Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth Bosch Group

Rexroth IndraDrive Drive Controllers Control Sections

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Edition 05

Project Planning Manual

Title Rexroth IndraDrive
Drive Controllers
Control Sections

Type of Documentation Project Planning Manual

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Purpose of Documentation This documentation provides information on …

- how to design the control cabinet
- how to install the drive system

Record of Revisions

Description	Release Date	Notes
DOK-INDRV*-CSH********-PR01-DE-P	11.2003	First edition
DOK-INDRV*-CSH********-PR02-DE-P	04.2004	Revision
DOK-INDRV*-CSH********-PR03-EN-P	02.2005	Revision (not published)
DOK-INDRV*-CSH********-PR04-EN-P	07.2005	Revision
DOK-INDRV*-CSH********-PR05-EN-P	01.2006	Revision

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

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Bgm.-Dr.-Nebel-Str. 2 • D-97816 Lohr a. Main
Telephone +49 (0)93 52/40-0 • Tx 68 94 21 • Fax +49 (0)93 52/40-48 85
http://www.boschrexroth.de/
Dept. BRC/EDY1

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

Contents

1 Introduction

1.1 Guide to the Documentation

Document Structure

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4	Brief Description, Applications	**product description** (for those doing project planning)
5	Identifying the Control Section	
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9	Other Technical Data	
10	Accessory	
11	Disposal and Environmental Protection	**practical application** (for operators and maintenance staff)
12	Service & Support	general **information**
13	Index	

Fig. 1-1: Document structure

Reference Documentations

Title	Type of documentation	Document typecode[1)]
Rexroth IndraDrive Drive System	Project Planning Manual	DOK-INDRV*-SYSTEM*****-PRxx-EN-P
Rexroth IndraDrive Drive Controllers Control Sections Cxx	Project Planning Manual	DOK-INDRV*-CSH********-PRxx-EN-P
Rexroth IndraDrive Supply Units HMV01	Project Planning Manual	DOK-INDRV*-HMV-*******-PRxx-EN-P
Rexroth IndraDrive M Drive Controllers Power Sections HMx01	Project Planning Manual	DOK-INDRV*-HMS+HMD****-PRxx-EN-P
Rexroth IndraDrive C Drive Controllers Power Sections HCS02.1	Project Planning Manual	DOK-INDRV*-HCS02.1****-PRxx-EN-P
Rexroth IndraDrive C Drive Controllers Power Sections HCS03.1	Project Planning Manual	DOK-INDRV*-HCS03.1****-PRxx-EN-P
Rexroth IndraDrive Additional Components	Project Planning Manual	DOK-INDRV*-ADDCOMP****-PRxx-EN-P
Rexroth IndraDrive Integrated Safety Technology	Functional and Application Description	DOK-INDRV*-SI*-**VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Functional Description	DOK-INDRV*-MP*-02VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Functional Description	DOK-INDRV*-MP*-03VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Functional Description	DOK-INDRV*-MP*-04VRS**-FKxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Parameter Description	DOK-INDRV*-GEN-**VRS**-PAxx-EN-P
Rexroth IndraDrive Firmware for Drive Controllers	Troubleshooting Guide	DOK-INDRV*-GEN-**VRS**-WAxx-EN-P
Rexroth Connection Cables	Selection Data	DOK-CONNEC-CABLE*STAND-AUxx-EN-P
Rexroth IndraDyn A Asynchronous Motors	Project Planning Manual	DOK-MOTOR*-MAD/MAF****-PRxx-EN-P
Rexroth IndraDyn H Frameless Synchronous Spindle Motors	Project Planning Manual	DOK-MOTOR*-MBS-H******-PRxx-EN-P
Rexroth IndraDyn L Synchronous Linear Motors	Project Planning Manual	DOK-MOTOR*-MLF********-PRxx-EN-P
Rexroth IndraDyn S Synchronous Motors	Project Planning Manual	DOK-MOTOR*-MSK********-PRxx-EN-P
Rexroth IndraDyn T Synchronous Torque Motors	Project Planning Manual	DOK-MOTOR*-MBT********-PRxx-EN-P
Third-Party Motors	Project Planning and Commissioning Manual	DOK-DRIVE*-3RDPART*MOT-AWxx-EN-P
Safety Instructions for Electrical Drives	Safety Guidelines	DOK-GENERAL-DRIVE******-SVSx-MS-P

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

Fig. 1-2: Documentations - overview

Box with Project Planning Manuals on Rexroth IndraDrive

You can order all the Project Planning Manuals on the drive system Rexroth IndraDrive in a box. This box contains:

- Project Planning Manual Drive System
- Project Planning Manual Control Sections CSx
- Project Planning Manual Supply Units HMV01
- Project Planning Manual Power Sections HMx
- Project Planning Manual Power Sections HCS02.1
- Project Planning Manual Power Sections HCS03.1
- Project Planning Manual Additional Components

Order data of the box:

- part number: R911310293
- document typecode: DOK-INDRV*-PROJEKTIER*-8201-EN-P

Your Feedback

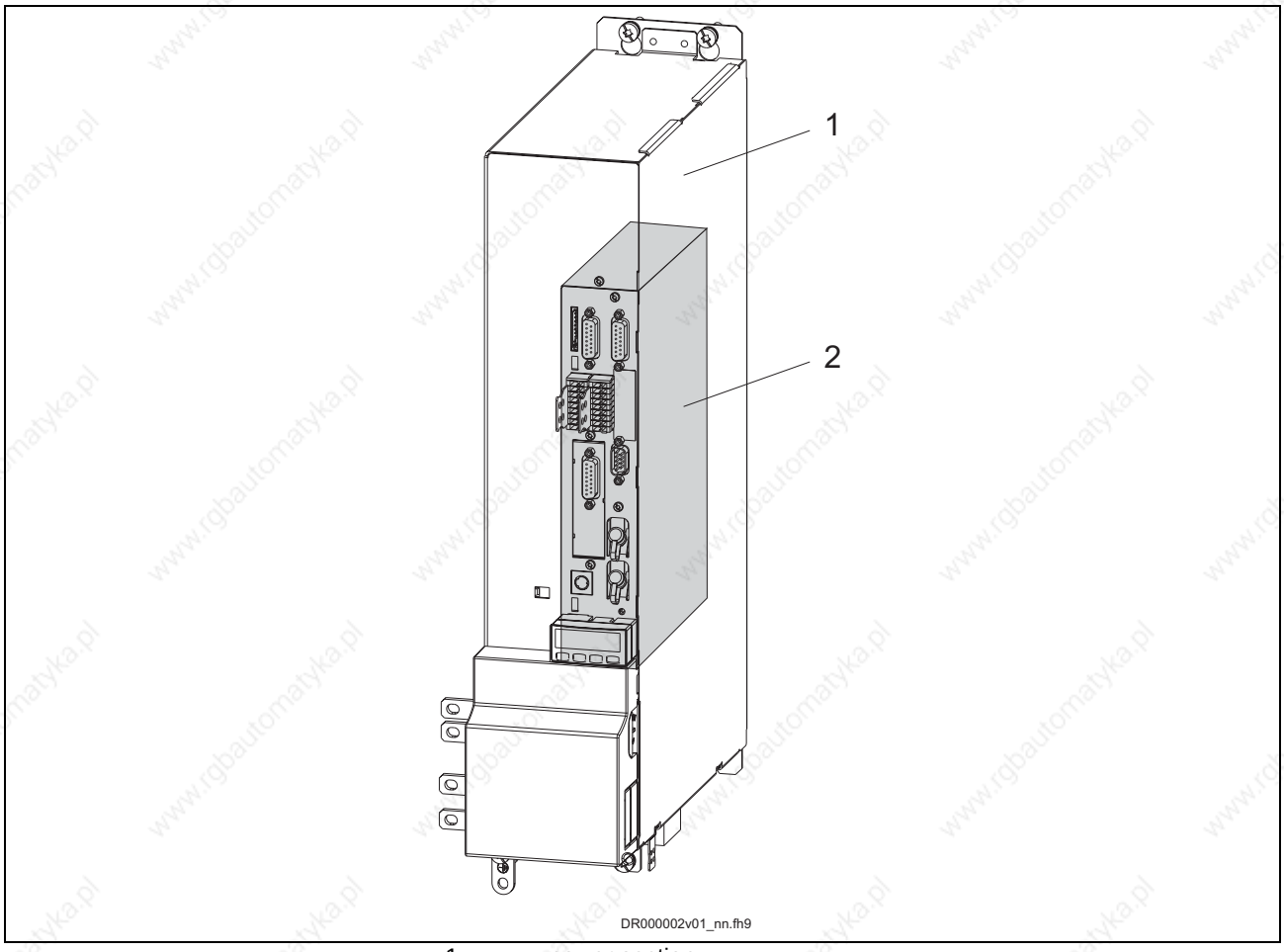
Your experience is important for our improvement processes of products and documentations.

Inform us about mistakes you discovered and changes you suggest; we would be grateful for your feedback.

Please send your remarks to:

Bosch Rexroth AG
Dept. BRC/EDY1
Bürgermeister-Dr.-Nebel-Str. 2
97816 Lohr
Germany
Telefax +49 (0) 93 52 / 40-43 80

1.2 Basic Design of the Rexroth IndraDrive Controllers



1: power section
2: control section

Fig. 1-3: Basic design of the Rexroth IndraDrive controllers

The drive controller consists of two essential parts:

- power section
- control section

For detailed information on the power sections see Project Planning Manuals for Rexroth IndraDrive Power Sections (see page 1-2).

Delivery

The control section is a separate component that is plugged into the power section. As a standard, the drive controller is supplied ex works complete with control section. In exceptional cases, control sections can be delivered separately.

Mounting and Dismounting the Control Section

In case the control section is delivered separately, observe the following instructions:

Training

CAUTION

Risk of damage to the control section by inappropriate handling!

⇒ Only such persons trained by Rexroth for mounting and dismounting control sections are allowed to mount and dismount control sections.

ESD Protection

CAUTION

Risk of damage to the control section and interference with their operational safety caused by electrostatic charges!

Exposed conductive parts coming into contact with the control section must be previously discharged by means of grounding.

Such exposed conductive parts include:

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

Control sections may only be stored or dispatched in conductive packaging.

Limited Number of Plug-In Actions

CAUTION

Risk of damage to the control section or power section by mounting and dismounting the control section too often!

⇒ For a drive controller the control section mustn't be mounted and dismounted more than a maximum of **20 times**.

2 Important Directions for Use

2.1 Appropriate Use

Introduction

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

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

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

Before using Rexroth products, make sure that all the pre-requisites for an appropriate use of the products are satisfied:

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

Areas of Use and Application

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

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

Note: The drive controllers may only be used with the accessories and parts specified in this document. If a component has not been specifically named, then it may not be either mounted or connected. The same applies to cables and lines.

Operation is only permitted in the specified configurations and combinations of components using the software and firmware as specified in the relevant Functional Descriptions.

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

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

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

Typical applications of the drive controllers include:

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

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

2.2 Inappropriate Use

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

Drive controllers must not be used, if

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

3 Safety Instructions for Electric Drives and Controls

3.1 General Information

Using the Safety Instructions and Passing them on to Others

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

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

WARNING

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

Instructions for Use

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

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

- The devices have been designed for installation in industrial machinery.
- The ambient conditions given in the product documentation must be observed.
- Only use safety-relevant applications that are clearly and explicitly approved in the Project Planning Manual. If this is not the case, they are excluded.
  Safety-relevant are all such applications which can cause danger to persons and material damage.
- The information given in the documentation of the product with regard to the use of the delivered components contains only examples of applications and suggestions.

  The machine and installation manufacturer must
  - make sure that the delivered components are suited for his individual application and check the information given in this documentation with regard to the use of the components,
  - make sure that his application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Startup of the delivered components is only permitted once it is sure that the machine or installation in which they are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only permitted if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the documentation "EMC in Drive and Control Systems".
- The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national regulations.
- Technical data, connections and operational conditions are specified in the product documentation and must be followed at all times.

Explanation of Warning Symbols and Degrees of Hazard Seriousness

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

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

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

Hazards by Improper Use

DANGER

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

DANGER

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

WARNING

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

WARNING

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

CAUTION

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

CAUTION

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

CAUTION

Risk of injury by improper handling of batteries!

3.2 Instructions with Regard to Specific Dangers

Protection Against Contact with Electrical Parts

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

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

DANGER

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

- ⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain and repair this equipment.
- ⇒ Follow general construction and safety regulations when working on electrical power installations.
- ⇒ Before switching on the device, the equipment grounding conductor must have been non-detachably connected to all electrical equipment in accordance with the connection diagram.
- ⇒ Do not operate electrical equipment at any time, even for brief measurements or tests, if the equipment grounding conductor is not permanently connected to the mounting points of the components provided for this purpose.
- ⇒ Before working with electrical parts with voltage potentials higher than 50 V, the device must be disconnected from the mains voltage or power supply unit. Provide a safeguard to prevent reconnection.
- ⇒ With electrical drive and filter components, observe the following:

  Wait 30 minutes after switching off power to allow capacitors to discharge before beginning to work. Measure the voltage on the capacitors before beginning to work to make sure that the equipment is safe to touch.
- ⇒ Never touch the electrical connection points of a component while power is turned on.
- ⇒ Install the covers and guards provided with the equipment properly before switching the device on. Before switching the equipment on, cover and safeguard live parts safely to prevent contact with those parts.
- ⇒ A residual-current-operated circuit-breaker or r.c.d. cannot be used for electric drives! Indirect contact must be prevented by other means, for example, by an overcurrent protective device according to the relevant standards.
- ⇒ Secure built-in devices from direct touching of electrical parts by providing an external housing, for example a control cabinet.

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

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

With electrical drive and filter components, observe the following:

DANGER

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

⇒ Before switching on, the housings of all electrical equipment and motors must be connected or grounded with the equipment grounding conductor to the grounding points. This is also applicable before short tests.

⇒ The equipment grounding conductor of the electrical equipment and the units must be non-detachably and permanently connected to the power supply unit at all times. The leakage current is greater than 3.5 mA.

⇒ Over the total length, use copper wire of a cross section of a minimum of 10 mm^2 for this equipment grounding connection!

⇒ Before start-up, also in trial runs, always attach the equipment grounding conductor or connect with the ground wire. Otherwise, high voltages may occur at the housing causing electric shock.

Protection Against Electric Shock by Protective Low Voltage (PELV)

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

WARNING

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

⇒ To all connections and terminals with voltages between 0 and 50 Volt, only devices, electrical components, and conductors may be connected which are equipped with a PELV (Protective Extra-Low Voltage) system.

⇒ Connect only voltages and circuits which are safely isolated from dangerous voltages. Safe isolation is achieved for example by isolating transformers, safe optocouplers or battery operation without mains connection.

Protection Against Dangerous Movements

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

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

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

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

DANGER

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

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

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

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

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

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

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

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

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

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

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

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

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

⇒ Disconnect electrical power to the equipment using a master switch and secure the switch against reconnection for:

- maintenance and repair work
- cleaning of equipment
- long periods of discontinued equipment use

⇒ Prevent the operation of high-frequency, remote control and radio equipment near electronics circuits

and supply leads. If the use of such devices cannot be avoided, verify the system and the installation for possible malfunctions in all possible positions of normal use before initial startup. If necessary, perform a special electromagnetic compatibility (EMC) test on the installation.

Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

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

WARNING

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

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

- Areas in which electrical equipment and parts are mounted, being operated or commissioned.
- Areas in which parts of motors with permanent magnets are being stored, repaired or mounted.

⇒ If it is necessary for somebody with a pacemaker to enter such an area, a doctor must be consulted prior to doing so. The interference immunity of present or future implanted heart pacemakers differs greatly, so that no general rules can be given.

⇒ Those with metal implants or metal pieces, as well as with hearing aids must consult a doctor before they enter the areas described above. Otherwise health hazards may occur.

Protection Against Contact with Hot Parts

CAUTION

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

⇒ Do not touch surfaces of device housings and chokes in the proximity of heat sources! Danger of burns!

⇒ Do not touch housing surfaces of motors! Danger of burns!

⇒ According to operating conditions, temperatures can be **higher than 60 °C, 140 °F** during or after operation.

⇒ Before accessing motors after having switched them off, let them cool down for a sufficiently long time. Cooling down can require **up to 140 minutes**! Roughly estimated, the time required for cooling down is five times the thermal time constant specified in the Technical Data.

⇒ After switching drive controllers or chokes off, wait 15 minutes to allow them to cool down before touching them.

⇒ Wear safety gloves or do not work at hot surfaces.

⇒ For certain applications, the manufacturer of the end product, machine or installation, according to the respective safety regulations, has to take measures to avoid injuries caused by burns in the end application. These measures can be, for example: warnings, guards (shielding or barrier), technical documentation.

Protection During Handling and Mounting

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

CAUTION

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

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

Battery Safety

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

CAUTION

Risk of injury by improper handling!

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

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

Protection Against Pressurized Systems

According to the information given in the Project Planning Manuals, motors cooled with liquid and compressed air, as well as drive controllers, can be partially supplied with externally fed, pressurized media, such as compressed air, hydraulics oil, cooling liquids, and cooling lubricating agents. In these cases, improper handling of external supply systems, supply lines, or connections can cause injuries or damages.

CAUTION

Risk of injury by improper handling of pressurized lines!

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

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

4 Brief Description, Applications

4.1 Terms

Control Section

The control section is a separate component which is plugged into the power section.

Basic Control Section Circuit Board

The basic control section circuit board is the main part of the control section. It has its own interfaces and, in the case of configurable control sections, additional optional slots for optional modules.

Optional Slot

Slot into which you can plug an optional module. Only configurable control sections have optional slots.

Optional Module

By means of optional modules, the configurable control sections are equipped with various functions. There are optional modules for:

- master communications
- encoder evaluation
- I/O extensions
- safety technology
- control panels

Master Communication

Depending on the kind of command value input, we distinguish different master communications. Command values can be input via field buses, SERCOS, digital or analog inputs.

Configuration

Configuration means combination of optional modules to form a configured control section which is ideally suited for the intended application.

4.2 Fields of Application 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 realizes a large number of drive tasks in the most varied applications.

Fields of Application

Typical fields of application in the following 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 various control sections of different configurations available.

4.3 Control Sections CSH01, CSB01, CDB01

Control sections CSH, CSB and CDB are used to

- operate drive controllers HMS, HMD and HCS
- fulfill open-loop and closed-loop control tasks with analog command value input

The different control sections can be used as follows:

Device type	Usage
CSH01	**Advanced** The CSH01 control section is used in HMS01, HCS02 and HCS03 drive controllers.
CSB01	**BASIC single-axis** The CSB01 control section is used in HMS01, HCS02 and HCS03 drive controllers.
CDB01	**BASIC double-axis** The CDB01 control section is used • in HMD01 drive controllers and • in HAC01.1 control section housings

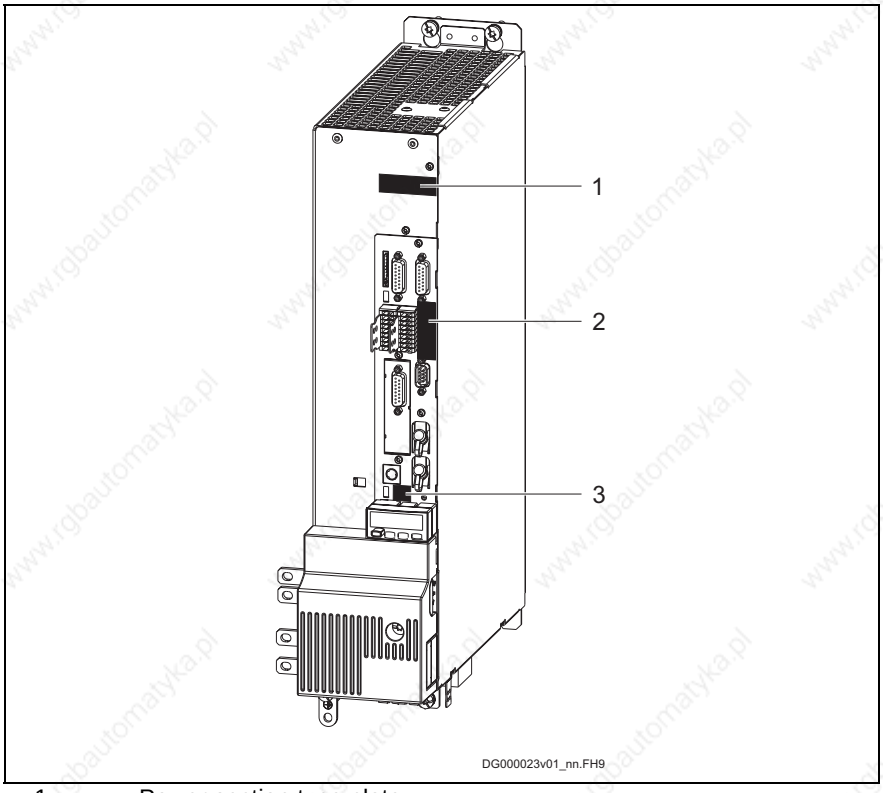
Fig. 4-1: Control section usage

5 Identifying the Control Section

5.1 Type Plates

Each drive component is marked by a type designation.
There is a type plate attached to all devices.

Type Plates at the Drive Controller



1: Power section type plate
2: Control section type plate
3: Firmware type plate

Fig. 5-1: Type plates at the drive controller

Type Plates at the Control Section

Control Section Type Plate

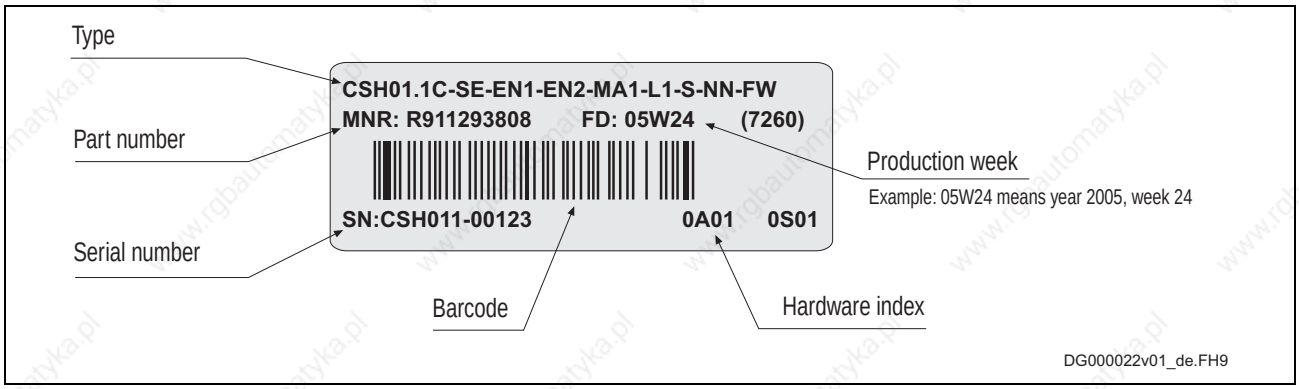


Fig. 5-2: Control section type plate (example)

Firmware Type Plate

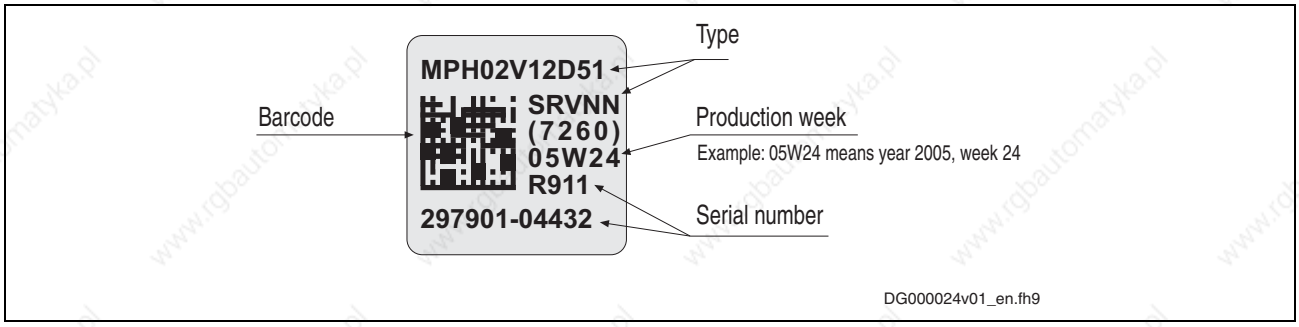


Fig. 5-3: Firmware type plate (example)

Example of Text for Purchase Order

The text for the purchase order of the product firmware consists of:

- IndraDrive firmware: FWA-INDRV*
- base package: MPH
- version: 02V
- latest release: RS (in the illustrated example the release is "12")
- language: D5
- other

FWA-INDRV*-MPH-02VRS-D5-1-NNN-NN

For further information see documentation "Rexroth IndraDrive, Firmware for Drive Controllers MPH-03, MPD-03, MPB-03, Functional Description"; part number R911308329.

Your sales representative will help you select the appropriate firmware.

6 Rexroth IndraDrive Control Sections

6.1 Overview of Types

Control section range	Characteristic	Type	Features
BASIC	BASIC OPEN LOOP	CSB01.1N-FC (Basic 1)	not configurable single-axis
	BASIC SERCOS	CSB01.1N-SE (Basic 2)	not configurable 1) single-axis
	BASIC ProfiBus	CSB01.1N-PB (Basic 3)	not configurable 1) single-axis
	BASIC Analog	CSB01.1N-AN (Basic 4)	not configurable 1) single-axis
BASIC UNIVERSAL	BASIC UNIVERSAL	CSB01.1C (Basic 5)	configurable single-axis
		CDB01.1C	configurable double-axis
ADVANCED	ADVANCED	CSH01.1C CSH01.2C	configurable single-axis

1) exception: option L1 (starting lockout) is possible

Fig. 6-1: Control section overview

6.2 Overview of Functions and Interfaces

The control sections differ with regard to their configurability, the available interfaces, as well as the cycle times or switching frequencies (pulse frequencies). The table below contains an overview:

	CSB01.1N-FC	CSB01.1N-SE	CSB01.1N-PB	CSB01.1N-AN	CSB01.1C	CDB01.1C	CSH01.1C CSH01.2C
configurable	no	no	no	no	yes	yes	yes
configuration slots safety technology	0	1 [1)]	1 [1)]	1 [1)]	1	2	1
serial interface RS232	1	1	1	1	1	1	1
inputs/outputs:							
number of digital inputs	8	8	8	9	8	22	11
thereof probe	0	1	1	0	1	2	2
number of digital outputs	0	3	3	4	3	4	4
number of analog inputs	2 voltage; 2 current	0	0	2	0	1	1
number of analog outputs	2	0	0	0	0	2	2
number of relay contacts	1 N/O; 2 changeover switches	1 N/O	1 N/O	1 N/O	1 N/O	1 N/O	1 N/O
cycle times [2)]:							
current control	125 µs	125 µs	125 µs	125 µs	125 µs	125 µs	62,5 µs/ 125 µs
velocity control	250 µs/ 500 µs	250 µs/ 500 µs	250 µs/ 500 µs	250 µs/ 500 µs	250 µs/ 500 µs	250 µs/ 500 µs	125 µs/ 250 µs
position control	500 µs/ 1000 µs	500 µs/ 1000 µs	500 µs/ 1000 µs	500 µs/ 1000 µs	500 µs/ 1000 µs	500 µs/ 1000 µs	250 µs/ 500 µs
minimum SERCOS cycle time	-	1000 µs	-	-	1000 µs	1000 µs	250 µs
switching frequencies [3)]:							
2 kHz	x	x	x	x	x	x	x
4 kHz	x	x	x	x	x	x	x
8 kHz	x	x	x	x	x	x	x
12 kHz	--	--	--	--	--	--	x
16 kHz	--	--	--	--	--	--	x

1) option starting lockout can be configured
2) cycle times depend on firmware version
3) clock frequencies also depend on power section

Fig. 6-2: Overview of control section functions

Note: For more details on possible configurations please see chapter "Optional Slots" in the description of the respective control section.

6.3 BASIC Control Sections

Type Codes BASIC and BASIC UNIVERSAL

Type Code BASIC CSB01.1N

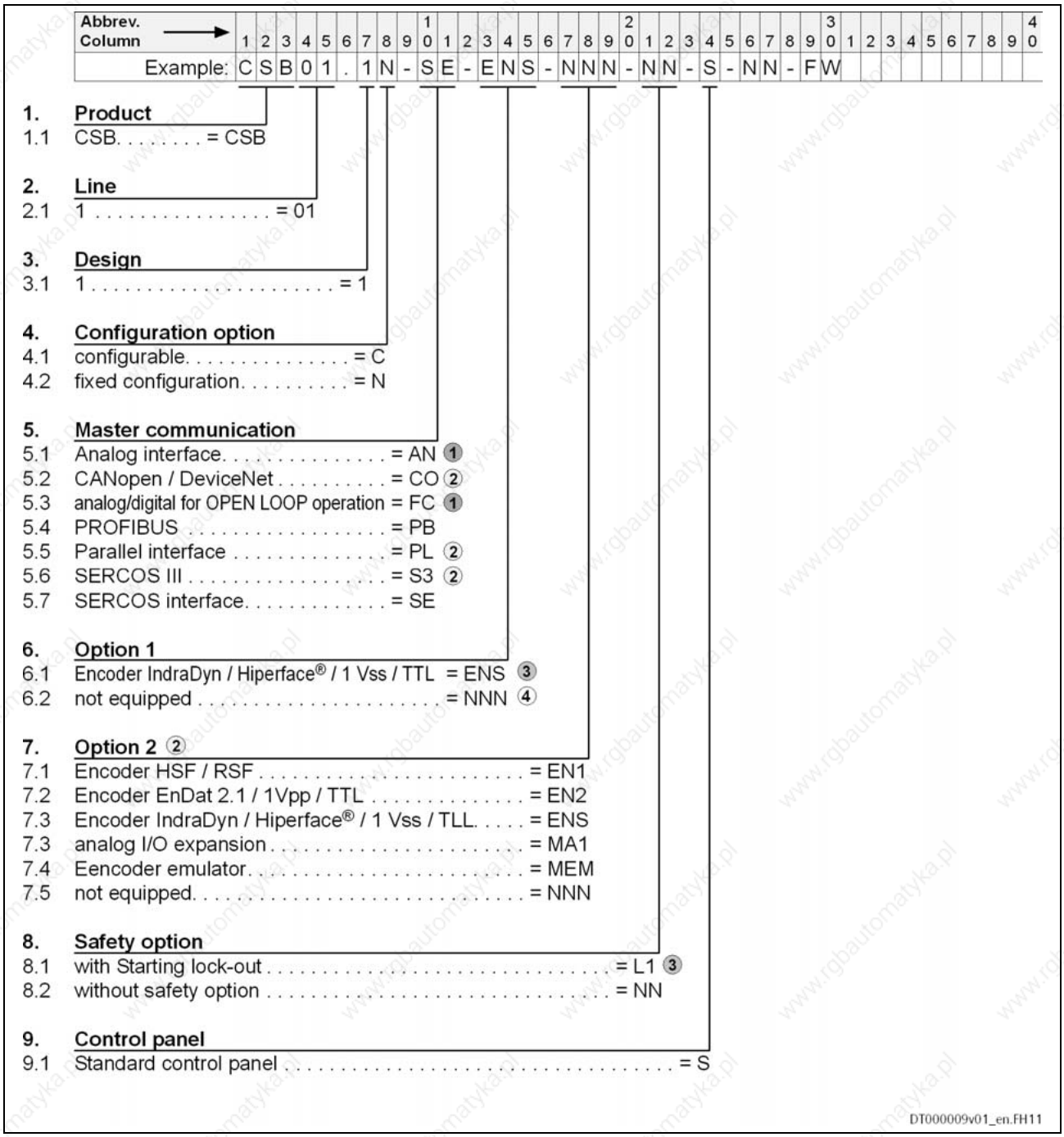


Fig. 6-3: Type code control section BASIC (single-axis); (to be continued on next page)

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:	C	S	B	0	1	.	1	N	-	S	E	-	E	N	S	-	N	N	N	-	N	N	-	S	-	N	N	-	F	W											

10. Other design

10.1 none . . . . . = NN

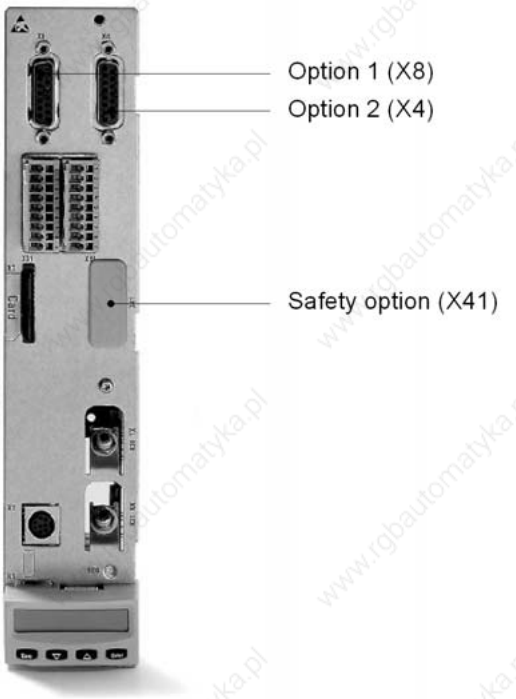
11. Firmware

11.1 Denotes that firmware must be ordered as separate subposition. . . . . = FW

Note:

1. only available if configuration option "N"
2. only available if configuration option "C"
3. not available if master communication "FC"
4. only available for master communication "FC"

Illustration example: CSB01.1



DT000010v01_en.FH1

Fig. 6-4: Type code control section BASIC (single-axis); (continuation)

