LTI MOTION
KÖRBER SOLUTIONS

CDE/CDB3000

Operation Manual

Positioning controller

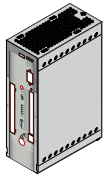
2 A to 210 A

Sizes (BG)

BG1

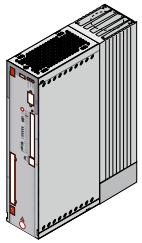
CDE/B 32.003,C
CDE/B 32.004,C

BG2



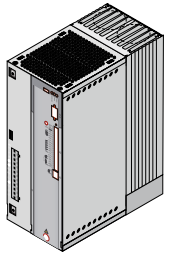
CDB 32.008,C
CDE/B 32.008,W
CDE/B 34.003,C
CDE/B 34.004,W
CDE/B 34.006,W

BG3



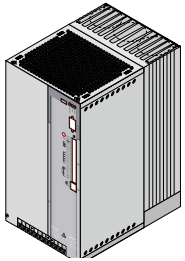
CDE/B 34.008,W
CDE/B 34.010,W
CDE 34.010,W,S

BG4



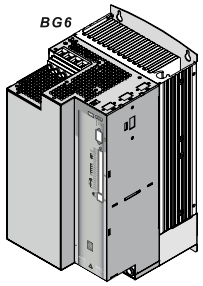
CDE/B
34.014,W
CDE/B
34.017,W

BG5



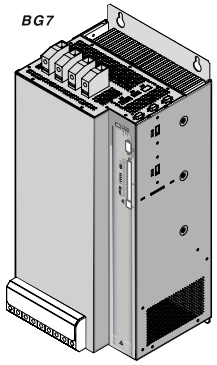
CDE/B 34.024,W
CDE/B 34.032,W

BG6



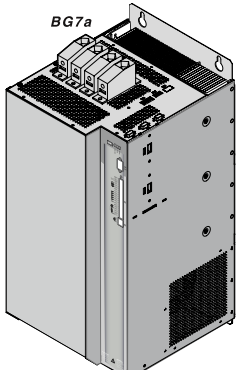
CDE/B 34.044.W / 34.044,L
CDE/B 34.058.W / 34.058,L
CDE/B 34.070.W / 34.070,L

BG7



CDE/B 34.088.W / 34.088,L
CDE/B 34.108.W / 34.108,L

BG7a



CDE/B 34.140.W / 34.140,L
CDE/B 34.168.W / 34.168,L
CDE/B 34.208,L

Operation Manual CDE/CDB3000
ID no.: 1001.20B.9-01
Date: 05/2017
Applicable as from software CDE V3.1 and CDB V3.0

Note: The German version is the original of this operation manual.

Subject to technical change without notice.

The content of our documentation was compiled with the greatest care and attention, and based on the latest information available to us. We should nevertheless point out that this document cannot always be updated simultaneously with the on-going technical development of our products. Information and specifications may be subject to change at any time.
For information on the latest version please visit www.lti-motion.com.

Table of contents

1 General

The product DVD from LTI Motion contains the complete documentation for the related product series. The documentation for a product series includes the operation manual (hardware description), device help (software description) as well as further user manuals (e.g. field bus description) and specifications. They are available in the formats PDF, HTML or chm.

1.1 Target group

Dear user,

the documentation forms part of the device and contains important information on operation and service. It is aimed at all persons who undertake mounting, installation, commissioning and servicing work on the product.

1.2 Prerequisites

Prerequisites for the usage of devices from LTI Motion GmbH:

- The documentation on the devices is to be stored so it legible, accessible at all times and for the entire life of the product.
- Read and ensure you understand the documentation on your device.
- Qualification: to prevent injury or damage, personnel may only work on the device if they have electrical engineering qualifications.
- Knowledge required:
  - National health and safety regulations (e.g. BGV A3 in Germany)
  - Mounting, installation, commissioning and operation of the device

Work in other areas, for example transport, storage and disposal is only allowed to be undertaken by trained personnel.

NOTE
Only the CDE/CDB3000 positioning controller as described in this operation manual.

1.3 Reference documents

Documentation on the c-line drives product range

Document	Contents	ID no.	Format
Operation Manual CDE/CDB3	Mechanical installation, electrical installation, safety, specification	1001.20B.9-xx	PDF
Operation Manual CDF3000	Mechanical installation, electrical installation, safety, specification	1040.20B.3-xx	PDF
Operation Manual CDB2000	Mechanical installation, electrical installation, safety, specification	1515.20B.2-xx	PDF
Application Manual CDE/CDB3000	Adaptation of the drive system to the application	1001.22B.x	PDF
Communication Manual CANopen	Project planning and function description	1005.26B.x	PDF
Communication Manual PROFIBUS-DP	Project planning and function description	0916.20B.x	PDF

Other documents

Document	Contents	ID no.	Format
CDE/CDB3000 brochure	• Overview with main functional features of the SystemOne CM	0920.2033.xx	PDF
CDE/CDB3000 Order Catalogue	• Overview with notes on ordering and planning information for: SystemOne CM and MotionOne with variants and accessories	1001.24B.9-xx	PDF
c-line Drives Project Manual	• Overview and background information on planning projects for drive systems	0927.25B.2-xx	PDF

Date of manufacture

On the rating plate on the CDE/CDB3000 drive units you will find the serial no. from which you can read the date of manufacture using the following key.

Scope of supply

The scope of supply includes:

- Positioning controller CDE/CDB3000
- Product DVD

.1 Pictograms

The pictograms used in this operation manual signify the following for the user:

NOTE
Useful information or reference to other documents.

1.*(digit)* **ACTION TO BE TAKEN**
Action undertaken by the user or the system.

You will find the pictograms used in this operation manual for "safety instructions and warnings" in *chapter 2 Safety.*

.2 Disclaimer

Following the documentation on the devices from LTI Motion GmbH is a prerequisite:

- For safe operation.
- To achieve stated performance features and product characteristics.

LTI Motion GmbH does not accept any liability for injuries, damage or financial losses that result from the failure to follow the documentation.

.3 Disposal

Follow the applicable national regulations! If necessary, dispose of individual parts, depending on their characteristics and existing national regulations, e.g. as:

- Electrical waste
- Plastic
- Metal

Or engage a certified disposal organisation with scrapping

.4 Support & Service Center

Our Helpline will provide you with fast, specific assistance if you have any technical queries relating to project planning or commissioning your device.

Address:	LTI Motion GmbH Gewerbestrasse 5-9 35633 Lahnau

The Helpline is available by e-mail or telephone:

Service hours:	Mo.-Fr.: 8 a.m. - 5 p.m. (CET)
E-mail:	helpline@lti-motion.com
Telephone:	+49 6441 966-180

If you need service assistance, the specialists in Global Sales Support (GSS) will be pleased to be of assistance.

Internet:	www.lti-motion.com → Support & Service → Trouble Ticket
Service hours:	Mo.-Fr.: 8 a.m. - 5 p.m. (CET)
E-mail:	salessupport@lti-motion.com
Telephone:	+49 6441 966-0

Note:

You will find detailed information on our services on our web site www.lti-motion.com in "Support & Service".

2 Safety

2.1 Overview

Our devices are state-of-the-art and comply with recognised safety regulations, nevertheless hazards can arise. In this chapter:

- We provide information on residual risks and hazards that can emanate from our devices on usage as intended.
- We warn about the foreseeable misuse of our devices.
- We refer to the necessary care and measures to be taken to prevent risks.

2.2 Measures for your safety

NOTE

Only install and place in operation your device taking into account the documentation for the related device family!

Our devices are quick and safe to operate. For your own safety and for the safe function of your device, please be sure to observe the following points:

1. **Follow safety instructions for the devices**:
Follow all safety instructions and warnings in the entire documentation related to the device series.

2. **Electric drives are dangerous:**

- Due to electrical voltages up to 480 V AC and up to 800 V DC
- Even 10 min. after switching off the mains supply, dangerously high voltages of ≥50 V may still be present (capacitor charge). So check that electrical power is not present! See also the warning label on the front panel on the device.
- Rotating parts
- Automatically starting drives.
- Hot components and surfaces

3. **Protection against magnetic and/or electromagnetic fields during installation and operation.**

Persons fitted with heart pacemakers, metallic implants and hearing aids etc. must not be allowed access to the following areas:

- Areas in the immediate vicinity of electrical equipment!
- Areas in which electronics components and drive controllers are installed, repaired and operated!
- Areas where motors are installed, repaired and operated!
  Motors with permanent magnets pose particular hazards.

4. **During installation observe the following:**

- Comply with connection conditions and technical data as per the documentation and the rating plate!
- Comply with standards and directives on electrical installation, such as cable cross-section, shielding, etc.!
- Do not touch electronic components and contacts!
  Electrostatic discharge can harm people and destroy components!
- Take protection measures and use protective devices as per the applicable regulations (e.g. EN 60204 or EN 61800-5-1)!
- Take "device earthing" protection measure!

5. **Ambient conditions**

- Follow the instructions on the transport, storage and correct operation of the devices stated in the operation manual in "A Appendix".

2.3 General safety instructions and warnings

Hazards may emanate from our devices. For this reason it is imperative you follow the safety instructions and warnings in this document.

DANGER!	**Risk of injury due to electrical power!**
	• **Carelessness will result in serious injuries or death.** Follow safety instructions and warnings in this document and on the device.

WARNING!	**Risk of injury due to electrical power!**
	• **Carelessness may result in serious injuries or death.** Follow safety instructions and warnings in this document and on the device.

CAUTION!	**Risk of injury or damage to the device due to incorrect operation!**
	• **Carelessness may result in minor injuries or damage.** Follow safety instructions and warnings in this document and on the device.

WARNING!	**Risk of injury due to hot surfaces and components!**
	• **Carelessness may result in serious burns.** Electronic components may become hot during operation! Follow safety instructions and warnings in this document and on the device!

Caution!	**Damage due to electrostatic discharge!**
	• **Electrostatic discharge can destroy components.** Do not touch electronic components and contacts! Follow safety instructions and warnings in this document and on the device!

DANGER!	**Risk of injury due to rotating parts on the motor!**
	• **Carelessness will result in serious injuries or death.** Follow safety instructions and warnings in this document.

Pay attention to **special safety instructions and warnings** that are given here in the document before a specific action and that warn the user about a **specific hazard**!

NOTE:

The pictograms may also be used on their own with the signal word, e.g. in the connection diagrams, however they have the same function as in the complete warning.

DANGER	**WARNING**	**CAUTION**
		

2.4 Intended use

Our devices are components intended for stationary electrical systems and machines in the industrial and commercial sector.

CE

The positioning controller CDB3000 is conform to the **Low Voltage Directive 2014/35/EC**

The positioning controllers CDB3000-SH and CDE3000 are conform to the **Machinery-Directive 2006/42/EC**

Tested and certified in accordance with applicable standards (see declaration of conformity in chap. 2.8).

When installed in machines it is prohibited to start-up intended operation until it has been ascertained that the completed machine fully complies with the provisions of the Machinery Directive (2006/42/EC); compliance with EN 60204 is mandatory.

Starting intended operation incl. all accessories such as mains filters and mains chokes is only permitted on compliance with the EMC directive 2014/30/EU.

The devices meet the requirements of the harmonised product standard EN 61800-5-1.

You will find information on the installation of your device in chapter “3 Mechanical installation”.

Repair

Only have repairs undertaken by authorised repair shops. Unauthorised opening and incorrect intervention could lead to death, physical injury or material damage. The warranty provided by LTI Motion will be rendered void.

2.5 Misuse

Our devices are:

- Not intended for installation in vehicles. Deployment of the device in mobile equipment is classed as non-standard ambient conditions, and is permissible only by special agreement.
- Not intended for installation in environments with harmful oils, acids, gases, vapours, dusts, radiation etc.
- Not approved for usage in special applications (e.g. in potentially explosive atmospheres or areas in which there is a risk of fire).
- Not approved for usage outside a switch cabinet
- Not approved for the generation of high-frequency onboard networks for which the device is not designed

2.6 Responsibility

Electronic devices are not fail-safe. The installer and/or operator of a complete machine or system is responsible for ensuring:

- That the drive is rendered safe if the device fails
- The safety of personnel and machinery
- The complete machine is in correct working order
- For the risk assessment on the complete machine or system according to EN 12100:2011 (formerly DIN EN 14121:2007) and EN ISO 13849-1 (formerly DIN EN 954-1)

Pay attention to the topic of “Electrical equipment of machines” in EN 60204-1:2006 “Safety of machinery”. The safety requirements on electrical machines defined there are intended to protect personnel and machinery or systems.

The emergency stop function (as per EN 60204) shuts down the supply of power to a machine, which results in the drives coasting down in an uncontrolled manner. To avert hazards, check whether it is appropriate:

- To keep individual drives in operation
- To initiate specific safety procedures
- To incorporate a Safe Torque Off function (Safe Torque Off: movement stop by "switching off the electrical supply" - STO)

2.7 Relevant laws, standards and directives applied

For information on the laws, standards and directives applied by LTI MOTION GmbH, refer to the declaration of conformity.

NOTE:

Depending on the specific application for the devices, other laws, standards and directives with provisions on "Safety" may apply. If necessary, contact the machine or system manufacturer.

2.8 EU Declaration of Conformity

LTI MOTION KÖRBER SOLUTIONS

EU-Konformitätserklärung
EU Declaration of Conformity

Der Hersteller *The manufacturer*	LTI Motion GmbH Gewerbestraße 5-9 35633, Lahnau

erklärt hiermit, dass die folgenden Produkte
declares that the following products

Produktbezeichnung: *Product designation:*	Positionierregler *Positioning Controller*
Produkttypen: *Product types:*	CDB Baugröße 1 bis 7 *CDB frame size 1 to 7*

den Sicherheitsbestimmungen der nachstehenden EU-Richtlinie entsprechen:
comply with the essential requirements of the following EU Directive:

2014/35/EU *2014/35/EU*	[Niederspannungsrichtlinie] *[Low Voltage Directive]*

und dass folgende angeführte harmonisierte Norm angewandt wurde:
and that the following harmonised standard has been applied:

EN 61800-5-1:2007
Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl - Teil 5-1: Anforderungen an die Sicherheit: Elektrische, thermische und energetische Anforderungen
Adjustable speed electrical power drive systems – Part 5-1: Safety requirements – Electrical, thermal and energy

Jahr der CE-Kennzeichnung / *Year of CE-marking:* 2010

Unterschrift / *signature*	
Name / *name:*	Dr. Josef Wiesing
Stellung / *position:*	Geschäftsführer / *Managing Director*
Datum / *date:*	20.04.2016

Dokument: 1001.0DK.2-00

FB 0106 EU-Konformitätserklärung 2016/04 A

LTI MOTION KÖRBER SOLUTIONS

EU-Konformitätserklärung
EU Declaration of Conformity

Der Hersteller *The manufacturer*	LTI Motion GmbH Gewerbestraße 5-9 35633, Lahnau

erklärt hiermit, dass die folgenden Produkte
declares that the following products

Produktbezeichnung *Product designation:*	Positionierregler *Positioning Controller*
Produkttypen *Product types:*	CDB3000 SH, CDE3000, CDF3000 *CDB3000 SH, CDE3000, CDF3000*
ab Seriennummer *from serial number:*	1110XXXXX *1110XXXXX*

den Sicherheitsbestimmungen der nachstehenden EG- und EU-Richtlinien entsprechen
comply with the essential requirements of the following EC and EU Directives:

2006/42/EG *2006/42/EC*	[Maschinenrichtlinie] *[Machinery-Directive]*
2014/30/EU *2014/30/EU*	[EMV-Richtlinie] *[EMC-Directive]*

und dass folgende angeführten harmonisierten Normen angewandt wurden:
and that the following harmonised standards have been applied:

EN ISO 13849-1:2008 + AC:2009
EN 61800-3:2004+A1:2012
EN 60204-1:2006 + A1:2009+AC:2010 (in extracts)
EN 50178:1997
EN 61800-5-1:2007
EN 62061:2005+AC:2010+A1:2013
EN 61800-5-2:2007

Folgende weitere Norm wurde angewandt
The following additional standard has been applied:

IEC 61508 1-7:2010

Jahr der CE-Kennzeichnung / *Year of CE-marking:* 2011

EG-Baumusterprüfung / *EC type examination*

Benannte Stelle *Notified body:*	TÜV Rheinland Industrie Service GmbH Am Grauen Stein, 51105 Köln
Kennnummer *Identification-No.:*	0035 0035
EG Baumusterprüfung Bescheinigung Nr. *EC type examination Certificate-No.:*	01/205/5032.01/15 01/205/5032.01.15

Unterschrift / *signature*		
Name / *name:*	Dr. Josef Wiesing	Matthias Wagner
Stellung: *Position:*	Geschäftsführer *Managing Director*	Dokumentationsbeauftragter *Responsible for documentation*
Datum / *date:*	20.04.2016	20.04.2016

Dokument: 1001.0DK.3 -00_CDB_CDE_CDF_SH

FB 0106 EU-Konformitätserklärung 2016/04 A

3 Mechanical installation

3.1 Notes for operation

Please strictly avoid ...

- penetration of damp into the device;
- aggressive or conductive substances in the immediate vicinity;
- drill chippings, screws or foreign bodies dropping into the device;
- covering the ventilation openings during operation,
- using the device in mobile equipment, otherwise it may be damaged.

3.2 Wall mounting

Step	Action	Comment
1.	Mark out the position of the tapped holes on the backing plate. Cut a thread for each fixing screw in the backing plate.	For dimensional drawings/hole spacing see Table 3.1. The thread surface area will provide good contact.
2.	Mount the positioning inverter VERTICALLY on the backing plate.	Observe the mounting clearances! The contact area must be bare metal.
3.	Mount the other components, e.g. mains filter, mains choke etc. on the backing plate.	Cable between mains filter and inverter is allowed to be max. 30 cm long.
4.	Continue with the electrical installation in chapter 4.	

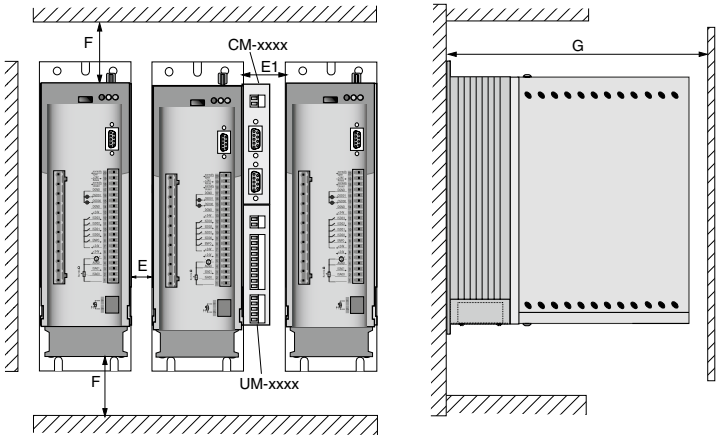


Figure 3.1 Mounting clearances (see Table 3.1)

CDE/CDB3 ...,Wx.x	BG1[2]	BG2[2]	BG2	BG3 BG3S	BG4	BG5	BG6	BG7	BG7a
Weight [kg]	1.6	2.3	3.5	4.4	6.5	7.2	13	28	32
B (width)	70				120	170	190	280	280
H (height) (CDE/ CDB)	220/193	245/218	247/247	300			348	540	540
T (depth)	120	145	220	218			230	267.5	321
A	50		40		80	130	150	200	200
C (CDE/CDB)	230/205	255/230	260	320			365	581	581
DØ	Ø 4.8						Ø 5.6	Ø 9.5	Ø 9.5
Screws	4 x M4						4 x M5	4 x M9	4 x M9
E see Figure 2.1	0	0[4]	0				10		10
E1 see Figure 2.1	35/50[1]								35/50[1]
F see Figure 2.1	100[3]								100[3]
G see Figure 2.1	≥ 300								≥ 500
J (CDE/CDB)	18/45			45		55	Shield plate provided	-	
K	215	240	270	330			382	600	

1) 50 mm spacing between the controllers to be able to change the option module on the side (without removing the drive controller).

2) Corresponds to the cold plate model, on this issue note Table 3.2.

3) Take into account additional space underneath for the bending radii of the connection cables.

4) Row mounting not allowed for CDB32.208, Cx.x. Please use CDB32.108, Wx.x.

Table 3.1 Dimensional drawings (dimensions in mm)

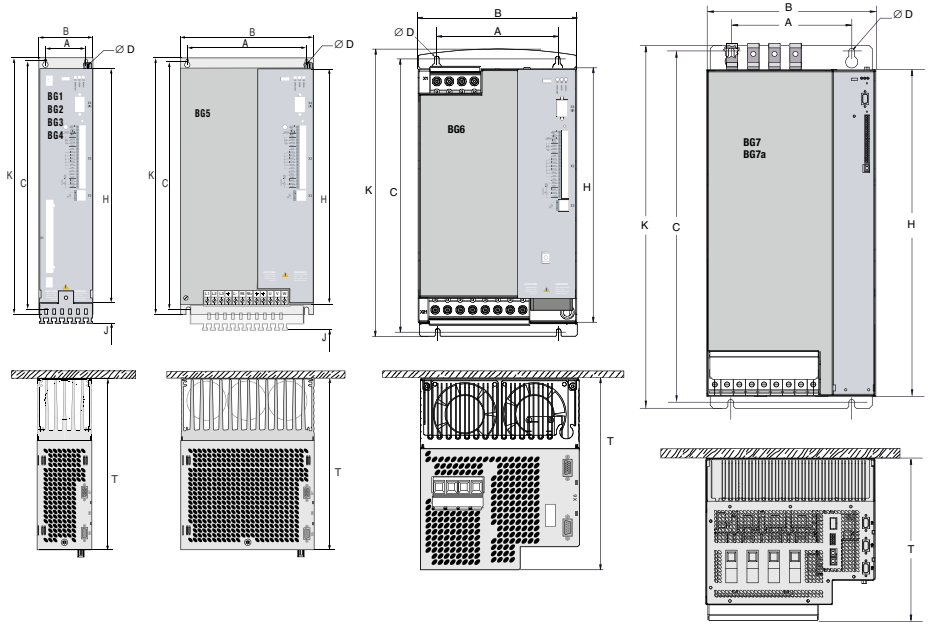


Figure 3.2 Dimensional drawings wall mounting

3.3 Cold plate

Size	Power	Positioning controller	$R_{th}K$[1] [K/W]	Backing plate (unpainted steel) min. cooling area[2]
BG1	0.375 kW	CDE/CDB32.003, C	0.05	None
	0.75 kW	CDE/CDB32.004, C	0.05	650x100 mm = 0.065 m²
BG2	1.5 kW	CDE/CDB32.008, C	0.05	650x460 mm = 0.3 m²
	0.75 kW	CDE/CDB34.003, C	0.05	None

1) Thermal resistance between active cooling surface and cooler

2) On mounting in a row, an external heat sink HS3x.xxx or the "wall mounting" model is to be used if there is no backing plate.

Table 3.2 Cooling necessary with cold plate

NOTE:

- Air must be able to flow unhindered through the device.
- On installation in cabinets with convection (= heat loss is dissipated to the outside via the switch cabinet walls), always fit an internal air circulation fan.
- The backing plate must be well-earthed.
- To attain the best result for effective EMC installation you should use a chromated or galvanised backing plate. If backing plates are varnished, remove the coating from the contact area!
- The positioning controllers of size 1 (CDE/CDB32.003 and CDE/CDB32.004) must be mounted on chromated/galvanised switch cabinet backing plates with 0.065 m² cooling area per positioning controller.
- On mounting without additional cooling area (cold plate model), the heat sink types as per the product range HS3X.xxxx are to be used.
- You will find further information on ambient conditions in appendix A.3.

3.4 Push-through heat sink

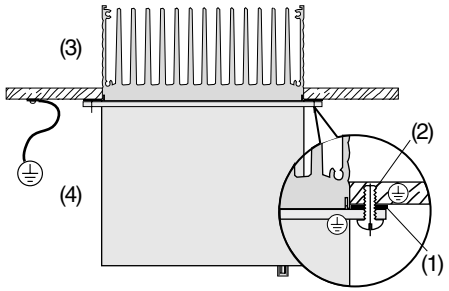
Step	Action	Comment
1.	Mark out the position of the tapped holes and the cutout on the backing plate. Cut a thread for each fixing screw in the backing plate.	For dimensional drawings/hole spacing see Table 3.4. The thread surface area will provide good contact.
2.	Mount the positioning controller vertically on the backing plate. Tighten all screws evenly.	Observe the mounting clearances! The mounting seal must be in clean contact.
3.	Mount the other components, e.g. mains filter, mains choke etc. on the backing plate.	Mains filter-drive controller connection cable max. 30 cm
4.	Continue with the electrical installation in chapter 4.	

NOTE:

- Division of the power dissipation:

		BG3	BG4	BG5	BG6
Power dissipation	Outside (3)	70 %	75 %	80 %	80 %
	Inside (4)	30 %	25 %	20 %	20 %
Protection	Heat sink side (3)	IP54	IP54	IP54	IP54
	Device side (4)	IP20	IP20	IP20	IP20

- The mounting collar has a seal all around. This seal must be in clean contact and is not allowed to be damaged:



1. Seal
2. Tapped hole for effective EMC contact
3. Outside
4. Inside

NOTE:

- The backing plate must be well-earthed.
- To attain the best result for effective EMC installation you should use a chromated or galvanised backing plate. If backing plates are varnished, remove the coating from the contact area!

