DBR AUTOMATION

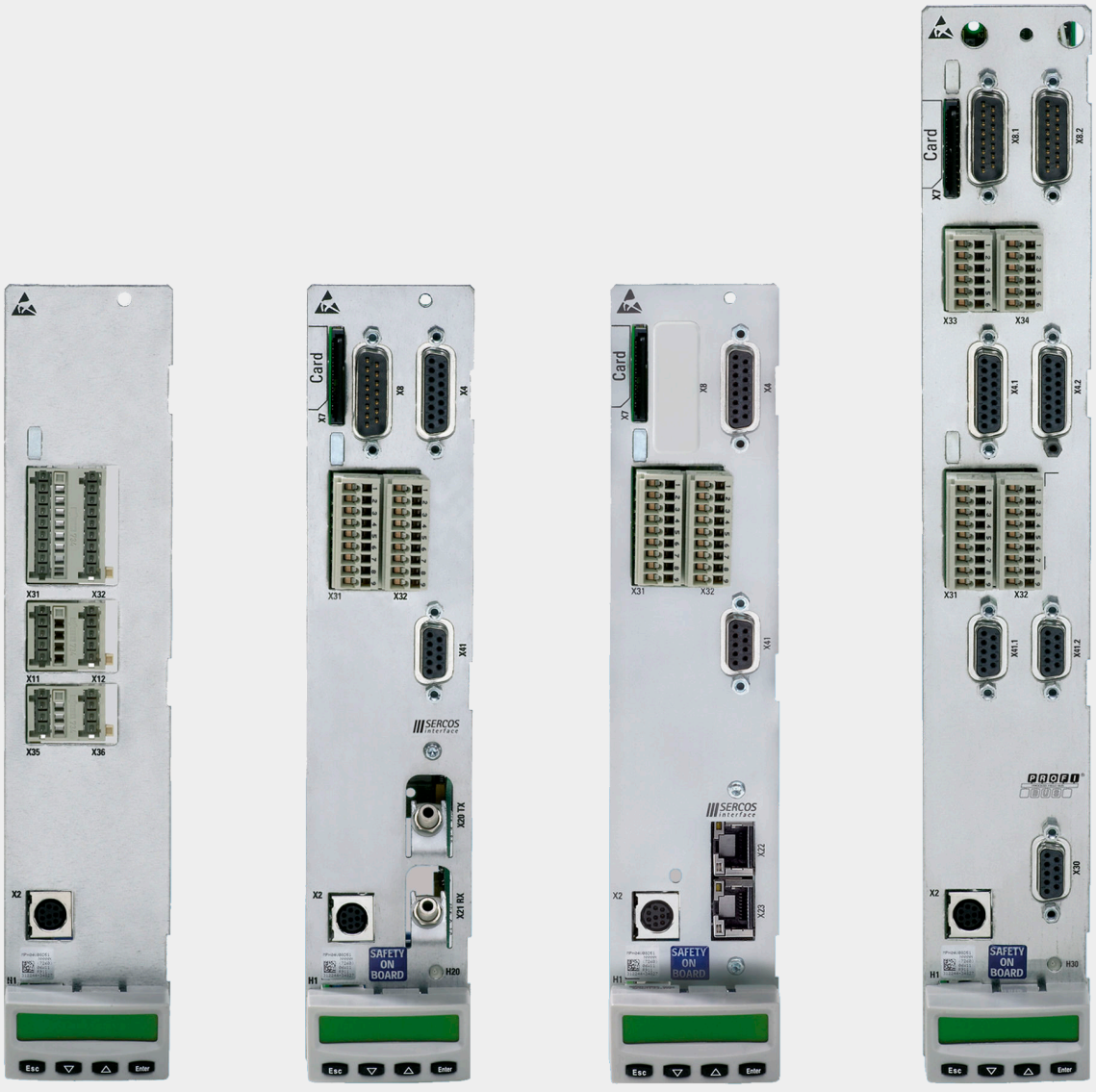
rexroth
A Bosch Company

IndraDrive

Drive Controllers
Control Sections CSB01, CSH01, CDB01

Project Planning Manual
R911295012

Edition 09



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Copyright	
Liability	The specified data is intended for product description purposes only and shall not be deemed to be a guaranteed characteristic unless expressly stipulated in the contract. All rights are reserved with respect to the content of this documentation and the availability of the product.
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1 Introduction

1.1 Documentation

1.1.1 Editions

Edition	Release date	Notes
01	2003-11	-
02	2004-04	-
03	2005-03	-
04	2005-07	-
05	2006-07	-
06	2007-02	-
07	2007-10	-
08	2009-12	-
09	2019-06	• Included note on RoHS conformity of the CSB01, CSH01 and CDB01 control sections (chapter "Important directions for use") • Updated type code • Updated chapter "Overview of documentations" • Changed type designations of the digital inputs (type 1 → type A, type 2 → type B, type 3 → type C) • Included digital inputs "type D" • CDB01 (X33.5, X34.5): included axis reference of probes • Multi-Ethernet (ET option): corrected connector designations • CANopen (CO option): corrected terminating resistor • Encoder evaluation (ENS option): revised HIPERFACE® third-party encoder connection diagram • Replaced RKB0011 cable by RKB0021 • Removed comfort control panel

Tab. 1-1: Editions

1.1.2 Overview of documentations

Drive systems, system components

Title Rexroth IndraDrive …	Type of documentation	Document typecode[1)] DOK-INDRV*-…	Material number R911…
Drive Systems with HMV01/02 HMS01/02, HMD01, HCS02/03	Project Planning Manual	SYSTEM*****-PRxx-EN-P	309636
Mi Drive Systems with KCU02, KSM02, KMS02	Project Planning Manual	KCU02+KSM02-PRxx-EN-P	335703
Supply Units, Power Sections HMV, HMS, HMD, HCS02, HCS03	Project Planning Manual	HMV-S-D+HCS-PRxx-EN-P	318790

Title Rexroth IndraDrive …	Type of documentation	Document typecode[1)] DOK-INDRV*-…	Material number R911…
Drive Controllers Control Sections CSB01, CSH01, CDB01	Project Planning Manual	CSH********-PRxx-EN-P	295012
Control Sections CSE02, CSB02, CDB02, CSH02	Project Planning Manual	Cxx02******-PRxx-EN-P	338962
Additional Components and Accessories	Project Planning Manual	ADDCOMP****-PRxx-EN-P	306140

1) In the document typecodes, "xx" is a placeholder for the current edition of the documentation (e.g.: PR01 is the first edition of a Project Planning Manual)

Tab. 1-2: Documentations – overview

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

1) In the document typecodes, "xx" is a placeholder for the current edition of the documentation (e.g.: AW01 is the first edition of an Application Manual)

Tab. 1-3: Documentations – overview

Motors

Title	Type of documentation	Document typecode[1)] DOK-MOTOR*-…	Material number R911…
MAD / MAF Asynchronous Motors MAD / MAF	Project Planning Manual	MAD/MAF****-PRxx-EN-P	295781
MBS-H Synchronous Kit Spindle Motors	Project Planning Manual	MBS-H******-PRxx-EN-P	297895
MLF Synchronous Linear Motors	Project Planning Manual	MLF********-PRxx-EN-P	293635
MCL Ironless Linear Motors MCL	Project Planning Manual	MCL********-PRxx-EN-P	330592
MKE Synchronous Motors Synchronous Servo Motors for Potentially Explosive Areas acc. to ATEX and UL / CSA	Project Planning Manual	MKE*GEN2***-PRxx-EN-P	297663
MSK Synchronous Servo Motors	Project Planning Manual	MSK********-PRxx-EN-P	296289

Title	Type of documentation	Document typecode[1)] DOK-MOTOR*-…	Material number R911…
MSK Synchronous Servo Motors for Potentially Explosive Areas	Project Planning Manual	MSK*EXGIIK3-PRxx-EN-P	312709
MSM Synchronous Servo Motors	Data Sheet	MSM********-DAxx-EN-P	329338
MS2E Synchronous Servo Motors acc. to ATEX Directive 2014/34/EU	Project Planning Manual	MS2E*******-PR01-EN-P	394140
MS2N Synchronous Servo Motors	Project Planning Manual	MS2N*******-PRxx-EN-P	347583
MBT Synchronous Torque Motors	Project Planning Manual	MBT********-PRxx-EN-P	298798

1) In the documentation typecodes, "xx" is a placeholder for the current edition of the documentation (e.g.: PR01 is the first edition of a Project Planning Manual)

Tab. 1-4: Documentations – motors

Cables

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

1) In the document typecodes, "xx" is a placeholder for the current edition of the documentation (e.g.: CA02 is the second edition of the "Selection Data" documentation)

Tab. 1-5: Documentations – overview

Firmware

Title Rexroth IndraDrive …	Kind of documentation	Document typecode[1)] DOK-INDRV*-…	Part number R911…
Firmware for Drive Controllers MPH-08, MPB-08, MPD-08, MPC-08	Functional Description	MP*-08VRS**-APxx-EN-P	332643
Firmware for Drive Controllers MPH-07, MPB-07, MPD-07, MPC-07	Functional Description	MP*-07VRS**-FKxx-EN-P	328670
Firmware for Drive Controllers MPH-06, MPB-06, MPD-06, MPC-06	Functional Description	MP*-06VRS**-FKxx-EN-P	326766
Firmware for Drive Controllers MPH-05, MPB-05, MPD-05	Functional Description	MP*-05VRS**-FKxx-EN-P	320182
Firmware for Drive Controllers MPH-04, MPB-04, MPD-04	Functional Description	MP*-04VRS**-FKxx-EN-P	315485

Title Rexroth IndraDrive …	Kind of documentation	Document typecode[1)] DOK-INDRV*-…	Part number R911…
Firmware for Drive Controllers MPH-03, MPB-03, MPD-03	Functional Description	MP*-03VRS**-FKxx-EN-P	308329
Firmware for Drive Controllers MPH-02, MPB-02, MPD-02	Functional Description	MP*-02VRS**-FKxx-EN-P	299223
Drive Controllers MPx-02 to MPx-08	Parameter Description	GEN-**VRS**-PAxx-EN-P	297317
MPx-02 to MPx-08 and HMV	Troubleshooting Guide	GEN-**VRS**-WAxx-EN-P	297319
Integrated Safety Technology	Functional and Application Description	SI*-**VRS**-FKxx-EN-P	297838
Integrated Safety Technology According to IEC61508	Functional Description	SI2-**VRS**-FKxx-EN-P	327664
Rexroth IndraMotion MLD	Application Manual	MLD-**VRS**-AWxx-EN-P	306084
Rexroth IndraMotion MLD Library	Library Description	MLD-SYSLIB*-FKxx-EN-P	309224

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

Tab. 1-6: Documentations – Overview

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

1) In the document typecodes, "xx" is a placeholder for the current edition of the documentation (e.g.: AW01 is the first edition of an Application Manual)

Tab. 1-7: Documentations – overview

1.1.3 Your comments

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

If you find any mistakes in this documentation or have suggestions for changes, please send your feedback to the following address:

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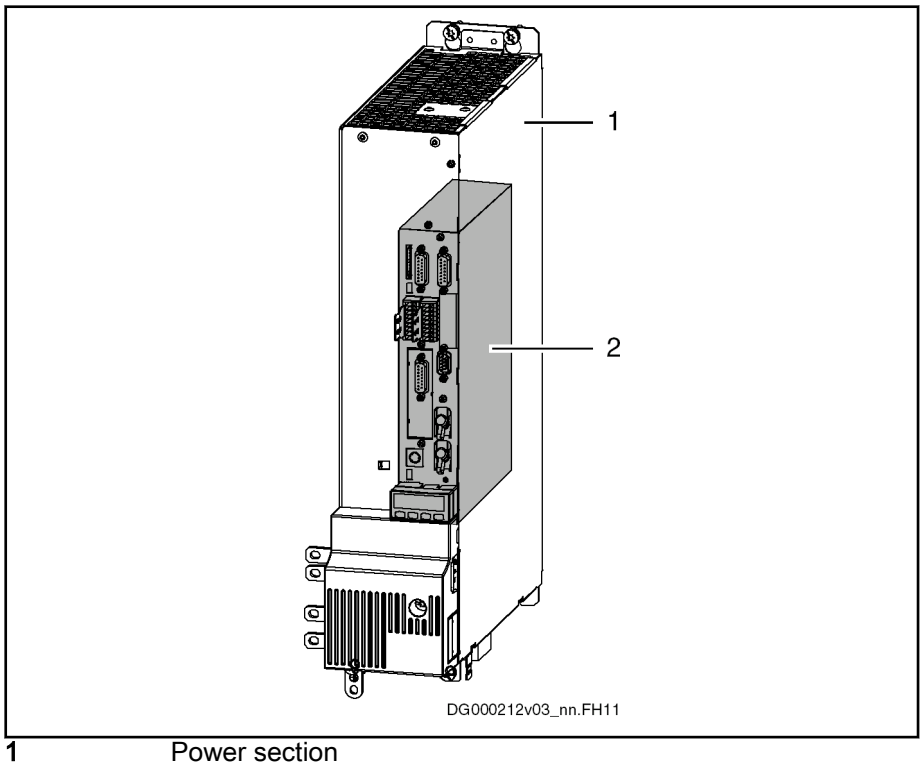
97816 Lohr am Main, Germany
Email: dokusupport@boschrexroth.de

1.2 Basic design of a Rexroth IndraDrive controller

1.2.1 General information



1 Power section
2 Control section

Fig. 1-1: Basic design of a IndraDrive controller

The drive controller consists of two essential parts:

- Power section
- Control section

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 as a complete device including the 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

NOTICE **Risk of damage to the control section by improper handling!**

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

ESD protection

NOTICE **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 (grounding by touching a conductive, grounded object)
- Parts and tools (place them on a conductive surface)

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

Limited number of plug-in actions

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

The control section of a drive controller cannot be mounted and dismounted more than a maximum of **20 times**.

