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 06

Project Planning Manual

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Rexroth IndraDrive
Drive Controllers
Control Sections

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

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Bosch Rexroth AG, 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. EDY1 (RR/US/BB)

Note
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1.1 Guide to the Documentation

1.1.1 Documentation Structure

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8 Other Technical Data	
9 Accessories	
10 Disposal and Environmental Protection	**practical application** (for operators and maintenance staff)

Fig. 1-1: Documentation structure

1.1.2 Changes

Changes in Comparison to Previous Edition

Chapter	Changes
5	additional requirement of polarity reversal protection diodes at I/O extension modules included signal names harmonized
6.3	min. amplitude encoder signal for ENS, EN1 and EN2 specified
6	connection diagram EN2 with C0 modified - shield at GND connection “EN1 with Hall sensor box SHL01” included identifier for connection points added current consumption L1 and S1 specified with minimum and maximum values
8	power consumption of optional modules arranged power consumption of non-configurable control sections with entire equipment included
7.2.2	technical data of probe inputs added additional probe type (20 µs–200 µs) included
7.3.3	technical data (among other things, input bandwidth, input resistance, converter width) corrected
7.3.2	example of connection diagram for shield connection at X32 added

Fig. 1-2: Changes

Introduction

1.1.3 Reference Documentations

Overview

☞ The following documentations contain detailed information on the allowed applications, as well as the application, ambient and operating conditions.

Reference Documentations - Drive Controllers

Title	Kind of documentation	Document typecode[1)]
Rexroth IndraDrive – Drive System	Project Planning Manual	DOK-INDRV*-SYSTEM*****-PRxx-EN-P
Rexroth IndraDrive Supply Units and Power Sections	Project Planning Manual	DOK-INDRV*-HMV-S-D+HCS-PR01-EN-P
Rexroth IndraDrive – Drive Controllers Control Sections	Project Planning Manual	DOK-INDRV*-CSH********-PRxx-EN-P
Rexroth IndraDrive Additional Components	Project Planning Manual	DOK-INDRV*-ADDCOMP****-PRxx-EN-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.1-3: Documentations - overview

☞ The following documentations describe the firmware and contain information on its scope of functions.

Reference Documentations - Firmware for Drive Controllers

Title	Kind of documentation	Document typecode[1)]
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 IndraDrive Integrated Safety Technology	Functional and Application Description	DOK-INDRV*-SI*-**VRS**-FKxx-EN-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.1-4: Documentations - overview

Reference Documentations - Motors

Title	Kind of documentation	Document typecode[1)]
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

Title	Kind of documentation	Document typecode[1)]
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

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. 1-5: Documentations - overview

1.1.4 Box with Project Planning Manuals on Rexroth IndraDrive

You can order all the Project Planning Manuals for Rexroth IndraDrive in a box. The box contains the following Project Planning Manuals:

- Rexroth IndraDrive, Drive System
- Rexroth IndraDrive, Supply Units and Power Sections
- Rexroth IndraDrive, Drive Controllers, Control Sections
- Rexroth IndraDrive, Additional Components

Order data of the box:

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

1.1.5 Your Feedback

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

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

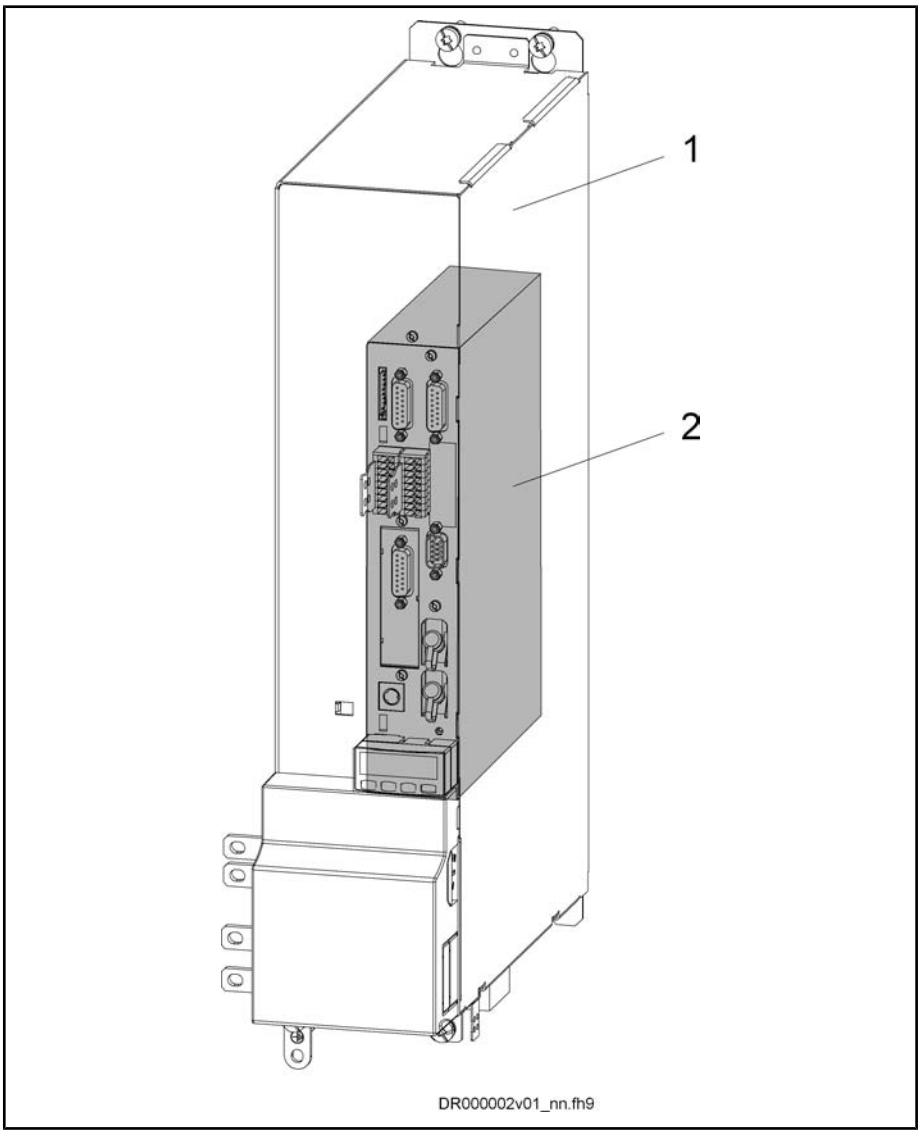
Please send your remarks to:

Address for Your Feedback

Bosch Rexroth AG
Dept. BRC/EDY1
Bürgermeister-Dr.-Nebel-Str. 2
D-97816 Lohr
e-mail: brcedy1-dokusupport-drives@boschrexroth.de

1.2 Basic Design of the Rexroth IndraDrive Controllers

1.2.1 General Information



1 power section
2 control section
Fig.1-6: 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 Manual for Rexroth IndraDrive supply units and power sections.

1.2.2 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.

1.2.3 Mounting and Dismounting the Control Section

General Information

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 its 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

2.1.1 Introduction

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

WARNING

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

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

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

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

- Personnel that in any way, shape or form uses our products must first read and understand the relevant safety instructions and be familiar with 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.

2.1.2 Areas of Use and Application

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

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

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

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

Drive controllers have to be programmed before commissioning, making it possible for the motor to execute the specific functions of an application.

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

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

Typical applications include:

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

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

2.2 Inappropriate Use

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

Drive controllers 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, 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 Safety Instructions - General Information

3.1.1 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, these safety instructions must be delivered with the device in the official language of the user's country.

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!

Observe the safety instructions!

3.1.2 How to Employ the Safety Instructions

Read these instructions before initial commissioning of the equipment in order to eliminate the risk of bodily harm and/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 commissioning 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 product, 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.
- Commissioning 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 section on EMC in the respective documentation (Project Planning Manuals of components and system).

  The machine or installation manufacturer is responsible for compliance with the limiting values as prescribed in the national regulations.
- Technical data, connection and installation conditions are specified in the product documentation and must be followed at all times.

National regulations which the user must take into account

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

3.1.3 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	Signal word	Degree of hazard seriousness acc. to ANSI Z 535.4-2002
	Danger	Death or severe bodily harm will occur.
	Warning	Death or severe bodily harm may occur.
	Caution	Minor or moderate bodily harm or material damage may occur.

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

3.1.4 Hazards by Improper Use

DANGER

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

Observe the safety instructions!

DANGER

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

Observe the safety instructions!

WARNING

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

Observe the safety instructions!

WARNING

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

Observe the safety instructions!

CAUTION

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

Observe the safety instructions!

CAUTION

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

Observe the safety instructions!

CAUTION

Risk of injury by improper handling of batteries!

Observe the safety instructions!

3.2 Instructions with Regard to Specific Dangers

3.2.1 Protection Against Contact with Electrical Parts and Housings

☞ This section concerns devices and drive components with voltages of **more than 50 volts**.

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 units 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 permanently 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.
- For 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 electrical 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.

☞ For electrical drive and filter components with voltages of **more than 50 volts**, observe the following additional safety instructions.

DANGER

High housing voltage and high 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 devices 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 commissioning, also in trial runs, always attach the equipment grounding conductor or connect to the ground wire. Otherwise, high voltages may occur at the housing causing electric shock.

3.2.2 Protection Against Electric Shock by Protective Extra-Low Voltage

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

All connections and terminals with voltages between 5 and 50 volts at Rexroth products are PELV systems. [1] It is therefore allowed to connect devices equipped with basic insulation (such as programming devices, PCs, notebooks, display units) to these connections and terminals.

WARNING

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

If extra-low voltage circuits of devices containing voltages and circuits of more than 50 volts (e.g. the mains connection) are connected to Rexroth products, the connected extra-low voltage circuits must comply with the requirements for PELV. [2]

3.2.3 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

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

1) *"Protective Extra-Low Voltage"*

2) *"Protective Extra-Low Voltage"*

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/or 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 commissioning. Do not operate the device if the emergency stop switch 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 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 commissioning. If necessary, perform a special electromagnetic compatibility (EMC) test on the installation.

3.2.4 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 noise 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.

3.2.5 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 the 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.

3.2.6 Protection During Handling and Mounting

In unfavorable conditions, handling and mounting 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 mounting.
- Use suitable devices for mounting 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.

3.2.7 Battery Safety

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

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.
- When replacing the battery/batteries do not damage electrical parts installed in the devices.
- Only use the battery types specified by the manufacturer.

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

3.2.8 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. Improper handling of the connected supply systems, supply lines or connections can cause injuries or material damage.

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.

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

4 Identifying the Control Section

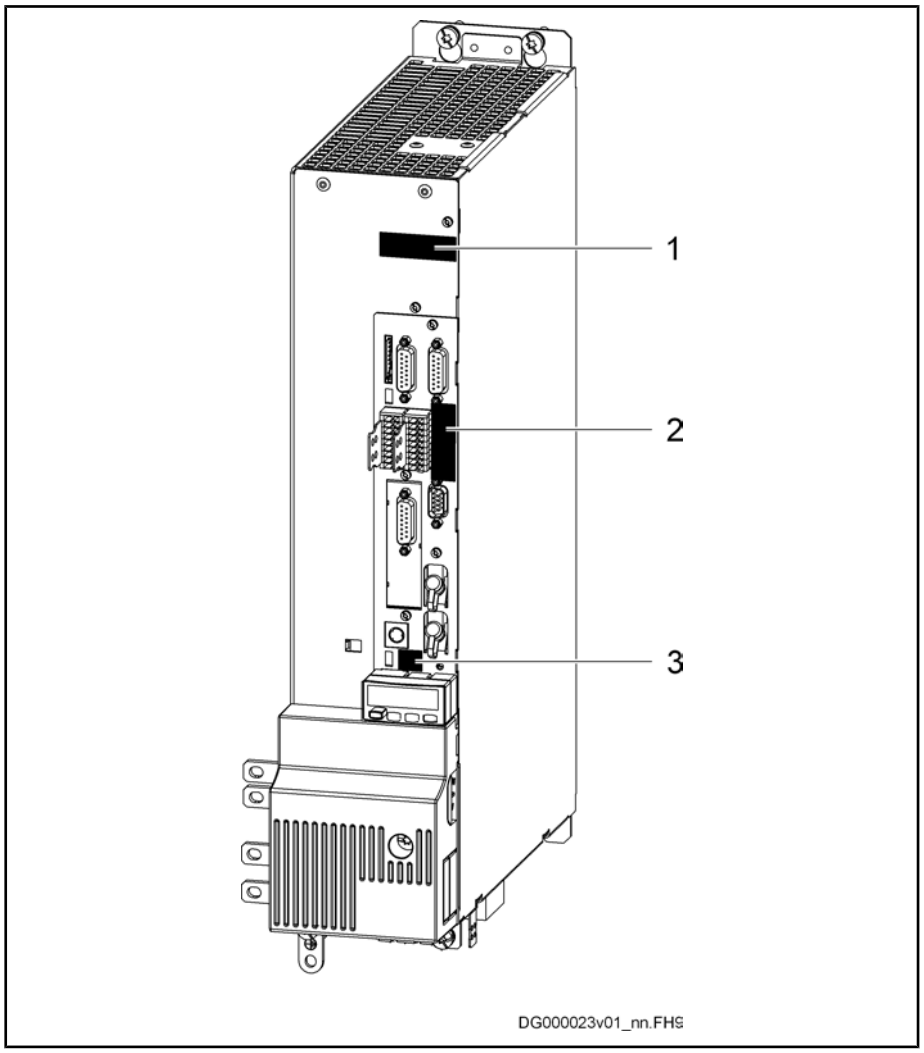
4.1 Type Plates

4.1.1 General Information

Each drive component is marked by a type designation.

There is a type plate attached to all devices.

4.1.2 Type Plates at the Drive Controller

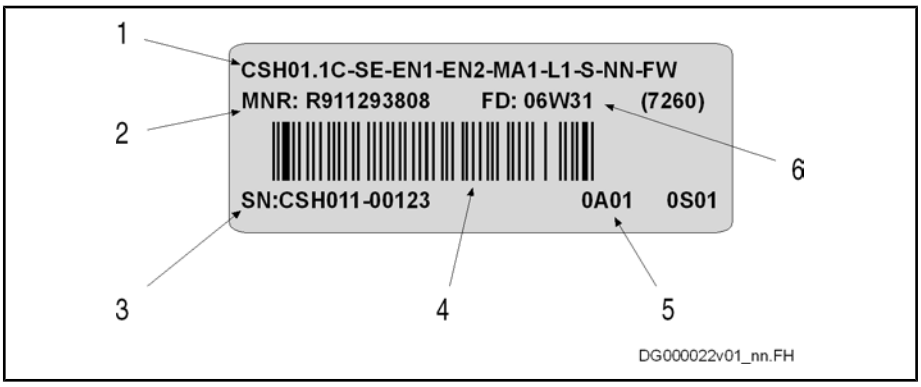


1 power section type plate
2 control section type plate
3 firmware type plate

Fig.4-1: Type plates at the drive controller

4.1.3 Type Plates at the Control Section

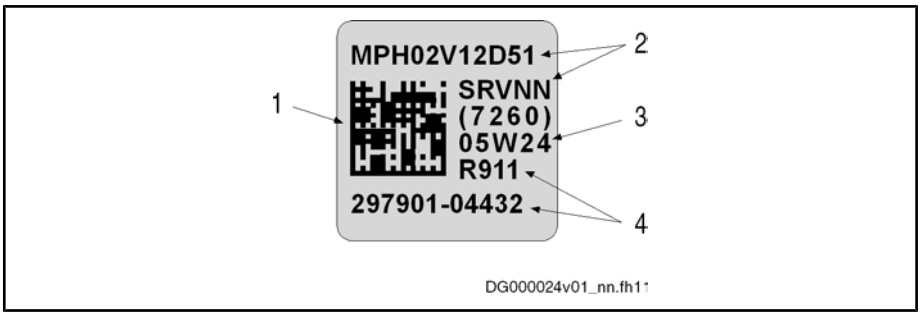
Control Section Type Plate



1) type
2) part number
3) serial number
4) bar code
5) hardware index
6) production week (example: 06W31 means year 2006, week 31)

Fig.4-2: Control section type plate (example)

Firmware Type Plate



1) bar code
2) type
3) production week (example: 05W24 means year 2005, week 24)
4) serial number

Fig.4-3: Firmware type plate (example)

Example of Purchase Order Text

The purchase order text for the firmware product consists of:

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

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

For further information, see documentation “Rexroth IndraDrive, Firmware for Drive Controllers MPH, MPD, MPB, Functional Description”.

Our sales representative will help you select the appropriate firmware.

5 Rexroth IndraDrive Control Sections

5.1 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.5-1: Control section overview

5.2 Overview of Functions and Interfaces

The control sections differ with regard to

- their configurability
- the available interfaces
- 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
operation with comfort control panel VCP01.2	yes [4]	no	no	no	no	no	no
serial interface RS232	1	1	1	1	1	1	1
Inputs/outputs:							
number of dig. inputs, thereof	8	8	8	9	8	22	11
probe type 2	0	1	1	0	1	2	2
probe type 3	0	1	1	0	1	0	0
number of dig. 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

Rexroth IndraDrive Control Sections

	CSB01.1N-FC	CSB01.1N-SE	CSB01.1N-PB	CSB01.1N-AN	CSB01.1C	CDB01.1C	CSH01.1C CSH01.2C
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	■	■	■	■	■	■	■
4 kHz	■	■	■	■	■	■	■
8 kHz	■	■	■	■	■	■	■
12 kHz	-	-	-	-	-	-	■
16 kHz	-	-	-	-	-	-	■

1) option starting lockout can be configured
2) cycle times depend on firmware version
3) clock frequencies also depend on power section, see Parameter Description "P-0-0001, Switching frequency of the power output stage"
4) as of firmware version MPB04V12

Fig.5-2: Overview of control section functions

☞ For more details on possible configurations see section “Optional Slots” in the description of the respective control section.

5.3 BASIC Control Sections

5.3.1 Type Codes BASIC and BASIC UNIVERSAL

Type Code BASIC CSB01.1N

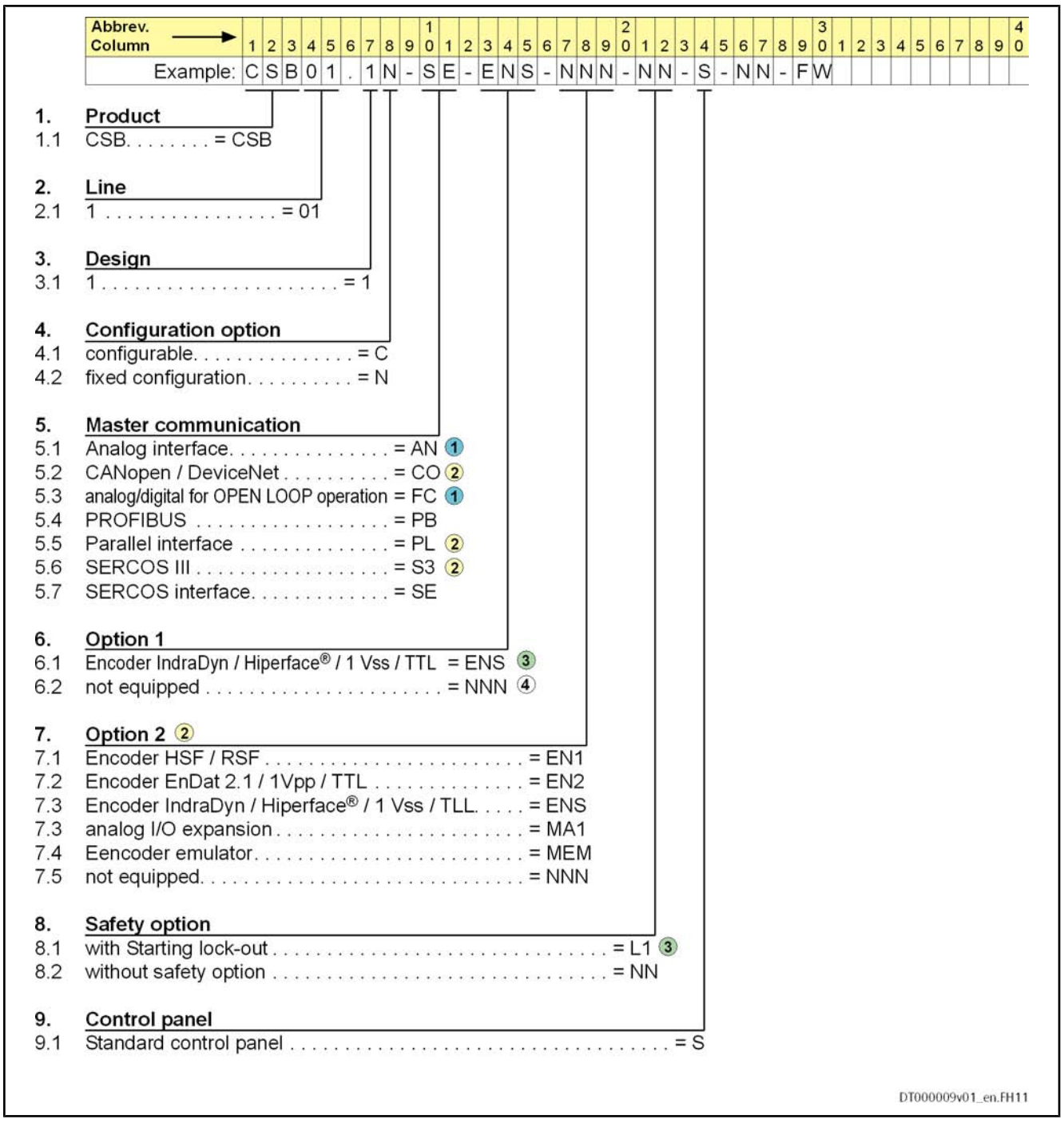


Fig.5-3: Type code control section BASIC (single-axis); (to be continued)

Rexroth IndraDrive Control Sections

Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1	2	3	4	5	6	7	8	9	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

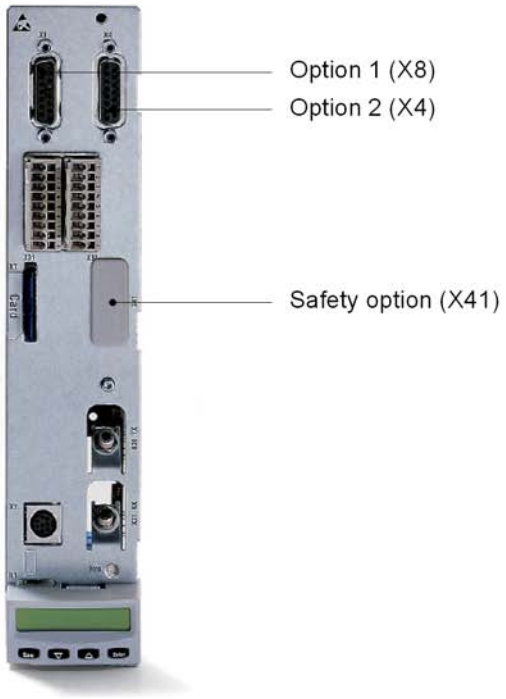
11. Firmware

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.5-4: 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

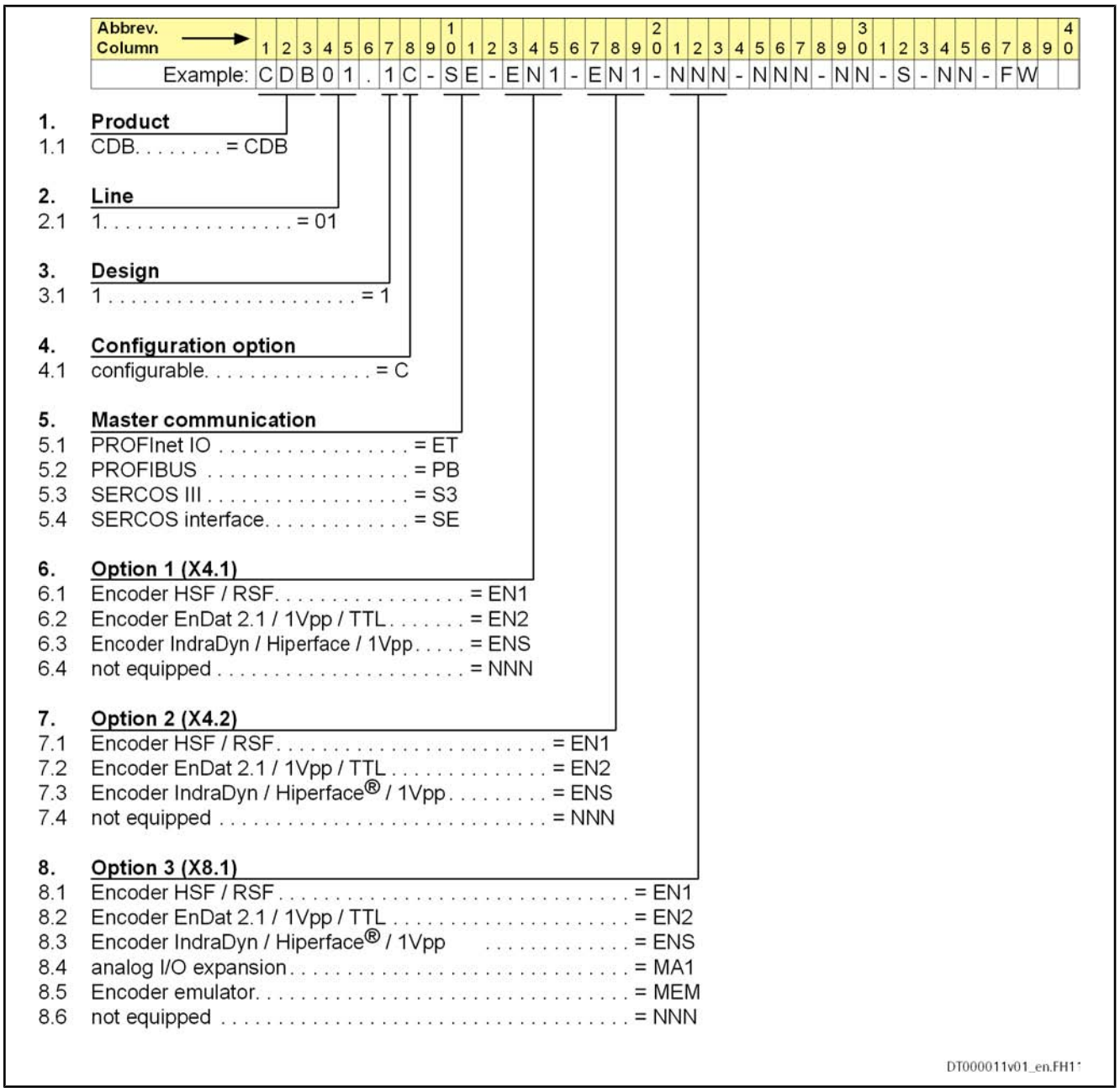


Fig.5-5: Type code control section BASIC (double-axis); (to be continued)

Rexroth IndraDrive Control Sections

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	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

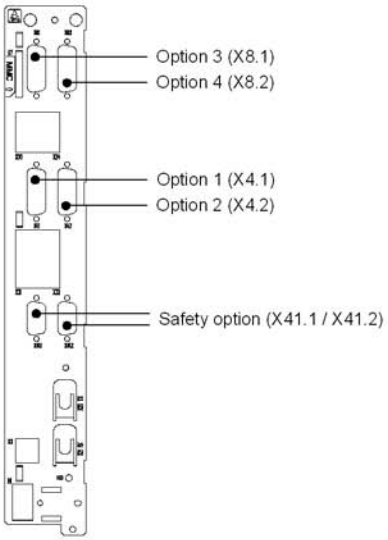
13. Firmware

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.5-6: Type code control section BASIC (double-axis); (continuation)

5.3.2 Dimensions BASIC

Dimensions BASIC and BASIC UNIVERSAL Single-Axis

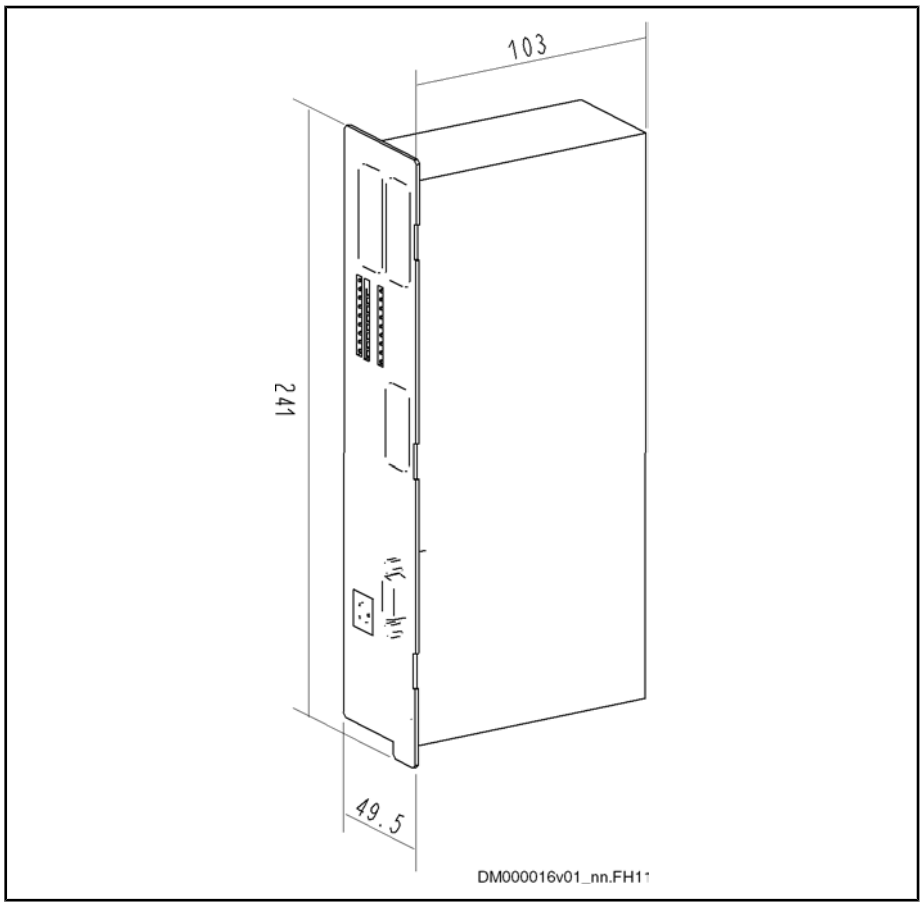


Fig.5-7: Dimensions CSB

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

Rexroth IndraDrive Control Sections

Dimensions BASIC UNIVERSAL Double-Axis

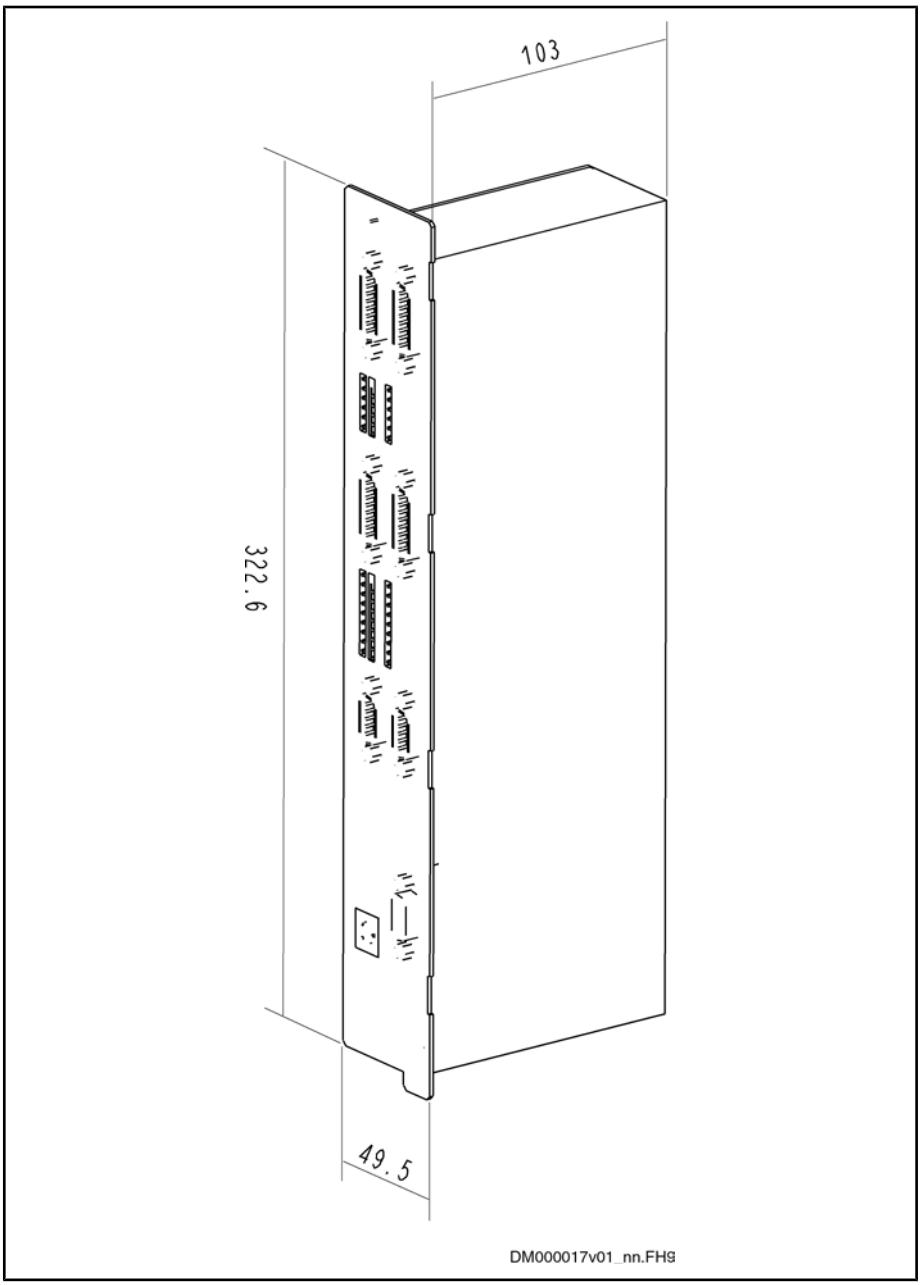


Fig.5-8: Dimensions CDB

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

5.3.3 CSB01.1N-FC - BASIC OPENLOOP

Front View with Connections at Basic Circuit Board

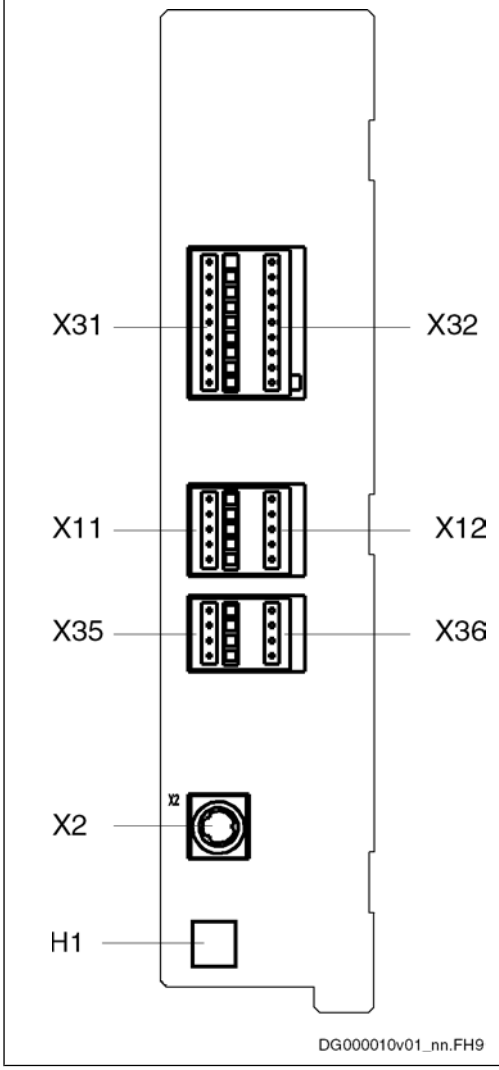
Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	X31 / X32	0,08–1,5	28–14	-	digital and analog inputs/outputs; voltage input (24V, 0V)
	X11 / X12	0,08–1,5	28–14	-	relay contacts
	X35 / X36	0,08–1,5	28–14	-	analog inputs / outputs; voltage output (24V, 0V)
	X2	0,25–0,5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

Fig.5-9: Connections BASIC OPENLOOP

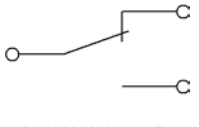
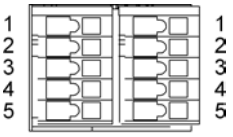
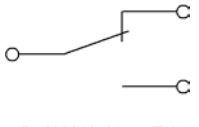
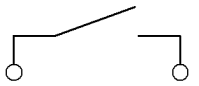
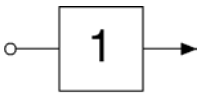
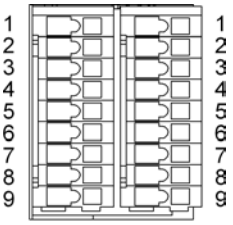
Functions

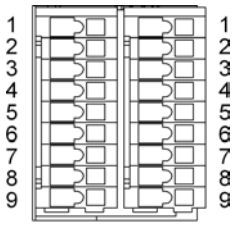
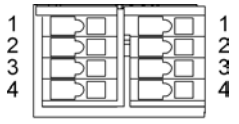
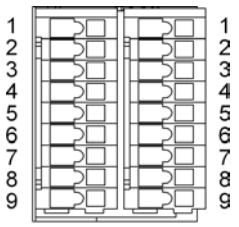
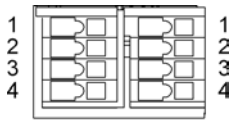
The specified factory settings apply to firmware MPx04.

