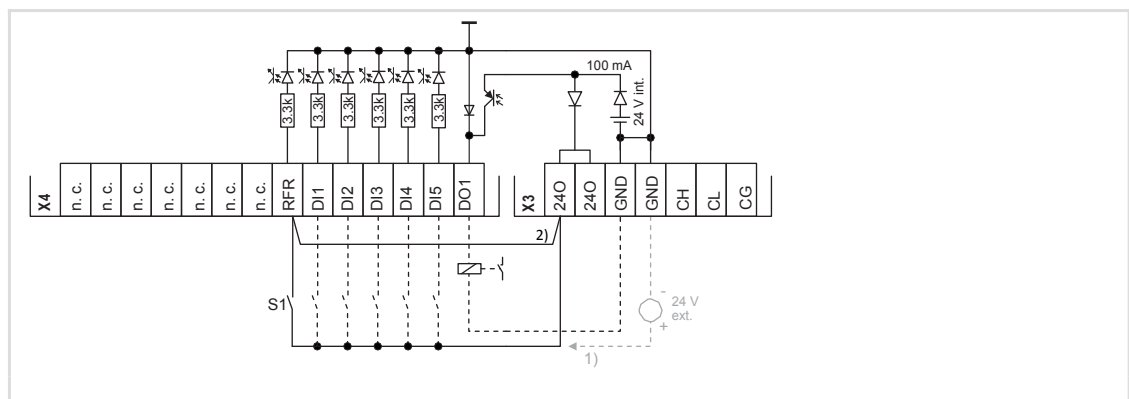
CANopen®

5.5.3

CANopen®

Terminals

Mode	Features		
CANopen 01-6361-02	Controller enable	RFR	1
	Digital inputs	DI	5
	Digital outputs	DO	1
	Analog inputs	AI	-
	Relay	NO	-
	External 24 V supply	24E	-



- 1) External alternative voltage supply
- 2) Wire jumper for permanent controller enable (delivery state)

## 6 Commissioning



### Note!

- ▶ Please observe the general safety instructions (📖 12).
- ▶ Please observe the notes regarding residual hazards (📖 18).

### 6.1 Before you start

#### Selection of the appropriate commissioning tool



### Tip!

Use the »Easy Starter« to carry out extensive parameter setting and configuration. The online help which is available for each device and the accompanying software documentation will assist you.

#### Low rotating field frequency with a self-ventilated motor



### Danger!

- ▶ For thermal reasons, continuous operation of self-ventilated motors at low field frequency and rated motor current is not permissible. If required, activate a motor temperature monitoring with C00585
  - motor temperature monitoring with I<sup>2</sup>xt (see software manual)
  - motor temperature monitoring with motor PTC (see software manual).
- ▶ When setting the V/f base frequency (C00015), please observe the following:  
For the Emotron CDN drive, the reference voltage for the V/f base frequency is the rated motor voltage (C00090) according to the motor nameplate (independently of the line-side supply voltage).

#### Fan for 5.5 ... 7.5 kW Drive Unit



### Note!

If the heatsink temperature of the 5.5 ... 7.5 kW Drive Unit exceeds a permanently defined limit value, the fans of the Drive Unit will switch on automatically.

- ▶ The limit value for the temperature monitoring function is defined in the device and cannot be parameterised.

**Tip!**

In the Default setting, the VFCplus motor control (V/f characteristic control) with linear characteristic is set in C00006.

- ▶ VFCplus is especially suitable for the operation of machines with a linear or square-law load torque characteristic (e. g. fan).
- ▶ The parameters are preset so that, with an inverter that is adapted in terms of power and a 50 Hz motor, the inverter is ready for operation without further parameterisation and the motor is working satisfactorily.

Recommendations for the following application cases:

- ▶ Inverter and motor differing strongly in terms of power:
  - Set code C00022 ( $I_{\max}$  limit in motor mode) to  $2 \times I_{\text{rated}}$  motor.
- ▶ High starting torque:
  - Set code C00016 (Vmin boost) in no-load operation of the motor, so that the rated motor current is flowing with a rotating field frequency  $f = 3$  Hz (C00058).
- ▶ Noise optimisation:
  - Set code C00018 to the value "3" (switching frequency 16 kHz).
- ▶ High torque at low speeds (without feedback):
  - Select "Vector control" operating mode.