2 Important directions for use

2.1 Intended use

2.1.1 Introduction

Rexroth products are developed and manufactured to the state-of-the-art. The products are tested prior to delivery to ensure operational safety and reliability.

⚠ WARNING **Personal injury and property damage by using products incorrectly!**

The products have been designed for use in an industrial environment and may only be used as intended. Failure to use them in the intended way may cause situations resulting in property damage and personal injury.

☞ Rexroth as the manufacturer shall not honor any warranty, liability or compensatory claims for damages resulting from unintended use of the products. The user alone shall bear the risks of unintended use of the products.

Before using Rexroth products, make sure that all the prerequisites for an intended use of the products are satisfied:

- Personnel that in any way, shape or form uses our products must first read and understand the relevant safety instructions and be familiar with their intended use.
- Leave hardware products in their original state, i.e., do not make any structural modifications. It is not permitted to decompile software products or alter their source codes.
- Do not install damaged or faulty products or put them into operation.
- Make sure that the products have been installed as described in the relevant documentation.

2.1.2 Areas of use and application

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

Controlling and monitoring the Drive controllers may require additional sensors and actuators.

☞ The drive controllers may only be used with the accessories and attachments specified in this documentation. Components that are not expressly mentioned may neither be attached nor connected. The same applies to cables and lines.

Operation is only allowed in the specified configurations and combinations of the components using the software and firmware as specified in the relevant functional descriptions.

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

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

Device types with different drive power and interfaces are available for using the Drive controllers in specific applications.

Typical applications include, for example:

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

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

☞ Note regarding the **RoHS Directive 2011/65/EU**:

The CSB01, CSH01 and CDB01 control sections do not meet the requirements of the RoHS Directive 2011/65/EU.

However, the CSB01, CSH01 and CDB01 control sections may still be placed on the market within the EU if they are exclusively used in applications that are so-called "large-scale stationary industrial tools" or so-called "large-scale fixed installations".

This is stated by the derogation contemplated by Article 2, paragraph 4 of the RoHS Directive 2011/65/EU. Article 3 of this Directive specifies the definitions.

2.2 Unintended use

"Unintended use" refers to using the Drive controllers outside of the operating conditions, technical data and specifications described in this documentation.

Drive controllers must not be used, if …

- they are exposed to operating conditions that do not meet the specified ambient conditions. This includes, for example, operation under water, under extreme temperature fluctuations or extreme maximum temperatures.
- Furthermore, Drive controllers may not be used in applications that have not been expressly authorized by Rexroth. Therefore, please carefully follow the specifications outlined in the general safety instructions!

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

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

3 Safety instructions for electric drives and controls

3.1 Definitions of terms

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Qualified personnel for handling functionally safe products

Individuals configuring, commissioning and operating functionally safe products must have the knowledge specified under "Qualified persons". Additionally, these individuals must be familiar with technical safety concepts as well as prevailing standards and regulations in the field of functional safety.

User

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

3.2 General information

3.2.1 Using the Safety instructions and passing them on to others

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

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

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

3.2.2 Requirements for safe use

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

- Rexroth is not liable for damages resulting from failure to observe the safety instructions.
- Read the operating, maintenance and safety instructions in your language before commissioning. If you find that you cannot completely understand the application documentation in the available language, please ask your supplier to clarify.
- Proper and correct transport, storage, mounting and installation, as well as care in operation and maintenance, are prerequisites for optimal and safe operation of the component.
- Only qualified persons may work with components of the electric drive and control system or within its proximity.
- Only use accessories and spare parts approved by Rexroth.

- Follow the safety regulations and requirements of the country in which the components of the electric drive and control system are operated.
- Only use the components of the electric drive and control system in the manner that is defined as appropriate. See chapter "Appropriate Use".
- The ambient and operating conditions given in the available application documentation must be observed.
- Applications for functional safety are only allowed if clearly and explicitly specified in the application documentation "Integrated Safety Technology". If this is not the case, they are excluded. Functional safety is a safety concept in which measures of risk reduction for personal safety depend on electrical, electronic or programmable control systems.
- The information given in the application documentation with regard to the use of the delivered components contains only examples of applications and suggestions.

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

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

National regulations which the user has to comply with

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

3.2.3 Hazards by improper use

- High electrical voltage and high working current! Danger to life or serious injury by electric shock!
- High electrical voltage by incorrect connection! Danger to life or injury by electric shock!
- Dangerous movements! Danger to life, serious injury or property damage by unintended motor movements!
- Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric drive systems!
- Risk of burns by hot housing surfaces!
- Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!
- Risk of injury by improper handling of batteries!
- Risk of injury by improper handling of pressurized lines!

3.3 Instructions with regard to specific dangers

3.3.1 Protection against contact with electrical parts and housings

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

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

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

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

  Always wait **30 minutes** after switching off power to allow live capacitors to discharge before accessing an electric component. Measure the electrical voltage of live parts before beginning to work to make sure that the equipment is safe to touch.

- Install the covers and guards provided for this purpose before switching on.
- Never touch any electrical connection points of the components while power is turned on.
- Do not remove or plug in connectors when the component has been powered.
- Under specific conditions, electric drive systems can be operated at mains protected by residual-current-operated circuit-breakers sensitive to universal current (RCDs/RCMs).
- Secure built-in devices from penetrating foreign objects and water, as well as from direct contact, by providing an external housing, for example a control cabinet.

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

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

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

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

3.3.2 Protective extra-low voltage as protection against electric shock

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

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

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

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

3.3.3 Protection against dangerous movements

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

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

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

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

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

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

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

To avoid accidents, injury and/or property damage:

- Keep free and clear of the machine's range of motion and moving machine parts. Prevent personnel from accidentally entering the machine's range of motion by using, for example:
  - Safety fences
  - Safety guards
  - Protective coverings
  - Light barriers
- Make sure the safety fences and protective coverings are strong enough to resist maximum possible kinetic energy.
- Mount emergency stopping switches in the immediate reach of the operator. Before commissioning, verify that the emergency stopping equipment works. Do not operate the machine if the emergency stopping switch is not working.
- Prevent unintended start-up. Isolate the drive power connection by means of OFF switches/OFF buttons or use a safe starting lockout.
- Make sure that the drives are brought to safe standstill before accessing or entering the danger zone.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
  - mechanically securing the vertical axes,
  - adding an external braking/arrester/clamping mechanism or
  - ensuring sufficient counterbalancing of the vertical axes.
- The standard equipment **motor holding brake** or an external holding brake controlled by the drive controller is **not sufficient to guarantee personal safety**!
- Disconnect electrical power to the components of the electric drive and control system using the master switch and secure them from reconnection ("lock out") for:
  - Maintenance and repair work
  - Cleaning of equipment
  - Long periods of discontinued equipment use
- Prevent the operation of high-frequency, remote control and radio equipment near components of the electric drive and control system and their supply leads. If the use of these devices cannot be avoided, check the machine or installation, at initial commissioning of the electric drive and control system, for possible malfunctions when operating such high-frequency, remote control and radio equipment in its possible positions of normal use. It might possibly be necessary to perform a special electromagnetic compatibility (EMC) test.

3.3.4 Protection against electromagnetic and magnetic fields during operation and mounting

Electromagnetic and magnetic fields!

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

- Hazards for the above-mentioned groups of persons by electromagnetic and magnetic fields in the immediate vicinity of drive controllers and the associated current-carrying conductors.

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

3.3.5 Protection against contact with hot parts

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

- Do not touch hot surfaces of, for example, braking resistors, heat sinks, supply units and drive controllers, motors, windings and laminated cores!
- According to the operating conditions, temperatures of the surfaces can be **higher than 60 °C** (140 °F) during or after operation.
- Before touching motors after having switched them off, let them cool down for a sufficient period of time. Cooling down can require **up to 140 minutes**! The time required for cooling down is approximately five times the thermal time constant specified in the technical data.
- After switching chokes, supply units and drive controllers off, wait **15 minutes** to allow them to cool down before touching them.
- Wear safety gloves or do not work at hot surfaces.
- For certain applications, and in accordance with the respective safety regulations, the manufacturer of the machine or installation must take measures to avoid injuries caused by burns in the final application. These measures can be, for example: Warnings at the machine or installation, guards (shieldings or barriers) or safety instructions in the application documentation.

3.3.6 Protection during handling and mounting

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

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

3.3.7 Battery safety

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

Risk of injury by improper handling!

- Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- Do not attempt to recharge the batteries as this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not dismantle batteries.
- When replacing the battery/batteries, do not damage the electrical parts installed in the devices.
- Only use the battery types specified for the product.

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

3.3.8 Protection against pressurized systems

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

Risk of injury by improper handling of pressurized lines!