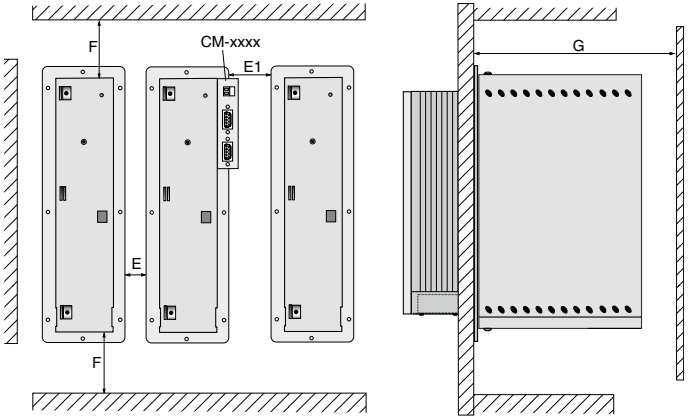


Figure 3.3 Mounting clearances (see Table 3.4)

Dimensions of the cutout	BG3	BG4	BG5	BG6
B (width)	75	125	175	200
H (height)	305	305	305	355

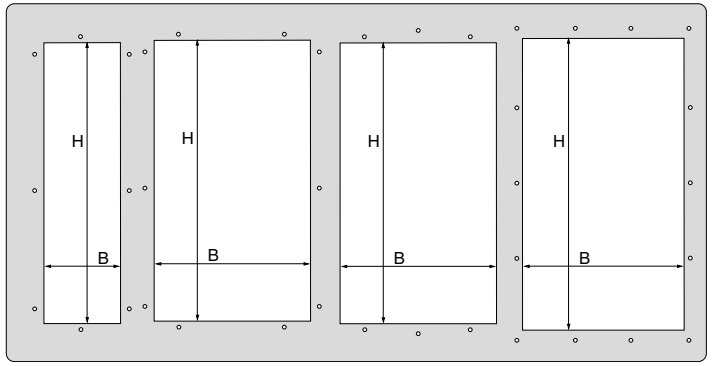


Table 3.3 Cutout for push-through heat sink (dimensions in mm)

CDE/CDB3...,Dx.x	BG3	BG4	BG5	BG6
Weight [kg]	4.6	6.7	7.4	15
B / B1 (width)	70 / 110	120 / 160	170 / 210	190 / 250
H (height)	300			345
T (depth)	138			161 / T1=85
A	90	140	190	236
A1	–	80	100	78
C	320			398
C1	200			*)
D Ø	Ø 4.8	Ø 4.8	Ø 4.8	Ø 7.5
Screws	8 x M4	10 x M4	10 x M4	14 x M7
E 2)	10			10
E1 (with module)2)	40			
F 2)	100[1)]			
G 2)	≥ 300			
J	45		55	Shield plate provided
K	340			405
*) C1=7 / C2=104.75 / C3=202.5 / C4=300.25				
1) Take into account additional space underneath for the bending radii of the connection cable.				
2) For dimensions E to G see Figure 2.3				

Table 3.4 Dimensional drawings push-through heat sink (dimensions in mm)

NOTE: For further information on ambient conditions, see appendix A.3.

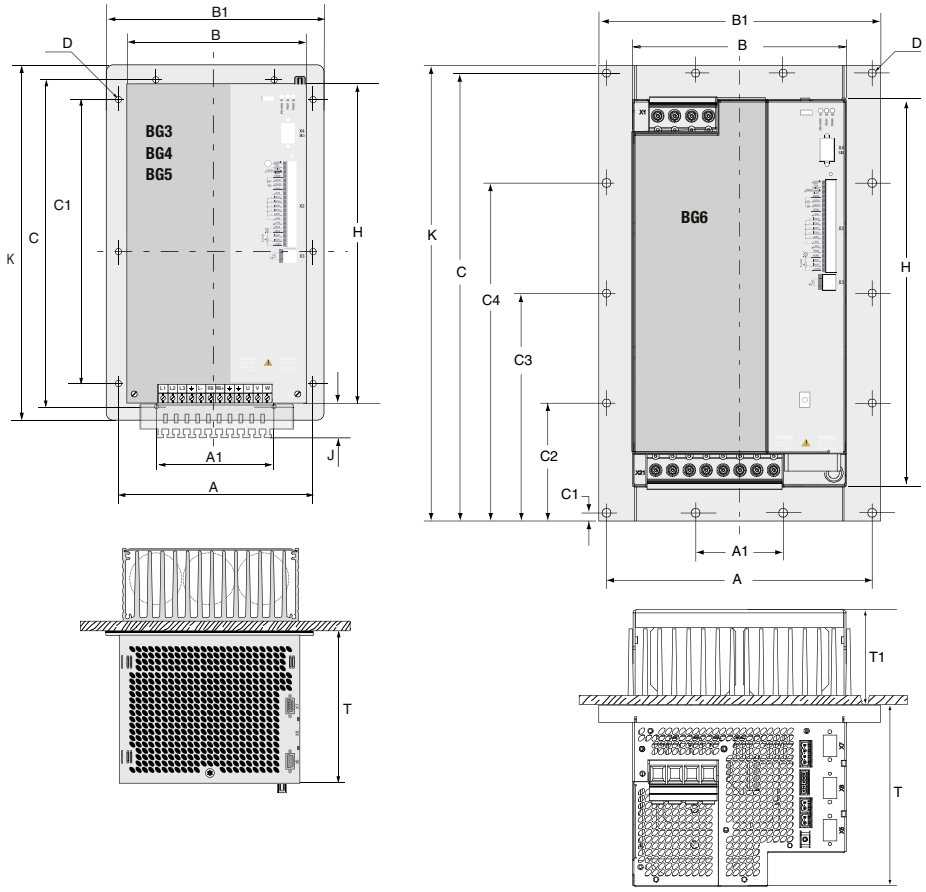


Figure 3.4 Dimensional drawings push-through heat sink (dimensions in mm)

3.5 Liquid cooling

Step	Action	Comment
1.	Mark out the position of the tapped holes on the backing plate. Cut a thread for each fixing screw in the backing plate.	For dimensional drawings/hole spacing see Table 3.1. The thread surface area will provide good contact.
2.	Mount the positioning controller vertically on the backing plate.	Observe the mounting clearances! The contact area must be bare metal.
3.	Connect the supply for the liquid chiller.	For specification see Specification CDX.X4.XXX,L (ID no.: 181-20945 • 07/2008)
4.	Mount the other components, e.g. mains filter, mains choke etc. on the backing plate.	Cable between mains filter and inverter is allowed to be max. 30 cm long.
5.	Continue with the electrical installation in chapter 4.	

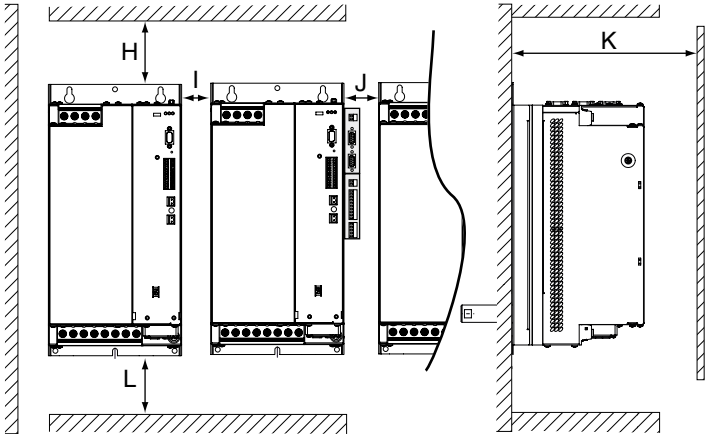


Figure 3.5 Mounting clearances for drive units with liquid cooling

CDE/B...LX.X	BG6	BG7	BG7a
H [mm]	50	50	50
I [mm]	10	10	10
J [mm]	40	40	40
K [mm]	200	240	450
L [mm]	200	200	200

Table 3.5 Mounting clearances for drive units with liquid cooling

CDE/CDB3...,Lx.x	BG6	BG7	BG7a
Weight	15 kg	28 kg	32 kg
Dimensions	BG6 [mm]	BG7 [mm]	BG7a [mm]
B (width)	190	280	280
H (height)	394.75	600	600
T (depth)	190	201	281
A1	148	200	200
A2	148	200	200
C	377.25	581	581
D1 ø	ø 7.0	ø 9.5	ø 9.5
D2 ø	ø15	ø15	ø15
E1	61.75	66.5	66.5
F1	130	175	175
F2	70	70	70
G	73.5	73.5	73.5
S	3/8“	3/8“	3/8“

Table 3.6 Dimensional drawings liquid cooling (dimensions in mm)

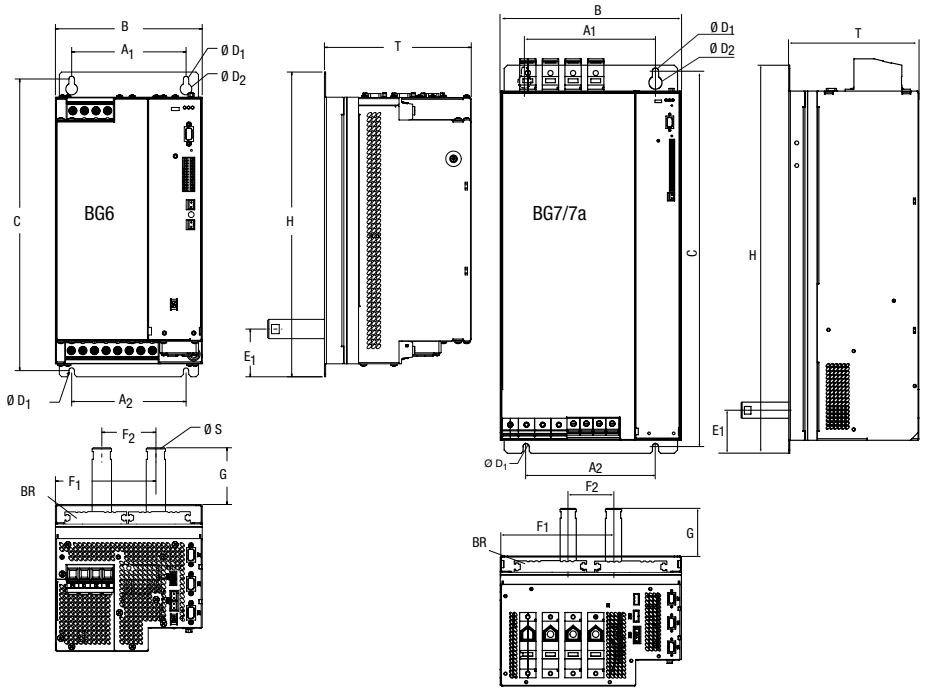


Figure 3.6 Dimensional drawings liquid cooling

4 Electrical installation

4.1 Overview of the connections, CDE3000

NOTE: Installation must only be carried out by electrical engineering experts who have been specially instructed in the necessary accident prevention measures.

No.		Details	Designation	Function
H1, H2, H3		*Page 61*	Light emitting diodes	Device state indication
NO1		*Page 46*	Rotary code switch	Setting the CAN address
X1	BG1-5	*Page 25* Mains *Page 35* Motor	Power connection	Mains, motor, DC supply (L+/L-) braking resistor L+/RB,
⏚		*Page 22*	Protective earth conductor connection	
X2		*Page 27*	Control connection	STO with relay output 8 digital inputs, 2 analogue inputs, 10 bits 3 digital outputs, 1 relay
X3[1)]		*Page 35*	Motor temperature monitoring (on usage of the encoder interface X7)	PTC, based on DIN 44082 linear temperature sensor KTY 84-130 or automatic thermal switch Klixon
X4		*Page 45*	RS232 connection	For PC with DriveManager 3.x or KeyPad KP300 (formerly KP200-XL)
X5		*Page 46*	CAN interface	Access to the integrated CAN interface CiA402
X6		*Page 32*	Resolver connection	With temperature monitoring
X7		*Page 33*	TTL/SSI encoder interface SinCos Hiperface®	TTL encoder SSI absolute value encoder, Optional: Sin-Cos encoder
X8		*Page 17*	Option slot	Expansion slot, e.g. for option module PROFIBUS-DP (CM-DPV1)
X9		*Page 29*	Brake driver	2 A

1) The PTC is only allowed to be connected to one of the two possible connections X3 or X6.

Table 4.1 Key to connection diagram, CDE3000 BG1 - 5

Connection diagram CDE3000 (BG1 ... BG5)

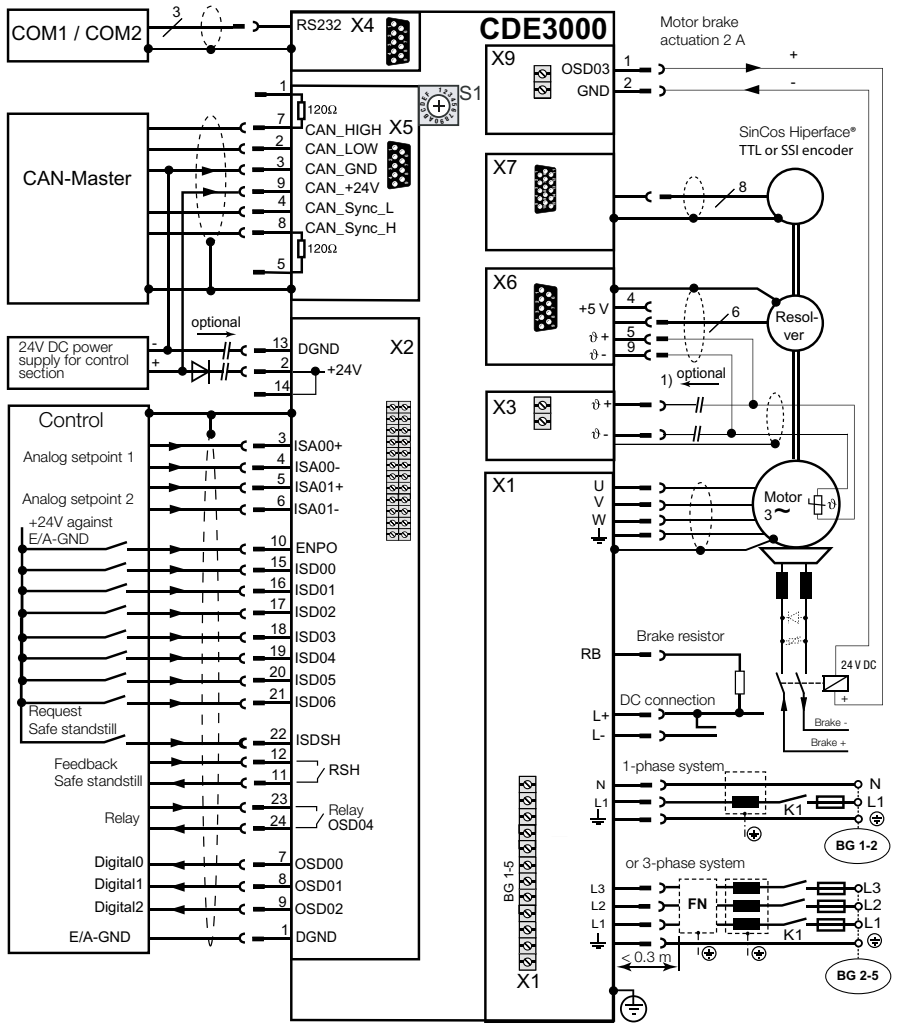


Figure 4.1 Connection diagram CDE3000 (BG1... BG5)

Connection diagram CDE3000 (BG6, 7, 7a)

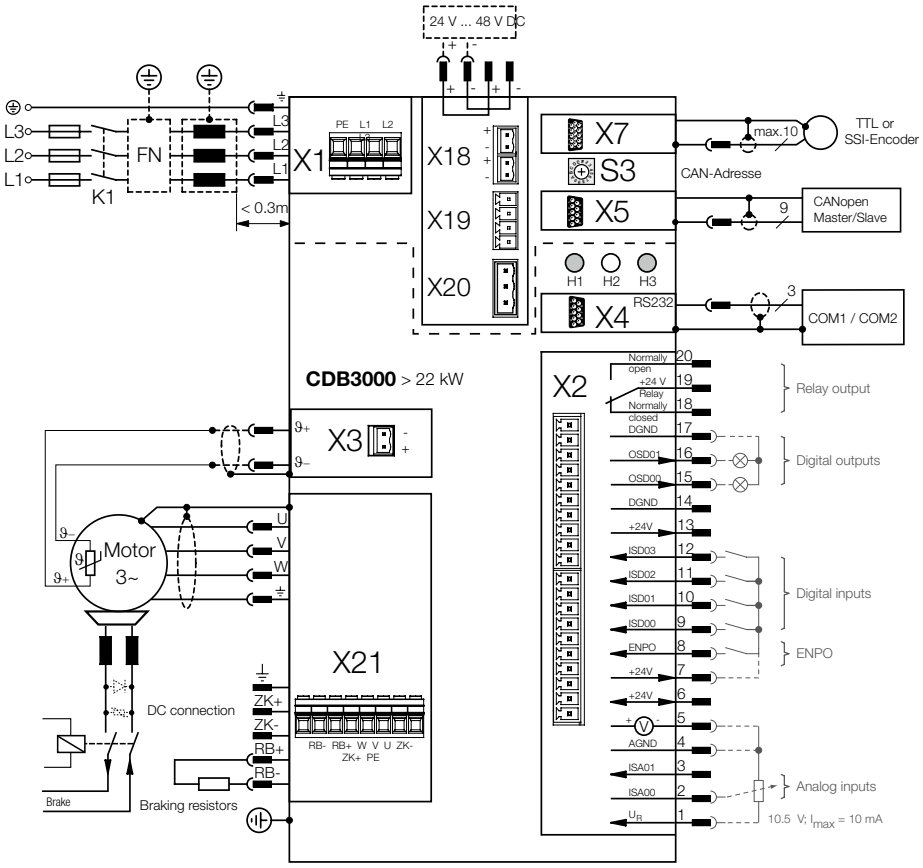


Figure 4.2 Connection diagram CDE3000 (BG6, 7, 7a)

NOTE:Installation must only be carried out by electrical engineering experts who have been specially instructed in the necessary accident prevention measures.

No.		Page	Designation	Function
H1, H2, H3		*Page 61*	Light emitting diodes	Device state indication
NO1		*Page 46*	Coding switch	Setting the CAN address
X1	BG6-7	*Page 25*	Mains connection	Mains
X21	BG6-7	*Page 35*	Power connection	Motor, DC supply (ZK+/ZK-) braking resistor RB+/RB-
⏚		*Page 22*	Protective earth conductor connection	
X2		*Page 27*	Control connection	STO with relay output 8 digital inputs, 2 analogue inputs, 10 bits 3 digital outputs, 1 relay
X3[1)]		*Page 34*	Motor temperature monitoring (on usage of the encoder interface X7)	PTC, based on DIN 44082 linear temperature sensor KTY 84-130 or automatic thermal switch Klixon
X4		*Page 45*	RS232 connection	For PC with DriveManager 3.x or KeyPad KP300 (formerly KP200-XL)
X5		*Page 46*	CAN interface	Access to the integrated CAN interface CiA402
X6		Page 36	Resolver connection	With temperature monitoring
X7		*Page 33*	TTL/SSI encoder interface SinCos Hiperface®	TTL encoder SSI absolute value encoder, Optional: Sin/Cos encoder
X8		*Page 17*	Option slot	Expansion slot, e.g. for option module PROFIBUS-DP (CM-DPV1)
X9		*Page 29*	Brake driver	2 A
X18			External drive power supply	24V -25 % to 48 V +10 % DC (Required from UZK < 200 V)
X19	X20	-	-	No function

1) The PTC is only allowed to be connected to one of the two possible connections X3 or X6.

Table 4.2 Key to connection diagram, CDE3000 (BG6, 7, 7a)

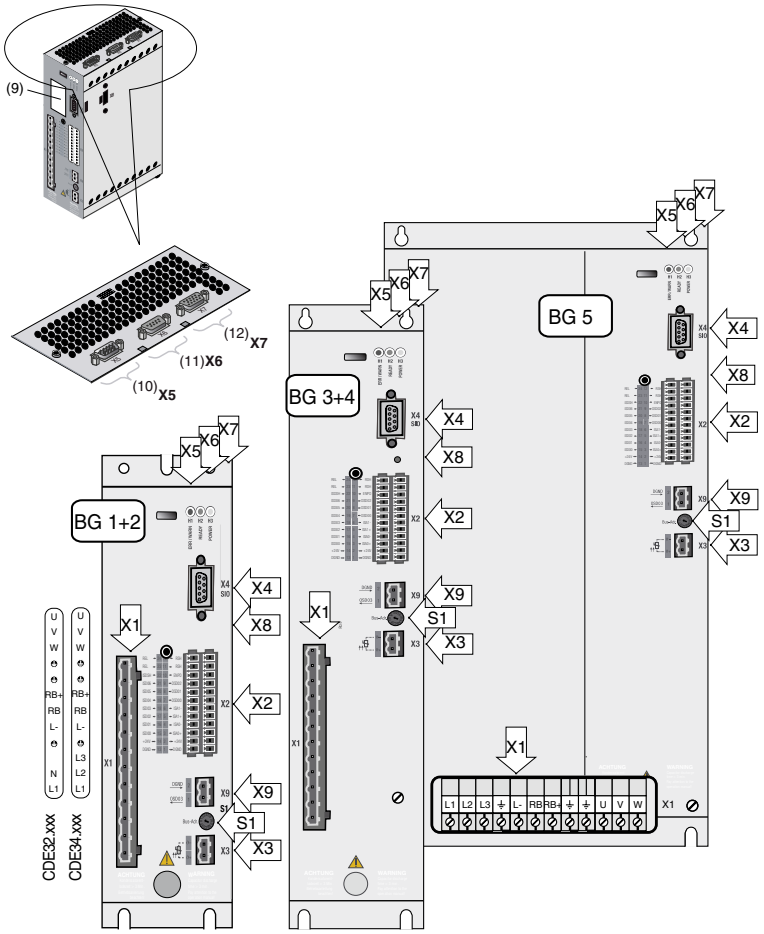


Figure 4.3 Layout of the CDE3000 (BG1 to BG5)

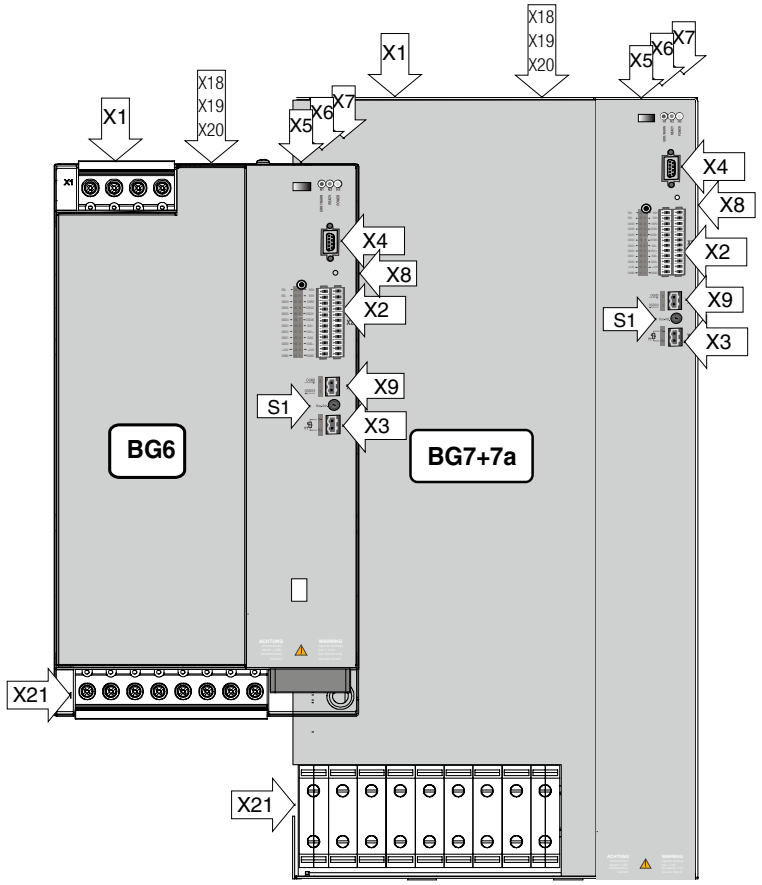


Figure 4.4 Layout of the CDE3000 (BG6, BG7 and BG7a)

4.2 Overview of the connections, CDB3000

Connection diagram CDB3000 (BG1 ... BG5)

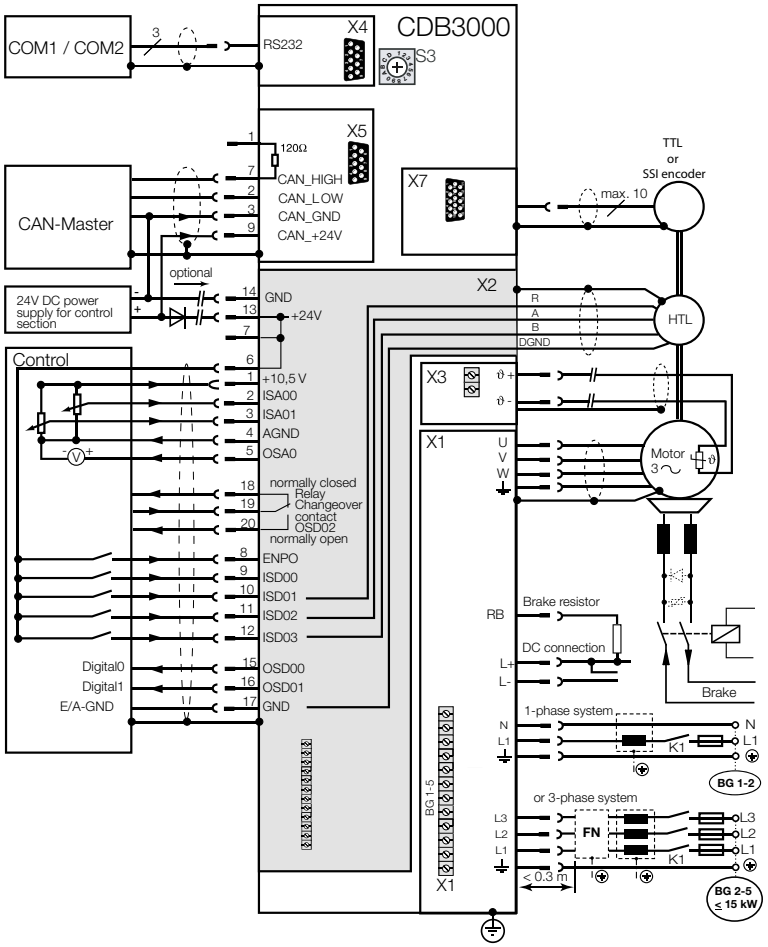


Figure 4.5 Connection diagram CDB3000 (BG1 ...BG5)

NOTE: Installation must only be carried out by electrical engineering experts who have been specially instructed in the necessary accident prevention measures.

