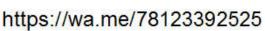


## Ремонт сервоусилителей / сервоконтроллеров Indramat Bosch Rexroth

Ремонт DKC01.3-008-3-MGP-01VRS









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# ECODRIVE03 Drive Controllers

**Project Planning Manual** 

SYSTEM200



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Type of Documentation	Project Planning Manual		
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Supplementary documentation	Note:	The following documentation is not required in its entirety for project planning.
	"Servo Ap - Selectio	oplications with 1,5 s Acceleration Time" n lists -
	DOK-ECO	DDR3-SERV-GEN***-AUxx-MS-P
	- Selectio	oplications with 400 ms Acceleration Time" n lists - DDR3-SERV-WZM***-AUxx-MS-P
	"Main driv - Selectio	ves with 2AD-, ADF- and 1MB-motors" n lists -
	DOK-ECO	DDR3-MAIN*WZM***-AUxx-MS-P
	"List of Co - Selectio	onnecting Cables for DIAX04 and ECODRIVE03" n lists -
	DOK-CO	NNEC-CABLE*STAND-AUxx-EN-P
		VE03 Drive for Machine Tool Applications With SERCOS-, nd Parallelinterface"
		nal Description -
	DOK-ECC	DDR3-SMT-01VRS**-FKxx-EN-P
		VE03 Drive for Machine Tool Applications With SERCOS-, nd Parallelinterface"
		nal Description - DDR3-SMT-02VRS**-FKxx-EN-P
		VE03 Drive for General Automation With SERCOS-, Analog- lelinterface"
		nal Description -
	DOK-ECO	DDR3-SGP-01VRS**-FKxx-EN-P
		VE03 Drive for General Automation With Fieldbus-Interfaces" nal Description -
	DOK-ECO	DDR3-FGP-01VRS**-FKxx-EN-P
	- Functior	VE03 Drive for General Automation With Fieldbus-Interfaces" nal Description - DDR3-FGP-02VRS**-FKxx-EN-P



"ECODRIVE03 Drive for General Automation With Fieldbus-Interfaces" - Functional Description -DOK-ECODR3-FGP-03VRS\*\*-FKxx-EN-P

"LWL - Handling" - Application Manual -DOK-CONNEC-CABLE\*LWL-AWxx-EN-P

"Electromagnetic Compatibility (EMC) in Drive and Control Systems" - Project Planning Manual -DOK-GENERL-EMV\*\*\*\*\*\*-PRxx-EN-P

"Digital AC Motors MKD" - Project Planning Manual -DOK-MOTOR\*-MKD\*\*\*\*\*\*\*-PRxx-EN-P

"Digital AC Motors MHD" - Project Planning Manual -DOK-MOTOR\*-MHD\*\*\*\*\*\*\*-PRxx-EN-P

"MKE Digital AC Motors for potentially explosive areas" - Project Planning Manual -DOK-MOTOR\*-MKE\*\*\*\*\*\*-PRxx-EN-P

"2AD AC Motor" - Project Planning Manual -DOK-MOTOR\*-2AD\*\*\*\*\*\*-PRxx-EN-P

"ADF Main Spindle Motors" - Project Planning Manual -DOK-MOTOR\*-ADF\*\*\*\*\*\*-PRxx-EN-P

"1MB Frameless Spindle Motor" - Project Planning Manual -DOK-MOTOR\*-1MB\*\*\*\*\*\*\*-PRxx-EN-P

"Synchronous MBS Kit Spindle Motors" - Project Planning Manual -DOK-MOTOR\*-MBS\*\*\*\*\*\*-PRxx-EN-P

LAR 070-132 Gehäuse-Linearmotoren - Selection and Project Planning -DOK-MOTOR\*-LAR\*\*\*\*\*\*-AWxx-DE-P



"LAF050 – 121 Linear Motors"

- Selection and Project Planning -DOK-MOTOR\*-LAF\*\*\*\*\*\*-AWxx-EN-P

"Linear Synchronous Direct Drives LSF" - Project Planning Manual -

DOK-MOTOR\*-LSF\*\*\*\*\*-PRxx-EN-P

"AC Drive Units in Personnel Conveyor Systems" - Application Manual -DOK-GENERL-ANTR\*PERSON-ANxx-EN-P

"AC Drive Units in Hazardous Areas (Expl. Protection)"

- Application Manual -

DOK-GENERL-ANTR\*EXPLOS-ANxx-EN-P

"ECODRIVE03 Drive for Machine Tool Applications With SERCOS-, Analog- and Parallelinterface"

- Troubleshooting Guide -

DOK-ECODR3-SMT-01VRS\*\*-WAR\*-EN-P

"ECODRIVE03 Drive for Machine Tool Applications With SERCOS-, Analog- and Parallelinterface"

- Troubleshooting Guide -

DOK-ECODR3-SMT-02VRS\*\*-WAR\*-EN-P

"ECODRIVE03 Drive for General Automation With SERCOS-, Analogand Parallelinterface"

- Troubleshooting Guide -

DOK-ECODR3-SGP-01VRS\*\*-WAxx-EN-P

"ECODRIVE03 Drive for General Automation With Fieldbus-Interfaces" - Troubleshooting Guide -

DOK-ECODR3-FGP-01VRS\*\*-WAxx-EN-P

"ECODRIVE03 Drive for General Automation With Fieldbus-Interfaces" - Troubleshooting Guide -DOK-ECODR3-FGP-02VRS\*\*-WAxx-EN-P

"ECODRIVE03 Drive for General Automation With Fieldbus-Interfaces" - Troubleshooting Guide -DOK-ECODR3-FGP-03VRS\*\*-WAxx-EN-P

"DOLFI, Auxiliary for Download Firmware" - Application Manual -DOK-DOLFI DO01D\*\*W



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## 1 Introduction to the System

## 1.1 Drive package ECODRIVE03

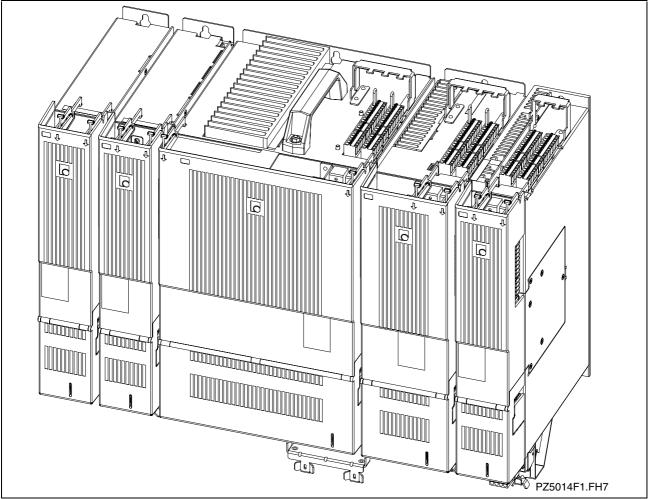


Fig. 1-1: Digital intelligent drive system

The digital intelligent automation system **ECODRIVE03** is the costeffective solution with a high level of functionality for single and multiple axis drive and control tasks.

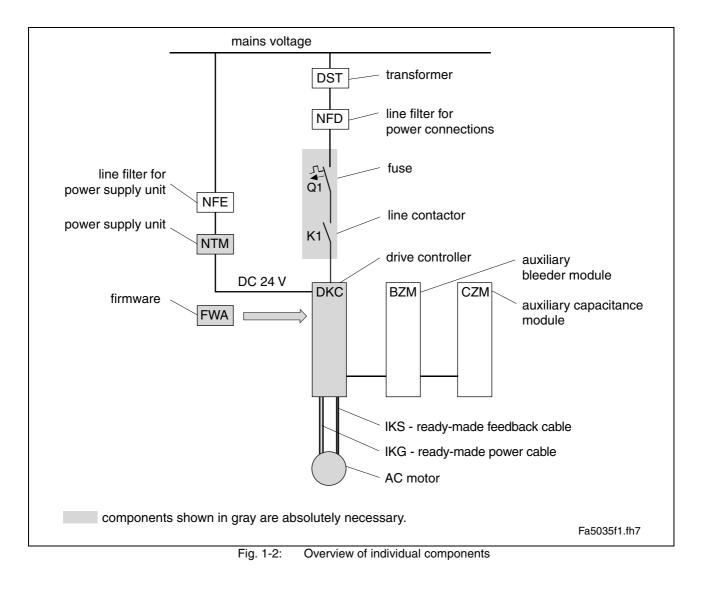
**ECODRIVE03** can be used to implement a variety of drive tasks in the most varied applications. Different device types are available with graduated drive power.

Typical application areas are:

- handling systems
- packaging machines
- assembly systems
- printing machines
- machine tools



## 1.2 An Overview of Individual Components of the ECODRIVE03 Family





#### An Overview of Drive Controllers and Auxiliary 1.3 Components

#### An Overview of Communications Interfaces

		Device type							
	DKC11.3*	DKC01.3	DKC21.3	DKC02.3	DKC22.3	DKC03.3	DKC04.3	DKC05.3	DKC06.3
Interface									
RS232 / RS485*	x	х	X	X	X	Х	Х	Х	x
Analog Interface	x	х	X	X	X	Х	Х	Х	x
Parallel Interface		х							
Parallel Interface 2			X						
Stepper Interface		X							
SERCOS interface				X					
SERCOS interface 2					X				
Profibus-DP Interface						x			
InterBus Interface							X		
CANopen Interface								Х	
DeviceNet Interface									x

\* The DKC11.3 device type resp. the RS485 interface does not exist for the DKC\*\*.3-016-7-FW drive controllers. Fig. 1-3: An overview of interfaces



#### An Overview of Measuring Systems Supported

#### **Connecting the Systems to the Encoder Inputs**

	Encoder 1 (plug X4)				Encoder 2 (plug X8)			
Type of motor	Digital servo- feedback (1)		Resolver with FDS (2)	Resolver without FDS (3)	Sine encoder (4)	EnDat encoder (5)	Gear-type encoder with 1Vss signals (6)	Square-wave encoder with 5V TTL signals
	DSF	HSF	-					(7)
MKD			X					
MKE			X					
MHD		Х						
2AD	X	Х						<b>X</b> *)
ADF	X	Х						X *)
1MB					x	Х	X	X *)
MBW					x	Х	X	X *)
LAR					x	Х		<b>X</b> *)
LAF					x	Х		X *)
LSF						Х		
MBS				Х	x	Х		

Fig. 1-4: Connecting the measuring systems

- (2) : resolver or multi-turn resolver (RSF) with feedback data storage (FDS)
- (3) : resolver or multi-turn resolver (RSF) without feedback data storage (FDS)
- (4) : incremental measuring system with sine signals (1Vss signals)
- (5) : absolute measuring system with EnDat interface
- (6) : gear-type encoder with 1Vss signals (The drive controller does not compensate the offset of an uncompensated gear-type encoder.)
- (7) : square-wave encoder with 5V TTL signals; not recommended (due to maximum input frequency of 200 kHz)
- **Note:** It is only resolvers with FDS that can be connected to the DKC\*\*.3-016-7-FW drive controllers.
- **Note:** The cable type designations of the connecting cables required are listed in the motor project planning manual or "List of Connecting Cables for DIAX04 and ECODRIVE03".

See also the functional description: "Setting the Measurement System".



#### Type Code for Drive Controller DKC

Type code fields:	Example:	DKC 03.3 - 040 - 7 - FW
Series		
Version	3	
Type current		
16 A 40 A	016 040	
100 A 200 A	100 200	
Voltage category	7 -	
Firmware A firmware specifying the functions of the drive must be ordered separately.	FW	TL0001F1.FH7

Fig. 1-5: Type code

**Note:** The above illustrates how the type codes are put together. Your sales representative will help with the current status of available versions.



#### Type Code Auxiliary Braking Resistor Module BZM

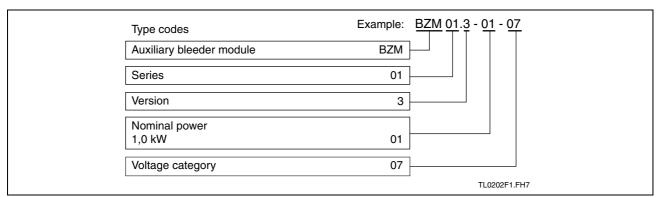


Fig. 1-6: Type Code

#### Type Code for CZM Auxiliary Braking Resistor Module

Type code fields Exam	nple: <u>CZM 01.3 - 02 - 07</u>
Auxiliary capacitance module C	
Series	01
Version	3
Rated capacity 2,4 mF	02
Voltage category	07
	TL0206F1.FH7

Fig. 1-7: Type code



## 2 Important directions for use

## 2.1 Appropriate use

#### Introduction

Rexroth Indramat products represent state-of-the-art developments and manufacturing. They are tested prior to delivery to ensure operating safety and reliability.

The products may only be used in the manner that is defined as appropriate. If they are used in an inappropriate manner, then situations can develop that may lead to property damage or injury to personnel.

Before using Rexroth Indramat products, make sure that all the prerequisites for an appropriate use of the products are satisfied:

- Personnel that in any way, shape or form uses our products must first read and understand the relevant safety instructions and be familiar with appropriate use.
- If the product takes the form of hardware, then they must remain in their original state, in other words, no structural changes are permitted. It is not permitted to decompile software products or alter source codes.
- Do not mount damaged or faulty products or use them in operation.
- Make sure that the products have been installed in the manner described in the relevant documentation.



**Note:** Rexroth Indramat, as manufacturer, is not liable for any damages resulting from inappropriate use. In such cases, the guarantee and the right to payment of damages resulting from inappropriate use are forfeited. The user alone carries all responsibility of the risks.

#### Areas of use and application

Drive controllers made by Rexroth Indramat are designed to control electrical motors and monitor their operation.

Control and monitoring of the motors may require additional sensors and actors.

Note: The drive controllers may only be used with the accessories and parts specified in this document. If a component has not been specifically named, then it may not be either mounted or connected. The same applies to cables and lines.
 Operation is only permitted in the specified configurations and combinations of components using the software and firmware

as specified in the relevant function descriptions.

Every drive controller has to be programmed before starting it up, making it possible for the motor to execute the specific functions of an application.

The drive controllers of the ECODRIVE03 family are designed for use in single or multiple-axis drive and control applications.

To ensure an application-specific use, the drive controllers are available with differing drive power and different interfaces.

Typical applications of drive controllers belonging to the ECODRIVE03 family are:

- handling and mounting systems,
- packaging and foodstuff machines,
- printing and paper processing machines and
- machine tools.

The drive controllers may only be operated under the assembly, installation and ambient conditions as described here (temperature, system of protection, humidity, EMC requirements, etc.) and in the position specified.

#### 2.2 Inappropriate use

Using the drive controllers outside of the above-referenced areas of application or under operating conditions other than described in the document and the technical data specified is defined as "inappropriate use".

Drive controllers may not be used if

- they are subject to operating conditions that do not meet the above specified ambient conditions. This includes, for example, operation under water, in the case of extreme temperature fluctuations or extremely high maximum temperatures or if
- Rexroth Indramat has not specifically released them for that intended purpose. Please note the specifications outlined in the general safety instructions!



## 3 Safety Instructions for Electric Drives and Controls

## 3.1 Introduction

Read these instructions before the initial startup of the equipment in order to eliminate the risk of bodily harm or material damage. Follow these safety instructions at all times.

Do not attempt to install or start up this equipment without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation of the equipment prior to working with the equipment at any time. If you do not have the user documentation for your equipment, contact your local Rexroth Indramat representative to send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the equipment is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the equipment.



Improper use of this equipment, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, may result in material damage, bodily harm, electric shock or even death!

### 3.2 Explanations

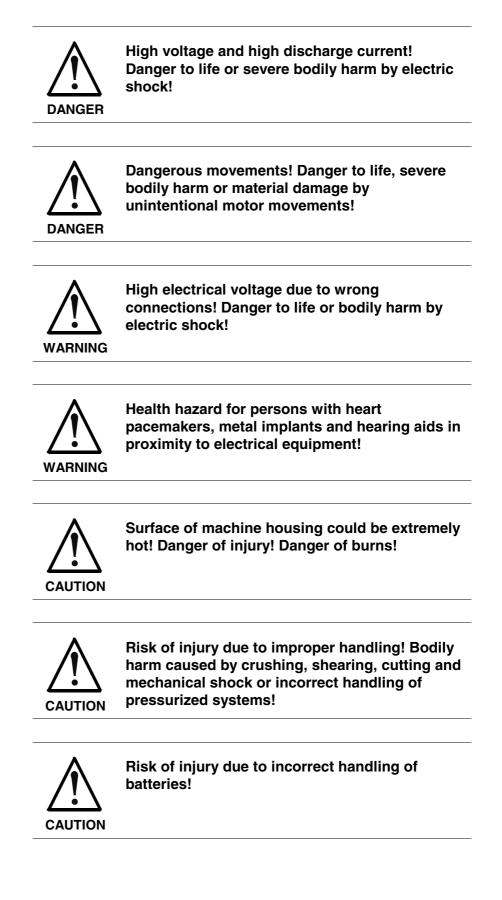
The safety instructions describe the following degrees of hazard seriousness in compliance with ANSI Z535. The degree of hazard seriousness informs about the consequences resulting from non-compliance with the safety instructions.

Warning symbol with signal word	Degree of hazard seriousness according to ANSI
DANGER	Death or severe bodily harm will occur.
WARNING	Death or severe bodily harm may occur.
	Bodily harm or material damage may occur.

Fig. 3-1: Hazard classification (according to ANSI Z535)



### 3.3 Hazards by Improper Use



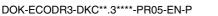


## 3.4 General Information

- Rexroth Indramat GmbH is not liable for damages resulting from failure to observe the warnings provided in this documentation.
- Read the operating, maintenance and safety instructions in your language before starting up the machine. If you find that you cannot completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Only persons who are trained and qualified for the use and operation of the equipment may work on this equipment or within its proximity.
  - The persons are qualified if they have sufficient knowledge of the assembly, installation and operation of the equipment as well as an understanding of all warnings and precautionary measures noted in these instructions.
  - Furthermore, they must be trained, instructed and qualified to switch electrical circuits and equipment on and off in accordance with technical safety regulations, to ground them and to mark them according to the requirements of safe work practices. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.
- The equipment is designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Use only safety features and applications that are clearly and explicitly approved in the Project Planning Manual.
   For example, the following areas of use are not permitted: construction cranes, elevators used for people or freight, devices and vehicles to transport people, medical applications, refinery plants, transport of hazardous goods, nuclear applications, applications sensitive to high frequency, mining, food processing, control of protection equipment (also in a machine).
- The information given in this documentation with regard to the use of the delivered components contains only examples of applications and suggestions.

The machine and installation manufacturer must

- make sure that the delivered components are suited for his individual application and check the information given in this documentation with regard to the use of the components,
- make sure that his application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Startup of the delivered components is only permitted once it is sure that the machine or installation in which they are installed complies with the national regulations, safety specifications and standards of the application.





regulations.

- Operation is only permitted if the national EMC regulations for the application are met. The instructions for installation in accordance with EMC requirements can be found in the documentation "EMC in Drive and Control Systems". The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national
- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.



### 3.5 **Protection Against Contact with Electrical Parts**

**Note:** This section refers to equipment and drive components with voltages above 50 Volts.

Touching live parts with voltages of 50 Volts and more with bare hands or conductive tools or touching ungrounded housings can be dangerous and cause electric shock. In order to operate electrical equipment, certain parts must unavoidably have dangerous voltages applied to them.



# High electrical voltage! Danger to life, severe bodily harm by electric shock!

- ⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.
- $\Rightarrow$  Follow general construction and safety regulations when working on high voltage installations.
- ⇒ Before switching on power the ground wire must be permanently connected to all electrical units according to the connection diagram.
- ⇒ Do not operate electrical equipment at any time, even for brief measurements or tests, if the ground wire is not permanently connected to the points of the components provided for this purpose.
- ⇒ Before working with electrical parts with voltage higher than 50 V, the equipment must be disconnected from the mains voltage or power supply. Make sure the equipment cannot be switched on again unintended.
- $\Rightarrow$  The following should be observed with electrical drive and filter components:
- ⇒ Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning to work. Measure the voltage on the capacitors before beginning to work to make sure that the equipment is safe to touch.
- $\Rightarrow$  Never touch the electrical connection points of a component while power is turned on.
- ⇒ Install the covers and guards provided with the equipment properly before switching the equipment on. Prevent contact with live parts at any time.
- ⇒ A residual-current-operated protective device (RCD) must not be used on electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.
- ⇒ Electrical components with exposed live parts and uncovered high voltage terminals must be installed in a protective housing, for example, in a control cabinet.



To be observed with electrical drive and filter components:



High electrical voltage on the housing! High leakage current! Danger to life, danger of injury by electric shock!

- ⇒ Connect the electrical equipment, the housings of all electrical units and motors permanently with the safety conductor at the ground points before power is switched on. Look at the connection diagram. This is even necessary for brief tests.
- ⇒ Connect the safety conductor of the electrical equipment always permanently and firmly to the supply mains. Leakage current exceeds 3.5 mA in normal operation.
- ⇒ Use a copper conductor with at least 10 mm<sup>2</sup> cross section over its entire course for this safety conductor connection!
- ⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. Otherwise, high voltages can occur on the housing that lead to electric shock.

# 3.6 Protection Against Electric Shock by Protective Low Voltage (PELV)

All connections and terminals with voltages between 0 and 50 Volts on Rexroth Indramat products are protective low voltages designed in accordance with international standards on electrical safety.



#### High electrical voltage due to wrong connections! Danger to life, bodily harm by electric shock!

WARNING

⇒ Only connect equipment, electrical components and cables of the protective low voltage type (PELV = Protective Extra Low Voltage) to all terminals and clamps with voltages of 0 to 50 Volts.

⇒ Only electrical circuits may be connected which are safely isolated against high voltage circuits. Safe isolation is achieved, for example, with an isolating transformer, an opto-electronic coupler or when battery-operated.



#### **3.7 Protection Against Dangerous Movements**

Dangerous movements can be caused by faulty control of the connected motors. Some common examples are:

- improper or wrong wiring of cable connections
- incorrect operation of the equipment components
- wrong input of parameters before operation
- malfunction of sensors, encoders and monitoring devices
- defective components
- software or firmware errors

Dangerous movements can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring in the drive components will normally be sufficient to avoid faulty operation in the connected drives. Regarding personal safety, especially the danger of bodily injury and material damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.





# Dangerous movements! Danger to life, risk of injury, severe bodily harm or material damage!

- ⇒ Ensure personal safety by means of qualified and tested higher-level monitoring devices or measures integrated in the installation. Unintended machine motion is possible if monitoring devices are disabled, bypassed or not activated.
- $\Rightarrow$  Pay attention to unintended machine motion or other malfunction in any mode of operation.
- ⇒ Keep free and clear of the machine's range of motion and moving parts. Possible measures to prevent people from accidentally entering the machine's range of motion:
  - use safety fences
  - use safety guards
  - use protective coverings
  - install light curtains or light barriers
- ⇒ Fences and coverings must be strong enough to resist maximum possible momentum, especially if there is a possibility of loose parts flying off.
- ⇒ Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the machine if the emergency stop is not working.
- ⇒ Isolate the drive power connection by means of an emergency stop circuit or use a starting lockout to prevent unintentional start.
- ⇒ Make sure that the drives are brought to a safe standstill before accessing or entering the danger zone. Safe standstill can be achieved by switching off the power supply contactor or by safe mechanical locking of moving parts.
- ⇒ Secure vertical axes against falling or dropping after switching off the motor power by, for example:
  - mechanically securing the vertical axes
  - adding an external braking/ arrester/ clamping mechanism
  - ensuring sufficient equilibration of the vertical axes

The standard equipment motor brake or an external brake controlled directly by the drive controller are not sufficient to guarantee personal safety!



- ⇒ Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for:
  - maintenance and repair work
  - cleaning of equipment
  - long periods of discontinued equipment use
- ⇒ Prevent the operation of high-frequency, remote control and radio equipment near electronics circuits and supply leads. If the use of such equipment cannot be avoided, verify the system and the installation for possible malfunctions in all possible positions of normal use before initial startup. If necessary, perform a special electromagnetic compatibility (EMC) test on the installation.

### 3.8 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated near current-carrying conductors and permanent magnets in motors represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.



#### Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

⇒ Persons with heart pacemakers, hearing aids and metal implants are not permitted to enter the following areas:

- Areas in which electrical equipment and parts are mounted, being operated or started up.
- Areas in which parts of motors with permanent magnets are being stored, operated, repaired or mounted.
- ⇒ If it is necessary for a person with a heart pacemaker to enter such an area, then a doctor must be consulted prior to doing so. Heart pacemakers that are already implanted or will be implanted in the future, have a considerable variation in their electrical noise immunity. Therefore there are no rules with general validity.
- ⇒ Persons with hearing aids, metal implants or metal pieces must consult a doctor before they enter the areas described above. Otherwise, health hazards will occur.



## 3.9 Protection Against Contact with Hot Parts



#### Housing surfaces could be extremely hot! Danger of injury! Danger of burns!

- $\Rightarrow$  Do not touch housing surfaces near sources of heat! Danger of burns!
- $\Rightarrow$  After switching the equipment off, wait at least ten (10) minutes to allow it to cool down before touching it.
- $\Rightarrow$  Do not touch hot parts of the equipment, such as housings with integrated heat sinks and resistors. Danger of burns!

## 3.10 Protection During Handling and Mounting

Under certain conditions, incorrect handling and mounting of parts and components may cause injuries.



#### Risk of injury by incorrect handling! Bodily harm caused by crushing, shearing, cutting and mechanical shock!

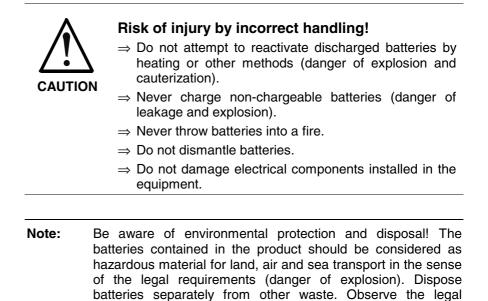
CAUTION

- $\Rightarrow$  Observe general installation and safety instructions with regard to handling and mounting.
- $\Rightarrow$  Use appropriate mounting and transport equipment.
- $\Rightarrow$  Take precautions to avoid pinching and crushing.
- $\Rightarrow$  Use only appropriate tools. If specified by the product documentation, special tools must be used.
- $\Rightarrow$  Use lifting devices and tools correctly and safely.
- ⇒ For safe protection wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.
- $\Rightarrow$  Never stand under suspended loads.
- $\Rightarrow$  Clean up liquids from the floor immediately to prevent slipping.



### 3.11 Battery Safety

Batteries contain reactive chemicals in a solid housing. Inappropriate handling may result in injuries or material damage.



#### 3.12 Protection Against Pressurized Systems

Certain motors and drive controllers, corresponding to the information in the respective Project Planning Manual, must be provided with pressurized media, such as compressed air, hydraulic oil, cooling fluid and cooling lubricant supplied by external systems. Incorrect handling of the supply and connections of pressurized systems can lead to injuries or accidents. In these cases, improper handling of external supply systems, supply lines or connections can cause injuries or material damage.

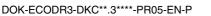
requirements in the country of installation.



# Danger of injury by incorrect handling of pressurized systems !

- $\Rightarrow$  Do not attempt to disassemble, to open or to cut a pressurized system (danger of explosion).
- $\Rightarrow$  Observe the operation instructions of the respective manufacturer.
- $\Rightarrow$  Before disassembling pressurized systems, release pressure and drain off the fluid or gas.
- $\Rightarrow$  Use suitable protective clothing (for example safety glasses, safety shoes and safety gloves)
- $\Rightarrow$  Remove any fluid that has leaked out onto the floor immediately.

**Note:** Environmental protection and disposal! The media used in the operation of the pressurized system equipment may not be environmentally compatible. Media that are damaging the environment must be disposed separately from normal waste. Observe the legal requirements in the country of installation.





#### Notes

## 4 ECODRIVE03 DKC\*\*.040, DKC\*\*.100, DKC\*\*.200

## 4.1 Technical Data

#### Dimensions



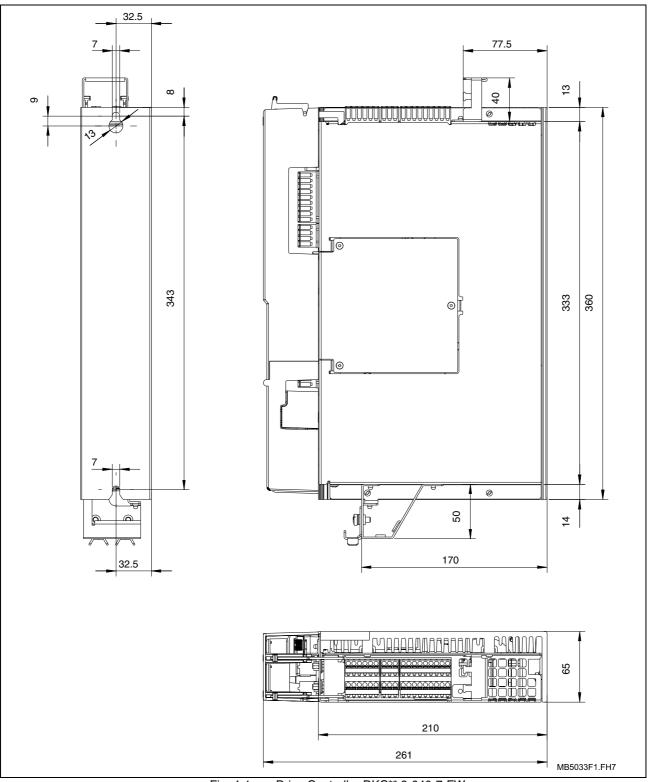
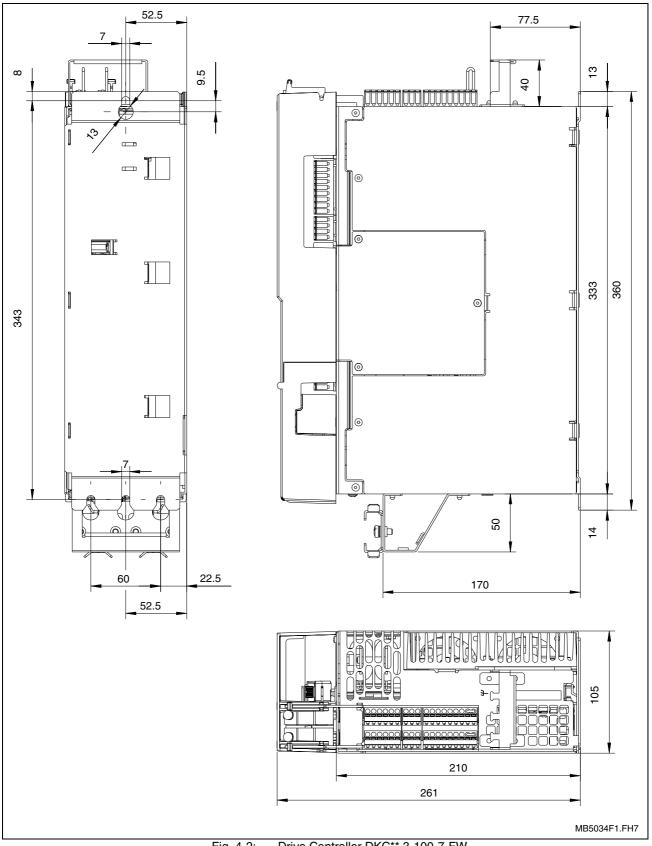


Fig. 4-1: Drive Controller DKC\*\*.3-040-7-FW

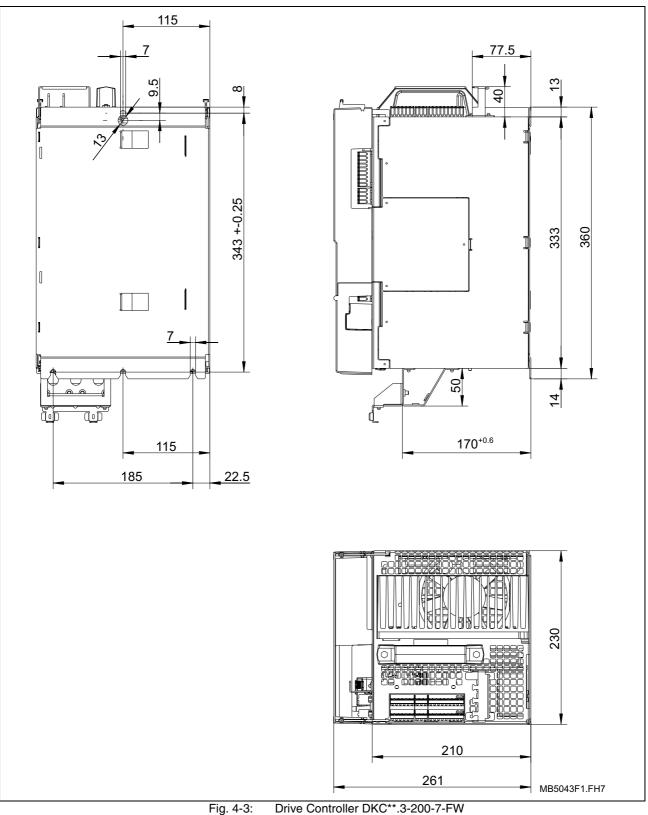




Drive Controller DKC\*\*.3-100-7-FW

Drive Controller DKC\*\*.3-100-7-FW Fig. 4-2:





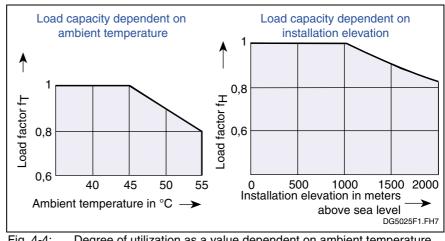
#### Drive Controller DKC\*\*.3-200-7-FW

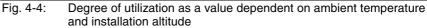
### Ambient and operating conditions

	Note:	ECODRIVE03 drive control devices and its auxiliary components are designed for control cabinet mounting.						
Ambient temperature and installation altitude	Selection lists are specified for each motor/drive combination.							
	and ope	The selection lists apply to motors and drives within the specified ambient and operating conditions (see "Fig. 4-5: Ambient and operating conditions").						
	Differing conditions reduce the performance specifications							
	of the drive:							
	allowed DC bus continuous output							
	continuous bleeder output							
	continuous current							
	of the motor:							
	• OL	utput						
	• cc	ontinuous torque at standstill						

- S1 continuous torque
- Short-time operating torque *M*<sub>kB</sub>

according to the diagrams (see "Fig. 4-4: Degree of utilization as a value dependent on ambient temperature and installation altitude"). If deviating ambient temperatures and higher installation altitudes occur simultaneously, both utilization factors must be multiplied. The installation altitude must only be taken into account once. Deviating ambient temperatures must be taken into account separately for motor and drive controller.







	Unit	DKC**.3-***-7-FW			
T <sub>A</sub>	°C	+5 +45			
T <sub>A</sub>	°C	The values specified in the selection lists for output and torque are reduced in the range +45+55 °C by 2% per °C temperature increase			
TL	°C	-30 +85			
	m	1000			
	m	2000			
	%	95			
	g/m³	25			
2, according to EN 50178 fine dust no allowed, no condensation					
IP20, acco	ording to EN	N 60529 = DIN VDE 0470-1-1992 (ICE 529-1989)			
ı sinus in oper	ration accor	0.3 mm (peak-to-peak) at 5 57 Hz			
		2 g at 57 500 Hz			
	%	± 15			
tion (Random	) in operatio	on according to IEC 68-2-36			
	Hz	20 500			
	g²/Hz	0.01			
	dB	± 3			
	g	2.2			
	ration accor	ding to EN 60068-2-27			
eck not in ope					
	TL IP20, acco n sinus in oper	TL °C m m % g/m³ fine of IP20, according to EN n sinus in operation accor sinus in operation accor % tion (Random) in operation Hz g²/Hz dB			

**Note:** The user must check that the ambient conditions are maintained, especially the control cabinet temperature, by calculating the thermal performance of the control cabinet.



### Electric Data of the Individual DKC\*\*.3 Components

Mains connections, Power section DKC**.3-040-7-FW
and DKC**.3-100-7-FW

Designation	Symbol	Unit	DKC**.3-	DKC**.3-040-7-FW		DKC**.3-100-7-FW	
Operating mode at the mains			single phase	three phase	single phase	three phase	
Mains input voltage	U <sub>N1</sub> V		1 x AC 3 x AC (200 480) ± 10%		1 x AC 3 x AC (200 480) ± 10%		
Mains frequency	f <sub>N1</sub>	Hz		(50	60) ± 2		
Rotary field			clo	ockwise or co	unter-clockwi	se	
Connected load	S <sub>N1</sub>	kVA	see p	age 11-1: "N	lains Connec	tions"	
Nominal charging current (dependent on mains input voltage)	I <sub>EIN1</sub>	А	5	. 12	12 .	28	
Soft-start resistor	R <sub>Softstart</sub>	Ohm	6			4	
Continuous power soft-start resistor	PSoftstart	kW	0.1	5 <sup>2)</sup>	0.8	5 <sup>3)</sup>	
Switching frequency (selectable)	fs	kHz			or 8		
Type current = peak current 1	I <sub>PEAK1</sub>	А		) <sup>1)</sup>		0 <sup>1)</sup>	
Peak current 2 for $f_S = 4 \text{ kHz}$	IPEAK2(4kHz)	А		<sup>1)</sup>	40	) <sup>1)</sup>	
Peak current 2 for $f_S = 8 \text{ kHz}$	IPEAK2(8kHz)	А	12.	5 <sup>1)</sup>	32	1)	
Continuous current 1 for $f_S = 4 \text{ kHz}$	I <sub>CONT1(4kHz)</sub>	А	13			1)	
Continuous current 2 for $f_S = 4 \text{ kHz}$	I <sub>CONT2(4kHz)</sub>	А		<sup>1)</sup>		) <sup>1)</sup>	
Continuous current 1 for $f_S = 8 \text{ kHz}$	I <sub>CONT1(8kHz)</sub>	А	9		21 <sup>1)</sup>		
Continuous current 2 for $f_S = 8 \text{ kHz}$	I <sub>CONT2(8kHz)</sub>	А	12.	5 <sup>1)</sup>	32 <sup>1)</sup>		
Max. output frequency at f <sub>S</sub> =4 kHz	f <sub>out</sub>	Hz	40	00	400		
Max. output frequency at f <sub>S</sub> =8 kHz	f <sub>out</sub>	Hz	80	00	800		
Device power dissipation without internal continuous bleeder power for I <sub>CONT2</sub>	Pv	W		30 page 12-1: "F	42 Power dissipa	20 tion")	
Peak bleeder power DKC when $U_{ZW} = 850 \text{ V}$	P <sub>BS</sub>	kW		0		20	
for permissible load cycle				, 33 s off	0.25 s on, 60 s off		
Continuous bleeder power DKC when $T_a \leq 45 \text{ °C}$	P <sub>BD</sub>	kW	0.	15	0	.5	
under max. temperature range with distance	ΔT d	K mm	2			50 0	
Max. energy dissipation	W <sub>R,MAX</sub>	kWs	5	.0	3	1	
Max. DC bus charge	W <sub>MAX</sub>	kWs	5	.0	3	1	
Internal DC bus dynamic brake (ZKS)			not present prese		sent		
Resistor for ZKS	R <sub>ZKS</sub>	Ohm	not pr	resent	(	6	
Storable energy of the DC bus capacitors	W <sub>zw</sub>	Ws	see diagrams page 4-17: "Storable energy the bus"		energy in		
Nominal DC bus capacitance DKC	Czw	mF	0.27	±20%	0.675	±20%	
DC bus voltage (dependent on mains input voltage)	Uzw	V	DC 300 800				
DC bus continuous power (dependent on mains input voltage)	P <sub>zwd</sub>		see diagrams page 4-28 "Allow continuous power"			DC bus	

Designation	Symbol	Unit	DKC**.3-040-7-FW	DKC**.3-100-7-FW	
max. DC bus continuous power for a single source supply where $U_{N1} = 3 \text{ x AC 400V}$ , at $T_a \leq 45 \text{ °C}$	P <sub>zwD</sub>	kW	1.3	3.3	
max. DC bus continuous power for a single source supply where $U_{N1} = 3 \text{ x AC } 480 \text{V}$ , when $T_a \leq 45 ^\circ\text{C}$	P <sub>zwD</sub>	kW	1.5	4	
max. DC bus continuous power for a single source supply where $U_{N1} = 3 \times AC 400V$ , CZM01.3, when $T_a \leq 45$ °C	P <sub>ZWD</sub>	kW	1.3	10.5	
max. DC bus continuous power for a single source supply where $U_{N1} = 3 \times AC 480V$ , CZM01.3, when $T_a \leq 45$ °C	P <sub>zwD</sub>	kW	1.5	12	
DC bus peak power	Pzws		see diagrams on pag pov	e 4-27 "DC bus peak ver"	
Power section cooling			with interr	nal blower	
Cooling the bleeder resistor			with internal blower via heatsink and back wall of unit	with internal blower	
Cooling air flow			together for bleede	r and power section	
Volumetric capacity of the forced cooling		m³/h	approx. 24	approx. 48	
Insulation resistance at DC500V	Ris	MOhm	> 8	> 8	
Coupling capacitance power section against housing	Скор	nF	200	200	

Fig. 4-6: Technical Data Mains connection and Power section



Designation	Symbol	Unit	DKC**.3-200-7-FW			
Operating mode at the mains	I		single phase	three phase		
Mains input voltage	U <sub>N1</sub>	V	1 x AC	3 x AC		
			(200 4	80) ± 10%		
Mains frequency	f <sub>N1</sub>	Hz	(50	60) ± 2		
Rotary field			clockwise or co	ounter-clockwise		
Connected load	S <sub>N1</sub>	kVA	see page 11-1: "M	lains Connections"		
Nominal charging current (dependent on mains input voltage)	I <sub>EIN</sub>	А	12 .	28		
Soft-start resistor	R <sub>Softstart</sub>	Ohm	2	24		
Continuous power soft-start resistor	P <sub>Softstart</sub>	kW	1	3)		
Switching frequency (selectable)	f <sub>S</sub>	kHz	4 0	or 8		
Type current = peak current 1	I <sub>PEAK1</sub>	А	20	00 <sup>1)</sup>		
Peak current 2 for $f_S = 4 \text{ kHz}$	I <sub>PEAK2(4kHz)</sub>	А	10	10 <sup>1)</sup>		
Peak current 2 for $f_S = 8 \text{ kHz}$	I <sub>PEAK2(8kHz)</sub>	А	68	8 <sup>1)</sup>		
Continuous current 1 for $f_S = 4 \text{ kHz}$	I <sub>CONT1(4kHz)</sub>	А	8	5 <sup>1)</sup>		
Continuous current 2 for $f_S = 4 \text{ kHz}$	I <sub>CONT2(4kHz)</sub>	А	10	10 <sup>1)</sup>		
Continuous current 1 for $f_S = 8 \text{ kHz}$	I <sub>CONT1(8kHz)</sub>	А	48	8 <sup>1)</sup>		
Continuous current 2 for $f_S = 8 \text{ kHz}$	I <sub>CONT2(8kHz)</sub>	А	68	8 <sup>1)</sup>		
Max. Output frequency at f <sub>S</sub> =4 kHz	f <sub>out</sub>	Hz	4	00		
Max. Output frequency at fs=8 kHz	f <sub>out</sub>	Hz	8	00		
Device power dissipation without internal continuous bleeder power for I <sub>CONT2</sub>	Pv	W	-	60 Power dissipation")		
Peak bleeder power DKC	P <sub>BS</sub>	kW	1	20		
when $U_{ZW} = 850V$ for permissible load cycle			0.5 s on	i, 60 s off		
Continuous bleeder power DKC when $T_a \leq 45$ °C	P <sub>BD</sub>	kW		,00		
under max. temperature range with distance	ΔT d	K mm		00 30		
Max. energy dissipation	W <sub>R,MAX</sub>	kWs	6	60		
Max. DC bus charge	W <sub>MAX</sub>	kWs	6	60		
Internal DC bus dynamic brake (ZKS)			pre	sent		
Resistor for ZKS	R <sub>ZKS</sub>	Ohm		6		
Storable energy of the DC bus capacitors	W <sub>ZW</sub> ,	Ws	0 1 0	17: "Storable energy ir bus"		
Nominal DC bus capacitance DKC	Czw	mF	1.5	±20%		
DC bus voltage (dependent on mains input voltage)	Uzw	V	DC 300	0 800		
DC bus continuous power (dependent on mains input voltage)	P <sub>zwb</sub>			4-28 "Allowed DC bus us power"		

### Mains connections, Power section DKC\*\*.3-200-7-FW

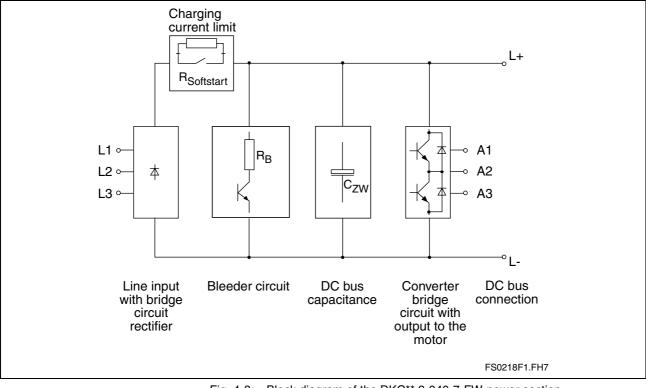
Designation	Symbol	Unit	DKC**.3-200-7-FW
max. DC bus continuous power for a single source supply where $U_{N1} = 3 \text{ x AC } 400 \text{V}$ , at $T_a \leq 45 ^\circ\text{C}$	P <sub>ZWD</sub>	kW	10.3
max. DC bus continuous power for a single source supply where $U_{N1} = 3 \text{ x} \text{ AC} 480 \text{V}$ , when $T_a \leq 45 ^\circ\text{C}$	P <sub>ZWD</sub>	kW	12
max. DC bus continuous power for a single source supply where $U_{N1} = 3 \times AC 400V$ , plus smoothing choke and CZM01.3, at $T_a \le 45$ °C	P <sub>ZWD</sub>	kW	24
max. DC bus continuous power for a single source supply where $U_{N1} = 3 \text{ x AC } 480\text{V}$ , plus smoothing choke and CZM01.3, at $T_a \leq 45 \text{ °C}$	P <sub>ZWD</sub>	kW	27
DC bus peak power	P <sub>zws</sub>		see diagrams on page 4-27 "DC bus peak power"
Cooling power section and bleeder resistor			with internal blower
Cooling air flow			together for bleeder and power section
Volumetric capacity of the forced cooling		m³/h	approx. 150
Insulation resistance at DC500V	R <sub>is</sub>	MOhm	> 25
Coupling capacitance power section against housing	Скор	nF	200

Fig. 4-7: Technical Data Mains connection and Power section

1) Sine threshold value

- 2) Softstart resistor is used after softstart as bleeder (R<sub>B</sub>).
- 3) Softstart resistor is used after softstart as bleeder (R<sub>B</sub>) and DC bus short-circuit resistor (R<sub>ZKS</sub>).