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

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

3.4 Explanation of signal words and the Safety alert symbol

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

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

4 Identifying the control section

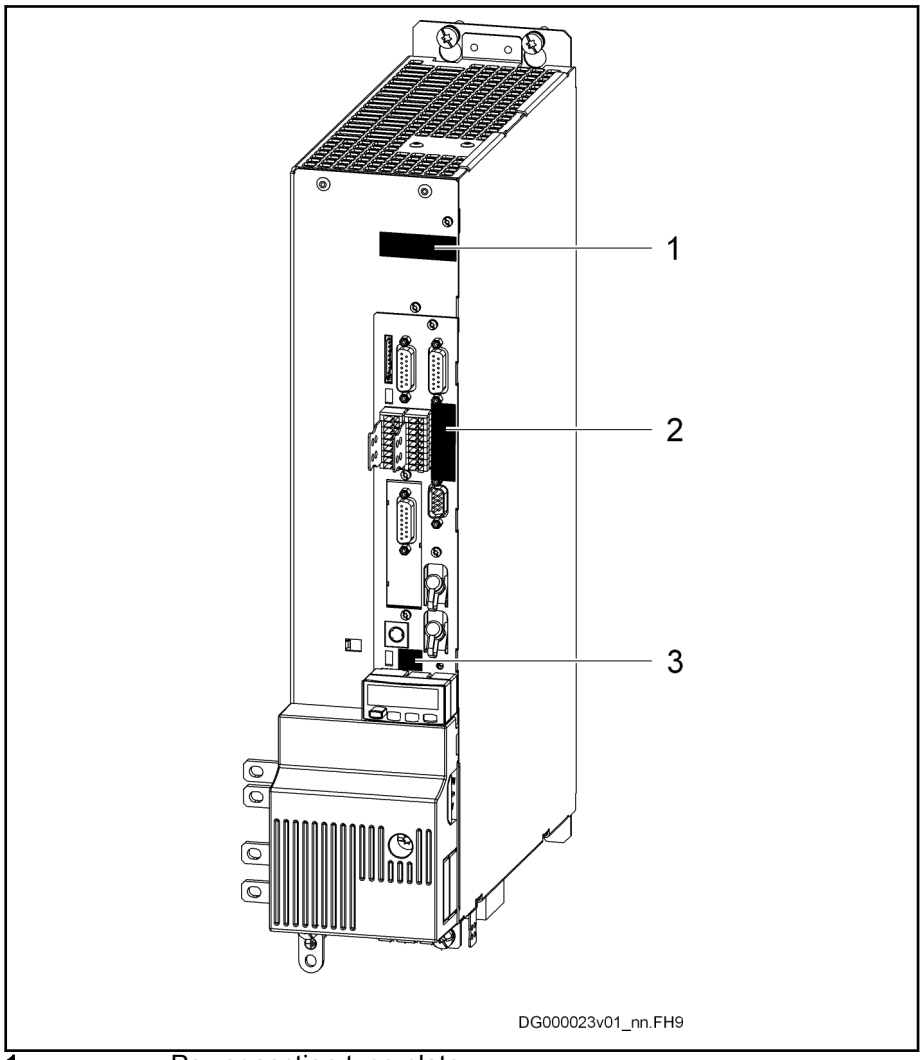
4.1 Type plates

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

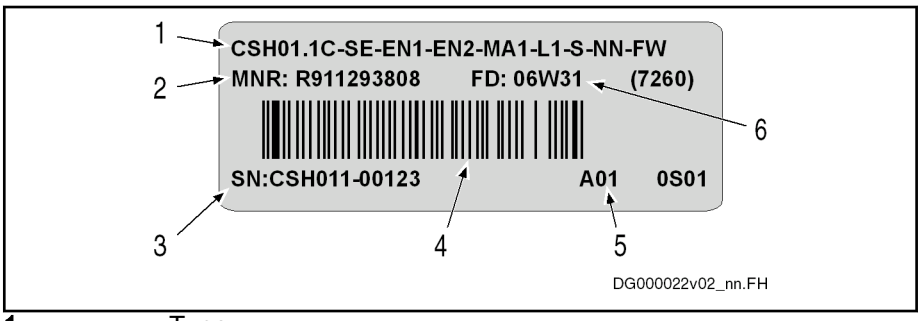


1 Power section type plate
2 Control section type plate
3 Firmware type plate

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

4.1.3 Type plates at the control section

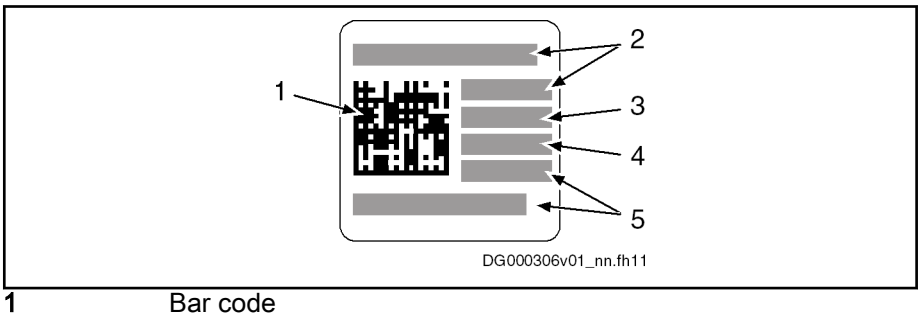
Control section type plate



1 Type
2 Material 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 Factory identifier
4 Production week (example: 11W36 means: year 2011, week 36)
5 Part number

Fig. 4-3: Type Plate (Firmware)

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 CSH01.3C	Configurable single-axis

1) Exception: Option L1 (starting lockout) is possible

Tab. 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 CSH01.3C
Configurable	No	No	No	No	Yes	Yes	Yes
Safety technology configuration slots	0	1 1)	1 1)	1 1)	1	2	1
Serial interface RS232	1	1	1	1	1	1	1
Inputs/outputs:							
Number of dig. inputs, thereof …	8	5-8 5)	5-8 5)	5-9 6)	5-8 5)	18-22 6)	7-11 6)
… probes (dig. input type B)	0	1	1	0	1	2	2
… probes (dig. input type C)	0	1	1	0	1	2 4)	0
Number of dig. outputs	0	0-3 5)	0-3 5)	0-4 6)	0-3 5)	0-4 6)	0-4 6)
Number of analog inputs	2 voltage; 2 current	0	0	2	0	1 7)	1 7)
Number of analog outputs	2	0	0	0	0	2	2

	CSB01.1N-FC	CSB01.1N-SE	CSB01.1N-PB	CSB01.1N-AN	CSB01.1C	CDB01.1C	CSH01.1C CSH01.2C CSH01.3C
Number of relay contacts	1 N/O; 2 changeover switches	1 N/O	1 N/O	1 N/O	1 N/O	1 N/O	1 N/O
Cycle times [2]:							
Current control	125 µs	125 µs	125 µs	125 µs	125 µs	125 µs	62.5 µs 125 µs
Velocity control	250 µs 500 µs	250 µs 500 µs	250 µs 500 µs	250 µs 500 µs	250 µs 500 µs	250 µs	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	250 µs 500 µs
Minimum Sercos cycle time	-	500 µs 1000 µs	-	-	500 µs 1000 µs	500 µs	250 µs 500 µs
Switching frequencies [3]:							
2 kHz	■	■	■	■	■	■	■
4 kHz	■	■	■	■	■	■	■
8 kHz	■	■	■	■	■	■	■
12 kHz	-	-	-	-	-	-	■
16 kHz	-	-	-	-	-	-	■

1) Starting lockout option can be configured
2) Cycle times depend on firmware version
3) Clock frequencies also depend on power section, see description of parameter "P-0-0001, Switching frequency of the power output stage"
4) With firmware version MPD-05V06 and above
5) There are 3 combined I/Os which can be configured as digital input or as digital output
6) There are 4 combined I/Os which can be configured as digital input or as digital output
7) 2 digital inputs can be used as one analog voltage input

Tab. 5-2: Overview of control sections functions

☞ For more details on the configuration options, see section "Optional slots" in the description of the respective control section.

5.3 BASIC control sections

5.3.1 BASIC and BASIC UNIVERSAL type codes

BASIC CSB01.1N type code

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

1. Product
1.1 CSB. . . . . = CSB

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

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

4. Configuration option
4.1 configurable . . . . . = C
4.2 fixed configuration . . . . . = N

5. Communication
5.1 Analog interface. . . . . = AN (1)
5.2 CANopen / DeviceNet . . . . . = CO (2)
5.3 analog/digital for OPEN LOOP operation = FC (1)
5.4 MultiEthernet. . . . . = ET (2)
5.5 PROFIBUS. . . . . = PB
5.6 Parallel interface . . . . . = PL (2)
5.7 Sercos III . . . . . = S3 (2) (5)
5.8 Sercos II. . . . . = SE (5)
5.9 not equipped . . . . . = NN (2)

6. Option 1
6.1 Encoder IndraDyn / Hiperface® / 1 Vss / TTL = ENS (3) (5)
6.2 not equipped . . . . . = NNN (4)

7. Option 2
7.1 Encoder HSF / RSF . . . . . = EN1 (2)
7.2 Encoder EnDat 2.1 / 1Vss / TTL . . . . . = EN2 (2)
7.3 Encoder IndraDyn / Hiperface® / 1 Vss / TTL . . . . = ENS (2)
7.4 analog I/O extension. . . . . = MA1 (2)
7.5 Encoder emulator. . . . . = MEM (2)
7.6 not equipped . . . . . = NNN (5)

8. Safety option
8.1 with starting lockout . . . . . = L1 (3) (5)
8.2 Safe Torque off (SIL3 / cat. 3 PL e). . . . . = L2 (3)
8.3 without safety option. . . . . = NN

9. Control panel
9.1 Standard control panel. . . . . = S

DT000009v03_en.FH11

Fig. 5-1: BASIC control section type code (single-axis); (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	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 communication "FC"
4. only available if communication "FC"
5. only available if communication „S3“ or „SE“, Option 1 „ENS“, Option 2 „NNN“ and Safety option „L1“

Illustration example: CSB01.1

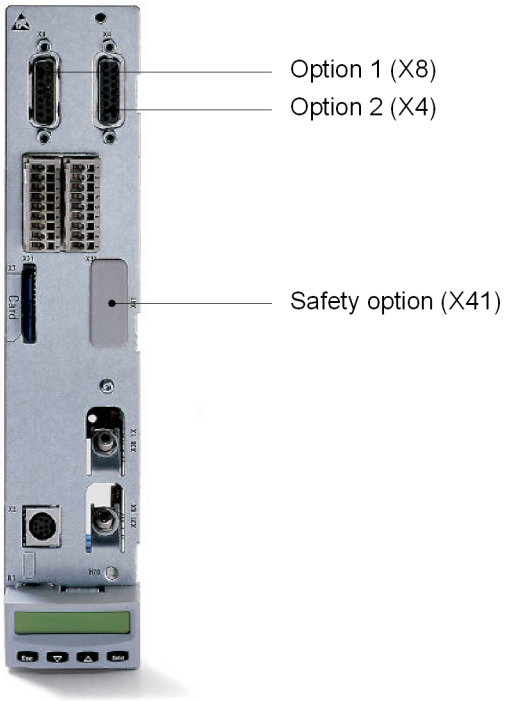


Fig. 5-2: BASIC control section type code (single-axis); (continuation)

BASIC UNIVERSAL single-axis CSB01.1C type code

See BASIC CSB01.1N type code

BASIC UNIVERSAL double-axis CDB01.1C type code

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		

1. Product
1.1 CDB . . . . . = CDB

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

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

4. Configuration option
4.1 configurable . . . . . = C

5. Communication
5.2 MultiEthernet . . . . . = ET
5.3 PROFIBUS . . . . . = PB
5.4 Sercos III . . . . . = S3
5.5 Sercos II . . . . . = SE

6. Option 1 (X4.1)
6.1 Encoder HSF / RSF . . . . . = EN1
6.2 Encoder EnDat 2.1 / 1Vss / TTL . . . . . = EN2
6.3 Encoder IndraDyn / Hiperface® / 1Vss / TLL = ENS
6.4 not equipped . . . . . = NNN

7. Option 2 (X4.2)
7.1 Encoder HSF / RSF . . . . . = EN1
7.2 Encoder EnDat 2.1 / 1Vss / TTL . . . . . = EN2
7.3 Encoder IndraDyn / Hiperface® / 1Vss / TTL . . . . . = ENS
7.4 not equipped . . . . . = NNN

8. Option 3 (X8.1)
8.1 Encoder HSF / RSF . . . . . = EN1
8.2 Encoder EnDat 2.1 / 1Vss / TTL . . . . . = EN2
8.3 Encoder IndraDyn / Hiperface® / 1Vss / TTL . . . . . = ENS
8.4 analog I/O extension . . . . . = MA1
8.5 Encoder emulator . . . . . = MEM
8.6 not equipped . . . . . = NNN

DT000011v04_en.FH

Fig. 5-3: BASIC control section type code (double-axis); (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	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® / 1 Vpp / TTL . . . . . = ENS
9.4 Analog I/O extension . . . . . = MA1
9.5 Encoder emulation. . . . . = MEM
9.6 Not equipped . . . . . = NNN

10. Safety option (X41.1 / X41.2)

10.1 With starting lockout. . . . . = L1
10.2 Safe Torque Off (SIL3 / cat. 3 PL e) . . . . . = L2
10.3 Without safety option. . . . . = NN
10.4 With safety technology I/O . . . . . = S1 (1)
10.5 Safe Motion (SIL2 / cat. 3 PL d) . . . . . = S2 (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) Safety options "S1" or "S2" are only allowed if "Option 1" or "Option 2" is equipped with a suitable encoder

Illustration example: CDB01.1

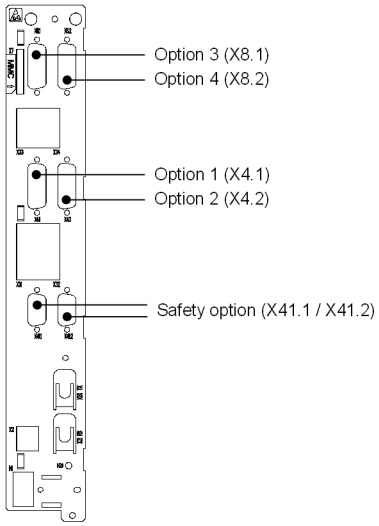


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Fig. 5-4: Control section double-axis type code (continuation)

