EN

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CDD3000-HF

Operation Manual

Inverter Drive System
2.2 A - 32 A

LUST

Sizes (BG)

BG1
2,4...4,0A

CDD32.003-HF
CDD32.004-HF

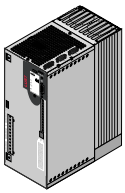
BG2
5,5...5,7A

CDD32.006-HF
CDD32.008-HF
CDD34.003-HF
CDD34.005-HF
CDD34.006-HF

BG3
7,8...10,0A

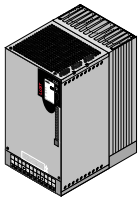
CDD34.008-HF
CDD34.010-HF

BG4
14,0...17,0A



CDD34.014-HF
CDD34.017-HF

BG5
24...32A



CDD34.024-HF
CDD34.032-HF

CDD3000-HF Operation Manual

ID No.: 0998.00B.1-00 • **03/2005**

We reserve the right to make technical changes.

Dear user

Step	Action	Comment
1	This Operation Manual will enable you to install and commission the CDD3000-HF drive system very quickly and easily.	Guide to **quick-starting**
2	Simply follow the *step-by-step tables* in sections 2/3/4. Experience **"Plug 'n Play"** with the CDD3000-HF.	And away you go!

Signposts

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Overview Documentation

If you want more information on the drive solutions presented here and on the full scope of software features of the drive system, please refer to the **CDD3000 Application Manual**. You can order the following documents from us, or download them free of charge from our website at www.lust-tec.de:

CDD3000-HF Operation Manual	CDD3000-HF Catalogue	Application Manual CDD3000
		
Quick and easy initial commissioning	Selecting and ordering a drive system	Adaptation of the drive system to the application

CAN_{Lust} Communication Module Manual	CAN_{open} Communication Module Manual	PROFIBUS-DP Communication Module Manual
		
Project planning, installation and commissioning of the CDD3000-HF on the field bus	Project planning, installation and commissioning of the CDD3000-HF on the field bus	Project planning, installation and commissioning of the CDD3000-HF on the field bus

Pictograms

➢ **Attention!** Misoperation may result in damage to the drive or malfunctions.

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

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

➢ **Note:** Useful information.

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1 Safety

1.1 Measures for your safety

The CDD3000-HF servo drives are quick and safe to handle. For your own safety and for the safe functioning of your device, please be sure to observe the following points:

Read the Operation Manual first!

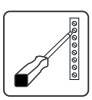
- Follow the safety instructions!

Electric drives are dangerous:

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

Your qualification:

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



During installation observe the following instructions:

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

1.2 Intended use

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

When installed in machines the commissioning of the drive controller (i. e. startup 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 inteded operation) is only permitted when strictly complying with EMC-directive (89/336/EEC).

CE The CDD3000-HF 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.

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

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2.1 Notes for operation

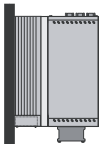
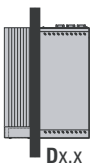
Please ensure that ...

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

The device may otherwise be damaged.

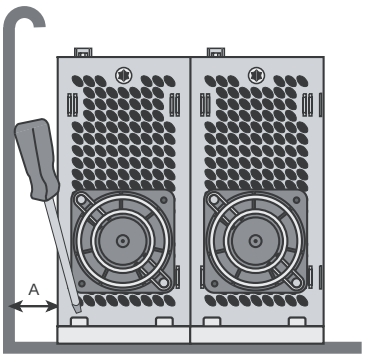
2.2 Mounting variants

Step	Action	Comment
1	Refer to the name plate to find out the mounting variant of your drive controller.	The mounting variants differ in their mode of cooling.

Name plate	Mounting and cooling variant		Continued on
CDD3...-HF,**W**x.x	Wall mounting		Page 2-3
CDD3...-HF,**C**x.x	Cold plate		Page 2-5
CDD3...-HF,**D**x.x	Push-through heat sink		Page 2-8

Mounting and cooling variants

Attention: When mounting drive controller for highspeed drives sizes BG 1 and BG 2, version C x.x (cold plate) directly on the switch cabinet wall, a clearance A must be maintained. This clearance A must be sufficient for the screwdriver to be inserted.



Note: If the installation prevents the clearance A from being maintained, the mounting set CDD (order no. 0927.0017) is available. See Order Catalogue for highspeed drive systems (order no. 1000.24B.0).
The clearance to devices of different power classes must be at least 20 mm. The minimum mounting clearance of the other devices must also be taken into account.

2.3 Wall mounting

Step	Action	Comment
1	Mark out 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 drive controller for highspeed drives **vertically** on the backing plate.	Pay attention to the mounting clearances! The contact surface must be metallically bright.
3	Mount the other components, such as the mains filter, line choke etc., on the backing plate.	Mains filter max. 20 cm below the drive controller for highspeed drives
4	Continue with electrical installation in section 3.	

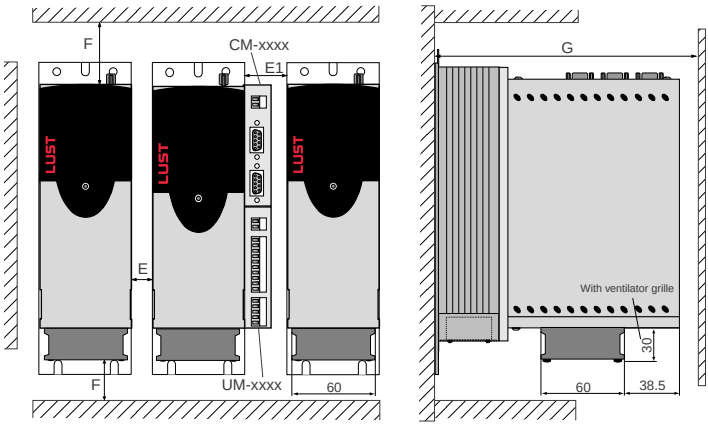
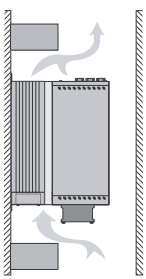


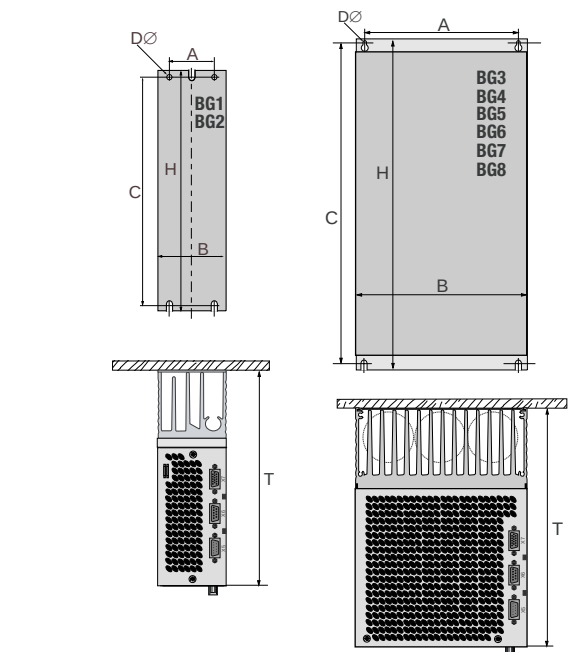
Figure 2.1 Mounting clearances (see Table 2.1)



Note the following points:

- Air must be able to flow unhindered through the device.
- The backing plate must be well grounded.
- The best result for effective EMC installation is attained with a chromated or galvanized backing plate. If backing plates are varnished, the coating must be removed in the area of the contact surface!

CDD3...-HF,Wx.x	BG1 2)	BG2 2)	BG3	BG4	BG5
Weight [kg]	2.4	3.5	4.4	6.5	7.2
B (width)	70		70	120	170
H (height)	245	270	330		
D (depth)	195	220	218		
A	40		40	80	130
C	235	260	320		
D∅	∅ 4.8		∅ 4.8		
Screws	4 x M4		4 x M4		
E 3)	0				
E1 (with module) 3)	45				
F 3)	100				
G 3)	≥ 300				



1) Additionally allow enough space at the bottom for the bending radii of the connecting cables.

2) Corresponding to cold plate version with accessory heat sink HS3X.xxx

3) Mounting clearances see Figure 2.1.

Table 2.1 Dimensional drawings: Wall mounting (dimensions in mm)

2.4 Cold plate

Step	Action	Comment
1	Mark out the positions of the tapped holes on the backing plate or the cooler. Cut a tap for each fixing screw in the backing plate.	Dimensional drawings/hole spacing see Table 2.2. The tapping area will provide you with good, full-area contact.
2	Clean the contact surface and coat it thinly and evenly with **heat transfer compound**.	The contact surface must be metallically bright.
3	Mount the drive controller for highspeed drives **vertically** on the backing plate or cooler. Tighten all screws to the same tightness.	Pay attention to the mounting clearances! Size of cooling surface see Table 2.3.
4	Mount the other components, such as the mains filter, line choke etc., on the backing plate.	Mains filter max. 20 cm below the drive controller for highspeed drives
5	Continue with electrical installation in section 3.	

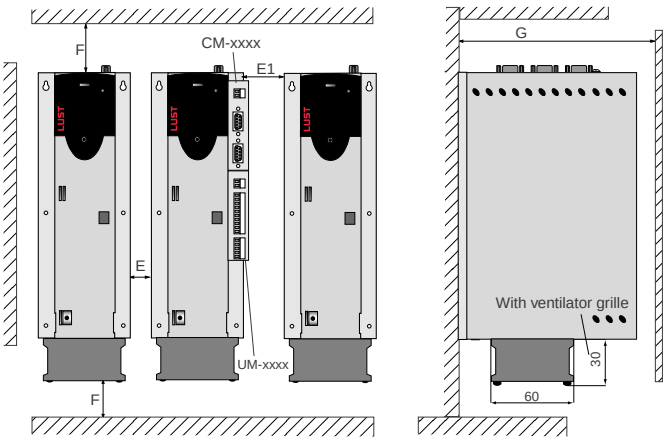
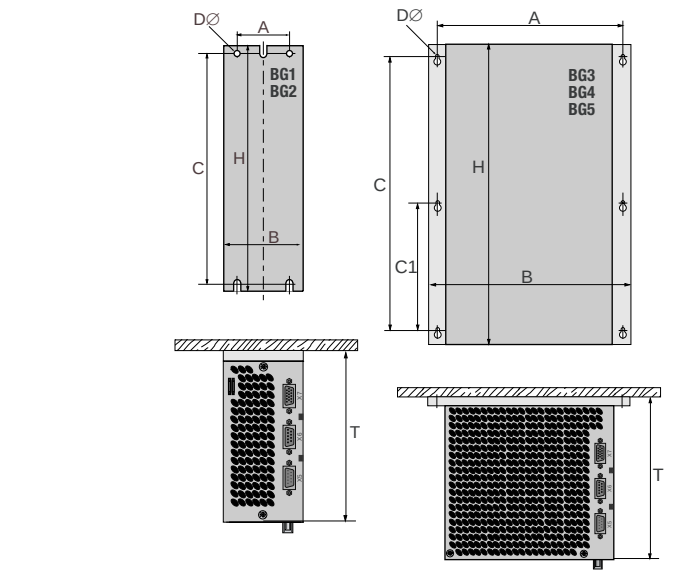


Figure 2.2 Mounting clearances (see Table 2.2)

CDD3...-HF,Cx.x	BG1	BG2	BG3	BG4	BG5
Weight [kg]	1.6	2.3	3.2	5.2	6.4
B (width)	70	70	100	150	200
H (height)	215	240	300		
H (overall height with ventilator)	235	260	-	-	-
D (depth)	120	145	150		
A	50		85	135	185
C	205	230	200		
C (with mounting set)	230	255	-	-	-
C1	–		100		
D∅	∅ 4.8		∅ 5.5		
Screws	4 x M4		6 x M5		
E [1)]	0		0		
E1 (with module) [1)]	45		15		
F [1)]	100[2)]				
G [1)]	≥ 300				

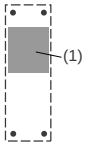


1) Mounting clearances see Figure 2.2.
2) Additionally allow enough space at the bottom for the bending radii of the connecting cables.

Table 2.2 Dimensional drawings: Cold plate (dimensions in mm)

Note the following points:

- Cooling can be attained either by a sufficiently large backing plate (see Table 2.3) or by an additional cooler. The cooler must be mounted centrally behind the hottest area (1) of the device. See also “Project planning notes, “Cold plate”” in Appendix A.3.



- The temperature on the rear panel of the drive controller for highspeed drives must not exceed 85.0 °C. At a temperature > 85 °C the device shuts down automatically. It can only be restarted when it has cooled.
- Required evenness of contact surface = 0.05 mm, maximum roughness of contact surface = roughness factor 6.3

Size	Device rated power	drive controller for highspeed drives	P_V [W] at 4/ 8-16 kHz	R_{thK} 3) [K/W]	Backing plate (unvarnished steel min. cooling area	Ambient temperature
BG1	1.0 kVA	CDD32.003-HF,Cx.x	49 / 52 W	0.05	None	45°C
	1.6 kVA	CDD32.004-HF,Cx.x	63 / 70 W	0.05	650x100mm = 0.065m²	45°C1), 40°C2)
BG2	2.2 kVA	CDD32.006-HF,Cx.x	90 / 97 W	0.05	650x460mm = 0.3m²	45°C1), 40°C2)
	2.8 kVA	CDD32.008-HF,Cx.x	110 / 120 W	0.05	650x460mm = 0.3m²	45°C1), 40°C2)
	1.5 kVA	CDD34.003-HF,Cx.x	70 / 85 W	0.05	None	45°C1), 40°C2)
	2.8 kVA	CDD34.005-HF,Cx.x	95 / 127 W	0.05	650x460mm = 0.3m²	45°C1), 40°C2)
	3.9 kVA	CDD34.006-HF,Cx.x	121 / 163 W	0.05	**An additional cooler is required to supply adequate cooling. For project planning notes see Appendix A.3.**	
BG3	5.4 kVA	CDD34.008-HF,Cx.x	150 / 177 W	0.03		
	6.9 kVA	CDD34.010-HF,Cx.x	187 / 222 W	0.03		
BG4	9.7 kVA	CDD34.014-HF,Cx.x	225 / 283 W	0.02		
	11.8 kVA	CDD34.017-HF,Cx.x	270 / 340 W	0.02		
BG5	16.6 kVA	CDD34.024-HF,Cx.x	330 / 415 W	0.015		
	22.2 kVA	CDD34.032-HF,Cx.x	415 / 525 W	0.015		
	1) With a power stage clock frequency of 4 kHz 2) With a power stage clock frequency of 8/12/16 kHz 3) Thermal resistance between active cooling area and cooler					

Table 2.3 Required cooling with cold plate

Note the following points:

- The backing plate must be grounded over a large area.
- The best result for effective EMC installation is attained with a chromated or galvanized backing plate. If backing plates are varnished, the coating must be removed in the area of the contact surface!