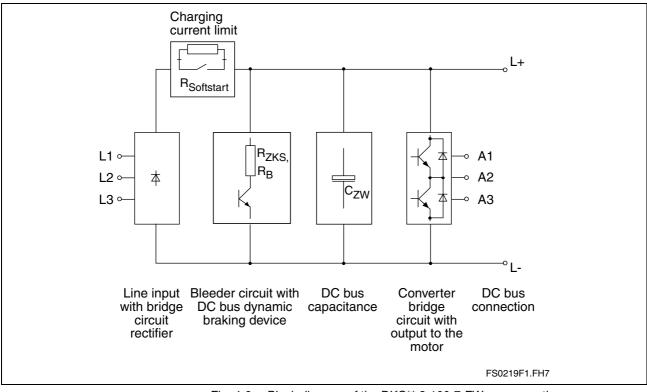




#### Block diagram of the DKC\*\*.3-040-7-FW power section

Fig. 4-8: Block diagram of the DKC\*\*.3-040-7-FW power section

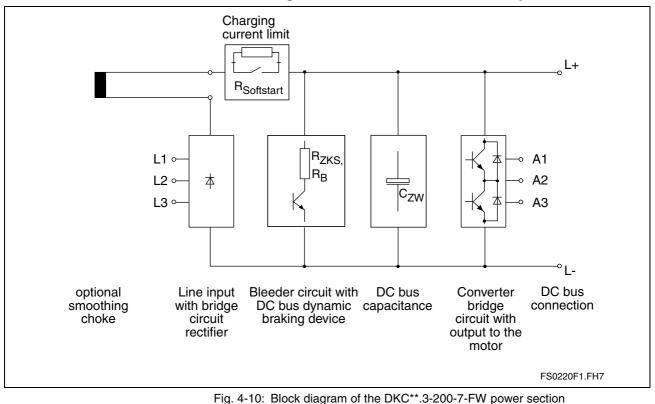




#### Block diagram of the DKC\*\*.3-100-7-FW power section

Fig. 4-9: Block diagram of the DKC\*\*.3-100-7-FW power section





#### Block diagram of the DKC\*\*.3-200-7-FW power section

### Control voltage connection for DKC

(Data applies to ambient temperature of 25 °C)

Designa	ation	Symbol	Unit	DKC**.3-040-7-FW	DKC**.3-100-7-FW		
Control v	oltage	U <sub>N3</sub>	V	DC (19.2	2 28.8) V		
max. ripple effect w		w		may not exceed	input voltage range		
	max. allowed U <sub>N3max</sub>		V	45 V for 1 ms, non repetitive *)			
max. cha current	rging	I <sub>EIN3</sub>	A	4.0 (see diagram on page 4-16 "Output current characteristic curves for servo applications")			
max. puls of I <sub>EIN3</sub>	se duration	t <sub>N3Lade</sub>	ms	12 (see diagram on page 4-16 "Output current characteristic curves for servo applications")			
max. inpu capacitar		C <sub>N3</sub>	mF	0.9 * 1.2 0.9 * 1.2			
Power co (X1)	onsumption		dependen	t on type of unit, without external loa encoder interface 2	ad at control outputs and		
	DKC01.3	P <sub>N3</sub>	W	19	24		
	DKC02.3	P <sub>N3</sub>	W	19	24		
	DKC03.3	P <sub>N3</sub>	W	20	25		
	DKC04.3	P <sub>N3</sub>	W	21	26		
	DKC05.3	P <sub>N3</sub>	W	20	25		
	DKC06.3	P <sub>N3</sub>	W	20	25		
	DKC11.3	P <sub>N3</sub>	W	18 23			
	DKC21.3	P <sub>N3</sub>	W	20	25		
	DKC22.3	P <sub>N3</sub>	W	20	25		

Fig. 4-11: Control voltage connection for DKC



Design	ation	Symbol	Unit	DKC**.3-200-7-FW
Control	voltage	U <sub>N3</sub>	V	DC (19.2 28.8) V
max. rip	max. ripple effect			may not exceed input voltage range
	max. allowed overvoltage		V	45 V for 1ms, non repetitive *)
max. cha current	max. charging		A	6.0
	max. pulse duration of I <sub>EINmax</sub>		ms	9
max. inp capacita		C <sub>N3</sub>	mF	1.0 * 1.2
Power c (X1)	onsumption		depender	t on type of unit, without external load at control outputs and encoder interface 2
	DKC01.3	P <sub>N3</sub>	W	27
	DKC02.3	P <sub>N3</sub>	W	27
	DKC03.3	P <sub>N3</sub>	W	28
	DKC04.3	P <sub>N3</sub>	W	29
	DKC05.3	P <sub>N3</sub>	W	28
	DKC06.3	P <sub>N3</sub>	W	28
	DKC11.3	P <sub>N3</sub>	W	26
	DKC21.3	P <sub>N3</sub>	W	28
	DKC22.3	P <sub>N3</sub>	W	28

Fig. 4-12: Control voltage connection for DKC

\*<sup>1</sup> To be obtained by appropriate mains sections and shielded wire routing. Connections for control voltage: see page 4-45 X1, Connections for Control voltage.

- **Note:** Overvoltages of more than 45 V have to be derived by measures in the electrical equipment of the machine or installation. This includes:
  - 24-Volt mains sections that reduce incoming overvoltages to the allowed value.
  - Overvoltage limiters at the control cabinet input that limit existing overvoltages to the allowed value. This also applies to long 24-Volt lines that have been laid in parallel with power and mains cables and can absorb overvoltages caused by inductive or capacitive coupling.



## Amplitude of the DKC control voltage charging current at startup, to selecting power source

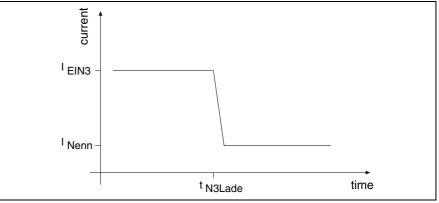


Fig. 4-13: Example of charging current inrush of control voltage

Note: For n parallel-switched inputs the charging current inrush is n-fold.

#### Voltage connection for holding brake

Designation	Symbol	Unit	DKC**.3-040-7-FW	DKC**.3-100-7-FW	DKC**.3-200-7-FW			
Input voltage	U <sub>HB</sub>	V	depends on motor type, listed in motor project planning manual					
Ripple content	w	%	(see also page 4-67 X6, Motor temperature monitoring and holding brakes)					
Current consumption	I <sub>HB</sub>	А						
				a u la a lallus au la ma lua				

Fig. 4-14: Voltage connection for holding brake

#### Materials used, Mass

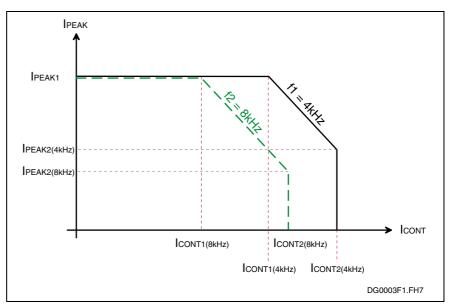
Designation	Symbol	Unit	DKC**.3-040-7-FW	DKC**.3-100-7-FW	DKC**.3-200-7-FW		
Mass	m	kg	5.7	9.7	19.5		
materials used			Free of asbestos and silicone				

Fig. 4-15: Materials used, mass



## Output current characteristic curves for servo applications ( acceleration times $\leq$ 400 ms)

Static profile illustrated:

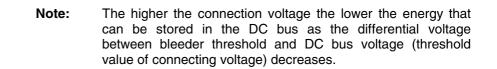


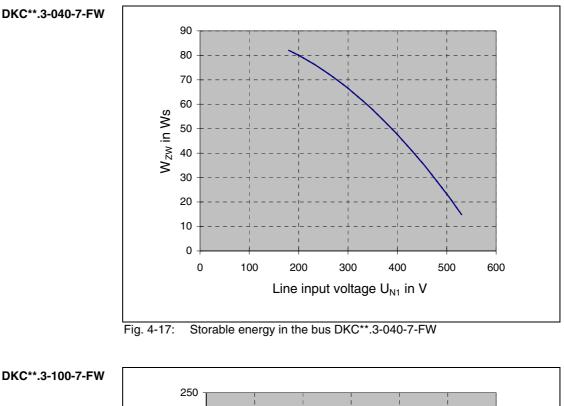


See also the table with electric data page 4-6 onward.



### Storable energy in the bus





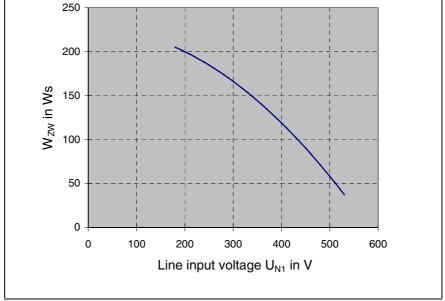


Fig. 4-18: Storable energy in the bus DKC\*\*.3-100-7-FW



DKC\*\*.3-200-7-FW

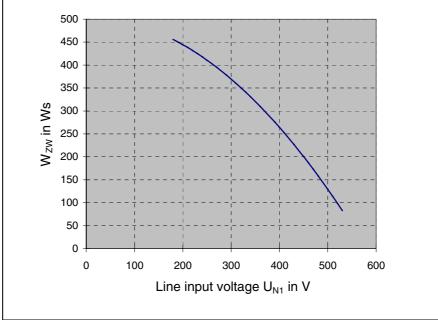


Fig. 4-19: Storable energy in the bus DKC\*\*.3-200-7-FW



#### Mains supply options

#### Single source supply

"Single source supply" is the standard mains supply if only one DKC driver controller (or a DKC drive controller with additional components) is to be supplied with mains voltage.

Characteristic for the single source supply is that the mains voltage is applied to the DKC drive controller via individual mains connections.

#### **Group supply**

"Group supply" is the standard supply if several DKC drive controllers are to supplied from one supply voltage.

Characteristic for the "group supply" is that the mains voltage is applied to groups of DKC drive controllers via a common mains contactor.

The group supply is divided into:

- "group supply with DC bus connection" and
- "group supply without DC bus connection"

Both supply options have their advantages for various demands.

See page 4-21 "Selection criteria for supply options".

#### **Central supply**

A "central supply" is one where several DKC drive controllers are provided with power via a common DC bus from only one DKC drive controller.

Characteristic for the "central supply" is the central power supply through the DKC drive controller that is connected over a single mains contactor to the mains voltage.

**Note on central supply** The "central supply" option is connected at the single phase/three phase input with the DKC that has the highest current type.

**Note:** The connection of the devices DKC\*\*.3-100 and DKC\*\*.3-200 to the mains power is to protect the integrated DC bus dynamic brake (ZKS).

See also "Fig. 4-146: Block diagram interlock ZKS/Mains"



# Number of ECODRIVE03 Units and Auxiliary Components on one DC bus

	Note: The total number of units with bleeder set up on one DC be should not exceed <b>max. 12</b> . Up to this number combination as shown below are possible.							
	Max. numbe	Max. number ECODRIVE components on one DC bus (including supplying unit)						
	DKC**.3-200	DKC**.3-100	DKC**.3-040	BZM01.3-01	CZM01.3-02			
Central supply via DKC**.3-200	3	8	11	4	2			
Central supply via DKC**.3-200 with GLD 12	3	8	11	4	4			
Central supply via DKC**.3-100	0 (not allowed)	3	6	2	2			
Group supply with DC bus connection DKC**.3-040	0 (not allowed)	0 (not allowed)	12	2	1			

Central supply via DKC\*\*.3-200 with GLD 12:

Fig. 4-20: Max. number of ECODRIVE03 components on one DC bus

Example:

• 3 \* DKC\*\*.3-200

- 4 \* DKC\*\*.3-100
- 3 \* DKC\*\*.3-040
- 1 \* BZM01.3-01
- 3 \* CZM01.3-02

Sum of ECODRIVE03 components with bleeder:12Sum of all ECODRIVE03 components:15

Drive controllers with higher rated current can be replaced by drive controllers with lower rated current. Example for central supply via DKC\*\*.3-100 (see table above):  $(3 \times DKC^{**}.3-100) + (6 \times DKC^{**}.3-040)$  can be replaced by  $(9 \times DKC^{**}.3-40)$ .



### Selection criteria for supply options

	Mains supply options				
Selection criteria for "Mains supply options."	Single source supply	Group supply without DC bus connection	Group supply with DC bus connection	Central supply	
only 40 A units	x	x	x		
only 100 A units	х	x		x	
only 200 A units	х	x		x	
Units with different current types	х	x		X (via unit with highest current type )	
largest possible continuous bleeder output			x	x	
largest possible peak bleeder output			x	x	
largest possible regenerative power			x	x	
largest possible DC bus output	x	X <sup>1)</sup>			
least possible installation resources (space, wiring, fuse protection)				x	
highest level of availability of the drive package in case of error	x				
smallest possible charging current inrush				x	
fastest possible DC bus charging		X <sup>2)</sup>	X <sup>3)</sup>		

Fig. 4-21: Selection criteria for supply options

1) Limited to the specifications of the used tripping circuit breaker.

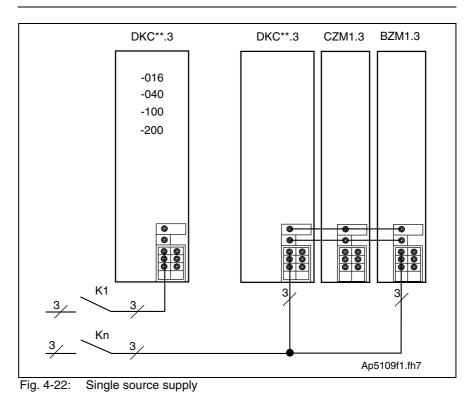
2) No power flux of high power drives onto those with low power flux.

3) All participating discharge units (self or ZKS-discharging) operate parallel.



#### Arranging the Single source supply

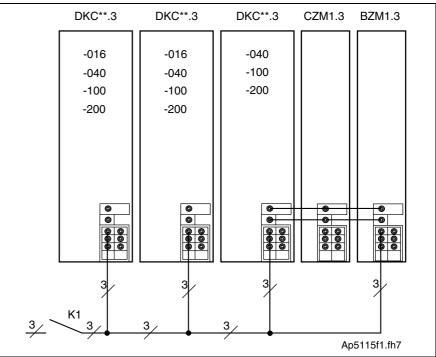
### **Note:** DC bus connection of drive controllers that are connected to the mains via separate contactors is not allowed!



### **Note:** In addition to the illustrated connections of the BZM01.3 at the DC bus, the following connections must be wired as well:

- Bb contact
- control voltage supply





Arranging the Group supply without DC bus connection

Fig. 4-23: Group supply without DC bus connection

**Note:** In addition to the illustrated connections of the BZM01.3 at the DC bus, the following connections must be wired as well:

- Bb contact
- control voltage supply



#### Arranging the Group supply with DC bus connection

**Note:** Increase the available continuous power in the common DC bus for the devices DKC\*\*.3-040.

See also page 16-5 Calculating the allowed continuous braking resistor and DC bus power.

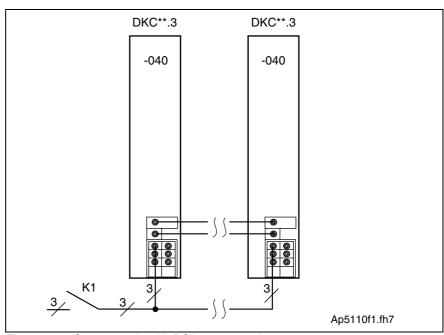


Fig. 4-24: Group supply with DC bus connection

- **Note:** In addition to the illustrated connections of the drive controller at the DC bus, the following connections must be wired as well:
  - Bb contact
  - control voltage supply



#### Arranging the Central supply

- **Note:** DKC\*\*.3-040 as supply unit in "Central supply" not allowed!
- **Note:** The connection of the devices DKC\*\*.3-100 and DKC\*\*.3-200 to the mains power is not to increase the allowed DC bus continuous power but to protect the integrated DC bus dynamic brake setup (ZKS).

DKC\*\*.3 DKC\*\*.3 CZM1.3 DKC\*\*.3 BZM1.3 -040 -100 -100 -200 -200 9 ф ۹ 0 0 0000000 00 00 00 000 3 K1 3 3 Ap5112f1.fh7

See also "Fig. 4-146: Block diagram interlock ZKS/Mains"

Fig. 4-25: Central supply

- **Note:** In addition to the illustrated connections of the drive controller at the DC bus, the following connections must be wired as well:
  - Bb contact
  - control voltage supply
  - Ud and Udpower supply (see "Fig. 4-149: UD power supply")



### Energy circuit DKC\*\*.3 using "Central supply" as an example

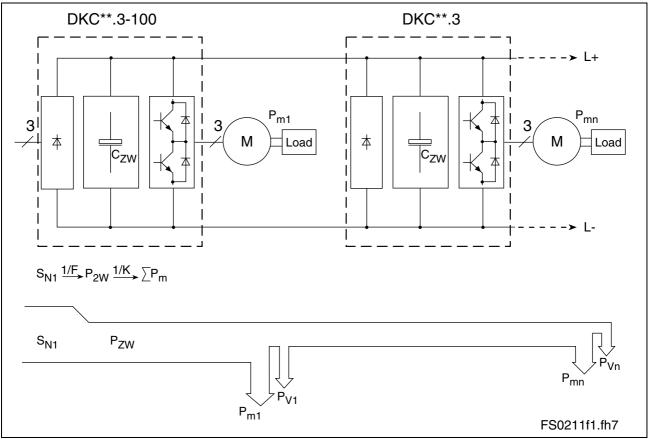
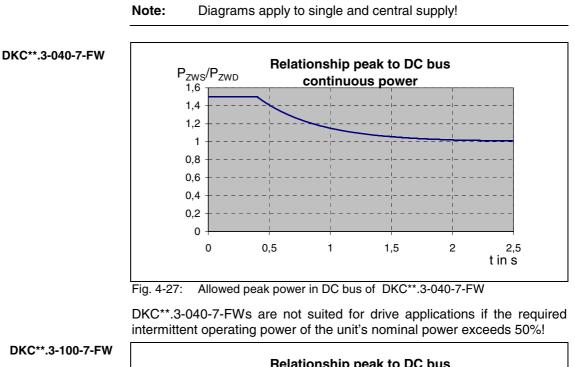
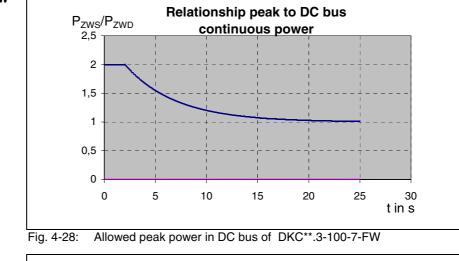


Fig. 4-26: Energy circuit DKC\*\*.3 using "Central supply" as an example



#### Allowed DC bus Peak Power





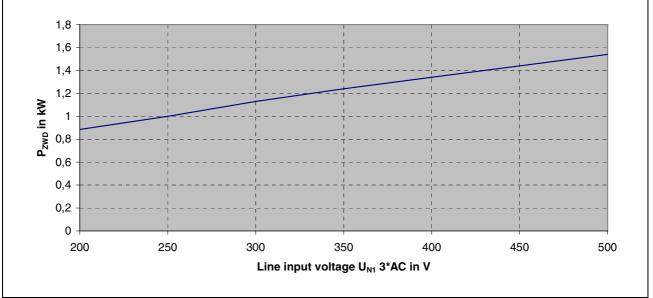
Relationship peak to DC bus P<sub>ZWS</sub>/P<sub>ZWD</sub> 3,5 continuous power 3 2,5 2 1,5 1 0,5 0 20 0 40 60 80 100 120 140 t in s

Fig. 4-29: Allowed peak power in DC bus of DKC\*\*.3-200-7-FW

DKC\*\*.3-200-7-FW



### Allowed DC bus continuous power without auxiliary components



DKC\*\*.3-040-7 in "Single source supply":

Fig. 4-30: Allowed DC bus continuous power for Single source supply DKC\*\*.3-040-7

### DKC\*\*.3-040-7 in "Group supply without DC bus connection":

No increase in the allowed continuous power rating!

See page 4-23: "Arranging the Group supply without DC bus connection"

## DKC\*\*.3-040-7 in "Group supply with DC bus connection":

Further DKC\*\*.3-040-7 devices on the common DC-bus increase the available continuous power. The increase can be seen in the diagram "Fig. 4-30: Allowed DC bus continuous power for Single source supply DKC\*\*.3-040-7". It represents 80% of the value indicated.

### DKC\*\*.3-040-7 in "Central supply":

DKC\*\*.3-040-7 as supply in "central supply" not allowed !



DKC\*\*.3-100-7 in "Single source supply": 4,5 4 3,5 3 P<sub>zwb</sub> in kW 2,5 2 1,5 1 0,5 0 250 300 450 500 200 350 400 Line input voltage U<sub>N1</sub> 3\*AC in V Fig. 4-31: Allowed DC bus continuous power for Single source supply DKC\*\*.3-100-7

### DKC\*\*.3-100-7 in "Group supply without DC bus connection":

No increase in the allowed continuous power!

See page 4-23: "Arranging the Group supply without DC bus connection"

## DKC\*\*.3-100-7 in "Group supply with DC bus connection":

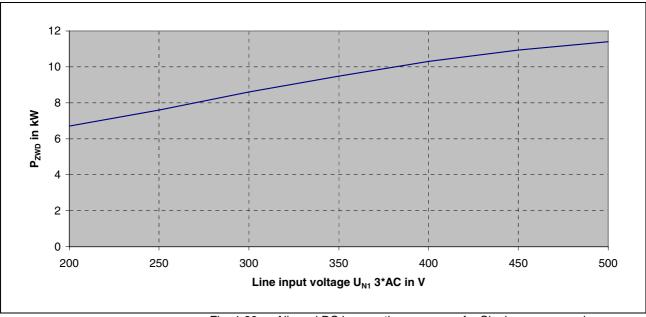
See "DKC\*\*.3-100-7 in "Central supply":"

#### DKC\*\*.3-100-7 in "Central supply":

Further DKC\*\*.3-\*\*\*-7 devices on the common DC-bus increase the sum of the available continuous power. The increase can be seen in the diagram "DKC\*\*.3-\*\*\*-7 in Single source supply" of each particular device.

The sum of the allowed DC bus continuous power is limited to the performance specifications of the DKC\*\*.3-100-7 with CZM 01.3 in single source supply.





DKC\*\*.3-200-7 in "Single source supply":

Fig. 4-32: Allowed DC bus continuous power for Single source supply DKC\*\*.3-200-7

### DKC\*\*.3-200-7 in "Group supply without DC bus connection":

No increase in the allowed continuous power!

See page 4-23: "Arranging the Group supply without DC bus connection"

## DKC\*\*.3-200-7 in "Group supply with DC bus connection":

See "DKC\*\*.3-200-7 in "Central supply":"

#### DKC\*\*.3-200-7 in "Central supply":

Further DKC\*\*.3-\*\*\*-7 devices on the common DC-bus increase the sum of the available continuous power. The increase can be seen in the diagram "DKC\*\*.3-\*\*\*-7 in Single source supply" of each particular device.

The sum of the allowed DC bus continuous power is limited to the performance specifications of the DKC\*\*.3-200-7 with CZM 01.3 in single source supply.



#### Allowed DC bus continuous power with CZM01.3 auxiliary components

- **Note:** The allowed DC bus continuous power of the drive controllers is increased by adding components.
- CZM01.3 reduces the load of the DC bus capacitor in drive controllers.

#### DKC\*\*.3-040-7 with CZM01.3 in "Single source supply":

No increase in the allowed continuous power!

### DKC\*\*.3-040-7 with CZM01.3 in "Group supply without DC bus connection":

No increase in the allowed continuous power!

See page 4-23: "Arranging the Group supply without DC bus connection"

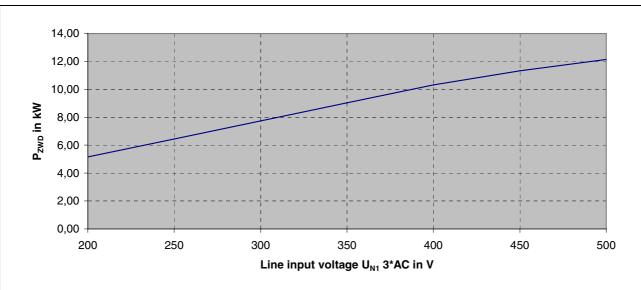
### DKC\*\*.3-040-7 with CZM01.3 in "Group supply with DC bus connection":

No increase in the allowed continuous power!

#### DKC\*\*.3-040-7 with CZM01.3 in "Central supply":

DKC\*\*.3-040-7 as supply in "central supply" not allowed!





DKC\*\*.3-100-7 with CZM01.3 in "Single source supply":

Fig. 4-33: Allowed DC bus continuous power for Single source supply DKC\*\*.3-100-7 with CZM01.3

### DKC\*\*.3-100-7 with CZM01.3 in "Group supply without DC bus connection":

No increase in the allowed continuous power!

See page 4-23: "Arranging the Group supply without DC bus connection"

## DKC\*\*.3-100-7 with CZM01.3 in "Group supply with DC bus connection":

See "DKC\*\*.3-100-7 with CZM01.3 in "Central supply":"

#### DKC\*\*.3-100-7 with CZM01.3 in "Central supply":

Further DKC\*\*.3-\*\*\*-7 devices on the common DC-bus increase the sum of the available continuous power. The increase can be seen in the diagram "DKC\*\*.3-\*\*\*-7 in Single source supply" of each particular device.

The sum of the allowed DC bus continuous power is limited to the performance specifications of the DKC\*\*.3-100-7 with CZM 01.3 in Single source supply.



DKC\*\*.3-200-7 with CZM01.3 in "Single source supply":

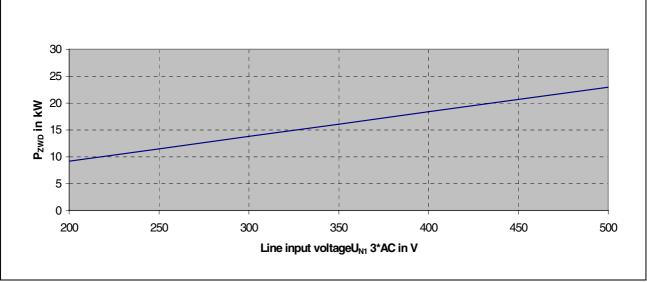


Fig. 4-34: Allowed DC bus continuous power for Single source supply DKC\*\*.3-200-7 with CZM01.3

### DKC\*\*.3-200-7 with CZM01.3 in "Group supply without DC bus connection":

No increase in the allowed continuous power!

See page 4-23: "Arranging the Group supply without DC bus connection"

### DKC\*\*.3-200-7 with CZM01.3 in "Group supply with DC bus connection":

See "DKC\*\*.3-200-7 with CZM01.3 in "Central supply":"

#### DKC\*\*.3-200-7 with CZM01.3 in "Central supply":

Further DKC\*\*.3-\*\*\*-7 devices on the common DC-bus increase the sum of the available continuous power. The increase can be seen in the diagram "DKC\*\*.3-\*\*\*-7 in Single source supply" of each particular device.

The sum of the allowed DC bus continuous power is limited to the performance specifications of the DKC\*\*.3-200-7 with CZM 01.3 in Single source supply.

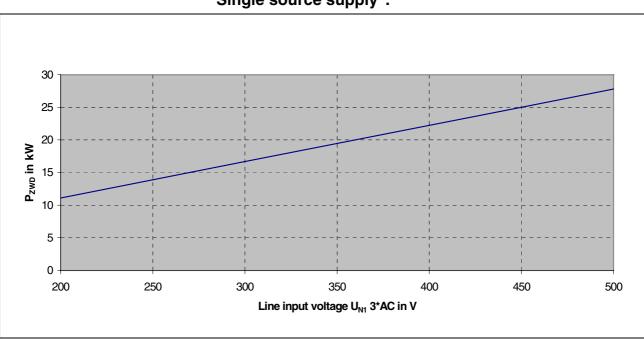


# Allowed DC bus continuous power with CZM01.3 and GLD12 smoothing choke

Note:	The allowed DC bus continuous power of a DKC is increased
	by adding components.

- CZM01.3 reduces the load on the DC bus capacitor in DKCs.
- GLD 12 improves form factor of the connected load and thus the DC bus capacitor load in DKCs (possible with DKC\*\*.3-200-7).





DKC\*\*.3-200-7 with CZM01.3 and filter choke GLD12 in "Single source supply":

Fig. 4-35: Allowed DC bus continuous power for single source supply DKC\*\*.3-200-7 with CZM01.3 and filter choke GLD12

### DKC\*\*.3-200-7 with CZM01.3 and filter choke GLD12 in "Group supply without DC bus connection":

No increase in the allowed continuous power!

See page 4-23: "Arranging the Group supply without DC bus connection"

### DKC\*\*.3-200-7 with CZM01.3 and filter choke GLD12 in "Group supply with DC bus connection":

See "DKC\*\*.3-200-7 with CZM01.3 and filter choke GLD12 in "Central supply":"

### DKC\*\*.3-200-7 with CZM01.3 and filter choke GLD12 in "Central supply":

Further DKC\*\*.3-\*\*\*-7 devices on the common DC-bus increase the sum of the available continuous power. The increase can be seen in the diagram "DKC\*\*.3-\*\*\*-7 in Single source supply" of each particular device.

The sum of the allowed DC bus continuous power is limited to the performance specifications of the DKC\*\*.3-200-7 with CZM 01.3and filter choke GLD12 in Single source supply.

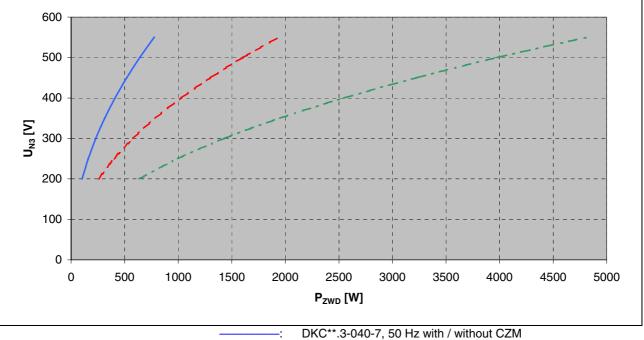


### Allowed DC bus continuous power with single-phase mains connection

The operation of a single-phase mains supply reduces the allowed DC bus continuous power as per the following diagram.

### Allowed DC bus continuous power in single-phase mode at supply networks with a frequency of 50 Hz

DKC\*\*.3-040-7, DKC\*\*.3-100-7

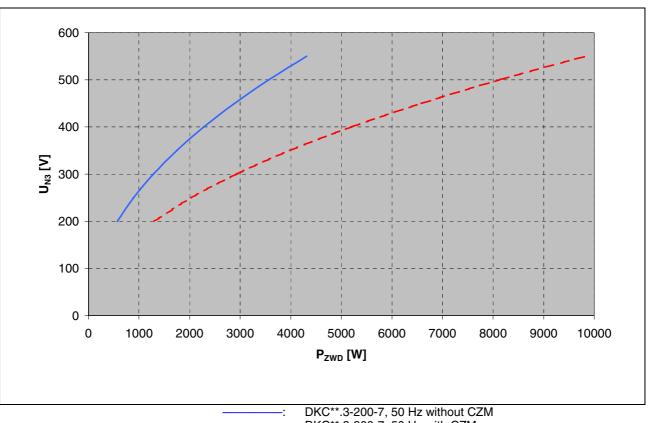


- — - — : DKC\*\*.3-100-7, 50 Hz without CZM

Fig. 4-36: Allowed DC bus continuous power in single-phase mode with 50 Hz



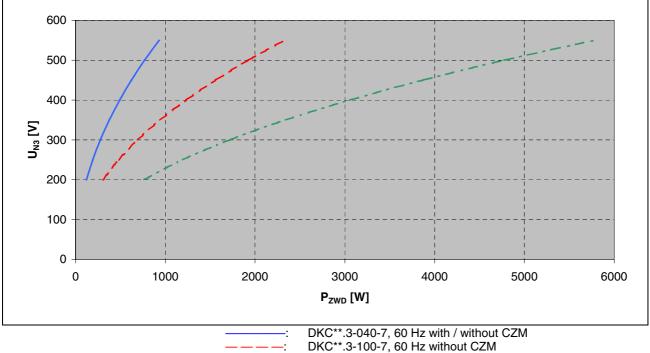
Note: The single-phase mains connection is only permitted with single source supply! With single-phase operation peak power in the DC bus is the same as continuous power.



DKC\*\*.3-200-7

# Allowed DC bus continuous power in single-phase mode with networks with a frequency of 60 Hz

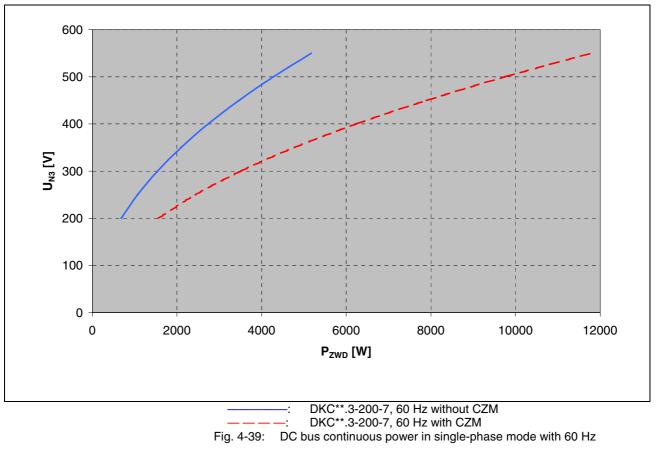
DKC\*\*.3-040-7, DKC\*\*.3-100-7



— - — : DKC ::3-100-7, 60 Hz without CZM — - — : DKC\*\*:3-100-7, 60 Hz without CZM

Fig. 4-38: DC bus continuous power in single-phase mode with 60 Hz

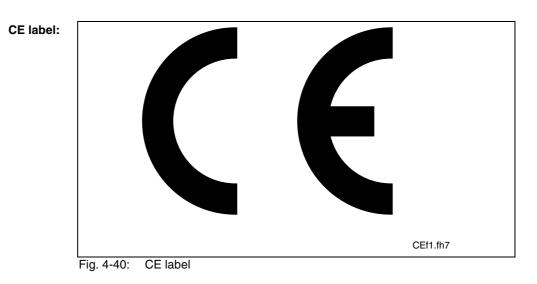






Note:	Do not operate DKC**.3-200-7s with single-phase mains with
	smoothing choke !

### CE label, C-UL listing, Tests



C-UL listing:

• Per UL508 C under file no. E134201.

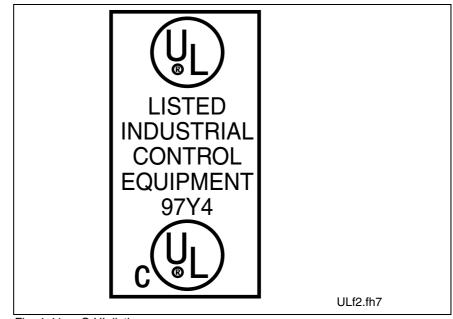


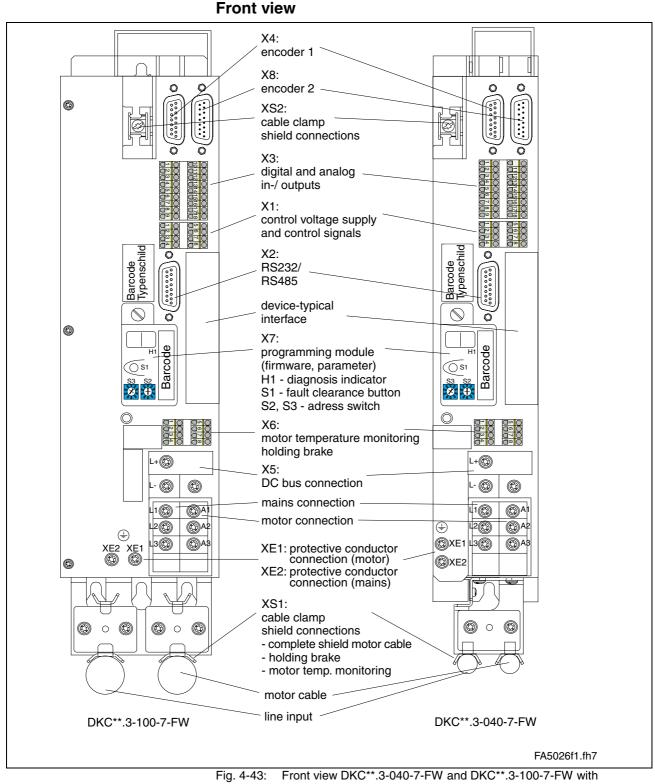
Fig. 4-41: C-UL listing

DKC\*\*.3-040-7s and DKC\*\*.3-100-7s are C-UL listed.

Tests:	High-voltage test according to EN50178	Routine test with DC2100 V	1 s
	Insulation test according to EN50178	Routine test with DC500 V	1 s
	Separation between the electrical circuits of the control and high voltage power	safe separation according to EN50178	
	Clearances and creepage distances	according to EN50178	
	Fig. 4-42: Tests		



# 4.2 Electrical connections - independent of the drive controller type



# A look at the drive controller and connector designations

Connectors



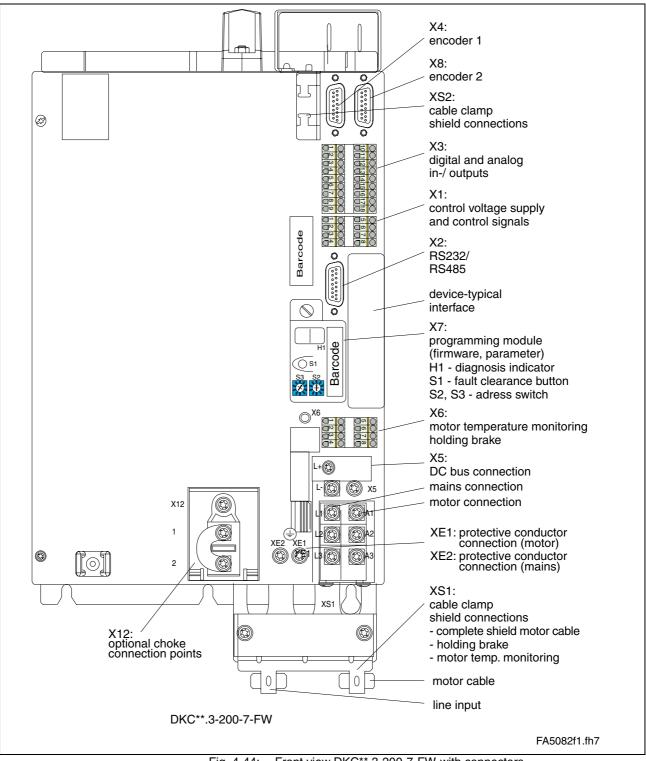
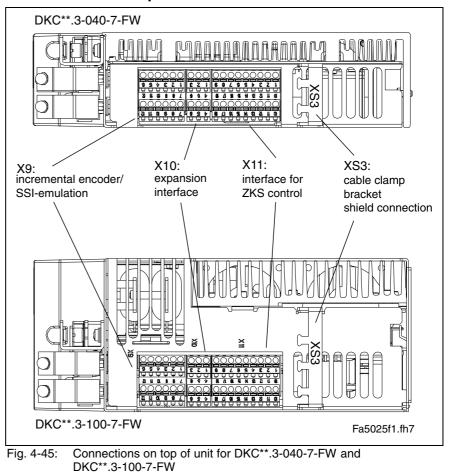
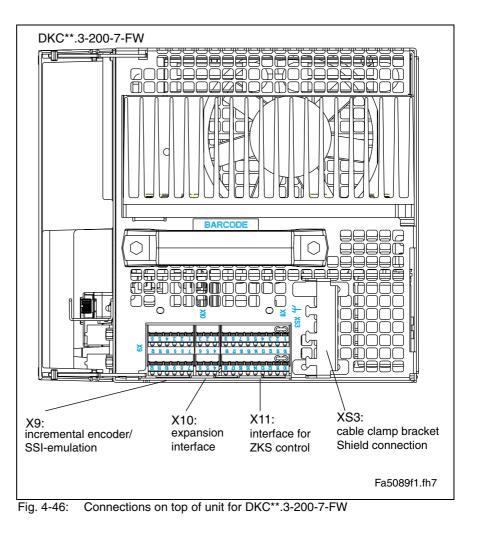


Fig. 4-44: Front view DKC\*\*.3-200-7-FW with connectors



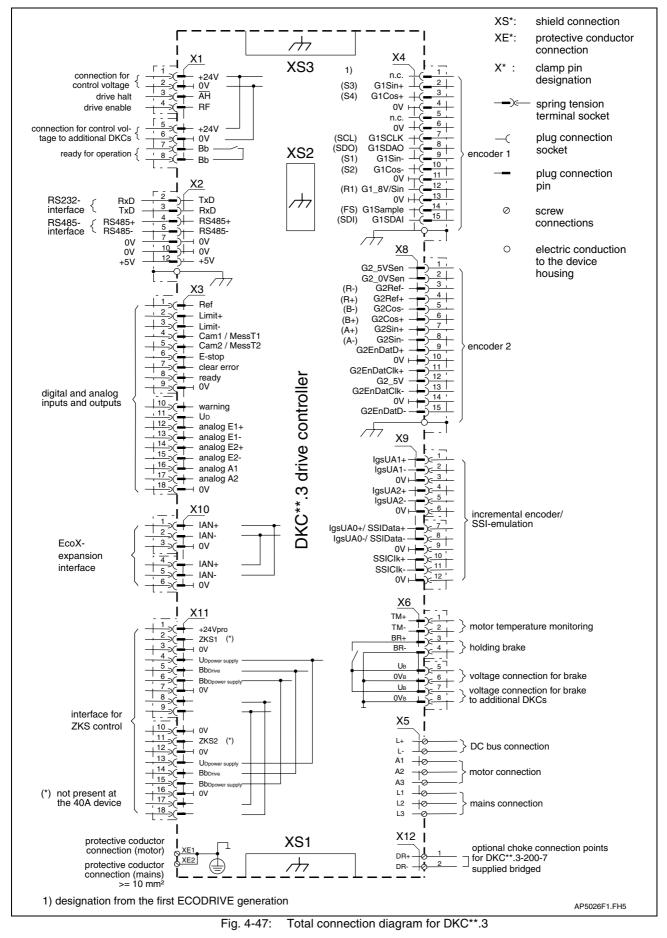


# Connections on top of the drive controller





# Independent of the drive controller type – total connecting diagram



# X1, Connections for Control voltage

### **Technical description of connector**

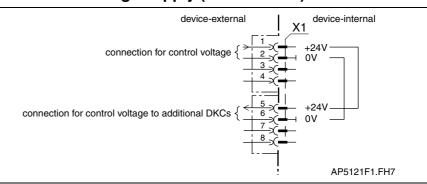
Illustration:	Fig. 4-48: Connector X1	□       □	
Design:	Туре	No. of pins	Design
	Spring contact	2 x 4	Bushing on connector
	Fig. 4-49: Design	•	
Connection cross section:	Cross section single wire	Cross section multi core wire	Cross section in AWG

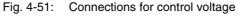
single wire<br/>[mm²]multi core wire<br/>[mm²]in AWG<br/>Gauge no.:0,2-2,51,5-2,516-12

Fig. 4-50: Connection cross section

### 24V control voltage supply (+24V and 0V)







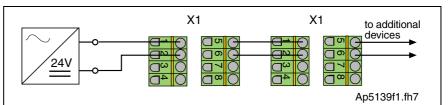


Fig. 4-52: Looping through control voltage

#### Example for application: see page 16-6.

Connection loads +24V and 0V:	Voltage at X1/1 against X1/2: Current or power consumption X1/1:	See page 4-13 "Control voltage connection for DKC"
	Reverse voltage protection:	Via allowed voltage range using internal protection diodes
	Max. allowed current load when looping through the control voltage via X1.1/2 to X1.5/6:	DC 10 A

Technical data for control voltage supply: see page 4-13 Control voltage connection for DKC.



**Note:** Strong mechanical influence on the test tap of the terminals can increase the transition resistance and destroy the terminals.

**Note:** The input 0 V is connected directly to the device potential. The utilization of an insulation monitoring for +24 V and 0 V against device is therefore not possible!

wire +24V and 0V:

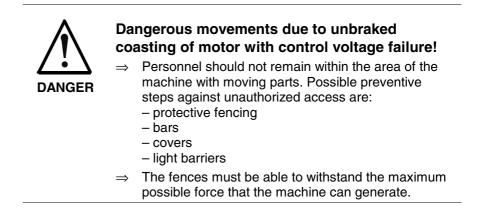
wire cross section:	min. 1 mm <sup>2</sup>
	for looping through: min. 2,5 mm <sup>2</sup>
wire routing:	parallel if possible
Max. allowed inductance between 24V source and X1:	100 μH (equals about 2 x 75 m)

**Note:** If the cross sections of the lines for looping through the control voltage are too small, the terminals can be damaged.

#### Note:

- Exceeding allowed control voltage generates error message "+24 volt error". (=> See also firmware functional description.)
- Control voltage failure causes the running motor to coast torque-free (without brake).

See page 11-5: "Control Circuits with internal DC bus dynamic brake (ZKS)"





# Drive halt (AH) and Drive enable (RF)

#### Note:

- Inputs work with inactive bus communication.
- Inputs don't work with active bus communication (SERCOS interface, Profibus-DP, ...).

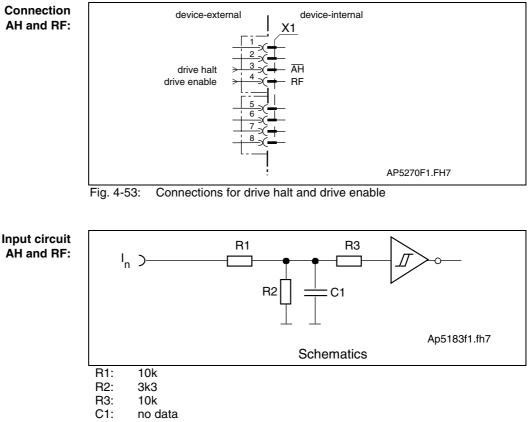


Fig. 4-54: Input circuit

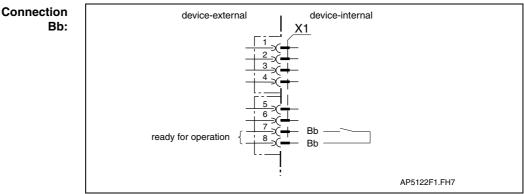
#### Inputs AH and RF:

s	Input voltage:	min.	max.
:	High	16 V	30 V
	Low	-0.5 V	3 V
	Input resistance	13.3 kOhm ± 5%	
	Reaction time	See firmware functional description	

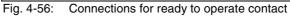
Fig. 4-55: Inputs

- **AH:** The drive halt function is used to bring an axis to standstill with defined acceleration and jerk (see firmware functional description).
- **RF:** The input drive enable (RF) activates the drive with a 0-1 edge.
  - **Note:** If the inputs are controlled by a power supply other than the DC24 volt supply of the drive controller, then the reference lead of the other power supply must be connected to X1.2 (0 V).





# Ready to operate contact Bb



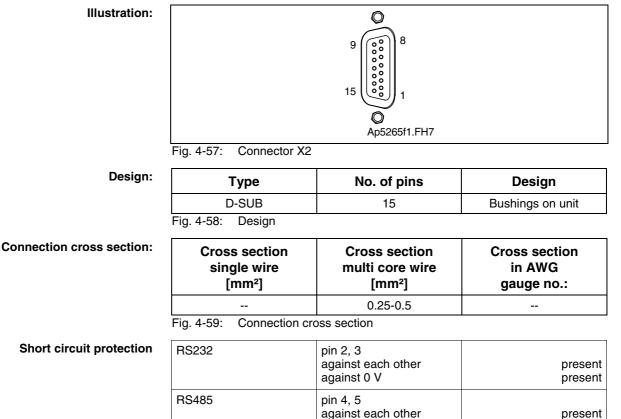
Loodobility of the connection	0.11.1			
Loadability of the connection Bb:	max. Switching voltage:		DC 40 V	
	max. Switching	g current:	DC 1 A	
	max. continuou	us current:	DC 1 A	
	Minimum conta	act load:	10 mA	
	Guaranteed number of switching operations at max. time constant of load < 50 ms:		250,000	
Switching states	The Bb contac	cts opens:		
Bb:	<ul> <li>if control voltage for DKC is not applied</li> </ul>			
	<ul> <li>if 24 volts not present at the emergency stop input when the E-stop function is activated (depends on parameterization, see function description).</li> </ul>			
	• With an error in the drive (depends on parameterization, see firmware functional description: "Power off on error").			
	How to use th Connection"	he contact, see page 11-2 "	Control Circuits for the Mains	
	Â	Damage possible if Bb of The ready to operate contact is ready for mains voltage.	contact not connected! ct Bb acknowledges the drive	
	WARNING	⇒ Integrate Bb contact as Mains Connection".	s per "Control Circuits for the	
		$\Rightarrow$ The evaluation of the E cause any operating de	Bb contact by a PLC may not lay of more than 10 ms.	



# X2, Serial Interface

**Note:** Serial interfaces are generally used for programming, parameterization and diagnoses upon commissioning and during service. It can be operated either as RS232 or RS485.

### Technical description of connector



against 0 V

Fig. 4-60: Short circuit protection



present

#### RS232 interface

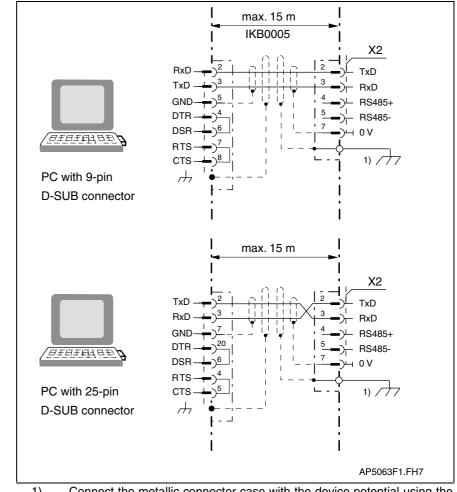
The RS232 interface is used for programming, parameterization and diagnoses at start up and service.

It makes possible:

- a participant number of maximum 1
- a transmission length of up to 15 m
- transmission rates of 9600/19200 baud

Using an RS232 interface only one drive at a time can be parametrized with the DriveTop start up program.

