The Drive & Control Company

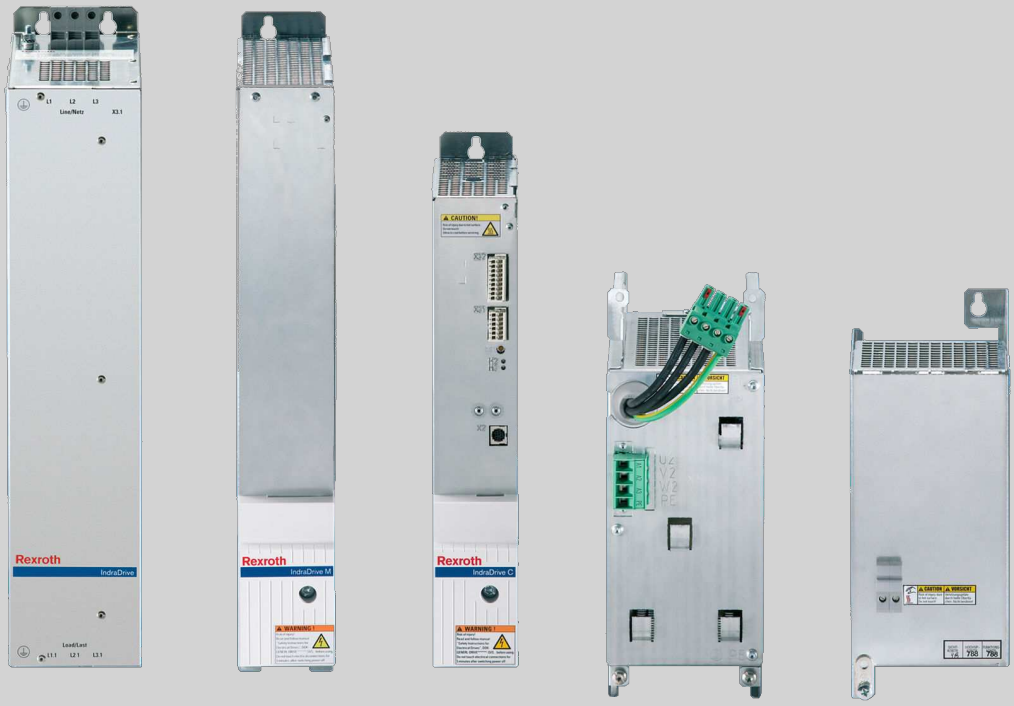
Rexroth
Bosch Group

Rexroth IndraDrive

Additional Components and Accessories

Project Planning Manual
R911306140

Edition 05



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1 Introduction

1.1 Documentation

1.1.1 General information

This documentation

This documentation describes the following additional components and accessories for Rexroth IndraDrive systems:

- Transformers (DST)
- Mains filters (HNF, HNK, HNS, NFE, NFD)
- Mains chokes (HNL)
- DC bus chokes (HLL)
- DC bus capacitor units (HLC)
- DC bus resistor units (HLB)
- Braking resistors (HLR)
- Braking units (HLT01)
- Motor filters (HMF)
- Housings for control sections (HAC)
- Control module for holding brake (HAT01)
- Control module for inductive loads (HAT02)
- Safety zone module (HSZ)
- Fan unit (HAB)
- Accessories (HAS)

⚠ WARNING **Personal injury and property damage by incorrect configuration of applications, machines and installations!**

Take the contents of the following documentation into account: "Rexroth IndraDrive, Drive Systems with HMV01/02, HMS01/02, HMD01, HCS02/03" (DOK-INDRV*-SYSTEM*****-PRxx-EN-P; mat. no.: R911309636). This documentation, among other things, contains:

- General specifications for the components of the drive system
- Configuration of the drive system components
- Arranging the components in the control cabinet
- Electromagnetic compatibility (EMC)
- Types of mains connection
- Requirements on the mains connection
- Control circuits for the mains connection
- Connections of the components in the drive system
- Fusing and selection of the mains contactor
- 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)

Introduction

1.1.2 Editions

Edition	Notes
05	Changes in comparison to previous edition: *New contents* • HAT02 control module for inductive loads • HNF01.1**C** mains filter • HAS05.1-016, -017, -018, -019, -020 accessories

Edition	Notes
04	Changes in comparison to previous edition: *New contents* • HSZ safety zone module • HLT braking unit • HAB fan unit *Revised contents* • HMF01 motor filter: – Updated type code – Updated data • Mains filter: – Updated type code – HNF01: Added data of connection points – HNK01: Updated data, added connection cross sections • Mains choke: – Updated type code – HNL02: Added data of connection points • HLL DC bus choke: – Removed "Preliminary" note – Updated type code – Included current characteristic • HLC DC bus capacitor unit: – Updated data • HLB DC bus resistor unit: – Updated type code – Updated data • HLR braking resistors: – Updated type code – Updated data – Included braking resistors for HCS04 • Updated accessories • General data and specifications: – Included information on control cabinet design and cooling – Removed information regarding motors • Updated overview of documentations • Modified design of safety instructions in accordance with the ANSI Z535.6 standard

Tab. 1-1: Editions

Introduction

1.1.3 Overview of Documentations

Drive Systems, System Components

Title Rexroth IndraDrive …	Kind of documentation	Document typecode[1)] DOK-INDRV*-…	Material number R911…
Drive Systems with HMV01/02 HMS01/02, HMD01, HCS02/03	Project Planning Manual	SYSTEM*****-PRxx-EN-P	309636
Mi Drive Systems with KCU01, KSM01, KMS01	Project Planning Manual	KCU+KSM****-PRxx-EN-P	320924
Mi Drive Systems with KCU02, KSM02, KMS02	Project Planning Manual	KCU02+KSM02-PRxx-EN-P	335703
Supply Units, Power Sections HMV, HMS, HMD, HCS02, HCS03	Project Planning Manual	HMV-S-D+HCS-PRxx-EN-P	318790
Drive Controllers Control Sections CSB01, CSH01, CDB01	Project Planning Manual	CSH********-PRxx-EN-P	295012
Control Sections CSE02, CSB02, CDB02, CSH02	Project Planning Manual	Cxx02******-PRxx-EN-P	338962
Additional Components and Accessories	Project Planning Manual	ADDCOMP****-PRxx-EN-P	306140

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)

Tab. 1-2: Documentations – Overview

Title	Kind of documentation	Document typecode[1)]	Material number R911…
Automation Terminals Of The Rexroth Inline Product Range	Application Manual	DOK-CONTRL-ILSYSINS***-AWxx-EN-P	317021

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: AW01 is the first edition of an Application Manual)

Tab. 1-3: Documentations – Overview

Motors

Title Rexroth IndraDyn …	Kind of documentation	Document typecode[1)] DOK-MOTOR*-…	Material number R911…
A Asynchronous Motors MAD / MAF	Project Planning Manual	MAD/MAF****-PRxx-EN-P	295781
H Synchronous Kit Spindle Motors	Project Planning Manual	MBS-H******-PRxx-EN-P	297895
L Synchronous Linear Motors	Project Planning Manual	MLF********-PRxx-EN-P	293635

Title Rexroth IndraDyn …	Kind of documentation	Document typecode[1)] DOK-MOTOR*-…	Material number R911…
S Synchronous Motors MSK	Project Planning Manual	MSK********-PRxx-EN-P	296289
T Synchronous Torque Motors	Project Planning Manual	MBT********-PRxx-EN-P	298798

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)

Tab. 1-4: Documentations – Overview

Cables

Title	Kind of documentation	Document typecode[1)] DOK-…	Material number R911…
Rexroth Connection Cables IndraDrive and IndraDyn	Selection Data	CONNEC-CABLE*INDRV-CAxx-EN-P	322949

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: CA02 is the second edition of the documentation "Selection Data")

Tab. 1-5: Documentations – Overview

Firmware

Title Rexroth IndraDrive …	Kind of documentation	Document typecode[1)] DOK-INDRV*-…	Part number R911…
Firmware for Drive Controllers MPH-08, MPB-08, MPD-08, MPC-08	Functional Description	MP*-08VRS**-APxx-EN-P	332643
Firmware for Drive Controllers MPH-07, MPB-07, MPD-07, MPC-07	Functional Description	MP*-07VRS**-FKxx-EN-P	328670
Firmware for Drive Controllers MPH-06, MPB-06, MPD-06, MPC-06	Functional Description	MP*-06VRS**-FKxx-EN-P	326766
Firmware for Drive Controllers MPH-05, MPB-05, MPD-05	Functional Description	MP*-05VRS**-FKxx-EN-P	320182
Firmware for Drive Controllers MPH-04, MPB-04, MPD-04	Functional Description	MP*-04VRS**-FKxx-EN-P	315485
Firmware for Drive Controllers MPH-03, MPB-03, MPD-03	Functional Description	MP*-03VRS**-FKxx-EN-P	308329
Firmware for Drive Controllers MPH-02, MPB-02, MPD-02	Functional Description	MP*-02VRS**-FKxx-EN-P	299223
Drive Controllers MPx-02 to MPx-08	Parameter Description	GEN-**VRS**-PAxx-EN-P	297317
MPx-02 to MPx-08 and HMV	Troubleshooting Guide	GEN-**VRS**-WAxx-EN-P	297319
Integrated Safety Technology	Functional and Application Description	SI*-**VRS**-FKxx-EN-P	297838

Introduction

Title Rexroth IndraDrive …	Kind of documentation	Document typecode[1)] DOK-INDRV*-…	Part number R911…
Integrated Safety Technology According to IEC61508	Functional Description	SI2-**VRS**-FKxx-EN-P	327664
Rexroth IndraMotion MLD	Application Manual	MLD-**VRS**-AWxx-EN-P	306084
Rexroth IndraMotion MLD Library	Library Description	MLD-SYSLIB*-FKxx-EN-P	309224

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: FK02 is the second edition of a Functional Description)

Tab. 1-6: Documentations – Overview

Title	Kind of documentation	Document typecode[1)]	Material number R911…
Rexroth IndraDrive MPx-18 Functions	Application Manual	DOK-INDRV*-MP*-18VRS**-APxx-EN-P	338673
Rexroth IndraDrive MPx-18 Version Notes	Release Notes	DOK-INDRV*-MP*-18VRS**-RNxx-EN-P	338658
Rexroth IndraDrive MPx-16 to MPx-18 Parameters	Reference Book	DOK-INDRV*-GEN1-PARA**-RExx-EN-P	328651
Rexroth IndraDrive MPx-16 to MPx-18 Diagnostic Messages	Reference Book	DOK-INDRV*-GEN1-DIAG**-RExx-EN-P	326738
Rexroth IndraDrive Integrated Safety Technology as of MPx-1x (Safe Torque Off)	Application Manual	DOK-INDRV*-SI3-**VRS**-APxx-EN-P	332634
Rexroth IndraDrive Integrated Safety Technology as of MPx-1x (Safe Motion)	Application Manual	DOK-INDRV*-SI3*SMO-VRS-APxx-EN-P	338920
Rexroth IndraDrive Rexroth IndraMotion MLD (2G) Libraries as of MPx-18	Reference Book	DOK-INDRV*-MLD-SYSLIB3-RExx-EN-P	338916
Rexroth IndraDrive Rexroth IndraMotion MLD (2G) as of MPx-18	Application Manual	DOK-INDRV*-MLD3-**VRS*-APxx-EN-P	338914

Title	Kind of documentation	Document typecode[1)]	Material number R911…
Rexroth IndraDrive Rexroth IndraMotion MLD (2G) as of MPx-18	Commissioning Manual	DOK-INDRV*-MLD3-F*STEP-COxx-EN-P	341708
Rexroth IndraMotion MLD 13VRS Service Tool	Reference Book	DOK-IM*MLD-IMST****V13-RExx-EN-P	341347

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: RE02 is the second edition of a Reference Book)

Tab. 1-7: Documentations – Firmware

Title	Kind of documentation	Document typecode[1)]	Material number R911…
Productivity Agent Extended Diagnostic Functions with Rexroth IndraDrive	Application Manual	DOK-INDRV*-MLD-PAGENT*-AWxx-EN-P	323947

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: AW01 is the first edition of an Application Manual)

Tab. 1-8: Documentations – Overview

2 Important directions for use

2.1 Appropriate use

2.1.1 Introduction

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

⚠ WARNING **Personal injury and property damage caused by incorrect use of the products!**

The products have been designed for use in the industrial environment and may only be used in the appropriate way. If they are not used in the appropriate way, situations resulting in property damage and personal injury can occur.

☞ 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 their 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 install damaged or faulty products or put them into operation.
- Make sure that the products have been installed in the manner described in the relevant documentation.

2.1.2 Areas of use and application

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

Control and monitoring of the Drive controllers may require additional sensors and actuators.

☞ The drive controllers may only be used with the accessories and parts specified in this documentation. If a component has not been specifically named, then it may neither be mounted nor 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.

Drive controllers have to be programmed before commissioning to ensure that the motor executes the specific functions of an application.

Drive controllers of the Rexroth IndraDrive series have been developed for use in single- and multi-axis drive and control tasks.

Important directions for use

To ensure application-specific use of Drive controllers, device types of different drive power and different interfaces are available.

Typical applications include, for example:

- Handling and mounting systems
- Packaging and food machines
- Printing and paper processing machines
- Machine tools

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 may 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, Drive controllers may not be used in applications which have not been expressly authorized by Rexroth. Please carefully follow the specifications outlined in the general Safety Instructions!

Components of the Rexroth IndraDrive system are **products of Category C3** (with restricted distribution) in accordance with IEC 61800-3. This Category comprises EMC limit values for line-based and radiated noise emission. Compliance with this Category (limit values) requires the appropriate measures of interference suppression to be used in the drive system (e.g., mains filters, shielding measures).

These components are not provided for use in a public low-voltage mains supplying residential areas. If these components are used in such a mains, high-frequency interference is to be expected. This can require additional measures of interference suppression.

3 Safety instructions for electric drives and controls

3.1 Definitions of terms

Application documentation Application documentation comprises the entire documentation used to inform the user of the product about the use and safety-relevant features for configuring, integrating, installing, mounting, commissioning, operating, maintaining, repairing and decommissioning the product. The following terms are also used for this kind of documentation: Operating Instructions, Commissioning Manual, Instruction Manual, Project Planning Manual, Application Description, etc.

Component A component is a combination of elements with a specified function, which are part of a piece of equipment, device or system. Components of the electric drive and control system are, for example, supply units, drive controllers, mains choke, mains filter, motors, cables, etc.

Control system A control system comprises several interconnected control components placed on the market as a single functional unit.

Device A device is a finished product with a defined function, intended for users and placed on the market as an individual piece of merchandise.

Electrical equipment Electrical equipment encompasses all devices used to generate, convert, transmit, distribute or apply electrical energy, such as electric motors, transformers, switching devices, cables, lines, power-consuming devices, circuit board assemblies, plug-in units, control cabinets, etc.

Electric drive system An electric drive system comprises all components from mains supply to motor shaft; this includes, for example, electric motor(s), motor encoder(s), supply units and drive controllers, as well as auxiliary and additional components, such as mains filter, mains choke and the corresponding lines and cables.

Installation An installation consists of several devices or systems interconnected for a defined purpose and on a defined site which, however, are not intended to be placed on the market as a single functional unit.

Machine A machine is the entirety of interconnected parts or units at least one of which is movable. Thus, a machine consists of the appropriate machine drive elements, as well as control and power circuits, which have been assembled for a specific application. A machine is, for example, intended for processing, treatment, movement or packaging of a material. The term "machine" also covers a combination of machines which are arranged and controlled in such a way that they function as a unified whole.

Manufacturer The manufacturer is an individual or legal entity bearing responsibility for the design and manufacture of a product which is placed on the market in the individual's or legal entity's name. The manufacturer can use finished products, finished parts or finished elements, or contract out work to subcontractors. However, the manufacturer must always have overall control and possess the required authority to take responsibility for the product.

Product Examples of a product: Device, component, part, system, software, firmware, among other things.

Project Planning Manual A Project Planning Manual is part of the application documentation used to support the sizing and planning of systems, machines or installations.

Qualified persons In terms of this application documentation, qualified persons are those persons who are familiar with the installation, mounting, commissioning and operation of the components of the electric drive and control system, as well as with the hazards this implies, and who possess the qualifications their work

requires. To comply with these qualifications, it is necessary, among other things,

- to be trained, instructed or authorized to switch electric circuits and devices safely on and off, to ground them and to mark them.
- to be trained or instructed to maintain and use adequate safety equipment.
- to attend a course of instruction in first aid.

User A user is a person installing, commissioning or using a product which has been placed on the market.

3.2 General information

3.2.1 Using the Safety instructions and passing them on to others

Do not attempt to install and operate the components of the electric drive and control system without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with these components. If you do not have the user documentation for the components, contact your responsible Rexroth sales partner. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the components.

If the component is resold, rented and/or passed on to others in any other form, these safety instructions must be delivered with the component in the official language of the user's country.

Improper use of these components, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, could result in property damage, injury, electric shock or even death.

3.2.2 Requirements for safe use

Read the following instructions before initial commissioning of the components of the electric drive and control system in order to eliminate the risk of injury and/or property damage. You must follow these safety instructions.

- Rexroth is not liable for damages resulting from failure to observe the safety instructions.
- Read the operating, maintenance and safety instructions in your language before commissioning. If you find that you cannot completely understand the application documentation in the available language, please ask your supplier to clarify.
- Proper and correct transport, storage, mounting and installation, as well as care in operation and maintenance, are prerequisites for optimal and safe operation of the component.
- Only qualified persons may work with components of the electric drive and control system or within its proximity.
- Only use accessories and spare parts approved by Rexroth.
- Follow the safety regulations and requirements of the country in which the components of the electric drive and control system are operated.
- Only use the components of the electric drive and control system in the manner that is defined as appropriate. See chapter "Appropriate Use".
- The ambient and operating conditions given in the available application documentation must be observed.

- Applications for functional safety are only allowed if clearly and explicitly specified in the application documentation "Integrated Safety Technology". If this is not the case, they are excluded. Functional safety is a safety concept in which measures of risk reduction for personal safety depend on electrical, electronic or programmable control systems.
- The information given in the application documentation with regard to the use of the delivered components contains only examples of applications and suggestions.

  The machine and installation manufacturers must

  – make sure that the delivered components are suited for their individual application and check the information given in this application documentation with regard to the use of the components,
  – make sure that their individual application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Commissioning of the delivered components is only allowed once it is sure that the machine or installation in which the components are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only allowed if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the section on EMC in the respective application documentation.

  The machine or installation manufacturer is responsible for compliance with the limit values as prescribed in the national regulations.
- The technical data, connection and installation conditions of the components are specified in the respective application documentations and must be followed at all times.

National regulations which the user has to comply with

- European countries: In accordance with European EN standards
- United States of America (USA):
  – National Electrical Code (NEC)
  – National Electrical Manufacturers Association (NEMA), as well as local engineering regulations
  – Regulations of the National Fire Protection Association (NFPA)
- Canada: Canadian Standards Association (CSA)
- Other countries:
  – International Organization for Standardization (ISO)
  – International Electrotechnical Commission (IEC)

3.2.3 Hazards by improper use

- High electrical voltage and high working current! Danger to life or serious injury by electric shock!
- High electrical voltage by incorrect connection! Danger to life or injury by electric shock!
- Dangerous movements! Danger to life, serious injury or property damage by unintended motor movements!

- Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric drive systems!
- Risk of burns by hot housing surfaces!
- Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!
- Risk of injury by improper handling of batteries!
- Risk of injury by improper handling of pressurized lines!

3.3 Instructions with regard to specific dangers

3.3.1 Protection against contact with electrical parts and housings

☞ This section concerns components of the electric drive and control system with voltages of **more than 50 volts**.

Contact with parts conducting voltages above 50 volts can cause personal danger and electric shock. When operating components of the electric drive and control system, it is unavoidable that some parts of these components conduct dangerous voltage.

High electrical voltage! Danger to life, risk of injury by electric shock or serious injury!

- Only qualified persons are allowed to operate, maintain and/or repair the components of the electric drive and control system.
- Follow the general installation and safety regulations when working on power installations.
- Before switching on, the equipment grounding conductor must have been permanently connected to all electric components in accordance with the connection diagram.
- Even for brief measurements or tests, operation is only allowed if the equipment grounding conductor has been permanently connected to the points of the components provided for this purpose.
- Before accessing electrical parts with voltage potentials higher than 50 V, you must disconnect electric components from the mains or from the power supply unit. Secure the electric component from reconnection.
- With electric components, observe the following aspects:

  Always wait **30 minutes** after switching off power to allow live capacitors to discharge before accessing an electric component. Measure the electrical voltage of live parts before beginning to work to make sure that the equipment is safe to touch.
- Install the covers and guards provided for this purpose before switching on.
- Never touch any electrical connection points of the components while power is turned on.
- Do not remove or plug in connectors when the component has been powered.
- Under specific conditions, electric drive systems can be operated at mains protected by residual-current-operated circuit-breakers sensitive to universal current (RCDs/RCMs).

- Secure built-in devices from penetrating foreign objects and water, as well as from direct contact, by providing an external housing, for example a control cabinet.

High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!

- Before switching on and before commissioning, ground or connect the components of the electric drive and control system to the equipment grounding conductor at the grounding points.
- Connect the equipment grounding conductor of the components of the electric drive and control system permanently to the main power supply at all times. The leakage current is greater than 3.5 mA.
- Establish an equipment grounding connection with a minimum cross section according to the table below. With an outer conductor cross section smaller than 10 mm^2 (8 AWG), the alternative connection of two equipment grounding conductors is allowed, each having the same cross section as the outer conductors.

Cross section outer conductor	Minimum cross section equipment grounding conductor Leakage current ≥ 3.5 mA	
	1 equipment grounding conductor	2 equipment grounding conductors
1.5 mm^2 (16 AWG)	10 mm^2 (8 AWG)	2 × 1.5 mm^2 (16 AWG)
2.5 mm^2 (14 AWG)		2 × 2.5 mm^2 (14 AWG)
4 mm^2 (12 AWG)		2 × 4 mm^2 (12 AWG)
6 mm^2 (10 AWG)		2 × 6 mm^2 (10 AWG)
10 mm^2 (8 AWG)		-
16 mm^2 (6 AWG)	16 mm^2 (6 AWG)	-
25 mm^2 (4 AWG)		-
35 mm^2 (2 AWG)		-
50 mm^2 (1/0 AWG)	25 mm^2 (4 AWG)	-
70 mm^2 (2/0 AWG)	35 mm^2 (2 AWG)	-
...	...	...

Tab. 3-1: Minimum cross section of the equipment grounding connection

3.3.2 Protective extra-low voltage as protection against electric shock

Protective extra-low voltage is used to allow connecting devices with basic insulation to extra-low voltage circuits.

On components of an electric drive and control system provided by Rexroth, all connections and terminals with voltages up to 50 volts are PELV ("Protective Extra-Low Voltage") systems. It is allowed to connect devices equipped with basic insulation (such as programming devices, PCs, notebooks, display units) to these connections.

Safety instructions for electric drives and controls

Danger to life, risk of injury by electric shock! High electrical voltage by incorrect connection!

If extra-low voltage circuits of devices containing voltages and circuits of more than 50 volts (e.g., the mains connection) are connected to Rexroth products, the connected extra-low voltage circuits must comply with the requirements for PELV ("Protective Extra-Low Voltage").

3.3.3 Protection against dangerous movements

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

- Improper or wrong wiring or cable connection
- Operator errors
- Wrong input of parameters before commissioning
- Malfunction of sensors and encoders
- Defective components
- Software or firmware errors

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

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

Dangerous movements! Danger to life, risk of injury, serious injury or property damage!

A **risk assessment** must be prepared for the installation or machine, with its specific conditions, in which the components of the electric drive and control system are installed.

As a result of the risk assessment, the user must provide for monitoring functions and higher-level measures on the installation side for personal safety. The safety regulations applicable to the installation or machine must be taken into consideration. Unintended machine movements or other malfunctions are possible if safety devices are disabled, bypassed or not activated.

To avoid accidents, injury and/or property damage:

- Keep free and clear of the machine’s range of motion and moving machine parts. Prevent personnel from accidentally entering the machine’s range of motion by using, for example:
  - Safety fences
  - Safety guards
  - Protective coverings
  - Light barriers
- Make sure the safety fences and protective coverings are strong enough to resist maximum possible kinetic energy.
- Mount emergency stopping switches in the immediate reach of the operator. Before commissioning, verify that the emergency stopping equip-

ment works. Do not operate the machine if the emergency stopping switch is not working.

- Prevent unintended start-up. Isolate the drive power connection by means of OFF switches/OFF buttons or use a safe starting lockout.
- Make sure that the drives are brought to 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 counterbalancing of the vertical axes.
- The standard equipment **motor holding brake** or an external holding brake controlled by the drive controller is **not sufficient to guarantee personal safety**!
- Disconnect electrical power to the components of the electric drive and control system using the master switch and secure them from reconnection ("lock out") 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 components of the electric drive and control system and their supply leads. If the use of these devices cannot be avoided, check the machine or installation, at initial commissioning of the electric drive and control system, for possible malfunctions when operating such high-frequency, remote control and radio equipment in its possible positions of normal use. It might possibly be necessary to perform a special electromagnetic compatibility (EMC) test.

3.3.4 Protection against electromagnetic and magnetic fields during operation and mounting

Electromagnetic and magnetic fields!

Health hazard for persons with active implantable medical devices (AIMD) such as pacemakers or passive metallic implants.

- Hazards for the above-mentioned groups of persons by electromagnetic and magnetic fields in the immediate vicinity of drive controllers and the associated current-carrying conductors.
- Entering these areas can pose an increased risk to the above-mentioned groups of persons. They should seek advice from their physician.
- If overcome by possible effects on above-mentioned persons during operation of drive controllers and accessories, remove the exposed persons from the vicinity of conductors and devices.

3.3.5 Protection against contact with hot parts

Hot surfaces of components of the electric drive and control system. Risk of burns!

- Do not touch hot surfaces of, for example, braking resistors, heat sinks, supply units and drive controllers, motors, windings and laminated cores!
- According to the operating conditions, temperatures of the surfaces can be **higher than 60 °C** (140 °F) during or after operation.
- Before touching motors after having switched them off, let them cool down for a sufficient period of time. Cooling down can require **up to 140 minutes**! The time required for cooling down is approximately five times the thermal time constant specified in the technical data.
- After switching chokes, supply units and drive controllers 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, and in accordance with the respective safety regulations, the manufacturer of the machine or installation must take measures to avoid injuries caused by burns in the final application. These measures can be, for example: Warnings at the machine or installation, guards (shieldings or barriers) or safety instructions in the application documentation.

3.3.6 Protection during handling and mounting

Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!

- Observe the relevant statutory regulations of accident prevention.
- Use suitable equipment for mounting and transport.
- Avoid jamming and crushing by appropriate measures.
- Always use suitable tools. Use special tools if specified.
- Use lifting equipment and tools in the correct manner.
- Use suitable protective equipment (hard hat, safety goggles, safety shoes, safety gloves, for example).
- Do not stand under hanging loads.
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

3.3.7 Battery safety

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

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 attempt to recharge the batteries as this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not dismantle batteries.
- When replacing the battery/batteries, do not damage the electrical parts installed in the devices.
- Only use the battery types specified for the product.

☞ Environmental protection and disposal! The batteries contained 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 separately from other waste. Observe the national regulations of your country.

3.3.8 Protection against pressurized systems

According to the information given in the Project Planning Manuals, motors and components cooled with liquids and compressed air can be partially supplied with externally fed, pressurized media, such as compressed air, hydraulics oil, cooling liquids and cooling lubricants. Improper handling of the connected supply systems, supply lines or connections can cause injuries or property damage.

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 dismounting lines, relieve pressure and empty medium.
- Use suitable protective equipment (safety goggles, safety shoes, safety gloves, for example).
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

☞ Environmental protection and disposal! The agents (e.g., fluids) used to operate the product might not be environmentally friendly. Dispose of agents harmful to the environment separately from other waste. Observe the national regulations of your country.

Safety instructions for electric drives and controls

3.4 Explanation of signal words and the Safety alert symbol

The Safety Instructions in the available application documentation contain specific signal words (DANGER, WARNING, CAUTION or NOTICE) and, where required, a safety alert symbol (in accordance with ANSI Z535.6-2011).

The signal word is meant to draw the reader's attention to the safety instruction and identifies the hazard severity.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words DANGER, WARNING and CAUTION, is used to alert the reader to personal injury hazards.

⚠ DANGER

In case of non-compliance with this safety instruction, death or serious injury **will** occur.

⚠ WARNING

In case of non-compliance with this safety instruction, death or serious injury **could** occur.

⚠ CAUTION

In case of non-compliance with this safety instruction, minor or moderate injury could occur.

NOTICE

In case of non-compliance with this safety instruction, property damage could occur.

4 Brief description, use

4.1 General information

In terms of "Appropriate use", cases of operation and applications not mentioned in this chapter are not allowed.

4.2 Applications of the Drive System Rexroth IndraDrive

The digital, intelligent drive system Rexroth IndraDrive is the cost-efficient solution with a high degree of functionality for single-axis and multi-axis drive and control tasks.

The drive system Rexroth IndraDrive fulfills a large number of drive tasks in the most varied applications.

Typical applications are the industrial sectors:

- Printing and paper converting
- Packaging and food
- Mounting and handling
- Wood machining
- Machine tools
- Metal forming
- General automation

For these applications there are different device types of graduated performance.

Brief description, use

4.3 Mains Transformers DST and DLT

DST and DLT transformers are used to transform mains voltages to the allowed nominal voltages of the devices.

DLT transformers are used to

- prevent overvoltage between outer conductor and ground
- protect other loads against leakage currents

Type	Usage
DST autotransformer	Adjusting voltage range in **grounded** mains
DLT isolating transformer	Adjusting voltage range in **ungrounded** mains

Tab. 4-1: Usage of Transformers

As a matter of principle, DLT isolating transformers have to be used at ungrounded mains.

4.4 Mains Filters HNF, HNK, NFE, HNS02 and NFD

Mains filters reduce radio interference and mains pollution.

☞ When using mains filters HNF01, NFD03, HNS02 and HNK01 at **mains grounded via outer conductor**, use an isolating transformer between mains and mains filter.

Type	Usage
NFE01.1	Interference suppression of power supply units up to 230 V
NFE02.1	Interference suppression of single-phase drive controllers up to 230 V
NFD03.1	Interference suppression of three-phase drive controllers up to 480 V for 1-6 axes and motor cable lengths up to max. 75 m single-axis / 120 m multi-axis
HNF01.1	Interference suppression of three-phase drive controllers up to 480 V for drive systems with a high number of axes and long motor cables
HNK01.1	Interference suppression of three-phase drive controllers HCS03.1E up to 500 V
HNS02	Interference suppression of three-phase drive controllers up to 480 V for drive systems with a maximum of 12 axes and a maximum of 200 m motor cable length Integrated switch-disconnector

Tab. 4-2: Usage of Mains Filters

☞ Only operate expressly allowed components at the mentioned mains filters. Operating, for example, blowers, pumps etc. at HNF mains filters is not allowed.

Brief description, use

4.5 Mains Chokes HNL01 and HNL02

(Standard) mains chokes HNL01.1E, HNL01.1R and HNL02.1R

- reduce harmonics in the mains current
- increase the allowed DC bus continuous power of certain converters
- allow operating regenerative supply units at the mains

Current-compensated mains chokes HNL01.1E-****-S and HNL01.1R-****-S reduce asymmetric currents (leakage currents) in the mains connection phase of the drive system.

The different types may be used **exclusively** as follows:

Type	Usage
HNL01.1R	For connection to components with regeneration to the supply mains (HMV01.1R)
HNL01.1E	For connection to components without regeneration to the supply mains (HMV01.1E, HCS02.1E, HCS03.1E)
HNL01.1*-****-S	Current-compensated chokes for use with HNL01.1 mains chokes to reduce asymmetric currents (leakage currents) in the mains connection phase of the drive system (HMV01.1E, HMV01.1R, HCS02.1E, HCS03.1E)
HNL02.1R	Mains chokes in housing for control cabinet mounting for connection to components with regeneration to the supply mains (HMV02.1R)

Tab. 4-3: Usage of Mains Chokes

4.6 DC Bus Resistor Unit HLB01

DC bus resistor units HLB01

- Convert generated kinetic energy into thermal energy
- Increase the continuous regenerative power in the drive system
- Increase the peak regenerative power in the drive system
- Allow the DC bus short circuit function ("ZKS") in the drive system

Type	Usage
HLB01.1C	In drive systems of the Rexroth IndraDrive C product range with a device mounting depth of 265 mm.
HLB01.1D	In drive systems of the Rexroth IndraDrive M product range with a device mounting depth of 322 mm.

Tab. 4-4: DC Bus Resistor Units HLB

Brief description, use

4.7 Braking Resistor HLR01

HLR01.1N-xxxx-Nxxx-A-007-NNNN braking resistors convert generated kinetic energy into thermal energy. For this purpose, the line covers a wide range of continuous power and energy absorption capacity.

Type	Usage
HLR01.1**A**	**Type of construction A** (version for device mounting): To be mounted to drive controllers of the Rexroth IndraDrive C product range. For this purpose, the drive controllers must be equipped with a brake chopper.
HLR01.1**N**	**Type of construction N** (version for free assembly): For free assembly in the installation, operated by drive controller of the Rexroth IndraDrive C product range. For this purpose, the drive controllers must be equipped with a brake chopper.

Tab. 4-5: Braking Resistors HLR

Designs of type of construction N:

- Fixed resistor IP 20 **type A**

  Cement-coated, wire-wound, tube-type fixed resistors; screwed on side walls; perforated cover; connections in terminal box with PG gland
- Steel-grid fixed resistor IP 20 **type B**

  Fixed resistor in steel-grid design; connection depending on type
- Steel-grid fixed Resistor IP 20 **type C**

  Fixed resistor in steel-grid design; connection depending on type

4.8 DC Bus Capacitor Unit HLC01

DC bus capacitor units HLC01 store energy in the DC bus of the drive system.

Type	Usage
HLC01.1C	In drive systems of the product ranges Rexroth IndraDrive C and Rexroth IndraDrive M
HLC01.1D	In drive systems of the product ranges Rexroth IndraDrive C and Rexroth IndraDrive M

Tab. 4-6: DC Bus Capacitor Units HLC

Brief description, use

4.9 Motor Filters HMF01

HMF01 motor filters

- reduce the rise of the output voltage of drive controllers
- reduce leakage currents of the motor lines
- reduce interference voltage on the motor lines

Type	Usage
HMF01.1	At the motor output of HCS drive controllers

Tab. 4-7: Usage of HMF01 Motor Filters

4.10 Housing for Control Sections HAC01

Additional components HAC01 are used to

- insert control sections in them
- supply control sections with 24V control voltage

Type	Usage
HAC01.1-002-NNN-NN	To insert CDB control sections in it

Tab. 4-8: HAC01 Type

4.11 HSZ01 safety zone module

Type	Use
HSZ01	The safety zone module HSZ01 belongs to the Rexroth IndraDrive product range and provides the following safety functions: • Safety Zone Acknowledge (SZA) • Safety Zone Error (SZE) • Safety Zone Input (SZI) • Safe Door Locking (SDL)

Tab. 4-9: Use

5 General data and specifications

5.1 Acceptance tests and approvals

Declaration of conformity

Declarations of conformity confirm that the components comply with the valid EN standards and EC directives. If required, our sales representative can provide you with the declarations of conformity for components.

	**Drive controllers, Supply units**	**Motors**
CE conformity regarding Low-Voltage Directive	EN 61800-5-1:2007	EN 60034-1:2010+Cor.:2010 EN 60034-5:2001+A1:2007
CE conformity regarding EMC product standard	EN 61800-3:2004 + A1:2012	

Tab. 5-1: CE - applied standards

C-UL-US listing

The components are listed by **UL** (Underwriters Laboratories Inc.®).

Proof of certification can be found online:

www.ul.com/database

Under "UL File Number" enter the file number or under "Company Name" enter the company name "Bosch Rexroth AG".

	• UL standard: UL 508C • CSA standard: Canadian National Standard C22.2 No. 14-10
	Company Name BOSCH REXROTH ELECTRIC DRIVES & CONTROLS GMBH Category Name: Power Conversion Equipment
	File numbers Rexroth IndraDrive components: • E134201 • E227957 The **control sections** are part of the listed components. The **HAB01.1-0350-1640-NN fan unit** is part of the listed components HMV01.1R-W0210 and HMS01.1N-W0350.

Tab. 5-2: C-UL listing

General data and specifications

UL ratings

When using the component in the scope of CSA/UL, observe the UL ratings for each component.

Only the following components have been approved in the scope of CSA/UL for supplying HMS, HMD, KCU, KSM and KMS components:

- HMV01.1E
- HMV01.1R
- HMV02.1R
- HCS02.1E
- HCS03.1E

Make sure that the indicated **SCCR short-circuit rating** is not exceeded, e.g., by using appropriate fuses in the mains connection of the supply unit.

Wiring material UL

In the scope of CSA / UL, use copper 60/75 °C only; class 1 or equivalent only.

Allowed pollution degree

Comply with the permitted pollution degree of the components (see "Ambient and operating conditions").

C-UR-US listing

The components are listed by **UL** (Underwriters Laboratories Inc.®).

Proof of certification can be found online:

www.ul.com/database

Under "UL File Number" enter the file number or under "Company Name" enter the company name "Bosch Rexroth AG".

c ® US CUR_Zeichen.fh11	• UL standard: UL 1004-1 • CSA standard: Canadian National Standard C22.2 No. 100
	Company Name BOSCH REXROTH ELECTRIC DRIVES & CONTROLS GMBH Category Name: Servo and Stepper Motors - Component
	File numbers MSK, MSM motors: E335445

Tab. 5-3: C-UR listing

Wiring material UL (ready-made cables by Rexroth)

In the scope of CSA / UL, use copper 60/75 °C only; class 6 or equivalent only.

Allowed pollution degree

Comply with the permitted pollution degree of the components (see "Ambient and operating conditions").

CCC (China Compulsory Certification)

The CCC mark is a compulsory certification of safety and quality for certain products mentioned in the product catalog "First Catalogue of Products Subject to Compulsory Certification" and in the CNCA document "Application Scope for Compulsory Certification of Products acc. first Catalogue" and put in circulation in China. This compulsory certification has existed since 2003.

CNCA is the Chinese authority responsible for certification guidelines. When a product is imported in China, the certification will be checked at customs using the entries in a database. Three criteria are typically critical for certification being required:

1. Customs tariff number (HS code) according to CNCA document "Application Scope for Compulsory Certification of Products acc. first Catalogue".
2. Area of application according to CNCA document "Application Scope for Compulsory Certification of Products acc. first Catalogue".
3. For the IEC product standard used, a corresponding Chinese GB standard must exist.

For the drive components by Rexroth described in this documentation, **certification is currently not required**, so they are not CCC certified. Negative certifications will not be issued.

5.2 Transport and storage

5.2.1 Transporting the components

Ambient and operating conditions for transport

Description	Symbol	Unit	Value
Temperature range	T_{a_tran}	°C	-20 … +70
Relative humidity		%	5 … 95
Absolute humidity		g/m^3	1 … 60
Climatic category (IEC 721)			2K3
Moisture condensation			Not allowed
Icing			Not allowed

Tab. 5-4: Ambient and operating conditions for transport

General data and specifications

5.2.2 Storing the components

NOTICE **Risk of damage to components from long-term storage!**

Some components contain electrolytic capacitors which may deteriorate during storage.

When storing the following components for a longer period of time, run them **once a year for at least 1 hour**:

- Converters and supply units: Operated with mains voltage U_{LN}
- Inverters and DC bus capacitor units: Operated with DC bus voltage U_{DC}

Ambient and operating conditions for storage

Description	Symbol	Unit	Value
Temperature range	T_{a_store}	°C	-20 … +55
Relative humidity		%	5 … 95
Absolute humidity		g/m^3	1 … 29
Climatic category (IEC 721)			1K3
Moisture condensation			Not allowed
Icing			Not allowed

Tab. 5-5: Ambient and operating conditions for storage

5.3 Installation conditions

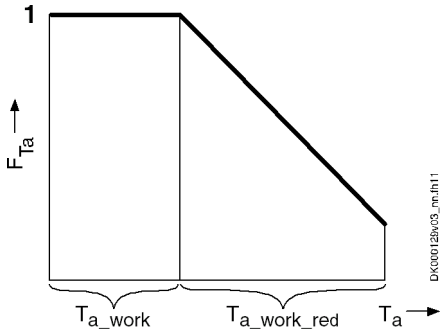
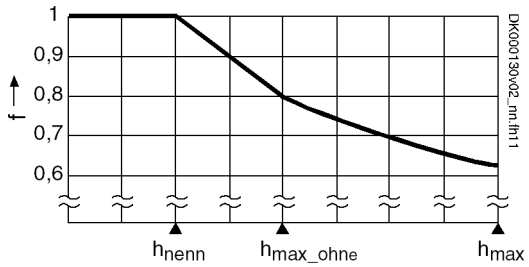
5.3.1 Ambient and operating conditions

☞ Check that the ambient conditions, in particular the control cabinet temperature, are complied with by calculating the heat levels in the control cabinet. Afterwards, make the corresponding measurements to verify that the ambient conditions have actually been complied with.

The power dissipation is indicated in the technical data of the individual components as an important input value for calculating the heat levels.

Ambient and operating conditions (HCS, HMV, HMS, HMD, HCQ, HCT, KCU, HLC)

Description	Symbol	Unit	Value
Conductive dirt contamination			Not allowed Protect the devices against conductive dirt contamination by mounting them in control cabinets with the degree of protection IP54 (in accordance with IEC529).
Degree of protection of the device (IEC529)			IP20
Use within scope of CSA / UL			For use in NFPA 79 Applications only.

Description	Symbol	Unit	Value
Temperature during storage			see chapter 5.2.2 "Storing the components" on page 42
Temperature during transport			see chapter 5.2.1 "Transporting the components" on page 41
Allowed mounting position Definition of mounting positions: See chapter "Mounting positions of components" on page 45			G1 3)
Installation altitude	h_{nenn}	m	1000
Ambient temperature range	T_{a_work}	°C	0 … 40
Derating vs. ambient temperature: The performance data are reduced by the factor F_{Ta} in the ambient temperature range $T_{a\_work\_red}$: $F_{Ta} = 1 - [(T_a - 40) \times f_{Ta}]$ Example: With an ambient temperature T_a = 50 °C and a capacity utilization factor f_{Ta} = 2 %/K, the rated power is reduced to $P_{DC\_cont\_red} = P_{DC\_cont} \times F_{Ta} =$ $P_{DC\_cont} \times (1 - [(50 - 40) \times 0.02]) = P_{DC\_cont} \times 0.8$ Operation at ambient temperatures outside of T_{a_work} and $T_{a\_work\_red}$ is not allowed!			
	$T_{a\_work\_red}$	°C	40 … 55
	f_{Ta}	%/K	2.0 Exception HMV02.1R-W0015-A-07-NNNN: 2.7
Derating vs. installation altitude: At an installation altitude h > h_{nenn}, the performance data reduced by **factor f**2) are available. At an installation altitude in the range h_{max_ohne} to h_{max}, an isolating transformer has to be installed at the drive system mains connection. Operation above h_{max} is not allowed!			
	h_{max_ohne}	m	2000
	h_{max}	m	4000
Simultaneous derating for ambient temperature **and** installation altitude			Allowed; reduce performance data with the product f × F_{Ta}
Relative humidity		%	5 … 95
Absolute humidity		g/m³	1 … 29
Climatic category (IEC 60721-3-3)			3K3
Allowed pollution degree (EN 50178)			2
Resistance to chemically active substances (IEC 60721-3-3)			Class 3C1

General data and specifications

Description	Symbol	Unit	Value
Vibration sine: Amplitude (peak-peak) at 10 … 57 Hz [1)]		mm	0.15
Vibration sine: Acceleration at 57 … 150 Hz [1)]		g	1
Overvoltage category			III (according to IEC 60664-1)

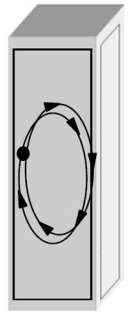
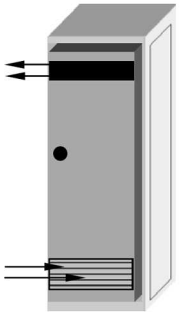
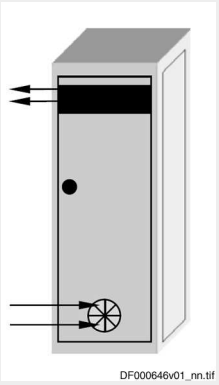
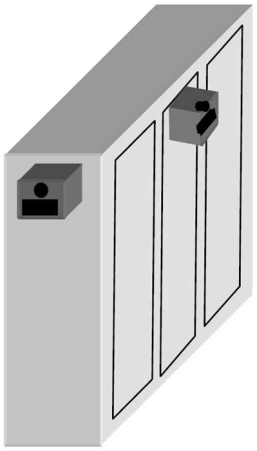
1) According to EN 60068-2-6
2) Reduced performance data for drive controllers: allowed DC bus continuous power, braking resistor continuous power, continuous current; additionally for HCS01, HCQ, HCT drive controllers: allowed mains voltage
3) Some components can be operated in mounting positions other than G1. The allowed mounting positions are specified in the technical data of the component.

Tab. 5-6: Ambient and operating conditions (HCS, HMV, HMS, HMD, HCQ, HCT, KCU, HLC)

5.3.2 Control cabinet design and cooling

☞ The only mounting position allowed for supply units and drive controllers to be installed in control cabinets is G1.

Possibilities of heat dissipation

Closed control cabinet with air circulation	Closed control cabinet with heat exchanger	Control cabinet with fan	Closed control cabinet with air conditioning unit
 DF000644v01_nn.tif	 DF000645v01_nn.tif	 DF000646v01_nn.tif	 DF000647v01_nn.tif
P_Q ~ 400 W	P_Q ~ 1700 W	P_Q ~ 2700 W	P_Q ~ 4000 W

P_Q Dissipated heat output

Tab. 5-7: Possibilities of heat dissipation

The section below describes the "control cabinet with fan".

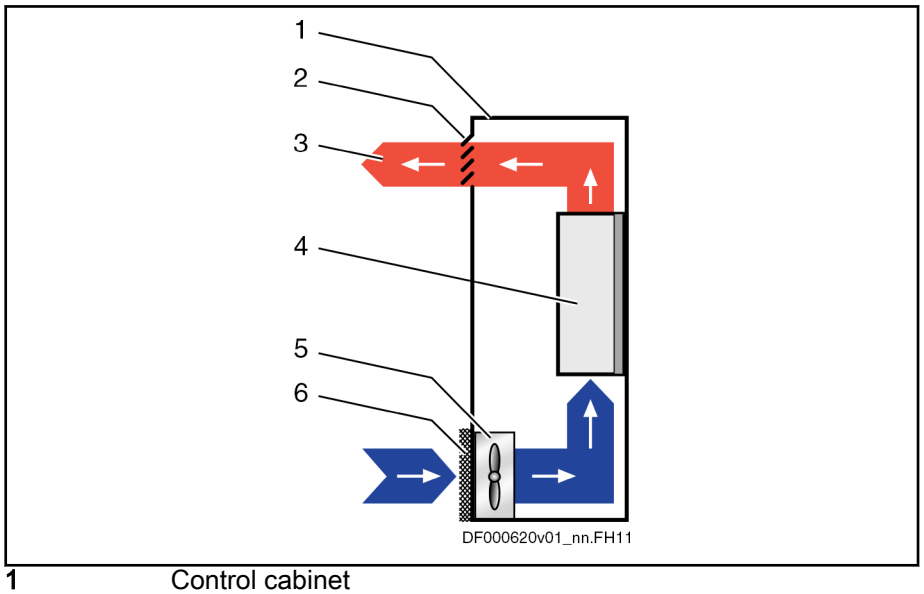
Requirements for control cabinets with fan

NOTICE **Risk of damage by unclean air in the control cabinet!**

Operating a control cabinet with a fan, but without the corresponding filters, can damage the devices or cause malfunction.

- Install filters at the air intake opening of the control cabinet so that unclean air cannot get into the control cabinet.
- Service the filters at regular intervals according to the dust loading in the environment.
- Only replace the filters when the fan has been switched off, because otherwise the fan sucks in the dirt coming off the filter and the dirt gets into the control cabinet.

Control cabinet ventilation (schematic diagram)



1 Control cabinet
2 Air outlet opening
3 Heat discharge
4 Device in control cabinet
5 Control cabinet fan
6 Filter at air intake opening

Fig. 5-1: Control cabinet ventilation (schematic diagram)

Only clean air gets into the control cabinet through the filter at the air intake opening. The control cabinet fan behind the air intake opening conveys the air into the control cabinet and generates overpressure in the control cabinet. The overpressure prevents unclean air from getting into the control cabinet through possibly existing leaky points (leaky cable ducts, damaged seals, etc.).

5.3.3 Mounting position

Mounting positions of components

NOTICE **Risk of damage to the components by incorrect mounting position!**

Only operate the components in their allowed mounting positions. The allowed mounting positions are specified in the technical data of the components.

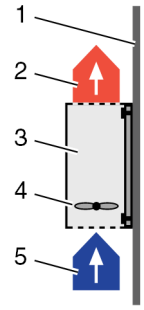
For supply units and drive controllers installed in control cabinets, only the mounting position G1 is usually allowed.

General data and specifications

Some components can also be operated in mounting positions other than G1. The allowed mounting positions are specified in the technical data of the component.

Mounting positions

The allowed mounting positions are specified with G1, G2, G3, G4 or G5 in the technical data of the components.

Mounting position	Description	
G1		**Normal mounting position** The air heated inside the component can flow unimpeded vertically upward. In the case of components with integrated fans, the natural convection supports the forced cooling air current. 1. Mounting surface 2. Outgoing, heated air 3. Component 4. Fan within the component (forces the cooling air current) 5. Cooling air
G2	180° to normal mounting position	
G3	90° to normal mounting position	
G4	bottom mounting; mounting surface on the bottom	
G5	top mounting; mounting surface at the top	

Tab. 5-8: Mounting positions

5.3.4 Compatibility with foreign matters

All Rexroth controls and drives are developed and tested according to the state-of-the-art technology.

As it is impossible to follow the continuing development of all materials (e.g. lubricants in machine tools) which may interact with the controls and drives, it cannot be completely ruled out that any reactions with the materials we use might occur.

For this reason, before using the respective material a compatibility test has to be carried out for new lubricants, cleaning agents etc. and our housings/ materials.

5.4 Voltage testing and insulation resistance testing

According to standard, the **components** of the Rexroth IndraDrive range are tested with voltage.

Testing	Test rate
Voltage testing	100% (EN 61800-5-1)
Insulation resistance testing	100% (EN 60204-1)

Tab. 5-9: Applied standards

5.5 Control voltage (24V supply)

PELV[1] for 24V power supply unit

For the 24V supply of the devices of the Rexroth IndraDrive range, use a power supply unit or a control-power transformer with protection by PELV according to IEC 60204-1 (section 6.4).

In the scope of CSA/UL, the data of the control-power transformer are limited to:

- Max. output voltage: 42.4 V_{peak} or 30 V_{ac}
- Max. output power: 10000 VA

The data in the table below generally apply to the 24V supply of the devices of the Rexroth IndraDrive range. For other data, such as power consumption and inrush currents, see the technical data for each device.

The specified values apply at the connections (+24V, 0V) to the "24V supply" of the devices!

Description	Symbol	Unit	Value
Control voltage for drive systems **without** operation of **motor holding brakes** in Rexroth motors	U_{N3}	V	**20.4 … 28.8** (24 +20% -15%) When using HMV01.1E, HMV01.1R, HMV02.1R, HLB01.1D supply units: **22.8 … 27.3** (24 -5%, 26 +5%)
Control voltage for drive systems **with** operation of **motor holding brakes** in Rexroth motors	U_{N3}	V	Depending on the motor cable length, the control voltage has to be within the following voltage ranges: • Motor cable length **<** 50 m: **22.8 … 25.2** (24 ±5%) • Motor cable length **>** 50 m: **24.7 … 27.3** (26 ±5%) Take the data of the corresponding motor holding brake into account.
External control voltage at HCS02 devices of "NNN**V**" design (see HCS02 type code; other design: DC 24 V power supply from the DC bus and external)	U_{N3}	V	**26 … 28.8** The output voltage of the internal switching power supply unit is 24 ±10%.
Max. ripple content	w	-	The amplitudes of the alternating component on U_{N3} must be within the specified voltage range.
Maximum allowed overvoltage	U_{N3max}	V	33 (max. 1 ms)

Tab. 5-10: Control voltage

1) Protective Extra Low Voltage

General data and specifications

Description	Symbol	Unit	Value
Control voltage for drive systems **without** operation of **motor holding brakes** in Rexroth motors	U_{N3}	V	**19.2 … 30** (see also "Max. ripple content")
Control voltage for drive systems **with** operation of **motor holding brakes** in Rexroth motors	U_{N3}	V	Observe the following aspects when selecting the control voltage: • Voltage drop on the line between drive controller and motor (current consumption, copper cross section, cable length) • Allowed voltage tolerance of the brake (see data sheet of brake) When using Rexroth cables up to a cable length of 40 m: 24 V ±5%
Max. ripple content	w	-	The amplitudes of the alternating component on U_{N3} must be within the specified voltage range.
Maximum allowed overvoltage	U_{N3max}	V	33 (max. 1 ms)

Tab. 5-11: Control voltage

☞ **Overvoltage**

Overvoltage greater than 33 V 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 overvoltage 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 overvoltage by inductive or capacitive coupling.

☞ Applies to all devices except HCS01 and HMV02:

Insulation monitoring impossible

The input 0 V is connected in conductive form to the housing potential. Insulation monitoring at +24 V and 0 V against housing is impossible.

6 Transformers

6.1 General Information

Transformers are only needed when the mains voltage is outside of the allowed nominal voltage of the drive controller.

Grounded Mains

For grounded mains, the mains voltage is adjusted to the nominal voltage of the device by means of **autotransformers** which have been sized for **a specific output voltage range**.

Ungrounded Mains

For voltage adjustment of ungrounded mains, always connect **isolating transformers** to prevent overvoltages between outer conductor and ground.

Transformers

6.2 Autotransformers for Drive Controllers

6.2.1 Types

Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	T	R	A	F	O		D	S	T		•	4	,	0	0	/	L	/	3	8	0	,	4	1	5	,	4	4	0	-	2	2	0				1	0	M	M

1. Object
1.1 Transformer . . . . = TRAFO

2. Product
2.1 DST . . . . . = DST

3. Nominal power
3.1 2.0 kVA . . . . . = •2,00
3.2 2.5 kVA . . . . . = •2,50
3.3 4.0 kVA . . . . . = •4,00
3.4 5.0 kVA . . . . . = •5,00
3.5 7.5 kVA . . . . . = •7,50
3.6 10.0 kVA . . . . . = 10,00
3.7 12.5 kVA . . . . . = 12,50
3.8 15.0 kVA . . . . . = 15,00
3.9 18.0 kVA . . . . . = 18,00
3.10 20.0 kVA . . . . . = 20,00
3.11 25.0 kVA (for vertical mounting **only**) . . . . . = 25,00
3.12 35.0 kVA (for vertical mounting **only**) . . . . . = 35,00
3.13 50.0 kVA (for vertical mounting **only**) . . . . . = 50,00

4. Construction (design)
4.1 Suitable for mounting into IP55 housing . . . . . = G
4.2 Horizontal mounting . . . . . = L
4.3 Vertical mounting . . . . . = S

5. Nominal input voltage (phase-phase)
5.1 e.g., AC 380 V, AC 415 V, AC 440 V . . . . . = 380, 415, 440

6. Nominal output voltage (phase-phase)
6.1 e.g., AC 230 V . . . . . = 220

7. Special design
7.1 Does not apply to standard transformers.
7.2 Frequency: e.g., 100 Hz . . . . . = 100HZ
7.3 Max. line diameter: e.g., 10 mm^2 . . . . . = 10MM
7.4 Degree of protection: e.g., IP23, in protective housing ST0 . . . . . = IP23
7.5 Nema type . . . . . = NEMA
7.6 UL standard . . . . . = UL-N

8. Standard reference

Standard	Title	Edition
DIN EN 60529	Degrees of protection provided by enclosures (IP code) (IEC 60529:1989 + A1:1999); German version EN 60529:1991 + A1:2000	2000-09

Note:
• = Field does not apply

Illustration example: DST

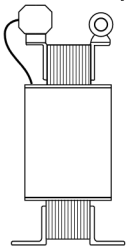


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Fig. 6-1: Type Code DST

6.2.2 Selection

Select the autotransformer according to the mains voltage and the power requirements of the installation. For the selection, proceed as follows:

1. By means of the required nominal mains voltage range from the diagram "Classification of the Three-Phase Current Autotransformers in Type Groups", determine the type group and read the transformation ratio "i".
2. Calculate the actual transformer output voltage by means of the given nominal mains voltage and the transformation ratio "i".
3. Check the drive data. The output voltage of the transformer has an effect on the drive data.
4. Select the three-phase current autotransformer for the determined mains connected load S_{LN}.

   Determining the mains connected load: See Project Planning Manual "Rexroth IndraDrive, Drive System" → "Calculations" → "Calculations for the Mains Connection" → "Calculating the Mains-Side Phase Current"

   The nominal power of the transformer must at least equal the mains connected load S_{LN}.

   For DST transformers, the nominal power is identical to the throughput rating.

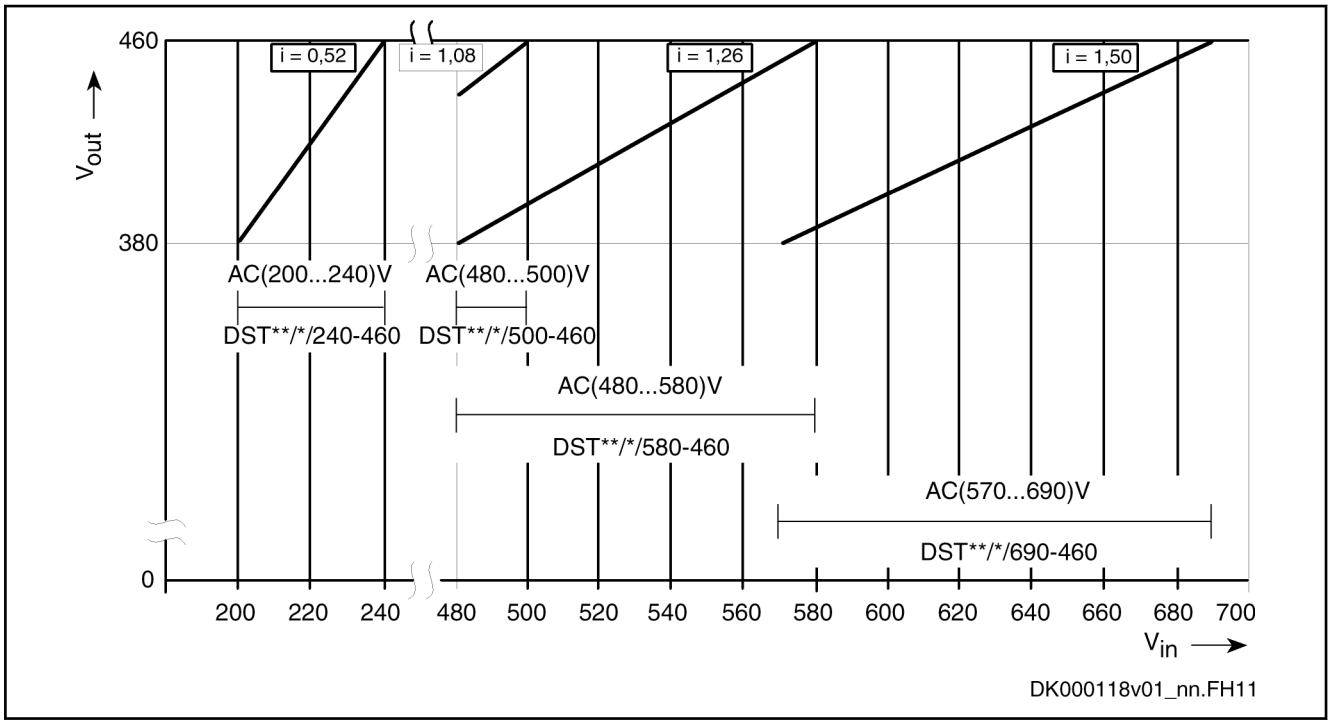


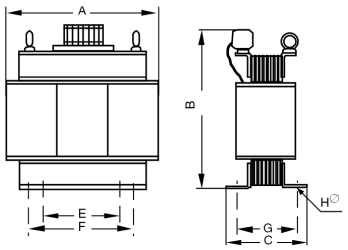
Fig. 6-2: Classification of the Three-Phase Current Autotransformers in Type Groups

Transformers

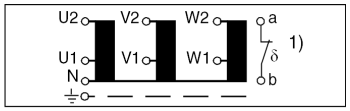
6.2.3 Technical Data

DST autotransformers with a secondary or output voltage of AC 380 ... 460 V

Upright design for foot mounting: DST..,../S



Circuit diagram



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

Type plate (example)

Type designation DST...	Conn. load in kVA	Trans-formation ratio	Dimensions in mm A	C	B	F	E	G	H ∅	Power dissipation in W	Max. conn. cross section in mm²	Weight in kg
Input voltage:	AC 200 ... 240 V ±10%											
4/S/240-460	4		240	150	260	170	110	120	11	120	10	24,5
7,5/S/240-460	7,5		335	175	365	230	160	145	11	225	10	55
12,5/S/240-460	12,5	0.52	360	190	395	250	170	160	11	310	10	70
25/S/240-460	25		480	195	500	356	-----	158	13	500	35	135
50/S/240-460	50		580	265	540	400	270	215	18	750	70	195
Input voltage:	AC (380...440) V ±10%											
2/S/380,415,440-220	2		205	120	210	145	95	85	7		4	12
Input voltage:	AC (480...500) V ±10%											
4/S/500-460	4		180	105	190	125	80	75	7	160	4	8,5
7,5/S/500-460	7,5		205	130	210	145	95	95	7	260	4	13
12,5/S/500-460	12,5	1.08	240	140	260	170	110	110	11	440	10	22
25/S/500-460	25		300	155	325	210	140	125	11	750	16	36
50/S/500-460	50		335	175	365	230	160	145	11	1050	35	53
Input voltage:	AC (480...580) V ±10%											
4/S/580-460	4		240	130	260	170	110	100	11	140	4	18
7,5/S/580-460	7,5		240	140	260	170	110	110	11	260	4	22
12,5/S/580-460	12,5	1.26	300	155	325	210	140	125	11	375	10	37
25/S/580-460	25		360	190	395	250	170	160	11	625	10	72
50/S/580-460	50		420	215	450	280	190	155	14	1000	35	95
Input voltage:	AC (570...690) V ±10%											
4/S/690-460	4		240	140	260	170	110	110	11	140	10	22
7,5/S/690-460	7,5		300	155	325	210	140	125	11	225	10	37
12,5/S/690-460	12,5	1.5	335	175	365	230	160	145	11	375	10	57
25/S/690-460	25		420	205	450	280	190	145	14	500	16	88
50/S/690-460	50		480	222	500	356	-----	185	13	750	35	178

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Fig. 6-3: DST Autotransformers for Drive Controllers for Mains Voltage Adjustment

7 Mains filters

7.1 Mains Filters NFD / NFE

7.1.1 Type Code NFE / NFD

NFE01.1 - Mains Filter, Single-Phase

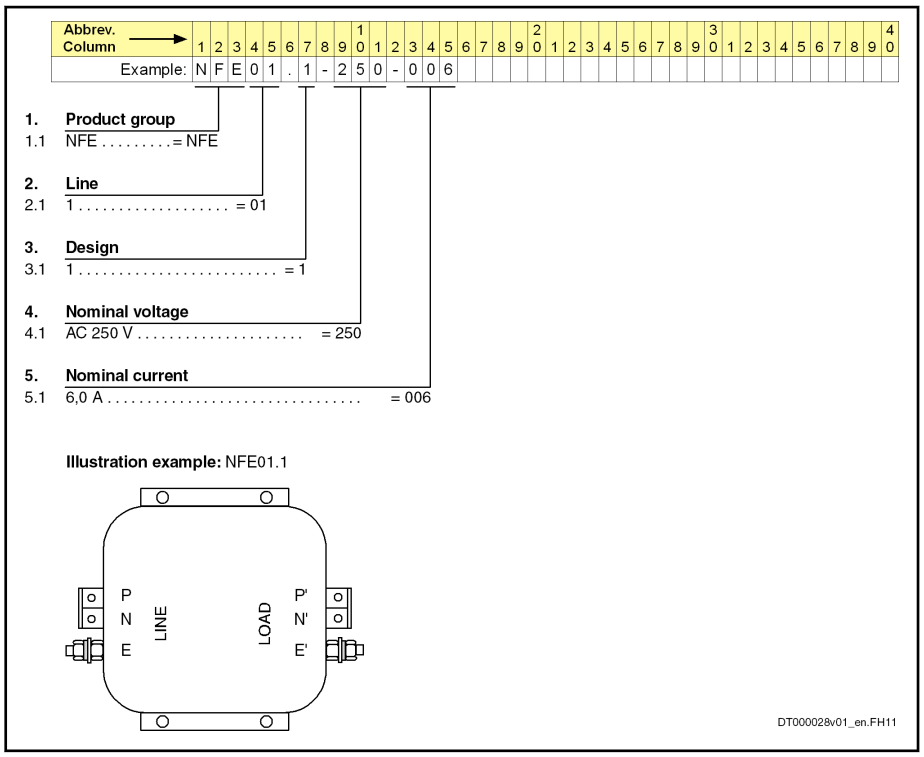


Fig. 7-1: Type Code NFE01.1

NFE02.1 - Mains Filter, Single-Phase

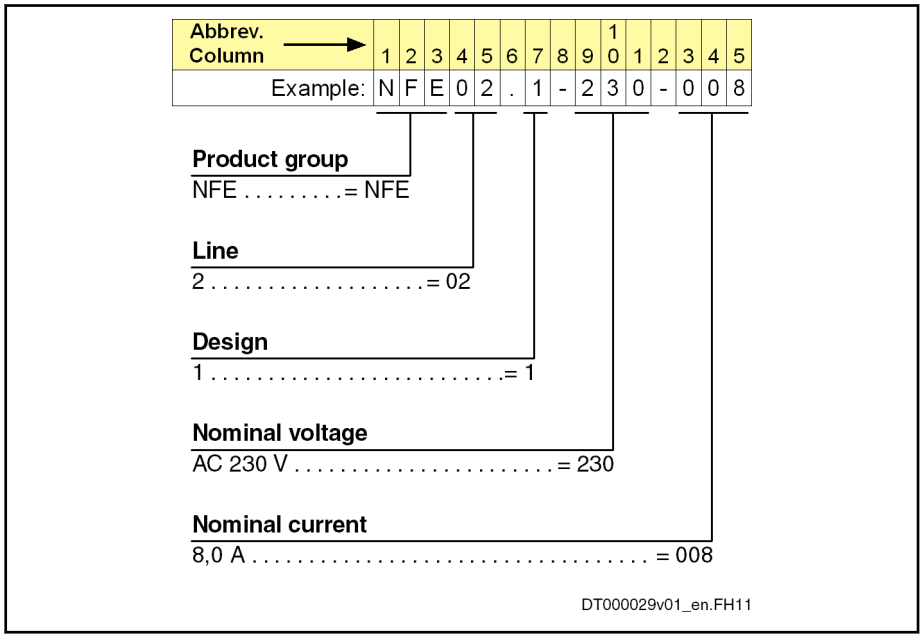


Fig. 7-2: Type Code NFE02.1

Mains filters

NFD03.1 - Mains Filter, Three-Phase

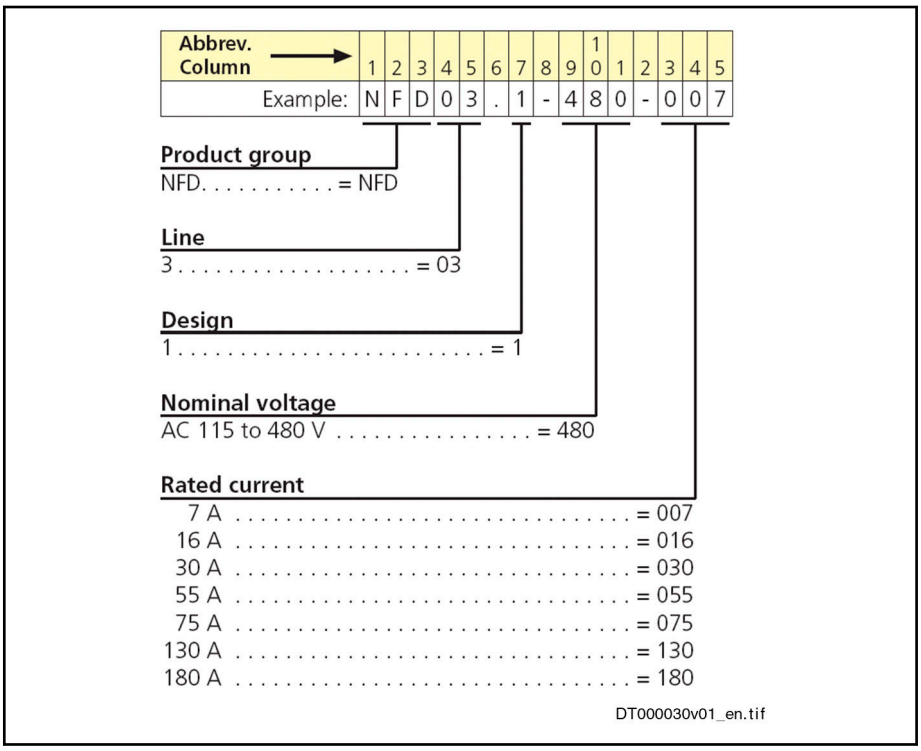


Fig. 7-3: Type Code NFD03.1

7.1.2 Mechanical Data NFE / NFD

NFE01.1

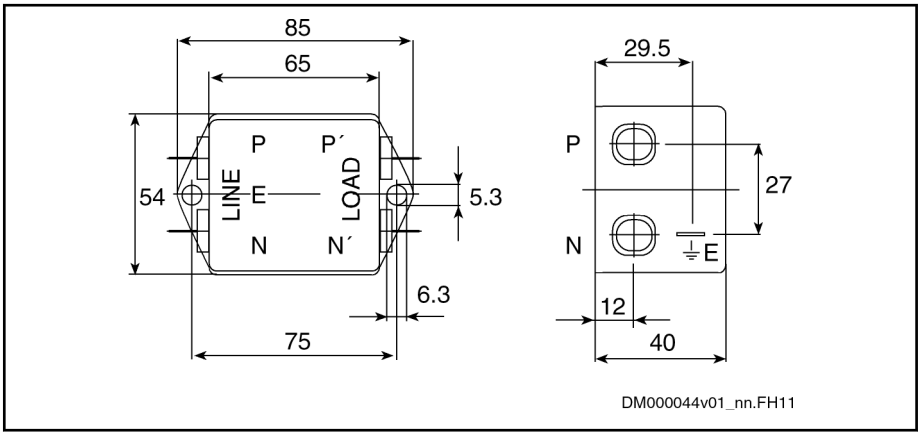
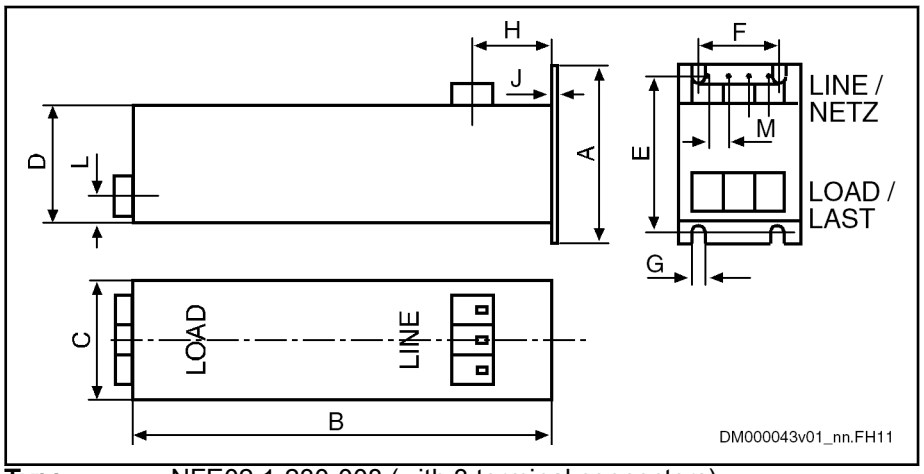


Fig. 7-4: Single-Phase Filter NFE01.1-250-006 for Interference Suppression of Power Supply Unit NTM

Allowed Mounting Positions Every mounting position is allowed.

The mains filter is connected by means of tab receptacles (b = 6.3 mm, d = 1 mm).

NFE02.1



Type NFE02.1-230-008 (with 3 terminal connectors)

Fig. 7-5: Single-Phase Filter NFE02.1 for Drives

Allowed Mounting Positions Every mounting position is allowed.

Mains filters

NFD03.1

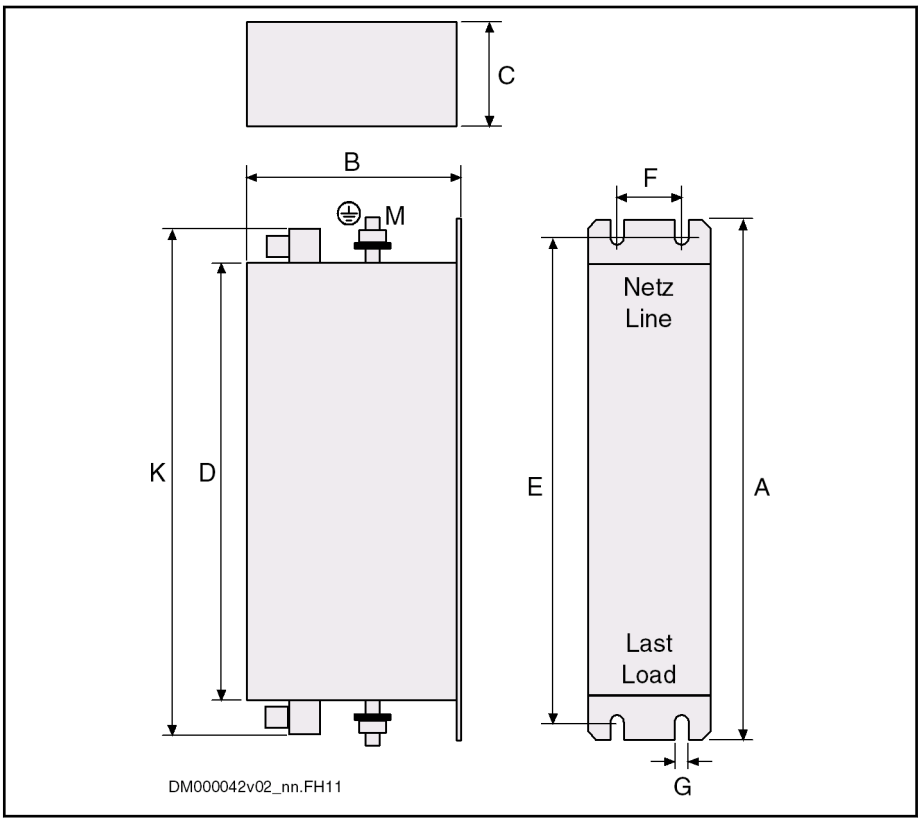


Fig. 7-6: Three-Phase Current Filter NFD03.1 for Drives

Tolerance limits for NFD03.1:

- The dimensions B, C, D, K are maximum values. They can be reduced up to 15 mm.
- The ground studs M can also be arranged horizontally (protruding from the mounting flange), instead of vertically (as illustrated above).

Mains filter type	A	B	C	D	E	F	G	H	J	K	L	M	M_{AE}	M_{AKI}
NFD 03.1-480-007	190	90	50	160	180	20	5,4	-	-	190	-	M5	2,2	0,8
NFD 03.1-480-016	250	90	55	220	235	25	5,4	-	-	250	-	M5	2,2	0,8
NFD 03.1-480-030	270	100	60	240	255	30	5,4	-	-	270	-	M5	2,2	2
NFD 03.1-480-055	250	105	90	220	235	60	5,4	-	-	260	-	M6	4	2,2
NFD 03.1-480-075	270	145	90	240	255	60	6,5	-	-	280	-	M6	4	4,5
NFD 03.1-480-130	270	160	100	240	255	65	6,5	-	-	330	-	M10	18	8
NFD 03.1-480-180	380	180	130	350	365	102	6,5	-	-	455	-	M10	18	20
NFE 02.1-230-008	90	210	60	60	80	40	5,3	40	0,75	-	15	10	0,8	0,8
NFE 01.1-250-006	See drawing													

M_{AE} Maximum tightening torque of the ground stud in Nm
M_{AKI} Maximum tightening torque of the terminal in Nm

Tab. 7-1: Dimensions of the Mains Filters NFD/NFE

Allowed Mounting Positions

Mounting position	Note
G1	Allowed without restrictions
G2	Allowed without restrictions
G3	Mains filter may only be loaded with 80% of the maximum allowed continuous current
G4	Allowed without restrictions
G5	Mains filter may only be loaded with 80% of the maximum allowed continuous current

Tab. 7-2: Allowed Mounting Positions

7.1.3 Electrical Data NFE / NFD

Using mains filters in mains grounded via outer conductor

When using mains filters NFD03 in **mains grounded via outer conductor**, use an isolating transformer between mains and mains filter.

Maximum mains connection voltage of mains 50…60 Hz U_N	Nominal mains current I_{nenn} (1)	Number of phases	Mains filter type	Terminal connectors (3)			Power dissipation approx.	Weight	Type of construction
In V	In A			Flexible [mm²]	Rigid [mm²]	AWG	W	kg	
AC 480V +10%	7	3	NFD 03.1-480-007	4 (3)	6 (3)	AWG 12	3,9	0,7	Vertical
AC 480V +10%	16	3	NFD 03.1-480-016	4 (3)	6 (3)	AWG 12	6,4	1,0	Vertical
AC 480V +10%	30	3	NFD 03.1-480-030	10	16	AWG 6	11,9	1,4	Vertical
AC 480V +10%	55	3	NFD 03.1-480-055	16	25	AWG 4	25,9	2,0	Vertical
AC 480V +10%	75	3	NFD 03.1-480-075	25	35	AWG 3	30,4	3,5	Vertical
AC 480V +10%	130	3	NFD 03.1-480-130	50	50	AWG 1/0	38	4,7	Vertical
AC 480V +10%	180	3	NFD 03.1-480-180	95	95	AWG 4/0	61	10	Vertical

Mains filters

Maximum mains connection voltage of mains 50…60 Hz U_N	Nominal mains current I_{nenn} (1)	Number of phases	Mains filter type	Terminal connectors (3)			Power dissipation approx.	Weight	Type of construction
AC 230V +10%	7,5	1	NFE 02.1-230-008	4 (3)	6 (3)	AWG 10	7,2	1,1	Vertical
AC 230V +10%	4,7	1	NFE01.1-250-006 (2)	Tab connectors 6.3 × 0.8 mm			4	0,245	Horizontal

NFD Three-phase filter
NFE Single-phase filter
(1) Mains-side maximum continuous current at 45 °C ambient temperature
(2) Only use for interference suppression of the power supply unit NTM
(3) For the equipment grounding conductor, connect a conductor cross section of 10 mm2 by means of terminal pin or ring cable lug

Tab. 7-3: Technical data

Operating frequency	From 0-60 Hz at 45 °C
Power dissipation	Measured 2 or 3 × RI^2 $_{Nenn\ DC}$
Temperature range	-25 … +85 °C
Overload	1.5 × I_{Nenn} for 1 minute per hour or 4 × I_{Nenn} for 10 seconds per hour
Effective attenuation	Frequency range 0.15-30 MHz
Saturation behavior	Reduction of filter attenuation by 6 dB at 2.5-fold to 3-fold nominal current
Test voltage	L/N → PE or L → PE: 2000 V, 50 Hz, 2 s at 25 °C L/ N → L: DC 1,100 V, 2 s at 25 °C
Current reduction in the case of overtemperature	See formula for reduction in chapter "Calculations"
Leakage current at 50 Hz	Symmetrical three-phase operation: Typ. 30 mA Single-phase operation or in the case of tripped fuses of a phase: Typ. 175 … 190 mA
Degree of protection	IP 20 NFE01.1-250-006: IP 10

Tab. 7-4: Technical Data

7.2 HNF01.1 - mains filter, 3-phase

7.2.1 Type code HNF01.1

HNF01.1

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	N	F	0	1	.	1	A	-	F	2	4	0	-	R	0	0	9	4	-	A	-	4	8	0	-	N	N	N	N												
	①			②			③	④		⑤					⑥	⑦					⑧		⑨				⑩															

①	**Product:** HNF = HNF
②	**Series:** 01 = 1
③	**Design:** 1 = 1
④	**EMC area in accordance with DIN EN 61800-3:** A = industrial areas C3 B = residential areas C1/C2 C = residential areas C2 H = residential areas, harmonic filter [1)]
⑤	**Applications:** A075 = 1 axis, max. cable length 75 m A100 = 1 axis, max. cable length 100 m F240 = 6 axes, max. cable length 240 m H350 = 8 axes, max. cable length 350 m M240 = 15 axes, max. cable length 240 m M750 = 15 axes, max. cable length 750 m M900 = 15 axes, max. cable length 900 m N1K0 = 22 axes, max. cable length 1000 m P2K0 = 45 axes, max. cable length 2000 m
⑥	**Supply system:** E = For feeding devices only R = For regenerative devices only
⑦	**Nominal current:** 0094 = e.g. 94 A
⑧	**Degree of protection:** A = IP20 N = IP00

Mains filters

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	N	F	0	1	.	1	A	-	F	2	4	0	-	R	0	0	9	4	-	A	-	4	8	0	-	N	N	N	N												
	①			②			③	④		⑤					⑥	⑦					⑧		⑨				⑩															

⑨	**Mains connection voltage:** 415 = 3 × AC 380 … 415V - 15 + 10%, 50/60 Hz [1)] 480 = 3 × AC 400 … 480V - 15 + 10%, 50/60 Hz 500 = 3 × AC 400 … 500V - 15 + 10%, 50/60 Hz 530 = 3 × AC 230 … 530V - 15 + 10%, 50/60 Hz 69A = 3 × AC 500 V - 15% … 3 × AC 690V + 10%, 50/60 Hz
⑩	**Other design:** NNNN = None NNNT = For IT mains

1) EMC area "H" is only available with mains connection voltage "415"

Tab. 7-5: HNF01.1, type code

7.2.2 Mechanical data HNF01.1

Dimensions

Mounting position and distances

Mount HNF01 in the control cabinet in normal mounting position G1 and allow cooling by natural convection. For this purpose, keep at least 80 mm free from mounted parts, at the top side and bottom side of HNF.

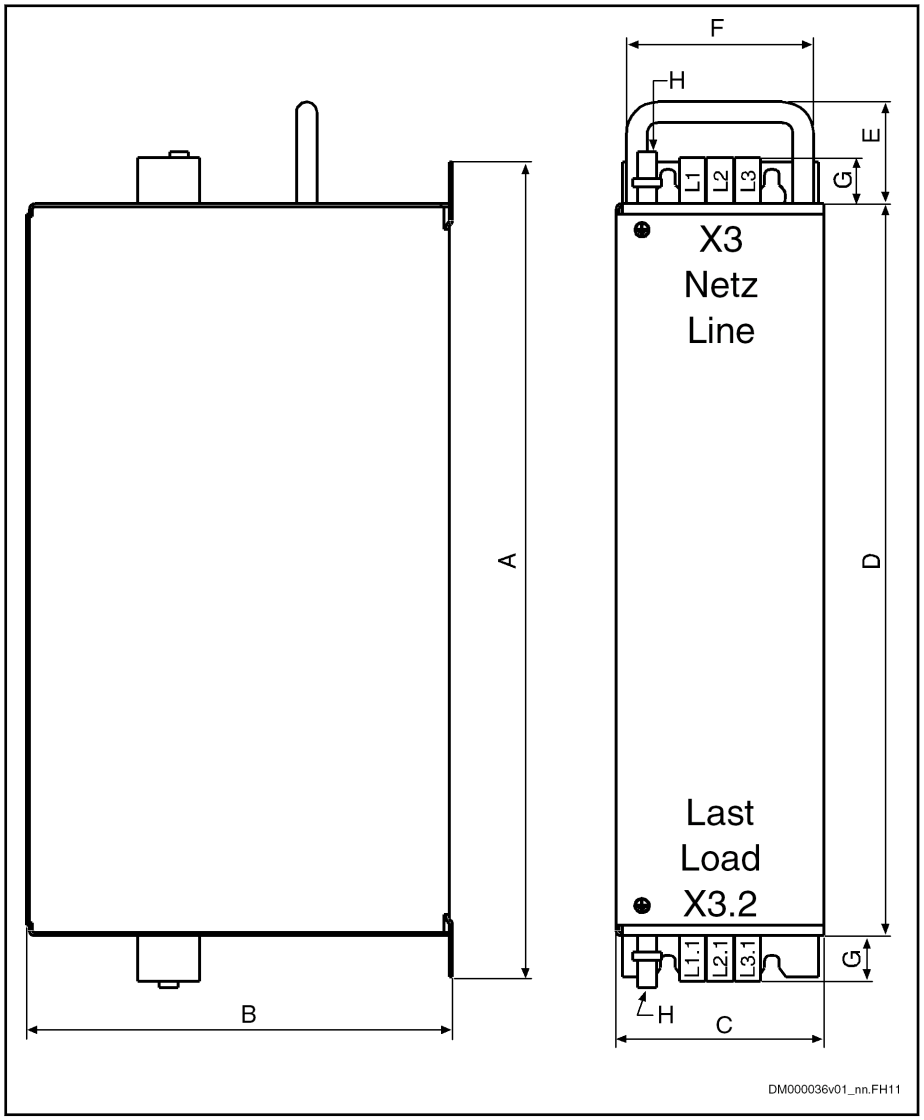


Fig. 7-7: Dimensions

Mains filters

HNF01.1A-...	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H		L1, L2, L3 L1.1, L2.1, L3.1	
								[mm]	[Nm] *)	[mm²] **) [AWG]	[Nm] *)
F240-R0026	480	262	100	440	-	-	26	M6×23	3.15	10 8 AWG	1.8
F240-E0051 M900-E0051	480	262	100	440	-	-	33	M6×16	8.6	16 6 AWG	2.3
M900-R0026	480	262	150	440	-	-	26	M6×20	8.6	10 8 AWG	1.8
F240-R0065 M900-R0065	480	262	150	440	40	110	40	M6×16	8.6	25 4 AWG	4.5
F240-R0094 M900-R0094	480	262	150	440	40	110	45	M10×30	25	50 1 AWG	8
F240-E0125 M900-E0125	480	262	150	440	40	110	45	M10×30	25	50 1 AWG	8
F240-E0202	480	262	150	440	40	110	63.5	M10×30	25	150 5/0 AWG	30
M900-E0202	480	262	250	440	40	110	63.5	M10×30	25	150 5/0 AWG	30
H350-R0180	480	262	250	440	40	110	67	M10×30	25	150 5/0 AWG	30

*) Maximum tightening torque
**) Maximum connection cross section

Tab. 7-6: HNF01.1A, dimensions

Mains filters

HNF01.1C-...	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H		L1, L2, L3 L1.1, L2.1, L3.1	
								[mm]	[Nm] *)	[mm²] **) [AWG]	[Nm] *)
F240-E0055	330	200	80	298	-	-	38.5	M10×39	11	25 4 AWG	4.5
F240-E0080	330	200	80	298	-	-	43	M10×39	11	50 1 AWG	8
F240-E0130	330	200	80	298	-	-	43	M10×39	11	50 1 AWG	8
F240-E0150	330	200	80	298	-	-	43	M10×39	11	50 1 AWG	8
F240-E0225	480	258	199	440	-	-	50.5	M10×38.5	11	95 3/0 AWG	20

*) Maximum tightening torque
**) Maximum connection cross section

Tab. 7-7: HNF01.1C, dimensions

Mains filters

Drilling pattern

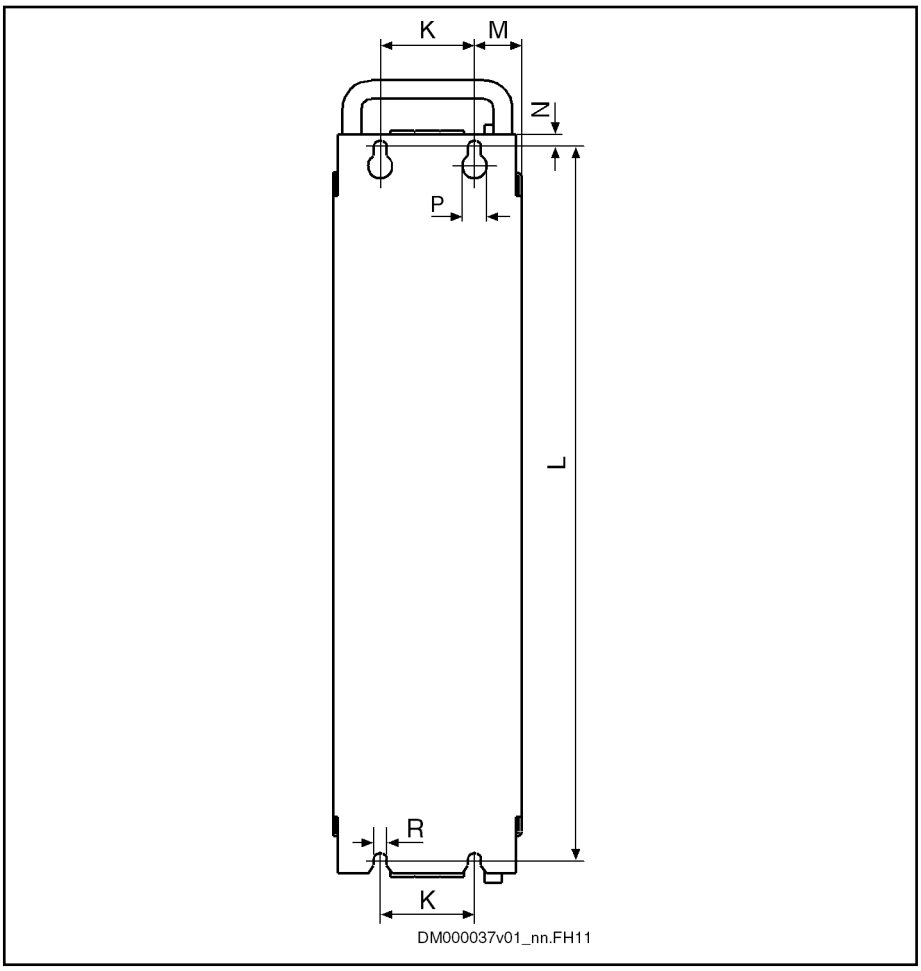


Fig. 7-8: Drilling pattern

HNF01.1A- …	K [mm]	L [mm]	M [mm]	N [mm]	P [mm]	R [mm]
F240-E0051 M900-E0051	50	466	25	7	13	6.5
F240-E0125 M900-E0125	125	466	12.5	7	13	6.5
F240-E0202	125	466	12.5	7	13	6.5
M900-E0202 H350-R0180	150	466	50	7	13	6.5
F240-R0026	50	466	25	7	13	6.5
M900-R0026	100	466	25	7	13	6.5
F240-R0065 M900-R0065	100	466	25	7	13	6.5
F240-R0094 M900-R0094	125	466	12.5	7	13	6.5

Tab. 7-8: HNF01.1A

HNF01.1C- …	K [mm]	L [mm]	M [mm]	N [mm]	P [mm]	R [mm]
F240-E0055	55	315	10.5	7.5	-	6.5
F240-E0080	55	315	10.5	7.5	-	6.5
F240-E0130	55	315	10.5	7.5	-	6.5
F240-E0150	55	315	10.5	7.5	-	6.5
F240-E0225	150	465	22.5	2.5	13	6.5

Tab. 7-9: HNF01.1C

Mains filters

7.2.3 Electrical data HNF01.1

HNF01.1A

HNF01.1A-xxxx-Exxxx-A-480-NNNN data for feeding supply systems

Using mains filters in mains grounded via outer conductor

When using HNF01 mains filters in **mains grounded via outer conductor**, use an isolating transformer between mains and mains filter.

Operation at a lower voltage than the specified voltage is not allowed, since this causes saturation phenomena in the input choke due to asymmetric currents. The filter thereby loses its effect, particularly in the higher frequency range.

Technical data - currents, voltages, power

Description	Symbol	Unit	HNF01.1A-F240-E0051-A-480-NNNN	HNF01.1A-F240-E0125-A-480-NNNN	HNF01.1A-F240-E0202-A-480-NNNN	HNF01.1A-M900-E0051-A-480-NNNN	HNF01.1A-M900-E0125-A-480-NNNN	HNF01.1A-M900-E0202-A-480-NNNN
Degree of protection according to IEC 60529	IP		IP20					
Listing in accordance with UL standard			UL1283					
Listing in accordance with CSA standard			C22.2 No. 8					
Mass	m	kg	15.00	18.00	29.00	15.00	30.00	37.00
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	380...480					
Three-phase mains voltage at Corner-grounded-Delta mains[1)]	U_{LN}	V	Not allowed					
Three-phase mains voltage at IT mains[2)]	U_{LN}	V	Not allowed					
Tolerance rated input voltage U_{LN}		%	±10					
Mains frequency	f_{LN}	Hz	50...60					
Mains frequency tolerance		Hz	±2					
Nominal current	I_{LN}	A	51.00	125.00	202.00	51.00	125.00	202.00
Maximum allowed peak current[3)]	I_{L_max}	A	77.00	188.00	303.00	77.00	188.00	303.00
Power dissipation at continuous current and continuous DC bus power respectively[4)]	P_{Diss_cont}	W	Less than 89	Less than 127	Less than 373	Less than 91	Less than 174	Less than 373
Last modification: 2007-11-28								

Description	Symbol	Unit	HNF01.1A-F240-E0051-A-480-NNNN	HNF01.1A-F240-E0125-A-480-NNNN	HNF01.1A-F240-E0202-A-480-NNNN	HNF01.1A-M900-E0051-A-480-NNNN	HNF01.1A-M900-E0125-A-480-NNNN	HNF01.1A-M900-E0202-A-480-NNNN
Insulation resistance at 500 V DC	R_{is}	MOhm	1.18					
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[5)]	A_{LN}	AWG	6	1	4/0	6	1	4/0
Last modification: 2007-11-28								

1) 2) Mains voltage > U_{LN}: Use a transformer with grounded neutral point, do not use autotransformers!

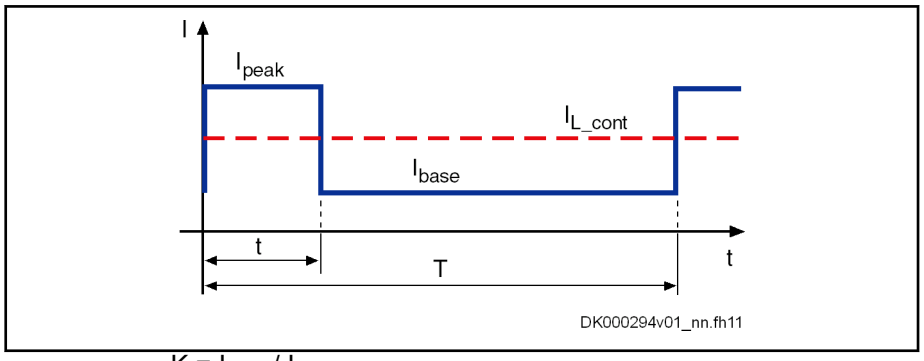
3) R-types: t = 0.3 s; T = 1.42 s; K = 2.5; E-types: t = 0.3 s; T = 0.67 s; K = 2.5

4) Plus dissipation of braking resistor and control section

5) Copper wire; PVC-insulation (conductor temperature 90 °C; T_a ≤ 40 °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

Tab. 7-10: HNF - technical data - currents, voltages, power

Exemplary profile



$K = I_{peak} / I_{base}$

$I_{peak} \leq I_{L\_max}$

$I_{rms} \leq I_{L\_cont}$

Fig. 7-9: Exemplary profile

HNF01.1A-xxxx-Rxxxx-A-480-NNNN data for regenerative supply systems

Using mains filters in mains grounded via outer conductor

When using HNF01 mains filters in **mains grounded via outer conductor**, use an isolating transformer between mains and mains filter.

Mains filters

Technical data - currents, voltages, power

Description	Symbol	Unit	HNF01.1A-F240-R0026-A-480-NNNN	HNF01.1A-F240-R0065-A-480-NNNN	HNF01.1A-F240-R0094-A-480-NNNN	HNF01.1A-H350-R0180-A-480-NNNN	HNF01.1A-M900-R0026-A-480-NNNN	HNF01.1A-M900-R0065-A-480-NNNN	HNF01.1A-M900-R0094-A-480-NNNN
Degree of protection according to IEC 60529	IP		IP20						
Listing in accordance with UL standard			UL1283			-	UL1283		
Listing in accordance with CSA standard			C22.2 No. 8			-	C22.2 No. 8		
Mass	m	kg	14.00	25.00	28.00	45.00	17.00	26.00	29.00
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	380...480						
Three-phase mains voltage at Corner-grounded-Delta mains[1)]	U_{LN}	V	Not allowed						
Three-phase mains voltage at IT mains[2)]	U_{LN}	V	Not allowed						
Tolerance rated input voltage U_{LN}		%	±10						
Mains frequency	f_{LN}	Hz	50...60						
Mains frequency tolerance		Hz	±2						
Nominal current	I_{LN}	A	26.00	65.00	94.00	180.00	26.00	65.00	94.00
Maximum allowed peak current[3)]	I_{L_max}	A	65.00	163.00	235.00	270.00	65.00	163.00	235.00
Power dissipation at continuous current and continuous DC bus power respectively[4)]	P_{Diss_cont}	W	Less than 73	Less than 163	Less than 135	305.00	77.00	157.00	146.00
Insulation resistance at 500 V DC	R_{is}	MOhm	0.17		1.18	1.33	0.17		
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[5)]	A_{LN}	AWG	10	6	3	4/0	10	6	3
Last modification: 2007-11-28									

1) 2) Mains voltage > U_{LN}: Use a transformer with grounded neutral point, do not use autotransformers!

3) R-types: t = 0.3 s; T = 1.42 s; K = 2.5; E-types: t = 0.3 s; T = 0.67 s; K = 2.5

4) Plus dissipation of braking resistor and control section

5) Copper wire; PVC-insulation (conductor temperature 90 °C; $T_a \leq 40$ °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

Tab. 7-11: HNF - technical data - currents, voltages, power

HNF01.1C

HNF01.1C-xxxx-Exxxx-A-480-NNNN data for feeding supply systems

Using mains filters in mains grounded via outer conductor

When using HNF01 mains filters in **mains grounded via outer conductor**, use an isolating transformer between mains and mains filter.

Operation at a lower voltage than the specified voltage is not allowed, since this causes saturation phenomena in the input choke due to asymmetric currents. The filter thereby loses its effect, particularly in the higher frequency range.

Technical data - currents, voltages, power

Description	Symbol	Unit	HNF01.1C-F240-E0055-A-480-NNNN	HNF01.1C-F240-E0080-A-480-NNNN	HNF01.1C-F240-E0130-A-480-NNNN	HNF01.1C-F240-E0150-A-480-NNNN	HNF01.1C-F240-E0225-A-480-NNNN
Degree of protection according to IEC 60529	IP		IP20				
Listing in accordance with UL standard			UL1283				
Listing in accordance with CSA standard			C22.2 No. 8				
Mass	m	kg	5.50	8.00	14.50	17.00	18.50
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	400 … 480				
Three-phase mains voltage at Corner-grounded-Delta mains[1)]	U_{LN}	V	Not allowed				
Three-phase mains voltage at IT mains[2)]	U_{LN}	V	Not allowed				
Tolerance rated input voltage U_{LN}		%	±10				
Mains frequency	f_{LN}	Hz	50 … 60				
Mains frequency tolerance		Hz	±2				
Nominal current	I_{LN}	A	55.00	80.00	130.00	150.00	225.00
Maximum allowed peak current (for 3 minutes per hour)	I_{L_max}	A	82.50	120.00	195.00	225.00	337.50
Maximum allowed peak current (for 30 seconds per hour)	I_{L_max}	A	137.50	200.00	325.00	375.00	562.50
Power dissipation at continuous current and continuous DC bus power respectively[3)]	P_{Diss_cont}	W	34	29	76	51	76

Mains filters

Description	Symbol	Unit	HNF01.1C-F240-E0055-A-480-NNNN	HNF01.1C-F240-E0080-A-480-NNNN	HNF01.1C-F240-E0130-A-480-NNNN	HNF01.1C-F240-E0150-A-480-NNNN	HNF01.1C-F240-E0225-A-480-NNNN
Insulation resistance at 500 V DC	R_{is}	MOhm	1.3				
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	4	1	1	1	3/0

1) 2) Mains voltage > U_{LN}: Use a transformer with grounded neutral point, do not use autotransformers!

3) Plus dissipation of braking resistor and control section

4) Copper wire; PVC-insulation (conductor temperature 90 °C; $T_a \leq 40$ °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

Tab. 7-12: HNF - technical data - currents, voltages, power

Allowed leakage capacitance in nF at 4 kHz chopper frequency

Filter type HNF01.1C-F240-…	230 V with mains choke	230 V without mains choke	400 V with mains choke	400 V without mains choke	500 V with mains choke	500 V without mains choke
E0055	200	180	120	120	120	60
E0055	-	-	110	110	110	50
E0080	-	-	70	110	110	70
E0130	-	-	190	110	110	70
E0150	-	-	800	800	800	800
E0225	-	-	190	110	110	110

Tab. 7-13: Allowed leakage capacitance [nF] at 4 kHz chopper frequency

Allowed leakage capacitance in nF at 8/12/16 kHz chopper frequency

Filter type HNF01.1C-F240-…	230 V with mains choke	230 V without mains choke	400 V with mains choke	400 V without mains choke	500 V with mains choke	500 V without mains choke
E0055	200	120	120	-	120	-
E0055	-	-	110	-	110	-
E0080	-	-	70	110	110	70
E0130	-	-	70	70	70	70
E0150	-	-	40	40	80	40
E0225	-	-	110	70	70	70

Tab. 7-14: Allowed leakage capacitance [nF] at 8/12/16 kHz chopper frequency

Nominal power, filter [kW]

Filter type HNF01.1C-F240-…	with choke		without choke	
	400 V	500 V	400 V	500 V
E0055	33	41	25	31
E0080	48	60	36	45
E0130	78	98	59	73
E0150	96	121	72	90
E0225	136	170	101	127

Tab. 7-15: Nominal power, filter [kW]

All values apply with HAS04 accessories connected (capacitor 2 × 470 nF).

Mains filters

7.3 HNK01.1 - mains filter, with mains choke

7.3.1 Type code HNK01.1

Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	N	K	0	1	.	1	A	-	A	0	7	5	-	E	0	0	5	0	-	A	-	5	0	0	-	N	N	N	N												

1. Product
1.1 HNK. . . . . = HNK

2. Line
2.1 1. . . . . = 01

3. Design
3.1 1 . . . . . = 1

4. EMC area per DIN EN 61800-3
4.1 industrial area . . . . . = A

5. Applications
5.1 1 axis, cable length max. 75 m . . . = A075

6. Supply system
6.1 only for feeding units. . . . . .= E

7. Nominal current
7.1 e.g. 50 A . . . . . = 0050

8. Degree of protection
8.1 IP20 . . . . . = A

9. Mains connecting voltage
9.1 3 AC 400...500V -15+10%, 50/60 Hz. . . . . = 500

10. Other design
10.1 none . . . . . = NNNN

11. Standard reference

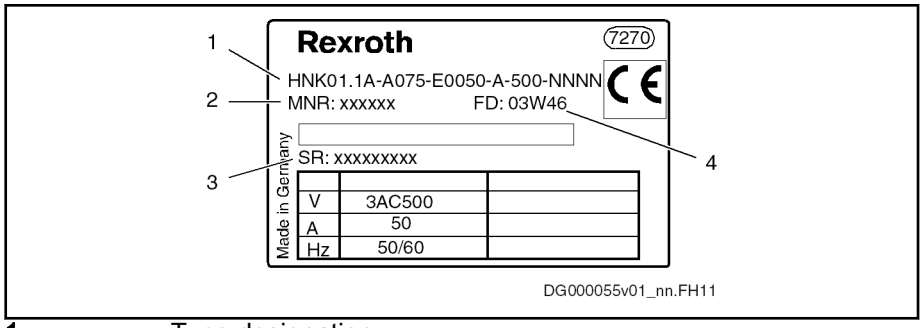
Standard	Title	Edition
DIN EN 60529	Degrees of protection provided by enclosures (IP-Code)	2000-09
DIN EN 61800-3	Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test methods (IEC 61800-3:1996); German version 61800-3:1996 + A11:2000	2001-02

DT000058v01_en.FH11

Fig. 7-10: Type code HNK01.1

7.3.2 Type plate HNK01.1

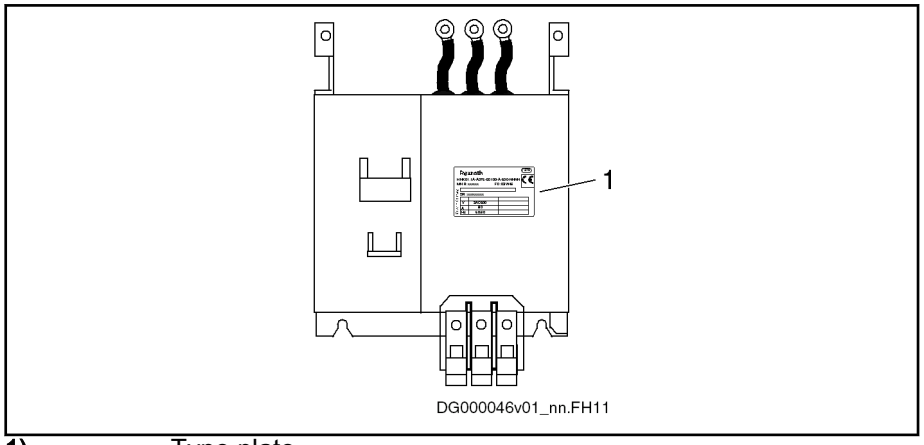
Each mains filter is identified by a type designation. There is a type plate attached to all components.



1 Type designation
2 Material number
3 Serial number
4 Production date

Fig. 7-11: Example of type plate HNK01.1

Position of type plate:



1) Type plate

Fig. 7-12: Type plate arrangement

Mains filters

7.3.3 Mechanical data HNK01.1

Dimensions

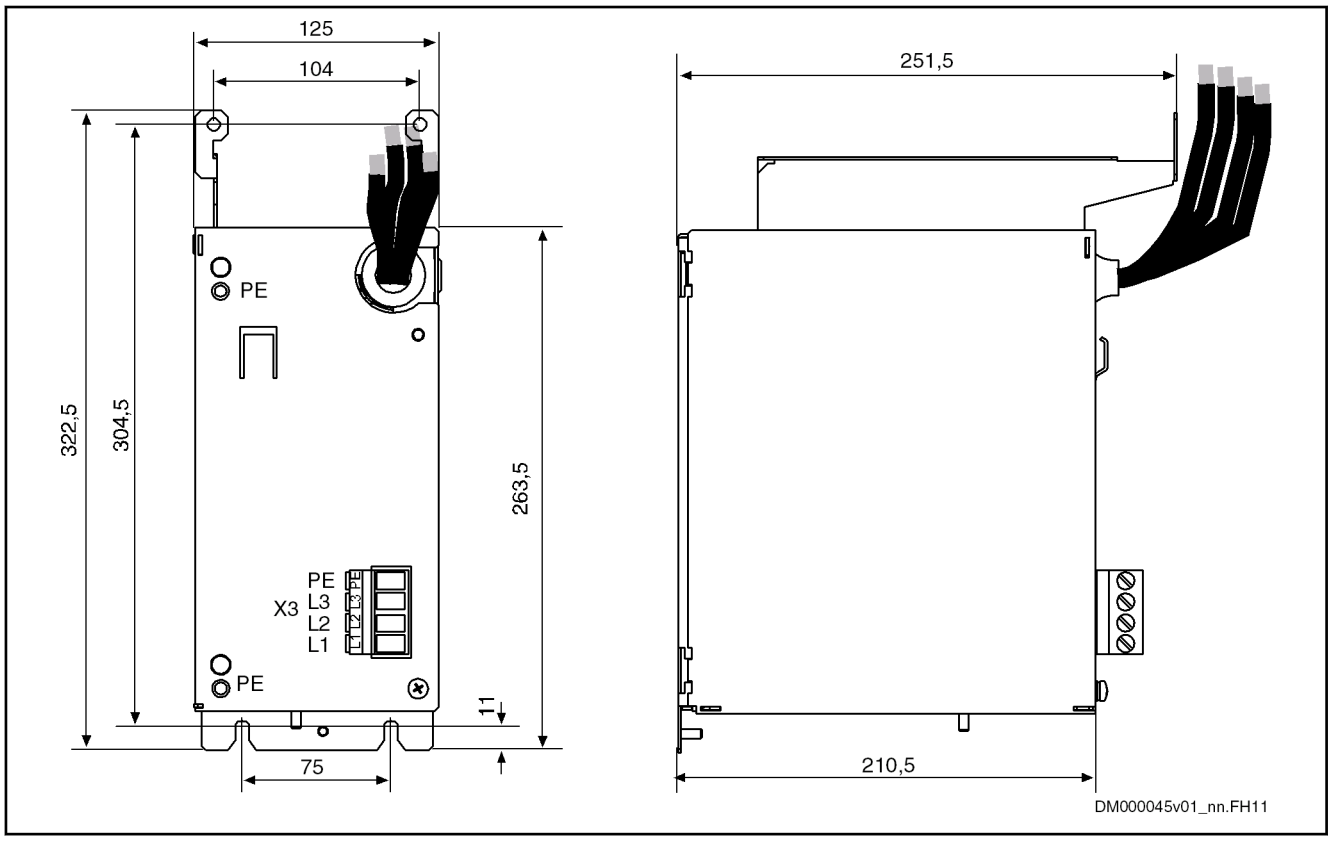


Fig. 7-13: Mains filter dimensions HNK01.1A-A075-E0050

Mains filters

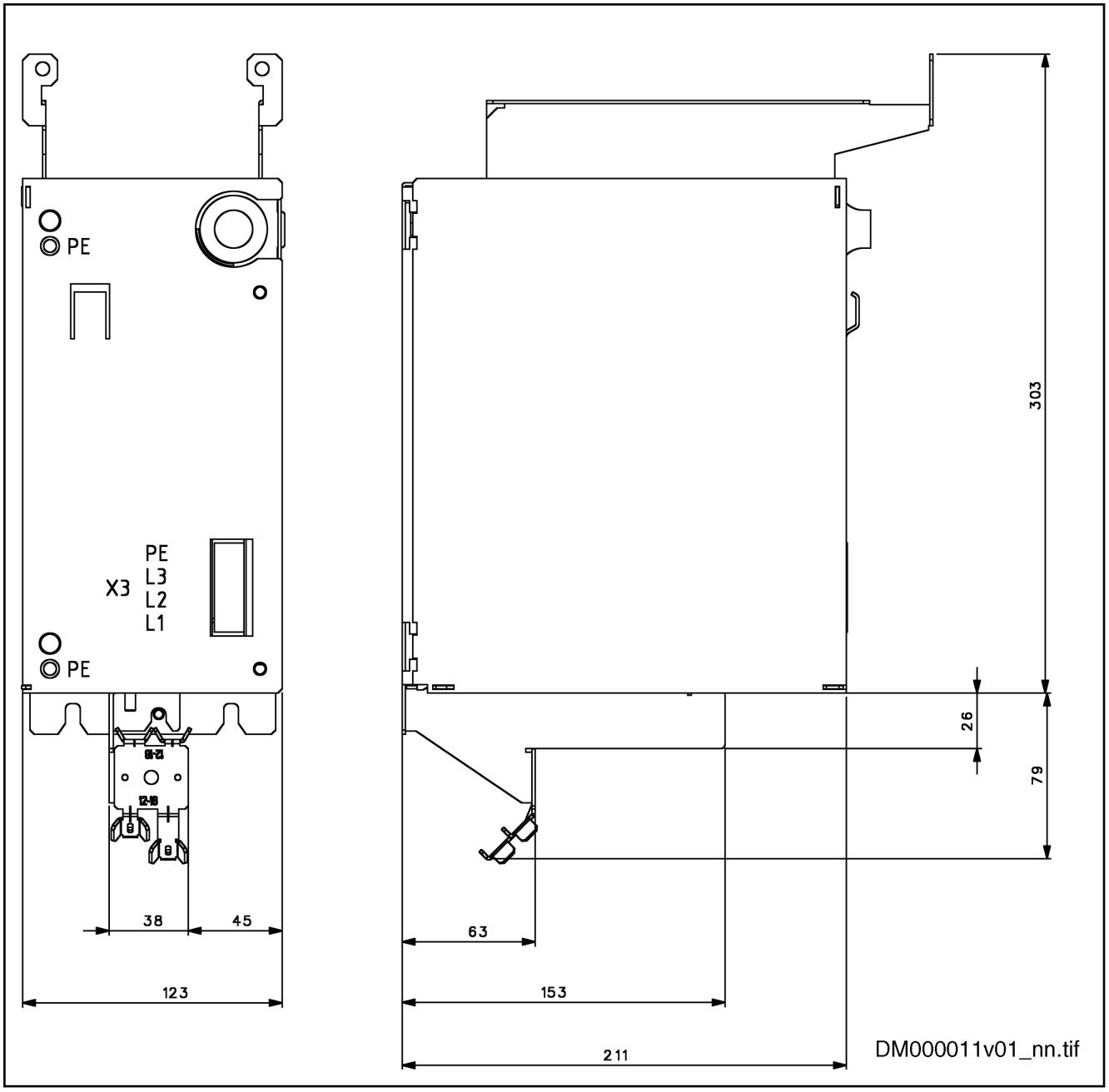


Fig. 7-14: Mains filter dimensions HNK01.1A-A075-E0050 with HAS02

Mains filters

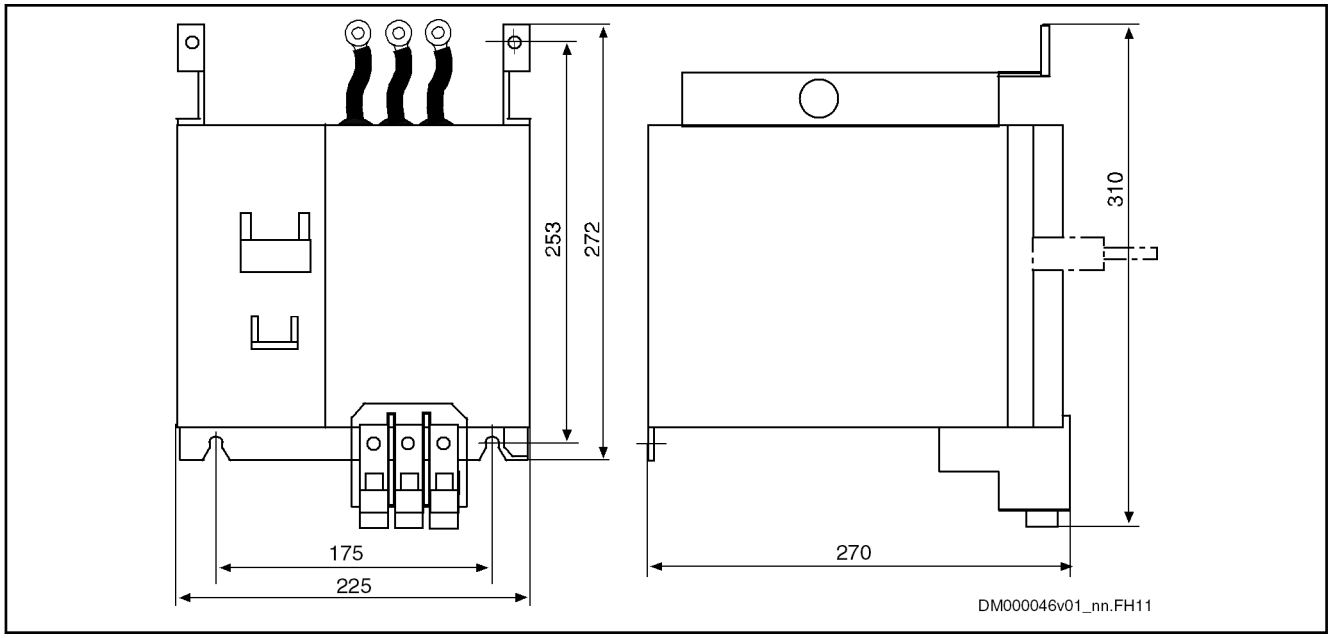


Fig. 7-15: Mains filter dimensions HNK01.1A-A075-E0080/0106

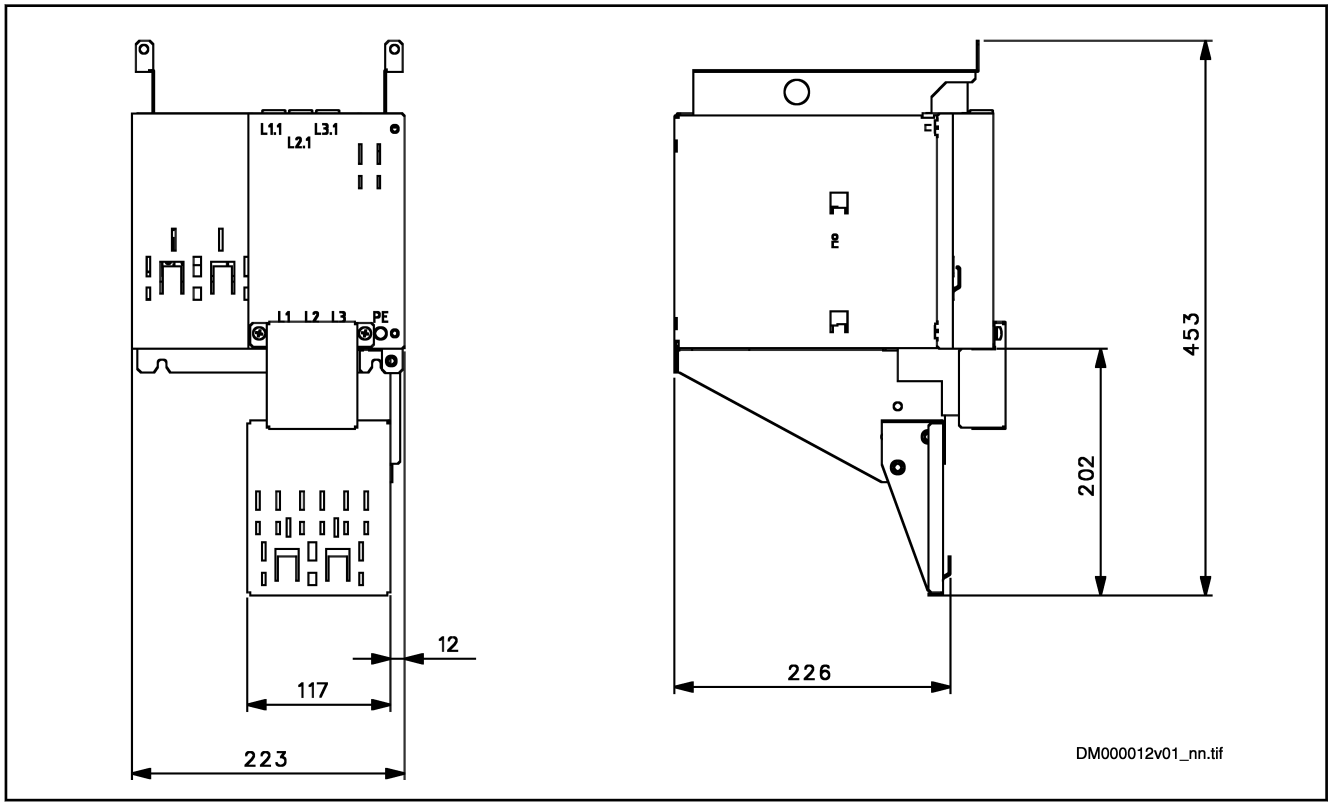


Fig. 7-16: Mains filter dimensions HNK01.1A-A075-E0080/0106 with HAS02

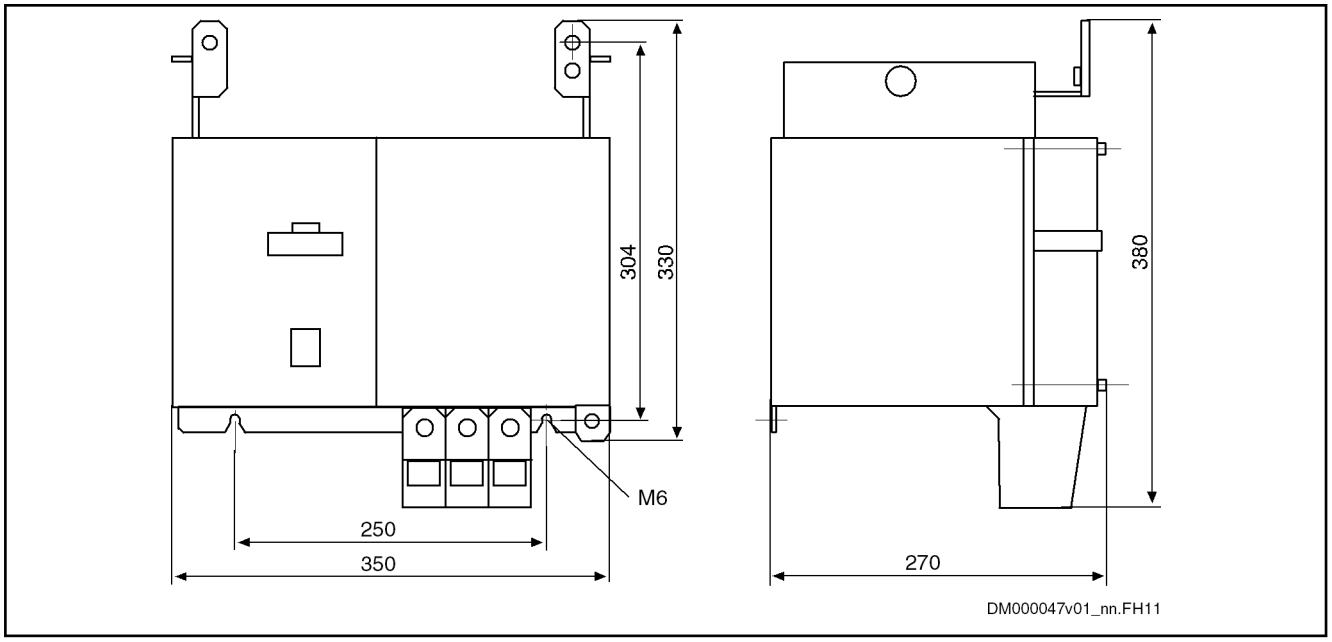


Fig. 7-17: Mains filter dimensions HNK01.1A-A075-E0146

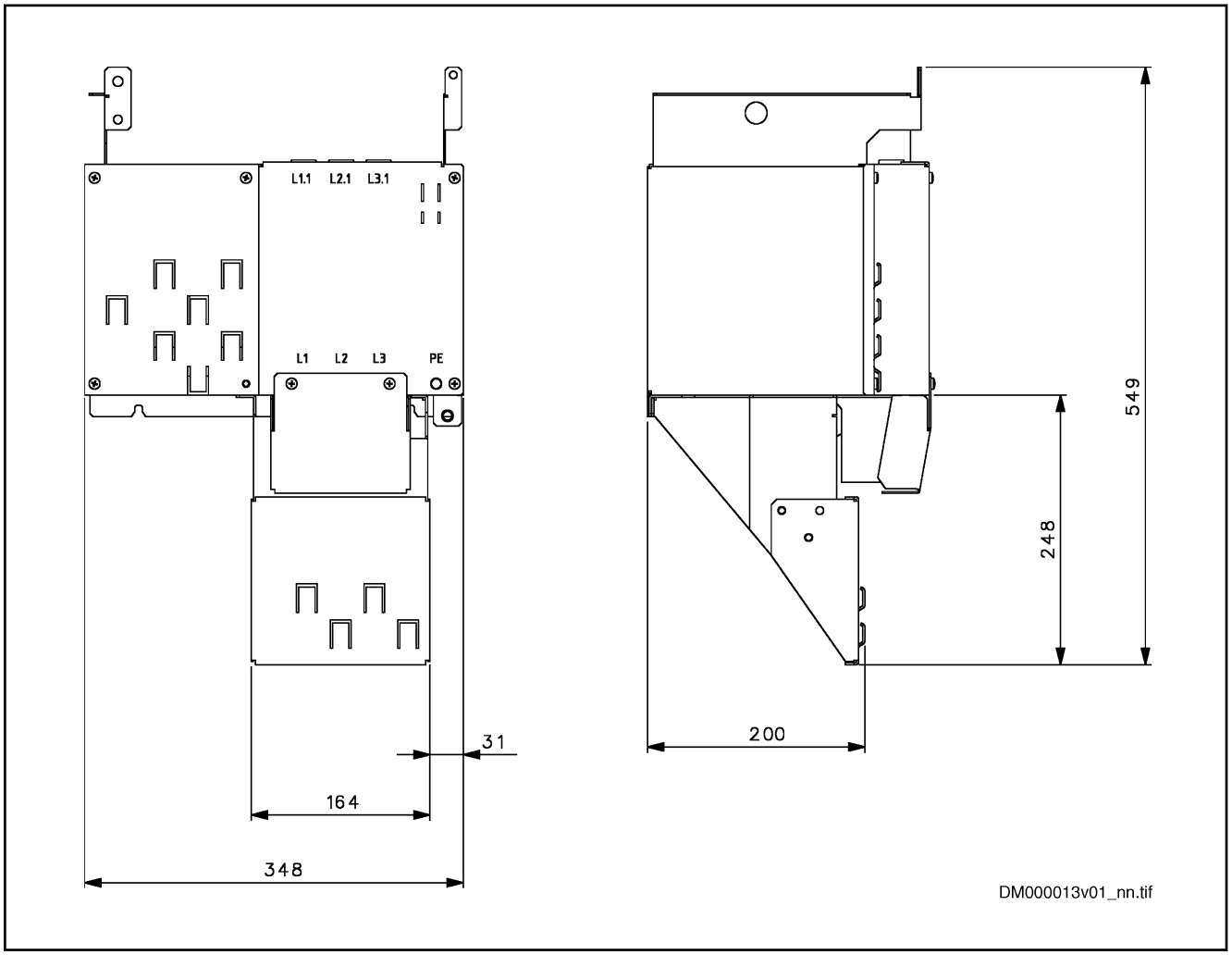
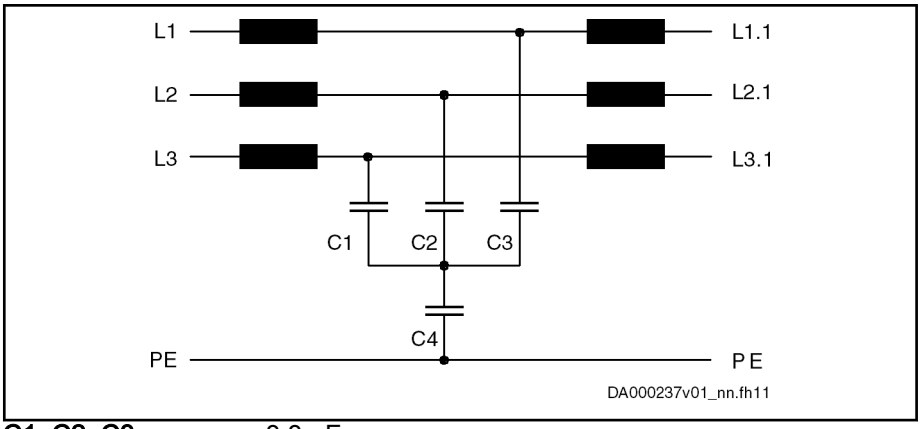


Fig. 7-18: Mains filter dimensions HNK01.1A-A075-E0146 with HAS02

Mains filters

7.3.4 Electrical data HNK01.1

Circuit diagram



C1, C2, C3 approx. 3.3 µF
C4 approx. 0.5 µF

Fig. 7-19: Block diagram HNK01

Technical data - currents, voltages, power

Description	Symbol	Unit	HNK01.1A-A075-E0050-A-500-NNNN	HNK01.1A-A075-E0080-A-500-NNNN	HNK01.1A-A075-E0106-A-500-NNNN	HNK01.1A-A075-E0146-A-500-NNNN
Degree of protection according to IEC 60529	IP		IP20			
Listing in accordance with UL standard			Listed as optional part of HCS03			
Listing in accordance with CSA standard			-			
Minimum distance on the bottom of the device[1)]	d_{bot}	mm	100			
Minimum distance on the top of the device[2)]	d_{top}	mm	Mounted to HCS03			
Mass	m	kg	15.00	20.00		28.00
Three-phase mains voltage at TN-S, TN-C, TT mains	U_{LN}	V	400...500			
Three-phase mains voltage at Corner-grounded-Delta mains[3)]	U_{LN}	V	-			
Three-phase mains voltage at IT mains[4)]	U_{LN}	V	400...500			
Tolerance rated input voltage U_{LN}		%	+10 -15			
Mains frequency	f_{LN}	Hz	50...60			
Mains frequency tolerance		Hz	±2			
Continuous current	I_{L_cont}	A	50	80	106	146
Typical inductance per winding at I_{cont}	L_{typ}	µH	571	362	240	170
						Last modification: 2010-06-14

Description	Symbol	Unit	HNK01.1A-A075-E0050-A-500-NNNN	HNK01.1A-A075-E0080-A-500-NNNN	HNK01.1A-A075-E0106-A-500-NNNN	HNK01.1A-A075-E0146-A-500-NNNN
Power dissipation at continuous current and continuous DC bus power respectively[5)]	P_{Diss_cont}	W	55	90	120	140
Insulation resistance at 500 V DC	R_{is}	MOhm	>15			
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[6)]	A_{LN}	AWG	8 AWG	4 AWG	2 AWG	1/0 AWG
Last modification: 2010-06-14						

1) 2) See fig. "Air intake and air outlet at device"
3) 4) Mains voltage > U_{LN}: Use a transformer with grounded neutral point, do not use autotransformers!
5) Plus dissipation of braking resistor and control section
6) Copper wire; PVC-insulation (conductor temperature 90 °C; $T_a \leq 40$ °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

Tab. 7-16: HNK - technical data - currents, voltages, power

Connection cross sections

HNK01.1A-A075	Unit	E0050	E0080	E0106	E0146
Maximum connection cross section	mm²	16	35	50	70
	AWG	6	2	1	2/0

Tab. 7-17: Connection cross sections

7.3.5 Arranging the components HCS03 drive controller and HNK01 mains filter

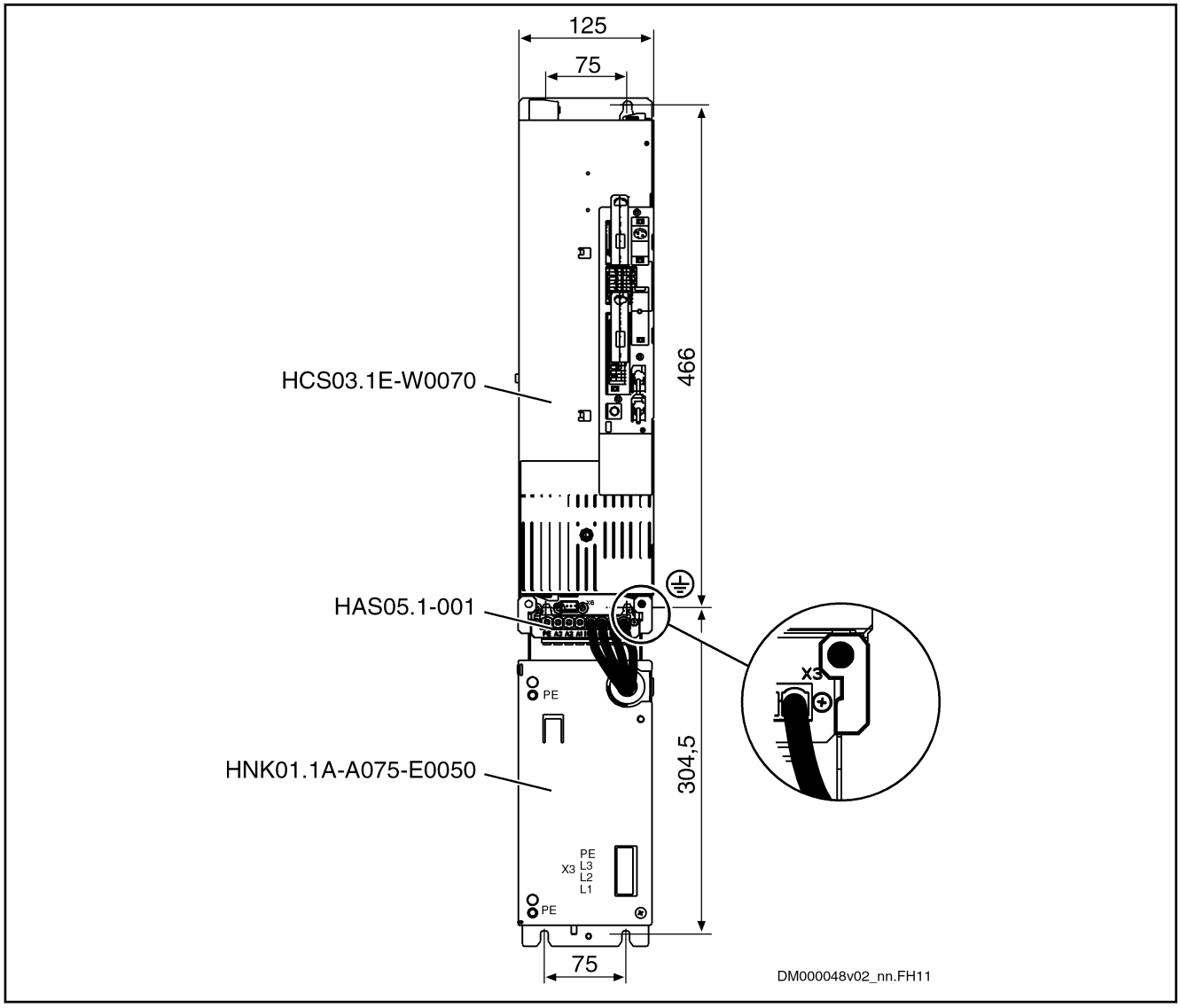
⚠ WARNING **Lethal electric shock from live parts with more than 50V!**

Establish equipment grounding connection between HNK01 mains filter and HCS03 drive controller. Screw joint bars to guide bar.