5.3.2 BASIC dimensions

BASIC and BASIC UNIVERSAL single-axis dimensions

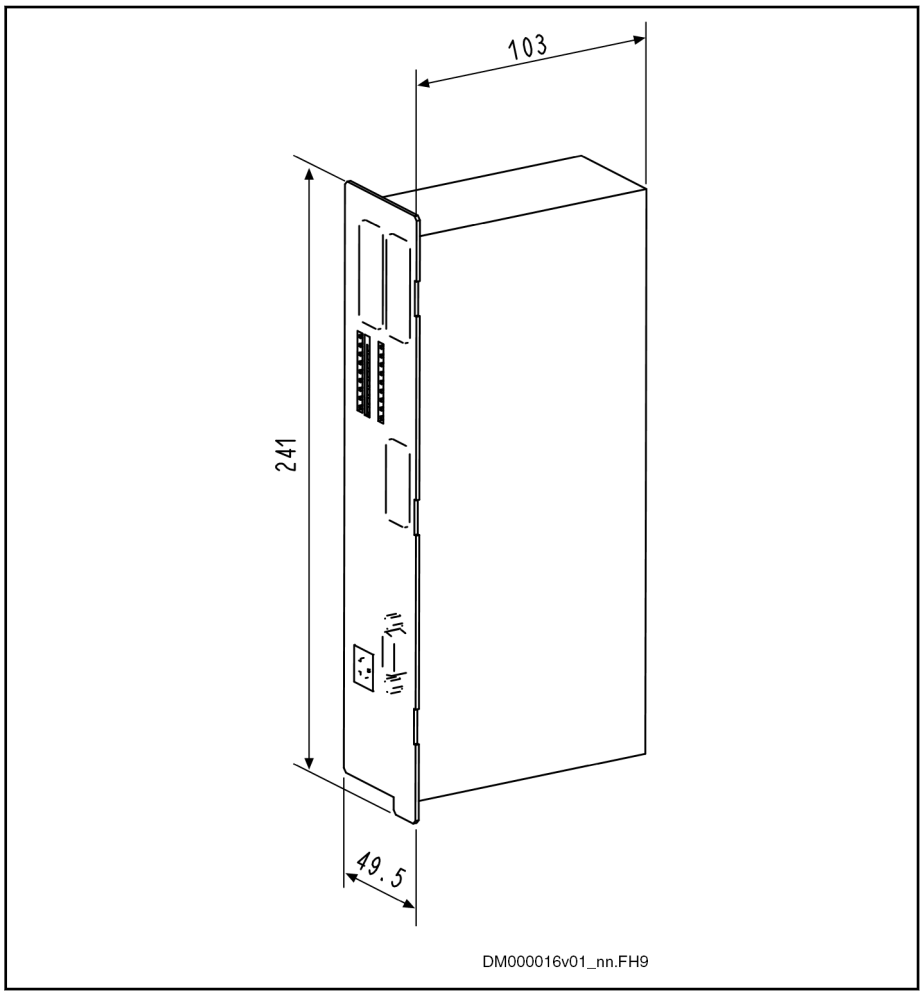


Fig. 5-5: CSB dimensions

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

BASIC UNIVERSAL double-axis dimensions

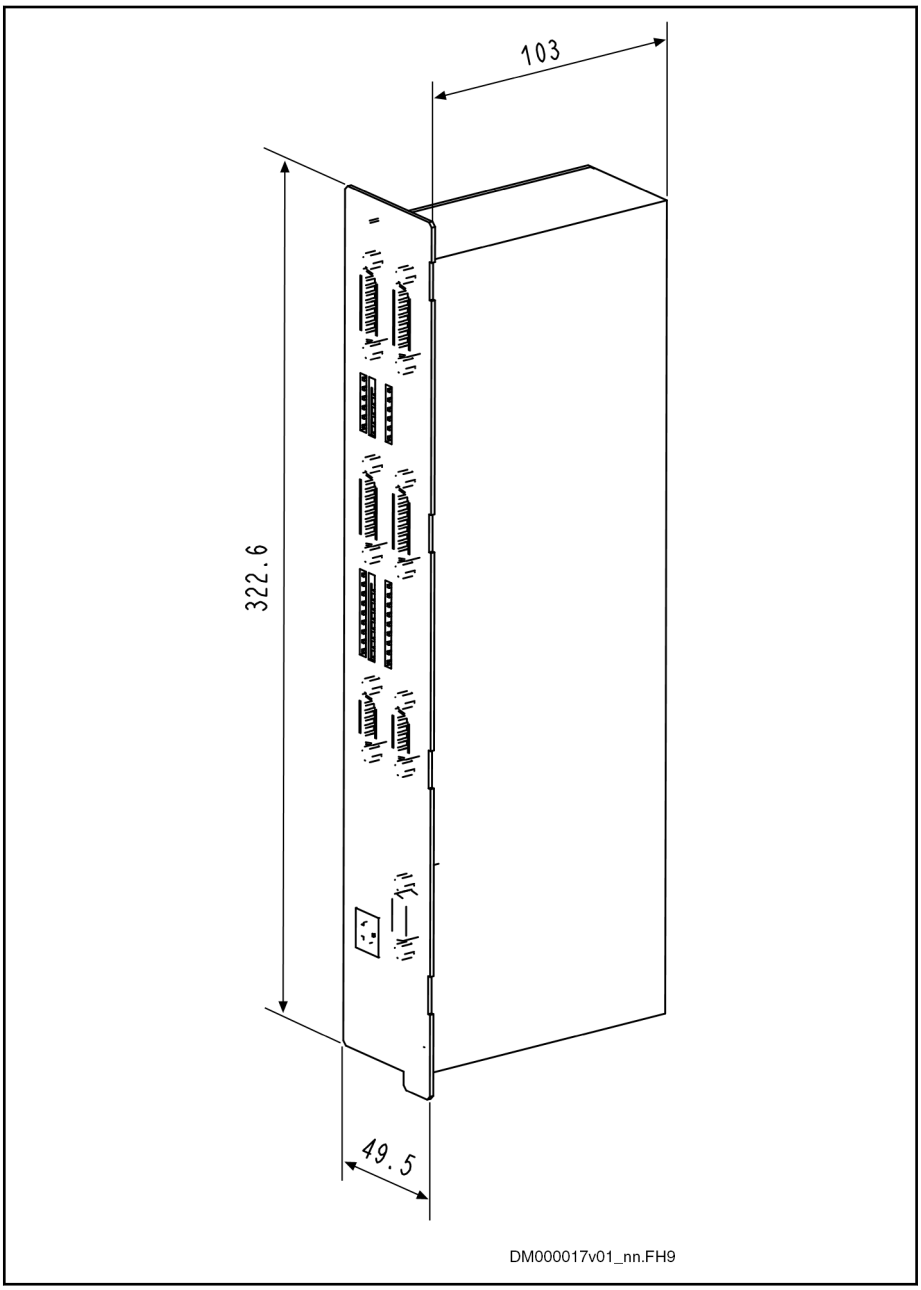
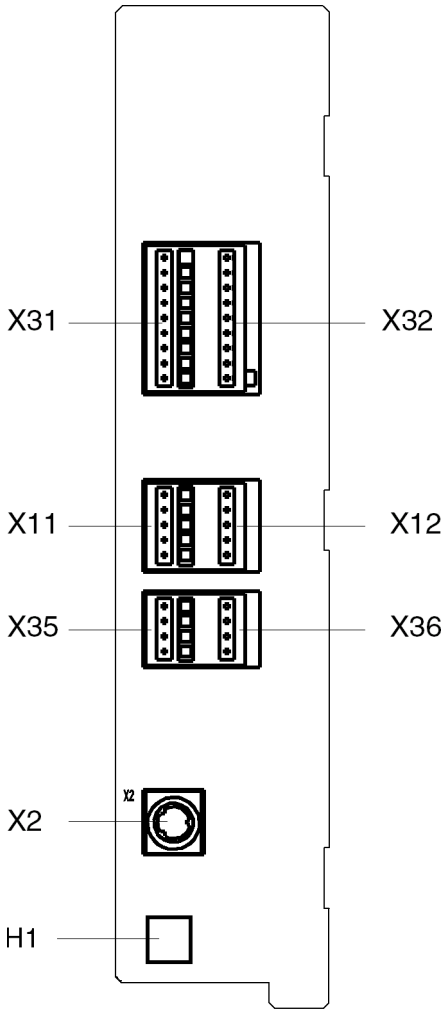


Fig. 5-6: CDB dimensions

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

Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	X31 / X32 Coding: X31: 1 X32: 9	0.75-1.5	20-14	-	Digital and analog inputs; analog outputs; voltage input (24V, 0V)
	X11 / X12 Coding: X11: 1 X12: 5	0.75-1.5	20-14	-	Relay contacts
	X35 / X36 Coding: X35: 1 X36: 4	0.75-1.5	20-14	-	Analog inputs / outputs; voltage output (24V, 0V)
	X2	0.25-0.5	-	-	Serial interface
	H1	-	-	-	Interface for control panel

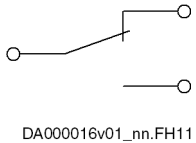
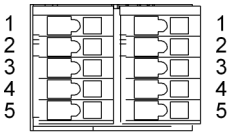
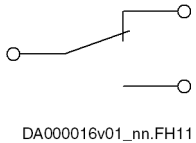
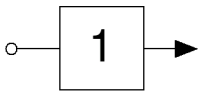
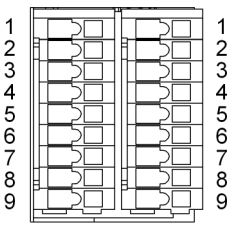
Tab. 5-3: BASIC OPENLOOP connections

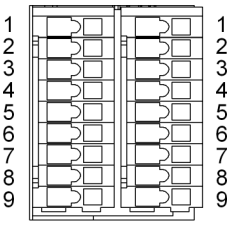
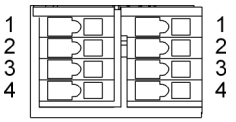
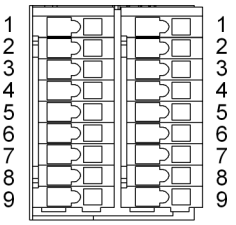
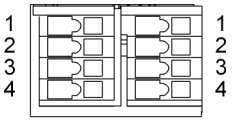
Functions and pin assignments

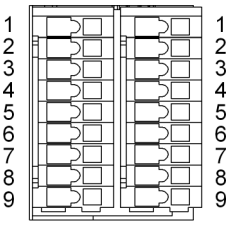
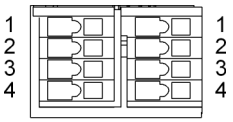
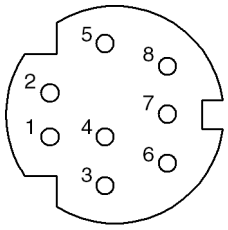
☞ The specified factory settings apply to firmware MPx-04VRS.