Connection RS232:



 Connect the metallic connector case with the device potential using the fastening screws of the connector

Fig. 4-61: Connecting a PC to the RS232 interface on a DKC

See page 13-4: "Additional Accessories".



#### RS485 interface

The RS485 interface is used for programming, parameterization and diagnoses at start up and service.

It makes possible:

- the implementation of a serial bus with up to 31 participants connected via a two-wire cable (half duplex mode)
- A transmission length of up to 500 m
- Transmission rates of 9600/19200 baud
- The use of a centrally PC supported visualization unit

Using an RS485 enables the commissioning of several DKCs with DriveTop without changing the interface cables is possible.

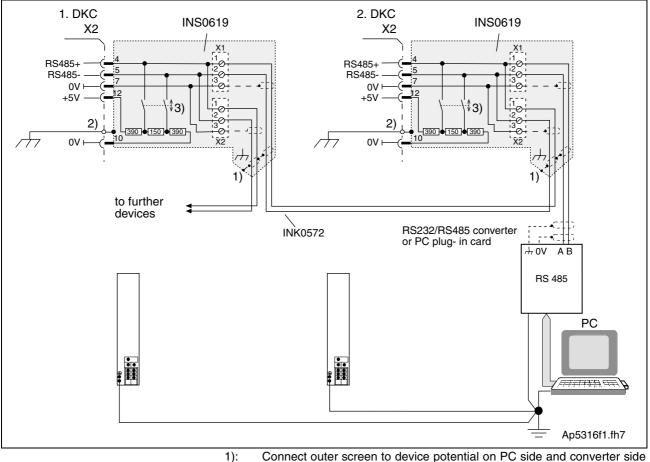
The following options for working with RS485 are available

- RS232/RS485 converter between PC and drives
- RS485 plug-in card in PC

Please contact your PC supplier to help find solutions.

Installation notes for RS485 – cables

**Note:** Details are listed in "Electromagnetic compatibility (EMC) and control systems", doc. Type DOK-GENERL-EMV\*\*\*\*\*\*\*-PRxx.



#### Connection for RS485 interface:

- 1): Connect outer screen to device potential on PC side and converter side (strain relief of metallic connector case)
- 2) Connect the metallic connector case with the device potential using the fastening screws of the connector
- 3) If the drive controller is fitted as the last participant of a RS485 bus, activate the bus termination. => Shift switch to "I".
- Fig. 4-62: Connection example of RS485 interface
- $\Rightarrow$  See also the firmware functional description: "Serial Communications"



# X3, Digital and analog I/Os

## **Technical description of connector**

#### Illustration:

Design:



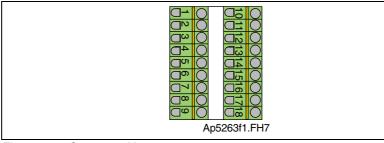


Fig. 4-63: Connector X3

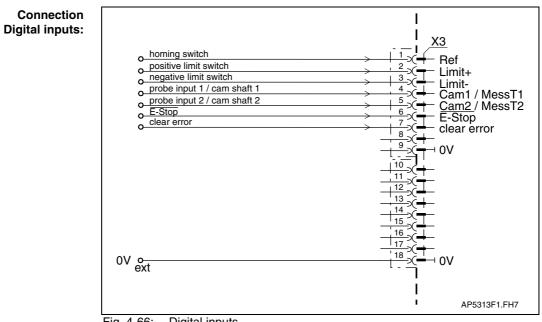
Туре	No. of pins	Design
Spring contact	2 x 9	Bushing on connector
Fig. 4-64: Design		

**Connection cross section:** 

Cross section	Cross section	Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	Gauge no.:
0,2-2,5	0.2-1.5	24-16

Fig. 4-65: Connection cross section

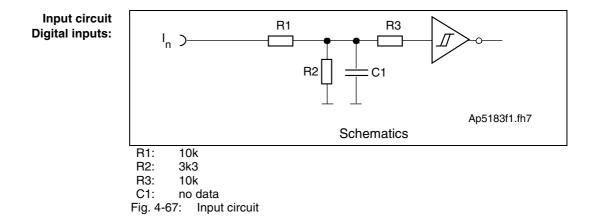
# Digital Inputs (Ref, Limit+, Limit-, Cam1/ MessT1, Cam2/ MessT2, E-Stop and clear error)



#### Digital inputs Fig. 4-66:



max.



#### Inputs Digital inputs:

Input voltage:

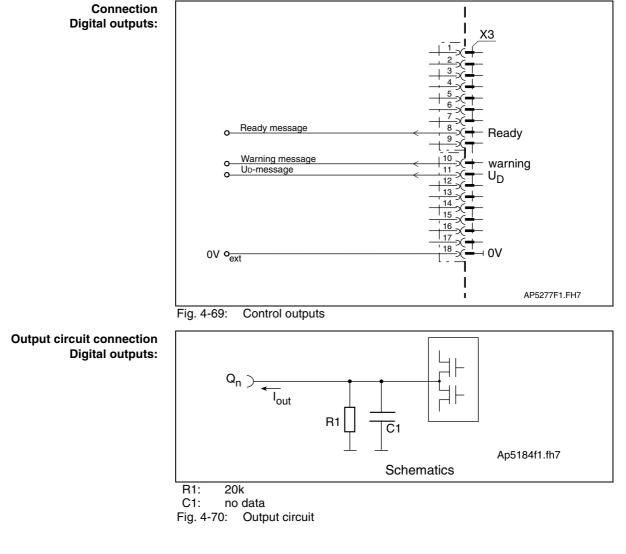
Digital inputs:	High		16 V	30 V
	Low		-0,5 V	3 V
	Input resi	stance	13,3 kOł	nm ± 5%
	Reaction	time	see firmware functional description	
	Fig. 4-68:	Inputs		
	DC24 volt supply		controlled by a power of the DKC, then the ly must be connected to	reference lead of the
Homing switch:	The positive edge of the homing switch is always evaluate			aluated.
Limit+, Limit-:			or N/O depending functional description.	on how the drive is
Probes:	Position and time measurements are read using two binary input signals.			binary input signals.
Cams:	Switching-signal dependent to the next block possible wit			

min.

**Note:** If the functions probe and following block mode are simultaneously activated, then both functions evaluate the inputs independently of each other.

- **E-Stop:** At delivery, the E-stop function is deactivated depending on what has been parametrized. See firmware functional description.
- **Clear error:** With a positive edge at the input "clear error", all errors (up to four) are cleared. With the actuation of the S1 button (firmware module) only the error in the display is cleared and any other errors present are then shown.
  - **Note:** The errors entered in the back-up memory are not cleared with the "clear error" input.

Digital outputs (ready, warning and U<sub>D</sub>-message)



#### Output connections Digital outputs:

min.	max.	
16 V	U <sub>ext</sub> (at X1.1-1V)	
-0.5 V	1.5 V	
80 mA		
about < 600 ns		
<ul> <li>short circuit protection; at I<sub>out</sub> &gt; 300 mA the outputs switch off</li> <li>thermal shutdown</li> </ul>		
-	16 V -0.5 V 80 about < - short circuit protection at I <sub>out</sub> > 300 mA the o	

#### Fig. 4-71: Outputs



- **Warnings:** Depending on operating mode and parameter programming a number of monitoring functions are conducted. If a condition is detected that still allows for correct operations but would eventually lead to an error, then the warning is set to high.
  - $\Rightarrow$  See also firmware functional description.
  - **Ready:** If the unit is ready for the drive enable, then the output ready is set to high.

The output is set to low

- with a pending error
- with DC bus voltage < (0.75 x threshold value of applied mains voltage)
- with lacking control voltage
- $\Rightarrow$  See also functional firmware description: "Ready".

See page 4-88: "UD power supply".

Delay time  $t_d$  from applying mains voltage to the setting of the  $U_D$  signal is

#### • single phase mains connection:

Γ		td = 2 * Rsoftstart * 1.2 * Czw * 3 + 50ms
_	t <sub>d</sub>	delay time
	Reatterart	take value from "technical data" list

Czw: sum of DC bus capacitors

Fig. 4-72: Delay time for single phase mode

See page 4-36: "Allowed DC bus continuous power with single-phase mains connection".

#### • three-phase main connection:

td = Rsoftstart \* 1.2 \* Czw \* 3 + 50ms

Fig. 4-73: Delay time for three-phase mode

Resulting load resistance R:

This resistance of all mains voltages connected to DKC at one DC bus

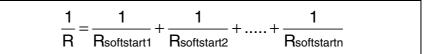


Fig. 4-74: Load resistance

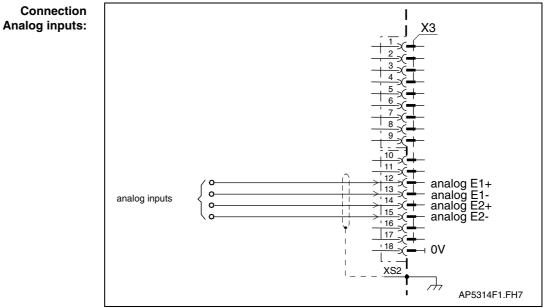
**Resulting DC bus capacitance C:** 

#### The resulting DC bus capacitance of all units on one DC bus

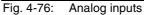
C = CZW, DKC1 + CZW, DKC2 + ... + CZW, DKCn + CZW, CZM

Fig. 4-75: DC bus capacitance

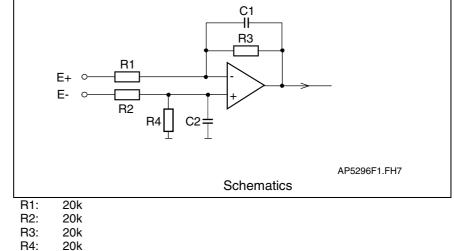




#### Analog inputs 1 and 2







- 14: 20K
- C1: no data C2: no data
- Fig. 4-77: Input circuit
- Inputs

Ana	og	inp	uts:
-----	----	-----	------

Input voltage range	Working range	max.	
between E+ and E-:	± 10 V ± 15 V		
between E+ and 0 V:	± 10 V	± 15 V	
between E- and 0 V:	± 10 V	± 15 V	
Input current	no data		
Input resistance for differential signal	40 kOhm ± 5%		
AD converter	12 Bit		
Resolution per bit	4,88 mV		
Limit frequency	800 Hz		
Probe	See function description		

Fig. 4-78: Inputs



Analog inputs:

- The analog differential inputs 1 and 2 can be parametrized as needed and can be used, for example, as an analog speed command value inputs, override inputs or for analog torque reduction.
  - See Function Description also: "Analog inputs".  $\Rightarrow$

# Analog outputs 1 and 2

#### Connection Analog outputs:

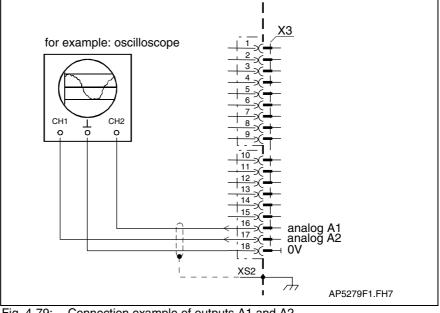


Fig. 4-79: Connection example of outputs A1 and A2



#### **Risk of damage!**

Allowed maximum cable length at X3.16 and X3.17: ⇒ 3 m.

#### Outputs Analog outputs:

Output voltage	min.	max.
between A1 and 0 V:	- 10 V	+ 10 V
between A2 and 0 V:	- 10 V	+ 10 V
output current	max. 2	2 mA
output resistance	150	R
DA converter	8 B	it
Resolution per bit	78 n	۱V
short-circuit and overload protection	not pre	esent
Probe	See firmware funct	tional description

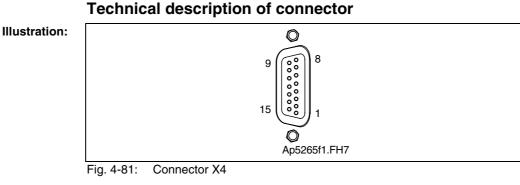
Fig. 4-80: Outputs

Analog outputs: Analog outputs 1 and 2 can be freely parameterized and used for diagnostics or implementation of master/slave mode.

 $\Rightarrow$  See also firmware functional description: "Analog outputs"



# X4, Encoder 1



#### Design:

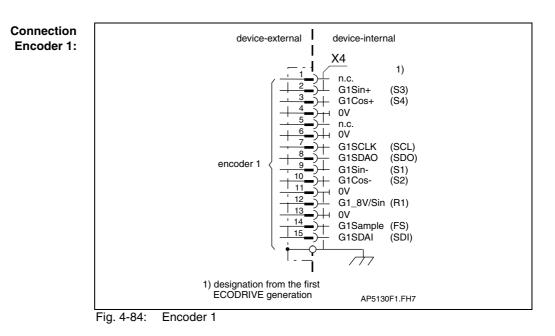
Туре	No. of pins	Design
D-SUB	15	bushing on unit
Fig. 4-82: Design		

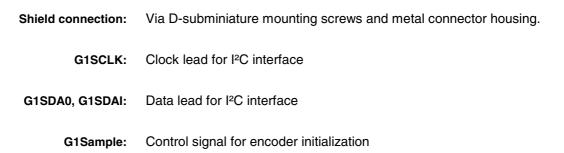
#### **Connection cross section:**

Cross section single wire [mm²]	Cross section multi core wire [mm²]	Cross section in AWG gauge no.:
	0.25-0.5	

Fig. 4-83: Connection cross section

# **Encoder 1**

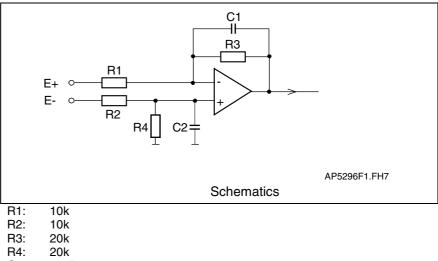






G1Sin+ (S3), G1Sin- (S1):

Input circuit G1Sin+ (S3), G1Sin- (S1):



C1: no data

C2: no data

Fig. 4-85: Input circuit

#### Features of the differential input circuit G1Sin+ (S3), G1Sin- (S1):

	Digital servo feedback	Resolver
max. allowed amplitude encoder signal	(1,0 + 0,1) Vss	9,0 Vss
Evaluation AD converter	12 Bit	12 Bit
Limit frequency	75 kHz	
Input resistance	20k ± 5%	

Fig. 4-86: Features of the differential input circuit

#### G1Cos+ (S4), G1Cos- (S2): See (

See G1Sin+ (S3), G1Sin- (S1)

#### G1\_8V/Sin: Features of the encoder output amplifier stage G1\_8V/Sin:

	Digital servo feedback	Resolver
Output voltage	8 V <sub>DC</sub> ± 0,2V	18,2 Vss (sine with 4 kHz)
max. output current	DC 250 mA	AC 70 mA eff.
min. DC resistance of the load		35 R

Fig. 4-87: Features of the encoder output amplifier stage



Signal allocation (X4)	signal des	signation	signal form	actual position value (with default setting)
	G1Sin+(S3) G1Sin- (S1) G1Cos+(S4) G1Cos- (S2)		DSF (sine 1 Vss without 120 Ohm matching resistor, I <sup>2</sup> C-Bus)	increasing
	G1Sin+(S3) G1Sin- (S1) G1Cos+(S4) G1Cos- (S2)		Resolver	increasing
amplitude-modulated signal				

# Signal allocation to the actual position value

Fig. 4-88: Signal allocation to the actual position value

Note:	3					
	=> see (Encode		functional	description:	"Motor	Encoder"

# **Connecting the Measuring System**

See page 1-4: "An Overview of Measuring Systems Supported".



# X5, DC bus, Motor and Mains Connections

### Technical description of connector

Illustration:			L+ (3) L- (3) L2 (3) (3) A3 Ap5267f1.FH7
	Fig. 4-89:	Connector X5	· · · ·

Design:

Туре	No. of pins	Design
connection block	2/3/3	screw-in connection for ring terminals M5
Fig. 4-90: Design		

**Tightening torque:** 

min. tightening torque [Nm]	max. tightening torque [Nm]
2.5	3.0

Fig. 4-91: Tightening torque

Connection cross section:

Cross section	max. connectable	max. Cross section
single wire	cross section	in AWG
[mm²]	[mm²]	gauge no.:
	25	

Fig. 4-92: Connection cross section

# **DC** bus connection

The DC bus connection connects several controllers to each other plus it connects controllers together with auxiliary components

- Increase allowed DC bus continuous power
- Increase allowed bleeder continuous load
- Allow connections for "Central supply"

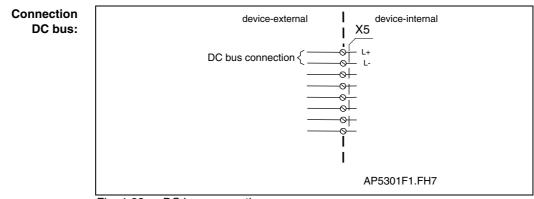


Fig. 4-93: DC bus connection





Damage possible if DC bus connections L+ and L- are reversed!

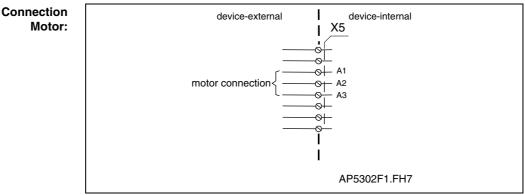
 $\Rightarrow$  Make sure polarity is correct.

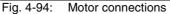
wire If the DC bus rails supplied do not make a connection possible, then use DC bus: short twisted wires to do so.

wire length:	max. 2 x 1 m
wire cross section:	min. 10 mm², not smaller than the cross section of the mains supply lead
wire protection	With a fuse in the mains connections
Voltage resistance of individual wires to ground	≥ 750 V (e.g., litz wires - H07)



#### **Motor connection**





**Cable** Use Rexroth Indramat motor power cables to connect motor and **Motor:** controller.

**Note:** For technical data on connections and cross sections, see the motor project planning manual.

#### Cable length:

Maximum length equals 75 m:

- With two connections between controller and motor (e.g., plugs at exit of control cabinet and at machine)
- Standard cables from Rexroth Indramat
- Ambient temperatures of ≤ 40 °C per EN 60 204
- Switch frequency of 4 kHz

Maximum allowed capacitance per unit length at A1, A2, A3:

- with regard to ground: 0.5 nF/m
- cable to cable: 0.5 nF/m

Maximum allowed inductance per unit length an A1, A2, A3:

• 100 nH/m

To maintain EMC values, the motor cable length is limited with a switching frequency of > 4 kHz. It is largely dependent on the application and ambient conditions at the installation and machine.

A guide value is listed below:

Cycle frequency drive controller	Max. length for class B, EN 55011	Max. length for class A, EN 55011
standard setting switching frequency 4 kHz	75 m	75 m
parameter setting switching frequency 8 kHz	25 m	50 m

Fig. 4-95: Guide value for maximum motor cable lengths





#### No guarantee!

If third party cables are used, then the guarantee is forfeited for the entire system.

 $\Rightarrow$  Use Rexroth Indramat cables!



### **Mains connections**

The mains connector serves as the connection of the drive controller with the power supply.

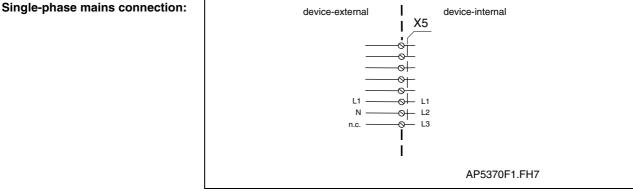
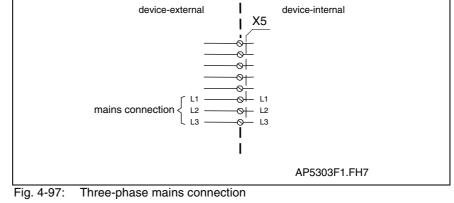


Fig. 4-96: Single-phase mains connection

Three-phase mains connection:



**Note:** Mains connections should not be daisy-chained between the units (intermediate connectors for the supply source should be used).

See page 11-1: "Mains Connections"



# X6, Motor temperature monitoring and holding brakes

### **Technical description of connector**

#### Illustration:

	<b>56</b> <b>0</b> <b>0</b> <b>0</b> <b>0</b> <b>0</b> <b>0</b> <b>0</b> <b>0</b> <b>0</b> <b>0</b>
Ap	5264f1.FH7

Fig. 4-98: Connector X6

Design:

Туре	No. of pins	Design
Spring contact	2 x 4	Bushing on connector
Fig 4.00; Decign		

Fig. 4-99: Design

#### Connection cross section:

Cross section single wire [mm²]	Cross section multi core wire [mm²]	Cross section in AWG Gauge no.:	
0.2-2.5	1,5-2,5	16-12	
Fig. 4-100: Connection cross section			

Fig. 4-100: Connection cross section



# Damages by exchanging the connectors X6.1-4 and X6.5-8!

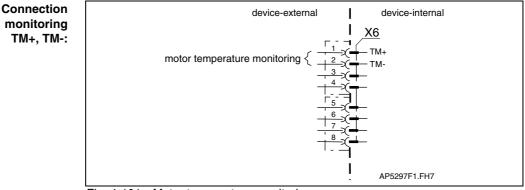
 $\Rightarrow$  Do not exchange connectors X6.1-4 and X6.5-8.

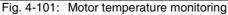
 $\Rightarrow$  Only use lines with sufficient cross section.



# Motor temperature monitoring (TM+, TM)

Connections TM+ and TM- are used to evaluate the temperature of connected Rexroth Indramat motors. These are equipped with a temperature-dependent resistor (either PTC or NTC dependent on the motor type) to monitor temperature. The connection leads are in the motor power cable.





Motor temperature evaluation:

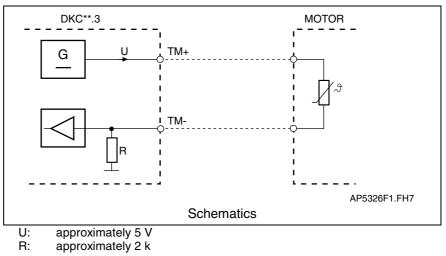


Fig. 4-102: Motor temperature evaluation

**Note:** Connections TM+ and TM- are only to be used with Rexroth Indramat motors.

 $\Rightarrow$  See also firmware functional description : "Temperature monitoring".



# Holding brake (BR+, BR-)



Dangerous movements! Danger to personnel from falling or dropping axes!

- ⇒ The standard equipment motor brake or an external brake controlled directly by the servo drive are not sufficient to guarantee the safety of personnel!
- $\Rightarrow$  Personnel safety must be acquired with higher-ranking procedures:

Dangerous areas should be blocked off with fences or grids.

Secure vertical axes against falling or slipping after switching off the motor power by, for example:

- Mechanically securing the vertical axes
- Adding an external brake / clamping mechanism
- Balancing and thus compensating for the vertical axes mass and the gravitational force

These connections control the holding brakes in the connected motors.

For the switching performance, see function description.

To connect external loads note allowed contact loads.

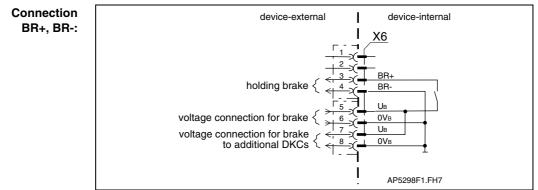


Fig. 4-103: Holding brake and voltage connection

#### Loadability of connections BR+, BR-:

Units	DKC**.3-040-7, DKC**.3-100-7	DKC**.3-200-7
max. switching voltage:	DC 40 V	
max. switching current:	DC 2 A	DC 4 A
max. continuous current:	DC 2 A	DC 4 A
Minimum contact load:	100 mA	
Guaranteed number of switches at max. time constant of load <50ms (L <sub>Bremse</sub> /(24V/I <sub>Bremse</sub> )):	250.000	
Short-circuit and overload protection in the row to the contact	present	



# Voltage connection for brakes

**Note:** The motor holding brake is not supplied by the controller. Given one voltage source for brake and control voltage, use parallel leads from the voltage source. Note the voltage range for the motor holding brake according to the motor projection.



#### Risk of damage!

⇒ The maximum allowed current load of the terminals for the voltage supply of the brake and the control voltage supply must also be observed in the case of a short circuit.

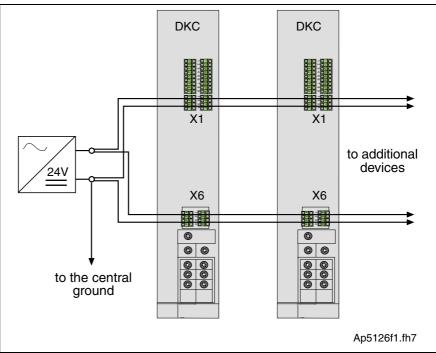


Fig. 4-104: Shared voltage source for brakes and control voltage supply

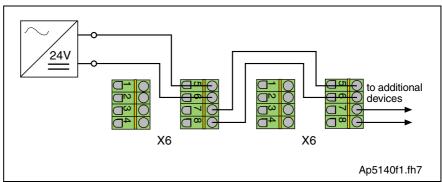


Fig. 4-105: Looping through the brake supply



Voltage connection for brakes	max. voltage at X6.5/7 against X6.6/8:		DC 40 V
on DKC:	current consumption at X6.5 and needed supply voltage:		see "Technical data" brake in the motor manual
	max. allowed current load when looping through brake supply over X6.5/6 to X6.7/8:		DC 10 A
Wire voltage connection for brake:	wire cross section:	min. 1 mm <sup>2</sup> for looping through: min. 2.5 mm <sup>2</sup>	
	Voltage resistance of single wire to ground		≥ 750 V (e.g.: litz wires - H07)

ground	(e.g.: litz wires - H07)
wire routing	parallel if possible (twisted)
max. inductance between 24 V source and X6	100 µH (equals about 2 x 75 m)



#### Risk of damage!

Risk of damage by increased transition resistance in the case of strong mechanical influence at the test tap.

### Motor holding brake

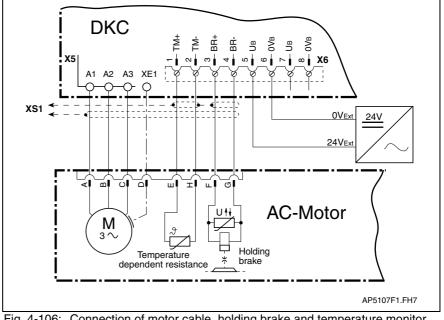
Controlling the motor holding brake:

The controller controls the holding brake.

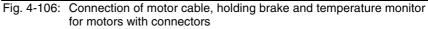
Technical data Motor holding brake:

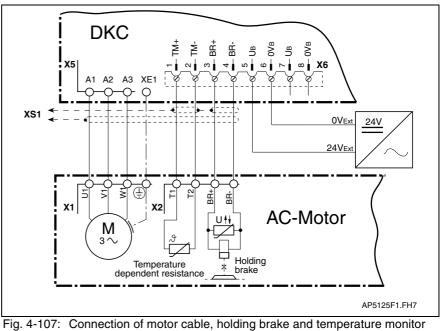
Supply voltage, current consumption, linking, separating time, holding torque, etc. see motor manual.

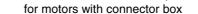




Basic connection of motor power, holding brake and motor temperature monitoring







**Note:** The cable designations and all details on making cables are outlined in the cable or motor document.

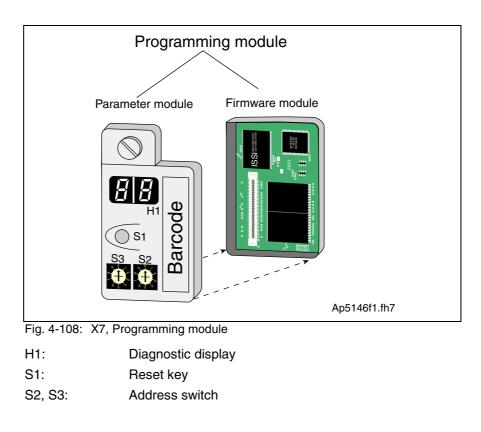


# X7, Connection for Programming module

# **Programming module**

The programming module can be broken down into

- Parameter module for user-specific parameters
- Firmware modules for unit-specific firmware



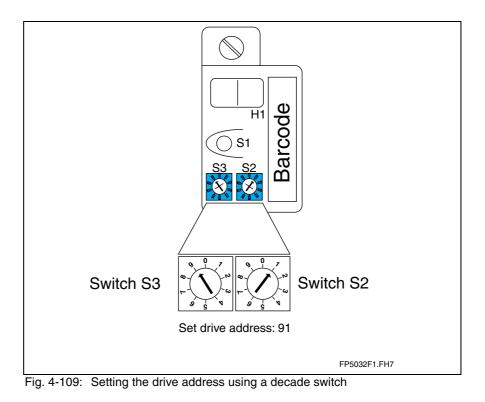


# **Setting the Drive Address**

Switch S2, S3; Two decade switches are used to set the drive address. It can be set to any number between 1 and 99.

Example:

Switch setting S3 = 9 (value of tens) Switch setting S2 = 1 (value of ones) Drive address = 9 \* 10 + 1 = 91



Note: The address is not set at delivery. The setting of switches S2 and S3 depends on the model, firmware and the drive address wanted.

 $\Rightarrow$  See firmware functional description.



# X8, Encoder 2

# Technical description of connector

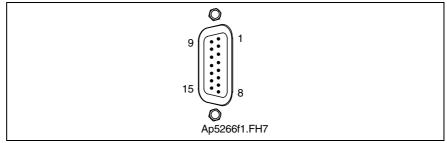


Fig. 4-110: Connector X5

Design:

Illustration:

gn:	Туре	No. of pins	Design
	D-SUB	15	Pins on unit
	Fig. 4-111: Design		

**Connection cross section:** 

Cross section	Cross section	Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge no.:
	0.25-0.5	

Fig. 4-112: Connection cross section

#### Encoder 2

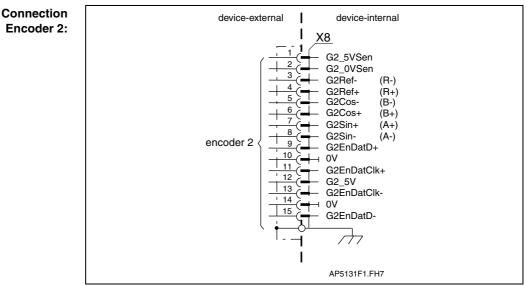


Fig. 4-113: Encoder 2

Shield connection: Via D-subminiature mounting screws and metal connector housing.

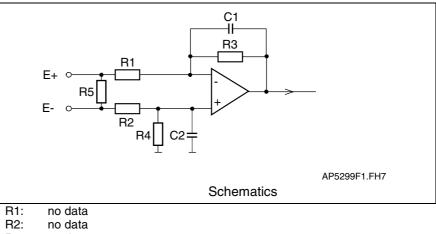
G2EnDat+, G2EnDat-: Differential signal of the EnDat Data lead.

G2EnDatClk+, G2EnDatClk-: Differential signal of the EnDat Pulse lead.



G2Sin+ (A+), G2Sin- (A-):

A-): Input circuit for sine signals G2Sin+ (A+), G2Sin- (A-):



R3: no data

R4: no data

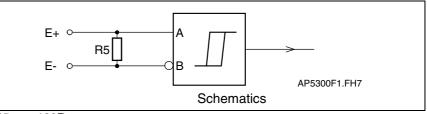
R5: 120R

C1: no data

C2: no data

Fig. 4-114: Input circuit for sine signals

#### Input circuit for square-wave signals G2Sin+ (A+), G2Sin- (A-):



R5: 120R

Fig. 4-115: Input circuit for square-wave signals

#### Features of the differential input G2Sin+ (A+), G2Sin- (A-):

Sine encoder:

	Input voltage
max. allowed amplitude encoder signal (U <sub>SSencoder signal</sub> )	(1,0 + 0,2) Vss
Evaluation AD converter	12 Bit
Limit frequency	200 kHz
Input resistance	120 R
Resolution over a encoder cycle	See the following note

Fig. 4-116: Features of the differential input (Sine encoder)

# **Note:** Resolution over a period under the assumption of the following conditions:

- Differential signal 1.0V<sub>SS</sub>
- Reference voltage for the differential signal 2.7 V
- $\frac{\text{Position resolution}}{\text{Encoder cycle}} = \frac{2^{12}}{1,2\text{Vss}} \bullet \text{UsSencodersignal}$ Example: If U<sub>SSencoder signal</sub> = 1 V<sub>ss</sub>  $\frac{\text{Position resolution}}{\text{Encoder cycle}} = \frac{2^{12}}{1,2\text{Vss}} \bullet 1\text{Vss} = 6826$

=> see also firmware functional description "Optional encoder" (Encoder 2)



Square-wave	encoder
-------------	---------

	Input voltage	
Signal amplitude nominal: (referencing unit ground)	min.	max.
High	> 2.4 V	5 V
Low	0 V	< 0,8 V
Limit frequency	200 kHz	
Input resistance	120 R	

Fig. 4-117: Features of the differential input (Square-wave encoder)

G2Ref+ (R+), G2Ref- (R-):	See "G2Sin+ (A+), G2Sin- (A-):"
---------------------------	---------------------------------

#### G2Cos+ (B+), G2Cos- (B-): See "G2Sin+ (A+), G2Sin- (A-):"

**G2\_5VSen, G2\_0VSen:** Returning encoder supply to amplifier so that encoder cable can be regulated and 5V are pending at the encoder independent of cable length.

#### G2\_5V: Features of the encoder output amplifier stage G2\_5V:

Output voltage:	5 V <sub>DC</sub>	
max. output current:	300 mA	
Fig. 4.440. Franking of the superside subset and lifes stars		

Fig. 4-118: Features of the encoder output amplifier stage



Signal allocation (X8)	signal des	signation	signal form	actual position value (with default setting)
	G2Sin+(A+) G2Sin-(A-)	° ∩ ∩ ∩ ∩		
	G2Cos+(B+) G2Cos- (B-)	o _ _ _ _ _ _ O	sine (1Vss) without absolute value (e.g. gearwheel encoder)	reducing
	G2Ref+(R+) G2Ref- (R-)	° − ⊳ − ○		
	G2Sin+(A+) G2Sin- (A-)			
	G2Cos+(B+) G2Cos- (B-)		square (TTL) without absolute value	reducing
	G2Ref+(R+) G2Ref- (R-)			
	G2Sin+(A+) G2Sin-(A-)		sine (1 V <sub>ss</sub> ) with absolute value	increasing
	G2Cos+(B+) G2Cos- (B-)	° ↓ ↓ ↓	(e.g. EnDat)	
<u> </u>				

# Signal allocation to the actual position value

Fig. 4-119: Signal allocation to the actual position value

Note:	Default setting:
	=> see firmware functional description "Optional encoder" (Encoder 2)

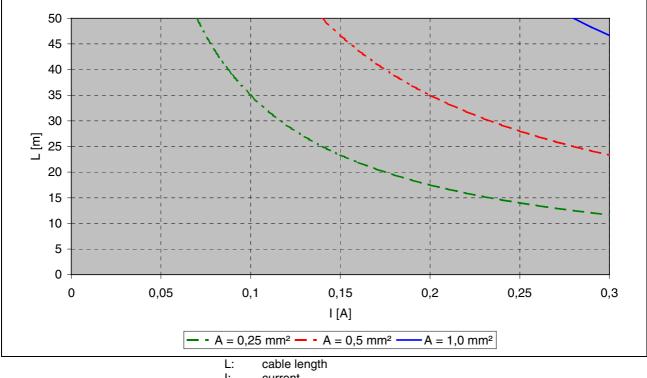


# Allowed encoder cable lengths

#### Selecting wire cross sections

Note:	The current consumption of the connected encoder systems generates a voltage drop due to the resistively ( dependent upon the wire cross sections and lengths) of the wire. This reduces the signal at the encoder input.
	To compensate the voltage drop, the DKC can influence the encoder power source. Using a voltage sensor, the available voltage at the encoder is known.

 $\Rightarrow$  For a given wire length and encoder current consumption, a minimum cross section becomes necessary. This relationship is illustrated below.



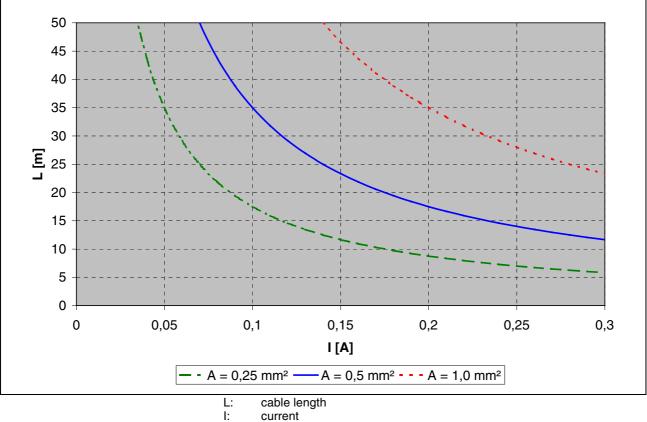
#### 1. With sensor connection in the encoder lead

I: current

A: wire cross sections

Fig. 4-120: With sensor connection





#### 2. Without sensor connection in the encoder lead

A: wire cross sections

Fig. 4-121: Without sensor connection

# **Measuring Systems Connections**

See page 1-4: "An Overview of Measuring Systems Supported".



# X9, Incremental and Absolute Encoder Emulation (SSI format)

#### **Technical description of connector**

#### Illustration:

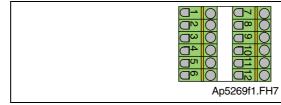


Fig. 4-122: Connector X9

Design:

Туре	No. of pins	Design
Spring contact	2 x 6	Bushing on connector

Fig. 4-123: Design

#### Connection cross section:

Cross section	Cross section	Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	Gauge no.:
0.2-2.5	0.2-1.5	24-16

Fig. 4-124: Connection cross section

#### **Connection encoder - emulation**

Cable:	max. cable length:	40 m
	max. allowed capacitance per length unit – between the outputs – between output and 0 V	5 nF 10 nF
	shielding see also "Fig. 4-125: Connection of incremental actual position value output" and "Fig. 4-129: Output of absolute actual position value in SSI format"	double shield protected



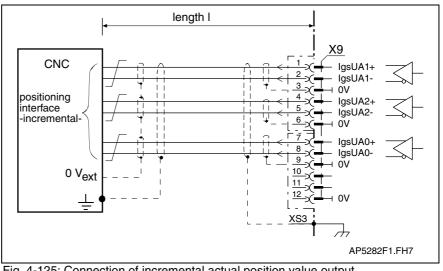
Damaging potential by utilizing non and single shielded cables.

 $\Rightarrow$  Utilize double shielded cables.

#### **Encoder - emulation**

Note: The output of the actual position value is updated every  $500 \ \mu s$ . Due to the non synchronized processing of these signals in the controller sampling inaccuracies and beat effects arise.





# Incremental encoder emulation

Fig. 4-125: Connection of incremental actual position value output

#### **Differential outputs incremental** encoder emulation:

Output voltage:	min.	max.
High	2.5 V	5 V
Low	0 V	0.5 V
max. output current Iout	I20I mA	
max. load capacitance between output and 0 V	10 nF	
max. output frequency f	1 MHz	
Overload protection	Outputs may not be short circuited. Danger of damage!	

Fig. 4-126: Differential outputs

Note: The differential outputs correspond to RS422 specs. A termination resistor is required an the controller side, if it is not present then add an external resistance of 150 - 180 Ohm.

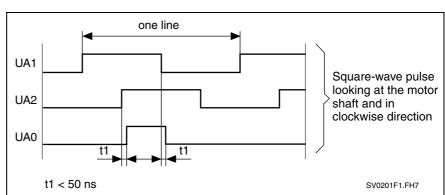


Fig. 4-127: Signal for incremental actual position value output



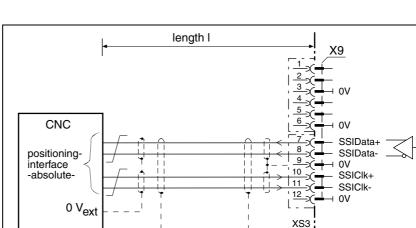
#### Signal for incremental actual position value output:



Output frequency f:				
	$f = \frac{\text{Line Quantity}}{\text{Revolutions}} \bullet n$			
	f: output frequency n: velocity (rotary)			
	Fig. 4-128: Calculating the output frequency f			
	<b>Note:</b> The output frequency results from the parameter setting.			
	=> See also firmware functional description: "Encoder Emulation".			
Pass-band width of the controller-side signal filtering for UA1 and UA2::	for Note: Conditionally due to the internal signal processing the po			
		UA1 and UA2 arise.		
	• $f ≥ 500 \text{ kHz}$ $f_{Pass} ≥ 1 \text{ MHz}$ • $f < 500 \text{ kHz}$ $f_{Pass} ≥ 2 \text{ x f}$			
RPM Measurement:				
	Note:	The frequency measurement is <b>not</b> suitable for the RPM measurement derived from the incremental emulator signals.		

 $\mathcal{A}$ 

AP5283F1.FH7



Absolute Encoder Emulation (SSI format)

#### Connection Absolute Encoder Emulation:

**Differential input circuit** 

absolute encoder emulation:

Fig. 4-129: Output of absolute actual position value in SSI format

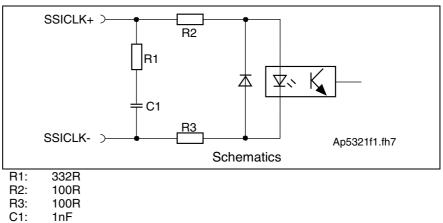


Fig. 4-130: Differential input circuit

#### Differential inputs absolute encoder emulation:

Input voltage:	min.	max.	
High	2.5 V	5 V	
Low	0 V	0.5 V	
Input resistance	see circuit		
Pulse frequency (100 – 1000 kHz)			
Polarity protected within allowable input voltage range			
Fig. 4 121: Differential outputs			

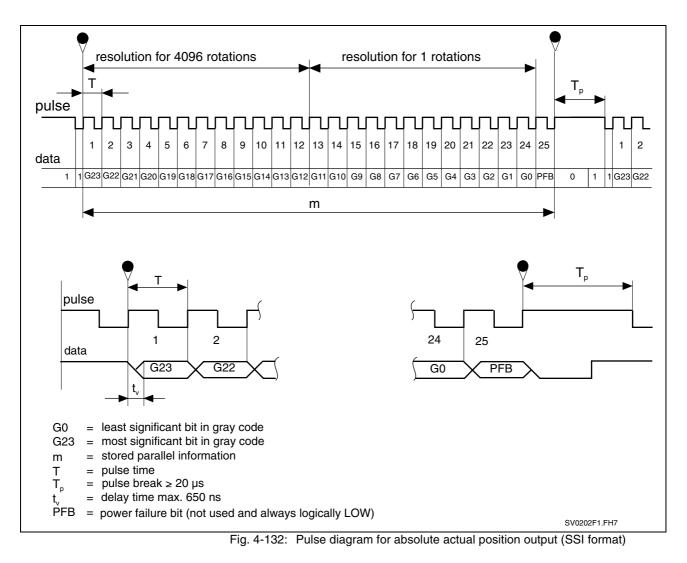
Fig. 4-131: Differential outputs

Differential outputs absolute encoder emulation:

See "Fig. 4-126:Differential outputs".

Note: The differential outputs correspond to RS422 specs. A termination resistor is required an the controller side, if it is not present then add an external resistance of 150 - 180 Ohm.





#### Pulse diagram for absolute actual position output (SSI format)



# X10, EcoX Expansion interface

Note:	EcoX allows:

- synchronizing drives and I/O modules
- connecting up to 2 modules with 16 digital inputs and outputs each per drive controller
- transmitting a command value from one drive controller to a maximum of three other drive controllers

#### **Technical description of connector**

Illustration	
--------------	--

Ap5	5268f1.FH7

Fig. 4-133: Connector X10

Design:

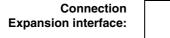
Туре	No. of pins	Design
Spring contact	2 x 3	Bushing on connector
Fig. 4-134: Design		

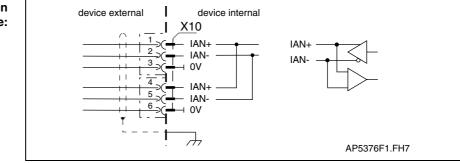
#### Connection cross section:

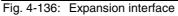
Cross section	Cross section	Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge no.:
0.2-2.5	0.2-1.5	

Fig. 4-135: Connection cross section

# **Expansion interface**









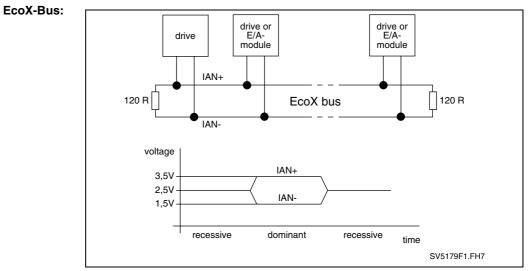


Fig. 4-137: EcoX interface

Bus cable:

max. bus length I:	20 m
bus terminating resistors on both ends of the bus cable	2 x 120 R / 250 mW

⇒ see also Project Planning Manual "EMD Module Decentral Additional Component for Digital Drive Controllers". Dok.-Type: DOK-DRIVE\*-ECOX\*\*\*\*\*\*\*-PRxx-EN-P



# X11, DC bus dynamic brake (ZKS), $U_D$ power supply

#### Technical description of connector

#### Illustration:

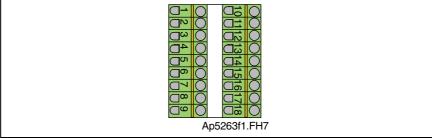


Fig. 4-138: Connector X11

Design:

n:	Туре	No. of pins	Design
	Spring contact	2 x 9	Bushing on connector
	Fig. 4-139: Design		

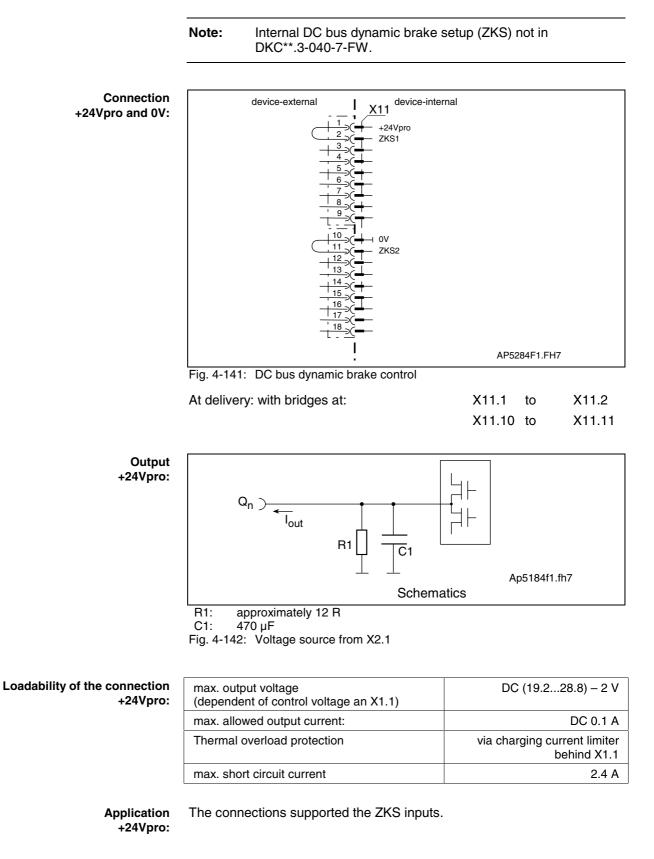
Connection cross section:

Cross section multi core wire [mm²]	Cross section in AWG Gauge no.:
0.2-1.5	24-16
	multi core wire [mm <sup>2</sup> ]

Fig. 4-140: Connection cross section



# **ZKS control supply**





# **ZKS control input**

See page 4-89: "ZKS control supply".

Connection ZKS1 and ZKS2:

Input circuit ZKS1 and ZKS2:

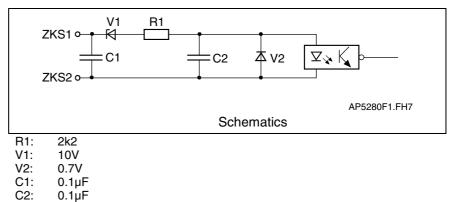


Fig. 4-143: Input circuit

Inputs

ZKS1 and ZKS2:

min.	max.	
15 V	28.8 V	
0 V	4 V	
min. 40 ms	max. 80 ms	
about 2	2 kOhm	
Potential isolation to 50 Veff		
Polarity protected within allowed input voltage range		
	15 V 0 V min. 40 ms about 2 to 50	

Fig. 4-144: Inputs

#### Use ZKS1 and ZKS2:

Trigger behavior of DC bus setup:

Mains voltage at X5	DC input	DC bus setup
not applied	no current	active
not applied	current	not active
applied	not current	not active
applied	current	not active

The connections supply the ZKS input and permit potential free control of

Fig. 4-145: Trigger behavior of ZKS setup

DC bus dynamic brake setup via a relay contact.



