ECODRIVE03
Drive Controllers

Project Planning Manual

SYSTEM200

DOK-ECODR3-DKC**.3****-PR04-EN-P

Title ECODRIVE03 Drive Controllers

Type of Documentation Project Planning Manual

Document Typecode DOK-ECODR3-DKC**.3****-PR04-EN-P

Internal File Reference

- Box 71 / 72 / 73
- Document number: 120-1000-B307-04/EN

Purpose of Documentation This documentation describes …

- planning the mechanical control cabinet construction
- planning the electrical control cabinet construction
- logistical handling of the equipment
- preparing the necessary equipment for startup operation

Record of Revisions

Description	Release Date	Notes
DOK-ECODR3-DKC**.3****-PRJ1-EN-P	04.98	1st edition
DOK-ECODR3-DKC**.3****-PR03-EN-P	09.99	new edition
DOK-ECODR3-DKC**.3****-PR04-EN-P	05.00	revision

Published by Rexroth Indramat GmbH
Bgm.-Dr.-Nebel-Str. 2 • D-97816 Lohr a. Main

Telephone 09352/40-0 • Tx 689421 • Fax 09352/40-4885

http://www.rexroth.com/indramat

Dept. ECD (RR/JR)

Note This document has been printed on chlorine-free bleached paper..

Supplementary documentation

Note: The following documentation is not required in its entirety for project planning.

"Servo Applications with 1,5 s Acceleration Time"
- Selection lists -
DOK-ECODR3-SERV-GEN***-AUxx-MS-P

"Servo Applications with 400 ms Acceleration Time"
- Selection lists -
DOK-ECODR3-SERV-WZM***-AUxx-MS-P

"Main drives with 2AD-, ADF- and 1MB-motors"
- Selection lists -
DOK-ECODR3-MAIN*WZM***-AUxx-MS-P

"List of Connecting Cables for DIAX04 and ECODRIVE03"
- Selection lists -
DOK-CONNEC-CABLE*STAND-AUxx-EN-P

"ECODRIVE03 Drive for Machine Tool Applications With SERCOS-, Analog- and Parallelinterface"
- Functional Description -
DOK-ECODR3-SMT-01VRS**-FKxx-EN-P

"ECODRIVE03 Drive for Machine Tool Applications With SERCOS-, Analog- and Parallelinterface"
- Functional Description -
DOK-ECODR3-SMT-02VRS**-FKxx-EN-P

"ECODRIVE03 Drive for General Automation With SERCOS-, Analog- and Parallelinterface"
- Functional Description -
DOK-ECODR3-SGP-01VRS**-FKxx-EN-P

"ECODRIVE03 Drive for General Automation With Fieldbus-Interfaces"
- Functional Description -
DOK-ECODR3-FGP-01VRS**-FKxx-EN-P

"ECODRIVE03 Drive for General Automation With Fieldbus-Interfaces"
- Functional Description -
DOK-ECODR3-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-, Analog- and 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

Changes form previous version:
DOK-ECODR3-DKC.3****-PR03-EN-P**

Where?	**What?**
Chapter 2	Chapter "Important directions for use" included
Technical data DKC and BZM	updated
DKC and BZM	With mains power on dictate ZKS-latching via the connection of L1, L2 and L3
Chapter 4	Chapter "Mains supply options" over-worked
Line filter	Chapter "NFD / NFE line filters" slaked
Attachment	Chapter "Bringing to a safe standstill" slaked
Attachment	Insertion of new construction example

Fig. : Changes

Note: The list may be incomplete. The author withholds the right to make small changes which do not appear in this list.

Contents

Notes

1 Introduction to the System

1.1 Drive package ECODRIVE03

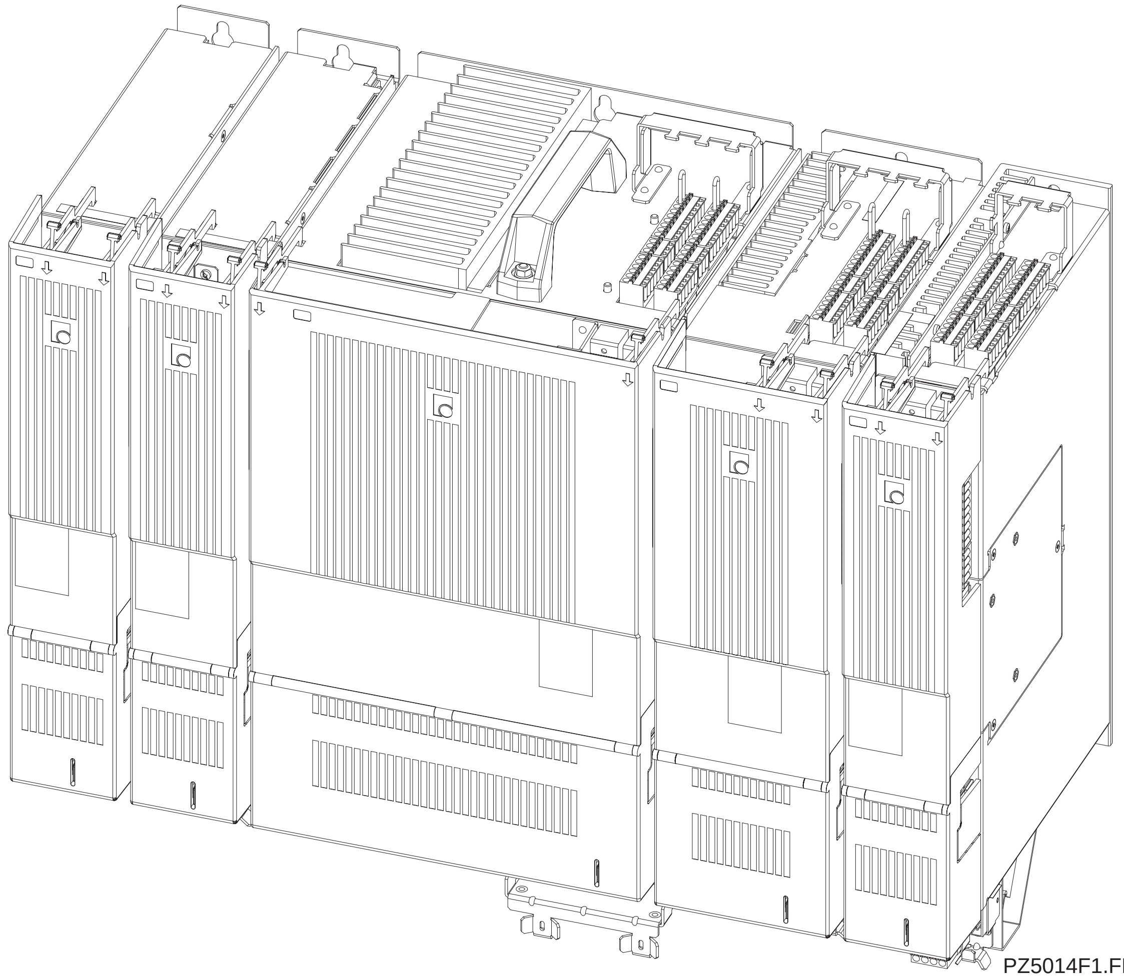


Fig. 1-1: Digital intelligent drive system

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

ECODRIVE 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

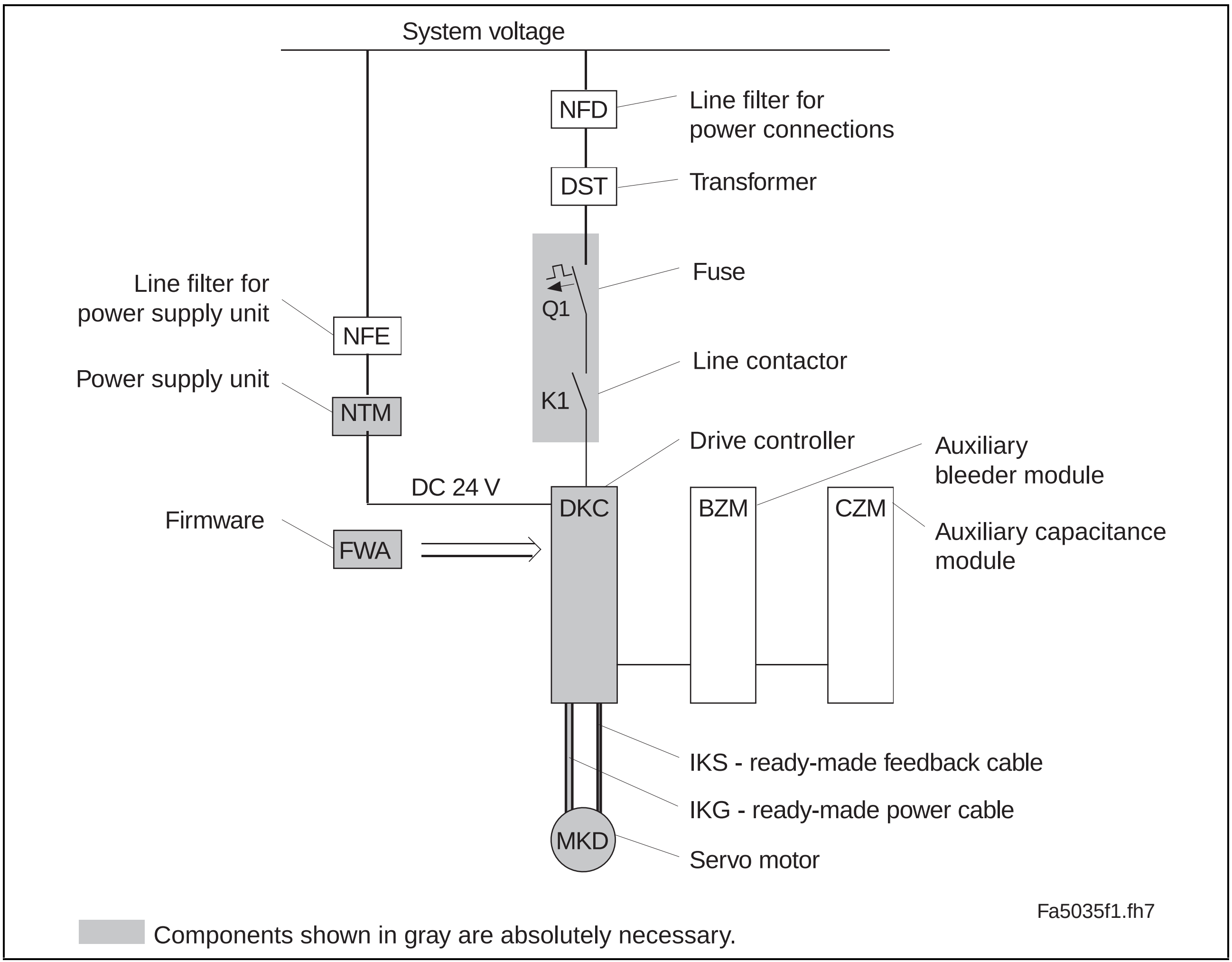


Fig. 1-2: Overview of individual components

1.3 An Overview of Drive Controllers and Auxiliary Components

An Overview of Communications Interfaces

	Device type							
	DKC11.3	DKC01.3	DKC21.3	DKC02.3	DKC03.3	DKC04.3	DKC05.3	DKC06.3
Interface								
RS232 / 485	x	x	x	x	x	x	x	x
Analog Interface	x	x	x	x	x	x	x	x
Parallel Interface		x						
Parallel Interface 2			x					
Stepper Interface		x						
SERCOS Interface				x				
Profibus-DP Interface					x			
InterBus Interface						x		
CANopen Interface							x	
DeviceNet Interface								x

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 or without FDS (2)**	**Sine encoder (3)**	**EnDat encoder (4)**	**Gear-type encoder with 1Vss signals (5)**	**Square-wave encoder with 5V TTL signals (6)**
MKD/MKE		X				
MHD	X					
2AD	X					X
ADF	X					X
1MB			X	X	X	X
MBW	X		X	X	X	X
LAR			X	X		X
LAF			X	X		X
LSF				X		
MBS				X		

Fig. 1-4: Connecting the measuring systems

(1) : single-turn or multi-turn DSF / HSF

(2) : resolver or multi-turn resolver (RSF) with or without feedback data storage (FDS)

(3) : incremental measuring system with sine signals (1Vss signals)

(4) : absolute measuring system with EnDat interface

(5) : gear-type encoder with 1Vss signals

(6) : square-wave encoder with 5V TTL signals -> not recommended!

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 Codes for Drive Controller DKC

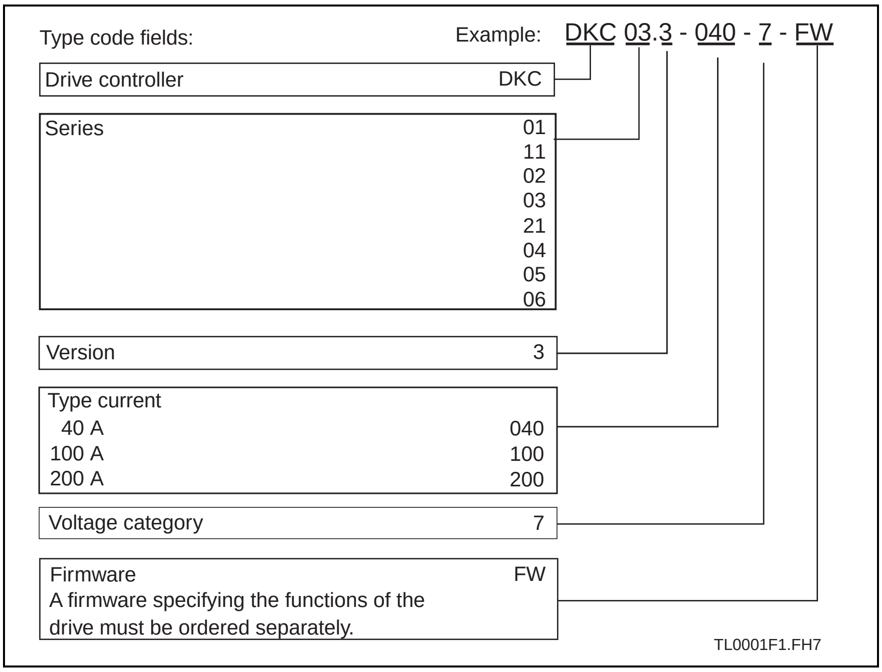


Fig. 1-5: Type codes - DKC

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

Type Codes Auxiliary Bleeder Module BZM

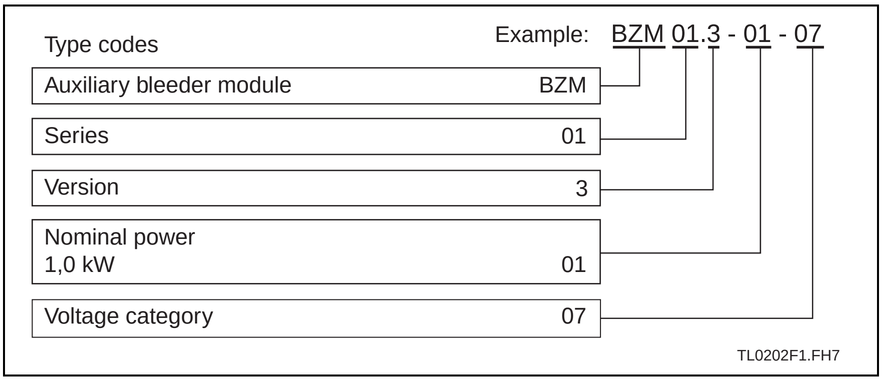


Fig. 1-6: Type Codes

Type Codes for CZM Auxiliary Bleeder Module

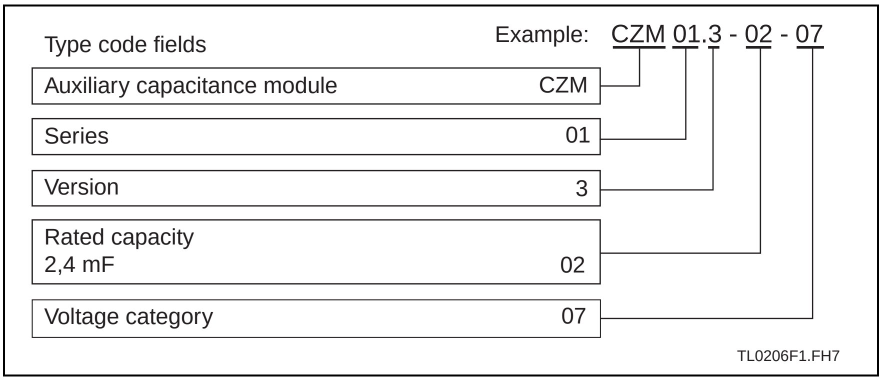


Fig. 1-7: Type Codes

1.4 Overview, Motors

MKD synchronous motor for standard applications

Application:

- general automation technology
- handling systems
- axes that only need to approach fixed positions (no path operation)
- applications with low-precision demands (accuracy of up to approx. 1/20000 of one motor revolution)

Construction:

- motor in a chassis configuration
- motor cooling method: natural convection
  surface cooling is optional for the MKD112

Fig. 1-8: An MKD motor

MHD Synchronous Motors for high-precision applications

Application:

- Automated production with the highest demands for accuracy (up to 1/4000000 of a motor revolution)
- high demands on dynamics
- axes in path operation

Constuction:

- Motor in a chassis configuration
- Motor cooling method: natural convection
  surface cooling is optional for the MHD093, MHD112, MHD115
  liquid cooling is optional for the MHD093, MHD115

Fig. 1-9: An MHD motor

MKE Synchronous Motor for Potentially Explosive Areas

Application:

- potentially explosive areas such as: painting installations, chemical industries in general automation engineering
- applications with low-precision demands (accuracy of up to approx. 1/20000 of one motor revolution)

Construction:

- motor in a chassis configuration
- motor cooling method: natural convection

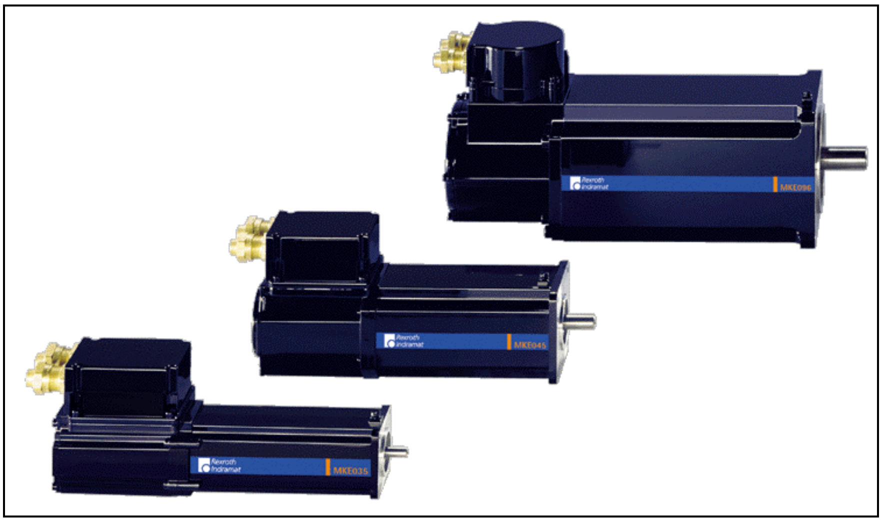


Fig. 1-10: An MKE motor

2AD Asynchronous Motor for Standard Applications

Application:

- main spindle and servo axes in machine tools for drive tasks with high performance demands
- highest demands on accuracy (up to 1/2000000 of a motor revolution)
- axes in path operation

Construction:

- motor in a chassis configuration
- motor cooling method: surface cooled

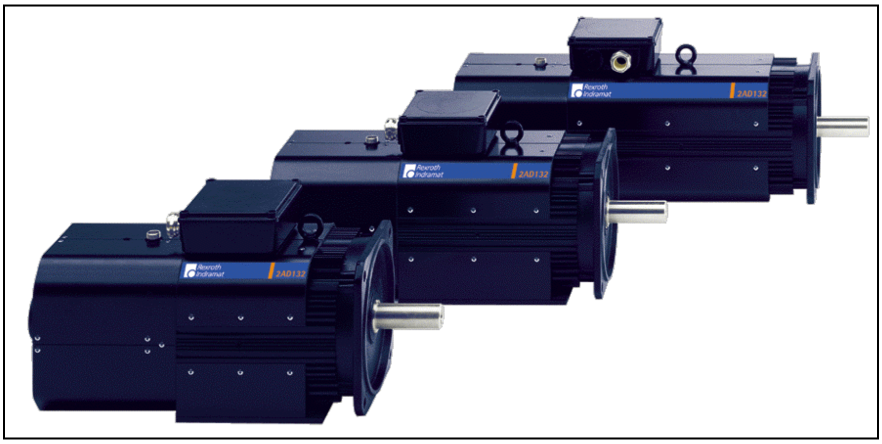


Fig. 1-11: An 2AD motor

ADF Asynchronous Motor for Standard Applications

Application:

- main spindle and servo axes in machine tools for drive tasks with high performance demands
- highest demands on accuracy (up to 1/2000000 of a motor revolution possible)
- axes in path operation

Construction:

- motor in a chassis configuration
- motor cooling method: liquid cooled

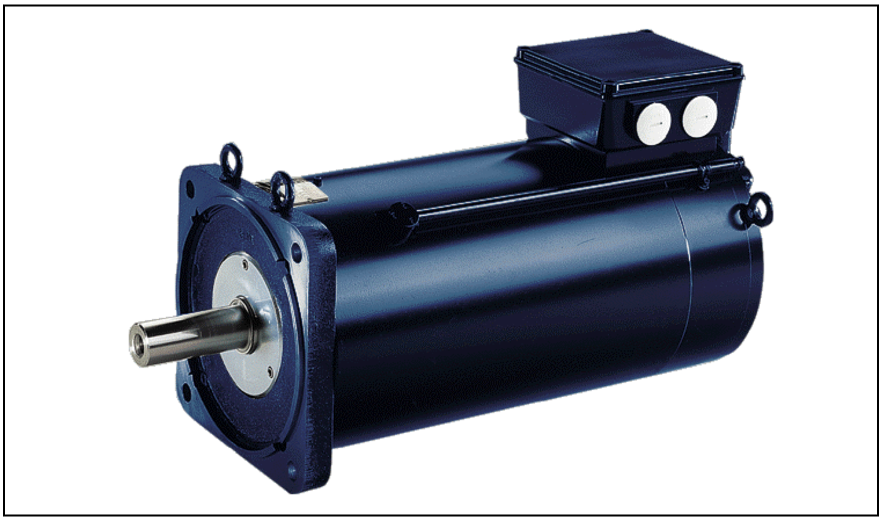


Fig. 1-12: An ADF motor

1MB Asynchronous Assembly Motor

Application:

- compact machine concepts for main spindles and servo axes in lathes, milling machines, grinding machines and processing centers
- for main spindles in high-speed processing
- for drive tasks with high performance demands
- highest demands on accuracy (up to 1/4000000 of a motor revolution possible)
- axes in path operation

Construction:

- motor as assembly kit for integration into the machine components
- motor cooling method: liquid cooled

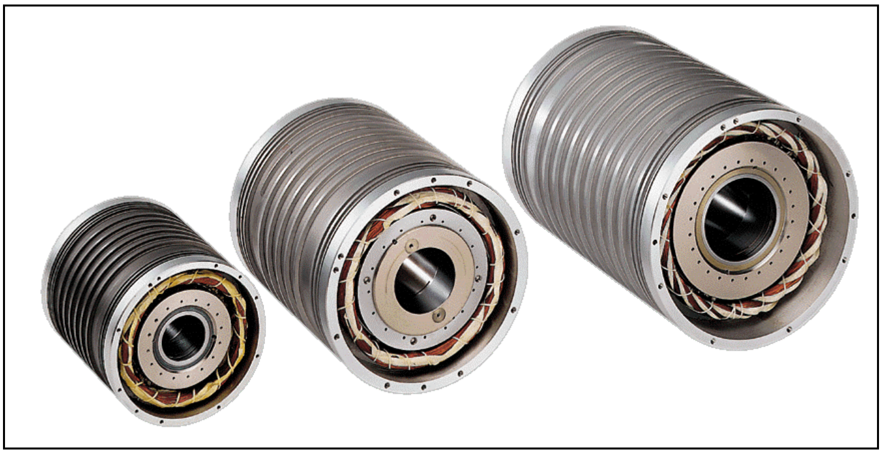


Fig. 1-13: An 1MB motor

MBW Asynchronous Motor for Printing Roller Applications

Application:
- for printing roller applications with high demands for accuracy

Construction:
- motor for mounting directly onto the printing roller
- motor cooling method: liquid cooled

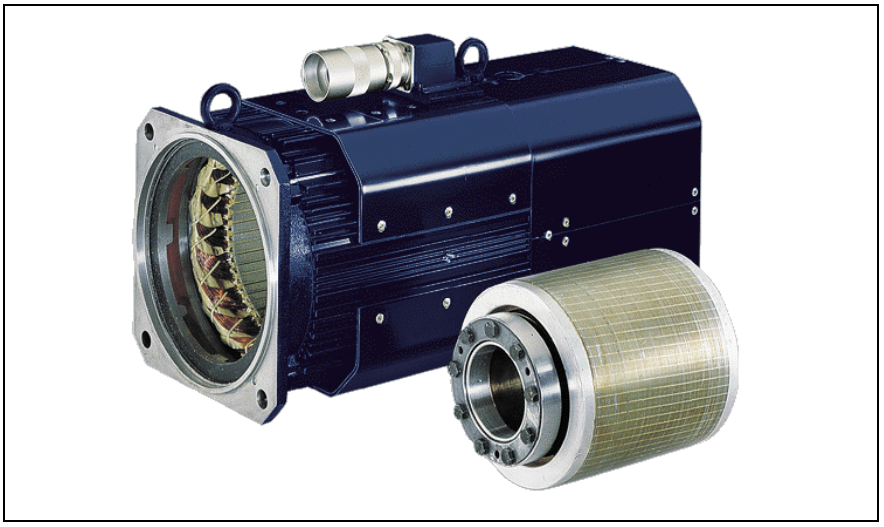


Fig. 1-14: An MBW motor

MBS Synchronous Assembly Motor

Application:
- compact machine concepts for main spindles and servo axes in lathes, milling machines, grinding machines and processing centers
- for main spindles in high-speed processing
- highest demands on accuracy

Construction:
- motor as assembly kit for integration into machine components
- motor cooling method: liquid cooled

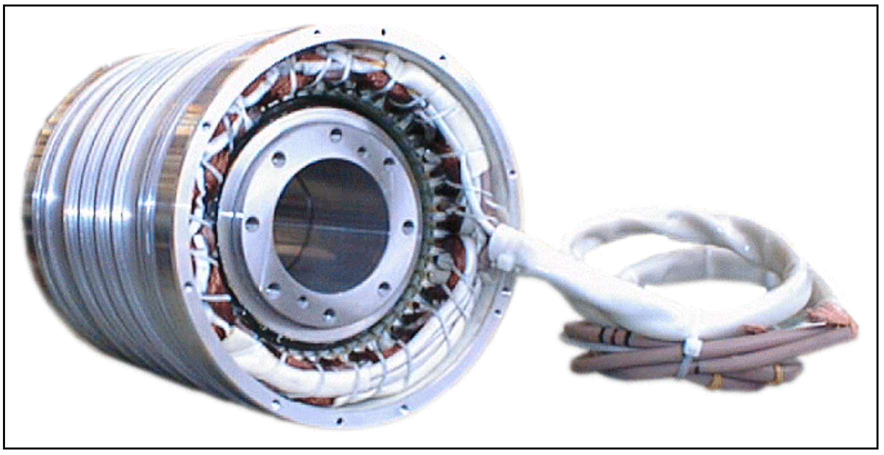


Fig. 1-15: An MBS motor

LAR Linear Asynchronous Motor with Housing

Application:

- for short-stroke motions with high dynamics
- compact machine concepts particularly in the textile industry

Construction:

- housing motor for mounting onto machines
- motor cooling method: surface cooled or liquid cooled

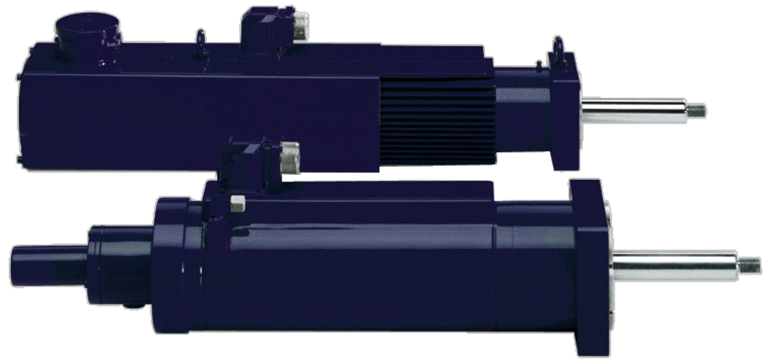


Fig. 1-16: An LAR motor

LAF Linear Asynchronous Assembly Motor

Application:

- For precision applications in new compact machine concepts for main spindles and servo axes in lathes, milling machines, grinding machines and processing centers for use in high-speed processing
- machine concepts in printing, packaging, and sheet metal processing machines
- highest demands on accuracy (less than 0.5 µm possible)

Construction:

- motor as assembly kit for integration into machine components
- motor cooling method: liquid cooled

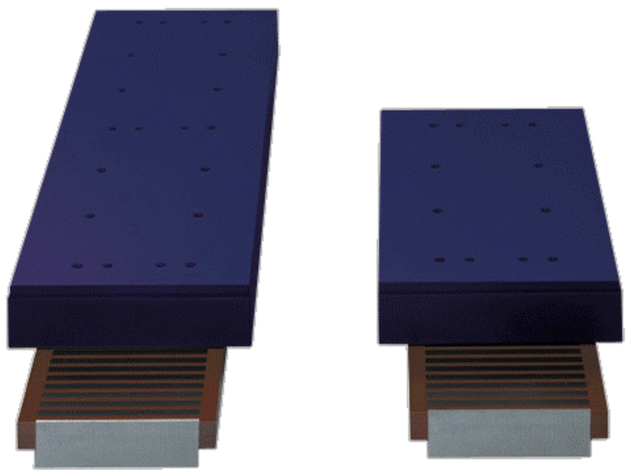


Fig. 1-17: An LAF motor

LSF Linear Synchronous Assembly Motor

Application:

- For precision applications in new compact machine concepts for main spindles and servo axes in lathes, milling machines, grinding machines and processing centers for use in high-speed processing
- machine concepts in printing, packaging, and sheet metal processing machines
- highest demands on accuracy (less than 0.5 µm possible)

Construction:

- motor as assembly kit for integration into machine components
- motor cooling method: liquid cooled

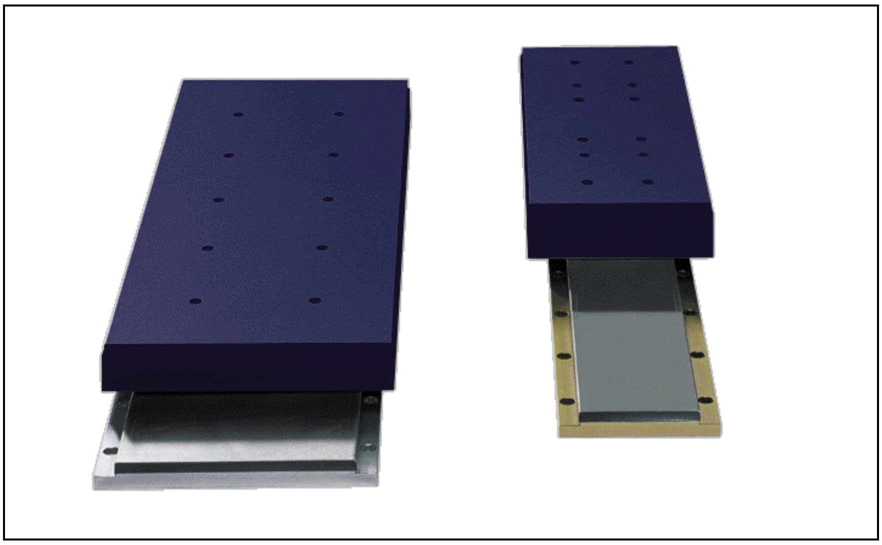


Fig. 1-18: An LSF motor

Notes

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.

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.

Before using Rexroth Indramat products, make sure that all the pre-requisites 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.

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 Servo Drives

3.1 Introduction

Read these instructions before the equipment is used and eliminate the risk of personal injury or property damage. Follow these safety instructions at all times.

Do not attempt to install, use or service 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 product is resold, rented or transferred or passed on to others, then these safety instructions must be delivered with the product.

WARNING

Inappropriate 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 product damage, personal injury, severe electrical shock or death!

3.2 Explanations

The safety warnings in this documentation describe individual degrees of hazard seriousness in compliance with ANSI:

Warning symbol with signal word	**Degree of hazard seriousness** The degree of hazard seriousness describes the consequences resulting from non-compliance with the safety guidelines.
DANGER	Bodily harm or product damage will occur.
WARNING	Death or severe bodily harm may occur.
CAUTION	Death or severe bodily harm may occur.

Fig. 3-1: Classes of danger with ANSI

3.3 Hazards by inappropriate use

DANGER

High voltage and high discharge current! Danger to life, risk of severe electrical shock and risk of injury!

DANGER

Dangerous movements! Danger to life and risk of injury or equipment damage by unintentional motor movements!

WARNING

High electrical voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!

WARNING

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

CAUTION

Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!

CAUTION

Risk of injury due to inappropriate handling! Bodily injury caused by crushing, shearing, cutting and mechanical shock or improper handling of pressurized systems!

CAUTION

Risk of injury due to inappropriate handling of batteries!

3.4 General Information

- Rexroth Indramat GmbH is not liable for damages resulting from failure to observe the warnings given in these documentation.
- Order operating, maintenance and safety instructions in your language before starting up the machine. If you find that due to a translation error you can not 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.
- Trained and qualified personnel in electrical equipment:
  Only trained and qualified personnel may work on this equipment or within its proximity. Personnel are qualified if they have sufficient knowledge of the assembly, installation and operation of the product as well as an understanding of all warnings and precautionary measures noted in these instructions.
  Furthermore, they should be trained, instructed and qualified to switch electrical circuits and equipment on and off, to ground them and to mark them according to the requirements of safe work practices and common sense. 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 on commercial machinery.

European countries: see directive 89/392/EEC (machine guideline).

- The ambient conditions given in the product documentation must be observed.
- Use only safety features that are clearly and explicitly approved in the Project Planning manual.
  For example, the following areas of use are not allowed: Construction cranes, Elevators used for people or freight, Devices and vehicles to transport people, Medical applications, Refinery plants, the transport of hazardous goods, Radioactive or nuclear applications, Applications sensitive to high frequency, mining, food processing, Control of protection equipment (also in a machine).
- Start-up is only permitted once it is sure that the machine, in which the product is installed, complies with the requirements of national safety regulations and safety specifications of the application.
- 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 INDRAMAT document "EMC in Drive and Control Systems”.
  The machine builder is responsible for compliance with the limiting values as prescribed in the national regulations and specific EMC regulations for the application.

European countries: see Directive 89/336/EEC (EMC Guideline).

U.S.A.: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must consult the above noted items at all times.

- 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 with voltages above 50 Volts.

Making contact with parts conducting voltages above 50 Volts could be dangerous to personnel and cause an electrical shock. When operating electrical equipment, it is unavoidable that some parts of the unit conduct dangerous voltages.

DANGER

High electrical voltage! Danger to life, severe electrical shock and severe bodily injury!

⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain or repair this equipment.

⇒ Follow general construction and safety regulations when working on electrical 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 if the ground wire is not permanently connected, even for brief measurements or tests.

⇒ Before working with electrical parts with voltage potentials higher than 50 V, the equipment must be disconnected from the mains voltage or power supply.

⇒ The following should be observed with electrical drives, power supplies, and filter components:

Wait five (5) minutes after switching off power to allow capacitors to discharge before beginning work. Measure the voltage on the capacitors before beginning work to make sure that the equipment is safe to touch.

⇒ 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 (r.c.d.) must not be used on an electric drive! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.

⇒ Equipment that is built into machines must be secured against direct contact. Use appropriate housings, for example a control cabinet.

European countries: according to EN 50178/1998, section 5.3.2.3.

U.S.A: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA) and local building codes. The user of this equipment must observe the above noted instructions at all times.

To be observed with electrical drives, power supplies, and filter components:

DANGER

High electrical voltage! High leakage current! Danger to life, danger of injury and bodily harm from electrical shock!

⇒ Before switching on power for electrical units, all housings and motors must be permanently grounded according to the connection diagram. This applies even for brief tests.

⇒ Leakage current exceeds 3.5 mA. Therefore the electrical equipment and units must always be firmly connected to the supply network.

⇒ Use a copper conductor with at least 10 mm² cross section over its entire course for this protective connection!

⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. High voltage levels can occur on the housing that could lead to severe electrical shock and personal injury.

European countries: EN 50178/1998, section 5.3.2.1.

USA: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must maintain the above noted instructions at all times.

3.6 Protection by protective low voltage (PELV) against electrical shock

All connections and terminals with voltages between 5 and 50 Volts on INDRAMAT products are protective low voltages designed in accordance with the following standards on contact safety:

- International: IEC 364-4-411.1.5
- EU countries: see EN 50178/1998, section 5.2.8.1.

WARNING

High electrical voltage due to wrong connections! Danger to life, severe electrical shock and severe bodily injury!

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

⇒ Only safely isolated voltages and electrical circuits may be connected. 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 or the connected motors. These causes are be various such as:

- unclean or wrong wiring of cable connections
- inappropriate or wrong operation of equipment
- malfunction of sensors, encoders and monitoring circuits
- defective components
- software errors

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

The monitors in the drive components make faulty operation almost impossible. Regarding personnel safety, especially the danger of bodily harm and property damage, this alone should not be relied upon to ensure complete safety. Until the built-in monitors become active and effective, it must be assumed in any case that some faulty drive movements will occur. The extent of these faulty drive movements depends upon the type of control and the state of operation.

DANGER

Dangerous movements! Danger to life and risk of injury or equipment damage!

⇒ Personnel protection must be secured for the above listed reason by means of superordinate monitors or measures.

These are instituted in accordance with the specific situation of the facility and a danger and fault analysis conducted by the manufacturer of the facility. All the safety regulations that apply to this facility are included therein. By switching off, circumventing or if safety devices have simply not been activated, then random machine movements or other types of faults can occur.

Avoiding accidents, injury or property damage:

⇒ Keep free and clear of the machine's range of motion and moving parts. Prevent people from accidentally entering the machine's range of movement:

- use protective fences
- use protective railings
- install protective coverings
- install light curtains or light barriers

⇒ Fences must be strong enough to withstand maximum possible momentum.

⇒ Mount the emergency stop switch (E-stop) 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 start-inhibit system to prevent unintentional start-up.

⇒ Make sure that the drives are brought to standstill before accessing or entering the danger zone.

⇒ 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

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

⇒ 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

⇒ Avoid operating high-frequency, remote control and radio equipment near electronics circuits and supply leads. If use of such equipment cannot be avoided, verify the system and the plant for possible malfunctions at all possible positions of normal use before the first start-up. If necessary, perform a special electromagnetic compatibility (EMC) test on the plant.

3.8 Protection against magnetic and electromagnetic fields during operations and mounting

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

WARNING

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

⇒ Persons with pacemakers, metal implants and hearing aids are not permitted to enter 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 pacemaker to enter such an area, then a physician must be consulted prior to doing so. Pacemaker, that are already implanted or will be implanted in the future, have a considerable deviation in their resistance to interference. Due to the unpredictable behavior 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

CAUTION

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

⇒ Do not touch surfaces near the source of heat! Danger of burns!

⇒ Wait ten (10) minutes before you access any hot unit. Allow the unit to cool down.

⇒ Do not touch hot parts of the equipment, such as housings, heatsinks or resistors. Danger of burns!

3.10 Protection during handling and installation

Under certain conditions unappropriate handling and installation of parts and components may cause injuries.

CAUTION

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

⇒ Observe general instructions and safety regulations during handling installation.

⇒ Use only appropriate lifting or moving equipment.

⇒ Take precautions to avoid pinching and crushing.

⇒ Use only appropriate tools. If specified by the product documentation, special tools must be used.

⇒ Use lifting devices and tools correctly and safely.

⇒ Wear appropriate protective clothing, e.g. safety glasses, safety shoes and safety gloves.

⇒ Never stay under suspended loads.

⇒ Clean up liquids from the floor immediately to prevent personnel from slipping.

3.11 Battery safety

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

CAUTION

Risk of injury through incorrect handling!

⇒ Do not attempt to reactivate discharged batteries by heating or other methods (danger of explosion and corrosion).

⇒ Never charge batteries (danger from leakage and explosion).

⇒ Never throw batteries into a fire.

⇒ Do not dismantle batteries.

⇒ Handle with care. Incorrect extraction or installation of a battery can damage equipment.

Note: Environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air and sea transport in the sense of the legal requirements (danger of explosion). Dispose batteries separately from other refuse. Observe the legal requirements given in the country of installation.

3.12 Protection against pressurized Systems

Certain Motors (ADS, ADM, 1MB etc.) and drives, corresponding to the information in the Project Planning manual, must be provided with and remain under a forced load such as compressed air, hydraulic oil, cooling fluid or coolant. In these cases, improper handling of the supply of the pressurized systems or connections of the fluid or air under pressure can lead to injuries or accidents.

CAUTION

Danger of injury when pressurized systems are handled by untrained personnel!

⇒ Do not attempt to disassemble, to open or to cut a pressurized system.

⇒ Observe the operation restrictions of the respective manufacturer.

⇒ Before the disassembly of pressurized systems, lower pressure and drain off the fluid or gas.

⇒ Use suitable protective clothing (for example protective eyewear, safety shoes and gloves)

⇒ Remove any fluid that has leaked out onto the floor immediately.

Note: Environmental protection and disposal! The fluids used in the operation of the pressurized system equipment is not environmentally compatible. Fluid that is damaging to the environment must be disposed of separate from normal waste. Observe the national specifications of the country of installation.

4 ECODRIVE03 DKC Drive Controller

4.1 Technical Data

Dimensions

Drive Controller DKC.3-040-7-FW**

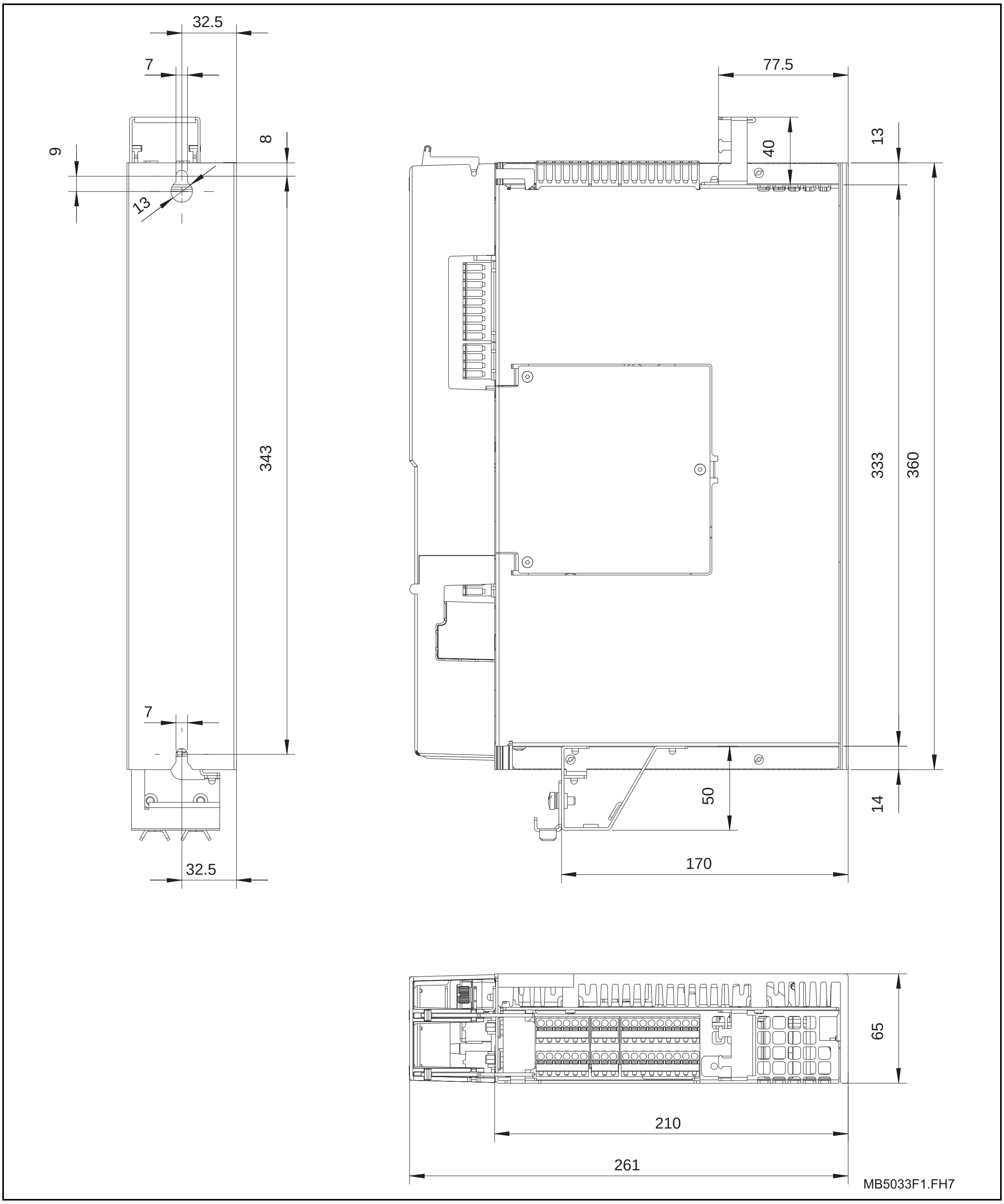


Fig. 4-1: Drive Controller DKC**.3-040-7-FW

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

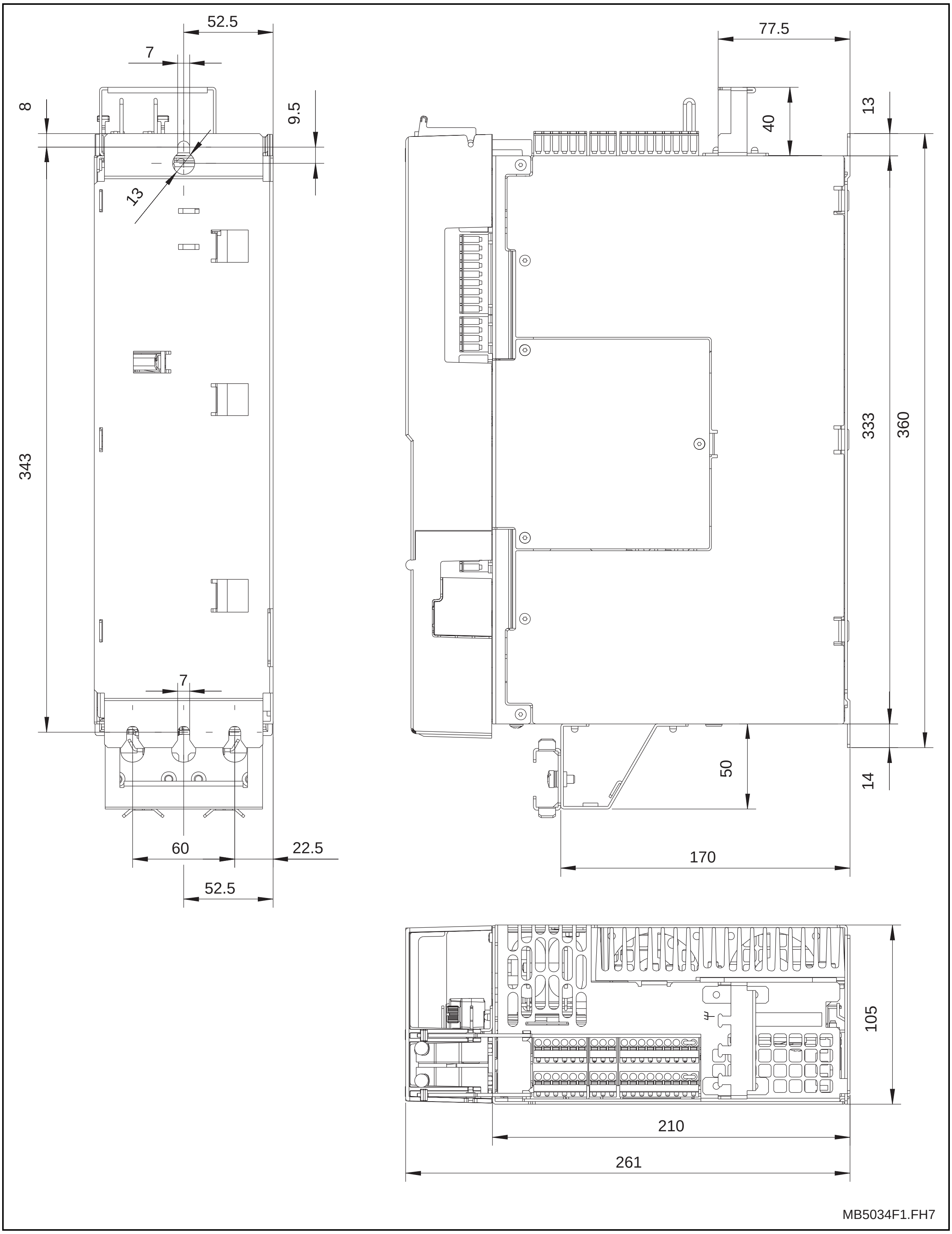


Fig. 4-2: Drive Controller DKC**.3-100-7-FW

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

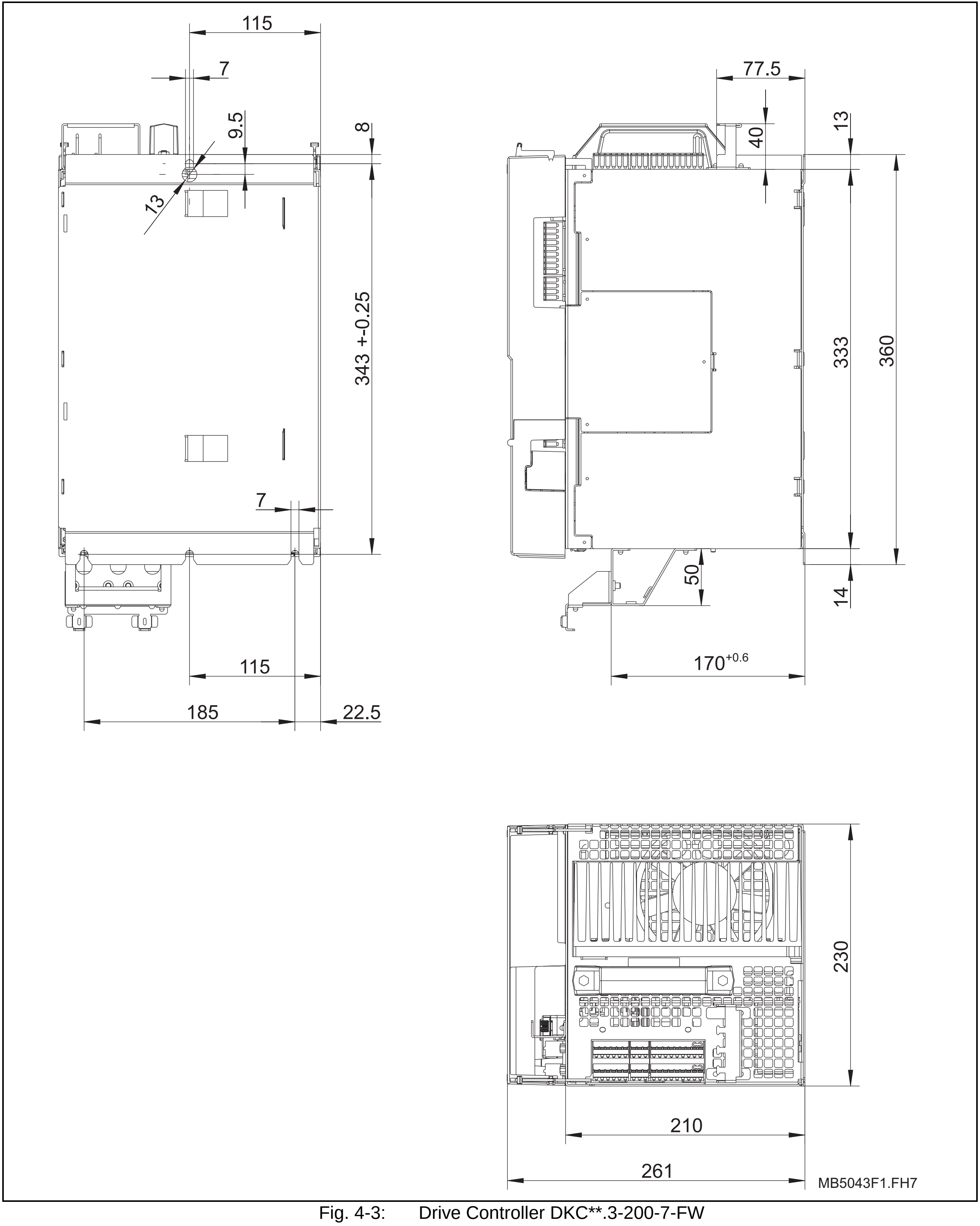


Fig. 4-3: Drive Controller DKC**.3-200-7-FW

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.

The selection lists apply to motors and drives within the specified ambient and operating conditions (see "Fig. 4-5: Ambient and operating conditions").

The following performance specifications of the drive are reduced if conditions deviate:

- allowed DC bus continuous output
- continuous bleeder output

of the motor:

- output
- continuous torque at standstill
- S1 continuous torque
- Short-time operating torque M_{KB}

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.

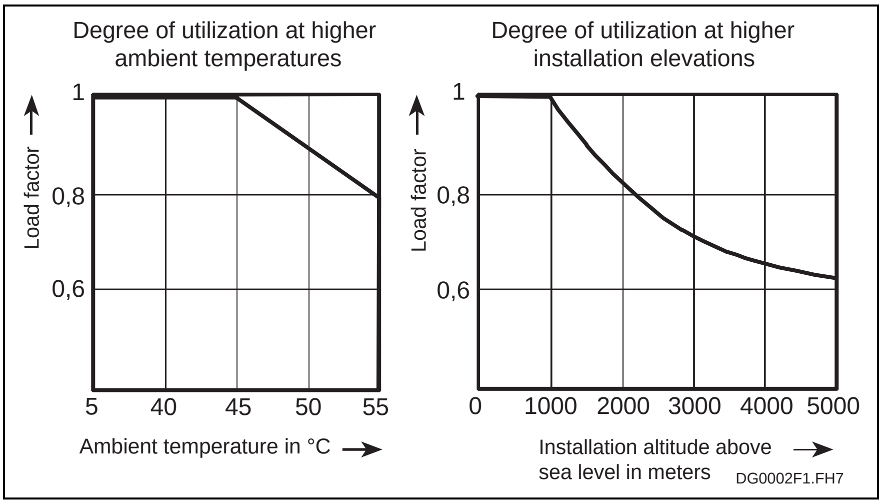


Fig. 4-4: Degree of utilization as a value dependent on ambient temperature and installation altitude

Designation	Symbol	Unit	DKC**.3-***-7-FW
Permissible ambient and air inlet temperature for the output ratings	T_A	°C	+5 ... +45
Max. permissible ambient and air inlet temperature for reduced output ratings	T_A	°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
Storage and shipping temperatures	T_L	°C	-30 ... +85
Max. installation altitude for the output ratings		m	1000
Max. permissible relative humidity		%	95
Max. permissible absolute humidity		g/m³	25
Allowable degree of contamination	2, according to EN 50178 fine dust no allowed, no condensation		
Type of protection	IP20, according to EN 60529 = DIN VDE 0470-1-1992 (ICE 529-1989)		
Vibration sinus in operation according to EN 60068-2-6			
Amplitude and Frequency			0.3 mm (peak-to-peak) at 5 ... 57 Hz 2 g at 57 ... 500 Hz
Tolerance		%	± 15
Vibration distortion (Random) in operation according to IEC 68-2-36			
Frequency		Hz	20 ... 500
Spectral acceleration density amplitude		g^2/Hz	0.01
Tolerance		dB	± 3
Virtual value (r.m.s.) of the total acceleration		g	2.2
Shock check not in operation according to EN 60068-2-27			
Halve sine in 3 axis			15 g / 11 ms

Fig. 4-5: Ambient and operating conditions

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**.3-040-7-FW		DKC**.3-100-7-FW	
Operating mode at the mains			single phase	three phase	single phase	three phase
Mains input voltage	U_{N1}	V	1 x AC	3 x AC	1 x AC	3 x AC
			(200 ... 480) ± 10%		(200 ... 480) ± 10%	
Mains frequency	f_{N1}	Hz	(50 ... 60) ± 2			
Connected load	S_{N1}	kVA	see page 10-1: "Mains Connections"			
Nominal charging current (dependent on mains input voltage)	I_{EIN1}	A	5 ... 12		12 ... 28	
soft-start resistor	$R_{Softstart}$	Ohm	60		24	
continuous power soft-start resistor	$P_{Softstart}$	kW	0.15 2)		0.5 3)	
Switching frequency (selectable)	f_S	kHz	4 or 8			
Type current = peak current 1	I_{PEAK1}	A	40 1)		100 1)	
Peak current 2 for f_S = 4kHz	$I_{PEAK2(4kHz)}$	A	16 1)		40 1)	
Peak current 2 for f_S = 8kHz	$I_{PEAK2(8kHz)}$	A	12.5 1)		32 1)	
Continuous current 1 for f_S = 4kHz	$I_{CONT1(4kHz)}$	A	13 1)		32 1)	
Continuous current 2 for f_S = 4kHz	$I_{CONT2(4kHz)}$	A	16 1)		40 1)	
Continuous current 1 for f_S = 8kHz	$I_{CONT1(8kHz)}$	A	9 1)		21 1)	
Continuous current 2 for f_S = 8kHz	$I_{CONT2(8kHz)}$	A	12.5 1)		32 1)	
Max. output frequency at f_S=4kHz	f_{out}	Hz	400		400	
Max. output frequency at f_S=8kHz	f_{out}	Hz	800		800	
Device power dissipation without internal continuous bleeder power for I_{CONT2}	P_V	W	180 (see page 11-1: "Power dissipation")		420	
Peak bleeder power DKC when U_{ZW} = 850V for permissible load cycle	P_{BS}	kW	10 0.5 s on, 33 s off		120 0.25 s on, 60 s off	
Continuous bleeder power DKC when Ta≤45°C under max. temperature range with distance	P_{BD} ΔT d	KW K mm	0.15 28 80		0.5 150 80	
Max. energy dissipation	W_{MAX}	kWs	5.0		31	
Max. DC bus charge	W_{MAX}	kWs	5.0		31	
Internal DC bus dynamic brake (ZKS)			not present		present	
Resistor for ZKS	R_{ZKS}	Ohm	not present		6	
Storable energy of the DC bus capacitors	W_{ZW}	Ws	see diagrams page 4-15: "Storable energy in the bus"			
nominal DC bus capacitance DKC	C_{ZW}	mF	0.27		0.675	
DC bus voltage (dependent on mains input voltage)	U_{ZW}	V	DC 300 ... 800			
DC bus continuous power (dependent on mains input voltage)	P_{ZW}		see diagrams page 4-27 "Allowed DC bus continuous power"			

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 x AC 400V, at Ta≤45°C	P_{ZW}	kW	1.3	3.3
max. DC bus continuous power for a single source supply where U_{N1} = 3 x AC 480V, when Ta≤45°C	P_{ZW}	kW	1.5	4
max. DC bus continuous power for a single source supply where U_{N1} = 3 x AC 400V, CZM01.3, when Ta≤45°C	P_{ZW}	kW	1.3	10.5
max. DC bus continuous power for a single source supply where U_{N1} = 3 x AC 480V, CZM01.3, when Ta≤45°C	P_{ZW}	kW	1.5	12
Power section cooling			with internal blower	
Cooling the bleeder resistor			with internal blower via heatsink and backwall of unit	with internal blower
Cooling air flow			together for bleeder and power section	
Volumetric capacity of the forced cooling		m³/h	approx. 24	approx. 48
Insulation resistance at DC500V	R_{is}	MOhm	>8	>8
Coupling capacitance power section against housing	C_{Kop}	nF	200	200

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

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

Designation	Symbol	Unit	DKC**.3-200-7-FW	
Operating mode at the mains			single phase	three phase
Mains input voltage	U_{N1}	V	1 x AC	3 x AC
			(200 ... 480) ± 10%	
Mains frequency	f_{N1}	Hz	(50 ... 60) ± 2	
Connected load	S_{N1}	kVA	see page 10-1: "Mains Connections"	
Nominal charging current (dependent on mains input voltage)	I_{EIN}	A	12 ... 28	
soft-start resistor	$R_{Softstart}$	Ohm	24	
continuous power soft-start resistor	$P_{Softstart}$	kW	1 3)	
Switching frequency (selectable)	f_S	kHz	4 or 8	
Type current = peak current 1	I_{PEAK1}	A	200 1)	
Peak current 2 for f_S = 4kHz	$I_{PEAK2(4kHz)}$	A	100 1)	
Peak current 2 for f_S = 8kHz	$I_{PEAK2(8kHz)}$	A	68 1)	
Continuous current 1 for f_S = 4kHz	$I_{CONT1(4kHz)}$	A	85 1)	
Continuous current 2 for f_S = 4kHz	$I_{CONT2(4kHz)}$	A	100 1)	
Continuous current 1 for f_S = 8kHz	$I_{CONT1(8kHz)}$	A	48 1)	
Continuous current 2 for f_S = 8kHz	$I_{CONT2(8kHz)}$	A	68 1)	
Max. Output frequency at f_S=4kHz	f_{out}	Hz	400	
Max. Output frequency at f_S=8kHz	f_{out}	Hz	800	
Device power dissipation without internal continuous bleeder power for I_{CONT2}	P_V	W	960 (see page 11-1: "Power dissipation")	
Peak bleeder power DKC when U_{ZW} = 850V for permissible load cycle	P_{BS}	kW	120 0.5 s on, 60 s off	
Continuous bleeder power DKC when Ta≤45°C under max. temperature range with distance	P_{BD} ΔT d	KW K mm	1,00 100 80	
Max. energy dissipation	$W_{MAX,}$	kWs	60	
Max. DC bus charge	$W_{MAX,}$	kWs	60	
Internal DC bus dynamic brake (ZKS)			present	
Resistor for ZKS	R_{ZKS}	Ohm	6	
Storable energy of the DC bus capacitors	$W_{ZW,}$	Ws	see diagrams page 4-15: "Storable energy in the bus"	
nominal DC bus capacitance DKC	C_{ZW}	mF	1.5	
DC bus voltage (dependent on mains input voltage)	U_{ZW}	V	DC 300 ... 800	
DC bus continuous power (dependent on mains input voltage)	P_{ZW}		see diagrams page 4-27 "Allowed DC bus continuous power"	

Designation	Symbol	Unit	DKC**.3-200-7-FW
max. DC bus continuous power for a single source supply where U_{N1} = 3 x AC 400V, at Ta≤45°C	P_{ZW}	kW	10.3
max. DC bus continuous power for a single source supply where U_{N1} = 3 x AC 480V, when Ta≤45°C	P_{ZW}	kW	12
max. DC bus continuous power for a single source supply where U_{N1} = 3 x AC 400V, plus smoothing choke and CZM01.3, at Ta≤45°C	P_{ZW}	kW	24
max. DC bus continuous power for a single source supply where U_{N1} = 3 x AC 480V, plus smoothing choke and CZM01.3, at Ta≤45°C	P_{ZW}	kW	27
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_{is}	MOhm	>25
Coupling capacitance power section against housing	C_{Kop}	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_B).

3) Softstart resistor is used after softstart as bleeder (R_B) and DC bus short-circuit resistor (R_{ZKS}).