☞ The HNK01 mains filters are **cooled** by the cooling air of the drive controller flowing in.

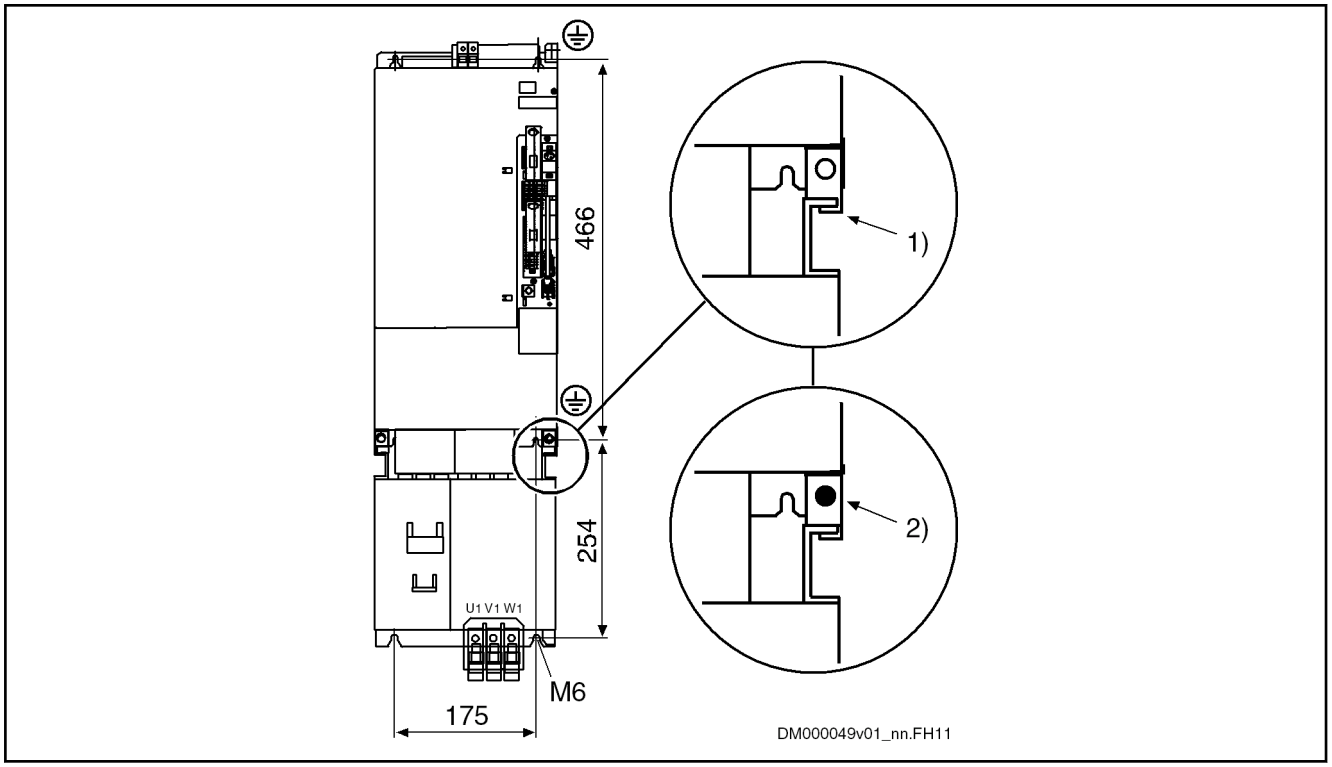
Arrange HNK01 at HCS03 drive controller as pictured.

Mains filters



Fit mains filter to guide bar. Ensure equipment grounding connection by screwing the mounting link.

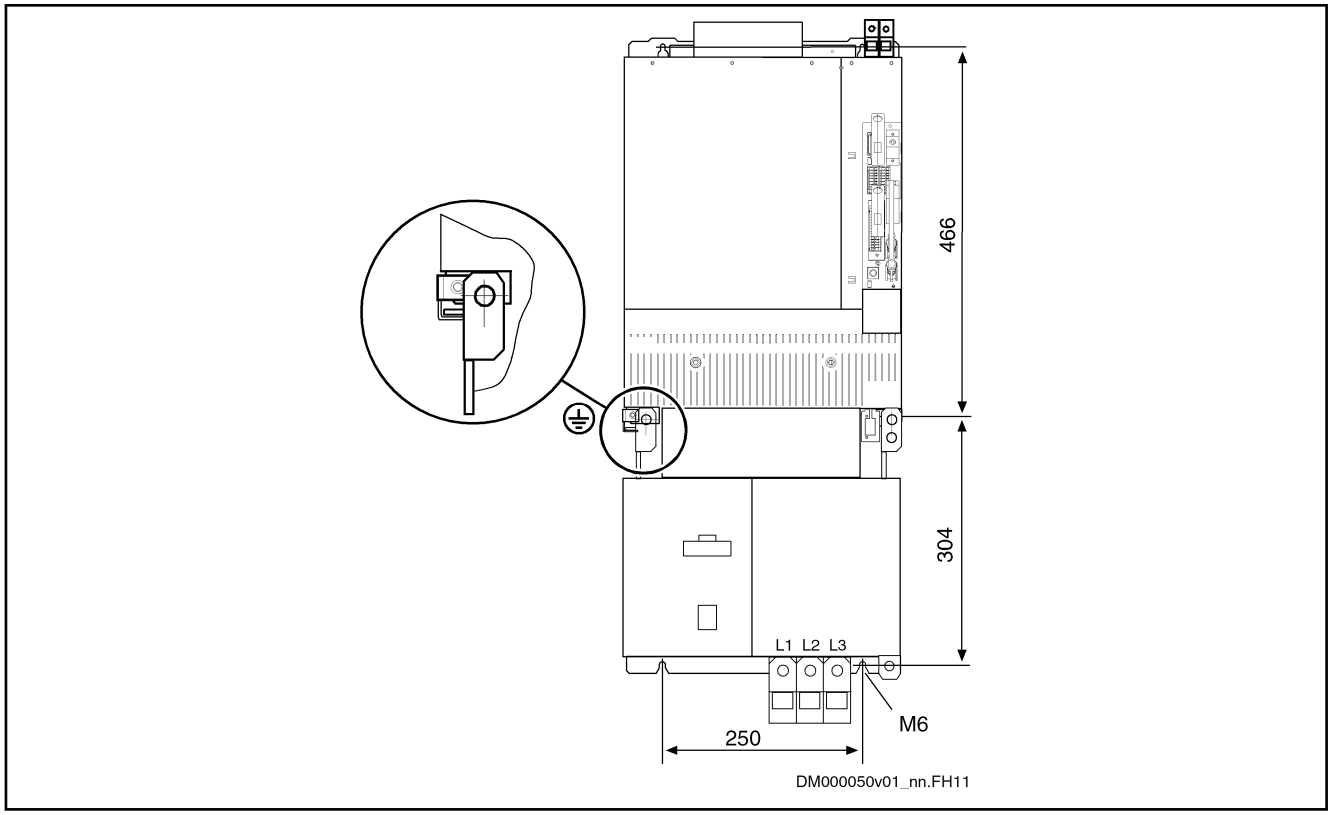
Fig. 7-20: Arranging HCS03.1E-W0070 device and HNK01.1A-A075-E0050 mains filter



1) Fit mains filter to guide bar
2) Ensure equipment grounding connection by screwing the mounting link

*Fig. 7-21: Arranging HCS03.1E-W0100 / …-W0150 device and HNK01.-*** - E0080 / …-E0106 mains filter*

Mains filters



Fit mains filter to guide bar. Ensure equipment grounding connection by screwing the mounting link.

*Fig. 7-22: Arranging HCS03.1E-W0210 device and HNK01.-***-E0146 mains filter*

7.4 HNS02.1 - mains filter, with switch-disconnector

7.4.1 Identification

Type code

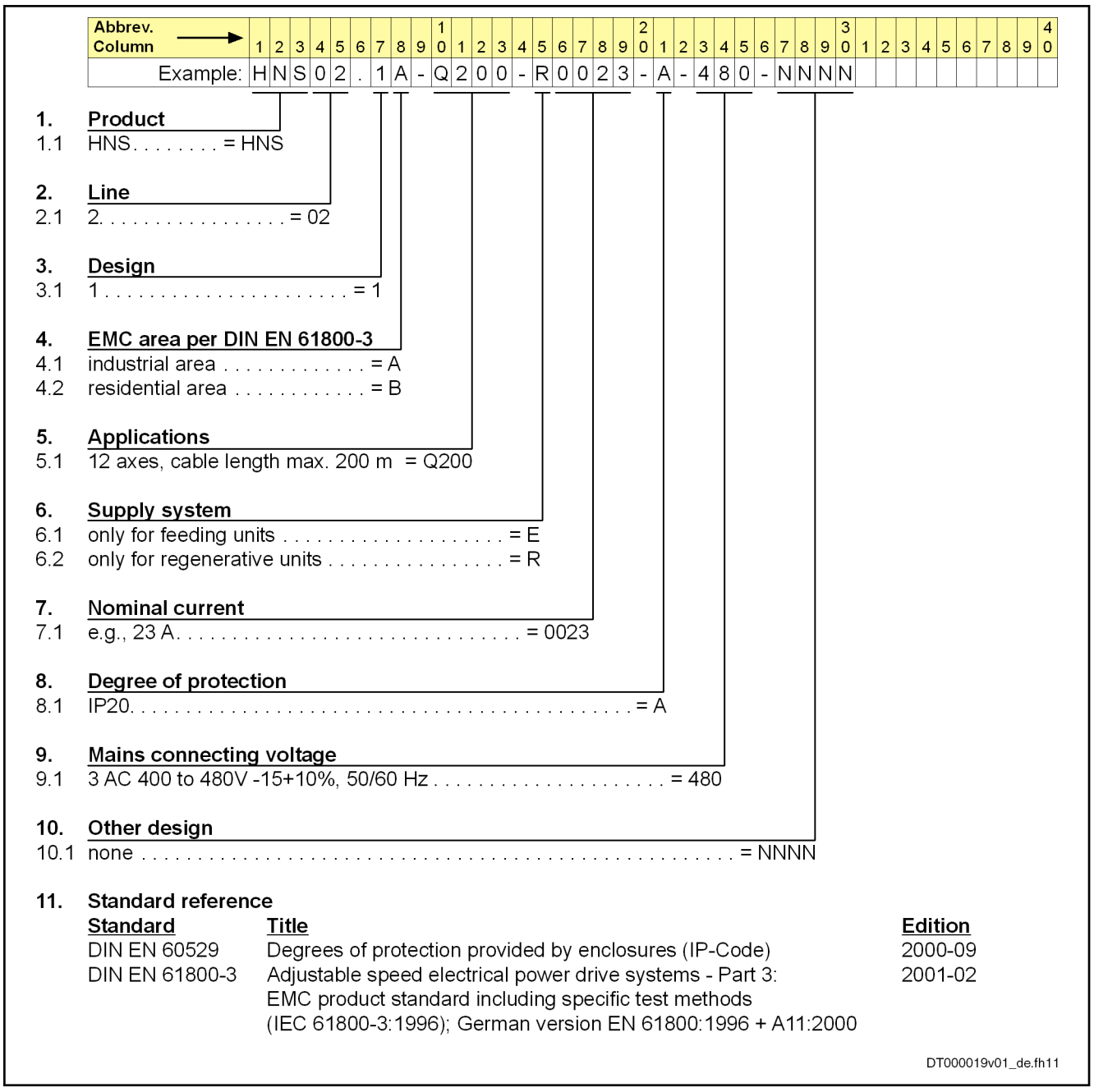


Fig. 7-23: Type code

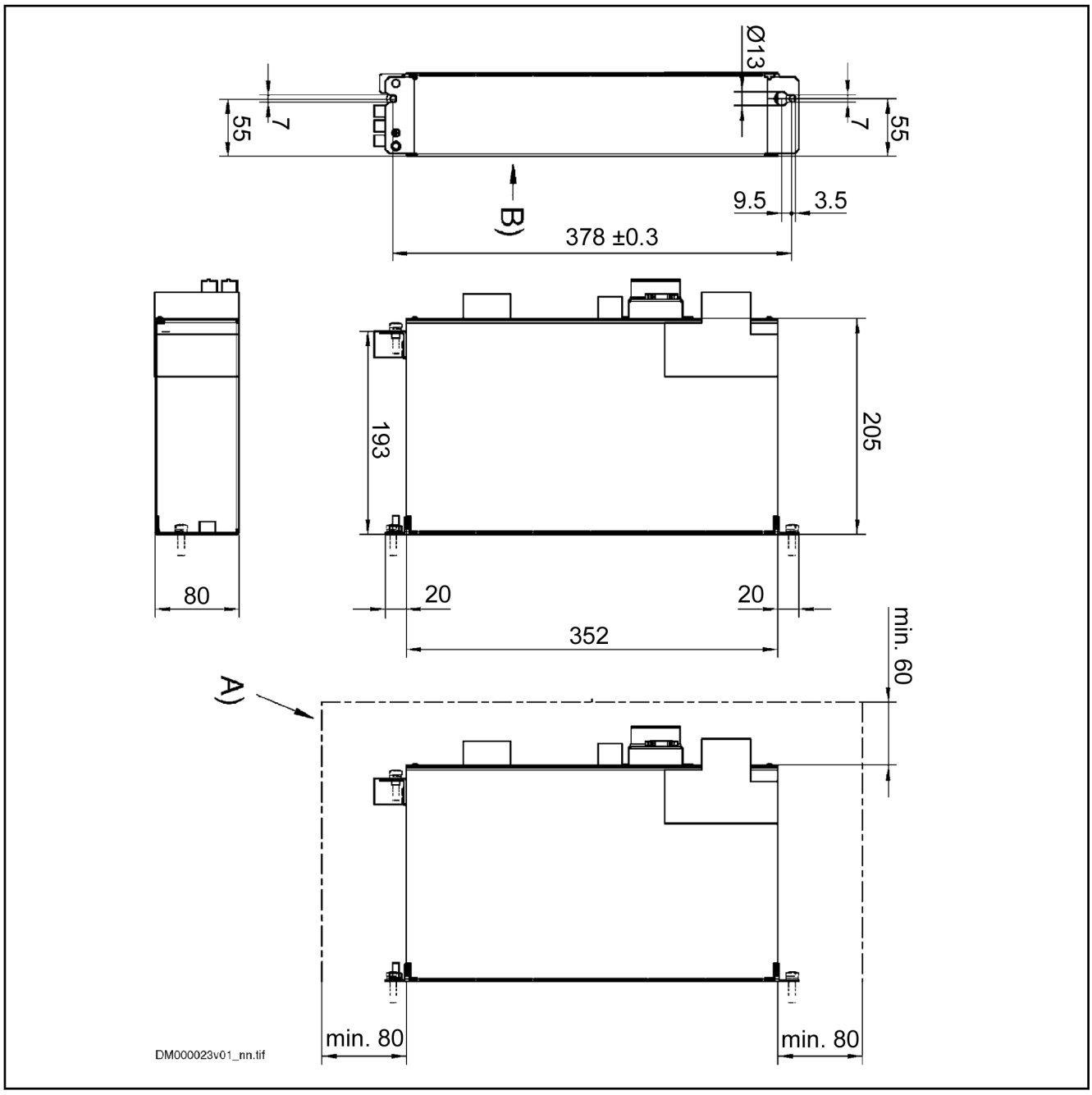
Mains filters

7.4.2 Mechanical data HNS02.1

Dimensions

Mounting position and distances

Mount HNS02.1 in the control cabinet in normal mounting position G1 and allow cooling by natural convection. Observe the minimum mounting clearance of the device.



Data in mm
A) Minimum mounting clearance
B) Rear view!

Fig. 7-24: Dimensions HNS02.1

7.4.3 Electrical data HNS02.1

Description	Symbol	Value
Power dissipation	W	75
Phase current (continuous current)	A	23
Phase current (peak current [1)])	A	55
Maximum leakage current at filter input (mains side) with 12 drive controllers and 200 m motor cable	A	0.57
Leakage current at filter output (load side) with 12 drive controllers and 200 m motor cable	A	0.7

Tab. 7-18: Data

Description	Symbol	Value
Allowed THD (Total Harmonic Distortion)	%	See Project Planning Manual "Rexroth IndraDrive Drive Systems with HMV01/02 HMS01/02, HMD01, HCS02/03"
Reduction of allowed operating data due to harmonics component	-	
Supply voltage	V	3 × AC 380 … 480 ±10%, 50/60 Hz ±2%
Sum of leakage currents at filter input with supply unit switched off: 1 phase failed 2 phases failed	 A A	 < 0.8 < 2.0
Insulation resistance (phase - ground) (discharging resistances of Y-capacitors)	kOhm	> 730
Degree of protection	-	IP20
Weight	kg	14.9
Materials	-	Free of asbestos and silicone

1) Duration: 300 ms
Duty cycle for feeding devices: 0.67 s
Duty cycle for regenerative devices: 1.42 s
Basic load: 60% continuous current

Tab. 7-19: Data

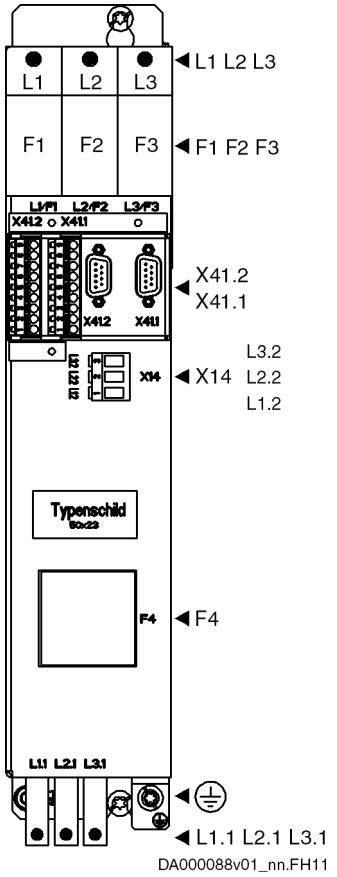
7.4.4 Connection points

⚠ WARNING **Lethal electric shock from live parts with more than 50 V!**

Before working on the wiring at filter, mains choke or supply unit:

1. Disconnect the device from the mains voltage
2. Discharge the device-internal capacitors (short-circuit the power connections at filter output or choke input)

Mains filters

View	Description	Significance
	L1, L2, L3	Input for supply with mains voltage
	F1, F2, F3	Fuses between mains input (L1, L2, L3) and mains output (L1.1, L2.1, L3.1) (Mat. no.: R911311988, SICHERUNG-GRC 50A/690V)
	X41.1, X41.2	Converter (D-Sub ↔ terminal block)
	X14 (L1.2, L2.2, L3.2)	Output to load HMV02 (X14, mains voltage synchronization)
	F4	Fuses before output X14
	⏚	Equipment grounding conductor connection point
	L1.1, L2.1, L3.1	Output to load HMV02 (X3, mains connection)

Tab. 7-20: Connection points and fuses

L1, L2, L3

L1, L2, L3	Unit	min.	max.
Connection cable flexible	mm^2	4	25
	AWG	12	4
Connection cable rigid	mm^2	4	35
Tightening torque	Nm	-	4.5

Tab. 7-21: Data - connection points L1, L2, L3

L1.1, L2.1, L3.1

L1.1, L2.1, L3.1	Unit	min.	max.
Connection cable flexible	mm^2	4	10
	AWG	12	8
Connection cable rigid	mm^2	4	16
Tightening torque	Nm	-	1.8

Tab. 7-22: Data - connection points L1.1, L2.1, L3.1

8 HNL - mains chokes for supply units and converters

8.1 Identification

8.1.1 Type code

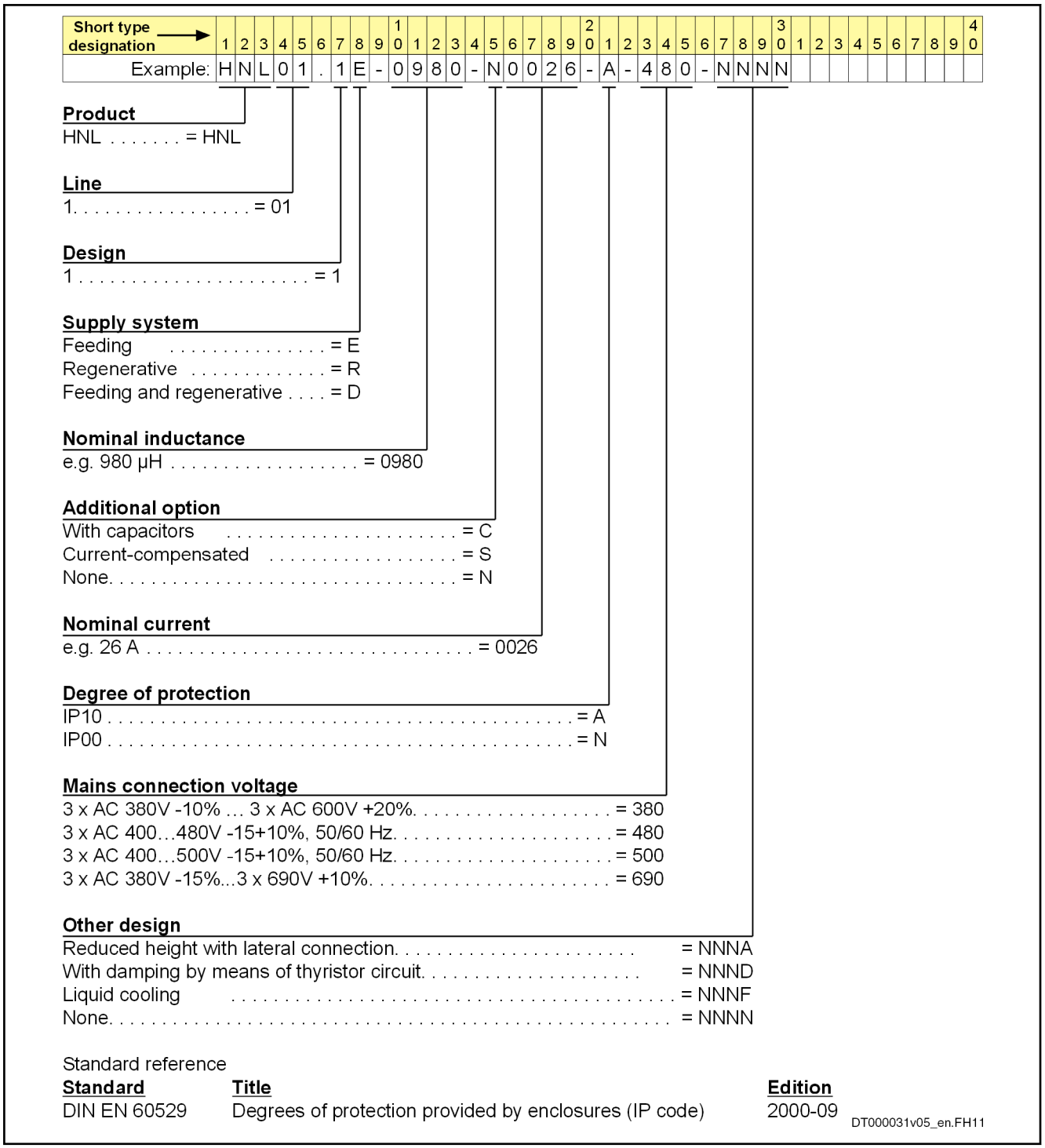
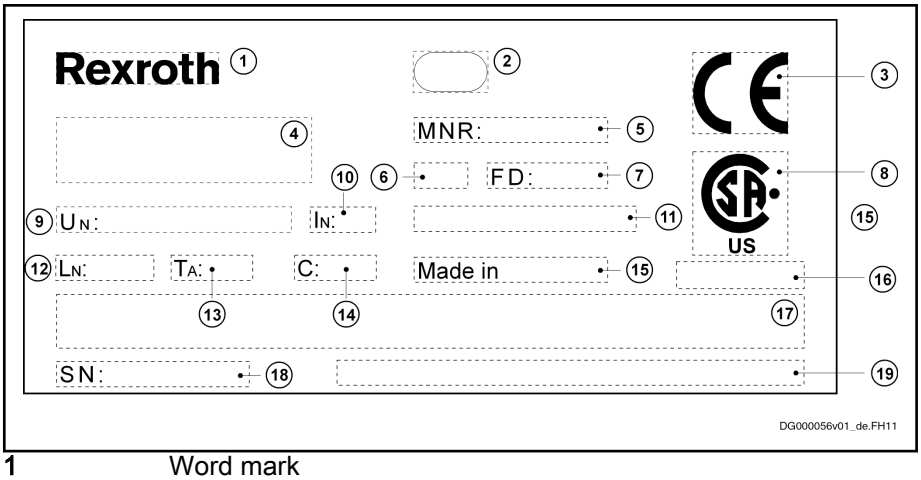


Fig. 8-1: Type code

HNL - mains chokes for supply units and converters

8.1.2 Type plate



1	Word mark
2	Business facility number
3	CE label
4	Type designation (two lines, 20 characters each)
5	Part number
6	Change release
7	Production date (YYWww)
8	Certification label
9	Nominal voltage / frequency
10	Nominal current
11	Number of design specification
12	Nominal inductance
13	Temperature
14	Number and value of additional capacitors
15	Designation of origin
16	Approval number
17	Bar code (39 or 93)
18	Serial number
19	Company address

Fig. 8-2: Type plate

8.2 HNL01.1E - mains chokes, feeding

8.2.1 Technical data

Mechanics and mounting

Allowed Mounting Positions Every mounting position is allowed.

Type 1 dimensions:

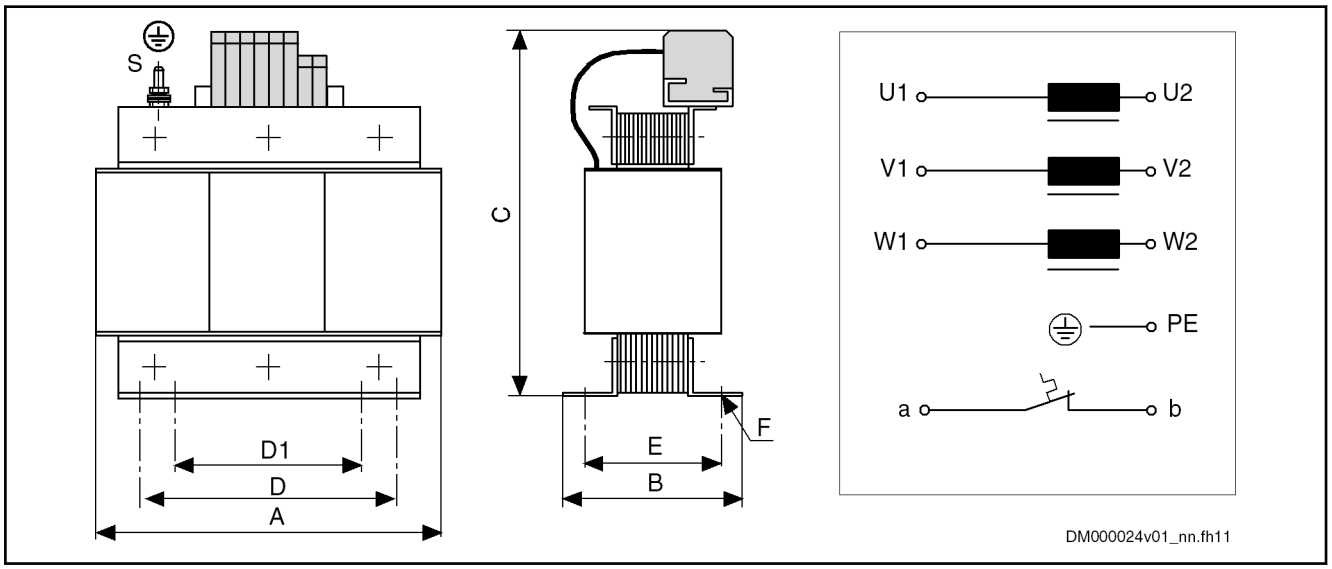


Fig. 8-3: Type 1 dimensions

Type 2 dimensions:

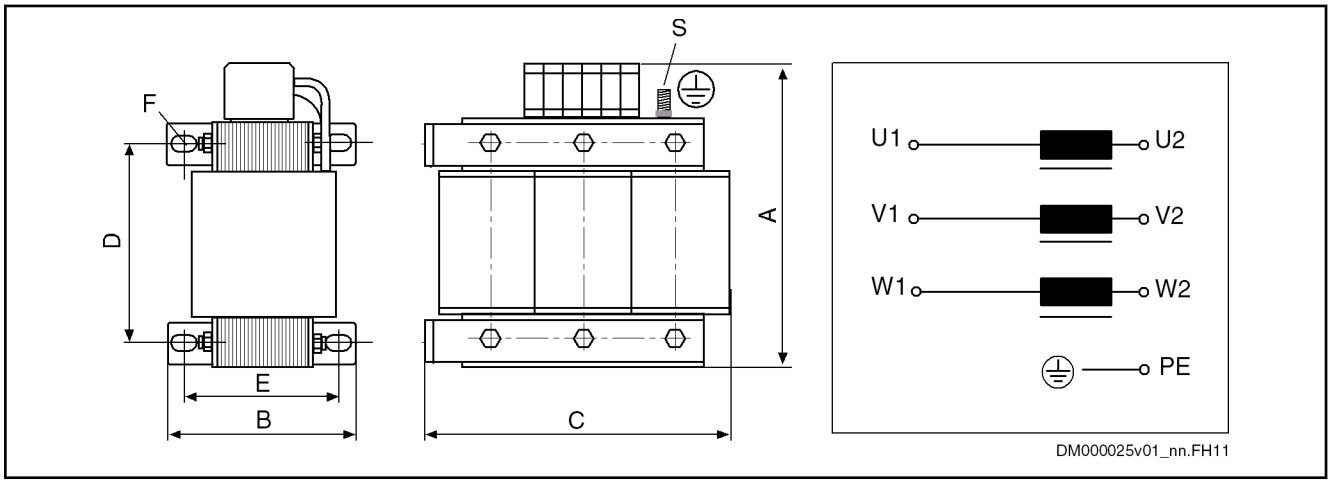


Fig. 8-4: Type 2 dimensions

Type 3 dimensions:

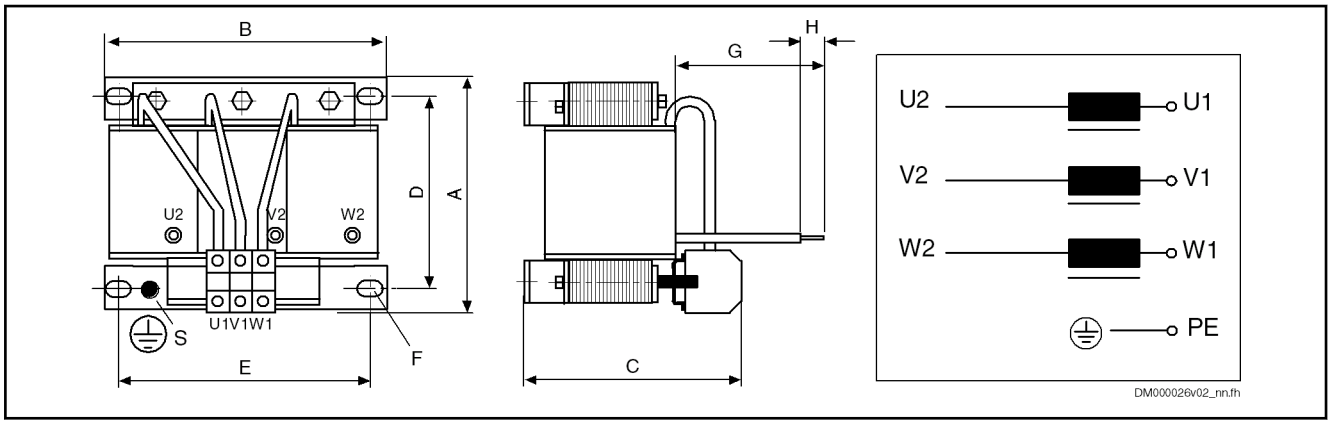


Fig. 8-5: Type 3 dimensions

HNL - mains chokes for supply units and converters

Type 4 dimensions:

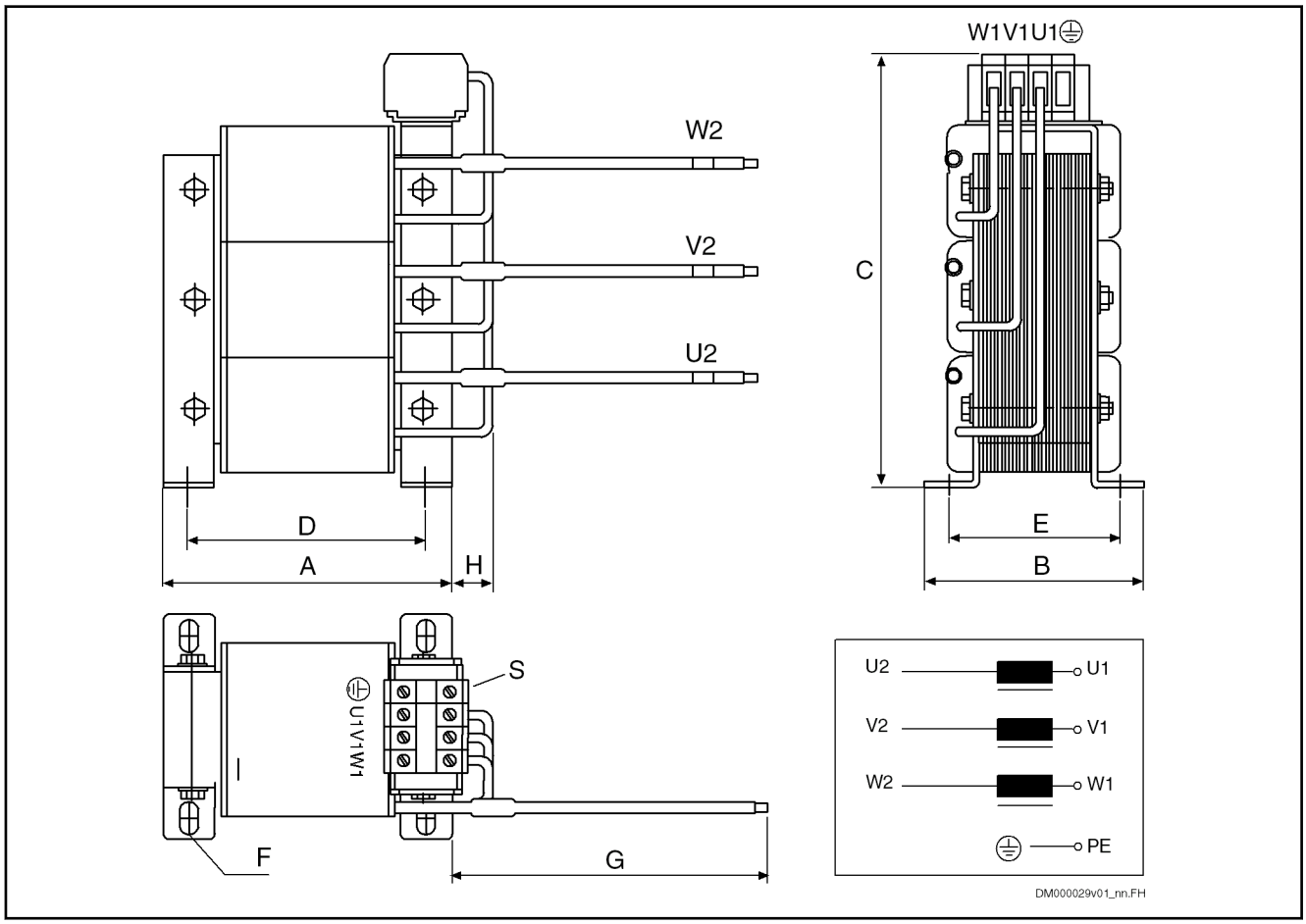


Fig. 8-6: Type 4 dimensions

Type 5 dimensions:

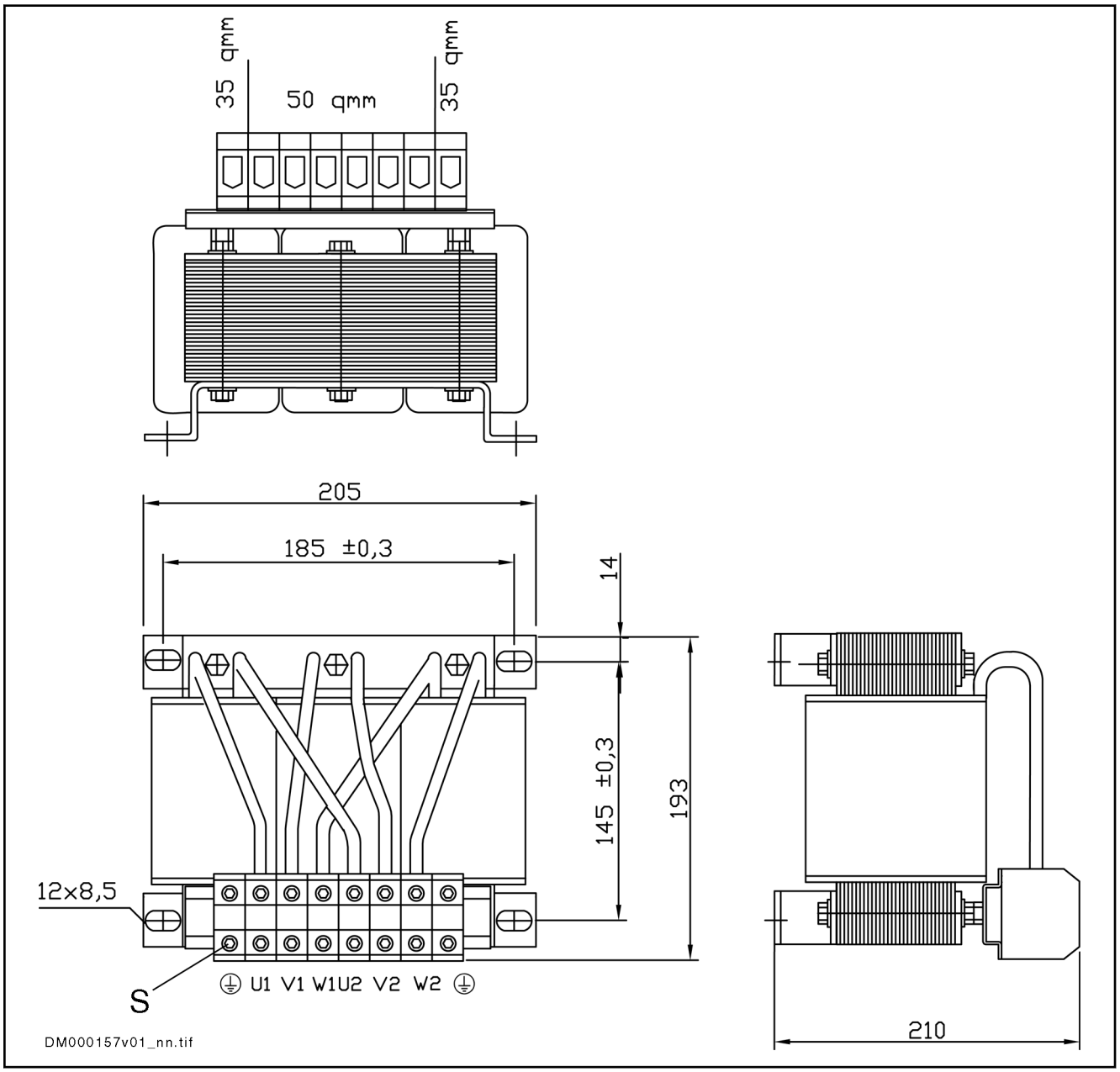


Fig. 8-7: Type 5 dimensions

Mains choke	Type	Dimensions [mm]										Weight [kg]
		A	B	C	D	D1	E	F 1)	G	H	S	
HNL01.1E-1000-N0012-A-500	1	120	61	164	81	-	44	6.4 × 11	-	-	M5	2.7
HNL01.1E-1000-N0020-A-500	1	150	66.5	184	113	-	49.5	6.4 × 11	-	-	M5	3.9
HNL01.1E-0600-N0032-A-500	1	150	66.5	185	113	-	49.5	6.4 × 11	-	-	M5	4.5
HNL01.1E-0571-N0050-A-500	4	153	100	238	127	-	80	8.5 × 12	400	30	-	13
HNL01.1E-0400-N0051-A-480	1	180	112	225	125	80	87	7 × 15	-	-	M6	13.5

HNL - mains chokes for supply units and converters

Mains choke	Type	Dimensions [mm]										Weight [kg]
		A	B	C	D	D1	E	F [1)]	G	H	S	
HNL01.1E-0362-N0080-A-500	3	175	205	180	145	-	185	8.5 × 12	350	approx. 12	M6	13
HNL01.1E-0240-N0106-A-500	5	See dimensional drawing							-	-	-	15
HNL01.1E-0200-N0125-A-480	1	230	148	295	180	-	122	8 × 12	-	-	M8	24
HNL01.1E-0170-N0146-A-500	3	230	250	205	170	-	230	15 × 9	1400	approx. 12 [2)]	M8	23
HNL01.1E-0100-N0202-A-480	1	265	152	350	215	-	126	15 × 11	-	-	M8	33

1) Long hole in "B" direction
2) Ring terminal M8

Tab. 8-1: Dimensions, weight

Mains choke	Maximum connection cross section			Tightening torque Nm	
	U1, V1, W1 [mm²]	U2, V2, W2 [AWG]	a, b [mm²]	U1, V1, W1 U2, V2, W2	a, b
HNL01.1E-1000-N0012-A-500	4	-	4	Observe the data imprinted on the component.	
HNL01.1E-1000-N0020-A-500	6	-	4		
HNL01.1E-0600-N0032-A-500	10	-	4		
HNL01.1E-0571-N0050-A-500	16	8 AWG	-		
HNL01.1E-0400-N0051-A-480	16	-	2.5		
HNL01.1E-0362-N0080-A-500	35	6 AWG	-		
HNL01.1E-0240-N0106-A-500	50	1 AWG	-		
HNL01.1E-0200-N0125-A-480	70	-	2.5		
HNL01.1E-0170-N0146-A-500	50	1/0 AWG	-		
HNL01.1E-0100-N0202-A-480	150	-	2.5		

Tab. 8-2: Connection cross section, tightening torque

Basic data

Mains choke	U_N [V]	I_N [A]	L_N [µH]	P_V [W]	I_{max} [A]	L_{min} at I_{max}
HNL01.1E-1000-N0012-A-500	500	12	3 × 1000	40	25	50% of L_N
HNL01.1E-1000-N0020-A-500	500	20	3 × 1000	60	50	50% of L_N
HNL01.1E-0600-N0032-A-500	500	32	3 × 600	75	80	50% of L_N
HNL01.1E-0571-N0050-A-500	500	50	3 × 571	50	100	50% of L_N
HNL01.1E-0400-N0051-A-480	480	51	3 × 400	165	77	50% of L_N
HNL01.1E-0362-N0080-A-500	500	80	3 × 362	80	160	50% of L_N
HNL01.1E-0240-N0106-A-500	500	106	3 × 240	100	212	50% of L_N

Mains choke	U_N [V]	I_N [A]	L_N [µH]	P_V [W]	I_{max} [A]	L_{min} at I_{max}
HNL01.1E-0200-N0125-A-480	480	125	3 × 200	170	188	50% of L_N
HNL01.1E-0170-N0146-A-500	500	146	3 × 170	130	292	50% of L_N
HNL01.1E-0100-N0202-A-480	480	202	3 × 100	200	303	50% of L_N

Tab. 8-3: Electrical data

Temperature contact a, b

Switching capacity	Switching temperature
1 A / AC 250 V DC 24 V	125 °C HNL01.1E mains chokes of type 1 are equipped with a temperature contact (a, b), types 2, 3 and 4 are not.

Tab. 8-4: Temperature contact

8.3 HNL01.1R - mains chokes, regenerative

8.3.1 Safety instruction

⚠ WARNING **High electrical voltage! Danger to life, risk of injury by electric shock or serious injury!**

- After switch-off, the capacitors in the choke will remain charged for a longer time which can cause electric shock.
- Only operate the choke with connected discharging device or with connection to "X14, mains voltage synchronization" at a regenerative HMV supply unit (HMV01.1R).
- Unless you use a supply unit with connection "X14, mains voltage synchronization", operation is only allowed with a connected discharging device, e.g. with HNF mains filter or additional discharging resistors.
- Before accessing the choke, wait up to 30 minutes after switching off power to allow the choke to discharge.
- Verify that energized connections have been isolated from supply before touching the connections.
- Before switching on, read and observe the notes on project planning.

8.3.2 Technical data

Mechanics and mounting

Allowed Mounting Positions Every mounting position is allowed.

HNL - mains chokes for supply units and converters

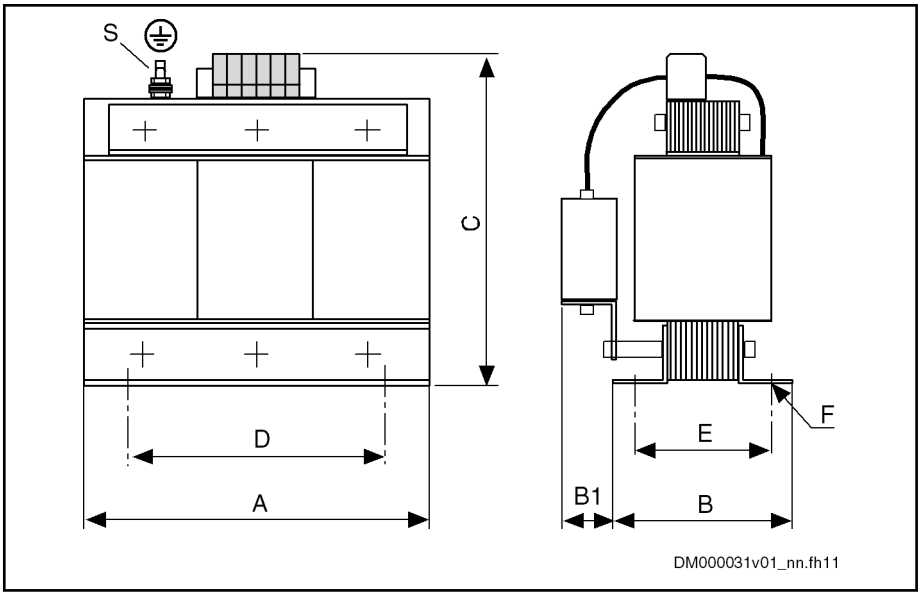


Fig. 8-8: Dimensions

Mains choke	Dimensions [mm]								Weight [kg]
	A	B	B1	C	D	E	F 1)	S	
HNL01.1R-0980-C0026-A-480	210	108	64	245	175	85	8 × 12	M6	16
HNL01.1R-0590-C0065-A-480	300	155	50	360	240	123	11 × 15	M8	45
HNL01.1R-0540-C0094-A-480	340	174	55	385	290	132	11 × 15	M8	65
HNL01.1R-0300-C0180-A-480	340	191	70	400	290	147	11 × 15	M8	73

1) Long hole in "B" direction

Tab. 8-5: Dimensions, weight

Basic data

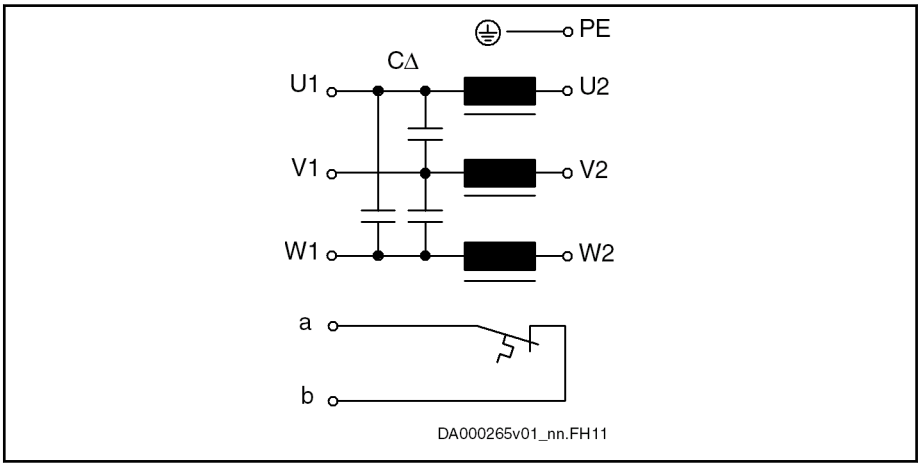


Fig. 8-9: Circuit diagram HNL01.1R

Connect the choke inputs U1, V1, W1 to the **power grid** and the choke outputs U2, V2, W2 to the input of the **supply unit**.

Mains choke	Connection cross section mm² (AWG)		Tightening torque Nm	
	U1, V1, W1 U2, V2, W2	a, b	U1, V1, W1 U2, V2, W2	a, b
HNL01.1R-0980-C0026-A-480	16 (6 AWG)	2.5 (14 AWG)	Observe the data imprinted on the component.	
HNL01.1R-0590-C0065-A-480	50 (1 AWG)	2.5 (14 AWG)		
HNL01.1R-0540-C0094-A-480	70 (2/0 AWG)	2.5 (14 AWG)		
HNL01.1R-0300-C0180-A-480	95 (3/0 AWG)	2.5 (14 AWG)		

Tab. 8-6: Connection cross section, tightening torque

Temperature contact a, b

Switching capacity	Switching temperature
1 A / AC 250 V	125 °C
DC 24 V	150 °C (HNL01.1R-0300-C0180-A-480-NNNN)

Tab. 8-7: Temperature contact a, b

Electrical data

Mains choke	U_N [V]	I_N [A]	P_V [W]	L_N [µH]	I_{max} 1) [A]	L_{min} at I_{max}	CΔ [µF]
HNL01.1R-0980-C0026-A-480	480	26	225	3 × 980	65	80% of L_N	3 × 10
HNL01.1R-0590-C0065-A-480	480	65	310	3 × 590	163	80% of L_N	3 × 20
HNL01.1R-0540-C0094-A-480	480	94	420	3 × 540	235	80% of L_N	3 × 20
HNL01.1R-0300-C0180-A-480	480	180	800	3 × 300	360	80% of L_N	3 × 30

1) For 300 ms at 1.42 s duty cycle and 60% basic load

Tab. 8-8: Electrical data

8.4 HNL01.1*-****-S - mains chokes, current-compensated

8.4.1 Function

Current-compensated mains chokes

- reduce asymmetric currents (leakage currents) in the mains connection phase of the drive system by high asymmetric inductance values
- are operated in series with conventional mains chokes

In mains in which it is not allowed to operate HNF mains filters (e.g., in mains grounded via outer conductor), current-compensated mains chokes HNL01.1*-****-S make it possible to operate HMV01 supply units in conjunction with specific mains filters (not HNF) and HNL01 mains chokes.

Arranging the components

With feeding supply units

- Mains → specific mains filter → HNL01.1E mains choke → current-compensated mains choke HNL01.1E-****-S → HMV**.*E supply unit

HNL - mains chokes for supply units and converters

With regenerative supply units

- Mains → specific mains filter → HNL01.1R mains choke → current-compensated mains choke HNL01.1R-****-S → HMV**.*R supply unit

8.4.2 Technical data

Mechanics and mounting

Allowed Mounting Positions Every mounting position is allowed.

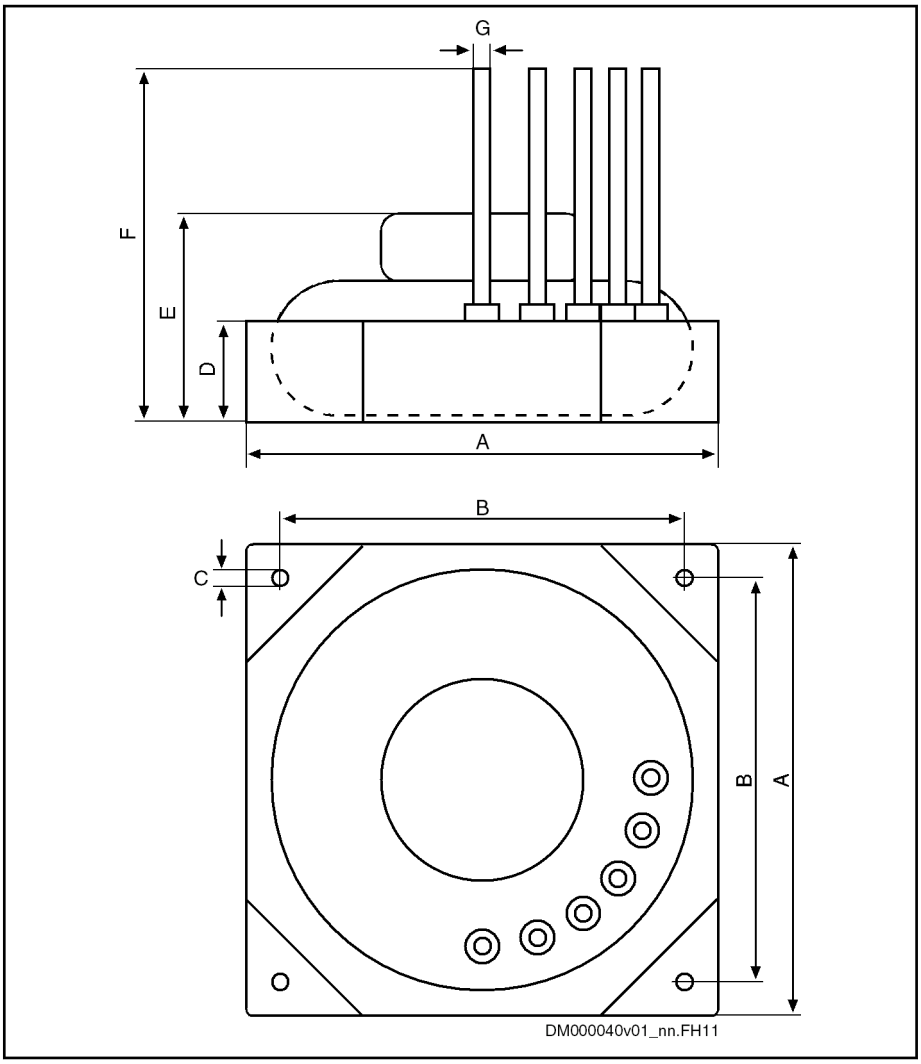


Fig. 8-10: Dimensions

Mains choke	Dimensions [mm²]							Weight [kg]
	A	B	C	D	E	F	G	
HNL01.1E-5700-S0051-A-480	230	200	6.5	30	105	600	25 [1)]	11
HNL01.1E-2800-S0125-A-480	340	280	8.4	83	150	600	1/0 [2)]	26
HNL01.1E-3400-S0202-A-480	340	280	8.4	83	185	600	5/0 [2)]	30
HNL01.1R-4200-S0026-A-480	230	200	6.5	30	125	600	16 [1)]	12

Mains choke	Dimensions [mm²]							Weight [kg]
	A	B	C	D	E	F	G	
HNL01.1R-6300-S0065-A-480	250	200	6.5	55	155	600	25 1)	14
HNL01.1R-3000-S0094-A-480	340	280	8.4	83	170	600	50 1)	24

1) mm2
2) AWG

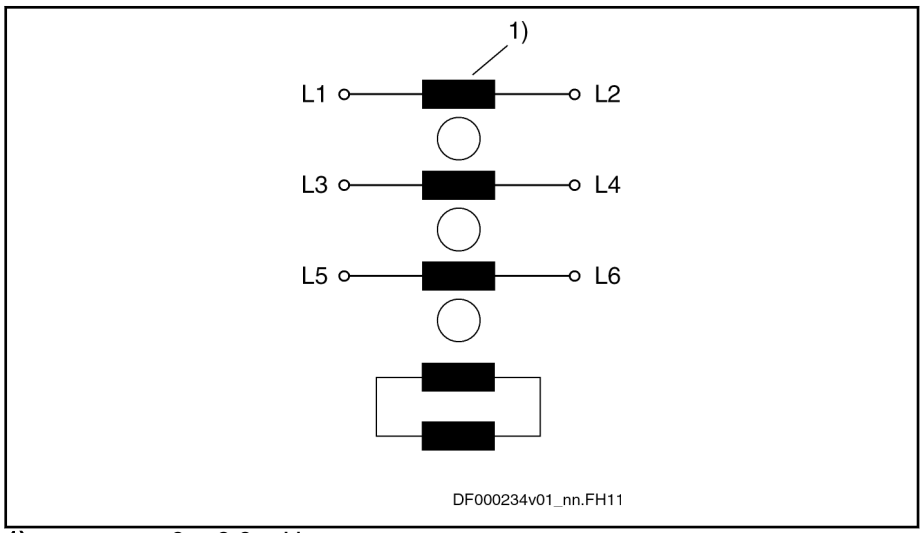
Tab. 8-9: Dimensions, weight

Basic data

	Unit	E-5700-S0051	E-2800-S0125	E-3400-S0202	R-4200-S0026	R-6300-S0065	R-3000-S0094
Degree of protection		IP10					
Materials		Free of asbestos and silicone					
Certification		Acc. to UL 508 and CSA C22.2 No. 14-M91					
Supply voltage	V	3 × AC 380 … 480 ±10%, 50/60 Hz ±2%					
Inductance L_N	mH	3 × 5.7	3 × 2.8	3 × 3.4	3 × 4.2	3 × 6.3	3 × 3.0
Minimum inductance, L_{min}		0.8 × L_N at I_{max}					
Nominal current	A	51	125	202	26	65	94
Peak current 1)	A	77	188	303	65	163	235
Total leakage current at power connection	A	< 2	< 2.2	< 2.2	< 2	< 2	< 2
Allowed power dissipation at nominal current and maximum leakage current	W	83	179	320	80	138	142

1) Duration: 300 ms; duty cycle: for feeding devices: 0.67 s; for regenerative devices: 1.42 s; basic load: 60%

Tab. 8-10: Basic data



1) 3 × 6.3 mH

Fig. 8-11: Circuit diagram HNL…S (example HNL01.1R-6300-S0065-A-480-NNNN)

HNL - mains chokes for supply units and converters

As a matter of principle, the current-compensated mains choke is connected between the conventional mains choke and the mains input of the supply unit.

8.5 HNL02.1 - mains choke

8.5.1 Identification

Type code

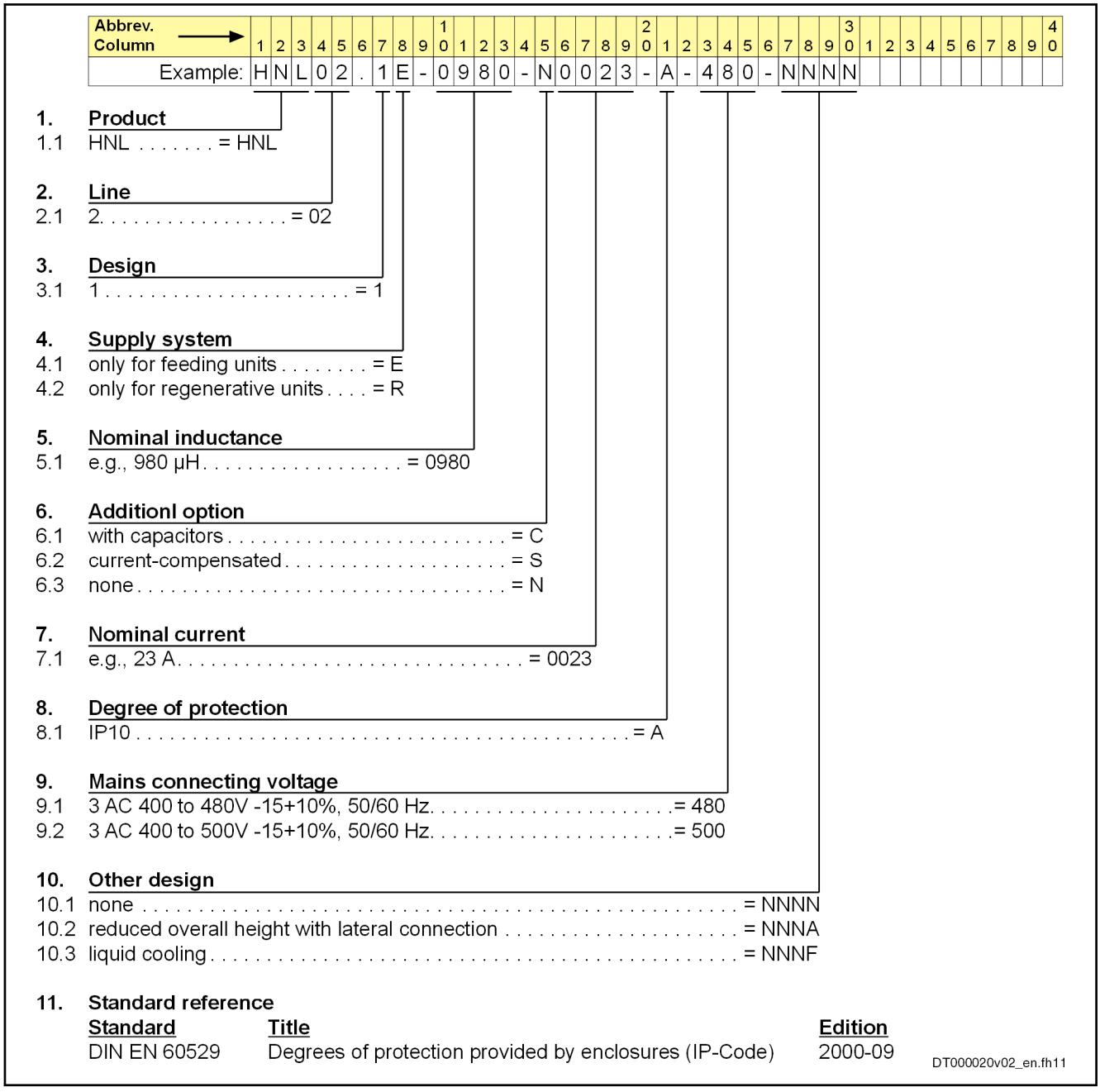


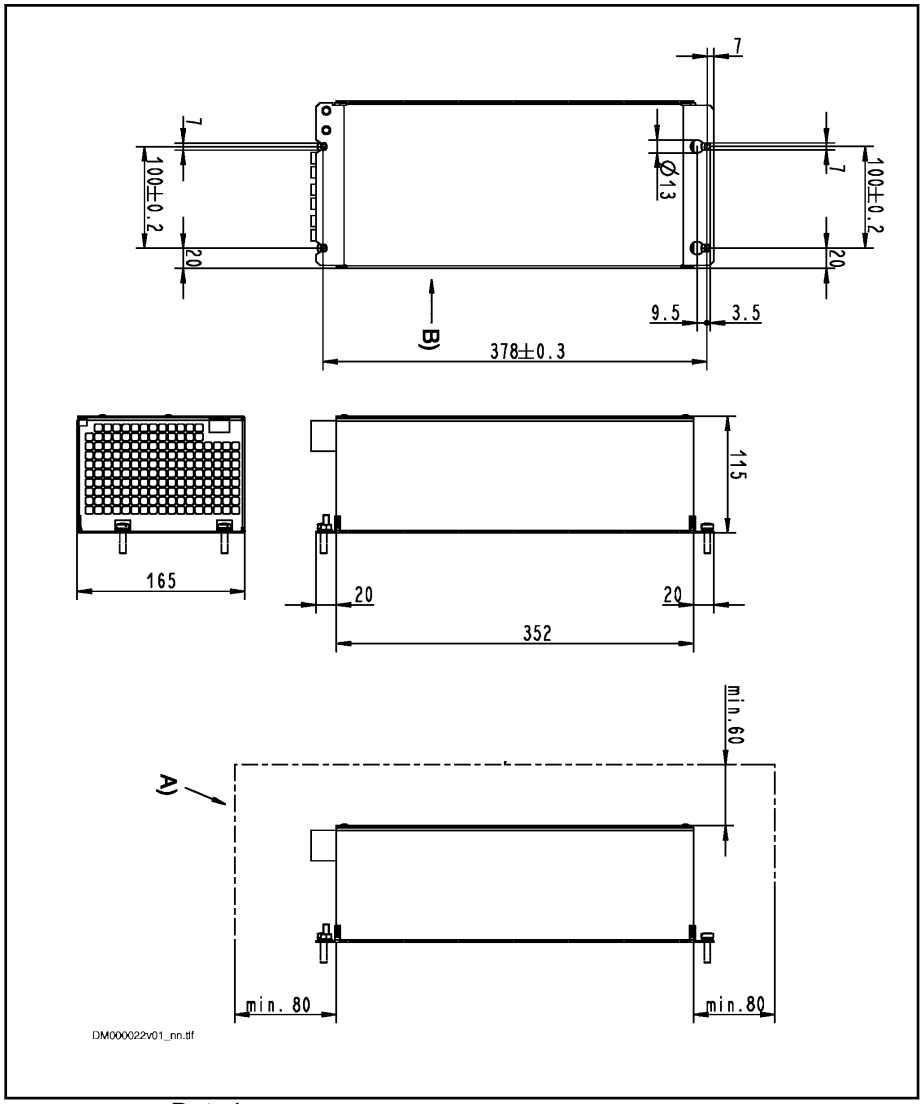
Fig. 8-12: Type code

8.5.2 Technical data

Mechanics and mounting

Mounting position G1

Dimensions



Data in mm
A) Minimum mounting clearance
B) Rear view!

Fig. 8-13: Dimensions HNL02.1

Weight

HNL02.1R-0980-N0023-A-480-NNNN	HNL02.1R-0980-C0023-A-480-NNNN
12.5 kg	13 kg

Tab. 8-11: Weight

Basic data

	Unit	HNL02.1R-0980-N0023-A-480-NNNN	HNL02.1R-0980-C0023-A-480-NNNN
Degree of protection		IP20	
Operation temperature	°C	0 … 55	

HNL - mains chokes for supply units and converters

	Unit	HNL02.1R-0980-N0023-A-480-NNNN	HNL02.1R-0980-C0023-A-480-NNNN
Nominal operating temperature	°C	40	
Certification		UL 506 and CAN/CSA C22.2 No. 66	UL 508 C and CSA C22.2 No. 14-M91
Materials		Free of asbestos and silicone	
Rated voltage U_{LN}	V	3 AC 380 … 480 ±10%	
Nominal frequency f_{LN}	Hz	50/60 Hz ±2%	
Inductance L_N	mH	3 × 0.98	
Minimum inductance, L_{min}		0.8 × L_N at I_{max}	
Capacitors at mains input	C_x	-	3 × 10 µF
Nominal current	A	23	
Peak current I_{max} 1)	A	55	
Total leakage current at power connection with 12 drive controllers and 200 m motor cable	A	< 0.7	
Power dissipation at nominal current and maximum leakage current	W	95	
Maximum allowed fusing of fan or temperature contact connection	A	4	
Temperature contact switching capacity (N/C)	V	AC 30 2)	AC 30 DC 24
	A	3	
Trigger temperature	°C	130	
Power consumption of internal fan	W	2.7	

1) Duration: 300 ms
Duty cycle for feeding devices: 0.67 s
Duty cycle for regenerative devices: 1.42 s
Basic load: 60%

2) In the scope of UL, operation with direct voltage is not allowed

Tab. 8-12: Specific data

Connection points

⚠ WARNING **Lethal electric shock from live parts with more than 50 V!**

If wiring work is to be carried out at filter, mains choke or supply unit, discharge the device-internal capacitors after disconnecting the mains voltage. (Short-circuit the power connections at filter output or choke input)

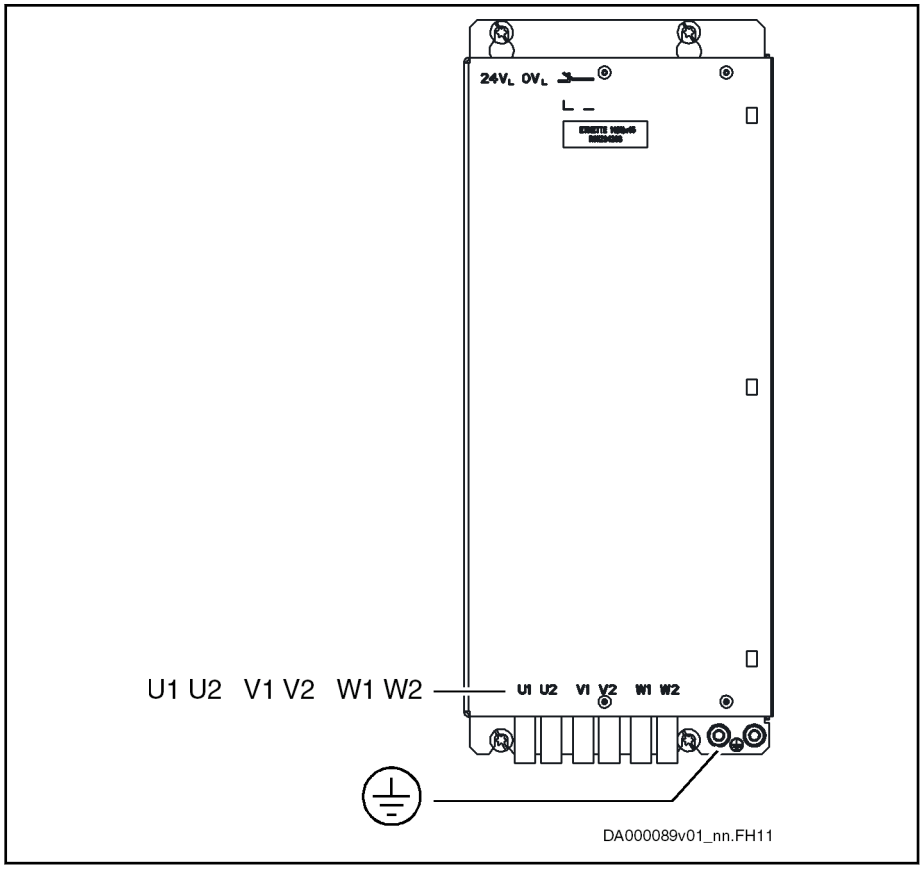
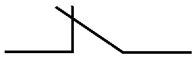
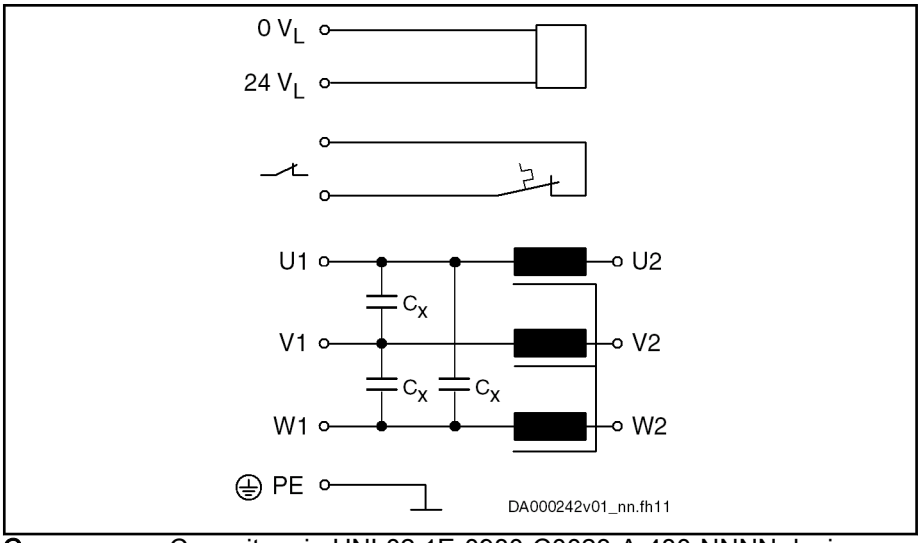


Fig. 8-14: Connection points

Connection	Significance	Max. connection cross section mm² / AWG	Max. tightening torque Nm
U1, V1, W1	Input from power grid	Stranded wire: 16 / 6 AWG Solid wire: 10 / 6 AWG	1.8
U2, V2, W2	Output to supply unit HMV02		
24V$_L$	Supply voltage internal fan	Stranded wire: 4 / 10 AWG	0.8
0V$_L$			
	Temperature contact Switching capacity: 1 A / DC 24 V Switching temperature: 125 °C		
	Equipment grounding conductor	M6 × 25	6

Tab. 8-13: Connection points

HNL - mains chokes for supply units and converters



C_x Capacitors in HNL02.1E-0980-C0023-A-480-NNNN design

Fig. 8-15: Circuit diagram

9 HLL01 - DC Bus Choke, Current-Compensated

9.1 Brief Description, Use and Commissioning

9.1.1 Brief Description

HLL01 DC bus chokes connect Rexroth IndraDrive systems to supply units. The DC bus choke connects the DC bus of the supply unit to the DC bus of the drive system.

9.2 Type Code and Identification

9.2.1 Type Code

☞ The figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

HLL01 - DC Bus Choke, Current-Compensated

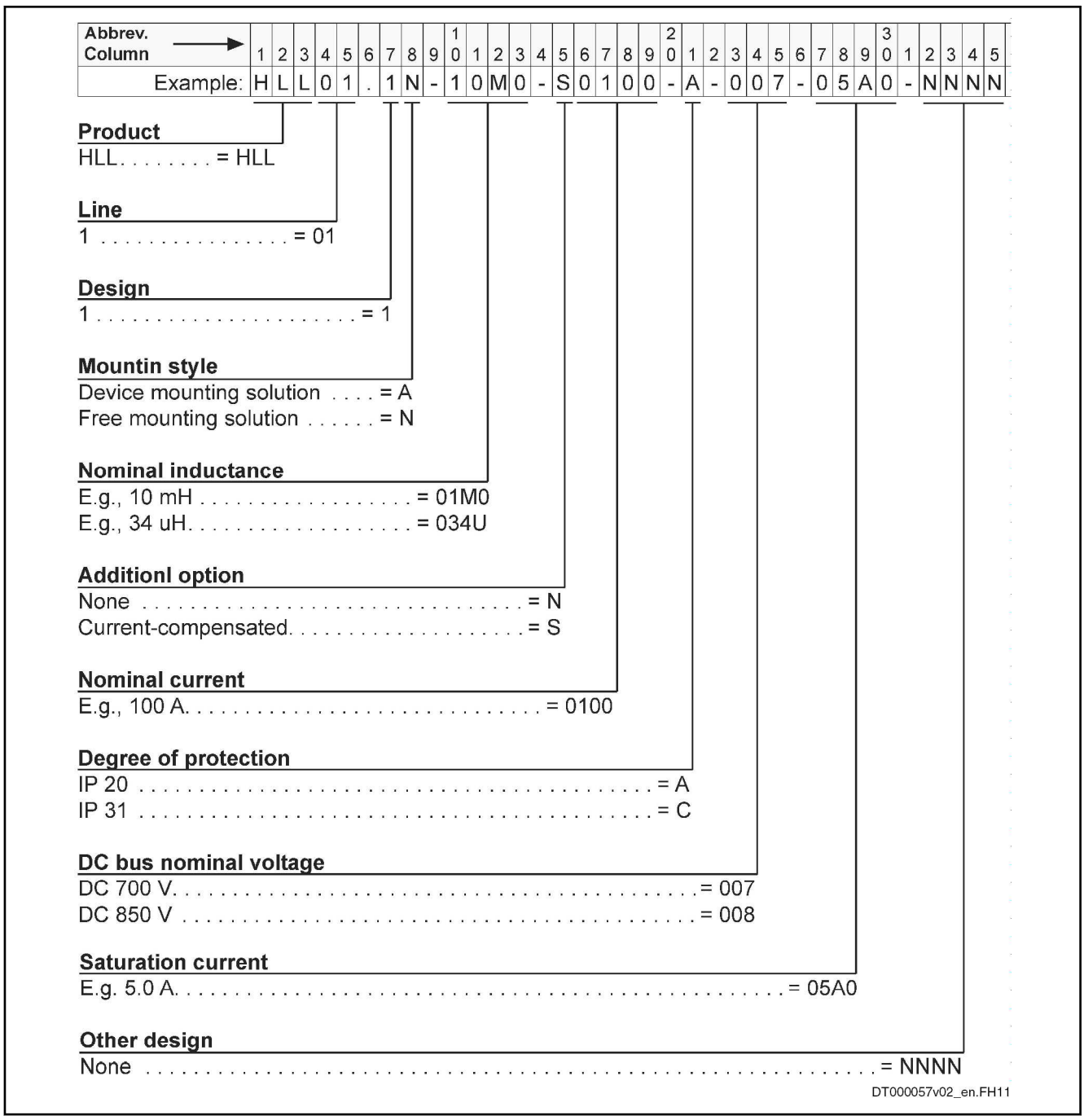
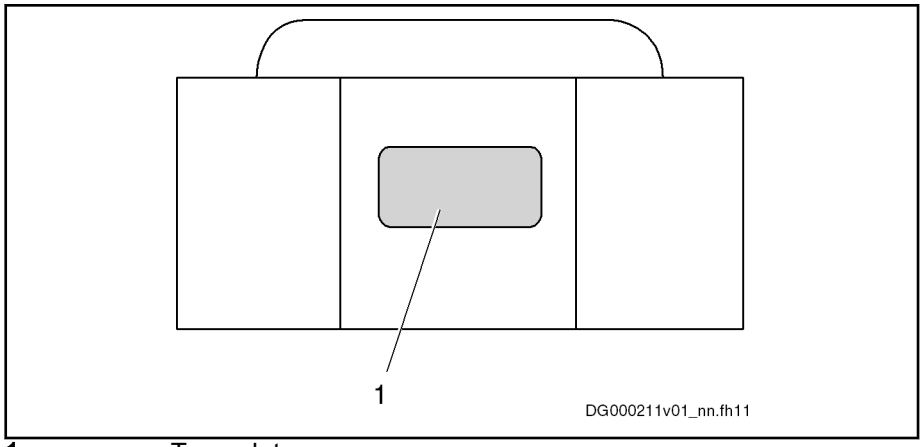


Fig. 9-1: Type Code of DC Bus Choke HLL01.1

9.2.2 Identification

Each DC bus choke is marked by a type designation. There is a type plate attached to all components.

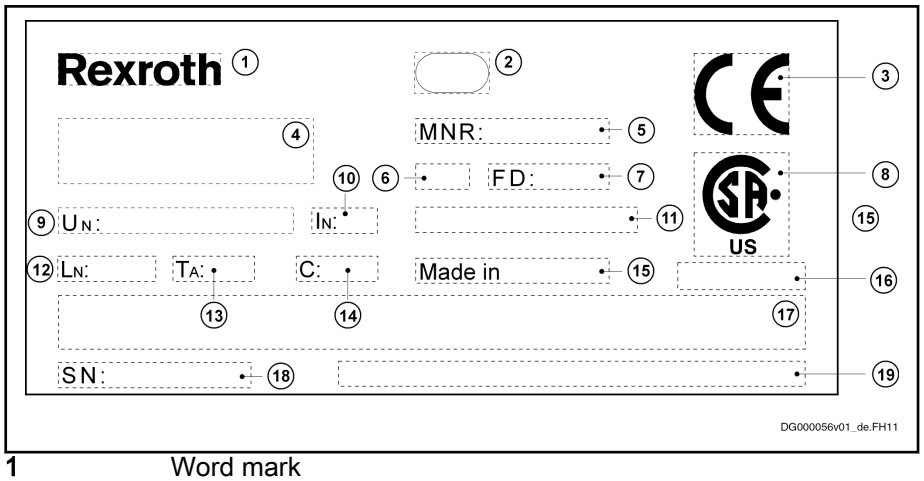
Type Plate Arrangement



1 Type plate

Fig. 9-2: Position of Type Plate

Type Plate



1 Word mark
2 Business facility number
3 CE label
4 Type designation (two lines, 20 characters each)
5 Material number
6 Change release
7 Production date (YYWww)
8 Certification label
9 Nominal voltage / frequency
10 Nominal current
11 Number of design specification
12 Nominal inductance
13 Temperature
14 Number and value of additional capacitors
15 Designation of origin
16 Approval number
17 Bar code (39 or 93)
18 Serial number
19 Company address

Fig. 9-3: Type Plate

9.3 Scope of Supply

DC bus choke HLL01

HLL01 - DC Bus Choke, Current-Compensated

9.4 Installation and Mounting

9.4.1 General Information

⚠ WARNING **Lethal electric shock by live parts with more than 50 V!**

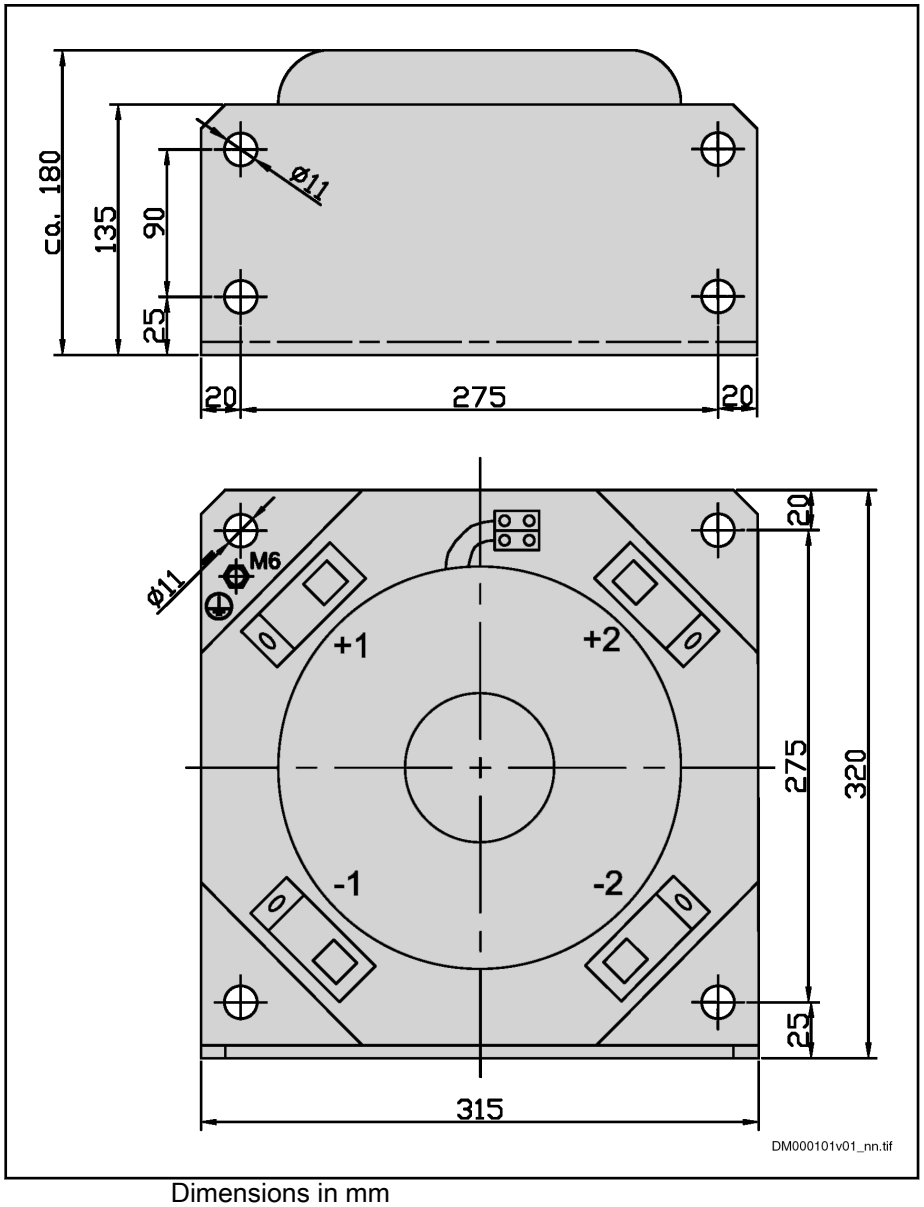
Connect the DC bus choke to the equipment grounding system of the control cabinet.

Check the continuity of the equipment grounding conductors from the mains connection to the connected motors.

For the equipment grounding conductor, run stationary lines with the cross section of the lines of the DC bus choke power connections, but at least 10 mm^2.

- Mount HLL01 to a bare metal mounting plate which has been connected to the equipment grounding system of the control cabinet.
- Twist the connection lines.

9.4.2 Dimensions HLL01



Dimensions in mm

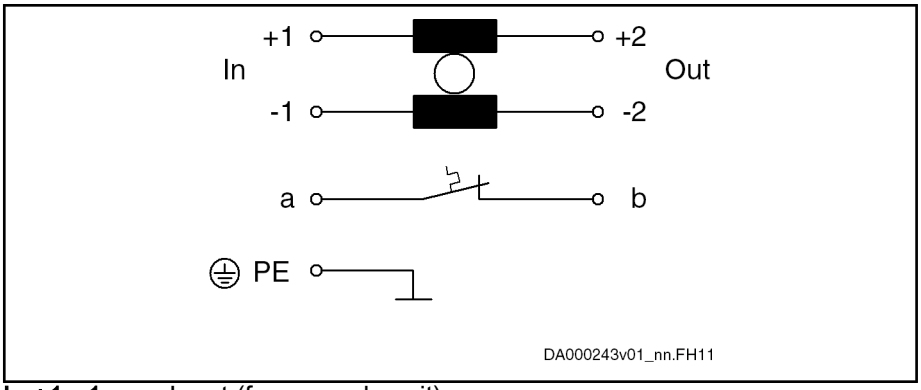
Fig. 9-4: Dimensions of DC Bus Choke HLL01.1

9.4.3 Circuit Diagram HLL01

Risk of short circuit, observe correct polarity

Connect the positive pole of the DC bus at the supply unit to the positive pole at the drive system via the HLL01 connections +1, +2.

HLL01 - DC Bus Choke, Current-Compensated



In +1, -1 Input (from supply unit)
Out +2, -2 Output (to drive system)
a, b Temperature contact
PE Connection point of equipment grounding conductor
Fig. 9-5: Circuit Diagram HLL01.1

9.5 Technical Data

Technical Data - Currents, Voltages, Power

Description	Symbol	Unit	HLL01.1N-10M0-S0100-A-007-05A0-NNNN
Degree of protection according to IEC529			IP20
Allowed ambient temperature range	T_{a_work}	°C	0 … 40
Allowed ambient temperature range during operation with reduced nominal data	$T_{a\_work\_red}$	°C	0 … 55
Reduced nominal current at $T_{a\_work} < T_a < T_{a\_work\_red}$	f_{Ta}	%/K	2,0
Allowed mounting position			Horizontally or vertically on mounting surface
Minimum distance on the bottom of the device	d_{bot}	mm	All around 80; allow free convection
Minimum distance on the top of the device	d_{top}	mm	
Horizontal spacing on the device	d_{hor}	mm	
Mass (weight)	m	kg	35
Nominal inductance	L_{nenn}	mH	10
Nominal voltage	U_{LN}	V	DC 540 … 750
Tolerance U_{LN}			±10%
Nominal current	I_{L_cont}		100
Maximum allowed peak current[6)]	I_{L_max}	A	250
Maximum allowed leakage current	I_{ab}	A	5 at 70% × I_{L_cont} 2 at 100% × I_{L_cont}
Power dissipation at continuous current and continuous DC bus power respectively	P_{Diss_cont}	W	300
Required wire size according to IEC 60364-5-52; at I_{L_cont}[9)]	A_{LN}	mm²	50

Description	Symbol	Unit	HLL01.1N-10M0-S0100-A-007-05A0-NNNN
Required wire size according to UL 508 A (internal wiring); at I_{L_cont} (UL)[10)]	A_{LN}		AWG 2
Recommended fuse at operation under rated conditions		A	125; gL
Allowed range tightening torque	M	Nm	6,0 … 6,5
Temperature contact			
Typical switching temperature of temperature contact	T_{schalt}	°C	150
Switching capacity of temperature contact			1 A / 250V AC; 24 V DC
Cross section of connection cable	A	mm²	1 … 2,5
Cross section of connection cable	A		AWG 18 … 14
Allowed range tightening torque	M	Nm	0,5 … 0,6

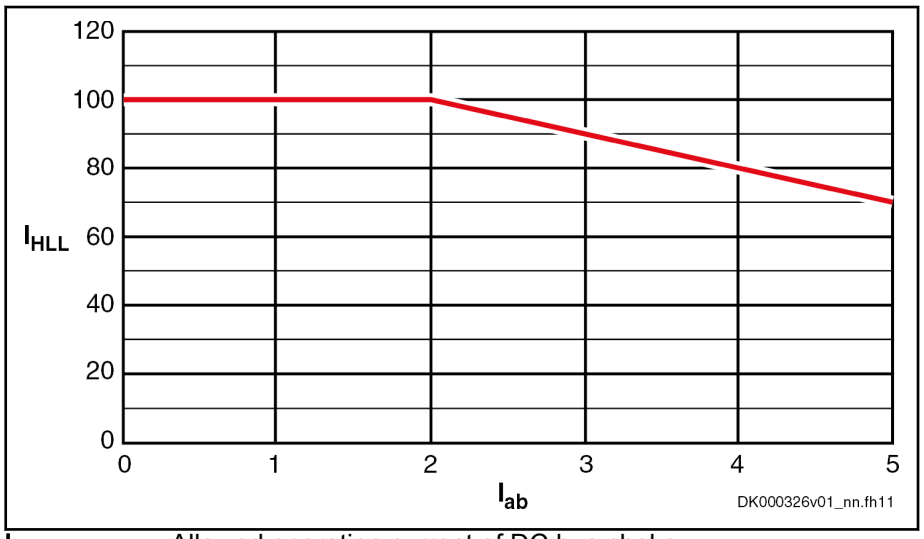
6) t = 0.3 s; T = 1.42 s; K = 2.5

9) Copper wire; PVC-insulation (conductor temperature 70 °C); installation method B2; table B52-4; $T_a \leq 40$ °C

10) Copper wire; PVC-insulation (conductor temperature 90 °C); table 13.5.1; $T_a \leq 40$ °C

Tab. 9-1: HLL - Technical Data - Currents, Voltages, Power

Operation Current vs. Leakage Current



I_{HLL} Allowed operation current of DC bus choke

I_{ab} Allowed leakage current

Fig. 9-6: Current Characteristic of the DC Bus Choke

10 HLC01 - DC Bus Capacitor Unit

10.1 Application Instructions

NOTICE **Damage to the drive controller!**

In operating cycles of more than 30 cycles per minute or in the case of falling mains voltage, the DC bus capacitors **in the drive controller** can be overloaded when the mains connection voltage decreases.

Additionally use DC bus capacitor units.

Using a DC bus capacitor unit can increase the storable energy in the DC bus. This makes sense in the following cases:

- Applications with short cycle times (> approx. 30 cycles per minute) or when stable mains voltage is not available. Voltage and current ripples on the DC bus capacitors are reduced which results in a longer service life of the DC bus capacitors. In addition, the continuous power of a braking resistor will be reduced and with it the dissipation heat generated in the control cabinet.
- Applications which need a certain amount of energy, also in case of mains failure (e.g. for return motions)
- Systems with DC bus connections > 2 m between the drive controllers to back up the DC bus

HLC01 - DC Bus Capacitor Unit

10.2 Identification

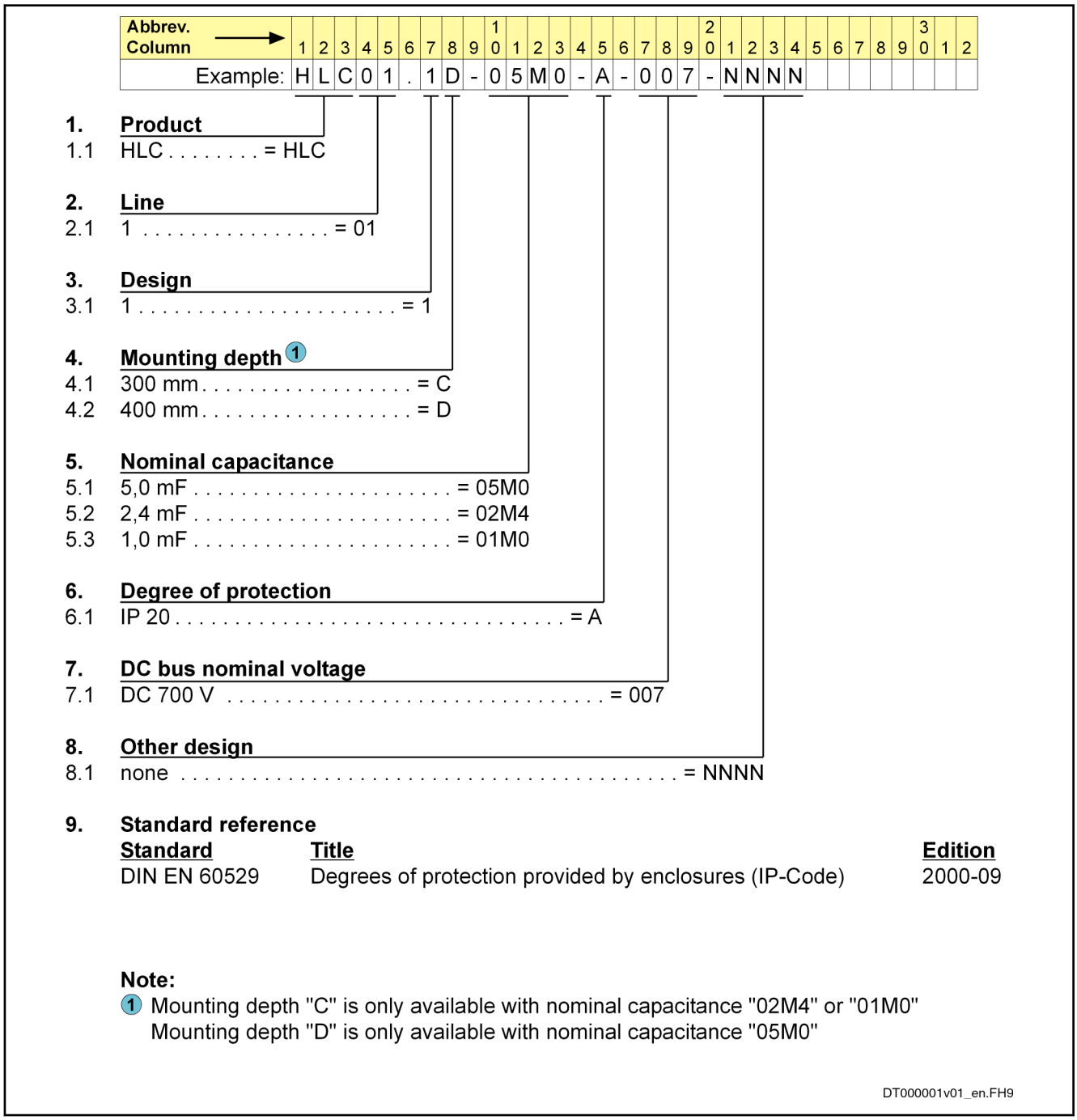


Fig. 10-1: Type Code

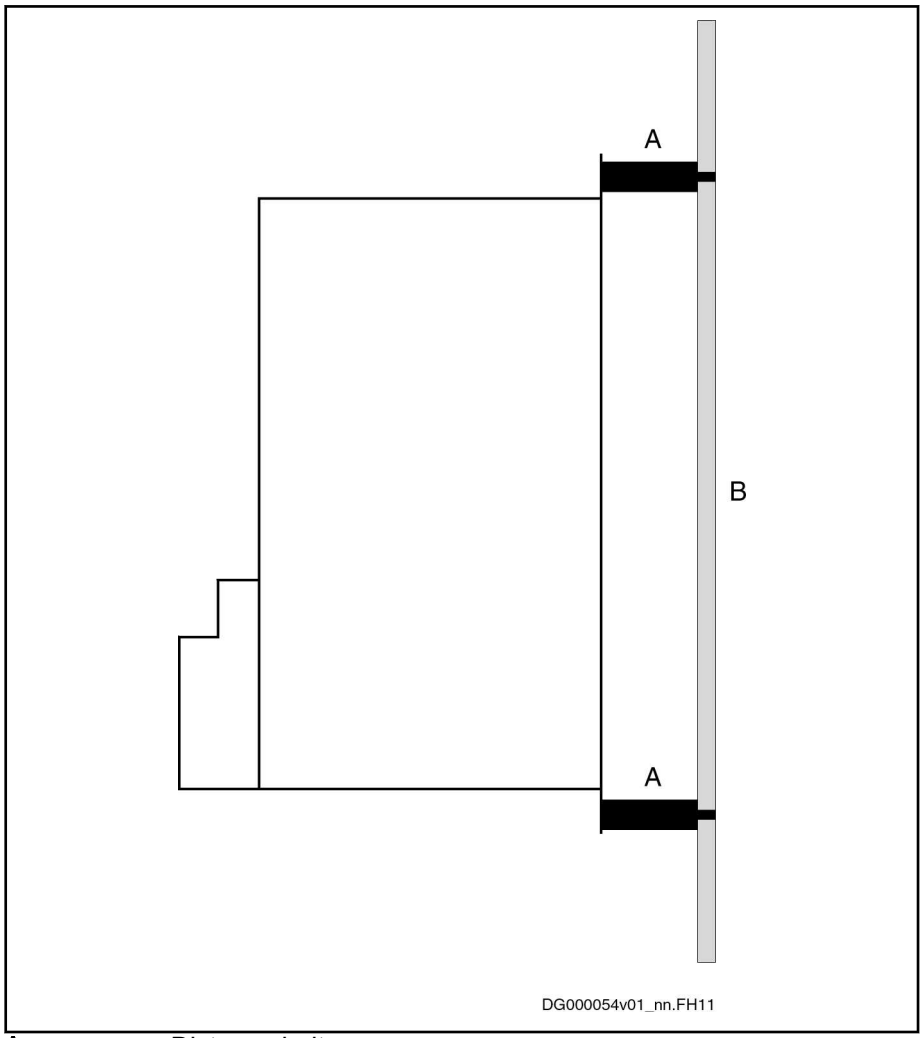
10.3 Mounting

10.3.1 Notes

- Always mount the DC bus capacitor unit directly next to the drive controller with the highest DC bus continuous power.
- To compensate the different mounting depths of a DC bus capacitor unit **HLC01.1C** and **IndraDrive M drive controllers**, there are suitable dis-

tance bolts (accessory HAS03.1-002-NNN-NN; contains 2 distance bolts). You are only allowed to use the distance bolts when the DC bus capacitor unit is mounted directly next to the drive controller. In this case you also have to connect the contact bars for DC bus and control voltage connection to the DC bus capacitor unit.

- Mount the distance bolts to the bare metal mounting surface of the control cabinet.



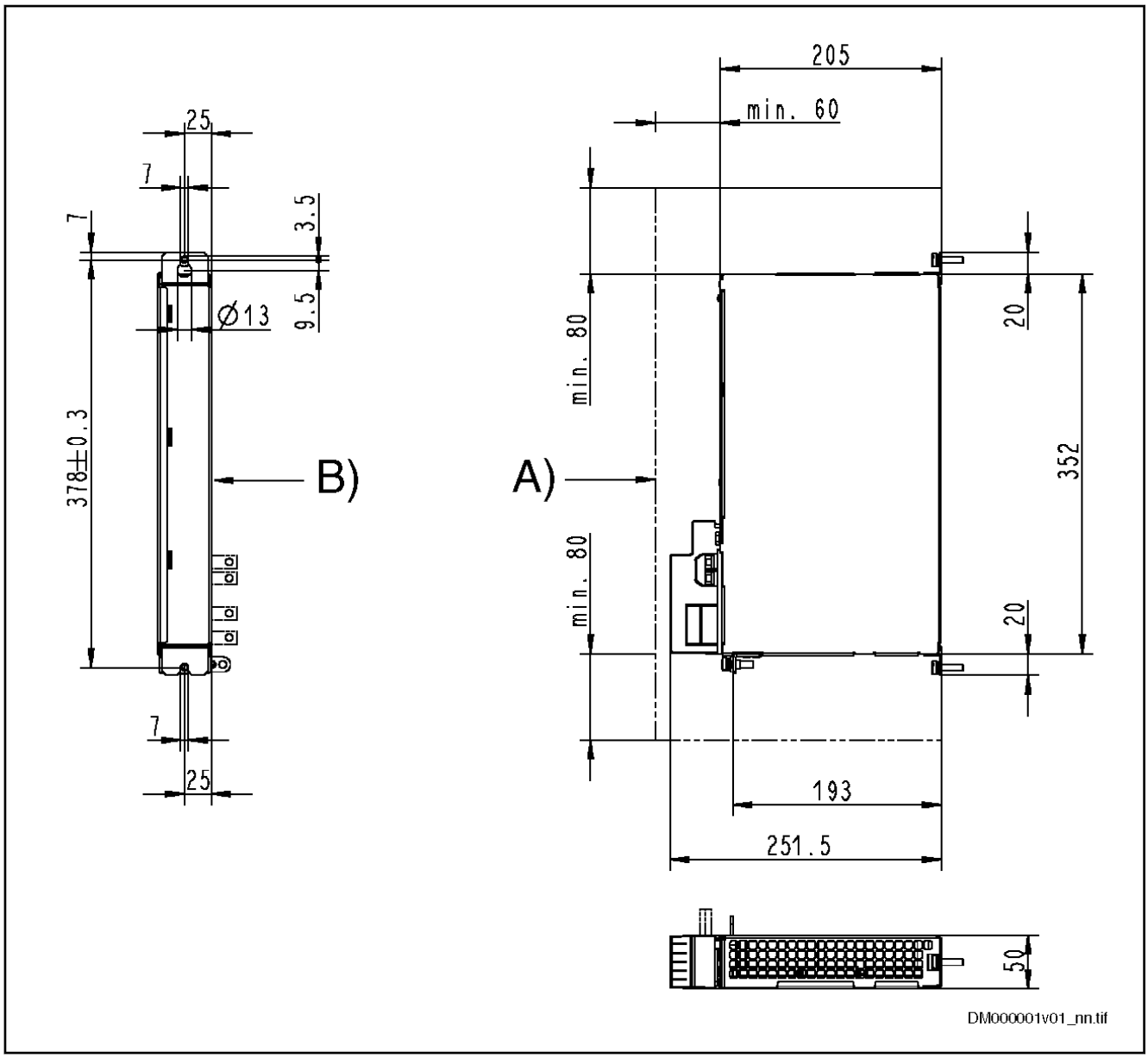
A Distance bolts
B Mounting surface in control cabinet

Fig. 10-2: How to Use the Distance Bolts

HLC01 - DC Bus Capacitor Unit

10.3.2 Mechanical Data

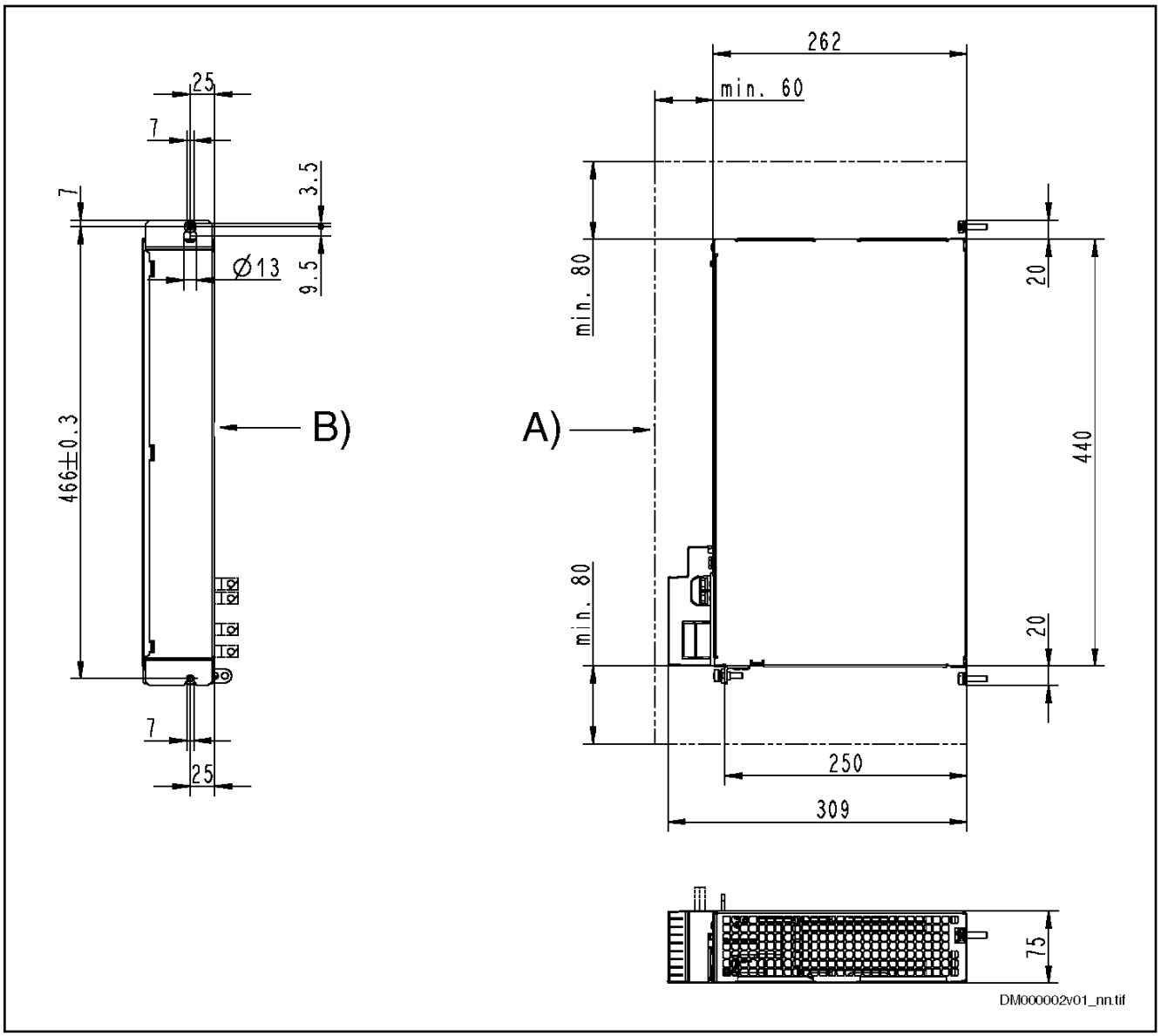
Dimensions HLC01.1C



A) Minimum mounting clearance
B) Rear view

Fig. 10-3: Dimensions HLC01.1C

Dimensions HLC01.1D



A) Minimum mounting clearance
B) Rear view

Fig. 10-4: Dimensions HLC01.1D

Weight

Type	Weight [kg]
HLC01.1C-01M0-A-007-NNNN	3,2
HLC01.1C-02M4-A-007-NNNN	4,3
HLC01.1D-05M0-A-007-NNNN	8,6

Tab. 10-1: Weight

Mounting Position

Allowed mounting position: **G1**

HLC01 - DC Bus Capacitor Unit

10.4 Installation

10.4.1 Electrical Data

Description	Symbol	Unit	Type		
			HLC01.1C-01M0	HLC01.1 C-02M4	HLC01.1D-05M0
Allowed input voltage	U_{DC}	V	DC 254 … 750 V		
Nominal DC bus capacitance	C_{DC}	mF	1	2,4	5
Maximum discharge time from 820 V to 50 V	T	s	228	274	748
Power dissipation (at 750 V DC bus voltage)	P_v	W	8,5	16,5	13
Insulation resistance	R_{is}	Mohm	> 25		
Maximum current (at 55 °C ambient temperature)	I_{Crms}	A	20	50	60
Cooling			Natural convection		

Tab. 10-2: Electrical Data

☞ As the mains connection voltage increases, the storable energy in the DC bus decreases, because the differential voltage between braking resistor threshold and DC bus voltage (peak value of supply voltage) is reduced.

