



DKR05.2 Drive Controller Project Planning Manual

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Follow-up of modifications

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Note on Industrial Property Rights

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Legal validity

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List of contents

1	Important Notes on Utilization	1-1
1.1	Intended Use	1-1
	Introduction	1-1
	Use and Application	1-2
1.2	Non-Intended Use	1-2
2	Safety Notes on Electrical Drives and Controls	2-1
2.1	Introduction.....	2-1
2.2	Explanations.....	2-1
2.3	Risks by Misuse	2-2
2.4	General.....	2-3
2.5	Protection from Touching Electrical Parts.....	2-4
2.6	Protection from Electrical Shock by Protective Extra-Low Voltage (PELV) Systems	2-6
2.7	Protection from Dangerous Movements	2-6
2.8	Protection from Magnetic or Electromagnetic Fields in Operation and Assembly.....	2-8
2.9	Protection from Touching Hot Parts.....	2-9
2.10	Protection on Handling and Assembly.....	2-9
2.11	Safety in Handling Batteries.....	2-10
2.12	Protection from Pressurized Lines	2-10
2.13	Precautions in Handling Electrostatic Sensitive Devices (ESDs)	2-11
3	Description	3-1
3.1	Characteristics	3-1
3.2	Components.....	3-2
	Basic Unit.....	3-3
	Firmware module	3-3
	Command Interface Card.....	3-4
	Auxiliary Plug-In Module	3-4
3.3	Brake Chopper	3-4
3.4	Type Code.....	3-5
3.5	Technical Data	3-7
	Floating DC-Link Voltage	3-8
4	Mechanical Installation	4-1
4.1	Storage and Mounting.....	4-1
	Storage.....	4-1
	Minimum Requirements on the Mounting Site.....	4-1
	Mounting Altitudes Above 1000 Meters Above Sea Level:.....	4-1

Cooling.....	4-2
Blower.....	4-3
4.2 Dimensions	4-4
5 Electrical Installation	5-1
5.1 10 Rules for Electromagnetically Compatible Drive Design	5-1
5.2 Warnings und Notes.....	5-2
5.3 Connector Positions, Pin Assignments, and Cross Sections.....	5-3
Positions of Terminals and Connectors	5-4
Entry of Cables	5-5
Power Connection.....	5-7
X1 Motor Connection Terminal	5-10
X2 RS232 Interface.....	5-10
X3 Analog Outputs and Signal Contacts	5-10
X4 Motor Feedback.....	5-11
X6 Motor Temperature Registration and Brake Addressing.....	5-12
Connection for Motor Fans at the Q2 Motor Protection Switch	5-12
X7 Signal Outputs	5-13
X9 Control Input for Internal Input Power	5-14
6 Accessories	6-1
6.1 Sets of Connectors.....	6-1
Connector Set for the Basic Unit.....	6-1
Connector Set for all Plug-In Modules of a Configuration Including Feedback Connection.....	6-1
6.2 Optical Fiber.....	6-2
7 Transport and Storage	7-1
7.1 Transport.....	7-1
7.2 Storage.....	7-1
8 Identification of the Products	8-1
8.1 General.....	8-1
8.2 Delivery Note and Type Plate Label	8-1
8.3 Type Plates of the Drive Controller	8-2
9 Mounting and Installation	9-1
9.1 Mounting of the Control Cabinet	9-1
9.2 Wiring of the Control Cabinet.....	9-2
10 Service and Tests	10-1
10.1 Error Diagnosis	10-1
11 Index	11-1
12 Service & Support	12-1

12.1 Helpdesk	12-1
12.2 Service-Hotline.....	12-1
12.3 Internet	12-1
12.4 Vor der Kontaktaufnahme... - Before contacting us.....	12-1
12.5 Kundenbetreuungsstellen - Sales & Service Facilities	12-2

1 Important Notes on Utilization

1.1 Intended Use

Introduction

The Rexroth Indramat products are state-of-the-art in development and manufacturing engineering. They are checked for operational safety before being supplied to the customer.

The products may only be used as intended. When they are not used as intended, situations may arise which result in damage to person or material.

Note: Indramat Refu as manufacturer will take no warranty or liability, and will pay no damages for consequences of non-intended use of the products; the user shall take all risks arising in connection with non-intended use of the products.

Before you use any Rexroth Indamat products, the following requirements must be met to warrant intended use of the products:

- Anybody dealing with one of our products in any way must read and understand the respective Safety Regulations and the notes on Intended Use.
- If they are hardware, the products must be left in their original condition, i.e. no structural modifications may be made to them. Software products must not be decompiled, and their source codes must not be modified.
- Any damaged or faulty products must not be installed or set up.
- It must be ensured that the products are installed in correspondence with the instructions in the Documentation.

Use and Application

The intended use of Rexroth Indramat drive controllers is the control of electrical motors and the monitoring of their operation.

For controlling and monitoring a motor, the connection of additional sensors and actuators may be required.

Note: The drive controllers must only be used with the accessories and mounting parts listed in this Documentation. Any components not expressly provided for in the Documentation must not be mounted or installed. The same goes for cables and lines.

The drive controllers must only be operated with the expressly specified configurations and combinations of components and with the software and firmware mentioned and specified in the respective Description of Functions.

Before commissioning, each drive controller must be programmed to have the motor execute the specific functions for the application.

For the application-specific use of the drive controller, device types with various drive powers and various interfaces are provided.

Typically, DKR05.2 drive controllers are used for the following applications:

machine tools,

- NC-controlled machine tools, and
- printing presses.

The drive controller must be operated only in the mounting and installation conditions, the position, and the ambient conditions (temperature, degree of protection, moisture, EMC, etc.) specified in this Documentation.

1.2 Non-Intended Use

Utilization of drive controllers outside of the above fields of application, or in operating conditions and with technical data other than those specified in the Documentation, is considered "Non-Intended Use".

The drive controllers must not be used if ...

- they are exposed to operating conditions that do not meet the specified ambient requirements. For example, operation under water, or exposed to extreme temperature fluctuations or extreme maximum temperatures is forbidden;
- Rexroth Indramat have not expressly approved the proposed use. In this connection, make absolutely sure that the General Notes on Safety are observed!

2 Safety Notes on Electrical Drives and Controls

2.1 Introduction

To prevent personal injury and/or damages, read the following notes before the first start-up of the plant. The safety notes must be observed at any time.

Do not attempt to install or start up this unit before you have carefully read through all documents enclosed in the delivery. These Safety Notes and all other user information must be read each time before working with this unit. Should you have no user information for the unit, contact your responsible Rexroth Indramat sales representative. Ask for the documents to be sent immediately to those responsible for safe operation of the unit.

When selling, letting, and/or other passing on the of unit to third parties, always enclose these Safety Notes!



WARNING

Any misuse of these units and non-observance of these Safety Notes, as well as unqualified interference with the safety equipment may cause damage, bodily injury, electric shock, or even death.

2.2 Explanations

The Safety Notes concern the following danger classes according to ANSI:

Warning symbol with signal word	Danger class according to ANSI The danger class identifies the risk on non-observance of the safety information:
 DANGER	Death or severe bodily injury will occur.
 WARNING	Death or severe bodily injury may occur.
 CAUTION	Bodily injury or damage may occur.

Fig. 2-1: Danger levels (according to ANSI)

2.3 Risks by Misuse



DANGER

High electric voltage and high working current! Risk of death or severe bodily injury by electric shock!



DANGER

Dangerous movements! Risk of death, severe bodily injury, or damage by unintended movements of the motors!



WARNING

High electric voltage because of incorrect connection! Risk of death or bodily injury by electric shock!



WARNING

Health risk for persons with cardiac pacemakers, metallic implants, and hearing aids in direct proximity of electrical equipment!



CAUTION

Surfaces of the housing may be hot! Risk of injury! Risk of burns!



CAUTION

Risk of injury by improper handling! Risk of bodily injury by bruising, shearing, cutting, hitting, or improper handling of pressurized lines!



CAUTION

Risk of injury by improper handling of batteries!

2.4 General

- Rexroth Indramat GmbH does not take any liability for damages caused by non-observance of the warning in these Operating Instructions.
- Before commissioning, thoroughly read the instructions on operation, maintenance, and the Safety Notes. If you do not completely understand the Documentation in the language provided to you, please contact your supplier.
- Proper and qualified transport, storage, assembly and installation, as well as conscientious operation and maintenance are preconditions for faultless and safe operation of this unit.
- Assign trained and qualified staff to work with electrical systems. Only trained and qualified staff should work at or close to this unit. To be qualified, staff must be sufficiently familiar with assembly, installation, and operation of the product, as well as with all warnings and precautions mentioned in these Operating Instructions. Furthermore, qualified staff must be trained, instructed, or authorized to switch on and off and to ground electric circuits and units according to the safety regulations, and to mark them appropriately according to the work instructions. Qualified staff must have sufficient safety equipment and have first aid training.
- Only accessories and spares permitted by the manufacturer must be used.
- The safety laws and regulations of the country where the unit will be used must be observed.
- The units are provided for installation in machines used in industry.

European countries: EC Directive 89/92/EEC (Machines Directive)

- The ambient conditions specified in the Product Documentation must be met.
- Unless expressly and clearly specified in the project documentation, no safety-relevant applications are admissible. For example, the following areas of application and use are inadmissible: Crane construction, passenger or freight elevators, units and vehicles for passenger transport, medical engineering, refineries, dangerous goods transport, nuclear technology, application in high-frequency sensitive areas, mining, control of protective equipment (also in machines).
- Commissioning is not allowed before the machine into which the products are installed has been found to confirm to the national regulations and the safety regulations for the application.
- Operation is only admissible if the national EMC regulations for the respective application are observed.

The manufacturer of the system or machine is responsible for observance of the limits specified by the national regulations.

European countries: EC Directive 89/92/EEC (EMC Directive).

USA: See National Electrical Code (NEC), National Electrical Manufacturers' Association (NEMA), as well as local engineering regulations. The operator must observe all the above regulations at any time.

- The technical data and the requirements for connection and installation are to be found in the product documentation and must be absolutely observed.

2.5 Protection from Touching Electrical Parts

Note: This section only concerns units and drive components with voltages of more than 50 Volt.

Touching parts with voltages of more than 50 Volt can be dangerous and cause electrical shock. When operating electrical equipment, it cannot be avoided that certain parts of this equipment are under dangerous tension.



DANGER

High electrical voltage! Risk of death or severe bodily injury by electric shock!

- ⇒ This unit must only be operated, maintained, and/or repaired by staff trained or qualified for working at or with electrical equipment.
- ⇒ Observe the general construction and safety regulations for working with electrical power installations.
- ⇒ Before switching on the unit, the ground wire must have been non-detachably connected to all electrical equipment in accordance with the connection diagram.
- ⇒ Even for temporary measuring and testing, the unit may only be operated with the ground wire non-detachably connected to the specified points of the components.
- ⇒ Before accessing electrical parts with voltages greater than 50 Volt, disconnect the unit from the mains or the power supply unit. Protect from unintentional re-connection.
- ⇒ With electrical drive and filter components, observe the following:
 - After switching off, wait for 5 minutes to allow the capacitors to discharge before accessing the equipment. Measure the voltage of the capacitors before taking up work to avoid any risk by touching.
- ⇒ Do not touch electrical connections of the components when switched on.

- ⇒ Before switching on the equipment, install the provided covers and protective devices for touch protection. Securely cover and protect live parts before switching on so that they cannot be touched. ⇒ Residual current devices (RCDs) cannot be used for electrical drives! Protection from indirect touching must be ensured by other measures, for example by overcurrent protection devices according to the relevant standards.
- ⇒ Secure built-in unit from direct touching of electrical parts by providing an external housing, for example a control cabinet.

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

USA: See National Electrical Code (NEC), National Electrical Manufacturers' Association (NEMA), as well as local engineering regulations. The operator must observe all the above regulations at any time.

With electrical drive and filter components, observe the following:



**High housing voltage and large leakage current!
Risk of death or bodily injury by electric shock!**

- ⇒ Before switching on, the housings of all electrical equipment and motors must be connected or grounded with the ground wire to the grounding points. This is also applicable for short tests.
- ⇒ The ground wire of the electrical equipment and the units must be non-detachably connected to the power supply unit at all times. The leakage current is greater than 3.5 mA.
- ⇒ Over the total length, use copper wire of a cross section of a minimum of 10 mm² for this ground wire connection!
- ⇒ Before start-up, also in trial runs, always attach the ground wire or connect with the ground wire. Otherwise, high voltages may occur at the housing causing electrical shock.

European countries: corresponding to EN 50178/ 1998, section 5.3.2.1.

USA: See National Electrical Code (NEC), National Electrical Manufacturers' Association (NEMA), as well as local engineering regulations. The operator must observe all the above regulations at any time.

2.6 Protection from Electrical Shock by Protective Extra-Low Voltage (PELV) Systems

All connections and terminals with voltages between 5 and 50 Volt at Rexroth Indramat products are protective extra-low voltage systems which are provided with touch guard according to the following standards:

- internationally: IEC 60364-4-41
- European EU countries: EN 50178/ 1998, section 5.2.8.1.



WARNING

High electric voltage because of incorrect connection! Risk of death or bodily injury by electric shock!

- ⇒ To all connections and terminals with voltages between 0 and 50 Volt, only units, electrical components, and conductors may be connected which are equipped with a PELV (Protective Extra-Low Voltage) system.
- ⇒ Connect only voltages and circuits which are safely isolated from dangerous voltages. Safe isolation is achieved for example by isolating transformers, safe optocouplers, or battery operation without mains connection.

2.7 Protection from Dangerous Movements

Dangerous movements can be caused by faulty control of connected motors. The reasons can be extremely varied:

- careless or faulty wiring or cabling
- errors in operating the components
- faults in the measured-value and signal transmitters
- faulty components
- errors in the software

These faults can occur immediately after switching on, or at any time during operation.

As far as possible, monitoring in the drive components precludes faults in the connected drives. Where personnel safety is concerned, particularly where there is a risk of physical injury and/or damage to property, this fact should not be relied on exclusively. Until the built-in monitoring systems become active faulty drive movement is always to be expected; the degree of movement depends on the type of control unit and the operating status.

**DANGER**

Dangerous movements! Risk of death, injury, severe physical injury or damage to property!

⇒ For the reasons given above, protection of personnel is to be guaranteed by means of monitoring or other higher-ranking measures within the system.

For this purpose risk and fault analysis are to be provided for by the system designer according to the specific conditions within the system. The safety regulations applicable for the system are also to be taken into consideration. Arbitrary movements in the machine or other erratic functions can occur if safety devices are switched off, bypassed or activated wrongly.

To avoid accidents, physical injury and/or damage to property:

⇒ Do not stay within the motional range of the machine or machine parts. Possible measures to prevent personnel accidentally accessing the machine:

- protective fencing
- protective grid
- protective cover
- light barrier

⇒ Fencing and covers must be adequately secured against the maximum possible force of movement.

⇒ Position emergency stop switches within the immediate vicinity and so that they are easily accessible. Check that the emergency stop equipment is functioning before start-up. Do not operate the device if the emergency stop switch is not functioning correctly.

⇒ Protect against the device starting unintentionally by providing safety isolation for the drive's power connection by means of an emergency stop circuit or by using a safe starting lockout function.