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

Function			Connection	Factory setting	Nominal data	Figure Data
Power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section "Power consumption"	
Relay contact Rel 3	 DA000016v01_nn.FH11	no Rel 3	X11.3	Speed reached S-0-0013	AC 250 V 2 A; DC 30 V 1 A	X11 I X12  DA000050v01_nn.FH9 Relay contact type 1 see chapter "Technical data - functions"
		com Rel 3	X11.4			
		nc Rel 3	X11.5			
Relay contact Rel 2	 DA000016v01_nn.FH11	no Rel 2	X12.3	Ready signal HMS: P-0-0115 HCS02/HCS03: P-0-0861	AC 250 V 2 A; DC 30 V 1 A	
		com Rel 2	X12.4			
		nc Rel 2	X12.5			
Relay contact Rel 1	 DA000017v01_nn.fh11	no Rel 1	X12.1	Ready for operation HMS: P-0-0115 HCS02/HCS03: P-0-0861	AC 250 V 2 A; DC 30 V 1 A	
		no Rel 1	X12.2			
Digital inputs	 DX000037v01_nn.fh11	I_1	X31.3	Clear error S-0-0099	24V 3 mA	X31 I X32  DA000051v01_nn.FH9 Digital inputs see chapter "Technical data - functions"
		I_2	X31.4	Drive ON P-0-4028		
		I_3	X31.5	Velocity cmd value from memory of fixed values P-0-1200		
		I_4	X31.6	Velocity cmd value from memory of fixed values P-0-1200		
		I_5	X31.7	Velocity cmd value from memory of fixed values P-0-1200		
		I_8	X32.6	E-Stop P-0-0223		
		I_9	X32.7	Velocity cmd value from memory of fixed values P-0-1200		
		I_10	X32.8	Velocity cmd value from memory of fixed values P-0-1200		

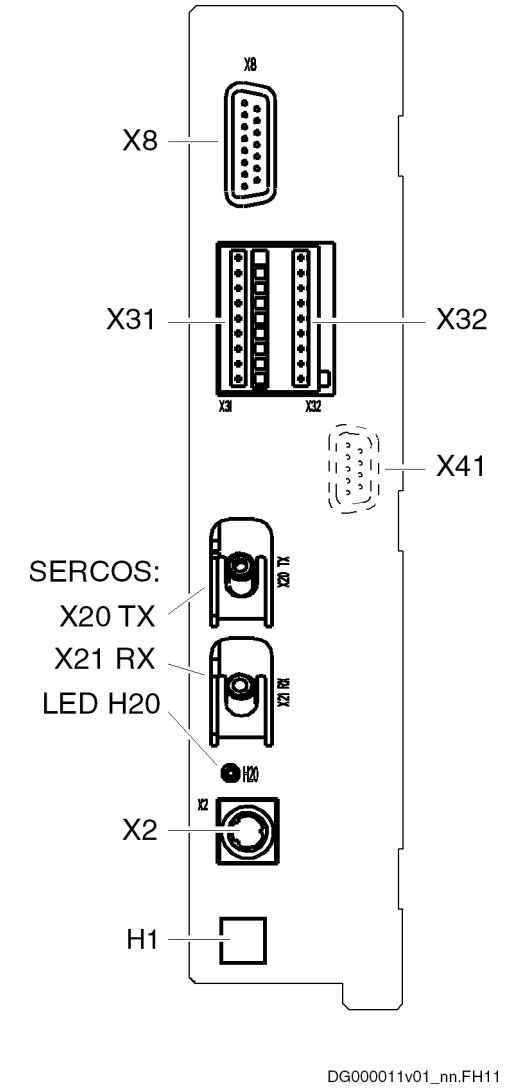
Function			Connection	Factory setting	Nominal data	Figure Data
Analog inputs	Voltage input	I_a_1+	X32.4		±10 V	X31 I X32  DA000051v01_nn.FH9 Analog inputs type 1 see chapter "Technical data - functions"
		I_a_1-	X32.5			
	Voltage input	I_a_2+	X32.1			
		I_a_2-	X32.2			
	Current input	I_ai3+	X36.1		0 … 20 mA	X35 I X36  DA000052v01_nn.FH9 Analog inputs type 3 see chapter "Technical data - functions"
		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 Analog outputs type 1 see chapter "Technical data - functions"
	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 Analog outputs type 1 see chapter "Technical data - functions"
	Reference potential for analog voltage output	GND_a	X35.4			

Function			Connection	Factory setting	Nominal data	Figure 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 see chapter "Technical data - functions"

Tab. 5-4: BASIC OPENLOOP functions

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 Coding: X31: 1 X32: 9	0.75-1.5	20-14	-	Digital inputs/outputs; voltage input (24V, 0V)
	X41	0.25-0.5		-	Optional: Starting lockout
	X20 / X21			0.3	Sercos communication
	X2	0.25-0.5	-	-	Serial interface
	H1	-	-	-	Interface for control panel

Tab. 5-5: BASIC SERCOS connections

Functions and pin assignments

The specified factory settings apply to the MPx-04VRS firmware.

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

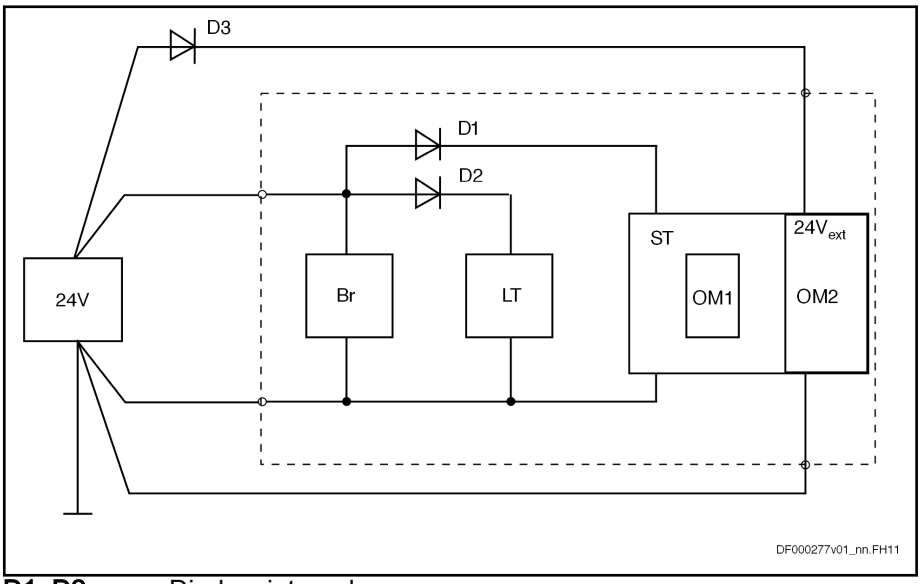
- Digital inputs/outputs

External supply required!

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

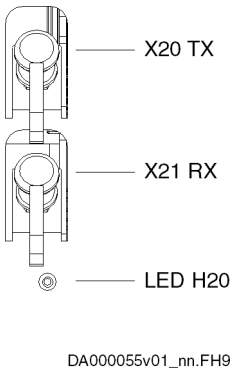
Use protective diode!

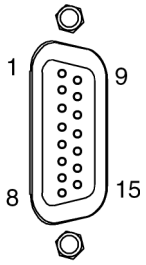
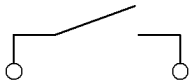
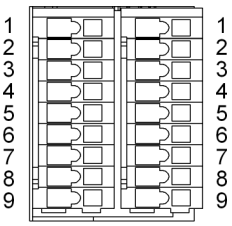
Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

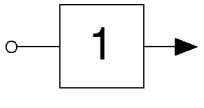
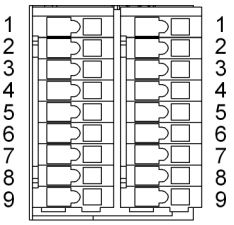
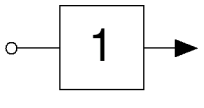
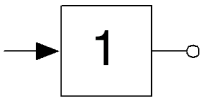
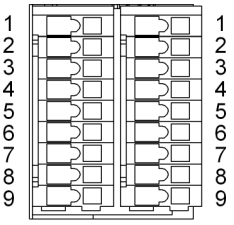


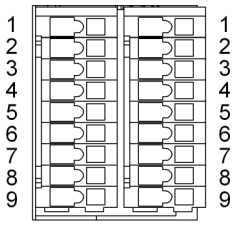
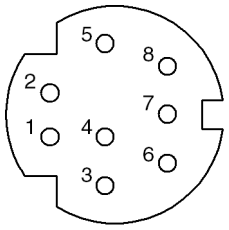
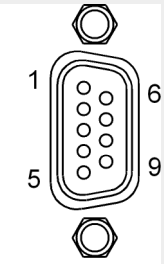
D1, D2 Diodes, internal
D3 Protective diode, external
LT Power section
BR Circuit motor holding brake
ST Control section
OM1 Optional modules
OM2 Optional modules with supply voltage connection, e.g. MA1, MD2

Fig. 5-7: Block Diagram of 24V Supply

Function			Connection	Factory setting	Nominal data	Figure Data
Power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section "Power consumption"	
Communication	sercos	SE	X20; X21		max. 16 MBaud	

Function			Connection	Factory setting	Nominal data	Figure Data
Encoder interfaces	ENS		X8		DC 11.6 V 300 mA	 DA000053v01_nn.FH9
Relay contact	 DA000017v01_nn.fh11	Rel 1 Rel 1	X31.1 X31.2	Ready for operation HMS: P-0-0115 HCS02/HCS03: P-0-0861	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 Relay contact type 2 see chapter "Technical data - functions"

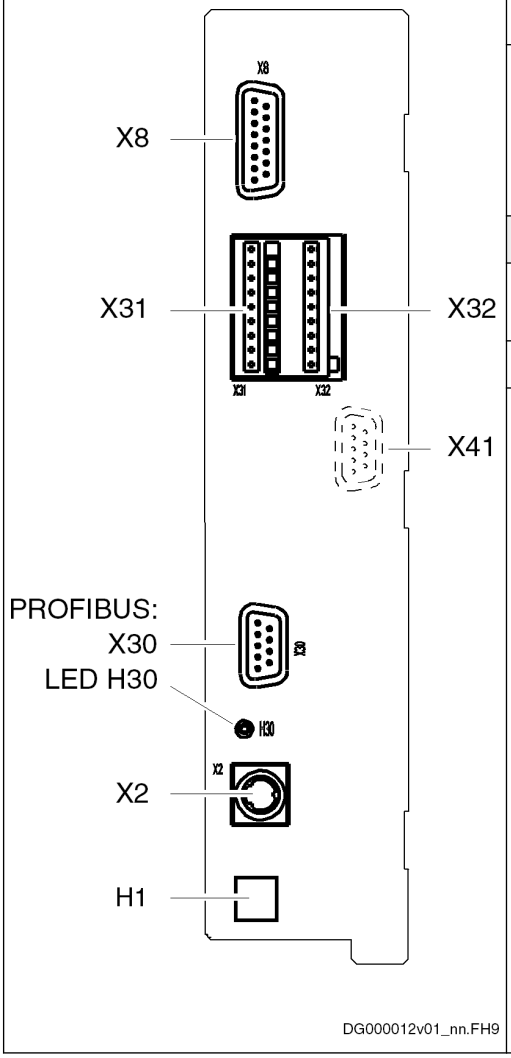
Function			Connection	Factory setting	Nominal data	Figure Data
Digital inputs	 DX000037v01_nn.fh11	I_1 Type B (probe)	X31.3	Probe 1 S-0-0401	can be configured as probe 24 V 3 mA typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical data - functions" → "Digital inputs type A" "Digital inputs type B (probe)" "Digital inputs type C (probe)"
	 DX000037v01_nn.fh11	I_2 Type C (probe)	X31.4		24V 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	 DX000038v01_nn.fh11	I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24V 0.5 A	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical data - functions"
		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			Connection	Factory setting	Nominal data	Figure 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 see chapter "Technical data - functions"
Optional: Starting lockout			X41			 DA000054v01_nn.FH9

Tab. 5-6: BASIC SERCOS functions

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 Coding: X31: 1 X32: 9	0.75-1.5	20-14	-	Digital inputs/outputs; voltage input (24V, 0V)
	X41	0.25-0.5		-	Optional: Starting lockout
	X30	0.08-0.5	-	-	PROFIBUS communication
	X2	0.25-0.5	n.s.	-	Serial interface
	H1	-	-	-	Interface for control panel

Tab. 5-7: BASIC PROFIBUS connections

Functions and pin assignments

The specified factory settings apply to the MPx-04VRS firmware.

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

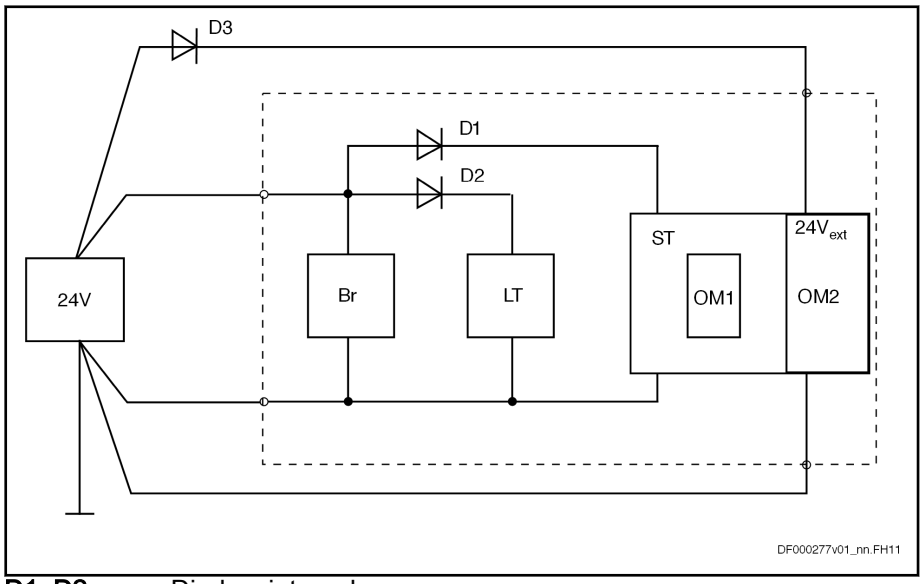
- Digital inputs/outputs

External supply required!