Type Code BASIC UNIVERSAL Single-Axis CSB01.1C

see type code BASIC CSB01.1N

Type Code BASIC UNIVERSAL Double-Axis CDB01.1C

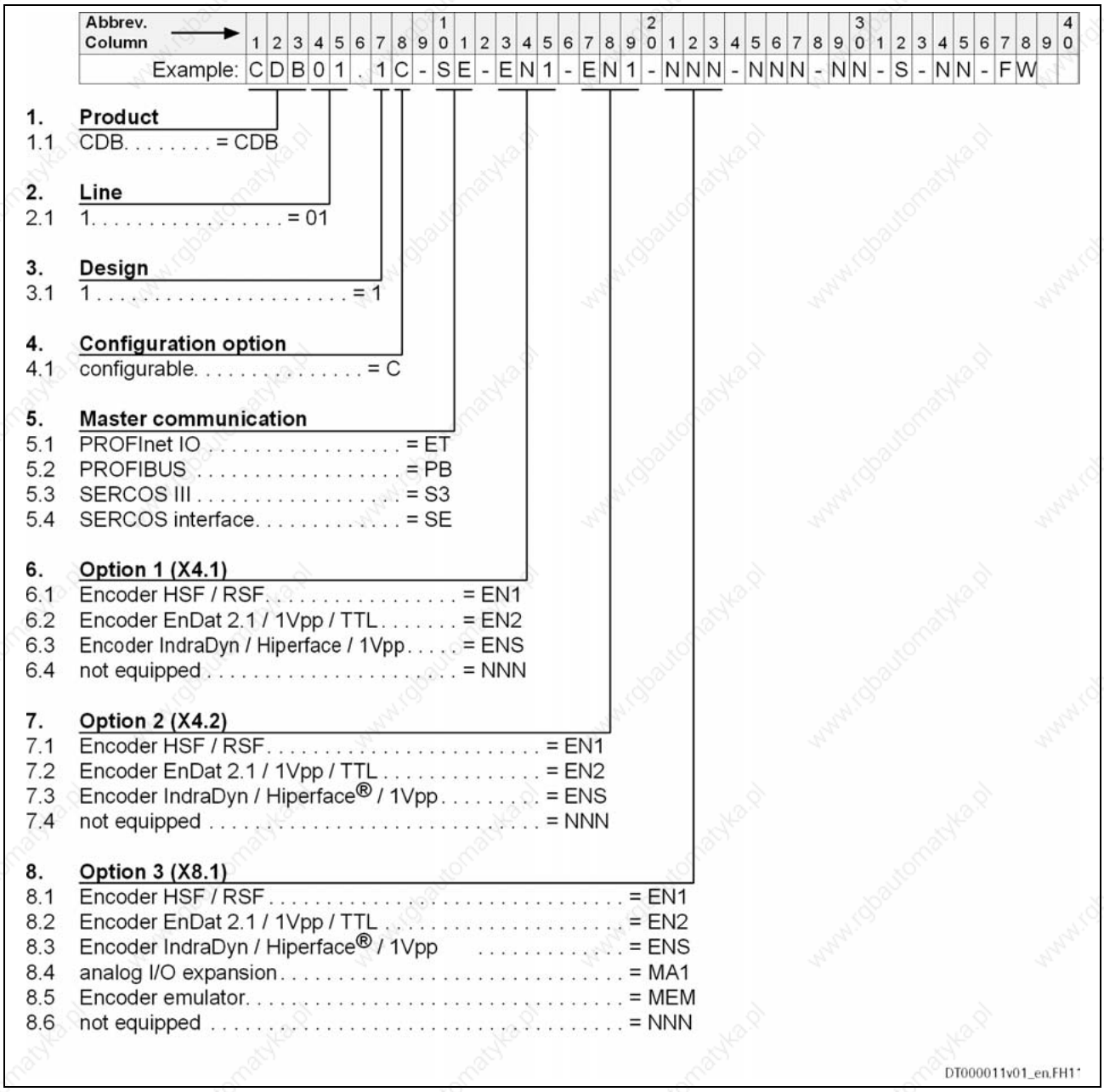


Fig. 6-5: Type code control section BASIC (double-axis); (to be continued on next page)

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:	C	D	B	0	1	.	1	C	-	S	E	-	E	N	1	-	E	N	1	-	N	N	N	-	N	N	-	S	-	N	N	-	F	W							

9. Option 4 (X8.2)

9.1	Encoder HSF / RSF	= EN1
9.2	Encoder EnDat 2.1 / 1Vpp / TTL	= EN2
9.3	Encoder IndraDyn / Hiperface® / 1Vpp	= ENS
9.4	analog I/O expansion	= MA1
9.5	Encoder emulator	= MEM
9.6	not equipped	= NNN

10. Safety option (X41.1 / X42.1)

10.1	with Starting lock-out	= L1
10.2	without safety option	= NN
10.3	with Safety technology I/O	= S1 ①

11. Control panel

11.1	standard control panel	= S

12. Other design

12.1	none	= NN

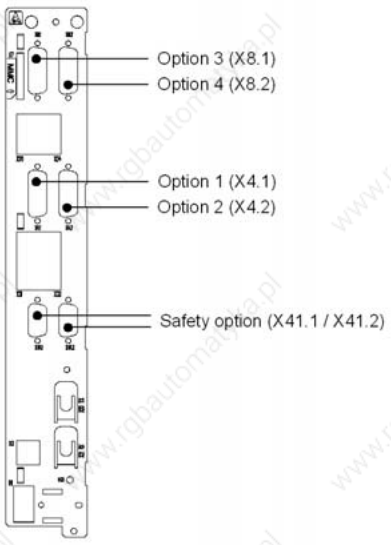
13. Firmware

13.1	Denotes that firmware must be ordered as separate subposition	= FW

Note:

① = only allowed if "Option 1" and "Option 2" have been equipped with an encoder

Illustration example: CDB01.1



DT000012v01_en.FH11

Fig. 6-6: Type code control section double-axis (continuation)

Dimensions BASIC

Dimensions BASIC and BASIC UNIVERSAL Single-Axis

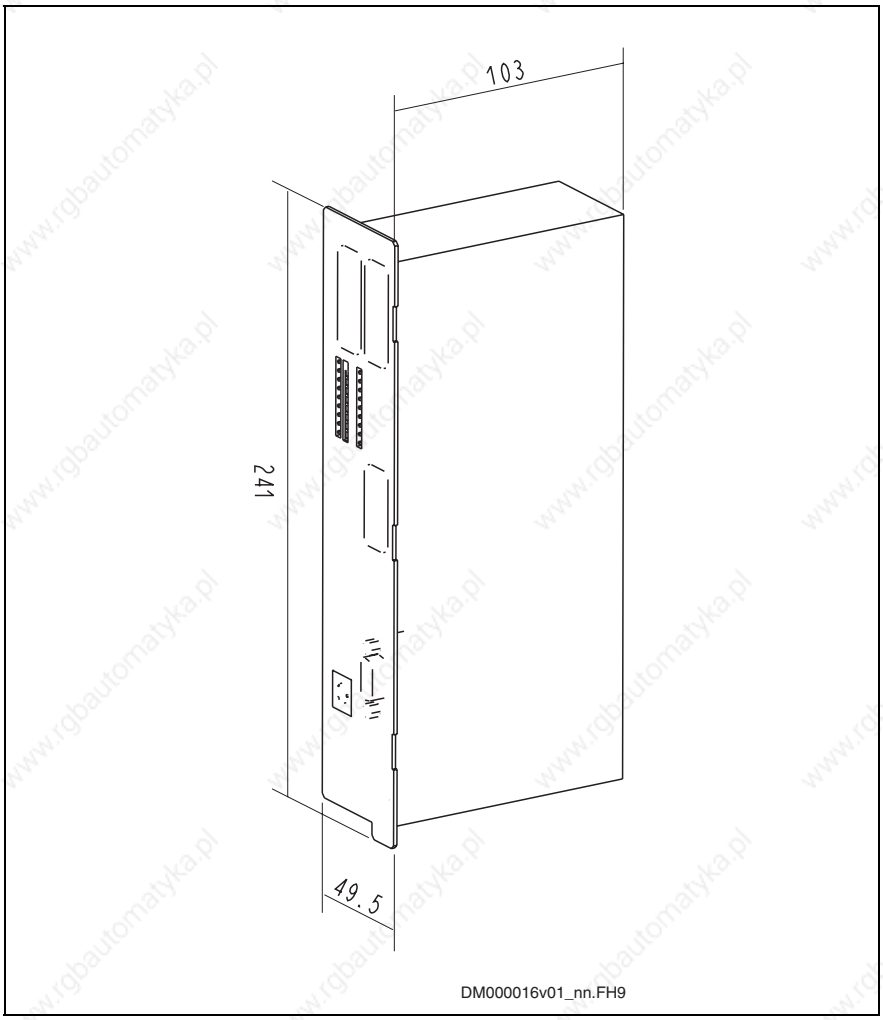


Fig. 6-7: Dimensions CSB

Note: For the mounting dimensions in the front area please see the mounting dimensions of the drive controllers.

Dimensions BASIC UNIVERSAL Double-Axis

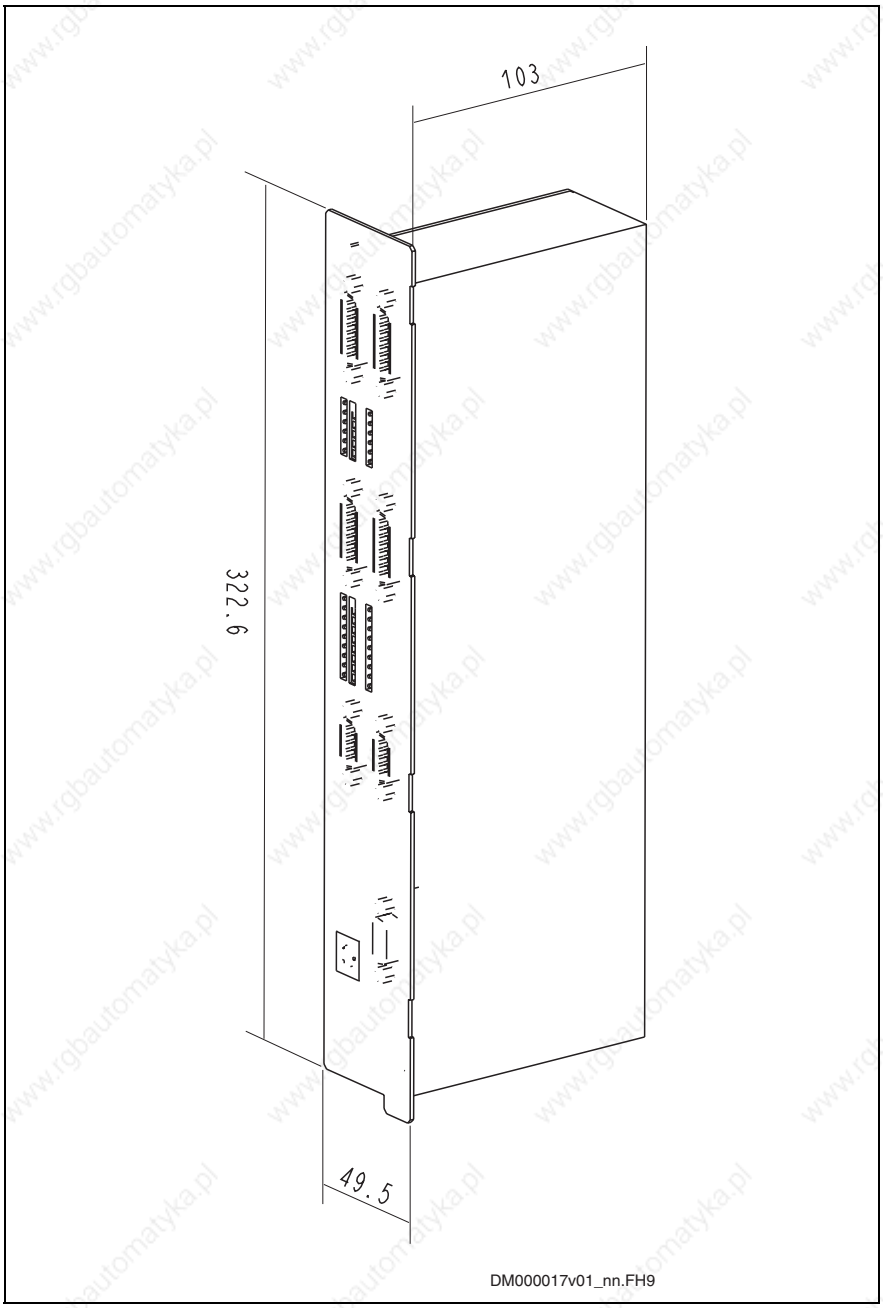
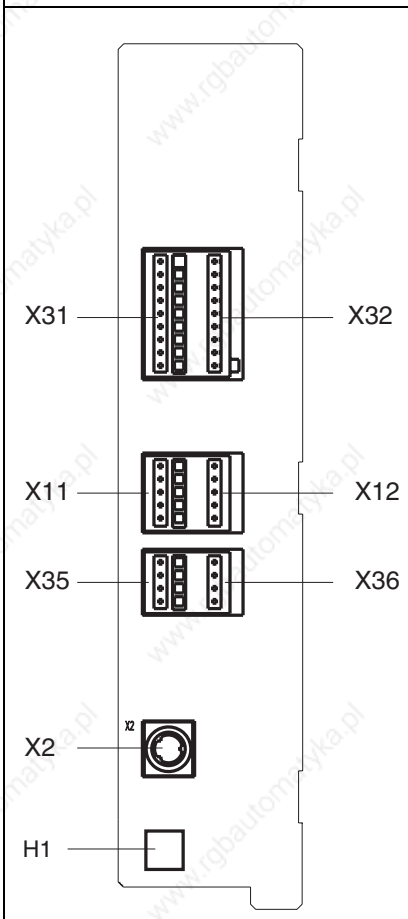
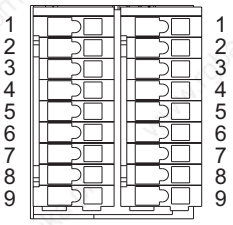
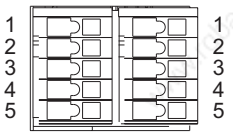
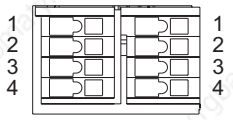
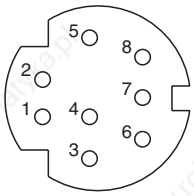


Fig. 6-8: Dimensions CDB

Note: For the mounting dimensions in the front area please see the mounting dimensions of the drive controllers.

BASIC OPENLOOP - CSB01.1N-FC

Front View with Connections at Basic Circuit Board

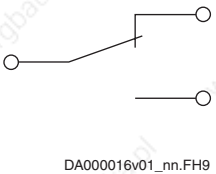
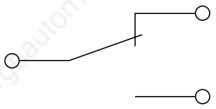
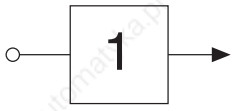
Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description	Figure
 DG000010v01_nn.FH9	X31 / X32	0,08-1,5	28-14	-	digital and analog inputs/outputs; voltage input (24V, 0V)	 DA000051v01_nn.FH9
	X11 / X12	0,08-1,5	28-14	-	relay contacts	 DA000050v01_nn.FH9
	X35 / X36	0,08-1,5	28-14	-	analog inputs / outputs ; voltage output (24V, 0V)	 DA000052v01_nn.FH9
	X2	0,25-0,5	-	-	serial interface	 DA000049v01_nn.FH9
	H1	-	-	-	interface for control panel	-

see also chapter "Connections with Spring Terminals"

Fig. 6-9: Connections BASIC OPENLOOP

Functions

Note: Factory settings depend on the firmware. Following settings are valid for firmware MPx04.

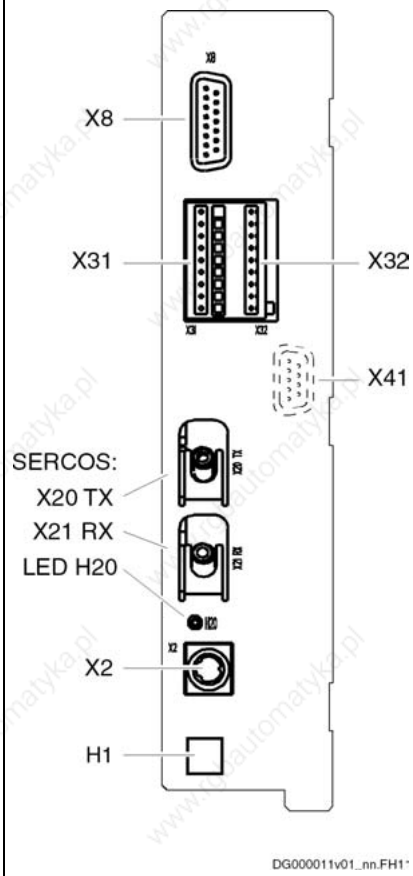
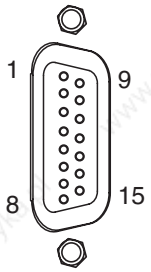
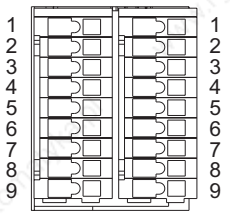
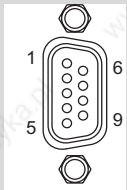
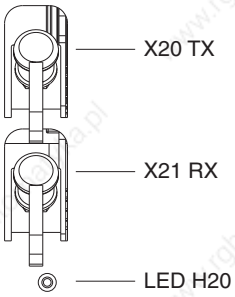
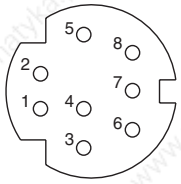
Function			Connection	Factory setting	Nominal data	Technical data
relay contact Rel 3	 DA000016v01_nn.FH9	no Rel 3	X11.3	"speed reached", S-0-0013	AC250V /2A DC30V /1A	relay contact type 1
		com Rel 3	X11.4			
		nc Rel 3	X11.5			
relay contact Rel 2	 DA000016v01_nn.FH9	no Rel 2	X12.3	"Ready", P-0-0115	AC250V /2A DC30V /1A	
		com Rel 2	X12.4			
		nc Rel 2	X12.5			
relay contact Rel 1	 DA000017v01_nn.FH9	no Rel 1	X12.1	ready for operation, P-0-0115	AC250V /2A DC30V /1A	
		no Rel 1	X12.2			
digital inputs	 DA000022v01_nn.FH9	E1	X31.3	"clear error", S-0-0099	24 V / 3 mA	digital inputs
		E2	X31.4	"drive ON", P-0-4028		
		E3	X31.5	"velocity cmd value from memory of fixed values", P-0-1200		
		E4	X31.6	"velocity cmd value from memory of fixed values", P-0-1200		
		E5	X31.7	"velocity cmd value from memory of fixed values", P-0-1200		
		E8	X32.6	"E-Stop", P-0-0223		
		E9	X32.7	"velocity cmd value from memory of fixed values", P-0-1200		
		E10	X32.8	"velocity cmd value from memory of fixed values", P-0-1200		

Function			Connection	Factory setting	Nominal data	Technical data
analog inputs	voltage input	EAn1+	X32.4		+/- 10 V	analog inputs type 1
		EAn1-	X32.5			
	voltage input	EAn2+	X32.1			
		EAn2-	X32.2			
	current input	AI1+	X36.1		0…20 mA	analog inputs type 3
		AI1-	X36.2			
	current input	AI2+	X36.3			
		AI2-	X36.4			
analog output	voltage output	AN1	X32.9		0…+10 V	analog outputs type 1
	reference potential for analog voltage output	A_GND	X32.3			
analog output	voltage output	AN2	X35.3		0…+10 V	analog outputs type 1
	reference potential for analog voltage output	A_GND	X35.4			
input for voltage supply of digital inputs	supply of digital inputs	+24V	X31.8			DC 19…30 V; max. 0,1A
		0V	X31.9			
output (source) for voltage supply of digital inputs	connect supply (source) of digital inputs with X31.8 or X31.9	+24V	X35.1			DC 19…30 V max. 0,1A; protected against polarity reversal; short-circuit proof
		0V	X35.2			
serial interface			X2		corresponds to RS232	see Technical Data Functions

Fig. 6-10: Functions BASIC OPENLOOP

BASIC SERCOS - CSB01.1N-SE

Front View with Connections at Basic Circuit Board

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description	Figure
 DG000011v01_nn.FH1*	X8	0,25-0,5	-	-	encoder evaluation ENS	 DA000053v01_nn.FH9
	X31 / X32	0,08-1,5	28-14	-	digital inputs/outputs; voltage input (24V, 0V)	 DA000051v01_nn.FH9
	X41	0,25-0,5		-	**optional:** starting lockout	 DA000054v01_nn.FH9
	X20; X21			0,3	SERCOS master communication	 DA000055v01_nn.FH9
	X2	0,25-0,5	-	-	serial interface	 DA000049v01_nn.FH9
	H1	-	-	-	interface for control panel	-

see also chapter "Connections with Spring Terminals"

Fig. 6-11: BASIC SERCOS

Functions

Note: Factory settings depend on the firmware. Following settings are valid for firmware MPx04.

Note: Observe that the connections X32.6, X32.7 and X32.8 can be configured as digital input (E8, E9, E10) or digital output (A8, A9, A10).

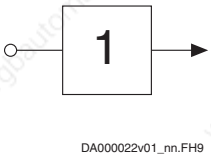
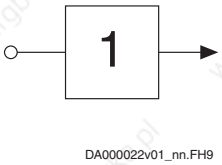
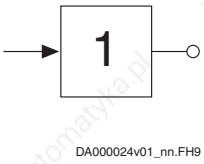
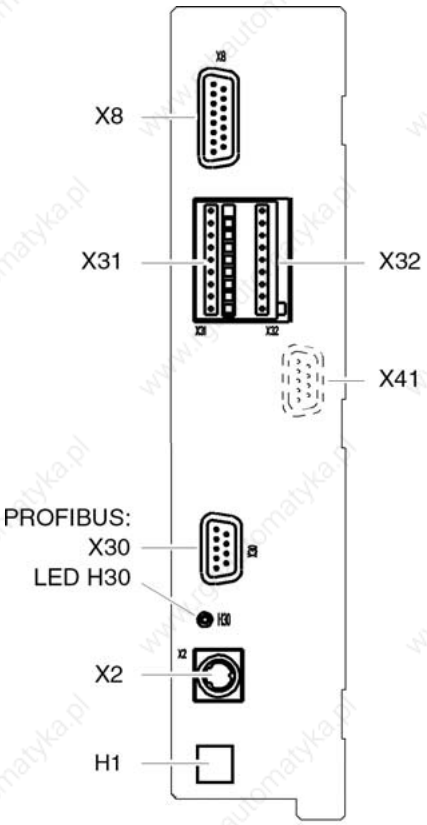
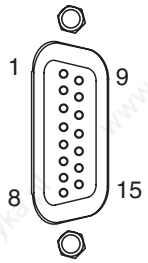
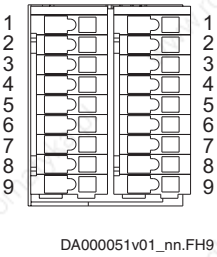
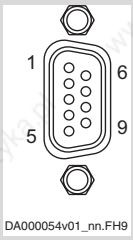
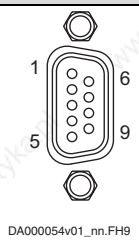
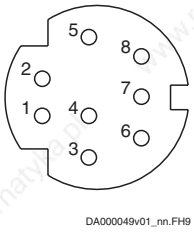
Function			Connection	Factory setting	Nominal data	Technical data
master communication	SERCOS	SE	X20; X21		max. 16 MBaud	see Optional Module Master Communication SERCOS
encoder interfaces	ENS		X8		DC11V6, 300 mA	see Optional Module ENS
relay contact	 DA000017v01_nn.FH9	Rel 1	X31.1	"ready for operation" P-0-0115	DC24V / 1A	relay contact type 2
		Rel 1	X31.2			
digital inputs	 DA000022v01_nn.FH9	E1	X31.3	"probe 1" S-0-0401	can be configured as probe; 24 V / 3 mA; typ. 1 us	digital inputs
	 DA000022v01_nn.FH9	E2	X31.4		24 V / 3 mA	
		E3	X31.5	"travel range limit switch" P-0-0222		
		E4	X31.6	"travel range limit switch" P-0-0222		
		E5	X31.7	"home switch" S-0-0400		
		E8	X32.6	"E-Stop" P-0-0223		
		E9	X32.7			
		E10	X32.8			
digital outputs	 DA000024v01_nn.FH9	A8	X32.6		24 V / 0,5 A	digital outputs
		A9	X32.7			
		A10	X32.8			
voltage supply of digital inputs/outputs	voltage supply of digital inputs/outputs	+24V	X31.8			DC 19…30 V; max. 1,1 A
		0V	X31.9			
serial interface	RS232		X2			serial interface
optional: starting lockout			X41			see Optional Module Starting Lockout

Fig. 6-12: Functions BASIC SERCOS

BASIC PROFIBUS - CSB01.1N-PB

Front View with Connections at Basic Circuit Board

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description	Figure
	X8	0,25-0,5	-	-	encoder evaluation ENS	
	X31 / X32	0,08-1,5	28-14	-	digital inputs/outputs; voltage input (24V, 0V)	
	X41	0,25-0,5		-	**optional:** starting lockout	
	X30	0,08-0,5	-	-	master communication PROFIBUS	
	X2	0,25-0,5	k.A.	-	serial interface	
	H1	-	-	-	Schnittstelle für Bedienteil	-

see also chapter "Connections with Spring Terminals"

Fig. 6-13: BASIC PROFIBUS

Functions

Note: Factory settings depend on the firmware. Following settings are valid for firmware MPx04.

Note: Observe that the connections X32.6, X32.7 and X32.8 can be configured as digital input (E8, E9, E10) or digital output (A8, A9, A10).

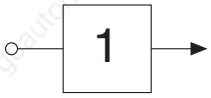
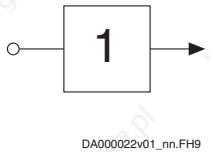
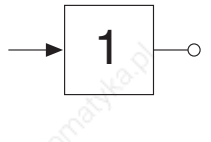
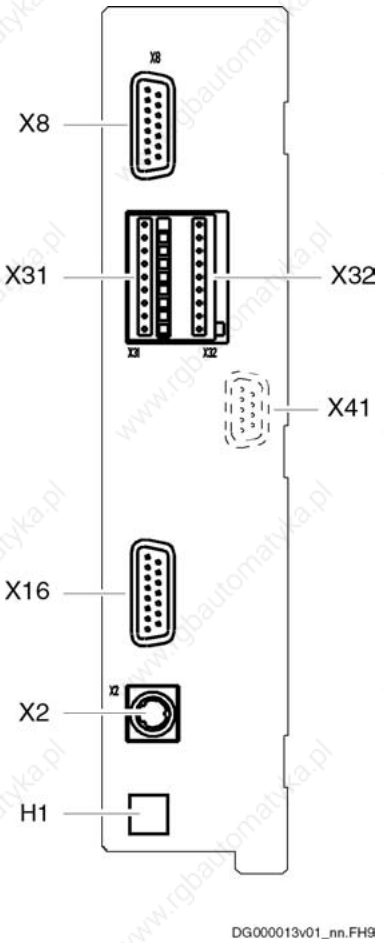
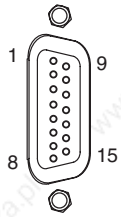
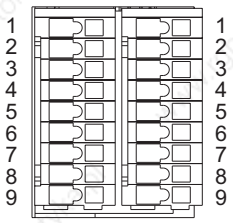
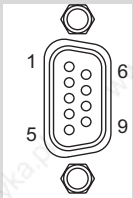
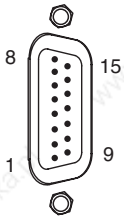
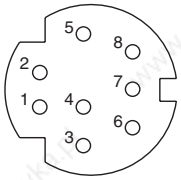
Function			Con-nection point	Factory setting	Nominal data	Technical data
master communication	PROFIBUS	PB	X30		12 MBaud	
encoder interfaces	ENS		X8		DC11V6, 300 mA	see Technical Data Optional Module ENS
relay contact	 DA000017v01_nn.FH9	Rel 1	X31.1	"ready for operation" P-0-0115	DC24V / 1A	relay contact type 2
		Rel 1	X31.2			
digital inputs	 DA000022v01_nn.FH9	E1	X31.3	"probe 1" S-0-0401	can be configured as probe; 24 V / 3 mA; typ. 1us	digital inputs
	 DA000022v01_nn.FH9	E2	X31.4		24 V / 3 mA	digital inputs
		E3	X31.5	"travel range limit switch" P-0-0222		
		E4	X31.6	"travel range limit switch" P-0-0222		
		E5	X31.7	"home switch" S-0-0400		
		E8	X32.6	"E-Stop" P-0-0223		
		E9	X32.7			
		E10	X32.8			
digital outputs	 DA000024v01_nn.FH9	A8	X32.6		24 V / 0,5 A	digital outputs
		A9	X32.7			
		A10	X32.8			
voltage supply of digital inputs/outputs	voltage supply of digital inputs/outputs	+24V	X31.8			DC 19…30 V; max. 1,1A
		0V	X31.9			
serial interface	RS232		X2			serial interface
optional: starting lockout			X41			see Optional Module Starting Lockout

Fig. 6-14: Functions BASIC PROFIBUS

BASIC ANALOG - CSB01.1N-AN

Front View with Connections at Basic Circuit Board

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description	Figure
 DG000013v01_nn.FH9	X8	0,25-0,5	-	-	encoder evaluation ENS	 DA000053v01_nn.FH9
	X31 / X32	0,08-1,5	28-14	-	digital inputs/outputs; voltage input (24V, 0V)	 DA000051v01_nn.FH9
	X41	0,25-0,5		-	**optional:** starting lockout	 DA000054v01_nn.FH9
	X16	0,25-0,5	-	-	encoder emulation MEM	 DA000056v01_nn.FH9
	X2	0,25-0,5	k.A.	-	serielle Schnitt-stelle	 DA000049v01_nn.FH9
	H1	-	-	-	Schnittstelle für Bedienteil	-

see also chapter "Connections with Spring Terminals"

Fig. 6-15: BASIC ANALOG

Functions

Note: Factory settings depend on the firmware. Following settings are valid for firmware MPx04.

Note: Observe that the connections X32.6, X32.7, X32.8 and X32.9 can be configured as digital input (E8, E9, E10, E11) or digital output (A8, A9, A10, A11).

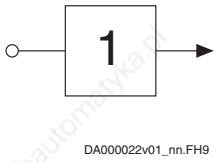
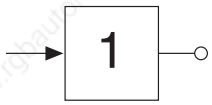
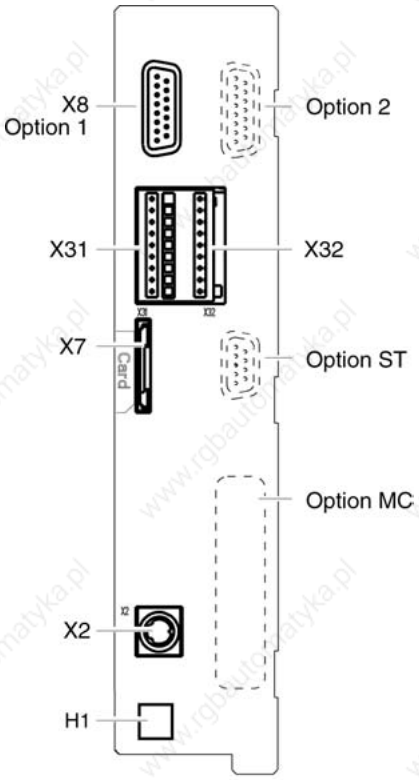
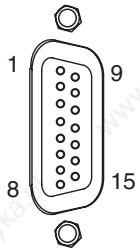
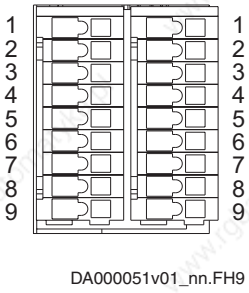
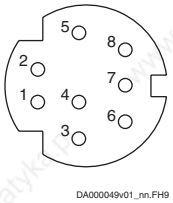
Function			Connection	Factory setting	Nominal data	Technical data
relay contact	 DA000017v01_nn.FH9	Rel 1	X31.1	"ready for operation" P-0-0115	DC24V / 1A	relay contact type 2
		Rel 1	X31.2			
digital inputs	 DA000022v01_nn.FH9	E1	X31.3	"clear error" S-0-0099	24 V / 3 mA	digital inputs
		E2	X31.4	"drive ON" P-0-4028		
		E3	X31.5	"travel range limit switch" P-0-0222		
		E4	X31.6	"travel range limit switch" P-0-0222		
		E5	X31.7	"home switch" S-0-0400		
		E8	X32.6	"E-Stop" P-0-0223		
		E9	X32.7	"Drive Halt" P-0-4028		
		E10	X32.8			
		E11	X32.9			
digital outputs	 DA000024v01_nn.FH9	A8	X32.6		24V / 0,5 A	digital outputs
		A9	X32.7			
		A10	X32.8	"Ready signal" P-0-0115		
		A11	X32.9	"warning" P-0-0115		
analog inputs	voltage input	EAn1+	X32.4		+/-10 V	analog inputs type 1
		EAn1-	X32.5			
	voltage input	EAn2+	X32.1			
		EAn2-	X32.2			
	reference potential for analog input	A_GND	X32.3			
voltage supply of digital inputs/outputs	voltage supply of digital inputs/outputs	+24V	X31.8			DC 19…30 V; max. 1,1 A
		0V	X31.9			
serial interface	RS232		X2			see Technical Data Functions
optional: starting lockout			X41			see Optional Module Starting

Fig. 6-16: Functions BASIC ANALOG

BASIC UNIVERSAL CSB01.1C, Single-Axis

Front View with Connections at Basic Circuit Board

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description	Figure
	X8	0,25-0,5	-	-	encoder evaluation ENS	
					Option 2	
	X31 / X32	0,08-1,5	28-14	-	digital inputs/outputs; voltage input (24V, 0V)	
	X7				memory card slot	
					Option ST	
					Option MC	
	X2	0,25-0,5	-	-	serial interface	
	H1	-	-	-	interface for control panel	-

see also chapter "Connections with Spring Terminals"

Fig. 6-17: BASIC UNIVERSAL CSB01.1C, single-axis

Functions

Note: Observe that the connections X32.6, X32.7 and X32.8 can be configured as digital input (E8, E9, E10) or digital output (A8, A9, A10).