Block diagram of the DKC**.3 power section

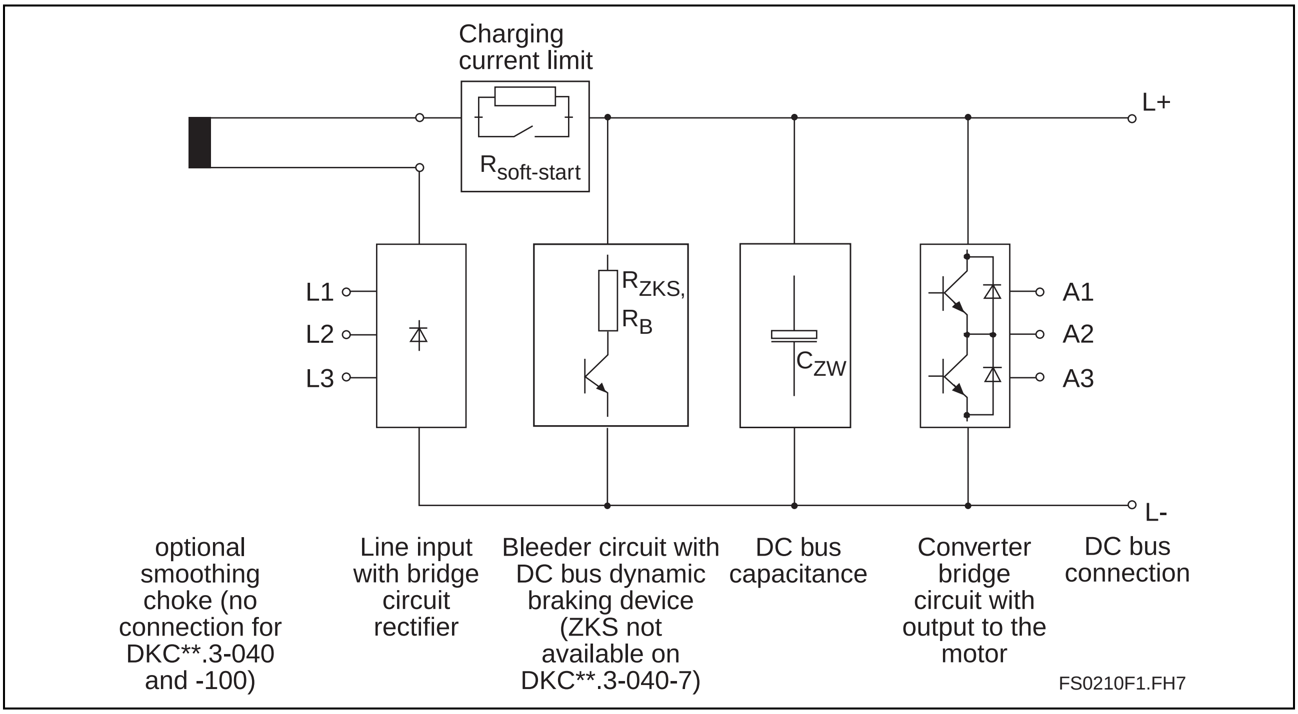


Fig. 4-8: Block diagram of the DKC**.3 power section

Control voltage connection for DKC

(Data applies to ambient temperature of 25°C)

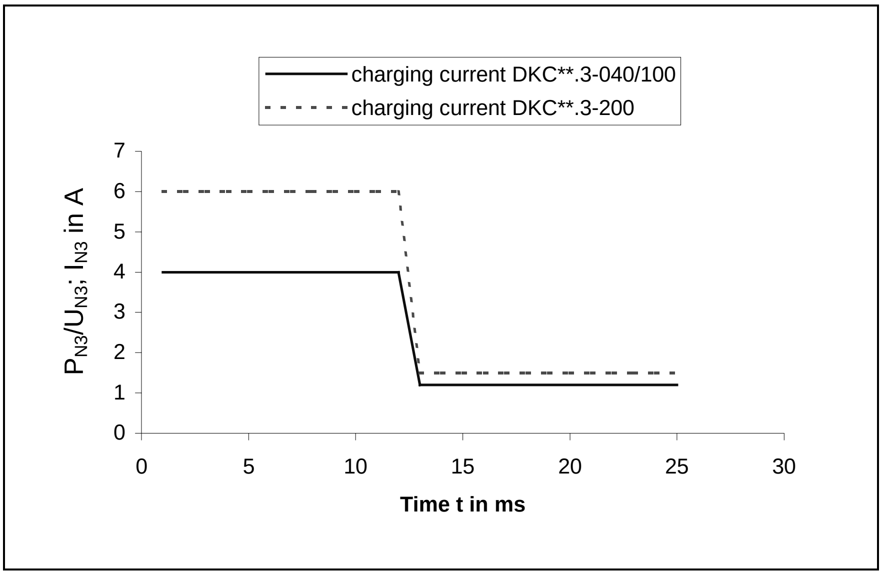
Designation		Symbol	Unit	DKC**.3-040-7-FW	DKC**.3-100-7-FW
Control voltage		U_{N3}	V	DC (19.2 ... 28.8) V	
max. ripple effect		w		may not exceed input voltage range	
max. charging current		I_{EIN3}	A	4.0 (see diagram "Amplitude of the DKC control voltage charging current at startup, to selecting power source")	
max. pulse duration of I_{EIN3}		t_{N3Lade}	ms	12 (see diagram "Amplitude of the DKC control voltage charging current at startup, to selecting power source")	
max. input capacitance		C_{N3}	mF	0.9 * 1.2	0.9 * 1.2
Power consumption (X1)		dependent on type of unit, without external load at control outputs			
	DKC11.3	P_{N3}	W	18	23
	DKC21.3	P_{N3}	W	20	25
	DKC01.3	P_{N3}	W	19	24
	DKC02.3	P_{N3}	W	19	24
	DKC03.3	P_{N3}	W	20	25
	DKC04.3	P_{N3}	W	21	26
	DKC05.3	P_{N3}	W	20	25
	DKC06.3	P_{N3}	W	20	25

Fig. 4-9: Control voltage connection for DKC

Designation		Symbol	Unit	DKC**.3-200-7-FW
Control voltage		U_{N3}	V	DC (19.2 ... 28.8) V
max. ripple effect		w		may not exceed input voltage range
max. charging current		I_{EIN3}	A	6.0
max. pulse duration of I_{EINmax}		t_{N3Lade}	ms	9
max. input capacitance		C_{N3}	mF	1.0 * 1.2
Power consumption (X1)		dependent on type of unit, without external load at control outputs		
	DKC11.3	P_{N3}	W	26
	DKC21.3	P_{N3}	W	28
	DKC01.3	P_{N3}	W	27
	DKC02.3	P_{N3}	W	27
	DKC03.3	P_{N3}	W	28
	DKC04.3	P_{N3}	W	29
	DKC05.3	P_{N3}	W	28
	DKC06.3	P_{N3}	W	28

Fig. 4-10: Control voltage connection for DKC

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



P_{N3}: Power consumption
U_{N3}: Control voltage
I_{N3}: Current consumption after charging current inrush

Fig. 4-11: 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_{HB}	V	depends on motor type, listed in motor project planning manual		
Ripple content	w	%			
Current consumption	I_{HB}	A			

Fig. 4-12: 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. 4-13: Materials used, Mass

Output current characteristic curves for servo applications (acceleration times ≤ 400 ms)

Static profile illustrated:

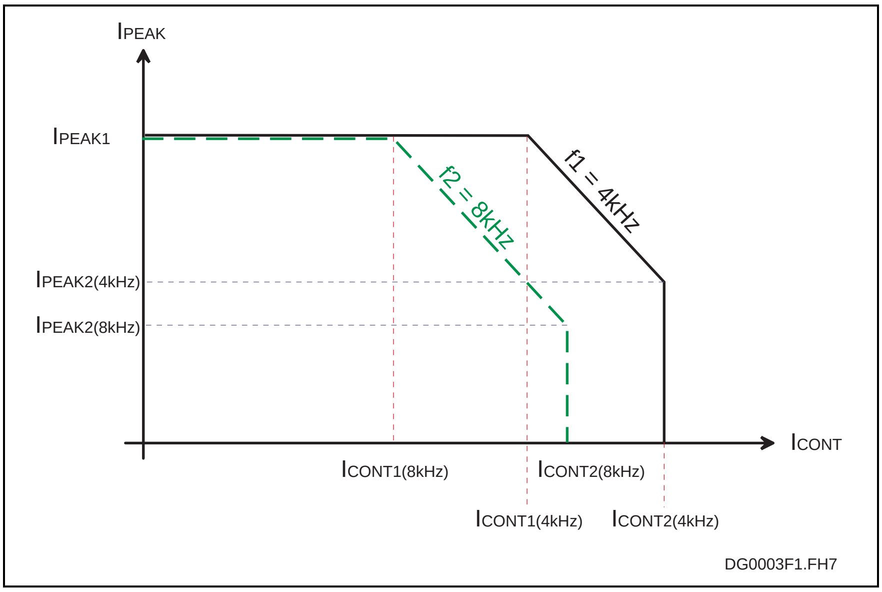


Fig. 4-14: Output current characteristic curves for servo applications

Output current characteristic curves for servo applications (acceleration times ≧ 400 ms)

The dynamic profile of the output current limit is illustrated using a temperture model **without** initial conditions, as a response to a sudden torque change at the motor.

Note: For electrical rotary field frequency < 3 Hz

(Mechanical speed * number of pole pairs)

- peak current available for only about 10% of shown time,

- output current tends to continuous current 1 (see table on page 4-6: "Electric Data of the Individual DKC**.3 Components").

Rexroth Indramat

DKC.3-040-7-FW**

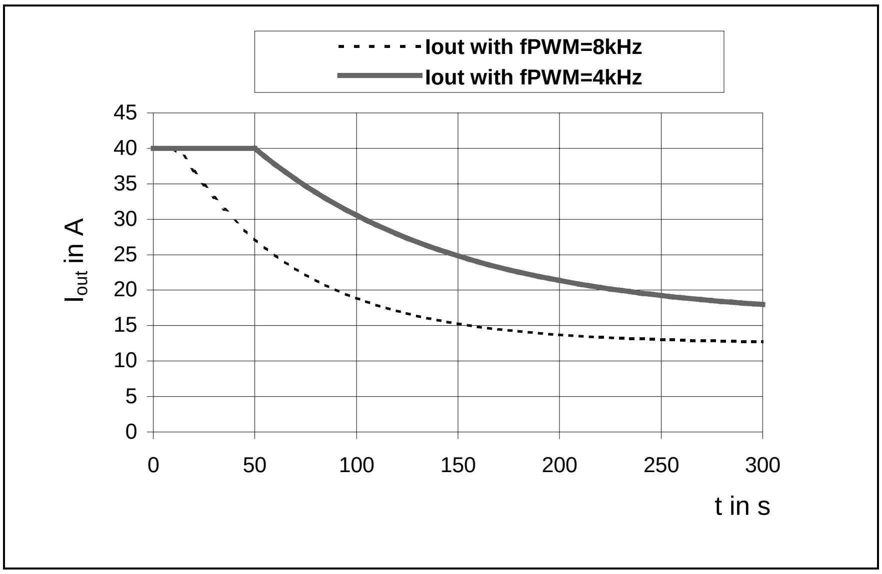


Fig. 4-15: Output current characteristics for DKC**.3-040-7 at 4kHz and 8kHz

DKC.3-100-7-FW**

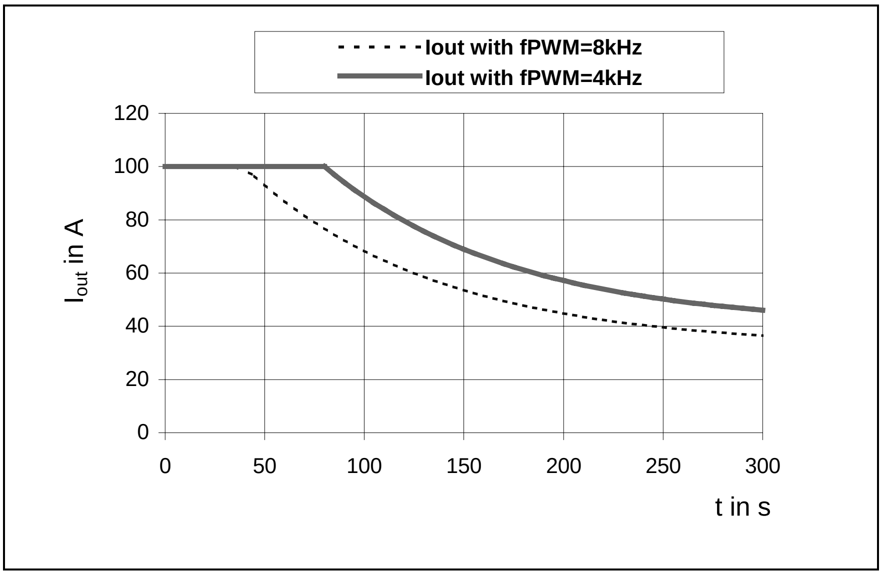


Fig. 4-16: Output current characteristics for DKC**.3-100-7 at 4kHz and 8kHz

DKC.3-200-7-FW**

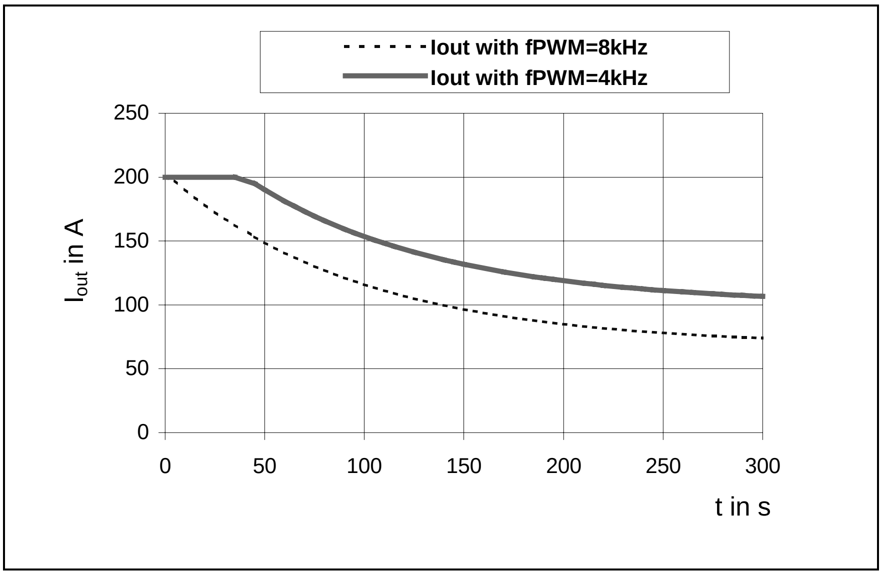


Fig. 4-17: Output current characteristics for DKC**.3-200-7 at 4kHz and 8kHz

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.

DKC.3-040-7-FW**

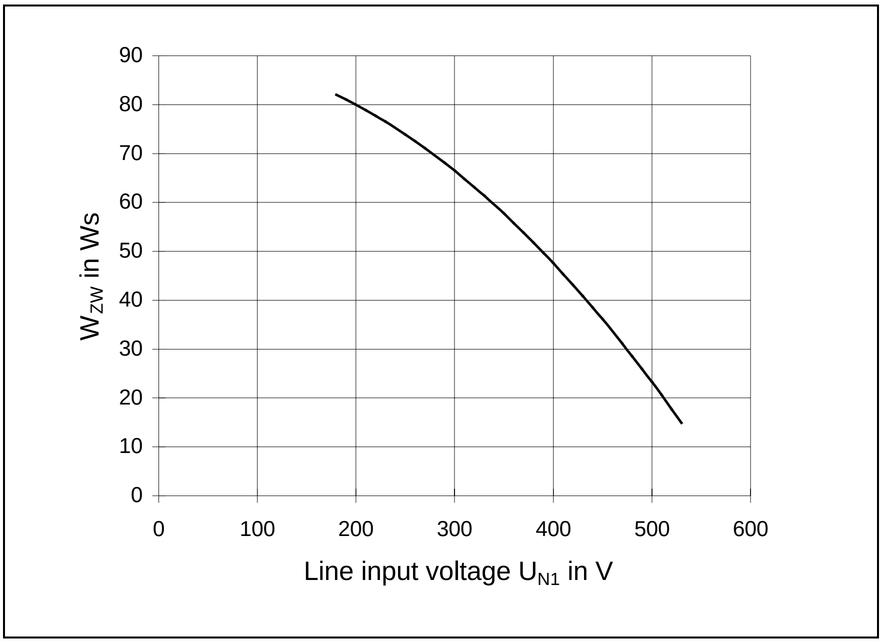


Fig. 4-18: Storable energy in the bus DKC**.3-040-7-FW

DKC.3-100-7-FW**

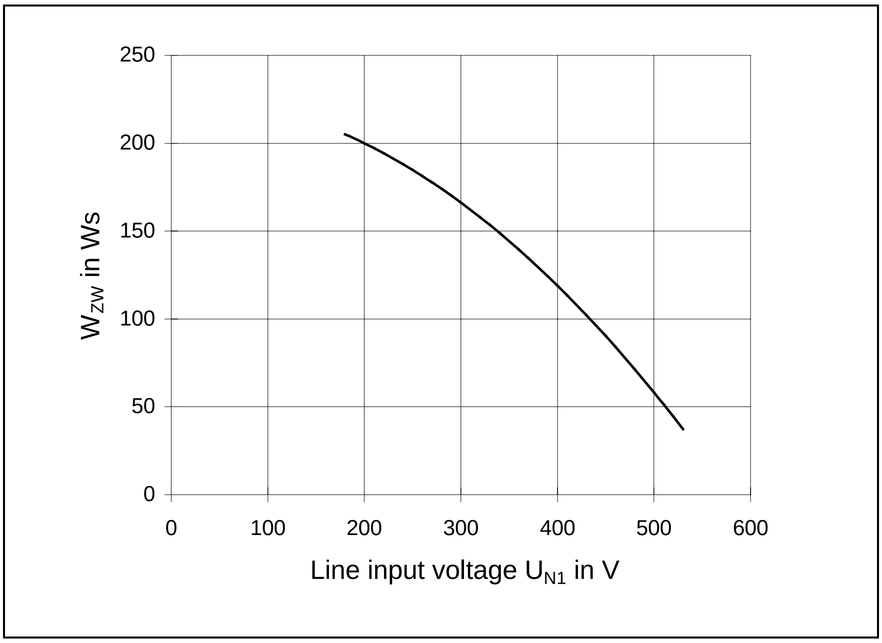


Fig. 4-19: Storable energy in the bus DKC**.3-100-7-FW

DKC.3-200-7-FW**

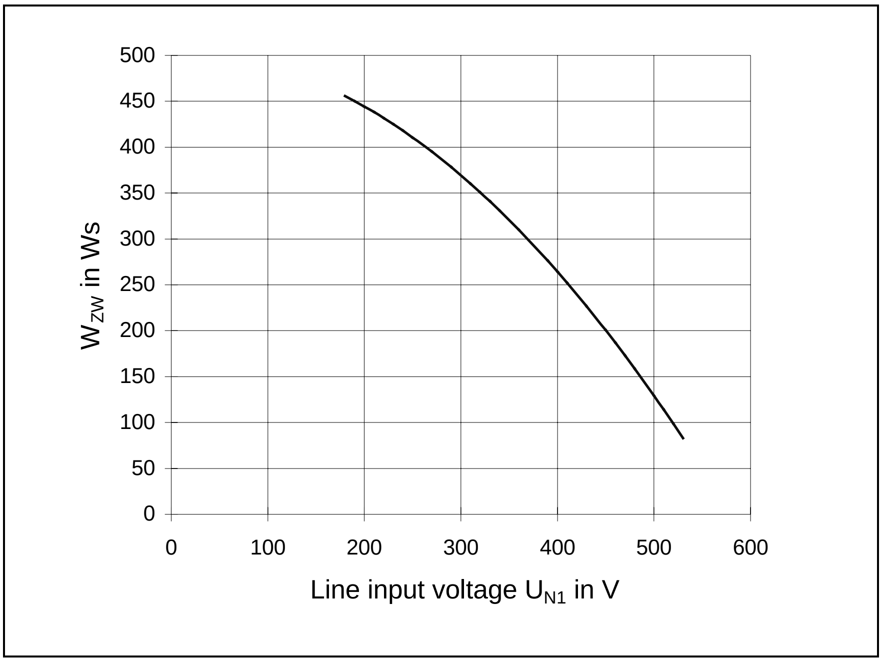


Fig. 4-20: Storable energy in the bus DKC**.3-200-7-FW

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 4-19: "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. 4-147: 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 bus should not exceed **max. 12**. Up to this number combinations as shown below are possible.

	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

Fig. 4-21: Max. number of ECODRIVE03 components on one DC bus

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

- 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: 12
Sum of all ECODRIVE03 components: 15

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 40A units	**X**	**X**	**X**	
only 100A units	**X**	**X**		**X**
only 200A units	**X**	**X**		**X**
Units with different current types	**X**	**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** [1)]		
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** [2)]	**X** [3)]	

Fig. 4-22: 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 DKC drives with individual mains supply contactors. Parallel supply is not permitted!

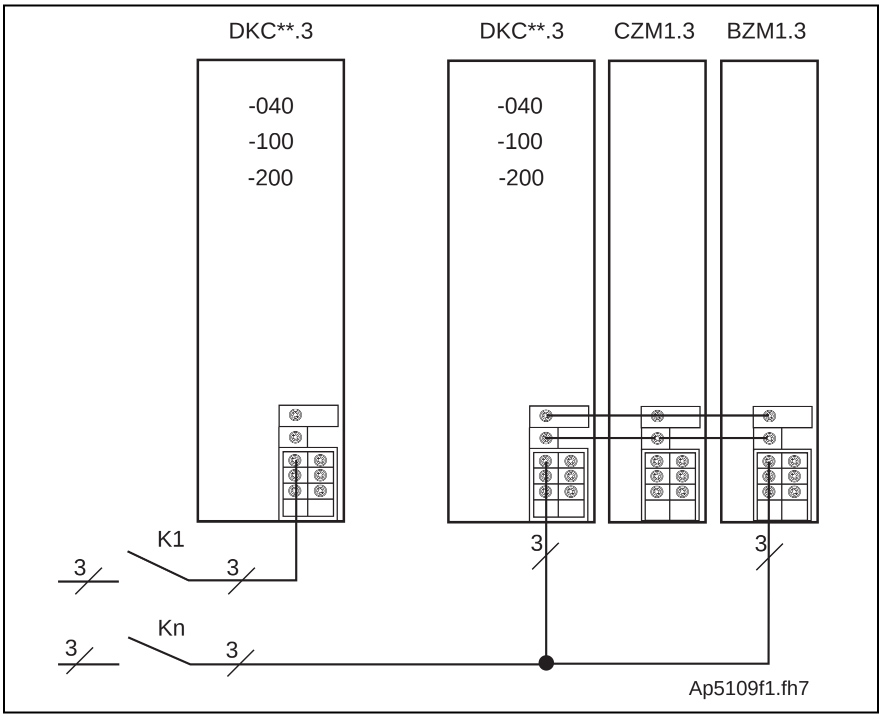


Fig. 4-23: Single source supply

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

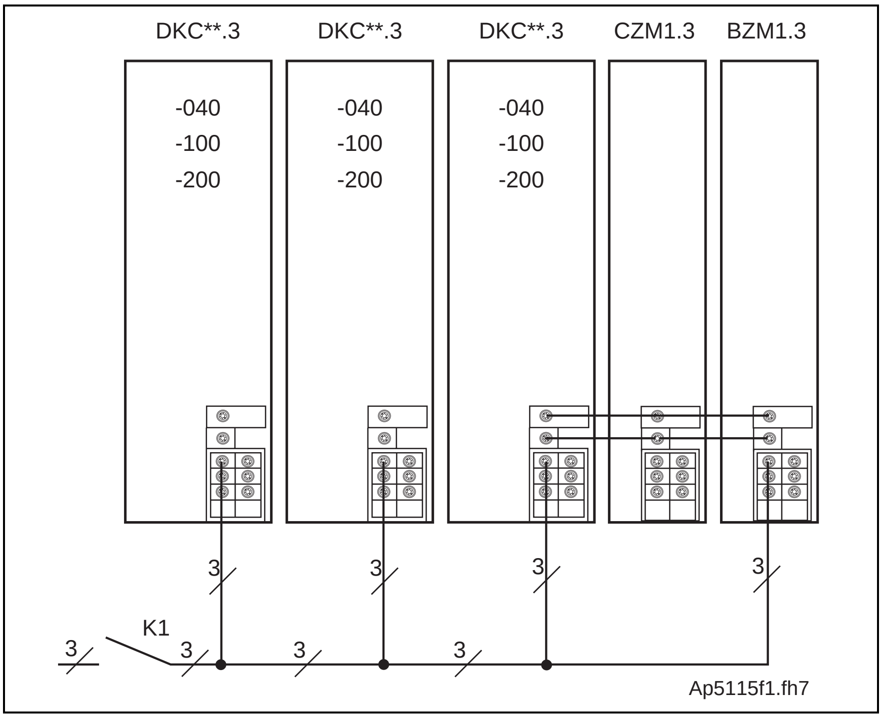


Fig. 4-24: Group supply without DC bus connection

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 (are integrated in the resistors for a symmetrical power consumption of the mains power).

See also page 4-24: "Calculating the allowed bleeder period and DC bus continuous output".

The preferable configuration for groups consists of DKC**.3-040-devices.

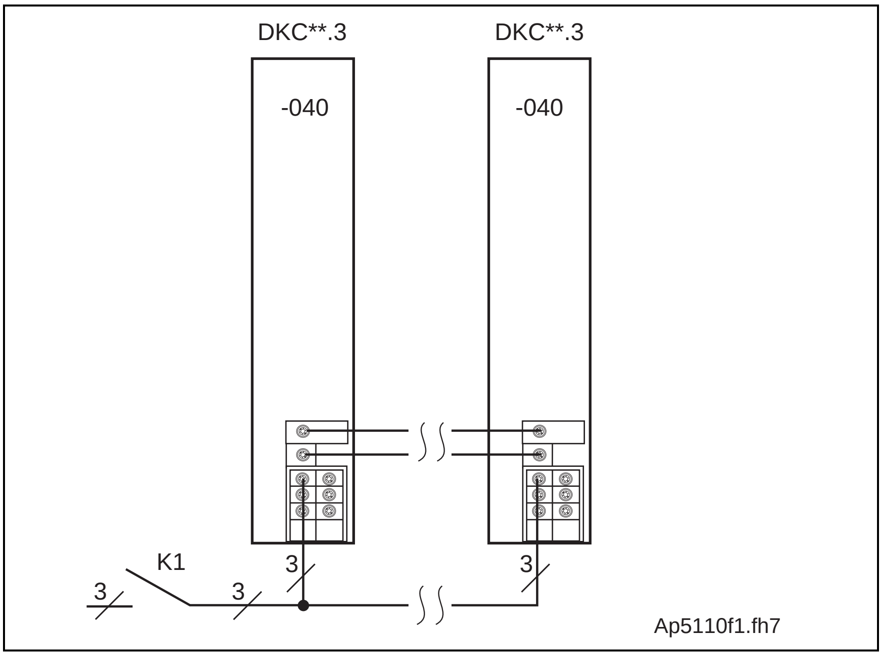


Fig. 4-25: Group supply with DC bus connection

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 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).

see also "Fig. 4-147: Block diagram interlock ZKS/Mains"

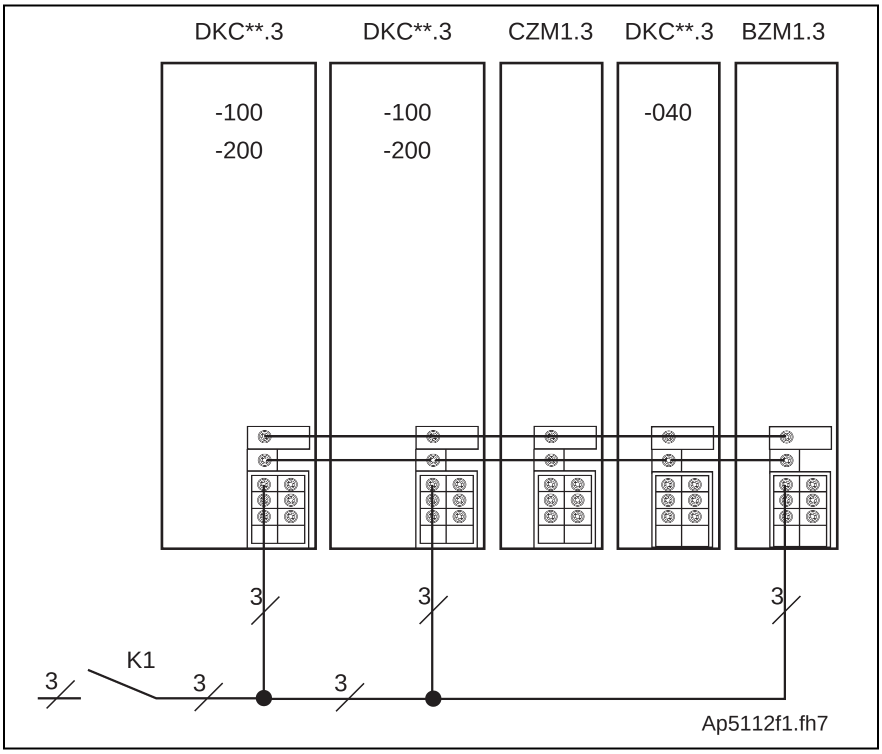


Fig. 4-26: Central supply

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
- Ud and Udpower supply (see "Fig. 4-150: UD power supply")

Rexroth Indramat

Calculating the allowed bleeder period and DC bus continuous output

By connecting the DC bus connections of several DKC drive controllers and BZM bleeder modules controllers, the regenerative power and continuous regenerative power output accumulated in the common DC bus are distributed evenly to all ECODRIVE03 components with bleeder.

The power is distributed to the components involved at an 80% balancing factor.

For central supply and group supply with DC bus connection

$$P_{BD,\,devices} = \sum (P_{BD,\,DKC} + P_{BD,\,BZM}) * 0{,}8$$

$P_{BD,\,devices}$: continuous bleeder output that can be processed by all devices on the common DC bus in continuous operation in kW

$P_{BD,\,DKC}$: continuous bleeder output that the drive controller can process in continuous operation in kW

$P_{BD,\,BZM}$: the continuous bleeder output that the auxiliary bleeder module can process in continuous operation in kW

Fig. 4-27: The continuous bleeder output of all devices on the common DC bus

$$P_{ZW,\,devices} = \sum P_{ZW} * 0{,}8$$

$P_{ZW,\,devices}$: The available continuous DC bus output of all devices on the common DC bus in kW

P_{ZW}: The DC bus continuous output of the individual devices in kW

Fig. 4-28: The DC bus continuous output of all devices on the common DC bus

For single source supply and group supply without DC bus connection

See page 4-6: "Electric Data of the Individual DKC**.3 Components"

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

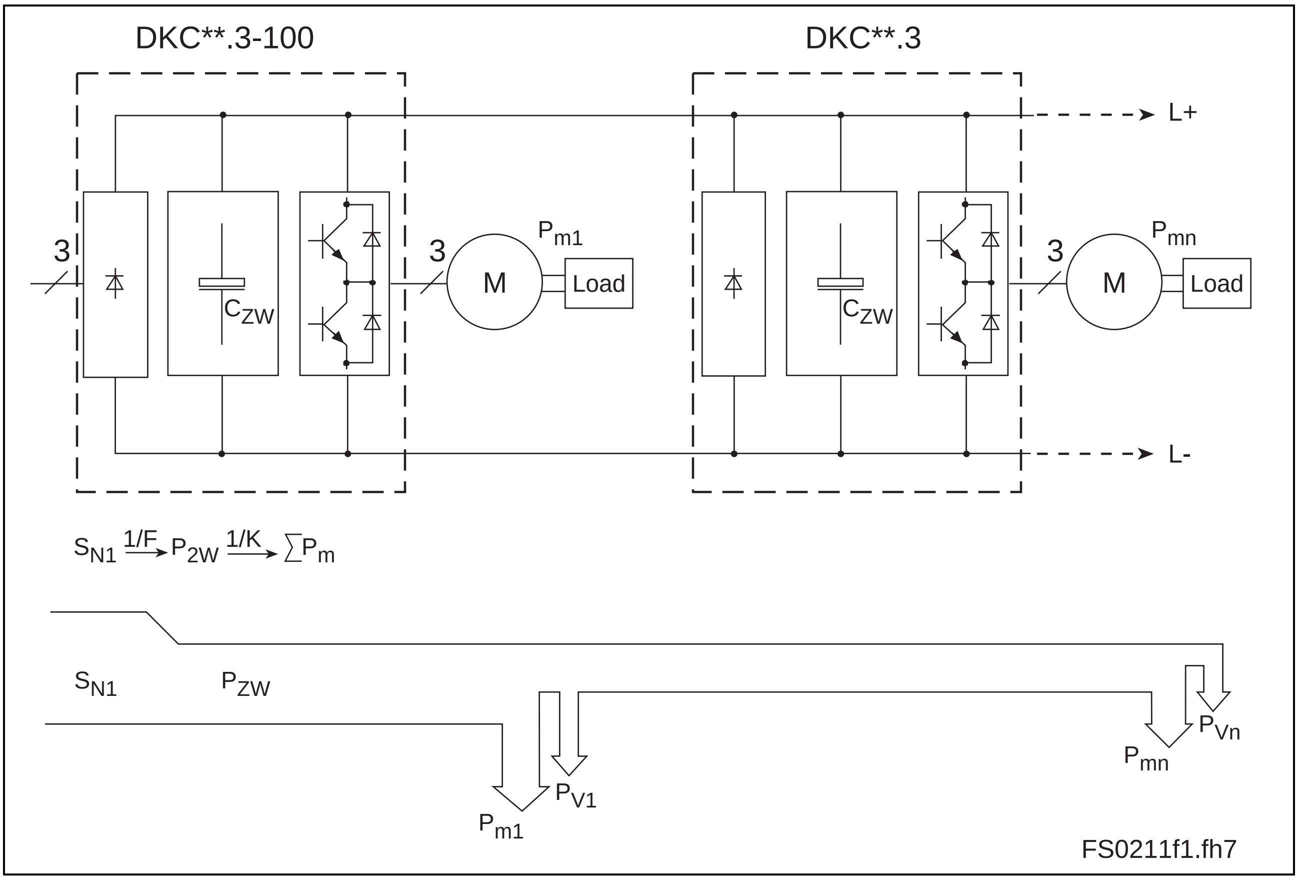


Fig. 4-29: Energy circuit DKC**.3 using "Central supply" as an example

Allowed Peak Power in DC bus intermittent operating power:

Note: Diagrams apply to single and central supply !

DKC.3-040-7-FW**

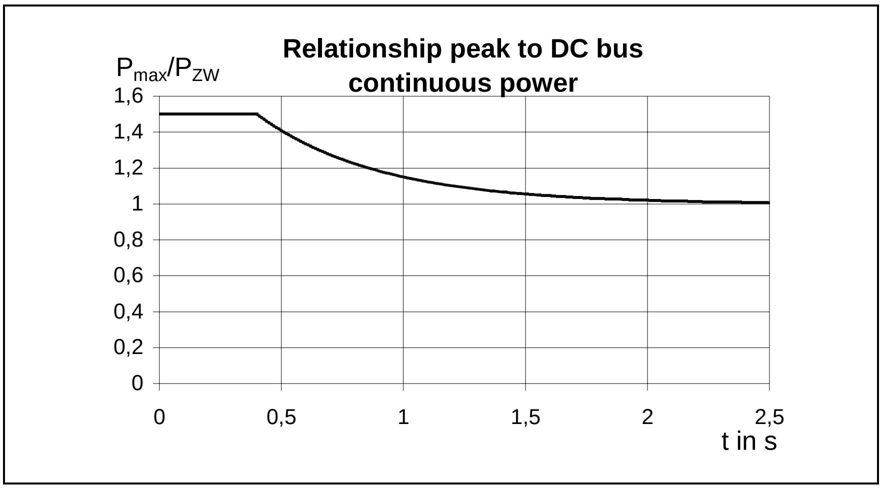


Fig. 4-30: Allowed peak power in DC bus of DKC**.3-040-7-FW

DKC**.3-040-7-FWs are not suited for drive applications if the required intermittent operating power of the unit's nominal power exceeds 50%!

DKC.3-100-7-FW**

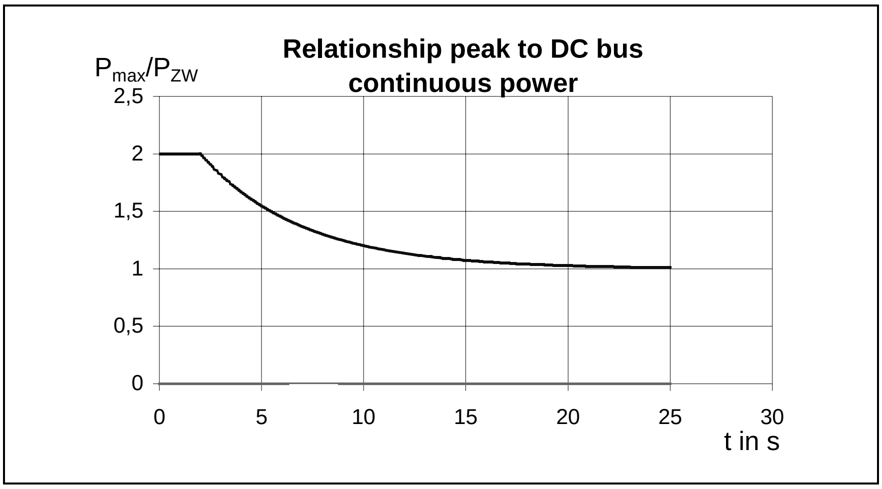


Fig. 4-31: Allowed peak power in DC bus of DKC**.3-100-7-FW

DKC.3-200-7-FW**

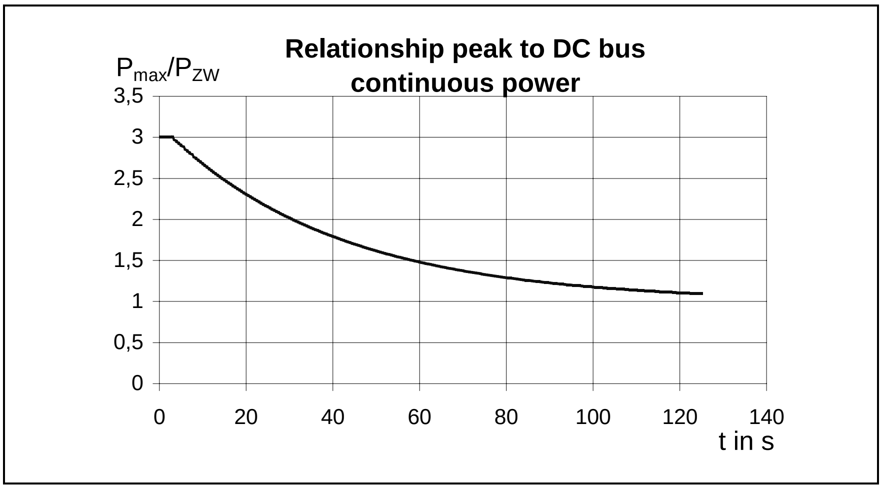


Fig. 4-32: Allowed peak power in DC bus of DKC**.3-200-7-FW

Allowed DC bus continuous power without auxiliary components

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

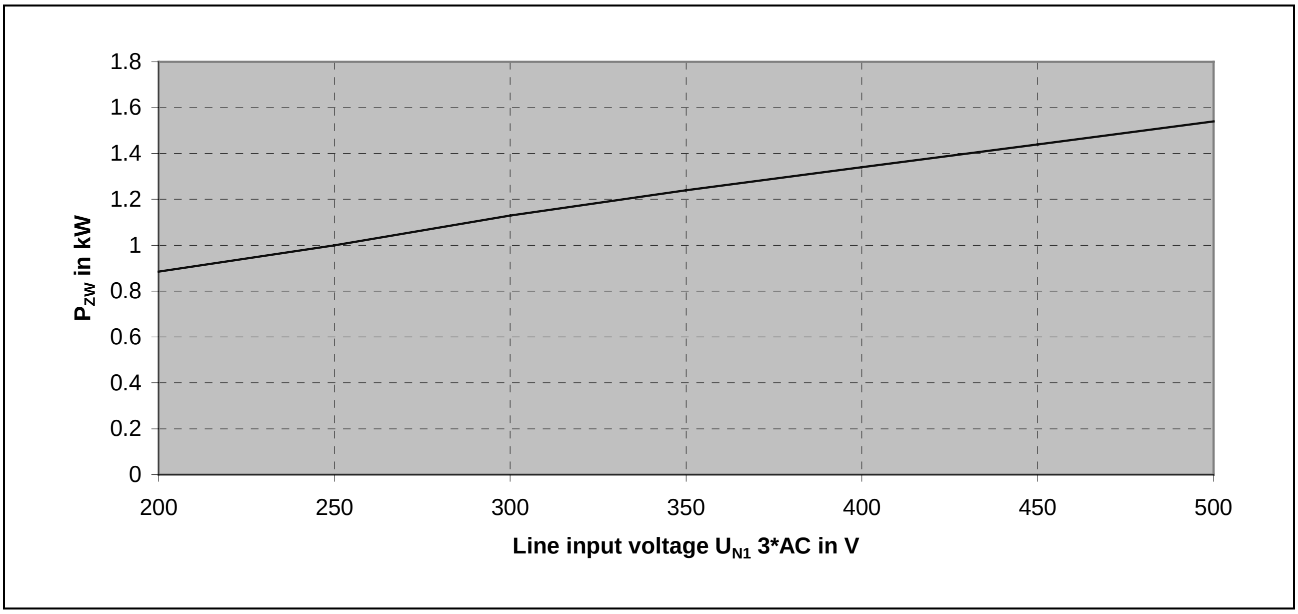


Fig. 4-33: Allowed DC bus continuous power for Single source supply DKC**.3-040-7

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

No increase in the allowed continuous power rating!

see page 4-21: "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. 4-33: 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 !

Note: Definition of terms, see page 4-17: "Mains supply options".

Rexroth Indramat

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

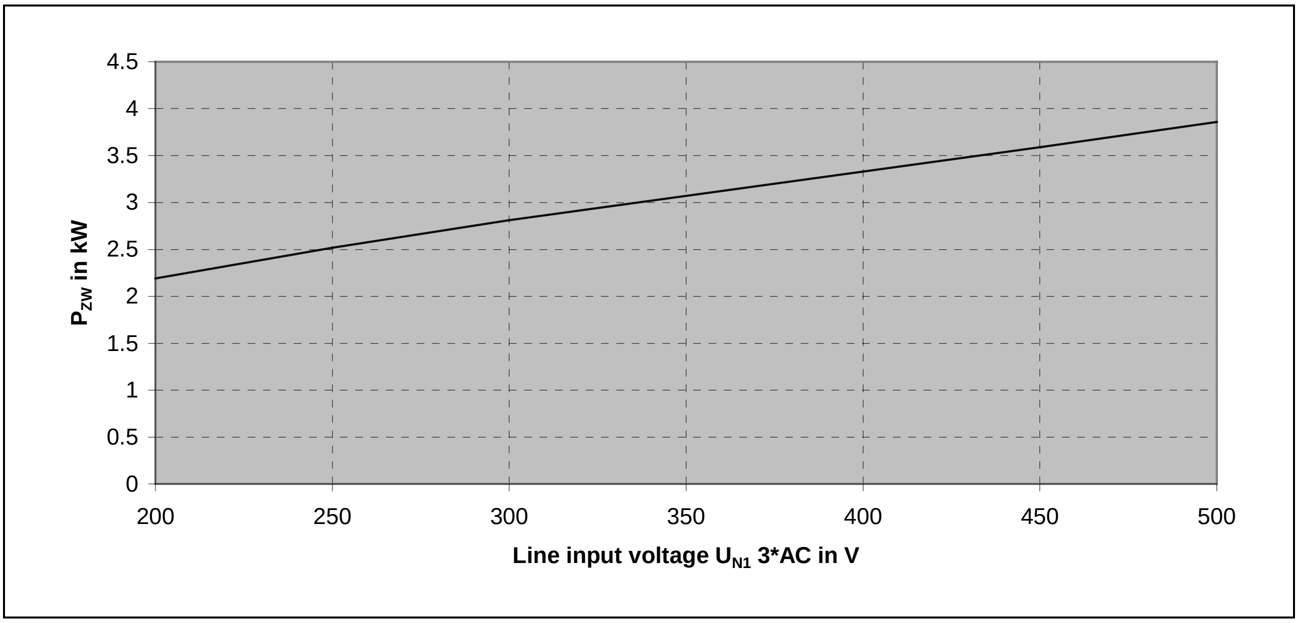


Fig. 4-34: Allowed DC bus continuous power for Single source supply DKC**.3-100-7

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

No increase in the allowed continuous power!

see page 4-21: "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.

Note: Definition of terms, see page 4-17: "Mains supply options".

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

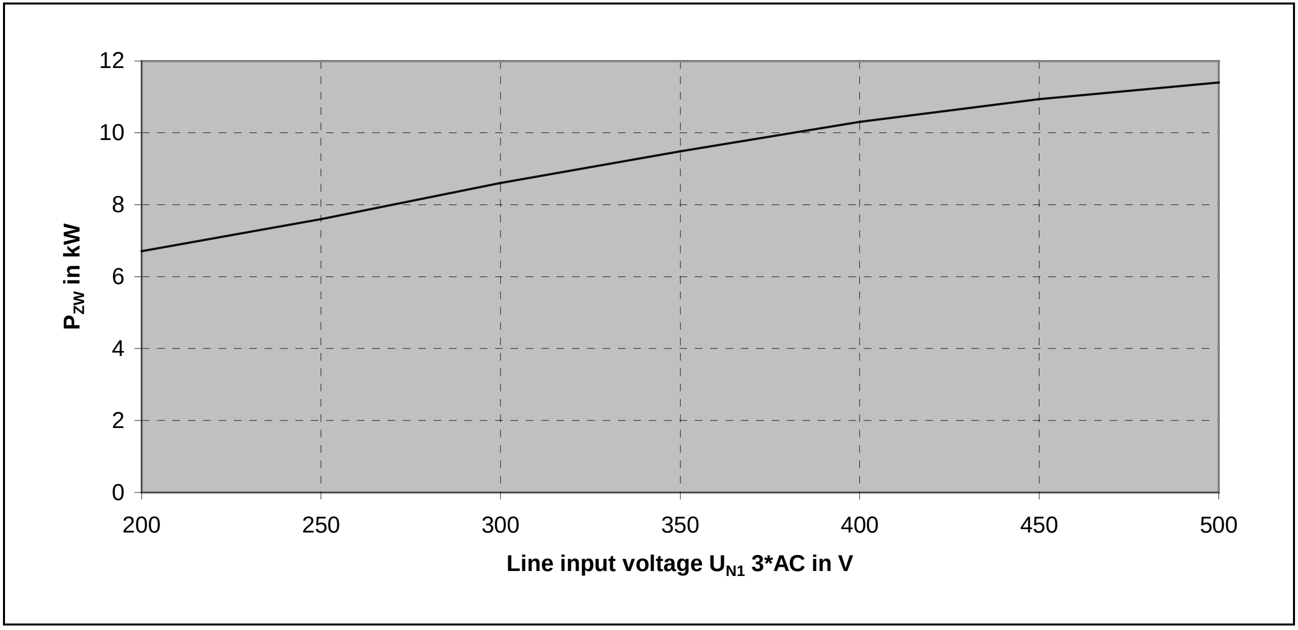


Fig. 4-35: Allowed DC bus continuous power for Single source supply DKC**.3-200-7

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

No increase in the allowed continuous power!

see page 4-21: "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.

Note: Definition of terms, see page 4-17: "Mains supply options".

Allowed DC bus continuous power with CZM01.3 auxiliary components

Note: The allowed DC bus continuous power of the DCK's is increased by adding components.

- CZM01.3 reduces the load of the DC bus capacitor in DKC's.

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 4-21: "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!

Note: Definition of terms, see page 4-17: "Mains supply options".

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

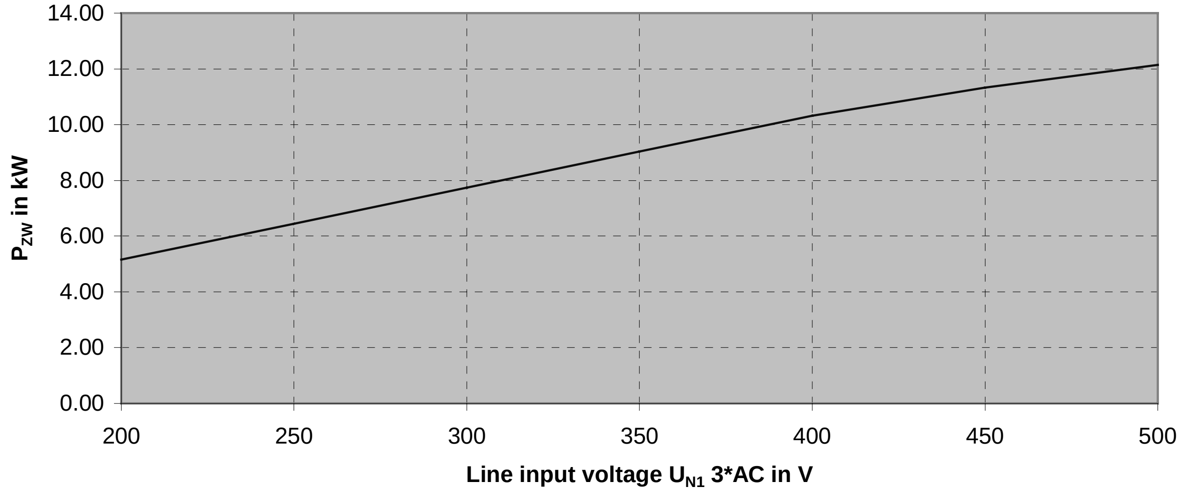


Fig. 4-36: Allowed DC bus continuous power for Single source supply DKC**.3-100-7 with CZM01.3

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

No increase in the allowed continuous power!

see page 4-21: "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.

Note: Definition of terms, see page 4-17: "Mains supply options".

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

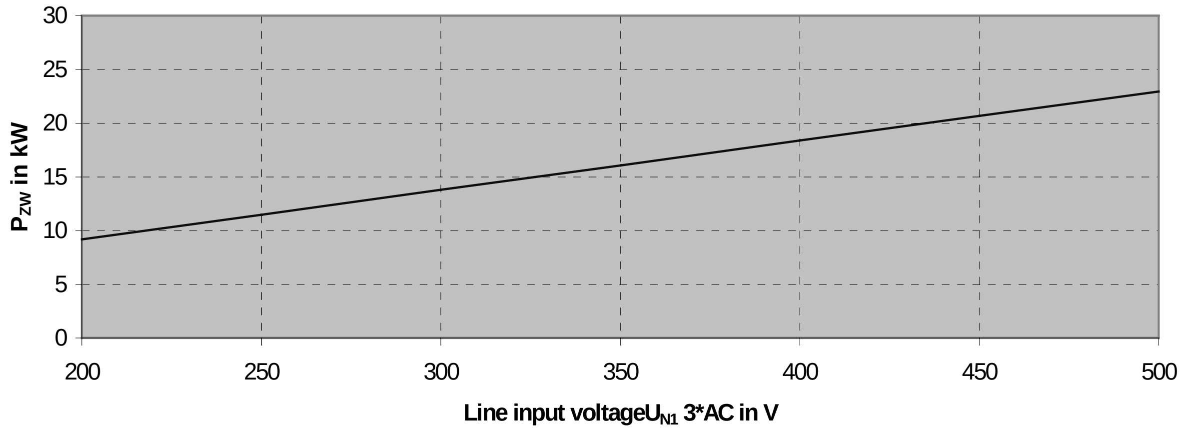


Fig. 4-37: Allowed DC bus continuous power for Single source supply DKC**.3-200-7 with CZM01.3

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

No increase in the allowed continuous power!

see page 4-21: "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.

Note: Definition of terms, see page 4-17: "Mains supply options".

Allowed DC bus continuous power with component 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 DKC's.
- 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":

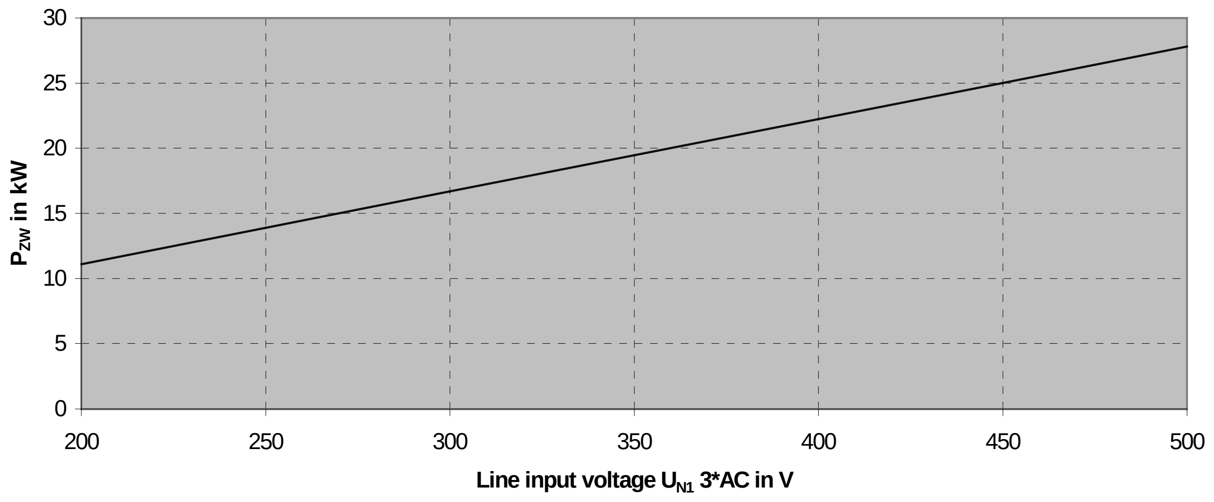


Fig. 4-38: Allowed DC bus continuous power for single source supply DKC**.3-200-7 with CZM01.3 and filter choke GLD12

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 4-21: "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.

Note: Definition of terms, see page 4-17: "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 50Hz

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

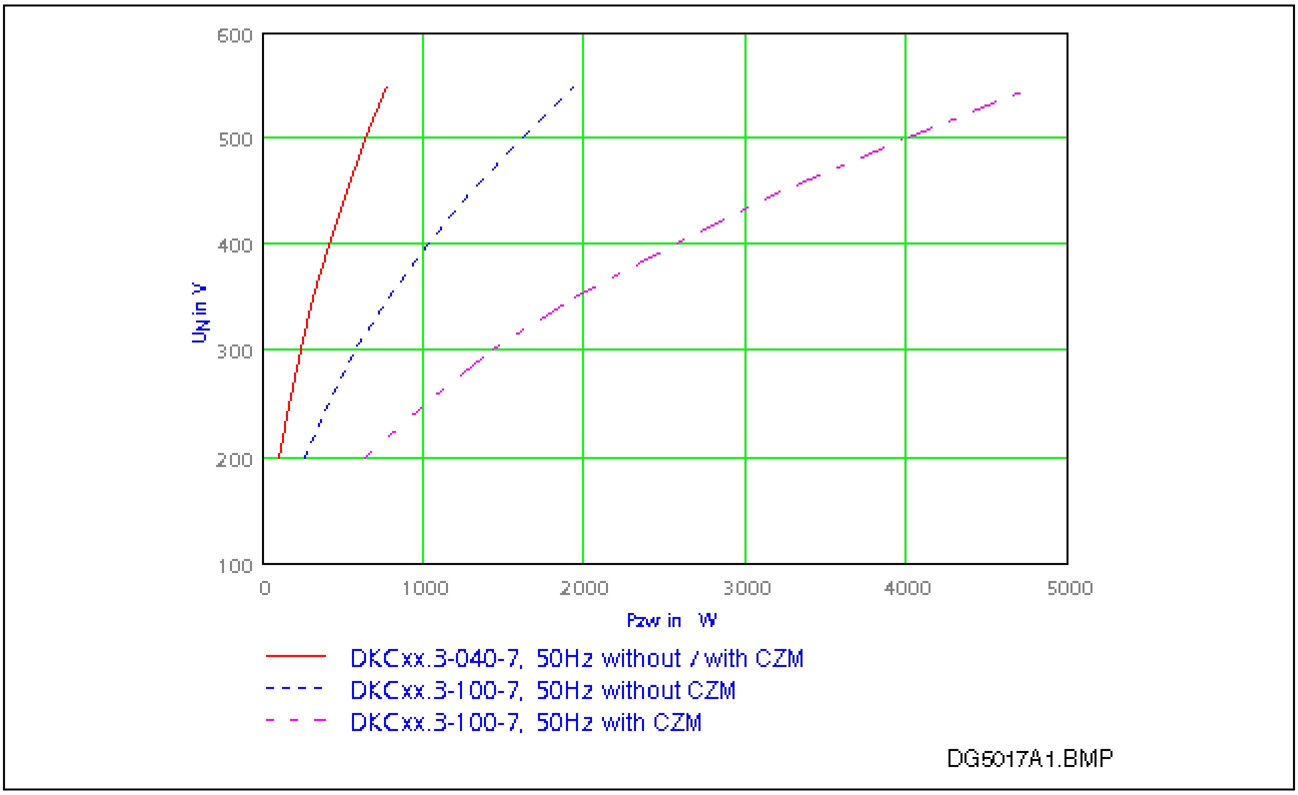


Fig. 4-39: Allowed DC bus continuous power in single-phase mode with 50Hz

DKC.3-200-7**

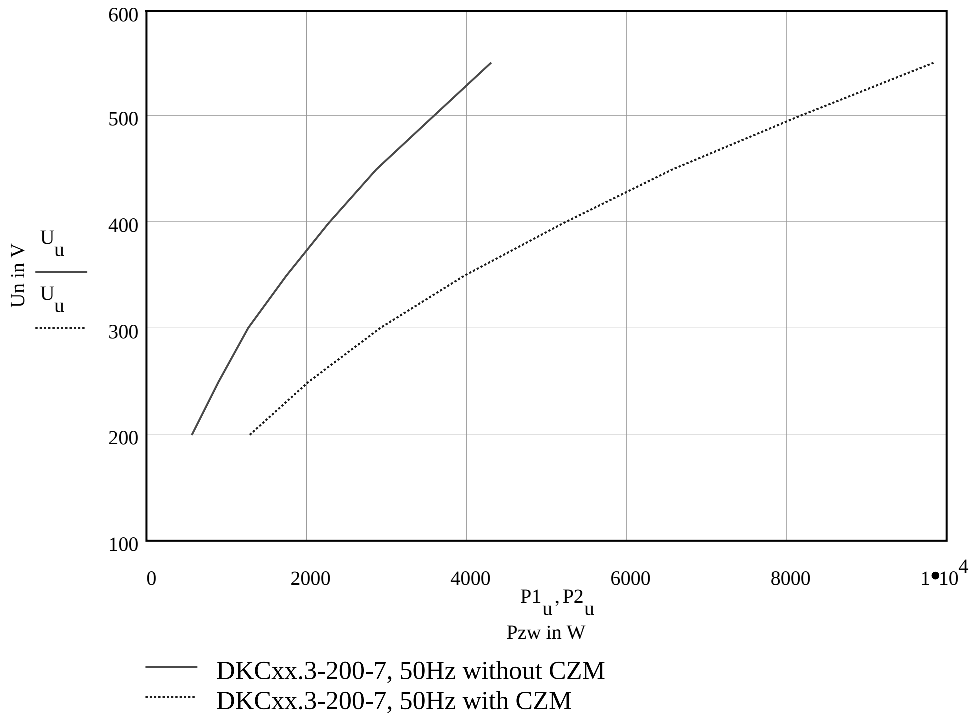


Fig. 4-40: Allowed DC bus continuous power in single-phase mode with 50Hz

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

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

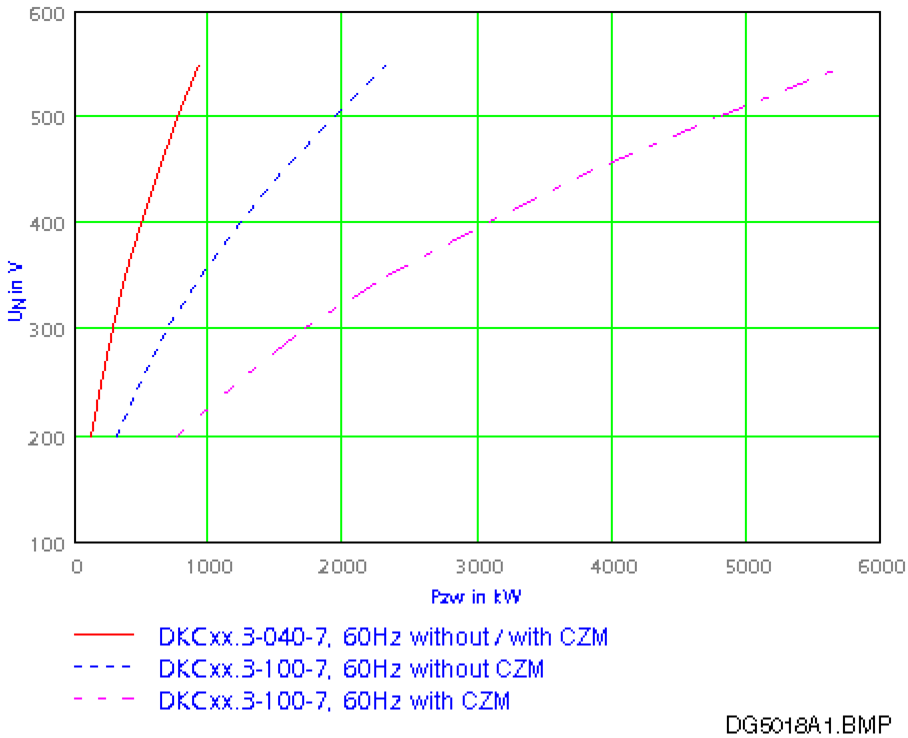


Fig. 4-41: DC bus continuous power in single-phase mode with 60Hz

DKC.3-200-7**

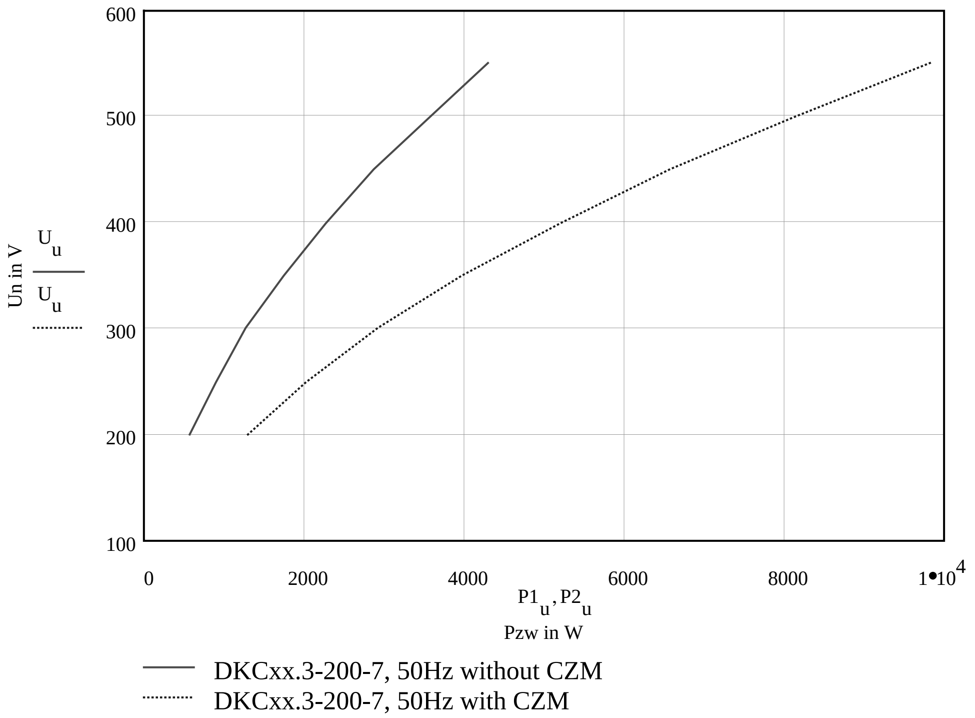


Fig. 4-42: DC bus continuous power in single-phase mode with 60Hz

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

CE label, C-UL listing, Tests

CE label:

Fig. 4-43: CE label

C-UL listing:

- Per UL508 C under file no. E134201.

