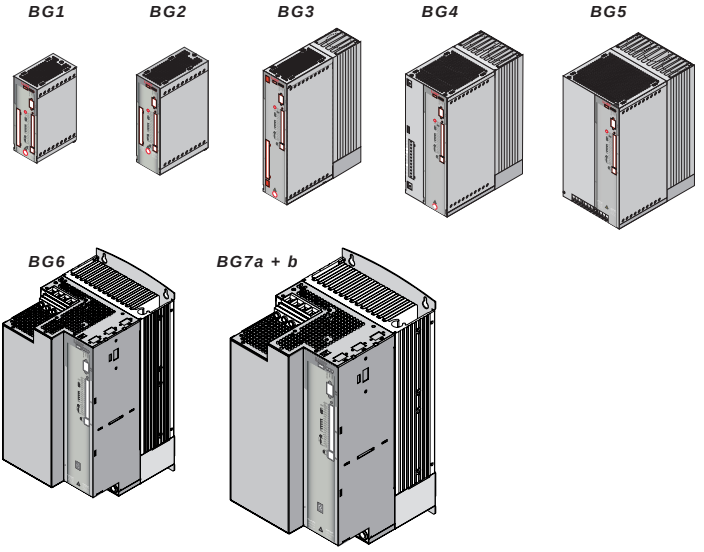
EN

CDE/CDB3000

Operation Manual

Positioning Controllers
2 A to 170 A

LUST



CDE/CDB3000 Operation Manual

ID no.: 1001.20B.2-0 • **08/2005**

Valid from software version CDE V1.0 and CDB V1.0.

We reserve the right to make technical changes.

Overview of documents

Document	Ordering designation	Pupose
Application Manual CDE/CDB3000	1001.22B.x-xx	Adaptation of drive system to the application
CANopen Communication Manual	1005.26B.x-xx	Project planning and description of function
PROFIBUS-DP Communication Manual	0916.20B.x-xx	Project planning and description of function

Sign posts

Pictograms

⇨ **Attention!** Misoperation may result in damage to the drive or malfunction.

⇨ **Danger from electrical tension!** Improper behaviour may endanger human life.

⇨ **Danger from rotating parts!** The drive may start running automatically.

⇨ **Note:** Useful information

A Appendix

B Index

1 Safety

1.1 Measures for your safety

In order to avoid physical injury and/or material damage the following information must be read before initial start-up.
The safety regulations must be strictly observed at any time.

Read the Operation Manual first!

- Follow the safety instructions!
- Please observe the user information

Electric drives are generally potential danger sources:

- Electrical voltage 230 V/460 V:
  Dangerously high voltage may still be present 10 minutes after the power is cut. You should therefore always
  check that there is no voltage present.
- Rotating parts
- Hot surfaces

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

- For persons with pacemakers, metal containing implants and hearing aids etc. access to the following areas is prohibited:
  - Areas in which drive systems are installed, repaired and operated.
  - Areas in which motors are assembled, repaired and operated. Motors with permanent magnets are sources of special dangers.

Danger: If there is a necessity to access such areas a decision from a physician is required.

Your qualification:

- In order to prevent personal injury or damage to property, only personnel with electrical engineering qualifications may work on the device.
- The qualified personnel must familiarise themselves with the Operation Manual (refer to IEC364, DIN VDE0100).
- Knowledge of the national accident prevention regulations (e. g. BGV A2 (VBG 4) in Germany)

During installation follow these instructions:

- Always comply with the connection conditions and technical specifications.
- Comply with the standards for electrical installations, such as wire cross-section, earthing lead and ground connections.
- Do not touch electronic components and contacts (electrostatic discharge may destroy components).

Pictograms used in this manual

The notes on safety describe the following danger classes.
The danger class describes the risk which may arise when not complying with the note on safety.

Warning symbols	General explanation	Danger class acc. to ANSI Z 535
	**Attention!** Operating errors may cause damage to or malfunction of the drive.	This may result in physical injury or damage to material.
	**Danger, high voltage!** Improper behaviour may cause fatal accident.	Danger to life or severe physical injury.
	**Danger from rotating parts!** The drive may automatically start.	Danger to life or severe physical injury..

1.2 Intended use

Drive controllers are components for installation into stationary electric systems or machines.

When installed in machines the commissioning of the drive controller (i. e. start-up of intended operation) is prohibited, unless it has been ascertained that the machine fully complies with the regulations of the EC-directive 98/37/EC (Machine Directive); compliance with EN 60204 is mandatory.

Commissioning (i. e. starting intended operation) is only permitted when strictly complying with EMC-directive (89/336/EEC).

CE The CDE/CDB3000 complies with the low voltage directive 73/23/EEC.

For the drive controller the harmonized standards of series EN 50178/ DIN VDE 0160 in connection with EN 60439-1/ VDE 0660 part 500 and EN 60146/ VDE 0558 are applied.

If the drive controller is used in special applications, e. g. in areas subject to explosion hazards, the applicable regulations and standards (e. g. in Ex-environments EN 50014 “General provisions” and EN 50018 “Flameproof housing”) must be strictly observed.

Repairs must only be carried out by authorized repair workshops. Unauthorised opening and incorrect intervention could lead to physical injury or material damage. The warranty granted by LUST will become void.

Note: The use of drive controllers in mobile equipment is assumed an exceptional environmental condition and is only permitted after a special agreement.

1.3 Responsibility

Electronic devices are never fail-safe. The company setting up and/or operating the machine or plant is itself responsible for ensuring that the drive is rendered safe if the device fails.

EN 60204-1/DIN VDE 0113 "Safety of machines", in the section on "Electrical equipment of machines", stipulates safety requirements for electrical controls. They are intended to protect personnel and machinery, and to maintain the function capability of the machine or plant concerned, and must be observed.

An emergency stop system does not necessarily have to cut the power supply to the drive. To protect against danger, it may be more beneficial to keep individual drives running or to initiate specific safety sequences. Execution of the emergency stop measure is assessed by means of a risk analysis of the machine or plant, including the electrical equipment in accordance with DIN EN 1050, and is determined by selecting the circuit category in accordance with DIN EN 954-1 "Safety of machines - Safety-related parts of controls".

2 Mechanical installation

2.1 Notes for operation

Please ensure that ...

- no moisture enters into the device,
- no aggressive or conductive substances are in the immediate vicinity,
- no drill chippings, screws or foreign bodies drop into the device,
- the ventilation openings are not covered over.

The unit may otherwise be damaged.

2.2 Wall mounting

Step	Action	Comment
1	Mark the position of the tapped holes on the backing plate. Cut a tap for each fixing screw in the backing plate.	Dimensional drawings/hole spacing see Table 2.1. The tapping area will provide you with good, full-area contact.
2	Mount the positioning converter **vertically** on the backing plate.	Do not forget the mounting clearances! The metal of the contact surface must not be insulated.
3	Mount the additional components, such as line filter and power choke, on the backing plate.	The cable between line filter and converter must not be longer than max. 30 cm
4	Continue with the electrical installation in section 3.	

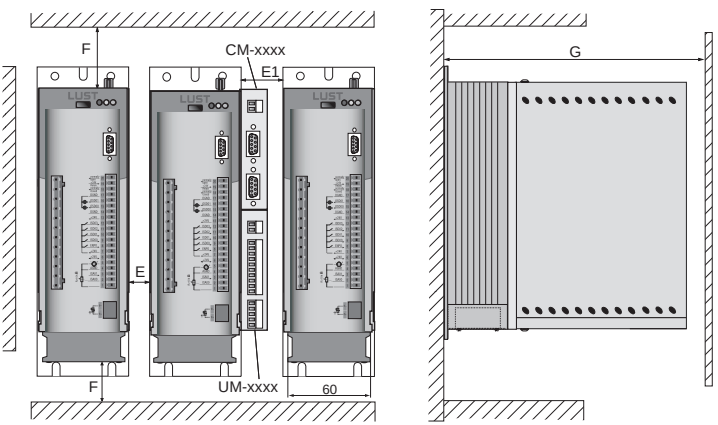
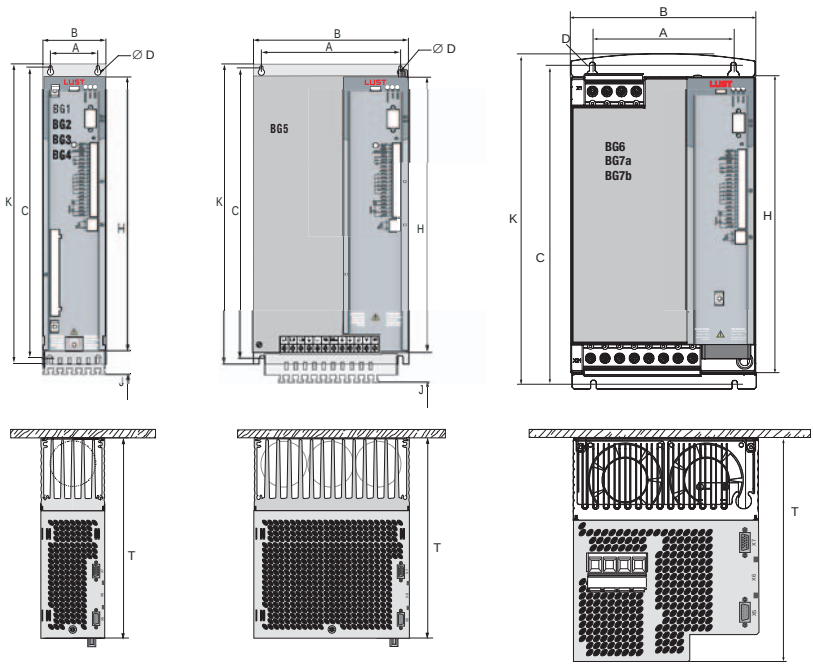


Fig. 2.1 Mounting clearances (see Table 2.1)

CDE/CDB3...,Wx.x	BG1[2)]	BG2[2)]	BG2	BG3	BG4	BG5	BG6	BG7
Weight [kg]	1,6	2,3	3,5	4,4	6,5	7,2	10	30/38
B (Width)	70				120	170	190	280
H (Height) (CDE/CDB)	220/193	245/230	247	330			348	540
T (Depth)	120	145	220	218			230	240,5
A	50		40		80	130	150	200
C (CDE/CDB)	230/205	255/230	260	320			365	581
D∅	∅ 4,8						∅ 5,6	∅ 9,5

Table 2.1 Dimensional drawings for wall mounting (dimensions in mm)

CDE/CDB3...,Wx.x	BG1[2)]	BG2[2)]	BG2	BG3	BG4	BG5	BG6	BG7
Screws	4 x M4						4 x M5	4 x M9
E	0	0[4)]	0					
E1 see Fig. 2.1	35/50[1)]							
F see Fig. 2.1	100[3)]							
G see Fig. 2.1	≥ 300							
J (CDE/CDB)	18/45			45		55	Provide a plate screen	-
K	215	240	270	330			382	600



1) 50 mm distance between the controllers to be able to replace the lateral optional module (without having to disassemble the drive controller).
2) Complies with cold plate version, in this context please observe Table 2.2.
3) Also allow enough space at the bottom for the bending radii of the connecting cables.
4) Butt mounting not permitted with CDB32.008, Cx.x. Please use CDB32.008, Wx.x.

Table 2.1 Dimensional drawings for wall mounting (dimensions in mm)

2.3 Cold Plate

Size	Power	Positioning controller	R_{thK} 1) [K/W]	Backing plate (unvarnished steel) min. cooling surface 2)
BG1	0.375kW	CDE/CDB32.003, C	0,05	None
	0.75 kW	CDE/CDB32.004, C	0,05	650x100mm = 0.065m²
BG2	1,5 kW	CDE/CDB32.008, C	0,05	650x460mm = 0.3m²
	0.75 kW	CDE/CDB34.003, C	0,05	None

1) Thermal resistance between active cooling area and cooler
2) For side-by-side mounting and with missing backing plate, use an external heat sink HS3x.xxx or the "wall mounting" version.

Table 2.2 Required cooling with cold plate

Please note:

- Air must be able to flow through the device without restriction.
- For mounting in switch cabinets with convection (= heat loss is discharged to the outside via the 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 use a chromated or galvanised backing plate. If backing plates are varnished, remove the coating from the contact area.
- The position converters of size 1 (CDE/CDB32.003 and CDE/CDB32.004) must be mounted on chrome/zinc coated backing plates in the control cabinet with a cooling surface of 0.065m² per positioning converter.
- When assembling without additional cooling surface (Cold Plate design) heat sink types according to series HS3X.xxx must be used.
- Further information on environmental conditions can be found in appendix A3.

2.4 Push-through heat sink

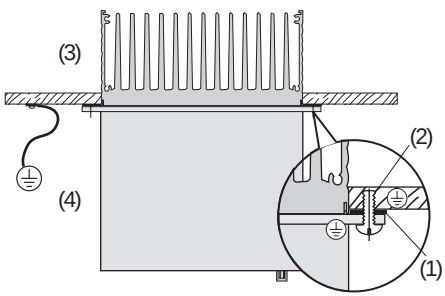
Step	Action	Comment
1	Mark out the positions of the tapped holes and the breakthrough on the backing plate. Cut a tap for each fixing screw in the backing plate.	Dimensional drawings/hole spacing see Table 2.4. The tapping area will provide you with good, full-area contact.
2	Mount the positioning converter **vertically** on the backing plate. Tighten all screws evenly.	Observe the mounting clearances! The mounting seal must have good contact on the surface.
3	Mount the additional components, such as the line filter and power choke, on the backing plate.	Connecting line between line filter and drive controller max. 30 cm
4	Continue with the electrical installation in section 3.	

Please note:

- Distribution of power loss:

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

- The all-around mounting collar is fitted with a seal. This seal must have good surface contact and should be free of damaged:



(1) Seal
(2) Tapped hole for EMC-compatible contact
(3) Outside
(4) Inside

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

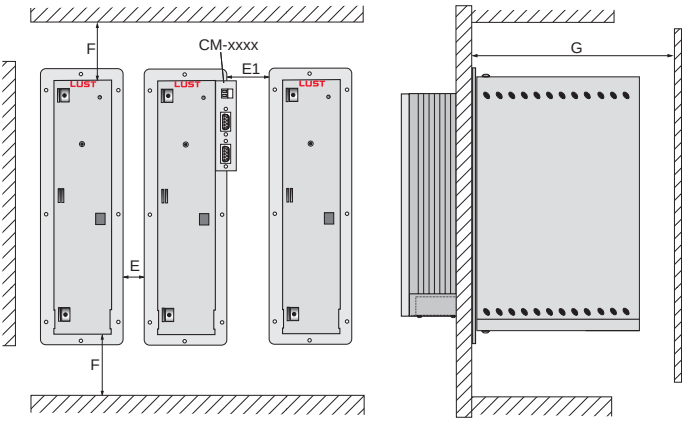


Fig. 2.2 Mounting clearances (see Table 2.4)

Dimensions of breakthrough	BG3	BG4	BG5	BG6
B (Width)	75	125	175	200
H (Height)	305	305	305	355

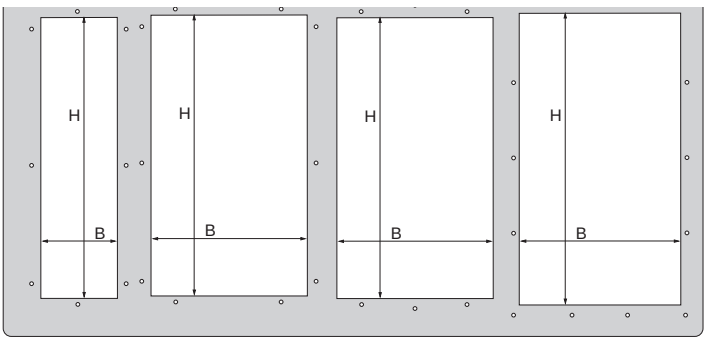
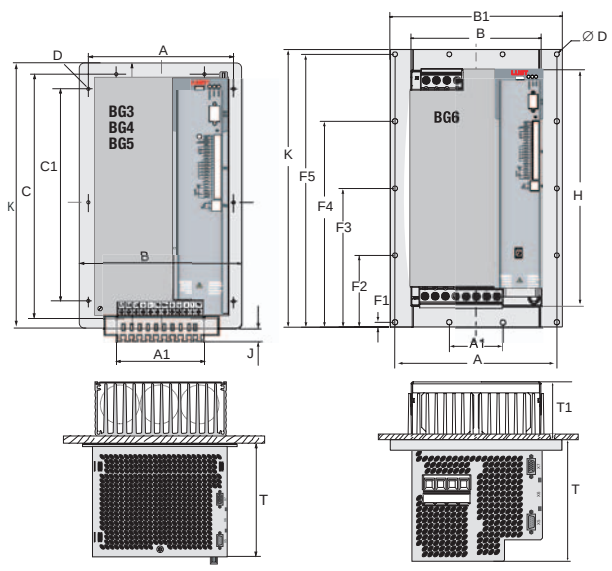


Table 2.3 Breakthrough for push-through heat sink (dimensions in mm)

For more information on the ambient conditions see appendix A.3.

CDE/CDB3...,Dx.x	BG3	BG4	BG5	BG6
Weight [kg]	4,6	6,7	7,4	10
B (Width)	110	160	210	190 / B1=250
H (Height)	340			345
T (Depth)	138			161 / T1=85
A	90	140	190	236
A1	–	80	100	78
C	320			-
C1	200			*)
D∅	∅ 4,8	∅ 4,8	∅ 4,8	∅ 7.5
Screws	8 x M4	10 x M4	10 x M4	14 x M7
E [2)]	10			405
E1 (with module)[2)]	40			
F [2)]	100[1)]			
G [2)]	≥ 300			
J	45		55	Provide a plate screen
K	340			405
*) F1=7 / F2=104 / F3=202.5 / F4=300.25 / F5=398				



1) Also allow enough space at the bottom for the bending radii of the connecting cables.
2) Dimensional drawings see Fig. 2.2

Table 2.4 Dimensional drawings: push-through heat sink (dimensions in mm)

3 Installation

Attention: Installation must only be carried out by qualified electricians who have undergone instruction in the necessary accident prevention measures.