For additional notes on function and commissioning, see the following sections in the Functional Description of the firmware:

- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

Rexroth IndraDrive Control Sections

<table>
<tr><th colspan="3">Function</th><th>Con-nection</th><th>Factory setting</th><th>Nominal data</th><th>Figure; technical data</th></tr>
<tr><td colspan="3">power consumption from 24V supply;
connection at power section X13 or +24V/0V</td><td>-</td><td>-</td><td colspan="2">see section “Power Consumption”</td></tr>
<tr><td>relay contact Rel 3</td><td rowspan="3"> 
DA000016v01_nn.FH11</td><td>no Rel 3</td><td>X11.3</td><td rowspan="3">speed reached
S-0-0013</td><td rowspan="3">AC 250 V
2 A
DC 30 V
1 A</td><td rowspan="3">X11 I X12
 
DA000050v01_nn.FH9
data see chapter 7.1 Relay Contacts , page 139</td></tr>
<tr><td>com Rel 3</td><td>X11.4</td></tr>
<tr><td>nc Rel 3</td><td>X11.5</td></tr>
<tr><td>relay contact Rel 2</td><td rowspan="3"> 
DA000016v01_nn.FH11</td><td>no Rel 2</td><td>X12.3</td><td rowspan="3">ready signal
P-0-0115</td><td rowspan="3">AC 250 V
2 A
DC 30 V
1 A</td></tr>
<tr><td>com Rel 2</td><td>X12.4</td></tr>
<tr><td>nc Rel 2</td><td>X12.5</td></tr>
<tr><td>relay contact Rel 1</td><td rowspan="2"> 
DA000017v01_nn.fh11</td><td>no Rel 1</td><td>X12.1</td><td rowspan="2">ready for operation
P-0-0115</td><td rowspan="2">AC 250 V
2 A
DC 30 V
1 A</td></tr>
<tr><td>no Rel 1</td><td>X12.2</td></tr>
<tr><td rowspan="10">digital inputs</td><td rowspan="10"> 
DA000022v01_nn.FH9</td><td>I_1</td><td>X31.3</td><td>clear error
S-0-0099</td><td rowspan="10">24 V
3 mA</td><td rowspan="10">X31 I X32
 
DA000051v01_nn.FH9
data see chapter 7.2 Digital Inputs/Out-puts, page 140</td></tr>
<tr><td>I_2</td><td>X31.4</td><td>drive ON
P-0-4028</td></tr>
<tr><td>I_3</td><td>X31.5</td><td>velocity cmd value from memory of fixed values
P-0-1200</td></tr>
<tr><td>I_4</td><td>X31.6</td><td>velocity cmd value from memory of fixed values
P-0-1200</td></tr>
<tr><td>I_5</td><td>X31.7</td><td>velocity cmd value from memory of fixed values
P-0-1200</td></tr>
<tr><td>I/O_8</td><td>X32.6</td><td>E-Stop
P-0-0223</td></tr>
<tr><td>I/O_9</td><td>X32.7</td><td>velocity cmd value from memory of fixed values
P-0-1200</td></tr>
<tr><td>I/O_10</td><td>X32.8</td><td>velocity cmd value from memory of fixed values
P-0-1200</td></tr>
</table>

Function			Con-nection	Factory setting	Nominal data	Figure; technical data
analog inputs	voltage input	I_a_1+	X32.4		±10 V	X31 I X32  DA000051v01_nn.FH9 data see chapter Analog Input Type 1 , page 145
		I_a_1-	X32.5			
	voltage input	I_a_2+	X32.1			
		I_a_2-	X32.2			
	current input	I_ai3+	X36.1		0…20 mA	X35 I X36  DA000052v01_nn.FH9 data see chapter Analog Input Type 3 , page 146
		I_ai3-	X36.2			
	current input	I_ai4+	X36.3			
		I_ai4-	X36.4			
analog output	voltage output	O_a_1	X32.9		0…+10 V	X31 I X32  DA000051v01_nn.FH9 data see chapter Analog Output Type 1 , page 148
	reference potential for analog voltage output	GND_a	X32.3			
analog output	voltage output	O_a_2	X35.3		0…+10 V	X35 I X36  DA000052v01_nn.FH9 data see chapter Analog Output Type 1 , page 148
	reference potential for analog voltage output	GND_a	X35.4			

Rexroth IndraDrive Control Sections

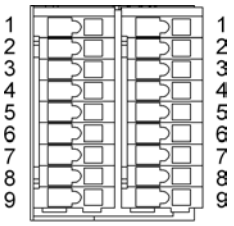
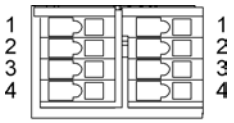
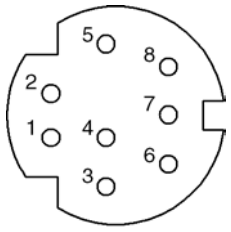
Function			Con-nection	Factory setting	Nominal data	Figure; technical data
input for power supply of digital inputs	supply of digital inputs	+24V	X31.8			X31 I X32  DA000051v01_nn.FH9 DC 19…30 V; max. 0.1 A
		0V	X31.9			
output (source) for power supply of digital inputs	connect supply (source) of digital inputs to X31.8 or X31.9	+24V	X35.1			X35 I X36  DA000052v01_nn.FH9 DC 19…30 V; max. 0.1 A; protected against polarity reversal; short-circuit proof
		0V	X35.2			
serial interface			X2		corresponds to RS232	 DA000049v01_nn.FH data see chapter 7.4 X2, Serial Interface (RS232) , page 149

Fig.5-10: Functions BASIC OPENLOOP

5.3.4 CSB01.1N-SE - BASIC SERCOS

Front View with Connections

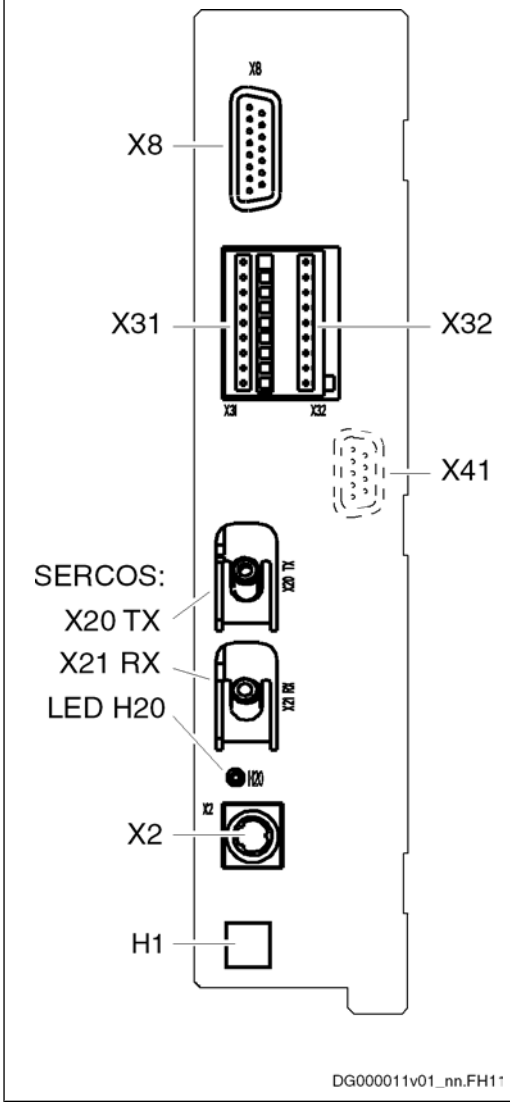
Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	X8	0,25–0,5	-	-	encoder evaluation ENS
	X31 / X32	0,08–1,5	28–14	-	digital inputs/outputs; voltage input (24V, 0V)
	X41	0,25–0,5		-	optional: starting lockout
	X20 / X21			0,3	master communication SERCOS
	X2	0,25–0,5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

Fig.5-11: Connections BASIC SERCOS

Functions

The specified factory settings apply to firmware MPx04.

For additional notes on function and commissioning, see the following sections in the Functional Description of the firmware:

- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

External supply required!

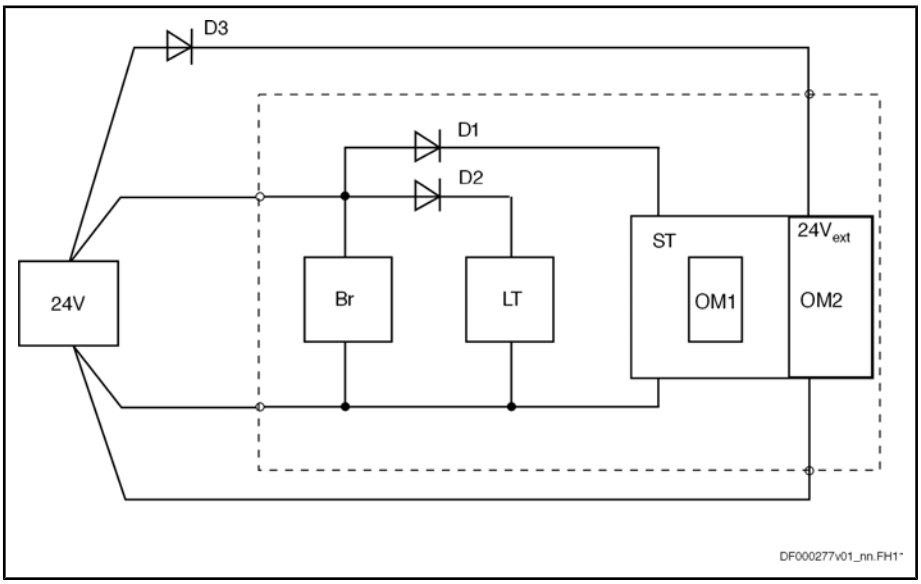
Digital I/Os require external supply voltage at X31.8 and X31.9.

Use protective diode!

Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

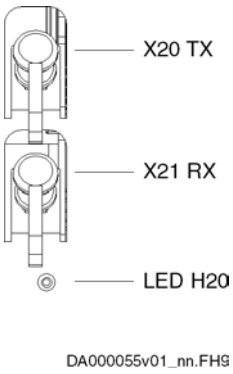
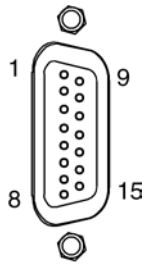
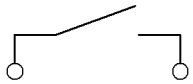
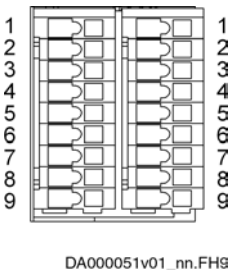
Configuration is possible as input or output!

Observe that the connections **X32.6, X32.7, X32.8** can be configured as digital inputs or outputs (I/O_8, I/O_9, I/O_10). At CDB01 and CSH01 control sections, additionally **X32.9** as I/O_11.

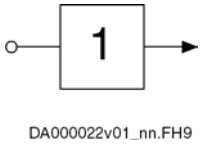
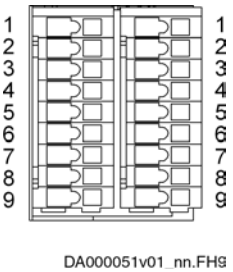
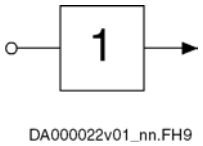
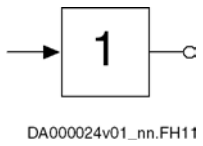
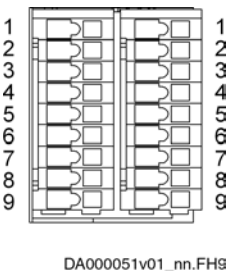


D1, D2	diodes, internal
D3	protective diode, external
LT	power section
BR	circuit for motor holding brake
ST	control section
OM1	optional modules
OM2	optional modules with supply voltage connection, e.g. MA1, MD2

Fig.5-12: Block diagram 24V supply

Function			Con-nection	Factory setting	Nominal data	Figure; technical data
power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section “Power Consumption”	
master commu-nication	SERCOS	SE	X20; X21		max. 16 MBaud	 data see chapter 6.2.1 SE - SERCOS , page 88
encoder interfa-ces	ENS		X8		DC 11.6 V 300 mA	 data see chapter 6.3.1 ENS - Standard Encoder Evaluation , page 104
relay contact		Rel 1 Rel 1	X31.1 X31.2	ready for operation P-0-0115	DC 24 V 1 A	X31 I X32  data see chapter 7.1 Relay Contacts , page 139

Rexroth IndraDrive Control Sections

Function			Connection	Factory setting	Nominal data	Figure; technical data
digital inputs		I_1 type 2 (probe)	X31.3	probe 1 S-0-0401	can be configured as probe 24 V 3 mA typ. 1 µs	X31 I X32  data see chapter 7.2 Digital Inputs/Outputs, page 140
		I_2 type 3 (probe)	X31.4		24 V 3 mA	
		I_3	X31.5	travel range limit switch P-0-0222		
		I_4	X31.6	travel range limit switch P-0-0222		
		I_5	X31.7	home switch S-0-0400		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		
digital outputs		I/O_8	X32.6	combined I/O configured as input I/O_8; see also P-0-0302	24 V 0.5 A	X31 I X32  data see chapter 7.2.3 Digital Outputs , page 143
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		

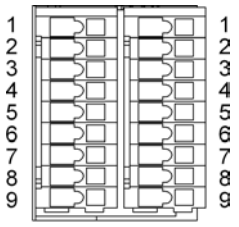
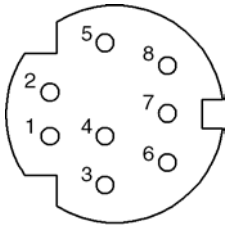
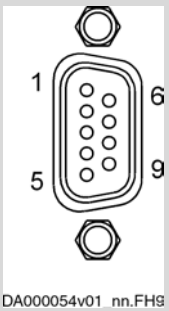
Function			Con-nection	Factory setting	Nominal data	Figure; technical data
power supply of digital inputs/out-puts		+24V	X31.8			X31 I X32  DA000051v01_nn.FHS DC 19…30 V; max. 1.1 A see note on “protective diode”
		0V	X31.9			
serial interface	RS232		X2			 DA000049v01_nn.FH data see chapter 7.4 X2, Serial Interface (RS232) , page 149
optional: starting lockout			X41			 DA000054v01_nn.FHS data see chapter 6.5.1 L1 - Starting Lock-out , page 134

Fig.5-13: Functions BASIC SERCOS

5.3.5 CSB01.1N-PB - BASIC PROFIBUS

Front View with Connections

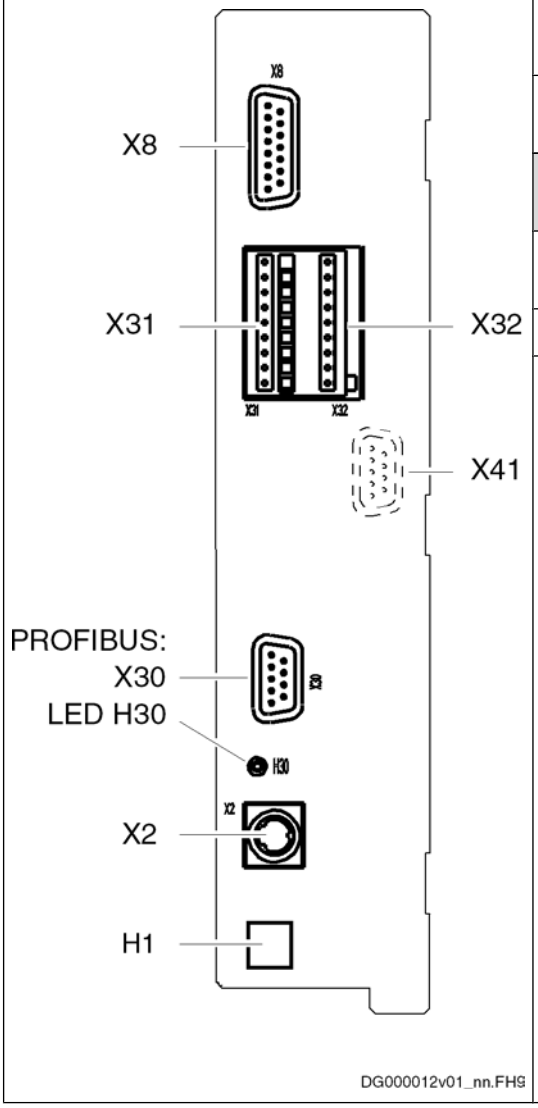
Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	X8	0,25–0,5	-	-	encoder evaluation ENS
	X31 / X32	0,08–1,5	28–14	-	digital inputs/outputs; voltage input (24V, 0V)
	X41	0,25–0,5		-	optional: starting lockout
	X30	0,08–0,5	-	-	master communication PROFIBUS
	X2	0,25–0,5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

Fig.5-14: Connections BASIC PROFIBUS

Functions

The specified factory settings apply to firmware MPx04.

For additional notes on function and commissioning, see the following sections in the Functional Description of the firmware:

- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

External supply required!

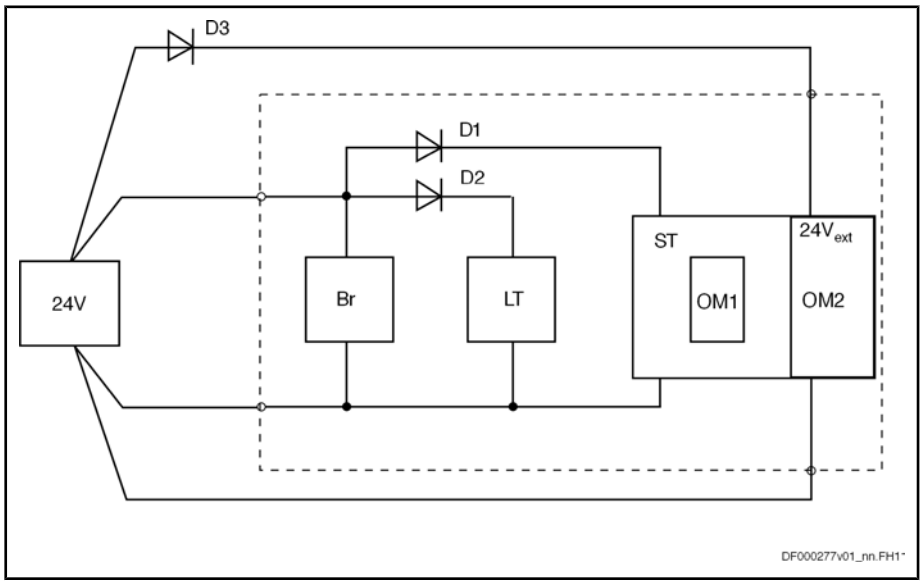
Digital I/Os require external supply voltage at X31.8 and X31.9.

Use protective diode!

Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

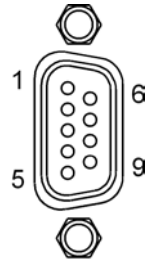
Configuration is possible as input or output!

Observe that the connections **X32.6, X32.7, X32.8** can be configured as digital inputs or outputs (I/O_8, I/O_9, I/O_10). At CDB01 and CSH01 control sections, additionally **X32.9** as I/O_11.

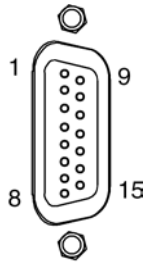
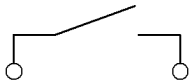
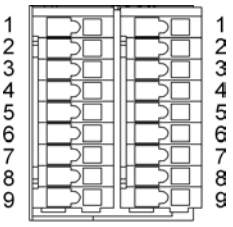


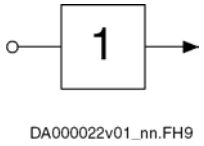
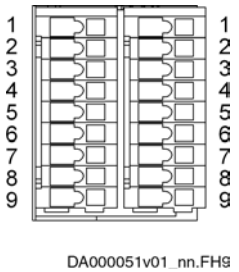
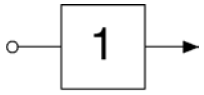
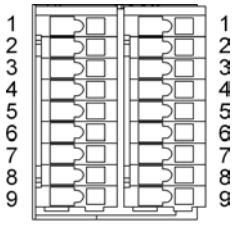
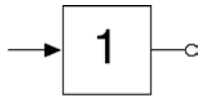
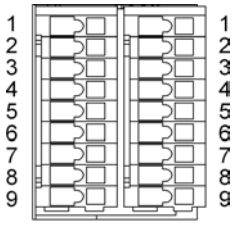
D1, D2	diodes, internal
D3	protective diode, external
LT	power section
BR	circuit for motor holding brake
ST	control section
OM1	optional modules
OM2	optional modules with supply voltage connection, e.g. MA1, MD2

Fig.5-15: Block diagram 24V supply

Function			Connection	Factory setting	Nominal data	Figure; technical data
power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section “Power Consumption”	
master communication	PROFIBUS	PB	X30		12 MBaud	

Rexroth IndraDrive Control Sections

Function			Con-nection	Factory setting	Nominal data	Figure; technical data
encoder interfa-ces	ENS		X8		DC 11.6 V 300 mA	 DA000053v01_nn.FH9 data see chapter 6.3.1 ENS - Standard Encoder Evaluation , page 104
relay contact	 DA000017v01_nn.fh11	Rel 1 Rel 1	X31.1 X31.2	ready for operation P-0-0115	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.1 Relay Contacts , page 139

Function			Con-nection	Factory setting	Nominal data	Figure; technical data
digital inputs	 DA000022v01_nn.FH9	I_1 type 2 (probe)	X31.3	probe 1 S-0-0401	can be configured as probe 24 V 3 mA typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2 Digital Inputs/Outputs, page 140
	 DA000022v01_nn.FH9	I_2 type 3 (probe)	X31.4		24 V 3 mA	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2 Digital Inputs/Outputs, page 140
		I_3	X31.5	travel range limit switch P-0-0222		
		I_4	X31.6	travel range limit switch P-0-0222		
		I_5	X31.7	home switch S-0-0400		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		
digital outputs	 DA000024v01_nn.FH11	I/O_8	X32.6	combined I/O configured as input I/O_8; see also P-0-0302	24 V 0.5 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2.3 Digital Outputs , page 143
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		

Rexroth IndraDrive Control Sections

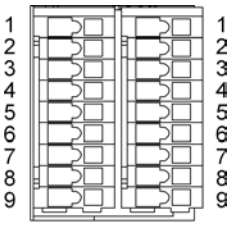
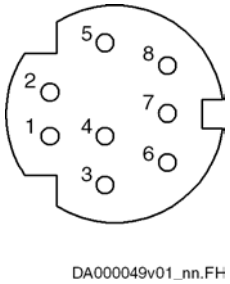
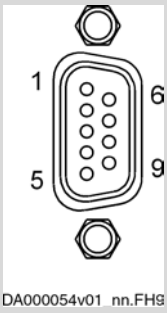
Function			Con-nection	Factory setting	Nominal data	Figure; technical data
power supply of digital inputs/outputs	power supply of digital inputs/outputs	+24V	X31.8			X31 I X32  DC 19…30 V; max. 1.1 A see note on “protective diode”
		0V	X31.9			
serial interface	RS232		X2			 serial interface data see chapter 7.4 X2, Serial Interface (RS232) , page 149
optional: starting lockout			X41			 data see chapter 6.5.1 L1 - Starting Lockout , page 134

Fig.5-16: Functions BASIC PROFIBUS

5.3.6 CSB01.1N-AN - BASIC ANALOG

Front View with Connections

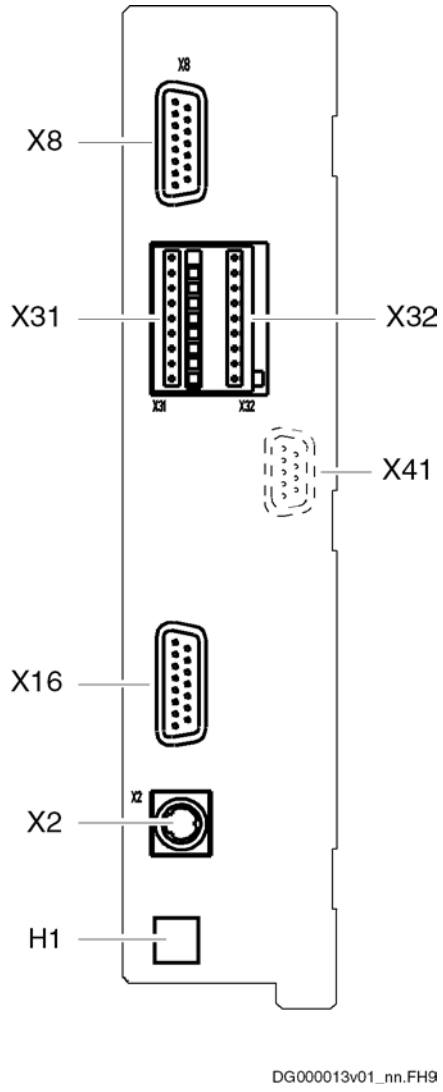
Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	X8	0,25–0,5	-	-	encoder evaluation ENS
	X31 / X32	0,08–1,5	28–14	-	digital and analog inputs/outputs; voltage input (24V, 0V)
	X41	0,25–0,5		-	optional: starting lockout
	X16	0,25–0,5	-	-	encoder emulation MEM
	X2	0,25–0,5	n.s.	-	serial interface
	H1	-	-	-	interface for control panel

Fig.5-17: Connections BASIC ANALOG

Functions

The specified factory settings apply to firmware MPx04.

For additional notes on function and commissioning, see the following sections in the Functional Description of the firmware:

- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

External supply required!

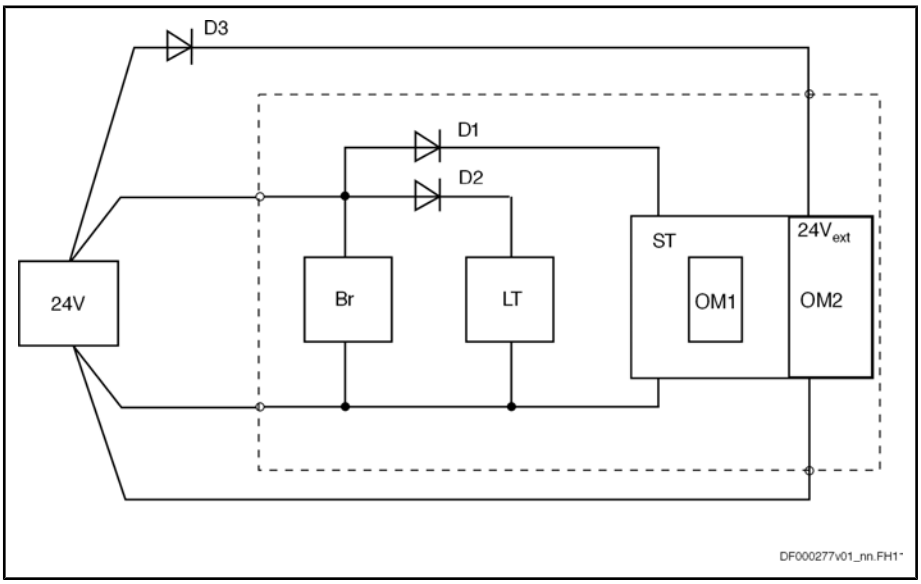
Digital I/Os require external supply voltage at X31.8 and X31.9.

Use protective diode!

Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

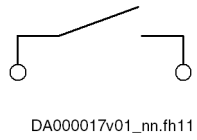
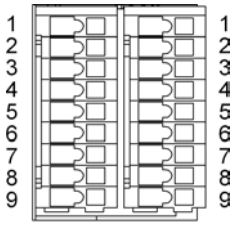
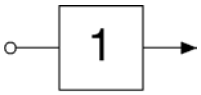
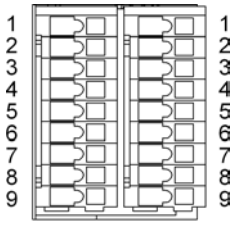
Configuration is possible as input or output!

Observe that the connections **X32.6, X32.7, X32.8** can be configured as digital inputs or outputs (I/O_8, I/O_9, I/O_10). At CDB01 and CSH01 control sections, additionally **X32.9** as I/O_11.