No.		Page	Designation	Function
H1, H2, H3		*Page 61*	Light emitting diodes	Device state indication
S3		*Page 46*	Rotary code switch	Setting the CAN address
X1	BG1-5	*Page 25* Mains *Page 43*Motor	Power connection	Mains, motor, DC supply (L+/L-) braking resistor L+/RB
⏚		*Page 22*	Protective earth conductor connection	
X2		*Page 37*	Control connection	5 digital inputs, 2 analogue inputs, STO function only in model CDB3000 SH 2 digital outputs, 1 relay, 1 analogue output
X3		*Page 43*	Motor temperature monitoring	PTC, based on DIN 44082 linear temperature sensor KTY 84-130 or automatic thermal switch Klixon
X4		*Page 45*	RS232 connection	For PC with DriveManager 3.x or KeyPad KP300 (formerly KP200-XL)
X5		*Page 46*	CAN interface	Access to the integrated CAN interface CiA402
X7		*Page 40*	TTL/SSI encoder interface	TTL encoder SSI absolute value encoder
X8		-	Option slot	Expansion slot, e.g. for option module Profibus-DP (UM-DPV1)

Table 4.3 Key to connection diagram CDB3000 (BG1 - 5)

Connection diagram CDB3000 (BG6, 7, 7a)

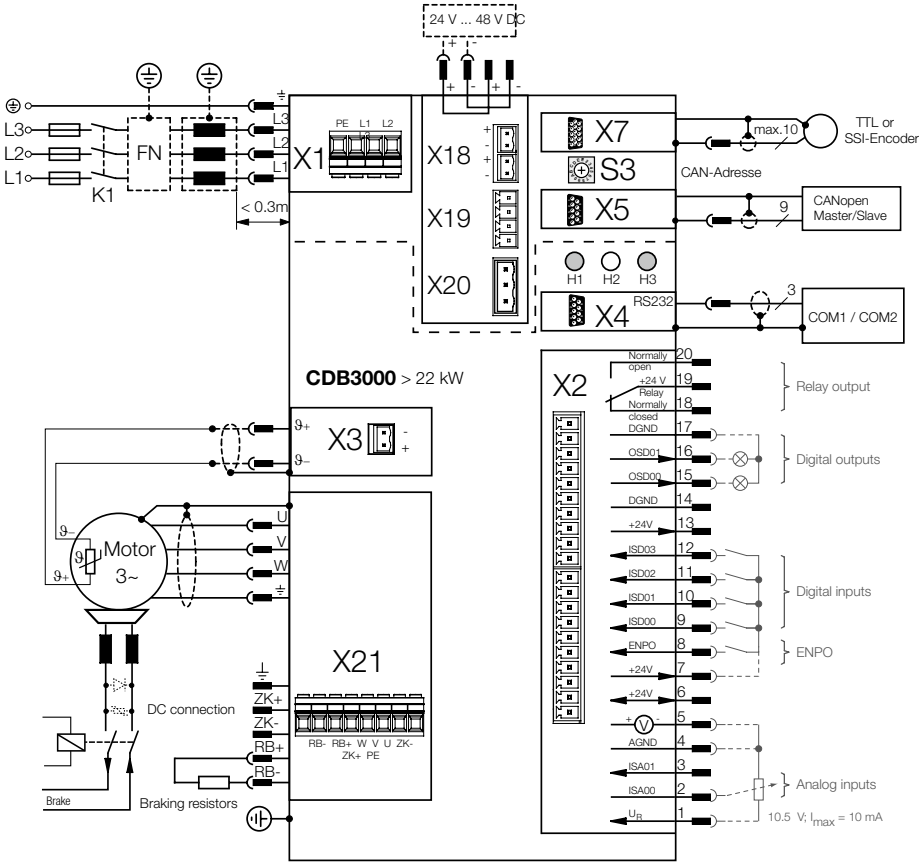


Figure 4.6 Connection diagram CDB3000 (BG6, 7, 7a)

NOTE: Installation must only be carried out by electrical engineering experts who have been specially instructed in the necessary accident prevention measures.

No.		Page	Designation	Function
H1, H2, H3		*Page 61*	Light emitting diodes	Device state indication
S3		*Page 46*	Rotary code switch	Setting the CAN address
X1	BG6-7	*Page 25*	Mains connection	Mains
X21	BG6-7	*Page 43*	Power connection	Motor, DC supply (ZK+/ZK-) braking resistor RB+/RB-
⏚		*Page 22*	Protective earth conductor connection	
X2		*Page 37*	Control connection	5 digital inputs, 2 analogue inputs, STO function only in model CDB3000 SH 2 digital outputs, 1 relay, 1 analogue output
X3		*Page 43*	Motor temperature monitoring (on usage of the encoder interface X7)	PTC, based on DIN 44082 linear temperature sensor KTY 84-130 or automatic thermal switch Klixon
X4		*Page 45*	RS232 connection	For PC with DriveManager 3.x or KeyPad KP300 (formerly KP200-XL)
X5		*Page 46*	CAN interface	Access to the integrated CAN interface CiA402
X7		*Page 40*	TTL/SSI encoder interface	TTL encoder SSI absolute value encoder
X8		-	Option slot	Expansion slot, e.g. for option module Profibus-DP (UM-DPV1)
X18		-	External drive power supply	24V -25 % to 48 V +10 % DC (required from UZK < 200 V)
X19	X20	-	-	No function

Table 4.4 Key to connection diagram, CDB3000 (BG6, 7, 7a)

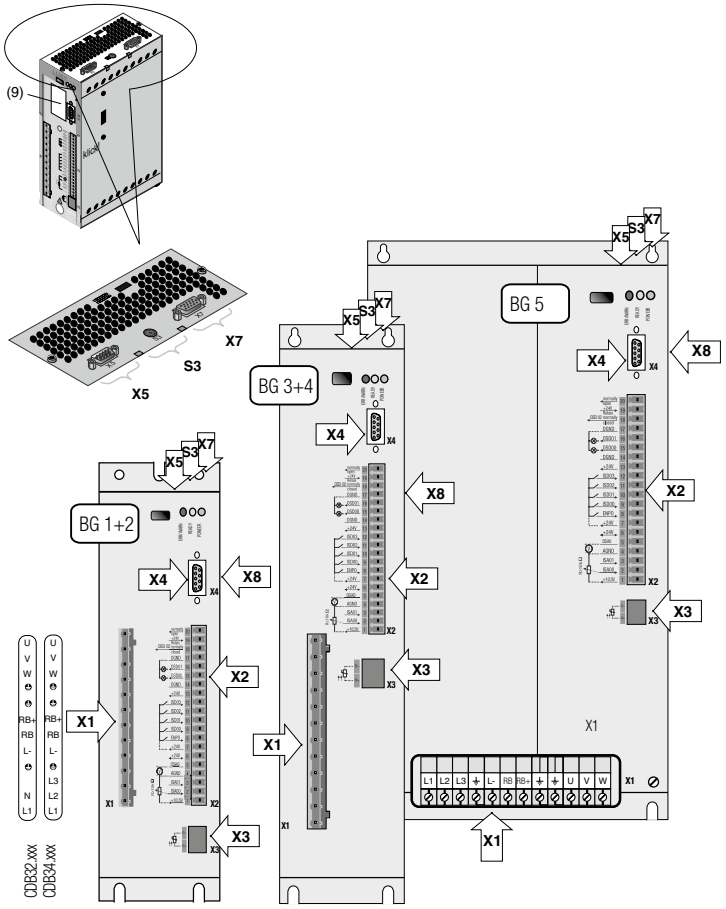


Figure 4.7 Layout DB3000 (BG1 to 5)

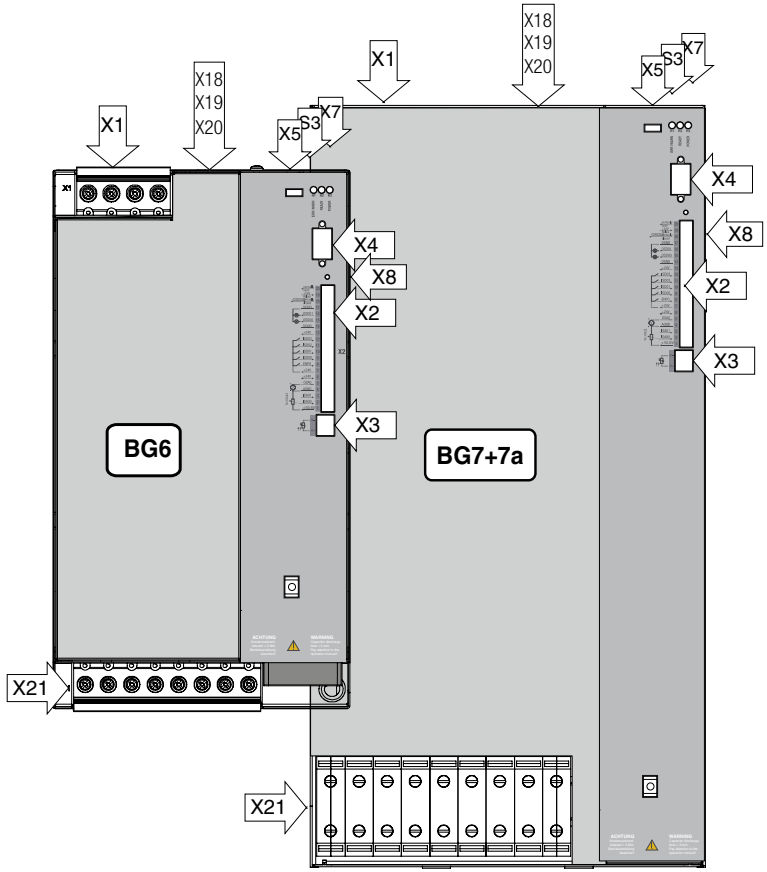


Figure 4.8 Layout DB3000 (BG6, 7 and 7a)

4.3 Effective EMC installation CDE/CDB3000

The positioning inverters are components for installation in industrial and commercial plants and machinery.

Commissioning (i.e. start-up of intended operation) is only permitted on compliance with the EMC Directive (2004/108/EC).

The installer/operator of a machine and/or system must provide proof of compliance with the protection targets stipulated in the EMC Directive.

NOTE: If the installation instructions in this operation manual are followed and the related RFI filters are used, as a rule the EMC protection goals will be met.

Allocation of drive controllers with internal mains filter

All drive controllers CDE/CDB have a sheet steel housing with an aluminium-zinc surface for improved interference immunity as per IEC 61800-3, environment 1 and 2.

The drive controllers 0.37 kW to 7.5 kW and 22 kW to 37 kW are equipped with integrated mains filters. With the measurement method specified by the standard, the drive controllers are compliant with the EMC product standard EN61800-3 for "First environment" (residential) and "Second environment" (industrial).

– Public low-voltage network (first environment) residential: up to 10 m motor cable length, you will find exact data in appendix A.5.

NOTE: This is a restricted availability product in accordance with IEC 61800-3. This product may cause radio interference in residential areas; in such cases the operator may need to take appropriate measures.

– Industrial low-voltage network (second environment) industrial: up to 25 m motor cable, you will find exact data in appendix A.5.

Allocation of drive controllers with external mains filter

External radio frequency interference suppression filters (EMCxxx) are available for all drive controllers. With these mains filters, the drive controllers are compliant with the EMC product standard EN 61800-3 for "First environment" (residential) and "Second environment" (industrial).

– Public low-voltage network (first environment) residential: up to 100 m motor cable length.

NOTE: This is a restricted availability product in accordance with IEC 61800-3. This product may cause radio interference in residential areas; in such cases the operator may need to take appropriate measures.

– Industrial low-voltage network (second environment) industrial: up to 150 m motor cable length.

NOTE: By using external mains filters it is also possible to achieve "general availability" with short motor cable lengths. If this issue is important for you, contact our sales engineers or your project engineer.

Topic	Project planning and installation rules
Protective earth conductor connection equipotential bonding	Use bare metal backing plate. Use cable cross-sections as large as possible and/or ground straps. Arrange protective earth conductor connection for the components in a star topology. To establish a low-impedance HF connection, the earthing (PE) and the shield connection must be connected to the PE rail on the backing plate using a large area connection. PE mains connection according to DIN VDE 0100 Part 540 • Mains connection < 10 mm²/Cu: use protective earth conductor cross-section min. 10 mm² or two wires with the cross-section of the mains power cables. • Mains connection ≥ 10 mm²/Cu: protective earth conductor cross-section to suit the cross-section of the mains power cables.
Cable routing	• If possible, lay motor cable separated from signal cables and mains cable. • Always route the motor cable without interruptions and the shortest way out of the switch cabinet. • If a motor contactor or motor choke/motor filter is used, this component should be positioned directly at the drive controller. Do not strip back the shield too far on the motor cable. • Avoid unnecessarily long cables.
Cable type	The drive controllers are always to be wired using shielded motor cables and signal cables. A cable type with double copper braiding, with 60-70% coverage, must be used for all shielded connections.

Topic	Project planning and installation rules
Further tips for switch cabinet layout	• Contactors, relays, solenoid valves (switched inductances) must be wired with suppressors. The wiring must be directly connected to the respective coil. • Any switched inductance should be at least 20 cm away from the process-controlled assemblies. • Place larger loads near the supply. • If possible, signal lines should only enter from one side. • Wires for the same electric circuit must be twisted. In general, cross-talk is reduced if cables are laid close to earthed sheet metal plates. Connect spare cores to switch cabinet ground (earth) at both ends.
Additional information	You will find additional information in the related connection description.

Table 4.5 Project planning and installation rules

4.4 Protective earth conductor connection CDE/CDB

As the leakage current is > 3.5 mA, it is imperative the requirements on the PE connection described in the following are followed.

Step	Action	Comment: PE mains connection according to EN 61800-5-1
1.	Earth each of the positioning controllers! Connect terminal ⏚ X1/ **in a star topology** to the PE rail (main earth) in the switch cabinet.	**Mains connection < 10 mm²/Cu:** use protective earth conductor cross-section min. 10 mm² or 2 wires with the cross-section of the mains power cables.
2.	Also connect the PE conductor terminals on all other components, such as mains choke, filter, etc. in a **star topology** to the PE rail (main earth) in the switch cabinet.	**Mains connection ≥ 10 mm²/Cu:** protective earth conductor cross-section to suit the cross-section of the mains power cables.

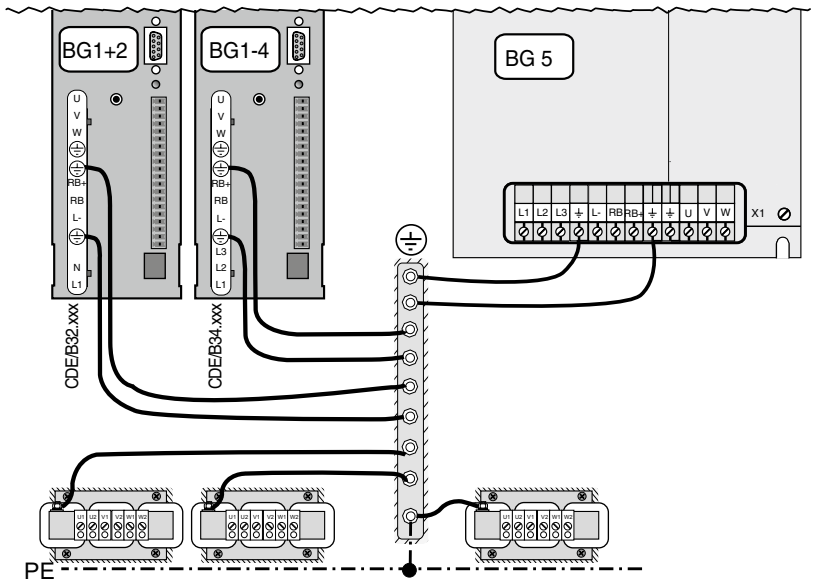


Figure 4.9 Protective earth conductor connection with star topology (BG1-5)

NOTE:

- To comply with the EMC standards, the PE conductor is to be laid with a star topology.
- The backing plate must be well-earthed.
- The motor cable, mains cable and control cable are to be laid physically separated.
- Avoid loops of cable and use short routes.
- The leakage current in operation is > 3.5 mA.

4.5 Electrical isolation concept CDE/CDB3000

The control electronics with their logic, inputs and outputs, are electrically isolated from the voltage on the DC link via a two-stage power supply.

1. The first stage SNT1 generates a 24 V voltage from the voltage on the DC link. On the one hand this supplies the secondary, input or output side of the digital inputs and outputs. It can be boosted externally to increase the maximum current. This action is necessary if the 24 V is loaded with a current greater than 100 mA (e.g. due to the connection of a motor holding brake to OSD03 to the CDE3000).
2. On the other hand, this 24 V supply provides power to a second power supply unit SNT2 where the voltages for the microcontroller, the encoder interfaces, the primary side of the CANopen interface and the analogue inputs are generated at the same potential. The analogue ground is used as a reference potential for the analogue setpoint input.

Therefore the digital inputs and outputs supplied using the voltage in 1.) are electrically isolated from 2.). In this way interference is kept away from the processor and the analogue signal processing.

The internal CANopen interface is electrically isolated from the control electronics. The 24 V power supply for the secondary side or interface to the application is to be supplied externally via the connector X5.

Expansion modules such as the I/O terminal expansion UM-8I4O or the PROFIBUS-DP module CM-DPV1 are also electrically isolated from the basic device. The interface to the module's application is to be supplied externally via a 24 V connection on the expansion module.

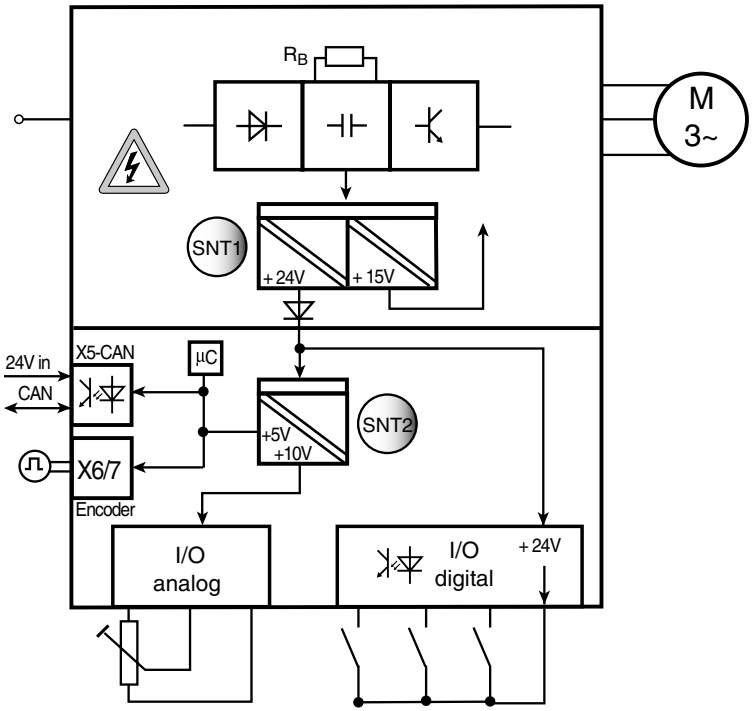


Figure 4.10 Electrical isolation concept/power supply on the CDE3000/CDB3000

During the selection of the cables, attention is to be paid to ensuring the cables for the analogue inputs and outputs are always shielded. The cable or core screen on shielded pair cables should be connected using a connection with an area as large as possible for EMC reasons. In this way high-frequency interference will be reliably removed (skin effect). Wiring that is effective for EMC is imperative and must be ensured.

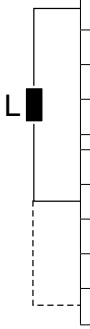
Special case: usage of the analogue inputs as digital inputs

NOTE: The analogue inputs must be used either both for an analogue function or both for a digital function. It is not allowed to mix the analogue inputs with one input with an analogue function and one with a digital function.

The usage of the internal 24 V DC as a power supply on the usage of an analogue input with the "digital input" function requires the connection of an analogue ground and digital ground. For the reasons stated above this configuration can cause interference and requires increased care during the selection and connection of the control cables.

Reliable operation in relation to the burst immunity according to EN 61000-4-4 is not affected by the connection of the analogue and digital ground. To minimise the interference currents in the ground connection, the analogue (AGND) and digital ground (DGND) are to be connected via a VHF choke (820 µH, 0.5 A, e.g. EPCOS B82500-C-A5).

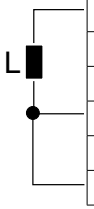
Jumper is only necessary on the usage of the internal 24 V.



X2	Function
1	Reference voltage 10 V, 10 mA
2	ISA00, as dig. input
3	ISA01, as dig. input
4	Analogue ground
5	OSA00
6	Auxiliary voltage 24 V, max. 200 mA
7	
13	Auxiliary voltage 24 V
14	Digital ground
15	OSD00
16	OSD01
17	Digital ground

Figure 4.11 Loss of the electrical isolation on the usage of the analogue inputs with a digital function on the CDB3000

Jumper is only necessary on the usage of the internal 24 V.



X2	Function
1	Digital ground DGND
2	Auxiliary voltage UV=24 V DC
3	Analogue input ISA0+
4	Analogue input ISA0-
5	Analogue input ISA1+
6	Analogue input ISA1-

Figure 4.12 Loss of the electrical isolation on the usage of the analogue inputs with a digital function on the CDE3000

CAUTION: The ground connection is not allowed to be made or routed into the system via the analogue ground terminal 4 on the CDB3000, (terminals 4, 6 on the CDE3000). It is only allowed to be connected via one of the DGND terminals (see Figure 4.13).

Example: Risk of interference

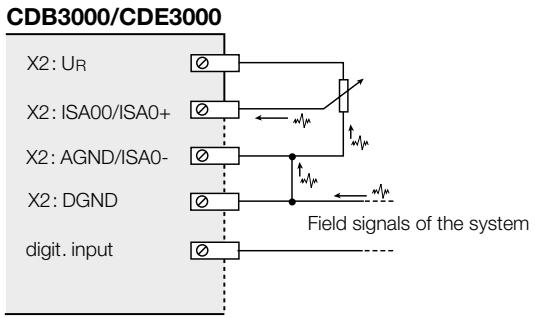


Figure 4.13 Interference on the analogue input with inappropriate wiring

NOTE:If more digital inputs and outputs are required than are available on the positioning controllers, we recommend the usage of the terminal expansion module UM-8I4O with 8 digital inputs and 4 digital outputs.

4.6 Mains connection CDE/CDB3000

Step	Action	Comment
1.	Specify the **cable cross-section** depending on the maximum current and ambient temperature.	Cable cross-section according to local and country-specific regulations and conditions.
2.	Wire the drive controller with the **mains filter**, the max. distance between the filter housing and drive controller is 0.3 m!	This step is not required for BG1 to BG4, up to 7.5 kW a mains filter is already integrated.
3.	Connect the **mains choke** see appendix A.5 On BG 6-7 max. 0.3 m distance between choke housing and drive controller!	Reduces the distortion (THD) in the system and prolongs the service life.
4.	Install a mains isolating device K1 (power circuit breaker, contactor, etc.).	**Do not switch on the power!**
5.	Use mains fuses (utilisation class gG) to isolate all poles of the drive controller from the mains supply.	For compliance with equipment safety as per in EN 61800-5-1

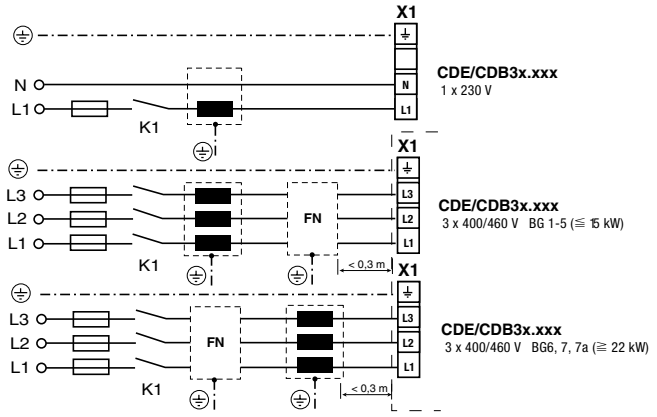


Figure 4.14 Mains connection

CAUTION: For devices of sizes BG6 to BG7/7a, a mains choke is imperative. Due to the precharging technology in these devices, it is to be ensured that the mains choke is installed between the drive controller and mains filter, otherwise the mains filter may be damaged.For information on benefits of the mains choke, see appendix A.4

DANGER! Never make or disconnect electrical connections while they are live! Always disconnect the power before working on the device. Wait until the DC link voltage on the terminals X1/L+ and L- (BG 1-5) or X21/ ZK+, ZK- (BG 6, 7, 7a) has dropped to the protective extra low voltage before you work on the device (approx. 10 min.).