⇒ Before accessing or entering the danger area bring the drives safely to a standstill.

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

- mechanically locking the vertical axis,
- providing external brake/catching/clamping mechanisms or
- adequately counterbalancing the axis.

The standard motor holding brake provided or an external motor holding brake controlled directly by the drive controller are not sufficient on their own to guarantee the safety of personnel!

⇒ De-energize electrical equipment by means of the main switch and secure against reconnection during:

- maintenance and repair work
- cleaning work
- lengthy breaks in operation

- ⇒ Avoid operating high-frequency, remote controlled and radio devices in the vicinity of the device electronics and their power supply cables. If the use of these devices cannot be avoided, check the system and installation for possible faults in all working areas before switching on the system for the first time. If necessary, the system will require a special EMC test.
-

2.8 Protection from Magnetic or Electromagnetic Fields in Operation and Assembly

Magnet and electromagnetic fields exist in direct proximity of power-carrying conductors and motor permanent magnets and can be a serious danger for people having cardiac pacemakers, metallic implants, and hearing aids.



WARNING

Health risk for persons with cardiac pacemakers, metallic implants, and hearing aids in direct proximity of electrical equipment!

- ⇒ People with cardiac pacemakers and metallic implants are forbidden to access the following areas:
- Areas in which electrical equipment and parts are assembled, operated, or set up; and
 - areas in which motor parts with permanent magnets are stored, repaired, or assembled.
- ⇒ If a cardiac pacemaker patient must access these areas, a physician must be consulted beforehand. The interference immunity of present or future implanted cardiac pacemakers differs greatly, so that no general rules can be given.
- ⇒ Patients with metal implants or metal chips, or persons wearing hearing aids must consult their physicians before accessing these areas, as their health may be impaired there.
-

2.9 Protection from Touching Hot Parts



CAUTION

Surfaces of the housing may be hot! Risk of injury! Risk of burns!

- ⇒ Do not touch housing surfaces in the proximity of heat sources! Risk of burns!
- ⇒ Before accessing a unit, leave it to cool for 10 minutes after switching off.
- ⇒ Touching hot parts of the equipment as e.g. housings in which heatsinks or resistors are located can cause burns!

2.10 Protection on Handling and Assembly

In unfavorable conditions, handling and assembling certain parts and components in an improper way can cause injuries.



CAUTION

Risk of injury by improper handling! Bodily injury by bruising, shearing, cutting, hitting!

- ⇒ Observe the general construction and safety regulations on handling and assembly.
- ⇒ Observe suitable devices for assembly and transport.
- ⇒ Avoid jamming and bruising by appropriate measures.
- ⇒ Always use suitable tools. Use special tools if specified.
- ⇒ Use lifting equipment and tools in the correct manner.
- ⇒ If necessary, use suitable protective equipment (for example safety goggles, safety shoes, safety gloves).
- ⇒ Do not stand under hanging loads.
- ⇒ Immediately clean up any spilled liquids because of the danger of skidding.

2.11 Safety in Handling Batteries

Batteries consist of active chemicals enclosed in a solid housing. Therefore, improper handling can cause injury or damages.



CAUTION

Risk of injury by improper handling!

- ⇒ Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- ⇒ Do not recharge the batteries as this may cause leakage or explosion.
- ⇒ Do not throw batteries into open flames.
- ⇒ Do not dismount batteries.
- ⇒ Do not damage electrical parts installed in the units.

Note: Environmental protection and disposal! The batteries installed in the product are considered dangerous goods during land, air, and sea transport (risk of explosion) in the sense of the legal regulations. Dispose of used batteries separate from other waste. Observe the local regulations in the country of assembly.

2.12 Protection from Pressurized Lines

According to the information in the project documentation, certain motors (ADS, ADM, 1 MB, etc) and drive controllers can be partially supplied with externally fed, pressurized media as compressed air, hydraulics oil, cooling liquids, and cooling lubricating agents. In these cases, improper handling of external supply systems, supply lines, or connections can cause injuries or damages.



CAUTION

Risk of injury by improper handling of pressurized lines!

- ⇒ Do not attempt to disconnect, open, or cut pressurized lines (risk of explosion).
- ⇒ Observe the respective manufacturer's operating instructions.
- ⇒ Before disassembling any lines, the pressure and the medium (air or liquid) must be released.
- ⇒ Use suitable protective equipment (for example safety goggles, safety shoes, safety gloves).
- ⇒ Immediately clean up any spilled liquids from the floor.

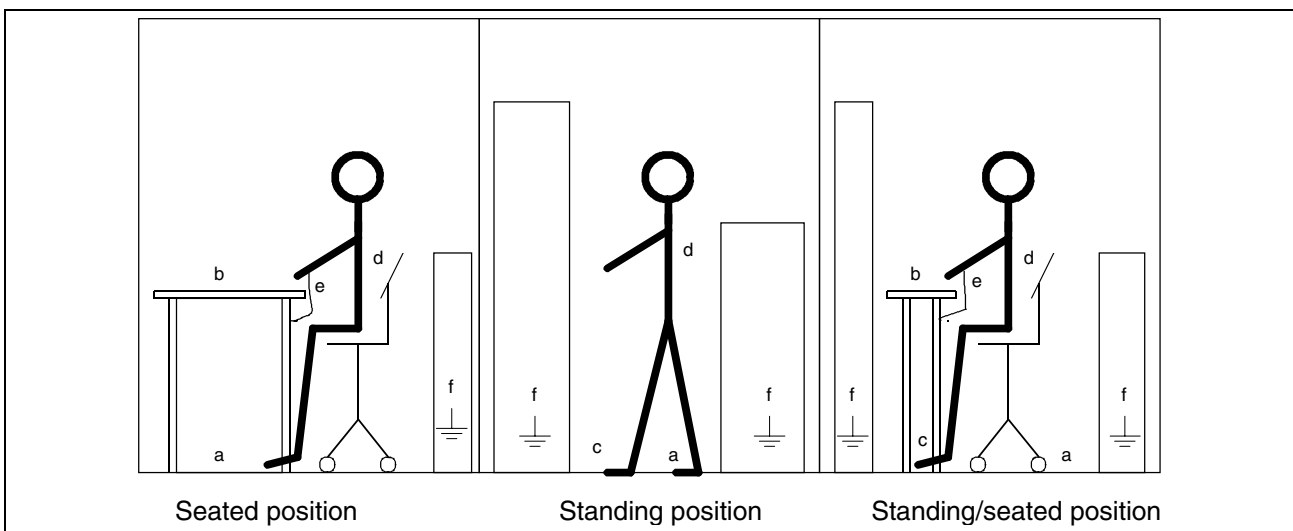
Note: Environmental protection and disposal! The agents used to operate the product might not be economically friendly. Dispose of ecologically harmful agents separate from other waste. Observe the local regulations in the country of assembly.

2.13 Precautions in Handling Electrostatic Sensitive Devices (ESDs)

The units comprise electrostatic sensitive devices. Improper handling can destroy these devices. When working with electronic subassemblies, please observe the following notes:

- Only touch electronic subassemblies if absolutely necessary in connection with the work to be done to them.
- When you must touch electronic subassemblies, make sure to discharge your body immediately before the contact.
- Electronic subassemblies must not be touched by highly insulating material (e.g. plastic foils, insulating table tops, synthetic fiber clothing).
- Always place electronic subassemblies on conductive surfaces.
- When soldering electronic subassemblies, the tip of the soldering iron must be grounded.
- Electronic subassemblies and components must only be stored or dispatched in conductive packaging (e.g. metallized plastic or metal containers).
- If packaging is not conductive, the electronic subassemblies must be covered in a conductive material before being packed. For example conductive foam rubber or household tinfoil can be used.

The following figure once more illustrates the necessary ESD protections:



- a: conductive floor
 b: ESD table
 c: ESD shoes
 d: ESD coat
 e: ESD waste band
 f: grounding connection of the cabinets

Fig. 2-2: ESD precautions

3 Description

3.1 Characteristics

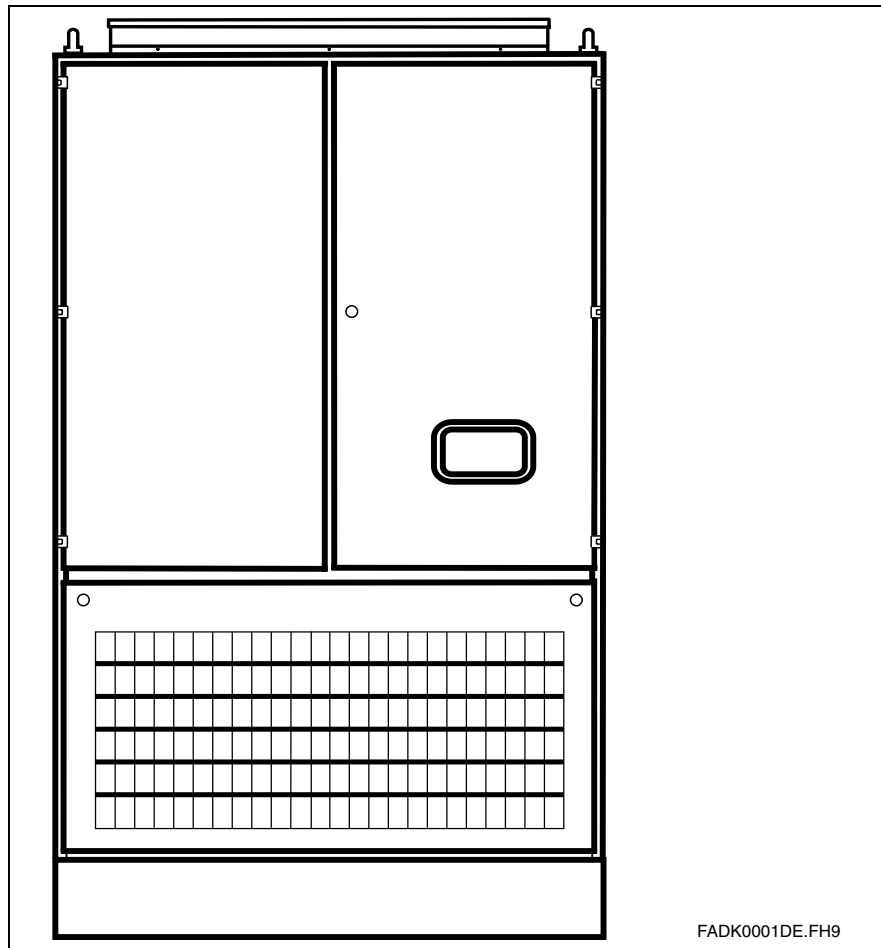


Fig.: 3-1 DKR05.2 Front view

Range of application: Digital intelligent drive systems with Rexroth Indramat 2AD motors with a rated motor power of 115 to 375 kW.

For precise closed and open-loop control of the motors, DKR drive controllers of various rating classes are available.

Drives with a DKR drive controller excel by

- high control quality,
- large speed range with constant rating,
- and mains regeneration.

Thanks to these characteristics, they are especially well suited for operation with

- NC controlled machine tools, or
- printing presses.

Construction: Compact drive controller with:

- integrated main switch,
- prewired control cabinet,
- integrated cooling system – no additional ventilator or heat exchangers are required.

Power connection: DKR drive controllers are designed for direct power connection to grounded 3-phase networks with:

- 3 x AC 400 V +15 % -5 % (50 Hz / 60 Hz) or
- 3 x AC 480 V +10 % -15 % (50 Hz / 60 Hz).

Configuration of the basic unit: Drive controllers of the DKR type must be equipped with the plug-in modules required for an application. The assembled controller then has a so-called drive configuration which is ordered through the hardware configuration labeling.

3.2 Components

The basic unit is adapted to your application by plug-in modules individually fitted to slots U1 to U5; it is supplied completely fitted (= configured). A configured drive controller consists of:

- basic unit
- firmware module
- command interface card, and
- auxiliary plug-in module(s).

For unambiguous labeling of the configured drive controller, three type plates are installed.

In each case, a configured DKR and as a sub-position, the required firmware FWA-DIAX03-... is ordered. .

Firmware is the operating software of the DKR. It is in the form of EPROMs in the firmware module DSM2.3 and is likewise installed in an auxiliary plug-in module.

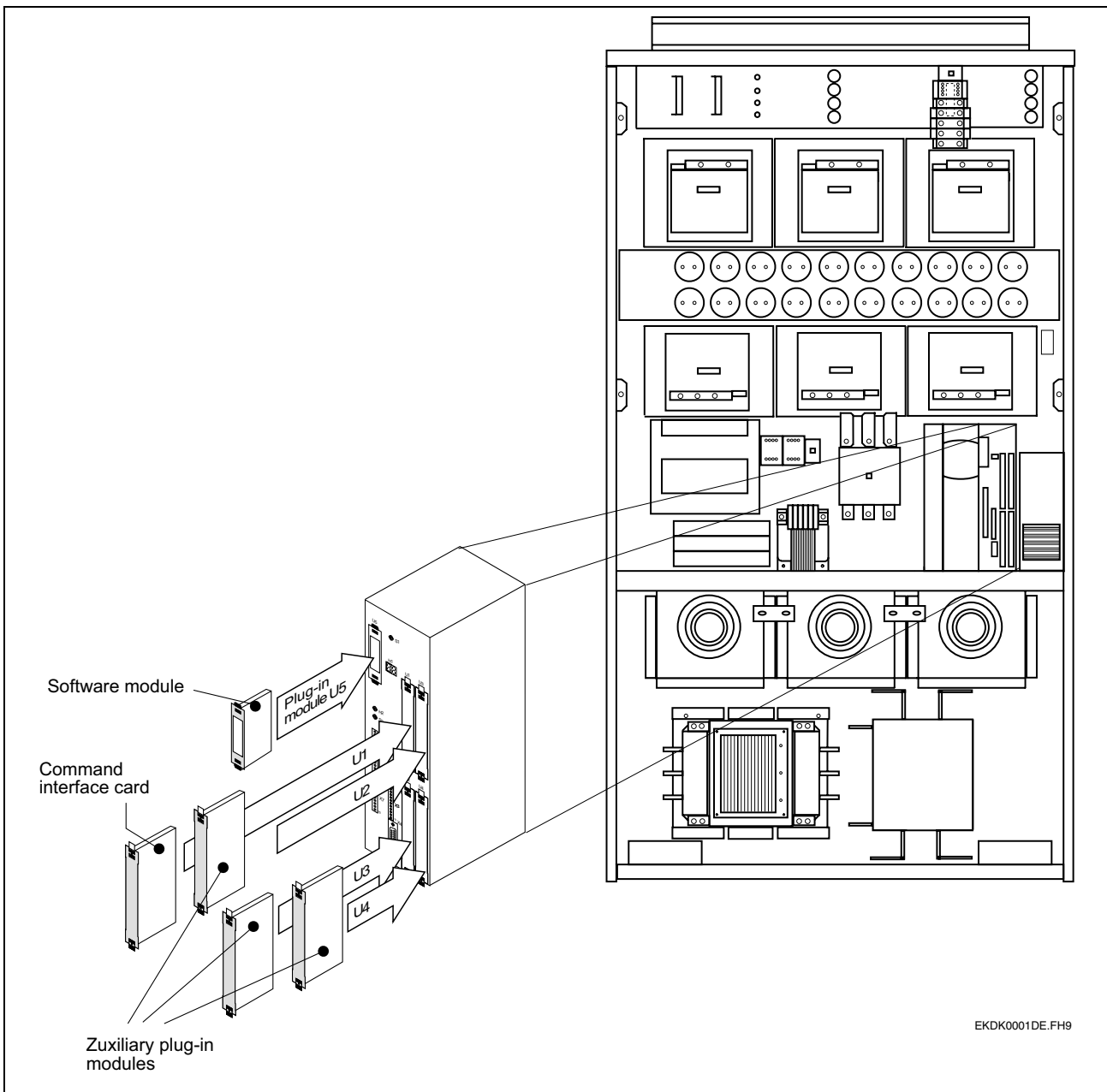


Fig.: 3-2 Components of a configured drive controller

Basic Unit

In a basic unit, the slots U1 to U5 are not fitted.