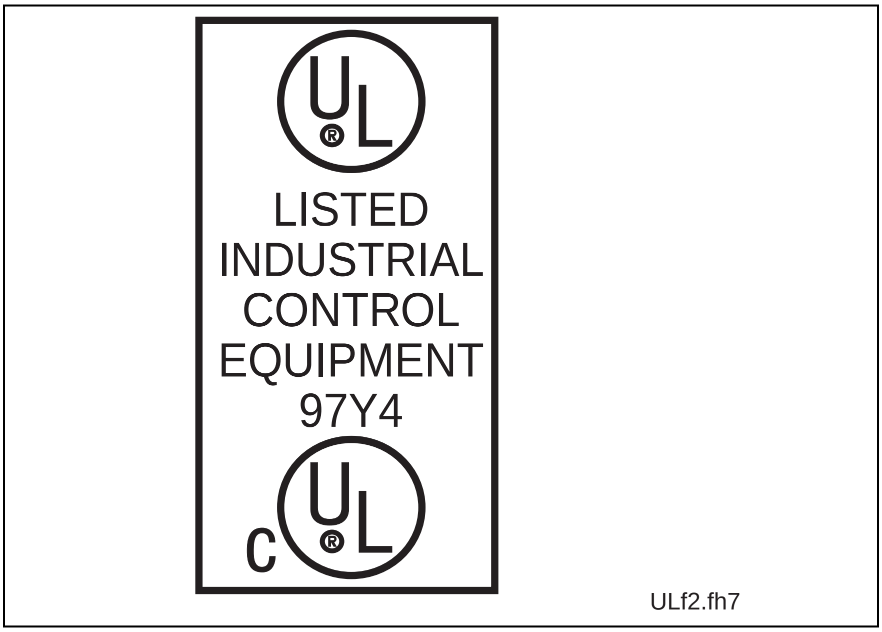


Fig. 4-44: C-UL listing

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

Tests:

High-voltage test according to EN50178	Routine test with DC2100V 1s
Insulation test according to EN50178	Routine test with DC500 1s
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. 4-45: Tests

4.2 Electrical connections - independent of the drive controller type

A look at the drive controller and connector designations

Front view

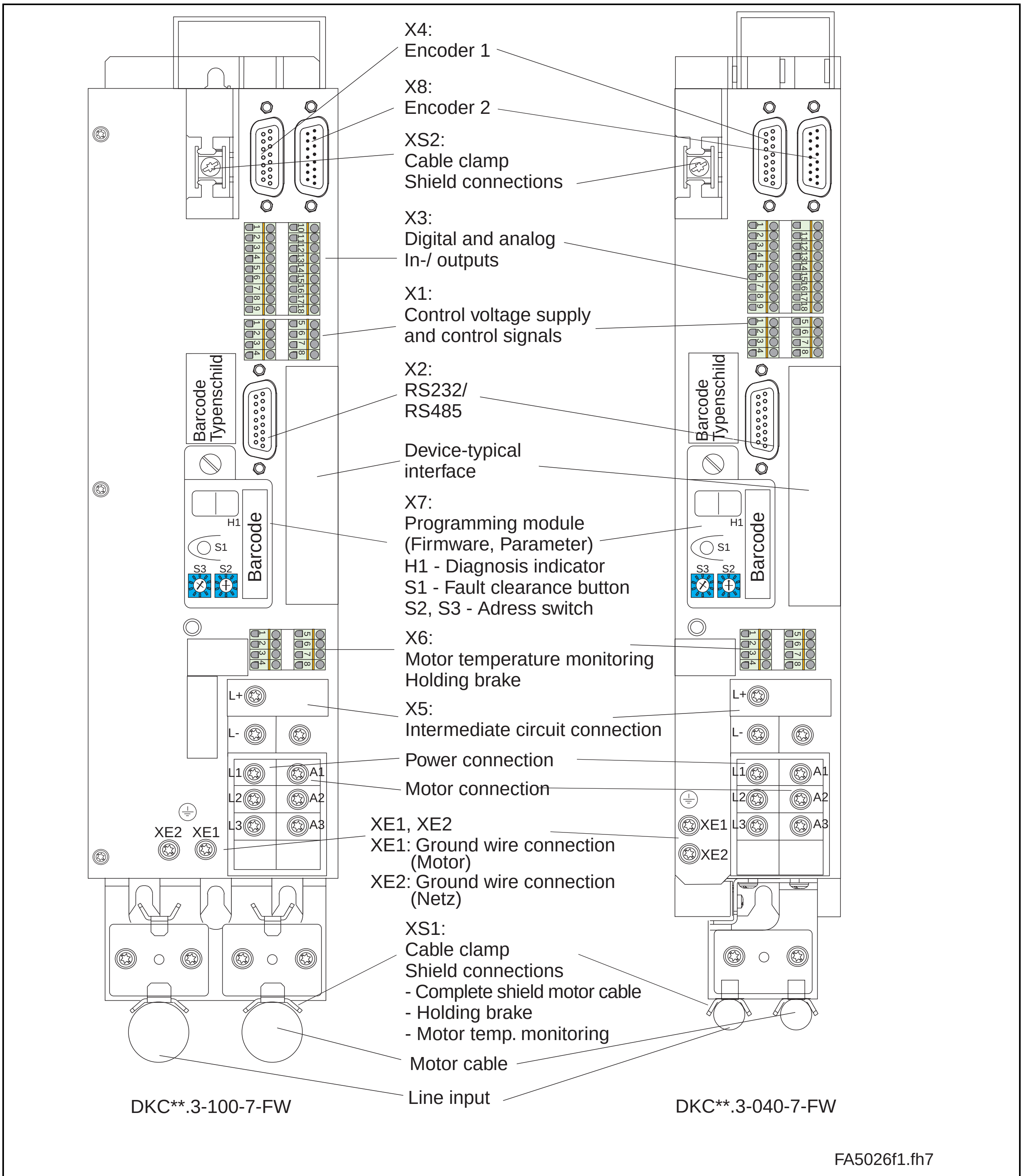


Fig. 4-46: Front view DKC**.3-040-7-FW and DKC**.3-100-7-FW with Connectors

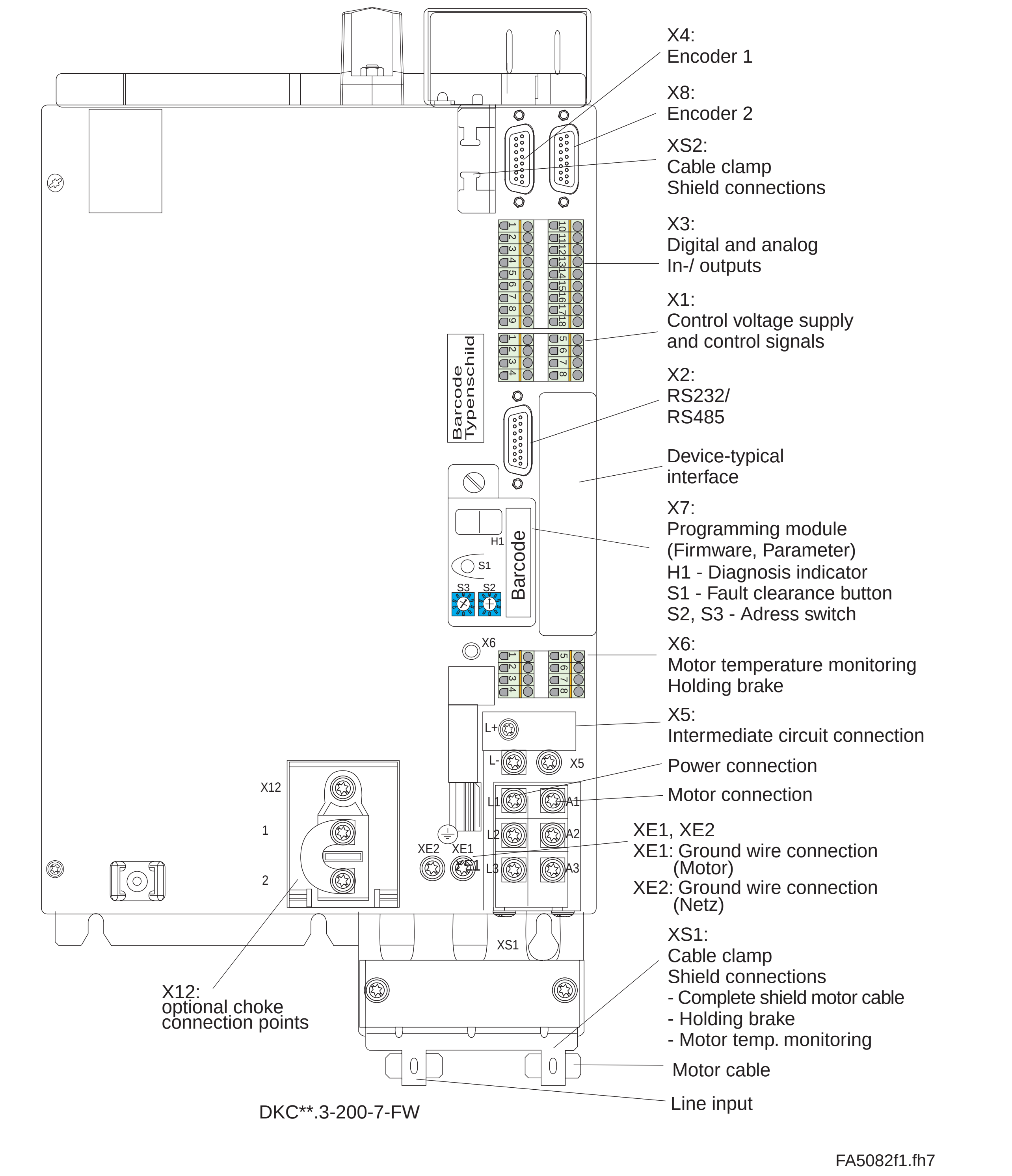


Fig. 4-47: Front view DKC**.3-200-7-FW with connectors

Connections on top of the drive controller

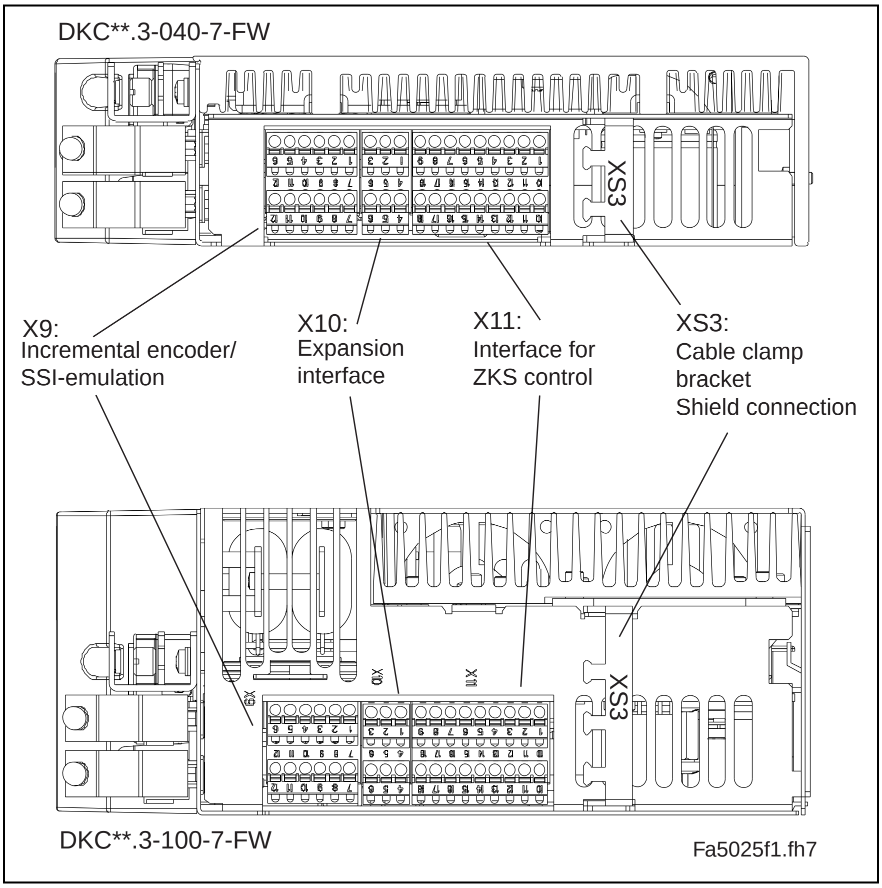


Fig. 4-48: Connections on top of unit for DKC**.3-040-7-FW and DKC**.3-100-7-FW

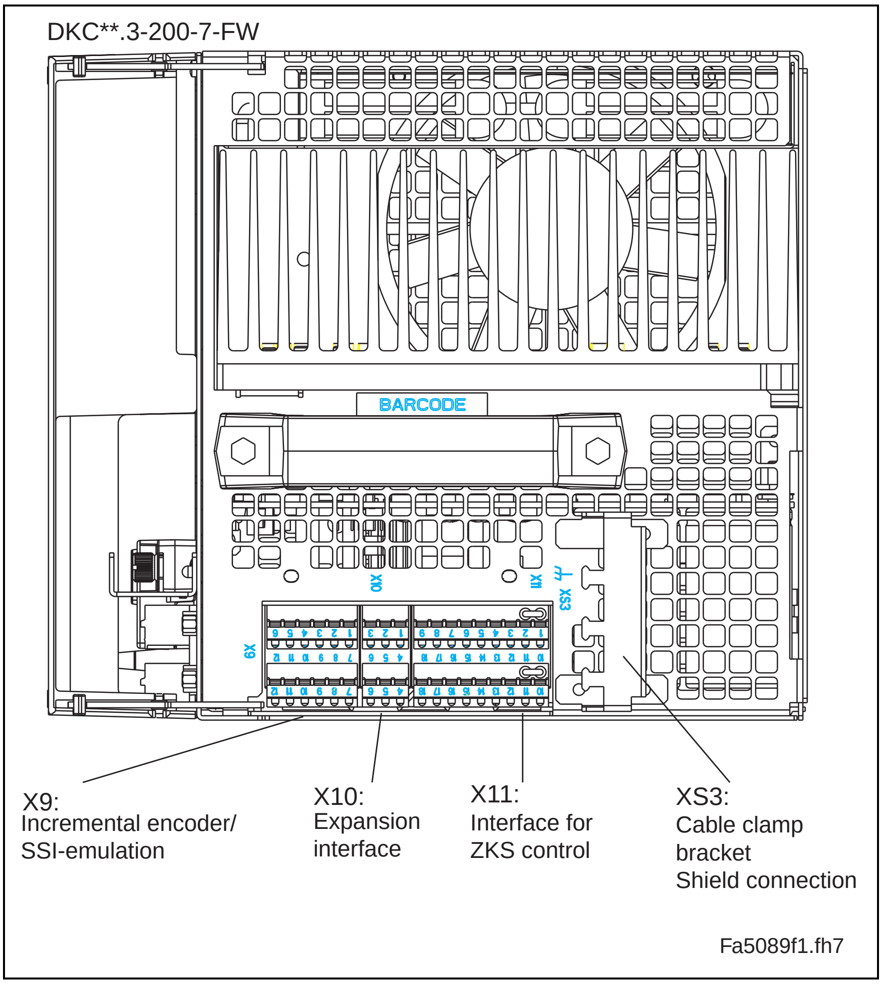


Fig. 4-49: Connections on top of unit for DKC**.3-200-7-FW

Independent of the drive controller type – total connecting diagram

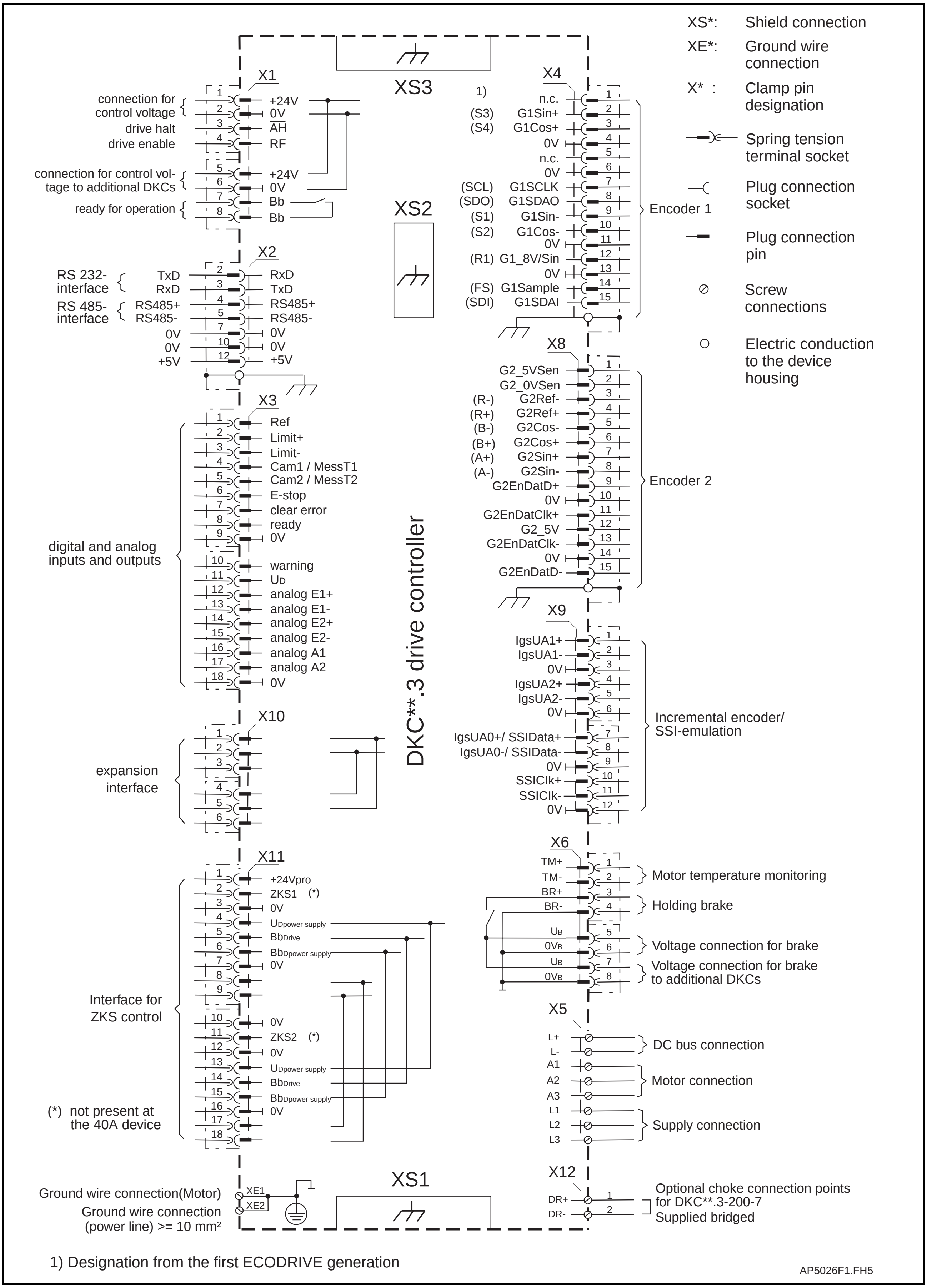


Fig. 4-50: Total connection diagram for DKC**.3

X1, Connections for Control voltage

Technical description of connector

Illustration:

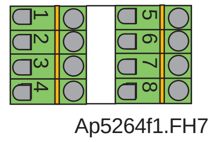


Fig. 4-51: connector X1

Design:

Type	No. of pins	Design
Spring contact	2 x 4	Bushing on connector

Fig. 4-52: 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	0,2-1,5	24-16

Fig. 4-53: Connection cross section

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

Connection +24V and 0V:

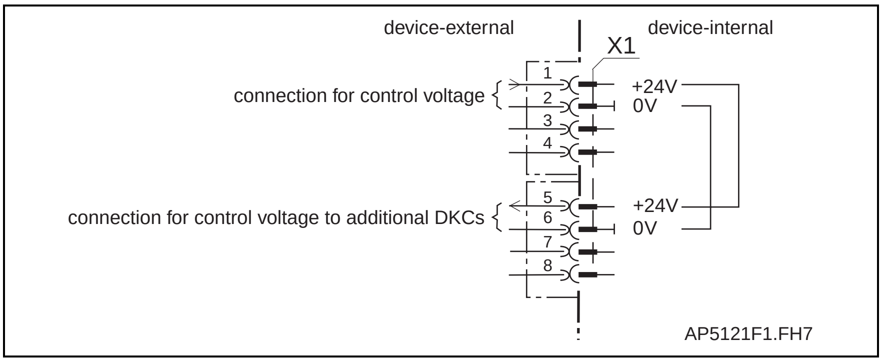


Fig. 4-54: Connections for control voltage

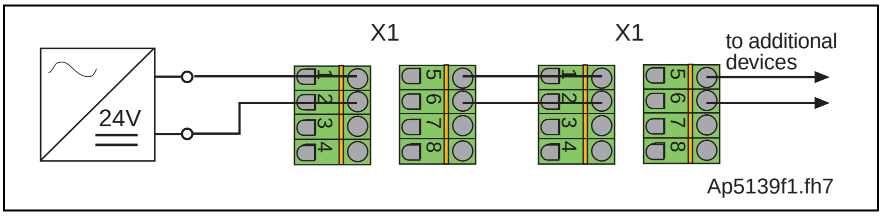


Fig. 4-55: Looping through control voltage

Connection loads +24V and 0V:

Voltage at X1/1 against X1/2:	DC +24 V (19,2...28,8)
Reverse voltage protection:	Via allowed voltage range using internal protection diodes
Current or power consumption X1/1:	see page 4-11: "Technical data –> Control voltage connection for DKC"
Max. allowed current load when looping through the control voltage via X1.1/2 to X1.5/6:	DC 10 A

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

wire +24V and 0V:

wire cross section:	min. 1 mm²
wire routing:	parallel if possible
Max. allowed inductance between 24V source and X1:	100µ (equals about 2 x 75m)

Note:

- Exceeding allowed control voltage generates error message "+24 volt error". (=> See also functional description.).
- Control voltage failure causes the running motor to coast torque-free (without brake).
  See page 10-4: "Control Circuits with internal DC bus dynamic brake (ZKS)"

DANGER

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

⇒ Personnel should not remain within the area of the 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 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, ...).

Connection AH and RF:

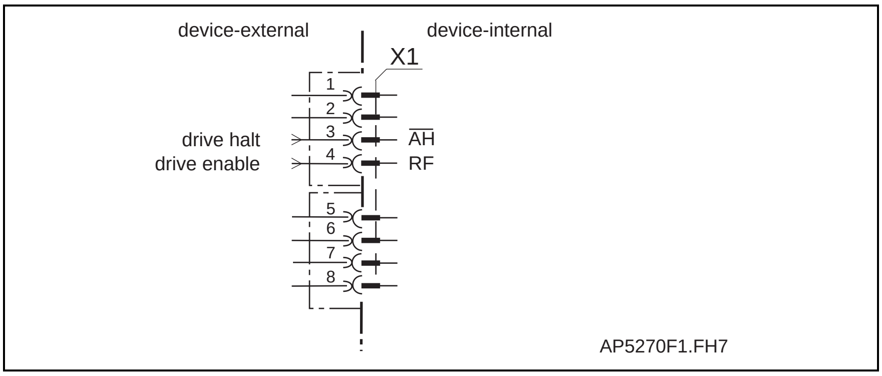
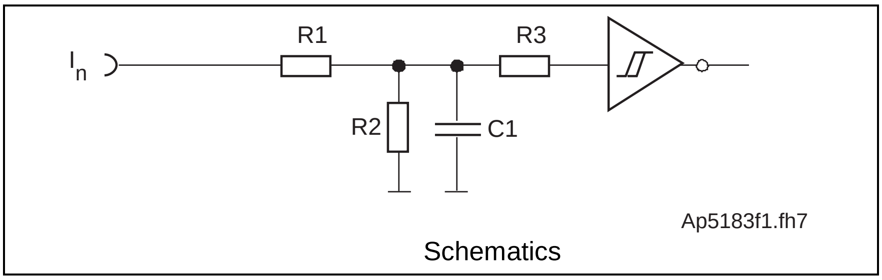


Fig. 4-56: Connections for drive halt and drive enable

Input circuit AH and RF:



R1: 10k
R2: 3k3
R3: 10k
C1: N/A.

Fig. 4-57: 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 description	

Fig. 4-58: Inputs

AH: The drive halt function is used to bring an axis to standstill with defined accel and jerk (see 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 DKC, then the reference lead of the other power supply must be connected to X1.2 (OV).

Ready to operate contact Bb

Connection Bb:

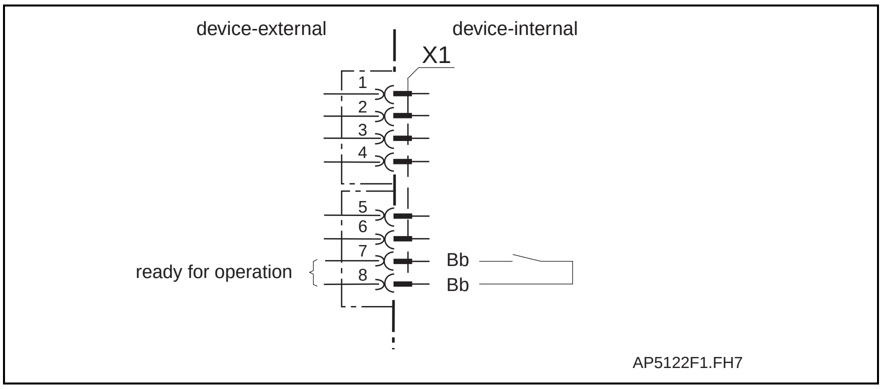


Fig. 4-59: Connections for ready to operate contact

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 <50ms:	250,000

Switching states Bb:

The Bb contacts opens:

- if control voltage for DKC is not applied
- if 24 volts not present at the emergency stop input when the E-stop function is activated (depends on parametrization, see function description).
- With an error in the drive (depends on parametrization, see functional description: "Power off on error").

How to use the contact, see page 10-2: "Control Circuits for the Mains"

WARNING

Damage possible if Bb contact not connected !

The ready to operate contact Bb acknowledges the drive is ready for mains voltage.

⇒ Integrate Bb contact as per "Control Circuits for Connect the Mains".

X2, Serial Interface

Note: Serial interfaces are generally used for programming, parametrization and diagnoses upon commissiong and during service. It can be operated either as RS 232 or RS 485.

Technical description of connector

Illustration:

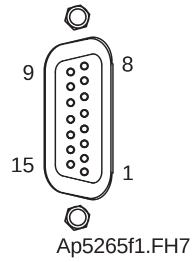


Fig. 4-60: Connector X2

Design:

Type	No. of pins	Design
D-SUB	15	Bushings on unit

Fig. 4-61: 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. 4-62: Connection cross section

Short circuit protection

RS 232	pin 4, 5 against each other against 0 V	present
RS 485	pin 2, 3 against each other against 0 V	present

Abb. 4-63: short circuit protection

RS 232 interface

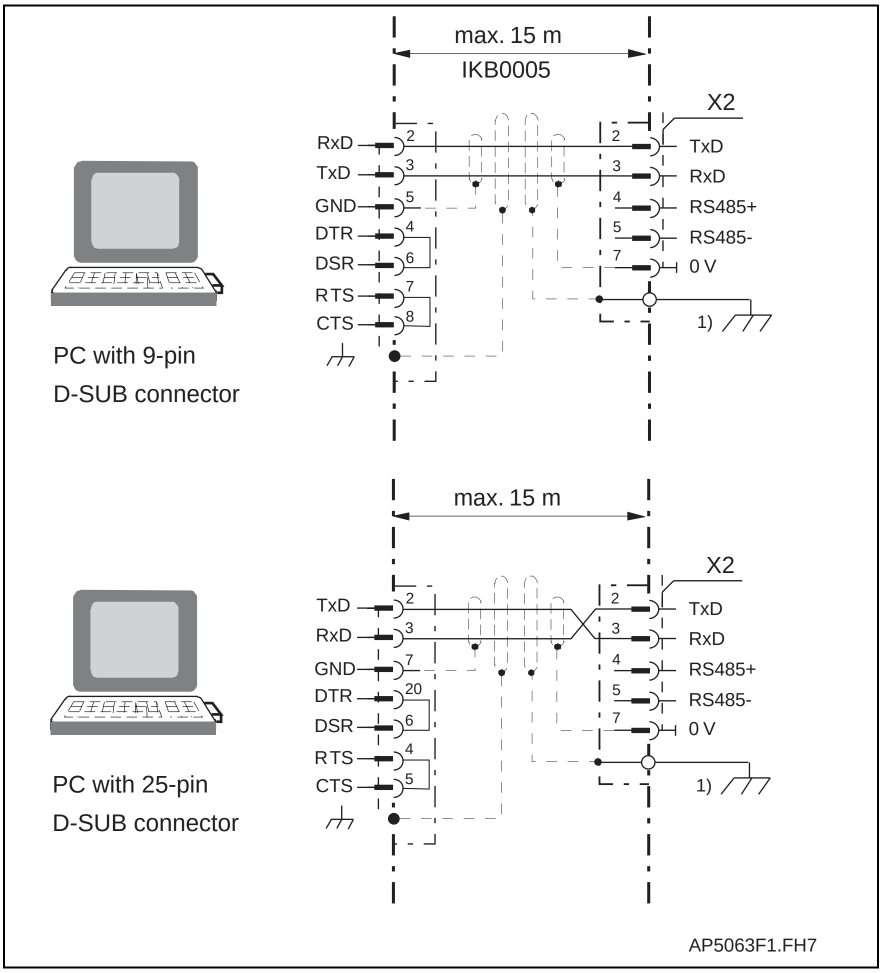
The RS 232 interface is used for programming, parametrization and diagnoses at start up and service.

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 RS 232 interface only one drive at a time can be parametrized 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

Abb. 4-64: Connecting a PC to the RS 232 interface on a DKC

See page 12-4: "Additional Accessories".

RS 485 Interface

The RS 485 interface is used for programming, parametrization 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 RS 485 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

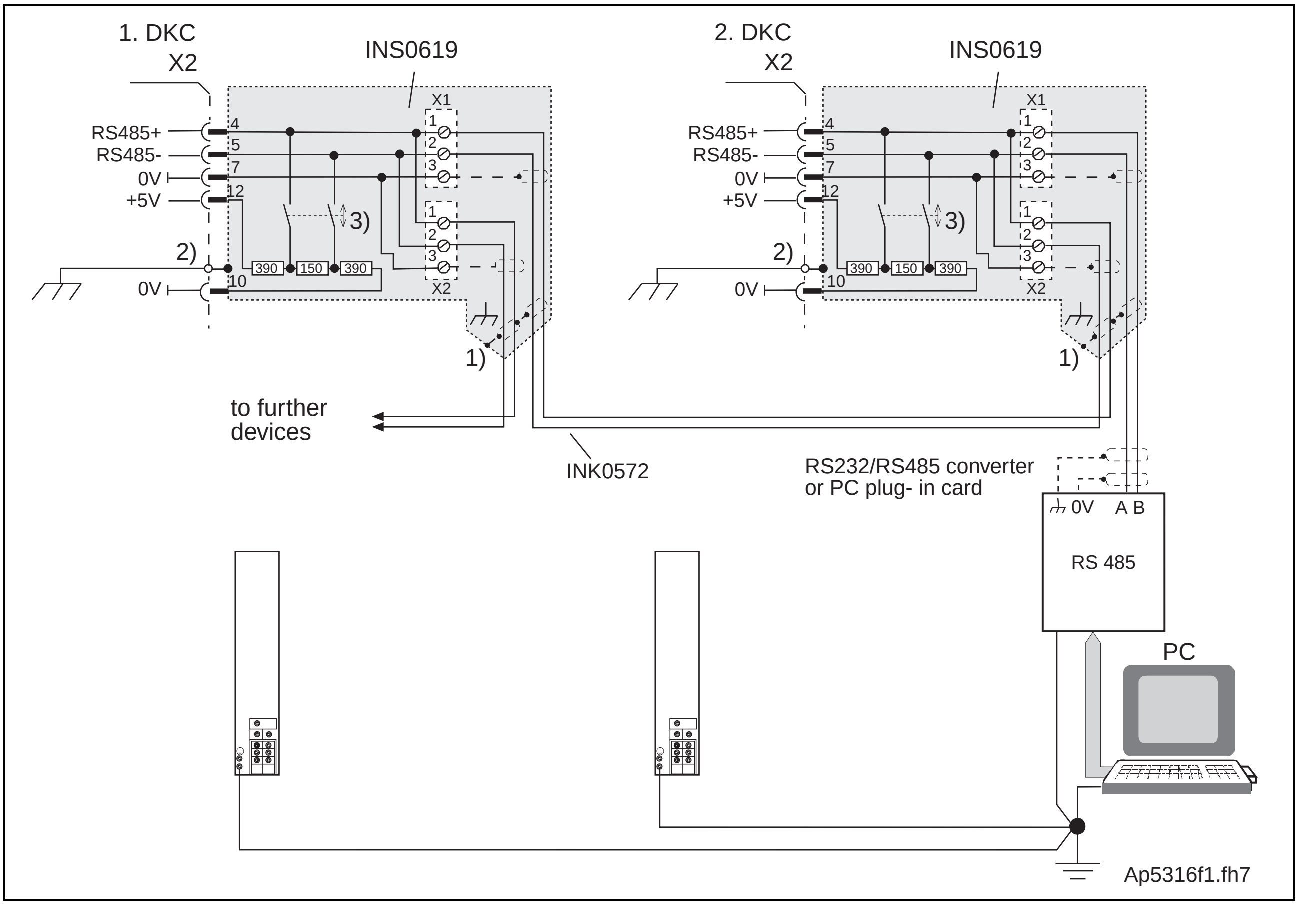
Please contact your PC supplier to help find solutions.

Installation notes for RS485 – cables

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

Connector for RS485 interface

Connection RS485:



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 RS- 485 bus, activate the bus termination. => Shift switch to "I".

Fig. 4-65: Connection example of RS485 interface

⇒ See also the functional description: "Serial Communications"

X3, Digital and analog I/Os

Technical description of connector

Illustration:

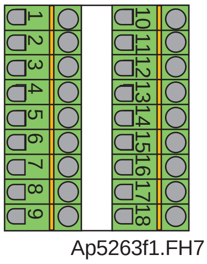


Fig. 4-66: Connector X3

Design:

Type	No. of pins	Design
Spring contact	2 x 9	Bushing on connector

Fig. 4-67: 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	0.2-1.5	24-16

Fig. 4-68: Connection cross section

Digital Inputs (Ref, Limit+, Limit-, cam1/ MessT1, cam2/ MessT2, E-Stop and clear error)

Connection Digital inputs:

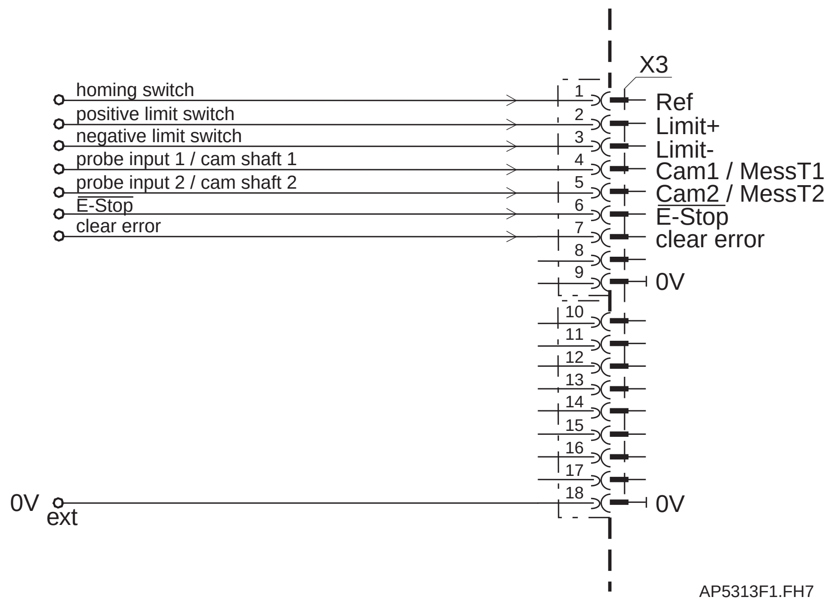
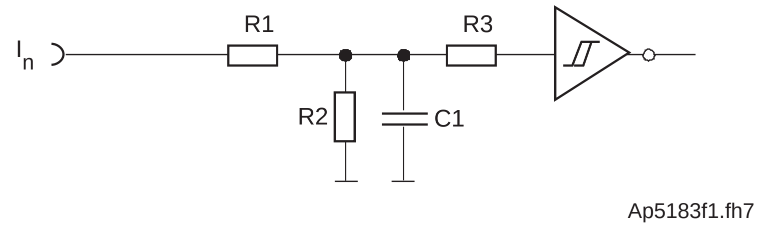


Fig. 4-69: Digital inputs

Input circuit Digital inputs:



Schematics

R1: 10k
R2: 3k3
R3: 10k
C1: N/A.

Fig. 4-70: 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	See functional description	

Fig. 4-71: 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 X3.18 (OV).

Homing switch: The positive edge of the homing switch is always evaluated.

Limit+, Limit-: End switches can be N/C or N/O depending on how the drive is parametrized. See functional 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 parametrized. See 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_D-message)

Connection Digital outputs:

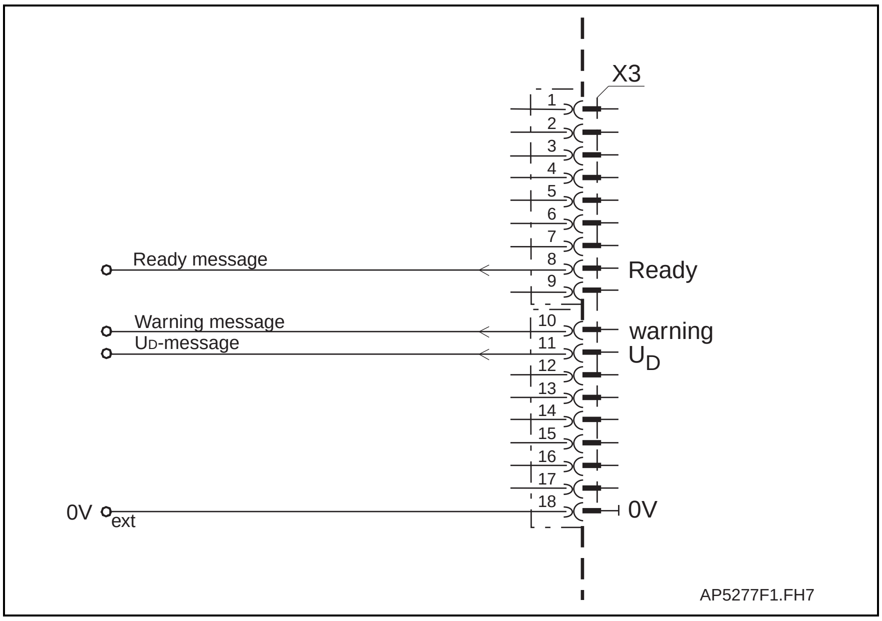
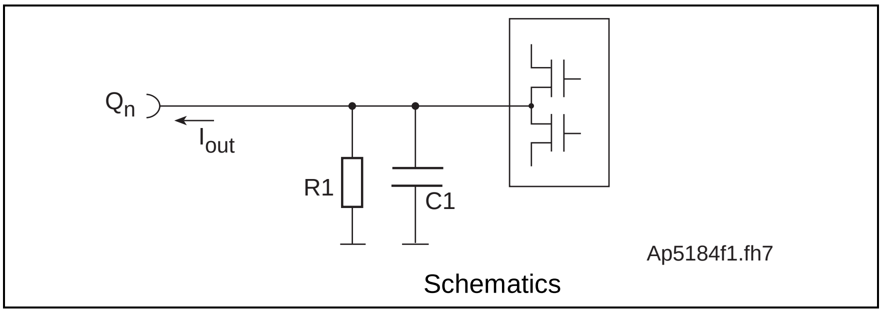


Fig. 4-72: Control outputs

Output circuit connection Digital outputs:



R1: 20k
C1: N/A.
Fig. 4-73: Output circuit

Output connections Digital outputs:

Output voltage:	min.	max.
High	16 V	U_{ext} (an X1.1-1V)
Low	-0.5 V	1.5 V
Output current I_{out}	80 mA	
Rise and drop time	about < 600 ns	
Overload protection	- short circuit protectoin At I_{out} > 300 mA the outputs switch off . Thermal shutdown	

Fig. 4-74: 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.

⇒ See also 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 < (0.75 x threshold value of applied mains voltage)
- with lacking control voltage

U_D-message: Once the minimum voltage in the power DC bus is reached, then the controller is ready to output power and the U_D output is set to high. Signal U_D-message has a special meaning for "central supply" whereby it supplies input $U_{D\ power\ supply}$.

See page 4-86: "Bb drive, Bb power supply and UD power supply".

Delay time t_d from applying mains voltge to the setting of the UD signal is

- **single phase** mains connection:

$$t_d = 2 * R_{softstart} * 1.2 * C_{ZW} * 3 + 50ms$$

t_d	delay time
$R_{Softstart}$	take value from "technical data" list
Czw:	sum of DC bus capacitors

Fig. 4-75: Delay time for single phase mode

See page 4-35: "Allowed DC bus continuous power with single-phase mains connectioni".

- **Three-phase** main connection:

$$t_d = R_{softstart} * 1.2 * C_{ZW} * 3 + 50ms$$

Fig. 4-76: Delay time for three-phase mode

Resulting load resistance R: This resistance of all mains voltages connected to DKC at one DC bus

$$\frac{1}{R} = \frac{1}{R_{softstart1}} + \frac{1}{R_{softstart2}} + ... + \frac{1}{R_{softstartn}}$$

Fig. 4-77: Load resistance

Resulting DC bus capacitance C: The resulting DC bus capacitance of all units on one DC bus

$$C = C_{ZW,DKC1} + C_{ZW,DKC2} + ... + C_{ZW,DKCn} + C_{ZW,CZM}$$

Fig. 4-78: DC bus capacitance

Analog inputs 1 and 2

Connection Analog inputs:

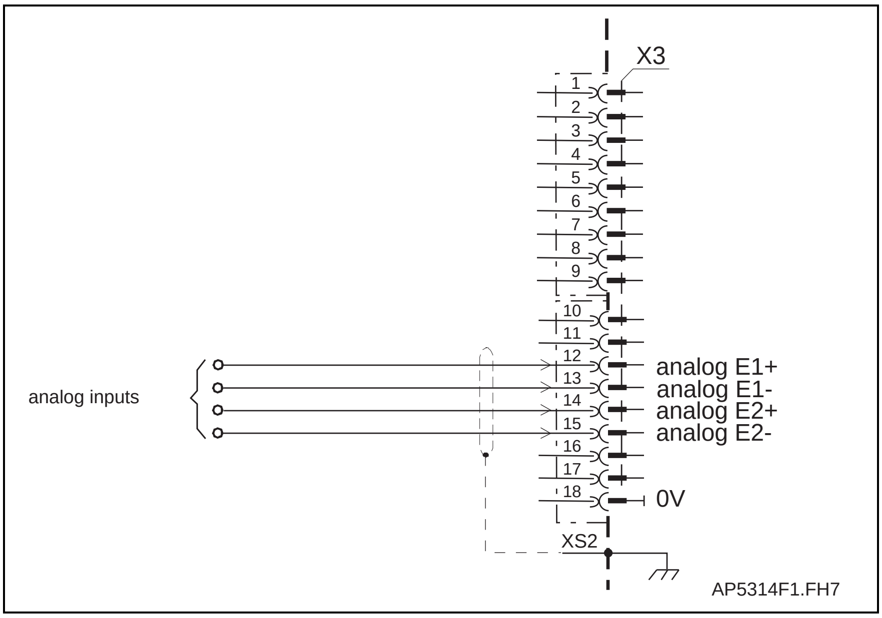
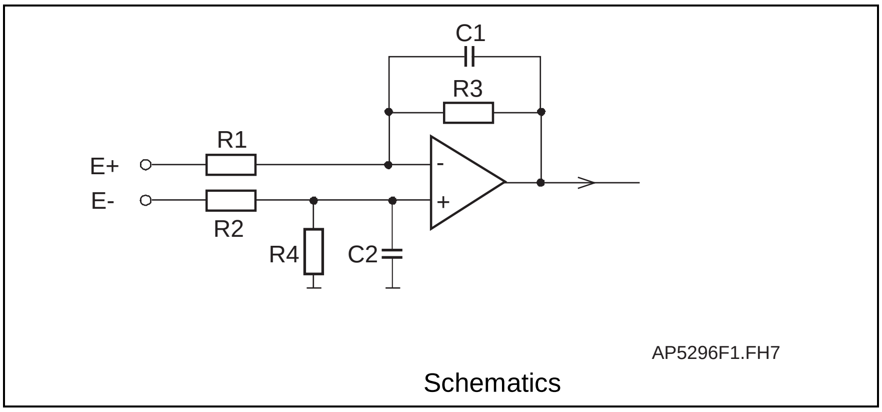


Fig. 4-79: Analog inputs

Input circuit Analog inputs:



R1: 20k
R2: 20k
R3: 20k
R4: 20k
C1: N/A.
C2: N/A.

Fig. 4-80: Input circuit

Inputs Analog inputs:

Input voltage range	Working range	max.
between E+ & E-:	± 10 V	± 15 V
between E+ & 0 V:	± 10 V	± 15 V
between E- & 0 V:	± 10 V	± 15 V
Input current	N/A.	
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. 4-81: 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".

Analog outputs 1 and 2

Connection Analog outputs:

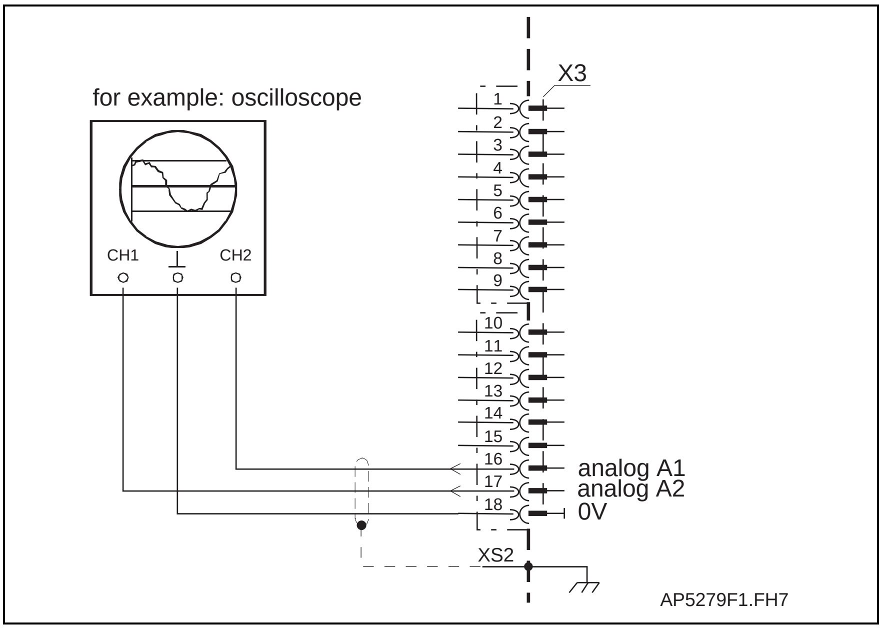


Fig. 4-82: Connection example of outputs A1 and A2

Outputs Analog outputs:

Output voltage	min	max.
between A1 & 0 V:	- 10 V	+ 10 V
between A2 & 0 V:	- 10 V	+ 10 V
output current	Max. 2 mA	
output resistance	150R	
DA converter	8 Bit	
Resolution per bit	78 mV	
short-circuit and overload protection	not present	
Probe	See functional description	

Fig. 4-83: Outputs

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

⇒ See also functional description: "Analog outputs".

X4, Encoder 1

Technical description of connector

Illustration:

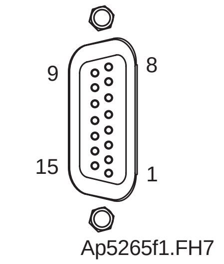


Fig. 4-84: Connector X4

Design:

Type	No. of pins	Design
D-SUB	15	bushing on unit

Fig. 4-85: 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. 4-86: Connection cross section

Encoder 1

Connection Encoder 1:

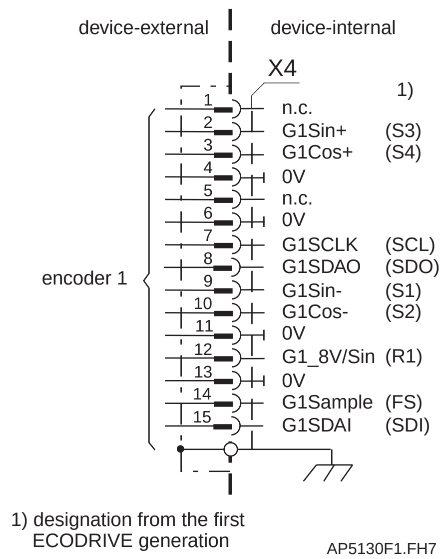


Fig. 4-87: Encoder 1

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

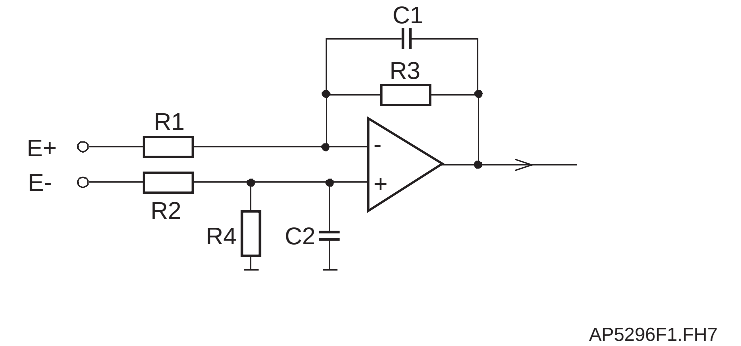
G1SCLK: Clock lead for I²C interface

G1SDA0, G1SDAI: Data lead for I²C interface

G1Sample: Control signal for encoder initialization

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

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



R1: 10k
R2: 10k
R3: 20k
R4: 20k
C1: N/A.
C2: N/A.

Fig. 4-88: 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. 4-89: Features of the differential input circuit

G1Cos+ (S4), G1Cos- (S2): 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_{DC} ± 0,2V	18,2 Vss (sine with 4 kHz)
max. output current	DC 250 mA	AC 70 mA eff.
min. Gleichstrom-widerstand der Last	--	35 R

Fig. 4-90: Features of the encoder output amplifier stage

Signal allocation to the actual position value

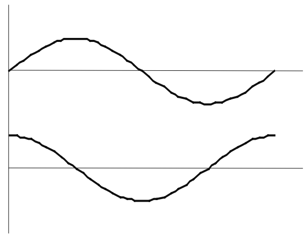
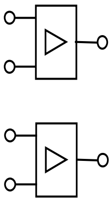
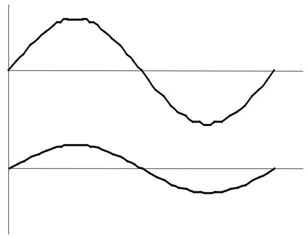
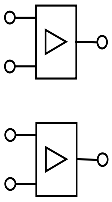
Signal allocation (X4)	signal designation	signal form	actual position value (with default setting)
	G1Sin+(S3) G1Sin- (S1) G1Cos+(S4) G1Cos- (S2) 	DSF (sine 1Vss without 120 Ohm matching resistor, I²C-Bus)	increasing
 amplitude-modulated signal	G1Sin+(S3) G1Sin- (S1) G1Cos+(S4) G1Cos- (S2) 	Resolver	increasing

Fig. 4-91: Signal allocation to the actual position value

Note: default setting:
=> see functional description: "Motor Encoder" (Encoder 1).

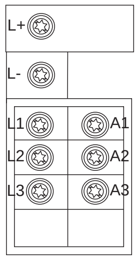
Connecting the Measuring System

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

X5, DC bus, Motor and Mains Connections

Technical description of connector

Illustration:



Ap5267f1.FH7

Fig. 4-92: Connector X5

Design:

Type	No. of pins	Design
connection block	2 / 3 / 3	screw-in connection for ring terminals M5

Fig. 4-93: Design

Tightening torque:

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

Fig. 4-94: Tightening torque

Connection cross section:

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

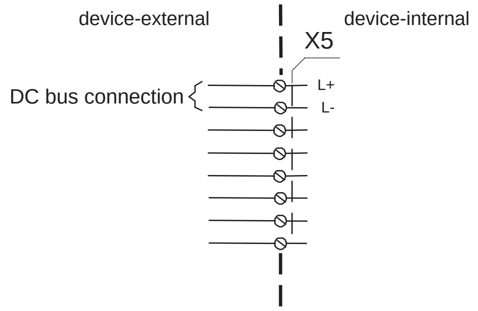
Fig. 4-95: Connection cross section

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"

Connection DC bus:



AP5301F1.FH7

Fig. 4-96: DC bus connection

CAUTION

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

⇒ 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 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	≥ 750V (e.g., litz wires - H07)

Motor connections

Connection Motor:

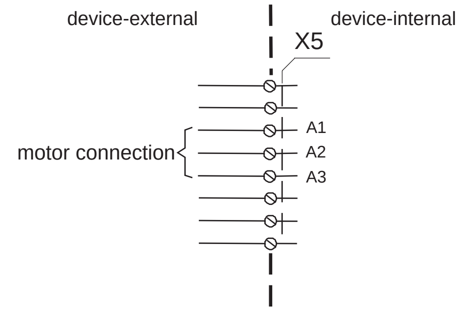


Fig. 4-97: Motor connections

Cable Motor: Use Rexroth Indramat motor power cables to connect motor and 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 and
- Ambient temperatures of ≤ 40° C per EN 60 204
- Switch frequency of 4 kHz

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. 4-98: Guide value for maximum motor cable lengths

WARNING

No guarantee!

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

⇒ Use Rexroth Indramat cables!

Mains Connections

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

Connection mains:

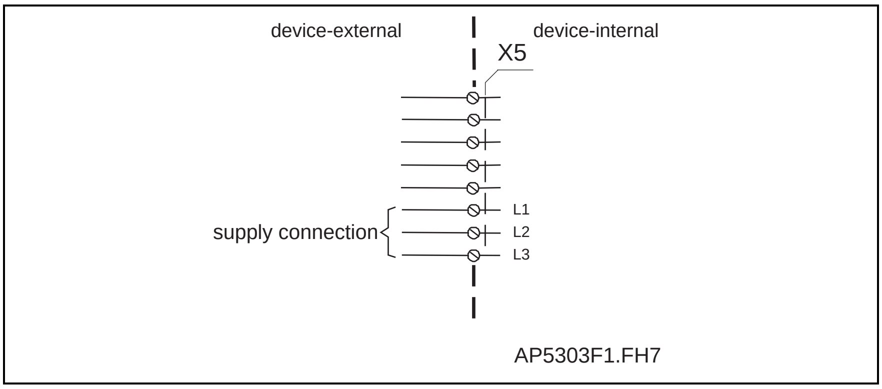


Fig. 4-99: Mains connections

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

See page 10-1: "Mains Connections"

X6, Motor temperature monitoring and holding brakes

Technical description of connector

Illustration:

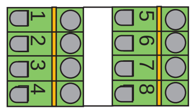


Fig. 4-100: Connector X6

Design:

Type	No. of pins	Design
Spring contact	2 x 4	Bushing on connector

Fig. 4-101: 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	0.2-1.5	24-16

Fig. 4-102: Connection cross section

CAUTION

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

⇒ Do not exchange connectors X6.1-4 and X6.5-8.

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.

Connection monitoring TM+, TM-:

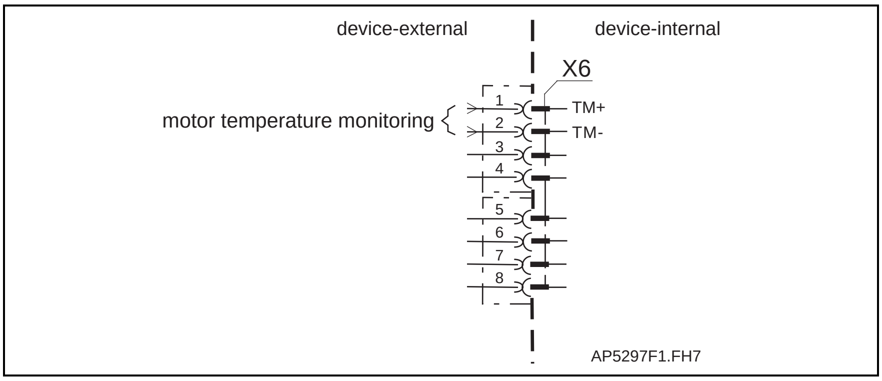
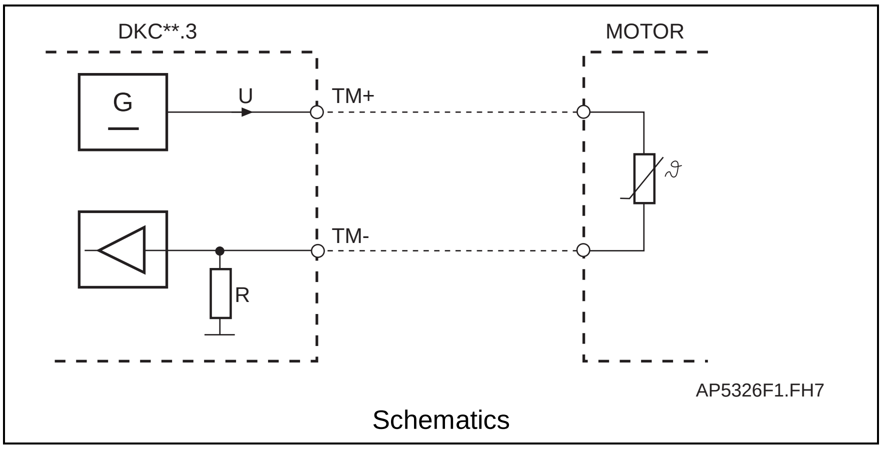


Fig. 4-103: Motor temperature monitoring

Motor temperature evaluation:



U: approximately 5 V
R: approximately 2 k

Abb. 4-104: Motor temperature evaluation

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

⇒ See also functional description : "Temperature monitoring".

Holding brake (BR+, BR-)

DANGER

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!

⇒ 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-:

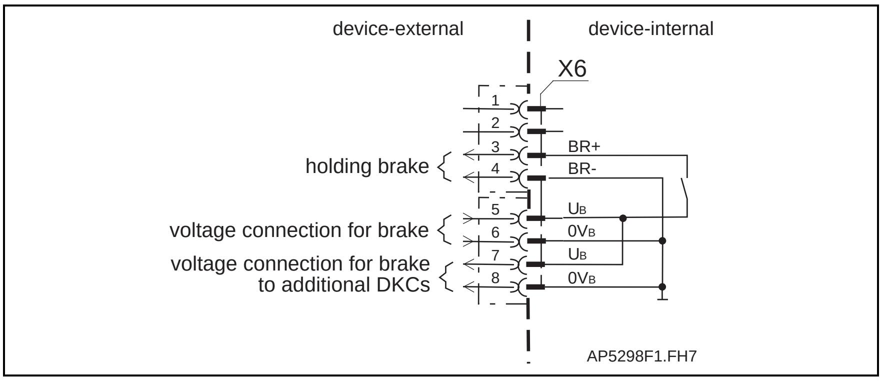


Fig. 4-105: Holding brake and voltage connection

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 ($L_{Bremse}/(24V/I_{Bremse})$):	250.000	
Short-circuit and overload protection in the row to the contact	present	

Voltage connection for brakes

Connection voltage brake connection:

See page 4-66 : "Holding brake (BR+, BR-)".

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.

