

Rexroth IndraDrive C Drive Controllers Power Sections HCS03.1

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Edition 03

Project Planning Manual



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Validity	<p>The specified data only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The given information does not release the user from the obligation of own judgement and verification. It must be remembered that our products are subject to a natural process of wear and aging.</p>
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1 Introduction

1.1 Documentation

About this Documentation

This documentation basically contains the technical data of the Rexroth IndraDrive C HCS03.1 drive controllers.



WARNING

Personal injury and property damage caused by incorrect project planning for applications, machines and installations!

⇒ Take the content of the Project Planning Manual "Rexroth IndraDrive Drive System" (DOK-INDRV*-SYSTEM****-PRxx-EN-P; part no. R911309636) into account.

For complete project planning of a Rexroth IndraDrive drive system you need, in any case, the Project Planning Manual "Rexroth IndraDrive Drive System" (DOK-INDRV*-SYSTEM****-PRxx-EN-P; part no. R911309636). This Project Planning Manual, among other things, contains:

- specifications for the components of the drive system
- configuration of the drive system components
- arrangement of the components in the control cabinet
- electromagnetic compatibility (EMC)
- types of mains connection
- requirements to the mains connection
- control circuits for the mains connection
- connections of the components in the drive system
- fusing and selecting the mains contactor
- accessories in the drive system
- calculations (determining appropriate drive controller; mains connection; leakage capacitance; operating data of mains filters; selecting the 24V supply; braking behavior when using a DC bus resistor unit)
- notes on how to replace devices

Documentations - Overview

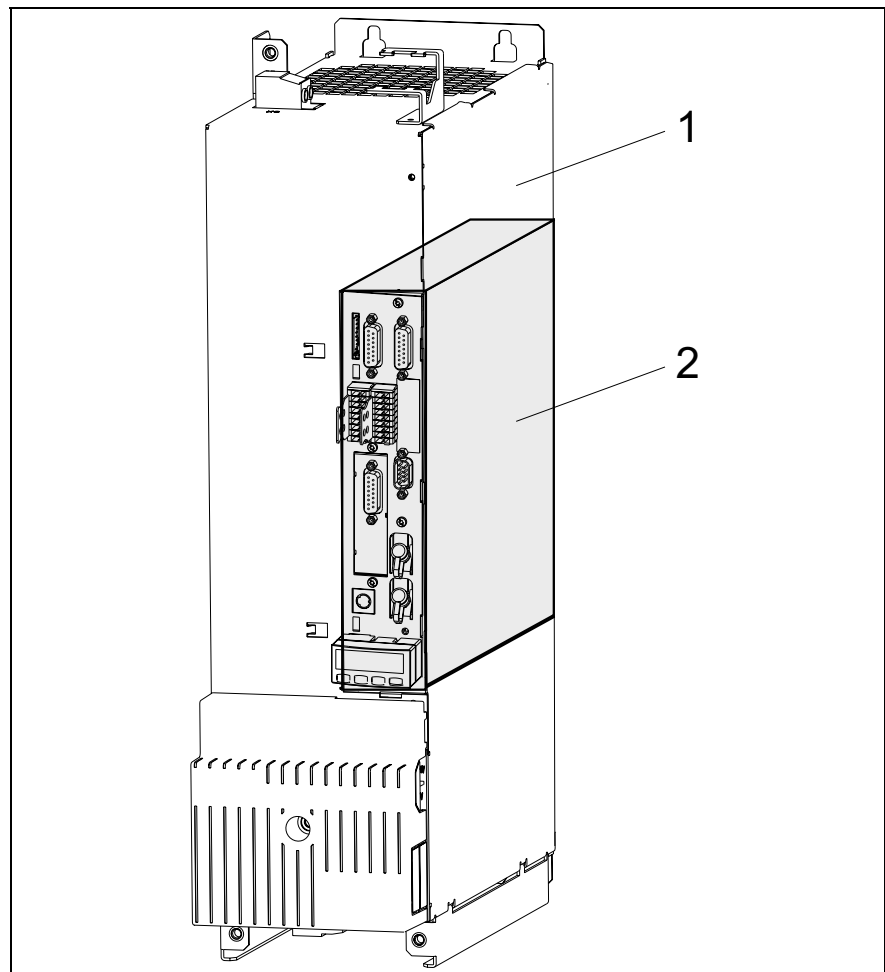
For project planning of the drive system the following documentations are available:

Title	Kind of documentation	Document typecode ¹⁾
Rexroth IndraDrive Drive System	Project Planning Manual	DOK-INDRV*-SYSTEM*****-PRxx-EN-P
Rexroth IndraDrive Drive Controllers Control Sections CSx	Project Planning Manual	DOK-INDRV*-CSH*****-PRxx-EN-P
Rexroth IndraDrive M Drive Controllers Power Sections HMx	Project Planning Manual	DOK-INDRV*-HMS+HMD****-PRxx-EN-P
Rexroth IndraDrive C Drive Controllers Power Sections HCS02.1	Project Planning Manual	DOK-INDRV*-HCS02.1****-PRxx-EN-P
Rexroth IndraDrive C Drive Controllers Power Sections HCS03.1	Project Planning Manual	DOK-INDRV*-HCS03.1****-PRxx-EN-P
Rexroth IndraDrive Supply Units	Project Planning Manual	DOK-INDRV*-HMV-*****-PRxx-EN-P
Rexroth IndraDrive Additional Components	Project Planning Manual	DOK-INDRV*-ADDCOMP****-PRxx-EN-P
Rexroth IndraDrive Integrated Safety Technology	Functional and Application Description	DOK-INDRV*-SI**-**VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Functional Description	DOK-INDRV*-MP*-02VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Functional Description	DOK-INDRV*-MP*-03VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Functional Description	DOK-INDRV*-MP*-04VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Parameter Description	DOK-INDRV*-GEN**-**VRS**-PAxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Troubleshooting Guide	DOK-INDRV*-GEN**-**VRS**-WAxx-EN-P
Rexroth Connection Cables	Selection Data	DOK-CONNEX-CABLE*STAND-AUxx-EN-P
Rexroth IndraDyn A Asynchronous Motors MAD/MAF	Project Planning Manual	DOK-MOTOR*-MAD/MAF****-PRxx-EN-P
Rexroth IndraDyn S Synchronous Motors MSK	Project Planning Manual	DOK-MOTOR*-MSK*****-PRxx-EN-P
Rexroth IndraDyn T Synchronous Torque Motors MBT	Project Planning Manual	DOK-MOTOR*-MBT*****-PRxx-EN-P
Rexroth IndraDyn H Synchronous Kit –Spindle Motors MBS-H	Project Planning Manual	DOK-MOTOR*-MBS-H*****-PRxx-EN-P
Rexroth IndraDyn L Synchronous Linear Motors MLF	Project Planning Manual	DOK-MOTOR*-MLF*****-PRxx-EN-P
Safety Instructions for Electrical Drives	Safety Guidelines	DOK-GENERAL-DRIVE*****-SVSx-MS-P

1) In the document typecodes "xx" is a wild card for the current edition of the documentation (example: "PR01" is the first edition of a Project Planning Manual)

Fig. 1-1: Documentations - overview

1.2 Basic Design of a Drive Controller



- 1: Power section
2: Control section

Fig. 1-2: Basic design

The drive controller consists of two essential parts:

- Power section
- Control section

Power Section

The following are connected to the power section:

- mains voltage
- motor
- 24 V power supply (optional)
- module bus (for cross communication in the case of DC bus connection with other devices)
- motor holding brake (optional)
- motor temperature sensor (optional)
- braking resistor (optional)

Control Section

The control section is a separate component that is plugged into the power section. The drive controller is supplied ex works complete with control section.

The control section may only be replaced by qualified personnel.

The contacts X31/1 and X31/2 are connected to the control section as Bb contacts.

Note: The control sections are described in a separate documentation (see page 1-2).

1.3 General Information on How to Install the Drive Controller

Damage can be caused to the drive controller or circuit boards if electrostatic charging present in people and/or tools is discharged across them. Therefore, please note the following information:



CAUTION

Electrostatic charges can cause damage to electronic components and interfere with their operational safety!

Exposed conductive parts coming into contact with components and circuit boards must be discharged by means of grounding. Otherwise errors may occur when triggering motors and moving elements.

Such exposed conductive parts include:

- the copper bit when soldering
- the human body (ground connection caused by touching a conductive, grounded item)
- parts and tools (place them on a conductive support)

Endangered components may only be stored or dispatched in conductive packaging.

Note: Rexroth connection diagrams are only to be used for producing installation connection diagrams! The machine manufacturer's installation connection diagrams must be used for wiring the installation!

- Lay signal lines separately from the load resistance lines because of the occurrence of interference.
- Transmit analog signals (e.g. command values, actual values) via shielded lines.
- Do not connect mains, DC bus or power leads to low voltages or allow them to come into contact with these.
- When carrying out a high voltage test or an applied-overvoltage withstand test on the machine's electrical equipment, disconnect all connections to the devices. This protects the electronic components (allowed in accordance with EN 60204-1). During their routine testing, Rexroth drive components are tested for high voltage and insulation in accordance with EN 50178.



CAUTION

Risk of damage to the drive controller by connecting and disconnecting live connections!

⇒ Do not connect and disconnect live connections.

2 Important Directions for Use

2.1 Appropriate Use

Introduction

Rexroth 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 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 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 products take 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 Bosch Rexroth 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 Functional Descriptions.

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

The drive controllers have been developed for use in single- and multi-axis drive and control tasks.

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

Typical applications of the drive controllers include:

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

The drive controllers may only be operated under the assembly and installation conditions described in this documentation, in the specified position of normal use and under the ambient conditions as described (temperature, degree of protection, humidity, EMC, etc.).

2.2 Inappropriate Use

Using the drive controllers outside of the operating conditions described in this documentation and outside of the indicated technical data and specifications is defined as "inappropriate use".

Drive controllers must not be used, if...

- ...they are subject to operating conditions that do not meet the specified ambient conditions. This includes, for example, operation under water, under extreme temperature fluctuations or extremely high maximum temperatures.
- Furthermore, the drive controllers must not be used in applications which have not been expressly authorized by Rexroth.
- Please carefully follow the specifications outlined in the general Safety Instructions!

3 Safety Instructions for Electric Drives and Controls

3.1 General Information

Using the Safety Instructions and Passing them on to Others

Do not attempt to install or commission this device without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with the device. If you do not have the user documentation for the device, contact your responsible Bosch Rexroth sales representative. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the device.

If the device is resold, rented and/or passed on to others in any other form, then these safety instructions must be delivered with the device.



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

Instructions for Use

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

- Bosch Rexroth AG is not liable for damages resulting from failure to observe the warnings provided in this documentation.
- Read the operating, maintenance and safety instructions in your language before starting up the machine. If you find that you cannot completely understand the documentation for your product, please ask your supplier to clarify.
- Proper and correct transport, storage, assembly and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this device.
- Only assign trained and qualified persons to work with electrical installations:
 - Only persons who are trained and qualified for the use and operation of the device may work on this device or within its proximity. The persons are qualified if they have sufficient knowledge of the assembly, installation and operation of the equipment as well as an understanding of all warnings and precautionary measures noted in these instructions.
 - Furthermore, they must be trained, instructed and qualified to switch electrical circuits and devices on and off in accordance with technical safety regulations, to ground them and to mark them according to the requirements of safe work practices. They must have adequate safety equipment and be trained in first aid.
- Only use spare parts and accessories approved by the manufacturer.
- Follow all safety regulations and requirements for the specific application as practiced in the country of use.

- The devices have been designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Only use safety-relevant applications that are clearly and explicitly approved in the Project Planning Manual. If this is not the case, they are excluded.
Safety-relevant are all such applications which can cause danger to persons and material damage.
- The information given in the documentation of the product with regard to the use of the delivered components contains only examples of applications and suggestions.
The machine and installation manufacturer must
 - make sure that the delivered components are suited for his individual application and check the information given in this documentation with regard to the use of the components,
 - make sure that his application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Startup of the delivered components is only permitted once it is sure that the machine or installation in which they are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only permitted if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the documentation "EMC in Drive and Control Systems".
- The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national regulations.
- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

Explanation of Warning Symbols and Degrees of Hazard Seriousness

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




Warning symbol with signal word	Degree of hazard seriousness according to ANSI Z 535
 DANGER	Death or severe bodily harm will occur.
 WARNING	Death or severe bodily harm may occur.
 CAUTION	Bodily harm or material damage may occur.

Fig. 3-1: Hazard classification (according to ANSI Z 535)

Hazards by Improper Use



DANGER

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



DANGER

Dangerous movements! Danger to life, severe bodily harm or material damage by unintentional motor movements!



WARNING

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



WARNING

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



CAUTION

Hot surfaces on device housing! Danger of injury! Danger 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!

3.2 Instructions with Regard to Specific Dangers

Protection Against Contact with Electrical Parts

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

Contact with parts conducting voltages above 50 Volts can cause personal danger and electric shock. When operating electrical equipment, it is unavoidable that some parts of the devices conduct dangerous voltage.



DANGER

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

- ⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain and repair this equipment.
- ⇒ Follow general construction and safety regulations when working on electrical power installations.
- ⇒ Before switching on the device, the equipment grounding conductor must have been non-detachably connected to all electrical equipment in accordance with the connection diagram.
- ⇒ Do not operate electrical equipment at any time, even for brief measurements or tests, if the equipment grounding conductor is not permanently connected to the mounting points of the components provided for this purpose.
- ⇒ Before working with electrical parts with voltage potentials higher than 50 V, the device must be disconnected from the mains voltage or power supply unit. Provide a safeguard to prevent reconnection.
- ⇒ With electrical drive and filter components, observe the following:
Wait 30 minutes after switching off power to allow capacitors to discharge before beginning to work. Measure the voltage on the capacitors before beginning to work to make sure that the equipment is safe to touch.
- ⇒ 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 device on. Before switching the equipment on, cover and safeguard live parts safely to prevent contact with those parts.
- ⇒ A residual-current-operated circuit-breaker or r.c.d. cannot be used for electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device according to the relevant standards.
- ⇒ Secure built-in devices from direct touching of electrical parts by providing an external housing, for example a control cabinet.

European countries: according 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:



DANGER

**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 equipment grounding conductor to the grounding points. This is also applicable before short tests.
- ⇒ The equipment grounding conductor of the electrical equipment and the units must be non-detachably and permanently 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 equipment grounding connection!
- ⇒ Before start-up, also in trial runs, always attach the equipment grounding conductor or connect with the ground wire. Otherwise, high voltages may occur at the housing causing electric shock.

Protection Against Electric Shock by Protective Low Voltage (PELV)

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



WARNING

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

- ⇒ To all connections and terminals with voltages between 0 and 50 Volt, only devices, 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.

Protection Against Dangerous Movements

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

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

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

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

**DANGER**

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

⇒ For the above reasons, ensure personal safety by means of qualified and tested higher-level monitoring devices or measures integrated in the installation.

They have to be provided for by the user according to the specific conditions within the installation and a hazard and fault analysis. The safety regulations applicable for the installation have to be taken into consideration. Unintended machine motion or other malfunction is possible if safety devices are disabled, bypassed or not activated.

To avoid accidents, bodily harm and/or material damage:

⇒ Keep free and clear of the machine's range of motion and moving parts. Possible measures to prevent people from accidentally entering the machine's range of motion:

- use safety fences
- use safety guards
- use protective coverings
- install light curtains or light barriers

⇒ Fences and coverings must be strong enough to resist maximum possible momentum.

⇒ Mount the emergency stop switch in the immediate reach of the operator. Verify that the emergency stop works before startup. Don't operate the device if the emergency stop is not working.

⇒ Isolate the drive power connection by means of an emergency stop circuit or use a safety related starting lockout to prevent unintentional start.

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

⇒ Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example:

- mechanically securing the vertical axes,
- adding an external braking/ arrester/ clamping mechanism or
- ensuring sufficient equilibration of the vertical axes.

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

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

Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated by current-carrying conductors and permanent magnets in motors represent a serious personal danger to those 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 heart pacemakers and metal implants are not permitted to enter following areas:
 - Areas in which electrical equipment and parts are mounted, being operated or commissioned.
 - Areas in which parts of motors with permanent magnets are being stored, repaired or mounted.
 - ⇒ If it is necessary for somebody with a pacemaker to enter such an area, a doctor must be consulted prior to doing so. The interference immunity of present or future implanted heart pacemakers differs greatly, so that no general rules can be given.
 - ⇒ Those with metal implants or metal pieces, as well as with hearing aids must consult a doctor before they enter the areas described above. Otherwise health hazards may occur.
-

Protection Against Contact with Hot Parts



CAUTION

Hot surfaces at motor housings, on drive controllers or chokes! Danger of injury! Danger of burns!

- ⇒ Do not touch surfaces of device housings and chokes in the proximity of heat sources! Danger of burns!
 - ⇒ Do not touch housing surfaces of motors! Danger of burns!
 - ⇒ According to operating conditions, temperatures can be **higher than 60 °C, 140 °F** during or after operation.
 - ⇒ Before accessing motors after having switched them off, let them cool down for a sufficiently long time. Cooling down can require **up to 140 minutes!** Roughly estimated, the time required for cooling down is five times the thermal time constant specified in the Technical Data.
 - ⇒ After switching drive controllers or chokes off, wait 15 minutes to allow them to cool down before touching them.
 - ⇒ Wear safety gloves or do not work at hot surfaces.
 - ⇒ For certain applications, the manufacturer of the end product, machine or installation, according to the respective safety regulations, has to take measures to avoid injuries caused by burns in the end application. These measures can be, for example: warnings, guards (shielding or barrier), technical documentation.
-

Protection During Handling and Mounting

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.
- ⇒ Use 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.

Battery Safety

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 dismantle batteries.
- ⇒ Do not damage electrical parts installed in the devices.

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.

Protection Against Pressurized Systems

According to the information given in the Project Planning Manuals, motors cooled with liquid and compressed air, as well as drive controllers, can be partially supplied with externally fed, pressurized media, such 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 dismantling lines, relieve pressure and empty medium.
 - ⇒ 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.

4 Identification

4.1 Device Types

Type Code

Note: The following figure illustrates the basic structure of the type code. Your sales representative will help with the current status of available versions.