USAGE OF EARTH LEAKAGE CIRCUIT BREAKERS:

If local regulations require the installation of an earth leakage circuit breaker, the following applies:

In the event of a fault the drive controller is able to generate DC leakage currents without zero crossing. Drive controllers therefore must only be operated with RCDs [1] type B for AC fault currents, pulsating or smooth DC fault currents, which are suitable for servo controller operation, see IEC 60755. RCMs[2] can also be used for monitoring tasks.

- Switching the mains power: cyclic mains switching every 60 s is allowed, jogging using a mains contactor is not allowed.
  - In the event of excessively frequent switching, the device protects itself by means of high-impedance decoupling from the mains.
  - After a rest phase of a few minutes the device is ready to start once again.
- TN and TT system: operation is permitted if:
  - With single-phase devices for 1 x 230 V AC the supply system conforms to the maximum overvoltage category III as per EN61800-5-1.
  - With three-phase devices with phase voltages 3 x 400 V AC, 3 x 460 V AC
  - The star point of the supply system is earthed and the supply system conforms to the maximum overvoltage category III as per EN 61800-5-1 at a system voltage (phase -> star point) of maximum 265 V.

- IT system: not allowed!
  - If there is an earth fault the voltage is approx. twice as high, clearances and creepages to EN 50178 are no longer maintained.
  - The connection of the positioning inverter via a mains choke with a short-circuit voltage of UK = 4 % (BG1 to 5) and UK = 2 % (BG6, 7, 7a) of the rated voltage is imperative:
  - On the usage of the drive controller in applications with interference corresponding to environment class 3, as per EN 61000-2-4 and higher (hostile industrial environment).
  - For compliance with EN 61800-3 or IEC 1800-3, see appendix A.5.
  - If the DC links on several drive controllers are coupled.

You will find further information on current carrying capacity, technical data and ambient conditions in the appendix A.1 to A.3. - For information on benefits of the mains choke, see appendix A.4

[1] Residual current protective device

[2] Residual current monitor

ENVIRONMENT CLASS 3 ACCORDING TO EN 61000-2-4

The characteristics of environment class 3 include:

- Mains voltage fluctuations > + 10% UN
- Brief interruptions between 10 ms and 60 s
- Voltage asymmetry between the phases > 3 %

Environment class 3 is typically present if:

- A major portion of the load is supplied by power converters (DC choppers or soft-starting devices),
- There are welding machines,
- There are induction furnaces or electric arc furnaces,
- Large motors are started frequently,
- Current loads fluctuate quickly.

Drive controller	Device connected load with mains choke (4 % UK) [kVA]	Without mains choke [kVA]	Max. cable cross-section of the terminals [mm²][1)]	Mains fuse (gG) [A]
CDE/CDB32.004	1.7	1.96	2.5	1 x 10
CDE/CDB32.006	2.3	2.7	2.5	1 x 16
CDE/CDB32.008	3.0	3.5		1 x 16
CDE/CDB34.003	1.5	2.1		3 x 10
CDE/CDB34.005	2.8	3.9		3 x 10
CDE/CDB34.006	3.9	5.4	2.5	3 x 10
CDE/CDB34.008	5.4	7.3	2.5	3 x 10
CDE/CDB34.010	6.9	9.4	2.5	3 x 16
CDE34.010,W,S	6.9	9.4	4.0	3 x 32
CDE/CDB34.014	9.7	13.1	4.0	3 x 20
CDE/CDB34.017	11.8	15.9		3 x 25
CDE/CDB34.024	16.6	22.5	16	3 x 35
CDE/CDB34.032	22.2	30.0		3 x 50
CDE/CDB34.044	31	-	25	3 x 63
CDE/CDB34.058	42	-		3 x 80
CDE/CDB34.070	50	-		3 x 100
CDE/CDB34.088	62	-	50	3 x 125
CDE/CDB34.108	76	-		3 x 160
CDE/CDB34.140	99	-	95	3 x 200
CDE/CDB34.168	118	-		3 x 224
CDE/CDB34.208	128	-		3 x 250

1) The minimum cross-section of the mains power cable depends on the local regulations and conditions.

Table 4.6 Cable cross-sections and mains fuses

4.6.1 Note on EN 61000-3-2

Load on the mains due to harmonics

Our positioning controllers and drive controllers are "professional equipment" in the context of EN61000 such that with a nominal connected load ≤ 1 kW they fall within the scope of the standard. On the direct connection of drive units ≤ 1 kW to the public low-voltage network, either measures to conform to the standard are to be taken or the responsible utility must grant approval for connection.

If you should use our drive units as a component in your machine / system, then the scope of the standard is to be checked for the complete machine / system.

4.7 CDE3000

4.7.1 Control connections CDE3000

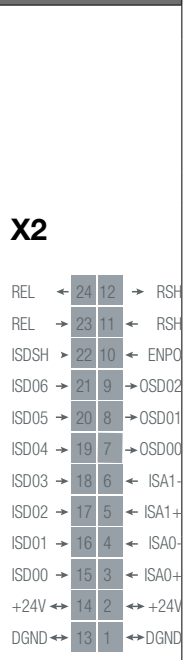
Step	Action	Comment
1.	Check whether a **SmartCard** or a **DriveManager 3.x data set** with complete device settings is already available, i.e. whether the drive has already been configured.	
2.	If so, a special control terminal assignment applies. It is imperative you contact your project engineer to obtain the terminal assignment!	**Series production customers** You will find information on how to load the data set into the positioning controller load in chapter 5.2.
3.	Choose a terminal assignment.	**Initial commissioning** Various preset solutions are available for straightforward commissioning.
4.	Wire the control terminals using shielded cables. The following are imperative: STO X2.22 ENPO X2.10 and a start signal (on control via terminal).	Earth cable shields over a large area at both ends. Cable cross-section maximum 1.5 mm² or two cores per terminal with 0.5 mm²
5.	Keep all contacts open (inputs inactive).	
6.	Check all connections again!	Continue with commissioning in chapter 5.

NOTE:

- Always wire the control terminals with shielded cables.
- Lay the control cables separately from the mains power and motor cables.
- You will find further preset drive solutions in the Application Manual CDE/CDB3000.
- A cable type with double copper braiding, with 60 - 70 % coverage, must be used for all shielded connections.

Specification of the control connections CDE

Des.	Terminal	Specification	Electrical isolation	Control terminal
Analogue inputs				
ISA0+ ISA0- ISA1+ ISA1-	X2-3 X2-4 X2-5 X2-6	• U_{IN} = ±10 V DC; • Resolution 10 bits; R_{IN}=110 kΩ • Terminal scan cycle = 1 ms • Tolerance: U: ±1 % of the measuring range end value	Yes, in relation to DGND	
Digital inputs				
ISD00 ISD01 ISD02 ISD03 ISD04 ISD05	X2-15 X2-16 X2-17 X2-18 X2-19 X2-20	• Frequency range < 500 Hz • Terminal scan cycle = 1 ms • Switching level low/high: <4.8 V / >18 V • At 24 V typ. 3 mA • R_{IN} = 3 kΩ	Yes	
ISD06	X2-21	• Frequency range < 500 Hz • Switching level low/high: <4.8 V / >18 V • Imax at 24 V = 10 mA • R_{IN} = 3 kΩ • Internal signal delay < 2 µs • suitable as trigger input for quickly saving the actual position	Yes	
ENPO	X2-10	• Enable power stage = High level • Frequency range < 500 Hz • Response time approx. 10 ms • Switching level low/high: <4.8 V / >18 V • At 24 V typ. 3 mA • R_{IN} = 3 kΩ	Yes	
Digital outputs				
OSD00 OSD01 OSD02	X2-7 X2-8 X2-9	• Short circuit proof • I_{max} = 50 mA, PLC-compatible • Terminal scan cycle = 1 ms • High-side driver	Yes	



Des.	Terminal	Specification	Electrical isolation	Control terminal
STO For further information see chapter 3.13: Safe Torque Off (STO)				
ISDSH	X2-22	• Input STO • Frequency range < 500 Hz • Terminal scan cycle = 1 ms • Switching level low/high: <4.8 V / >18 V • At 24 V typ. 3 mA • R_{IN} = 3 kΩ	Yes	
RSH RSH	X2-11 X2-12	• Relay RSH with STO function, one normally open contact with self-resetting circuit breaker (polyswitch) X2:12 / X2:11 • 25 V / 200 mA AC, cos φ =1 • 30 V / 200 mA DC, cos φ =1	Yes	
Relay outputs				
REL REL	X2-23 X2-24	• Relay, 1 NO contact • 25 V / 1 A AC, usage category AC1 • 30 V / 1 A DC, usage category DC1 • Switching delay approx. 10 ms • Cycle time 1 ms	Yes	
+24 V	X2-2 X2-14	• Auxiliary voltage UV = 24 V DC + 25 %, short circuit proof • I_{max} = 100 mA (total, also includes the driver currents for outputs OSD00 and OSD01, OSD02 and OSD03) • External 24 V - possible for supplying the control electronics on a mains failure, current consumption Imax = 1000 mA + holding brake current Tolerance on the supply + 20 % Caution: Depending on the type of power supply unit, a decoupling diode may be necessary as a protective measure to protect the power supply unit because, depending on the tolerances on the 24 V from the CDE/CDBs and 24 V power supply unit, power may be fed back.	Yes	
Digital ground				
DGND	X2-1 X2-13	• Reference ground for 24 V		
1) Applicable to a limited extent				

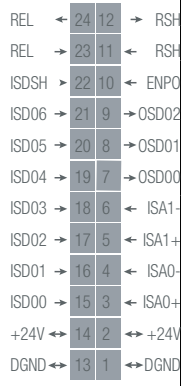


Table 4.7 Specification of the control connections CDE3000

Brake driver X9

The connector X9 is intended to be used to connect a motor brake.

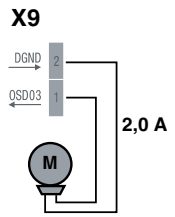
Brake driver X9			Electrical isolation	Brake driver X9
OSD03 DGND	X9-1 X9-2	Short circuit proof Cable break monitoring • External power supply 24 V required (I_{IN} = 2.1 A) • Suitable for actuating a motor holding brake • I_{max} = 2.0 A up to ϑ_{Umax} <45 °C • Reduced from I_{max} (with external 24 V supply) • Overcurrent causes shutdown • Can also be used as configurable digital output without external power supply. Without external power supply I_{MAX} = 50 mA	Yes	

Table 4.8 Specification of the terminal connections X9

Standard terminal assignment CDE

Terminal assignment with **factory setting**

Preset solution, speed control +10 V setpoint, control via terminal.

Features

- Scalable analogue setpoint (+10 V, 10 bits)
- Programmable, time-optimised acceleration profile

Parameter

152-ASTER = SCT_1

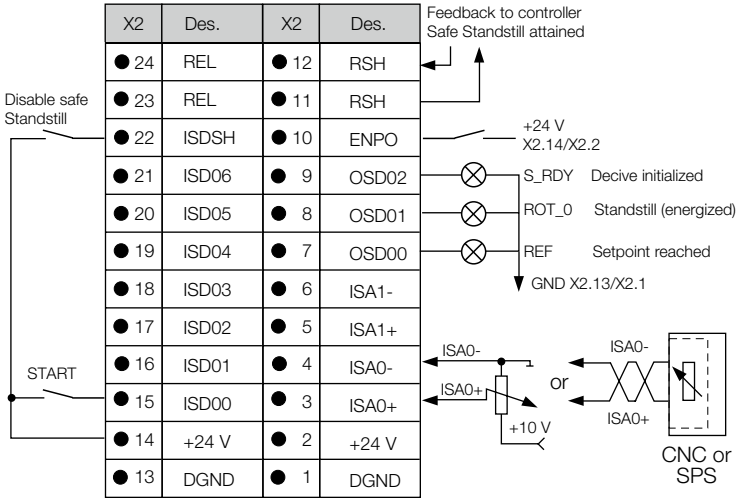


Figure 4.15 Control terminals, drive without encoder evaluation

4.7.2 CDE encoder connection on LTi motors

Please use the ready made motor cables (for type see Figure 4.1) and encoder cables (for type see Figure 4.1) for the connection to LTi synchronous motors.

Overview - encoder cables - connection to drive controller

Compare the rating plates of the components. Make absolutely sure you are using the correct components according to variant A, B or C!

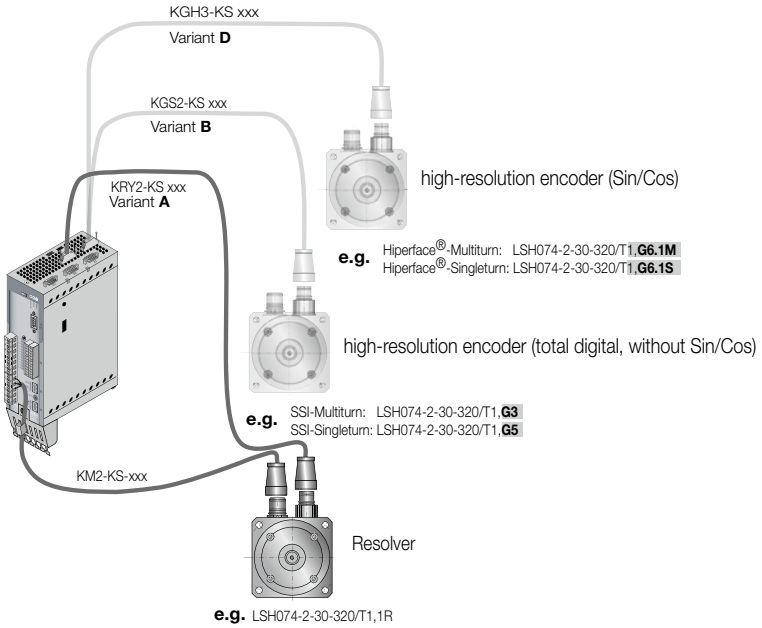


Figure 4.16 Connection of motor/encoder cable to drive controller CDE3000

NOTE: The encoder cable is not allowed to be cut, e.g. to route the signals via terminals in the switch cabinet.The knurled screws on the D-Sub connector housing must be tightly locked!

Which encoder types are available for LTi motors and which type of encoder cable is to be used?

Variant	Motor (with encoder installed)	Encoder cable	Connection on the drive controller
A	With resolver 1R, 3R, 5R e.g. LSH/LST074-2-30-320/T1,**1R**	KRY2-KSxxx	X6
B	With encoder G3, or G5 (absolute value SSI) e.g. LSH/LST074-2-30-320/T1,G3	KGS2-KSxxx	X7
D	G6: = Sin/cos singleturn encoder with HIPERFACE®-interface e.g. LSH/LST 074-2-30-320/T1,G6.1S	KGH3-KSxxx	X7
	G6M: = Sin/cos multiturn encoder with HIPERFACE®-interface e.g. LSH/LST 074-2-30-320/T1,G6.1M	KGH3-KSxxx	X7

Table 4.9 Variants, motor encoders - encoder cables

NOTE: On the simultaneous connection of a resolver to X6 and an encoder to X7, the device is to be supplied with a voltage of 24 V / 1 A (X2).

Ready made encoder cable

The specifications can only be assured on the usage of LTI system cables.

Order code	K	RY2	-	KS	005
Encoder cable					
Ready made cable					
Resolver cable Encoder cable SSI (G3, G5) Encoder cable Sin/Cos Hiperface® (G6.1 and G6.2)		RY2 GS2 GH3			
Encoder system					
Suitable for energy chains				KS	
Model					
Length 2 m Length: 3 m Length: 5 m Length: 8 m Length: 10 m Length: 15 m Length: 20 m					002 003 005 008 010 015 020
Cable length					

Ready made encoder cable

Cable type		KRY2-KSxxx	KGS2-KSxxx	KGH3-KSxxx
For drive controller		CDE3000		
For encoder system		Resolver	G3, G5, G12.x (Single / multiturn encoder with SSI)	G6.xS, G6.xM (Single / multiturn encoder with HIPERFACE® interface)
Suitable for energy chains		Yes		
Minimum bending radius:	in fixed installation	-	40 mm	-
	in flexible use	90 mm	100 mm	90 mm
Temperature range:	in fixed installation	-40 ... +85 °C	-35 ... +80 °C	-40 ... +85 °C
	in flexible use		-40 ... +85 °C	
Cable diameter approx.		8.8 mm		
Outer sheath material		PUR		
Resistance		Oil, hydrolysis and microbe resistant (VDE0472)		
Approvals		UL style 20233, 80 °C - 300 V, CSA-C22.2N.210 -M90, 75 °C - 300 V FT1		
Allocation of the cores		1 = S2 2= S4 3 = S1 4 = n.c. 5 = PTC+ 6 = R1 7 = R2 8 =n S3 9 = PTC-	1 = A- 2 = A+ 3 = Vcc (+5 V) 4 = DATA+ 5 = DATA- 6 = B- 8 = GND 11 = B+ 12 = Vcc (sense) 13 = GND (sense) 14 = CLK+ 15 = CLK- 7, 9, 10 = n.c.	1 = REFCOS 2 = +COS 3 = Us 7 – 12 V 4 = Data+ RS485 5 = Data- RS485 6 = REFSIN 7 = Jumper to pin 12 8 = GND 11 = +SIN 12 = Jumper to pin 7 9, 10, 13, 14, 15 = n.c.

Table 4.10 Technical data

4.7.3 Encoder connection, motors from other manufacturers on the CDE3000

Resolver

A resolver is connected to slot X6 (9-pin D-Sub socket).

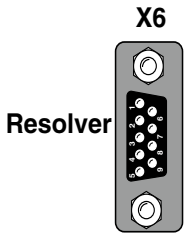
X6/pin	Function	Figure
1	Sin+ / S2 / (sin +)	
2	Refsin / S4 / (Refsin)	
3	Cos+ / S1 / (cos+)	
4	+ 5 V (in relation to pin 7)	
5*	J + (PTC, KTY, Klixon)	
6	Ref+ / R1 / (Ref+)	
7	Ref- / R2 / (Ref-)	
8	Refcos / S3 / (Refcos)	
9*	J - (PTC, KTY, Klixon)	
* *The motor PTC must be adequately isolated in relation to the motor winding (safe isolation 4 kV test voltage). This isolation is provided on the usage of LTi motors.*		

Table 4.11 Pin assignment X6

High-resolution encoders

It is possible to connect the following encoder types via the encoder interface X7.

- Incremental TTL encoder
- SSI encoder without Sin/Cos (fully digital)
- Sin/Cos Hiperface® encoder

NOTE:

- Encoder power supply
  - Power supply at the encoder: + 5 V +/-5 %, max. current consumption 150 mA (including load)
  - The encoders must have a separate sensor cable connection. The sensor cables are required to measure the supply voltage drop on the encoder cable. Only by using the sensor cables is it ensured that the encoder is supplied with the correct voltage.
    The sensor cables must always be connected!
- Incremental encoder with RS422-compatible track signals (TTL-compatible)
  - 32 to 2048 pulses/revolution
- SSI multiturn encoder as per the reference list with the general specifications:
  - Transmission protocol "SSI", gray-coded
  - 25 bits multiturn (12/13 bits multiturn/singleturn information, MSB first)

You will find the electrical specification for the interface in Table 4.12, the terminal assignment in Table 4.8.

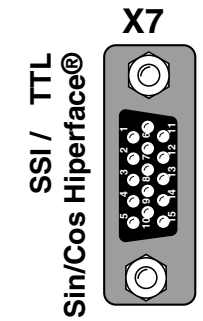
Specification for interface X7 for high-resolution encoder

	TTL encoder	SSI encoder	SinCos Hiperface®
Connection	Miniature D-SUB 15-pin socket (high density)		
Interface	RS422 (differential)		
Wave terminating resistor	Track A, B, R: 120 Ω (internal)	DATA: 120 Ω (internal) CLK: Termination not necessary	DATA: 120 Ω (internal) CLK: Termination not necessary
Max. signal frequency fLimit	150 kHz		
Power supply	+ 5 V ±5% (regulated via signal cables) max. 150 mA Not electrically isolated in relation the control electronics		7 to 12 V (typ. 11 V + 5% / 100 mA)
Sampling frequency for the regulation	4 kHz	4 kHz	4 kHz
Interface protocol	-	SSI (gray code)	Hiperface®
Pulses per revolution/ resolution	32 - 2048	13 bits (singleturn) 12 bits (multiturn)	15 bits (singleturn) 12 bits (multiturn)
Maximum cable length	50 m (Further cable specifications as per information from motor manufacturer)		

Table 4.12 Specification for the encoder interface X7 CDE3000

Select the cable type specified by the motor or encoder manufacturer. During this process bear in mind the following boundary conditions:

- Always used shielded cables. Connect the shield at both ends.
- Connect the differential track signals A, B, R or CLK, DATA using twisted pair cable cores.
- The encoder cable is not allowed to be cut, e.g. to route the signals via terminals in the switch cabinet.

X7/pin	TTL function	SSI function	Absolute encoder HIPERFACE®	Figure
1	A-, (track A) [1]	Don't use	REFCOS	
2	A+, (track A)	Don't use	+COS	
3	+ 5 V (150 mA)		7 to 12 V / (typ. 11 V) 100 mA [3]	
4	Don't use	Data + differential input RS485	Data +	
5	Don't use	Data - differential input RS485	Data -	
6	B-, (track B) [1]	Don't use	REFSIN	
7	Don't use	Don't use	U_S - Switch [4]	
8	GND (for the 5 V on pin 3)		GND	
9	R- (zero pulse) [1]	Don't use		
10	R+ (zero pulse)	Don't use		
11	B+, (track B) [1]	Don't use	+SIN	
12	Sensor + sensor cable for measuring the 5 V supply at the encoder		U_S - Switch [4]	
13	Sensor - sensor cable for measuring the 5 V supply at the encoder		-	
14	Don't use	CLK + differential output, clock signal	-	
15	Don't use	CLK - differential output, clock signal	-	

[1] The cables for tracks A B, R and data are connected internally using 120 Ω.

[3] The sum of the currents drawn at X7/3 and X6/4 must not exceed the value given!

[4] After connecting pin 7 and pin 12, there is a voltage of 11.8 V on X7/3 and X6/4!

Table 4.13 Pin assignment for the encoder interface X7 CDE3000

4.7.4 Motor temperature monitoring CDE

CAUTION! The motor temperature sensor must, in relation to the motor winding, on connection to X3 be provided with **basic insulation**, on connection to X6 with **reinforced insulation** as per EN 61800-5-1!

Connection	Sensor type	Insulation in the motor winding
X3	Temperature switch (Klixon), PTC	Sensor with basic insulation
X6	Temperature switch (Klixon), PTC, KTY	Sensor with reinforced insulation

Table 4.14 Connection of motor temperature sensor

4.7.5 Connection of LTI motors

To connect LTI servomotors, product range LSH and LST, please use the ready made motor cable KM2-KS-005.

Ready made motor cable

Order code	KM 2	-	KS	005
Motor cable				
Ready made cable				
Suitable for energy chains			KS	
Model				
Length 2 m				002
Length 3 m				003
Length 5 m				005
Length 8 m				008
Length 10 m				010
Length 15 m				015
Length 20 m				020
Cable length				

Technical data, motor cable		KM2-KSxxx
Minimum bending radius:	in fixed installation	60 mm
	in flexible use	120 mm
Temperature range:	in fixed installation	-50 ... +90 °C
	in flexible use	-50 ... +90 °C
Cable diameter approx.		ø 12 mm
Outer sheath material		PUR
Allocation of the cores		U = 1 V = 2 W = 3 Ground = ye/gn PTC = 5 PTC = 6 Brake + = 7 Brake - = 8
Note: For motors up to 16 A rated current with plug-in power connection		

Table 4.15 Technical data, ready made motor cable

NOTE: Cores 5 and 6 (PTC) are required only for motors with high-resolution encoders (G3, G5, G6, G6M).For LSH motors with resolver, the PTC is monitored via the resolver cable.

4.7.6 Connection of motors from other manufacturers

Step	Action	Comment
1.	Specify the cable cross-section depending on the maximum current and ambient temperature.	Cable cross-section as per VDE0100, part 523, see chapter 4.6.
2.	Connect the motor phases U, V, W using a shielded cable and earth the motor at X1/ ⏚ or X21.	Connect the shield at both ends to reduce interference emissions.
3.	Wire the temperature sensor (PTC, KTY, Klixon) (if fitted) to X3 using separate shielded cables and activate the temperature evaluation using DriveManager 3.x.	Connect the shield at both ends to reduce interference emissions.

CAUTION:It is to be ensured the motor temperature sensor used is adequately isolated in relation to the motor winding (basic insulation test voltage 2 kV).

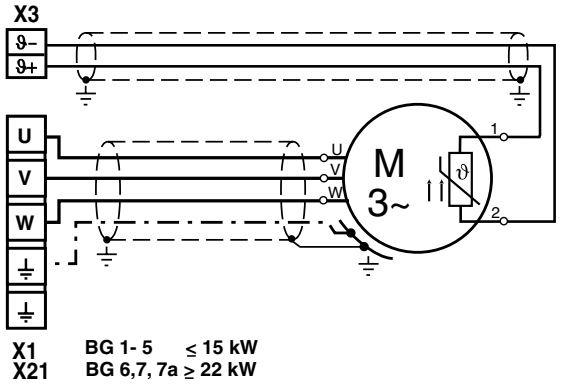


Figure 4.17 Connection of the motor

NOTE: The CDE3000 positioning controller is protected against short circuits and earth faults on the terminals during operation.If a short circuit or earth fault occurs in the motor cable, the power stage is disabled and an error message is output.