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

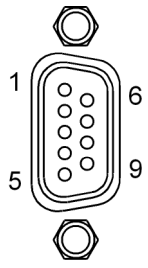
Use protective diode!

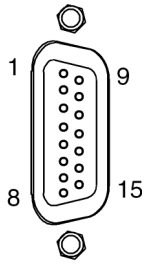
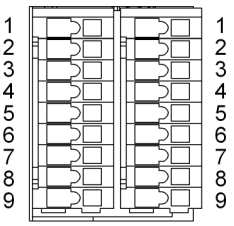
Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

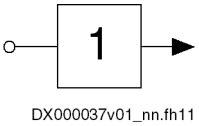
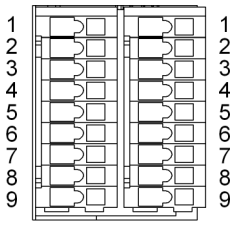
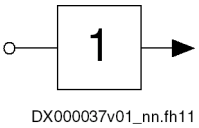
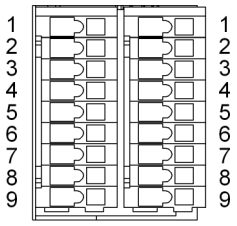


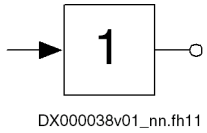
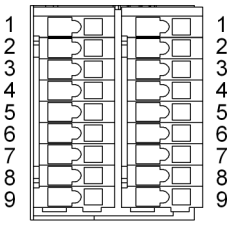
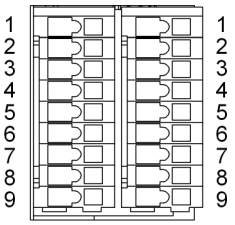
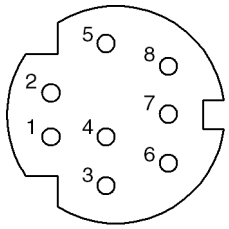
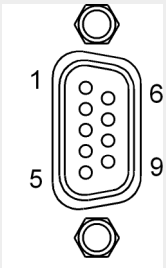
D1, D2 Diodes, internal
D3 Protective diode, external
LT Power section
BR Circuit motor holding brake
ST Control section
OM1 Optional modules
OM2 Optional modules with supply voltage connection, e.g. MA1, MD2

Fig. 5-8: Block Diagram of 24V Supply

Function			Connection	Factory setting	Nominal data	Figure Data
Power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section "Power consumption"	
Communication	PROFIBUS	PB	X30		12 MBaud	

Function			Connection	Factory setting	Nominal data	Figure Data
Encoder interfaces	ENS		X8		DC 11.6 V 300 mA	 DA000053v01_nn.FH9
Relay contact	 DA000017v01_nn.fh11	Rel 1 Rel 1	X31.1 X31.2	Ready for operation HMS: P-0-0115 HCS02/HCS03: P-0-0861	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 Relay contact type 2 see chapter "Technical data - functions"

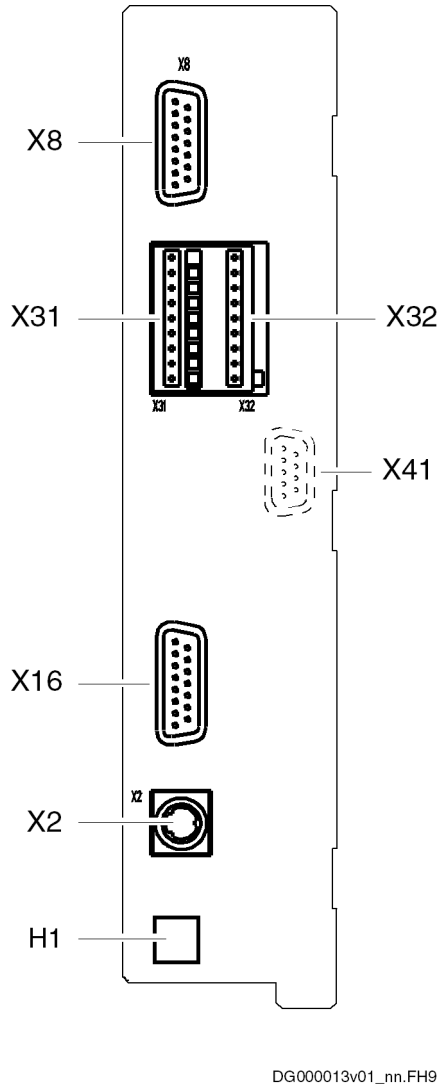
Function			Connection	Factory setting	Nominal data	Figure Data
Digital inputs	 DX000037v01_nn.fh11	I_1 Type B (probe)	X31.3	Probe 1 S-0-0401	can be configured as probe 24 V 3 mA typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical Data - Functions" → "Digital inputs type B (probe)"
	 DX000037v01_nn.fh11	I_2 Type C (probe)	X31.4		24V 3 mA	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical Data - functions" → "Digital inputs type A" "Digital inputs type C (probe)"
		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		

Function			Connection	Factory setting	Nominal data	Figure Data
Digital outputs	 DX000038v01_nn.fh11	I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24V 0.5 A	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical data - functions"
		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		
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 see chapter "Technical data - functions"
Optional: Starting lockout			X41			 DA000054v01_nn.FH9

Tab. 5-8: BASIC PROFIBUS functions

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 Coding: X31: 1 X32: 9	0.75-1.5	20-14	-	Digital inputs/outputs; analog inputs; 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

Tab. 5-9: BASIC ANALOG connections

Functions and pin assignments

The specified factory settings apply to the MPx-04VRS firmware.

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

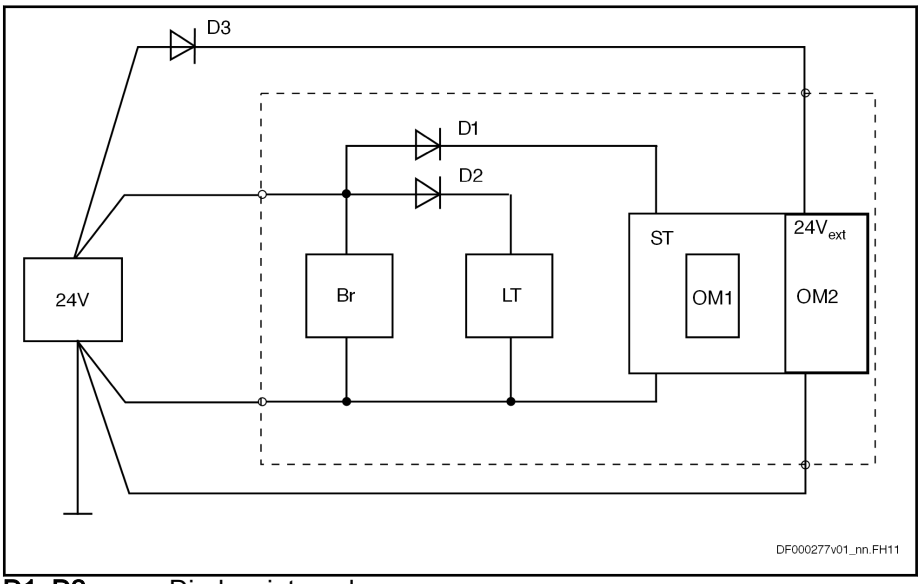
- Analog inputs
- Digital inputs/outputs

External supply required!

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

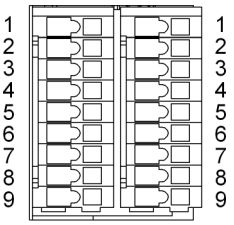
Use protective diode!

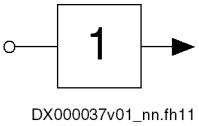
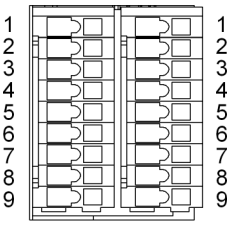
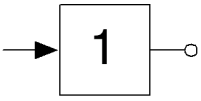
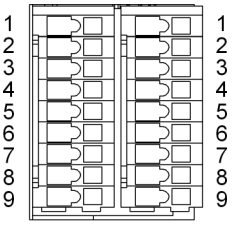
Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

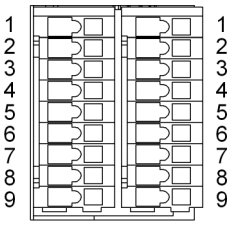
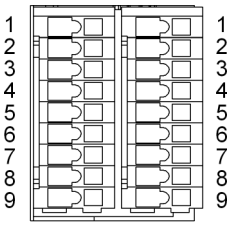
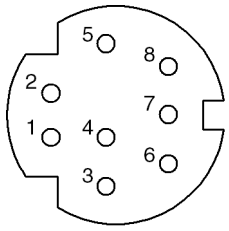


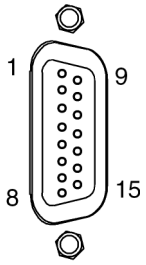
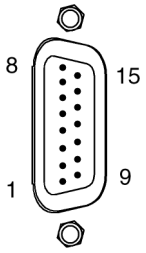
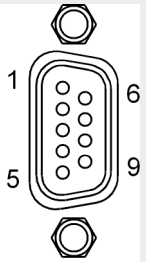
D1, D2 Diodes, internal
D3 Protective diode, external
LT Power section
BR Circuit motor holding brake
ST Control section
OM1 Optional modules
OM2 Optional modules with supply voltage connection, e.g. MA1, MD2

Fig. 5-9: Block Diagram of 24V Supply

Function			Connection	Factory setting	Nominal data	Figure 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 HMS: P-0-0115 HCS02/HCS03: P-0-0861	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 Relay contact type 2 see chapter "Technical data - functions"
		Rel 1	X31.2			

Function			Connection	Factory setting	Nominal data	Figure Data
Digital inputs	 DX000037v01_nn.fh11	I_1	X31.3	Clear error S-0-0099	24V 3 mA	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical data - functions"
		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		
Digital outputs	 DX000038v01_nn.fh11	I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24V 0.5 A	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical data - functions"
		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 HMS: P-0-0115 HCS02/HCS03: P-0-0861		
		I/O_11	X32.9	Warning HMS: P-0-0115 HCS02/HCS03: P-0-0861		

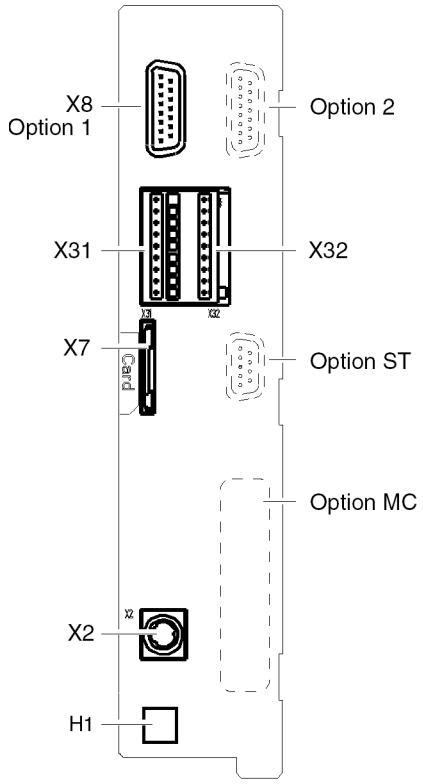
Function			Connection	Factory setting	Nominal data	Figure Data
Analog inputs	Voltage input	I_a_1+	X32.4		±10 V	X31 I X32  DA000051v01_nn.FH9 Analog inputs type 1 Example of connection see chapter, 7-11 "Shield connection X32" on page 171
		I_a_1-	X32.5			
	Voltage input	I_a_2+	X32.1			
		I_a_2-	X32.2			
	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			
Serial interface	RS232		X2			 DA000049v01_nn.FH see chapter "Technical data - functions"

Function			Connection	Factory setting	Nominal data	Figure Data
Encoder interfaces	ENS		X8		DC 11.6 V 300 mA	 DA000053v01_nn.FH9
Encoder emulation	MEM		X16			 DA000056v01_nn.FH9
Optional: Starting lockout			X41			 DA000054v01_nn.FH9

Tab. 5-10: BASIC ANALOG functions

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 Coding: X31: 1 X32: 9	0.75-1.5	20-14	-	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 = communication

Tab. 5-11: BASIC UNIVERSAL single-axis CSB01.1C connections

Functions and pin assignments

The specified factory settings apply to the MPx-04VRS firmware.