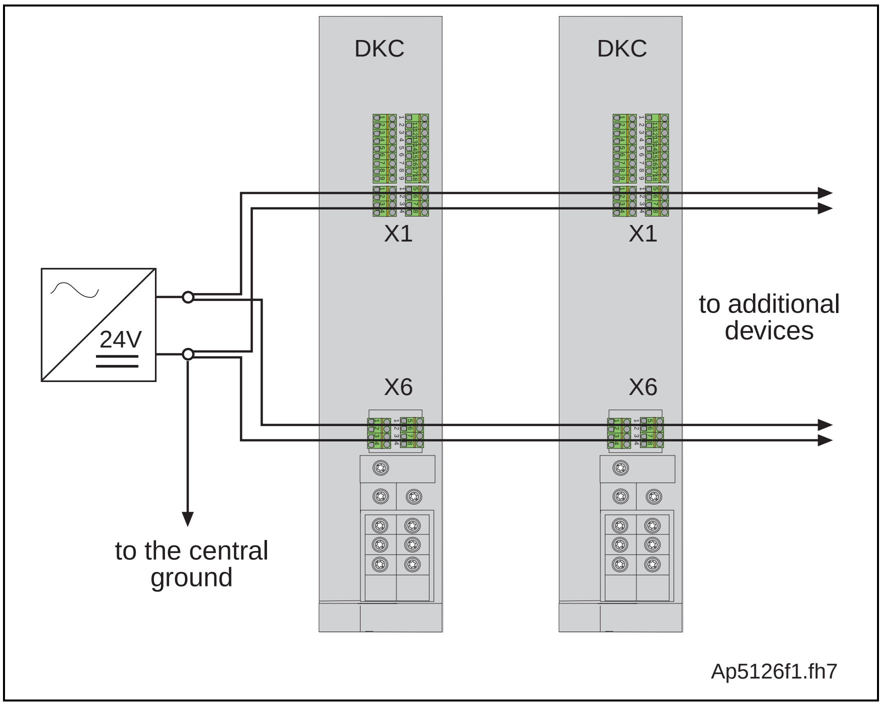


Fig. 4-106: Shared voltage source for brakes and control voltage supply

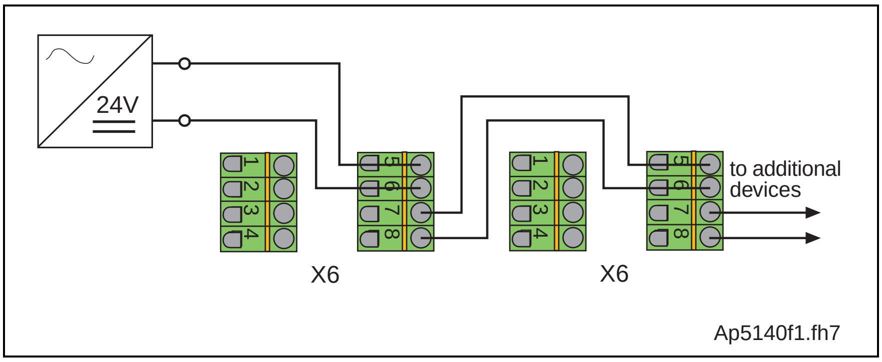


Fig. 4-107: Looping through the brake supply

Voltage connection for brakes on DKC:

max. voltage at X6.5/7 against X6.6/8:	DC 40 V
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 mm²
Voltage resistance of single wire to ground	≥ 750V (e.g.: litz wires - H07)
wire routing	parallel if possible (twisted)
max. inductance between 24V source and X6	100 µH (equals about 2 x 75 m)

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

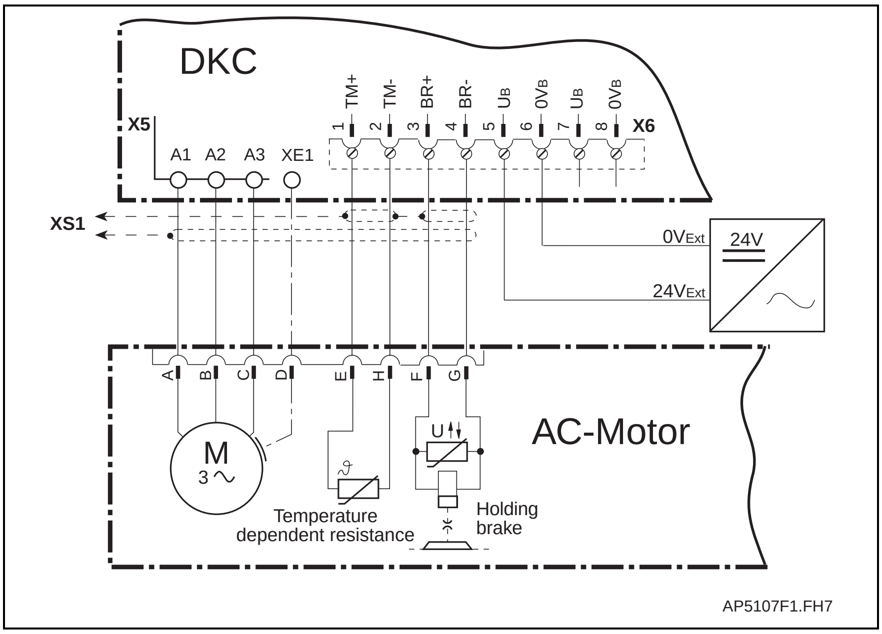


Fig. 4-108: Connection of motor cable, holding brake and temperature monitor for motors with connectors

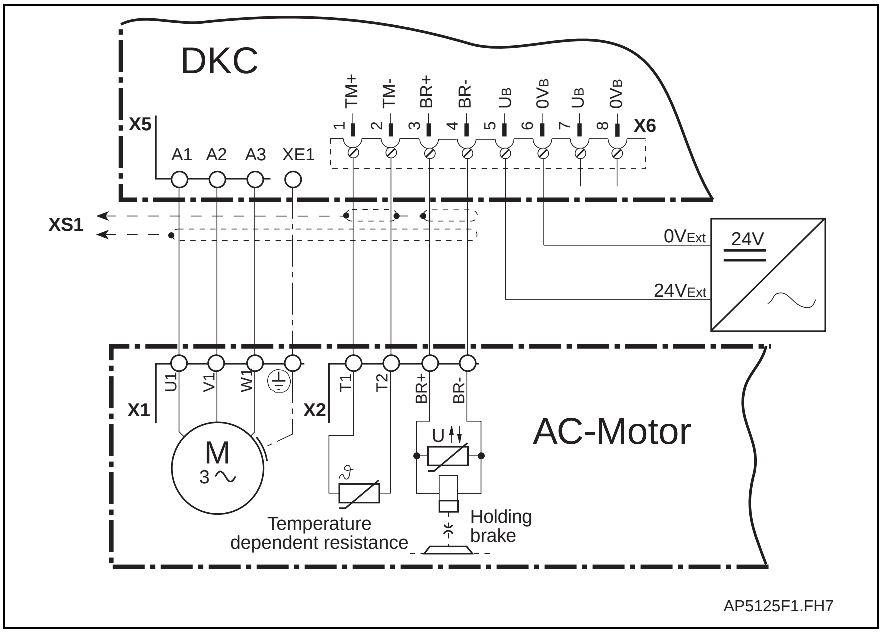


Fig. 4-109: Connection of motor cable, holding brake and temperature monitor for motors with connector box

---

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

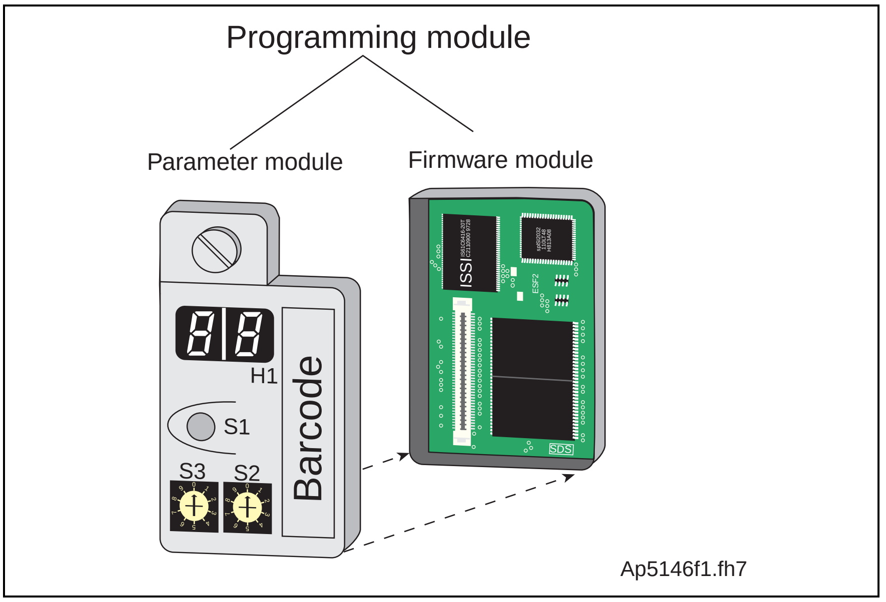


Fig. 4-110: X7, Programming module

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

Setting the Drive Address

Switch S2, S3 drive address

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

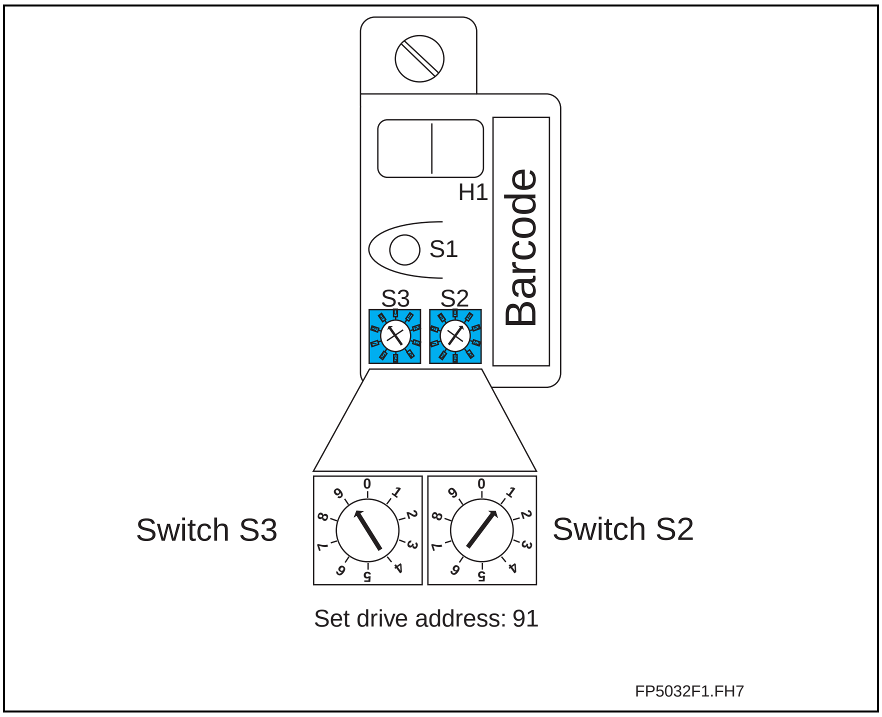


Fig. 4-111: Setting the drive address using a decade switch

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

⇒ See functional description.

Rexroth Indramat

X8, Encoder 2

Technical description of connector

Illustration:

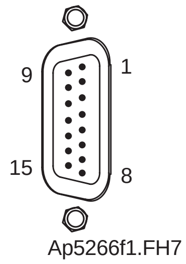


Fig. 4-112: Connector X5

Design:

Type	No. of pins	Design
D-SUB	15	Pins on unit

Fig. 4-113: 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. 4-114: Connection cross section

Encoder 2

Connection Encoder 2:

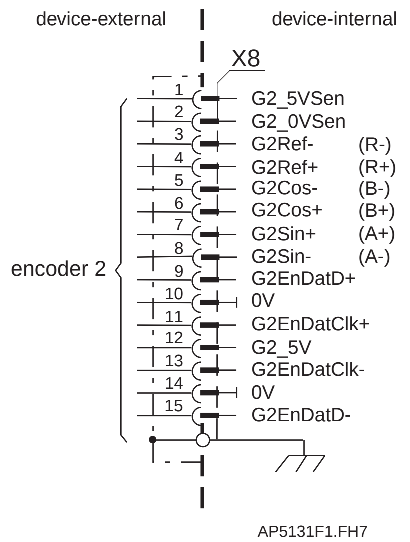


Fig. 4-115: Encoder 2

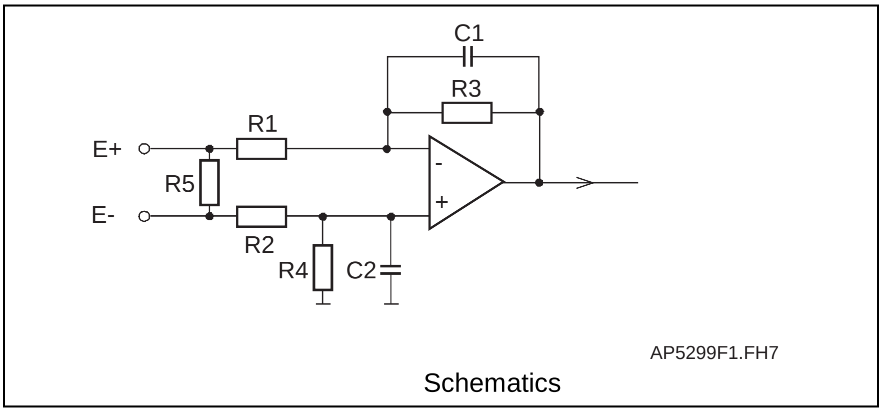
Shield connection: Via D-subminiature mounting screws and metal connector housing.

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

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

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

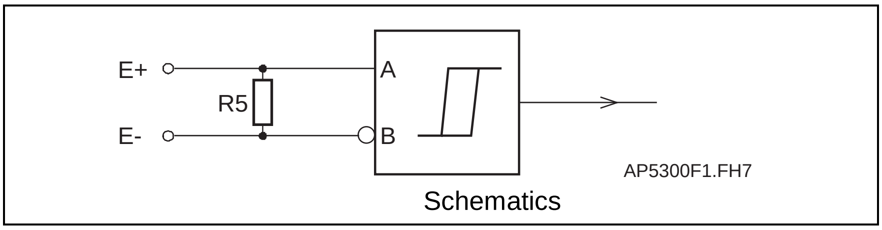
Input circuit for sine signals G2Sin+ (A+), G2Sin- (A-):



R1:	N/A.
R2:	N/A.
R3:	N/A.
R4:	N/A.
R5:	120R
C1:	N/A.
C2:	N/A.

Fig. 4-116: Input circuit for sine signals

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



R5: 120R

Fig. 4-117: Input circuit for square-wave signals

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

Sine encoder

	Input voltage
max. allowed amplitude encoder signal ($U_{SSencoder\ signal}$)	(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. 4-118: Features of the differential input (Sine encoder)

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

- Differential signal $1.0V_{SS}$
- Reference voltage for the differential signal 2.7 V
- $$\frac{\text{Position resolution}}{\text{Encoder cycle}} = \frac{2^{12}}{1{,}2V_{SS}} \bullet U_{SSencodersignal}$$

Example: If $U_{SSencoder\ signal} = 1\ V_{SS}$

$$\frac{\text{Position resolution}}{\text{Encoder cycle}} = \frac{2^{12}}{1{,}2V_{SS}} \bullet 1V_{SS} = 6826$$

=> see also 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. 4-119: 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_{DC}
max. output current:	300 mA

Fig. 4-120: Features of the encoder output amplifier stage

Signal allocation to the actual position value

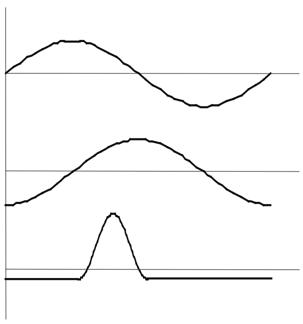
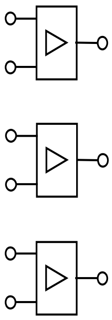
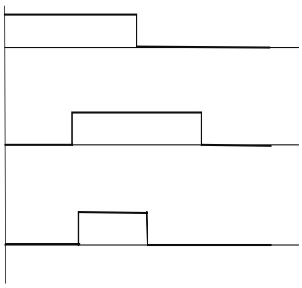
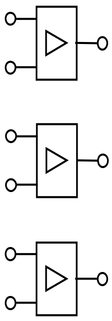
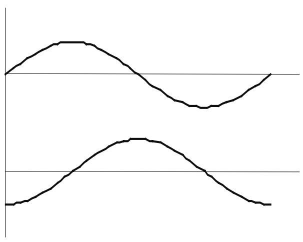
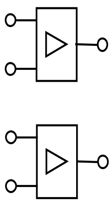
Signal allocation (X8)	**signal designation**	**signal form**	**actual position value (with default setting)**
	G2Sin+(A+) G2Sin- (A-) G2Cos+(B+) G2Cos- (B-) G2Ref+(R+) G2Ref- (R-) 	sine (1Vss) without absolute value (e.g. gearwheel encoder)	reducing
	G2Sin+(A+) G2Sin- (A-) G2Cos+(B+) G2Cos- (B-) G2Ref+(R+) G2Ref- (R-) 	square (TTL) without absolute value	reducing
	G2Sin+(A+) G2Sin- (A-) G2Cos+(B+) G2Cos- (B-) 	sine (1Vss) with absolute value (e.g. EnDat)	increasing

Fig. 4-121: Signal allocation to the actual position value

Note: default setting:
=> see 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.

⇒ 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

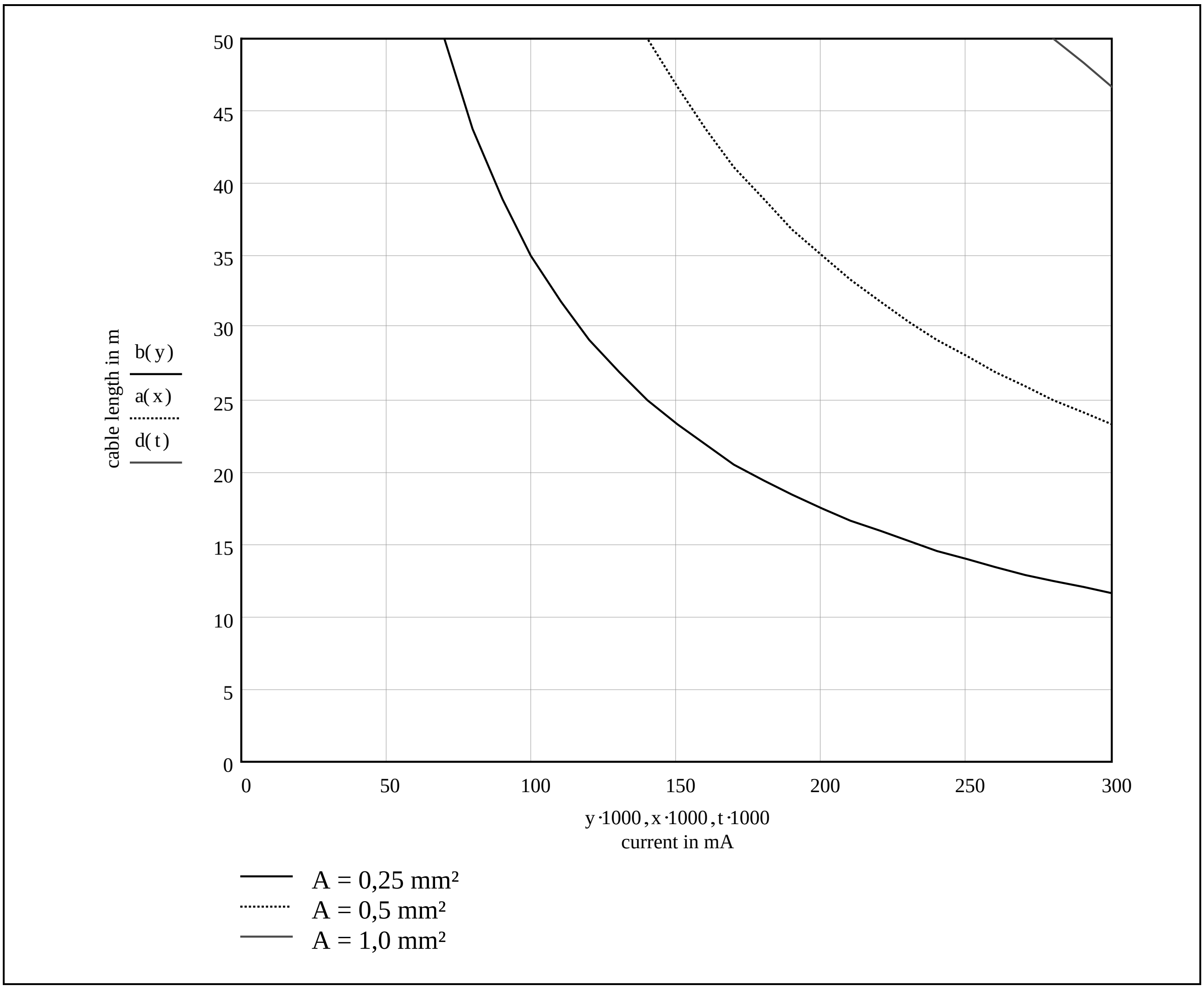


Fig. 4-122: With sensor connection

2. Without sensor connection in the encoder lead

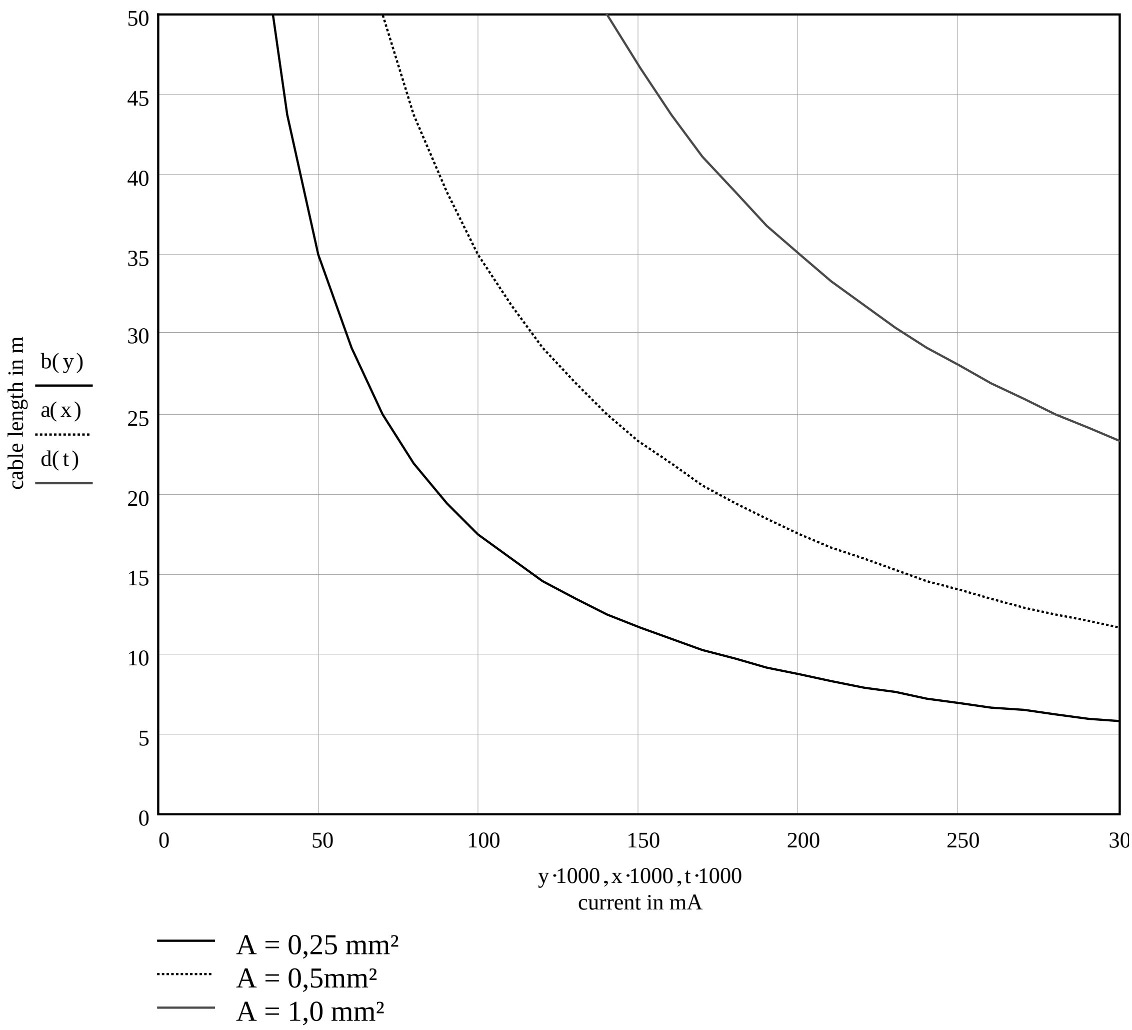


Fig. 4-123: Without sensor connection

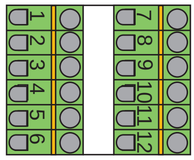
Measuring Systems Connections

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

X9, Incremental and Absolute Encoder Emulation (SSI format)

Technical description of connector

Illustration:



Ap5269f1.FH7

Fig. 4-124: Connector X9

Design:

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

Fig. 4-125: 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	0.2-1.5	24-16

Fig. 4-126: Connection cross section

Connection encoder - emulation

cable:

max. cable length:	40 m
shielding see also "Fig. 4-127: Connection of incremental actual position value output" and "Fig. 4-131: Output of absolute actual position value in SSI format"	double shield protected

CAUTION

Damaging potential by utilising non and single shielded cables.

⇒ Utilise double shielded cables.

Encoder - emulation

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

Incremental encoder emulation

Connection Incremental encoder emulation:

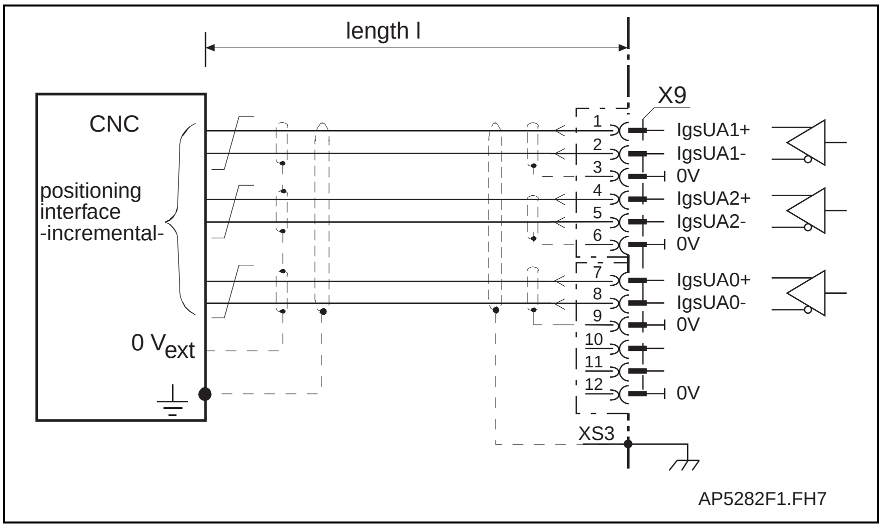


Fig. 4-127: Connection of incremental actual position value output

Differential outputs incremental encoder emulation

Output voltge:	min.	max.
High	2.5 V	5 V
Low	0 V	0.5 V
max. output current I_{out}	I20I mA	
max. output frequency f	500 kHz	
Overload protection	Outputs may not be short circuited. Danger of damage!	

Fig. 4-128: 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.

Signal for incremental actual position value output

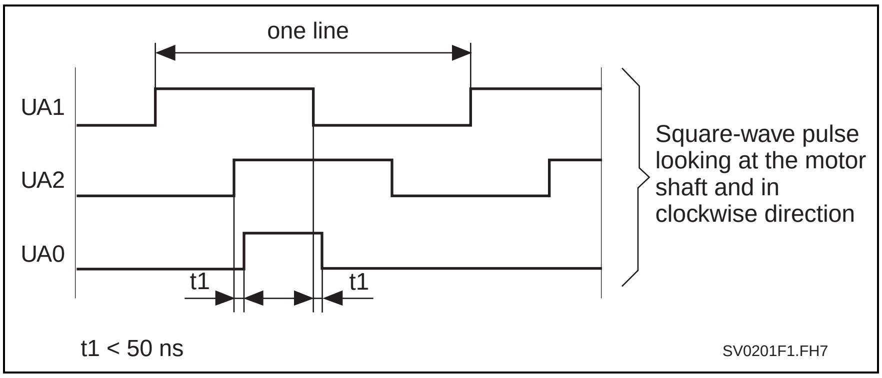


Fig. 4-129: Signal for incremental actual position value output

Output frequency f:

$$f = \frac{\text{Line Quantity}}{\text{Revolutions}} \bullet n$$

f: output frequency
n: velocity (rotary)

Fig. 4-130: Calculating the output frequency f

Note: The output frequency results from the parameter setting.
=> See also functional description: "Encoder Emulation".

Pass-band width of the controller-side signal filtering for UA1 and UA2::

Note: Conditionally due to the internal signal processing the period duration and the duty cycle of the signals put out vary. Therefore the following requirements of the signal filtering for UA1 and UA2 arise.

- $f \geq 250$ kHz $f_{Pass} \geq 500$ kHz
- $f < 250$ kHz $f_{Pass} \geq 2 \times f$

RPM Measurement:

Note: The frequency measurement is **not** suitable for the RPM measurement derived from the incremental emulator signals.

Absolute Encoder Emulation (SSI format)

Connection Absolute Encoder Emulation:

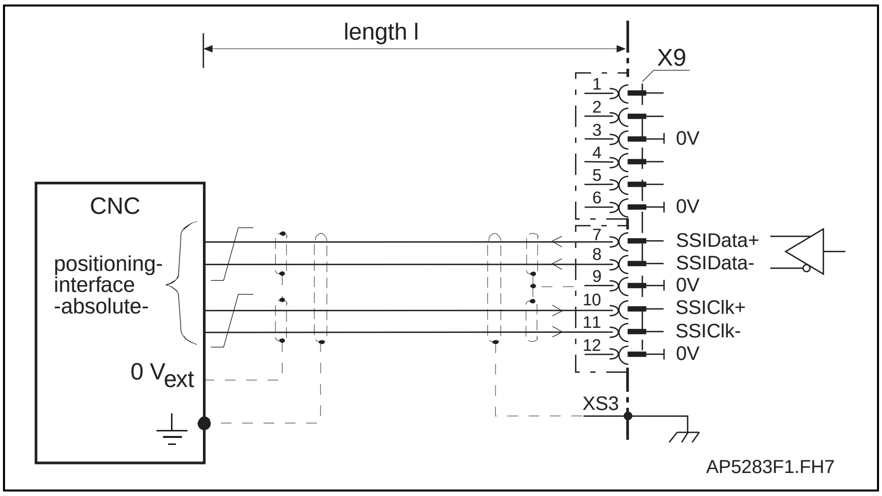
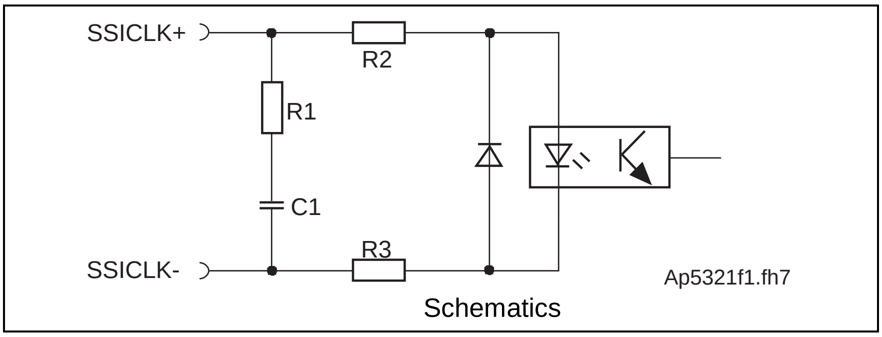


Fig. 4-131: Output of absolute actual position value in SSI format

Differential input circuit absolute encoder emulation:



R1: 332R
R2: 100R
R3: 100R
C1: 1nF

Fig. 4-132: 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		

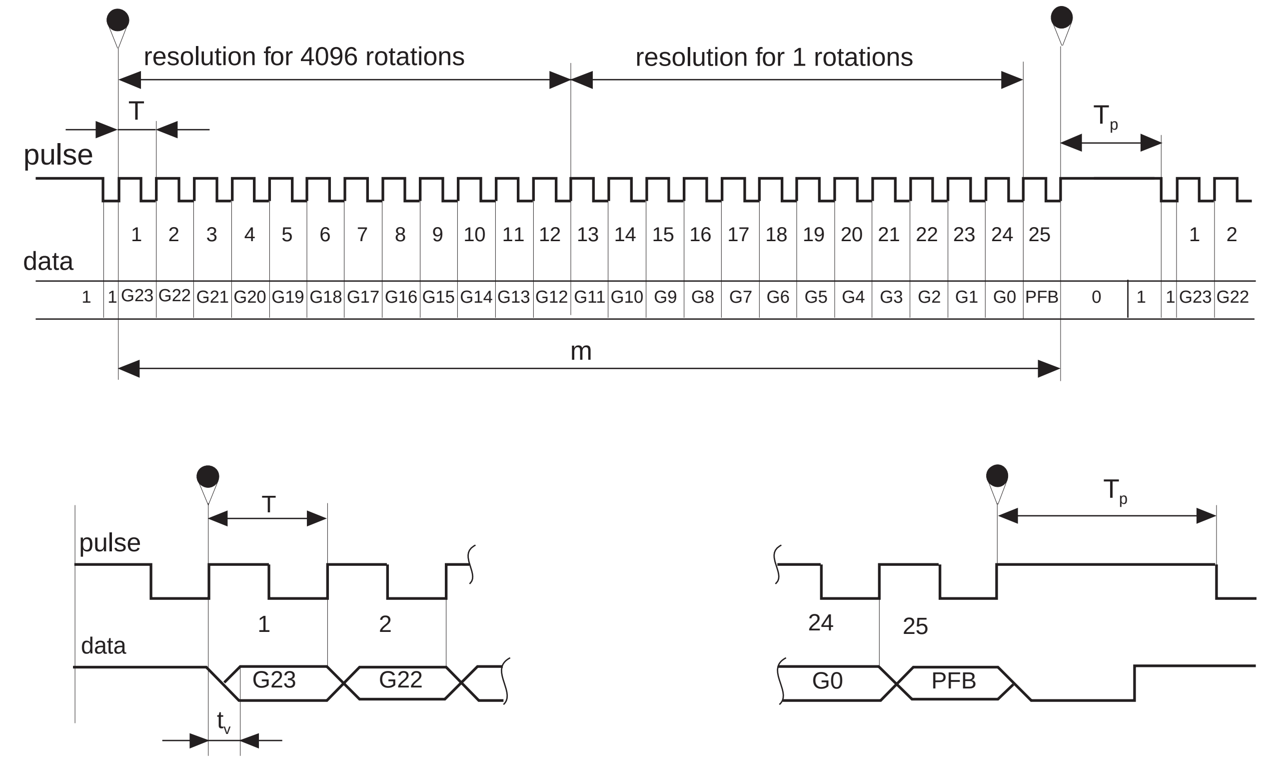
Fig. 4-133: Differential outputs

Differential outputs absolute encoder emulation:

See "Fig. 4-128: 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)



G0 = least significant bit in gray code
G23 = most significant bit in gray code
m = stored parallel information
T = pulse time
T_p = pulse break ≥ 20 µs
t_v = delay time max. 650 ns
PFB = power failure bit (not used and always logically LOW)

SV0202F1.FH7

Fig. 4-134: Pulse diagram for absolute actual position output (SSI format)

X10, Expansion interface

Technical description of connector

Illustration:

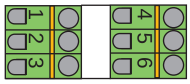


Fig. 4-135: Connector X10

Design:

Type	No. of pins	Design
Spring contact	2 x 3	Bushing on connector

Fig. 4-136: 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	0.2-1.5	24-16

Fig. 4-137: Connection cross section

Expansion interface

Connection expansion interface:

Utilisation in preparation

Fig. 4-138: Expansion interface

X11, DC bus dynamic brake (ZKS), UD power supply

Technical description of connector

Illustration:

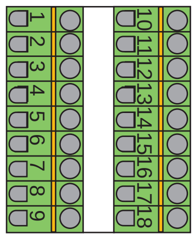


Fig. 4-139: Connector X11

Design:

Type	No. of pins	Design
Spring contact	2 x 9	Bushing on connector

Fig. 4-140: 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	0.2-1.5	24-16

Fig. 4-141: Connection cross section

ZKS control supply

Note: Internal DC bus dynamic brake setup (ZKS) not in DKC**.3-040-7-FW.

Connection +24Vpro and OV:

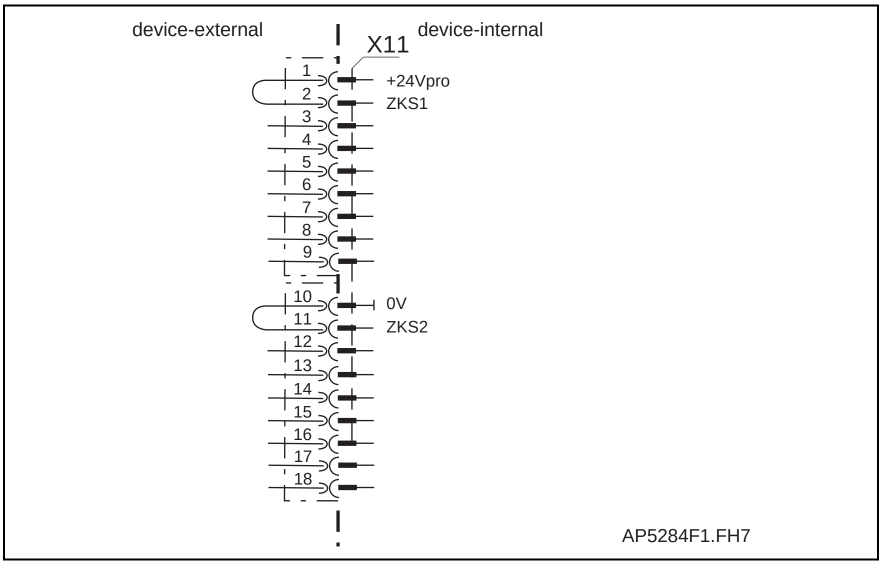
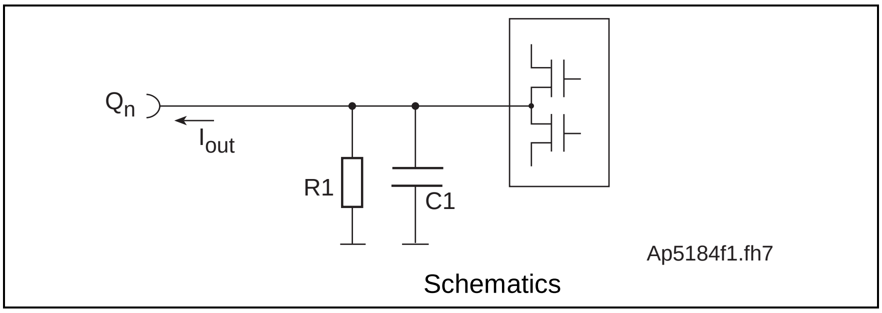


Fig. 4-142: DC bus dynamic brake control

At delivery: with bridges at:

X11.1	to	X11.2
X11.10	to	X11.11

Output +24Vpro:



R1: approximately 12 R
C1: 470 µF
Fig. 4-143: Voltage source from X2.1

Loadability of the connection +24Vpro:

max. output voltage (dependent of control voltage an X1.1)	DC (19.2...28.8) – 2V
max. allowed output current:	DC 0.1 A
Thermal overload protection	via charging current limiter behind X1.1
max. short circuit current	2.4 A

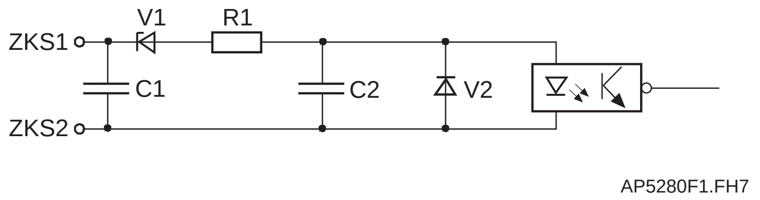
Application +24Vpro: The connections supported the ZKS inputs.

ZKS control input

Connection ZKS1 and ZKS2:

See page 4-84: "ZKS control supply".

Input circuit ZKS1 and ZKS2:



R1: 2k2
V1: 10V
V2: 0.7V
C1: 0.1µF
C2: 0.1µF

Fig. 4-144: Input circuit

Inputs ZKS1 and ZKS2:

Input voltage: High Low	min. 15 V 0 V	max. 28.8 V 4 V
trigger delay t_d due to contactor drop delay	min. 40 ms	max. 80 ms
Input resistance	about 2 kOhm	
Potential isolation	to 50Veff	
Polarity protected within allowed input voltage range.		

Fig. 4-145: 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. 4-146: 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!

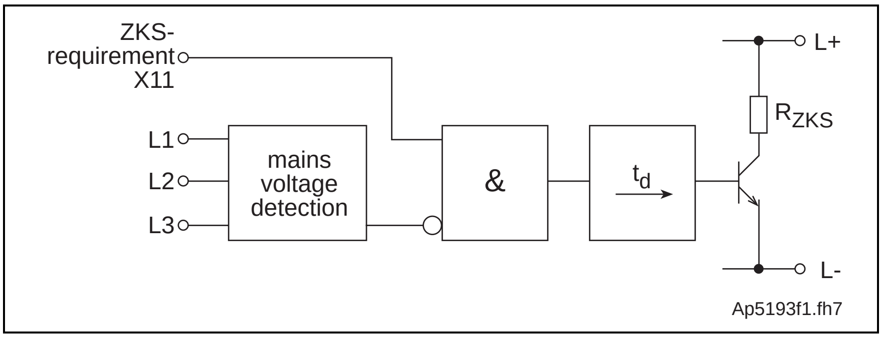


Fig. 4-147: Block diagram interlock ZKS/Mains

See page 4-23: "Arranging the Central supply" and
page 10-4: "Control Circuits with internal DC bus dynamic brake (ZKS)".

Bb drive, Bb power supply and UD power supply

Connection Bb drive, Bb and UD mains section:

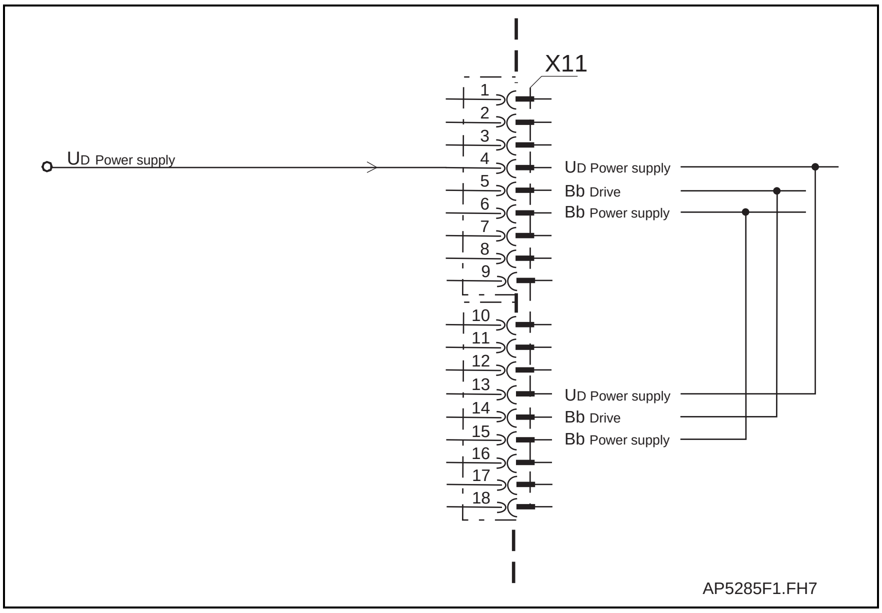


Fig. 4-148: Bb drive, Bb power supply and UD power supply

Input circuit Bb drive, Bb and UD mains section:

See page 4-46: "Drive halt (AH) and Drive enable (RF)".

Inputs Bb drive, Bb power supply and UD power supply: See page 4-46: "Drive halt (AH) and Drive enable (RF)".

UD power supply: With central mains supply (see page 4-23: "Arranging the Central supply") the DKC's operated on one DC bus must be informed about the status of the power supply.

The output $U_{Dmessage}$ (X3.11) is high, upon completion DC bus load.

With this type of mains supply, the UD-message X3.11 serves as a signal source to the DKC's connected to the mains supply.

The UD-message is daisy-chained via connector X11.4 and X11.13 and at the end of the connection sequence the signal is available at connector X11.13 for relaying to the control.

UD power supply:

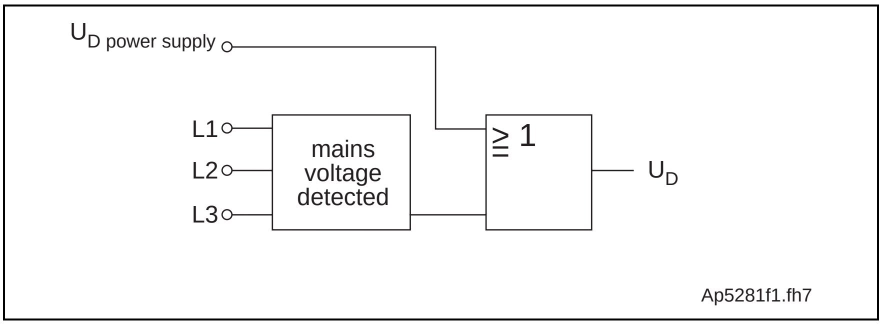


Fig. 4-149: Correlation of $U_{D\ power\ supply}$ and U_D ($U_{D\ message}$)

See page 4-54: "Digital outputs (ready, warning and U_D)".

Connection UD power supply:

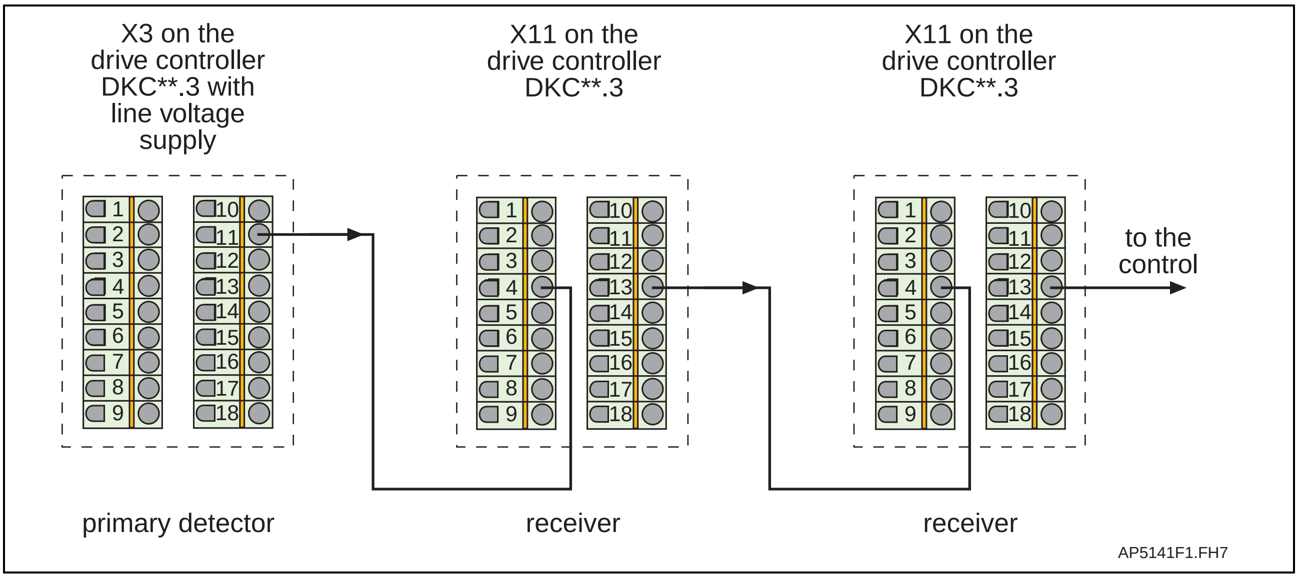


Fig. 4-150: UD power supply

Bb drive and Bb power supply:

Note: Utilisation in preparation

Rexroth Indramat

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

Technical description of connector

Illustration:

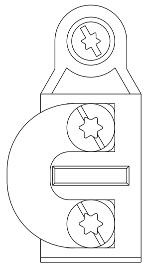


Fig. 4-151: Connector X12

Design:

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

Fig. 4-152: Design

Tightening torque:

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

Fig. 4-153: Tightening torque

Connection cross section:

Cross section single wire [mm²]	Cross section multi core wire [mm²]	Cross section in AWG Gauge no.:
--	min. 10 mm² max. 35 mm²	--

Fig. 4-154: Connection cross section

Choke Connection (DR+, DR-)

Connection DR+, DR-:

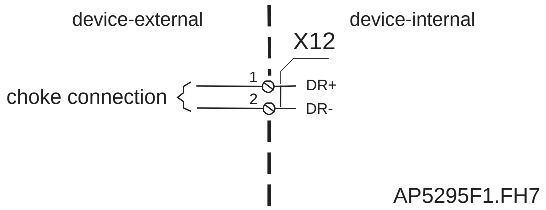


Fig. 4-155: Optional choke connection for DKC**.3-200-7

At delivery: with bridges at: X12.1 to X12.2

Loadability of the connection DR+, DR-:

max. voltage against L-:	DC 900 V
voltage against ground	Applied mains voltage
max. continuous current (rms):	70 A

wire DR+, DR-:

wire length:	max. 10 m
wire cross section:	min. 10 mm², but not smaller than mains wire cross section
wire routing	twisted
Voltage resistance of single litz to ground:	≥ 750V (e.g.: litz wires - H07)

Note: Connection bridged at delivery.

XE1, XE2 Protective conductor connections for motor and mains

Technical description of connector

Illustration: See page 4-39: "A look at the drive controller and connector designations".

Design:

Type	No. of pins	Design
screw-in connection	1	screw-in connection for ring terminals M5

Fig. 4-156: Design

Tightening torque:

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

Fig. 4-157: Tightening torque

Connection cross section:

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

Fig. 4-158: Connection cross section

XE1, Protective conductor connection for motor

See page 4-63: "Motor connections".

XE2, Protective conductor connection for mains

PE connection ≥ 10 mm²

Reason: high leakage currents (prEN 50178/1994, section:5.3.2.1)

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.

4.3 Electrical Connections – dependent on the drive controller type

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

View of interface to command communications

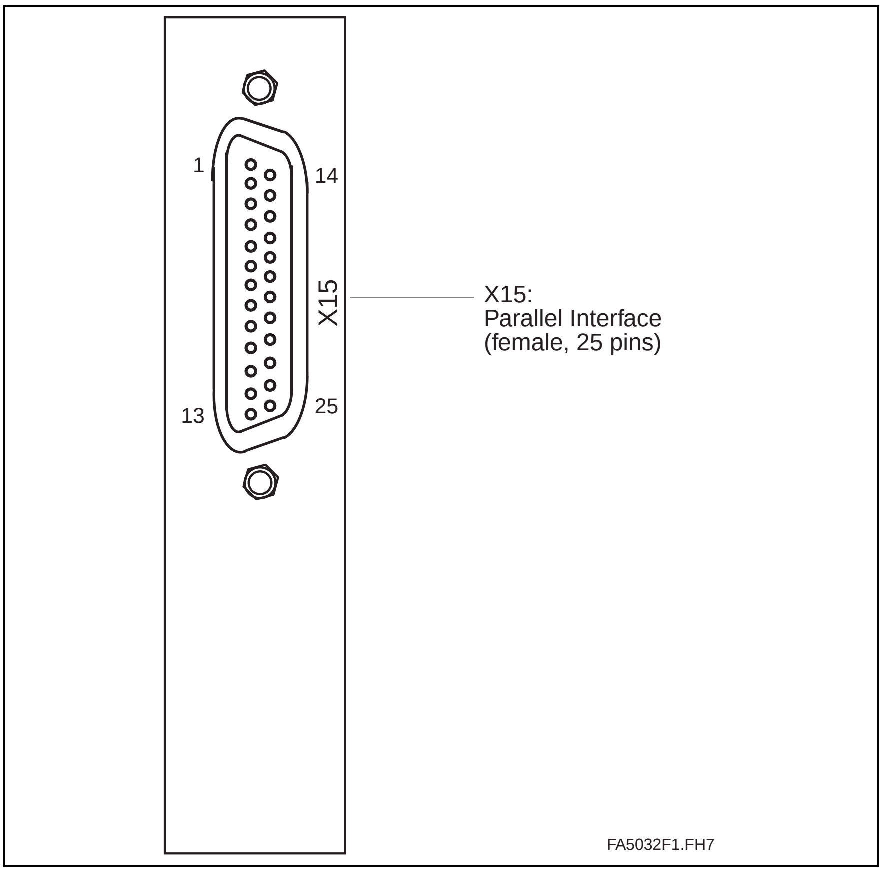


Fig. 4-159: View of interface to command communications

Technical description of connector

Design:

Type	No. of pins	Design
D-SUB	25	Bushing on the unit

Fig. 4-160: Design

Connection cross section:

Cross sections single wire [mm²]	Cross sections multi core wire [mm²]	Cross sections in AWG 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 DC 24 volts of the DKC controls the inputs, then connect the standard lead (GND) of the separate mains section to X15.13 (OV).

Connection Parallel Interface:

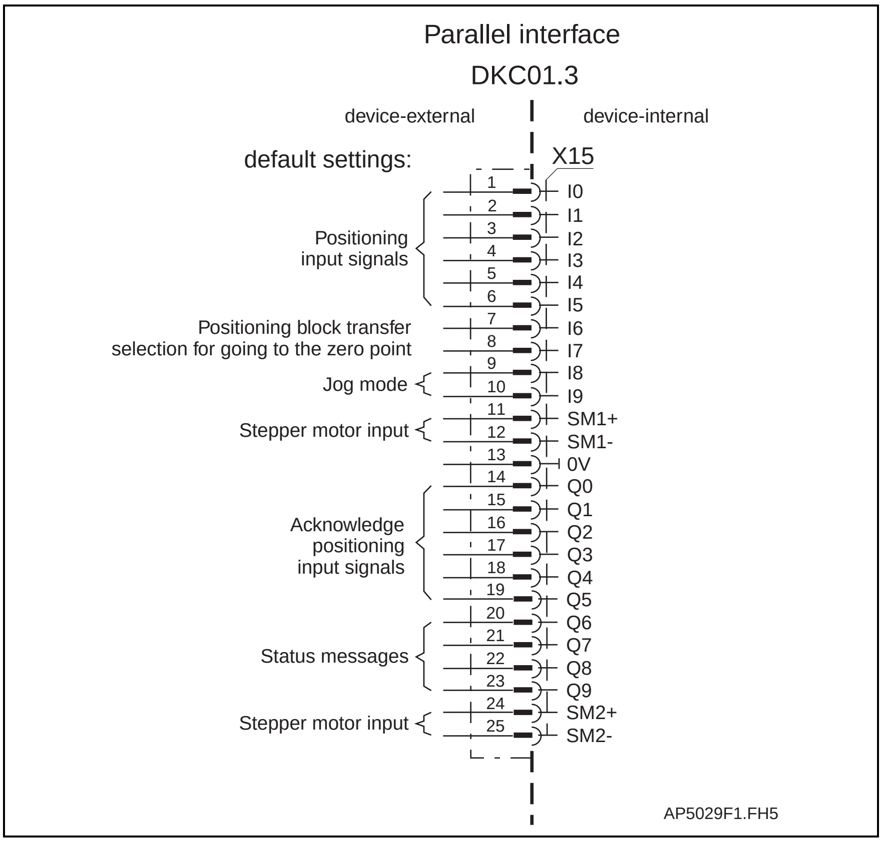


Fig. 4-162: Parallel interface for DKC01.3

Plug-in connector assignment X15:

Pin	IO	Function	Pin	IO	Function
1	I	I 0	14	O	Q 0
2	I	I 1	15	O	Q 1
3	I	I 2	16	O	Q 2
4	I	I 3	17	O	Q 3
5	I	I 4	18	O	Q 4
6	I	I 5	19	O	Q 5
7	I	I 6	20	O	Q 6
8	I	I 7	21	O	Q7
9	I	I 8	22	O	Q 8
10	I	I 9	23	O	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.

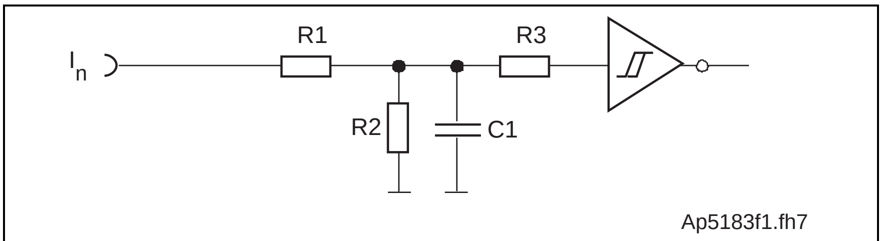
Default allocation of the binary I/Os:

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

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

Note: The I/O allocation can be configured.
=> See functional description.

Input circuit I 0 – I 9:



Schematics

R1: 10k
R2: 3k3
R3: 10k
C1: N/A.

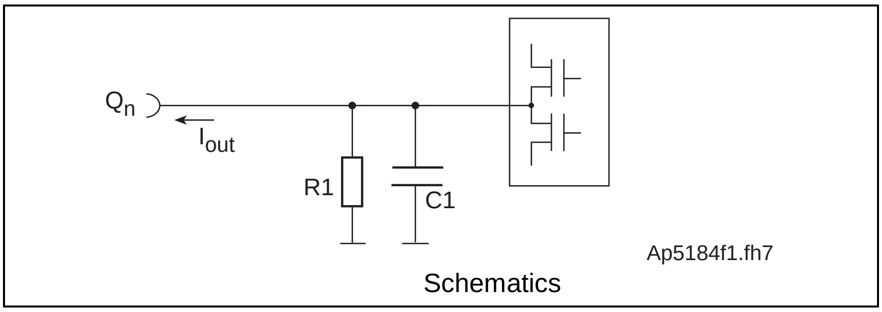
Fig. 4-165: Input circuit

Signal range of inputs I 0 – I 9:

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

Fig. 4-166: Inputs

Output circuit Q 0 – Q 9:



R1: 20k
C1: N/A.
Fig. 4-167: Output circuit

Signal level of outputs Q 0 – Q 9:

Output voltage: High Low	min. 16 V -0.5 V	max. U_{ext} (an X1.1-1V) – 1.5 V
Output current I_{out}	80 mA	
rise and drop time	about < 600 ns	
overload protection	- short circuit protection At I_{out} > 300 mA outputs switch off. - thermal off	

Fig. 4-168: Outputs

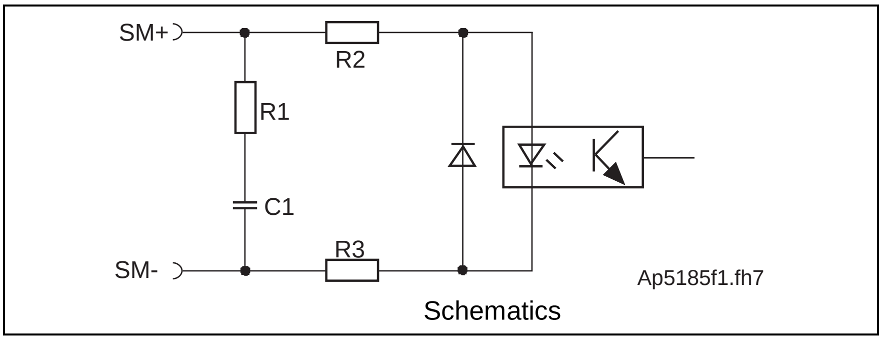
Default allocation of step-motor inputs:

Pin	Inputs		Pin	Outputs	
11	SM1+	Diff input	24	SM2+	Diff input
12	SM1-	Diff input	25	SM2-	Diff input

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:



R1: 121R
R2: 121R
R3: 121R
C1: 1 nF
Fig. 4-170: Differential input circuit

Signal voltages of differential inputs:

Input voltages Difference:	min. |3| V	max. |5| V
input current:	min. |5| mA	max. |15| mA
cycle freq.	max. 1 MHz	

Fig. 4-171: Differential inputs

CAUTION

Overloads destroy inputs!

⇒ 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.

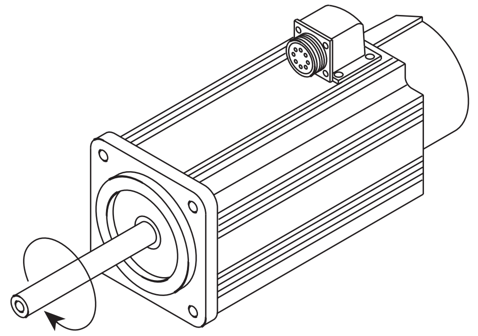


Fig. 4-172: Rotational direction with jog+

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 – I7: 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.

Connection single channel:

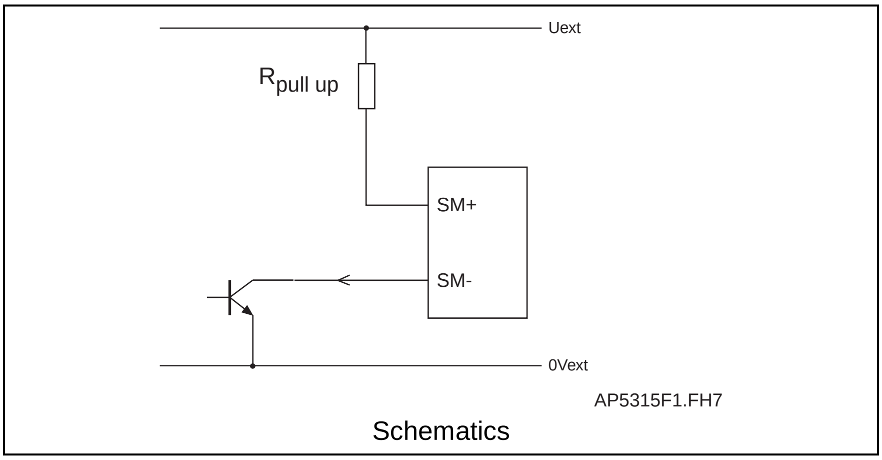


Fig. 4-173: Controlling with open collector outputs

CAUTION

Overloads damage inputs!

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

Controlling with the stepper motor interface:

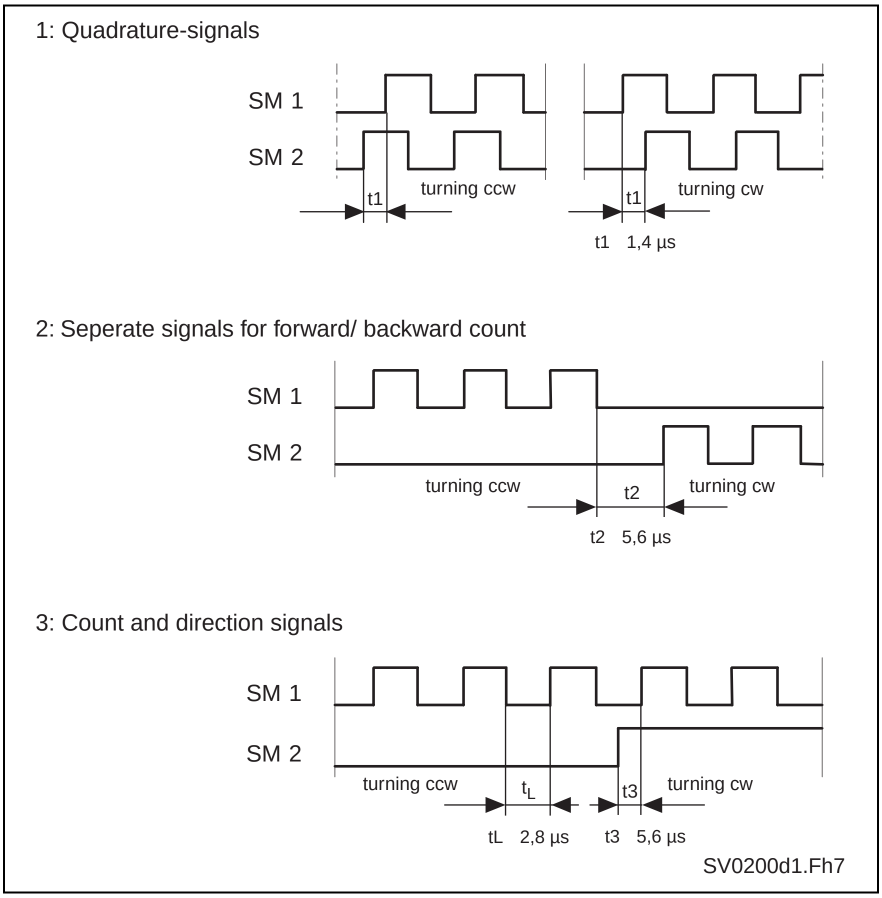


Fig. 4-174: Stepper motor interface types of control

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

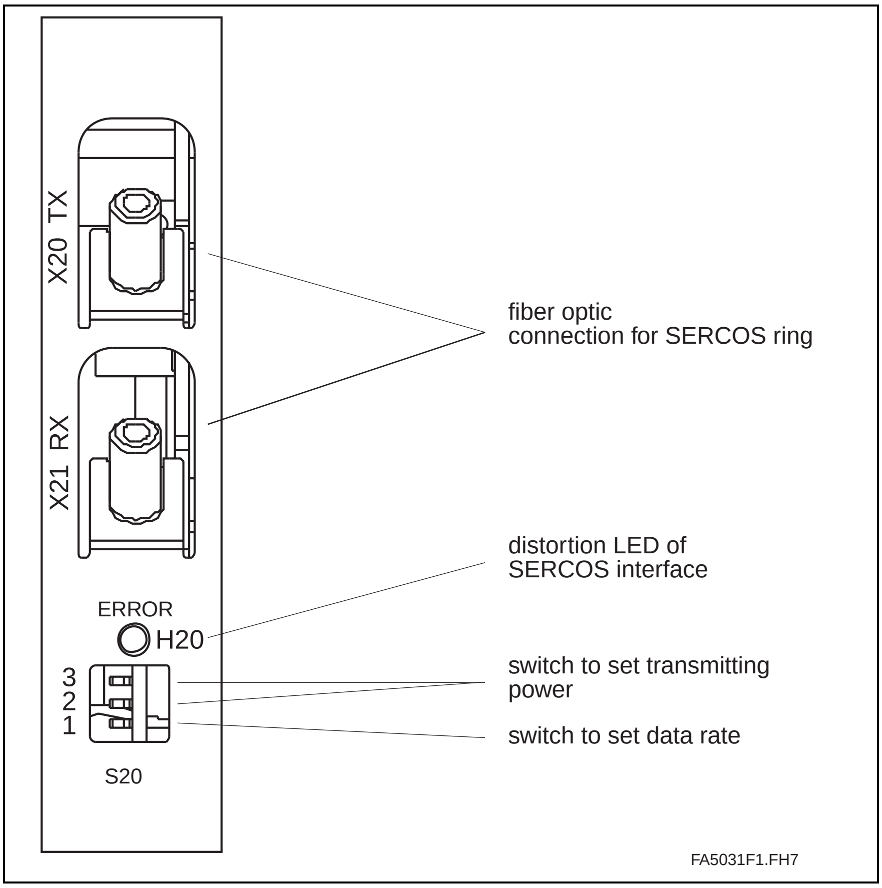


Fig. 4-175: View of command communication interface

Connection diagram for SERCOS interface

Connection SERCOS interface:

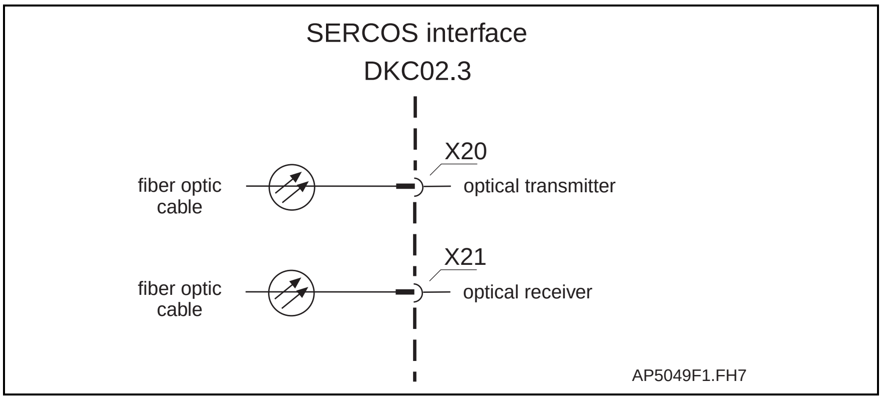


Fig. 4-176: I/O connection allocations for DKC02.3

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).