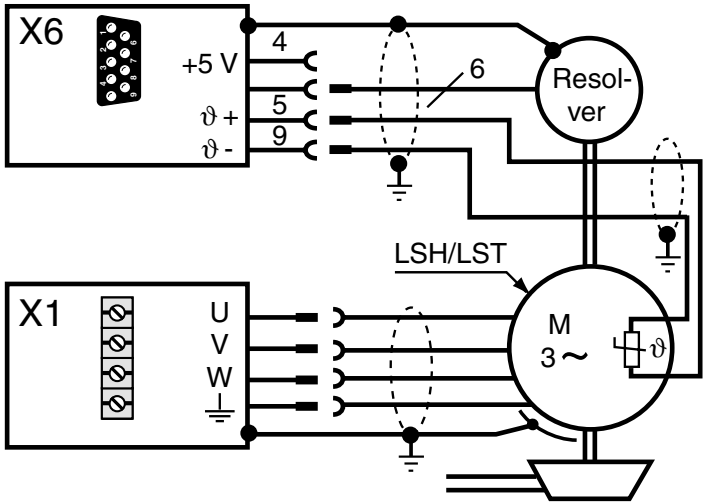
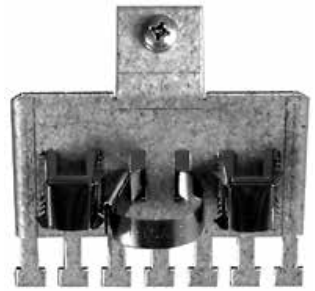


Figure 4.18 Connection of the PTC on LSH/LST motors

4.7.7 Shield connection and effective EMC installation, CDE

NOTE:

- Connect shield via shield connection STxx. From size 7 (45 kW/ 90 A) the shield connection is to be made directly underneath the device on the backing plate.
- For an effective EMC installation, the motor terminal box must be sealed in relation to HF (metal or metallised plastic). Cable glands with a large area shield connection are to be used for cable entries.



Shield connection plate STxx

Shield connection with clip and metal cable ties

NOTE:

- The screws for fastening the shield connection plates ST02 to ST06 are only allowed to be tightened to a tightening torque of **max. 1.3 Nm**. If this instruction is not followed, the tapped hole on the front of the device may be irreparably damaged.

You will find further information on current carrying capacity, technical data and ambient conditions in annex A.1 to A.3.

The matching motor temperature sensor (PTC) or temperature-dependent switch and I²xt monitoring for the protection of the motor can be configured on this screen (Figure 4.19)

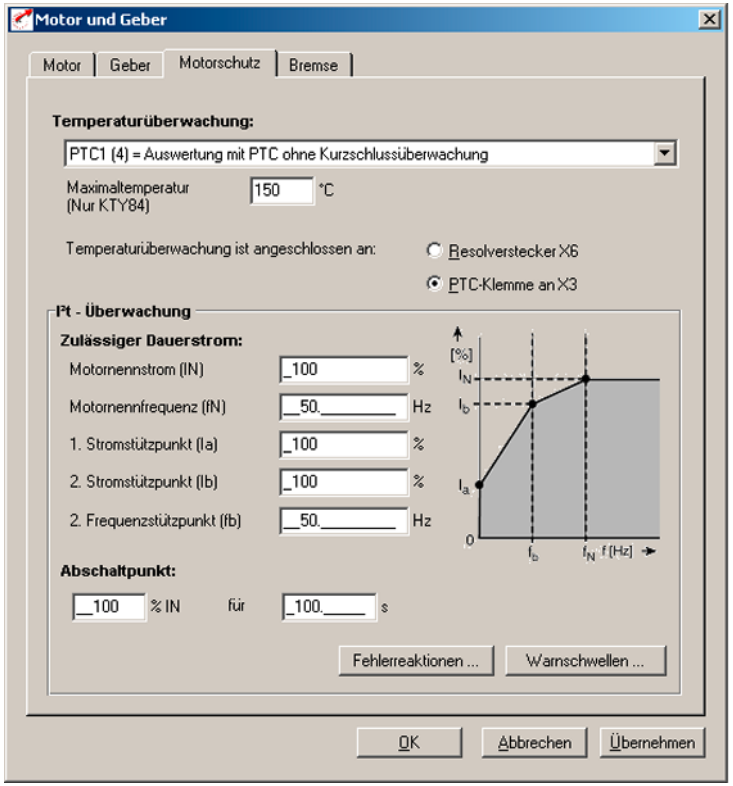


Figure 4.19 Motor protection tab

4.8 CDB3000

4.8.1 Control connections CDB3000

Step	Action	Comment
1.	Check whether a SmartCard or a DriveManager 3.x data set with complete device settings is already available, i.e. whether the drive has already been configured.	
2.	If so, a special control terminal assignment applies. It is imperative you contact your project engineer to obtain the terminal assignment!	Series production customers You will find information on how to load the data set into the positioning controller load in chapter 5.2.
3.	Choose a terminal assignment.	Initial commissioning Various preset solutions are available for straightforward commissioning.
4.	Wire the control terminals using shielded cables. The only imperative signals are ENPO and a start signal (for control via terminals).	Earth cable shields over a large area at both ends. Cable cross-section maximum 1.5 mm² or two cores per terminal with 0.5 mm²
5.	Leave all contacts open (inputs inactive).	
6.	Check all connections again!	Continue with commissioning in chapter 5.

NOTE:

- Always wire the control terminals with shielded cables.
- Lay the control cables separately from the mains power and motor cables.
- You will find further preset drive solutions in the Application Manual CDE/CDB3000.
- A cable type with double copper braiding, with 60 - 70 % coverage, must be used for all shielded connections.

Specification of the control connections CDB3000

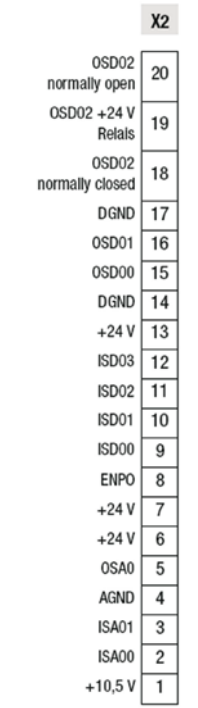
Des.	Terminal	Specification	Floating	Control terminal
Analogue inputs				
ISA00	X2-2	• U_{IN} = +10 V DC, ±10 V DC • I_{IN} = (0) 4-20 mA DC, in the software can be switched to: • 24 V digital input, PLC-compatible • Switching level low/high: <4.8 V / >8 V DC • Resolution 10 bits • R_{IN}=110 kΩ • Terminal scan cycle = 1 ms • Tolerance: U: ±1% of the measuring range end value • I: ±1% of the measuring range end value	In relation to digital GND	
ISA01	X2-3	• U_{IN} = +10 V DC, in the software can be switched to: • 24 V digital input, PLC-compatible • Switching level low/high: <4.8 V / >8 V DC • Resolution 10 bits • R_{IN}=110 kΩ • Terminal scan cycle = 1 ms • Tolerance: U: ±1% of the measuring range end value	In relation to digital GND	
Analogue output				
OSA00	X2-5	• PWM with carrier frequency 1 kHz • Resolution 10 bits • R_{OUT}= 100 Ω • U_{OUT}= +10 V DC • I_{max}= 5 mA • Short circuit proof • Tolerance +2.5 %		
Digital inputs * For model CDB3000,SH: see chapter 3.13: Safe Torque Off (STO)				

Table 4.16 Specification of the control connections CDB3000

Des.	Terminal	Specification	Floating	Control terminal
ISD00 *	X2-9	• Cut-off frequency 5 kHz • PLC-compatible • Switching level low/high: < 5 V / > 18 V DC • I_{max} at 24 V = 10 mA • R_{IN} = 3 kΩ • Internal signal delay ≈ 100 µs • Terminal scan cycle = 1 ms	Yes	
ISD01	X2-10	• Cut-off frequency 500 kHz • PLC-compatible • Switching level low/high: < 5 V / > 18 V DC • I_{max} at 24 V = 10 mA • R_{IN} = 3 kΩ • Internal signal delay ≈ 2 µs • Terminal scan cycle = 1 ms • R-input (zero pulse) 24 V - HTL encoder in relation to DGND	Yes	
ISD02	X2-11	• Cut-off frequency 500 kHz • PLC-compatible • Switching level low/high: < 5 V / > 18 V DC • I_{max} at 24 V = 10 mA • R_{IN} = 3 kΩ • Internal signal delay ≈ 2 µs • Terminal scan cycle = 1 ms • A input for square wave encoder evaluation for 24 V HTL encoder in relation to DGND permissible number of pulses 32...8192 pulses/rev. See chapter	Yes	
ISD03	X2-12	• Cut-off frequency 500 kHz • PLC-compatible • Switching level low/high: < 5 V / > 18 V DC • I_{max} at 24 V = 10 mA • R_{IN} = 3 kΩ • Internal signal delay ≈ 2 µs • Terminal scan cycle = 1 ms • B input for square wave encoder evaluation for 24 V HTL encoder in relation to DGND permissible number of pulses 32...8192 pulses/rev.		

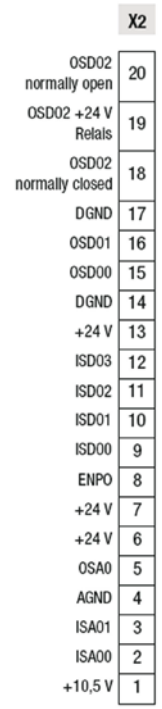


Table 4.16 Specification of the control connections CDB3000

Des.	Terminal	Specification	Floating	Control terminal
ENPO	X2-8	• Enable power stage = High level • Switching level low/high: < 5 V / > 18 V DC • Imax at 24 V = 10 mA • R_{IN} = 3 kΩ • Internal signal delay ≈ 20 µs, for model CDB-SH = 10 ms • Terminal scan cycle = 1 ms • PLC-compatible	Yes	
Digital outputs				
OSD00	X2-15	• Short circuit proof • PLC-compatible • I_{max}= 50 mA • Internal signal delay ≈ 250 µs • Terminal scan cycle = 1 ms • Protection against inductive load • High-side driver	Yes	
OSD01	X2-16	• Short circuit proof • PLC-compatible • I_{max}= 50 mA • Internal signal delay ≈ 2 µs • Terminal scan cycle = 1 ms • No internal free-wheeling diode, provide external protection • High-side driver		
1) Applicable to a limited extent				
Relay output For model CDB3000,SH: see chapter 3.13: Safe Torque Off (STO)				
OSD02	X2-18 X2-19 X2-20	• Relay, 1 changeover contact • 25 V / 1 A AC, usage category AC1, cos j: =1 • 30 V / 1 A DC, usage category DC1, cos j: =1 • Switching delay approx. 10 ms • 0.2 A with polyswitch on CDB-SH	Yes	
Power supply				
+10.5 V	*X2-1*	• Auxiliary voltage UR =10.5 V DC • Short circuit proof • Imax_in = 10 mA	-	

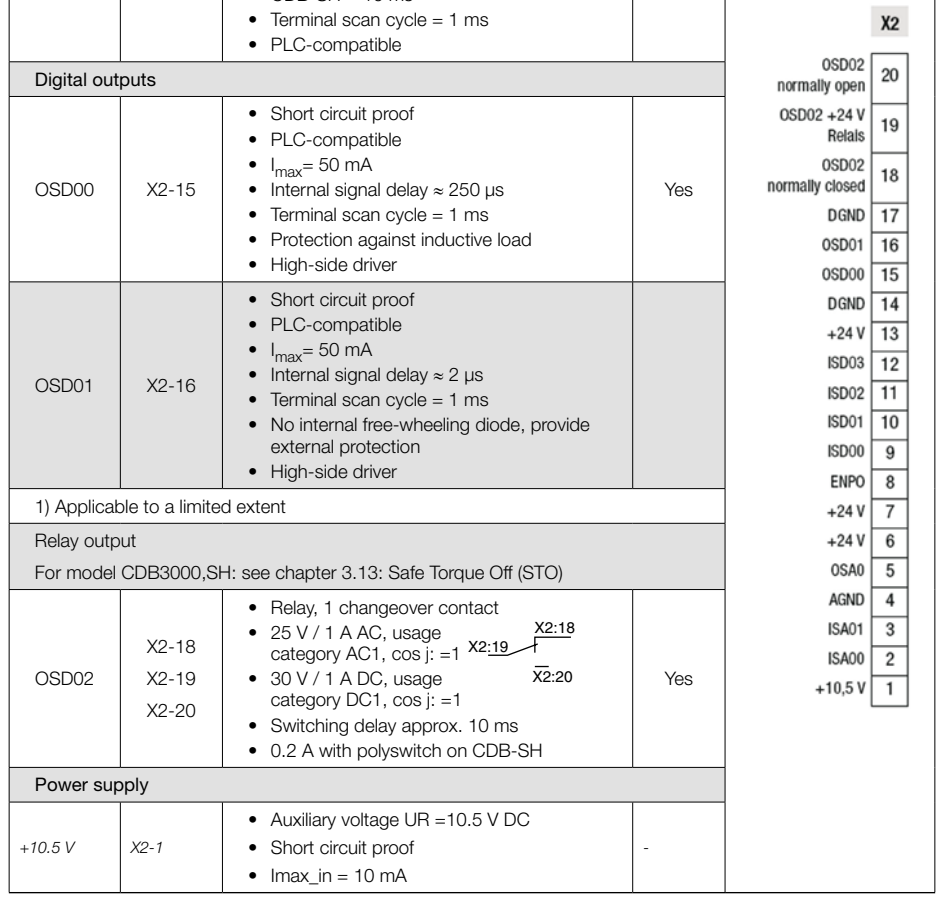


Table 4.16 Specification of the control connections CDB3000

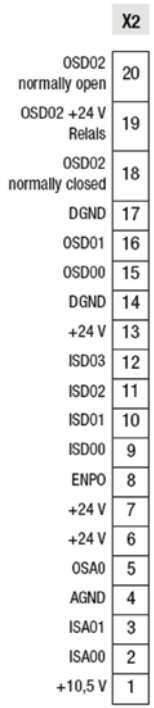
Des.	Terminal	Specification	Floating	Control terminal
+24 V	X2-6 X2-7 X2-13	• Auxiliary voltage U_V = 24 V DC + 25 %, short circuit proof • I_{max} = 100 mA (total, also includes the driver currents for outputs OSD00 and OSD01) • If an encoder is not connected to X7, I_{max} = 200 mA applies (total, also includes the driver currents for outputs OSD00 and OSD01) • External 24 V - possible for supplying the control electronics on a mains failure, current consumption I_{max} = 900 mA Tolerance on the supply voltage + 20 % Caution: Depending on the type of power supply unit, a decoupling diode may be necessary as a protective measure to protect the power supply unit because, depending on the tolerances on the 24 V from the CDBs and the 24 V power supply unit, power may be fed back.	Yes	
AGND	X2-4	• Electrically isolated from DGND		
Digital ground				
DGND	X2-14 X2-17	• Electrically isolated from AGND		
STO Only for special model CDB3x.xxx,SH!				
ISDOO	X2-9	• Cut-off frequency 5 kHz • PLC-compatible • Switching level low/high: <5 V / >18 V DC • Imax at 24 V = 10 mA • R_{IN} = 3 kΩ • Internal signal delay ≈ 100 µs • Terminal scan cycle = 1 ms	Yes	

Table 4.16 Specification of the control connections CDB3000

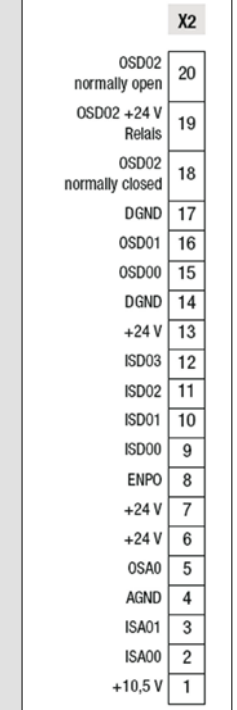
Des.	Terminal	Specification	Floating	Control terminal
OSD02	X2-18 X2-19 X2-20	• Relay, 1 changeover contact • 25 V / 200 mA AC, usage category AC1 • 30 V / 200 mA DC, usage category DC1 • Switching delay approx. 10 ms • Protection against overload by means of internal circuit breaker that can be reset (PTC) • 3 x 10^6 switching operations	Yes	

Table 4.16 Specification of the control connections CDB3000

NOTE: The behaviour of the inputs is undefined in the range > 5 V / < 18 V.

Standard terminal assignment CDB3000 (factory setting)

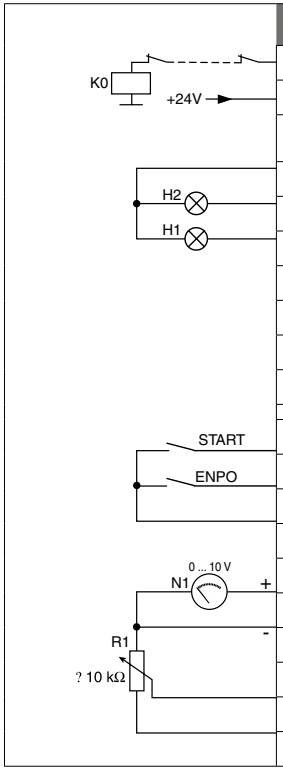
Preset solution, speed control +10 V setpoint, control via terminal.

Features

- Scalable analogue setpoint (+10 V, 10 bits)
- Programmable, time-optimised acceleration profile

Parameter

152-ASTER = SCT_1



X2	Des.	Function
20	OSD02	14 / 11 / 12: Relay contact for "ready" signal
19	OSD02	
18	OSD02	
17	DGND	Digital ground
16	OSD01	"Standstill" signal
15	OSD00	"Setpoint reached" signal
14	DGND	Digital ground
13	UV	Auxiliary voltage 24 V
12	ISD03	Not used
11	ISD02	Not used
10	ISD01	Not used
9	ISD00	START regulation
8	ENPO	Hardware enable for the power stage
7	UV	Auxiliary voltage 24 V
6	UV	Auxiliary voltage 24 V
5	OSA00	Speed actual value 0 ... NMAX
4	AGND	Analogue ground
3	ISA01	Not used
2	ISA00	Setpoint -10 V ... + 10 V
1	UR	Reference voltage 10 V, 10 mA

Figure 4.20 Control terminals, drive without encoder evaluation

NOTE:

- For terminal assignments for other preset solutions, see Application Manual CDE/CDB3000.
- The setting for the control terminals can be adjusted specifically to suit your application.

4.8.2 Encoder connections CDB3000

Step	Action
1.	Select the appropriate encoder type.
2.	Wire the encoder connection using shielded cables.

High-resolution encoders

It is possible to connect the following encoder types via the encoder interface X7.

- Incremental TTL encoder
- Encoder with SSI interface

It is only allowed to connect encoders with the following specification:

NOTE:

- Encoder power supply
  - Power supply at the encoder: + 5 V ±5 %, max. current consumption 150 mA (including load)
  - The encoders must have a separate sensor cable connection. The sensor cables are required to measure the supply voltage drop on the encoder cable. Only by using the sensor cables is it ensured that the encoder is supplied with the correct voltage.
    The sensor cables must always be connected!
- Incremental encoder with RS422-compatible track signals (TTL-compatible)
  - 32-8192 pulses/revolution
- SSI multiturn encoder as per the reference list with the general specifications:
  - Transmission protocol "SSI", gray-coded
  - 25 bits multiturn (12/13 bits multiturn/singleturn information, MSB first)

You will find the electrical specification for the interface in Table 4.17, the terminal assignment in Table 4.9.

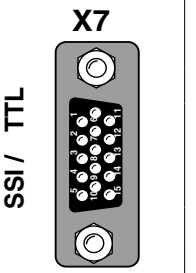
Specification for interface for high-resolution encoder

Step	Action	Comment
Connection	Miniature D-SUB 15-pin socket (high density)	
Interface	RS422 (differential)	
Wave terminating resistor	Track A, R: 120 Ω (internal) Track B wired at the customer	DATA: 120 Ω (internal) CLK: Termination not necessary
Max. signal frequency f_{Limit}	500 kHz	
Power supply	+ 5 V ±5 % (regulated via sensor cables) max. 150 mA Not electrically isolated in relation the control electronics	
Sampling frequency for the regulation	4 kHz	4 kHz
Interface protocol	-	SSI (gray code)
Pulses per revolution/ resolution	32-8192	13 bits (singleturn) 25 bits (multiturn)
Maximum cable length	50 m (Further cable specifications as per information from motor manufacturer)	

Table 4.17 Specification for the encoder interface X7

Select the cable type specified by the motor or encoder manufacturer. During this process bear in mind the following boundary conditions:

- Always used shielded cables. Connect the shield at both ends.
- Connect the differential track signals A, B, R or CLK, DATA using twisted pair cable cores.
- The encoder cable is not allowed to be cut, e.g. to route the signals via terminals in the switch cabinet.

X7/pin	TTL function	SSI function	D-Sub
1	A-	DATA-	
2	A+	DATA+	
3	+5 V (150 mA)	+5 V (150 mA)	
4	Don't use	Don't use	
5	Don't use	Don't use	
6	B-	CLK-	
7	Don't use	Don't use	
8	GND	GND	
9	R-	Don't use	
10	R+	Don't use	
11	B+	CLK+	
12	+5 V (sensor)	+5 V (sensor)	
13	GND (sensor)	GND (sensor)	
14	(Jumper between pin 14 and pin 15 to activate terminating resistor)[1] Terminating resistor R = 120 Ω	Don't use	
15		Don't use	

1) Track B must be terminated using a jumper between pin 14 and 15. The terminating resistor is installed in the device. Wiring by the customer is necessary because the track CLK (pin 6, 11) is not allowed to be connected if an SSI interface is used.

Table 4.18 Assignment for the encoder interface X7 CDB3000

Connection of 2nd encoder (type HTL) via control terminal X2

In parallel to the TTL/SSI encoder connection to X7 (see chapter 4.8.2) it is possible to evaluate an HTL encoder via the control terminal.

On simultaneous usage, as shown in Figure 4.21, the TTL/SSI encoder on X7 is to be used only for the position control. Motor commutation and superimposed speed control is then undertaken via the HTL encoder on control terminal X2.

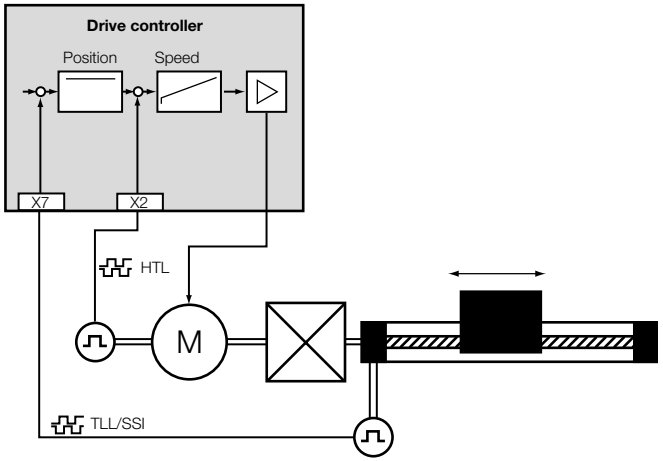


Figure 4.21 Drive with two measuring systems

	Specification	Comment
Interface	HTL (24 V)	Low = < 5 V, high = > 18 V
Max. signal frequency fLimit	150 kHz	
Power supply	+ 24 V, max. 80 mA	The total current carrying capacity of the control terminal is limited to 100 mA. If the encoder has a higher current consumption, the power for the encoder is to be supplied by the customer as per the description below.
Sampling frequency for the regulation	4 kHz	
Pulses per revolution	32-8192	
Maximum cable length	30 m	Select the cable type specified by the motor or encoder manufacturer. Always used shielded cables. Connect the shield at both ends. The encoder cable is not allowed to be cut, e.g. to route the signals via terminals in the switch cabinet.

Table 4.19 Electrical specification for the HTL encoder interface

Terminal assignment HTL encoder

X2	Terminal identifier	HTL function
14	GND	GND
13	+24 V (100 mA for entire control terminal)	+24 V
12	ISD03	B+
11	ISD02	A+

Table 4.20 Assignment for HTL encoder connection to X2

NOTE: : Inverted encoder signals as well as a zero pulse cannot be connected or evaluated.

Power supply for the HTL encoder

If the maximum current of 100 mA on the 24 V auxiliary voltage is exceeded by the connection of an HTL encoder, the encoder is to be supplied with power using an external power supply as per Figure Figure 4.22.

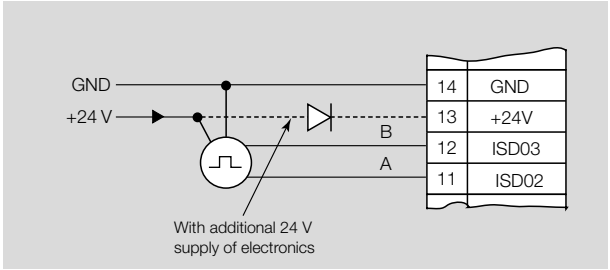


Figure 4.22 Supplying the HTL encoder using an external power supply

If an external power supply is also necessary for the drive controller (e.g. for the operation of the field bus communication with the mains voltage switched off), then this supply is to be decoupled from controller supply using a diode.

You will find information related to project planning on the selection of the encoder in chapter 4.8.2.

4.8.3 Motor connection on the CDB3000

Step	Action	Comment
1.	Specify the cable cross-section depending on the maximum current and ambient temperature.	Cable cross-section as per VDE0100, part 523, see chapter 4.6.
2.	Connect the motor phases U, V, W using a shielded cable and earth the motor at X1/⏚	Connect the shield at both ends to reduce interference emissions.
3.	Wire the temperature sensor PTC (if fitted) using separate shielded cables.	Connect the shield at both ends to reduce interference emissions.

CAUTION:
It is to be ensured the temperature sensor used is adequately isolated in relation to the motor winding (basic insulation = 2 kV test voltage).