2.5 Push-through heat sink (Dx.x)

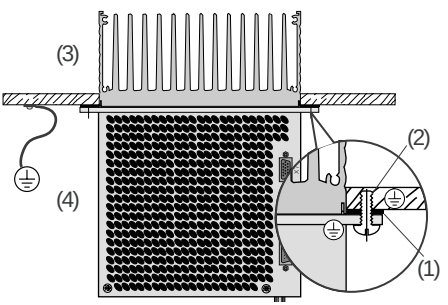
Step	Action	Comment
1	Mark out the positions of the tapped holes and the breakthrough on the backing plate. Cut a tap for each fixing screw in the backing plate and cut out the breakthrough.	Dimensional drawings/hole spacing see Table 2.5. The tapping area will provide you with good, full-area contact.
2	Mount the drive controller for high-speed drives **vertically** on the backing plate. Tighten all screws to the same tightness.	Pay attention to the mounting clearances! The mounting seal must contact flush on the surface.
3	Mount the other components, such as the mains filter, line choke etc., on the backing plate.	Mains filter max. 20 cm below the drive controller for highspeed drives
4	Continue with electrical installation in section 3.	

Note the following points:

- Distribution of power loss:

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

- The all-round mounting collar must be fitted with a seal. The seal must fit flush on the surface and must not be damaged.



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

- The backing plate must be well grounded.
- The best result for effective EMC installation is attained with a chromated or galvanized backing plate. If backing plates are varnished, the coating must be removed in the area of the contact surface!

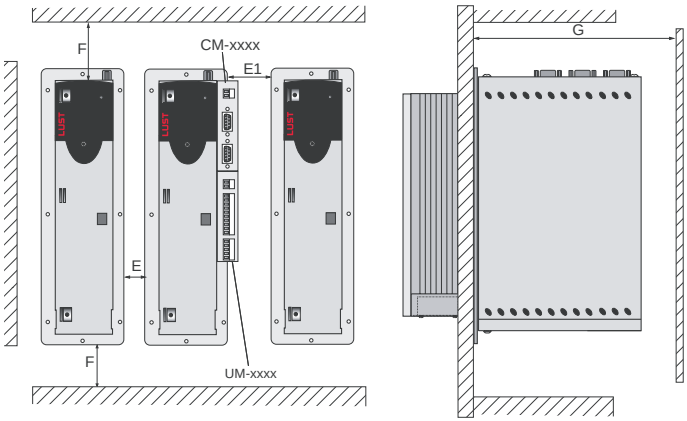


Figure 2.3 Mounting clearances (see Table 2.5)

Dimensions of breakthrough	BG3	BG4	BG5
B (width)	75	125	175
H (height)	305	305	305

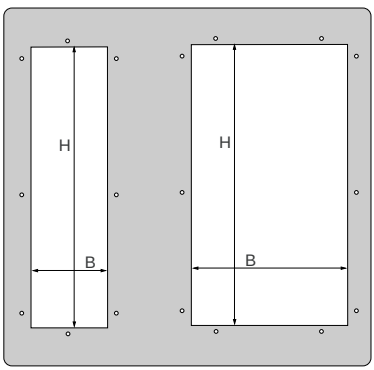
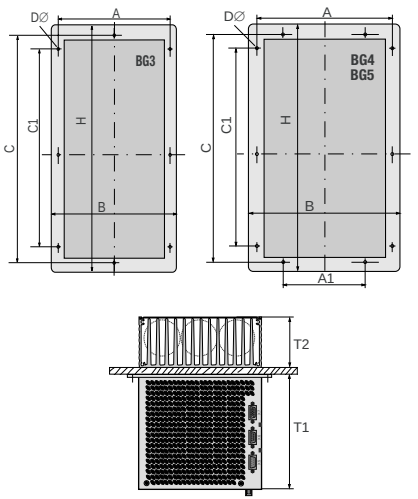


Table 2.4 Breakthrough for push-through heat sink (dimensions in mm)

For further ambient conditions,
see appendix A.2

CDD3...-HF,Dx.x	BG3	BG4	BG5
Weight [kg]	4.6	6.7	7.4
B (width)	110	160	210
H (height)	340		
D (depth)	T1 138, T2 80		T1 138, T2 135
A	90	140	190
A1	–	80	100
C	320		
C1	200		
DØ	Ø 4.8	Ø 4.8	Ø 4.8
Screws	8 x M4	10 x M4	10 x M4
E [1]	10		
E1 (with module) [1]	10		
F [1]	100 [2]		
G [1]	≥ 300		



1) Mounting clearances, see Figure 2.3

2) Additionally allow enough space at the bottom for the bending radii of the connecting cables.

Table 2.5 Dimensional drawings: push-through heat sink (dimensions in mm)

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

3.1 Overview

The terminal layout for all sizes is presented in Appendix A7.

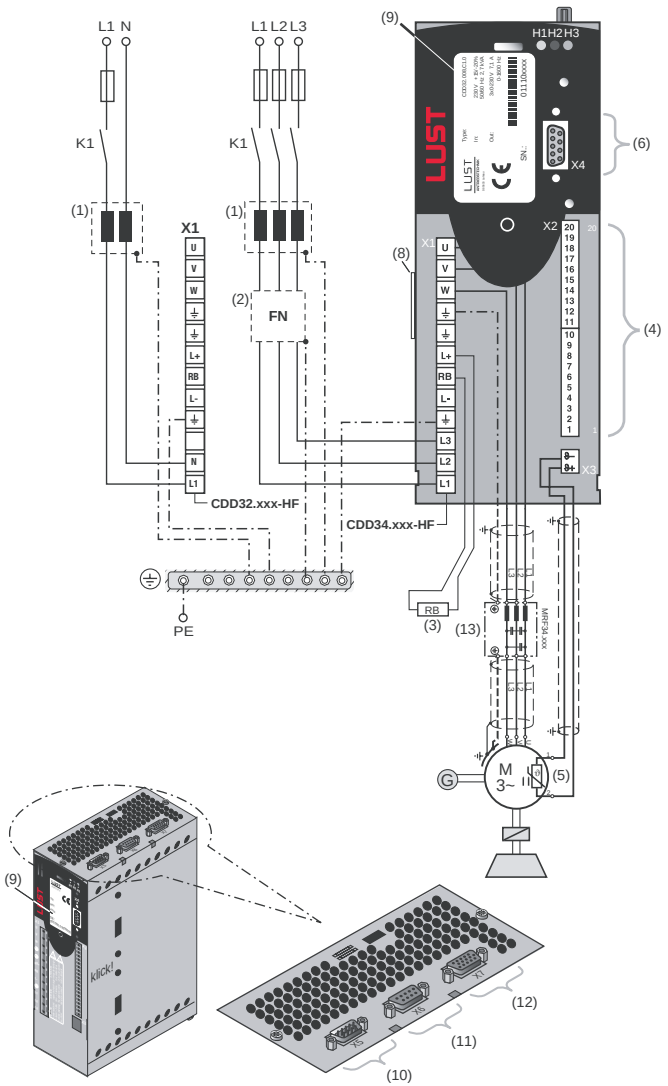


Bild 3.1 Connection overview

For all shielded connections a cable type with double copper braiding with 60-70% coverage must be used.

Key		Explanation
(1)	Line choke[1)]	Reduces the voltage distortions in the system
(2)	Mains filter[1) 2)]	Suppresses line-borne interference emission
(3)	Braking resistor[1)]	Required for fast braking
(4)	Control connections X2	Connection, see section 3.6
(5)	Motor PTC connection X3	For thermal monitoring of the motor, see section 3.3.2
(6)	RS232 connection X4	For operation with KEYPAD/DRIVEMANAGER, see section 4.6/4.5
(8)	Software name plate	Indicates the shipped software status
(9)	Name plate	Contains the hardware data and the serial number
(10)	Encoder simulation/master encoder X5, TTL encoder	Connection and specification, see section 3.8
(11)	Resolver connection X6	Connection and specification, see section 3.3.3
(12)	opt. Encoder connection X7	Connection and specification, see section
(13) motor filter [1)]		Reduces harmonic current waves

1) For supplementary components see Order Catalogue for highspeed drive systems.

2) In CDD3000-HF drive controllers up to 11.8 kVA (BG1 to BG4) the mains filter is built-in.

3.2 Grounding lead connection

Step	Action	Note: PE mains connection to VDE 0100 part 540
1	Ground every CDD3000-HF drive controller! Connect terminal X1 / ⏚ (next to the power connection) **in star configuration** to the PE-rail (main ground) in the switch cabinet.	***Mains connection < 10 mm²:*** Grounding lead cross-section min. 10 mm² or use 2 wires with cross-section of mains leads.
2	Also connect the grounding lead connections of all other components, such as the line choke, filter, heat sink, etc., in **star configuration**, to the PE-rail (main ground) in the switch cabinet.	**Mains connection > 10 mm²:** Use grounding lead (PE) cross section according to cross-section of mains leads.

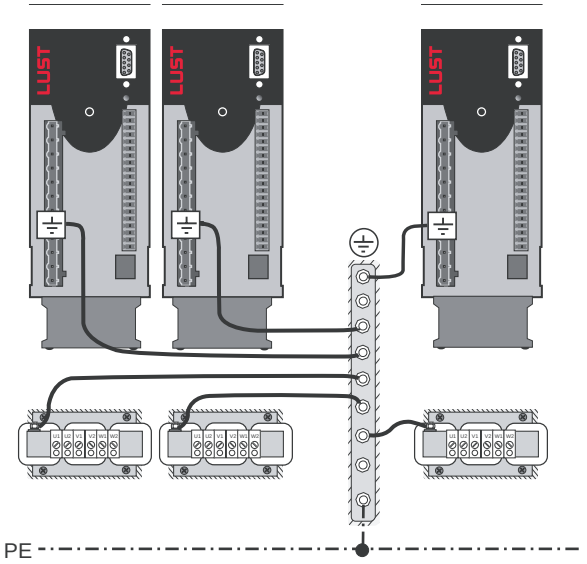


Figure 3.1 Star configuration layout of the grounding lead

Note the following points:

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

3.3 Motor connection

Step	Action	Comment	Section
1	Define the **wire cross-section** dependent on the maximum current and ambient temperature. Wire the **motor phases** U, V, W by way of a shielded cable and ground the motor to X1 directly next to the UVW terminals.	Wire cross-section to VDE0100, part 523, see section 3.4 "Mains connection" Mount shield at both ends to reduce interference emission.	3.3.1
2	Wire the **temperature sensor** (if fitted) with separately shielded wires or with wires routed in the motor cable.	Mount shield at both ends to reduce interference emission.	3.3.2
3	Wire the **holding brake** (if fitted) with separately shielded wires or with wires routed in the motor cable.	Mount shield at both ends to reduce interference emission.	3.3.3
4	Connect the **encoder** by a ready made-up cable to the CDD3000-HF drive controller.	Various ready made-up cables are available for connection of the encoder.	
5	Wire the **external ventilator unit** (if fitted) with separate wires.	An adequate flow of cooling air is required.	

Note the following points:

- Always use shielded cables to connect the motor.
- Shield contact on the CDD3000-HF drive controller:
  - For CDD3000-HF drive controller BG1 ... 5 (1.0 ... 22.2 kVA) there is an accessory shield (ST02, ST04 or ST05) permitting simple clip mounting with all-round contact.
- The motor at the CDD3000-HF output may be shut off by means of a contactor or motor circuit-breaker. The CDD3000-HF drive controller cannot be damaged in the process. A error message may occur however, see section 5 "Diagnosis/Fault rectification"

If you have any further queries refer to the "Helpline" (see page 5-3).

3.3.1 Motor phase connection

Note: The CDD3000-HF drive controller drives are protected against shorting and ground faults at the terminals when in operation. In the event of a short-circuit or ground fault in the motor cable, the power stage is disabled and an error message is delivered.

Attention: **Do not confuse the motor and unit ends of the motor phases U, V and W!**If the motor phases are incorrectly connected, the CDD3000-HF drive controller will lose control over the motor and the motor may buck or accelerate uncontrollably (“run away”). The entire system may be damaged as a result! There may consequently also be danger to human life.

Caution - Danger to life: **Do not touch the motor terminals!** There may also be dangerously high voltages present at motor terminals U, V and W in the “power stage off” condition!

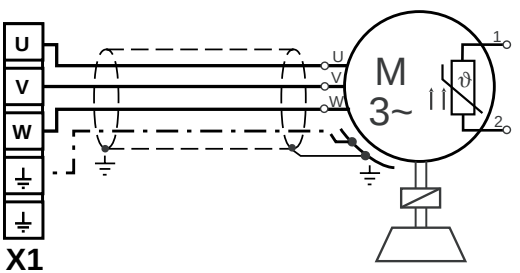


Figure 3.2 Connection of motor phases

3.3.2 Motor temperature monitoring

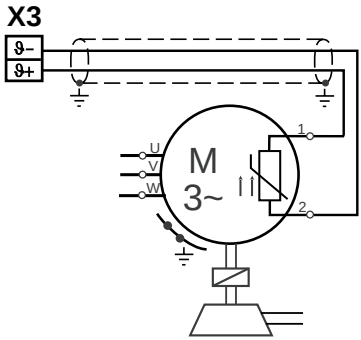


Figure 3.3 Connection of the temperature sensor

For thermal monitoring of the motor winding, the temperature sensors specified in Table 3.1 can be connected to terminals X3 / ϑ- and ϑ+.

Sensor / Tech. data	No PTC used	Standard PTC	Linear voltage evaluation	TSS, thermostatic circuit-breaker
Usable type	-	PTC based on DIN44082	KTY84, yellow	Klixon
Parameters 330-MOPTC =	OFF	DIN	KTY	TSS
Measurement voltage U_{MAX}	–	12 V		–

Table 3.1 Motor temperature monitoring specification

Attention: Contrary to DIN VDE 0660-303 (short circuit dedection < 20 Ω) the CDD3000-HF will note a short circuit at < 50 Ω.

For commissioning the correct type of temperature sensor used in the connected motor must be set up. This measure is not necessary if a matching motor data set is available.

3.3.3 Holding brake (if installed)

The holding brake is actuated via the digital output OSD03 at terminal X2. In the factory setting the wire-break and short-circuit shut-off is active by default. You can disable it by way of parameter 469_03CFL or from the DRIVEMANAGER menu by choosing > Digital outputs > Wire-break monitor.

Function		Symbol	Value		
			min.	typ	max.
Input: X2: 18 (VCC03) X2: 19 (GND03)	Voltage supply	V_{IN}	21.6 V	24 V	26.4 V
	Current consumption	I_{IN}	-	-	2.1 A
Output: X2: 20 (OSD03)	Output voltage	V_{OUT}	-	V_{IN}	-
	Output current	I_L	-	-	2.0 A
Monitoring function (shutdown)	Cable break shut-off	$I_{L(OL)}$	-	-	150 mA
	Short circuit shut-off	$I_{L(SCr)}$	-	4 A	-
Ambient temperature maximum 45°C, above that the maximum output current is reduced.					