Protecting the ZKS setup with mains voltage applied:

If mains voltage applied at X5 then DC bus dynamic brake not executed! The ZKS control is realized with the currentless input.

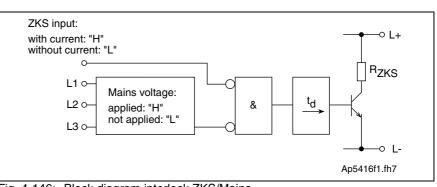


Fig. 4-146: Block diagram interlock ZKS/Mains

See page 4-25: "Arranging the Central supply" and page 11-5: "Control Circuits with internal DC bus dynamic brake (ZKS)".

#### U<sub>D</sub> power supply

Note:

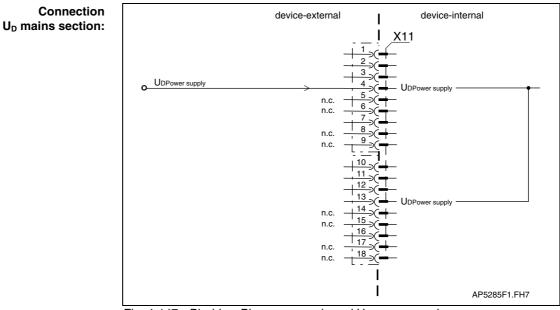


Fig. 4-147: Bb drive, Bb power supply and U<sub>D</sub> power supply

Input circuit U<sub>D</sub> mains section:

See page 4-47: "Drive halt (AH) and Drive enable (RF)".



Inputs U<sub>D</sub> power supply:

See page 4-47: "Drive halt (AH) and Drive enable (RF)".

power supply:

**U**<sub>D</sub> **power supply:** With central mains supply (see page 4-25: "Arranging the Central supply") the DKC's operated on one DC bus must be informed about the status of the power supply.

The output U<sub>Dmessage</sub> (X3.11) is high, upon completion DC bus load.

With this type of mains supply, the  $U_{\rm D}\text{-message}$  X3.11 serves as a signal source to the DKC's connected to the mains supply.

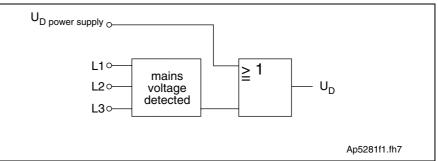
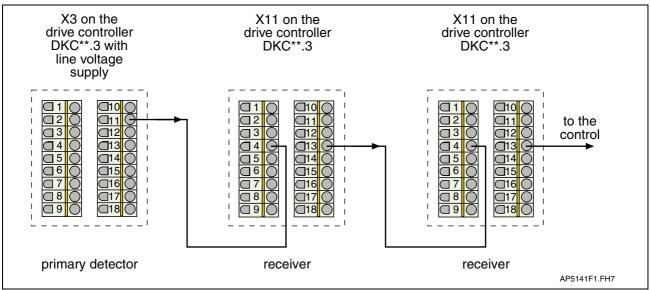


Fig. 4-148: Correlation of U<sub>D power supply</sub> and U<sub>D</sub> (U<sub>D message</sub>)

See page 4-55: "Digital outputs (ready, warning and UD)".



#### Connection $U_D$ power supply:

Fig. 4-149: U<sub>D</sub> power supply

# X12, Optional Choke Connection for DKC\*\*.3-200-7

#### Technical description of connector

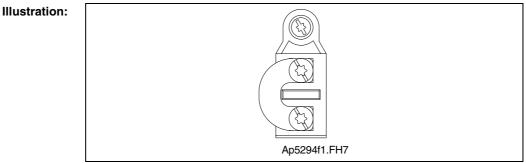


Fig. 4-150: Connector X12

Design:

Туре	No. of pins	Design
Screw-in connector	2	screw-in connection for ring terminals M5

Fig. 4-151: Design

**Tightening torque:** 

min. tightening torque	max. tightening torque
[Nm]	[Nm]
2.5	3.0

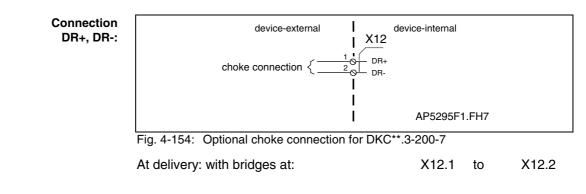
Fig. 4-152: Tightening torque

#### Connection cross section:

Cross section	Cross section	Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	Gauge no.:
	10 - 25	

Fig. 4-153: Connection cross section

# Connection Choke (DR+, DR-)



Loadability of the connection	max. voltage against L-:	DC 900 V
DR+, DR-:	voltage against ground	Applied mains voltage
	max. continuous current (rms):	70 A

Wire	wire length:	max. 10 m
DR+, DR-:	wire cross section:	min. 10 mm², but not smaller than mains wire cross section
	wire routing	twisted
	voltage resistance of single litz to ground:	≥ 750 V (e.g.: litz wires - H07)
	Note: Connection bridged at delivery.	

Choke type: See page 8-1: "Choke GLD 12".



# XE1, XE2 Protective conductor connections for motor and mains

#### **Technical description of connector**

Illustration:

: See page 4-40: "A look at the drive controller and connector designations".

Туре	No. of pins	Design
screw-in connection	1	screw-in connection for ring terminals M5
Fig. 4-155: Design		

**Tightening torque:** 

min. tightening torque	max. tightening torque
[Nm]	[Nm]
2.5	3.0

Fig. 4-156: Tightening torque

#### Connection cross section:

Cross section	Max. connectable	Max. cross section
single wire	cross section	in AWG
[mm²]	in mm <sup>2</sup>	gauge no.:
	25	

Fig. 4-157: Connection cross section

#### XE1, Protective conductor connection for motor

See page 4-64: "Motor connection".

#### XE2, Protective conductor connection for mains

Note:	PE connection $\geq$ 10 mm <sup>2</sup>					
	Reason: section: 5.	•	leakage	currents	(EN	50178/1998,



# XS1, XS2, XS3 Shield Connections

# XS1

Connection for shield:

- Total motor cable shield
- Holding brake
- Motor temperature monitoring
- Mains supply

#### XS2

Connection for shields of cables at X1, X3 and those for the command communication interfaces.

#### XS3

Connection for shields of cables at X9, X10 and X11.

#### Allowed outside diameters:

Drive controller	XS1	XS2	XS3
DKC**.3-040	12-18	6-15	6-15
DKC**.3-100	12-35	6-15	6-15
DKC**.3-200	19-35	6-15	6-15

Fig. 4-158: Allowed outside diameters in mm

**Note:** Always connect the shield connections of the cables (especially of the motor cables) with a large contact surface.



# 4.3 Electrical Connections – dependent on the drive controller type

# DKC 01.3-\*\*\*-7-FW – Parallel Interface

# View of interface to command communications

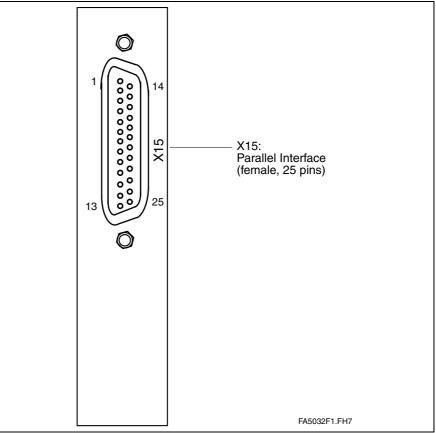


Fig. 4-159: View of interface to command communications

# Technical description of connector

Design:

Туре	No. of pins	Design
D-SUB	25	Bushing on the unit
Fig. 4-160: Design		

Connection cross section:

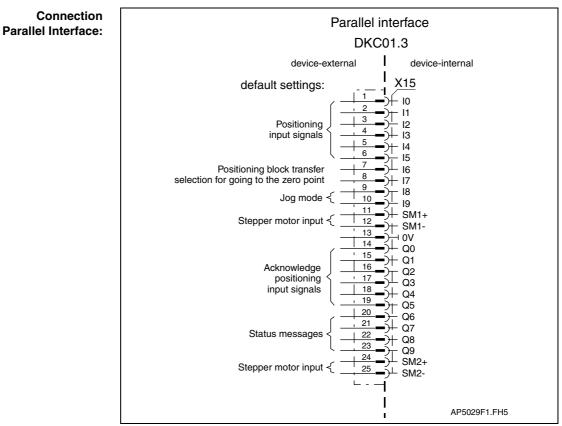
Cross sections	Cross sections	Cross sections
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge no.:
	0.08-0.5	

Fig. 4-161: Connection cross sections



# **Connection diagram for Parallel Interface**

**Note:** If a power supply other than the DC24 volts of the DKC controls the inputs, then connect the standard lead (GND) of the separate mains section to X15.13 (0 V).





Plug-in connector assignment X15:	Pin	10	Function	Pin	10	Function
	1	I	10	14	0	Q 0
	2	I	1	15	0	Q 1
	3	I	12	16	0	Q 2
	4	I	13	17	0	Q 3
	5	I	4	18	0	Q 4
	6	I	Ι5	19	0	Q 5
	7	I	Ι6	20	0	Q 6
	8	I	17	21	0	Q 7
	9	I	18	22	0	Q 8
	10	I	19	23	0	Q 9
	11	SM1+	Diff input+	24	SM2+	Diff input+
	12	SM1-	Diff input-	25	SM2-	Diff input-
	13	0V	0V			

Fig. 4-163: Signal assignment X15

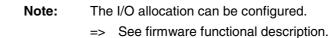
Shield connection: Via D-subminiature mounting screws and metal connector housing.



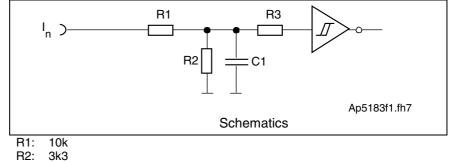
Default allocation of the binary I/Os:

ſ	Pin	Inputs		Pin		Outputs
	1	10	Pos 0		Q 0	PosQ 0
	2	11	Pos 1	15	Q 1	PosQ 1
	3	12	Pos 2	16	Q 2	PosQ 2
	4	13	Pos 3	17	Q 3	PosQ 3
	5	14	Pos 4	18	Q 4	PosQ 4
	6	15	Pos 5	19	Q 5	PosQ 5
	7	16	Start	20	Q6	End position reached
	8	17	Start home	21	Q 7	standstill
	9	18	Jog +	g + 22 Q 8 in refe		in reference
	10	19	Jog -	23	Q 9	position switching point
	13	0V	0V			

Fig. 4-164: Default allocation of I/Os



Input circuit 10-19:



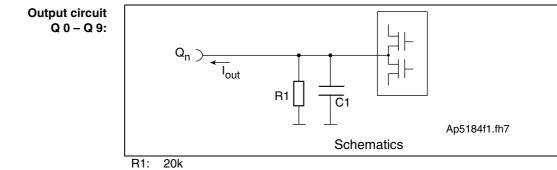
- R3: 10k C1: no data
- Fig. 4-165: Input circuit

#### Signal range of inputs 10-19:

Input voltage:	min.	max.		
High	16 V	30 V		
Low	-0.5 V	3 V		
Input resistance	13.3 kOhm ±5%			
reaction time	=> see firmware functional description			
Fig 4 166: Inpute				

Fig. 4-166: Inputs





C1: no data

Fig. 4-167: Output circuit

#### Signal level of outputs Q 0 – Q 9:

Output voltage:	min.	max.		
High	16 V	U <sub>ext</sub> (an X1.1-1V) – 1.5 V		
Low	-0.5 V			
Output current Iout	80 mA			
rise and drop time	about < 600 ns			
overload protection	<ul> <li>short circuit protection; at I<sub>out</sub> &gt; 300 mA outputs switch off</li> </ul>			
Fig. 4.100: Outputs	- thermal off			

Fig. 4-168: Outputs

# Default allocation of step-motor inputs:

Pin		Outputs
24	SM2+	Diff input
25	SM2-	Diff input
	25	

Fig. 4-169: Default allocation of step motor inputs

The stepper motor inputs are galvanically isolated from the drive controller. They function as differential inputs to process RS422 compatible signals.

Stepper motor inputs SM1+, SM1-, SM2+, SM2 Circuit:

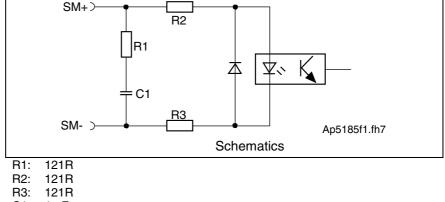




Fig. 4-170: Differential input circuit



Signal voltages of differential inputs:

Input voltages	min.	max.
Difference:	131 V	151 V
input current:	min.	max.
	151 mA	1151 mA
cycle frequency	max.	1 MHz
Fig. 4-171: Differential inputs		

#### **Overloads destroy inputs!**

 $\Rightarrow$  Maximum input current may not be exceeded.

# Control inputs for jog mode (Jog+, Jog-)

**Jog+**, **Jog-**: The axis can be moved positively or negatively in jog mode by using the jog+ and jog- inputs.

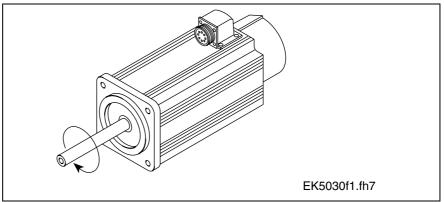


Fig. 4-172: Rotational direction with jog+

View from front of the output drive side, arrow indicates positive direction.

# Inputs and outputs for positioning block mode

- I 0 I 5: Select leads (binary coded)
- I 6 I 7: Positioning block accept (start), selection to go to zero
- Q 0 Q 5: Select acknowledge leads (binary code)
- Q 6 Q 9: Status output



# Control inputs for stepper motor mode (SM1+, SM1-, SM2+, SM2-)

**Note:** The control of the stepper motor interface with differential signals is preferable to single-channel control because the noise immunity of differential signals is better than zero-referenced signals.

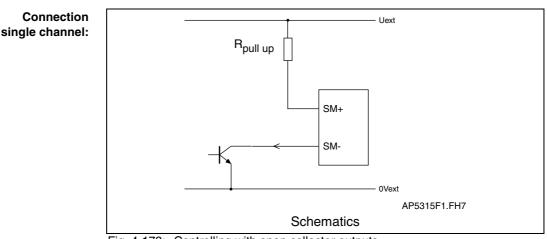


Fig. 4-173: Controlling with open collector outputs



#### **Overloads damage inputs!**

 $\Rightarrow$  Resistance  $R_{pull up}$  must be sized so that the maximum allowed input current is never exceeded.

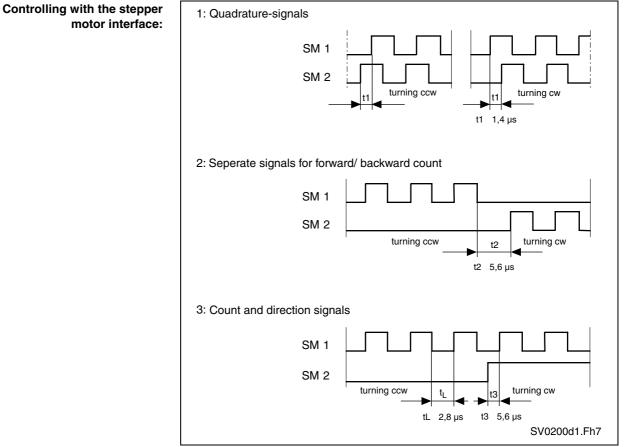


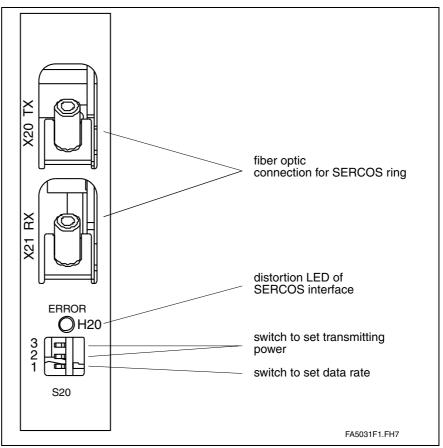
Fig. 4-174: Stepper motor interface types of control

Control with differential signals:

- Logic 1 is detected with a positive voltage difference of SM+ to SM-.
- Logic 0 is detected with a negative voltage difference of SM+ to SM-.
- To increase noise immunity the amplitude of the voltage difference should equal at least 3.0 volts. The greater the voltage difference, the better the noise immunity.



# DKC 02.3-\*\*\*-7-FW – SERCOS interface



#### View of command communication interface

Fig. 4-175: View of command communication interface

# **Connection diagram for SERCOS interface**

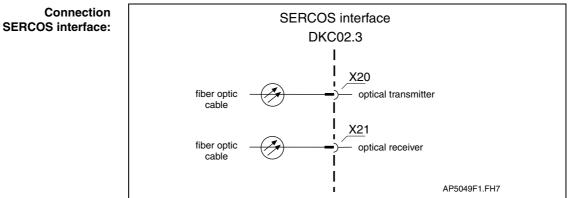


Fig. 4-176: I/O connection allocations for DKC02.3



# Switch S20

Data rate, transmitter power	The transmitter power and the data rate for the SERCOS interface are set with the switch S20.
	The DKC is factory set to an average transmitter power (-4.5 dBm) and the lowest data rate(2 Mbit/s).
Position of switch	The switches are in OFF position if the switch lever is facing the rear (rear

panel). Switch S20/1 is down (see marking on the unit).

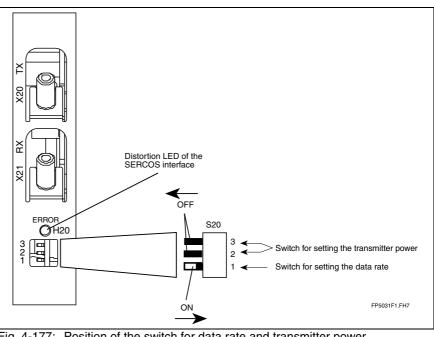


Fig. 4-177: Position of the switch for data rate and transmitter power demonstrating how to switch it ON and OFF

The data rate is set with the switch S20/1.

Position of switch S20/1	Data rate in Mbit/s
OFF	2
ON	4

Fig. 4-178: Relationship between switch position S20/1 and the data rate



#### Transmitter power

The transmitter power is set with the switches S20/2 and S20/3.

The following table demonstrates the relationship between switch position and transmitter power.

Switch position S20/2	Switch position S20/3	Transmission power at optimum high level in dBm	Transmission power at optimum high level in μW	Maximum length with plastic fiber optic (*1)	Maximum length with glass fiber optic (*1)
OFF	OFF	-7	200	015 m	
ON	OFF	-4,5	350	1525 m	
OFF	ON	-1	800	2535 m	
ON	ON	0	1000	3550 m	0500 m

Fig. 4-179: Relationship between switch position S20/2, S20/3 and the data rate

(\*1): The data for the maximum lengths of the fiber optic cable only apply if the following preconditions have been met:

- Rexroth Indramat fiber optic cables IKO 982, IKO985 or IKO 001 are used
- Connection without separation. If couplings are used, the maximum length for plastic fiber optic cables is reduced by about 10 meter, 100 meters for glass fiber optic cables.

#### **Fiber optic cables**

Drives with a SERCOS interface are connected to higher-level controls with a fiber optic cable.

The fiber optic cables (cables, connectors or complete leads) must be ordered separately.

For more information, see "Fiber optic cables" in application description "LWL-Handling" (DOK-CONNEC-CABLE\*LWL-AWxx-EN-P).

"LWL-Handling" discusses:

- Fiber optics in general
- Basic plans for optical transmission systems
- Routing guidelines for fiber optic cables
- Attenuation readings of standard LWL cables
- Available fiber optic-FSMA plug-in connectors and fiber optic cables
- Guidelines on making an FSMA connector
- Tools for making fiber optic cables

Use the following illustration to find out which fiber optic cable to order.



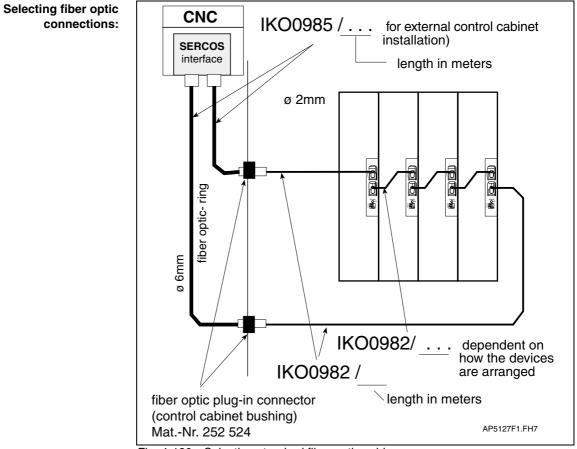
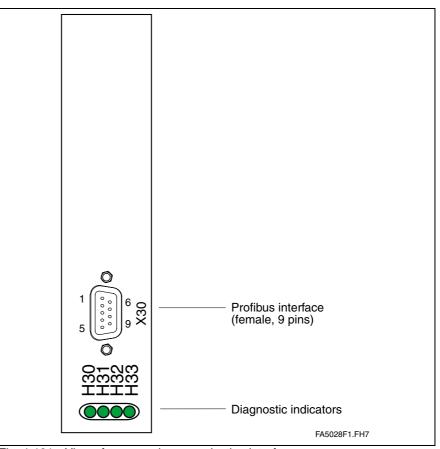


Fig. 4-180: Selecting standard fiber optic cables



# DKC 03.3-\*\*\*-7-FW – Profibus-DP Interface



# View of command communication interface

Fig. 4-181: View of command communication interface

#### **Technical description of connector**

Design:

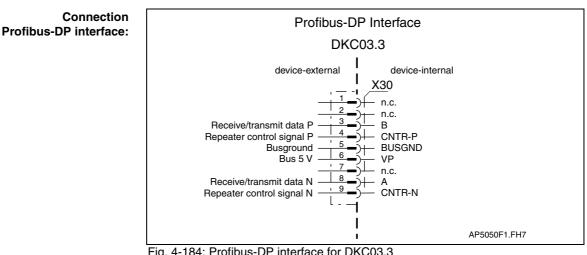
Туре	No. of pins	Design
D-SUB	9	Bushing on the unit
Fig. 4-182: Design		

**Connection cross sections:** 

Cross sections	Cross sections	Cross sections
single wire	multi core wire	in AWG
[mm <sup>2</sup> ]	[mm²]	gauge no.:
	0.08-0.5	

Fig. 4-183: Connection cross sections





# **Connection diagram for Profibus-DP Interface**

Fig. 4-184: Profibus-DP interface for DKC03.3

Interface compatibility:

As per DIN EN 50 170

**Recommended cable type:** 

X30:

**Plug-in connector assignment** 

as per DIN EN 50 170 - 2, cable type A

Pin	DIR	Signal	Function
1			n.c.
2			n.c.
3	I/O	RS485+	receive/transmit data plus
4	0	CNTR-P	Repeater control signal
5		0 V	0 V
6	0	+5 V	Repeater supply
7			n.c.
8	I/O	RS485-	receive/transmit data minus
9		0 V	0 V

Fig. 4-185: Signal assignment of connector X30

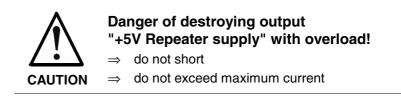
Shield connection: Via D-subminiature screws and metal connector housing.



#### **Signal Specification:**

Signal	Specification
+5 V	+5 V (±10%)
Repeater supply	max. 75 mA
Repeater control signal	TTL compatible 1: transmit 0: receive Output resistance: 350 R $V_{OL} \le 0.8$ V at $I_{OL} \le 2$ mA $V_{OH} \ge 3.5$ V at $I_{OH} \le 1$ mA
Receive/send data	EIA-RS485 standard

Fig. 4-186: Signal specification



Diagnostic display H30 – H33: The definition of the displays are in the firmware.



#### **Bus Connector**

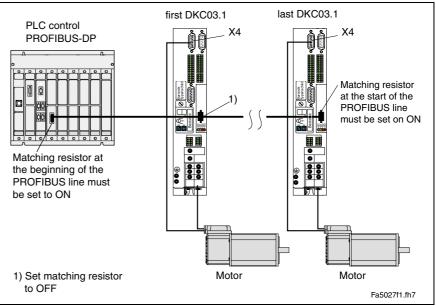


Fig. 4-187: An example of connecting a DKC03.3 to the PLC control via the PROFIBUS-DP

The PROFIBUS connectors each have a connectable terminating resistor. The terminating resistor must always be active at both the first and last bus stations. Do not interchange the A and B wires. Perform the connection as shown in the figures below.

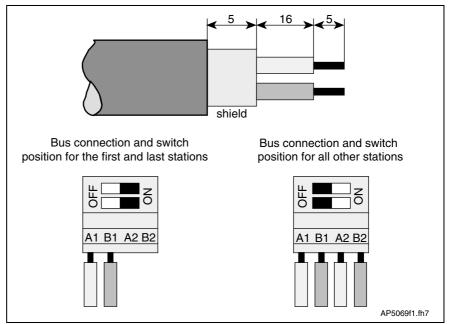


Fig. 4-188: Preparing a cable for connecting a bus connector

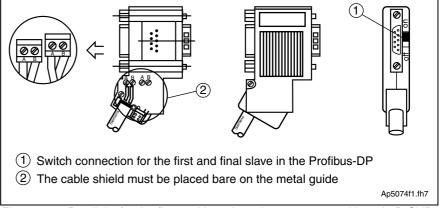


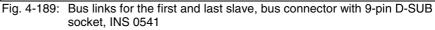
To prepare a bus cable, proceed as follows:

- Use cable DIN EN50170 / 2 edition 1996
- Strip cable (see previous illustration)
- Insert both cores into screw terminal block

Note: Do not switch A and B.

- Press cable sheath between both clamps
- Screw both strands into screw terminals





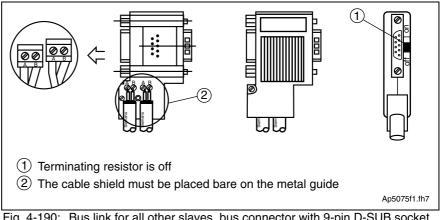
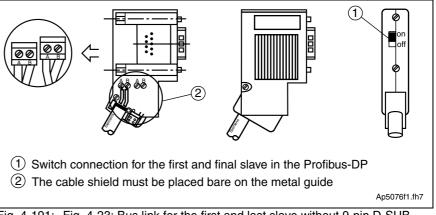
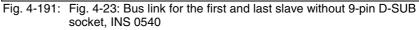


Fig. 4-190: Bus link for all other slaves, bus connector with 9-pin D-SUB socket, INS 0541







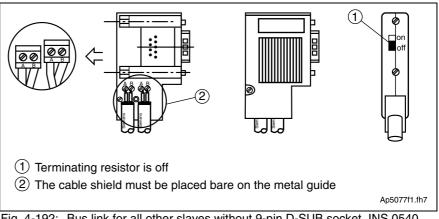
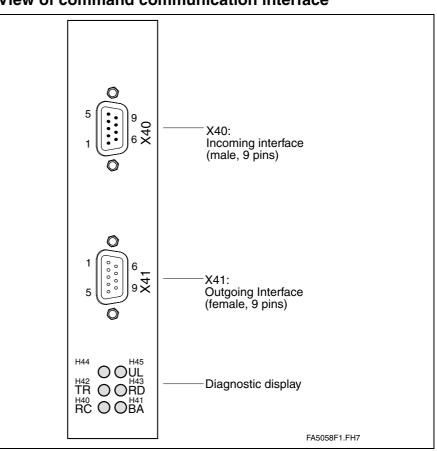


Fig. 4-192: Bus link for all other slaves without 9-pin D-SUB socket, INS 0540

Connect the DKC03.3 to a control unit using a shielded two-wire conductor in accordance with DIN 19245/ section 1.



# DKC 04.3-\*\*\*-7-FW – InterBus Interface



View of command communication interface

Fig. 4-193: View of command communication interface

#### Technical description of connector

Design:

X40: X41:

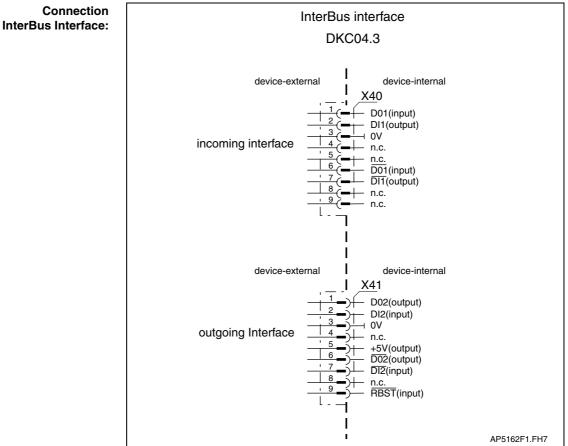
:	Туре	No. of pins	Design
:	D-SUB	9	bushing on the unit
:	D-SUB	9	pins on the unit
	Fig. 4-194: Design		

Connection cross section:

Cross sections	Cross sections	Cross sections
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge no.:
	0.08-0.5	

Fig. 4-195: Connection cross sections





#### Connection diagram for InterBus Interface

Fig. 4-196: InterBus Interface for DKC04.3

Interface compatibility as per DIN EN 50 254 - 1

Signal specification as per DIN EN 50 254 - 1

Lead length: as per DIN EN 50 254 - 1

**Recommended cable:** 

as per DIN EN 50 254 - 2

Plug-in connector assignment X40 Incoming interface:

Pin	DIR	definition
1	I	DO1
2	0	DI1
3	0	0V
4		n.c.
5		n.c.
6	I	/DO1
7	0	/DI1
8		n.c.
9		n.c.

Fig. 4-197: Allocation of interface signals X40, Incoming interface

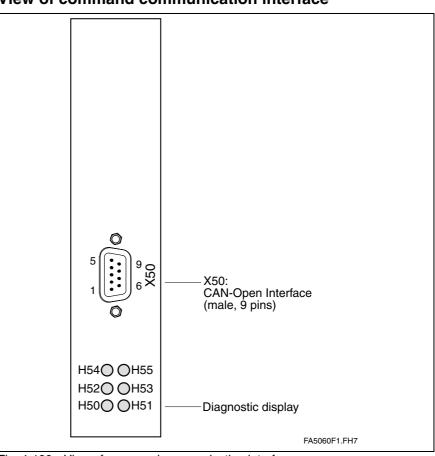


H40 – H45:

Plug-in connector assignment	Pin	DIR	definition
X41 - outgoing interface:	1	0	DO2
	2	I	DI2
-	3	0	0V
	4		n.c.
-	5	0	+ 5V
	6	0	/DO2
	7	I	/DI2
-	8		n.c.
	9	I	/RBST

Shield connection:	Via D-subminiature mounting screws and metal connector housing.
Signal specification:	as per DIN EN 50 254 - 1 Incoming and outgoing interfaces must be isolated from each other and
	galvanically from the controller.
Diagnostics display	The definition of the displays are in the firmware function description.

# DKC 05.3-\*\*\*-7-FW – CANopen Interface



#### View of command communication interface

Fig. 4-199: View of command communication interface

#### Technical description of connector

Design:

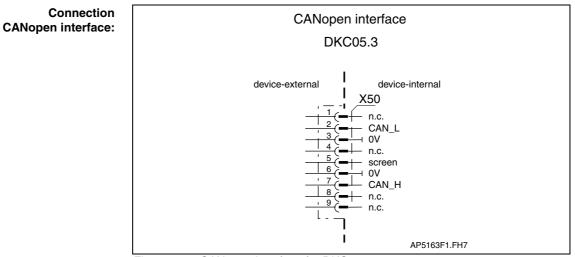
Туре	No. of pins	Design
D-SUB	9	pins on the unit
Fig. 4-200: Design		

#### Connection cross sections:

Cross sections single wire [mm²]	Cross sections multi core wire [mm²]	Cross sections in AWG gauge no.:	
	0.08-0.5		
Fig. 4-201: Connection cross sections			

Fig. 4-201: Connection cross sections





#### **Connection diagram for CANopen Interface**

Fig. 4-202: CANopen interface for DKC05.3

Interface compatibility: as per ISO 11 898

**Recommended cable:** 

as per ISO 11 898

ent 50:	Pin	Definition		
50.	1	n.c.	n.c.	
	2	CAN_L	Differential signal	
	3	0V	Gnd	
	4	n.c.	n.c.	
	5	shield	Shield connection	
	6	0V	0V	
	7	CAN_H	Differential signal	
	8	n.c.	n.c.	
	9	n.c.	n.c.	

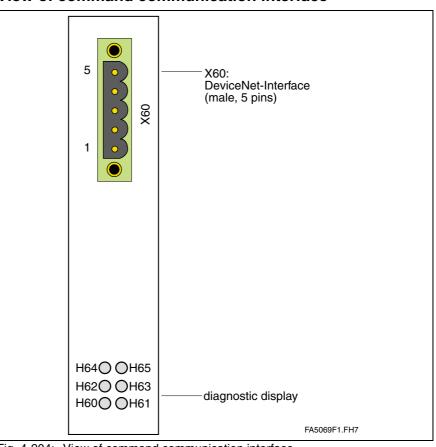
Fig. 4-203: Interface signal allocation

Shield connection: Via D-subminiature mounting screws and metal connector housing.

Diagnostic displayThe definition of the diagnostic displays are in the firmware functionH50 - H55:description.

Plug-in connector assignment X50:

# DKC 06.3-\*\*\*-7-FW – DeviceNet Interface



#### View of command communication interface

Fig. 4-204: View of command communication interface

#### Technical description of connector

Design:

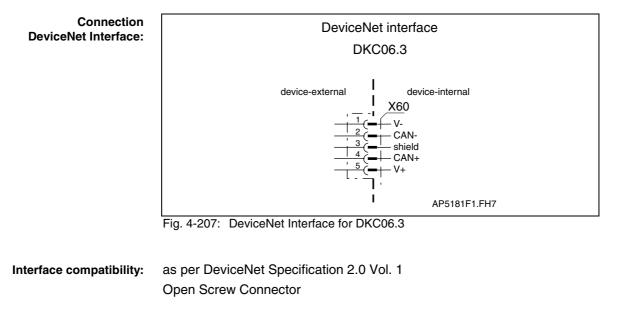
Туре	No. of pins	Design
COMBICON	5	Bushing on the connector
Fig. 4-205: Design		

Connection cross sections:

Cross sections	Cross sections	Cross sections
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge No.:
0.2-2.5	0.2-1.5	24-16

Fig. 4-206: Connection cross sections





#### Connection diagram for DeviceNet-Interface

Recommended cable:as per DeviceNet Specification 2.0 Vol. 1, Appendix BBus participant connections:as per DeviceNet specification 2.0 Vol. 1, Appendix B

end resistance: 121 Ohm, 1%, 1/4 W

as per DeviceNet specification 2.0 Vol. 1,

. .

Baud rate and cable length:

```
Plug-in connector assignment X60:
```

Pin	Definition		
1	V- 0V		
2	CAN- Differential signal		
3	shield	d Shield connection	
4	CAN+	Differential signal	
5	V+ Interface supply		

Fig. 4-208: Interface signal allocation

#### Maximum bus voltage: +30 V

Current feed at bus:

Bus voltage	Current feed
11 V	70 mA
18 V	45 mA
24 V	35 mA
32 V	28 mA

Fig. 4-209: Current feed via bus connector

Diagnostic display H60 – H65: The definition of the diagnostic displays is in the firmware function description.



# DKC 11.3-\*\*\*-7-FW – Analog Interface

See page 4-40" "ECODRIVE03 DKC\*\*.040, DKC\*\*.100, DKC\*\*.200 Electrical connections - independent of the drive controller type".

# DKC 21.3-\*\*\*-7-FW – Parallel Interface 2

#### View of command communications interface

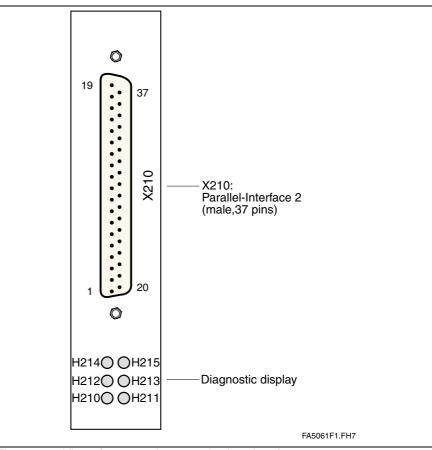


Fig. 4-210: View of command communications interface

#### Technical description of connector

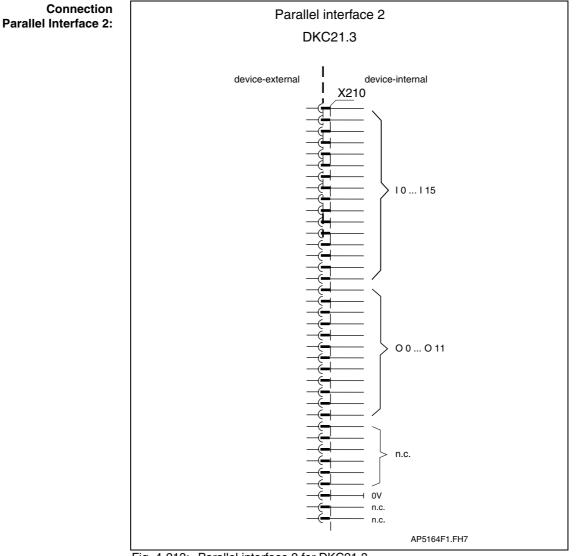
Туре	No. of pins	Design
D-SUB	37	pins on the unit
Fig. 4-211: Design	·	

Connection cross section:

Cross sections	Cross sections	Cross sections
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge No.:
	0.08-0.5	

Fig. 4-212: Connection cross sections





## Connection diagram for parallel interface 2

Fig. 4-213: Parallel interface 2 for DKC21.3

Diagnoses display H210 – H215:

The definitions of the displays are listed in the firmware functional description.



Plug-in connector as	ssignment
	X210:

Pin	10	Function	Pin	ю	Function
1	I	I 00	20	0	Q 03
2	I	l 01	21	0	Q 04
3	I	I 02	22	0	Q 05
4	I	I 03	23	0	Q 06
5	I	I 04	24	0	Q 07
6	I	I 05	25	0	Q 08
7	I	I 06	26	0	Q 09
8	I	I 07	27	0	Q 10
9	I	I 08	28	0	Q 11
10	I	I 09	29		n.c.
11	I	l 10	30		n.c.
12	I	l 11	31		n.c.
13	I	l 12	32		n.c.
14	I	l 13	33		n.c.
15	I	l 14	34		n.c.
16	I	l 15	35		0V
17	0	Q 00	36		n.c.
18	0	Q 01	37		n.c.
19	0	Q 02			

Fig. 4-214: Signal assignment of 37-pin connector X210

#### Shield connection:

Via D-subminiature mounting screws and metal connector housing.

#### Input circuit I 1 – I 15:

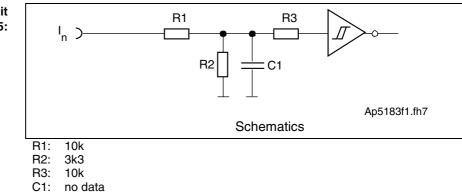


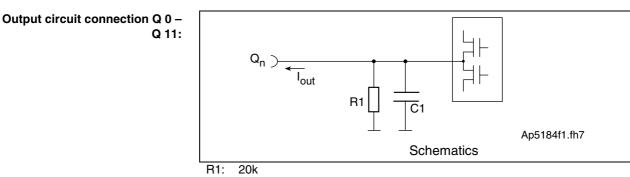
Fig. 4-215: input circuit

# Signal range of inputs I 1 – I 15:

Input voltage:	min.	max.
High	16 V	30 V
Low	-0.5 V	3 V
Input resistance	13.3 kC	hm ±5%
reaction time	=> see firmware	functional description

Fig. 4-216: Inputs





C1: no data

Fig. 4-217: Output circuit

#### Output connection Q 0 – Q 11:

Output voltage:	min.	max.	
High	16 V	U <sub>ext</sub>	
Low	-0.5 V	1.5 V	
Output current Iout	80	mA	
rise and drop time	about < 600 ns		
overload protection	<ul> <li>short circuit protection; at I<sub>out</sub> &gt; 300 mA outputs switch off</li> </ul>		
Fig. 4. 219: Outpute	- thermal off		

Fig. 4-218: Outputs

#### Default allocation of binary I/Os:

Pin		Inputs			Outputs
1	10	Parameter	17	Q 0	Hand
2	11	Hand / Auto	18	Q 1	Auto
3	12	Start	19	Q 2	Error
4	13	STOP	20	Q 3	Run
5	14	Jog+	21	Q 4	Output 01
6	15	Jog-	22	Q 5	Output 02
7	16	Input 01	23	Q 6	Output 03
8	17	Input 02	24	Q 7	Output 04
9	17	Input 03	25	Q 8	Output 05
10	19	Input 04	26	Q 9	Output 06
11	I 10	Input 05	27	Q 10	Output 07
12	111	Input 06	28	Q 11	Output 08
13	l 12	Input 07			
14	I 13	Input 08			
15	I 14	Input 09			
16	l 15	Input 10			

Fig. 4-219: Default allocation of the inputs and outputs

Note: Inputs 01 ... 10 and Output 01 ... 08 can be configured.



# DKC 22.3-\*\*\*-7-FW – SERCOS interface



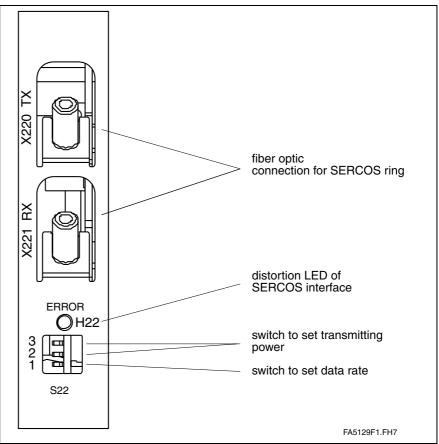


Fig. 4-220: View of command communication interface

#### Connection diagram for SERCOS interface 2

Connection SERCOS Interface 2:

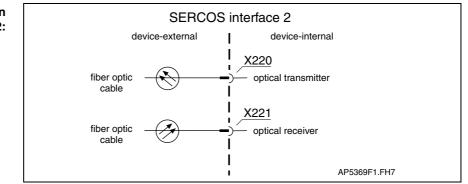


Fig. 4-221: I/O connection allocations

#### Switch S22

See page 4-105: "Switch S20".

#### Fiber optic cables

See page 4-106: "Fiber optic cables".

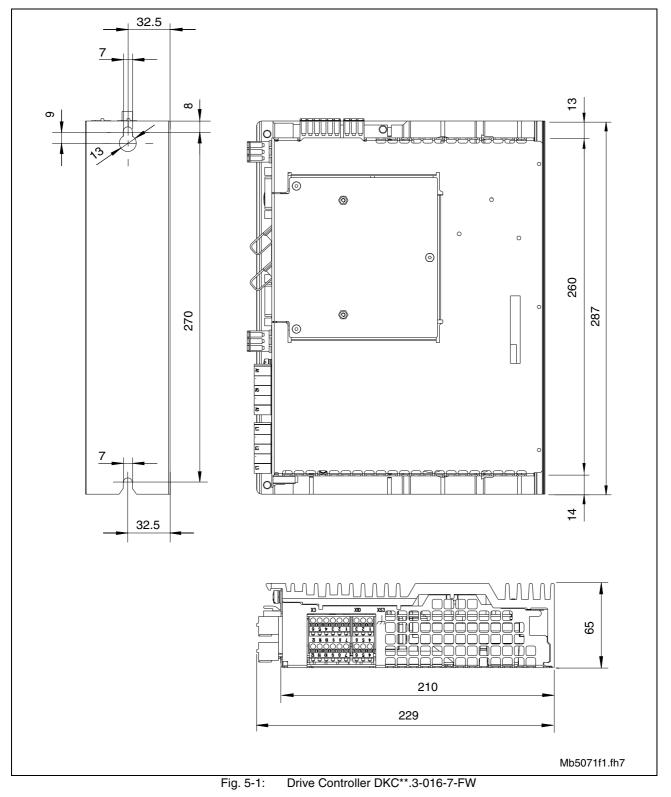


#### Notes

# 5 ECODRIVE03 DKC\*\*.3-016

# 5.1 Technical Data

# Dimensions





# Materials used, Mass

Designation	Symbol	Unit	DKC**.3-016-7-FW
Mass	m	kg	3,2
Materials used	free of asbestos and silicone		
Fig. 5-2: Materials	s used; mass	;	

Rexroth Indramat

# Ambient and operating conditions

See page 4-4.



# Electric Data of the Individual DKC\*\*.3-016 Components

# Mains connections, Power section DKC\*\*.3-016-FW

Designation	Symbol	Unit	DKC**.3-0	DKC**.3-016-7-FW		
Operating mode at the mains			single phase	three phase		
Mains input voltage	U <sub>N1</sub>	V	1 x AC (200 48	3 x AC 30) ± 10%		
Mains frequency	f <sub>N1</sub>	Hz	(50 6	60) ± 2		
Rotary field			clockwise or cou	unter-clockwise		
Connected load	S <sub>N1</sub>	kVA	see page 11-1: "M	ains Connections"		
Nominal charging current (dependent on mains input voltage)			1.2	. 2.8		
Soft-start resistor	R <sub>Softstart</sub>	Ohm	24	-		
Continuous power soft-start resistor	P <sub>Softstart</sub>	kW	0.05	$5^{(2)}$		
Switching frequency (selectable)	fs	kHz	4 or	· 8		
Type current = peak current 1	I <sub>PEAK1</sub>	А	16			
Peak current 2 for $f_S = 4 \text{ kHz}$	IPEAK2(4kHz)	А	6			
Peak current 2 for f <sub>S</sub> = 8 kHz	IPEAK2(8kHz)	А	5			
Continuous current 1 for $f_S = 4 \text{ kHz}$	I <sub>CONT1(4kHz)</sub>	А	4	1)		
Continuous current 2 for $f_S = 4 \text{ kHz}$	I <sub>CONT2(4kHz)</sub>	А	6	1)		
Continuous current 1 for $f_S = 8 \text{ kHz}$	I <sub>CONT1(8kHz)</sub>	А	2.8	1)		
Continuous current 2 for $f_S = 8 \text{ kHz}$	I <sub>CONT2(8kHz)</sub>	А	5	1)		
Max. output frequency at fs=4 kHz	f <sub>out</sub>	Hz	40	0		
Max. output frequency at f <sub>S</sub> =8 kHz	f <sub>out</sub>	Hz	80	0		
Device power dissipation without internal continuous bleeder power for I <sub>CONT2</sub>	Pv	W	80 (see page 12-1: "P	•		
Peak bleeder power DKC when $U_{ZW} = 850 V$ for permissible load cycle	P <sub>BS</sub>	kW	2. 0.29 s on			
Continuous bleeder power DKC	P <sub>BD</sub>	kW	0.0			
when $T_a \leq 45$ °C under max. temperature range with distance	ΔT d	K mm	40 80 (see pa			
Max. energy dissipation	W <sub>R,MAX</sub>	kWs	1.			
Max. DC bus charge	W <sub>MAX</sub>	kWs	1.	0		
Internal DC bus dynamic brake (ZKS)			not pro	esent		
Resistor for ZKS	R <sub>ZKS</sub>	Ohm	not pr	esent		
Storable energy of the DC bus capacitors	W <sub>zw</sub>	Ws	see diagrams page 5-9: bu			
Nominal DC bus capacitance DKC	Czw	mF	0.135	±20%		
DC bus voltage (dependent on mains input voltage)	U <sub>zw</sub>	V	DC 300	800		
DC bus continuous power (dependent on mains input voltage)	P <sub>zwb</sub>		see diagrams page 5 continuou			
max. DC bus continuous power for a single source supply where $U_{N1} = 3 \times AC 400 \text{ V}$ , when Ta $\leq 45 \text{ °C}$	P <sub>ZWD</sub>	kW	0.	5		

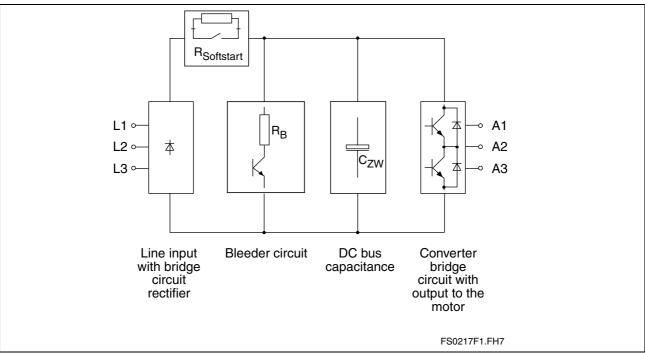


Designation	Symbol	Unit	DKC**.3-016-7-FW
max. DC bus continuous power for a single source supply where $U_{N1} = 3 \text{ x AC } 480 \text{ V}$ , when Ta $\leq 45 \text{ °C}$	P <sub>zwb</sub>	kW	0.6
DC bus peak power	P <sub>zws</sub>		see diagrams "Allowed DC bus Peak Power " on page 5-12
Power section cooling			natural convection
Cooling the bleeder resistor			natural convection
Cooling air flow			no forced cooling
Volumetric capacity of the forced cooling		m³/h	no forced cooling
Insulation resistance at DC500V	R <sub>is</sub>	MOhm	> 1
Coupling capacitance power section against housing	С <sub>Кор</sub>	nF	100 nF

<sup>1)</sup> Sine threshold value

 $^{2)}$  Softstart resistor is used after softstart as bleeder (R\_B).