10.4.2 Connection Points

General Information

⚠ WARNING **Lethal electric shock by live parts with more than 50 V!**

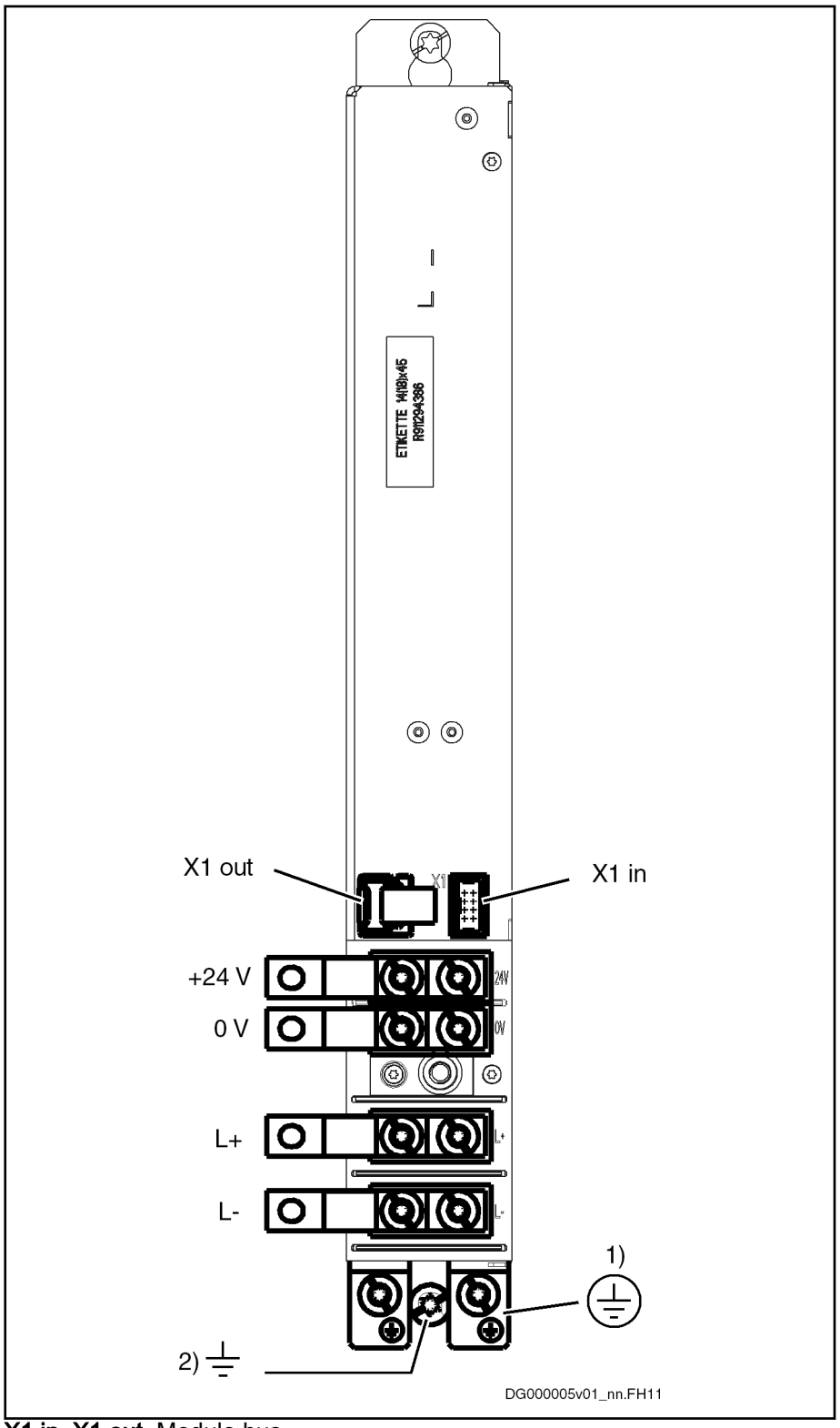
Before working on live parts: De-energize installation and secure power switch against unintentional or unauthorized re-energization.

Wait at least **30 minutes** after switching off the supply voltages to allow **discharging**.

Check whether voltage has fallen below 50 V before touching live parts!

☞ When using **HMV** supply units, the discharge time of the DC bus capacitors can be reduced by activating the function "ZKS".

Overview



X1 in, X1 out	Module bus
24V, 0V	Control voltage
L+, L-	DC bus
1)	Connection point of equipment grounding conductor

HLC01 - DC Bus Capacitor Unit

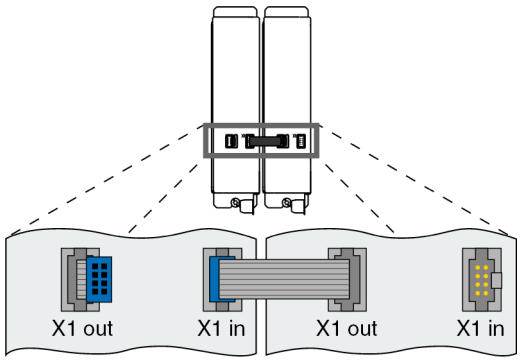
2) Ground connection

Fig. 10-5: Connections - Overview

X1, module bus

Function, pin assignment

The module bus is an **internal system connection** and is used to exchange data between the devices.

View	Identification	Function
	X1 in	Receives the module bus connector
	X1 out	Passes the module bus connection to the neighboring device

Tab. 10-3: X1, Module Bus

Installation instructions

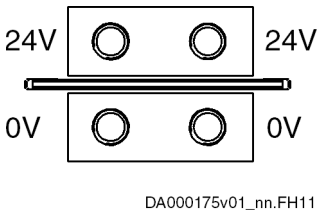
- Keep the ribbon cable in the **parking position**, if the connection to the neighboring device is not established.
- If used for the module bus, **extension cables** must be **shielded**. Their total length may not exceed a **maximum of 40 m**. The module bus connection can be extended by means of accessory **RKB0001**.
- When using **DC bus capacitor units**:

  Do not establish this connection at the DC bus capacitor unit, if the DC bus capacitor unit is the last device in the drive system.

Control Voltage (+24 V, 0 V)

When using DC bus capacitor units: Do not establish this connection at the DC bus capacitor unit, if the DC bus capacitor unit is the last device in the drive system.

Technical Data of the Connection Point

View	Identification	Function
	+24V	Power supply Connection to neighboring devices with contact bars from accessory HAS01.1
	0V	Reference potential for power supply Connection to neighboring devices with contact bars from accessory HAS01.1

Screw connection	Unit	Min.	Max.
M6 thread at device (terminal block)			

Tightening torque	Nm	5,5	6,5
Polarity reversal protection		Within the allowed voltage range by internal protective diode	
Current carrying capacity "looping through" from 24V to 24V, 0V to 0V (contact bars in scope of supply of accessory HAS01)			
With contact bars -072	A	220	

Tab. 10-4: Function, Pin Assignment, Properties

L+ L-, DC Bus Connection

⚠ WARNING **Lethal electric shock by live parts with more than 50 V!**

Before working on live parts: De-energize installation and secure power switch against unintentional or unauthorized re-energization.

Wait at least **30 minutes** after switching off the supply voltages to allow **discharging**.

Check whether voltage has fallen below 50 V before touching live parts!

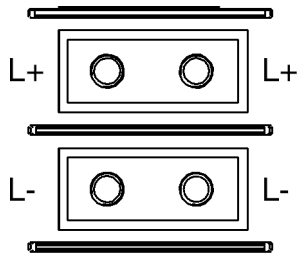
Function, Pin Assignment

The DC bus connection connects

- several drive controllers to one another
- a drive controller to additional components

☞ HCS02.1E-W0012 drive controllers do not have a DC bus connection.

Technical Data of the Connection Point

View	Identification	Function
 DA000176v01_nn.FH11	L+ L-	Connection points for connecting DC bus connections

Screw connection M6 thread at device (terminal block)	**Unit**	**Min.**	**Max.**
Tightening torque	Nm	5,5	6,5
Short circuit protection		Via fusing elements connected in the incoming circuit to the mains connection	
Current carrying capacity "looping through" from L+ to L+, L- to L- (contact bars in scope of supply of accessory HAS01)			

HLC01 - DC Bus Capacitor Unit

With contact bars -072	A		220
Additionally with contact bars -042 and end piece	A		245

Tab. 10-5: Function, Pin Assignment, Properties

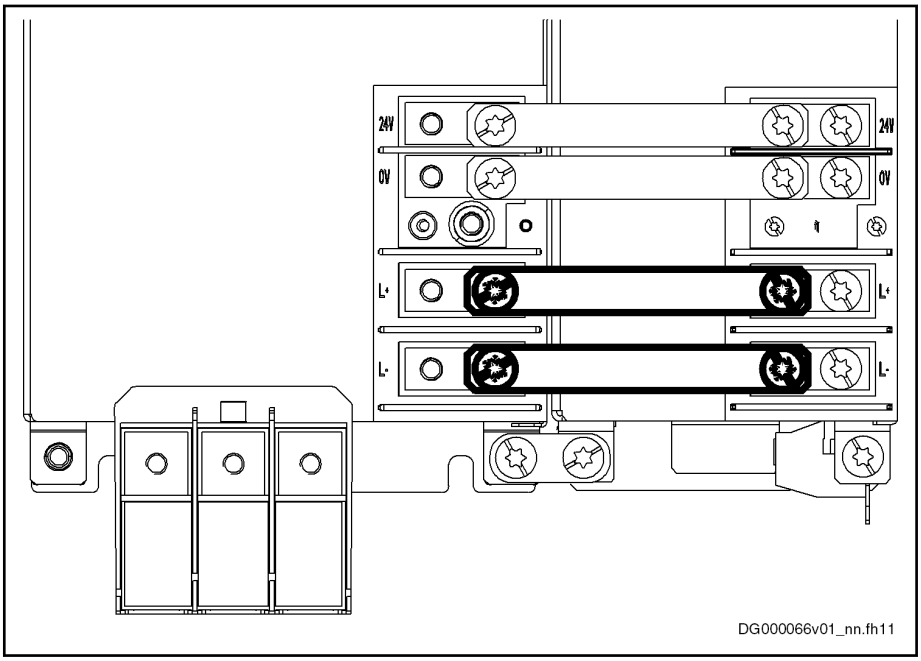


Fig. 10-6: DC Bus Connection with Contact Bars

Notes on Installation

If in special cases it is not possible to use the contact bars provided to establish the connection, the connection must be established using the shortest possible **twisted** wires.

NOTICE **Risk of damage by reversing the polarity of the DC bus connections L+ and L-**

Make sure the polarity is correct.

Length of twisted wire	Max. 2 m
Line cross section	Min. 10 mm^2, but not smaller than cross section of supply feeder
Line protection	By means of fuses in the mains connection
Dielectric strength of single strand against ground	≥ 750 V (e.g.: strand type - H07)

Tab. 10-6: DC Bus Line

Connection of equipment grounding conductor

⚠ WARNING **Lethal electric shock by live parts with more than 50 V!**

Connect the drive controller to the equipment grounding system of the control cabinet.

Supplying device **with** connection for joint bar:

- Via the joint bar on the front, connect the drive controller to the supplying device.

Supplying device **without** connection for joint bar:

- Via a separate connection line, connect the drive controller to the equipment grounding system of the control cabinet.

Via the joint bar on the front, connect the drive controller to the neighboring drive controller.

Connect the equipment grounding conductor connection of the supplying unit to the equipment grounding system of the control cabinet.

Check the continuity of the equipment grounding conductors from the mains connection to the connected motors.

☞ **Equipment grounding conductor: Material and cross section**

For the equipment grounding conductor, use the same metal (e.g. copper) as for the outer conductors.

For the connections from the equipment grounding conductor connection of the device to the equipment grounding conductor system in the control cabinet, make sure the cross sections of the lines are sufficient.

Cross sections of the equipment grounding connections:

- For **HCS03.1E** drive controllers, **HMV01** and **HMV02** supply units at least **10 mm² (AWG 8)**, but not smaller than the cross sections of the outer conductors of the mains supply feeder
- For **HCS02.1E** drive controllers, **at least 4 mm² (AWG 10)**, but not smaller than the cross sections of the outer conductors of the mains supply feeder

  Additionally, mount the housing of HCS02.1E to a bare metal mounting plate. Connect the mounting plate, too, with at least the same cross section to the equipment grounding conductor system in the control cabinet.

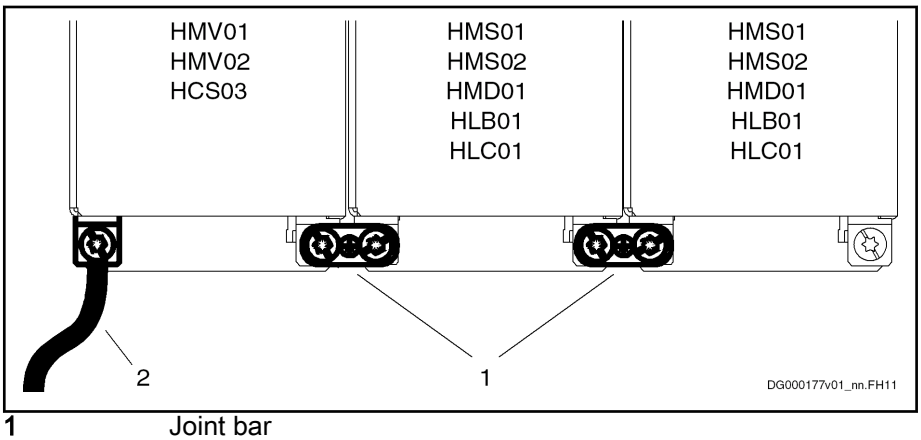
For outer conductors with a cross section greater than 16 mm², you can reduce the cross section of the equipment grounding connection according to the table "Equipment Grounding Conductor Cross Section".

HLC01 - DC Bus Capacitor Unit

Cross-sectional area A of outer conductors	Minimum cross-sectional area A_{PE} of equipment grounding connection
A ≤ 16 mm²	A
16 mm² < A ≤ 35 mm²	16
35 mm² < A	A / 2

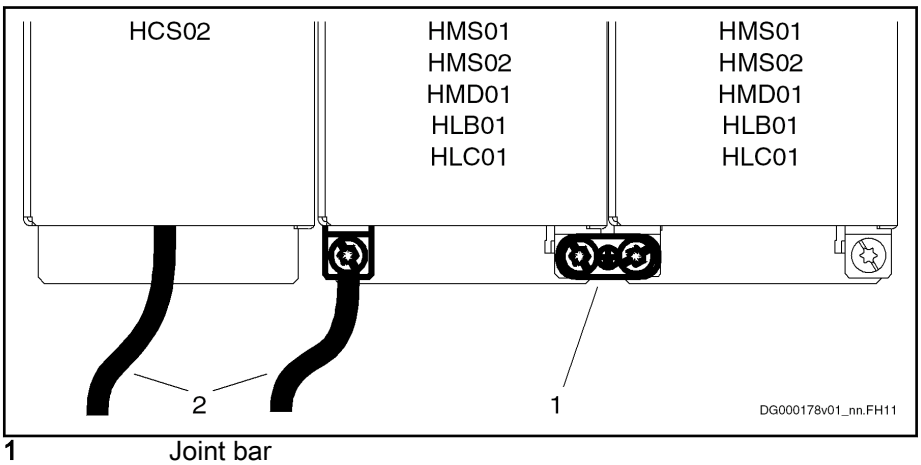
Tab. 10-7: Equipment grounding conductor cross section

☞ The line for the connection of the equipment grounding conductor must have at least the cross section of the mains supply feeder. With cross sections of the mains supply feeder smaller than 10 mm² (AWG 8), the equipment grounding conductor must have at least 10 mm² (AWG 8).



1 Joint bar
2 Connection to equipment grounding system

Fig. 10-7: Equipment Grounding Conductor Connection for Supply via HMV01, HMV02, HCS03



1 Joint bar
2 Connection to equipment grounding system

Fig. 10-8: Equipment Grounding Conductor Connection for Supply via HCS02

Design, tightening torque

The joint bars are connected by means of screws:

Design	Tightening torque
M6 × 25	6 Nm

Tab. 10-8: Data of Connection Point

Ground connection

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.
3. For the ground connection, observe the maximum allowed ground resistance.

   See Project Planning Manual of the drive system (index entry "Mains connection → Project planning").

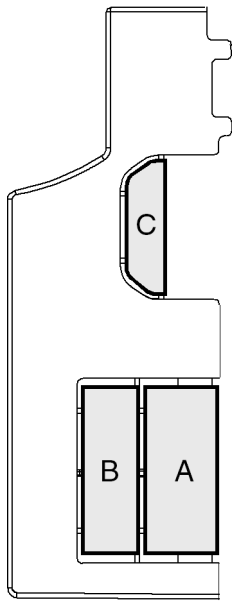
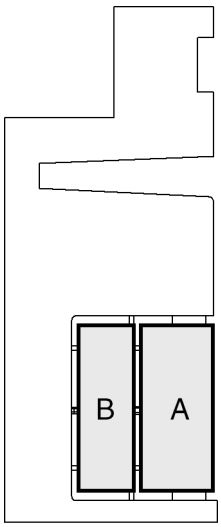
10.4.3 Touch guard at devices

Cutouts

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

- The appropriate touch guard must be mounted for each device following connection work.
- Never mount a damaged touch guard.
- Immediately replace a damaged touch guard by an undamaged touch guard.
- Keep the cutouts at the touch guard as small as possible. Only remove the cutouts if necessary.

HLC01 - DC Bus Capacitor Unit

Type 1	Type 2
 DG000050v01_nn.FH11	 DG000049v01_nn.FH11

Tab. 10-9: Cutouts at the Touch Guard

- If the DC bus and the control voltage are connected by means of **contact bars**, only **cutout A** may be removed from 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), the **cutouts A, B and C** may be removed from the touch guard.
- At the first and last device in a line of interconnected devices, you must **not remove any** cutout at the outer side of the touch guard.

Mounting

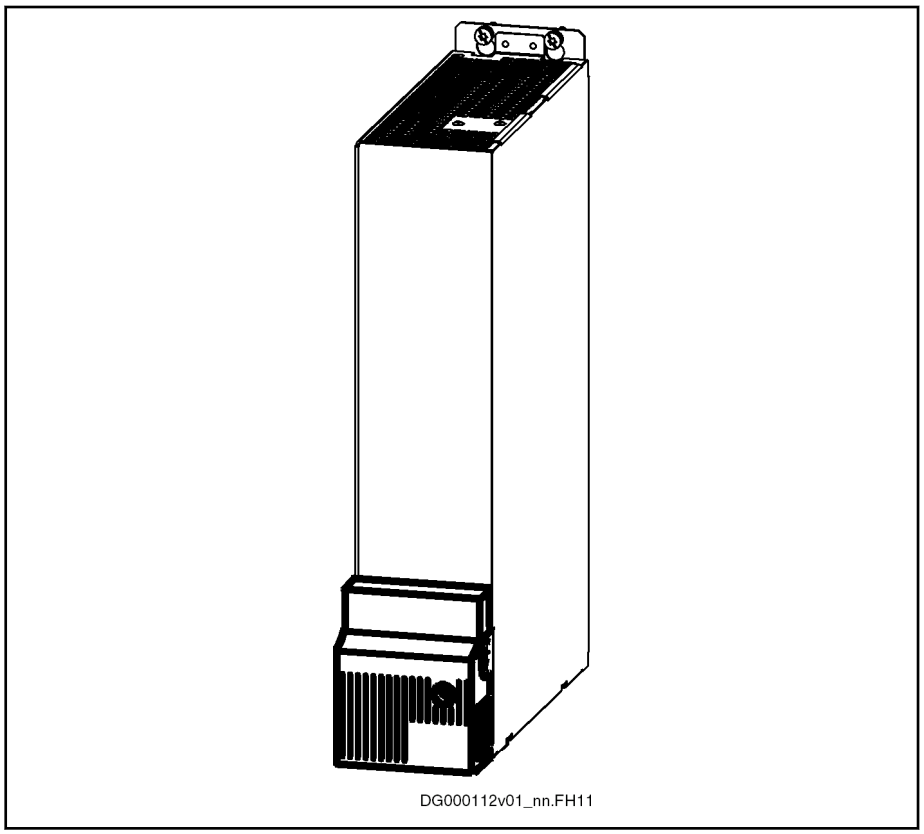


Fig. 10-9: Touch Guard at Device

The touch guard is fixed to the device with screws.

Tightening torque **Max. 2.8 Nm**

11 HLB01.1C and HLB01.1D - DC bus resistor unit

11.1 Description

The DC bus resistor unit can be advantageously used for

- increasing the available continuous regenerative power
- increasing the available peak regenerative power
- DC bus short circuit (ZKS) for quickly discharging the DC bus

11.2 Identification

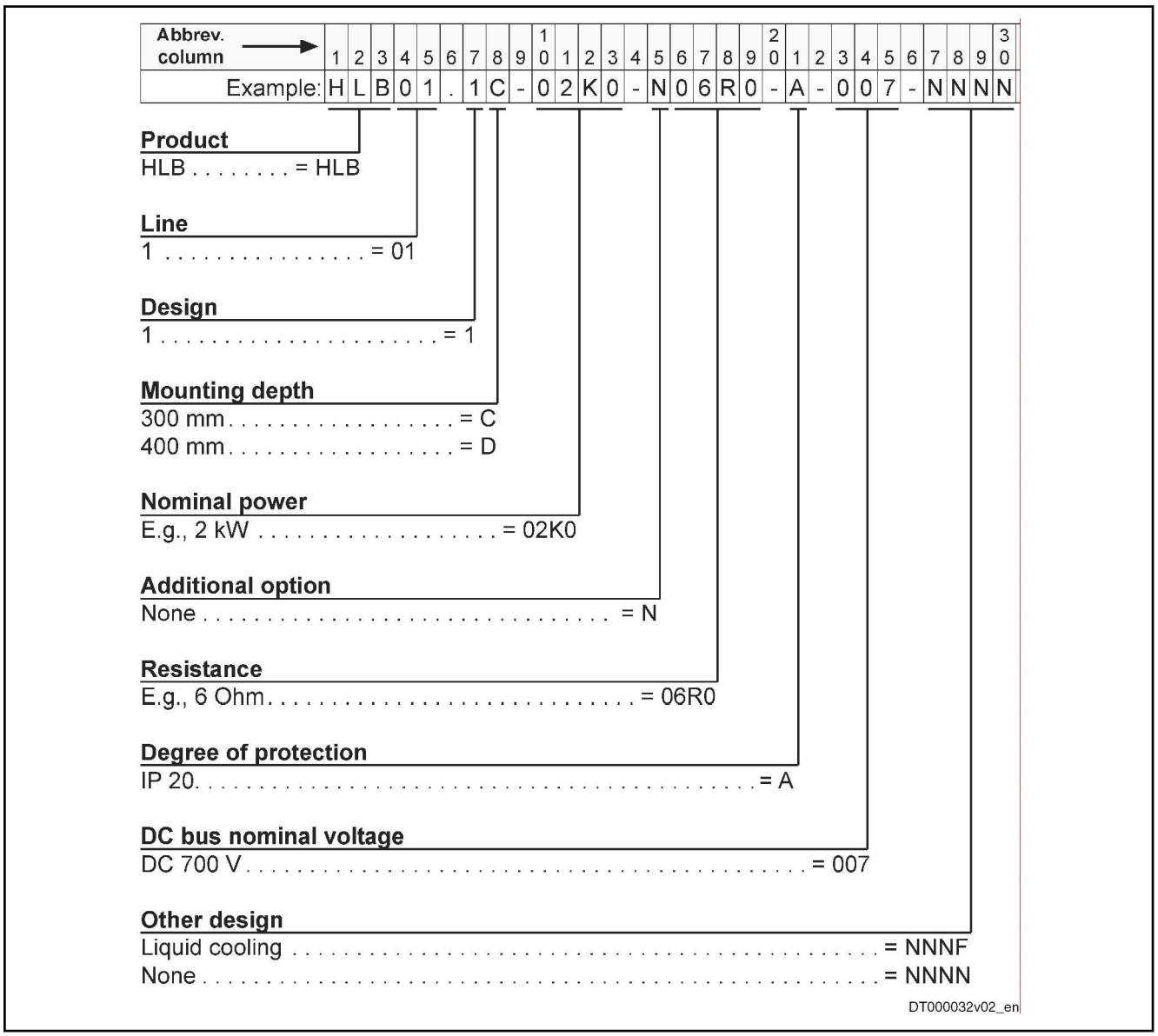


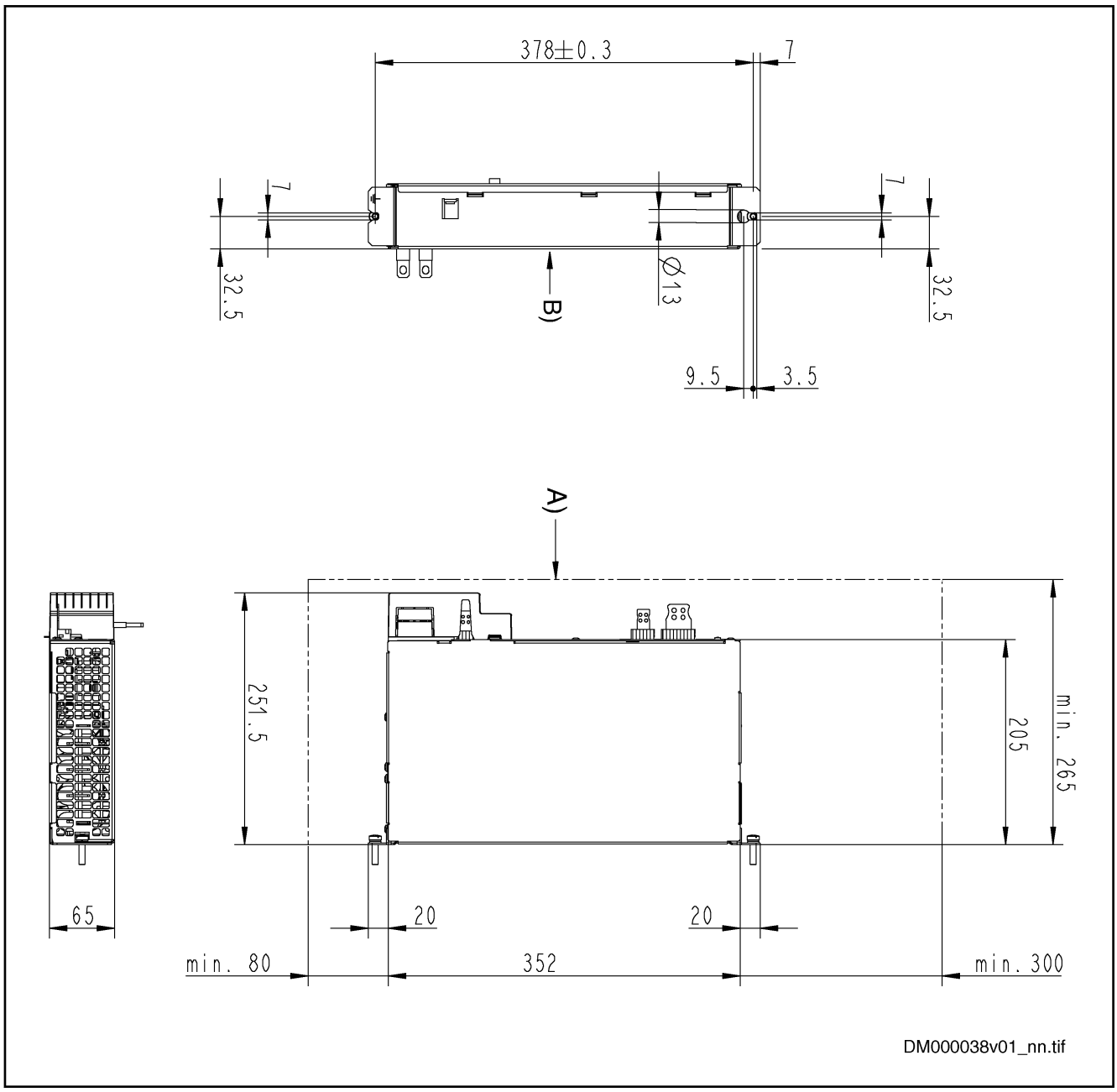
Fig. 11-1: Type code

HLB01.1C and HLB01.1D - DC bus resistor unit

11.3 Mounting HLB01.1

11.3.1 Mechanical data HLB01.1

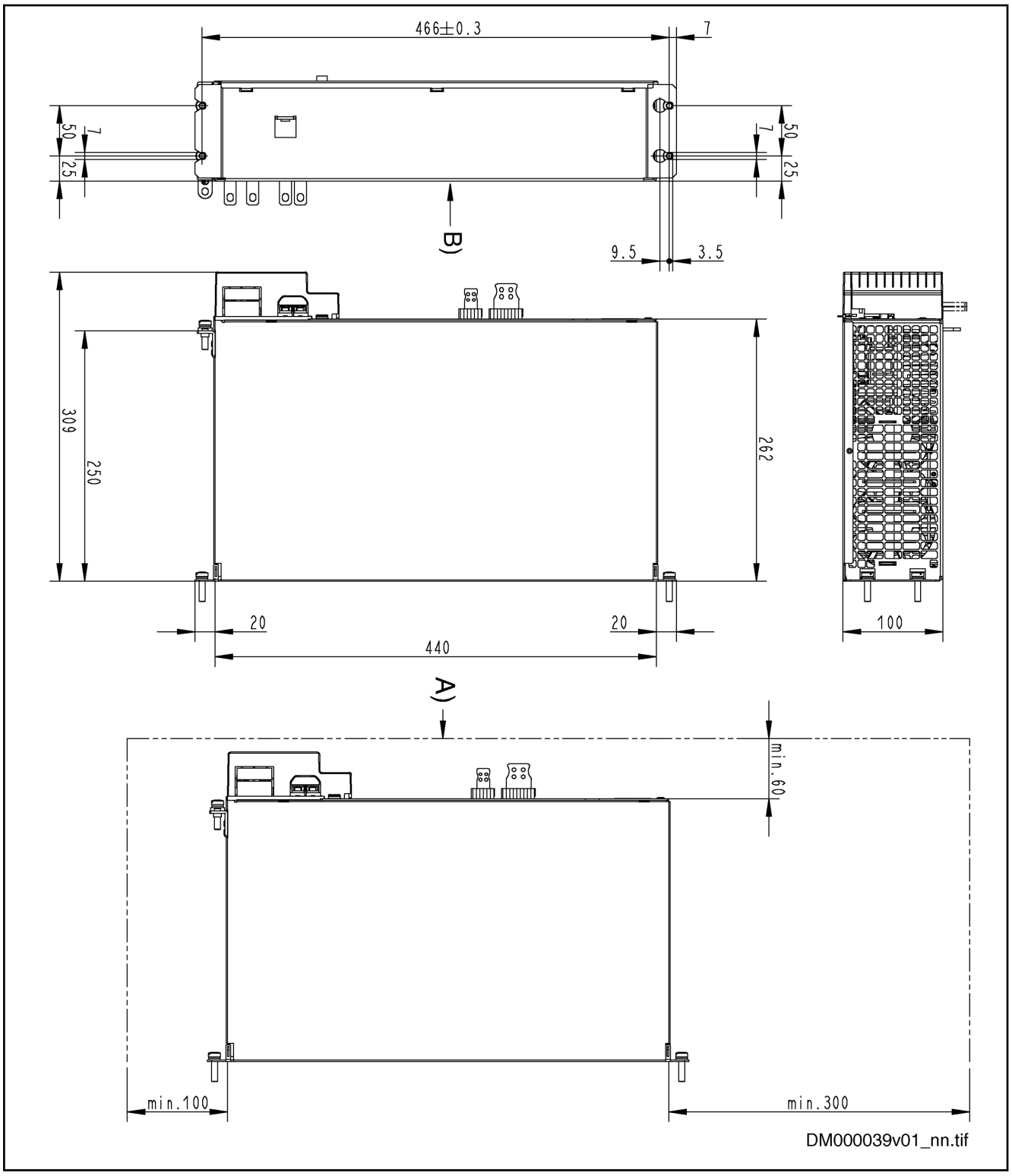
Dimensions HLB01.1C-…-NNNN



A) Minimum mounting clearance
B) Rear view!

Fig. 11-2: Dimensions HLB01.1C-…-NNNN

Dimensions HLB01.1D-…-NNNN



A) Minimum mounting clearance
B) Rear view!

Fig. 11-3: Dimensions HLB01.1D

HLB01.1C and HLB01.1D - DC bus resistor unit

Weight

Type	Weight [kg]
HLB01.1C	5.8
HLB01.1D	12.2

Tab. 11-1: Weight

Mounting Position

Allowed mounting position: **G1**

11.4 Installing HLB01.1

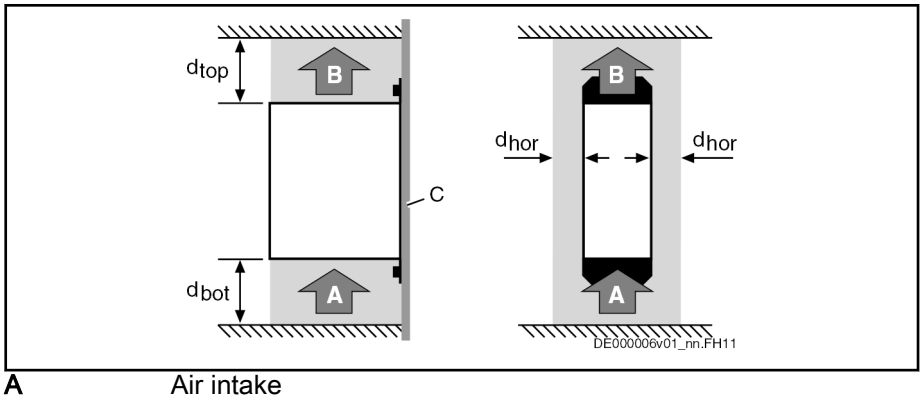
11.4.1 Electrical data HLB01.1

Technical data - currents, voltages, power

Description	Symbol	Unit	HLB01.1C-01K0-N06R0-A-007-NNNN	HLB01.1D-02K0-N03R4-A-007-NNNN
Rated control voltage input	U_{N3}	V	24V ±20%	
Rated power consumption control voltage input at U_{N3}	P_{N3}	W	14	
Max. inrush current at 24-V-supply	I_{EIN3_max}	A	3	
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	50	
Braking resistor continuous power	P_{BD}	kW	1	2
Braking resistor peak power	P_{BS}	kW	100	180
Regenerative power to be absorbed	W_{R_max}	kWs	100	500
Nominal braking resistance	$R_{DC\_Bleeder}$	ohm	6	3.4
Braking resistor switch-on threshold - independent of mains voltage[1)]	$U_{R\_DC\_On\_f}$	V	820	
Braking resistor switch-on threshold - depending on mains voltage[2)]	$U_{R\_DC\_On\_v}$	V	-	
Balancing factor for P_{BD} (for parallel operation at common DC bus)	f		0.8	
DC bus voltage	U_{DC}	V	254 ... 750	
Listing in accordance with UL standard	-	-	UL 508C	
UL files	-	-	E134201	
Minimum distance on the top of the device[3)]	d_{top}	mm	300	
Minimum distance on the bottom of the device[4)]	d_{bot}	mm	80	100
				Last modification: 2014-02-13 (m)

1) 2) Factory setting
3) 4) See fig. "Air intake and air outlet at device"

Tab. 11-2: HLB - technical data - currents, voltages, power



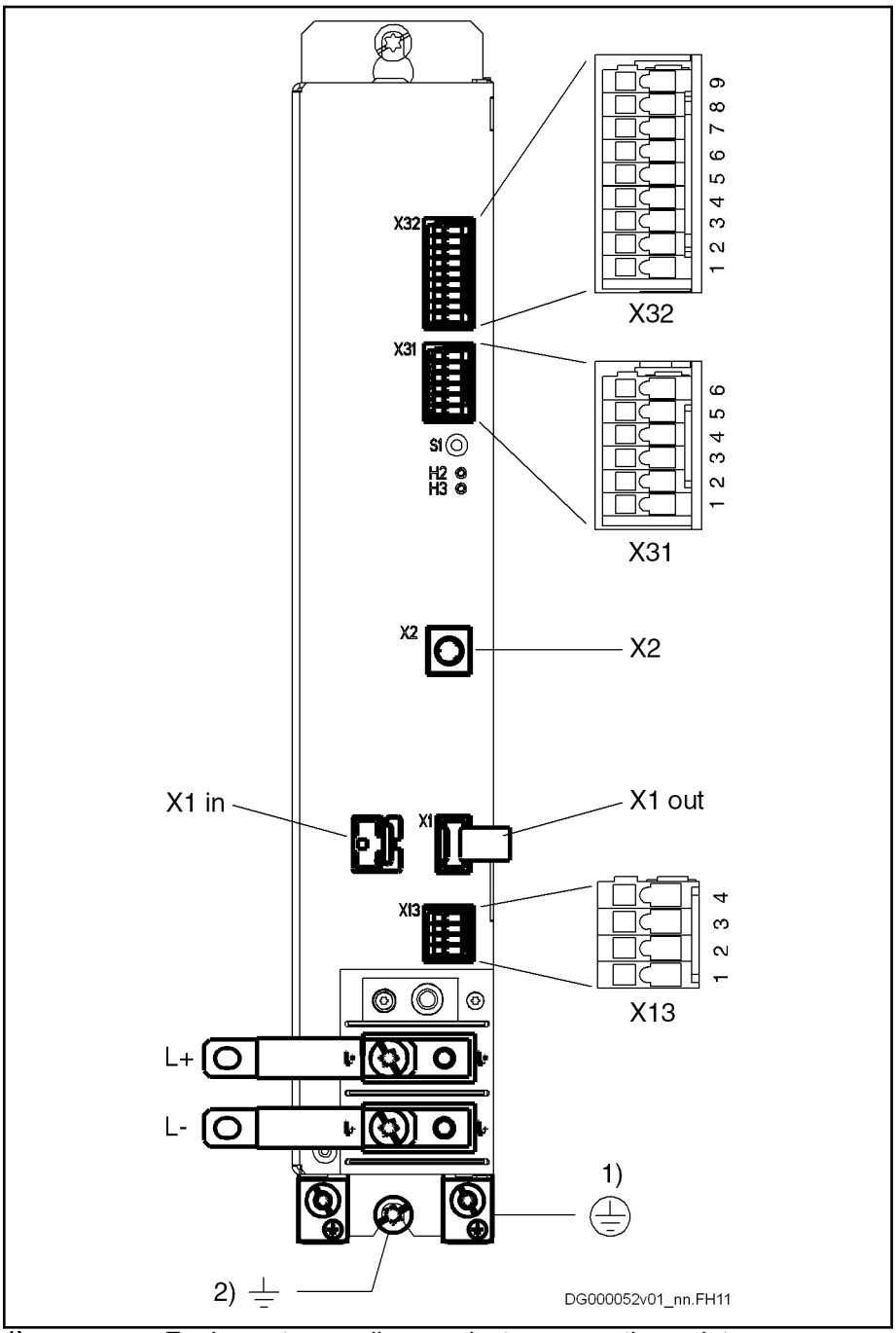
A	Air intake
B	Air outlet
C	Mounting surface in control cabinet
d_{top}	Distance top
d_{bot}	Distance bottom
d_{hor}	Distance horizontal

Fig. 11-4: Air intake and air outlet at device

HLB01.1C and HLB01.1D - DC bus resistor unit

11.4.2 Connection points

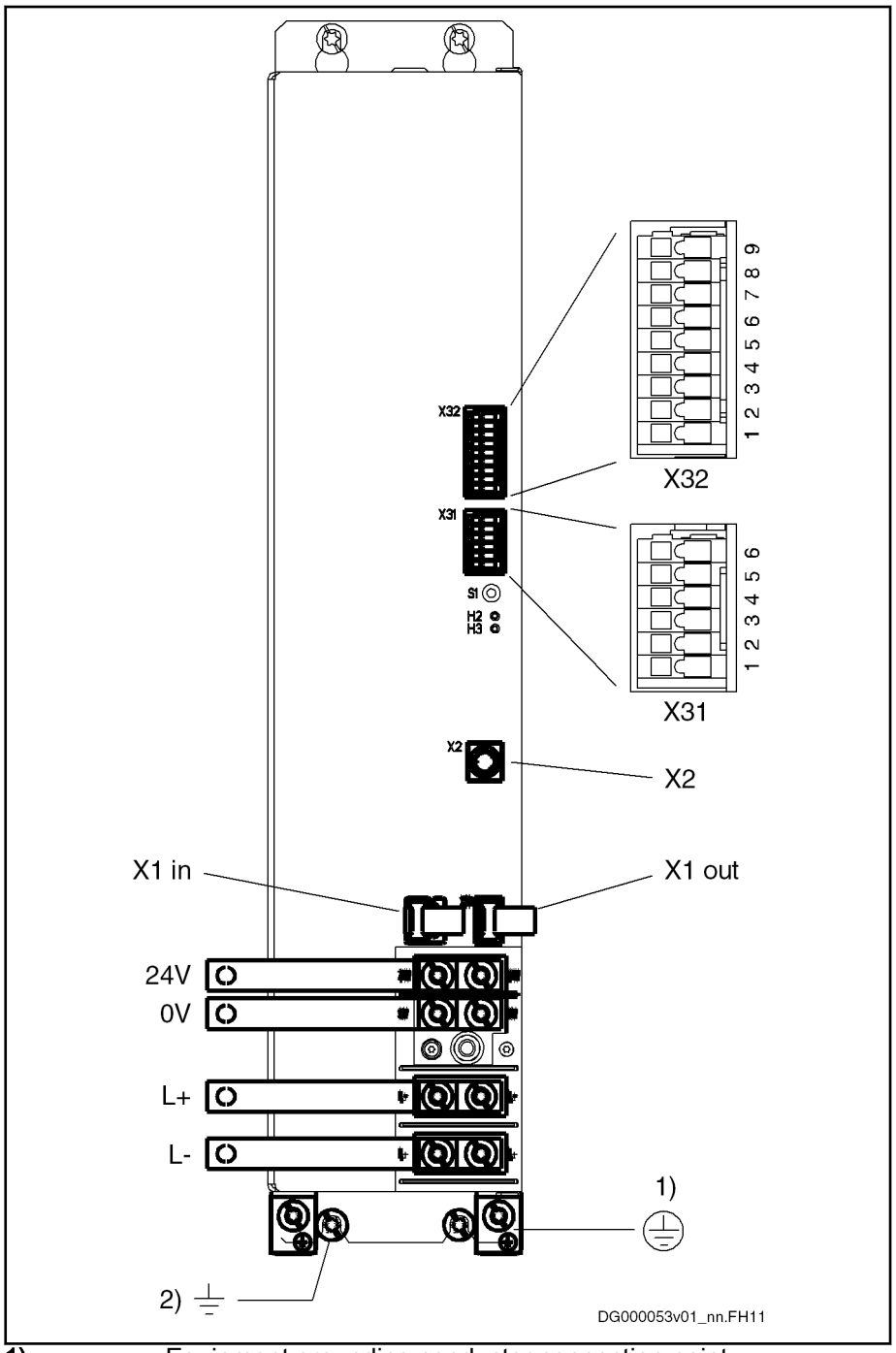
Overview HLB01.1C



1) Equipment grounding conductor connection point
2) Ground connection

Fig. 11-5: Connections HLB01.1C

Overview HLB01.1D



1) Equipment grounding conductor connection point
2) Ground connection

Fig. 11-6: Connections HLB01.1D

HLB01.1C and HLB01.1D - DC bus resistor unit

L+ L-, DC bus connection

⚠ WARNING **Lethal electric shock by live parts with more than 50 V!**

Before working on live parts: De-energize installation and secure power switch against unintentional or unauthorized re-energization.

Wait at least **30 minutes** after switching off the supply voltages to allow **discharging**.

Check whether voltage has fallen below 50 V before touching live parts!

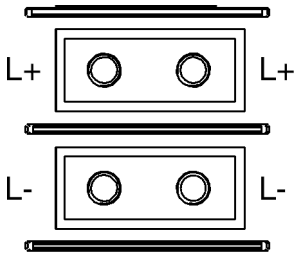
Function, pin assignment

The DC bus connection connects

- several drive controllers to one another
- a drive controller to additional components

☞ HCS02.1E-W0012 drive controllers do not have a DC bus connection.

Technical Data of the Connection Point

View	Identification	Function
 DA000176v01_nn.FH11	L+ L-	Connection points for connecting DC bus connections

Screw connection M6 thread at device (terminal block)	**Unit**	**Min.**	**Max.**
Tightening torque	Nm	5,5	6,5
Short circuit protection		Via fusing elements connected in the incoming circuit to the mains connection	
Overload protection		Via fusing elements connected in the incoming circuit to the mains connection	
Current carrying capacity "looping through" from L+ to L+, L- to L- (contact bars in scope of supply of accessory HAS01)			
With contact bars -072	A		220
Additionally with contact bars -042 and end piece	A		245

Tab. 11-3: Function, Pin Assignment, Properties

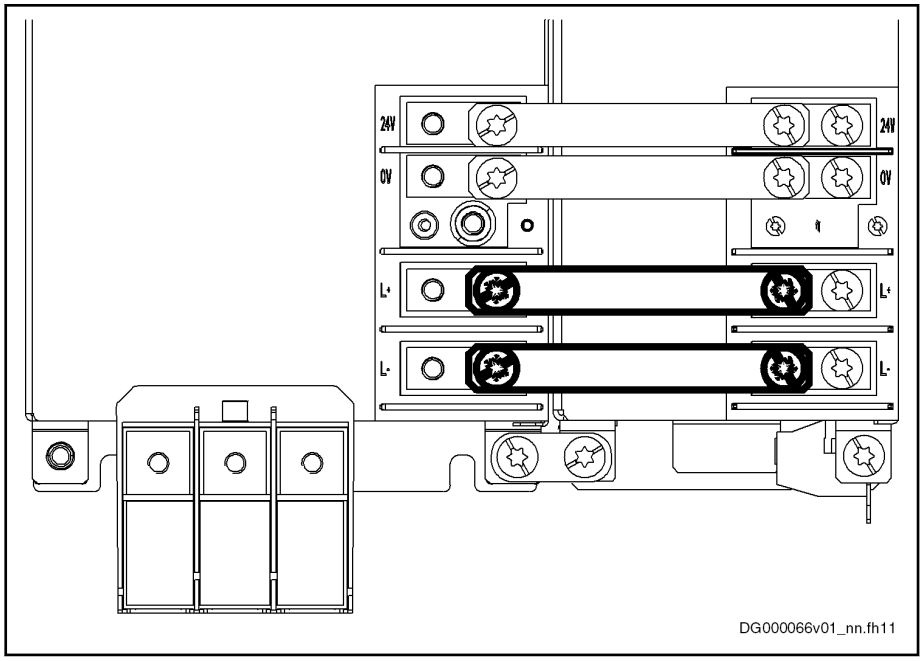


Fig. 11-7: DC Bus Connection with Contact Bars

Notes on installation

If in special cases it is not possible to use the contact bars provided to establish the connection, the connection must be established using the shortest possible **twisted** wires.

NOTICE **Risk of damage by reversing the polarity of the DC bus connections L+ and L-**

Make sure the polarity is correct.

Length of twisted wire	Max. 2 m
Line cross section	Min. 10 mm^2, but not smaller than cross section of supply feeder
Line protection	By means of fuses in the mains connection
Dielectric strength of single strand against ground	≥ 750 V (e.g.: strand type - H07)

Tab. 11-4: DC Bus Line

HLB01.1C and HLB01.1D - DC bus resistor unit

Connection of equipment grounding conductor

⚠ WARNING **Lethal electric shock by live parts with more than 50 V!**

Connect the drive controller to the equipment grounding system of the control cabinet.

Supplying device **with** connection for joint bar:

- Via the joint bar on the front, connect the drive controller to the supplying device.

Supplying device **without** connection for joint bar:

- Via a separate connection line, connect the drive controller to the equipment grounding system of the control cabinet.

Via the joint bar on the front, connect the drive controller to the neighboring drive controller.

Connect the equipment grounding conductor connection of the supplying unit to the equipment grounding system of the control cabinet.

Check the continuity of the equipment grounding conductors from the mains connection to the connected motors.

☞ **Equipment grounding conductor: Material and cross section**

For the equipment grounding conductor, use the same metal (e.g. copper) as for the outer conductors.

For the connections from the equipment grounding conductor connection of the device to the equipment grounding conductor system in the control cabinet, make sure the cross sections of the lines are sufficient.

Cross sections of the equipment grounding connections:

- For **HCS03.1E** drive controllers, **HMV01** and **HMV02** supply units at least **10 mm² (AWG 8)**, but not smaller than the cross sections of the outer conductors of the mains supply feeder
- For **HCS02.1E** drive controllers, **at least 4 mm² (AWG 10)**, but not smaller than the cross sections of the outer conductors of the mains supply feeder

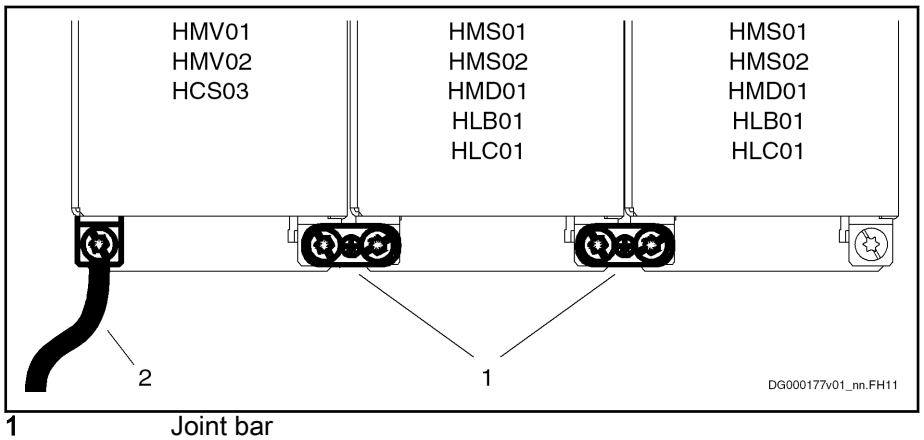
  Additionally, mount the housing of HCS02.1E to a bare metal mounting plate. Connect the mounting plate, too, with at least the same cross section to the equipment grounding conductor system in the control cabinet.

For outer conductors with a cross section greater than 16 mm², you can reduce the cross section of the equipment grounding connection according to the table "Equipment Grounding Conductor Cross Section".

Cross-sectional area A of outer conductors	Minimum cross-sectional area A_{PE} of equipment grounding connection
A ≤ 16 mm²	A
16 mm² < A ≤ 35 mm²	16
35 mm² < A	A / 2

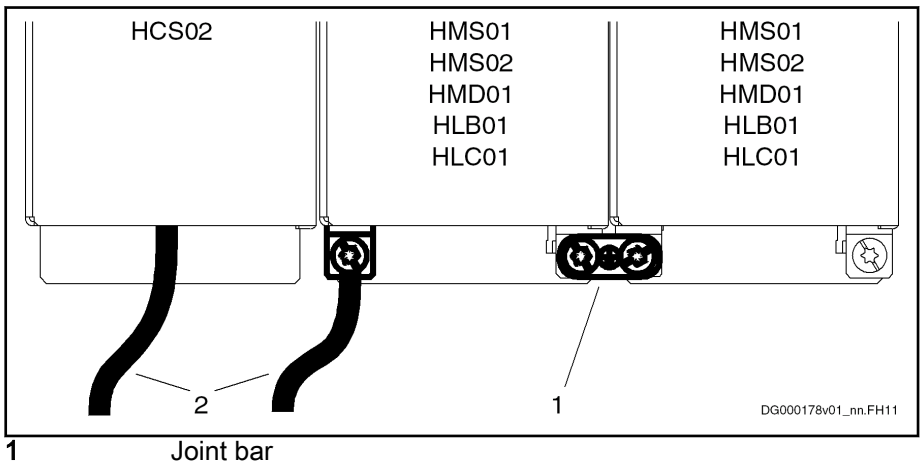
Tab. 11-5: Equipment grounding conductor cross section

The line for the connection of the equipment grounding conductor must have at least the cross section of the mains supply feeder. With cross sections of the mains supply feeder smaller than 10 mm² (AWG 8), the equipment grounding conductor must have at least 10 mm² (AWG 8).



1 Joint bar
2 Connection to equipment grounding system

Fig. 11-8: Equipment Grounding Conductor Connection for Supply via HMV01, HMV02, HCS03



1 Joint bar
2 Connection to equipment grounding system

Fig. 11-9: Equipment Grounding Conductor Connection for Supply via HCS02

Design, tightening torque

The joint bars are connected by means of screws:

Design	Tightening torque
M6 × 25	6 Nm

Tab. 11-6: Data of Connection Point

HLB01.1C and HLB01.1D - DC bus resistor unit

Ground connection

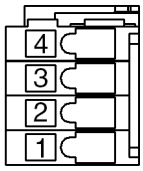
The ground connection of the housing is used to provide functional safety of the drive controllers and protection against contact in conjunction with the equipment grounding conductor.

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.
3. For the ground connection, observe the maximum allowed ground resistance.

   See Project Planning Manual of the drive system (index entry "Mains connection → Project planning").

X13 at HLB01, control voltage

Pin assignment	Connection	Signal name	Function
 DG000115v01_nn.FH11	4	+24V	Power supply and "looping through"
	3	+24V	
	2	0V	Reference potential for power supply and "looping through"
	1	0V	

Spring terminal (connector)	Unit	min.	max.
Connection cable, solid wire	mm^2	1	1.5
Connection cable, stranded wire	mm^2	1	1.5
Connection cable	AWG	18	16
Power consumption	W	P_{N3} (see technical data)	
Voltage load capacity	V	U_{N3} (see technical data)	
Current carrying capacity "looping through" from +24V to +24V, 0V to 0V Continuous current P_{N3}/U_{N3}	A		6
Current carrying capacity "looping through" from +24V to +24V, 0V to 0V Inrush current I_{EIN3}	A		12
Polarity reversal protection		Within the allowed voltage range by internal protective diode	

Tab. 11-7: Function, pin assignment, properties

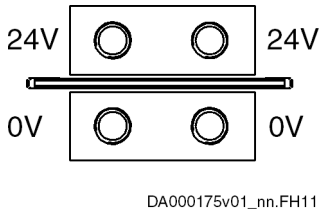
Notes on installation

Requirements on the connection to the 24V supply:

- Minimum cross-section: 1 mm^2
- Maximum allowed inductance: 100 µH (2 twisted single strands, 75 m long)
- Parallel line routing where possible

Control voltage HLB01.1D

Technical Data of the Connection Point

View	Identification	Function
 DA000175v01_nn.FH11	+24V	Power supply Connection to neighboring devices with contact bars from accessory HAS01.1
	0V	Reference potential for power supply Connection to neighboring devices with contact bars from accessory HAS01.1

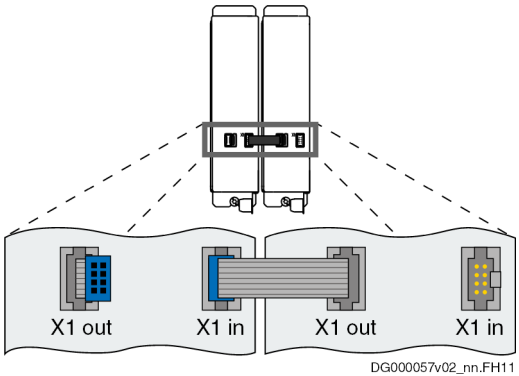
Screw connection M6 thread at device (terminal block)	**Unit**	**Min.**	**Max.**
Tightening torque	Nm	5,5	6,5
Power consumption	W	P_{N3} (see technical data)	
Voltage load capacity	V	U_{N3} (see technical data)	
Polarity reversal protection		Within the allowed voltage range by internal protective diode	
Current carrying capacity "looping through" from 24V to 24V, 0V to 0V (contact bars in scope of supply of accessory HAS01)			
With contact bars -072	A	220	

Tab. 11-8: Function, Pin Assignment, Properties

X1, module bus

Function, pin assignment

The module bus is an **internal system connection** and is used to exchange data between the devices.

View	Identification	Function
 DG000057v02_nn.FH11	X1 in	Receives the module bus connector
	X1 out	Passes the module bus connection to the neighboring device

Tab. 11-9: X1, Module Bus

Installation instructions

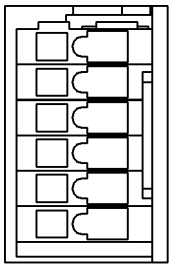
- Keep the ribbon cable in the **parking position**, if the connection to the neighboring device is not established.

HLB01.1C and HLB01.1D - DC bus resistor unit

- If used for the module bus, **extension cables** must be **shielded**. Their total length may not exceed a **maximum of 40 m**. The module bus connection can be extended by means of accessory **RKB0001**.
- When using **DC bus capacitor units**:

  Do not establish this connection at the DC bus capacitor unit, if the DC bus capacitor unit is the last device in the drive system.

X31 at HLB01, ready for operation and prewarning contact

Pin assignment	Connection	Signal name / function
 DA000251v01_nn.FH11	6	**Ready for operation contact:**
	5	**Closes** when the following conditions have been fulfilled: • Control voltage available • Heat sink temperature OK • Load resistor temperature OK • Continuous power is smaller than specified value (see technical data) • Maximum regenerative power is smaller than specified value (see technical data)
	4	n. c.
	3	n. c.
	2	**Prewarning contact:**
	1	**Opens** if one of the following conditions has been fulfilled: • Heat sink temperature too high • Continuous power > 90% • Regenerative power > 90%
Shields of control lines	Connect to shield connection XS1 of neighboring drive controller	

Spring terminal (connector)	Unit	min.	max.
Connection cable, solid wire	mm^2	0.5	1.5
Connection cable, stranded wire	mm^2	0.5	1.5
	AWG	20	16
Max. switching voltage	V	DC 30	
Max. switching current	A	DC 1	
Max. continuous current	A	DC 1	
Minimum load of the contacts	mA	10	

Tab. 11-10: Function, pin assignment, properties

X32 at HLB01, DC bus short circuit control, clear error, braking resistor switch-on threshold

NOTICE **Risk of fire caused by the "sacrificing behavior" of the ZKS stage!**

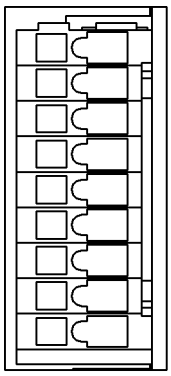
The "ZKS" input activates the "DC bus short circuit" function, when the 24V control voltage has not been applied and when there isn't any current flowing to the input. This condition can occur in the following situations:

- Failure of 24V control voltage
- Wire break
- Activation of serially connected contacts (e.g. axis limit switches)

If the kinetic energy of the mechanical axis system regenerated when braking is greater than the energy absorption capacity of HLB, the HLB device remains active when braking via ZKS takes place, until it is thermally destroyed (sacrificing behavior). Risk of fire! In this case, braking via ZKS may only come into effect in the case of an emergency (e.g. activation of an axis limit switch causes the mains supply to be cut off and simultaneously causes the 24V supply of the ZKS input to be interrupted).

Install a 24V UPS, if the "sacrificing behavior" of HLB is relevant to your drive system in the case of an emergency. This prevents the braking via ZKS which causes HLB to be destroyed due to the failure of the 24V control voltage. Braking via ZKS then will only take place in cases of emergency.

HLB01.1C and HLB01.1D - DC bus resistor unit

Pin assignment	Connection	Signal name / function HLB01.1C	Signal name / function HLB01.1D
 DA000252v01_nn.FH11	9	GND	n. c.
	8	Input **ZKS1** Input circuit: see figure " HLB01.1C input circuit ZKS"	Input **ZKS1** Input circuit: see figure " HLB01.1D input circuit ZKS"
	7	n. c.	
	6	n. c.	
	5	Input **clear error**: A negative edge at the input against GND clears all present errors that can be cleared.	Input **clear error**: A negative edge at the input against X32.4 clears all present errors that can be cleared.
	4	GND	Reference potential for input **clear error**: Applies to devices with hardware index ≥ A17 (see type plate)
	3		n. c. Applies to devices with hardware index ≥ A17 (see type plate)
	2	Input **braking resistor switch-on threshold**: Input not active; independent of the wiring, the braking resistor is switched on between DC 820 … 850 V (depending on the load)	
	1	n. c.	Connect **ZKS2** (reference potential for input ZKS1) to 0V
Shields of control lines	Connect to shield connection XS1 of neighboring drive controller		
DC bus short circuit control	**Unit**	**min.**	**max.**
High: ZKS stage not active, i.e. braking resistor **switched off** Voltage at input ZKS1 against ZKS2 (HLB01.1D) or against GND (HLB01.1C)	V	19.2	28.8
Low: ZKS stage active, i.e. braking resistor **switched on**	V	0	5
Delay t_{d_on} until braking resistor **switches on**	ms	approx. 160	
Delay t_{d_off} until braking resistor **switches off**	ms	approx. 1	
Input resistance	kOhm	2 ±10%	
Polarity reversal protection		Within the allowed input voltage range	

Electrical isolation		HLB01.1C: not electrically isolated, ZKS1 input with reference to GND HLB01.1D: ZKS1, ZKS2 inputs are electrically isolated, i.e. both inputs must be connected!

Input circuit ZKS

HLB01.1C

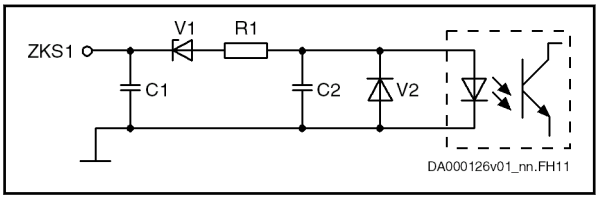


Fig. 11-10: HLB01.1C input circuit ZKS

HLB01.1D

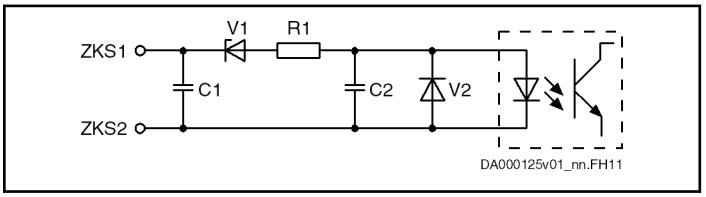


Fig. 11-11: HLB01.1D input circuit ZKS

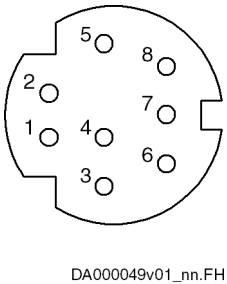
Spring terminal (connector)	Unit	min.	max.
Connection cross section solid wire	mm^2	0.5	1.5
Connection cross section stranded wire	mm^2	0.5	1.5
Connection cross section	AWG	28	14

Tab. 11-11: Function, pin assignment, properties

X2, serial interface (RS232)

General information

The serial interface (RS232) is required for programming, parameterization and diagnosis during commissioning and servicing.

Connection point	Type	Number of poles	Stranded wire [mm^2]	Description	Figure
X2	MiniDin, female (device)	8	0,25-0,5	Serial interface	

Tab. 11-12: Connections

Pin assignment

Pin	Signal	Function
1	RTS	Request to send
2	CTS	Clear to send
3	TxD	Transmit Data
4	GND	Reference potential
5	RxD	Receive Data
6	V_{cc}	Supply voltage

HLB01.1C and HLB01.1D - DC bus resistor unit

Pin	Signal	Function
7	n. c.	n. c.
8	n. c.	n. c.

n. c. not connected

Tab. 11-13: Pin Assignment of Serial Interface

Features

Feature	Unit	Min.	Typ.	Max.
Number of nodes				1
Allowed cable length	m			15
Transmission rates	kBaud	9,6		115
Connection		Galvanically connected to control section supply		
Allowed voltage difference between reference potentials of control section and data end device	V			1

Tab. 11-14: Features

The accessory HAS05.1-005 makes available a converter from RS232 to RS485 (see Project Planning Manual for additional components and accessories).

Connection diagrams serial interface to PC

Serial Interface to PC with 9-Pin D-Sub

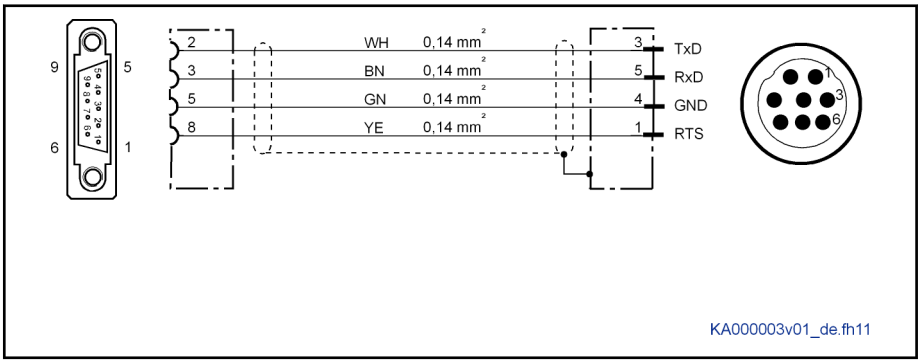


Fig. 11-12: Connection of Serial Interface to PC with 9-Pin D-Sub

For **direct** connection to the serial interface use our cable **IKB0041**.

Serial interface to PC with 25-Pin D-Sub

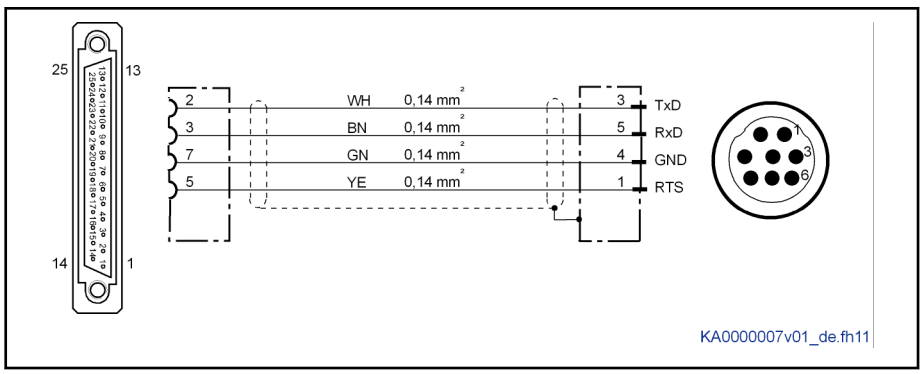


Fig. 11-13: Connection of Serial Interface to PC with 25-Pin D-Sub

X2, RS232 interface

For internal use only.

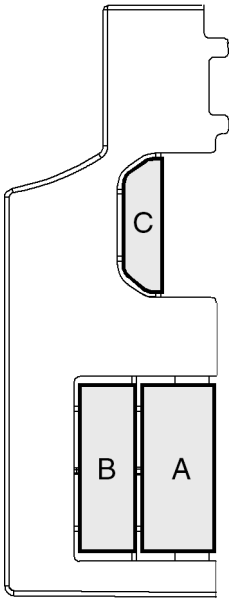
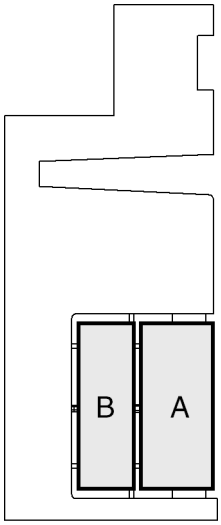
11.4.3 Touch guard at devices

Cutouts

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

- The appropriate touch guard must be mounted for each device following connection work.
- Never mount a damaged touch guard.
- Immediately replace a damaged touch guard by an undamaged touch guard.
- Keep the cutouts at the touch guard as small as possible. Only remove the cutouts if necessary.

HLB01.1C and HLB01.1D - DC bus resistor unit

Type 1	Type 2
 DG000050v01_nn.FH11	 DG000049v01_nn.FH11

Tab. 11-15: Cutouts at the Touch Guard

- If the DC bus and the control voltage are connected by means of **contact bars**, only **cutout A** may be removed from 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), the **cutouts A, B and C** may be removed from the touch guard.
- At the first and last device in a line of interconnected devices, you must **not remove any** cutout at the outer side of the touch guard.

Mounting

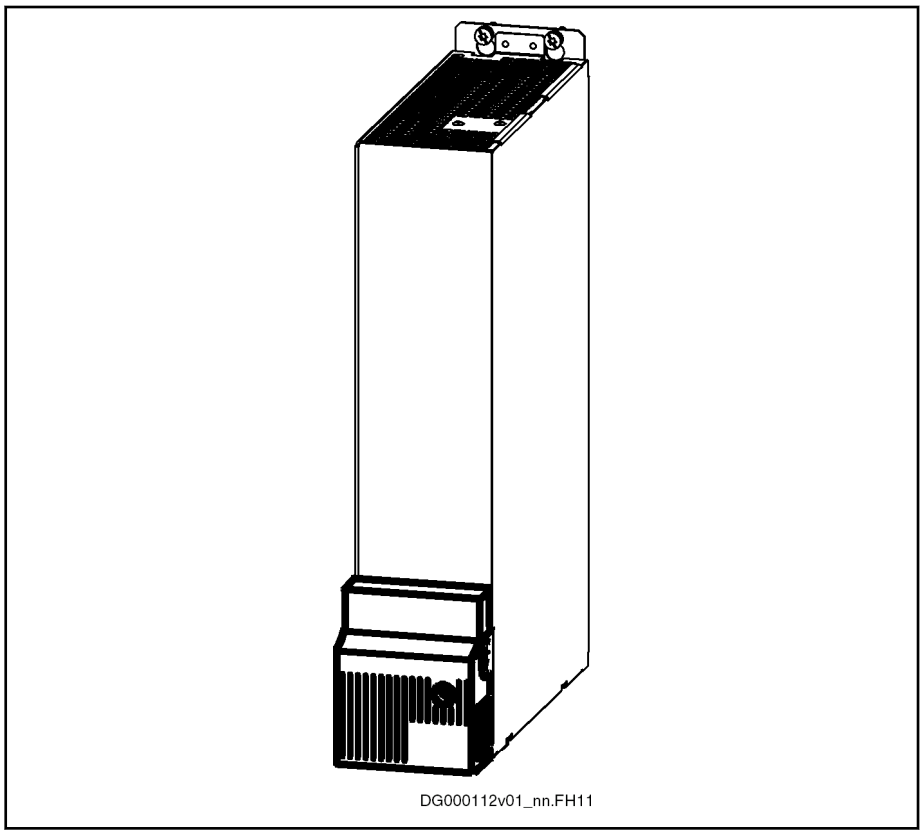


Fig. 11-14: Touch Guard at Device

The touch guard is fixed to the device with screws.

Tightening torque **Max. 2.8 Nm**

11.5 Commissioning, operation, diagnostics

NOTICE **Risk of fire caused by the "sacrificing behavior" of the ZKS stage!**

The "ZKS" input activates the "DC bus short circuit" function, when the 24V control voltage has not been applied and when there isn't any current flowing to the input. This condition can occur in the following situations:

- Failure of 24V control voltage
- Wire break
- Activation of serially connected contacts (e.g. axis limit switches)

If the kinetic energy of the mechanical axis system regenerated when braking is greater than the energy absorption capacity of HLB, the HLB device remains active when braking via ZKS takes place, until it is thermally destroyed (sacrificing behavior). Risk of fire! In this case, braking via ZKS may only come into effect in the case of an emergency (e.g. activation of an axis limit switch causes the mains supply to be cut off and simultaneously causes the 24V supply of the ZKS input to be interrupted).

Install a 24V UPS, if the "sacrificing behavior" of HLB is relevant to your drive system in the case of an emergency. This prevents the braking via ZKS which causes HLB to be destroyed due to the failure of the 24V control voltage. Braking via ZKS then will only take place in cases of emergency.

HLB01.1C and HLB01.1D - DC bus resistor unit

Other braking resistors take effect at the common DC bus. For example, converters (HCS02, HCS03) and supply units (HMV) have integrated braking resistors or operate external HLR braking resistors.

The following parameters are relevant for operating HLB01:

- P-0-0833, Braking resistor threshold
- P-0-0858, Data of external braking resistor
- P-0-0859, Data of internal braking resistor
- P-0-0860, Converter configuration

Braking resistor switch-on thresholds of supply units

- In the case of **feeding** supply units, the braking resistor switch-on threshold is set depending on the wiring at X32.2 of the supply unit.

  A jumper from X32.2 to X32.3, or X32.3 connected to 24 V, activates fixed braking resistor switch-on threshold 820-850 V.
- In the case of **regenerative** supply units, the braking resistor switch-on threshold is fixed to 820-850 V.

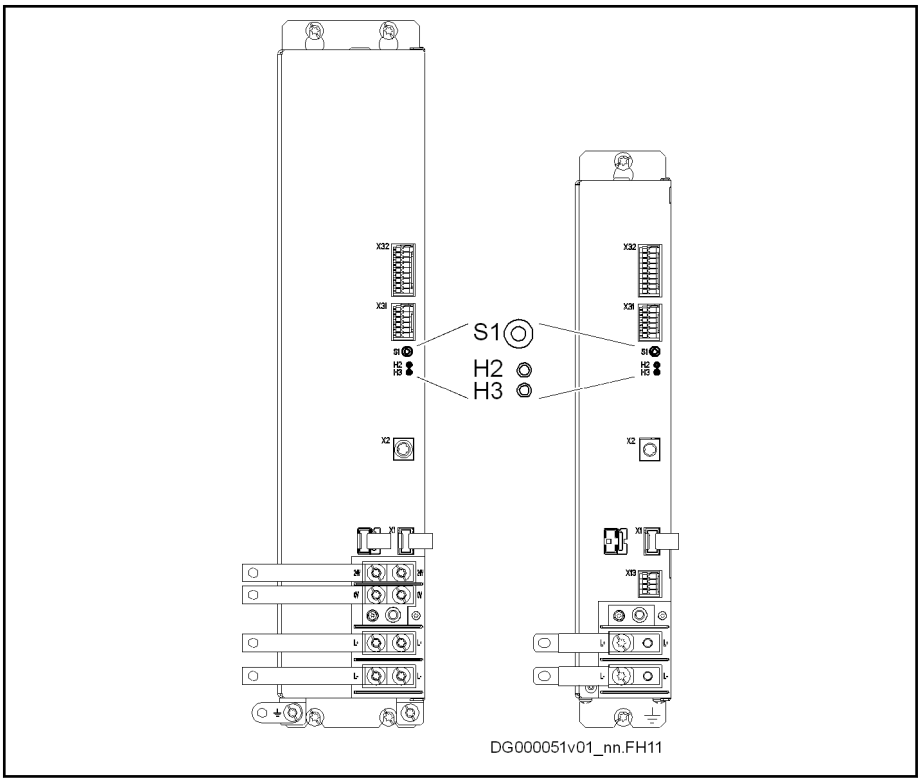


Fig. 11-15: Diagnostic LEDs and reset button

S1 reset button Is used for resetting errors.

Diagnostic LED H2 (green)

State	Significance
 Flashing	Device is ready for operation and U_{ZK} ≤ 50 V
 Continuous light	Device is ready for operation and U_{ZK} > 50 V

Tab. 11-16: Diagnostic LED H2 (green)

Diagnostic LED H3 (red)

State	Significance
 Flashing	• Overload prewarning at 90% load • Overtemperature prewarning
 Continuous light	• Overload • Overtemperature • Internal error

Tab. 11-17: Diagnostic LED H3 (red)

12 HLR01 - Braking Resistors

12.1 Braking Resistor HLR01

HLR01.1N-xxxx-Nxxx-A-007-NNNN braking resistors convert generated kinetic energy into thermal energy. For this purpose, the series covers a wide range of continuous power and energy absorption capacity.

To operate HLR01 braking resistors, the drive controller must be equipped with a brake chopper.

Type	Use
HLR01.1A	Type of construction A (version for device mounting): To be mounted to drive controllers of the Rexroth IndraDrive C product range. For this purpose, the drive controllers must be equipped with a brake chopper.
HLR01.1N	Type of construction N (version for free assembly): Braking resistors for free assembly in the installation (some types to be mounted to HCS03), operated by a drive controller of the Rexroth IndraDrive C product range.

Tab. 12-1: DC Bus Resistor Units HLR

Types of design:

- Fixed resistor IP 20 **type A**

  Cement-coated, wire-wound, tube-type fixed resistors; screwed on side walls; perforated cover; connections in terminal box with PG gland
- Steel-grid fixed resistor IP 20 **type B**

  Fixed resistor in steel-grid design; connection depending on type
- Steel-grid fixed resistor IP 20 **type C**

  Fixed resistor in steel-grid design; connection depending on type

12.2 Type Code and Identification

12.2.1 Type Code

☞ The figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

HLR01 - Braking Resistors

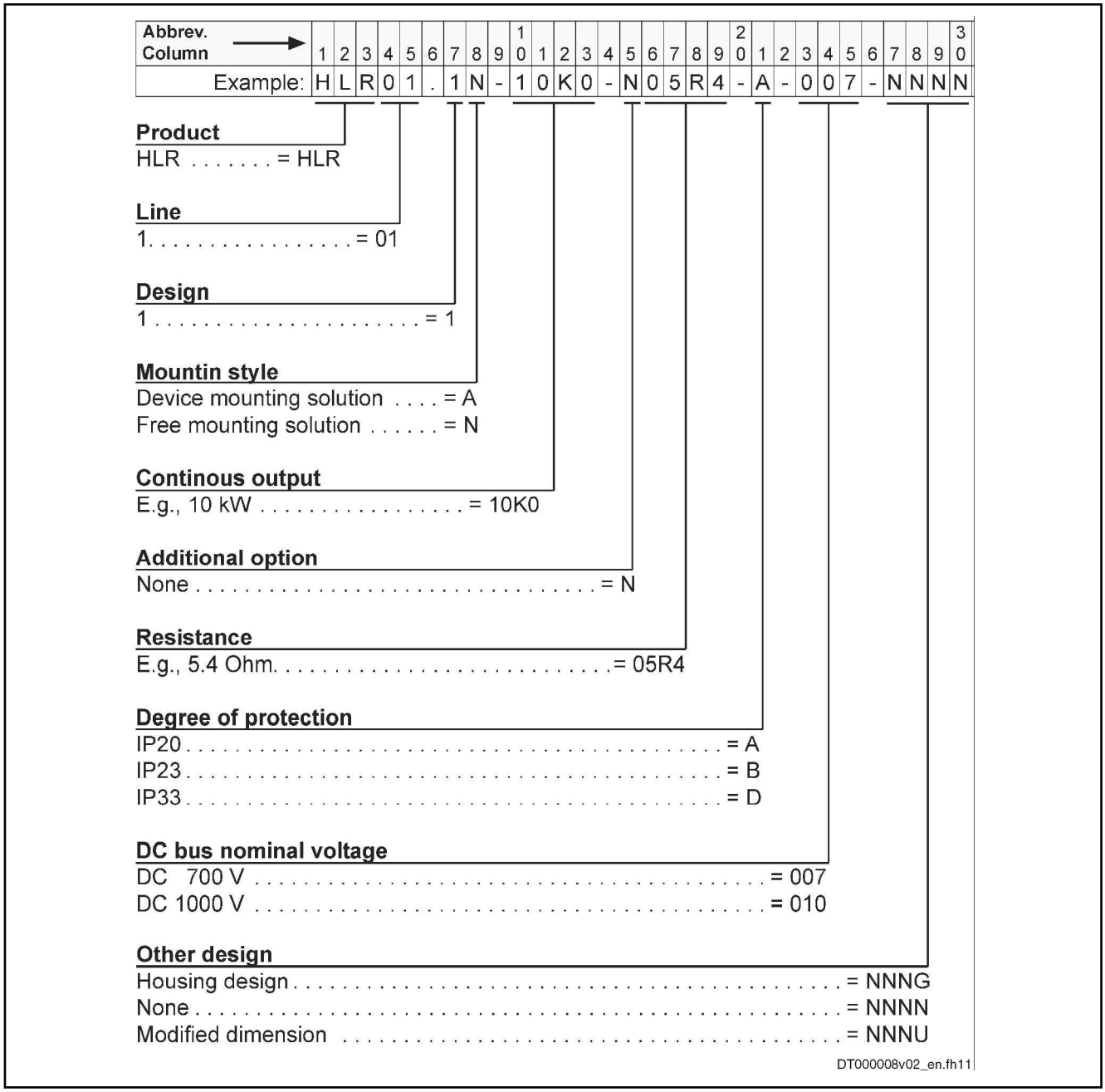
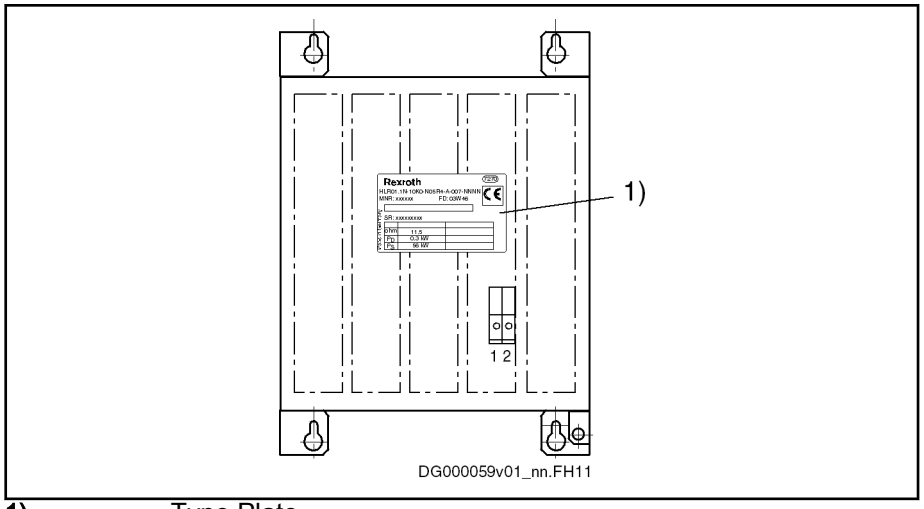


Fig. 12-1: Type Code Braking Resistor HLR01.1

12.2.2 Identification

Each braking resistor is identified by a type designation. There is a type plate attached to all components.

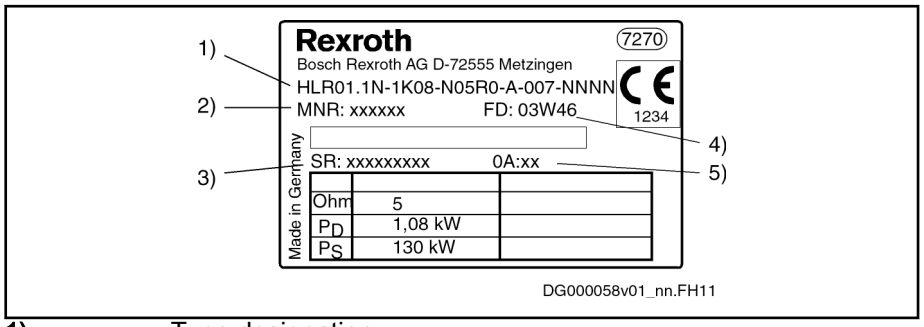
Type Plate Arrangement



1) Type Plate

Fig. 12-2: Position of Type Plate

Type Plate



1) Type designation
2) Material number
3) Serial number
4) Production date
5) Revision index

Fig. 12-3: Type Plate HLR01.1

12.3 Scope of Supply

The scope of supply of HLR braking resistors provided for mounting to drive controllers includes the joint bar for the equipment grounding conductor connection.

HLR01 - Braking Resistors

12.4 Technical Data

12.4.1 Technical Data HLR01 for HCS02.1

Assignment HLR01 to HCS02.1E

Braking Resistors HLR01 for HCS02

Converter	Braking resistor type[1)]	Type of construction [2)]	Type Dimensions [3)]
HCS02.1E-W0054-A-03-xNNx	HLR01.1N-01K8-N40R0-…	N	A7
HCS02.1E-W0054-A-03-xNNx	HLR01.1N-03K8-N40R0-…	N	B1
HCS02.1E-W0070-A-03-xNNx	HLR01.1N-02K4-N28R0-…	N	A8
HCS02.1E-W0070-A-03-xNNx	HLR01.1N-05K5-N28R2-…	N	B2

1) Complete type with: A-007-NNNN
2) A: Device mounting; N: Version for free assembly
3) See Project Planning Manual "Rexroth IndraDrive Additional Components and Accessories", dimension tables HLR

Tab. 12-2: Assignment Braking Resistors HLR ↔ HCS02

HLR01 for HCS02.1E-W0054

Technical Data - Currents, Voltages, Power

Description	Symbol	Unit	HLR01.1N-01K8-N40R0-A-007-NNNN	HLR01.1N-03K8-N40R0-A-007-NNNN
Degree of protection in accordance with IEC 60529	IP		IP20	
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0...40	
Mass	m	kg	6,60	9,50
Nominal braking resistance	$R_{DC\_Bleeder}$	ohm	40,00	
Braking resistor continuous power	P_{BD}	kW	1,80	3,80
Braking resistor peak power	P_{BS}	kW	18,00	
Regenerative power to be absorbed	W_{R_max}	kWs	72,00	300,00
Maximum allowed on-time duty	t_{on_max}	s	4,00	16,67
Minimum allowed cycle time	T_{cycl}	s	40,00	79,00
Cooling type			n	
Volumetric capacity of forced cooling	V	m^3/h	-	
Temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	65	
Minimum distance on the top of the device[1)]	d_{top}	mm	300	600
				Last modification: 2012-07-05

Description	Symbol	Unit	HLR01.1N-01K8-N40R0-A-007-NNNN	HLR01.1N-03K8-N40R0-A-007-NNNN
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	200	
Horizontal spacing on the device[3)]	d_{hor}	mm	200	
Allowed range tightening torque	M	Nm	1,80	2,00
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	12	
Last modification: 2012-07-05				

1) 2) 3) See fig. "Air Intake and Air Outlet at Device"
4) Copper wire; PVC-insulation (conductor temperature 90 °C); table 28.1; $T_a \leq 40$ °C

Tab. 12-3: HLR - Technical Data - Currents, Voltages, Power

NOTICE **Property damage due to temperatures higher than 105 °C!**

Observe the indicated minimum distances!

Above the devices there may only be such materials which

- are not combustible
- are insensitive to the occurring high temperatures

HLR01 for HCS02.1E-W0070

Technical Data - Currents, Voltages, Power

Description	Symbol	Unit	HLR01.1N-02K4-N28R0-A-007-NNNN	HLR01.1N-05K5-N28R0-A-007-NNNN
Degree of protection in accordance with IEC 60529	IP		IP20	
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0...40	
Mass	m	kg	7,90	13,00
Nominal braking resistance	$R_{DC\_Bleeder}$	ohm	28,00	
Braking resistor continuous power	P_{BD}	kW	2,40	5,50
Braking resistor peak power	P_{BS}	kW	26,00	
Regenerative power to be absorbed	W_{R_max}	kWs	100,80	420,00
Maximum allowed on-time duty	t_{on_max}	s	3,88	16,16
Minimum allowed cycle time	T_{cycl}	s	42,00	76,40
Cooling type			n	
Last modification: 2012-06-27				

HLR01 - Braking Resistors

Description	Symbol	Unit	HLR01.1N-02K4-N28R0-A-007-NNNN	HLR01.1N-05K5-N28R0-A-007-NNNN
Volumetric capacity of forced cooling	V	m^3/h	-	
Temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	65	
Minimum distance on the top of the device[1)]	d_{top}	mm	300	600
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	200	
Horizontal spacing on the device[3)]	d_{hor}	mm	200	
Allowed range tightening torque	M	Nm	1,80	2,00
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	12	
Last modification: 2012-06-27				

1) 2) 3) See fig. "Air Intake and Air Outlet at Device"
4) Copper wire; PVC-insulation (conductor temperature 90 °C); table 28.1; $T_a \leq 40$ °C

Tab. 12-4: HLR - Technical Data - Currents, Voltages, Power

NOTICE **Property damage due to temperatures higher than 105 °C!**

Observe the indicated minimum distances!

Above the devices there may only be such materials which

- are not combustible
- are insensitive to the occurring high temperatures

12.4.2 Technical Data HLR01 for HCS03.1E

Assignment HLR01 to HCS03.1E

Braking Resistors HLR01 for HCS03

Converter	Braking resistor type	Type of construction [1)]	Type Dimensions [2)]
HCS03.1E-W0070-A-05-xNBV	HLR01.1N-0300-N17R5-A-007-NNNN	A	See corresponding dimensional drawing
HCS03.1E-W0100-A-05-xNBV	HLR01.1N-0470-N11R7-A-007-NNNN		
HCS03.1E-W0150-A-05-xNBV	HLR01.1N-0780-N07R0-A-007-NNNN		
HCS03.1E-W0210-A-05-xNBV	HLR01.1N-1K08-N05R0-A-007-NNNN		
HCS03.1E-W0070-A-05-xNBV	HLR01.1N-01K6-N18R0-A-007-NNNN	N	A5
	HLR01.1N-01K6-N18R0-A-007-NNNU		A9
HCS03.1E-W0100-A-05-xNBV	HLR01.1N-02K0-N15R0-A-007-NNNN	N	A6
	HLR01.1N-02K0-N15R0-A-007-NNNU		A10

Converter	Braking resistor type	Type of construction 1)	Type Dimensions 2)
HCS03.1E-W0150-A-05-xNBV	HLR01.1N-04K5-N07R4-A-007-NNNN	N	B1
HCS03.1E-W0210-A-05-xNBV	HLR01.1N-06K5-N06R1-A-007-NNNN	N	B2
HCS03.1E-W0070-A-05-xNBV	HLR01.1N-03K5-N19R0-A-007-NNNN	N	B1
HCS03.1E-W0100-A-05-xNBV	HLR01.1N-05K0-N15R0-A-007-NNNN	N	B2
HCS03.1E-W0150-A-05-xNBV	HLR01.1N-08K5-N08R0-A-007-NNNN	N	B3
HCS03.1E-W0210-A-05-xNBV	HLR01.1N-12K5-N05R5-A-007-NNNN	N	B4
HCS03.1E-W0070-A-05-xNBV	HLR01.1N-04K5-N18R0-A-007-NNNN	N	B2
HCS03.1E-W0100-A-05-xNBV	HLR01.1N-07K0-N14R0-A-007-NNNN	N	B3
HCS03.1E-W0150-A-05-xNBV	HLR01.1N-11K0-N07R3-A-007-NNNN	N	B3
HCS03.1E-W0210-A-05-xNBV	HLR01.1N-17K0-N05R1-A-007-NNNN	N	B5
HCS03.1E-W0070-A-05-xNBV	HLR01.1N-06K5-N18R0-A-007-NNNN	N	B2
HCS03.1E-W0100-A-05-xNBV	HLR01.1N-09K5-N13R0-A-007-NNNN	N	B3
HCS03.1E-W0150-A-05-xNBV	HLR01.1N-15K0-N08R1-A-007-NNNN	N	B4
HCS03.1E-W0210-A-05-xNBV	HLR01.1N-23K0-N05R5-A-007-NNNN	N	C2
HCS03.1E-W0070-A-05-xNBV	HLR01.1N-10K0-N18R0-A-007-NNNN	N	B3
HCS03.1E-W0100-A-05-xNBV	HLR01.1N-14K5-N13R0-A-007-NNNN	N	B4
HCS03.1E-W0150-A-05-xNBV	HLR01.1N-24K0-N07R2-A-007-NNNN	N	C3
HCS03.1E-W0210-A-05-xNBV	HLR01.1N-36K0-N05R4-A-007-NNNN	N	C4

1) A: Device mounting; N: Version for free assembly
2) See Project Planning Manual "Rexroth IndraDrive Additional Components and Accessories", dimension tables HLR

Tab. 12-5: Assignment Braking Resistors HLR ↔ HCS03

HLR01 for HCS03.1E-W0070

Technical Data - Currents, Voltages, Power

Description	Symbol	Unit	HLR01.1N-01K6-N18R0-A-007-NNNN	HLR01.1N-0300-N17R5-A-007-NNNN	HLR01.1N-03K5-N19R0-A-007-NNNN	HLR01.1N-04K5-N18R0-A-007-NNNN	HLR01.1N-06K5-N18R0-A-007-NNNN	HLR01.1N-10K0-N18R0-A-007-NNNN
Degree of protection in accordance with IEC 60529	IP		IP20					
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0...40					
Mass	m	kg	5,20	3,00	9,50	13,00		22,00
Nominal braking resistance	$R_{DC\_Bleeder}$	ohm	18,00	17,50	19,00	18,00		
Braking resistor continuous power	P_{BD}	kW	1,60	0,30	3,50	4,50	6,50	10,00
Last modification: 2007-06-29								

HLR01 - Braking Resistors

Description	Symbol	Unit	HLR01.1N-01K6-N18R0-A-007-NNNN	HLR01.1N-0300-N17R5-A-007-NNNN	HLR01.1N-03K5-N19R0-A-007-NNNN	HLR01.1N-04K5-N18R0-A-007-NNNN	HLR01.1N-06K5-N18R0-A-007-NNNN	HLR01.1N-10K0-N18R0-A-007-NNNN
Braking resistor peak power	P_{BS}	kW	34,00	37,00	31,00	33,00		
Regenerative power to be absorbed	W_{R_max}	kWs	109,00	37,00	252,00	432,00	686,00	1080,00
Maximum allowed on-time duty	t_{on_max}	s	3,30	1,00	8,00	13,00	21,00	32,00
Minimum allowed cycle time	T_{cycl}	s	120,00					
Cooling type			n	f	n			
Volumetric capacity of forced cooling	V	m^3/h	-	200,00	-			
Temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	>40	20	>65		>100	
Minimum distance on the top of the device[1)]	d_{top}	mm	1000	80	1000			
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	200	80	300			
Horizontal spacing on the device[3)]	d_{hor}	mm	200	0	300			
Allowed range tightening torque	M	Nm	1,80	1,50	2,00			
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	14		12	10	8	
Last modification: 2007-06-29								

1) 2) 3) See fig. "Air Intake and Air Outlet at Device"
4) Copper wire; PVC-insulation (conductor temperature 90 °C); table 28.1; $T_a \leq 40$ °C

Tab. 12-6: HLR - Technical Data - Currents, Voltages, Power

NOTICE **Property damage due to temperatures higher than 105 °C!**

Observe the indicated minimum distances!

Above the devices there may only be such materials which

- are not combustible
- are insensitive to the occurring high temperatures

HLR01 for HCS03.1E-W0100

Technical Data - Currents, Voltages, Power

Description	Symbol	Unit	HLR01.1N-02K0-N15R0-A-007-NNNN	HLR01.1N-0470-N11R7-A-007-NNNN	HLR01.1N-05K0-N15R0-A-007-NNNN	HLR01.1N-07K0-N14R0-A-007-NNNN	HLR01.1N-09K5-N13R0-A-007-NNNN	HLR01.1N-14K5-N13R0-A-007-NNNN
Degree of protection in accordance with IEC 60529	IP		IP20					
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0...40					
Mass	m	kg	6,20	4,50	13,00	22,00		33,00
Nominal braking resistance	$R_{DC\_Bleeder}$	ohm	15,00	11,70	15,00	14,00	13,00	
Braking resistor continuous power	P_{BD}	kW	2,00	0,47	5,00	7,00	9,50	14,50
Braking resistor peak power	P_{BS}	kW	40,00	56,00	40,00	43,00	46,00	
Regenerative power to be absorbed	W_{R_max}	kWs	137,00	56,00	360,00	672,00	1003,00	1566,00
Maximum allowed on-time duty	t_{on_max}	s	3,40	1,00	9,00	16,00	22,00	34,00
Minimum allowed cycle time	T_{cycl}	s	120,00					
Cooling type			n	f	n			
Volumetric capacity of forced cooling	V	m^3/h	-	200,00	-			
Temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	>40	23	>65			
Minimum distance on the top of the device[1)]	d_{top}	mm	1000	80	1000			
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	200	80	300			
Horizontal spacing on the device[3)]	d_{hor}	mm	200	0	300			
Allowed range tightening torque	M	Nm	0,50	4,00	2,00			3,00
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	12		10	8		6
Last modification: 2013-11-14								

1) 2) 3) See fig. "Air Intake and Air Outlet at Device"
4) Copper wire; PVC-insulation (conductor temperature 90 °C); table 28.1; $T_a \leq 40$ °C

Tab. 12-7: HLR - Technical Data - Currents, Voltages, Power

HLR01 - Braking Resistors

NOTICE **Property damage due to temperatures higher than 105 °C!**

Observe the indicated minimum distances!

Above the devices there may only be such materials which

- are not combustible
- are insensitive to the occurring high temperatures

HLR01 for HCS03.1E-W0150

Technical Data - Currents, Voltages, Power

Description	Symbol	Unit	HLR01.1N-04K5-N07R4-A-007-NNNN	HLR01.1N-0780-N07R0-A-007-NNNN	HLR01.1N-08K5-N08R0-A-007-NNNN	HLR01.1N-11K0-N07R3-A-007-NNNN	HLR01.1N-15K0-N08R1-A-007-NNNN	HLR01.1N-24K0-N07R2-A-007-NNNN
Degree of protection in accordance with IEC 60529	IP		IP20					
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0...40					
Mass	m	kg	9,50	5,50	22,00		33,00	80,00
Nominal braking resistance	$R_{DC\_Bleeder}$	ohm	7,40	7,00	8,00	7,30	8,10	7,20
Braking resistor continuous power	P_{BD}	kW	4,50	0,78	8,50	11,00	15,00	24,00
Braking resistor peak power	P_{BS}	kW	81,00	93,00	75,00	82,00	74,00	83,00
Regenerative power to be absorbed	W_{R_max}	kWs	246,00	93,00	612,00	1056,00	1584,00	2592,00
Maximum allowed on-time duty	t_{on_max}	s	3,00	1,00	8,20	13,00	21,00	31,00
Minimum allowed cycle time	T_{cycl}	s	120,00					
Cooling type			n	f	n			
Volumetric capacity of forced cooling	V	m^3/h	-	200,00	-			
Temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	>100	20	>65			>100
Minimum distance on the top of the device[1)]	d_{top}	mm	1000	80	1000			
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	300	80	300			
Horizontal spacing on the device[3)]	d_{hor}	mm	300	0	300			

Last modification: 2007-06-29

Description	Symbol	Unit	HLR01.1N-04K5-N07R4-A-007-NNNN	HLR01.1N-0780-N07R0-A-007-NNNN	HLR01.1N-08K5-N08R0-A-007-NNNN	HLR01.1N-11K0-N07R3-A-007-NNNN	HLR01.1N-15K0-N08R1-A-007-NNNN	HLR01.1N-24K0-N07R2-A-007-NNNN
Allowed range tightening torque	M	Nm	3,00	4,00	3,00			6,00
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	8		6	3		2
Last modification: 2007-06-29								

1) 2) 3) See fig. "Air Intake and Air Outlet at Device"
4) Copper wire; PVC-insulation (conductor temperature 90 °C); table 28.1; $T_a \leq 40$ °C

Tab. 12-8: HLR - Technical Data - Currents, Voltages, Power

NOTICE **Property damage due to temperatures higher than 105 °C!**

Observe the indicated minimum distances!

Above the devices there may only be such materials which

- are not combustible
- are insensitive to the occurring high temperatures

HLR01 for HCS03.1E-W0210

Technical Data - Currents, Voltages, Power

Description	Symbol	Unit	HLR01.1N-06K5-N06R1-A-007-NNNN	HLR01.1N-12K5-N05R5-A-007-NNNN	HLR01.1N-17K0-N05R1-A-007-NNNN	HLR01.1N-1K08-N05R0-A-007-NNNN	HLR01.1N-23K0-N05R5-A-007-NNNN	HLR01.1N-36K0-N05R4-A-007-NNNN
Degree of protection in accordance with IEC 60529	IP		IP20					
Ambient temperature range for operation with nominal data	T_{a_work}	°C	0...40					
Mass	m	kg	13,00	33,00	43,00	8,00	56,00	93,00
Nominal braking resistance	$R_{DC\_Bleeder}$	ohm	6,10	5,50	5,10	5,00	5,50	5,40
Braking resistor continuous power	P_{BD}	kW	6,50	12,50	17,00	1,08	23,00	36,00
Braking resistor peak power	P_{BS}	kW	98,00	109,00	117,00	130,00	109,00	111,00
Regenerative power to be absorbed	W_{R_max}	kWs	356,00	900,00	1632,00	130,00	2429,00	3888,00
Maximum allowed on-time duty	t_{on_max}	s	3,60	8,30	14,00	1,00	22,00	35,00
Minimum allowed cycle time	T_{cycl}	s	120,00					
Cooling type			n			f	n	
Last modification: 2007-06-29								

HLR01 - Braking Resistors

Description	Symbol	Unit	HLR01.1N-06K5-N06R1-A-007-NNNN	HLR01.1N-12K5-N05R5-A-007-NNNN	HLR01.1N-17K0-N05R1-A-007-NNNN	HLR01.1N-1K08-N05R0-A-007-NNNN	HLR01.1N-23K0-N05R5-A-007-NNNN	HLR01.1N-36K0-N05R4-A-007-NNNN
Volumetric capacity of forced cooling	V	m^3/h	-			200,00	-	
Temperature rise with minimum distances d_{bot}; d_{top}; P_{BD}	ΔT	K	>100			22	>200	
Minimum distance on the top of the device[1)]	d_{top}	mm	1000			80	1000	
Minimum distance on the bottom of the device[2)]	d_{bot}	mm	300			80	300	
Horizontal spacing on the device[3)]	d_{hor}	mm	300			0	300	
Allowed range tightening torque	M	Nm	6,00					
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[4)]	A_{LN}	AWG	6	2		6	1/0	
Last modification: 2007-06-29								

1) 2) 3) See fig. "Air Intake and Air Outlet at Device"
4) Copper wire; PVC-insulation (conductor temperature 90 °C); table 28.1; $T_a \leq 40$ °C

Tab. 12-9: HLR - Technical Data - Currents, Voltages, Power

NOTICE **Property damage due to temperatures higher than 105 °C!**

Observe the indicated minimum distances!

Above the devices there may only be such materials which

- are not combustible
- are insensitive to the occurring high temperatures

12.4.3 Technical Data HLR01 for HCS04.2

Braking resistors for HCS04.2:

- HLR01.1N-22K0-N03R5-B-007-NNNN
- HLR01.1N-44K0-N03R3-B-007-NNNN
- HLR01.1N-66K0-N02R1-B-007-NNNN

Assignment and technical data:

📖 See Project Planning Manual "Rexroth IndraDrive Drive Controllers HCS04.2E" (material number: R911327334).

12.5 Installation and Mounting

12.5.1 Notes on Installation and Mounting

⚠ WARNING **Lethal electric shock by live parts with more than 50 V!**

Connect the braking resistor to the equipment grounding system of the control cabinet.

- Braking resistors of **type of construction A**: For the equipment grounding connection, mount the joint bar on the front between braking resistor and drive controller.
- Braking resistors of **type of construction N**: Connect the equipment grounding conductor in stationary form to the equipment grounding system of the control cabinet.

Check the continuity of the equipment grounding conductors from the mains connection to the housings of the braking resistors.

☞ **Equipment grounding conductor: Material and cross section**

For the equipment grounding conductor, use the same metal (e.g. copper) as for the outer conductors.

For the connections from the equipment grounding conductor connection of the device to the equipment grounding conductor system in the control cabinet, make sure the cross sections of the lines are sufficient.

Cross sections of the equipment grounding connections:

- For **HCS03.1E** drive controllers, **HMV01** and **HMV02** supply units at least **10 mm² (AWG 8)**, but not smaller than the cross sections of the outer conductors of the mains supply feeder
- For **HCS02.1E** drive controllers, **at least 4 mm² (AWG 10)**, but not smaller than the cross sections of the outer conductors of the mains supply feeder

  Additionally, mount the housing of HCS02.1E to a bare metal mounting plate. Connect the mounting plate, too, with at least the same cross section to the equipment grounding conductor system in the control cabinet.

For outer conductors with a cross section greater than 16 mm², you can reduce the cross section of the equipment grounding connection according to the table "Equipment Grounding Conductor Cross Section".

Cross-sectional area A of outer conductors	Minimum cross-sectional area A_{PE} of equipment grounding connection
A ≤ 16 mm²	A
16 mm² < A ≤ 35 mm²	16
35 mm² < A	A / 2

Tab. 12-10: Equipment grounding conductor cross section

⚠ CAUTION **Hot surface!**

The surface and housing parts of the braking resistor can have a temperature of more than 250 °C in operation.

Do not stress and do not touch surfaces and housing parts of braking resistors.

Before touching the surfaces and housing parts of braking resistors, wait for an adequate time after switching off power to allow the braking resistors to cool down.

NOTICE **High temperatures in the proximity of braking resistors!**

Mount the braking resistors to temperature-resistant mounting surfaces in such a way that the air can freely enter and escape and heat does not accumulate.

Take the minimum distances d_{top}, d_{bot} and d_{hor} into account.

Take into account that the temperatures in the range of the indicated minimum distances can be above 250 °C.

Leave sufficient distance to combustible objects and take into account that braking resistors dissipate a lot of heat.

Make sure there is free cooling air supply at the bottom d_{bot} and cooling air discharge at the top d_{top}.

The space must be able to discharge the energy converted by the braking resistor.

☞ **Observe degree of protection!**

When mounted outdoor or at the outside of the control cabinet, observe the degree of protection IP20 of the braking resistor.

Protect the devices against intrusion of water.

12.5.2 Braking Resistors HLR01.1, Type of Construction A (Version for Device Mounting)

General Information

Only HLR01 braking resistors of the **type of construction A** are suited for mounting to HCS03 drive controllers (see index entry "HLR01 → For HCS03").

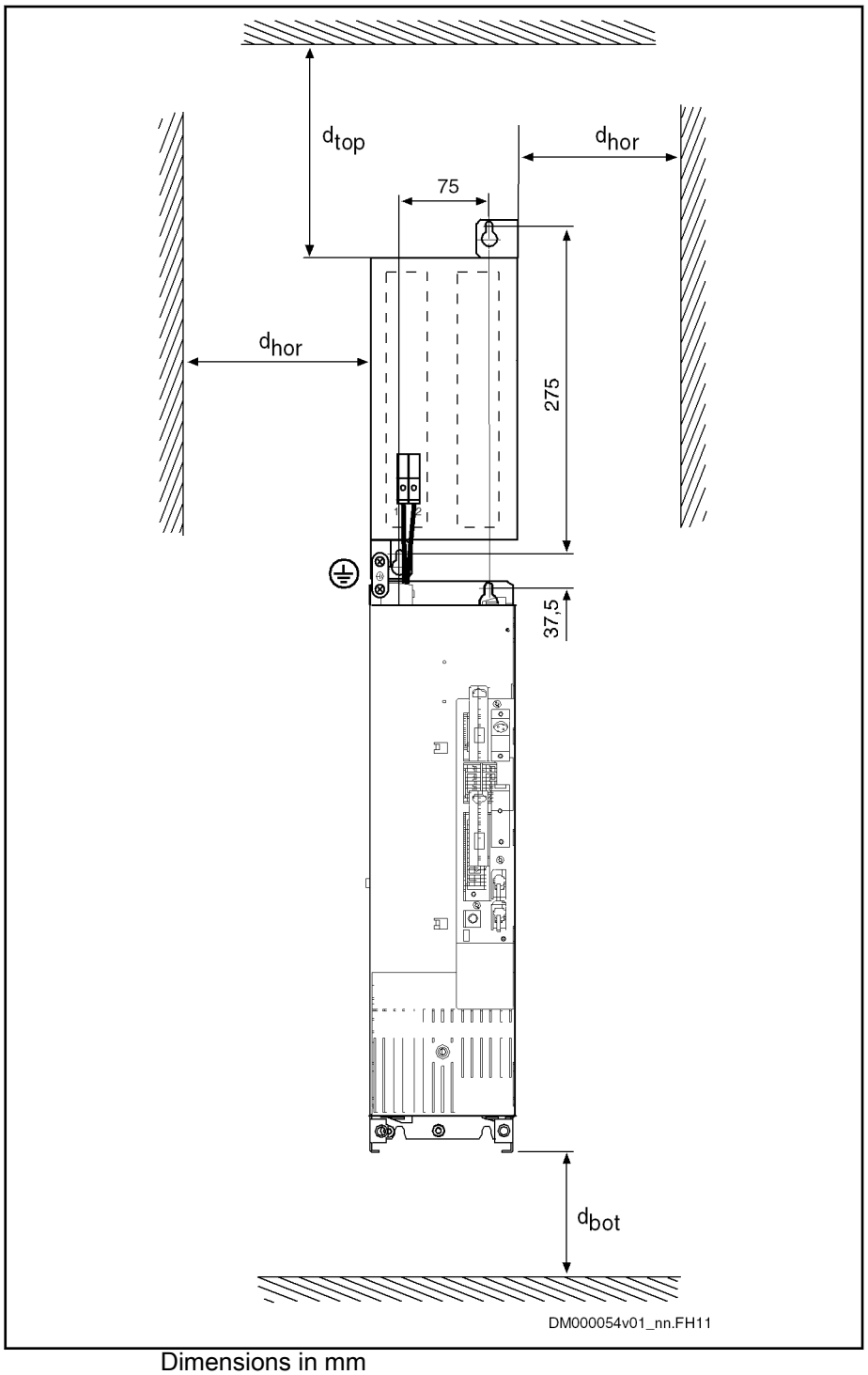
☞ The braking resistors provided for mounting above the HCS03 drive controllers are cooled by the cooling air of the drive controller flowing off.