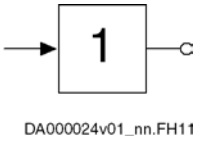
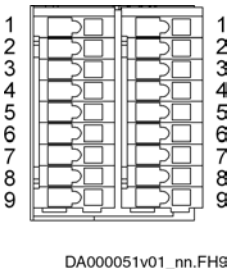
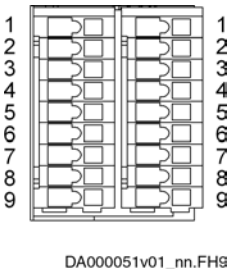
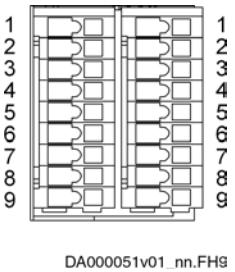


D1, D2	diodes, internal
D3	protective diode, external
LT	power section
BR	circuit for motor holding brake
ST	control section
OM1	optional modules
OM2	optional modules with supply voltage connection, e.g. MA1, MD2

Fig.5-18: Block diagram 24V supply

Function			Con-nection	Factory setting	Nominal data	Figure; technical data
power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section “Power Consumption”	
relay contact	 DA000017v01_nn.fh11	Rel 1	X31.1	ready for operation P-0-0115	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.1 Relay Contacts , page 139
		Rel 1	X31.2			
digital inputs	 DA000022v01_nn.FH9	I_1	X31.3	clear error S-0-0099	24 V 3 mA	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2 Digital Inputs/Outputs, page 140
		I_2	X31.4	drive ON P-0-4028		
		I_3	X31.5	travel range limit switch P-0-0222		
		I_4	X31.6	travel range limit switch P-0-0222		
		I_5	X31.7	home switch S-0-0400		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	Drive Halt P-0-4028		
		I/O_10	X32.8	combined I/O configured as output I/O_10; see also P-0-0302		
		I/O_11	X32.9	combined I/O configured as output I/O_11; see also P-0-0302		

Rexroth IndraDrive Control Sections

Function			Con-nection	Factory setting	Nominal data	Figure; technical data
digital outputs	 DA000024v01_nn.FH11	I/O_8	X32.6	combined I/O configured as input I/O_8; see also P-0-0302	24 V 0.5 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2.3 Digital Outputs , page 143
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	ready signal P-0-0115		
		I/O_11	X32.9	warning P-0-0115		
analog inputs	voltage input	I_a_1+	X32.4		±10 V	X31 I X32  DA000051v01_nn.FH9 data see chapter Analog Input Type 1 , page 145 example of connection see chapter 7-16Shield connection X32, page 144
		I_a_1-	X32.5			
	voltage input	I_a_2+	X32.1			
		I_a_2-	X32.2			
	reference potential for analog inputs connection for signal shields	GND_a	X32.3			
power supply of digital inputs/outputs		+24V	X31.8			X31 I X32  DA000051v01_nn.FH9 DC 19…30 V; max. 1.1 A see note on “protective diode”
		0V	X31.9			

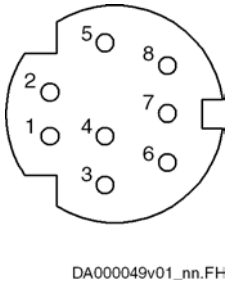
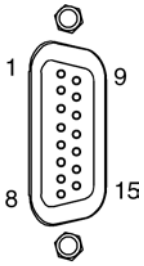
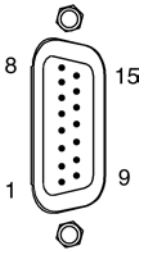
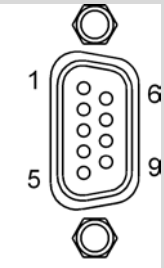
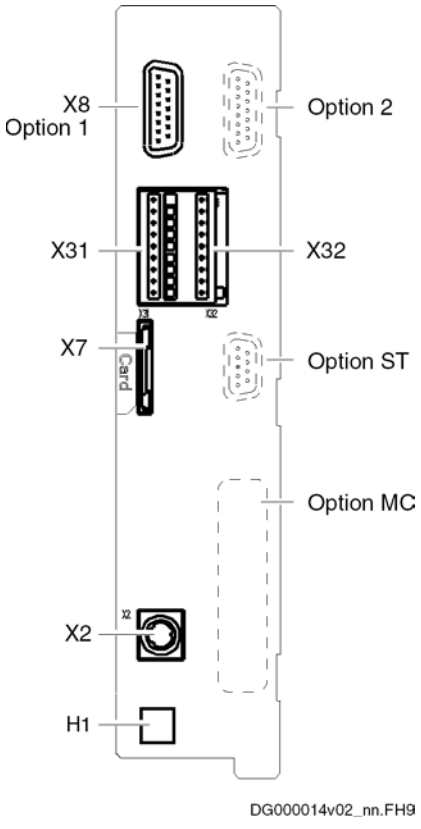
Function			Con-nection	Factory setting	Nominal data	Figure; technical data
serial interface	RS232		X2			 DA000049v01_nn.FH data see chapter 7.4 X2, Serial Interface (RS232) , page 149
encoder interfa-ces	ENS		X8		DC 11.6 V 300 mA	 DA000053v01_nn.FH9 data see chapter 6.3.1 ENS - Standard Encoder Evaluation , page 104
encoder emula-tion	MEM		X16			 DA000056v01_nn.FH9
optional: starting lockout			X41			 DA000054v01_nn.FH9 data see chapter 6.5.1 L1 - Starting Lock-out , page 134

Fig.5-19: Functions BASIC ANALOG

5.3.7 CSB01.1C - BASIC UNIVERSAL Single-Axis

Front View with Connections

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	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 [1]
					option MC [2]
	X2	0,25–0,5	-	-	serial interface
	H1	-	-	-	interface for control panel

1) option ST = safety technology
2) option MC = master communication

Fig.5-20: Connections BASIC UNIVERSAL single-axis CSB01.1C

Functions

The specified factory settings apply to firmware MPx04.

For additional notes on function and commissioning, see the following sections in the Functional Description of the firmware:

- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

External supply required!

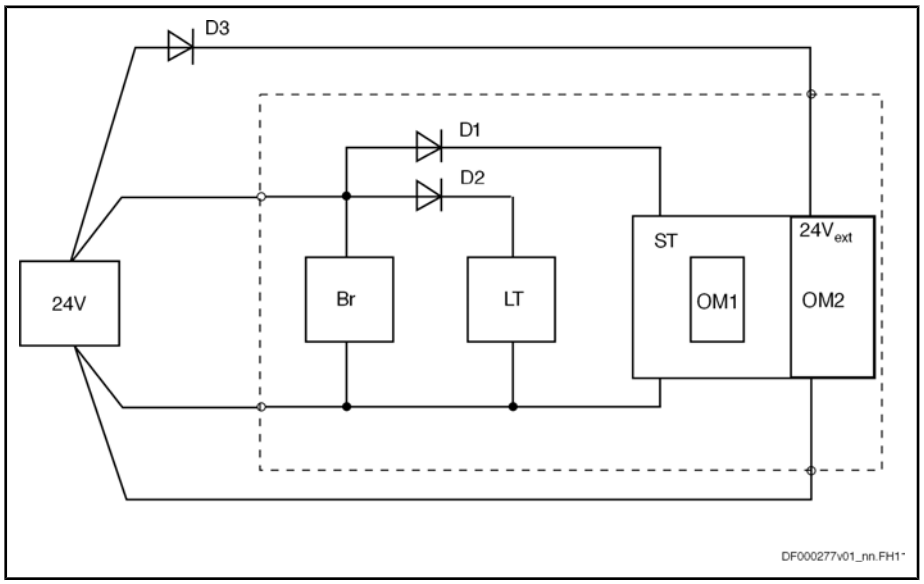
Digital I/Os require external supply voltage at X31.8 and X31.9.

Use protective diode!

Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

Configuration is possible as input or output!

Observe that the connections **X32.6, X32.7, X32.8** can be configured as digital inputs or outputs (I/O_8, I/O_9, I/O_10). At CDB01 and CSH01 control sections, additionally **X32.9** as I/O_11.

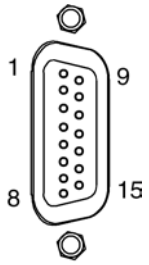
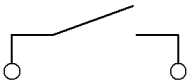
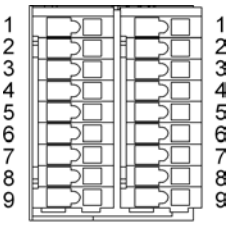


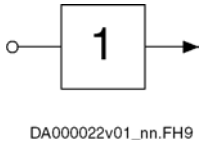
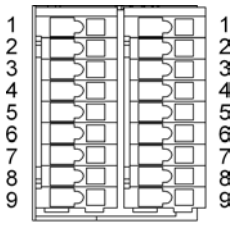
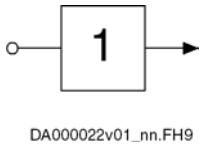
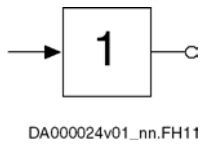
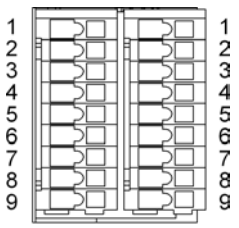
D1, D2	diodes, internal
D3	protective diode, external
LT	power section
BR	circuit for motor holding brake
ST	control section
OM1	optional modules
OM2	optional modules with supply voltage connection, e.g. MA1, MD2

Fig.5-21: Block diagram 24V supply

Function			Connection	Factory setting	Nominal data	Figure; technical data
power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section “Power Consumption”	
master communication	configurable					

Rexroth IndraDrive Control Sections

Function			Con-nection	Factory setting	Nominal data	Figure; technical data
encoder interfa-ces	ENS		X8		DC 11.6 V 300 mA	 DA000053v01_nn.FH9 data see chapter 6.3.1 ENS - Standard Encoder Evaluation , page 104
relay contact	 DA000017v01_nn.fh11	Rel 1 Rel 1	X31.1 X31.2	ready for operation P-0-0115	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.1 Relay Contacts , page 139

Function			Connection	Factory setting	Nominal data	Figure; technical data
digital inputs	 DA000022v01_nn.FH9	I_1 type 2 (probe)	X31.3	probe 1 S-0-0401	can be configured as probe 24 V 3 mA typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2 Digital Inputs/Outputs, page 140
	 DA000022v01_nn.FH9	I_2 type 3 (probe)	X31.4		24 V 3 mA	
		I_3	X31.5	travel range limit switch P-0-0222		
		I_4	X31.6	travel range limit switch P-0-0222		
		I_5	X31.7	home switch S-0-0400		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		
digital outputs	 DA000024v01_nn.FH11	I/O_8	X32.6	combined I/O configured as input I/O_8; see also P-0-0302	24 V 0.5 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2.3 Digital Outputs , page 143
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		

Rexroth IndraDrive Control Sections

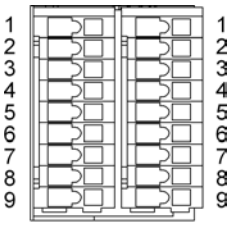
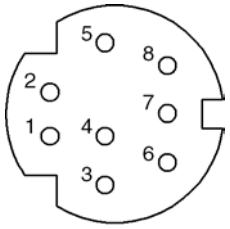
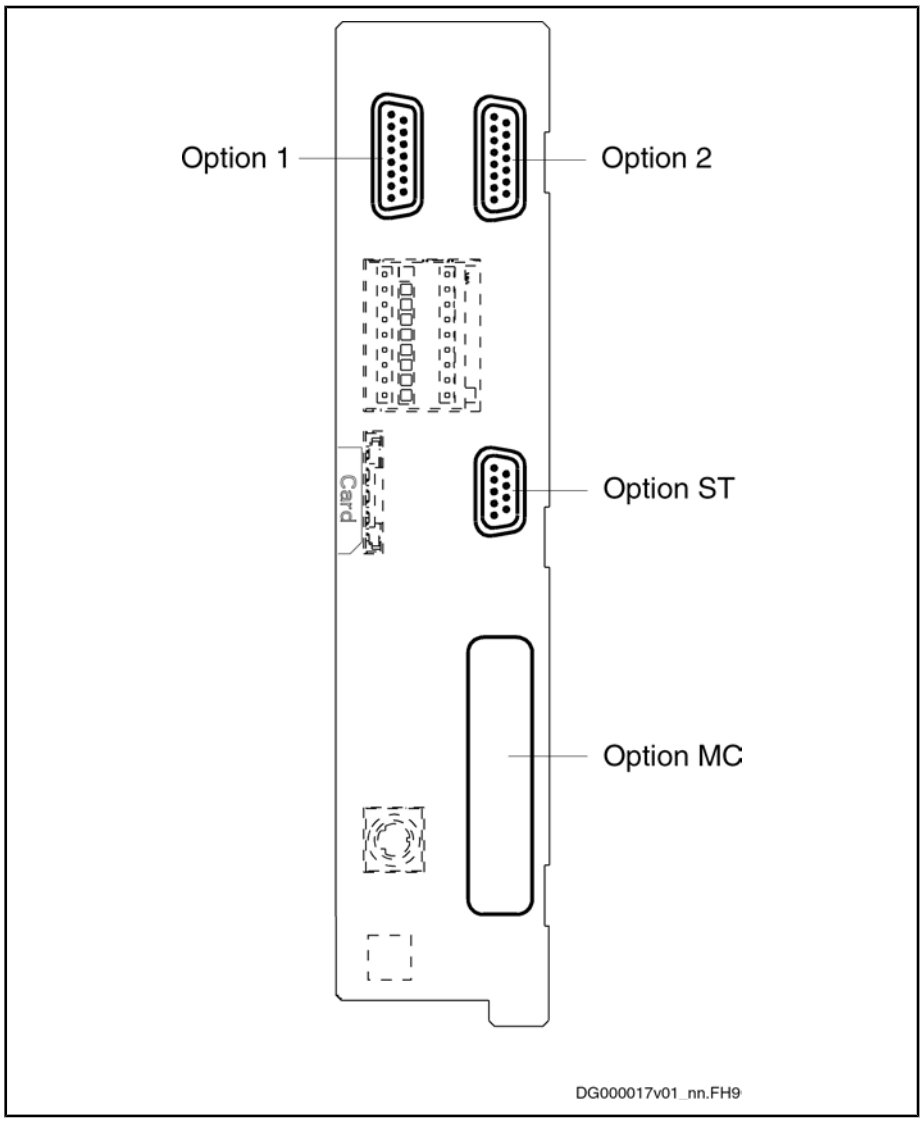
Function			Connection	Factory setting	Nominal data	Figure; technical data
power supply of digital inputs/outputs		+24V	X31.8			X31 I X32  DA000051v01_nn.FH9 DC 19…30 V max. 1.1 A see note on “protective diode”
		0V	X31.9			
serial interface	RS232		X2			 DA000049v01_nn.FH data see chapter 7.4 X2, Serial Interface (RS232) , page 149
optional functions	allowed options: see configuration table					see corresponding optional module

Fig.5-22: Functions BASIC UNIVERSAL single-axis CSB01.1C

Optional Slots



option MC master communication
option ST safety technology
Fig.5-23: Optional slots for BASIC UNIVERSAL single-axis CSB01.1C

The following configuration table shows which optional module is supported on which optional slot.

Our 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	■	-	-	-	-	-
PB	■	-	-	-	-	-
PL	■	-	-	-	-	-

Rexroth IndraDrive Control Sections

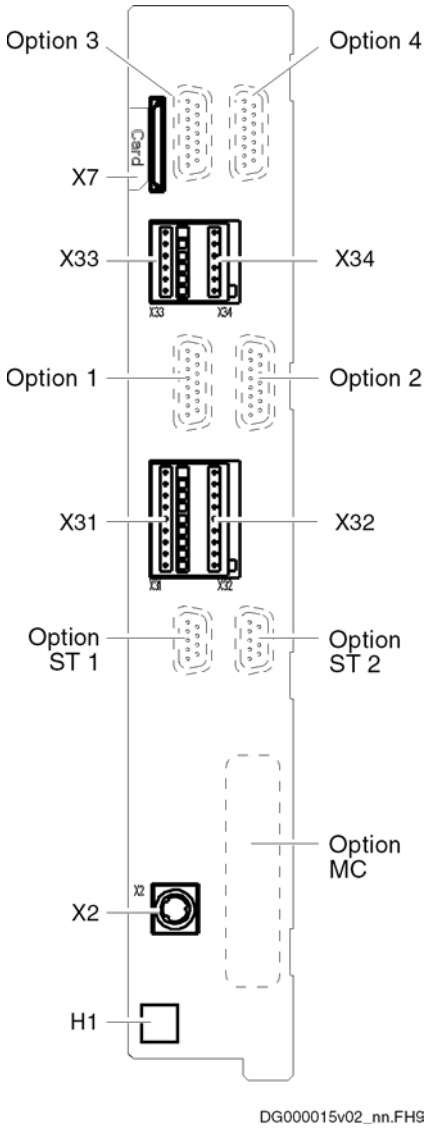
Optional module	Optional slot					
	option MC	option 1 (on board)	option 2	option ST (X41)	memory card slot (X7)	control panel (H1)
CO	■	-	-	-	-	-
ET	■	-	-	-	-	-
S3	■	-	-	-	-	-
CCD	-	-	-	-	-	-
ENS	-	■	■	-	-	-
EN1	-	-	■	-	-	-
EN2	-	-	■	-	-	-
MEM	-	-	■	-	-	-
MA1	-	-	■	-	-	-
MD1	-	-	-	-	-	-
MD2	-	-	-	-	-	-
L1	-	-	-	■	-	-
S1	-	-	-	-	-	-
S	-	-	-	-	-	■
PFM02	-	-	-	-	■	-

■ allowed optional module on optional slot
- not allowed

Fig.5-24: Configuration table

5.3.8 CDB01.1C - BASIC UNIVERSAL Double-Axis

Front View with Connections

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	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 [1]
					option ST2 [1]
					option MC [2]
	X2	0,25–0,5	-	-	serial interface
	H1	-	-	-	interface for control panel

1) option ST = safety technology
2) option MC = master communication

Fig.5-25: Connections BASIC UNIVERSAL double-axis

Functions

The specified factory settings apply to firmware MPx04.

For additional notes on function and commissioning, see the following sections in the Functional Description of the firmware:

- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

External supply required!

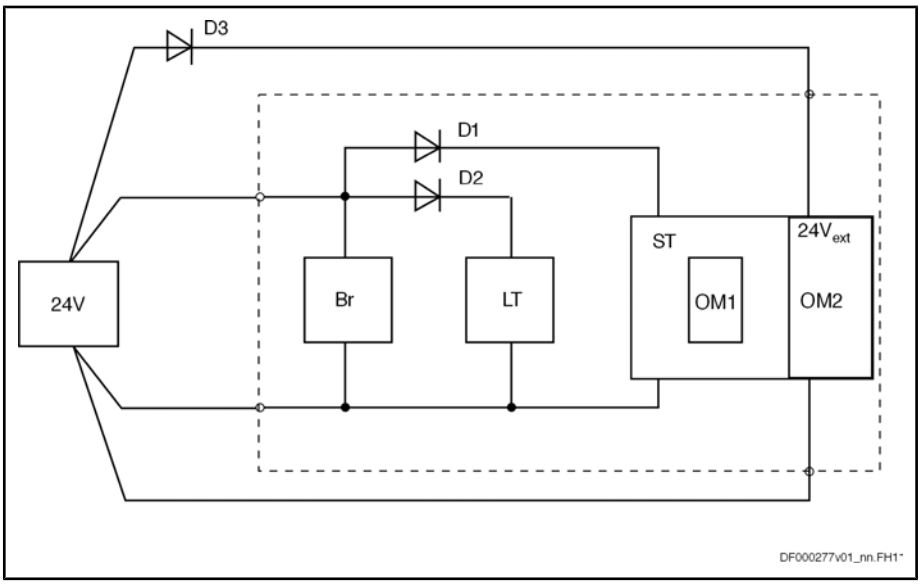
Digital I/Os require external supply voltage at X31.8 and X31.9.

Use protective diode!

Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

Configuration is possible as input or output!

Observe that the connections **X32.6, X32.7, X32.8** can be configured as digital inputs or outputs (I/O_8, I/O_9, I/O_10). At CDB01 and CSH01 control sections, additionally **X32.9** as I/O_11.



D1, D2	diodes, internal
D3	protective diode, external
LT	power section
BR	circuit for motor holding brake
ST	control section
OM1	optional modules
OM2	optional modules with supply voltage connection, e.g. MA1, MD2

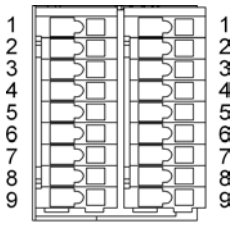
Fig.5-26: Block diagram 24V supply

Low input resistance

The digital inputs I_6 and I_7 are mounted in parallel to the analog input I_a_1. Observe that this reduces the input resistance of the analog input to the value of the digital inputs.

Signal sources with low impedance for a low degree of linearity error

If you need a low degree of linearity error, use signal sources with the lowest possible impedance at the analog input I_a_1. 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			Connection	Factory setting	Nominal data	Figure; technical data
power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section “Power Consumption”	
master communication	configurable					
relay contact	 DA000017v01_nn.fh11	Rel 1	X31.1	ready for operation P-0-0115	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.1 Relay Contacts , page 139
		Rel 1	X31.2			

Rexroth IndraDrive Control Sections

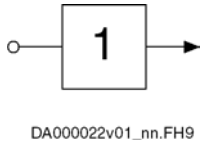
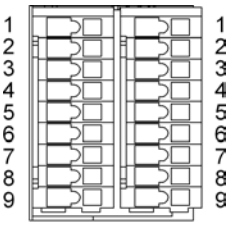
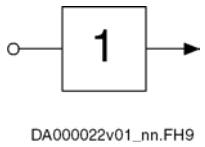
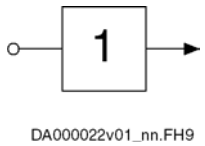
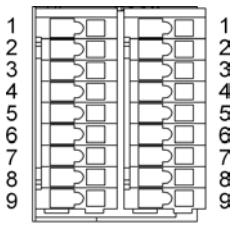
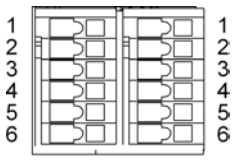
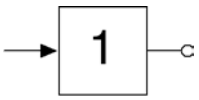
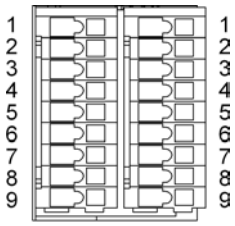
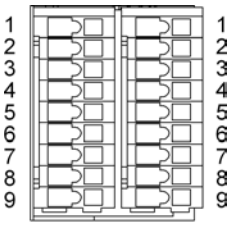
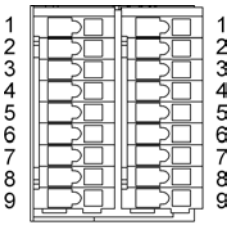
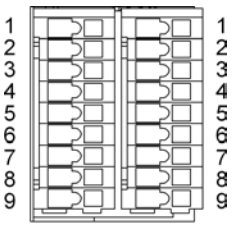
Function			Connection	Factory setting	Nominal data	Figure; technical data
digital inputs		I_1 type 2 (probe)	X31.3	axis 1: probe 1 S-0-0401	can be configured as probe; 24 V 3 mA typ. 1 µs	X31 I X32  data see chapter 7.2 Digital Inputs/Outputs, page 140
		I_2 type 2 (probe)	X31.4	axis 2: probe 1 S-0-0401		
		I_3	X31.5	axis 1: travel range limit switch P-0-0222	24 V 3 mA	
		I_4	X31.6	axis 1: travel range limit switch P-0-0222		
		I_5	X31.7	axis 1: home switch S-0-0400		
		I_6	X32.4	can also be used as analog input; see I_a_1+		
		I_7	X32.5	can also be used as analog input; see I_a_1-		

Fig.5-27: Functions BASIC UNIVERSAL double-axis CDB01.1C

Function			Con-nection	Factory setting	Nominal data	Figure; technical data
		I/O_8	X32.6	axis 1: E-Stop P-0-0223		X31 I X32  DA000051v01_nn.FH9
		I/O_9	X32.7	axis 2: travel range limit switch P-0-0222		
		I/O_10	X32.8	axis 2: travel range limit switch P-0-0222		
		I/O_11	X32.9	axis 2: home switch S-0-0400		X33 I X34  DA000059v01_nn.FH9
		I_12	X33.1			
		I_13	X33.2			
		I_14	X33.3			
		I_15	X33.4			
		I_16	X33.5			
		I_17	X33.6			
		I_18	X34.1			
		I_19	X34.2			
		I_20	X34.3			
		I_21	X34.4			
		I_22	X34.5			
	reference potential for digital inputs	0V	X34.6			
digital outputs	 DA000024v01_nn.FH11	I/O_8	X32.6	combined I/O configured as input I/O_8; see also P-0-0302	24 V 0.5 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2.3 Digital Outputs , page 143
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		
		I/O_11	X32.9	combined I/O configured as input I/O_11; see also P-0-0302		

Rexroth IndraDrive Control Sections

Function			Con-nection	Factory setting	Nominal data	Figure; technical data
analog inputs	voltage input	I_a_1+	X32.4	can also be used as digital input I_6	±10 V typ. 2 kohm	X31 I X32  DA000051v01_nn.FH9 data see chapter Analog Input Type 4 , page 147 example of connection see chapter 7-16Shield connection X32, page 144
		I_a_1-	X32.5	can also be used as digital input I_7		
analog outputs	voltage output	O_a_1	X32.1		5 V 1 mA	X31 I X32  DA000051v01_nn.FH9 data see chapter Analog Output Type 2 , page 148 example of connection see chapter 7-16Shield connection X32, page 144
		O_a_2	X32.2			
	reference potential for analog voltage output connection for signal shields	GND_a	X32.3			
power supply of digital inputs/outputs		+24V	X31.8			X31 I X32  DA000051v01_nn.FH9 DC 19…30 V; max. 1.1 A see note on “protective diode”
		0V	X31.9			

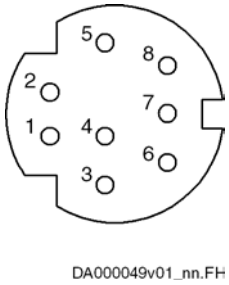
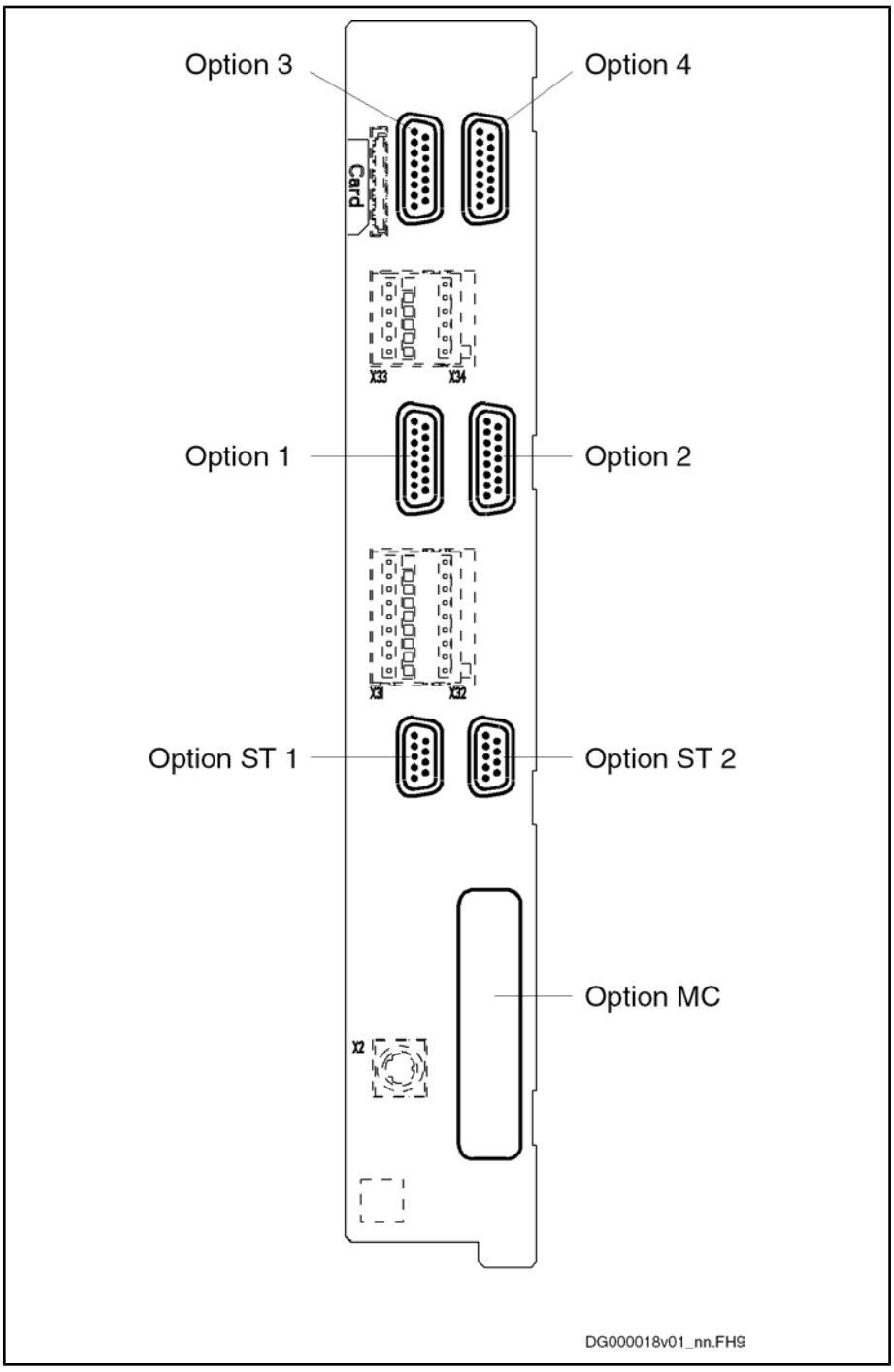
Function			Connection	Factory setting	Nominal data	Figure; technical data
serial interface	RS232		X2			 DA000049v01_nn.FH data see chapter 7.4 X2, Serial Interface (RS232) , page 149
optional functions	allowed options: see configuration table					see corresponding optional module

Fig.5-28: Functions BASIC UNIVERSAL double-axis CDB01.1C

Rexroth IndraDrive Control Sections

Optional Slots



option MC master communication
options and ST2 ST1 safety technology

Fig.5-29: Options for BASIC UNIVERSAL double-axis CDB01.1C

The following configuration table shows which optional module is supported on which optional slot.