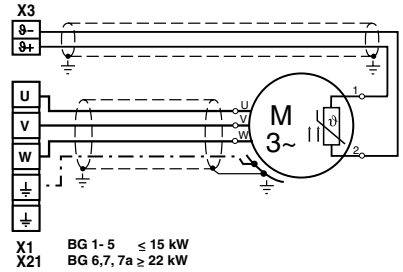


Figure 4.23 Connection of the motor on the CDB3000

NOTE: The CDB3000 positioning controller is protected against short circuits and earth faults on the terminals during operation. If a short circuit or earth fault occurs in the motor cable, the power stage is disabled and an error message is output.

4.8.4 Motor temperature monitoring CDB

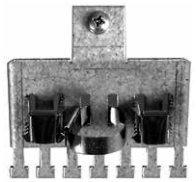
CAUTION!
The motor temperature sensor must, in relation to the motor winding, on CONNECTION TO X3, be provided with **basic insulation**!

Connection	Sensor type	Insulation in the motor winding
X3 (CDE/ CDB)	Temperature switch (Klixon), PTC	Sensor with basic insulation

Table 4.21 Connection of motor temperature sensor

Shield connection and effective EMC installation

NOTE:
- Connect shield via shield connection STxx. From size 7 (45 kW/ 90 A) the shield connection is to be made directly underneath the device on the backing plate.
- For an effective EMC installation, the motor terminal box must be sealed in relation to HF (metal or metallised plastic). Cable glands with a large area shield connection are to be used for cable entries.



Shield connection plate STxx

Shield connection with clip and metal cable ties

NOTE:
- The screws for fastening the shield connection plates ST02 to ST06 are only allowed to be tightened to a tightening torque of max. **1.3 Nm**. If this instruction is not followed, the tapped hole on the front of the device may be irreparably damaged.

You will find further information on current carrying capacity, technical data and ambient conditions in annex A.1 to A.3.

Switching in the motor cable

SWITCHING OFF THE MOTOR:

Motor cable switching must take place with the power switched off, as otherwise problems such as burnt contactor contacts, or over or undervoltage shutdown of the controller may occur.

To ensure unpowered switching, you must make sure that the contacts of the motor contactor are closed before the controller power stage is enabled. Conversely, it is necessary for the contacts to remain closed until the controller power stage is shut down and the motor current is 0.

This is achieved by using appropriate safety delays for the switching of the motor contactor in the control sequence for your machine or using the special software function in the CDE/CDB3000 positioning controller.

MULTI-MOTOR OPERATION:

The positioning controllers CDE3000 can be operated with several motors connected in parallel. Depending on the application, various instructions on project planning must be followed, see appendix A4. Multi-motor operation with the CDB3000 is not allowed.

SWITCHING IN THE MOTOR CABLE WITH THE POWER SWITCHED OFF:

Motor cable switching must always take place with the power switched off, as otherwise a shutdown with a fault may occur.

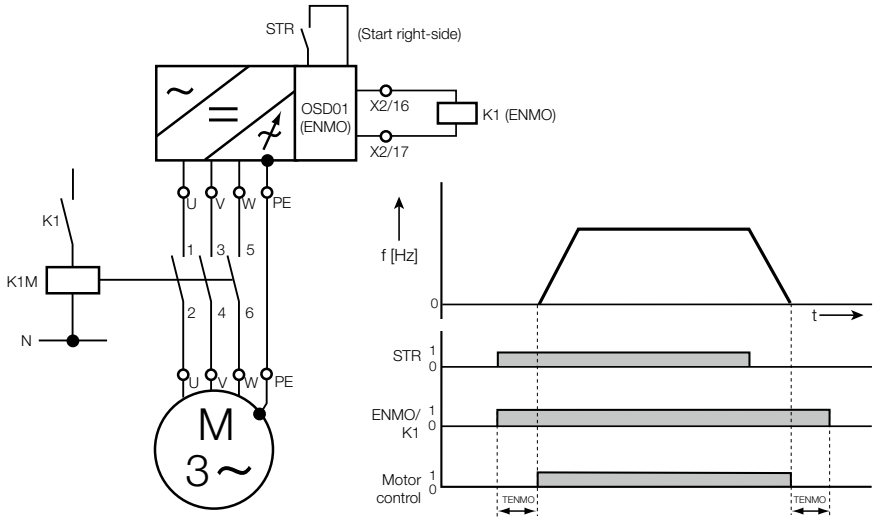


Figure 4.24 Connection example for ENMO. The shield connection is not shown.

Principle of operation

Starting the regulation: auxiliary contactor K1 becomes active at the start of regulation. The output frequency (output voltage) of the regulator starts with a delay as set in the parameter 247-TENMO.In this way it is ensured that the motor contactor is closed before the controller's output frequency (output voltage) starts.

Stopping the regulation: on the removal of "Start regulation" the auxiliary contactor K1 is drops out with a delay as set in the parameter 247-TENMO.In this way it is ensured that the motor contactor only opens once the controller power stage is no longer powered.

4.9 Serial interface (SIO) CDE/CDB3000

The serial interface (SIO, X4) is used to connect DriveManager 3.x and to connect the KeyPad. The ready made RS232 cable CCD-SUB 90X (maximum length 3 m) is used to connect the positioning controller to the PC / DriveManager 3.x.

Pin assignment X4

Pin no.	Function
1	+15 V DC for KeyPad KP300 (formerly KP200-XL)
2	TxD, send data
3	RxD, receive data
4	Do not use
5	GND for +15 V DC for the KeyPad KP300 (formerly KP200-XL)
6	+24 V DC (only for KP200)
7	Do not use
8	Do not use
9	GND for +24 V DC (only for KP200)

Table 4.22 Pin assignment for the serial interface X4, CDE/CDB3000

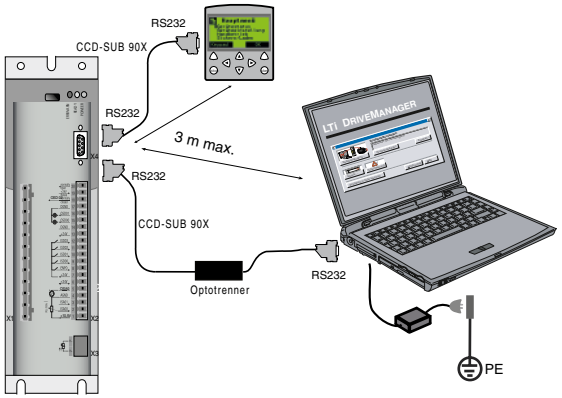


Figure 4.25 Connection X4

CAUTION: The RS232 interface is only used as a service diagnostics interface. Controlling via the interface is not permitted. For reasons related to the circuitry the interface is at the potential of the analogue inputs. Uncontrolled equalisation currents via the cable CCD-SUB 90X may cause irreparable damage to the drive controller and to the PC. We therefore strongly recommend the usage of an optocoupler.

4.10 CAN interface CDE/CDB3000

The CANopen interface is integrated into the drive controller. The connection is made via connector X5. The power for the electrically isolated connection is to be provided by the customer.

Connection	Miniature D-Sub 9-pin male
Wave terminating resistor - Bus termination -	A jumper (pin 1-2) activates the internal terminating resistor (120 Ω)
Max. input frequency	1 MHz
Ext. power supply	+ 24 V +25%, 50 mA (Floating in relation to the drive controller)

Assignment of connection X5:

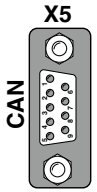
X5/pin	Function	D-Sub
1	Jumper to pin 2 for active bus termination	
2	CAN_LOW	
3	CAN_GND	
4	Do not use	
5	Do not use	
6	CAN_GND	
7	CAN_HIGH	
8	Do not use	
9	CAN_+24 V external supply voltage	

Table 4.23 Pin assignment X5

Bus address

The bus address for a CAN node is set using a coding switch.

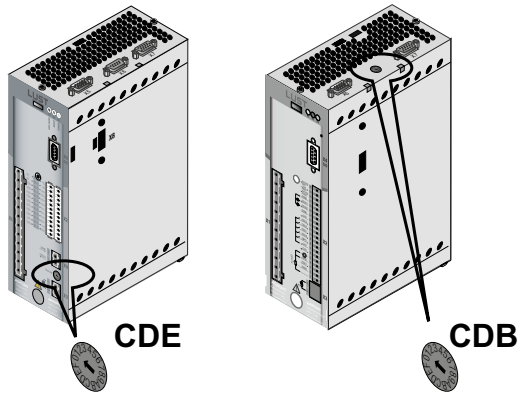


Figure 4.26 Coding switch position and setting for the CAN bus address

Alternatively, a bus address can be set using parameters. The addresses from the coding switch and the parameter configuration are added together.

PROJECT PLANNING AND FUNCTION DESCRIPTION:

You will find information on this aspect in Communication Manual CANopen. The interface is switched off with the works setting ASTER: OLT_1.

4.11 DC group CDE/CDB3000

The positioning controllers that are operated in the DC group (braking operation) supply energy to the DC group; the drive controllers in motor operation consume this energy.

CAUTION: It is imperative operation in a DC group is checked during the project planning. Please consult your project engineer.

4.12 Braking resistor (RB) CDE/CDB3000

In regenerative operation, e.g. while braking the drive, the motor feeds energy back to the drive controller. This increases the voltage in the DC link circuit (ZK). If the voltage exceeds a threshold value, the internal braking transistor is activated and the regenerated power is converted into heat by means of a braking resistor.

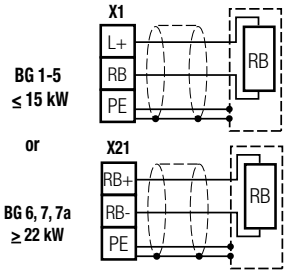


Figure 4.27 Connection of braking resistor

DANGER! Never make or disconnect electrical connections while they are live! Always disconnect the power before working on the device. Wait until the DC link voltage on the terminals X1/L+ and L- (BG 1-5) or X21/ ZK+, ZK- (BG 6-7) has dropped to the protective extra low voltage before you work on the device (approx. 10 min.).

CAUTION: If the error message E-OTI (overtemperature on the device heat sink) appears, the device connected must be disconnected from the mains supply because the braking resistor may be overloaded due to mains overvoltage. Please connect one of the digital outputs to suit your control concept, e.g. set OSDxx to WOTI (= warning device heat sink temperature).

Connection of an external braking resistor

CAUTION:

- Be sure to follow the installation instructions for the external braking resistor.
- The temperature sensor (bimetallic switch) on the braking resistor must be wired in such a way that the positioning inverter is disconnected from the mains supply if the braking resistor overheats.
- The minimum permissible connection resistance for the positioning inverter must not be infringed, for technical data see appendix 2.
- The braking resistor is integrated in the device model CDE/CDB3X.xxx, Wx.x, BR. It is not allowed to connect an additional braking resistor to terminals X1/L+ or RB+ or RB-; this would damage the inverter module.
- For further information, please consult your project engineer.

Monitoring the internal braking resistor

Model BR

The braking resistor is integrated in the device on model
BR - CDB3X.xxx, X, BR positioning controllers. Because, e.g. on mains overvoltage the internal braking resistor may be overloaded, this aspect must be specifically monitored.

You will find the max. permissible peak braking power in appendix A2. For further information, please consult your project engineer.

CAUTION: An external braking resistor must be monitored by the controller. The temperature of the braking resistor is monitored by a temperature sensor (Klixon).
In the event of overheating the positioning controller must be disconnected from the mains supply.

4.13 Safe Torque Off (STO)

Applies for all devices CDE3000 as well as for all devices of the special model CDB3000 SH from hardware index 2.4.

NOTE: You will find all information on the "STO" function in the document "CDE/CDB SH/CDF Description of the STO Safety Function" (ID no.:1001.21B.X-XX).

5 Commissioning

CAUTION: Commissioning must only be carried out by electrical engineering experts who have been specially instructed in the necessary accident prevention measures.

5.1 Selection during commissioning

Type of commissioning	Commissioning steps	Continue on
• Project planning and commissioning have already been undertaken. • Loading an existing data set.	Serial commissioning	Page 53
• Project planning and initial drive system commissioning	Initial commissioning	Page 54
• Project planning and basic configuration of the drive system have already been undertaken.	Test run	Page 60

5.2 Serial commissioning

Use this form of commissioning if you want to place in operation several identical drives (serial commissioning). In this situation the same type of positioning controller and the same motor must be used for each drive in the same application.

If you already have a complete data set, please skip the section "Save data set from device to a file" (using DriveManager 3.x).

5.2.1 Serial commissioning using DriveManager 3.x

Prerequisite:

- All positioning controllers are completely connected.
- The first drive has already been completely commissioned.
- A PC with the user software DriveManager 3.x is connected.

Step	Action	Comment
1.	Connect your PC to the positioning controller for the first drive and switch on the mains power supply for the positioning controller.	Use a standard serial cable (9-pin D-Sub female/male).
2.	Start DriveManager 3.x.	A connection to the positioning controller connected is established automatically.
	If the establishment of the connection fails, check the settings on the menu Extras > Options and try again using the button 	
3.	Using the button  , save the current data set either in the parameter database for DriveManager 3.x (folder: c:/../userdata) or on a floppy disk (a:/).	The current data set on the device connected is always saved using the button. Give the file a name of your choice.
4.	Close the connection to all devices using the button 	Connect your PC to the positioning controller for the next drive and switch on the mains power supply for the positioning controller.
5.	Using the button  establish a connection between DriveManager 3.x and the newly connected device	
6.	Using the button  load into the device the data set saved in step 4.	
7.	Using the button  open the main window. Save the setting using the button	Repeat steps 4 ... 7 on each further drive.

NOTE: You will find more information on DriveManager 3.x in the DriveManager Help.

5.3 Initial commissioning

Prerequisites	
• The positioning controller is fully connected, see chapter 3 • DriveManager from version V3.4 installed • Motor database for motors is installed on the PC • Device is connected via the RS232 interface (X4) on the PC	

DANGER:
Never make or disconnect electrical connections while they are live! Always disconnect the power before working on the device. Wait until the DC link capacitors are discharged. Only if a residual voltage of less than 60 V (between terminals L+ and L-) is present is it allowed to work on the device!

Input ENPO = low level (CDB terminal 8 (X2) / CDE terminal (X2)) present to prevent unintentional starting of the motor (power stage inhibited, mains voltage for the positioning controller switched on).

Preparations		
• Switch on the positioning controller • A self-test is undertaken Start DriveManager 3.x Establish connection to the device.		DriveManager 3.x > Connect or: Communication > Connect...
• Open the main window "Setup"		DriveManager 3.x or: Active device > Change settings

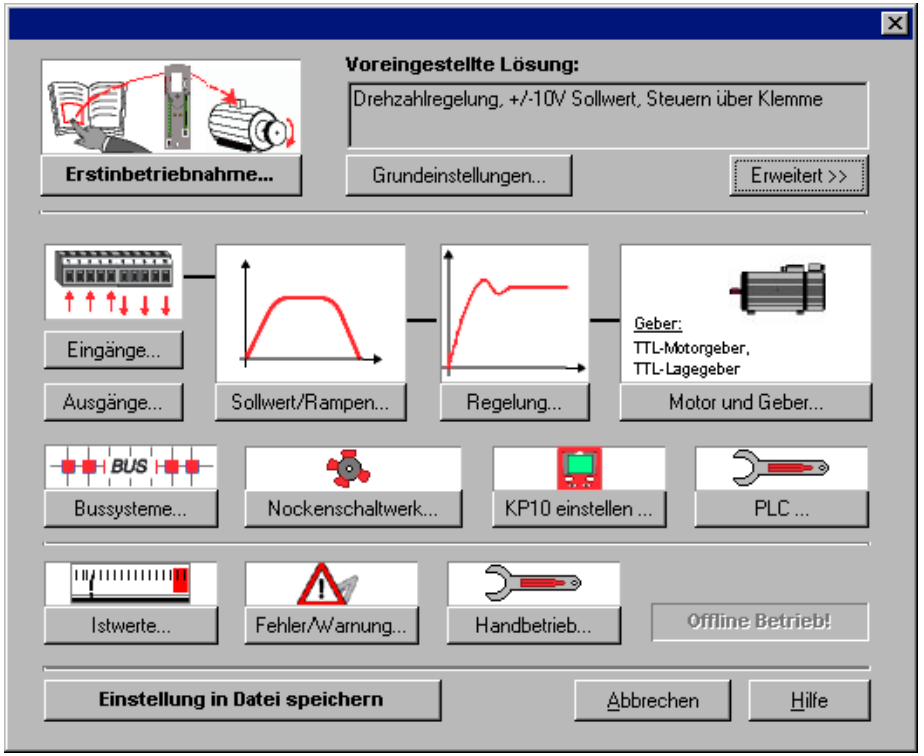
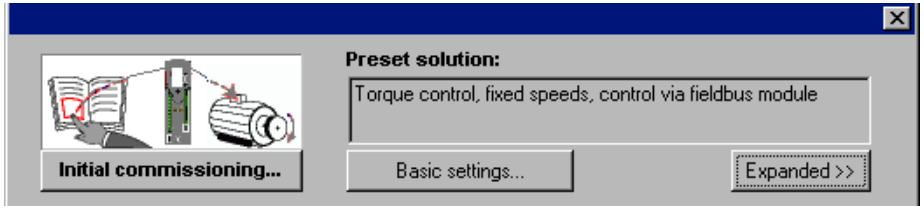


Figure 5.1 Main window for making various settings in DriveManager 3.x

Continue with:



5.3.1 Preset solutions

Preset solutions are complete parameter data sets for solving a very wide range of typical movement tasks in applications.

Figure 5.2 Initial commissioning

The positioning controller is configured automatically by loading a preset solution into the memory (RAM). The parameters for

- The control location of the drive controller,
- The setpoint source,
- The assignment of the inputs and outputs for the signal processing and
- The control mode

are preset.

The usage of a preset solution significantly simplifies and shortens the commissioning of the positioning controller. The preset solutions can be adapted to the requirements of the user's task by changing individual parameters. Preset solutions modified in this manner are saved in the device as user data sets. In this way you will complete the movement solution you require in less time.

A total of 20 preset solutions cover the typical applications for speed control using the controller CDE/CDB3000.

A total of 20 preset solutions cover the typical applications for speed control using the controller CDE/CDB3000.

Abbreviation	Setpoint source	Starting the regulation via/ bus control profile
TCT_1	+/-10 V analogue - torque	I/O terminals
SCT_1	+/-10 V analogue	I/O terminals
SCT_2	Fixed speed table	I/O terminals
SCC_2	Fixed speed table	CANopen field bus interface – EasyDrive profile "Basic"
SCB_2	Fixed speed table	Field bus option module (PROFIBUS) – EasyDrive profile "Basic"
SCC_3	CANopen field bus interface	CANopen field bus interface – EasyDrive profile "Basic"
SCB_3	Field bus option module (PROFIBUS)	Field bus option module (PROFIBUS) – EasyDrive profile "Basic"
SCP_3	PLC	PLC
SCT_4	PLC	I/O terminals
SCC_4	PLC	CANopen field bus interface – EasyDrive profile "ProgPos"
SCB_4	PLC	Field bus option module (PROFIBUS) – EasyDrive profile "ProgPos"
PCT_2	Driving set tables	I/O terminals
PCC_2	Driving set tables	CANopen field bus interface – EasyDrive profile "TabPos"
PCB_2	Driving set tables	Field bus option module (PROFIBUS) – EasyDrive profile "TabPos"
PCC_1	CANopen field bus interface	CANopen field bus interface – CiA 402 profile position mode – CiA 02 profile velocity mode – CiA 402 interpolated Mode
PCB_1	Field bus option module (PROFIBUS)	Field bus option module (PROFIBUS) – EasyDrive profile "DirectPos"
PCP_1	PLC	PLC
PCT_3	PLC	I/O terminals
PCC_3	PLC	CANopen field bus interface – EasyDrive profile "ProgPos"
PCB_3	PLC	Field bus option module (PROFIBUS) – EasyDrive profile "ProgPos"

Table 5.1 Preset solutions for speed control using CDE/CDB3000

All preset solutions have a specific basic settings window in DriveManager 3.x.

Procedure

- Select the preset solution to suit your application.

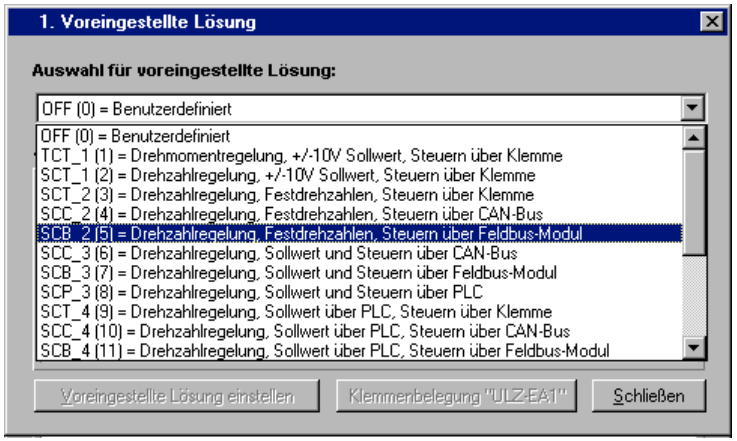


Figure 5.3 Selection of the preset solution

NOTE:For detailed information on the preset solutions and on the terminal assignment, see application manual CDE/CDB3000.

5.3.2 Configuration of motor and encoder

Procedure	
• Setting the motor data via the motor database	2.  Motor und Geber...

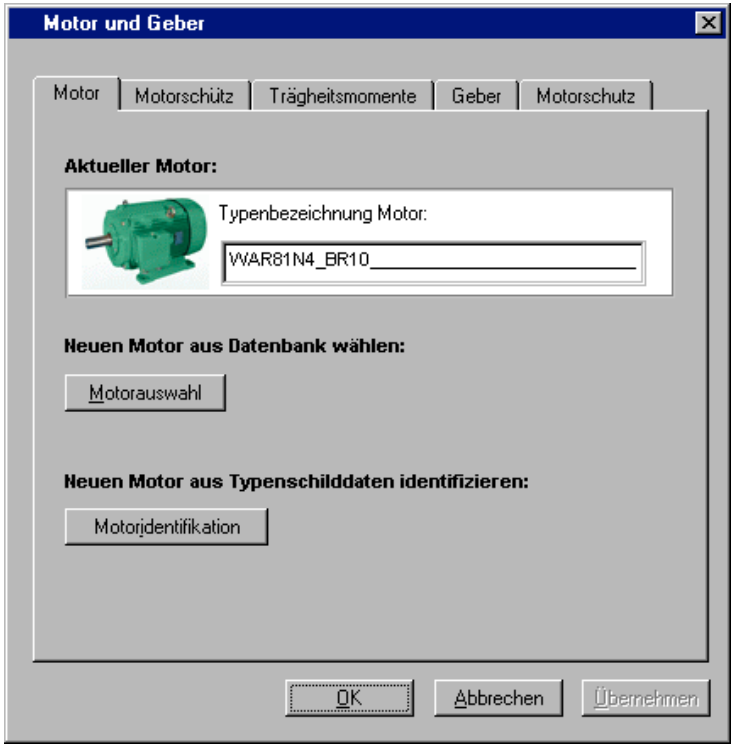


Figure 5.4 Setting motor and encoder

A database with the settings for all motors is available. By using the correct motor data set it is ensured

- That the parameters for the motor's electrical data are configured correctly,
- The motor protection ("Motor protection" tab) is correctly configured and

The control circuits for the drive are preset.

NOTE: The torque controller is optimally configured such that no further changes are necessary.

The speed controller configuration is based on the assumption that the machine moment of inertia scaled to the motor shaft is the same as the motor moment of inertia.

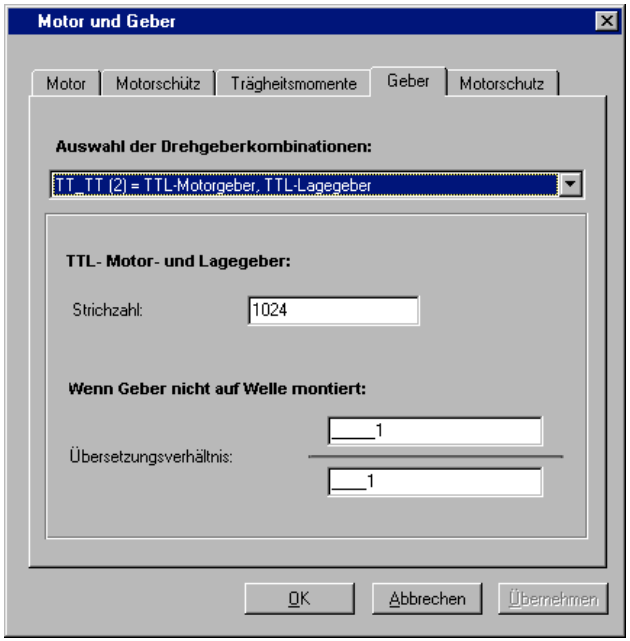
The speed and position controllers have high damping and are therefore also suitable for the regulation of elastic mechanisms.

For special configurations for the optimisation of the speed and position control circuit, please use the application manual for the CDE/CDB3000.

You can select the required motor from the database you have installed using the "Motor selection" button on the "Motor" tab. The motor type is given on the motor rating plate. If the motor data set is supplied on a data carrier (floppy disk, CD-ROM), it can be loaded directly using the "Different directory" button.

Configuration of the rotary encoder

Configure the rotary encoder connected to the motor on the Encoder tab. It is also possible to use two rotary encoders. Here the first rotary encoder is used for motor commutation and speed control (motor encoder), the second rotary encoder for position control (position controller). Both functions can also be realised using only one encoder.



Each encoder combination has a special configuration window.

You will find further information on the configuration of the rotary encoder in the application manual for the CDE/CDB3000.