3.1 Overview of connections CDE

Terminal diagram CDE3000

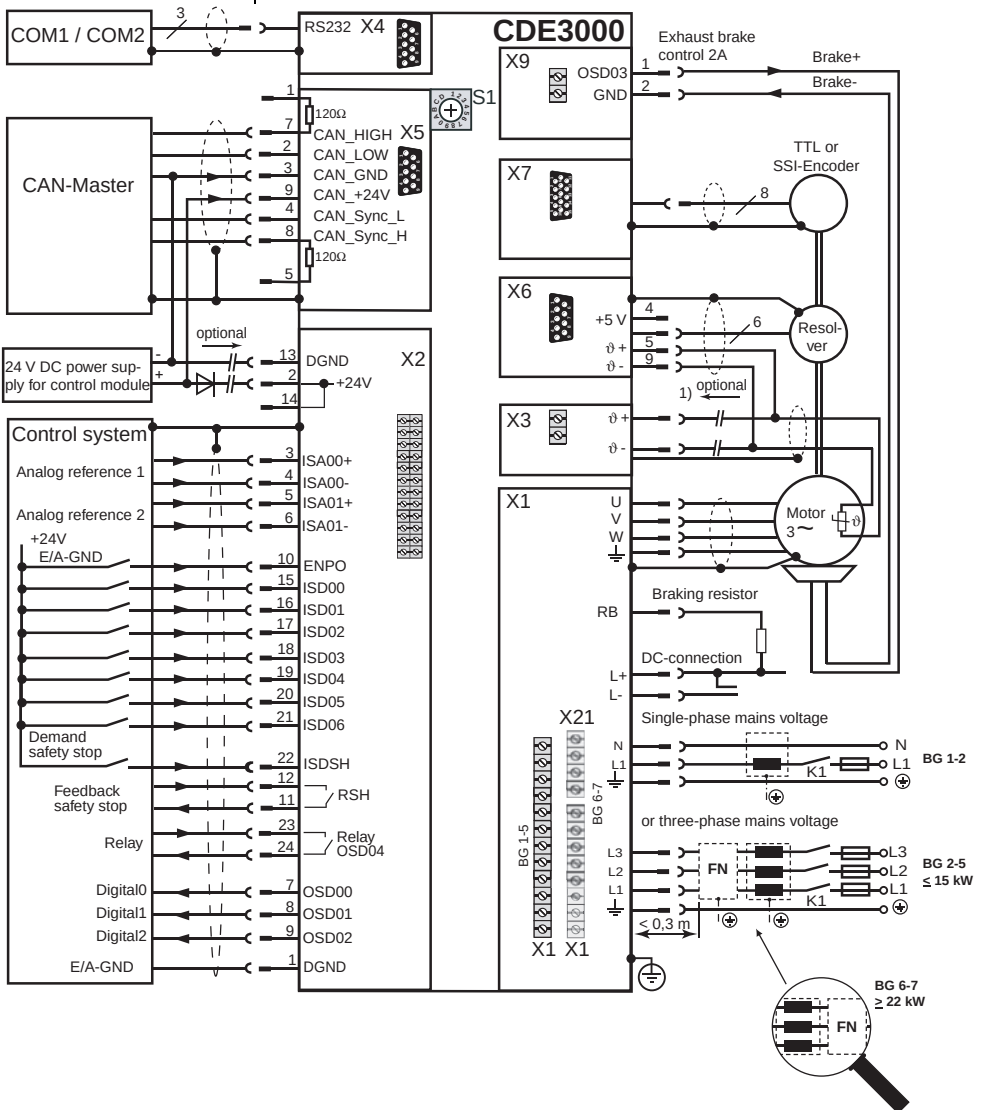
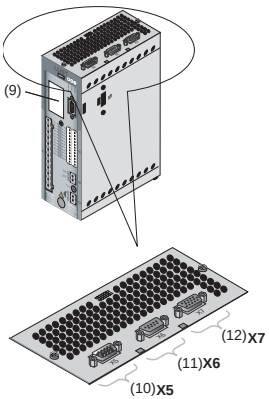


Fig. 3.1 Terminal diagram CDE3000

No.		Page	Designation	Function
H1, H2, H3			Light emitting diodes	Equipment status display
S1		3-55	Encoder switch	Setting the CAN-address
X1	BG1-5	3-19 a. 3-35	Power terminal	Mains, motor, DC supply (L+/L-) Braking resistor L+/RB,
	BG6-7	3-19	Mains connection	Mains
X21	BG 6-7	3-19 a. 3-35	Power terminal	Motor, DC supply (ZK+/ZK-) Braking resistor RB+/RB-
X2		3-24	Control terminal	„Safe Standstil“ with relay output 8 digital inputs, 2 analog inputs, 12 bit 2 digital outputs, 1 relay
X3[1)]		3-35	Motor temperature monitoring (when using the encoder interface X7)	PTC, following DIN 44082 linear temperature sensor KTY 84-130 or thermal circuit breaker Klixon
X4		3-54	RS232 port	for PC with DRIVEMANAGER or control unit KP200-XL
X5		3-55	CAN-interface	Access to integrated CAN-interface DSP402
X6		3-31	Resolver connection	with temperature monitoring
X7		3-31	TTL-/SSI encoder interface	TTL encoder SSI absolute value transducer, optionally: Sin-Cos transducer
X8			Optional board slot	Expansion board slot for e.g. optional module Profibus-DP
X9		3-27	Brake driver	2A

1) the PTC must only be connected to one of the two possible terminals X3 or X6.

Table 3.1 Legend to terminal diagram CDE3000



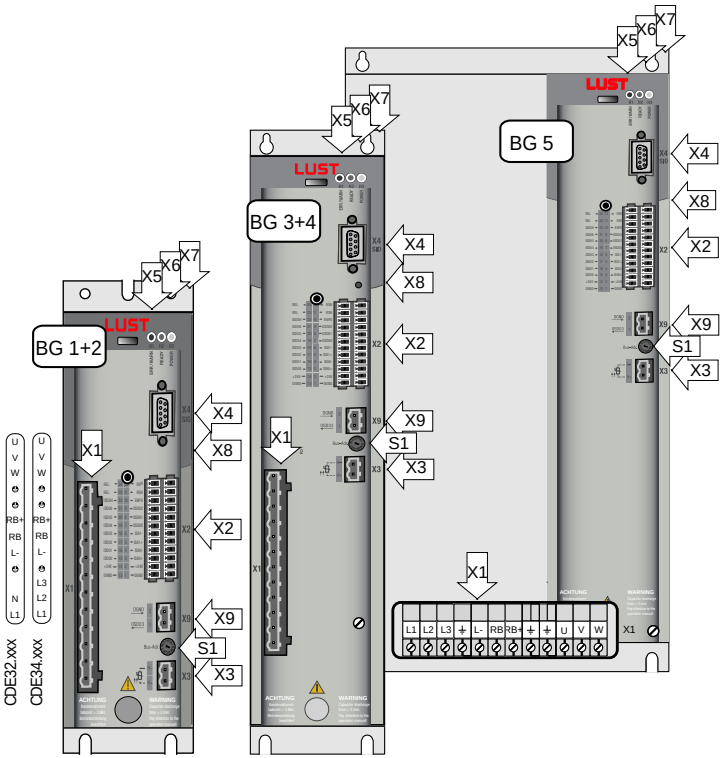


Fig. 3.2 Position plan of the CDE3000 BG1 to BG5

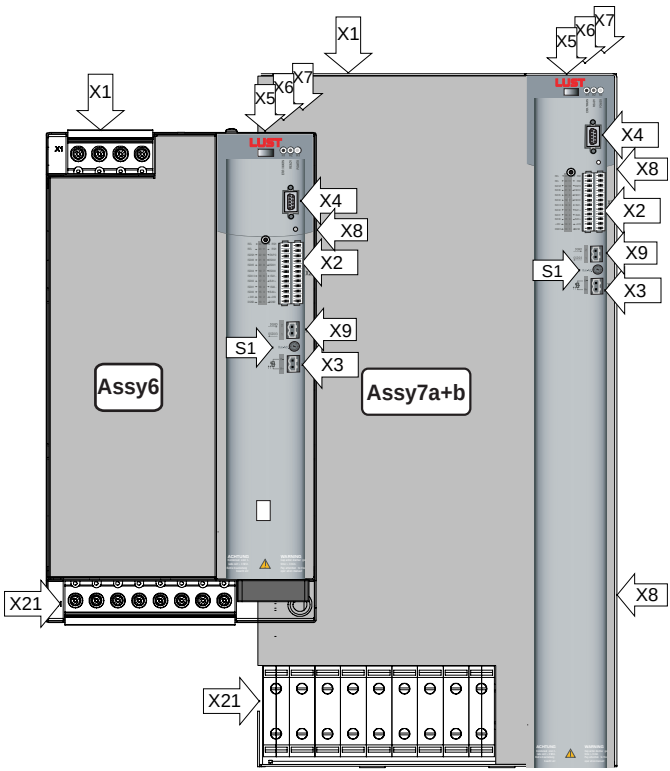


Fig. 3.3 Position plan of the CDE3000 BG6 and BG7a/b

3.2 Overview of connections CDB

Terminal diagram CDB3000

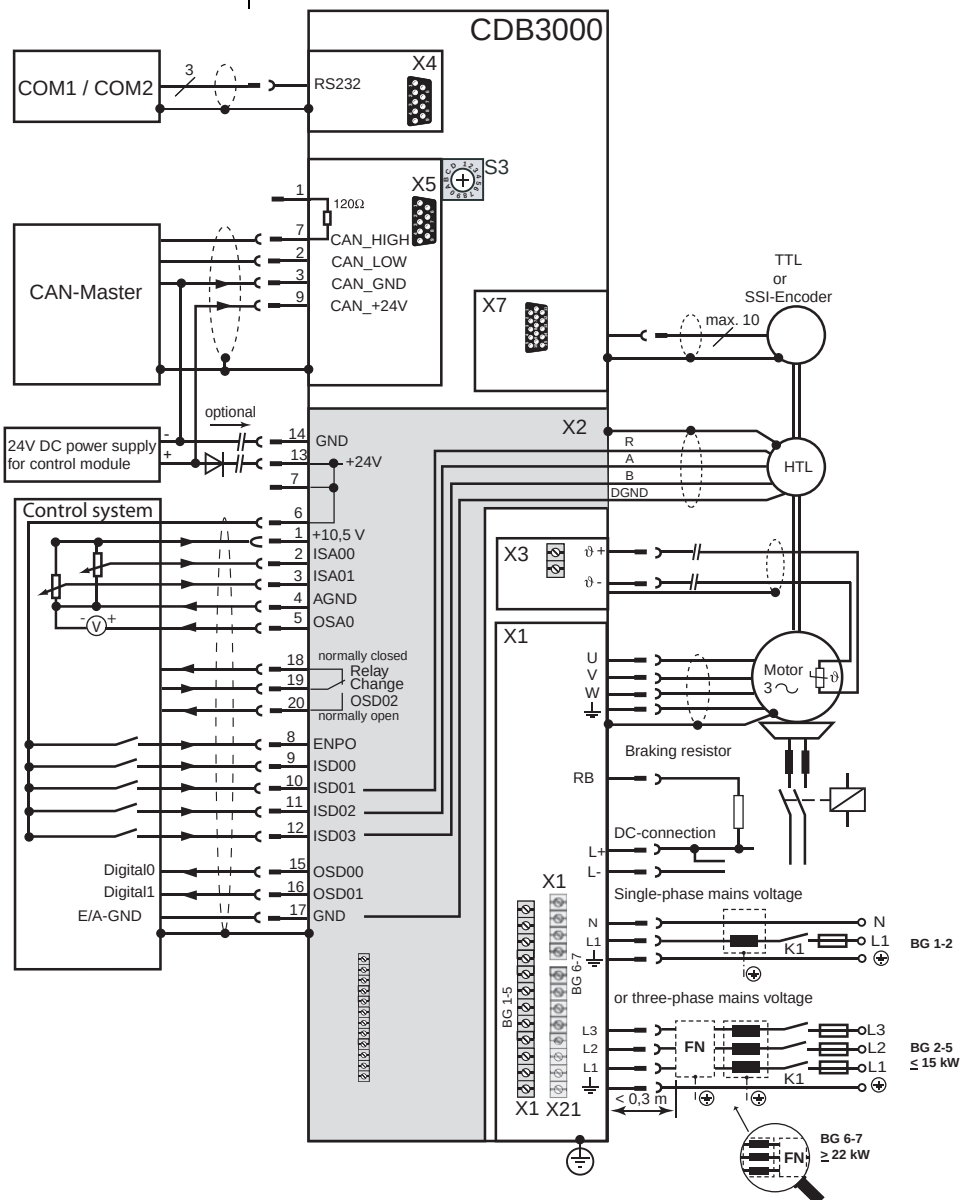
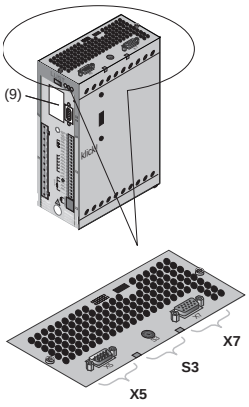


Fig. 3.4 Terminal diagram CDB3000

No.		Page	Designation	Function
H1, H2, H3			Light emitting diodes	Equipment status display
S3		3-55	Encoder switch	Setting the CAN-address
X1	BG1-5	3-19 a. 3-51	Power terminal	Mains, motor, DC supply (L+/L-) Braking resistor L+/RB
	BG6-7	3-19	Mains connection	Mains
X21	only BG 6-7	3-19 a. 3-51	Power terminal	Motor, DC supply (ZK+/ZK-) Braking resistor RB+/RB-
X2		3-38	Control terminal	5 digital inputs, 2 analog inputs, 10 bit 2 digital outputs, 1 relay, 1 analog output
X3		3-51	Motor temperature monitoring (when using the encoder interface X7)	PTC, following DIN 44082 linear temperature sensor KTY 84-130 or thermal circuit breaker Klixon or
X4		3-54	RS232 port	for PC with DRIVEMANAGER or control unit KP200-XL
X5		3-55	CAN-interface	Access to integrated CAN-interface DSP402
X7		3-46	TTL-/SSI encoder interface	TTL encoder SSI absolute value transducer
X8			Optional board slot	Expansion board slot for e.g. optional module PROFIBUS-DP

Table 3.2 Legend to terminal diagram CDB3000



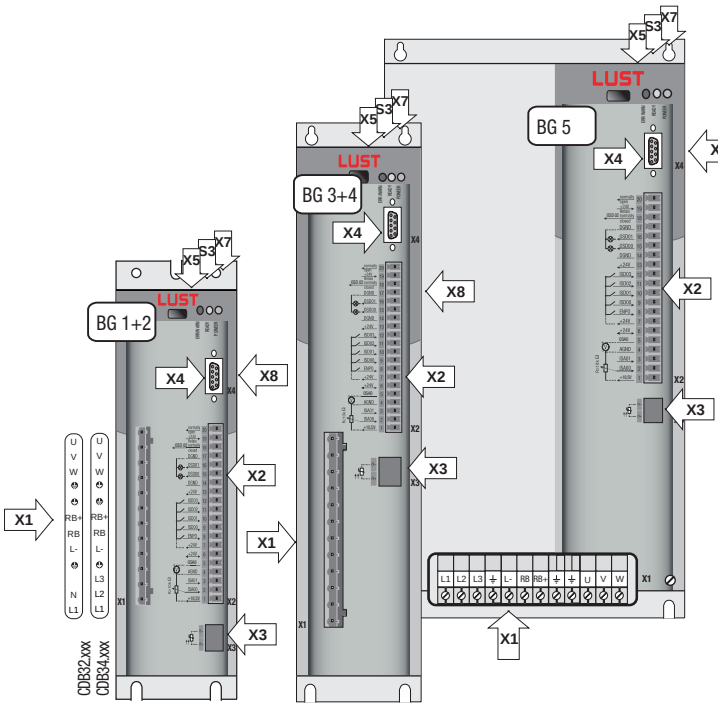


Fig. 3.5 Position plan of the CDB3000 BG1 to 5

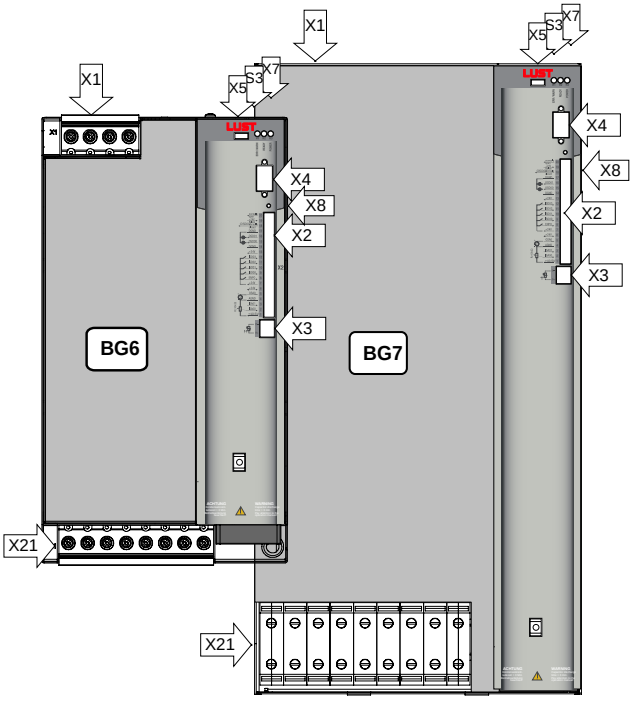


Fig. 3.6 Position plan of the CDB3000 BG6 and 7

3.3 EMC compliant installation CDE/ CDB

Position converters are components intended for installation into industrially and commercially used equipment and machines.

Commissioning (i. e. starting inteded operation) is only permitted when strictly complying with EMC-directive (89/336/EEC).

The installer/operator of a machine and/or equipment must provide evidence of the compliance with the protection targets stipulated in the EMC-directive.

Attention: Compliance with the required EMC-protection targets is normally achieved by observing the installation instructions in this manual and using the appropriate radio interference suppression filters.

Assignment of drive controller with internal line filter

All drive controllers CDE/CDB are fitted with a sheet steel housing with aluminium-zink surface to improve the interference immunity factor as specified in IEC61800-3, environment 1 and 2.

Drive controllers 0.37 kW to 7.5 kW and 22 kW to 37 kW are equipped with integrated line filters. With the measuring methods specified in the standard these drive controllers comply with the EMC product standard IEC61800-3 for "Environment 1" (living area) and "Environment 2" (industrial area).

– Public low voltage network (environment 1) living area: up to 10 m motor cable length, exact data can be found in appendix A.5.

Attention: This is a restricted availability product in accordance with IEC 61800-3. This product may cause radio interference in domestic environments; in such cases the operator may need to take appropriate countermeasures.

– Industrial low voltage network (environment 2) industrial area: up to 25 m motor cable length, exact data can be found in appendix A.5.

Assignment of drive controller with external line filter

An external radio interference suppression filter (EMCxxx) is available for all drive controllers. With this line filter the drive controllers comply with the EMC product standard IEC61800-3 for "Environment 1" (living area) and "Environment 2" (industrial area).

– Public low voltage network (environment 1) living area: up to 100 m motor cable length.

Attention: This is a restricted availability product in accordance with IEC 61800-3. This product may cause radio interference in domestic environments; in such cases the operator may need to take appropriate countermeasures.

– Industrial low voltage network (environment 2) industrial area: up to 150 m motor cable length.

Note: When using external line filters the status "general availability" can be reached too with shorter motor cable length. If this is of importance to you, please do not hesitate to contact our sales engineers or your projecting engineer.

Subject	Projecting and installation regulations
PE-terminal equipotential bonding	Use a bright backing plate. Use cables and/or ground straps with cross sections as large as possible. Route the PE-terminal connection for the components in a star-shaped fashion and ensure large area contact of earthing (PE) and shielding connecting on the PE-bar of the backing plate to establish a low-resistance HF-connection. PE-mains connection in accordance with DIN VDE 0100 part 540 • Mains connection < 10 mm² Protective conductor cross-section min. 10 mm² or use 2 conductors with a cross-section of the mains supply lines. • Mains connection > 10 mm²: Use a protective conductor cross-section in compliance with the cross-section of the mains supply lines.
Routing of cables	• Route the motor cable separated from signal and mains supply lines. The minimum distance between motor cable and signal line/mains line must be 20 cm, if necessary us separator. • Always route the motor cable without interruptions and the shortest way out of the control cabinet. • When using a motor contactor or a reactance control/motor filter, this should be directly mounted to the drive controller. Do not bare the core ends of the motor cable too soon. • Avoid unnecessary cable lengths.
Cable type	The drive controllers must always be wired with screened motor cables and signal lines. A cable type with double copper braiding with 60 -70% coverage must be used for all screened connections.
Further hints for the control cabinet design	• Contactors, relays, solenoid valves (switched inductivities) must be wired with fuses. The wiring must be directly connected to the respective coil. • The switched inductivities should be at least 20 cm away from the process sontrolled assemblies. • Place larger consumers near the supply. • If possible enter signal lines only from one side. • Lines of the same electric circuit must be twisted. Crosstalk is generally reduced by routing cables in close vicinity to earthed plates. Connect residual strands at both ends with the control cabinet ground (earth).
Supplementary information	Supplementary information can be found in the corresponding connection description

Table 3.3 Projecting and installation regulations

3.4 PE-terminal CDE/CDB

Step	Action	Note: PE-mains connection in accordance with DIN VDE 0100 part 540
1	Earth each of the positioning controllers! Connect terminal X1/⏚ **in star configuration** with the PE-rail (main earth) in the switch cabinet.	***Mains connection<10 mm²:*** Protective conductor cross-section min. 10 mm² *or* use 2 conductors with a cross-section of the mains supply lines.
2	Also connect the protective conductor terminals of all other components, such as line reactor, filter, etc. **in a start-shaped way** to the PE-bar (main earth) in the control cabinet.	**Mains connection>10 mm²:** Use a protective conductor cross-section in compliance with the cross-section of the mains supply lines.