Our 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 (X8.1)	option 4 (X8.2)	option ST 1 (X41.1)	option ST 2 (X41.2)	memory card slot (X7)	control panel (H1)
SE	■	-	-	-	-	-	-	-	-
PB	■	-	-	-	-	-	-	-	-
PL	-	-	-	-	-	-	-	-	-
CO	-	-	-	-	-	-	-	-	-
ET	■	-	-	-	-	-	-	-	-
S3	■	-	-	-	-	-	-	-	-
CCD	-	-	-	-	-	-	-	-	-
ENS	-	■	■	■	■	-	-	-	-
EN1	-	■	■	■	■	-	-	-	-
EN2	-	■	■	■	■	-	-	-	-
MEM	-	-	-	■	■	-	-	-	-
MA1	-	-	-	■	■	-	-	-	-
MD1	-	-	-	-	-	-	-	-	-
MD2	-	-	-	-	-	-	-	-	-
L1	-	-	-	-	-	■	■	-	-
S1	-	-	-	-	-	■	■	-	-
S	-	-	-	-	-	-	-	-	■
C	-	-	-	-	-	-	-	-	■
PFM02	-	-	-	-	-	-	-	■	-

■ allowed optional module on optional slot
- not allowed

Fig.5-30: Configuration table

Rexroth IndraDrive Control Sections

5.4 ADVANCED

5.4.1 Type Code ADVANCED (CSH01.1C)

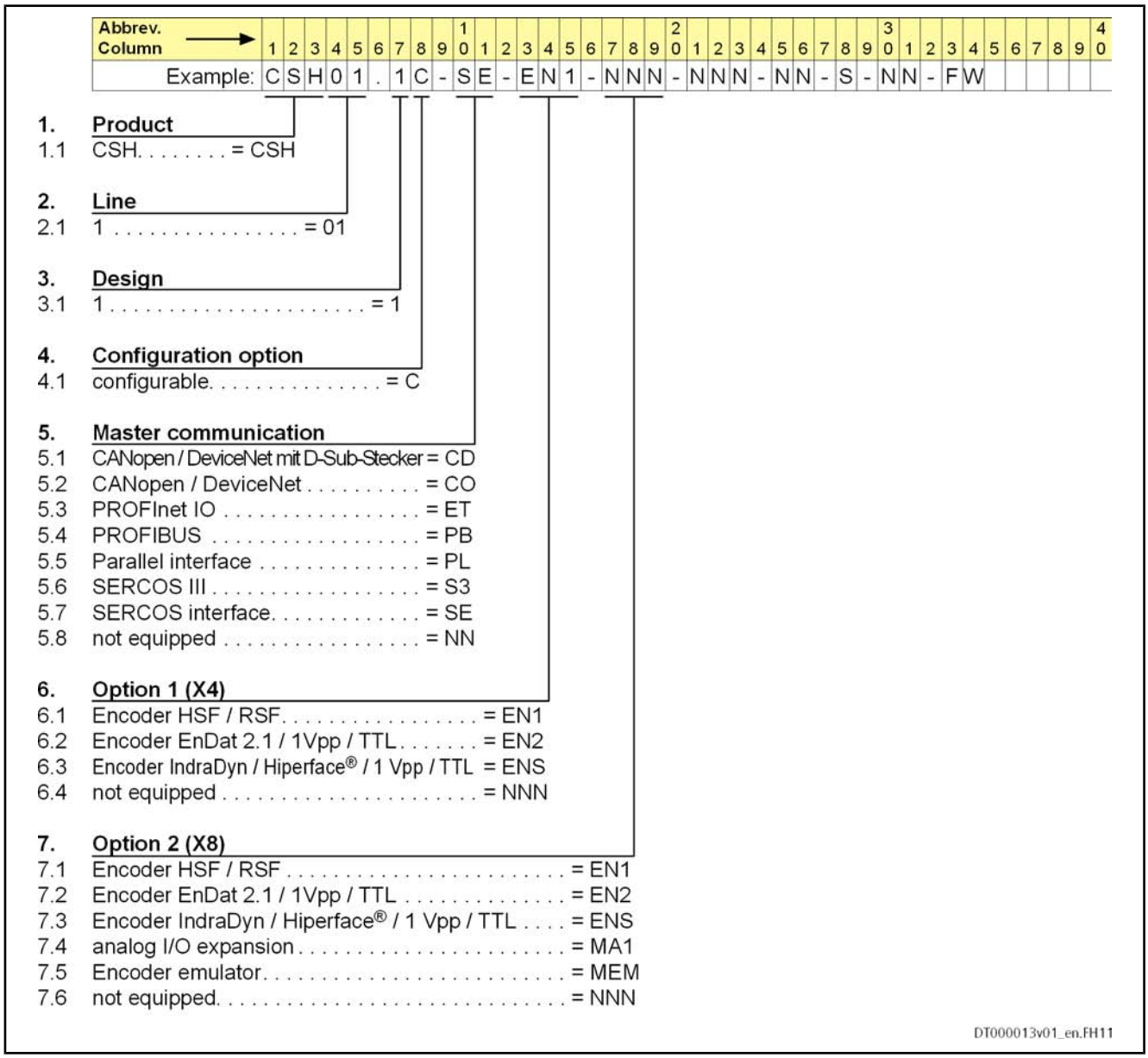


Fig.5-31: Type code control section ADVANCED (CSH01.1C); (to be continued)

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

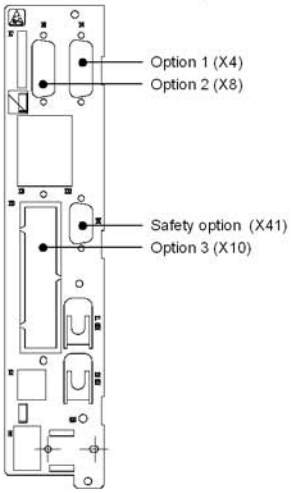
12. Firmware

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.5-32: Type code control section ADVANCED (CSH01.1C); (continuation)

Rexroth IndraDrive Control Sections

5.4.2 Type Code ADVANCED (CSH01.2C)

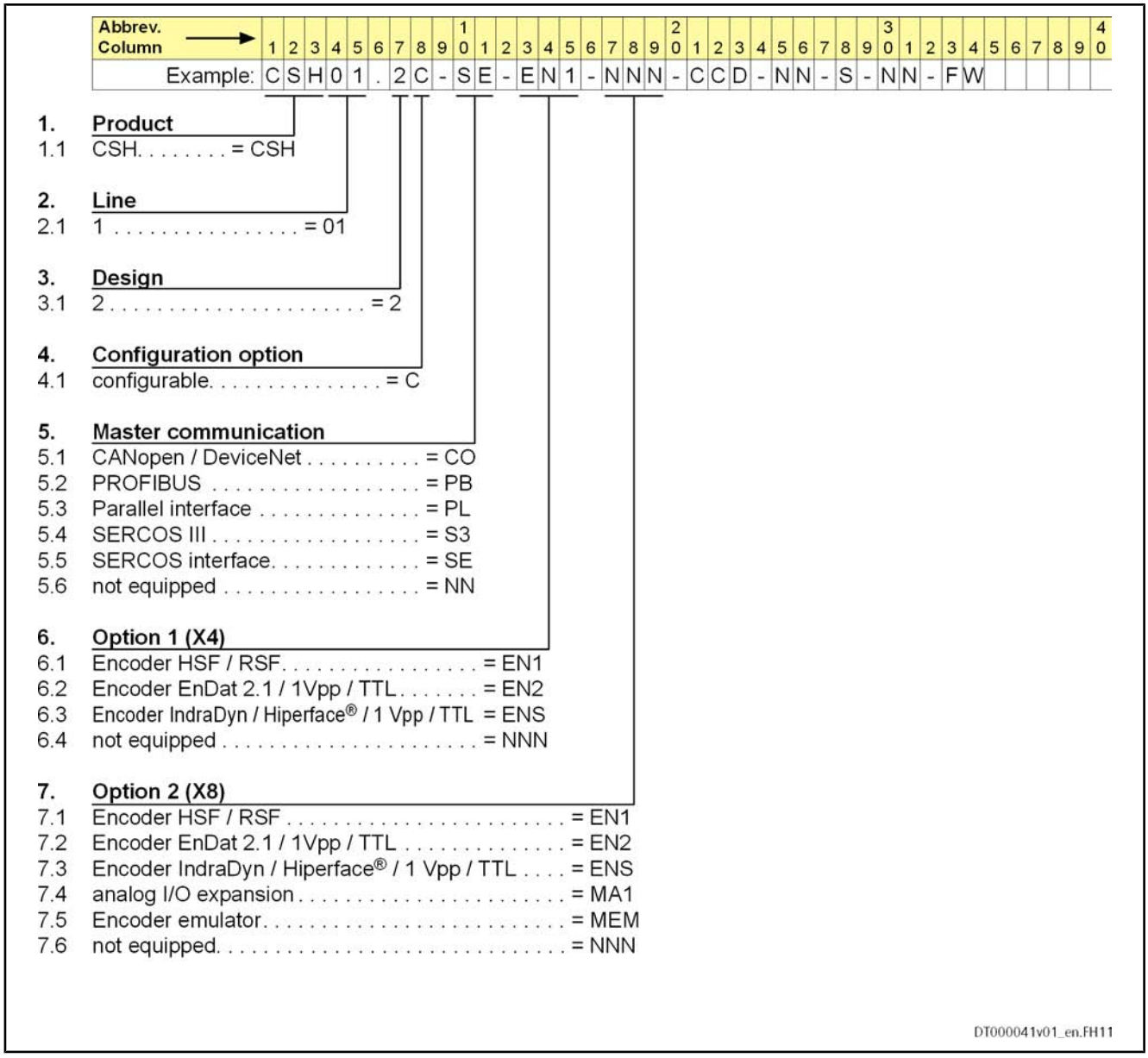


Fig.5-33: Type code control section ADVANCED (CSH01.2C); (to be continued)

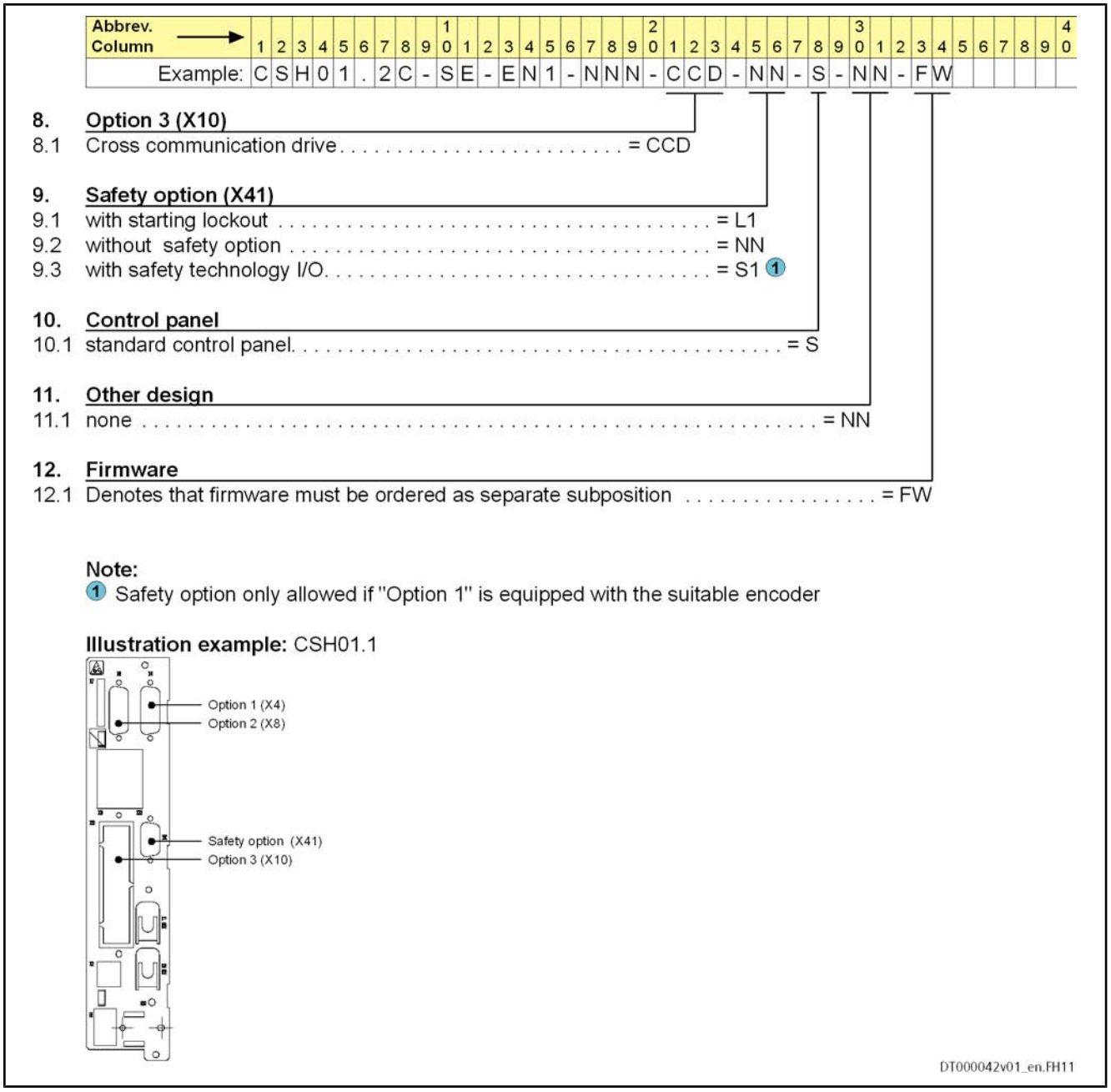


Fig.5-34: Type code control section ADVANCED (CSH01.2C); (continuation)

- In comparison to type CSH01.1C, the type CSH01.2C has the interface “cross communication - CCD” (at optional slot 3; CCD = Cross Communication Drives).
- For the purpose of engineering, the control section - in addition to the serial interface X2 - has an Ethernet-based interface.

5.4.3 Dimensions ADVANCED

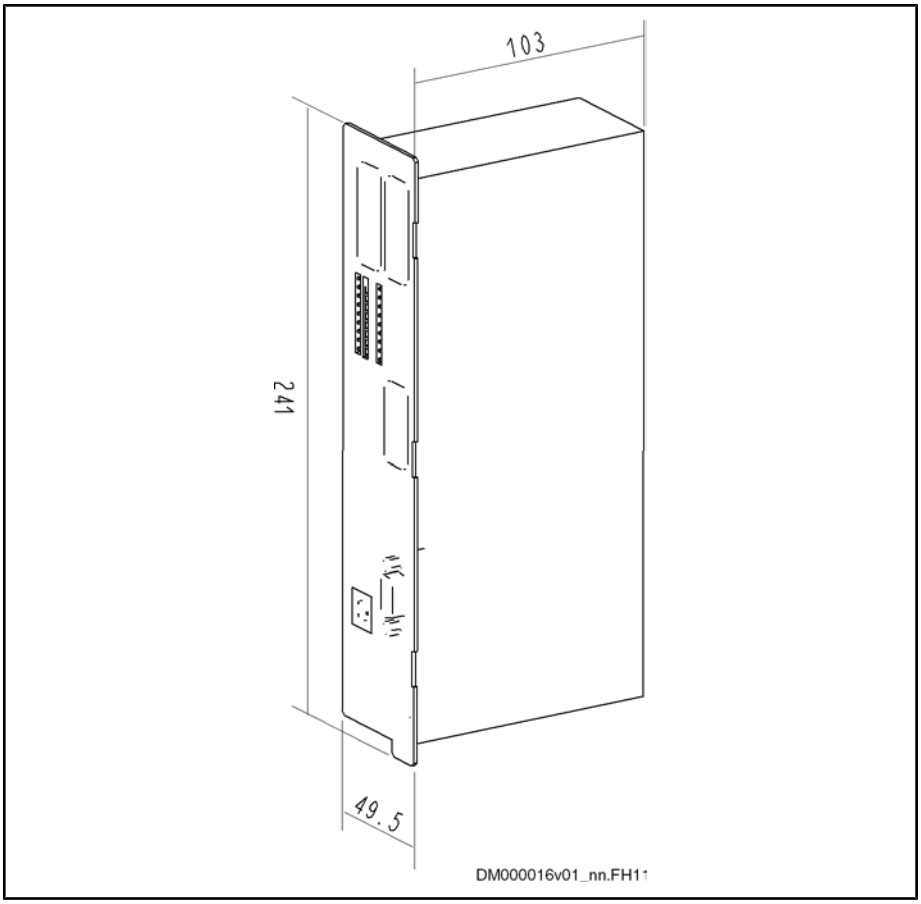
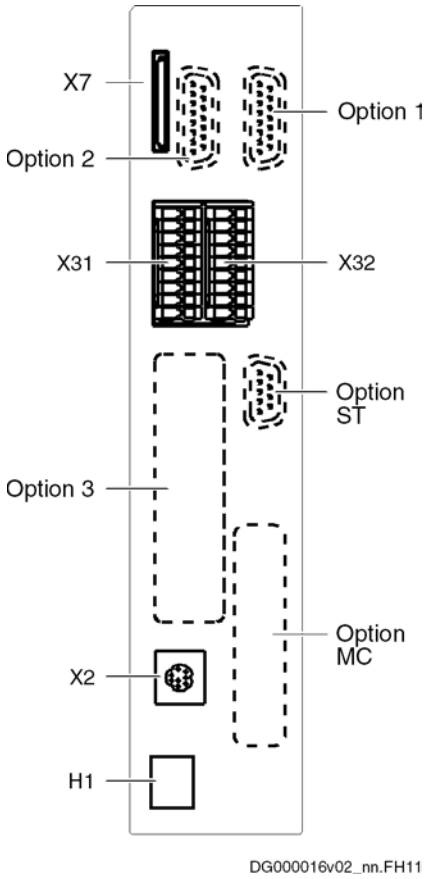


Fig.5-35: Dimensions ADVANCED

5.4.4 CSH01.1C - ADVANCED

Front View with Connections

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	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 [1]
					option MC [2]
	X2	0,25–0,5	-	-	serial interface
	H1	-	-	-	interface for control panel

1) option ST = safety technology
2) option MC = master communication

Fig.5-36: Connections ADVANCED CSH01.1C

Functions

The specified factory settings apply to firmware MPx04.

For additional notes on function and commissioning, see the following sections in the Functional Description of the firmware:

- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

External supply required!

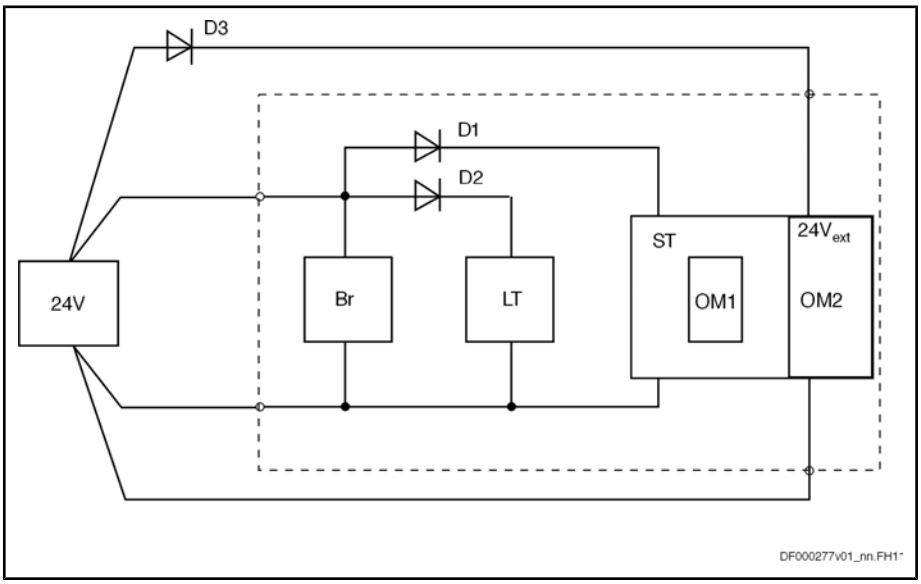
Digital I/Os require external supply voltage at X31.8 and X31.9.

Use protective diode!

Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

Configuration is possible as input or output!

Observe that the connections **X32.6, X32.7, X32.8** can be configured as digital inputs or outputs (I/O_8, I/O_9, I/O_10). At CDB01 and CSH01 control sections, additionally **X32.9** as I/O_11.



D1, D2	diodes, internal
D3	protective diode, external
LT	power section
BR	circuit for motor holding brake
ST	control section
OM1	optional modules
OM2	optional modules with supply voltage connection, e.g. MA1, MD2

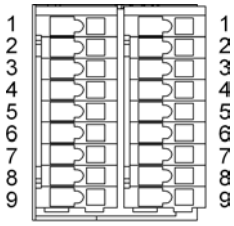
Fig.5-37: Block diagram 24V supply

Low input resistance

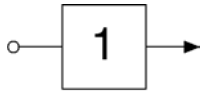
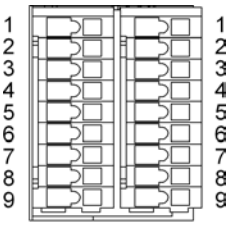
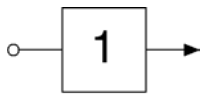
The digital inputs I_6 and I_7 are mounted in parallel to the analog input I_a_1. Observe that this reduces the input resistance of the analog input to the value of the digital inputs.

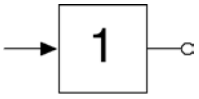
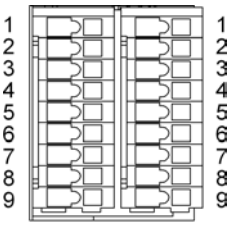
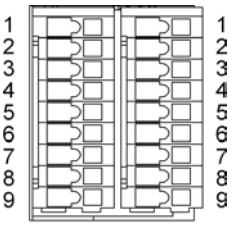
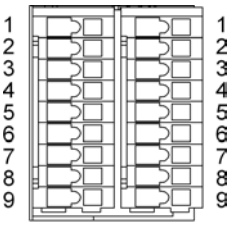
Signal sources with low impedance for a low degree of linearity error

If you need a low degree of linearity error, use signal sources with the lowest possible impedance at the analog input I_a_1. 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	Figure; technical data
power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section “Power Consumption”	
relay contact	 DA000017v01_nn.fh11	Rel 1	X31.1	ready for operation P-0-0115	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.1 Relay Contacts , page 139
		Rel 1	X31.2			

Rexroth IndraDrive Control Sections

Function			Connection	Factory setting	Nominal data	Figure; technical data
digital inputs	 DA000022v01_nn.FH9	I_1 type 2 (probe)	X31.3	probe 1 S-0-0401	can be configured as probe; 24 V 3 mA typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2 Digital Inputs/Outputs, page 140
		I_2 type 2 (probe)	X31.4	probe 2 S-0-0402		
	 DA000022v01_nn.FH9	I_3	X31.5	travel range limit switch P-0-0222	24 V 3 mA	
		I_4	X31.6	travel range limit switch P-0-0222		
		I_5	X31.7	home switch S-0-0400		
		I_6	X32.4	can also be used as analog input; see I_a_1+		
		I_7	X32.5	can also be used as analog input; see I_a_1-		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		
		I/O_11	X32.9	combined I/O configured as input I/O_11; see also P-0-0302		

Function			Con-nection	Factory setting	Nominal data	Figure; technical data
digital outputs	 DA000024v01_nn.FH11	I/O_8	X32.6	combined I/O configured as input I/O_8; see also P-0-0302	24 V 0.5 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2.3 Digital Outputs , page 143
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		
		I/O_11	X32.9	combined I/O configured as input I/O_11; see also P-0-0302		
analog inputs	voltage input	I_a_1+	X32.4	can also be used as digital input I_6	±10 V typ. 2 kohm	X31 I X32  DA000051v01_nn.FH9 data see chapter Analog Input Type 4 , page 147 example of connection see chapter 7-16Shield connection X32, page 144
		I_a_1-	X32.5	can also be used as digital input I_7		
analog outputs	voltage output	O_a_1	X32.1		5 V 1 mA	X31 I X32  DA000051v01_nn.FH9 data see chapter Analog Output Type 2 , page 148 example of connection see chapter 7-16Shield connection X32, page 144
		O_a_2	X32.2			
	reference potential for analog voltage output connection for signal shields	GND_a	X32.3			

Rexroth IndraDrive Control Sections

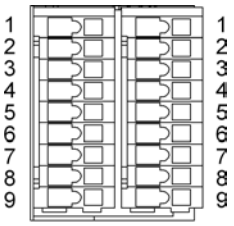
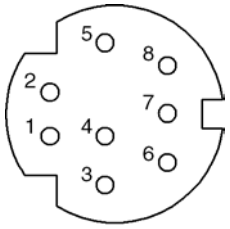
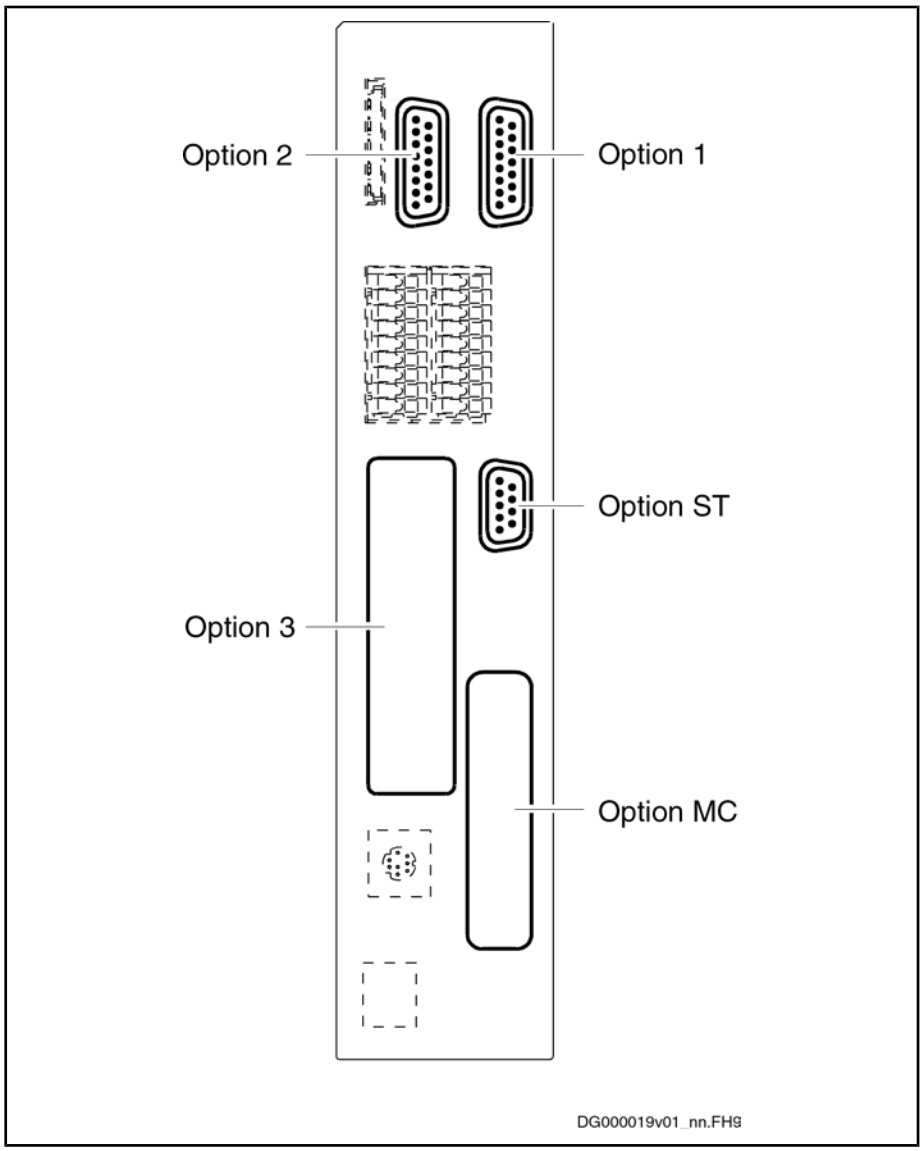
Function			Connection	Factory setting	Nominal data	Figure; technical data
power supply of digital inputs/outputs	power supply of digital inputs/outputs	+24V	X31.8			X31 I X32  DA000051v01_nn.FH9 DC 19…30 V; max. 1.1 A see note on “protective diode”
		0V	X31.9			
serial interface	RS232		X2			 DA000049v01_nn.FH data see chapter 7.4 X2, Serial Interface (RS232) , page 149
optional functions	allowed options: see configuration table					see corresponding optional module

Fig.5-38: Functions ADVANCED CSH01.1C

Optional Slots CSH01.1C



option MC Master communication
option ST safety technology
Fig.5-39: Options for ADVANCED CSH01.1C

The following configuration table shows which optional module is supported on which optional slot.

Our 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	■	-	-	-	-	-	-
PB	■	-	-	-	-	-	-

Rexroth IndraDrive Control Sections

Optional module	Optional slot						
PL	■	-	-	-	-	-	-
CO	■	-	-	-	-	-	-
ET	■	-	-	-	-	-	-
S3	■	-	-	-	-	-	-
CCD	-	-	-	■	-	-	-
ENS	-	■	■	■	-	-	-
EN1	-	■	■	■	-	-	-
EN2	-	■	■	■	-	-	-
MEM	-	■	■	■	-	-	-
MA1	-	-	■	■	-	-	-
MD1	-	-	-	■	-	-	-
MD2	-	-	-	■	-	-	-
L1	-	-	-	-	■	-	-
S1	-	-	-	-	■	-	-
S	-	-	-	-	-	-	■
PFM02	-	-	-	-	-	■	-

■ allowed optional module on optional slot
- not allowed

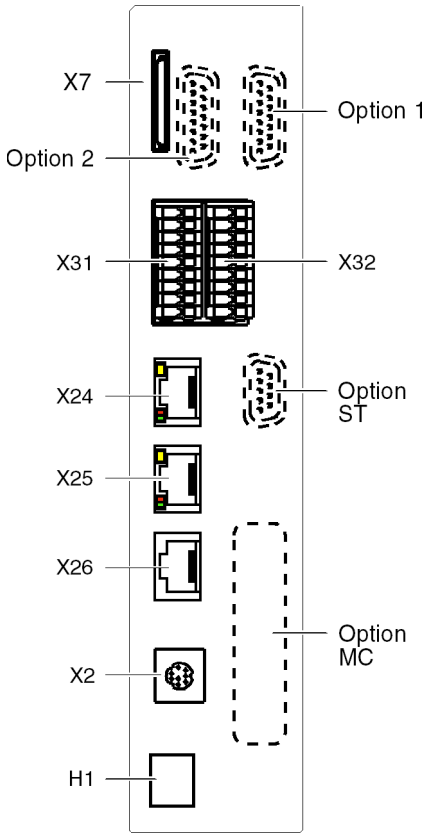
Fig.5-40: Configuration table CSH01.1C

5.4.5 CSH01.2C - ADVANCED

General Information

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
	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 - CCD
	X26	-	-	-	engineering interface
					option ST [1]
					option MC [2]
	X2	0,25–0,5	-	-	serial interface
	H1	-	-	-	interface for control panel

1) option ST = safety technology
2) option MC = master communication

Fig.5-41: Connections ADVANCED CSH01.2

Functions

The specified factory settings apply to firmware MPx04.

For additional notes on function and commissioning, see the following sections in the Functional Description of the firmware:

- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

External supply required!

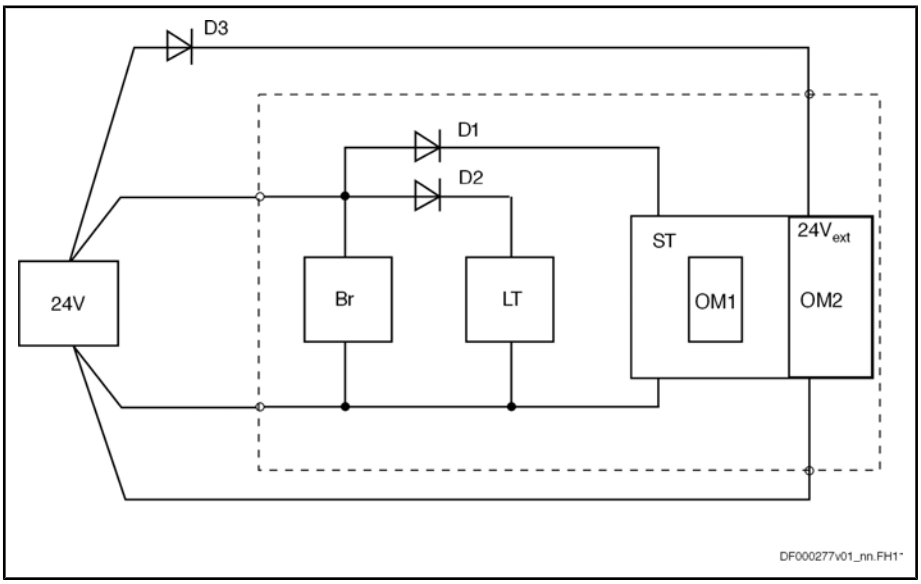
Digital I/Os require external supply voltage at X31.8 and X31.9.

Use protective diode!

Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

Configuration is possible as input or output!

Observe that the connections **X32.6, X32.7, X32.8** can be configured as digital inputs or outputs (I/O_8, I/O_9, I/O_10). At CDB01 and CSH01 control sections, additionally **X32.9** as I/O_11.



D1, D2	diodes, internal
D3	protective diode, external
LT	power section
BR	circuit for motor holding brake
ST	control section
OM1	optional modules
OM2	optional modules with supply voltage connection, e.g. MA1, MD2

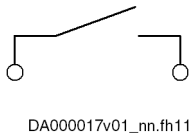
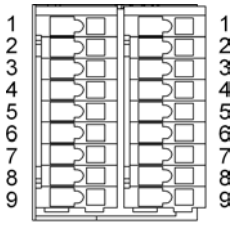
Fig.5-42: Block diagram 24V supply

Low input resistance

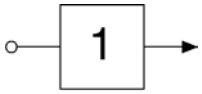
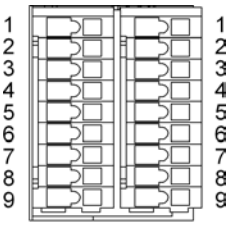
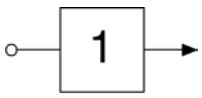
The digital inputs I_6 and I_7 are mounted in parallel to the analog input I_a_1. Observe that this reduces the input resistance of the analog input to the value of the digital inputs.

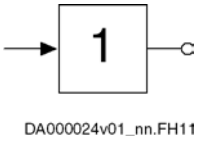
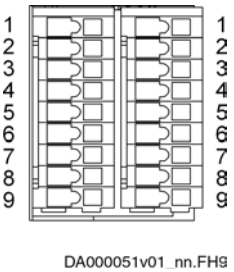
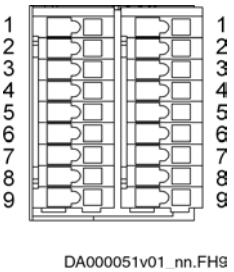
Signal sources with low impedance for a low degree of linearity error

If you need a low degree of linearity error, use signal sources with the lowest possible impedance at the analog input I_a_1. For example, you can achieve a linearity error smaller 5% with a 1 kohm potentiometer and smaller 2.5% with a 500 ohm potentiometer.