6.2 Handling the memory module



**Danger!**

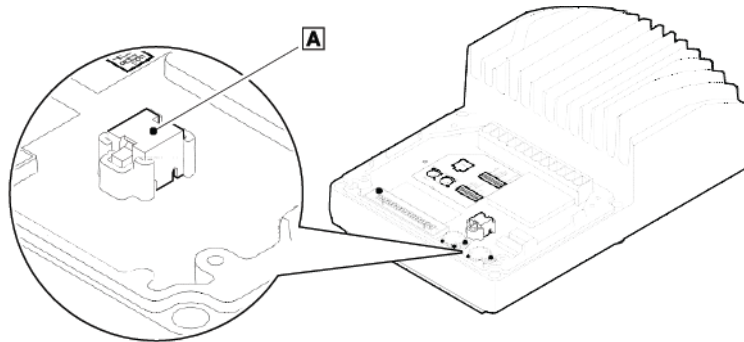
**After power-off, wait at least three minutes before working on the inverter.  
When removing the memory module, ensure that the inverter is deenergised.**

All parameters of the drive system are saved non-volatilely on the memory module. These include the parameters of the inverter and communication-relevant parameters for the communication unit used.

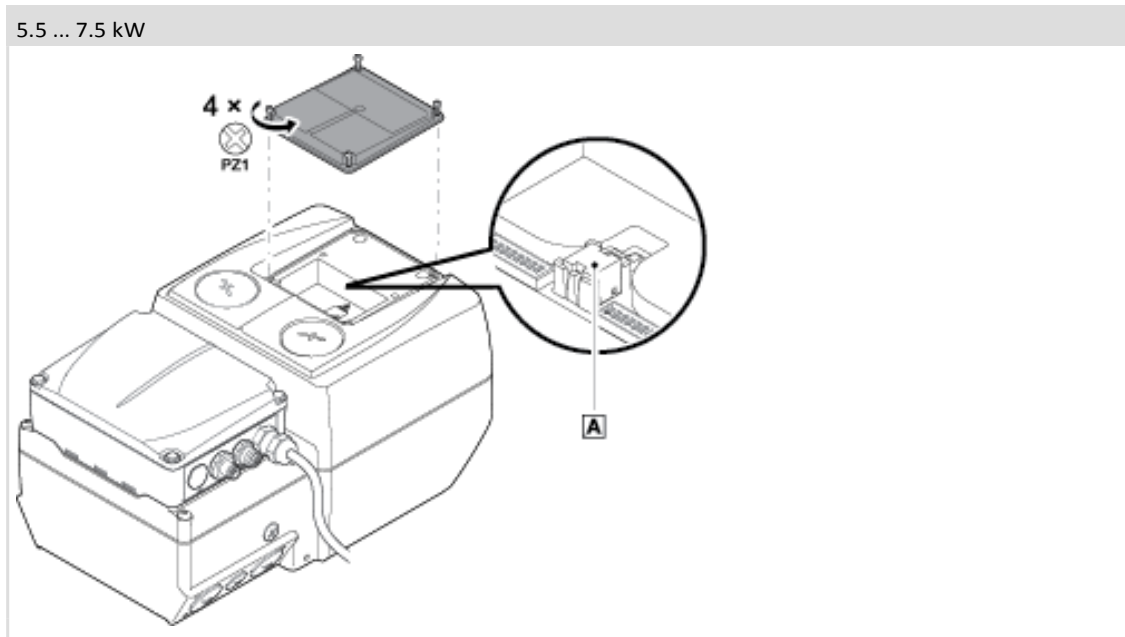
The plug-in version is especially suited for

- ▶ restoring an application after replacing a device

0.75 ... 4 kW



▣ Memory module, pluggable



**A** Memory module, pluggable



**Note!**

- ▶ When the device is switched on, all parameters are automatically loaded from the memory module to the main memory of the inverter.

When handling the memory module, a distinction is drawn between the following scenarios:

**Delivery status**

- ▶ The memory module is plugged into the EPM slot of the drive unit.
- ▶ The Default setting of the parameters is stored in the memory module.
- ▶ The memory module is available as a spare part <sup>✓</sup> without any data contents <sup>✓</sup>.

**During operation**

Parameter sets can be saved manually.