Table 3.2 Technical data, output OSD03

Note: At a holding brake current consumption > 2 A a relay should be inserted between OSD03 and the holding brake.

3.3.4 production of encoder cables

This section is intended for users of third-party motors. Ready made-up encoder cables in various lengths are available for connection of servomotors from the LUST range.

Resolver

Which resolver?

With the CDD3000-HF drive controller, resolvers to the following specification can be evaluated:

Function	Value
Number of poles	2 - 8 (permissible number of poles: 2, or equal to number of motor poles)
Input voltage	7 V_{eff}; 4 - 20 kHz
Input current	max. 65 mA
Transformer ratio	0.5 $\pm$10%
Recommended resolver	Siemens V23401-D1001-B101 or derivatives

Table 3.3 Resolver specification

Connection

The resolver is connected via plug connection X6 to the CDD3000-HF.

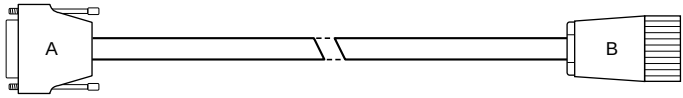


Figure 3.4 Resolver cable

Plug

Connector A (drive controller):D-Sub 9-pin plug, metal housing

Connector B (motor): custom, to motor manufacturer's specification (for LUST servomotors: signal plug, 12-pin socket, e.g. Interconnectron type PLD 121 NV 171187)

Cable type

Cable festoon compatible, e.g. Intercond 3MYI 17Z 10P (4x2x0.25 mm² + 2x1 mm²) or Lapp Unitronic FD CP TP (3x2x0.25 mm²) with UL approval.

Pin assignment

You can enter your custom assignment in the columns for connector B.

Connector A	Function	Connector B	Wire colour
CDD3000-HF-X6		Custom	
1	SIN+ (S2)		
2	SIN- (S4)		
3	COS+ (S1)		
4	GND		
5			
6	REF+ (R1) (8 kHz, approx. 7 V AC)		
7	REF- (R2) (GND)		
8	COS- (S3)		
9			
Outer shield on housing			

Table 3.4 Resolver cable pin assignment

Sinus/Cosinus encoder

With the drive controller the following rotary encoders can be evaluated:

Which encoders?

- Sine/cosine encoders from various manufacturers with zero pulse, U_V = 5 V ±5%, I_{MAX} = 150 mA (e.g. Heidenhain ERN1381, ROD486)
- Heidenhain sine/cosine encoder with SSI interface (Singleturn 13 or 25 bit and Multiturn 25 bit), U_V = 5 V ±5% , I_{MAX} = 150 mA (e.g. ECN1313))
- Stegmann SinCos encoder with HIPERFACE® interface (Single and Multiturn), U_V = 8 V, I_{MAX} = 100 mA (e.g. SRS50, SRM50)
- Toothed wheel encoder e.g. Lenord & Bauer GEL 244-KN

Connection

The optical encoder is connected via plug connection X7 to the CDD3000-HF.

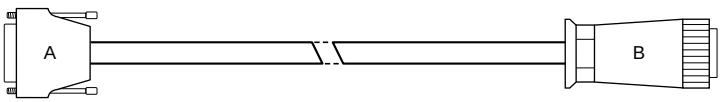


Figure 3.5 Encoder cable

Connector

Connector A (HF-drive controller)	D-Sub 15-pin plug, High-Density (as VGA plug), metal housing
Connector B (motor):	Custom, to motor manufacturer's specification

Cable types

Sine/cosine encoders with zero pulse:	Various manufacturers (3x2x0.14 mm² + 2x1 mm²) Heidenhain encoder: Cable festoon-compatible Heidenhain 244 957 01
Sine/cosine encoder with SSI interface (Heidenhain):	Cable festoon compatible, (4x2x0.14 mm² + 4x0.5 mm² + (4x0.14 mm²)) Heidenhain 266 306 01
SinCos encoder with HIPERFACE® interface (Stegmann):	e.g. Intercond special flex type 3MYI 17Z 10P ((4x2x0.25 mm² + 2x1 mm²) (UL approval))

Pin assignment

You can enter your custom assignment in the columns for connector B.

Connec-tor A	Function Sine/cosine	SSI function	HIPERFACE® function	Connec-tor B	Wire colour
CDD3000-HF X7				Custom	
1	A-	A-	REFCOS		
2	A+	A+	+COS		
3	+5 V / 150 mA	+5 V / 150 mA			
4		DATA+	Data+ RS485		
5		DATA-	Data- RS485		
6	B-	B-	REFSIN		
7			Us 7-12V / 100mA*		
8	GND	GND	GND		
9	R-				
10	R+				
11	B+	B+	+SIN		
12	+5 V / (sensor)	+5 V / (sensor)			
13	GND (sensor)	GND (sensor)			
14		CLK+			
15		CLK-			

Outer and inner shield (if fitted) on both sides of housing
* To 250 mA with external +24 V (-5 %/+20 %) supply via terminal X2 permitted.

Table 3.5 Encoder cable pin assignment

Technical data of LUST encoder cables

These cables are supplied ready made-up in various lengths.

	KRY-KSxxx[1)]	KGN-KSxxx[1)]	KGS-KSxxx[1)]	KGH-KSxxx[1)]
drive controller type	CDD3000-HF			
Motors with encoder system	R1, R2, R8, K1, K2, K8	G1	G2, G3, G5	G6, G7
Festoon-compatible	yes			

Table 3.6 Technical data of LUST encoder cables

	KRY-KSxxx[1)]	KGN-KSxxx[1)]	KGS-KSxxx[1)]	KGH-KSxxx[1)]
Minimum bending radius: in fixed installation in flexible use	90 mm	40 mm 100 mm		90 mm
Temperature range: in fixed installation in flexible use	-40 ... +85 °C	-35 ... +80 °C -35 ... +80 °C		-40 ... +85 °C
Cable diameter approx.	8.8 mm	8.0 mm		8.8 mm
Material of outer sheath	PUR	PUR		PUR
Resistance	Resistant to oil, hydrolysis and microbic attack (VDE0472), UL 20233 80 °C - 300 V	Resistant to oil, hydrolysis and microbic attack (VDE0472)		Resistant to oil, hydrolysis and microbic attack (VDE0472), UL 20233 80 °C - 300 V
1) xxx = Length of cable in metres, standard lengths: xxx = 05, 10 m; maximum 50 m (longer lengths on request)				

Table 3.6 Technical data of LUST encoder cables

Hall-IC encoder

With the CDD3000-HF motor integrated Hall-IC-switches can also be evaluated. These can be electrically aligned to 90° or 120°.

Cable type

For the evaluation of these Hall-IC's you require a cable with integrated adaptation of the Hall-IC-signals to the high frequency drive CDD3000-HF.

Connector

The two Hall-IC's must be connected via terminal X7 on the CDD3000-HF.

Figure 3.6 Hall-IC cable KHI-xxx

Wire colour	Function
red	+Ub
yollow	Hall A
green	Hall B
black	ground

Table 3.7 pin assignment KHI-xxx

3.4 Mains connection

Step	Action	Comment
1	Define the **wire cross-section** dependent on the maximum current and ambient temperature.	Wire cross-section to VDE0100, part 523
2	Wire the CDD3000-HF drive controller with the **mains filter**, max. line length 0.3 m (with unshielded cable)!	Step not applicable for BG1 to BG4; up to 11.8 kVA the mains filter is built-in.
3	Wire the **line choke**[1]**.**	Reduces the voltage distortions (THD) in the system and extends the service life.
4	Install a circuit-breaker K1 (power switch, contactor, etc.).	**Do not connect the power!**
5	Use mains fuses (type gL) or miniature circuit-breakers (trip characteristic C) to cut the mains power to all poles of the CDD3000-HF drive controller.	To protect the cable in accordance with VDE guidelines

[1] See appendix A.4.

Connection of the CDD3000-HF drive controller via a line choke with a short circuit voltage of 4 % of the mains voltage (u_k = 4 %) is obligatory:	
1.	Where the CDD3000-HF drive controller is used in applications with interference corresponding to environment class 3, as per EN 61000-2-4 and above (hostile industrial environment).
3.	Where there is a requirement to comply with the limit values for variable-speed electric drives (see standard EN 61800-3/ IEC 1800-3)
4.	Where there is a dc link between multiple CDD3000-HF drive controller.

Please note that the mains power cable and fuses used must conform to the specified listings (such as cUL, CSA).

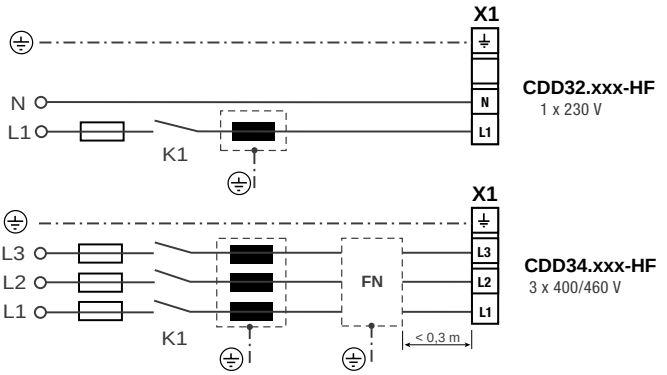


Figure 3.7 Mains connection

Attention: Danger to life! Never wire or disconnect electrical connections while they are live! Before working on the device disconnect the power. Wait until the DC-link voltage at terminals X1/L+ and L- has fallen to ≤ 60 V before working on the device.

Note the following points:

- Only all-current sensitive fault current breakers suitable for CDD3000-HF drive controller operation may be used.

- Switching the mains power: Cyclic power switching is permitted every 120 seconds; jog mode is not permitted.
  - If switching is too frequent, the device protects itself by means of 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: Not permitted!
  - In the event of a ground fault the voltage stress is around twice as high, and creepages and clearances to EN50178 are no longer maintained.

Mains filters

Size	Power range	Mains filter
BG1 ... 4	1.0 ... 11.8 kVA	Internal

1) For supplementary components see CDD3000-HF Order Catalogue

Note: Compliance with the limit curves to attenuate the line-borne interference voltage and the interference emitted from the CDD3000-HF drive controller depends on
· use of a line choke (recommended),
· the length of the motor cable and
· the pre-set clock frequency (4, 8, 12 or 16 kHz) of the CDD3000-HF drive controller power stage. For further information please contact your project engineer.

Wire cross-section

drive controller for highspeed drives	Connection load [kVA]	Max. possible wire cross-section of terminals [mm²]	Recommended mains fusing (gL) [A]
CDD32.003-HF	1.0	2.5	1 x 10
CDD32.004-HF	1.7		1 x 10
CDD32.006-HF	2.3	2.5	1 x 16
CDD32.008-HF	3.0		1 x 16
CDD34.003-HF	1.6		3 x 10
CDD34.005-HF	3.0		3 x 10
CDD34.006-HF	4.2	2.5	3 x 10
CDD34.008-HF	5.7	2.5	3 x 10
CDD34.010-HF	7.3		3 x 16
CDD34.014-HF	10.2	4.0	3 x 20
CDD34.017-HF	12.4		3 x 25
CDD34.024-HF	17.5	10	3 x 35
CDD34.032-HF	23.3		3 x 50

Table 3.8 Wire cross-sections and mains fuses (conformance to VDE 0298 is required)[1]

1) The minimum cross-section of the mains power cable is based on the local provisions (VDE 0100 Part 523, VDE 0298 Part 4), the ambient temperature and the specified rated current of the CDD3000-HF drive controller.

3.5 Braking resistor (RB)

During regenerative operation, e.g. when applying the brake to the drive, the motor returns energy to the CDD3000-HF 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 way of a braking resistor.

The switching transistor is installed as standard. The design of the external braking resistor depends on a number of drive factors: for example the load to be moved, the required dynamics of the drive or the braking and cycle duration.

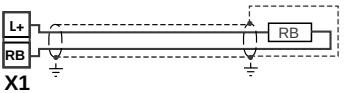


Figure 3.8 Braking resistor connection

Note: The design of the braking resistor must be clarified at the project planning stage. Please talk to us!

Attention: In device version
CDD3x.xxx-HF, Wx.x, **BR**
the braking resistor is built-in. No additional braking resistor may be connected to terminals X1/L+ and RB; this would damage the CDD3000-HF drive controller.

Attention: **Braking the drive is important to the safety of the machine or system!**
Commissioning should include a test for safe functioning of the braking system! Incorrect dimensioning (overload) could lead to destruction of the braking resistor or the braking electronics, and damage to the machine or system. Overload (failure of the braking device) can also lead to serious or fatal physical injury to human beings, for example in lifting applications!

Attention: At warning message „excessive temperature at unit heat sink“ the connected device must be separated from the mains, because an overvoltage of the mains leads to an overload of the braking resistor. Please integrate one of the digital outputs into your control concept, e.g. set OSDxx to ERRW (Warning heat sink temperature of device).

3.6 Control connections

Step	Action	Comment
1	Check whether your CDD3000-HF drive controller is fitted with a **modified software package (Sxx)** and/or a ready-to-run **data set (Dxx).** If this is the case, the control terminal assignment is different. Please contact your project engineer with regard to wiring and commissioning!!	 Position of software name plate see section 3.1 Page 3-2
2	Check whether you already have a **SmartCard** or a **DriveManager data set** with a complete device setup. If this is the case, the control terminal assignment is different. Please contact your project engineer to obtain the terminal assignment!	**Bulk customers** For details of how to load the data set into the CDD3000-HF drive controller refer to section 4.2.
3	Choose one of the preset solutions.	see section 4
4	Wire the control terminals with shielded wires. Only the ENPO signal is essential.	Ground the shields over a wide area at both ends. Wire cross-section maximum 1.5 mm² or two cores per terminal each 0.5 mm²
5	Keep all contacts open (inputs inactive).	
6	Check all connections again!	Continue with commissioning in section 4.

Note the following points:

- Always wire the control terminals with shielded cables.
- Lay the control cables separately from the mains lead and motor cable.