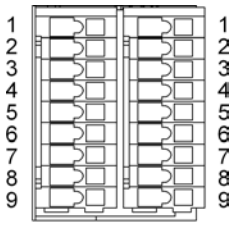
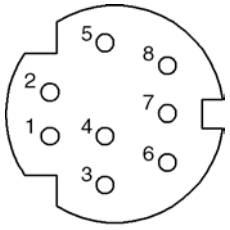
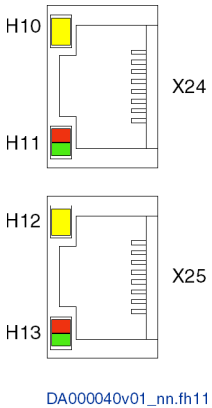
Function			Con-nection	Factory setting	Nominal data	Figure; technical data
power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section “Power Consumption”	
relay contact	 DA000017v01_nn.fh11	Rel 1	X31.1	ready for operation P-0-0115	DC24 V 1 A	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.1 Relay Contacts , page 139
		Rel 1	X31.2			

Rexroth IndraDrive Control Sections

Function			Connection	Factory setting	Nominal data	Figure; technical data
digital inputs	 DA000022v01_nn.FH9	I_1 type 2 (probe)	X31.3	probe 1 S-0-0401	can be configured as probe 24 V 3 mA typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 data see chapter 7.2 Digital Inputs/Outputs, page 140
		I_2 type 2 (probe)	X31.4	probe 2 S-0-0402		
	 DA000022v01_nn.FH9	I_3	X31.5	travel range limit switch P-0-0222	24 V 3 mA	
		I_4	X31.6	travel range limit switch P-0-0222		
		I_5	X31.7	home switch S-0-0400		
		I_6	X32.4	can also be used as analog input; see I_a_1+		
		I_7	X32.5	can also be used as analog input; see I_a_1-		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		
		I/O_11	X32.9	combined I/O configured as input I/O_11; see also P-0-0302		

Function			Connection	Factory setting	Nominal data	Figure; technical data
digital outputs		I/O_8	X32.6	combined I/O configured as input I/O_8; see also P-0-0302	24 V 0.5 A	X31 I X32  data see chapter 7.2.3 Digital Outputs , page 143
		I/O_9	X32.7	combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	combined I/O configured as input I/O_10; see also P-0-0302		
		I/O_11	X32.9	combined I/O configured as input I/O_11; see also P-0-0302		
analog inputs	voltage input	I_a_1+	X32.4	can also be used as digital input I_6	±10 V typ. 160 kohm	X31 I X32  data see chapter Analog Input Type 4 , page 147 example of connection see chapter 7-16Shield connection X32, page 144
		I_a_1-	X32.5	can also be used as digital input I_7		

Rexroth IndraDrive Control Sections

Function			Connection	Factory setting	Nominal data	Figure; technical data
analog outputs	voltage output	O_a_1	X32.1		5 V 1 mA	X31 I X32  DA000051v01_nn.FH9 data see chapter Analog Output Type 2 , page 148 example of connection see chapter 7-16Shield connection X32, page 144
		O_a_2	X32.2			
	reference potential for analog voltage output connection for signal shields	GND_a	X32.3			
power supply of digital inputs/outputs	power supply of digital inputs/outputs	+24V	X31.8			DC 19…30 V; max. 1.1 A see note on “protective diode”
		0V	X31.9			
serial interface	RS232		X2			 DA000049v01_nn.FH data see chapter 7.4 X2, Serial Interface (RS232) , page 149
CCD			X24			 DA000040v01_nn.fh11
CCD			X25			

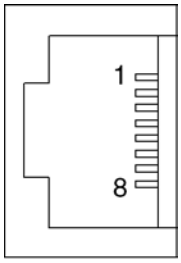
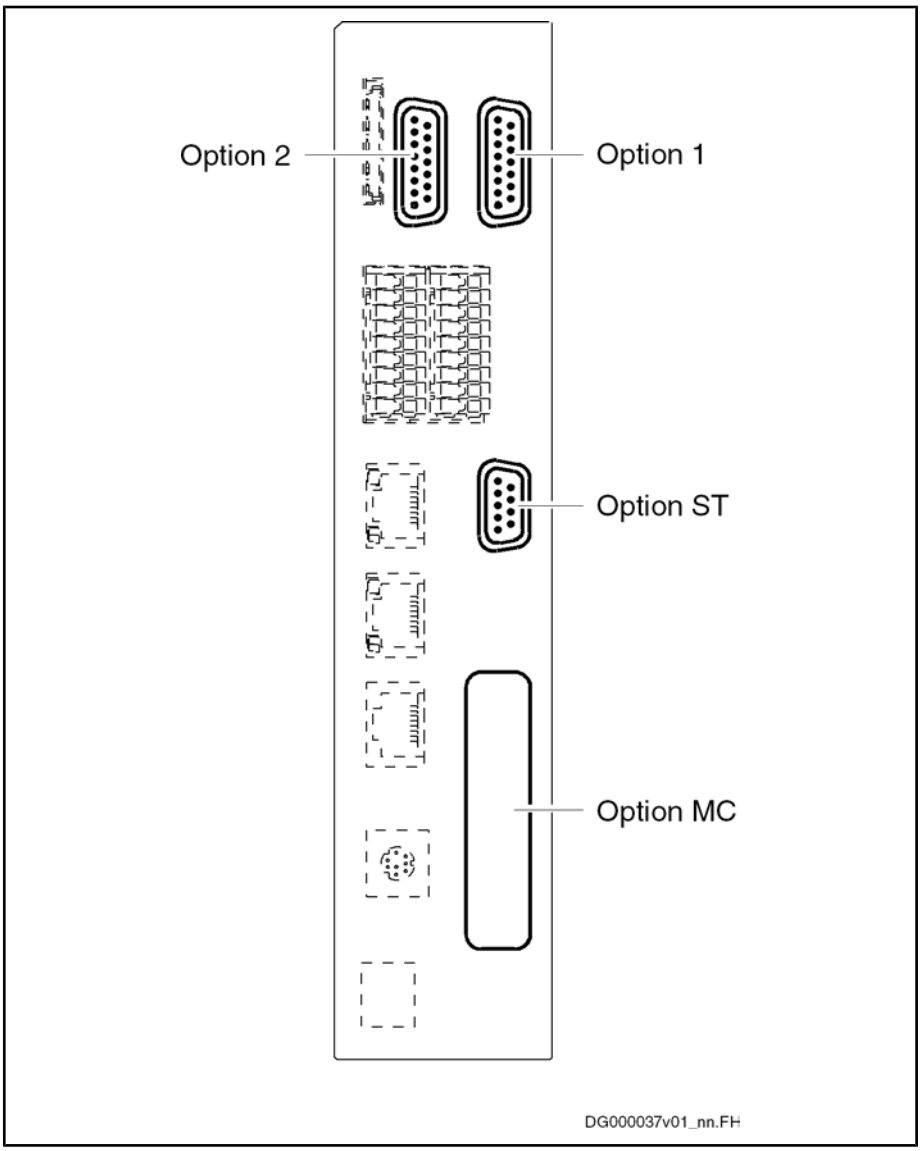
Function			Connection	Factory setting	Nominal data	Figure; technical data
engineering interface	Ethernet-based interface		X26			 DA000041v01_nn.FH9 data see chapter 7.5 X26, Engineering Interface , page 151
optional functions	allowed options: see configuration table					see corresponding optional module

Fig.5-43: Functions ADVANCED CSH01.2

Rexroth IndraDrive Control Sections

Optional Slots CSH01.2C



option MC master communication
option ST safety technology
Fig.5-44: Options for ADVANCED CSH01.2C

☞ The following configuration table shows which optional module is supported on which optional slot.

Our 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 (on board)	option ST (X41)	memory card slot (X7)	control panel (H1)
SE	■	-	-	-	-	-	-
PB	■	-	-	-	-	-	-

Optional module	Optional slot						
PL	■	-	-	-	-	-	-
CO	■	-	-	-	-	-	-
ET	■	-	-	-	-	-	-
S3	■	-	-	-	-	-	-
CCD	-	-	-	■	-	-	-
ENS	-	■	■	-	-	-	-
EN1	-	■	■	-	-	-	-
EN2	-	■	■	-	-	-	-
MEM	-	■	■	-	-	-	-
MA1	-	-	■	-	-	-	-
MD1	-	-	-	-	-	-	-
MD2	-	-	-	-	-	-	-
L1	-	-	-	-	■	-	-
S1	-	-	-	-	■	-	-
S	-	-	-	-	-	-	■
PFM02	-	-	-	-	-	■	-

■ allowed optional module on optional slot
- not allowed

Fig.5-45: Configuration table CSH01.2C

6 Optional Modules for Control Sections

6.1 Overview

Optional module	Function	Name of optional module Connection point	Notes
master communications	master communication via SERCOS interface	SE (HCC02) X20; X21	master communication based on fiber optic cables
	master communication via PROFIBUS	PB (HCC03) X30	field bus PROFIBUS
	master communication via DeviceNet	CO (HCC06) X60	field bus DeviceNet; connection via screw terminal
	master communication via DeviceNet	CD X61	field bus DeviceNet; connection via D-SUB interface (in preparation)
	master communication via parallel interface	PL (HCC01) X15	parallel interface
	master communication via CANopen	CO (HCC06) X60	field bus CANopen; connection via screw terminal
	master communication via CANopen	CD X61	field bus CANopen; connection via D-SUB interface (in preparation)
	master communication via PROFINET IO	ET (HCC08)	field bus PROFINET
	master communication via SERCOS III	S3 (HCC07) X22, X23	master communication based on Ethernet
communication	cross communication via SERCOS III	CCD (HMC01) X24, X25	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

Optional Modules for Control Sections

Optional module	Function	Name of optional module Connection point	Notes
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) X17, X16	16 digital inputs in 2 groups 16 digital outputs in 4 groups SSI encoder evaluation
safety technology	I/O for safety technology	S1 (HSI11) X41	
	starting lockout	L1 (HSI01) X41	
control panels	standard control panel	S	single-line display
	comfort control panel	C	multiline display
memory	exchangeable medium for parameters and firmware	PFM02.1 X7	MultiMediaCard (MMC)

Fig.6-1: Available optional modules

6.2 Master Communication

6.2.1 SE - SERCOS

CAUTION

Risk of damage!

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

Description

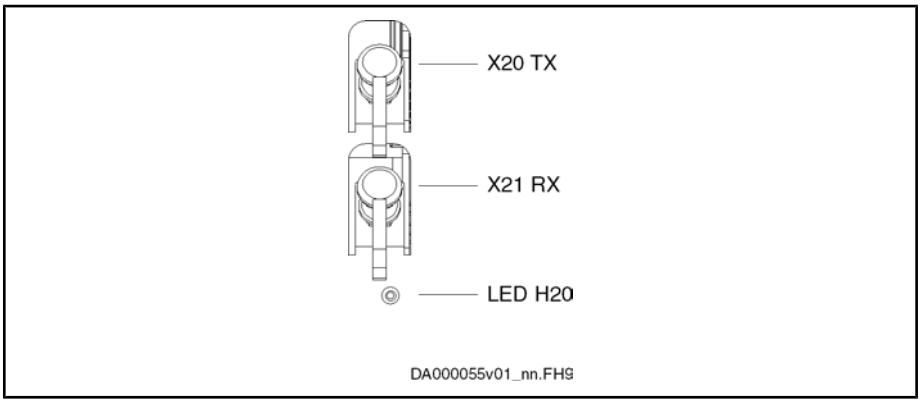


Fig.6-2: SERCOS interface

LED H20

Distortion LED of SERCOS interface

Pin Assignment

X20	TX
X21	RX

Fig.6-3: Pin assignment

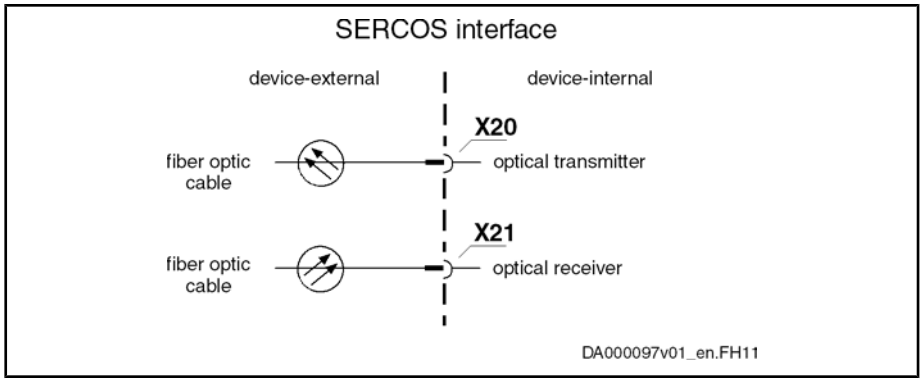


Fig.6-4: Pin assignment

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

The fiber optic cables (cables, connectors or ready-made cables) have to be ordered separately.

For more detailed information on the subject of “fiber optic cables”, see application manual “Rexroth Connection System, fiber optic cables” (DOK-CONNEC-CABLE*LWL**-AWxx-EN-P, part. no. R911284755). This application description contains the following points:

- Fiber optic cable - general information
- Basic planning information for optical transmission systems
- Routing guidelines for fiber optic cables
- Attenuation measurements of the standard plastic fiber optic cables
- FSMA selection list for plug-in connectors and fiber optic cables
- Assembly guidelines for FSMA connectors
- Tools for assembly of fiber optic cables

6.2.2 PB - PROFIBUS

Description

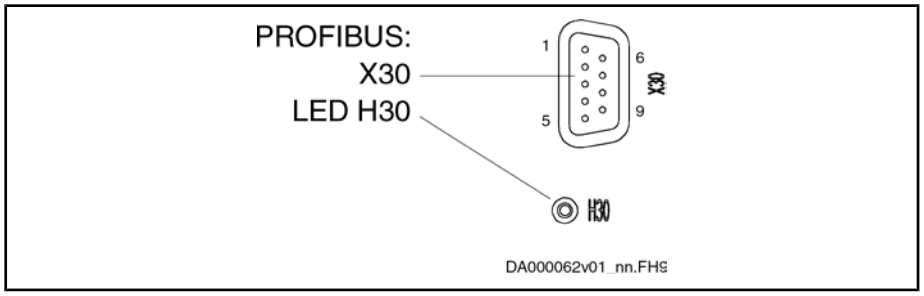


Fig.6-5: PROFIBUS interface

Optional Modules for Control Sections

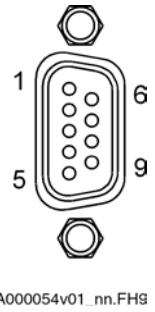
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
X30	D-Sub	9	female (device)	0,08–0,5	

Fig.6-6: Connections

Pin 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.6-7: Signal assignment

Shield Connection
Via D-sub 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.6-8: Signal specification

CAUTION

Danger of destroying output “+5V repeater supply” by overload!

Do not short-circuit the output.

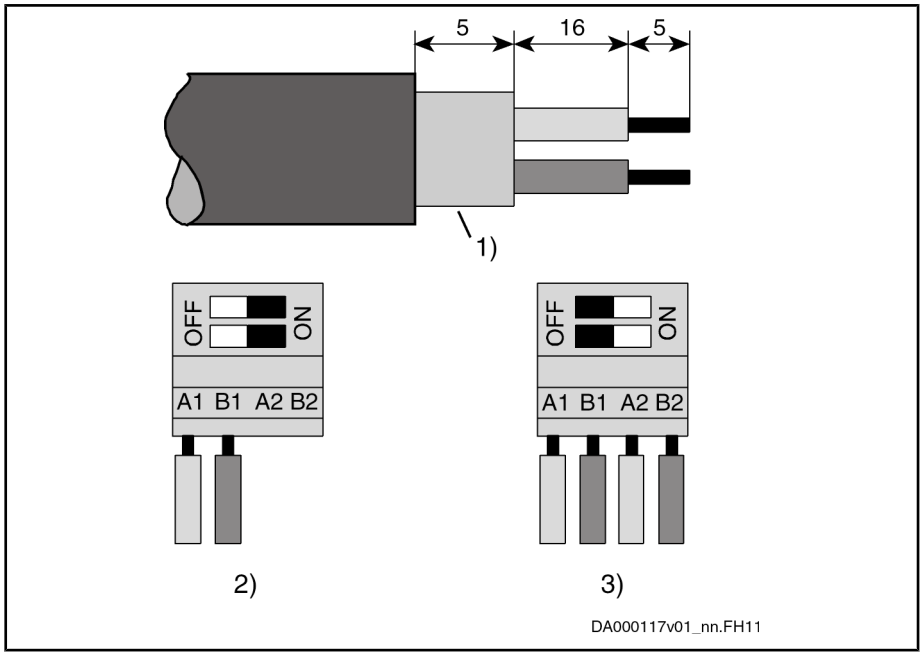
Do not exceed the maximum current.

Diagnostic Displays

For the significance of the diagnostic displays, see Functional Description of the respective firmware.

Bus Connectors

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



1) shield
2) bus connection and switch position for first node and last node
3) bus connection and switch position for all other nodes

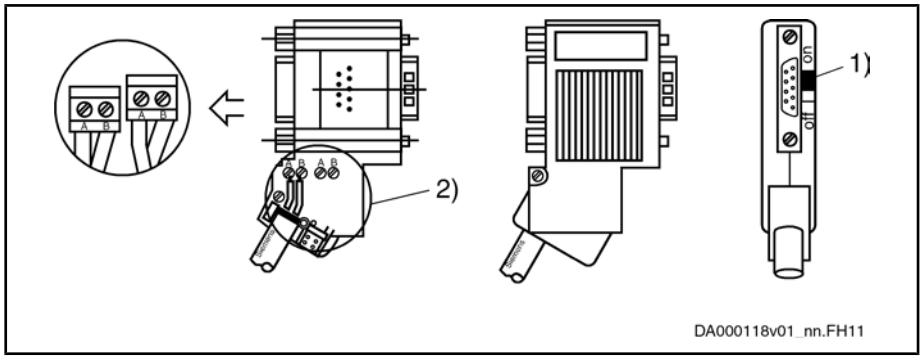
Fig.6-9: Preparing a cable for connecting a bus connector

To assemble the bus cable, proceed as follows:

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

☞ Do not interchange the cores for A and B.

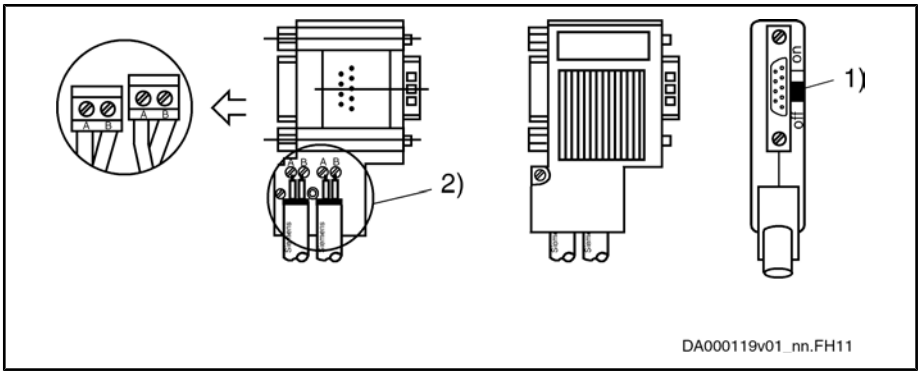
- press cable sheath between both clamps
- screw on both cores in screw terminals



1) switch position for first slave and last slave in PROFIBUS-DP
2) cable shield must have direct contact to metal

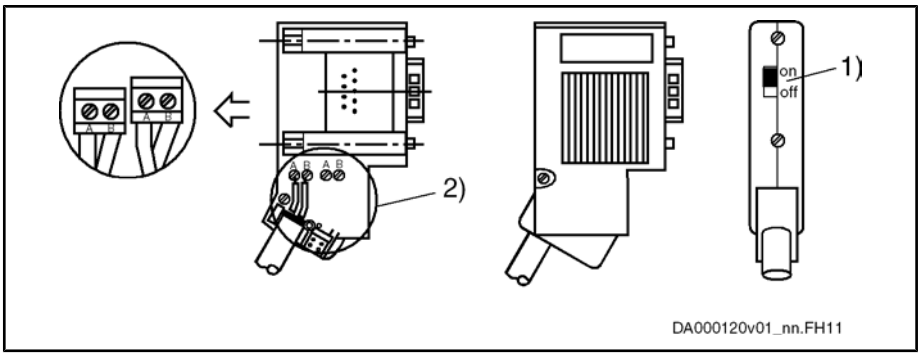
Fig.6-10: Bus connection for first slave and last slave, bus connector with 9-pin D-Sub female connector, INS0541

Optional Modules for Control Sections



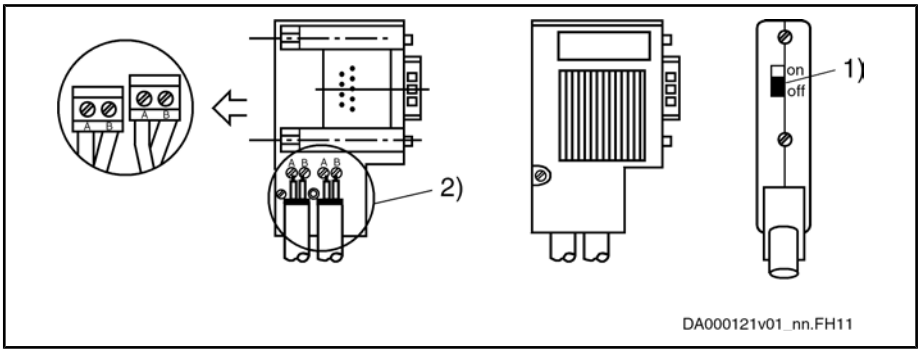
1) terminating resistor is off
2) cable shield must have direct contact to metal

Fig.6-11: Bus connection for all other slaves, bus connector with 9-pin D-Sub female connector, INS0541



1) switch position for first slave and last slave in PROFIBUS-DP
2) cable shield must have direct contact to metal

Fig.6-12: Bus connection for first slave and last slave, without 9-pin D-Sub female connector, INS0540



1) terminating resistor is off
2) cable shield must have direct contact to metal

Fig.6-13: Bus connection for all other slaves, without 9-pin D-Sub female connector, INS0540

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

6.2.3 PL - Parallel Interface

X15, Parallel Interface - PL

Description

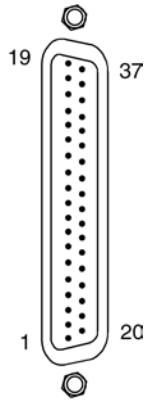
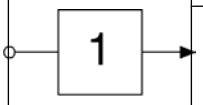
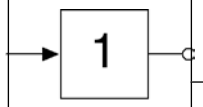
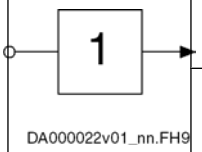
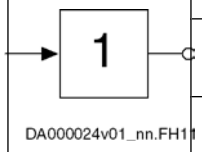
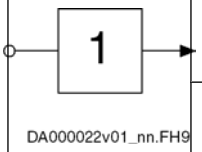
Connection point	Type	No. of poles	Type of design	Solid wire [mm²]	Stranded wire [mm²]	Figure
X15	D-Sub	37	pins on device	-	0,08–0,5	

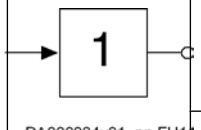
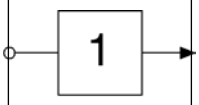
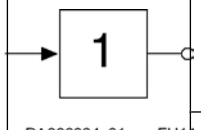
Fig.6-14: Connections

Pin Assignment

Function		Connection	Factory setting	Technical data
 digital input group 0	I_0.0	1	P-0-4026, Positioning block selection; bit 0	see chapter Digital Inputs Type 1 (Standard) , page 140
	I_0.1	20	P-0-4026, Positioning block selection; bit 1	
	I_0.2	2	P-0-4026, Positioning block selection; bit 2	
	I_0.3	21	P-0-4026, Positioning block selection; bit 3	
 digital output group 0	O_0.0	28	P-0-0115, bit 1; ready signal	see chapter Digital Outputs , page 143
	O_0.1	10	S-0-0059, Position switch flag parameter; bit 0	
	O_0.2	29	S-0-0403, Position feedback value status; bit 0	
	O_0.3	11	S-0-0331, Status 'n_feedback = 0'	

Optional Modules for Control Sections

Function		Con-nec-tion	Factory setting	Technical data
power supply for input/output group 0	+24V	30		DC 19 … 30 V max. 1.2 A
 DA000022v01_nn.FH9 digital input group 1	I_1.0	3	P-0-4026, Positioning block selection; bit 4	see chapter Digital Inputs Type 1 (Standard) , page 140
	I_1.1	22	P-0-4026, Positioning block selection; bit 5	
	I_1.2	4	P-0-4060, Positioning block control word; bit 0	
	I_1.3	23	S-0-0148, C0600 Drive-controlled homing procedure command; bit 0	
 DA000024v01_nn.FH1 digital output group 1	O_1.0	12	P-0-4061; bit 4, end position reached	see chapter Digital Outputs 143
	O_1.1	31	P-0-0115; bit 2, warning	
	O_1.2	13	S-0-0437; bit 12, jog mode active	
	O_1.3	32	S-0-0437; bit 3, interpolator halted	
power supply for input/output group 1	+24V	14		DC 19 … 30 V max. 1.2 A
 DA000022v01_nn.FH9 digital input group 2	I_2.0	5	S-0-0346, Positioning control word; bit 1	see chapter Digital Inputs Type 1 (Standard) , page 140
	I_2.1	24	S-0-0346, Positioning control word; bit 2	
	I_2.2	6	P-0-4028, Device control word; Drive ON; bit 15	
	I_2.3	25	P-0-4028, Device control word; Drive HALT; bit 13	

Function		Con-nec-tion	Factory setting	Technical data
 DA000024v01_nn.FH11 digital output group 2	O_2.0	33	P-0-4051, Positioning block acknowledgment; bit 0	see chapter Digital Outputs , page 143
	O_2.1	15	P-0-4051, Positioning block acknowledgment; bit 1	
	O_2.2	34	P-0-4051, Positioning block acknowledgment; bit 2	
	O_2.3	16	P-0-4051, Positioning block acknowledgment; bit 3	
power supply for input/output group 2	+24V	35		DC 19 … 30 V max. 1.2 A
 DA000022v01_nn.FH9 digital input group 3	I_3.0	7	S-0-0099, C0500 Reset class 1 diagnostics	see chapter Digital Inputs Type 1 (Standard) , page 140
	I_3.1	26		
	I_3.2	8		
	I_3.3	27		
 DA000024v01_nn.FH11 digital output group 3	O_3.0	17	P-0-4051, Positioning block acknowledgment; bit 4	see chapter Digital Outputs , page 143
	O_3.1	36	P-0-4051, Positioning block acknowledgment; bit 5	
	O_3.2	18	P-0-4051, Positioning block acknowledgment; bit 6	
	O_3.3	37	P-0-4051, Positioning block acknowledgment; bit 7	
power supply for input/output group 3	+24V	19		DC 19 … 30 V max. 1.2 A

Optional Modules for Control Sections

Function		Connection	Factory setting	Technical data
reference potential for inputs/outputs and power supply	0V	9		max. 5 A
cable shield connection	shld	connector housing		

Fig.6-15: Signal assignment

The inputs/outputs are galvanically isolated from the control section and require power which is supplied via the connections +24V and 0V.

6.2.4 CO - DeviceNet / CANopen

X60, DeviceNet / CANopen Interface - CO

Description

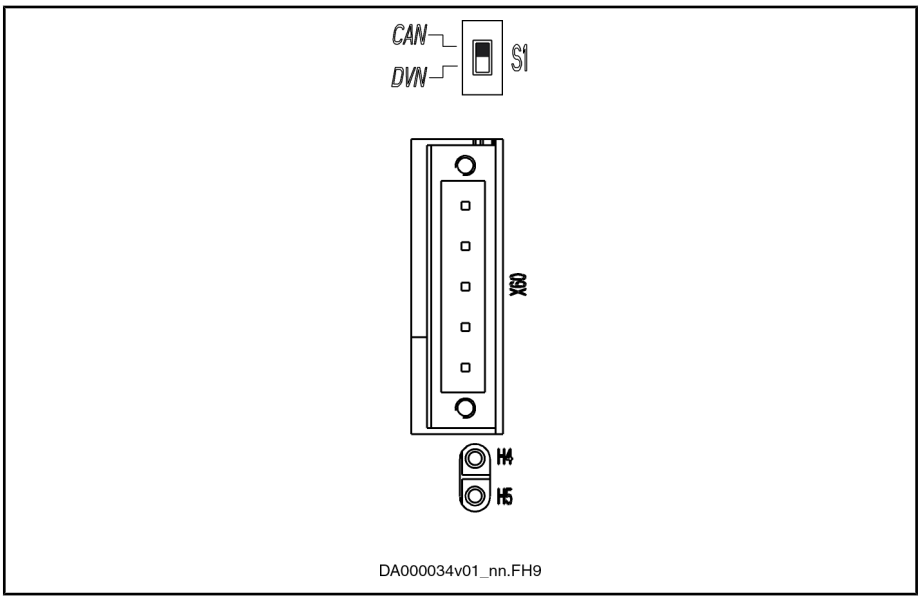


Fig.6-16: Description

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

Activate the desired master communication with switch S1:

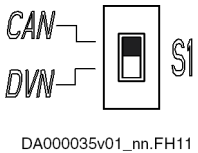
Switch position	Effect	Switch S1
up (as shown)	CANopen active	
down	DeviceNet active	

Fig.6-17: Switch

Properties of the Connector

Connection 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	 DA000036v01_nn.FH11

Fig.6-18: Connections

CAUTION

Risk of damage!

Maximum allowed tightening torque of locking screws: **0.5 Nm**.

Display Elements

Significance for CANopen

LED	Significance	Color	Description
H4	Run	green	signals operating states; for details see Functional Description
H5	Error	red	signals error states; for details see Functional Description

Fig.6-19: Significance of display elements for CANopen

Significance for 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.6-20: Significance of display elements for DeviceNet

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.6-21: Signal assignment optional module CO

Optional Modules for Control Sections

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 each, 1%, 200 mW; connect at both bus ends to X60.2 and X60.4	
transmission medium	2 twisted two-wire lines (4-pin) with shield	
max. allowed bus (line) lengths	depending on bit rate	
recommended connection cable	our RKS number or third-party type	

Fig.6-22: Main features

Allowed Network Dimension (Bus Lengths)

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

Fig.6-23: Network dimension

6.2.5 CD - DeviceNet / CANopen (Preliminary)

X61, DeviceNet / CANopen Interface - CD

Description

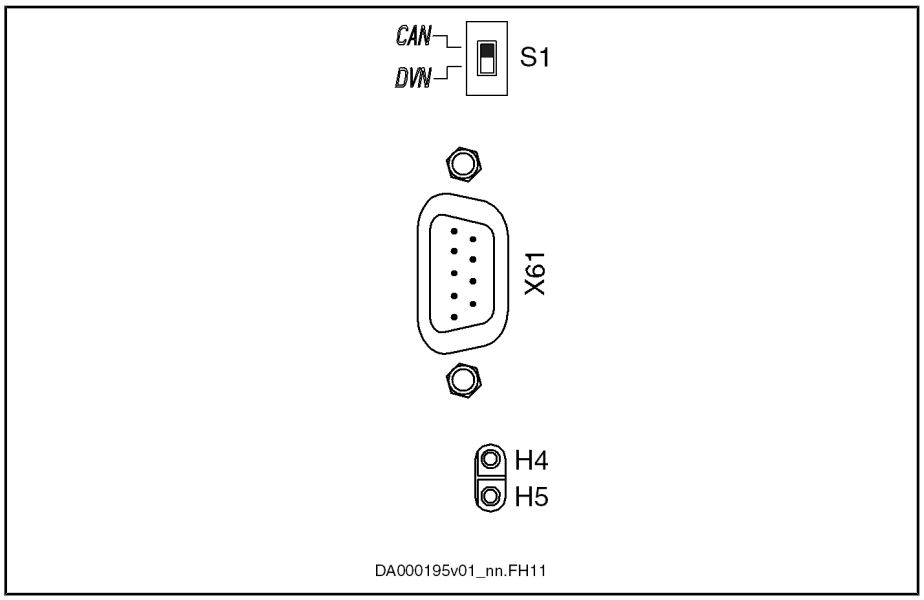


Fig.6-24: Description

The master communications DeviceNet and CANopen are realized with the same optional module “CD”. In comparison to the optional module “CO” with terminal block, the optional module “CD” has a D-SUB connector for field bus connection.

Activate the desired master communication with switch S1:

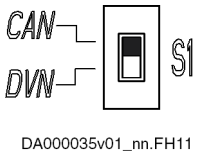
Switch position	Effect	Switch S1
up	CANopen active	
down	DeviceNet active	

Fig.6-25: Switch

Properties of the Connector

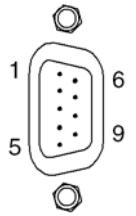
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
X61	D-Sub	9	pins on device	0,25–0,5	

Fig.6-26: Connection

Optional Modules for Control Sections

Display Elements

Significance for CANopen

LED	Significance	Color	Description
H4	Run	green	signals operating states; for details see Functional Description
H5	Error	red	signals error states; for details see Functional Description

Fig.6-27: Significance of display elements for CANopen

Significance for 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.6-28: Significance of display elements for DeviceNet

Assignment X61

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
6	n. c.	-
7	n. c.	-
8	n. c.	-
9	n. c.	-

Fig.6-29: Signal assignment optional module CD

Main Features

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

Fig.6-30: 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

Fig.6-31: Network dimension

6.2.6 S3 - SERCOS III

Description

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

Optional Modules for Control Sections

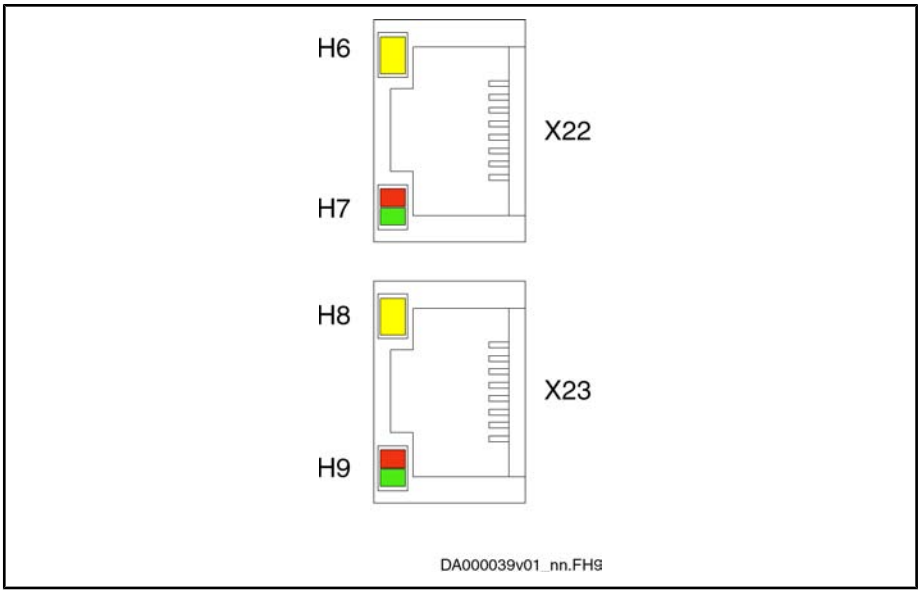


Fig.6-32: SERCOS III connection points

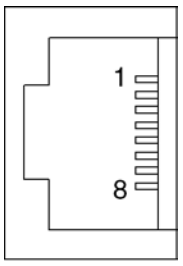
Connection points	Type	No. of poles	Figure
X22, X23	RJ45	8	

Fig.6-33: 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.6-34: 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	Description
H6, H8	Status	yellow	data transmission running
H7, H9	Link	green	connection to network available
H7, H9	-	orange	-

Fig.6-35: Significance of display elements

6.2.7 CCD - Cross Communication

Description

The interface corresponds to standard IEE 802.3.