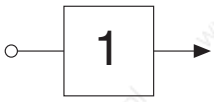
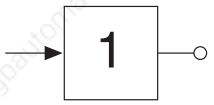
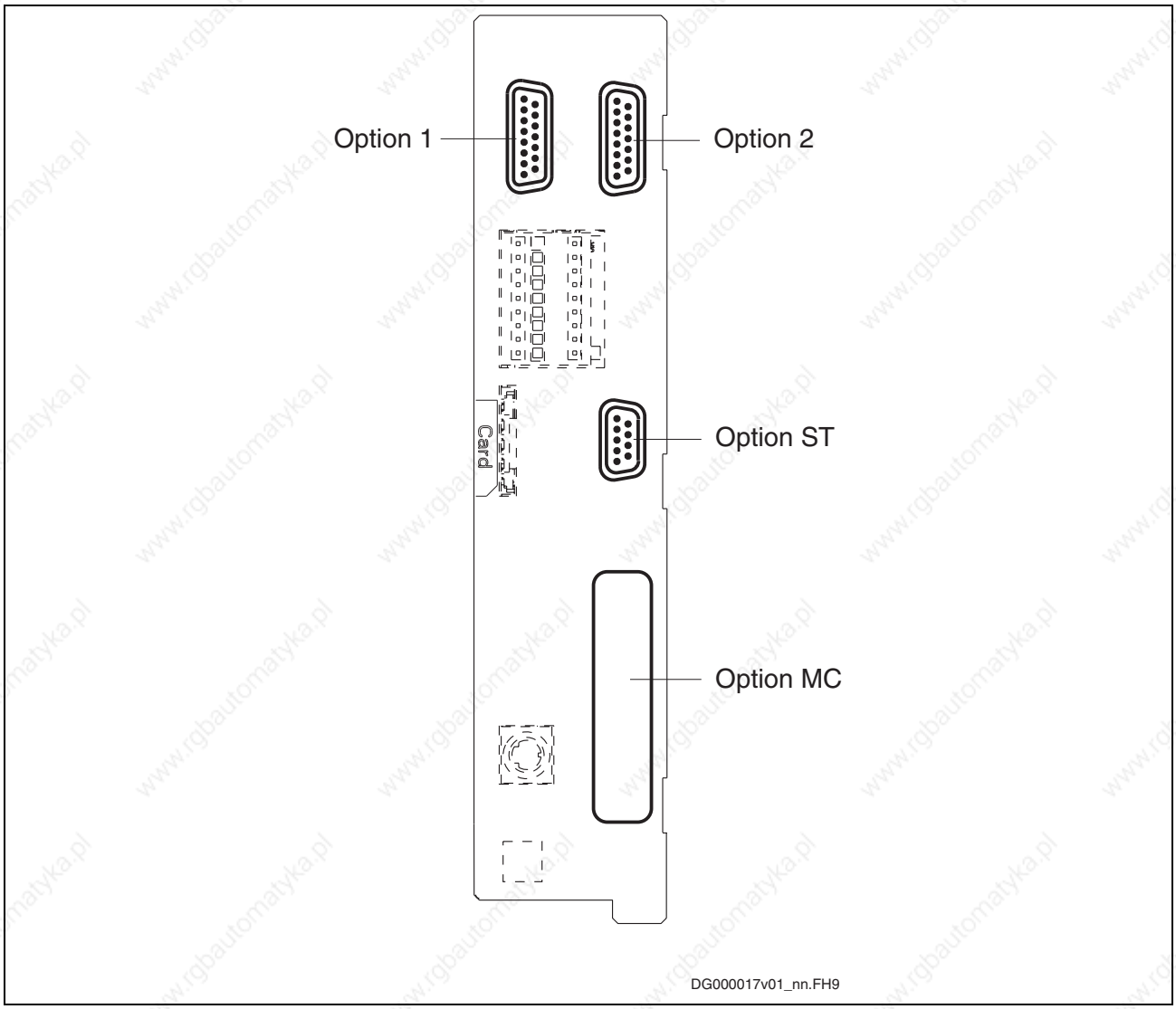
Function			Con-nection	Factory setting	Nominal data	Technical data
master communication	configurable					
encoder interfaces	ENS		X8		DC11V6, 300 mA	see Optional Module ENS
relay contact	 DA000017v01_nn.FH9	Rel 1	X31.1	"ready for operation" P-0-0115	DC24V / 1A	relay contact type 2
		Rel 1	X31.2			
digital inputs	 DA000022v01_nn.FH9	E1	X31.3	"probe 1" S-0-0401	can be configured as probe; 24 V / 3 mA; typ. 1us	digital inputs
	 DA000022v01_nn.FH9	E2	X31.4		24 V / 3 mA	
		E3	X31.5	"travel range limit switch" P-0-0222		
		E4	X31.6	"travel range limit switch" P-0-0222		
		E5	X31.7	"home switch" S-0-0400		
		E8	X32.6	"E-Stop" P-0-0223		
		E9	X32.7			
		E10	X32.8			
digital outputs	 DA000024v01_nn.FH9	A8	X32.6		24 V / 0,5 A	digital outputs
		A9	X32.7			
		A10	X32.8			
voltage supply of digital inputs/outputs		+24V	X31.8			DC 19…30 V; max. 1,1 A
		0V	X31.9			
serial interface	RS232		X2			serial interface
Optional functions	allowed options see configuration table					see corresponding optional module

Fig. 6-18: Functions BASIC UNIVERSAL CSB01.1C, single-axis

Optional Slots



Option MC: master communication
Option ST: safety technology

Fig. 6-19: Optional slots for BASIC CSB01.1C, single-axis

Note: The configuration table below shows which optional module is supported on which optional slot.

Your sales representative will inform you on whether a certain combination is allowed or not.

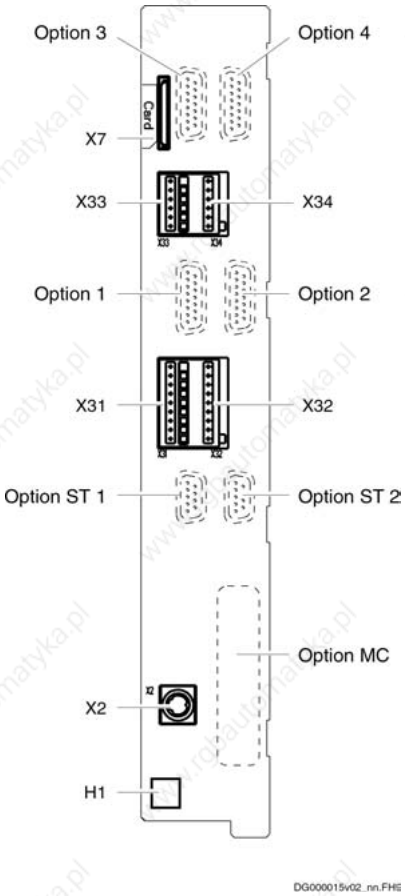
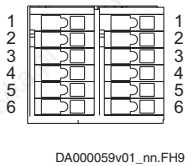
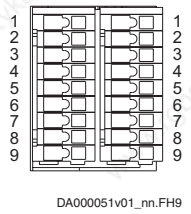
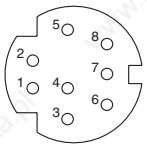
Optional module	Optional slot					
	Option MC	Option 1 (on board)	Option 2	Option ST (X41)	memory card slot (X7)	control panel (H1)
SE	**X**	O	O	O	O	O
PB	**X**	O	O	O	O	O
PL	**X**	O	O	O	O	O
CO	**X**	O	O	O	O	O
ET	**X**	O	O	O	O	O
S3	**X**	O	O	O	O	O
CCD	O	O	O	O	O	O
ENS	O	**X**	**X**	O	O	O
EN1	O	O	**X**	O	O	O
EN2	O	O	**X**	O	O	O
MEM	O	O	**X**	O	O	O
MA1	O	O	**X**	O	O	O
MD1	O	O	O	O	O	O
MD2	O	O	O	O	O	O
L1	O	O	O	**X**	O	O
S1	O	O	O	O	O	O
S	O	O	O	O	O	**X**
C	O	O	O	O	O	**X**
PFM02	O	O	O	O	**X**	O

X: allowed module on optional slot
O: not allowed

Fig. 6-20: Configuration table

BASIC UNIVERSAL CDB01.1C, Double-Axis

Front View with Connections at Basic Circuit Board

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description	Figure
	X7				memory card slot	
					option 3	
					option 4	
	X33 / X34	0,08-1,5	28-14	-	digital inputs	
					option 1	
					option 2	
	X31 / X32	0,08-1,5	28-14	-	digital and analog inputs/outputs; voltage input (24V, 0V)	
					option ST1	
					option ST2	
					option MC	
	X2	0,25-0,5	-	-	serial interface	
	H1	-	-	-	interface for control panel	

see also chapter "Connections with Spring Terminals"

Fig. 6-21: BASIC UNIVERSAL double-axis

Functions

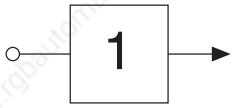
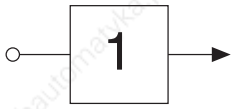
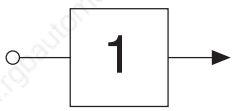
Note: Factory settings depend on the firmware. Following settings are valid for firmware MPx04.

Note: Digital I/Os require an external supply voltage at X31.8 and X31.9.

Connection X34.6 is not used for supply.

Note: The digital inputs E6 and E7 are positioned in parallel to the analog input EAn. Observe that this reduces the input resistance of the analog input to the value of the digital inputs.

If you need a low degree of linearity error, use signal sources with the lowest possible impedance at the analog input EAn. You can achieve a linearity error smaller 5% with a 1 kOhm potentiometer, for example.

Function			Con-nection	Factory setting	Nominal data	Technical data
master communication	configurable					
relay contact	 DA000017v01_nn.FH9	Rel 1	X31.1	"ready for operation" P-0-0115	DC24V / 1A	relay contact type 2
		Rel 1	X31.2			
digital inputs	 DA000022v01_nn.FH9	E1	X31.3	axis 1: "probe 1" S-0-0401	can be configured as probe; 24 V / 3 mA; typ. 1us	digital inputs
	 DA000022v01_nn.FH9	E2	X31.4	axis 2: "probe 1" S-0-0401		
	 DA000022v01_nn.FH9	E3	X31.5	axis 1: "travel range limit switch" P-0-0222	24 V / 3 mA	
		E4	X31.6	axis 1: "travel range limit switch" P-0-0222		
		E5	X31.7	axis 1: "home switch" S-0-0400		
		E6	X32.4			
		E7	X32.5			

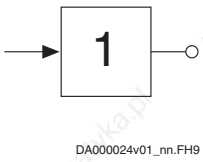
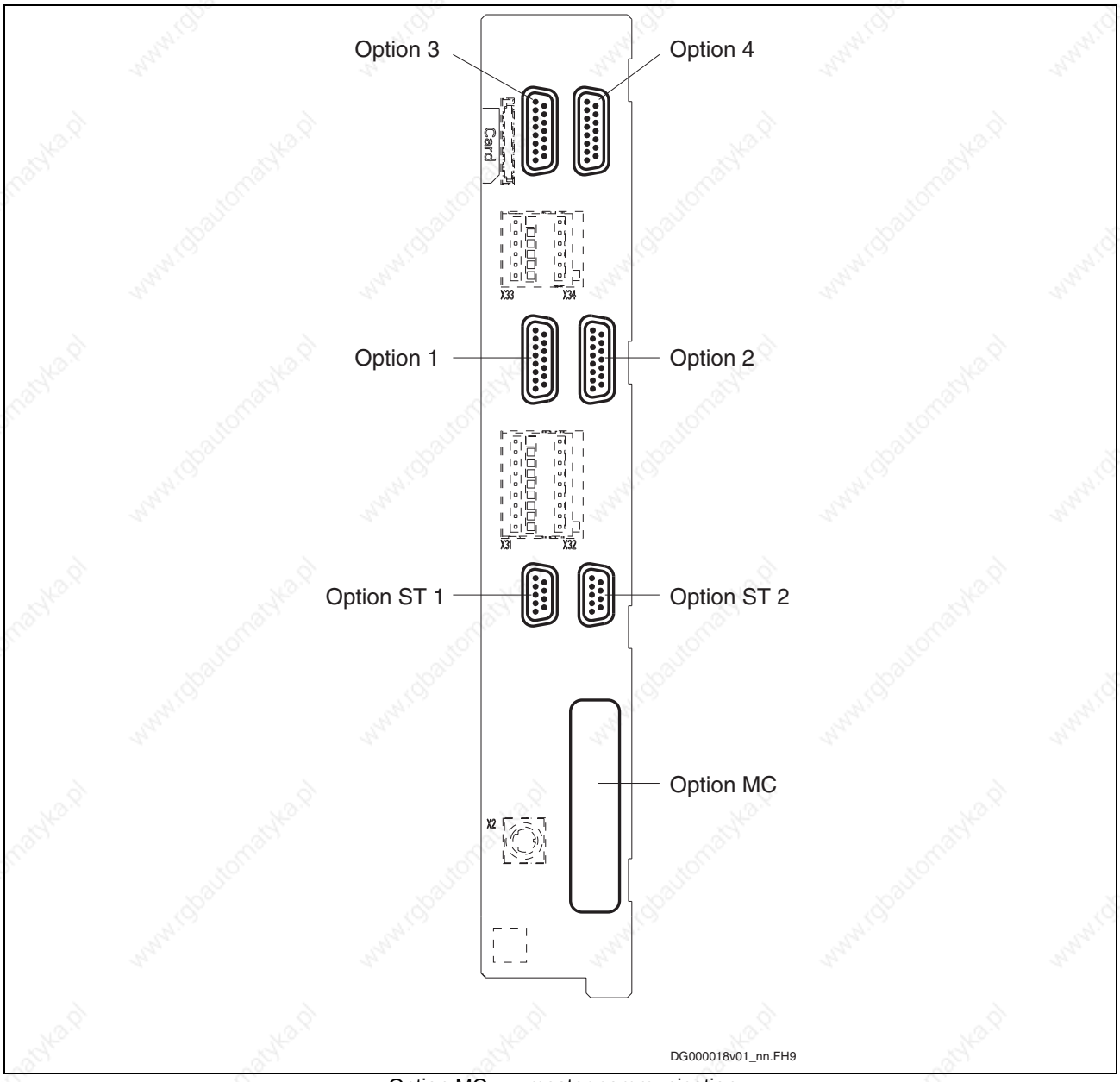
Function			Con-nection	Factory setting	Nominal data	Technical data
master communication	configurable					
		E8	X32.6	axis 1: "E-Stop" P-0-0223		
		E9	X32.7	axis 2: "travel range limit switch" P-0-0222		
		E10	X32.8	axis 2: "travel range limit switch" P-0-0222		
		E11	X32.9	axis 2: "home switch" S-0-0400		
		E12	X33.1			
		E13	X33.2			
		E14	X33.3			
		E15	X33.4			
		E16	X33.5			
		E17	X33.6			
		E18	X34.1			
		E19	X34.2			
		E20	X34.3			
		E21	X34.4			
		E22	X34.5			
	reference potential for digital inputs	0V	X34.6			
digital outputs	 DA000024v01_nn.FH9	A8	X32.6		24 V / 0,5 A	digital outputs
		A9	X32.7			
		A10	X32.8			
		A11	X32.9			
analog inputs	voltage input	EAn+	X32.4		+/-10 V; typ. 2 kOhm	analog inputs type 4
		EAn-	X32.5			
analog outputs	voltage output	An1	X32.1		5 V / 1 mA	analog outputs type 2
		An2	X32.2			
	reference potential for analog voltage output	A_GND	X32.3			
voltage supply of digital inputs/outputs	voltage supply of digital inputs/outputs	+24V	X31.8			DC 19…30 V; max. 1,1 A
		0V	X31.9			
serial interface	RS232		X2			serial interface
Optional functions	allowed options see configuration table					see corresponding optional module

Fig. 6-22: Functions BASIC UNIVERSAL double-axis

Optional Slots



Option MC: master communication
Options ST1 and ST2: safety technology

Fig. 6-23: Options for BASIC UNIVERSAL CDB01.1C, double-axis

Note: The configuration table below shows which optional module is supported on which optional slot.

Your sales representative will inform you on whether a certain combination is allowed or not.

Optional module	**Optional slot**								
	Option MC	Option 1	Option 2	Option 3	Option 4	Option ST 1 (X41.1)	Option ST 2 (X41.2)	memory card slot (X7)	control panel (H1)
SE	**X**	O	O	O	O	O	O	O	O
PB	**X**	O	O	O	O	O	O	O	O
PL	O	O	O	O	O	O	O	O	O
CO	O	O	O	O	O	O	O	O	O
ET	**X**	O	O	O	O	O	O	O	O
S3	**X**	O	O	O	O	O	O	O	O
CCD	O	O	O	O	O	O	O	O	O
ENS	O	**X**	**X**	**X**	**X**	O	O	O	O
EN1	O	**X**	**X**	**X**	**X**	O	O	O	O
EN2	O	**X**	**X**	**X**	**X**	O	O	O	O
MEM	O	O	O	**X**	**X**	O	O	O	O
MA1	O	O	O	**X**	**X**	O	O	O	O
MD1	O	O	O	O	O	O	O	O	O
MD2	O	O	O	O	O	O	O	O	O
L1	O	O	O	O	O	**X**	**X**	O	O
S1	O	O	O	O	O	**X**	**X**	O	O
S	O	O	O	O	O	O	O	O	**X**
C	O	O	O	O	O	O	O	O	**X**
PFM02	O	O	O	O	O	O	O	**X**	O

X: allowed module on optional slot
O: not allowed

Fig. 6-24: Configuration table

6.4 ADVANCED

Type Code ADVANCED CSH01.1C

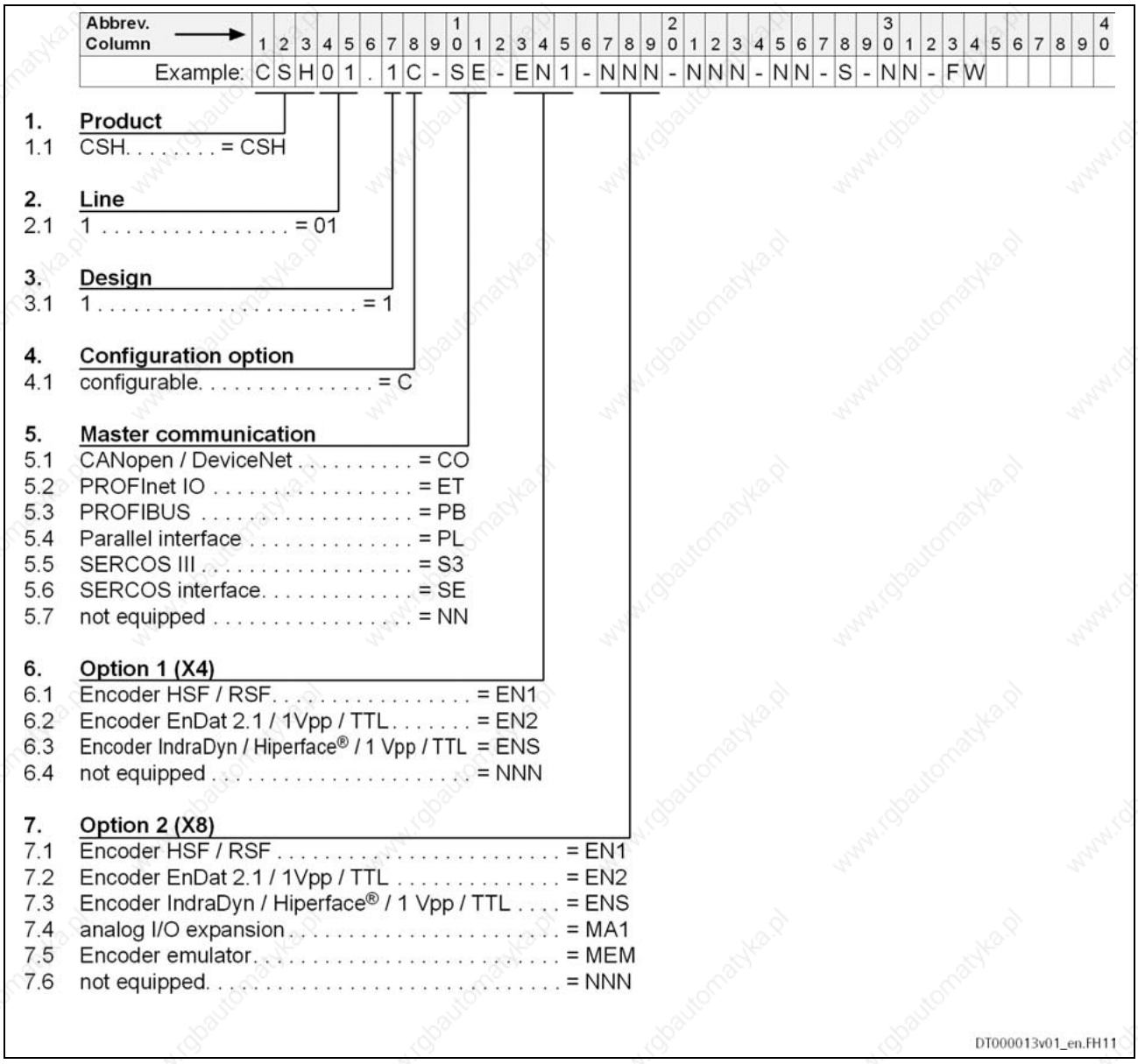


Fig. 6-25: Type code control section ADVANCED (to be continued on next page)

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:	C	S	H	0	1	.	1	C	-	S	E	-	E	N	1	-	N	N	N	-	N	N	N	-	N	N	-	S	-	N	N	-	F	W								

8. Option 3 (X10)

8.1 Cross communication drive . . . . . = CCD
8.2 Encoder HSF / RSF . . . . . = EN1
8.3 Encoder EnDat / 1Vpp / TTL . . . . . = EN2
8.4 Encoder IndraDyn / Hiperface® / 1 Vpp / TTL . . . . . = ENS
8.5 analog I/O expansion . . . . . = MA1
8.6 digital I/O expansion . . . . . = MD1
8.7 digital I/O expansion with SSI encoder interface . . . . . = MD2
8.8 Encoder emulator . . . . . = MEM
8.9 not equipped . . . . . = NNN

9. Safety option (X41)

9.1 with starting lockout . . . . . = L1
9.2 without safety option . . . . . = NN
9.3 with safety technology I/O . . . . . = S1 (1)

10. Control panel

10.1 standard control panel . . . . . = S

11. Other design

11.1 none . . . . . = NN

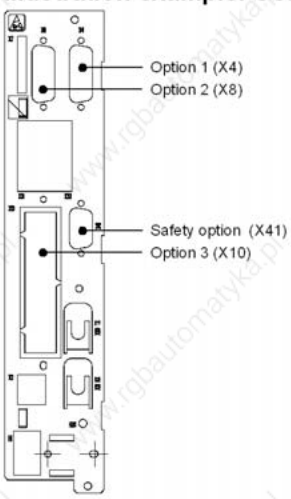
12. Firmware

12.1 Denotes that firmware must be ordered as separate subposition . . . . . = FW

Note:

(1) Safety option only allowed if "Option 1" is equipped with the suitable encoder

Illustration example: CSH01.1



DT000014v01_en.F11

Fig. 6-26: Type code control section ADVANCED (continuation)

Type code ADVANCED CSH01.2C

in preparation

Fig. 6-27: Type code control section ADVANCED CSH01.2C

- In comparison to control section CSH01.1C control section CSH01.2C has the interface "Cross Communication Drives – CCD" (at place of option 3)
- For purpose of engineering there is - in addition to the serial interface X2 - an Ethernet based interface.

Dimensions ADVANCED

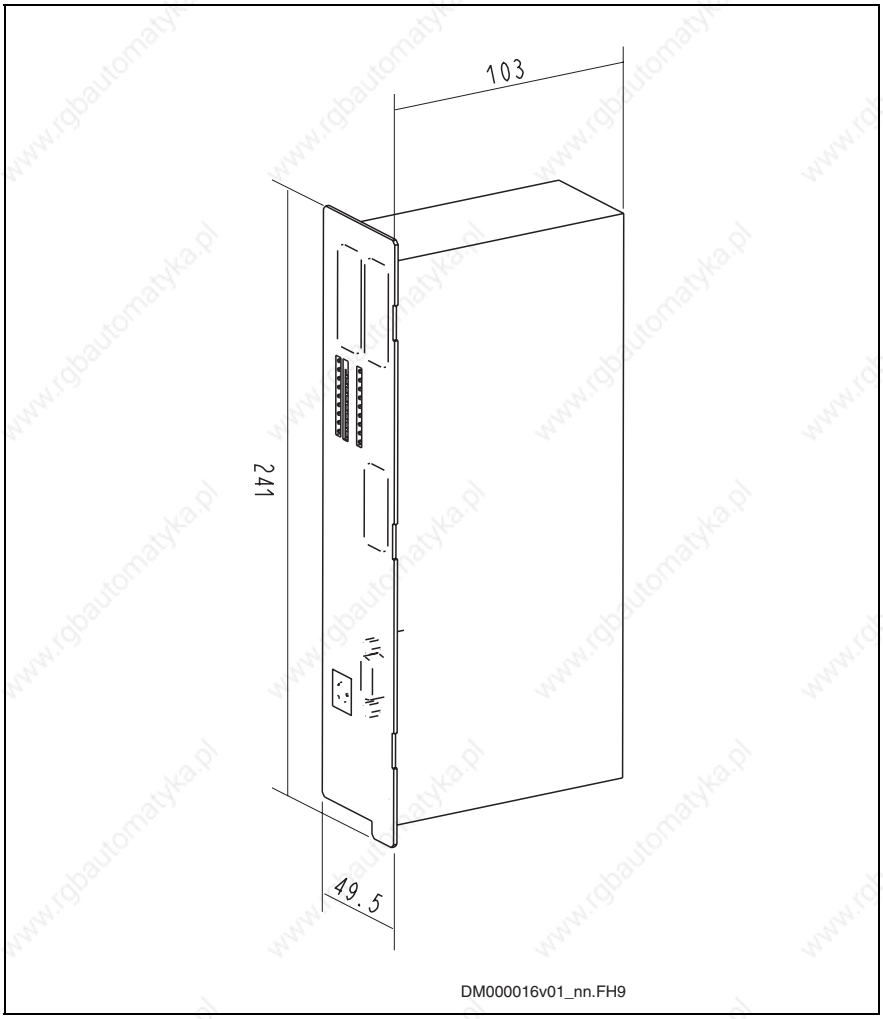
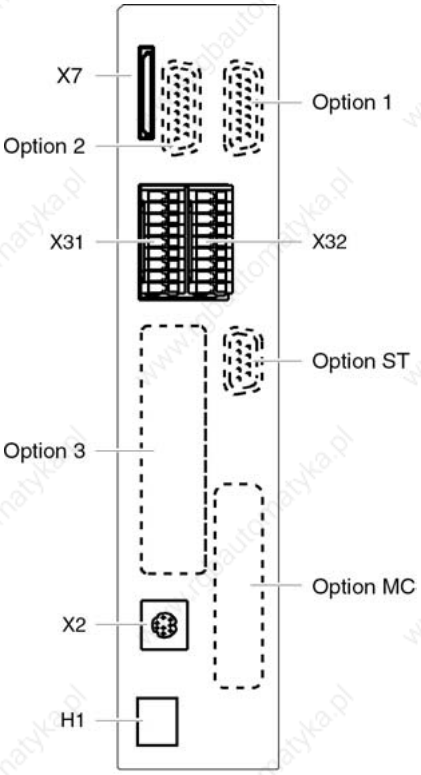
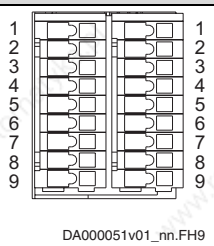
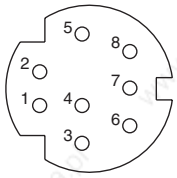


Fig. 6-28: Dimensions CSH

ADVANCED CSH01.1C

Front View with Connections

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description	Figure
	X7				memory card slot	
					option 1	
					option 2	
	X31/X32	0,08-1,5	28-14	-	digital and analog inputs/outputs ; voltage input (24V, 0V)	
					option 3	
					option ST	
					option MC	
	X2	0,25-0,5	-	-	serial interface	
	H1	-	-	-	interface for control panel	

see also chapter "Connections with Spring Terminals"

Fig. 6-29: ADVANCED CSH01.1C

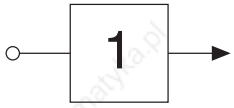
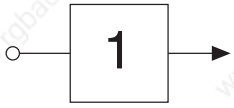
Functions

Note: The factory settings depend on the firmware. The following settings are valid for firmware MPx04.

Note: Observe that the connections X32.6, X32.7, X32.8 and X32.9 (E8, E9, E10, E11) can be configured as digital input or digital output (A8, A9, A10, A11).

Note: The digital inputs E6 and E7 are positioned in parallel to the analog input EAn. Observe that this reduces the input resistance of the analog input to the value of the digital inputs.

If you need a low degree of linearity error, use signal sources with the lowest possible impedance at the analog input EAn. For example, you can achieve a linearity error smaller 5% with a 1 kOhm potentiometer and smaller 2.5% with a 500 Ohm potentiometer.

Function			Con-nection	Factory setting	Nominal data	Technical data
relay contact	 DA000017v01_nn.FH9	Rel 1	X31.1	"ready for operation" P-0-0115	DC24V / 1A	relay contact type 2
		Rel 1	X31.2			
digital inputs	 DA000022v01_nn.FH9	E1	X31.3	"probe 1" S-0-0401	can be configured as probe; 24 V / 3 mA; typ. 1us	digital inputs
		E2	X31.4	"probe 2" S-0-0402		
	 DA000022v01_nn.FH9	E3	X31.5	"travel range limit switch" P-0-0222	24 V / 3 mA	
		E4	X31.6	"travel range limit switch" P-0-0222		
		E5	X31.7	"home switch" S-0-0400		
		E6	X32.4			
		E7	X32.5			
		E8	X32.6	"E-Stop" P-0-0223		
		E9	X32.7			
		E10	X32.8			
		E11	X32.9			

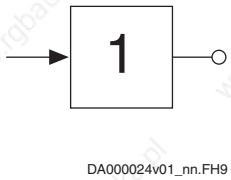
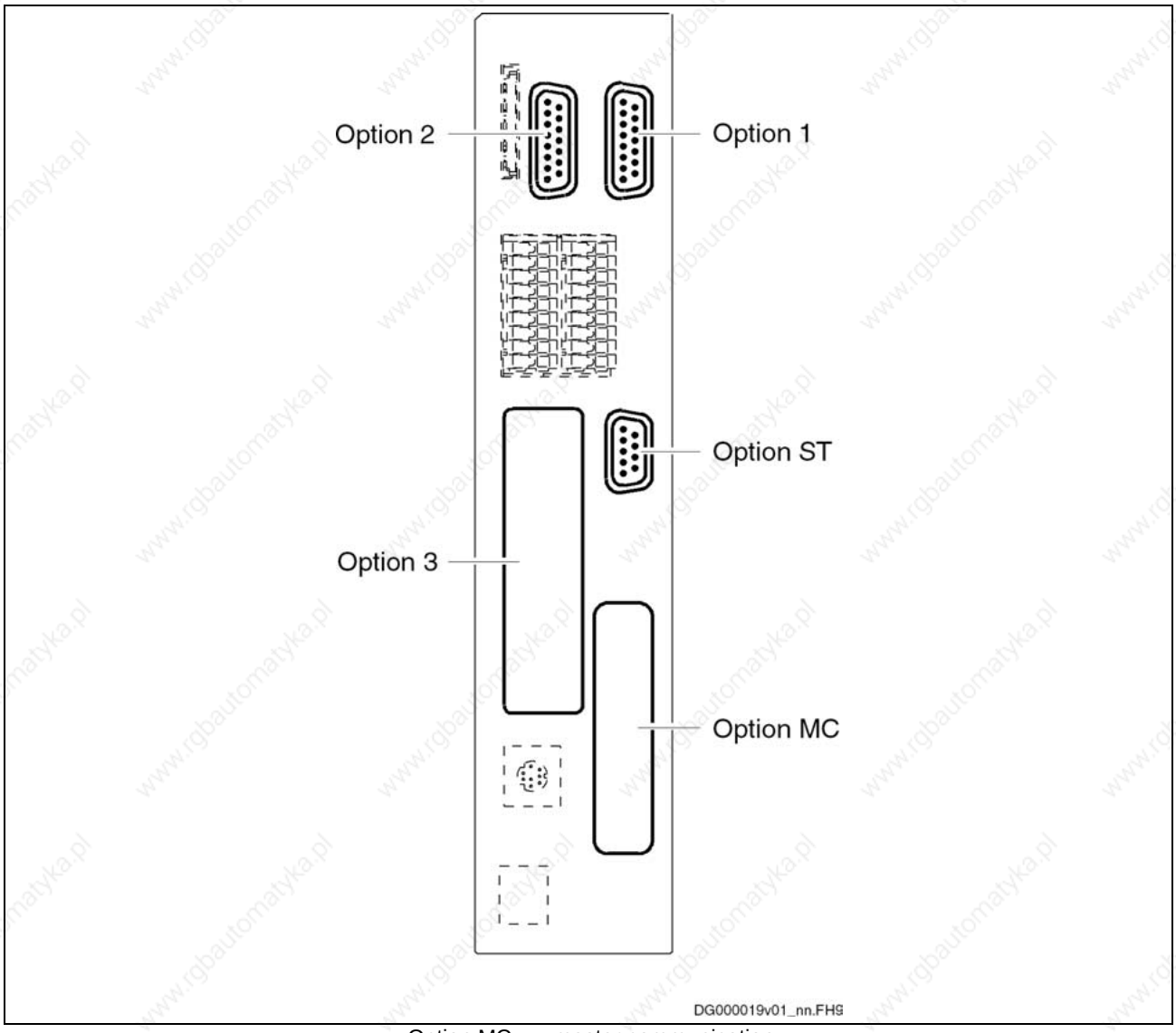
Function			Con-nection	Factory setting	Nominal data	Technical data
digital outputs		A8	X32.6		24 V / 0,5 A	digital outputs
		A9	X32.7			
		A10	X32.8			
		A11	X32.9			
analog inputs	voltage input	EAn+	X32.4		+/-10 V typ. 2 kOhm	analog inputs type 4
		EAn-	X32.5			
analog outputs	voltage output	An1	X32.1		5 V / 1mA	analog outputs type 2
		An2	X32.2			
	reference potential for analog voltage output	A_GND	X32.3			
voltage supply of digital inputs/outputs	voltage supply of digital inputs/outputs	+24V	X31.8			DC 19…30 V; max. 1,1 A
		0V	X31.9			
serial interface	RS232		X2			serial interface
Optional functions	allowed options see configuration table					see corresponding optional module

Fig. 6-30: Functions ADVANCED CSH01.1C

Optional Slots



Option MC: master communication
Option ST: safety technology

Fig. 6-31: Options for ADVANCED CSH01.1C

Note: The configuration table below shows which optional module is supported on which optional slot.

Your sales representative will inform you on whether a certain combination is allowed or not.

Optional module	**Optional slot**						
	Option MC	Option 1	Option 2	Option 3	Option ST (X41)	memory card slot (X7)	control panel (H1)
SE	**X**	O	O	O	O	O	O
PB	**X**	O	O	O	O	O	O
PL	**X**	O	O	O	O	O	O
CO	**X**	O	O	O	O	O	O
ET	**X**	O	O	O	O	O	O
S3	**X**	O	O	O	O	O	O
CCD	O	O	O	**X**	O	O	O
ENS	O	**X**	**X**	**X**	O	O	O
EN1	O	**X**	**X**	**X**	O	O	O
EN2	O	**X**	**X**	**X**	O	O	O
MEM	O	**X**	**X**	**X**	O	O	O
MA1	O	O	**X**	**O**	O	O	O
MD1	O	O	O	**X**	O	O	O
MD2	O	O	O	**X**	O	O	O
L1	O	O	O	O	**X**	O	O
S1	O	O	O	O	**X**	O	O
S	O	O	O	O	O	O	**X**
C	O	O	O	O	O	O	**X**
PFM02	O	O	O	O	O	**X**	O

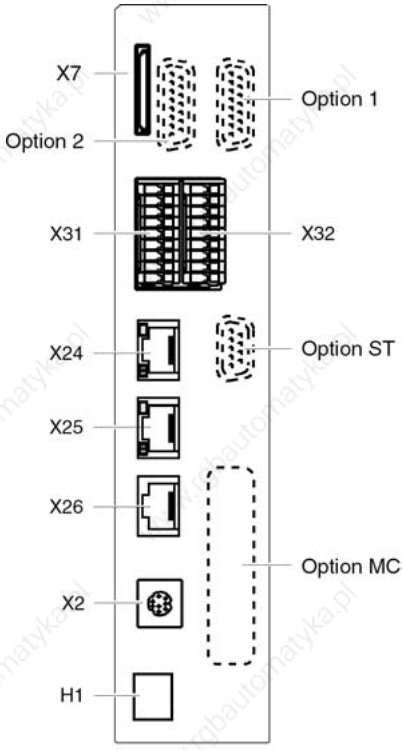
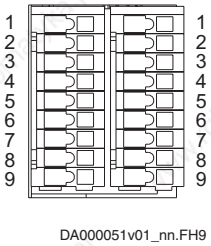
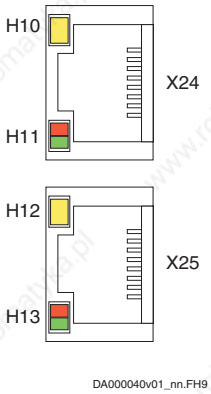
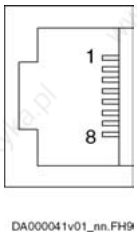
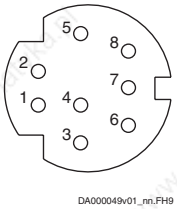
X: allowed module on optional slot
O: not allowed

Fig. 6-32: Configuration table CSH01.1C

ADVANCED CSH01.2C

The following documentation of ADVANCED CSH01.2C is preliminary.