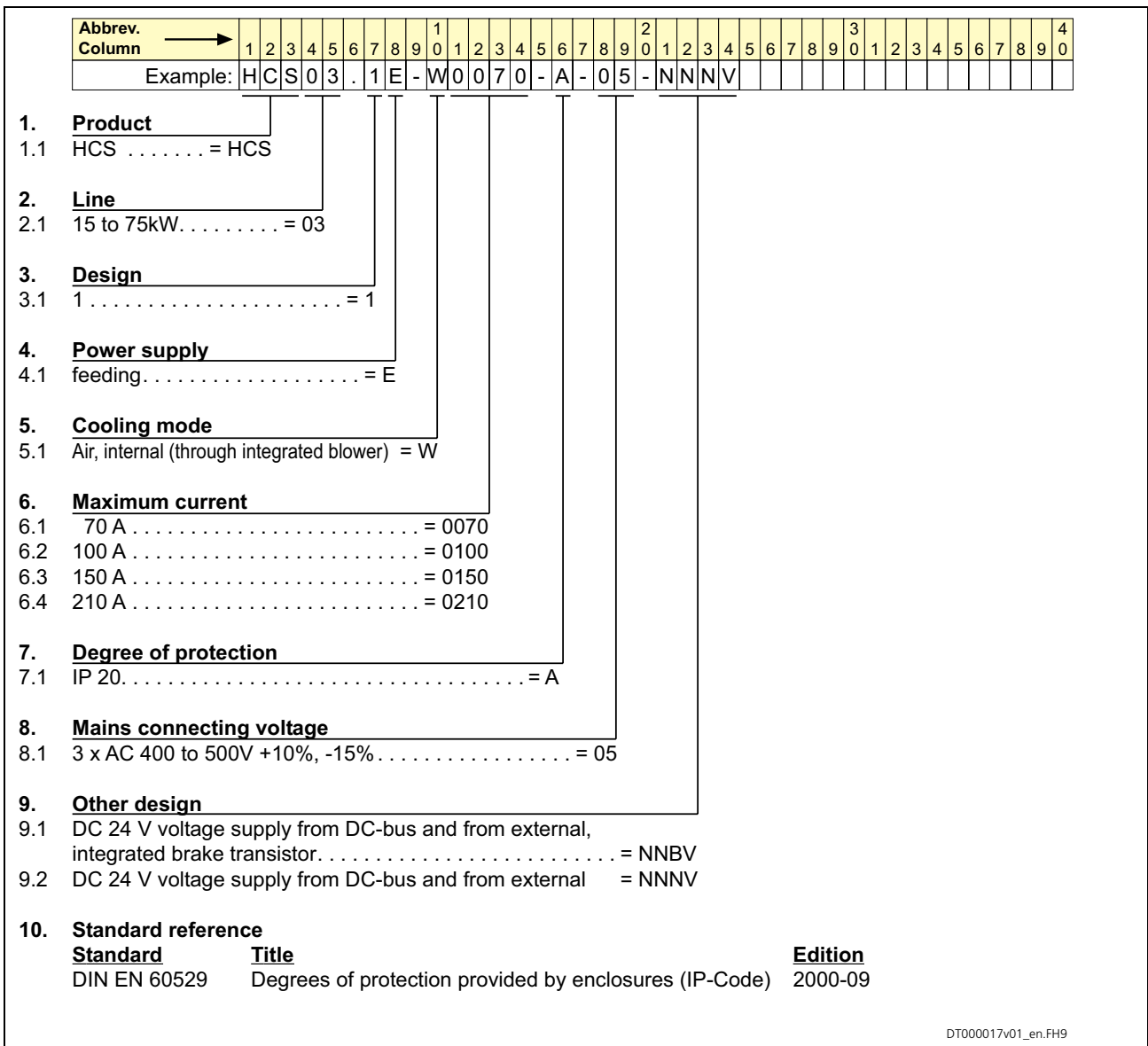


Fig. 4-1: Type code

4.2 Type Plates

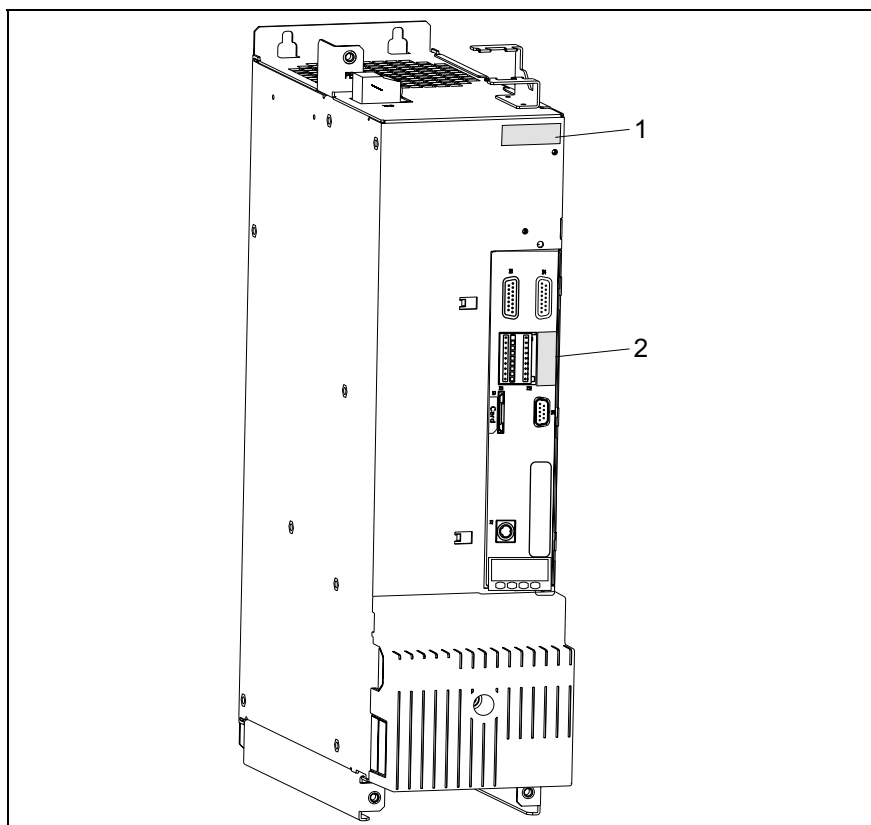
Each drive component is marked by a type designation.

There is a type plate attached to all devices.

A label (cable mark) is wrapped around ready-made cables. This label indicates the type designation and the length. (The designation of the cable itself - without connector - is printed on the cable sheath.)

The identification of accessories packed in bags is either printed on the bag or indicated in an accompanying note.

Type Plate Arrangement



1: Power section type plate
2: Control section type plate
Fig. 4-2: Type plate arrangement

Type Plate Power Section (Example)

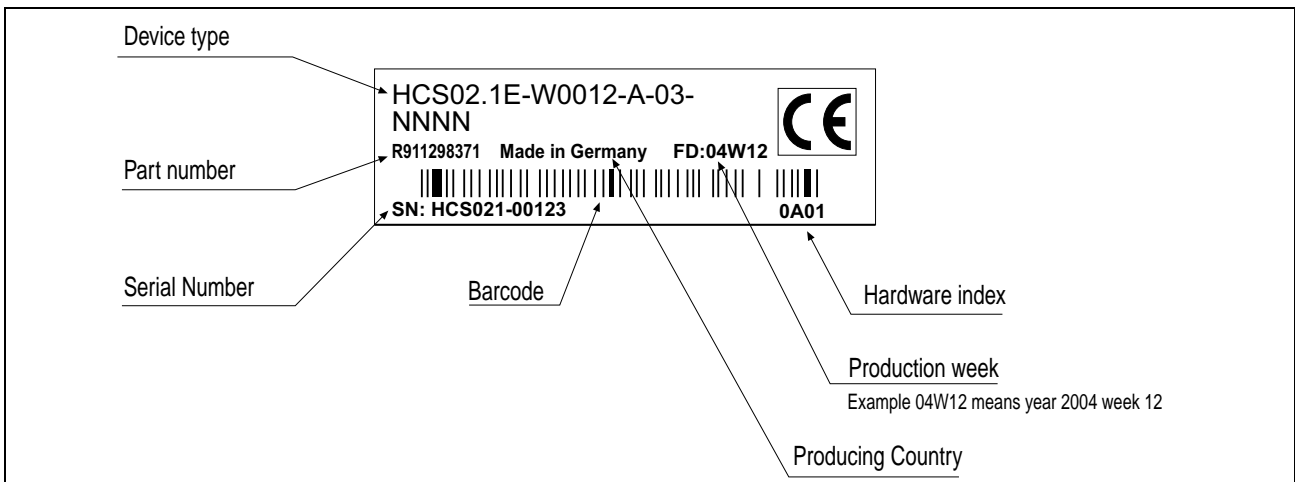


Fig. 4-3: Type plate power section

Type Plate Control Section

See Project Planning Manual of the control sections.

4.3 Scope of Delivery

Overview

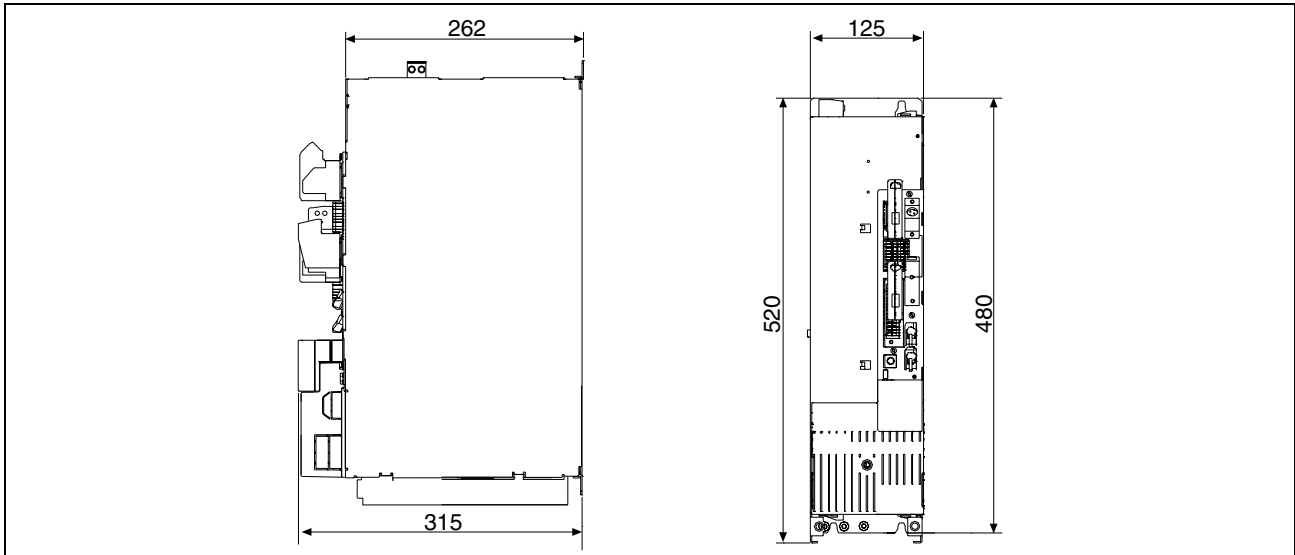
as standard	optional
Power section	Control section (with options where required)
Touch guard	Accessories HAS02
Connector X6	Accessories HAS01
Connector X3, X5	
Connector X9 (for HCS03.1E-W0070)	
Accessories HAS01	optional
	Further optional accessories

Fig. 4-4: Scope of delivery

5 Mechanical Data

5.1 Dimensions

Drive Controller HCS03.1E-W0070



all dimensions in mm

Fig. 5-1: Dimensional drawing HCS03.1E-W0070

Drive Controller HCS03.1E-W0070 with HAS02

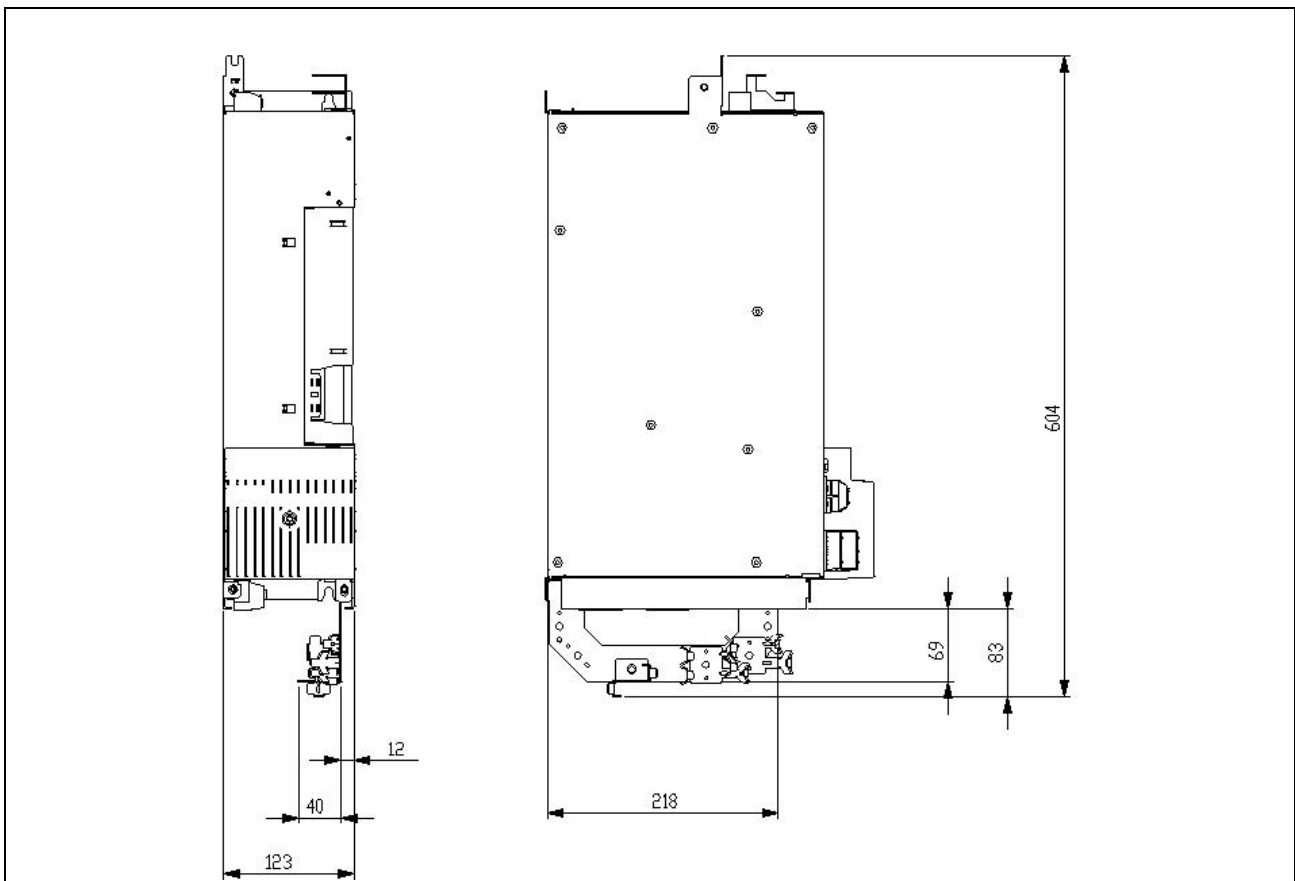
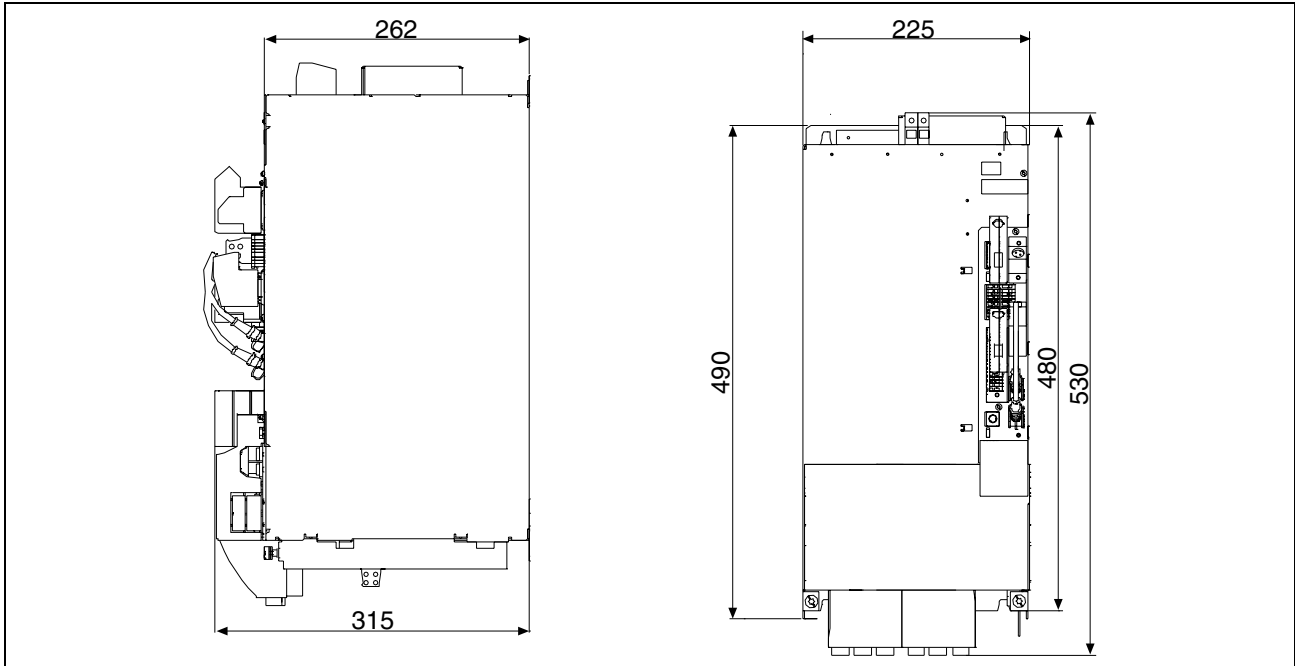