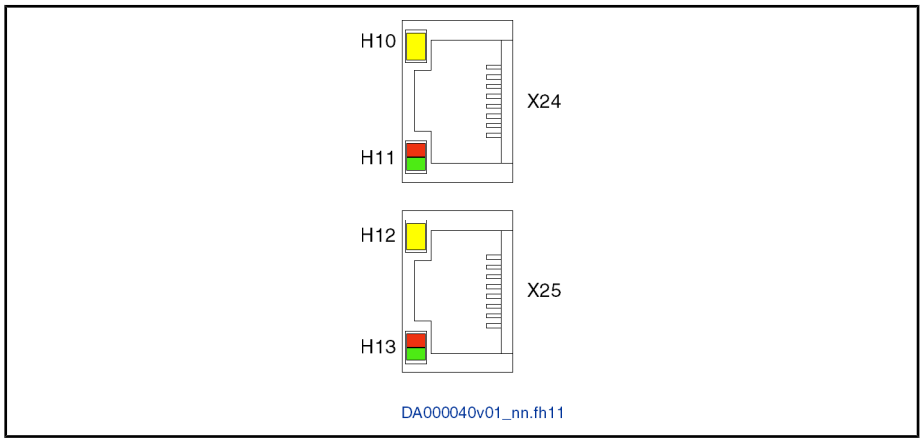


Fig.6-36: SERCOS III connection points CCD

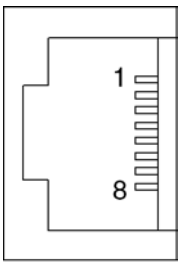
Connection points	Type	No. of poles	Figure
X24, X25	RJ45	8	

Fig.6-37: 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.6-38: 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	Description
H10, H12	Status	yellow	data transmission running
H11, H13	Link	green	connection to network available
H11, H13	-	orange	-

Fig.6-39: Significance of display elements

6.3 Encoder Evaluation

6.3.1 ENS - Standard Encoder Evaluation

Interface 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
- 5V-TTL square-wave encoder with reference

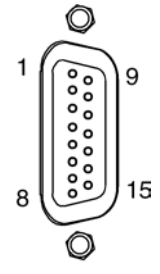
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
X8	D-Sub	15	female (device)	0,25–0,5	

Fig.6-40: Connection

Pin Assignment

Connection	Signal	Function
1	GND_shld	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.	
13	EncCLK+	clock positive
14	EncCLK-	clock negative
15	n. c.	

Fig.6-41: 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			500

Fig.6-42: Encoder supply ENS

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

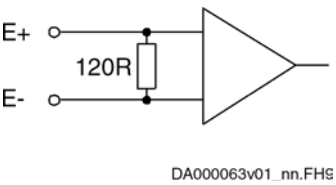


Fig.6-43: Input circuit for sine signals (block diagram)

Properties of Differential Input

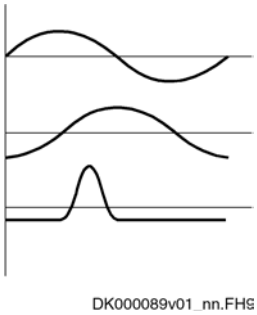
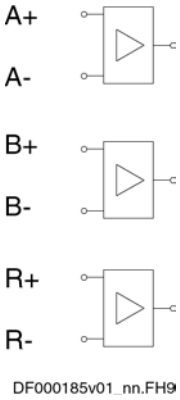
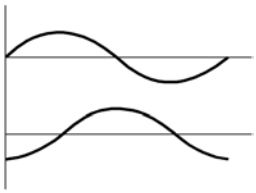
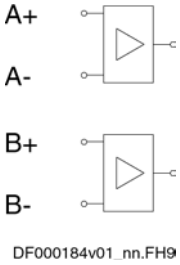
Data	Unit	Min.	Typ.	Max.
amplitude encoder signal ($U_{SSencodersignal}$)	V	0,8	1,0	1,0 + 0,2
input resistance	ohm		120	
converter width A/D converter	bit		12	
limit frequency (-3 dB)	kHz		500	
input frequency for 5V-TTL signals (square-wave)	kHz			400
amplitude 5V-TTL signals	V			5,25

Fig.6-44: Differential input

Optional Modules for Control Sections

The allowed input frequency for 5 V-TTL signals is lower than the limit frequency, because the differential input is overridden with applied 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.FHS	 A+ A- B+ B- R+ R- DF000185v01_nn.FH9	sine (1 V_{pp}) without absolute value	increasing
 DK000088v01_nn.FHS	 A+ A- B+ B- DF000184v01_nn.FH9	sine (1 V_{pp}) with absolute value	increasing

1) see following note

Fig.6-45: Signal assignment to the actual position value

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

- Track A (A+, A-, “cos”) advances track B (B+, B-, “sin”) 90° electrically.
- The actual position value increases in this case (unless negation takes effect).
- If available, the reference track R (R+, R-) provides the reference mark pulse at positive signals of track A and track B (in the so-called “0-th” quadrant).

Standard setting: see Functional Description of firmware

Connection Diagrams ENS

ENS with Encoder System S1 / M1

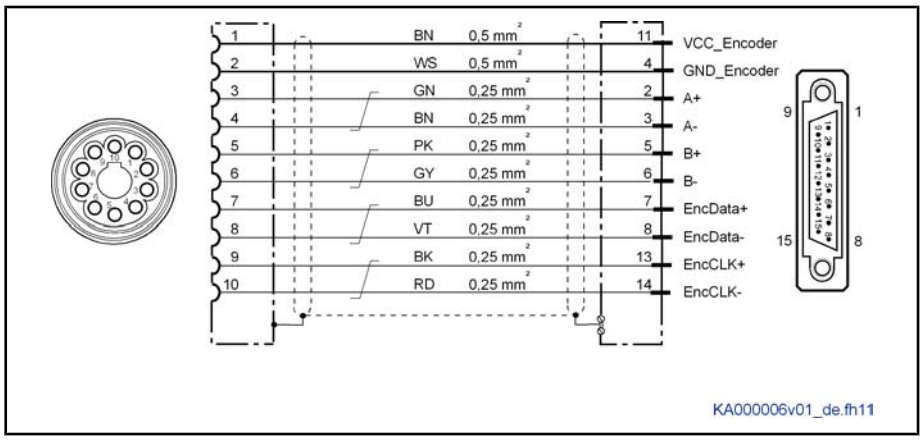


Fig.6-46: Connection diagram encoder system S1 / M1

For **direct** connection to the encoder system use our cable **RKG4200**.

ENS with Encoder System S2 / M2

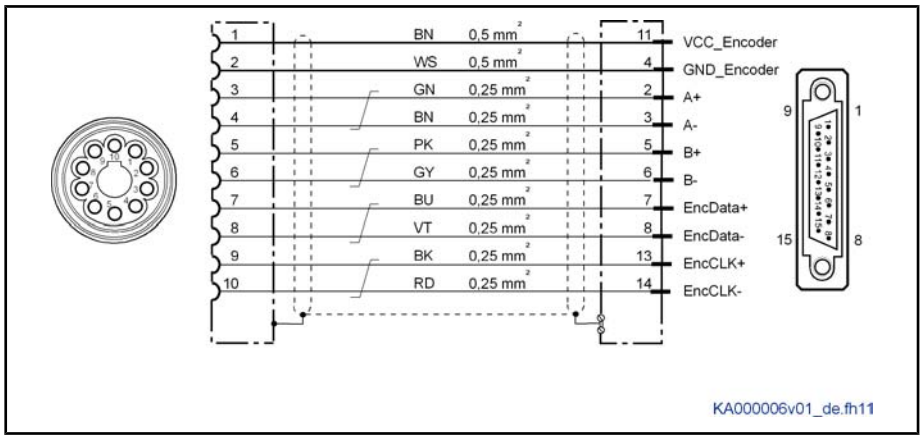


Fig.6-47: Connection diagram encoder system S2 / M2

For **direct** connection to the encoder system use our cable **RKG4200**.

Connection Diagrams ENS with Third-Party Encoder

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”.

Optional Modules for Control Sections

ENS with Third-Party Encoder HIPERFACE®

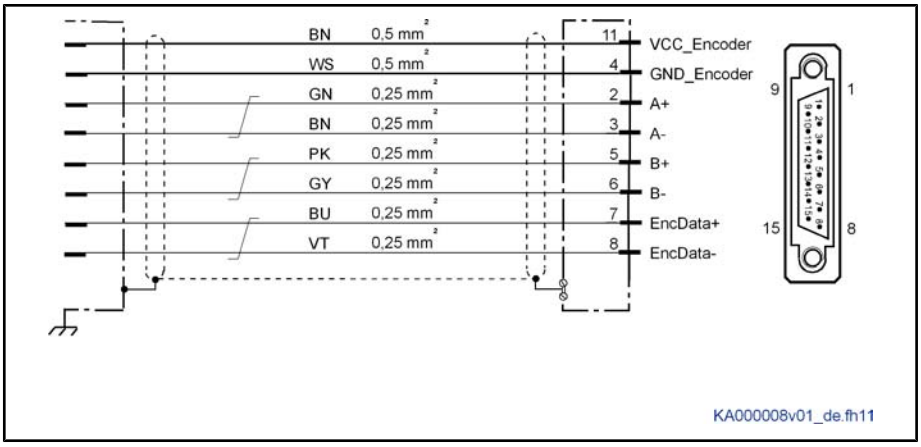


Fig.6-48: Connection diagram third-party encoder HIPERFACE®

ENS with Third-Party Encoder EnDat 2.1

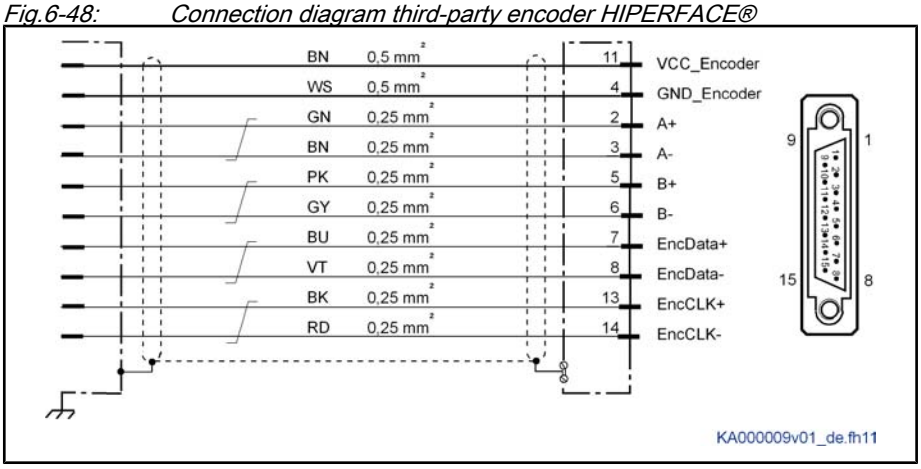


Fig.6-49: Connection diagram third-party encoder EnDat 2.1

ENS with Third-Party Encoder 1Vpp

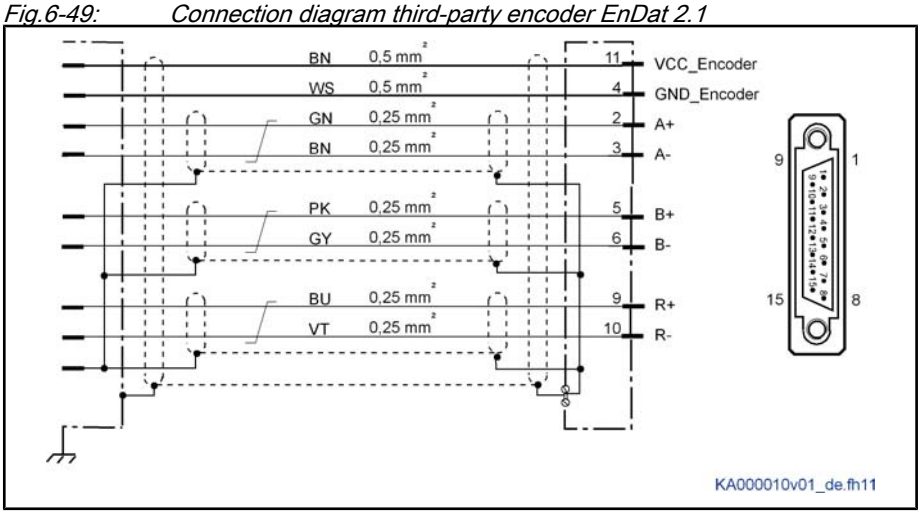


Fig.6-50: Connection diagram third-party encoder 1Vpp

ENS with Third-Party Encoder 5V-TTL

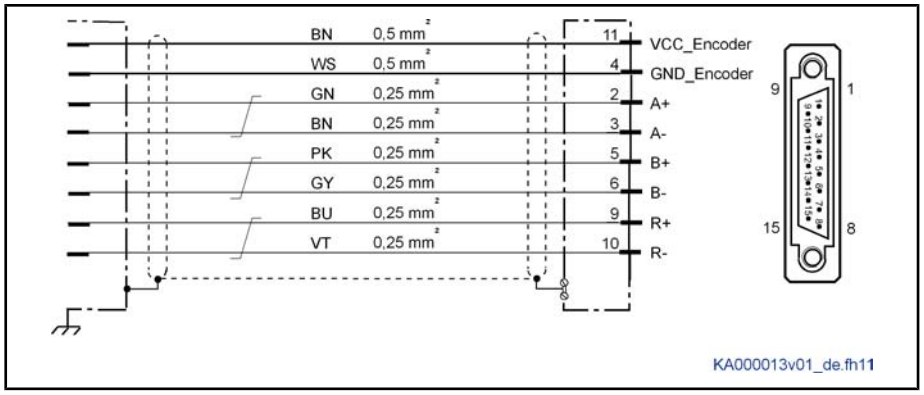
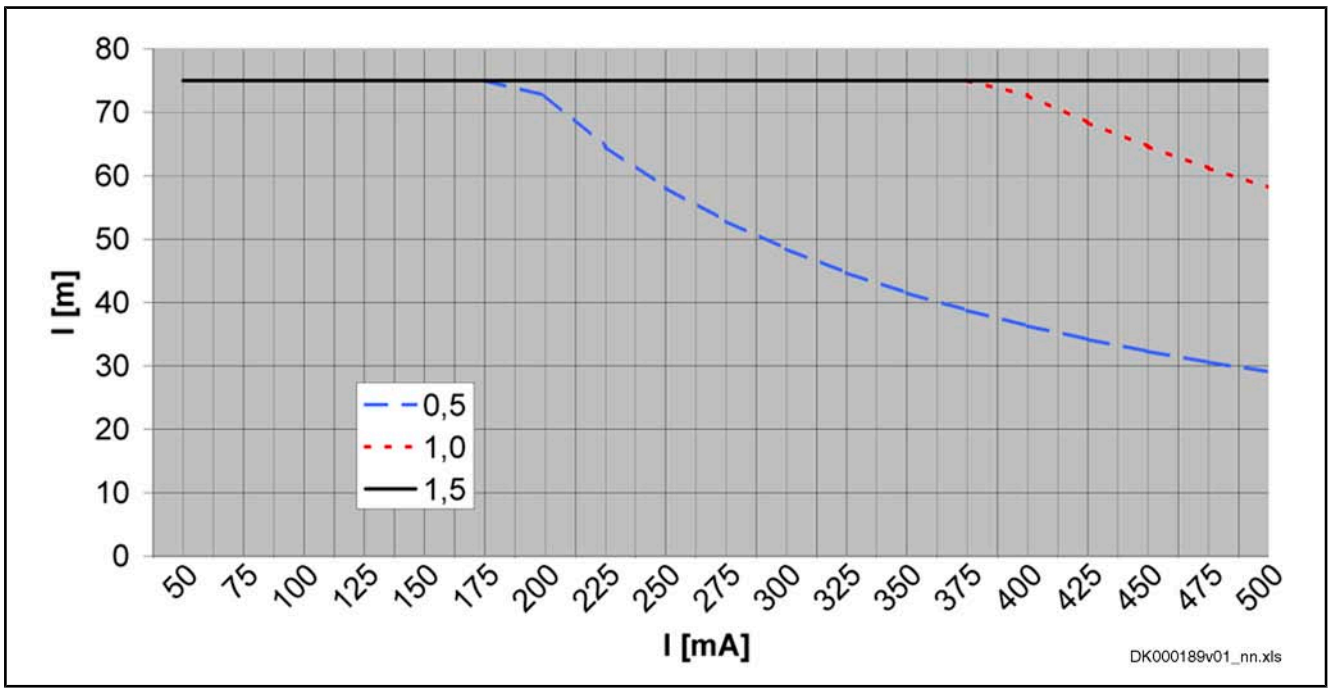


Fig.6-51: Connection diagram third-party encoder 5V-TTL

Allowed Encoder Cable Lengths at ENS

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



I [mA]	current consumption
l [m]	cable length
0,5; 1,0; 1,5	cable cross sections in mm2

Fig.6-52: Allowed encoder cable length

Example For an encoder cable with a length of 75 m and a cross section of 0.5 mm^2, encoder systems with a current consumption of a maximum of 175 mA are allowed. If current consumption is higher, this requires an encoder cable with a cross section greater than 0.5 mm^2.

6.3.2 EN1 - Resolver and HSF Encoder Evaluation

Interface Resolver and HSF Encoder Evaluation EN1

Description For encoder systems with a control voltage supply of DC8 volt or AC18.2 volt peak-peak:

Optional Modules for Control Sections

- digital servo feedback from Rexroth (encoder interface HSF for MHD motors)
- resolver (encoder interface for MKD motors)
- resolver without data memory
- Hall sensor box SHL01.1 (for position detection of the primary part of IndraDyn L and LSF motors)

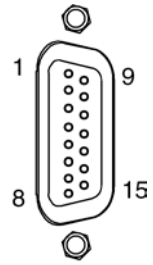
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
-	D-Sub	15	female (device)	0,25–0,5	

Fig.6-53: Connection

Pin Assignment

Connection	Signal	Function
1	GND_shld	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 from encoder

Fig.6-54: Pin assignment

Properties EN1

Encoder Supply Resolver

Data	Unit	Min.	Typ.	Max.
AC output voltage VVC_Encoder (peak-peak value)	V		18,2 [1)]	
output frequency sine	kHz		4	

Data	Unit	Min.	Typ.	Max.
output current	mA			70
d.c. resistance of load	ohm	35		

1) DC8V are applied in the switch-on phase.

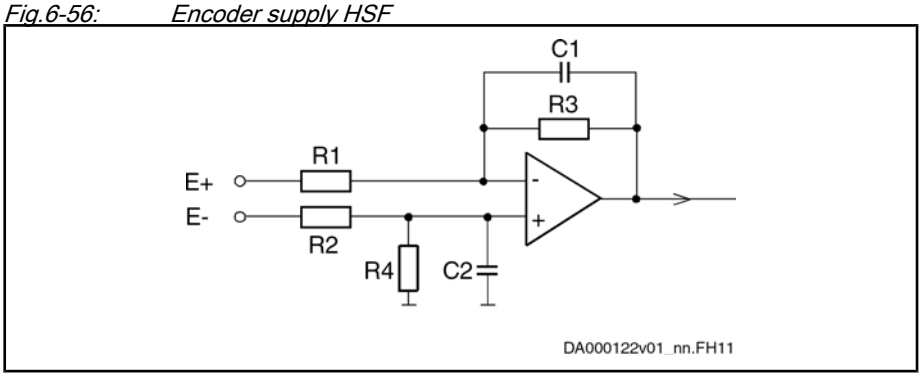
Fig.6-55: Encoder supply resolver

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.6-56: Encoder supply HSF

Input Circuit A+, A- or B+, B-



R1 5k
R2 5k
R3 20k (HSF) or 2k5 (resolver)
R4 20k (HSF) or 2k5 (resolver)
C1 not specified
C2 not specified

Fig.6-57: Input circuit (block diagram)

Differential Input for HSF Operation

Data	Unit	Min.	Typ.	Max.
amplitude encoder signal sine	V	0,8	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.6-58: Input data HSF

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.6-59: Input data resolver operation

Optional Modules for Control Sections

Signal Assignment to the Actual Position Value

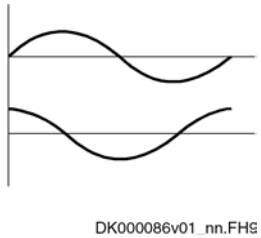
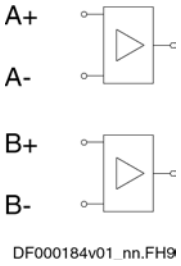
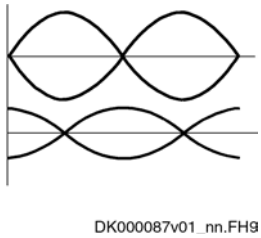
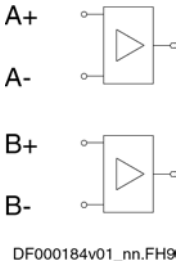
Signal assignment	Signal designation	Signal shape	Actual position value (with default setting)
		HSF (sine 1 V_{pp} without 120 ohm terminating resistor, I^2C bus)	increasing
 amplitude-modulated signal		resolver	increasing

Fig.6-60: Signal assignment to the actual position value

Connection Diagrams EN1

EN1 with Encoder System R0 and R1

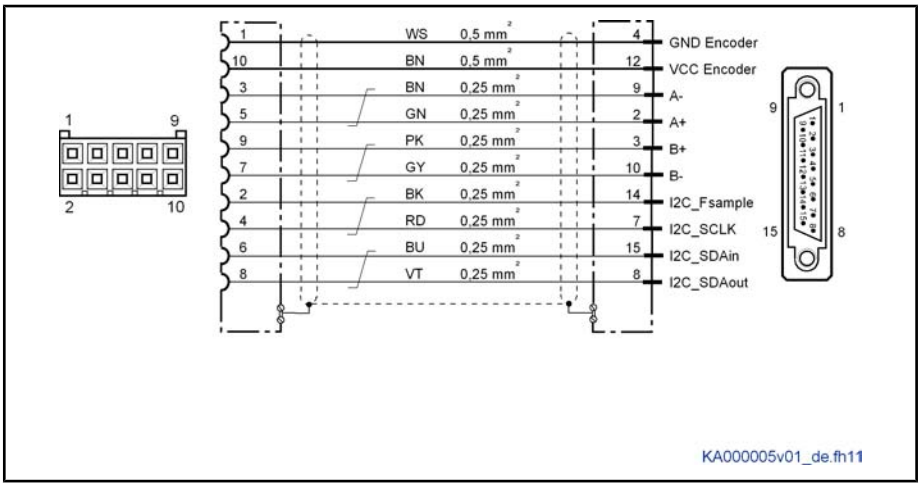


Fig.6-61: Connection diagram

For **direct** connection to the encoder system use our cable **IKS4043**.

EN1 with Encoder System S0 and M0

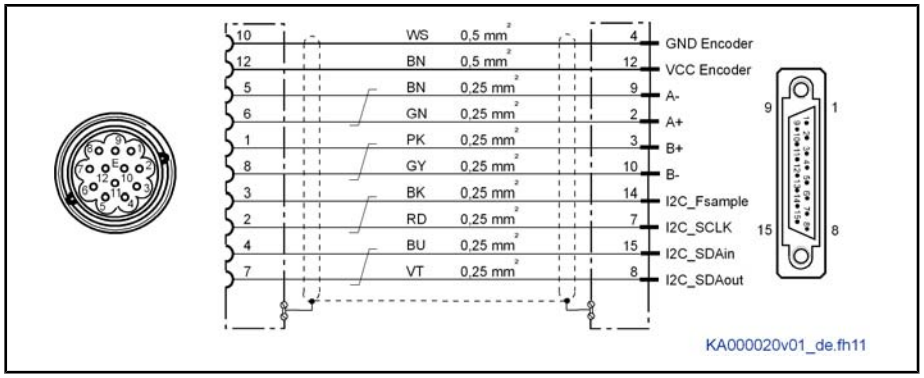


Fig.6-62: Connection diagram

☞ For **direct** connection to the encoder system use our cable **IKS4042**.

EN1 with Hall Sensor Box SHL01

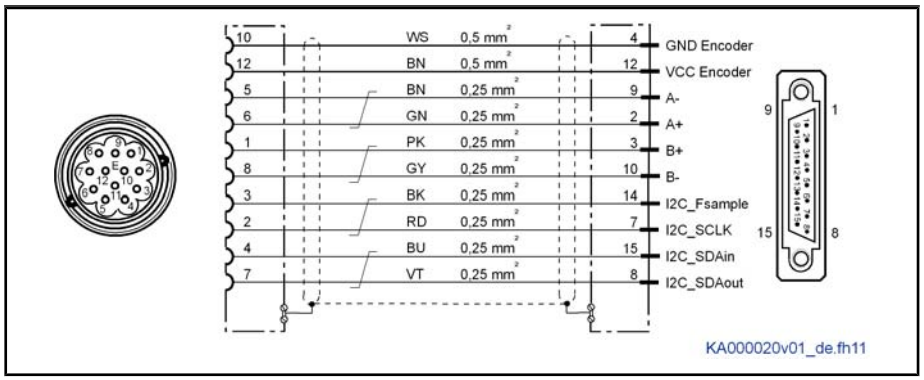


Fig.6-63: Connection diagram

☞ For **direct** connection to the encoder system use our cable **IKS4042**.

6.3.3 EN2 - Encoder Evaluation

Interface 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

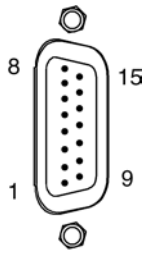
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
-	D-Sub	15	pins on device	0,25–1,0	

Fig.6-64: Connection

Optional Modules for Control Sections

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_shld	connection for signal shields
15	EncData-	data transmission

Fig.6-65: 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 current	mA			350
d.c. resistance of load	ohm	35		

Fig.6-66: Encoder supply EN2

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

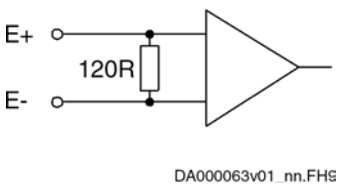


Fig.6-67: Input circuit for sine signals (block diagram)

Properties of Differential Input for Sine Signals

Data	Unit	Min.	Typ.	Max.
allowed amplitude of encoder signal peak-peak ($U_{PPencodersignal}$)	V	0,8	1,0	1,2
limit frequency (-3 dB)	kHz		500	
converter width A/D converter	bit		12	
input resistance	ohm		120	

Fig.6-68: Differential input sine

Input Circuit for Square-Wave Signals

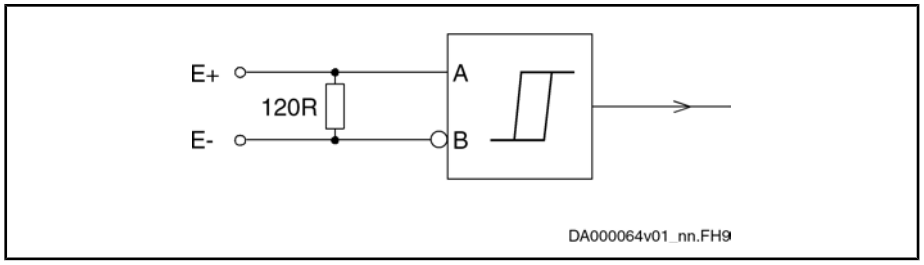


Fig.6-69: Input circuit for square-wave signals (block diagram)

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.6-70: Differential input square-wave signals

Sense+, Sense-

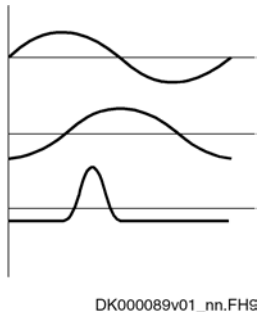
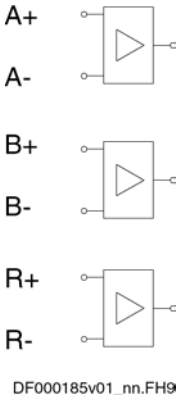
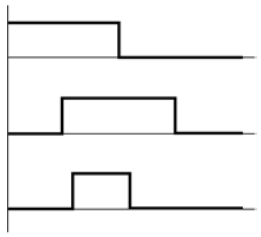
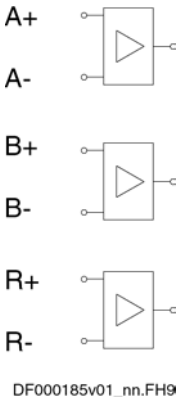
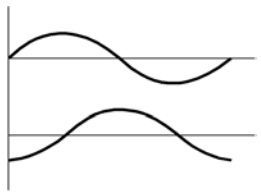
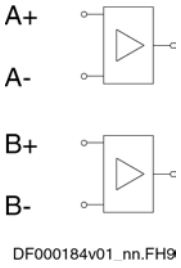
Return of encoder supply to amplifier to compensate for voltage drop in encoder cable and have required voltage range present at encoder.

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

- great cable lengths
- small cable cross sections
- many contact resistances

Optional Modules for Control Sections

Signal Assignment to the Actual Position Value

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

1) see following note

Fig.6-71: Signal assignment to the actual position value

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

- Track A (A+, A-) advances track B (B+, B-) 90° electrically.
- The actual position value increases in this case (unless negation takes effect).
- If available, the reference track R (R+, R-) provides the reference mark pulse at positive signals of track A and track B (in the so-called “0-th” quadrant).

☞ Standard setting: see Functional Description of firmware

Connection Diagrams EN2

EN2 with Encoder System C0

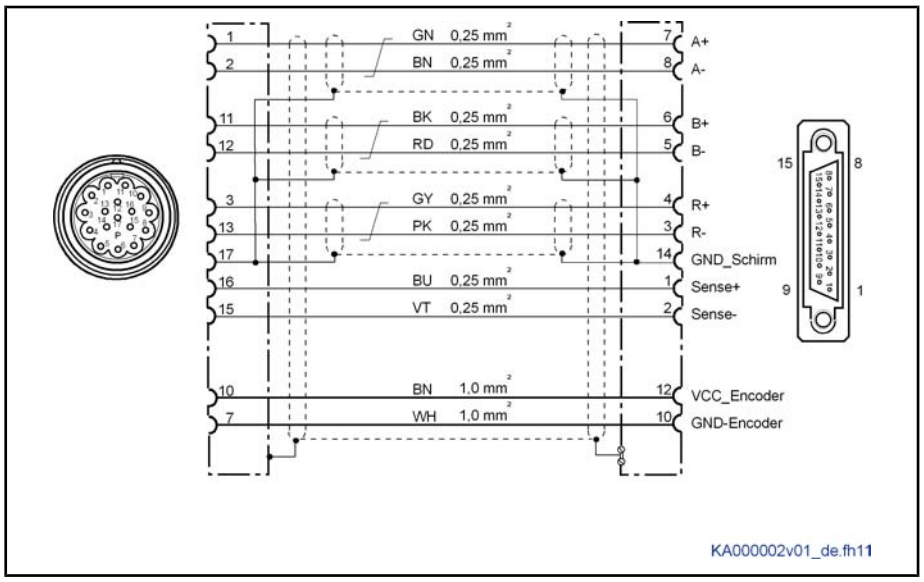


Fig.6-72: Connection diagram EN2 with encoder system C0

For **direct** connection to the encoder system use our cable **RKG0014**.

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

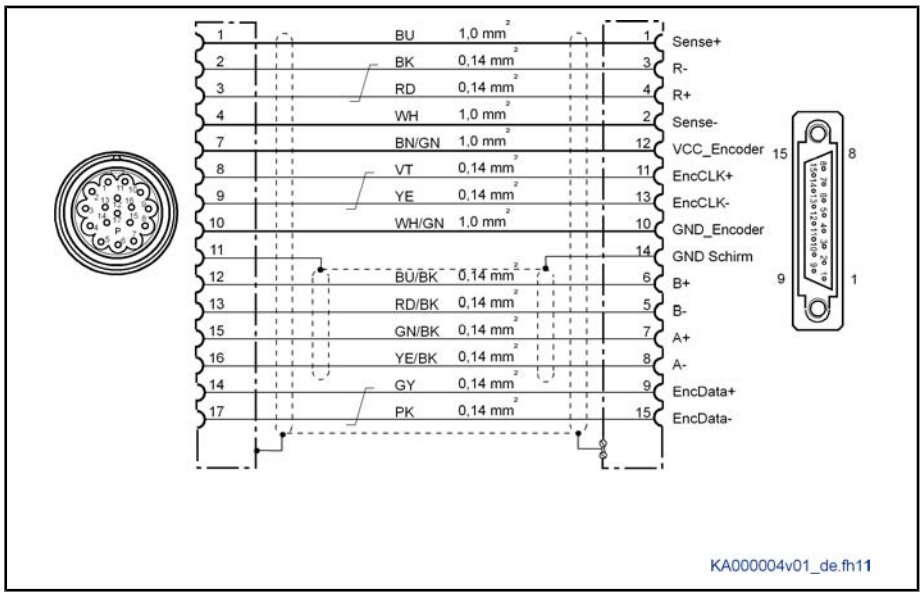


Fig.6-73: Connection diagram EN2 with third-party encoder EnDat2.1 (according to Heidenhain standard)

For **direct** connection to the encoder system use our cable **IKS4038**.