Front View with Connections

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description	Figure
	X7				memory card slot	
					option 1	
					option 2	
	X31/X32	0,08-1,5	28-14	-	digital and analog inputs/outputs; voltage input (24V, 0V)	
	X24/X25	--	--	--	cross communication drives - CCD	
	X26	--	--	--	engineering interface	
					option ST *	
					option MC *	
	X2	0,25-0,5	-	-	serial interface	
	H1	-	-	-	interface for control panel	

* option ST = safety technology
* option MC = master communication
see also chapter "Connections with Spring Terminals"

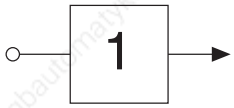
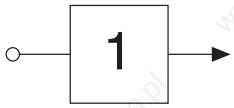
Fig. 6-33: Connections ADVANCED CSH01.2

Functions CSH01.2C

Note: The factory settings depend on the firmware. The following settings are valid for firmware MPx04.

Note: Observe that the connections X32.6, X32.7, X32.8 and X32.9 (E8, E9, E10, E11) can be configured as digital input or digital output (A8, A9, A10, A11).

Note: Observe that for the connections X32.4 and X32.5 either the analog inputs EAn or the digital inputs can be configured.

Function			Con-nection	Factory setting	Nominal data	Technical data
relay contact	 DA000017v01_nn.FH9	Rel 1	X31.1	"ready for operation" P-0-0115	DC24V / 1A	relay contact type 2
		Rel 1	X31.2			
digital inputs	 DA000022v01_nn.FH9	E1	X31.3	"probe 1" S-0-0401	can be configured as probe; 24 V / 3 mA; typ. 1us	digital inputs
		E2	X31.4	"probe 2" S-0-0402		
	 DA000022v01_nn.FH9	E3	X31.5	"travel range limit switch" P-0-0222	24 V / 3 mA	
		E4	X31.6	"travel range limit switch" P-0-0222		
		E5	X31.7	"home switch" S-0-0400		
		E6	X32.4			
		E7	X32.5			
		E8	X32.6	"E-Stop" P-0-0223		
		E9	X32.7			
		E10	X32.8			
		E11	X32.9			

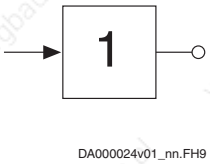
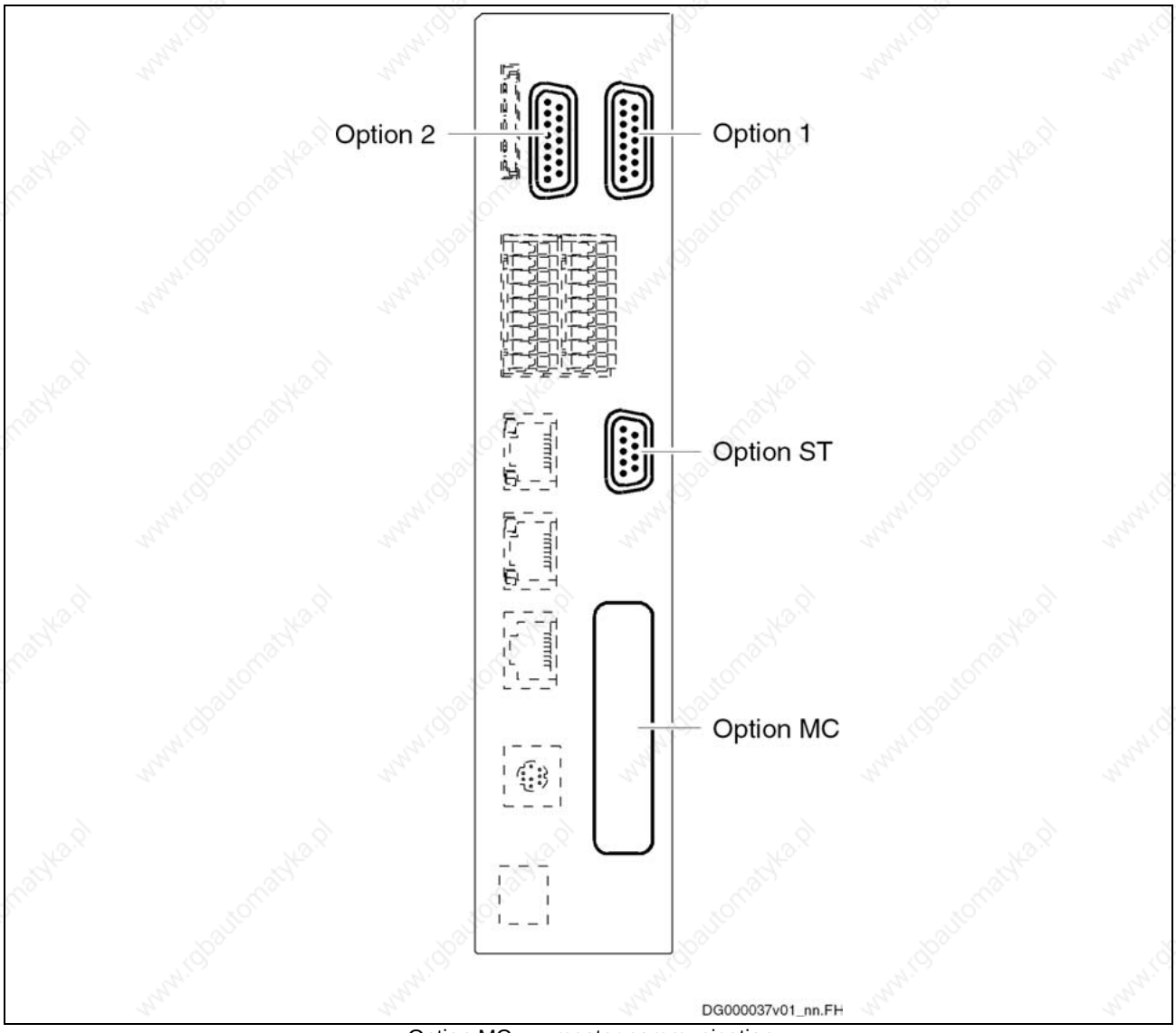
Function			Con-nection	Factory setting	Nominal data	Technical data
digital outputs		A8	X32.6		24 V / 0,5 A	digital outputs
		A9	X32.7			
		A10	X32.8			
		A11	X32.9			
analog inputs	voltage input	EAn+	X32.4		+/-10 V typ. 160 kOhm	analog inputs type 4
		EAn-	X32.5			
analog outputs	voltage output	An1	X32.1		5 V / 1mA	analog outputs type 2
		An2	X32.2			
	reference potential for analog voltage output	A_GND	X32.3			
voltage supply of digital inputs/outputs	voltage supply of digital inputs/outputs	+24V	X31.8			DC 19…30 V; max. 1,1 A
		0V	X31.9			
serial interface	RS232		X2			serial interface
CCD			X24			
CCD			X25			
engineering interface	Ethernet based interface		X26			
Optional functions	allowed options see configuration table					see corresponding optional module

Fig. 6-34: Functions ADVANCED CSH01.2

Optional Slots CSH01.2C



Option MC: master communication
Option ST: safety technology

Fig. 6-35: Options for ADVANCED CSH01.2C

Note: The configuration table below shows which optional module is supported on which optional slot.

Your sales representative will inform you on whether a certain combination is allowed or not.

Optional module	Optional slot						
	Option MC	Option 1	Option 2	Option 3	Option ST (X41)	memory card slot (X7)	control panel (H1)
SE	**X**	O	O	O	O	O	O
PB	**X**	O	O	O	O	O	O
PL	**X**	O	O	O	O	O	O
CO	**X**	O	O	O	O	O	O
ET	**X**	O	O	O	O	O	O
S3	**X**	O	O	O	O	O	O
CCD	O	O	O	**X**	O	O	O
ENS	O	**X**	**X**	O	O	O	O
EN1	O	**X**	**X**	O	O	O	O
EN2	O	**X**	**X**	O	O	O	O
MEM	O	**X**	**X**	O	O	O	O
MA1	O	O	**X**	O	O	O	O
MD1	O	O	O	O	O	O	O
MD2	O	O	O	O	O	O	O
L1	O	O	O	O	**X**	O	O
S1	O	O	O	O	**X**	O	O
S	O	O	O	O	O	O	**X**
C	O	O	O	O	O	O	**X**
PFM02	O	O	O	O	O	**X**	O

X: allowed module on optional slot
O: not allowed

Fig. 6-36: Configuration table CSH01.2C

Notes

7 Optional Modules for Control Sections

7.1 Overview

Optional module	Function	Name of optional module	Notes
Master communications	master communication via SERCOS interface	SE (HCC02)	master communication based on fiber optic cables
	master communication via PROFIBUS	PB (HCC03)	field bus PROFIBUS
	master communication via DeviceNet	CO (HCC06)	field bus DeviceNet
	master communication via parallel interface	PL (HCC01)	parallel interface
	master communication via CANopen	CO (HCC06)	field bus CANopen
	master communication via PROFINET IO	ET (HCC08)	field bus PROFINET
	master communication via SERCOS III	S3 (HCC07)	master communication based on Ethernet
Communication	cross communication via SERCOS III	CCD (HMC01)	communication between drive controllers based on Ethernet
Encoder evaluations	for encoder systems of IndraDyn motors	ENS (HFI03)	standard for motors of IndraDyn product range (encoder systems S1, M1, S2 and M2) 12 V power supply
	for resolvers and encoder systems with HSF interface	EN1 (HFI01)	standard for MKD, MKE and MHD motors (encoder systems R0, R1, S0 and M0) 8 V power supply
	for encoder systems with 5 V supply (Sense function required)	EN2 (HFI02)	5 V power supply (encoder systems C0)
	emulation of absolute and incremental encoders	MEM (HFE01)	emulation absolute encoder in SSI format
I/O extensions	extension "analog inputs/outputs"	MA1 (HAS01)	2 analog differential input channels; 2 analog output channels
	extension "digital inputs/outputs"	MD1 (HEA01)	12 digital inputs; 8 digital outputs
	extension "digital inputs/outputs"	MD2 (HEA02)	16 digital inputs in 2 groups; 16 digital outputs in 4 groups; SSI encoder evaluation
Safety technology	I/O for safety technology	S1 (HSI11)	
	starting lockout	L1 (HSI01)	
Control panels	standard control panel	S	single-line display
	comfort control panel	C	multiline display
Memory	exchangeable medium for parameters and firmware	PFM02.1	MMC - MultiMediaCard

Fig. 7-1: Available optional modules

7.2 Master Communications

SERCOS - SE

CAUTION

Risk of damage!

⇒ The **maximum tightening torque** of the union nut at the coupling elements of the fiber optic cables is **0.6 Nm**.

Description

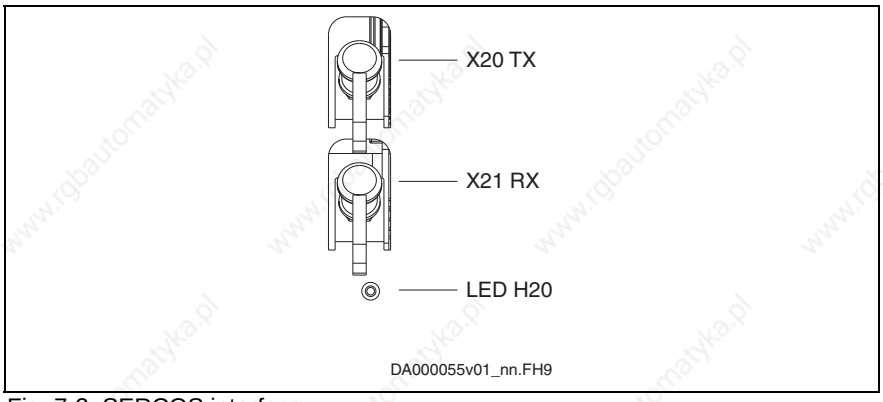


Fig. 7-2: SERCOS interface

LED H20 Distortion LED of SERCOS interface

Pin Assignment

X20		X21
TX		RX

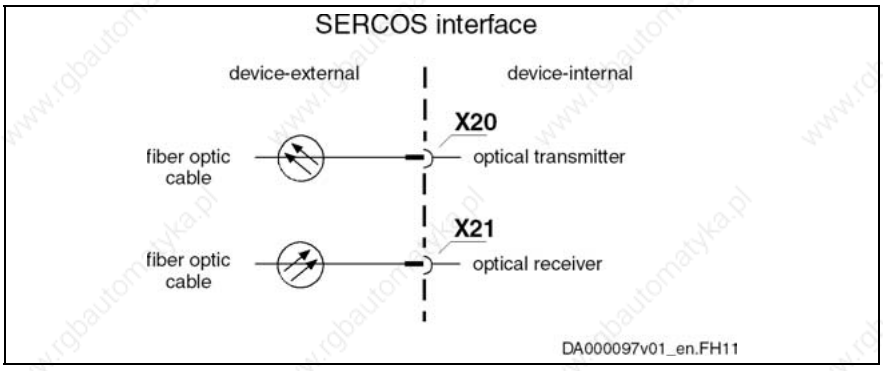


Fig. 7-3: Pin assignment

Data Rate, Transmission Power

The data rate and transmission power can be set via the serial interface X2 or with the control panel.

Fiber optic cables

Drive controllers with SERCOS interface are connected to higher-level control units by means of fiber optic cables.

The fiber optic cables (cable, connector or the entire ready-made cables) have to be ordered separately.

For more detailed information on the subject of "fiber optic cables" refer to the application manual "Rexroth Connection System, fiber optic cables" (DOK-CONNEC-CABLE*LWL**-AWxx-EN-P, part. no. 284755).

The following points are dealt with in the manual "Rexroth Connection System, fiber optic cables":

- general information on fiber optic cables
- basic planning information for optical transmission systems
- instructions for laying fiber optic cables
- attenuation measurement on ready-made fiber optic cable
- available fiber optic FSMA plug-in connectors and fiber optic cables
- instructions for assembling FSMA connectors
- tools for assembling fiber optic cables

PROFIBUS - PB

Description

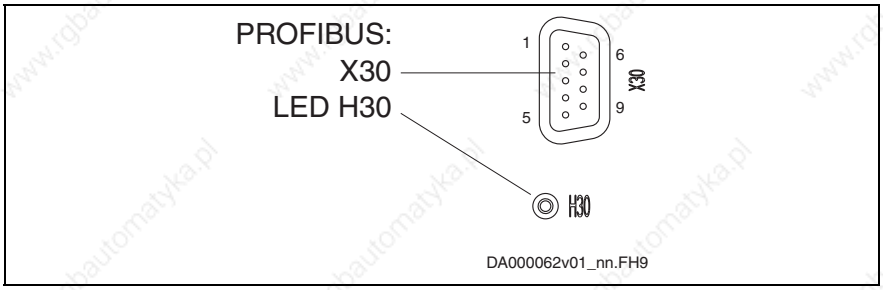


Fig. 7-4: PROFIBUS interface

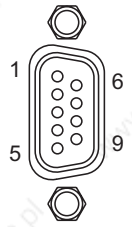
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
X30	D-Sub	9	female (device)	0,08-0,5	

Fig. 7-5: Connections

Assignment

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

Fig. 7-6: Signal assignment

Shield Connection Via D-subminiature fastening screws and metallized connector housing.

Compatibility of the Interface According to DIN EN 50 170

Recommended Cable Type According to DIN EN 50 170 – 2, cable type A

Signal Specification

Signal	Specification
+5V repeater supply	+5 V (±10%) max. 75 mA
repeater control signal	TTL-compatible 1: transmit 0: receive output resistance: 350R V_{OL} <= 0,8 V at I_{OL} <= 2 mA V_{OH} >= 3,5 V at I_{OH} <= 1 mA
receive/transmit data	EIA-RS485 standard

Fig. 7-7: Signal specification

CAUTION

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

⇒ do not short-circuit

⇒ do not exceed maximum current

Diagnostic Messages

For the definition of the diagnostic messages see the Functional Description of the respective firmware.

Bus Connectors

The PROFIBUS connectors each have a connectable terminating resistor. The terminating resistor must always have been switched on at the first and last bus node. Carry out the connection as shown in the figures below.

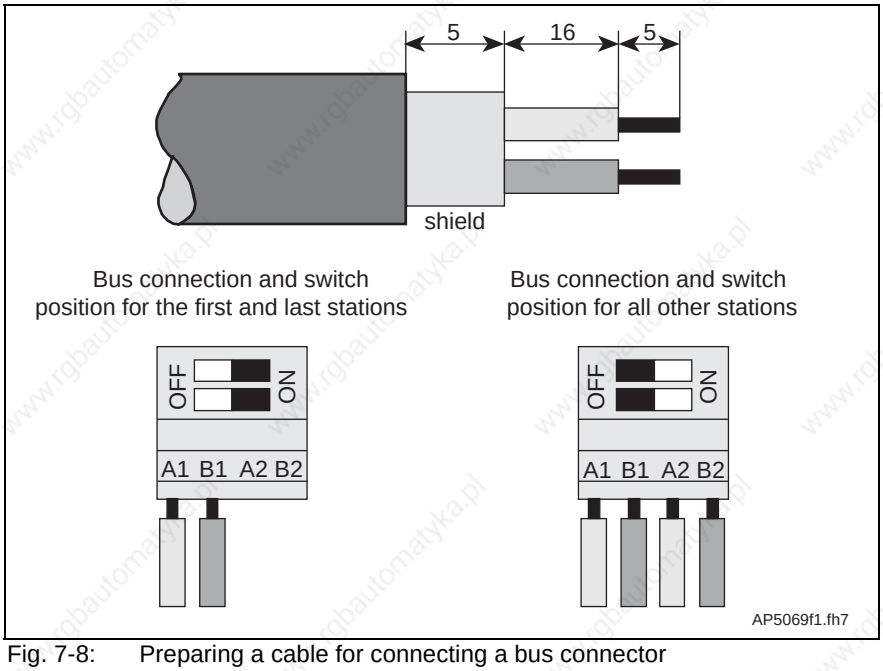


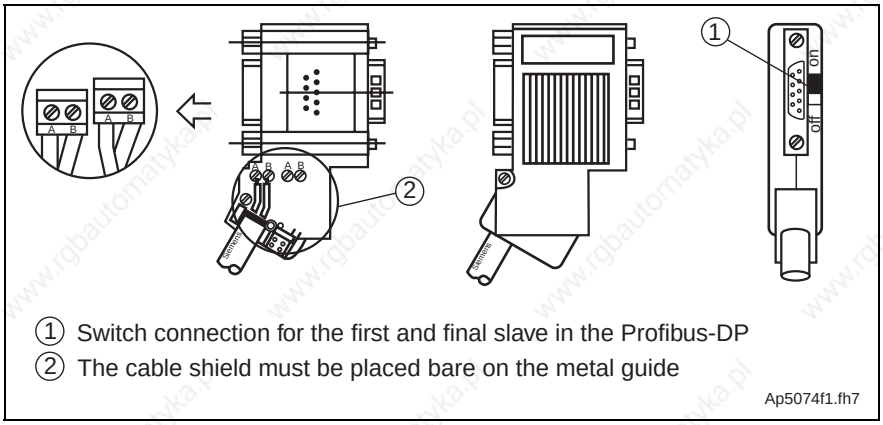
Fig. 7-8: Preparing a cable for connecting a bus connector

To prepare the bus cable, proceed as follows:

- use cable according to DIN EN50170 / 2 edition 1996
- strip cable (see previous illustration)
- insert both cores into screw terminal block

Note: Do not interchange the cores for A and B.

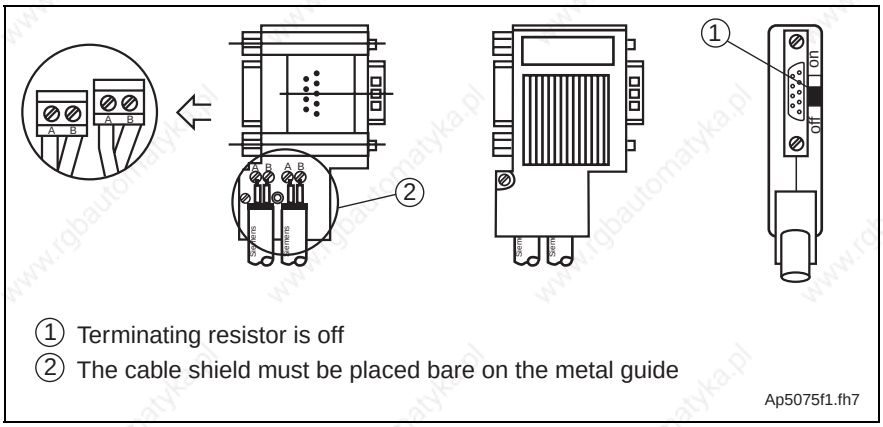
- press cable sheath between both clamps
- screw on both cores in screw terminals



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

Ap5074f1.fh7

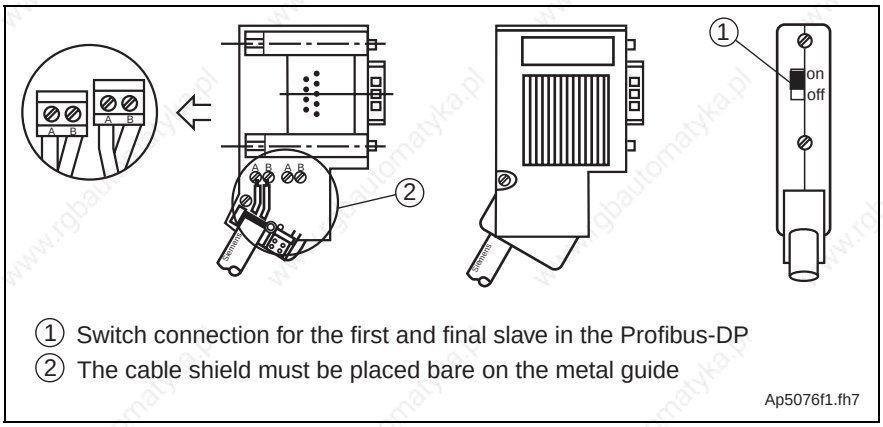
Fig. 7-9: Bus connection for the first and last slave, bus connector with 9-pin D-Sub female connector, INS 0541



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

Ap5075f1.fh7

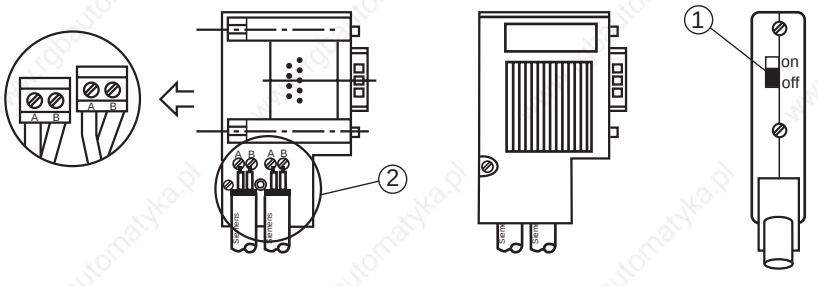
Fig. 7-10: Bus connection for all other slaves, bus connector with 9-pin D-Sub female connector, INS 0541



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

Ap5076f1.fh7

Fig. 7-11: Bus connection for the first and last slave, without 9-pin D-Sub female connector, INS 0540



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

Ap5077f1.fh7

Fig. 7-12: Bus connection for all other slaves without 9-pin D-Sub female connector, INS 0540

Connect the drive controller to a control unit using a shielded two-wire line in accordance with DIN 19245/ section 1.

Parallel Interface - PL

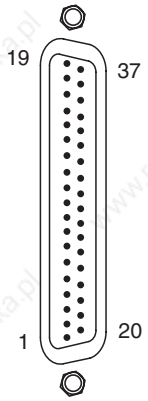
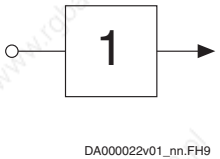
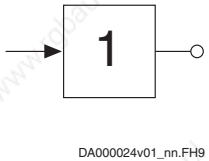
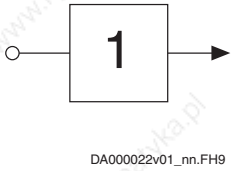
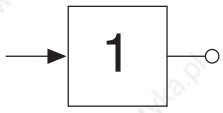
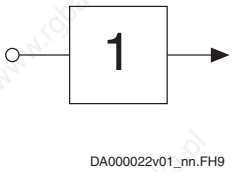
Connec-tion point	Type	No. of poles	Type of design	Solid wire [mm²]	Stranded wire [mm²]	Figure
X15	D-Sub	37	pins on device	-	0,08-0,5	

Fig. 7-13: Connections

Assignment

Function		Con-nection	Factory setting	Technical data
dig. input group 0 	Input 0.0	1	P-0-4026, Positioning block selection	see chapter "Technical Data Functions"
	Input 0.1	20	P-0-4026, Positioning block selection	
	Input 0.2	2	P-0-4026, Positioning block selection	
	Input 0.3	21	P-0-4026, Positioning block selection	
dig. output group 0 	Output 0.0	28	P-0-0115; ready signal	see chapter "Technical Data Functions"
	Output 0.1	10	S-0-0059, Position switch flag parameter	
	Output 0.2	29	S-0-0403, Position feedback value status	
	Output 0.3	11	S-0-0331, Status 'n_feedback = 0';	
power supply for input/output group 0	Uext_ea0	30		DC (19…30)V max. 1,2 A

Function		Con-nection	Factory setting	Technical data
dig. input group 1  DA000022v01_nn.FH9	Input 1.0	3	P-0-4026, Positioning block selection	see chapter "Technical Data Functions"
	Input 1.1	22	P-0-4026, Positioning block selection	
	Input 1.2	4	P-0-4060, Positioning block control word	
	Input 1.3	23	S-0-0148, C0600 Drive-controlled homing procedure command	
dig. output group 1  DA000024v01_nn.FH9	Output 1.0	12	P-0-4061 end position reached	see chapter "Technical Data Functions"
	Output 1.1	31	P-0-0115 warning	
	Output 1.2	13	S-0-0437 jog mode active	
	Output 1.3	32	S-0-0437 interpolator halted	
power supply for input/output group 1	Uext_ea1	14		DC (19…30)V max. 1,2 A
dig. input group 2  DA000022v01_nn.FH9	Input 2.0	5	S-0-0346, Positioning control word	see chapter "Technical Data Functions"
	Input 2.1	24	S-0-0346, Positioning control word	
	Input 2.2	6	P-0-4028, Device control word; Drive ON	
	Input 2.3	25	P-0-4028, Device control word; Drive HALT	

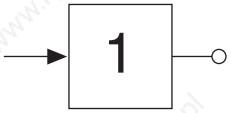
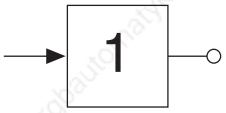
Function		Con-nection	Factory setting	Technical data
dig. output group 2  DA000024v01_nn.FH9	Output 2.0	33	P-0-4051, Positioning block acknow-ledgment	see chapter "Technical Data Functions"
	Output 2.1	15	P-0-4051, Positioning block acknow-ledgment	
	Output 2.2	34	P-0-4051, Positioning block acknow-ledgment	
	Output 2.3	16	P-0-4051, Positioning block acknow-ledgment	
power supply for input/output group 2	Uext_ea2	35		DC (19…30)V max. 1,2 A
dig. input group 3  DA000022v01_nn.FH9	Input 3.0	7	S-0-0099, C0500 Reset	see chapter "Technical Data Functions"
	Input 3.1	26		
	Input 3.2	8		
	Input 3.3	27		
dig. output group 3  DA000024v01_nn.FH9	Output 3.0	17	P-0-4051, Positioning block acknow-ledgment	see chapter "Technical Data Functions"
	Output 3.1	36	P-0-4051, Positioning block acknow-ledgment	
	Output 3.2	18	P-0-4051, Positioning block acknow-ledgment	
	Output 3.3	37	P-0-4051, Positioning block acknow-ledgment	
power supply for input/output group 3	Uext_ea3	19		DC (19…30)V max. 1,2 A
reference potential for inputs/outputs and power supply	GNDext	9		max. 5 A
connection cable shield	shield	con-nector housing		

Fig. 7-14: Signal assignment

Note: The inputs/outputs are galvanically isolated from the control section and require power supply via the connections Uext and GNDext.

DeviceNet / CANopen - CO

Description

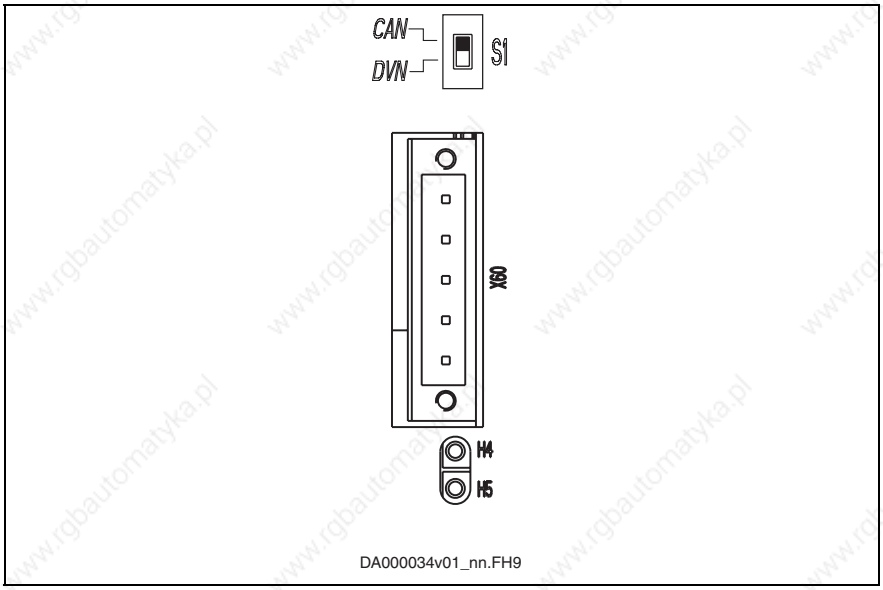


Fig. 7-15: Description

The master communications DeviceNet and CANopen are realized with the same optional module "CO".

Via switch S1 select the master communication which is to be active.

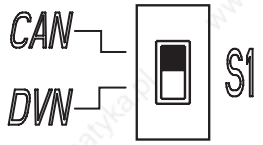
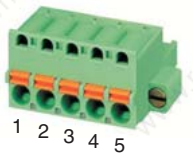
Switch position	Effect	Switch S1
up (as shown)	CANopen active	
down	DeviceNet active	

Fig. 7-16: Switch

Properties of the Connector

Con-nection point	Type	No. of poles	Solid wire [mm²]	Stranded wire [mm²]	AWG	Figure
X60	spring terminal, female (connector)	5	0,25-2,5	0,25-1,5	24-16	

see also chapter "Connections with Spring Terminals"

Fig. 7-17: Connections

Note: Maximum allowed tightening torque of the screws: **0.5 Nm**.

Display Elements

CANopen

LED	Significance	Color	Description
H4	Run	green	Signals operating status; for details see Functional Description
H5	Error	red	Signals error status, for details see Functional Description

Fig. 7-18: Significance of display elements

DeviceNet

LED	Significance	Color	Description
H4	Module status	red	malfunction on module; for details see Functional Description
		green	module OK; for details see Functional Description
H5	Network status	red	malfunction on network; for details see Functional Description
		green	network OK; for details see Functional Description

Fig. 7-19: Significance of display elements

Assignment X60

Pin	Signal	Function
1	VP-	0 V – Potential 24 V Supply Voltage
2	CAN_L	bidirectional data signal CAN_L
3	Drain/Shield	shield connection
4	CAN_H	bidirectional data signal CAN_H
5	VP+	24 V Supply Voltage - plus

Fig. 7-20: Signal assignment optional module CO

Main Features

Feature	DeviceNet	CANopen
compatibility	according to DIN EN 50325-2	according to EN 50325-4
max. possible number of nodes	64 nodes	max. 127 nodes
bus topology	line topology	line topology
bus terminator (ISO 11898)	124 Ohm, 1%, 200 mW at both bus ends (connect resistor with X60.2 and X60.4)	
transmission medium	2 twisted two-wire lines (4-pin) with shield	2 twisted two-wire lines (4-pin) with shield
max. allowed bus (line) lengths	depending on bit rate	depending on bit rate
recommended connecting cable	our RKS number or third-party type	our RKS number or third-party type

Fig. 7-21: Main features

Bus Lengths Depending on Bit Rates

Bit rate [kBaud]	Max. allowed network dimension [m]	
	DeviceNet	CANopen
1000	--	25
800	--	50
500	40	100
250	250	250
125	500	500
50	--	1000
20	--	2500
10	--	5000

-- bit rate not specified for this field bus

Fig. 7-22: Network dimension

SERCOS III - S3

Description

SERCOS III is the Ethernet-based version of SERCOS 2. The interface corresponds to standard IEE 802.3.

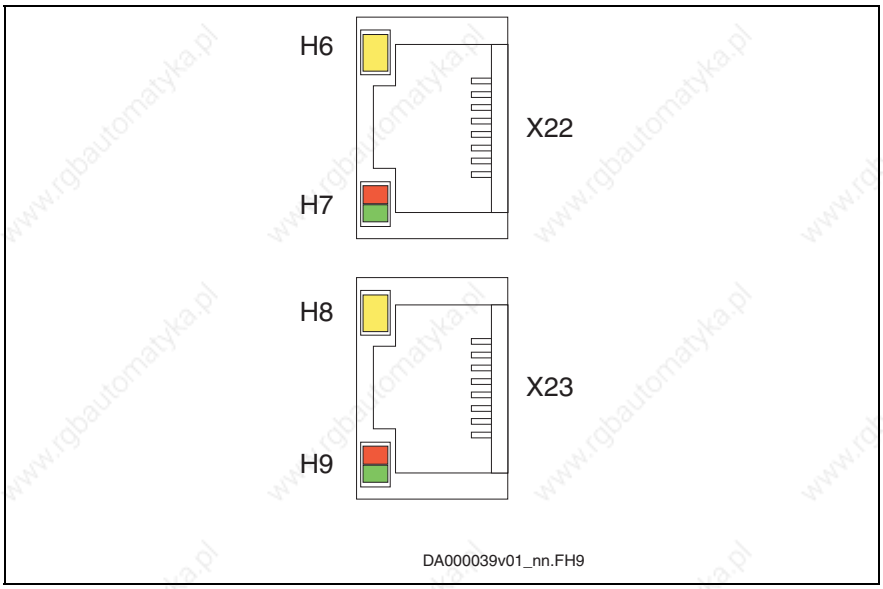


Fig. 7-23: SERCOS III connection points

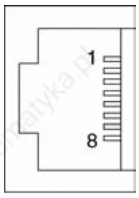
Connection points	Type	No. of poles	Figure
X22, X23	RJ-45	8	

Fig. 7-24: Connections

Assignment X22, X23

Pin	Signal	Function
1	**TD+**	10/100 Base-T Transmit, Differential Output A
2	**TD-**	10/100 Base-T Transmit, Differential Output B
3	**RD+**	10/100 Base-T Receive, Differential Input A
4	n. c.	-
5	n. c.	-
6	**RD-**	10/100 Base-T Receive, Differential Input B
7	n. c.	-
8	n. c.	-
housing		shield connection

Fig. 7-25: Signal assignment

Compatibility of the Interface

10 Base-T according to IEEE 802.3i

100 Base-T according to IEEE 802.3u

Recommended Cable Type According to CAT 5

Display Elements

LED	Significance	Color	
H6, H8	Status	yellow	data transmission running
H7, H9	Link	green	connection to network available
H7, H9	n.s.	orange	n.s.