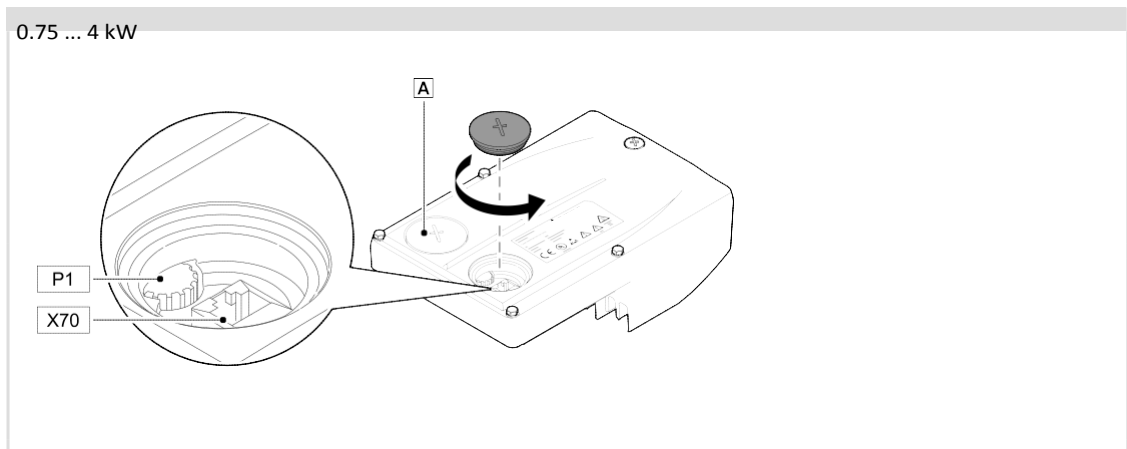
- ▶ Parameter sets can be loaded manually.
- ▶ Parameter changes can be saved automatically.

## 6.3 Setting elements

## Setting elements 0.75 ... 4 kW

The setting elements are located on the inner side of the drive unit.

Settings carried out via P1 must be activated. These settings are accepted again at every mains connection. Thus, changes on parameters made in the meantime may be overwritten.



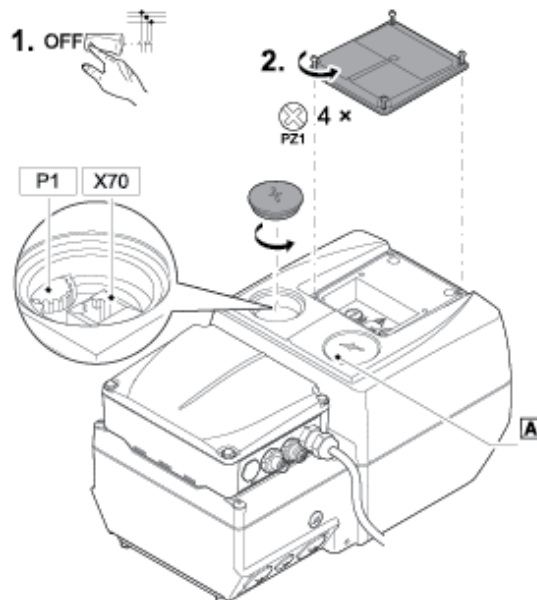
	Name
P1	Setting "Top Cover: Speed ... %"
X70	Connection for Easy Starter PC-tool.
A	LED statusdisplay

### Setting elements 5.5 ... 7.5 kW

The setting elements are located on the top of the drive unit.

- ▶ Provide for isolation from supply and secure to prevent a restart.
- ▶ Remove small cover on the top.

Settings carried out via P1 must be activated. These settings are accepted again at every mains connection. Thus, changes on parameters made in the meantime may be overwritten.



	Name
P1	Setting "Top Cover: Speed ... %"
X70	Connection for Easy Starter PC-tool.
A	LED status display

**Settings with P1**

(Default setting bold)

During operation you can use P1 to steplessly set the motor speed as a percentage of the rated speed in C00011.

Remove cap in order to be able to set potentiometer P1.

- ▶ Screw cap on again after the setting process, in order to ensure that the degree of protection of the inverter is provided.