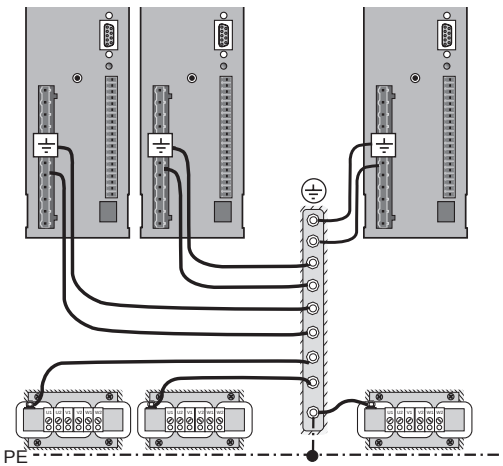


Fig. 3.7 Star configuration layout of the earthing lead

Please note:

- The earthing lead must be laid out in star configuration to conform to the EMC standards.
- The backing plate must be well earthed.
- The motor cable, mains lead and control cable must be laid out separately from each other.
- Avoid loops, and lay cable over short distances.
- The operational leakage current is > 3.5 mA.

3.5 Electrical isolation concept CDE/ CDB

The control electronics with its logics, inputs and outputs is galvanically separated from the d.c. link direct voltage by means of a two-stage power supply unit.

1. The first stage SNT1 converts the d.c. link direct voltage to a 24V voltage. This, on the one hand supplies the seondary side or the input or output side of the digital inputs and outputs. In order to increase the permissible current load it can be externally protected. This is generally required, if the 24V is loaded with a current higher than 100 mA (e.g. in case of CDE3000 by connected motor holding brake on OSD03).
2. On the other hand, this 24V voltage feeds into a second power supply unit SNT2, in which the voltages for micro-controller, encoder interfaces, primary side of the CANopen interface and the analoge inputs are generated on basis of the same potential. The analog ground serves as reference potential for the specification of the analog setpoint.

The digital inputs and outputs supplied with voltage under 1.) are thus electrically isolated from 2.). Disturbances are thereby kept away from processor and analog signal processing.

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

Expansion modules, such as I/O-terminal expansion UM-8I4O or the Profibus-DP-Module CM-DPV1 are also electrically isolated from the basic unit. The interface to the application of the module must be externally supplied through a 24V terminal on the expansion module.

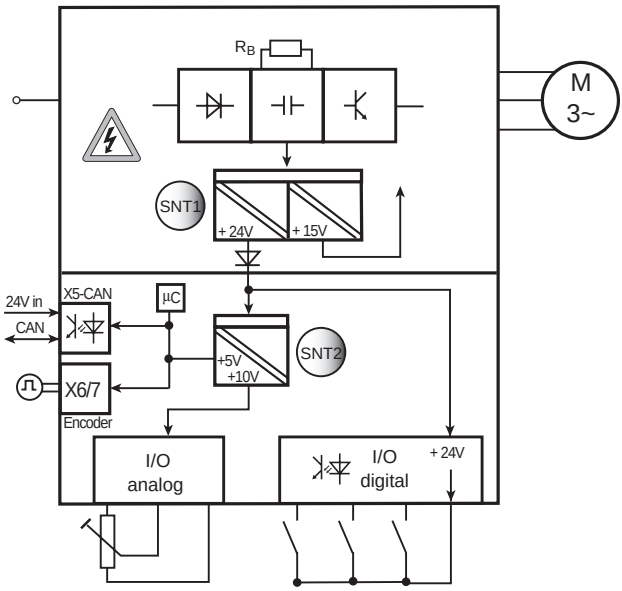


Fig. 3.8 Electrical isolation concept/voltage supply on DE3000/CDB3000

When choosing the lines please bear in mind that the lines for analog inputs and outputs must in any case be screened. On pair screened cables the conductor and strand screens should be put on as generously as possible, under EMC aspects. High frequency disturbance voltages are thus reliably discharged (Skin effect). An EMC-compatible wiring is mandatory and must be strictly assured.

Special case: Utilizing the analog inputs as digital inputs

Note: The analog inputs must either be both used only with analog or both with digital function. Mixing the analog inputs with one input with analog function and another input with digital function is not permitted.

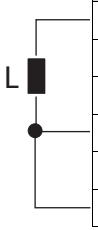
The use of the equipment internal 24 V DC as supply voltage while utilizing an analog input with the function "digital input" requires the connection of analog and digital ground. This can cause disturbances, as described above, and requires extreme care when selecting and connecting the control lines.

Safe operation is affected by the connection of analog and digital grounds. As a measure to minimize the parasitic currents affecting the ground connection, both the analog (AGND) and the digital ground (DGND) must be connected via a VHF-choke (820 µH, 0.5 A, e. g. EPCOS B82500-C-A5, wired).

The bridge is only necessary when using the internal 24 V voltage.

X2	Function
1	Reference voltage 10V, 10mA
2	ISA00, as digital input
3	ISA01, as digital input
4	analog 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

Fig. 3.9 Disabling the electrical isolation when using the analog inputs with digital function on the CDB3000



X2	Function
1	digital ground DGND
2	Auxiliary voltage U_V = 24 V DC
3	Analog input ISA0+
4	Analog input ISA0-
5	Analog input ISA1+
6	Analog input ISA1-

Fig. 3.10 Disabling the electrical isolation when using the analog inputs with digital function on the CDE3000

Attention: The ground connection or introduction into the unit must not use the analog ground terminal 4 on CDB3000 (terminals 4, 6 on the CDE3000). Thze connection must only be made via the DGND -terminals (see Fig. 3.11).

Example: Risk of disturbing influence

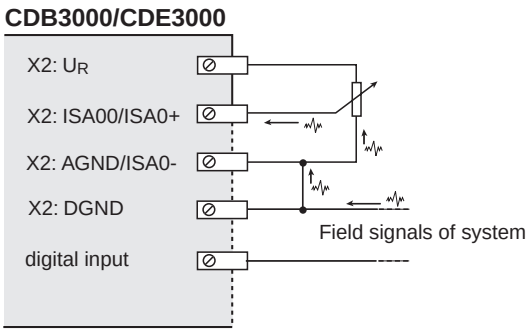


Fig. 3.11 Disturbing influence on the analog input in case of inappropriate wiring

Note: If the number of digital inputs and outputs on the positioning controllers is not high enough, we recommend the use of a terminal expansion module UM-8I4O with 8 digital inputs and 4 digital outputs.

3.6 Mains connection CDE/ CDB

Step	Action	Comment
1	Determine the **wire cross-section**, depending on maximum current and ambient temperature.	Wire cross-section according to VDE0100, part 523
2	Wire the drive controller with the **line filter**, max. 0.3 m between filter housing and drive!	Step not applicable for BG1 to BG4, up to 7.5 kW the line filter is already integrated.
3	Wire the **power choke** see appendix A.5 With Size 6-7 max. 0.3 m between choke housing and drive!	Reduces the voltage distortions (THD) in the net and prolongs the lifetime.
4	Install a K1 circuit breaker (power switch, contactor, etc.).	**Do not connect the power!**
5	Use the mains fuses (type gL) or miniature circuit-breakers (trip characteristic C) to cut the mains power to all poles of the drive controller.	To protect the line in accordance with VDE636, part 1

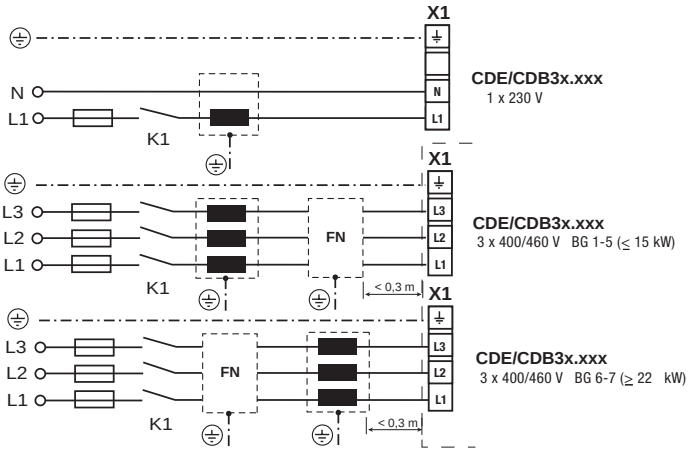


Fig. 3.12 Mains connection

Attention: Due to the precharging technology used in sizes 6 and 7 (≥ 22 kW) one must make sure that the power choke is installed between drive controller and line filter, as otherwise the line filter may get damaged.

Attention: Risk of fatal injury! Never wire or disconnect electrical connections while these are live. Always disconnect the power before working on the device. Wait until the d.c.link voltage on terminals X1/L+ and L- (BG 1-5) or X21/ ZK+, ZK- (BG 6-7) has dropped to the safety-low voltage before starting work on the equipment (approx. 10 minutes).

ATTENTION:

- Only all-current sensitive residual current circuit breakers suitable for positioning controller operation may be used.
  Residual current compatibility: In case of a fault the drive controller is able to generate d.c. residual currents without zero crossing. The drive controllers must therefore only be operated on all-current sensitive RCM (residual current operated protective device), see DIN VDE 0160 and DIN VDE 0664.
- Switching the mains power: Cyclic power switching is permitted every 60 seconds; jog mode with mains contactor is not permitted.
  - In case of too frequent switching the units protects itself by high-resistance isolation from the system.
  - After a rest phase of a few minutes the device is ready to start once again.
- TN network and TT network: permitted without restriction.
- IT network (insulated centre point): not permitted!
  - In the event of a earthing fault the voltage stress is around twice as high, and creepages and clearances in accordance with EN50178 are no longer maintained.
- Connection of the positioning converter via power choke with an impedance voltage of U_K = 4% of the rated voltage is mandatory:
  - where the positioning converter is used in applications with disturbance variables corresponding to environment class 3, as per EN 61000-2-4 and above (hostile industrial environment).
  - for compliance with EN61800-3 or IEC 1800-3, see appendix A5.
  - with a d.c. link between multiple positioning controllers.
- For further information on permissible current loads, technical data and environmental conditions please refer to the appendix A.1 to A.3 .

Using the power choke, see appendix A.5

Environment class 3 acc. to EN61000-2-4

Among others, environment class 3 is characterized by:

- Mains voltage fluctuations > ± 10% U_N
- Short-term interruptions between 10 ms to 60 s
- Voltage unbalance between the phases > 3%

Environment class 3 typically applies where:

- a major part of the load is supplied by power converters (dc choppers or soft-start equipment),
- welding machines are present,
- induction or arc furnaces are present,
- large motors are frequently started,
- electric loads fluctuate rapidly.

Drive controller	Device connected load with power choke (4 % UK) [kVA]	Without power choke [kVA]	max. possible cable cross-section for terminals [mm²][1)]	recommended mains fuse (gL) [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/CDB32.006	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		3 x 16
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	10	3 x 35
CDE/CDB34.032	22,2	30,0		3 x 50
CDE/CDB34.044	31	41,2	35	3 x 50
CDE/CDB34.058	42	54,3		3 x 63
CDE/CDB34.070	50	65,5		3 x 80
CDE/CDB34.088	62	82,3	50	3 x 100
CDE/CDB34.108	76	101,0		3 x 100
CDE/CDB34.140	99	131,0	95	3 x 125
CDE/CDB34.168	118	157,2		3 x 160

[1)] The minimum cross-section of the power supply cable depends on the local regulations (VDE 0100 part 523, VDE 0298 part 4), the ambient temperature and the required nominal current for the inverter.

Table 3.4 Wire cross-sections and mains fuses (observe VDE100 and VDE0298)

3.7 CDE3000

3.7.1 Control connections CDE

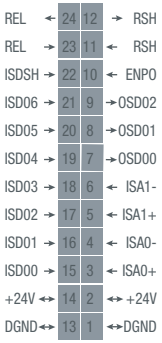
Step	Action	Comment
1	Please check whether you already have a **SmartCard** or a **DriveManager dataset** with a complete device setup available, i.e. the drive has already been planned as required.	
2	If this is the case, a special control terminal assignment applies. Please contact your project engineer to obtain the terminal assignment.	**Bulk customers** For details of how to load the data set into the positioning controller refer to section 4.2.
3	Choose a terminal assignment.	**Initial commissioning** There are various pre-set solutions available to make it easier to commission the device.
4	Wire the control terminals with shielded cables. The following is strictly required: "Safe Standstill" X2.22 ENPO X2.10 and a start signal (with control via terminal).	Earth the cable shields over a wide area at both ends. Wire cross-section maximum 1.5 mm² or two strands with 0.5 mm² per terminal
5	Keep all contacts open (inputs inactive).	
6	Check all connections once again!	Continue with commissioning in section 4.

Please note:

- Always wire the control terminals with shielded cables.
- Lay the control cables separately from the mains lead and motor cable.
- The CDE/CDB3000 Application Manual presents more preset drive solutions.
- A cable type with double copper braiding with 60 - 70% coverage must be used for all screened connections.

Specification of control connections CDE

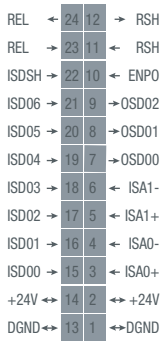
X2



Des.	Terminal	Specification	Electrical isolation
Analogue inputs			
ISA0+ ISA0- ISA1+ ISA1-	X2-3 X2-4 X2-5 X2-6	• U_{IN} = ±10 V DC; • Resolution 12 bit; R_{IN}=110kΩ • Terminal scan cycle = 1ms • Tolerance:U: ±1% of the measuring range end value.	no
Digital inputs			
ISD00 ISD01 ISD02 ISD03 ISD04 ISD05	X2-15 X2-16 X2-17 X2-18 X2-19 X2-20	• Frequency range < 500Hz • Terminal scan cycle = 1ms • 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 < 500Hz • Switching level low/high: <4,8 V / >18 V • I_{max} at 24 V = 10 mA • R_{IN} = 3 kΩ • internal signal delay time < 2µs suitable as trigger input for quick saving of the actual position	yes
ENPO	X2-10	• Power stage enable = High-Level • Frequency range < 500Hz • Reaction time approx. 10ms • 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 = 1ms • High-side driver	yes

Table 3.5 Specification of control connections CDE3000

X2



Des.	Terminal	Specification	Electrical isolation
"Safe Standstill" Further information can be found in chapter 3.13 "Safe Standstill".			
ISDSH	X2-22	• Input "Safe Standstill" • Frequency range < 500 Hz • Terminal scanning 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 „Safe Standstill“ function, a normally open relay with self-resetting lock (Polyswitch) X2:12 / X2:11 • 25 V / 200 mA AC, cos φ =1 • 30 V / 200 mA AC, cos φ =1	yes
Relay outputs			
REL REL	X2-23 X2-24	• Relay, 1 normally open • 25V / 1A AC, utilization category AC1 • 30V / 1A DC, utilization category DC1 • Operating delay approx. 10 ms • Cycle time 1 ms	yes

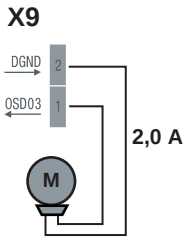
Table 3.5 Specification of control connections CDE3000

Des.	Terminal	Specification	Electrical isolation
Voltage supply			
+24V	X2-2 X2-14	• Auxiliary voltage U_V = 24 V DC ± 25%, short-circuit proof • I_{max} = 100 mA (overall, also includes driver currents for outputs OSD00 and OSD01, OSD02 and OSD03) • external 24 V - feed for supply of the control electronics in case of a mains failure possible, current consumption Imax = 1000 mA + holding brake current Tolerance of feed ± 20% ATTENTION: Depending on the type of power supply unit a decoupling diode to protect the mains unit may be required as a protective measure, because the 24 V of the CDE/CDB and the 24 V mains unit may feed back, depending on the tolerances.	yes
Digital ground			
DGND	X2-1 X2-13	Reference ground for 24 V	yes
1) applicable to limited degree			

Table 3.5 Specification of control connections CDE3000

Brake driver X9

The plug X9 is intended for connection of a motor brake.



Brake driver X9			Electrical isolation
OSD03 DGND	X9-1 X9-2	Short-circuit proof Cable breakage monitioring • 24 V external voltage supply required (I_{IN} = 2.1 A) • Suitable for controlling a motor holding brake • I_{max} = 2.0 A to ϑ_{Umax} <45 °C Reduced from I_{max} (with external 24 V supply) • Overcurrent causes shut down • Can also be used as configurable digital output without external voltage supply. Without external voltage supply I_{max} = 50 mA	yes

Table 3.6 Specification of terminal connections X9

Standard terminal assignment CDE

Terminal assignment **factory setting**

Pre-set solution speed control ±10 V nominal value, control via terminal

Features

- Scaleable analog reference (±10V, 12 bit)
- Programmable, time-optimised acceleration profile

Parameters

152-ASTER = SCT_1

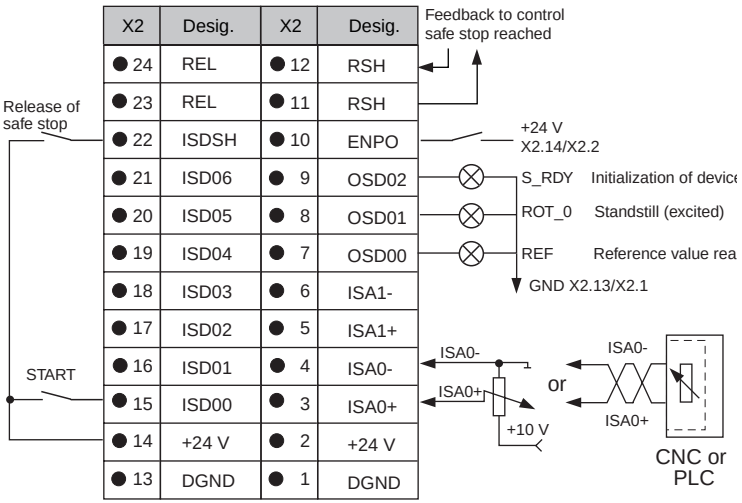


Fig. 3.13 Control terminals, traction drive without encoder evaluation

3.7.2 Encoder connection CDE

Encoder connection for Lust motors

Please use the prefabricated motor and sensor line to connect the synchronous motors from Lust.

Assignment motor - encoder cable - servo regulator connection

Compare the type plates on the components. Make absolutely sure to use the correct components according to a variant A or B!