Fig. 7-26: Significance of display elements

Cross Communication Drives - CCD

Description

The interface corresponds to standard IEE 802.3.

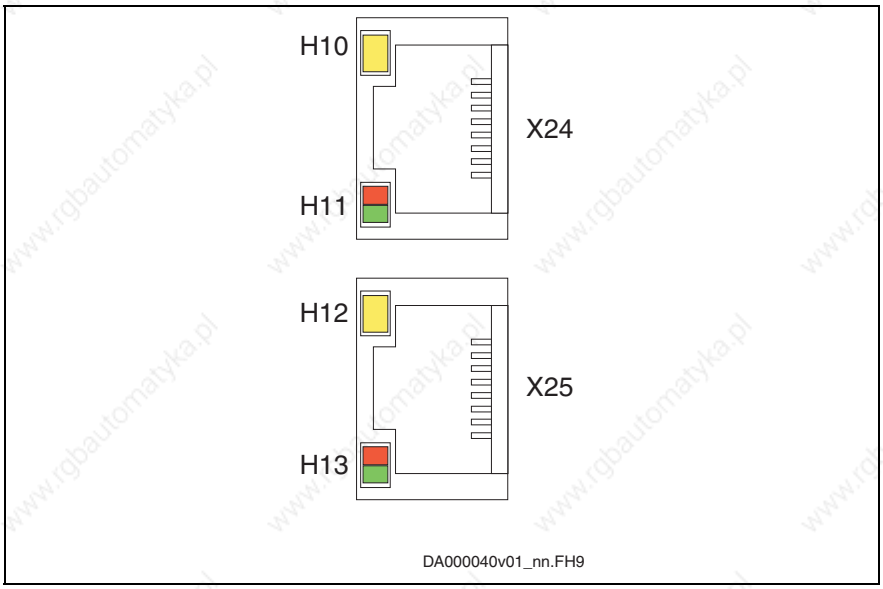


Fig. 7-27: SERCOS III connection points CCD

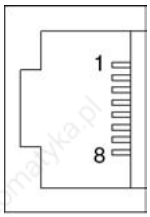
Connection points	Type	No. of poles	Figure
X24, X25	RJ-45	8	

Fig. 7-28: Connections

Assignment X24, X25

Pin	Signal	Function
1	**TD+**	10/100 Base-T Transmit, Differential Output A
2	**TD-**	10/100 Base-T Transmit, Differential Output B
3	**RD+**	10/100 Base-T Receive, Differential Input A
4	n. c.	-
5	n. c.	-
6	**RD-**	10/100 Base-T Receive, Differential Input B
7	n. c.	-
8	n. c.	-
housing		shield connection

Fig. 7-29: Signal assignment

Compatibility of the Interface

10 Base-T according to IEEE 802.3i
100 Base-T according to IEEE 802.3u

Recommended Cable Type

According to CAT 5

Display Elements

LED	Significance	Color	
H10; H12	Status	yellow	data transmission running
H11; H13	Link	green	connection to network available
H11; H13	n.s.	orange	n.s.

Fig. 7-30: Significance of display elements

7.3 Encoder Evaluations

Standard Encoder Evaluation ENS

Description

For encoders with a control voltage supply of 12 Volt:

- encoder system of IndraDyn S motors (MSK motors)
- 1 V_{pp} with HIPERFACE®
- 1 V_{pp} with EnDat 2.1
- 1 V_{pp} with reference track
- 5 V-TTL square-wave encoder with reference

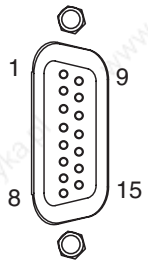
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
X8	D-Sub	15	female (device)	0,25-0,5	

Fig. 7-31: Connection

Pin Assignment

Connection	Signal	Function
1	GND_Shield	connection for signal shields
2	A+	track A positive
3	A-	track A negative
4	GND_Encoder	power supply reference potential
5	B+	track B positive
6	B-	track B negative
7	EncData+	data transmission positive
8	EncData-	data transmission negative
9	R+	reference track positive
10	R-	reference track negative
11	VCC_Encoder	power supply
12	n.c.	n.c.
13	EncCLK+	clock positive
14	EncCLK-	clock negative
15	n.c.	n.c.

Fig. 7-32: Pin assignment

Properties of ENS

Voltage for Encoder Supply VCC_Encoder

Data	Unit	Min.	Typ.	Max.
voltage for encoder supply VCC_Encoder	V	11,15	11,6	12,3
output current	mA			300

Fig. 7-33: Encoder supply ENS

Input Circuit for Sine Signals A+, A- or B+, B- or R+, R-

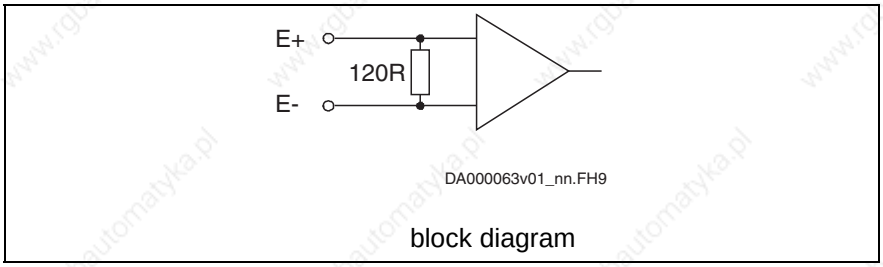


Fig. 7-34: Input circuit for sine signals

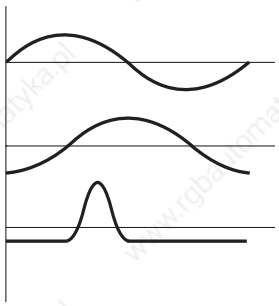
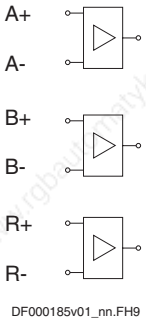
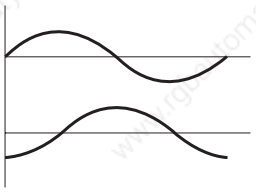
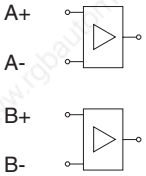
Properties of Differential Input

Data	Unit	Min.	Typ.	Max.
allowed amplitude of encoder signal ($U_{PPencodersignal}$)	V		1,0	1,0 + 0,2
input resistance	Ohm		120	
converter width A/D converter	Bit		12	
limit frequency (-3 dB)	kHz		500	
allowed input frequency for 5 V-TTL signals (square-wave)	kHz			400
allowed amplitude 5 V-TTL signals	V			5,25

Fig. 7-35: Differential input

Note: The allowed input frequency for 5 V-TTL signals is lower than the limit frequency because the differential input is overridden with 5 V signals.

Signal Assignment to the Actual Position Value

Signal assignment [1)]	Signal designation	Signal shape	Actual position value (with default setting)
 DK000089v01_nn.FH9	 DF000185v01_nn.FH9	sine (1 V_{pp}) without absolute value	increasing
 DK000088v01_nn.FH9	 DF000184v01_nn.FH9	sine (1 V_{pp}) with absolute value	increasing

1) see following note

Fig. 7-36: Signal assignment to the actual position value

Note: The encoder signal assignment to the inputs is based on clockwise rotation (front view at motor shaft).

- Track A (A+, A-) advances track B (B+, B-) 90° electrically
- The actual position value increases in this case (unless a negation takes effect)
- If present, the reference track R (R+, R-) makes the reference mark pulse at positive signals of track A and track B (within the 0-quadrant)

Note: Standard setting:
=> see Functional Description of firmware

Connection Diagrams ENS

ENS with Encoder System S1 / M1

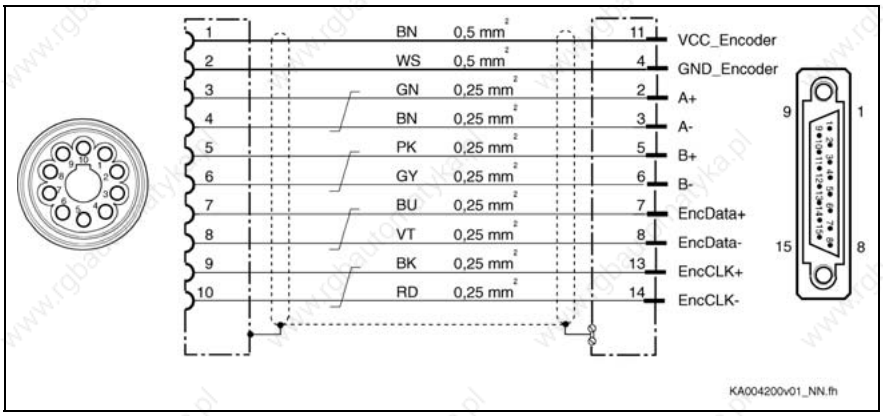


Fig. 7-37: Connection diagram encoder system S1 / M1

Note: For **direct** connection to the encoder system use our cable RKG 4200.

ENS with Encoder System S2 / M2

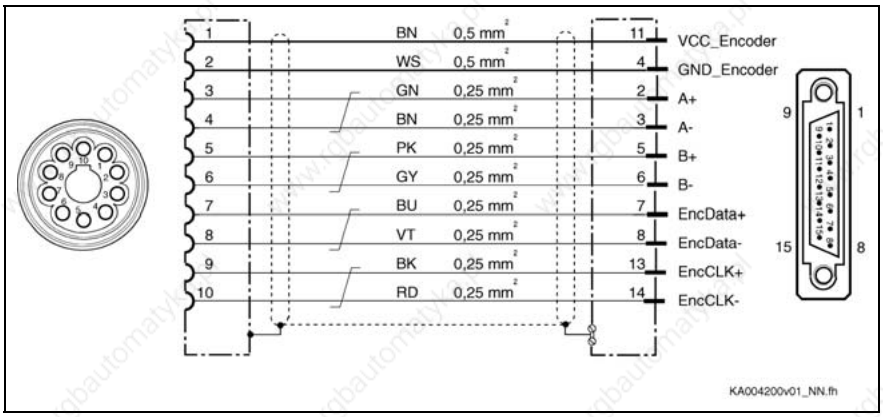


Fig. 7-38: Connection diagram encoder system S2 / M2

Note: For **direct** connection to the encoder system use our cable RKG 4200.

Connection Diagrams ENS with Third-Party Encoder

Note: Observe that the third-party encoder used has to be suited for the voltage supplied at the encoder evaluation ENS as voltage for encoder supply "VCC_Encoder".

ENS with Third-Party Encoder Hiperface

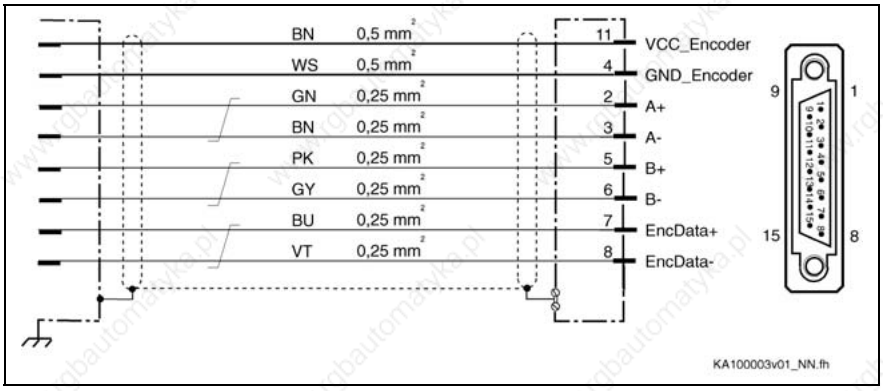


Fig. 7-39: Connection diagram third-party encoder Hiperface

ENS with Third-Party Encoder EnDat 2.1

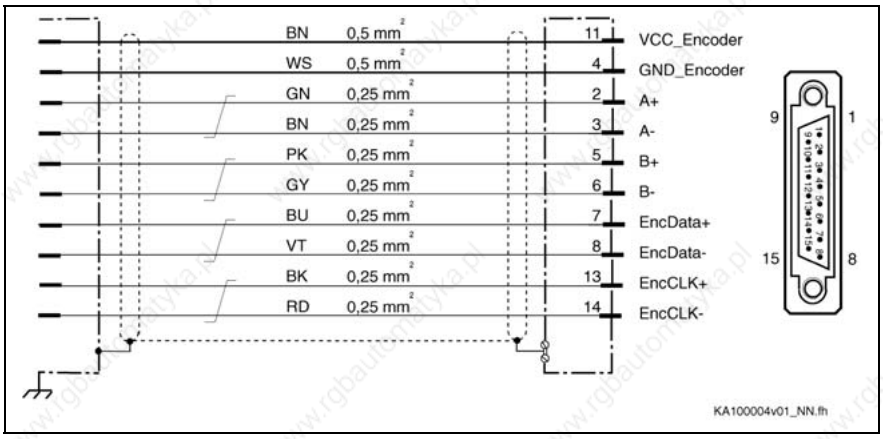


Fig. 7-40: Connection diagram third-party encoder EnDat 2.1

ENS with Third-Party Encoder 1Vpp

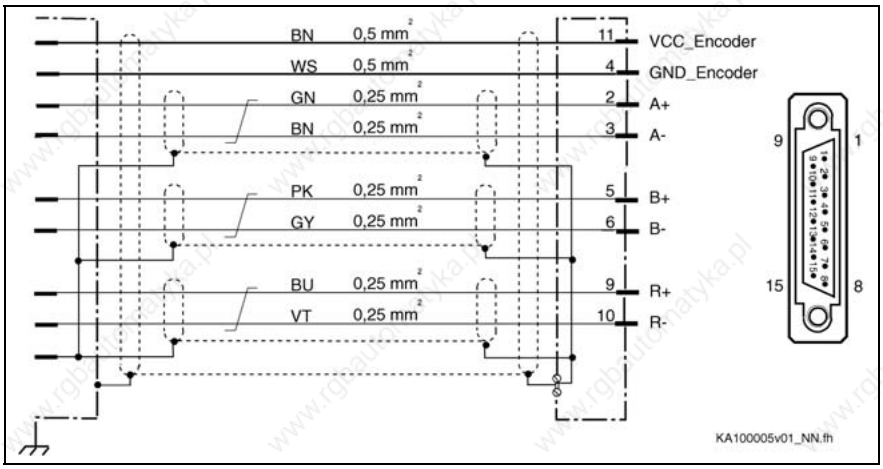


Fig. 7-41: Connection diagram third-party encoder 1Vpp

ENS with Third-Party Encoder 5V-TTL

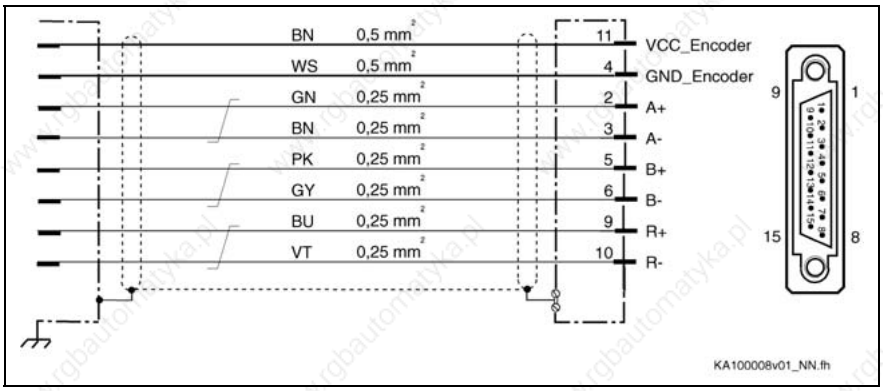


Fig. 7-42: Connection diagram third-party encoder 5V-TTL

Allowed Encoder Cable Lengths at ENS

The current consumption of the connected encoder system generates a voltage drop due to the ohmic resistance (line cross section and line length) of the encoder cable. This reduces the signal at the encoder input.

The diagrams below take into account that

- the **cross section of the wires** for supply voltage in the cable is at least 0.5 mm^2 (lower cross sections reduce the allowed length),
- the **allowed supply voltage** at the encoder is 10 V ±5%.

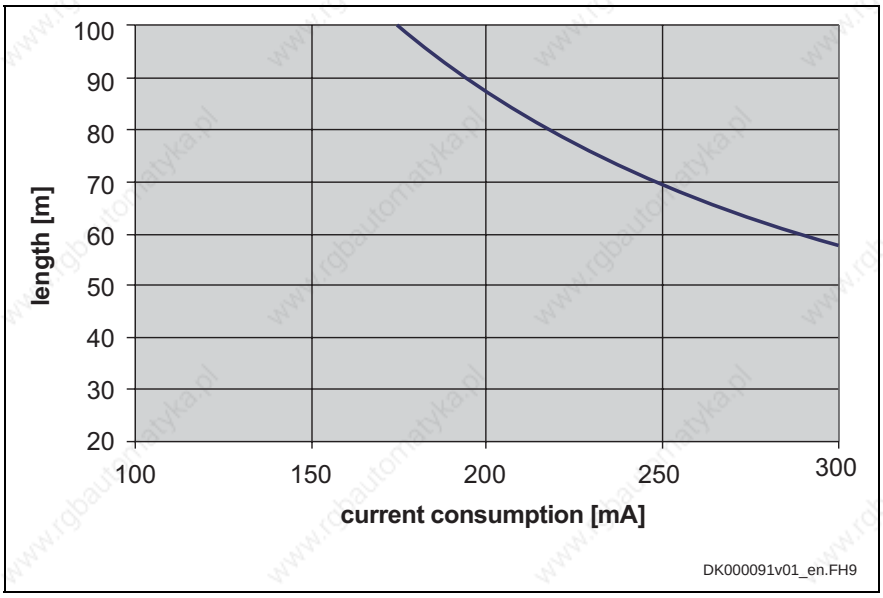


Fig. 7-43: Allowed encoder cable lengths

Example For a cable length of 75 m between motor encoder and drive controller, encoder systems with a max. current consumption of 225 mA are allowed. If the encoder system has a higher current consumption, take a cross section greater than 0.5 mm².

Resolver and HSF Encoder Evaluation EN1

Description

For encoders with a control voltage supply of DC8 Volt or AC18.2 Volt peak-peak:

- digital servo feedback from Rexroth (encoder interface HSF for MHD motors)
- resolver (encoder interface for MKD motors)
- resolver without data memory

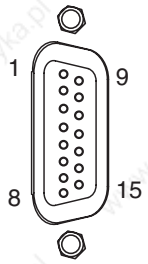
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
--	D-Sub	15	female (device)	0,25-0,5	

Fig. 7-44: Connection

Pin Assignment

Connection	Signal	Function
1	GND_Shield	connection for signal shields
2	A+	track A positive
3	B+	track B positive
4	GND_Encoder	power supply reference potential
5	n.c.	n.c.
6	n.c.	n.c.
7	I2C_SCLK	clock line for I²C interface
8	I2C_SDAout	data transmission to encoder
9	A-	track A negative
10	B-	track B negative
11	n.c.	n.c.
12	VCC_Encoder	power supply
13	n.c.	n.c.
14	I2C_Fsample	data request
15	I2C_SDAin	data transmission to encoder

Fig. 7-45: Pin assignment

Properties EN1

Encoder Supply Resolver

Data	Unit	Min.	Typ.	Max.
AC output voltage VVC_Encoder (peak-peak value)	V		18,2	
output frequency sine	kHz		4	
output current	mA			70
d.c. resistance of load	Ohm	35		

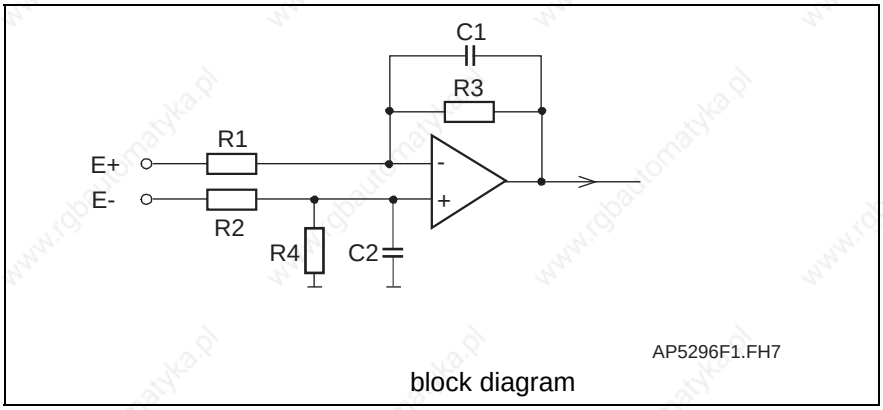
Fig. 7-46: Encoder supply resolver

Encoder Supply Digital Servo Feedback

Data	Unit	Min.	Typ.	Max.
DC output voltage VVC_Encoder	V	7,8	8	8,2
output current	mA			250

Fig. 7-47: Encoder supply HSF

Input circuit A+, A- or B+, B-



block diagram

R1: 5k
R2: 5k
R3: 20k (HSF) or 2k5 (resolver)
R4: 20k (HSF) or 2k5 (resolver)
C1: no data
C2: no data

Fig. 7-48: Input circuit

Differential Input for DSF Operation

Data	Unit	Min.	Typ.	Max.
allowed amplitude of encoder signal sine	V		1,0	1,1
input resistance	kOhm	9,5	10	10,5
converter width A/D converter	Bit		12	
limit frequency (-3 dB)	kHz		100	

Fig. 7-49: Input data DSF

Differential Input for Resolver Operation

Data	Unit	Min.	Typ.	Max.
allowed amplitude of encoder signal sine	V			9,0
input resistance	kOhm	9,5	10	10,5
converter width A/D converter	Bit		12	
limit frequency (-3 dB)	kHz		18	

Fig. 7-50: Input data resolver

Signal Assignment to the Actual Position Value

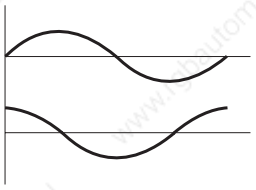
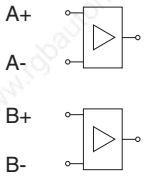
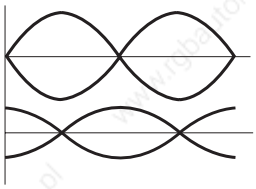
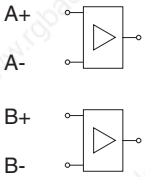
Signal assignment	Signal designation	Signal shape	Actual position value (with default setting)
 DK000086v01_nn.FH9	 DF000184v01_nn.FH9	HSF (sine 1 V_{pp} without 120 Ohm terminating resistor, I²C bus)	increasing
 DK000087v01_nn.FH9 amplitude-modulated signal	 DF000184v01_nn.FH9	resolver	increasing

Fig. 7-51: Signal assignment to the actual position value

Connection Diagrams EN1

EN1 with Encoder System R0 and R1

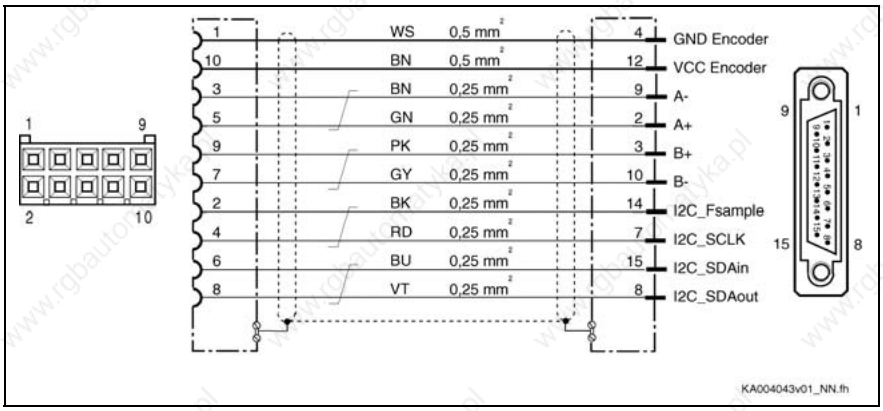


Fig. 7-52: Connection diagram

Note: For **direct** connection to the encoder system use our cable IKS 4043.

EN1 with Encoder System S0 and M0

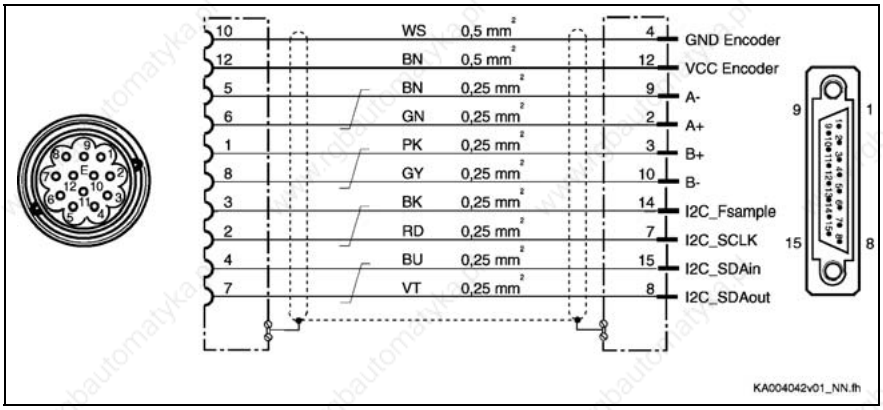


Fig. 7-53: Connection diagram

Note: For **direct** connection to the encoder system use our cable IKS 4042.

Encoder Evaluation EN2

Description

For encoders with a control voltage supply of 5 Volt:

- EnDat2.1 with Sense lines
- sine encoder (1 V_{pp}) with reference track
- square-wave encoder (TTL) with reference track

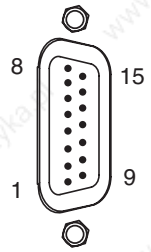
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
--	D-Sub	15	pins on device	0,25-1,0	 DA000056v01_nn.FH9

Fig. 7-54: Connection

Pin Assignment

Connection	Signal	Function
1	Sense+	return of supply voltage
2	Sense-	return of supply voltage
3	R-	reference track negative
4	R+	reference track positive
5	B-	track B negative
6	B+	track B positive
7	A+	track A positive
8	A-	track A negative
9	EncData+	data transmission
10	GND_Encoder	power supply reference potential
11	EncCLK+	clock positive
12	VCC_Encoder	power supply
13	EncCLK-	clock negative
14	GND_Shield	connection for signal shields
15	EncData-	data transmission

Fig. 7-55: Pin assignment

Properties EN2

VCC_Encoder (Encoder Supply)

Data	Unit	Min.	Typ.	Max.
DC output voltage VCC_Encoder **with** voltage return (Sense)	V	4,75	5,0	5,25
DC output voltage VCC_Encoder **without** voltage return (Sense)	V	4,85	5,1	5,35
output frequency sine	kHz		4	
output current	mA			300
d.c. resistance of load	Ohm	35		

Fig. 7-56: Encoder supply EN2

Input Circuit for Sine Signals A+, A- or B+, B- or R+, R-

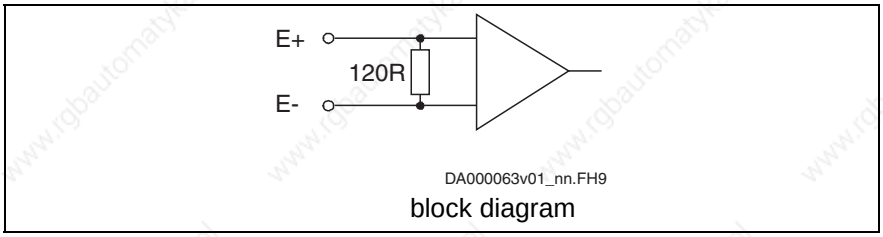


Fig. 7-57: Input circuit for sine signals

Properties of Differential Input for Sine Signals

Data	Unit	Min.	Typ.	Max.
allowed amplitude of encoder signal peak-peak ($U_{PPencodersignal}$)	V		1,0	1,2
limit frequency (-3 dB)	kHz		500	
converter width A/D converter	Bit		12	
input resistance	Ohm		120	

Fig. 7-58: Differential input sine

Input Circuit for Square-Wave Signals

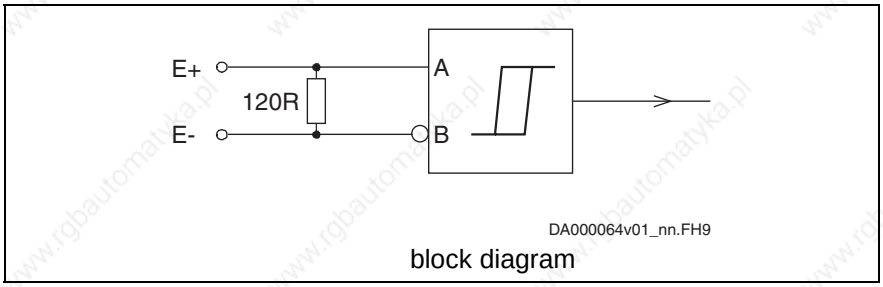


Fig. 7-59: Input circuit for square-wave signals

Properties of Differential Input for Square-Wave Signals

Data	Unit	Min.	Typ.	Max.
input voltage "high"	V	2,4		5,0
input voltage "low"	V	0		0,8
input frequency	kHz			1000
input resistance	Ohm		120	

Fig. 7-60: Differential input square-wave signals

Sense+, Sense-

Return of encoder supply to amplifier to compensate for voltage drop in encoder cable and have required voltage range present at encoder.

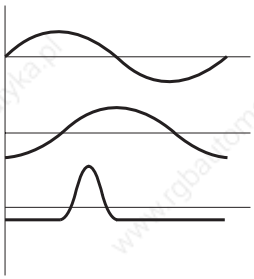
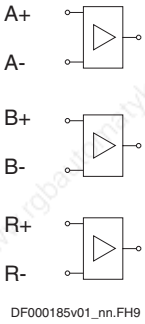
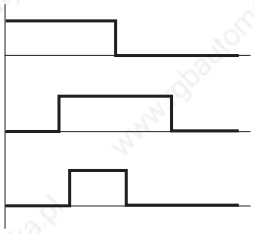
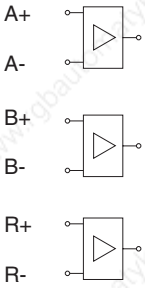
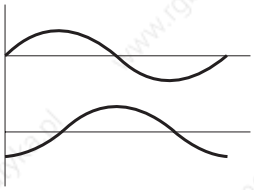
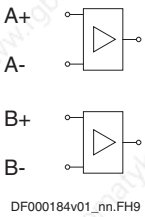
Note: Use cables with Sense lines for high degrees of voltage drop caused by

great cable lengths

small cable cross sections

many contact resistances

Signal Assignment to the Actual Position Value

Signal assignment [1)]	Signal designation	Signal shape	Actual position value (with default setting)
 DK000089v01_nn.FH9	 DF000185v01_nn.FH9	sine (1 V_{pp}) without absolute value	increasing
 DK000090v01_nn.FH9	 DF000185v01_nn.FH9	square-wave (TTL) without absolute value	increasing
 DK000088v01_nn.FH9	 DF000184v01_nn.FH9	sine (1 V_{pp}) with absolute value (e.g. EnDat)	increasing

1) see following note

Fig. 7-61: Signal assignment to the actual position value

Note: The encoder signal assignment to the inputs is based on clockwise rotation (front view at motor shaft).

- Track A (A+, A-) advances track B (B+, B-) 90° electrically
- The actual position value increases in this case (unless a negation takes effect)
- If present, the reference track R (R+, R-) makes the reference mark pulse at positive signals of track A and track B (within the 0-quadrant)

Note: Standard setting:
=> see Functional Description of firmware

Connection Diagrams EN2

EN2 with Encoder System C0

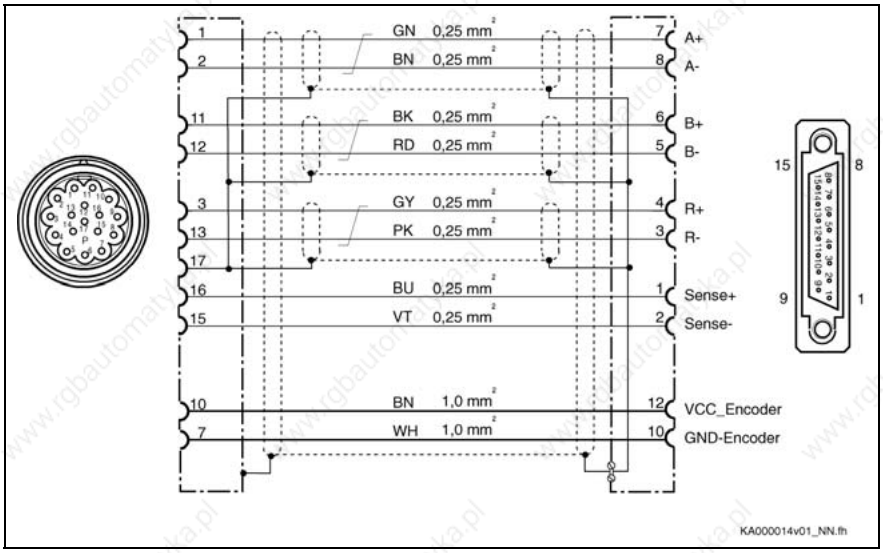


Fig. 7-62: Connection diagram

Note: For **direct** connection to the encoder system use our cable RKG 0014.

EN2 with Third-Party Encoder EnDat2.1 (According to Heidenhain Standard) and Sense Lines, 5 V Supply

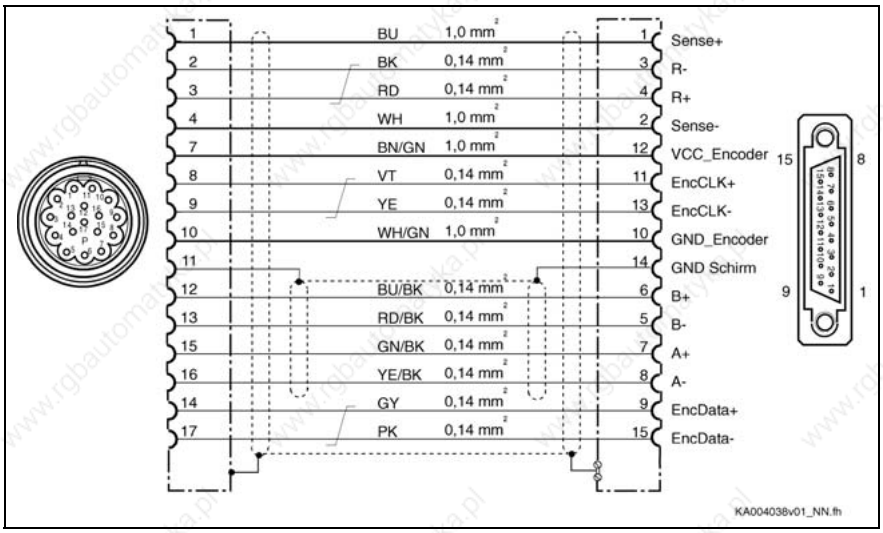


Fig. 7-63: Connection diagram

Note: For **direct** connection to the encoder system use our cable IKS 4038.