For other mounting situations, the HLR braking resistors must be separately cooled:

Cooling air current of at least 200 m³/h through the braking resistor

HCS03.1E-W0070-xNBV with HLR01.1N-0300-N17R-A-007-NNNN

Dimensions for Mounting



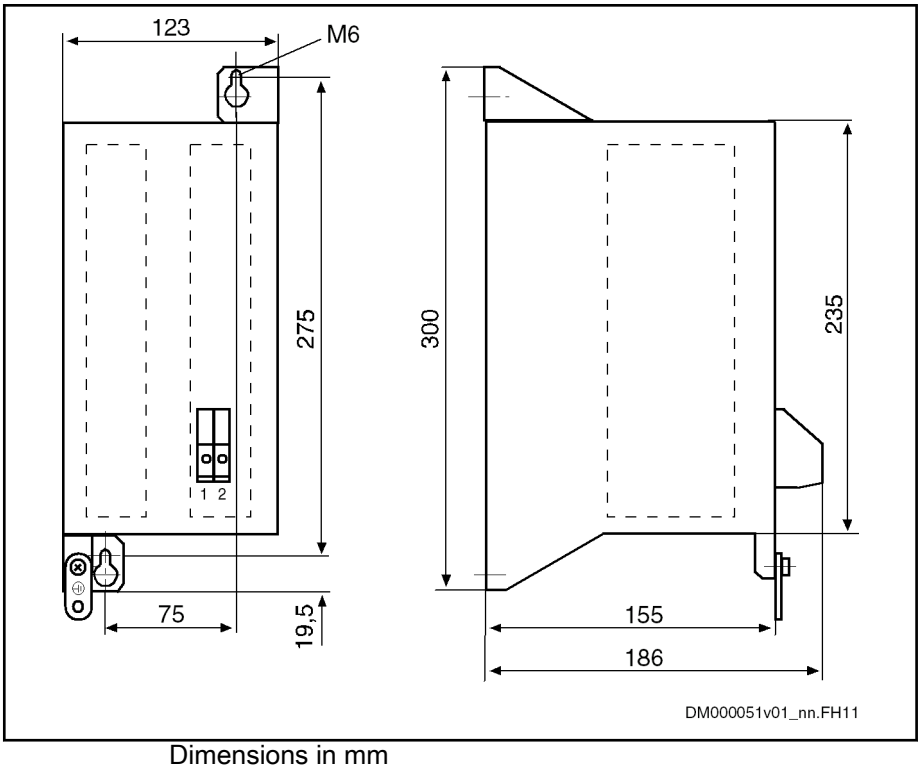
Dimensions in mm

d_{top}, d_{bot}, d_{hor} Distances at top and bottom and on the sides; values: see technical data

Fig. 12-4: Mounting Example Device / Braking Resistor HLR01.1N-0300-N17R5-A-007-NNNN

HLR01 - Braking Resistors

Dimensional Drawing HLR01.1N-0300-N17R5-A-007-NNNN

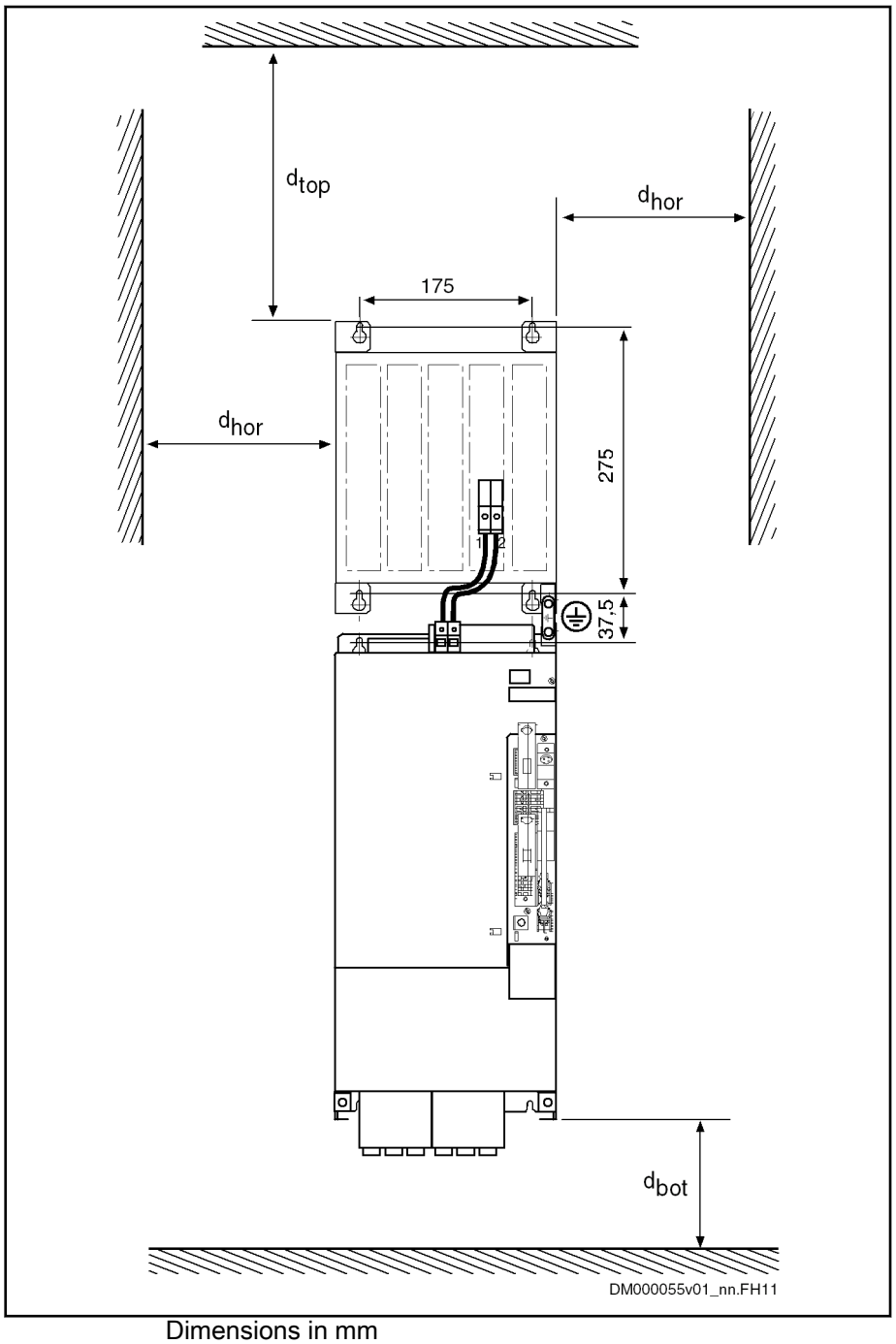


Dimensions in mm

Fig. 12-5: Dimensions Braking Resistor HLR01.1N-0300-N17R5-A-007-NNNN

HCS03.1E-W0100-xNBV with HLR01.1N-0470-N11R7-A-007-NNNN

Dimensions for Mounting



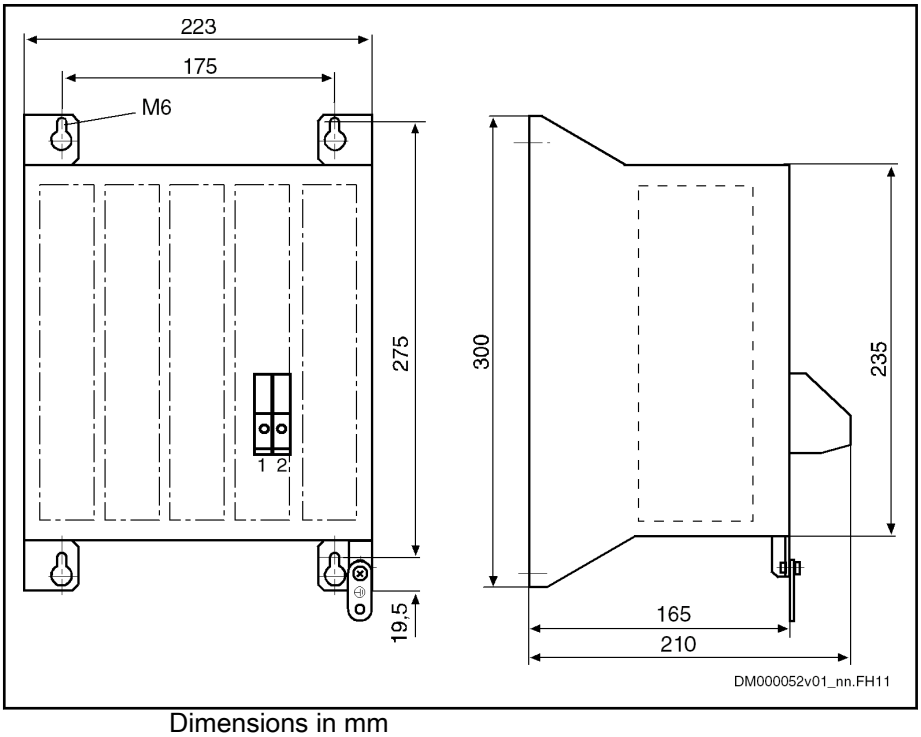
Dimensions in mm

d_{top}, d_{bot}, d_{hor} Distances at top and bottom and on the sides; values: see technical data

Fig. 12-6: Mounting Example Device / Braking Resistor HLR01.1N-0470-N11R7-A-007-NNNN and HLR01.1N-0780-N07R7-A-007-NNNN

HLR01 - Braking Resistors

Dimensional Drawing HLR01.1N-0470-N11R7-A-007-NNNN

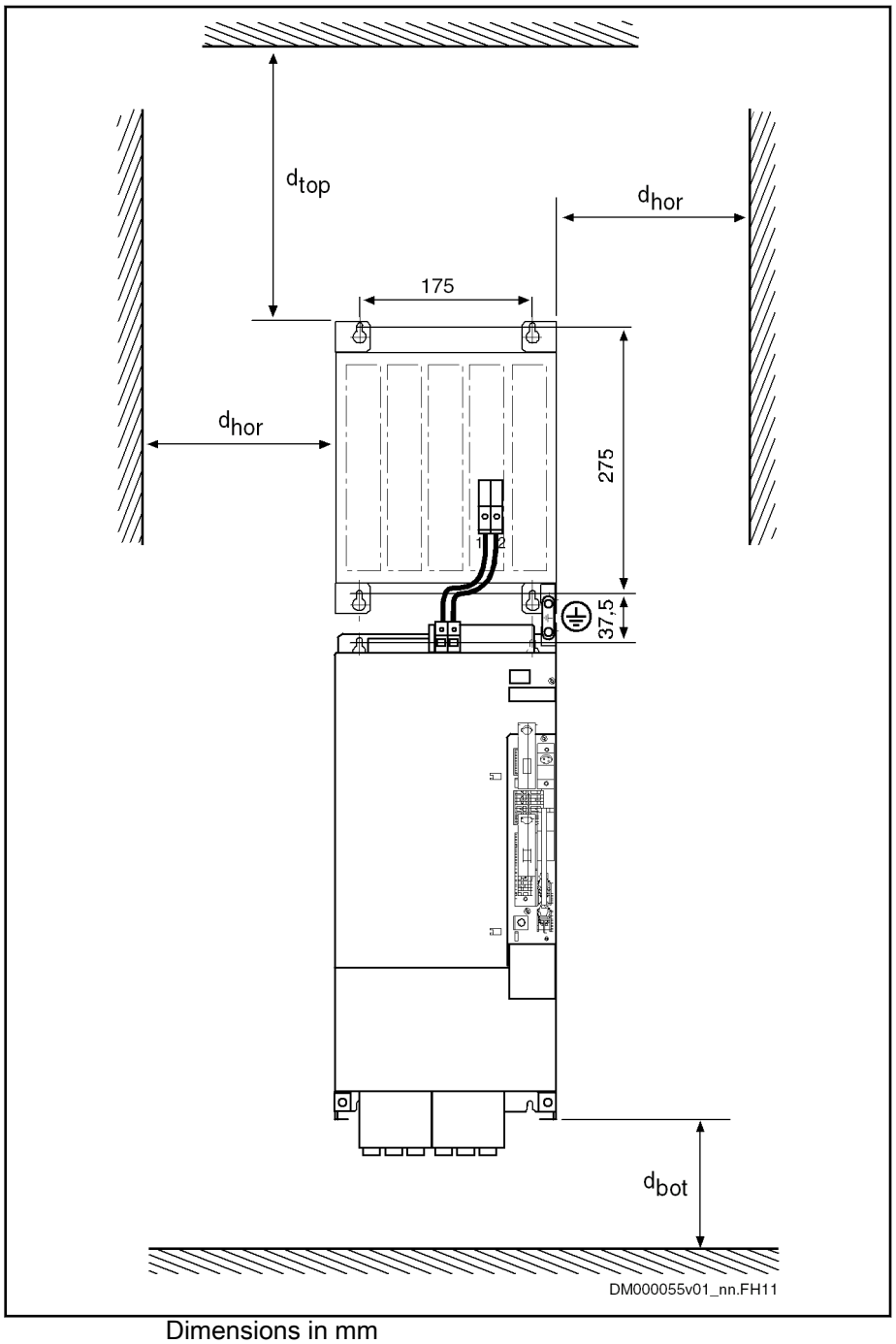


Dimensions in mm

Fig. 12-7: Dimensions Braking Resistor HLR01.1N-0470-N11R7-A-007-NNNN

HCS03.1E-W0150-xNBV with HLR01.1N-0780-N07R7-A-007-NNNN

Dimensions for Mounting



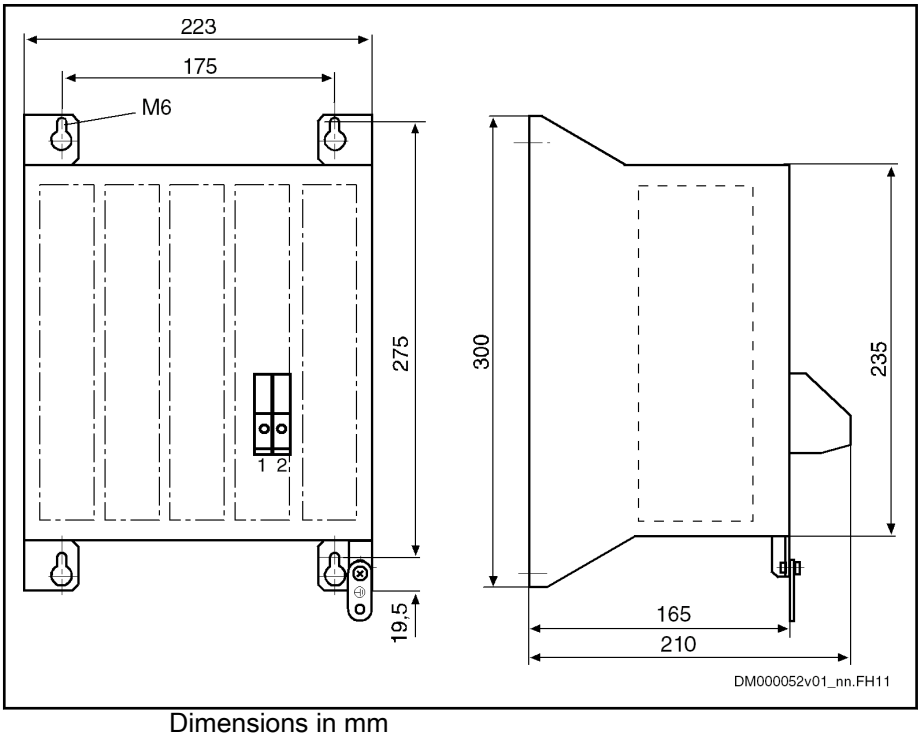
Dimensions in mm

d_{top}, d_{bot}, d_{hor} Distances at top and bottom and on the sides; values: see technical data

Fig. 12-8: Mounting Example Device / Braking Resistor HLR01.1N-0780-N07R7-A-007-NNNN

HLR01 - Braking Resistors

Dimensional Drawing HLR01.1N-0780-N07R0-A-007-NNNN

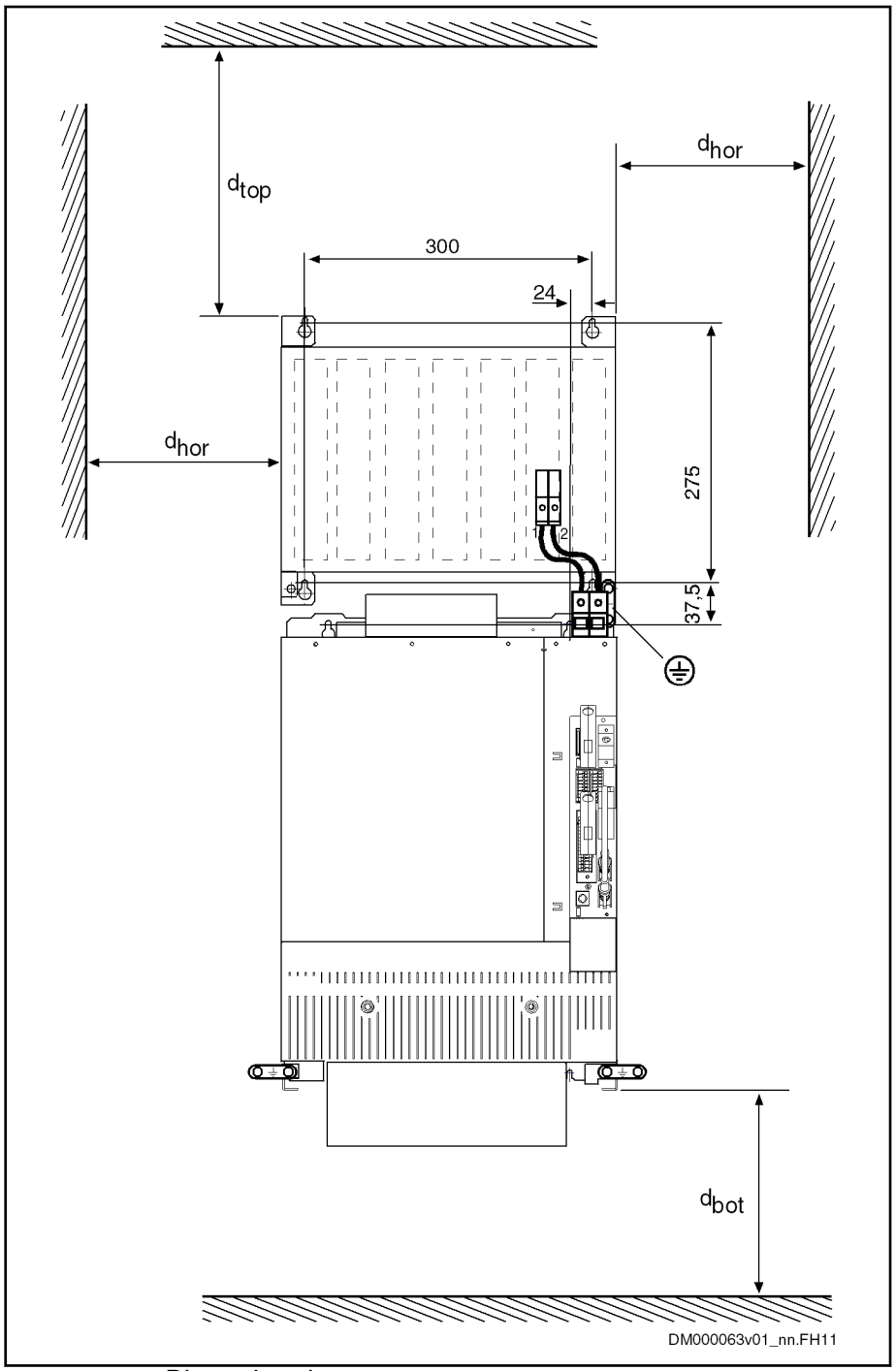


Dimensions in mm

Fig. 12-9: Dimensions Braking Resistor HLR01.1N-0780-N07R0-A-007-NNNN

HCS03.1E-W0210-xNBV with HLR01.1N-1K08-N05R0-A-007-NNNN

Dimensions for Mounting



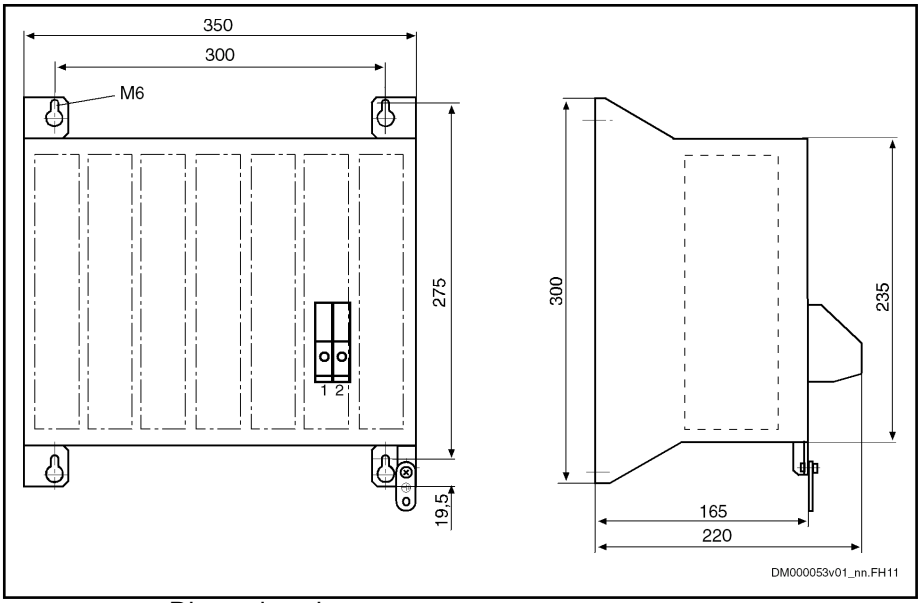
Dimensions in mm

d_{top}, d_{bot}, d_{hor} Distances at top and bottom and on the sides; values: see technical data

Fig. 12-10: Mounting Example Device / Braking Resistor HLR01.1N-1K08-N05R0-A-007-NNNN

HLR01 - Braking Resistors

Dimensional Drawing HLR01.1N-1K08-N05R0-A-007-NNNN

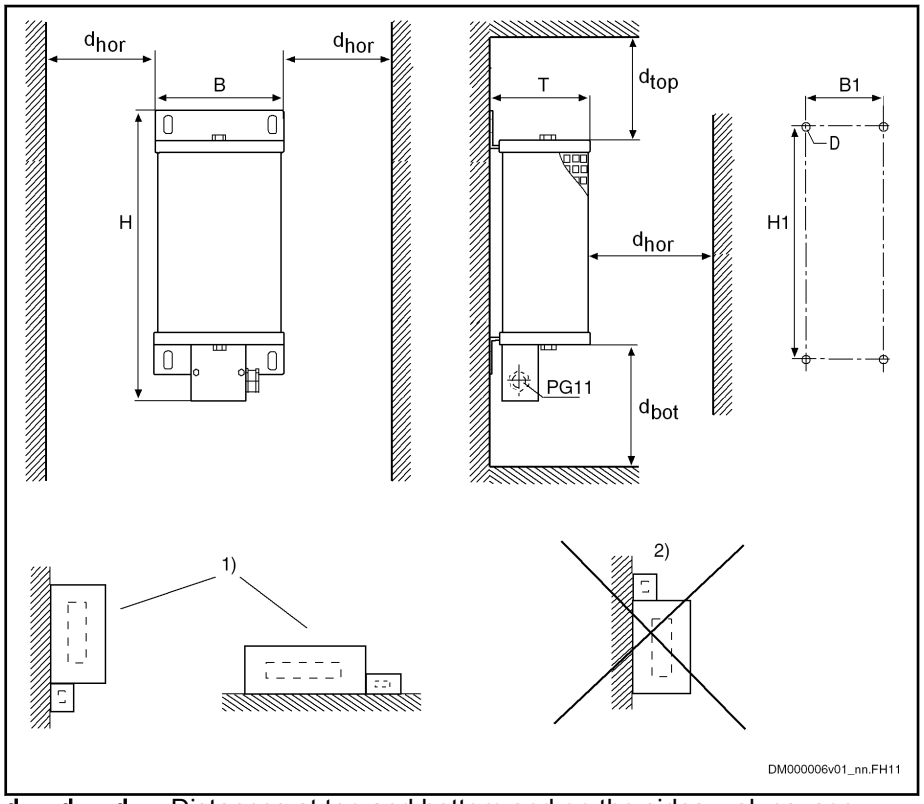


Dimensions in mm

Fig. 12-11: Dimensions Braking Resistor HLR01.1N-1K08-N05R0-A-007-NNNN

12.5.3 Braking Resistors HLR01.1, Type of Construction N (Version for Free Assembly)

Fixed Resistor IP 20 Type A



d_{top}, d_{bot}, d_{hor} Distances at top and bottom and on the sides; values: see technical data

1) Allowed mounting position (terminals at the bottom; on horizontal surfaces)

2) Inadmissible mounting position (terminals at the top, to the right and to the left)

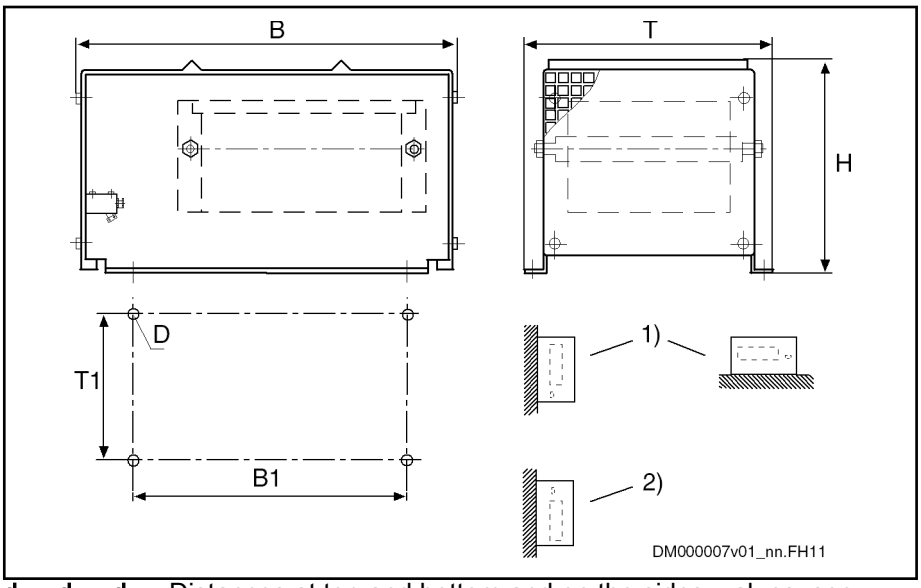
Fig. 12-12: Type A5 – A6

Type	Dimensions [mm]						Weight [kg]
	H	B	T	H1	B1	D	
A5	586	185	120	526	150	M6	5,2
A6	686	185	120	626	150	M6	6,2
A7	549	275	120	430	240	M6	6,6
A8	649	275	120	530	240	M6	7,9
A9	649	185	120	530	150	M6	5,8
A10	749	185	120	630	150	M6	6,7

Tab. 12-11: Dimension Table Braking Resistor Type A

HLR01 - Braking Resistors

Steel-Grid Fixed Resistor IP 20 Type B



d_{top}, d_{bot}, d_{hor} Distances at top and bottom and on the sides; values: see technical data

1) Allowed mounting position (terminals at the bottom; perforated sheet at the top and at the bottom; on horizontal surfaces)

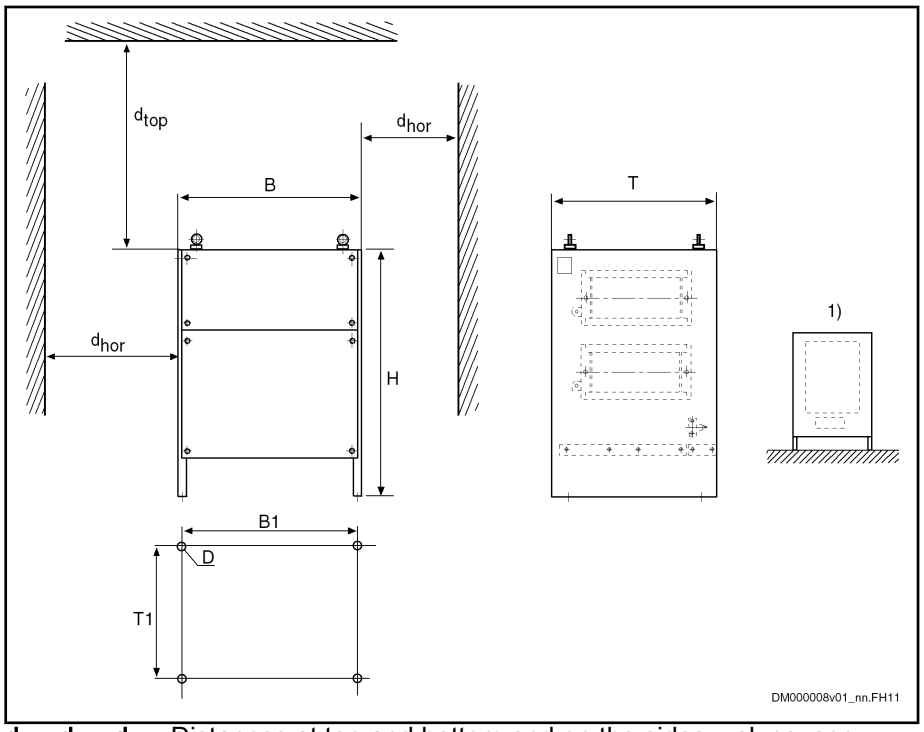
2) Inadmissible mounting position (terminals at the top, to the right and to the left)

Fig. 12-13: Type B1 – B4

Type	Dimensions [mm]						Weight [kg]
	B	T	H	B1	T1	D	
B1	490	300	270	380	270	M10	9,5
B2	490	400	270	380	370	M10	13
B3	490	600	270	380	570	M10	22
B4	490	800	270	380	770	M10	33
B5	490	1000	270	380	970	M10	44

Tab. 12-12: Dimension Table Braking Resistor Type B

Steel-Grid Fixed Resistor IP 20 Type C



d_{top}, d_{bot}, d_{hor} Distances at top and bottom and on the sides; values: see technical data

1) Allowed mounting position (vertically on horizontal surfaces)

Fig. 12-14: Type C1 – C7

Type	Dimensions [mm]						Weight [kg]
	B	T	H	B1	T1	D	
C2	595	490	710	570	380	M10	56
C3	795	490	710	770	380	M10	80
C4	995	490	710	970	380	M10	93

Tab. 12-13: Dimension Table Braking Resistor Type C

13 HLT01 - Braking Unit

13.1 Use

Function

An HLT controls an external HLR braking resistor, when no internal braking unit is available in the drive controller.

Drive controller with external braking unit HLT:

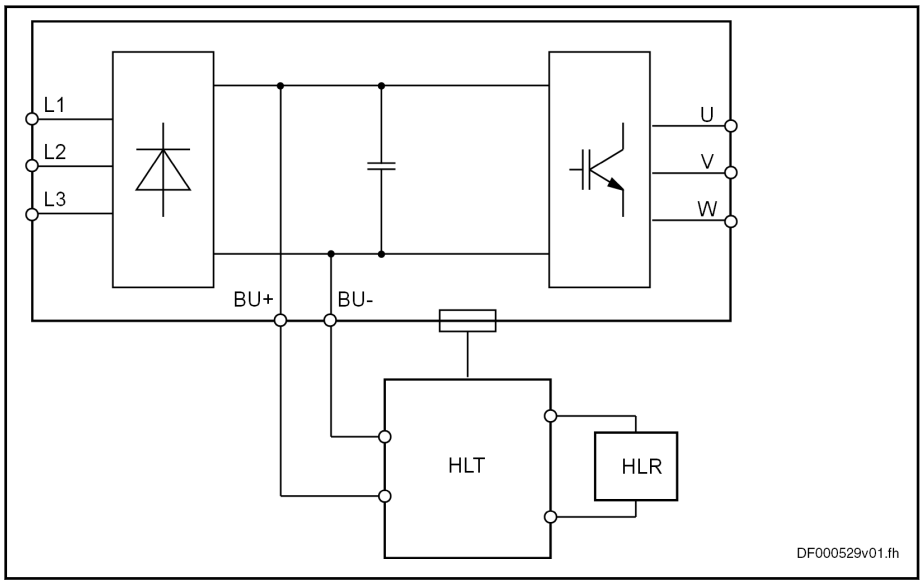


Fig. 13-1: External Braking Unit HLT

When the DC bus voltage, due to a deceleration process, exceeds a value to be set, the external braking resistor (as a load) is connected to the DC bus. The HLR braking resistor converts the generated energy into thermal energy and thereby keeps the DC bus voltage from rising.

HLT01 - Braking Unit

13.2 Identification

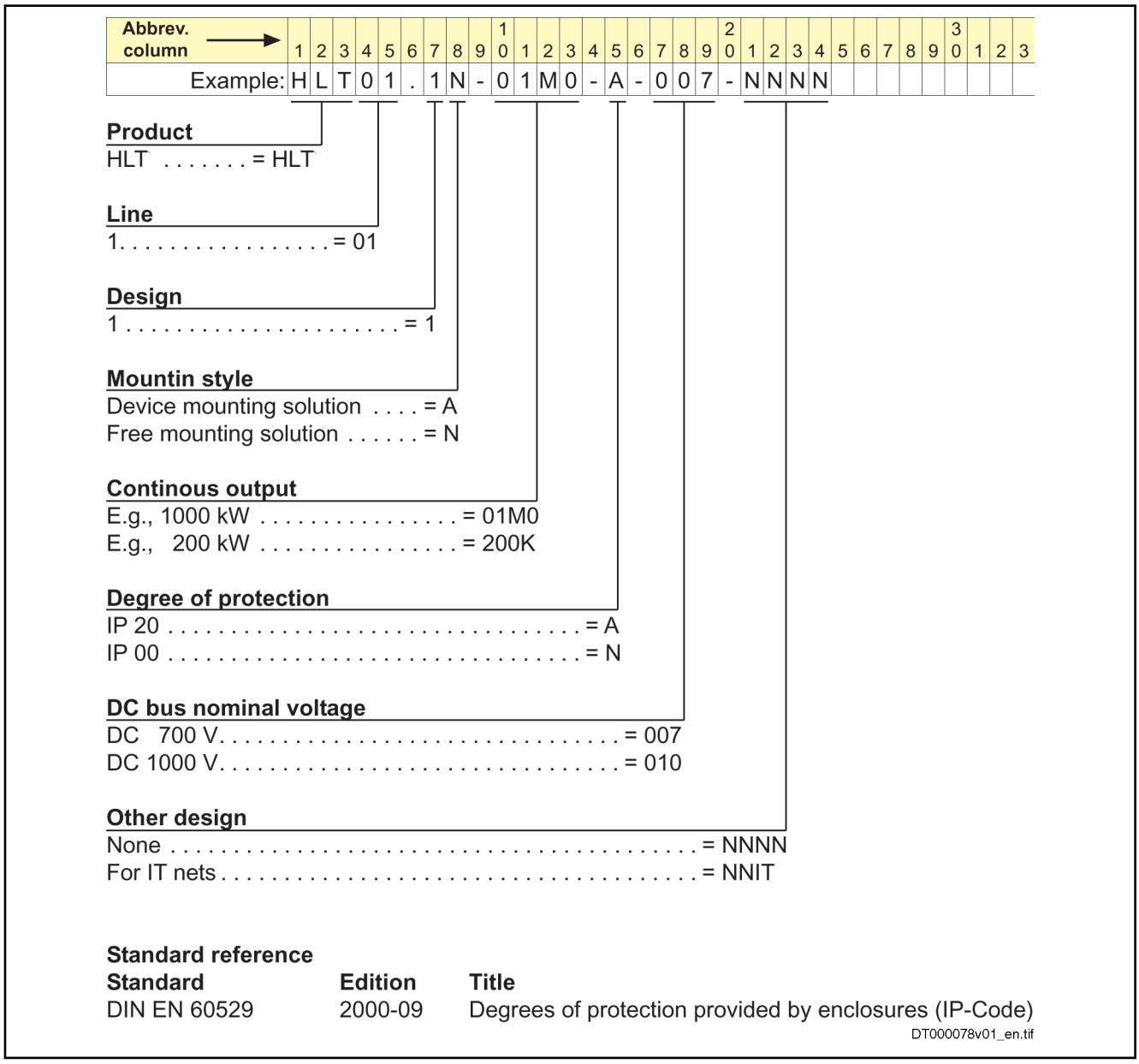


Fig. 13-2: Type Code

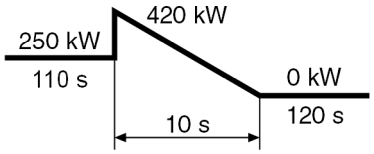
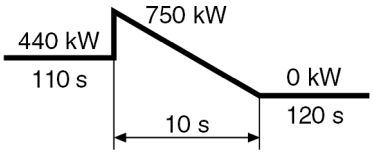
13.3 Braking Unit HLT01.1A

13.3.1 Technical Data

Vibrations	In accordance with IEC/EN 60068-2-6
	1.5 mm in the range of 3 … 10 Hz, 0.6 g from 10 … 200 Hz
	(3M3 in accordance with IEC/EN 60721-3-3)
Shock	In accordance with IEC/EN 60068-2-27
	4 g for 11 ms (3M2 in accordance with IEC/EN 60721-3-3)
Operating temperature	-10 … +40°C
	(3K3 in accordance with IEC/EN 60721-3-3)
	Up to +55°C with derating
Storage/transport temperature	-25 … +70°C
Degree of protection	Lateral, front IP31
	Top IP20
	Bottom IP00
Environment class / humidity	Class 3K3 in accordance with IEC/EN 60721-3-3 / no moisture condensation, max. 95% relative humidity
Installation altitude	Up to 1,000 m; above that, derating by 1% per 100 m up to 3,000 m
Allowed pollution	Pollution degree 2 in accordance with EN 61800-5-1
	3C2 and 3S2 in accordance with EN 60721-3-3
Protection class	Class 1 in accordance with EN 50178
Basic standard	The devices were developed, built and tested on the basis of EN 50178.
EMC immunity	In accordance with EN 61800-3, 1st and 2nd environment
	(IEC 1000-4-2; IEC 1000-4-3; IEC 1000-4-4; IEC 1000-4-5; IEC 1000-4-6)
EMC emission	In accordance with product standard EN 61800-3
	1st and 2nd environment, category C2, C3
Insulation	Galvanic isolation in accordance with EN 50178 PELV
	(Protective Extra Low Voltage)

	HLT01.1A-200K-N-007-NNNN	**HLT01.1A-400K-N-007-NNNN**
Assignment HCS04.2	HCS04.2E-W0640 HCS04.2E-W0790	HCS04.2E-W1010 HCS04.2E-W1240 HCS04.2E-W1540
Peak braking power	420 kW	750 kW
Max. continuous braking power	200 kW	400 kW
Possible braking power depending on the duty cycle	420 kW for 5% 320 kW for 15% 250 kW for 50%	750 kW for 5% 550 kW for 15% 440 kW for 50%
Cycle time	240 s	240 s

HLT01 - Braking Unit

	HLT01.1A-200K-N-007-NNNN	HLT01.1A-400K-N-007-NNNN
Typ. braking power for crane operation		
Min. braking resistance	1.05 Ω	0.7 Ω
Power dissipation at 100% I_N	550 W	1,050 W
Cooling air volume	100 m^3/h	600 m^3/h
Mass	30 kg	70 kg
Mounting	Attached to the left side wall of the converter. This increases the device width to 655 mm.	Mounted on the left next to the converter; the connection lines for a distance of 110 mm to the converter housing are included. A distance of up to 1 m is allowed with adjusted connection lines.

13.3.2 Braking Unit HLT01.1A -200K

Dimensions

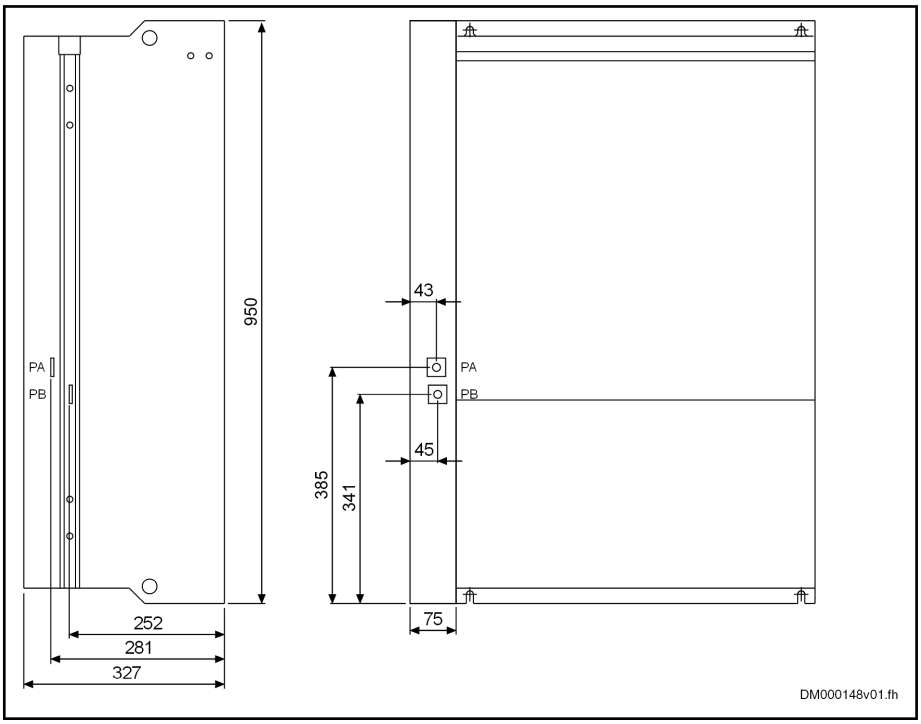
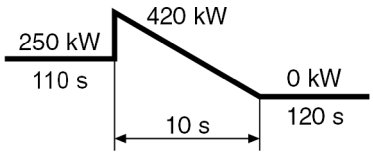


Fig. 13-3: Dimensions Braking Unit HLT01.1A -200K

Power connections

Description	Connection	Tightening torque
HLT01.1A+, HLT01.1A-	M10	24 Nm
PA, PB	M10	24 Nm

Technical Data

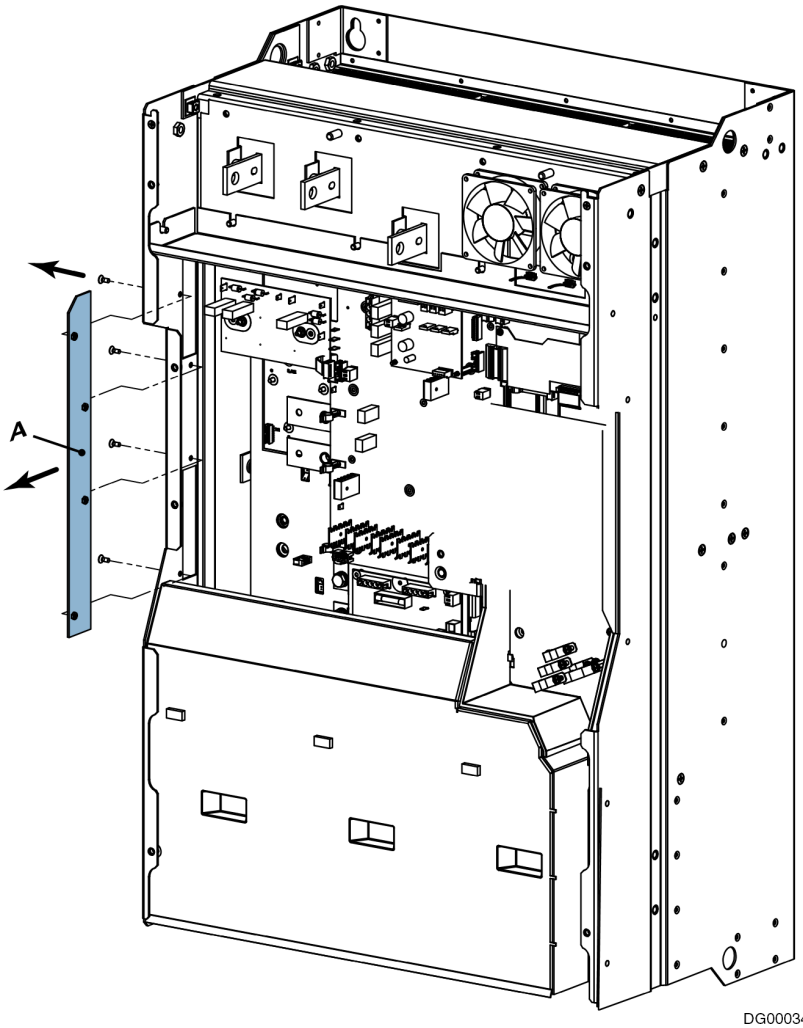
Braking unit	HLT01.1A-200K-N-007-NNNN
Power dissipation at 100% I_N	550 W
Cooling air volume	100 m^3/h
Peak braking power	420 kW
Max. continuous braking power	200 kW
Possible braking power depending on the duty cycle	420 kW for 5 % 320 kW for 15 % 250 kW for 50%
Cycle time	240 s
Typ. braking power for crane operation	
Min. braking resistance	1.05 Ω
Mass	30 kg

Installing HLT01.1A -200

Mount the braking unit at the left hand side of the converter. To do this, proceed as follows:

1. Mount the converter.
2. Remove the cover of the converter; when doing this, take the safety recommendations described in this manual into account.
3. Remove the detachable part A at the left of the converter.

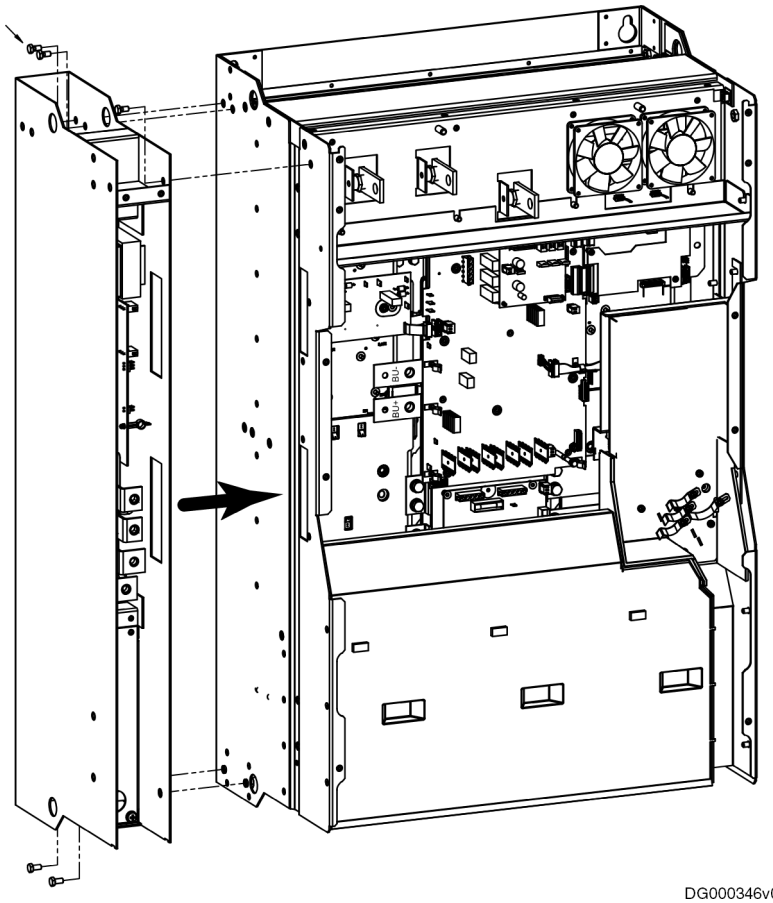
HLT01 - Braking Unit



DG000345v01.fh

4. Mount the braking unit at the left hand side of the converter. There are 5 mounting points (5xM8).

HLT01 - Braking Unit



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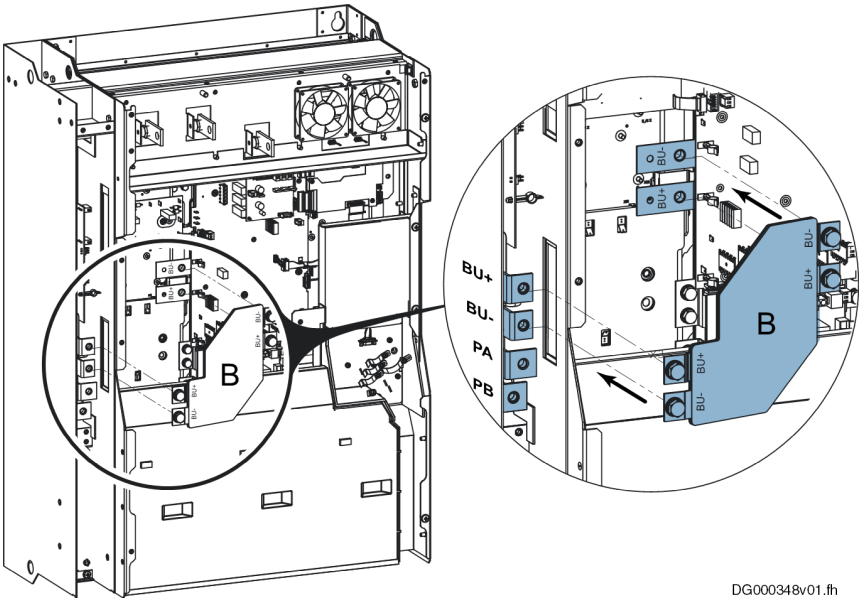
5. Connect the bus bar B between the terminals BU- and BU+ of the converter and the terminals BU- and BU+ of the braking unit.
6. Connect the braking resistor to PA and PB.



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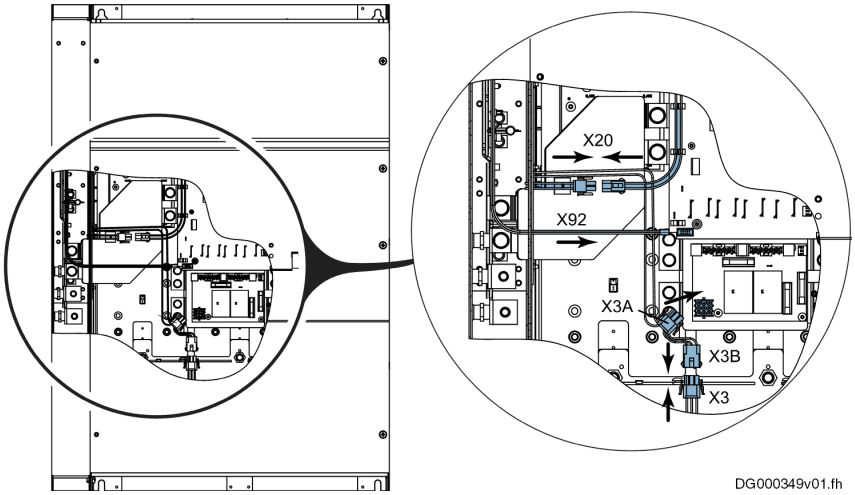
HLT01 - Braking Unit

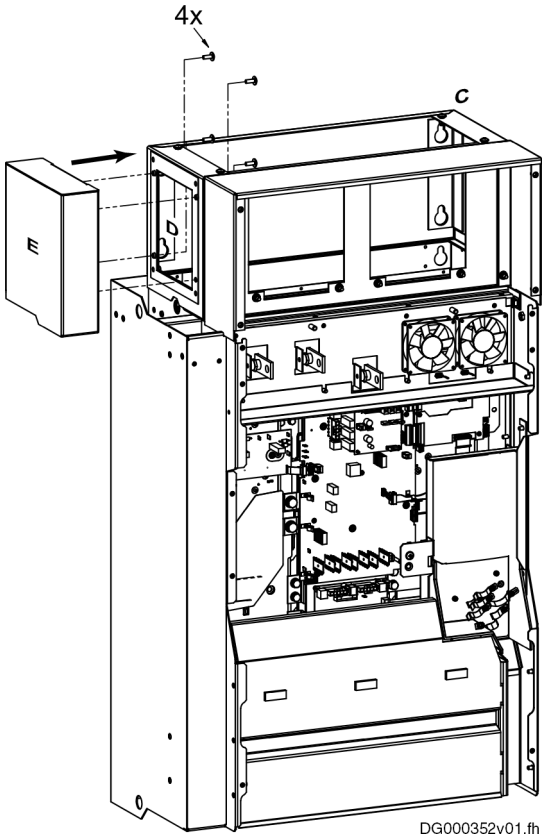
The bus bar used to connect the braking unit to "IndraDrive HCS04.2E" (BU+, BU-) is part of the scope of supply.

7. Connect the control cables:
   - Connect the control cable X20 of the braking unit to the cable X20 of the converter.
   - Connect the control cable X92 of the braking unit to the plug-in connector X20 of the converter.
   - Disconnect the cable X3 of the converter from the plug-in connector X3 on the converter circuit board.
   - Connect the cable X3 of the converter to the cable X3B of the braking unit.
   - Connect the cable X3A of the braking unit to the plug-in connector X3 on the converter circuit board.



8. Mount the housing of "HLL01.1A" (C) to the wall of the control cabinet.
9. Remove the detachable part (D) of the DC bus choke housing.
10. Mount the cover (E) of the braking unit to the DC bus choke housing.
11. Mount the DC choke(s) of the converter.

HLT01 - Braking Unit



HLT01 - Braking Unit

13.3.3 Braking Unit HLT01.1A -400K

Dimensions

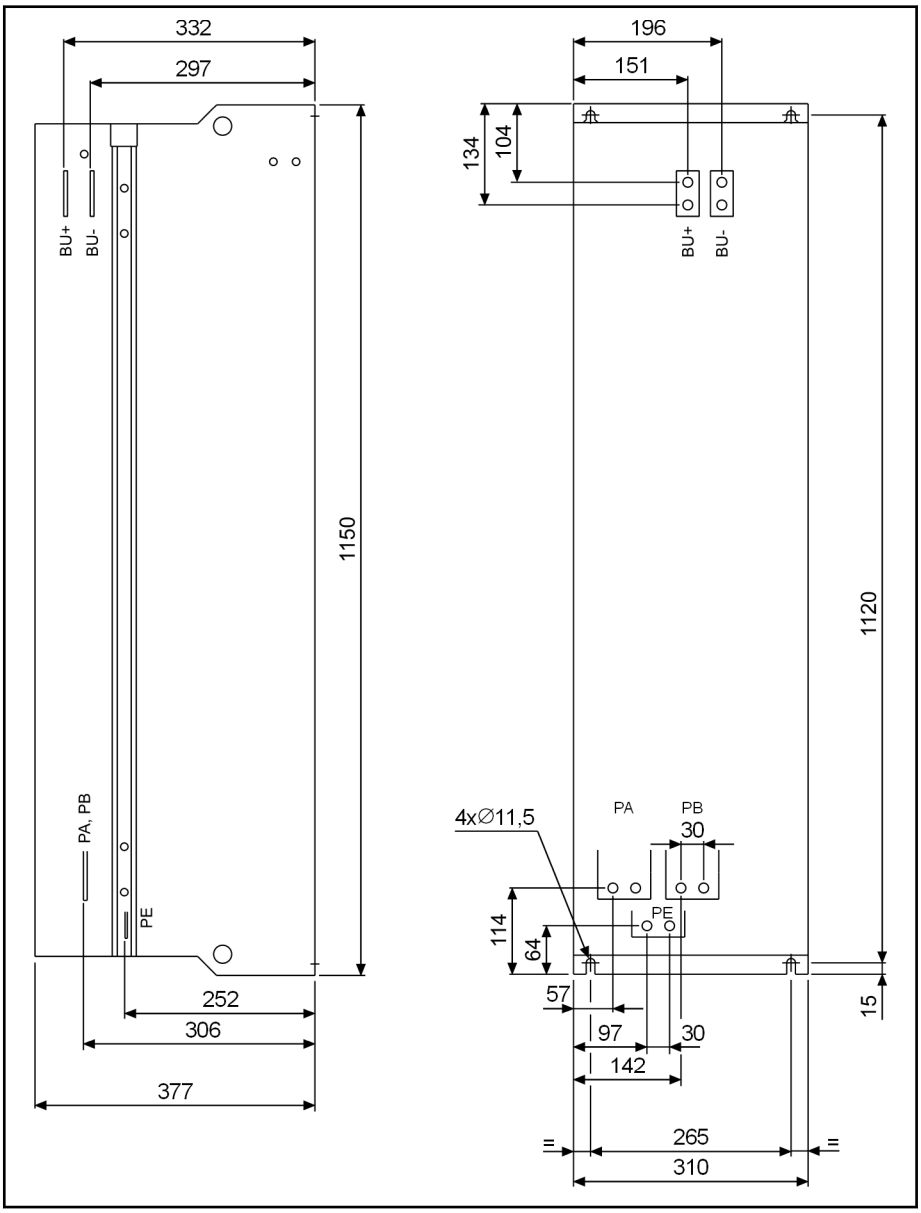


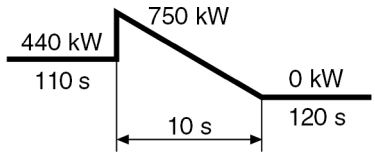
Fig. 13-4: Dimensions Braking Unit HLT01.1A -400K

Power connections

Description	Connection	Tightening torque
BU+, BU-	M12	41 Nm
PA, PB	M12	41 Nm
PE	M12	41 Nm

☞ The bus bars used to connect the braking unit to "IndraDrive HCS04.2E" (BU+, BU-) are part of the scope of supply. They are provided for a mounting distance of 110 mm. The maximum distance is 1 m. The distance between the bars must not be greater than 10 mm!

Technical Data

Braking unit	HLT01.1A -400
Power dissipation at 100% I_N	1,050 W
Cooling air volume	600 m^3/h
Peak braking power	750 kW
Max. continuous braking power	400 kW
Possible braking power depending on the duty cycle	750 kW for 5 % 550 kW for 15 % 440 kW for 50%
Cycle time	240 s
Typ. braking power for crane operation	
Min. braking resistance	0.7 Ω
Mass	70 kg

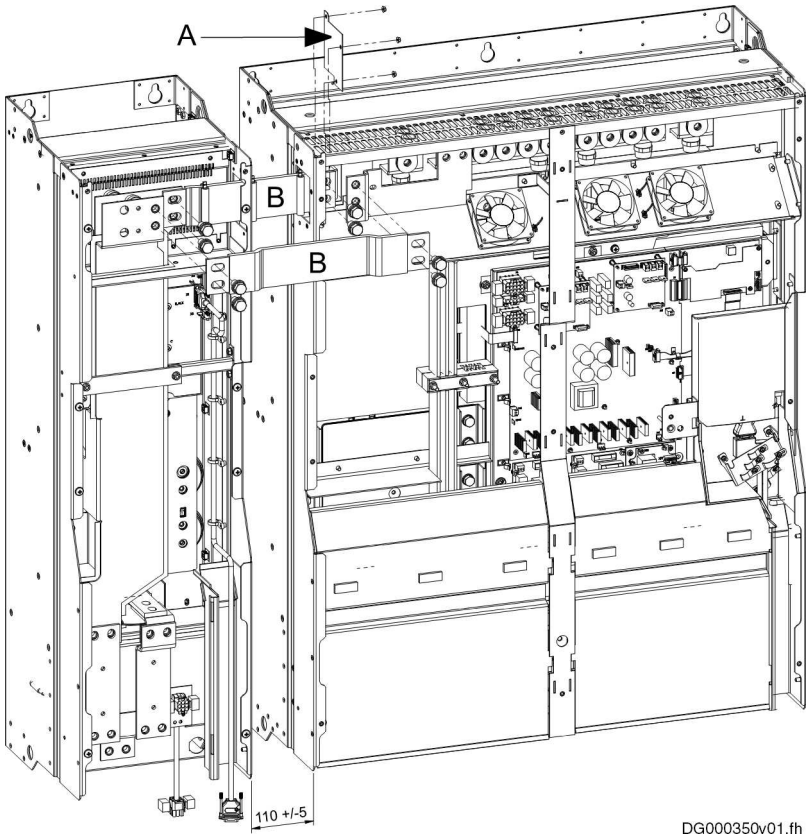
Installing HLT01.1A -400

Mount the braking unit at the left hand side of the converter with a distance of 110 mm (+/- 5 mm). This distance must be complied with due to the bus bars supplied with the braking unit. If you use your own bus bars (63 x 5 x 1 mm), you can extend the distance up to one meter.

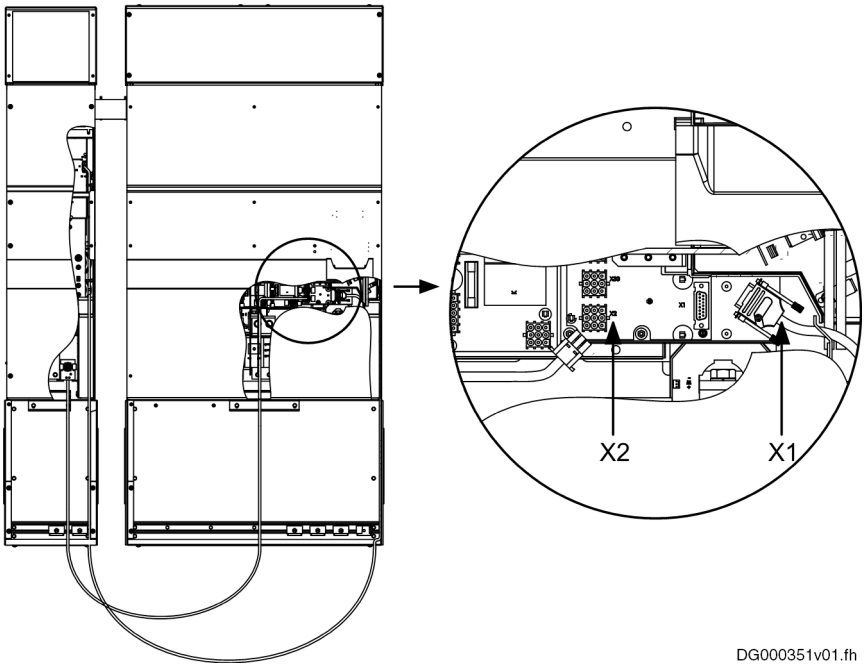
☞ The distance between the bus bars of the power section BU+ and BU- must not exceed 10 mm!

1. Mechanically install the converter and the braking unit.
2. Remove the cover of the converter; when doing this, comply with the safety recommendations.
3. Remove the detachable part A inside the converter.
4. By means of the bus bars B, connect the terminals BU- and BU+ of the converter to the terminals BU- and BU+ of the braking unit.

HLT01 - Braking Unit

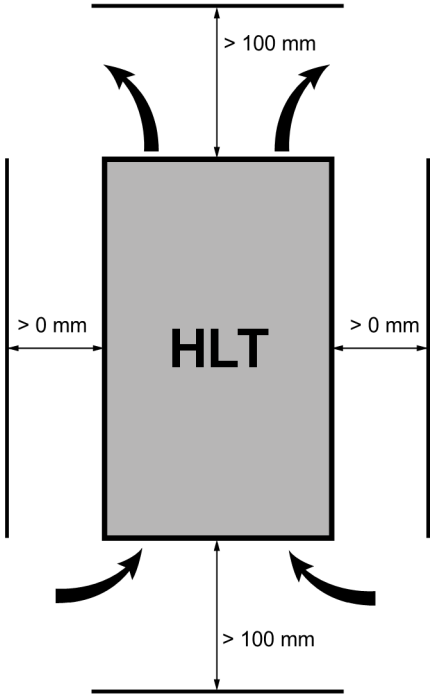


5. Connect the control cable and supply cable of the fan:
   - Connect the control cable X1 coming from the braking unit to the plug-in connector X1 of the converter.
   - Connect the supply cable of the fan coming from the braking unit to the plug-in connector X2 of the converter.



Distances to other devices or to the wall

HLT01 - Braking Unit



14 HMF01 - motor filter

14.1 Type code

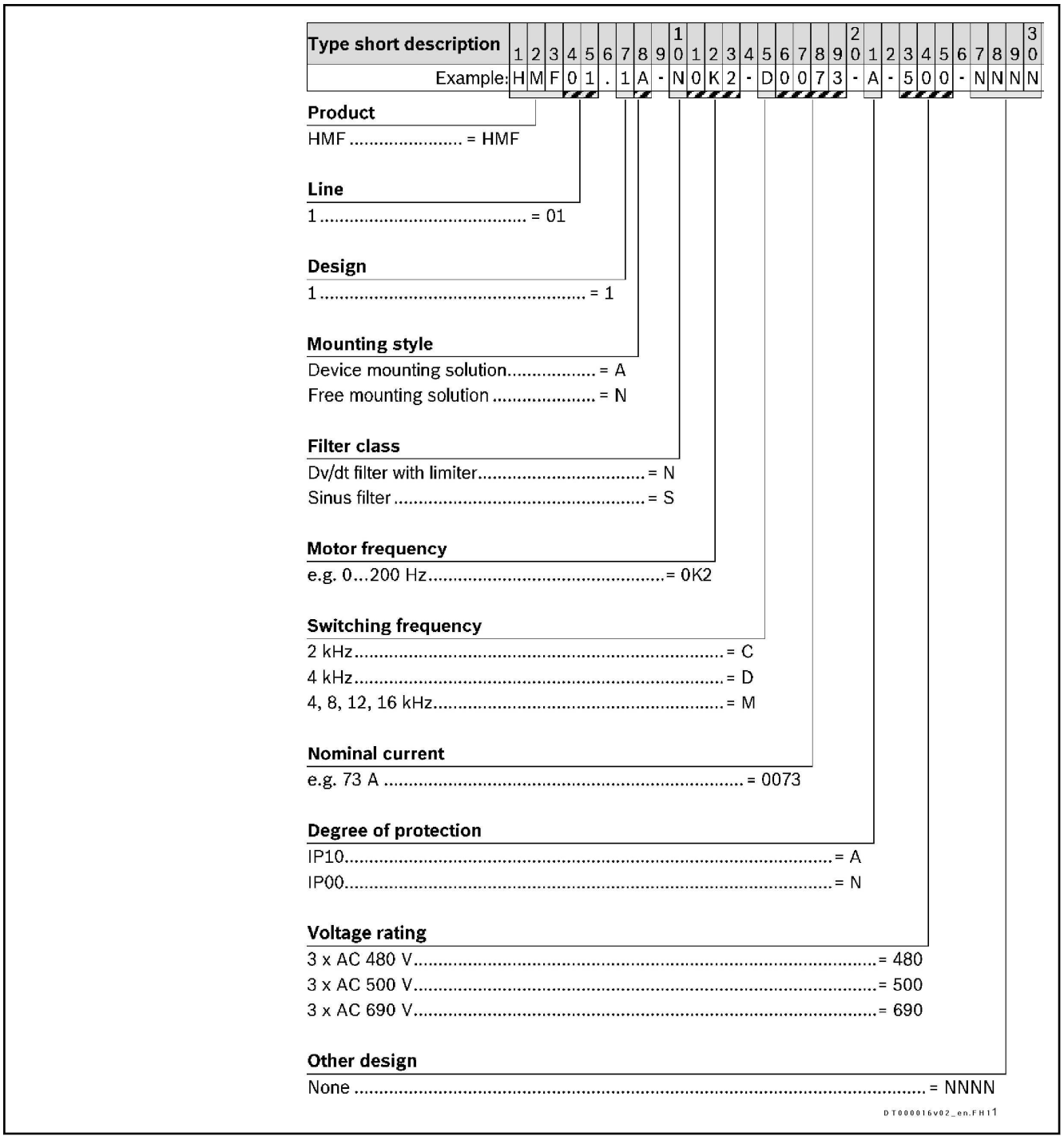
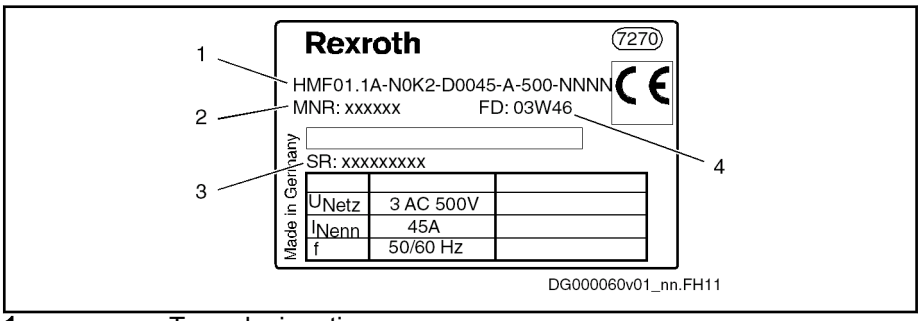


Fig. 14-1: Motor filter HMF01.1 type code

HMF01 - motor filter

14.2 Type plate

Each motor filter is identified by a type designation. There is a type plate attached to all components.



1 Type designation
2 Material number
3 Serial number
4 Production date

Fig. 14-2: Type plate

14.3 Electrical data

Motor frequency

The maximum motor frequency of the motor filters is specified in the type designation.

Example: For an HMF01.1A-N**0K2** motor filter, the maximum motor frequency is **200 Hz**.

Technical data - currents, voltages, power

Description	Symbol	Unit	HMF01.1A-N0K2-D0045-A-500-NNNN	HMF01.1A-N0K2-D0073-A-500-NNNN	HMF01.1A-N0K2-D0095-A-500-NNNN	HMF01.1A-N0K2-D0145-A-500-NNNN	HMF01.1N-N0K2-M0012-A-500-NNNN	HMF01.1N-N0K2-M0028-A-500-NNNN
Degree of protection according to IEC 60529	IP		IP10					
Listing in accordance with UL standard			UL 508C				UL 508	
Listing in accordance with CSA standard			C22.2 No. 14-10				C22.2 No. 14	
Mass	m	kg	15.00		20.00		5.10	11.20
Specific inductance	L	µH	3 x 160	3 x 100	3 x 78	3 x 50	3 x 900	3 x 450
Allowed switching frequencies[1)]	f_s	kHz	4				4, 8, 12, 16	
Continuous output current when f_s = 4 kHz	I_{out_cont4}	A	45.0000	73.0000	95.0000	145.0000	12.0000	28.0000
Maximum output current when f_s = 4 kHz	I_{out_max4}	A	70.0000	100.0000	150.0000	210.0000	28.0000	70.0000
Rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-ground (10-90%)[2)]	dv/dt	kV/µs	1.00					
Rise of voltage at output with U_{LN_nenn} and 15 m motor cable length phase-phase (10-90%)[3)]	dv/dt	kV/µs	1.00					
Power dissipation at continuous current and continuous DC bus power respectively[4)]	P_{Diss_cont}	W	120.00	160.00	190.00	220.00	25.00	50.00
Last modification: 2014-02-24								

HMF01 - motor filter

Description	Symbol	Unit	HMF01.1A-N0K2-D0045-A-500-NNNN	HMF01.1A-N0K2-D0073-A-500-NNNN	HMF01.1A-N0K2-D0095-A-500-NNNN	HMF01.1A-N0K2-D0145-A-500-NNNN	HMF01.1N-N0K2-M0012-A-500-NNNN	HMF01.1N-N0K2-M0028-A-500-NNNN
Insulation resistance at 500 V DC	R_{is}	MOhm	1.00				600.00	
Required wire size in accordance with NFPA 79 and UL 508 A (internal wiring);[5)]	A_{LN}	AWG	6	2	0	4/0	14	10
Last modification: 2014-02-24								

1) Also depending on firmware and control section; see parameter description "P-0-0001, Switching frequency of power output stage"; see "P-0-4058, Amplifier type data"
2) 3) Guide value, see following note
4) Plus dissipation of braking resistor and control section
5) Copper wire; PVC-insulation (conductor temperature 90 °C; $T_a \leq 40$ °C) in accordance with NFPA 79 chapter 12 and UL 508A chapter 28

Tab. 14-1: HMF - technical data - currents, voltages, power

Guide value "Rise of voltage at output"

Observe that the voltage load at the motor is almost independent of the power section used.

Especially when using **standard motors**, make sure that they comply with the occurring voltage load.

Observe the information on third-party motors at drive controllers (see documentation "Rexroth IndraDrive Drive Systems With HMV01/02 HMS01/02, HMD01, HCS02/03", index entry "Third-party motors → On drive controllers").

14.4 Mechanical data

14.4.1 Dimensions, mass

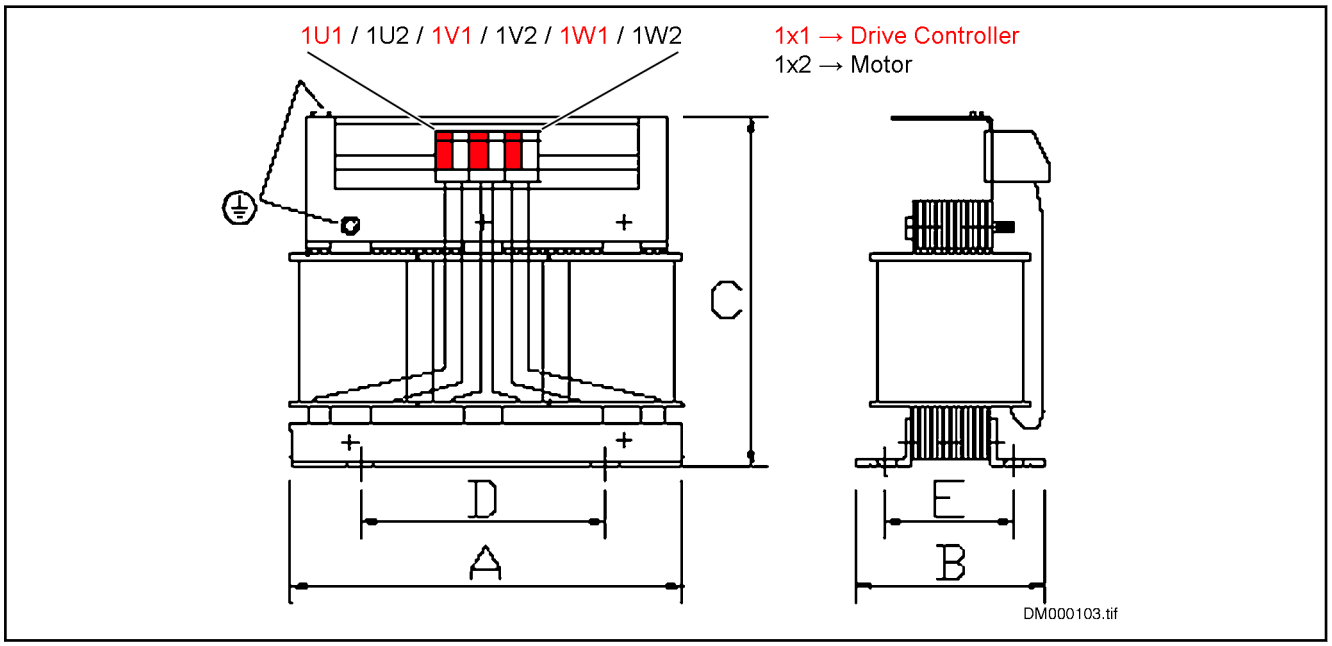


Fig. 14-3: Motor filter HMF01.1A-N0K2-M0012-A-500-NNNN dimensions

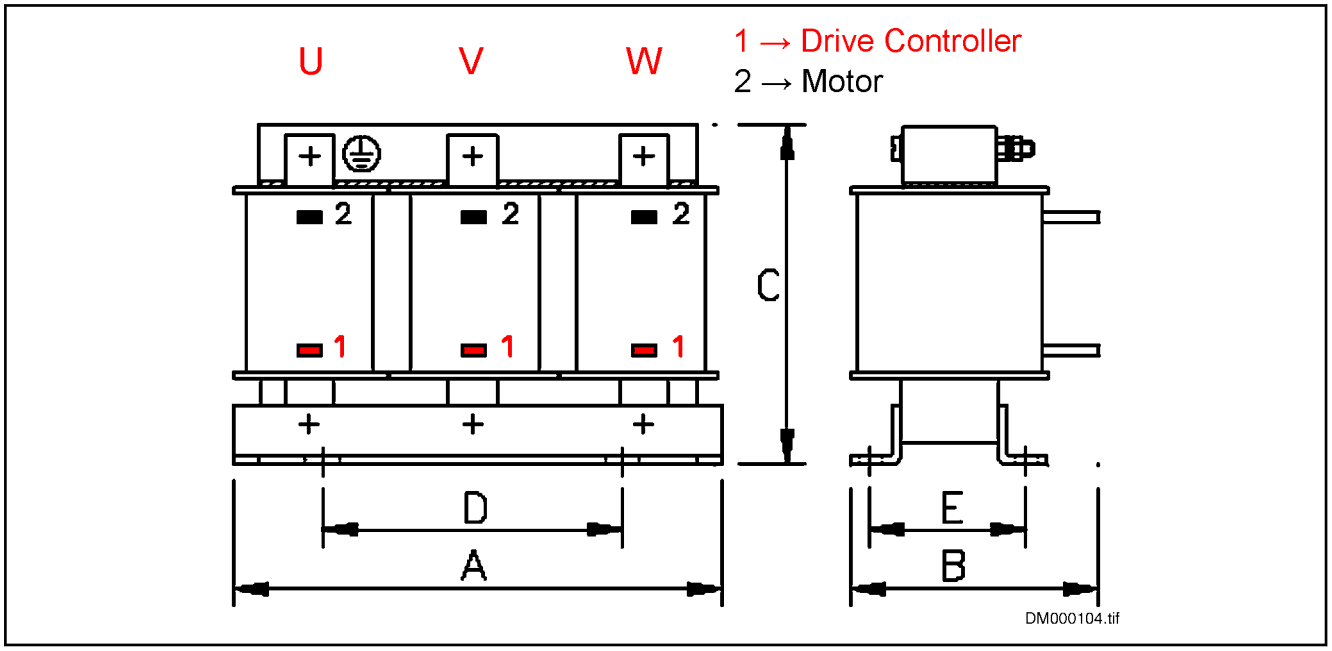
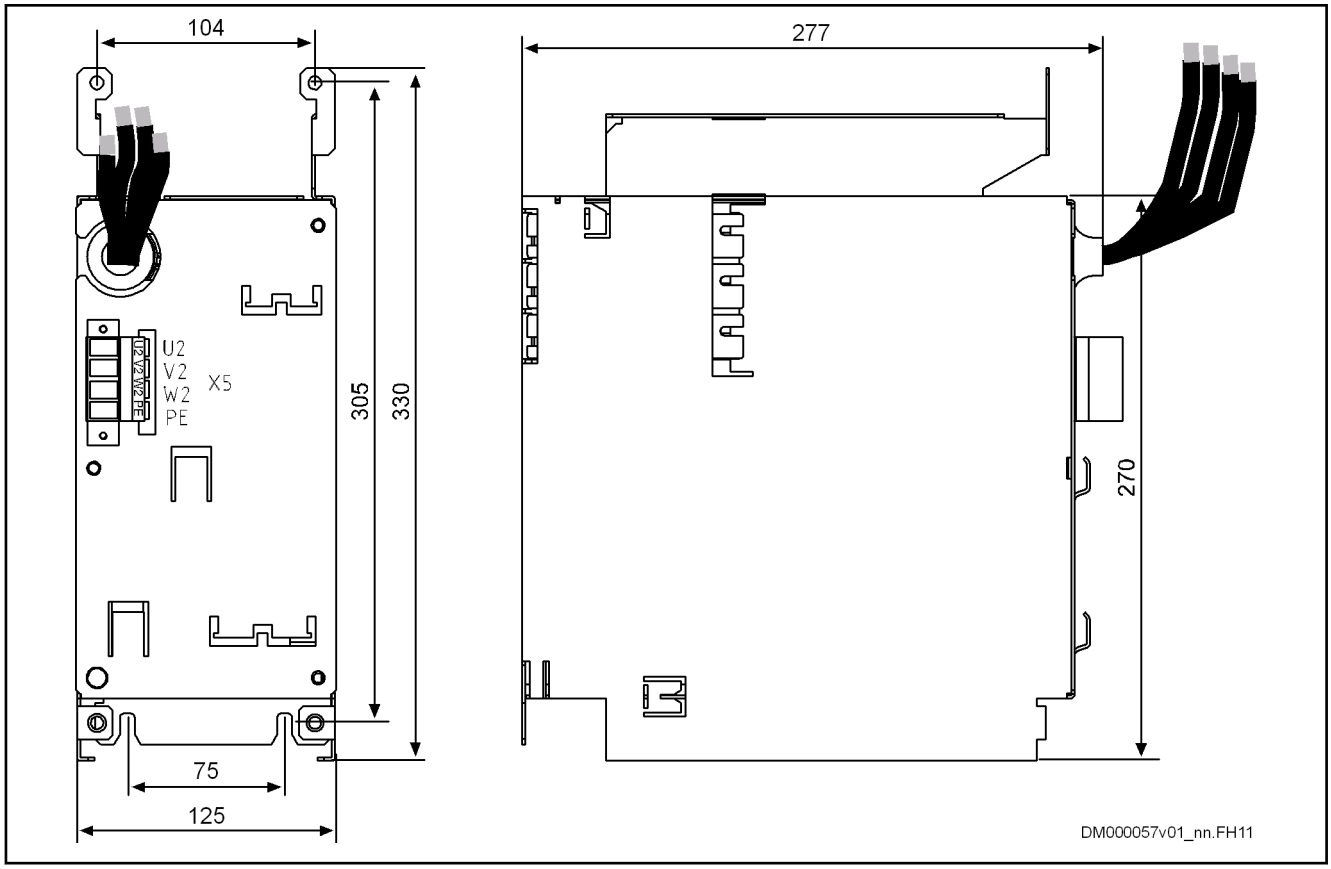


Fig. 14-4: Motor filter HMF01.1A-N0K2-M0028-A-500-NNNN dimensions

Type	Dimensions [mm]					Weight [kg]	Tightening torque electrical connections [Nm]
	A	B	C	D	E		
0012	155	91.5	162	130	71.5	5.1	0.6-0.8
0028	210	130	182	175	95	11.2	12

Tab. 14-2: Motor filter dimensions

HMF01 - motor filter



Dimensions in mm

Fig. 14-5: Motor filter HMF01.1A-N0K2-D0045-A-500-NNNN dimensions

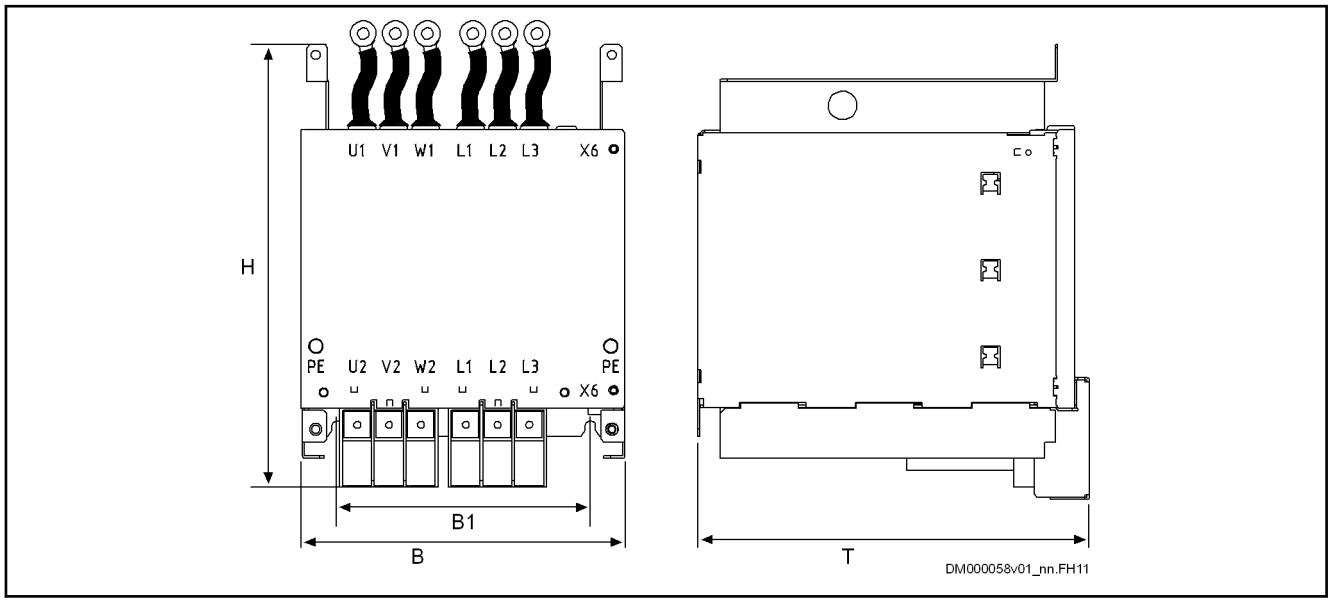


Fig. 14-6: Motor filters HMF01.1A-N0K2-D0073-A-500-NNNN, HMF01.1A-N0K2-D0095-A-500-NNNN and HMF01.1A-N0K2-D0145-A-500-NNNN dimensions

HMF01 - motor filter

Type	Dimensions [mm]					Weight [kg]	Tightening torque electrical connections [Nm]
	B	H	T	B	H1		
0045	see above fig. " Motor filter HMF01.1A-N0K2-D**0045**-A-500-NNNN dimensions"					15	1.5
0073	225	315	270	175	257	15	6
0095	225	315	270	175	257	20	6
0145	350	400	260	250	310	20	25

Tab. 14-3: Motor filter dimensions

14.5 Arranging the components HCS03.1 with HMF motor filter

☞ The HMF01 motor filters are **cooled** by the cooling air of the drive controller flowing in.

Arrange HMF01 at HCS03 drive controller as pictured.

HMF01 - motor filter

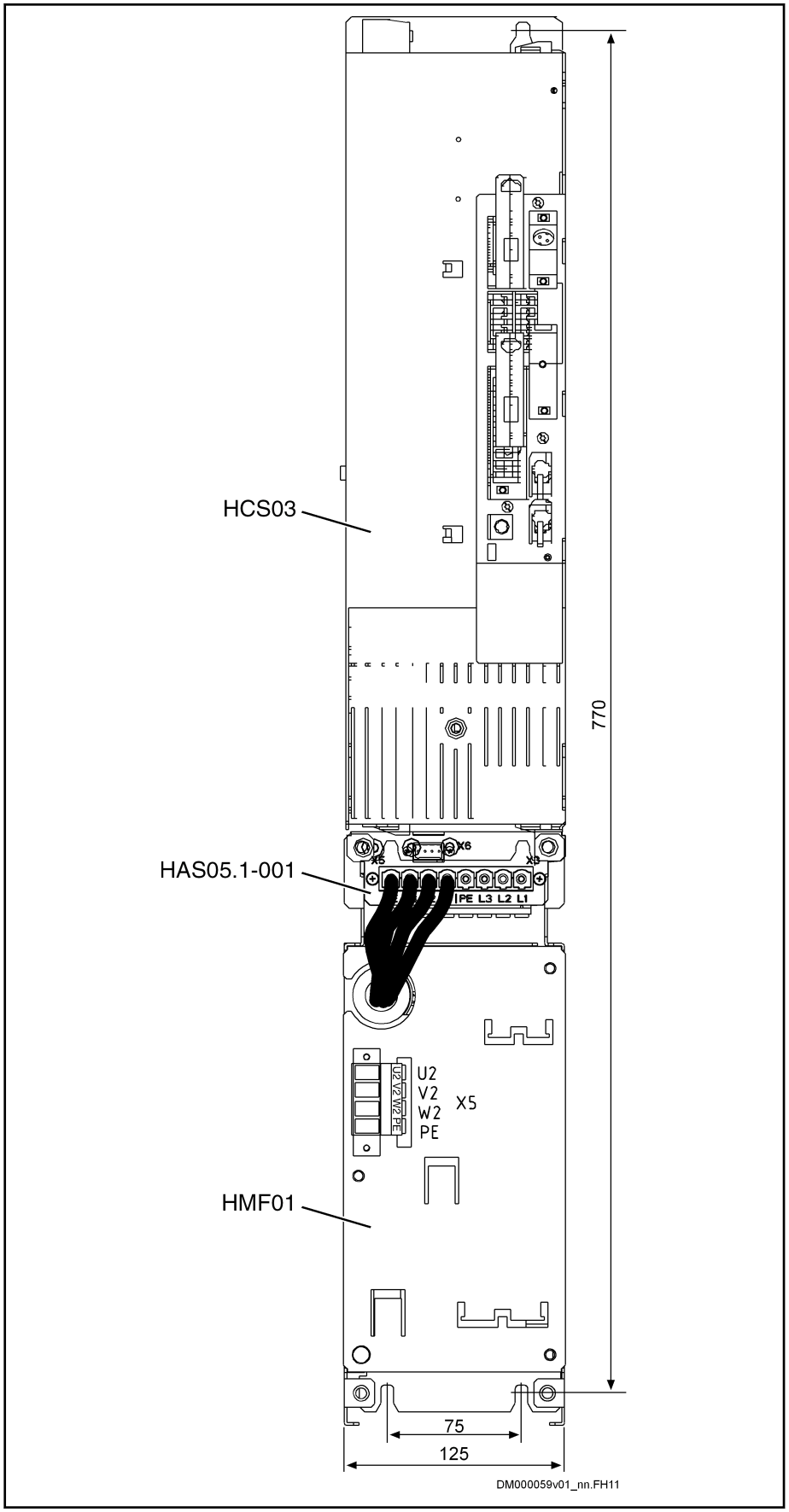


Fig. 14-7: Mounting example HCS03.1E-W0070 / HMF01.1A-D0K2-D0045

HMF01 - motor filter

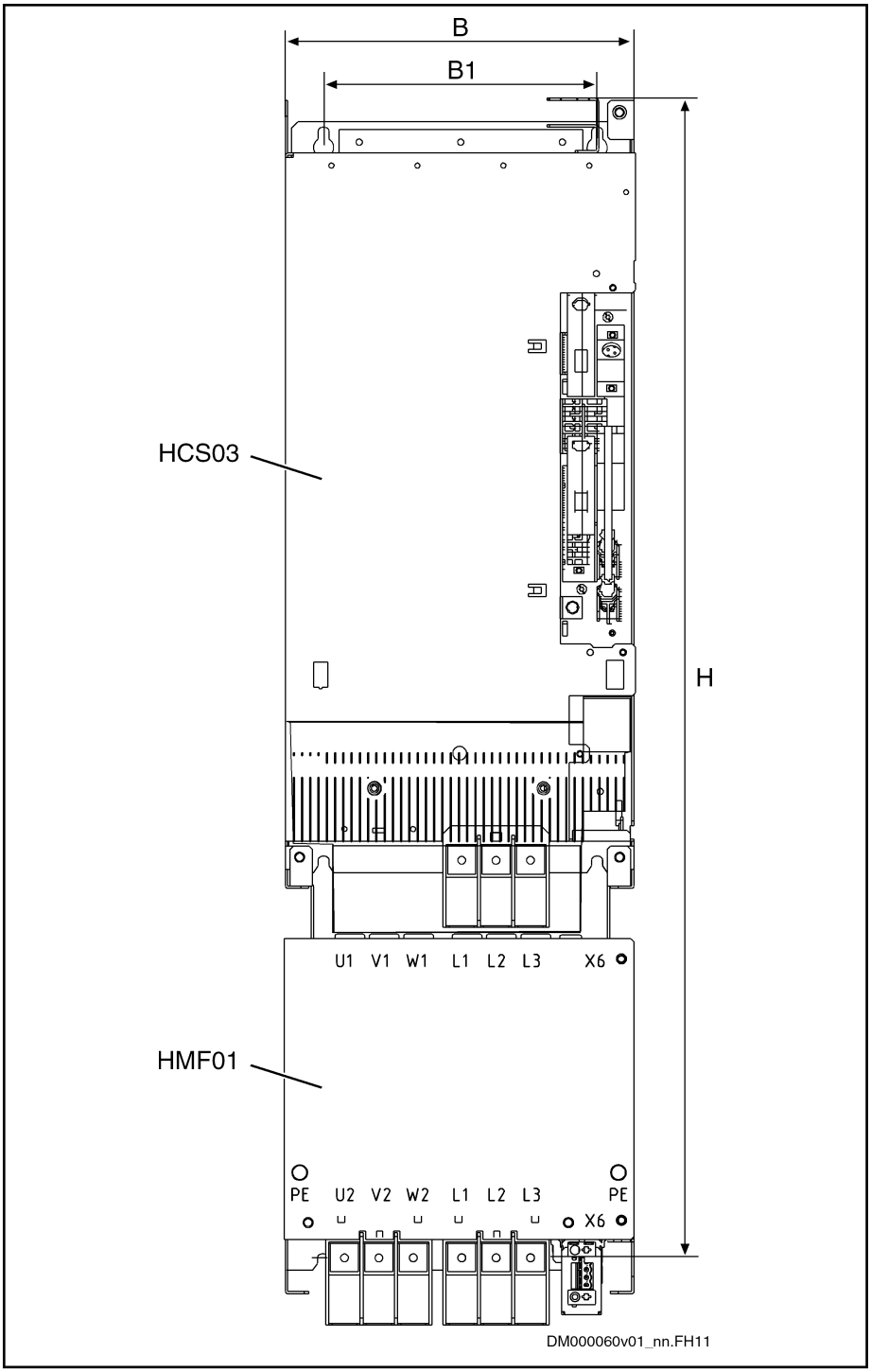


Fig. 14-8: Mounting example HCS03.1E-W0100, -0150, -0210 / HMF01 motor filter

HCS03.1E-	H	B	B1
W0100	720	225	175
W0150	720	225	175
W0210	780	350	250

Tab. 14-4: Dimension table for mounting example HCS03.1E-.. / HMF motor filter

14.6 Arranging the components HCS03.1 with motor filter and mains filter

☞ The HMF01 motor filters and HNK01 mains filters are **cooled** by the cooling air of the drive controller flowing in.

Arrange HMF01 and HNK01 at HCS03 drive controller as pictured.

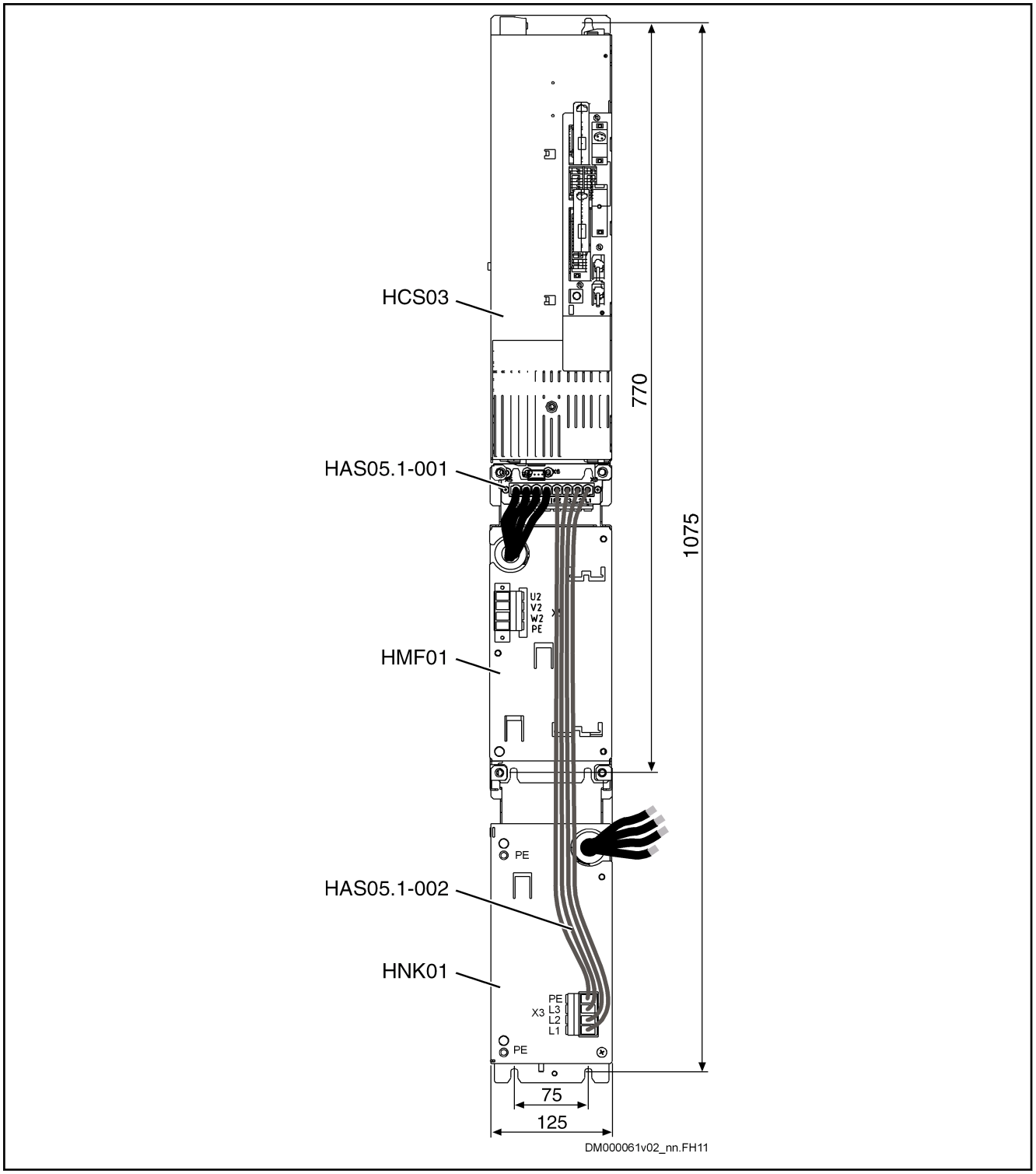


Fig. 14-9: Arranging HCS03.1E-W0070 / HMF motor filter and HNK01 mains filter + HAS05.1-001 + HAS05.1-002

For information on the **HAS05.1 accessories**, see index entry "HAS05.1- → 001" and "HAS05.1- → 002"

HMF01 - motor filter

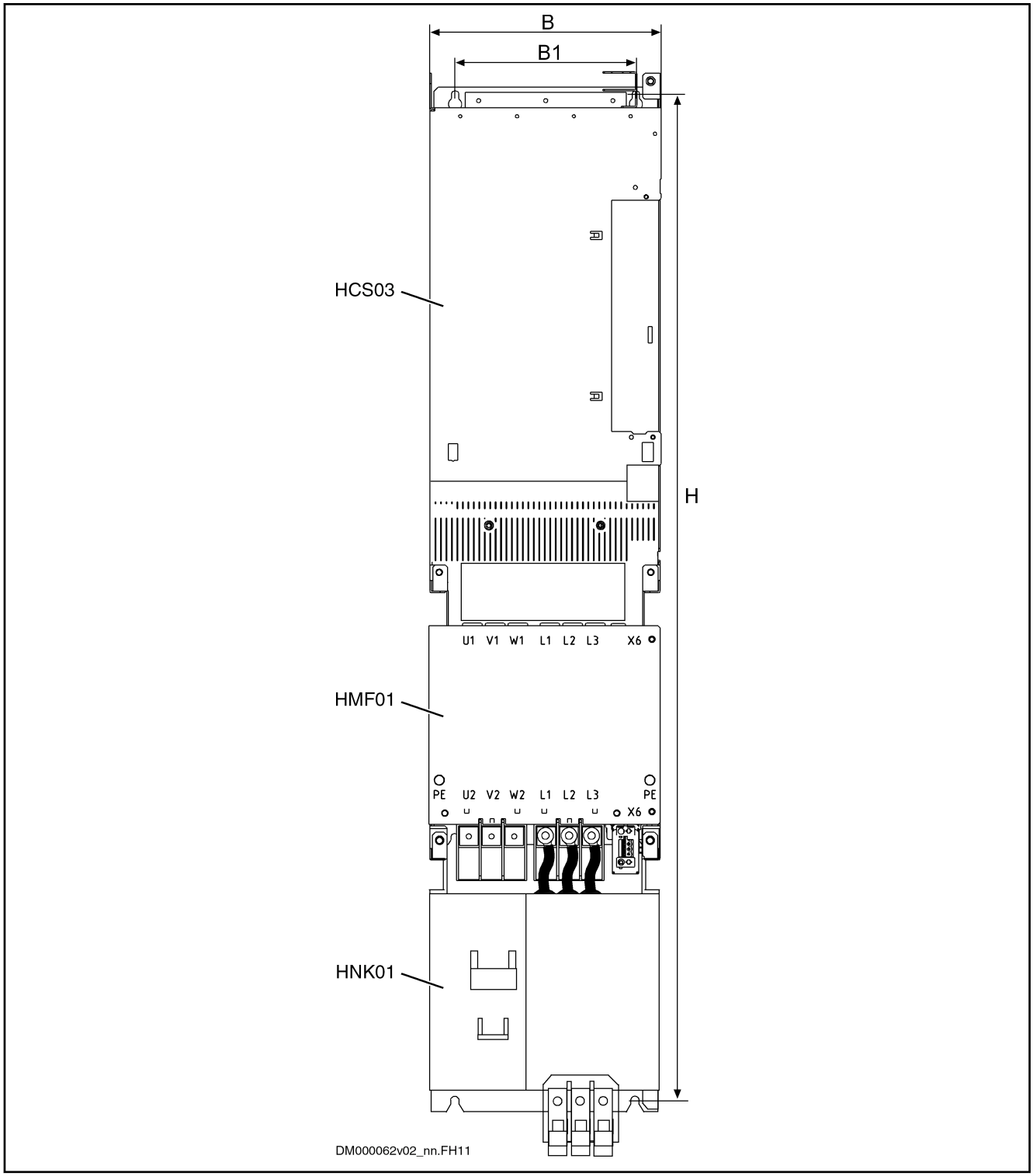


Fig. 14-10: Arranging device 0100, 0150, 0210 / motor filter and mains filter

HCS03.1E-	H	B1	B
W0100	980	175	225
W0150	980	175	225
W0210	1090	250	350

Tab. 14-5: Dimension table for mounting example HCS03.1E-… / mains filter / motor filter

15 HAC01 - Housing for Control Sections

15.1 Identification

15.1.1 Type Code

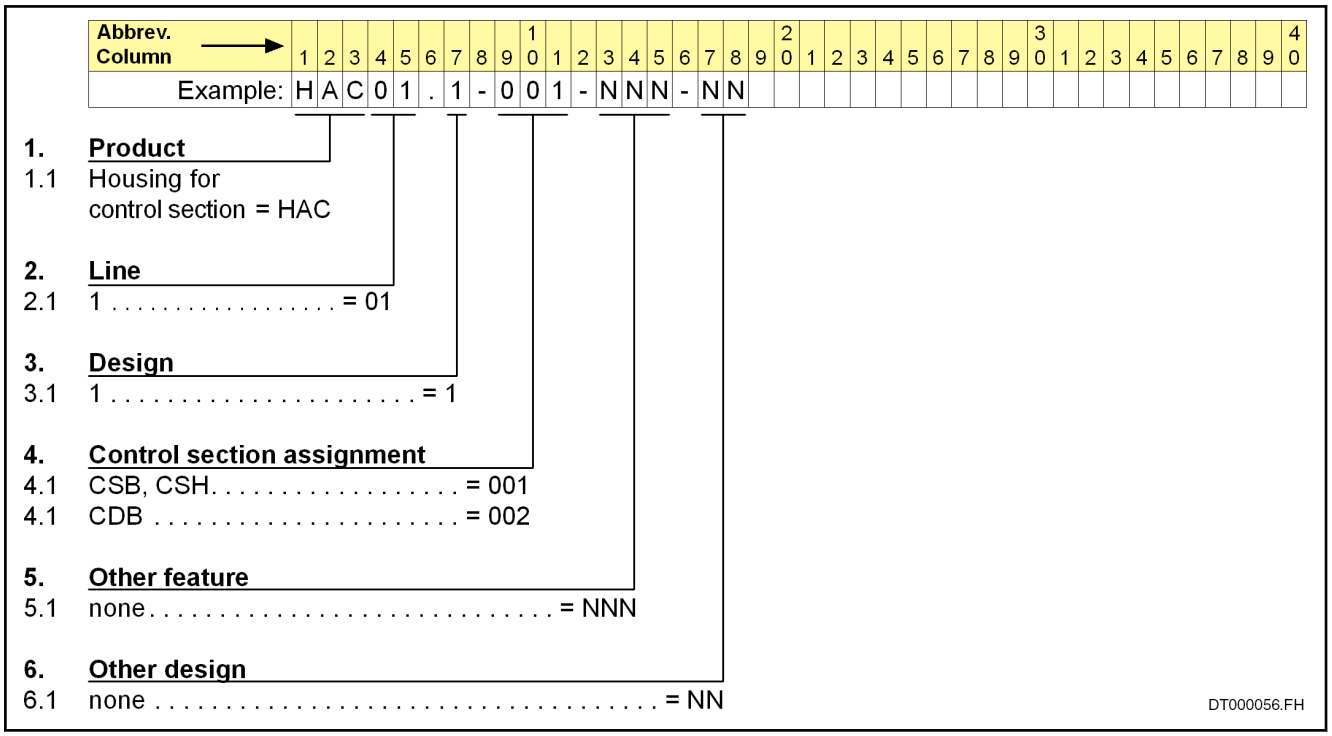
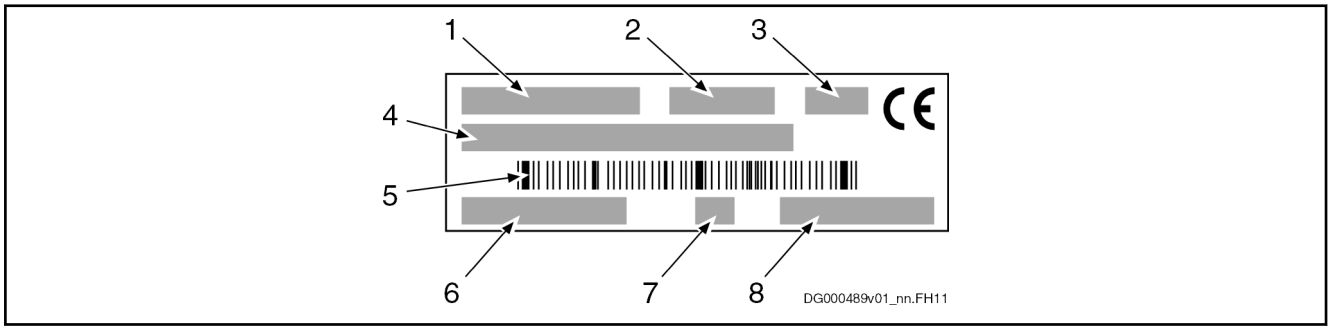


Fig. 15-1: Type Code HAC01.1

15.1.2 Type Plate

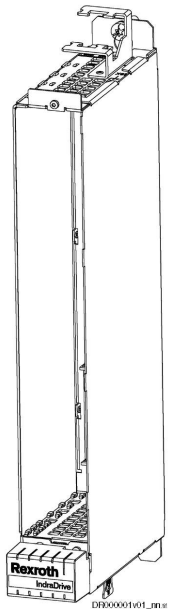


1	Material number
2	Production week (example: 06W31 meaning year 2006, week 31)
3	Factory identifier
4	Type
5	Bar code
6	Serial number
7	Hardware index
8	Country of manufacture

Fig. 15-2: Type Plate

HAC01 - Housing for Control Sections

15.2 Use

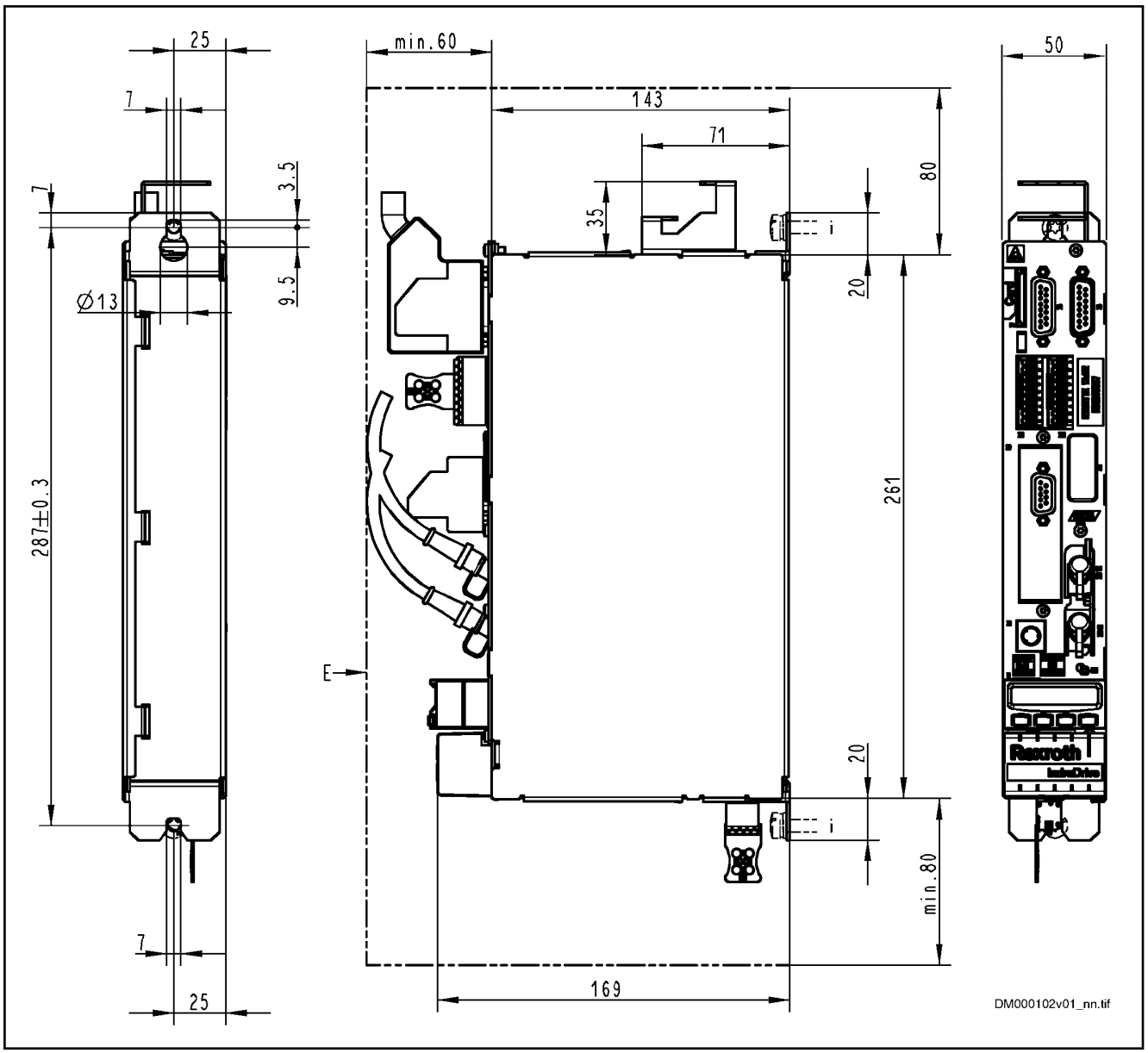
 HAC01	The additional component HAC01 is a housing in which control sections are inserted and loops through the control voltage supply from connection "0V, 24V" to the control sections. The additional component HAC01 can be optionally supplied. There is no control section contained in the scope of supply of HAC01. Make sure that the parameter ""P-0-0860, Converter configuration" has been set to operation as "SERCOS analog converter" (bit 15 = 1). Wrong setting will generate the error message "F8091 Power section defective".

Tab. 15-1: Use

15.3 Mechanical and Electrical Data

15.3.1 Dimensional Drawings HAC01.1

HAC01.1-001-NNN-NN



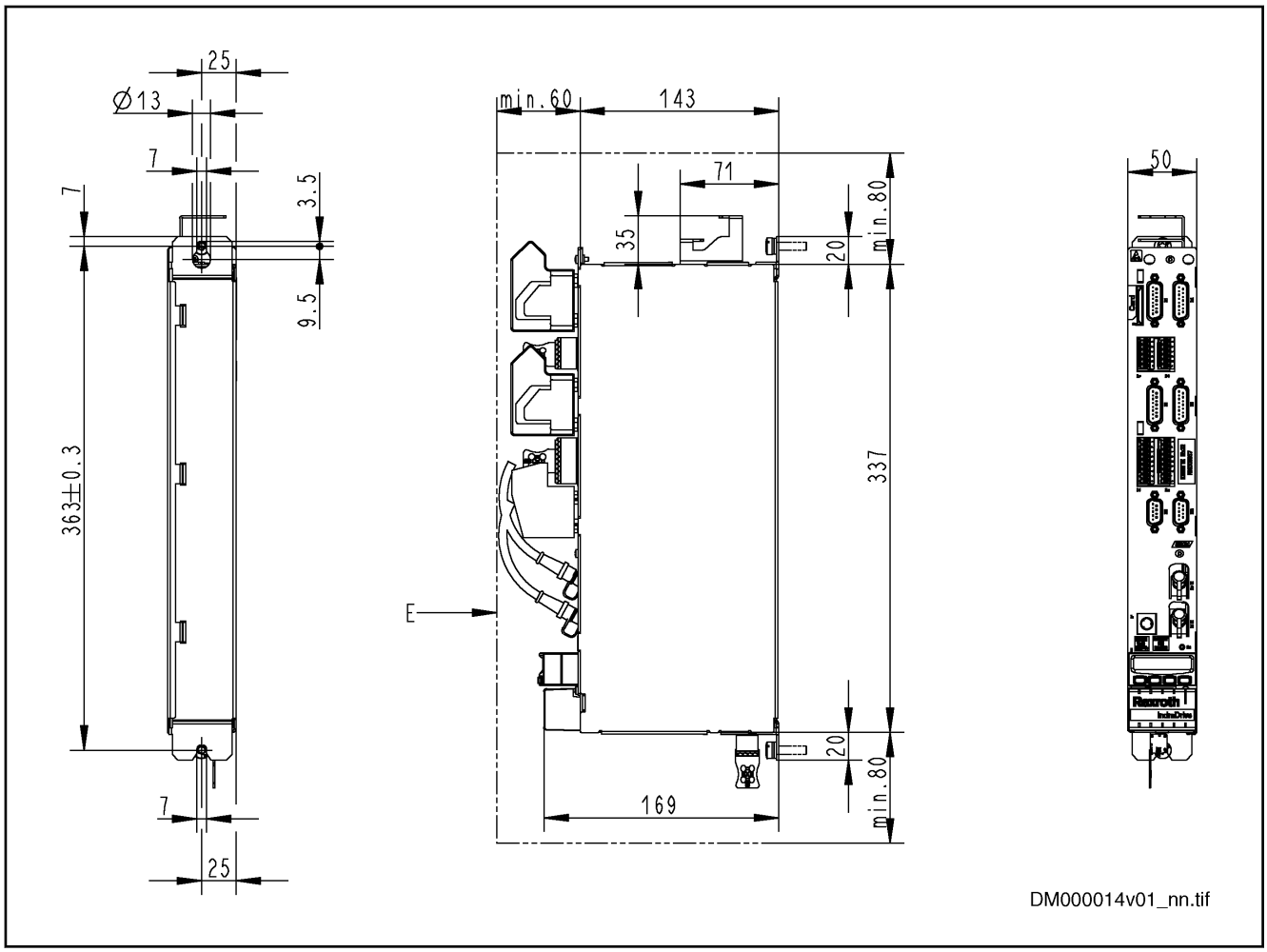
All dimensions in mm

E Minimum mounting clearance

Fig. 15-3: Dimensions HAC01.1-001-NNN-NN

HAC01 - Housing for Control Sections

HAC01.1-002-NNN-NN



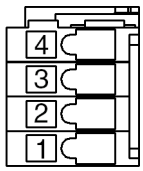
All dimensions in mm

E Minimum mounting clearance

Fig. 15-4: Dimensions HAC01.1-002-NNN-NN

15.3.2 Connections at HAC01

X13, Control Voltage

Assignment	Connection	Signal name	Function
 DG000115v01_nn.FH11	4	+24V	Power supply and "looping through"
	3	+24V	
	2	0V	Reference potential for power supply and "looping through"
	1	0V	

Spring terminal (connector)	Unit	Min.	Max.
Connection cross section solid wire	mm^2	1,0	1,5
Connection cross section stranded wire	mm^2	1,0	1,5

Connection cross section	AWG	18	16
Power consumption	W	P_{N3} (see technical data of the device)	
Voltage load capacity	V	U_{N3} (see technical data of the device)	
Current carrying capacity "looping through" from +24V to +24V, 0V to 0V Continuous current P_{N3}/U_{N3}	A		6
Current carrying capacity "looping through" from +24V to +24V, 0V to 0V Inrush current I_{EIN3}	A		12
Polarity reversal protection		Within the allowed voltage range by internal protective diode	

Tab. 15-2: Function, Pin Assignment, Properties

Power Consumption at X13

The power consumption at X13 is determined by the **control section** and **optional modules** used.

Overvoltage

Overvoltage greater than 33 V 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 overvoltage 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 overvoltage by inductive or capacitive coupling.

Specification of Control Voltage

See chapter 5.5 Control voltage (24V supply) , page 47

16 HAT01 - control module for holding brake

16.1 Brief description, use and design

Brief description

The HAT01 control module belongs to the Rexroth IndraDrive product range and is used for the "Safe braking and holding system".

HAT01 control modules are mounted on a top-hat rail in the control cabinet.

Use

The types are used as follows:

Type	Use
HAT01.1-002-NNN-NN	To control an electrically releasing, redundant holding brake.

Tab. 16-1: Use

☞ Operating the HAT01 control module requires components with the firmware MPx-04 … 08, such as Cxx01 control sections.

16.2 Type code and identification

16.2.1 Type code

☞ The figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

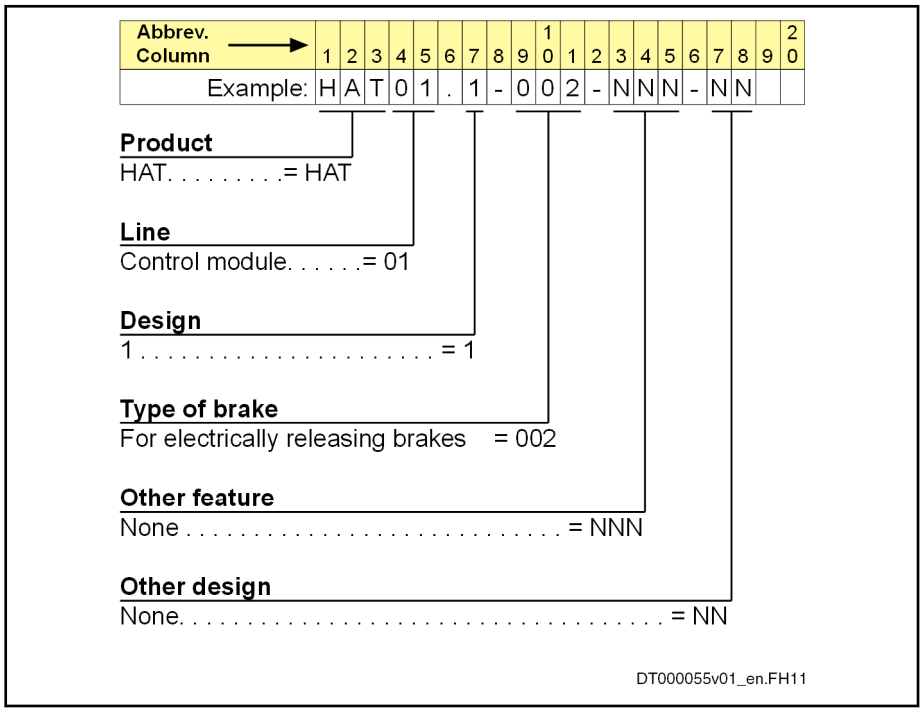
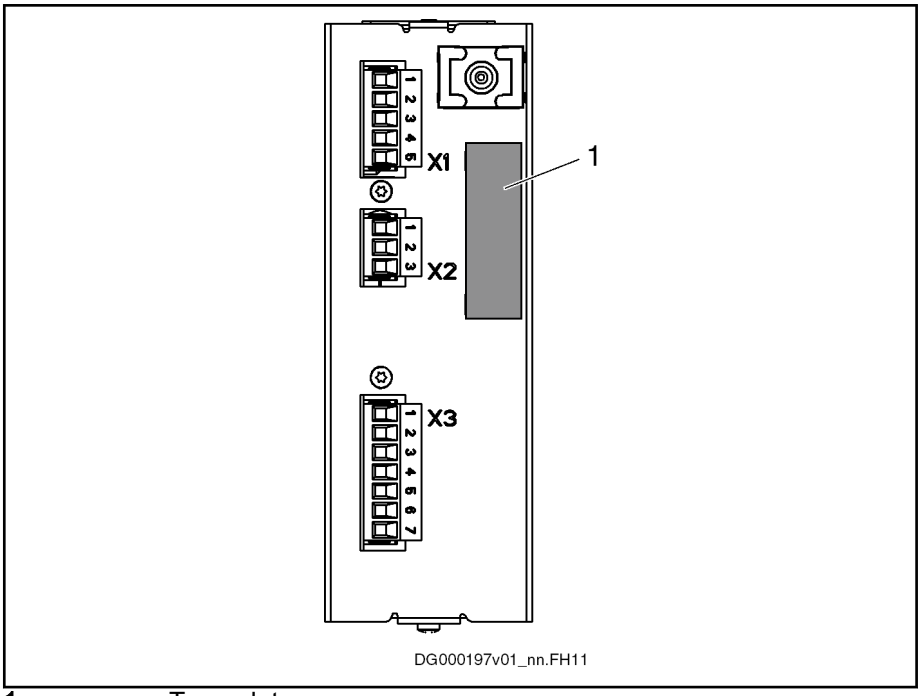


Fig. 16-1: Type code

HAT01 - control module for holding brake

16.2.2 Identification

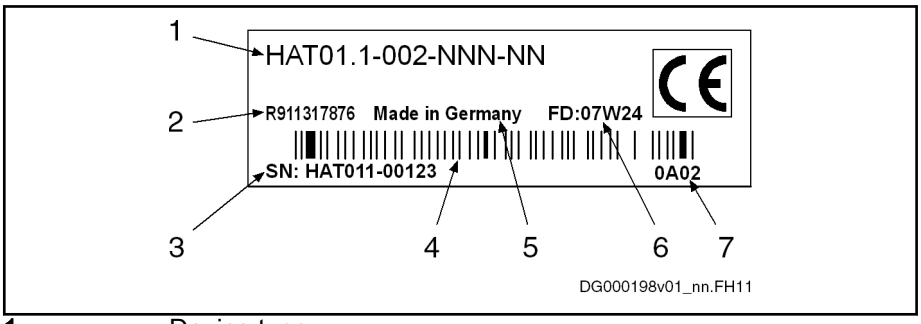
Type plate arrangement



1 Type plate

Fig. 16-2: Type plate arrangement

Type plate



1 Device type
2 Material number
3 Serial number
4 Bar code
5 Country of manufacture
6 Production week, 07W24 meaning year 2007, week 24
7 Hardware index

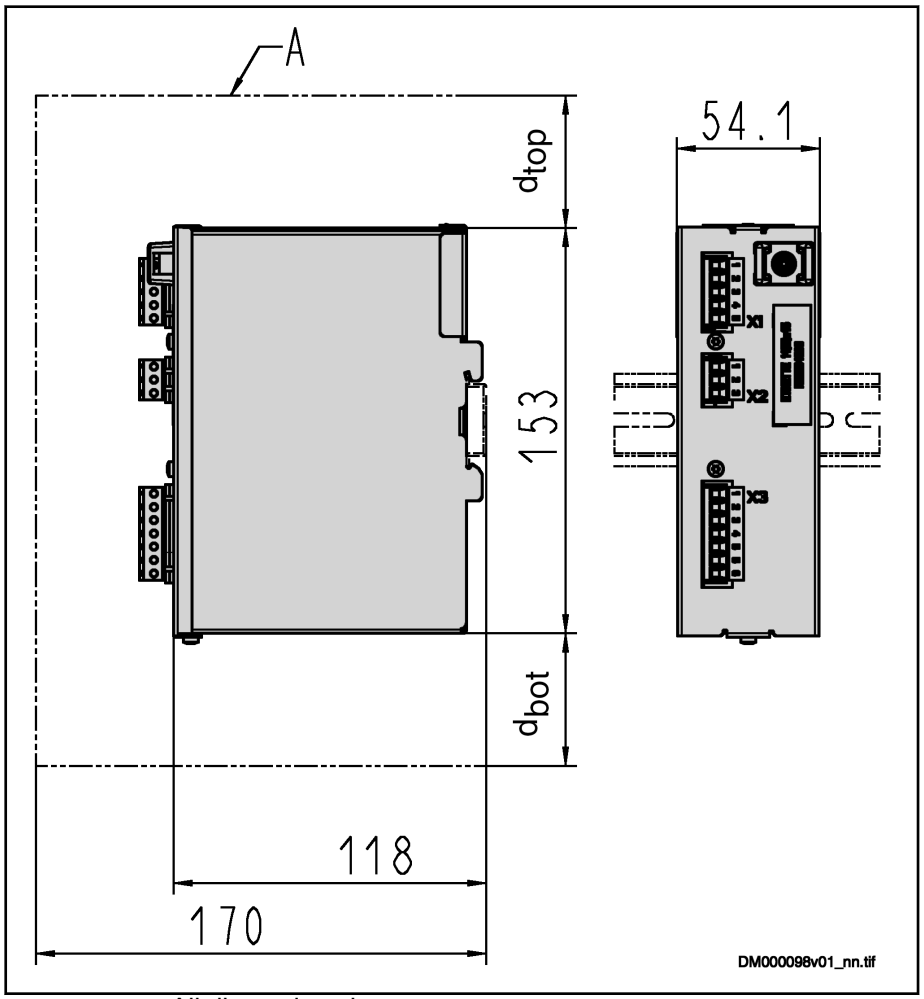
Fig. 16-3: Type plate

16.3 Scope of supply

The scope of supply of the HAT01 control module contains:

- Connectors X1, X2, X3

16.4 Dimensions



All dimensions in mm

A Minimum mounting clearance

d_{top}, d_{bot} See table "Technical data"

Fig. 16-4: Dimensions

16.5 Technical data

Technical data

Description	Symbol	Unit	HAT01.1-002-NNN-NN
Weight	m	kg	0.6
Degree of protection			IP20
Allowed mounting position			Vertical
Minimum distance from the top of the device[5)]	d_{top}	mm	50
Minimum distance from the bottom of the device[6)]	d_{bot}	mm	50
Minimum distance on the side of the device	d_{hor}	mm	-
Allowed ambient temperature range	T_{a_work}	°C	0 … 55

HAT01 - control module for holding brake

Description	Symbol	Unit	HAT01.1-002-NNN-NN
Cooling type[3)]			n
Listing in accordance with UL standard (UL)			UL 508C
UL files (UL)			E134201
Control voltage supply			
Rated control voltage input (UL)[1)]	U_{N3}	V	Brake cable length < 50 m: 24 ±5% Brake cable length > 50 m: 26 ±5%
Maximum allowed voltage for 1 ms[2)]	U_{N3_max}	V	33
Rated power consumption control voltage input at U_{N3} (UL)	P_{N3}	W	1.5
Inrush current at 24V supply	I_{EIN3}	A	35
Pulse width of I_{EIN3}	$t_{EIN3Lade}$	ms	4
Input capacitance	C_{N3}	mF	3.6
Power dissipation	P_{Diss}	W	max. 7.5 (brake controlled)
Output current	I_{Br}	A	See "X2, output to brake"

1) Observe supply voltage for holding brake
2) See following note regarding overvoltage
3) n: natural convection; f: forced cooling
5) 6) 7) See fig. "Air intake and air outlet at device"

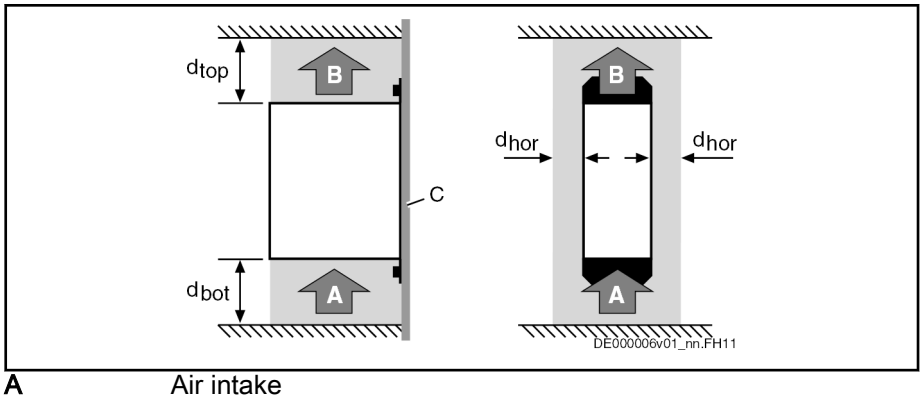
Tab. 16-2: HAT01 - technical data

☞ **Overvoltages** of more than 33 V have to be discharged using 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 overvoltages to the allowed values. This, too, applies to long 24V lines that are run in parallel to power cables and mains cables and that can absorb overvoltages by inductive or capacitive coupling.

Distances

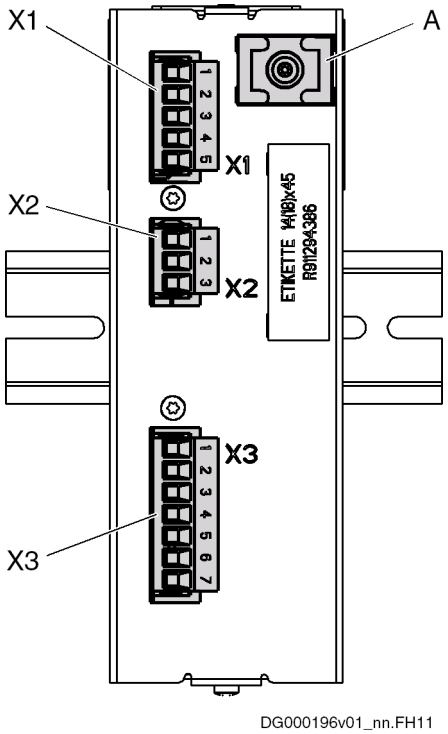


A	Air intake
B	Air outlet
C	Mounting surface in control cabinet
d_{top}	Distance top
d_{bot}	Distance bottom
d_{hor}	Distance horizontal

Fig. 16-5: Air intake and air outlet at device

16.6 Connection points

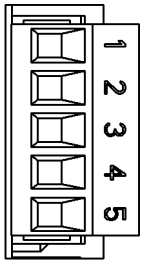
16.6.1 Front view

Front view	Connection point	Description
	X1	24 V power supply (24V, 0V)
	X2	Output to brake
	X3	Signal exchange with control section; connection with ready-made cable **RKS0007**
	A	Strain relief: Fix connection cable with cable tie

Tab. 16-3: Connection points

HAT01 - control module for holding brake

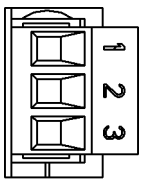
16.6.2 X1, 24 V power supply

Pin assignment	Connection	Signal name	Function
 DA000230v01_nn.FH11	X1.1	+24V	Power supply and "looping through"
	X1.2	+24V	
	X1.3	0V	Reference potential for power supply and "looping through"
	X1.4	0V	
	X1.5	-	Housing potential

Screw connection at connector	Unit	min.	max.
Tightening torque	Nm	0.5	0.6
Connection cable, stranded wire	mm^2	1.0	2.5
Connection cables	AWG	18	14
Power consumption	W	See P_{N3}	
Voltage load capacity	V	See U_{N3}	
Current carrying capacity "looping through" from +24V to +24V, 0V to 0V	A		6 (max. 1 other HAT01 for operation with HMD01)
Polarity reversal protection	-	Within the allowed voltage range by internal protective diode	

Tab. 16-4: Function, pin assignment, properties

16.6.3 X2, output to brake

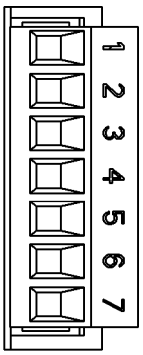
Pin assignment	Connection	Signal name	Function
 DA000231v01_nn.FH11	X2.1	Br+	Connection to positive pole of holding brake
	X2.2	Br-	Connection to negative pole of holding brake
	X2.3	-	HAT01 housing potential (connection for cable shield)

Screw connection at connector	Unit	min.	max.
Tightening torque	Nm	0.5	0.6
Connection cable, stranded wire	mm^2	1.0	2.5
Connection cables	AWG	18	14
Output current I_{Br_cont}	A	0.25	6
Output current I_{Br_max}; $t \leq 1$ s; $I_{AV} \leq I_{Br\_cont}$	A		7.5

Output voltage U_{Br}	V	U_{N3} - 0.5 V	U_{N3}
Output protection	-	Short-circuit proof and overload-proof within the allowed voltage range	

Tab. 16-5: Function, pin assignment, properties

16.6.4 X3, signal exchange with control section

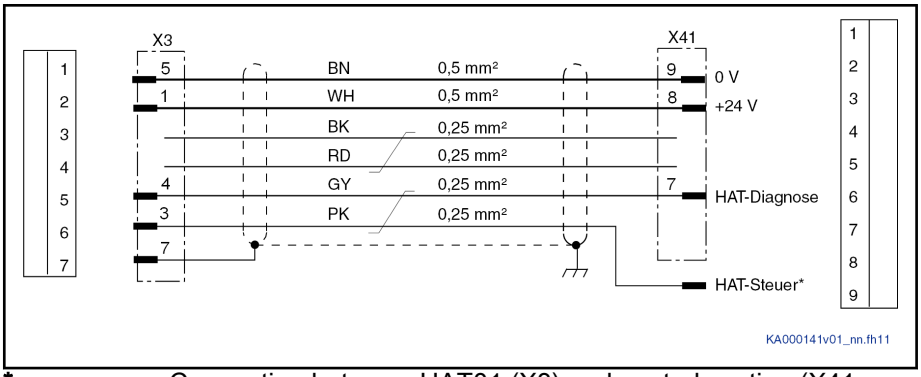
Pin assignment	Connection	Signal name	Function
 DA000234v01_nn.FH11	X3.1	+24V	Power supply of isolated inputs/outputs X3.3 and X3.4 with 24 V / 0.1 A
	X3.2	+24V	
	X3.3	HAT-Steuer	Input for brake control via U_{Br} (X2)
	X3.4	HAT-Diagnose	HAT-Diagnose output
	X3.5	0V	Reference potential for power supply at X3.1
	X3.6	0V	
	X3.7	-	Connection for cable shield

Screw connection at connector	Unit	min.	max.
Tightening torque	Nm	0.5	0.6
Connection cable, stranded wire	mm^2	1.0	2.5
Connection cables	AWG	18	14
Allowed cable length	m		3
Input X3.3 controls output Br+/Br- (X2) (dynamized input)		250 Hz ±20%, duty cycle ~50% → "H" level at Br (X2) output "H" level → "L" level at Br (X2) output "L" level → error state: "L" level at Br (X2) output	
Output voltage at X3.4 shows state of controlled brake	V	Brake applied: 150 Hz ±20% Brake released: "H", (max. X3.1 - 0.5 V) Brake faulty: "L"	
Ready-made connection cable	-	RKS0007	

Tab. 16-6: Function, pin assignment, properties

HAT01 - control module for holding brake

Interconnection diagram RKS0007



* Connection between HAT01 (X3) and control section (X41 [HAT-Diagnose], X32 [HAT-Steuer])

Fig. 16-6: Interconnection diagram RKS0007

17 HAT02 - control module for inductive loads

17.1 Brief description, use and design

Brief description

The HAT02 control module belongs to the Rexroth IndraDrive product range and complies with the following "Safety Integrity Level" (SIL) and "Performance Level" (PL):

- SIL3 according to EN 61508, IEC EN 62061 and IEC 61800-5-2, with dual-channel selection
- Category 4, PL e according to EN ISO 13849-1, with dual-channel selection

HAT02 control modules are mounted on a top-hat rail in the control cabinet.