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

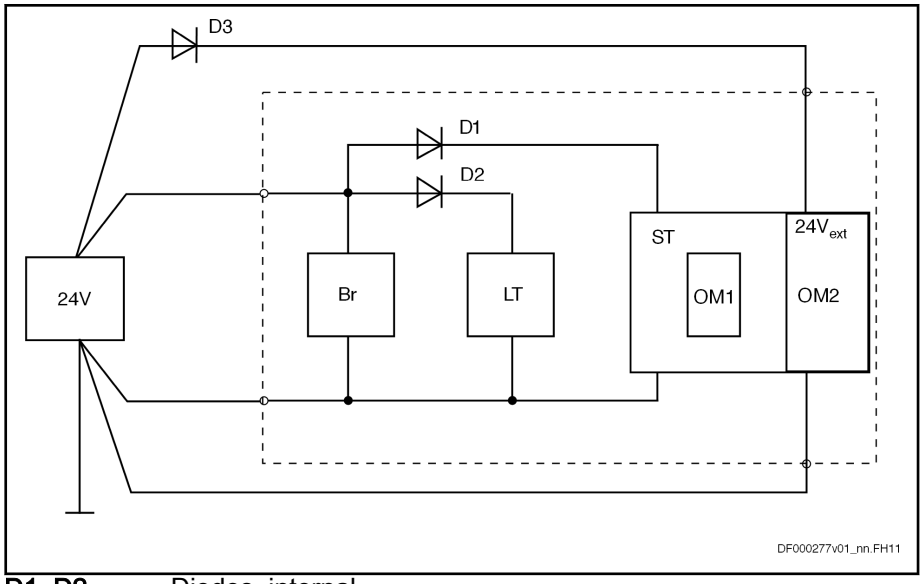
- Digital inputs/outputs

External supply required!

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

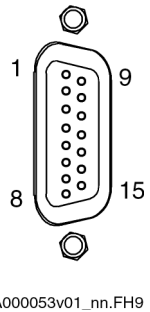
Use protective diode!

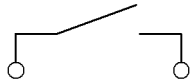
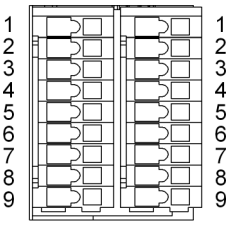
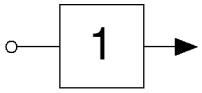
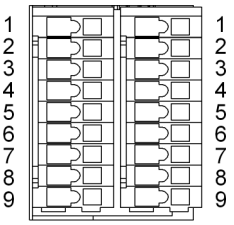
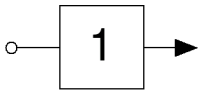
Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.

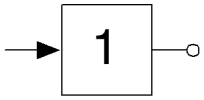
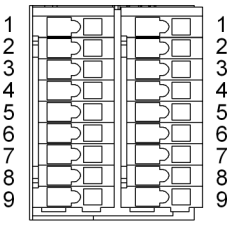
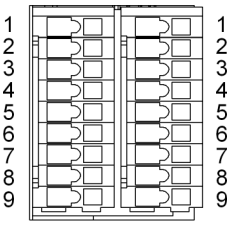
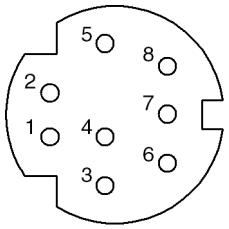


D1, D2 Diodes, internal
D3 Protective diode, external
LT Power section
BR Circuit motor holding brake
ST Control section
OM1 Optional modules
OM2 Optional modules with supply voltage connection, e.g. MA1, MD2

Fig. 5-10: Block Diagram of 24V Supply

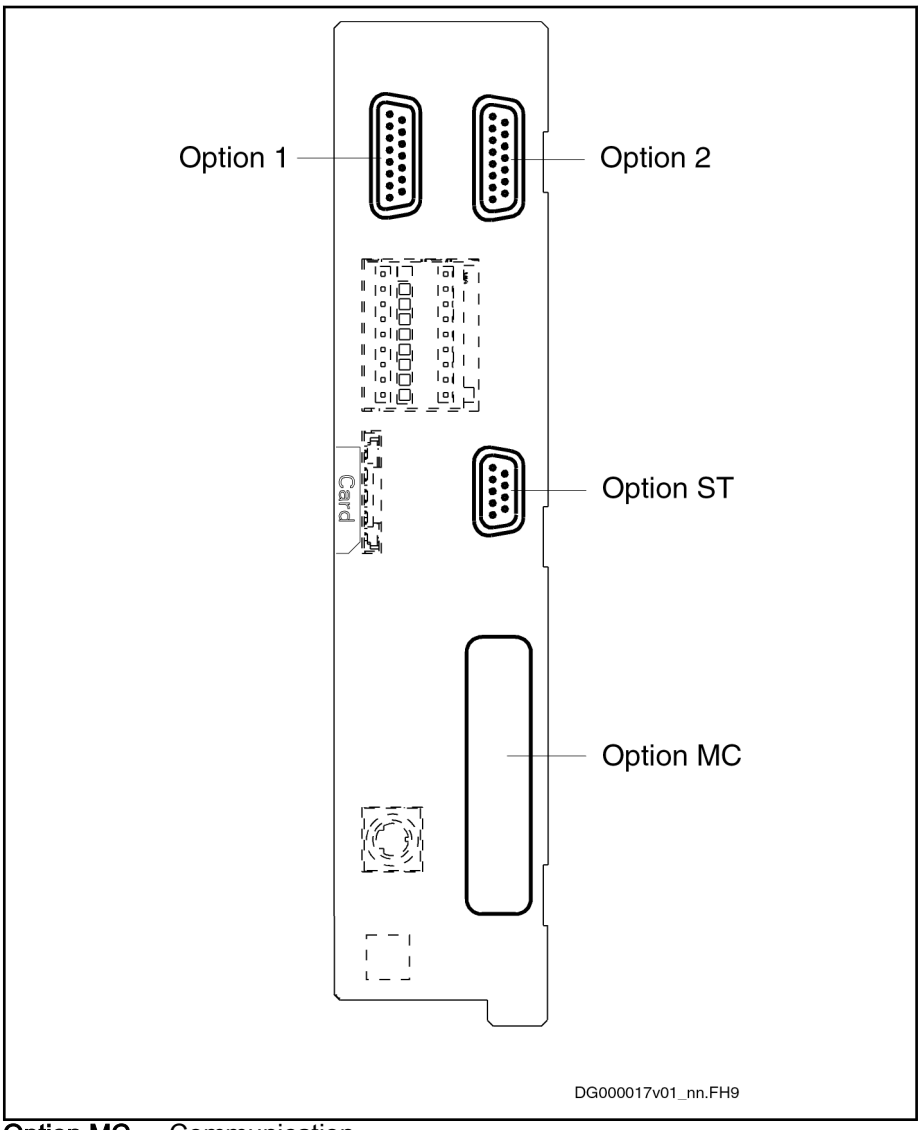
Function			Connection	Factory setting	Nominal data	Figure Data
Power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section "Power consumption"	
Communication	Configurable					
Encoder interfaces	ENS		X8		DC 11.6 V 300 mA	

Function			Connection	Factory setting	Nominal data	Figure Data
Relay contact	 DA000017v01_nn.fh11	Rel 1	X31.1	Ready for operation HMS: P-0-0115 HCS02/HCS03: P-0-0861	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 Relay contact type 2 see chapter "Technical data - functions"
		Rel 1	X31.2			
Digital inputs	 DX000037v01_nn.fh11	I_1 Type B (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 see chapter "Technical Data - functions" → "Digital inputs type A" "Digital inputs type B (probe)" "Digital inputs type C (probe)"
	 DX000037v01_nn.fh11	I_2 Type C (probe)	X31.4		24V 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		

Function			Connection	Factory setting	Nominal data	Figure Data
Digital outputs	 DX000038v01_nn.fh11	I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24V 0.5 A	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical data - functions"
		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		
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 see chapter "Technical data - functions"
Optional functions	Allowed options: see configuration table					see corresponding optional module

Tab. 5-12: BASIC UNIVERSAL single-axis CSB01.1C functions

Optional slots



Option MC Communication
Option ST Safety technology

Fig. 5-11: Optional slots for BASIC UNIVERSAL single-axis CSB01.1C

The 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 (X8, on board)	Option 2 (X4)	Option ST (X41)	Memory card slot (X7)	Control panel (H1)
AN	-	-	-	-	-	-
SE	■	-	-	-	-	-
PB	■	-	-	-	-	-

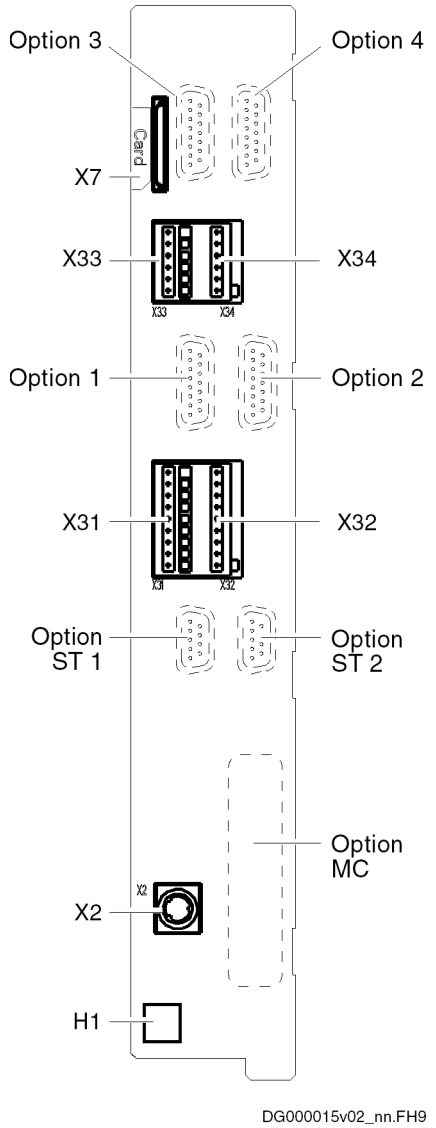
Optional module	Optional slot					
	Option MC	Option 1 (X8, on board)	Option 2 (X4)	Option ST (X41)	Memory card slot (X7)	Control panel (H1)
PL	■	-	-	-	-	-
CO	■	-	-	-	-	-
ET	■	-	-	-	-	-
S3	■	-	-	-	-	-
CCD	-	-	-	-	-	-
ENS	-	■	■	-	-	-
EN1	-	-	■	-	-	-
EN2	-	-	■	-	-	-
MEM	-	-	■	-	-	-
MA1	-	-	■	-	-	-
MD1	-	-	-	-	-	-
MD2	-	-	-	-	-	-
L1	-	-	-	■	-	-
L2	-	-	-	■	-	-
S1	-	-	-	-	-	-
S2	-	-	-	-	-	-
S	-	-	-	-	-	■
PFM02	-	-	-	-	■	-

■ Allowed optional module at optional slot
- Not allowed

Tab. 5-13: CSB01.1C 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 Coding: X33: 1 X34: 6	0.75-1.5	20-14	-	Digital inputs
					Option 1
					Option 2
	X31 / X32 Coding: X31: 1 X32: 9	0.75-1.5	20-14	-	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 = communication

Tab. 5-14: BASIC UNIVERSAL double-axis connections

Functions and pin assignments

The specified factory settings apply to firmware MPx-04VRS.

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

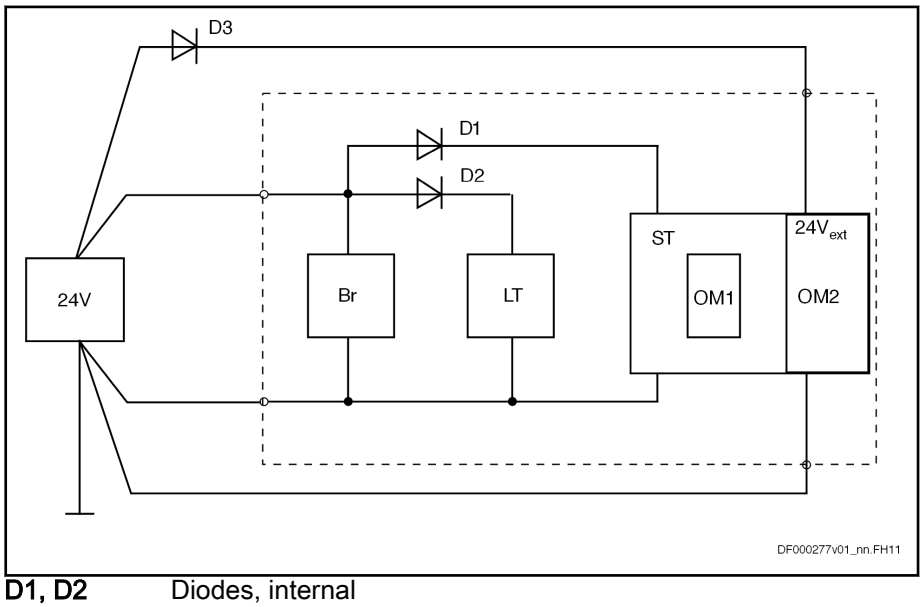
- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

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.