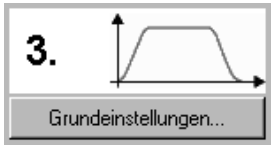
Checking the rotary encoder

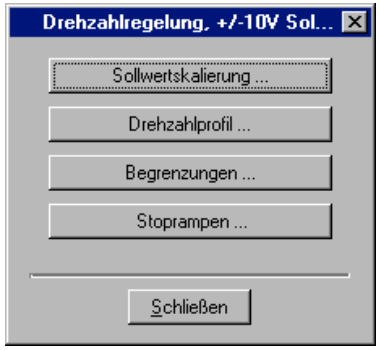
The motor shaft is rotated by hand to check the direction of rotation. The viewing angle is from the front on the end of the shaft (flange). For clockwise rotation, a positive speed must be displayed in the state indication "Setpoint and actual values" in "nist, Actual speed", a negative speed for counter clockwise rotation. If the speed is incorrect, the following points must be checked:

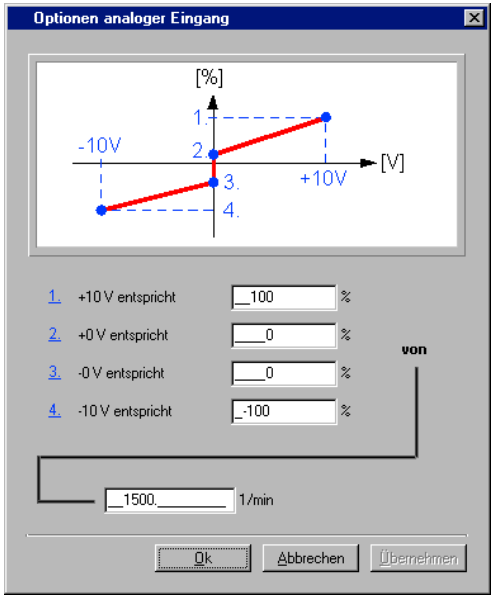
- Is the encoder cable connected correctly on the motor and on the positioning controller?
- Does the encoder cable match the encoder type?

5.3.3 Making basic settings

There are specific windows for the fine adjustment of each preset solution. Here you can adapt the drive to your application. You will find a detailed description of the individual functions in the application manual CDE/CDB3000.

Procedure	
• Making basic settings	



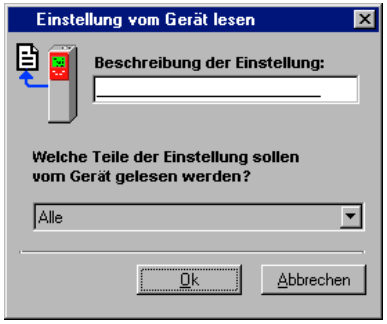


5.3.4 Saving the settings

Procedure		
DriveManager CDE/CDB3000 > Setup or: Active device > Change settings		**Saving the settings in the device** All changes that are to be saved in the device must be saved using the CDE/CDB3000 Setup window.

The changes made can also be saved in a file.

Procedure		
DriveManager CDE/CDB3000 Setup or: Active device > Store device settings on > File		**Saving the settings to file** Select the file name (e.g. mydata). All parameters are saved with the selected file name (e.g. mydata) with the corresponding file extension (*.00D). A description can be added to the device data before saving.



Continue with "Test run", see chapter 4.4.

5.4 Test run

The drive is tested without the coupled mechanism. The test run takes place independently of the preset solution selected in the speed-regulated mode.

A test is still possible even if the motor is already coupled to the system:

CAUTION:

Test run with motor installed:

In this case it must be assured that the test will not cause any damage to the system! Pay particular attention to the limitations of the positioning range.

Please note that you yourself are responsible for safe operation. LTi DRiVES GmbH will not accept any liability for any damage caused.

Mortal danger due to uncontrolled rotation!

Before commissioning motors with feather keys in the shaft end, these keys must be reliably secured against throwing out, if this is not already prevented by drive elements such as belt pulleys, couplings or similar.

Preset solution, torque control:

In this preset solution the drive is not allowed to be operated without load torque, because otherwise the motor shaft would be accelerated up to the speed limit set in an uncontrolled manner.

CAUTION:

Irreparable damage to motor:

The motors are intended for operation on the positioning controller. Direct connection to the mains supply can cause irreparable damage to the motor.

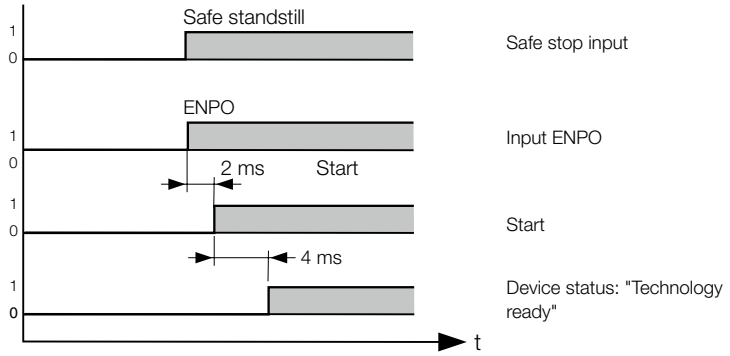
The motor surfaces may become extremely hot. No temperature sensitive parts may touch or be fastened to these areas, appropriate measures to prevent physical contact must be taken wherever necessary.

Any temperature sensor installed in the winding is to be connected so that the positioning controller temperature monitoring can prevent overheating of the motor.

The motor brake (if installed) should be checked for correct function before commissioning the motor.

The optionally installed motor holding brake is only designed for a limited number of emergency braking operations. Use as working brake is not allowed.

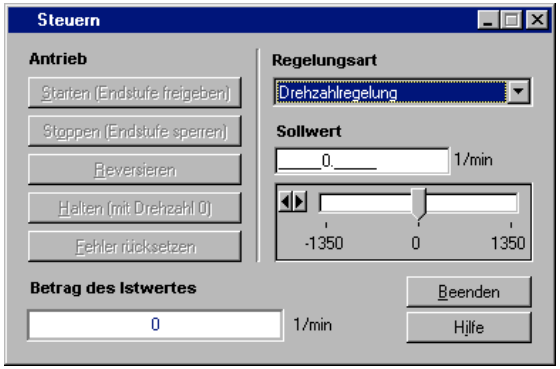
1. ENABLE SAFE STOP (ONLY CDE3000)
   High level on terminal X2/22
2. SET POWER STAGE ENABLE ENPO
   High level on terminal X2/10



Pay attention to the behaviour of the inputs over time.

3. CONTROL USING DRIVEMANAGER 3.X:
   Select "Speed control" and start the drive, e.g. with setpoint 100 min-1.

Procedure	
DriveManager 3.x > Control or: Active device > Control > Basic operation modes	



Procedure	
DriveManager > Digital scope or: Active device > Monitor > Quickly changing digital scope values	

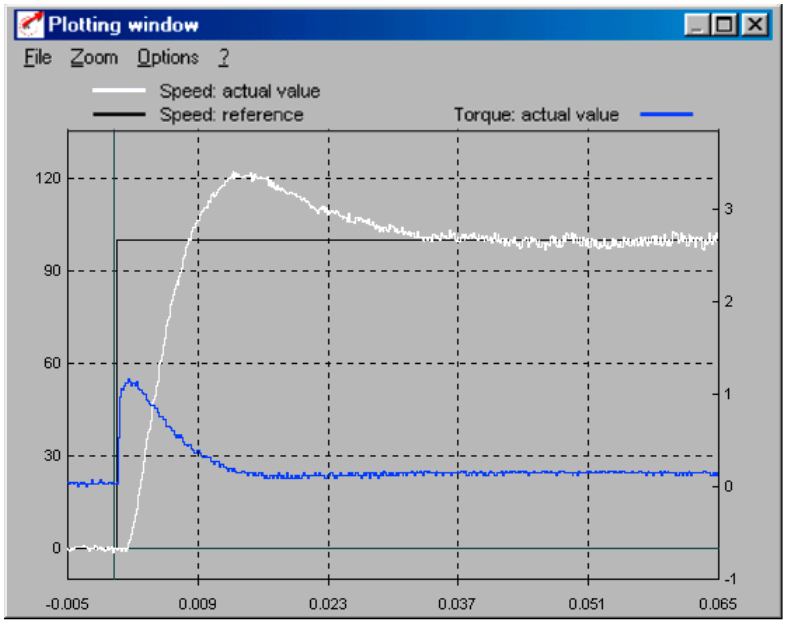
Checking the drive behaviour

The drive behaviour can now be evaluated with the aid of step responses that can be recorded using the digital scope function in DriveManager 3.x.

Select the three following parameters to record:
- 0: Speed: setpoint
- 1: Speed: actual value
- 2: Torque: actual value

Trigger condition:

Channel 0; rising edge, pretrigger 10 %; level: 30 min $^{-1}$



Start the drive using a setpoint of, e.g. 100 min^{-1}.

Compare the step response of your drive with the figure. With resolvers the overshoot on the actual speed value should be approx. 20 %, with incremental encoders approx. 30 % (referred to the setpoint). Make sure that the drive system exhibits a small signal response (the setpoint for the torque must be lower than the maximum value).

If the torque setpoint reaches its maximum value, reduce the speed step.

The behaviour of the speed control circuit over time (rise time, settling time) is independent of the magnitude of the step in the speed.

Result:

If the step response of your drive corresponds approximately to that in the figure, then it is ensured that the motor phases are wired correctly, the rotary encoder is connected correctly and the CDE/CDB3000 is configured for the correct motor.

If the step response differs significantly from the figure, it is to be assumed,

- That the motor data set has been selected incorrectly, or
- The wiring is incorrect.

Check the individual steps in chapter “4.1 Overview of the connections, CDE3000” and chapter “5.3 Initial commissioning” and repeat the test run.

A deviation from the step response is also possible if the ratio of the machine moment of inertia scaled to the motor shaft to the motor moment of inertia is very high. Here it is necessary to optimise the control settings. For special configurations for the optimisation of the speed control circuit and position control circuit, please use the application manual for the CDE/CDB3000.

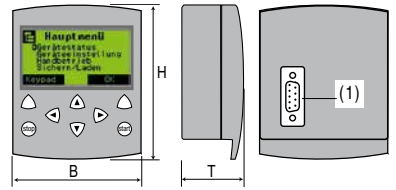
5.5 Operation using KeyPad KP300

The KP 300 can be connected directly to the positioning controller (X4). You will find exact details on the individual functions and their use in the KP300 Operation Manual.

Overview of KeyPad

Designation	Summary explanation
KP300	KeyPad with graphic display (128 x 64 pixels) for configuring parameters, actual value indication and serial commissioning of the positioning controller. Display of graphics such as unit status and text for parameters. Language German or English (can be configured). The KeyPad KP300 supports the SmartCard "SC-XL".

Mechanical KP300	
Dimensions (see fig.)	70 x 84 x 37 mm (W x H x D)
Weight	120 g
Connection (RS232)	
Standard (1)	Can be connected directly to the drive unit

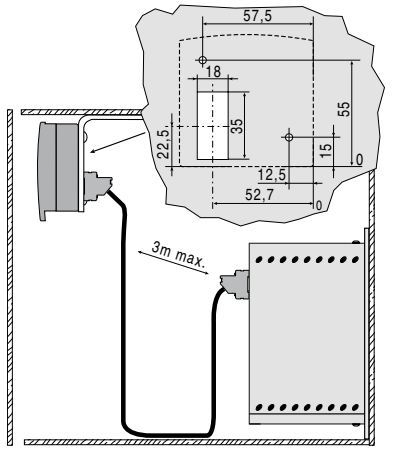


Mounting the KP300

The KeyPad can be mounted directly on the drive controller or in another position in the switch cabinet and connected via an RS232 cable (e.g. CCD-SUB903) (see drawing).

Please only use self-tapping screws for thermoplastics (e.g. EJOT PT screw, type K30 x 8 WN1412).

Note: The KP300 has degree of protection IP20. Because switch cabinets as a rule have degree of protection IP44 or higher, the KP300 is not allowed to be operated outside the switch cabinet (e.g. cutout in switch cabinet door) without additional protective measures.



5.6 Operating using DriveManager 3.x

Prerequisite:

- DriveManager from version V3.80 is installed on the PC.

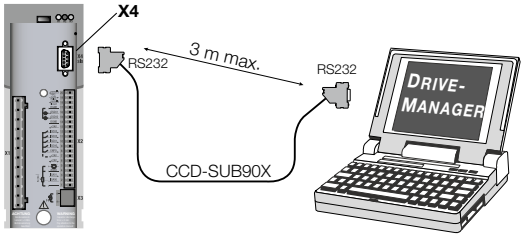


Figure 5.5 Connection of positioning controller to PC/DriveManager 3.x

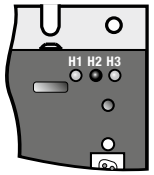
The most important functions

Icon	Function	Menu
	Change setting for the active device	Active device > Change settings
	Print parameter data set	Active device > Print settings
	Digital scope	Active device > Monitor > Quickly changing digital scope values
	Control drive	Active device > Control > Basic operation modes
	Establish connection to the device	Communication > Connect > Single device
	Bus initialisation, change setting	Communication > Bus configuration
	Disconnect all device connections	Communication > Connect
	Save data set for the active device to file	Active device > Store device settings on
	Transfer data set from file to active device	Active device > Load device settings from

6 Diagnostics/troubleshooting

6.1 Light emitting diodes

On the top right of the positioning controller there are three status LEDs in the colours red (H1), yellow (H2) and green (H3).

Device state	Red LED (H1)	Yellow LED (H2)	Green LED (H3)	
Supply voltage is present	-	-	●	
Ready (ENPO set)	❍	●	●	
In operation/autotuning active	❍	☼	●	
Warning	●	●/☼	●	
Error	☼ (Flashing code)	❍	●	
❍ LED off, ● LED on, ☼ LED flashing				

6.2 Error messages

If a malfunction occurs during operation, this situation is indicated by a flashing code on LED H1 (red) on the positioning controller. The code provides an indication of the nature of the error. If a KP300 (formerly KP200-XL) is connected, the KeyPad indicates the type of error as a code.

Flashing code on the red LED H1	Indication KeyPad	Explanation	Cause/solution
1x	E-CPU	Collective error	The exact error code can be read via the KeyPad or DriveManager 3.x.
2x	E-OFF	Undervoltage shutdown	Check mains power supply, appears also briefly on normal mains off.
3x	E-OC	Overcurrent shutdown	Short circuit, earth fault: check wiring for the power connections, check motor winding, check neutral conductor and earthing (see also chapter 3 Electrical installation.) Device setting not correct: check parameters for the control circuits, check ramp setting.
4x	E-OV	Overvoltage shutdown	Overvoltage from the mains: check mains voltage, restart device. Overvoltage due to power feedback from the motor (regenerative operation): slow down braking ramps - if not possible, use braking resistor.
5x	E-OLM	Motor protection shutdown	Motor overloaded (according to I x t monitoring): if possible slow down process cycle, check motor dimensions.
6x	E-OLI	Device protection shutdown	Device overloaded: check dimensioning, possibly use a larger device.
7x	E-OTM	Motor temperature too high	Motor PTC connected correctly? Parameter MOPTC set correctly (type of motor PTC evaluation)? Motor overloaded? Leave motor to cool down, check dimensioning.
8x	E-OTI	Positioning controller overtemperature	Ambient temperature too high: improve ventilation in the switch cabinet. Load too high on providing drive/braking: check dimensioning, possibly use braking resistor.
1) For further information, also see CDE/CDB/CDF3000 Application Manual			

Table 6.1 Error messages

6 Diagnostics/troubleshooting

If you have any technical queries relating to project planning or commissioning of the drive units, please contact our Helpline.

Helpline

How to reach us:

Mo.-Fr.: 8 a.m. - 5 p.m. Tel. 06441/966-180
E-mail: helpline@lti-motion.com
Fax: 06441/966-137

NOTE: If you need more detailed assistance and advice, you will find all the services we offer in the “Support & Service” Order Catalogue available on our web site http://drives.lt-i.com in the section of the same name; you can also download this catalogue from this page.

6.3 User errors during KeyPad operation

Error	Cause	Rectification
ATT1	Parameter is not allowed to be changed or cannot be edited in actual user level.	Select user level 1-MODE or higher.
ATT2	Motor is not allowed to be controlled via the CTRL menu.	Remove start signal from the other control location.
ATT3	Motor is not allowed to be controlled via the CTRL menu because there is an error state.	Reset error.
ATT4	New parameter value not allowed	Change value.
ATT5	New parameter value too high	Reduce value.
ATT6	New parameter value too low	Increase value.
ATT7	Board cannot be read in the actual state.	Reset start signal.
ERROR	Invalid password	Enter correct password.

Table 6.2 KeyPad user errors: reset using start/enter

6.4 User errors during SmartCard operation

Error	Cause	Rectification
ERR91	SmartCard write-protected	Use different SmartCard
ERR92	Error during plausibility check	
ERR93	SmartCard cannot be read, wrong positioning controller type	
ERR94	SmartCard cannot be read, parameters not compatible	
ERR96	Connection to the SmartCard interrupted	
ERR97	SmartCard data invalid (checksum)	
ERR98	Not enough space on SmartCard	
ERR99	Selected sub-section does not exist on SmartCard, no parameters from SmartCard applied	

Table 6.3 SmartCard error: reset using stop/return

6.5 Error during mains switching

Error	Cause	Rectification
Mains voltage is present. No reaction from positioning controller (LEDs off).	In the event of excessively frequent switching the device protects itself by means of high-resistance decoupling from the mains.	After a rest phase of a few minutes the device is ready to start once again.

6.6 Reset

The reset function is divided into two areas with different effects. Parameter reset resets to the last value saved in the device. Device reset resets the entire data set to the factory setting (state as delivered).

Parameter reset using KeyPad

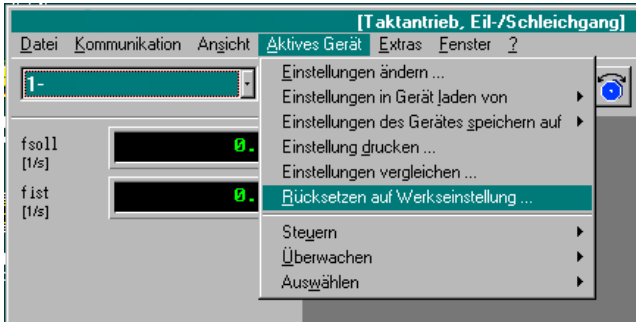
If you are in the setting mode for a parameter and press both arrow keys at the same time, the parameter you are editing will be reset to the last setting saved (= saved using parameter 150-SAVE).

Factory setting using KeyPad

Press the two arrow keys at the same time during positioning controller mains-on to set all parameters to the factory setting and re-initialise the controller.

Factory setting using DriveManager 3.x

On the "Active device" menu you can restore the device to the state as delivered using the command "Reset to factory setting".

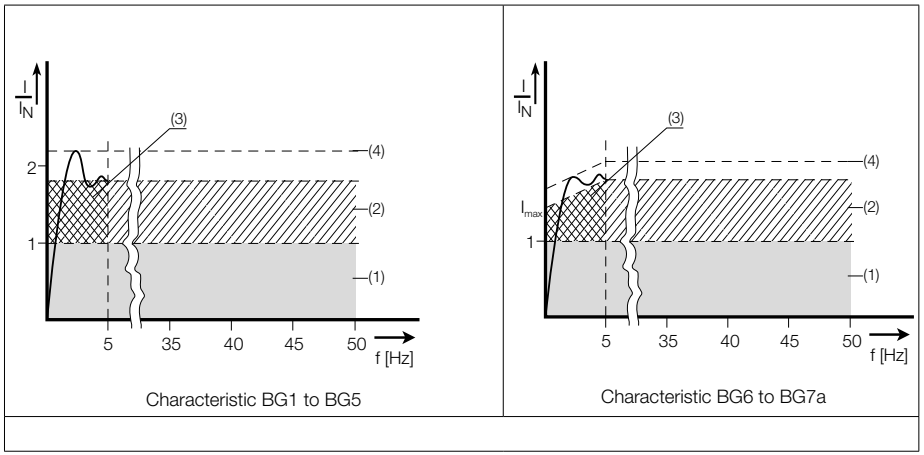


CAUTION: The preset solution selected will also be reset by the factory setting. Check the terminal assignment and the functionality of the positioning controller in this operation mode or load your user data set.

A Appendix

A.1 Positioning controller current carrying capacity

The maximum permissible positioning controller output current and peak current are dependent on the mains voltage, the motor cable length, the power stage switching frequency and the ambient temperature. If the conditions change, the maximum permissible current carrying capacity of the positioning controller also changes; see following characteristics and tables.



Characteristic BG1 to BG5

Characteristic BG6 to BG7a

Explanations on the characteristics:	Project planning rule: T= cycle time < 1 min $I_{eff} = \sqrt{\frac{1}{T} \cdot \Sigma_{i=1}^{n} I_i^2 \cdot t_i} \leq I_N$
(1) Continuous operation	
(2) Intermittent operation > 5 Hz rotating field frequency	
Peak current see Table A.1 to A.4	
(3) Intermittent operation 0 to 5 Hz rotating field frequency	
Peak current Imax see Table A.1 to A.4	
(4) Pulsed operation	
Pulse current = 1.15 times Imax for 20 ms	

Positioning controllers for 230 V systems

Servocontroller	Switching frequency of the power stage [kHz]	Ambient temperature [°C]	Rated current	Peak current [A_{eff}][3]		
			At 230 V [A_{eff}]	For intermittent operation 0 to 5 Hz	For intermittent operation > 5 Hz	For time[4] [s]
CDE/CDB 32.003,Cx.x	4	45	2.4	4.3	4.3	30
	8	40	2.4	4.3	4.3	
	12	40	2.1	3.75	3.75	
	16	40	1.8	3.2	3.2	
CDE/CDB 32.004,Cx.x[1]	4	45	4	7.2	7.2	30
	8	40	4	7.2	7.2	
	12	40	3.5	5.7	6.3	
	16	40	3	5.0	5.4	
CDB 32.008,Cx.x[1] CDE/CDB 32.008,Wx.x	4	40	7.1	12.8	12.8	30
	8	40	7.1	12.8	12.8	
	12	40	6.3	10	11.35	
	16	40	5.5	8	9.9	

[1] With heat sink HS3... or additional cooling surface
[3] For 230 V systems
[4] Shutdown as per I^2 x t characteristic
Motor cable length 10 m
Installation altitude 1000 m above sea level
Mounted in a row

Table A.1 Positioning controllers for 230 V systems

Positioning controllers for 400/460 V systems, model "W":

Servocontroller	Switching frequency of the power stage	Ambient temperature	Rated current		Peak current [A_{eff}][3]			
			At 400 V	At 460 V	At rotating field frequency increasing linearly 0 to 5 Hz		For intermittent operation	For time[4] [s]
	[kHz]	[°C]	[A_{eff}]	[A_{eff}]	0 Hz	5 Hz	> 5 Hz	
CDE/CDB 34.003,Cx.x (0.75 kW)	4	45	2.2	2.2	4	4	4 (1.8 IN)	30
	8	40	2.2	2.2	4	4	4 (1.8 IN)	
	12	40	1.6	1.6	2.9	2.9	2.9 (1.8 IN)	
	16	40	1.0	1.0	1.8	1.8	1.8 (1.8 IN)	
CDE/CDB 34.005,Wx.x (1.5 kW)	4	45	4.1	4.1	7.4	7.4	7.4 (1.8 I_N)	30
	8	40	4.1	3.6	7.4	7.4	7.4 (1.8 I_N)	
	12	40	3.2	2.4	5.7	5.7	5.7 (1.8 I_N)	
	16	40	2.4	1.8	4.3	4.3	4.3 (1.8 I_N)	
CDE/CDB 34.006,Wx.x (2.2 kW)	4	45	5.7	5.7	10.3	10.3	10.3 (1.8 I_N)	30
	8	40	5.7	5.7	10.3[1]/7.8[2]	10.3	10.3 (1.8 I_N)	
	12	40	4.15	3.1	7.5[1]/6.4[2]	7.5	7.5 (1.8 I_N)	
	16	40	2.6	1.9	4.7	4.7	4.7 (1.8 I_N)	
CDE/CDB 34.008,Wx.x (3 kW)	4	45	7.8	7.8	14	14	14 (1.8 I_N)	30
	8	40	7.8	7.8	14	14	14 (1.8 I_N)	
	12	40	6.4	4.8	11	11	11 (1.8 I_N)	
	16	40	5.0	3.7	7.8	9	9 (1.8 I_N)	
CDE/CDB 34.010,Wx.x (4 kW)	4	45	10	10	18	18	18 (1.8 I_N)	30
	8	40	10	8.8	18	18	18 (1.8 I_N)	
	12	40	8.1	6.0	13	14.5	14.5 (1.8 I_N)	
	16	40	6.2	4.6	7.8	11	11 (1.8 I_N)	
CDE 34.010, Wx.x,S	4	40	10	10	25	25	25 (2.5 I_N)	40
	8	40	10	8.8	18	25	25 (2.5 I_N)	
	12	40	7.0	5.2	13	17.5	17.5 (2.5 I_N)	
	16	40	5.92	4.4	11	14.8	14.8 (2.5 I_N)	

Table A.2 Positioning controllers for 400/460 V systems, model "W"