Firmware module

The firmware module is labeled DSM02.3. It contains the firmware for the drive controller (operating software) and stores all drive parameters. The firmware depends on the selected configuration and required features.

Before replacing a unit for servicing, all entered drive parameters can easily be transferred by refitting the firmware module to the replacement unit. Thus, the drive is immediately available once more with all specific characteristics.

Note: In the following, please find a list of the command interface cards and auxiliary plug-in modules currently available. For more information on their characteristics, refer to the documentation on plug-in modules.

Possible combinations of plug-in module and firmware types are to be found in the document type "Drive configuration".

Command Interface Card

Presently, command interface cards with the following interfaces are available:

- SERCOS interface
- Profibus interface
- INTERBUS interface, and
- analog interface.

Auxiliary Plug-In Module

Presently, auxiliary plug-in modules with the following features are available:

- Modules with digital inputs and outputs for bi-directional data exchange,
- Modules for various types of measuring systems:
 - incremental measuring systems with rectangular signal output,
 - incremental measuring systems with sinus signal output,
 - single-turn encoder measuring systems,
 - multi-turn absolute value encoder measuring systems with SSI signal output,
 - Rexroth-Indramat gear-type encoder,
 - measuring systems with analog output signal;
- Analog interface with position value output,
- Modules for the CLC group.

3.3 Brake Chopper

In case of power failure, the energy released by the braking processes is absorbed by the brake chopper. In this way, the motor can be shut down in a regular way also in case of power failure.

The DKR05.2 drive controllers can be supplied with brake chopper as an option.

3.4 Type Code

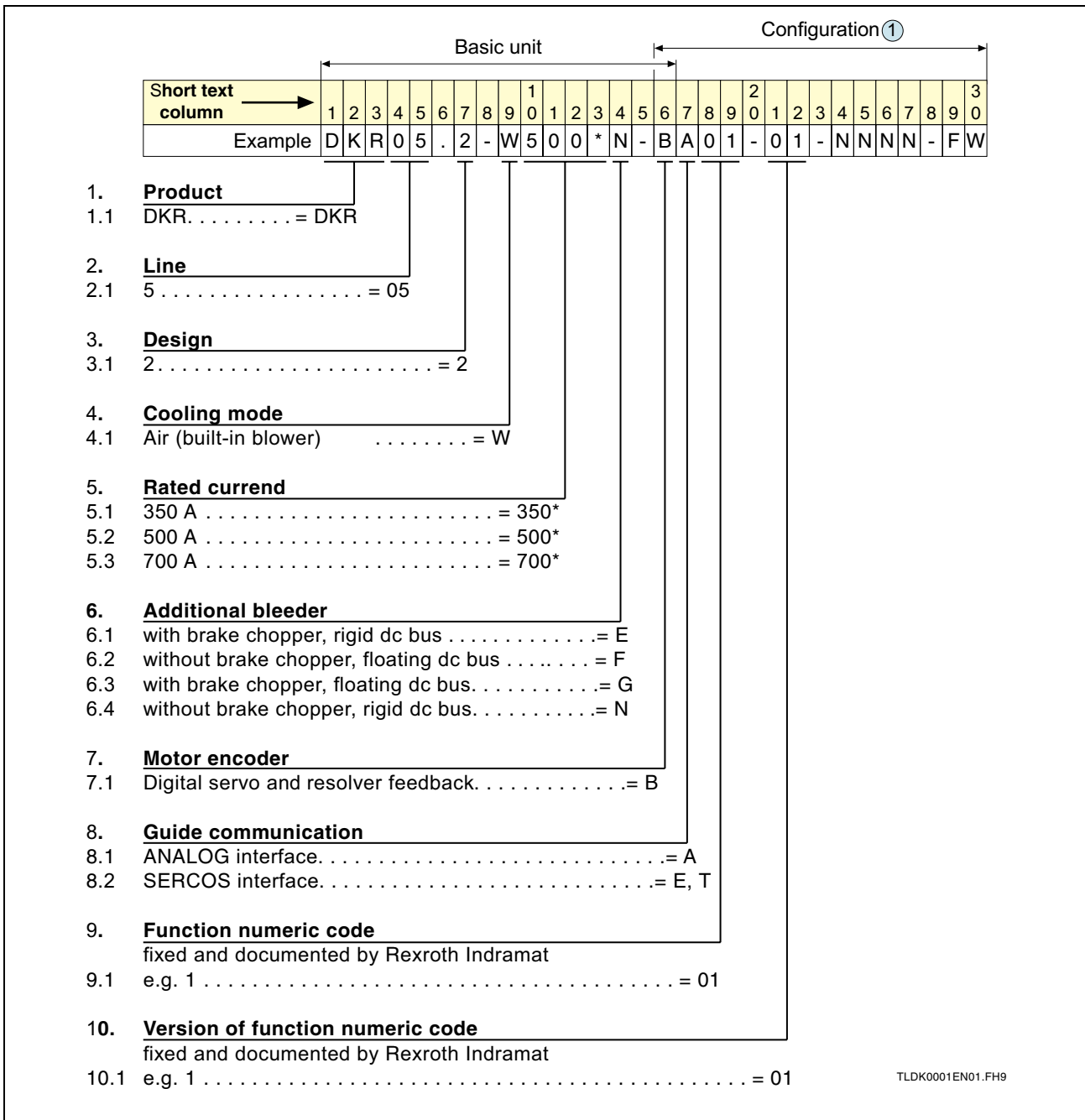


Fig.: 3-3 Type code DKR05.2

	Basic unit										Configuration ①																						
Short text column →	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	2	0	1	2	3	4	5	6	7	8	9	0	3
Example	D	K	R	0	5	.	2	-	W	5	0	0	*	N	-	B	A	0	1	-	0	1	-	0	1	-	N	N	N	N	-	F	W

11. **Control cabinet lock**

11.1 Lock for : 8 mm three-square socket wrench = A

11.2 Lock for : 3 mm two-way key = B

11.3 Lock for : 7 mm tee-handled square socket wrench. = C

11.4 Lock for : 8 mm tee-handled square socket wrench. = D

11.5 Lock for : Daimler-Chrysler insert = E

11.6 Lock for : 7 mm three square socket wrench = N

12. **Control cabinet color**

12.1 Light gray RAL7035 = 1

12.2 Pebble gray RAL7032. = N

13. **Door main switch**

13.1 Without door main switch = NN

13.2 With door main switch. = SN

11. **Firmware**

11.1 Identification that firmware must be ordered as a separate sub-position. = FW

Note:
 ① see BRC Intranet - Distribution - List of products introduced to or taken from the market

Fig.: 3-4 Type code DKR05.2 – special versions

3.5 Technical Data

DKR05.2 / current rating		W350	W500	W700
Rated connection voltage		3 AC 400 V +15 % -5 % 3 AC 480 V +10 % -15 %		
Control voltage		Internally generated		
System frequency	Hz	45 ... 65		
Rated output voltage	V	0 ... 520		
Rated output frequency	Hz	0 ... 250		
Rated motor power ¹⁾	kW	115	165	245
Current rating	A	350	500	700
Rated motor current ($f_p = 4$ kHz)	A_{eff}	170	241	358
Motor current ($f_p = 4$ kHz, 60 s)	A_{eff}	221	314	466
Rated motor current ($f_p = 8$ kHz)	A_{eff}	127	181	269
Motor current ($f_p = 8$ kHz, 60 s)	A_{eff}	153	217	323
max. dv / dt of the rated output voltage	V / μ s	2000		
Max. amplitude of the rated output voltage	V	1500		
Minimum leakage inductance of the motor with $f_p = 4$ kHz	μ H	330	232	166
Minimum leakage inductance of the motor with $f_p = 8$ kHz	μ H	165	116	83
Line current ($U_{mains} = 400$ V -5 %)	A_{eff}	200	287	426
DC bus voltage	V	Max. 850 V DC		
Power dissipation	kW	4,5	6,2	9,5
Weight	kg	500	550	650
Cabinet dimensions (WxHxD)	mm	1200 x 2290 x 600		
Ambient temperature:	C	0 ... 40		
Cooling system		Forced air cooling		
Protection degree electronics room		IP 54 according to EN 60529		
Protection degree cooling air room		IP 21 according to EN 60529		
Interference immunity		Industrial environment according to EN 61800-3		
Emitted interference		Industrial environment according to EN 61800-3, mains filter class A EN 55011		
Distortion factor (sinusoidal recovery)		< 5 %		

f_p : pulse frequency

1): $\eta_{Motor} = 0,95 - \cos \varphi_{Motor} = 0,8$

Table: 3-1 Technical data

Note: With output frequency = 3 Hz, the rated output power is reduced to 90%.

Floating DC–Link Voltage

When additional DC-link capacities are connected in the version with floating DC-link voltage, the energy temporarily stored in them can be used for cyclic short-time loading; for this purpose, the DC-link voltage is not set to a fixed value but can float freely within defined limits (floating DC-link voltage). In this way, short-term infeed and recovery currents are avoided, keeping mains reaction at a low level.

Usable voltage range for dimensioning the additional capacities:

Lower voltage limit	$(U_{\text{Mains}} + 15\%) \times 1,14$
Upper voltage limit	800 V
Bleeder (optional)	820 V
Switch-off limit	850 V

Table: 3-2

Example: $U_{\text{Mains}} = 400 \text{ V}$ usable voltage range $\Delta U_{\text{ZK}} = 649 \text{ V} \dots 800 \text{ V}$

Note: IGBT modules are used in the DKR05.2. In spite of being extremely reliable, these modules are subject to unavoidable wear on thermal varying load. Extreme load cycles repeated in cycles of 2 ... 30 can result in working lives of less than one year. An electronic limitation of temperature cycles is not possible. Through the "work load of thermal controllers" P-0-0141 signal, the temperature stress can be estimated.

4 Mechanical Installation

4.1 Storage and Mounting

Storage

The devices should be stored in clean, dry rooms. Storage temperature must be between -25 °C and $+70\text{ °C}$. Temperature deviations of more than 20 K per hour are not admissible.

Note: Frequency and infeed converters contain AL electrolytic capacitors and DC link capacitors. They can be stored in a de-energized state for a maximum of 2 years at a storage temperature of $\leq 40\text{ °C}$.

Minimum Requirements on the Mounting Site

- The operation room should be dust-free. Dusty air must be filtered (3k3 according to DIN EIC 721-3-3).
- The ambient temperature must be in the range of 0 ... 40°C.
- Relative humidity must not exceed 90%, condensation is not admissible.
- The supplied air must not contain any aggressive or electrically conductive gases, or gases endangering the functions.
- The air stream of the fans must not be blocked. The minimum clearances for fresh air and outlet air specified for the respective power class must not be narrowed by additional structures.
- The unit causes power dissipation and heats up its environment. Therefore, make sure there is sufficient distance to heat-sensitive devices.
- The built-in blowers start to work as soon as power (main contactor) is activated.

Mounting Altitudes Above 1000 Meters Above Sea Level:

With mounting altitudes above 1000 m above M.S.L., the work load of the DKR must be derated according to the diagram below. Maximum mounting altitude is 2000 m above M.S.L.

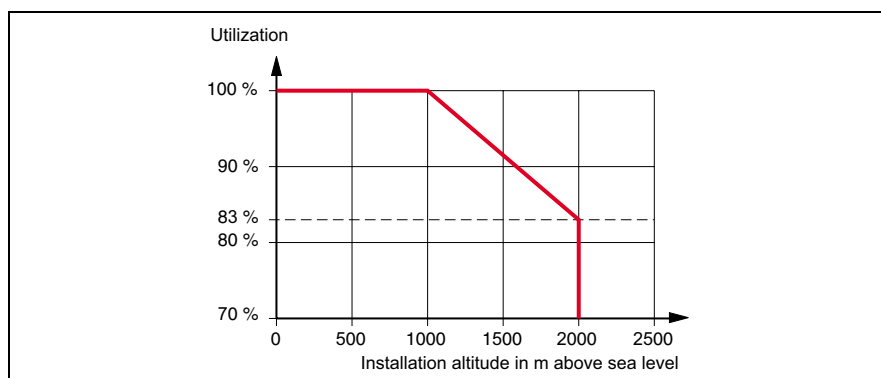


Fig.: 4-1 Derating in dependence on the mounting altitude.

Cooling

- The control cabinet is divided into an ambient air room (cooling air room IP21) and the electronics room (IP54). The rooms are divided by a partition wall.
- Air is sucked through the front grid panels with filter mats (filter mat: Indramat Refu Mat. No. 0021767)
- Removing the front plate to change the filter mat is possible while the unit is running because there is a second grid plate as a touch guard.
- ⇒ The filter mat must be cleaned or replaced in regular intervals to prevent reduction of the air flow rate required for cooling.
- ⇒ Damage to the unit by overheating is prevented by disconnection on faults (refer to Chapter 10, Service and Tests).
- ⇒ The unit must not be operated without a filter mat.
- Optionally, cooling air can be fed in via a tube at the side openings of the control cabinet. The covers of the side openings can be removed. In this case, the filter mats of the front grid plates must be replaced by an air-tight material.
- When running cables supplied by the Customer from the cooling air room into the electronics room through removable cable bushing panels, IP66 cable bushings must be used.
- The output reactors and balancing resistors are located in the cooling air channel.