Fig. 5-2: Dimensional drawing HCS03.1E-W0070 with HAS02

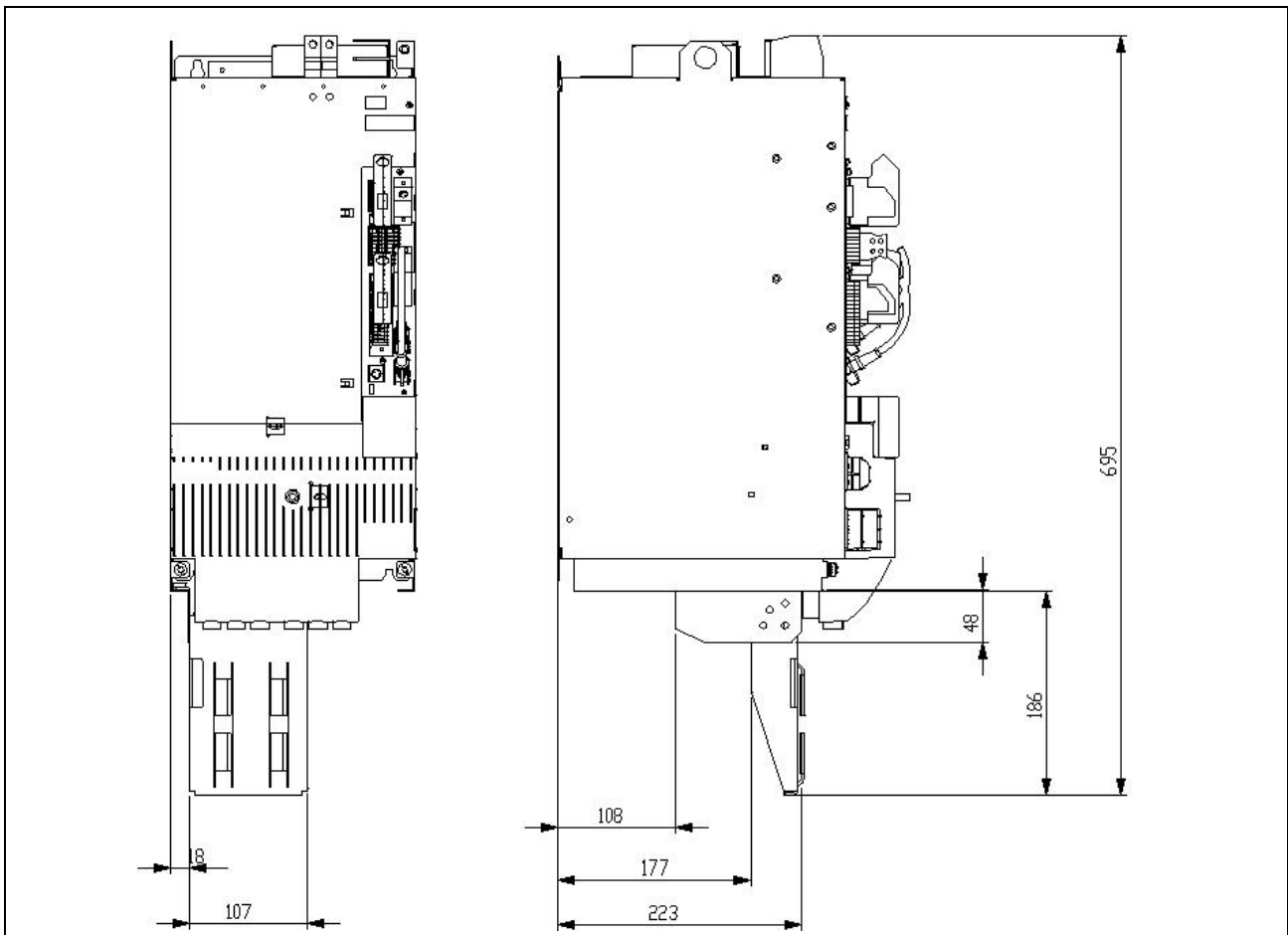
Drive Controller HCS03.1E-W0100, -W0150



all dimensions in mm

Fig. 5-3: Dimensional drawing HCS03.1E-W0100 and HCS03.1E-W0150

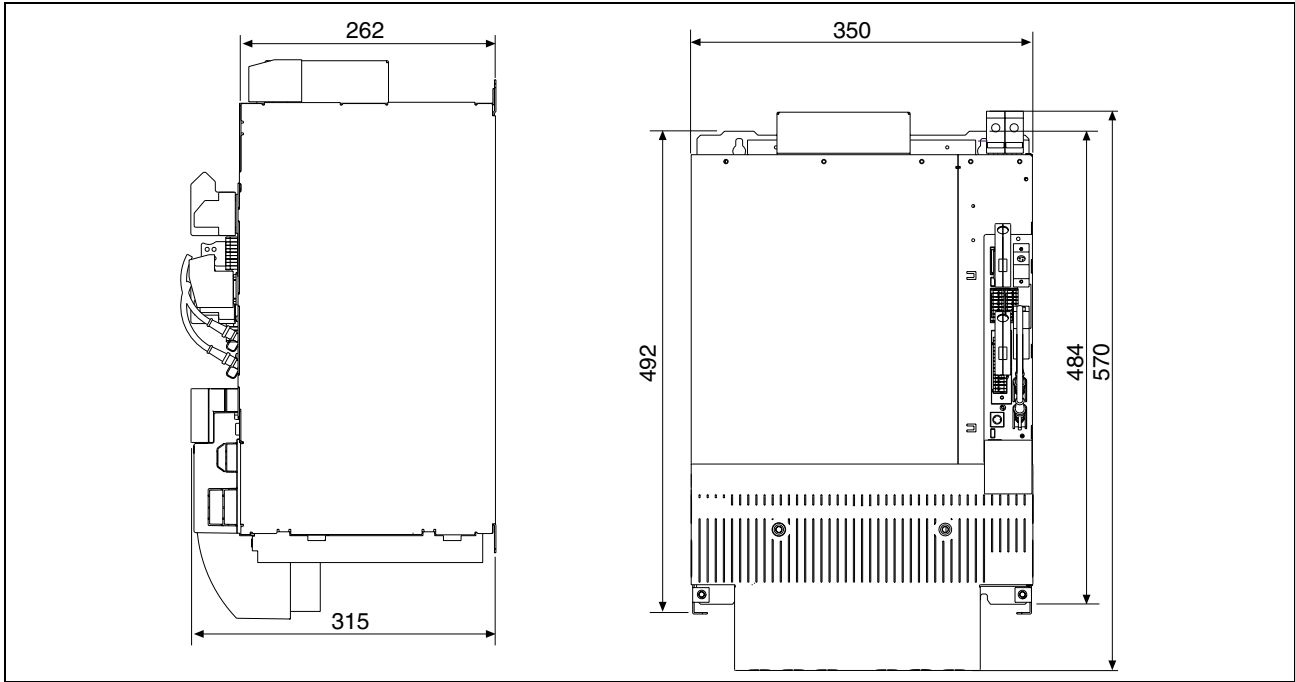
Drive Controller HCS03.1E-W0100, -W0150 with HAS02



all dimensions in mm

Fig. 5-4: Dimensional drawing HCS03.1E-W0100 and HCS03.1E-W0150 with HAS02

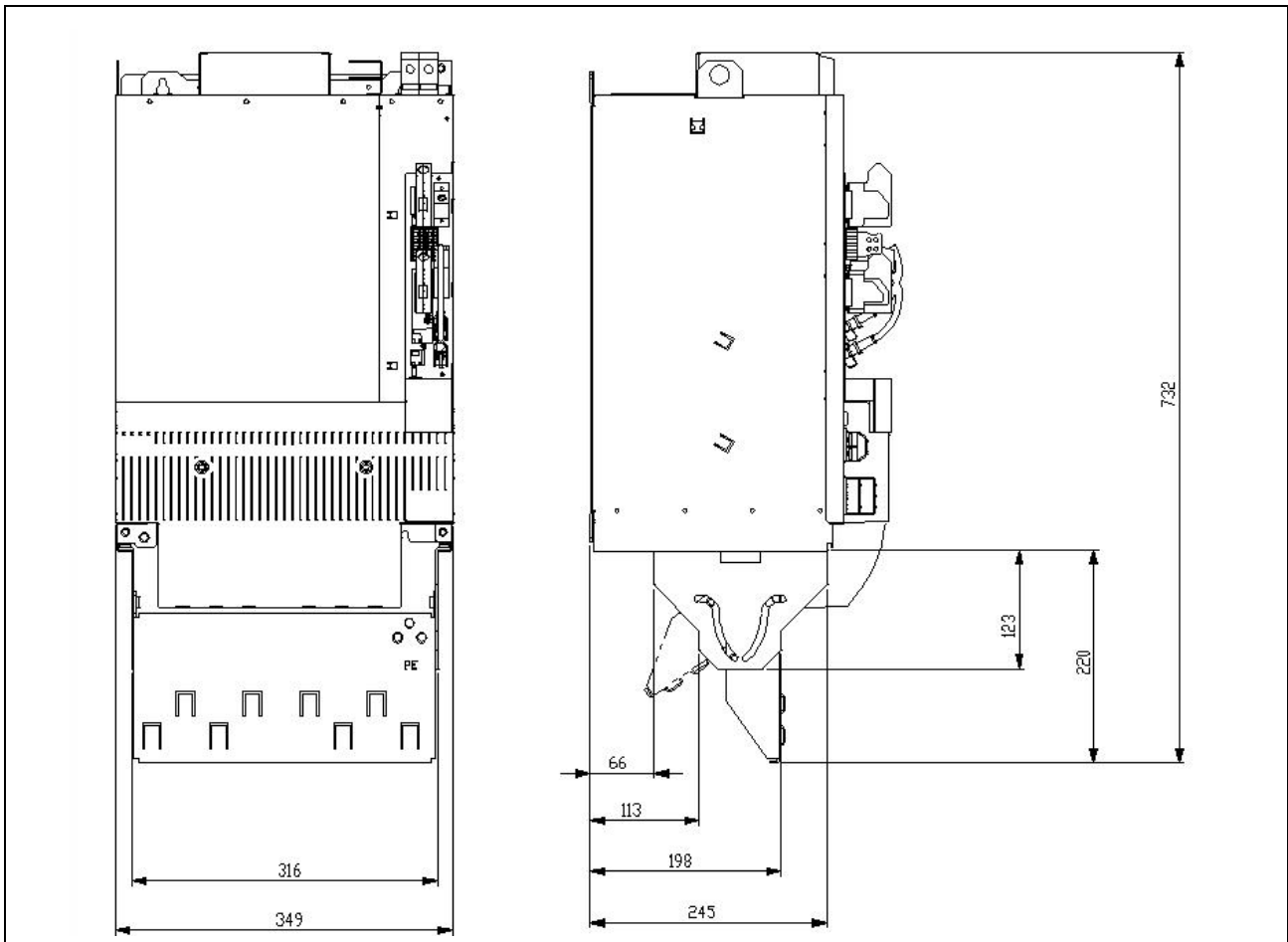
Drive Controller HCS03.1E-W0210



all dimensions in mm

Fig. 5-5: Dimensional drawing HCS03.1E-W0210

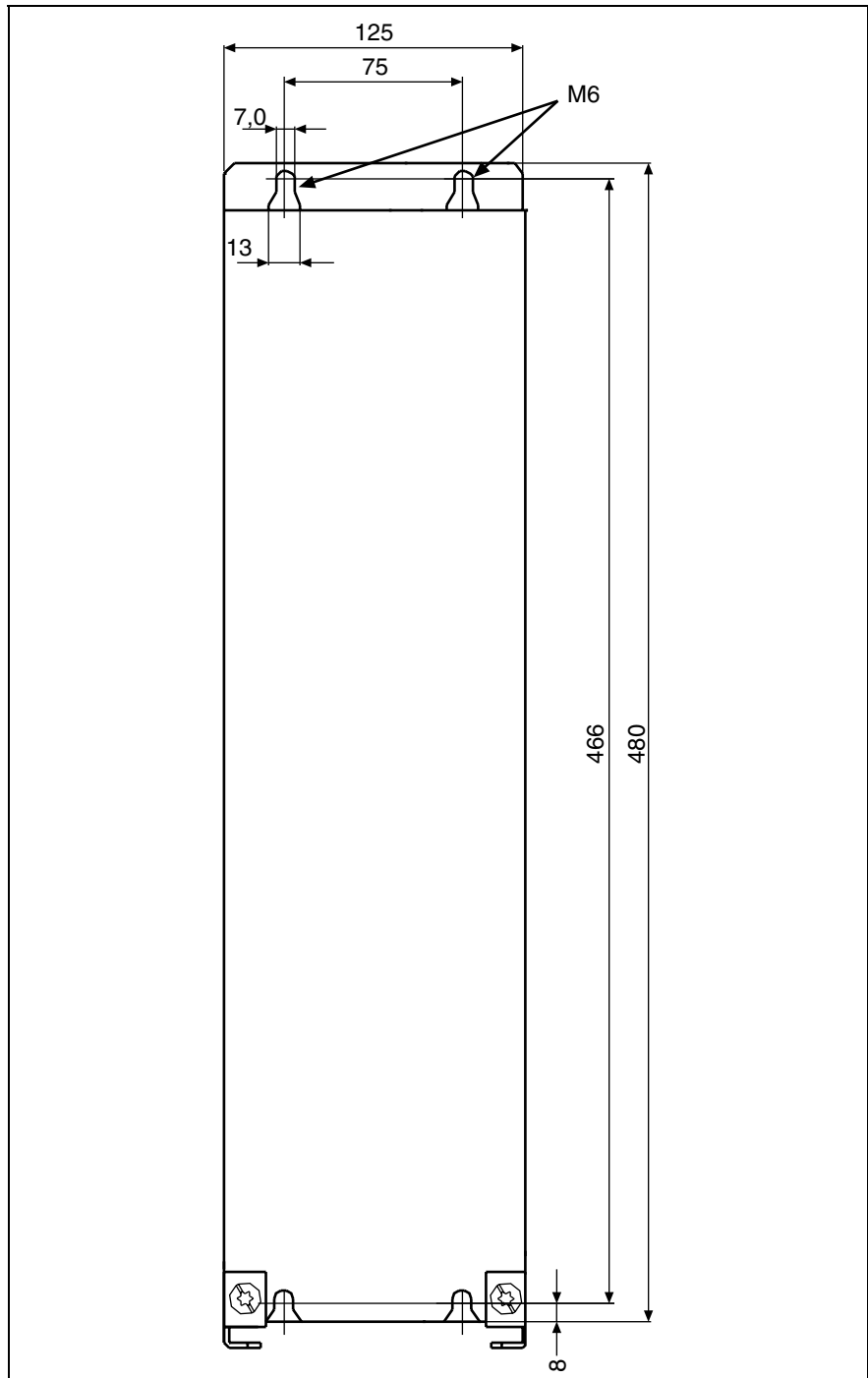
Drive Controller HCS03.1E-W0210 with HAS02



all dimensions in mm

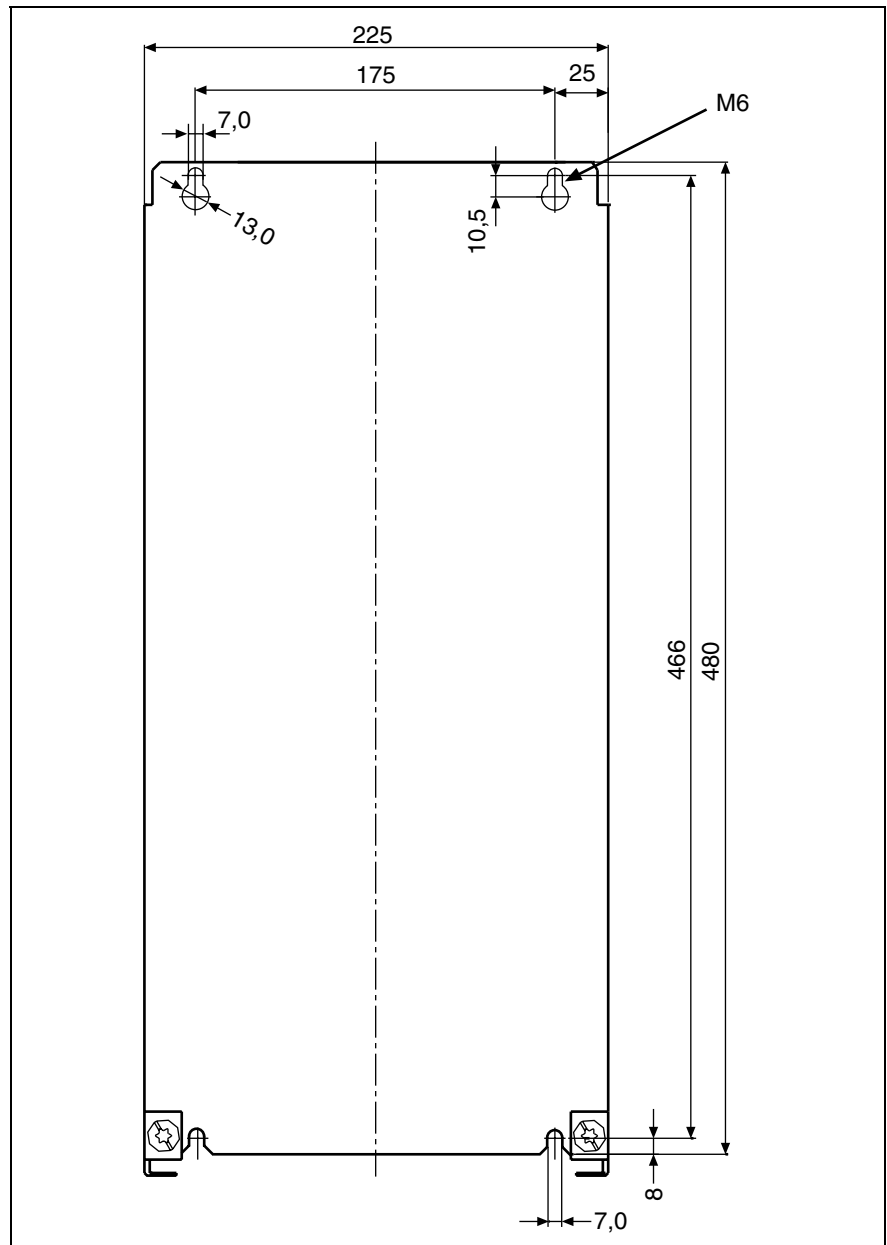
Fig. 5-6: Dimensional drawing HCS03.1E-W0210 with HAS02

Boring Dimensions



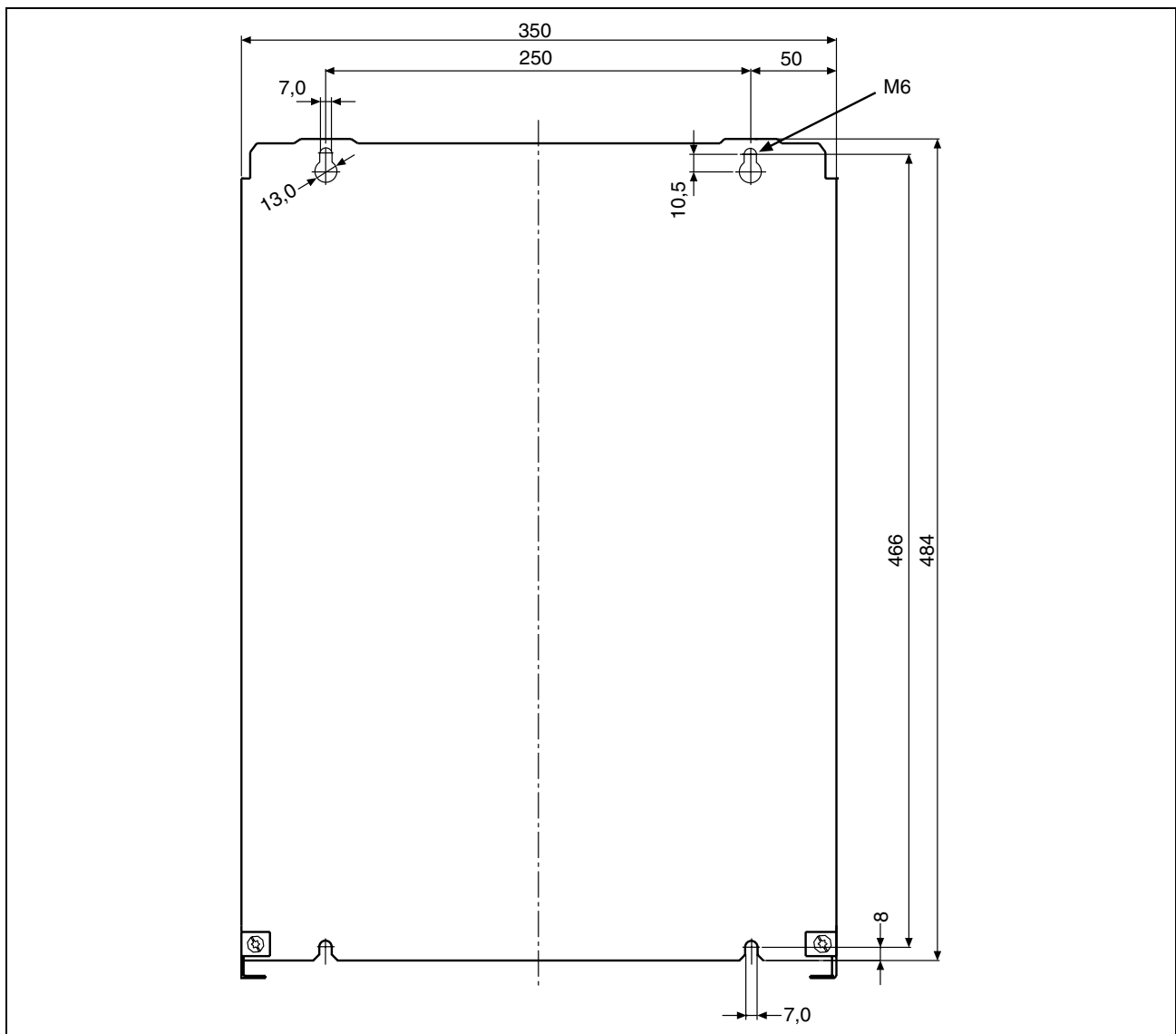
all dimensions in mm

Fig. 5-7: Boring dimensions HCS03.1E-W0070*



all dimensions in mm

Fig. 5-8: Boring dimensions HCS03.1E-W0100 and HCS03.1-W0150



all dimensions in mm

Fig. 5-9: Boring dimensions HCS03.1E-W0210

5.2 Weight

Device	Weight in kg
HCS03.1E-W0070	13
HCS03.1E-W0100	20
HCS03.1E-W0150	20
HCS03.1E-W0210	38

Fig. 5-10: Weight of the devices

Note: The control section is not contained in the weight data.
The weight of the control section is about 0.4 kg.