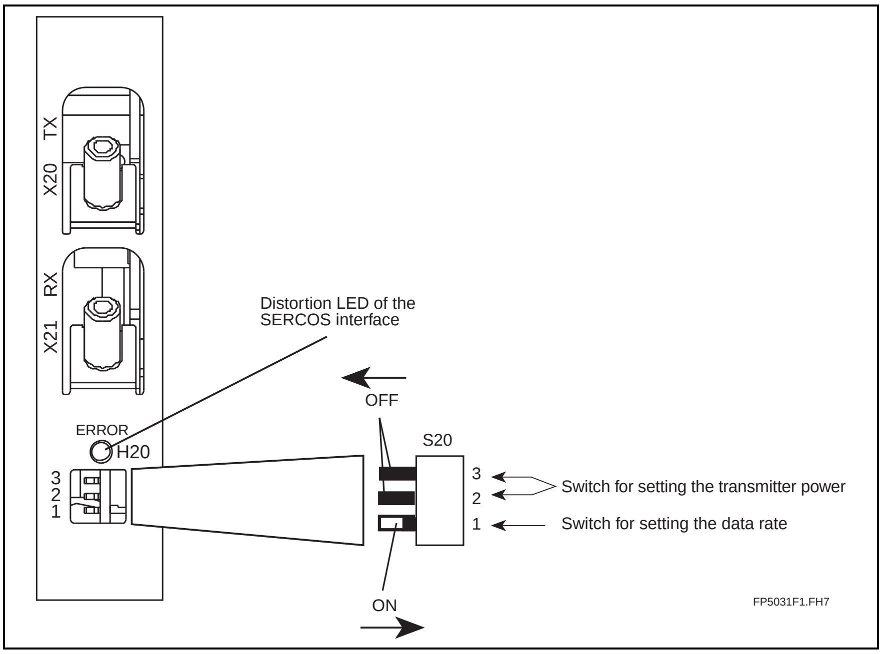


Fig. 4-177: Position of the switch for data rate and transmitter power demonstrating how to switch it ON and OFF

Data rate

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	0..15 m	--
ON	OFF	-4,5	350	15..25 m	--
OFF	ON	-1	800	25..35m	--
ON	ON	0	1000	35..50m	0..500m

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.

Selecting fiber optic connections:

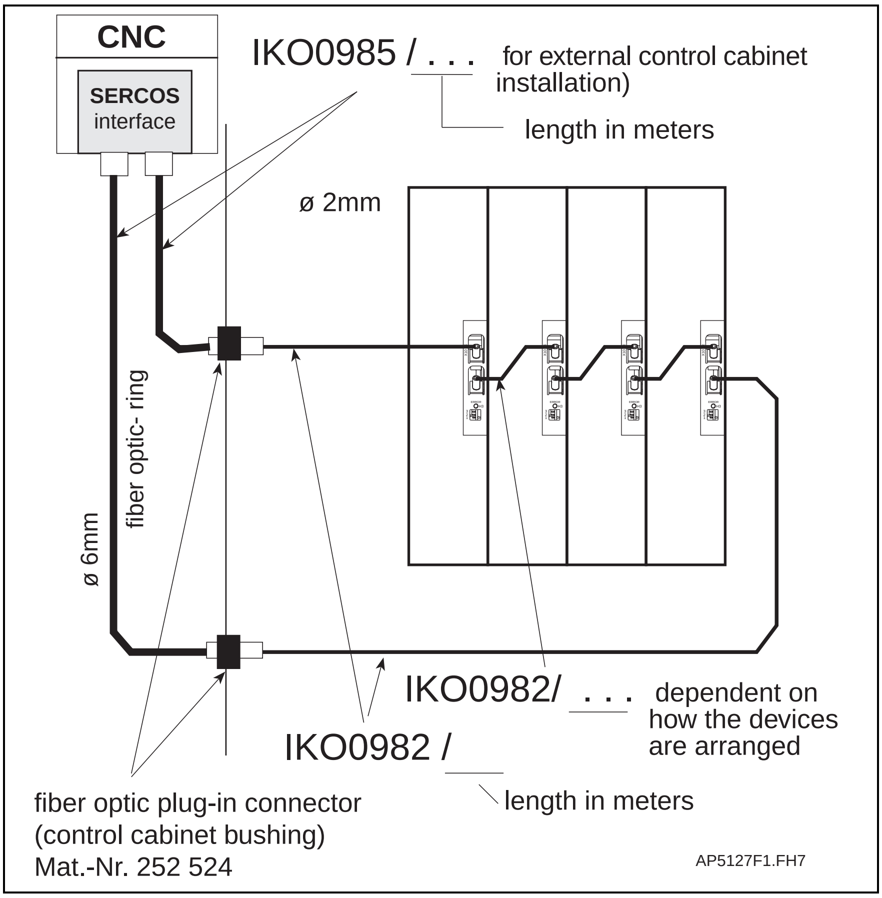


Fig. 4-180: Selecting standard LWLs

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

View of command communication interface

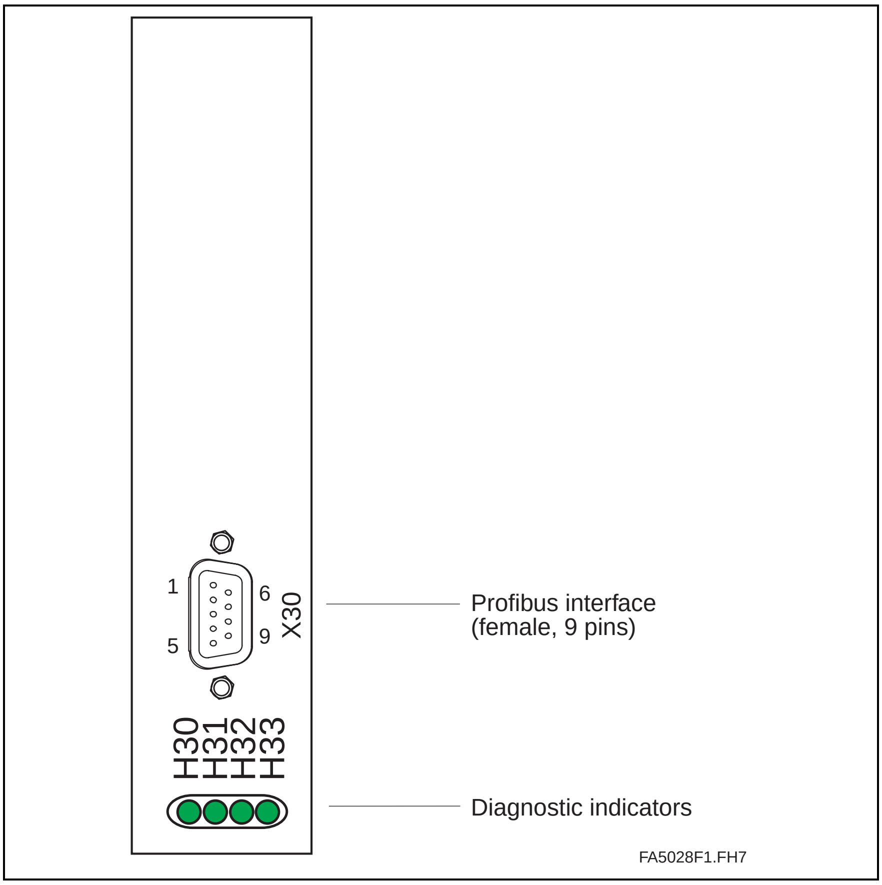


Fig. 4-181: View of command communication interface

Technical description of connector

Design:

Type	No. of pins	Design
D-SUB	9	Bushing on the unit

Fig. 4-182: 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. 4-183: Connection cross sections

Connection diagram for Profibus-DP Interface

Connection Profibus-DP interface:

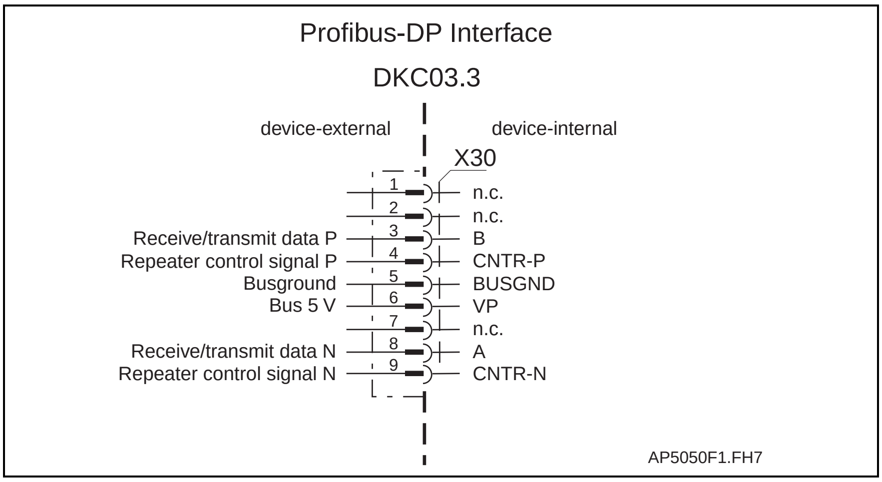


Fig. 4-184:Profibus-DP interface for DKC03.3

Interface compatibility: As per DIN EN 50 170

Recommanded cable type: as per DIN EN 50 170 – 2, cable type A

Plug-in connector assignment X30:

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

Fig. 4-185: Signal assignment of connector X30

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

Signal Specification:

Signal	Specification
+5V Repeater supply	+5V (±10%) max. 75 mA
Repeater control signal	TTL compatible 1: transmit 0: receive Output resistance: 350 R V_{OL} <= 0.8 V at I_{OL} <= 2 mA V_{OH} >= 3.5 V at I_{OH} <= 1 mA
Receive/send data	EIA-RS-485 standard

Fig. 4-186: Signal specification

CAUTION

Danger of destroying output
"+5V Repeater supply" with overload!

⇒ do not short

⇒ do not exceed maximum current

Diagnostic display H30 – H33:

The definition of the displays are in the firmware.

Bus Connector

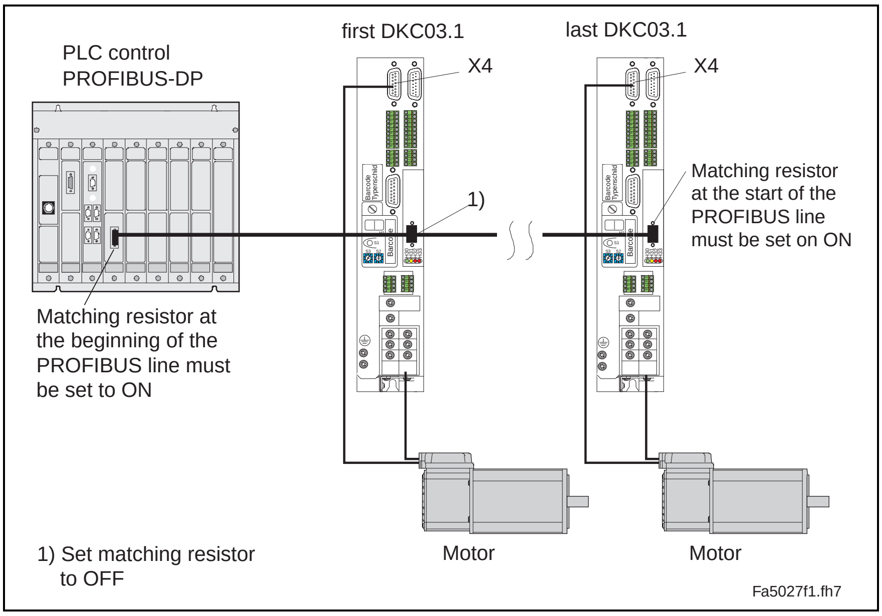


Fig. 4-187: An example of connecting a DKC03.3 to the PLC control via the PROFIBUS-DP

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.

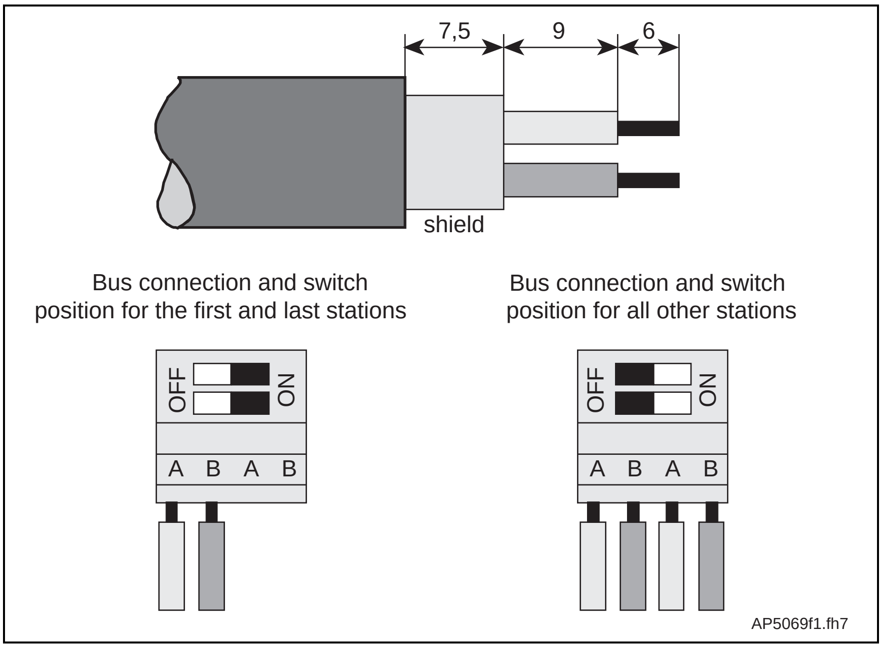


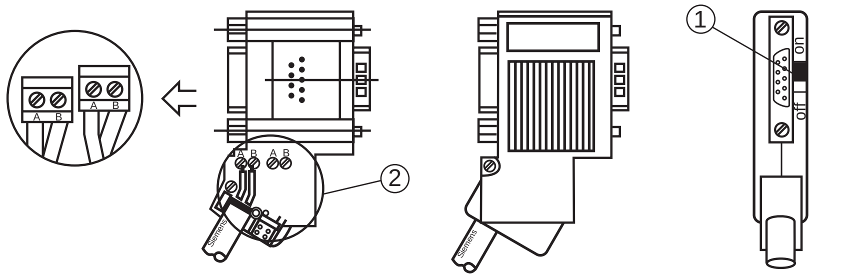
Fig. 4-188: Preparing a cable for connecting a bus connector

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.

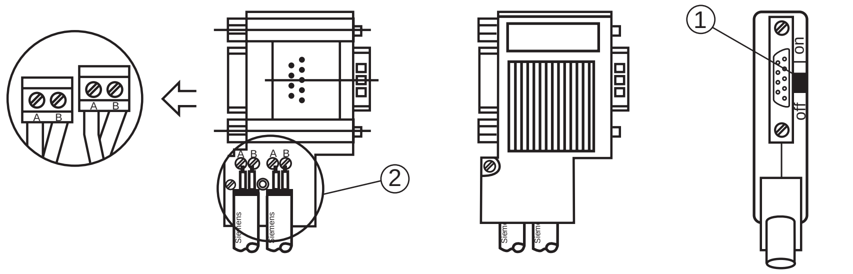
- Press cable sheath between both clamps
- Screw both strands into screw terminals



① Switch connection for the first and final slave in the Profibus-DP
② The cable shield must be placed bare on the metal guide

Ap5074f1.fh7

Fig. 4-189: Bus links for the first and last slave, bus connector **with** 9-pin D-SUB socket, INS 0541



① Terminating resistor is off
② The cable shield must be placed bare on the metal guide

Ap5075f1.fh7

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

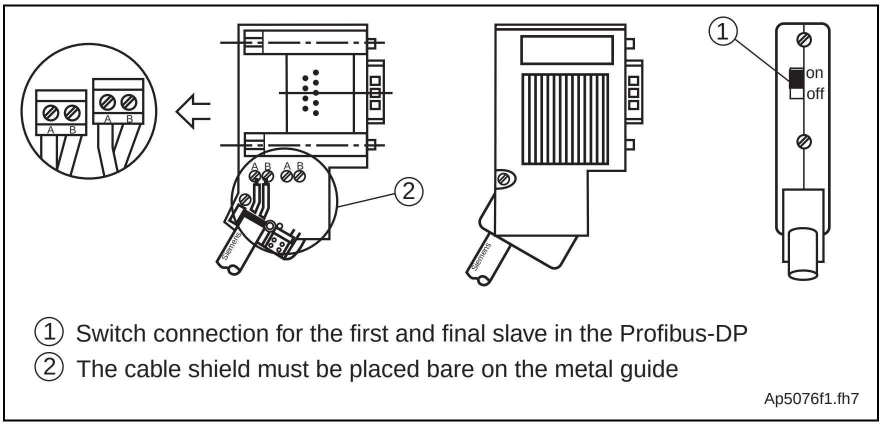


Fig. 4-191: Fig. 4-23: Bus link for the first and last slave **without** 9-pin D-SUB socket, INS 0540

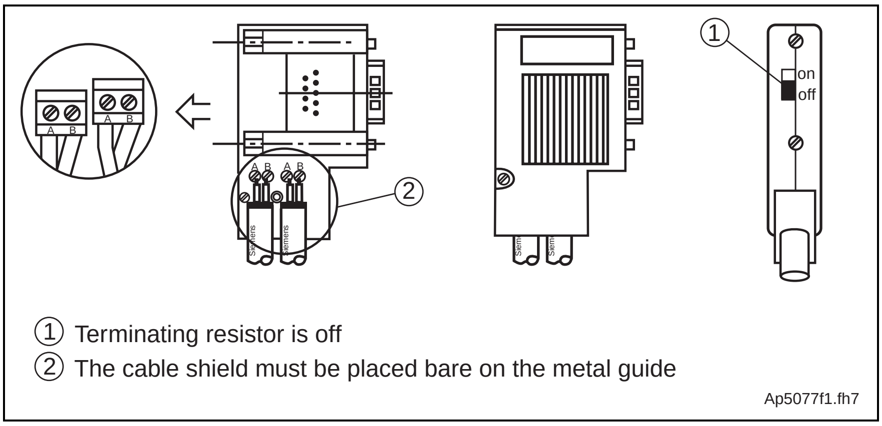


Fig. 4-192: Bus link for all other slaves **without** 9-pin D-SUB socket, INS 0540

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

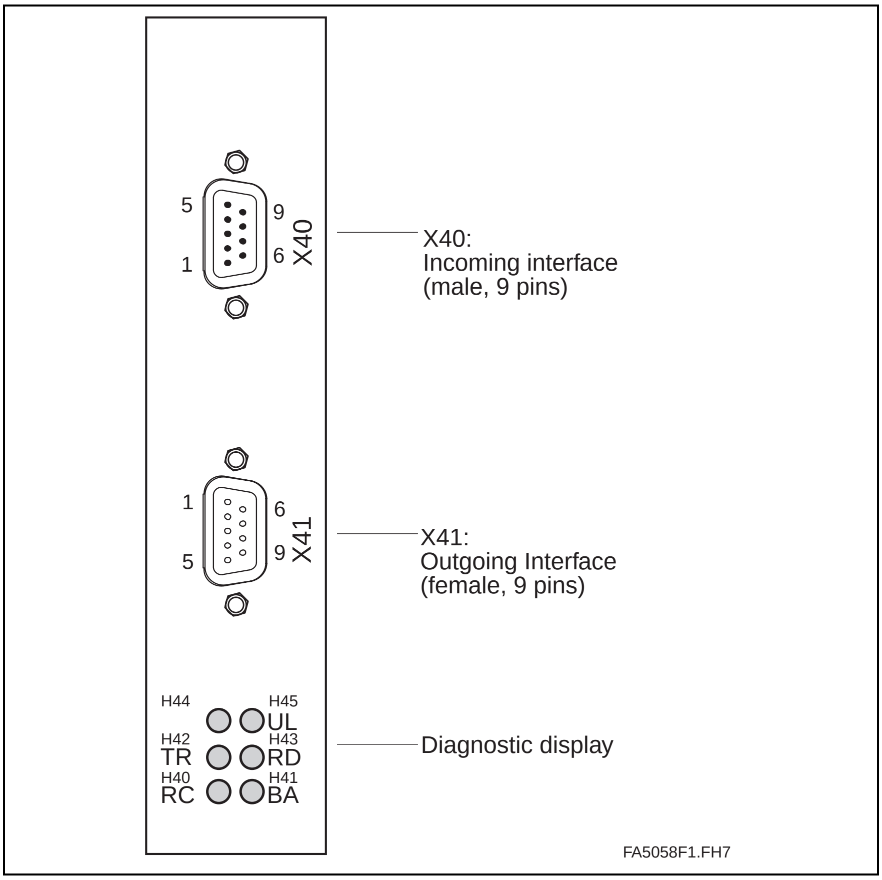


Fig. 4-193: View of command communication interface

Technical description of connector

Design:

	Type	No. of pins	Design
X40:	D-SUB	9	Bushing on the unit
X41:	D-SUB	9	pins on the unit

Fig. 4-194: Design

Connection cross section:

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

Fig. 4-195: Connection cross sections

Connection diagram for InterBus Interface

Connection InterBus Interface:

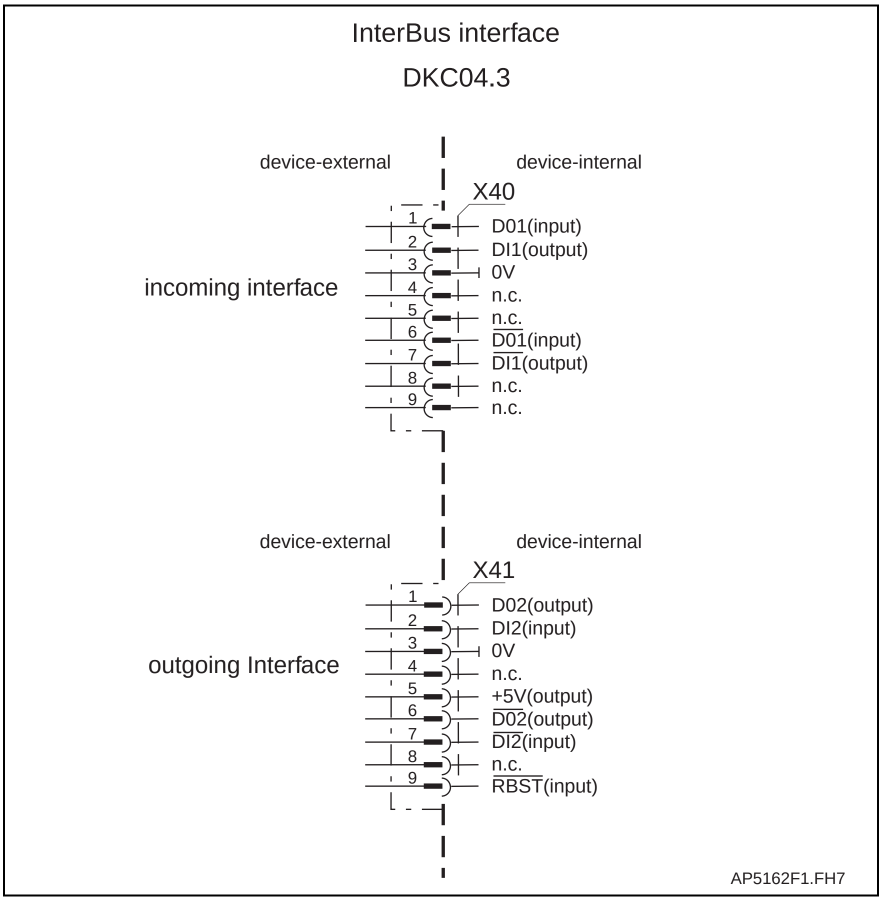


Fig. 4-196: InterBus Interface for DKC04.3

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	O	DI1
3	O	0V
4	--	n.c.
5	--	n.c.
6	I	/DO1
7	O	/DI1
8	--	n.c.
9	--	n.c.

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

Plug-in connector assignment X41 outgoing interface:

Pin	DIR	definition
1	O	DO2
2	I	DI2
3	O	0V
4	--	n.c.
5	O	+ 5V
6	O	/DO2
7	I	/DI2
8	--	n.c.
9	I	/RBST

Fig. 4-198: Allocation of interface signals X41, outgoing interface

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 H40 – H45: The definition of the displays are in the firmware.

DKC 05.3-***-7-FW – CANopen Interface

View of command communication interface

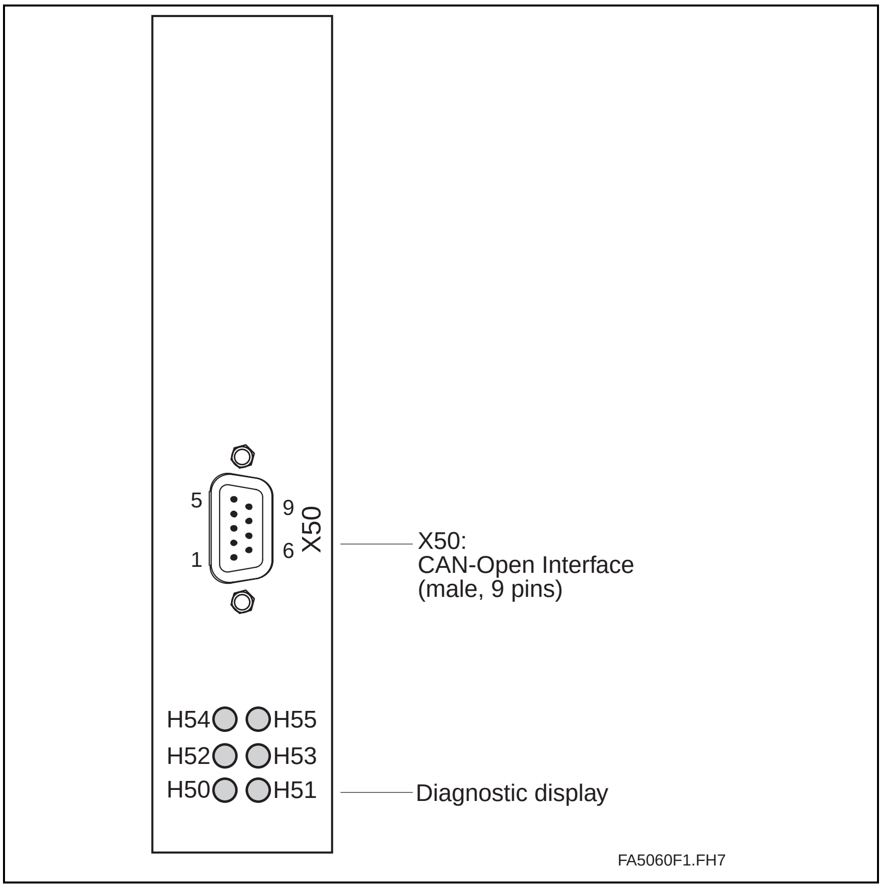


Fig. 4-199: View of command communication interface

Technical description of connector

Design:

Type	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

Connection diagram for CANopen Interface

Connection CANopen interface:

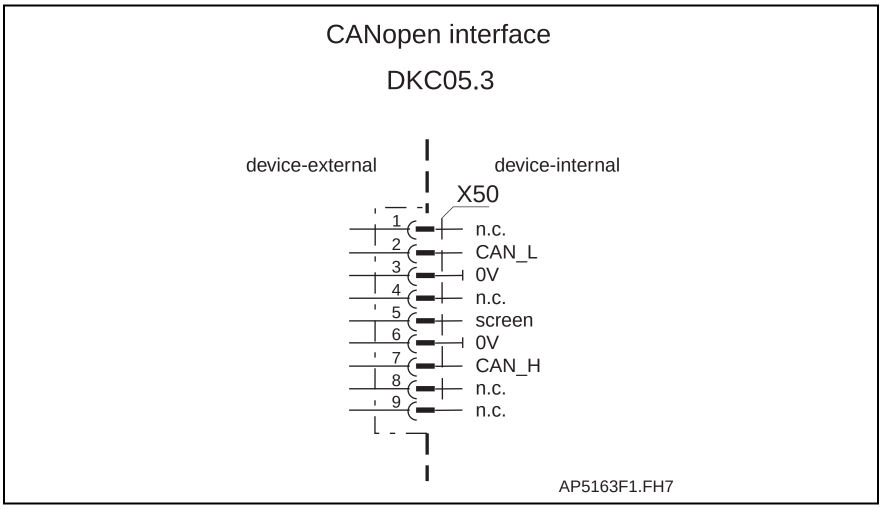


Fig. 4-202: CANopen interface for DKC05.3

Interface compatibility: as per ISO 11 898

Recommended cable: as per ISO 11 898

Plug-in connector assignment X50:

Pin	Definition	
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 display H50 – H55: The definition of the diagnostic displays are in the firmware.

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

View of command communication interface

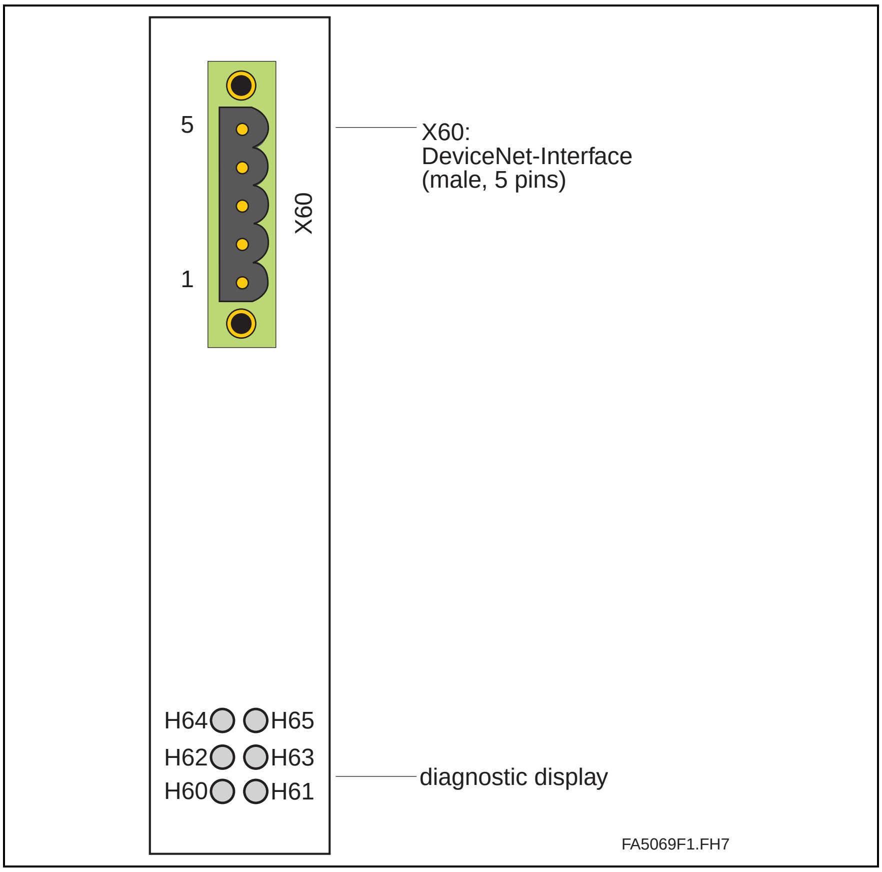


Fig. 4-204: View of command communication interface

Technical description of connector

Design:

Type	No. of pins	Design
COMBICON	5	Bushing on the connector

Fig. 4-205: Design

Connection cross sections:

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

Fig. 4-206: Connection cross sections

Connection diagram for DeviceNet-Interface

Connection DeviceNet Interface:

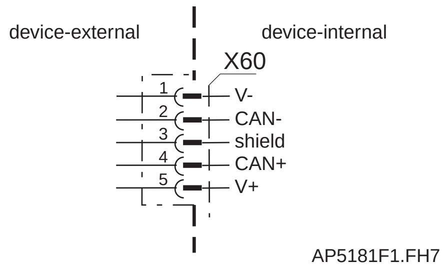


Fig. 4-207: DeviceNet Interface for DKC06.3

Interface compatibility: as per DeviceNet Specification 2.0 Vol. 1
Open Screw Connector

Recommended cable: as per DeviceNet Specification 2.0 Vol. 1, Appendix B

Bus participant connections: as per DeviceNet specification 2.0 Vol. 1, Appendix B
end resistance: 121 Ohm, 1%, ¼ W

Baudrate and cable length: as per DeviceNet specification 2.0 Vol. 1,

Plug-in connector assignment X60:

Pin	Definition	
1	V-	0V
2	CAN-	Differential signal
3	shield	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
11V	70 mA
18	45 mA
24	35 mA
32V	28 mA

Fig. 4-209: Current feed via bus connector

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

DKC 11.3-***-7-FW – Analog Interface

See page 4-39" "ECODRIVE03 DKC Drive Controller Electrical connections - independent of the drive controller type".

DKC 21.3-***-7-FW - Parallel Interface 2

View of command communications interface

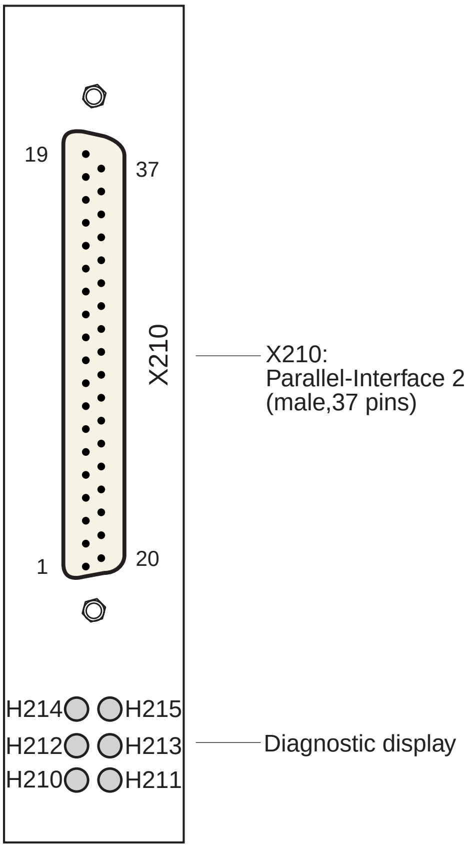


Fig. 4-210: View of command communications interface

Technical description of connector

Design:

Type	No. of pins	Design
D-SUB	37	pins on the unit

Fig. 4-211: Design

Connection cross section:

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

Fig. 4-212: Connection cross sections

Connection diagram for parallel interface 2

Connection Parallel Interface 2:

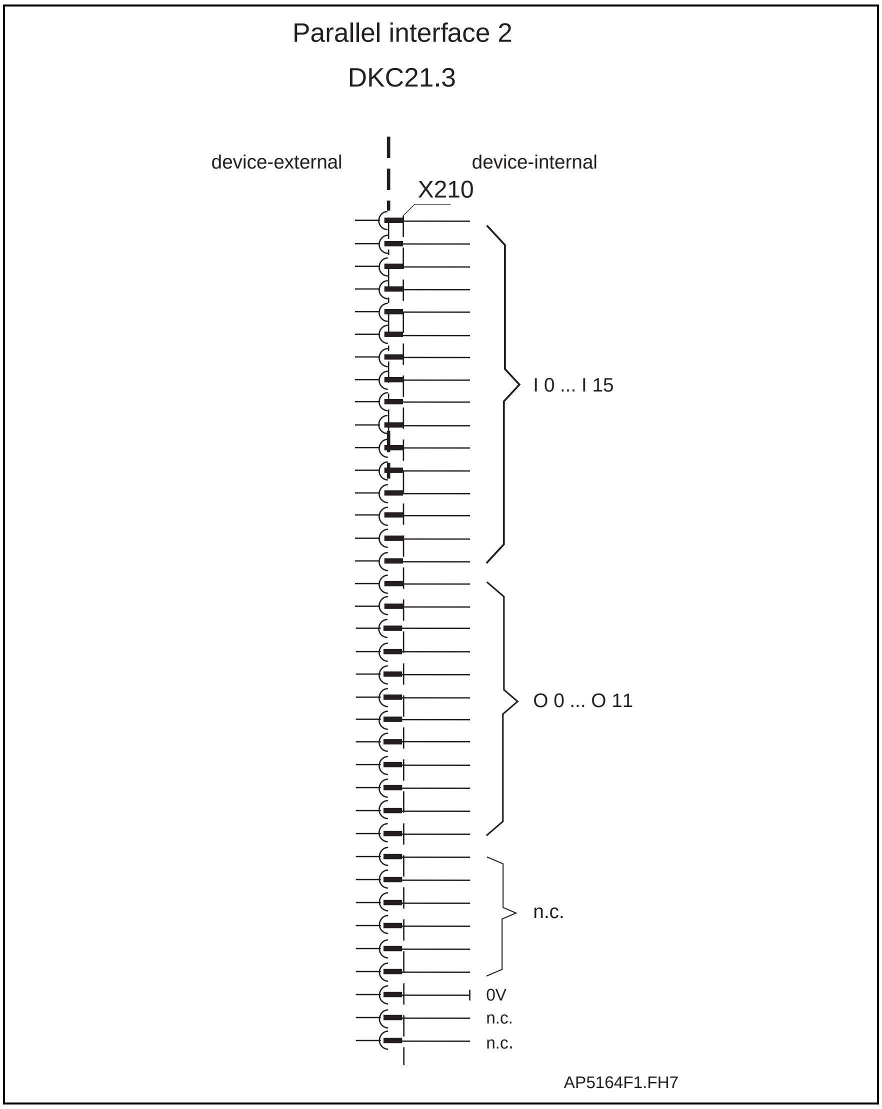


Fig. 4-213: Parallel interface 2 for DKC21.3

Diagnoses display H210 – H215: The definitions of the displays are listed in the firmware descriptions.

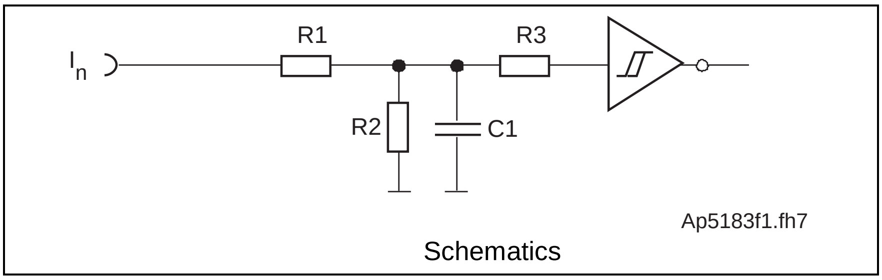
Plug-in connector assignment X210:

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



R1: 10k
R2: 3k3
R3: 10k
C1: N/A.

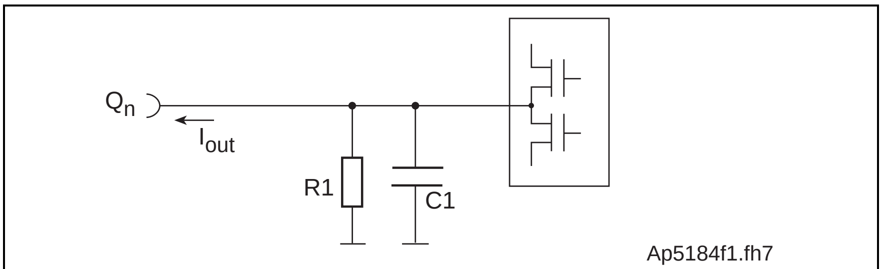
Fig. 4-215: input circuit

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 kOhm ±5%	
reaction time	=> see functional description	

Fig. 4-216: Inputs

Output circuit connection Q 0 – Q 11:



R1: 20k
C1: N/A.

Fig. 4-217: Output circuit

Output connection Q 0 – Q 11:

Output voltage: High Low	min. 16 V -0.5 V	max. U_{ext} 1.5 V
Output current I_{out}	80 mA	
rise and drop time	about < 600 ns	
overload protection	- short circuit protection At I_{out} > 300 mA outputs switch off. - thermal off	

Fig. 4-218: Outputs

Default allocation of binary I/Os:

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

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

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

5 ECODRIVE03 Auxiliary Bleeder Module BZM01.3

5.1 General

The Auxiliary Bleeder Module BZM01.3 is advantageously utilised 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.

5.2 Technical data

Dimensions

Dimensions Auxiliary Bleeder Module BZM01.3

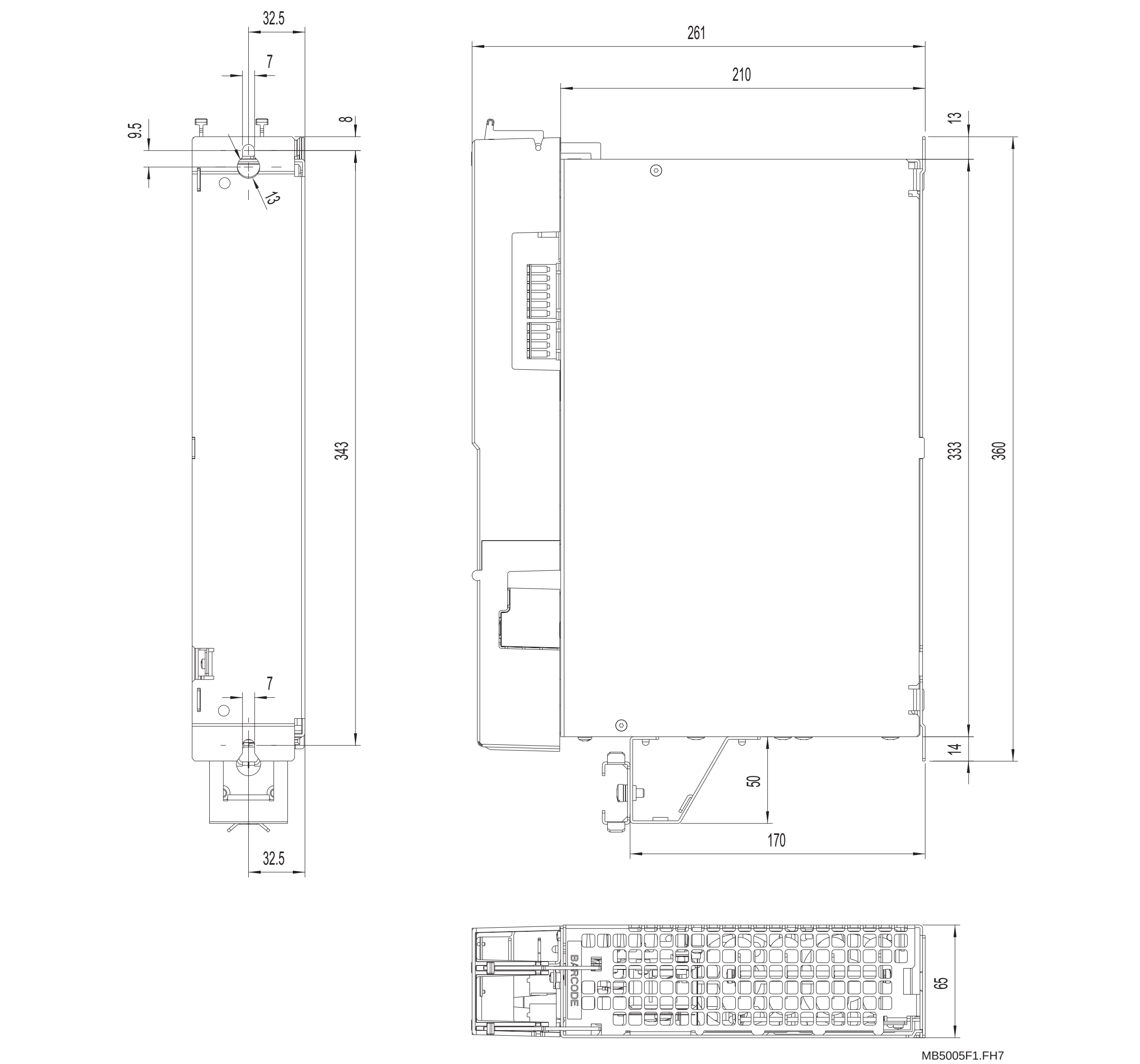


Fig. 5-1: Dimensions Auxiliary Bleeder Module BZM01.3

Also see page 11-1: "Constructing the Control ".

Ambient and operating conditions

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

Electrical data of auxiliary component BZM01.3

Power section

Designation	Symbol	Unit	BZM01.3
Operating mode at the mains			single phase / three phase The connection is for protection purposes. see page 5-12: "ZKS control input" and page 10-4: "Control Circuits with internal DC bus dynamic brake (ZKS)"
Nominal charging current (dependent on mains input voltage)	I_{EIN1}	A	~ 0
Mains input voltage	U_{N1}	V	See page 4-6: "Mains connections, Power section"
Mains frequency	f_{N1}	Hz	
Device power dissipation without internal continuous bleeder power	P_V	W	12
Peak bleeder power BZM	$P_{BS,BZM}$	kW	120
Continuous bleeder power BZM when Ta≤45°C under max. temperature range at a distance	$P_{BD,BZM}$ ΔT d	kW K mm	1 110 80
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 with symmetry factor	 f	 kW kW kW	 0.92 1.2 1.6 0.8
Max. energy Max. energy dissipation BZM	$W_{MAX,BZM}$	kWs	100
Internal DC bus dynamic brake (ZKS)			contained
nominal DC bus capacitance BZM	C_{ZW}	mF	0.33
Allowed input voltage at L+, L- at X5	U_{ZW}	V	DC bus voltage ECODRIVE DC (300 ... 800)
Cooling power section and bleeder resistor			with internal blowers
Volumetric capacity of the forced cooling		m³/h	approx. 48
Insulation resistance at DC500V	R_{is}	MOhm	>15

Fig. 5-2: Technical data mains connection and power section

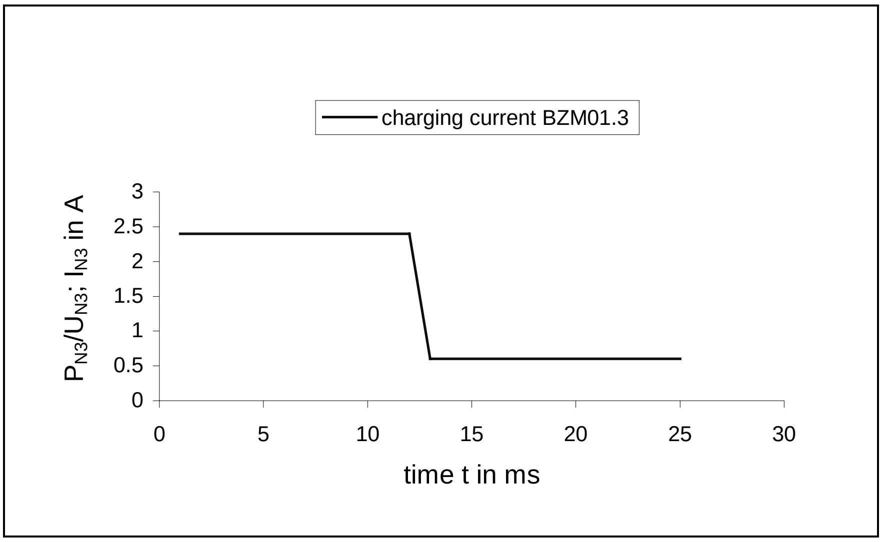
See also page 14-1: "BZM01.3"

DC24V voltage supply for BZM01.3

Designation	Symbol	Unit	BZM01.3
Input voltage	U_{N3}	V	DC (19.2 ... 28.8) V
maximum ripple effect	w	%	may not exceed input voltage range
current consumption	I_{N3}	A	0.5
max. charging current	I_{EIN3}	A	2.4

Fig. 5-3: Control voltage connection for BZM01.3

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



P_{N3}: Power consumption
U_{N3}: Control voltage
I_{N3}: Current consumption after charging current inrush

Fig. 5-4: Example of charging current inrush of control voltage

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

Materials used, Mass

Designation	Symbol	Unit	BZM01.3
Mass	m	kg	6.5
Materials			asbestos and silicone free

Fig. 5-5: Materials used, Mass

CE Label, Tests

CE label

Fig. 5-6: CE marking

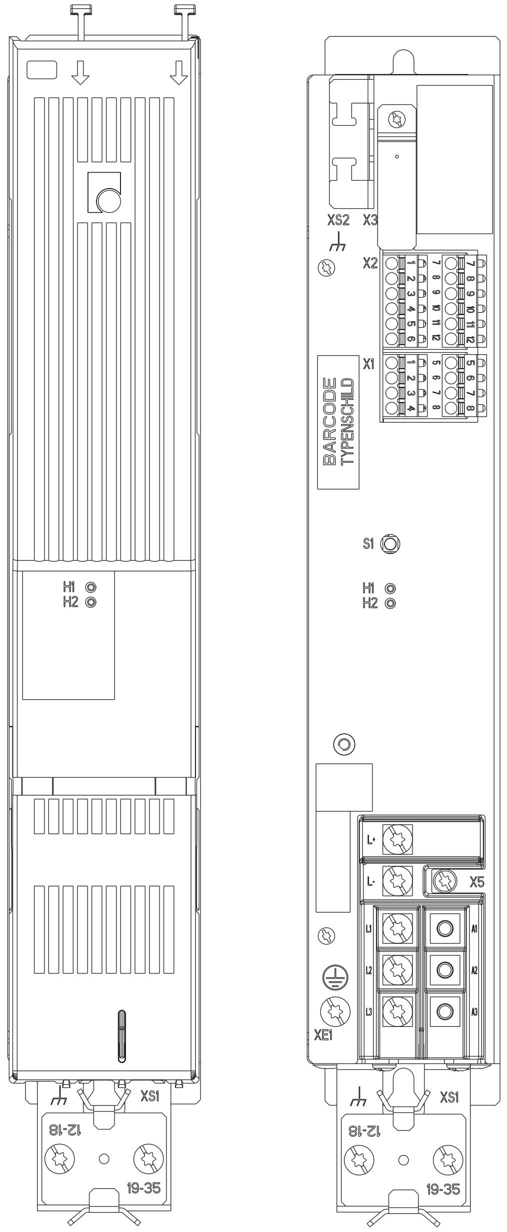
Tests:

High-voltage test according to EN50178	Routine test with DC2100V 1s
Insulation test according to EN50178	Routine test with DC500 1s
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. 5-7: Tests

5.3 Electrical Connections BZM01.3

Front View



FA5038F1.FH7

Fig. 5-8: Front view Auxiliary Bleeder Module BZM01.3

S1: Reset key

H1: Diagnosis green

H2: Diagnosis red

Rexroth Indramat

Complete Terminal Diagram

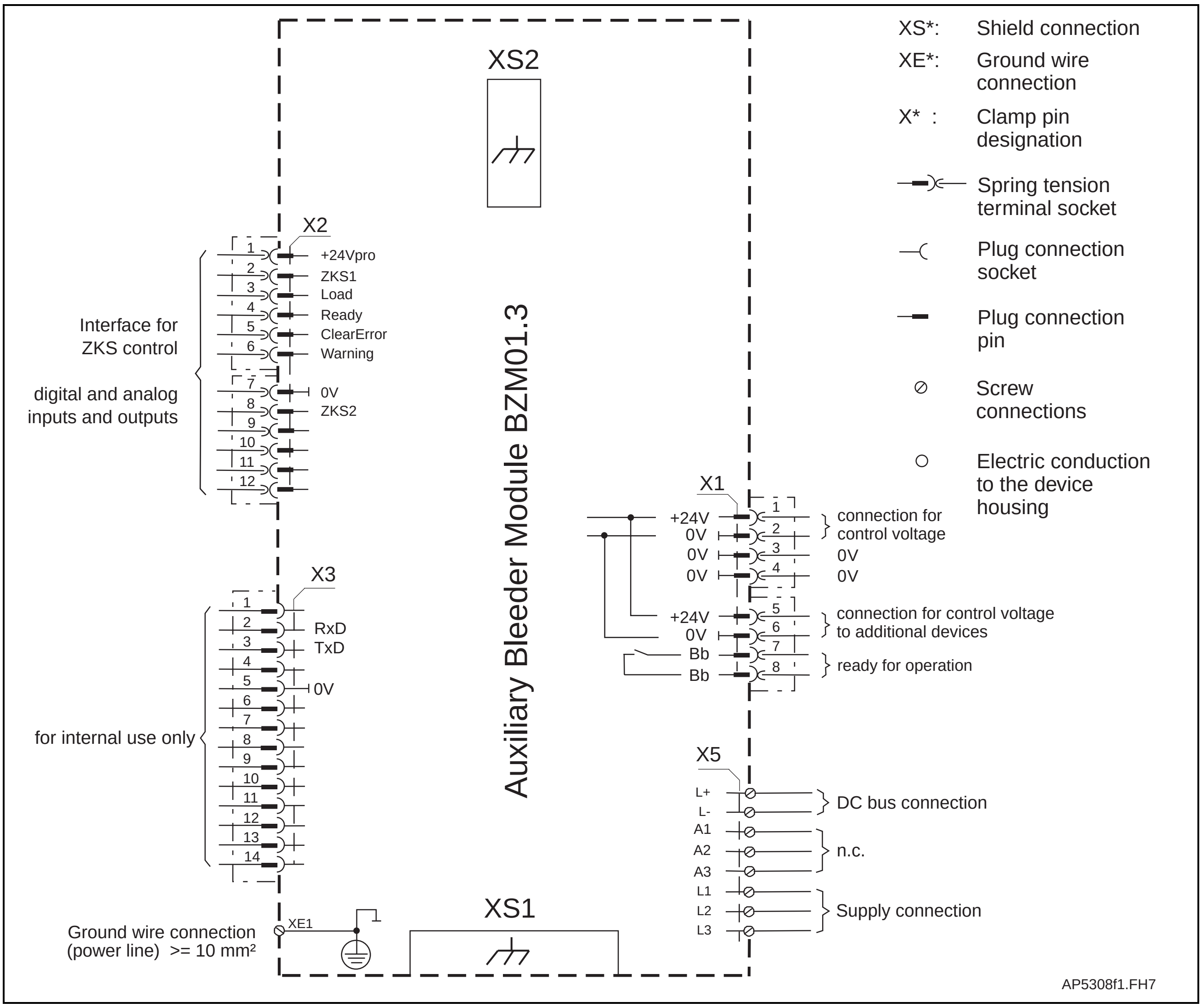


Fig. 5-9: Terminal diagram - BZM01.3

CAUTION

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 5-13: "Fig. 5-25: Block diagram interlock ZKS/Mains".

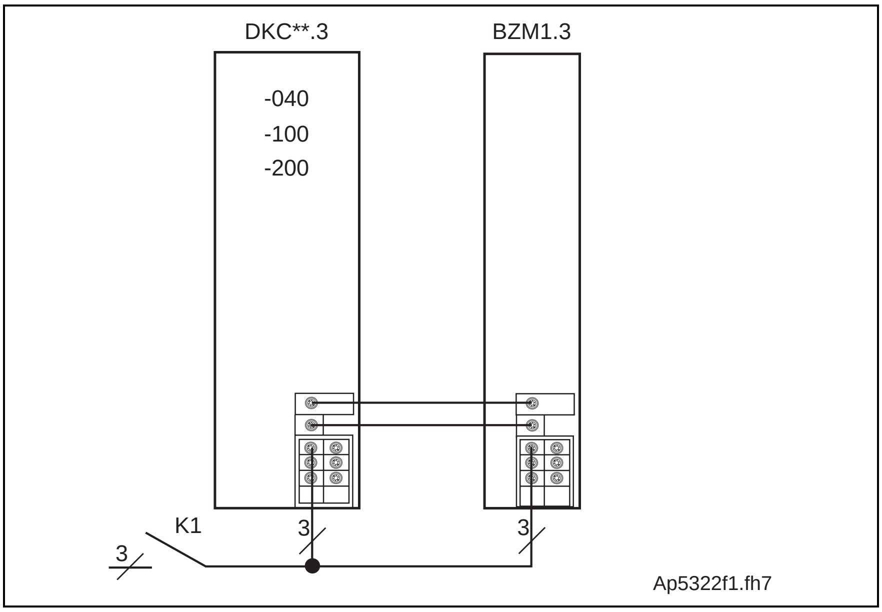


Abb. 5-10: DC bus and mains connection

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:

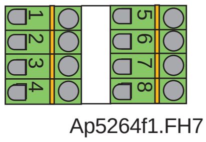


Fig. 5-11: connector X1

Design:

Type	No. of pins	Design
spring contact	2 x 4	bushing at connector

Fig. 5-12: 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	0.2-1.5	24-16

Fig. 5-13: Connection cross section

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

Connection +24V and 0V:

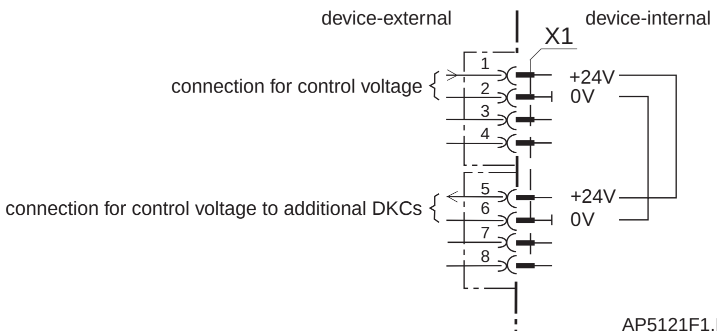


Fig. 5-14: Connections for control voltage

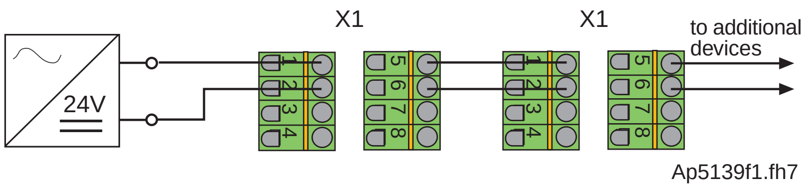


Fig. 5-15: Looping through the control voltage

Load capacity of connection +24V and 0V:

Voltage at X1/1 against X1/2:	DC +24 V (19.2...28.8)
Reverse voltage protection:	Via allowed voltage range using internal protection diodes
Current or power consumption X1/1:	See page 5-3 : "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 mm²
wire routing:	parallel if possible
Max. allowed inductance between 24V source and X1:	100µ (equals about 2 x 75m)

Note:

- Bleeder not available once control voltage fails.
- Control voltage failure causes the running motor to coast torque-free (without brake).
  See page 10-4: "Control Circuits with internal DC bus dynamic brake (ZKS)"

DANGER

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

⇒ Personnel should not remain within the area of the 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 possible force that the machine can generate.

Ready to operate contact Bb

Connection Bb:

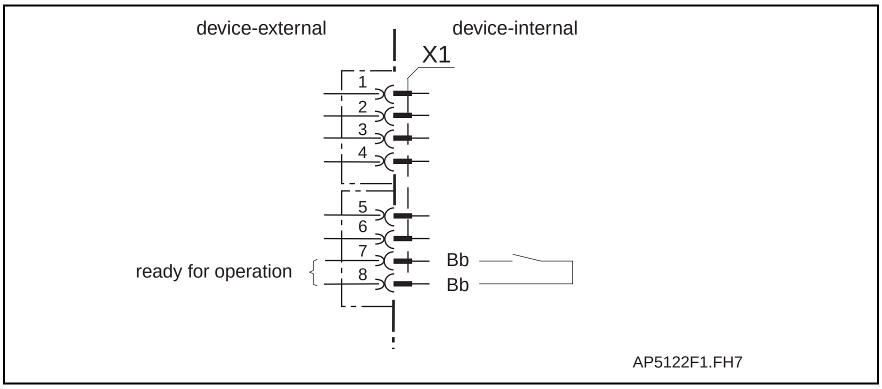


Fig. 5-16: Connections for ready to operate contact

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 <50ms:	250.000

Switching states Bb:

The Bb contact is open if:

- the control voltage for the BZM01.3 has not been applied or
- if there is an error in the BZM01.3.

How to use the contact, see page 10-2: "Control Circuits for the Mains".

WARNING

Damage possible if Bb contact not connected !

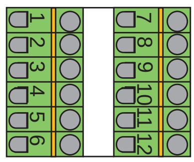
The Bb contact acknowledges auxiliary bleeder readiness to the application of power.

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

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

Technical description of connector

Illustration



Ap5269f1.FH7

Fig. 5-17: connector X2

Design:

Type	No. of pins	Design
spring contact	2 x 4	bushing on connector

Fig. 5-18: 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	0.2-1.5	24-16

Fig. 5-19: Connection cross section X2

ZKS control supply

Connection +24V pro and OV:

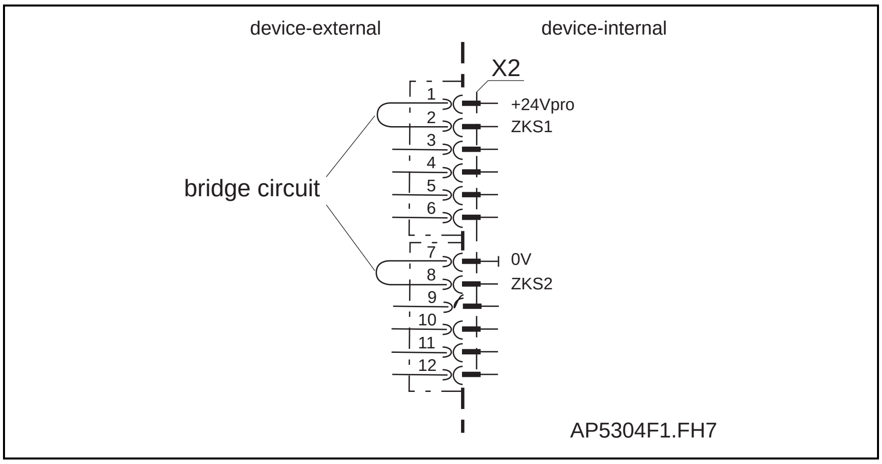
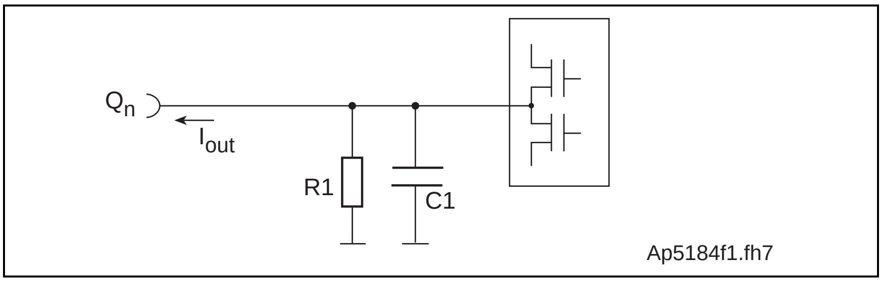


Fig. 5-20: Output +24V pro, 0V

At Delivery: with bridges at:	X2.1	to	X2.2
	X2.7	to	X2.8

Output +24V pro:



R1: approximately 50 R
C1: 100 µF
Fig. 5-21: Voltage source from X2.1

Loadability of the connection +24Vpro:

max. output voltage (dependent of control voltage at X1.1)	DC (19.2...28.8) – 2V
max. allowed output current:	DC 0.1 A
max. allowed lead length	10 m
thermal overload protection	via charging current limiter behind X1.1
max. short circuit current	2.4 A

Application +24V pro:

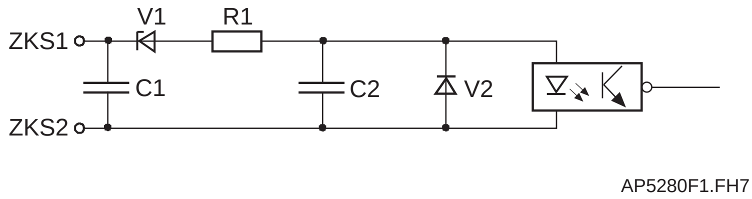
The connections supply current to the ZKS input.

ZKS control input

Connection ZKS1 and ZKS2:

See page 5-11: "Fig. 5-20: Output +24V pro, 0V".

Input circuit ZKS1 and ZKS2:



Schematics

R1: 2k2
V1: 10V
V2: 0.7V
C1: 0.1µF
C2: 0.1µF

Fig. 5-22: Input circuit

Inputs ZKS1 and ZKS2:

Input voltage: High Low	min. 17.6 V 0 V	max. 28.8 V 5 V
trigger delay t_d due to contactor drop delay	min. 40 ms	max. 80 ms
input resistance	about 2 kOhm	
potential isolation	to 50Veff	
Polarity reversal protection within allowed input voltage range		

Fig. 5-23: 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. 5-24: 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!

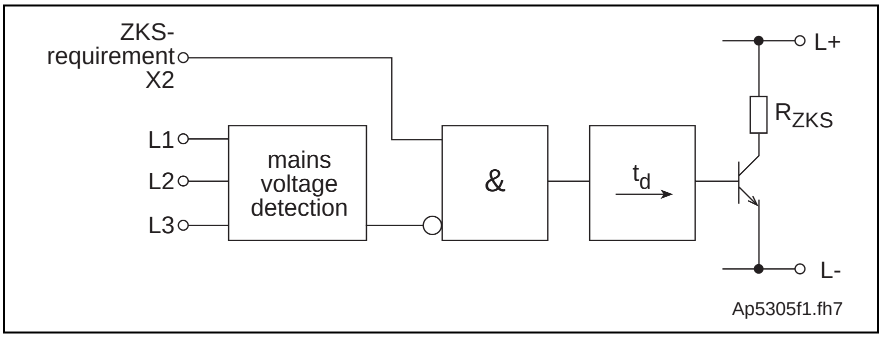


Fig. 5-25: Block diagram interlock ZKS/Mains

Also see page 4-23: "Arranging the Central supply" and
page 10-4: "Control Circuits with internal DC bus dynamic brake (ZKS)".