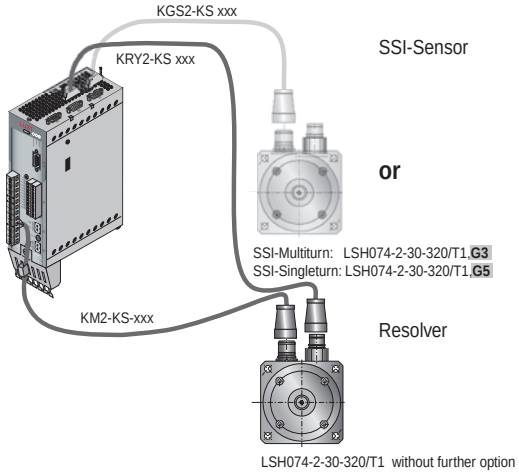


Fig. 3.14 Assignment motor/encoder cable

Type	Motor (with encoder installed)	Encoder cable	Connection of the servo controller
⇨ A	with resolver R,3R xxx - xx - xxRxx	KRY2-KSxxx	X6
⇨ B	with SSi absolute value transducer G2, G3 or G5) xxx - xx - xxG3x or - xxG5x	KGS2-KSxxx	X7
⇨ C	with absolute transducer HIPERFACE® G6, G6M, G7 xxx - xx - xxG6x	KGH2-KSxxx	X7
⇨ D	with TTL-encoder G8 xxx - xx - xxG8x	-	X5

Do not separate the encoder cable, for example to route the signals via terminals in the switch cabinet. The knurled screws on the D-Sub plug housing are tightly locked!

Note: With simultaneous connection of a resolver to X6 and an encoder to X7 the unit requires a 24V/ 1 A power supply (X2). Prefabricated encoder cables

The specifications can only be assured when using the Lust system cables.

K	RY2	-	KS	005
Encoder cable				
Prefabricated cable				
Resolver cable Encoder cable SSI (G3, G5)	RY2 GS2			
Encoder system				
Chain trailing capability			KS	
Design				
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				

Ordering key

Technical data:

		KRY2-KSxxx / KGS2-KSxxx
Controller type		**CDE/CDB3000**
Chain trailing capability		yes
Minimum bending radius:	for stationary routing	-
	for flexible applications	90 mm
Temperature range:	for stationary routing	-40 ... +85 °C
	for flexible applications	
Cable diameter approx.		8.8 mm
Material of oversheath		PUR
Resistance		against oil, hydrolysis and microbial activity (VDE0472)
Certifications		UL-Style 20233, 80 °C - 300 V, CSA-C22.2N.210 -M90, 75 °C - 300 V FT1

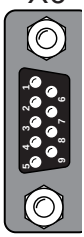
Table 3.7 Technical data

Encoder connection other motors on CDE3000

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

Resolver

X6



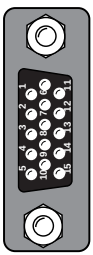
Pin	Function
Pin	Function
1	Sin+ / (S2)(track A)
2	Refsin / (S4)(track A)
3	Cos+ / (S1)(track B)
4	+ 5 V (opposite pin 7)
5*	ϑ + (PTC, KTY, Klixon)
6	Ref+ (index signal)
7	Ref- (index signal)
8	Refcos / (S3) (track B)
9*	ϑ - (PTC, KTY, Klixon)

* The motor PTC must be sufficiently insulated against the motor winding (safe separation 4 KV withstand voltage). When using Lust motors this insulation is assured.

Table 3.8 Pin assignment X6

SSI / TTL

X7



Encoder interface X7 is suitable for connection of an encoder with an

- incremental TTL-interface
  or
- SSI-interface

.

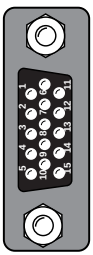
Note:

- Encoder voltage supply
  - Voltage supply on encoder: + 5 V +/-5%, max. power consumption 150 mA (including load)
  - The encoders must have a separate sensor line terminal. The sensor lines are required to measure a supply voltage driop in the encoder line. Only the use of the sensor lines assures that the encoder is supplied with the correct voltage.
    The sensor lines must always be connected!
- Incremental encoder with RS422 compatible track signals (TTL-compatible)
  - 32-8192 pulses/revolution
- SSI-Multiturn encoder acc. to the reference list with general specifications:
  - Line protocol "SSI", gray coded
  - 25 bit-Multiturn (12/13 bit Multi-/Singleturn information, MSB first)

The electrical specification of the interface is given in the Table 3.10, the terminal assignment in the 3.7.4.

X7

SSI / TTL



	TTL encoder	SSI encoder
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: no connection necessary
Max. signal frequency f_{Grenz}	500 kHz	
Voltage supply	+ 5 V ±5% (controlled via sensor lines) max. 150 mA not isolated from the control electronics	
Sampling rate of the controls	4 kHz	4 kHz
Interface log	-	SSI (Graycode)
Lines per revolution / resolution	32-8192	13 bit (single turn) 25 bit (multi turn)
Max. cable length	50 m (further cable specifications as specified by motor manufacturer)	

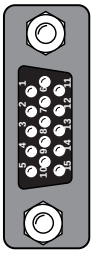
Table 3.9 Specification of encoder interface X7

Select the cable type specified by the motor or encoder manufacturer. Thereby please observe the following boundary conditions:

- Always used shielded cables. The shielding must be placed on both sides of the cable.
- Connect the differential track signals A, B, R or CLK, DATA to each other via twisted wires.
- Do not separate the encoder cable, for example to route the signals via terminals in the switch cabinet.

X7

SSI / TTL



X7-Pin	Function TTL	Function SSI
1	A-, (track A) 1)	don't use
2	A+, (track A)	don't use
3	+ 5 V (150 mA)	
4	don't use	Data + differential input RS485
5	don't use	Data - differential input RS485
6	B-, (track B) 1)	don't use
7	don't use	don't use
8	GND (for 5 V on Pin 3)	
9	R- (index signal) 1)	don't use
10	R+ (index signal)	don't use
11	B+, analog differential input track B 1)	don't use
12	Sensor + sensor line to measure the 5 V supply on the encoder	
13	Sensor - sensor line to measure the 5 V supply on the encoder	
14	don't use	CLK + differential output cycle signal
15	don't use	CLK - differential output cycle signal
1) The lines of tracks A, B, R and Data are internally terminated with 120 Ω		

Table 3.10 Pin assignment of encoder interface X7

3.7.3 Motor connection for Lust motors

Please use the prefabricated motor cable KM2-KS-005 to connect Lust servo motors of series LSH and LST.

Prefabricated motor cables

Motor cable KM2-KS-005

	KM 2	-	KS	005
Motor cable				
Prefabricated cable				
Chain trailing capability			KS	
Design				
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				

Ordering key

Technical data:

		KM2-KSxxx
Motor type		Motors up a rated current of 16 A with pluggable power terminal
Minimum bending radius:	for stationary routing	60 mm
	for flexible applications	120 mm
Temperature range:	for stationary routing	-50 ... +90 °C
	for flexible applications	-50 ... +90 °C
Cable diameter approx.		∅ 12 mm
Material of oversheath		PUR
Wiring		U = 1 V = 2 W = 3 Earth = ge/gn PTC = 5 PTC = 6 Brake + = 7 Brake - = 8

Table 3.11 Technical data

Note: Strands 5 and 6 (PTC) are only required for motors with optical sensors (G3, G5, G6, G6M). On the LSH-motors with resolver PTC-monitoring is accomplished through the resolver line.

3.7.4 Motor connection from third party manufacturers

Step	Action	Comment
1	Determine the **wire cross-section**, depending on maximum current and ambient temperature.	Wire cross-section according to VDE0100, part 523, see chapter 3.6.
2	Wire the **motor phases** U, V, W via a shielded cable and earth the motor to X1/ ⏚ or X21.	Mount screen at both ends to reduce interference emission.
3	Wire the temperature sensor (PTC, KTY, Klixon) (if present) to X3 with separately shielded cables and activate the temprature evaluation via the DRIVEMANAGER.	Mount screen at both ends to reduce interference emission.

Attention: It must be assured that the temperature monitor used is sufficiently insulated towards the motor winding (2 kV withstand voltage)).

During operation the CDE3000 positioning controller is protected against shorting and earth faults at the terminals. In the event of a short-circuit or earth fault in the motor cable, the power stage is disabled and an error message is delivered.

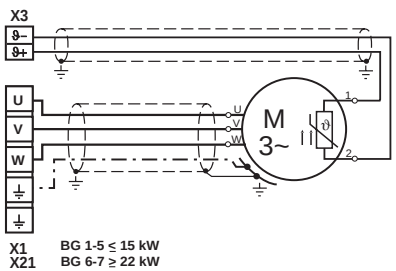


Fig. 3.15 Connection of motor

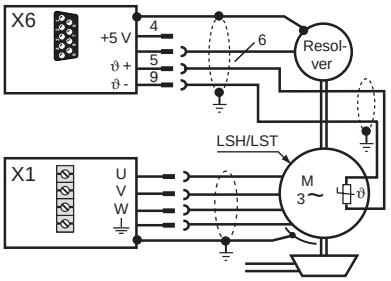
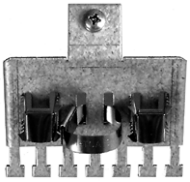


Fig. 3.16 Connection of PTC to LSH/LST-motors

Please note:

- Establish shield contact via shield connection STxx. From power class 75 kW the shield connection must be made directly underneath the converter on the backing plate.
- For proper EMC installation the motor terminal box must be HF-tight (metal or metallised plastic). For cable introduction, packing glands with large-area screen contact should be used.
- Further information on permissible current load, technical data and environmental conditions can be found in appendices A1 to A3.



STxx

This mask (Fig. 3.17) can be used to set the appropriate motor temperature sensor (PTC) or the temperature dependent switch and a I²xt-monitoring as a measure to protect the motor.

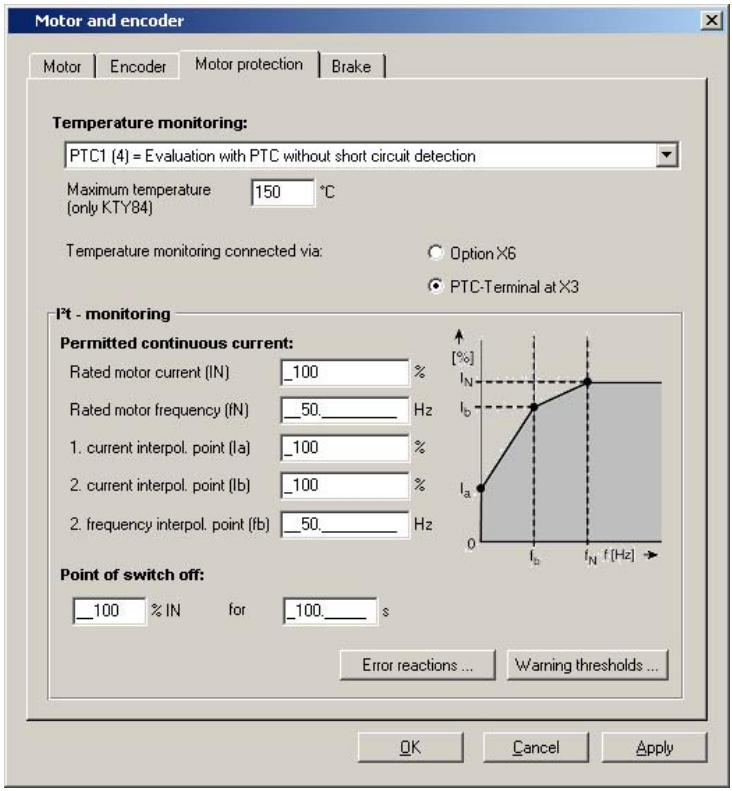


Fig. 3.17 Register motor protection

3.8 CDB3000

3.8.1 Control connections CDB

Step	Action	Comment
1	Please check whether you already have a **SMARTCARD** or a **DRIVEMANAGER dataset** with a complete device setup available, i.e. the drive has already been planned as required.	
2	If this is the case, a special control terminal assignment applies. Please contact your project engineer to obtain the terminal assignment.	**Bulk customers** For details of how to load the data set into the positioning controller refer to section 4.2.
3	Choose a terminal assignment.	**Initial commissioning** There are various pre-set solutions available to make it easier to commission the device.
4	Wire the control terminals with shielded cables. The only essential signals are the ENPO signals and a start signal (with control via terminal).	Earth the cable shields over a wide area at both ends. Wire cross-section maximum 1.5 mm² or two strands with 0.5 mm² per terminal
5	Keep all contacts open (inputs inactive).	
6	Check all connections once again!	Continue with commissioning in section 4.

Please note:

- Always wire the control terminals with shielded cables.
- Lay the control cables separately from the mains lead and motor cable.
- The CDE/CDB3000 Application Manual presents more preset drive solutions.
- A cable type with double copper braiding with 60 - 70% coverage must be used for all screened connections.

X2	Des.
20	OSD02 normally open
19	OSD02 +24 V Relay
18	OSD02 normally closed
17	DGND
16	OSD01
15	OSD00
14	DGND
13	+24 V
12	ISD03
11	ISD02
10	ISD01
9	ISD00
8	ENPO
7	+24 V
6	+24 V
5	OSA0
4	AGND
3	ISA01
2	ISA00
1	+10.5 V

Specification of control connections CDB

Des.	Terminal	Specification	potential-free
Analogue inputs			
ISA00	X2-2	• U_{IN} = +10 V DC, ±10 V DC I_{IN} = (0) 4-20 mA DC, software-switchable to: • 24V digital input, PLC-compatible • Switching level low/high: <4.8 V / >8 V DC • Resolution 10 Bit • R_{IN}=110kΩ • Terminal scan cycle = 1ms • Tolerance:U: ±1% of the measuring range end value. I: ±1% p. M.	against digital GND
ISA01	X2-3	• U_{IN} = +10 V DC, software-switchable to: • 24V digital input, PLC-compatible • Switching level low/high: <4.8 V / >8 V DC • Resolution 10 Bit • R_{IN}=110 kΩ • Terminal scan cycle = 1ms • Tolerance:U: ±1% of the measuring range end value.	against digital GND
Analog output			
OSA00	X2-5	• PWM with carrier frequency 1 kHz • Resolution 10 bit • R_{OUT}=100 Ω • U_{out}=+10 V DC • I_{max}=5 mA • short-circuit proof • Tolerance ±2.5%	
Note: In the range > 5 V / < 18 V the performance of the inputs is undefined.			

Table 3.12 Specification of control connections CDB3000

X2	Des.
20	OSD02 normally open
19	OSD02 +24 V Relay
18	OSD02 normally closed
17	DGND
16	OSD01
15	OSD00
14	DGND
13	+24 V
12	ISD03
11	ISD02
10	ISD01
9	ISD00
8	ENPO
7	+24 V
6	+24 V
5	OSA0
4	AGND
3	ISA01
2	ISA00
1	+10.5 V

Des.	Terminal	Specification	potential-free
Digital inputs * For special version CDB3000;SH chapter 3.13 "Safe Standstill" has to be considered.			
ISD00*	X2-9	• Limit 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 time ≈ 100µs • Terminal scan cycle = 1ms	✔
ISD01	X2-10	• Limit 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 time ≈ 2µs • Terminal scan cycle = 1ms • R-input (index signal) 24 V - HTL-sensor against DGND	✔
ISD02	X2-11	• Limit 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 time ≈ 2µs • Terminal scan cycle = 1ms • A-input with square encoder evaluation for 24V-HTL-encoder against DGND permissible pulse numbers 32...8192 pulses/rev. see chapter	✔
Note: In the range > 5 V / < 18 V the performance of the inputs is undefined.			

Table 3.12 Specification of control connections CDB3000

X2	Des.
20	OSD02 normally open
19	OSD02 +24 V Relay
18	OSD02 normally closed
17	DGND
16	OSD01
15	OSD00
14	DGND
13	+24 V
12	ISD03
11	ISD02
10	ISD01
9	ISD00
8	ENPO
7	+24 V
6	+24 V
5	OSA0
4	AGND
3	ISA01
2	ISA00
1	+10.5 V

Des.	Terminal	Specification	potential-free
ISD03	X2-12	• Limit 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 time ≈ 2µs • Terminal scan cycle = 1ms • B-input with square encoder evaluation for 24V-HTL-encoder against DGND permissible pulse numbers 32...8192 pulses/rev. see chapter	✔
ENPO	X2-8	• Power stage enable = High-Level • Switching level low/high: <5 V / >18 V DC • I_{max} at 24 V = 10 mA • R_{IN} = 3 kΩ • internal signal delay time ≈ 20µs CDB-SH: 10 ms • Terminal scan cycle = 1ms • PLC-compatible	✔
Digital outputs			
OSD00	X2-15	• short-circuit proof • PLC-compatible • I_{max} = 50 mA • internal signal delay time ≈ 250µs • Terminal scan cycle = 1ms • Protection against inductive load • High-side driver	✔
Note: In the range > 5 V / < 18 V the performance of the inputs is undefined.			

Table 3.12 Specification of control connections CDB3000

X2	Des.
20	OSD02 normally open
19	OSD02 +24 V Relay
18	OSD02 normally closed
17	DGND
16	OSD01
15	OSD00
14	DGND
13	+24 V
12	ISD03
11	ISD02
10	ISD01
9	ISD00
8	ENPO
7	+24 V
6	+24 V
5	OSA0
4	AGND
3	ISA01
2	ISA00
1	+10.5 V

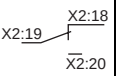
Des.	Terminal	Specification		potential-free
OSD01	X2-16	• short-circuit proof • PLC-compatible • I_{max} 50mA • internal signal delay time ≈ 2µs • Terminal scan cycle = 1ms • No internal freewheeling diode; provide external protection • High-side driver		
[1] applicable to limited degree				
Relay output * For special version CDB3000;SH chapter 3.13 "Safe Standstill" has to be considered.				
OSD02	X2-18 X2-19 X2-20	• Relay, 1 two-way contact • 25 V / 1 A AC, utilization category AC1, cos φ: =1 • 30 V / 1 A DC, utilization category DC1, cos φ: =1 • Operating delay approx. 10 ms • CDB-SH: 0,2 A with Polyswitch		✔
Voltage supply				
+10.5V	X2-1	• Auxiliary supply U_R =10.5 V DC • short-circuit proof • I_{max_in} = 10 mA		–
Note: In the range > 5 V / < 18 V the performance of the inputs is undefined.				

Table 3.12 Specification of control connections CDB3000

Des.	Terminal	Specification	potential-free
+24V	X2-6 X2-7 X2-13	• Auxiliary voltage U_V = 24 V DC ± 25%, short-circuit proof • I_{max} = 100 mA (overall, also includes driver currents for outputs OSD00 and OSD01) • If no encoder is connected to X7, I_{max} = 200 mA (overall, also includes driver currents for outputs OSD00 and OSD01) applies • external 24 V - feed for supply of the control electronics in case of a mains failure possible, current consumption Imax = 900 mA Tolerance of supply voltage ± 20% ATTENTION: Depending on the type of power supply unit a decoupling diode to protect the mains unit may be required as a protective measure, because the 24 V of the CDB and the 24 V mains unit may feed back, depending on the tolerances.	✔
Note: In the range > 5 V / < 18 V the performance of the inputs is undefined.			

Table 3.12 Specification of control connections CDB3000

X2	Des.
20	OSD02 normally open
19	OSD02 +24 V Relay
18	OSD02 normally closed
17	DGND
16	OSD01
15	OSD00
14	DGND
13	+24 V
12	ISD03
11	ISD02
10	ISD01
9	ISD00
8	ENPO
7	+24 V
6	+24 V
5	OSA0
4	AGND
3	ISA01
2	ISA00
1	+10.5 V

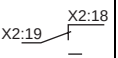
Des.	Terminal	Specification	potential-free
Analog ground			
AGND	X2-4	• isolated from DGND	
Digital ground			
DGND	X2-14 X2-17	• isolated from AGND	
Sicherer Halt Only for special version CDB3000,SH			
ISD00	X2-9	• Limit frequency 5 kHz • PLC-compatible • Switching level Low/High: <5 V / >18 V DC • Imax at 24 V = 10 mA • RIN = 3 kW • Internal signal delay time » 100 µs • Terminal scanning time = 1ms	✔
OSD92	X2-18 X2-19 X2-20	• Relay, 1 two-way contact • 25 V / 200 mA AC, utilization category AC1 • 30 V / 200 mA DC, utilization category DC1 • Switching delay approx. 10 ms • Overload protection by device integrated resetable fuse (PTC) • 3 x 106 switching cycles 	✔
Note: In the range > 5 V / < 18 V the performance of the inputs is undefined.			