P1	Setting		
Description	0	...	9
Motor speed in percent of the rated speed C00011 [%]	0	...	<b>100</b>



### 6.3.1 Before switching on

- ▶ The wiring unit is mounted and wired as described in the instructions,
  - directly on a motor clamping flange or
  - with the wall adapter on a suitable surface near the motor.
- ▶ Connections with the mains, motor, etc. have been established.
- ▶ The communication unit has been mounted and wired according to the scheduled application.
  - Input and output signals
  - Fieldbus  
(depending on the version, only optionally available)
- ▶ If required, the basic settings for "local mode" have been carried out.
  - Potentiometer
- ▶ The drive unit has been mounted and screwed together.
- ▶ Use available control functions reasonably, e.g.
  - Inhibit controller enable
  - Set speed adjustment to the minimum setting



#### **Danger!**

##### **Great hazard potential during commissioning**

Incorrect settings may cause unexpected and dangerous motor and system movements.

##### **Possible consequences:**

- ▶ Damage to material assets
- ▶ Injury to persons

##### **Protective measures:**

- ▶ Clear hazardous area
- ▶ Observe safety instructions and safety clearances

## 6.3.2 Commissioning steps

Proceed step by step:

- ▶ Switch on the mains
- ▶ Monitor status LED
  - After a short initialisation time, the LED must be flashing green.
- ▶ Set controller enable
  - After the set starting time, the motor must rotate with the speed set.
- ▶ Initial check of the expected behaviour:
  - Direction of rotation?
  - Starting time?
  - Speed?
  - Speed control?
- ▶ Check of optional control functions:
  - Is the analog setpoint selection working?
  - Are the digital control signals, e.g. start/stop, working?
  - Is the function for changing over the rotating direction working?
  - Are the control signals via fieldbus working?
- ▶ Switch off drive
  - Reduce speed
  - Inhibit controller enable
  - Switch off mains

**Note!**

Save parameter settings safe against mains failure

In order to prevent parameter settings carried out in the device from being lost by mains switching, you have to explicitly save the parameter set with mains failure protection in the device.

## 6.4 Diagnostics

On the top side of the Drive Unit, a two-coloured LED display indicates the respective operating status of the inverter. The LED shines through the transparent cap.

green "DRIVE READY"	red "DRIVE ERROR"	Description	Device status (Display in C00137)
OFF	OFF	OFF or initialisation active	Init
	OFF	Safe torque off is active	SafeTorqueOff
	OFF	Device is ready to start	ReadyToSwitchON
█	OFF	Device is switched on	SwitchedOn
█	OFF	Motor data identification/operation	OperationEnabled
 █ █ █ █ █		The inverter is ready to switch on, switched on, or operation is enabled and a warning is pending	
OFF	█ █ █	Error active	Fault

## Legend

## Meaning of the symbols used

	LED flashes once approx. every 3 seconds (slow flash)
	LED flashes once approx. every 1.25 seconds (flash)
	LED flashes twice approx. every 1.25 seconds (double flash)
█ █ █ █	LED is blinking every second
█	LED is permanently on

Braking operation without additional measures

## 7 Braking operation

## 7 Braking operation

### 7.1 Braking operation without additional measures

#### DC injection brake DCB

To decelerate small masses, the "DC injection brake DCB" function can be parameterised. DC-injection braking enables a quick deceleration of the drive to standstill.

- ▶ Code C00036 can be used to select the braking current.
- ▶ The maximum braking torque to be realised by the DC braking current amounts to approx. 20 ... 30 % of the rated motor torque.
- ▶ Automatic DC-injection braking (Auto-DCB) improves the starting performance of the motor when the operation mode without speed feedback is used.

Further information on the relevant parameters can be obtained from the software manual.

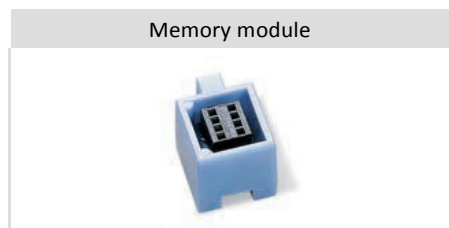
## 8 Accessories (overview)

### 8.1 Memory module

In the memory module, the parameters of the inverter are stored. The pluggable memory module provides for a quick parameter set transfer to an inverter of the same design. Possible reasons for a parameter set transfer:

- ▶ Restorage of an application after device replacement.

In order to remove the memory module, use a suitable screwdriver to lever the module out at the upper and lower groove. In order to plug in the module, insert it into the slot and push it with light pressure until end position is reached.







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