Analog Output Load:

Connection:

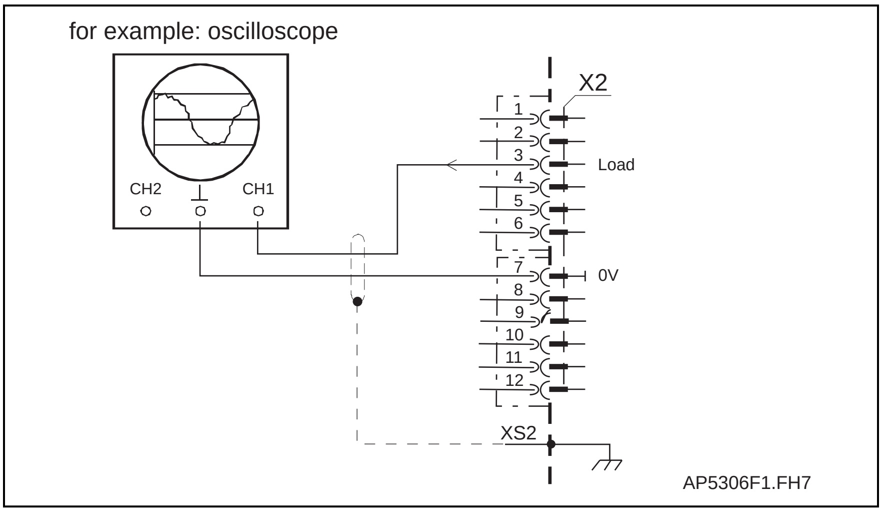
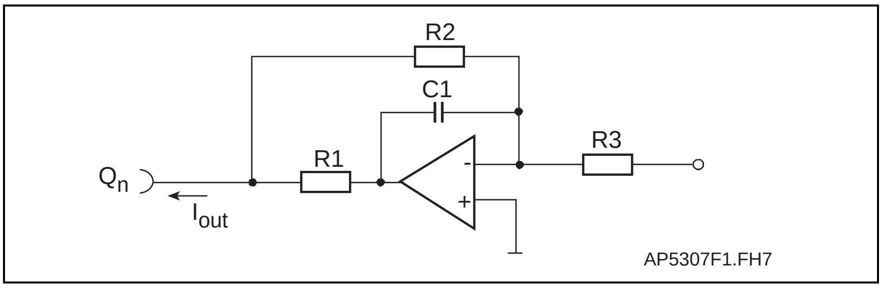


Fig. 5-26: Output load

Output circuit Load:



R1: 150 R
R2: 20 k
R3: 10 k
C1: N/A.

Fig. 5-27: Output circuit

Output Load:

Output voltage between load & 0 V:	min 0 V	max. 10 V
output current	Max. 2 mA	
DA converter	N/A.	
resolution per bit	N/A.	
short circuit and overload protection	not present	
evaluation	$\frac{U}{10V} \bullet P_{BD,BZM}$	

Fig. 5-28: Output load

Load: The connection is used to output an analog signal of the proportional load of the mounted bleeder resistor.

Ready, Warning:

Connection Ready, Warning:

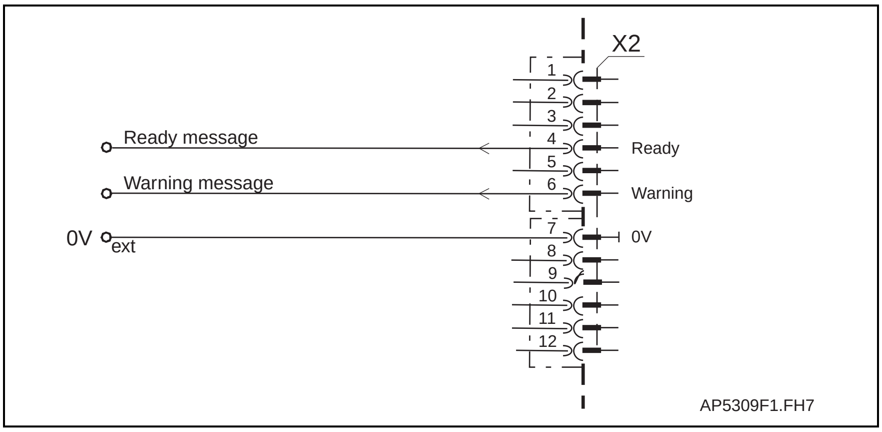
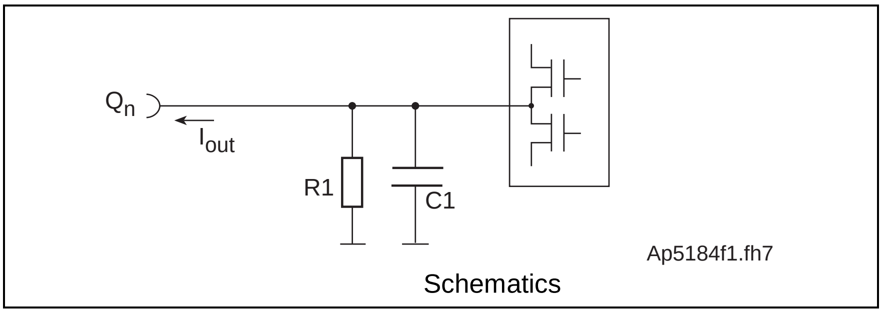


Fig. 5-29: Output Ready, Warning

Output circuit Ready, Warning:



R1:	20k
C1:	1nF

Fig. 5-30: Output circuit

Outputs Ready, Warning:

Output voltage:	min.	max.
High	16 V	U_{ext} (an X1.1-1V)
Low	-0.5 V	1.5 V
Output current I_{out}	80 mA	
Rise and drop time	about < 600 ns	
Overload protection	- short circuit protection at I_{out} > 300 mA outputs switch off - thermal shutdown	

Fig. 5-31: Outputs Ready, Warning

Warning message: 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.

Connection clear error:

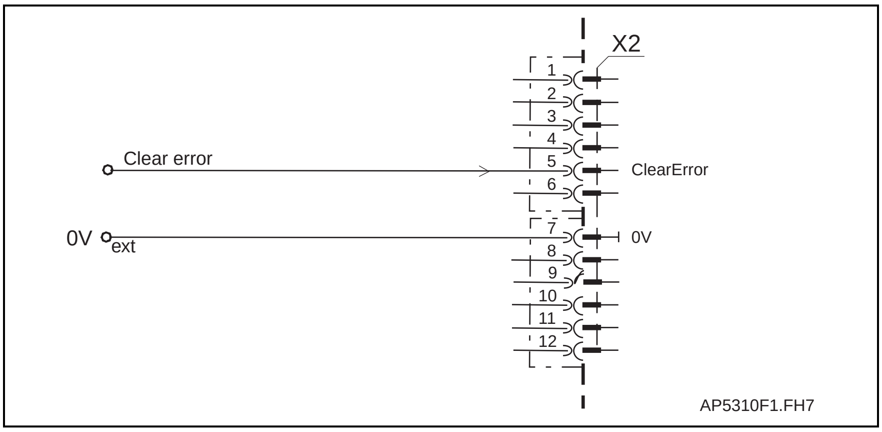
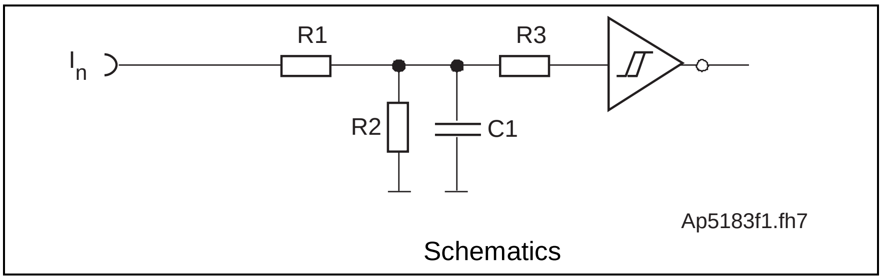


Fig. 5-32: Input clear error

Input circuit Clear error:



R1: 10k
R2: 3k3
R3: 10k
C1: 10nF

Fig. 5-33: Input circuit

Inputs Clear error:

Input voltage:	min.	max.
High	16 V	30 V
Low	-0.5 V	3 V
Input resistance	about 13.3 kOhm	

Fig. 5-34: 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:

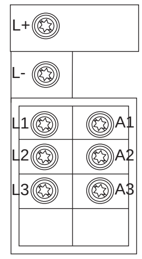


Fig. 5-35: connector X5

Design:

Type	No. of pins	Design
Connection block	2 / 3 / 3	Screw connection for ring terminal M5

Fig. 5-36: Design

Tightening torque:

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

Fig. 5-37: Tightening torque

Connection cross section:

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

Fig. 5-38: Connection cross section

Connection:

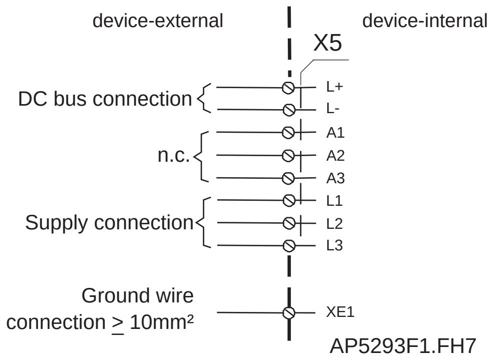


Fig. 5-39: DC bus, Motor and Mains connection of BZM01.3 – X5

Motor connection

Note: Connections A1, A2, A3 are not wired!

DC bus connection

Connection DC bus::

see "Fig. 5-39: DC bus, Motor and Mains connection of BZM01.3 – X5 ".

CAUTION

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

⇒ 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 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	≥ 750V (e.g., litz wires - H07)

Mains Connections

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

Connection mains:

see "Fig. 5-39: DC bus, Motor and Mains connection of BZM01.3 – X5 ".

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

See page 10-1: "Mains Connections"

XE1, Protective conductor connection for mains

Technical description of connector

Illustration: See "Fig. 5-8: Front view Auxiliary Bleeder Module BZM01.3".

Design:

Type	No. of pins	Design
screw	1	screw for ring terminals M5

Fig. 5-40: Version

Tightening torque:

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

Fig. 5-41: Tightening torque

Connection cross section:

Cross section single wire [mm²]	Cross section multi core wire [mm²]	Max. cross section in AWG gauge no.:
--	25	--

Fig. 5-42: Connection cross section

XE1, Protective conductor connection for mains

PE connection $\geq$ 10 mm²

Reason: high leakage current (prEN 50178/1994, section:5.3.2.1).

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 $U_{ZW} \leq 50$ V
continuous light	and DC bus voltage $U_{ZW} > 50$ V

Fig. 5-43: Diagnostic LED (green) H1

Diagnostic LED (red) H2:

State	Definition
blinking LEDs	$W_{BZM} > 90\% * W_{MAX, BZM}$ or $P_{BZM} > 90\% * P_{BD, BZM}$ or Temperature pre-warning (internal heatsink)
continuous light	overload, overtemperature, internal error

Fig. 5-44: Diagnostic LED (red) H2

Reset probe S1: Reset the H2 diagnostic LED once overload or overtemperature problems have been cleared.

6 ECODRIVE03 Auxiliary Capacitance Module CZM01.3

6.1 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

6.2 Technical data

Dimensions

Dimension sheets auxiliary capacitance module CZM01.3

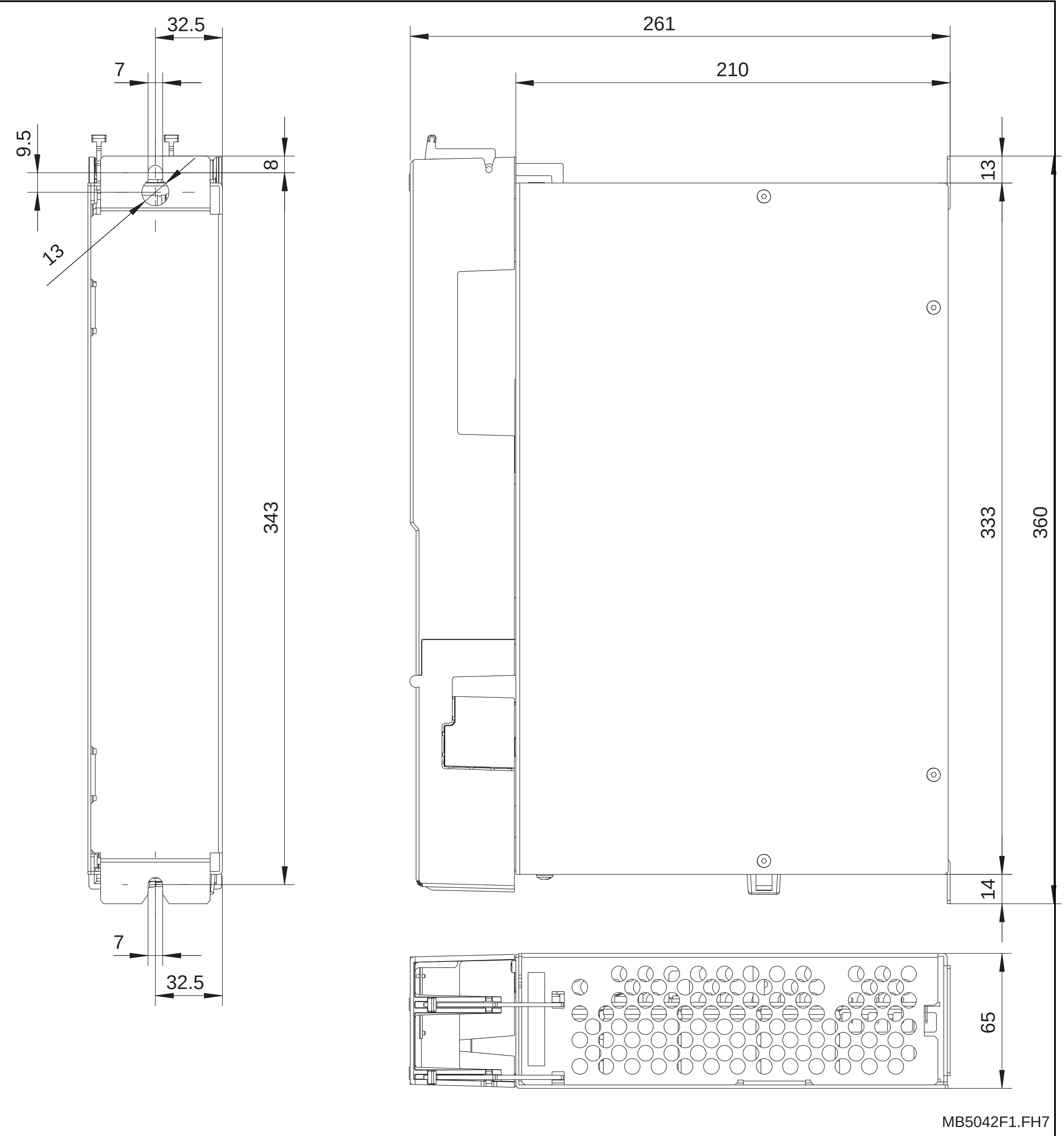


Fig. 6-1: Dimensions of the auxiliary capacitance module CZM01.3

Also see page 11-1: "Constructing the Control "

Ambient and operating conditions

See page 4-1: "Ambient and operating conditions"

Electrical Data of Auxiliary Component CZM01.3

Power section

Designation	Symbol	Unit	CZM01.3
nominal DC bus capacity	C_{ZW}	mF	2.4
Nom. discharge time constant	τ	s	43
Storable energy of the DC bus capacitors	$W_{ZW,CZM}$	Ws	See "Fig. 6-3: Storable energy in the DC bus for CZM01.3"
Allowed input voltage at L+, L- an X5	U_{ZW}	V	DC bus voltage ECODRIVE DC (300 ... 800)
Device power dissipation	P_V	W	50
Mains input voltage	U_N	V	n. c.
Cooling			natural convection
Insulation resistance at DC500V	R_{is}	MOhm	>25

Fig. 6-2: Technical data CZM01.3

See also page 14-3: "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.

Storable energy

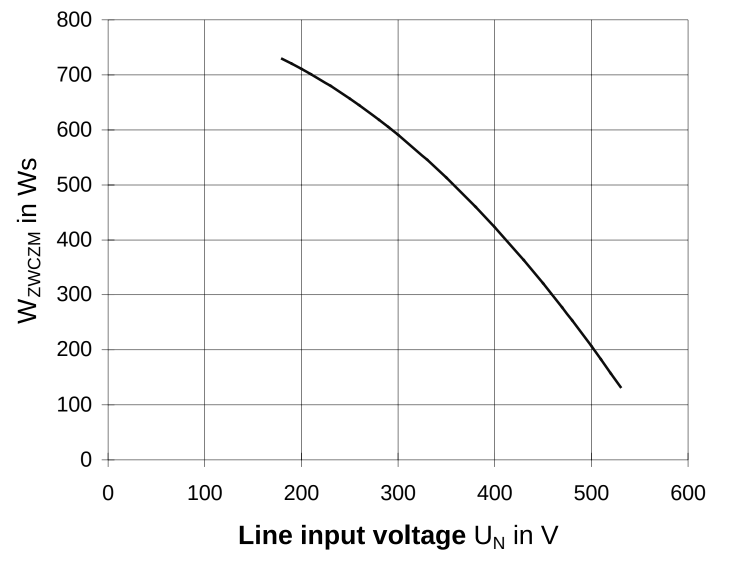


Fig. 6-3: Storable energy in the DC bus for CZM01.3

Rexroth Indramat

Materials used, Mass

Designation	Symbol	Unit	CZM01.3
Mass	m	kg	5
Materials used			asbestos and silicone free

Fig. 6-4: Materials used, Mass

CE Label, Tests

CE label

Fig. 6-5: CE label

Tests:

High-voltage test according to EN50178	Routine test with DC2100V 1s
Insulation test according to EN50178	Routine test with DC500 1s
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. 6-6: Tests

6.3 Electrical Connections of CZM01.3

Front View

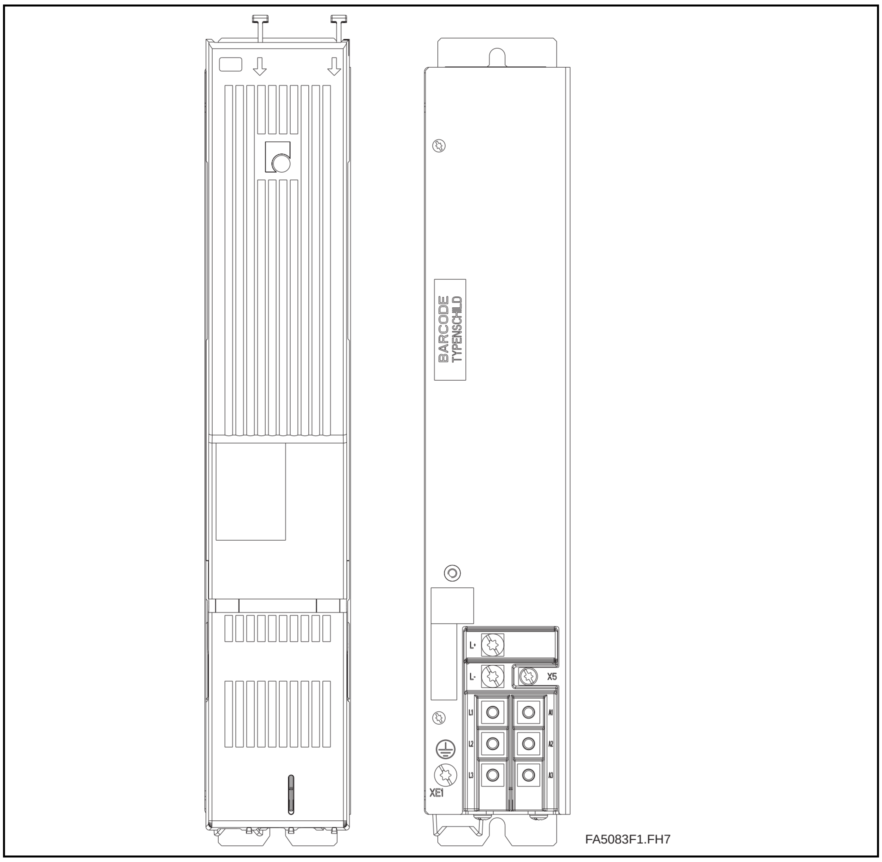


Fig. 6-7: Front view of auxiliary capacitance module CZM01.3

X5, DC bus connection

Technical description of connector

Illustration:

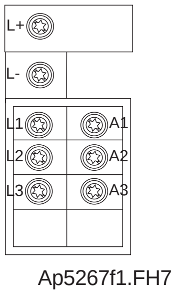


Fig. 6-8: connector X5

Design:

Type	No. of pins	Design
Terminal block	2 / 3 / 3	Screw for ring terminals M5

Fig. 6-9: Design

Tightening torque:

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

Fig. 6-10: Tightening torque

Connection cross section:

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

Fig. 6-11: Connection cross section

Connection:

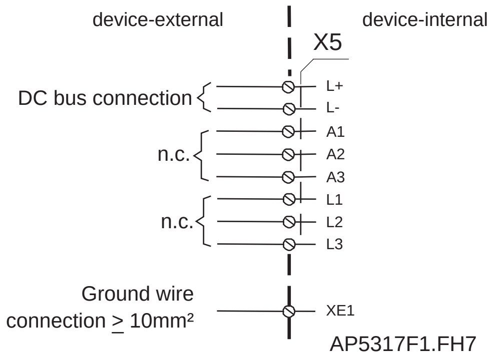


Fig. 6-12: DC bus connection of auxiliary capacitance module CZM01.3 – X5

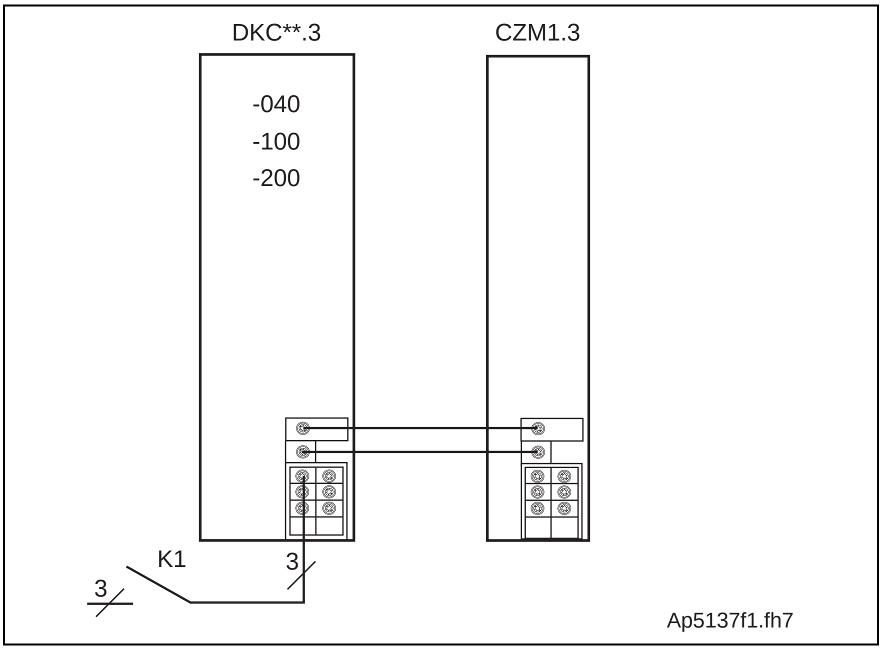


Fig. 6-13: Connection of auxiliary capacitance module CZM01.3

CAUTION

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

⇒ 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 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	≥ 750V (e.g., litz wires - H07)

XE1, Protective conductor connection for mains

Technical description of connector

Illustration: See page 6-5: "Front View".

Design:

Type	No. of pins	Design
screw	1	Screw for ring terminals M5

Fig. 6-14: Design

Tightening torque:

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

Fig. 6-15: Tightening torque

Connection cross section:

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

Fig. 6-16: Connection cross section

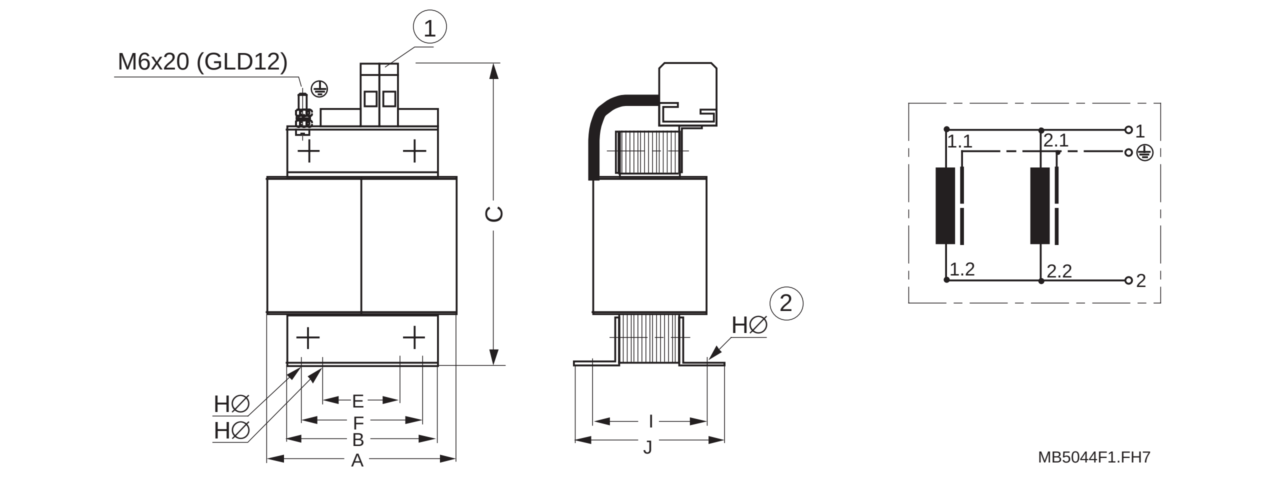
XE1, Protective conductor connection for mains

PE connection $\geq$ 10 mm².

Reason: high leakage currents (prEN 50178/1994, section:5.3.2.1).

7 Choke GLD 12

7.1 Dimensions and Mounting Dimensions



1: Electrical connection
2: Slot in "J" direction
Fig. 7-1: Dimensions GLD 12

Type	mH/A	Maße in mm								Maximum connection cross section	Mass kg	Power dissipation W
		A	B	C	E	F	HØ	I	J			
GLD12	1.0/100	160	121	285	60	100	7x14	97	121	35mm²	13.5	100

Fig. 7-2: Technical data for GLD 12

Notes

8 DC24V NTM power supplies

8.1 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.

Fuse protector Q2

Rexroth Indramat recommends a 10A 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.

8.2 Technical data

Designation	Symbol	Unit	NTM01.1-24-002	NTM01.1-24-004	NTM01.1-24-006
Rate current of the 24V output for 45°C ambient temperature	I_N	A	2.1	3.8	5.5
Output power for 45°C ambient temperature	P_{OUT}	VA	50	100	150
input current at 230 (115) V	I_{IN}	A	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_{EIN}	A	32 (16)	32 (16)	32 (16)
Input voltage	U_N	V	Standard AC 170...265 by changing the bridge circuit setting AC 85...132		

Fig. 8-1: Technical data for DC24V NTM power supply units

8.3 Dimensional sheets and installation dimensions

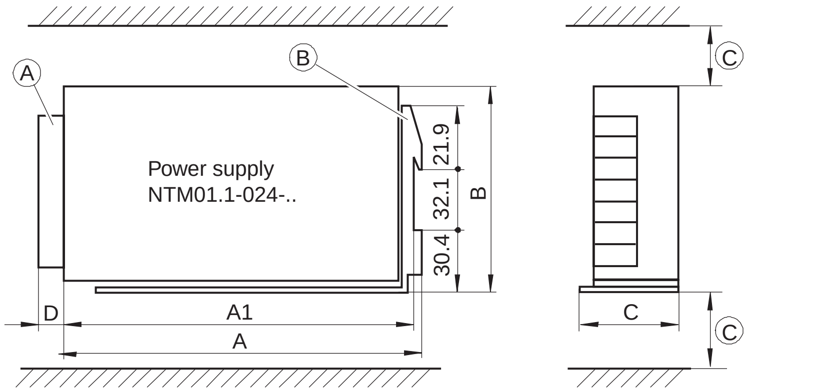


Table of dimensions

INDRAMAT Type of power supply	A	A1	B	C	D
NTM01.1-024-002	173	168.7	100	45	17
NTM01.1-024-004	202	197.7	97	51	20
NTM01.1-024-006	212	207.7	97	70	20

(A) Connecting block
(B) L rails DIN 50
(C) > 20 mm cooling clearance

MB0204F1.FH7

Fig. 8-2: Dimensional sheet DC24V – NTM power supplies

8.4 Front views

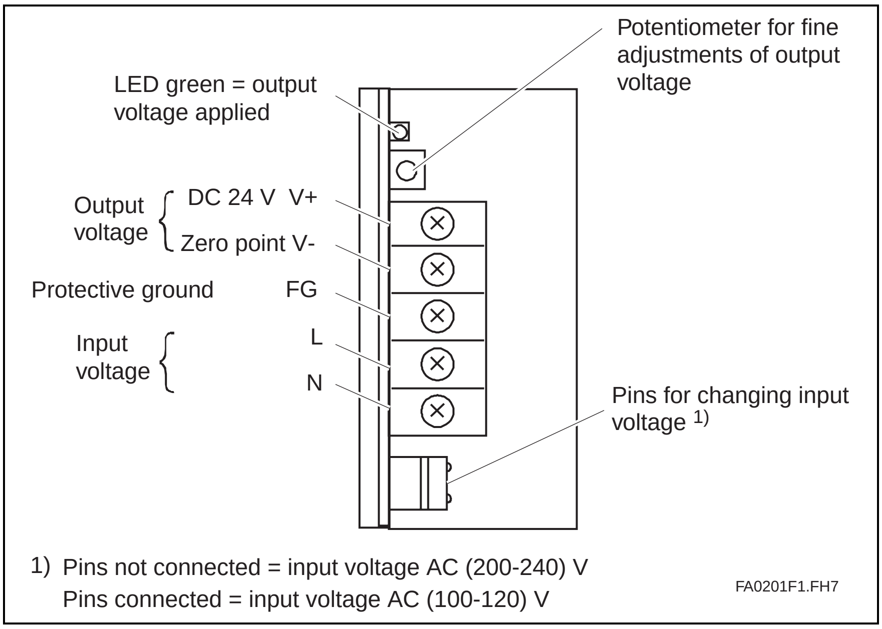


Fig. 8-3: Front view and terminal designations of the power supply NTM01.1-024-002

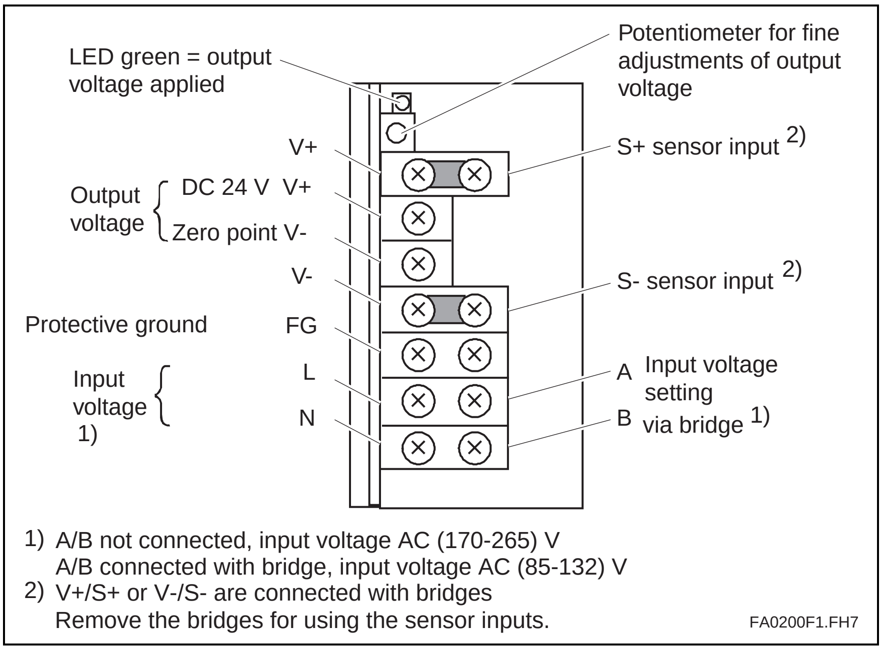


Fig. 8-4: Front view and terminal designation of the power supplies NTM01.1-024-004 and NTM01.1-024-006

8.5 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.

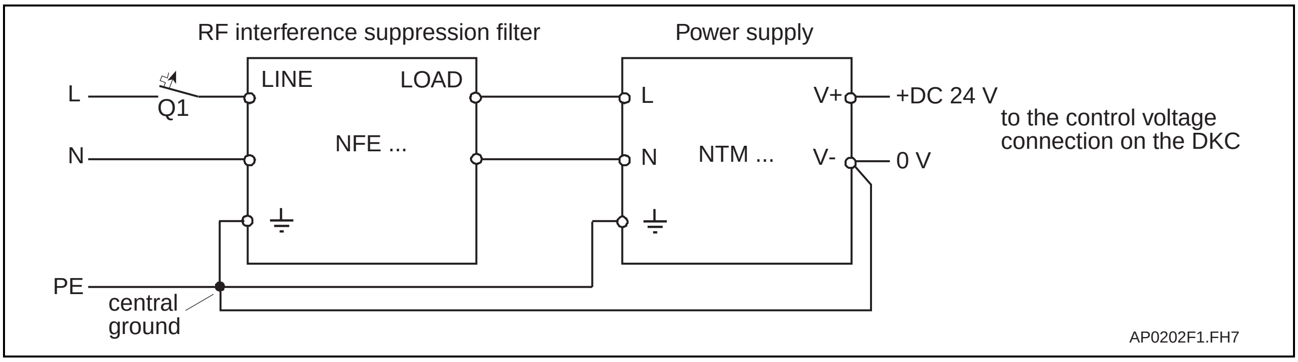


Fig. 8-5: Connecting the power supply to a line filter

Note: The contact bridge between V+/S+ and V-/S- must be removed if sensor inputs are used.

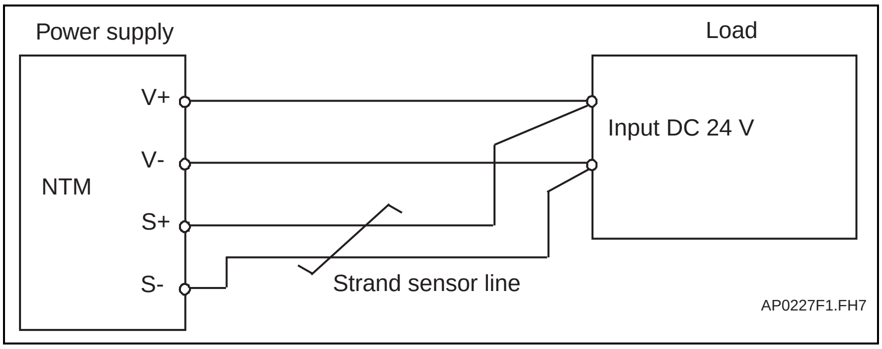


Fig. 8-6: Connecting the sensor cables NTM01.1-024-004 and NTM01.1-024-006

8.6 Type code

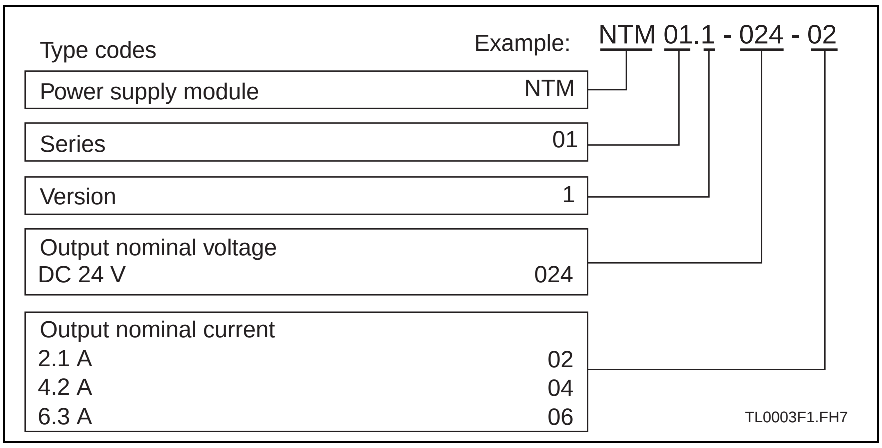


Fig. 8-7: Type code

9 DST transformers

9.1 Selection

Transformers are only needed if the systems voltage exceeds the rated voltage of the DKC.

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.

9.2 Autotransformers for Drive Controllers DKC**.3

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".

⇒ Check the drive data. The output voltage of the transformer has an effect on the drive data.

⇒ Select a three-phase autotransformer corresponding to the required connected load.

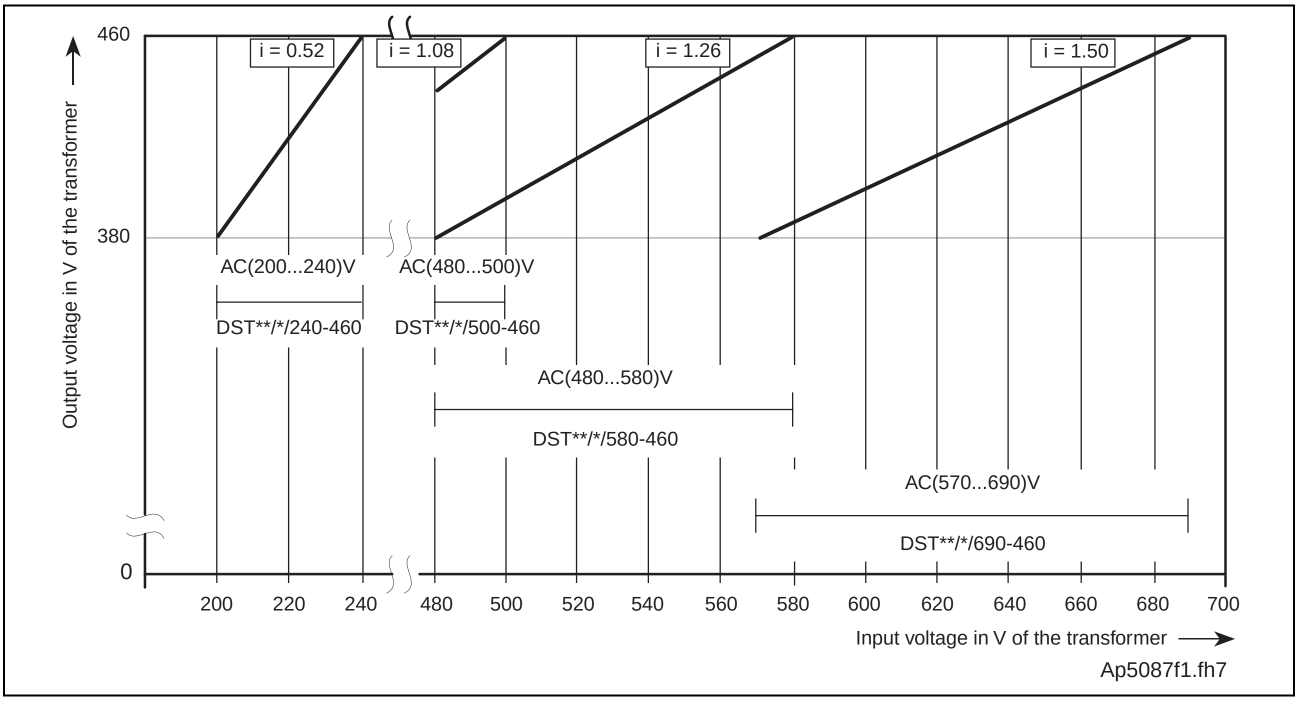
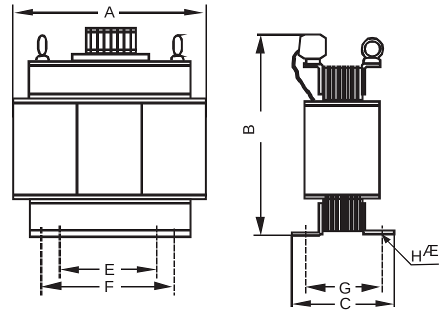


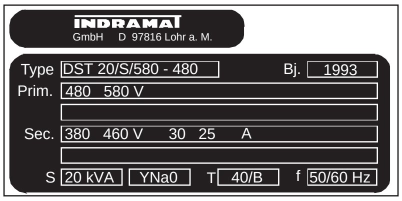
Fig. 9-1: Classification of three-phase autotransformers in rating groups

DST autotransformer with secondary or output voltage AC (380 to 460) V

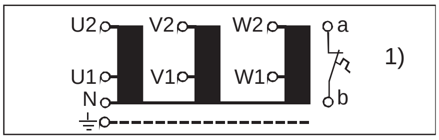
Standing version for mounting with base: DST..,../S



Rating plate (example)



Block diagram



1)Temperature switch max. load:
DC 24V/1A; AC 230V/1A

Type designation DST...	Conn. output in KVA	Trans-mission ratio	Dimensions in mm							Power loss in W	max. cross section in mm^2	Weight in kg
			A	C	B	F	E	G	H∅			
Input voltage: AC (200...240) V ±10%												
4/S/240-460	4		240	150	260	170	110	120	11	120	10	24.5
7,5/S/240-460	7.5		335	175	365	230	160	145	11	225	10	55
12,5/S/240-460	12.5	0.52	360	190	395	250	170	160	11	310	10	70
25/S/240-460	25		480	195	500	356	-----	158	13	500	35	135
50/S/240-460	50		580	265	540	400	270	215	18	750	70	195
Input voltage: AC (480...500) V ±10%												
4/S/500-460	4		180	105	190	125	80	75	7	160	4	8.5
7,5/S/500-460	7.5		205	130	210	145	95	95	7	260	4	13
12,5/S/500-460	12.5	1.08	240	140	260	170	110	110	11	440	10	22
25/S/500-460	25		300	155	325	210	140	125	11	750	16	36
50/S/500-460	50		335	175	365	230	160	145	11	1050	35	53
Input voltage: AC (480...580) V ±10%												
4/S/580-460	4		240	130	260	170	110	100	11	140	4	18
7,5/S/580-460	7.5		240	140	260	170	110	110	11	260	4	22
12,5/S/580-460	12.5	1.26	300	155	325	210	140	125	11	375	10	37
25/S/580-460	25		360	190	395	250	170	160	11	625	10	72
50/S/580-460	50		420	215	450	280	190	155	14	1000	35	95
Input voltage: AC (570...690) V ±10%												
4/S/690-460	4		240	140	260	170	110	110	11	140	10	22
7,5/S/690-460	7.5		300	155	325	210	140	125	11	225	10	37
12,5/S/690-460	12.5	1.5	335	175	365	230	160	145	11	375	10	57
25/S/690-460	25		420	205	450	280	190	145	14	500	16	88
50/S/690-460	50		480	222	500	356	-----	185	13	750	35	178

MB5007f1.fh7

Fig. 9-2: DST autotransformers for Drive Controllers DKC**.3 to match the line voltage

9.3 Type code

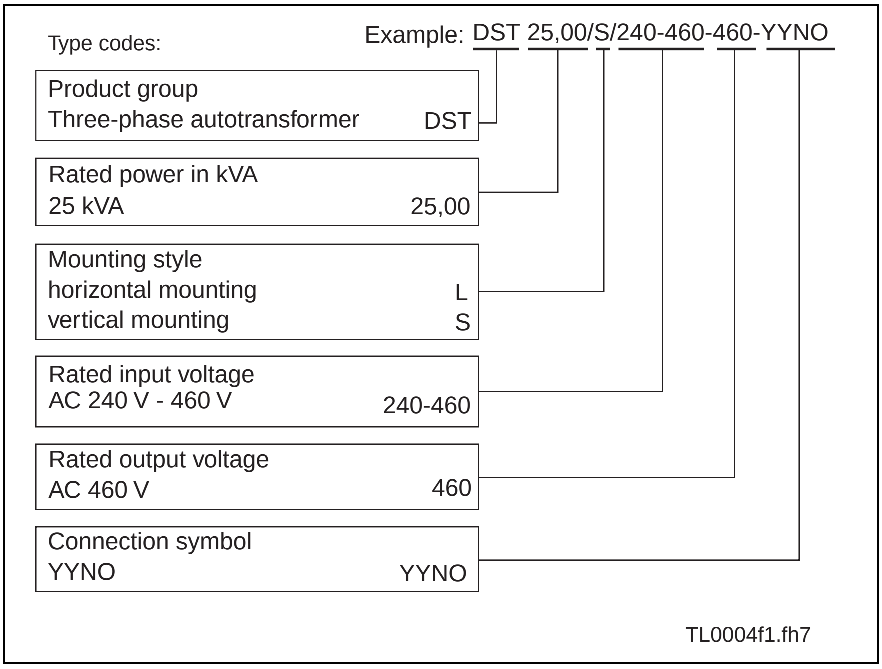


Fig. 9-3: An example of a type code for transformers

10 Mains Connections

10.1 General

Note: An ECODRIVE03 drive controller must be permanently connected to the power supply network.

Connection: see page 4-61: "X5, DC bus, 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", doc.-type DOK-GENERL-EMV********-PRxx.

10.2 The Ground Conditions of the Power Supply Network

Grounded three-phase current networks

Drive controllers of the ECODRIVE03 family can be operated on three-phase current networks with grounded star point or external conductors without potential isolation.

Ungrounded three-phase networks

Ungrounded networks (IT networks) present the increased danger of unallowed phase to ground overvoltages occurring. Drive controllers of the ECODRIVE03 family can be protected against overvoltages

- By connecting them via an isolating transformer (the star point of the output side and the PE connection of the power supply unit are linked on a shared ground rail)

- or -

- If the facility is protected via an overvoltage suppressor.

Connecting ECODRIVE03 drive controllers via an isolating transformer offers the best protection against overvoltage as well as the greatest operating safety.

Overvoltage

The periodic overvoltage of ECODRIVE03s between phase (L1, L2, L3) and ground may not exceed 1000 V (threshold value).

Transient overvoltage (< 50µs) may, as per EN61800-3/1996, equal a max value of 1000V phase to phase and 2000V 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.

10.3 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.

10.4 Control Circuits for the Mains Connection

The control circuits recommended by Rexroth Indramat specify the functional principle.

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.

CAUTION

Danger of damage !

⇒ 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

Also see page 4-47: "Ready to operate contact Bb".

⇒ See also 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.

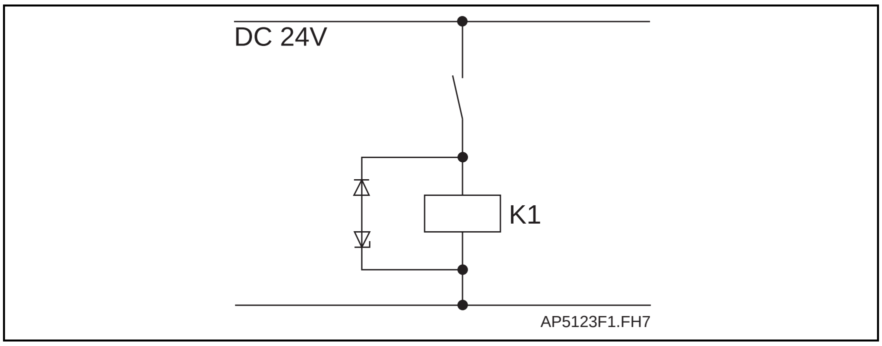


Fig. 10-1: Recommended protective circuits

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.

Control Circuits with E-Stop

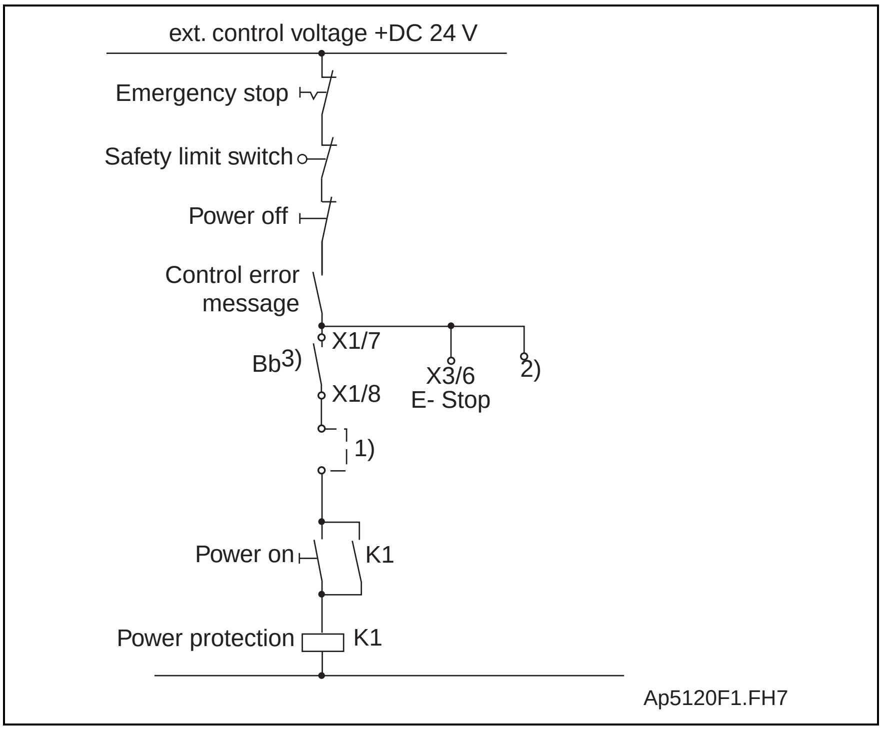
Pre-requisite:

The E-stop input is available if the E-stop function has been activated in the software (see 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.



1): Integrating Bb contacts of more DKC's and BZM**.* in series connection.
2): E-stop for more DKC's on same contactor.
3): Switching power of Bb contact must be noted.

Fig. 10-2: 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 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**.3-040-7-FWs have no internal ZKS setup.

The ZKS connection have bridges installed at delivery, thus deactivating the ZKS function.

=> See page 4-61: "X5, DC bus, Motor and Mains Connections".

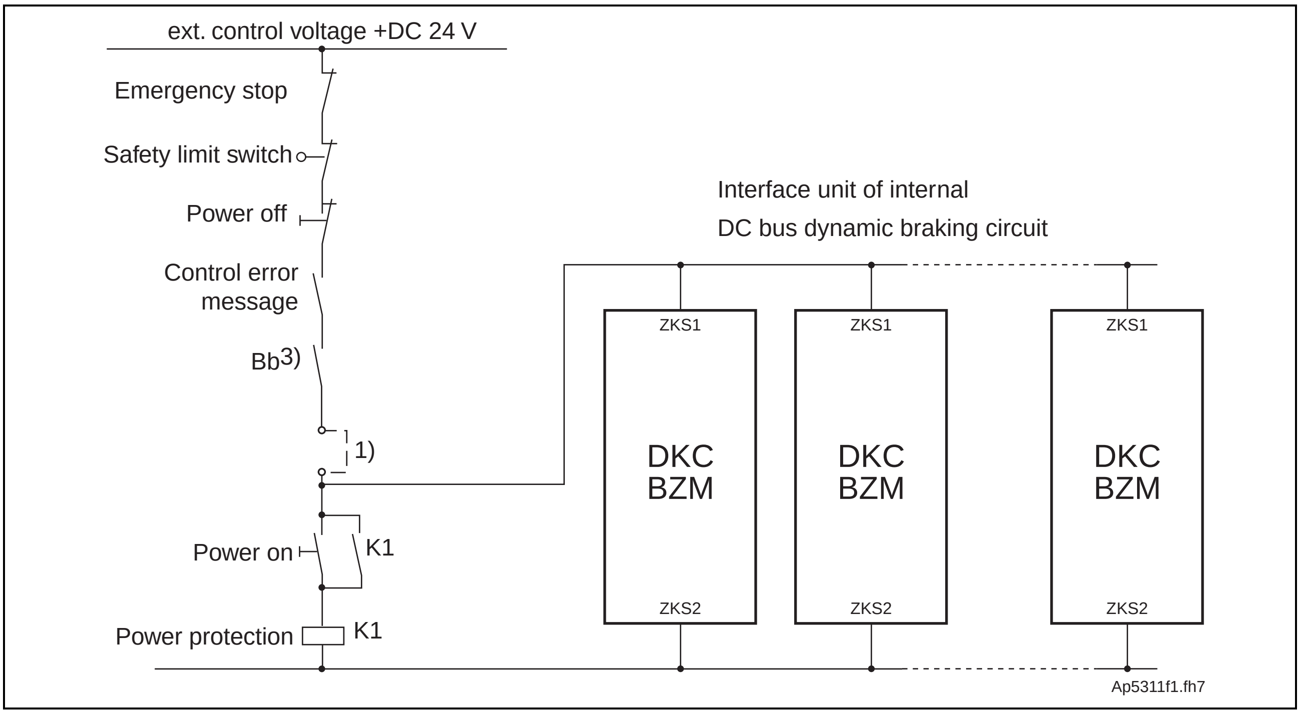
CAUTION

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!



1): Integrate Bb contacts of more DKC's and BZM**.* in series.
3): Switching power of Bb contact must be noted.

Fig. 10-3: Example of generating the DC ZKS signal

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 10-10: "Q1 Fuse and K1 Contactor".

CAUTION

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.

10.5 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.

$$P_{ZW} = \frac{M_{EFF} \cdot n_{MITTEL} \cdot 2 \cdot \pi}{60} \cdot k$$

P_{ZW}: required DC bus power in W
M_{EFF}: rms torque in Nm
n_{MITTEL}: mean speed in min-1
k: factor for motor and controller efficiency = 1.25 (MKD, MHD)

Fig. 10-4: Computing DC bus power

$$S_{N1} = P_{ZW} \cdot F$$

S_{N1}: connected load in VA
P_{ZW}: DC bus power in W
F: connected load factor
F=2.8 for single-phase feed
F for three-phase feed see page 10-8:
"Factor F for Computing the Connected Load"

Fig. 10-5: Computing mains connected load

Single-phase load: $$I_{N1} = \frac{S_{N1}}{U_{N1}}$$

Three-phase load: $$I_{N1} = \frac{S_{N1}}{U_{N1} \cdot \sqrt{3}}$$

I_{N1}: mains-side phase current in A
S_{N1}: connected load in VA
U_{N1}: voltage between phases of the mains in V

Fig. 10-6: Computing mains-side phase current

Computing Starting Current Inrush

$$I_{EINGerät} = \frac{U_{N1} * \sqrt{2}}{R_{Softstart}}$$

$$\sum I_{Einschalt} = I_{EinGerät\_1} + I_{EinGerät\_n}$$

$I_{EinGerät}$: starting current inrush of unit in A
$I_{Einschalt}$: starting current inrush in A
U_{N1}: mains input voltage
$R_{Softstart}$: softstart resistance of unit (see relevant technical data)

Fig. 10-7: Computing starting current inrush

Note: To compute the starting current inrush take all the units connected to the mains voltage into account.

Factor F for Computing the Connected Load

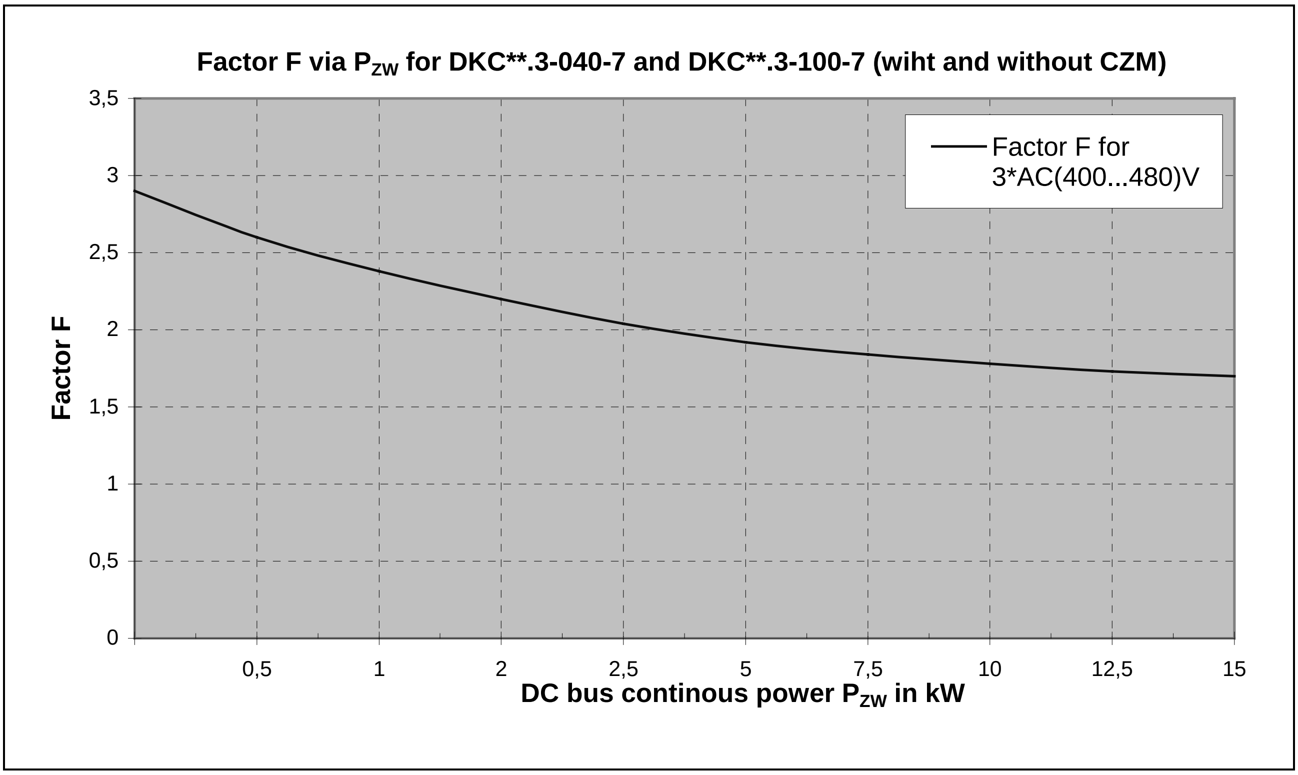


Fig. 10-8: Connected load factor for DKC**.3-040-7 and DKC**.3-100-7

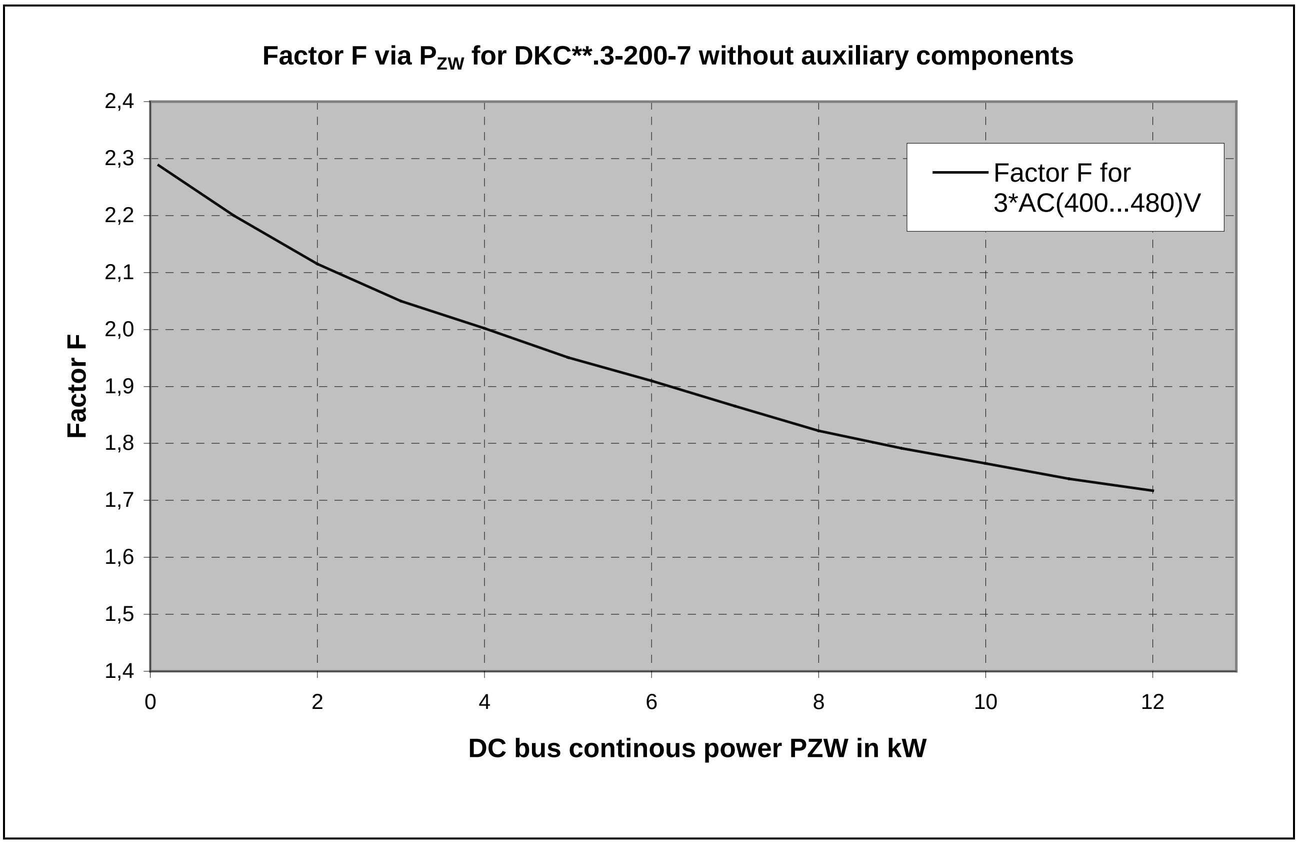


Fig. 10-9: Connected load factor for DKC**.3-200-

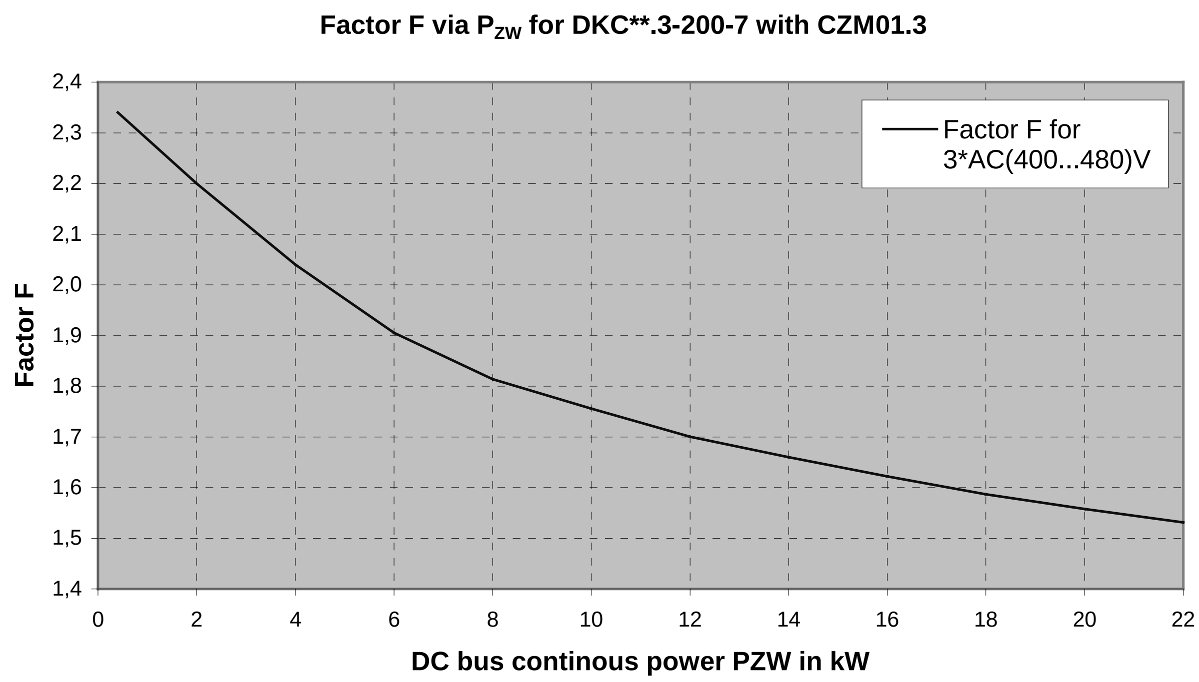


Fig. 10-10: Connected load factor for DKC**.3-200-7 with CZM01.3

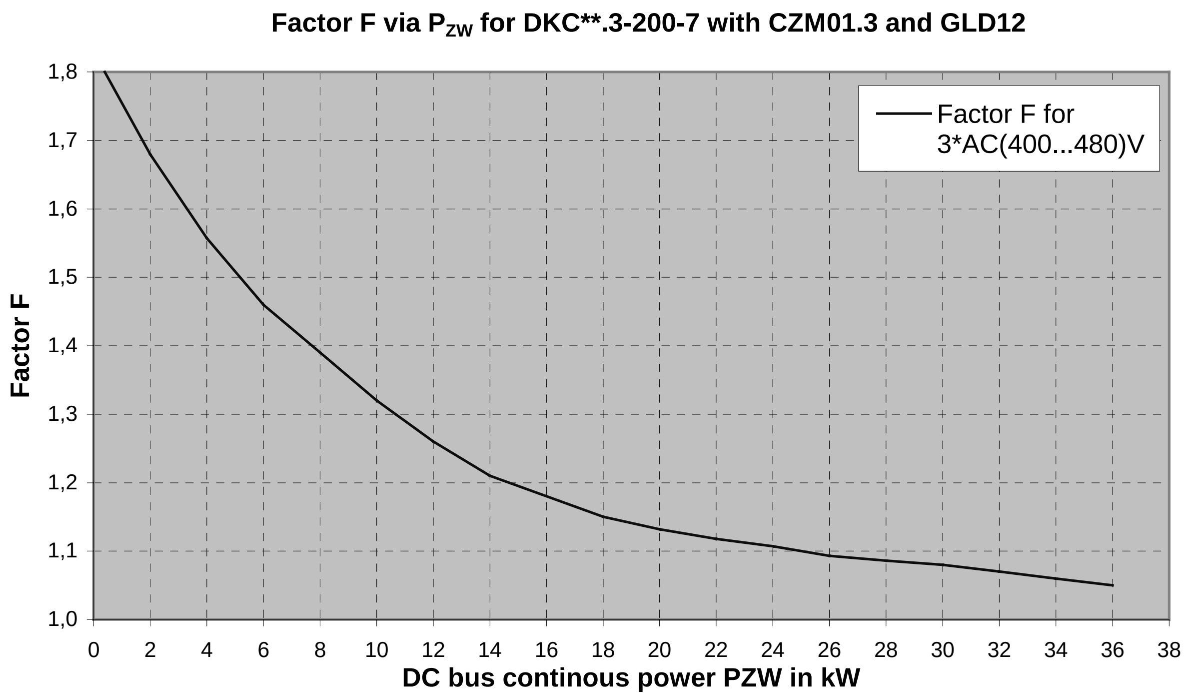


Fig. 10-11: Connected load factor for DKC**.3-200-7 with CZM01.3 and GLD12

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 (1)	Fuses (triggering characte. C) (2)	Power fuses (3)	Fusible links (operating class gl) (2)	Mains contactor (3)	Inrush current	Dropout delay t_{Abmax}	Pullup delay t_{Anmax}
in A	mm²	Current in A	Siemens type	Current in A	Siemens type	in A	in ms	in ms
9	1.0	10	3VU1300- .ML00 or 3RV1011-1JA10	10	3TF40 oder 3RT1016	54	80	120
12	1.5	16	3VU1300- .MM00 or 3RV1021-4AA10	16	3TF41 oder 3RT1017	72	80	120
16	2.5	20	3VU1300- .MM00 or 3RV1021-4AA10	20	3TF42 oder 3RT1025	96	110	190
22	4.0	25	3VU1300- .MP00 or 3RV1021-4DA10	25	3TF43 oder 3RT1026	132	110	190
32	6.0	32	3VU1600- .MP00 or 3RV1031-4EA10	35	3TF44 oder 3RT1034	186	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. 10-12: Selecting table for Q1 fuses and K1 contactors

11 Constructing the Control Cabinet

11.1 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 11-2.