Table 3.12 Specification of control connections CDB3000

Standard terminal assignment CDB

Terminal assignment **factory setting**

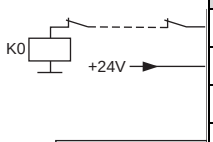
Pre-set solution speed control, +10 V reference, control via terminal

Features

- Scaleable analog reference (±10V, 10 bit)
- Programmable, time-optimised acceleration profile

Parameters

152-ASTER = SCT_1



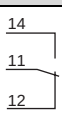
X2	Des.	Function	
20	OSD02		Relay contact for message "Ready"
19	OSD02		
18	OSD02		
17	DGND	digital ground	
16	OSD01	"Standstill" message	
15	OSD00	"Reference reached" message	
14	DGND	digital ground	
13	U_V	Auxiliary voltage 24 V	
12	ISD03	Not assigned	
11	ISD02	Not assigned	
10	ISD01	Not assigned	
9	ISD00	START loop control	
8	ENPO	Power stage hardware enable	
7	U_V	Auxiliary voltage 24 V	
6	U_V	Auxiliary voltage 24 V	
5	OSA00	Actual speed 0 ... NMAX	
4	AGND	analog ground	
3	ISA01	Not assigned	
2	ISA00	Reference -10 V ... +10 V	
1	U_R	Reference voltage 10V, 10mA	

Fig. 3.18 Control terminals, traction drive without encoder evaluation

Please note:

- Tterminal assignments for further preset solutions, see Application Manual CDE/CDB3000.
- You can set the control terminal individually to suit your application.

3.8.2 Encoder connection CDB3000

Step	Action	Comment
1	Select the correct encoder type.	
2	Wire the encoder connection with shielded wires.	

Encoder interface X7 is suitable for connection of an encoder with an

- incremental TTL-interface
  or
- SSI-interface

.

Only encoders matching the following specification may be connected:

Note:

- Encoder voltage supply
  - Voltage supply on encoder: + 5 V +/-5%, max. power consumption 150 mA (including load)
  - The encoders must have a separate sensor line terminal. The sensor lines are required to measure a supply voltage driop in the encoder line. Only the use of the sensor lines assures that the encoder is supplied with the correct voltage.
    The sensor lines must always be connected!
- Incremental encoder with RS422 compatible track signals (TTL-compatible)
  - 32-8192 pulses/revolution
- SSI-Multiturn encoder acc. to the reference list with general specifications:
  - Line protocol "SSI", gray coded
  - 25 bit-Multiturn (12/13 bit Multi-/Singleturn information, MSB first)

The electrical specification of the interface is given in the Table 3.13, the terminal assignment in the 3.9.

	TTL encoder	SSI encoder
Connection	Miniature D-SUB 15-pin socket (high-density)	
Interface	RS422 (differential)	
Wave terminating resistor	Track A, R: 120 Ω (internal) Track B wired by customer	DATA: 120 Ω (internal) CLK: no connection necessary
Max. signal frequency f_{Grenz}	500 kHz	
Voltage supply	+ 5 V ±5% (controlled via sensor lines) max. 150 mA not isolated from the control electronics	
Sampling rate of the controls	4 kHz	4 kHz
Interface log	-	SSI (Graycode)
Lines per revolution / resolution	32-8192	13 bit (single turn) 25 bit (multi turn)
Max. cable length	50 m (further cable specifications as specified by motor manufacturer)	

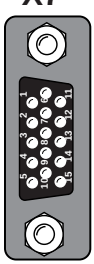
Table 3.13 Specification of encoder interface X7

Select the cable type specified by the motor or encoder manufacturer. Thereby please observe the following boundary conditions:

- Always used shielded cables. The shielding must be placed on both sides of the cable.
- Connect the differential track signals A, B, R or CLK, DATA to each other via twisted wires.
- Do not separate the encoder cable, for example to route the signals via terminals in the switch cabinet.

X7

SSI / TTL



X7-Pin	Function TTL	Function SSI
1	A-	DATA-
2	A+	DATA+
3	+5V (150 mA)	+5V (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

Table 3.14 Assignment of encoder interface X7

X7-Pin	Function TTL	Function SSI
8	GND	GND
9	R-	don't use
10	R+	don't use
11	B+	CLK+
12	+5V (Sensor)	+5V (Sensor)
13	GND (Sensor)	GND (Sensor)
14	B- (connect with Pin 15 to activate the connection resistance) 1)	don't use
15	Bridge 120 Ω termination track B (connect with Pin 14 to activate the connection resistance) 1)	don't use

1) Track B must be terminated via a bridge between Pins 14 and 15. The terminating resistor (120 Ω) is installed in the device. The customer must perform the wiring as track CLK (pin 6, 11) must not be terminated if an SSI interface is used.

Table 3.14 Assignment of encoder interface X7

Connection of 2nd encoder via X2

While the TTL/SSI encoder is being connected to X7 (see chapter 3.8.2), an HTL encoder can be evaluated via the control terminal.

During simultaneous use the TTL-/SSI-encoder must solely be used for the positioning controller, as described in Fig. 3.19.
The HTL encoder to X2 is then responsible for motor commutation and subsidiary speed control.

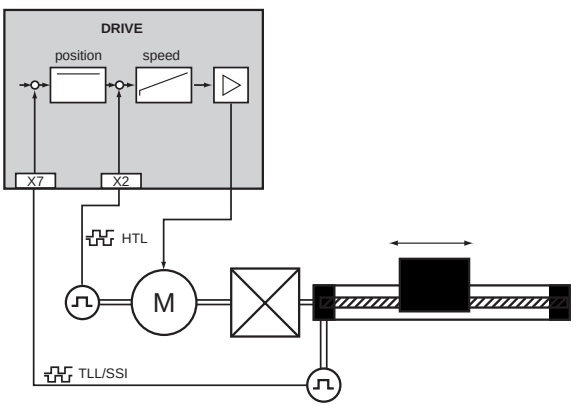


Fig. 3.19 Drive with two measuring systems

	Specification	Comment
Interface	HTL (24 V)	Low = < 5V, High = > 18 V
Max. signal frequency f_{Grenz}	150 kHz	
Voltage supply	+ 24 V, max. 80 mA	The entire ampacity of the control terminal is limited to 100 mA. If the encoder consumes more current, the customer must supply the extra current as shown in the description below.
Sampling rate of the controls	4 kHz	
Lines per revolution	32-8192	
Max. cable length	30 m	Select the cable type specified by the motor or encoder manufacturer. Always used shielded cables. The shielding must be placed on both sides of the cable. Do not separate the encoder cable, for example to route the signals via terminals in the switch cabinet.

Table 3.15 Electrical specification of the HTL-rencoder interface

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

Note: : Inverted encoder signals or a zero pulse cannot be connected or evaluated.

Table 3.16 Assignment for HTL encoder connection to X2

HTL encoder supply

If connecting an HTL encoder causes the maximum current of 100 mA from the 24V auxiliary voltage to be exceeded, feed the encoder with an external voltage as shown in Fig. 3.20.

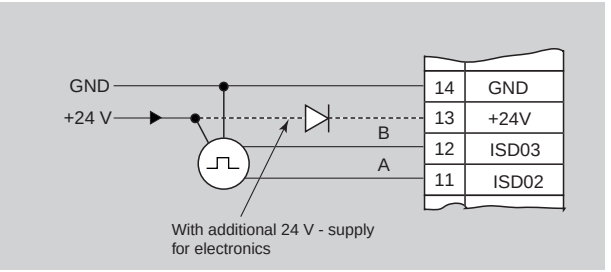


Fig. 3.20 Feeding the HTL encoder with an external voltage supply

If external voltage is still required to feed the drive controller (e.g. for operating the field-bus communication with the mains voltage switched off), decouple it from the controller voltage with a diode.

For further project planning notes on selecting an encoder, refer to Section 3.8.2.

3.8.3 Motor connection on CDB

Step	Action	Comment
1	Determine the **wire cross-section**, depending on maximum current and ambient temperature.	Wire cross-section according to VDE0100, part 523, see chapter 3.6.
2	Wire the **motor phases** U, V, W via a shielded cable and earth the motor to X1/ ⏚.	Mount screen at both ends to reduce interference emission.
3	Wire the temperature sensor PTC (if fitted) with separately screened wires.	Mount screen at both ends to reduce interference emission.

Attention: It must be assured that the temperature monitor used is sufficiently insulated towards the motor winding (2 kV withstand voltage)).

During operation the CDB3000 positioning controller is protected against shorting and earth faults at the terminals. In the event of a short-circuit or earth fault in the motor cable, the power stage is disabled and an error message is delivered.

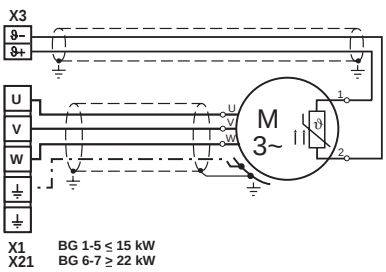
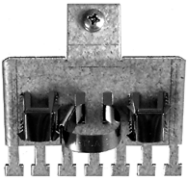


Fig. 3.21 Connection of motor



STxx

Please note:

- Establish shield contact via shield connection STxx. From power class 75 kW the shield connection must be made directly underneath the converter on the backing plate.
- For proper EMC installation the motor terminal box must be HF-tight (metal or metallised plastic). For cable introduction, packing glands with large-area screen contact should be used.
- Further information on permissible current load, technical data and environmental conditions can be found in appendices A1 to A3.

Switching in the motor line

Switching off the motor:
Switching processes in the motor lead must generally take place in de-energized state, as otherwise problems, such as burnt off contactor contacts, overvoltage or overcurrent breaks of the inverter will occur.

In order to assure de-energized switching you must make sure that the contacts of the motor contactor are closed before the inverter power stage is released. In the opposite case the contacts must remain closed until the inverter power stage has been switched of and the motor current has dropped to 0.

This can be achieved by implementing the corresponding safety periods for switching of the motor contactor into the control sequence of the machine or by using the special software function of the CDA3000 inverter.

Multi-motor operation:
The positioning converters can be operated with several motors connected in parallel mode. Depending on the application different notes on projecting must be observed, see appendix A4.

Switching off in the motor line:
Switching in the motor line should generally only take place in de-energized state, as otherwise a fault alarm shut-down may occur.

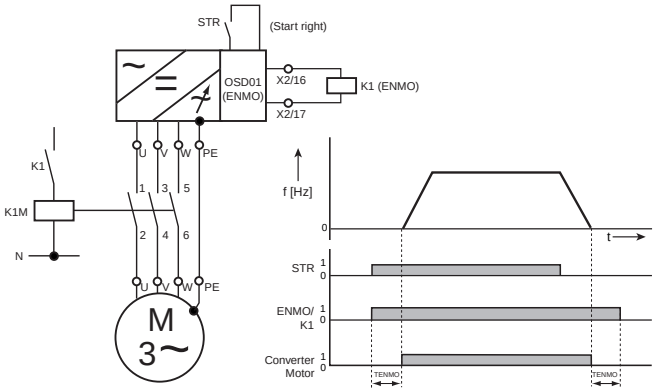


Fig. 3.22 Connection example for ENMO. The shielding connection is not shown.

Function

Start of closed loop control: Contactor relay K1 becomes active when starting the closed loop control. The output frequency (output voltage) of the converter starts delayed by the time set in parameter 247-TENMO. This ensures that the motor contactor is closed before the output frequency (output voltage) of the converter starts up.

Stopping the closed loop control: When removing "Start of closed loop control" the contactor relay K1 will drop off delayed by the the time set in parameter 247-TENMO. This ensures, that the motor contactor will only open after the converter power stage has been de-energized.

3.9 Serial interface (SIO) CDE/CDB

Pin assignment X4

The serial interface (SIO, X4) is used to connect the DRIVEMANAGER and serves as a slot for the KEYPAD

Pin-No.	Function
1	+15 V DC for control unit KP200-XL
2	TxD, data transmission
3	RxD, data reception
4	not used
5	GND for +15 V DC of the control unit KP200-XL
6	+24 V DC (only for KP200)
7	not used
8	not used
9	GND for +24 V DC (only for KP200)

Table 3.17 Pin assignment of the serial interface X4, CDE/CDB

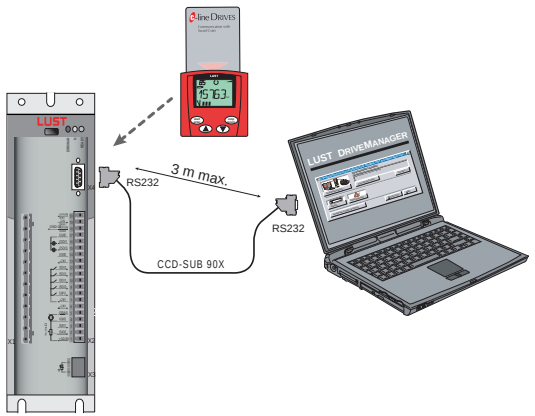


Fig. 3.23 Terminal X4

Please use only the prefabricated RS232 cable CCD-SUB 90X (max. length 3 m) to connect the positioning controller to the PC / DRIVEMANAGER.

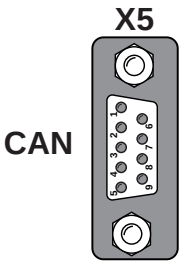
Attention: The RS232-interface should only be used as a service diagnostics interface. Using the interface for control purposes is not permitted.

3.10 CAN interface CDE/CDB

The CAN_{open}-interface is integrated in the drive controller. It is connected via connector X5. The customer is responsible for providing a power supply to the isolated connection.

Connection	Miniature D-Sub 9-pin pin
Wave terminating resistor - Bus termination -	a bridge (Pin 1-2) activates the internal terminating resistance (120 Ω)
Max. incoming frequency	1 MHz
Ext. Voltage supply	+ 24 V ±25%, 50 mA (potential-free to drive controller)

Assignment of connection X5:



Pin	Function
1	Bridge on 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

The CAN-bus node address is set via the encoder switch (CDE: S1 / CDB: S3).

A bus address can be alternatively set via parameters. The addresses via encoder switcha dn parameter are added up.

Project planning and description of function:
For informatiuon please refer to the CANopen communication manual. In the factory setting ASTER: OLT_1 the interface is switched off.

3.11 DC-network CDE/CDB

The positioning converters operated in a regenerative mode (braking operation) in a DC-network, feed energy into the DC-network, which is then consumed by the motor operated drive controllers.

Attention: It is essential that a DC network operation be checked at the project planning stage. Please consult your project engineer.

3.12 Braking resistor (RB) CDE/CDB

In regenerative operation, e. g. when braking the drive, the motor feeds energy back to the drive controller. This increases the voltage in the DC-link. 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.

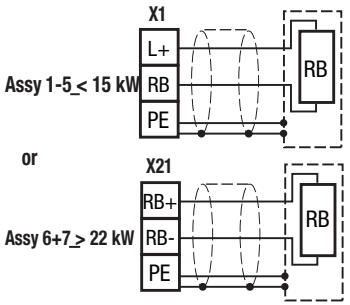


Fig. 3.24 Braking resistor connection

Attention: Risk of fatal injury! Never wire or disconnect electrical connections while these are live. Always disconnect the power before working on the device. Wait until the d.c.link voltage on terminals X1/L+, L- (BG 1-5) or X21/ ZK+, ZK- (BG 6-7) has dropped to the safety-low voltage before starting work on the equipment (approx. 10 minutes).

Connection of an external brake resistor

Attention:

- The installation instructions for the external braking resistor must be strictly observed.
- The temperature sensor (bimetal switch) on the braking resistor must be wired in such a way, that the connected positioning converter is disconnected from the mains supply if the system overheats.
- The minimum permissible connection resistance of the positioning converter must not be fallen short of, technical data see appendix 2.
- In version CDE/CDB3X.xxx, Wx.x, BR the braking resistor is integrated. No additional braking resistor must be connected to terminals X1/L+ bzw. RB+ bzw. RB-, this would damage the converter module.
- For further information please consult your project engineer.

Design BR

Monitoring of the internal braking resistor

Positioning converters of design BR - CDB3X.xxx, X, BR
are delivered with an integrated braking resistor. Since the internal braking resistor may be overloaded, e. g. by mains voltage peaks, the resistor must be specially monitored.

The max. permissible peak braking power is specified in appendix A2. For further information please consult your project engineer.

Attention: An external brake resistor must be monitored by the control. The temperature of the braking resistor is monitored by a temperature watchdog (Klixon).
In case of excessive temperatures the positioning controller must be disconnected from the mains supply.

3.13 Safe Standstill

Applies for all devices CDE3x.xxx and for all devices of special equipment CDB3x.xxx,SH:

3.13.1 Description of function

Positioning controllers CDE3000, and CDB3000,SH support the safety function "Safe Standstill", a protection against unexpected starting, according to the requirements of EN 954-1 “category 3”.

"Safe Standstill" acc. to EN 954-1 describes a protective measure in form of an interlocking or control function. Category 3 means that this safety function will remain in place in case a single fault occurs. The safety relevant parts must be designed in a way that:

- an isolated fault in any of these parts does not result in the loss of the safety function, and
- when ever possible if it can be carried out in an appropriate manner the isolated fault is detected.

For the function "Safe Standstill" acc. to EN954-1 „category 3“ the drive controllers are equipped with an integrated electric circuit with feedback contact. The logic interrupts the power supply to the pulse amplifiers used to trigger the power output stage. In combination with the controller release "ENPO" the system uses two channels to prevent a pulse pattern in the power circuit, which would be suitable to generate a rotating field in the motor.

In comparison with the solution with a motor contactor this variant offers the following advantages:

- Abandonment of the external motor contactor
- Resulting in less wiring work
- Space saving
- Better EMC-compatibility due to the continuous shielding of the motor lead.

3.13.2 Notes on safety

Always specify a validating plan. In this plan all examinations and analysis required for the accordance of our solution (e.g. suggestion for a circuit) with your application have to be described.

What to do in case of emergency in acc. with EN13850

Emergency-off switch to bring to a standstill in case of emergency
The Emergency-off is a procedure which is intented to halt a dangerous process or movement (EN 60204-1).

Emergency-off for switching off the frequency inverter in case of emergency
The Emergency-off is a procedure which is intented to interrupt the electrical power supply in case a hazard arises through electrical shock or other electrical hazards arize.

Danger:

- If the positioning controllers are in "Safe Standstill" state all motor and mains lines, brake resistors and d.c.-circuit voltage lines conduct dangerous voltages against protective conductors.
- With the function “Safe Standstill" an "Emergency Stop" is only possible with additional measures. There is no galvanic separation between motor and position controller! This means that a hazard due to electrical shock or other electrical hazards exists.

- If an external effect of forces can be expected in safety function "Safe Standstill", e.g. with hanging load, this motion must be reliably prevented by additional measures, e.g. by a mechanical brake or weight compensation.
- By two short circuits each in two offset branches of the power circuit a short-term movement of the axis can be triggered, dependent on the number of poles of the motor.