Servocontroller	Switching frequency of the power stage	Ambient temperature	Rated current		Peak current [A_{eff}][3]			
			At 400 V	At 460 V	At rotating field frequency increasing linearly 0 to 5 Hz		For intermittent operation	For time[4] [s]
	[kHz]	[°C]	[A_{eff}]	[A_{eff}]	0 Hz	5 Hz	> 5 Hz	
CDE/CDB 34.014,Wx.x (5.5 kW)	4	45	14	14	25	25	25 (1.8 I_N)	30
	8	40	14	12.2	25	25	25 (1.8 I_N)	
	12	40	10.3	7.7	18	18	18 (1.8 I_N)	
	16	40	6.6	4.9	12	12	12 (1.8 I_N)	
CDE/CDB 34.017,Wx.x (7.5 kW)	4	45	17	17	31	31	31 (1.8 I_N)	30
	8	40	17	13.5	31	31	31 (1.8 I_N)	
	12	40	12.5	9.3	23	23	23 (1.8 I_N)	
	16	40	8.0	6.0	14	14	14 (1.8 I_N)	
CDE/CDB 34.024,Wx.x (11 kW)	4	45	24.0	24	43	43	43 (1.8 I_N)	30
	8	40	24.0	24	43	43	43 (1.8 I_N)	
	12	40	19.5	14	35	35	35 (1.8 I_N)	
	16	40	15	11	27	27	27 (1.8 I_N)	
CDE/CDB 34.032,Wx.x (15 kW)	4	45	32	32	58	58	58 (1.8 I_N)	30
	8	40	32	28	58	58	58 (1.8 I_N)	
	12	40	26	20	39	47	47 (1.8 I_N)	
	16	40	20	15	32	36	36 (1.8 I_N)	

1) = CDE
2) = CDB
3) For 400 V systems
4) Shutdown as per $I^2 x t$ characteristic
Motor cable length 10 m
Installation altitude 1000 m above sea level
Mounted in a row

Table A.2 Positioning controllers for 400/460 V systems, model "W"

Positioning controllers for 400/480 V systems, model "W"

Servocontroller	Switching frequency of the power stage	Ambient temperature	Rated current		Peak current [A_{eff}][3]			
			At 400 V	At 480 V	At rotating field frequency increasing linearly 0 to 5 Hz		For intermittent operation	For time[4] [s]
	[kHz]	[°C]	[A_{eff}]	[A_{eff}]	0 Hz	5 Hz	> 5 Hz	
CDE 34.044,Wx.x (22 kW)	4	45	45	41	90	90	90 (2.0 I_N)	3[5]/10[6]
	8	40	45	41	90	90	90 (2.0 I_N)	
	12	40	45	41	90	90	90 (2.0 I_N)	
	16	40	42	38	84	84	84 (2.0 I_N)	
CDE 34.058,Wx.x (30 kW)	4	45	60	54	120	120	120 (2.0 I_N)	3[5]/10[6]
	8	40	60	54	120	120	120 (2.0 I_N)	
	12	40	58	52	116	116	116 (2.0 I_N)	
	16	40	42	38	84	84	84 (2.0 I_N)	
CDE 34.070,Wx.x (37 kW)	4	45	72	65	144	144	144 (2.0 I_N)	3[5]/10[6]
	8	40	72	65	144	144	144 (2.0 I_N)	
	12	40	58	52	116	116	116 (2.0 I_N)	
	16	40	42	38	84	84	84 (2.0 I_N)	
CDB 34.044,Wx.x (22 kW)	4	45	45	41	68	67.5	67 (1.5 I_N)	30[5]
	8	40	45	41	45	45	67 (1.5 I_N)	
	12	40	36	33	36	36	54 (1.5 I_N)	
	16	40	27	24	27	27	41 (1.5 I_N)	
CDB 34.070,Wx.x (37 kW)	4	45	72	65	108	108	108 (1.5 I_N)	30
	8	40	72	65	72	72	108 (1.5 I_N)	
	12	40	58	52	58	58	87 (1.5 I_N)	
	16	40	42	38	42	42	63 (1.5 I_N)	
CDE/CDB 34.088,Wx.x (47 kW)	4	45	90	81	170	180	180 (2.0 I_N)	30
	8	40	90	81	134	180	180 (2.0 I_N)	
	12	40	90	81	107	144	144 (1.6 I_N)	
	16	40	72	65	86	115	115 (1.6 I_N)	

Table A.3 Positioning controllers for 400/480 V systems, model "W"

Servocontroller	Switching frequency of the power stage	Ambient temperature	Rated current		Peak current [A_{eff}][3]			
			At 400 V	At 480 V	At rotating field frequency increasing linearly 0 to 5 Hz		For intermittent operation	For time[4] [s]
	[kHz]	[°C]	[A_{eff}]	[A_{eff}]	0 Hz	5 Hz	> 5 Hz	
CDE/CDB 34.108,Wx.x (55 kW)	4	45	110	99	170	220	220 (2.0 I_N)	30
	8	40	110	99	134	165	165 (1.5 I_N)	
	12	40	90	81	107	144	144 (1.6 I_N)	
	16	40	72	65	86	115	115 (1.6 I_N)	
CDE/CDB 34.140,Wx.x (75 kW)	4	45	143	129	270	286	286 (2.0 I_N)	30
	8	40	143	129	215	215	215 (1.5 I_N)	
	12	40	115	104	172	172	172 (1.5 I_N)	
	16	40	92	83	138	138	138 (1.5 I_N)	
CDE/CDB 34.168,Wx.x (90 kW)	4	45	170	153	190	315	315 (1.9 I_N)	10
	8	40	170	153	151	220	220 (1.3 I_N)	
	12	40	136	122	121	164	164 (1.2 I_N)	
	16	40	109	98	97	131	131 (1.2 I_N)	

1) = CDE
2) = CDB
3) For 400 V systems
4) Shutdown as per I^2 x t characteristic
5) At preload of max. 70%
6) At heat sink temperature < 45 °C
Motor cable length 10 m
Installation altitude 1000 m above sea level
Mounted in a row

Table A.3 Positioning controllers for 400/480 V systems, model "W"

Positioning controllers for 400/480 V systems, model "L"

Servocontroller	Switching frequency of the power stage	Ambient temperature	Rated current		Peak current [A_{eff}][3]			
			At 400 V	At 480 V	At rotating field frequency increasing linearly 0 to 5 Hz		For intermittent operation	For time[4] [s]
	[kHz]	[°C]	[A_{eff}]	[A_{eff}]	0 Hz	5 Hz	> 5 Hz	
CDB.x4.044,L (22 kW)	4	45	45	41	67.5	67.5	67.5 (1.5 I_N)	60
	8	40	45	41	45	45	67.5 (1.5 I_N)	
	12	40	36	41	36	36	54 (1.5 I_N)	
	16	40	27	24	27	27	41 (1.5 I_N)	
CDE.x4.044,L (22 kW)	4	45	45	41	90	90	90 (2.0 I_N)	30
	8	40	45	41	90	90	90 (2.0 I_N)	
	12	40	45	41	90	90	90 (2.0 I_N)	
	16	40	42	38	84	84	84 (2.0 I_N)	
CDB.x4.058,L (30 kW)	4	45	60	54	90	90	90 (1.5 I_N)	60
	8	40	60	54	60	60	90 (1.5 I_N)	
	12	40	48	43	48	48	72 (1.5 I_N)	
	16	40	36	33	36	36	54 (1.5 I_N)	
CDE.x4.058,L (30 kW)	4	45	60	54	120	120	120 (2.0 I_N)	30
	8	40	60	54	120	120	120 (2.0 I_N)	
	12	40	58	52	116	116	116 (2.0 I_N)	
	16	40	42	38	84	84	84 (2.0 I_N)	
CDB.x4.070,L (37 kW)	4	45	72	65	108	108	108 (1.5 I_N)	60
	8	40	72	65	72	72	108 (1.5 I_N)	
	12	40	58	52	58	58	87 (1.5 I_N)	
	16	40	42	38	42	42	63 (1.5 I_N)	
CDE.x4.070,L (37 kW)	4	45	72	65	144	144	144 (2.0 I_N)	30
	8	40	72	65	144	144	144 (2.0 I_N)	
	12	40	58	52	116	116	116 (2.0 I_N)	
	16	40	42	38	84	84	84 (2.0 I_N)	

Table A.4 Positioning controllers for 400/480 V systems, model "L"

Servocontroller	Switching frequency of the power stage	Ambient temperature	Rated current		Peak current [A_{eff}][3]			
			At 400 V	At 480 V	At rotating field frequency increasing linearly 0 to 5 Hz		For intermittent operation	For time[4] [s]
	[kHz]	[°C]	[A_{eff}]	[A_{eff}]	0 Hz	5 Hz	> 5 Hz	
CDB/CDE. x4.088,L (55 kW)	4	45	110	99	205	220	220 (2.0 I_N)	30
	8	45	110	99	165	187	187 (1.7 I_N)	
	12	45	110	99	132	165	165 (1.5 I_N)	
	16	45	90	81	106	135	135 (1.5 I_N)	
CDB/CDE. x4.108,L (75 kW)	4	45	143	129	230	286	286 (2.0 I_N)	30
	8	45	143	129	190	215	215 (1.5 I_N)	
	12	45	114	103	152	172	172 (1.5 I_N)	
	16	45	91	82	122	138	138 (1.5 I_N)	
CDB/CDE. x4.140,L (90 kW)	4	45	170	153	230	340	340 (2.0 I_N)	10
	8	45	170	153	190	255	255 (1.5 I_N)	
	12	45	136	122	152	204	204 (1.5 I_N)	
	16	45	109	98	122	163	163 (1.5 I_N)	
CDB/CDE. x4.168,L (110 kW)	4	45	210	189	230	340	340 (1.6 I_N)	10
	8	45	210	189	190	255	255 (1.2 I_N)	
	12	45	168	151	152	204	204 (1.2 I_N)	
	16	45	134	121	122	163	163 (1.2 I_N)	
CDB/CDE. x4.208,L (110 kW)	4	45	250	225	230	325	325 (1.3 I_N)	10
	8	45	250	225	190	255	255 (1.0 I_N)	
	12	45	168	151	152	204	204 (1.2 I_N)	
	16	45	134	121	122	163	163 (1.2 I_N)	

3) For 400 V systems

4) Shutdown as per I2 x t characteristic

Motor cable length 10 m

Installation altitude 1000 m above sea level

Mounted in a row

Table A.4 Positioning controllers for 400/480 V systems, model "L"

A.2 Technical data

CDE/CDB32.004,C to CDE/CDB34.006,W

Technical data \ Designation	CDE/CDB32.003	CDE/CDB32.004	CDE/CDB32.008	CDE/CDB34.003	CDE/CDB34.005	CDE/CDB34.006
Output, motor side [1]	BG1		BG2			
Recommended rated power with 4-pole standard motor for CDB	0.375 kW	0.75 kW	1.5 kW	0.75 kW	1.5 kW	2.2 kW
Voltage	3 x 0 ... 230 V			3 x 0 ... 400/460 V		
Continuous current, effective (I_N)	2.4 A	4.3 A	7.1 A	2.2 A	4.1 A	5.7 A
Peak current	(See Table A.1)			(See Table A.2)		
Rotating field frequency	0 ... 400 Hz					
Switching frequency of the power stage	4, 8, 12, 16 kHz (factory setting 8 kHz)					
Input, mains side						
Mains voltage	1 x 230 V -20 % +15 %			3 x 400 V (-15 %) ... 3 x 460 V (+10 %)		
Device power connection	1.0 kVA	1.6 kVA	3.0 kVA	1.5 kVA	3.0 kVA	4.2 kVA
Asymmetry of mains voltage	-			±3 % max.		
Frequency	50/60 Hz ±10 %			50/60 Hz ±10 %		
Power dissipation CDE at 4 kHz power stage clock frequency 8/16 kHz	49 W 52 W	63 W 70 W	110 W 120 W	90 W 97 W	95 W 127 W	121 W 163 W
Power dissipation CDB at 4 kHz power stage clock frequency 8/16 kHz	35 W 30 W	48 W 55 W	95 W 105 W	55 W 70 W	80 W 112 W	106 W 148 W
Brake chopper power electronics						
Peak braking power with int. braking resistor (only model CDE/ CDB34 ..., Wx.x, BR)	-	-	1.7 kW with 360 Ω	-	1.6 kW with 360 Ω	1.6 kW with 360 Ω

Table A.5 CDE/CDB32.004,C to CDE/CDB34.006,W

Technical data \ Designation	CDE/CDB32.003	CDE/CDB32.004	CDE/CDB32.008	CDE/CDB34.003	CDE/CDB34.005	CDE/CDB34.006
Minimum ohmic resistance of an externally installed braking resistor	100 Ω		56 Ω	180 Ω		

1) Data apply: for 1-phase devices at 230 V, for 3-phase devices at 400 V

Table A.5 CDE/CDB32.004,C to CDE/CDB34.006,W

CDB34.008,W to CDB34.032,W

Technical data \ Designation	CDE/CDB34.008	CDE/CDB34.010	CDE34.010,W,S	CDE/CDB34.014	CDE/CDB34.017	CDE/CDB34.024	CDECDB34.032
Output, motor side [1]	BG3			BG4		BG5	
Recommended rated power with 4-pole standard motor for CDB	3.0 kW	4.0 kW	-	5.5 kW	7.5 kW	11 kW	15 kW
Voltage	3 x 0 ... 400/460 V						
Continuous current, effective (I_N)	7.8 A	10 A	10 A	14 A	17 A	24 A	32 A
Peak current	(See Table A.2)						
Rotating field frequency	0 ... 400 Hz						
Switching frequency of the power stage	4, 8, 12, 16 kHz (factory setting 8 kHz)						
Input, mains side							
Mains voltage	3 x 400 V (-15 %) ... 3 x 460 V (+10 %)						
Device power connection	5.7 kVA	7.3 kVA	9.4 kVA	10.2 kVA	12.4 kVA	17.5 kVA	23.3 kVA
Asymmetry	±3 % max.						

Table A.6 CDB/CDE34.008 to CDB/CDE34.032

Technical data \ Designation	CDE/CDB34.008	CDE/CDB34.010	CDE34.010,W,S	CDE/CDB34.014	CDE/CDB34.017	CDE/CDB34.024	CDECDB34.032
Frequency	50/60 Hz ±10 %						
Power dissipation CDE at 4 kHz power stage clock frequency 8/16 kHz	150 W 177 W	187 W 222 W	-	225 W 283 W	270 W 340 W	330 W 415 W	415 W 525 W
Power dissipation CDB at 4 kHz power stage clock frequency 8/16 kHz	135 W 162 W	172 W 207 W	-	210 W 268 W	225 W 325 W	315 W 400 W	400 W 510 W
Brake chopper power electronics							
Peak braking power with int. braking resistor (only model CDE/ CDB34 ..., Wx.x, BR)	6.0 kW with 90 Ω		-	6.0 kW with 90 Ω		6.0 kW with 90 Ω	
Minimum ohmic resistance of an externally installed braking resistor	81 Ω		72 Ω	47 Ω		22 Ω	

1) Data apply: for 1-phase devices at 230 V, for 3-phase devices at 400 V

Table A.6 CDB/CDE34.008 to CDB/CDE34.032

CDB/CDE34.044,W to CDB/CDE34.168,W

Technical data \ Designation	CDE/CDB34.044	CDE/CDB34.058	CDE/CDB34.070	CDE/CDB34.088	CDE/CDB34.108	CDE/CDB34.140	CDE/CDB34.168
Output, motor side [1]	BG6			BG7		BG7a	
Recommended rated power with 2-pole standard motor for CDB	22 kW	30 kW	37 kW	47 kW	55 kW	75 kW	90 kW
Voltage [2]	3 x 0 ... 400/480 V						
Continuous current, effective (I_N)	45 A	60 A	72 A	90 A	110 A	143 A	170 A
Peak current	(See Table A.3)						
Rotating field frequency	0 ... 400 Hz						
Switching frequency of the power stage	4, 8, 12, 16 kHz (with CDE3000 factory setting 8 kHz) (with CDB3000 factory setting 4 kHz)						
Input, mains side							
Mains voltage	3 x 400 V (-15 %) ... 3 x 480 V (+10 %)						
Device power connection	31 kVA	42 kVA	50 kVA	62 kVA	76 kVA	99 kVA	118 kVA
Asymmetry	±3 % max.						
Frequency	50/60 Hz ±10 %						
Power dissipation CDB	520 W	700 W	860 W	1050 W	1300 W	1700 W	2000 W
Power dissipation CDE	610 W	830 W	1010 W	1300 W	1600 W	2100 W	2500 W
Brake chopper power electronics							
Minimum ohmic resistance of an externally installed braking resistor	≥ 18 Ω		≥ 13 Ω	≥ 12 Ω	≥ 10 Ω	≥ 8.5 Ω	≥ 6.5 Ω

1) Data apply: for 1-phase devices at 230 V, for 3-phase devices at 400 V

2) 3 x Umains x 0.95

Table A.7 CDB/CDE34.044,W to CDB/CDE34.168,W

CDB/CDE 34.044,L to CDB/CDE 34.208,L

Designation / Technical data	CDE/CDB34.044,L	CDE/CDB34.058,L	CDE/CDB34.070,L	CDE/CDB34.088,L	CDE/CDB34.108,L	CDE/CDB34.140,L	CDE/CDB34.168,L	CDE/CDB34.208,L
Output, motor side [1]	BG6			BG7		BG7a		
Recommended rated power with 2-pole standard motor for CDB	22 kW	30 kW	37 kW	55 kW	75 kW	90 kW	110 kW	110 kW
Voltage [2]	3 x 0 ... 400/480 V							
Continuous current, effective (I_N)	45 A	60 A	72 A	110 A	143 A	170 A	210 A	250 A
Peak current	(See Table A.4)							
Rotating field frequency	0 ... 400 Hz							
Switching frequency of the power stage	4, 8, 12, 16 kHz (with CDE3000 and CDB3000 factory setting 4 kHz)							
Input, mains side								
Mains voltage	3 x 400 V (-15 %) ... 3 x 480 V (+10 %)							
Device power connection	31 kVA	42 kVA	50 kVA	76 kVA	99 kVA	118 kVA	128 kVA	128 kVA
Asymmetry	±3 % max.							
Frequency	50/60 Hz ±10 %							
Power dissipation CDB / CDE	610 W	830 W	1010 W	1950 W	2300 W	2550 W	3000 W	3000 W
Brake chopper power electronics								
Minimum ohmic resistance of an externally installed braking resistor	≥ 10 Ω			≥ 12 Ω	≥ 10 Ω	≥ 8.5 Ω	≥ 6.5 Ω	≥ 5 Ω

1) Data apply: for 1-phase devices at 230 V, for 3-phase devices at 400 V

2) 3 x Umains x 0.95

Table A.8 CDB/CDE 34.044,L to CDB/CDE 34.208,L

A.3 Ambient conditions CDE/CDB3000

Feature		Positioning controller	Accessories (KP300 UM-xxxx/ CM-xxxx)
Climatic conditions	In operation as per EN 61800-2, IEC 60721-3-3 class 3K3	+5 ... 40 °C [2] with relative atmospheric humidity from 5 ... 85 % without condensation	0 ... 55 °C 2) with relative atmospheric humidity from 5 ... 85 % without condensation
	In storage as per EN 61800-2, IEC 60721-3-1 class 1K3 and 1K4	-25 ... +55 °C [3] with relative atmospheric humidity from 5 ... 95 %	
	In transit as per EN 61800-2, IEC 60721-3-2 class 2K3	-25 ... +70 °C [4] relative atmospheric humidity 95 % at max. +40 °C	
Protection	Device	IP20 (terminals IP00)	
	Cooling method	Push-through heat sink IP54	Convection IP20
Touch protection		BGV 3	
Installation altitude		Up to 1000 m above sea level, higher than 1000 m above sea level with power reduction, max. 2000 m above sea level	

2) The absolute humidity is limited to max. 25 g/m³. That means that the maximum values for temperature and relative atmospheric humidity stipulated in the table must not occur simultaneously.

3) The absolute humidity is limited to max. 29 g/m³. So the maximum values for temperature and relative atmospheric humidity stipulated in the table must not occur simultaneously.

4) The absolute humidity is limited to max. 60 g/m³. This means, at 70 °C for example, that the relative atmospheric humidity may only be max. 40%.

5) The devices are designed only for installation in a stationary switch cabinet.

Vibration limit in transit, as per EN 61800-2, IEC 60721-3-2 class 2M1		
Frequency	Amplitude	Acceleration
2 < f < 9 Hz	3.5 mm	Not applicable
9 < f < 200 Hz	Not applicable	10 m/s^2
200 < f < 500 Hz	Not applicable	15 m/s^2
Shock limit in transit as per EN 61800-2, IEC 60721-3-2 class 2M1		
Drop height of packed device max. 0.25 m		
Vibration limit for the system[5], as per EN 61800-2, IEC 60721-3-3 class 3M1		
Frequency	Amplitude	Acceleration
2 < f < 9 Hz	0.3 mm	Not applicable
9 < f < 200 Hz	Not applicable	1 m/s^2

2) The absolute humidity is limited to max. 25 g/m^3. That means that the maximum values for temperature and relative atmospheric humidity stipulated in the table must not occur simultaneously.

3) The absolute humidity is limited to max. 29 g/m^3. So the maximum values for temperature and relative atmospheric humidity stipulated in the table must not occur simultaneously.

4) The absolute humidity is limited to max. 60 g/m^3. This means, at 70 °C for example, that the relative atmospheric humidity may only be max. 40%.

5) The devices are designed only for installation in a stationary switch cabinet.

A.4 Usage of a mains choke

The usage of mains chokes is necessary:
• On the usage of the positioning controller in applications with interference corresponding to environment class 3, as per EN 61000-2-4 and higher (hostile industrial environment). • If the DC links on several positioning controllers are coupled.

The characteristics of environment class 3 include:

- Mains voltage fluctuations > + 10 % UN
- Brief interruptions between 10 ms and 60 s
- Voltage asymmetry > 3 %

Environment class 3 is typically present if:

- A major portion of the load is supplied by power converters (DC choppers or soft-starting devices)
- There are welding machines
- There are induction furnaces or electric arc furnaces
- Large motors are started frequently
- Current loads fluctuate quickly.

Mains load (example)

	Without mains choke	With mains choke	Change
	4 kW positioning controller, mains impedance 0.6 mH	4 kW positioning controller, mains impedance 6 mH	Without mains choke compare to with mains choke
Distortion (THD)[1)]	99 %	33 %	-67 %
Mains current amplitude	18.9 A	9.7 A	-48 %
Mains current, effective	8.5 A	6.23 A	-27 %
Commutation dips referred to the mains voltage	28 V	8 V	-70%
Service life of the DC link capacitors	Rated service life	2 to 3 times rated service life	+100 to 200 %
1) THD = Total Harmonic Distortion (harmonic U_5 ...U_{41})			

Table A.9 Change in the mains load due to usage of a mains choke with 4 % short-circuit voltage based on the example of a 4 kW positioning controller CDB34.010

Mains voltage asymmetry (example)

	Without mains choke			With mains choke		
	4 kW positioning controller, mains impedance 0.6 mH			4 kW positioning controller, mains impedance 6 mH		
Asymmetry of mains voltage	0 %	+3 %	-3 %	0 %	+3 %	-3 %
Mains current amplitude	18.9 A	25.4 A	25.1 A	9.7 A	10.7 A	11 A
Mains current, effective	8.5 A	10.5 A	10.2 A	6.2 A	6.7 A	6.8 A

Table A.10 Effect of the mains choke with asymmetrical mains voltage based on the example of a 4 kW positioning controller CDE/CDB34,010

RECOMMENDATION:
The example shows that the benefits of a mains choke with 4 % short-circuit voltage are multi-faceted.We therefore recommend you to use a mains choke in principle.

A.5 Mains filters

You will find details on the topic of "electromagnetic compatibility" in chapter 4.3.

Permissible motor cable length with internal RFI filter

Drive controller	4 kHz power stage clock frequency With integrated mains filter		8 kHz power stage clock frequency With integrated mains filter		16 kHz power stage clock frequency With integrated mains filter	
	Industrial	Residential	Industrial	Residential	Industrial	Residential
CDE/B32.003	1)	1)	20	10	25	10
CDE/B32.004	1)	1)	20	10	25	10
CDE/B32.006	25	10	20	10	25	10
CDE/B32.008	25	10	20	10	25	10
CDE/B34.003	10	10	25	10	1)	1)
CDE/B34.005	10	10	25	10	25	1)
CDE/B34.006	10	10	25	10	25	1)
CDE/B34.008	25	10	25	10	20	1)
CDE/B34.010	25	10	25	10	20	1)
CDE/B34.014	10	1)	25	10[2)]	20	1)
CDE/B34.017	10	1)	25	10[2)]	20	1)
CDE/B34.044	25	10	25	10	-	-
CDE/B34.058	25	10	25	10	-	-
CDE/B34.070	25	10	25	10	-	-
1), 2) See Table A.12						

Table A.11 Permissible motor cable length with integrated mains filter as a function of the standard 61800-3

Explanations on Table A.11	
Residential:	Limit according to EN 61800-3 (first environment), restricted availability. Maximum permissible motor cable length with which the interference emissions (>9 kHz) are below the permissible limits. Only 10/ 15 m were checked during the measurements.
Industrial:	Limit according to EN 61800-3 (second environment), restricted availability. Maximum permissible motor cable length with which the interference emissions (>9 kHz) are below the permissible limits. Only 25 m was checked during the measurements.
1)	The interference emissions at 10 m and/or 25 m were above the limits stipulated by the standard. However, this does not mean that the mains filter is ineffective, but only that it is not acting optimally over the entire frequency band. An external mains filter must therefore be used to comply with the standard.
2)	A mains choke (uK = 2 % or 4 %) must also be connected in series to comply with the standard.
12 kHz Power stage clock frequency	At a 12 kHz power stage clock frequency, external mains filters must be used because there are no measurements available with an internal mains filter.
Measuring method:	The permissible length of the motor cable was determined as per the standard (stipulated measuring method).

Table A.12 Explanations on Table A.11

A.6 UL certification

The description of all measures to maintain UL approval is to be found in the document "UL-Certification" (ID no.: 0927.21B.X.xx).

B Glossary

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B

C

D

E

F

I

K

L

M

N

O

P

R

S

T

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W

X

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