Use

Type	Use
HAT02.1-**002**	Safely controlling an inductive load, such as a self-applying motor holding brake, hydraulic/pneumatic valve, contactor.
HAT02.1-**003**	Safely controlling an inductive load, such as a self-applying motor holding brake, hydraulic/pneumatic valve, contactor. *Additional functions:* • Safety-related evaluation of up to two signaling contacts • Adjustable withstand voltage (power reduction) • Adjustable overexcitation time

Tab. 17-1: Use

☞ Operating the HAT02 control module requries components with the firmware MPx-18 or higher, such as Cxx02 or HCS01 control sections.

The Cxx02 control sections must have been manufactured from **production week 14W39** onward (see control section type plate).

The error F8353 occurs with older Cxx02 control sections (production week ≤ 14W38). The error already occurs when the device is switched on. The safe state is always ensured.

Commissioning

When the HAT02 control module is commissioned, the overall function with the inductive load (e.g. motor holding brake) has to be checked prior to the first safety-relevant use. The drive has to be able to open and close the inductive load.

Replacing the component

Observe the following aspects when replacing the component:

- The order numbers of the components have to be identical.
- Additionally for HAT02.1-003:
  The positions of the rotary coding switches have to be identical.
- After the installation:
  Make an acceptance test

HAT02 - control module for inductive loads

17.2 Type code and identification

17.2.1 Type code

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	A	T	0	2	.	1	-	0	0	2	-	N	N	N	-	N	N																								
	①			②			③			④				⑤				⑥																								

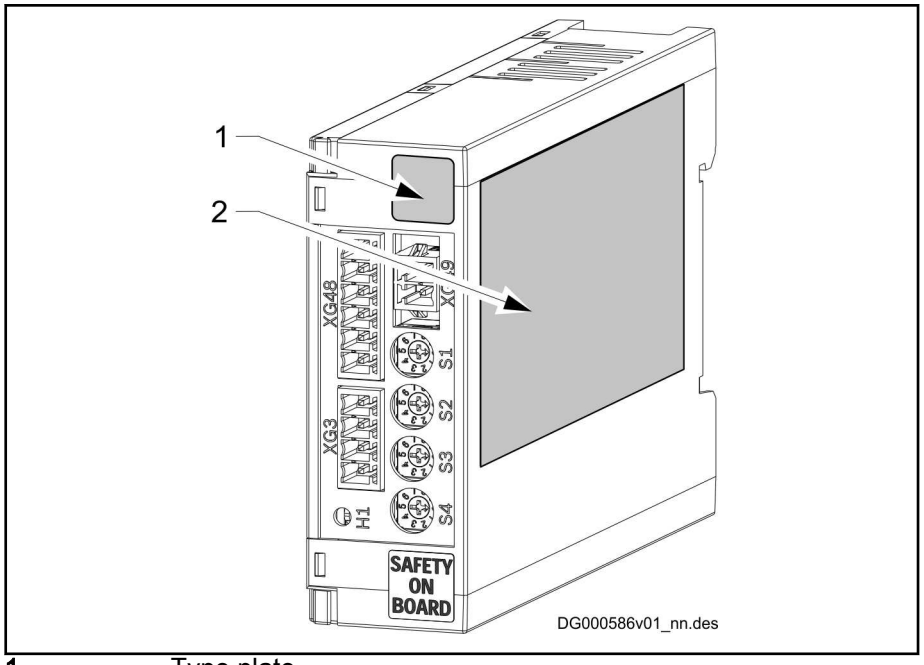
①	**Product:** HAT = Control module for inductive loads
②	**Series:** 02 = 02
③	**Design:** 1 = 1
④	**Brake type:** 002 = Safe switching of inductive loads 003 = Safe switching of inductive loads with state monitoring and overexcitation
⑤	**Other properties:** NNN = None
⑥	**Other design:** NN = None

Tab. 17-2: HAT02 type code

The figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

17.2.2 Identification

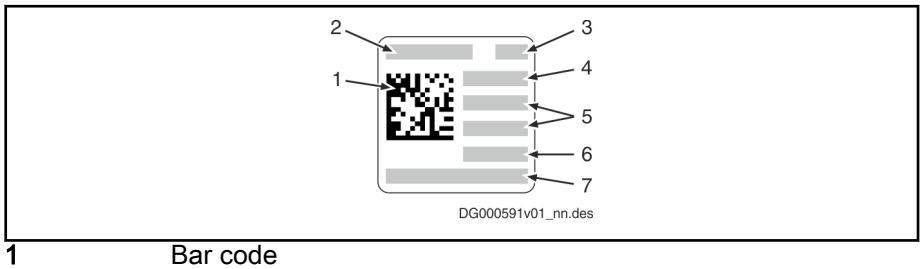
Plates



1 Type plate
2 Data plate

Fig. 17-1: Plates at device

Type plate



1 Bar code
2 Type
3 Hardware index
4 Production week (example: 13W38 means: year 2013, week 38)
5 Material number
6 Factory identifier
7 Serial number

Fig. 17-2: Type plate

Data plate

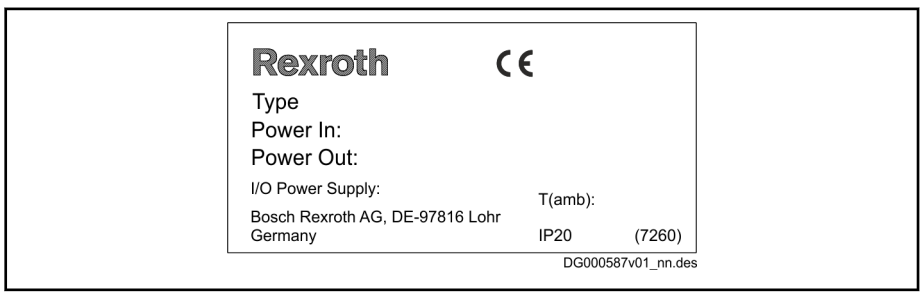


Fig. 17-3: Data plate

HAT02 - control module for inductive loads

17.3 Scope of supply

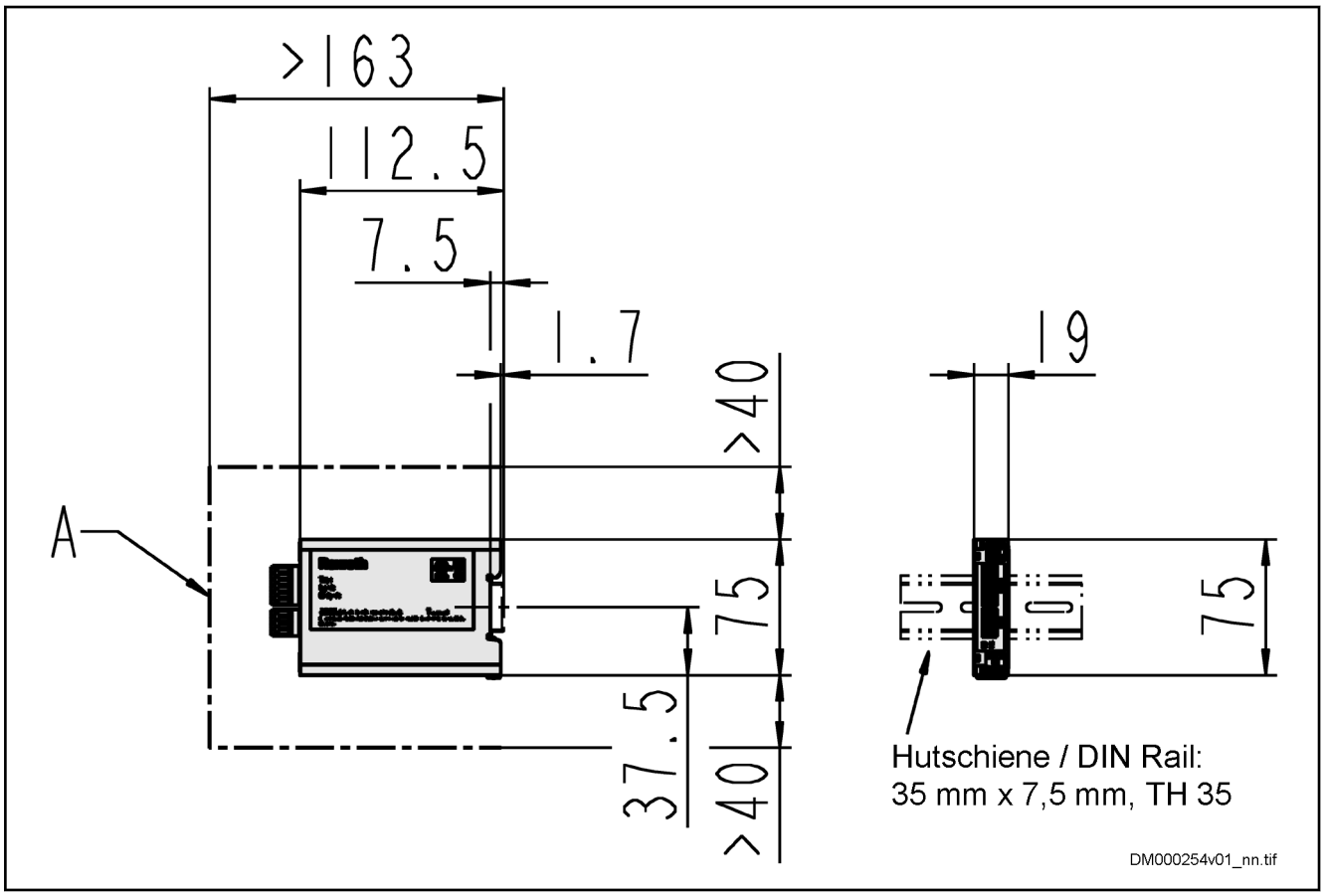
The scope of supply of the HAT02 control module contains:

HAT02.1-002	HAT02.1-003
Connector: XG3, XG48	Connector: XG3, XG48, XG49

Tab. 17-3: Scope of supply HAT02

17.4 Dimensions

HAT02.1-002



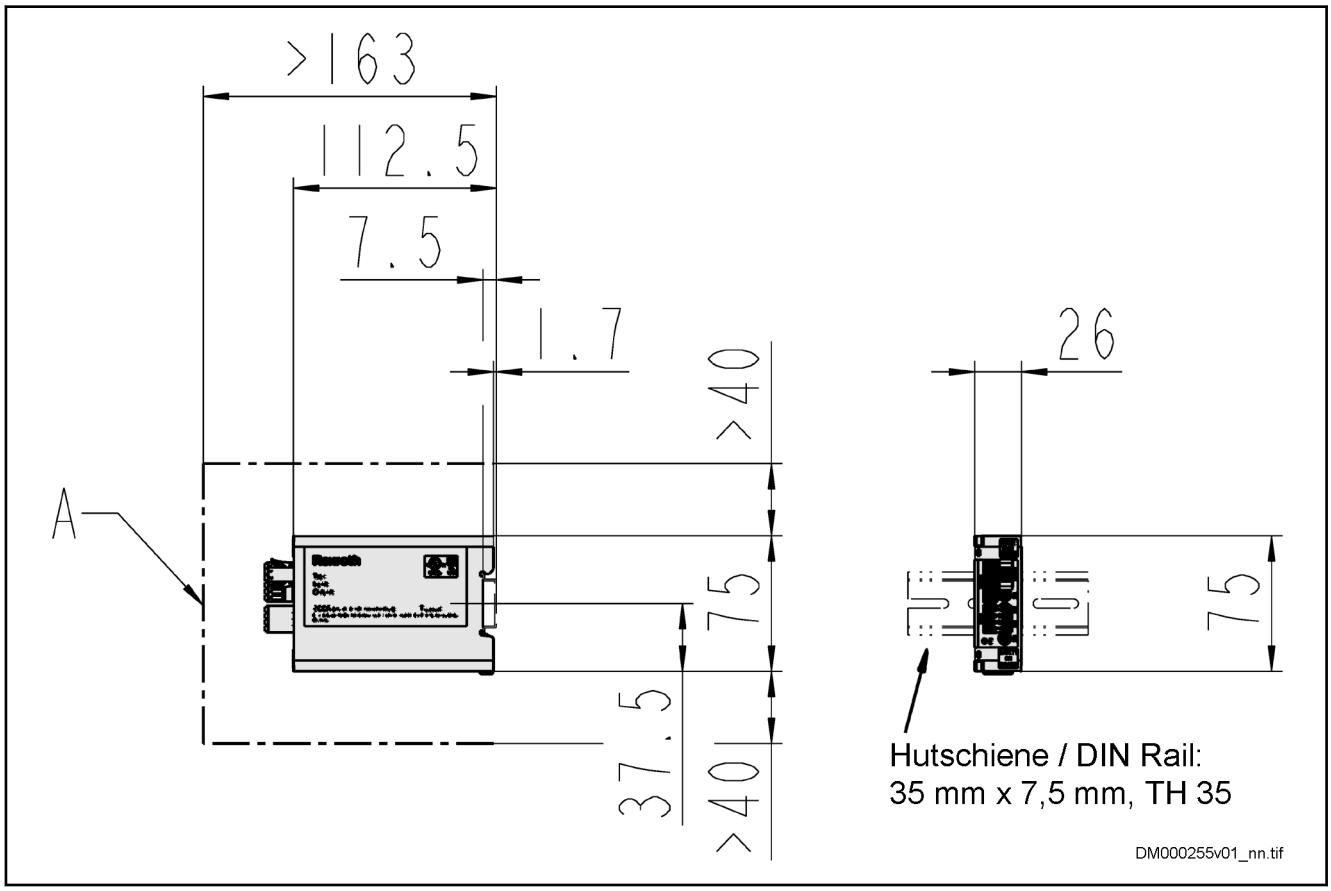
All dimensions in mm

A Minimum mounting clearance

Fig. 17-4: HAT02.1-002, dimensions

HAT02 - control module for inductive loads

HAT02.1-003



All dimensions in mm

A Minimum mounting clearance

Fig. 17-5: HAT02.1-003, dimensions

17.5 Technical data

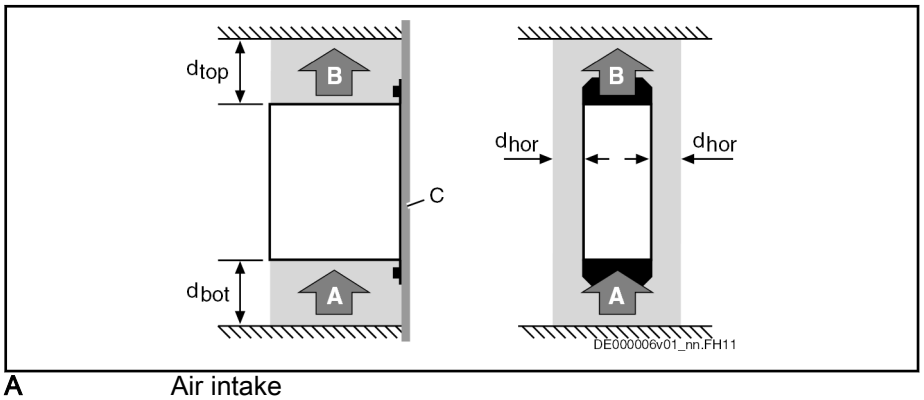
Technical data

Description	Symbol	Unit	HAT02
Mass	m	g	HAT02.1-002: 70 HAT02.1-003: 100
Degree of protection	-	-	IP20
Allowed mounting position	-	-	Vertical
Minimum distance from the top of the device [1)]	d_{top}	mm	40
Minimum distance from the bottom of the device [2)]	d_{bot}	mm	40
Minimum distance on the side of the device	d_{hor}	mm	-
Allowed ambient temperature range	T_{a_work}	°C	0 … 55
Cooling type	-	-	Natural convection

1) 2) See fig. "Air intake and air outlet at device"

Tab. 17-4: HAT02 - technical data

Distances



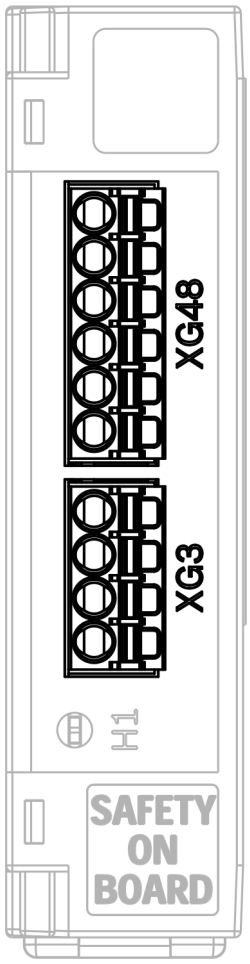
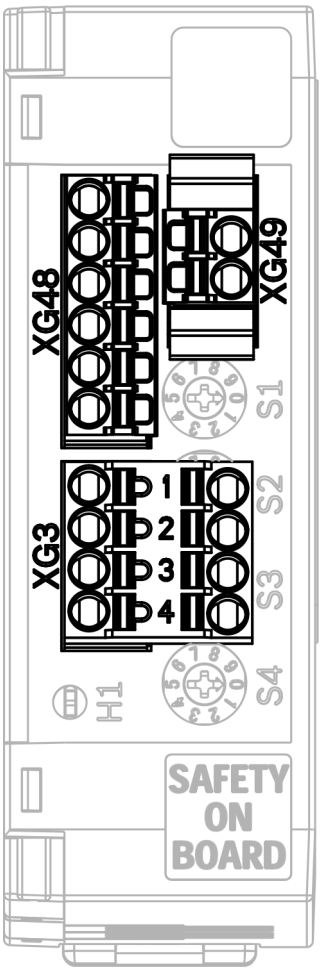
A Air intake
B Air outlet
C Mounting surface in control cabinet
d_{top} Distance top
d_{bot} Distance bottom
d_{hor} Distance horizontal

Fig. 17-6: Air intake and air outlet at device

HAT02 - control module for inductive loads

17.6 Connection points

17.6.1 Front view

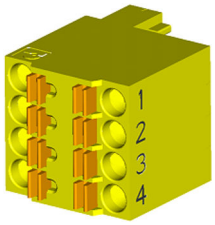
HAT02.1-002-NNN-NN	HAT02.1-003-NNN-NN	Connection point	Description
 DG000584v01_nn.des	 DG000585v01_nn.des	XG3	24 V power supply Brake connection
		XG48	Brake control input Signal exchange with control section
		XG49	Switching state signal input

Tab. 17-5: Connection points

17.6.2 XG3, 24 V power supply, brake connection

⚠ WARNING **In the case of error, injury and property damage due to inadmissibly high voltage!**

For selection and the 24 V supply of devices with integrated safety technology, use a 24 V power supply unit with protection by **SELV**[1)] in accordance with IEC 60950-1 or **PELV**[2)] in accordance with IEC 60204-1.

View	Connection	Signal name	Function
	1	Brake+	Brake connection
	2	Brake-	
	3	24V_Brake	Control module and brake power supply
	4	0V_Brake	

Tab. 17-6: Pin assignment

Mechanical data

Spring terminal	Unit	min.	max.
Connection cable, stranded wire	mm^2	0.2	1.5
Connection cable	AWG	24	16
Stripped length	mm	10	

Tab. 17-7: Mechanical data

Electrical data (control module and brake power supply)

Description	Symbol	Unit	min.	max.
Voltage input	U_{24V_Brake}	V	19.2 [1)]	30
Internal consumption	I_{24V_Brake}	A		0.1
Output driver current consumption	I_{max}	A		6
Polarity reversal protection			Present	

1) Observe allowed voltage tolerance of connected load

Tab. 17-8: Electrical data

☞ The power supply is monitored. The monitored undervoltage threshold is lower than the specified minimum value, and the overvoltage threshold is higher than the specified maximum value.

1) *Safety Extra Low Voltage*

2) *Protective Extra Low Voltage*

HAT02 - control module for inductive loads

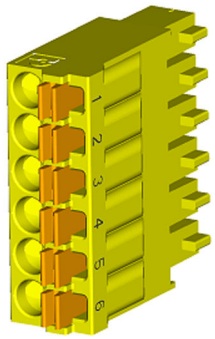
Electrical data (brake control Brake+/Brake-)

Description	Symbol	Unit	min.	max.
Output voltage On (Brake+/Brake-)	U_{On}	V	24V_Brake - 1	24V_Brake [1)]
Output current Off	I_{Off}	mA		5
Output current On	I_{On}	A	0.1 [4)]	6
Switching frequency at output	f	Hz		1
Energy content inductive load (f ≤ 0.1 Hz)	E_{Ind}	J		18 [2) 3)]
Test pulse duration (switching off) [5)]	$t_{Testpuls}$	µs	100	700
Short circuit protection			Present	
Overload protection			Present	

1) 24V_Brake corresponds to the power supply of the user interface. The voltage is accordingly reduced in the case of operation with voltage reduction.
2) An external connection with < 20 V free-wheeling voltage is required for inductive loads with a greater energy content.
3) A higher switching frequency is possible in the case of a smaller energy content.
4) Reason: Switch-off capability monitoring
5) Free-wheeling voltage during the test: approx. 1 V

Tab. 17-9: Electrical data

17.6.3 XG48, signal exchange with control section, brake control input

View	Connection	Signal name	Function
	1	Ext_SI_bSBC_Ch1	Channel 1 brake control input
	2	0V_EA	Reference potential of diagnostic inputs and output
	3	Ext_SI_bSBC_Ch2	Channel 2 brake control input
	4	24V_EA	Diagnostic output power supply
	5	Ext_Diag_I_Brake	Channel 1 and channel 2 diagnostic output
	6	GND	Ground connection

Tab. 17-10: Pin assignment

Mechanical data

Spring terminal	Unit	min.	max.
Connection cable, stranded wire	mm^2	0.2	1.5
Connection cable	AWG	24	16
Stripped length	mm	10	

Tab. 17-11: Mechanical data

Electrical data (power supply for control section signal exchange)

Description	Symbol	Unit	min.	max.
Voltage input	U_{24V_EA}	V	19.2	30
Internal consumption	I_{24V_EA}	mA		5
Output driver current consumption	I_{max}	mA		200
Polarity reversal protection			Present	

Tab. 17-12: Electrical data

The voltage at XG48.4/2 (24V_EA/0V_EA) and the voltage at the drive controller (e.g., X33.1/2) have to be provided by the same voltage source.

Wire the voltage source at the drive controller.

Electrical data (Ext_SI_bSBC_Ch1, Ext_SI_bSBC_Ch2 inputs)

Description	Symbol	Unit	min.	max.
Allowed input voltage	U_{In}	V	-3	30
Input voltage high	U_{In_High}	V	18	30
Input voltage low	U_{In_Low}	V	-3	5
Current consumption	I_{In_High}	mA	4	7
Reference potential			0V_EA	

Tab. 17-13: Electrical data

HAT02 - control module for inductive loads

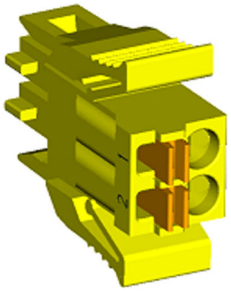
Electrical data (Ext_Diag_I_Brake output)

Description	Symbol	Unit	min.	max.
Output voltage On	U_{On}	V	24V_EA - 1	24V_EA [1)]
Output current Off	I_{Off}	mA		0.1
Output current On	I_{On}	mA		200
Energy content inductive load (f ≤ 1 Hz)	E_{Ind}	mJ		400
Short circuit protection			Present	
Overload protection			Present	
Reference potential			0V_EA	

1) 24V_EA corresponds to the device/brake power supply

Tab. 17-14: Electrical data

17.6.4 XG49, switching state signal input

View	Connection	Signal name	Function
	1	Feedback_1	Input for switching state signal 1
	2	Feedback_2	Input for switching state signal 2

Tab. 17-15: Pin assignment

Mechanical data

Spring terminal	Unit	min.	max.
Connection cable, stranded wire	mm^2	0.2	1.5
Connection cable	AWG	24	16
Stripped length	mm	10	

Tab. 17-16: Mechanical data

Electrical data (Feedback_1, Feedback_2 inputs)

Description	Symbol	Unit	min.	max.
Allowed input voltage	U_{In}	V	-3	30
Input voltage high	U_{In_High}	V	18	30
Input voltage low	U_{In_Low}	V	-3	5
Current consumption [1)]	I_{In_High}	mA	7.5	12
Reference potential			0V_Brake	

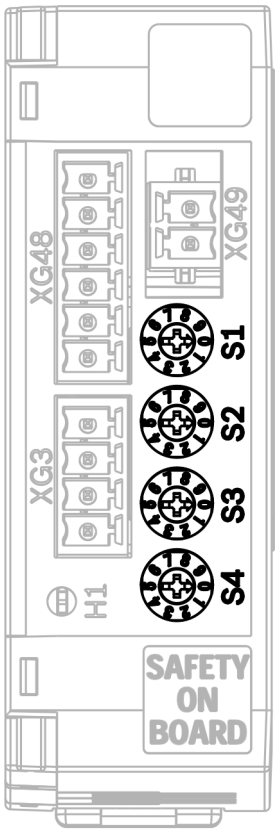
1) With 24 V, the current consumption is > 10 mA

Tab. 17-17: Electrical data

HAT02 - control module for inductive loads

17.7 Rotary coding switches S1, S2, S3, S4

17.7.1 Overview

HAT02.1-003, rotary coding switch		Function
 DG000588v01_nn.des	S1	Withstand voltage
	S2	Overexcitation duration
	S3	Switching state signal evaluation
	S4	Waiting time

Tab. 17-18: HAT02.1-003, rotary coding switch

17.7.2 S1, withstand voltage

The withstand voltage is set with S1. The withstand voltage is the voltage after the overexcitation is over.

S1 facilitates 2 functions:

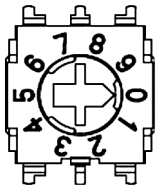
- Overexcitation
- Power reduction

The functions can be combined.

Overexcitation The voltage applied to the inductive load is higher than the one applied to the nominal voltage. Thus, the load reacts faster. After the overexcitation duration (rotary coding switch S2), the voltage is reduced to the nominal voltage.

Power reduction First the nominal voltage is applied to the inductive load for a specified duration (rotary coding switch S2). Afterwards, the voltage is set to a value lower than the nominal voltage. Thereby, the power dissipation at the load can be reduced.

The voltage reduction is not a safety function.

View	Position	Withstand voltage ±20%
	0	24V_Brake (XG3.3)
	1	2/3 × 24V_Brake (XG3.3)
	2	1/2 × 24V_Brake (XG3.3)
	3	1/3 × 24V_Brake (XG3.3)
	4	1/4 × 24V_Brake (XG3.3)
	5	Reserved
	6	Reserved
	7	Reserved
	8	Reserved
	9	Reserved

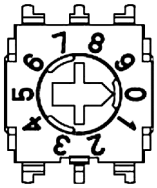
Tab. 17-19: S1, withstand voltage

HAT02 - control module for inductive loads

17.7.3 S2, overexcitation duration

S2 determines how long the voltage of 24V_Brake (XG3.3) is applied to the inductive load.

Prerequisite: Position of switch S1 ≠ 0.

View	Position	Overexcitation duration [s] ±10%
	0	0.02
	1	0.04
	2	0.08
	3	0.15
	4	0.3
	5	0.6
	6	1
	7	1.5
	8	2
	9	2.5

Tab. 17-20: S2, overexcitation duration

17.7.4 S3, switching state signal evaluation

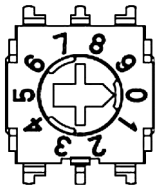
Signaling contacts directly mounted to the mechanics allow checking whether a brake or a valve has really switched or not.

Examples of signaling contacts: Microswitch, proximity switch, Hall sensor

The 24 V power supply of the signaling contacts has to have the same ground reference as 24V_Brake and 0V_Brake.

The S3 position depends on the type (N/C-N/O contact) and state (open/ closed) of the signaling contacts.

A maximum of 2 signaling contacts can be connected at XG49.

View	Position	Evaluation
	0	N/C [3] at Feedback_1, N/O [3] at Feedback_2 (closed and open) [1] [4]
	1	N/C [3] at Feedback_1 (closed and open) [1]
	2	N/O [3] at Feedback_1 (closed and open) [1]
	3	N/C [3] at Feedback_1 and N/O [3] at Feedback_2 (closed) [2] [4]
	4	N/C [3] at Feedback_1 (closed) [2]
	5	N/O [3] at Feedback_1 (closed) [2]
	6	Evaluation switched off
	7	Reserved
	8	Reserved
	9	Reserved

1 Evaluation with brake closed (currentless) and with brake open
2 Evaluation with brake closed (currentless)
3 N/C-N/O: Contact or PNP output
4 If two feedback signals are evaluated, the signals have to be antivalent

Tab. 17-21: S3, switching state signal evaluation

HAT02 - control module for inductive loads

17.7.5 S4, waiting time

During the transition of the inductive load from the inactivated state to the activated state, or vice versa, it is necessary to wait for a certain time before the switching state signals can be evaluated. This time is the waiting time.

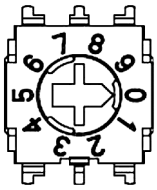
The **waiting times** of self-applying motor holding brakes are as follows:

- $(t_{V\_On\_max} + t_{Br\_Off\_max}) \times f$
- $(t_{V\_Off\_max} + t_{Br\_On\_max}) \times f$

The higher one of the two determined values is decisive for the waiting time.

Description	Significance
$t_{V\_On\_max}$	Maximum valve ON time (if brake controlled via a hydraulic/ pneumatic valve)
$t_{V\_Off\_max}$	Maximum valve OFF time (if brake controlled via a hydraulic/ pneumatic valve)
$t_{Br\_On\_max}$	Maximum clamping delay of brake
$t_{Br\_Off\_max}$	Maximum release delay of brake
f	Factor (see data sheet of brake)

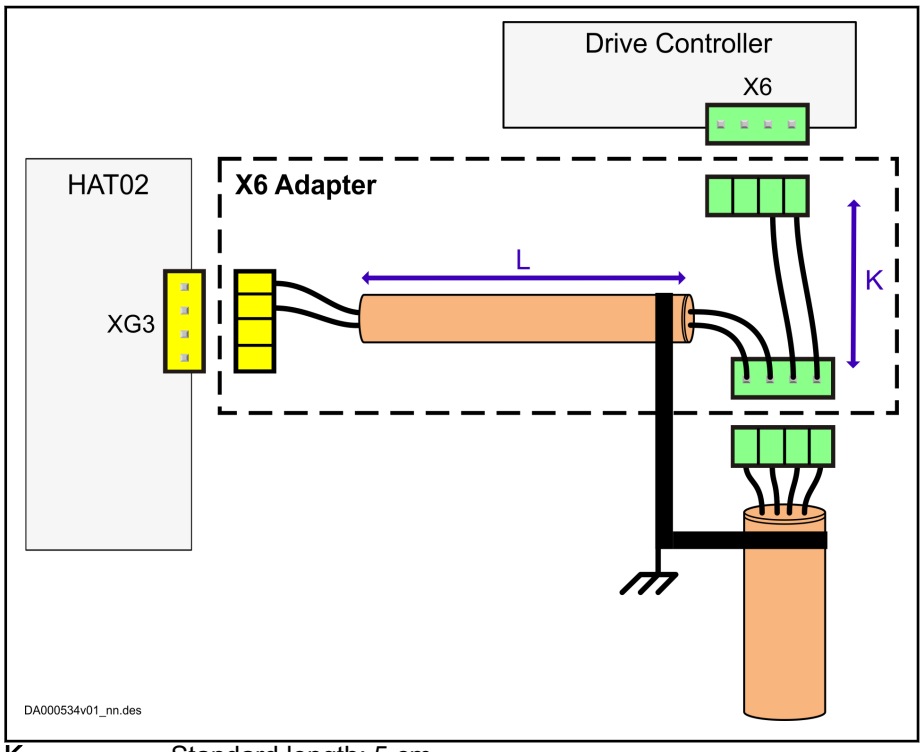
Tab. 17-22: Data for determining the waiting time

View	Position	Waiting time [s]
	0	0.02
	1	0.03
	2	0.05
	3	0.09
	4	0.15
	5	0.3
	6	0.6
	7	1.2
	8	2.5
	9	5

Tab. 17-23: S4, waiting time

17.8 X6 adapter (RKL0091, RKL0092)

When a motor holding brake is wired via the motor cable, the motor holding brake connections are diverted at the drive controller and connected to the HAT02 control module via a shielded connection. The shield is connected at one end to the motor cable shield at the drive controller.



K Standard length: 5 cm
L Length: depending on the application

Fig. 17-7: X6 adapter for diverting the motor holding brake connections

Depending on the drive controller performance, there are two types:

Type A	Type B
HMS01.1N-W0020 … -W0070 HMS02.1N-W0028, -W0054 HCS02.1E-W0012 … -W0070 HMD01.1N-W0012 … -W0036 HCS03.1E-W0070 Order code: RKL0091 (R911347795)	HMS01.1N-W0100 … -W0350 HCS03.1E-W0100 … -W0350 Order code: **RKL0092** (R911369814)

Tab. 17-24: X6 adapter, types

HAT02 - control module for inductive loads

17.9 LED H1

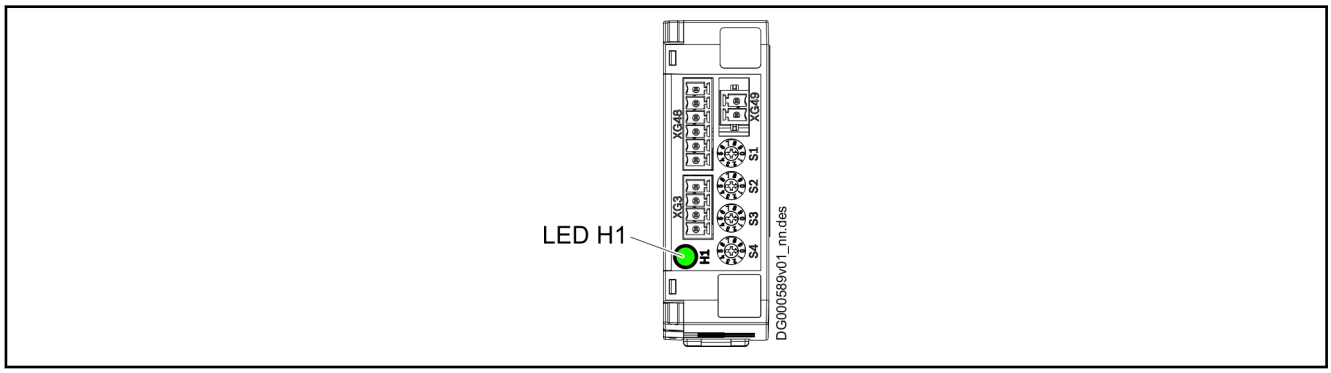


Fig. 17-8: LED H1

HAT02.1-002				
LED		**Significance**	**Action**	**Reset [1)]**
○	Off	24 V voltage is missing	Check supply voltage	
		Device defective	Replace device	
☀	Green	Device ready for operation		
☀	Flashing green	Supply voltage (24V_Brake) outside of tolerance range	Check supply voltage	R
☀	Flashing green-yellow	Overtemperature	Check ambient temperature	R
☀	Yellow	Wiring error at Brake+ or Brake- 24V_Brake outside of tolerance range during booting process	Check Brake+/- wiring Check supply voltage	PO
		Wire break at Brake+/-	Check Brake+/- wiring	R
		Short circuit Brake+ against 0V	Check Brake+/- wiring	PO
		Short circuit Brake+ against Brake-	Check Brake+/- wiring	PO
☀	Flashing yellow	Load current too high	Check current consumption at Brake+/-	PO
☀	Red	Device defective	Replace device	PO
☀	Flashing red	Error on interface to drive controller	Check XG48 wiring	PO
		Error in load control	Check Brake+/- wiring	R
		Device defective	Replace device	PO

1) **R:** Reset via drive; **PO:** "Power Off/On"; switch supply voltage (24V_Brake) off and on again

Tab. 17-25: LED display (HAT02.1-002)

The error state is displayed as long as the error is present. At least, however, until the SBC function is deselected the next time.

The error state is saved in the drive and has to be acknowledged at the drive.

18 HSZ01 - safety zone module

18.1 Brief description, use, features

Brief description, use

Type	Use
HSZ01	The safety zone module HSZ01 belongs to the Rexroth IndraDrive product range and provides the following safety functions: • Safety Zone Acknowledge (SZA) • Safety Zone Error (SZE) • Safety Zone Input (SZI) • Safe Door Locking (SDL)

Tab. 18-1: Use

Features

- **2 × 8 digital inputs** for dual-channel collective selection of the safety functions at the safety zone nodes or 16 inputs for single-channel selection
- **2 × 1 digital dynamized output** (1 output pair) for **safety zone acknowledge**, if all safety zone nodes signal safety
- **2 × 1 digital dynamized output** (1 output pair) for **safety zone error**, if at least one safety zone node signals an error
- **2 × 1 digital dynamized output** (1 output pair) for **monitoring** the wiring
- **2 × 1 digital output** (1 output pair) for controlling the safe **door locking**
- **Galvanic isolation** exists between the inputs and outputs of the safety zone module and the other nodes of a safety zone

HSZ01 - safety zone module

18.2 Type code and identification

18.2.1 Type code

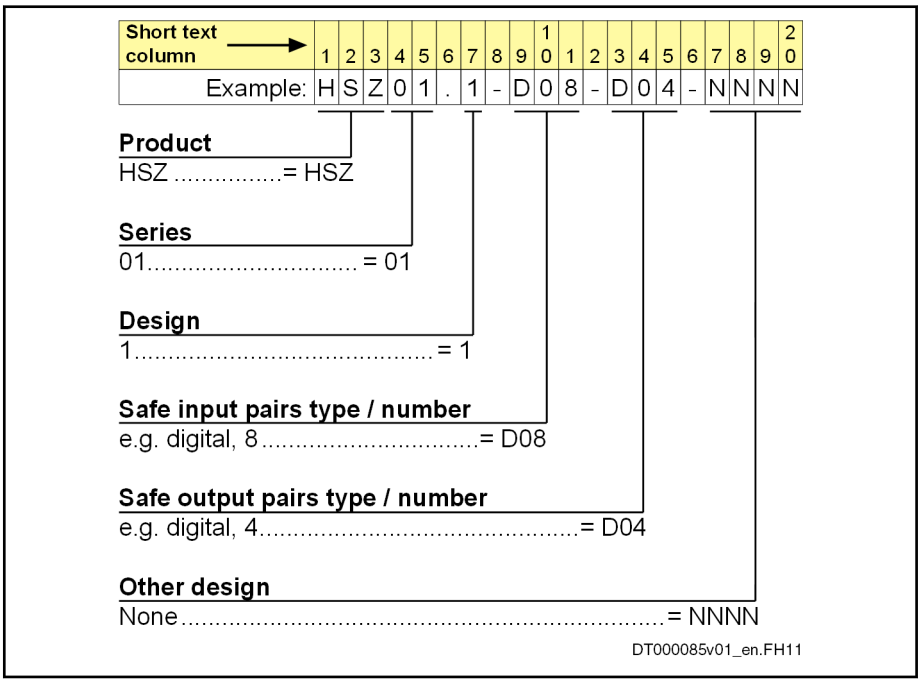
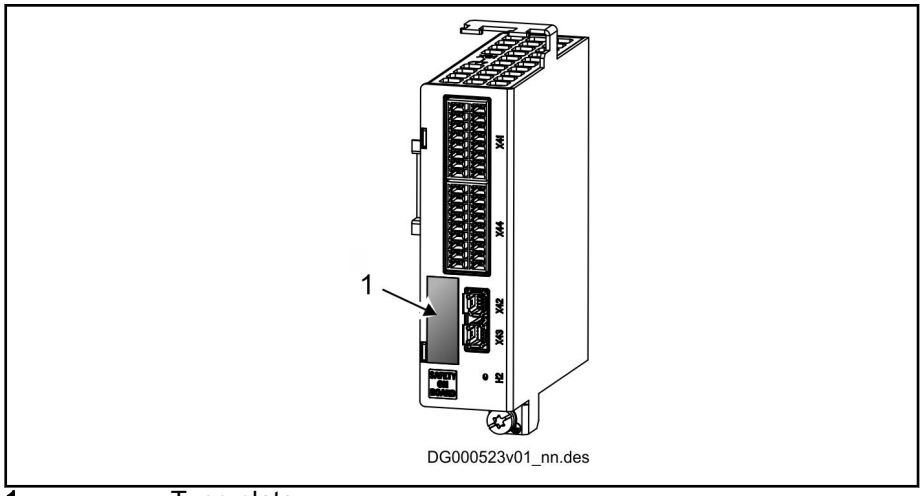


Fig. 18-1: Type code

The figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

18.2.2 Identification

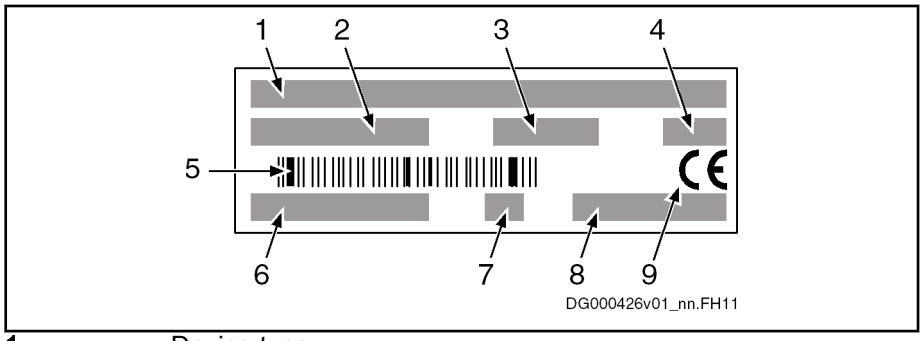
Type plate arrangement



1 Type plate

Fig. 18-2: Type plate arrangement

Type plate (device)



1 Device type
2 Part number
3 Production week; 11W36, for example, means year 2011, week 36
4 Factory identifier
5 Bar code
6 Serial number
7 Hardware index
8 Country of manufacture
9 Identification

Fig. 18-3: Type plate (device)

18.3 Scope of supply

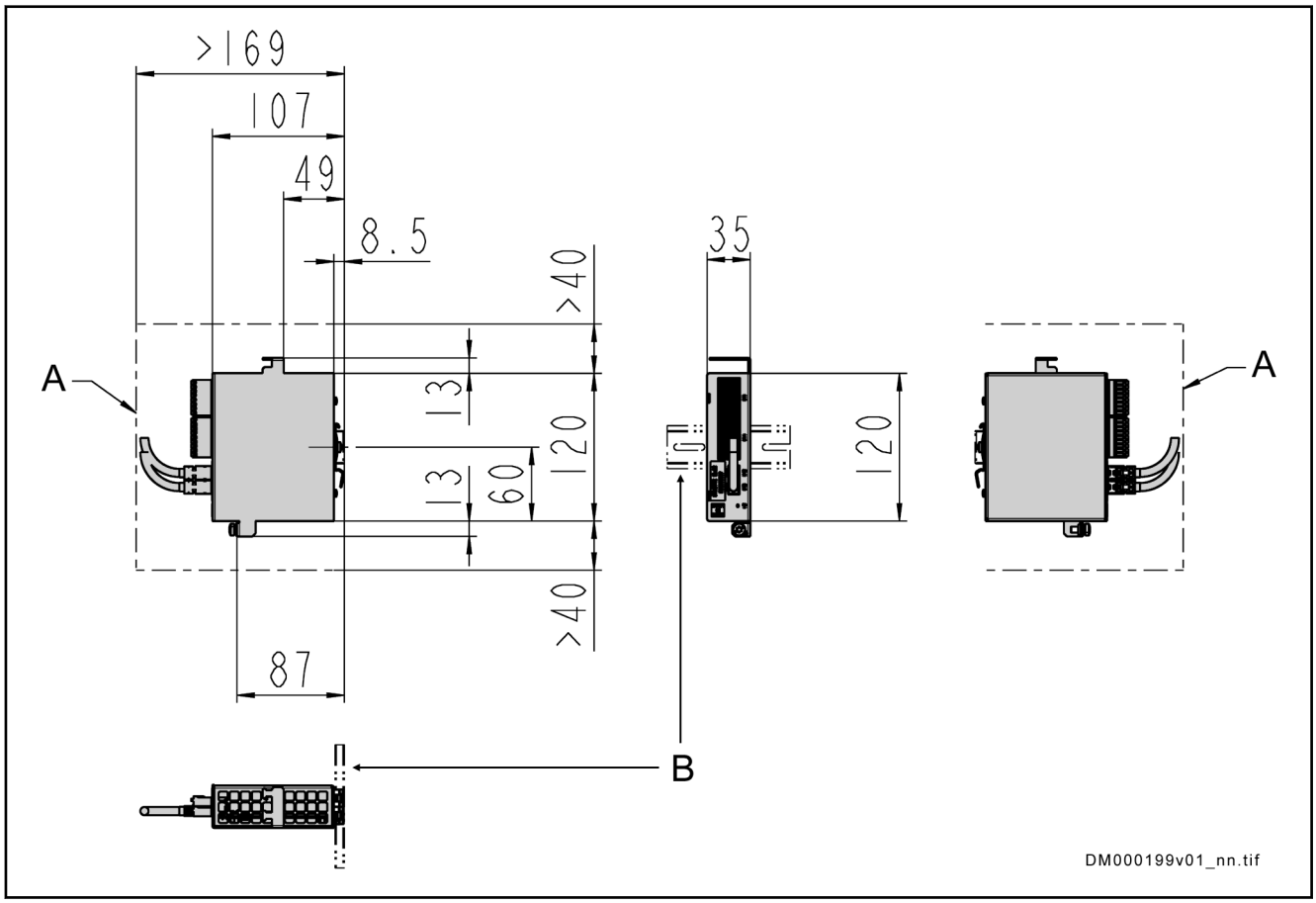
Scope of supply

- HSZ01 safety zone module
- Connector X41
- Connector X44

HSZ01 - safety zone module

18.4 Dimensions

18.4.1 Mounted on a top-hat rail



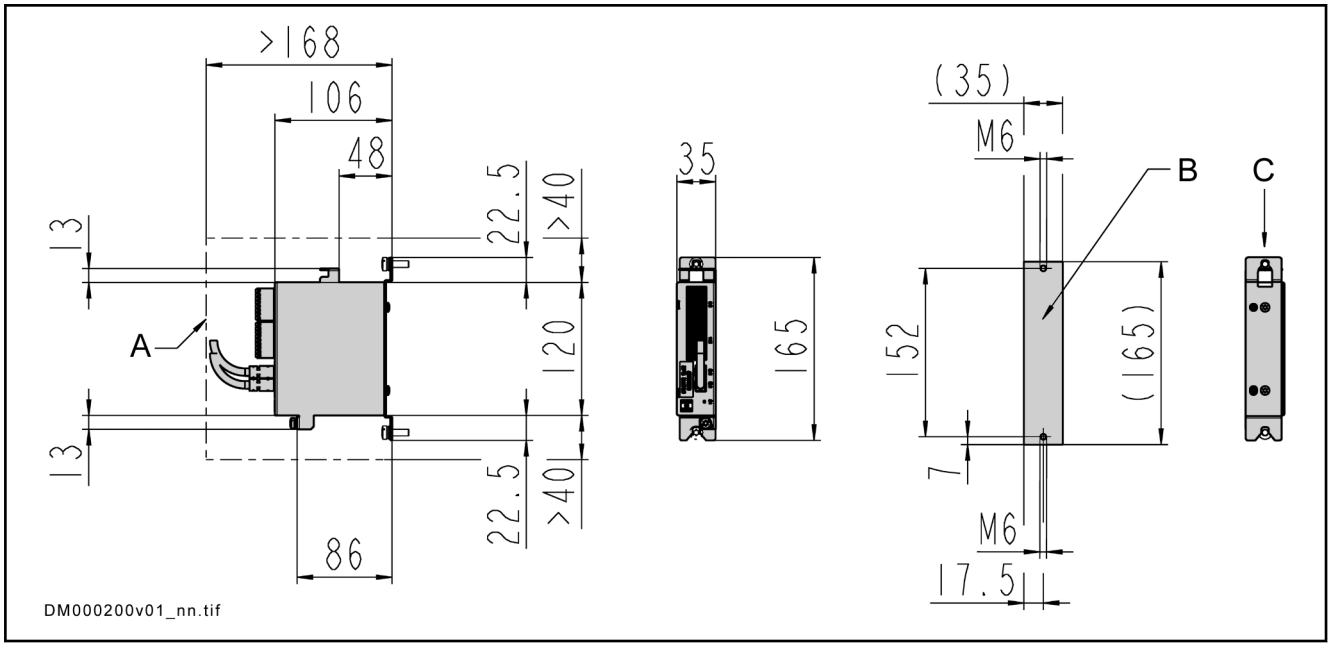
All dimensions in mm

A Minimum mounting clearance

B Top-hat rail (35 mm × 7.5 mm [according to EN50022])

Fig. 18-4: Dimensions

18.4.2 Mounted with accessories HAS05.1-014-NNN-NN



All dimensions in mm

A	Minimum mounting clearance
B	Drilling pattern
C	HAS05.1-014-NNN-NN

Fig. 18-5: Dimensions

See also chapter 20.5.13 "HAS05.1-014, Mounting Plate for Safety Zone Module" on page 399.

HSZ01 - safety zone module

18.5 Technical data

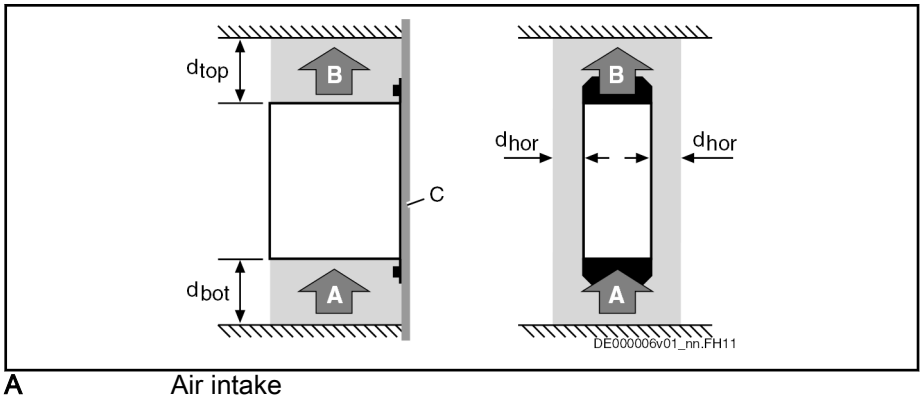
Technical data

Description	Symbol	Unit	HSZ01.1-D08-D04-NNNN
Degree of protection			IP20
Conductive dirt contamination			Not allowed (You can protect the devices against conductive dirt contamination, e.g., by mounting them in control cabinets with a degree of protection of IP54 in accordance with IEC529.)
Allowed mounting position			Vertical in a control cabinet
Weight	m	kg	0.65
Minimum distance from the top of the device [1)]	d_{top}	mm	40
Minimum distance from the bottom of the device [2)]	d_{bot}	mm	40
Minimum distance from the side of the device [3)]	d_{hor}	mm	-
Allowed ambient temperature range	T_{a_work}	°C	0 … 55
Allowed relative humidity		%	5 … 85
Cooling type [4)]			n
Control voltage supply			
Control voltage input [5)]	U_{ext}	V	19.2 … 30
Internal consumption	P_{ext}	W	0.5
Output current [6)]	I_{max}	A	3.4

1) 2) 3) See fig. "Air intake and air outlet at device"
4) n: natural convection; f: forced cooling
5) When selecting a control voltage supply, observe the requirements of the door locking device
6) Sum of all output currents at the outputs (without SDL_Ch2)

Tab. 18-2: HSZ01 - technical data

Distances



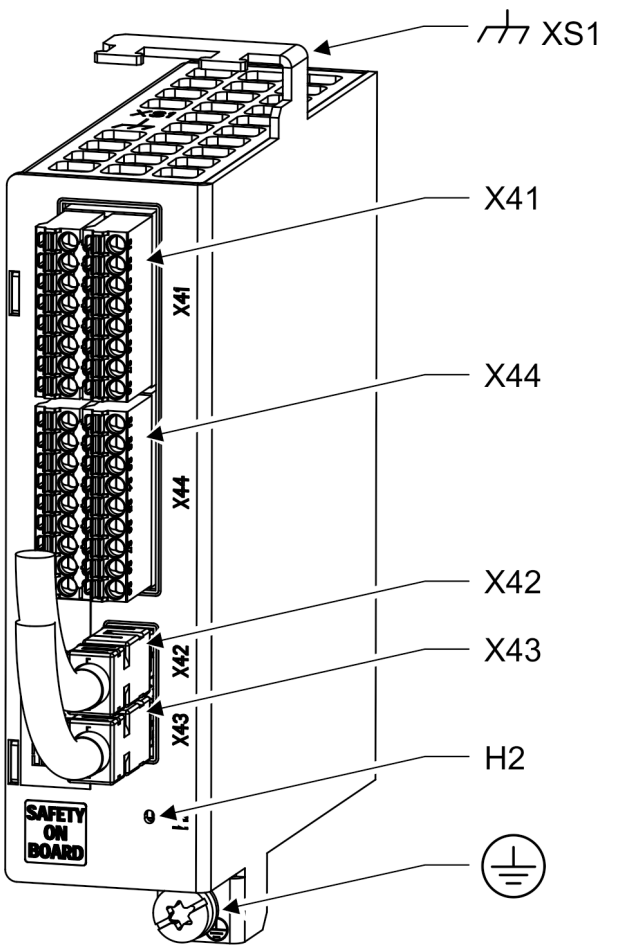
A	Air intake
B	Air outlet
C	Mounting surface in control cabinet
d_{top}	Distance top
d_{bot}	Distance bottom
d_{hor}	Distance horizontal

Fig. 18-6: Air intake and air outlet at device

HSZ01 - safety zone module

18.6 Connection points

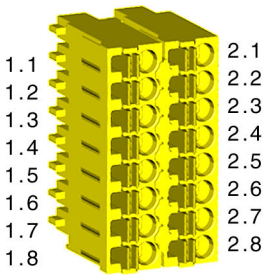
18.6.1 Position of connection points

View	Connection point	Description
	⏚ XS1	Shield connection
	X41	Digital inputs
	X42	Communication, input
	X43	Communication, output
	X44	Digital outputs Control voltage supply connection
	⏚	Equipment grounding conductor
	H2 (LED)	Status display (bicolor LED)

Tab. 18-3: Connection points

18.6.2 X41, digital inputs

Data

View	Identification	Function
	X41	Safe Motion
Spring terminal (connector)	**Unit**	**max.**
Connection cable Stranded wire	mm^2	1.5
	AWG	16
Stripped length	mm	10

Tab. 18-4: Data

Time behavior

Maximum **delay** when selecting and deselecting a digital input: **2.5 ms**

The delay results from the addition of the following times:

- Filter time of the digital input
- Time for adjusting the signal
- Transmission time to the drive controller

The reaction time of the drive controller is **not** contained in the specified time.

HSZ01 - safety zone module

18.6.3 Pin assignment, function

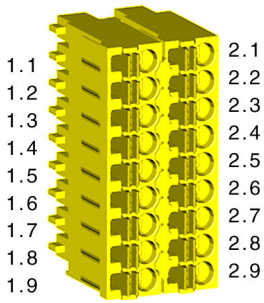
Connection	Signal name	Function	Dynamization [1)]	Input pair	Technical data
1.1	In_1	Input 1	DYN_Ch1	1	See chapter 18.7.1 "Digital inputs (safety technology S options)" on page 256
1.2	In_2	Input 2	DYN_Ch2		
1.3	In_3	Input 3	DYN_Ch1	2	
1.4	In_4	Input 4	DYN_Ch2		
1.5	In_5	Input 5	DYN_Ch1	3	
1.6	In_6	Input 6	DYN_Ch2		
1.7	In_7	Input 7	DYN_Ch1	4	
1.8	In_8	Input 8	DYN_Ch2		
2.1	In_9	Input 9	DYN_Ch1	5	
2.2	In_10	Input 10	DYN_Ch2		
2.3	In_11	Input 11	DYN_Ch1	6	
2.4	In_12	Input 12	DYN_Ch2		
2.5	In_13	Input 13	DYN_Ch1	7	
2.6	In_14	Input 14	DYN_Ch2		
2.7	In_15	Input 15	DYN_Ch1	8	
2.8	In_16	Input 16	DYN_Ch2		

1) Assigned dynamization output of HSZ01 in the case of selection via a passive safety unit

Tab. 18-5: Function, pin assignment, properties

18.6.4 X44, digital outputs, control voltage supply

18.6.5 Data

View	Identification	Function
	X44	Safe Motion
Spring terminal (connector)	**Unit**	**max.**
Connection cable Stranded wire	mm^2	1.5
	AWG	16
Stripped length	mm	10

Tab. 18-6: Data

HSZ01 - safety zone module

18.6.6 Pin assignment, function

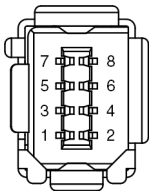
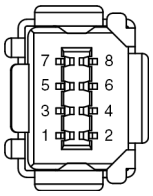
Function	Connection	Signal name	Technical data
Power supply	2.1	24V	Voltage: DC 19.2 … 30 V [1)]
Power supply	1.1	0V	Reference potential of power supply
Channel 1 zone error output	1.7	SZE_Ch1	• **High** on both outputs: All nodes are without error • **Low** on both outputs: At least one node has an error See also 2) and chapter 18.7.2 "Digital outputs (safety technology S options)" on page 257
Channel 2 zone error output	2.7	SZE_Ch2	
Channel 1 zone safety output	1.8	SZA_Ch1	• **High** on both outputs: All nodes are safe • **Low** on both outputs: At least one node is not safe See also 2) and chapter 18.7.2 "Digital outputs (safety technology S options)" on page 257
Channel 2 zone safety output	2.8	SZA_Ch2	
Safe door locking output, channel 1	1.9	SDL_Ch1	Output pair for controlling a door locking device. When the door latch is correctly controlled, SDL_Ch1 = High and SDL_Ch2 = Low. See also chapter 18.7.3 "Digital outputs (safety technology S options, SDL)" on page 259
Safe door locking output, channel 2	2.9	SDL_Ch2	
Channel 1 dynamization output	1.2	DYN_Ch1	**One** output pair for dynamization of the external wiring. To simplify the wiring, the connection of the output pair exists several times. See also 2) and chapter 18.7.2 "Digital outputs (safety technology S options)" on page 257
Channel 2 dynamization output	2.2	DYN_Ch2	
Channel 1 dynamization output	1.3	DYN_Ch1	
Channel 2 dynamization output	2.3	DYN_Ch2	
Channel 1 dynamization output	1.4	DYN_Ch1	
Channel 2 dynamization output	2.4	DYN_Ch2	
Channel 1 dynamization output	1.5	DYN_Ch1	
Channel 2 dynamization output	2.5	DYN_Ch2	
Channel 1 dynamization output	1.6	DYN_Ch1	
Channel 2 dynamization output	2.6	DYN_Ch2	

1) If the door locking device requires a tighter tolerance of the voltage, the power supply unit used has to comply with the tolerance of the door locking device.

2) If a relay is used, the minimum withstand voltage of the relay has to be > 2 V (2 V = maximum output voltage OFF of the digital output).

Tab. 18-7: Function, pin assignment, properties

18.6.7 X42 and X43, Safe Motion safety technology (communication)

View	Identification	Function
X42:  X43:  	X42 X43	Connection points for connecting the HSZ01 [1] safety zone module and the safety zone nodes: X42: Input X43: Output
Connection cable	• Maximum total length of **all** cables of a safety zone: **2500 m** • Maximum length of **one** cable between two connection points: **100 m** • Number of safety zone nodes (without HSZ01): – Maximum: 35 – Minimum: 1 • Ready-made cables that can be ordered: – **RKB0051** Short cables to connect devices arranged side by side in the control cabinet. Available lengths: 0.19 m; 0.25 m; 0.35 m; 0.55 m Minimum bending radius: 4xD (= 4x6 mm = 24 mm) Order code for a 0.55 m long cable: RKB0051/00,55 – **RKB0052** Long cables to connect remote communication nodes, also outside of the control cabinet. Available lengths: 1 m; 2 m; 5 m; 10 m Minimum bending radius: 8xD (= 8x6 mm = 48 mm) Order code for a 5 m long cable: RKB0052/005,0 Flexible installation of the cable is not allowed.	

1) See Project Planning Manual "IndraDrive Additional Components and Accessories" (R911306140).

Tab. 18-8: X42, X43

HSZ01 - safety zone module

18.7 Digital inputs and outputs

18.7.1 Digital inputs (safety technology S options)

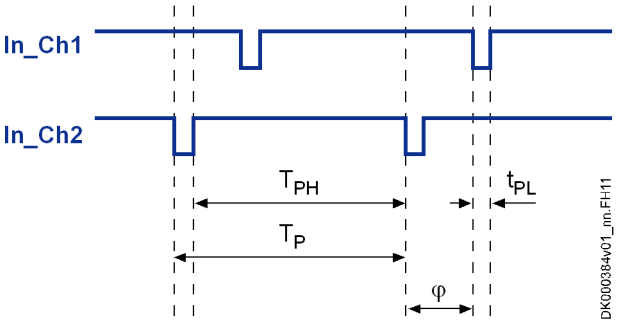
The digital inputs correspond to IEC 61131, type 1.

Data	Unit	min.	max.
Allowed input voltage	V	-3	30
High	V	15	30
Low	V	-3	5
Current consumption	mA	2	5

Tab. 18-9: Digital inputs (safety technology S options)

Time behavior

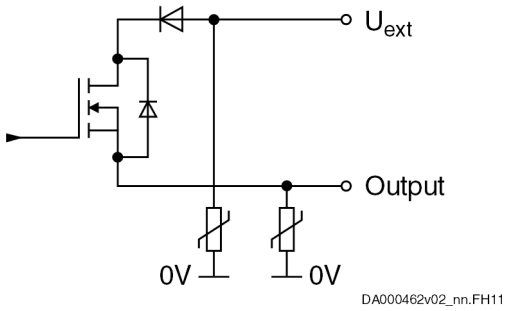
Description	Unit	min.	max.
Test pulse width (t_{PL})	µs	0	1000
Percentage of High time ($T_{PH}/T_P \times 100\%$)	%	90	100
Phase shift between two test pulses on both channels (φ)	ms	-	-



Tab. 18-10: Time behavior

18.7.2 Digital outputs (safety technology S options)

The digital outputs are compatible with digital inputs of types 1, 2 and 3 (IEC 61131).

Data	Unit	min.	max.
Output voltage ON	V	U_{ext} - 1	U_{ext}
Output voltage OFF	V		2
Allowed output current per output	mA		350
Allowed energy content of connected inductive loads, e.g. relay coils	mJ		400 [1) 2)]
Capacitive load	nF		320
Short circuit protection		Present	
Overload protection		Present	
Block diagram output:			
Error detection	The following errors are detected: • Wiring error with short circuit to high • Wiring error with short circuit to low • Wiring error with short circuit between the two channels • Internal errors In the case of an error, the control panel shows the corresponding error message: F83xx		

1) At a maximum switching frequency of 1 Hz

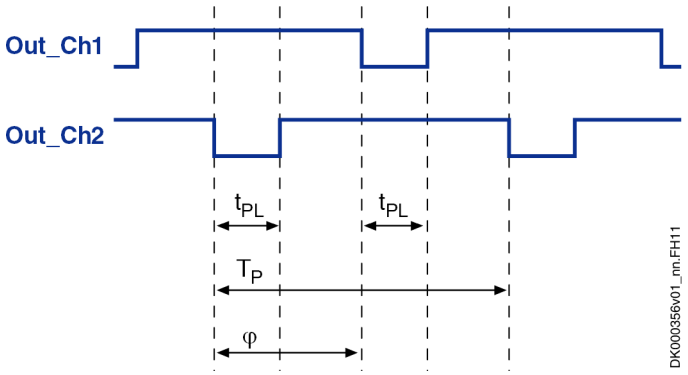
2) In the case of inductive loads with currents > 200 mA or in the case of inductive loads with a greater energy content, an external free-wheeling arm has to be installed. The effective terminal voltage has to be < 25 V.

Tab. 18-11: Digital outputs

HSZ01 - safety zone module

Time behavior

Description	Unit	min.	max.
Test pulse width (t_{PL})	µs	100	200
Periodic time (T_P)	ms	500	1000
Phase shift between two test pulses on both channels (φ)	ms	50	-



Tab. 18-12: Time behavior

18.7.3 Digital outputs (safety technology S options, SDL)

The digital outputs are compatible with digital inputs of type 1 (IEC 61131).

Data	Unit	min.	typ.	max.
Output voltage ON SDL_Ch1	V	U_{ext} - 1	24	U_{ext}
Output voltage ON SDL_Ch2	V	-		0.5
Output current ON	mA			1250
Output current OFF	mA			0.8
Allowed energy content of connected inductive loads, e.g. relay coils; only allowed as single pulse	mJ			2000 [1) 2)]
Short circuit protection		Present		
Overload protection		Present		
Overtemperature protection		Present		
Monitoring of internal switches T_Ch1 and T_Ch_2		Present		

1) With a maximum switching frequency of 0.5 Hz
2) In the case of greater inductive loads, an external free-wheeling arm must be installed. The effective terminal voltage must be < 20 V.

Tab. 18-13: Digital outputs

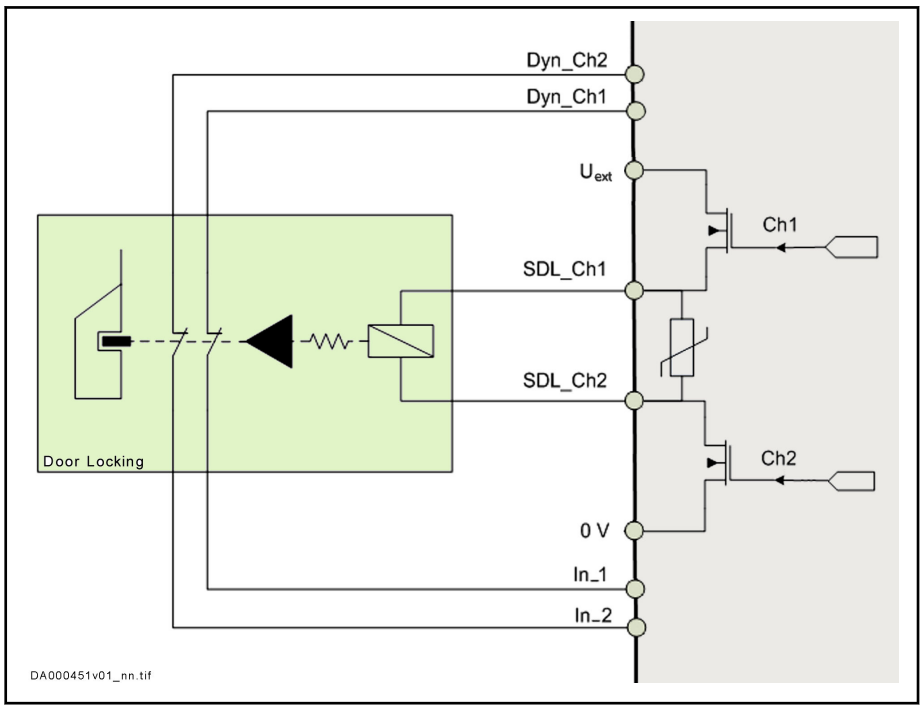


Fig. 18-7: Safe Door Locking SDL

HSZ01 - safety zone module

18.8 LED H2

LED	Color	Description
H2	Off	• Power supply missing • Device defective
	 Permanently lit green	Device functions without error
	 Flashing red	Errors present: See diagnostic display (e. g. F3152) on the drive controller Fixing: See firmware documentation "Diag. Messages"
	 Permanently lit red	• Hardware error • Firmware error • Communication error Diagnostic display: F7033

Tab. 18-14: LED H2

19 HAB01 Fan Unit

Type Code

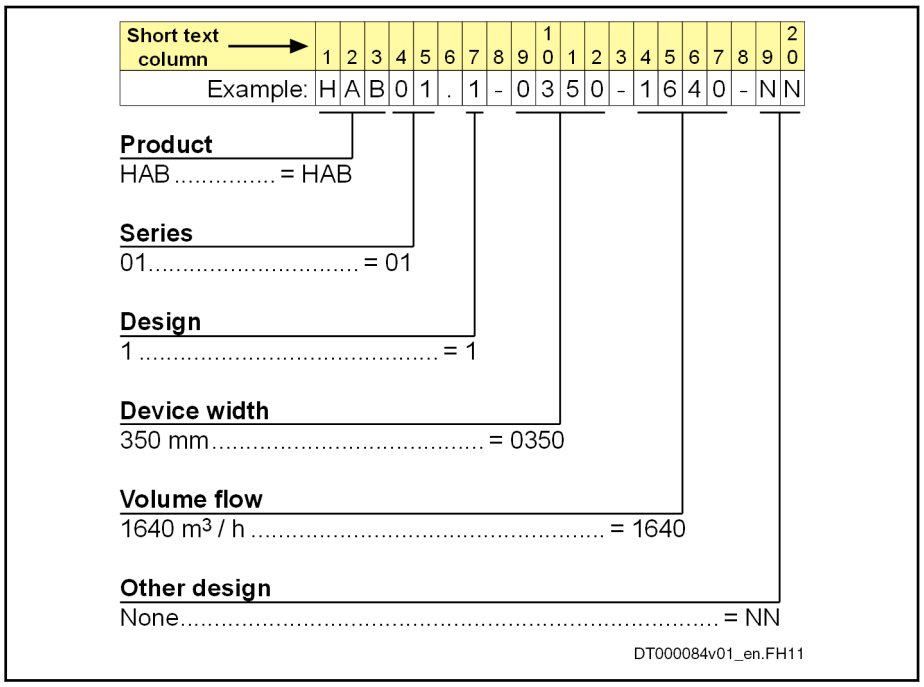


Fig. 19-1: Type Code

Data

Use	HAB01 cools • HMV01.1R-W0120 supply units • HMS01.1N-W0350 power sections
Complete designation	HAB01.1-0350-1640-NN
Volume flow	1,640 m^3/h
Weight	7.5 kg
Dimensions	See dimensional drawing

Tab. 19-1: HAB01 Fan Unit - Data

HAB01 Fan Unit

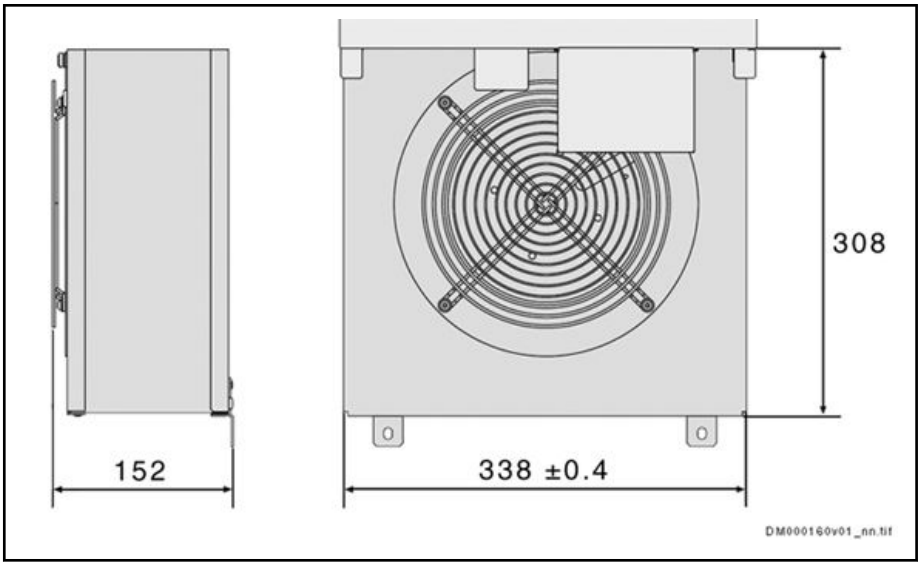
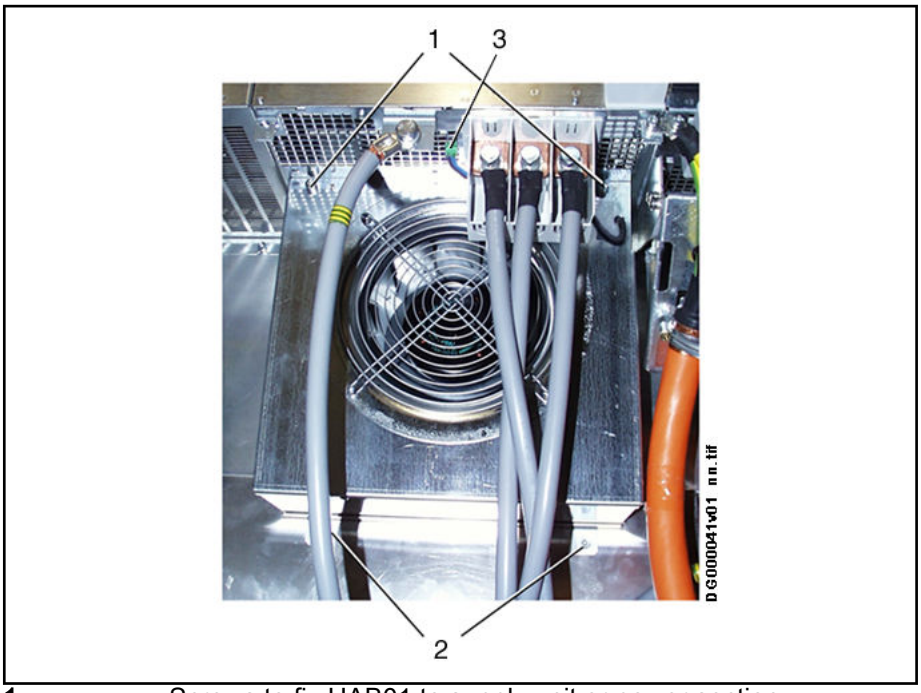


Fig. 19-2: HAB01 Fan Unit - Dimensional Drawing

See also dimensional drawing HMV01.1R-W0120 or HMS01.1N-W0350 in the documentation of the supply units and power sections.

Mounting

1. Mount supply unit or power section
2. Hang up HAB01
3. Screw on bottom of HAB01
4. Screw on top of HAB01
5. Connect HAB01 to X13



1 Screws to fix HAB01 to supply unit or power section
2 Screws to fix HAB01 to mounting plate
3 Connection X13 for power supply of HAB01 fan unit

Fig. 19-3: HAB01 Fan Unit - Mounting and Connection

20 Accessories

20.1 HAS01, Basic Accessories

20.1.1 Type Code

The figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

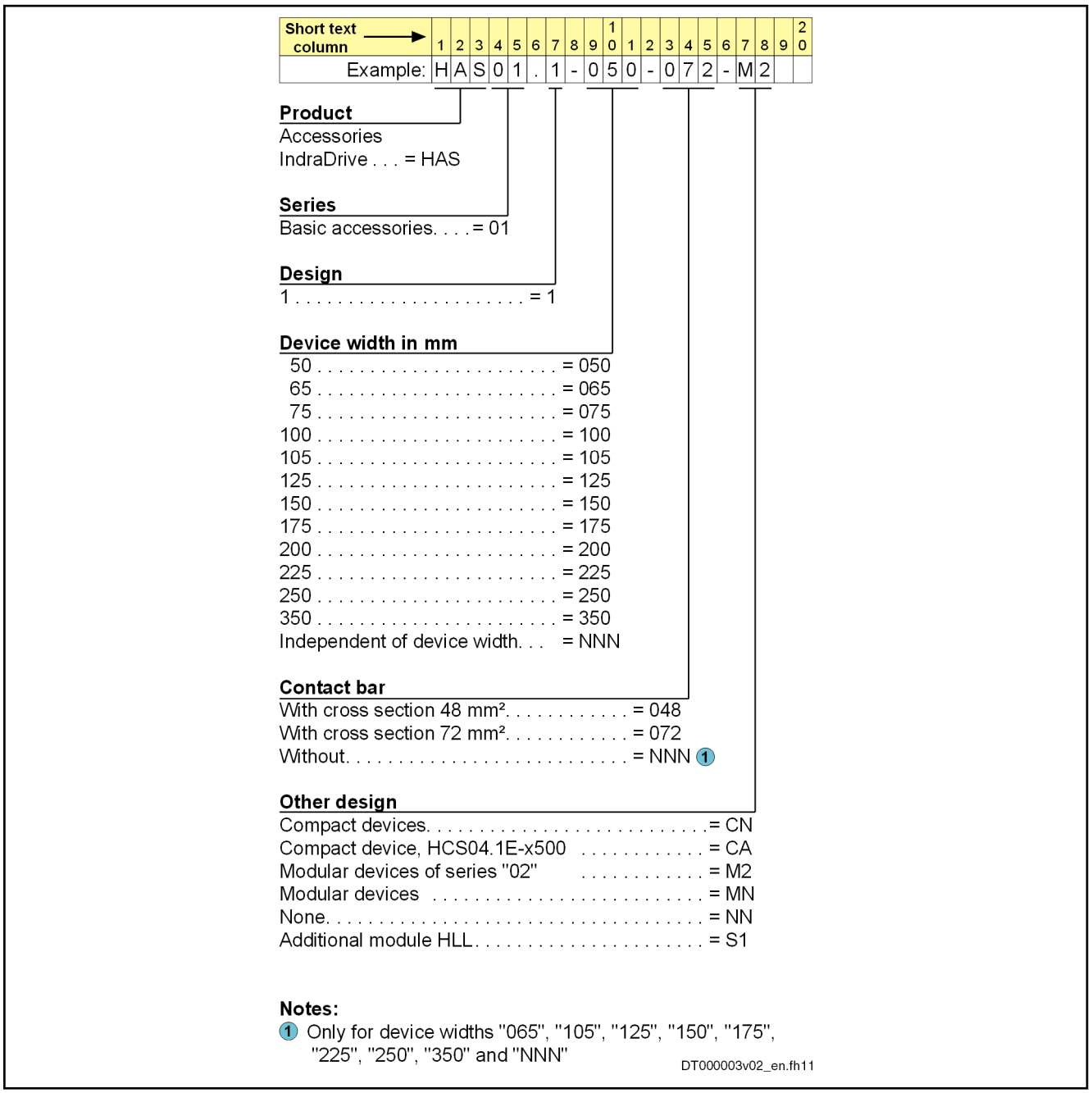


Fig. 20-1: Type Code HAS01.1

Accessories

20.1.2 Brief Description

Accessories for mounting and installing the drive controllers in a group, i.e. next to each other.

As adjusted to the device widths, we distinguish 3 types:

- HAS01 **without** contact bars, (-NNN)
- HAS01 **with** contact bars (-072-) to connect the DC buses
- HAS01 **with** contact bars (-072-) to connect the DC buses and joint bars to connect the equipment grounding conductors of the devices

☞ Observe that the contact bars of the basic accessories HAS01 are used for connection to the drive controller on the **left-hand** side.

20.1.3 Use

The HAS01 accessories are used to

- fix the drive controllers to a mounting surface
- connect the DC bus connections of drive controllers
- connect the 24V supply of drive controllers of the Rexroth IndraDrive M range
- connect the equipment grounding conductor from drive controller to drive controller or supply unit
- increase the current carrying capacity of the contact bars in the DC bus for high-performance devices (by means of the parts "end piece" and "bar" in HAS01; see chapter "Assignment")
- inform the user on safety risks. The HAS01 accessory contains adhesive labels with notes on safety in the English and French languages. Place the adhesive labels clearly visibly at the device or in the immediate vicinity of the device, if the adhesive labels existing at the device are hidden by neighboring devices.

☞ **Using the parts "end piece" and "bar"**

For high-performance devices, you have to mount the end pieces and bars contained in the HAS01 accessory (see chapter "Assignment").

See sections "DC Bus Connection (L+, L-)" and "Terminal Block, 24 - 0V (24V Supply)" in the Project Planning Manual for supply units and power sections.

20.1.4 Assignment

The accessories are assigned to the individual devices depending on the device width (see section "Type Code").

Device type		Width / mm	Accessory HAS01.1-	
				With "end piece"
HMS01.1N-	W0020	50	050	-
	W0036	50	050	-
	W0054	75	075	-
	W0070	100	100	-
	W0110	125	125	-
	W0150	150	150	-
	W0210	200	200	■
	W0300	200	200	■
	W0350	350	350	■
HMD01.1N-	W0012	50	050	-
	W0020	50	050	-
	W0036	75	075	-
HMS02.1N-	W0028	49.5	050	-
	W0054	74.5	075	-
HLB01.1	D	100	100	-
HLC01.1	D	75	075	-
HMV01.1E-	W0030	150	150	-
	W0075	250	250	■
	W0120	350	350	■
HMV01.1R-	W0018	175	175	-
	W0045	250	250	■
	W0065	350	350	■
	W0120	350	350	■
HMV02.1R-	W0015	150	150	-
HCS02.1N-	W0012	65	065	-
	W0028	65	065	-
	W0054	105	105	-
	W0070	105	105	-
HLB01.1	C	65	065	-
HLC01.1	C	50	050	-
HCS03.1N-	W0070	125	125	-
	W0100	225	225	-
	W0150	225	225	-
	W0210	350	350	■

Tab. 20-1: Device Width

Accessories

20.1.5 Scope of Supply

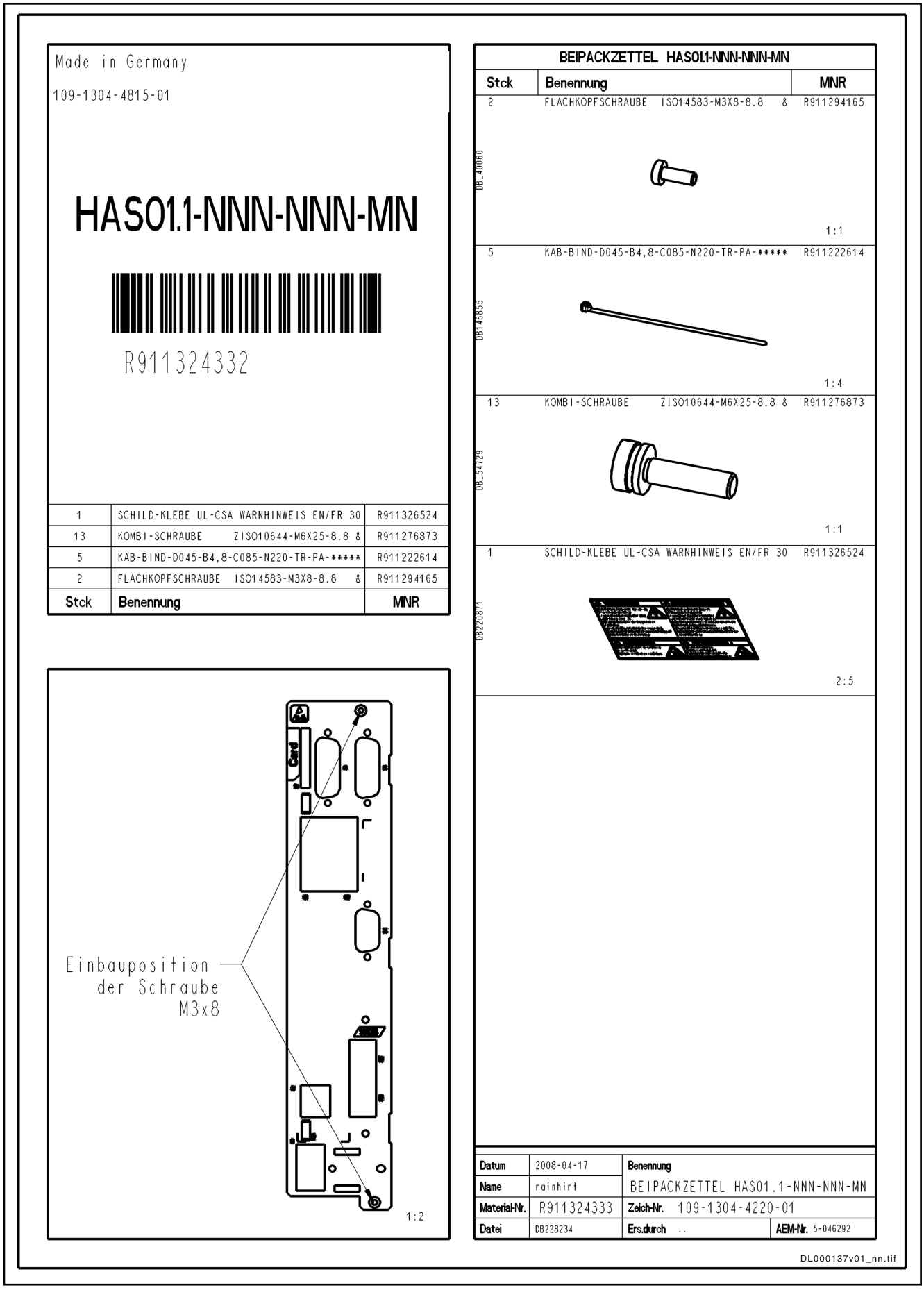


Fig. 20-2: Product Insert

Accessories

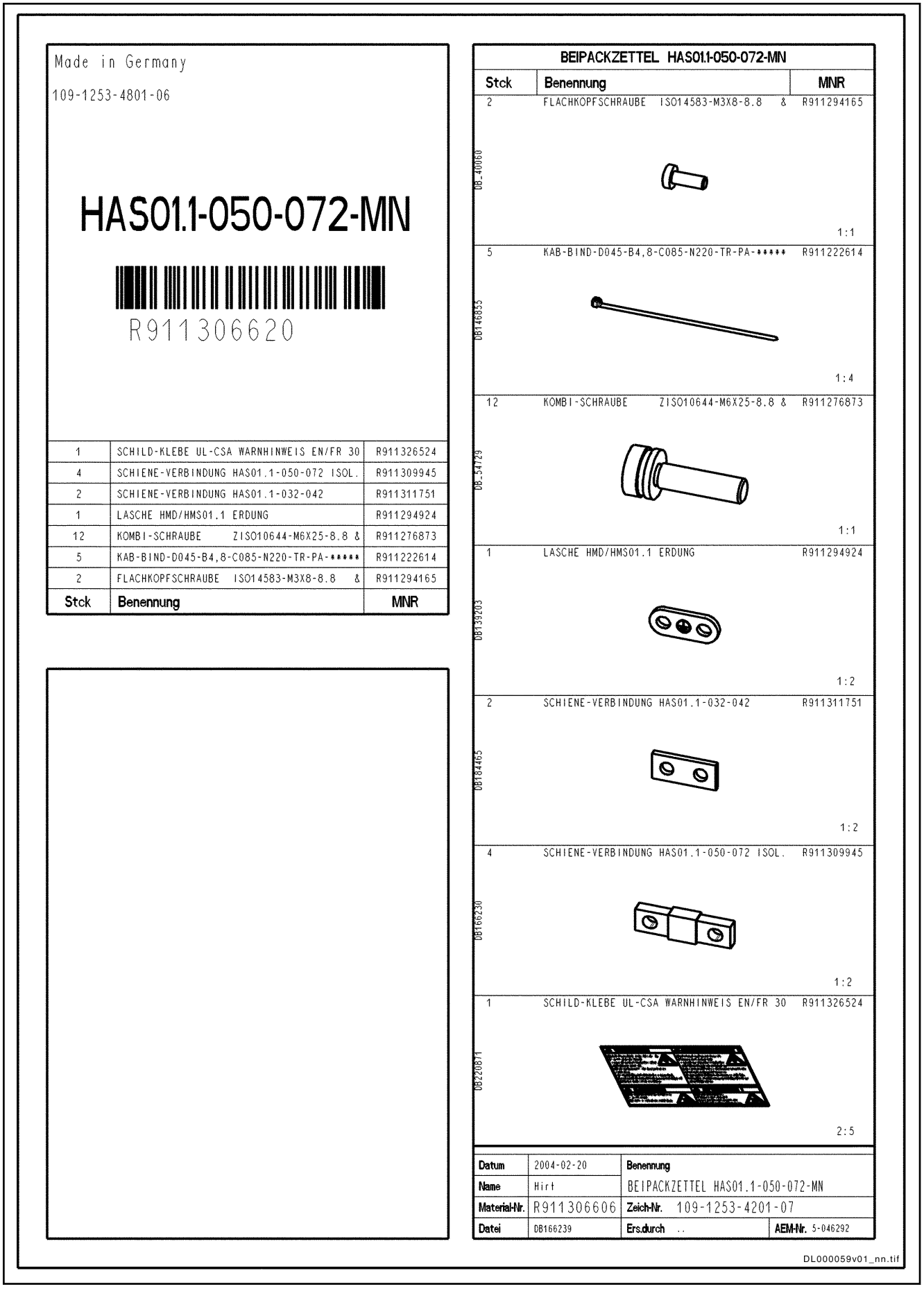


Fig. 20-3: Product Insert

Accessories

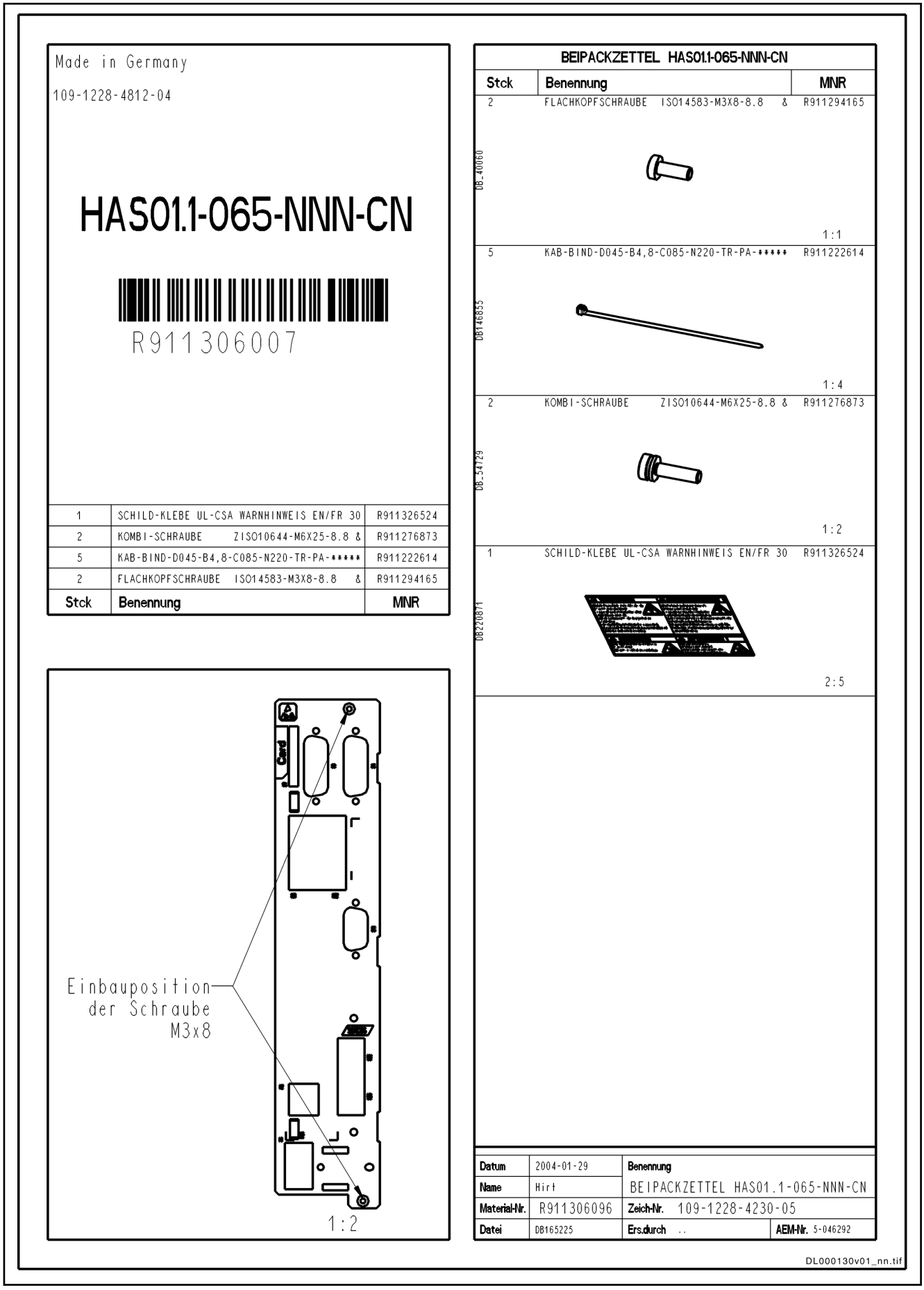


Fig. 20-4: Product Insert

Accessories

Made in Germany

109-1253-4802-06

HAS01.1-075-072-MN

R911306619

Stck	Benennung	MNR
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	SCHIENE-VERBINDUNG HAS01.1-075-072 ISOL.	R911309946
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
12	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

BEIPACKZETTEL HAS01.1-075-072-MN

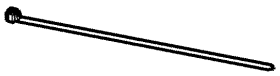
Stck	Benennung	MNR
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

1:1

5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

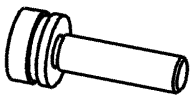
DB146855



1:4

12	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729



1:1

1	LASCHE HMD/HMS01.1 ERDUNG	R911294924

DB139203

1:2

2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751

DB184465

1:2

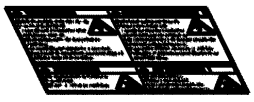
4	SCHIENE-VERBINDUNG HAS01.1-075-072 ISOL.	R911309946

DB166231

1:2

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220871



2:5

Datum	2004-02-20	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-075-072-MN	
Material-Nr.	R911306607	Zeich-Nr.	109-1253-4202-07
Datei	DB166241	Ers.durch ..	AEM-Nr. 5-046292

DL000060v01_nn.tif

Fig. 20-5: Product Insert

Accessories

Made in Germany

109-1253-4803-06

HAS01.1-100-072-MN

R911306621

Stck	Benennung	MNR
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	SCHIENE-VERBINDUNG HAS01.1-100-072 ISOL.	R911309947
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
14	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

BEIPACKZETTEL HAS01.1-100-072-MN

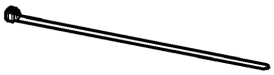
Stck	Benennung	MNR
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

1:1

5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

DB146835



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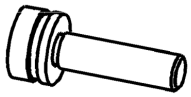
14	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_34729



1:1

1	LASCHE HMD/HMS01.1 ERDUNG	R911294924

DB139203

1:2

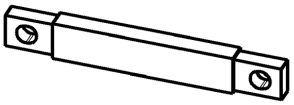
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751

DB184465

1:2

4	SCHIENE-VERBINDUNG HAS01.1-100-072 ISOL.	R911309947

DB166232



1:2

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220811

2:5

Datum	2004-02-20	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-100-072-MN	
Material-Nr.	R911306608	Zeich-Nr. 109-1253-4203-07	
Datei	DB166243	Ers.durch ..	AEM-Nr. 5-046292

Fig. 20-6: Product Insert HAS01.1-100-072-MN (Page 1)

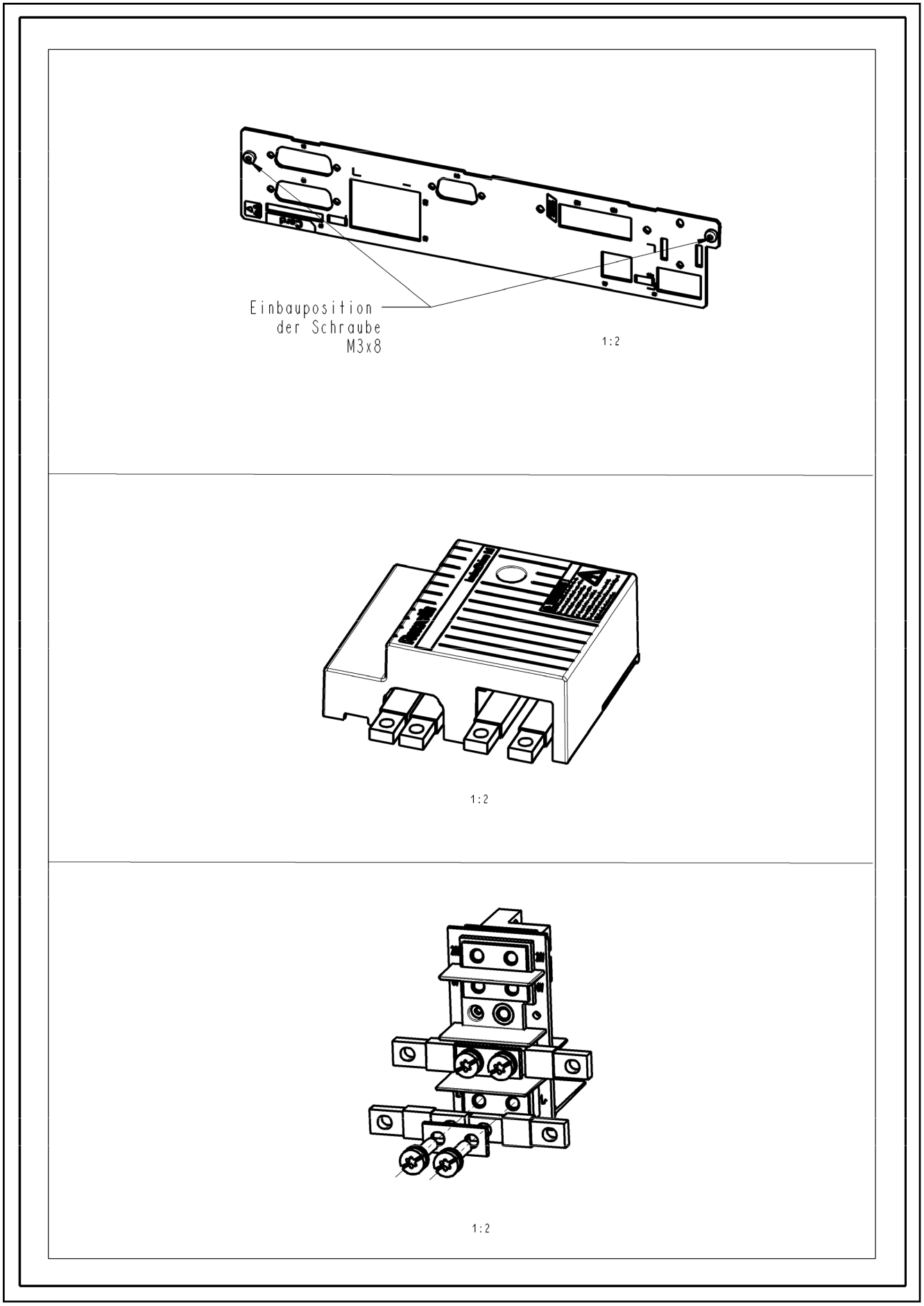


Fig. 20-7: Product Insert HAS01.1-100-072-MN (Page 2)

Accessories

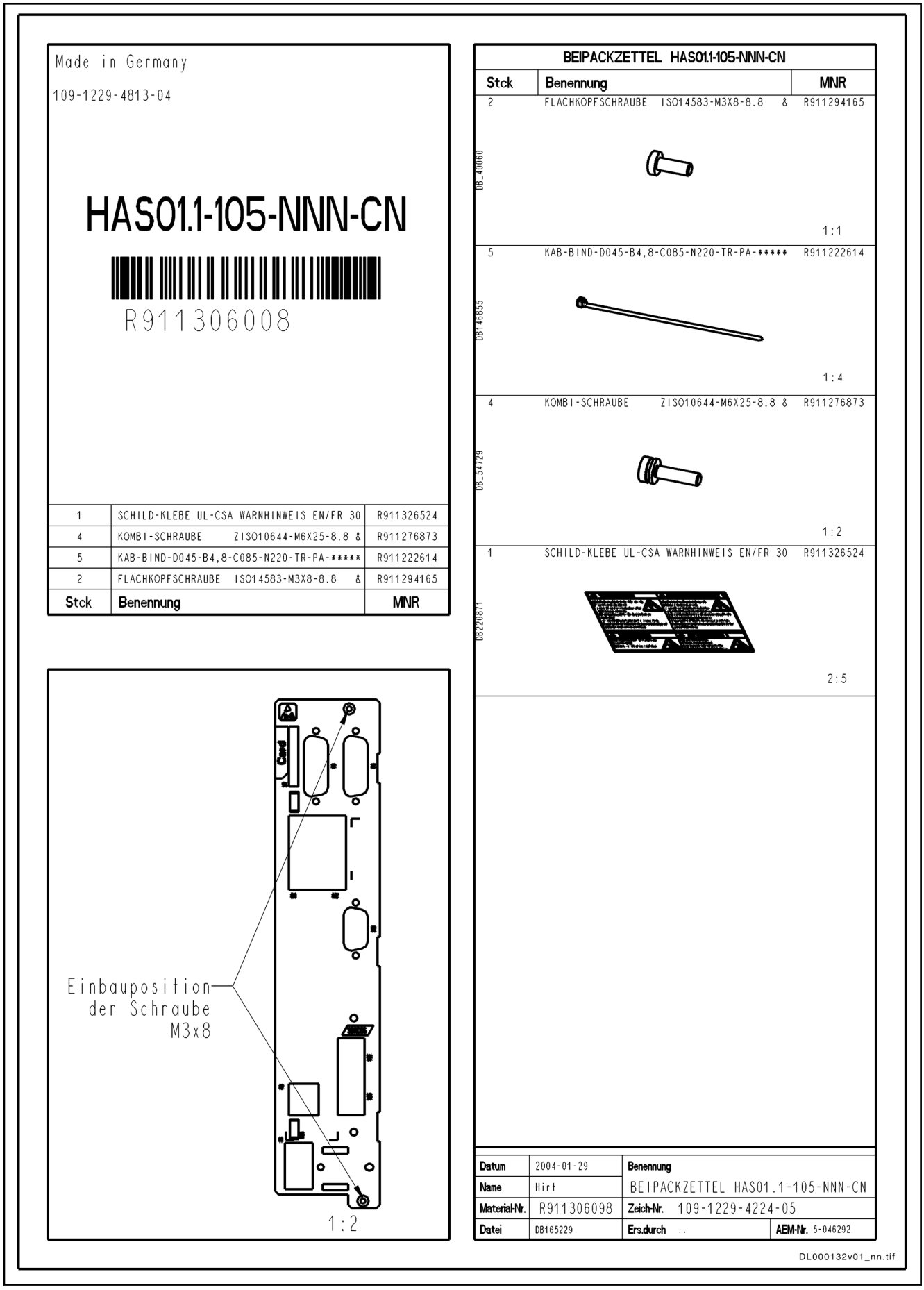


Fig. 20-8: Product Insert

Accessories

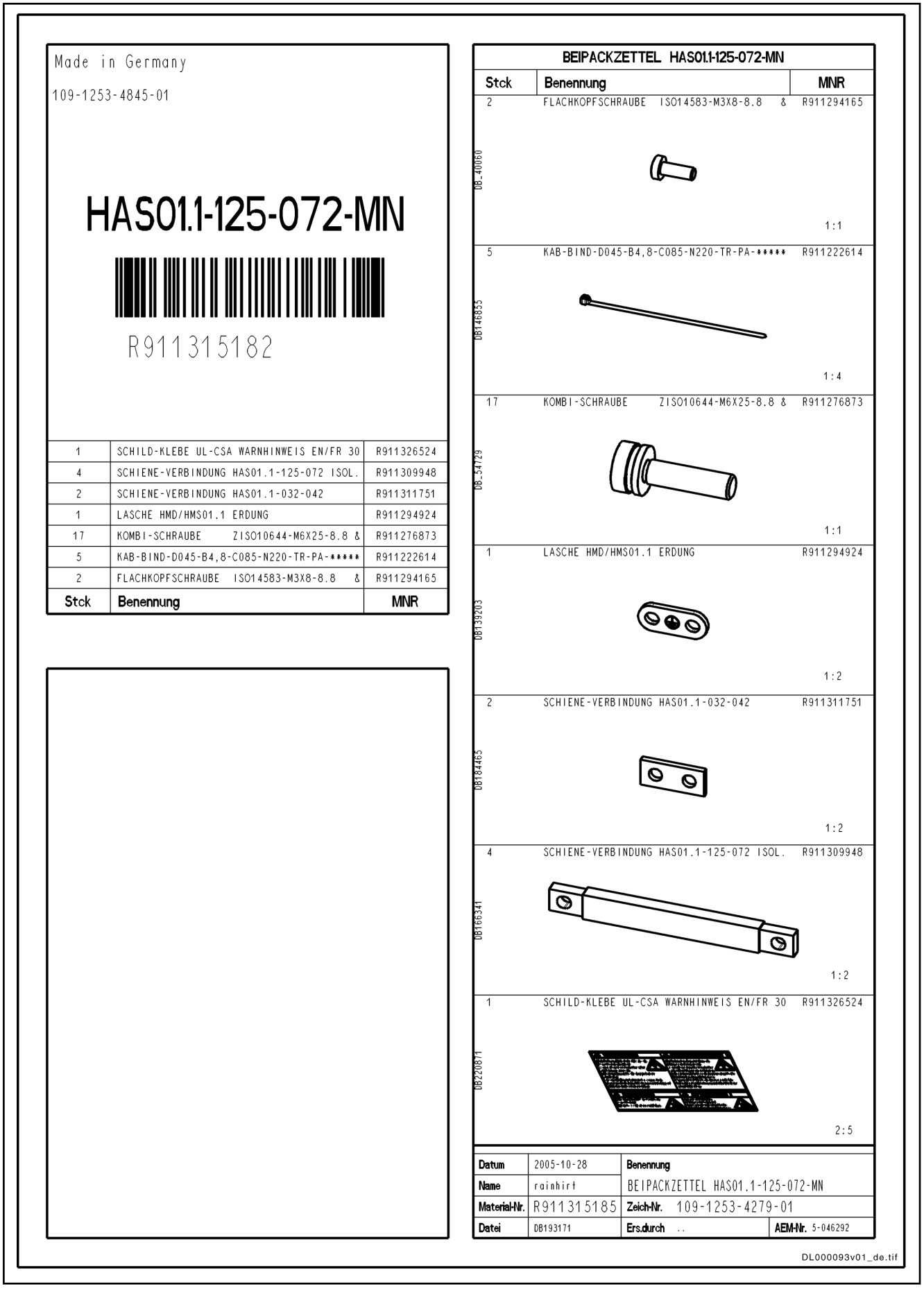


Fig. 20-9: Product Insert

Accessories

Made in Germany

109-1253-4851-01

HAS01.1-150-NNN-M2

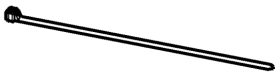
R911316848

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
2	LASCHE HMD/HMS01.1 ERDUNG	R911294924
17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
Stck	Benennung	MNR

BEIPACKZETTEL HAS01.1-150-NNN-M2

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

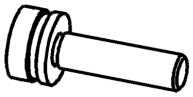
DB146855



1:4

17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729



1:1

2	LASCHE HMD/HMS01.1 ERDUNG	R911294924

DB139203

1:2

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220871

2:5

Datum	2006-03-23	Benennung	
Name	rainhirt	BEIPACKZETTEL HAS01.1-150-NNN-M2	
Material-Nr.	R911316849	Zeich-Nr. 109-1253-4293-01	
Datei	DB198361	Ers.durch ..	AEM-Nr. 5-046292

DL000098v01_de.tif

Fig. 20-10: Product Insert

Accessories

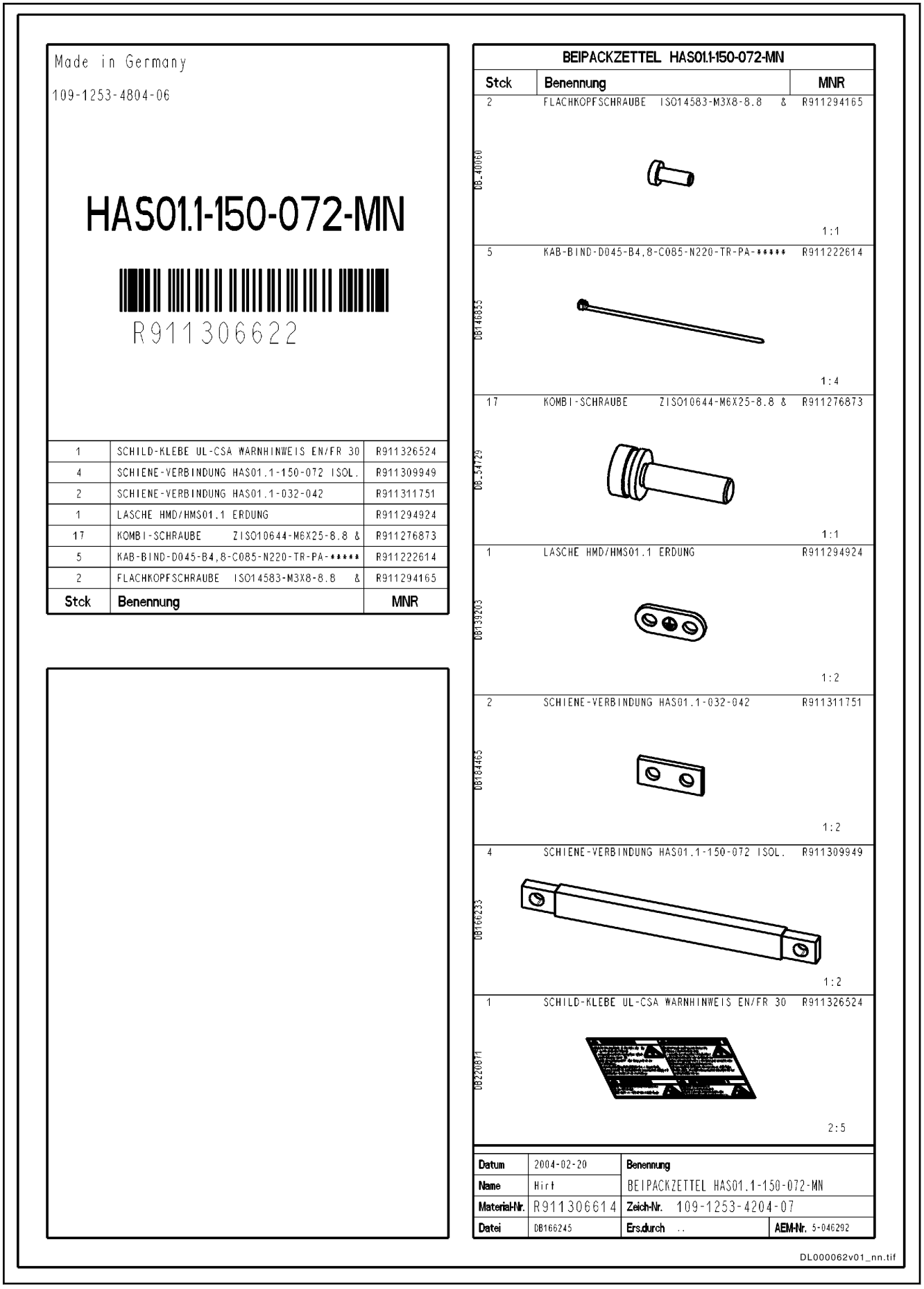


Fig. 20-11: Product Insert

Accessories

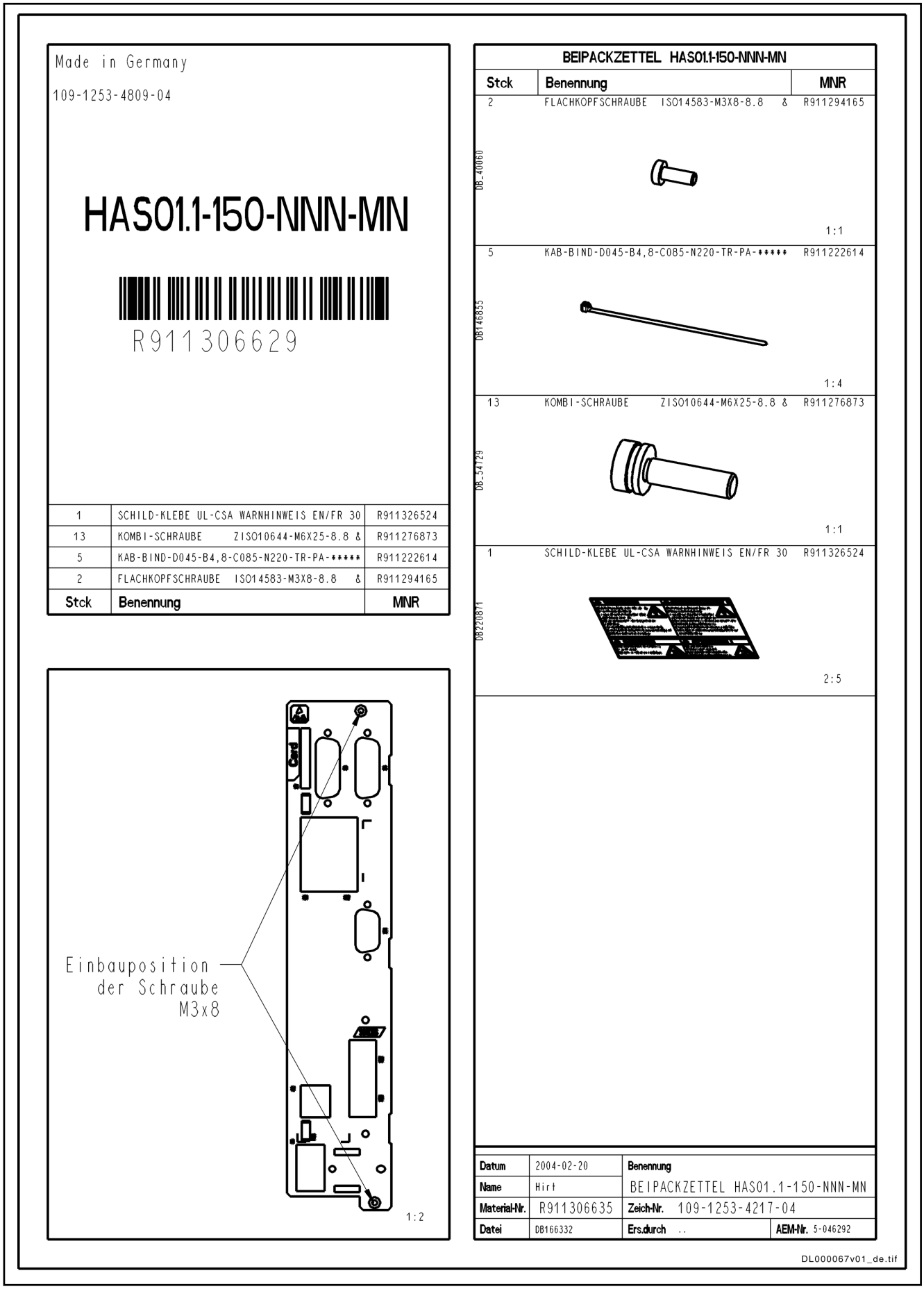


Fig. 20-12: Product Insert

Accessories

Made in Germany

109-1253-4805-06

HAS01.1-175-072-MN

R911306623

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	SCHIENE-VERBINDUNG HAS01.1-175-072 ISOL.	R911309950
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
Stck	Benennung	MNR

BEIPACKZETTEL HAS01.1-175-072-MN

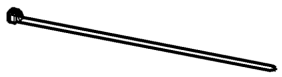
Stck	Benennung	MNR
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

1:1

5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

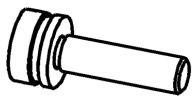
DB146855



1:4

17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729



1:1

1	LASCHE HMD/HMS01.1 ERDUNG	R911294924

DB139203

1:2

2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751

DB184465

1:2

4	SCHIENE-VERBINDUNG HAS01.1-175-072 ISOL.	R911309950

DB166234

7:20

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220871

2:5

Datum	2004-02-20	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-175-072-MN	
Material-Nr.	R911306615	Zeich-Nr. 109-1253-4205-07	
Datei	DB166274	Ers.durch ..	AEM-Nr. 5-046292

DL000063v01_nn.tif

Fig. 20-13: Product Insert

Accessories

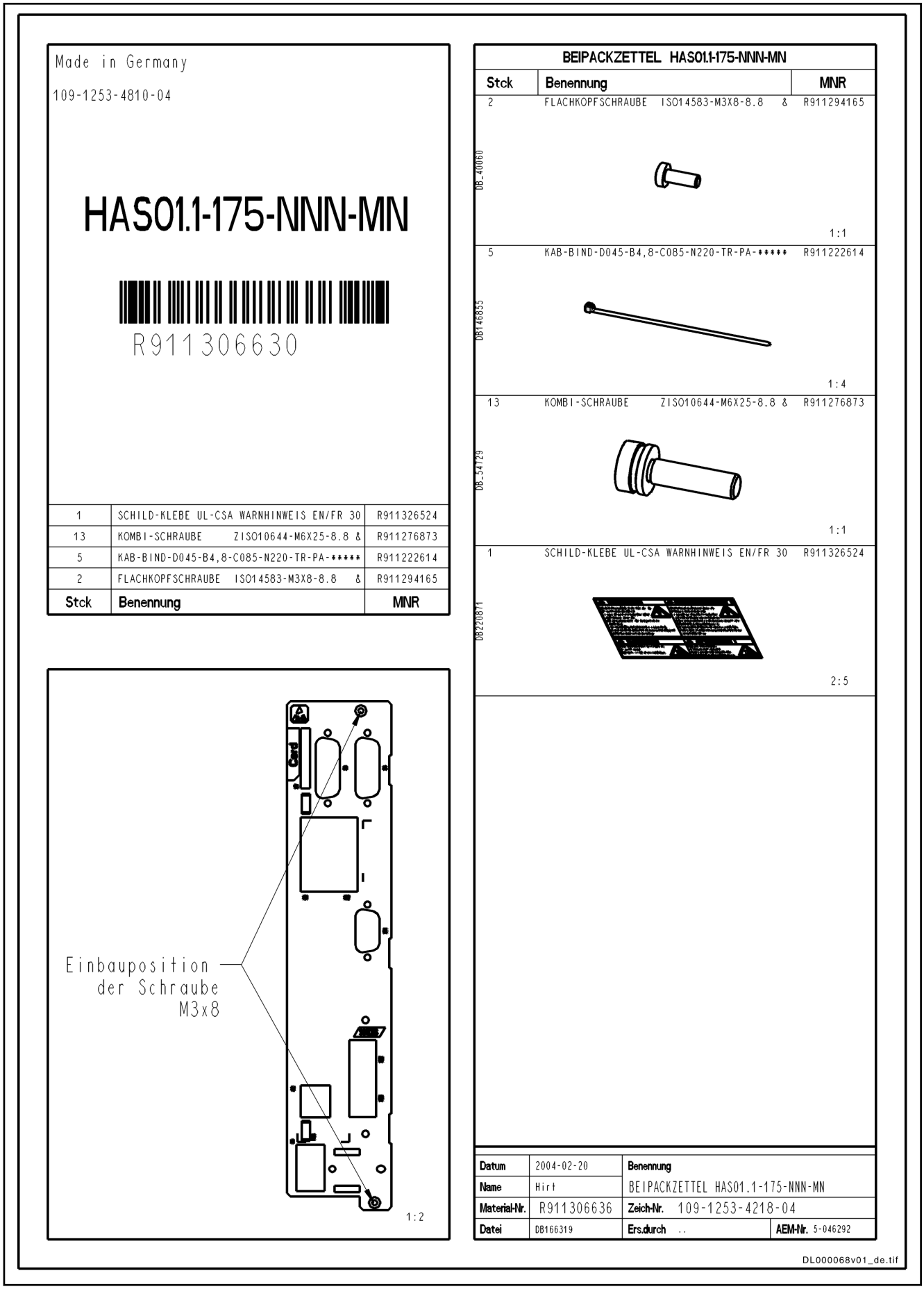


Fig. 20-14: Product Insert

Accessories

Made in Germany

109-1253-4806-06

HAS01.1-200-072-MN

R911306624

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	SCHIENE-VERBINDUNG HAS01.1-200-072 ISOL.	R911309951
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	Benennung	MNR