The temperature increases of the cooling air occurring in the effluent range of the drive controller DKC and the auxiliary bleeder module BZM are specified in the diagrams "Temperature increase vs. P_{BD}" on page 11-5. 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

⇒ Look up in the relevant motor document both the continuous standstill current I_{dN} and torque M_{dN}.

⇒ Determine rms torque M_{eff} of the application (see motor document).

⇒ Determine the following relationship I_{eff}

$$I_{eff} = \frac{I_{dN} * M_{eff}}{M_{dN}}$$

Fig. 11-1: Determining I_{eff}

⇒ Using I_{eff}, find the corresponding value of the current-dependent power dissipation $P_{V,\,DKC}$, using the diagrams "Determining Power Dissipation in the control cabinet".

⇒ Add both power losses ($P_{V,DKC}$ and $P_{V,Bleeder}$). Use the sum ($P_{V,ges}$) when planning the control cabinet.

⇒ Consider further components such as smoothing chokes, filters etc..

DKC.3-040-7-FW**

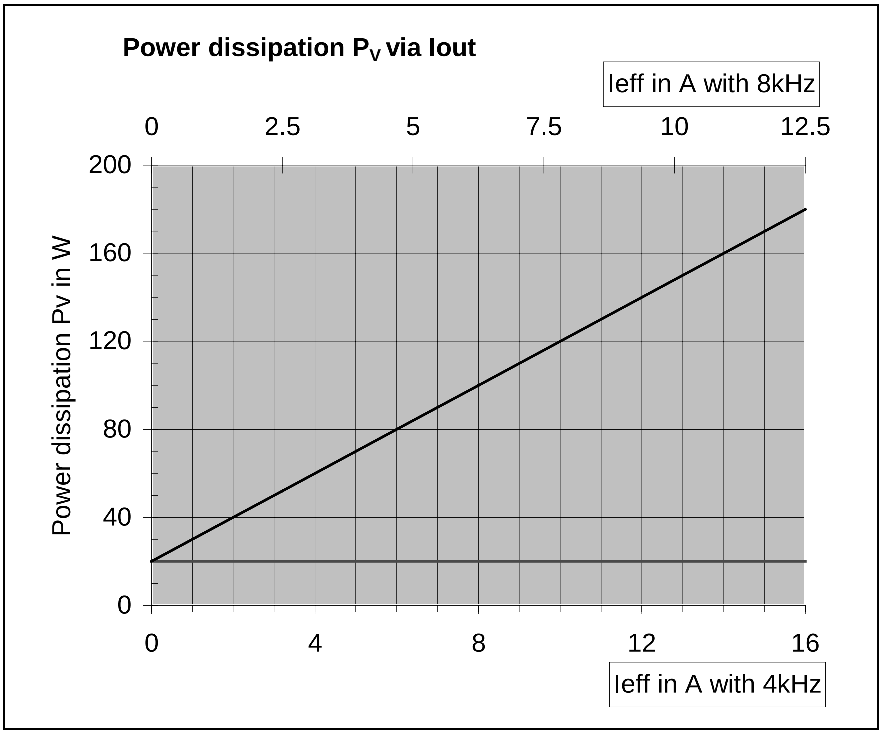


Fig. 11-2: Determining power dissipation in the control cabinet for each drive controller DKC**.3-040-7-FW without bleeder power

DKC.3-100-7-FW**

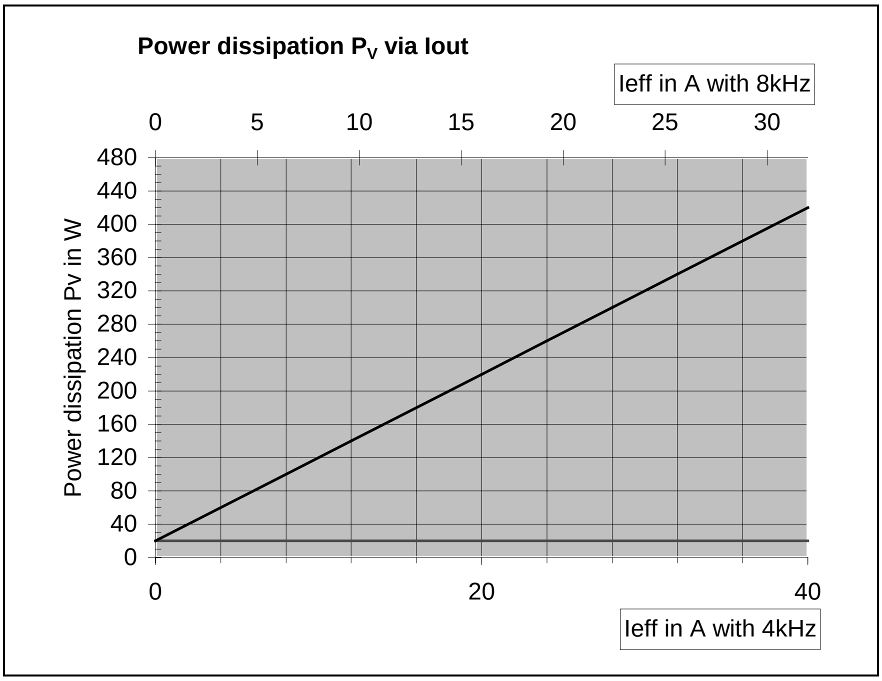


Fig. 11-3: Determining power dissipation in the control cabinet for each drive controller DKC**.3-100-7-FW without bleeder power

DKC.3-200-7**

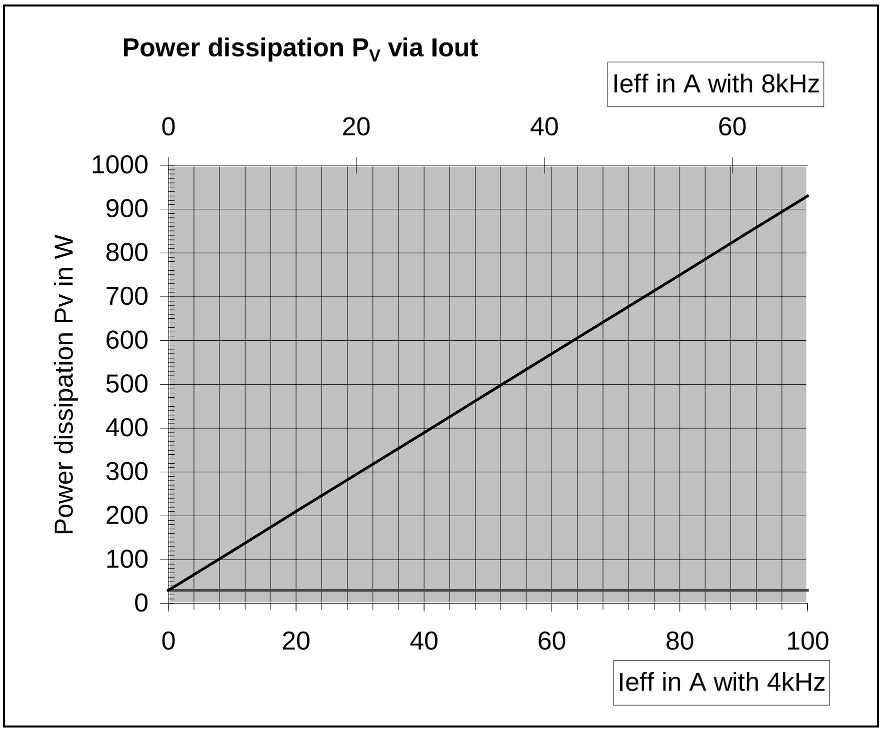


Fig. 11-4: Determining power dissipation in the control cabinet for each drive controller DKC**.3-200-7-FW without bleeder power

Mounting Position and Distances

Mounting Position

⇒ The mounting of the drive controller device DKC, the auxiliary bleeder 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.

Distances

Temperature Increase of Cooling Air

The power dissipation of the drive controller DKC and the auxiliary bleeder 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 bleeder power. The appropriate distance "d" is specified in the curve (interpolation allowed).

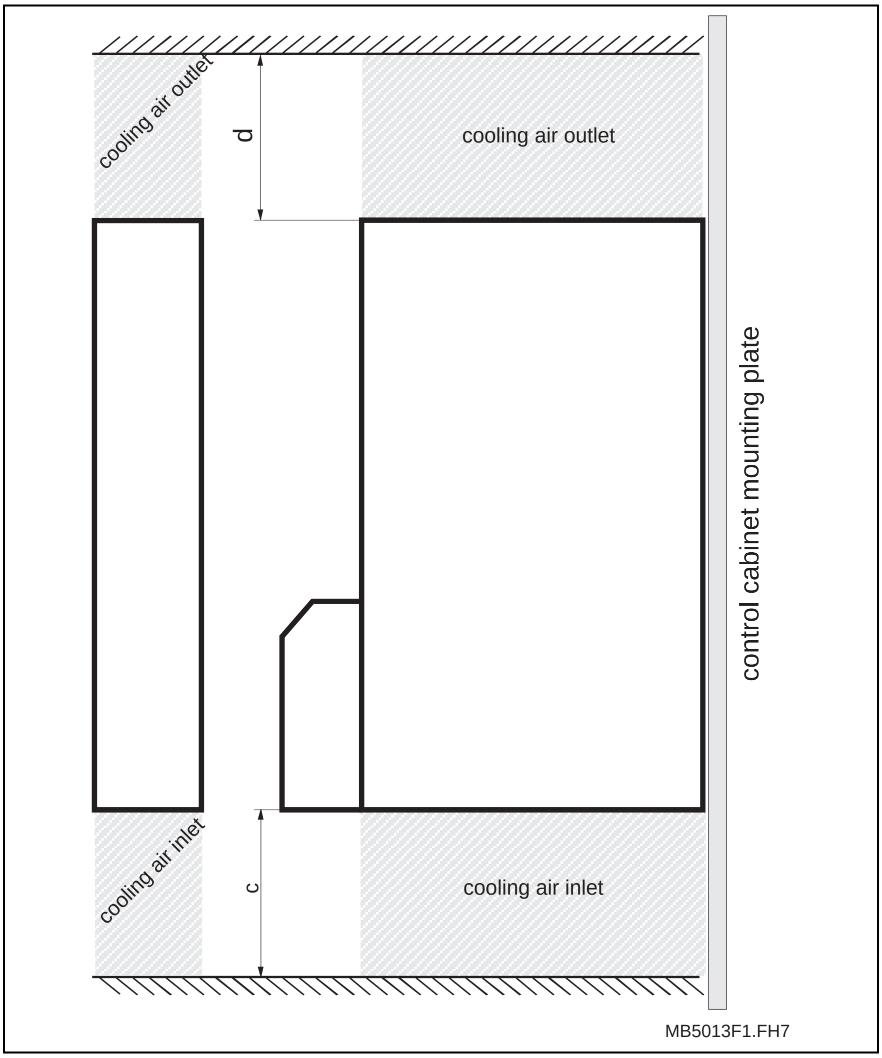


Fig. 11-5: Exit and entrance of cooling air

Note:

- When using the signals at connectors X9, X10 and X11 maintain a minimum distance of d=150mm.
- Without bleeder power dissipation and connections at X9, 10 and 11 it is possible to reduce distance d=80mm.
- The minimum distance of c=80mm enlarges itself in dependence of the utilised connection cables.

CAUTION

High temperature

Risk of damage to temperature-sensitive control cabinets in the area of the cooling air outlet.

⇒ 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 5-2: "Electrical data of auxiliary component BZM01.3".

Note: Diagram "Temperature increase via continuous bleeder power" shows the relationship between bleeder load and temperature of cooling air entering at unit underside and exiting top side under nominal current conditions of the controller.

DKC.3-040-7-FW**

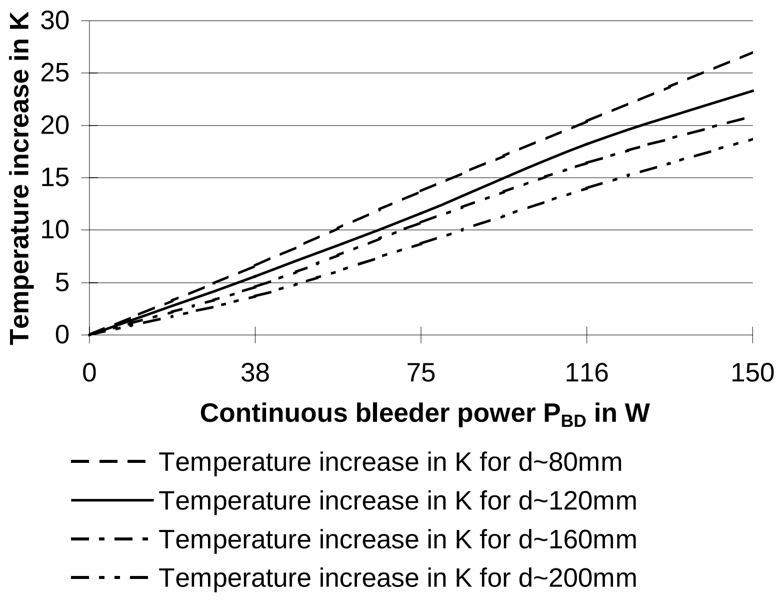


Fig. 11-6: Temperature increase DKC**.3-040-7-FW

DKC.3-100-7-FW**

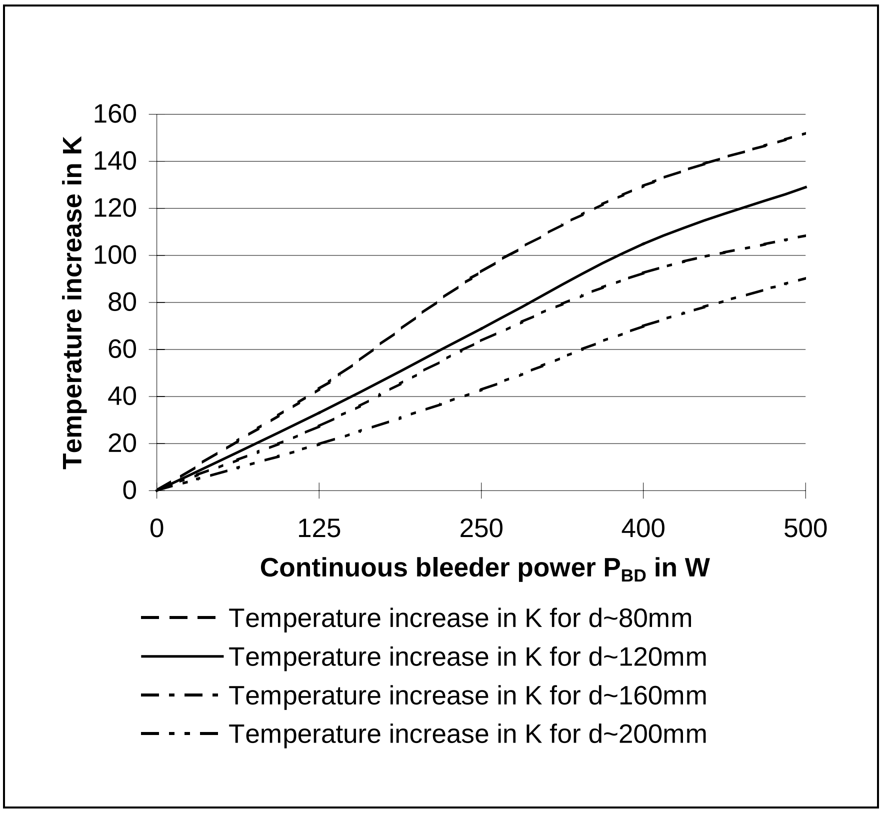


Fig. 11-7: Temperature increase DKC**.3-100-7-FW

DKC.3-200-7-FW**

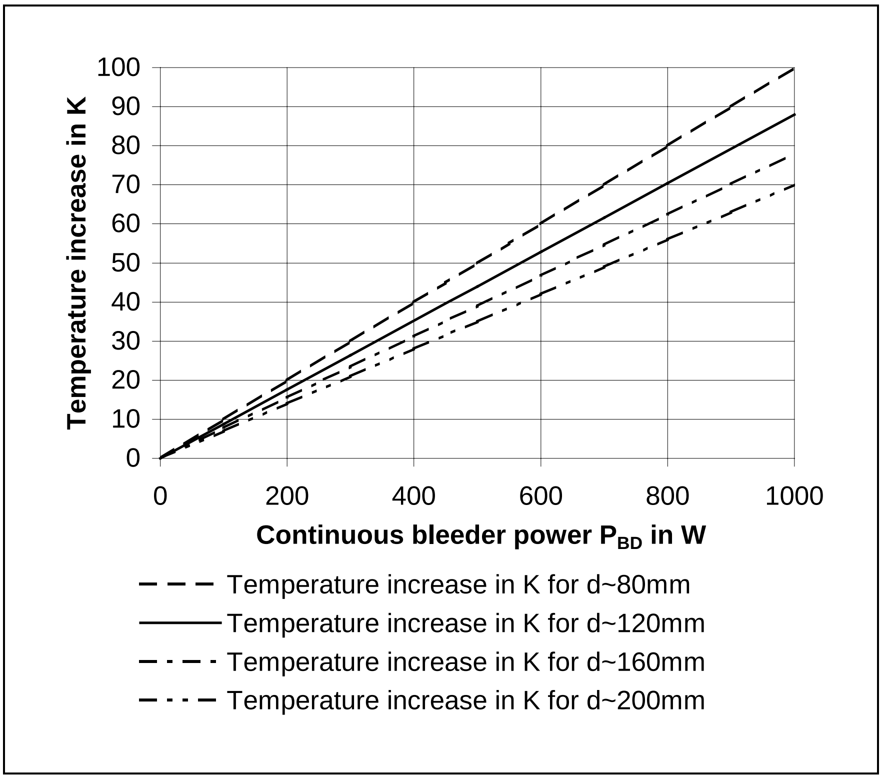


Fig. 11-8: Temperature increase DKC**.3-200-7-FW with nominal current

BZM.3-01-7**

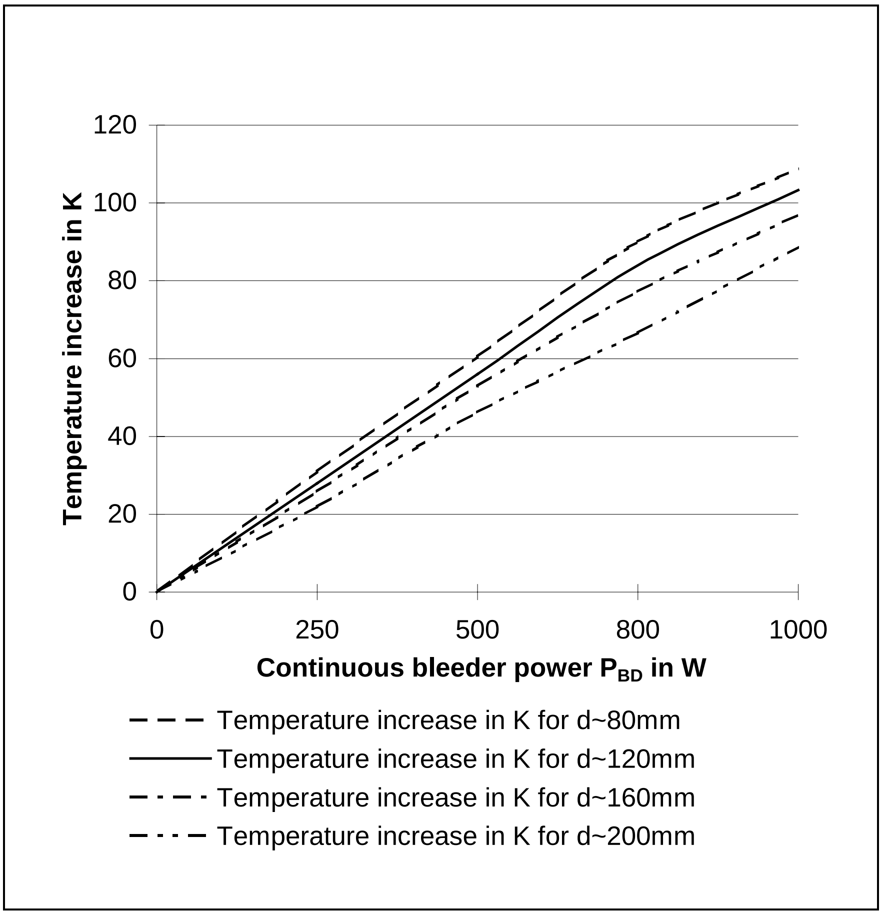


Fig. 11-9: Temperature increase BZM**.3-01-7

Module widths

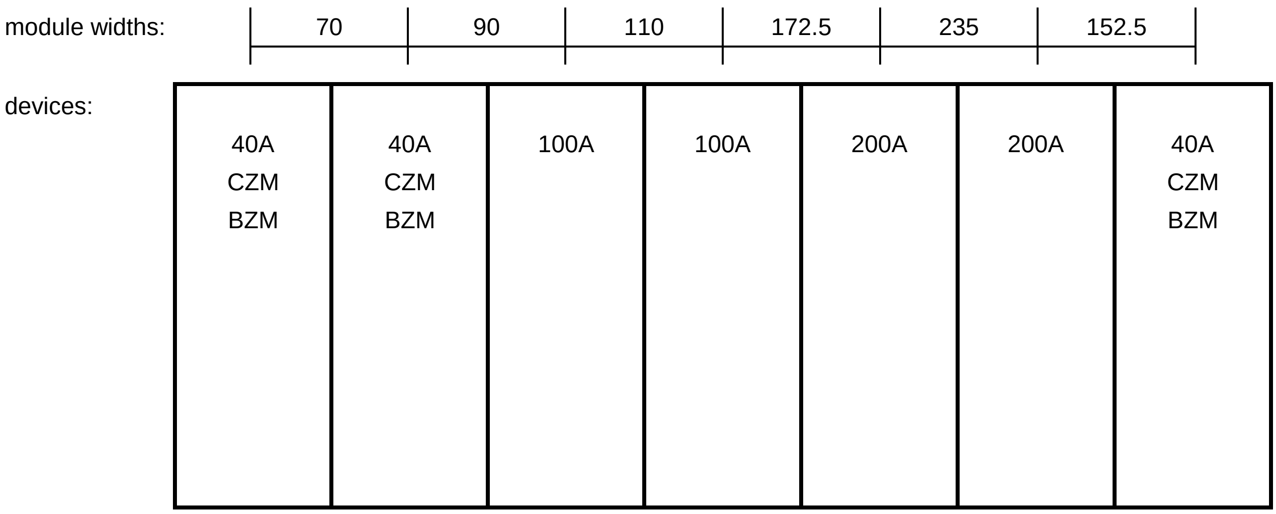


Fig. 11-10: Module widths

Note: Using the specified increments, there is a distance of 5 mm between the units.

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.

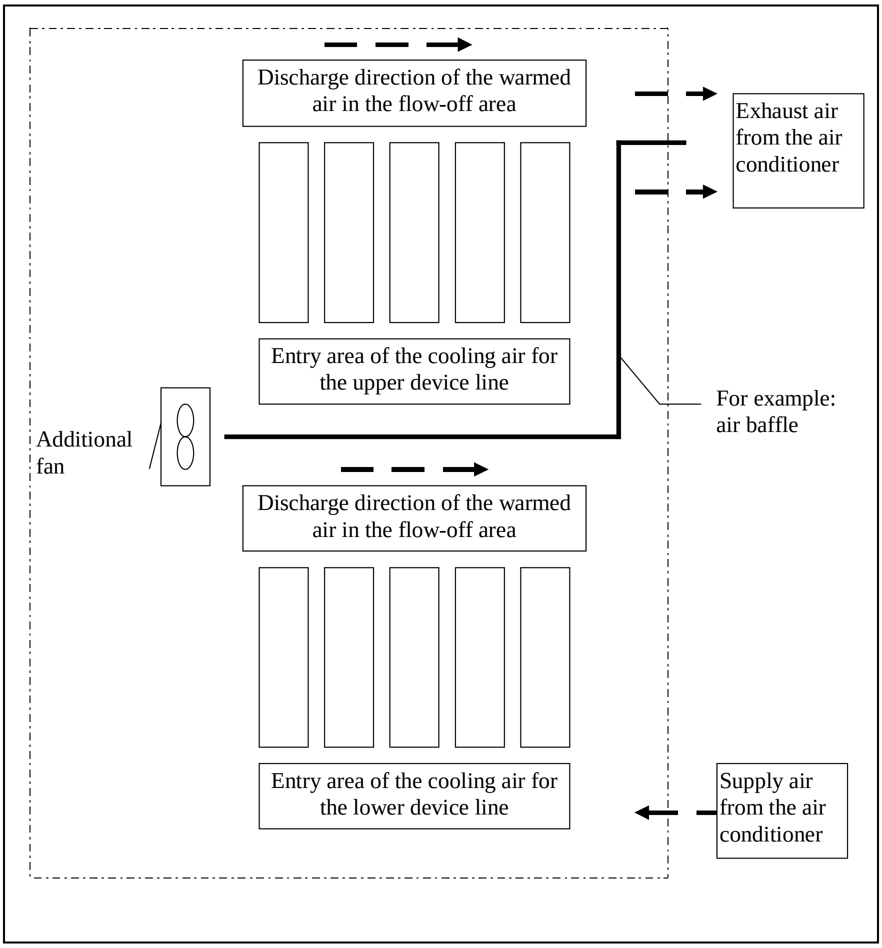


Fig. 11-11: Example of arranging ECODRIVE components in multiple rows

See also page 14-5: "Control Cabinet Construction with Recommendations for EMC and Cooling“.

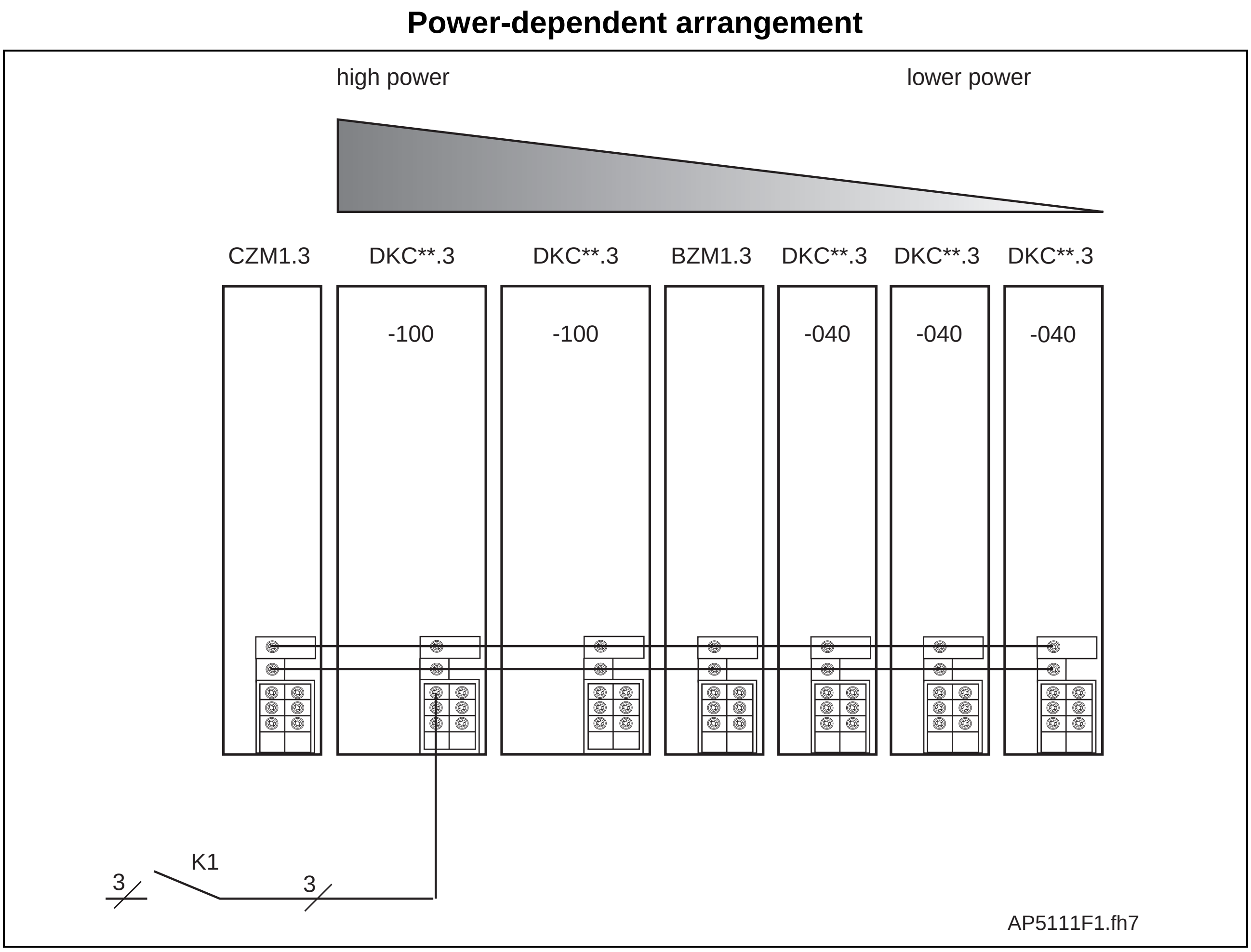


Fig. 11-12: Example of arrangement of a "Central feed"

- Arrange auxiliary capacitance module CZM next to drive with large DC bus continuous power.
- Arrange auxiliary bleeder module BZM next to drive with large feedback power.

See also page 14-5: "Control Cabinet Construction with Recommendations for EMC and Cooling".

11.2 Using Cooling Units in the Control Cabinet

The controller may only be operated if the ambient temperature does not exceed 45°C. Otherwise temperature must be reduced and it may be necessary to use a cooling unit.

CAUTION

Possible damage to controller
Endangers the operating safety of the machine
⇒ 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.

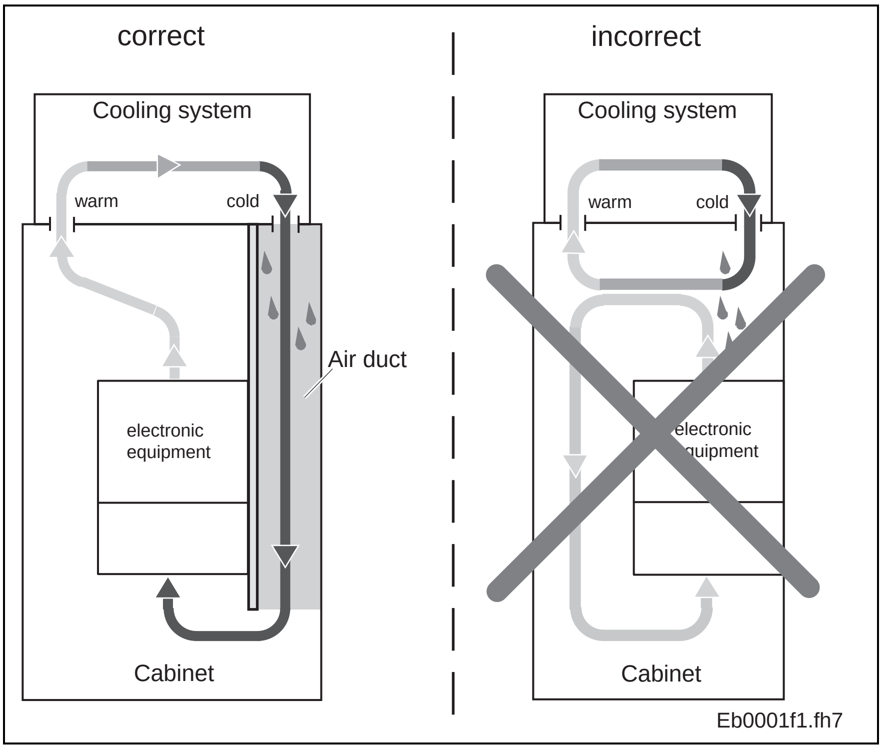


Fig. 11-13: Arranging cooling unit on cabinet

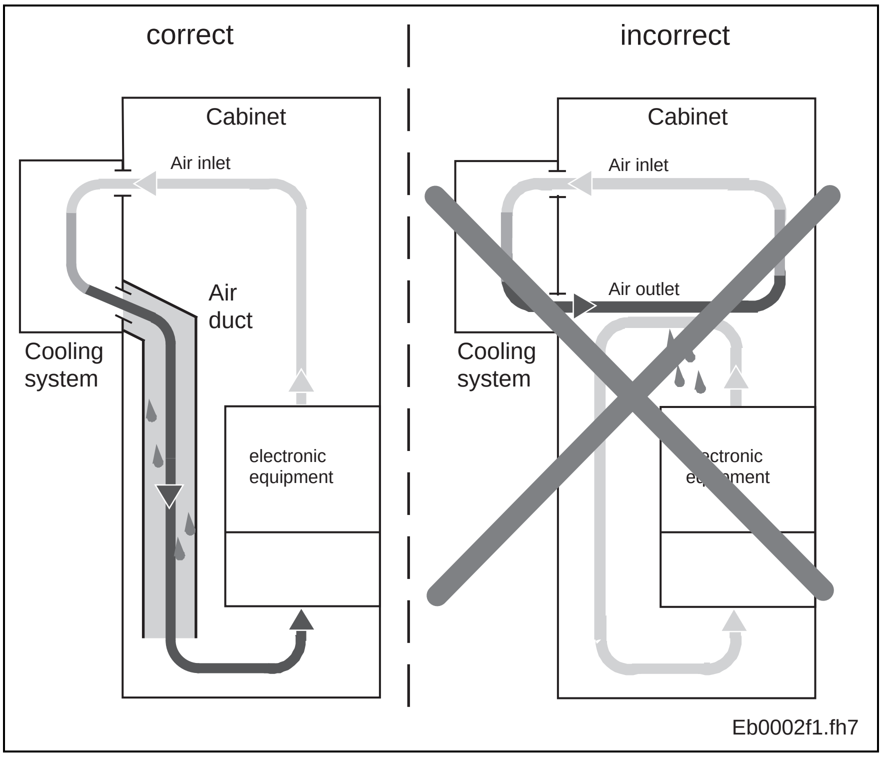


Fig. 11-14: Arranging cooling unit on front of cabinet

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.

11.3 General Notes

Electrostatic discharge from persons and/or tools can damage the controller or printed circuits boards (PCB's). Please note the following:

CAUTION

Error in the control of motors and moving parts

Electrostatic discharge endangers electronic parts and thus operating safety.

⇒ Objects coming into contact with machine parts and PCB's must be discharged by grounding them!

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.

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). INDRAMAT drive components are high-voltage and insulation tested as per EN 50178.

CAUTION

Potential damage of the controller device by connecting and disconnecting the connections with mains power on.

⇒ Do not connect and disconnect connections if the mains power is on.

11.4 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 channel with metal divider.

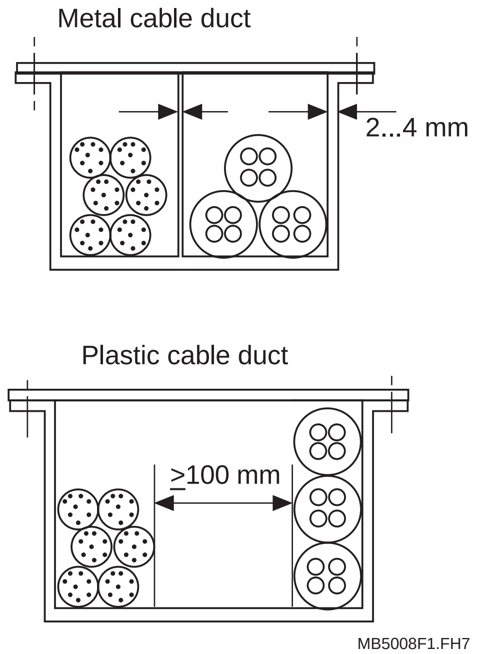


Fig. 11-15: Cable channel variant

Note: Details are specified in the project planning manual "Electromagnetic compatibility (EMC) or AC drives“, doc. Type DOK-GENERL-EMV********-PRxx.

11.5 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

12 State of Delivery of the Drive Components

12.1 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. 12-1: Barcode sticker on the packaging - breakdown

12.2 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.

12.3 Extent of Delivery

Included in the delivery:

- **The controller DKC**.3**
  - With firmware module
  - With contact protection
  - with connectors according to the following table

Type	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	X	X	X	X	X	X	X	X	X	X								
DKC02.3-***-7	X	X	X	X	X	X	X	X	X									
DKC03.3-***-7	X	X	X	X	X	X	X	X	X									
DKC04.3-***-7	X	X	X	X	X	X	X	X	X									
DKC05.3-***-7	X	X	X	X	X	X	X	X	X									
DKC06.3-***-7	X	X	X	X	X	X	X	X	X								X	
DKC11.3-***-7	X	X	X	X	X	X	X	X	X									
DKC21.3-***-7	X	X	X	X	X	X	X	X	X									

Fig. 12-2: In the delivery contained connectors

- **Connection and mounting accessories according to the enclosed packing slip (sample)**

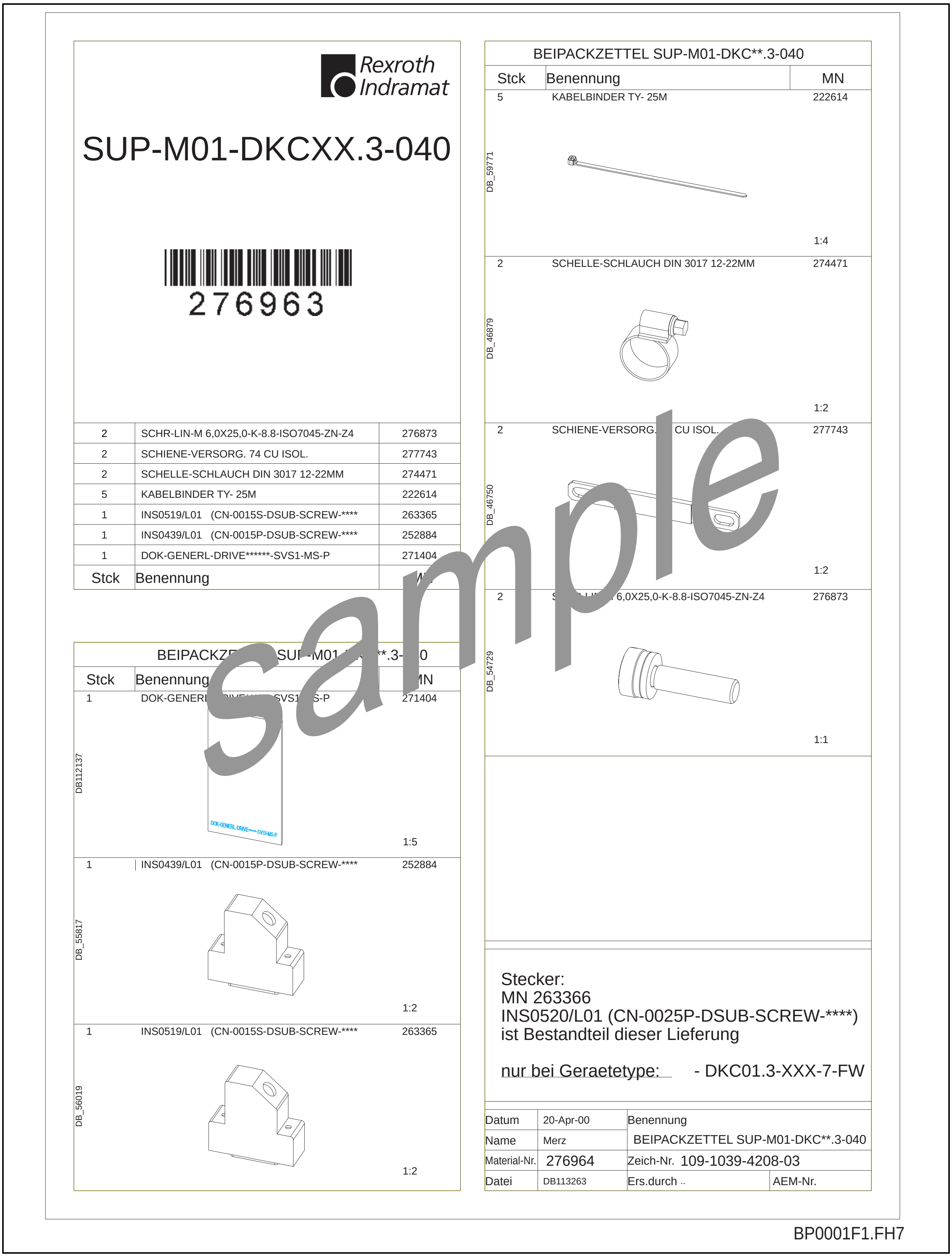


Fig. 12-3: packaging slip SUB-M01-DKCxx.3-040 (sample)

12.4 Ordering

Unit Types Available

DKC01.3-040-7	DKC01.3-100-7	DKC01.3-200-7
DKC11.3-040-7	DKC11.3-100-7	DKC11.3-200-7
DKC21.3-040-7	DKC21.3-100-7	DKC21.3-200-7
DKC02.3-040-7	DKC02.3-100-7	DKC02.3-200-7
DKC03.3-040-7	DKC03.3-100-7	DKC03.3-200-7
DKC04.3-040-7	DKC04.3-100-7	DKC04.3-200-7
DKC05.3-040-7	DKC05.3-100-7	DKC05.3-200-7
DKC06.3-040-7	DKC06.3-100-7	DKC06.3-200-7

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**.3-100
- 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.*

Additional Accessories

- Standard interface cables IKB0005/ four different lengths for RS232 (2m, 5m, 10m or 15m)
- Interface cable RS485 INK0572/ length

Mounting Accessories

A Torx screw driver TX40 with a 400mm long blade is available.

- Torx screw driver TX30 M6 400 lg (MN00282391)

Commissioning Aids

- Command value box
- DriveTop (Software for start-up)

13 Identifying the Components

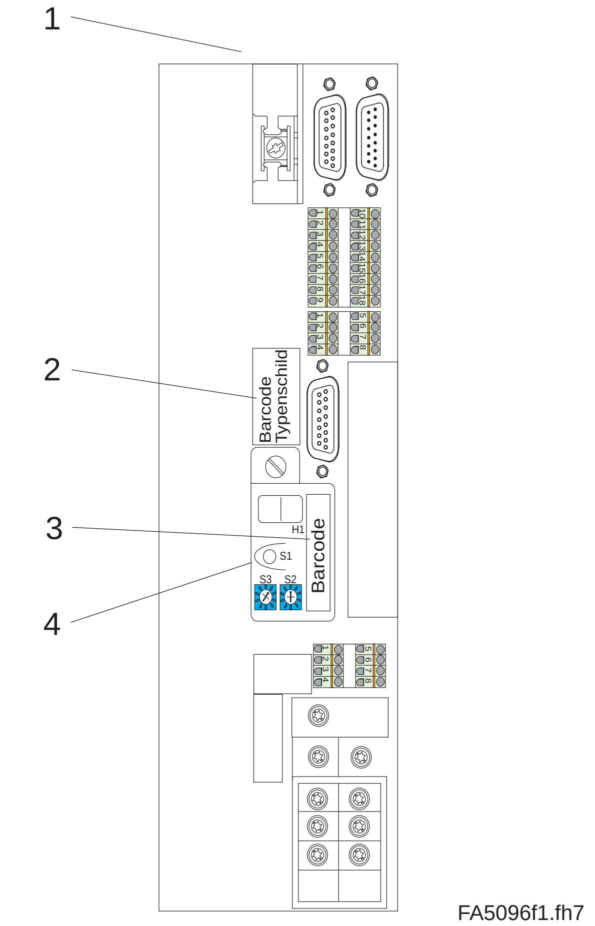
13.1 Component designations

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.



1: Basic unit – type plate
2: Unit design – type plate
3: Firmware – type plate
4: Programming module – type plate

Fig. 13-1: Type plates

Type Plates

(1) Basic Unit

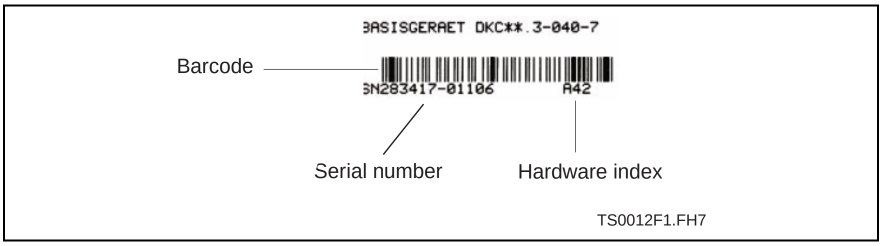


Fig. 13-2: Type plate

(2) Unit type

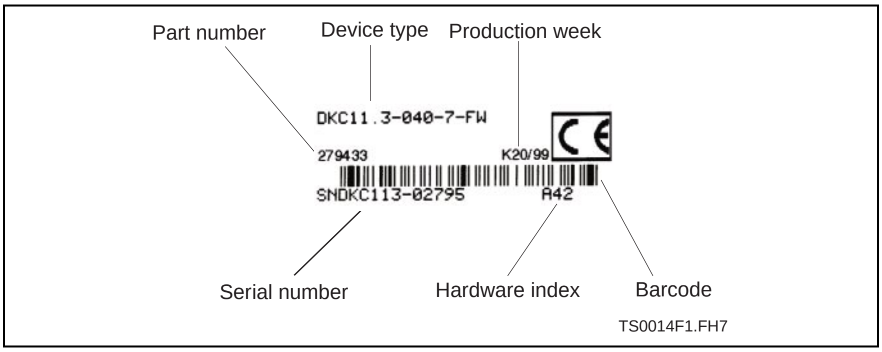


Fig. 13-3: Type plate – DKC example

Note: The type plates for units BZM, CZM, NTM, NFD/NFE is the same.

(3) Firmware

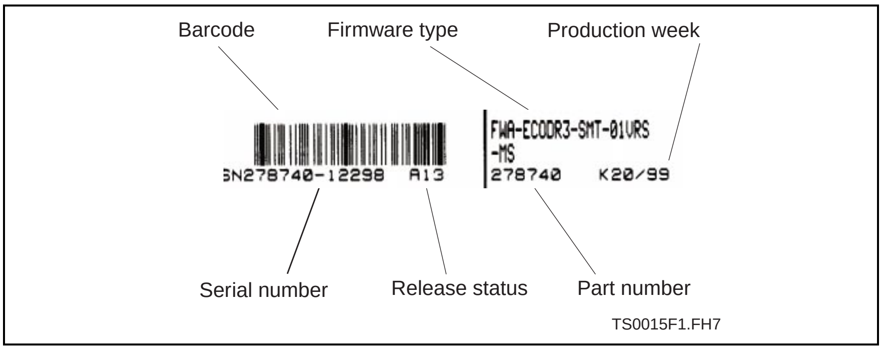


Fig. 13-4: Type plate

(4) Programming Module

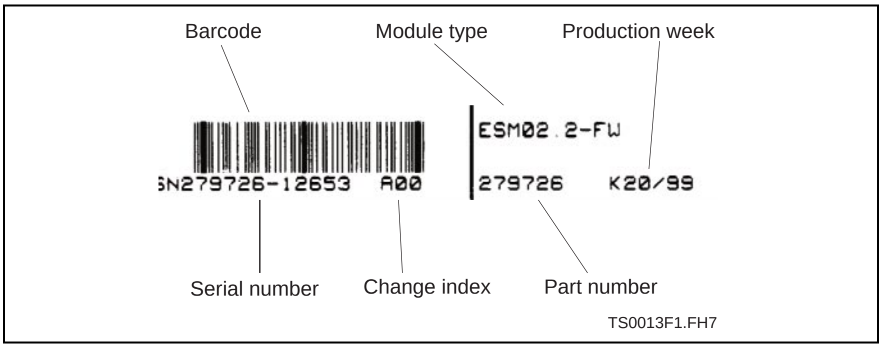


Fig. 13-5: Type plate

DST/DLT

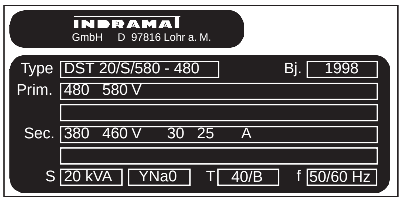


Fig. 13-6: Type plate DST/DLT

Notes

14 Attachment

14.1 Sizing components relevant to regeneration

BZM01.3

With every application it has to be checked whether pending

- continuous regeneration power
- continuous peak power
- and regenerated energy

can be accepted by the internal bleeder (brake resistor).

If the pending regenerated power and energy from the mechanics exceed the capacity of the bleeder in the drive controller, then this capacity can be increased in DKC**.3 drives prior to the use of an auxiliary bleeder module

- by linking the DC buses of other DKC's as per page 4-17: "Mains supply options" or
- the use of a CZM unit.

Also see page 4-17: "Mains supply options".

Regenerative power

1. Continuous regenerative power

$$\sum P_{RD} \leq f * [n * P_{BD,DKC40} + k * P_{BD,DKC100} + l * P_{BD,DKC200} + m * P_{BD,BZM}]$$

$$P_{RD} = \frac{\sum W_{ROT} + \sum W_{POT}}{t_Z * 1000} \qquad W_{ROT} = \frac{(J_{LAST} + J_M)}{2} \cdot (n_{NUTZ} \cdot \frac{2 \cdot \pi}{60})^2 \cdot z_{DEC}$$

$$W_{POT} = m_{LAST} \cdot g \cdot h \cdot z_{AB}$$

2. Peak regenerative power

$$\sum P_{RS} \leq f * [n * P_{BS,DKC40} + k * P_{BS,DKC100} + l * P_{BS,DKC200} + m * P_{BS,BZM}]$$

$$P_{RS} = \frac{M_{max} * n_{max}}{9550}$$

3. Regenerative power (single braking in emergency stop)

$$\sum W_{POT,MAX} + \sum W_{ROT,MAX} \leq f * [n * W_{Max,DKC40} + k * W_{MAX,DKC100} + l * W_{MAX,DKC200} + m * W_{MAX,BZM}]$$

$W_{MAX,DKC}$ - > see technical data DKC

$W_{MAX,BZM}$ - > see technical data BZM

P_{RD} :	continuous regenerative power from the mechanical system in continuous operation in kW
f = 1:	for operation without DC bus connection
f = 0.8:	for operation with DC bus connection
$P_{BD, DKC}$:	continuous regenerative power that the drive controller can process in continuous operation in KW
P_{RS} :	peak regenerative power in kW
W_{ROT} :	rotary energy in Ws
W_{POT} :	potential energy in Ws
$W_{ROT, MAX}$:	max. occurring rotary energy in the emergency-stop position in Ws
$W_{POT, MAX}$:	max. occurring potential energy in the emergency stop position in Ws
t_Z :	cycle time in s
J_{LAST} :	load torque in kgm²
J_M :	motor inertia, in kgm²
m_{LAST}:	load weight in kg
$W_{MAX, BZM}$:	storable energy in the BZM in kWs
$W_{MAX, DKC}$:	storable energy in the DKC in kWs
g:	9.81 ms²
h:	lowering distance in meters or number of braking actions
n_{NUTZ} :	motor speed used in min-1
z_{AB}:	number of drops per cycle
z_{DEC}:	number of braking actions per cycle
M_{MAX}	maximum torque in Nm. Locate in the selection lists
n_{MAX}	max. effective NC speed min^{-1}. Locate in the selection lists
$P_{BS, DKC}$:	peak bleeder power in DKC in kW
$P_{BS, BZM}$:	peak bleeder power BZM in kW
n:	number of DKC-040 on the common DC bus ($0 \leq n \leq 6$)
k:	number of DKC-100s on the common DC bus ($0 \leq k \leq 6$)
l:	number of DKC-100s on the common DC bus
m	number of BZMs on the common DC bus ($0 \leq m \leq 2$)

Fig. 14-1: Connecting the devices via a common DC bus

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 bleeder integrated into the DKC or an auxiliary bleeder can additionally be built in

- or -

- It can be stored as energy in the DKC with connected auxiliary capacitance module and then re-uesed 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:

$$W_{ROT} \leq W_{ZW,\,DKC+CZM}$$

Fig. 14-2: Conditions to avoid heat loss from regenerated energy

Computing rotary energy of an application

$$W_{ROT} = \frac{(J_{LAST} + J_M)}{2} \cdot (n_{NUTZ} \cdot \frac{2 \cdot \pi}{60})^2$$

W_{ROT} : rotary energy of the application in Ws
n_{NUTZ} : maximum effective speed in min-1
J_{LAST} : load inertia of the application in kgm²
J_M : motor inertia

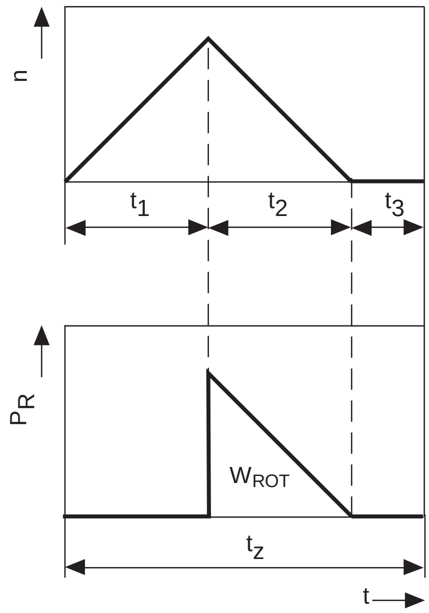
Fig. 14-3: Computing rotary energy

Application example

DKC01.3-040-7 with AC motor MKD 071 B with the following data:

Designation	Value
Rotor inertia of the MKD 071 B	J_M = 0.00087 kgm²
Maximum effective motor speed	n_{Nutz} = 3200 min-1
Load inertia of the application	J_{LAST} = 0.00261 kgm²
Cycle time	t_z =0.8 s
Line voltage	U_N = 400 V

Fig. 14-4: Technical data for application example DKC with MKD



t_1 = Accel time in seconds
t_2 = Decel. time in seconds
t_3 = Dwell time in seconds
t_Z = Cycle time in seconds
W_{ROT} = Rotary energy in Ws
n = RPM in min^{-1}
P_{RS} = Peak feedback output in kW
P_{RD} = Average of the regenerative power ir a during cycle (continous regenerated power)

$$P_{RD} = \frac{W_{ROT}}{t_Z}$$

DG0004F1.FH7

Fig. 14-5: Calculating the regenerative power in the processing cycle

This produces the following results:

W_{ROT} = 195 Ws

$W_{ZW,\ DKC+CZM}$ = 209 Ws

This indicates that the condition $W_{ROT} \leq W_{ZW,\ DKC+CZM}$ has been fulfilled. If the same amount of energy were released via a bleeder, this would result in a continuous regenerative power of 243 Watts as dissipated power in the control cabinet due to the cycle time.

14.2 Control Cabinet Construction with Recommendations for EMC and Cooling

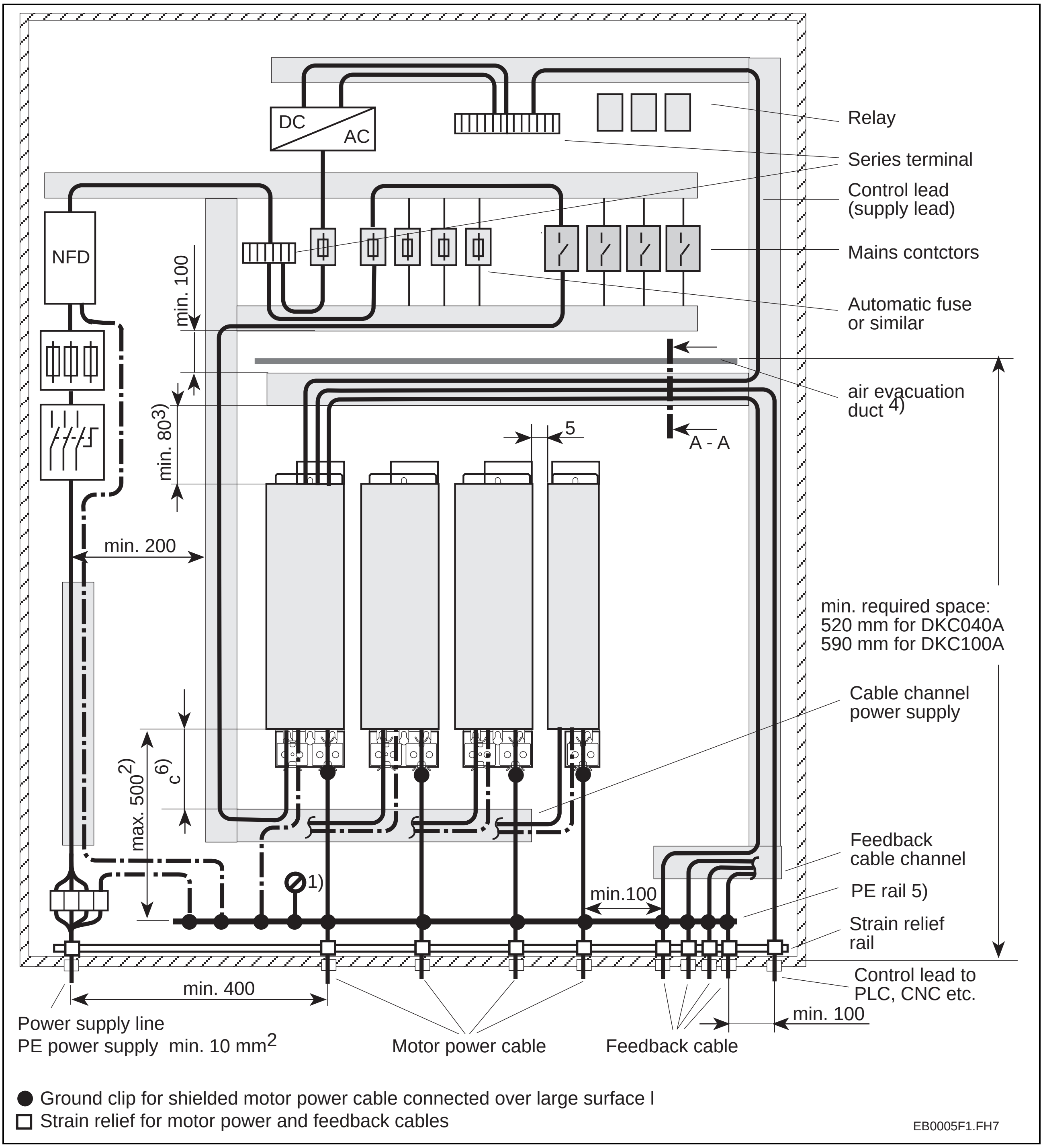


Fig. 14-6: Recommendations on constructing the control cabinett

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.

3) This dimension depends on the projected bleeder continuous power. See 11-4 "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. 14-6:
Recommendations on constructing the control cabinet, Fig. 14-7: Wall cooling unit in the control cabinet door and Fig. 14-8: Mounting the cooling unit onto top.
An air evacuation duct is always advisable with DKC100 or BZMs with high continuous bleeder 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 11-4 "Distances"

Sectional Drawing for Developing an Optimum Control Cabinet

The depth of the air evacuation duct depends on the size of the control cabinet.