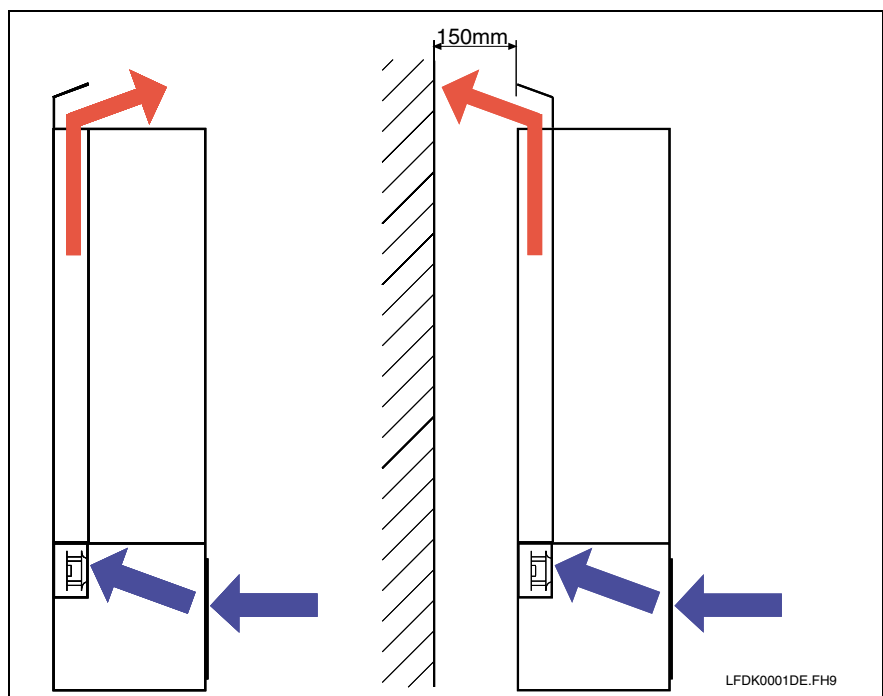


Fig.: 4-2 Air supply through the front grids

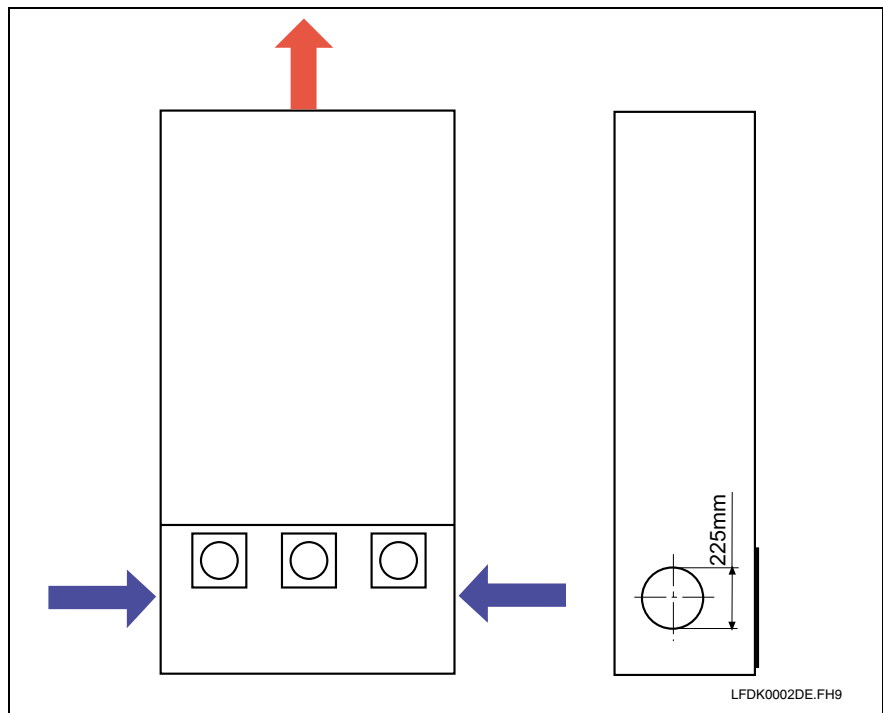


Fig.: 4-3 Air supply through the side openings

Blower

The built-in blowers start to work as soon as power (main contactor) is activated. The blowers are supplied via the auxiliary transformer T1. Connect this transformer in correspondence to the system voltage. See Chapter I5-7 (Auxiliary Voltage).

4.2 Dimensions

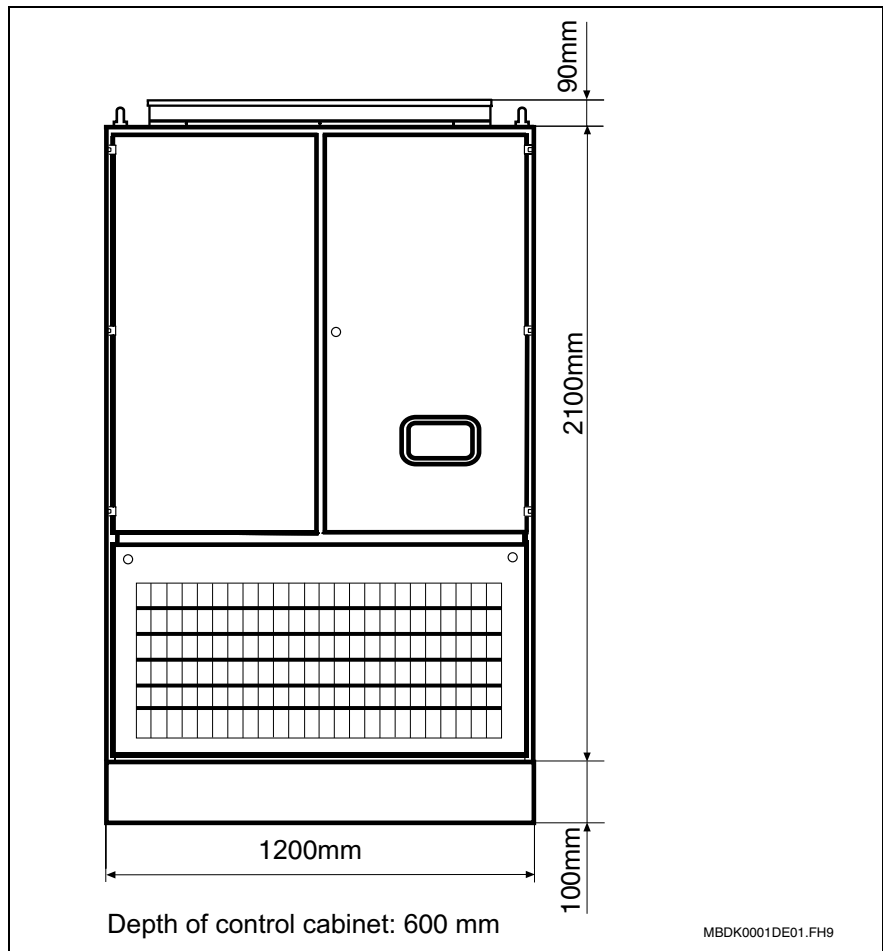


Fig.: 4-4 Dimensions of the control cabinet

5 Electrical Installation

5.1 10 Rules for Electromagnetically Compatible Drive Design

The following 10 rules are the basis for electromagnetically compatible drive design.

Rules 1 to 7 apply generally. Rules 8 to 10 are especially important to limit emitted interference.

- Rule 1** All metallic parts of the control cabinet must be connected to each other flatly and in a highly conductive manner (no paint on paint!) If necessary, use contact or scratch disks. Connect the cabinet door to the cabinet with ground straps of the minimum possible length.
- Rule 2** Signal, mains, motor, power cables must be laid separately from each other (avoid capacitive coupling!). Minimum distance: 20 cm. Provide separating sheets between power and signal lines. Repeatedly ground the separating sheets.
- Rule 3** Contactors, relays, solenoid valves, electromagnetic hours-run meters etc. in the control cabinet must be connected with interference suppression combinations, e.g. with RC elements, diodes, or varistors. The connection must take place directly at the respective coil.
- Rule 4** Unshielded cables of the same circuit (go and return cables) must be twisted together, or the space between go and return cable must be kept to a minimum. Ground reserve strands at both ends.
- Rule 5** Generally, interference-signal injections are reduced when lines are routed close to grounded sheets. For this reason, wiring should not be laid openly through the control cabinet but routed closely along the cabinet housing or mounting sheets. This also applies to reserve cables.
- Rule 6** Incremental encoders must be connected through a shielded line. A large-area shield must be applied at the incremental encoder and the frequency converter. The shield must not be interrupted, e.g. by intermediate terminals.
- Rule 7** Signal line shields must be connected to earth on both sides (transmitter and receiver) over a large area and in an effectively conductive manner. With bad equipotential bonding between the shield bondings, an additional equalizing conductor of at least 10 mm² must be laid parallel to the shield to reduce shield current. The shields may be grounded several times, e.g. at the cabinet housing and on the cable ladders. Foil shields are not recommended. The shielding effect of foil shields is worse by factor 5 than that of braided shields.
- With bad equipotential bonding, analog signal lines may only be grounded on one side at the converter to avoid low-frequency interfering radiation (50 Hz) on the shield.
- Rule 8** Always place an RF interference filter close to the source of interference. The filter must be connected flatly to the cabinet housing, mounting sheet, etc. The most favorable solution is a plain metallic mounting plate (e.g. of special steel or zinc-coated steel), as all the bearing surface creates electrical contact here.
- The input and output lines of the RF interference filter must be located at a distance from each other.
- Rule 9** All variable-speed motors should be connected with shielded cables, the shields being connected to the respective housings on both sides in a low-inductive (large-area) manner. The motor conductors must be shielded also within the control cabinet, at least through separating sheets. Suitable motor conductors are e.g. Siemens PROTOFLEX-EMV-CY (4 x 2.5 mm² ... 4 x 120 mm²) with Cu shield.
- Steel-shielded lines are not recommended.

To bear the shield at the motor, a suitable conduit thread connection with shield contact can be used (e.g. "SKINDICHT SHV/SRE/E" by Messrs. Lapp, Stuttgart). Always make sure there is a low-impedance connection between the motor terminal box and the motor housing. If necessary, use additional grounding flexible lead for the connection. **Do not use plastic motor terminal boxes!**

Rule 10 The shield between the motor and the frequency converter must not be interrupted by installation of components as e.g. output reactors, sinus filters, motor filters, fuses, or contactors. For this reason, the components must be installed on a mounting sheet which is simultaneously used as a shield support for the incoming and outgoing motor conductor. Separating sheets for shielding the components may be required.

5.2 Warnings und Notes



DANGER

Fatal electric shock by live parts of more than 50V!

- ⇒ The DKR05.2 units are operated at high voltages. No work must be done unless the unit is switched off!
- ⇒ Only qualified personnel must work on the units!
- ⇒ Non-observance of these warning may result in death, severe bodily injury, or significant damages.
- ⇒ Because of the DC link capacitors, dangerous voltage in the unit continues for up to 5 minutes after isolation from supply. For this reason, work to the unit or the DC link terminals may only be done after corresponding delay time and checking that the unit has been safely de-energized.
- ⇒ The power and control terminals may be live when the motor is at standstill.
- ⇒ With central supply of the DC bus voltage, make sure the power inverters are safely isolated from the DC bus voltage!
- ⇒ When working on the open unit, be aware of the fact that live parts are exposed.
- ⇒ The responsibility for installation and connection of all units according to the accepted technical regulations in the country of installation and any other applicable local regulations is with the User. In this connection, special attention is to be paid to cable dimensioning, fusing, grounding, shutdown, separation, and overcurrent protection.

**CAUTION**

The units can be damaged by incorrect rated connection voltage!

- ⇒ The DKR05.2 units are designed for different rated connecting voltage! For this reason, no system voltages for the terminal strips are given in the drawings and charts.
- ⇒ When installing the connections, be absolutely sure to observe the type plate and the rated connection voltage specified in the Technical Data.

Note on protective ground:

Because of the leakage currents of the units (>3.5 mA) via the ground wire (PE), the cross section of the incoming cable of the ground wire to the control cabinet must be at least 10 mm² Cu according to DIN VDE 0160, or a second ground wire must be laid electrically parallel. (VDE 0160, section 6.5.2). The leakage currents of the units can be up to several Amperes.

With greater connection ratings, the minimum cross section of the ground wire must be in a corresponding relation to the cross section of the external conductor. See DIN 57100 section 540 / VDE 0200 section 540 chart 2. The circuit of the converter on the mains side corresponds to circuit 7 (DIN VDE 0160-5.5.3.4.2 Figure 8).

Here, the residual current circuit breaker must not be used as a safeguard.

5.3 Connector Positions, Pin Assignments, and Cross Sections

The conductor cross-sections refer to rated converter current.

The respective ground wire cross section must be at least 10 mm² (if the power cables have cross sections >10 mm², see the above "Note on protective ground").

For Power Cables, the Following Requirements Apply:

- The cross sections are valid for one phase each with multi-wire conductors and have been specified according to the regulations of VDE0298.
- Up to 35 mm², single strands in the cable duct.
- From 50 mm², free non-contact routing in the control cabinet (alternatively, conductor bars are recommended).

For Motor Conductors, the Following Requirements Apply:

- The cross sections are valid for shielded 4-core cables and have been specified according to the regulations of VDE0298.
- Up to 35mm², routing in the cable duct without bundling.
- From 50 mm², free non-contact routing in the control cabinet.

Positions of Terminals and Connectors

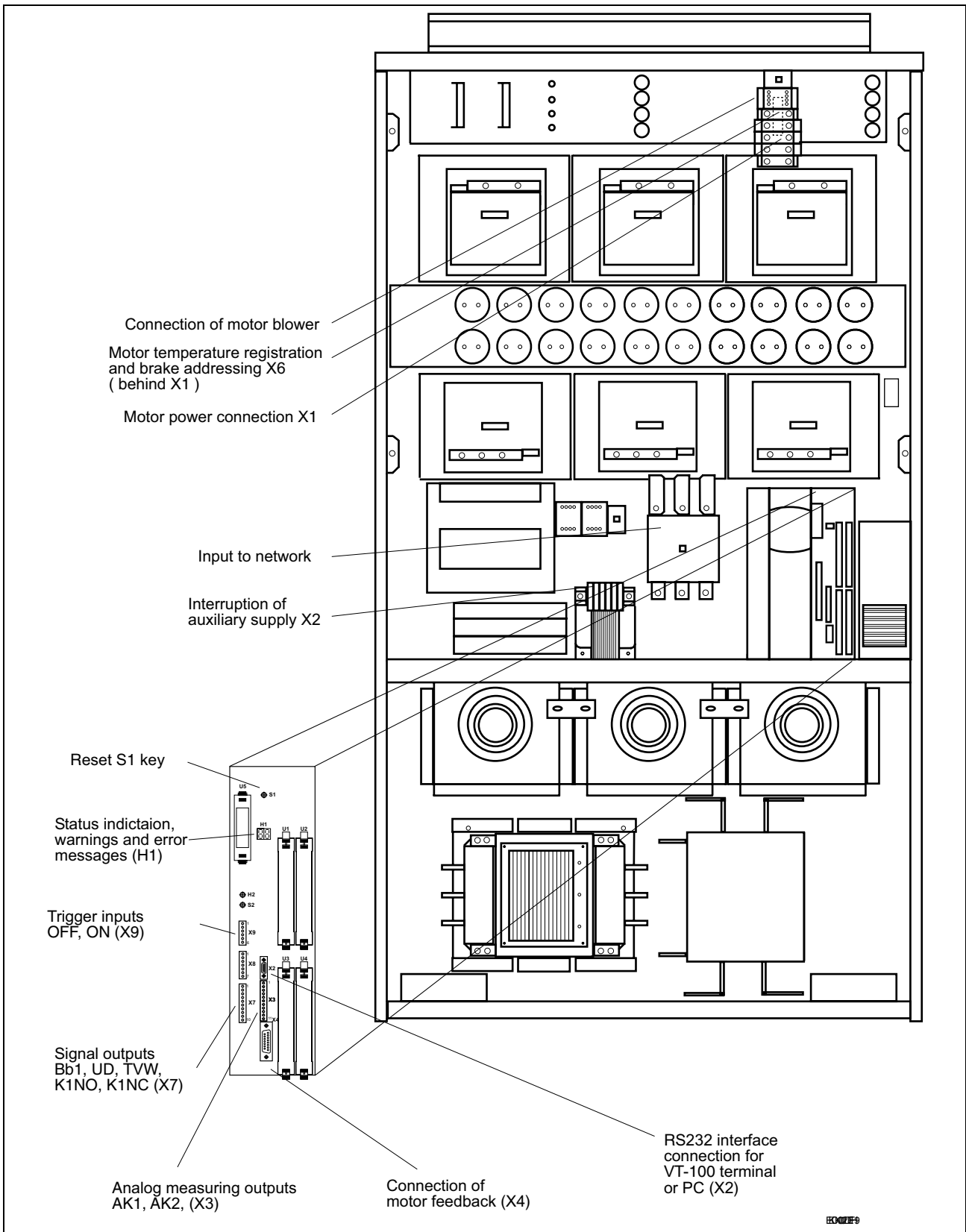


Fig.: 5-1 Positions of terminals and conductors in the control cabinet

Entry of Cables

Power and motor cables should preferably be supplied from the top, while sufficient distance is kept between control and power wiring.