EN2 with Third-Party Encoder 1 Vpp, 5 V Supply

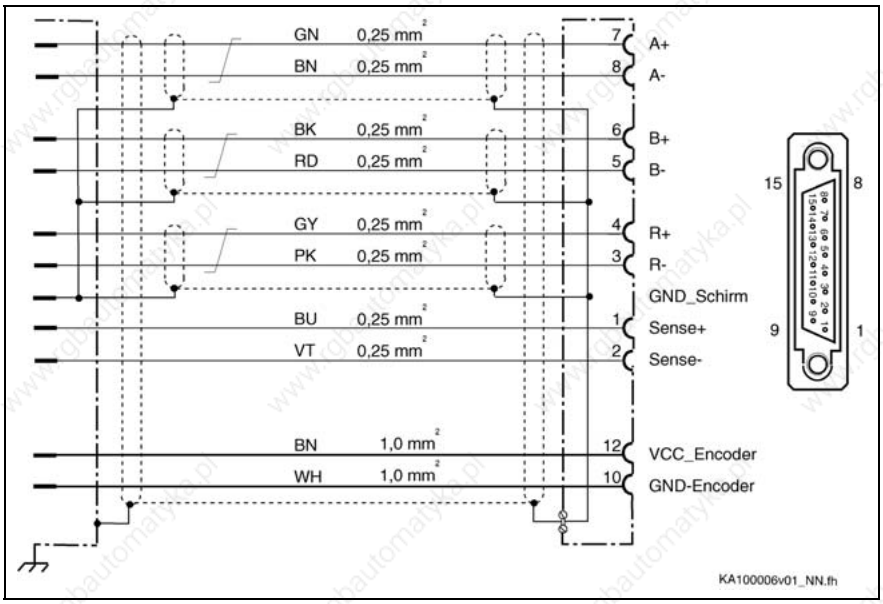


Fig. 7-64: Connection diagram

EN2 with Third-Party Encoder Square-Wave, 5 V Supply

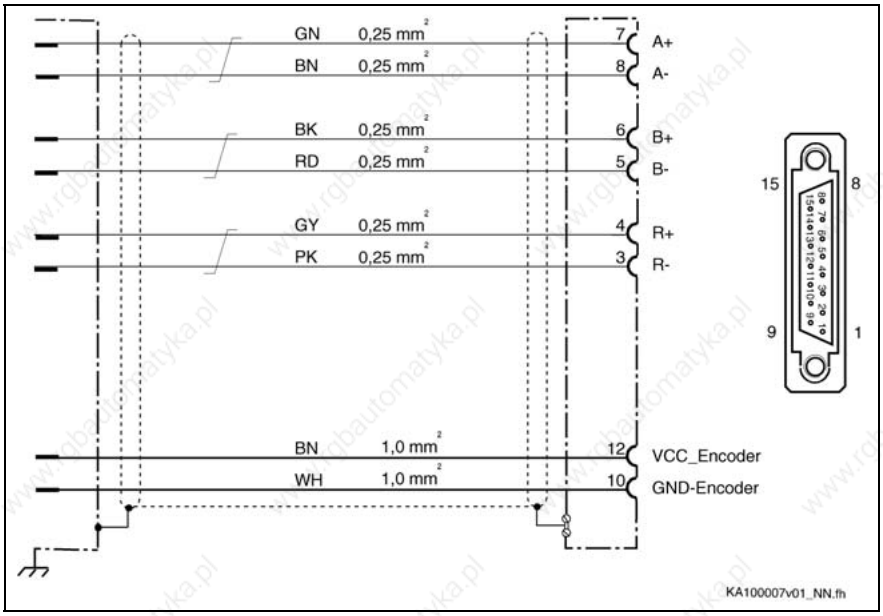


Fig. 7-65: Connection diagram

Allowed Encoder Cable Lengths at EN2

The current consumption of the connected encoder system generates a voltage drop due to the ohmic resistance (line cross section and line length) of the encoder cable. This reduces the signal at the encoder input.

The drive controller can influence the voltage for encoder supply (VCC_Encoder). For this purpose the actual voltage value at the encoder can be detected with the Sense lines.

If the cable and the encoder system have connections for the Sense+/Sense- signals, this value is transmitted from the encoder to the drive controller.

The diagrams below take into account that

- the **cross section of the wires** for supply voltage in the cable is at least 0.5 mm^2 (lower cross sections reduce the allowed length),
- the **allowed supply voltage** at the encoder is 5 V ±5%.

1. With Sense connection in the encoder line

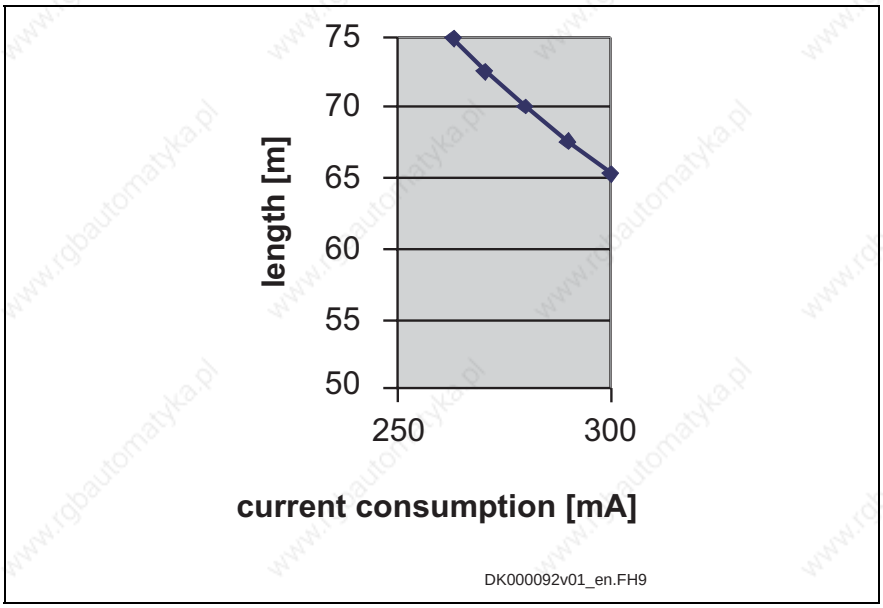


Fig. 7-66: Encoder cable lengths with Sense connection

Note: The maximum allowed length of cables **with** Sense lines is 75 m.

2. Without Sense connection in the encoder line

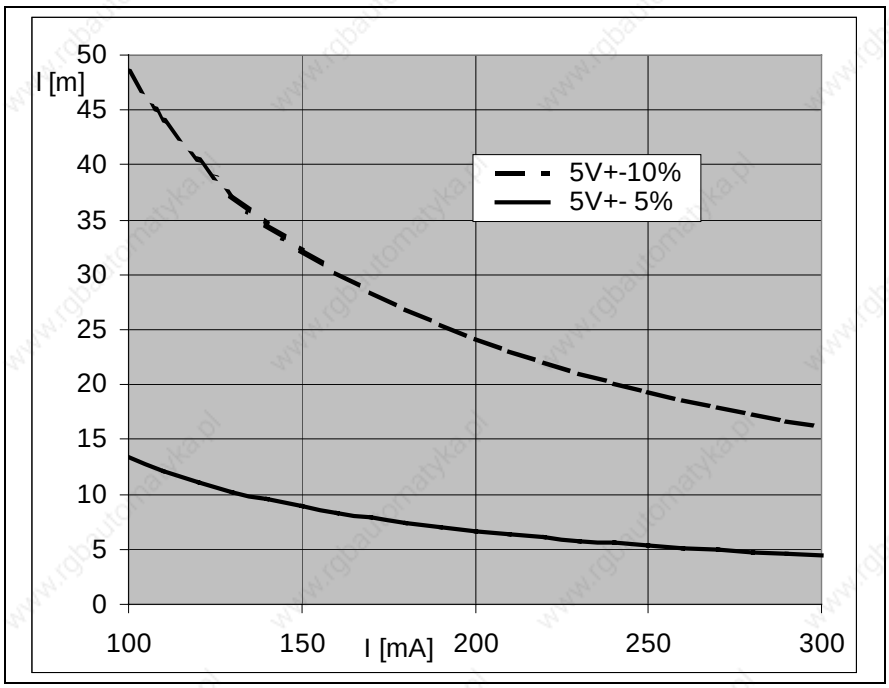


Fig. 7-67: Encoder cable lengths without Sense connection

Note: The maximum allowed length of cables **without** Sense lines is 50 m.

Smaller cross sections (e.g. of original Heidenhain cables) reduce the allowed cable length.

Encoder Emulation MEM

Description

Emulation of absolute and incremental encoders for further analysis by a control. The signals are galvanically isolated from the circuit board. External power supply is not necessary.

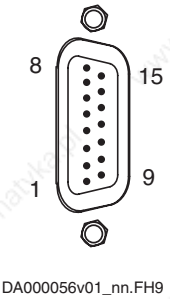
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
X10	D-Sub	15	pins on device	0,25-0,5	

Fig. 7-68: Connection

Pin Assignment X10

Connection	Signal	Function
1	n.c.	n.c.
2	n.c.	n.c.
3	SSI_CLK+	incremental encoder: n.c.; absolute encoder: clock pos.
4	SSI_CLK-	incremental encoder: n.c.; absolute encoder: clock neg.
5	n.c.	n.c.
6	n.c.	n.c.
7	n.c.	n.c.
8	n.c.	n.c.
9	UA0+ / SSI_Data+	incremental encoder: reference track; absolute encoder: data transmission
10	0V	reference potential
11	UA0- / SSI_Data-	incremental encoder: reference track; absolute encoder: data transmission
12	UA1+	incremental encoder: track A1; absolute encoder: n.c.
13	UA1-	incremental encoder: track A1; absolute encoder: n.c.
14	UA2+	incremental encoder: track A2; absolute encoder: n.c.
15	UA2-	incremental encoder: track A2; absolute encoder: n.c.

Fig. 7-69: Pin assignment

Line Data

Data	Unit	Min.	Typ.	Max.
allowed length l	m			40
allowed capacitance between outputs	nF/m			5
allowed capacitance between output and 0 V	nF/m			10
shielding		double shielding (individual shields and overall shield)		

Fig. 7-70: Line at MEM

CAUTION

Risk of damage by use of unshielded lines and lines with single shielding!

⇒ Use lines with double shielding.

Note: Update rate of actual position value output: see firmware documentation.

Incremental Encoder Emulation

Connection Incremental Encoder Emulation

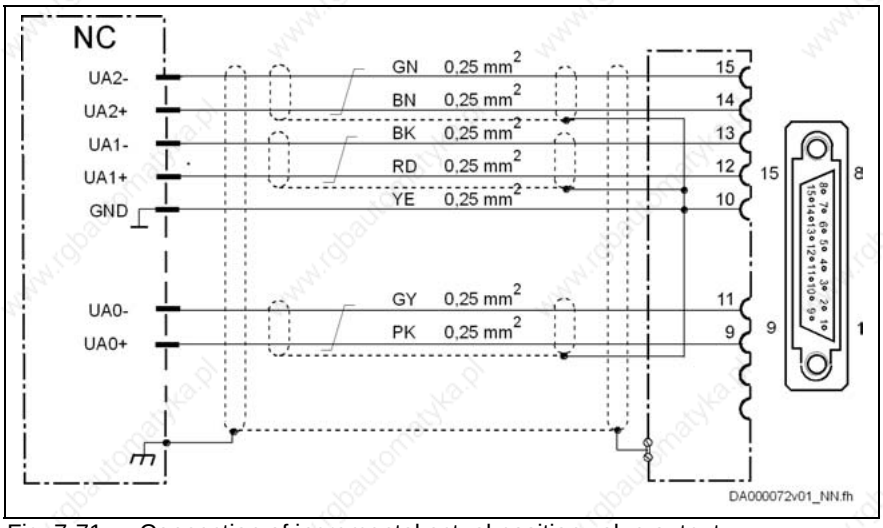


Fig. 7-71: Connection of incremental actual position value output

Differential Outputs Incremental Encoder Emulation

Data	Unit	Min.	Typ.	Max.
output voltage "high"	V	2,5		5
output voltage "low"	V	0		0,5
output current I_{out}	mA			I 20 I
load capacitance between output and 0 V	nF			10
output frequency f	MHz			1
overload protection		available		

Fig. 7-72: Differential outputs

Note: To adjust the output voltage levels, use the accessory HAS05.1-003. For the description of the accessory see chapter "Accessories" in this documentation.

Signals for Incremental Actual Position Value Output

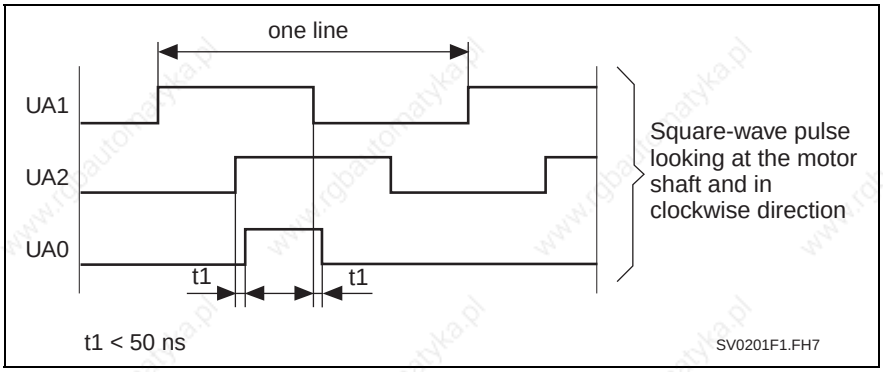


Fig. 7-73: Signals for incremental actual position value output

Output Frequency f

$$f = \frac{number\ of\ lines}{revolution} \bullet n$$

f: output frequency
n: speed

Fig. 7-74: Calculating the output frequency f

Note: The output frequency results from the respective parameter setting.

=> See also Functional Description of firmware: "Encoder Emulation".

Control-Side Signal Filter for UA1 and UA2

Note: Due to the signal processing in the control section, the periodic time and duty cycle of the output signals are influenced.

Depending on the parameterized output frequency, there are the following requirements to the signal filtering of the control unit for channels UA1 and UA2:

with $f_{out} \geq 500$ kHz $f_{filter} \geq 1$ MHz

with $f_{out} < 500$ kHz $f_{filter} \geq 2 * f_{out}$

Speed Measurement

Note: Frequency measurement is **not** suited to measure the speed from the incremental emulator signals.

Absolute Encoder Emulation (SSI Format)

Connection Absolute Encoder Emulation

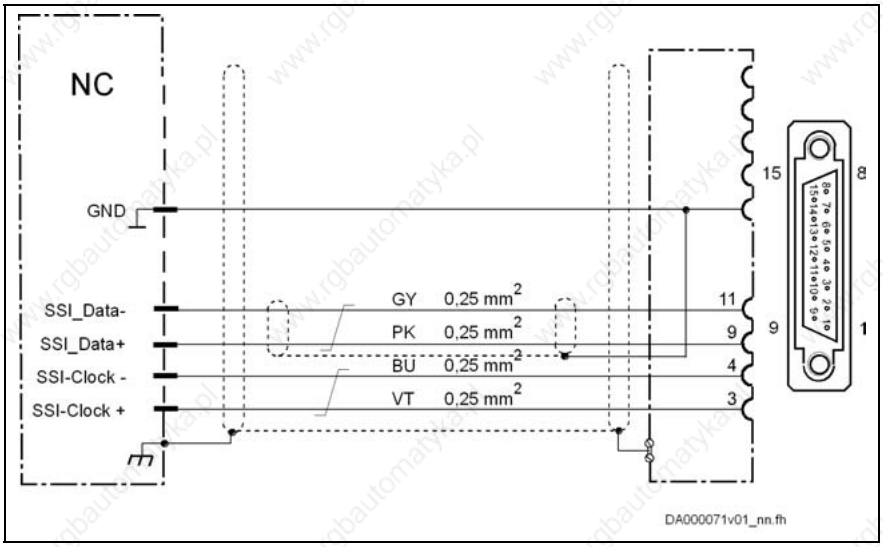
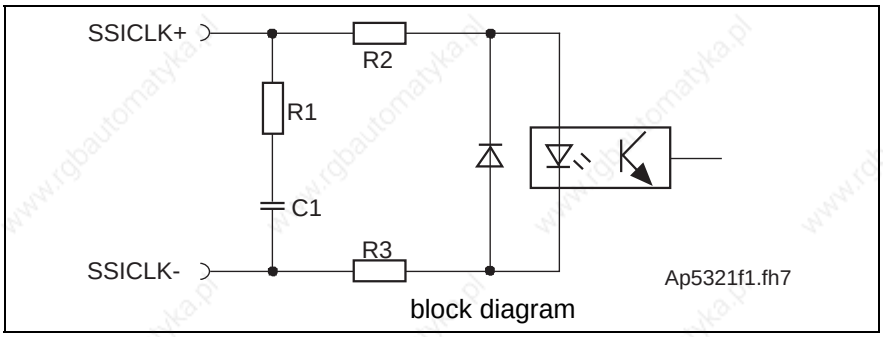


Fig. 7-75: Output of absolute actual position values according to SSI format

Differential Input Circuit Absolute Encoder Emulation



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

Fig. 7-76: Differential input circuit

Differential Inputs Absolute Encoder Emulation

Data	Unit	Min.	Typ.	Max.
input voltage "high"	V	2,5		5
input voltage "low"	V	0		0,5
input resistance	Ohm	approx. 150 (see circuit)		
clock frequency f	kHz	100 – 1000		
polarity reversal protection		within the allowed input voltage range		
galvanic isolation		signals from circuit board		

Fig. 7-77: Differential inputs

Differential Outputs Absolute Encoder Emulation

Data	Unit	Min.	Typ.	Max.
output voltage "high"	V	2,5		5
output voltage "low"	V	0		0,5
output current I_{out}	mA			I 20 I
load capacitance between output and 0 V	nF			10
output frequency f	MHz			1
overload protection		available		
terminating resistor at load	Ohm	150…180		

Fig. 7-78: Differential outputs

Note: The differential output corresponds to the RS422 specifications. On the control side, a line terminating resistor must be available for the SSI data signal. If this resistor is not available, connect an external line terminating resistor (150…180 Ohm).

Pulse diagram with absolute actual position value output (SSI format)

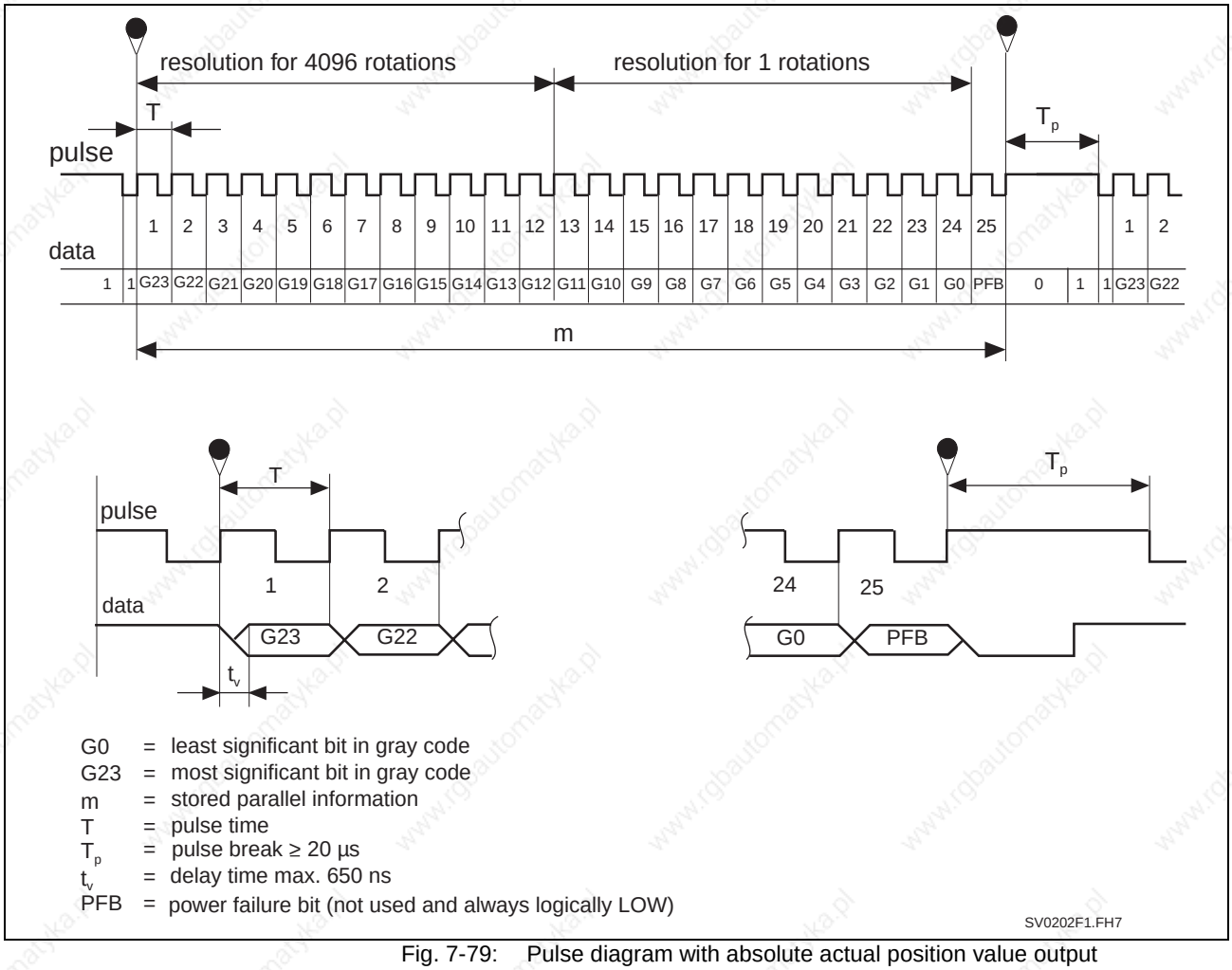


Fig. 7-79: Pulse diagram with absolute actual position value output (SSI format)

7.4 I/O Extensions

Analog I/O Extension MA1

Description

This option is used to increase the number of analog channels or to equip control sections with analog channels of better resolution.

The option makes available the following functions:

- 2 differential analog input channels ±10V (resolution: 12 bits)
- 2 analog output channels ±10V (resolution: 12 bits)

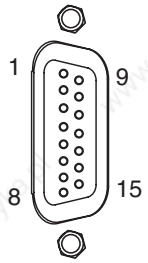
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
--	D-Sub	15	female (device)	0,08-0,5	 DA000053v01_nn.FH9

Fig. 7-80: Connection point MA1

Pin Assignment

Function		Connection	Technical data
GND connection to analog source AE1	GND_{100}	1	analog input type 2
analog differential input 1	+AE1	2	
	-AE1	9	
GND connection to analog source AE2	GND_{100}	3	analog input type 2
analog differential input 2	+AE2	4	
	-AE2	11	
analog output 1	+AA1	5	analog output type 3
reference potential for analog output 1 (GND measuring pin for external differential analog input)	GNDA	6	
shield connection for analog output 1 (AA1)	GND_{100}	13	
analog output 2	+AA2	14	analog output type 3

Function		Con-nection	Technical data
reference potential for analog output 2 (GND measuring pin for external differential analog input)	GNDA	15	
shield connection for analog output 2 (AA2)	GND_{100}	7	
housing (connection for overall shield)	housing	8	
unassigned GNDA pin (reference potential for analog output)	GNDA	10	
unassigned GNDA pin (reference potential for analog output)	GNDA	12	

Fig. 7-81: Pin assignment

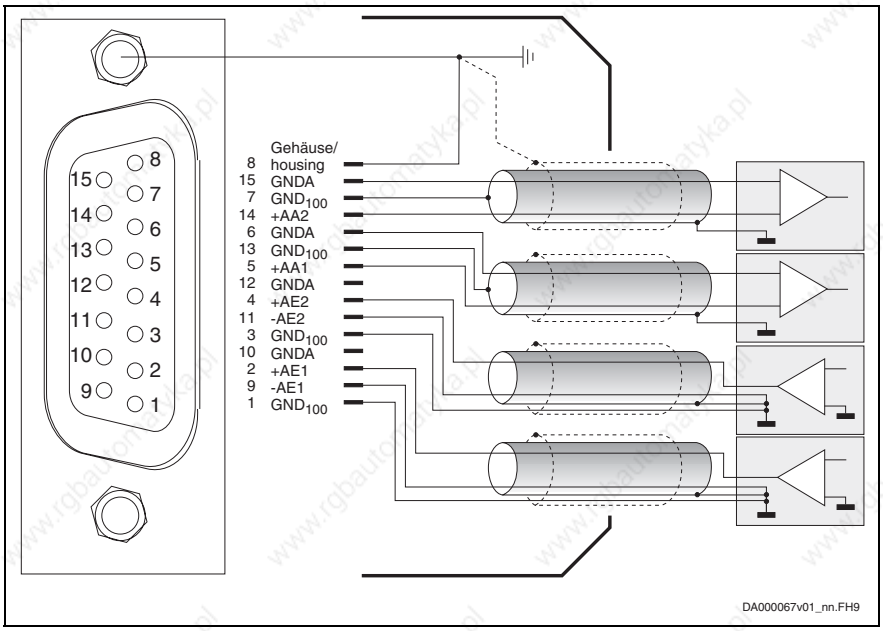


Fig. 7-82: Block diagram

For applications only using one or two analog I/Os you can also wire the individual cables directly at the D-Sub connector (see block diagram above).

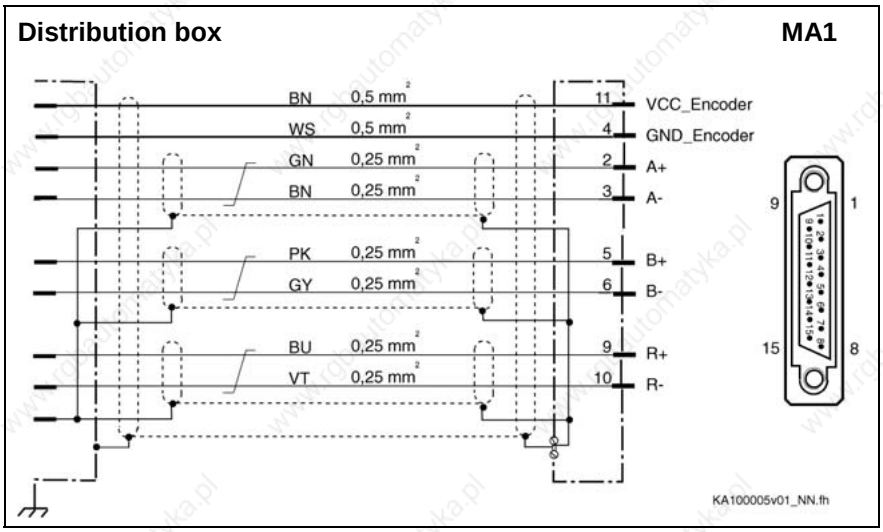
Observe that several individual cables in the connector housing and in the cable entry take more space than one overall cable only.

Use D-Sub connectors with metallized housings.

Note: For applications using several analog I/Os, use the appropriate distribution box (e.g. UM 45-D15SUB/S from Phoenix Contact).

For direct connection of the optional module MA1 to the distribution box, use our cable RKS0003.

Interconnection Diagram with Distribution Box UM 45



1) Connection of overall shield to housing of optional module MA1 via internal connection

Fig. 7-83: Interconnection diagram RKS0003

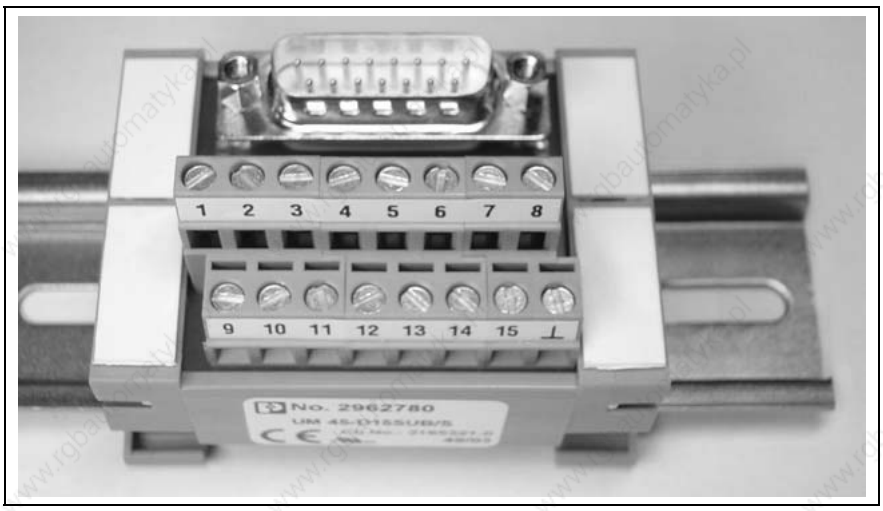


Fig. 7-84: Distribution box UM 45-D15SUB/S (Phoenix Contact)

Note: The connections in the distribution box are connected "1 to 1" from D-Sub connector to screw terminal connections. The housing potential of the distribution box is available at the remaining connection "⊥".

Digital I/O Extension MD1

Description

This options is en extension for Rexroth IndraDrive control sections.
The option makes available the following functions:

- 12 digital 24 V inputs
- 8 digital 24 V outputs

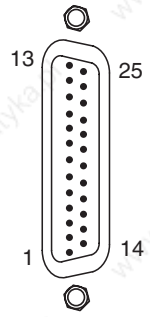
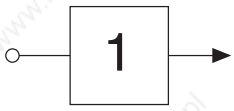
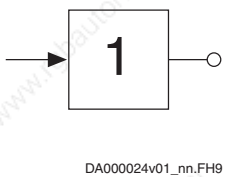
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
--	D-Sub	25	pins on device	0,08-0,5	

Fig. 7-85: Connection

Assignment

Function		Connection	Technical data
dig. **input group 0** 	Input 0.0	14	24 V / 3 mA see chapter "Technical Data Functions"
	Input 0.1	15	
	Input 0.2	16	
	Input 0.3	17	
	Input 0.4	18	
	Input 0.5	19	
	Input 0.6	20	
	Input 0.7	21	
	Input 0.8	22	
	Input 0.9	23	
	Input 0.10	24	
	Input 0.11	25	
power supply for input group 0	UL_ext_2	7	DC (19…30) V; max. 0,1 A
dig. **output group 0** 	Output 0.0	1	see chapter "Technical Data Functions"
	Output 0.1	2	
	Output 0.2	4	
	Output 0.3	5	
power supply for output group 0	UL_ext_0	3	DC (19…30) V; max. 1,2 A

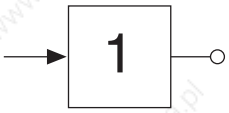
Function		Con-nection	Technical data
dig. **output group 1**  DA000024v01_nn.FH9	Output 1.0	9	see chapter "Technical Data Functions"
	Output 1.1	10	
	Output 1.2	12	
	Output 1.3	13	
power supply for output group 1	UL_ext_1	11	DC (19…30) V; max. 1,2 A
reference potential for input/output groups and power supply	GND_ext	8, 6	max. 2,5 A
connection cable shield	shield	connector housing	

Fig. 7-86: Signal assignment

Digital I/O Extension and SSI Encoder Evaluation MD2

Description

The optional module MD2 is a combined extension with the following functions:

- **Digital I/O extension** with 16 inputs and 16 outputs:
  - 2 input groups with 8 inputs each and separate supply voltage for each group
  - 4 output groups with 4 outputs each and separate supply voltage for each group
- **SSI encoder evaluation** for absolute position detection for different encoders with SSI interface

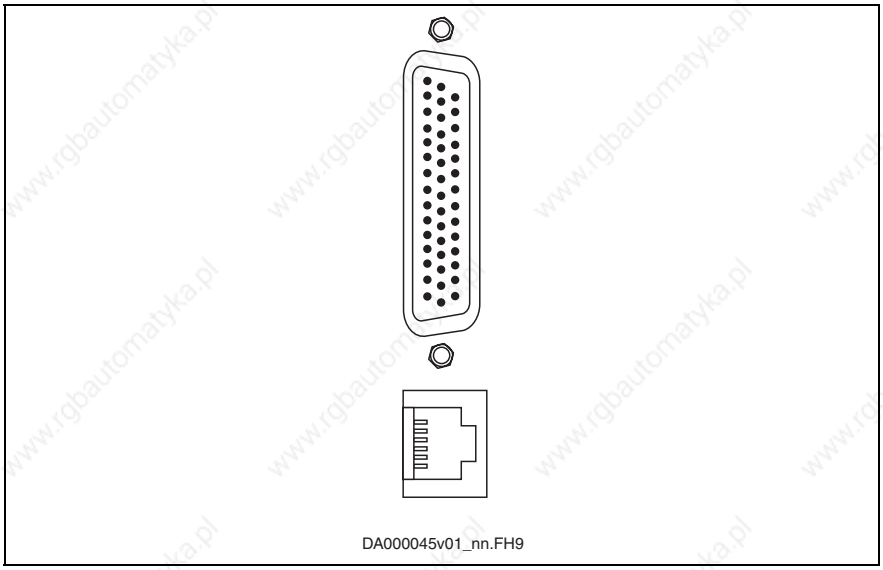


Fig. 7-87: Description MD2

Digital I/O Extension on MD2

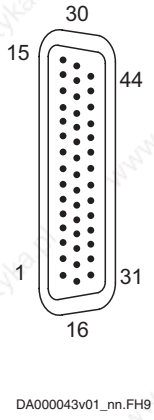
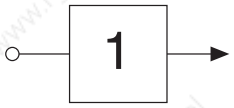
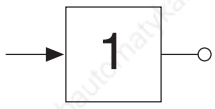
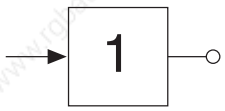
Connection point	Type	No. of poles	Description	Figure
X17	D-Sub (High Density)	44	I/O extension	

Fig. 7-88: Connection

Pin Assignment X17 I/O Extension

Function		Con-nection	Technical data
dig. **input group 0**  DA000022v01_nn.FH9	Input 0.0	7	24 V / 3 mA; see Technical Data Functions
	Input 0.1	22	
	Input 0.2	6	
	Input 0.3	21	
	Input 0.4	5	
	Input 0.5	20	
	Input 0.6	4	
	Input 0.7	19	
power supply for input group 0	+UL_ext_in_0	36	DC 19…30 V; max. 1,1 A
	GND_ext_in_0	35	
dig. **input group 1**  DA000022v01_nn.FH9	Input 1.0	3	24 V / 3 mA; see Technical Data Functions
	Input 1.1	18	
	Input 1.2	2	
	Input 1.3	32	
	Input 1.4	17	
	Input 1.5	1	
	Input 1.6	16	
	Input 1.7	31	
power supply for input group 1	+UL_ext_in_1	34	DC 19…30 V; max. 1,1 A
	GND_ext_in_1	33	
dig. **output group 0**  DA000024v01_nn.FH9	Output 0.0	15	24 V / 0,5 A see Technical Data Functions
	Output 0.1	30	
	Output 0.2	14	
	Output 0.3	29	
power supply for output group 0	+UL_ext_out_0	44	DC 19…30 V; max. 1,1 A
	GND_ext_out_0	43	
dig. **output group 1**  DA000024v01_nn.FH9	Output 1.0	13	24 V / 0,5 A see Technical Data Functions
	Output 1.1	28	
	Output 1.2	12	
	Output 1.3	27	
power supply for output group 1	+UL_ext_out_1	42	DC 19…30 V; max. 1,1 A
	GND_ext_out_1	41	

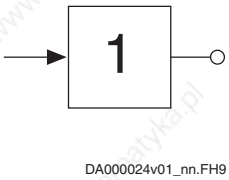
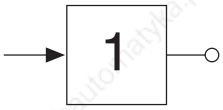
Function		Con-nection	Technical data
dig. **output group 2**  DA000024v01_nn.FH9	Output 2.0	11	24 V / 0,5 A see Technical Data Functions
	Output 2.1	26	
	Output 2.2	10	
	Output 2.3	25	
power supply for output group 2	+UL_ext_out_2	40	DC 19…30 V; max. 1,1 A
	GND_ext_out_2	39	
dig. **output group 3**  DA000024v01_nn.FH9	Output 3.0	9	24 V / 0,5 A see Technical Data Functions
	Output 3.1	24	
	Output 3.2	8	
	Output 3.3	23	
power supply for output group 3	+UL_ext_out_3	38	DC 19…30 V; max. 1,1 A
	GND_ext_out_3	37	
connection cable shield	shield	connector housing	

Fig. 7-89: Assignment

Note: The digital inputs/output are galvanically isolated from the control section.