Fig. 5-3: Technical Data DKC\*\*.3-016-7 Mains connection and Power section



#### Block diagram of the DKC\*\*.3-016-7-FW power section

Fig. 5-4: Block diagram of the DKC\*\*.3-016-7-FW power section



#### Control voltage connection

(Data applies to ambient temperature of 25 °C)

Designa	Designation Symbol Unit		Unit	DKC**.3-016-7-FW
Control v	oltage	U <sub>N3</sub>	V	DC (19.2 28.8) V
max. ripp	ole effect	w		may not exceed input voltage range
			45 V for 1 ms, non repetitive *)	
max. cha current	irging	I <sub>EIN3</sub>	A	2 (see diagram on page 5-7 "Charging current profile of control voltage")
max. pul of I <sub>EIN3</sub>	se duration	t <sub>N3Lade</sub>	ms	60 (see diagram on page 5-7 "Charging current profile of control voltage")
max. inp capacita		C <sub>N3</sub>	mF	3.0 x 1.2
Power co (X1)	onsumption		dependen	t on type of unit, without external load at control outputs and encoder interface 2
	DKC01.3	P <sub>N3</sub>	W	15
	DKC02.3	P <sub>N3</sub>	W	15
	DKC03.3	P <sub>N3</sub>	W	16
	DKC04.3	P <sub>N3</sub>	W	17
DKC05.3		P <sub>N3</sub>	W	16
DKC06.3 P <sub>N3</sub>		P <sub>N3</sub>	W	16
DKC21.3 P <sub>N3</sub>		W	16	
DKC22.3 P <sub>N3</sub> W		P <sub>N3</sub>	W	16

Fig. 5-5: Control voltage connection for DKC\*\*.3-016-7-FW

<sup>\*)</sup> To be obtained by appropriate mains sections and shielded wire routing.

Connections for control voltage: see page 5-19 "X1, Connections for control voltage".

Note:	Overvoltages of more than 45 V have to be derived by		
	measures in the electrical equipment of the machine or		
	installation. This includes:		

- 24-Volt mains sections that reduce incoming overvoltages to the allowed value.
- Overvoltage limiters at the control cabinet input that limit existing overvoltages to the allowed value. This also applies to long 24-Volt lines that have been laid in parallel with power and mains cables and can absorb overvoltages caused by inductive or capacitive coupling.



# Amplitude of the DKC control voltage charging current at startup, to selecting power source

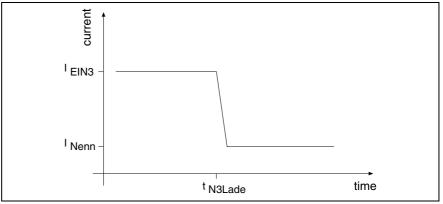


Fig. 5-6: Charging current profile of control voltage

**Note:** For n parallel-switched inputs the charging current inrush is n-fold.

#### Voltage connection for holding brake

Designation	Symbol	Unit	DKC**.3-016-7-FW	
Input voltage	U <sub>HB</sub>	V	depending on motor type, see motor project planning	
Ripple content	w	%		
Current consumption	I <sub>НВ</sub>	A	(see also page 5-36 onward)	

Fig. 5-7: Voltage connection for holding brake



# Output current characteristic curves for servo applications ( acceleration times $\leq$ 400 ms)

Static profile illustrated:

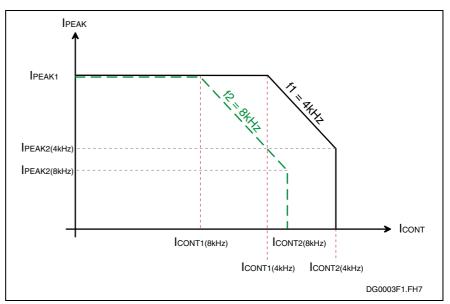


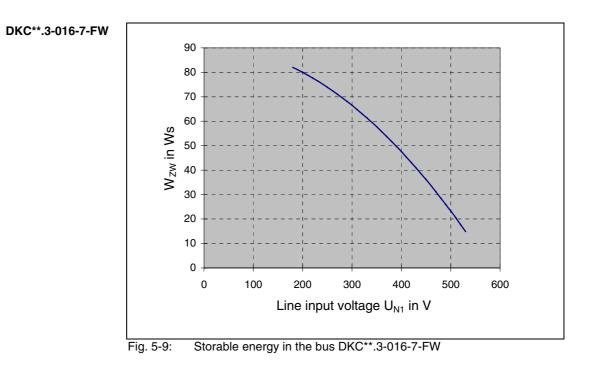
Fig. 5-8: Output current characteristic curves for servo applications

See also table with electrical data on page 5-4.



#### Storable energy in the bus

**Note:** The higher the connection voltage the lower the energy that can be stored in the DC bus as the differential voltage between bleeder threshold and DC bus voltage (threshold value of connecting voltage) decreases.

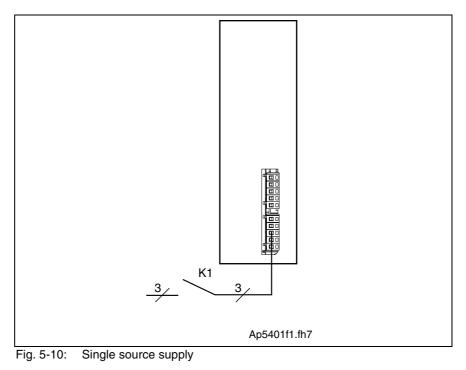


## Mains supply options

#### Single source supply

Characteristic for the single source supply is that the mains voltage is applied to the DKC drive controller via individual mains connections.

#### Arranging the single source supply



**Note:** In addition to the illustrated connections of the drive controller at the DC bus, the following connections must be wired as well:

- Bb contact
- control voltage supply



#### **Group supply**

"Group supply" is the standard supply if several DKC drive controllers are to supplied from one supply voltage.

Characteristic for the "group supply" is that the mains voltage is applied to groups of DKC drive controllers via a common mains contactor.

#### Arranging the single source supply

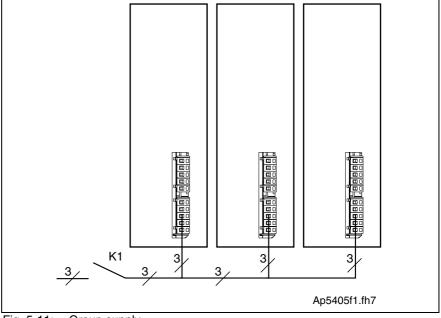
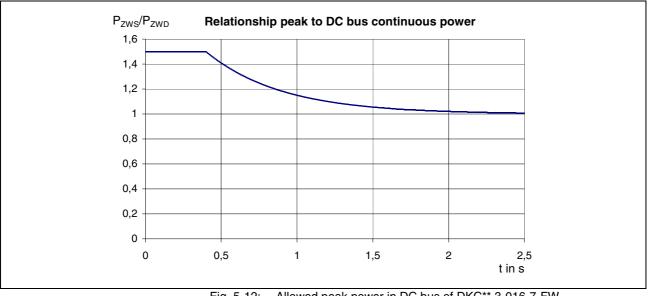


Fig. 5-11: Group supply

- **Note:** In addition to the illustrated connections of the drive controller at the DC bus, the following connections must be wired as well:
  - Bb contact
  - control voltage supply



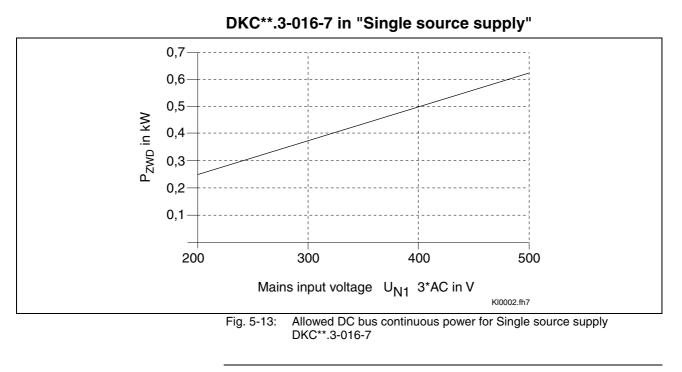


#### **Allowed DC bus Peak Power**

Allowed peak power in DC bus of DKC\*\*.3-016-7-FW Fig. 5-12:

DKC\*\*.3-016-7-FWs are not suited for drive applications if the required intermittent operating power of the unit's nominal power exceeds 50%!

## Allowed DC bus continuous power



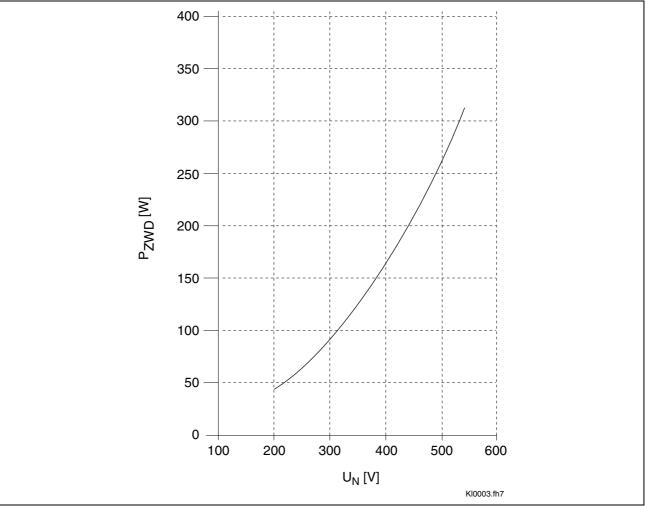
Note: Definition of terms, see page 5-10: "Mains supply options".



#### Allowed DC bus continuous power with single-phase mains connection

The operation of a single-phase mains supply reduces the allowed DC bus continuous power as per the following diagram.

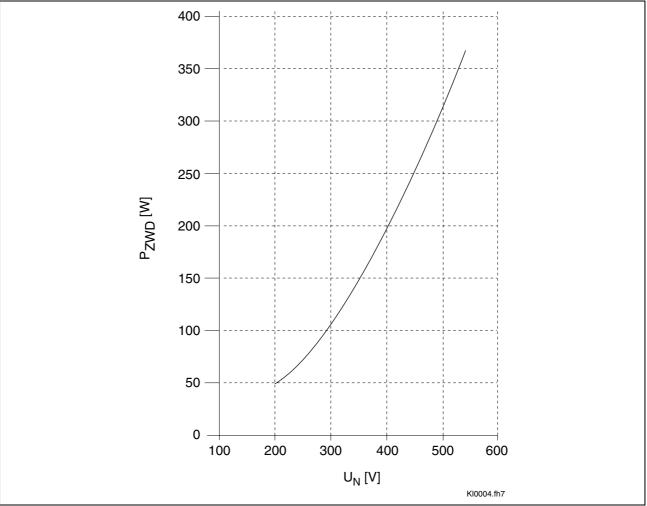
Note: The single-phase mains connection is only permitted with single source supply! With single-phase operation peak power in the DC bus is the same as continuous power.



Allowed DC bus continuous power in single-phase mode at supply networks with a frequency of 50 Hz

Fig. 5-14: Allowed DC bus continuous power in single-phase mode with 50 Hz



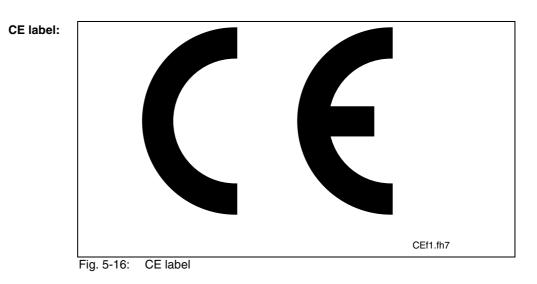


Allowed DC bus continuous power in single-phase mode at supply networks with a frequency of 60 Hz

Fig. 5-15: Allowed DC bus continuous power in single-phase mode with 60 Hz

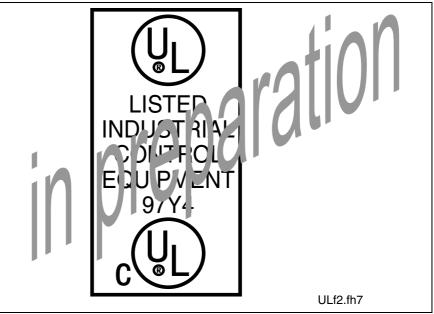


# CE label, C-UL listing, Tests



**C-UL listing:** 

Per UL508 C under file no. E134201



#### Fig. 5-17: C-UL listing

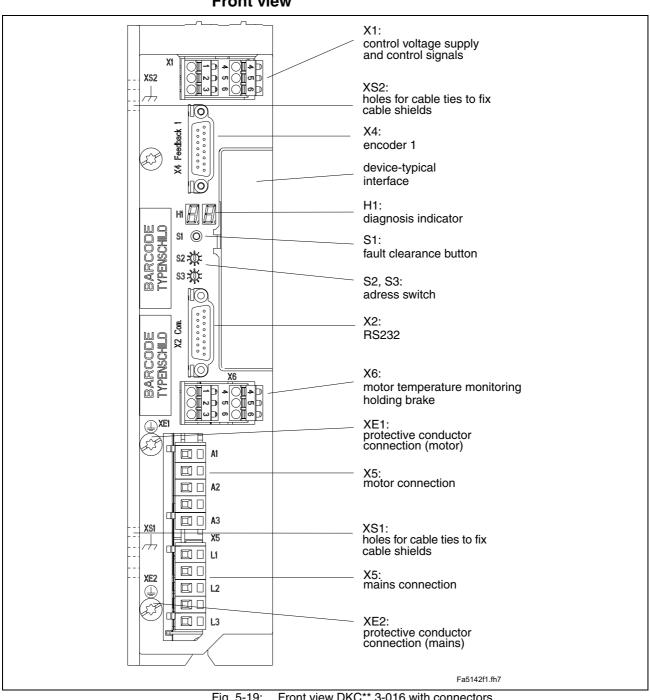
Tests: High-voltage test according to Routine test with DC2100V 1 s EN50178 Insulation test according to EN50178 Routine test with DC500 1 s Separation between the electrical safe separation according to circuits of the control and high EN50178 voltage power Clearances and creepage distances according to EN50178

Fig. 5-18: Tests



#### **Electrical connections** 5.2

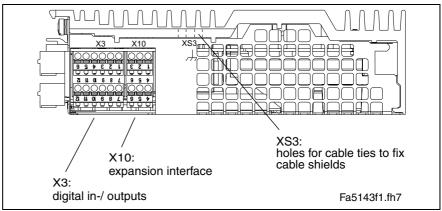
# A look at the drive controller and connector designations



Front view

Fig. 5-19: Front view DKC\*\*.3-016 with connectors





#### Connections on top of the drive controller

Fig. 5-20: Connections on top of unit for DKC\*\*.3-016-7-FW



# Independent of the drive controller type – total connecting diagram

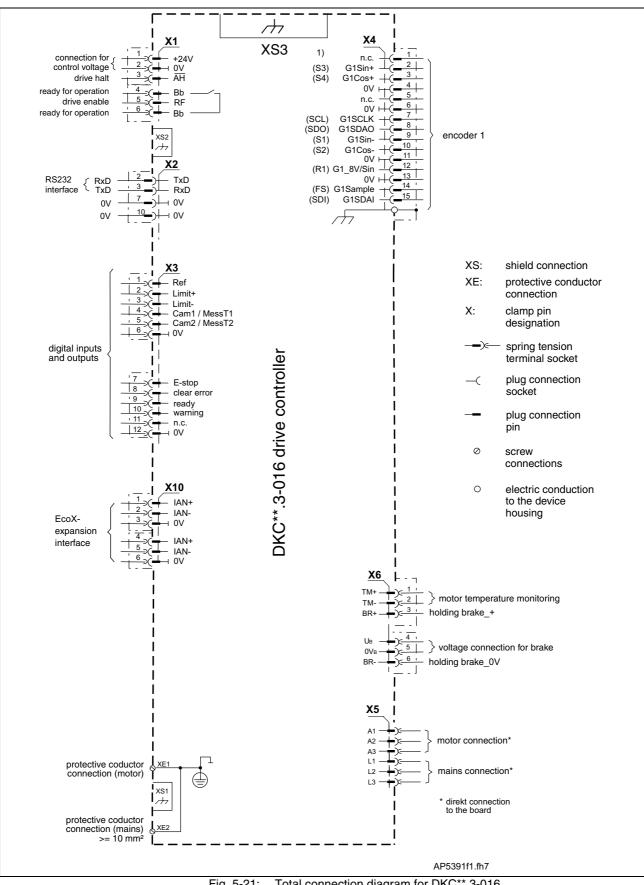


Fig. 5-21: Total connection diagram for DKC\*\*.3-016



16-12

# X1, Connections for control voltage

# Technical description of connector

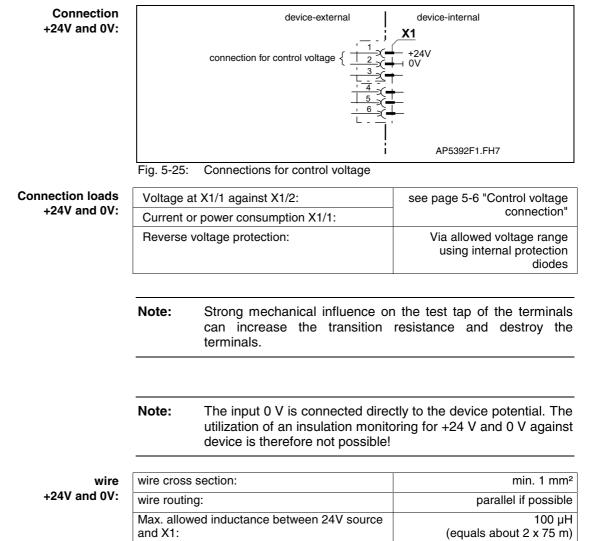
Connection cross section:	Cross section single wire [mm²]	Cross section multi core wire [mm²]	Cross section in AWG Gauge no.:	
	Fig. 5-23: Design			
	Spring contact	2 x 3	Bushing on connector	
Design:	Туре	No. of pins	Design	
	Fig. 5-22: Connector X1			
	Ap5382f1.FH7			
indstation.				
Illustration:				

0,2-2,5

Fig. 5-24: Connection cross section

#### 24V control voltage supply (+24V and 0V)

1,5-2,5



#### Note:

- Exceeding allowed control voltage generates error message "+24 volt • error". (=> See also functional firmware description.)
- Control voltage failure causes the running motor to coast torque-free (without brake).



#### Dangerous movements due to unbraked coasting of motor with control voltage failure!

DANGER

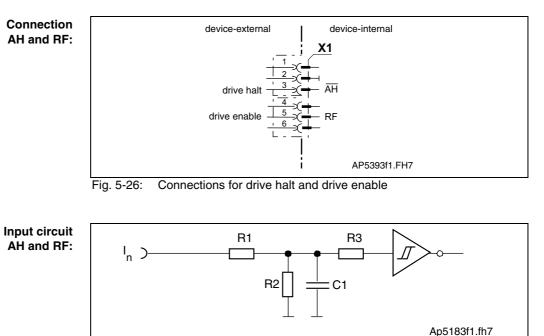
- Personnel should not remain within the area of the  $\Rightarrow$ machine with moving parts. Possible preventive steps against unauthorized access are:
  - protective fencing
  - bars
  - covers - light barriers
- The fences must be able to withstand the maximum  $\Rightarrow$ possible force that the machine can generate.



#### Drive halt (AH) and Drive enable (RF)

#### Note:

- Inputs work with inactive bus communication.
- Inputs don't work with active bus communication (SERCOS interface, Profibus-DP, ...).



R1: 10k R2: 3k3 R3: 10k

- C1: no data
- Fig. 5-27: Input circuit

#### Inputs AH and RF:

Input voltage:	min.	max.	
High	16 V	30 V	
Low	-0.5 V	3 V	
Input resistance	13.3 kOhm ± 5%		
Reaction time	See functional firr	nware description	

Schematics

Fig. 5-28: Inputs

- **AH:** The drive halt function is used to bring an axis to standstill with defined acceleration and jerk (see functional firmware description).
- RF: The input drive enable (RF) activates the drive with a 0-1 edge.
  - **Note:** If the inputs are controlled by a power supply other than the DC24 volt supply of the DKC, then the reference lead of the other power supply must be connected to X1.2 (0 V).



### Ready to operate contact Bb

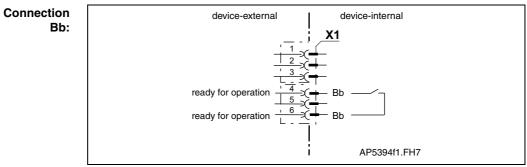


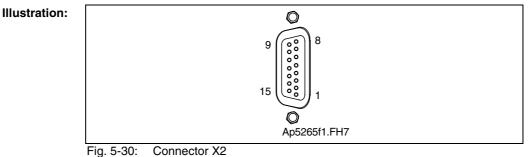
Fig. 5-29: Connections for ready to operate contact

	[		
Loadability of the connection	Max. switching	voltage:	DC 40 V
Bb:	Max. switching	current:	DC 1 A
	Max. continuou	us current:	DC 1 A
	Minimum conta	act load:	10 mA
		umber of switching operations onstant of load < 50 ms:	250,000
Switching states	The Bb contac	cts opens:	
Bb:	<ul> <li>if control voltage for DKC is not applied</li> </ul>		
		activated (depends on pa	cy stop input when the E-stop arameterization, see function
		ror in the drive (depends on pa escription: "Power off on error	arameterization, see functional ").
	How to use t Connection"	he contact, see page11-2: "	Control Circuits for the Mains
	Â	Damage possible if Bb of The ready to operate contact is ready for mains voltage.	contact not connected ! ct Bb acknowledges the drive
	WARNING	⇒ Integrate Bb contact as Mains Connection".	s per "Control Circuits for the
		$\Rightarrow$ The evaluation of the E cause any operating de	Bb contact by a PLC may not lay of more than 10 ms.

### X2, Serial Interface

**Note:** Serial interfaces (RS232) are generally used for programming, parameterization and diagnoses upon commission and during service.

#### Technical description of connector



-

Design:

Туре	No. of pins	Design
D-SUB	15	Bushings on unit
Fig 5-31 Design		

Fig. 5-31: Design

Connection cross section:

Cross section	Cross section	Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge no.:
	0.25-0.5	

Fig. 5-32: Connection cross section

Short circuit protection:

RS232	pin 2, 3 against each other against 0 V	present present

Fig. 5-33: Short circuit protection



#### RS232 interface

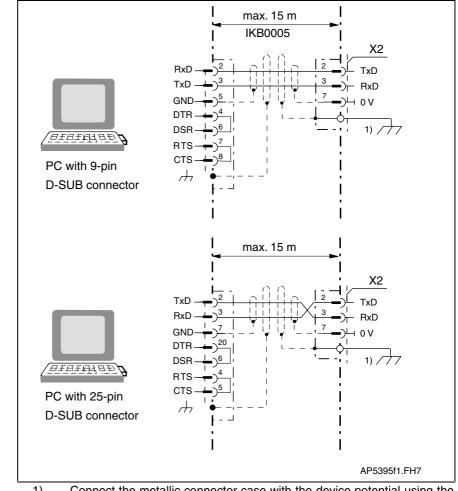
The RS232 interface is used for programming, parameterization and diagnoses at start up and service.

It makes possible:

- a participant number of maximum 1
- a transmission length of up to 15 m
- transmission rates of 9600/19200 baud

Using an RS232 interface only one drive at a time can be parameterized with the DriveTop start up program.

Connection RS232:



1) Connect the metallic connector case with the device potential using the fastening screws of the connector

Fig. 5-34: Connecting a PC to the RS232 interface on a DKC

See also page 13-4 "Additional Accessories".



# X3, Digital I/Os

# Technical description of connector

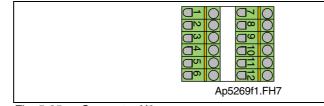


Fig. 5-35: Connector X3

Design:

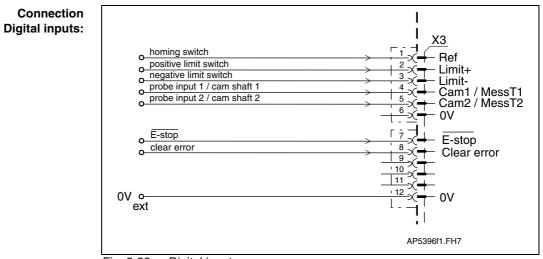
Туре	No. of pins	Design
Spring contact	2 x 6	Bushing on connector
Fig. 5-36: Design		

#### Connection cross section:

Cross section	Cross section	Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	Gauge no.:
0,2-2,5	0.2-1.5	24-16

Fig. 5-37: Connection cross section

Digital Inputs (Ref, Limit+, Limit-, Cam1/ MessT1, Cam2/ MessT2, E-stop, Clear error)







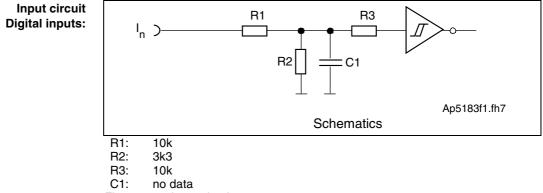


Fig. 5-39: Input circuit

#### Inputs **Digital inputs:**

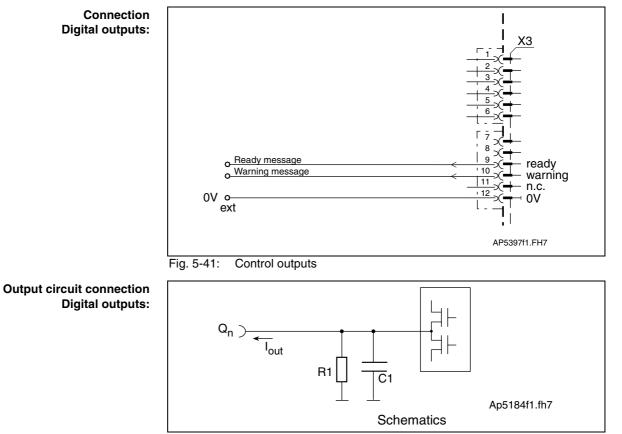
Input voltage:	min.	max.
High	16 V	30 V
Low	-0,5 V	3 V
Input resistance	13,3 kOhm ± 5%	
Reaction time	eaction time See functional firmware description	
Fig. 5-40: Inputs		

Note: If the inputs are controlled by a power supply other than the DC24 volt supply of the DKC, then the reference lead of the other power supply must be connected to X3.12 (0 V).

- Homing switch: The positive edge of the homing switch is always evaluated.
  - End switches can be N/C or N/O depending on how the drive is Limit+, Limit-: parametrized. See functional firmware description.
    - Probes: Position and time measurements are read using two binary input signals.
      - Cams: Switching-signal dependent continuous block switching makes transition to the next block possible with the use of an external switching signal.

Note: If the functions probe and following block mode are simultaneously activated, then both functions evaluate the inputs independently of each other.

- E-Stop: At delivery, the E-stop function is deactivated depending on what has been parameterized. See functional firmware description.
- With a positive edge at the input "clear error", all errors (up to four) are **Clear error:** cleared. With the actuation of the S1 button (firmware module) only the error in the display is cleared and any other errors present are then shown.
  - Note: The errors entered in the back-up memory are not cleared with the "clear error" input.



# Digital outputs (ready and warning message)

R1: 20k

C1: no data Fig. 5-42: Output circuit

Output connections Digital outputs:

Output voltage:	min.	max.	
High	16 V	U <sub>ext</sub> (an X1.1) - 1 V	
Low	-0.5 V	1.5 V	
Output current Iout	8	0 mA	
Rise and drop time	abou	t < 600 ns	
Overload protection	<ul> <li>short circuit protect</li> <li>thermal shutdown</li> </ul>	<ul> <li>short circuit protection</li> <li>thermal shutdown</li> </ul>	

Fig. 5-43: Outputs



- **Warnings:** Depending on operating mode and parameter programming a number of monitoring functions are conducted. If a condition is detected that still allows for correct operations but would eventually lead to an error, then the warning is set to high.
  - $\Rightarrow$  See also functional firmware description.
  - **Ready:** If the unit is ready for the drive enable, then the output ready is set to high.

The output is set to low

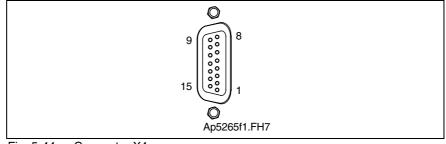
- with a pending error
- with DC bus voltage < (0.75 x threshold value of applied mains voltage)</li>
- with lacking control voltage
- ⇒ See also functional firmware description: "Ready"



# X4, Encoder 1

#### **Technical description of connector**







Desig

ign:	Туре	No. of pins	Design
	D-SUB	15	bushing on unit
	Fig E 4E: Design		

Fig. 5-45: Design

Connection cross section:

Cross section	Cross section	Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge no.:
	0.25-0.5	

Fig. 5-46: Connection cross section

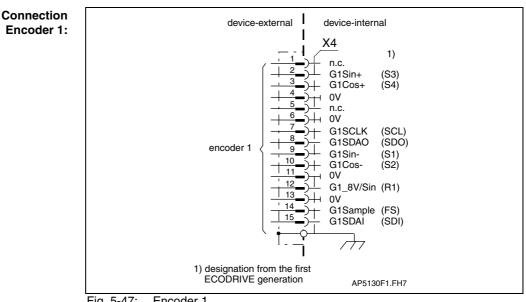


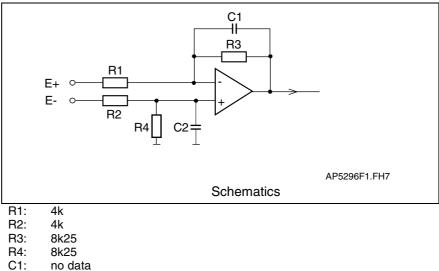
Fig. 5-47: Encoder 1

Shield connection: Via D-subminiature mounting screws and metal connector housing.

- Clock lead for I<sup>2</sup>C interface G1SCLK:
- G1SDA0, G1SDAI: Data lead for I<sup>2</sup>C interface
  - G1Sample: Control signal for encoder initialization

G1Sin+ (S3), G1Sin- (S1):

Input circuit G1Sin+ (S3), G1Sin- (S1):



C1: no data C2: no data

Fig. 5-48: Input circuit

#### Features of the differential input circuit G1Sin+ (S3), G1Sin- (S1):

	Resolver
max. allowed amplitude encoder signal	9,0 Vss
Evaluation AD converter	12 Bit
Limit frequency	
Input resistance	8k ± 5%

Fig. 5-49: Features of the differential input circuit

G1Cos+ (S4), G1Cos- (S2): see G

see G1Sin+ (S3), G1Sin- (S1)

#### G1\_8V/Sin: Features of the encoder output amplifier stage G1\_8V/Sin:

	Resolver
Output voltage	18,2 Vss (sine with 4 kHz)
max. output current	AC 70 mA eff.
min. D.C. resistance of the load	35 R

Fig. 5-50: Features of the encoder output amplifier stage



#### Signal allocation to the actual position value

Signal allocation (X4)	signal des	signation	signal form	actual position value (with default setting)
amplitude-modulated signal	G1Sin+(S3) G1Sin- (S1) G1Cos+(S4) G1Cos- (S2)		Resolver	increasing

Fig. 5-51: Signal allocation to the actual position value



#### **Connecting the Measuring System**

See page 1-4 "An Overview of Measuring Systems Supported".

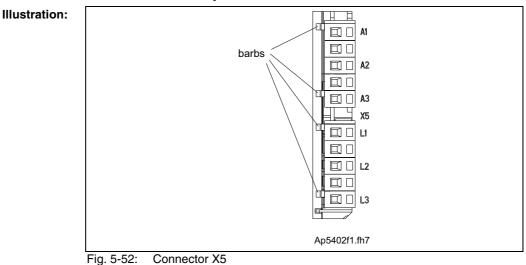


# X5, Motor and Mains Connections



# Lethal electric shock caused by live parts with more than 50 V!

- $\Rightarrow$  Before working on the drive controller, switch off the power supply via the main switch or the fuse.
- ⇒ Always mount or dismount both connectors (motor connector and mains connector) on the drive controller at the same time.
- $\Rightarrow$  Observe the information contained in chapter 3 Safety Instructions for Electric Drives and Controls".



#### **Technical description of connector**

Note:

- To pull off the connectors, loosen the barbs.
- The maximum number of insertion/withdrawal cycles is limited to 15.

Design:

Туре	No. of pins	Design
connection block	2 x 3	bushing on connector
Fig. 5-53: Design		

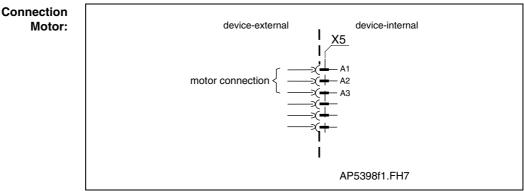
#### Connection cross section:

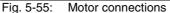
Cross section	max. connectable	max. Cross section
single wire	cross section	in AWG
[mm²]	[mm²]	gauge no.:
1,5	1,5	

Fig. 5-54: Connection cross section



#### **Motor connection**





**Cable** Use Rexroth Indramat motor power cables to connect motor and **Motor:** controller.

**Note:** For technical data on connections and cross sections, see the motor project planning manual.

#### Cable length:

Maximum length equals 35 m:

- With two connections between controller and motor (e.g., plugs at exit of control cabinet and at machine)
- Standard cables from Rexroth Indramat and
- Ambient temperatures of ≤ 40 °C per EN 60 204
- Switch frequency of 4 kHz

Maximum allowed capacitance per unit length at A1, A2, A3:

- with regard to ground: 0.5 nF/m
- cable to cable: 0.5 nF/m

Maximum allowed inductance per unit length an A1, A2, A3:

• 100 nH/m

To maintain EMC values, the motor cable length is limited with a switching frequency of > 4 kHz. It is largely dependent on the application and ambient conditions at the installation and machine.

A guide value is listed below:

Cycle frequency drive controller	Max. length for class B, EN 55011	Max. length for class A, EN 55011
standard setting switching frequency 4 kHz	35 m	35 m
parameter setting switching frequency 8 kHz	35 m	35 m

Fig. 5-56: Guide value for maximum motor cable lengths





No guarantee!

If third party cables are used, then the guarantee is forfeited for the entire system.

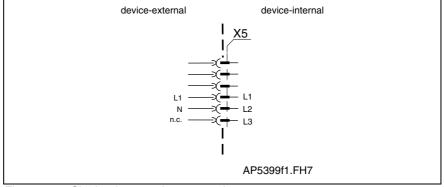
 $\Rightarrow$  Use Rexroth Indramat cables!

Illustration of the correctly connected motor cable: See page 16-19 Connection of motor and mains cable DKC\*\*.3-016-7".

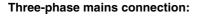
Single-phase mains connection:

#### **Mains connections**

The mains connector serves as the connection of the drive controller with the power supply.



Single-phase mains connection Fig. 5-57:



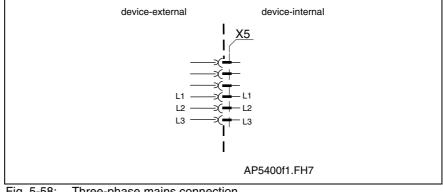


Fig. 5-58: Three-phase mains connection

Note: Mains connections should not be daisy-chained between the units (intermediate connectors for the supply source should be used).

Illustration of the correctly connected mains cable: See page 16-19 Connection of motor and mains cable DKC\*\*.3-016-7". See also page 11-1 "Mains Connections"



# X6, Motor temperature monitoring and holding brakes

#### Technical description of connector

#### Illustration:

Ap5382f1.FH7	

Fig. 5-59: Connector X6

Design:

Туре	No. of pins	Design
Spring contact	2 x 3	Bushing on connector
Fig 5 60: Docign		

Fig. 5-60: Design

Connection cross section:

single wire	multi core wire	in AWG
[mm²]	[mm <sup>2</sup> ]	Gauge no.:
0.2-2.5	1.5-2.5	16-12

Fig. 5-61: Connection cross section



# Damages by exchanging the connectors X6.1-3 and X6.4-6!

 $\Rightarrow$  Do not exchange connectors X6.1-3 and X6.4-6.

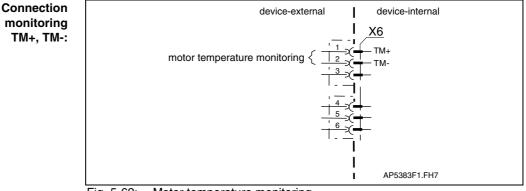
 $\Rightarrow$  Only use lines with sufficient cross section.

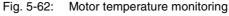
⇒ Strong mechanical influence on the test tap of the terminals can increase the transition resistance and destroy the terminals.



#### Motor temperature monitoring (TM+, TM)

Connections TM+ and TM- are used to evaluate the temperature of connected Rexroth Indramat motors. These are equipped with a temperature-dependent resistor (either PTC or NTC dependent on the motor type) to monitor temperature. The connection leads are in the motor power cable.





Motor temperature evaluation:

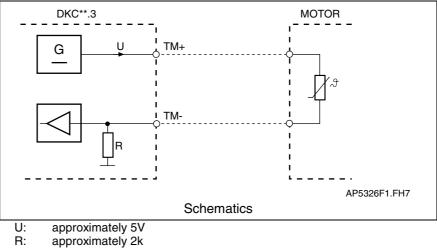


Fig. 5-63: Motor temperature evaluation

Note: Connections TM+ and TM- are only to be used with Rexroth Indramat motors.

 $\Rightarrow$  See also functional firmware description: "Temperature monitoring".



### Holding brake (BR+, BR-)



# Dangerous movements! Danger to personnel from falling or dropping axes!

- ⇒ The standard equipment motor brake or an external brake controlled directly by the servo drive are not sufficient to guarantee the safety of personnel!
- $\Rightarrow$  Personnel safety must be acquired with higher-ranking procedures:

Dangerous areas should be blocked off with fences or grids.

Secure vertical axes against falling or slipping after switching off the motor power by, for example:

- Mechanically securing the vertical axes
- Adding an external brake / clamping mechanism
- Balancing and thus compensating for the vertical axes mass and the gravitational force

These control the holding brakes in the connected motors.

For the switching performance, see function description.

To connect external loads note allowed contact loads.

#### Connection BR+, BR:

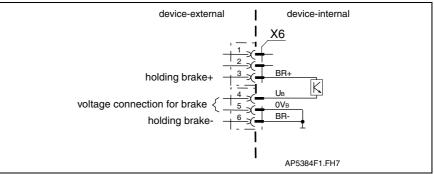


Fig. 5-64: Holding brake and voltage connection

#### Loadability of connections BR+, BR-:

max. switching voltage:	DC 36 V
max. switching current:	DC 1 A
max. continuous current:	DC 1 A
Minimum contact load:	100 mV
Guaranteed number of switches at max. time constant of load < 50 ms (L <sub>Bremse</sub> /(24V/I <sub>Bremse</sub> )):	unlimited (electronic contact free of wear)
Short-circuit and overload protection in the row to the contact	present



#### Voltage connection for brakes

**Note:** The motor holding brake is not supplied by the controller. Given one voltage source for brake and control voltage, use parallel leads from the voltage source. Note the voltage range for the motor holding brake according to the motor projection.

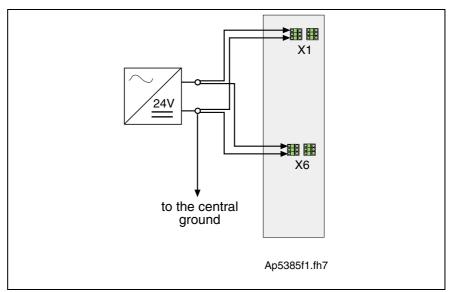


Fig. 5-65: Shared voltage source for brakes and control voltage supply

**Note:** Looping through the voltages to other drive controllers is impossible. Other drive controllers have to be connected in radial arrangement around the voltage source.

Voltage connection for brakes	
on DKC:	

s	max. voltage at X6.4 against X6.5:	DC 36 V
:	current consumption at X6.3 and needed supply voltage:	see "Technical data" brake in the motor manual



wire voltage connection for brake:

wire cross section:	min. 1 mm²
voltage resistance of single wire to ground	≥ 750 V (e.g.: litz wires - H07)
wire routing	parallel if possible (twisted)
max. inductance between 24 V source and X6	100 μH (equals about 2 x 75 m)

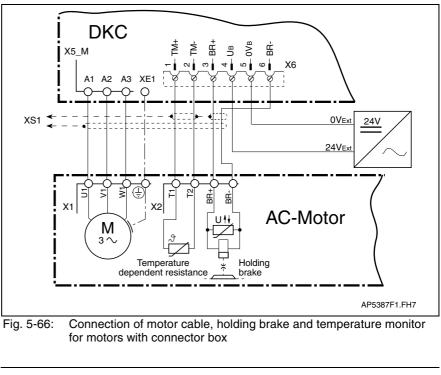
#### Motor holding brake

Controlling the motor holding brake:

Technical data Motor holding brake: The controller controls the holding brake.

Supply voltage, current consumption, linking, separating time, holding torque, etc. see motor manual.

# Basic connection of motor power, holding brake and motor temperature monitoring

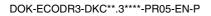


**Note:** The cable designations and all details on making cables are outlined in the cable or motor document.



# X10, EcoX Expansion interface

See page 4-86.





# XE1, XE2 Protective conductor connections for motor and mains

#### **Technical description of connector**

Illustration: See

: See page 5-16: "A look at the drive controller and connector designations".

Design:

n:	Туре	No. of pins	Design
	screw-in connection	2 x 1	screw-in connection for ring terminals M5

Fig. 5-67: Design

Tightening	torque:
------------	---------

min. tightening torque	max. tightening torque
[Nm]	[Nm]
2.5	3.0

Fig. 5-68: Tightening torque

Connection cross section:

Cross section	Max. connectable	Max. cross section
single wire	cross section	in AWG
[mm²]	in mm <sup>2</sup>	gauge no.:
	25	

Fig. 5-69: Connection cross section

#### XE1, Protective conductor connection for motor

See page 5-33: "Motor connection".

#### XE2, Protective conductor connection for mains

Note:	PE connect	tion <u>&gt;</u> 1	0 mm²			
	Reason: section: 5.3	0	leakage	currents	(EN	50178/1998,



### XS1, XS2, XS3 Shield Connections

#### XS1

Connection for shield:

- Total motor cable shield
- Holding brake
- Motor temperature monitoring

#### XS2

Connection for shields of cables at X1 and those for the command communication interfaces.

#### XS3

Connection for shields of cables at X3 and X10. 6 - 15 mm (for all shield connections)

Allowed outside diameter:

**Note:** Always connect the shield connections of the cables (especially of the motor cables) with a large contact surface.



# H1, S1, S2, S3: Diagnostic display, Reset key, Address switch

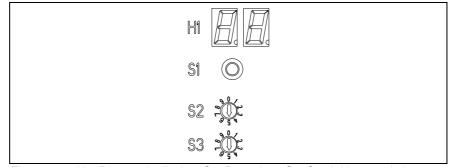


Fig. 5-70: H1: Diagnostic display, S1: Reset key, S2, S3: Address switch

#### H1

Number of diagnostic messages (errors and operating states).

#### **S1**

- Key for resetting diagnostic displays of errors
- Key for updating firmware

#### S2, S3

Switch for setting the drive address.

Address switch S2, S3; Two decade switches are used to set the drive address. It can be set to any number between 1 and 99.

#### Example:

Switch setting S3 = 9 (value of tens) Switch setting S2 = 1 (value of ones) Drive address = 9 \* 10 + 1 = 91

Note: The address is not set at delivery. The setting of switches S2 and S3 depends on the model, firmware and the drive address wanted.

 $\Rightarrow$  see functional firmware description

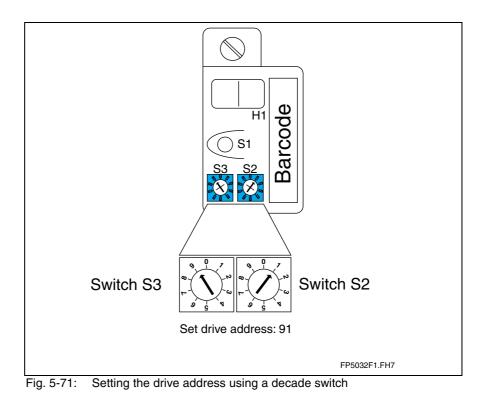


#### **Setting the Drive Address**

Switch S2, S3 Two decade switches are used to set the drive address. It can be set to any number between 1 and 99.

Example:

Switch setting S3 = 9 (value of tens) Switch setting S2 = 1 (value of ones) Drive address = 9 \* 10 + 1 = 91



Note: The address is not set at delivery. The setting of switches S2 and S3 depends on the model, firmware and the drive address wanted.

 $\Rightarrow$  See functional firmware description.



### Notes

# 6 ECODRIVE03 Auxiliary Bleeder Module BZM01.3

# 6.1 General

The Auxiliary Bleeder Module BZM01.3 is advantageously utilized to:

- To increase the allowed continuous regenerative power
- To increase the allowed peak regenerative power
- For internal DC bus dynamic brake (ZKS) with DKC\*\*.3-040-7-FW

# 6.2 Technical data

# Dimensions

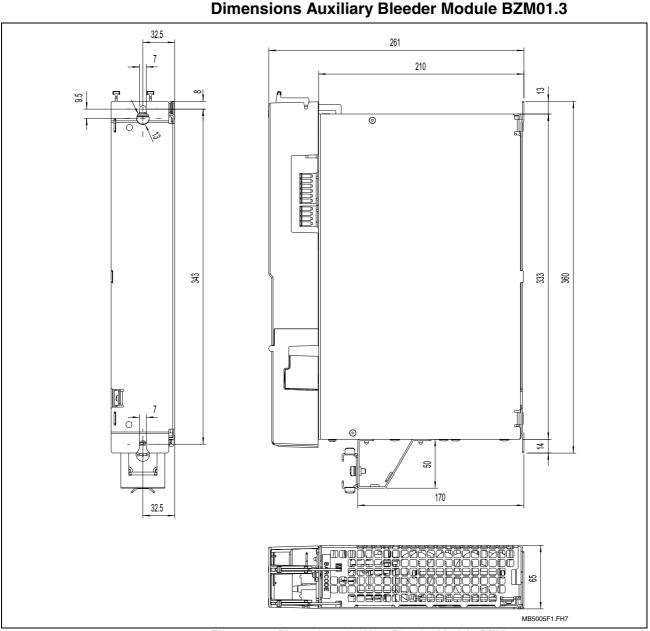


Fig. 6-1: Dimensions Auxiliary Bleeder Module BZM01.3

Also see page 12-1: "Constructing the Control Cabinet".