In the roof, the intermediate bottom, and the floor of the control cabinet, recesses are provided for cable bushings. For all cable bushings, the provided sheets must be used, which are to be equipped with IP66 rubber cable bushings in the distance plate, as well as with conduit thread screwed connections and/or bushing boxes for encoder cable and optical fiber cable in the roof and the floor of the control cabinet.

Indramat offers suitable bushings for the connection of encoder and optical fiber cable. See DOK-CONNEX-CABLE*STAND-AU**-EN-P 282688.

Example feedback cable DSF: Cable in the IKS4373 cabinet, bushing box INS0518/A01, external cable IKS4065.

Carefully check that the electronics and cooling air rooms are seal-tight.

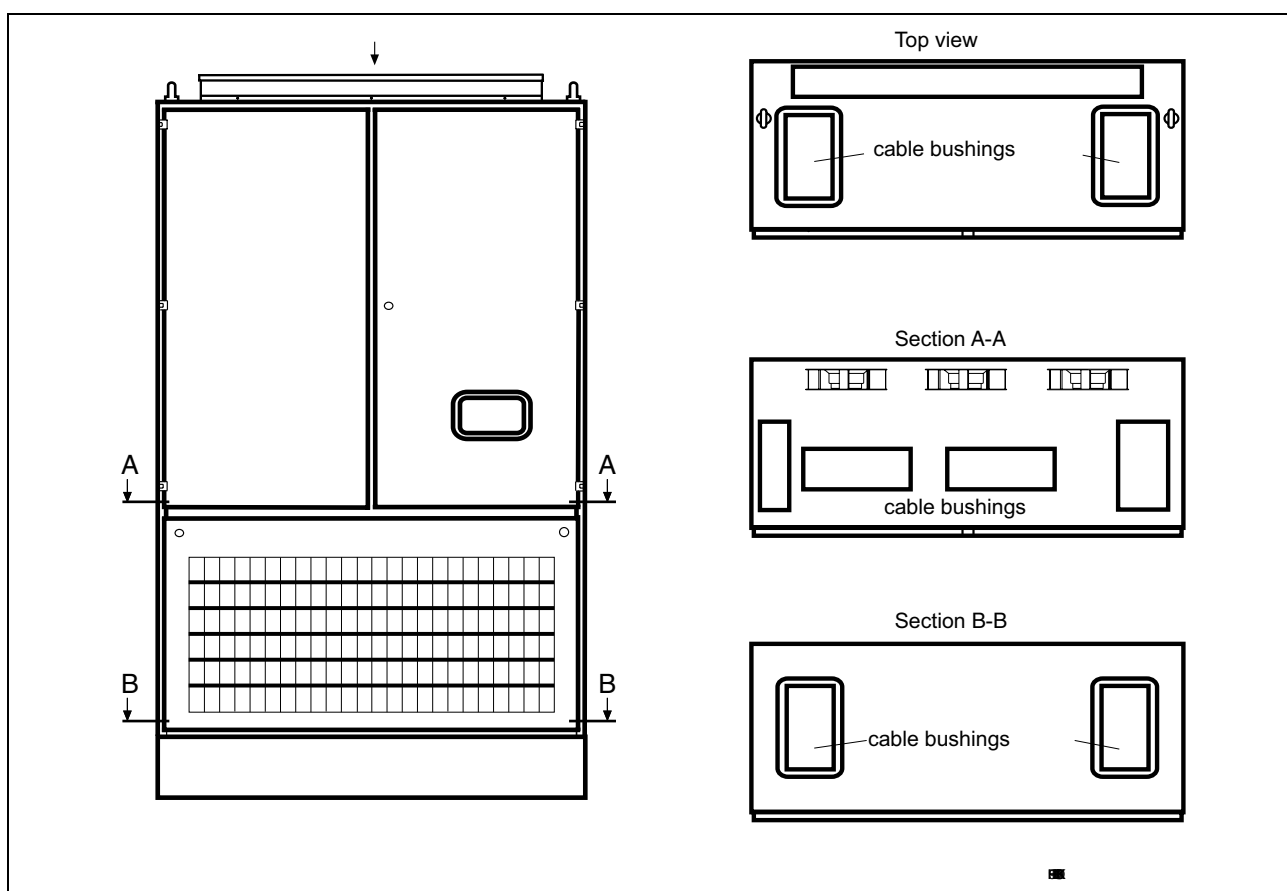


Fig.: 5-2 Cable bushings

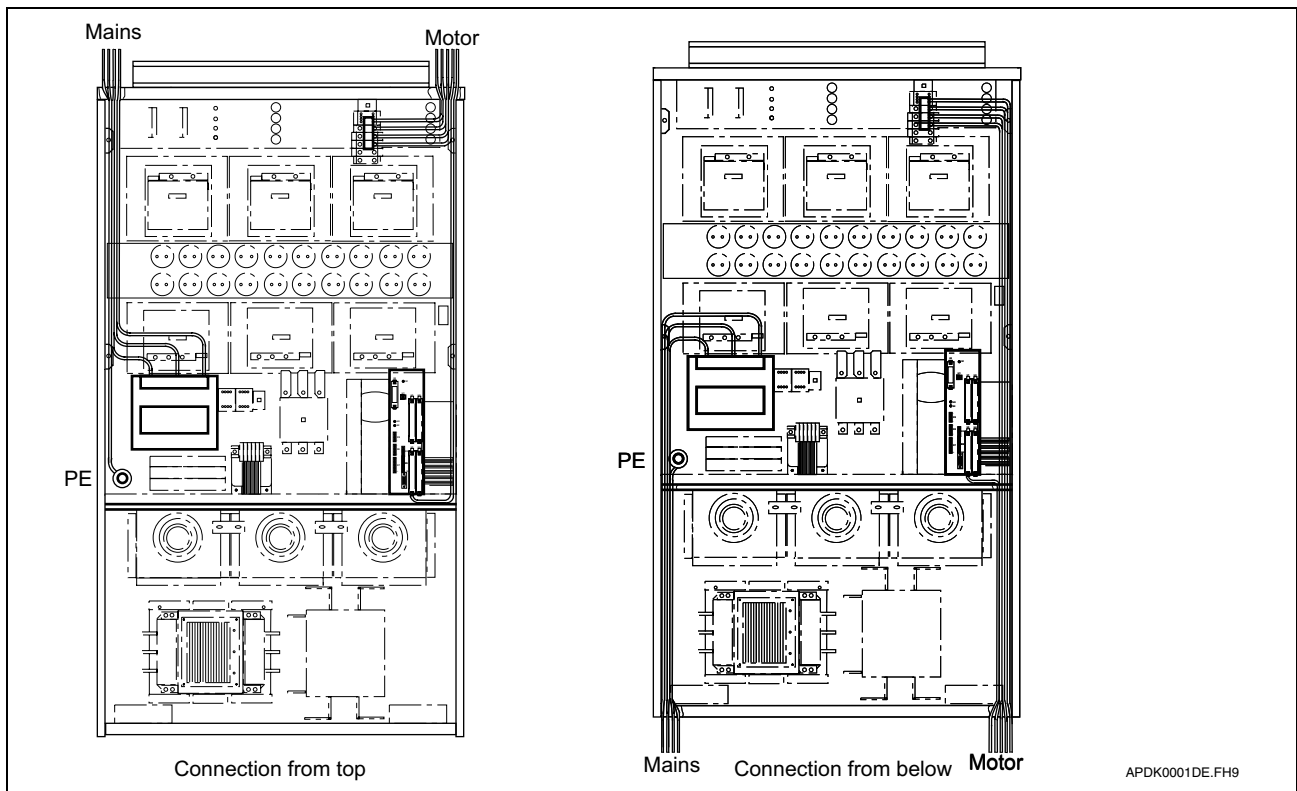


Fig.: 5-3 Connection top/bottom

Power Connection

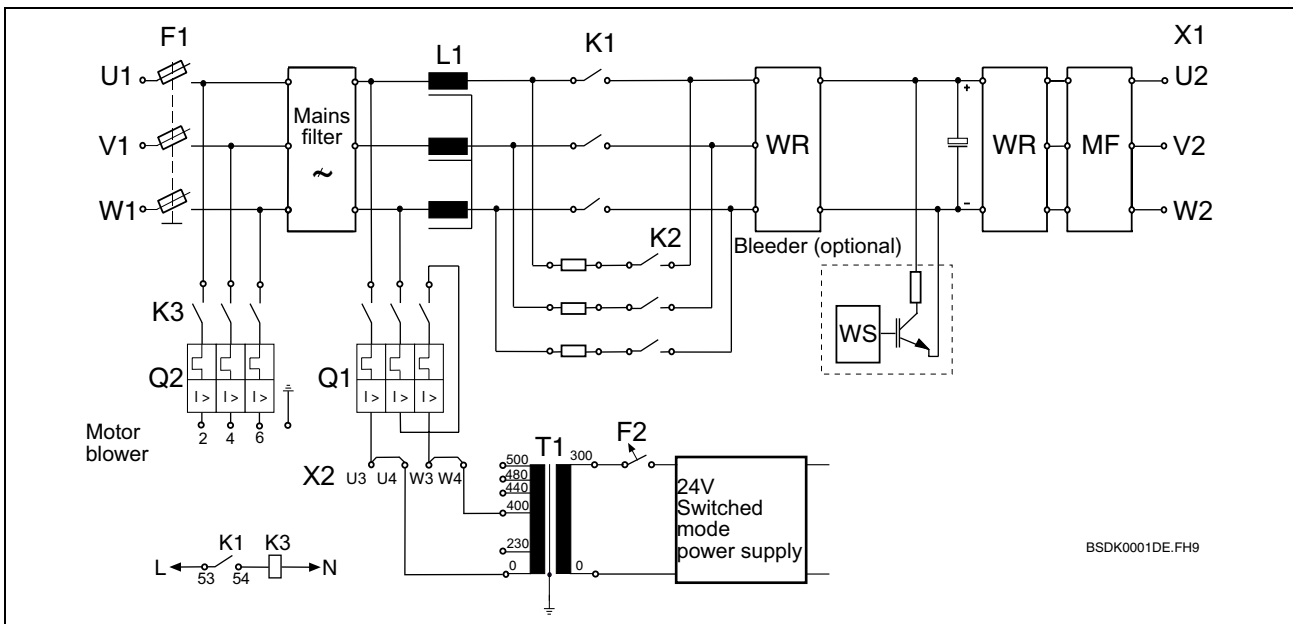


Fig.: 5-4 Switching principle power connection and power section



CAUTION

Error or malfunction caused by utilization of a residual-current circuit-breaker!

⇒ No residual-current circuit-breaker must be connected before the drive controller.

Admissible Rated Connecting Voltage

The following is applicable for system input voltage:

- U1, V2, W3: 3 x AC 400 V +15 % -5 %, 50 Hz / 60 Hz
- U1, V2, W3: 3 x AC 480 V +10 % -15 %, 50 Hz / 60 Hz

The power input line is directly connected to the fuse switch-disconnector (F1).

Direction of Rotating Field of the System Voltage

The rotating field of the system voltage in the sense of direction of U1, V1, W1 must be positive. With false sense of rotation, operation is not possible. The display of the system inverter control indicates "External warning".

Auxiliary Supply

The drive-internal auxiliary supply (1 x AC 230 V) is provided from the mains via a matching transformer. When the unit is operated with another voltage than 400 V (as preset by the manufacturer), the corresponding tapping of the primary winding must be connected at the T1 transformer. Connecting terminals for the voltages of 500 V, 480 V, 440 V, and 400 V are available. No changes must be made to the 0 V, 230 V, and 300 V connections.

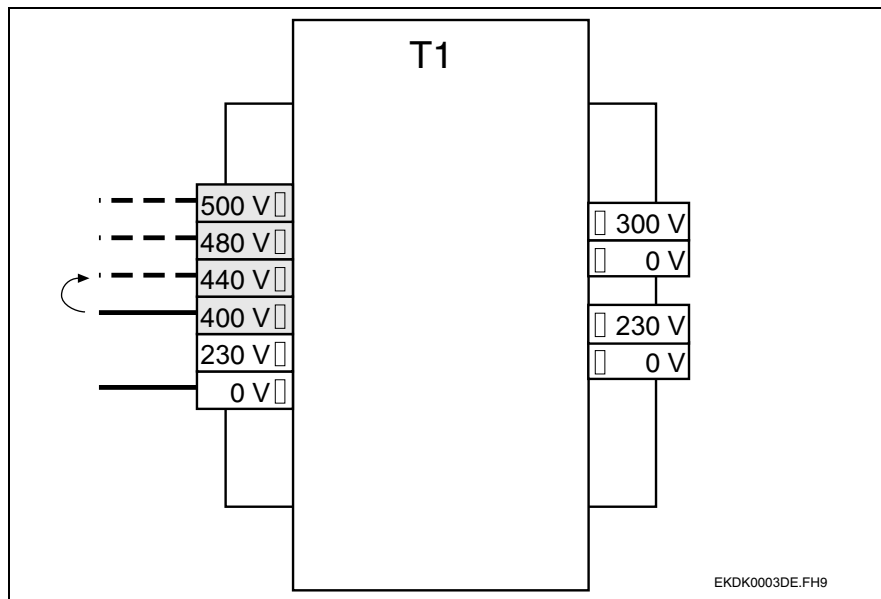


Fig.: 5-5 Auxiliary supply transformer T1

Interruption of Auxiliary Supply (De-Energization)

By removing the wire jumpers in the X2, U3 - X2, U4 and X2, W3 - X2, W4 terminals, the primary voltage of the T1 auxiliary supply transformer can be disconnected in a double-pole manner. In this way, precharge and main contactor have no supply voltage; thus, also 24 V supply is disconnected. Accordingly, the unit has been safely de-energized.



Fatal electric shock by live parts of more than 50V!

⇒ After switching off, wait for 5 minutes to allow the capacitors to discharge before accessing the equipment. Measure the voltage of the capacitors before taking up work to avoid any risk by touching.

Grounded 3-Phase Systems

The drive controller can be connected directly to 3-phase systems grounded via neutral point or outer conductor.