  Example synchronous motor: With a 6-pole synchronous motor the movement may be max. 30 degree. With a direct driven ball screw, e.g. 20 mm per revolution, this corresponds with a single linear movement of 1.67 mm.

  Since the exciting field collapses when reverse biasing the inverter and has fully decayed after approx. 1 second, the short circuits in two offset branches of the power section have almost no effect in synchronous motor applications.
- The function "Safe Standstill" does not replace the function "Safe Stopping Process" acc. to EN60204 Part 1.
  "Safe Stopping Process" is no independent function, but describes a process that can be realized by means of the control.

3.13.3 Overview of CDE3000 terminals

The CDE3000 offers a separate input for the save stop request and a separate relay contact for feedback via terminal X2.

X2	Designation	Function
1, 13	DGND	digital ground
2, 14	+24V	Auxiliary voltage U_V = 24 V DC
10	ENPO	Hardware release for output stage and reset of "Safe Standstill"
11	RSH	Relay contact for feedback (normally open)
12	RSH	
22	ISDSH	Input for "Safe Standstill" request

Table 3.18 "Safe Standstill" signal assignment for control terminal X2, CDE3000

3.13.4 Overview of CDB3000 terminals

The CDB3000 offers the function "Safe Standstill" only for the design variant SH (CDB3x.xxx, SH). The assignment of the control terminal has been changed in comparison to the standard device.

Input ISD00 is exclusively used for the "Safe Standstill" request. The feedback is routed through relay output OSD02.

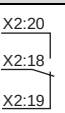
X2	Designation	Function	
20	OSD02/18	Make contact of two-way relay	
19	OSD02/19	Root of two-way relay	
18	OSD02/20	Break contact of two-way relay (not used here)	
9	ISD00	Input for "Safe Standstill" request	
8	ENPO	Hardware release for output stage and reset of "Safe Standstill"	
6, 7, 13	+24V	Auxiliary voltage 24 V DC	
14, 17	DGND	digital ground	

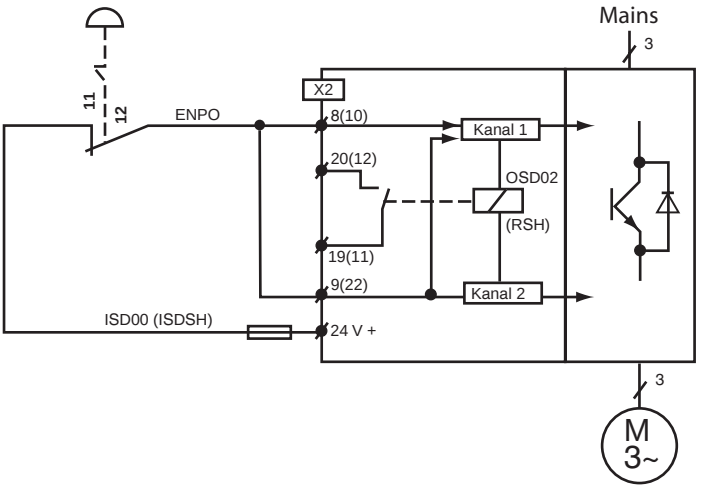
Table 3.19 "Safe Standstill" signal assignment for control terminal X2, CDB3000

Note: On CDB3000 both the input ISD00 and the output OSD02 have a different function assigned by selecting a preset solution. These functions must be parameterized to other inputs/outputs during commissioning.

3.13.5 Wiring and commissioning

For the function "Safe Standstill" acc. to EN954-1 the drive controllers are equipped with an integrated electric circuit with feedback contact. The logic interrupts the power supply to the pulse amplifiers used to trigger the power output stage. In combination with the controller release "ENPO" the system uses two channels to prevent a pulse pattern in the power circuit, which would be suitable to generate a rotating field in the motor.

The device internal function and the terminal for CDE3000 in () is shown in Fig. 3.25.



Values in ( ) for CDE3000

Fig. 3.25 Request "Safe Standstill" for emergency-stop (emergency-stop cutoff)

ENPO	ISD00 (CDB) ISDSH (CDE)	„Safe Standstill“	Controller status	Relay [1] OSD02 / (CDB) RSH (CDE)
L	L	ON[3]	Output stage locked via two channels. Hardware restart lock activ.	
L	(L) ➜ H	ON	Output stage locked via two channels. Hardware restart lock activ.	
(H) ➜ L	H	OFF	Output stage locked via one channel.	
H	L	ON	Output stage locked via two channels. Hardware restart lock activ.	
H	(L) ➜ H	ON	Output stage locked via two channels. Hardware restart lock activ.	
(L) ➜ H[2]	H[2]	OFF[3]	Output stage at standby.	

( ) Previous status
1) 3 x 10^6 switching cycles at 200 mA (rest position: normally open)
2) In order to deactivate the restart lock the control signals must be simultaneously (max. errors 5 ms) set to High (H), or ISD00 (ISDSH) must be reliably set to High (H) before ENPO.
3) Switching combination for Safe Standstill , category 3

Note: If you need further information about any curcuit e.g. with safety relay modules, please do not hesitate to contact your projecting engineer.

3.13.6 Testing

The applied control signals "ISDSH" (CDE) and "ENPO" (CDB-SH) must always be checked for plausibility by the operator or a superimposed control.

The occurrence of an implausible status is a sign for a system fault (installation or positioning controller). In this case the drive must be switched off and the fault rectified.

Attention: The function "Safe Standstill", protection against unexpected start" must generally be checked for correct function:

- Initial commissioning
- After any intervention in to the wiring of the system
- After replacing one or several appliances in the system.

4 Commissioning

Attention: Commissioning must only be carried out by qualified electricians who have undergone instruction in the necessary accident prevention measures.

4.1 Choice of commissioning

Mode of commissioning	Commissioning steps	Continued on
• Project planning and commissioning have already been completed. • Loading an existing data set.	Serial commissioning	Page 4-2
• Initial project planning and commissioning of the drive system.	Initial commissioning	PAGE 4-5
• Project planning and basic setting of the drive system have already been carried out.	Test run	PAGE 4-15

4.2 Serial commissioning

Apply this mode of commissioning when you want to commission several identical drives (i.e. serial commissioning). The same positioning controller and motor must be set for each drive in an identical application.

If you already have a complete dataset available, please skip the paragraph "Saving dataset to SMARTCARD" (with KP200) or *"Save dataset from unit to file"* (with DRIVEMANAGER).

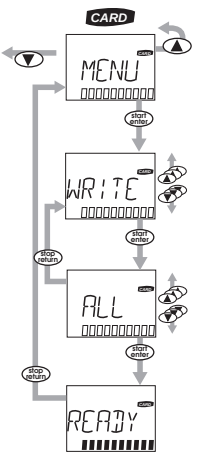
4.2.1 Serial commissioning with KEYPAD

Prerequisite:

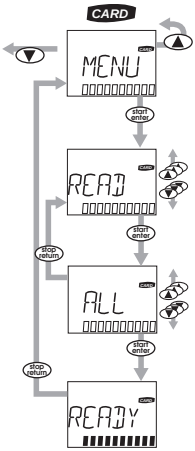
- All positioning controllers are completely connected.
- The **first** drive has already been fully taken into operation.

Attention: The CARD-menu can only be selected as long as the **drive is not active**!

Saving dataset to SMARTCARD

Step	Action	Comment	Representation
1	Connect the KEYPAD to the positioning controller of the **first** drive, insert a SMARTCARD and switch on the mains supply.		
2	Select the CARD menu.	= load/save with the SMARTCARD	
3	Choose WRITE.	= save dataset	
4	Choose ALL and start the save operation with the *Start/Enter key.*	= complete dataset will be saved	
5	READY is displayed.	= saving completed without errors	
With this process you have written your dataset to a SMARTCARD.			

Loading dataset from SMARTCARD into next positioning controller

Step	Action	Comment	Representation
1	Connect the KEYPAD to the positioning controller of the **next** drive, insert a SMARTCARD with the required dataset and switch on the mains supply.		
2	Select the CARD menu.	= load/save with the SMARTCARD	
3	Choose READ.	= load dataset	
4	Choose ALL and start the load operation with the *Start/Enter key.*	= complete dataset will be loaded	
5	READY is displayed.	= loading completed without errors	
	Repeat this loading process on all other drives.		

Note: The dataset is automatically saved in the positioning controller.

4.2.2 Serial commissioning with DRIVEMANAGER

Prerequisite:

- All positioning controllers are completely connected.
- The **first** drive has already been fully taken into operation.
- A PC with the user software DRIVEMANAGER installed is connected.

Step	Action	Comment
1	Connect your PC with the positioning controller of the **first** drive and switch on the mains supply for the positioning controller.	Use a standard serial cable (9pole D-SUB, socket/pin).
2	START DRIVEMANAGER.	Automatically links the connected positioning controller.
	If the connection setup fails you should check the settings in the menu **Extras** > **Options** and retry it via the icon. 	
3	Save the current dataset by clicking on the icon ,  either to the parameter database (directory: c:/../userdata) of the DRIVEMANAGER or to a floppy disk (a:/).	The icon always saves the most current dataset of the connected unit. Name the file as desired.
4a	Use this icon to disconnect from all devices 	
4b	Connect your PC with the positioning controller of the **next** drive and switch on the mains supply for the positioning controller.	
5	Click on icon to establish a link between the DRIVEMANAGER and the newly connected device. 	
6	Click on icon to load the dataset saved in step 4 into the device. 	
7	Use the icon to select the main window.  Save the settings with the button -> 	
	Repeat steps 4 ... 7 for all further drives.	

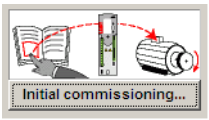
Save dataset from unit to file

Load dataset from file into unit

Please remember to save the setting.

For further information concerning the DRIVEMANAGER please refer to the DRIVEMANAGER manual.

4.3 Initial commissioning



Attention: Never wire or disconnect electrical connections while they are live.
Before working on the device disconnect the power. Wait until the DC-ling have been fully discharged. Work on the unit is only permitted when the residual voltage (between terminals L+ and L-) has dropped below 60 V!

Prerequisites:

- The positioning controller is completely connected, see Chapter 3
- Installed DRIVEMANAGER from version V3.4
- The database for motors is installed on the PC
- The unit is connected to the PC via the RS232 interface (X4)

Input ENPO = apply Low-Level (CDB terminal 8 (X2) / CDE terminal (X2)) to avoid unintended starting of the motor (power stage locked, mains voltage for positioning controller switched on).

Preparations:

- Switch on the positioning controller.
  A self-test is performed.
- Start the DRIVEMANAGER.

DRIVEMANAGER Connect
or:
Communication > Connect...

Set up a connection to the device.

DRIVEMANAGER *or:*
Active device >
Change settings

Opening the main window "Settings":

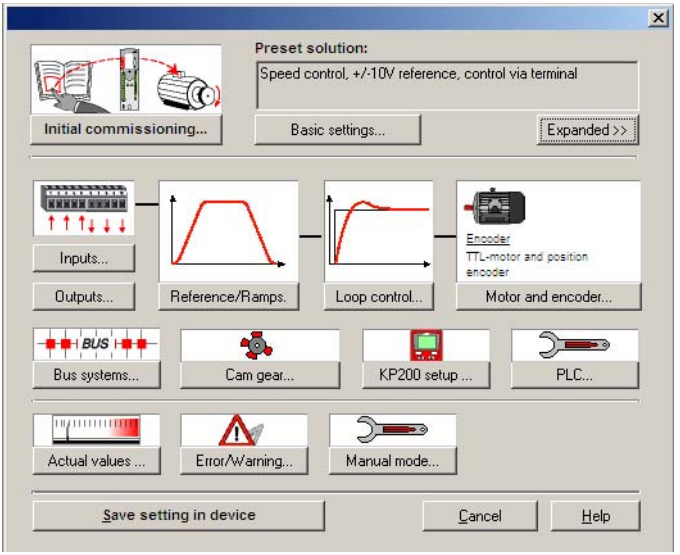


Fig. 4.1 Main window for the different settings in the DRIVEMANAGER.

Continue with:

4.3.1 Preset solutions

Pre-set solutions are complete parameter data sets which are provided to handle a wide variety of typical application movement tasks.

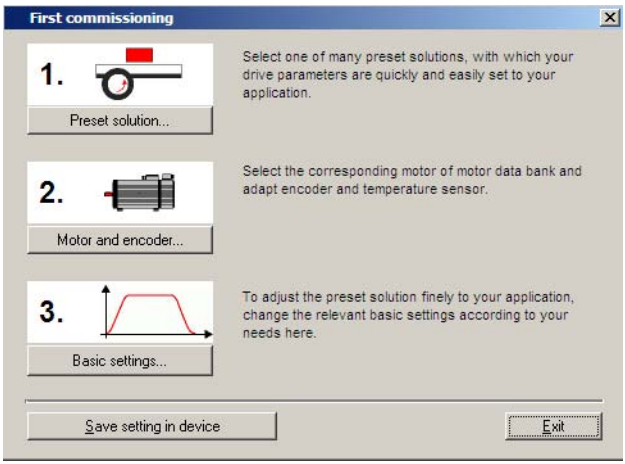


Fig. 4.2 Initial commissioning

The position controller is automatically configured by loading a pre-set solution into the random access memory (RAM). The parameters for

- the control location of the drive controller,
- the reference source,
- the assignment of signal processing input and outputs and
- the type of control

are the focal points of the setting.

The use of a pre-set solution considerably simplifies and shortens the commissioning of the positioning controller. By changing individual parameters, the preset solutions can be adapted to the needs of the specific task. Pre-set solutions modified this way are stored in the unit as user datasets. In this way, you can arrive more rapidly at your desired movement solution.

A total of 20 preset solutions covers the typical areas of application for speed control with the controller CDE/CDB3000.

Abbreviation	Reference source	Start of controller via/ Bus control profile
TCT_1	+/-10V-analog - torque	I/O-terminals
SCT_1	+/-10V-analog	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 options module (Profibus) - EasyDrive-Profile "Basic"
SCC_3	CANopen field bus interface	CANopen field bus interface - EasyDrive-Profile "Basic"
SCB_3	Field bus options module (Profibus)	Field bus options module (Profibus) - EasyDrive-Profile "Basic"
SCP_3	PLC	PLC
SCT_4	PLC	I/O-terminals
SCC_4	PLC	CANopen field bus interface - EasyDrive-Profile "Basic"
SCB_4	PLC	Field bus options module (Profibus) - EasyDrive-Profile "Basic"
PCT_2	Drive set tables	I/O-terminals
PCC_2	Drive set tables	CANopen field bus interface - EasyDrive-Profile "TabPos"
PCB_2	Drive set tables	Field bus options module (Profibus) - EasyDrive-Profile "TabPos"
PCC_1	CANopen field bus interface	CANopen field bus interface - DSP402-Profiles position mode - DSP402-Profiles velocity mode - DSP 402-Interpolated Mode
PCB_1	Field bus options module (Profibus)	Field bus options module (Profibus) - EasyDrive-Profile "DirectPos"
PCP_1	PLC	PLC
PCT_3	PLC	I/O-terminals
PCC_3	PLC	CANopen field bus interface - EasyDrive-Profile "PlcPos"
PCB_3	PLC	Field bus options module (Profibus) - EasyDrive-Profile "PlcPos"

Table 4.1 Preset solutions for speed control with CDE/CDB3000

All pre-set solutions have an individual window for basic settings in DRIVEMANAGER.

Select the pre-set solution matching your application.

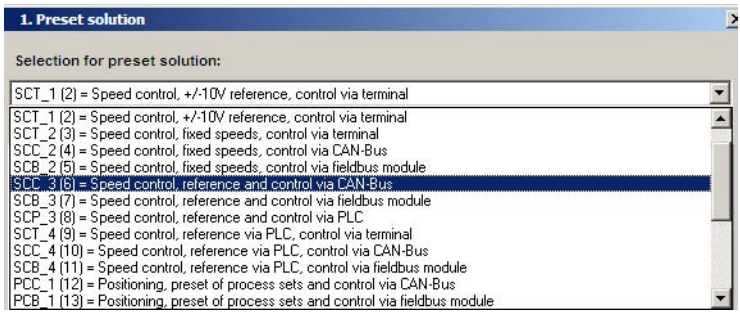
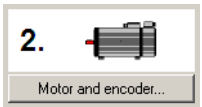


Fig. 4.3 Selecting the pre-set solution

Note: For more detailed information on pre-set solutions and terminal assignment please refer to the CDE/CDB3000 application manual.

4.3.2 Setting motor and encoder



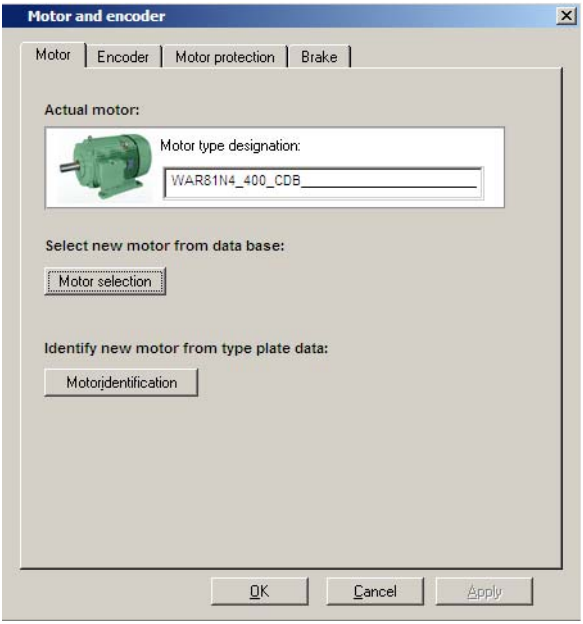


Fig. 4.4 Setting the motor and encoder

Setting up the motor data via the motor database

A database with the settings for all motors is available. Using the correct motor dataset ensures:

- that the electrical parameters of the motor are correctly set,
- that the motor protection ("Motor protection" tab) is correctly set and

the control circuits for the drive are pre-set.

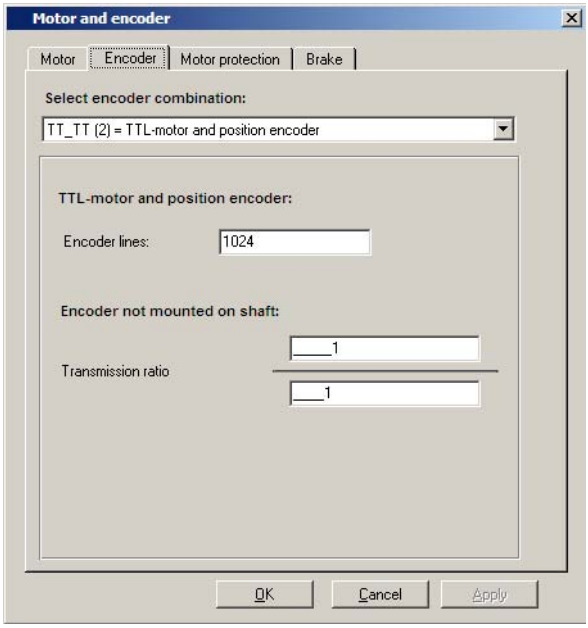
Note: The torque control is optimally adjusted, so that no further adaptations are required.
The setting of the speed control is based on the assumption that the moment of inertia of the machine reduced to the motor shaft is identical with the moment of inertia of the motor.
The speed and positioning controllers have a high level of attenuation and therefore also suitable for the control of elastic mechanical components.

For special settings in optimizing the speed and position control circuitry you should use the CDE/CDB3000 application manual.