BEIPACKZETTEL HAS01.1-200-072-MN

Stck	Benennung	MNR
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

DB181131

1:2

2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

1:1

BEIPACKZETTEL HAS01.1-200-072-MN

Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

DB146855

1:4

17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729

1:1

1	LASCHE HMD/HMS01.1 ERDUNG	R911294924

DB139203

1:2

2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751

DB184465

1:2

4	SCHIENE-VERBINDUNG HAS01.1-200-072 ISOL.	R911309951

DB166235

7:20

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220841

2:5

Datum	2004-02-20	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-200-072-MN	
Material-Nr.	R911306616	Zeich-Nr. 109-1253-4206-07	
Datei	DB166247	Ers.durch ..	AEM-Nr. 5-046292

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Fig. 20-15: Product Insert

Accessories

Made in Germany

109-1253-4807-07

HAS01.1-250-072-MN

R911306625

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	SCHIENE-VERBINDUNG HAS01.1-250-072 ISOL.	R911309953
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	Benennung	MNR

BEIPACKZETTEL HAS01.1-250-072-MN

Stck	Benennung	MNR
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

DB187131

1:2

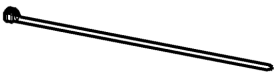
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

1:1

5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

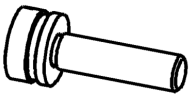
DB146855



1:4

17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729



1:1

1	LASCHE HMD/HMS01.1 ERDUNG	R911294924

DB139203

1:2

2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751

DB184465

1:2

4	SCHIENE-VERBINDUNG HAS01.1-250-072 ISOL.	R911309953

DB166236

1:4

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220871

2:5

Datum	2004-02-20	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-250-072-MN	
Material-Nr.	R911306617	Zeich-Nr. 109-1253-4207-08	
Datei	DB166276	Ers.durch ..	AEM-Nr. 5-046292

DL000065v01_de.tif

Fig. 20-16: Product Insert

Accessories

Made in Germany

109-1253-4811-05

HAS01.1-250-NNN-MN

R911306631

Stck	Benennung	MNR
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
13	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

BEIPACKZETTEL HAS01.1-250-NNN-MN

Stck	Benennung	MNR
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

DB187131

1:2

2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

1:1

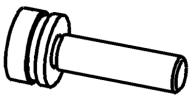
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

DB146855

1:4

13	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729



1:1

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220871

2:5

Datum	2004-02-20	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-250-NNN-MN	
Material-Nr.	R911306637	Zeich-Nr. 109-1253-4219-05	
Datei	DB166334	Ers.durch ..	AEM-Nr. 5-046292

DL000069v01_de.tif

Fig. 20-17: Product Insert

Accessories

Made in Germany

109-1253-4808-07

HAS01.1-350-072-MN

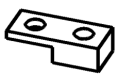
R911306626

4	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	SCHIENE-VERBINDUNG HAS01.1-350-072 ISOL.	R911309954
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
4	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
4	FEDERRING DIN127-B10-FST &	R911213251
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	Benennung	MN

BEIPACKZETTEL HAS01.1-350-072-MN

Stck	Benennung	MN
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

DB187131



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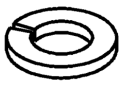
4	FEDERRING DIN127-B10-FST &	R911213251

DB113025



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2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

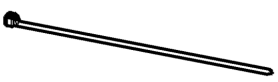
DB_40060

1:1

BEIPACKZETTEL HAS01.1-350-072-MN

Stck	Benennung	MN
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

DB146855



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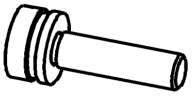
17	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729



1:1

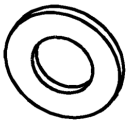
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924

DB139203

1:2

4	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277

DB_49243



1:1

2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751

DB184465

1:2

4	SCHIENE-VERBINDUNG HAS01.1-350-072 ISOL.	R911309954

DB166237

1:5

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220871

1:4

4	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050

DB115976

1:2

Datum	2004-02-23	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-350-072-MN	
Material-Nr.	R911306618	Zeich-Nr.	109-1253-4208-08
Datei	DB166280	Ers.durch ..	AEM-Nr. 5-046292

DL000066v01_de.tif

Fig. 20-18: Product Insert

Accessories

Made in Germany

109-1253-4812-06

HAS01.1-350-NNN-MN

R911306632

4	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
15	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
4	FEDERRING DIN127-B10-FST &	R911213251
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	Benennung	MN

BEIPACKZETTEL HAS01.1-350-NNN-MN

Stck	Benennung	MN
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

DB181131

1:2

4	FEDERRING DIN127-B10-FST &	R911213251

DB113025

1:1

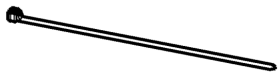
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

1:1

5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

DB146855



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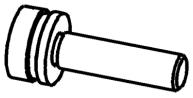
15	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54129



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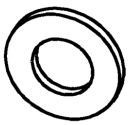
4	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277

DB_49243



1:1

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220811

2:5

4	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050

DB115976

1:2

Datum	2004-02-24	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-350-NNN-MN	
Material-Nr.	R911306633	Zeich-Nr.	109-1253-4220-06
Datei	DB166325	Ers.durch ..	AEM-Nr. 5-046292

DL000070v01_de.tif

Fig. 20-19: Product Insert

Accessories

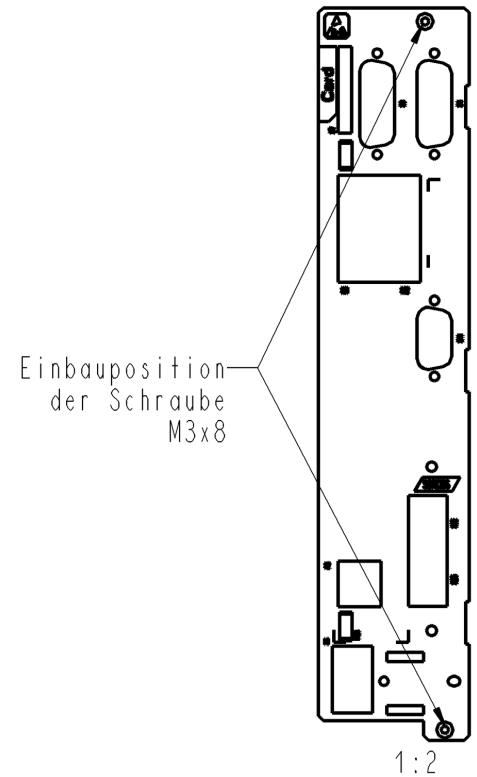
Made in Germany

109-1253-4827-01

HAS01.1-065-072-CN

R911311807

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
2	SCHIENE-VERBINDUNG HAS01.1-065-072 ISOL.	R911311806
6	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
Stck	Benennung	MNR



BEIPACKZETTEL HAS01.1-065-072-CN

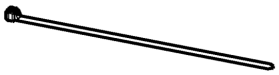
Stck	Benennung	MNR
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

1:1

5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

DB146855



1:4

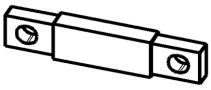
6	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729

1:2

2	SCHIENE-VERBINDUNG HAS01.1-065-072 ISOL.	R911311806

DB187254



1:2

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220871

2:5

Datum	2005-06-01	Benennung	
Name	rainhirt	BEIPACKZETTEL HAS01.1-065-072-CN	
Material-Nr.	R911311810	Zeich-Nr. 109-1253-4265-01	
Datei	DB187295	Ers.durch ..	AEM-Nr. 5-046292

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Fig. 20-20: Product Insert

Accessories

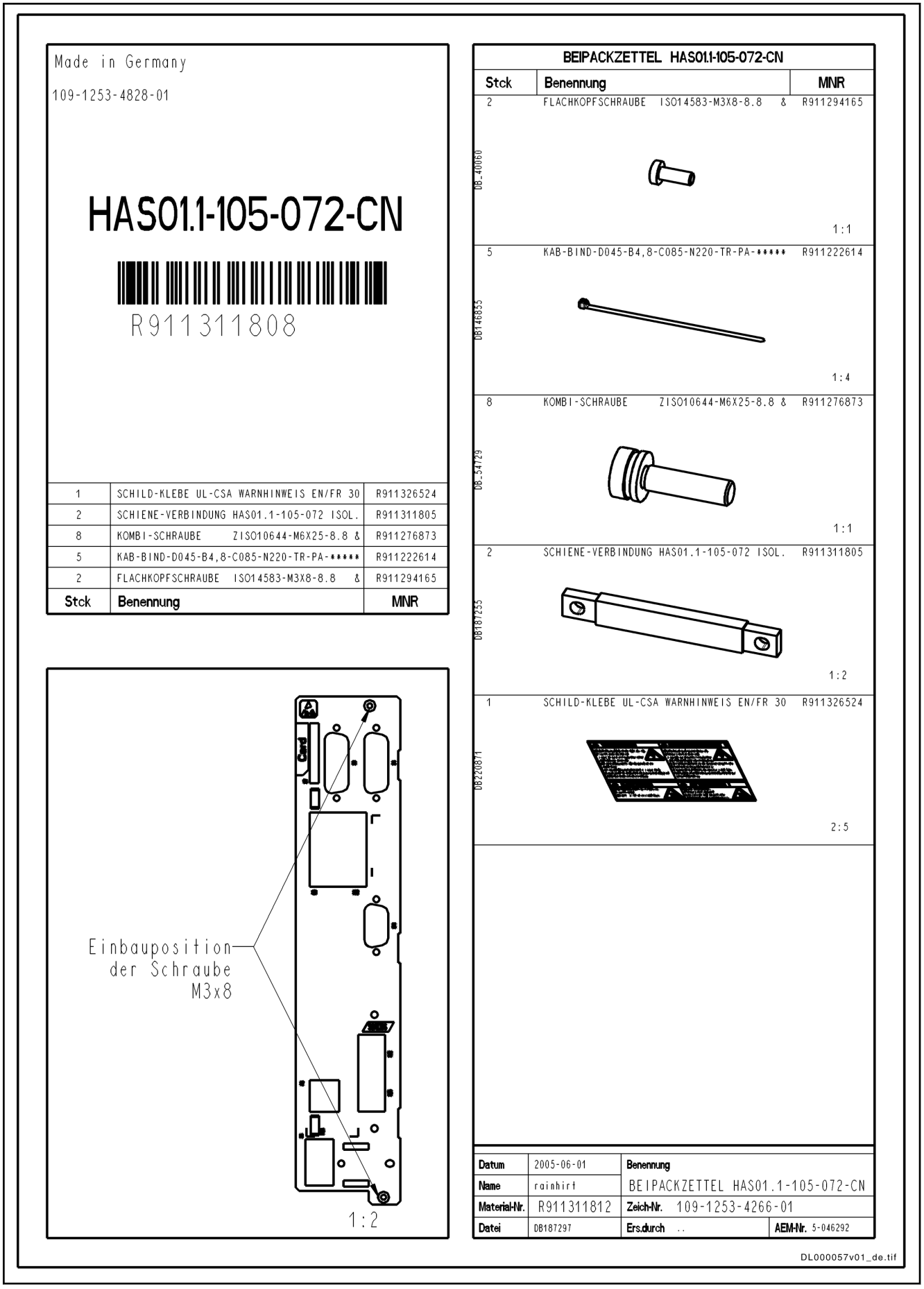


Fig. 20-21: Product Insert

Accessories

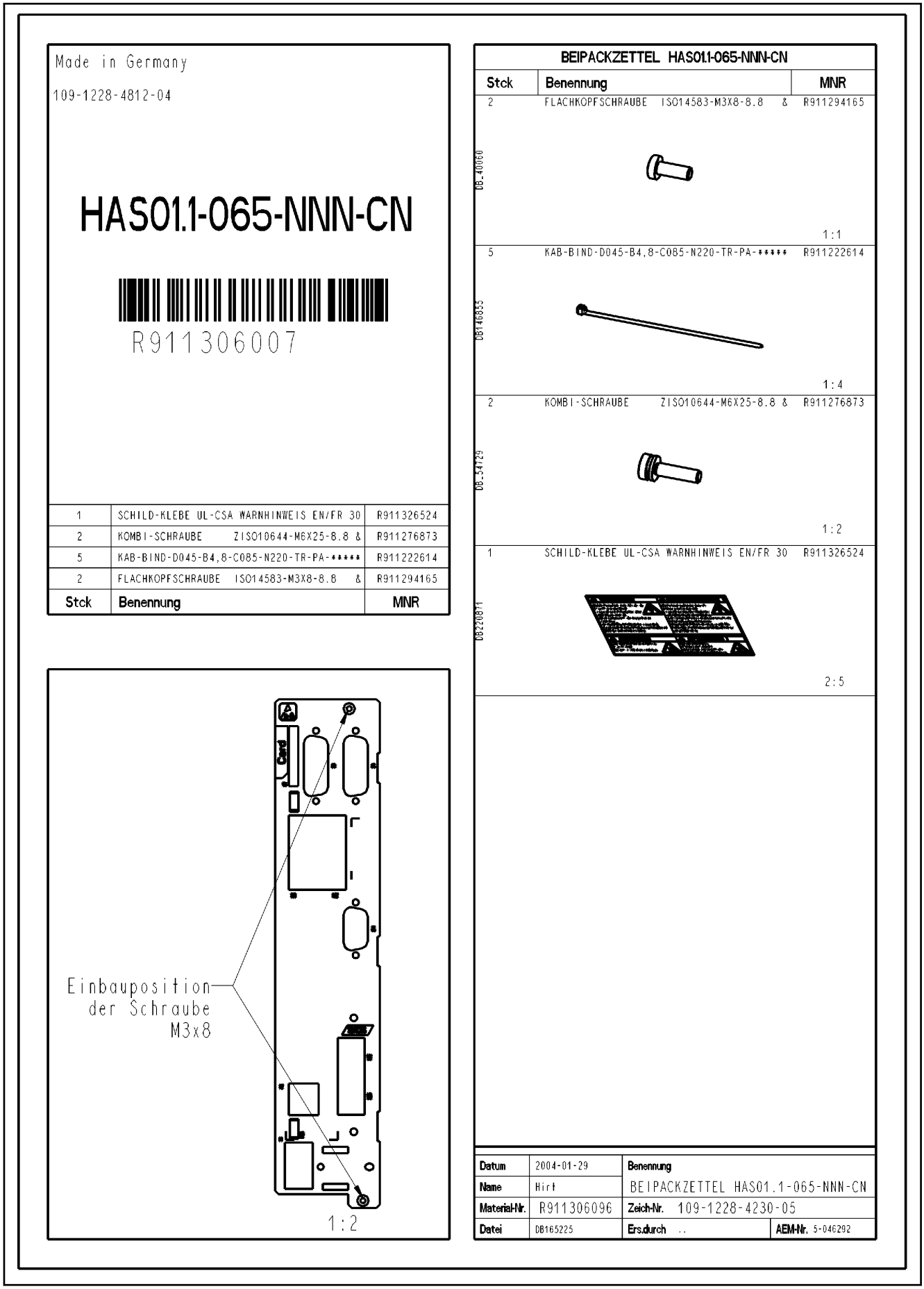


Fig. 20-22: Product Insert

Accessories

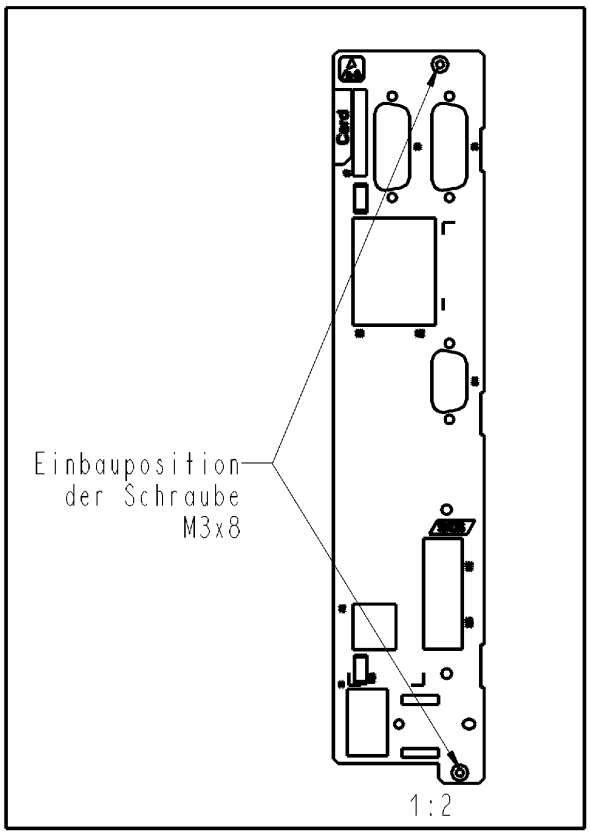
Made in Germany

109-1229-4813-04

HAS01.1-105-NNN-CN

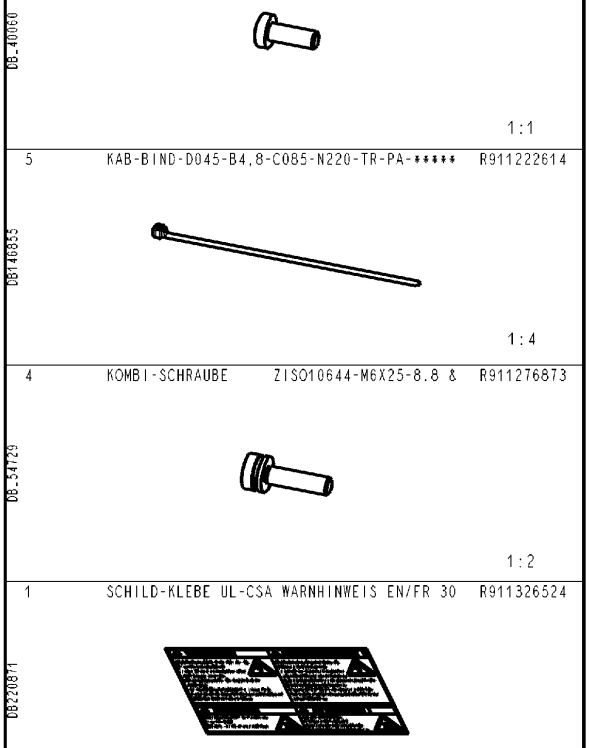
R911306008

Stck	Benennung	MNR
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165



BEIPACKZETTEL HAS01.1-105-NNN-CN

Stck	Benennung	MNR
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
4	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524



Datum	2004-01-29	Benennung	
Name	Hirt	BEIPACKZETTEL HAS01.1-105-NNN-CN	
Material-Nr.	R911306098	Zeich-Nr. 109-1229-4224-05	
Datei	DB165229	Ers.durch ..	AEM-Nr. 5-046292

Fig. 20-23: Product Insert

Accessories

Made in Germany

109-1253-4813-05

HAS01.1-125-072-CN

R911306664

Stck	Benennung	MNR
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	SCHIENE-VERBINDUNG HAS01.1-125-072 ISOL.	R911309948
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
15	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

BEIPACKZETTEL HAS01.1-125-072-CN

Stck	Benennung	MNR
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

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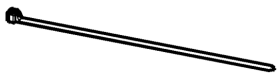
Stck	Benennung	MNR
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

DB146855



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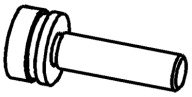
Stck	Benennung	MNR
15	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729



1:1

Stck	Benennung	MNR
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924

DB139203

1:2

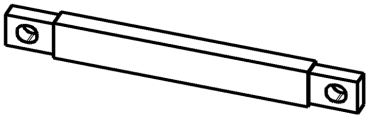
Stck	Benennung	MNR
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751

DB184465

1:2

Stck	Benennung	MNR
4	SCHIENE-VERBINDUNG HAS01.1-125-072 ISOL.	R911309948

DB166341



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Stck	Benennung	MNR
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220871

2:5

Datum	2004-02-26	Benennung	
Name	Hirt / Sleven	BEIPACKZETTEL HAS01.1-125-072-CN	
Material-Nr.	R911306672	Zeich-Nr. 109-1253-4223-06	
Datei	DB166375	Ers.durch ..	AEM-Nr. 5-046292

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Fig. 20-24: Product Insert

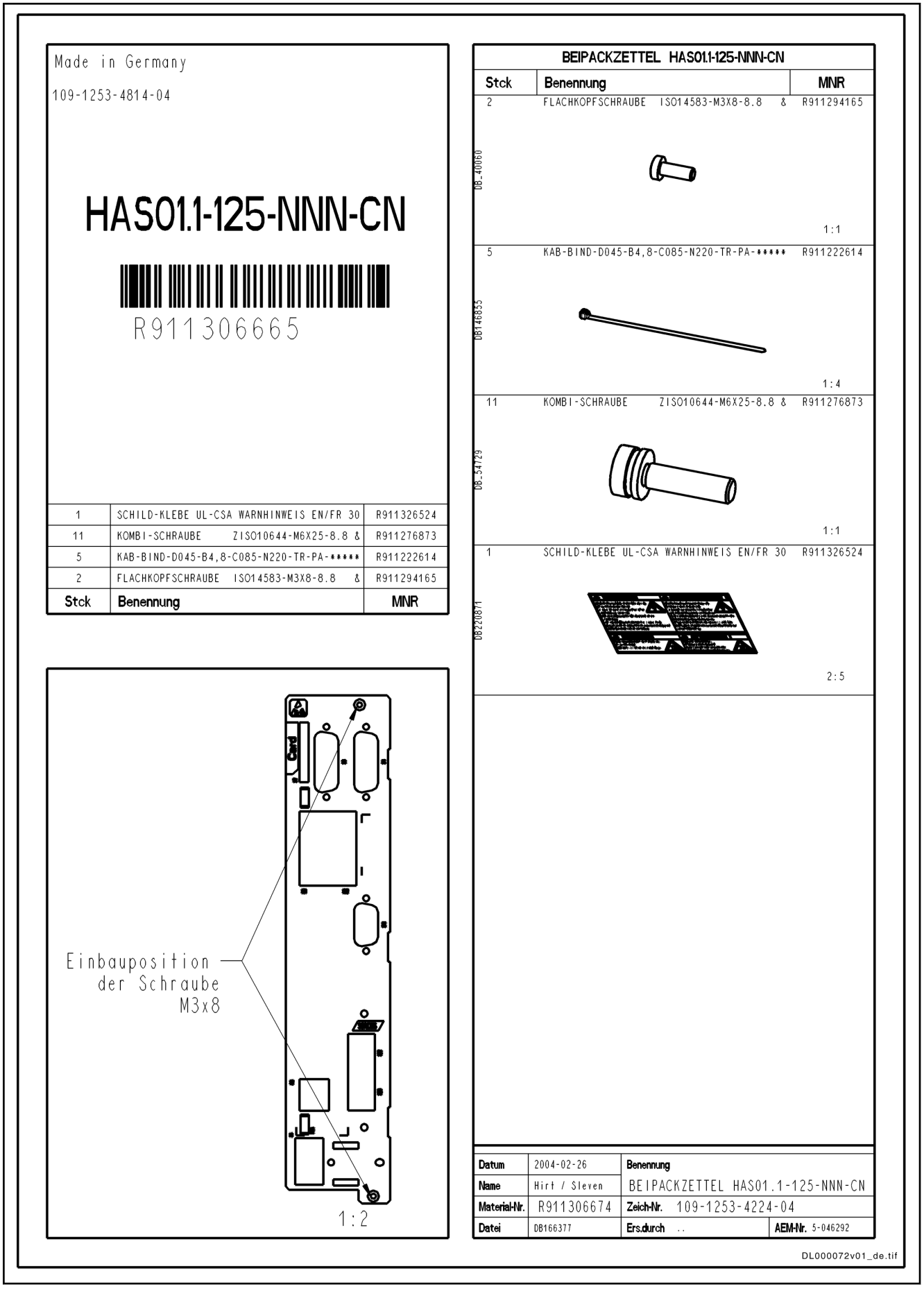
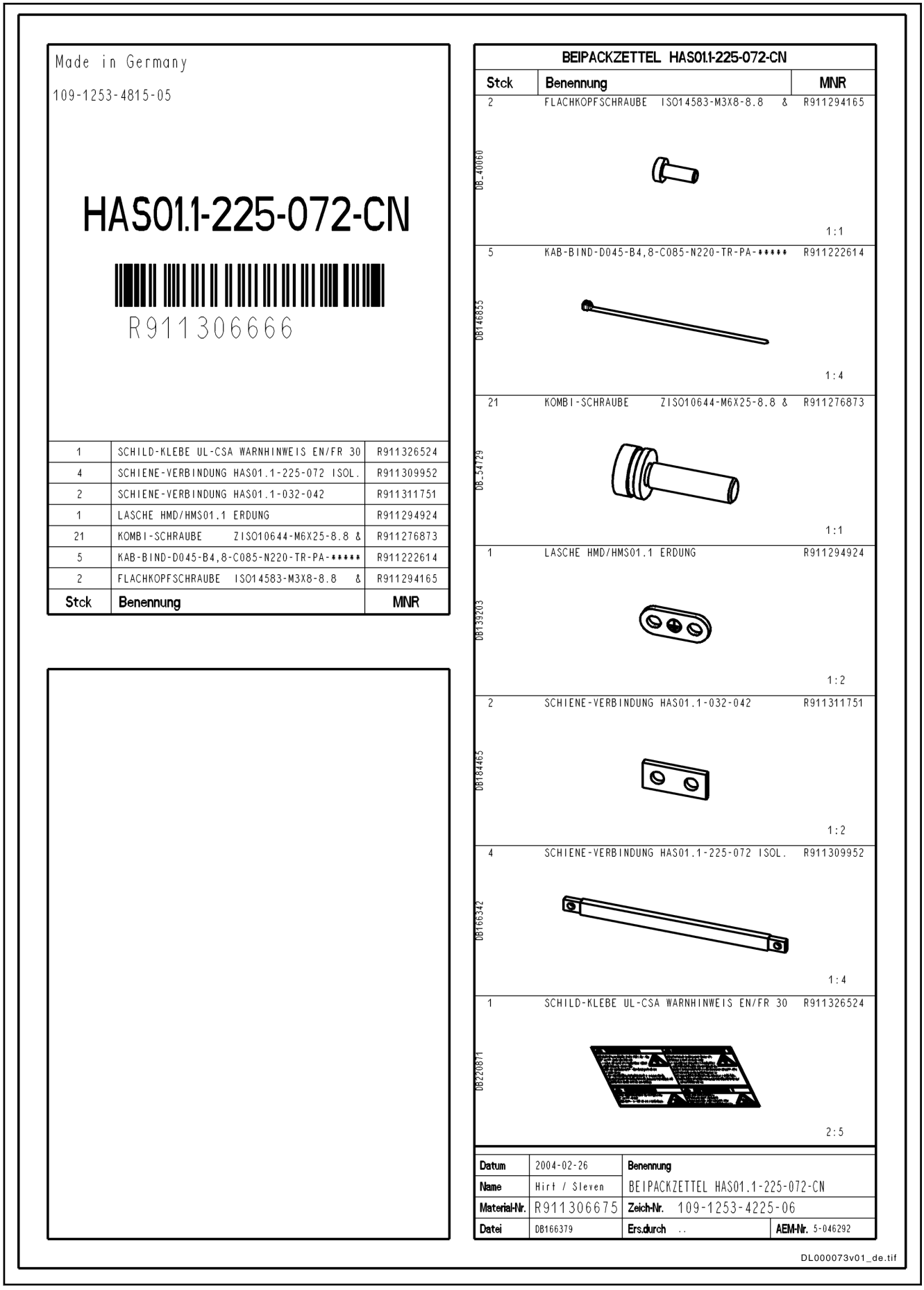


Fig. 20-25: Product Insert

Accessories



Stck	Benennung	MNR
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	SCHIENE-VERBINDUNG HAS01.1-225-072 ISOL.	R911309952
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
21	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

Stck	Benennung	MNR
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
21	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
4	SCHIENE-VERBINDUNG HAS01.1-225-072 ISOL.	R911309952
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

Datum	2004-02-26	Benennung	
Name	Hirt / Sleven	BEIPACKZETTEL HAS01.1-225-072-CN	
Material-Nr.	R911306675	Zeich-Nr. 109-1253-4225-06	
Datei	DB166379	Ers.durch ..	AEM-Nr. 5-046292

Fig. 20-26: Product Insert

Accessories

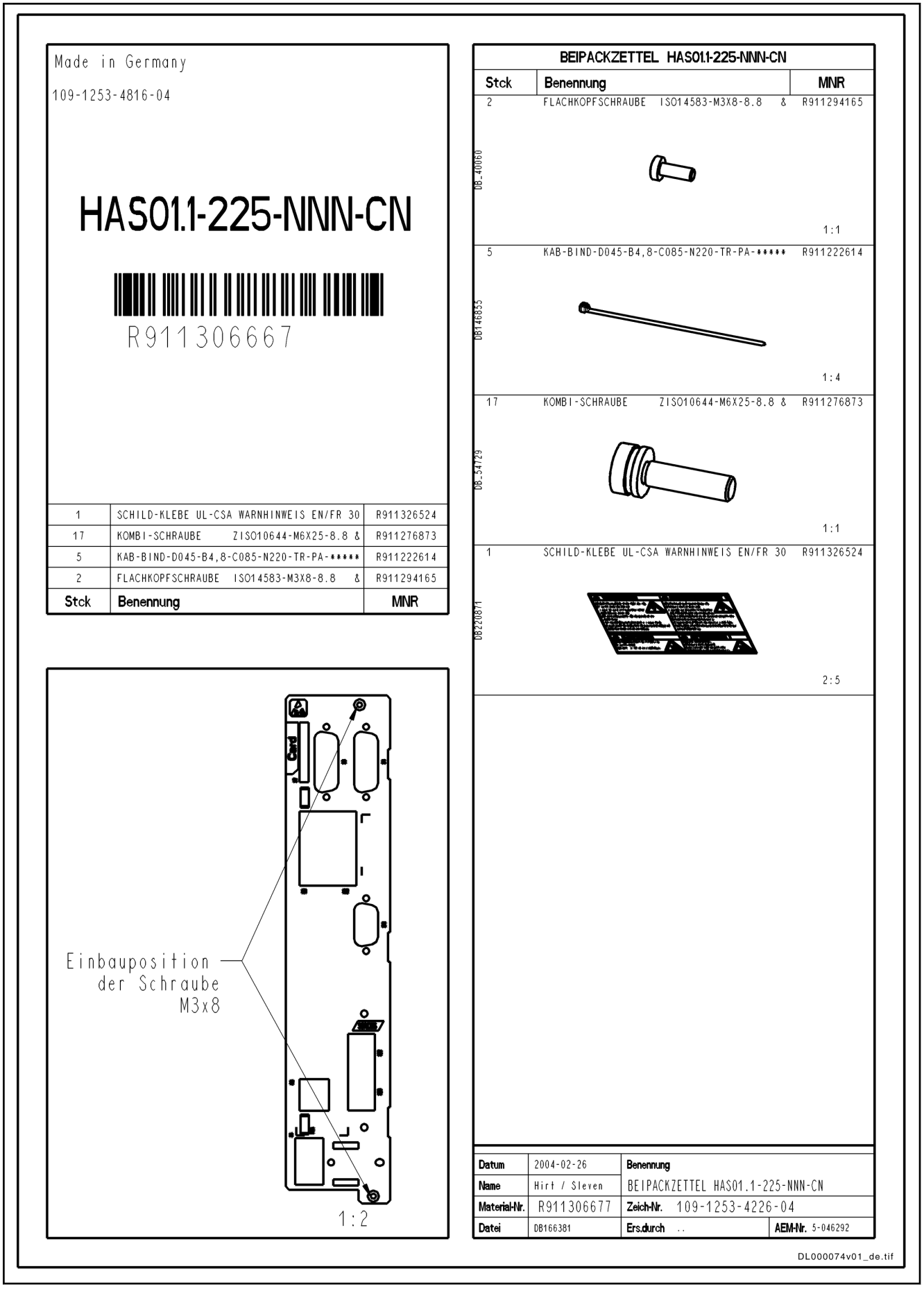


Fig. 20-27: Product Insert

Accessories

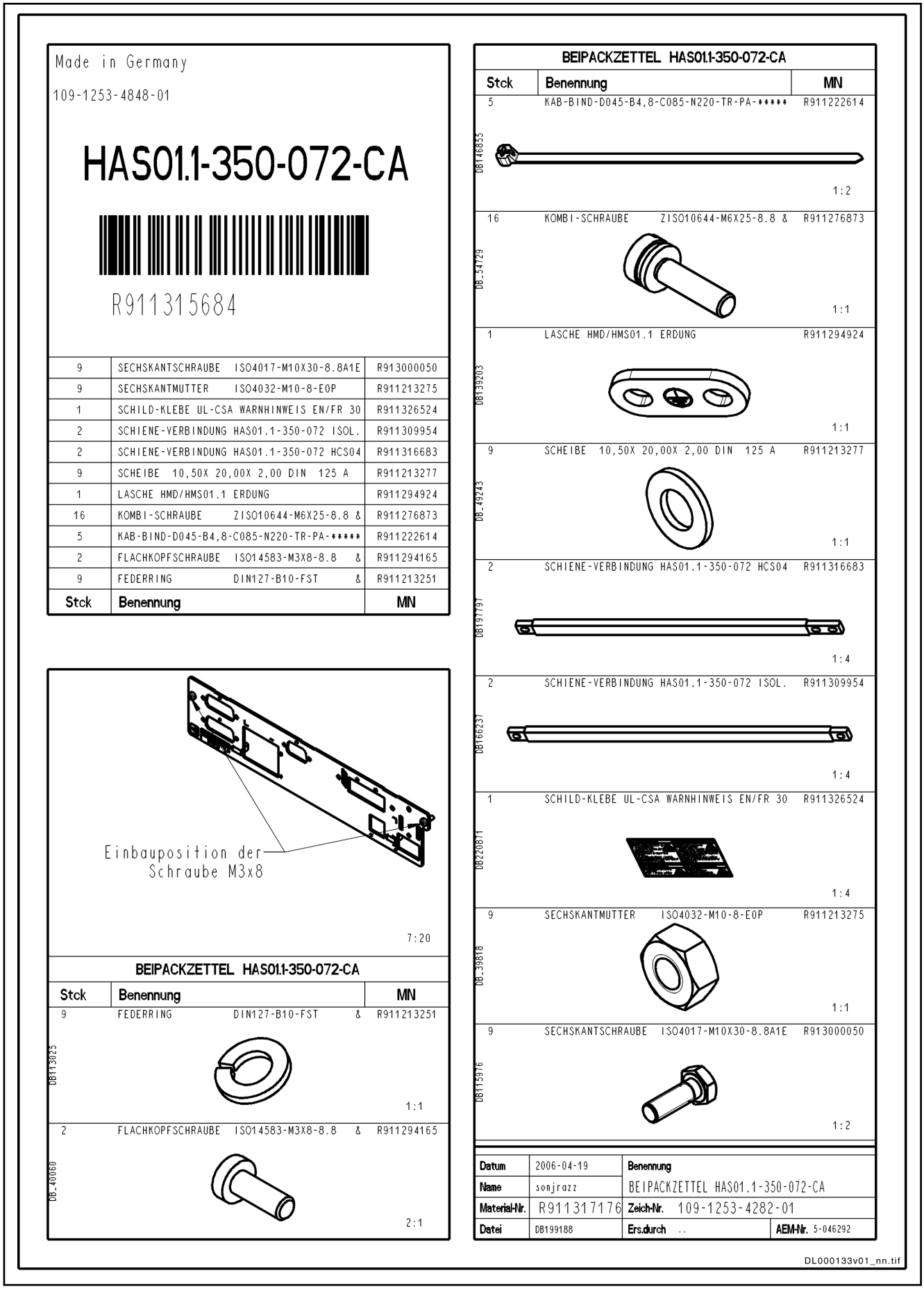


Fig. 20-28: Product Insert

Made in Germany

109-1253-4817-07

HAS01.1-350-072-CN

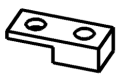
R911306668

1	SECHSKANTSCHRAUBE ISO4017-M8X25-8.8 &	R911292421
6	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
4	SCHIENE-VERBINDUNG HAS01.1-350-072 ISOL.	R911309954
2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751
6	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
1	LASCHE HMD/HMS01.1 ERDUNG	R911294924
1	LASCHE HCS03.1E-W0210 ERDUNG	R911025419
15	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
6	FEDERRING DIN127-B10-FST &	R911213251
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	Benennung	MN

BEIPACKZETTEL HAS01.1-350-072-CN

Stck	Benennung	MN
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

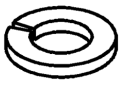
DB181131



1:2

6	FEDERRING DIN127-B10-FST &	R911213251

DB113025



1:1

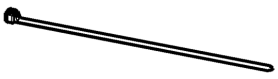
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

1:1

5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

DB146835

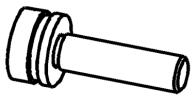


1:4

BEIPACKZETTEL HAS01.1-350-072-CN

Stck	Benennung	MN
15	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729



1:1

1	LASCHE HCS03.1E-W0210 ERDUNG	R911025419

DB186040

1:4

1	LASCHE HMD/HMS01.1 ERDUNG	R911294924

DB139203

1:2

6	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277

DB_49243

1:2

2	SCHIENE-VERBINDUNG HAS01.1-032-042	R911311751

DB184465

1:2

4	SCHIENE-VERBINDUNG HAS01.1-350-072 ISOL.	R911309954

DB166237

1:5

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220811

1:4

6	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050

DB115916

1:2

1	SECHSKANTSCHRAUBE ISO4017-M8X25-8.8 &	R911292421

DB_51517

1:2

Datum	2004-02-28	Benennung	
Name	Hirt / Sleven	BEIPACKZETTEL HAS01.1-350-072-CN	
Material-Nr.	R911306678	Zeich-Nr.	109-1253-4227-08
Datei	DB166387	Ers.durch ..	AEM-Nr. 5-046292

DL000075v01_de.tif

Fig. 20-29: Product Insert

Accessories

Made in Germany

109-1253-4818-07

HAS01.1-350-NNN-CN

R911306669

1	SECHSKANTSCHRAUBE ISO4017-M8X25-8.8 &	R911292421
6	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
6	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
1	LASCHE HCS03.1E-W0210 ERDUNG	R911025419
13	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
6	FEDERRING DIN127-B10-FST &	R911213251
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	Benennung	MN

BEIPACKZETTEL HAS01.1-350-NNN-CN

Stck	Benennung	MN
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

DB187131

1:2

6	FEDERRING DIN127-B10-FST &	R911213251

DB113025

1:1

2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

1:1

BEIPACKZETTEL HAS01.1-350-NNN-CN

Stck	Benennung	MN
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

DB146855

1:4

13	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729

1:1

1	LASCHE HCS03.1E-W0210 ERDUNG	R911025419

DB186040

1:4

6	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277

DB_49243

1:1

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220811

2:5

6	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8A1E	R913000050

DB115976

1:2

1	SECHSKANTSCHRAUBE ISO4017-M8X25-8.8 &	R911292421

DB_57577

1:2

Datum	2004-02-26	Benennung	
Name	Hirt / Sleven	BEIPACKZETTEL HAS01.1-350-NNN-CN	
Material-Nr.	R911306679	Zeich-Nr.	109-1253-4228-08
Datei	DB166390	Ers.durch ..	AEM-Nr. 5-046292

DL000076v01_de.tif

Fig. 20-30: Product Insert

Accessories

Made in Germany

109-1253-4849-01

HAS01.1-350-NNN-CA

R911315683

9	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8AIE	R913000050
9	SECHSKANTMUTTER ISO4032-M10-8-E0P	R911213275
1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524
9	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277
16	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614
2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165
9	FEDERRING DIN127-B10-FST &	R911213251
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982
Stck	Benennung	MN

BEIPACKZETTEL HAS01.1-350-NNN-CA

Stck	Benennung	MN
2	ENDSTUECK HAS01.1 SCHIENE-VERBINDUNG	R911311982

DB187131

1:2

9	FEDERRING DIN127-B10-FST &	R911213251

DB113025

1:1

2	FLACHKOPFSCHRAUBE ISO14583-M3X8-8.8 &	R911294165

DB_40060

2:1

BEIPACKZETTEL HAS01.1-350-NNN-CA

Stck	Benennung	MN
5	KAB-BIND-D045-B4,8-C085-N220-TR-PA-*****	R911222614

DB146855

1:4

16	KOMBI-SCHRAUBE ZISO10644-M6X25-8.8 &	R911276873

DB_54729

1:1

9	SCHEIBE 10,50X 20,00X 2,00 DIN 125 A	R911213277

DB_49243

1:1

1	SCHILD-KLEBE UL-CSA WARNHINWEIS EN/FR 30	R911326524

DB220871

1:4

9	SECHSKANTMUTTER ISO4032-M10-8-E0P	R911213275

DB_39818

1:1

9	SECHSKANTSCHRAUBE ISO4017-M10X30-8.8AIE	R913000050

DB115976

1:2

Datum	2006-01-17	Benennung	
Name	sonjrazz	BEIPACKZETTEL HAS01.1-350-NNN-CA	
Material-Nr.	R911315811	Zeich-Nr.	109-1253-4283-01
Datei	DB195173	Ers.durch ..	AEM-Nr. 5-046292

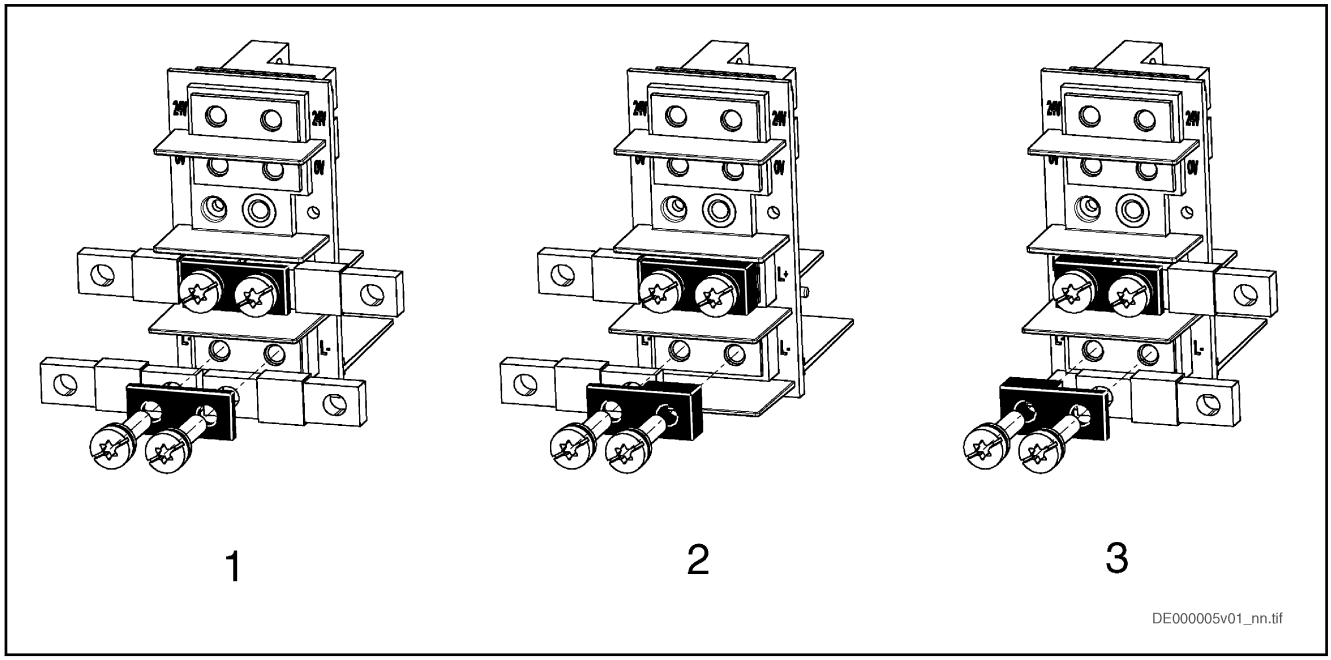
DL00091v01_nn.tif

Fig. 20-31: Product Insert

Accessories

20.1.6 Mounting the "Bar" and "End Piece" Parts of the HAS01 Accessory

The "bar" and "end piece" parts increase the current carrying capacity of the DC bus connections by reducing the involved contact resistances.



1 Bar
2 End piece (right end)
3 End piece (left end)

Fig. 20-32: Mounting the Bar and End Piece of HAS01

- **Ad 1:** Use the bars (-042) contained in all HAS01.1-***-072-** as shown in the figure at L+ and L-.
- **Ad 2 and 3:** Use the end pieces contained in all HAS01.1-350-***-** and HAS01.1-200-***-** at the right and left ends of the DC bus connections in the drive system.

20.2 HAS02, shield connection

20.2.1 General information

Accessories for appropriate connection of the motor cable to the drive controller, especially the shield connection of the motor cable.

There are appropriate HAS02 accessories for the different drive controllers.

Accessories

20.2.2 Type code

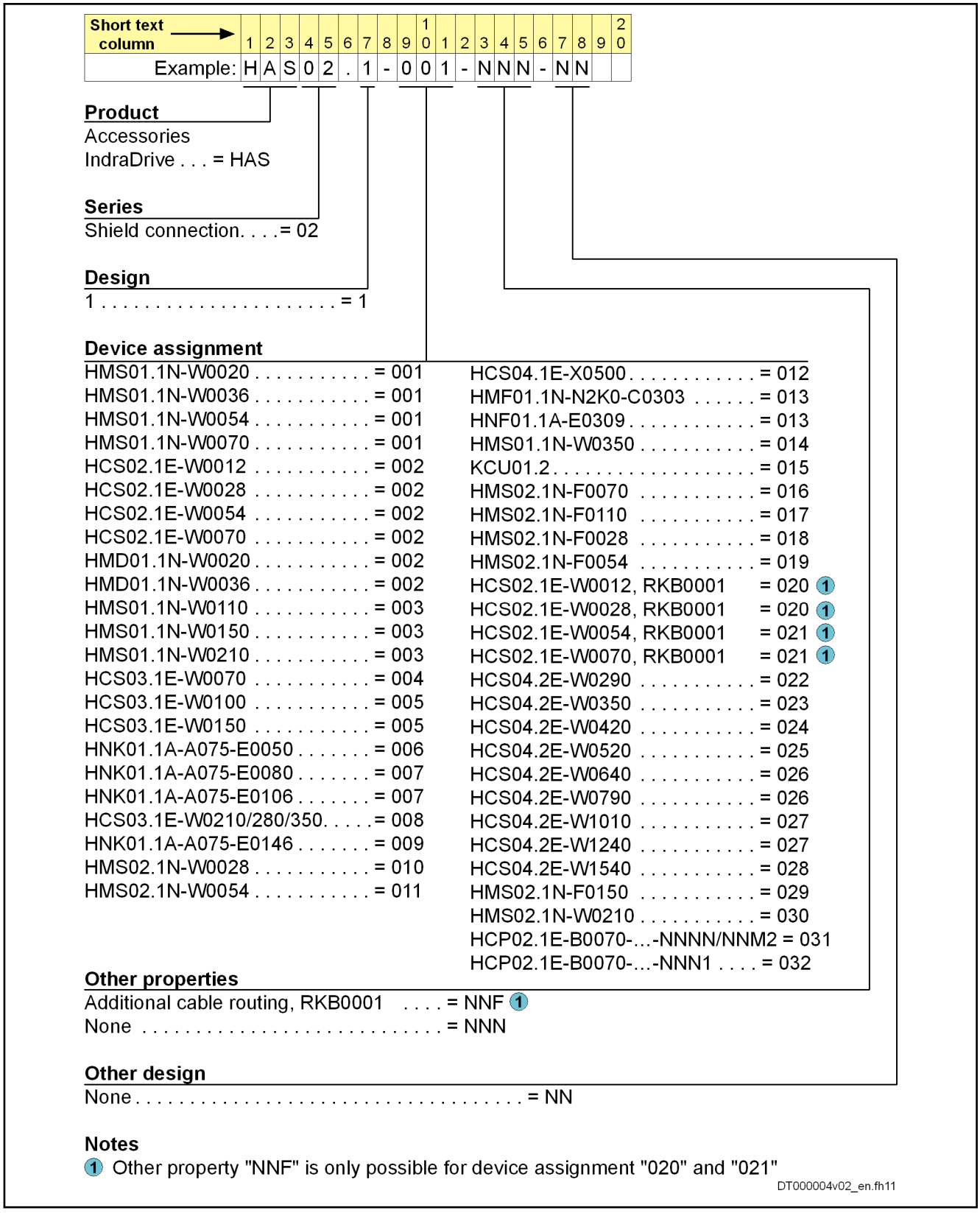


Fig. 20-33: Type Code HAS02.1

20.2.3 Use

The HAS02 accessories are used to

- provide strain relief of the motor cable
- connect the shield of the motor cable to the drive controller

20.2.4 Assignment of accessory HAS02

See section "Type Code (Device Assignment)"

20.2.5 Scope of supply

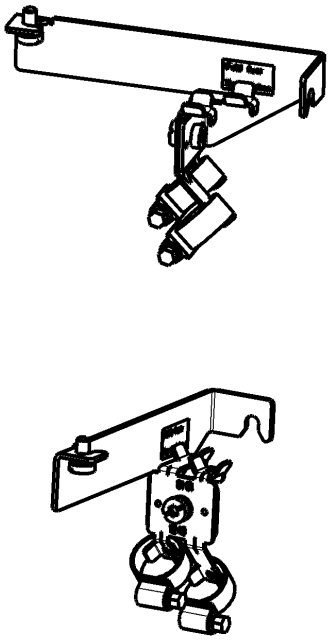
For the scope of supply and the components of HAS02, see the corresponding product inserts.

Accessories

HAS02.1-001-NNN-NN

R911306330

Stck	Benennung	MN
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
2	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551
1	HALTERUNG HMS01.1 KABELD. 12-30	R911306336
1	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851



BEIPACKZETTEL HAS02.1-001-NNN-NN

Stck	Benennung	MN
1	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851

DB163070

1:5

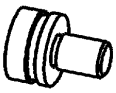
1	HALTERUNG HMS01.1 KABELD. 12-30	R911306336

DB164826

7:20

2	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551

DB_38405



1:1

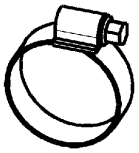
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471

DB_46879

1:2

1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472

DB_46868



1:2

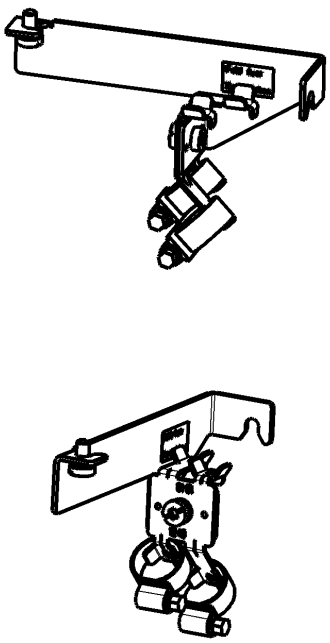
Datum	2004-02-03	Benennung	
Name	Hirt	BEIPACKZETTEL HAS02.1-001-NNN-NN	
Material-Nr.	R911306332	Zeich-Nr. 109-1214-4213-03	
Datei	DB165406	Ers.durch ..	AEM-Nr. 5-046998

Fig. 20-34: Product Insert

HAS02.1-002-NNN-NN

R911306106

Stck	Benennung	MN
2	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
2	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551
1	HALTERUNG HCS02.1 KABELD. 12-18	R911305852
1	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851



BEIPACKZETTEL HAS02.1-002-NNN-NN

Stck	Benennung	MN
1	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851

DB163070

1:5

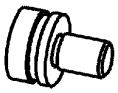
1	HALTERUNG HCS02.1 KABELD. 12-18	R911305852

DB163246

7:20

2	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551

DB_38405



1:1

2	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471

DB_46819

1:2

Datum	2004-01-30	Benennung	
Name	michborn	BEIPACKZETTEL HAS02.1-002-NNN-NN	
Material-Nr.	R911306107	Zeich-Nr. 109-1228-4231-03	
Datei	DB165311	Ers.durch ..	AEM-Nr. 5-046998

Fig. 20-35: Product Insert

Accessories

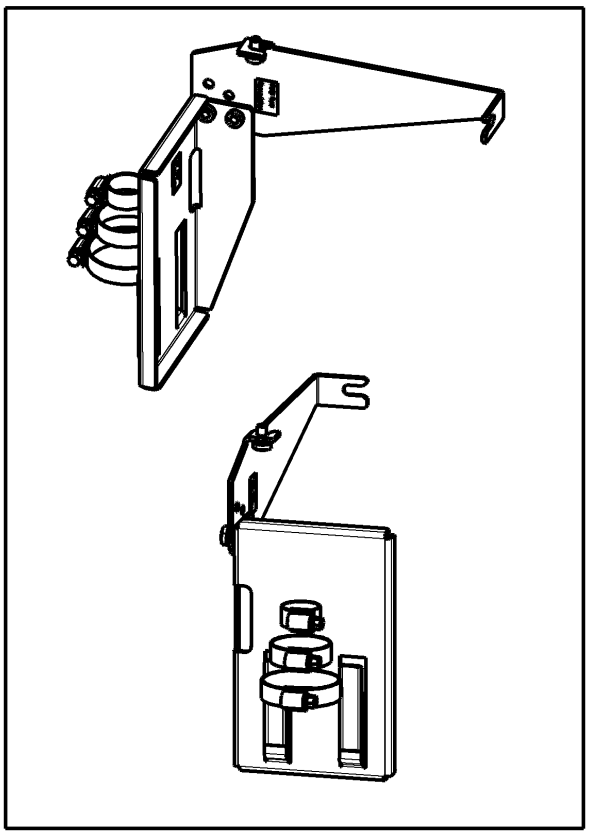
Made in Germany

109-1217-4816-02

HAS02.1-003-NNN-NN

R911306331

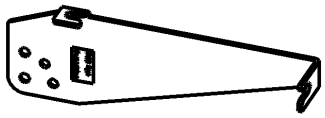
1	WINKEL HMS01.1-W0210 ABSCHIRMANSCHLUSS	R911305950
3	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
1	BLECH HMS01.1-W0210 ABSCHIRMANSCHLUSS	R911305940
Stck	**Benennung**	**MN**



BEIPACKZETTEL HAS02.1-003-NNN-NN

Stck	Benennung	MN
1	BLECH HMS01.1-W0210 ABSCHIRMANSCHLUSS	R911305940

DB164075



1:4

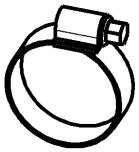
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471

DB_46879

1:2

1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472

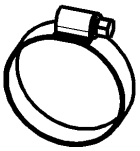
DB_46868



1:2

1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565

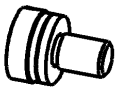
DB148043



2:5

3	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551

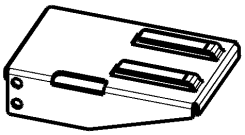
DB_38405



1:1

1	WINKEL HMS01.1-W0210 ABSCHIRMANSCHLUSS	R911305950

DB164163



1:5

Datum	2004-02-03	**Benennung**	
Name	Koblinger	BEIPACKZETTEL HAS02.1-003-NNN-NN	
Material-Nr.	R911306333	**Zeich-Nr.** 109-1217-4262-02	
Datei	DB164151	**Ers.durch** ..	**AEM-Nr.** 5-07273

Fig. 20-36: Product Insert

Accessories

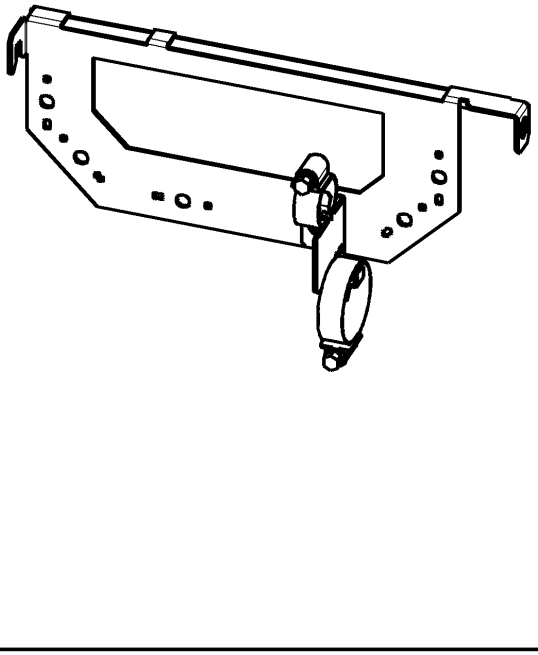
Made in Germany

109-1253-4819-01

HAS02.1-004-NNN-NN

R911306720

Stck	Benennung	MN
1	WINKEL HCS03.1E-W0070 ABSCHIRMANSCHLUSS	R911024542
1	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z4I	R911252551
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
1	HALTERUNG HMS01.1 KABELD. 12-35	R911296081



BEIPACKZETTEL HAS02.1-004-NNN-NN

Stck	Benennung	MN
1	HALTERUNG HMS01.1 KABELD. 12-35	R911296081

DB145411

7:20

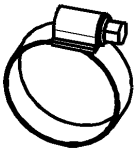
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471

DB_46879

1:2

1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472

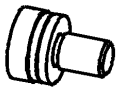
DB_46868



1:2

1	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z4I	R911252551

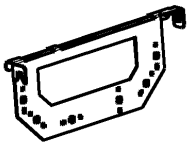
DB_38405



1:1

1	WINKEL HCS03.1E-W0070 ABSCHIRMANSCHLUSS	R911024542

DB186610



3:20

Datum	2004-03-02	Benennung	
Name	Hirt / Sleven	BEIPACKZETTEL HAS02.1-004-NNN-NN	
Material-Nr.	R911306724	Zeich-Nr.	109-1253-4229-02
Datei	DB166622	Ers.durch ..	AEM-Nr. 5-015092

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Fig. 20-37: Product Insert

Accessories

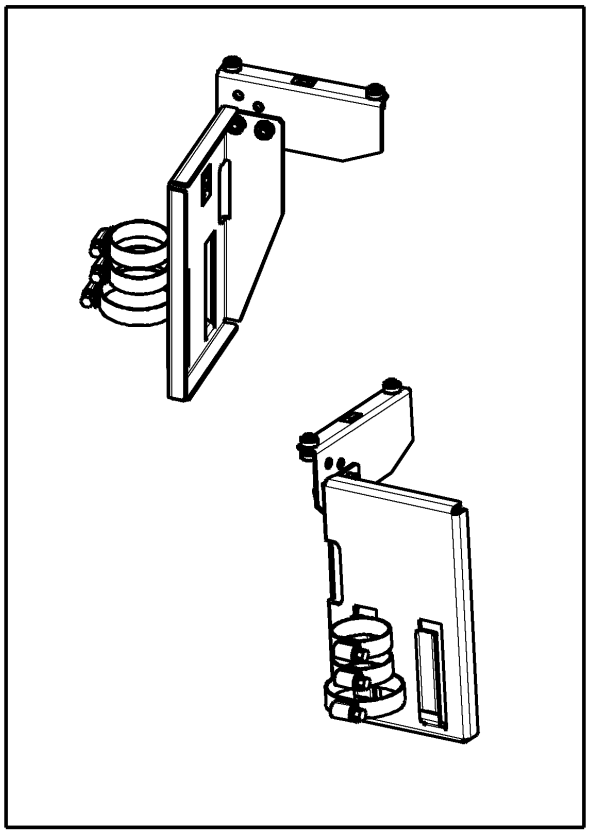
Made in Germany

109-1253-4820-02

HAS02.1-005-NNN-NN

R911306721

1	WINKEL HMS01.1-W0210 ABSCHIRMANSCHLUSS	R911305950
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z4I	R911252551
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	BLECH HCS03.1E-W0150 ABSCHIRMANSCHLUSS	R911025559
Stck	Benennung	MN



BEIPACKZETTEL HAS02.1-005-NNN-NN

Stck	Benennung	MN
1	BLECH HCS03.1E-W0150 ABSCHIRMANSCHLUSS	R911025559
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z4I	R911252551
1	WINKEL HMS01.1-W0210 ABSCHIRMANSCHLUSS	R911305950

DB166085 1:4

DB_46868 1:2

DB148043 7:20

DB_38405 1:1

DB164163 1:5

Datum	2004-03-02	Benennung	
Name	Hirt / Sleven	BEIPACKZETTEL HAS02.1-005-NNN-NN	
Material-Nr.	R911306725	Zeich-Nr. 109-1253-4230-02	
Datei	DB166623	Ers.durch ..	AEM-Nr. 5-015092

DL000078v01.de.tif

Fig. 20-38: Product Insert

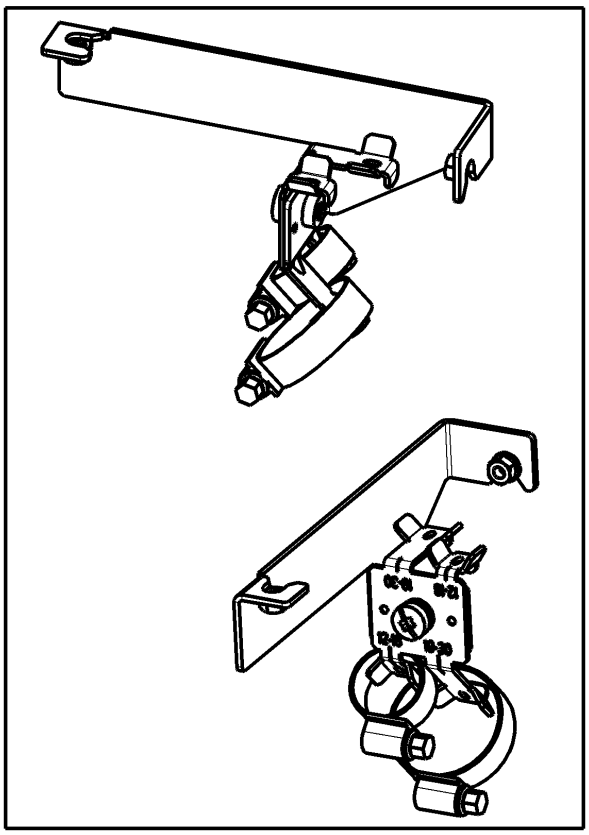
Made in Germany

109-1253-4821-01

HAS02.1-006-NNN-NN

R911306722

1	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z4I	R911252551
1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
2	MUTTER-KOM-M 5,0-D10-H05,80 A2-B	R911210162
1	HALTERUNG HMS01.1 KABELD. 12-30	R911306336
1	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851
Stck	**Benennung**	**MN**



BEIPACKZETTEL HAS02.1-006-NNN-NN

Stck	Benennung	MN
1	BLECH HCS02.1 KABELBEFESTIGUNG	R911305851

DB163070

1:5

1	HALTERUNG HMS01.1 KABELD. 12-30	R911306336

DB164826

7:20

2	MUTTER-KOM-M 5,0-D10-H05,80 A2-B	R911210162

DB_39161

1:1

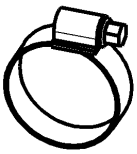
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471

DB_46879

1:2

1	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472

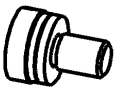
DB_46868



1:2

1	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z4I	R911252551

DB_38405



1:1

Datum	2004-03-02	**Benennung**	
Name	Hirt / Sleven	BEIPACKZETTEL HAS02.1-006-NNN-NN	
Material-Nr.	R911306726	**Zeich-Nr.** 109-1253-4231-01	
Datei	DB166624	**Ers.durch** ..	**AEM-Nr.** 5-07273

Fig. 20-39: Product Insert

Accessories

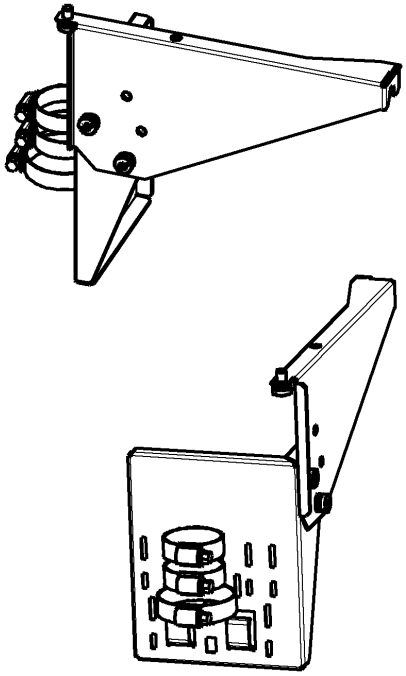
Made in Germany

109-1253-4822-01

HAS02.1-007-NNN-NN

R911306723

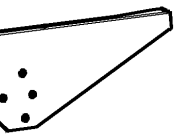
Stck	Benennung	MN
1	WINKEL HNK01.1A-A075-W0080/0106 ABSCHIRM	R911024565
3	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z4I	R911252551
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	BLECH HNK01.1A-A075-E0080/0106 ABSCHIRM	R911024564



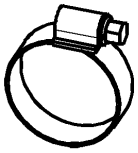
BEIPACKZETTEL HAS02.1-007-NNN-NN

Stck	Benennung	MN
1	BLECH HNK01.1A-A075-E0080/0106 ABSCHIRM	R911024564
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
3	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z4I	R911252551
1	WINKEL HNK01.1A-A075-W0080/0106 ABSCHIRM	R911024565

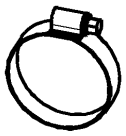
DB186446 3:20



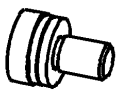
DB_46868 1:2



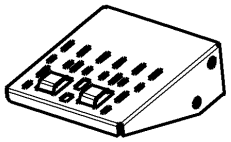
DB148043 7:20



DB_38405 1:1



DB186587 1:5



Datum	2004-03-02	Benennung	
Name	Hirt / Sleven	BEIPACKZETTEL HAS02.1-007-NNN-NN	
Material-Nr.	R911306727	Zeich-Nr. 109-1253-4232-02	
Datei	DB166625	Ers.durch ..	AEM-Nr. 5-015092

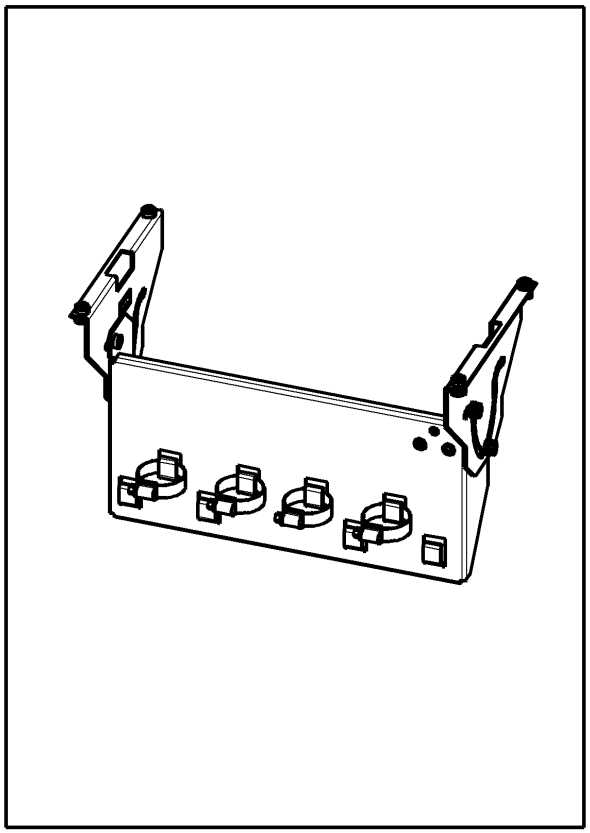
Fig. 20-40: Product Insert

Made in Germany
109-1253-4823-00

HAS02.1-008-NNN-NN

R911309579

1	WINKEL HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025285
4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
4	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427
4	FEDERRING DIN127-B6-FST &	R911213515
2	BLECH HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025286
Stck	Benennung	MN



BEIPACKZETTEL HAS02.1-008-NNN-NN

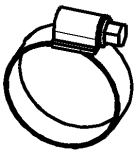
Stck	Benennung	MN
2	BLECH HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025286
4	FEDERRING DIN127-B6-FST &	R911213515
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427
4	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492
1	WINKEL HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025285

DB186112 3:20

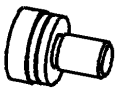
DB_35462 1:1

DB_42215 1:1

DB_46888 1:2

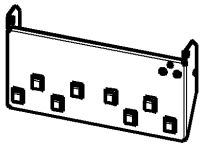


DB_38405 1:1



DB178730 1:1

DB186125 1:10



Datum	2004-11-08	Benennung	
Name	Sieren	BEIPACKZETTEL HAS02.1-008-NNN-NN	
Material-Nr.	R911311655	Zeich-Nr. 109-1253-4233-01	
Datei	DB178779	Ers.durch ..	AEM-Nr. 5-015092

Fig. 20-41: Product Insert

Accessories

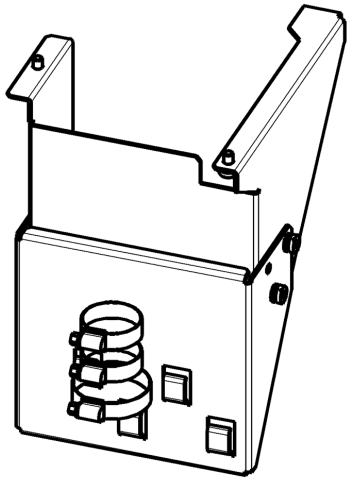
Made in Germany

109-1253-4824-02

HAS02.1-009-NNN-NN

R911308225

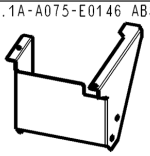
Stck	Benennung	MN
1	WINKEL HNK01.1A-A075-E0146 ABSCHIRMANSCH	R911025036
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
6	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551
1	BLECH HNK01.1A-A075-E0146 ABSCHIRMANSCH	R911025035



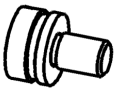
BEIPACKZETTEL HAS02.1-009-NNN-NN

Stck	Benennung	MN
1	BLECH HNK01.1A-A075-E0146 ABSCHIRMANSCH	R911025035
6	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
1	WINKEL HNK01.1A-A075-E0146 ABSCHIRMANSCH	R911025036

DB186560 1:10



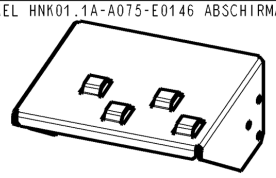
DB_38405 1:1



DB_46868 1:4

DB148043 1:4

DB186428 1:5



Datum	2004-07-06	Benennung	
Name	Hirt	BEIPACKZETTEL HAS02.1-009-NNN-NN	
Material-Nr.	R911308255	Zeich-Nr.	109-1253-4234-03
Datei	DB171948	Ers.durch ..	AEM-Nr. 5-028806

DL000081v01_de.tif

Fig. 20-42: Product Insert

Made in Germany

109-1253-4841-00

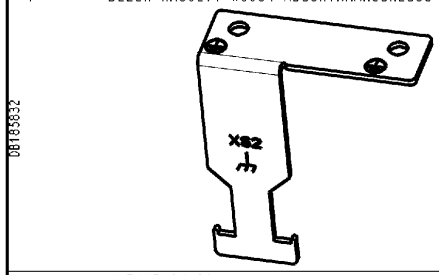
HAS02.1-010-NNN-NN

R911306209

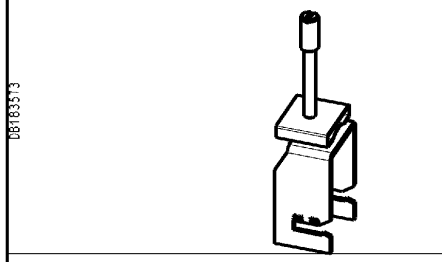
Stck	Benennung	MN
1	KLEMME SK 20	R911313176
1	BLECH HMS02.1-W0054 ABSCHIRMANSCHLUSS	R911311526

BEIPACKZETTEL HAS02.1-010-NNN-NN

Stck	Benennung	MN
1	BLECH HMS02.1-W0054 ABSCHIRMANSCHLUSS	R911311526



1	KLEMME SK 20	R911313176



Datum	2005-08-19	Benennung	
Name	rainhirt	BEIPACKZETTEL HAS02.1-010-NNN-NN	
Material-Nr.	R911313050	Zeich-Nr.	109-1253-4277-00
Datei	DB190746	Ers.durch ..	AEM-Nr. ..

Fig. 20-43: Product Insert

Accessories

Made in Germany

109-1253-4842-00

HAS02.1-011-NNN-NN

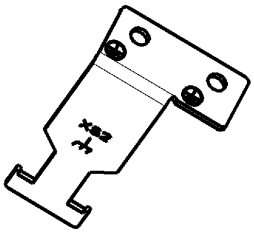
R911306471

Stck	Benennung	MN
1	KLEMME SK 20	R911313176
1	BLECH HMS02.1 W0028 ABSCHIRMANSCHLUSS	R911311525

BEIPACKZETTEL HAS02.1-011-NNN-NN

Stck	Benennung	MN
1	BLECH HMS02.1 W0028 ABSCHIRMANSCHLUSS	R911311525

DB186447



1:2

Stck	Benennung	MN
1	KLEMME SK 20	R911313176

DB183513

1:2

Datum	2005-08-19	Benennung	
Name	rainhirt	BEIPACKZETTEL HAS02.1-011-NNN-NN	
Material-Nr.	R911306628	Zeich-Nr.	109-1253-4278-00
Datei	DB190747	Ers.durch ..	AEM-Nr. ..

Fig. 20-44: Product Insert

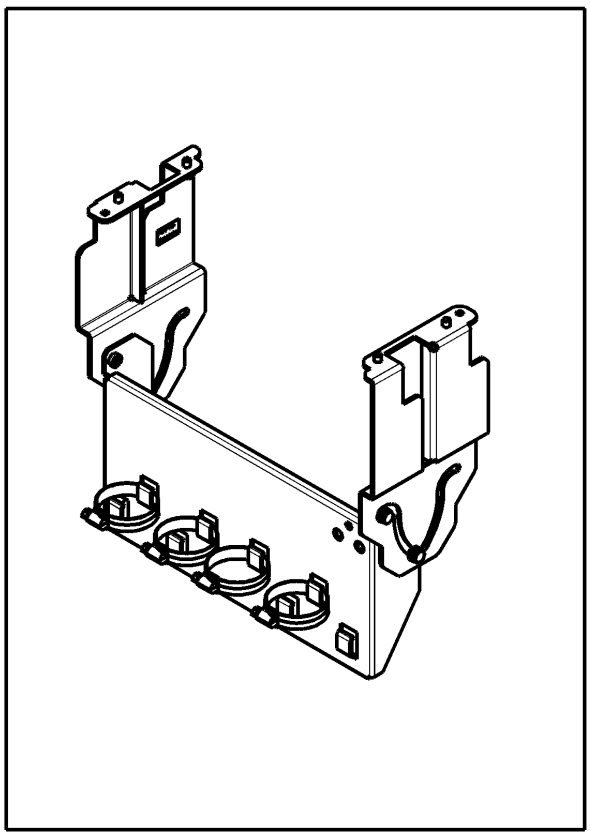
Made in Germany

109-1253-4850-00

HAS02.1-012-NNN-NN

R911315682

Stck	Benennung	MN
1	WINKEL HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025285
4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
4	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427
4	FEDERRING DIN127-B6-FST &	R911213515
2	BLECH HCS04.1E-W0500 ABSCHIRMANSCHLUSS	R911027316



BEIPACKZETTEL HAS02.1-012-NNN-NN

Stck	Benennung	MN
2	BLECH HCS04.1E-W0500 ABSCHIRMANSCHLUSS	R911027316
4	FEDERRING DIN127-B6-FST &	R911213515
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427
4	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
4	SCHR-LIN-M 6,0X12,0-K-8.8-ISO7045-ZN-Z41	R911252551
4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492
1	WINKEL HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025285

DB195166

1:10

DB_35462

1:1

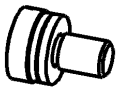
DB_42215

1:1

DB148043

2:5

DB_38405

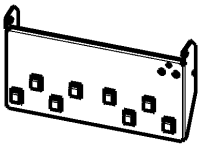


1:1

DB178750

1:1

DB186125



1:10

Datum	2006-01-19	Benennung	
Name	Sonjrazz	BEIPACKZETTEL HAS02.1-012-NNN-NN	
Material-Nr.	R911315849	Zeich-Nr.	109-1253-4284-00
Datei	DB195390	Ers.durch ..	AEM-Nr. ..

Fig. 20-45: Product Insert

Accessories

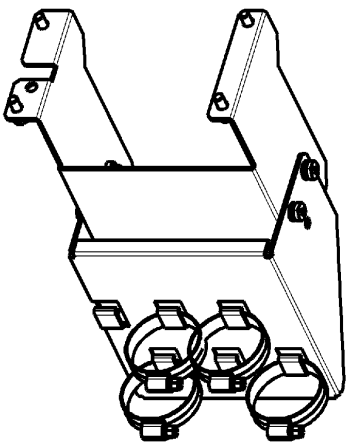
Made in Germany

109-1287-4820-00

HAS02.1-013-NNN-NN

R911318183

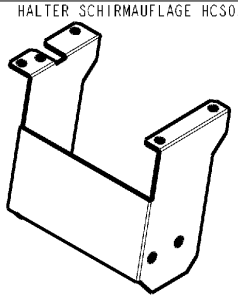
Stck	Benennung	MN
4	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
8	KOMBI-SCHRAUBE ZISO10644-M6X16-8.8 &	R911294530
1	0027843 SCHIRMAUFLAGE HCS0500	R911203470
1	0027842 HALTER SCHIRMAUFLAGE HCS0500	R911203471



BEIPACKZETTEL HAS02.1-013-NNN-NN

Stck	Benennung	MN
1	0027842 HALTER SCHIRMAUFLAGE HCS0500	R911203471

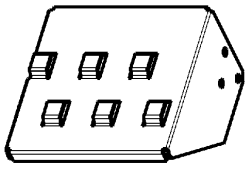
DB204197



1:5

1	0027843 SCHIRMAUFLAGE HCS0500	R911203470

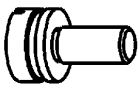
DB199932



1:5

8	KOMBI-SCHRAUBE ZISO10644-M6X16-8.8 &	R911294530

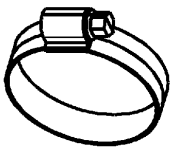
DB149685



1:1

4	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565

DB148043



1:2

Datum	2006-08-21	Benennung	
Name	mattame1	BEIPACKZETTEL HAS02.1-013-NNN-NN	
Material-Nr.	R911318184	Zeich-Nr.	109-1287-4203-00
Datei	DB204202	Ers.durch ..	AEM-Nr. ..

Fig. 20-46: Product Insert

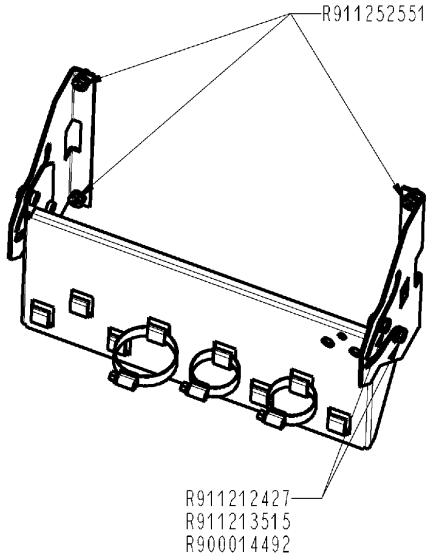
Made in Germany

109-1253-4857-00

HAS02.1-014-NNN-NN

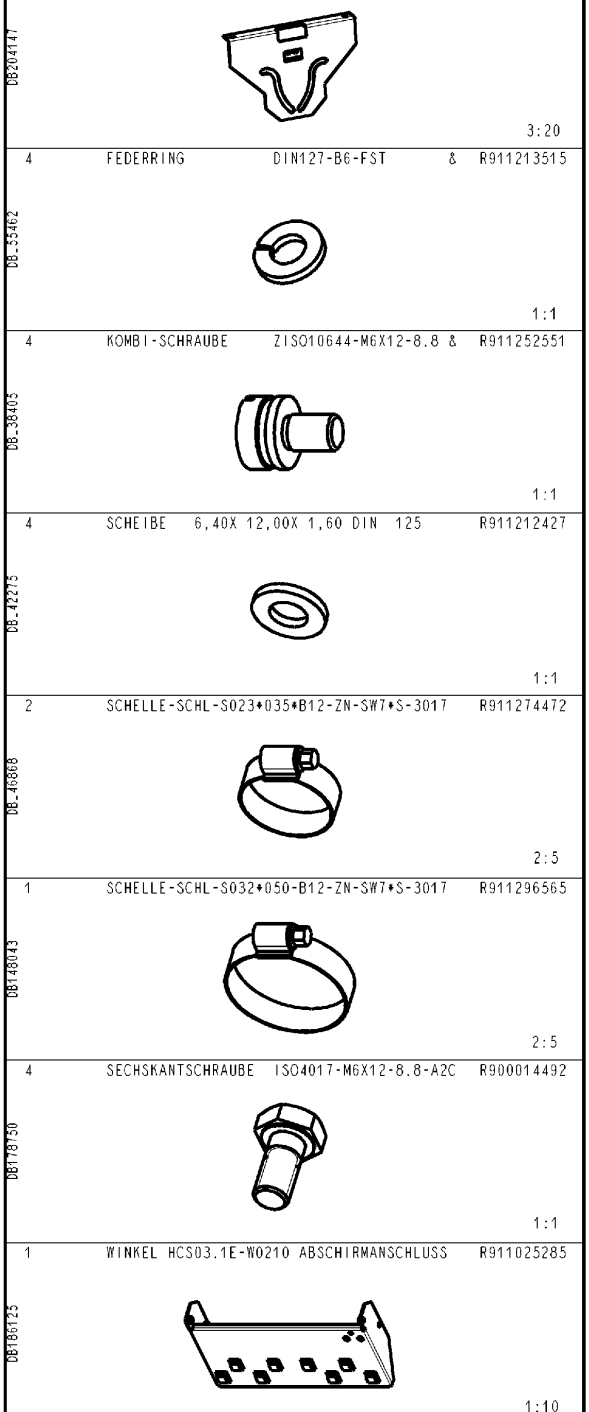
R911319050

1	WINKEL HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025285
4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427
4	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551
4	FEDERRING DIN127-B6-FST &	R911213515
2	BLECH HMS01.1-W0350 ABSCHIRMANSCHLUSS	R911318661
Stck	Benennung	MN



BEIPACKZETTEL HAS02.1-014-NNN-NN

Stck	Benennung	MN
2	BLECH HMS01.1-W0350 ABSCHIRMANSCHLUSS	R911318661
4	FEDERRING DIN127-B6-FST &	R911213515
4	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551
4	SCHEIBE 6,40X 12,00X 1,60 DIN 125	R911212427
2	SCHELLE-SCHL-S023*035*B12-ZN-SW7*S-3017	R911274472
1	SCHELLE-SCHL-S032*050-B12-ZN-SW7*S-3017	R911296565
4	SECHSKANTSCHRAUBE ISO4017-M6X12-8.8-A2C	R900014492
1	WINKEL HCS03.1E-W0210 ABSCHIRMANSCHLUSS	R911025285



Datum	2006-10-11	Benennung	
Name	siegfis0	BEIPACKZETTEL HAS02.1-014-NNN-NN	
Material-Nr.	R911319013	Zeich-Nr. 109-1253-4298-00	
Datei	DB20599D	Ers.durch ..	AEM-Nr. ..

Fig. 20-47: Product Insert

Accessories

Made in Germany

109-1253-4850-AB

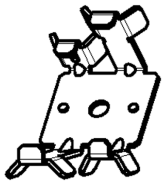
HAS02.1-015-NNN-NN

R911320785

Stck	Benennung	MN
1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
1	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551
1	HALTERUNG HMS01.1 KABELD. 12-30	R911306336

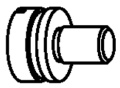
BEIPACKZETTEL HAS02.1-015-NNN-NN

Stck	Benennung	MN
1	HALTERUNG HMS01.1 KABELD. 12-30	R911306336



1:2

1	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551



1:1

1	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471

1:2

Datum	2007-03-09	Benennung	
Name	rainhirt	BEIPACKZETTEL HAS02.1-015-NNN-NN	
Material-Nr.	R911320791	Zeich-Nr. 109-1253-4299-AB	
Datei	DB212340	Ers.durch 109-1253-4299-00	AEM-Nr. 5-75318

Fig. 20-48: Product Insert

Accessories

Made in Germany

109-1304-4813-00

HAS02.1-020-NNF-NN

R911323839

Stck	Benennung	MN
2	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
3	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551
1	HALTERUNG HCS02.1 KABELD. 12-18	R911305852
1	BLECH HAS02.1-020-NNF-NN	R911323763
1	ABSCHIRMBLECH HAS02.1-020-NNF-NN	R911323764
Stck	Benennung	MN

BEIPACKZETTEL HAS02.1-020-NNF-NN

Stck	Benennung	MN
1	ABSCHIRMBLECH HAS02.1-020-NNF-NN	R911323764

DB225152

1:5

1	BLECH HAS02.1-020-NNF-NN	R911323763

DB225270

1:4

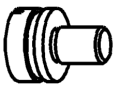
1	HALTERUNG HCS02.1 KABELD. 12-18	R911305852

DB163246

1:4

3	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551

DB_38405



1:1

2	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471

DB_46819

1:2

Datum	2008-02-28	Benennung	
Name	rainhirt	BEIPACKZETTEL HAS02.1-020-NNF-NN	
Material-Nr.	R911323843	Zeich-Nr. 109-1304-4218-01	
Datei	DB226241	Ers.durch ..	AEM-Nr. 5-046998

Fig. 20-49: Product Insert HAS02.1-020-NNF-NN (Page 1)

Accessories

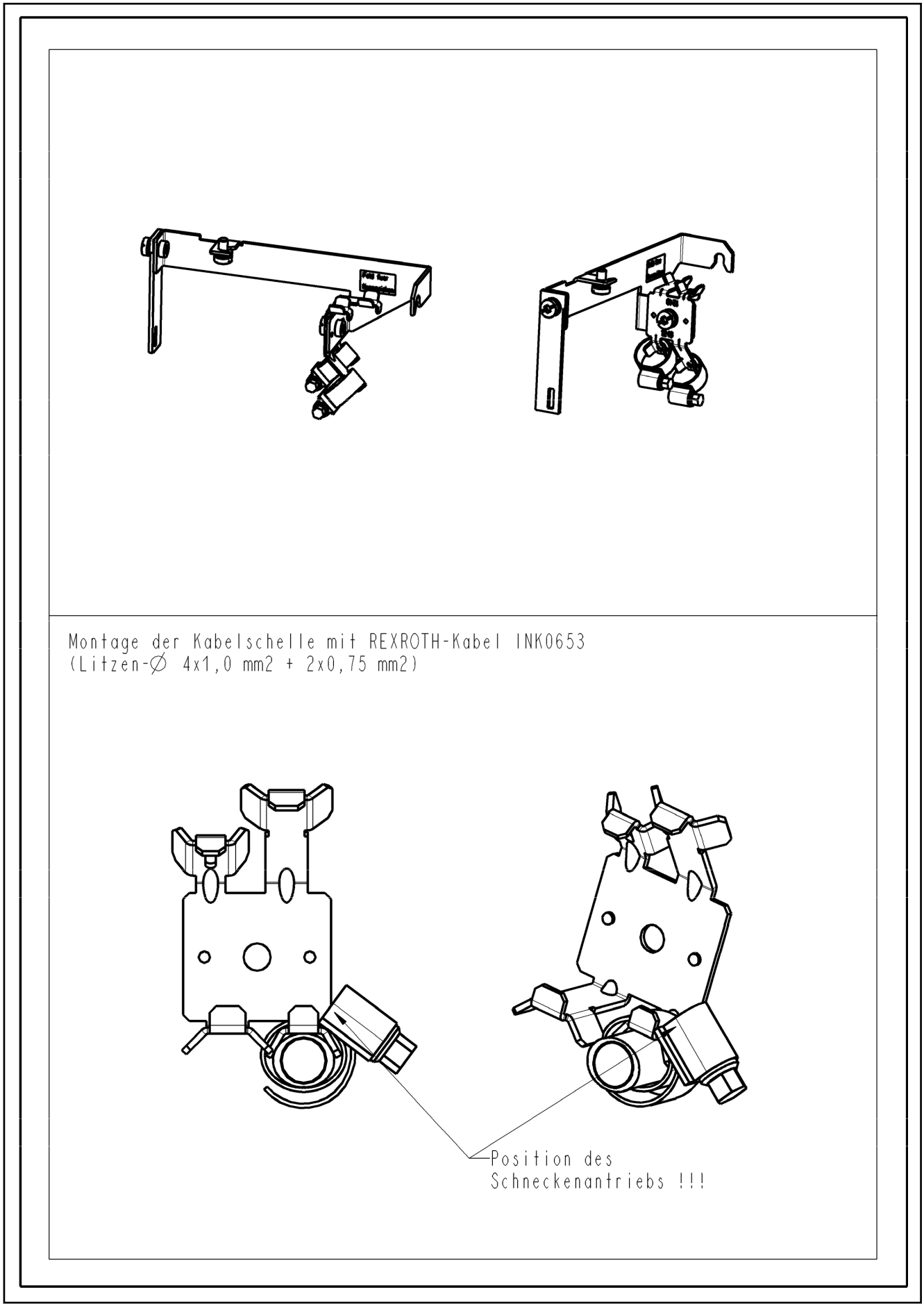


Fig. 20-50: Product Insert HAS02.1-020-NNF-NN (Page 2)

Accessories

Made in Germany

109-1304-4814-00

HAS02.1-021-NNF-NN

R911323840

Stck	Benennung	MN
2	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471
2	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551
1	HALTERUNG HCS02.1 KABELD. 12-18	R911305852
1	BLECH HAS02.1-021-NNF-NN	R911323762
1	ABSCHIRMBLECH HAS02.1-021-NNF-NN	R911323765

BEIPACKZETTEL HAS02.1-021-NNF-NN

Stck	Benennung	MN
1	ABSCHIRMBLECH HAS02.1-021-NNF-NN	R911323765

DB222748

1:5

1	BLECH HAS02.1-021-NNF-NN	R911323762

DB223881

1:4

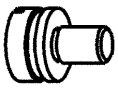
1	HALTERUNG HCS02.1 KABELD. 12-18	R911305852

DB163246

1:4

2	KOMBI-SCHRAUBE ZISO10644-M6X12-8.8 &	R911252551

DB_38405



1:1

2	SCHELLE-SCHL-S012*022-B12-ZN-SW7*S-3017	R911274471

DB_46819

1:2

Datum	2008-02-28	Benennung	
Name	rainhirt	BEIPACKZETTEL HAS02.1-021-NNF-NN	
Material-Nr.	R911323842	Zeich-Nr. 109-1304-4219-01	
Datei	DB226255	Ers.durch ..	AEM-Nr. 5-046998

Fig. 20-51: Product Insert HAS02.1-021-NNF-NN (Page 1)

Accessories

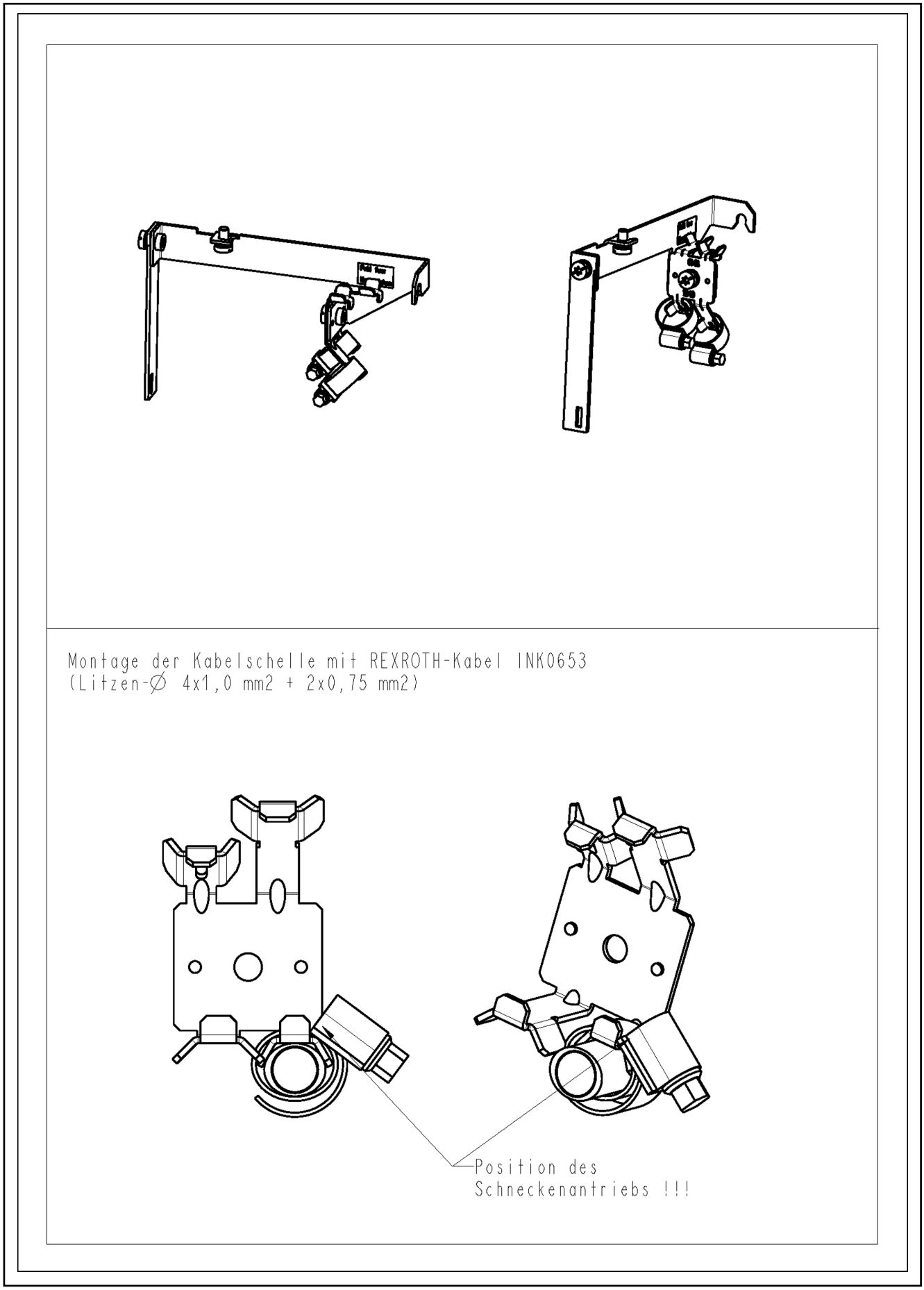
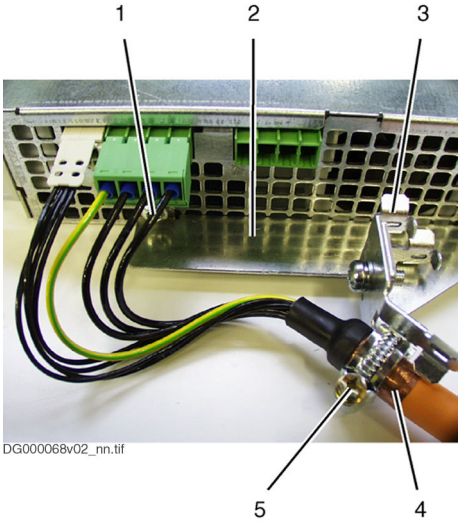


Fig. 20-52: Product Insert HAS02.1-021-NNF-NN (Page 2)

20.2.6 Mounting the accessory HAS02

General information



1 Screw in thread XS2
2 Fixing device of shielding plate
3 Shielding plate
4 Shield of motor cable
5 Clip

Fig. 20-53: Strain Relief and Shield Connection of Motor Cable

- Unscrew bottom or bottom left mounting screw of drive controller.
- Put fixing device of accessories to bottom of drive controller and screw down mounting screw of drive controller again.

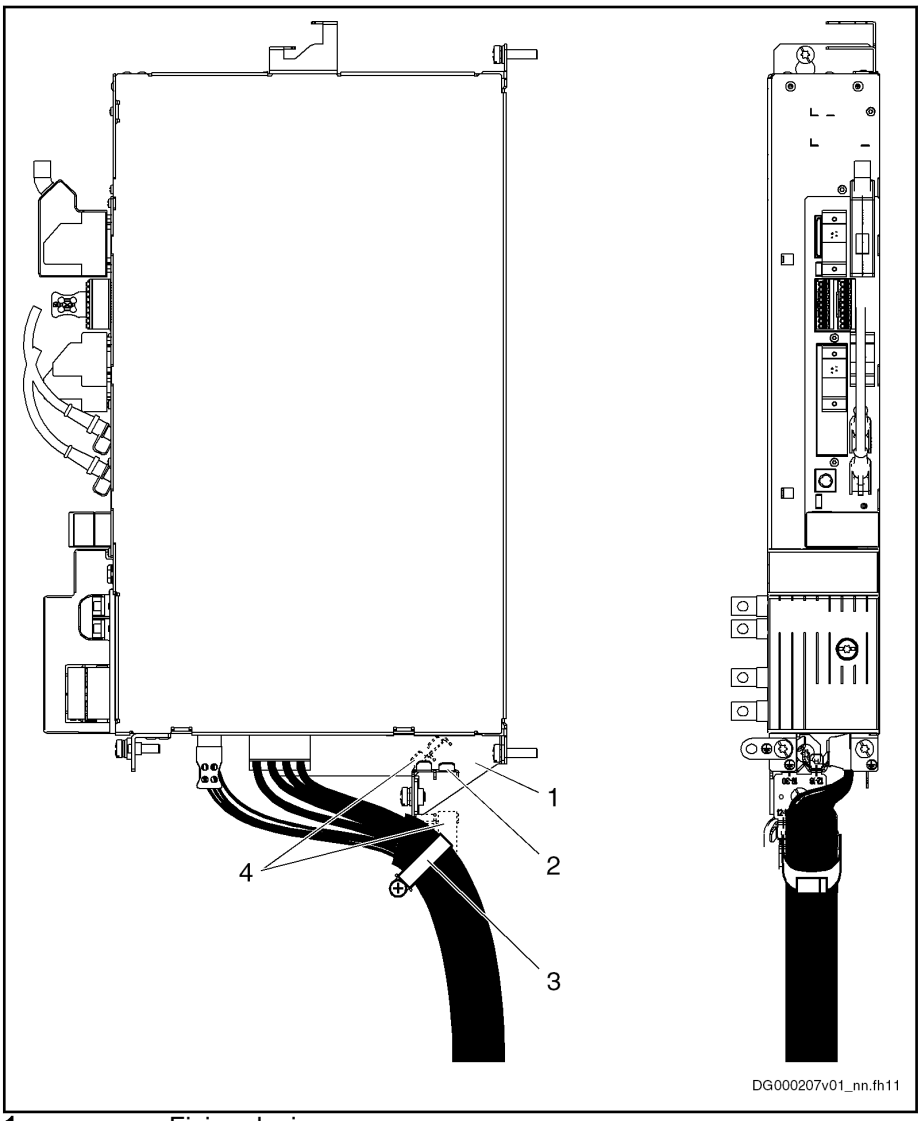
NOTICE **Risk of damage to the drive controller by too long screws!**

Exclusively use screws of a **maximum length of 12 mm** for the thread of shield connection XS2.

- Screw second screw (M6 × 12) in thread XS2 at bottom of drive controller.
- Screw shielding plate to sheet metal of accessories according to desired cable routing of motor cable (45° or horizontal). (The figure below illustrates cable routing with 45°.)
- According to diameter of motor cable, fix motor cable at corresponding point of shielding plate (12-18 mm or 19-30 mm) with a clip. Make sure that shield of motor cable has good contact with shielding plate (see figure below).

Accessories

HAS02.1-001 at HMS01.1N-W0054



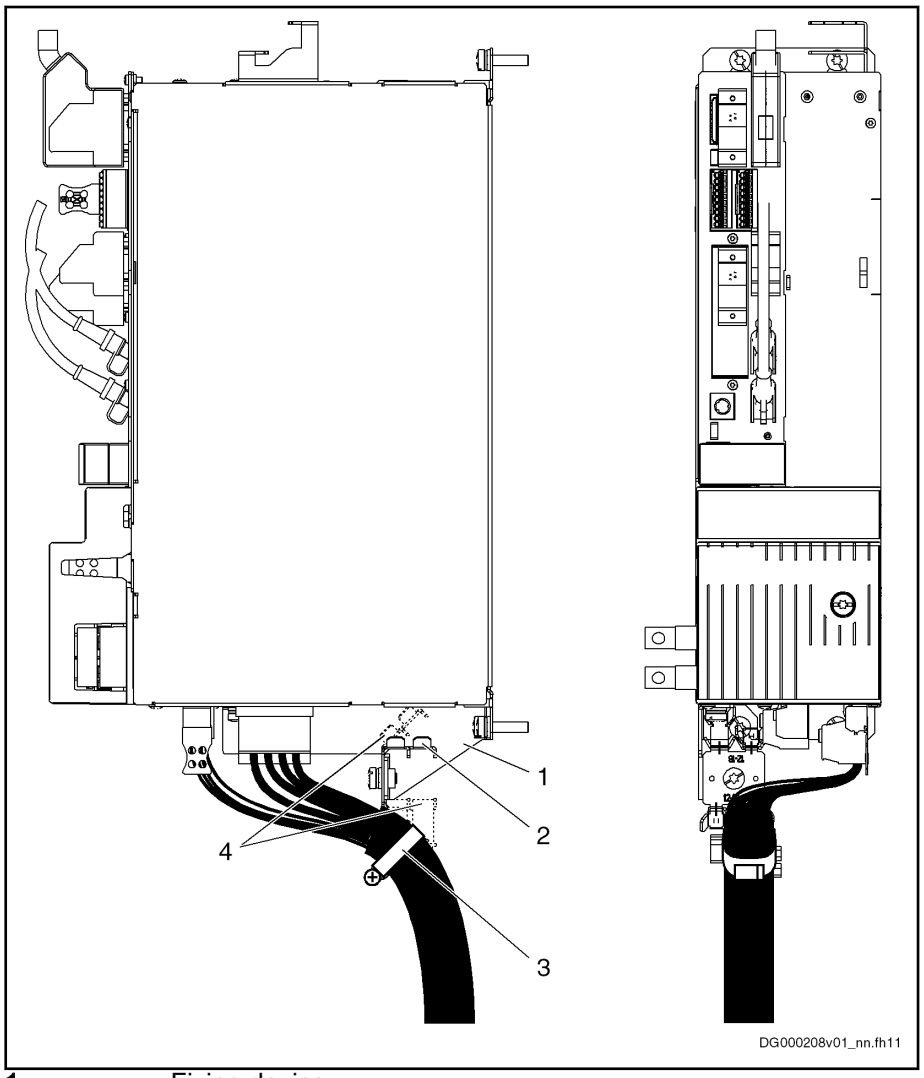
1 Fixing device
2 Shielding plate
3 Clip
4 Different possibilities of mounting the shielding plate, according to motor cable routing

Fig. 20-54: HAS02.1-001 at Bottom of Drive Controller HMS01.1N-W0054

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

HAS02.1-002 at HCS02.1E-W0054



1 Fixing device
2 Shielding plate
3 Clip
4 Different possibilities of mounting the shielding plate, according to motor cable routing

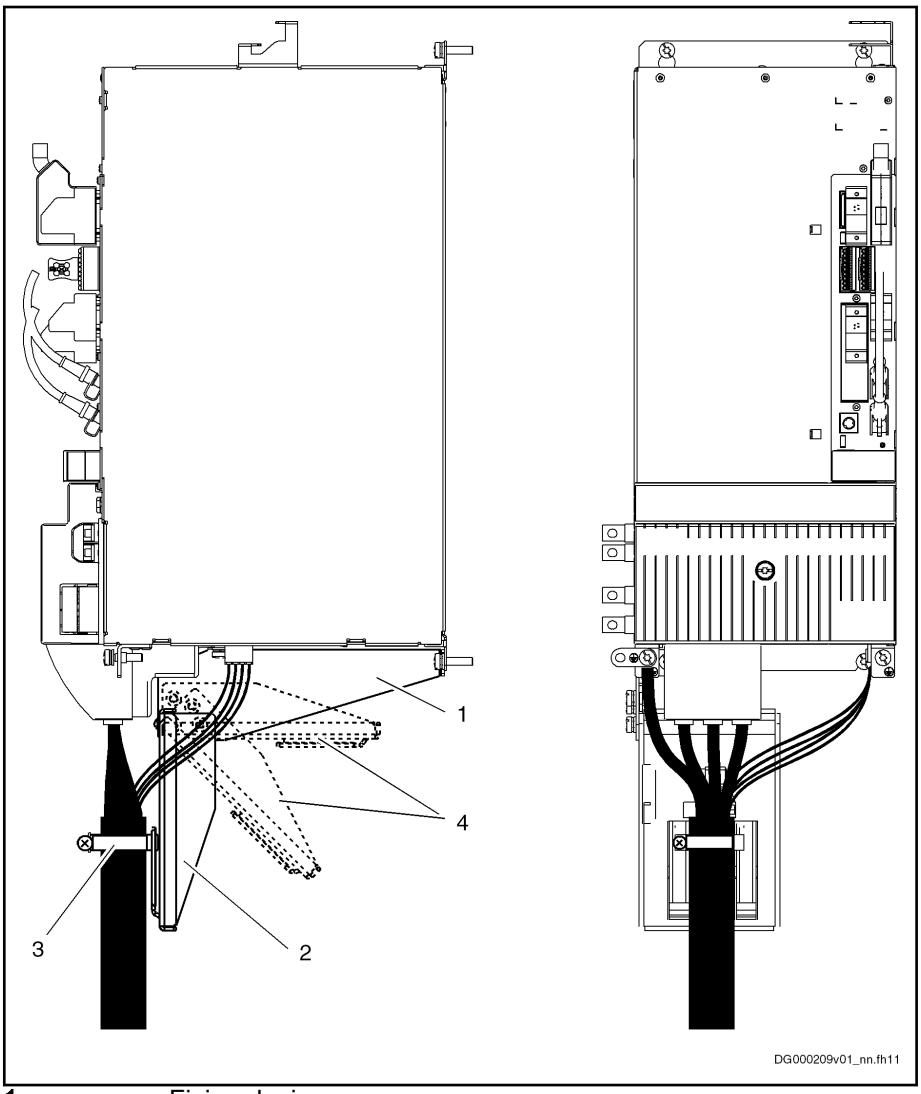
Fig. 20-55: HAS02.1-002 at Bottom of Drive Controller HCS02.1E-W0054

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

Accessories

HAS02.1-003 at HMS01.1N-W0210/300



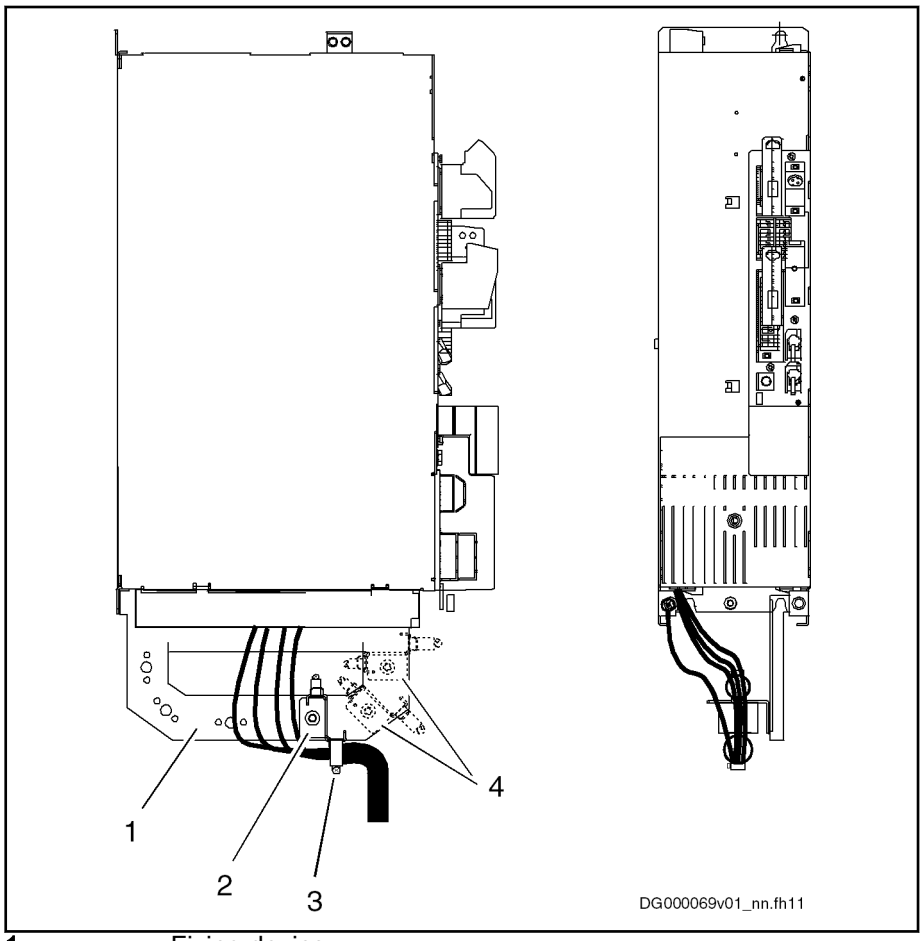
1 Fixing device
2 Shielding plate
3 Clip
4 Different possibilities of mounting the shielding plate, according to motor cable routing

Fig. 20-56: HAS02.1-003 at Bottom of Drive Controller HMS01.1N-W0210/300

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

HAS02.1-004 at HCS03.1E-W0070



1 Fixing device
2 Shielding plate
3 Clip
4 Different possibilities of mounting the shielding plate, according to motor cable routing

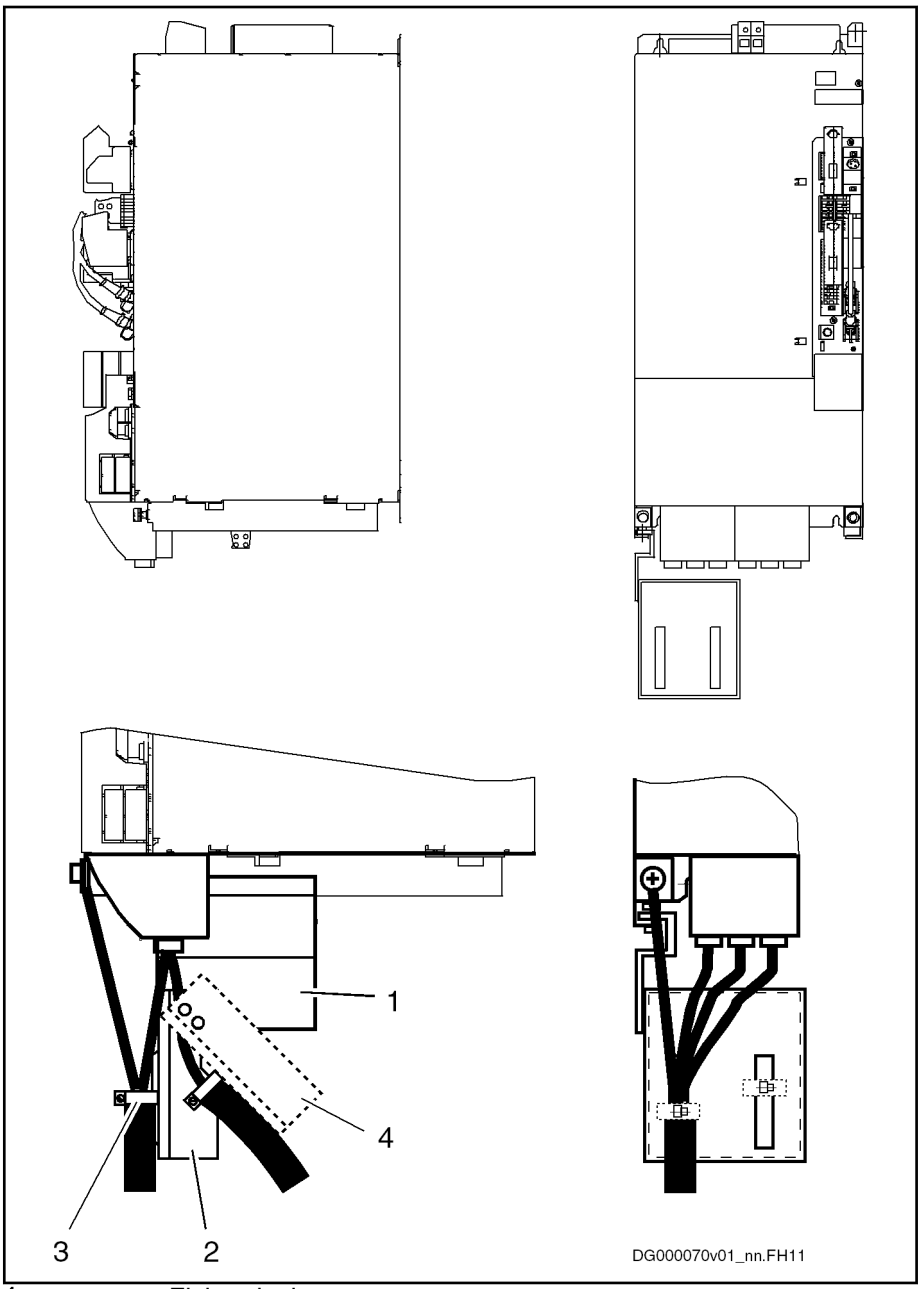
Fig. 20-57: HAS02.1-004 at Bottom of Drive Controller HCS03.1E-W0070

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

Accessories

HAS02.1-005 at HCS03.1E-W0100/150



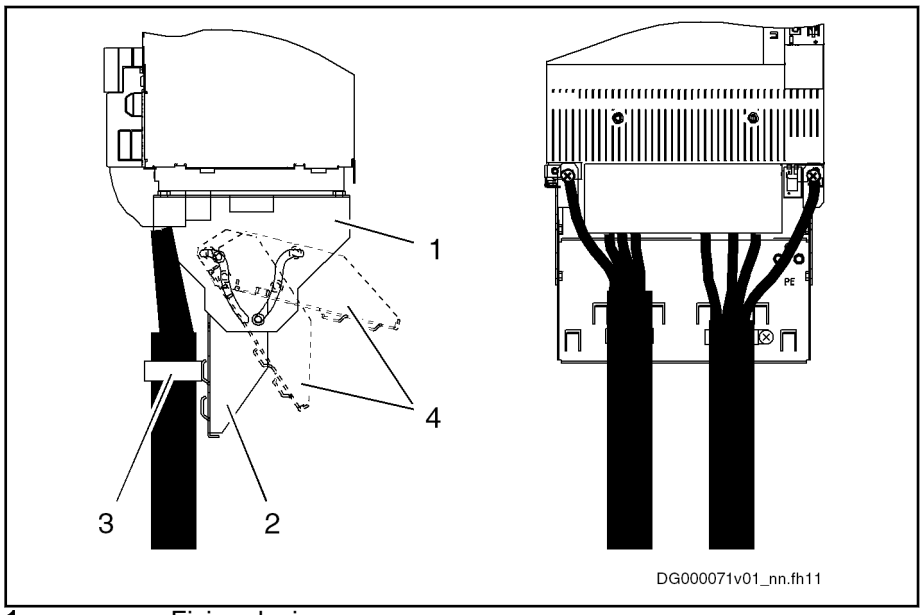
1 Fixing device
2 Shielding plate
3 Clip
4 Different possibilities of mounting the shielding plate, according to motor cable routing

Fig. 20-58: HAS02.1-005 at Bottom of Drive Controller HCS03.1E-W0100/0150

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

HAS02.1-008 at HCS03.1E-W0210/280/350



1 Fixing device
2 Shielding plate
3 Clip
4 Different possibilities of mounting the shielding plate, according to motor cable routing

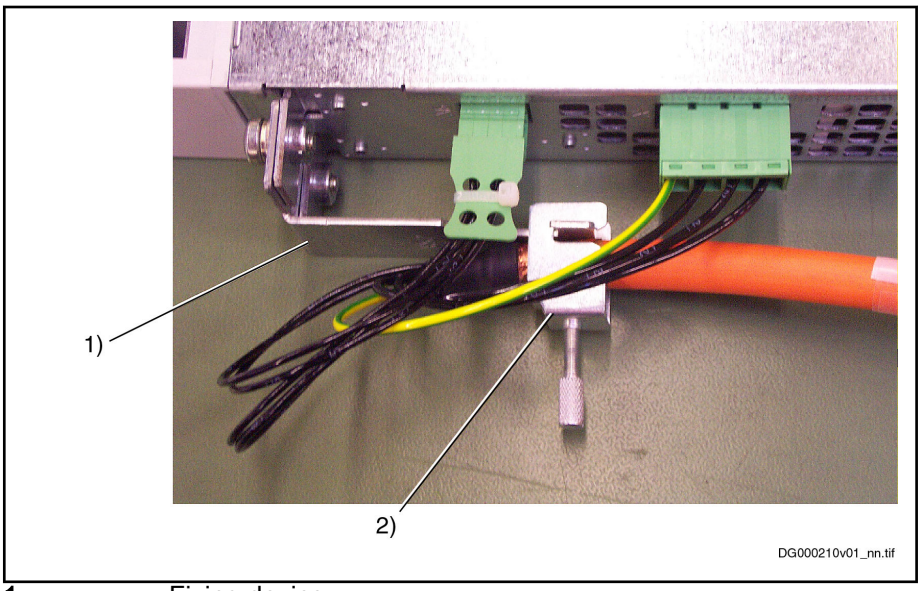
Fig. 20-59: HAS02.1-008 at Bottom of Drive Controller HCS03.1E-W0210/280/350

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

Accessories

HAS02.1-010 at HMS02.1N-W0028/54

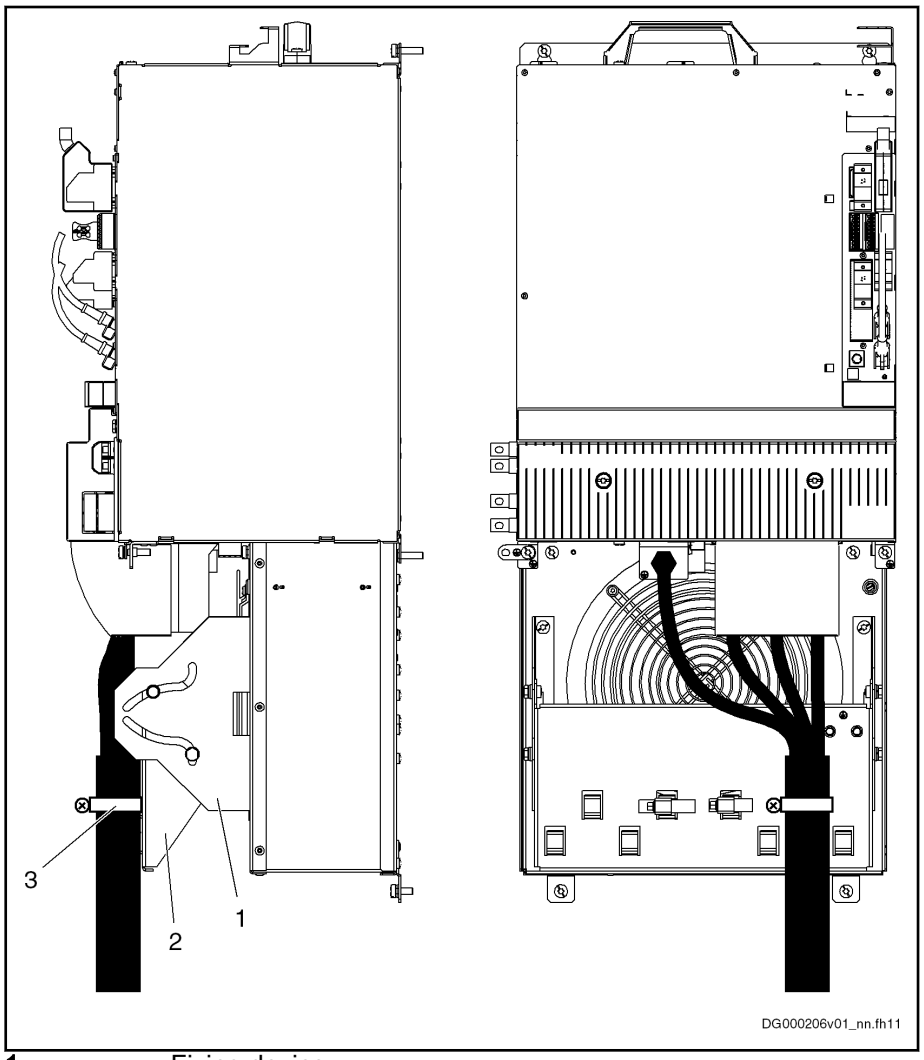


1 Fixing device
2 Shielding plate

Fig. 20-60: HAS02.1-010-NNN-NN at Bottom of Drive Controller HMS02.1N-W0028/54

1. Screw fixing device to equipment grounding conductor connection of drive controller.
2. Fix shield of cable with shielding plate to fixing device.