Mounting Position

Drive controllers and DC bus resistor unit should be mounted in such a way that their longitudinal axis corresponds to the natural direction of convection (motor and power connections facing downwards).

In this way, natural convection supports the forced cooling air flow. This avoids the generation of pockets of heat in the drive controller.

Temperatures Above the Top of the Device

The drive controllers have a high efficiency. Outlet temperatures higher than the ambient temperature are nevertheless produced at the top of the devices, among other things due to the converted energies. High outlet temperatures are particularly produced in the case of insufficient cooling or when the cooling air current (blower failure) fails.



CAUTION

Risk of damage caused by too high outlet temperatures!

- ⇒ When mounting and installing other components, make sure the distance to the top of the drive controllers is sufficient.
- ⇒ You have to take into account that higher outlet temperatures can occur when the cooling air current fails.

Outlet Temperatures

Designation	Symbol	Unit	HCS03.1
temperature rise with distance of 10 mm from top of device	ΔT	K	30

Fig. 5-11: Outlet temperatures

6 Electrical Data

Note: The current and power data below apply when the allowed motor cable length is complied with (see data in section "X5, Motor Connection"). They refer to 3AC400 V.

6.1 Power Section - Mains Supply

Designation	Symbol	Unit	HCS03.1E- W0070	HCS03.1E- W0100	HCS03.1E- W0150	HCS03.1E- W0210
three-phase mains connection			allowed			
single-phase mains connection			not allowed			
rotary field			no rotary field condition			
total power factor TPF at P_{DC} with / without mains choke	TPF		0,85/0,57	0,83/0,59	0,81/0,61	0,78/0,62
power factor of fundamental component DPF P_{DC} with / without mains choke	$\cos\phi^{h1}$		0,95/0,64	0,95/0,67	0,94/0,70	0,93/0,73
assigned mains choke HNL01.1E-			0571-N0050-A-500-NNNN	0362-N0080-A-500-NNNN	0240-N0106-A-500-NNNN	0170-N0146-A-500-NNNN
mains input voltage range	U_{LN}	V	3AC400...500 +10% -15%			
mains frequency	f_{LN}	Hz	50...60 \pm 2 Hz			
mains input continuous current at $P_{DC\ cont}$	$I_{L,cont}$	A	50	80	106	146
maximum inrush current (at max. input voltage)	$I_{L,trans\ max\ (on)}$	A	2,8	5,7	5,7	17
mains connection power at $P_{DC\ cont}$; $U_{LN}=AC400V$; with HNL01.1E	S_{LN}	kVA	35	55,2	72,9	99,3
mains connection power at $P_{DC\ cont}$; $U_{LN}=AC400V$; without HNL01.1E	S_{LN}	kVA	22,6	40,3	54	76

Fig. 6-1: Electrical data: power section - mains supply

6.2 Power Section - DC Bus

Designation	Symbol	Unit	HCS03.1E- W0070	HCS03.1E- W0100	HCS03.1E- W0150	HCS03.1E- W0210
DC bus voltage range (unloaded)	U_{DC}	V	uncontrolled $U_{LN} * 1,41$			
internal DC bus capacitance	C_{DC}	mF	0,94	1,44	1,88	4,7
max. allowed external DC bus capacitance	C_{DCext}	mF	nicht zulässig			50 ¹⁾
limitation of inrush current			charging via resistor; N/O contact: min. 250.000 switching actions			charging by means of phase control ¹⁾
storable energy of the internal DC bus capacitors at 3AC400V	W_{DC}	Ws	150	230	300	752
braking resistor switch-on threshold	U_{DC} (R_DC On)	V	820...850	820...850	820...850	820...850
lower DC bus voltage limit (switch-off threshold)	$U_{DC \text{ limit}}$ (min)	V	400	400	400	400
upper DC bus voltage limit (switch-off threshold)	$U_{DC \text{ limit}}$ (max)	V	900	900	900	900
capacitance in DC bus against ground; between L+ and L-	C_Y	nF	100	100	100	100
balancing factor for $P_{DC \text{ cont}}$ (for parallel operation with common DC bus) with/without mains choke		-	1/0,8	1/0,8	1/0,8	1/0,8
rated power at $U_{LN} = 400V$ without mains choke	$P_{DC \text{ cont}}$	kW	13	24	34	47
minimum inductance of mains supply	L_{min}	μH	40	40	40	40
rated power at $U_{LN} = 400V$ with mains choke	$P_{DC \text{ cont}}$	kW	25	43	56	85

¹⁾: as of hardware index 03 (see type plate)
Fig. 6-2: Electrical data: power section - DC bus

6.3 Power Section - DC Bus Power

Designation	Symbol	Unit	HCS03.1E- W0070	HCS03.1E- W0100	HCS03.1E- W0150	HCS03.1E- W0210
profile DC bus power overload operation overload capacity: $K = \frac{P_{DC_peak}}{P_{DC_base}}$						
DC bus peak power U _{LN} = 3AC400 V, at Ta=40 °C; t=0,4 s; T=4 s without mains choke with mains choke	P _{DC_peak_1}	kW	20 40	33 59	54 89	68 124
DC bus power U _{LN} = 3AC400 V, at Ta=40 °C; t=0,4 s; T=4 s without mains choke with mains choke	P _{DC_base_1}	kW	10 20	18 32	24 40	37 67
DC bus peak power U _{LN} = 3AC400 V, at Ta=40 °C; t=2 s; T=20 s without mains choke with mains choke	P _{DC_peak_3}	kW	18 36	30 53	53 87	68 124
DC bus power U _{LN} = 3AC400 V, at Ta=40 °C; t=2 s; T=20 s without mains choke with mains choke	P _{DC_base_3}	kW	10 20	16 29	21 35	35 64
DC bus peak power U _{LN} = 3AC400 V, at Ta=40 °C; t=60 s; T=5 min without mains choke with mains choke	P _{DC_peak_4}	kW	14 27	25 44	40 66	52 94
DC bus power U _{LN} = 3AC400 V, at Ta=40 °C; t=60 s; T=5 min without mains choke with mains choke	P _{DC_base_4}	kW	11 21	17 29	24 39	37 67
DC bus peak power U _{LN} = 3AC400 V, at Ta=40 °C; t=60 s; T=10 min without mains choke with mains choke	P _{DC_peak_5}	kW	14 27	25 44	40 66	52 94
DC bus power U _{LN} = 3AC400 V, at Ta=40 °C; t=60 s; T=10 min without mains choke with mains choke	P _{DC_base_5}	kW	11 21	17 29	24 39	37 67

Fig. 6-3: Electrical data: power section - DC bus power



WARNING

Damage due to drive controller overload!

⇒ Make sure the specified performance data - peak power and continuous power - are complied with by correct drive dimensioning and selective fusing in the mains connection.

Mains Connection Power and DC Bus Continuous Power

The diagrams below illustrate the interrelation between mains connection power (S_{LN}) and DC bus continuous power ($P_{DC cont}$) with and without the use of mains chokes.

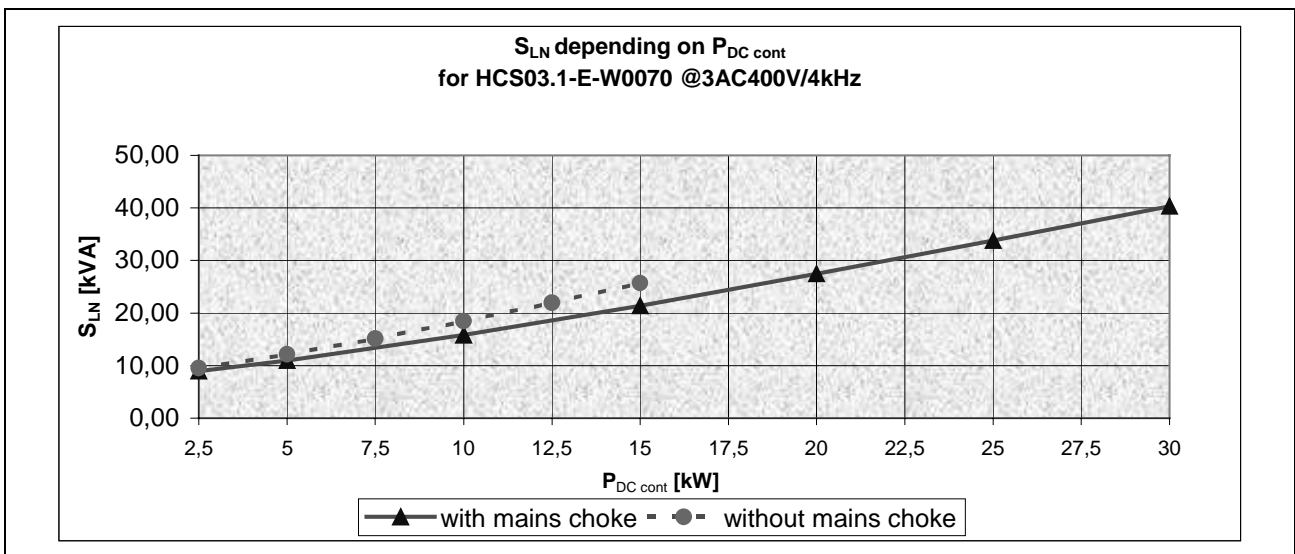


Fig. 6-4: Interrelation of S_{LN} / P_{DC} for HCS03.1-E-W0070

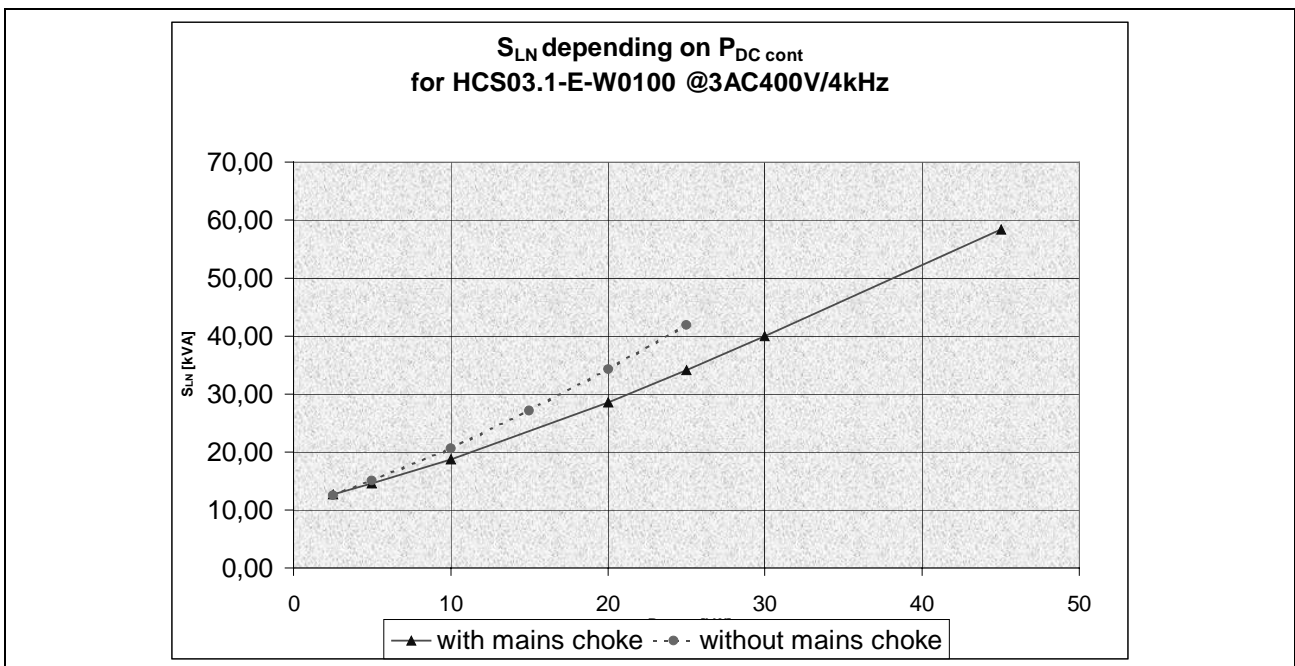


Fig. 6-5: Interrelation of S_{LN} / P_{DC} for HCS03.1-E-W0100

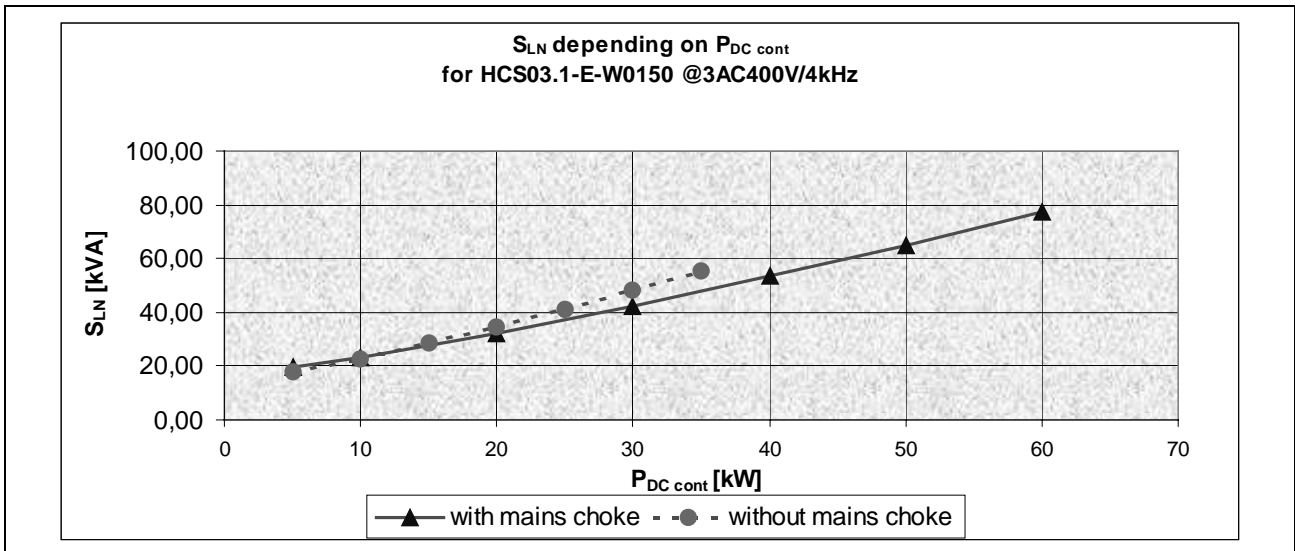


Fig. 6-6: Interrelation of S_{LN} / P_{DC} for HCS03.1-E-W0150

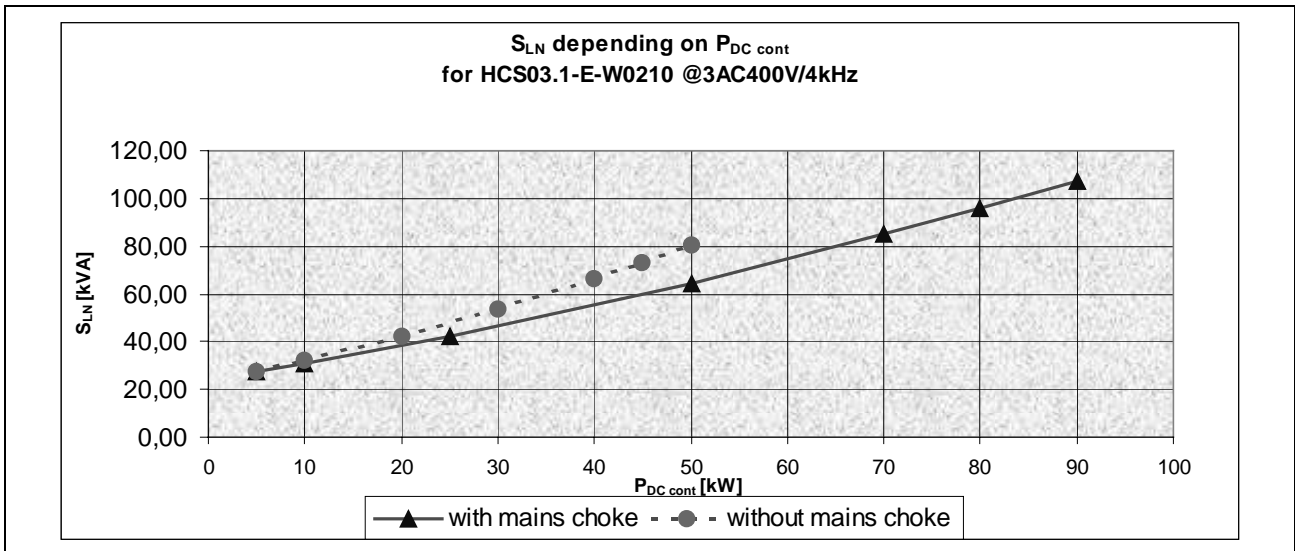


Fig. 6-7: Interrelation of S_{LN} / P_{DC} for HCS03.1-E-W0210

6.4 Power Section - Braking Resistor

Designation	Symbol	Unit	HCS03.1E- W0070	HCS03.1E- W0100	HCS03.1E- W0150	HCS03.1E- W0210
nominal braking resistor	$R_{DC(Bleeder)}$	Ohm	internally not contained			
operating external braking resistor (optional)			allowed	allowed	allowed	allowed
braking resistor switch-on threshold	$R_{DC (R_{DC} On)}$	V	see Functional Description of firmware			
balancing factor for P_{BD} (for parallel operation with common DC bus)			0,8	0,8	0,8	0,8
min. resistance value of external braking resistor	$R_{DC(Bleeder)}$	Ohm	17,5	11,7	7	5
allowed continuous power of external braking resistor	$P_{contchopper}$	kW	13,2	18,9	25,2	42,6
ext. braking resistor peak power at ED=60% and t=120s	P_{BS}	kW	22	31,5	42	71
peak power brake chopper for t=1s	$P_{peakchopper}$	kW	42	63	97	137