# Materials used, Mass

Designation	Symbol	Unit	BZM01.3
Mass	m	kg	6.5
Materials	-	-	asbestos and silicone free
	Fig. 6-2: M	laterials used,	Mass

Rexroth Indramat

# Ambient and operating conditions

See page 4-4: "Ambient and operating conditions"

# Electrical data of auxiliary component BZM01.3

#### **Power section**

Designation	Symbol	Unit	BZM	101.3
Operating mode at the mains	•		single phase	three phase
			See page 6-14: "Zk page 11-5: "Control Circ	r protection purposes. (S control input" and cuits with internal DC bus rake (ZKS)"
Nominal charging current (dependent on mains input voltage)	I <sub>EIN1</sub>	A	~	0
Mains input voltage	U <sub>N1</sub>	V	See page 4-6: "Main	s connections, Power
Mains frequency	f <sub>N1</sub>	Hz	sec	tion"
Rotary field			clockwise or co	ounter-clockwise
Device power dissipation without internal continuous bleeder power	Pv	W	1	2
Peak bleeder power BZM	P <sub>BS,BZM</sub>	kW	1:	20
Continuous bleeder power BZM when Ta<45°C	P <sub>BD,BZM</sub>	kW		1
under max. temperature range at a distance	ΔT d	K mm		10 30
max. available continuous bleeder power in the DC bus if operating: 1 x DKC**.3-040-7 1 x DKC**.3-100-7 1 x DKC**.3-200-7		kW kW kW	1	92 .2 .6
with symmetry factor	f		0	.8
Max. energy Max. energy dissipation BZM	W <sub>R,MAX,BZM</sub>	kWs	1	00
Internal DC bus dynamic brake (ZKS)			cont	ained
nominal DC bus capacitance BZM	C <sub>zw</sub>	mF	0.	33
Allowed input voltage at L+, L- at X5	U <sub>zw</sub>	V		ge ECODRIVE 0 800)
Cooling power section and bleeder resistor			with interr	nal blowers
Volumetric capacity of the forced cooling		m³/h	appro	ox. 48
Insulation resistance at DC500V	R <sub>is</sub>	MOhm	>	15

Fig. 6-3: Technical data mains connection and power section

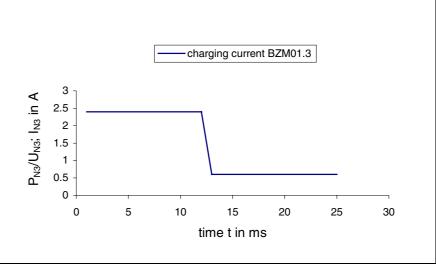


Designation	Symbol	Unit	BZM01.3
Input voltage	U <sub>N3</sub>	V	
maximum ripple effect	w	%	see page 4-13 Control voltage connection for DKC"
max. allowed overvoltage	U <sub>N3max</sub>	V	
current consumption	I <sub>N3</sub>	А	0.5
max. charging current	I <sub>EIN3</sub>	А	2.4
max. input capacitance	C <sub>N3</sub>	mF	0.22 * 1.2

#### DC24V voltage supply for BZM01.3

Fig. 6-4: Control voltage connection for BZM01.3

# Amplitude of the BZM control voltage charging current at startup, to selecting power source



P<sub>N3</sub>: Power consumption

U<sub>N3</sub>: Control voltage

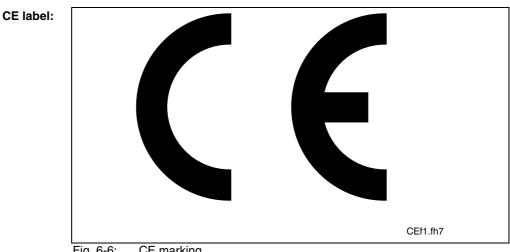
I<sub>N3</sub>: Current consumption after charging current inrush

Fig. 6-5: Example of charging current inrush of control voltage

Note: For n parallel-switched inputs the charging current inrush is n-fold.



# **CE Label, Tests**



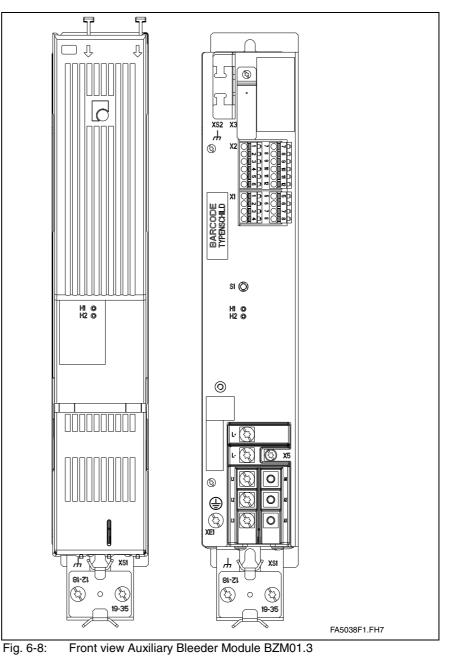
CE marking Fig. 6-6:

Tests:	High-voltage test according to EN50178	Routine test with DC2100V	1 s
	Insulation test according to EN50178	Routine test with DC500V	1 s
	Separation between the electrical circuits of the control and high voltage power	safe separation according to EN50178	
	Clearances and creepage distances	according to EN50178	
	Fig. 6-7: Tests		



# 6.3 Electrical Connections BZM01.3

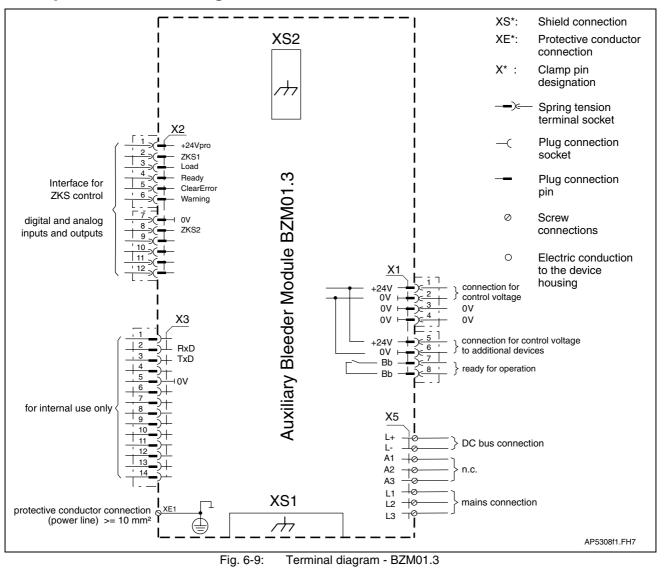
# **Front View**



- S1: Reset key
- H1: Diagnosis green
- H2: Diagnosis red



### **Complete Terminal Diagram**







Mains power not applied to L1, L2, L3 causes damages to the drive controller device and to the BZM!

⇒ Apply switched mains power see also page 6-15: "Fig. 6-25: Block diagram interlock ZKS/Mains".

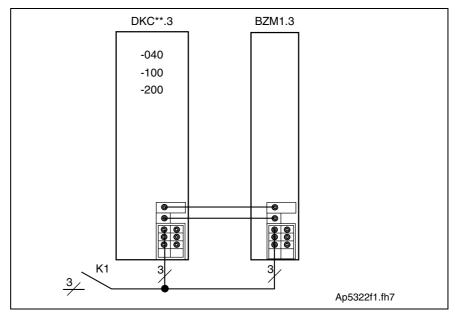


Fig. 6-10: DC bus and mains connection

Note:	In addition to the illustrated connections of the BZM01.3 at the
	DC bus, the following connections must be wired as well:

- Bb contact
- control voltage supply



# X1, Control voltage connections

#### Technical description of connector

		-	
Illustration:			□       □
	Fig. 6-11:	Connector X1	

Design:

Туре	No. of pins	Design
spring contact	2 x 4	bushing at connector
Fig. 6-12: Design		

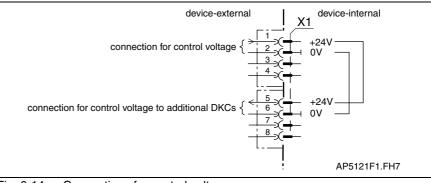
Connection cross section:

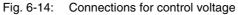
Cross section multi core wire [mm²]	Cross section in AWG gauge no.:
0.2-1.5	24-16
	multi core wire [mm²]

Fig. 6-13: Connection cross section

### 24V control voltage supply (+24V and 0V)

Connection +24V and 0V:





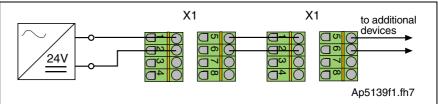


Fig. 6-15: Looping through the control voltage



Load capacity of connection +24V and 0V:

Voltage at X1/1 against X1/2:	see page 4-13 Control voltage connection for DKC"
Reverse voltage protection:	Via allowed voltage range using internal protection diodes
Current or power consumption X1/1:	See page 6-5 : "Technical data -> DC24V voltage supply for BZM01.3"
Max. allowed current load with looping through the control voltage via X1.1/2 to X1.5/6:	DC 10 A

wire

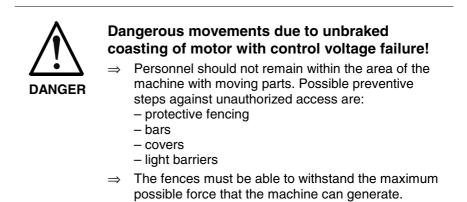
+24V and 0V:

wire cross section:	min. 1 mm <sup>2</sup>
wire routing:	parallel if possible
Max. allowed inductance between 24V source and X1:	100 μH (equals about 2 x 75 m)

#### Note:

- Bleeder not available once control voltage fails.
- Control voltage failure causes the running motor to coast torque-free (without brake).

See page 11-5: "Control Circuits with internal DC bus dynamic brake (ZKS)"



#### Ready to operate contact Bb

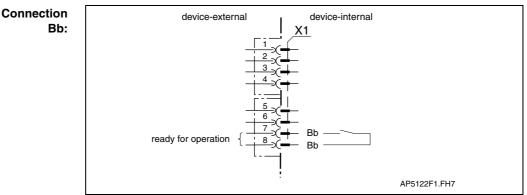


Fig. 6-16: Connections for ready to operate contact



Loadability of the connection Bb:	max. Switching voltage:	DC 40 V
	max. Switching current:	DC 1 A
	max. continuous current:	DC 1 A
	Minimum contact load:	10 mA
	Guaranteed number of switching operations at max. time constant of load < 50 ms:	250.000
Switching states Bb:		
	How to use the contact, see page 11-2: ' Connection".	Control Circuits for the Mains
	Damage possible if Bb The Bb contact acknowledg to the application of power.	contact not connected! les auxiliary bleeder readiness

Integrating the Bb contact of the BZM01.3 as per  $\Rightarrow$ "Control Circuits for Connect the Mains".

# X2, DC bus dynamic brake (ZKS), Diagnostic Signals

WARNING

#### Technical description of connector

Illustration:

Design:

		000000 7 8 9 10 10 11 12	
Ap5269f1.FH7			

Fig. 6-17: Connector X2

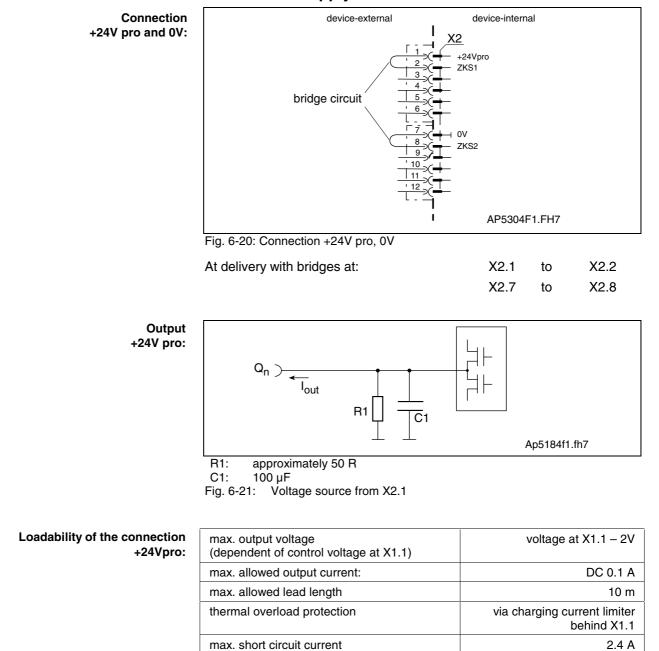
Туре	No. of pins	Design
spring contact	2 x 4	bushing on connector
Fig. 6-18: Design		

Connection cross section:

Cross section	Cross section	Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge no.:
0.2-2.5	0.2-1.5	24-16

Fig. 6-19: Connection cross section X2





### **ZKS control supply**

Application +24V pro:

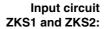
The connections supply current to the ZKS input.

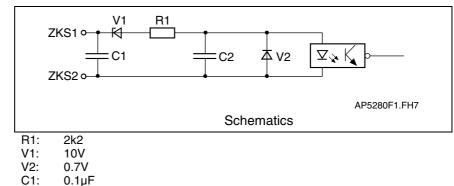


#### **ZKS control input**

Connection ZKS1 and ZKS2:

See page 6-13 "Fig. 6-20: Connection +24V pro, 0V".





C2: 0.1µF

Fig. 6-22: Input circuit

#### Inputs ZKS1 and ZKS2:

Input voltage:	min.	max.	
High	17.6 V	28.8 V	
Low	0 V	5 V	
trigger delay t <sub>d</sub> due to contactor drop delay	min. 40 ms	max. 80 ms	
input resistance	about 2 kOhm ± 5%		
potential isolation to 50 Veff			
Polarity reversal protection within allowed input voltage range			

Fig. 6-23: Inputs

# Use ZKS1 and ZKS2:

The connections supply the ZKS input and permit potential free control of DC bus dynamic brake setup via a relay contact.

Trigger behavior of DC bus setup:

Mains voltage at X5	DC input	DC bus setup
not applied	no current	active
not applied	current	not active
applied	not current	not active
applied	current	not active

Fig. 6-24: Trigger behavior of ZKS setup

Protecting the ZKS setup with mains voltage applied:

**Note:** If mains voltage applied at X5 then DC bus dynamic brake not executed! The ZKS control is realized with the currentless input.



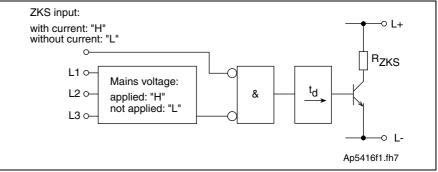
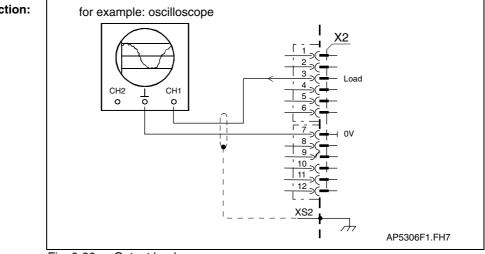


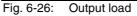
Fig. 6-25: Block diagram interlock ZKS/Mains

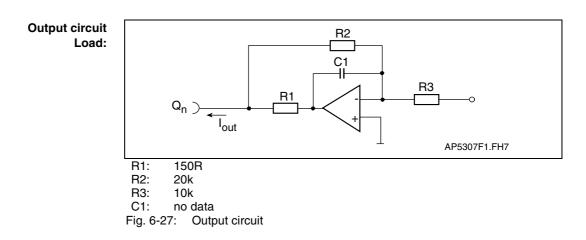
Also see page 4-25: "Arranging the Central supply" and page 11-5: "Control Circuits with internal DC bus dynamic brake (ZKS)".

#### **Analog Output Load:**

Connection:









Output Load:	Output voltage between load and 0 V:	min 0 V	max. 10 V
	output current	Max. 2 mA	
	DA converter	no data	
	resolution per bit	no data	
	short circuit and overload protection	not present	
	evaluation	U 10V ● P <sub>BD,BZM</sub>	

Fig. 6-28: Output load

**Load:** The connection is used to output an analog signal of the proportional load of the mounted bleeder resistor.



Connection Ready, Warning:

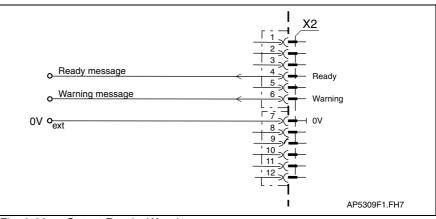


Fig. 6-29: Output Ready, Warning

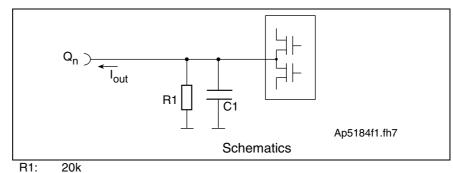




Fig. 6-30: Output circuit

Outputs Ready, Warning:

Output circuit Ready, Warning:

Output voltage:	min.	max.
High	16 V	U <sub>ext</sub> (an X1.1-1V)
Low	-0.5 V	1.5 V
Output current Iout	80 mA	
Rise and drop time	about < 600 ns	
Overload protection	<ul> <li>short circuit protection at l<sub>out</sub> &gt; 300 mA outputs switch off</li> <li>thermal shutdown</li> </ul>	

Fig. 6-31: Outputs Ready, Warning



Warning message:

e: The signal is set to "High"

- if pre-warning signal threshold for maximum bleeder load exceeded (internally permanently set)
- or if pre-warning signal threshold is exceeded for maximum bleeder temperature (internally permanently set).

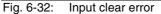
Further operations up to the shutdown threshold is possible but this causes the Bb contact to open.

Ready: Output set to "low"

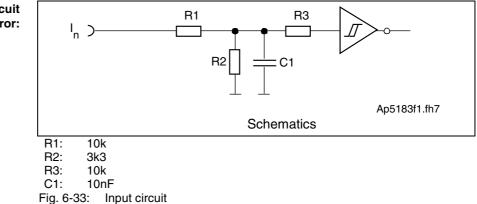
- if error is pending
- if control voltage failed

#### Clear error

The clear error input supports the resetting of the unit's internal error memory.



Input circuit Clear error:



Inputs Clear error:

puts	Input voltage:	min.	max.
rror:	High	16 V	30 V
	Low	-0.5 V	3 V
	Input resistance	about 13	.3 kOhm
	Fig 6-34 <sup>·</sup> Inputs		

Fig. 6-34: Inputs

**Clear error:** Giving a positive edge at input the "Clear error", the entire error memory is deleted.



### X3, RS 232 Interface

**Note:** For internal use only.

### X5, DC bus and Mains connection

### Technical description of connector

Illustration:	L+③
	L- 🕲
	L1@ @A1 L2@ @A2
	Ap5267f1.FH7

Fig. 6-35: Connector X5

Design:

Туре	No. of pins	Design
Connection block	2/3/3	Screw connection for ring terminal M5
Fig 6-36 Design		

Fig. 6-36: Design

#### **Tightening torque**

ue:	min. tightening torque [Nm]	max. tightening torque [Nm]	
	2.5	3.0	

Fig. 6-37: Tightening torque

#### Connection cross section

on:	Cross section	Cross section	Max. Cross section
	single wire	multi core wire	in AWG
	[mm <sup>2</sup> ]	[mm²]	gauge no.:
		25	

Fig. 6-38: Connection cross section



#### **DC** bus connection

Connection DC bus:		device-exte		device-internal (5
20 503.		DC bus connectio		L+ L-
			I	AP5301F1.FH7
	Fig. 6-39:	Connection DC bus		



# Damage possible if DC bus connections L+ and L- are reversed!

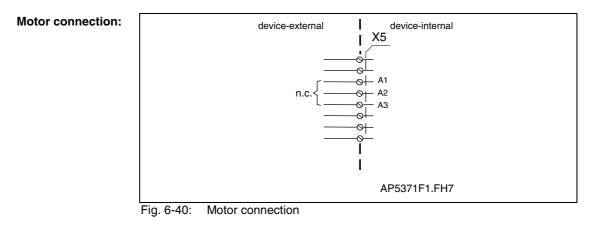
 $\Rightarrow$  Make sure polarity is correct.

wire DC bus

If the DC bus rails supplied do not make a connection possible, then use short twisted wires to do so.

wire length:	max. 2 x 1 m
wire cross section:	min. 10 mm <sup>2</sup> , not smaller than the cross section of the mains supply lead
wire protection	With a fuse in the mains connections
Voltage resistance of individual wires to ground	≥ 750 V (e.g., litz wires - H07)

#### **Motor connection**

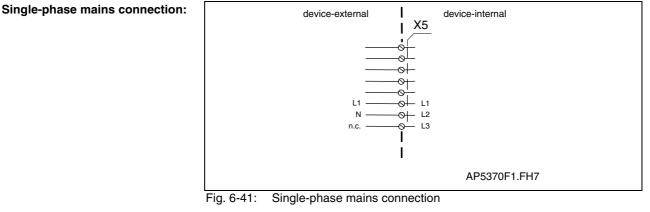


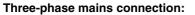
Note: Connections A1, A2, A3 are not wired!

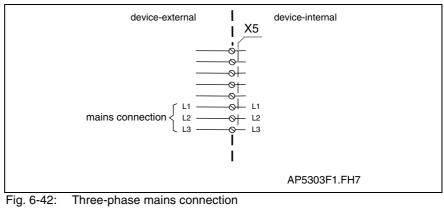


#### **Mains connections**

The mains connector serves as the connection of the drive controller with the power supply.







**Note:** Mains connections should not be daisy-chained between the units (intermediate connectors for the supply source should be used).

See page 11-1: "Mains Connections"



## XE1, Protective conductor connection for mains

#### **Technical description of connector**

Illustration:

See "Fig. 6-8: Front view Auxiliary Bleeder Module BZM01.3" on page 6-7.

sign:	Туре	No. of pins	Design
	screw	1	screw for ring terminals M5

Fig. 6-43: Version

Tightening torque:	min. tightening
	[NIm]

min. tightening torque	max. tightening torque
[Nm]	[Nm]
2.5	3.0

Fig. 6-44: Tightening torque

Connection cross section:

Cross section	Cross section	Max. cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge no.:
	25	

Fig. 6-45: Connection cross section

### XE1, Protective conductor connection for mains

Note:	PE connection $\geq 10 \text{ mm}^2$					
	Reason: h section: 5.3.2	•	leakage	currents	(EN	50178/1998,

### XS1, XS2, Shield connections

#### XS1 and XS2

Further shield connections.



### **Diagnostic LEDs and Reset Probe**

Diagnostic LED (green) H1:

State	Definition
blinking LED	applied control voltage is ok and DC bus voltage $U_{ZW} \le 50 \text{ V}$
continuous light	and DC bus voltage $U_{ZW} > 50 \text{ V}$

Fig. 6-46: Diagnostic LED (green) H1

#### Diagnostic LED (red) H2:

State	Definition	
blinking LED	$W_{BZM} > 90\% * W_{MAX, BZM}$ or $P_{BZM} > 90\% * P_{BD, BZM}$ or Temperature pre-warning (internal heatsink)	
continuous light	overload, overtemperature, internal error	

Fig. 6-47: Diagnostic LED (red) H2

**Reset probe S1:** Reset the H2 diagnostic LED once overload or overtemperature problems have been cleared.



### Notes

# 7 ECODRIVE03 Auxiliary Capacitance Module CZM01.3

## 7.1 General

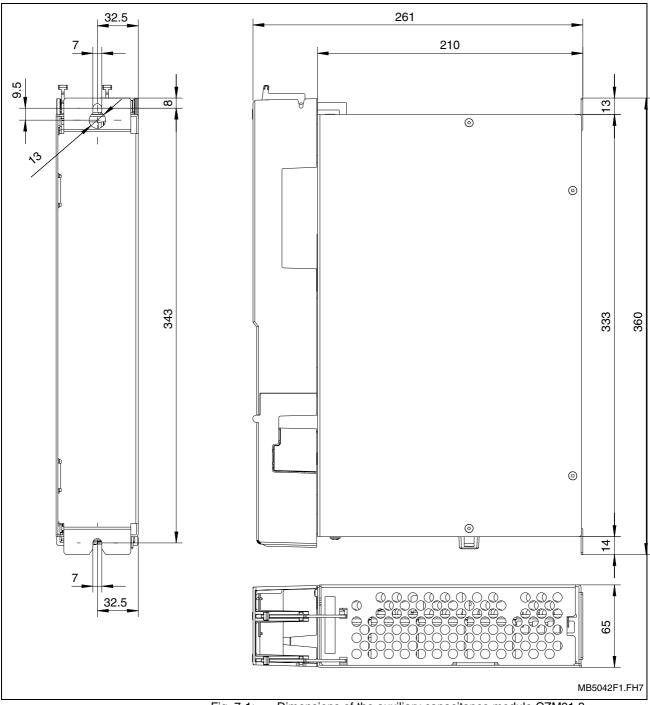
The auxiliary capacitance module is advantageous in the following situations:

- reducing power loss within the control cabinet
- storing energy in drive applications with short cycle times
- increasing allowed continuous power in the DC bus of DKC controllers



## 7.2 Technical data

### Dimensions



Dimension sheets auxiliary capacitance module CZM01.3

Fig. 7-1: Dimensions of the auxiliary capacitance module CZM01.3

Also see page 12-1: "Constructing the Control Cabinet"



### Materials used, Mass

Designation	Symbol	Unit	CZM01.3
Mass	m	kg	5
Materials used	-	-	asbestos and silicone free
	Fig 7-2: M	latoriale usod	Mass

Fig. 7-2: Materials used, Mass

### Ambient and operating conditions

See page 4-4: "Ambient and operating conditions"

### **Electrical Data of Auxiliary Component CZM01.3**

Designation	Symbol	Unit	CZM01.3	
nominal DC bus capacity	C <sub>zw</sub>	mF	2.4	
Nom. discharge time constant	τ	S	43	
Storable energy of the DC bus capacitors	W <sub>zw,czm</sub>	Ws	See "Fig. 7-4: Storable energy in the DC bus for CZM01.3"	
Allowed input voltage at L+, L- at X5	U <sub>zw</sub>	V	DC bus voltage ECODRIVE DC (300 800)	
Device power dissipation	Pv	W	50	
Mains input voltage	U <sub>N</sub>	V	n.c.	
Cooling			natural convection	
Insulation resistance at DC500V	R <sub>is</sub>	MOhm	> 25	

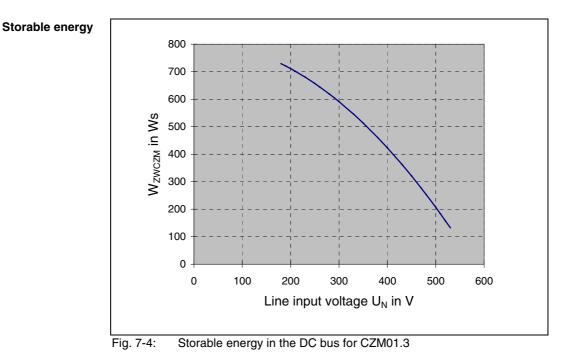
#### **Power section**

Fig. 7-3: Technical data CZM01.3

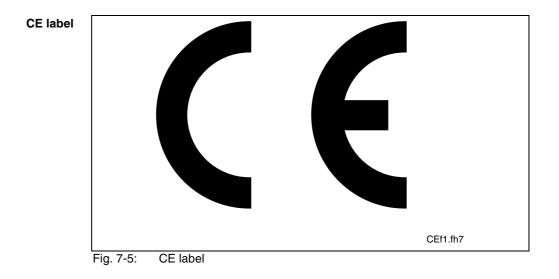
See also page 16-4 CZM01.3

**Note:** The higher the connection voltage the lower the energy that can be stored in the DC bus as the differential voltage between bleeder threshold and DC bus voltage (threshold value of connecting voltage) decreases.





### CE Label, Tests

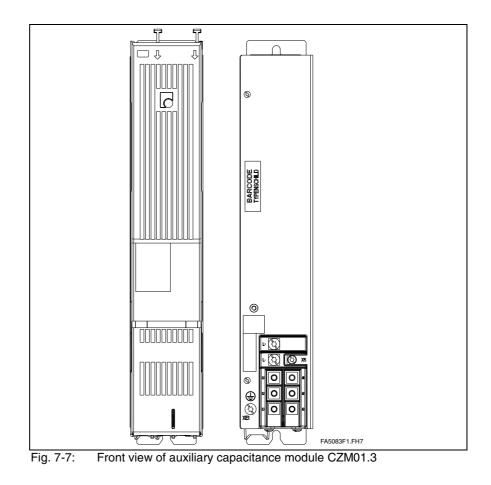


Tests:	High-voltage test according to EN50178	Routine test with DC2100V	1 s
	Insulation test according to EN50178	Routine test with DC500	1 s
Separation between the electrical circuits of the control and high voltage power		safe separation according to EN50178	
Clearances and creepage distances		according to EN50178	
	Fig. 7-6: Tests	•	



## 7.3 Electrical Connections of CZM01.3

### **Front View**



DOK-ECODR3-DKC\*\*.3\*\*\*\*-PR05-EN-P



### X5, DC bus connection

#### Illustration:

#### Technical description of connector

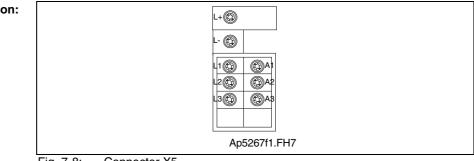


Fig. 7-8: Connector X5

Design:

Туре	No. of pins	Design
Terminal block	2/3/3	Screw for ring terminals M5

Fig. 7-9: Design

Tightening torque:	min. tightening torque [Nm]	max. tightening torque [Nm]
	2.5	3.0

Fig. 7-10: Tightening torque

#### Connection cross section:

Cross section	Cross section	Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge no.:
	25	

Fig. 7-11: Connection cross section

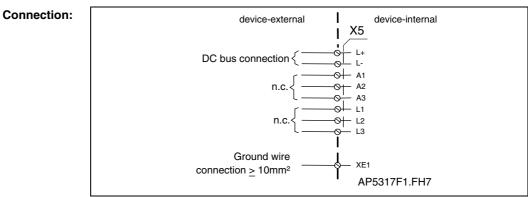
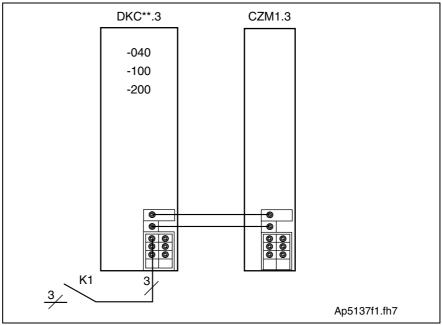
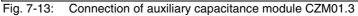


Fig. 7-12: DC bus connection of auxiliary capacitance module CZM01.3 – X5







Damage possible if DC bus connections L+ and<br/>L- are reversed!⇒ Make sure polarity is correct.

CAUTION

WireIf the DC bus rails supplied do not make a connection possible, then useDC bus:short twisted wires to do so.

wire length:	max. 2 x 1 m
wire cross section:	min. 10 mm <sup>2</sup> , not smaller than the cross section of the mains supply lead
wire protection	with a fuse in the mains connections
voltage resistance of individual wires to ground	≥ 750V (e.g., litz wires - H07)



### XE1, Protective conductor connection for mains

#### Technical description of connector

Illustration:

: See page 7-5: "Front View".

Design:

screw 1 S	
	crew for ring erminals M5

Fig. 7-14: Design

**Tightening torque:** 

ue:	min. tightening torque [Nm]	max. tightening torque [Nm]		
	2.5	3.0		

Fig. 7-15: Tightening torque

Connection cross section:

Cross section	Cross section	Max. Cross section
single wire	multi core wire	in AWG
[mm²]	[mm²]	gauge no.:
	25	

Fig. 7-16: Connection cross section

Note:	PE connection $\geq 10 \text{ mm}^2$
	Reason: high leakage currents (EN 50178/1998, section: 5.3.2.1)

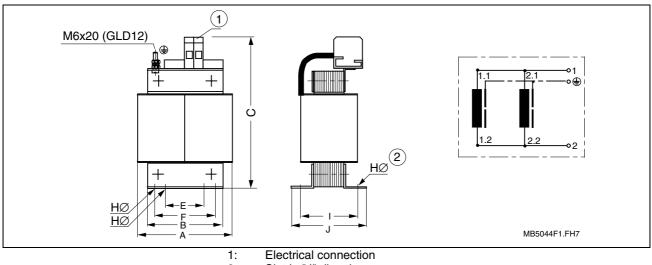


# 8 Choke GLD 12

## 8.1 General

The use of choke GLD 12 increases the allowed DC bus continuous power.

## 8.2 Dimensions and Mounting Dimensions



2: Slot in "J" direction Fig. 8-1: Dimensions GLD 12

Туре	mH/A		Maße in mm							Maximum	Mass	Power
		Α	В	С	Е	F	НØ	I	J	connection cross section	kg	dissipation W
GLD12	1.0/100	160	121	285	60	100	7x14	97	121	35 mm²	13.5	100
		Fig. 8-2:					ical data	a for GLI	D 12			

Connection see page 4-93: "X12, Optional Choke Connection for DKC\*\*.3-200-7" GLD 12:



### Notes

## 9 DC24V NTM power supplies

## 9.1 Application recommendations

If there is no external DC24V control voltage available, then Rexroth Indramat recommends the use of NTM power supply units.

- Features
   The power supplies contain an overvoltage safety switch with automatic shutdown. After the automatic shutdown device has responded, operation can be resumed by switching the power supply off, briefly, and on again.
  - The power supplies always function with a starting current limiter. However, if you switch off and on again within a period of 10 s, the starting current limit do not work!
  - The NTM01.1-024-004 and NTM01.1-024-006 power supplies make it possible to measure the voltage applied to the load via cable sensor. If there is a voltage drop, the power supply will increase the output voltage accordingly.
  - Installation in enclosed control cabinet required.
- **Fuse protector Q2** Rexroth Indramat recommends a 10 A automatic circuit breaker with tripping characteristics C for DC24V NTM power supplies.

Line filter

**Note:** Mains filters are available to comply with EMC-limits. For a selection of information see project planning manual "Electromagnetic Compatibility (EMC) in Drive and Control Systems", doc.-type DOK-GENERL-EMV\*\*\*\*\*\*\*-PRxx.

## 9.2 Technical data

Designation	Symbol	Unit	NTM01.1-24-002	NTM01.1-24-004	NTM01.1-24-006
Output rated voltage	U <sub>out</sub>	VDC	24	24	24
Adjustment range		%	+-10	+-10	+-10
Rate current of the 24V output for 45 °C ambient temperature	I <sub>N</sub>	A	2.1	3.8	5.5
Output power for 45 °C ambient temperature	P <sub>OUT</sub>	VA	50	100	150
input current at 230 (115) V	l <sub>iN</sub>	Α	0.61 (1.2)	1.2 (2.2)	1.9 (3.2)
inrush current for 230 (115) V at the power input line when the NTM is switched on. Size the back-up fusing accordingly	I <sub>EIN</sub>	A	32 (16)	32 (16)	32 (16)
Input voltage	U <sub>N</sub>	V	Standard AC 170265 by changing the bridge circuit setting AC 85132		
Degree of protection	installation in enclosed control cabinet required				

Fig. 9-1: Technical data for DC24V NTM power supply units



## 9.3 Dimensional sheets and installation dimensions

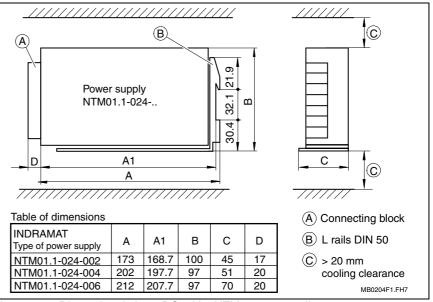
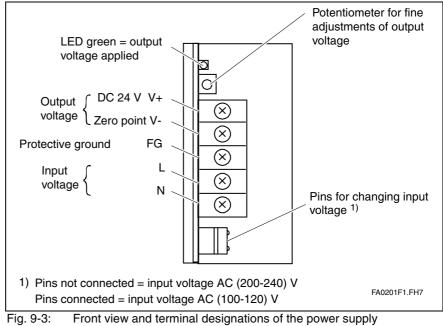
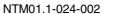


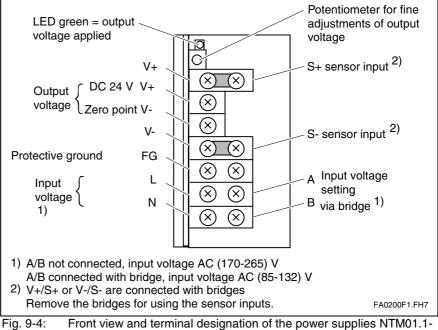
Fig. 9-2: Dimensional sheet DC24V – NTM power supplies

## 9.4 Front views





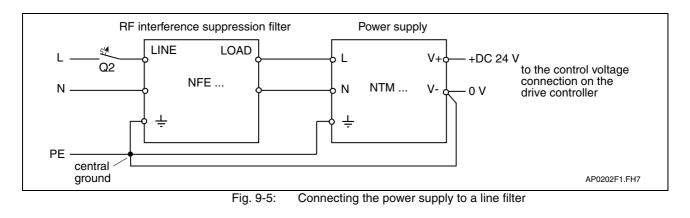




ig. 9-4: Front view and terminal designation of the power supplies NTM01.1-024-004 and NTM01.1-024-006

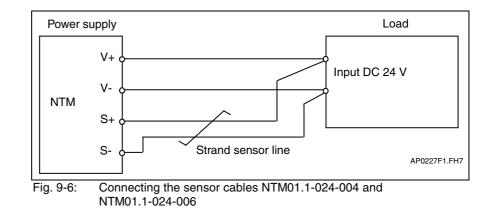
## 9.5 Electrical connection

Note: Always use the NTM together with the line filter NFE01.1-250-006. For further information on NFE, see project planning manual "Electromagnetic Compatibility (EMC) in Drive and Control Systems", doc.-type DOK-GENERL-EMV\*\*\*\*\*\*\*-PRxx.



**Note:** The contact bridge between V+/S+ and V-/S- must be removed if sensor inputs are used.





## 9.6 Type code

Type codes Power supply module	Example: NTM	NTM 01.1 - 024 - 02
Series	01	
Version	1	
Output nominal voltage DC 24 V	024	]
Output nominal current		
2.1 A	02	
4.2 A	04	
6.3 A	06	TL0003F1.FH7

Fig. 9-7: Type code



# 10 DST transformers

## 10.1 Selection

Transformers are only needed if the systems voltage exceeds the rated voltage of the drive controller.

Grounded power supply lines	For grounded power supply lines, the line voltage is matched to the rated
	voltage of the units using autotransformers which are suited to one
	specific output voltage range.

**Ungrounded power supply lines** To match the voltage for ungrounded power supply lines, always connect isolating transformers to prevent excess phase to ground voltages.

## **10.2 Autotransformers for Drive Controllers**

Select an autotransformer suited to both the line voltage and the power requirements of the system.

Proceed with the selection as follows:

- ⇒ Determine the rating group using the required rated line voltage range in the diagram "Classification of the three-phase alternating current autotransformers and then locate the transformer ratio "i".
- ⇒ Calculate the actual transformer output voltage using the rated line voltage and the transformation ratio "i".
- $\Rightarrow$  Check the drive data. The output voltage of the transformer has an effect on the drive data.
- $\Rightarrow$  Select a three-phase autotransformer corresponding to the required connected load.



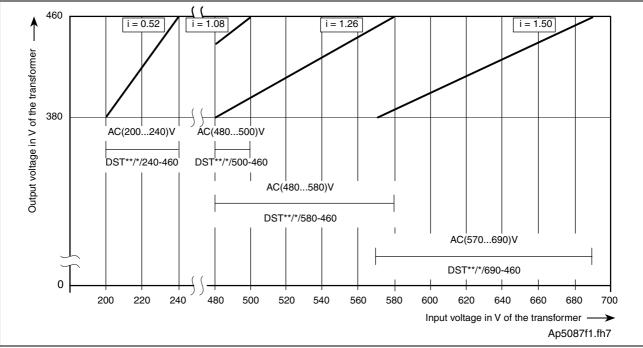
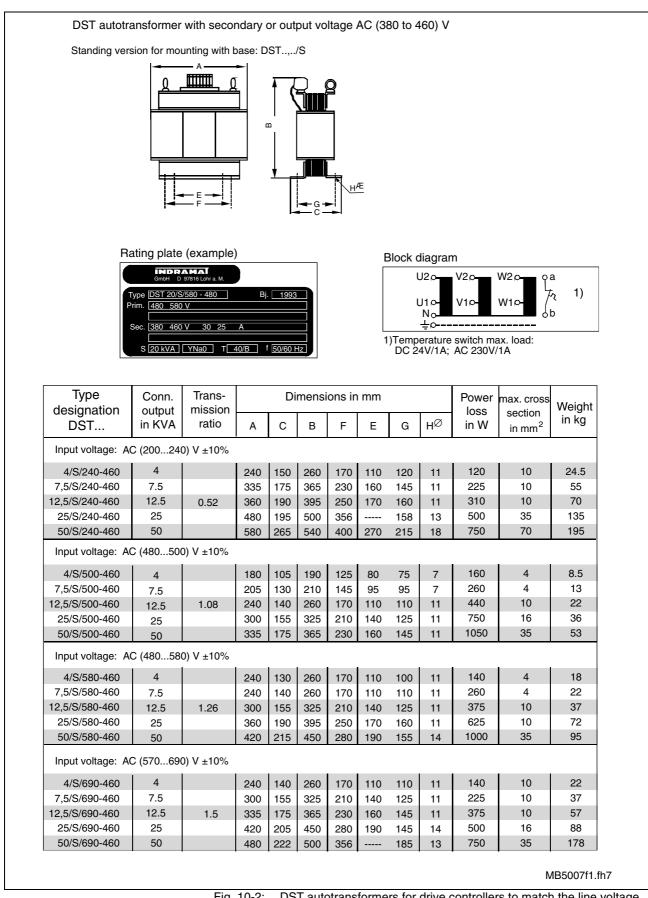


Fig. 10-1: Classification of three-phase autotransformers in rating groups



DST autotransformers for drive controllers to match the line voltage Fig. 10-2:

## 10.3 Type code

Type codes:	Example: DST 25,00/S/240-460-460-YYNO	
Product group Three-phase autotransforme	er DST	
Rated power in kVA 25 kVA	25,00	
Mounting style horizontal mounting vertical mounting	L S	
Rated input voltage AC 240 V - 460 V	240-460	
Rated output voltage AC 460 V	460	
Connection symbol YYNO	YYNO	
	TL0004f1.fh7	

Fig. 10-3: Type code



# 11 Mains Connections

## 11.1 General

	Note:	An ECODRIVE03 drive controller must be permanently connected to the power supply network.			
Connection	DKC**.3-040/100/200-7-FW: see page 4-62 X5, DC bus, Motor and Mains Connections. DKC**.3-016-7-FW: see page 5-32 X5, Motor and Mains Connections.				
Line filter	Note:	Mains filters are available to comply with EMC-limits. For a selection of information see project planning manual "Electromagnetic Compatibility (EMC) in Drive and Control Systems", doctype DOK-GENERL-EMV*******-PRxx.			

# **11.2 The Ground Conditions of the Power Supply Network**

Grounded three-phase current networks	phase cu	ntrollers of the ECODRIVE03 family can be operated on three- urrent networks with grounded star point or external conductors otential isolation.	
Ungrounded three-phase networks	Ungrounded networks (IT networks) present the increased danger of unallowable phase to ground overvoltages occurring. Drive controllers of the ECODRIVE03 family can be protected against overvoltages		
	outpu	nnecting them via an isolating transformer (the star point of the t side and the PE connection of the power supply unit are linked shared ground rail)	
	- or -		
	If the	facility is protected via an overvoltage suppressor.	
		ng ECODRIVE03 drive controllers via an isolating transformer e best protection against overvoltage as well as the greatest g safety.	
Overvoltage	The periodic overvoltage of ECODRIVE03 drive controllers between phase (L1, L2, L3) and ground may not exceed 1000 V (threshold value).		
	Transient overvoltage (< 50 $\mu s)$ may, as per EN61800-3/1996, equal a max value of 1000 V phase to phase and 2000 V phase to ground.		
	Note:	If higher overvoltages occur, then they must be limited with the use of overvoltage suppressors in the cabinet or building.	
	Note:	Mains voltages exceeding the specified range require the use of a step-down transformer.	



### 11.3 Earth-leakage circuit breaker

It is not possible to use a earth-leakage circuit breaker in ECODRIVE03 drive controllers (EN 50178/1994, section: 5.3.2.3).

Protection against indirect contact is implemented by the protective grounded housing of the components of the drive system.

## **11.4 Control Circuits for the Mains Connection**

The control circuits recommended by Rexroth Indramat specify the functional principle.

	Note:	The choice of control and its effects depends on the extent of the functions and the operating sequence of facility or machine. It is therefore the responsibility of the manufacturer of the installation and machine.		
Signal contact Bb ready to operate	The ready to operate message is output via a relay contact (N/O). If the Bb contact closes, then the drive is ready to receive power. The contact is thus a precondition for connecting the mains contactor.			
		Danger of damage !		
		ION ⇒ The effectiveness of the separation of, the mains connection via signal contact "Ready to operate Bb" or the multi-circuits of all ECODRIVE Bb contacts must be ensured !		
Switching states	See also DKC**.3	o page 4-48: "Ready to operate contact Bb" resp. page 5-22 for 3-016.		
	$\Rightarrow$ See also firmware functional description: "Power shutdown with fault"			
	Note:	When the mains contactor is shut off the mains coil causes overvoltages. These can cause the Bb contact to drop prematurely. To attenuate overvoltage use overvoltage limiters with diode combinations.		
		DC 24V		





K1

AP5123F1.FH7

The use of varistors and RC modules as protective circuits is not allowed. Varistors age and increase their locking currents. RC modules make excessive demands of the switching capabilities of the Bb contact. This leads to early failures of connected components and units.

**Note:** Load limits of the Bb contacts must be maintained. Contactors with AC excitation or those that exceed the load limits of the effected contact elements (Bb contacts, etc.) can be controlled with the use of auxiliary contactors.



#### Damages!

 $\Rightarrow$  Before switching the device on again, wait at least 300 ms plus the fall-delay time of the mains contactor (see page 11-12).

### **Control Circuits with E-Stop**

#### Pre-requisite:

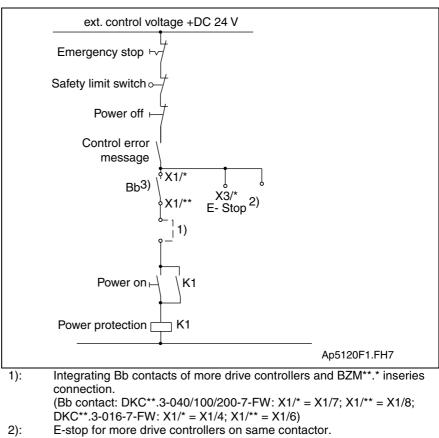
The E-stop input is available if the E-stop function has been activated in the software (see firmware functional description).

Use the E-stop function if drive-internal error reactions must be activated as quickly as possible as a result of the following events:

- The emergency off button is pressed.
- Power is shut down.
- Error message from control (lag error monitor, emergency off actuated by the control).

If the E-stop function is not used, then the drive-internal error reaction is not triggered until the K1 contactor opens and, as a result, "undervoltage in DC bus" is detected in the controller.





- (Bb contact: DKC\*\*.3-040/100/200-7-FW: X3/\* = X3/6; DKC\*\*.3-016-7-FW: X3/\* = X3/7)
- 3): Switching power of Bb contact must be noted.
- Fig. 11-2: Example of generating the E-stop signal

**Note:** Do not pick off the E-Stop signal after the Bb contact. If the safety end switches illustrated also function as a travel range limit, then a separate set-up must be created in case of actuation, which makes it possible to move back out of the end position!

=> See also firmware functional description: "Travel range limits".

### Control Circuits with internal DC bus dynamic brake (ZKS)

The internal DC bus dynamic brake is used:

- To brake energized permanent-magnet servo motors, if a controlled braking with the drive controller is not possible as a result of a unit fault.
- For a quick discharge of the DC bus.
- Note: DKC\*\*.3-016-7-FWs and DKC\*\*.3-040-7-FWs have no internal ZKS setup.

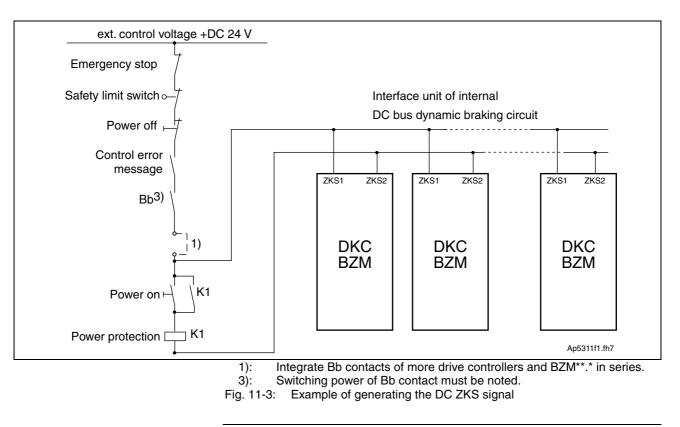
The ZKS connection have bridges installed at delivery, thus deactivating the ZKS function.

=> See page 4-62: "X5, DC bus, Motor and Mains Connections".

#### The ZKS does not guarantee personnel safety!



- ⇒ A DC bus dynamic brake will bring synchronous motors to a standstill regardless of whether the drive electronics are still working or not.
- ⇒ Without this, synchronous motors run uncontrolled if the drive control electronics are faulty.
- ⇒ Asynchronous motors do not brake if the DC bus voltage is short circuited!



- Note: All ZKS setups are controlled parallel on shared DC bus loop! Any delay in the drop out of the main contactor also causes a delay in the activation of the ZKS function.
  - => See page 11-12: "Q1 Fuse and K1 Contactor".