HAS02.1-014 at HMS01.1N-W0350



1 Fixing device
2 Shielding plate
3 Clip

Fig. 20-61: HAS02.1-014 at Bottom of Drive Controller HMS01.1N-W0350

1. By means of supplied screws, fasten fixing device to front of fan unit.

2. Fix shielding plate to fixing device.

3. Fix shield of cable to shielding plate with appropriate clip.

20.2.7 Shield connection of the motor cable via mains filter

General information

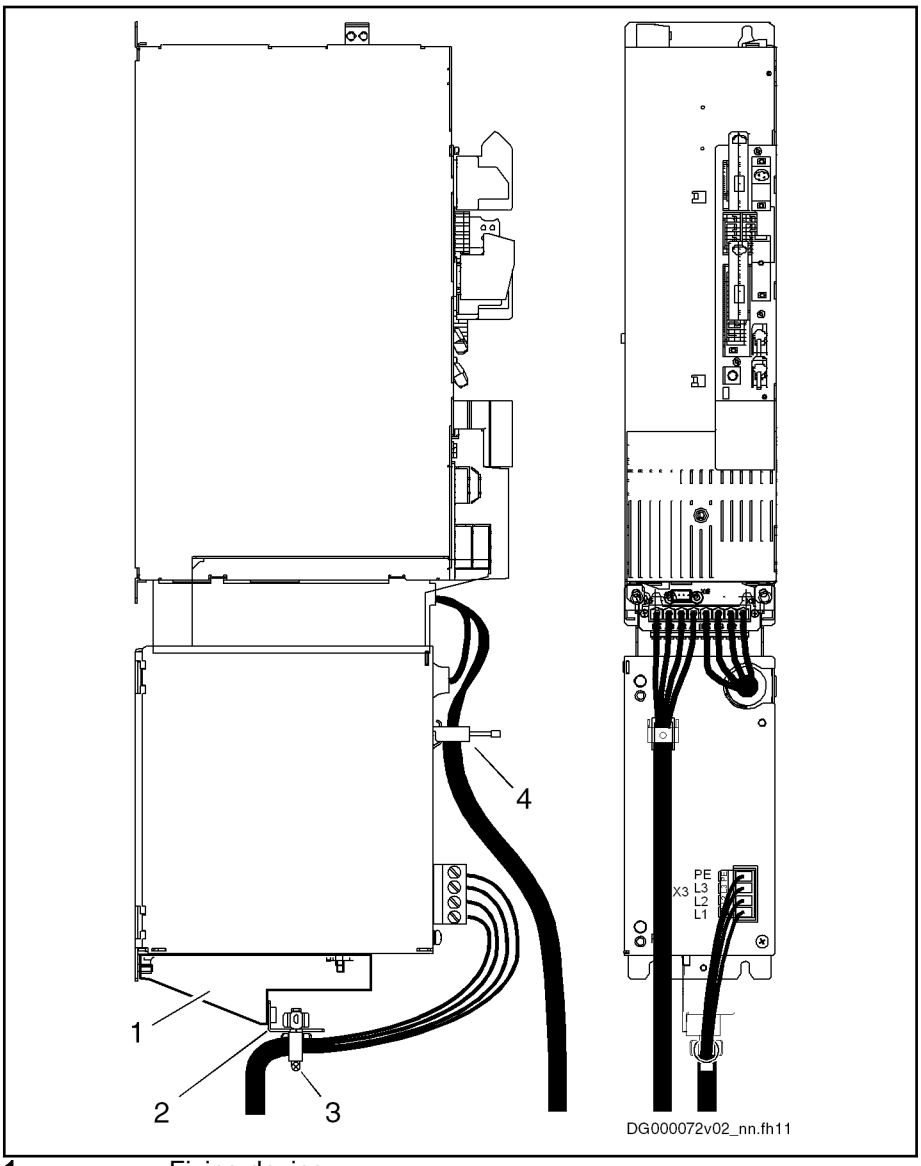
For shield connection of the motor cable at the drive controller via the mains filter, a special shielding plate is available:

☞ Using the shielding plate guarantees optimum shield contact of the motor cable. You should therefore, **where possible, always** use the shielding plate.

The shielding plate is only available as an option.

Accessories

HAS02.1-006 with mains filter



1 Fixing device
2 Shielding plate (power supply cable)
3 Clip
4 Shielding plate (motor cable)

Fig. 20-62: HAS02.1-006 at Bottom of Mains Filter (Rated Current 50 A)

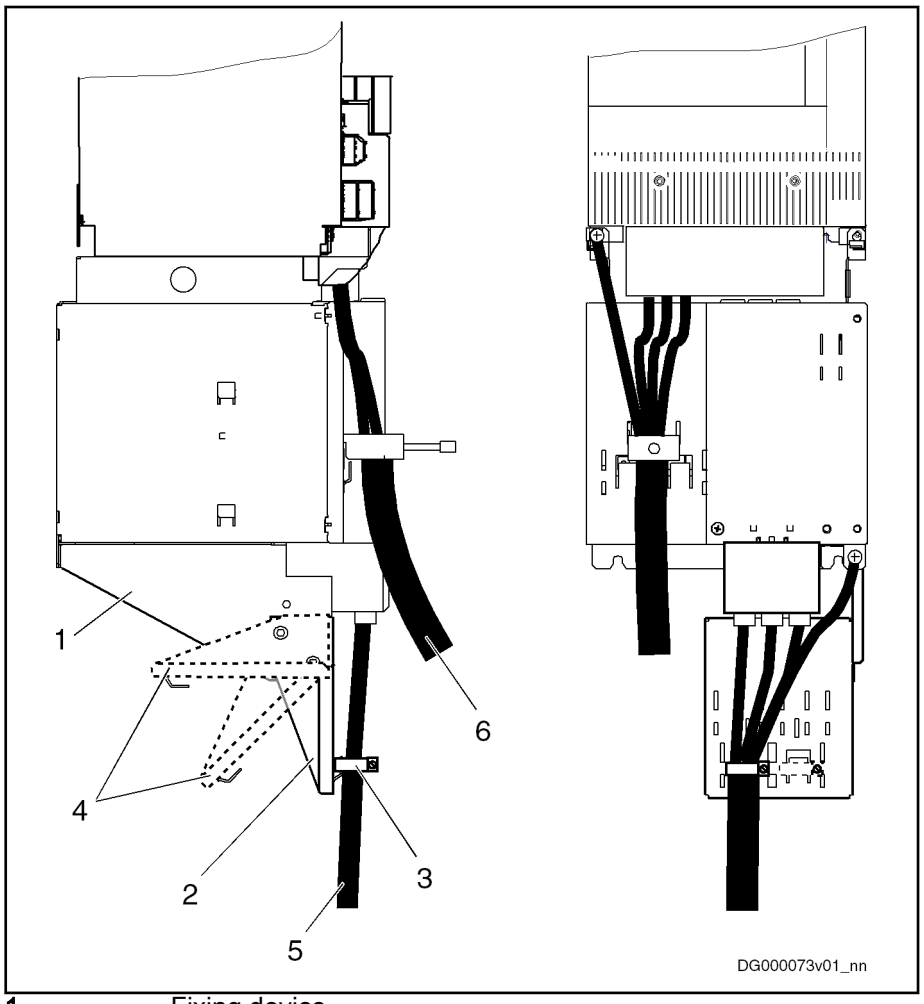
1.Hang up fixing device at bottom of mains filter at threaded bolts and fasten with supplied nuts.

2. Screw shielding plate to fixing device.

3. Fix shield of cable to shielding plate with appropriate clip.

☞ The shield terminals must not be used to provide strain relief.

HAS02.1-007 with mains filter



1	Fixing device
2	Shielding plate
3	Clip
4	Different possibilities of mounting the shielding plate, according to cable routing
5	Power supply cable
6	Motor cable

Fig. 20-63: HAS02.1-007 at Bottom of Mains Filter (Rated Current 80 A / 106 A)

1.Hang up fixing device at bottom of mains filter and fasten with supplied screws.

2. Screw shielding plate to fixing device.

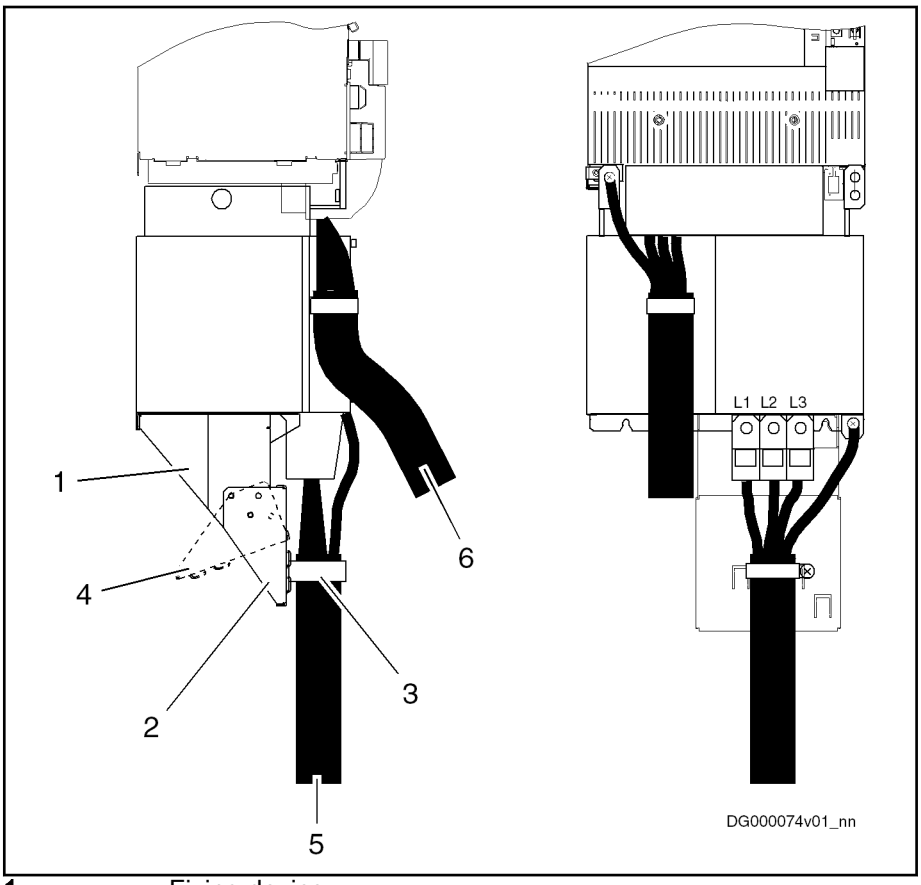
According to desired cable routing, the shielding plate can be mounted in different positions.

3. Fix shield of cable to shielding plate with clip.

The shield terminals must not be used to provide strain relief.

Accessories

HAS02.1-009 with power supply cable and mains filter



1 Fixing device
2 Shielding plate
3 Clip
4 Different possibilities of mounting the shielding plate, according to cable routing
5 Power supply cable
6 Motor cable

Fig. 20-64: Shielding Plate HAS02.1-009 at Bottom of Mains Filter (Rated Current 146 A)

Mounting

1. By means of supplied screws, fasten fixing device to bottom of drive controller.
2. Fix shielding plate to fixing device according to desired motor cable routing.
3. Fix shield of cable to shielding plate with appropriate clip.

☞ The shield terminals must not be used to provide strain relief.

20.3 HAS03, control cabinet adapter

20.3.1 Type code

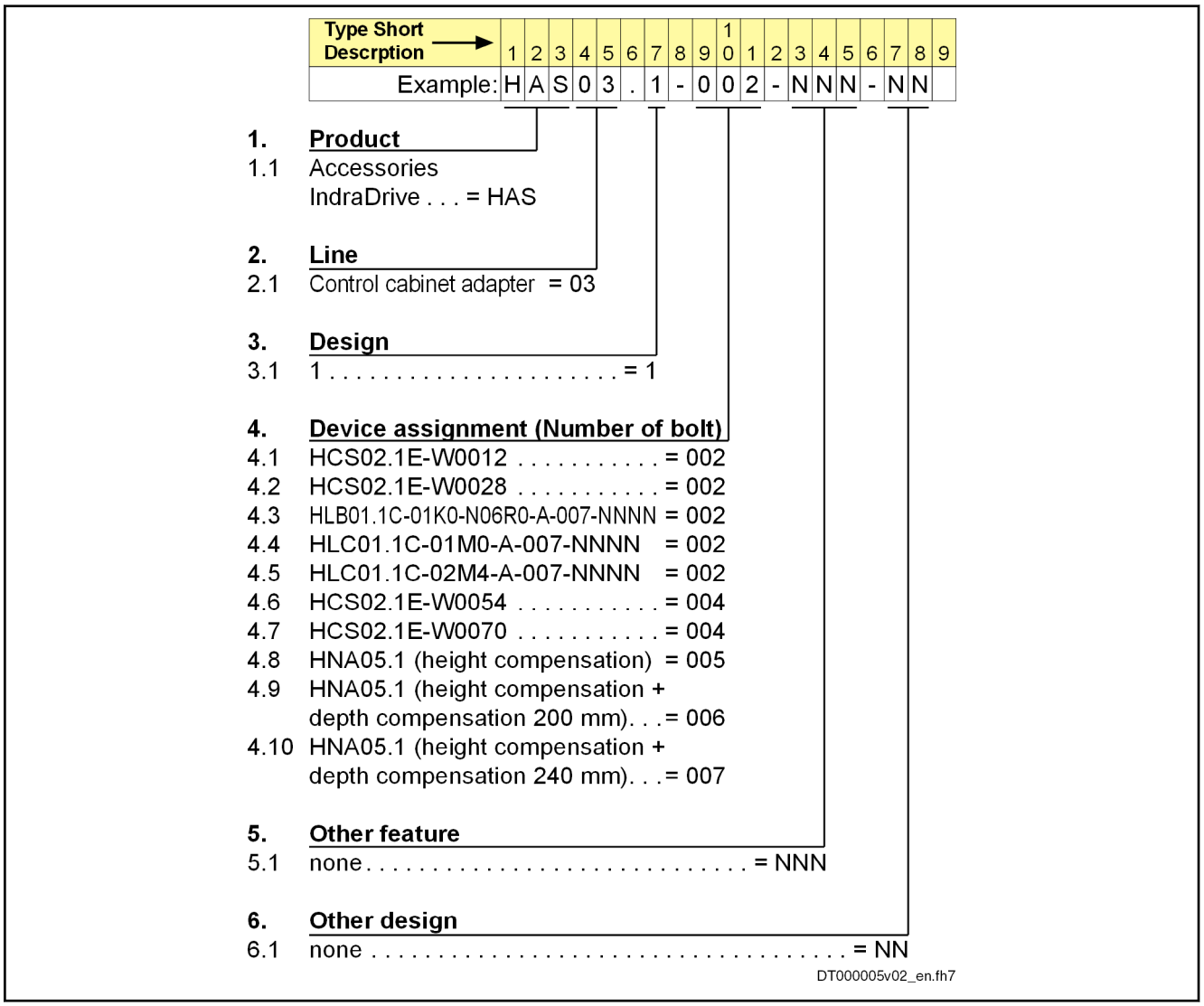
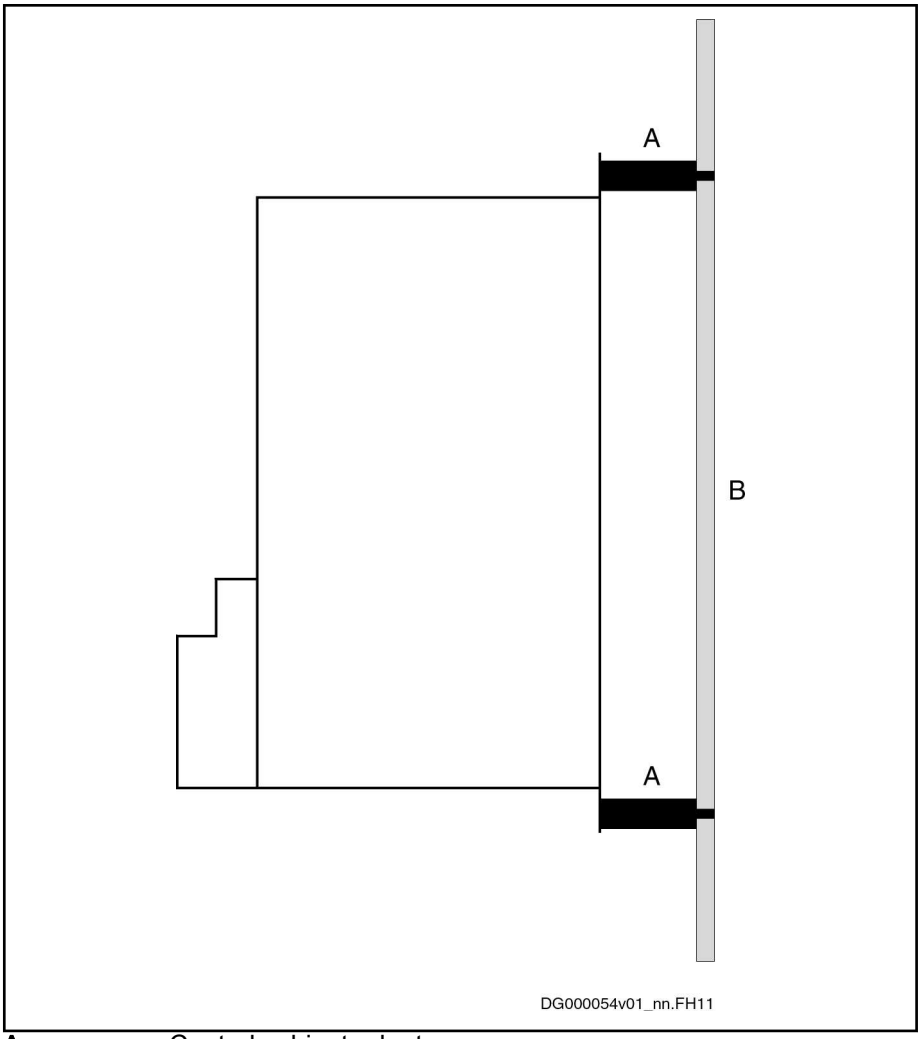


Fig. 20-65: Type code HAS03.1

20.3.2 Use

The control cabinet adapter is used to compensate different mounting depths of HCS02.1E drive controllers and HLC01.1C and HMS01 / HMD01 when mounted to a common mounting surface.

Accessories



A Control cabinet adapter
B Mounting surface in control cabinet

Fig. 20-66: How to use the control cabinet adapters

☞ Observe the maximum allowed **tightening torque** of **6 Nm** at HAS03.

☞ Mechanical stability of the adapted device requires a rigid connection via DC bus bars to a neighboring device without adapter.

- Do not operate HAS03 without neighboring device.
- Mount HAS03 to bare metal mounting plate.

20.3.3 Assigning HAS03 accessories

See "Type code (device assignment)".

20.3.4 Scope of supply

Scope of supply For the scope of supply and the parts of HAS03, see the corresponding product insert.

Accessories

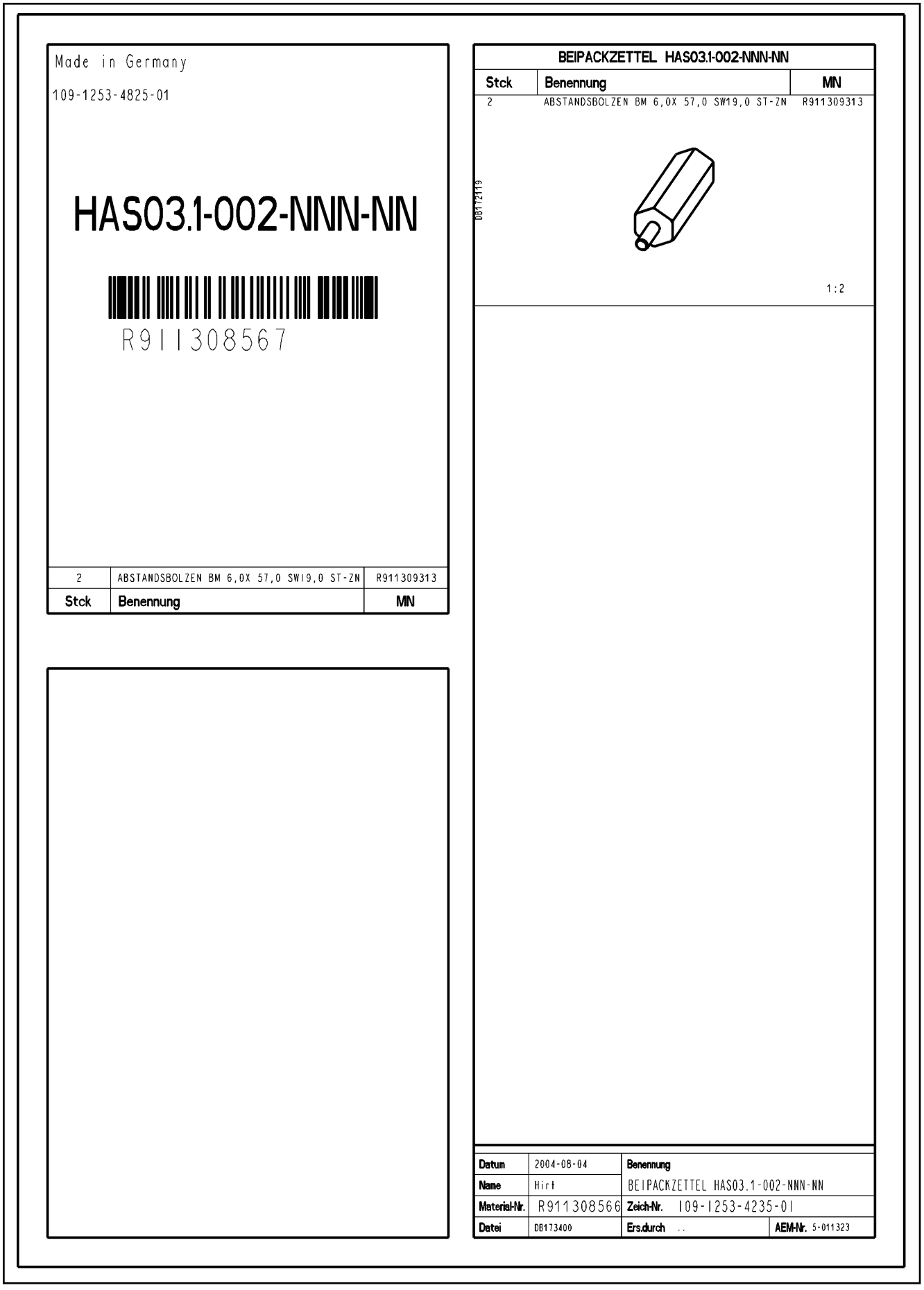


Fig. 20-67: Product insert

Accessories

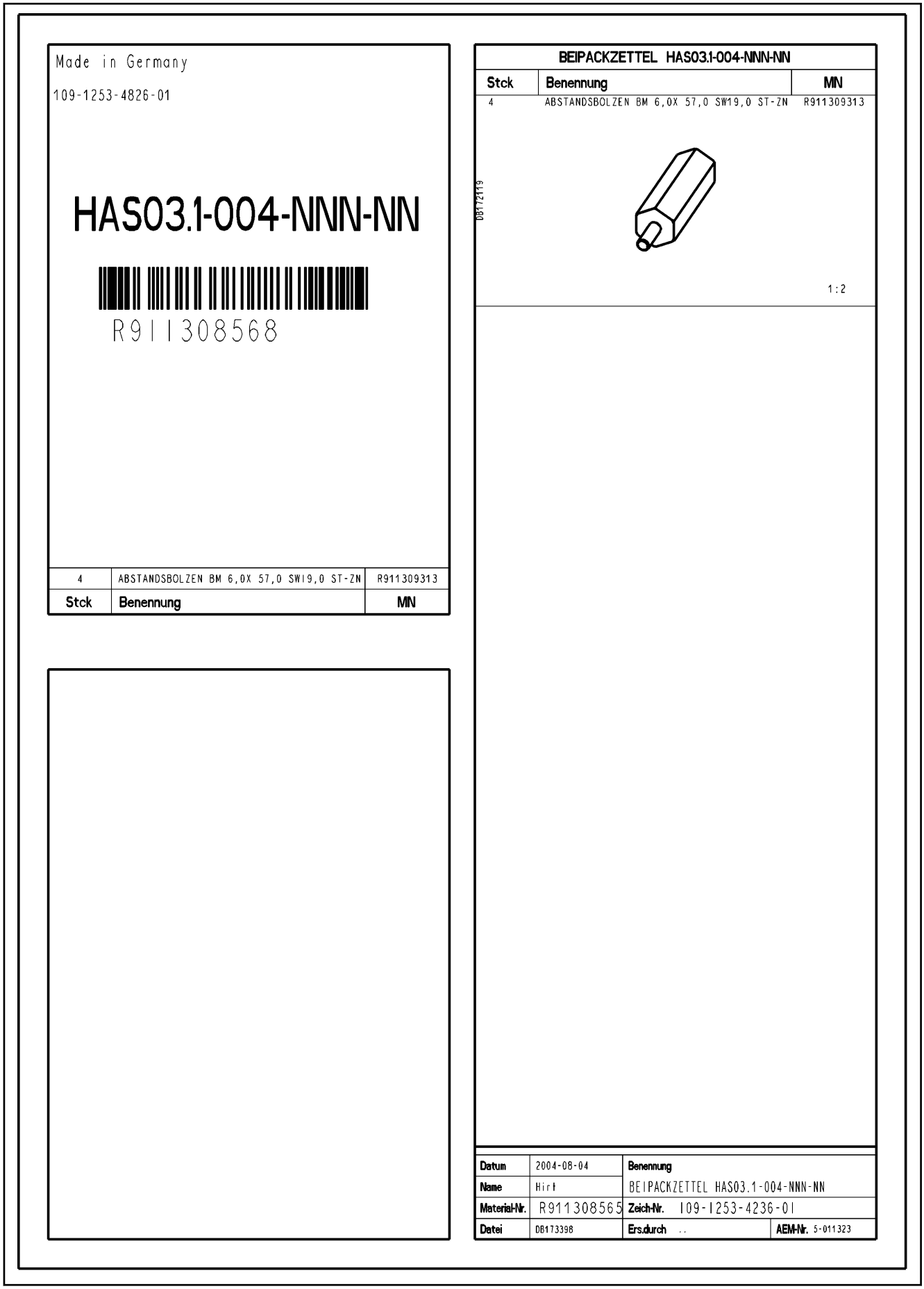


Fig. 20-68: Product insert

20.4 HAS04, capacitor

20.4.1 General information

Capacitors from the DC bus connections L+ and L- against housing.

20.4.2 Type code

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	A	S	0	4	.	1	-	0	0	1	-	N	N	N	-	N	N																								
	①			②			③			④				⑤				⑥																								

①	**Product:** HAS = IndraDrive accessories
②	**Series:** 04 = Capacitor
③	**Design:** 1 = 1
④	**Capacitor:** 001 = 2 × 470 nF (HCS02.x) 002 = 2 × 470 nF (HCS03.x) 003 = 2 × 2.5 µF (HLL05)
⑤	**Other properties:** NNN = None
⑥	**Other design:** NN = None

Tab. 20-2: HAS04, type code

☞ Using the HAS04 accessories requires additional mounting clearance at the drive controller.

Take the dimensions of HAS04 into account.

20.4.3 Use

The HAS04 accessories are used to

- operate HCS02 and HCS03 drive controllers at HNF01.1 mains filter
- operate HMS01, HMS02 and HMD01 drive controllers at HCS02 and HCS03 drive controllers
- operate HMU05 universal inverters at HLL05 DC bus chokes

HAS04 type	Use
HAS04.1-001-NNN-NN	At DC bus connections of HCS02 drive controllers
HAS04.1-002-NNN-NN	At DC bus connections of HCS03 drive controllers
HAS04.1-003-NNN-NN	At DC bus connections of HMU05 universal inverters Further information: See HMU05 Project Planning Manual.

Tab. 20-3: HAS04 type

Accessories

20.4.4 Assignment

	HAS04.1		
Device	**-001**	**-002**	**-003**
HCS02.1E-W0028	■	-	-
HCS02.1E-W0054	■	-	-
HCS02.1E-W0070	■	-	-
HCS03.1E-W0070	-	■	-
HCS03.1E-W0100	-	■	-
HCS03.1E-W0150	-	■	-
HCS03.1E-W0210	-	■	-
HMU05/HLL05	-	-	■

Tab. 20-4: Assigning HAS04 accessories

20.4.5 Scope of supply

The HAS04 accessories are available as an option, they are not part of the standard scope of supply.

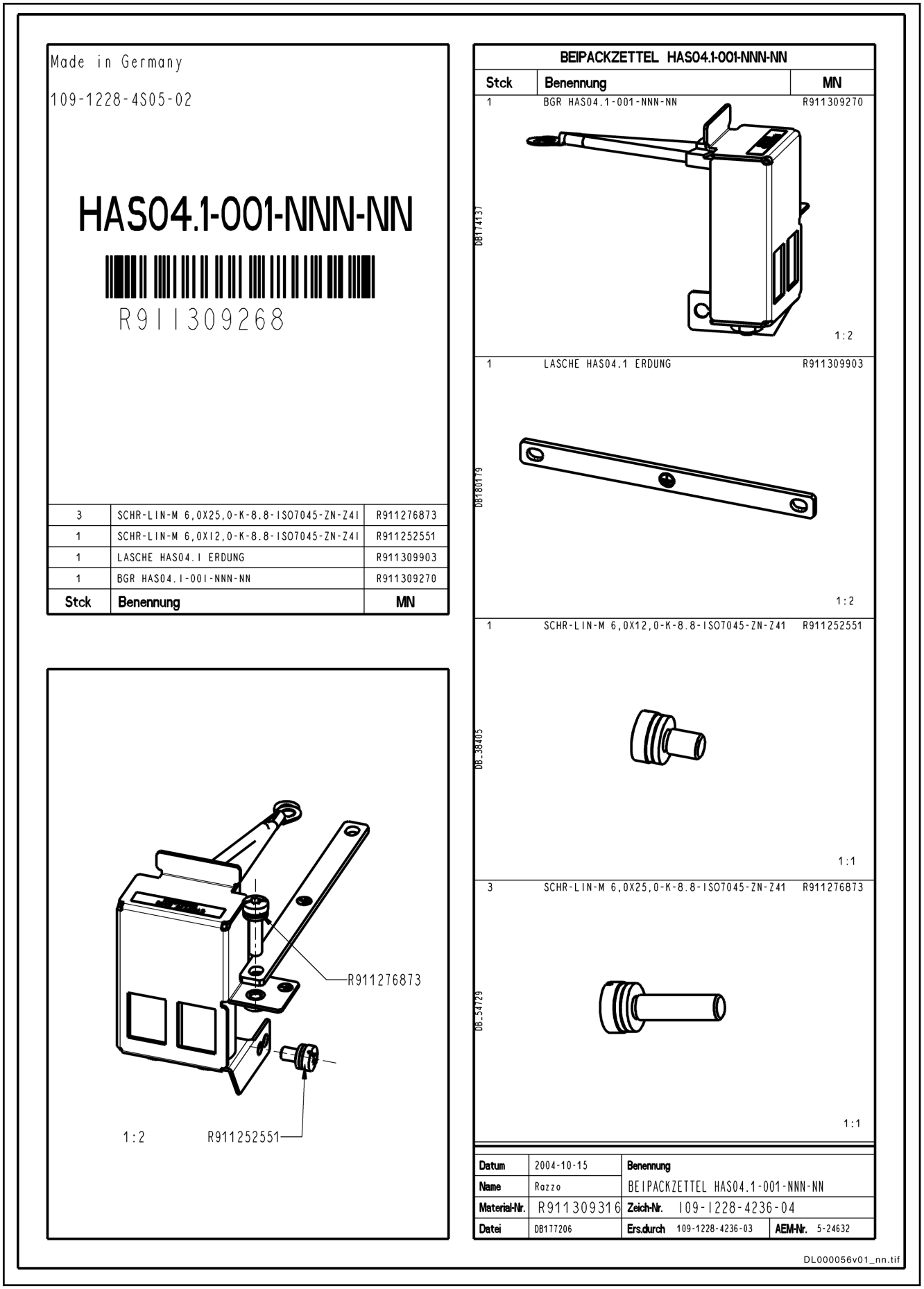


Fig. 20-69: Product insert HAS04.1-001

Accessories

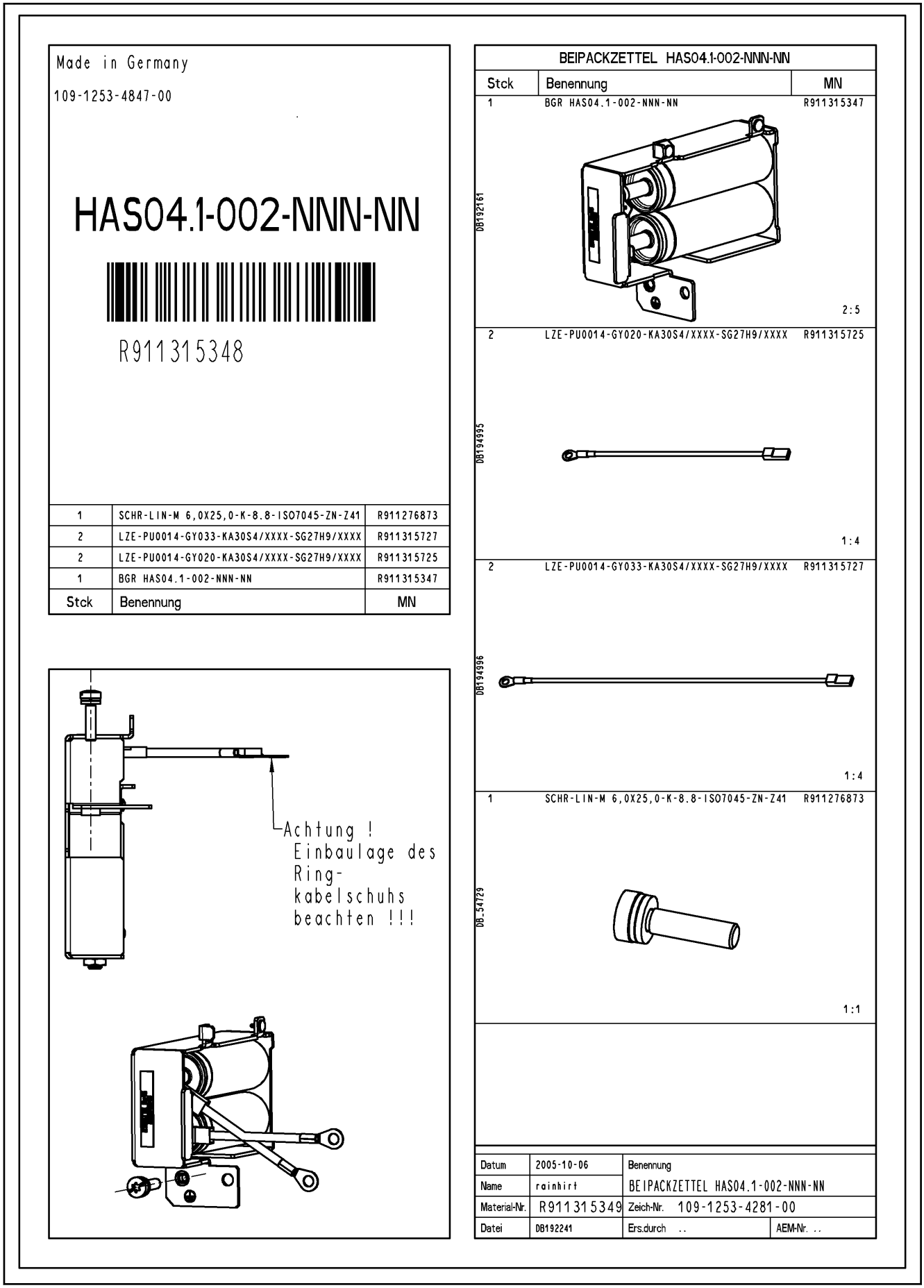


Fig. 20-70: Product insert HAS04.1-002

20.4.6 Capacitor

Connection HAS04

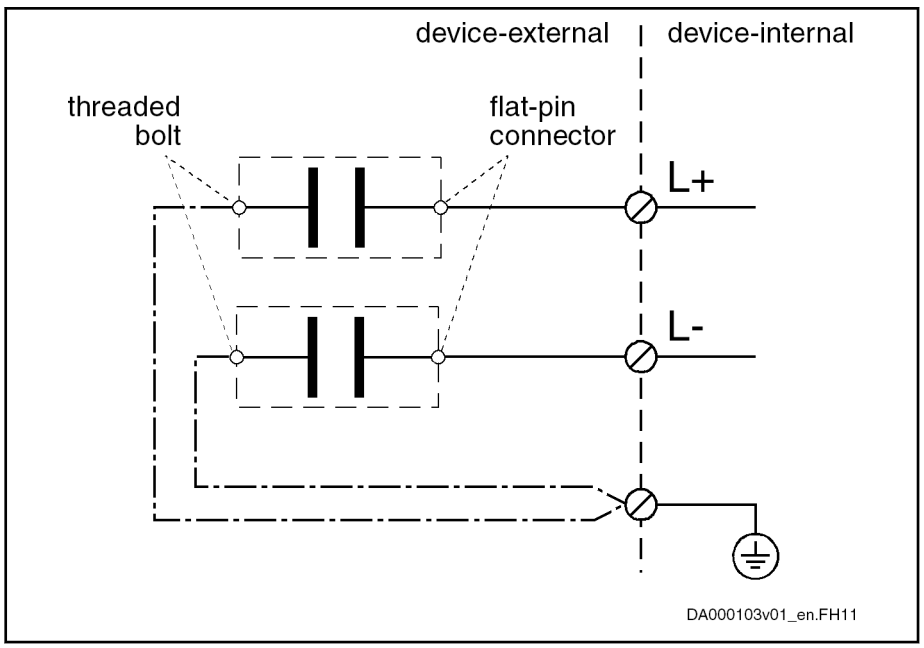


Fig. 20-71: Connection HAS04

20.4.7 Mounting dimensions

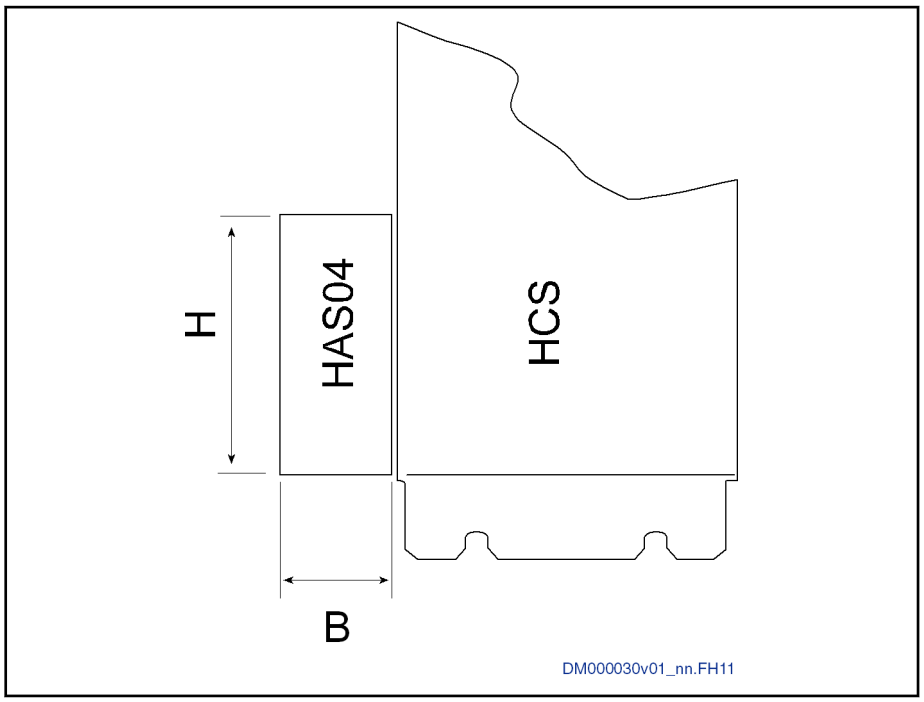


Fig. 20-72: Mounting dimensions HAS04

Accessories

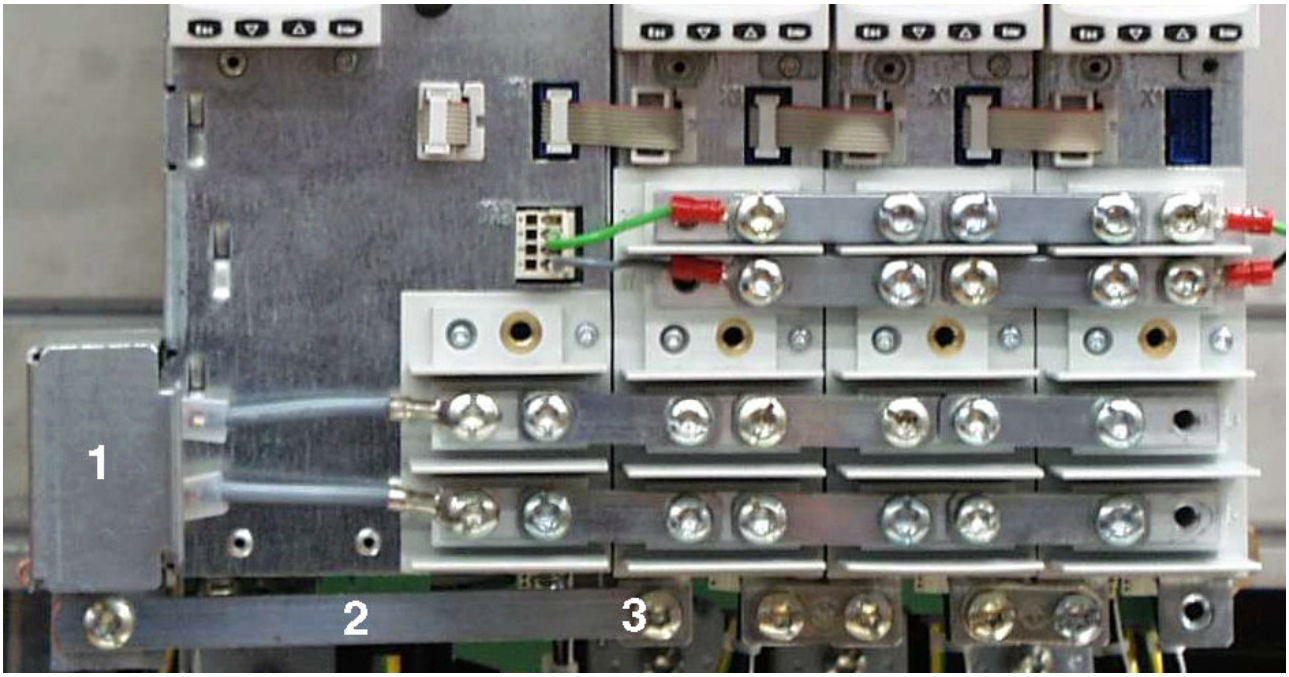
Device	Min. installation width B [mm]	Device height H [mm]	Device depth [mm]
HAS04.1-001	30	75	< 150
HAS04.1-002	40	75	< 150

Tab. 20-5: Mounting dimensions

20.4.8 Mounting the HAS04.1-001 accessories

⚠ WARNING **Dangerous contact voltage at device housing! Lethal electric shock!**

Connect the HMx01 drive controllers to the HCS02 drive controller using bus bar 2 (see figure below). Bus bar 2 replaces the equipment grounding connection 3 at HMx01 (see figure below) to the equipment grounding system.



1 HAS04.1-001 accessories mounted with connections to L + and L-
2 Bus bar mounted
3 Equipment grounding connection at HMx01

Fig. 20-73: HAS04.1-001 at drive system HCS02 with HMx01 without touch guard mounted

1 HAS04.1-001 accessories mounted
2 Bus bar mounted

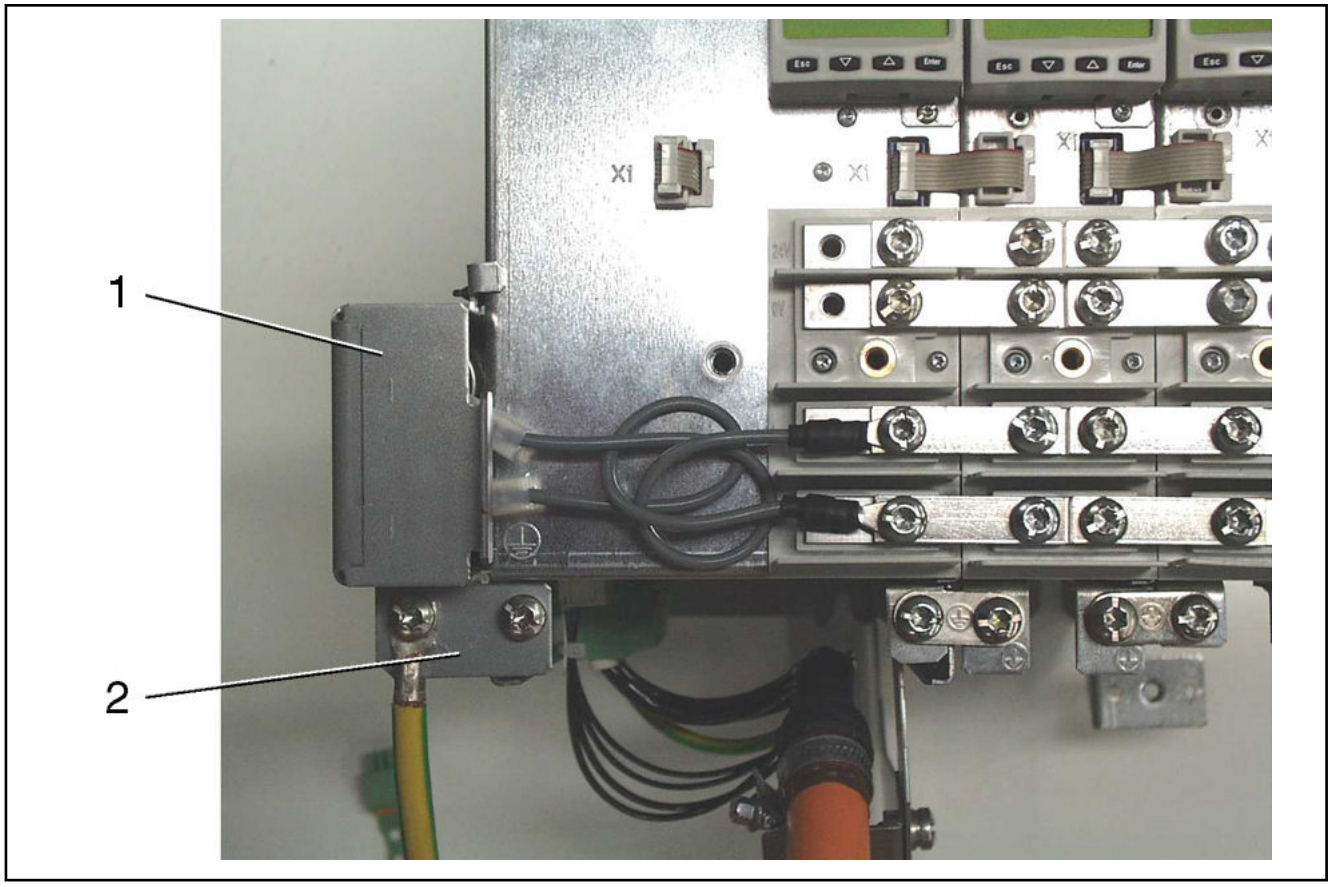
Fig. 20-74: HAS04.1-001 at drive system HCS02 with HMx01 with touch guard mounted

20.4.9 Mounting the HAS04.1-002 accessories

⚠ WARNING **Dangerous contact voltage at device housing! Lethal electric shock!**

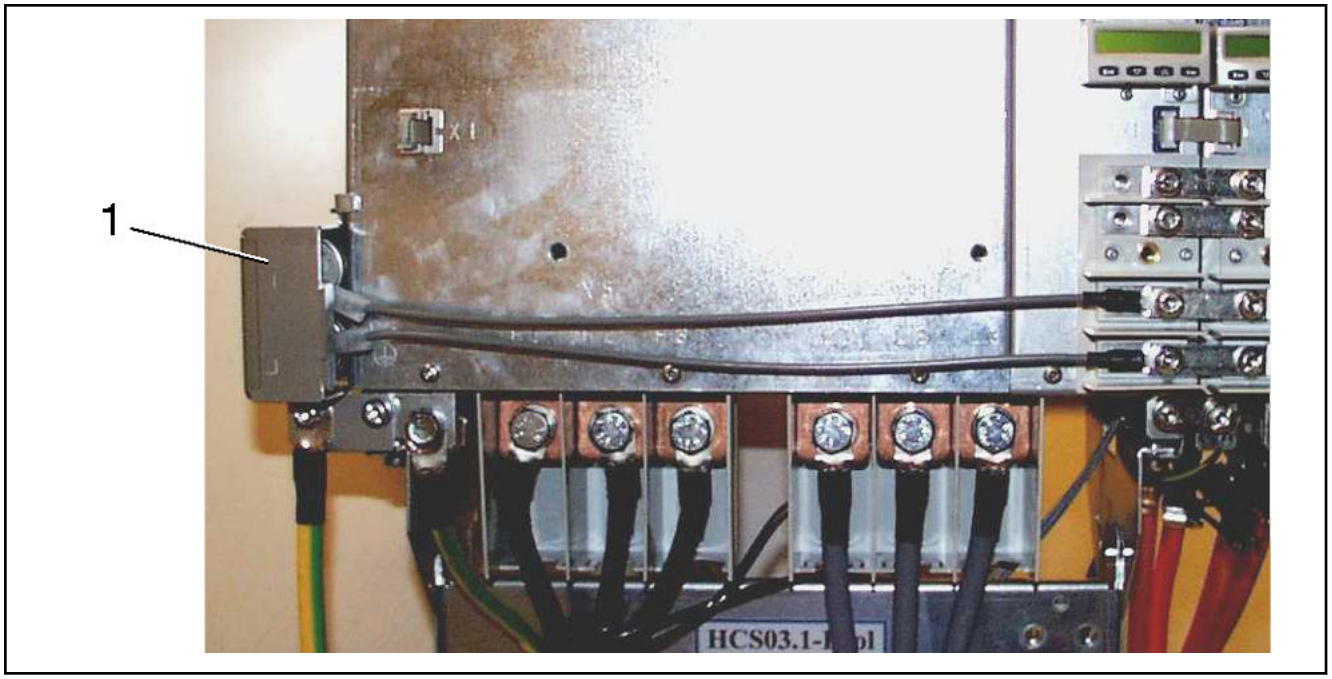
Connect the HAS04.1-002 accessories to the HCS03 drive controller via the joint bar (see figure below).

Accessories



1	HAS04.1-002 accessories mounted with connections to L + und L-
2	Joint bar

Fig. 20-75: HAS04.1-002 at drive system HCS03.1E-W0070, -W0100, -W0150 with HMx01 without touch guard mounted



1 HAS04.1-002 accessories mounted with connections to L + und L-

Fig. 20-76: HAS04.1-002 at drive system HCS03.1E-W0210 with HMx01 without touch guard mounted

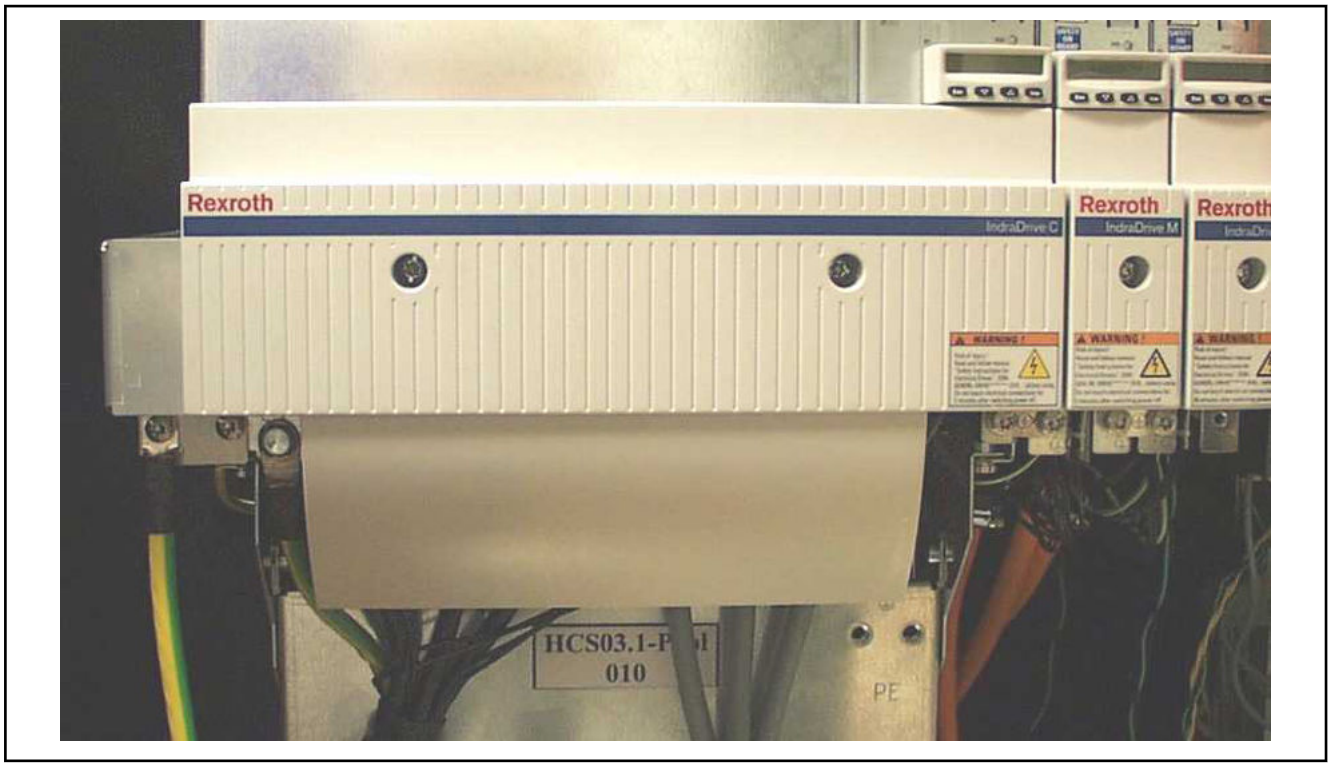


Fig. 20-77: HAS04.1-002 at drive system HCS03 with HMx01 with touch guard mounted

Accessories

20.5 HAS05, accessories for connection points

20.5.1 Overview of types

The HAS05 product series includes:

- Cables
- Connectors
- Adapters

HAS05 type	Brief description / use
HAS05.1-001-NNN-NN	Adapter for mains and motor connection Is used for electrical connection between output filter HMF01.1A-D0K2-D0045 and HCS03.1E-W0070, as well as between mains filter HNK01.1A-A075-E0050 and HCS03.1E-W0070
HAS05.1-002-NNN-NN	Extension Is used for electrical connection between mains filter HNK01.1A-A075-E0050 and HCS03.1E-W0070, if an output filter has been mounted between HCS03.1 and mains filter
HAS05.1-003-NNN-NN	Encoder emulation signal level converter Increases voltage level at output of optional module MEM (encoder emulation) to voltage range 5 … 30 V
HAS05.1-004-NN**L**-NN HAS05.1-004-NN**R**-NN	DC bus connection adapter With this accessory, you can wire several systems of drive controllers with greater cross sections at DC bus connections L+ and L- NN**L**: Outgoing direction "left" NN**R**: Outgoing direction "right"
HAS05.1-005-NNN-NN	Signal level converter RS232/RS485 Converts the serial interface of control sections from RS232 standard to RS485 standard
HAS05.1-006-NNN-NN	Adapter for controlling motor holding brake
HAS05.1-007-NN**L**-NN HAS05.1-007-NN**R**-NN	Adapter from D-Sub to terminal connector Universal adapter for safety technology for more easily wiring X41 of 2nd channel NN**L**: For mounting to double-axis control sections CDB01 at OP ST1 NN**R**: For mounting to double-axis control sections CDB01 at OP ST2
HAS05.1-008-NNN-NN	Adapter for connecting two cables With this accessory, you can connect 2 ring cable lugs each at connections A1, A2 and A3 of X5 (motor connection)
HAS05.1-009-NNN-NN	Coding pin for terminal connector RHS
HAS05.1-010-NNN-NN	Brake current monitoring Monitors current and voltage of motor holding brakes

HAS05 type	Brief description / use
HAS05.1-014-NNN-NN	Mounting plate for safety zone module HSZ01
HAS05.1-015-NNN-NN	Snap-on ferrite for HLR01.2
HAS05.1-016-NNN-NN	Brake module with connectors
HAS05.1-017-NNN-NN	X6 adapter (RKL0091, RKL0092)
HAS05.1-018-NNN-NN	KMS03 (dummy plate for encoder connection)
HAS05.1-019-NNN-NN	KNK03 (mains voltage connection accessories)
HAS05.1-020-NNN-NN	KMV03 (control voltage connection accessories)

Tab. 20-6: HAS05 types

Accessories

20.5.2 Type code

☞ The figure illustrates the basic structure of the type code. Our sales representative will help you with the current status of available versions.

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	A	S	0	5	.	1	-	0	1	7	-	N	N	N	-	N	N																								
	①			②			③			④					⑤				⑥																							

①	**Product:** HAS = IndraDrive accessories
②	**Series:** 05 = Cables, connectors, adapters
③	**Design:** 1 = 1
④	**Device assignment:** 001 = HCS03.1E-W0070 002 = HMF01.1 … -0070- 003 = encoder emulation level adjustment 004 = DC bus, 2 × 50 mm^2 005 = RS232/RS485 converter 006 = brake module 007 = X41 adapter 008 = motor connection, 2 × 16 mm^2 009 = coding pin for RHS plug-in connector 010 = brake current monitoring 011 = HCP02.1E-B0070-…-NNNN/NNM2 012 = HMP01.1L-N0126B 013 = HCP02.1E-B0070-…-NNM1 014 = HSZ01.1-D08-D04-NNNN 015 = snap-on ferrite for HLR01.2 016 = brake module with connectors 017 = X6 adapter 018 = KMS03 (dummy plate for encoder connection) 019 = KNK03 (mains voltage) 020 = KMV03 (control voltage)

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	A	S	0	5	.	1	-	0	1	7	-	N	N	N	-	N	N																								
	①			②			③			④				⑤				⑥																								

⑤	**Other properties:** NHN = Top-hat rail mounting NNB = Mounting direction: both-way NNL = Mounting direction: left NNN = None NNR = Mounting direction: right
⑥	**Other design:** NN = None

Tab. 20-7: HAS05, type code

Accessories

20.5.3 HAS05.1-001, Adapter for Mains and Motor Connection

Brief Description and Use

Brief Description

The accessory HAS05.1-001 brings the mains and motor connections from the bottom of the device to the front of an HCS03.1-W0070.

You need this adapter when additional components are mounted to HCS03.1E-W0070 in order to connect them to the mains and motor input.

Assignment

HAS05.1-001 can be used at the following drive controllers:

Device	HAS05.1-001
HCS03.1E-W0070	■

Tab. 20-8: Assignment Accessory HAS05.1-001

Scope of Supply

Order this accessory as a separate item. It is not part of the scope of supply of the device.

Parts of the accessory: See product insert

Accessories

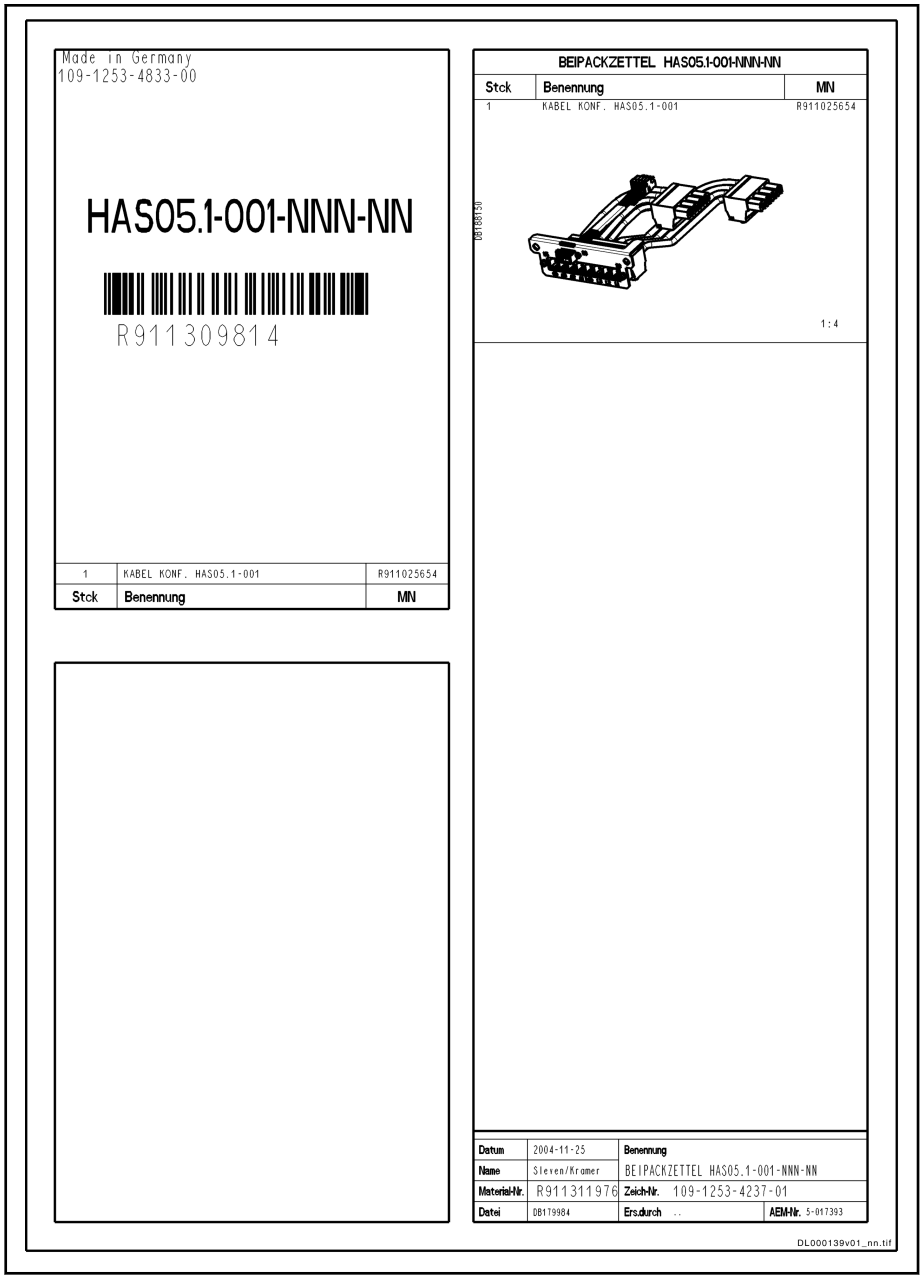


Fig. 20-78: Product Insert

Accessories

Parts of HAS05.1-001

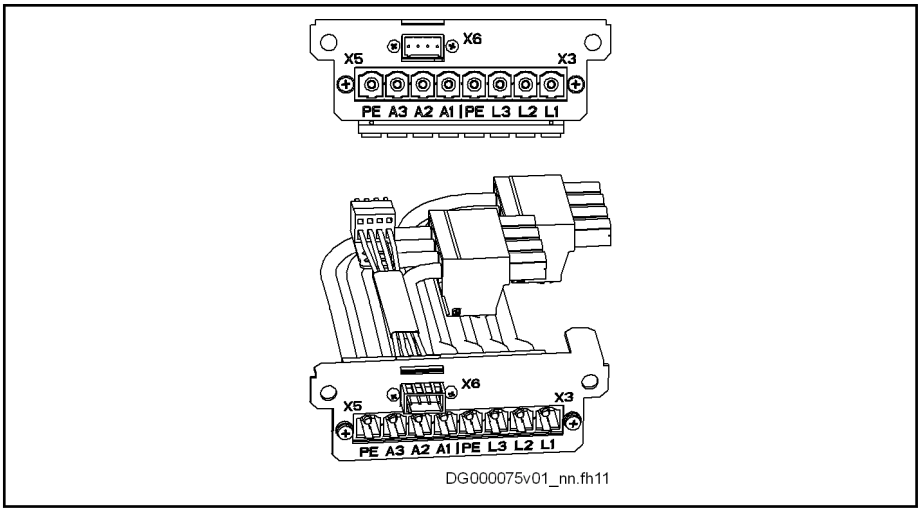


Fig. 20-79: Parts of HAS05.1-001

Technical Data

Connection, Mounting Dimensions

Allowed Cross Sections

The accessory HAS05.1 has been dimensioned to insert lines with ferrules in it.

	Unit	HAS05.1-001
Allowed connection cross section stranded wire	mm²	16
Allowed connection cross section stranded wire	AWG	6

Tab. 20-9: Connection Cross Section HAS05.1-001

Mounting Dimensions

The mounted adapter remains within the outer housing dimensions of the involved components HMF and HCS03.

Connection

- **HMF01**

  Connect input of output filter HMF01 to X5 at HAS05.1-001 (motor output of HCS03).

- **HNK01**

  Connect output of mains filter HNK01 to X3 at HAS05.1-001 (mains input of HCS03).

Examples of Installation

Mounted accessory

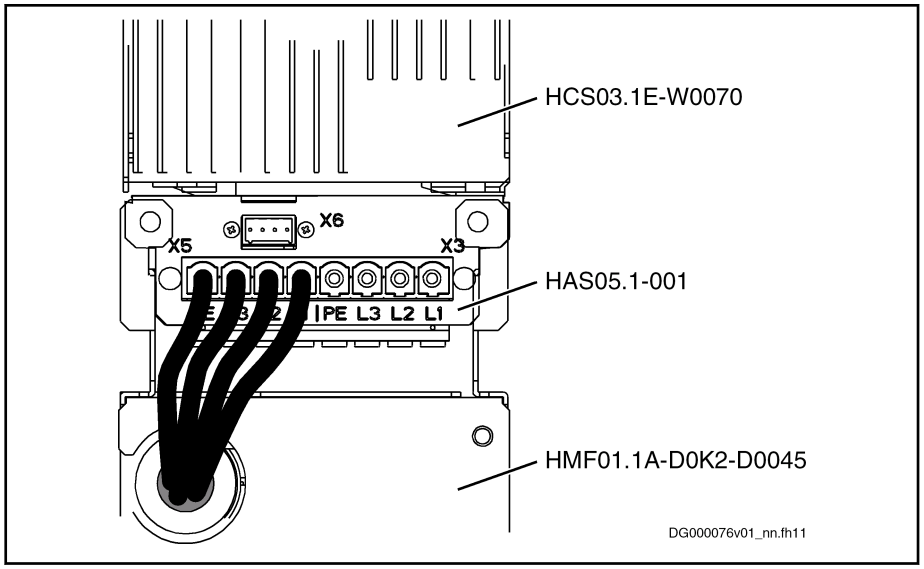


Fig. 20-80: Arrangement HCS03 / HAS05.1-001 / HMF01

Accessories

20.5.4 HAS05.1-002, Extension

Brief Description and Use

Brief Description

The accessory HAS05.1-002 is an extension which connects the output of the HNK01 mains filter to the mains input of HCS03 (X3).

This adapter is required when the additional components HNK01 **and** HMF01 are mounted to HCS03.1E-W0070. The adapter is not required without HMF01.

Assignment

HAS05.1-002 can be used at the following drive controllers:

Device	HAS05.1-002
HCS03.1E-W0070 With HNK01 and HMF01	■

Tab. 20-10: Assignment Accessory HAS05.1-002

Scope of Supply

Order this accessory as a separate item. It is not part of the scope of supply of the device.

Parts of the accessory: See product insert

Accessories

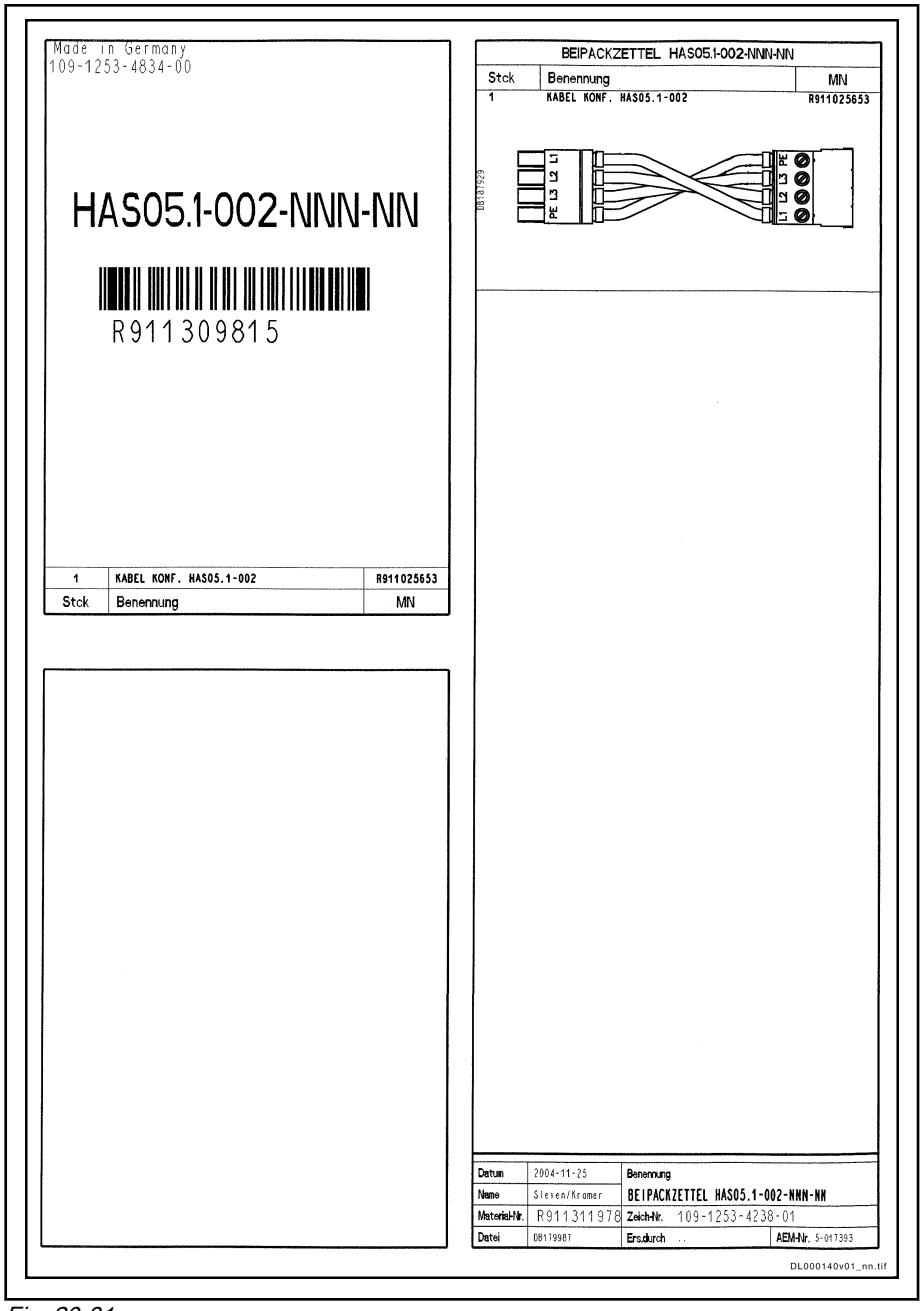


Fig. 20-81:

Parts of HAS05.1-002

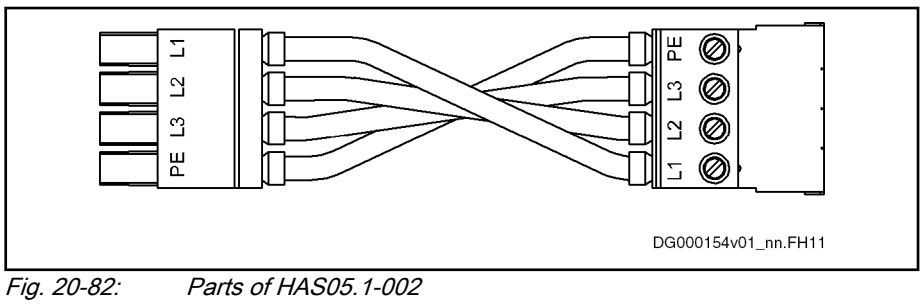


Fig. 20-82: Parts of HAS05.1-002

Accessories

20.5.5 HAS05.1-003, Signal Level Converter Encoder Emulation

Usage

Accessories	Usage
HAS05.1-003-NNN-NN	Adjusts voltage level at output of optional module MEM to voltage range 5-30 V

Tab. 20-11: Usage

Scope of Supply

Scope of Supply

Order this accessory as a separate item. It is not part of the scope of supply of the device.

Parts of the accessory: See product insert

Dimensions

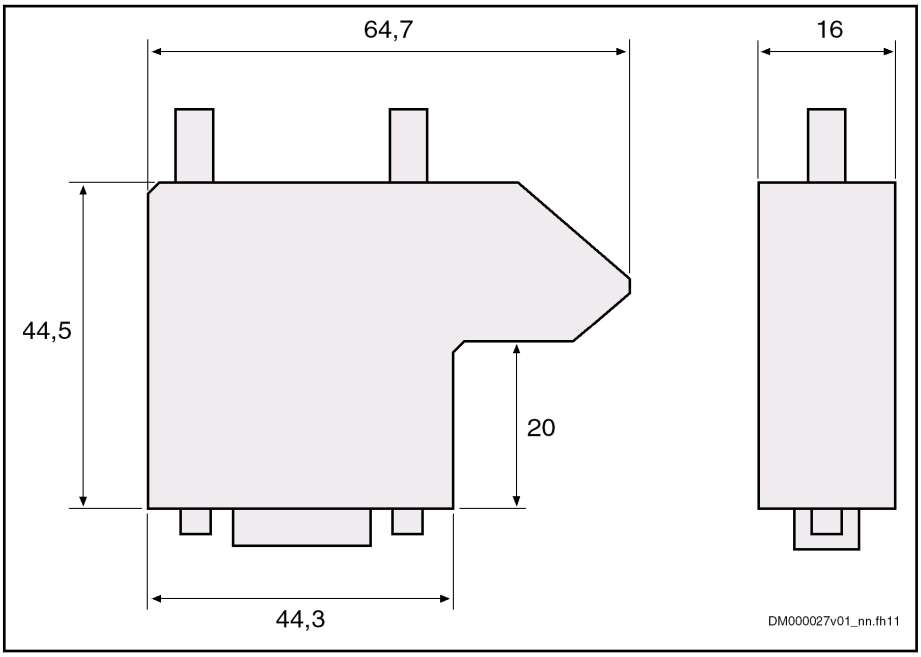
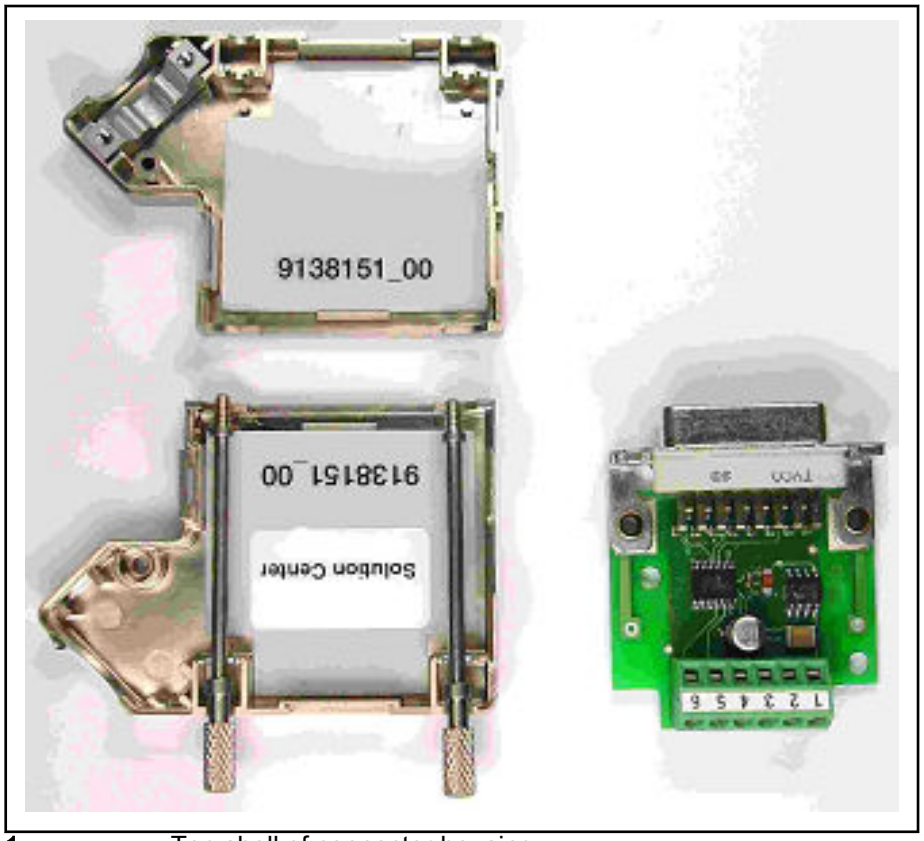


Fig. 20-83: Dimensions HAS05.1-003

Parts



1	Top shell of connector housing
2	Bottom shell of connector housing
3	Electronics circuit board with internal connection point

Fig. 20-84: Parts

Accessories

Description

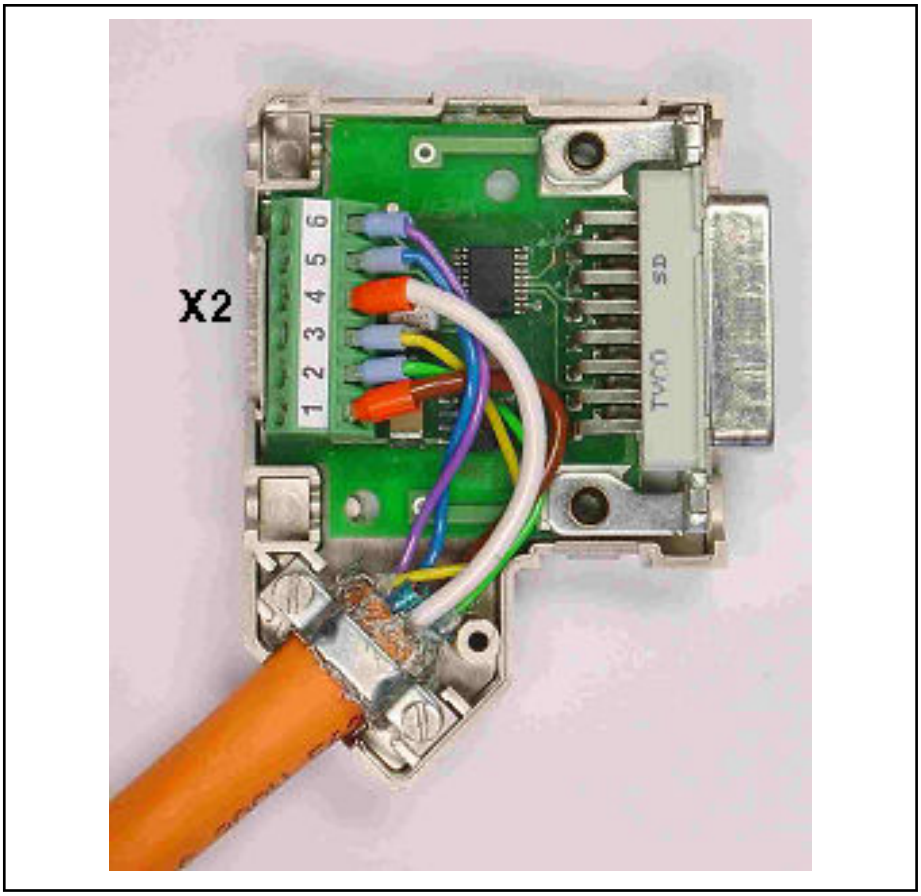


Fig. 20-85: Accessory HAS05.1-003

Connection point	Type	No. of poles	Stranded wire [mm²]
X2	Screw terminal block	6	0,14-1,5

Tab. 20-12: Connection

Pin Assignment

Pin	Signal	Function
1	UB	Voltage supply for electronics
2	UL	Voltage supply for output driver
3	UA2+	Incremental encoder track A2
4	0Vext	Reference potential
5	UA1+	Incremental encoder track A1
6	UA0+	Incremental encoder reference track A0
	Shield	Connect cable shield to connector housing

Tab. 20-13: Assignment

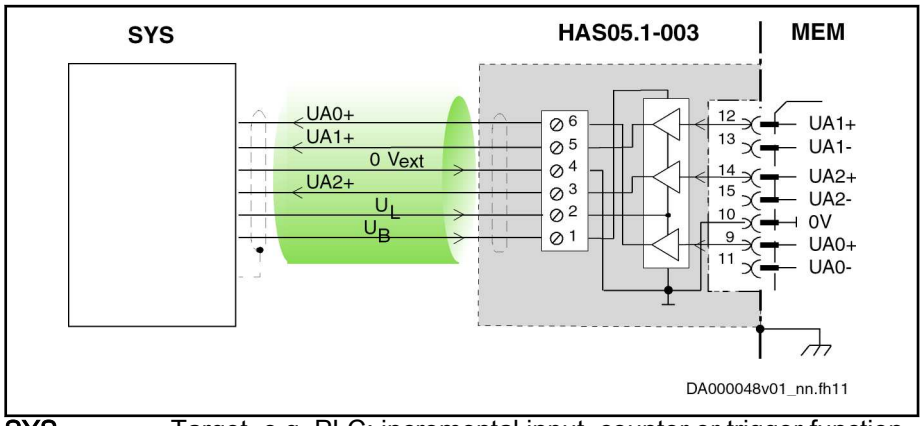
☞ If the required output voltage UL is greater than 7V, it can be used to supply the electronics (UB), too.

Electrical Data

Data	Unit	Min.	Typ.	Max.
Supply voltage UL (output driver)	V	5		30
Supply current UL (output driver)	mA		16	
Supply voltage UB (electronics)	V	7		30
Supply current UB (electronics)	mA		17	
Output voltage UA0+, UA1+, UA2+	V			UL
Allowed output current per output UA0+, UA1+, UA2+	mA			40
Output resistance	kOhm			
Short circuit protection		Present		
Overload protection		Present, output voltage is reduced		

Tab. 20-14: Supply and outputs

Example of Connection



SYS Target, e.g. PLC; incremental input, counter or trigger function

Fig. 20-86: Example of connection

Accessories

20.5.6 HAS05.1-004, Adapter DC Bus Connection

Brief Description and Usage

Brief Description

The accessory HAS05.1-004-NNR and HAS05.1-004-NNL is an adapter which allows connecting lines with cross sections of up to 2 × 50 mm² to the DC bus connections.

It is typically used at the DC bus connections of high-performance supply units and inverters, when these devices have not been arranged directly side by side (e.g. with multiple-line arrangement or with decentralized supply concepts between several control cabinets).

The types "NNR" and "NNL" allow connections with outgoing directions to the right and left (view to front of drive controller).

Assignment

The use of the HAS05.1-004 accessory is restricted by the width of the drive controllers:

- NNL: Device width is at least 125 mm
- NNR: Can be used independently of the device width

At devices with a width of 50 mm, the outgoing direction to the left can also be used with the type "NNR".

For devices up to a width of 125 mm and for the outgoing direction to the left, you can fix lines with a **maximum cross section of 1 × 35 mm²** (1 ring cable lug) without fixing device (01) and without bar (05) directly at the terminal block (see picture 4).

The accessory can be used at the following drive controllers:

Device	HAS05.1-004-	
	NNL	NNR
HMV01.1E-W0030, -W0075, -W0120	■	■
HMV01.1R-W0018, -W0065, -W0120	■	■
HMS01.1N: type current < W0110	-	■
HMS01.1N: type current ≥ W0110	■	■
HMD01.1N-W0012, -W0020, -W0036	-	■
HCS03.1E: type current ≥ W0070	■	■
HLB01.1D	-	■
HLC01.1D	-	■

Tab. 20-15: Assignment accessory HAS05.1-004

Scope of Supply

Order this accessory as a separate item. It is not part of the scope of supply of the device.

Parts of the accessory: See product insert

Accessories

Product Insert HAS05.1-004-NNR-NN

Made in Germany

109-1253-4837-00

Rexroth Bosch Group

HAS05.1-004-NNR-NN

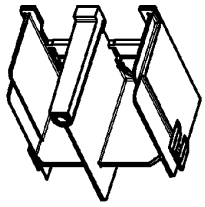
R911312154

1	SCHR-EJO-P-KL 40X14 WN1452*-SN-***	R911268139
2	SCHIENE-STROM HAS05.1-004-NNR	R911315873
2	MUTTER-KOM-M 6,0-D12-H06,70 A2-B	R911221473
2	KAB-BIND-D078-B4,8-C085-N220-TR-PA-*****	R911269782
1	BERUEHRUNGSSCHUTZ WINKEL HAS05.1-004-NNR	R911315622
1	BERUEHRUNGSSCHUTZ DECKEL HAS05.1-004-NNR	R911315621
Stck	Benennung	MN

BEIPACKZETTEL HAS05.1-004-NNR-NN

Stck	Benennung	MN
1	BERUEHRUNGSSCHUTZ DECKEL HAS05.1-004-NNR	R911315621

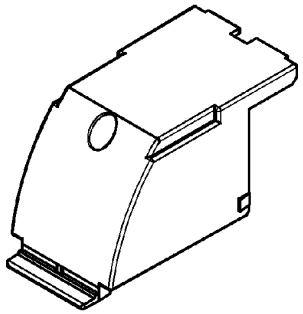
DB194603



1:2

1	BERUEHRUNGSSCHUTZ WINKEL HAS05.1-004-NNR	R911315622

DB193779

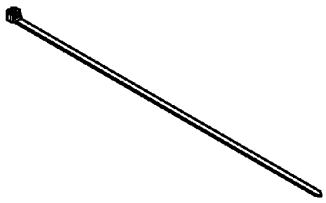


1:2

BEIPACKZETTEL HAS05.1-004-NNR-NN

Stck	Benennung	MN
2	KAB-BIND-D078-B4,8-C085-N220-TR-PA-*****	R911269782

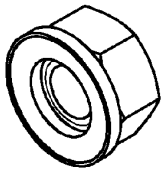
DB196491



1:4

2	MUTTER-KOM-M 6,0-D12-H06,70 A2-B	R911221473

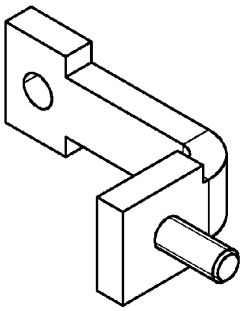
DB_39162



2:1

2	SCHIENE-STROM HAS05.1-004-NNR	R911315873

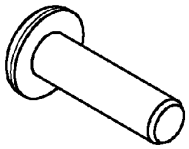
DB195392



1:1

1	SCHR-EJO-P-KL 40X14 WN1452*-SN-***	R911268139

DB_38384



2:1

Datum	2006-02-13	Benennung	
Name	sonjrazz	BEIPACKZETTEL HAS05.1-004-NNR-NN	
Material-Nr.	R911312185	Zeich-Nr. 109-1253-4275-00	
Datei	DB196528	Ers.durch ..	AEM-Nr. ..

Fig. 20-87: Product Insert HAS05.1-004-NNR-NN

Accessories

Product Insert HAS05.1-004-NNL

Made in Germany

109-1253-4836-00

Rexroth
Bosch Group

HAS05.1-004-NNL-NN

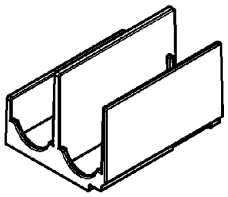
R911312153

2	SCHIENE-STROM HAS05.1-004-NNL	R911315869
2	MUTTER-KOM-M 6,0-D12-H06,70 A2-B	R911221473
3	KAB-BIND-D078-B4,8-C085-N220-TR-PA-*****	R911269782
1	HALTERUNG KABEL HAS05.1-004-NNL/NNB	R911315620
1	HALTERUNG HAS05.1-004 LINKS	R911312216
Stck	Benennung	MN

BEIPACKZETTEL HAS05.1-004-NNL-NN

Stck	Benennung	MN
1	HALTERUNG HAS05.1-004 LINKS	R911312216

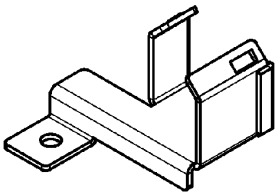
DB166348



1:2

1	HALTERUNG KABEL HAS05.1-004-NNL/NNB	R911315620

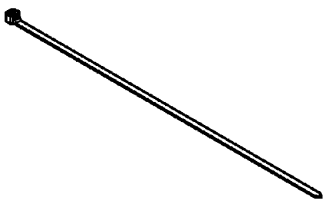
DB194342



1:2

3	KAB-BIND-D078-B4,8-C085-N220-TR-PA-*****	R911269782

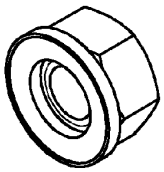
DB196491



1:4

2	MUTTER-KOM-M 6,0-D12-H06,70 A2-B	R911221473

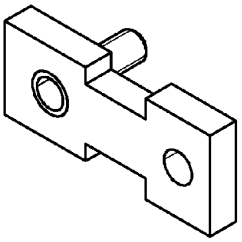
DB_39162



2:1

2	SCHIENE-STROM HAS05.1-004-NNL	R911315869

DB195396



1:1

Datum	2006-02-10	Benennung	
Name	sonjrazz	BEIPACKZETTEL HAS05.1-004-NNL-NN	
Material-Nr.	R911312183	Zeich-Nr. 109-1253-4274-00	
Datei	DB196502	Ers.durch ..	AEM-Nr. ..

Fig. 20-88: Product Insert HAS05.1-004-NNL-NN

Technical Data

Connection, Mounting Dimensions

Allowed Cross Sections, Lengths

The accessory HAS05.1-004 is used to connect lines with ring cable lugs. At each connection point, it is allowed to use 1 or 2 lines of the same cross section.

	Unit	HAS05.1-004-NNL	HAS05.1-004-NNR
Allowed connection cross section stranded wire; 1 ring cable lug mounted	mm²	35 50	35 50
	AWG	2 1/0	2 1/0
Allowed connection cross section stranded wire; 2 ring cable lugs mounted	mm²	35 50	35 50
	AWG	2 1/0	2 1/0
Maximum tightening torque	Nm	6,6	6,6
Minimum tightening torque	Nm	5,4	5,4
Allowed length, required lengths of lay etc.		See Project Planning Manual "Rexroth IndraDrive, Drive System" → "Connections of the Components in the Drive System" → "Connection of the DC Bus Connections"	
Fusing		Observe requirement on line protection! See Project Planning Manual "Rexroth IndraDrive, Drive System" → "Connections of the Components in the Drive System" → "Connection of the DC Bus Connections"	

Tab. 20-16: Connection cross section HAS05.1-004

Mounting Dimensions

When mounted, the accessory requires the following mounting clearance to the left or to the right.

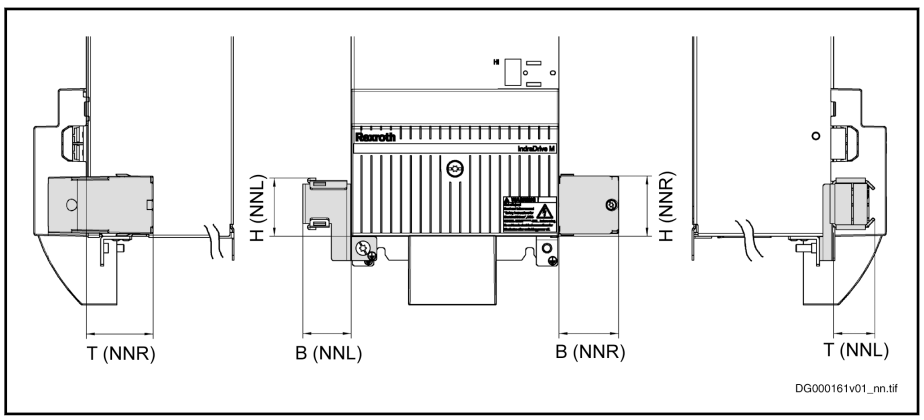


Fig. 20-89: Mounting dimensions HAS05.1-004-NNR, -NNL

Accessories

☞ Observe the minimum bending radiuses of the lines used. This requires additional mounting clearance, particularly on the left side.

Dimension	Unit	HAS05.1-004-NNL	HAS05.1-004-NNR
Mounting dimension B	mm	41	50
Mounting dimension H	mm	50	51
Mounting dimension T	mm	35	56

Tab. 20-17: Mounting dimensions HAS05.1-004

How to Mount HAS05.1-004

Cases to be Distinguished

- Outgoing direction of the lines to the right (HAS05.1-004-NNR)
- Outgoing direction of the lines to the left (HAS05.1-004-NNL)
- Outgoing direction of the lines to both sides (HAS05.1-004-NNR and HAS05.1-004-NNL)

Outgoing Direction of the Lines to the Right (HAS05.1-004-NNR)

1. Mount bar

   Without DC bus contact bars (see picture 1):

   Screw bar (5) and end piece (12) to terminal block (tightening torque: 6 Nm)

   With DC bus contact bars (see picture 2):

   Screw bar (5), DC bus contact bar (11) and connection piece (13) to terminal block (tightening torque: 6 Nm)

2. Mount line:

   (See picture 1 and picture 2)

   Screw ring cable lug (10) to bar (5) (tightening torque: 6 Nm; with 2 ring cable lugs, observe inverse arrangement)

3. Mount touch guard:

   (See picture 3)

   Mount touch guard of drive controller (tightening torque: max. 2.8 Nm)

   Insert touch guard of bars (2) and touch guard cover (1) and screw them together (tightening torque: 1.6 Nm)

Picture 1

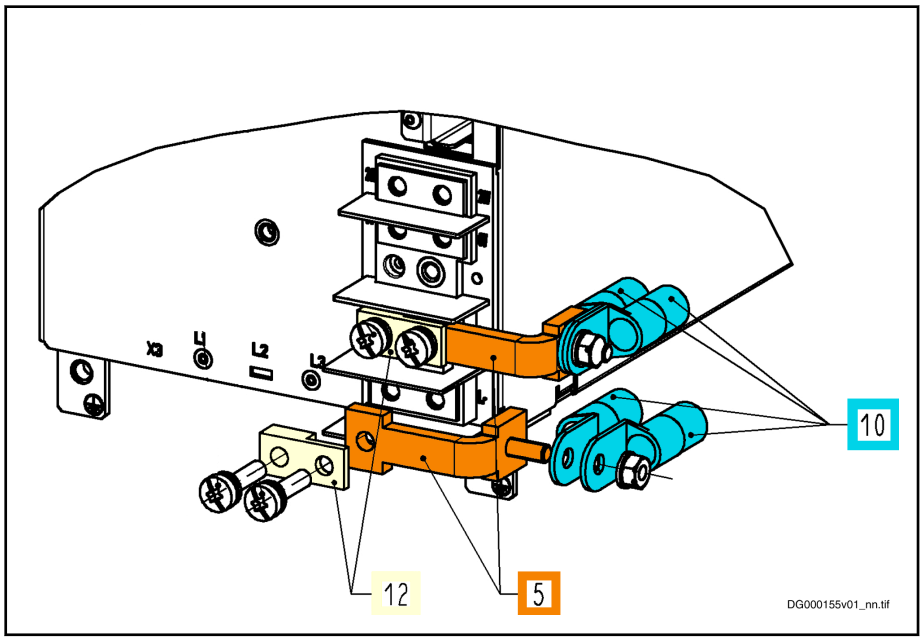


Fig. 20-90: HAS05.1-004-NNR; outgoing direction of the lines to the right; without DC bus contact bars

Picture 2

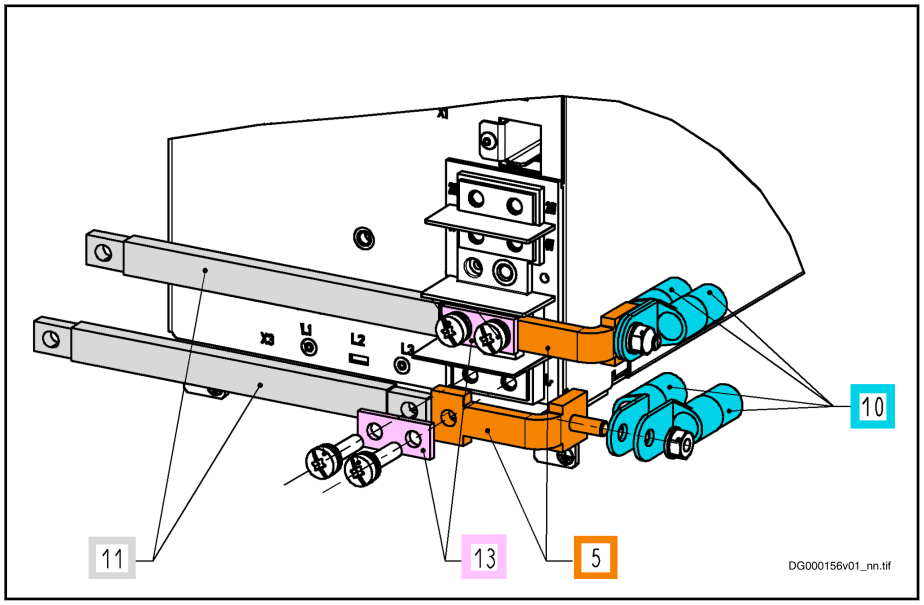


Fig. 20-91: HAS05.1-004-NNR; outgoing direction of the lines to the right; with DC bus contact bars

Accessories

Picture 3

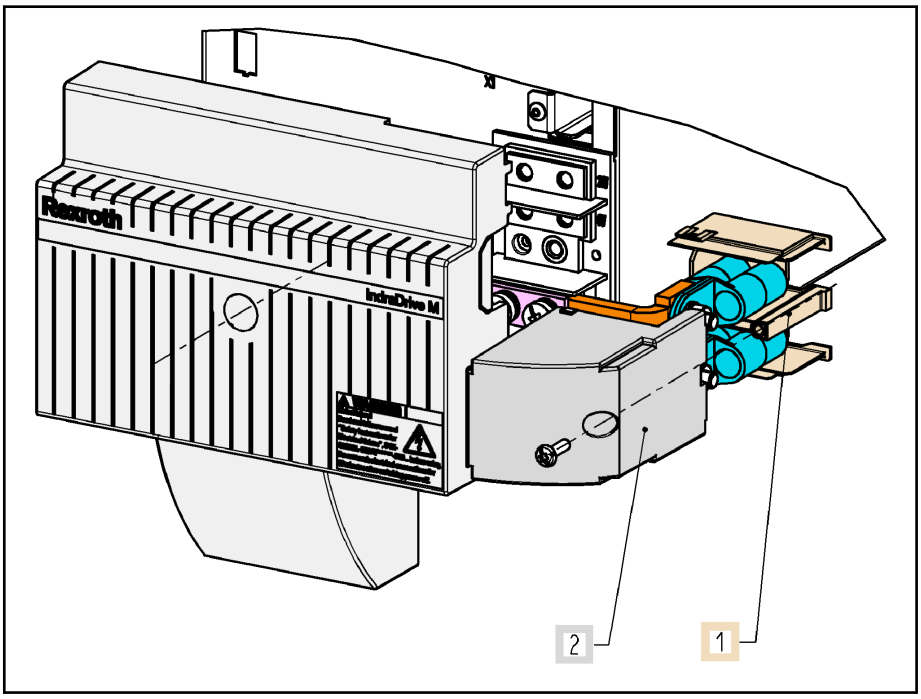


Fig. 20-92: HAS05.1-004-NNR; mounting the touch guard

Make sure there is strain relief for the lines outgoing backward.

Outgoing Direction of the Lines to the Left (HAS05.1-004-NNL)

1. Mount bar

   Without DC bus contact bars (see picture 4):

   Screw bar (05) and end piece (12) to terminal block (tightening torque: 6 Nm)

   With DC bus contact bars (see picture 5):

   Screw bar (05), DC bus contact bar (11) and connection piece (13) to terminal block (tightening torque: 6 Nm)
2. Put fixing device (01) on bar (05)
3. Screw cable holder (02) to left equipment grounding connection
4. Mount line:

   (See picture 4 and picture 5)

   Screw ring cable lug (10) to bar (05) (tightening torque: 6 Nm; with 2 ring cable lugs, observe inverse arrangement)

   Fix lines with cable tie to cable holder (02)
5. Mount touch guard of drive controller (tightening torque: max. 2.8 Nm)

Picture 4

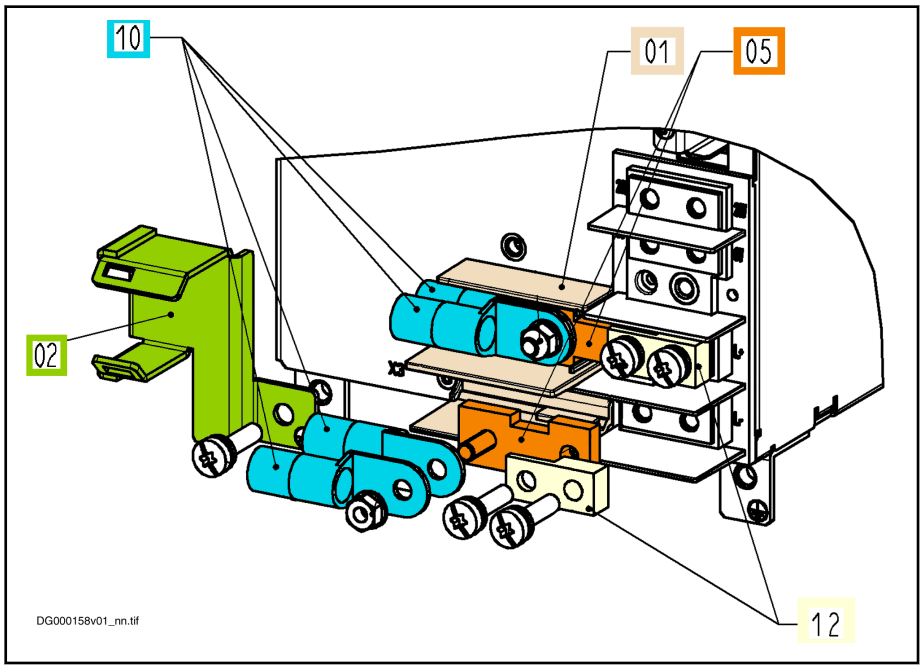


Fig. 20-93: HAS05.1-004-NNL; outgoing direction of the lines to the left; without DC bus contact bars

Picture 5

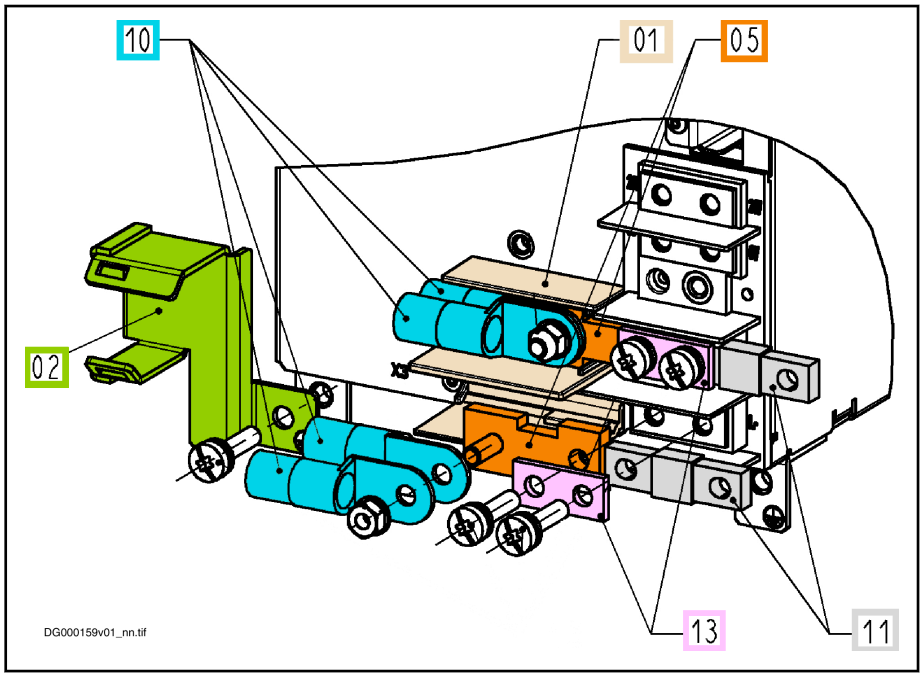


Fig. 20-94: HAS05.1-004-NNL; outgoing direction of the lines to the left; with DC bus contact bars

Accessories

Beneath the touch guard, run the non-twisted lines in parallel.

Outside of the touch guard (after the strain relief), twist the line pairs.

In the case of four lines at the connections L+ and L-, twist L+ and L- to form one pair.

Keep the surface between the individual lines of a pair as small as possible.

Run the line pairs with the smallest possible distance to each other.

Outgoing Direction of the Lines to Both Sides (HAS05.1-004-NNR and HAS05.1-004-NNL)

For mounting with outgoing direction to both sides, observe the descriptions on " Outgoing Direction of the Lines to the Left (HAS05.1-004-NNL)" and "Outgoing Direction of the Lines to the Right (HAS05.1-004-NNR)".

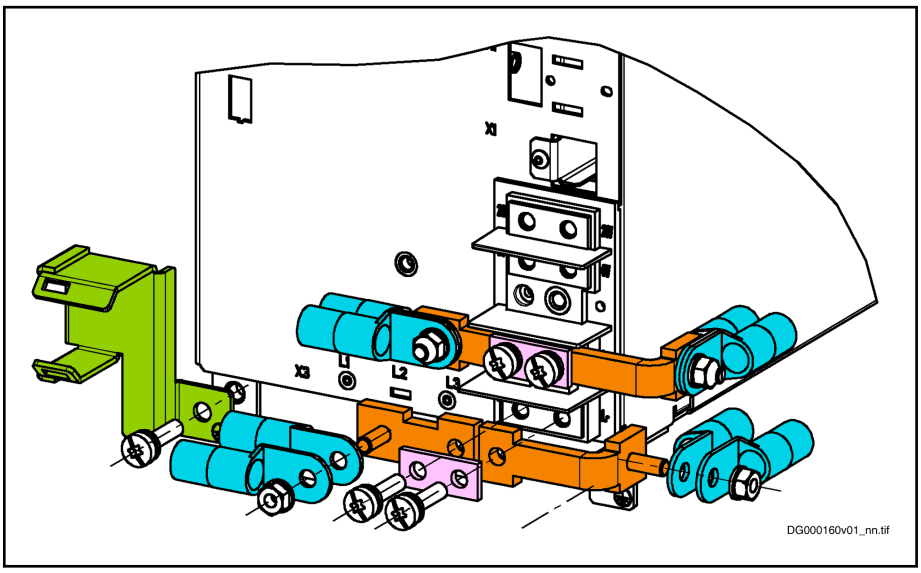


Fig. 20-95: Mounting HAS05.1-004-NNL and -NNR

20.5.7 HAS05.1-005, Signal Level Converter RS232/RS485

Use

Accessories	Use
HAS05.1-005-NNN-NN	Converts serial interface of Rexroth IndraDrive control sections from RS232 standard to RS485 standard

Tab. 20-18: Use

Scope of Supply

Scope of Supply

Order this accessory as a separate item. It is not part of the scope of supply of the device.

Parts of the accessory: See product insert

Fig. 20-96: Product Insert

Accessories

Scope of Supply

- Converter
- Connector at X2 and X3
- Cable tie
- Product Insert

Technical Data

Dimensions

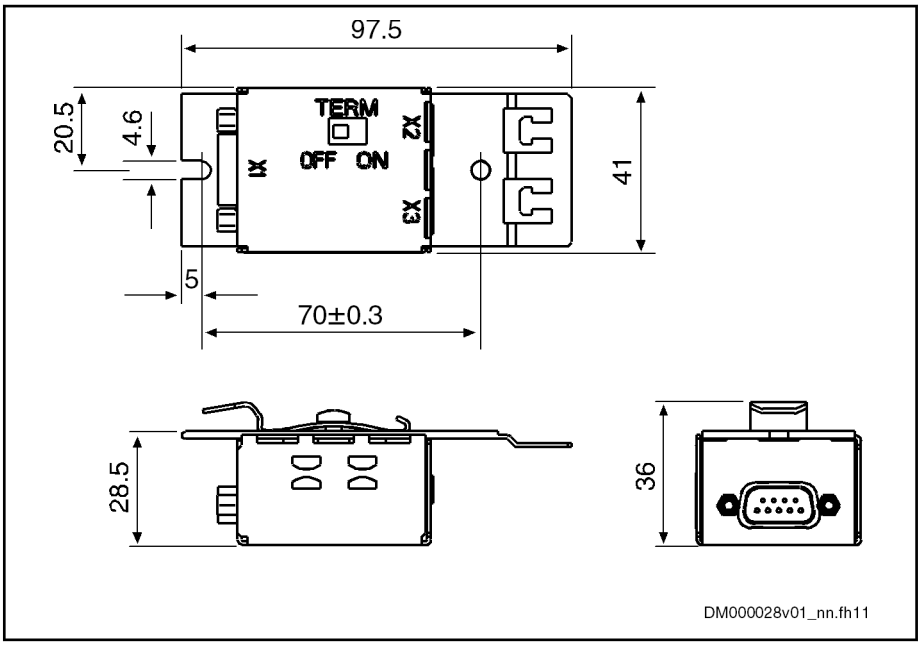


Fig. 20-97: Dimensions

HAS05.1-005 can be mounted on a top-hat rail. For mounting it at a wall, remove the top-hat rail clip at the back of the housing.

You can also mount HAS05.1-005 on electrically insulating surfaces.

Electrical Data

Feature	Unit	Min.	Typ.	Max.
Number of nodes				31
Allowed cable length [1)]	m			500
Transmission rates [2)]	kBaud	9,6		115
Operation mode		Semi-duplex 2-wire line		
Connection between X1 and X2, X3		Galvanically connected		
Allowed voltage difference between the reference potentials of the drive controllers (housing)	V			20
Current consumption at X1.1	mA			50
Termination (TERM)		Switchable ON, OFF		
Short-circuit protection		Data+ against Data- Data+, Data- against GND		
Cable length at X1	m			5

Feature	Unit	Min.	Typ.	Max.
Cable length at X2, X3	m	Comply with bus length; see allowed cable length		
Connections X2, X3		Spring terminal		
Connection cross section stranded wire	mm^2 /AWG	0.14-1.5 / 28-16; ferrule without insulating sleeve		

1) Bus length RS485, corresponds to total length of all connected cables

2) Is set via firmware used

Tab. 20-19: Technical Characteristics

Position of Connections, Termination

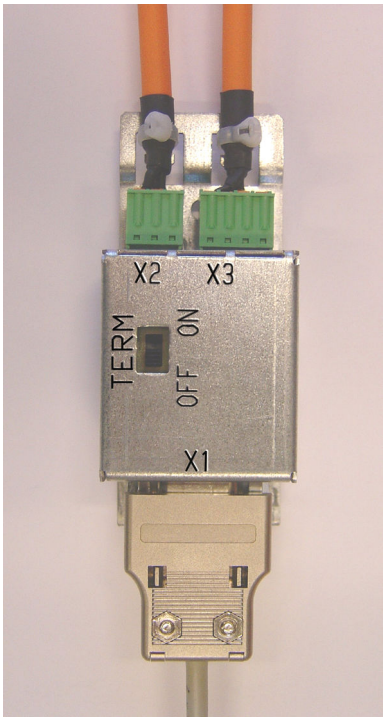


Fig. 20-98: HAS05.1-005 with Connection Cables

Pin Assignment X1

Connection	Signal	Function
1	V_{cc}	Supply voltage (+5V)
2	RxD	Receive Data
3	TxD	Transmit Data
4	n. c.	n. c.
5	GND	Reference potential
6	n. c.	n. c.
7	n. c.	n. c.
8	RTS	Request to send
9	n. c.	n. c.

Tab. 20-20: Pin Assignment X1

Accessories

Pin Assignment X2

Connection	Signal	Function
1	Data+	Data transmission +
2	Data-	Data transmission -
3	Shield	Connection overall shield

Tab. 20-21: Pin Assignment X2

Pin Assignment X3

Connection	Signal	Function
1	Data+	Data transmission +
2	Data-	Data transmission -
3	Shield	Connection overall shield
4	GND	Connection inner shield (signal shield)

Tab. 20-22: Pin Assignment X3

Installation

General Information

Three connections connect the accessory HAS05.1-005 to form an RS485 bus:

- Connection X1 to serial interface X2 at control section
- Connection X2 to connection X3 at next HAS05
- Connection X2 to bus master (e.g. RS232/485 converter controlled by a PC)

☞ Terminate the RS485 bus line at the most remote bus ends.

To do this, switch on the termination at the bus master (converter at PC). At the last node, set the "TERM" switch to "ON".

📖 See also Functional Description of firmware "Communication via RS485 Interface" and Parameter Description, e.g. "P-0-4050, Answer delay RS-232/485"

Example of Connection

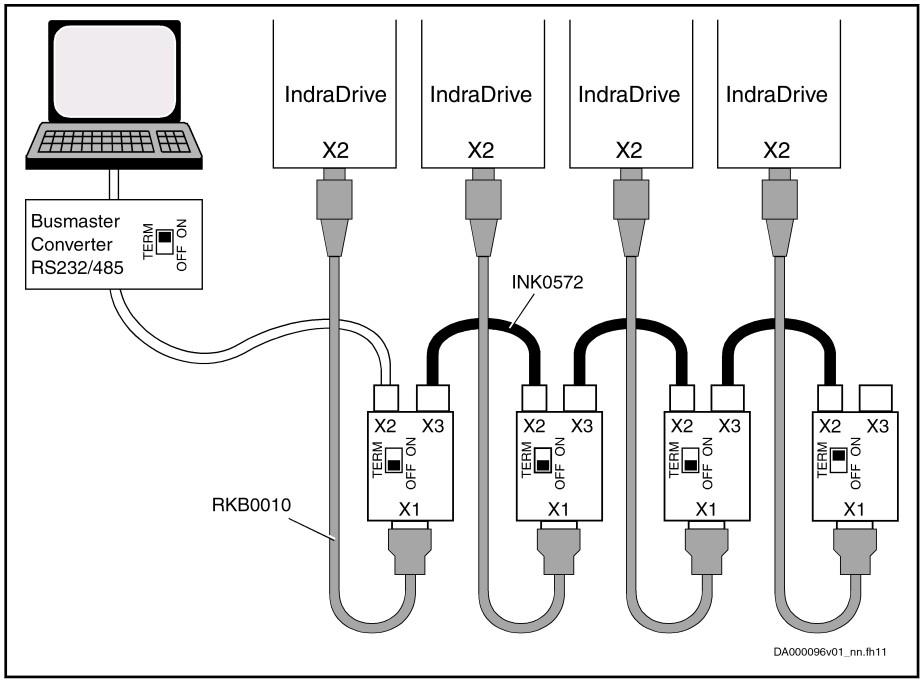


Fig. 20-99: Example of Connection

Connect PC and RS485 bus to a so-called bus master converter; this RS232/485 converter automatically generates the RTS control signal.

The accessory HAS05.1-005 does not accomplish this function!

Connection at X1

Connection From X1 to Control Section (X2)

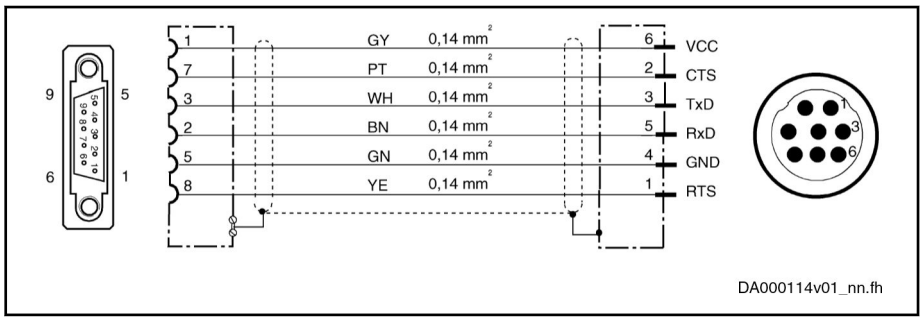


Fig. 20-100: Connection Cable RKB0010

For **direct** connection from X1 to the control section, use our cable **RKB0010** and observe its maximum allowed length (see "Electrical Data" on page 368).

Connection at X2 and X3

Connect X2 and X3 with a cable according to the interconnection diagram below.

Accessories

Connection Between X2 and X3

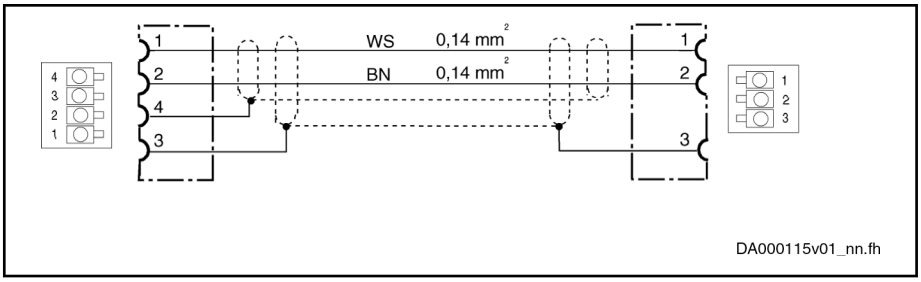


Fig. 20-101: Connection Cable at X2 and X3

To assemble connection cables at X2 and X3, use our bulk cable **INK0572**.

Strain Relief at Connection X2 and X3

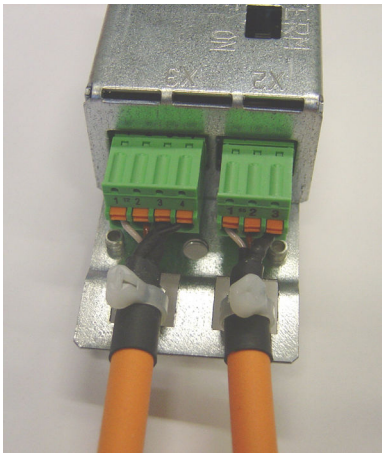


Fig. 20-102: Strain Relief at Connection X2 and X3

Provide sufficient strain relief for the connections at X2 and X3!
Use the supplied cable ties.

20.5.8 HAS05.1-006, Adapter for Controlling Motor Holding Brake

Use

Assignment

The accessory HAS05.1-006 can be used at the following drive controllers:

- HMS02.1N-W0028
- HMS02.1N-W0054

Function

The accessory HAS05.1-006 switches the power supply of the motor holding brake (connection point X6, motor temperature monitoring and motor holding brake) and has a feedback contact to the switching action.

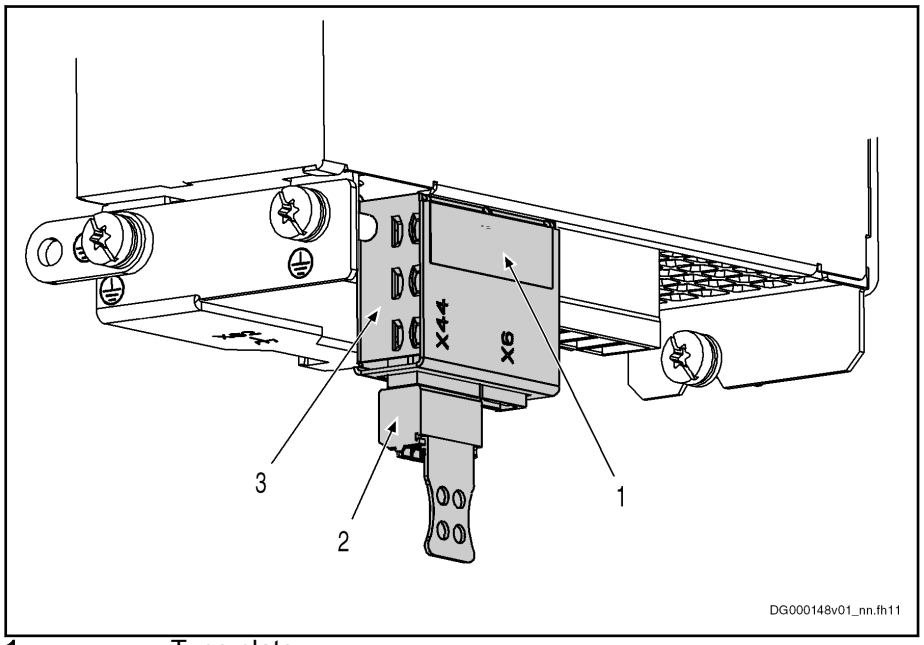
Scope of Supply

Connector at X44

(Connector at X6 is not part of the scope of supply. Use the connector of the power section.)

Identification, Parts

The accessory has a type plate for identification.