If the system voltage does not equal the admissible rated connecting voltage, an autotransformer is required for voltage matching.

Ungrounded 3-Phase Systems

At ungrounded systems (IT systems), there is a higher risk of inadmissible overvoltages occurring between outer conductors and housing. DKR05.2 can be protected from inadmissible overvoltages

- by connecting it through an isolating transformer (the neutral point of the output side and the PE connection of the DKR05.2 must be connected on the same ground rail),

- or -

- when the system is protected by **overvoltage detectors**.

Note: Connecting the DKR05.2 through an isolation transformer guarantees best operation safety and best protection from overvoltage.

Thermal dimensioning Because of the additional thermal load by harmonics of the sinusoidal power input or power recovery current, any autotransformers connected on line side for voltage matching, or isolating transformers connected on line side for electrical isolation, must be dimensioned for a power 30 % greater than the rated output.

Stray inductances The transformer must not have greater stray inductances than the inductance of the internal line reactor. Observe the following maximum values:

- DKR05.2 - W350*N $L_{\sigma\max} = 510 \mu\text{H}$
- DKR05.2 - W500*N $L_{\sigma\max} = 390 \mu\text{H}$
- DKR05.2 - W700*N $L_{\sigma\max} = 220 \mu\text{H}$

Additional DC Link Capacitors:

With all DKR05.2, additional capacities of max. 200 mF can be connected at the DC link.

- With the DKR05.2-W350 and DKR05.2-W500, the terminals "C" (plus pole) and "D" (minus pole) are provided for this purpose.
- With the DKR05.2-W700, bolts are provided to receive cable lugs.

When dimensioning the additional capacity, the following unit-internal capacities can be taken into consideration:

Device type	Internal auxiliary capacity
DKR05.2-W350	C = 9,9 mF (-10 / +30%)
DKR05.2-W500	C = 13,4 mF (-10 / +30%)
DKR05.2-W700	C = 28,0 mF (-10 / +30%)

Tab.: 5-1

The lines to the capacitors should be dimensioned in the same way as the motor connection lines; they should be routed in a low-inductive manner, i.e. closely together or stranded, if possible.

Shielding is not required.

The external electrolytic capacitor battery must be coupled in a double-pole manner via DC fuses.

Recommendation

Device type	Fuse type	Rated current in A	AC rated voltage in V
DKR05.2-W350	SIEMENS Sitor fuse 3NE3 227	250	AC 1000
DKR05.2-W500	SIEMENS Sitor fuse 3NE3 231	350	AC 1000
DKR05.2-W700	SIEMENS Sitor fuse 3NE3 233	450	AC 1000

Tab.: 5-2

Note: The electric strength of the capacitor battery must be at least 900 V. Please observe the manufacturer's notes on balancing the series-connected capacitors. When dimensioning the additional capacitor, take into consideration the tolerance and the age-related reduction of capacity. The discharge time of the DC link can be increased significantly if no sufficiently low-resistance balancing or discharge resistors are connected.

X1 Motor Connection Terminal

Current rating in A	Terminals Phoenix	Recommended minimum cross section in mm ²	Connectible line cross section in mm ²	Breakaway torque in Nm
350	UKH150	2x50	35 ... 150	25 ... 30
500	UKH150	2x70	35 ... 150	25 ... 30
700	UKH240	2x120	70 ... 240	25 ... 30

Tab.: 5-3

When connecting parallel motor cables, make sure that the flexible leads of the individual cable are crimped in a common connector sleeve. For this purpose, use a suitable crimping tool.

X2 RS232 Interface

Only for service purposes.

X3 Analog Outputs and Signal Contacts

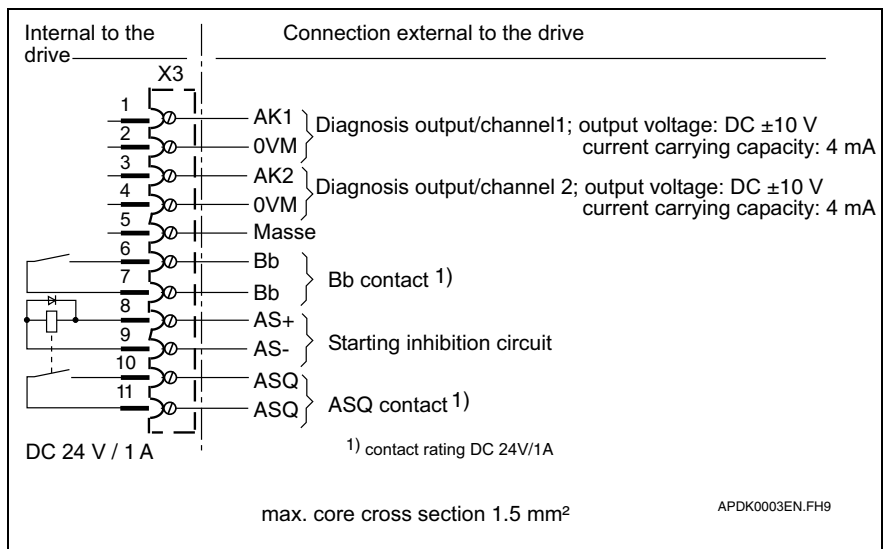


Fig.: 5-6 Terminal assignment at X3

Analog diagnosis outputs (AK1 and AK2)

By means of the analog diagnosis outputs, various internally-generated values can be output for test purposes. For more details, refer to the documentation "DIAX03 – Description of Functions".

Range of output voltage: DC ±10 V

Current carrying capacity: 4 mA

Ready for input power (Bb contact)

The Bb contact is closed when all drive-internal monitor functions signal a regular status.

Then, the drive is ready for input power.

In case of malfunction, the contact opens and internal power contactor drops if P-0-0118 = 1 is set.

**CAUTION**

Damages can be caused by uncontrolled coasting of the motor after opening of the Bb contact!

⇒ If coasting of the motor after opening of the Bb contact is critical for your application, use a bleeder or a service brake.

**CAUTION**

Malfunction of the unit by damaged Bb1 contact!

⇒ Observe the following instructions to avoid damaging the Bb1 contact and thus prevent malfunctioning of the unit.

- Do not overlap the contact (loadability: refer to Fig.: 5-6).
- Do not connect the contactor coils directly to the contact (high short-time currents!)
- Do not use any varistors to protect the contact.

Starting lockout function (Inputs As+, AS-)

You can avoid unintended motor starting in case of malfunction by means of the inputs AS+ and AS-.

Note: This function does not allow for stopping axes which are being moved!

To activate the starting lockout function, apply 20 ... 30 V DC between the AS+ and AS- terminals. The output of the power supply unit must be at least 1.5 W.

Acknowledgement starting lockout function (ASQ contact)

The contact closes when the "Starting lockout function" is active. Use the ASQ contact as an acknowledgement for activation of the internal starting lockout relay.

Contact load: DC 24 V, 1 A

X4 Motor Feedback

To connect motor feedback, please observe the following instructions:

- Use the Rexroth Indramat ready-made feedback cable.
- When planning the system, take note of the maximum cable length of 75 m (Rexroth Indramat cable).
- Only operate motor-and-controller combinations which are documented in the configuration sheets.

**CAUTION**

Malfunction of the drive, or unforeseeable danger at the system by incorrectly connected feedback lines!!

⇒ Make sure that the feedback connection is correctly wired (ensured when you use the Rexroth Indramat readymade feedback cables).

⇒ Only connect motors to X4 which have DSF or GDS feedback.

⇒ Connect the feedback lines of motors with gear-type encoders to the auxiliary plug-in module DZF.

X6 Motor Temperature Registration and Brake Addressing

Terminals Phoenix	Recommended minimum cross section in mm ²	Connectible line cross section in mm ²	Breakaway torque in Nm
	2,5	0,5 ... 6	0.5 ... 1

Tab.: 5-4

Terminal	Designation
X6.1	TM +
X6.2	TM -
X6.3	Mass
X6.4	Brake +
X6.5	Brake 0V

Tab.: 5-5

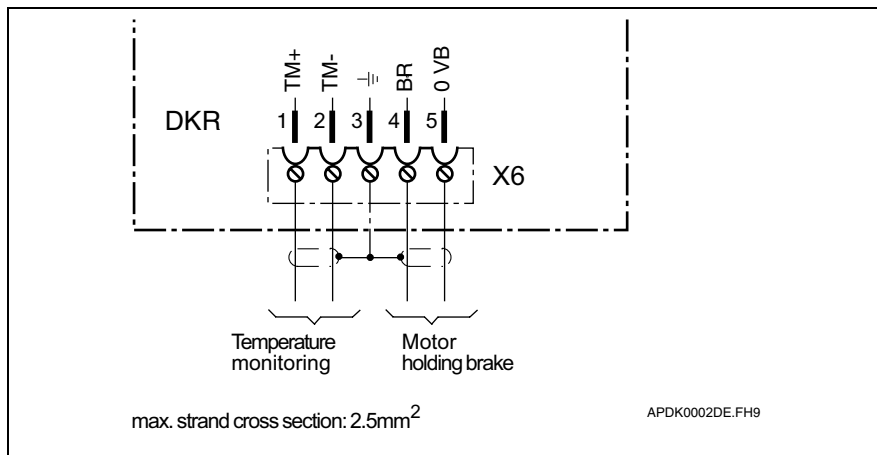


Fig.: 5-7 Terminal assignment to X6

The motor temperature as well as the holding brake are monitored and controlled by the drive controller. For connecting the cables the X6 terminal, you have two alternatives:

- Use a ready-made motor power cable, or
- use two shielded line pairs (motor temperature monitoring will not function without a shield!).

The maximum cable length is 75 m.

Connection for Motor Fans at the Q2 Motor Protection Switch

Q2 power circuit-breaker	Max. rated current in A	Connectible conductor cross-section in mm ²	Recommended minimum cross section in mm ²
Siemens 3RV1011	5	1 – 2 x 0,5 ... 2,5	1,5

Tab.: 5-6

Voltage is supplied to the motor fan only after power supply has been activated. See Fig.: 5-4

X7 Signal Outputs

Internal to the drive	External to the drive	Internal contact	
		Open	Closed
	Bb1 contact, "Ready for operation"	<ul style="list-style-type: none"> • Error • No electronics supply 	Ready for input power
	UD Contact	<ul style="list-style-type: none"> • DC bus voltage < 400 V 	<ul style="list-style-type: none"> • Power input in order
	TVW Contact, early temperature warning (not used)	<ul style="list-style-type: none"> • Overload of emergency bleeder 	<ul style="list-style-type: none"> • Emergency bleeder in order
	K1NC Contact "Acknowledgement Power OFF" (aux. contact of K1)	<ul style="list-style-type: none"> • Power contactor has picked up 	<ul style="list-style-type: none"> • Power contactor has dropped
	K1NO Contact "Acknowledgement Power ON" (auxiliary contact of K1)	<ul style="list-style-type: none"> • Power contactor has dropped 	<ul style="list-style-type: none"> • Power contactor has picked up

Max. strand cross-section: 2.5 mm²

APDK0004EN.FH9

Fig.: 5-8 X7 Signal outputs



Malfunctioning of the unit by damages signal contacts!

⇒ Observe the following instructions to avoid damaging the signal contacts and thus prevent malfunctioning of the unit.

- ⇒ Do not overload the contacts (see Fig.: 5-8)
- ⇒ Do not connect the contactor coils directly to the contacts (high short-time currents!)
- ⇒ Do not use varistors to protect the signal contacts

Ready for input power (Bb1 contact)

The Bb1 contact is closed when

- after activation of control voltage, voltage is available at L1, L2, and L3, and
- all drive-internal monitor functions signal regular status.

Then, the drive is ready for input power.

The contact will open:

- in the event of an error.

Early temperature warning (TVW contact)

The TVW contact opens in case of overload of the internal optional emergency bleeder.

Acknowledgement power OFF (K1NC contact)

The K1NC contact is closed when the internal line contactor has dropped out. You can use the contact as a condition for the release of the door lock.

Acknowledgement power ON (K1NO contact)

The K1NO contact is closed when the internal line contactor is activated. You can use the contact as a condition for the release of the door lock.

UD contact

The UD contact acknowledges regular power supply to the DKR.

It will open in case of the following faults:

- DC bus voltage < 400 V
- power contactor open

Utilization:

- condition for feed release
- Diagnosis

X9 Control Input for Internal Input Power

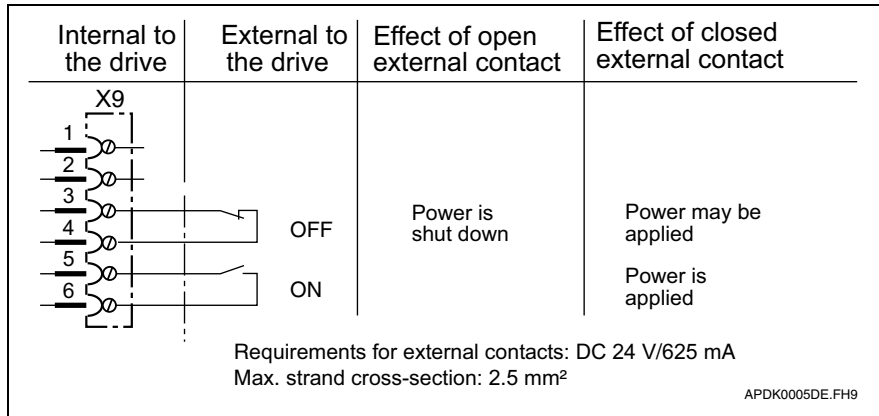


Fig.: 5-9 X9 connector

OFF contact The internal power contactor can be brought into the circuit only when closed (see ON contact).
Opening of the OFF contact immediately switches off the internal power contactor.

Note: The power contactor is not dimensioned to be constantly working under load; i.e. it is suitable only for de-energization and occasional EMERGENCY STOP operations. For EMERGENCY STOP braking, use the "E stop" function (refer to DIAX03 Description of Functions).

ON contact On closing of the ON contact, the internal power contactor is brought into the circuit when

- the OFF contact is closed, and
- drive-internal readiness for operation is signaled (also refer to Bb1 contact).

When the internal power contactor is brought into the circuit, it goes into sealing status.

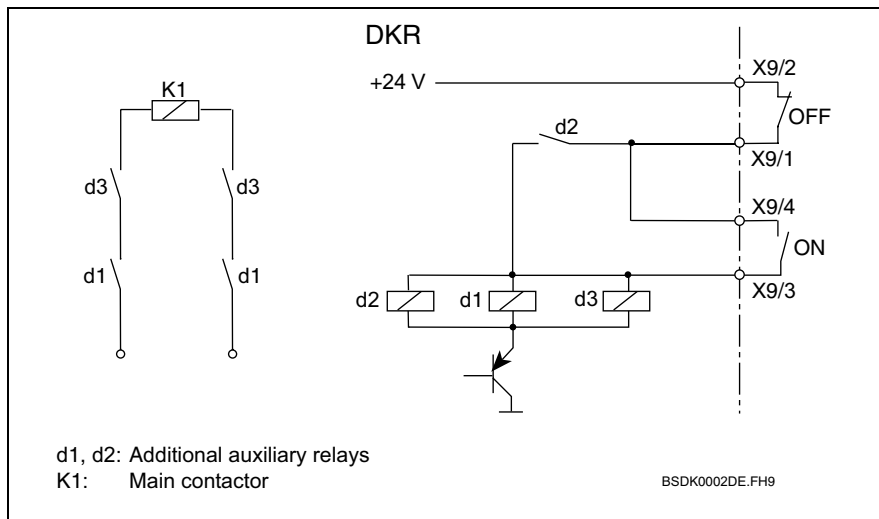


Fig.: 5-10 Internal connection diagram of ON/OFF logics (block diagram)

6 Accessories

6.1 Sets of Connectors

To connect the drive controller, you require:

- the S1-DKS 1 set of connectors (for the connections at the basic unit, without feedback connector).
- The S..-DDS 2 connector set (for the connection of all plug-in modules comprised in the basic unit including the feedback connector).