With the button "Motor selection" in tab "Motor" you can select the required motor from your installed motor database. The motor type is stamped on the motor type plate. If the motor dataset is supplied on a data carrier (floppy disk, CD-ROM) it can be directly loaded via button "Other directory".

Setting up the encoder

The encoder connected to the motor is set in the tab "Encoder". There is also the possibility to work with two encoders. In such cases, the first rotary encoder is used for commutation and speed control of the motor (motor encoder), the second one for position control (position controller). It is also possible to perform both functions with a single encoder.



Every rotary encoder combination has a special setup screen.

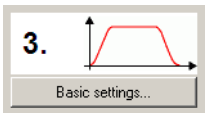
For more information on setting the encoders, refer to the CDE/CDB3000 Application Manual.

Checking the encoder

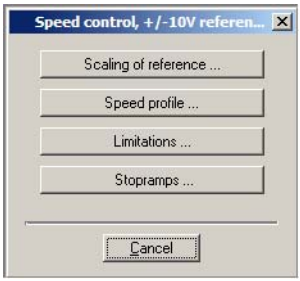
To check the encoder, rotate the motor shaft by hand. The viewing is from the front onto the end of the shaft (flange). The "reference and actual values" status display, under "nist, Actual speed", must indicate a positive speed in clockwise rotation and a negative speed in counter-clockwise rotation. If the speed is incorrect, check the following points:

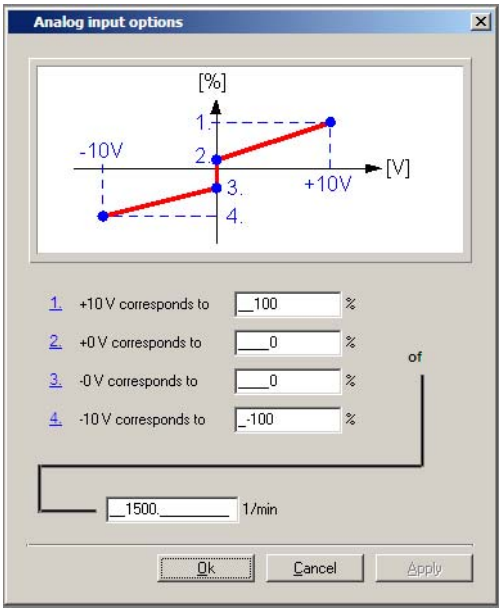
- Is the encoder cable correctly connected to the motor and the positioning controller?
- Is the encoder cable in use the correct one for the type of encoder?

4.3.3 Making basic settings



Custom setup screens are provided for fine adjustment of each preset solution. You can use them to adapt the drive to your application. A detailed description of the individual functions can be found in the CDE/CDB3000 Application Manual.





4.3.4 Saving the settings

DRIVEMANAGER
CDE/CDB3000 Settings

or:
Active device > Change

Saving the settings in the device

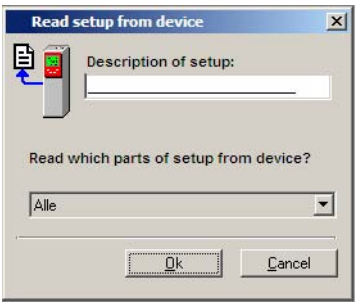
All changes that are to be permanently stored in the device, must be saved via the mask CDE/*CDB3000 Settings*.

These changes can also be saved in a file.

Saving the settings in a file

DRIVEMANAGER
CDE/CDB3000 Settings

or:
Active device > Save device settings in a > file



Choose the file name (e.g. mydata). All parameters are saved under the chosen file names (e.g. mydata) with the appropriate extension (*.00D). It is possible to assign a description to the device data prior to saving it.

Continue with "Test run", see chapter 4.4.

4.4 Test run

The drive is tested without the coupled mechanics. The test run is conducted in the speed controlled mode, independently from the selected pre-set solution.

A test run is still possible, even if the motor has already been coupled to the system:

Attention: **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. Lust Antriebstechnik GmbH will not assume liability for any occurring damage.

Danger to life from uncontrolled rotation!
Before starting motors with feather keys in the shaft end these must be reliably secured against being ejected, as far as this is not already prevented by drive elements such as belt pulleys, couplings or similar.

Pre-set solution for torque control:
In this pre-set solution the drive must not be operated without load torque, because otherwise the motor shaft would accelerate uncontrolled up to the adjusted speed limit.

Attention: **Destruction of motor**:
The motors are intended for operation on the positioning controller. Direct connection to the mains can destroy the motor.
The surface temperatures on the motors may increase to a very high level. No temperature sensitive parts may touch or be mounted to these areas, appropriate measures to prevent contact must be applied wherever necessary.
A temperature sensor that may possibly be installed in the winding, must be connected to the positioning controller, so that overheating of the motor can be prevented by the temperature monitoring system.
Before starting the motor the motor brake (if present) must be checked for correct function.
The optionally installed holding brake is only designed for a limited number of emergency brake operations. Use as working brake is strictly prohibited.

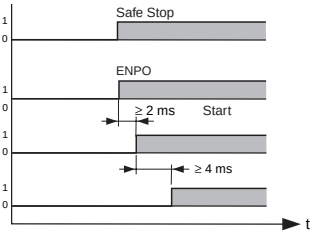
1. Power stage enable
High-level at terminal 8 (X2)

Input Safe Standstill (only CDE)

Input ENPO

Input Start

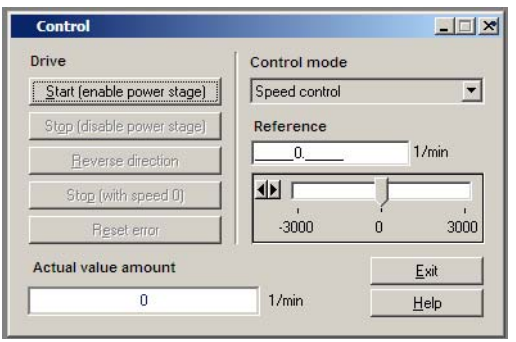
Device status: "Loop control active"



Observe the temporal behaviour of the inputs.

2. Control with DRIVEMANAGER**:**
Set the input ENPO and the "Input Safe Standstill" (only CDE3000), select "Speed control" and start the drive, e.g. with nominal value 100 min^{-1}.

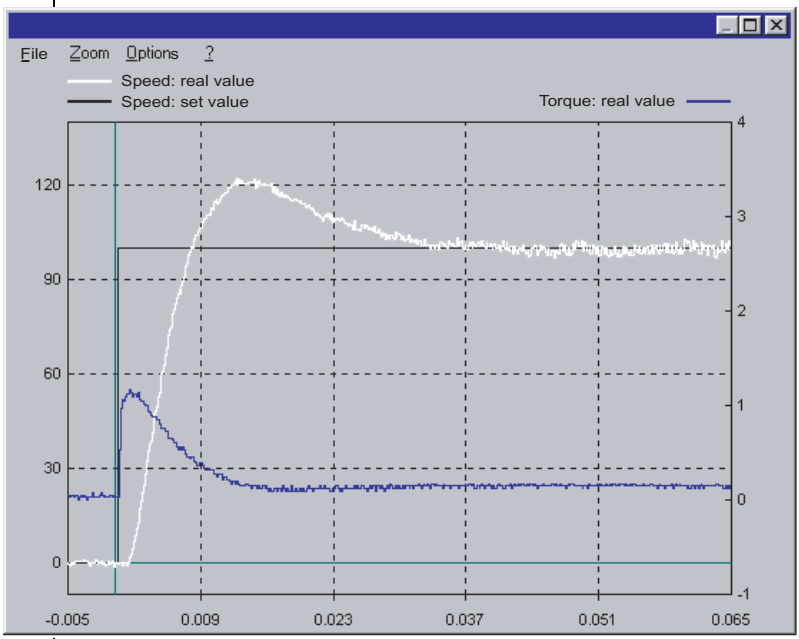
DRIVEMANAGER
Open-loop control
or:
Active device > Open-loop control> Basic operating modes



Check the drive response
Now you can assess the drive performance with the aid of step responses, which can be recorded using the digital scope function of the DRIVEMANAGER.
Select the following three recording variables:
- 0: Speed:Reference
- 1: Speed:Actual value
- 2: Torque:Actual value

DRIVEMANAGER
Digital Scope
or:
Active device > Monitor > Quickly changing digital scope values

Triggering condition:
Channel 0; rising flank, pre-trigger 10%; level: 30 min $^{-1}$



Start the drive with a reference value of e.g. 100 min^{-1}.
Compare the step response of your drive with the illustration. With resolvers the overshoot of the actual speed value should be around 20 %; with incremental encoders approx. 30% (with reference to the nominal value). Make sure that the drive system shows small-signal response (the nominal value of the torque must be less than the maximum value).

If the torque reference reaches its maximum, reduce the speed step.

The time response (rise time, correction time) of the speed control loop is independent of the speed step.

Result:

If the step response of your drive does approximately correspond with the illustration, it is assured that the motor phases are correctly wired, the encoder is correctly connected and the CDE/CDB3000 is parameterized to the correct motor.

If the step response deviates considerably from the illustration, it is to be assumed that

- the motor dataset was incorrectly selected or
- the wiring is incorrect

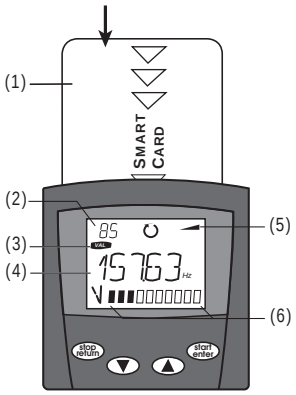
Check the individual steps from Chapter 3 "Installation" and Chapter 4.3 "Initial commissioning" and repeat the test run.

The step response may also deviate if the ratio of the machine moment of inertia reduced onto the motor shaft relative to the motor moment of inertia is very high. Here the loop control settings must be optimized. For special settings to optimize the speed and position control circuitry, please use the CDE/CDB3000 Application Manual.

4.5 Operation with KEYPAD

Overview KEYPAD

The KEYPAD can be directly plugged onto the positioning control (X4).



(1) Chip card SMARTCARD to save and transfer settings

(2) 3-digit numerical display, e. g. for parameter number

(3) current menu

(4) 5-digit numerical display for parameter name and value

(5) Acceleration and deceleration ramp active

(6) Bar graph display, 10-digit

start enter — Call up menu branches or parameters; save changes; Control start in drive

stop return — Quit menu branches; Cancel changes; Control stop in drive

▲ — Select menu, subject area or parameter; Increase setting

▼ — Select menu, subject area or parameter; Reduce setting

Fig. 4.1 Operating and display elements of the KEYPAD KP200

Menu structure

The KEYPAD has a menu structure for clearly arranged operation

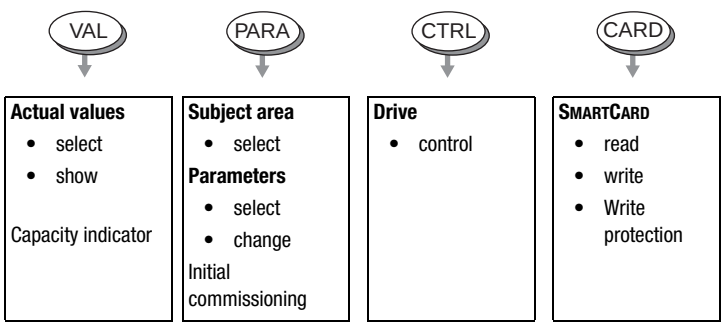


Fig. 4.2 Menu functions

Example parameter setting (PARA-menu)

- The parameters in the PARA menu are grouped into subject areas according to their functions to provide a clearer overview.
- Only the parameters to which the current user level permits access can be changed.

1. Select PARA-menu

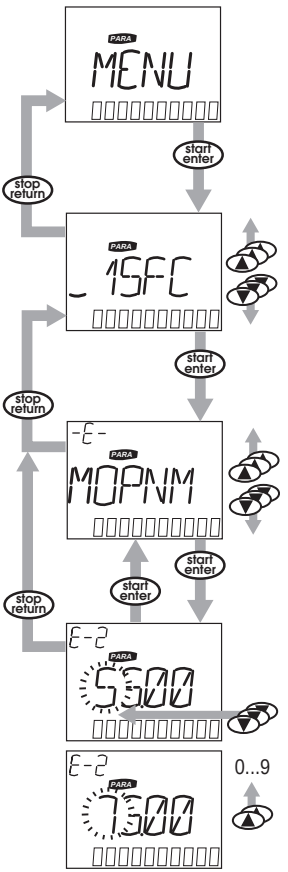
2. Select the desired subject area with the arrow keys and confirm with **start/enter**.

3. Select the desired parameter with the arrow keys (user level 1-MODE = 2).

4. The current value is displayed, the last digit flashes. Press the arrow **down** key to jump to the next digit. With the arrow **up** key the flashing digit can be changed. The fifth digit on the left indicates the prefix: (–) = minus.

The exponent can be entered as the last digit.

Save the new value with **start/enter** or abort (without saving) with **stop/return.**



CARD-MENU

SMARTCARD read/write:

- In this menu positioning controller settings can be saved to SMARTCARD and transferred to other positioning controllers.
- When saving **all** parameters are saved to the SMARTCARD. When reading you can either read all parameters or only the parameters for a certain subject area (per reading process).

Function	Meaning
READ > ALL	reads all parameters from SMARTCARD
READ > _27RS	Reads in parameters from subject area, e. g. _27RS (structure of nominal values)
WRITE	writes all parameters to SMARTCARD
LOCK	SMARTCARD with write protect
UNLOCK	Removing the write protection

4.6 Operation with DRIVEMANAGER

Prerequisite:

- DRIVEMANAGER version V3.4 or higher is installed on the PC.

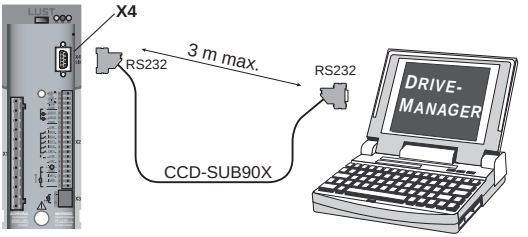


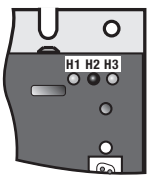
Fig. 4.3 Connection of positioning controller to PC/DRIVEMANAGER

The most important functions

Icon	Function	Menu
	Changing the setting of the active device	Active device > Change settings
	Print parameter dataset	Active device > Print settings
	Digital Scope	Active device > Monitor > Quickly changing digital scope values
	Control drive	Active device > Open-loop control > Basic operation modes
	Connect to device	Communication > Connect > Single device
	Bus-initialization, Change settings	Communication> Bus-configuration
	Disconnect all devices	Communication > Disconnect
	Save dataset of active device in file	Active device > Save settings of device to
	Dataset transfer from file to active device	Active device > Load settings into device from

5 Troubleshooting

5.1 Light emitting diodes



The positioning controller is fitted with three status LED's in red (H1), yellow (H2) and green (H3) at the top right.

Device status	red LED (H1)	yellow LED (H2)	green LED (H3)
Power on	-	-	●
Ready (ENPO set)	❍	●	●
In service/auto-tuning active	❍	✳	●
Warning	●	● / ✳	●
Error	✳ (flash code)	❍	●
❍ LED off, ● LED on, ✳ LED flashing			

5.2 Error messages

If an error occurs during operation it is indicated by a flash code from LED H1 (red) on the positioning controller. The code indicates the type of error. If a KP200 is connected, the KP200 indicates the error type as an abbreviation.

Flash code of red LED H1	Display KeyPad	Explanation	Cause/Remedy
1x	E-CPU	Collective error	The exact error code can be read out via the KeyPad or the DriveManager.
2x	E-0FF	Undervoltage shut-off	Check power supply, also occurs briefly in response to normal power-off.
3x	E-0C	Overcurrent shut-off	**Short-circuit, earthing fault**: Check cabling of connections, check motor coil, check neutral conductor and earthing (see also section 3, Installation). **Device setup not correct**: Check parameters of control circuits, check ramp setting.
4x	E-0V	Overvoltage shut-off	**Voltage overload from mains**: Check mains voltage, restart device. **Voltage overload resulting from feedback from motor** (regenerative operation): Decelerate brake ramps - if not possible use braking resistor.
5x	E-0LM	Motor protection shut-off	**Motor overloaded** (after I x t-monitoring): If possible slow down process cycle, check dimensioning of motor.
6x	E-0LI	Device protection shut-off	**Device overloaded**: Check dimensioning, if necessary use a larger device.
7x	E-0TM	Motor temperature too high	**Motor-PTC correctly connected**? **Parameter MOPTC correctly set** (type of motor-PTC evaluation)? **Motor overloaded**: Allow motor to cool down, check dimensioning.
8x	E-0TI	Excessive temperature of positioning controller	**Ambient temperature too high**: Improve ventilation in control cabinet. Excessive load during driving/braking: Check dimensioning, if necessary use braking resistor.
1) For further information please refer also to the **CDB3000 application manual**			

Table 5.1 Error messages

Helpline

If you have any technical questions for project planning or commissioning of the drive device, please contact our helpline.

You can reach us:

Mon.-Thur.:	8 a.m. - 4.30 p.m.	Tel. +49-6441/966-180
Fri.:	8 a.m. - 4 p.m.	Tel. +49-6441/966-180
Fax:	+49-441/966-137	
E-mail:	helpline@lust-tec.de	

Service/support

If you search for further support in service case, we - the specialists of the LUST-service center - would like to help you.

You can reach us:

Mon.-Thur.:	8 a.m. - 4.30 p.m.	Tel. +49-6441/966-171
Fri.:	8 a.m. - 4 p.m.	Tel. +49-6441/966-171
Fax:	+49-441/966-211	
E-mail:	service@lust-tec.de	

5.3 User errors in KEYPAD operation

Error	Cause	Remedy
ATT1	Parameter cannot be changed at current user level or is not editable	Select user level 1-MODE higher.
ATT2	Motor must not be controlled via the CTRL menu	Cancel start signal from a different control location.
ATT3	Motor must not be controlled via the CTRL menu because of error state	Reset error.
ATT4	New parameter value impermissible	Change value.
ATT5	New parameter value too high	Reduce value.
ATT6	New parameter value too low	Increase value.
ATT7	Card must not be read in current state	Reset start signal.
ERROR	Invalid password	Enter correct password.

*Table 5.2 User errors KEYPAD: Reset with **start/enter***

5.4 User errors in SMARTCARD operation

Error	Meaning	Remedy
ERR91	SMARTCARD write-protected	Use different SMARTCARD
ERR92	Error in plausibility check	
ERR93	SMARTCARD not readable, wrong positioning controller type	
ERR94	SMARTCARD not readable, parameter not compatible	
ERR96	Connection to SMARTCARD interrupted	
ERR97	SMARTCARD data invalid (checksum)	
ERR98	Insufficient memory on SMARTCARD	
ERR99	Selected area not present on SMARTCARD, no parameters transferred from SMARTCARD	

*Table 5.3 SMARTCARD error: Reset with **stop/return***

5.5 Errors in power switching

Error	Cause	Remedy
Power on. Positioning controller shows no response (LEDs off).	In case of too frequent switching the units protects itself by high-resistance isolation from the system.	After a rest phase of a few minutes the device is ready to start once again.

5.6 Reset

The reset function is divided into two areas with differing effects. Parameter reset restores to the last value stored in the device. Device reset restores the entire dataset to factory setting (delivery defaults).