#### Danger of damage!

⇒ If as a result of the application a manual actuation of the load contactor K1 is necessary then the built in DC bus dynamic brake setups must be protected by applying switched mains voltage to the mains connecting terminals of the DKC and BZM units in use.



## 11.5 Mains Contactor / Fuses

To select suitable mains contactor and fuses for the power connection, a selection table is available. Note the inrush current of the selected contactor.

### Computing phase current on the mains

To select a suitable mains contactor and fuses for the power connections it is necessary to first compute the phase current  $I_N$  at the mains.

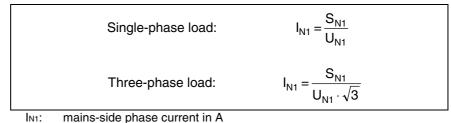
The mains-side phase current  $I_N$  is determined out of the mains connecting power  $S_{AN}$ .

Select the mains connecting power in the list or compute it according to the following formula. With multiple controllers, add the individual powers.

	$P_{\text{ZWD}} = \frac{M_{\text{EFF}} \cdot n_{\text{MITTEL}} \cdot 2 \cdot \pi}{60} \cdot \mathbf{k}$	
P <sub>ZWD</sub> :	required DC bus continuous power in W	
M <sub>EFF</sub> :	rms torque in Nm	
<b>N</b> MITTEL:	mean speed in min-1	
k:	k: factor for motor and controller efficiency = 1.25 (MKD, MHD)	
Fig. 11-4:	Computing DC bus power	

	$S_{\rm N1} = P_{\rm ZWD} \cdot F$
SN1:	connected load in VA
Pzwd:	DC bus continuous power in W
F:	connected load factor
	F=2.8 for single-phase feed
	F for three-phase feed see page 11-9:
	"Factor F for Computing the Connected Load"
Eig 11 5.	Computing mains connected load





SN1: connected load in VA

SN1: Connected load in VA

UN1: voltage between phases of the mains in V Fig. 11-6: Computing mains-side phase current



# Computing charging current inrush

	$I_{EIN} = \frac{U_{N1} * \sqrt{2}}{R_{Softstart}}$ $\sum I_{Ein} = I_{EinGesamt}$
IEin: IEinGesamt: UN1: RSoftstart: Fig. 11-7:	charging current inrush of unit in A total charging current inrush in A (value relevant for fusing) mains input voltage softstart resistance of unit (see relevant technical data) Computing charging current inrush
Note:	To compute the charging current inrush take all the units

connected to the mains voltage into account.



## Factor F for Computing the Connected Load

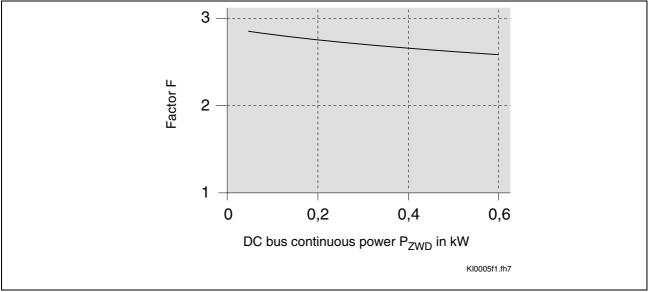
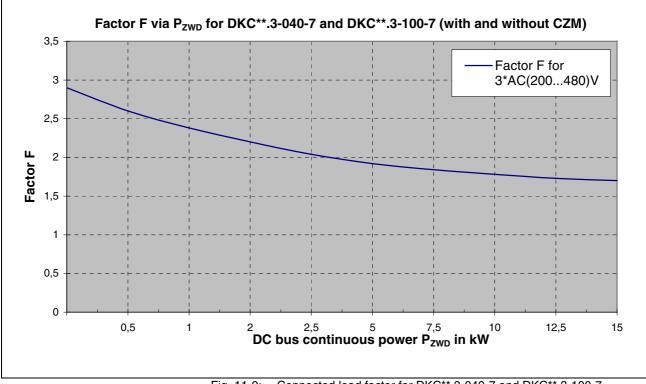
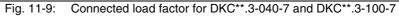


Fig. 11-8: Connected load factor for DKC\*\*.3-016-7 (for 3\*AC (200 ... 480) V)







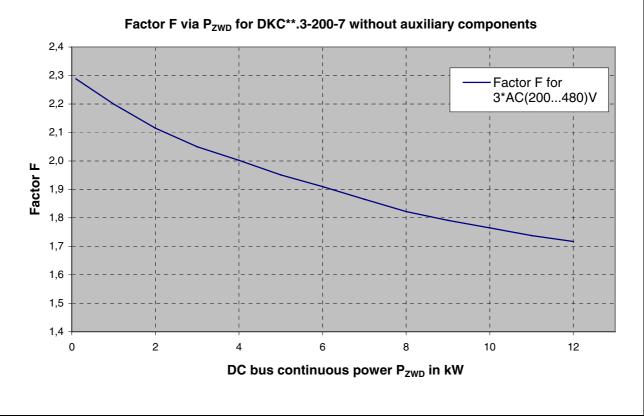
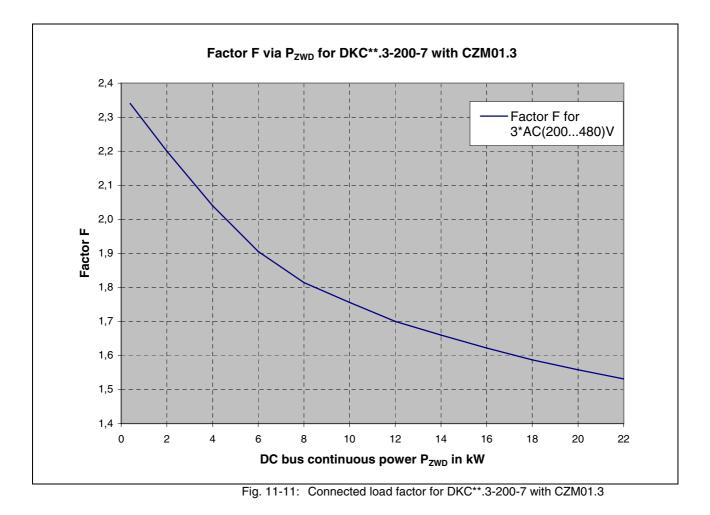


Fig. 11-10: Connected load factor for DKC\*\*.3-200-7



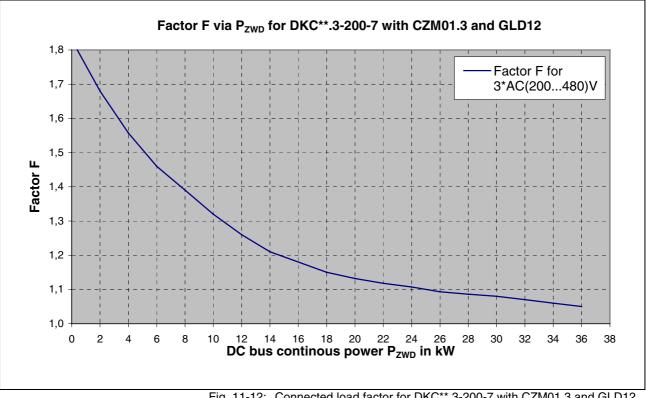


Fig. 11-12: Connected load factor for DKC\*\*.3-200-7 with CZM01.3 and GLD12



## Q1 Fuse and K1 Contactor

When selecting a mains contactor and fuses, the continuous current in the supply leads as well as the starting inrush current must be taken into account. Several controllers can be operated on a single fuse and mains contactor. The phase currents and inrush currents of the individual drives must then simply be added up. If a transformer is used, then the fuses and contactors must be installed on the primary side.

The Siemens type fuses and contactors in the selection table below are only examples. Products of equal rating from other manufacturers can be used.

Phase current	Lead cross sections	Fuses (triggering characte. C)	Power fuses	Fusible links (operating class gl)	Mains contactor	Inrush current	Dropout delay t <sub>Abmax</sub>	Pull-up delay t <sub>Anmax</sub>
	(1)	(2)	(3)	(2)	(3)			
in A	mm <sup>2</sup>	Current in A	Siemens type	Current in A	Siemens type	in A	in ms	in ms
9	1.0	10	3VU1300ML00	10	3TF40	54		
			or		or			
			3RV1011-1JA10		3RT1016		80	120
12	1.5	16	3VU1300MM00	16	3TF41	72		
			or		or			
			3RV1021-4AA10		3RT1017		80	120
16	2.5	20	3VU1300MM00	20	3TF42	96		
			or		or			
			3RV1021-4AA10		3RT1025		110	190
22	4.0	25	3VU1300MP00	25	3TF43	132		
			or		or			
			3RV1021-4DA10		3RT1026		110	190
32	6.0	32	3VU1600MP00	35	3TF44	186		
			or		or			
			3RV1031-4EA10		3RT1034		200	120

1. Lead cross sections per EN 60204 - Installation B1 - correction factors not taken into account.

2. With recommended fuses short-term operating loads can be used by the drive for two minutes. If this is needed for extended periods, then use a bigger fuse.

3. Allocation "2" per DIN IEC 60947-4: easily separable contact welding at contactors are permitted as a result of short circuits.

Fig. 11-13: Selecting table for Q1 fuses and K1 contactors

**Note:** To make sure the mains contactor is not overloaded by the load current in the case of frequent switching off, you first have to switch off the drive via the drive enable in the master communication and then switch off the mains contactor.



# **12** Constructing the Control Cabinet

# 12.1 Notes on Control Cabinet Project Planning

All ECODRIVE drive components, with the exception of motors, are intended for mounting into a control cabinet. When planning the control cabinet, take the technical data of the drive components into account.

To determine the necessary control cabinet size, not only the mechanical dimensions (dimension sheets, etc.) but also such thermal features as the power dissipation of the individual components, cooling air effluent temperatures and so on must be taken into consideration.

The power dissipation of ECODRIVE03 drive controller are specified in the diagrams on page 12-2.

The temperature increases of the cooling air occurring in the effluent range of the drive controller DKC and the auxiliary braking resistor module BZM are specified in the diagrams "Temperature increase vs.  $P_{BD}$ " on page 12-8. The distances to the temperature-sensitive control cabinet components such as leads and cable channels must be maintained.

## **Power dissipation**

Power dissipation is determined by the current load and the regenerated power. The actual generated power dissipation depends on the relevant load cycle, which is limited by the servo motor being used.

On the average, the maximum continuous standstill current  $I_{dN}$  of the motor flows through the drive controller

### **Determining power dissipation**

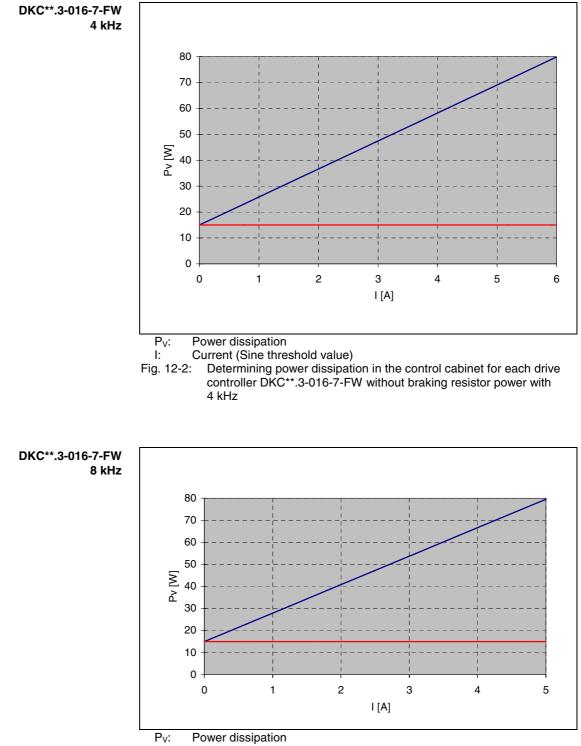
- $\Rightarrow$  Look up in the relevant motor document both the continuous standstill current I<sub>dN</sub> and torque M<sub>dN</sub>.
- $\Rightarrow$  Determine rms torque M<sub>eff</sub> of the application (see motor document).
- $\Rightarrow$  Determine the following relationship current I

I = IdN * Meff	
Man	

Fig. 12-1: Determining current I

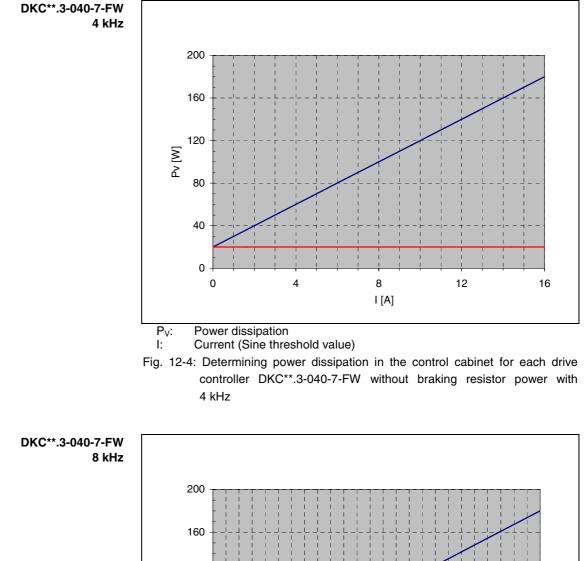
- ⇒ Using current I, find the corresponding value of the current-dependent power dissipation *Pv*, DKC, using the diagrams "Determining Power Dissipation in the control cabinet".
- $\Rightarrow$  Add both power losses ( $P_{V,DKC}$  and  $P_{V,Braking resistor}$ ). Use the sum ( $P_{V,ges}$ ) when planning the control cabinet.
- $\Rightarrow$  Consider further components such as smoothing chokes, filters etc.

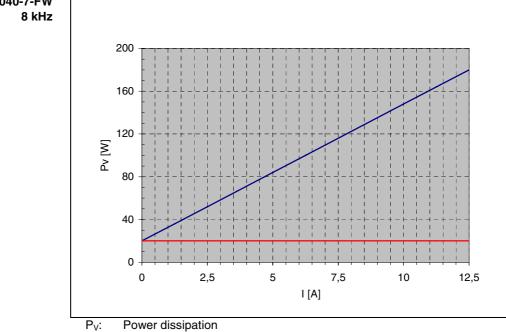




- I: Current (Sine threshold value)
- Fig. 12-3: Determining power dissipation in the control cabinet for each drive controller DKC\*\*.3-016-7-FW without braking resistor power with 8 kHz





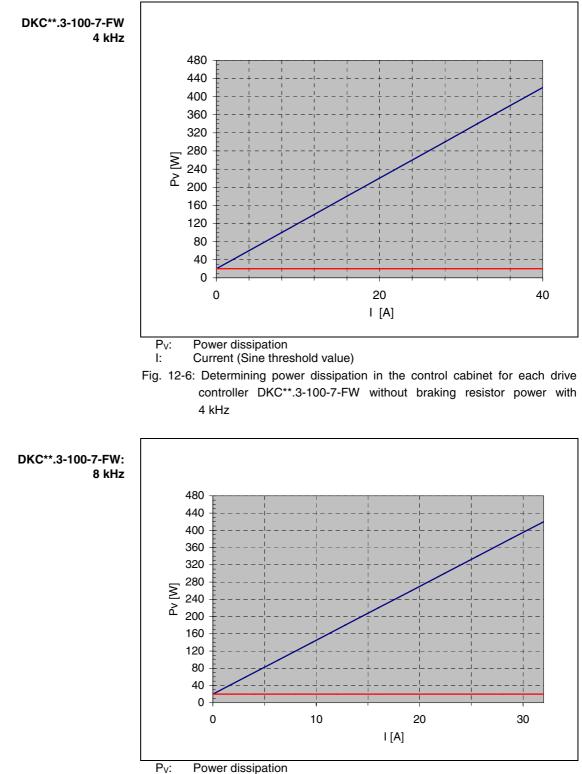


Current (Sine threshold value)

I:

Fig. 12-5: Determining power dissipation in the control cabinet for each drive controller DKC\*\*.3-040-7-FW without braking resistor power with 8 kHz

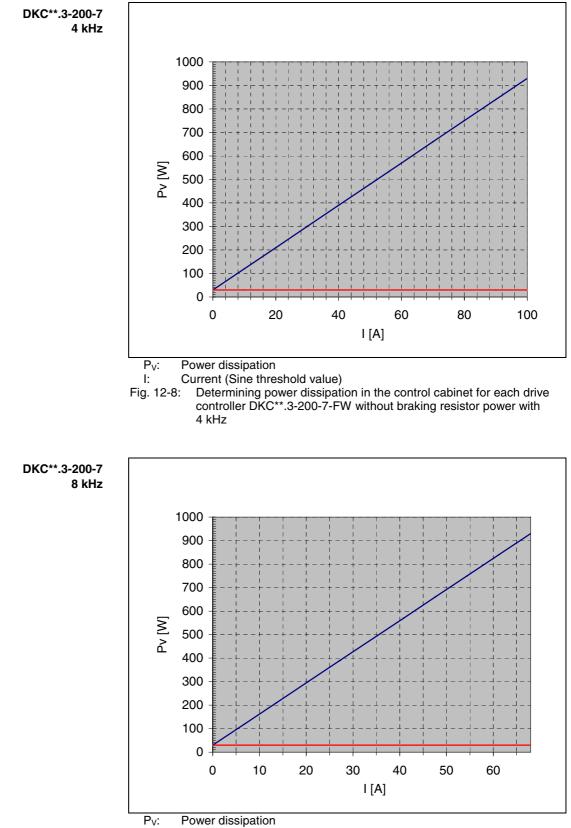


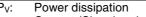


I: Current (Sine threshold value)

Fig. 12-7: Determining power dissipation in the control cabinet for each drive controller DKC\*\*.3-100-7-FW without braking resistor power with 8 kHz







- I: Current (Sine threshold value)
- Fig. 12-9: Determining power dissipation in the control cabinet for each drive controller DKC\*\*.3-200-7-FW without braking resistor power with 8 kHz



## **Mounting Position and Distances**

### **Mounting Position**

- ⇒ The mounting of the drive controller device DKC, the auxiliary braking resistor module BZM and the auxiliary capacitance module CZM is to be performed in such a way that their longitudinal axis correlates with the natural direction of convection (connection block X5 towards the bottom). The natural convection supports the forced cooling air stream. The build up of warm spots in the device is inhibited.
- $\Rightarrow$  Put the backs of the drive controllers on the mounting surface (mounting plate)of the control cabinet with all-over contact.

### Distances

Temperature Increase of Cooling Air The power dissipation of the drive controller DKC and the auxiliary braking resistor module BZM means that the cooling air from the point of entrance on the underside of the unit until the point of exit on the top side is warmed up. The following illustrates this increase as dependent on the occurring continuous braking resistor power.

 $\Rightarrow$  The appropriate distance "d" is specified in the curve (interpolation allowed).

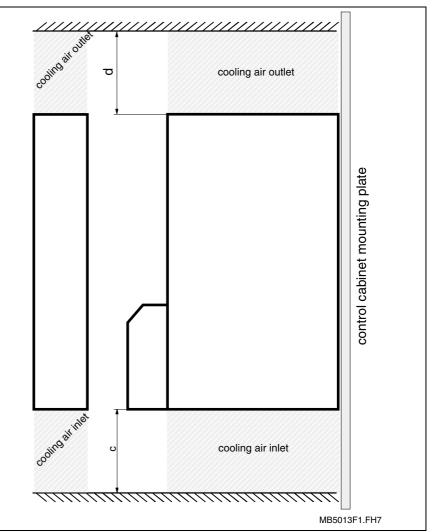


Fig. 12-10: Exit and entrance of cooling air



#### Note:

- When using the signals at connectors X9, X10 and X11 maintain a minimum distance of d = 150 mm.
- Without braking resistor power dissipation and connections at X9, X10 and X11 it is possible to reduce distance d = 80 mm.
- The minimum distance of **c** = 80 mm enlarges itself in dependence of the utilized connection cables.



### High temperature

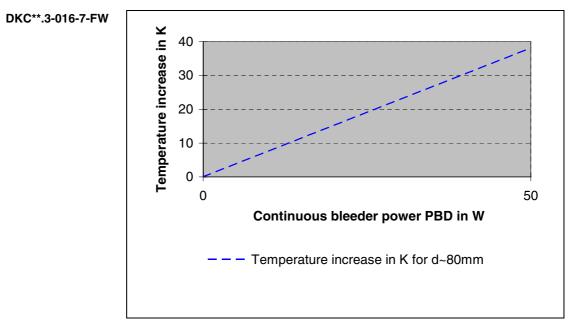
Risk of damage to temperature-sensitive control cabinets in the area of the cooling air outlet.

 $\Rightarrow$  Observe the distance "d".

Volumetric capacity of the forced cooling

see also page 4-6: "Electric Data of the Individual DKC\*\*.3 Components" and page 6-3: "Electrical data of auxiliary component BZM01.3".

**Note:** Diagram "Temperature increase via continuous braking resistor power" shows the relationship between braking resistor load and temperature of cooling air entering at unit underside and exiting top side under nominal current conditions of the controller.



#### Fig. 12-11: Temperature increase DKC\*\*.3-016-7-FW



DKC\*\*.3-040-7-FW

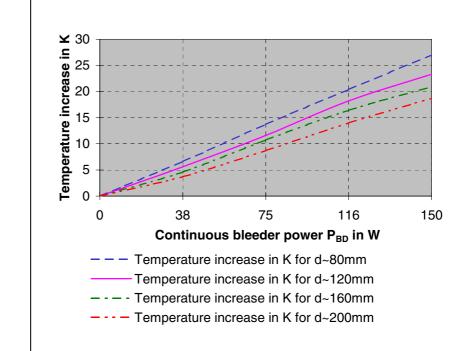


Fig. 12-12: Temperature increase DKC\*\*.3-040-7-FW

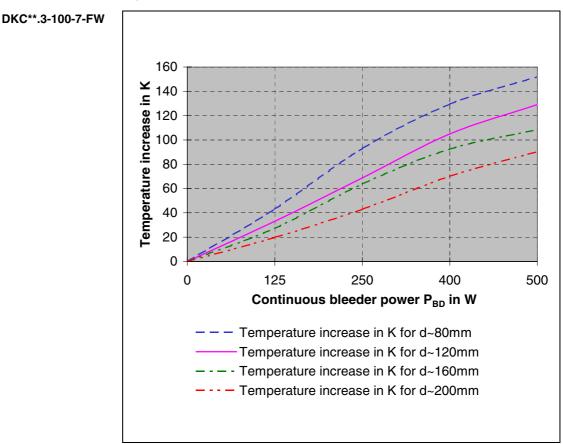


Fig. 12-13: Temperature increase DKC\*\*.3-100-7-FW



DKC\*\*.3-200-7-FW

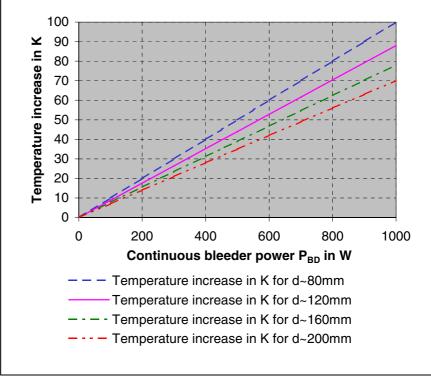


Fig. 12-14: Temperature increase DKC\*\*.3-200-7-FW



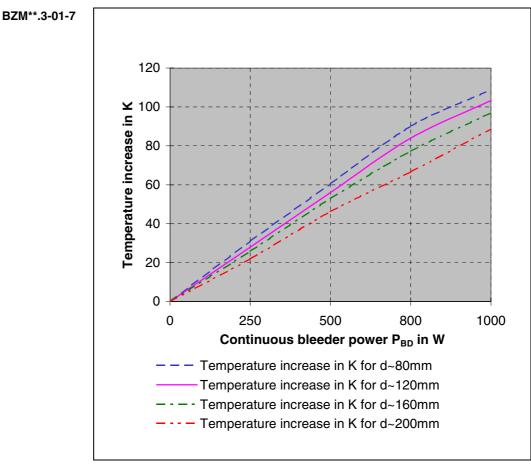


Fig. 12-15: Temperature increase BZM\*\*.3-01-7



## Module widths

	70	90 1	10	172.5	2	35	152.5		
o 16A 40A CZM BZM	o 16A 40A CZM BZM	o 100A	0 100A		o 200A	0 200A		o 16A 40A CZM BZM	
0	0	0 0	0	0 0	0	0	0	<b>0</b> MB5062F	

Fig. 12-16: Module widths

Note: Using the specified increments, there is a distance of 5 mm between the units.
In order to observe the specified vibration fatigue limit (see page 4-5), please note the following:
In case fastening screws are part of the drive controller's scope of supply, you have to use these screws for mounting the drive controller.

• In the case of the DKC\*\*.3-100 and DKC\*\*.3-200 drive controllers, you have to use the two outer fastening holes.



## Arranging ECODRIVE03 Components in the Control Cabinet

### **Multiple Row Construction of the Control Cabinet**

**Note:** In particular when arranging ECODRIVE03 components in multiple rows within the control cabinet, it is important to note the entrance temperature (see technical data) and, if necessary, mount air guiding plates with blowers.

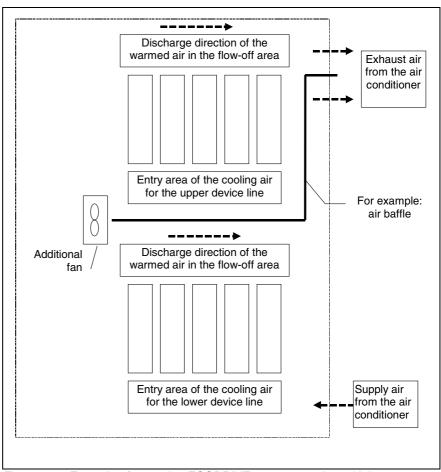
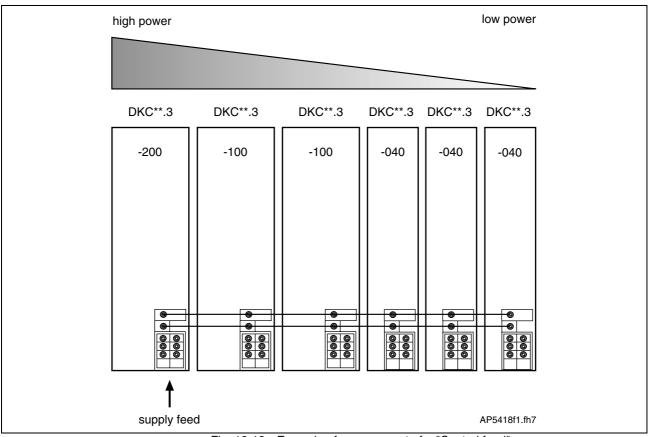


Fig. 12-17: Example of arranging ECODRIVE components in multiple rows

See also page 16-7: "Control Cabinet Construction with Recommendations for EMC and Cooling".





**Power-dependent arrangement** 

Fig. 12-18: Example of arrangement of a "Central feed"

- For mounting details please see page 4-21 onward.
- Arrange auxiliary capacitance module CZM next to drive with large DC bus continuous power.
- Arrange auxiliary braking resistor module BZM next to drive with large feedback power.

See also page 16-7: "Control Cabinet Construction with Recommendations for EMC and Cooling".



# 12.2 Using Cooling Units in the Control Cabinet

The controller may only be operated if the ambient temperature does not exceed 45  $^{\circ}$ C. Otherwise temperature must be reduced and it may be necessary to use a cooling unit.



### Possible damage to controller

Endangers the operating safety of the machine  $\Rightarrow$  Note the following information!

Avoiding dripping or spraying water

Under normal conditions, if a cooling unit is used, then water condensation occurs. Therefore, note the following:

- Always arrange cooling so that water condensation cannot drip onto electronic units within the cabinet.
- Place the unit so that the cooling unit blower cannot spray condensation onto electronic components.

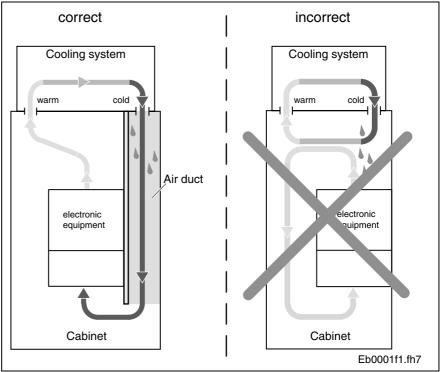


Fig. 12-19: Arranging cooling unit on cabinet



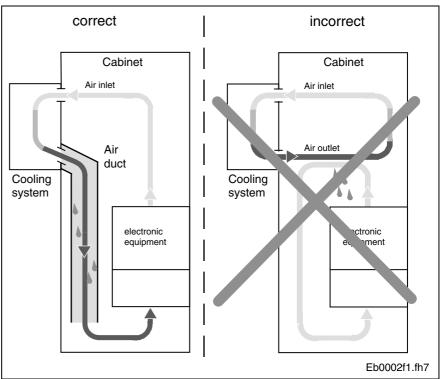


Fig. 12-20: Arranging cooling unit on front of cabinet

Avoiding condensation

Condensation occurs if the temperature of the unit is lower than the ambient temperature.

- Cooling units with temperature settings must be set to maximum room temperature and no lower!
- Cooling units with temperature must be set so that the inside temperature of cabinet is not lower than the outside temperature. Set temp limit to maximum room temperature !
- Use only well-insulated cabinets to avoid condensation resulting from humid outside air penetrating the cabinet.
- If cabinets are operated with doors open (commissioning, service, etc.), then make sure that once the doors are closed the controller is at no point in time cooler than the air in the cabinet. This avoids condensation build up. In other words, ensure sufficient circulation in the cabinet to avoid any hot spots.



## 12.3 General Notes

Electrostatic discharge from persons and/or tools can damage the controller or printed circuits boards (PCB). Please note the following:



Risk of damaging the electronic components and endangering the operating safety caused by electrostatic charges!

⇒ Objects coming into contact with machine parts and PCB must be discharged by grounding them. Otherwise errors can occur when controlling motors and elements in motion.

Such objects can be:

- The soldering iron when soldering
- The human body (ground by touching a conductive, grounded object).
- Parts and tools (place on conductive surface)

Parts at risk may only be stored and shipped in conductive packaging.

Note:	The diagrams of Rexroth Indramat should only be used by a
	Machine Manufacturer to create terminal diagrams for a facility. When wiring a facility, an End user should only use the diagrams of the Machine Manufacturer.
	ulayiants of the Machine Manufacturer.

#### General notes

- Route signal lines separately from load lines to avoid interference.
- Conduct analog signals (e.g., command/actual values) via shielded leads.
- Mains, DC bus and power lines should not be connected to low voltages or come into contact with them.
- When conducting a high voltage test or external voltage capacity test of the electrical components of the machine, disconnect or remove all connections of the units. This protects the electronic components (allowed as per EN 60204-1). Rexroth Indramat drive components are high-voltage and insulation tested as per EN 50178.



Potential damage of the controller device by connecting and disconnecting the connections with mains power on.

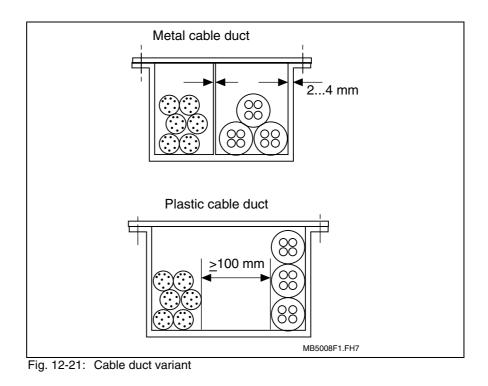
CAUTION

 $\Rightarrow$  Do not connect and disconnect connections if the mains power is on.



# 12.4 Wire routing in the Control Cabinet

- A distance of at least 100 mm between power and control or signal cables (e.g., feedback cables) must be maintained or
- Separate cable duct with metal divider.



Note: Details are specified in the project planning manual "Electromagnetic compatibility (EMC) or AC drives", doc. Type DOK-GENERL-EMV\*\*\*\*\*\*\*-PRxx.

# 12.5 EMC in the Control Cabinet

**Note**: Details are specified in the project planning manual "Electromagnetic Compatibility (EMC) in Drive and Control Systems", doc. type DOK-GENERL-EMV\*\*\*\*\*\*\*-PRxx.



## Notes



# **13** State of Delivery of the Drive Components

# 13.1 Packaging

- Units ECODRIVE03 components come in separate units.
- **Material** Rexroth Indramat takes the packaging material back free of charge. The customer is charged for the return transport.
- Sticker The barcode sticker on the packaging lists the contents of the components and the order number.



Fig. 13-1: Barcode sticker on the packaging - breakdown



## 13.2 Papers

There is an envelope on one of the packages which contains two copies of the delivery slip. There are no more papers.

On the delivery slip or freight papers, the entire number of transport containers is specified.

# 13.3 Extent of Delivery

Included in the delivery:

### • The controller DKC\*\*.3

- With firmware module (integrated in the case of DKC\*\*.3-016)
- With contact protection (not for DKC\*\*.3-016)
- with connectors according to the following table

Туре	Connectors - type independent X								Connectors - type dependent X							
	1	2	3	4	5	6	10	15	20	21	30	40	41	50	60	210
DKC01.3-***-7	Х		х		Х	Х	X	Х								
DKC02.3-***-7	х		Х		Х	Х	X									
DKC03.3-***-7	х		Х		Х	Х	X									
DKC04.3-***-7	х		х		Х	Х	X									
DKC05.3-***-7	х		х		Х	Х	X									
DKC06.3-***-7	х		х		Х	Х	X								х	
DKC21.3-***-7	х		х		Х	Х	X									
DKC22.3-***-7	х		х		х	Х	X									

### DKC\*\*.3-016-7-FW:

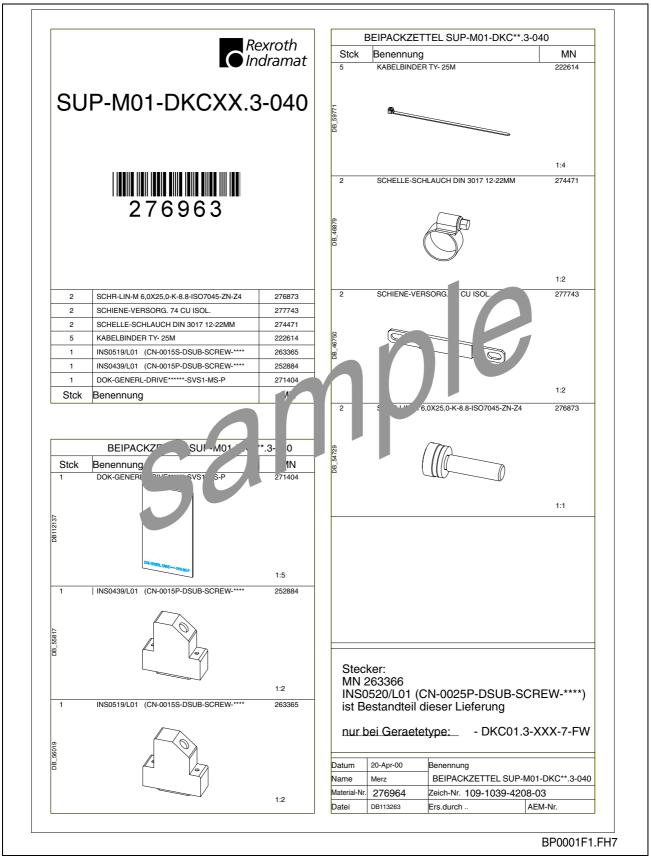
Fig. 13-2: Connectors for DKC\*\*.3-016-7-FW included in the delivery

Туре	Connectors - type independent X										Connectors - type dependent X							
	1	2	3	4	6	8	9	10	11	15	20	21	30	40	41	50	60	210
DKC01.3-***-7	Х		Х	Х	Х	Х	Х	Х	Х	х								
DKC02.3-***-7	Х		х	х	х	Х	х	Х	х									
DKC03.3-***-7	Х		х	Х	Х	Х	Х	Х	Х									
DKC04.3-***-7	х		х	х	х	х	х	Х	х									
DKC05.3-***-7	х		х	х	х	х	х	Х	х									
DKC06.3-***-7	х		х	х	х	х	х	Х	х								Х	
DKC11.3-***-7	х		х	х	х	х	х	Х	х									
DKC21.3-***-7	Х		х	Х	Х	Х	Х	Х	Х									
DKC22.3-***-7	х		Х	х	х	х	х	х	х									1

### DKC\*\*.3-040/100/200-7-FW:

Fig. 13-3: Connectors for DKC\*\*.3-040...200-7-FW included in the delivery





# • Connection and mounting accessories according to the enclosed packing slip (sample)

Fig. 13-4: Packaging slip SUB-M01-DKCxx.3-040 (sample)



Rexroth Indramat

## 13.4 Ordering

## **Unit Types Available**

DKC01.3-016-7	DKC01.3-040-7	DKC01.3-100-7	DKC01.3-200-7
DKC02.3-016-7	DKC02.3-040-7	DKC02.3-100-7	DKC02.3-200-7
DKC03.3-016-7	DKC03.3-040-7	DKC03.3-100-7	DKC03.3-200-7
DKC04.3-016-7	DKC04.3-040-7	DKC04.3-100-7	DKC04.3-200-7
DKC05.3-016-7	DKC05.3-040-7	DKC05.3-100-7	DKC05.3-200-7
DKC06.3-016-7	DKC06.3-040-7	DKC06.3-100-7	DKC06.3-200-7
-	DKC11.3-040-7	DKC11.3-100-7	DKC11.3-200-7
DKC21.3-016-7	DKC21.3-040-7	DKC21.3-100-7	DKC21.3-200-7

**Note:** List of available types is constantly being expanded, please request current status from a sales office of Rexroth Indramat GmbH.

## **Replacement Parts**

- Contact protection
- Connecting and mounting accessories SUP-M\*\*-DKC\*\*.3-040
- Connecting and mounting accessories SUP-M\*\*-DKC\*\*.3-040
- Connecting and mounting accessories SUP-M\*\*-DKC\*\*.3-100
- Connecting and mounting accessories SUP-M\*\*-DKC\*\*.3-200
- Connecting and mounting accessories SUP-E01-DKC\*\*.3
- Connecting and mounting accessories SUP-E02-DKC\*\*.3
- Firmware module ESM 2.\* (not for DKC\*\*.3-016-7-FW)

## **Additional Accessories**

- Standard interface cables IKB0005/length four different lengths for RS232 (2 m, 5 m, 10 m or 15 m)
- Interface cable RS485 INK0572/ length (not for DKC\*\*.3-016-7-FW)

### **Mounting Accessories**

- A Torx screw driver TX30 with a 400 mm long blade is available.
- Torx screw driver TX30 M6 400 lg (MN00282391)

### **Commissioning Aids**

- Command value box (not for DKC\*\*.3-016-7-FW)
- DriveTop (Software for start-up)



# 14 Identifying the Components

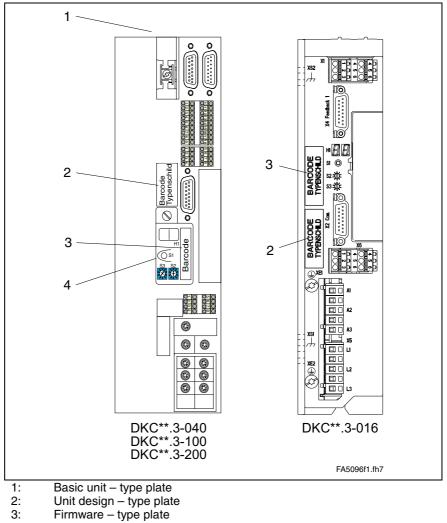
# 14.1 Component designations

Every drive component is labelled with a type designation.

There is a type plate on every unit including the motor.

There is a label around the standard cable (cable brand). Type designation and length is on this label. (The designation of the actual cable without connector is printed on the cable sheath.)

The accessories in the bags are either identified with their ID on the bag or there is a packaging slip.



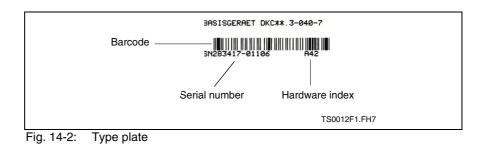
4: Programming module – type plate

Fig. 14-1: Type plates

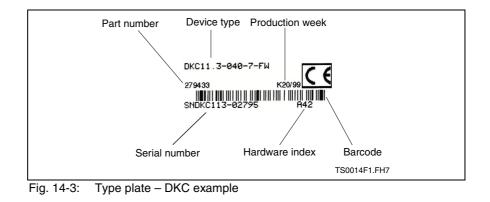


## **Type Plates**

## (1) Basic Unit



## (2) Unit type



Note: The type plates for units BZM, CZM, NTM, NFD/NFE is the same.

## (3) Firmware

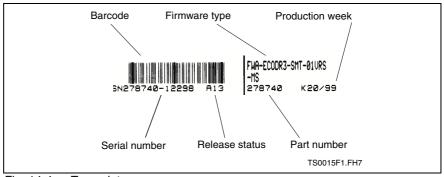


Fig. 14-4: Type plate



## (4) Programming Module

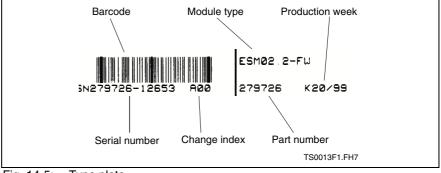


Fig. 14-5: Type plate

### DST/DLT

INDRAMAI GmbH D 97816 Lohra. M.	
Type         DST 20/S/580 - 480         Bj.         1998           Prim.         480         580 V	
Sec. 380 460 V 30 25 A	
S 20 KVA YNa0 T 40/B f 50/60 Hz	TS0004F1.FH7

Fig. 14-6: Type plate DST/DLT



## Notes

# **15 Replacing or Exchanging Drive Components**

## 15.1 General

The diagnostic display enables an aimed and effective problem search in order to:

- avoid production downtimes due to extensive searches in individual units and repairs of units on the machine
- · assume operations without extensive assembly and adjustments
- to quickly eliminate the problem, and replace the defective component

When returning a defective unit to Indramat Customer Service, please complete the Fault Report in its entirety. This fault report is this section (see page 15-6) and may be copied for your convenience.



**Note:** The new drive components must have the same type designations as the old! To ensure this, register the entire type designation when requesting a replacement part.

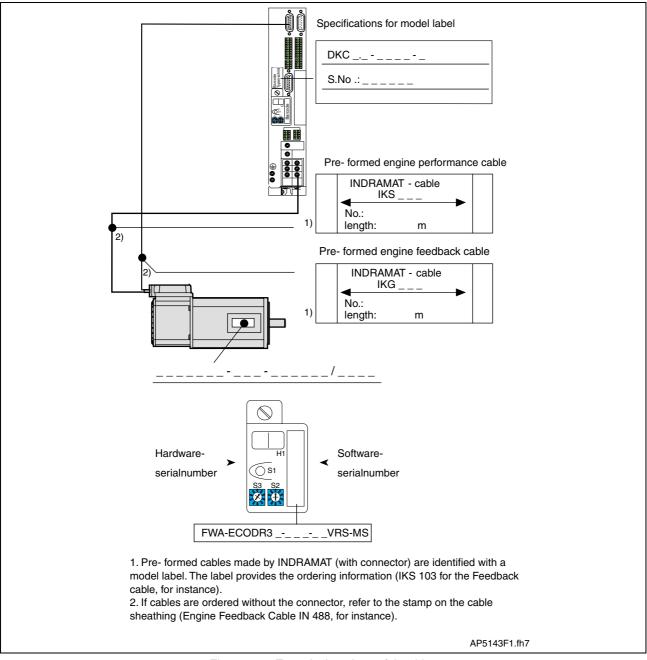


Fig. 15-1: Type designations of the drive components



## 15.2 Procedure on Replacing the Unit

**Note:** Note the safety instructions in section 3 when exchanging any parts!

### **Replacing the drive controller**

- Make sure the drive controller is completely de-energized.
- Switch main switch off.
- Secure against being switched back on.



# Lethal electric shock caused by charged capacitor!

⇒ Prior to touching bear connecting cables and terminals, wait for the capacitor to discharge! Only then work on the cables!

- Remove contact protection and separate connecting line from the drive controller.
- Release screws on top and bottom of housing.
- Remove the drive controller.
- Insert programming module from defective drive controller into new one. This eliminates the reloading of parameter files. If the programming module is defective, see "Replacing Firmware" on page 15-7.
- Hand new drive controller into place and tighten screws.
- Connect drive controller as specified in the machine terminal diagrams.
- Start up installation.



## **Replacing the Motor**

- Switch main switch off.
- Secure against being switched back on.
- Disconnect plug-in connectors.
- **Note:** When replacing the motor, cap open connector ends particularly if there might be the change that coolant or grease could be sprayed or splashed in their vicinity (allowable level of dirt contamination is V2 (according to DIN VDE 0160).
- Replace motor.
- **Note:** To mechanically replace the AC servo motor, note the instructions of the machine manufacturer.
- Connect plug-in connectors.



### Danger of unwanted movements!

- Servo axes with an indirect path measuring systems via a motor encoder will loose the reference dimension if the motor is replaced! This reference to machine coordinate system must therefore be reestablished.
- Servo axes with absolute motor encoder: Reestablish the absolute reference

## **Replacing cables**



### Danger from high-voltage levels.

⇒ Power connector of the cables may only be inserted or separated if power in the installation has been shutdown!

**Note:** When replacing cables, note the instructions of the machine manufacturer.

If a standard cable from Rexroth Indramat is not used, then check to ensure that the cable agrees with the terminal diagram of the machine manufacturer!

- Switch main switch off.
- Secure against being switched back on.
- Disconnect plug-in connectors.



- **Note:** When replacing the motor, cap open connector ends particularly if there might be the change that coolant or grease could be sprayed or splashed in their vicinity (allowable level of dirt contamination is V2 (according to DIN VDE 0160).
- Replace cables
- Connect plug-in connectors

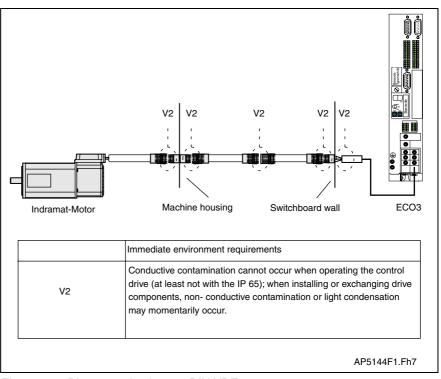


Fig. 15-2: Dirt contamination per DIN VDE 0160



# Property damage caused by bad power connectors!

Connect power connections only when they are dry and clean.