Connector Set for the Basic Unit

You generally require the connector set S1-DKS 1. It comprises the following connectors:

- X6: Mat. no. 221159
- X9: Mat. no. 219830
- X7: Mat. no. 219464
- X3: Mat. no. 241592

The connector for the motor feedback connection (X4: Mat. no. 231715) is always comprised in the set of connector accessories for the configuration S.. – DDS 2.

Connector Set for all Plug-In Modules of a Configuration Including Feedback Connection

The configuration of your drive controller defines the required connector set S..-DDS 2. Apart from the connectors for all plug-in modules, this also comprises the connector for connecting the feedback to the drive controller.

Because of the multitude of possible combinations, no connector sets are specified in this Documentation. To find out which connector set you require, please contact your Rexroth Indramat sales engineer.

Note: If you wish to use ready-made cable, you may not need some of the connectors of a connector set S..-DDS 2. For this reason, Rexroth Indramat alternatively offers the connectors of all components individually. To this effect, please refer to the Documentation entitled "DIAX03 Plug-In Modules for Digital Intelligent Drive Controllers" or the project planning documents for the respective motor.

Note: Indramat offers appropriate bushings for the connection of the control cables.
See DOK-CONNEX-CABLE*STAND-AU**-EN-P 282688.
Example: DSF feedback cable: Cable in the IKS4373 cabinet, bushing box INS0518/A01, external cable IKS4065.

6.2 Optical Fiber

Controllers with SERCOS interface are connected to the higher-level controls by means of optical fibers.

The optical fibers (cable, connector, or completely ready-made cable) must be ordered separately.

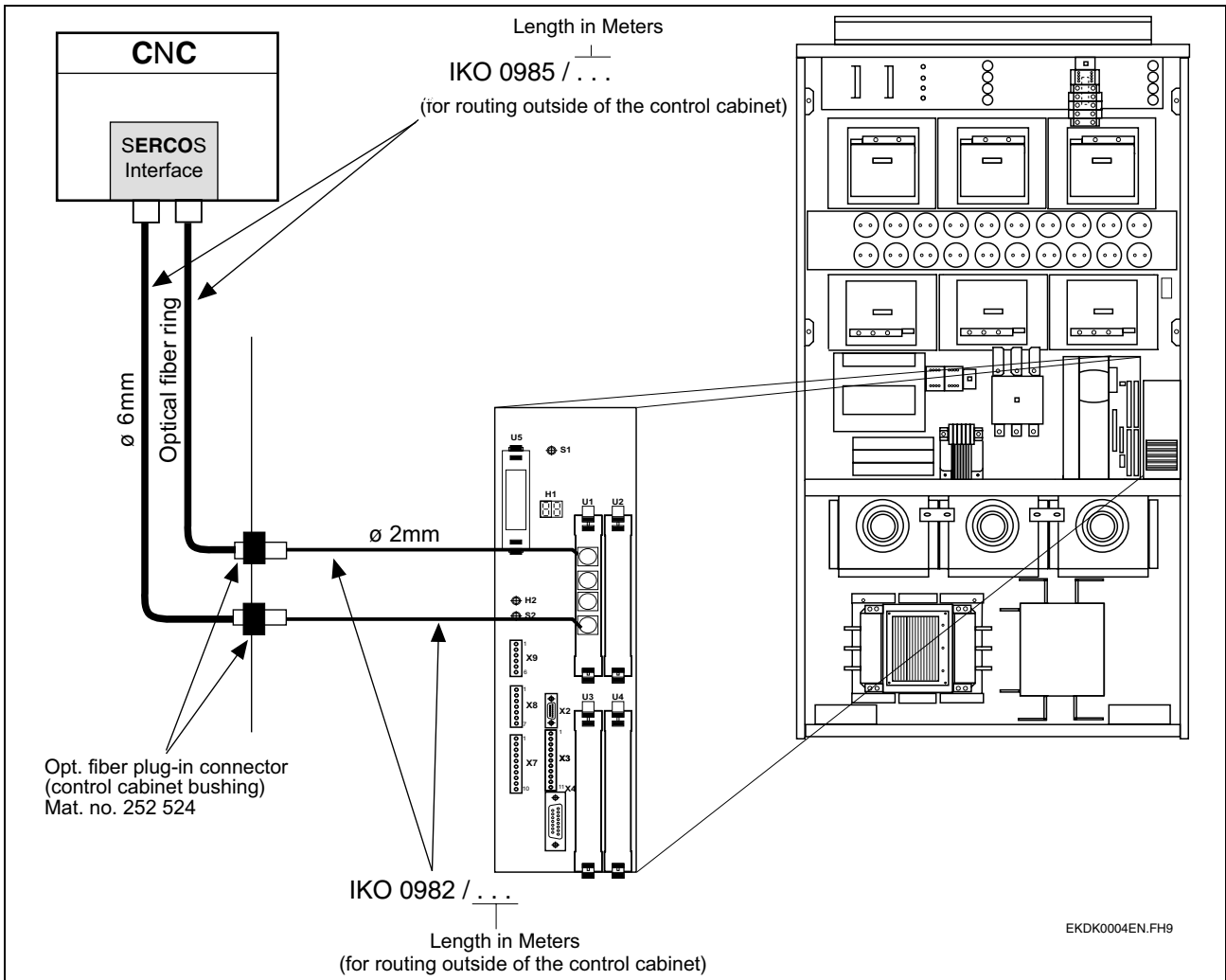


Fig.: 6-1 Selection of ready-made optical fibers

Note: For more detailed information on optical fibers, please refer to the user manual "Handling of Optical Fibers".

7 Transport and Storage

7.1 Transport



CAUTION

Material damage by incorrect transport!

- ⇒ Use suitable means of transport.
 - ⇒ Use a shock-damping base if significant shocks can occur during transport.
 - ⇒ Always send electrostatic sensitive devices (e.g. plug-in modules) in conductive packaging.
-

7.2 Storage



CAUTION

Material damage by incorrect storage!

- ⇒ When selecting your location for storing the products, observe the admissible temperature range for storing the devices / plug-in modules: -30 °C to +85 °C.
 - ⇒ Store the devices /plug-in modules in a dry, dust-free and shock-proof place.
 - ⇒ Always keep electrostatic sensitive devices (e.g. plug-in modules) in conductive packaging.
-

8 Identification of the Products

8.1 General

On delivery, the drive controller with all accessories is packed in a cardboard box. Attached to the cardboard box, you will find one copy of the delivery note in an envelope. Unless specifically asked for, there will be no other accompanying documents.

With larger orders, the delivery may be packed into several boxes. This will be noted in the delivery note or the bill of lading.

8.2 Delivery Note and Type Plate Label

In the delivery note, all the products included in the delivery are listed by name and order identification.

On the packaging of the drive controller itself, there is a type plate label to identify the drive controller and the order handling process.

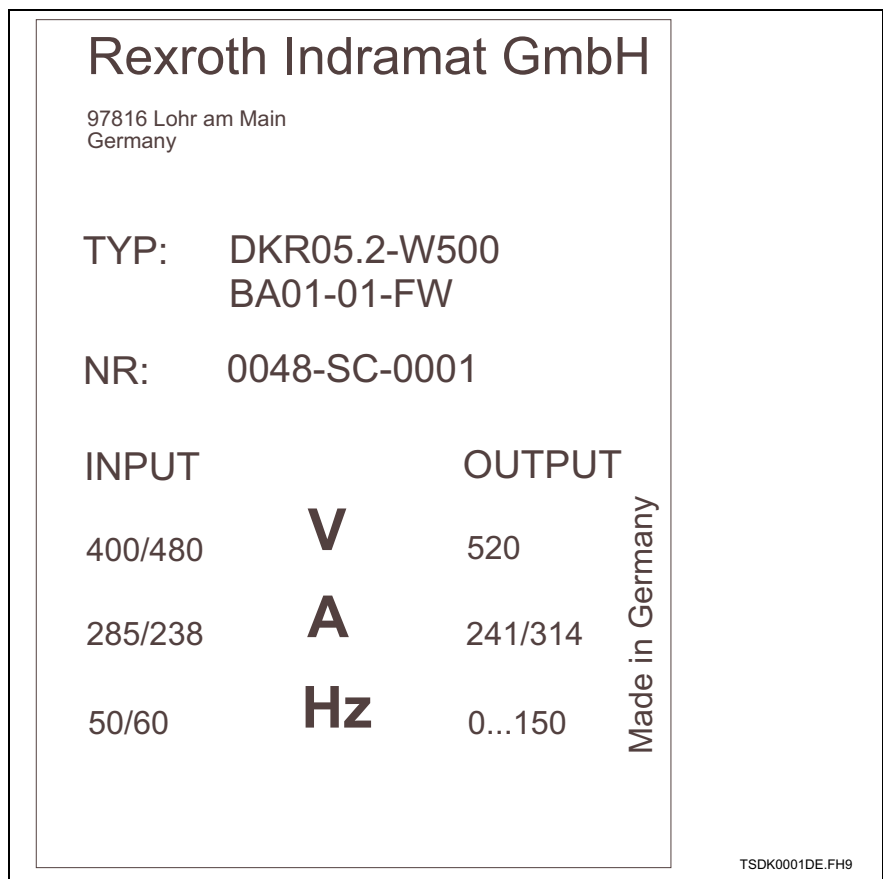


Fig.: 8-1 Type plate DKR05.2

8.3 Type Plates of the Drive Controller

The drive controller is unambiguously identified by two type plates:

- Type plate of the basic unit in the control cabinet below the right capacitor support.
- System configuration type plate at the inside of the cabinet door. This plate is used to:
 - identify the basic unit,
 - identify the components installed / the configuration (any plug-in modules),
 - procure spare parts in case of malfunction, and
 - to provide service information.

Note: Compare all components actually installed in the drive controller to the information on the type plate.

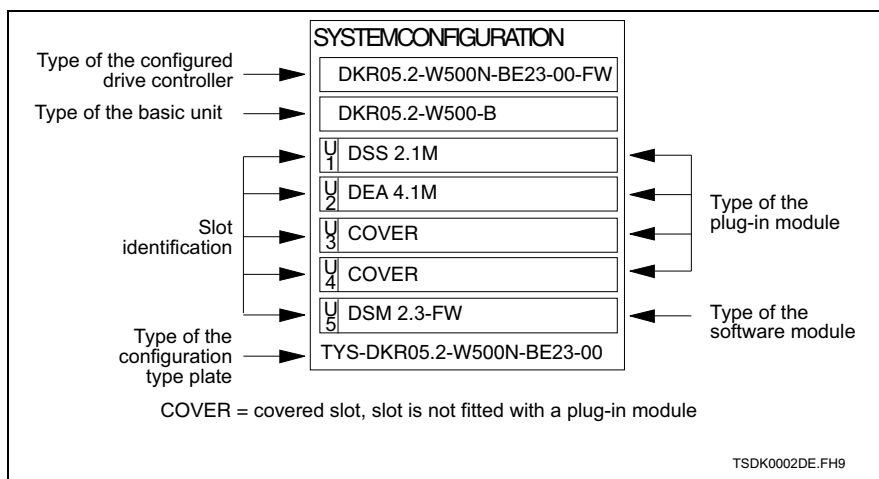


Fig.: 8-2 Example: Configuration type plate DKR05.2.

9 Mounting and Installation

9.1 Mounting of the Control Cabinet



DANGER

Fatal electric shock by live parts with more than 50V!

- ⇒ De-energized the control cabinet before starting to work at it. The mains switch must be protected from unintended or unauthorized reconnection.
- ⇒ Before taking up work, a skilled person must check by means of a suitable measuring tool whether parts of the control cabinet are under residual voltage (caused e.g. by capacitors etc.). If this is the case, wait for them to discharge.

Note: Use suitable lifting tools to mount the control cabinet. Observe the weight information for the DKR05.2.

DKR	Weight in kg
DKR05.2-W350	500
DKR05.2-W500	550
DKR05.2-W700	600

Tab.: 9-1 Weight table DKR05.2

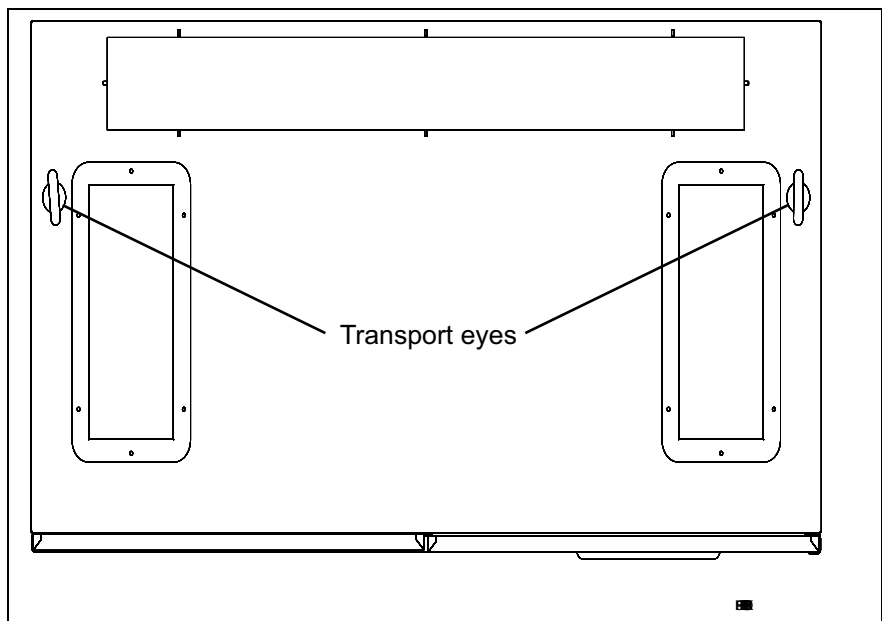


Fig.: 9-1 Transport eyes

9.2 Wiring of the Control Cabinet

Note: All Rexroth Indramat connection diagrams are exclusively provided to draw up the plant diagrams. For wiring the plant, the machine manufacturer's plant diagrams are generally binding!



DANGER

Fatal electric shock by live parts with more than 50V!

- ⇒ Only skilled persons are qualified to perform work at the electrical plant. Electric tools are indispensable.
 - ⇒ Before starting to work, de-energize the plant and protect the mains switch from unintended reconnection.
 - ⇒ Before taking up work, check by means of a suitable measuring tool whether parts in the control cabinet are under residual voltage (caused e.g. by capacitors etc.). If this is the case, wait for them to discharge.
-



CAUTION

Interrupting or connecting live conductors can cause personal injury or damage!