3.6.1 Specification of control connections

	No.	Des.	Specification	Isolation
Analog Inputs	1 2	ISA00+ ISA00-	• ISA00: U_{IN} = ± 10 V DC, resolution 12-bit, sampling time 1 ms (special function 125 µs)	
	3 4	ISA01+ ISA01-	• ISA01: U_{IN} = + 10 V DC, resolution 10-bit, sampling time 1 ms • Tolerance: ± 1% of meas. • 24 V digital input, PLC-compatible Switching level Low/High: <4.8 V / > 8 V DC Sampling time 1 ms • R_{IN} = 110 kΩ	
Digital Inputs	8 9 10 11 12	ISD00 ISD01 ISD02 ISD03 ISD04	• ISD00-ISD02: Frequency range < 500 Hz, sampling time 1ms • ISD03-ISD04: Frequency range < 500 kHz, sampling time 1ms (special functions < 2 µs) • PLC-compatible Switching level Low/High: <5 V / > 18 V DC • I_{max} (at 24 V) = 10 mA • R_{IN} = 3 kΩ	✓
	7	ENPO	• Hardware enable of power stage = High level • Specification as ISD00	✓
Digital Outputs	14	OSD00	• Short-circuit-proof • PLC-compatible, sampling time 1 ms • I_{max} = 50 mA, high-side driver • Protection against inductive load	✓

	No.	Des.	Specification	Isolation
	15	OSD01	• Short-circuit-proof • PLC-compatible, sampling time 1 ms • I_{max} = 50 mA, high-side driver • Protection against inductive load	✓
Relay output	16 17	OSD02	• Relay, 1 NO contact • 25 V / 0,25 A AC, usage category AC1 • 30 V / 0,25 A DC, usage category DC1 • Sampling time 1 ms • Operating delay approx. 10 ms	✓
Voltage supply	5 6, 13	+24 V DGND [1]	• Auxiliary voltage U_V = 24 V DC, short-circuit-proof • Tolerance: ±20% • I_{max} = 100 mA (overall, also includes driver currents for outputs OSD0x) • External 24V supply to control electronics in case of power failure possible, current consumption I_{max} = 1 A	✓
Motor holding brake	18 19 20	VCC03 GND03 OSD03	• Digital +24 V output, high-active • Short-circuit-proof • Suitable for actuation of a motor holding brake (specification, see section 3.3.3) • I_{max} = 2.0 A (current overload causes shut-off) to υ_{Umax}=45°C; reduction of I_{max} at υ_U > 45°C. • I_{min} = 150 mA (I < I_{min} wire break causes shut-off) • Separate voltage supply required: U_{IN} = + 24 V ± 10% I_{IN} = 2.1 A • Also usable as configurable digital output	✓

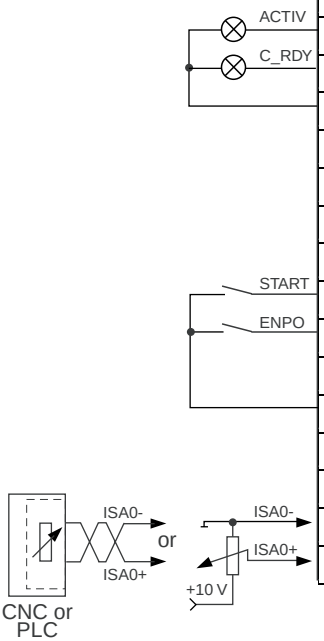
1) Functional isolation between digital (DGND) and analog (AGND) ground. For more information see section 3.6.3 "Isolation".

3.6.2 Standard terminal assignment

Terminal assignment in **factory setting**.

Features

- Preset solution, speed control with ± 10 V reference input (ISA00)



X2	Des.	Function
20	OSD03	Not assigned
19	GND03	Not assigned
18	VCC03	Not assigned
17	OSD02	Not assigned
16	OSD02	Not assigned
15	OSD01	Loop control active
14	OSD00	Device ready
13	DGND	Digital ground
12	ISD04	Not assigned
11	ISD03	Not assigned
10	ISD02	Not assigned
9	ISD01	Not assigned
8	ISD00	Start loop control
7	ENPO	Hardware enable of power
6	DGND	Digital ground
5	U_V	Auxiliary voltage 24 V
4	ISA01-	Not assigned
3	ISA01+	Not assigned
2	ISA00-	Differential analog reference -
1	ISA00+	Differential analog reference +

Figure 3.9 Standard terminal assignment

Note the following points:

- For terminal assignments for further preset solutions refer to CDD3000 Application Manual.

3.6.3 Isolation

The analog and digital inputs are isolated from each other in order to avoid transient currents and interference over the connected lines. The analog inputs are connected to the potential of the servo drive processor. The digital inputs and outputs are isolated, thereby keeping interference away from the processor and the analog signal processing.

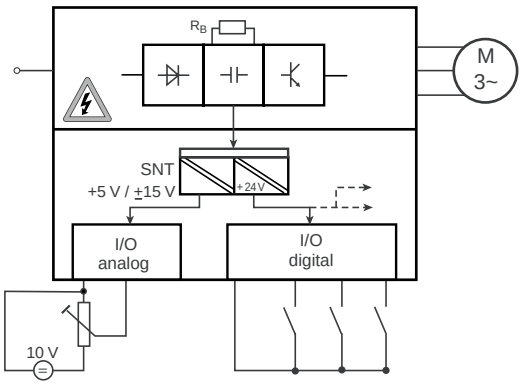


Figure 3.10 Voltage supply to I/Os

When selecting the cable, note that the cables for the analog inputs and outputs must always be shielded. The cable or wire core shield on shielded pairs should cover as large an area as possible in respect of EMC considerations, thereby providing safe discharge of high-frequency interference voltages (skin effect).

For special cases refer to the CDD3000 Application Manual.

3.7 EMC compliant installation

Servo controllers 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 and mains filter

All drive controllers CDD3000 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 up to 17 A are equipped with integrated mains filters. Compliance with the EMC product standard IEC 69800-3 (limited availability) has been tested and verified.

- Public low voltage network (first environment) living area up to a motor cable length of 10 m.

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 (second environment) industrial environment up to a motor cable length of 25 m.

For drive controllers without integrated radio interference suppression filters or for appolications with longer motor cables external mains filters must be provided. For this purpose a comprehensive mains filter program EMCxxx is available, see catalog CDD3000.

3.8 Encoder simulation - Master encoder input

The plug connection **X5** of the CDD3000-HF drive controller is designed alternatively to provide the

- incremental encoder simulation **or**
- incremental master encoder input

function. The signals are isolated from the control electronics.

Step	Action	Comment
1	Define the **function** of the connection: • Encoder simulation 3.8.1 • Master encoder input 3.8.2	
2	Specify the wire according to the application. A wire cross-section of less than 0.14 mm² should not be chosen. The differential signals (A, B and R) must be connected to twisted pair wires.	Mount shield at both ends to reduce interference emission
3	Wire the circuit according to the application	

3.8.1 Encoder simulation

Encoder simulation forms incremental encoder-compatible pulses from the position of the rotary encoder connected to the motor. Accordingly, pulses are delivered in two 90° offset signals A and B as well as a zero pulse R.

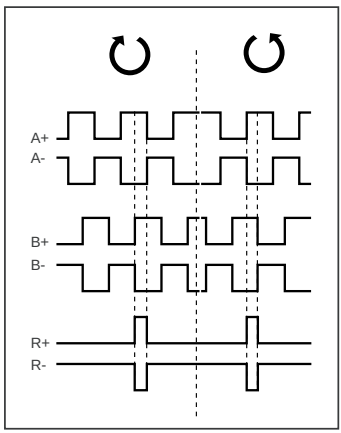
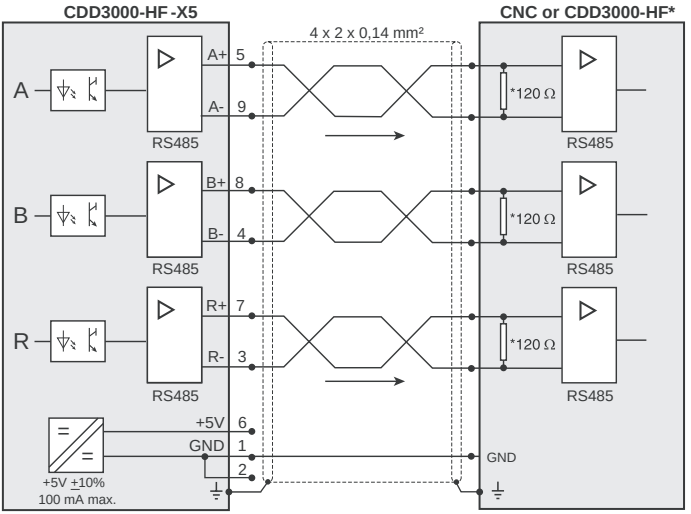


Figure 3.11 Encoder simulation signals looking onto the motor shaft (at left when motor rotating clockwise)

The resolution of the encoder simulation is adjustable when a resolver is used; when incremental encoders are used it corresponds to the resolution of the connected encoder. Rotary encoders of type G2-G6 emit no zero pulse.



* CDD3000-HF does not include wave terminating resistor.
It must be wired externally.

Figure 3.12 Encoder simulation connection and signal description

Electrical specification

Interface: RS422
Recommended wire cross-section >0.14 mm²
(e.g. 3x2x0.14 mm²)
Max. cable length 10 m
Connector: 9-pin D-SUB, socket

	min.	max.	Comments
Output frequency	0 Hz	500 kHz	
Output voltage			
• High level	2.5 V	-	(I_{OH} = -20 mA)
• Low level	-	0.5 V	(I_{OL} = 48 mA)
• Differential	2.0 V	-	

Table 3.9 Encoder simulation electrical specification

The controller connected to the encoder simulation must be able to process its output frequencies.

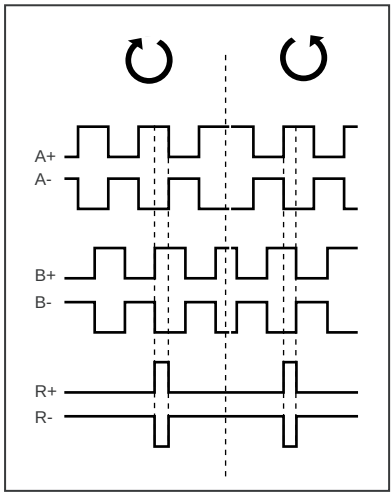
Example:

$$f = \frac{3000\text{min}^{-1} \cdot 2048\text{Impulse}}{60\text{min}^{-1}\text{s}} = 102,4\text{kHz}$$

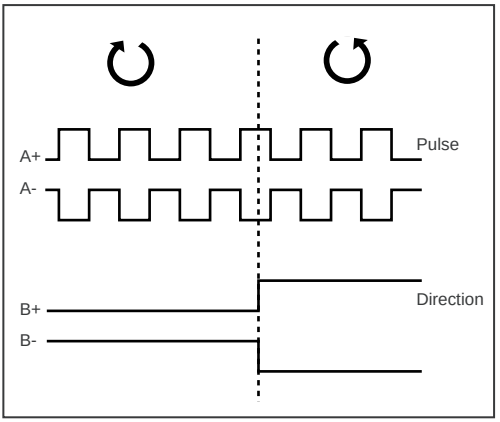
3.8.2 Master encoder

The master encoder input **X5** permits incremental reference input for loop control. The reference generator is either the encoder simulation of another CDD3000-HF drive controller, a standard commercially available incremental encoder or a stepper motor controller. The signal shape corresponds either to

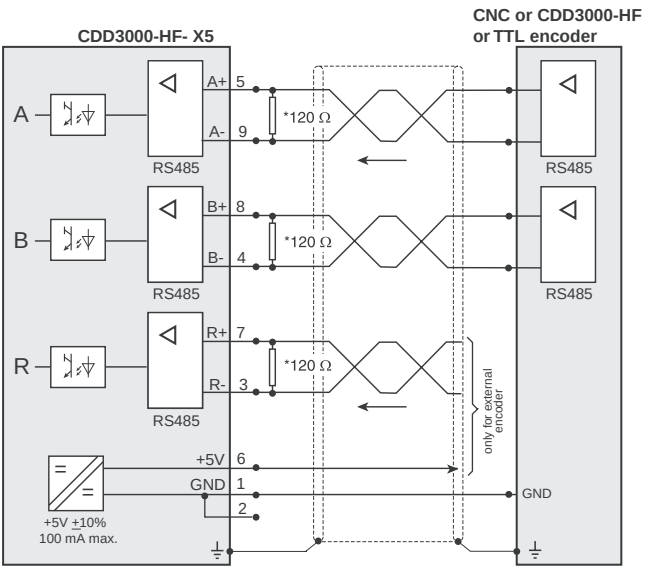
- **A/B incremental encoder signals** or



- **pulse direction signals** when a stepper motor controller is connected.



Parameters to evaluate the signals can be set for signal type, lines per revolution and transmission ratio.



* For the CDD3000-HF the wave terminating resistor must be connected externally

Figure 3.13 Master encoder input connection and signal description

Electrical specification

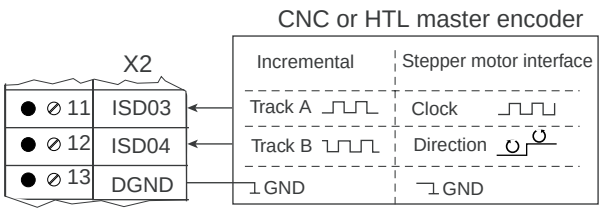
Interface: RS422
Recommended wire cross-section >0.14 mm²
(e.g. 3x2x0.14 mm²)
Max. cable length 10 m
Connector: 9-pin D-SUB, socket

	min.	max.	Type
Input frequency	0 Hz	500 kHz	
Input voltage • High level • Low level • Differential	 0.2 V -	 - 0.2 V ± 6 V	
Wave terminating resistance			120 Ω
Voltage supply to external encoder	4.5 V	5.5 V	5 V / 100 mA

Table 3.10 Master encoder input electrical specification

HTL master encoder

A master encoder with HTL level (24V) can alternatively be connected via control terminal X2. Digital inputs ISD03 and ISD04 are used for this.



You will find the specification of the digital inputs of control terminal X2 in section 3.6 "Control connections".

Note: When a HTL master encoder is in use, both the encoder simulation and the master encoder input at X5 are inactive.

TTL encoder

A rotary encoder with TTL level can also be connected to master encoder input X5. For the terminal assignment refer to Figure 3.13 .

Attention: Operation of a synchronous high frequency motor with a TTL encoder additionally requires setting of the commutation detection parameters. (For more information on this refer to the CDD3000 Application Manual). This setting is not required for asynchronous motors.

4 Commissioning

4.1 Choice of commissioning 4-2
4.2 Serial commissioning 4-2
4.2.1 Serial commissioning with DRIVEMANAGER 4-2
4.2.2 Serial commissioning with KEYPAD 4-4
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4.3.2 Selecting preset solution 4-9
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4.3.5 Setting function parameters 4-14
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4.3.9 Saving settings 4-17
4.4 Test run 4-18
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4.6 Operation with KEYPAD KP200 4-24

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 are already complete. • Loading of an existing data set.	Serial commissioning	Page 4-2
• Initial project planning and commissioning of the drive system	Initial commissioning	Page 4-6
• Project planning and basic setting of the drive system have been carried out.	Test run	Page 4-18

4.2 Serial commissioning

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

If you already have a complete data set, skip the paragraphs headed *"Saving a data set from the device to a file"* (with DRIVEMANAGER, steps 1-4) and *"Saving a data set to a SMARTCARD"* (with KEYPAD).

A test run is essential, see section 4.4.