Connect connection point X17 to the terminal strip in the control cabinet by means of our cable RKS0004. The cable RKS0004 is available up to a length of 10 M, see also example of connection MD2.

SSI Encoder Evaluation on MD2

The encoder is supplied by the connections X16.5 and X16.6 of the 24 V control voltage supply (U_{N3}) of the power section.

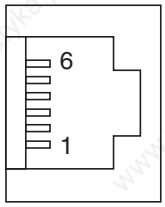
Connection point	Type	No. of poles	Description	Figure
X16	RJ11	6	SSI encoder evaluation	 DA000044v01_nn.FH9

Fig. 7-90: Connection

Pin Assignment X16 SSI Interface

Connection	Signal	Function	Technical Data
1	SSI_CLK-	clock neg.	
2	SSI_CLK+	clock pos.	
3	SSI_Data+	data transmission positive	
4	SSI_Data-	data transmission negative	
5	+24V	supply voltage encoder	U_{N3}-1V; max. 0,2 A
6	0V	reference potential	
connector housing	shield	connection cable shield	

Fig. 7-91: Assignment

Max. Line Length

SSI_CLK frequency that is set (see also P-0-0906) [kHz]	Max. allowed line length [m]
125	75
250	75
500	75
1000	40

Fig. 7-92: Line length and SSI_CLK frequency

Example of Connection Principle MD2

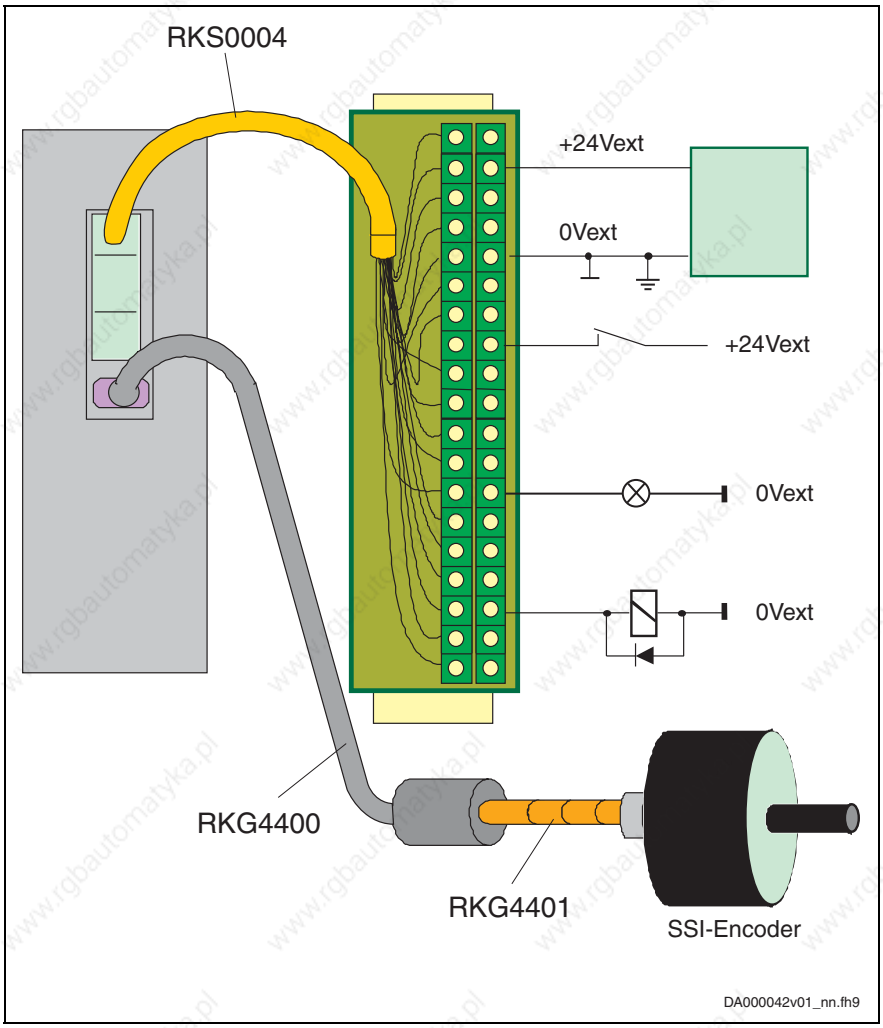


Fig. 7-93: Example of connection I/O extension MD2

Note: The connection to the SSI encoder consists of two cable sections:

- Cable **RKG 4400** from X16 to coupling element (max. length 1.5 m).
- Adapter cable between connecting cable and the respective encoder used with different connector pin assignments. For SSI encoders from Stegmann use our cable **RKG 4401**.

7.5 Safety Technology

Starting Lockout L1

Description The starting lockout complies with stop category 0 acc. to EN60204-1.

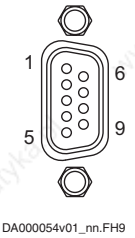
Connection point	Type	No. of poles	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Figure
X41	D-Sub, female (device)	9	0,25-0,5	-	-	

Fig. 7-94: Connection

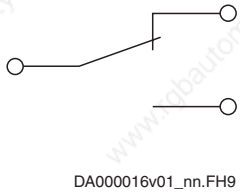
Function			Con-nection	Nominal data	Technical data
inverted acknowledgment		ASQ2	6	DC24V / 1A	relay contact type 3
supply for acknowledgment potential		ASQ	4		
acknowledgment		ASQ1	5		
control signal starting lockout assignment A		AS-A	1	24 V / 3 mA	digital inputs
inverted control signal starting lockout		AS n	2		
control signal starting lockout assignment B		AS B	3		
input for power supply		+24V	8	DC24V / 0,1A	DC 19,2…30 V; max. 0,1 A
		0 V_E	9		
n. c.			7		

Fig. 7-95: Pin assignment

Function

AS	ASn	Status	ASQ1	ASQ2
1	0	starting lockout active	= ASQ	open
0	1	starting lockout not active	open	= ASQ
0	0	error when selecting starting lockout	open	= ASQ
1	1			

Fig. 7-96: Function

Connection Accessory Cable **RKS0001** (9-pin cable with connector and single wire ends)

Safety Technology S1

Description This option allows different application-related safety functions, such as safety related standstill, safety related drive interlock, safety related reduced speed, safety related direction of motion etc.

Note: This option can only be used in conjunction with an encoder (at slot X4 or X4.1 and X4.2).

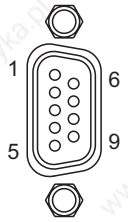
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Figure
X41	D-Sub	9	female (device)	0,25-0,5	-	-	

Fig. 7-97: Connection

Function			Connection	Nominal data	Technical data
input/output forced dynamization	digital input	IO30	1	24 V / 3 mA	digital inputs
	digital output			24 V / 0,5 A	digital outputs
input/output acknowledgment	digital input	IO20	2	24 V / 6 mA	digital inputs
	digital output			24 V / 0,5 A	digital outputs
input/output / relay contact diagn. message/ door locking device	digital input	IO10n	3	24 V / 3 mA	digital inputs
	digital output			24 V / 0,5 A	digital outputs
	N/O contact			DC24 V / 1A	relay contact type 3
digital inputs	operating mode selection	I1n	4	24 V / 3 mA	digital inputs
		I2n	5		
		I3n	6		
		I4n	7		
input for power supply		+24V	8	DC24 V / 0,1A	DC 19,2…30 V; max. 0,1 A
		0 V_E	9		

Fig. 7-98: Pin assignment

7.6 Control Panels

Standard Control Panel "S"

Description

The standard control panel

- has a single-line display
- is **not suited for hot plug**, i.e. you mustn't plug it in nor disconnect it when the drive controller has been switched on
- must have been plugged in when the drive controller is switched on so that it can be recognized

Fig. 7-99: Standard control panel with exemplary display and control elements

- The **display** shows operating states, command and error diagnoses and pending warnings.
- Using the four **keys**, the commissioning engineer or service technician, in addition to master communication via the commissioning tool or NC control unit, can have extended diagnoses displayed at the drive controller and trigger simple commands.

Overview of Functions

Using the control panel you can:

- set the drive address
- SERCOS: set the transmission power
- SERCOS Autodetect: set the field bus transmission rate
- establish the position data reference
- have a look at the error memory
- start the basic load defaults procedure
- set the analog outputs

Comfort Control Panel "C"

Description

The comfort control panel

- has a graphics display with a resolution of 128 * 64 pixel,
- is **suited for hot plug**, i.e. you may disconnect it when the drive controller has been switched on,
- must have been plugged in when the drive controller is switched on so that it can be recognized.

Fig. 7-100: Comfort control panel with exemplary display and control elements

- The **display** shows operating states, command and error diagnoses and pending warnings.
- Via the **keys** the drive can be commissioned **without PC**.
- Using the **keys**, the commissioning engineer or service technician, in addition to master communication via the commissioning tool or NC control unit, can have extended diagnoses displayed at the drive controller and trigger simple commands.

Overview of Functions

Using the comfort control panel you can:

- set the drive address
- SERCOS: set the transmission power
- SERCOS Autodetect: set the field bus transmission rate
- establish the position data reference
- have a look at the error memory
- start the basic load defaults procedure
- set the analog outputs

Note: For further information see the Functional Description of the firmware.

7.7 Memory

Memory Card PFM02.1

Description The memory card PFM02.1 is used for reading and storing data (firmware, drive parameters, operating data) from or on a standard MultiMediaCard (MMC).

Note: The memory card PFM02 is not contained in the standard scope of supply of the control sections.

Note: In the documentation of the firmware you can find a description of how to handle the memory card.

8 Technical Data Functions

8.1 Relay Contacts

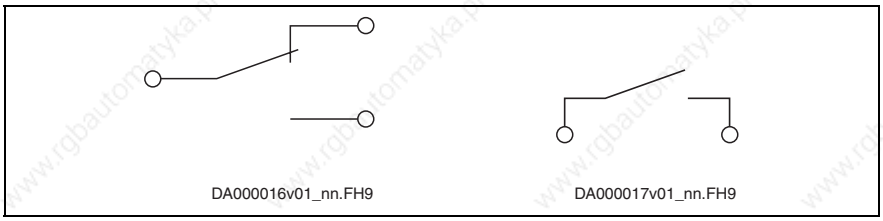


Fig. 8-1: Relay contacts

Relay Contact Type 1

Data	Unit	Min.	Typ.	Max.
current load capacity	A			DC 1 AC 2
voltage load capacity	V			DC 30 AC 250
minimum contact load	mA	10		
contact resistance at minimum current	mOhm			1000
switching actions at max. time constant of load		100.000		
number of mechanical switching cycles			$1 * 10^6$	
time constant of load	ms			50
pick up delay	ms			10
drop out delay	ms			10

Fig. 8-2: Relay contacts type 1

Relay Contact Type 2

Data	Unit	Min.	Typ.	Max.
current load capacity	A			DC 1
voltage load capacity	V			DC 30
minimum contact load	mA	10		
contact resistance at minimum current	mOhm			1000
switching actions at max. time constant of load			$1 * 10^6$	
number of mechanical switching cycles			$1 * 10^8$	
time constant of load	ms	ohmic		
pick up delay	ms			10
drop out delay	ms			10

Fig. 8-3: Relay contacts type 2

Relay Contact Type 3

Data	Unit	Min.	Typ.	Max.
current load capacity	A			DC 1
voltage load capacity	V			DC 30
minimum contact load	mA	10		
contact resistance at minimum current	mOhm			1000
switching actions at max. time constant of load			$1 * 10^6$	
number of mechanical switching cycles			$1 * 10^7$	
time constant of load	ms	ohmic		
pick up delay	ms			10
drop out delay	ms			10

Fig. 8-4: Relay contacts type 3

8.2 Digital Inputs/Outputs

The digital inputs/outputs correspond to IEC 61131, type 1.

Note: Do not operate digital outputs at low-resistance sources.

Observe Functional Description of the firmware section "Notes on Commisioning" particularly parameter P-0-0302, Digital I/O, Direction.

Digital Inputs

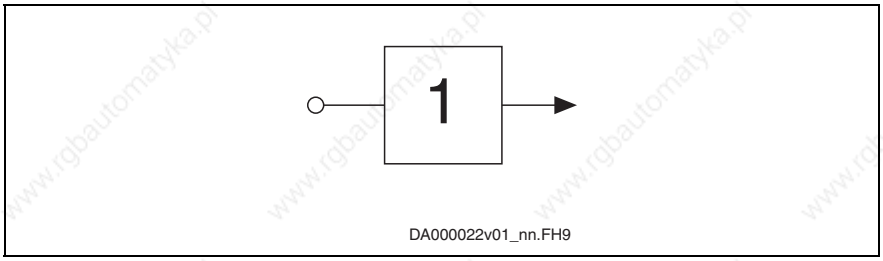


Fig. 8-5: Symbol of digital input

Data	Unit	Min.	Typ.	Max.
allowed input voltage	V	-3		30
On	V	15		
Off	V			5
input current	mA	2		5
input resistance	kOhm	non-linear, varies depending on input voltage		
sampling frequency	kHz	depending on firmware		
probe input delay	us		1	

Fig. 8-6: Digital inputs

Note: **Probe inputs** are fast inputs. For triggering use bounce-free switches.

Digital Outputs

The digital outputs correspond to IEC 61131.

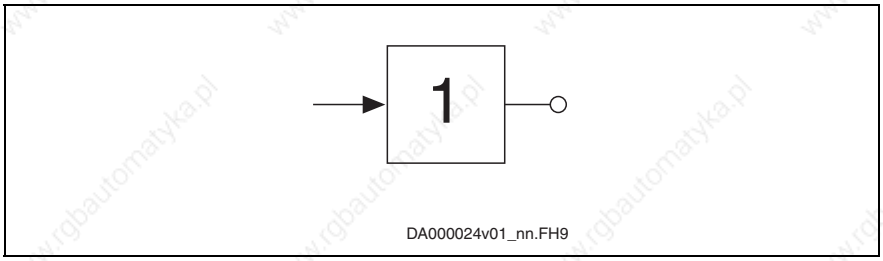


Fig. 8-7: Symbol of digital output

Data	Unit	Min.	Typ.	Max.
output voltage "ON"	V	Uext - 0,5	24	Uext
output voltage "OFF"	V			2,1
output current "OFF"	mA			0,05
allowed output current per output	mA			500
allowed output current total or per group	mA			1000
update interval	ns	depending on firmware		
short circuit protection		present		
overload protection		present		
allowed energy content of connected inductive loads, e.g. relay coils; only allowed as single pulse	mJ			400

Fig. 8-8: Digital outputs

Note: The digital outputs have been realized with so-called high-side switches. This means that these outputs can actively supply current but not drain it.

Note: The energy absorption capacity of the outputs is used to limit voltage peaks caused when inductive loads are switched off.

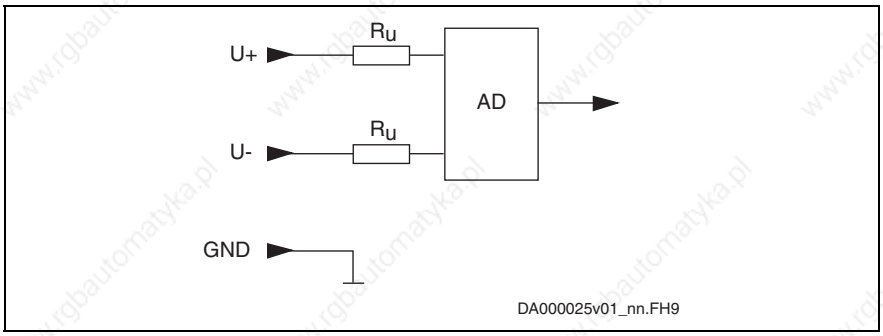
Limit voltage peaks by using free-wheeling diodes directly at the relay coil.

8.3 Analog Inputs/Outputs

The analog inputs correspond to IEC 61 131.

Analog Inputs

Analog Input Type 1



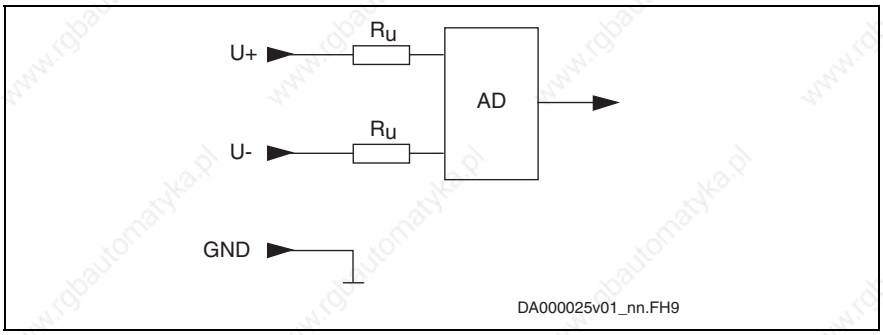
AD: analog/digital converter

Fig. 8-9: Analog voltage inputs

Data	Unit	Min.	Typ.	Max.
allowed input voltage voltage inputs	V	-10		+10
input resistance voltage input	kOhm		180	
input bandwidth	kHz		6	
common-mode range	V	-20		+20
common-mode rejection	dB			
relative measuring error at 90% U_{emax}	%	-1		+1
converter width A/D converter incl. polarity sign	Bit		10	
oversampling			8-fold	
dynamic converter width with oversampling	Bit		12	
resulting resolution	mV/Ink		5,5	
cyclic conversion	us	500 (depending on firmware)		
conversion time	us		n.s.	

Fig. 8-10: Analog voltage inputs

Analog Input Type 2



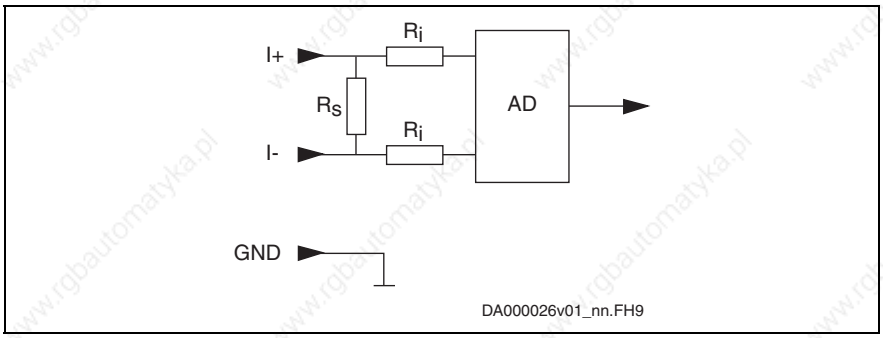
AD: analog/digital converter

Fig. 8-11: Analog voltage inputs

Data	Unit	Min.	Typ.	Max.
allowed input voltage voltage inputs	V	-10		+10
input resistance voltage input	kOhm	1000		
input bandwidth	kHz		50	
common-mode range	V	-50		+50
common-mode rejection	dB	70		
relative measuring error at 90% U_{emax}	%	-0,3		+0,3
converter width A/D converter incl. polarity sign	Bit		12	
oversampling			8-fold	
dynamic converter width with oversampling	Bit		14	
resulting resolution	mV/Ink		1,25	
cyclic conversion	us	500 (depending on firmware)		
conversion time	us		40	

Fig. 8-12: Analog voltage inputs

Analog Input Type 3



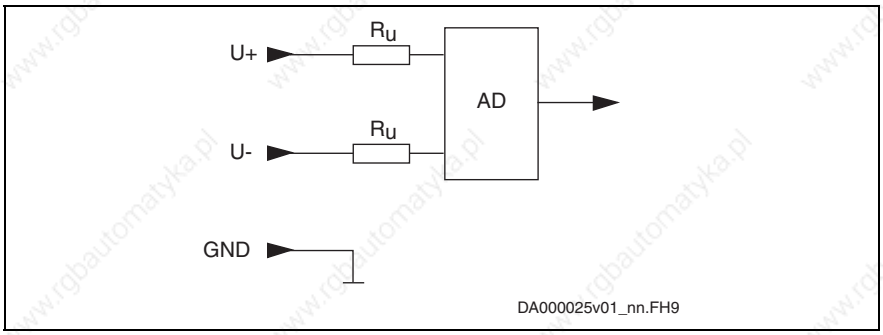
AD: analog/digital converter

Fig. 8-13: Analog current inputs

Data	Unit	Min.	Typ.	Max.
allowed input current	mA	0		+20
input resistance	Ohm		200	
input bandwidth	kHz		3	
common-mode range	V	-20		+20
common-mode rejection	dB			
relative measuring error at 90% U_{emax}	%	-1		+1
converter width A/D converter incl. polarity sign	Bit		10	
oversampling			8-fold	
dynamic converter width with oversampling	Bit		12	
resulting resolution	µA/Ink		5,45	
cyclic conversion	us	500 (depending on firmware)		
conversion time	us		n.s.	

Fig. 8-14: Analog current inputs

Analog Input Type 4



AD: analog/digital converter

Fig. 8-15: Analog voltage inputs

Data	Unit	Min.	Typ.	Max.
allowed input voltage voltage inputs	V	-10		+10
input resistance voltage input	kOhm		2	
input resistance voltage input CSH01.2C	kOhm		160	
input bandwidth	kHz		10	
common-mode range	V	-20		+20
common-mode rejection	dB			
relative measuring error at 90% U_{emax}	%	-1		+1
converter width A/D converter incl. polarity sign	Bit		12	
oversampling			8-fold	
dynamic converter width with oversampling	Bit		14	
resulting resolution	mV/Ink		1,23	
cyclic conversion	us	500 (depending on firmware)		
conversion time	us		n.s.	

Fig. 8-16: Analog voltage inputs

Analog Outputs

Analog Output Type 1

Data	Unit	Min.	Typ.	Max.
output voltage	V	0		+10
output load	kOhm	2		
output current	mA	0		+5
converter width digital/analog converter incl. polarity sign	Bit	10		
resolution	mV/Ink	9,8		
conversion time (incl. response time)	us		10	
cyclic conversion	us	depending on firmware		
short circuit protection		present		
overload protection		present		

Fig. 8-17: Analog outputs type 1

Analog Output Type 2

Data	Unit	Min.	Typ.	Max.
output voltage	V	0		+5
output load	kOhm	5		
output current	mA	0		+1
converter width digital/analog converter incl. polarity sign	Bit	8		
resolution	mV/Ink	19,5		
accuracy at R=5 kOhm	%	5 of FMR		
accuracy at R=10 kOhm	%	2,5 of FMR		
conversion time (incl. response time)	us		10	
cyclic conversion	us	depending on firmware		
short circuit protection		present		
overload protection		present		

FMR: final value of measuring range

Fig. 8-18: Analog outputs type 2

Analog Output Type 3

Data	Unit	Min.	Typ.	Max.
output voltage	V	-10		+10
output load	kOhm	1		
output current	mA	0		+1
converter width digital/analog converter incl. polarity sign	Bit	12		
resolution	mV/Ink	5		
accuracy at R = 1 kOhm	%	1 of FMR		
accuracy at R = 10 kOhm	%	0,2 of FMR		
conversion time (incl. response time)	us		10	
cyclic conversion	us	depending on firmware		
short circuit protection		present		
overload protection		present		

FMR: final value of measuring range

Fig. 8-19: Analog outputs type 3

8.4 Serial Interface (RS232)

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

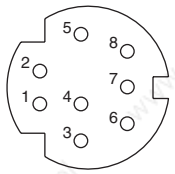
Connection point	Type	No. of poles	Stranded wire [mm²]	Description	Figure
X2	MiniDin, female (device)	8	0,25-0,5	serial interface	

Fig. 8-20: 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
7	n.c.	n.c.
8	n.c.	n.c.

Fig. 8-21: 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

Fig. 8-22: Features of serial interface

Note: Accessory HAS05.1-005 is a converter RS232 to RS485. (see section "Accessory").

Connection Diagrams for Serial Interface to PC

Serial Interface to PC with 9-Pin SUB-D

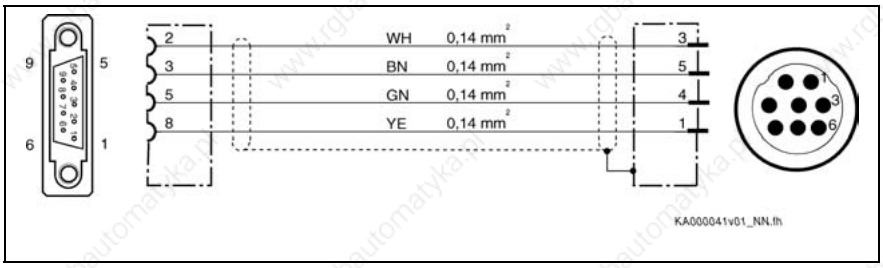


Fig. 8-23: Connection of serial interface to PC with 9-pin SUB-D

Note: For **direct** connection to the serial interface, use our cable IKB 0041.

Serial Interface to PC with 25-Pin SUB-D

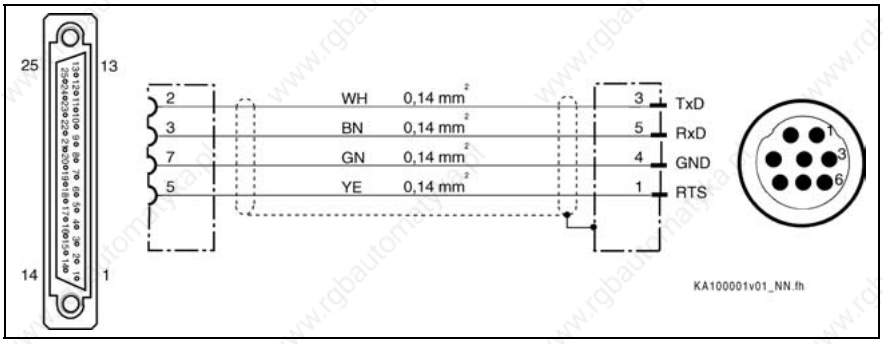


Fig. 8-24: Connection of serial interface to PC with 25-pin SUB-D

8.5 Engineering Interface

The following description of the Engineering Interface is preliminary.

Description

The interface corresponds to the IEE 802.3 standard.

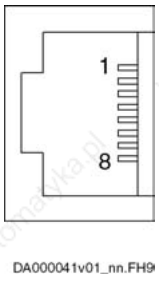
Connection point	Type	No. of poles	Figure
X26	RJ-45	8	

Fig. 8-25: Connections

Pin Assignment

Pin	Signal	Function
1	**TD+**	10/100 Base-T Transmit, Differential Output A
2	**TD-**	10/100 Base-T Transmit, Differential Output B
3	**RD+**	10/100 Base-T Receive, Differential Input A
4	n. c.	-
5	n. c.	-
6	**RD-**	10/100 Base-T Receive, Differential Input B
7	n. c.	-
8	n. c.	-
Housing		shield connection

Fig. 8-26: Pin assignment

Compatibility of Interface

10 Base-T according to IEEE 802.3i
100 Base-T according to IEEE 802.3u

Recommended cable type

According to CAT 5

9 Other Technical Data

9.1 Power Consumption

The power consumption of the control sections consists of the components for

- basic equipment and
- optional equipment

Note: The control sections are supplied via the terminal connectors 24V and 0V at the power section (24V supply).

Basic Circuit Boards of Control Section

Note: According to the options with which the control section has been equipped, the power consumption of the optional modules have to be added. This does not change the data for inrush current and pulse width.

Designation	Power consumption P_{N3} 1) [W]	Typ. inrush current I_{EIN3} [A]	Max. pulse width $t_{EIN3Lade}$ [ms]
CSB01.1N-FC…	7,5	1,5	120
CSB01.1N-SE…	7,5	5	40
CSB01.1N-PB…	7,5	5	40
CSB01.1N-AN…	8,0	1,5	130
CSB01.1C-…	6,5	4,5	110
CDB01.1C-…	7,5	6	60
CSH01.1C-…	6,0	4	100
CSH01.2C-…	7,0	4	100

1) at max. allowed output load without optional modules

Fig. 9-1: Power consumption of control sections

Note: The isolated inputs/outputs at X31 and X32 are not supplied via the connections of the 24V supply of the power section. A separate voltage supply is required for these inputs/outputs.

Optional Modules

OP [1]	Optional module	Power consumption P_{N3} 2) [W]
SE	master communication SERCOS	1,5
PB	master communication PROFIBUS-DP	2,0
PL	master communication parallel interface	1,0
CO	master communication DeviceNet and CANopen	1,0
S3	master communication SERCOS III	1,0
CCD	cross communications SERCOS III	1,0
S	standard control panel	1,0
C	comfort control panel	1,0
ENS	IndraDyn, HIPERFACE®, 1Vpp	5,5
EN1	HSF, resolver	6,0
EN2	EnDat2.1 / 1Vpp / 5V TTL	5,5
MEM	encoder emulator	1,2
L1	starting lockout	1,5
S1	safety technology I/O	1,0
MD1	digital I/O extension	1,0
MA1	analog I/O extension	2,0
MD2	digital I/O extension and SSI encoder evaluation	1,0
PFM	MultiMediaCard	0,5

1) code from the control section type codes
2) at max. allowed output load without circuits to be supplied externally

Fig. 9-2: Power consumption of optional modules

9.2 Connections

The connection points at Rexroth IndraDrive control sections are equipped with spring terminals and screw terminal blocks.

Note: To connect 2 conductors in one terminal connecting point:

- use stranded wires with min. 0.5 mm² and max. 1.0 mm²
- use wires of the same cross section
- use TWIN ferrules

Connections with Spring Terminals

Spring terminals can be wired with wire ends equipped **with or without ferrules**. Preferably use wire ends without ferrules.

When preparing the connections, make sure

- that all strands of a stranded wire are placed in the funnel of the terminal connector.
- not to use solid wires, where possible.
- that the cross section that can be connected at the spring terminals is max. 1 mm².
- to use appropriate crimping tools for the wire ends with ferrules.

Connections with Screw Terminal Blocks

On screw terminal blocks use wire ends **with** ferrules. Make sure to use appropriate crimping tools.

When preparing the connections, make sure that all strands of a stranded wire are placed in the funnel of the terminal connector.

10 Accessory

10.1 Signal Level Converter for Encoder Emulation, HAS05.1-003

Usage

Accessory	Usage
HAS05.1-003-NNN-NN	The accessory is used to adjust voltage levels at the output of the optional module MEM to the voltage range of 5…30V.

Fig. 10-1: Accessory for control section

Scope of Supply

The accessories have to be ordered separately. They are not part of the scope of supply of the control sections.