1 Type plate
2 Connector at connection point X44
3 HAS05.1-006

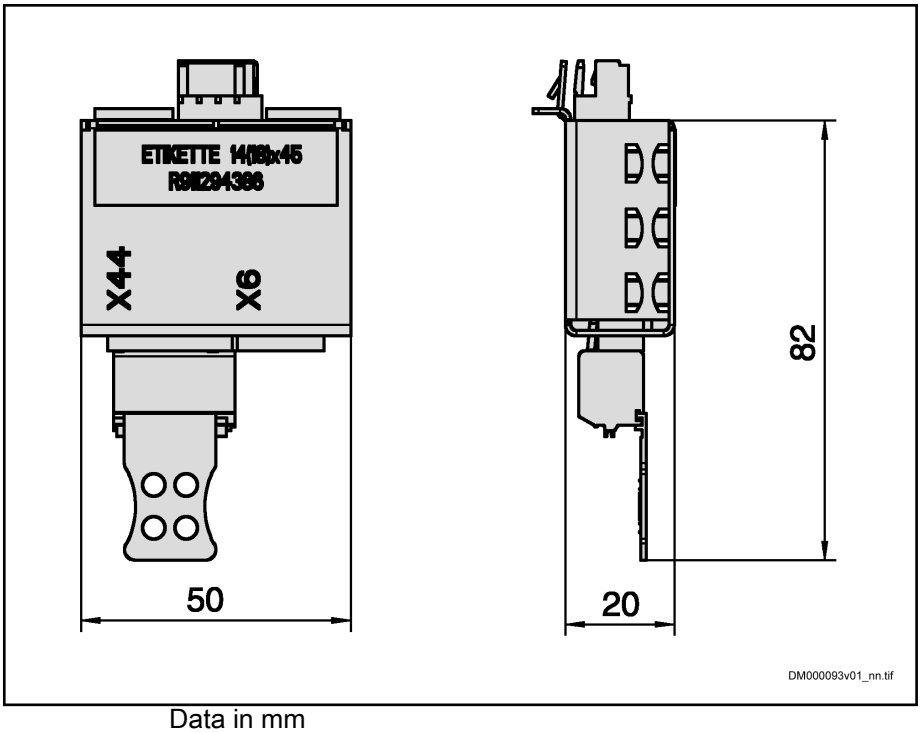
Fig. 20-103: HAS05.1-006 at Connection Point X6 at Drive Controller

Technical Data

Mounting Dimensions

The accessory requires the following mounting clearance at the drive controller.

Accessories



Data in mm

Fig. 20-104: Mounting Dimensions

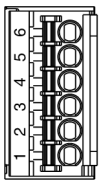
Observe the minimum bending radiuses of the lines used. This requires additional mounting clearance at the drive controller, particularly downward.

Connection Points

X6

The connection point is described in the Project Planning Manual "Rexroth IndraDrive Supply Units and Power Sections" → "Functions and Electrical Connection Points" → "X6, Motor Temperature Monitoring and Motor Holding Brake".

X44

View	Connection	Signal name	Function
 DG000526v01_nn.fh11	X44.6	nc_Rel	Relay contact "N/C"
	X44.5	nc_Rel	
	X44.4	0V	Relay control
	X44.3		
	X44.2	+24V	
	X44.1		

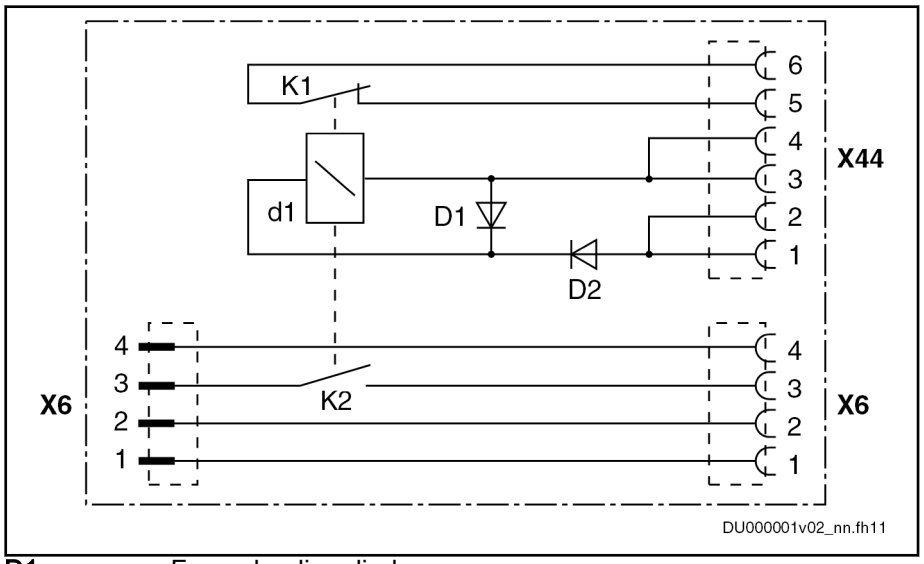
Spring terminal (connector)	Unit	Min.	Max.
Connection cross section solid wire	mm^2	0,14	1,5
Connection cross section stranded wire	mm^2	0,14	1,5

Connection cross section	AWG	28	16
Electrical data			
Supply d1 (X44.1/2, X44.3/4)	V	19,2	28,8
	mA		50
Switching capacity K1 (X44.5, X44.6)	A	-	2
Switching capacity K2 (X6.3, X6.4)	V		28,8
Minimum load of the contacts	mA	10	
Contact resistance at minimum current	Ω		1
Pick up delay	ms		30
Drop out delay	ms		30
Time constant of load	ms	ohmic	
Number of switching actions at maximum time constant of load		1×10^6	
Number of mechanical switching cycles		1×10^6	
Short circuit protection		See description of the connection point "X6, Motor Temperature Monitoring and Motor Holding Brake" in the Project Planning Manual "Rexroth IndraDrive Supply Units and Power Sections"	
Overload protection			

Tab. 20-23: Function, Pin Assignment

Application

Block Diagram

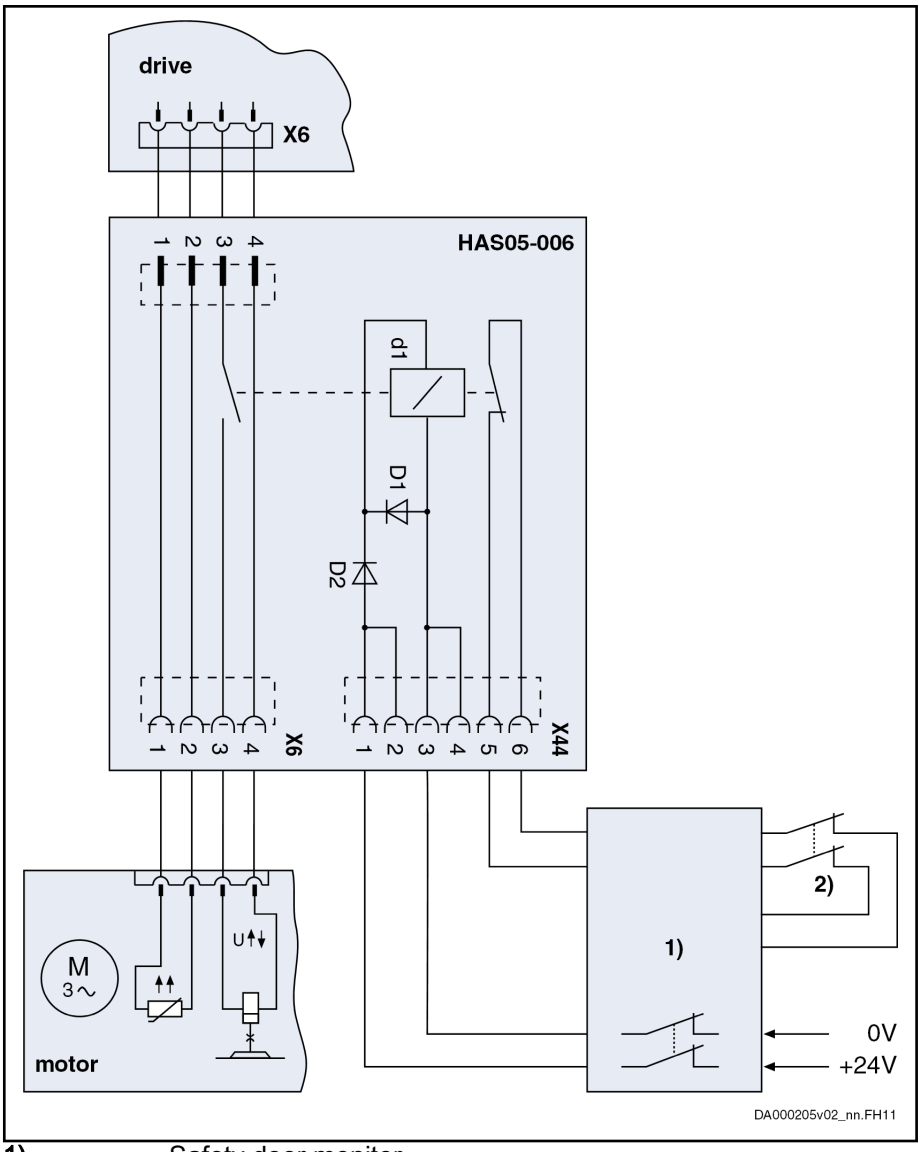


D1 Free-wheeling diode
D2 Polarity reversal protection diode
d1 Relay
K1 N/C contact
K2 N/O contact

Fig. 20-105: Block Diagram

Accessories

Example of Use



1) Safety door monitor
2) Safety door contacts

Fig. 20-106: Example of Connection

Mounting

Mount HAS05.1-006

1. Plug HAS05.1-006 in connection point X6 at drive controller

☞ Make sure that HAS05.1-006 snaps in at X6 at the drive controller.

2. Plug connectors X6 and X44 in HAS05.1-006

☞ Make sure there is sufficient strain relief for the connectors.

Dismount HAS05.1-006

1. Remove connection cable from HAS05.1-006

2. Loosen snap-in connection with screwdriver and remove HAS05.1-006 from drive controller

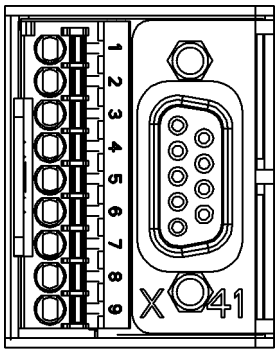
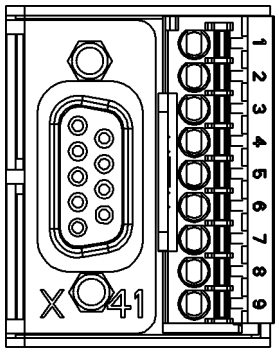
Accessories

20.5.9 HAS05.1-007, Adapter From D-Sub to Terminal Connector

Use

The adapter **HAS05.1-007** exists in the following types of design:

- **NNL:** Mounting direction left (outgoing direction spring terminal left)
- **NNR:** Mounting direction right (outgoing direction spring terminal right)

HAS05.1-007-	
NNL	**NNR**
 DA000233v01_nn.FH11	 DA000220v01_nn.FH11

Tab. 20-24: Types of Design

Assignment

The accessory HAS05.1-007 can be used at the following control sections:

HAS05.1-007-NNL	HAS05.1-007-NNR
CSH01.1C at X41 (Condition: Option 3 not equipped)	CSH01.1C at X41
CDB01.1C at X41.1 (option ST1)	CSH01.2C at X41 CSH01.3C at X41
	CDB01.1C at X41.2 (option ST2)

Tab. 20-25: Assignment HAS05.1-007

At **CDB01** control sections, you can use both types of design together. However, there is the following restriction:

When using the type of design NNL at HMD01.1N-W0012 or HMD01.1N-W0020 drive controllers of a width of 50 mm, you cannot use the adapter of type of design NNR at the neighboring control section on the left-hand side.

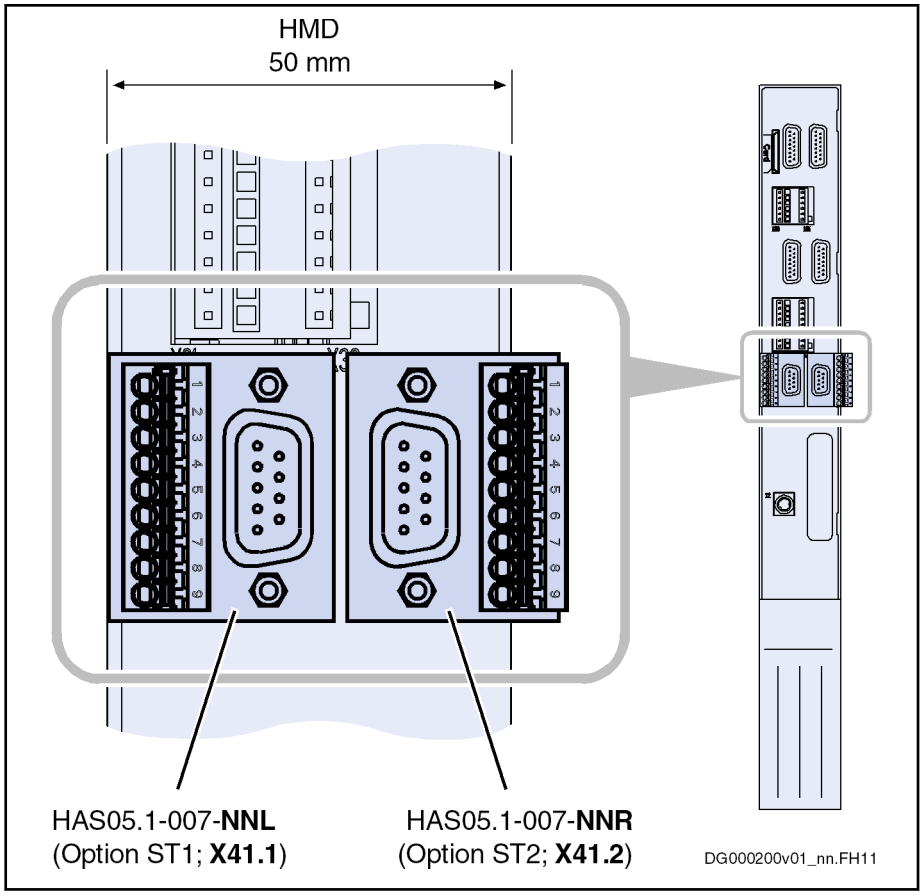


Fig. 20-107: HAS05.1-007-NNL and -NNR at HMD Drive Controller of a Width of 50 mm

Function

Universal adapter for safety technology

Usage:

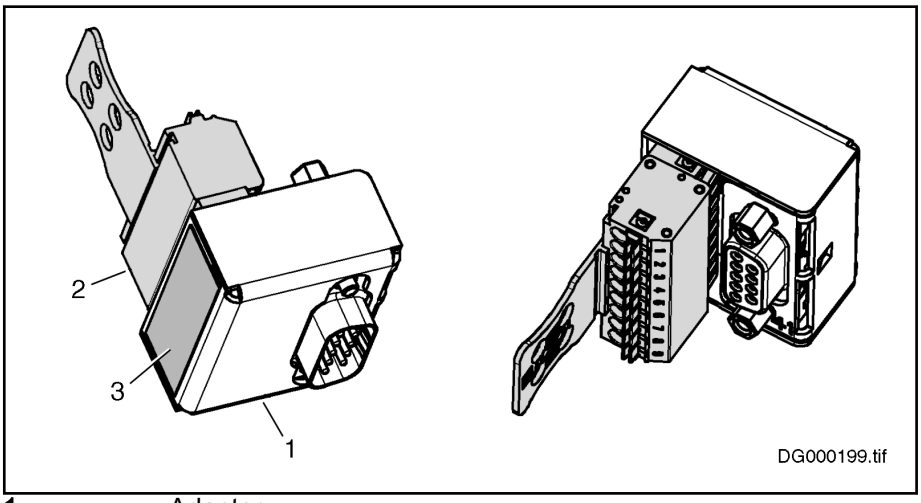
1. Converter of D-Sub connection to terminal connection for an axis
2. Connection of additional component HAT01 to the optional module S1 or S2
3. Converter of D-Sub connection to terminal connection for bus connection of optional modules S1 or S2 of the axes of one zone (see figure "Wiring Example With HAS05.1-007-NNR" on page 383)

Identification, Parts

The accessory has a type plate for identification.

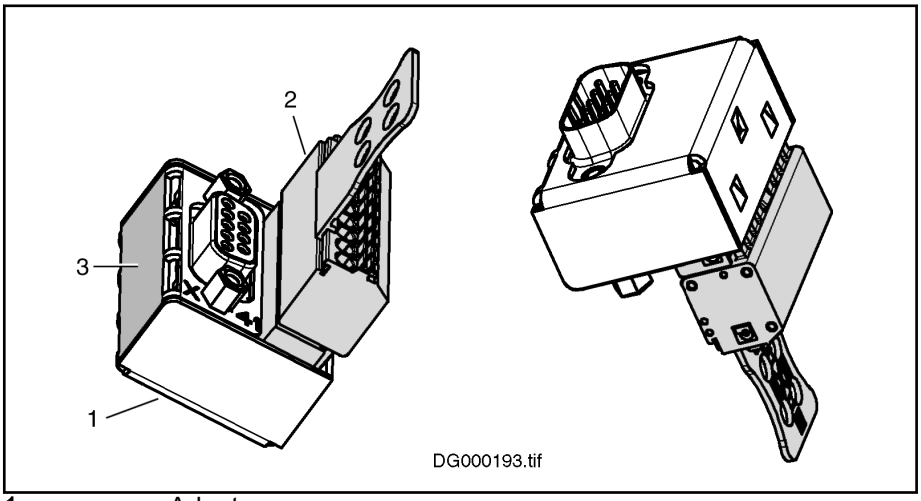
Accessories

HAS05.1-007-NNL



1 Adapter
2 Connector (spring terminal)
3 Type plate
Fig. 20-108: HAS05.1-007-NNL

HAS05.1-007-NNR



1 Adapter
2 Connector (spring terminal)
3 Type plate
Fig. 20-109: HAS05.1-007-NNR

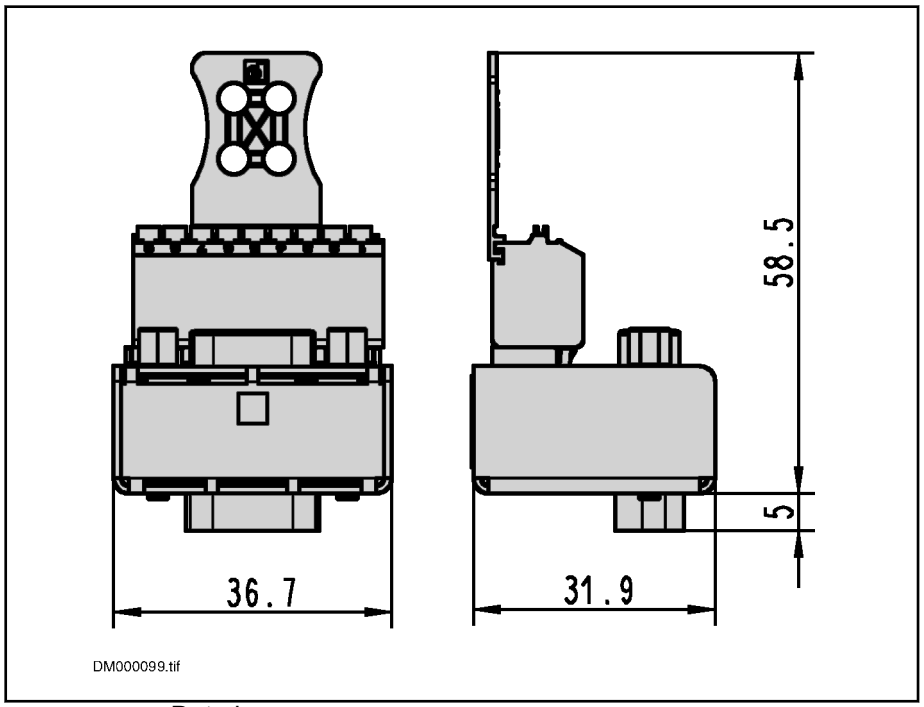
The adapter is plugged in the connection point X41 (resp. X41.1 or X41.2 for double-axis devices) of the control section and secured with screws (screw tightening torque: 0.5 Nm).

Technical Data

Mounting Dimensions

The accessory requires the following mounting clearance at the drive controller.

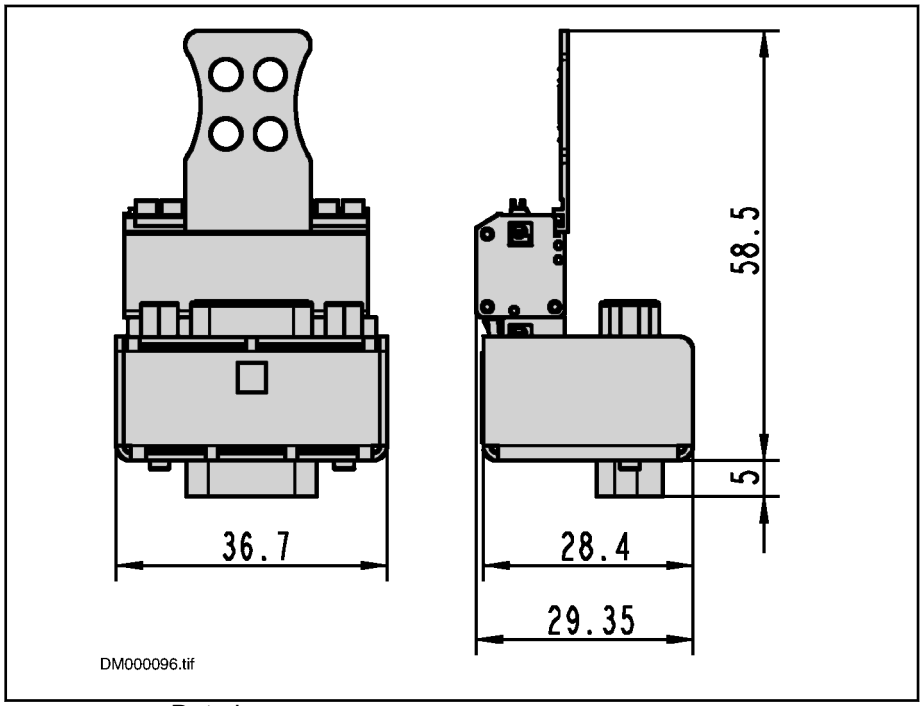
HAS05.1-007-NNL



Data in mm

Fig. 20-110: Mounting Dimensions HAS05.1-007-NNL

HAS05.1-007-NNR



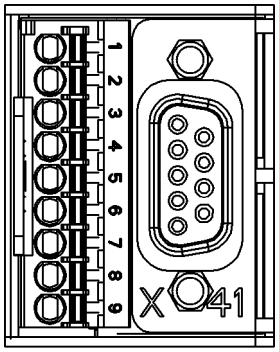
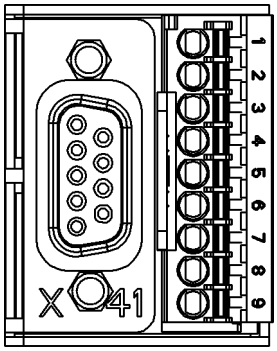
Data in mm

Fig. 20-111: Mounting Dimensions HAS05.1-007-NNR

Observe the minimum bending radiuses of the lines used. This requires additional mounting clearance at the front of the drive controller.

Accessories

Connection Point X41

View	Connection (terminal)	Signal name	Function
HAS05.1-007-**NNL** Spring terminal / D-Sub female connector  DA000233v01_nn.FH11 HAS05.1-007-**NNR** D-Sub female connector / spring terminal  DA000220v01_nn.FH11	1	X41.1	The adapter brings the connections of X41 to the connections 1-9 of a spring terminal and a D-Sub female connector. Description of connection point X41: See Project Planning Manual "Rexroth IndraDrive Control Sections", section "Optional Modules for Control Sections, Safety Technology".
	2	X41.2	
	3	X41.3	
	4	X41.4	
	5	X41.5	
	6	X41.6	
	7	X41.7	
	8	X41.8	
	9	X41.9	

Spring terminal (connector)	Unit	Min.	Max.
Cable cross section stranded wire	mm^2	0,5	1,5
Cable cross section	AWG	20	16
Coding	At both types of design, the connection point 5 has been coded, i.e. provided with a coding section. The spring terminal was already assembled accordingly at the factory.		

Electrical Data	Description of connection point X41: See Project Planning Manual "Rexroth IndraDrive Control Sections", section "Optional Modules for Control Sections, Safety Technology".
• **Mating connector for D-Sub female connector** • **Ribbon cable**	• **RBS0017/S05** → D-Sub connector, 9-pin (Screw tightening torque: 0.5 Nm) • **REB0401** → Ribbon cable, 9-pin, can be ordered in steps of 0.1 m For professional assembly of the ribbon cable in the D-Sub connector, use the following Tyco tools: • Pistol-Grip tool (part number 734155-1) • Matrix for D-Sub connector (part number 734148-1)

Tab. 20-26: Function, Pin Assignment

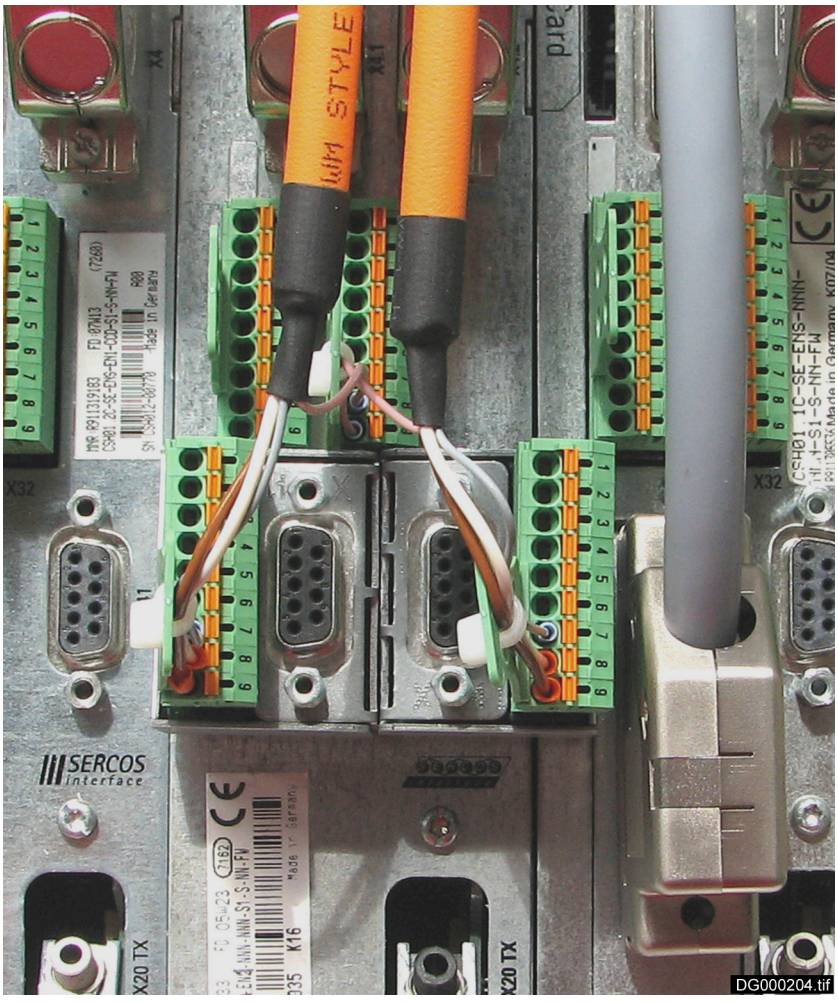
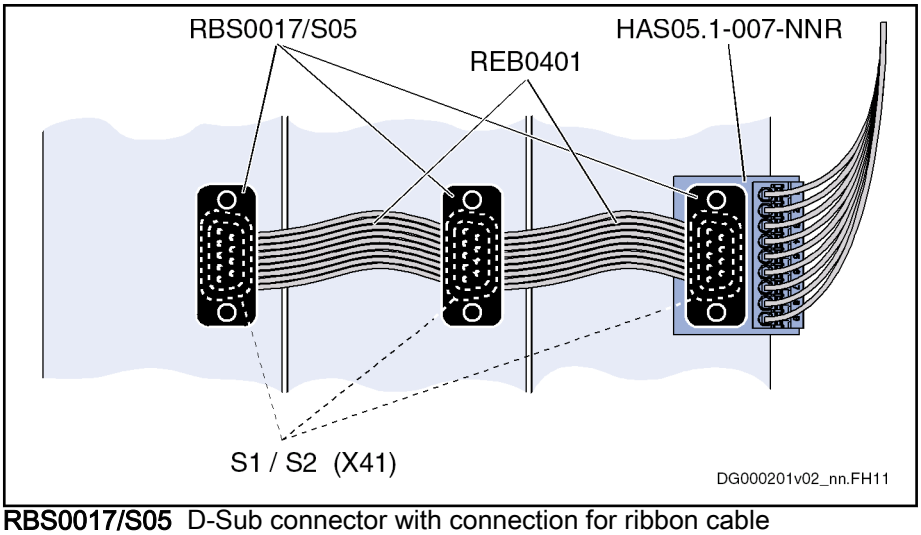


Fig. 20-112: HAS05.1-007-NNL and HAS05.1-007-NNR at CDB Control Section

Wiring Example With HAS05.1-007-NNR

HAS05.1-007-NN**R** is the preferred adapter for the bus connection of several optional modules S1 or S2.

Accessories



RBS0017/S05 D-Sub connector with connection for ribbon cable
REB0401 Ribbon cable
Fig. 20-113: HAS05.1-007-NNR

At CSH01.1C control sections, the adapter HAS05.1-007-NN**L** can only be used at the left end of the bus connection, when option 3 has not been equipped.

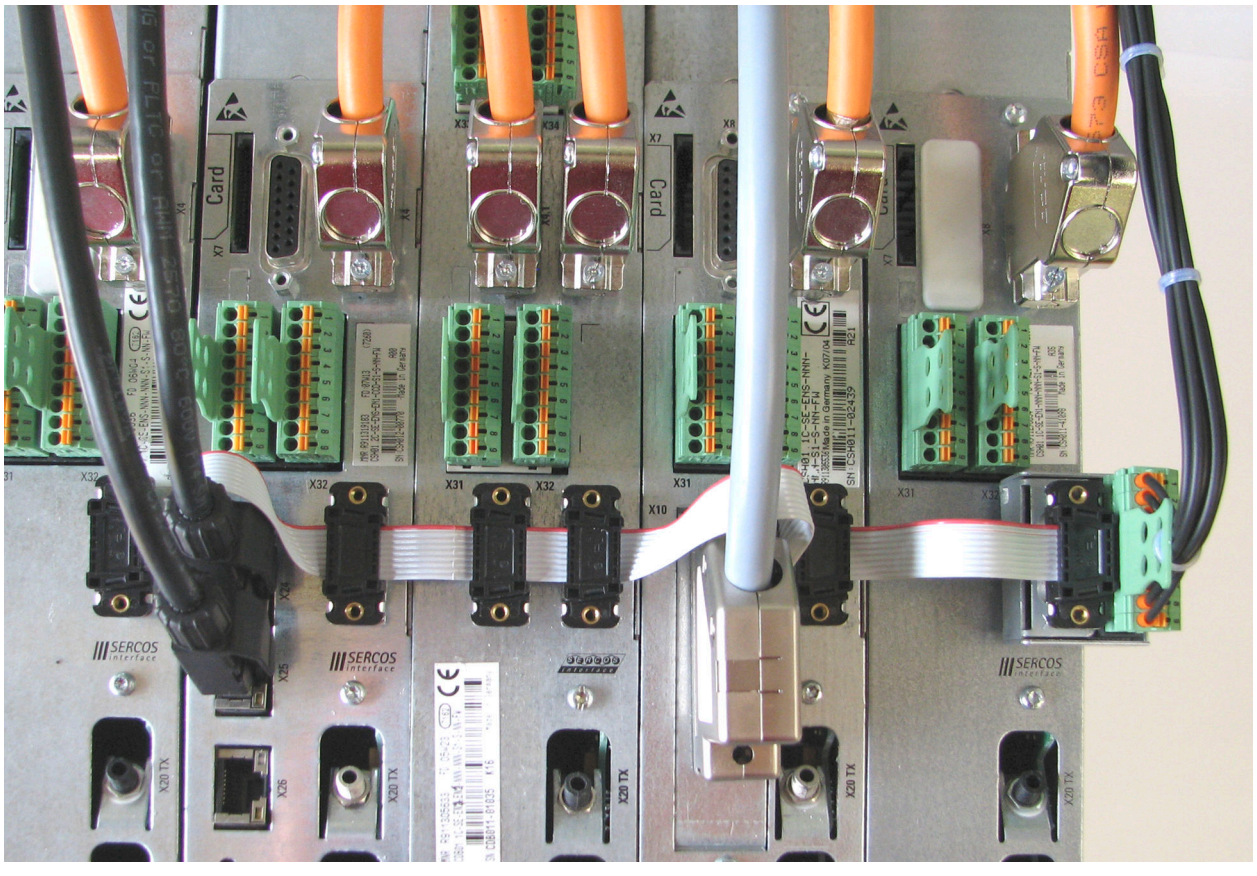


Fig. 20-114: HAS05.1-007-NNR, RBS0017/S05 and REB0401 for Bus Connection of Optional Modules S1 or S2 of the Axes of One Zone

20.5.10 HAS05.1-008, Adapter for Connecting two Cables

Usage

Assignment

The accessory HAS05.1-008 can be used at the following drive controllers:

- HCS03.1E-W0100…0210
- HMS01.1N-W0150…0210

Function

With the accessory HAS05.1-008, you can connect two 16 mm^2 cables with ring cable lugs at the mentioned devices at terminal block X5 (motor connection), each at A1, A2 and A3.

Scope of Supply

The accessory contains:

- 3 × adapter
- 3 × screw M6 × 25

Accessories

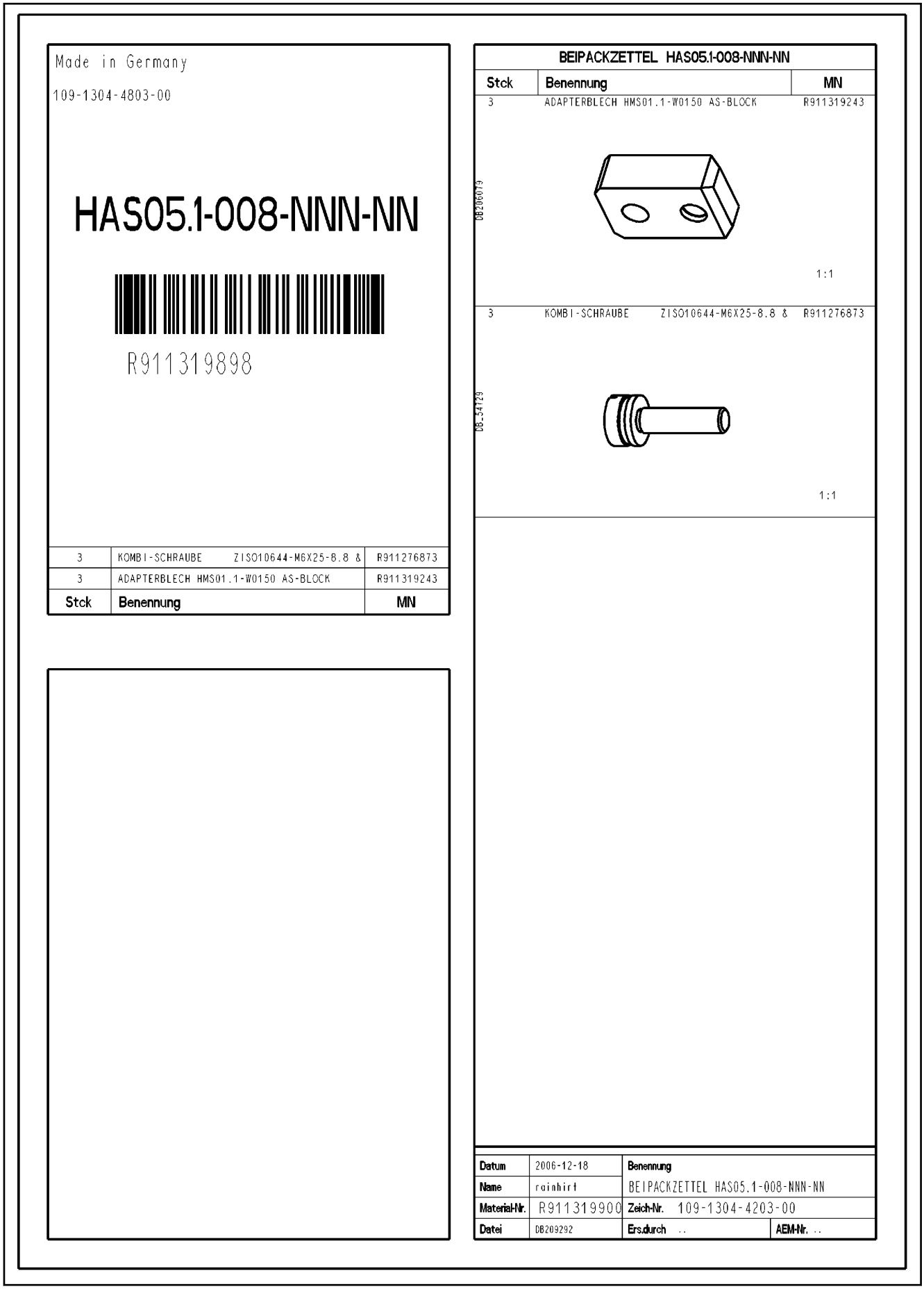
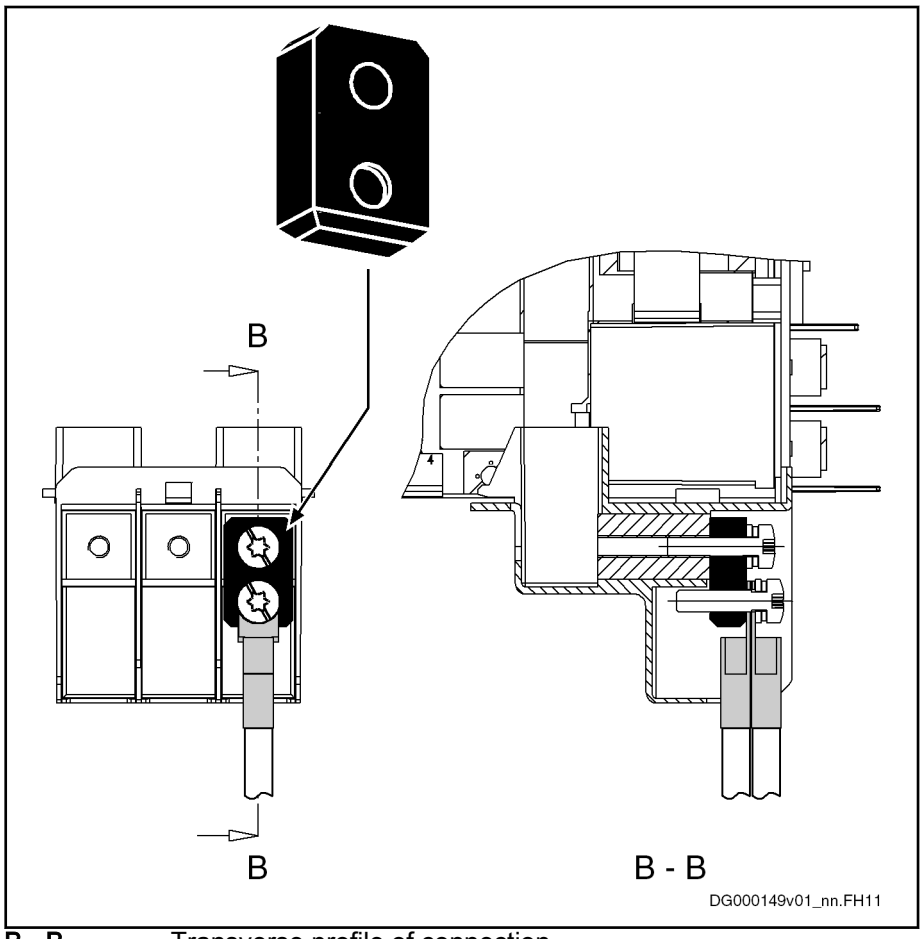


Fig. 20-115: Product Insert

Mounting



B - B Transverse profile of connection

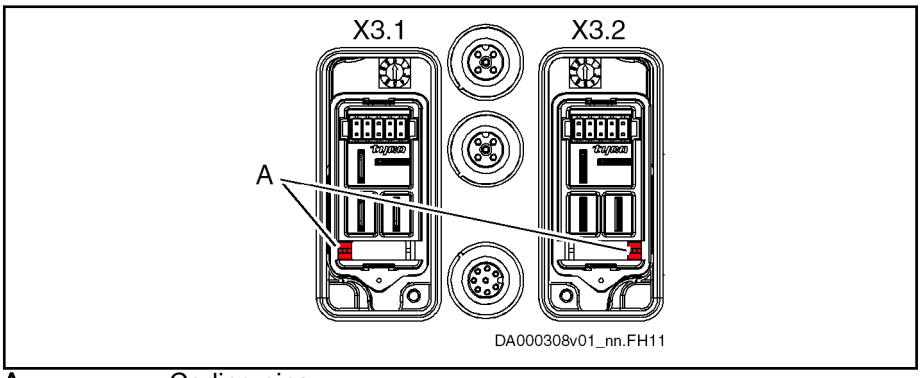
Fig. 20-116: HAS05.1-008 at an X5 connection point

1. Screw adapter to connection point with supplied screw.
2. Connect cable as shown and screw it on.
3. Repeat steps 1 and 2 for each connection point.

Accessories

20.5.11 HAS05.1-009, Coding Pin for Terminal Connector RHS

Terminal connectors RHS are used at distributed servo drives KSM and distributed drive controllers KMS at the conection point X3.1 or X3.2. Coding pins prevent a terminal connector, which has not been coded accordingly, from being accidentally plugged on.



A Coding pins

Fig. 20-117: Coding Pins at X3.1 and X3.2

20.5.12 HAS05.1-010, Brake Current Monitoring

Use

Assignment

The accessory HAS05.1-010 can be used at the following drive controllers:

HCS02.1E-...	HMS01.1N-...
W0012	W0020
W0028	W0036
W0054	W0054
W0070	W0070

Tab. 20-27: Assignment Accessories ↔ Drive Controller

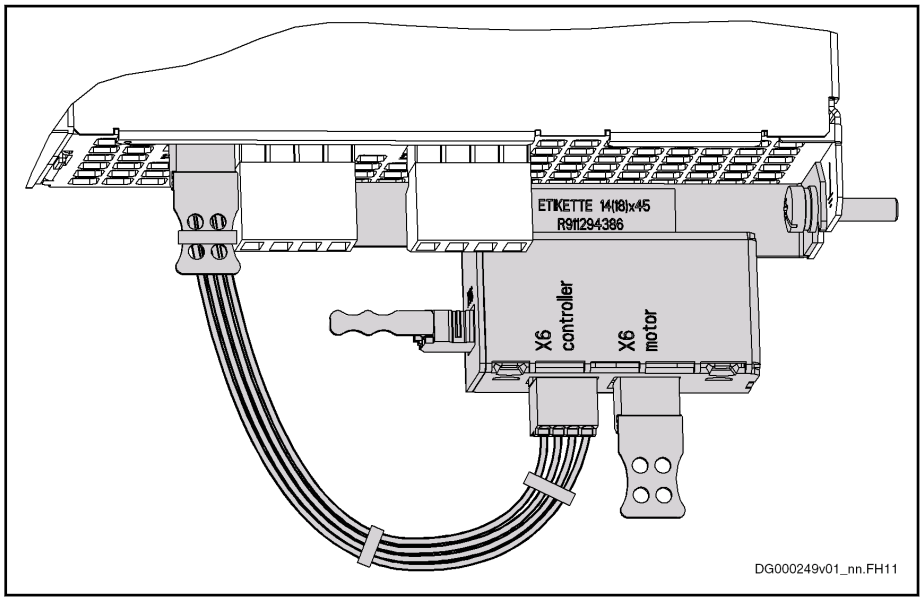


Fig. 20-118: HAS05.1-010 at an HCS02 Drive Controller

Function

The accessory HAS05.1-010 monitors motor holding brakes.

These values are monitored:

- Maximum value of brake current (2.5 A; short circuit monitoring)
- Minimum value of brake current (0.15 A; wire break monitoring)
- Minimum value of brake voltage (20 V; output HAS05.1-010)

Scope of Supply

Order this accessory as a separate item. It is not part of the scope of supply of the device.

Parts of the accessory: See product insert

Accessories

Product Insert HAS05.1-010-NNN-NN

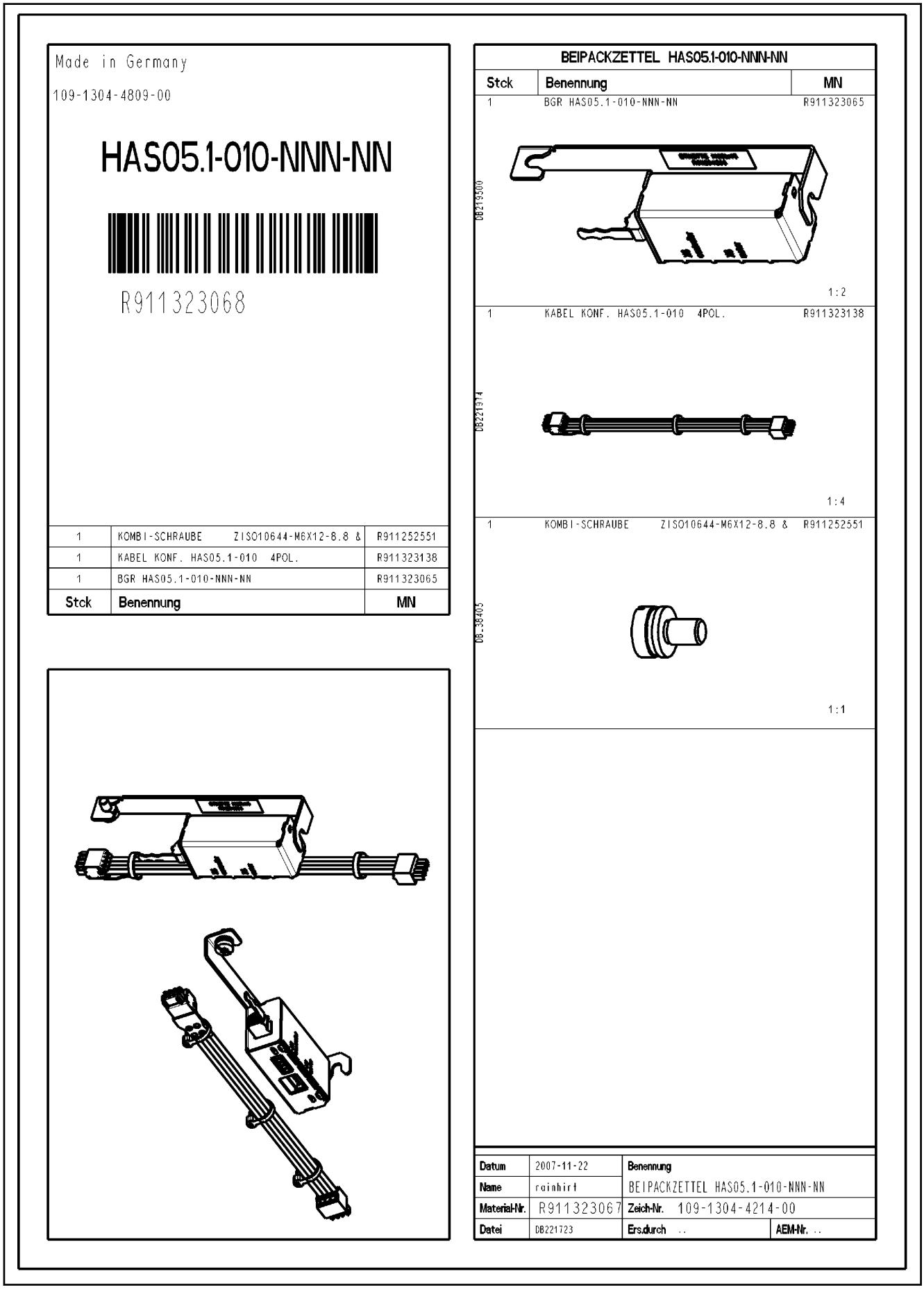


Fig. 20-119: Product Insert

Accessories

Product Insert HAS05.1-010-NHN-NN

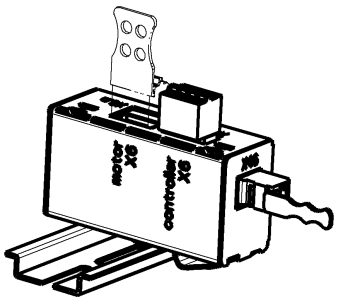
Made in Germany

109-1304-4820-00

HAS05.1-010-NHN-NN

R911326569

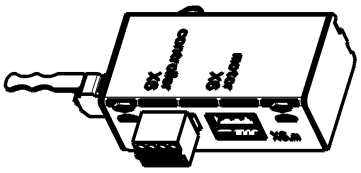
Stck	Benennung	MN
1	STECK-KL3,50 F FK MCW P 1,5/ 4STZ D 1- 4	R911308462
1	BGR HAS05.1-010-NHN-NN	R911326420



BEIPACKZETTEL HAS05.1-010-NHN-NN

Stck	Benennung	MN
1	BGR HAS05.1-010-NHN-NN	R911326420

DB236825



1:2

Stck	Benennung	MN
1	STECK-KL3,50 F FK MCW P 1,5/ 4STZ D 1- 4	R911308462

DB113233

1:2

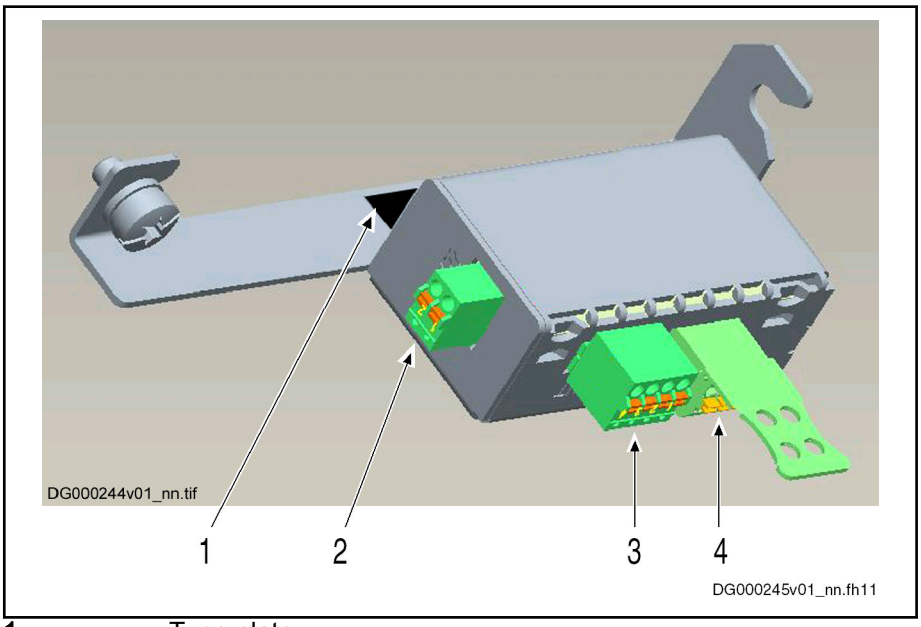
Datum	2008-10-16	Benennung	
Name	rainhirt	BEIPACKZETTEL HAS05.1-010-NHN-NN	
Material-Nr.	R911326567	Zeich-Nr.	109-1304-4226-00
Datei	DB236843	Ers.durch ..	AEM-Nr. 5-0

Fig. 20-120: Product Insert

Accessories

Identification, Parts

The accessory has a type plate for identification.



1 Type plate
2 Connector at connection point X46 (part of the accessories)
3 Connector at connection point X6_Controller (part of the enclosed adapter cable)
4 Connector at connection point X6_Motor (part of the motor cable)

Fig. 20-121: HAS05.1-010 with Connectors

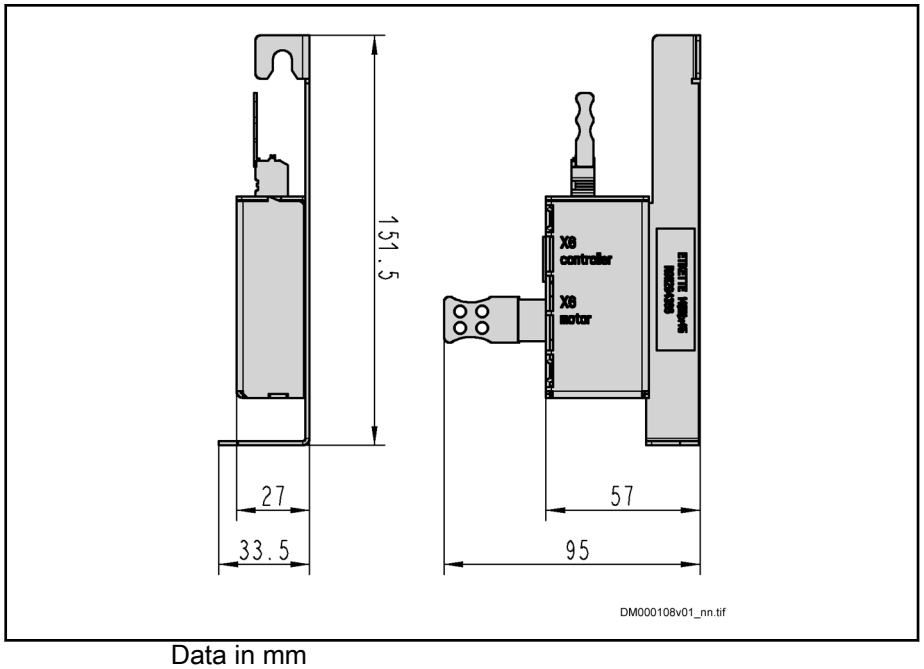
Technical Data

Mounting Dimensions

☞ When HAS05.1-010 is mounted, it is not possible to mount **HAS02** (strain relief and shield connection for motor cable) at the drive controller.

Observe the minimum **bending radiuses** of the lines used. This requires additional mounting clearance at the drive controller, particularly downward.

The accessory requires the following mounting clearance at the drive controller.

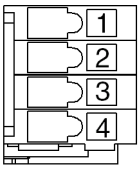


Data in mm

Fig. 20-122: Mounting Dimensions

Connection Points

X6_Controller, X6_Motor

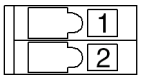
View	Connection	Signal name	Function
 DG000097v01_nn.FH11	1	MotTemp+	Input motor temperature evaluation
	2	MotTemp-	
	3	+24V	Output for controlling the motor holding brake
	4	0V	

Spring terminal (connector)	Unit	Min.	Max.
Connection cable solid wire	mm^2	0,5	1,5
Connection cable stranded wire	mm^2	0,5	1,5
	AWG	20	16
Short circuit protection		X6_Motor: Available	
Overload protection		X6_Controller: Not available	

Tab. 20-28: Function, Pin Assignment

Accessories

X46, Brake Check

View	Connection	Signal name	Function
 DG000246v01_nn.fh11	X46.1	+24V	Power supply
	X46.2	High ↔ Low	Diagnostic output: • Signal level **"high"**: Brake current and brake voltage are okay • Signal level **"low"**: Brake current and brake voltage are **not** okay
Spring terminal (connector)	**Unit**	**Min.**	**Max.**
Connection cross section solid wire	mm^2	0,5	1,5
Connection cross section stranded wire	mm^2	0,5	1,5
Connection cross section	AWG	20	16
Electrical data			
Signal level "high"			≥ 15 V Max. 10 mA
Signal level "low"		Output gets highly resistive	
Short circuit protection		Available	
Overload protection			

Tab. 20-29: Function, Pin Assignment

Mounting and Installation

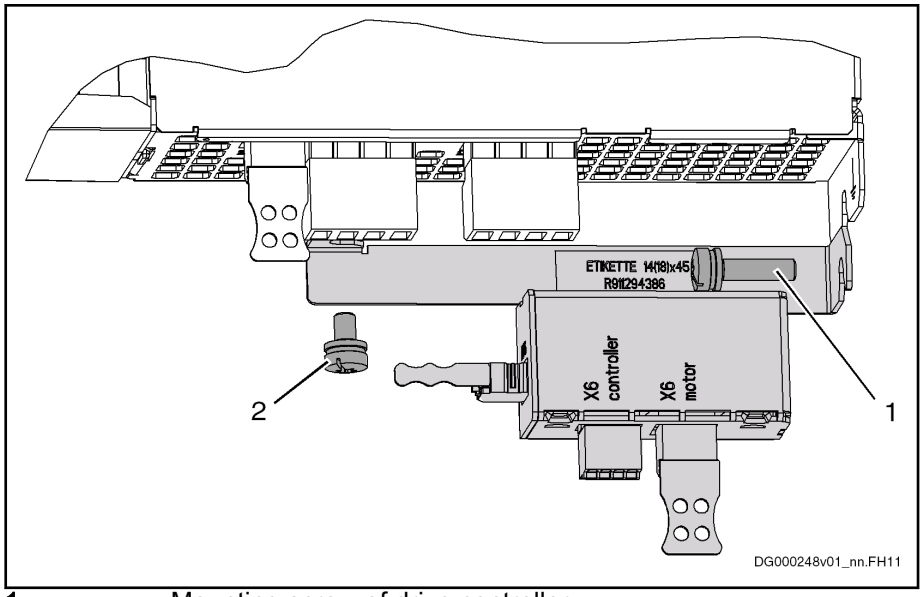
Mounting

When HAS05.1-010 is mounted, it is not possible to mount **HAS02** (strain relief and shield connection for motor cable) at the drive controller.

HAS05.1-010 is mounted to the the bottom of the drive controller.

NOTICE **Risk of damage to the drive controller by too long screws!**

Exclusively use screws of a **maximum length of 12 mm** for the thread of shield connection XS2.



1 Mounting screw of drive controller
2 Mounting screw of accessories

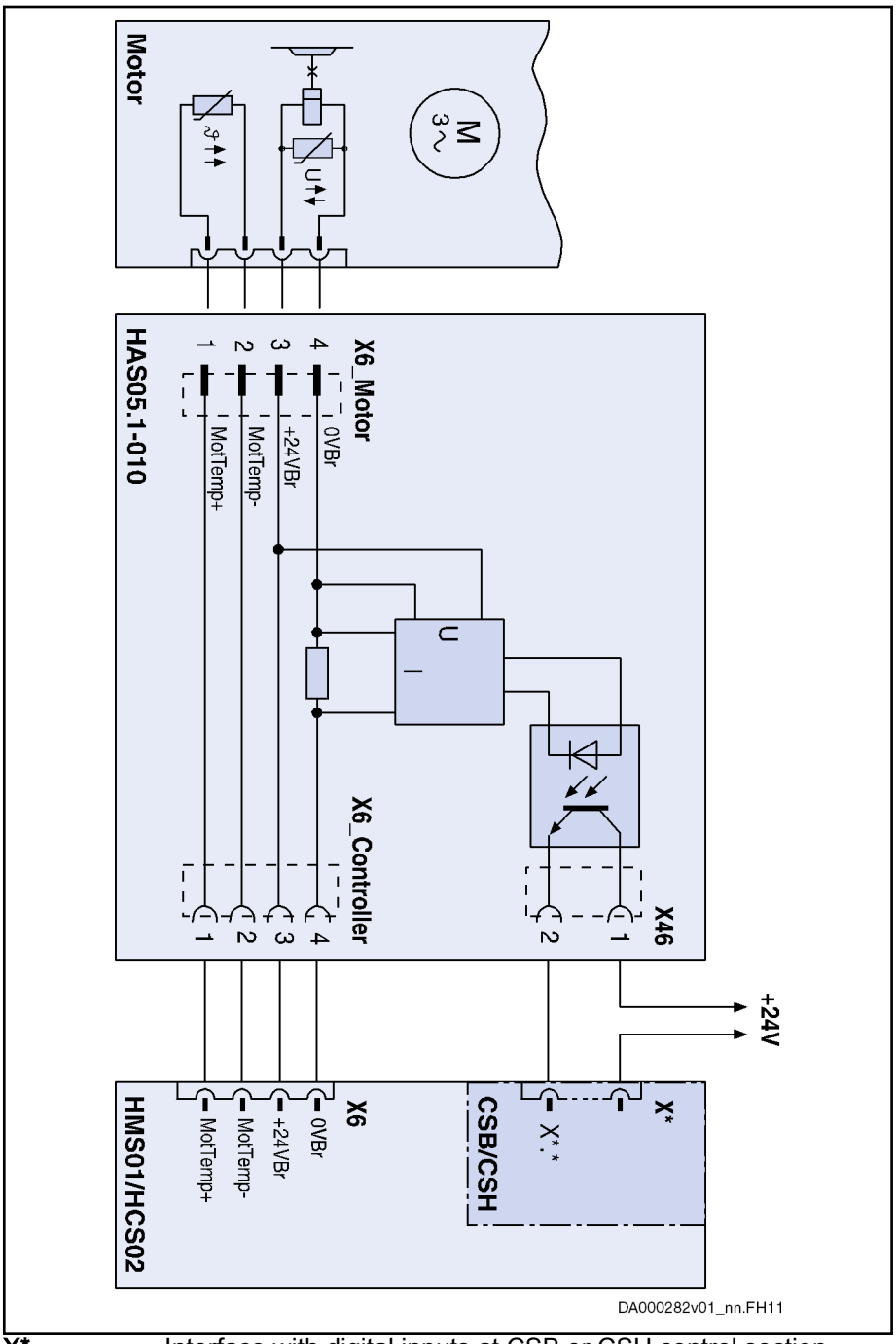
Fig. 20-123: Mounting HAS05.1-010

Mount HAS05.1-010

1. Unscrew bottom or bottom left mounting screw (1) of drive controller.
2. Put HAS05.1-010 to bottom of drive controller and screw down mounting screw (1) at drive controller again.
3. Screw mounting screw (2) of accessories (M6 × 12) in thread XS2 at bottom of drive controller.

Accessories

Installation



X*	Interface with digital inputs at CSB or CSH control section
X*.*	Unassigned digital input of interface X*
+24V	24 V power supply for diagnostic output X46.2 of brake current monitoring and for digital I/Os of interface X*

Fig. 20-124: Example of Connection

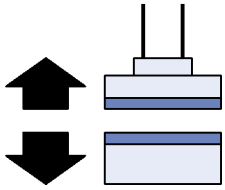
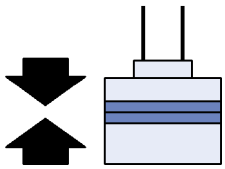
Wire HAS05.1-010

1. Connect **control voltage supply** (+24V) to **X46.1**. When doing this, run control voltage supply in parallel to power supply of digital I/Os of control section.
2. Connect motor cable to connection point **X6_Motor**.

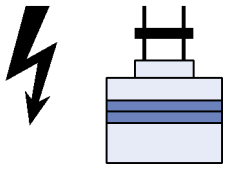
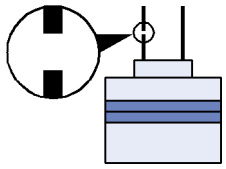
3. With enclosed adapter cable, connect connection point **X6_Controller** to **X6** (drive controller).
4. Connect **X46.2** to an unassigned digital input at control section. (Via parameters "P-0-0300" and "P-0-0301", drive signal is assigned to digital input.)

Signal Evaluation

Signal Evaluation at Diagnostic Output X46.2

Motor holding brake	Diagnostic output X46.2
Release 	When the releasing of the motor holding brake starts, incorrect diagnostic messages are sometimes output at the diagnostic output X46.2. **Before evaluating the diagnostic output X46.2, wait until the delay of the motor holding brake (S-0-0206) has passed.** After the delay has passed: **X46.2 → "high"** (provided that no short circuit and no current interruption are present). When drive enable (AF = Antriebsfreigabe) is set by the control unit, the releasing of the motor holding brake is triggered. The motor holding brake is released with a delay, due to the inductance of the winding and the motor line. The drive controller is informed on this delay via the parameter "S-0-0206, Drive on delay time". The content of this parameter is automatically set für Rexroth motors with feedback data memory. For other motors, you must parameterize this parameter in accordance with the specification of the motor holding brake used. See also Functional Description of firmware → Operating Behavior of the Motor Holding Brake
Apply 	When the applying of the motor holding brake ends, incorrect diagnostic messages are sometimes output at the diagnostic output X46.2. **Before evaluating the diagnostic output X46.2, wait until the delay of the motor holding brake (S-0-0207) has passed.** When the current has fallen below 0.15 A: **X46.2 → "low"** When drive enable (AF) is reset, the applying of the motor holding brake is triggered. The motor holding brake is applied with a delay, due to the inductance of the winding and the motor line. The drive controller is informed on this delay via "S-0-0207, Drive off delay time". The content of this parameter is automatically set für Rexroth motors with feedback data memory. For other motors, you must parameterize this parameter in accordance with the specification of the motor holding brake used. See also Functional Description of firmware → Operating Behavior of the Motor Holding Brake

Accessories

Motor holding brake	Diagnostic output X46.2
Short circuit at output "X6_Motor" 	The short circuit (I ≥ 2.5 A) is detected: **X46.2 → "low"** The drive controller or HAS05.1-010 (thermal overcurrent protection) interrupts the power supply of the motor holding brake (+24VBr).
Current interruption at output "X6_Motor" 	The current interruption (I ≤ 0.15 A; e.g. in the case of wire break) is detected: **X46.2 → "low"**

Tab. 20-30: Signal Evaluation at Diagnostic Output X46.2

20.5.13 HAS05.1-014, Mounting Plate for Safety Zone Module

Use

As a standard, the safety zone module HSZ01 is equipped to be mounted on a top-hat rail.

The accessories HAS05.1-014-NNN-NN (material number: R911340518) allow mounting the safety zone module HSZ01 without a top-hat rail.

Mounting

1. Remove top-hat rail terminal connectors at the back of safety zone module HSZ01.
2. With supplied screws (M4), screw plate from accessories to back of safety zone module HSZ01 (tightening torque: 1.4 Nm).
3. With supplied screws (M6), mount safety zone module HSZ01 vertically in control cabinet (tightening torque: 6 Nm).

   When mounting the safety zone module HSZ01, observe the minimum distances to be complied with.

Accessories

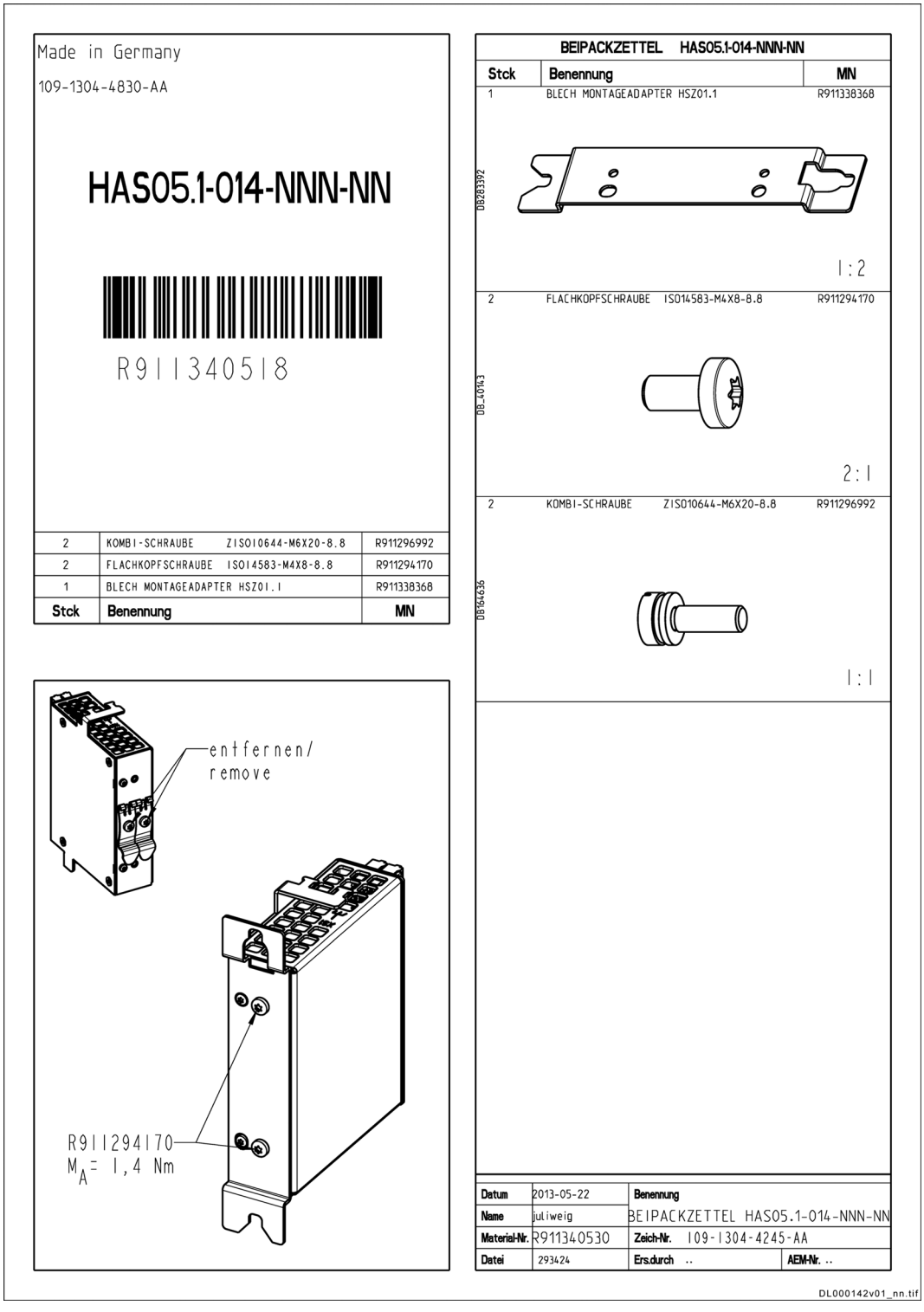


Fig. 20-125: Product Insert

20.5.14 Snap-on ferrite (HAS05.1-015)

Use

The accessory HAS05.1-015-NNN-NN (snap-on ferrite) ensures that Class C3 of the EMC Directive EN 61800-3 is complied with for braking resistors installed outside of the control cabinet.

The snap-on ferrite is designed for the following components:

- HCS01.1E-W00**18** + HLR01.2N-01K0-N**68**R0-E-007
- HCS01.1E-W00**28** + HLR01.2N-01K0-N**68**R0-E-007
- HCS01.1E-W00**54** + HLR01.2N-01K0-N**28**R0-E-007

Product insert

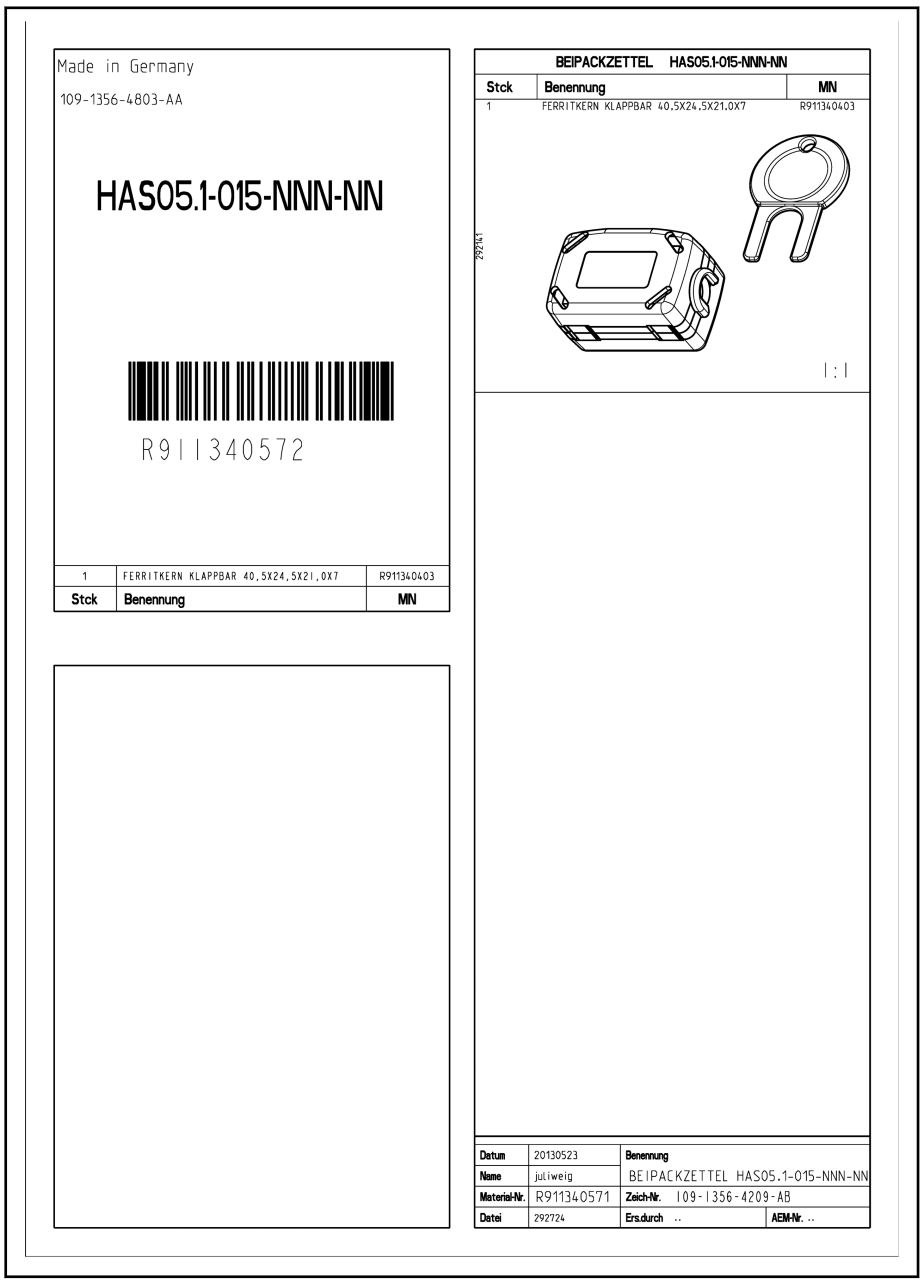


Fig. 20-126: Product insert

Accessories

Mounting

- Before mounting the snap-on ferrite, store it for at least 1 hour at a temperature of 15 … 25 °C.
- When mounting the snap-on ferrite, avoid putting it under mechanical stress. The housing or the ferrite core might brake.
- Do not mount the snap-on ferrite in the immediate vicinity of strong heat sources. The maximum allowed ambient temperature of the snap-on ferrite is 105 °C.
- Fix the snap-on ferrite within the control cabinet to the cable jacket of the connection line of the braking resistor (see picture). The snap-on ferrite is designed for cable diameters of 6.5 … 7 mm.

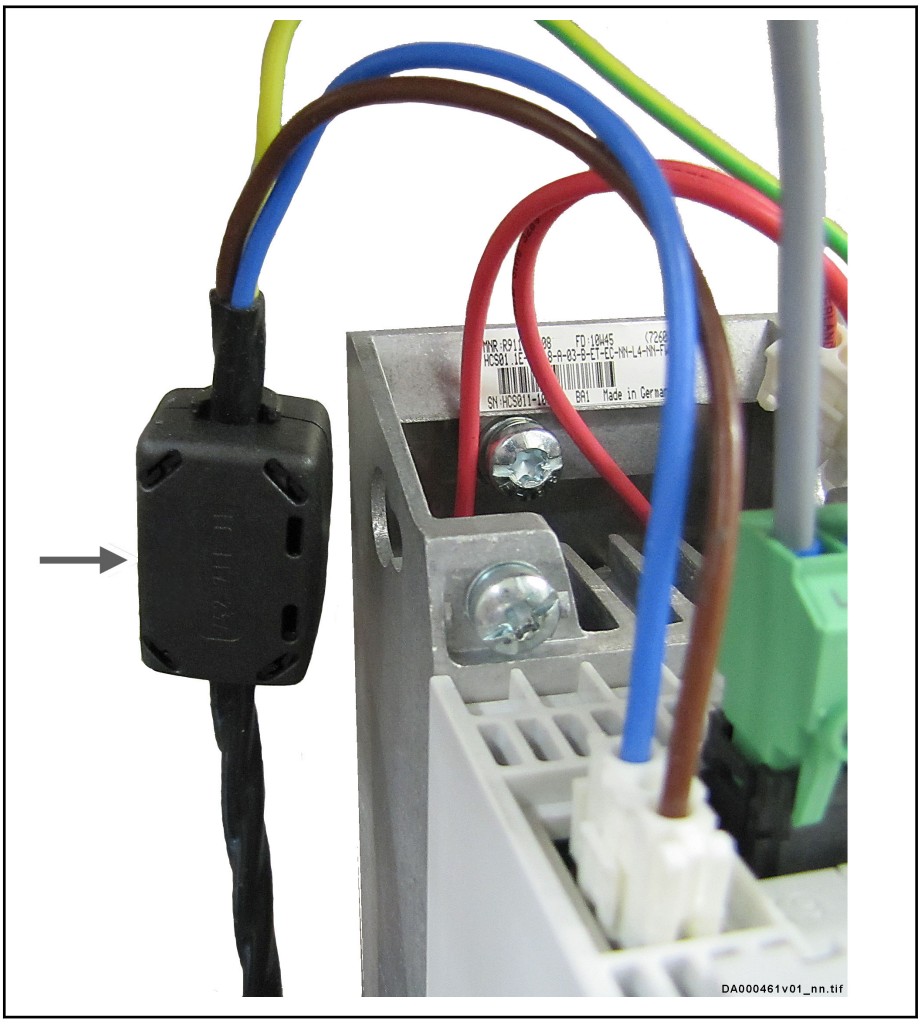


Fig. 20-127: Snap-on ferrite at connection line of external braking resistor

To open the snap-on ferrite, use the proper tool:

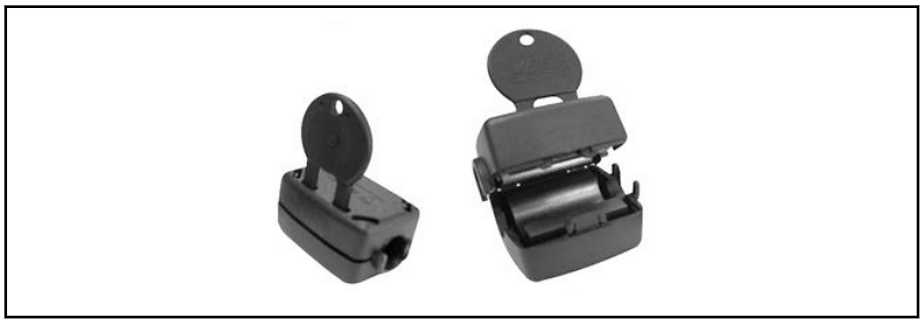
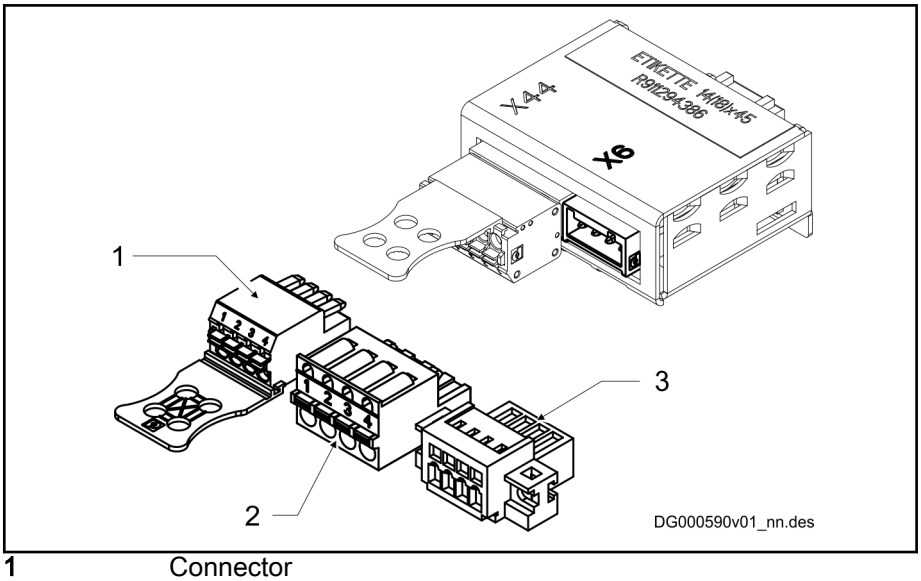


Fig. 20-128: Opening the snap-on ferrite

Accessories

20.5.15 HAS05.1-016, brake module with connectors

The brake module of the HAS05.1-016 accessories corresponds to the brake module of the HAS05.1-006 accessories.



1 Connector
2 Connector
3 Connector

Fig. 20-129: HAS05.1-016, brake module with connectors

20.5.16 HAS05.1-017, X6 adapter

See chapter 17.8 "X6 adapter (RKL0091, RKL0092)" on page 239.

Accessories

20.5.17 HAS05.1-018, dummy plate for KMS03 encoder connection

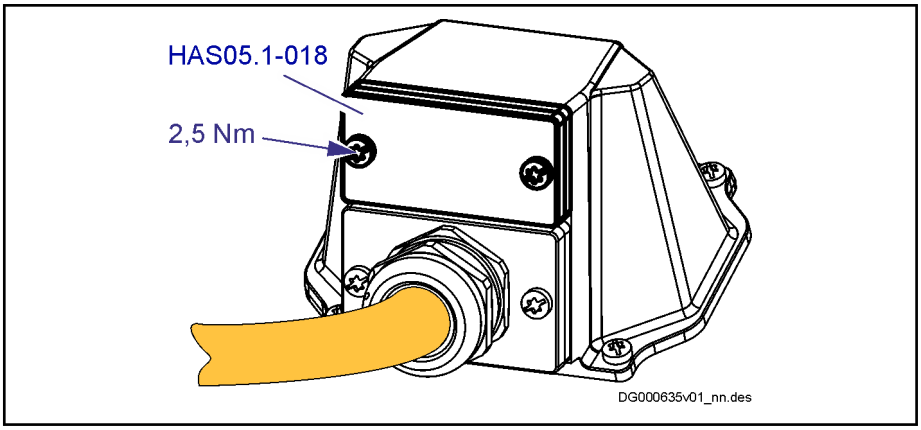


Fig. 20-130: HAS05.1-018, dummy plate for KMS03 encoder connection

20.5.18 HAS05.1-019, KNK03 mains voltage

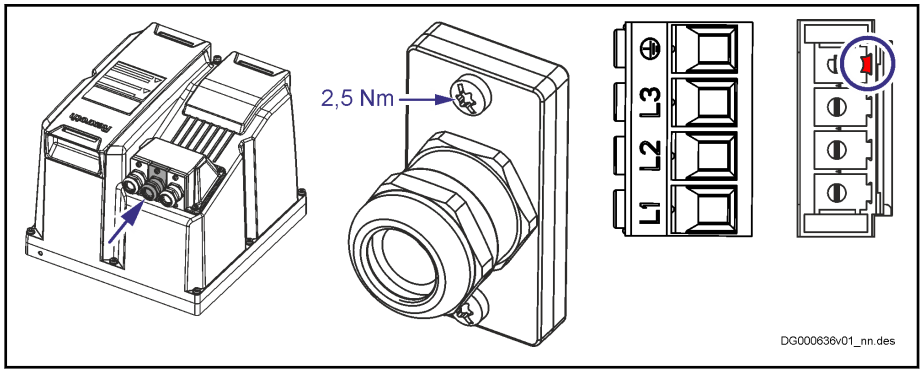


Fig. 20-131: HAS05.1-019, KNK03 mains voltage

The accessory contains the following parts:

- Cable gland (plastic, M20, range: 6 … 12 mm)
- Plate incl. screws
- Connector (screw terminal)
- Coding pin

Accessories

20.5.19 HAS05.1-020, KMV03 control voltage

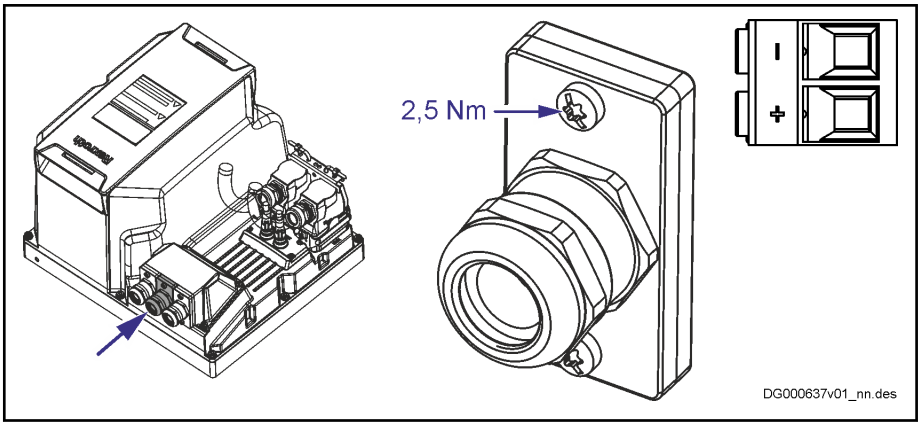


Fig. 20-132: HAS05.1-020, KMV03 control voltage

The accessory contains the following parts:

- Cable gland (plastic, M20, range: 6 … 12 mm)
- Plate incl. screws
- Connector (screw terminal)

20.6 HAS10, mechanical mounting parts

20.6.1 Type code

Short type designation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	H	A	S	1	0	.	1	-	0	0	1	-	0	0	2	-	N	N																								
	①			②			③			④					⑤				⑥																							
①	**Product:** HAS = IndraDrive accessories																																							
②	**Series:** 10 = Mechanical mounting parts																																							
③	**Design:** 1 = 1																																							
④	**Device assignment [1]:** 001 = KSM01.2, KSM02.1 KMS01.2 and KMS02.1 002 = HMU05.1 and HCS05.1																																							
⑤	**Other properties [2]:** 001 = Fixing clip of connectors for increased vibration resistance 002 = Fixing clip of connectors and master communication for increased vibration resistance 003 = Dummy cover for slide-in ducts: 1 × parallel module / 1 × motor mains module / 1 × control section 004 = Motor monitor grounding 005 = Mounting plate for device width 200 mm 006 = Mounting plate for device width 220 mm																																							
⑥	**Other design:** NN = None																																							

Tab. 20-31: HAS10, type code

20.6.2 Use

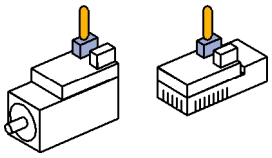
Use

HAS10	Use
HAS10.1-001-**001**-NN	Fixing clip for hybrid cables at devices **without** option TO, ES …
HAS10.1-001-**002**-NN	Fixing clip for hybrid cables at devices **with** option TO, ES …
HAS10.1-001-**003 … 006**-NN	Mechanical mounting parts for HMU05 universal inverters. Further information: See HMU05 Project Planning Manual.

Tab. 20-32: HAS10

Accessories

Restricted Usage of the Accessory:



The accessory **cannot** be used at **hybrid cables with a vertical outgoing direction** of the cable from the connector.

HAS10.1-001-001-NN

The accessory **HAS10.1-001-001-NN** consists of a fixing clip with a screw.

The fixing clip is screwed to a KSM or KMS and increases the vibration resistance of the connected hybrid cable connectors.

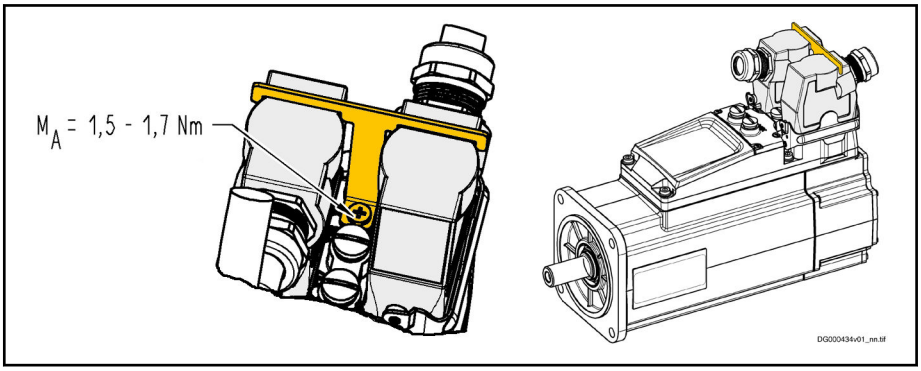


Fig. 20-133: HAS10.1-001-001-NN

HAS10.1-001-002-NN

The **HAS10.1-001-002-NN** accessory consists of the following parts:

- Fixing clip with screw (tightening torque: 1.5 … 1.7 Nm)
- RKB0043 cable
- Cable tie

The fixing clip increases the vibration resistance of the connected hybrid cable connectors. The RKB0043 cable is fixed to the fixing clip with 2 cable ties.

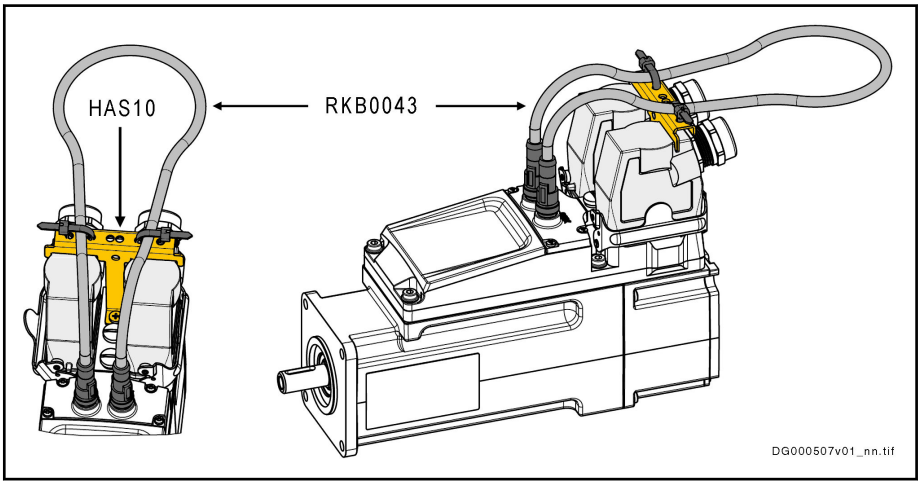


Fig. 20-134: HAS10.1-001-002-NN

20.6.3 Scope of supply

Scope of supply Components of the accessory: see product insert

Accessories

Product insert HAS10.1-001-001-NN

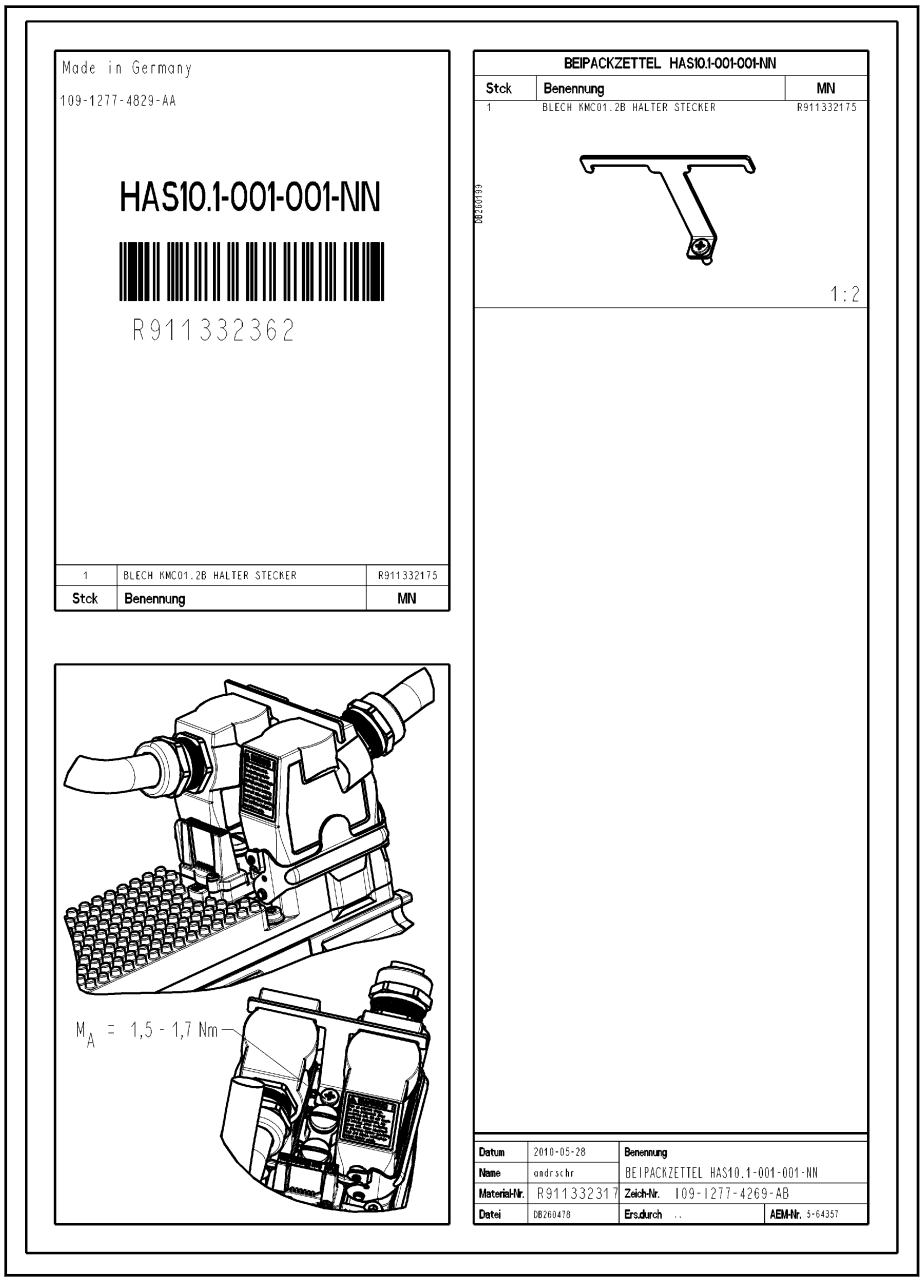


Fig. 20-135: Product insert HAS10.1-001-001-NN

Accessories

Product insert HAS10.1-001-002-NN

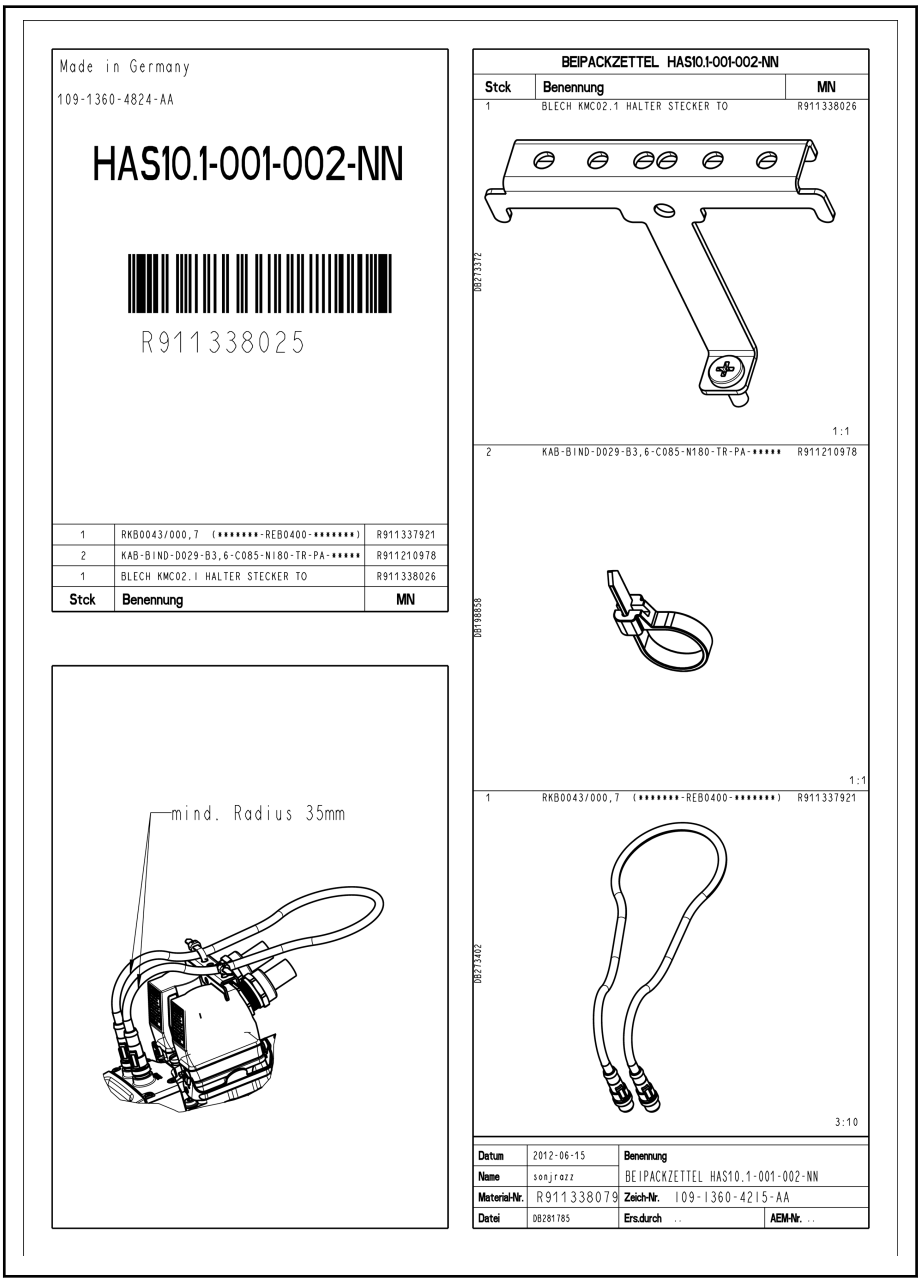
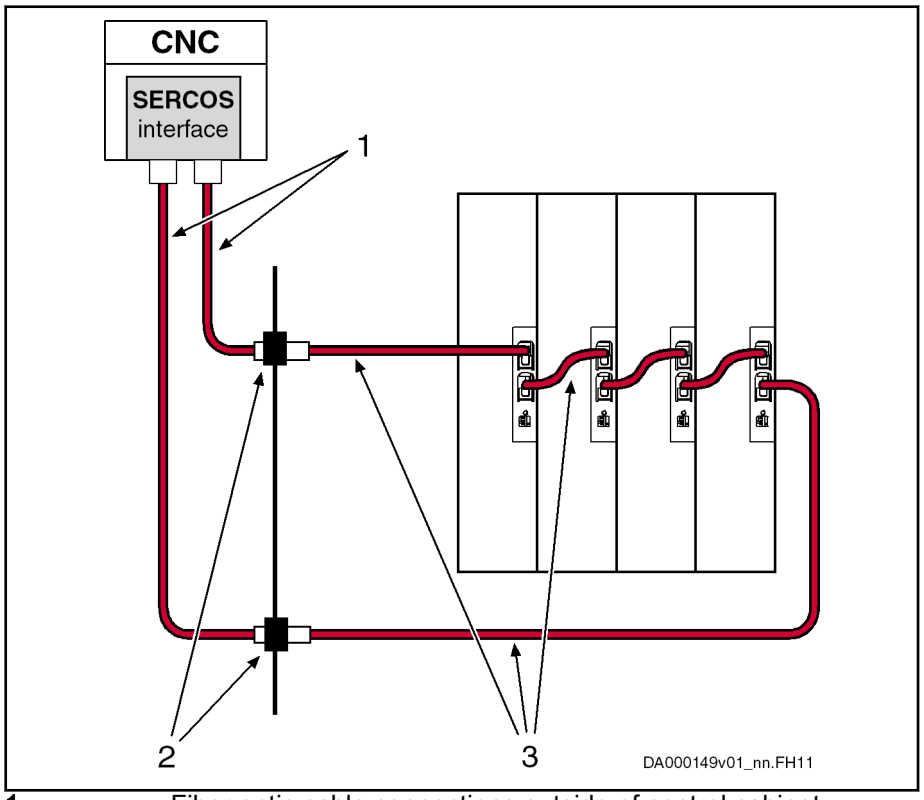


Fig. 20-136: Product insert HAS10.1-001-002-NN

20.7 Fiber Optic Cable Connections

20.7.1 Overview of Types



1 Fiber optic cable connections outside of control cabinet
2 Control cabinet duct
3 Fiber optic cable connections inside of control cabinet

Fig. 20-137: Fiber Optic Cable Connections

Point of installation	Description	Type designation
Outside of control cabinet	Robust fiber optic cable connections from peripherals to control cabinet	RKO0101
At control cabinet	Control cabinet duct with plug-in connectors	INS0610
Inside of control cabinet	Fiber optic cable connections to and between drive controllers	RKO0100

Tab. 20-33: Fiber Optic Cable Connection Elements

For ordering the fiber optic cable connection, you have to generate the complete order code containing details on type and length.

For the type designation see the above table and add the required length to it.

Determine the length by means of the list of different device arrangements.

Example of order code for arrangement HCS02 (left 105 mm) next to HCS02 (right 65 mm):

- Required length: 0.25 m

Accessories

- Type designation: RKO0100
- Order code: RKO0100 / 0,25

20.7.2 Interconnection of Drive Controllers

General Information

For selecting the fiber optic cable connection of drive controllers, take different possible combinations and different device widths into account.

Combination of HCS02 and HCS02

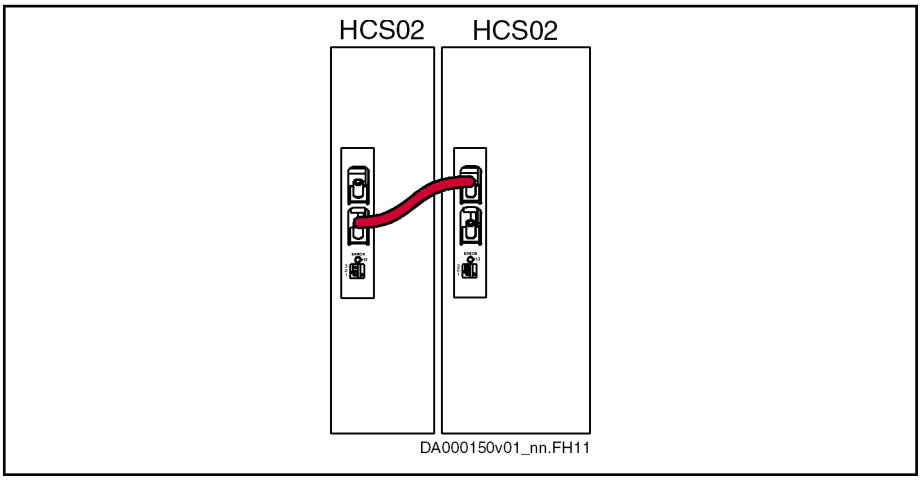


Fig. 20-138: HCS02 with HCS02

For fiber optic cables from **CSB01.1N-SE** control sections to other control section types, take fiber optic cables which are **0.05 m** longer (at the devices, SERCOS connections are at different heights and sides).

Observe the routing guidelines and technical data (e.g. allowed bending radiuses) contained in documentation "Rexroth Connection Cables", DOK-CONNEC-CABLE*LWL**-AW**-**-*.

Required fiber optic cable length [m]		
Width left HCS02 [mm]	**Width right HCS02 [mm]**	
	65	105
65	0,15	0,15
105	0,25	0,25

Tab. 20-34: Fiber Optic Cable Lengths

Combination of HCS02 to the Right of HMS or HMD

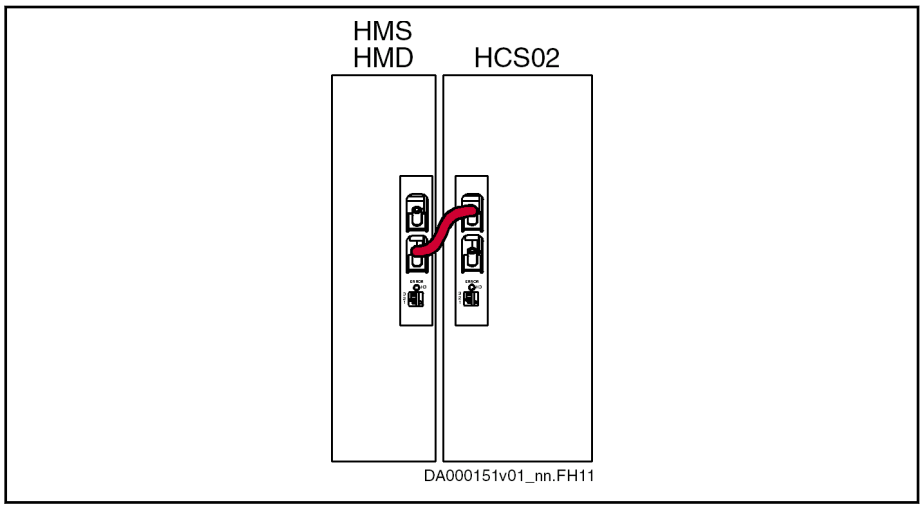


Fig. 20-139: HCS02 to the Right of HMS or HMD

Independent of the width of the devices, cable length is 0.15 m.

Combination of HCS02 to the Left of HMS or HMD

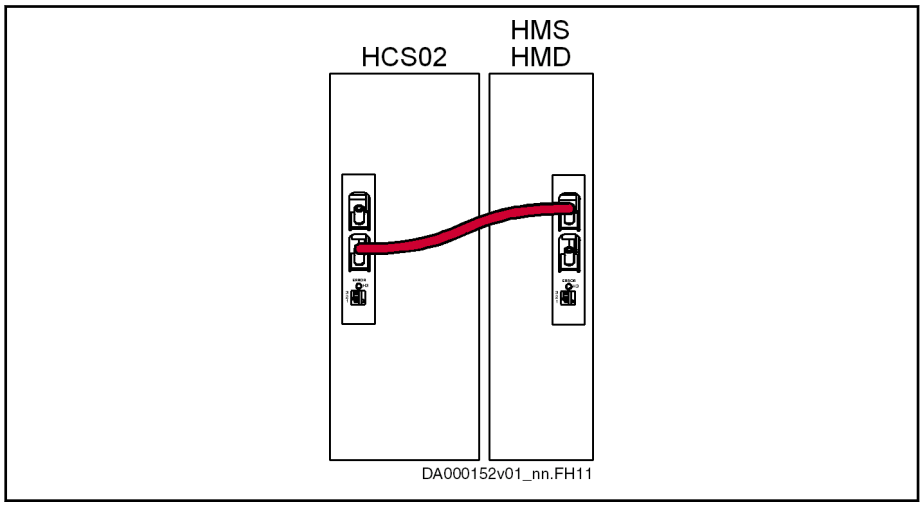


Fig. 20-140: HCS02 to the Left of HMS or HMD

For fiber optic cables from **CSB01.1N-SE** control sections to other control section types, take fiber optic cables which are **0.05 m** longer (at the devices, SERCOS connections are at different heights and sides).

Observe the routing guidelines and technical data (e.g. allowed bending radiuses) contained in documentation "Rexroth Connection Cables", DOK-CONNEC-CABLE*LWL**-AW**-**-*.

Cable length = width HCS02 + width HMS/HMD + 10 cm

Required fiber optic cable length [m]				
Width HCS02 [mm]	Width HMS / HMD [mm]			
	50	75	100	125

Accessories

Required fiber optic cable length [m]				
65	0,25	0,25	--	--
105	0,25	0,30	0,30	0,30

Tab. 20-35: Fiber Optic Cable Lengths

Combination of HCS03 to the Right of HMS or HMD

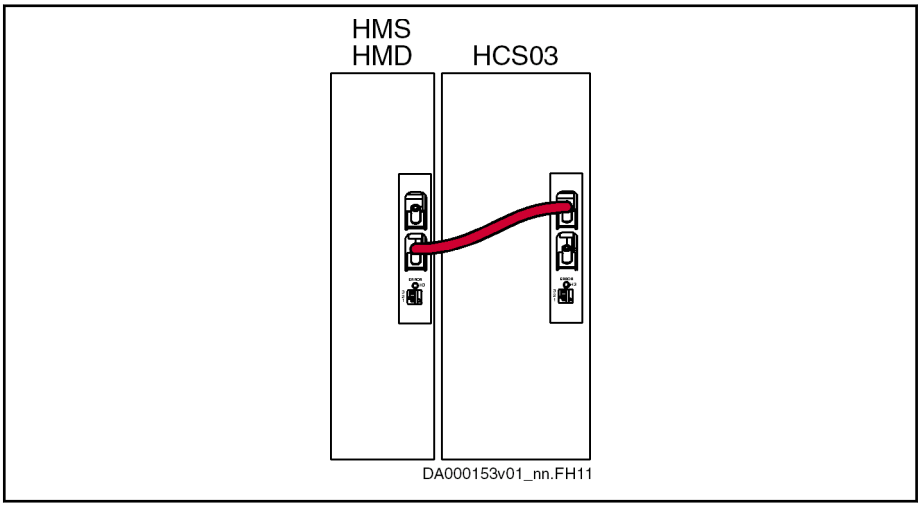


Fig. 20-141: HCS03 to the Right of HMS or HMD

Combination of HCS03 to the Left of HMS or HMD

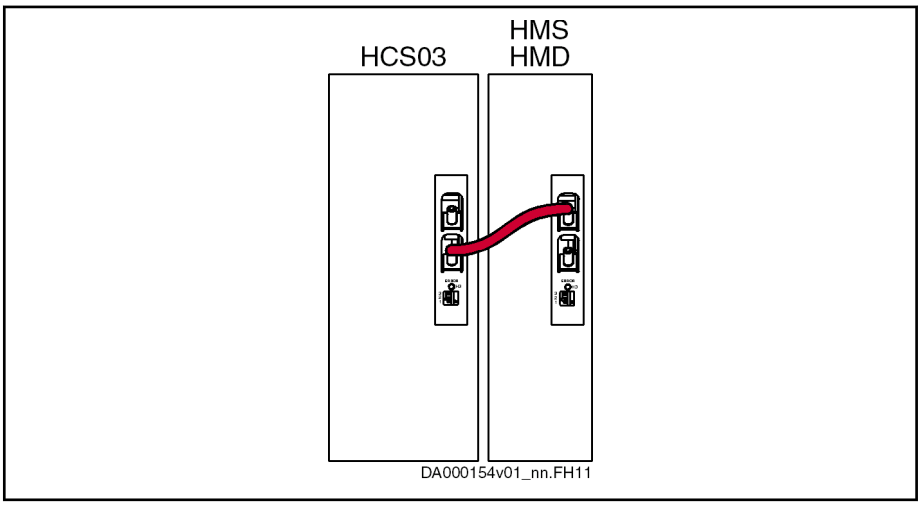


Fig. 20-142: HCS03 to the Left of HMS or HMD

For fiber optic cables from **CSB01.1N-SE** control sections to other control section types, take fiber optic cables which are **0.05 m** longer (at the devices, SERCOS connections are at different heights and sides).

Observe the routing guidelines and technical data (e.g. allowed bending radiuses) contained in documentation "Rexroth Connection Cables", DOK-CONNEC-CABLE*LWL**-AW**-**-*.

Required fiber optic cable length [m]								
Width left device [mm]	Width right device [mm]							
	50	75	100	125	150	200	225	350
50	0,15	0,25	0,25	0,25	0,30	0,50	0,50	0,50
75	0,15	0,25	0,25	0,25	0,30	0,50	0,50	0,50
100	0,15	0,25	0,25	0,25	0,30	0,50	0,50	0,50
125	0,15	0,25	0,25	0,25	0,30	0,50	0,50	0,50
150	0,15	0,25	0,25	0,25	0,30	0,50	0,50	0,50
200	0,15	0,25	0,25	0,25	0,30	0,50	0,50	0,50
225	0,15	0,25	0,25	0,25	0,30	0,50	0,50	0,50
350	0,15	0,25	0,25	0,25	0,30	0,50	0,50	0,50

Tab. 20-36: Fiber Optic Cable Lengths

Accessories

20.8 RKB0001, Extension for Module Bus Connections

20.8.1 Use

Assignment

The extension **RKB0001** can be used at:

- HMV01.1E
- HMV01.1R
- HMS01.1N
- HMD01.1N
- HMV02.1R
- HMS02.1N
- HCS03.1E-W0070, -W0100, -W0150, -W0210

The extension RKB0001 cannot be mounted at HCS02 drive controllers.

Function

With the accessory RKB0001 you can extend the module bus connection between devices, when the distance between the drive controllers is greater than 5 mm, e.g. for multiple-line arrangement.

Lengths That Can Be Ordered, Order Code

Lengths: 0.5 m to 40 m (in steps of 0.5 m)

Parts:

- Housing with hinged cover
- Cable with strain relief mounted at both ends

Indicate the complete order code for your order.

Example:

- Required length: 2.5 m
- Type designation: RKB0001
- Order code: **RKB0001 / 02,5**

20.8.2 Mounting

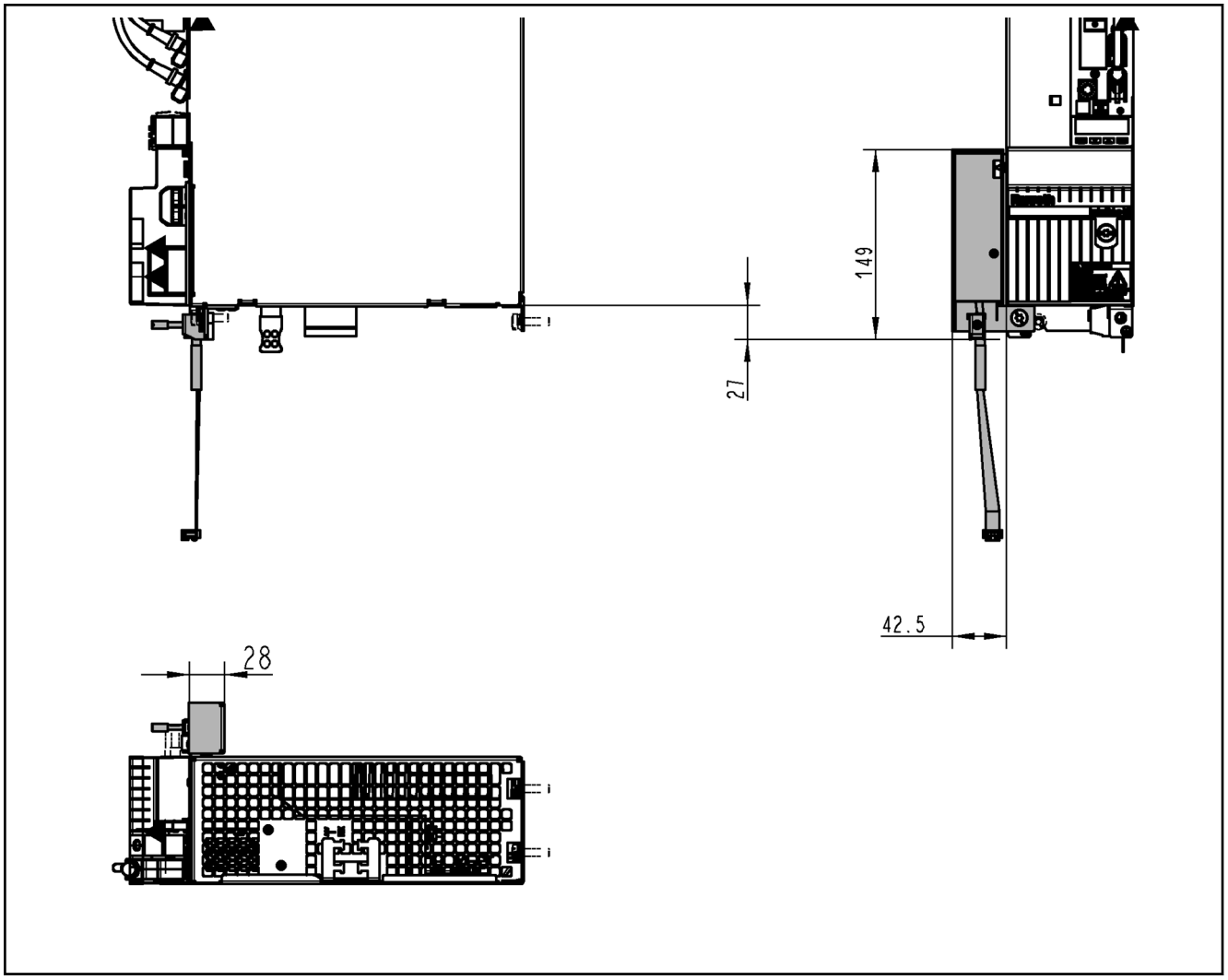


Fig. 20-143: Dimensions RKB0001

Accessories

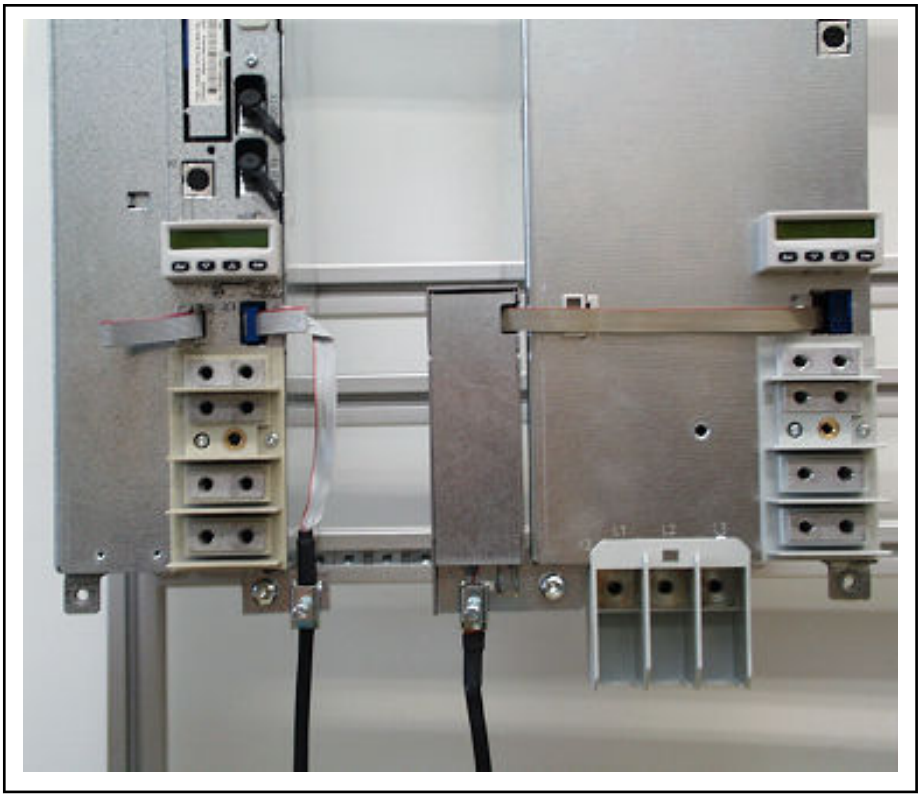


Fig. 20-144: Extension of Module Bus

Mounting the RKB0001 Bus Cable

1. Mount housing to point of connection for equipment grounding conductor.
2. Open cover and plug ribbon cable of right device into circuit board.
3. Close cover.
4. Screw strain relief down to point of connection for equipment grounding conductor.
5. Plug ribbon cable into X1.

☞ Make sure the connection between strain relief and point of connection for equipment grounding conductor is well conductive.

By means of appropriate wiring, establish equipment grounding connections of devices that are not directly adjoining.

21 Environmental protection and disposal

21.1 Environmental protection

Production processes

The products are made with energy- and resource-optimized production processes which allow re-using and recycling the resulting waste. We regularly try to replace pollutant-loaded raw materials and supplies by more environment-friendly alternatives.

No release of hazardous substances

Our products do not contain any hazardous substances which may be released in the case of appropriate use. Normally, our products will not have any negativ influences on the environment.

Significant components

Basically, our products contain the following components:

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

Motors
- steel
- aluminum
- copper
- brass
- magnetic materials
- electronic components and modules

21.2 Disposal

Return of products

Our products can be returned to our premises free of charge for disposal. It is a precondition, however, that the products are free of oil, grease or other dirt.

Furthermore, the products returned for disposal must not contain any undue foreign material or foreign components.

Send the products ”free domicile” to the following address:

Bosch Rexroth AG
Electric Drives and Controls
Buergermeister-Dr.-Nebel-Strasse 2
97816 Lohr am Main, Germany

Packaging

The packaging materials consist of cardboard, wood and polystyrene. These materials can be recycled anywhere without any problem.

For ecological reasons, please refrain from returning the empty packages to us.

Batteries and accumulators

Batteries and accumulators can be labeled with this symbol.

The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin.

The end user within the EU is legally obligated to return used batteries. Outside the validity of the EU Directive 2006/66/EC keep the stipulated directives.

Used batteries can contain hazardous substances, which can harm the environment or the people´s health when they are improper stored or disposed of.

After use, the batteries or accumulators contained in Rexroth products have to be properly disposed of according to the country-specific collection.

Recycling

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

Environmental protection and disposal

Metals contained in electric and electronic modules can also be recycled by means of special separation processes.

Products made of plastics can contain flame retardants. These plastic parts are labeled according to EN ISO 1043. They have to be recycled separately or disposed of according to the valid legal requirements.

22 Service and support

Our worldwide service network provides an optimized and efficient support. Our experts offer you advice and assistance should you have any queries. You can contact us **24/7**.

Service Germany

Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the **Service Hotline** and **Service Helpdesk** under:

Phone:	**+49 9352 40 5060**
Fax:	**+49 9352 18 4941**
E-mail:	service.svc@boschrexroth.de
Internet:	http://www.boschrexroth.com

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide

Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information

To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

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