4.2.1 Serial commissioning with DRIVEMANAGER

Precondition:

- All CDD3000-HFs are fully connected.
- The **first** drive is already fully commissioned.
- A PC with installed DRIVEMANAGER user software (V3.4 or higher) is connected.

Saving a data set from the device to a file

Step	Action	Comments
1	Connect your PC to the CDD3000-HF of the **first** drive and switch on the power to the CDD3000-HF.	Use a standard serial cable (9-pin D-SUB, pin-and-socket) e.g. LUST accessory CCD-SUB90x .
2	START DriveManager.	Automatically connects to the linked CDD3000-HF.
	If the connection fails, check the bus settings in the **Communication** > **Bus Configuration** menu and try again by clicking on the icon. 	
3	Save the current settings by clicking on the icon  , either in the parameter database (directory: c:/../userdata) of the DRIVEMANAGER or to a floppy disk (a:/).	Clicking on the icon always saves the current settings of the connected device. Assign the file a name of your choice. If you are using the “Positioning, fully programming” preset, also save the positioning programs and data.[1)]
4	Disconnect with 	
5	Connect your PC to the CDD3000-HF of the **next** drive and switch on the power to the CDD3000-HF.	
6	Click on the icon to make a connection between the DRIVEMANAGER and the newly connected device. 	
7	Choose the icon  to load the data set saved in step 3 into the device (select all files).	The data set is stored in the device. The selection box shows all the stored files in the data set.
8	Save the setting by clicking on the “Save setting in device” button. 	
	Repeat steps 5 ... 8 on each additional CDD3000-HF.	

1) For details of save operation see Section 4.3.9.

Load data set from file into device

Remember to save setting.

Note: For more information refer to the DRIVEMANAGER Manual.

4.2.2 Serial commissioning with KEYPAD

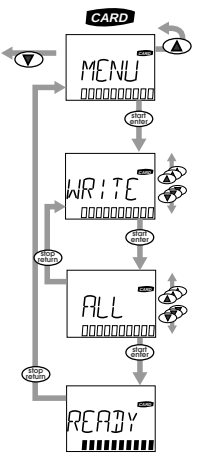
Note: Serial commissioning with KEYPAD is **not** possible with a position controlled preset solution.

Precondition:

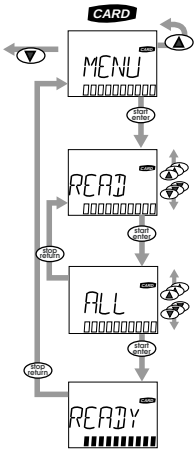
- All CDD3000-HF drive controller are fully connected.
- The **first** drive is already fully commissioned.

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

Saving a data set to a SMARTCARD

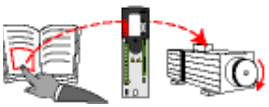
Step	Action	Comment	Display
1	Connect the KEYPAD to the CDD3000-HF of the **first** drive, insert a SMARTCARD and switch on the power.		
2	Press **stop/return** twice to call up the CARD menu.	= Load/save with the SMARTCARD	
3	Choose WRITE.	= Save data set	
4	Choose ALL and start the save operation with the *start/enter key.*	= Complete data set is saved	
5	READY appears.	= Save operation completed without error	
	By this action you have written your data set to a SMARTCARD.		

Load data set from SMARTCARD into next CDD3000-HF

Step	Action	Comment	Display
1	Connect the KEYPAD to the CDD3000-HF of the **next** drive, insert the SMARTCARD with the desired data set and switch on the power.		
2	Choose the CARD menu.	= Load/save with the SMARTCARD	
3	Choose READ.	= Load data set	
4	Choose ALL and start the load operation with the *start/enter key.*	= Complete data set is loaded	
5	READY appears.	= Load operation completed without error	
	Repeat the load operation on each additional drive.		

Note: The data set is automatically saved in the CDD3000-HF.

4.3 Initial commissioning



Preconditions:

- The CDD3000-HF is fully connected; see Section 3
- Installed DRIVEMANAGER version V3.4 or higher
- Motor database for LUST servomotors is installed on the PC
- Device is connected to PC via RS232 interface (X4)

Attention: Never wire or disconnect electrical connections while they are live!
Before working on the device disconnect the power. Wait for the DC-link capacitors to discharge. Work may only be carried out on the device when the residual voltage (between terminals L+ and L-) is below 60 V!

Connect input ENPO = Low level at terminal 7 (X2) to prevent unintentional startup of the motor (power stage disabled, CDD3000-HF power on).

Preparations:

- Switch on the CDD3000-HF.
  A self-test is carried out.
- Start the DRIVEMANAGER.
- Connect to the device.

DRIVEMANAGER
Connect
or:
Communication > Connect...

DRIVEMANAGER CDD3000-HF setup

or: Active device > Change settings

Open the main window „Adjust CDD3000“:

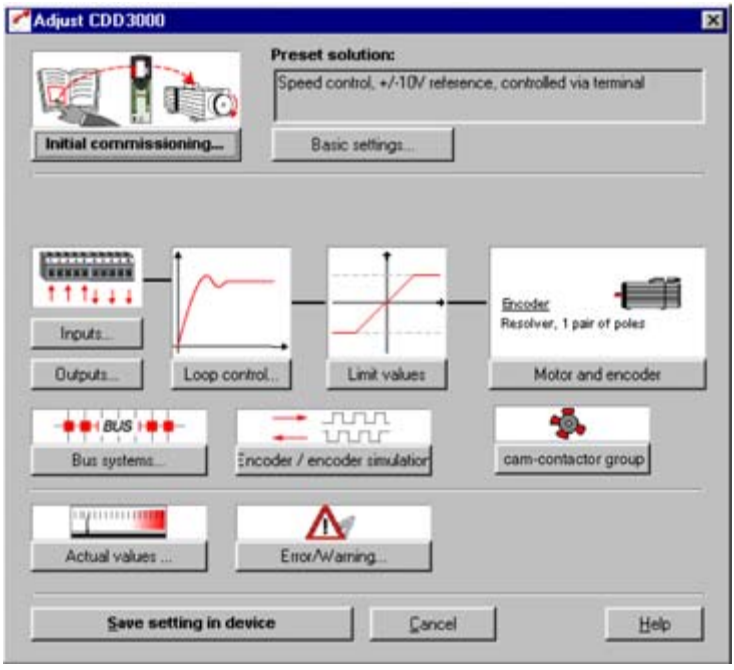
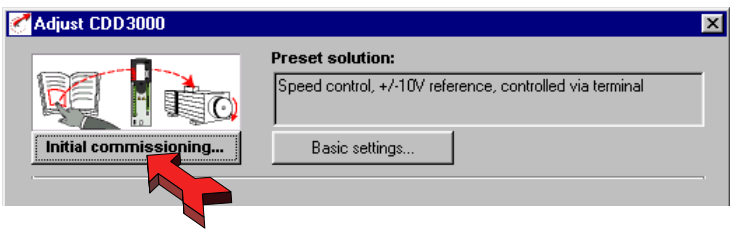


Figure 4.1 Main window for the various settings in the DRIVEMANAGER.

Continue with:



4.3.1 Selecting the unit for speed values

The CDD3000-HF provides the possibility to evaluate all nominal and actual speed values in the units [Hz] or [rpm].

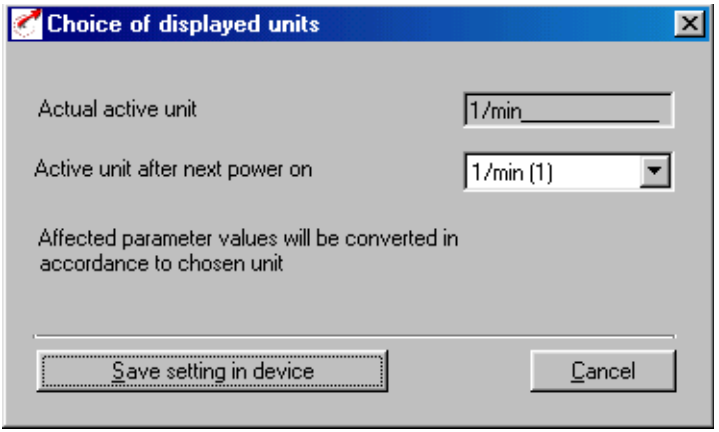


Bild 4.2

The desired unit can be set under the option "Selection of display unit". All parameters concerned will be converted to the newly selected unit.

4.3.2 Selecting preset solution

Preset solutions

The preset solution is selected according to the type of drive task. A preset solution is a presetting of the CDD3000-HF which can subsequently be adapted to the application.

The CDD3000-HF provides a wide range of preset solutions, each described briefly in the DRIVEMANAGER. The application preset by a preset solution can optionally be controlled via the control terminals or over a field bus.

The preset solutions are:

- Torque control, ±10V reference (TCT_1)
- Speed control with external position control (SCT_1)
- Speed control, ±10V reference (SCT_2, SCB_2)
- Speed control, fixed speeds (SCT_3, SCB_3)
- Speed control, pulse input (SCT_4, SCB_4)
- Speed control, reference and control over fieldbus (SCB_5)
- Electronic gearing (PCT_1, PCB_1)
- Positioning over fieldbus (PCB_2)
- Positioning, fixed positions (PCT_3, PCB_3)
- Positioning, fully programmable (PCT_4, PCB_4)

With the DRIVEMANAGER the desired preset solution can be selected and modified.

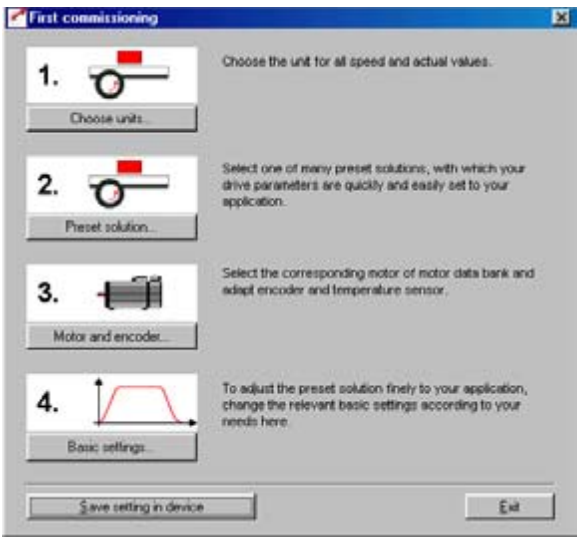


Figure 4.3 Initial commissioning

Select the preset solution matching your application. The various screens list the application and functional features offered by the individual solutions.

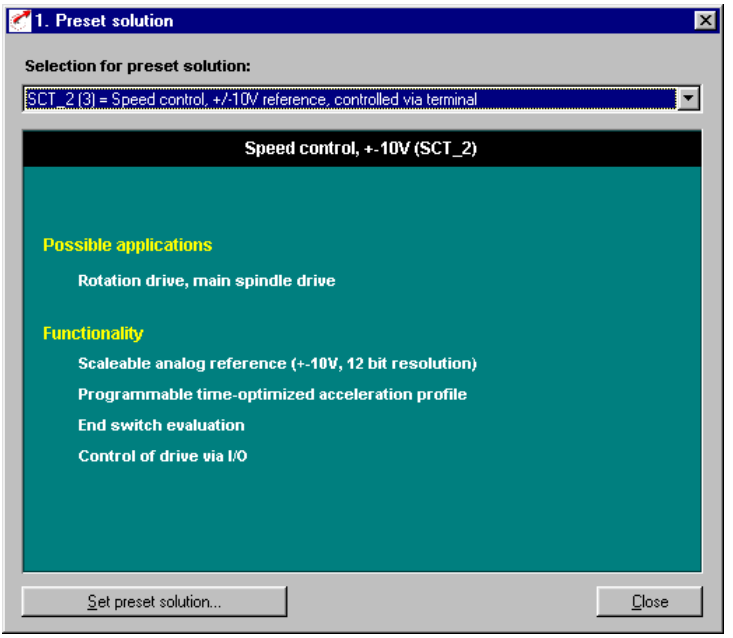


Figure 4.4 Selection of preset solution

Note: For detailed information on preset solutions and on terminal assignment refer to the CDD3000 Application Manual.

4.3.3 Setting the motor and encoder

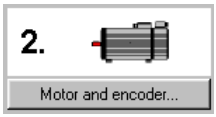


Figure 4.5 Motor and encoder setup

Setting the motor data

A database is available containing the settings for all Lust servomotor. Using the correct motor data set ensures

- that the electrical parameters of the motor are correctly set,
- that the motor protection (“Motorprotection” tab) is correctly set and
- that the control circuits of the drive are preset.

Note: The torque controller is set up optimally, so no further adjustments are necessary.
The setting of the speed controller is based on the assumption that the machine moment of inertia reduced onto the motor shaft is equal to the motor moment of inertia.
The speed and position controllers offer a high degree of damping, and so are also suitable for loop control of elastic mechanisms.

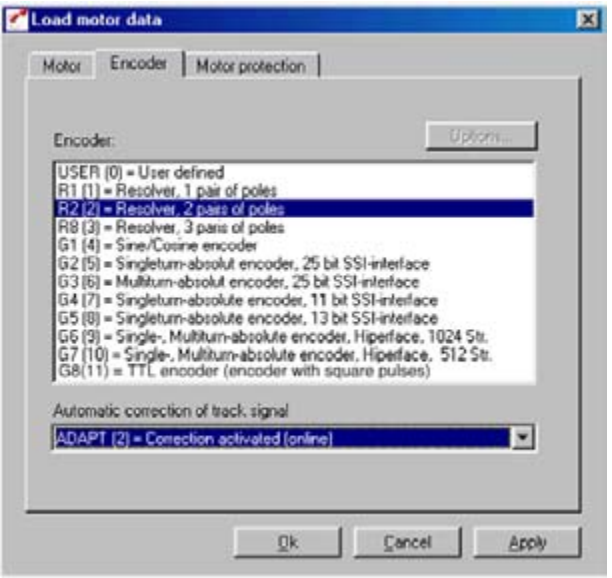
For special settings to optimize the speed and position control loops, please use the CDD3000 Application Manual.

Click on the “Other Motor” button on the “Motor” tab to select the right motor from your installed database. The motor type is indicated on its name plate. If the motor data set is supplied on a data carrier (floppy disk, CD-ROM), it can be loaded directly by clicking on the “Change directory” button.

If you are using a motor which is not in the database, Lust Antriebstechnik GmbH offers custom data sets as a special service. Please consult your project engineer on this.

Setting of the rotary encoder

The rotary encoder connected to the motor is set up on the Encoder tab. Resolvers are assigned the abbreviation Rx, encoders Gx. The encoder used is entered on the motor name plate.



Example:

Type ASM-11-20**R2**3 specifies the setting by the designation **R2** (resolver, 2 pole pairs), here shown in bold as an example.

When selecting a user-defined encoder type, the settings are entered under “Optionen...”. For notes on the specification of rotary encoders refer to Appendix A.5.