Fault Report for digital AC Servo Drives DKC					
This fault report is intended to clarify problems and their causes. It is absolutely necessary for finding and eliminating hidden, sporadic or application-related problems. - Always include a Fault report with any parts returned for repair. - Otherwise, send Fault Reports to your Rexroth Indramat representative					
Fault Report	Co.:	Loc.:	Date:		
dated:	Dept.:	Name:	Tel.:		
H1 S.N X5 DC bus com mains connection single phase three-phase Information about Machine manuf.: Machine number: Manufacturer and type of	t machine at which pi machine control:	DKC            S.N.:            FWA-ECODR3         VRS           Software-            S.N            roblem occurred:            Oper. hours:            Comm. date:			
Additional data:					
Problem:	Causes:	Auxiliary problems:			
always present     at startup     occurs sporadically     occurs after hrs.     with vibrations     depends on temperature     Additional data:	<ul> <li>unknown</li> <li>incorrect connection</li> <li>external cause</li> <li>mechanical damage</li> <li>loose cable connection</li> <li>moisture in unit</li> <li>foreign object in unit</li> </ul>	<ul> <li>problem in the mechanical system</li> <li>power section failure</li> <li>control system failure</li> <li>motor failure</li> <li>cable break</li> <li>defective blower</li> <li>defective feedback</li> </ul>	Is there an air conditioner in the cabinet ? Y / N Have there been previous problems at this machine ? How often: Did the problems occur on the same day or the same time of the day ?		
			Pi6005f1.fh7		



### 15.3 Replacing Firmware (DKC\*\*.3-040/100/200-7-FW)

#### **Replacing the Parameter Module**

- Secure parameters (DriveTop)
- Switch drive controller off
- Remove programming module
- Open the lock on the back

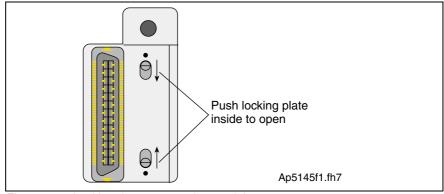


Fig. 15-4: Locking the programming module

• Open the programming module

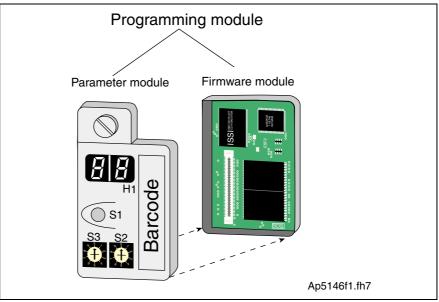
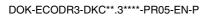


Fig. 15-5: Programming module

- Connect new parameter module and old firmware module
- Close lock (switch outward)
- Insert programming module
- Switch drive controller on
- Load parameters (DriveTop)





#### **Replacing the Firmware Module**

- Switch drive controller off
- Loosen screw at programming module and pull programming module
   out
- Pull programming module out
- Open the lock on the back of the programming module
- Open the programming module
- Insert old parameter module into new firmware module
- Close lock (lock must be pushed outward)
- Insert programming module and screw on
- Switch drive controller on

#### **Replacing the Programming Module (complete module)**

- Secure parameters (DriveTop)
- Switch drive controller off
- Loosen screw at programming module and pull programming module out
- Insert new programming module
- Switch drive controller on
- Load parameters (DriveTop)



### 15.4 Replacing Firmware (DKC\*\*.3-016-7-FW)

- Secure parameters (DriveTop)
- Set Parameter *P-0-4021, Baud-Rate RS-232/485* to 0 (Baud rate 9600)
- Close DriveTop
- Start DOLFI
- Press Button "Connect"
- Open IBF-file of the fimware by pressing button "Open file"
- Transfer the three files of the IBF-file by pressing button "Transfer file" and confirm the transfers.
- In event of download problems you have to reduce the Baud rate (see menu item "Settings"; see also help system of DOLFI)
- Restart the drive with "Serial disconnecting"
- Load parameters (DriveTop)



#### Notes



## 16 Attachment

## 16.1 Sizing relevant to supply and regeneration

### Requirements

	Note: When sizing the drive, you must check and observe the conditions relevant to supply and regeneration mentioned below.	
Requirements for supply	(Energy flux from supply system to installation)	
operation:	PZWD, system ≤ PZWD, units	
	PzwD,system:       required DC bus continuous power of the system         PzwD,units:       allowed DC bus continuous power of the units	
	Fig. 16-1: DC bus continuous power	
	PZWS, system ≤ PZWS, units	
	Pzws,system:required DC bus peak power of the systemPzws,units:allowed DC bus peak power of the units	
	Fig. 16-2: DC bus peak power	
Requirements for regenerative	(Energy flux from installation to DC bus)	
operation:	PRD,system ≤ PRD,units	
	PRD,system:required continuous regenerative power of the systemPRD,units:allowed continuous regenerative power of the units	
	Fig. 16-3: Continuous regenerative power	
	PRS, system ≤ PRS, units	
	PRS,system:required peak regenerative power of the systemPRS,units:allowed peak regenerative power of the units	
	Fig. 16-4: Peak regenerative power	
	WR, system ≤ WR, units	
	WR,system:required regenerative power of the systemWR,units:allowed regenerative power of the units	

Fig. 16-5: Regenerative power



## Calculations with regard to the power and energy allowed on the device side

n * Рzwd, dкc40 + k * Рzwd, dкc100 + I * Рzwd, dкc200 + m * Рzwd, вzм]
n * Pzws, dkc40 + k * Pzws, dkc100 + I * Pzws, dkc200 + m * Pzws, bzm]
* Prd, dkc40 + k * Prd, dkc100 + I * Prd, dkc200 + m * Prd, bzm]
* Prs, dkc40 + k * Prs, dkc100 + I * Prs, dkc200 + m * Prs, bzm]
* Wr, max, dkc40 + k * Wr, max, dkc100 + I * Wr, max, dkc200 + m * Wr, max, bzm]
allowed DC bus continuous power of the units
allowed DC bus continuous power DKC (40A, 100A, 200A)
allowed DC bus continuous power BZM
allowed DC bus peak power of the units
allowed DC bus peak power DKC (40A, 100A, 200A)
allowed DC bus peak power BZM
allowed continuous regenerative power of the units
allowed continuous regenerative power
DKC (40A, 100A, 200A)
allowed continuous regenerative power BZM
allowed peak regenerative power of the units
allowed peak regenerative power DKC (40A, 100A, 200A)
allowed peak regenerative power BZM
allowed regenerative power of the units
max. regenerative power in DKC (40A, 100A, 200A)
max. regenerative power in BZM
for operation without DC bus connection
for operation with DC bus connection
number of DKC-040 on the common DC bus
number of DKC-100s on the common DC bus
number of DKC-200s on the common DC bus
number of BZMs on the common DC bus

Fig. 16-6: Power and energy allowed on the device side

Individual data see page 6-1: "Dimensions Auxiliary Bleeder Module BZM01.3" and following.

## Calculations with regard to the power and energy resulting on the installation side

 $P_{ZWD, \ Anlage} \ = \ \frac{M_1 * \omega_1 * t_1 + M_2 * \omega_2 * t_2 + \ldots + M_i * \omega_i}{* t_i + M_i * \omega_i * t_i} \cdot 1$  $\omega=2^{*}\pi^{*}n_{i}$ tz Pzws, Anlage =  $M_{max} * \omega_{max} * \frac{1}{n}$  (acceleration)  $P_{RD, Anlage} = \frac{\sum W_{ROT} + \sum W_{POT}}{t_7} * \eta$  $W_{ROT} = \frac{(J_{LAST} + J_M)}{2} * (n * \frac{2 * \pi}{60})^2 * z_{DEC}$  $W_{POT} = m_{LAST} * g * h * z_{AB}$  $P_{RS,Anlage} = M_{max} * \omega_{max} * \eta$  (deceleration)  $W_{R,Anlage} = (\sum W_{ROT} + \sum W_{POT})^* \eta$ resulting DC bus continuous power of the system PzwD,Anlage: Pzws,Anlage: resulting DC bus peak power of the system PRD, Anlage: resulting continuous regenerative power of the system resulting peak regenerative power of the system PRS,Anlage: WR,Anlage: resulting regenerative power of the system WROT: rotary energy potential energy WPOT: tz: cycle time time of influence t<sub>i</sub>: JLAST : load inertia Јм: motor inertia load weight **MLAST**: 9,81 ms<sup>2</sup> g: h: lowering distance in meters motor speed n: number of drops per cycle Z<sub>AB</sub>: number of braking actions per cycle ZDEC: maximum torque M<sub>max</sub>: torgue at the motor shaft M:: max. motor speed n<sub>max</sub>: operating motor speed n<sub>i</sub>: efficiency in the drive line (converter, motor, gearing)  $\eta$ :

Fig. 16-7: Power and energy resulting on the installation side



#### Calculation with regard to reduction of resulting power dissipation

#### CZM01.3

When braking the drive, the rotary energy present in the mechanics is fed back to the DC bus of the DKC in the form of regenerated energy. It can

• Be reduced to dissipated heat via the braking resistor integrated into the DKC or an auxiliary braking resistor can additionally be built in

- or -

• It can be stored as energy in the DKC with connected auxiliary capacitance module and then re-used for acceleration procedures. This reduces the heat in the control cabinet and lowers energy consumption.

For a successful implementation and an avoidance of unnecessary heat loss in the control cabinet, it applies:

 $W_{R,Anlage} \leq W_{ZW,DKC} + W_{ZW,CZM}$ 

WR,Anlage:required regenerative power of the systemWzw:storable energy of the DC bus capacitors

Fig. 16-8: Condition to avoid power dissipation from the regenerative power



#### Calculating the allowed continuous braking resistor and DC bus power

By connecting the DC bus connections of several DKC and BZM drive controllers the regenerative power and regenerative continuous power resulting in the common DC bus is evenly distributed to all ECODRIVE03 components with a braking resistor.

The distribution to the components involved is realized takes place with a high balancing factor.

## For central supply and group supply with DC bus connection

	$P_{BD,Ger extsf{ate}}=\sum{(P_{BD,DKC}+P_{BD,BZM})^*0,8}$
<b>P</b> BD, Geräte :	continuous braking resistor power that can be consumed in continuous operation by all devices on the common DC bus, in kW
<b>Р</b> ВD, DKC :	continuous braking resistor power that the drive controller can consume in continuous operation, in kW
<i>Р</i> вд, вzм :	continuous braking resistor power that the auxiliary braking resistor module can consume in continuous operation, in kW
Fig. 16-9: Continuous braking resistor power of all devices on the common DC	
bus	

	$P_{ZW, Geräte} = \sum P_{ZW} * 0,8$
PZW, Geräte:	available continuous DC bus power on the common DC bus, in kW
<i>P</i> zw :	continuous DC bus power of the single devices in kW

Fig. 16-10: Continuous DC bus power of all devices on the common DC bus

For single source supply and group supply without DC bus connection

See page 4-6.



# 16.2 Use of the connections for looping through the control voltage

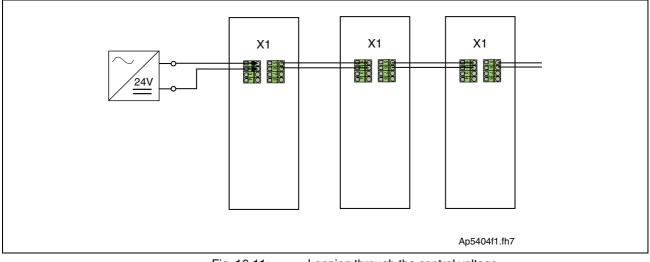


Fig. 16-11: Looping through the control voltage

Calculation for 3 DKC02.3-040 drive controllers:

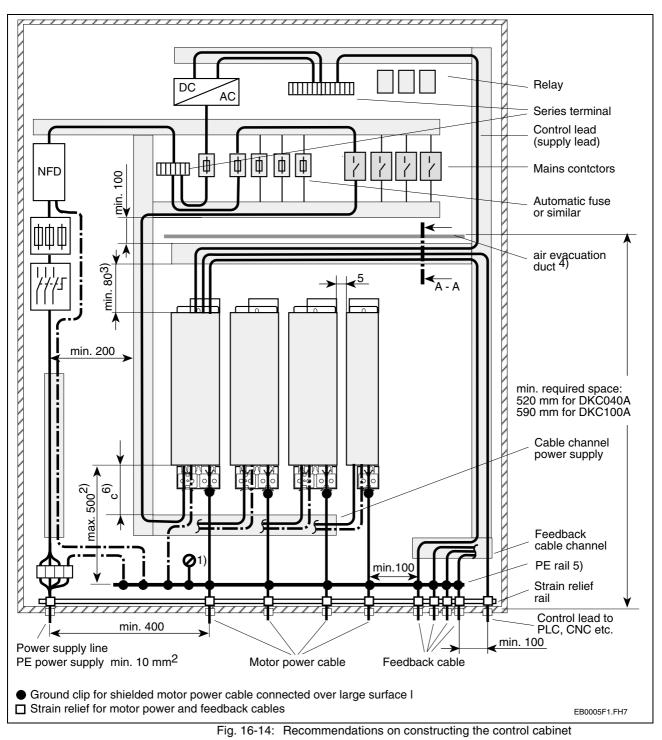
	$I_D = 3 \times \frac{P_{N3}}{U_{N3}} = 3 \times \frac{19 W}{24 V} = 2,31 A$	
Fig. 16-12:	Continuous current I <sub>D</sub>	
I <sub>E</sub> = 3 x I <sub>EIN3</sub> = 3 x 4 A= 12 A		
Fig. 16-13:	Charging current I <sub>E</sub>	

Duration of the charging current peak according to figure Amplitude of the DKC control voltage charging current at startup, to selecting power source" on page 4-15: approx. 12 ms

**Note:** In the case of the DKC\*\*.3-016-7-FW, the control voltage cannot be looped through.



## 16.3 Control Cabinet Construction with Recommendations for EMC and Cooling



- 1) PE rails linked over a large surface with the bare metal of the mounting panel.
- 2) Given a distance less than 500 mm between the point of clamping of the motor cable and the PE rail, the motor cable does not have to run through the cable channel on the mounting panel.



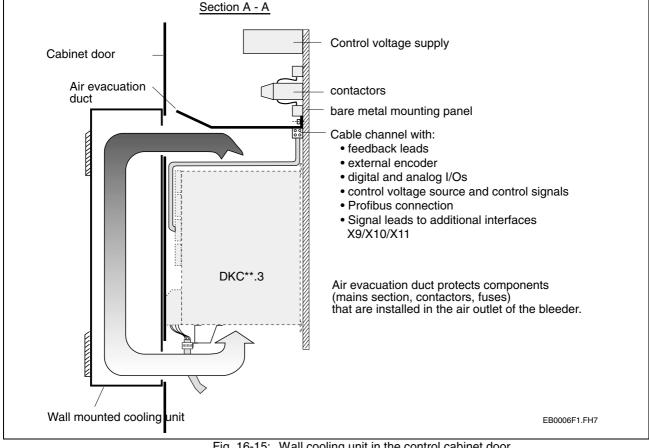
- This dimension depends on the projected continuous braking resistor power. See 12-6 "Distances"
   A DKC100A or BZM unit, under full load needs greater distances, up to 300mm, or an air evacuation duct. A DKC100A with connection to connector strips X9/X10/X11 needs a minimum distance of 150 mm. For DKC 040 As, 80 mm is generally acceptable.
- 4) Depending on air ducts or cabinet cooling method, it is advisable to mount an air evacuation duct, see section A A in Fig. 16-14: Recommendations on constructing the control, Fig. 16-15: Wall cooling unit in the control cabinet door and Fig. 16-16: Mounting the cooling unit onto top.
   An air evacuation duct is always advisable with DKC100 or BZMs with
  - high continuous braking resistor power.
- 5) The PE rail must be mounted directly to the strain relief track on the control cabinet leadthrough of the motor power cable.
- 6) Distance c see page 12-6 "Distances"

#### Sectional Drawing for Developing an Optimum Control Cabinet

The depth of the air evacuation duct depends on the size of the control cabinet.

 $\mathsf{ECODRIVE}$  has been designed for a minimum control cabinet depth of 300 mm.

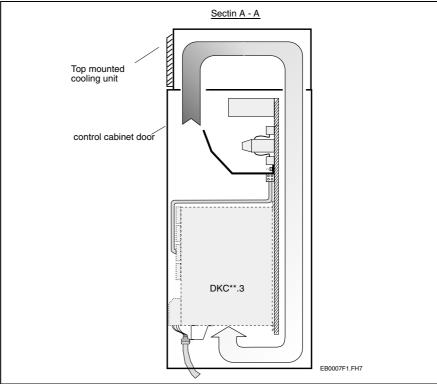
This offers several options on conducting air out of the cabinet.



#### Wall cooling unit in the control cabinet door

Fig. 16-15: Wall cooling unit in the control cabinet door





#### Mounting the cooling unit onto top

Fig. 16-16: Mounting the cooling unit onto top



## 16.4 Wire routing and wiring of the drive controller

#### DKC\*\*.3-016 control connections

#### View of DKC02.3-016

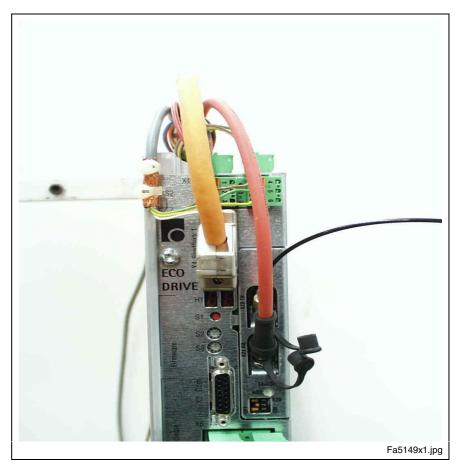


Fig. 16-17: View with SERCOS interface



#### View of DKC03.3-016



Fig. 16-18: View with Profibus-DP Interface



#### View of DKC21.3-016

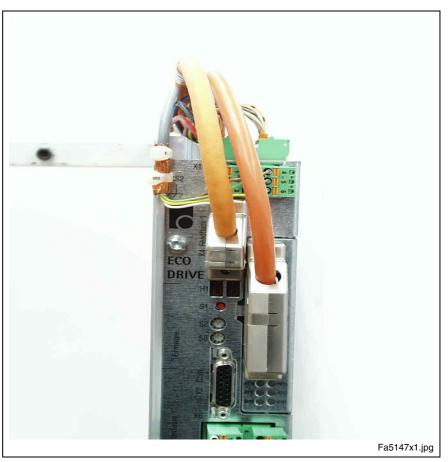
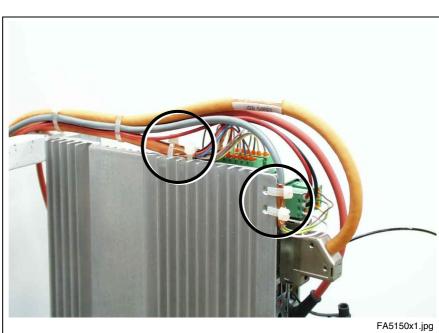


Fig. 16-19: View with Parallel Interface 2





Detail view X1, X3, X10, XS2 and XS3 with cable shield connection

Fig. 16-20: Detail view X1, X3, X10, XS2 and XS3

• Fasten the cable shields with 2 cable ties each at XS2 or XS3.

#### Control connection DKC\*\*.3-040/100/200

**Note:** Representing all DKC\*\*.3 – drive controller devices the following construction examples are based on the device DKC\*\*.3-040-7.





#### View with contact protection

Fig. 16-21: View with contact protection



#### View of DKC02.3-040-7

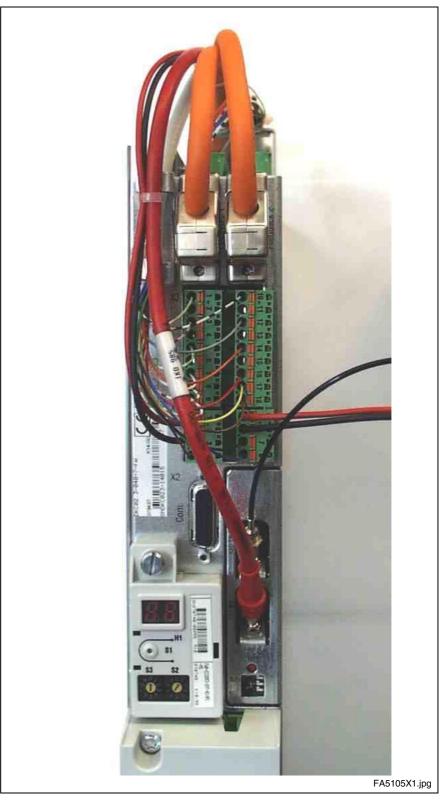


Fig. 16-22: View with SERCOS interface



#### View of DKC03.3-040-7

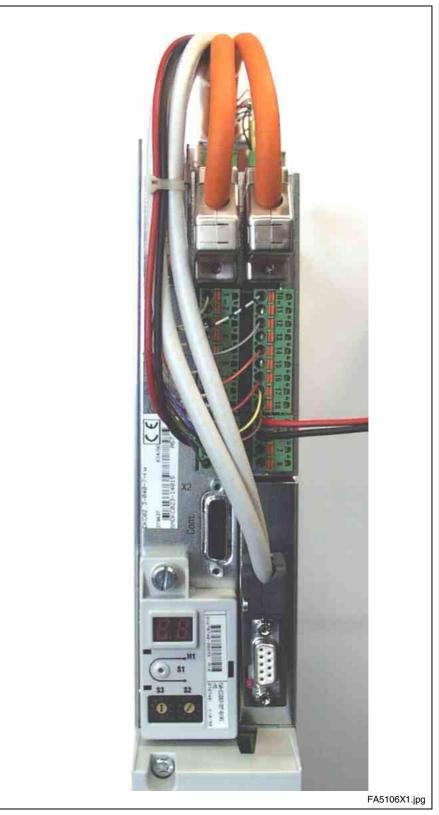


Fig. 16-23: View with Profibus-DP Interface



#### View of DKC21.3-040-7

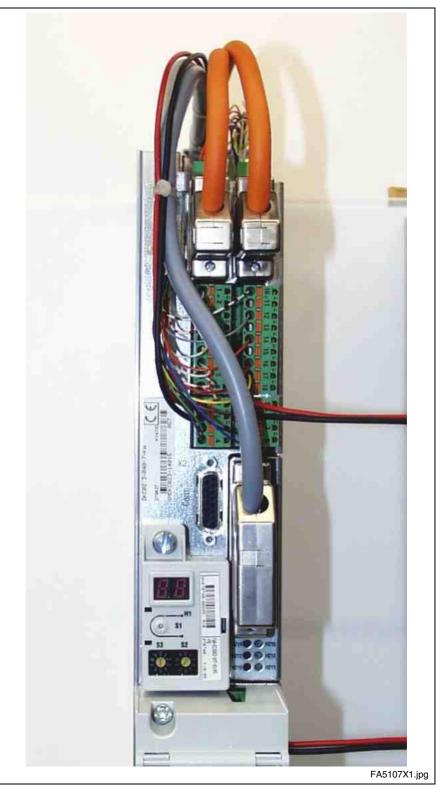
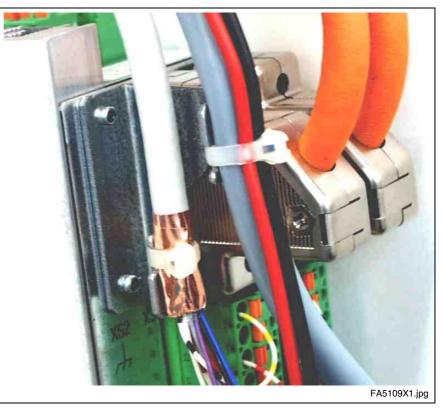


Fig. 16-24: View with Parallel Interface 2





Detail view X4, X8 and XS2 with cable shield connection

Fig. 16-25: Detail view X4, X8, XS2

## Detail view X9, X10, X11 and XS3 with cable shield connection

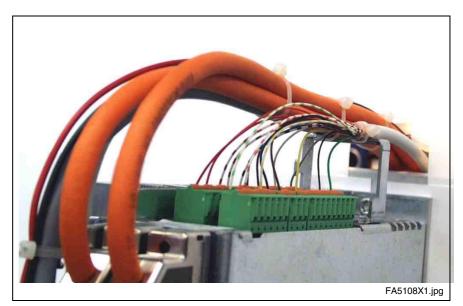
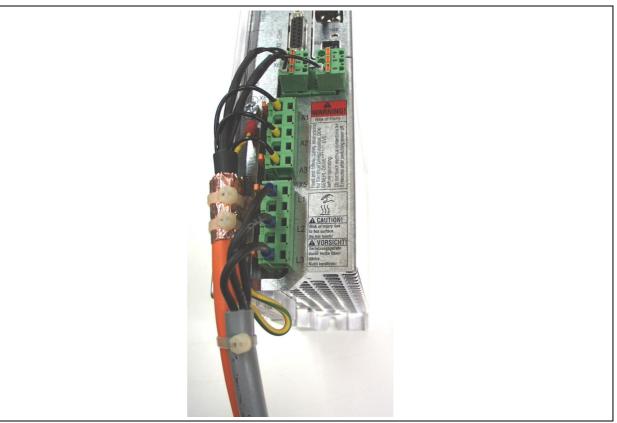


Fig. 16-26: Detail view X9, X10, X11, XS3



#### **Power connection**

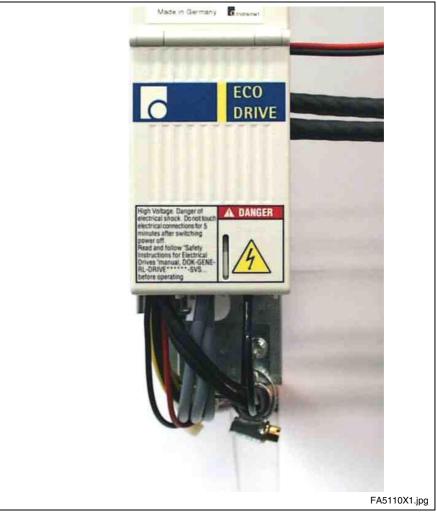


#### Connection of motor and mains cable DKC\*\*.3-016-7

Fig. 16-27: Connection of motor and mains cable

- Fasten the motor cable with two cable ties to the shield connection at the heatsink.
- Fasten the motor cable and the mains cable in the control cabinet as near as possible to the drive controller, because the two cable ties do not serve as strain relief.
- Always place the direct connectors for motor and mains connection on the drive controller in such a way that the barbs lock into place.



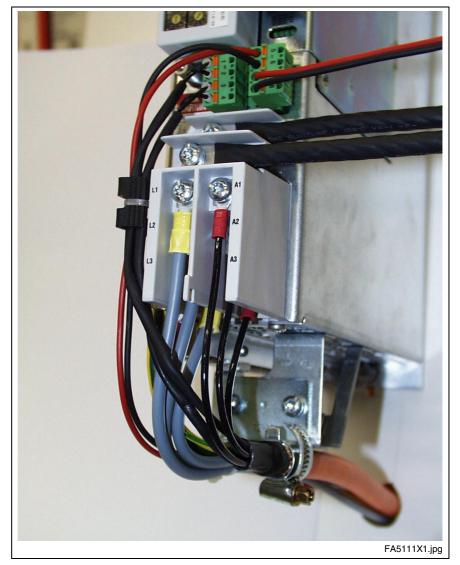


#### View with contact protection DKC\*\*.3-040-7

Fig. 16-28: View with contact protection

**Note:** SUP-E01-DKC\*\*.3 as of hardware index A65 is integrated in device DKC\*\*.3-040-7.





## View X5, X6, XE1, XE2 and XS1 with cable shield connection on DKC\*\*.3-040-7

Fig. 16-29: View X5, X6, XE1, XE2 and XS1

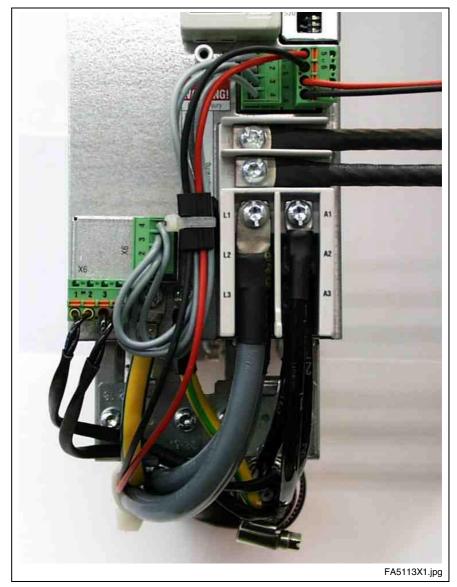




View with contact protection DKC\*\*.3-100-7

Fig. 16-30: View with contact protection





View X5, X6, XE1, XE2 and XS1 with cable shield connection on DKC\*\*.3-100-7

Fig. 16-31: View X5, X6, XE1, XE2 and XS1





View with contact protection DKC\*\*.3-200-7

Fig. 16-32: View with contact protection

Note: Two bridges may be cut off to simplify the seating of the contact protection when using circular cross sections  $\ge 16 \text{ mm}^2$ .

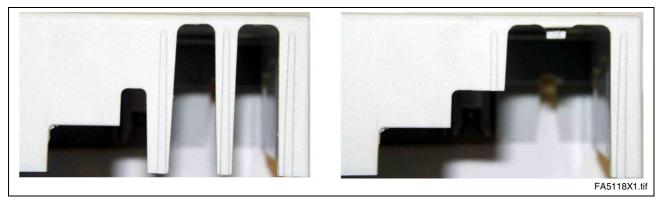
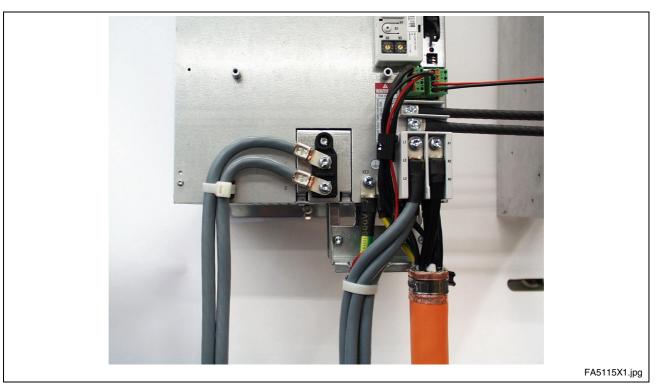


Fig. 16-33: Contact protection with and without bridges



## View X5, X6, X12, XE1, XE2 and XS1 with cable shield connection on DKC\*\*.3-200-7

Fig. 16-34: View X5, X6, X12, X100, XE1, XE2 and XS1



#### **RS485 - Connector**

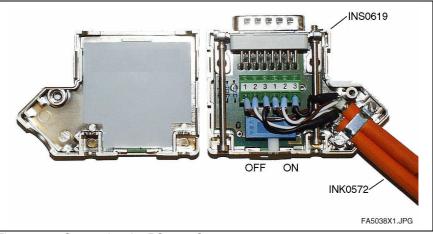


Fig. 16-35: Connecting the RS485 - Connectors

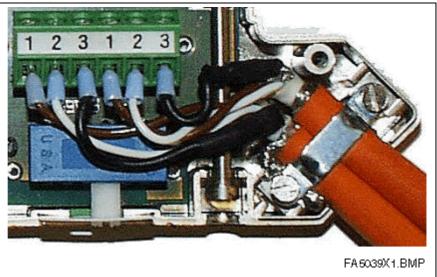


Fig. 16-36: Connecting the RS485 - Connectors



#### 16.5 What is needed to prepare to start-up

To start up an ECODRIVE drive system, the following is needed:

- Measuring equipment
- PC
- Linking cables (PC-drive controller)
- **Measuring devices** To be able to read off torque, current and velocity in the form of analog signals at the analog outputs, the following measuring equipment is needed:
  - Multimeter to take voltage readings (suffices with a serial start-up)
  - Oscilloscope or plotter (only needed to record signal paths when commissioning a prototype)

**Personal computer (PC)** The PC is needed to program, parameterize and diagnose when starting up and servicing.

Hardware requirements:

- IBM compatible
- min. 80486 microprocessor (Pentium 166 or higher recommended)
- at least 16 MB RAM memory
- hard drive with at least 80 MB available memory
- CD-ROM drive
- A free serial RS232 interface on the PC (COM 1 or COM 2)

Software pre-requisites:

- Windows 95/98, NT4.0, 2000, ME
- DriveTop start-up program

Link cables (PC-drive controller) DKC\*\*.3-040/100/200: See page 4-49 X2, Serial Interface resp. DKC\*\*.3-016: See page 5-23 X2, Serial Interface

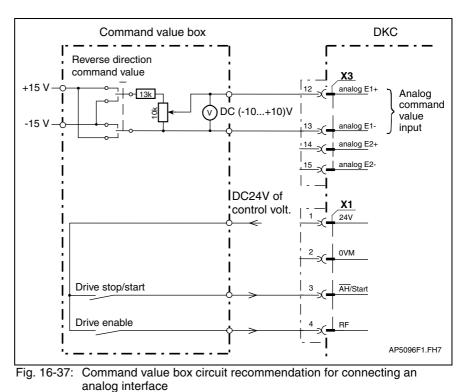


### 16.6 Command Value Box Connection

**Command Value Box** To run the drive, a command value must be set at the relevant interface (positioning, analog or step motor interface).

For test purposes, a velocity command value can be set with the help of a command value box via the analog interface.

The following illustrates a command value box circuit recommendation.



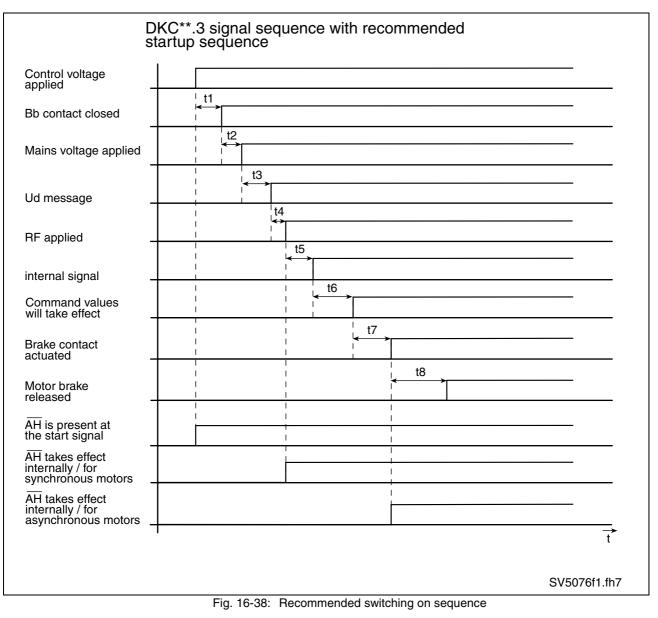


Note: The analog input (not present on DKC\*\*.3-016) used has to be parameterized. See firmware functional description.



## 16.7 Signal Sequence DKC\*\*.3

#### **Recommended Switching On Sequence**



- t1: Depends on functions and configuration.
- t2: Made up of "Slow operation of mains contactor K1" and "PLC times".
- t3: See page 4-55: "Digital outputs (ready, warning and UD-message)".
- t4: Apply RF after signal U<sub>D</sub>-Signal.
- t5: Internal delay time 8 ms.
- t6: 300 ms due to field built up in asynchronous motors, not applicable to synchronous motors.
- t7: Internal delay time due to brake relay:330 ms with asynchronous30 ms with synchronous motors
- t8: Separation time of brake used, listed in relevant motor project planning manual.



#### **Explanation of Chronological Sequence**

"Control voltage applied" DC24V – supply at X1

"Bb contact closed" Bb contact in DKC\*\*.3 on X1

"Mains voltage applied" Power supply at X5, Start of DC bus charge procedure

"U<sub>d</sub> - Signal" Signal output at X3 (not for DKC\*\*.3-016)

"RF applied" Signal drive enable applied by user.

"Actual brake contact" Brake contact in DKC\*\*.3 on X6 is triggered. Brake contact parameterized as N/C or N/O (see firmware functional description)

"Motor brake released" Brake controlled via motor contact has been released.

" AH applied"

Signal AH (start signal at X1 (see firmware functional description).

" AH is working internally"

Internal signal sequence depends on motor used.



#### **Recommended Off Sequence**

D	OKC**.3 signal sequence with recommended hutdown sequence	
RF withdrawn; start "optimum shutdown"		
Brake contact actuated		
Brake closed, drive torque free		
K1 contactor dropped out; line voltage at X5 cleared	t3	
Ud message		
Control voltage cleared		
Bb contact opened		
		t t
	Fig. 16-39: Recommended off sequence	'7f1.fh7
	•	
	<ul> <li>t1: Brake time of drive Maximum value parameterizable (see firmware functional description).</li> </ul>	

- t2: (see firmware functional description) Brake delay time parameterizable with link time of brake (see relevant motor project manual), cannot be parameterized in MKDs and MHDs, fixed at 150 ms
- t3: Can be shortened by activating DC bus dynamic brake.



### **Explanation of Chronological Sequence**

with r starts	ved"; start "Best possible standstill" emoval of RF signal at X1 the recommended off sequence and "best possible standstill" (see firmware function iption).
Brake	ntact actuated": e contact in DKC**.3 actuated at X6, e contact parameterizable as N/C or N/O contact (see firmware onal description)
"Brake clo brake	sed": e connected via brake contact is closed.
	r K1 removed"; "Mains contactor at X5 removed": DC bus dynamic brake discharge
	": Il output at X3 or DKC**.3-016)
	bltage removed" V supply at X1
	ct open": ut DC24V at X1 the Bb relay in DKC**.3 is brought into home on (N/O opened).
Note:	Removing the DC24V at X1 causes the Bb contact to open, the removal of the $U_D$ signal and the loss of the diagnosis displayed at H1 despite the existing DC bus voltage.



# 16.8 Directory of Standards and Guidelines

Standards	Edition	Title
		Principles for computers in safety-related systems
prEN 1921	1995	Industrial automation systems - Safety of integrated manufacturing systems - Basic requirements (ISO 11161:1994 modified)
EN 50170/2	1996-12	"General purpose field communication system; English version EN 50170:1996 Volume 2/3 PROFIBUS"
EN 50254	1998-12	High efficiency communication subsystem for small data packages
EN 60204-1	1997-12	Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:1997 + Corrigendum 1998)
EN 60529 + EN 60259/A1	1991-10 2000-02	Degrees of protection provided by enclosures (IP code) (IEC 60529:1989 + A1:1999)
EN 292-1	1991	"Safety of machinery; basic concepts, general principles for design; part 1: basic terminology, methodology"
prEN 292-1	2000-04	"Safety of machinery; basic concepts, general principles for design; part 1: basic terminology, methodology (Identical with ISO/DIS 12000-1); Revision of EN 292-1:1991"
EN 292-2 EN 292-2/A1	1991-09 1995-03	"Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications; German version EN 292-2:1991 + A1:1995"
prEN 292-2	2000-04	"Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications (Identical with ISO/DIS 12000-2); Revision of EN 292-2:1991 and EN 292-2:1991/A1:1995"
EN 61941	1998-08	Electrical equipment of industrial machines - Serial data link for real-time communication between controls and drives (IEC 61491:1995, modified)
EN 954-1	1996-12	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
EN 1037	1995-12	Safety of machinery - Preventation of unexpected start-up
EN 12415	1996-05	Machine tools - Safety - Small numerically controlled turning machines and turning centres
EN 12417	1996-05	Machine tools - Safety - Machining centres
EN 775	1992-10	"Manipulating industrial robots; safety (ISO 10218:1992, modified)"
ISO 11898	1993-11	"Road vehicles - Interchange of digital information - Controller area network (CAN) for high-speed communication; identical with ISO 11898:1993 (Status as of 1994)"
EN 50178	1997-10	Electronic equipment for use in power installations
EN 61800-3	1996-10	Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test methods (IEC 61800-3:1996)
73/23/EEC	1973-02-19	"Council Directive of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits
93/68/EEC	1993-07-22	93/68/EEC: COUNCIL DIRECTIVE 93/68/EEC of 22 July 1993 amending Directives 87/404/EEC (simple pressure vessels), 88/378/EEC (safety of toys), 89/106/EEC (construction products), 89/336/EEC (electromagnetic compatibility), 89/392/EEC (machinery), 89/686/EEC (personal protective equipment), 90/384/EEC (non- automatic weighing instruments), 90/385/EEC (active implantable medicinal devices), 90/396/EEC (appliances burning gaseous fuels), 91/263/EEC (telecommunications terminal equipment), 92/42/EEC (new hot-water boilers fired with liquid or gaseous fuels) and 73/23/EEC (electrical equipment designed for use within certain voltage limits)
89/336/EEC	1989-05-03	COUNCIL DIRECTIVE of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (89/336/EEC)

Fig. 16-40: Standards and Guidelines



Norm	Ausgabe	Titel
DIN V VDE 0801	1990-01	Grundsätze für Rechner in Systemen mit Sicherheitsaufgaben
E DIN EN 1921	1995-10	Industrielle Automatisierungssysteme - Sicherheit von integrierten Fertigungssystemen - Grundlegende Anforderungen (ISO 11161:1994, modifiziert)
DIN EN 50170/2	1997-07	"Universelles Feldkommunikationssystem; Englische Fassung EN 50170:1996 Band 2/3 PROFIBUS"
DIN EN 50254	1999-07	Kommunikationssubsystem mit hoher Effizienz für kleine Datenpakete
DIN EN 60204-1, VDE 0113 Teil 1	1998-11	Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen - Teil 1: Allgemeine Anforderungen (IEC 60204-1:1997 + Corrigendum 1998)
DIN EN 60529, VDE 0470 Teil 1	2000-09	Schutzarten durch Gehäuse (IP-Code) (IEC 60529:1989 + A1:1999)
DIN EN 292-1	1991-11	"Sicherheit von Maschinen; Grundbegriffe, allgemeine Gestaltungsleitsätze; Teil 1: Grundsätzliche Terminologie, Methodik"
E DIN EN 291-1	2000-06	"Sicherheit von Maschinen; Grundbegriffe, allgemeine Gestaltungsleitsätze; Teil 1: Grundsätzliche Terminologie, Methodik (Identisch mit ISO/DIS 12100-1); Überarbeitung von EN 292-1:1991"
DIN EN 292-2	1995-06	"Sicherheit von Maschinen - Grundbegriffe, allgemeine Gestaltungsleitsätze - Teil 2: Technische Leitsätze und Spezifikationen; Deutsche Fassung EN 292-2:1991 + A1:1995"
E DIN EN 292-2	2000-06	"Sicherheit von Maschinen - Grundbegriffe, allgemeine Gestaltungsleitsätze - Teil 2: Technische Leitsätze und Spezifikationen (Identisch mit ISO/DIS 12100-2); Überarbeitung von EN 292-2:1991 + EN 292-2:1991/A1:1995"
DIN EN 61941	1999-11	Elektrische Ausrüstung von Industriemaschinen - Serielle Datenverbindung für Echtzeit-Kommunikation zwischen Steuerungen und Antrieben (IEC 61491:1995, modifiziert)
DIN EN 954-1	1997-03	Sicherheit von Maschinen - Sicherheitsbezogene Teile von Steuerungen - Teil 1: Allgemeine Gestaltungsleitsätze
DIN EN 1037	1996-04	Sicherheit von Maschinen - Vermeidung von unerwartetem Anlauf
DIN EN 12415	1996-08	Werkzeugmaschinen - Sicherheit - Kleine numerisch gesteuerte Drehmaschinen und Drehzentren
DIN EN 12417	1996-08	Werkzeugmaschinen - Sicherheit - Bearbeitungszentren
DIN EN 775	1993-08	"Industrieroboter; Sicherheit (ISO 10218:1992, modifiziert)"
DIN ISO 11898	1995-08	Straßenfahrzeuge - Austausch digitaler Informationen - Steuergerätenetz (CAN) für schnellen Datenaustausch (ISO 11898:1993) (Stand 1994)
DIN EN 50178 VDE 0160	1998-04	Ausrüstung von Starkstromanlagen mit elektronischen Betriebsmitteln
DIN EN 61800-3	1997-08	Drehzahlveränderbare elektrische Antriebe - Teil 3: EMV-Produktnorm einschließlich spezieller Prüfverfahren (IEC 61800-3:1996
73/23/EWG	1973-02-19	Richtlinie des Rates vom 19. Februar 1973 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten betreffend elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen
93/68/EWG	1993-07-22	Richtlinie 93/68/EWG des Rates vom 22. Juli 1993 zur Änderung der Richtlinien 87/404/EWG (einfache Druckbehälter), 88/378/EWG (Sicherheit von Spielzeug), 89/106/EWG (Bauprodukte), 89/336/EWG (elektromagnetische Verträglichkeit), 89/392/EWG (Maschinen), 89/686/EWG (persönliche Schutzausrüstungen), 90/384/EWG (nichtselbsttätige Waagen), 90/385/EWG (aktive implantierbare medizinische Geräte), 90/396/EWG (Gasverbrauchseinrichtungen), 91/263/EWG (Telekommunikationsendeinrichtungen), 92/42/EWG (mit flüssigen oder gasförmigen Brennstoffen beschickte neue Warmwasserheizkessel) und 73/23/EWG (elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen)
89/336/EWG	1989-05-03	Richtlinie des Rates vom 3. Mai 1989 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit

Fig. 16-41: Normen und Richtlinien



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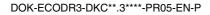
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#### Service & Support 18

## 18.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

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- +49 (0) 9352 40 49 41 per Fax:
- per e-Mail: service@indramat.de

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

+49 (0) 9352 40 50 60 by phone: via Service Call Entry Center Mo-Fr 7:00 am - 6:00 pm +49 (0) 9352 40 49 41 by fax: service@indramat.de

by e-mail:

## 18.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service After helpdesk hours, contact our service direkt ansprechbar unter department directly at +49 (0) 171 333 88 26 +49 (0) 171 333 88 26 +49 (0) 172 660 04 06 +49 (0) 172 660 04 06 oder or

# 18.3 Internet

www.indramat.de Unter finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die aktuellen Adressen \*) unserer auf den folgenden Seiten aufgeführten Vertriebsund Servicebüros.

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Niederlassungen mit Kundendienst

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

\*) http://www.indramat.de/de/kontakt/adressen Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

At www.indramat.de you may find additional notes about service, repairs and training in the Internet, as well as the actual addresses \*) of our sales- and service facilities figuring on the following pages.

sales agencies offices providing service

Please contact our sales / service office in your area first.

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# 18.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

- 1. detaillierte Beschreibung der Störung und der Umstände.
- 2. Angaben auf dem Typenschild der betreffenden Produkte. insbesondere Typenschlüssel und Seriennummern.
- 3. Tel.-/Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

For quick and efficient help, please have the following information ready:

- 1. Detailed description of the failure and circumstances.
- 2. Information on the type plate of the affected products, especially type codes and serial numbers.
- Your phone/fax numbers and e-mail address, З. so we can contact you in case of questions.

# 18.5 Kundenbetreuungsstellen - Sales & Service Facilities

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Bosch Rexroth-Korea Ltd. 1515-14 Dadae-Dong, Saha-Ku Rexroth Indramat Division Pusan Metropolitan City, 604-050 Republic of South Korea Tel.: +82 (0)51 26 00 741 Fax: +82 (0)51 26 00 747 gyhan@rexrothkorea.co.kr	Bosch Rexroth Sdn.Bhd. 11, Jalan U8/82 Seksyen U8 40150 Shah Alam Selangor, Malaysia Tel.: +60 (0) 3 78 44 80 00 Fax: +60 (0) 3 78 45 48 00 hockhwa@hotmail.com rexroth1@tm.net.my	Bosch Rexroth SDN BHD. No.11, Jalan Astaka U8/82 Seksyen U8 40150 Shah Alam Selangor Darul Ehsan Tel.: +65 (0) 3 7844 8000 Fax: +65 (0) 3 7845 4800 kenton.peh@boschrexroth.com.sg	TECTRA Automation (Pty) Ltd.         71 Watt Street, Meadowdale         Edenvale 1609         Tel.: +27 (0)11 971 94 00         Fax: +27 (0)11 971 94 40         Hotline: +27 (0)82 903 29 23         georgv@tectra.co.za
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Canada East - Kanada Ost	Canada West - Kanada West	Mexico	Mexico
Bosch Rexroth Canada Corporation Burlington Division 3426 Mainway Drive Burlington, Ontario Canada L7M 1A8	Bosch Rexroth Canada Corporation 5345 Goring St. Burnaby, British Columbia Canada V7J 1R1	Bosch Rexroth S.A. de C.V. Calle Neptuno 72 Unidad Ind. Vallejo 07700 Mexico, D.F.	Bosch Rexroth S.A. de C.V. Calle Argentina No 3913 Fracc. las Torres 64930 Monterey, N.L.
Tel.: +1 905 335 55 11 Fax: +1 905 335-41 84 <u>michael.moro@boschrexroth.ca</u>	Tel. +1 604 205-5777 Fax +1 604 205-6944 david.gunby@boschrexroth.ca	Tel.: +52 5 754 17 11 +52 5 754 36 84 +52 5 754 12 60 Fax: +52 5 754 50 73 +52 5 752 59 43	Tel.: +52 8 333 88 3436 +52 8 349 80 9193 Fax: +52 8 346 78 71 mario.quiroga@boschrexroth.com.mx

## Südamerika – South America

Argentina - Argentinien	Argentina - Argentinien	Brazil - Brasilien	Brazil - Brasilien
Bosch Rexroth S.A.I.C. "The Drive & Control Company" Acassusso 48 41/47 1605 Munro Prov. Buenos Aires	NAKASE Servicio Tecnico CNC Calle 49, No. 5764/66 1653 Villa Balester Prov Buenos Aires	Bosch Rexroth Ltda. Av. Tégula, 888 Ponte Alta, Atibaia SP CEP 12942-440	Bosch Rexroth Ltda. R. Dr.Humberto Pinheiro Vieira, 100 Distrito Industrial [Caixa Postal 1273] 89220-390 Joinville - SC
Tel.: +54 (0)11 4756 01 40 Fax: +54 (0)11 4756 01 36 victor.jabif@boschrexroth.com.ar	Tel.: +54 (0) 11 4768 36 43 Fax: +54 (0) 11 4768 24 13 nakase@usa.net nakase@nakase.com gerencia@nakase.com (Service)	Tel.: +55 (0)11 4414 56 92 +55 (0)11 4414 56 84 Fax sales: +55 (0)11 4414 57 07 Fax serv.: +55 (0)11 4414 56 86 alexandre.wittwer@rexroth.com.br	Tel./Fax: +55 (0)47 473 58 33 Mobil: +55 (0)47 9974 6645 prochnow@zaz.com.br
Columbia - Kolumbien Reflutec de Colombia Ltda. Calle 37 No. 22-31 Santafé de Bogotá, D.C. Colombia	-		
Tel.: +57 1 368 82 67 +57 1 368 02 59 Fax: +57 1 268 97 37 reflutec@neutel.com.co			