Optional Modules for Control Sections

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

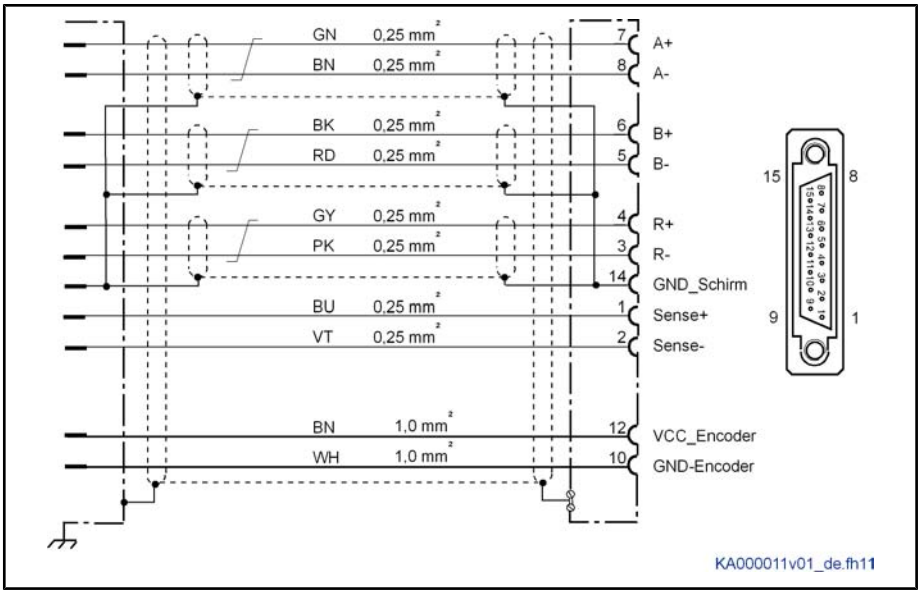


Fig.6-74: Connection diagram EN2 with third-party encoder 1 Vpp, 5 V supply

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

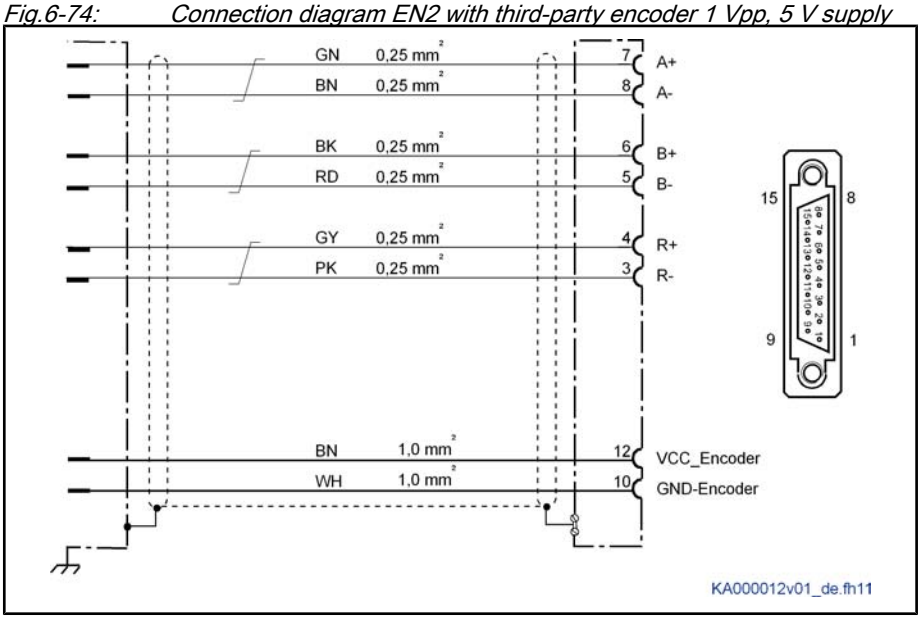


Fig.6-75: Connection diagram EN2 with third-party encoder square-wave, 5 V supply

Allowed Encoder Cable Lengths at EN2

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

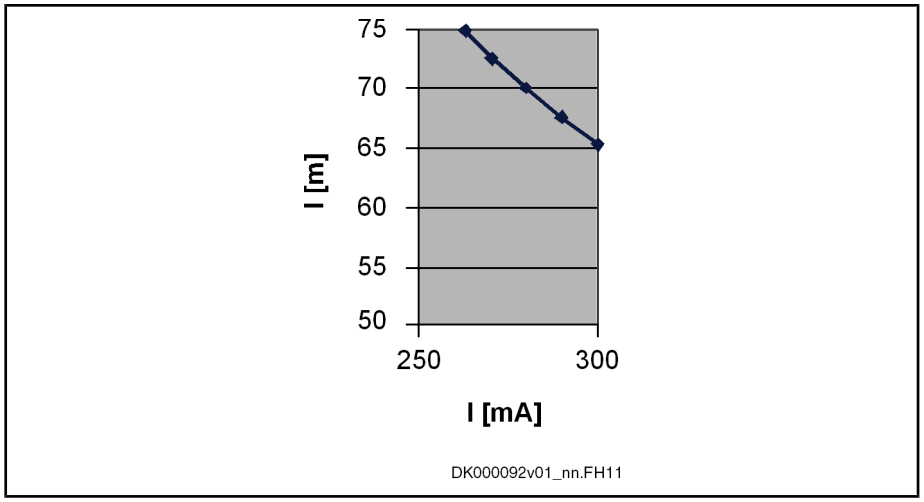
The drive controller can influence the voltage for encoder supply (VCC_Encoder). For this purpose, the actual voltage value at the encoder can be detected with the Sense lines.

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%

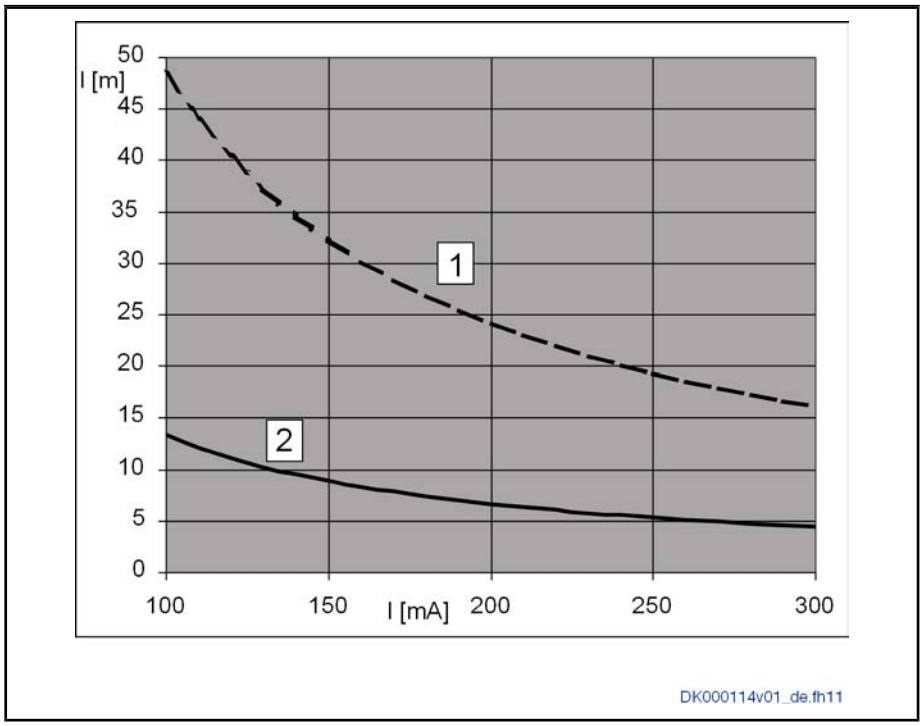
With Sense Connection in the Encoder Line



l [mA] current consumption
l [m] length
Fig.6-76: Encoder cable lengths with Sense connection

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

Without Sense Connection in the Encoder Line



1 encoder tolerates supply voltage of 5V - 10%
2 encoder tolerates supply voltage of 5V - 5%
Fig.6-77: Encoder cable lengths without Sense connection

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

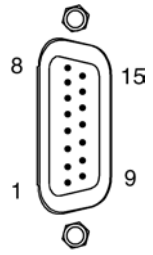
Smaller cross sections (e.g. of original Heidenhain cables) reduce the allowed cable length.

6.3.4 MEM - Encoder Emulation

Interface Encoder Emulation MEM

Description

Emulation of absolute value and incremental encoders for further evaluation by a control unit. 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
X8.1[1)] X8.2[2)] X10[3)] X16[4)]	D-Sub	15	pins on device	0,25–0,5	

1) 2) see also control section CDB01.1C configuration table: option 3, option 4

3) see also control section CSH01.1C configuration table: option 3

4) see also control section CSB01.1N-AN, front view

Fig.6-78: Connection

Pin Assignment

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.

Connection	Signal	Function
14	UA2+	incremental encoder: track A2; absolute encoder: n. c.
15	UA2-	incremental encoder: track A2; absolute encoder: n. c.

Fig.6-79: 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.6-80: Line at MEM

CAUTION

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

Use lines with double shielding.

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

Incremental Encoder Emulation

Connection Incremental Encoder Emulation

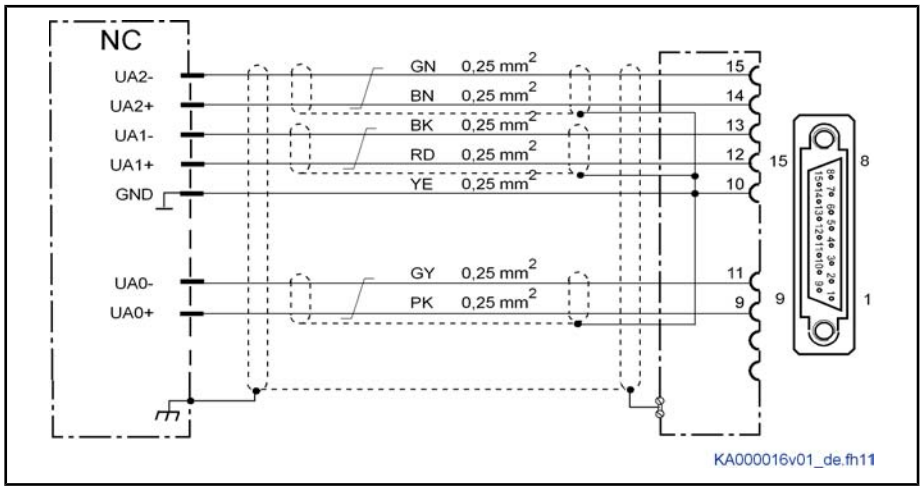


Fig.6-81: Connection of incremental actual position value output

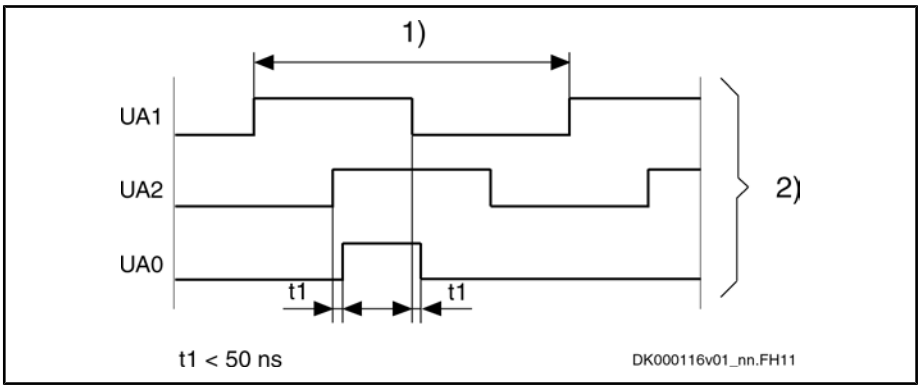
Differential Outputs Incremental Encoder Emulation

Data	Unit	Min.	Typ.	Max.
output voltage “high”	V	2,5		5
output voltage “low”	V	0		0,5

Optional Modules for Control Sections

Data	Unit	Min.	Typ.	Max.
output current Iout	mA			I 20 I
load capacitance between output and 0 V	nF			10
output frequency f	MHz			1
overload protection		available		

Fig.6-82: Differential outputs



Signals for Incremental Actual Position Value Output

t1 < 50 ns
1) one line
2) square-wave pulses with view to the motor shaft and clockwise rotation
Fig.6-83: Signals for incremental actual position value output

Output Frequency f

$$f = \frac{S}{U} \times n$$

f output frequency
S number of lines
U revolution
n speed
Fig.6-84: Calculating the output frequency f

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

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: $f_{filter} \geq 2 \times f_{out}$

Speed Measurement

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

Absolute Encoder Emulation (SSI Format)

Absolute Encoder Emulation

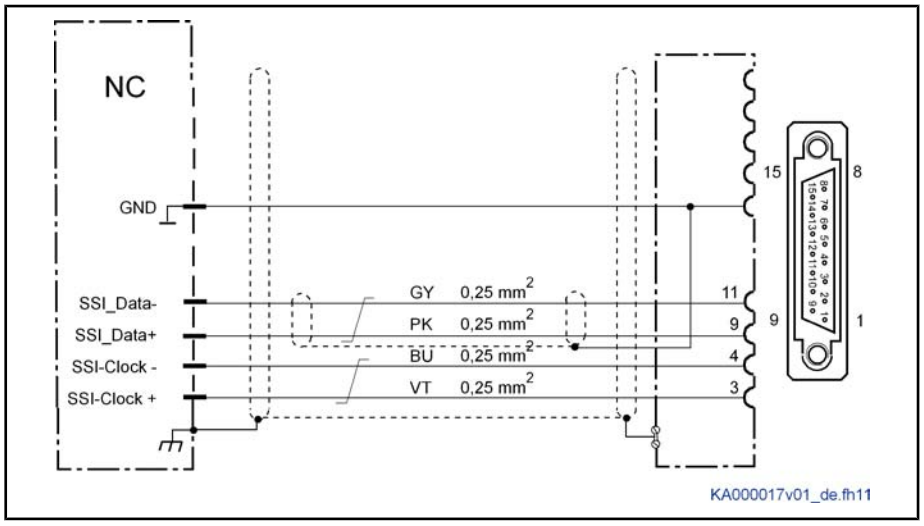


Fig.6-85: Output of absolute actual position values according to SSI format

Differential Input Circuit Absolute Encoder Emulation

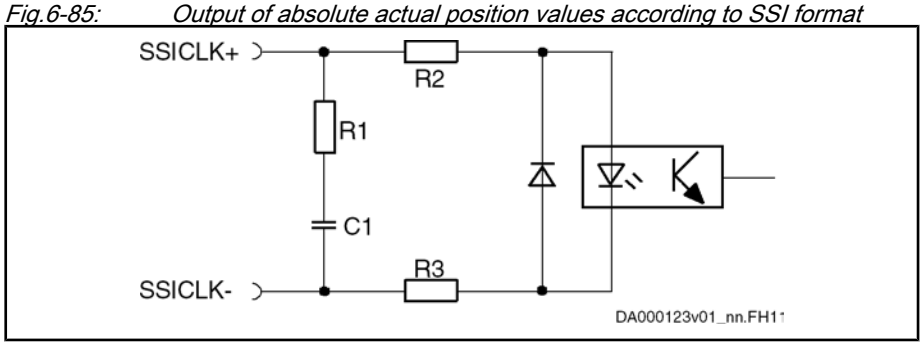


Fig.6-86: Differential input circuit (block diagram)

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.6-87: Differential inputs

Differential Outputs Absolute Encoder Emulation

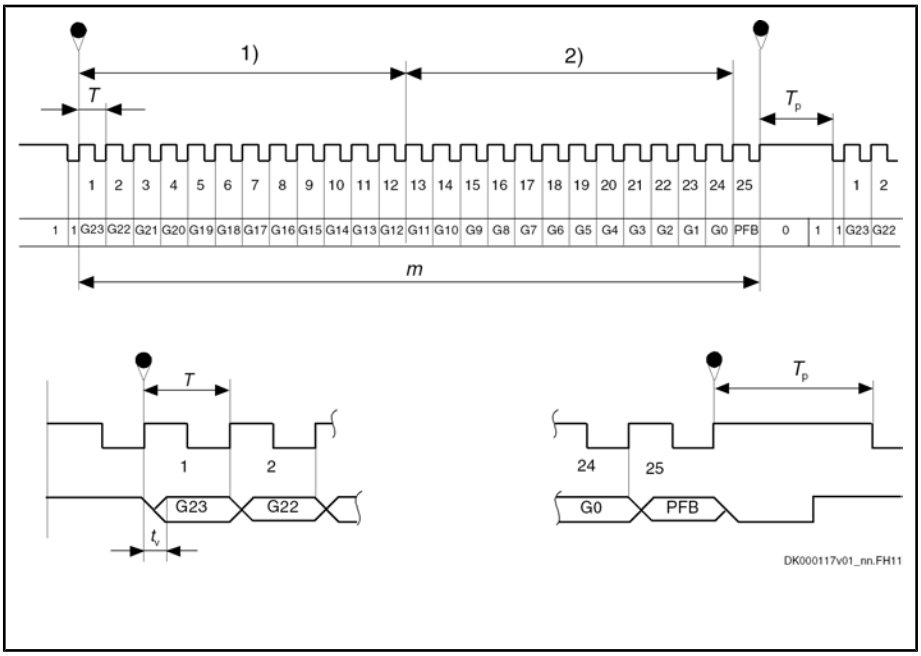
Data	Unit	Min.	Typ.	Max.
output voltage “high”	V	2,5		5
output voltage “low”	V	0		0,5

Optional Modules for Control Sections

Data	Unit	Min.	Typ.	Max.
output current Iout	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.6-88: Differential outputs

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).



1) resolution for 4096 revolutions
2) resolution for 1 revolution
G0 least significant bit in Gray code
G23 most significant bit in Gray code
m stored parallel information
T clock time
T_p clock break ≥ 20 µs
t_v delay time max. 650 ns
PFB power failure bit (not used and always logically LOW)

Fig.6-89: Pulse diagram with absolute actual position value output (SSI format)

6.4 I/O Extensions

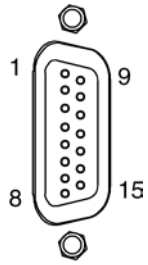
6.4.1 MA1 - Analog I/O Extension

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
X8 [1] **X8.1** [2] **X8.2** [3] **X10** [4]	D-Sub	15	female (device)	0,08–0,5	

[1] see also control sections CSH01.1C, CSH01.2C configuration table: option 2

[2] [3] see also control section CDB01.1C configuration table: option 3, option 4

[2] see also control section CSB01.1C configuration table: option 2

Fig.6-90: Connection point MA1

Pin Assignment

Function	Signal	Pin[1]	Technical data
GND connection to analog source AE1	GND_{100}	1	see chapter Analog Input Type 2 , page 146
analog differential input 1	I_a_1+	2	
	I_a_1-	9	
GND connection to analog source AE2	GND_{100}	3	see chapter Analog Input Type 2 , page 146
analog differential input 2	I_a_2+	4	
	I_a_2-	11	
analog output 1	O_a_1	5	see chapter Analog Output Type 3 , page 149
reference potential for analog output 1 (GND measuring pin for external differential analog input)	GND_a	6	
shield connection for analog output 1 (O_a_1)	GND_{100}	13	

Optional Modules for Control Sections

Function	Signal	Pin[1)]	Technical data
analog output 2	O_a_2	14	see chapter Analog Output Type 3 , page 149
reference potential for analog output 2 (GND measuring pin for external differential analog input)	GND_a	15	
shield connection for analog output 2 (O_a_2)	GND_{100}	7	
housing (connection for overall shield)	housing	8	
unassigned GNDA pin (reference potential for analog output)	GND_a	10	
unassigned GNDA pin (reference potential for analog output)	GND_a	12	

1) applies to all connection points X8, X10

Fig.6-91: Pin assignment

For notes on function and commissioning, see sections **Analog Outputs** and **Analog Inputs** in the Functional Description of the firmware.

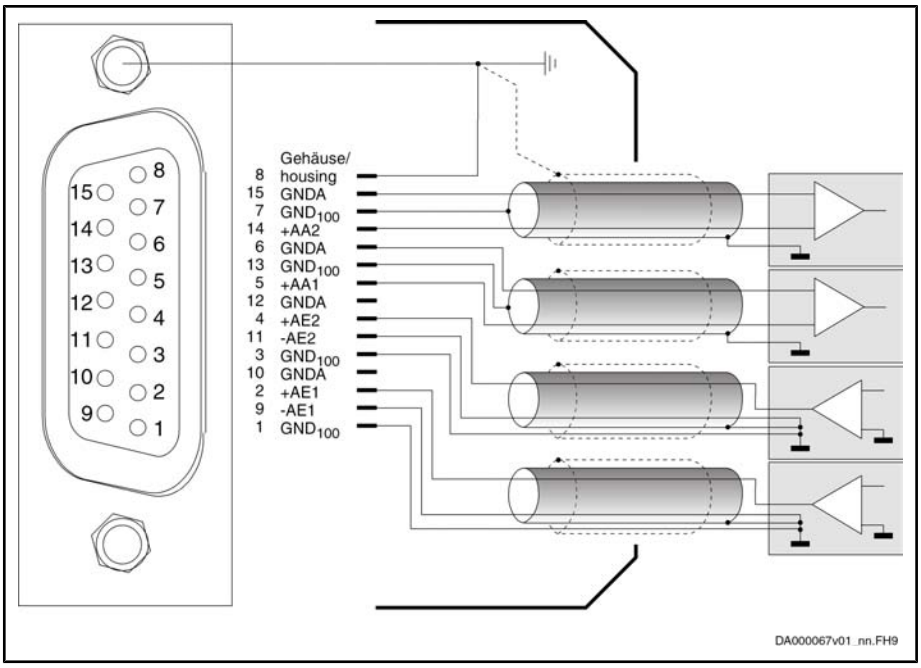


Fig.6-92: Basic wiring

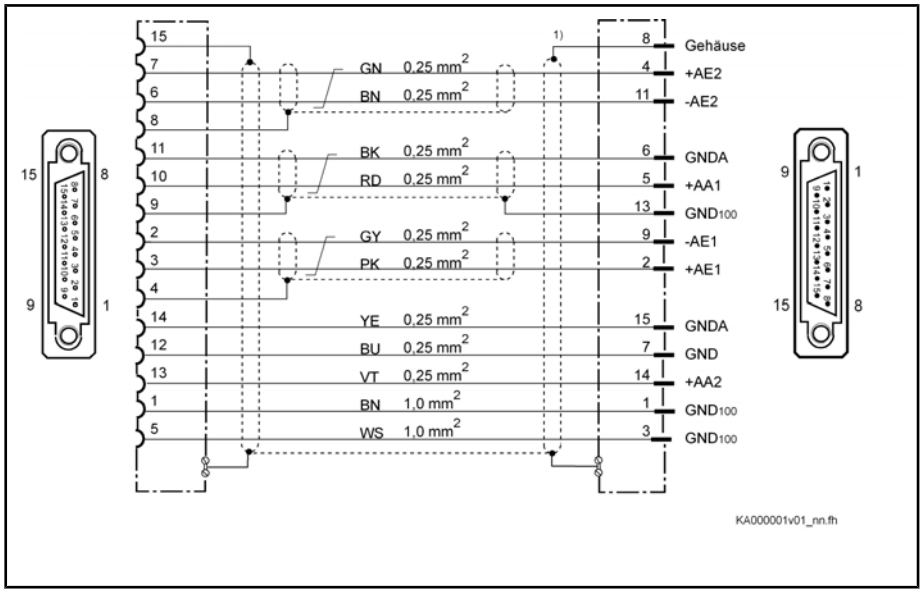
For applications only using one or two analog I/Os, you can also wire the individual cables directly at the D-Sub connector (see basic wiring above). Observe

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.

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 MA 1 with Distribution Box UM 45



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

Fig.6-93: Interconnection diagram RKS 0003

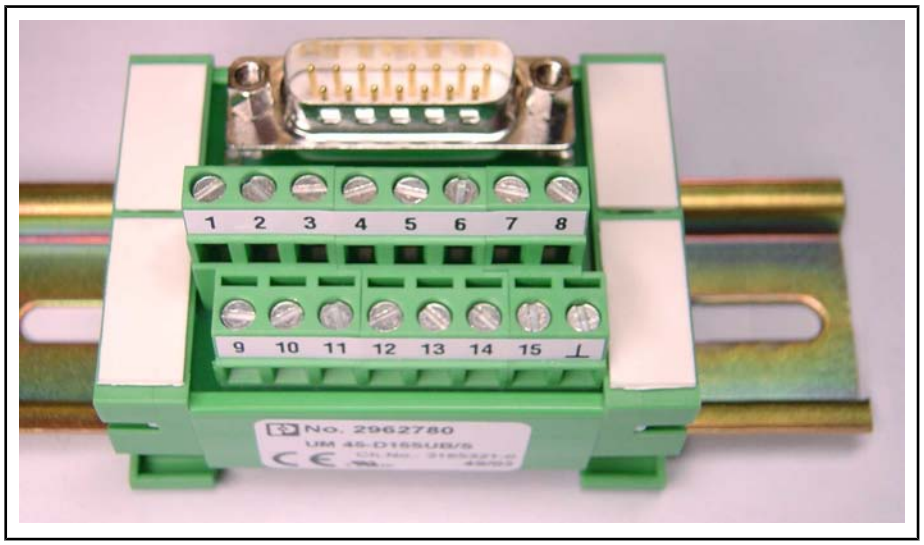


Fig.6-94: Distribution box UM 45-D15SUB/S (Phoenix Contact)

The connections in the distribution box are executed “1 to 1” from D-Sub connector to screw terminal connections. The connection point “⊥” is connected to the housing potential of the distribution box.

6.4.2 MD1 - Digital I/O Extension

Description

This option is an extension for Rexroth IndraDrive control sections.

The option makes available the following functions:

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

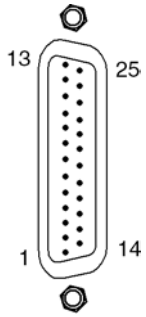
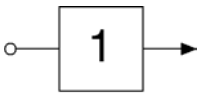
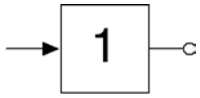
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	Figure
-	D-Sub	25	pins on device	0,08–0,5	 DA000057v01_nn.FH9

Fig.6-95: Connection

Pin Assignment

Function	Signal	Connection	Technical data
 DA000022v01_nn.FH9 digital input group 0	I_0.0	14	24 V 3 mA see chapter Digital Inputs Type 1 (Standard) , page 140
	I_0.1	15	
	I_0.2	16	
	I_0.3	17	
	I_0.4	18	
	I_0.5	19	
	I_0.6	20	
	I_0.7	21	
	I_0.8	22	
	I_0.9	23	
	I_0.10	24	
	I_0.11	25	
power supply for input group 0	+24V	7	DC 19 … 30 V max. 0.1 A
 DA000024v01_nn.FH11 digital output group 0	O_0.0	1	24 V 0.5 A see chapter Digital Outputs , page 143
	O_0.1	2	
	O_0.2	4	
	O_0.3	5	

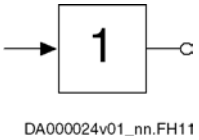
Function	Signal	Connection	Technical data
power supply for output group 0	+24V	3	DC 19 … 30 V max. 1.2 A
 digital output group 1	O_1.0	9	24 V 0.5 A see chapter Digital Outputs , page 143
	O_1.1	10	
	O_1.2	12	
	O_1.3	13	
power supply for output group 1	+24V	11	DC 19 … 30 V max. 1.2 A
reference potential for input/output groups and power supply	0V	8, 6	max. 2.5 A
cable shield connection	shld	connector housing	

Fig.6-96: Signal assignment

For notes on function and commissioning, see section **Digital Inputs/Outputs** in the Functional Description of the firmware.

6.4.3 MD2 - Digital I/O Extension and SSI Encoder Evaluation Interface

Description

This option 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

Optional Modules for Control Sections

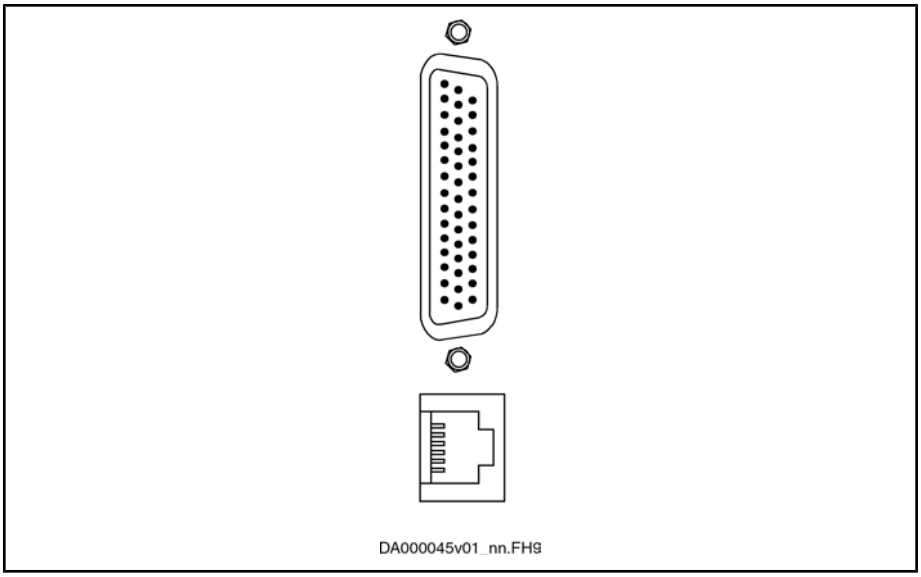


Fig.6-97: MD2

X17, Digital I/O Extension on MD2

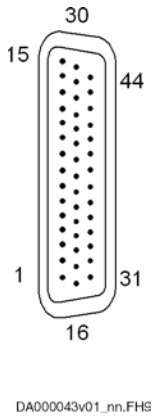
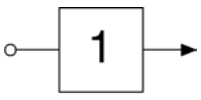
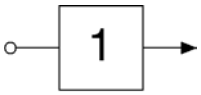
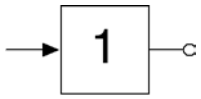
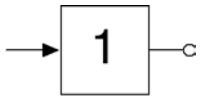
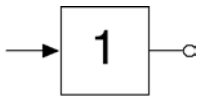
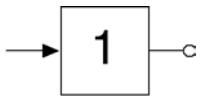
Connection point	Type	No. of poles	Description	Figure
X17	D-Sub (High Density)	44	I/O extension	

Fig.6-98: Connection

Pin Assignment X17 I/O Extension

Function	Signal	Connection	Technical data
 DA000022v01_nn.FH9 digital input group 0	I_0.0	7	24 V 3 mA see chapter Digital Inputs Type 1 (Standard) , page 140
	I_0.1	22	
	I_0.2	6	
	I_0.3	21	
	I_0.4	5	
	I_0.5	20	
	I_0.6	4	
	I_0.7	19	

Function	Signal	Connection	Technical data
power supply for input group 0	+24V	36	DC 19 … 30 V
	0V	35	max. 1.1 A
 DA000022v01_nn.FH9 digital input group 1	I_1.0	3	24 V 3 mA see chapter Digital Inputs Type 1 (Standard) , page 140
	I_1.1	18	
	I_1.2	2	
	I_1.3	32	
	I_1.4	17	
	I_1.5	1	
	I_1.6	16	
	I_1.7	31	
power supply for input group 1	+24V	34	DC 19 … 30 V
	0V	33	max. 1.1 A
 DA000024v01_nn.FH11 digital output group 0	O_0.0	15	24 V 0.5 A see chapter Digital Outputs , page 143
	O_0.1	30	
	O_0.2	14	
	O_0.3	29	
power supply for output group 0	+24V	44	DC 19 … 30 V
	0V	43	max. 1.1 A
 DA000024v01_nn.FH11 digital output group 1	O_1.0	13	24 V 0.5 A see chapter Digital Outputs , page 143
	O_1.1	28	
	O_1.2	12	
	O_1.3	27	
power supply for output group 1	+24V	42	DC 19 … 30 V
	0V	41	max. 1.1 A
 DA000024v01_nn.FH11 digital output group 2	O_2.0	11	24 V 0.5 A see chapter Digital Outputs , page 143
	O_2.1	26	
	O_2.2	10	
	O_2.3	25	
power supply for output group 2	+24V	40	DC 19 … 30 V
	0V	39	max. 1.1 A
 DA000024v01_nn.FH11 digital output group 3	O_3.0	9	24 V 0.5 A see chapter Digital Outputs , page 143
	O_3.1	24	
	O_3.2	8	
	O_3.3	23	

Optional Modules for Control Sections

Function	Signal	Connection	Technical data
power supply for output group 3	+24V	38	DC 19 … 30 V
	0V	37	max. 1.1 A
cable shield connection	shld	connector housing	

Fig.6-99: Pin assignment

For notes on function and commissioning, see section **Digital Inputs/Outputs** in the Functional Description of the firmware.

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 up to 10 m long. See also example of connection MD2.

X16, SSI Encoder Evaluation on MD2

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

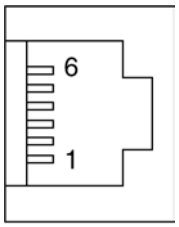
Connection point	Type	No. of poles	Description	Figure
X16	RJ11	6	SSI encoder evaluation	 DA000044v01_nn.FH9

Fig.6-100: 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}-1 V
6	0V	reference potential	max. 0.2 A
connector housing	shld	cable shield connection	

Fig.6-101: Pin assignment

Max. Line Length

SSI_CLK frequency which is set (see also P-0-0910) [kHz]	Max. allowed line length [m]
125	75
250	75
500	75
1000	40

Fig.6-102: Line length and SSI_CLK frequency

Example of Connection Principle MD2

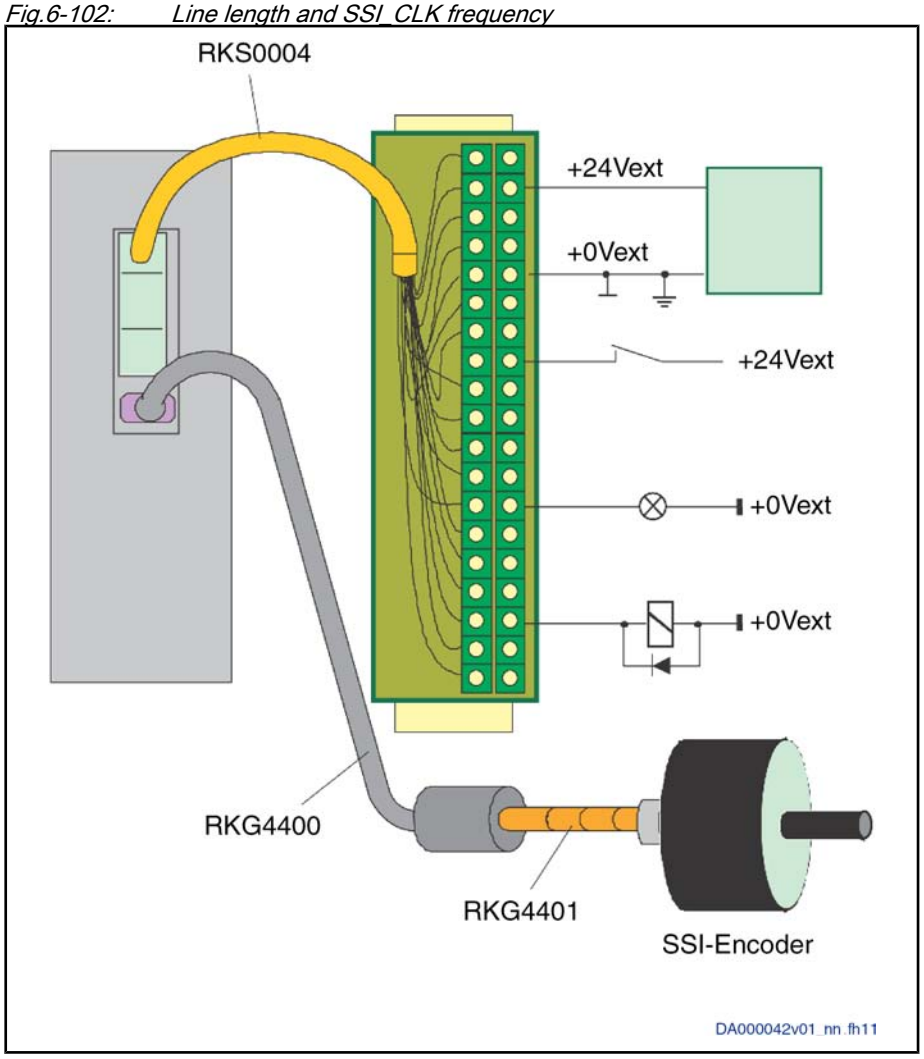


Fig.6-103: Example of connection I/O extension MD2

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

- Cable **RKG4400** from X16 to coupling element (max. length 1.5 m).
- Adapter cable between connection cable and the respective encoder used with different connector pin assignments. For SSI encoders from Stegmann, use our cable **RKG4401** .