The automatic track signal correction enhances the smooth running of the drive. It can be applied with values stored once on the basis of a teach-in process, or in online adaptive mode.

For more information on setting up user-defined encoders and on automatic track signal correction refer to the CDD3000 Application Manual.

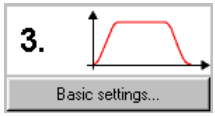
Checking the encoder

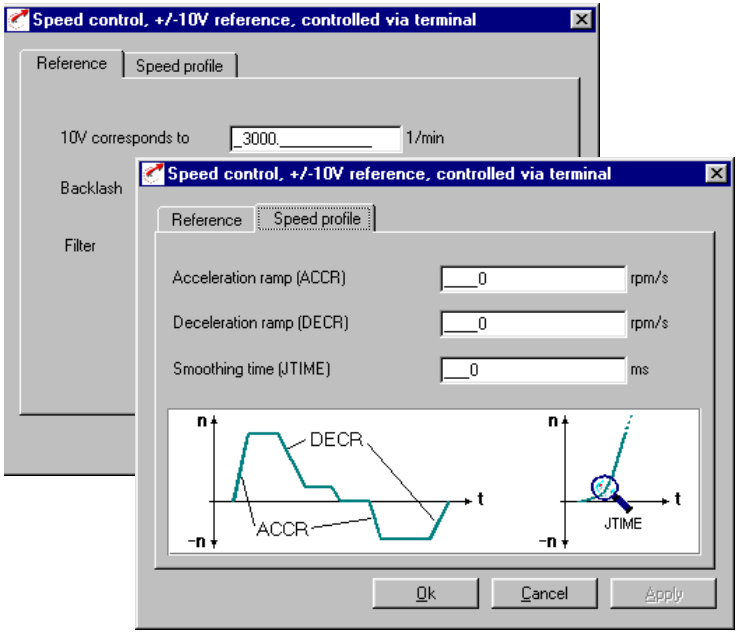
To check the encoder the motor shaft is rotated by hand. The viewing angle when checking is from the front onto the shaft end (flange). The “CDD3000-HF reference and actual values” status display, under “nist, Actual speed”, must indicate a positive speed in clockwise rotation and a negative speed in counter-clockwise rotation. If the speed is incorrect, the following points must be checked (see also section 3.3.4):

- Is the encoder cable correctly connected to the motor and the CDD3000-HF ?
- Is the encoder cable in use the correct one for the type of encoder ?

4.3.4 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. For a detailed description of the individual functions refer to the CDD3000 Application Manual.





4.3.5 Setting function parameters

Once the preset solution, its basic settings and the motor data have been set, general function settings can also be made.

In contrast to the basic settings, the functions are independent of the preset solution.

Example:
Setting “max. torque”

The required functions, such as the maximum torque, can be programmed using the DRIVEMANAGER. When you select “Limit values”:

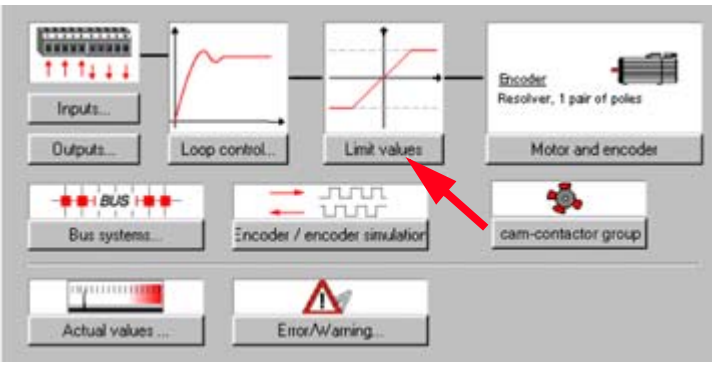
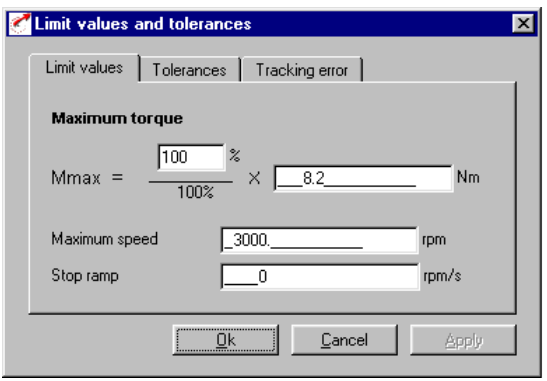


Figure 4.6 Parameter setting in the DRIVEMANAGER:

this window opens up:



The maximum torque can be set on the “Limit values” tab.

4.3.6 Safety functions

Check the safety relevant parameters.
The "Limit value" function can be used to enter further limit values for the max. speed or the overspeed threshold besides the maximum torque.

Please check also the data for motor protection in the motor and transducer function. In the window "Motor protection“ you can set the warning and maximum temperatures for the motor sensor (KTY).

Bild 4.7 DRIVEMANAGER mask "Motor protection"

4.3.7 Motor filter

Sinusoidal filter

For the reduction of harmonic waves motor filters in the form of motor choke or LC-sinusiodal filters are used in certain applications.

In the regulation of synchronous machines the use of sinusoidal filters for the reduction of harmonic waves is supported. The capacitance value is entered under "Sine filter". If only a motor choke is used, this must be entered in the field "Motor choke", irrespective of the motor type.

Bild 4.8 DRIVEMANAGER mask "Motor filter"

4.3.8 Switching frequency

For high frequency applications the switching frequency of the output stage should be at least 10 times the value of the output frequency.

The switching frequency can be selected under "Control - output stage". Please observe the permissible current load of the output stage for the different switching frequencies (see appendix A1).

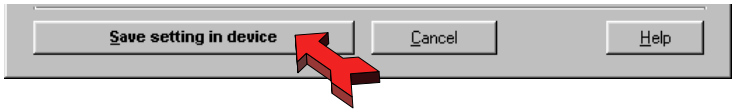
4.3.9 Saving settings

DRIVEMANAGER
CDD3000-HF setup

or: Active device > Change settings

Saving the settings in the device

Any changes which are to be stored permanently in the device must be saved by way of the *CDD3000-HF setup* screen.

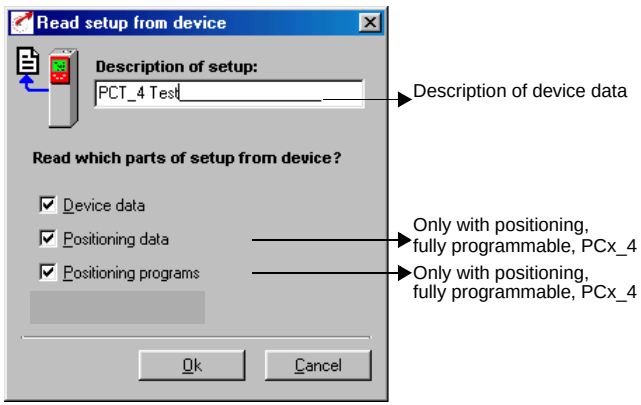


The changes made can also be saved to a file.

DRIVEMANAGER
CDD3000-HF setup

or: Active device> Save device settings to>file

Saving the settings to a file



Depending on the preset solution, the CDD3000-HF has a range of data sets which together form the device configuration.

Save…	Necessary with preset solution	With KEYPAD to SMARTCARD	With DRIVEMANAGER to file
Device data (="Settings") (device settings and motor data)	All	yes	yes (*.00D), (*.00T), (*.00X)
Positioning data (variables, flags and table position of sequence control)	Positioning, fully programmable (PCT_4 PCB_4)	no	yes (*.01D), (*.01T), (*.01X)
Sequence programs	Positioning, fully programmable (PCT_4 PCB_4)	no	yes (*.prg)

Choose the file name (e.g. mydata). Then the data sets are selected depending on the preset solution. All files are saved under the chosen file names (e.g. mydata) with the appropriate extension (*.00D). The device data can be assigned a description prior to saving.

Continue with:"Test run", see section 4.4.

4.4 Test run

The drive is tested without the coupled mechanism. The test run is carried out in speed controlled mode, independently of the chosen preset solution.

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

Attention: Test run with installed servomotor:
In this case it must be ensured that the test does not damage the system! In particular, pay attention to positioning range limits.
Please note that you yourself are responsible for safe operation. Lust Antriebstechnik GmbH cannot be held responsible for any damage incurred.

Danger to life from uncontrolled rotation!
Before motors with a feather key at the shaft end are commissioned, the feather key should be secured against being ejected, if this cannot be prevented by drive elements such as pulleys, couplings, or the like.

Preset solution, torque control:
In this preset solution the drive must not be run without load torque, otherwise the motor shaft would accelerate uncontrolled up to the preset speed limit.

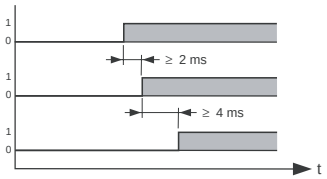
Attention: Destruction of the motor:
The motors are intended for service on the CDD3000-HF highspeed drives. Direct connection to the mains may lead to destruction of the motor.
The motors may be subject to surface temperatures of over 100 °C. Temperature-sensitive items should therefore not be placed on top of or attached to the motors. Protective measures may be needed to prevent touching.
The temperature sensor installed in the winding is to be connected to the CDD3000-HF in order to prevent overheating of the motor by the temperature monitor.
The brake (if installed) should be checked for fault-free functioning before installation of the motor.
The standstill holding brake (installation optional) is only designed for a limited number of emergency brakings. Use as a working brake is prohibited.

1. Set power stage enable ENPO
High level at terminal 7 (X2)

ENPO input

Start input

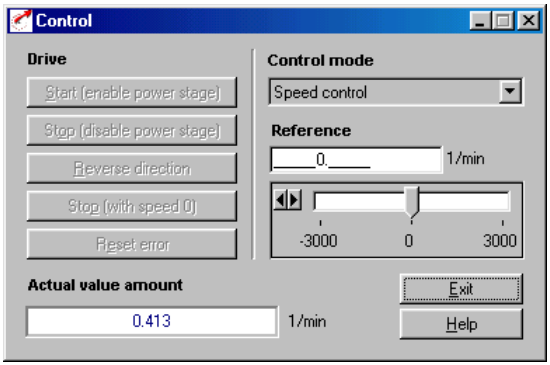
Device status:
“Loop control active”



Pay attention to the time response of the inputs.

2. Control with DRIVEMANAGER:
Set the ENPO input, select “Speed control” and start the drive, e.g. at reference speed 100 rpm.

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

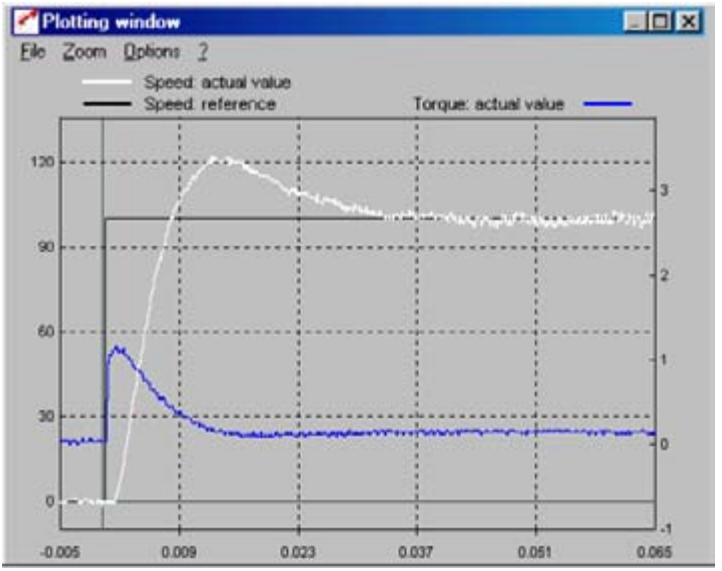


DRIVEMANAGER
Digital scope
or:
Active device > Monitoring > Quickly changing digital scope values

Check the drive response
Now you can assess the drive response with the aid of step responses, which can be recorded using the DRIVEMANAGER's digital scope function. Select the following four recording variables:

- 0: Speed: Reference
- 1: Speed: Actual
- 2: Torque: Reference
- 3: Torque: Actual

Trigger condition:
Channel 0; rising edge, pretrigger 10%; level: 30 rpm



Start the drive with a reference value of 100 rpm for example.
Compare the step response of your drive with the diagram. With resolvers the overshoot of the actual speed should be around 20 %; with sin/cos incremental encoders around 30 % (referred to the reference value). Make sure the drive system exhibits small signal response (the torque reference value must be less than the maximum).

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 more or less matches the diagram, you can be sure that the motor phases are correctly wired, the encoder is correctly connected, and the CDD3000-HF parameters are set to the correct motor.

If the step response deviates severely from the diagram, it is to be assumed that

- the motor data set was selected incorrectly, or
- the cabling is faulty

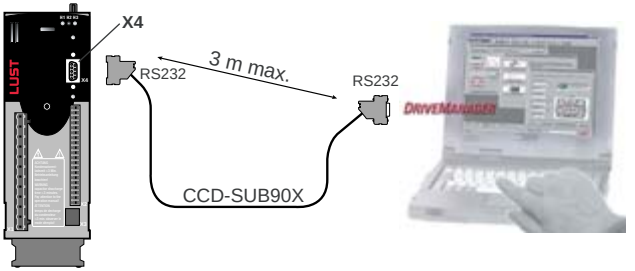
Check the individual steps from Section 3 "Installation" and Section 4.3 "Initial commissioning" and repeat the test run.

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 loops, please use the CDD3000 Application Manual.

4.5 Operation with DRIVEMANAGER

Precondition:

DRIVEMANAGER user software (version V3.4 or higher) installed on the PC.



CDD3000-HF connection to PC/DRIVEMANAGER

The key functions

For more information refer to the DRIVEMANAGER Manual.

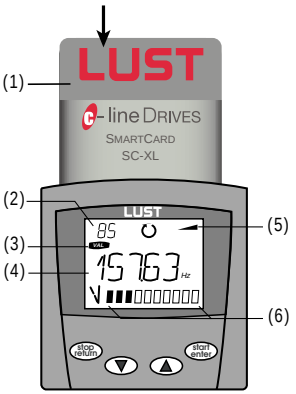
Icon	Function	Menu
	Connect to device	Communication > Connect > Single device
	Change device settings	Active device > Change settings
	Print parameter data set	Active device > Print settings
	Control drive	Active device > Open-loop control > Basic operation modes, no position references
	Digital scope	Active device > Monitoring > Quickly changing digital scope values

Icon	Function	Menu
	Save settings from device to file	Active device > Save device settings to
	Load settings from file into device	Active device > Load device settings from
	Bus initialization (change settings)	
	Disconnect from device	Cut all device connections
	Compare device settings	Active device> Compare settings

4.6 Operation with KEYPAD KP200

The KEYPAD can be plugged directly into slot X4 of the CDD3000-HF.