Parameter reset with KEYPAD

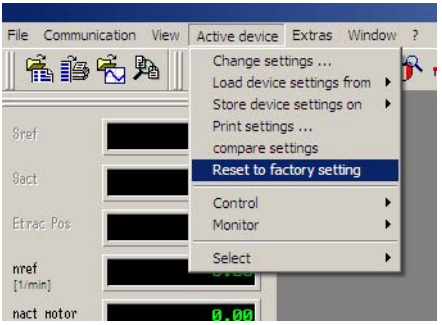
If you are in the setup mode of a parameter and press the two cursor keys simultaneously, the parameter you are currently editing will be reset to the last setting saved (= saved with parameter 150-SAVE).

Factory setting with KEYPAD

Press both cursor keys simultaneously during positioning controller power-up to reset all parameters to their factory defaults and reinitialise the system

Factory setting with DRIVEMANAGER

In the "Active device" menu, the "Reset to factory setting" option can be used to restore the delivery defaults of the device.

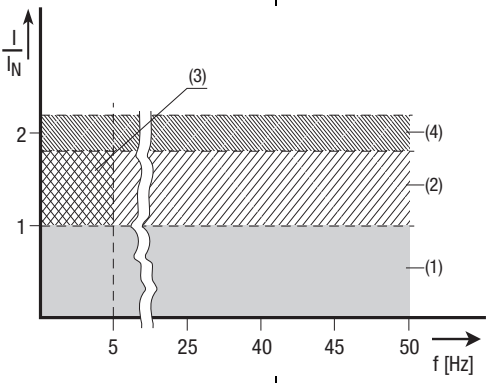


Note: Attention! This factory setting also resets the selected default solution. Check the terminal assignment and the functionality of the positioning controller in these operating modes or load your user dataset.

A Appendix

A.1 Ampacity of positioning controllers

Maximum permissible positioning controller output current and peak current depend on the mains voltage, the motor cable length, the output stage switching frequency and the ambient temperature. With changing application related conditions, the maximum permissible ampacity of the positioning controllers will also change. Refer to the following graphs and tables.



** Intermittent operation $I_N > I_{eff}$*

$$I_{eff} = \sqrt{\frac{1}{T} \cdot \Sigma_{i=1}^{n} I_i^2 \cdot t_i}$$

(1) Continuous operation

(2) Intermittent operation* > 5 Hz rotating field frequency
Positioning control 0.7 to 15 kW (CDE/CDB)
I/I_N = 1,8 for 30 s at 4/8/16 kHz
Positioning control 45 to 170 A (CDE)
I/I_N = 2.0 for 3 s at 4/8 kHz
Positioning control 22 to 90 kW (CDB)
I/I_N = 1,5 for 30 s at 4/8 kHz

(3) Intermittent operation* 0 to 5 Hz rotating field frequency
Positioning control 0.7 to 15 kW (CDE/CDB)
I/I_N = 1.8 for 30 s at 4 kHz
I/I_N = 1.25- 1.8 for 30 s at 8 kHz
Positioning control 45 to 170 A (CDE)
I/I_N = 2.0 for 3 s at 4/8 kHz
Positioning control 22 to 90 kW (CDB)
I/I_N = 1,5 for 30 s at 4 kHz
I/I_N = 1,0-1,15 for 30 s at 8 kHz

(4) Pulse operation
Positioning controller 0.7 to 15 kW
I/I_N = approx. 2.2 at 4/8/16 kHz
Positioning control 45 to 170 A (CDE)
I/IN = approx. 2.2 at 4/8 kHz
Positioning control 22 to 90 kW (CDB)
I/I_N = approx. 1.8 at 4/8 kHz

Positioning controller for 230 V networks

Positioning module	Recomm. 4 pin standard motor [kW]	Power stage switching frequency [kHz]	Nominal current [A]	Peak current for intermittent operation 0 to 5 Hz [A]	Peak current for intermittent operation > 5 Hz [A]
CDE/CDB 32.003,Cx.x	0,37	4 8 12 16	2,4 2,4 2,1 1,8	4,3 4,3 3,75 3,2	4,3 4,3 3,75 3,2
CDE/CDB 32.004,Cx.x[1)]	0,75	4 8 12 16	4 4 3,5 3	7,2 7,2 5,7 5,0	7,2 7,2 6,3 5,4
CDB 32.008,Cx.x[1)] CDE/CDB 32.008,Wx.x	1,5	4 8 12 16	7,1 7,1 6,3 5,5	12,8 12,8 10 8	12,8 12,8 11,35 9,9

Peak current for 30 s with positioning controller 0.375 to 1.5 kW / 2.4 to 7.1 A
Cooling air temperature 45 °C (40°C CDB32.008,Cx.x)
with power stage switching frequency 4 kHz
40 °C with power stage switching frequency 8, 16 kHz
1) with heat sink HS3... or additional cooling surface

Mains voltage 1 x 230 V -20 % +15 %
Motor cable length 10 m
Mounting altitude 1000m above MSL
End-to-end mounting

Table A.1 Positioning controller for 230 V networks

Positioning controller for 400/460 V networks:

Positioning module	Recomm. 4 pin standard motor [kW]	Power stage switching frequency [kHz]	Rated current I_N[A] at 400 V	Rated current I_N[A] at 460 V	Peak current for intermittent operation 0 to 5 Hz [A]	Peak current for intermittent operation > 5 Hz [A]
CDE/CDB 34.003,Cx.x	0,75	4 8 12 16	2,2 2,2 1,6 1,0	2,2 2,2 1,6 1,0	4 4 2,9 1,8	4 4 2,9 1,8
CDE/CDB 34.005,Wx.x	1,5	4 8 12 16	4,1 4,1 3,2 2,4	4,1 3,6 - -	7,4 7,4 5,7 4,3	7,4 7,4 5,7 4,3
CDE/CDB 34.006,Wx.x	2,2	4 8 12 16	5,7 5,7 4,15 2,6	5,7 5,7 - -	10,3 10,3(CDE)/7,8(CDB) 7,5(CDE)/6,4(CDB) 4,7	10,3 10,3 7,5 4,7
CDE/CDB 34.008,Wx.x	3,0	4 8 12 16	7,8 7,8 6,4 5	7,8 7,8 - -	14 14 11 7,8	14 14 11 9
CDE/CDB 34.010,Wx.x	4,0	4 8 12 16	10 10 8,1 6,2	10 8,8 - -	18 18 13 7,8	18 18 14,5 11
CDE/CDB 34.014,Wx.x	5,5	4 8 12 16	14 14 10,3 6,6	14 12,2 - -	25 25 18 12	25 25 18 12
CDE/CDB 34.017,Wx.x	7,5	4 8 12 16	17 17 12,5 8	17 13,5 - -	31 31 23 14	31 31 23 14
CDE/CDB 34.024,Wx.x	11	4 8 12 16	24 24 19,5 15	24 24 - -	43 43 35 27	43 43 35 27

Cooling air temperature 45 °C (40°C CDB34.003,Cx.x) at
power stage switching frequency 4 kHz
40 °C with power stage switching frequency 8, 16 kHz

Motor cable length 10 m
Mounting altitude 1000m above MSL
End-to-end mounting

[1] Device is in process of development.

[2] Not yet available at printing deadline.

Table A.2 Positioning controller for 400/460 V networks:

Positioning module	Recomm. 4 pin standard motor [kW]	Power stage switching frequency [kHz]	Rated current I_N[A] at 400 V	Rated current I_N[A] at 460 V	Peak current for intermittent operation 0 to 5 Hz [A]	Peak current for intermittent operation > 5 Hz [A]
CDE/CDB 34.032,Wx.x	15	4 8 12 16	32 32 26 20	32 28 - -	58 58 39 32	58 58 47 36
CDE34.044,Wx.x	-	4 8	45	45	90	90
CDE34.058,Wx.x	-	4 8	60	60	120	120
CDE34.070,Wx.x	-	4 8	72	72	144	144
CDE34.088,Wx.x[1)]	-	4 8	90	90	2)	180
CDE34.108,Wx.x[1)]	-	4 8	110	110	2)	220
CDE34.140,Wx.x[1)]	-	4 8	143	143	2)	286
CDE34.168,Wx.x[1)]	-	4 8	170	170	2)	306
CDB34.044,Wx.x	22 kW	4 8	45 45	45 45	67 52	67 67
CDB34.058,Wx.x	30 kW	4 8	60 60	60 60	90 60	90 90
CDB34.070,Wx.x	37 kW	4 8	72 72	72 72	108 74	108 108
CDE34.088,Wx.x[1)]	45 kW	4 8	90 90	90 90	2)	135 135
CDB34.108,Wx.x[1)]	55 kW	4 8	110 110	110 110	2)	165 165
CDB34.140,Wx.x[1)]	75 kW	4 8	143 143	143 143	2)	215 215
CDB34.168,Wx.x[1)]	90 kW	4 8	170 170	170 170	2)	255 255

Cooling air temperature 45 °C (40°C CDB34.003,Cx.x) at
power stage switching frequency 4 kHz
40 °C with power stage switching frequency 8, 16 kHz

Motor cable length 10 m
Mounting altitude 1000m above MSL
End-to-end mounting

[1)] Device is in process of development.

[2)] Not yet available at printing deadline.

Table A.2 Positioning controller for 400/460 V networks:

A.2 Technical data | CDE/CDB32.004 to CDE/CDB34.006

Technical data \ Designation	CDE/CDB32.003	CDE/CDB32.004	CDE/CDB32.008	CDE/CDB34.003	CDE/CDB34.005	CDE/CDB32.006
Output motor side[1)]						
Recommended nominal power with 4-pin 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	4,0 A	7,1 A	2,2 A	4,1 A	5,7 A
Peak current 1,8 x I_N for 30 s	4,3 A	7,2 A	12,8 A	4,0 A	7,4 A	10,3 A
Rotating field frequency	0 ... 400 Hz					
Power stage switching frequency	4, **8**, 12, 16 kHz					
Input mains supply side						
Mains voltage	1 x 230 V -20 % +15 %			3 x 460 V -25 % +10 %		
Device connected load	1,1 kVA	1,7 kVA	3,0 kVA	1,6 kVA	3,0 kVA	4,2 kVA
Asymmetry of the mains voltage	-			±3 % max.		
Frequency	50/60 Hz ±10 %			50/60 Hz ±10 %		
Power loss CDE at 4 kHz Power stage cycle frequency8/16 kHz	49 W 52 W	68 W 70 W	110 W 120 W	70 W 85 W	95 W 127 W	121 W 153 W
Power loss CDB at 4 kHz Power stage cycle frequency8/16 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 brake power with int. brake resistor (only for version CDE/CDB34 ..., Wx.x, BR)	-	-	1,7 kW at 360 Ω	-	1,6 kW at 360 Ω	1,6 kW at 360 Ω
Minimum ohmic resistance of an externally installed braking resistor	100 Ω		56 Ω	180 Ω		
1) Data related to an output voltage of 400 V and a switching frequency of **8** kHz						

Table A.3 CDE/CDB32.004 to CDE/CDB34.006

CDB34.008 to CDB34.032

Designation / Technical data	CDE/CDB34.008	CDE/CDB34.010	CDE/CDB34.014	CDE/CDB34.017	CDE/CDB34.024	CDECDB34.032
Output motor side[1)]						
Recommended nominal power with 4-pin 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	14 A	17 A	24 A	32 A
Peak current 1,8 x I_N for 30 s	14 A	18 A	25 A	31 A	43 A	58 A
Rotating field frequency	0 ... 400 Hz					
Power stage switching frequency	4, **8**, 12, 16 kHz					
Input mains supply side						
Mains voltage	3 x 460 V -25 % +10 %					
Device connected load	5,4 kVA	6,9 kVA	9,7 kVA	11,8 kVA	16,6 kVA	22,2 kVA
Asymmetry	±3 % max.					
Frequency	50/60 Hz ±10 %					
Power loss CDE at 4 kHz Power stage cycle 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 loss CDB at 4 kHz Power stage cycle 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 brake power with int. brake resistor (only for version CDE/CDB34 ..., Wx.x, BR)	6,0 kW at 90 Ω		6,0 kW at 90 Ω		6,0 kW at 90 Ω	
Minimum ohmic resistance of an externally installed braking resistor	81 Ω		47 Ω		22 Ω	

1) Data related to an output voltage of 400 V and a switching frequency of **8** kHz

Table A.4 CDB34.008 to CDB34.032

CDB34.044 to CDB34.168

Designation / Technical data	CDE/CDB34.044	CDE/CDB34.058	CDE/CDB34.070	CDE/CDB34.088 [2]	CDE/CDB34.108 [2]	CDE/CDB34.140 [2]	CDE/CDB34.168 [2]
Output motor side[1]							
Recommended nominal power with 2-pin standard motor for CDB	22 kW	30 kW	37 kW	45 kW	55 kW	75 kW	90 kW
Voltage	3 x 0 ... **400**/460 V						
Continuous current effective (I_N)	45 A	60 A	72 A	90 A	110 A	143 A	170 A
Peak current 2.0 x I_N for 3 s CDE Peak current 1,5 x I_N for 30 s CDB	90 67	120 90	144 108	180 135	220 165	286 215	306 255
Rotating field frequency	0 ... 400 Hz						
Power stage switching frequency	**4**, 8 kHz						
Input mains supply side							
Mains voltage	3 x 460 V -25 % +10 %						
Device connected load	31 kVA	42 kVA	50 kVA	62 kVA	76 kVA	99 kVA	118 kVA
Asymmetry	±3 % max.						
Frequency	50/60 Hz ±10 %						
Power loss at 4 kHz Power stage switching frequency 8 kHz	350 W 600 W	480 W 820 W	600 W 1020 W	1000 W 1700 W	1200 W 2050 W	1600 W 2700 W	2000 W 3400 W
Brake chopper power electronics							
Minimum ohmic resistance of an externally installed braking resistor	18		13	12	10	5, 6	5,6

1) Data related to an output voltage of 400 V and a switching frequency of **4** kHz
permissible currents at 460 V and changed switching frequencies are documented on page A.4

2) Device is in process of development.

Table A.5 CDB34.044 to CDB34.168

A.3 Environmental conditions CDE/ CDB

Characteristic		Positioning controller
Temperature range	during operation	-10 ... 45 °C (BG1 ... BG5) [2] at 8 kHz -10 ... 45 °C (BG6 ... 7) at 4 kHz up to 55 °C with power reduction [1]
	during storage	-25 ... +55 °C
	during transport	-25 ... +70 °C
Relative air humidity		15 ... 85 %, dewing not permitted
Protection	Device	IP20 (NEMA 1)
	Cooling concept	Cold Plate IP20 Wall mounting IP20 Push-through heat sink IP54 (3 -37 kW)
Protection against direct contact		VBG 4
Mounting height		up to 1000 m above MSL, higher than 1000 m above MSL with power reduction of 1% per 100 m, max. 2000 m above MSL

1) not for controllers CDB32.008,C and CDB34.003,C
2) -10 ... -40 °C for controllers CDB32.008,C and CDB34.003,C

Table A.6 Environmental conditions CDE/CDB3000 and modules

Attention: Do not install the drive controllers in places where they are permanently exposed to vibrations.

A.4 Use of a power choke

The use of power chokes is necessary:
• where the drive controller is used in applications with disturbance variables corresponding to environment class 3, as per EN 61000-2-4 and above (hostile industrial environment). • With a dc-link between multiple positioning controllers.

Among others, environment class 3 is characterized by:

- Mains voltage fluctuations > $\pm$ 10% U_N
- Short-term interruptions between 10 ms to 60 s
- Voltage asymmetry > 3%

Environment class 3 typically applies where:

- a major part of the load is supplied by power converters (dc choppers or soft-start equipment).
- welding machines are present.
- induction or arc furnaces are present.
- large motors are frequently started.
- loads fluctuate rapidly.

Mains load (example)

	Without power choke	With power choke	Change
	4 kW positioning controller, mains impedance 0,6 mH	4 kW positioning controller, mains impedance 6 mH	without power choke compared to with power choke
Voltage 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 notches referred to the mains voltage	28 V	8 V	-70%
Life of the DC-link capacitors	Nominal lifetime	2 to 3 times the nominal lifetime	+100 to 200 %
1) THD = Total Harmonic Distortion (harmonic voltage wave U_5 ...U_{41})			

Table A.7 *Change in system load resulting from use of a power choke with 4% short-circuit voltage based on the example of a 4 kW positioning controller CDB34.010*

Mains voltage asymmetry (example)

	Without power choke			With power choke		
	4 kW positioning controller, mains impedance 0,6mH			4 kW positioning controller, mains impedance 6mH		
Asymmetry of the 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.8 *Effect of the power 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 power choke with 4 % short-circuit voltage are multi-faceted. We therefore recommend that you use a power choke as a matter of course.

A.5 Line filter

Details concerning the subject "Electromagnetic Compatibility" can be found in chapter 3.3.

Permissible motor cable length with internal radio interference suppression filter

Drive controller	4 kHz power stage cycle frequency		8 kHz power stage cycle frequency		16 kHz power stage cycle frequency	
	With integrated line filter		With integrated line filter		With integrated line filter	
	Industrial area	Living area	Industrial area	Living area	Industrial area	Living area
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	25	1)
CDE/B34.010	25	10	25	10	25	1)
CDE/B34.014	1)	10	25	10 2)	25	1)
CDE/B34.017	1)	10	25	10 2)	25	1)
CDE/B34.044	25	10	25	10	-	-
CDE/B34.058	25	10	25	10	-	-
CDE/B34.070	25	10	25	10	-	-

Table A.9 Permissible motor cable length with integrated line filter in compliance with standard 61800-3

Explanation on Table A.9

with intermitted interference

Living area:	Limit values acc. to EN 61800-3 (first environment), limited availability. Maximum permissible motor cable length at which the emitted interference (>9 kHz) is below the permitted limit values. Measurements were only performed for 10 (15 m).
Industrial area:	Limit values acc. to EN 61800-3 (first environment), limited availability. Maximum permissible motor cable length at which the emitted interference (>9 kHz) is below the permitted limit values. Measurements were only performed for 25 m.
1)	For 10 m and/or 25 m the emitted interference was beyond the specified limit values. However, this does not mean that the line filter is ineffective, but only that it has no optimal effect over the entire frequency band. An external line filter must therefore be used in order to comply with the standard.
2)	For compliance with the standard the power choke must be adjusted (u_K=4%).
12 kHz Power stage cycle frequency	With a 12 kHz power stage cycle frequency external line filters must be used, because measuring results with internal line filters are not available.
Measuring method:	The permissible motor cable length was determined according to the standard (specified measuring method).

Appendix B Index

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Hinweis zur EN 61000-3-2 DE	Notes on EN 61000-3-2 EN
(rückwirkende Netzbelastung durch Oberwellen) Unsere Positionierregler und Servoregler sind im Sinne der EN61000 "professionelle Geräte", so daß sie bei einer Nennanschlußleistung ≤1kW in den Geltungsbereich der Norm fallen. Beim direkten Anschluß von Antriebsgeräten ≤1kW an das öffentliche Niederspannungsnetz sind entweder Maßnahmen zur Einhaltung der Norm zu treffen oder das zuständige Energieversorgungsunternehmen muß eine Anschlußgenehmigung erteilen. Sollten Sie unsere Antriebsgeräte als eine Komponente in Ihrer Maschine/ Anlage einsetzen, dann ist der Geltungsbereich der Norm für die komplette Maschine/ Anlage zu prüfen.	(limits for harmonic current emissions) Our positioning controllers and servocontrollers are "professional devices" in the sense of the European Standard EN 61000, and with a rated power of ≤1kW they are covered by the scope of this standard. Direct connection of drive units ≤1kW to the public low-voltage grid only either by means of measurements for keeping the standard or via an authorization of connection from the responsible public utility. In case our drive units are used as a component of a machinery/ plant, so the appropriate scope of the standard of the machinery/ plant must be checked.

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ID No.: 1001.20B.2-00 • 08/2005