Fig. 6-8: Data power section - braking resistor

Example for Calculating Brake Chopper Continuous Power

$$P_{contchopper} = \frac{P_{peakchopper 60\%}}{120s} \times 72s$$

$P_{contchopper}$: brake chopper continuous power

$P_{peakchopper}$: brake chopper peak power

Fig. 6-9: Example for calculating brake chopper continuous power

6.5 Power Section - Inverter

Designation	Symbol	Unit	HCS03.1E- W0070	HCS03.1E- W0100	HCS03.1E- W0150	HCS03.1E- W0210
output voltage fundamental component of voltage	U _{out} with open-loop U/f ctrl with closed- loop oper.	V	U _{DC} * 0,85 / 1,41			
		V	U _{DC} * 0,85 / 1,41			
output frequency range - at f _s = 4 kHz - at f _s = 8 kHz - at f _s = 12 kHz - at f _s = 16 kHz	f _{out}	Hz	0...400 0...800 0...1200 0...1600	0...400 0...800 0...1200 0...1600	0...400 0...800 0...1200 0...1600	0...400 0...800 0...1200 0...1600
rise of voltage at output at U _{LN} =400V and 15 m motor cable length ¹⁾	dv/dt 10% - 90%	kV/ µs	5	5	5	5
maximum output current	I _{out_max} (4 kHz)	A	70	100	150	210
	I _{out_max} (8 kHz)		62	86	137	190
	I _{out_max} (12 kHz)		47	60	105	135
	I _{out_max} (16 kHz)		34	50	86	105
continuous output current or rated current	I _{out_cont} (4 kHz)	A	45	73	95	145
	I _{out_cont} (8 kHz)		33	50	66	100
	I _{out_cont} (12 kHz)		24	37	48	72
	I _{out_cont} (16 kHz)		18	27	37	54
continuous output current or rated current at electric rotational frequency 0 Hz	I _{out_cont} (4 kHz)	A	29	47	61	93
	I _{out_cont} (8 kHz)		18	30	40	58
	I _{out_cont} (12 kHz)		12	21	27	38
	I _{out_cont} (16 kHz)		8	15	20	28

1) recommended value; see following note

Fig. 6-10: Data power section - inverter

Note: Observe that the load **at the motor terminal** is almost independent of the power section used.

Especially when using **standard motors**, make sure that they can withstand the voltage load.

Observe section "Using Third-Party Motors in Drive System Rexroth IndraDrive" of the Project Planning Manual "Rexroth IndraDrive Drive System".

Note: Depending on the electric rotational frequency, the output current is reduced for thermal protection of the power section.

The output current is reduced when the value of the electric rotational frequency falls below 4 Hz.

6.6 Power Section - Examples of Allowed Output Current Profiles

The capacity of the drive controllers when operated with mains choke is described below with examples of load profiles.

Designation	Symbol	Unit	HCS03.1E-W0070	HCS03.1E-W0100	HCS03.1E-W0150	HCS03.1E-W0210
output current profile for overload operation overload capacity: $K \triangleq \frac{I_{out_peak}}{I_{out_base}}$						
maximum output current $t=400\text{ms}; T=4\text{s}$	I_{out_peak1} (4 kHz) I_{out_peak1} (8 kHz) I_{out_peak1} (12 kHz) I_{out_peak1} (16 kHz)	A	70 50 36 28	100 70 50 40	150 100 75 60	210 150 100 75
base load current available at maximum current $t=400\text{ms}; T=4\text{s}$	I_{out_base1} (4 kHz) I_{out_base1} (8 kHz) I_{out_base1} (12 kHz) I_{out_base1} (16 kHz)	A	35 25 18 14	54 37 28 19	67 50 36 26	116 78 59 45
maximum output current $t=2\text{s}; T=20\text{s}$	I_{out_peak3} (4 kHz) I_{out_peak3} (8 kHz) I_{out_peak3} (12 kHz) I_{out_peak3} (16 kHz)	A	63 45 32 23	90 65 45 32	147 100 70 50	210 150 100 80
base load current available at maximum current $t=2\text{s}; T=20\text{s}$	I_{out_base3} (4 kHz) I_{out_base3} (8 kHz) I_{out_base3} (12 kHz) I_{out_base3} (16 kHz)	A	35 25 19 15	49 30 25 21	59 44 35 28	109 73 57 41

Designation	Symbol	Unit	HCS03.1E-W0070	HCS03.1E-W0100	HCS03.1E-W0150	HCS03.1E-W0210
maximum output current t=60s; T=5min	I_{out_peak4} (4 kHz)	A	47	75	111	160
	I_{out_peak4} (8 kHz)		34	52	80	110
	I_{out_peak4} (12 kHz)		25	38	60	80
	I_{out_peak4} (16 kHz)		19	28	45	60
base load current available at maximum current t=60s; T=5min	I_{out_base4} (4 kHz)	A	37	50	66	115
	I_{out_base4} (8 kHz)		23	34	42	80
	I_{out_base4} (12 kHz)		16	21	28	55
	I_{out_base4} (16 kHz)		10	19	22	42
maximum output current t=60s; T=10min	I_{out_peak5} (4 kHz)	A	47	75	111	160
	I_{out_peak5} (8 kHz)		34	52	80	110
	I_{out_peak5} (12 kHz)		25	38	60	80
	I_{out_peak5} (16 kHz)		19	28	45	60
base load current available at maximum current t=60s; T=10min	I_{out_base5} (4 kHz)	A	37	50	66	118
	I_{out_base5} (8 kHz)		23	34	42	82
	I_{out_base5} (12 kHz)		16	21	28	56
	I_{out_base5} (16 kHz)		10	19	22	43

Fig. 6-11: Technical data for power section

Note: The load profiles are characterized by their time flow and the corresponding currents and represent the output current capacity. These profiles are limited by the drive controller via the thermal effect of the output current. When the current limitation is triggered, it is therefore necessary to compare the actual load with the above data and, if necessary,

- reduce the load with I_{out_max} or
- reduce the pulse time or
- increase the cycle time or
- reduce the switching frequency f_s or
- use a device with higher type current

(See also Functional Description and Troubleshooting Guide of the firmware.)

Note: The load profiles are available if particularly the maximum current at switching frequencies of 8, 12 and 16 kHz is externally (e.g. by the control unit) limited to the indicated values.

6.7 Power Section - Operating Standard Motors

The following table specifies the nominal power P_{Nenn} of 4-pole standard motors, which can be operated with the respective drive controller. There apply following conditions:

- the dedicated mains choke is used
- switching frequency: 4 kHz
- output frequency: > 4 Hz
- ambient temperature: $T_a \leq T_{amax}$ °C
- control factor: $a_0 > 0,8$
- relation of overload: $K = P_{peak} / P_{base}$

$U_{LN} = 3AC400V, 48...62$ Hz:

Designation	Symbol	Unit	HCS03.1E-W0070 ¹⁾	HCS03.1E-W0100 ¹⁾	HCS03.1E-W0150 ¹⁾	HCS03.1E-W0210 ¹⁾
standard motor nominal power for overload operation: t=2 s; T=20 s; K=2,0	P_{Nenn}	kW	15	22	33	55
standard motor nominal power for overload operation: t=60 s; T=5 min; K=1,5	P_{Nenn}	kW	15	22	33	55
standard motor nominal power for overload operation: t=60 s; T=10 min; K=1,1	P_{Nenn}	kW	18,5	27	35	60
standard motor nominal power for continuous operation: t>10 min; K=1,0	P_{Nenn}	kW	22	37	45	75

1) preliminary data

Fig. 6-12: Standard motors 3AC400V, 50 Hz

$U_{LN} = 3AC460...480V, 48...62$ Hz

Designation	Symbol	Unit	HCS03.1E-W0070 ¹⁾	HCS03.1E-W0100 ¹⁾	HCS03.1E-W0150 ¹⁾	HCS03.1E-W0210 ¹⁾
standard motor nominal power for overload operation: t=2 s; T=20 s; K=2,0	P_{Nenn}	kW	15	22	33	55
standard motor nominal power for overload operation: t=60 s; T=5 min; K=1,5	P_{Nenn}	kW	15	22	33	55
standard motor nominal power for overload operation: t=60 s; T=10 min; K=1,1	P_{Nenn}	kW	18,5	27	35	60
standard motor nominal power for continuous operation: t>10 min; K=1,0	P_{Nenn}	kW	22	37	45	75

1) preliminary data

Fig. 6-13: Standard motors 3AC460V, 60 Hz

6.8 Power Section - Cooling, Power Dissipation, Insulation Resistance, Sound Pressure

Designation	Symbol	Unit	HCS03.1E-W0070	HCS03.1E-W0100	HCS03.1E-W0150	HCS03.1E-W0210
cooling of power section			forced	forced	forced	forced
volumetric capacity of forced cooling		m ³ /h	265	367	367	780
max. device power dissipation at rated current (with inverter, chopper and rectifier losses; without continuous braking resistor power and without control section)	$P_{Diss, Drive}$	W	800	950	1150	2000
min. insulation resistance at DC500 V	R_{is}	MOhm	11	11	11	11
capacitance power section against housing	C_{Kop}	nF	210	210	210	210
sound pressure level		dB(A)	85	80	80	95

Fig. 6-14: Data power section - cooling, power dissipation, insulation resistance, sound pressure

6.9 Control Voltage

Devices with Control Voltage Generation from DC Bus (HCS03.1E-W0xxx-NNxV)

The internally generated control voltage is used for stand-alone supply of the drive controller or for buffering in case the external 24V supply fails. It is not used for supplying motor holding brakes.

(Data based on an ambient temperature of 25 °C)

Designation	Symbol	Unit	Value
external control voltage supply	U_{N3}	V	24 ±20% (if no motor holding brake has to be supplied) If motor holding brakes are to be supplied, observe the data of the motor documentation. The following values are normally sufficient: 24 ±5% with motor cable length < 50 m 26 ±5% with motor cable length > 50 m
max. ripple content	w	-	mustn't exceed the control voltage range
max. allowed overvoltage	U_{N3max}	V	33 (max. 1 ms)
max. inrush current	I_{EIN3}	A	2,8 plus inrush current of control section (see Project Panning Manual IndraDrive Control Sections)
max. pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	5
max. input capacitance	C_{N3}	mF	1,2 * 0,47
power consumption (in the case of external supply)*:			
HCS03.1E-W0070	P_{N3}	W	approx. 22.5
HCS03.1E-W0100	P_{N3}	W	approx. 25
HCS03.1E-W0150	P_{N3}	W	approx. 25
HCS03.1E-W0210	P_{N3}	W	approx. 30
internally generated control voltage	U_{N3}	V	24 ±10% (not used for supplying the motor holding brake)

*: data without motor holding brake and control section taken into account

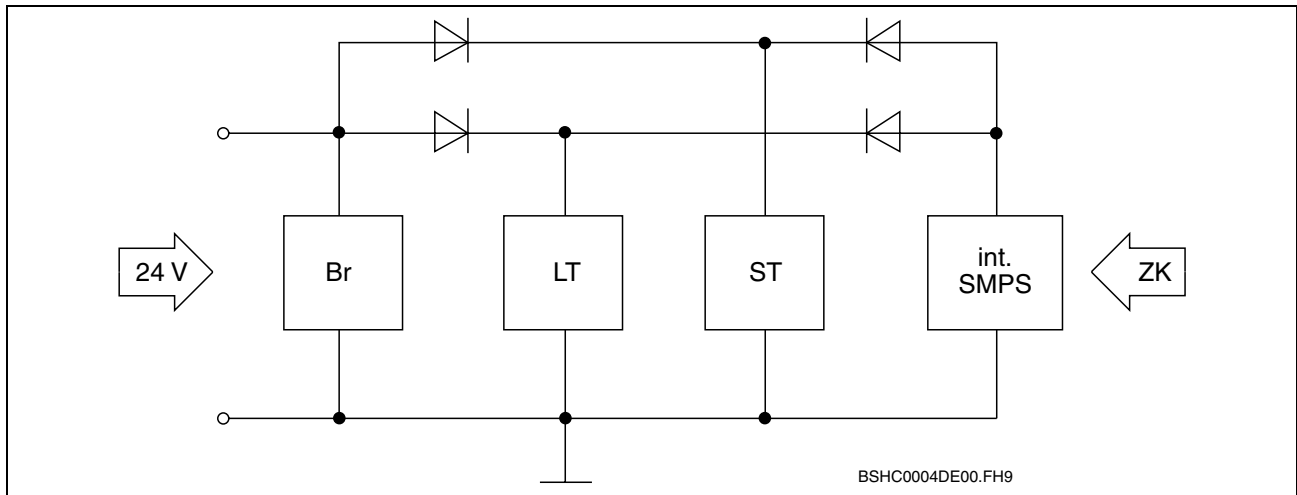
Fig. 6-15: Control voltage

Note: Overvoltage of more than 33V has to be discharged by means of the appropriate electrical equipment of the machine or installation.

This includes:

- 24V power supply units that reduce incoming overvoltages to the allowed value.
- Overvoltage limiters at the control cabinet input that limit existing overvoltage to the allowed value. This, too, applies to long 24V lines that have been run in parallel to power cables and mains cables and can absorb overvoltages by inductive or capacitive coupling.

Block Diagram of Control Voltage Generation from the DC Bus



- Br: brake circuit
- LT: power section
- ST: control section
- SMPS: internal switching-mode power supply
- ZK: DC bus