KEYPAD KP200 overview



(1) Chipcard (SMARTCARD) to back-up and transfer settings

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

(3) Current menu

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

(5) Acceleration or braking ramp active

(6) Bar graph display, 10-digit

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

stop return — Quit menu branches; cancel changes; stop in “Control drive” mode

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

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

Figure 4.1 Controls and displays on the KEYPAD KP200

Menu structure

The KEYPAD KP200 offers a user-friendly menu structure, shown below.

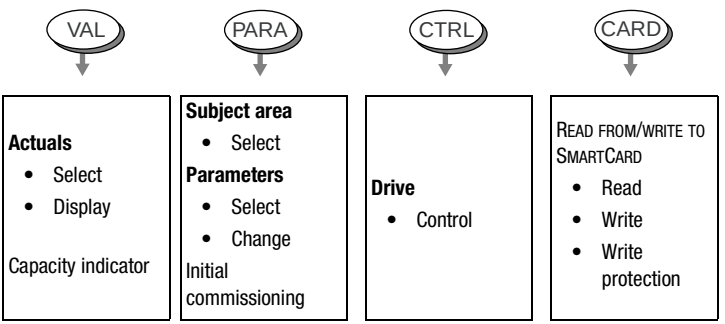


Figure 4.2 Functions of the menus

Example parameter setting (PARA menu)

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

1. Select PARA menu.

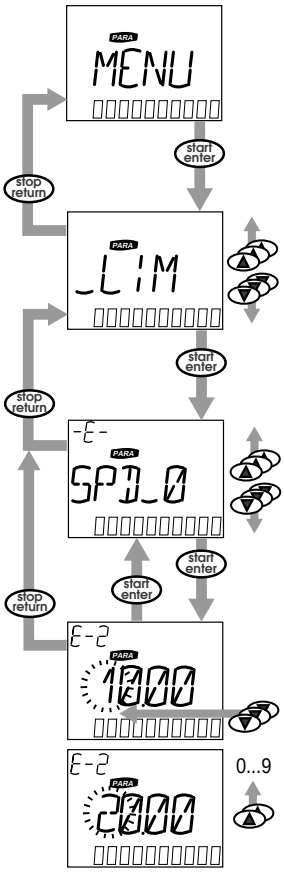
2. Select desired subject area with cursor keys and confirm with **start/enter**.

3. Select desired parameter with cursor keys (pay attention to user level).

4. The current value is displayed, with the last character flashing. Switch to the next character using the **down key**. Use the **up key** to change the flashing character. The fifth character at the extreme left indicates the preceding sign: (–) = minus.

The last character can be entered as an exponent.

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



CARD menu

It is not possible to use the Card menu or save data on the SMARTCARD for position controlled preset solutions!

Read from/write to SMARTCARD:

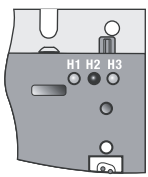
- In this menu CDD3000-HF settings can be saved to the SMARTCARD and transferred to other CDD3000-HF.
- In every storage operation **all** parameters are always saved to the SMARTCARD. For read operations, either all parameters or only parameters for motor setup (per read operation) can be read-in.

Function	Meaning
READ > ALL	Read all parameters from SMARTCARD
READ > DRIVE	Parameters from subject area, e.g. read-in motor settings
WRITE	Store all parameters on the SMARTCARD
LOCK	Write-protect the SMARTCARD
UNLOCK	Cancel the write protection

5 Diagnosis/Fault rectification

5.1 LEDs 5-1
5.2 Fault response.....5-2
5.3 Error messages 5-3
5.4 Resetting errors 5-4
5.5 User errors in KEYPAD operation 5-5
5.6 User errors in SMARTCARD operation 5-5
5.7 Errors in power switching 5-5
5.8 Reset 5-6

5.1 LEDs



At the top right of the CDD3000-HF there are three status LEDs coloured red (H1), yellow (H2) and green (H3).

Device status	Red LED (H1)	Yellow LED (H2)	Green LED (H3)
Power on	❍	❍	●
CDD3000-HF ready (ENPO set)	❍	●	●
Control enabled	❍	✳	●
Error	✳ F(flash code)	❍	●
Warning (in “ready” condition)	●	●	●
Warning (in “control enabled” condition)	●	✳	●
❍LED off, ● LED on, ✳ LED flashing			

DE
EN

5.2 Fault response

When a fault occurs the CDD3000-HF responds with a specific function sequence. This is allocated to a corresponding **response number**.

Display KeyPad	Response no.	Function
WARN	0	Signal error only, no further response (warning)
HALT	1	Signal error and disable power stage
STOP	2	Signal error, quick-stop and wait for cancellation of start signal
LOCKH	3	Signal error, disable power stage and secure against restarting [1)]
LOCKS	4	Signal error, quick-stop, wait for cancellation of start signal and secure against restarting [1)]
RESET	5	Signal error, disable power stage and wait for error reset; error reset only possible by complete cutting of power.

1) Only relevant with programmed autostart function.

5.3 Error messages

If a fault occurs in operation it is indicated by a flash code from LED H1 (red) on the CDD3000-HF. If a KP200 is connected the KP200 indicates the error type as an abbreviation. When the DRIVEMANAGER is active the error is additionally reported in plain text.

Flash code of red LED H1	Display KEYPAD	Response No.	Explanation	Cause/Remedy
1x	Various messages	0-5	Various errors	See Application Manual, Appendix B, Fault rectification
2x	E-0FF	1	Undervoltage shut-off	Check power supply. Also occurs briefly in response to normal power-off.
3x	E-0C	3	Current overload shut-off	Short-circuit, ground fault: Check cabling of connections, check motor coil, check neutral conductor and grounding (see also section 3, Installation). Device setup not correct: Check parameters of control loops. Check ramp setting.
4x	E-0V	3	Voltage overload shut-off	Voltage overload from mains: Check mains voltage. Restart device. Voltage overload resulting from feedback from motor (regenerative operation): Slow down braking ramps. If not possible, use a braking resistor.
5x	E-0LM	3	Motor protection shut-off	Motor overloaded (after I x t monitoring): Slow down process cycle rate if possible. Check motor dimensioning.
6x	E-0LI	3	Device protection shut-off	Device overloaded: Check dimensioning. Possibly use a larger device.
7x	E-0TM	3	Motor temperature too high	Motor PTC correctly connected?: Motor PTC evaluation correctly set? Motor overloaded? Allow motor to cool down. Check dimensioning.
8x	E-0TI	3	Overheating in CDD3000-HF	Ambient temperature too high: Improve ventilation in switch cabinet. Load too high during driving/braking: Check dimensioning. Possibly use a braking resistor.

Table 5.1 Error messages

Helpline

If you need further assistance, our specialists at the Lust Helpline will be glad to help.

You can reach us:

Mon.-Thur.: 8 a.m. - 4.30 p.m. Tel. +49-6441/966-180, Fax -177
Fri.: 8 a.m. - 4 p.m. Tel. +49-6441/966-180, Fax -177
E-mail: helpline@lust-tec.de

5.4 Resetting errors

Resetting errors (after eliminating the cause)

Resetting errors with response number 1 to 4 (WRN-LOCKS):

- In control via terminals: rising edge at **input ENPO** (attention: control is shut off!) or: with input Ixxx, to which the function FIxxx = RSERR (Reset Error) is assigned
- In control via KeyPad: press **stop/return** key on KeyPad for approx. 3 seconds
- In control via DRIVEMANAGER: click on “Reset error” button
- In control via fieldbus: set “Reset error” bit in bus control word

Starting the drive after an error

- Cancel start signal and reapply it.
- With programmed auto-start function:
  - In error responses 1 and 2 the drive automatically restarts when the error is reset.
  - In error responses 3 and 4 the drive does not restart until the start signal has been withdrawn and re-sent.

Resetting errors with response number 5 (RESET):

Errors with response number 5 (RESET) are serious device errors. They can only be reset by switching all supply voltages (mains, possibly 24V) off and back on again.

5.5 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 KeyPad USER ERROR: Reset with **start/enter***

5.6 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 CDD3000-HF type	
ERR94	SmartCard not readable, parameter not compatible	
ERR96	Connection to SmartCard broken	
ERR97	SmartCard DATA invalid (checksum)	
ERR98	Insufficient memory on SmartCard	
ERR99	Selected area not present on SmartCard, no parameters transferred to SmartCard	

*Table 5.3 SmartCarderror: Reset with **stop/return***

5.7 Errors in power switching

Error	Cause	Remedy
Power on. CDD3000-HF shows no response (LEDs off).	If switching is too frequent, the device protects itself by means of high-resistance isolation from the system.	After a rest phase of a few minutes the device is ready to start once again.

5.8 Reset

Parameter reset

In PARA menu of KEYPAD:
Press the two cursor keys to reset the parameter currently being edited to the factory defaults.

In the DRIVEMANAGER:
In the focused setup window by pressing the F1 key. The factory setting of the parameter is indicated on the “Value range” tab and is to be entered there.

Factory setting

KEYPAD:
Press both KEYPAD cursor keys simultaneously during CDD3000-HF power-up to reset all parameters to their factory defaults and the system is reinitialized.

DRIVEMANAGER:
Select the “Reset to factory setting” function from the “Active Device” menu.

Note: Attention! Resetting the factory defaults will delete the motor data settings and the preset solution “SCT_2-Speed control, ±10 V reference, controlled via terminal” will be loaded. Pay attention to the terminal assignment and the functionality of the CDD3000-HF in this preset solution.

A Appendix

A.1 Technical data A-2
A.2 Ambient conditions A-8
A.3 Project planning notes, “Cold plate” A-9
A.4 Change in system load through use of a line choke A-10
A.5 UL approbation A-12
A.6 Layout A-14

A.1 Technical data

CDD32.003-HF to CDD34.006-HF

Designation / Technical data	CDD32.003-HF	CDD32.004-HF	CDD32.006-HF	CDD32.008-HF	CDD34.003-HF	CDD34.005-HF	CDD34.006-HF
Output, motor end[1)]							
Device rated power	1.0 kVA	1.6 kVA	2.2 kVA	2.8 kVA	1.5 kVA	2.8 kVA	3.9 kVA
voltage	3 x 0 ... 230 V				3 x 0 ... 400/460 V		
Continuous current (RMS) (I_N)	2.4 A	4.0 A	5.5 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	9.9 A	12.8 A	4.0 A	7.4 A	10.3 A
Rotating field frequency	0 ... 1600 Hz						
Switching frequency of power stage	4, **8**, 12, 16 kHz						
Input, mains side							
Mains voltage	1 x 230 V -20 % +15 %				3 x 400 V / 3 x 460 V -25 % +10 %		
Current (with line choke)	4.4 A	7.3 A	10.0 A	12.9 A	2.3 A	4.3 A	6.0 A
Asymmetry of mains voltage	–				±3 % max.		
Frequency	50/60 Hz ±10 %				50/60 Hz ±10 %		
Power loss at 4 / 8.16 kHz [W]	49 / 52	63 / 70	90 / 97	110 / 120	70 / 85	95 / 127	121 / 163
Braking chopper power electronics							
Peak braking power with int. braking resistor (only with version CDD34 ..., Wx.x, BR)	-		-		–	–	1.6 kW at 360 Ω
Minimum ohmic resistance of an externally installed braking resistor	100 Ω		56 Ω		180 Ω		

1) Data referred to output voltage 230 V/400 V and switching frequency 8 kHz

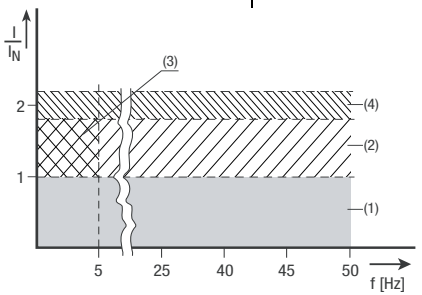
CDD34.008-HF to CDD34.032-HF

Designation / Technical data	CDD34.008-HF	CDD34.010-HF	CDD34.014-HF	CDD34.017-HF	CDD34.024-HF	CDD34.032-HF
Output, motor end[1)]						
Device rated power	5.4 kVA	6.9 kVA	9.7 kVA	11.8 kVA	16.6 kVA	22.2 kVA
Voltage	3 x 0 ... 400/460 V					
Continuous current (RMS) (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 ... 1600 Hz					
Switching frequency of power stage	4, **8**, 12, 16 kHz					
Input, mains side						
Mains voltage	3 x 400 V / 3 x 460 V -25 % +10 %					
Current (with line choke)	8.2 A	10.5 A	14.7 A	17.9 A	25.3 A	33.7 A
Frequency	50/60 Hz ±10 %					
Power loss at 4 / 8.16 kHz [W]	150 / 177	187 / 222	225 / 283	270 / 340	330 / 415	415 / 525
Braking chopper power electronics						
Peak braking power with int. braking resistor (only with version CDD34 ..., 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 referred to output voltage 400 V and switching frequency 8 kHz

.

The maximum permissible controller output current and the peak current of the CDD3000-HF are dependent on the mains voltage, the motor cable length, the power stage switching frequency and the ambient temperature. If the conditions change, the maximum permissible current capacity of the CDD3000-HF also changes. For details of which current load on the power stage modules is permissible under which changed background conditions, refer to the following characteristic diagrams and tables.