Dimensions

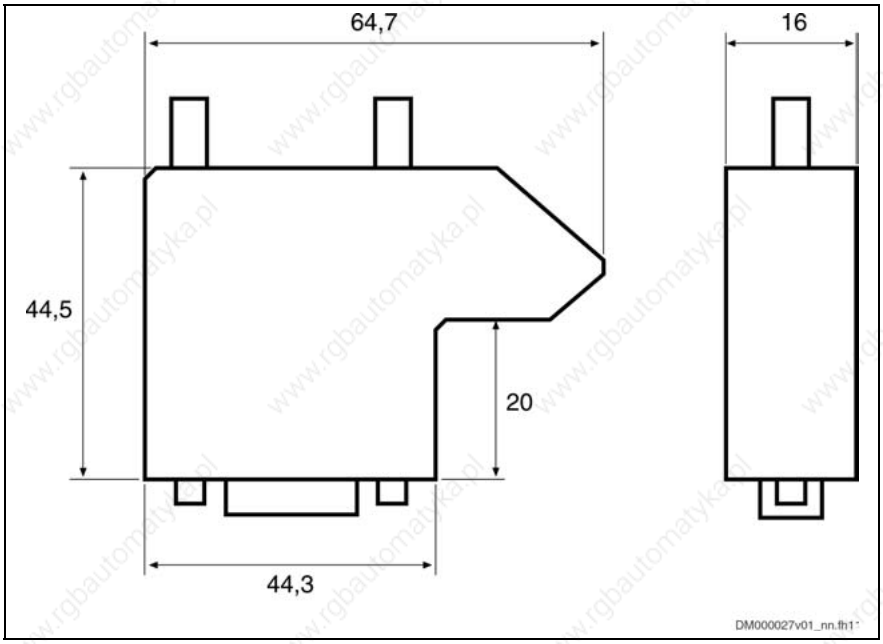
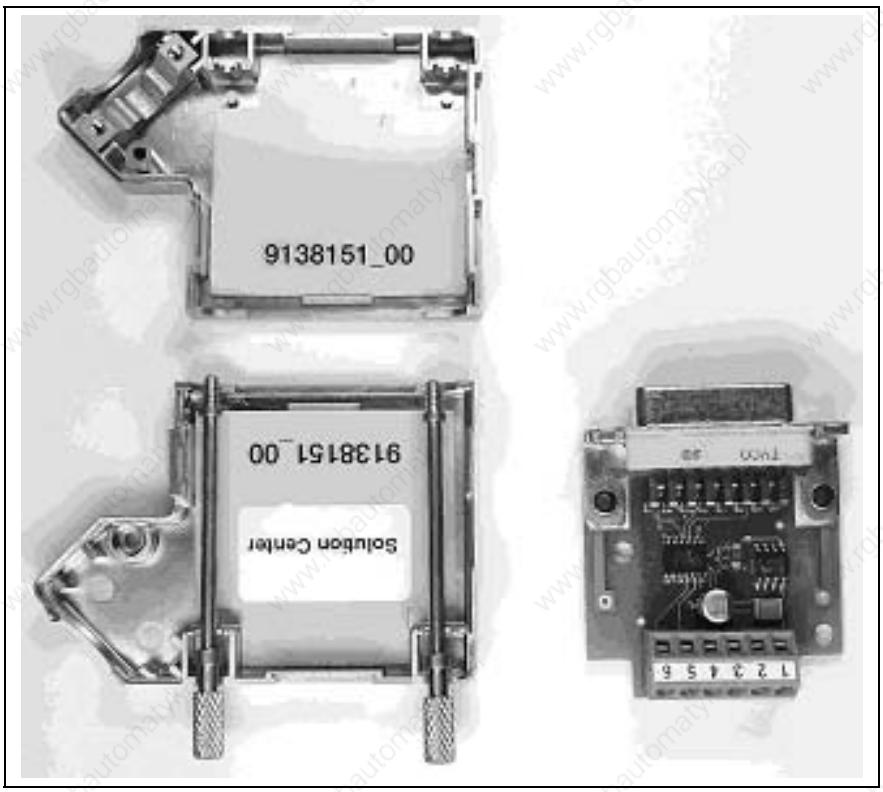


Fig. 10-2: Dimensions HAS05.1-003

Components



1: top shell of connector housing
2: bottom shell of connector housing
3: electronics circuit board with internal connection point

Fig. 10-3: Components of signal level converter

Description

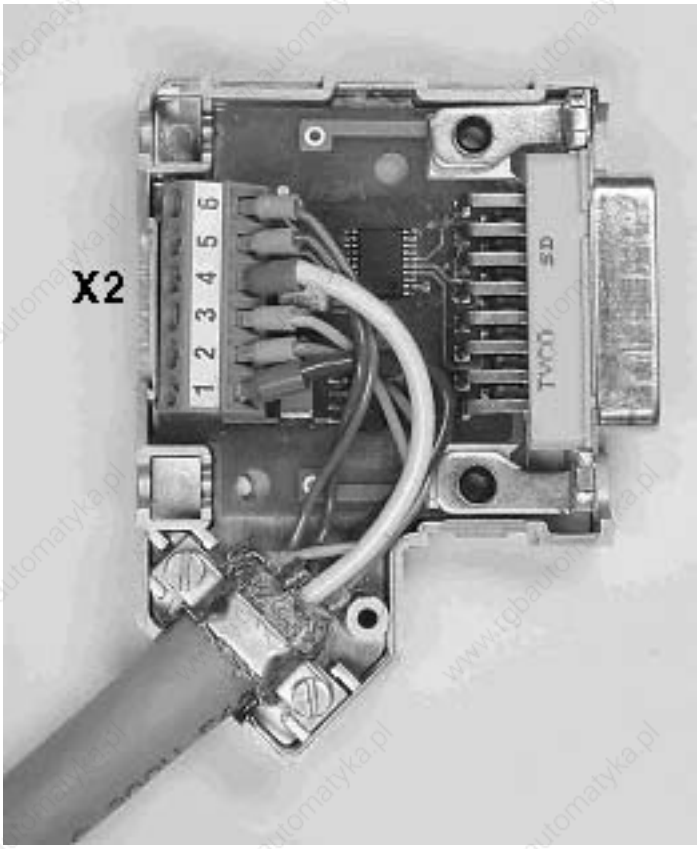


Fig. 10-4: Accessory HAS05.1-003

Connection point	Type	No. of poles	Stranded wire [mm²]
X2	screw terminal block	6	0,14 – 1,5

see also chapter "Connections with Screw Terminal Blocks"

Fig. 10-5: 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

Fig. 10-6: Assignment

Note: 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 voltage UL (output driver)	mA		16	
supply voltage UB (electronics)	V	7		30
supply voltage 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		

Fig. 10-7: Supply and outputs

Example of Connection

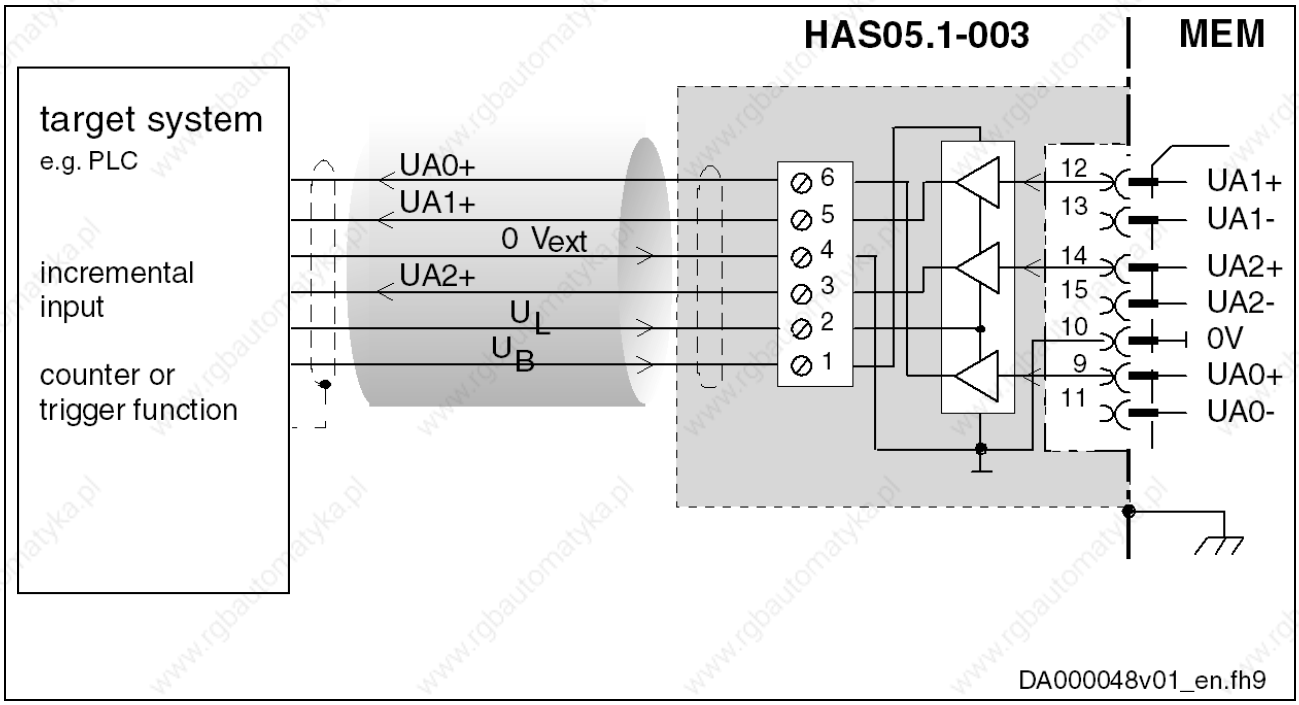


Fig. 10-8: Example of connection

10.2 Signal Level Converter RS232/RS485, HAS05.1-005

Following documentation of the signal level converter HAS05.1-005 is preliminary.

Usage

Accessory	Usage
HAS05.1-005-NNN-NN	Converts the serial interface of Rexroth IndraDrive control sections from RS232 standard to RS485 standard.

Fig. 10-9: Usage

Scope of Supply

The accessories have to be ordered separately. They are not part of the scope of supply of the control sections.

Scope of supply of the accessories:

- converter
- connectors at X2 and X3
- cable ties
- accompanying note

Technical Data

Dimensions

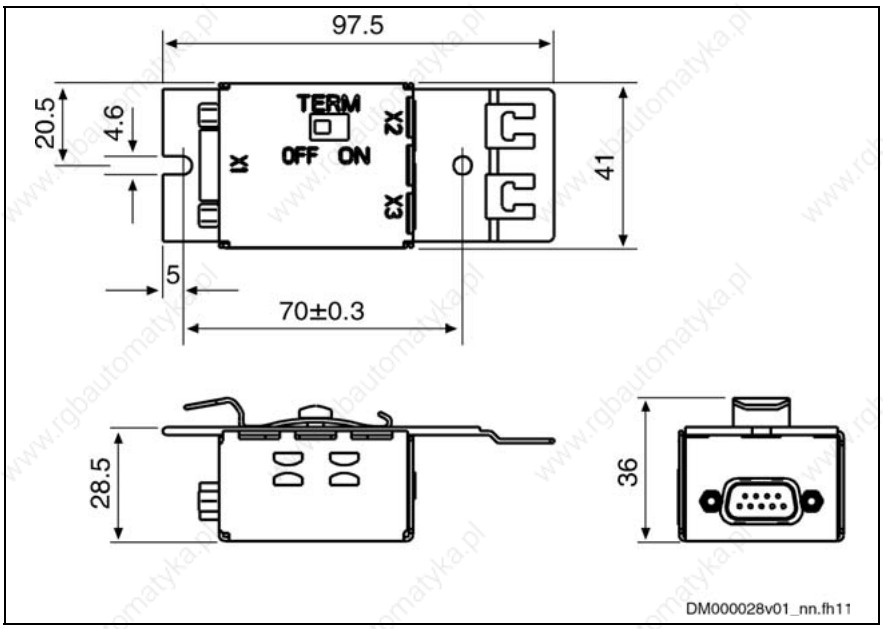


Fig. 10-10: Dimensions

Note: HAS05.1-005 can be mounted on a top hat rail. For mounting it on a plane surface, remove the rail clamp from the back of the housing.

You can mount it also on electrically insulating surfaces.

Electrical Data

Feature	Unit	Min.	Typ.	Max.
number of nodes				31
allowed cable length 1)	m			500
transmission rate 2)	kBaud	9,6		115
operation mode		half duplex two-wire-line		
coupling between X1 and X2, X3		galvanically coupled		
allowed difference of voltage between potentials of reference of 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
cable length at X2, X3	m	keep the bus propagation, see allowed cable length		
connection X2, X3		spring terminal		
connection cross section multi-wire	mm² / AWG	0,14…1,5 / 28…16; ferrule without insulating shroud		

1) bus propagation RS485 comes up to the total length of all connected lines
2) is set via the firmware

Fig. 10-11: Technical features

Position of Connections, Termination

Fig. 10-12: HAS05.1-005 with connections

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.

Fig. 10-13: Assignment X1

Assignment X2

Connection	Signal	Function
1	Data+	Data transmission +
2	Data-	Data transmission -
3	shield	connection outer shield

Fig. 10-14: Assignment X2

Assignment X3

Connection	Signal	Function
1	Data+	Data transmission +
2	Data-	Data transmission -
3	shield	connection outer shield
4	GND	connection inner shield (signal shield)

Fig. 10-15: Assignment X3

Installation

Three connections connect the converter HAS05.1-005 to one RS485 bus:

- connection X1 with the serial interface X2 of the control section
- connection X2 with the connection X3 of the next HAS05
- connection X2 of bus master (e.g. RS232/485 converter controlled by PC)

Note: Terminate the RS485 bus line at the farthest bus end.

Switch on bus master termination (converter at PC). Set "TERM" switch of the last node to "ON".

See also Functional Description MPx04 "Serial Communication" ->"Communication via RS485 Interface".

Example

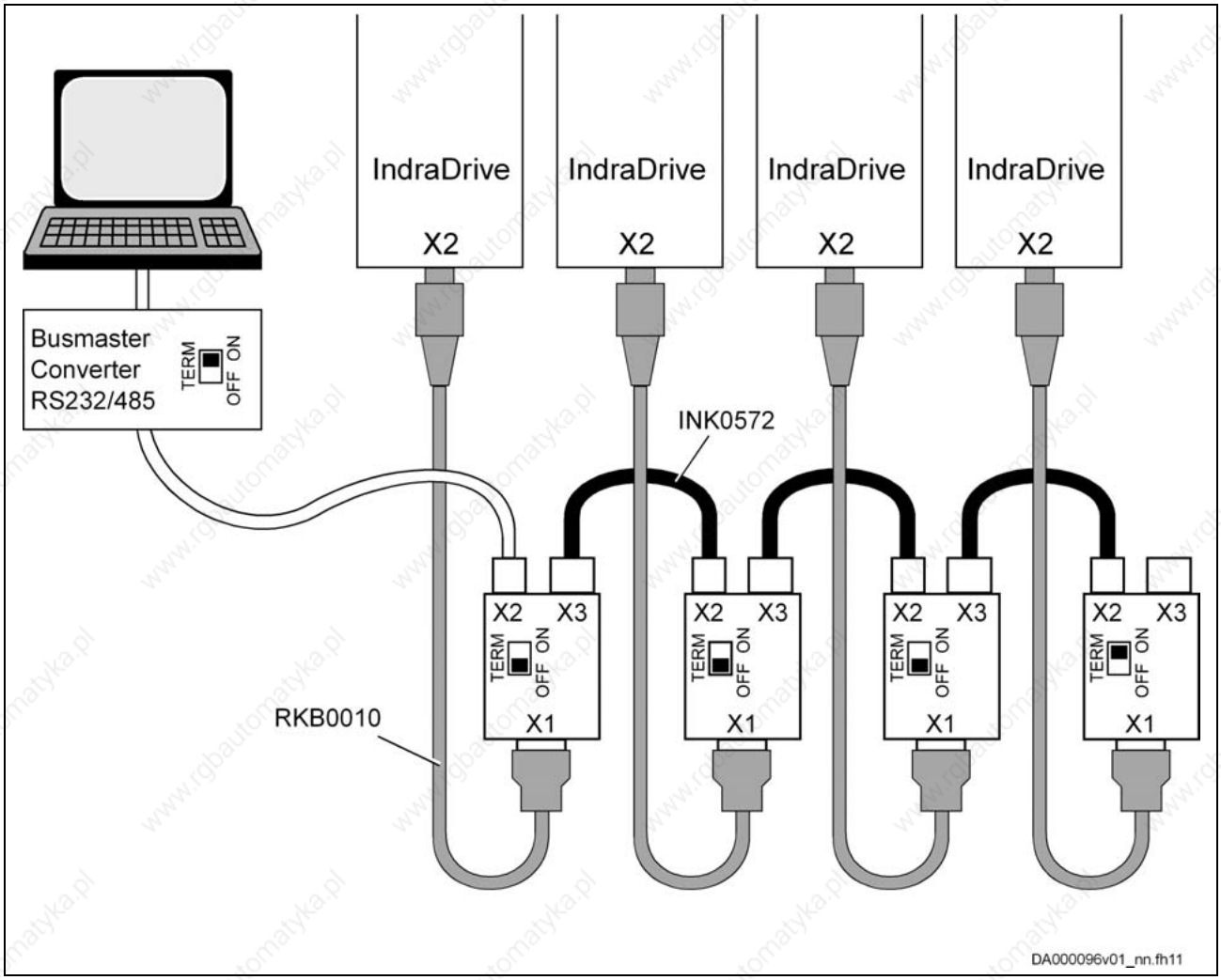


Fig. 10-16: Example

Note: Connect PC and RS485 bus via a RS232/485 converter.

When selecting a RS232/485 converter, please observe that for switching the data direction the RTS signal of interface RS232 of the PC often is used. If the software uses the RTS signal, the RS232/485 converter must support this signal.

Connection X1

Connection from X1 to Control Section (X2)

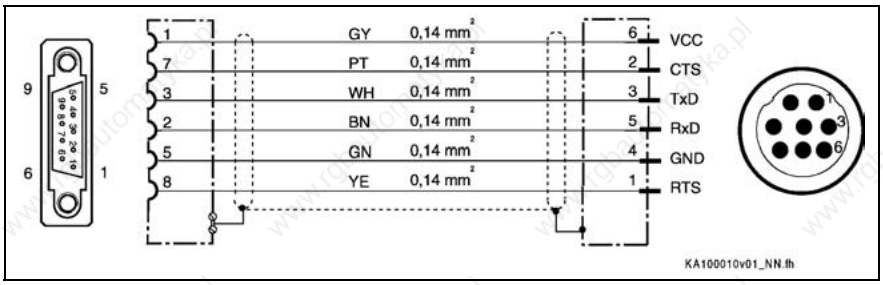


Fig. 10-17: Cable RKB00010

Note: For a **direct** connection from X1 to the control section use our cable RKB00010 and observe its maximum length (see Technical Data of HAS05).

Connection X2 and X3

Connect X2 and X3 with a cable according to the following figure:

Connection X2 to X3

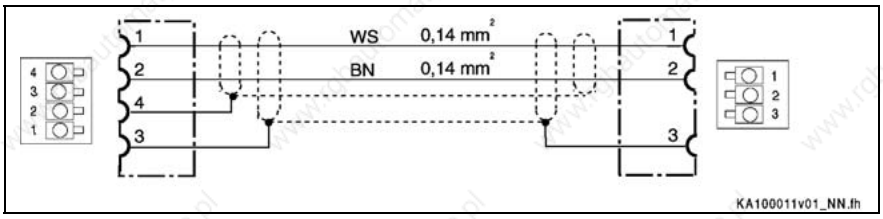


Fig. 10-18: Cable for connecting X2 and X3

Note: Use our non-assembled cable INK0572 to make your cable.

Strain Relief at X2 and X3

Fig. 10-19: Strain relief at X2 and X3

Note: Pay attention to a sufficient strain relief at X2 and X3. Use cable ties.

11 Disposal and Environmental Protection

11.1 Disposal

Products

Our products can be returned to us 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 matter or foreign component.

Please send the products free domicile to the following address:

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

Packaging Materials

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

11.2 Environmental Protection

No Release of Hazardous Substances

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

Materials Contained in the Products

Electronic Devices

Electronic devices mainly contain:

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

Motors

Motors mainly contain:

- steel
- aluminium
- copper
- brass
- magnetic materials
- electronic components and modules

Recycling

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

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

12 Service & Support

12.1 Helpdesk

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

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

- telefonisch - by phone: **+49 (0) 9352 40 50 60**
  über Service Call Entry Center Mo-Fr 07:00-18:00
  - via Service Call Entry Center Mo-Fr 7:00 am - 6:00 pm
- per Fax - by fax: **+49 (0) 9352 40 49 41**
- per e-Mail - by e-mail: **service.svc@boschrexroth.de**

12.2 Service-Hotline

Außerhalb der Helpdesk-Zeiten ist der Service direkt ansprechbar unter

After helpdesk hours, contact our service department directly at

+49 (0) 171 333 88 26

oder - or **+49 (0) 172 660 04 06**

12.3 Internet

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

- Verkaufsniederlassungen
- Niederlassungen mit Kundendienst

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

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

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

- sales agencies
- offices providing service

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

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

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

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

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

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

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

12.5 Kundenbetreuungsstellen - Sales & Service Facilities

Deutschland – Germany

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

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

Europa (West) - Europe (West)

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

Austria - Österreich

Bosch Rexroth GmbH
Electric Drives & Controls
Stachegasse 13
1120 Wien
Tel.: +43 (0) 1 985 25 40
Fax: +43 (0) 1 985 25 40-93

Austria – Österreich

Bosch Rexroth GmbH
Electric Drives & Controls
Industriepark 18
4061 Pasching
Tel.: +43 (0)7221 605-0
Fax: +43 (0)7221 605-21

Belgium - Belgien

Bosch Rexroth NV/SA
Henri Genessestraat 1
1070 Bruxelles

Tel: +32 (0) 2 451 26 08
Fax: +32 (0) 2 451 27 90
info@boschrexroth.be
service@boschrexroth.be

Denmark - Dänemark

BEC A/S
Zinkvej 6
8900 Randers

Tel.: +45 87 11 90 60
Fax: +45 87 11 90 61

Great Britain – Großbritannien

Bosch Rexroth Ltd.
Electric Drives & Controls
Broadway Lane, South Cerney
Cirencester, Glos GL7 5UH

Tel.: +44 (0)1285 863000
Fax: +44 (0)1285 863030
sales@boschrexroth.co.uk
service@boschrexroth.co.uk

Finland - Finnland

Bosch Rexroth Oy
Electric Drives & Controls
Ansatie 6
017 40 Vantaa

Tel.: +358 (0)9 84 91-11
Fax: +358 (0)9 84 91-13 60

France - Frankreich

Bosch Rexroth SAS
Electric Drives & Controls
Avenue de la Trentaine
(BP. 74)
77503 Chelles Cedex
Tel.: +33 (0)164 72-63 22
Fax: +33 (0)164 72-63 20
Hotline: +33 (0)608 33 43 28

France - Frankreich

Bosch Rexroth SAS
Electric Drives & Controls
ZI de Thibaud, 20 bd. Thibaud
(BP. 1751)
31084 Toulouse
Tel.: +33 (0)5 61 43 61 87
Fax: +33 (0)5 61 43 94 12

France – Frankreich

Bosch Rexroth SAS
Electric Drives & Controls
91, Bd. Irène Joliot-Curie
69634 Vénissieux – Cedex
Tel.: +33 (0)4 78 78 53 65
Fax: +33 (0)4 78 78 53 62

Italy - Italien

Bosch Rexroth S.p.A.
Strada Statale Padana
Superiore 11, no. 41
20063 Cernusco S/N.MI
Hotline: +39 02 92 365 563
Tel.: +39 02 92 365 1
Service: +39 02 92 365 300
Fax: +39 02 92 365 500
Service: +39 02 92 365 516

Italy - Italien

Bosch Rexroth S.p.A.
Via Paolo Veronesi, 250
10148 Torino

Tel.: +39 011 224 88 11
Fax: +39 011 224 88 30

Italy - Italien

Bosch Rexroth S.p.A.
Via Mascia, 1
80053 Castellamare di Stabia NA

Tel.: +39 081 8 71 57 00
Fax: +39 081 8 71 68 85

Italy - Italien

Bosch Rexroth S.p.A.
Via del Progresso, 16 (Zona Ind.)
35020 Padova

Tel.: +39 049 8 70 13 70
Fax: +39 049 8 70 13 77

Italy - Italien

Bosch Rexroth S.p.A.
Via Isonzo, 61
40033 Casalecchio di Reno (Bo)

Tel.: +39 051 29 86 430
Fax: +39 051 29 86 490

Netherlands - Niederlande/Holland

Bosch Rexroth Services B.V.
Technical Services
Kruisbroeksestraat 1
(P.O. Box 32)
5281 RV Boxtel
Tel.: +31 (0) 411 65 19 51
Fax: +31 (0) 411 67 78 14
Hotline: +31 (0) 411 65 19 51
services@boschrexroth.nl

Netherlands – Niederlande/Holland

Bosch Rexroth B.V.
Kruisbroeksestraat 1
(P.O. Box 32)
5281 RV Boxtel

Tel.: +31 (0) 411 65 16 40
Fax: +31 (0) 411 65 14 83
www.boschrexroth.nl

Norway - Norwegen

Bosch Rexroth AS
Electric Drives & Controls
Berghagan 1 or: Box 3007
1405 Ski-Langhus 1402 Ski
Tel.: +47 64 86 41 00

Fax: +47 64 86 90 62

Hotline: +47 64 86 94 82
jul.ruud@rexroth.no

Spain – Spanien

Goimendi Automation S.L.
Parque Empresarial Zuatzu
C/ Francisco Grandmontagne no.2
20018 San Sebastian

Tel.: +34 9 43 31 84 21
- service: +34 9 43 31 84 56
Fax: +34 9 43 31 84 27
- service: +34 9 43 31 84 60
sat.indramat@goimendi.es

Spain - Spanien

Bosch Rexroth S.A.
Electric Drives & Controls
Centro Industrial Santiga
Obradors 14-16
08130 Santa Perpetua de Mogoda
Barcelona
Tel.: +34 9 37 47 94 00
Fax: +34 9 37 47 94 01

Spain - Spanien

Bosch Rexroth S.A.
Electric Drives & Controls
c/ Almazara, 9
28760 Tres Cantos (Madrid)

Tel.: +34 91 806 24 79
Fax: +34 91 806 24 72
fernando.bariego@boschrexroth.es

Sweden - Schweden

Bosch Rexroth AB
Electric Drives & Controls
- Varuvägen 7
(Service: Konsumentvägen 4, Älfsjö)
125 81 Stockholm

Tel.: +46 (0) 8 727 92 00
Fax: +46 (0) 8 647 32 77

Sweden - Schweden

Bosch Rexroth AB
Electric Drives & Controls
Ekvändan 7
254 67 Helsingborg
Tel.: +46 (0) 4 238 88 -50
Fax: +46 (0) 4 238 88 -74

Switzerland East - Schweiz Ost

Bosch Rexroth Schweiz AG
Electric Drives & Controls
Hemrietstrasse 2
8863 Buttikon
Tel. +41 (0) 55 46 46 111
Fax +41 (0) 55 46 46 222

Switzerland West - Schweiz West

Bosch Rexroth Suisse SA
Av. Général Guisan 26
1800 Vevey 1

Tel.: +41 (0)21 632 84 20
Fax: +41 (0)21 632 84 21

Europa (Ost) - Europe (East)

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from abroad: don't dial (0) after country code

Czech Republic - Tschechien Bosch -Rexroth, spol.s.r.o. Hviezdoslavova 5 627 00 Brno Tel.: +420 (0)5 48 126 358 Fax: +420 (0)5 48 126 112	Czech Republic - Tschechien DEL a.s. Strojírenská 38 591 01 Zdar nad Sázavou Tel.: +420 566 64 3144 Fax: +420 566 62 1657	Hungary - Ungarn Bosch Rexroth Kft. Angol utca 34 1149 Budapest Tel.: +36 (1) 422 3200 Fax: +36 (1) 422 3201	Poland – Polen Bosch Rexroth Sp.zo.o. ul. Staszica 1 05-800 Pruszków Tel.: +48 (0) 22 738 18 00 – service: +48 (0) 22 738 18 46 Fax: +48 (0) 22 758 87 35 – service: +48 (0) 22 738 18 42
Poland – Polen Bosch Rexroth Sp.zo.o. Biuro Poznan ul. Dabrowskiego 81/85 60-529 Poznan Tel.: +48 061 847 64 62 /-63 Fax: +48 061 847 64 02	Romania - Rumänien East Electric S.R.L. Bdul Basarabia no.250, sector 3 73429 Bucuresti Tel./Fax:: +40 (0)21 255 35 07 +40 (0)21 255 77 13 Fax: +40 (0)21 725 61 21 eastel@rdsnet.ro	Romania - Rumänien Bosch Rexroth Sp.zo.o. Str. Drobety nr. 4-10, app. 14 70258 Bucuresti, Sector 2 Tel.: +40 (0)1 210 48 25 +40 (0)1 210 29 50 Fax: +40 (0)1 210 29 52	Russia - Russland Bosch Rexroth OOO Wjatskaja ul. 27/15 127015 Moskau Tel.: +7-095-785 74 78 +7-095 785 74 79 Fax: +7 095 785 74 77 laura.kanina@boschrexroth.ru
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Africa, Asia, Australia – incl. Pacific Rim

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China Bosch Rexroth China Ltd. 15/F China World Trade Center 1, Jianguomenwai Avenue Beijing 100004, P.R.China Tel.: +86 10 65 05 03 80 Fax: +86 10 65 05 03 79	China Bosch Rexroth China Ltd. Guangzhou Repres. Office Room 1014-1016, Metro Plaza, Tian He District, 183 Tian He Bei Rd Guangzhou 510075, P.R.China Tel.: +86 20 8755-0030 +86 20 8755-0011 Fax: +86 20 8755-2387	China Bosch Rexroth (China) Ltd. A-5F., 123 Lian Shan Street Sha He Kou District Dalian 116 023, P.R.China Tel.: +86 411 46 78 930 Fax: +86 411 46 78 932	China Melchers GmbH BRC-SE, Tightening & Press-fit 13 Floor Est Ocean Centre No.588 Yanan Rd. East 65 Yanan Rd. West Shanghai 200001 Tel.: +86 21 6352 8848 Fax: +86 21 6351 3138
Hongkong Bosch Rexroth (China) Ltd. 6th Floor, Yeung Yiu Chung No.6 Ind Bldg. 19 Cheung Shun Street Cheung Sha Wan, Kowloon, Hongkong Tel.: +852 22 62 51 00 Fax: +852 27 41 33 44 alexis.siu@boschrexroth.com.hk	India - Indien Bosch Rexroth (India) Ltd. Electric Drives & Controls Plot. No.96, Phase III Peenya Industrial Area Bangalore – 560058 Tel.: +91 80 51 17 0-211...-218 Fax: +91 80 83 94 345 +91 80 83 97 374 mohanvelu.t@boschrexroth.co.in	India - Indien Bosch Rexroth (India) Ltd. Electric Drives & Controls Advance House, II Floor Ark Industrial Compound Narol Naka, Makwana Road Andheri (East), Mumbai - 400 059 Tel.: +91 22 28 56 32 90 +91 22 28 56 33 18 Fax: +91 22 28 56 32 93 singh.op@boschrexroth.co.in	India - Indien Bosch Rexroth (India) Ltd. S-10, Green Park Extension New Delhi – 110016 Tel.: +91 11 26 56 65 25 +91 11 26 56 65 27 Fax: +91 11 26 56 68 87 koul.rp@boschrexroth.co.in
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Korea Bosch Rexroth-Korea Ltd. Electric Drives & Controls 1515-14 Dadae-Dong, Saha-gu Pusan Metropolitan City, 604-050 Tel.: +82 51 26 00 741 Fax: +82 51 26 00 747 eunkyong.kim@boschrexroth.co.kr	Korea Bosch Rexroth-Korea Ltd. Electric Drives & Controls 1515-14 Dadae-Dong, Saha-gu Ulsan, 680-010 Tel.: +82 52 256-0734 Fax: +82 52 256-0738 keonhyun.jeong@boschrexroth.co.kr	Malaysia Bosch Rexroth Sdn.Bhd. 11, Jalan U8/82, Seksyen U8 40150 Shah Alam Selangor, Malaysia Tel.: +60 3 78 44 80 00 Fax: +60 3 78 45 48 00 hhlim@boschrexroth.com.my rexroth1@tm.net.my	Singapore - Singapur Bosch Rexroth Pte Ltd 15D Tuas Road Singapore 638520 Tel.: +65 68 61 87 33 Fax: +65 68 61 18 25 lai.ts@boschrexroth.com.sg
South Africa - Südafrika TECTRA Automation (Pty) Ltd. 100 Newton Road, Meadowdale Edenvale 1609 Tel.: +27 11 971 94 00 Fax: +27 11 971 94 40 **Hotline: +27 82 903 29 23** georgv@tectra.co.za	Taiwan Bosch Rexroth Co., Ltd. Taichung Industrial Area No.19, 38 Road Taichung, Taiwan 407, R.O.C. Tel : +886 - 4 -235 08 383 Fax: +886 - 4 -235 08 586 jim.lin@boschrexroth.com.tw david.lai@boschrexroth.com.tw	Taiwan Bosch Rexroth Co., Ltd. Tainan Branch No. 17, Alley 24, Lane 737 Chung Cheng N.Rd. Yungkang Tainan Hsien, Taiwan, R.O.C. Tel : +886 - 6 –253 6565 Fax: +886 - 6 –253 4754 charlie.chen@boschrexroth.com.tw	Thailand NC Advance Technology Co. Ltd. 59/76 Moo 9 Ramintra road 34 Tharang, Bangkhen, Bangkok 10230 Tel.: +66 2 943 70 62 +66 2 943 71 21 Fax: +66 2 509 23 62 Hotline +66 1 984 61 52 sonkawin@hotmail.com

Nordamerika – North America

USA Headquarters - Hauptniederlassung	USA Central Region - Mitte	USA Southeast Region - Südost	**USA SERVICE-HOTLINE**
Bosch Rexroth Corporation Electric Drives & Controls 5150 Prairie Stone Parkway Hoffman Estates, IL 60192-3707 Tel.: +1 847 645-3600 Fax: +1 847 645-6201 servicebrc@boschrexroth-us.com repairbrc@boschrexroth-us.com	Bosch Rexroth Corporation Electric Drives & Controls 1701 Harmon Road Auburn Hills, MI 48326 Tel.: +1 248 393-3330 Fax: +1 248 393-2906	Bosch Rexroth Corporation Electric Drives & Controls 2810 Premiere Parkway, Suite 500 Duluth, GA 30097 Tel.: +1 678 957-4050 Fax: +1 678 417-6637	- 7 days x 24hrs - **+1-800-REXROTH** **+1 800 739-7684**
USA Northeast Region – Nordost	USA West Region – West		
Bosch Rexroth Corporation Electric Drives & Controls 99 Rainbow Road East Granby, CT 06026 Tel.: +1 860 844-8377 Fax: +1 860 844-8595	Bosch Rexroth Corporation Electric Drives & Controls 7901 Stoneridge Drive, Suite 220 Pleasanton, CA 94588 Tel.: +1 925 227-1084 Fax: +1 925 227-1081		
Canada East - Kanada Ost	Canada West - Kanada West	Mexico	Mexico
Bosch Rexroth Canada Corporation Burlington Division 3426 Mainway Drive Burlington, Ontario Canada L7M 1A8 Tel.: +1 905 335 5511 Fax: +1 905 335 4184 michael.moro@boschrexroth.ca	Bosch Rexroth Canada Corporation 5345 Goring St. Burnaby, British Columbia Canada V7J 1R1 Tel. +1 604 205 5777 Fax +1 604 205 6944 david.gunby@boschrexroth.ca	Bosch Rexroth Mexico S.A. de C.V. Calle Neptuno 72 Unidad Ind. Vallejo 07700 Mexico, D.F. Tel.: +52 55 57 54 17 11 Fax: +52 55 57 54 50 73 mario.francioli@boschrexroth.com.mx	Bosch Rexroth S.A. de C.V. Calle Argentina No 3913 Fracc. las Torres 64930 Monterrey, N.L. Tel.: +52 81 83 65 22 53 +52 81 83 65 89 11 +52 81 83 49 80 91 Fax: +52 81 83 65 52 80

Südamerika – South America

Argentina - Argentinien	Argentina - Argentinien	Brazil - Brasilien	Brazil - Brasilien
Bosch Rexroth S.A.I.C. "The Drive & Control Company" Rosario 2302 B1606DLD Carapachay Provincia de Buenos Aires Tel.: +54 11 4756 01 40 +54 11 4756 02 40 +54 11 4756 03 40 +54 11 4756 04 40 Fax: +54 11 4756 01 36 +54 11 4721 91 53 victor.jabif@boschrexroth.com.ar	NAKASE SRL Servicio Tecnico CNC Calle 49, No. 5764/66 B1653AOX Villa Balester Provincia de Buenos Aires Tel.: +54 11 4768 36 43 Fax: +54 11 4768 24 13 **Hotline: +54 11 155 307 6781** nakase@usa.net nakase@nakase.com gerencia@nakase.com (Service)	Bosch Rexroth Ltda. Av. Tégula, 888 Ponte Alta, Atibaia SP CEP 12942-440 Tel.: +55 11 4414 56 92 +55 11 4414 56 84 Fax sales: +55 11 4414 57 07 Fax serv.: +55 11 4414 56 86 alexandre.wittwer@rexroth.com.br	Bosch Rexroth Ltda. R. Dr.Humberto Pinheiro Vieira, 100 Distrito Industrial [Caixa Postal 1273] 89220-390 Joinville - SC Tel./Fax: +55 47 473 58 33 Mobil: +55 47 9974 6645 sergio.prochnow@boschrexroth.com.br
Columbia - Kolumbien			
Reflutec de Colombia Ltda. Calle 37 No. 22-31 Santafé de Bogotá, D.C. Colombia Tel.: +57 1 368 82 67 +57 1 368 02 59 Fax: +57 1 268 97 37 reflutec@etb.net.co			

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Rexroth
Bosch Group

Bosch Rexroth AG
Electric Drives and Controls
P.O. Box 13 57
97803 Lohr, Germany
Bgm.-Dr.-Nebel-Str. 2
97816 Lohr, Germany
Phone +49 (0)93 52-40-50 60
Fax +49 (0)93 52-40-49 41
service.svc@boschrexroth.de
www.boschrexroth.com

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