Fig. 6-16: Block diagram of internal control voltage generation

6.10 Connections

Overall Connection Diagram

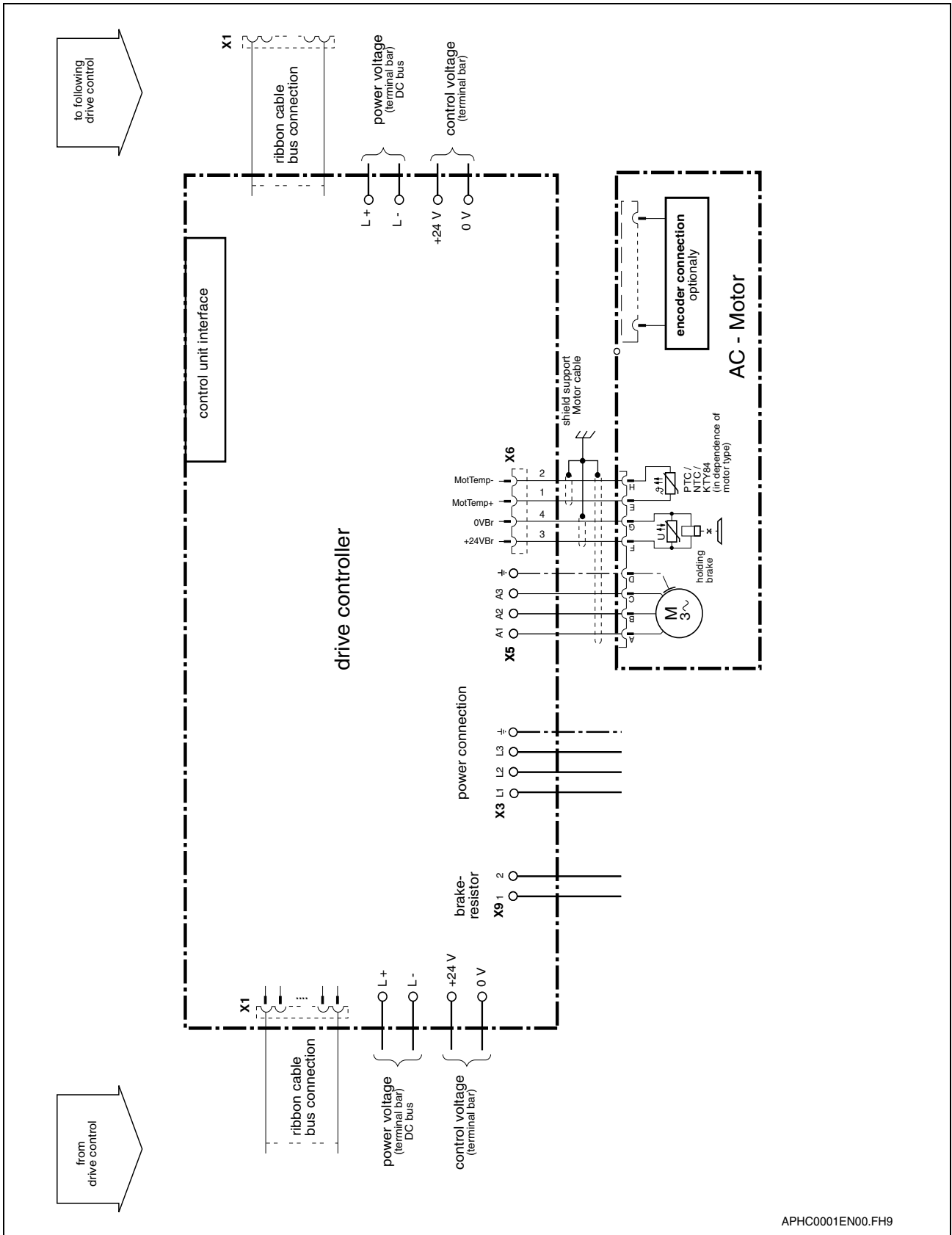


Fig. 6-17: Overall connection diagram

6.11 Connections at Power Section HCS03.1

Overview

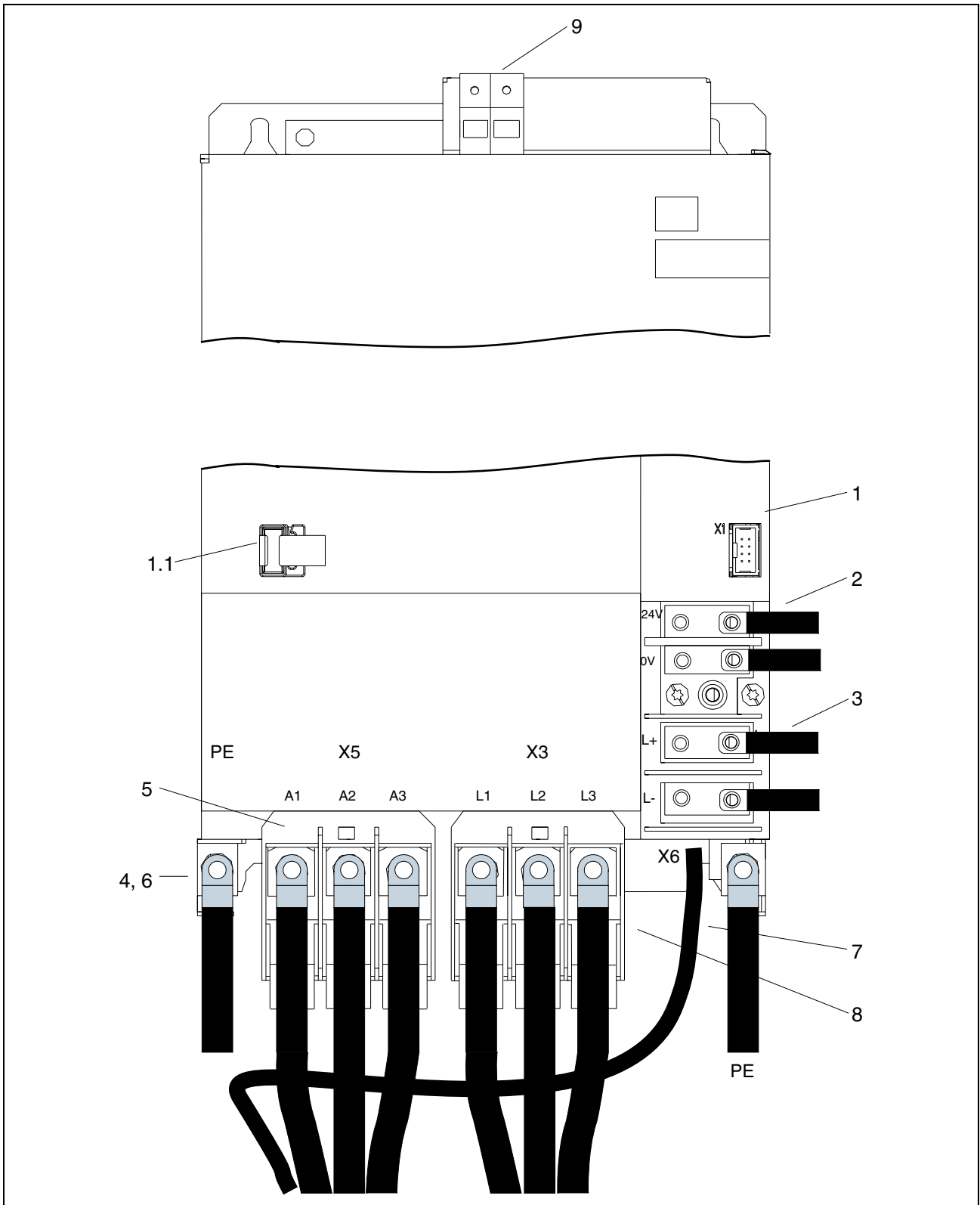


Fig. 6-18: Connections at power section HCS03.1

No.	Designation	Design	Connection obligatory?	Note on terminal description
1	Module bus X1	Ribbon cable	no	The module bus connection is only necessary if a converter of identical rating or an inverter is connected to L+ and L-.
1.1	Park position X1			
2	Control voltage; +24 V and 0 V	Bars	yes (for compliance with UL terms and utilization of integrated safety technology)	Connection of an external 24 V supply is only necessary if an external mains contactor or a holding brake is used. If connection with bars is not possible, short twisted wires may be used as an alternative.
3	DC bus; L+ and L-	Bars	no	Connection is only necessary if two converters of identical rating are to be linked via the DC bus or if an inverter is connected. If connection with bars is impossible, lines may be used as an alternative.
4	Connection of equipment grounding conductor	Joint bar	yes	If connection with joint bar is impossible, lines may be used as an alternative.
5	Motor (X5)	Shielded motor cable	yes	4 connections: A1, A2, A3, PE
6	Shield connection of motor cable		yes	Alternatively, shield connection can be realized via the mounting plate available as an option.
7	Motor temperature monitoring and motor holding brake (X6)	Shielded cable or shielded motor cable with integrated connection cable for X6	no	This connection is only required if the motor is equipped with temperature monitoring function and/or holding brake and if these functions are to be used.
8	Mains connection	Single cores or 4-core non-metallic-sheathed cable	yes	
9	Braking resistor connection	Single cores	no	

Fig. 6-19: Connections at power section (overview)

HCS03.1E

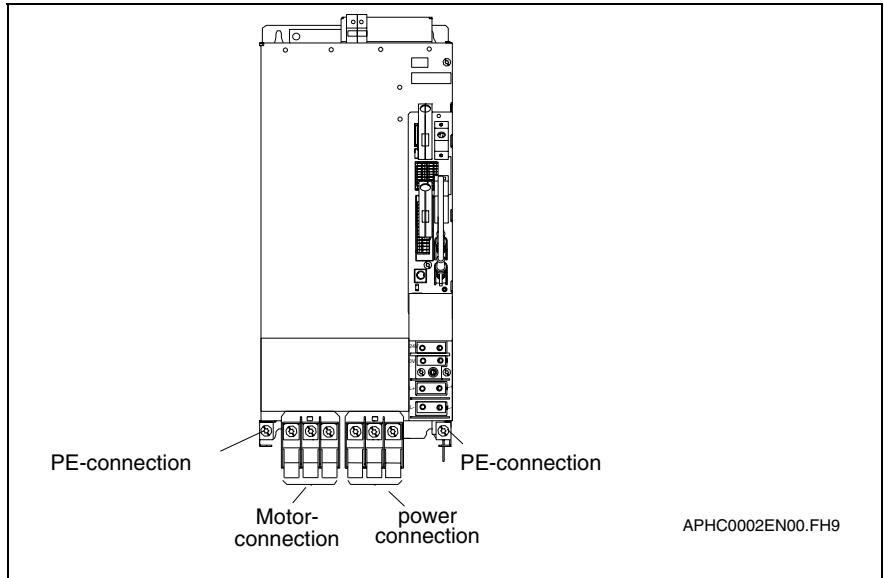
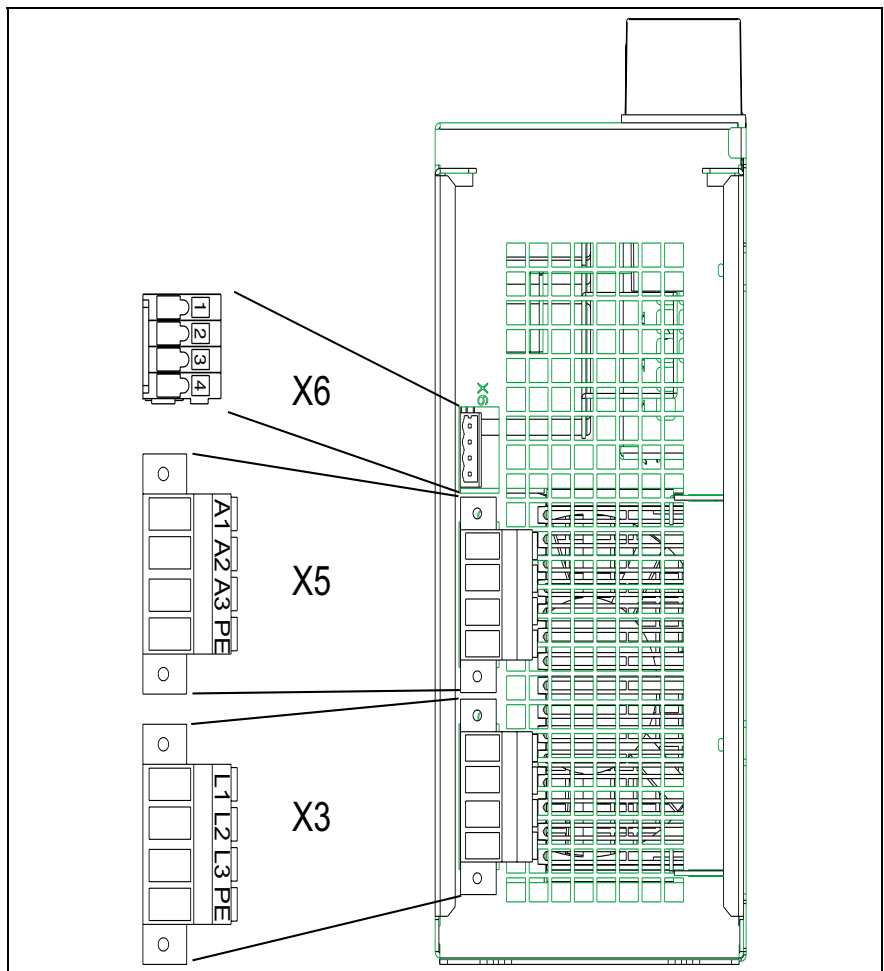


Fig. 6-20: Connections at power section (front) HCS03.1E-W0100...210



- X3: Mains connection
- X5: Motor connection
- X6: Connection of motor temperature, motor holding brake

Fig. 6-21: Connections at power section (bottom) HCS03.1E-W0070

Optional Control Voltage

Control voltage is supplied by an external 24V power supply unit.

Note: Technical data of control voltage: See page 6-12

Design	The control voltage supply is connected via contact bars and screws (M6) at the front of the drive controller (cross section of a contact bar: 6 x 12 mm). Depending on the width of the drive controllers, there are contact bars of different lengths.
Tightening Torque	6 Nm

DC Bus

By means of the DC bus connection, the following components are linked:

- the converter to other inverters
- external additional capacitors are not allowed (except –W0210)

Design	The DC bus is connected via contact bars and screws (M6) at the front of the drive controller (cross section of a contact bar: 6 x 12 mm). Depending on the width of the drive controllers, there are contact bars of different lengths.
Tightening Torque	6 Nm

DC Bus Wiring If in special cases it is not possible to use the DC bus rails for connection, connection must be established using the shortest possible twisted wires.

Length of twisted wire	max. 4 m
Wire cross section	minimum 10 mm ² (AWG 8) but not less than supply feeder cross section
Wire protection	by means of fuses in the mains supply
Dielectric strength of single strand against ground	≥ 750 V DC (e.g.: strand type – H07)



CAUTION

Damage caused by voltage arcing!

⇒ When electrical lines and not the contact bars are used to connect the converter, the connections must be executed correctly.



CAUTION

Damage caused by voltage arcing!

⇒ If drive controllers are stacked in the control cabinet, the connections for the DC buses between the drive controllers have to be correctly made.



CAUTION

Damage due to converter overload!

⇒ Only converters of identical DC bus power may be connected.

X1, Module Bus

The module bus is used to exchange data between two converters of identical rating or between one converter and inverters connected to the DC bus.

Graphic Representation

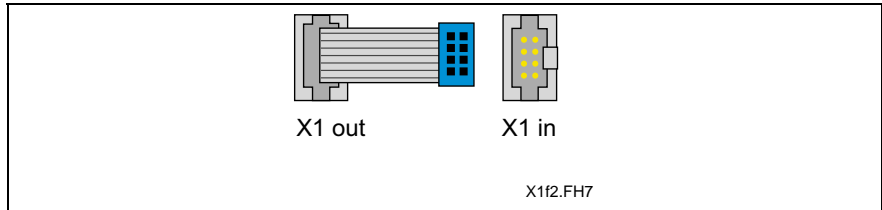


Fig. 6-22: Graphic representation module bus

Design

Type	No. of poles	Type of design
Ribbon cable connector	8	Connector at device
Ribbon cable socket	8	Socket at ribbon cable

Fig. 6-23: Design module bus

Note: When extension cables are used for the module bus, they must be shielded. Their total length must not exceed 40 m.

X3, Mains Connection

Operation in IT mains is possible without restrictions up to a pulse frequency = 8 kHz. Operation at a pulse frequency of > 8 kHz is not allowed.

For operation in grounded IT mains take into account that when filter HNK is used, leakage currents can occur which might trigger circuit breakers or earth-leakage monitors.

Remedy Install an isolating transformer.

Design

HCS03.1E-	Type	No. of poles	Type of design
W0070	Connector	4	Screw connection
W0100	Terminal block	3	Screw connection for M6 ring cable lugs
W0150	Terminal block	3	Screw connection for M6 ring cable lugs
W0210	Terminal block	3	Screw connection for M10 ring cable lug

Fig. 6-24: Design mains connection

Identification of the individual connections:


Identification	Significance
L1	phase 1
L2	phase 2
L3	phase 3
 (PE)	equipment grounding conductor

Fig. 6-25: Identification of the individual connections mains connection

Connection Cross Section

HCS03.1E-	Cross section [mm ²]	Cross section flexible [mm ²]	Cross section AWG
W0070	16	-	6
W0100	35	-	2
W0150	50	2*25	0
W0210	95	2*50	4/0

Fig. 6-26: Connection cross sections mains connection

Tightening Torque

HCS03.1E-	Tightening torque [Nm]
W0070	1.5
W0100	6
W0150	6
W0210	18

Fig. 6-27: Tightening torques mains connection



DANGER

Dangerous movements caused by unbraked coasting to stop of the motor in case supply voltage fails!

- ⇒ Do not stay within the motional range of the machine.
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.

X5, Motor Connection

Design

HCS03.1E-	Type	No. of poles	Type of design
W0070	Connector	4	Screw connection
W0100	Terminal block	3	Screw connection for M6 ring cable lugs
W0150	Terminal block	3	Screw connection for M6 ring cable lugs
W0210	Terminal block	3	Screw connection for M10 ring cable lugs

Fig. 6-28: Design motor connection

Identification of the individual connections:


Identification	Significance
A1	phase 1
A2	phase 2
A3	phase 3
 (PE)	equipment grounding conductor

Fig. 6-29: Identification of the individual connections motor connection

Connection Cross Section

HCS03.1E-	Cross section [mm ²]	Cross section flexible [mm ²]	Cross section in AWG
W0070	16	-	6
W0100	35	-	2
W0150	50	2*25	0
W0210	95	2*50	4/0

Fig. 6-30: Connection cross sections motor connection

Tightening Torque

HCS03.1E-	Tightening torque [Nm]
W0070	1.5
W0100	6
W0150	6
W0210	18

Fig. 6-31: Tightening torques motor connection

**CAUTION****Damage to the drive controller!**

⇒ Strain relief for the motor power cables cannot be provided at the drive controller. Therefore, make sure strain relief of the motor power cables is provided in the control cabinet.

Connection of the Motor Power Cable

For the connection between drive controller and motor, use Rexroth motor power cables.

The Rexroth motor power cable comprises:

- three conductors for motor power connection
- one conductor for equipment grounding connection
- a separately shielded pair of conductors for motor temperature monitoring
- a separately shielded pair of conductors for motor holding brake
- an overall shield to be applied to shield contact.

Alternatively the cable can be composed of four twisted single wires (3 phases, 1 equipment grounding conductor) with separately guided, shielded wires for temperature monitoring and connecting the brake.

Note: For more details on the technical data, connection and cross section, please refer to the respective motor description.

Data of the Motor Cable

To avoid overload of the drive controller the motor cable length is limited at a switching frequency > 4 kHz.

The lengths indicated in the table below are recommended as guide values (at an ambient temperature of ≤ 40 °C in accordance with EN 60 204).

Allowed line lengths for motor connection **without** filter measures at motor output:

Drive controller switching frequency	Max. length for 2 nd environment (industrial area), EN61800-3
4 kHz	75 m
8 kHz	50 m
12 kHz	25 m
16 kHz	18 m

Fig. 6-32: Cable lengths

Note: If greater cable lengths are required, the additional component HMF01.1 must be used.
The maximum allowed cable length with HMF01.1 is 200 m, the maximum allowed switching frequency of the drive controller in this case has to be limited to 4 kHz.

Note: If two motor cables connected in parallel are used between drive controller and motor, the maximum allowed length of the motor cable is reduced by half.

X6, Motor Temperature Monitoring and Motor Holding Brake

Graphic Representation

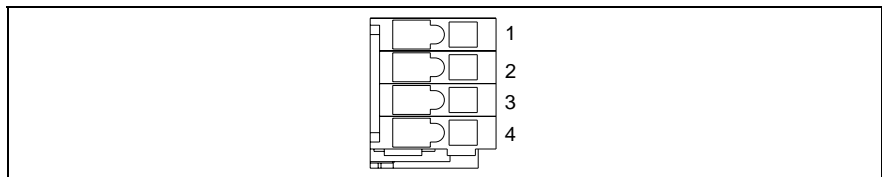


Fig. 6-33: Terminal X6

Design

Type	No. of poles	Type of design
Spring tension	4	Pins on device

Fig. 6-34: Design X6

Connection

1	MotTemp+	Motor temperature monitoring
2	MotTemp-	
3	+24 V	Motor holding brake
4	0 V	

Fig. 6-35: Pin assignment X6

Connection Cross Section

HCS03.1E-W0070:

Cross section single-wire [mm ²]	Cross section multi-wire [mm ²]	Cross section in AWG
1,5	1,5	16

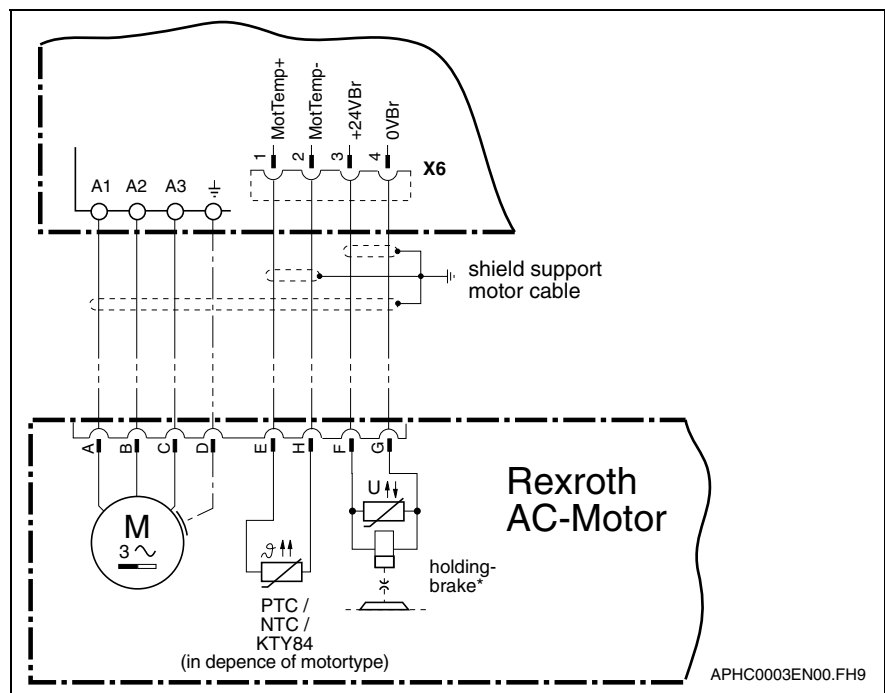
Fig. 6-36: Connection cross section X6 (HCS03.1E-W0070)

HCS03.1E-W0100, -W0150 and -W0210:

Cross section single-wire [mm ²]	Cross section multi-wire [mm ²]	Cross section in AWG
2,5	2,5	12

Fig. 6-37: Connection cross-section X6 (HCS03.1E-W0100...0210)

Note: The brake is supplied via the optional 24 V control voltage.