*Intermittent $I_N > I_{eff}$

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

Current capacity of drive controllers

(1)Continuous

(2)Intermittent* > 5 Hz rotating field frequency

drive controllers 2.4 A to 32 A:
I/I_N = **1.8** (for 30 s at 4 kHz)
I/I_N = **1.8** (for 30 s at 8 kHz)
I/I_N = **1.8** (for 30 s at 16 kHz)

(3)Intermittent* 0 to 5 Hz rotating field frequency

drive controllers 2.4 A to 32 A:
I/I_N = **1.8** (for 30 s at 4 kHz)
I/I_N = **1.25-1.8** (for 30 s at 8 kHz)

(4)Pulse mode

drive controllers 2.4 A to 32 A:
I/I_N = **approx. 2.2** (at 4, 8, 16 kHz)

Drive controller for highspeed drives for 230 V systems

drive controller for highspeed drives	Device rated power output [kVA]	Switching frequency of power stage [kHz]	Rated current [A]	Peak current for intermittent mode 0 to 5 Hz [A]	Peak current for intermittent mode > 5 Hz [A]
CDD32.003-HF,Cx.x	1.0	4	2.4	4.3	4.3
		8	2.4	4.3	4.3
		12	2.1	3.8	3.8
		16	1.8	3.2	3.2
CDD32.004-HF,Cx.x[1)]	1.6	4	4	7.2	7.2
		8	4	7.2	7.2
		12	3.5	6.3	6.3
		16	3	5.4	5.4
CDD32.006-HF,Cx.x[1)]	2.2	4	5.5	9.9	9.9
		8	5.5	9.9	9.9
		12	4.9	7.1	8.8
		16	4.3	7.7	7.7
CDD32.008-HF,Cx.x[1)]	2.8	4	7.1	12.8	12.8
		8	7.1	12.8	12.8
		12	6.3	9.1	11.3
		16	5.5	8	9.9

Peak current for 30 s with drive controllers 2.4 to 32 A
Cooling air temperature: 45 °C at power stage switching frequency 4 kHz
40 °C at power stage switching frequency 8,12,16 kHz
1) With heat sink HS3... or additional cooling surface

Mains voltage 1 x 230 V
Motor cable length 10 m
Mounting height 1000 m above MSL
End-to-end mounting

Drive controller for highspeed drives for 400/460 V systems

drive controller	Device rated power [kVA]	Switching frequency of power stage [kHz]	Rated current I_N[A][2)]	Rated current I_N[A][3)]	Peak current for intermittent mode 0 to 5 Hz [A]	Peak current for intermittent mode > 5 Hz [A]
CDD34.003-HF,Cx.x	1.5	4 8 12 16	2.2 2.2 1.6 1.0	2.2 2.2 1.6 1.0	4 4 1.8 1.1	4 4 2.9 1.8
CDD34.005-HF,Cx.x[1)]	2.8	4 8 12 16	4.1 4.1 3.2 2.4	4.1 3.6 - -	7.4 7.4 5.8 4.3	7.4 7.4 5.8 4.3
CDD34.006-HF,Cx.x[1)]	3.9	4 8 12 16	5.7 5.7 4.1 2.6	5.7 5.7 - -	10.3 10.3 7.4 4.7	10.3 10.3 7.5 4.7
CDD34.008-HF,Wx.x	5.4	4 8 12 16	7.8 7.8 6.4 5	7.8 7.8 - -	14 14 9.9 7.8	14 14 11.5 9
CDD34.010-HF,Wx.x	6.9	4 8 12 16	10 10 8.1 6.2	10 8.8 - -	18 16.5 10.1 7.8	18 18 14.5 11
CDD34.014-HF,Wx.x	9.7	4 8 12 16	14 14 10.3 6.6	14 12.2 - -	25 21 14.4 9.2	25 25 14.6 11.9
CDD34.017-HF,Wx.x	11.8	4 8 12 16	17 17 12.5 8	17 13.5 - -	31 21.2 14.4 9.2	31 31 22.5 14.4

drive controller	Device rated power [kVA]	Switching frequency of power stage [kHz]	Rated current I_N[A][2)]	Rated current I_N[A][3)]	Peak current for intermittent mode 0 to 5 Hz [A]	Peak current for intermittent mode > 5 Hz [A]
CDD34.024-HF,Wx.x	16.6	4	24	24	43	43
		8	24	24	40	43
		12	19.5	-	28.3	35
		16	15	-	22	27
CDD34.032-HF,Wx.x	22.2	4	32	32	58	58
		8	32	28	40	58
		12	26	-	29.1	47
		16	20	-	22	36

Peak current for 30 s with drive controllers 2.4 to 32 A
Cooling air temperature: 45 °C at power stage switching frequency 4 kHz
40 °C at power stage switching frequency 8, 12, 16 kHz

[1)] With heat sink HS3... or additional cooling surface

[2)] Mains voltage 3 x 400 V±10%

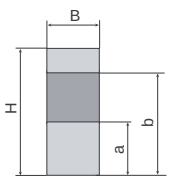
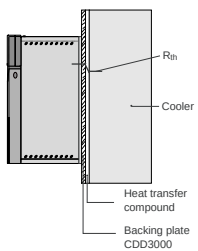
[3)] Mains voltage 3 x 460 V±10%

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

A.2 Ambient conditions

Characteristic		drive controller
Temperature range	in operation	-10 ...45 °C (BG1 ... BG5) with power reduction to 55 °C
	in storage	-25 ... +55 °C
	in transit	-25 ... +70 °C
Relative air humidity		15 ... 85 %, condensation not permitted
Mechanical strength to IEC 68-2-6	Vibration	0.075 mm in frequency range 10 ... 57 Hz 1 g in frequency range 57 ... 150 Hz
Protection	Device	IP20 (NEMA 1)
	Cooling method	Cold plate: IP20 Push-through heat sink: IP54 (3 ...15 kW)
Touch protection		VBG 4
Mounting height		up to 1000 m above MSL, above 1000 m above MSL with power reduction 1% per 100 m, max. 2000 m above MSL
max. holding brake current 2 A to T_U = 45°C, derating 50 mA/°C to T_{Umax} = 55°C		
Voltage stress of the motor winding		typical slew rate 3 - 6 kV/µs

A.3 Project planning notes, “Cold plate”

<table>
<tr><th>Subject</th><th>Project planning notes</th></tr>
<tr><td>Thermal connection to cooler</td><td>
• Evenness of contact surface = 0.05 mm
Roughness of contact surface = roughness factor 6.3
• Coat area between drive controller (“cold plate” backing plate) and cooler with heat transfer compound (coat thickness 30-70µ).
• The temperature in the middle of the drive controller backing plate must not exceed 85 °C.
</td></tr>
<tr><td>Distribution of power loss</td><td>
<table>
<tr><th>Size</th><th>Device rated power [kVA]</th><th>Heat sink</th><th>Housing</th></tr>
<tr><td>BG 1/2</td><td>1.0 to 3.9</td><td>approx. 65%</td><td>approx. 35%</td></tr>
<tr><td>BG 3</td><td>5.4 to 6.9</td><td>approx. 70%</td><td>approx. 30%</td></tr>
<tr><td>BG 4</td><td>9.7 to 11.8</td><td>approx. 75%</td><td>approx. 25%</td></tr>
<tr><td>BG 5</td><td>16.6 to 22.2</td><td>approx. 80%</td><td>approx. 20%</td></tr>
</table>
</td></tr>
<tr><td>Active cooling area
 
</td><td>
<table>
<tr><th rowspan="2">Size</th><th rowspan="2">Device rated power [kVA]</th><th colspan="2">Device basic area [mm]</th><th colspan="2">Active cooling area [mm]</th></tr>
<tr><th>B</th><th>H</th><th>a</th><th>b</th></tr>
<tr><td>BG 1</td><td>1.0 to 1.6</td><td>70</td><td>193</td><td>50</td><td>165</td></tr>
<tr><td>BG 2</td><td>2.2 to 3.9</td><td>70</td><td>218</td><td>90</td><td>200</td></tr>
<tr><td>BG 3</td><td>5.4 to 6.9</td><td>100</td><td>303</td><td>120</td><td>260</td></tr>
<tr><td>BG 4</td><td>9.7 to 11.8</td><td>150</td><td>303</td><td>65</td><td>215</td></tr>
<tr><td>BG 5</td><td>16.6 to 22.2</td><td>200</td><td>303</td><td>80</td><td>300</td></tr>
</table>
</td></tr>
<tr><td>Thermal resistance
 
</td><td>
<table>
<tr><th>Size</th><th>Device rated power [kVA]</th><th>Thermal resistance between active cooling area and cooler R_{th} [K/W]</th></tr>
<tr><td>BG 1</td><td>1.0 to 1.6</td><td>0.05</td></tr>
<tr><td>BG 2</td><td>2.2 to 3.9</td><td>0.05</td></tr>
<tr><td>BG 3</td><td>5.4 to 6.9</td><td>0.03</td></tr>
<tr><td>BG 4</td><td>9.7 to 11.8</td><td>0.02</td></tr>
<tr><td>BG 5</td><td>16.6 to 22.2</td><td>0.015</td></tr>
</table>
</td></tr>
</table>

A.4 Change in system load through use of a line choke

System load

	Without line choke	With line choke	Change
	7.3 kVA drive controller, mains impedance 0.6 mH	7.3 kVA drive controller, mains impedance 6 mH	Without line choke compared to with line 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 life	2 to 3 times nominal life	+100 to 200 %

Change in system load through use of a line choke with 4 % short circuit voltage based on the example of a 7.3 kVA drive controller CDD34.010-HF operating in the part load range

1) THD = Total Harmonic Distortion (U_5 ...U_{41})

Mains voltage asymmetry

	Without line choke			With line choke		
	7.3 kVA drive controller, mains impedance 0.6 mH			7.3 kVA drive controller, mains impedance 6 mH		
Asymmetry of mains voltage	0 %	+3 %	-3 %	0 %	+3 %	-3 %
Mains current amplitude	18.9 A	25.4 A	25.1 A	9.7 A	10.7 A	11 A
Mains current effective	8.5 A	10.5 A	10.2 A	6.2 A	6.7 A	6.8 A

Effect of line choke with asymmetric mains voltage based on the example of a 7.3 kVA drive controller CDD34.010-HF operating in the part load range

Recommended:
The example shows that the benefits of a line choke with 4 % short-circuit voltage are multi-faceted. We therefore recommend that you use a line choke as a matter of course.

Line chokes are required:

- 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).
- To comply with the limit values for variable-speed electric drives (standard EN61800-3 / IEC1800-3)
- With a dc-link between multiple drive controllers.

Characteristics of environment class 3 include:

- Mains voltage fluctuations > $\pm$ 10% U_N
- Short-time interruptions between 10 ms and 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 started frequently
- loads fluctuate rapidly.

A.5 UL approbation

Measures to maintain UL approbation

1. Switch cabinet mounting with IP54 protection and contamination level 2 is mandatory.
2. The devices are only usable in systems with surge strength class III.
3. Only UL approved fuses and circuit-breakers may be used.
   CDD32.xxx-HF : Mains fuses min. 250 V H or K5
   CDD34.xxx-HF : Mains fuses min. 600 V H or K5
4. The devices are usable in systems with a maximum current capacity of 5000 A.
5. The connecting cables (mains power, motor and control cables) must be UL approved.
   CDD32.xxx-HF : Min. 300 V cables (mains/motor), Cu 75° C min.
   CDD34.xxx-HF : Min. 600 V cables (mains/motor), Cu 75° C min.

Tightening torque of grounding lead terminal [Nm]	Tightening torque of mains terminals [Nm]	Device	Wire cross-section	Mains fuse
0.5 ... 0.6	0.5 ... 0.6	CDD32.004-HF	AWG 16 N/M	10 A
0.5 ... 0.6	0.5 ... 0.6	CDD32.006-HF	AWG 14 N/AWG 16 M	10 A
0.5 ... 0.6	0.5 ... 0.6	CDD32.008-HF	AWG 14 N/AWG 16 M	20 A
0.5 ... 0.6	0.5 ... 0.6	CDD34.003-HF	AWG 16 N/M	10 A
0.5 ... 0.6	0.5 ... 0.6	CDD34.005-HF	AWG 16 N/M	10 A
0.5 ... 0.6	0.5 ... 0.6	CDD34.006-HF	AWG 16 N/M	10 A
0.5 ... 0.6	0.5 ... 0.6	CDD34.008-HF	AWG 14 N/M	15 A
0.5 ... 0.6	0.5 ... 0.6	CDD34.010-HF	AWG 14 N/M	15 A
0.5 ... 0.6	0.5 ... 0.6	CDD34.014-HF	AWG 12 N/M	20 A
0.5 ... 0.6	0.5 ... 0.6	CDD34.017-HF	AWG 12 N/M	25 A
1.2 ... 1.5	1.2 ... 1.5	CDD34.024-HF	AWG 10 N/M	30 A
1.2 ... 1.5	1.2 ... 1.5	CDD34.032-HF	AWG 8 N/M	50 A

Table A.4 Cable cross-sections - mains (N), motor (M)

Attention: The drive controllers can typically be overloaded with 1.8 x I_N for 30 s. The effective servo capacity utilization ($I_{eff.} \leq I_N$) must never be greater than I_N (rated current).

Minimum cross-section of the grounding lead to DIN VDE 0100 Part 540

Cross-section	PE mains connection
Mains power cable <10 mm²	Grounding lead (PE) cross section of at least 10 mm² **or** lay a second electrical conductor parallel to the existing grounding lead, because the operational leakage current is > 3.5 mA.
Mains power cable >10 mm²	PE conductor with cross-section of mains power cable - see VDE 0100 Part 540

Table A.5 Minimum cross-section of the grounding lead

A.6 Layout

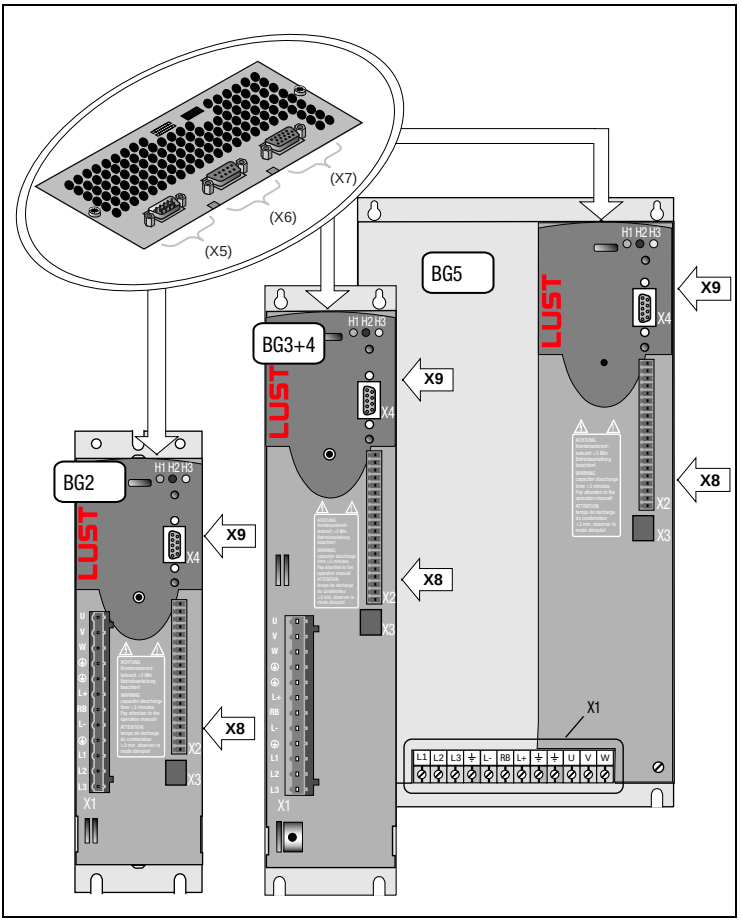


Figure A.3 Layout of CDD3000-HF drive controller, size 1 to 5

Terminal	Explanation
X1	Power connections
X2	Control connections
X3	Motor PTC connections
X4	PC/KP200 connection (RS232-interface)
X5	Encoder simulation/master encoder
X6	Resolver connection
X7	Optical encoder connection
X8	UM-xxx module connection
X9	CM-xxx module connection

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Hinweis zur EN 61000-3-2 DE	Notes on EN 61000-3-2 EN
(rückwirkende Netzbelastung durch Oberwellen) Unsere Frequenzumrichter 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 frequency inverters and drive controllers are “professional devices” in the sense of the European Standard EN 61000, and with a rated power of ≤1kW obtained in 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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