- ⇒ Only connect or separate plug-in connector when they are dry, and the plant is switched off.
 - ⇒ During operation of the plant, all plug-in connectors must be securely screwed down.
-



WARNING

Risk of short circuit by cooling liquid or lubricant!

- ⇒ When mounting or replacing drive components, cover the open sides of power plug-in connectors by protective caps if contact with cooling liquid or lubricant cannot be excluded.
 - ⇒ 1MB frameless spindle motors with power plug-in connectors: The back of the flange socket at the spindle or machine housing must not be moistened with cooling liquid or lubricant.
-



CAUTION

Damage to electronic components by electrostatic discharge!!

- ⇒ Before taking up work, touch a grounded object (e.g. door of the control cabinet). This will discharge your body.
 - ⇒ Always place parts and tools on grounded spaces.
 - ⇒ For soldering, always use grounded soldering irons.
-

10 Service and Tests

10.1 Error Diagnosis

The drive controller signals drive errors through

- the Drive Top, and
- the H1 status display at the front of the unit.

Diagnosis by way of Documentation

To interpret any error messages of the drive controller, you must have the Documentation entitled "Notes on Trouble Shooting".

Diagnosis per hotline

Control panel with a display to indicate actual values and statuses of the inverter at the mains side (infeed/recovery).

Diagnosis by way of the control panel of the system inverter

The control panel is only used for indication purposes. Only service personnel may parameterize the electronic control circuitry by means of the control panel.

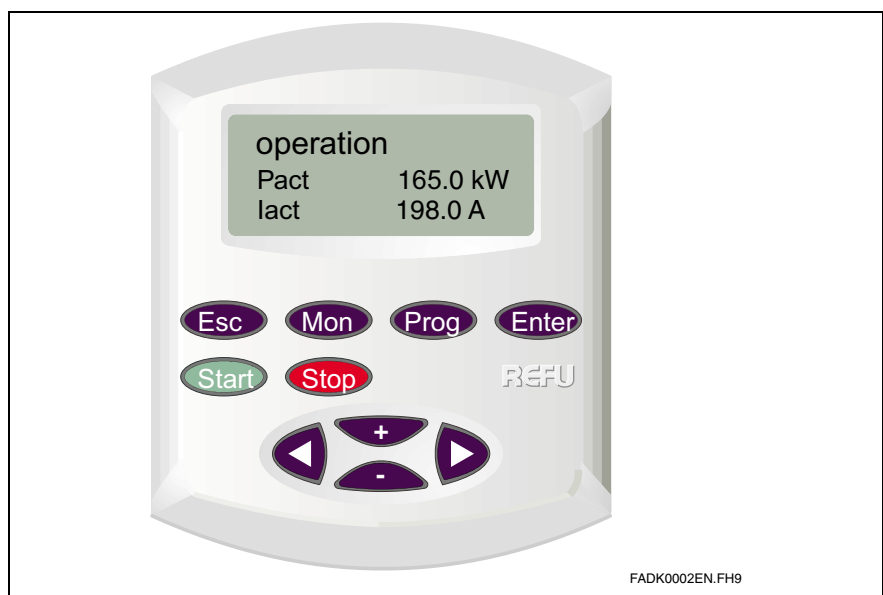


Fig.: 10-1 Control panel RZB01.1

Display and Indications

Operation	Status
P_{act} 165,0 kW	Mains active power (current value)
L_{act} 198,0 A	Line current (actual/current value)

Statuses and their Meaning

Ready for operation: for	Voltages are available, mains inverter is waiting ON command
Operation:	Mains inverter is working ($U_{ZK} = 750 \text{ V}$)
External warning:	(after voltage has been applied) faulty direction of rotating field U1, V1, W1.
Error:	see List of Errors

	Mains inverter fault	Description	DIAX03 fault
1	External fault 1	Phase error, mains low voltage	F2/82
2	External fault 3	Mains overvoltage	F2/83
3	External fault 4	Mains failure	F2/81
4	Excessive DC bus voltage	Excessive DC bus voltage	F8/93
5	DC bus voltage too low	DC bus voltage too low	F2/26
6	Unit overtemperature	Overtemperature in the power section	F8/89
7	Main contactor	Faulty status main contactor	F2/26
8	Precharging	Precharging process interrupted	F8/91
9	Inverter	Overcurrent in the power section	F8/89
10	Power supply	Faulty supply of +/- 15 V	F8/90
11	Braking resistor overload	Overload of braking resistor	F8/20

Tab.: 10-1

The above inverter faults can generally be acknowledged through the operation process of the DIAX03 after the cause of fault has been remedied.

	Mains inverter fault	Error handling
1	External fault 1	<p>The applied system voltage is permanently monitored. During checking, a phase error was recognized.</p> <p>Cause: A mains phase has failed or is outside of the admissible tolerance.</p> <p>Remedy: Check the power connection according to the project documentation of the used drive controller.</p>
2	External fault 3	<p>Cause: System voltage is above the admissible value (>480 V +10%)</p> <p>Remedy: Check the power connection according to the project planning documentation of the used drive controller.</p>
3	External fault 4	<p>Cause: During operation, the system voltage has failed for at least 3 mains periods. Thereafter, the drive was stopped with the set error reaction.</p> <p>Remedy: Check power connection according to the project planning documentation.</p>
4	Excessive DC bus voltage	<p>Regenerative power cannot be returned to the mains.</p> <p>Cause:</p> <ol style="list-style-type: none"> 1. Irregular power connection 2. Excessive regenerative power 3. Regeneration defect <p>Remedy:</p> <p>Ad 1 Check power connection according to the project planning documentation. Ad 2 Check drive machine and control. Ad 3. Replace unit</p>

	Mains inverter fault	Error handling
5	DC bus voltage too low	<p>DC bus voltage is monitored. The drive controller is informed whether the DC bus voltage is above a minimum admissible value. When the value falls below this limit, the settings of P-0-0119 define the reaction, i.e. cancellation of the DC bus voltage message by the line-side inverter.</p> <p>Prerequisite: In parameter P-0-0118, Power shutdown in case of error, handling of undervoltage has been set as an error.</p> <p>Cause:</p> <ol style="list-style-type: none"> 1. Power shutdown without previous drive de-activation through drive enable signal (DE) 2. Drive activation through drive enable signal (DE) without previous activation of the power section. 3. Mains failure. <p>Remedy:</p> <p>Ad 1. + 2. Check the logics for activation of the drive in the connected control.</p> <p>Ad 3. Check power connection according to the project planning documentation.</p>
6	Unit overtemperature	<p>The unit has switched off for excess heat sink temperature.</p> <p>Cause:</p> <ol style="list-style-type: none"> 1. Soiled air filter. 2. Blower failure. 3. Inadmissible ambient conditions. <p>Remedy:</p> <p>Ad 1. Replace air filter</p> <p>Ad 2. Replace blower</p> <p>Ad 3. Check ambient conditions according to the project planning documentation.</p>
7	Main contactor	<p>The status of the main contactor is monitored.</p> <p>Cause:</p> <ol style="list-style-type: none"> 1. Main contactor "sticks" 2. Main contactor activation or main contactor reaction faulty 3. No trigger command <p>Remedy:</p> <p>Ad 1. Replace main contactor</p> <p>Ad 2. Re-wire, or replace main contactor</p> <p>Ad 3. Please contact our customer service department.</p>
8	Precharging	<p>No DC bus voltage builds up after switching on of the precharge contactor.</p> <p>Cause:</p> <ol style="list-style-type: none"> 1. Mains undervoltage 2. In case of short circuit of the DC bus, no voltage can build up when the unit is switched on. <p>Remedy:</p> <p>Ad 1. Check power connection according to the project planning documentation.</p> <p>Ad 2. Please contact our customer service department.</p>
9	Inverter	<p>The current supplied or returned by the unit has reached the switch-off limit of the power transistors.</p> <p>Cause:</p> <ol style="list-style-type: none"> 1. System voltage fault 2. Power section defect <p>Remedy:</p> <p>Ad 1. Check power connection according to the project planning documentation.</p> <p>Ad 2. Please contact our customer service department.</p>
10	Power supply	<p>Cause:</p> <p>+/- 15 V electronics power supply does not work</p> <p>Remedy:</p> <p>Please contact our customer service department.</p>

	Mains inverter fault	Error handling
11	Braking resistor overload	<p>Cause: The energy of a braking motor cannot be converted with sufficient speed by the braking resistors (bleeders) used. The energy converted by the internal bleeder is computed. When the maximum amount of energy the bleeder is able to absorb is exceeded, the bleeder is switched off. A bleeder overload error is signaled.</p> <p>Remedy: Reduce the gradient of the braking ramp, or increase bleeder resistance by an additional bleeder. After the bleeder has cooled off, the unit can be operated once more.</p>

11 Index

2

2AD-Motor 3-1

A

Accessories 6-1

Acknowledgement power OFF 5-13

Acknowledgement power ON 5-13

Acknowledgement starting lockout function 5-11

Auxiliary plug-in module 3-4

Auxiliary supply 5-7

Auxiliary supply transformer 5-8

B

Basic Unit 3-3

Bb1 contact 5-13

Brake chopper 3-4

C

Cable cross sections 5-3

Command interface card 3-4

Components 3-2

Connection for motor fans at the Q2 motor protection switch 5-12

Konstruktion 3-1

Control panel 10-1

Cooling 4-2

D

DC link capacitors 5-9

Derating 4-1

Dimensions 4-4

Dimensions of the control cabinet 4-4

DKR05.2 Front view 3-1

DSM02.3 3-3

E

Early temperature warning 5-13

Electromagnetically compatible drive design 5-1

Elektrical installation 5-1

Entry of cables 5-5

Error

Braking resistor overload 10-4

DC bus voltage too low 10-3

Excessive DC bus voltage_ 10-2

External fault 1_ 10-2

External fault 3_ 10-2

External fault 4_ 10-2

Inverter 10-3

Main contactor 10-3

Power supply 10-3

Precharging 10-3

Unit overtemperature 10-3

Error diagnosis 10-1

Error handling 10-2

F

Filter mat 4-2

Firmware module 3-3

Floating DC-link voltage 3-8

G

Ground wire cross section 5-3
Grounded 3-phase systems 5-8

H

H1 status display 10-1

I

Identification 8-1
Intended use
 Fields of application 1-2
 Introduction 1-1
Interruption of auxiliary supply 5-8

L

Lifting tools 9-1

M

Mechanical installation 4-1
Motor conductors 5-3
Mounting site 4-1

N

Non-intended use
 consequences, exclusion of liability 1-1
Non-Intended Use 1-2

O

Optical Fiber 6-2

P

Plant diagram 9-1
Positions of terminals and conductors 5-4
Power cables 5-3
Power connection 3-2, 5-7
Protective ground 5-3

R

Range of application 3-1
Ready for operation 5-13
Residual-current circuit-breaker 5-7
Rotating field 5-7
RZB01.1 10-1

S

S.-DDS 2 6-1
S1-DKS 1 6-1
Safety notes for electrocical drives 2-1
SERCOS interface 6-2
Set of connectors 6-1
Starting lockout function 5-11
Status indication 10-1
Storage 4-1, 7-1
Stray inductance 5-9
System configuration type plate 8-2

T

Technical data 3-7
Terminal assignment to X6 5-12
Thermal dimensioning 5-9
Transport 7-1
Type code 3-5
Type plate DKR05.2 8-1

U

UD contact 5-13
Ungrounded 3-phase systems 5-8
Use *See* appropriate use *and see* inappropriate use

V

Varistors 5-11

W

Warnings 5-2
Wiring of the control cabinet 9-1

X

X1 Motor connection terminal 5-10
X2 RS232 interface 5-10
X3 Analog outputs and signal contacts 5-10
X4 Motor feedback 5-11
X6 Motor temperature registration and brake addressing 5-12
X7 Signal outputs 5-13
X9 Control input for internal input power 5-14

12 Service & Support

12.1 Helpdesk

Unser Kundendienst-Helpdesk im Hauptwerk Lohr am Main steht Ihnen mit Rat und Tat zur Seite. Sie erreichen uns

- telefonisch: **+49 (0) 9352 40 50 60**
über Service Call Entry Center Mo-Fr 07:00-18:00
- per Fax: **+49 (0) 9352 40 49 41**
- per e-Mail: **service@indramat.de**

Our service helpdesk at our headquarters in Lohr am Main, Germany can assist you in all kinds of inquiries. Contact us

- by phone: **+49 (0) 9352 40 50 60**
via Service Call Entry Center Mo-Fr 7:00 am - 6:00 pm
- by fax: **+49 (0) 9352 40 49 41**
- by e-mail: **service@indramat.de**

12.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

oder **+49 (0) 171 333 88 26**
+49 (0) 172 660 04 06

After helpdesk hours, contact our service department directly at

or **+49 (0) 171 333 88 26**
+49 (0) 172 660 04 06

12.3 Internet

Weitere Hinweise zu Service, Reparatur und Training finden Sie im Internet unter

www.indramat.de

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit Ihrem lokalen Ansprechpartner auf. Die Adressen sind im Anhang aufgeführt.

- Verkaufsniederlassungen
- Niederlassungen mit Kundendienst

Additional notes about service, repairs and training are available on the Internet at

www.indramat.de

Please contact the sales & service offices in your area first. Refer to the addresses on the following pages.

- sales agencies
- offices providing service

12.4 Vor der Kontaktaufnahme... - Before contacting us...

Wir können Ihnen schnell und effizient helfen wenn Sie folgende Informationen bereithalten:

1. detaillierte Beschreibung der Störung und der Umstände.
2. Angaben auf dem Typenschild der betreffenden Produkte, insbesondere Typenschlüssel und Seriennummern.
3. Tel./Faxnummern und e-Mail-Adresse, unter denen Sie für Rückfragen zu erreichen sind.

For quick and efficient help, please have the following information ready:

1. Detailed description of the failure and circumstances.
2. Information on the type plate of the affected products, especially type codes and serial numbers.
3. Your phone/fax numbers and e-mail address, so we can contact you in case of questions.

12.5 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

vom Ausland: (0) nach Landeskennziffer weglassen!
from abroad: don't dial (0) after country code!

Vertriebsgebiet Mitte Germany Centre Rexroth Indramat GmbH Bgm.-Dr.-Nebel-Str. 2 97816 Lohr am Main Kompetenz-Zentrum Europa Tel.: +49 (0)9352 40-0 Fax: +49 (0)9352 40-4885	SERVICE CALL ENTRY CENTER MO – FR von 07:00 - 18:00 Uhr from 7 am – 6 pm Tel. +49 (0) 9352 40 50 60 service@indramat.de	SERVICE HOTLINE MO – FR von 17:00 - 07:00 Uhr from 5 pm - 7 am + SA / SO Tel.: +49 (0)172 660 04 06 oder / or Tel.: +49 (0)171 333 88 26	SERVICE ERSATZTEILE / SPARES verlängerte Ansprechzeit - extended office time - ♦ nur an Werktagen - only on working days - ♦ von 07:00 - 18:00 Uhr - from 7 am - 6 pm - Tel. +49 (0) 9352 40 42 22
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