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

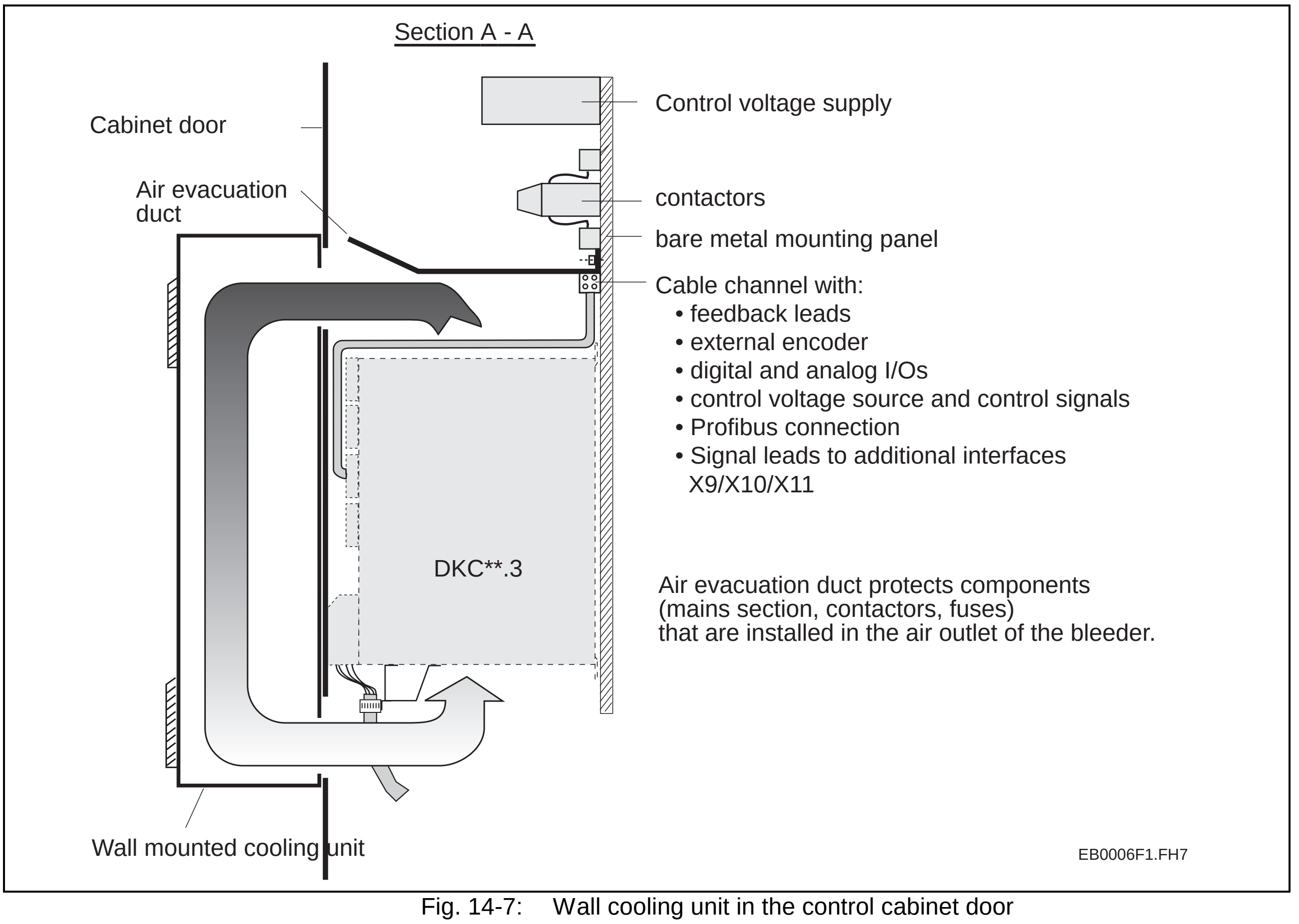


Fig. 14-7: Wall cooling unit in the control cabinet door

Mounting the cooling unit onto top

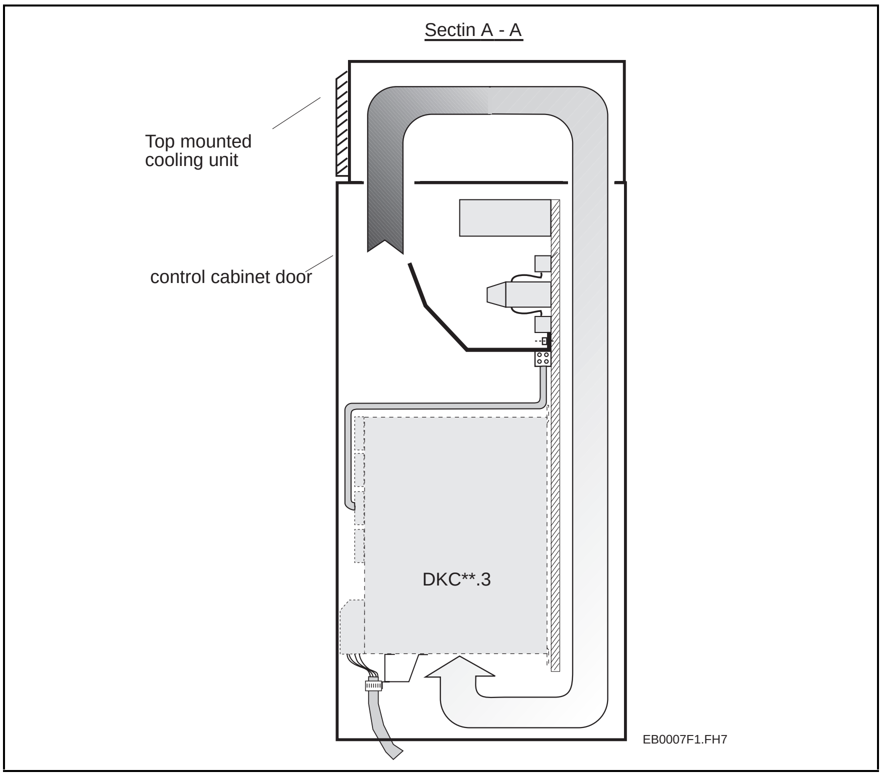


Fig. 14-8: Mounting the cooling unit onto top

14.3 Wire routing and wiring of the drive controller

Control connection

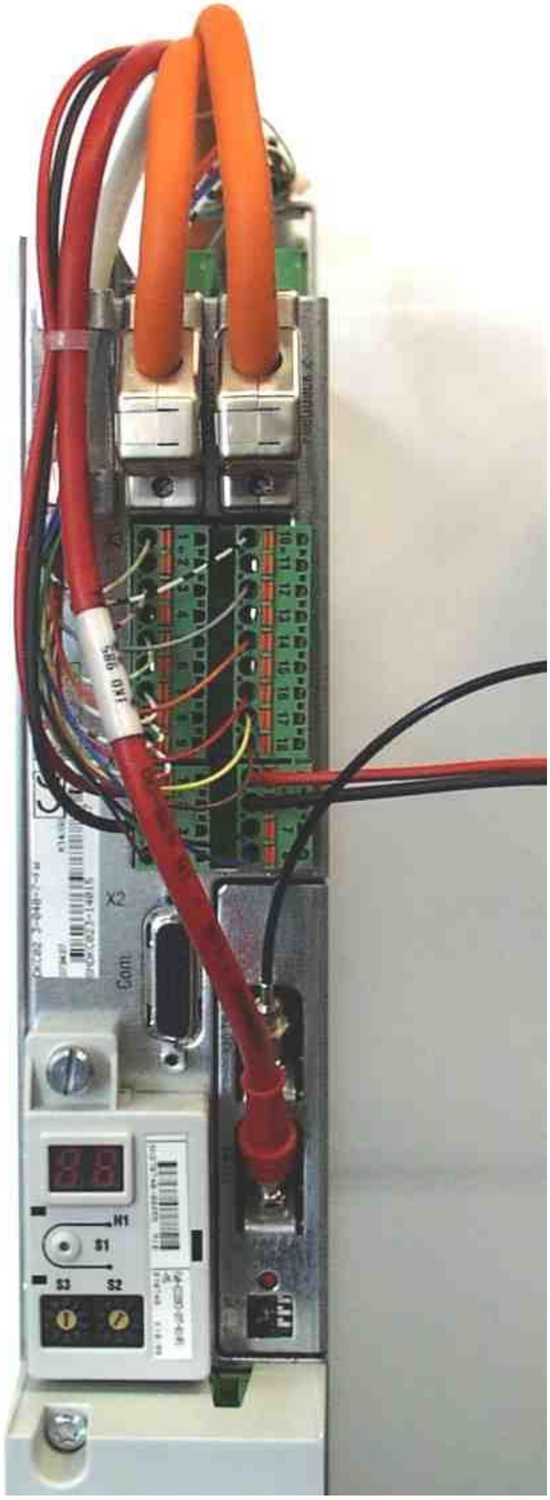
Note: Representing all DKC**.3 – drive controller devices the following construction examples are based on the device DKC**.3-040-7.

View with contact protection

FA5104X1.jpg

Fig. 14-9: View with contact protection

View DKC02.3-040-7



FA5105X1.jpg

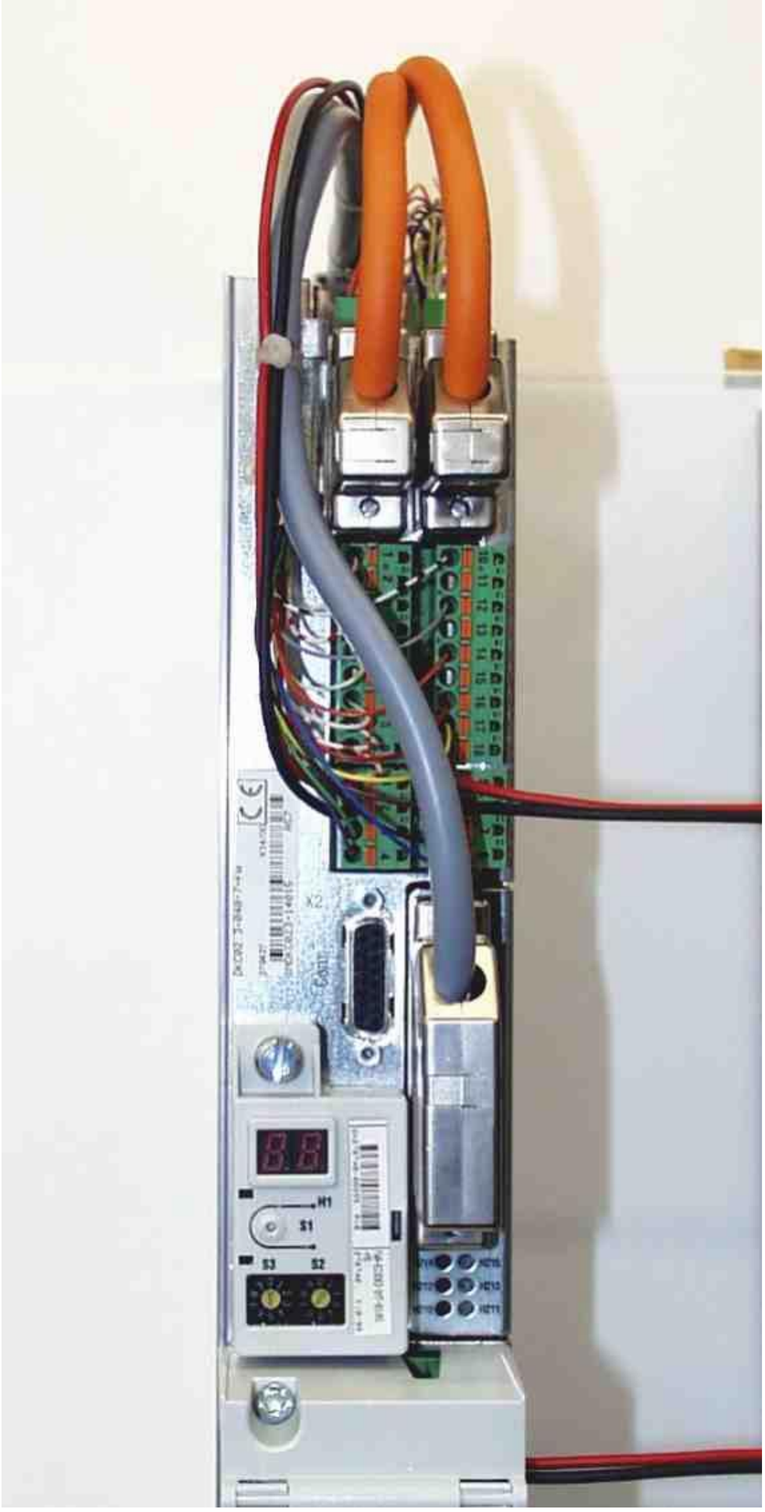
Fig. 14-10: View with SERCOS interface

View DKC03.3-040-7

FA5106X1.jpg

Fig. 14-11: View with Profibus-DP Interface

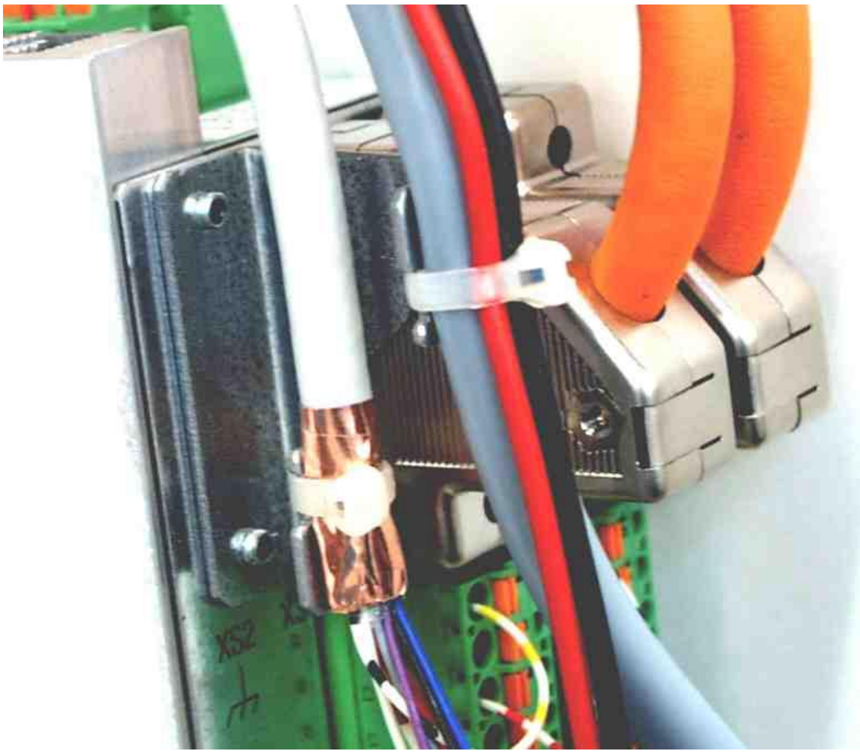
View DKC21.3-040-7



FA5107X1.jpg

Fig. 14-12: View with Parallel Interface 2

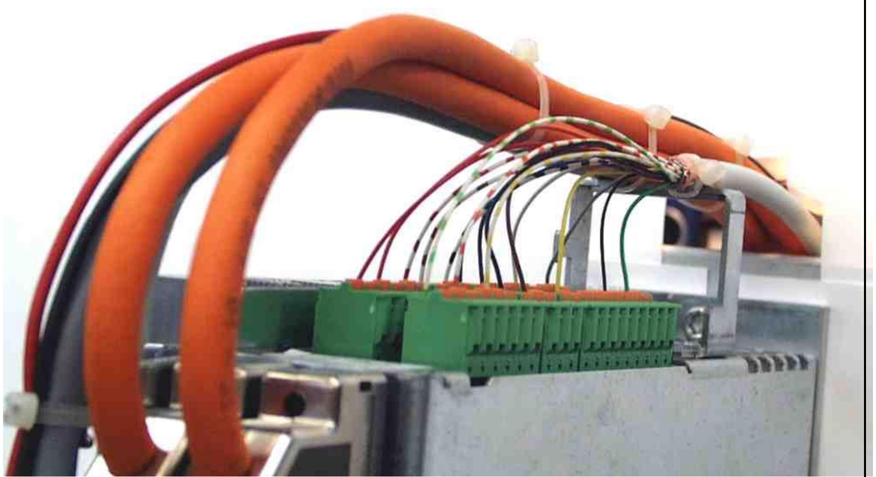
Detail view X4, X8 and XS2 with shield connection



FA5109X1.jpg

Fig. 14-13: Detail view X4, X8, XS2

Detail view X9, X10, X11 and XS3 with shield connection



FA5108X1.jpg

Fig. 14-14: Detail view X9, X10, X11, XS3

Power connection

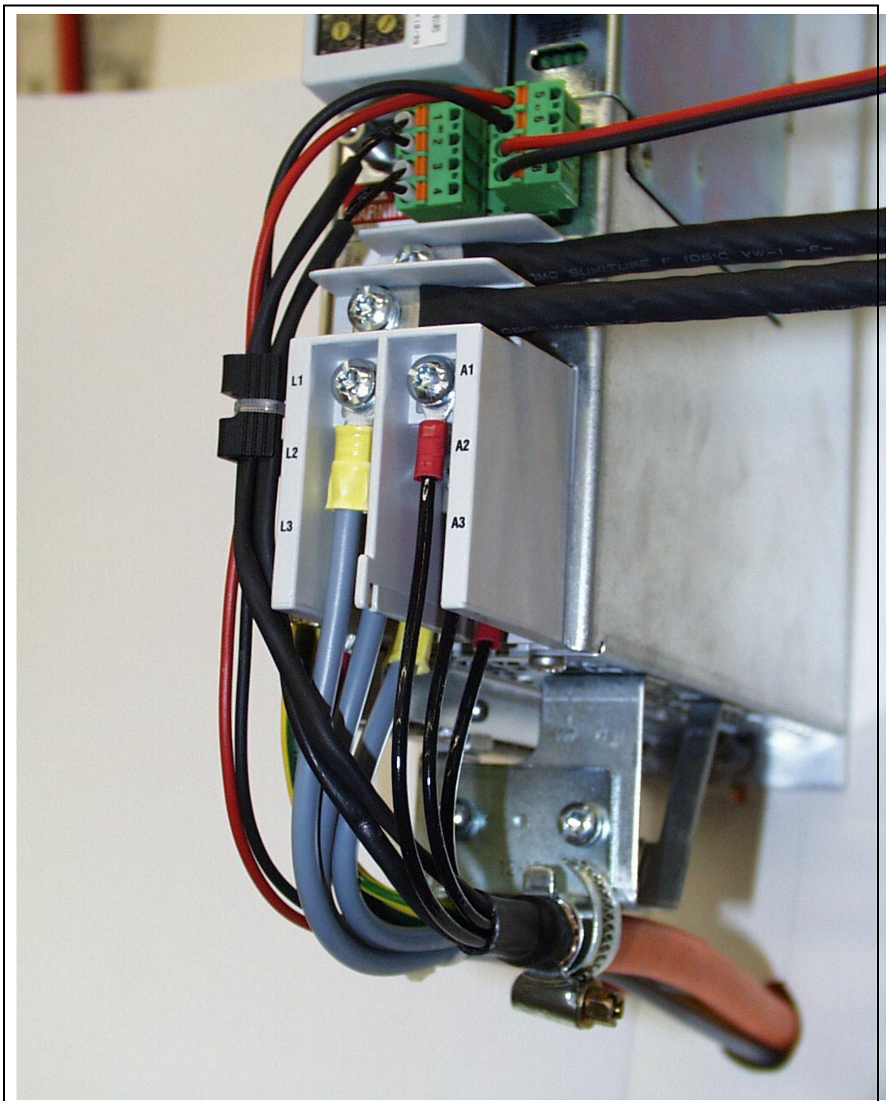
View with contact protection DKC**.3-040-7

FA5110X1.jpg

Fig. 14-15: 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 shield connection on DKC**.3-040-7



FA5111X1.jpg

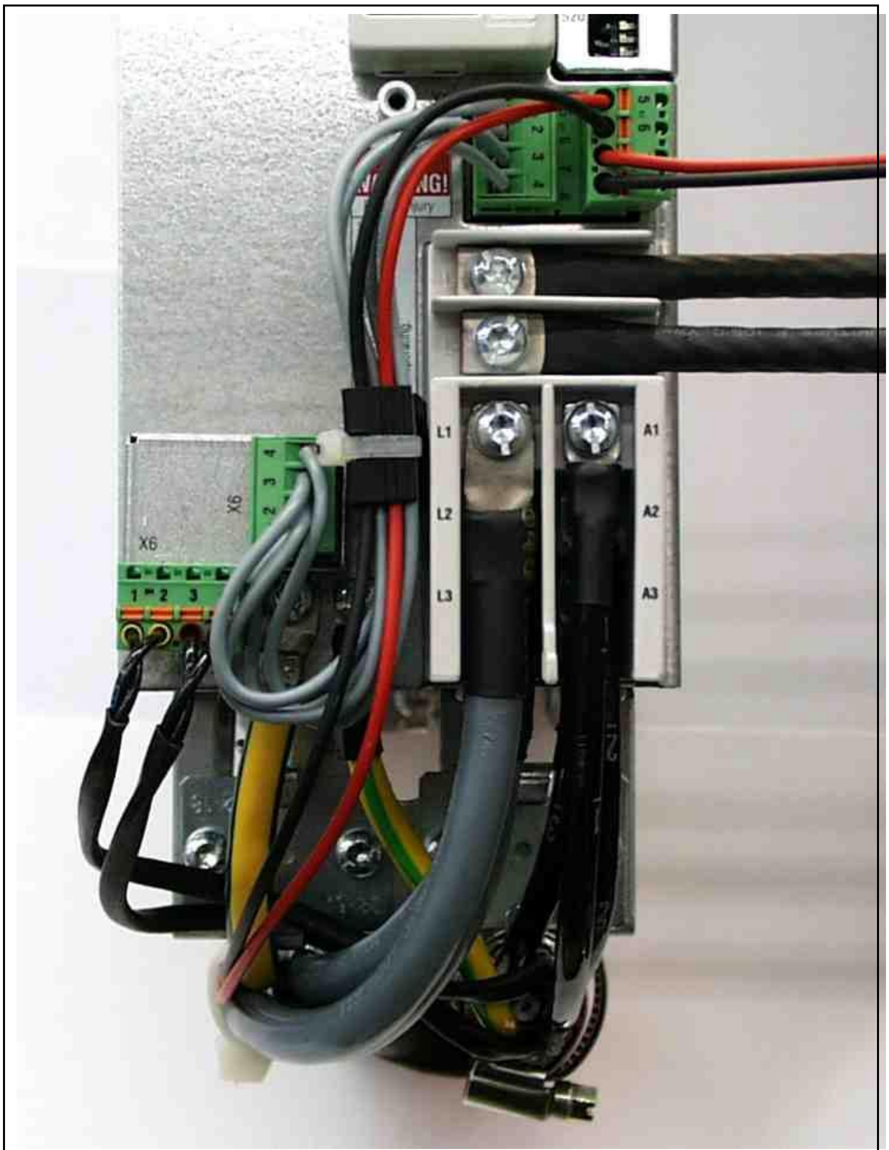
Fig. 14-16: View X5, X6, XE1, XE2 and XS1

View with contact protection DKC**.3-100-7

FA5112X1.jpg

Fig. 14-17: View with contact protection

View X5, X6, XE1, XE2 and XS1 with shield connection on DKC**.3-100-7



FA5113X1.jpg

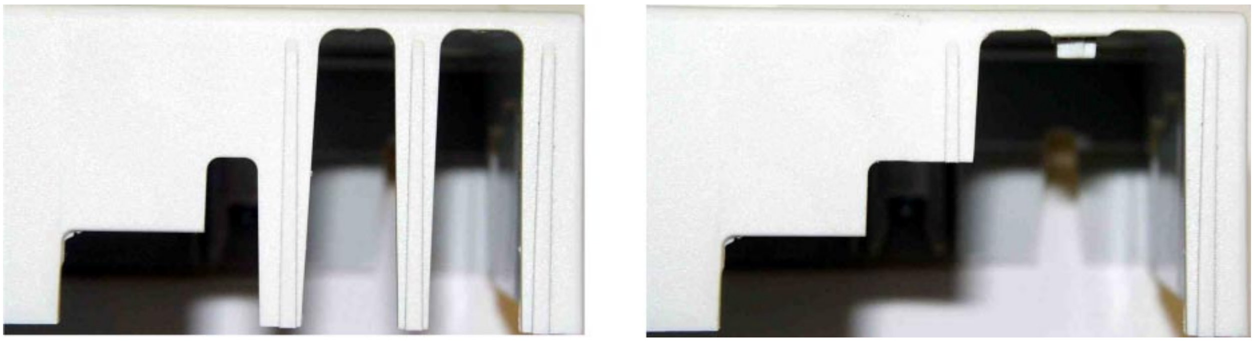
Fig. 14-18: View X5, X6, XE1, XE2 and XS1

View with contact protection DKC**.3-200-7

FA5114X1.jpg

Fig. 14-19: View with contact protection

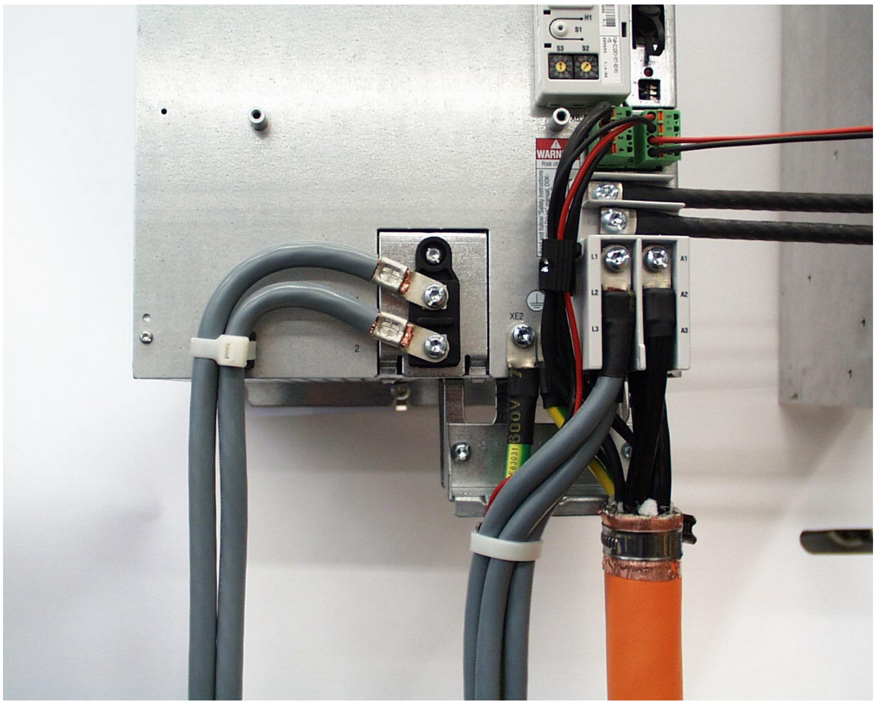
Note: Two bridges may be cut off to simplify the seating of the contact protection when using circular cross sections ≥ 16 mm².



FA5118X1.tif

Fig. 14-20: Contact protection with and without bridges

View X5, X6, X12, XE1, XE2 and XS1 with shield connection on DKC**.3-200-7



FA5115X1.jpg

Fig. 14-21: View X5, X6, X12, X100, XE1, XE2 and XS1

RS485 - Connector

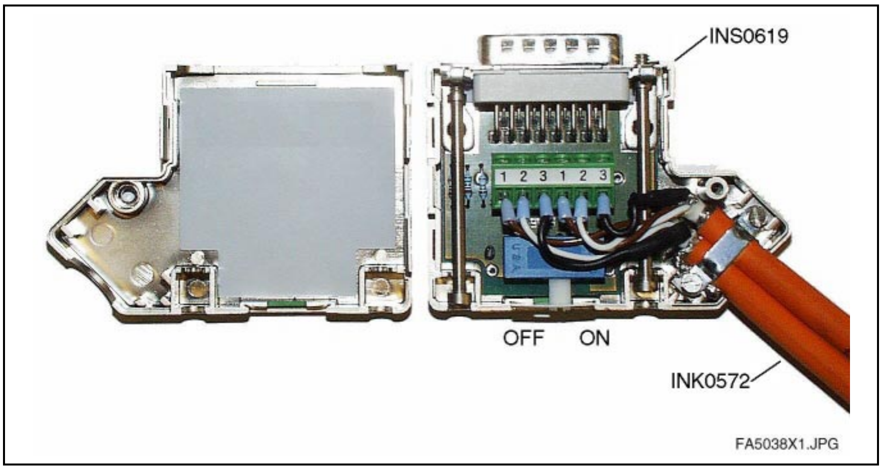


Fig. 14-22: Connecting the RS485 - Connectors

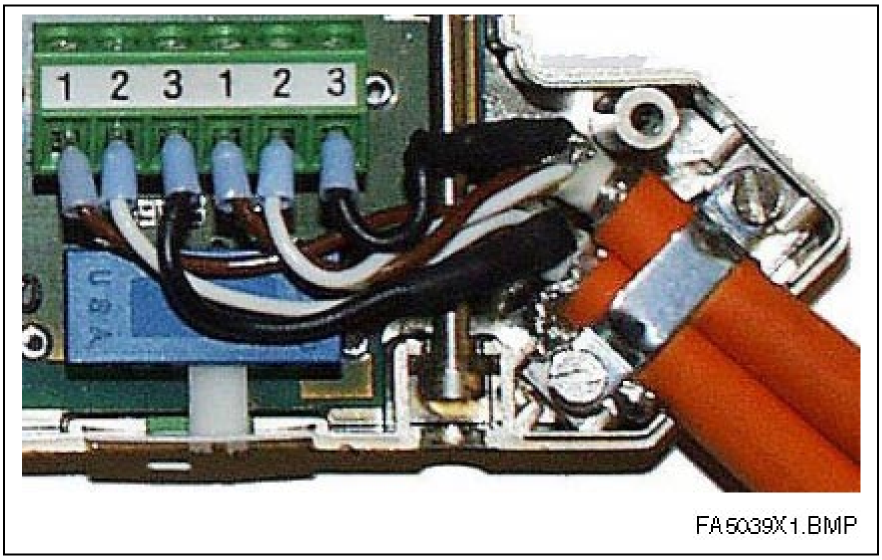


Fig. 14-23: Connecting the RS485 - Connectors

14.4 What is needed to prepare to start-up

To start up an ECODRIVE drive system, the following is needed:

- Measuring equipment
- A PC
- Linking cables (PC-DKC)

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, parametrize 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 25 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
- DriveTop start-up program

Link cables (PC-DKC)

See page 4-48: "X2, Serial Interface"

14.5 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.

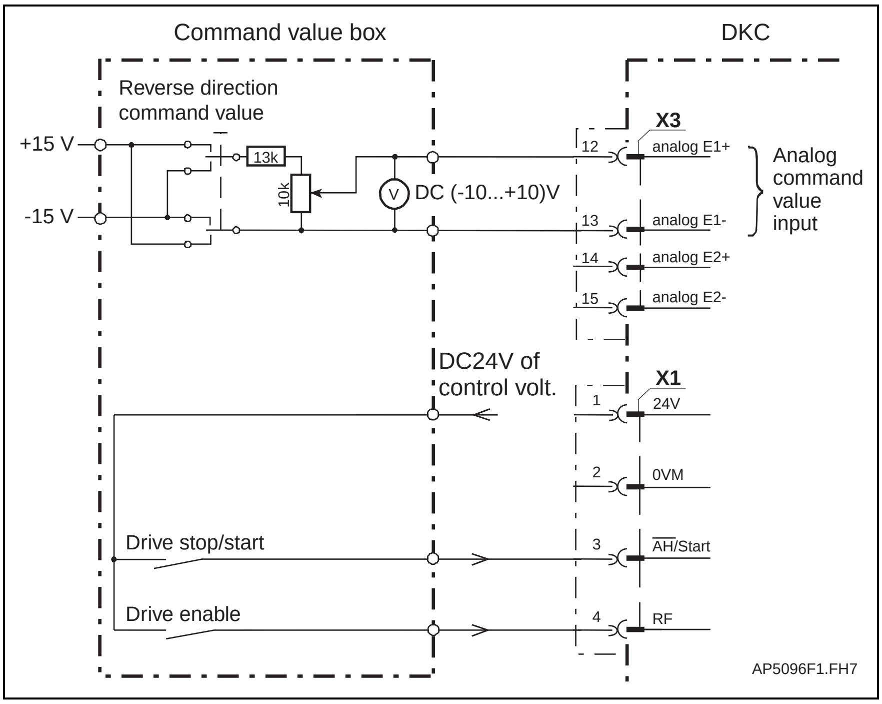


Fig. 14-24: Command value box circuit recommendation for connecting an analog interface

Note: The analog input used has to be parametrized (see functional description).

Rexroth Indramat

14.6 Signal Sequence DKC**.3

Recommended Switching On Sequence

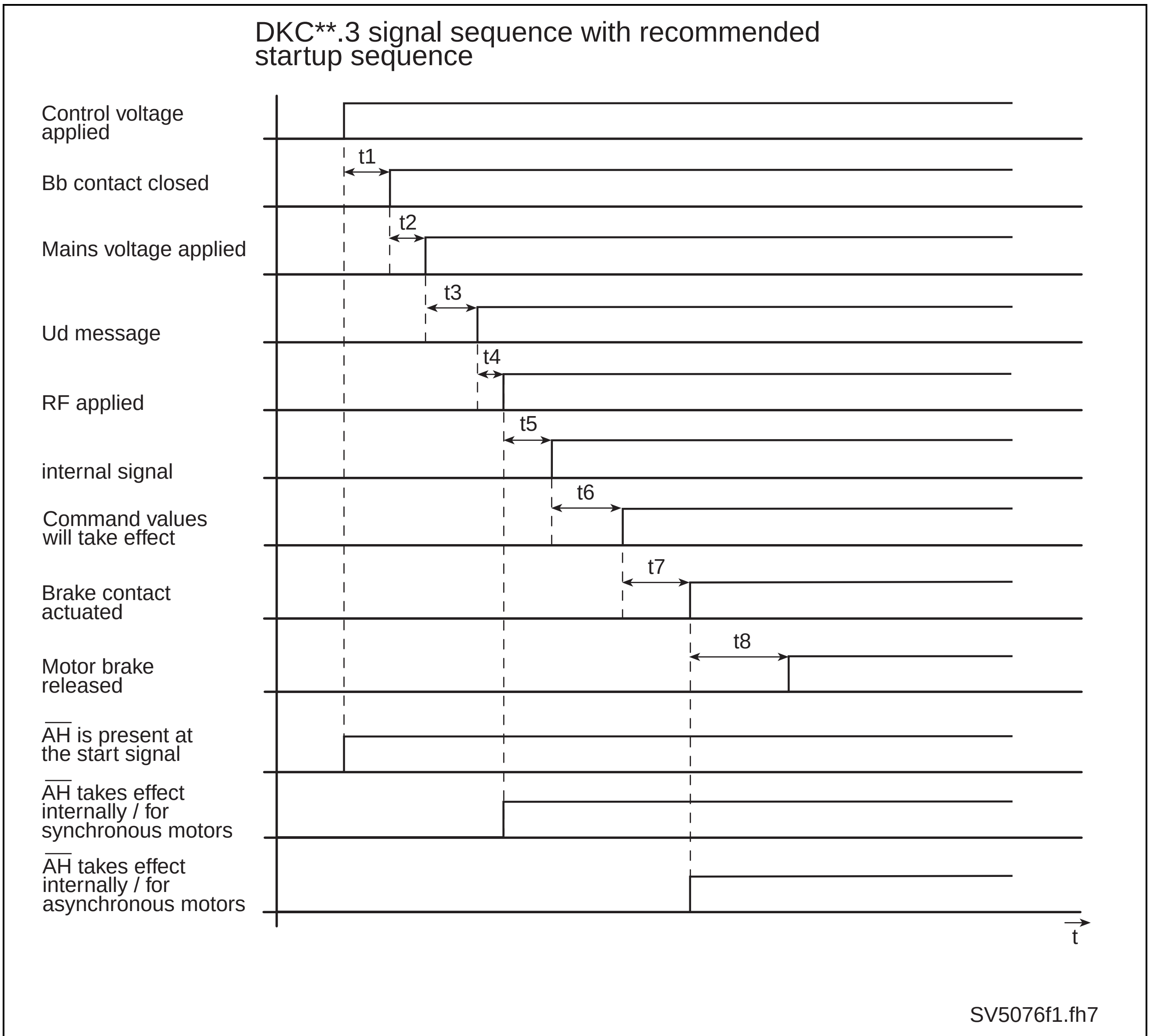


Fig. 14-25: Recommended switching on sequence

t1: Depends on functions and configuration.

t2: Made up of "Slow operation of mains contactor K1" and "PLC times".

t3: See page 4-54: "Digital outputs (ready, warning and UD-message)".

t4: Apply RF after signal U_d-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 asynchronous
30 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 im DKC**.3 an X1

"Mains voltage applied"
Power supply at X5,
Start of DC bus discharge procedure

"U_d - Signal"
Signal output at X3

"RF applied"
Signal drive enable applied by user.

"Actual brake contact"
Brake contact in DKC**.3 an X4 is triggered.
Brake contact parametrized as N/C or N/O (see Function Description)

"Motor brake released"
Brake controlled via motor contact has been released.

" $\overline{AH}$ applied"
Signal $\overline{AH}$ (start signal at X1 (see function description).

" $\overline{AH}$ is working internally"
Internal signal sequence depends on motor used.

Recommended Off Sequence

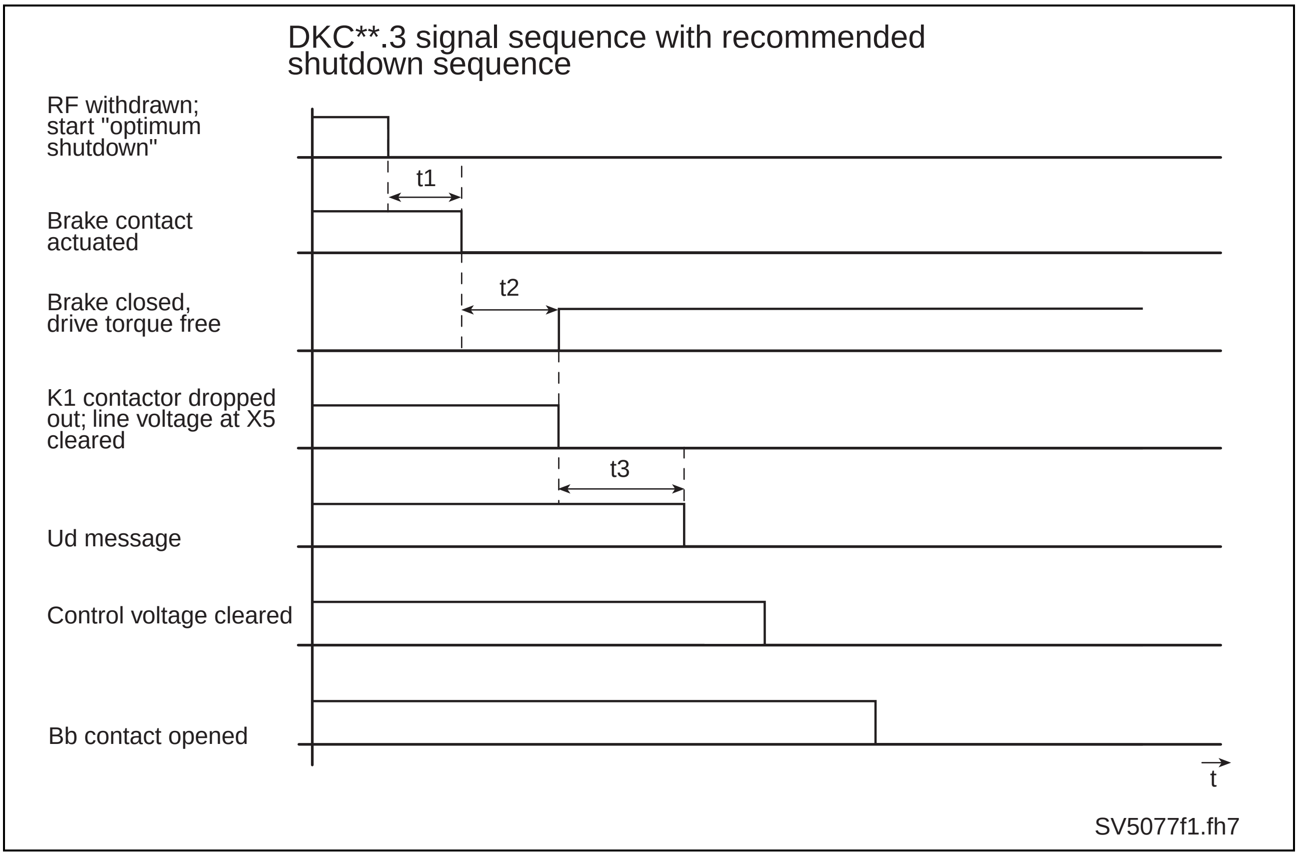


Fig. 14-26: Recommended off sequence

t1: Brake time of drive
Maximum value parametrizable (see functional description).

t2: (see functional description)
Brake delay time parametrizable with link time of brake (see relevant motor project manual),
cannot be parametrized in MKDs and MHDs, fixed at 150 ms

t3: Can be shortened by activating DC bus dynamic brake.

Explanation of Chronological Sequence

"RF removed"; start "Best possible standstill"
with removal of RF signal at X1 the recommended off sequence starts and "best possible standstill" (see Function Description).

"Brake contact actuated":
Brake contact in DKC**.3 actuated at X4,
Brake contact parametrizable as N/C or N/O contact (see Function Description

"Brake closed":
brake connected via brake contact is closed.

"Contactor K1 removed"; "Mains contactor at X5 removed":
start DC bus dynamic brake discharge

"U_D-Signal":
Signal output at X3

"Control voltage removed"
DC24V supply at X1

"Bb contact open":
without DC24V at X1 the Bb relay in DKC**.3 is brought into home position (N/O opened).

Note: Removing the DC24V at X1 causes the Bb contact to open, the removal of the DU signal and the loss of the diagnosis displayed at H1 despite the existing DC bus voltage.

14.7 Directory of Standards and Guidelines

Standards and Guidelines Relevant to Product

Subject	EU Directives	Standard	Title
Antrieb- und Steuerungsgeräte, Gebersysteme / drive and control equipment, encoder	73/ 23/ EWG und 93/ 68/ EWG (EG-Richtlinie Niederspannung / EC-low-voltage directive)	EN 50178	Ausrüstung von Starkstromanlagen mit elektronischen Betriebsmitteln / Electronic equipment for use in power installations
EMV für Antriebs- und Steuerungssysteme / EMC drive and control equipment	89/ 336/ EWG mit 91/ 263/ EWG und 93/ 68/ EWG (EMV-Richtlinie / EMC-directive)	EN 61800-3	Drehzahlveränderbare elektrische Antriebe - Teil 3: EMV-Produktnorm einschließlich spezieller Prüfverfahren (IEC 61800-3) / adjustable speed elctrical power drive systems- Part 3: EMC product standard including specific test methods

Fig. 14-27: Product-relevant Standards and Guidelines

Standards and Guidelines Relevant to Application (Selection)

Standard	Title
89/ 392/ EWG	EG-Richtlinie Maschinen / Machinery directive (MD)
DIN 19245-3 E	Profibus DP – Dezentrale Peripherie Universelles Feldkommunikationssystem (Profibus)/ Profibus, Process field bus – Decentral periphery (DP)
DIN 19258 E	Leittechnik – Interbus S Sensor-Aktornetzwerk für industrielle Steuersysteme / Interbus S sensor-actor network for industrial control equipment
DIN V VDE 0801	Grundsätze für Rechner in Systemen mit Sicherheitsaufgaben / Principles for computers in saqgety-related systems
EN 1921	Sicherheit von integrierten Fertigungssystemen / Industrial automation systems – Safety of integrated manufacturing systems - Basic requirements
EN 292-1 und -2	Sicherheit von Maschinen - Grundbegriffe, allgemeine Gestaltungsleitsätze / Safety of machinery – Basic concepts, general principles for design
EN 50170	Universelles Feldkommunikationssystem (Profibus) / Universal fieldcommunication system
EN 50254	Kommunikationssystem mit hoher Effizienz für kleine Datenpakete (InterBus Interface Spezifikation) / High efficiency communication subsystem for small data packages
EN 60204-1	Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen / Safety of machinery – Electrical equipment of machines
EN 60529, IEC 60529	Schutzart durch Gehäuse (IP-Code) / Degrees of protection provided by enclosures (IP-Code)
EN 61491, IEC 61491	Elektrische Ausrüstung von Industriemaschinen, Serielle Datenübermittlung in Echtzeit zwischen Steuerungen und Antrieben (SERCOS Interface Spezifikation) / Electrical equipment of industrial machines, Serial communication realtime
EN 954-1	Sicherheit von Maschinen, Teil 1: Allgemeine Gestaltungsleitsätze - Sicherheitsbezogene Teile von Steuerungen / Safety of machinery – Safety related parts of control systems- Part 1: General principles for design
prEN 1037	Sicherheit von Maschinen. Vermeidung von unerwarteten Anlauf / Safety of machinery – Prevention of unexpected start-up
prEN 12415	Machine-tools – Safety – Small numerically controlled turning machines and turning centres
prEN 12417	Machine tools – Safety –Machining centres
prEN 775	Sicherheit Industrieroboter / Manipulating industrial robots: Safety
ISO 11519-2	Road vehicles – Low speed serial data communication part 2 – Low speed controller area network (CAN) (CANopen Interface Spezifikation)
ISO 11898	Road vehicles – Interchange of digital information – Controller area network (CAN) for high speed communication (CANopen Interface Spezifikation)

Fig. 14-28: Standards and Guidelines Relevant to Application (Selection)

Notes

15 Index

2

A

B

C

D

E

M

N

O

P

V

W

X

Z

16 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

vom Ausland: (x) nach Landeskennziffer weglassen!!
from abroad: don't dial (x) after country code!

Vertriebsgebiet Mitte ☒ SALES Germany Centre ☒ Service Rexroth Indramat GmbH Bgm.-Dr.-Nebel-Str. 2 97816 Lohr am Main Telefon: +49 (0)9352/40-0 Telefax: +49 (0)9352/40-4885	Vertriebsgebiet Mitte ☒ SALES Germany Centre ☐ Service Mannesmann Rexroth AG Gesch.ber. Rexroth Indramat Lilistraße 14-18 63067 Offenbach Telefon: +49 (0) 69/82 00 90-0 Telefax: +49 (0) 69/82 00 90-80	Vertriebsgebiet Ost ☒ SALES Germany East ☒ Service Rexroth Indramat GmbH Beckerstraße 31 09120 Chemnitz Telefon: +49 (0)371/35 55-0 Telefax: +49 (0)371/35 55-333	Vertriebsgebiet Ost ☒ SALES Germany East ☐ Service Mannesmann Rexroth AG GB Rexroth Indramat GmbH Holzhäuser Str. 122 04299 Leipzig Telefon: +49 (0)341/86 77-0 Telefax: +49 (0)341/86 77-219
Vertriebsgebiet Süd ☒ SALES Germany South ☐ Service Rexroth Indramat GmbH Ridlerstraße 75 80339 München Telefon: +49 (0)89/540138-30 Telefax: +49 (0)89/540138-10 indramat.mue@t-online.de	Gebiet Südwest ☒ SALES Germany South-West ☒ Service Mannesmann Rexroth AG Vertrieb Deutschland – VD-BI Geschäftsbereich Rexroth Indramat Regionalzentrum Südwest Ringstrasse 70 / Postfach 1144 70736 Fellbach / 70701 Fellbach Tel.: +49 (0)711/57 61–100 Fax: +49 (0)711/57 61–125	Vertriebsgebiet Nord ☒ SALES Germany North ☐ Service Rexroth Indramat GmbH Kieler Straße 212 22525 Hamburg Telefon: +49 (0)40/85 31 57-0 Telefax: +49 (0)40/85 31 57-15	Vertriebsgebiet Nord ☒ SALES Germany North ☐ Service Mannesmann Rexroth AG Vertriebsniederlassung Region Nord Gesch.ber. Rexroth Indramat Walsroder Str. 93 30853 Langenhagen Telefon: +49 (0) 511/72 66 57-0 Telefax: +49 (0) 511/72 66 57-93
Vertriebsgebiet West ☒ SALES Germany West ☒ Service Mannesmann Rexroth AG Vertrieb Deutschland Regionalzentrum West Borsigstrasse 15 D - 40880 Ratingen Telefon: +49 (0)2102/409-0 Telefax: +49 (0)2102/409-406		SERVICE - Hotline - 7 Tage / 24h - **HELPDESK** **MO – FR - von 7 – 17 Uhr** Telefax +49 (0)9352/40-4941 Telefon +49 (0)9352/40- Bernard A. -4894 Kolb R. -4922 Roeper P. -4359 Scheiner W. -4921 **HOTLINE** (17 - 07 + SA / SO) Telefon: +49 (0)172/660 04 06 oder/or Telefon: +49 (0)171/333 88 26	ERSATZTEIL - Hotline ♦ nur an Werktagen - only on working days - ♦ von 15 -18 Uhr - from 15-18 o'clock - **Tel. +49 (0) 93 52/40 42 22**

Kundenbetreuungsstellen in Deutschland - Service agencies in Germany

Europa – Europe

vom Ausland: (x) nach Landeskennziffer weglassen, 0 nach Landeskennziffer mitwählen (Italien)!
from abroad: don't dial (x) after country code, dial 0 after country code (Italy)!

Austria ☒ SALES ☐ Service Mannesmann Rexroth Ges.m.b.H. Gesch.ber. Rexroth Indramat Hägelingasse 3 A - 1140 Wien Telefon: +43 (0)1/9852540-400 Telefax: +43 (0)1/9852540-93	Austria ☐ SALES ☒ Service Mannesmann Rexroth G.m.b.H. Gesch.ber. Rexroth Indramat Industriepark 18 A - 4061 Pasching Telefon: +43 (0)7221/605-0 Telefax: +43 (0)7221/605-21	Belgium ☒ SALES ☒ Service Mannesmann Rexroth N.V.-S.A. Gesch.ber. Rexroth Indramat Industrielaan 8 B-1740 Ternat Telefon: +32 (0)2/5830719 Telefax: +32 (0)2/5830731 E-mail: indramat@rexroth.be	Denmark ☒ SALES ☒ Service BEC AS Zinkvej 6 DK-8900 Randers Telefon: +45 (0)87/11 90 60 Telefax: +45 (0)87/11 90 61
Czech Rep. ☒ SALES ☐ Service Mannesmann-Rexroth, spol.s.r.o. Hviezdoslavova 5 CS - 627 00 Brno Telefon: +420 (0)5/48 126 358 Telefax: +420 (0)5/48 126 112	England ☒ SALES ☒ Service Mannesmann Rexroth Ltd. Rexroth Indramat Division Broadway Lane, South Cerney GB - Cirencester, Glos GL7 5UH Telefon: +44 (0)1285/863000 Telefax: +44 (0)1285/863030	Finland ☒ SALES ☐ Service Rexroth Mecman Oy Rexroth Indramat division Ansatie 6 SF-017 40 Vantaa Telefon: +358 (0)9/84 91-11 Telefax: +358 (0)9/84 91-13 60	France ☒ SALES ☒ Service Mannesmann Rexroth S.A. Division Rexroth Indramat Parc des Barbanniers 4, Place du Village F-92632 Gennevilliers Cedex Telefon: +33 (0)141 47 54 30 Telefax: +33 (0)147 94 69 41 Hotline: +33 (0)6 08 33 43 28
France ☒ SALES ☐ Service Mannesmann Rexroth S.A. Division Rexroth Indramat 270, Avenue de Lardenne F - 31100 Toulouse Telefon: +33 (0)5 61 49 95 19 Telefax: +33 (0)5 61 31 00 41	France ☒ SALES ☐ Service Mannesmann Rexroth S.A. Division Rexroth Indramat 91, Bd. Irène Joliot-Curie F - 69634 Vénissieux – Cedex Telefon: +33 (0)4 78 78 53 65 Telefax: +33 (0)4 78 78 53 62	Hungary ☒ SALES ☐ Service Mannesmann Rexroth Kft. Angol utca 34 H - 1149 Budapest Telefon: +36 (1) 364 00 02 Telefax: +36 (1) 383 19 80	Italy ☒ SALES ☒ Service Mannesmann Rexroth S.p.A. Divisione Rexroth Indramat Via G. Di Vittoria, 1 I - 20063 Cernusco S/N.MI Telefon: +39 02/92 36 52 70 Telefax: +39 02/92 36 55 12
Italy ☒ SALES ☒ Service Mannesmann Rexroth S.p.A. Divisione Rexroth Indramat Via Borgomanero, 11 I - 10145 Torino Telefon: +39 011/7 50 38 11 Telefax: +39 011/7 71 01 90	Italy ☒ SALES ☐ Service Mannesmann Rexroth S.p.A. Divisione Rexroth Indramat Via del Progresso, 16 (Zona Ind.) I - 35020 Padova Telefon: +39 049/8 70 13 70 Telefax: +39 049/8 70 13 77	Italy ☐ SALES ☒ Service Mannesmann Rexroth S.p.A. Divisione Rexroth Indramat Via Mascia, 1 I - 80053 Castellamare di Stabia NA Telefon: +39 081/8 71 57 00 Telefax: +39 081/8 71 68 85	Italy ☒ SALES ☐ Service Mannesmann Rexroth S.p.A. Divisione Rexroth Indramat Viale Oriani, 38/A I - 40137 Bologna Telefon: +39 051/34 14 14 Telefax: +39 051/34 14 22
Netherlands ☒ SALES ☐ Service Hydraudyne Hydrauliek B.V. Kruisbroeksestraat 1 (P.O. Box 32) NL - 5281 RV Boxtel Telefon: +31 (0)411/65 19 51 Telefax: +31 (0)411/65 14 83 e-mail: indramat@hydraudyne.nl	Netherlands ☐ SALES ☒ Service Hydrocare B.V. Kruisbroeksestraat 1 (P.O. Box 32) NL - 5281 RV Boxtel Telefon: +31 (0)411/65 19 51 Telefax: +31 (0)411/67 78 14	Norway ☒ SALES ☐ Service Rexroth Mecman AS Rexroth Indramat Division Berghagan 1 or: Box 3007 N -1405 Ski-Langhus N -1402 Ski Telefon: +47 (0)64 86 41 00 Telefax: +47 (0)64 86 90 62	Poland ☒ SALES ☐ Service Mannesmann Rexroth Sp.zo.o. Biuro Poznan ul. Dabrowskiego 81/85 PL - 60-529 Poznan Telefon: +48 061/847 67 99 Telefax: +48 061/847 64 02
Rumania ☒ SALES ☐ Service Mannesmann Rexroth Sp.zo.o. Str. Drobety nr. 4-10, app. 14 RO - 70258 Bucuresti, Sector 2 Telefon: +40 (0)1/210 48 25 +40 (0)1/210 29 50 Telefax: +40 (0)1/210 29 52	Russia ☐ SALES ☒ Service Tschudnenko E.B. Arsenia 22 RUS - 153000 Ivanovo Rußland Tel./Fax: +7 093/223 95 48 oder/or Tel. +7 093/223 96 33	Spain ☒ SALES ☒ Service Mannesmann Rexroth S.A. Divisiòn Rexroth Indramat Centro Industrial Santiga Obradors s/n E-08130 Santa Perpetua de Mogoda Barcelona Telefon: +34 937 47 94 00 Telefax: +34 937 47 94 01	Spain ☒ SALES ☒ Service Goimendi S.A. División Rexroth Indramat Jolastokieta (Herrera) Apartado 11 37 E - 20017 San Sebastian Telefon: +34 9 43/40 01 63 Telefax: +34 9 43/39 17 99
Sweden ☒ SALES ☒ Service Rexroth Mecman Svenska AB Rexroth Indramat Division Varuvägen 7 S - 125 81 Stockholm Telefon: +46 (0)8/727 92 00 Telefax: +46 (0)8/647 32 77	Slowenia ☒ SALES ☒ Service Rexroth Indramat elektromotorji d.o.o. Otoki 21 SLO - 64 228 Zelezniki Telefon: +386 64/61 73 32 Telefax: +386 64/64 71 50	Switzerland-East- ☒ SALES ☒ Service Mannesmann Rexroth Schweiz AG Gesch.ber. Rexroth Indramat Gewerbestraße 3 CH - 8500 Frauenfeld Telefon: +41 (0)52/720 21 00 Telefax: +41 (0)52/720 21 11	Switzerland-West- ☒ SALES ☐ Service Mannesmann Rexroth Suisse SA Département Rexroth Indramat Rue du village 1 CH - 1020 Renens Telefon: +41 (0)21/632 84 20 Telefax: +41 (0)21/632 84 21
Turkey ☒ SALES ☒ Service Mannesmann Rexroth Hidropar A..S. Fevzi Cakmak Cad No. 3 TR - 34630 Sefaköy Istanbul Telefon: +90 212/541 60 70 Telefax: +90 212/599 34 07			

Europäische Kundenbetreuungsstellen (ohne Deutschland)
European Service agencies (without Germany)

Außerhalb Europa - outside Europe

vom Ausland: (x) nach Landeskennziffer weglassen!
from abroad: don't dial (x) after country code!

Argentina ☒ SALES ☐ Service

Mannesmann Rexroth S.A.I.C.
Division Rexroth Indramat
Acassusso 48 41/7
RA - 1605 Munro (Buenos Aires)

Telefon: +54 (0)11/4756 01 40
Telefax: +54 (0)11/4762 6862
e-mail:mannesmann@impsat1.com.ar

Argentina ☒ SALES ☒ Service

NAKASE
Servicio Tecnico CNC
Calle 49, No. 5764/66
RA - 1653 Villa Balester
Prov. - Buenos Aires

Telefon: +54 (0) 11/4768 36 43
Telefax: +54 (0) 11/4768 24 13
e-mail: nakase@usa.net
nakase@infovia.com.ar

Australia ☒ SALES ☒ Service

AIMS - Australian Industrial
Machinery Services Pty. Ltd.
Unit 3/45 Horne ST
Campbellfield , VIC 3061
AUS - Melbourne

Telefon: +61 (0)3/93 59 02 28
Telefax: +61 (0)3/93 59 02 86

Australia ☒ SALES ☐ Service

Mannesmann Rexroth Pty. Ltd.
No. 7, Endeavour Way
Braeside Victoria, 31 95
AUS – Melbourne

Telefon: +61 (0)3/95 80 39 33
Telefax: +61 (0)3/95 80 17 33
Email: mel@rexroth.com.au

Brazil ☒ SALES ☒ Service

Mannesmann Rexroth
Automação Ltda.
Divisão Rexroth Indramat
Rua Georg Rexroth, 609
Vila Padre Anchieta
BR - 09951-270 Diadema-SP
[Caixa Postal 377]
[BR-09901-970 Diadema-SP]

Telefon: +55 (0)11/745 90 60
+55 (0)11/745 90 70
Telefax: +55 (0)11/745 90 50
e-mail: awittwer@rexroth.com.br

Brazil ☐ SALES ☒ Service

Mannesmann Rexroth
Automação Ltda.
Divisão Rexroth Indramat
R. Dr.Humberto Pinheiro Vieira, 100
Distrito Industrial
BR - 89220-390 Joinville - SC
[Caixa Postal 1273]

Tel./Fax: +55 (0)47/473 58 33
Mobil: +55 (0)47 974 66 45
e-mail: prochnow@zaz.com.br

Canada East ☒ SALES ☒ Service

Basic Technologies Corporation
Burlington Division
3426 Mainway Drive
Burlington, Ontario
Canada L7M 1A8

Telefon: +1 905/335 55 11
Telefax: +1 905/335-41 84

Canada West ☒ SALES ☒ Service

Basic Automation Burnaby
5345 Goring St.
Burnaby, British Columbia
Canada V7J 1R1

Tel. +1 604 / 205-5777
Fax +1 604 / 205-6944
e-mail: dave.gunby@basic.ca

China ☒ SALES ☒ Service

Rexroth International Trade
(Shanghai) Co., Ldt.
Wai Gaoqiao Free Trade Zone
No.122, Fu Te Dong Yi Road
Shanghai 200131 - P.R.China

Telefon: +86 21/58 66 30 30
Telefax: +86 21/58 66 55 23

China ☒ SALES ☐ Service

Mannesmann Rexroth (China) Ldt.
15/F China World Trade Center
1, Jianguomenwai Avenue
Beijing 100004, P.R.China

Telefon: +86 10/65 05 03 80
Telefax: +86 10/65 05 03 79

China ☒ SALES ☐ Service

Mannesmann Rexroth (China) Ldt.
A-5F., 123 Lian Shan Street
Sha He Kou District
Dalian 116 023, P.R.China

Telefon: +86 411/46 78 930
Telefax: +86 411/46 78 932

China ☒ SALES ☐ Service

Mannesmann Rexroth (China) Ldt.
Guangzhou Repres. Office
Room 1014-1016, Metro Plaza,
Tian He District, 183 Tian He Bei Rd
Guangzhou 510075, P.R.China

Telefon: +86 20/8755-0030
+86 20/8755-0011
Telefax: +86 20/8755-2387

Hongkong ☒ SALES ☒ Service

Rexroth (China) Ldt.
1/F., 19 Cheung Shun Street
Cheung Sha Wan,
Kowloon, Hongkong

Telefon: +852 22 62 51 00
Telefax: +852 27 41 33 44

India ☒ SALES ☒ Service

Mannesmann Rexroth (India) Ltd.
Rexroth Indramat Division
Plot. 96, Phase III
Peenya Industrial Area
IND - Bangalore - 560058

Telefon: +91 (0)80/8 39 73 74
Telefax: +91 (0)80/8 39 43 45

India ☒ SALES ☒ Service

Mannesmann Rexroth (India) Ltd.
Rexroth Indramat Division
Plot. A-58, TTC Industrial Area
Thane Turbhe Midc Road
Mahape Village
IND - Navi Mumbai - 400 701

Telefon: +91 (0)22/7 61 46 22
Telefax: +91 (0)22/7 68 15 31

Indonesia ☒ SALES ☐ Service

PT. Rexroth Wijayakusuma
Jl. Raya Bekasi Km 21
Pulogadung
RI - Jakarta Timur 13920

Telefon: +62 21/4 61 04 87
+62 21/4 61 04 88
Telefax: +62 21/4 60 01 52

Japan ☐ SALES ☒ Service

Rexroth Automation Co., Ltd.
Service Center Japan
Yutakagaoka 1810, Meito-ku,
NAGOYA 465-0035, Japan

Telefon: +81 (0)52/777 88 41
+81 (0)52/777 88 53
+81 (0)52/777 88 79
Telefax: +81 (0)52/777 89 01

Japan ☒ SALES ☒ Service

Rexroth Automation Co., Ltd.
Rexroth Indramat Division
1F, I.R. Building
Nakamachidai 4-26-44, Tsuzuki-ku
YOKOHAMA 224-0041, Japan

Telefon: +81 (0)45/942 72 10
Telefax: +81 (0)45/942 03 41

Mexico ☒ SALES ☐ Service

Mannesmann Rexroth Mexico S.A.
de C.V.
Calle Neptuno 72
Unidad Ind. Vallejo
MEX - 07700 Mexico, D.F.

Telefon: +52 5 754 17 11
+52 5 754 36 84
+52 5 754 12 60
Telefax: +52 5 754 50 73
+52 5 752 59 43

e-mail: gsoria@rexroth-mexico.com

Korea ☒ SALES ☒ Service

Mannesmann Rexroth-Korea Ltd.
Rexroth Indramat Division
1500-12 Dadae-Dong- Saha-Ku
Pusan, 604-050
Republic of South Korea

Telefon: +82 (0)51/2600 741
Telefax: +82 (0)51/2600 747

South Africa ☒ SALES ☒ Service

TECTRA Automation (Pty) Ltd.
28 Banfield Road,Industria North
RSA - Maraisburg 1700

Telefon: +27 (0)11/673 20 80
Telefax: +27 (0)11/673 72 69

Taiwan ☒ SALES ☐ Service

Rexroth Uchida Co., Ltd.
No.1, Tsu Chiang Street
Tu Cheng Ind. Estate
Taipei Hsien, Taiwan, R.O.C.

Telefon: +886 2/2 68 13 47
Telefax: +886 2/2 68 53 88

Kundenbetreuungsstellen außerhalb Europa - Service agencies outside Europe

Außerhalb Europa / USA - outside Europe / USA

USA ☒ SALES ☒ Service	USA ☒ SALES ☒ Service	USA ☒ SALES ☒ Service	USA ☒ SALES ☒ Service
Mannesmann Rexroth Corporation Rexroth Indramat Division 5150 Prairie Stone Parkway USA -Hoffman Estates, IL 60192-3707 Telefon: +1 847/6 45 36 00 Telefax: +1 847/6 45 62 01 service@indramat.com	Mannesmann Rexroth Corporation Rexroth Indramat Division Central Region Technical Center USA - Auburn Hills, MI 48326 Telefon: +1 248/3 93 33 30 Telefax: +1 248/3 93 29 06	Mannesmann Rexroth Corporation Rexroth Indramat Division Southeastern Technical Center 3625 Swiftwater Park Drive USA - Suwanee Georgia 30174 Telefon: +1 770/9 32 32 00 +1 770/9 32 19 03	Mannesmann Rexroth Corporation Rexroth Indramat Division Northeastern Technical Center 99 Rainbow Road USA - East Granby, Connecticut 06026 Telefon: +1 860/8 44 83 77 +1 860/8 44 85 95
USA ☒ SALES ☒ Service	Thailand ☒ SALES ☒ Service		USA Service HOTLINE
Mannesmann Rexroth Corporation Rexroth Indramat Division Charlotte Regional Sales Office 14001 South Lakes Drive USA - Charlotte, North Carolina 28273 Telefon: +1 704/5 83 97 62 +1 704/5 83 14 86	NC Advance Technology Co. Ltd. 59/76 Moo 9, Soi Ramintra 34 Ramintra Road Tharang, Bangkhen Bangkok 10230 Telefon: +662 943-7062 + -7121 +662 519-0353 Telefax: +662 509-2362		**+1-800-860-1055** - 7 days / 24hrs -

Kundenbetreuungsstellen außerhalb Europa / USA
Service agencies outside Europe / USA

280107

Printed in Germany

Rexroth Indramat