*: Holding brake (optional)

Fig. 6-38: Connection of motor temperature monitoring and motor holding brake



Maximum allowed braking current:

- W0070: 2 A
- W0100: 2 A
- W0150: 2 A
- W0210: 2 A

Where braking currents are higher, the motor holding brake must be activated by means of an external contact element.

Note: With the HCS03.1 devices it is possible to operate a motor brake with a switching frequency of 0.5 Hz.

Note: The output to the motor holding brake (+24 V, 0 V) is protected against overload and short-circuit by means of an internal electronic switch.

**DANGER**

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

- ⇒ 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!
- ⇒ Personnel safety must be achieved using higher-ranking, fail-safe procedures:
 - Dangerous areas should be blocked off with protective fences or grids.
 - Additionally secure vertical axes against falling or sinking after switching off the motor power by, for example:
 - mechanically locking the vertical axis
 - providing external braking/catching/clamping mechanisms
 - adequately counterbalancing the axis.

For the current consumption of the motor holding brake see the project planning documentation for the AC motors.

The motor holding brake of the AC motors has not been designed as a service brake. After approximately 20,000 motor revolutions against the closed brake armature disc it will be worn.

Controlling the Motor Holding Brake

The drive controller can assume the control of the motor holding brake.

Note: If the drive controller controls the brake, external supply with +24V is required.

Note: For operating Rexroth motors with motor brake, external supply of 24 V +/-10 % is required (please also take the data sheet of the motors into account).

Note: In the condition as supplied, control is not activated.

X9, Braking Resistor

Design	HCS03.1E-	Type	No. of poles	Type of design
	W0070	Connector	2	Screw connection
	W0100	Screw terminal block	2	Screw connection
	W0150	Screw terminal block	2	Screw connection
	W0210	Screw terminal block	2	Screw connection

Fig. 6-39: Design X9 braking resistor

Identification of the individual connections:

Identification	Significance
1	connection of chopper IGBT
2	DC bus L+

Fig. 6-40: Identification of the individual connections X9 braking resistor

Connection Cross Section

HCS03.1E-	Cross section in [mm ²]	Cross section in AWG
W0070	16	6
W0100	25	4
W0150	25	4
W0210	50	0

Fig. 6-41: Connection cross sections X9 braking resistor

Tightening Torque

HCS03.1E-	Tightening torque [Nm]
W0070	1.5
W0100	2
W0150	2
W0210	8

Fig. 6-42: Tightening torques X9 braking resistor

Note: With twisted or shielded cable, the maximum cable length for the braking resistor is 5 m.

XS1, Shield Connection

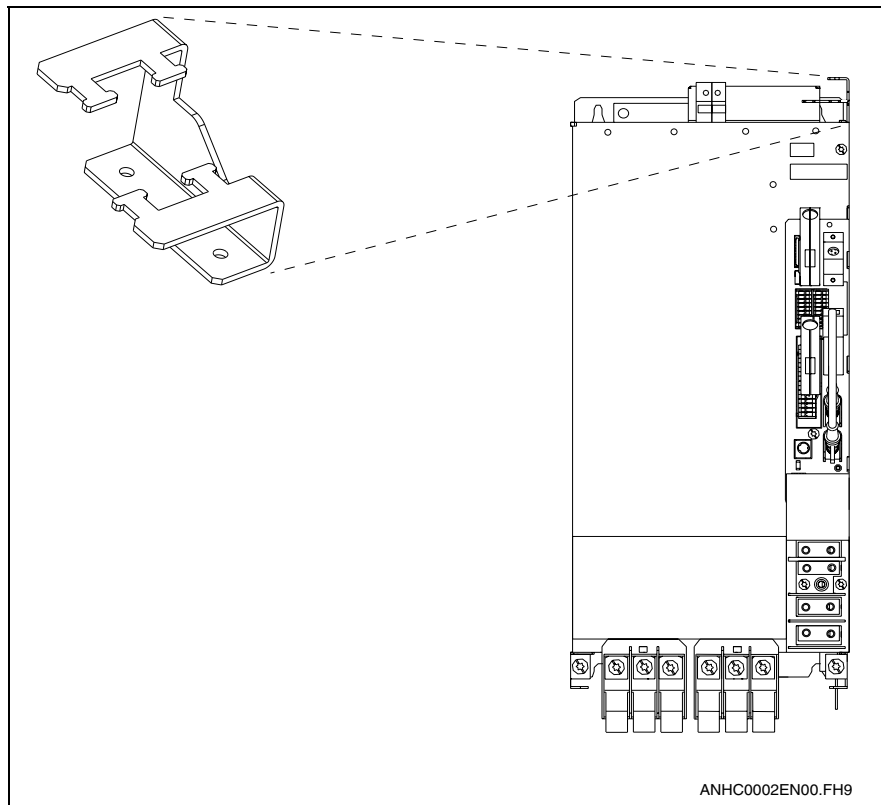


Fig. 6-43: Shield connection XS1

Connection for shields of lines connected to the control section (only for lines with connectors, which do not have their own shield connection).

Note: Always connect shields of control lines with a large metal-to-metal contact surface.

Ground Connection of Housing

The ground connection of the housing is used to provide functional safety of the drive controllers and protection against contact in conjunction with the equipment grounding conductor.

Ground the housings of the drive controllers:

1. Connect the bare metal back panel of the drive controller in conductive form to the mounting surface in the control cabinet. To do this use the supplied mounting screws.
2. Connect the mounting surface of the control cabinet in conductive form to the equipment grounding system.

See also Project Planning Manual of drive system, chapter "System Connections of the Components"

Connection Point of Equipment Grounding Conductor

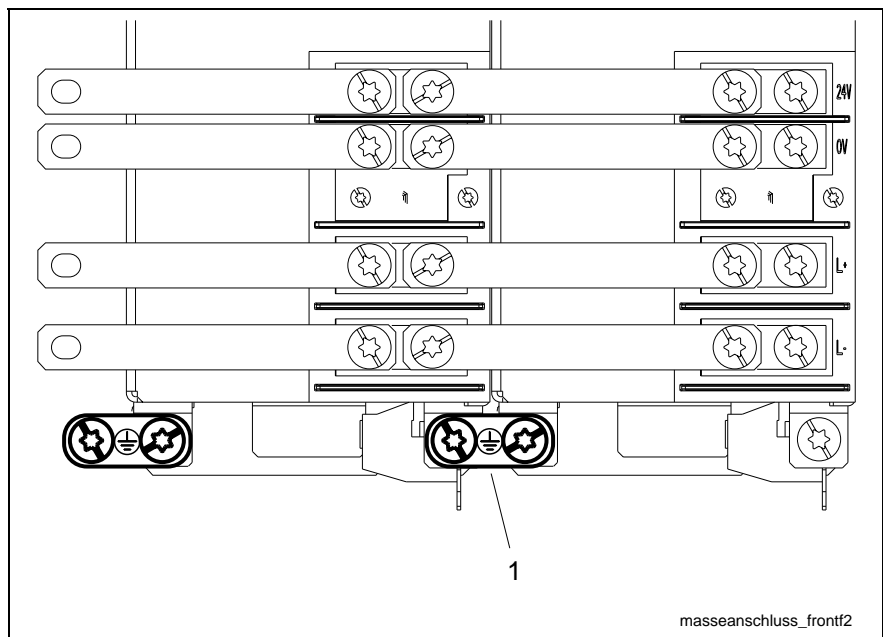


DANGER

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

- ⇒ Connect the drive controller to the equipment grounding system.
- ⇒ Via the joint bar on the front connect the drive controller **to the neighboring drive controller**.

See also Project Planning Manual of drive system, chapter "System Connections of the Components"



1: joint bar

Fig. 6-44: Equipment grounding connection to neighboring device

Note: Cables used for connection of the equipment grounding conductor must have a cross section of at least 10 mm^2 (however not smaller than the supply feeder cross section).

Design The joint bar is mounted by means of screws (M6 x 25).

Tightening Torque 6 Nm

7 Touch Guard



WARNING

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

- ⇒ The appropriate touch guard must be mounted for each drive controller following connection work.
- ⇒ Never mount a damaged touch guard.
- ⇒ Immediately replace a damaged touch guard by an undamaged touch guard.

Cutouts

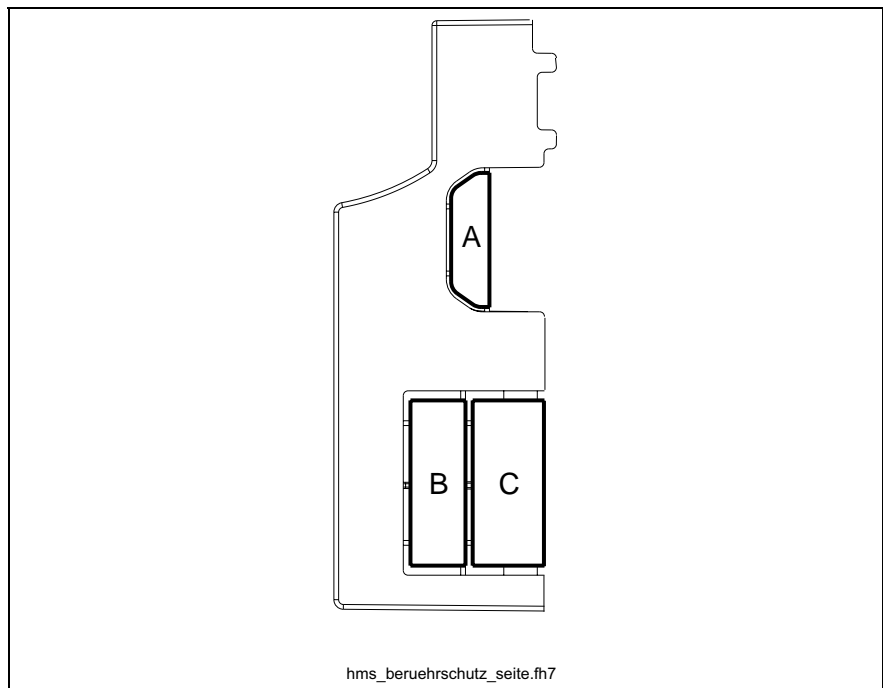


Fig. 7-1: Cutouts at the touch guard



WARNING

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

- ⇒ You have to provide the best possible protection against contact. Therefore keep the cutouts at the touch guard as small as possible.
- ⇒ Only break off the cutouts if necessary.

- If the DC bus and the control voltage are connected by means of **contact rails**, only the **cutout C** (see picture) may be broken off the touch guard.
- If the DC bus and the control voltage are connected by means of **cables** (e.g. in the case of multiple-line arrangement of the drive controllers), the **cutouts A, B and C** (see picture) may be broken off the touch guard.
- At the first and last drive controller in a line of drive controllers connected to each other there **mustn't any** cutout be broken off at the outer side of the touch guard.

Mounting

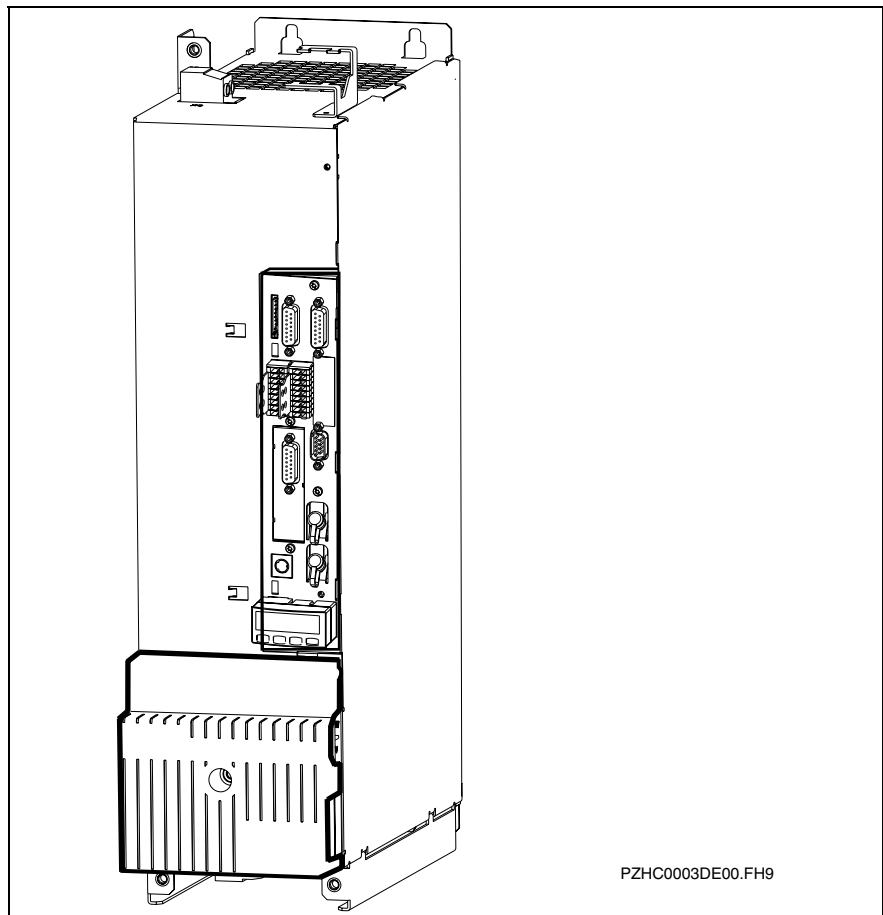


Fig. 7-2: Touch guard

The touch guard must always be mounted following connection work.

Note: Risk of damage to the touch guard!
The maximum tightening torque for the fixing screw for the touch guard is **2.8 Nm**.

8 Replacing Devices

8.1 General Information

The diagnostic display enables aimed and effective troubleshooting in order to:

- avoid production downtimes due to extensive searches in individual devices and repairs of devices in the installation.
- start operating the installation again without extensive assembly and adjustments.
- quickly eliminate the problem and easily replace defective drive components.

When returning a defective device to our Customer Service, please enclose the completed Fault Report. The Fault Report is included in this chapter and may be copied for your convenience.

Note: The new drive component must have the same type designation as the faulty device. To ensure this, indicate the entire type designation when requesting replacement parts.

8.2 How to Proceed When Replacing Devices

Note: For replacing devices you absolutely have to observe the safety instructions contained in chapter 3!

Replacing the Drive Controller

- save parameter set
- open main switch
- make sure main switch cannot be switched on again
- make sure drive controller is completely de-energized



DANGER

Lethal electric shock caused by contact to live parts!

⇒ Before touching live parts allow the capacitors to discharge! Only then start working on the connection cables!

-
- remove touch guard and separate connecting lines from drive controller
 - unscrew screws on top and bottom of housing
 - take drive controller out of drive system
 - mount new drive controller
 - connect new drive controller as specified in machine circuit diagram
 - mount touch guard
 - copy firmware and parameter set to new drive controller (see firmware documentation)

Replacing the Motor

- open main switch
- make sure main switch cannot be switched on again
- disconnect plug-in connectors

Note: When replacing the motor, cover the open mating sites of power lines with protective caps if sprinkling with cooling liquid/lubricant or soiling may occur (allowed degree of soiling according to EN50178: 2).

- replace motor

Note: To mechanically replace the AC servo motor, observe the instructions of the machine manufacturer.

- connect plug-in connectors



Risk of accident due to accidental axis movement!

⇒ Servo axes with indirect distance measuring system via the motor encoder will lose the position data reference when the motor is replaced! This position data reference to the machine coordinate system must therefore be reestablished after replacement.

-
- for servo axes with absolute motor encoder, reestablish the position data reference

Replacing Cables



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

⇒ Power connectors of the cables may only be separated or connected if the installation has been de-energized!

Note: When replacing cables, observe the instructions of the machine manufacturer.
If you do not use ready-made Rexroth cables, check to ensure that the cables match the terminal diagram of the machine manufacturer!

- open main switch
 - make sure main switch cannot be switched on again
 - disconnect plug-in connectors
-

Note: When replacing cables, cover the open mating sites of power lines with protective caps if sprinkling with cooling liquid/lubricant or soiling may occur (allowed degree of soiling according to EN50178: 2).

- replace cable
-



Property damage caused by bad power connectors!

⇒ Only connect clean and dry power connectors.