6.5 Safety Technology

6.5.1 L1 - Starting Lockout

Description

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

X41, Connection Point Starting Lockout L1

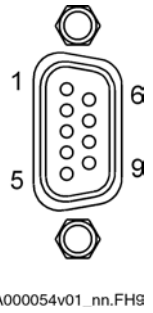
Connection point	Type	No. of poles	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Figure
X41	D-Sub, female (device)	9	0,25–0,5	-	-	

Fig.6-104: Connection

Function		Signal	Connection	Nominal data	Technical data
inverted acknowledgment		ASQ2	6	DC 24 V / 1 A	see chapter Relay Contact Type 3 , page 140
supply for acknowledgment potential		ASQ	4		
acknowledgment		ASQ1	5		
control signal starting lockout assignment A		AS A	1	24 V / 3 mA	see chapter Digital Inputs Type 1 (Standard) , page 140
inverted control signal starting lockout		AS n	2		
control signal starting lockout assignment B		AS B	3		
input for power supply		+24V	8	DC 24 V	DC 19.2 … 30 V min. 0.1 A max. 1.1 A (depending on load of outputs)
		0VE	9		
n. c.			7		

Fig.6-105: Pin assignment

Function

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

AS	ASn	Status	ASQ1	ASQ2
0	0	error when selecting starting lockout	open	= ASQ
1	1			

Fig.6-106: Function

Connection Accessory, Starting Lockout L1

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

6.5.2 S1 - Safety Technology

Description Safety Technology S1

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

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

X41, Connection Point Safety Technology S1

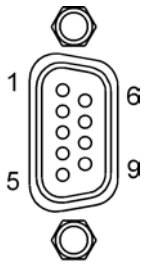
Connection point	Type	No. of poles	Type of design	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Figure
X41	D-Sub	9	female (device)	0,25–0,5	-	-	

Fig.6-107: Connection

Function		Signal	Connection	Nominal data	Technical data
input/output forced dynamization	digital input	EA30	1	24 V / 3 mA	see chapter Digital Inputs Type 1 (Standard) , page 140
	digital output			24 V / 0.5 A	see chapter Digital Outputs , page 143
input/output acknowledgment	digital input	EA20	2	24 V / 3 mA	see chapter Digital Inputs Type 1 (Standard) , page 140
	digital output			24 V / 0.5 A	see chapter Digital Outputs , page 143

Optional Modules for Control Sections

Function		Signal	Connection	Nominal data	Technical data
input/output / relay contact diagn. message / door locking device	digital input	EA10n	3	24 V / 3 mA	see chapter Digital Inputs Type 1 (Standard) , page 140
	digital output			24 V / 0.5 A	see chapter Digital Outputs , page 143
	N/O contact			DC 24 V / 1A	see chapter Relay Contact Type 3 , page 140
digital inputs	operating mode selection	E1n	4	24 V / 3 mA	see chapter Digital Inputs Type 1 (Standard) , page 140
		E2n	5		
		E3n	6		
		E4n	7		
input for power supply [1]		+24V	8	DC 24 V	DC 19.2…30 V; min. 0.1 A max. 1.6 A (depending on load of outputs)
		0 VE	9		

[1] The maximum current consumption depends on the required current at the outputs EA10n, EA20 and EA30 (3 x 0.5 A + 0.1 A = 1.6 A).

Fig.6-108: Pin assignment

6.6 Control Panels

6.6.1 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.6-109: 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 standard 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

6.6.2 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
- requires at least the firmware version MPx04V12

Fig.6-110: 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

☞ For further information, see the Functional Description of the firmware.

6.7 Memory

6.7.1 X7, 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).

☞ The memory card PFM02.1 is not contained in the standard scope of supply of the control sections.

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

7 Technical Data Functions

7.1 Relay Contacts

7.1.1 Symbolic Illustration

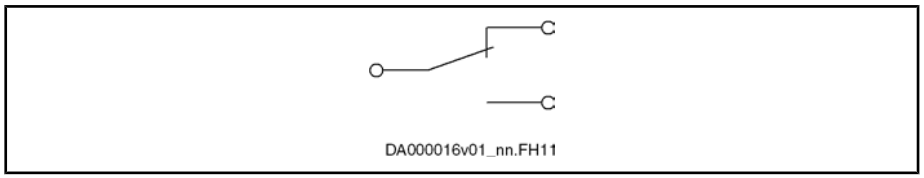


Fig.7-1: Relay contact

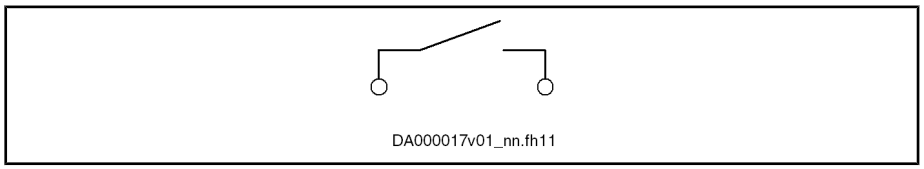


Fig.7-2: Relay contact

7.1.2 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	mΩ			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.7-3: Relay contacts type 1

7.1.3 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	mΩ			1000

Data	Unit	Min.	Typ.	Max.
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.7-4: Relay contacts type 2

7.1.4 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	mΩ			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.7-5: Relay contacts type 3

7.2 Digital Inputs/Outputs

7.2.1 General Information

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

☞ Do **not** operate digital outputs at low-resistance **sources**!

In the Functional Description of the firmware, observe the Notes on Commissioning for digital inputs/outputs of the control section, particularly the parameter “P-0-0302, Digital I/Os, direction”.

7.2.2 Digital Inputs

Digital Inputs Type 1 (Standard)

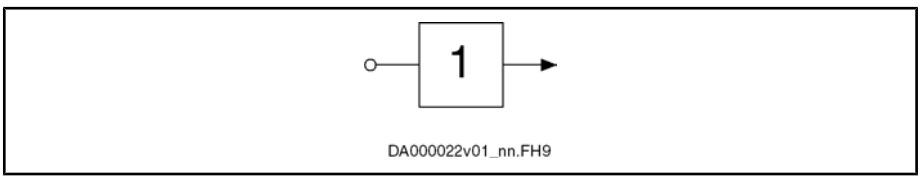


Fig.7-6: Symbol

Data	Unit	Min.	Typ.	Max.
allowed input voltage	V	-3		30
On	V	15		
Off	V			5
input current	mA	2		5
input resistance	kΩ	non-linear, varies depending on input voltage		
sampling frequency	kHz	depending on firmware		
delay	µs	20		100 + 1 cycle time of position control (see also Overview of Functions and Interfaces , page 21)

Fig.7-7: Digital inputs type 1

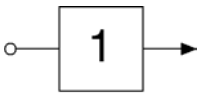
Digital Inputs - Probe

Digital Inputs Type 2 (Probe)

Function

See “Probe” in the Functional Description of the firmware.

Technical Data

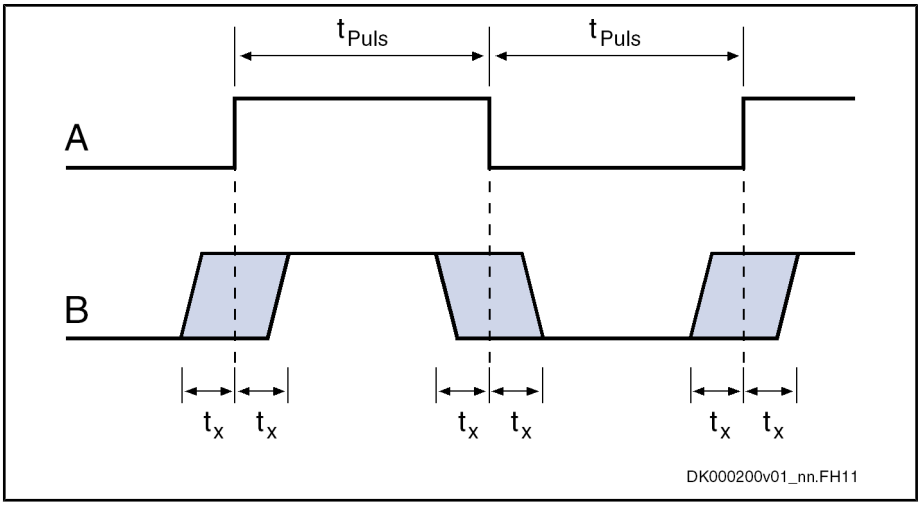


DA000022v01_nn.FH9

Fig.7-8: Symbol

Data	Unit	Min.	Typ.	Max.
allowed input voltage	V	-3		30
On	V	15		
Off	V			5
input current	mA	2		5
input resistance	kΩ	non-linear, varies depending on input voltage		
pulse width t_{Puls}	µs	4		
measuring accuracy t_x	µs			1

Fig.7-9: Digital inputs type 2



A	signal
B	signal detection at probe input
t_{Puls}	pulse width
t_x	measuring accuracy

Fig.7-10: Signal detection at probe input

Usage For detecting sophisticated measuring marks, e.g. when positioning glue dots.

☞ **Probe inputs** are “rapid” inputs. For control use bounce-free switching elements (e.g. electronic switches) to avoid incorrect evaluation.

Digital Inputs Type 3 (Probe)

Function See “Probe” in the Functional Description of the firmware.

Technical Data

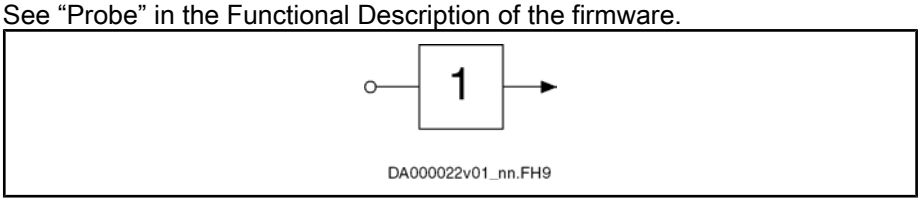
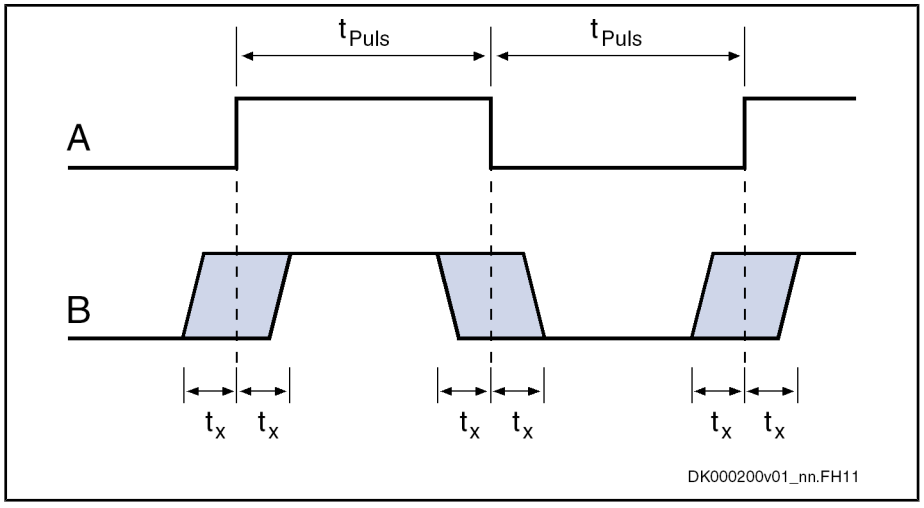


Fig.7-11: Symbol

Data	Unit	Min.	Typ.	Max.
allowed input voltage	V	-3		30
On	V	15		
Off	V			5
input current	mA	2		5
input resistance	kΩ	non-linear, varies depending on input voltage		
pulse width t_{Puls}	µs	200		
measuring accuracy t_x	µs			20

Fig.7-12: Digital inputs type 3



A	signal
B	signal detection at probe input
t_{Puls}	pulse width
t_x	measuring accuracy

Fig.7-13: Signal detection at probe input

Usage For detecting less sophisticated measuring marks, e.g. recognizing the passage of workpieces through a machine.

☞ **Probe inputs** are “rapid” inputs. For control use bounce-free switching elements (e.g. electronic switches) to avoid incorrect evaluation.

7.2.3 Digital Outputs

The digital outputs correspond to IEC 61131.

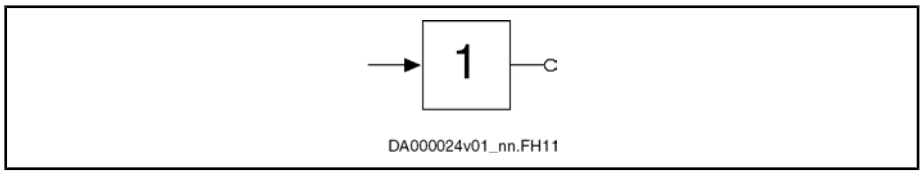


Fig.7-14: Symbol

Data	Unit	Min.	Typ.	Max.
output voltage ON	V	U_{ext} - 0.5	24	U_{ext}
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		

Data	Unit	Min.	Typ.	Max.
overload protection			present	
allowed energy content of connected inductive loads, e.g. relay coils; only allowed as single pulse	mJ			400

Fig.7-15: Digital outputs

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

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

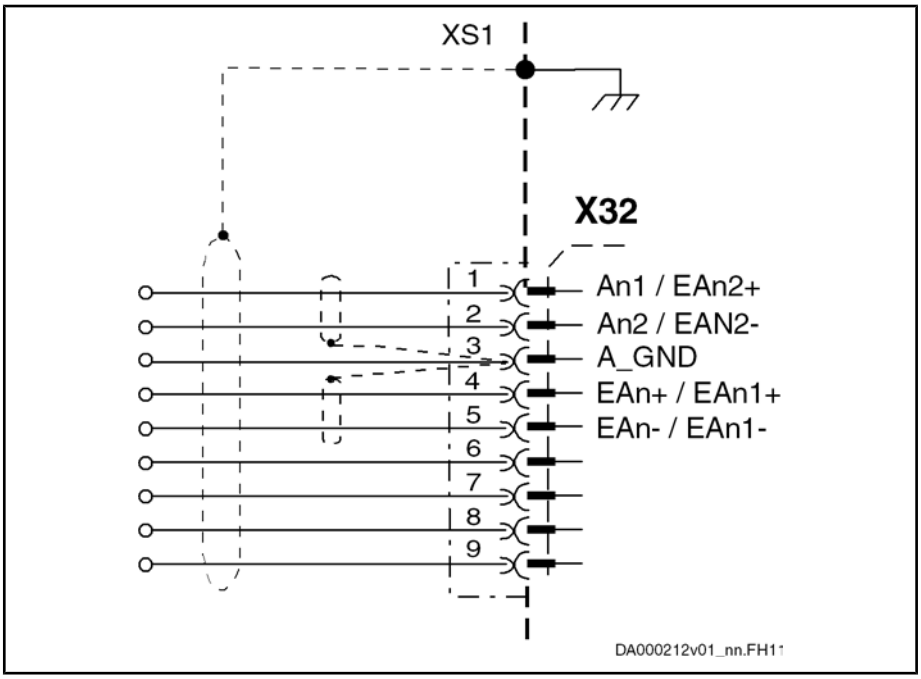
Limit voltage peaks by using free-wheeling diodes directly at the relay coil.

7.3 Analog Inputs/Outputs

7.3.1 General Information

The analog inputs correspond to IEC 61131.

7.3.2 Connection Diagram - Example



XS1 shield connection at drive controller

Fig.7-16: Shield connection X32

☞ Connect the cable shield (overall shield) at both ends of the cable.

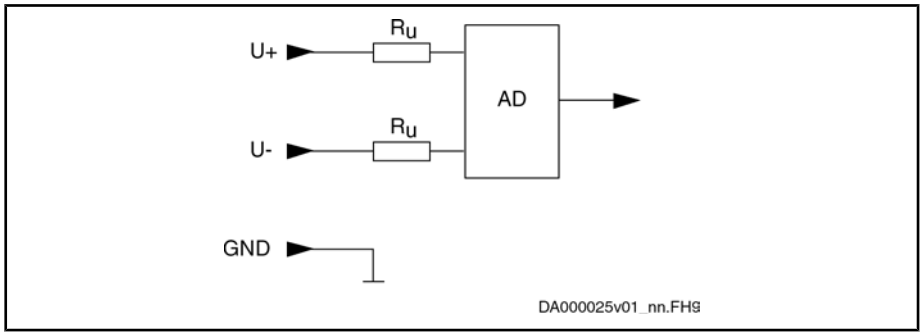
At the drive controller, connect the cable shield at connection XS1.

Both signal shields (inner shields) may only be connected at one side of the cable so that compensating current does not flow.

At CSB01.1N-FC control sections, it is not allowed to connect signal shields at X32.3.

7.3.3 Analog Inputs

Analog Input Type 1



AD analog/digital converter

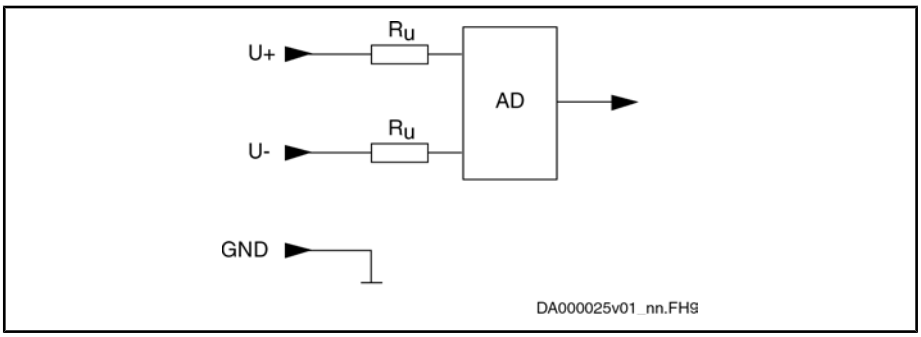
Fig.7-17: Analog voltage inputs

Data	Unit	Min.	Typ.	Max.
allowed input voltage	V	-30		+30
working range input voltage U_{on_work}	V	-10		+10
input resistance	kΩ		180	
input bandwidth	kHz		2	
common-mode range	V	-20		+20
common-mode rejection	dB	48		
relative measuring error at 90% U_{on_work}	%	-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/inc		5,5	
cyclic conversion	µs	n.s.		
conversion time	µs	n.s.		

Fig.7-18: Analog voltage inputs

Technical Data Functions

Analog Input Type 2

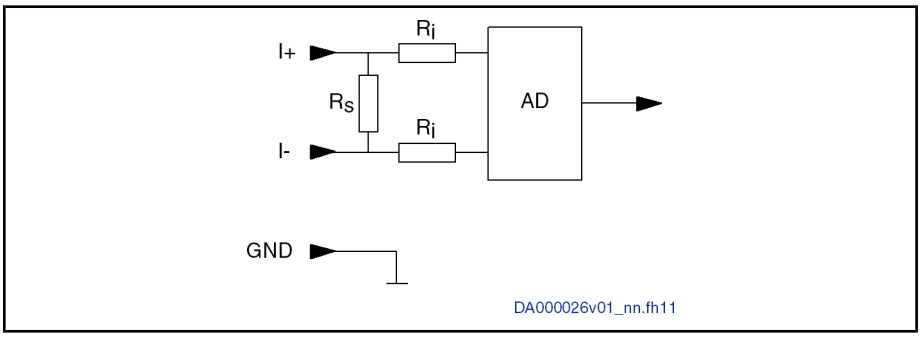


AD analog/digital converter
Fig.7-19: Analog voltage inputs

Data	Unit	Min.	Typ.	Max.
allowed input voltage	V	-30		+30
working range input voltage U_{on_work}	V	-10		+10
input resistance	kΩ		2000	
input bandwidth	kHz		1	
common-mode range	V	-40		+40
common-mode rejection	dB		70	
relative measuring error at 90% U_{on_work}	%	-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/inc		5,5	
cyclic conversion	µs	n.s.		
conversion time	µs	n.s.		

Fig.7-20: Analog voltage inputs

Analog Input Type 3

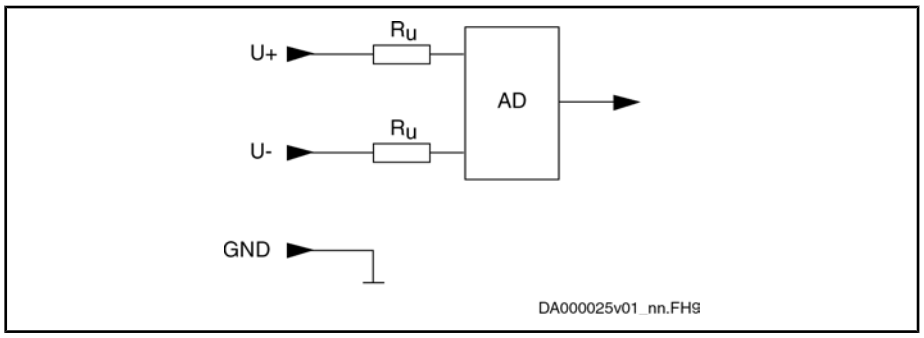


AD analog/digital converter
Fig.7-21: Analog current inputs

Data	Unit	Min.	Typ.	Max.
allowed input current	mA	0		+20
working range input current I_{on_work}	mA	0		+20
input resistance	Ω		200	
input bandwidth	kHz		2	
common-mode range	V	-26		+26
common-mode rejection	dB	48		
relative measuring error at 90% I_{on_work}	%	-1		+1
converter width A/D converter incl. polarity sign	bit		12	
oversampling			8-fold	
dynamic converter width with oversampling	bit		14	
resulting resolution	µA/inc		10,7	
cyclic conversion	µs	n.s.		
conversion time	µs	n.s.		

n.s. not specified
Fig.7-22: Analog current inputs

Analog Input Type 4



AD analog/digital converter
Fig.7-23: Analog voltage inputs

Data	Unit	Min.	Typ.	Max.
allowed input voltage	V	-10		+30
working range input voltage U_{on_work}	V	-10		+10
input resistance voltage input CSH01.2C	kΩ		160	
input bandwidth	kHz		15	
common-mode range	V	-20		+20
common-mode rejection	dB	48		
relative measuring error at 90% U_{on_work}	%	-1		+1

Data	Unit	Min.	Typ.	Max.
converter width A/D converter incl. polarity sign	bit		12	
oversampling			8-fold	
dynamic converter width with oversampling	bit		14	
resulting resolution	mV/inc		1,23	
cyclic conversion	µs	500 (depending on firmware)		
conversion time	µs		-	

Fig.7-24: Analog voltage inputs

7.3.4 Analog Outputs

Analog Output Type 1

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

Fig.7-25: Analog outputs type 1

Analog Output Type 2

Data	Unit	Min.	Typ.	Max.
output voltage	V	0		+5
output load	kΩ	5		
output current	mA	0		+1
converter width digital/analog converter incl. polarity sign	bit	8		
resolution	mV/inc	19,5		
accuracy at R = 5 kohm	%	5 of FMR [1)]		
accuracy at R = 10 kohm	%	2.5 of FMR [1)]		
conversion time (incl. response time)	µs		10	
cyclic conversion		depending on firmware		

Data	Unit	Min.	Typ.	Max.
short circuit protection			present	
overload protection			present	

1) FMR: final value of measuring range

Fig.7-26: Analog outputs type 2

Analog Output Type 3

Data	Unit	Min.	Typ.	Max.
output voltage	V	-10		+10
output load	kΩ	1		
output current	mA	0		+1
converter width digital/analog converter incl. polarity sign	bit		12	
resolution	mV/inc		5	
accuracy at R = 1 kohm	%		1 of FMR [1)]	
accuracy at R = 10 kohm	%		0.2 of FMR [1)]	
conversion time (incl. response time)	µs		10	
cyclic conversion			depending on firmware	
short circuit protection			present	
overload protection			present	

1) FMR: final value of measuring range

Fig.7-27: Analog outputs type 3

7.4 X2, Serial Interface (RS232)

7.4.1 General Information

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

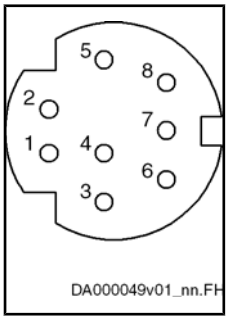
Connection point	Type	No. of poles	Stranded wire [mm²]	Description	Figure
X2	MiniDin, female (device)	8	0,25–0,5	serial interface	

Fig.7-28:

Fig.7-29: Connections

Technical Data Functions

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.7-30: 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.7-31: Features of serial interface

The accessory HAS05.1-005 is a converter from RS232 to RS484. For its description see chapter "Accessories" in Project Planning Manual "Rexroth IndraDrive, Drive System".

7.4.2 Connection Diagrams Serial Interface to PC

Serial Interface to PC with 9-Pin D-Sub

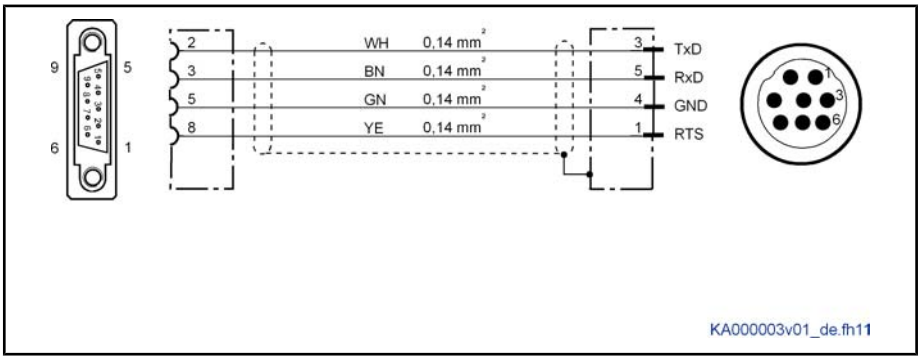


Fig.7-32: Connection serial interface to PC with 9-pin D-Sub

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

Serial Interface to PC with 25-Pin D-Sub

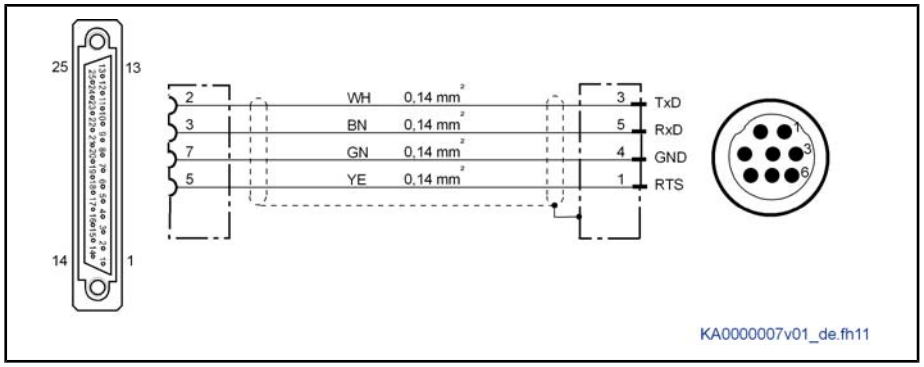


Fig.7-33: Connection serial interface to PC with 25-pin D-Sub

7.5 X26, Engineering Interface

Description

The following documentation of the engineering interface is preliminary.

The interface corresponds to standard IEE 802.3.

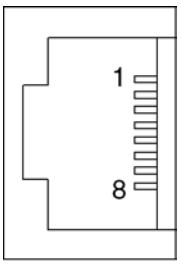
Connection point	Type	No. of poles	Figure
X26	RJ-45	8	

Fig.7-34: Connections

Assignment X26

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.7-35: 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

8 Other Technical Data

8.1 Power Consumption

8.1.1 General Information

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

- basic equipment and
- optional equipment

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

8.1.2 Basic Circuit Boards of Control Section

☞ According to the options with which the configurable control sections have 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} at U_{N3}=DC24V [W]	Typ. inrush current I_{EIN3} [A]	Max. pulse width $t_{EIN3Lade}$ [ms]
CSB01.1N-FC	8,5 [1)]	1,5	120
CSB01.1N-SE	15,5 [1)]	5	40
CSB01.1N-PB	16 [1)]	5	40
CSB01.1N-AN	16 [4)]	1,5	130
CSB01.1C-…	8 [2) 3)]	4,5	110
CDB01.1C-…	9 [2) 3)]	6	60
CSH01.1C-…	7,5 [2) 3)]	4	100
CSH01.2C-…	8,5 [2) 3)]	4	100

1) incl. encoder interface "ENS"; corresponding master communication and control panel "C" or "S"
2) incl. MultiMediaCard "PFM" and control panel "C" or "S"
3) at maximum allowed output load, plus power consumption of optional modules
4) incl. encoder interface "ENS", encoder emulation "MEM" and control panel "C" or "S"

Fig.8-1: Power consumption of control sections

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

8.1.3 Optional Modules

Option[1)]	Optional module	Power consumption P_{N3} at U_{N3}=DC24V[2)] [W]
C	comfort control panel	1
CCD	cross communication SERCOS III	
CO	master communication DeviceNet and CANopen	
MD1	digital I/O extension	
MD2	digital I/O extension and SSI encoder evaluation	
PL	master communication parallel interface	
S	standard control panel	
S1	safety technology I/O	
S3	master communication SERCOS III	
MEM	encoder emulator	2
L1	starting lockout	
SE	master communication SERCOS	
MA1	analog I/O extension	
PB	master communication PROFIBUS-DP	
EN1	HSF, resolver	6
EN2	EnDat2.1 / 1 V_{pp} / 5 V TTL	
ENS	IndraDyn, HIPERFACE®, 1 Vpp	

1) code from the control section type codes
2) at maximum allowed output load, plus circuits to be supplied externally

Fig.8-2: Power consumption of optional modules

8.2 Connections

8.2.1 General Information

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

☞ To connect 2 conductors in one terminal connecting point:

- use stranded wires with min. 0.5 mm^2 and max. 1.0 mm^2
- use wires of the same cross section
- use TWIN ferrules

8.2.2 Connections with Spring Terminals

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

When assembling 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 which can be connected at the spring terminals is max. 1 mm^2.
- to use appropriate crimping tools for the wire ends with ferrules.

8.2.3 Connections with Screw Terminal Blocks

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

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

9 Accessories

The following accessories are available for control sections:

- HAS05.1-003 “signal level converter for encoder emulation”
- HAS05.1-005 “signal level converter RS232/RS485”

The accessories are described in the “Rexroth IndraDrive, Drive System - Project Planning Manual” documentation.

10 Disposal and Environmental Protection

10.1 Disposal

10.1.1 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 mustn't contain any undue foreign matter or foreign component.

Please send the products free domicile to the following address:

Bosch Rexroth AG

Electric Drives and Controls

Bürgermeister-Dr.-Nebel-Straße 2

D-97816 Lohr am Main

10.1.2 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.

10.2 Environmental Protection

10.2.1 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.

10.2.2 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

10.2.3 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.

If the products contain batteries or accumulators, these have to be removed before recycling and disposed of.

11 Service & Support

11.1 Helpdesk

Our service helpdesk at our headquarters in Lohr, Germany, will assist you with all kinds of enquiries.

Contact us:

- By phone through the Service Call Entry Center,
  Mo - Fr 7:00 am - 6:00 pm CET
  +49 (0) 9352 40 50 60
- By Fax
  +49 (0) 9352 40 49 41
- By email: service.svc@boschrexroth.de

11.2 Service Hotline

Out of helpdesk hours please contact our German service department directly:

+49 (0) 171 333 88 26

or

+49 (0) 172 660 04 06

Hotline numbers for other countries can be found in the addresses of each region (see below).

11.3 Internet

Additional notes regarding service, maintenance and training, as well as the current addresses of our sales and service offices can be found on

http://www.boschrexroth.com

Outwith Germany please contact our sales/service office in your area first.

11.4 Helpful Information

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

- detailed description of the fault and the circumstances
- information on the type plate of the affected products, especially type codes and serial numbers
- your phone / fax numbers and e-mail address so we can contact you in case of questions

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Notes

Rexroth
Bosch Group

Bosch Rexroth AG
Bgm.-Dr.-Nebel-Str. 2
D-97816 Lohr a. Main
info@boschrexroth.de
www.boschrexroth.de

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