- connect plug-in connectors

8.3 Fault Report

Rexroth Bosch Group	Fault Report for Drive Systems	Date: Report No.:		
<p>This fault report is intended to help eliminate problems that might possibly be related to drive systems. Please fill it out carefully and send it, together with the parameter file with which the fault occurred, to Bosch Rexroth.</p>				
Contact person: Customer (machine manufacturer): End customer: Branch of industry:	Telephone: Fax: E-mail: @			
<p>System description:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p><u>Firmware</u> Firmware version: FWA- - - V -MS</p> <p><u>Software:</u> DriveTop version: SWA-DTOP**-INB- V -MS Operating system: Service pack: Language: PC designation: Hardware configuration (system RAM, hard disk memory,...):</p> </td> <td style="width: 50%; vertical-align: top;"> <p><u>Drive system</u></p> <p>Power section: Type code: - - - - Serial number: SN Hardware index:</p> <p>Control section: Type code: - - - - - - Serial number: SN Hardware index:</p> <p>Supply module: Type code: - - - - Serial number:</p> </td> </tr> </table>			<p><u>Firmware</u> Firmware version: FWA- - - V -MS</p> <p><u>Software:</u> DriveTop version: SWA-DTOP**-INB- V -MS Operating system: Service pack: Language: PC designation: Hardware configuration (system RAM, hard disk memory,...):</p>	<p><u>Drive system</u></p> <p>Power section: Type code: - - - - Serial number: SN Hardware index:</p> <p>Control section: Type code: - - - - - - Serial number: SN Hardware index:</p> <p>Supply module: Type code: - - - - Serial number:</p>
<p><u>Firmware</u> Firmware version: FWA- - - V -MS</p> <p><u>Software:</u> DriveTop version: SWA-DTOP**-INB- V -MS Operating system: Service pack: Language: PC designation: Hardware configuration (system RAM, hard disk memory,...):</p>	<p><u>Drive system</u></p> <p>Power section: Type code: - - - - Serial number: SN Hardware index:</p> <p>Control section: Type code: - - - - - - Serial number: SN Hardware index:</p> <p>Supply module: Type code: - - - - Serial number:</p>			
<p><u>Motor</u> Type designation: Serial number: S.No. Motor encoder: Mounting position:</p>	<p>Additional components (e.g. control system involved, external encoder, filter, cooling system in control cabinet,...):</p>			
Fault description (detailed description of situation before, during and after fault occurred):				
To quickly resolve your problem we ask you to send us also the parameter set with which the fault occurred. Name of parameter set file:				

General conditions:

Mode at time fault occurred: Operating mode Parameterization mode
 Switch phase

Operating mode active at time fault occurred: Encoder , ,

7-segment display... ..before fault occurred:
 ...after fault occurred:

Fault status	Causes	Other defects
<input type="checkbox"/> occurs permanently	<input type="checkbox"/> unknown	<input type="checkbox"/> problems in the mechanical system
<input type="checkbox"/> occurs during commissioning	<input type="checkbox"/> incorrect connection	<input type="checkbox"/> power section failure
<input type="checkbox"/> occurs sporadically	<input type="checkbox"/> external cause	<input type="checkbox"/> control system failure
<input type="checkbox"/> occurs after approx. hours	<input type="checkbox"/> mechanical damage	<input type="checkbox"/> motor failure
<input type="checkbox"/> occurs with shocks	<input type="checkbox"/> loose cable connection	<input type="checkbox"/> cable break
<input type="checkbox"/> depends on temperature	<input type="checkbox"/> moisture in unit	<input type="checkbox"/> defective blower
	<input type="checkbox"/> foreign body in unit	<input type="checkbox"/> defective feedback

Wiring / mechanical setup (e. g. length of cables, grounding, assembly,...):

Information on the machine (e. g. operating hours, type, serial number,...):

Mains conditions (e. g. frequency, voltage,...):

Ambient conditions (e. g. ambient temperature, humidity,...):

In case of problems with DriveTop

Name of dialog in which fault occurred:

Drive connection:

Note: In order to resolve your DriveTop problem quickly, we would like to ask you to send us the file "debug.log". You can find it in the DriveTop directory.

Fig. 8-1: Fault report

9 Disposal and Environmental Protection

9.1 Disposal

Products

Our products can be returned to us free of charge for disposal. However, the products must be free of oil, grease or other dirt.

Furthermore, the products returned for disposal must not contain any undue foreign matter or foreign component.

Please send the products free domicile to the following address:

Bosch Rexroth AG
Electric Drives and Controls
Bürgermeister-Dr.-Nebel-Straße 2
D-97816 Lohr am Main

Packaging Materials

The packaging materials consist of cardboard, wood, and polystyrene. These materials can be easily recycled in any municipal recycling system. For ecological reasons, please refrain from returning the empty packages to us.

9.2 Environmental Protection

No Release of Hazardous Substances

Our products do not contain any hazardous substances which may be released in the case of appropriate use. Accordingly, our products will normally not have any negative effect on the environment.

Materials Contained in the Products

Electronic Devices

Electronic devices mainly contain:

- steel
- aluminum
- copper
- synthetic materials
- electronic components and modules

Recycling

Due to their high content of metal, most of the product components can be recycled. In order to recycle the metal in the best possible way, the products must be disassembled into individual modules.

Metals contained in electric and electronic modules can also be recycled by means of special separation processes. The synthetic materials remaining after these processes can be thermally recycled.

10 Service & Support

10.1 Helpdesk

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

- telefonisch - by phone:
über Service Call Entry Center
- via Service Call Entry Center

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

+49 (0) 9352 40 50 60
Mo-Fr 07:00-18:00
Mo-Fr 7:00 am - 6:00 pm

- per Fax - by fax:

+49 (0) 9352 40 49 41

- per e-Mail - by e-mail: service.svc@boschrexroth.de

10.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

After helpdesk hours, contact our service department directly at

+49 (0) 171 333 88 26

oder - or

+49 (0) 172 660 04 06

10.3 Internet

Unter www.boschrexroth.com finden Sie ergänzende Hinweise zu Service, Reparatur und Training sowie die **aktuellen** Adressen *) unserer auf den folgenden Seiten aufgeführten Vertriebs- und Servicebüros.



Verkaufsniederlassungen



Niederlassungen mit Kundendienst

Außerhalb Deutschlands nehmen Sie bitte zuerst Kontakt mit unserem für Sie nächstgelegenen Ansprechpartner auf.

*) Die Angaben in der vorliegenden Dokumentation können seit Drucklegung überholt sein.

At www.boschrexroth.com you may find additional notes about service, repairs and training in the Internet, as well as the **actual** addresses *) of our sales- and service facilities figuring on the following pages.



sales agencies



offices providing service

Please contact our sales / service office in your area first.

*) Data in the present documentation may have become obsolete since printing.

10.4 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.

10.5 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

vom Ausland:
from abroad:

(0) nach Landeskennziffer weglassen!
don't dial (0) after country code!

<p>Vertriebsgebiet Mitte Germany Centre</p> <p>Rexroth Indramat GmbH Bgm.-Dr.-Nebel-Str. 2 / Postf. 1357 97816 Lohr am Main / 97803 Lohr</p> <p>Kompetenz-Zentrum Europa</p> <p>Tel.: +49 (0)9352 40-0 Fax: +49 (0)9352 40-4885</p>	<p>SERVICE AUTOMATION</p> <p>CALL ENTRY CENTER Helpdesk MO – FR von 07:00 - 18:00 Uhr from 7 am – 6 pm</p> <p>Tel. +49 (0) 9352 40 50 60 Fax +49 (0) 9352 40 49 41 service.svc@boschrexroth.de</p>	<p>SERVICE AUTOMATION</p> <p>HOTLINE 24 / 7 / 365</p> <p>außerhalb der Helpdesk-Zeit out of helpdesk hours</p> <p>Tel.: +49 (0)172 660 04 06 oder / or Tel.: +49 (0)171 333 88 26</p>	<p>SERVICE AUTOMATION</p> <p>ERSATZTEILE / SPARES verlängerte Ansprechzeit - extended office time -</p> <p>◆ nur an Werktagen - only on working days -</p> <p>◆ von 07:00 - 18:00 Uhr - from 7 am - 6 pm -</p> <p>Tel. +49 (0) 9352 40 42 22</p>
<p>Vertriebsgebiet Süd Germany South</p> <p>Bosch Rexroth AG Landshuter Allee 8-10 80637 München</p> <p>Tel.: +49 (0)89 127 14-0 Fax: +49 (0)89 127 14-490</p>	<p>Vertriebsgebiet West Germany West</p> <p>Bosch Rexroth AG Regionalzentrum West Borsigstrasse 15 40880 Ratingen</p> <p>Tel.: +49 (0)2102 409-0 Fax: +49 (0)2102 409-406 +49 (0)2102 409-430</p>	<p>Gebiet Südwest Germany South-West</p> <p>Bosch Rexroth AG Service-Regionalzentrum Süd-West Siemensstr. 1 70736 Fellbach</p> <p>Tel.: +49 (0)711 51046-0 Fax: +49 (0)711 51046-248</p>	
<p>Vertriebsgebiet Nord Germany North</p> <p>Bosch Rexroth AG Walsroder Str. 93 30853 Langenhagen</p> <p>Tel.: +49 (0) 511 72 66 57-0 Service: +49 (0) 511 72 66 57-256 Fax: +49 (0) 511 72 66 57-93 Service: +49 (0) 511 72 66 57-783</p>	<p>Vertriebsgebiet Mitte Germany Centre</p> <p>Bosch Rexroth AG Regionalzentrum Mitte Waldecker Straße 13 64546 Mörfelden-Walldorf</p> <p>Tel.: +49 (0) 61 05 702-3 Fax: +49 (0) 61 05 702-444</p>	<p>Vertriebsgebiet Ost Germany East</p> <p>Bosch Rexroth AG Beckerstraße 31 09120 Chemnitz</p> <p>Tel.: +49 (0)371 35 55-0 Fax: +49 (0)371 35 55-333</p>	<p>Vertriebsgebiet Ost Germany East</p> <p>Bosch Rexroth AG Regionalzentrum Ost Walter-Köhn-Str. 4d 04356 Leipzig</p> <p>Tel.: +49 (0)341 25 61-0 Fax: +49 (0)341 25 61-111</p>

Europa (West) - Europe (West)

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Italy: dial 0 after country code

<p>Austria – Österreich</p> <p>Bosch Rexroth GmbH Electric Drives & Controls Stachegasse 13 1120 Wien</p> <p>Tel.: +43 (0)1 985 25 40 Fax: +43 (0)1 985 25 40-93</p>	<p>Austria – Österreich</p> <p>Bosch Rexroth GmbH Electric Drives & Controls Industriepark 18 4061 Pasching</p> <p>Tel.: +43 (0)7221 605-0 Fax: +43 (0)7221 605-21</p>	<p>Belgium - Belgien</p> <p>Bosch Rexroth NV/SA Henri Genessestraat 1 1070 Bruxelles</p> <p>Tel: +32 (0) 2 451 26 08 Fax: +32 (0) 2 451 27 90 info@boschrexroth.be service@boschrexroth.be</p>	<p>Denmark - Dänemark</p> <p>BEC A/S Zinkvej 6 8900 Randers</p> <p>Tel.: +45 (0)87 11 90 60 Fax: +45 (0)87 11 90 61</p>
<p>Great Britain – Großbritannien</p> <p>Bosch Rexroth Ltd. Electric Drives & Controls Broadway Lane, South Cerney Cirencester, Glos GL7 5UH</p> <p>Tel.: +44 (0)1285 863000 Fax: +44 (0)1285 863030 sales@boschrexroth.co.uk service@boschrexroth.co.uk</p>	<p>Finland - Finnland</p> <p>Bosch Rexroth Oy Electric Drives & Controls Ansatie 6 017 40 Vantaa</p> <p>Tel.: +358 (0)9 84 91-11 Fax: +358 (0)9 84 91-13 60</p>	<p>France - Frankreich</p> <p>Bosch Rexroth SAS Electric Drives & Controls Avenue de la Trentaine (BP. 74) 77503 Chelles Cedex</p> <p>Tel.: +33 (0)164 72-63 22 Fax: +33 (0)164 72-63 20 Hotline: +33 (0)608 33 43 28</p>	<p>France - Frankreich</p> <p>Bosch Rexroth SAS Electric Drives & Controls ZI de Thibaud, 20 bd. Thibaud (BP. 1751) 31084 Toulouse</p> <p>Tel.: +33 (0)5 61 43 61 87 Fax: +33 (0)5 61 43 94 12</p>
<p>France – Frankreich</p> <p>Bosch Rexroth SAS Electric Drives & Controls 91, Bd. Irène Joliot-Curie 69634 Vénissieux – Cedex</p> <p>Tel.: +33 (0)4 78 78 53 65 Fax: +33 (0)4 78 78 53 62</p>	<p>Italy - Italien</p> <p>Bosch Rexroth S.p.A. Via G. Di Vittorio, 1 20063 Cernusco S/N.MI</p> <p>Hotline: +39 02 92 365 563 Tel.: +39 02 92 365 1 Service: +39 02 92 365 300 Fax: +39 02 92 365 500 Service: +39 02 92 365 516</p>	<p>Italy - Italien</p> <p>Bosch Rexroth S.p.A. Via Paolo Veronesi, 250 10148 Torino</p> <p>Tel.: +39 011 224 88 11 Fax: +39 011 224 88 30</p>	<p>Italy - Italien</p> <p>Bosch Rexroth S.p.A. Via Mascia, 1 80053 Castellammare di Stabia NA</p> <p>Tel.: +39 081 8 71 57 00 Fax: +39 081 8 71 68 85</p>
<p>Italy - Italien</p> <p>Bosch Rexroth S.p.A. Via del Progresso, 16 (Zona Ind.) 35020 Padova</p> <p>Tel.: +39 049 8 70 13 70 Fax: +39 049 8 70 13 77</p>	<p>Italy - Italien</p> <p>Bosch Rexroth S.p.A. Via Isonzo, 61 40033 Casalecchio di Reno (Bo)</p> <p>Tel.: +39 051 29 86 430 Fax: +39 051 29 86 490</p>	<p>Netherlands - Niederlande/Holland</p> <p>Bosch Rexroth Services B.V. Technical Services Kruisbroeksestraat 1 (P.O. Box 32) 5281 RV Boxtel</p> <p>Tel.: +31 (0) 411 65 19 51 Fax: +31 (0) 411 67 78 14 Hotline: +31 (0) 411 65 19 51 services@boschrexroth.nl</p>	<p>Netherlands – Niederlande/Holland</p> <p>Bosch Rexroth B.V. Kruisbroeksestraat 1 (P.O. Box 32) 5281 RV Boxtel</p> <p>Tel.: +31 (0) 411 65 16 40 Fax: +31 (0) 411 65 14 83 www.boschrexroth.nl</p>
<p>Norway - Norwegen</p> <p>Bosch Rexroth AS Electric Drives & Controls Berghagan 1 or: Box 3007 1405 Ski-Langhus 1402 Ski</p> <p>Tel.: +47 (0) 64 86 41 00</p> <p>Fax: +47 (0) 64 86 90 62</p> <p>Hotline: +47 (0)64 86 94 82 jul.ruud@rexroth.no</p>	<p>Spain – Spanien</p> <p>Goimendi Automation Parque Empresarial Zuatzu C/ Francisco Grandmontagne no.2 20018 San Sebastian</p> <p>Tel.: +34 9 43 31 84 21 - service: +34 9 43 31 84 56 Fax: +34 9 43 31 84 27 - service: +34 9 43 31 84 60 sat.indramat@goimendi.es</p>	<p>Spain - Spanien</p> <p>Bosch Rexroth S.A. Electric Drives & Controls Centro Industrial Santiga Obradors s/n 08130 Santa Perpetua de Mogoda Barcelona</p> <p>Tel.: +34 9 37 47 94 00 Fax: +34 9 37 47 94 01</p>	<p>Spain - Spanien</p> <p>Bosch Rexroth S.A. Electric Drives & Controls c/ Almazara, 9 28760 Tres Cantos (Madrid)</p> <p>Tel.: +34 91 806 24 79 Fax: +34 91 806 24 72 fernando.bariego@boschrexroth.es</p>
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<p>Korea</p> <p>Bosch Rexroth-Korea Ltd. 1515-14 Dadae-Dong, Saha-gu Electric Drives & Controls Pusan Metropolitan City, 604-050</p> <p>Tel.: +82 51 26 00 741 Fax: +82 51 26 00 747 eunkyong.kim@boschrexroth.co.kr</p>	<p>Malaysia</p> <p>Bosch Rexroth Sdn.Bhd. 11, Jalan U8/82, Seksyen U8 40150 Shah Alam Selangor, Malaysia</p> <p>Tel.: +60 3 78 44 80 00 Fax: +60 3 78 45 48 00 hockhwa@hotmail.com rexroth1@tm.net.my</p>	<p>Singapore - Singapur</p> <p>Bosch Rexroth Pte Ltd 15D Tuas Road Singapore 638520</p> <p>Tel.: +65 68 61 87 33 Fax: +65 68 61 18 25 sanjay.nemade@boschrexroth.com.sg</p>	<p>South Africa - Südafrika</p> <p>TECTRA Automation (Pty) Ltd. 71 Watt Street, Meadowdale Edenvale 1609</p> <p>Tel.: +27 11 971 94 00 Fax: +27 11 971 94 40 Hotline: +27 82 903 29 23 georgv@tectra.co.za</p>
<p>Taiwan</p> <p>Bosch Rexroth Co., Ltd. Taichung Industrial Area No.19, 38 Road Taichung, Taiwan 407, R.O.C.</p> <p>Tel.: +886 - 4 -235 08 383 Fax: +886 - 4 -235 08 586 jim.lin@boschrexroth.com.tw david.lai@boschrexroth.com.tw</p>	<p>Taiwan</p> <p>Bosch Rexroth Co., Ltd. Tainan Branch No. 17, Alley 24, Lane 737 Chung Cheng N.Rd. Yungkang Tainan Hsien, Taiwan, R.O.C.</p> <p>Tel.: +886 - 6 -253 6565 Fax: +886 - 6 -253 4754 charlie.chen@boschrexroth.com.tw</p>	<p>Thailand</p> <p>NC Advance Technology Co. Ltd. 59/76 Moo 9 Ramintra road 34 Tharang, Bangkok Bangkok 10230</p> <p>Tel.: +66 2 943 70 62 +66 2 943 71 21 Fax: +66 2 509 23 62 Hotline +66 1 984 61 52 sonkawin@hotmail.com</p>	

Nordamerika – North America

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USA East Region – Ost Bosch Rexroth Corporation Electric Drives & Controls Charlotte Regional Sales Office 14001 South Lakes Drive Charlotte, North Carolina 28273 Tel.: +1 704 583-9762 +1 704 583-1486	USA Northeast Region – Nordost Bosch Rexroth Corporation Electric Drives & Controls Northeastern Technical Center 99 Rainbow Road East Granby, Connecticut 06026 Tel.: +1 860 844-8377 Fax: +1 860 844-8595	USA West Region – West Bosch Rexroth Corporation 7901 Stoneridge Drive, Suite 220 Pleasant Hill, California 94588 Tel.: +1 925 227-1084 Fax: +1 925 227-1081	
Canada East - Kanada Ost Bosch Rexroth Canada Corporation Burlington Division 3426 Mainway Drive Burlington, Ontario Canada L7M 1A8 Tel.: +1 905 335 5511 Fax: +1 905 335 4184 Hotline: +1 905 335 5511 michael.moro@boschrexroth.ca	Canada West - Kanada West Bosch Rexroth Canada Corporation 5345 Goring St. Burnaby, British Columbia Canada V7J 1R1 Tel.: +1 604 205 5777 Fax: +1 604 205 6944 Hotline: +1 604 205 5777 david.gunby@boschrexroth.ca	Mexico Bosch Rexroth Mexico S.A. de C.V. Calle Neptuno 72 Unidad Ind. Vallejo 07700 Mexico, D.F. Tel.: +52 55 57 54 17 11 Fax: +52 55 57 54 50 73 mariofelipe.hernandez@boschrexroth.com.mx x	Mexico Bosch Rexroth S.A. de C.V. Calle Argentina No 3913 Fracc. las Torres 64930 Monterrey, N.L. Tel.: +52 81 83 65 22 53 +52 81 83 65 89 11 +52 81 83 49 80 91 Fax: +52 81 83 65 52 80

Südamerika – South America

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Columbia - Kolumbien Reflutec de Colombia Ltda. Calle 37 No. 22-31 Santafé de Bogotá, D.C. Colombia Tel.: +57 1 368 82 67 +57 1 368 02 59 Fax: +57 1 268 97 37 reflutec@etb.net.co			

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