D1, D2	Diodes, internal
D3	Protective diode, external
LT	Power section
BR	Circuit motor holding brake
ST	Control section
OM1	Optional modules
OM2	Optional modules with supply voltage connection, e.g. MA1, MD2

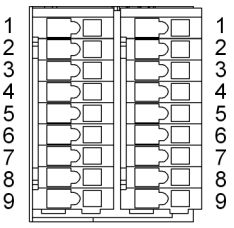
Fig. 5-12: Block Diagram of 24V Supply

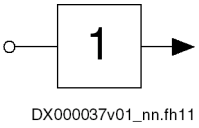
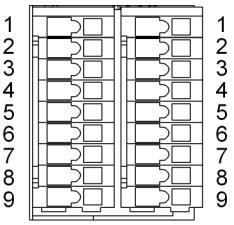
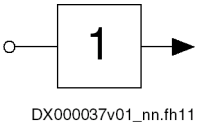
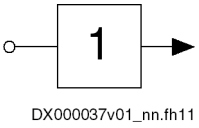
Low input resistance

The digital inputs I_6 and I_7 are mounted in parallel to the analog input I_a_1. 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

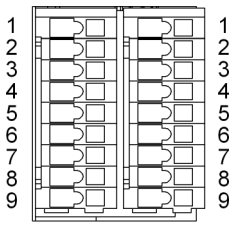
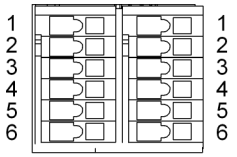
If you need a low degree of linearity error, use signal sources with the lowest possible impedance at the analog input I_a_1. For example, you achieve a linearity error smaller 5% with a 1 kohm potentiometer and smaller 2.5% with a 500 ohm potentiometer.

Function			Connection	Factory setting	Nominal data	Figure Data
Power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see section "Power consumption"	
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 Relay contact type 2 see chapter "Technical data - functions"
		Rel 1	X31.2			

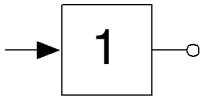
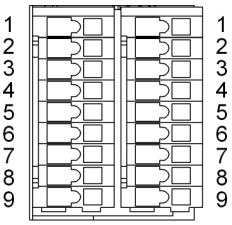
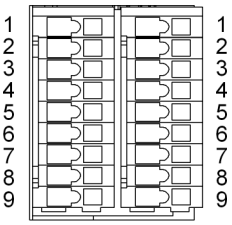
Function			Connection	Factory setting	Nominal data	Figure Data
Digital inputs	 DX000037v01_nn.fh11	I_1 *) Type B (probe)	X31.3	Axis 1: Probe 1 S-0-0401	can be configured as probe; 24 V 3 mA typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical Data - functions" → "Digital inputs type A" "Digital inputs type B (probe)" "Digital inputs type D"
	 DX000037v01_nn.fh11	I_2 *) Type B (probe)	X31.4	Axis 2: Probe 1 S-0-0401		
	 DX000037v01_nn.fh11	I_3	X31.5	Axis 1: Travel range limit switch P-0-0222	24V 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 Type D	X32.4	Can also be used as analog input; see I_a_1+		
		I_7 Type D	X32.5	Can also be used as analog input; see I_a_1-		

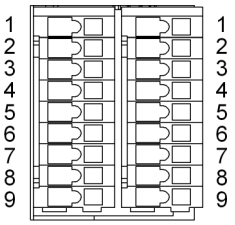
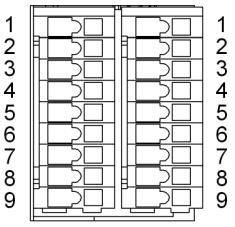
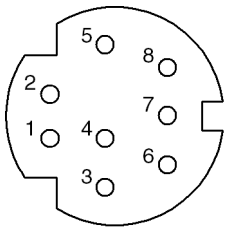
*) As regards the axes, signals can only be assigned to the probe inputs in the way specified by the factory setting.

Tab. 5-15: BASIC UNIVERSAL double-axis CDB01.1C functions

Function			Connection	Factory setting	Nominal data	Figure Data
		I/O_8	X32.6	Axis 1, axis 2: E-Stop P-0-0223		X31 I X32  DA000051v01_nn.FH9 X33 I X34  DA000059v01_nn.FH9 see chapter "Technical Data - functions" → "Digital inputs type A" "Digital inputs type C (probe)"
		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		
		I_12	X33.1			
		I_13	X33.2			
		I_14	X33.3			
		I_15	X33.4			
		I_16 *) Type C (probe[1)])	X33.5	Axis 1: Probe 2 S-0-0402		
		I_17	X33.6			
		I_18	X34.1			
		I_19	X34.2			
		I_20	X34.3			
		I_21	X34.4			
		I_22 **) Type C (probe)	X34.5	Axis 2: Probe 2 S-0-0402		
	Reference potential for digital inputs	0V	X34.6			

1) *with FWA-…-MPD05V06 and above*

Function			Connection	Factory setting	Nominal data	Figure Data
Digital outputs	 DX000038v01_nn.fh11	I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24V 0.5 A	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical data - functions"
		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  DA000051v01_nn.FH9 Analog inputs type 4 see chapter "Technical data - functions" Example of connection see chapter 7-11 "Shield connection X32" on page 171
		I_a_1-	X32.5	Can also be used as digital input I_7		

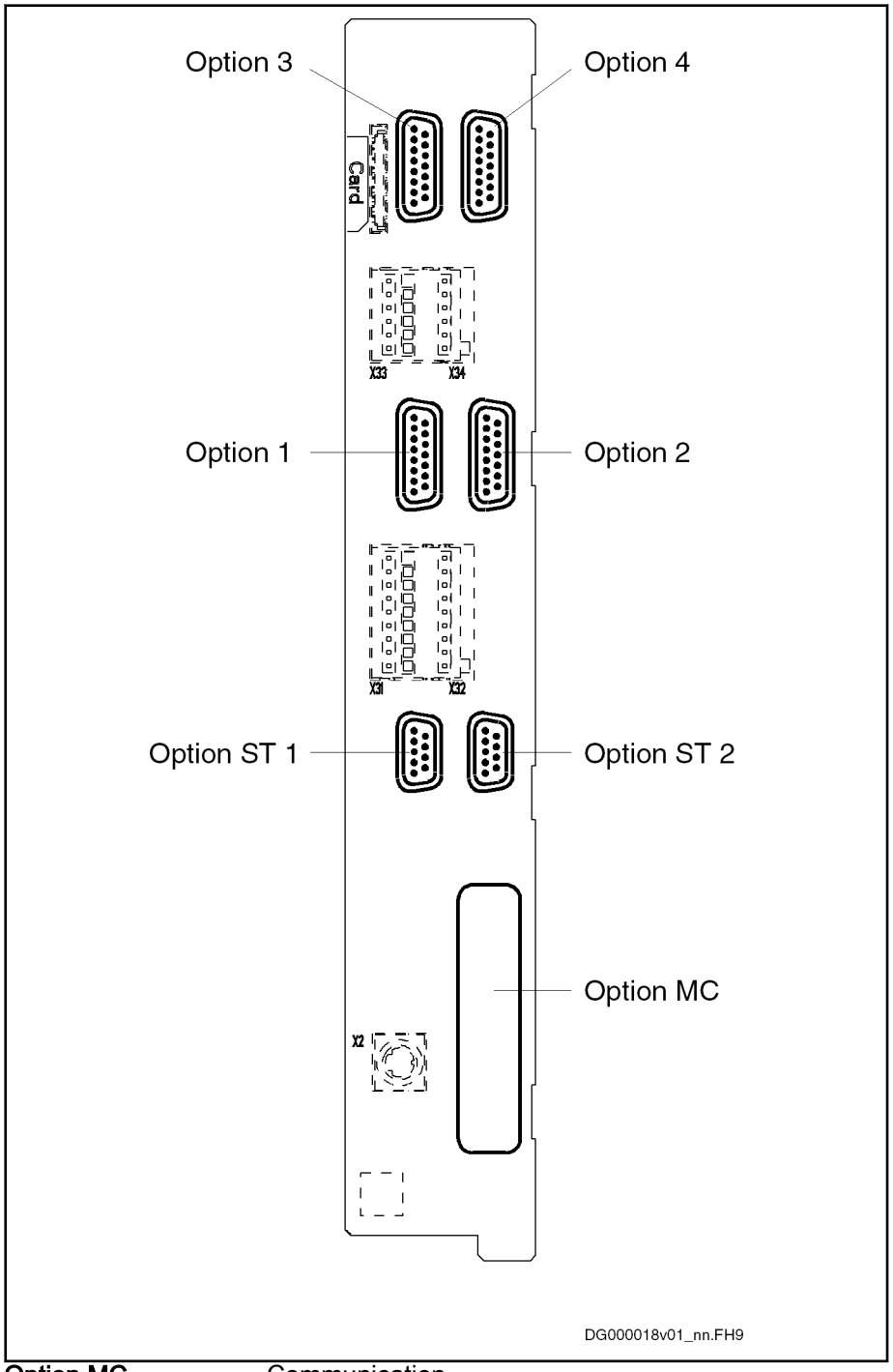
Function			Connection	Factory setting	Nominal data	Figure Data
Analog outputs	Voltage output	O_a_1	X32.1		5 V 1 mA	X31 I X32  DA000051v01_nn.FH9 Analog outputs type 2 see chapter "Technical data - functions" Example of connection see chapter 7-11 "Shield connection X32" on page 171
		O_a_2	X32.2			
	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			
Serial interface	RS232		X2			 DA000049v01_nn.FH see chapter "Technical data - functions"
Optional functions	Allowed options: see configuration table					see corresponding optional module

*) This probe input can only be evaluated by axis 1; probe evaluation available with FWA-…-MPD05V06 and above

**) This probe input can only be evaluated by axis 2; probe evaluation available with FWA-…-MPD05V06 and above

Tab. 5-16: BASIC UNIVERSAL double-axis CDB01.1C functions

Optional slots



Option MC Communication
Options ST1 and ST2 Safety technology

Fig. 5-13: Options for BASIC UNIVERSAL double-axis CDB01.1C

☞ The 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 (OM)	Optional slot (OS)								
	Option MC	Option 1 (X4.1)	Option 2 (X4.2)	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)
AN	-	-	-	-	-	-	-	-	-
SE	■	-	-	-	-	-	-	-	-
PB	■	-	-	-	-	-	-	-	-
PL	-	-	-	-	-	-	-	-	-
CO	-	-	-	-	-	-	-	-	-
ET	■	-	-	-	-	-	-	-	-
S3	■	-	-	-	-	-	-	-	-
CCD	-	-	-	-	-	-	-	-	-
ENS 1)	-	■	■	■	■	-	-	-	-
EN1 1)	-	■	■	■	■	-	-	-	-
EN2 1)	-	■	■	■	■	-	-	-	-
MEM	-	-	-	■	■	-	-	-	-
MA1 1)	-	-	-	■	■	-	-	-	-
MD1	-	-	-	-	-	-	-	-	-
MD2	-	-	-	-	-	-	-	-	-
L1 2)	-	-	-	-	-	■	■	-	-
L2 2)	-	-	-	-	-	■	■	-	-
S1 2)	-	-	-	-	-	■	■	-	-
S2 2)	-	-	-	-	-	■	■	-	-
S	-	-	-	-	-	-	-	-	■
C	-	-	-	-	-	-	-	-	■
PFM02	-	-	-	-	-	-	-	■	-

1) Axis function, allowed twice
2) Device function
■ Allowed optional module at optional slot
- Not allowed

Tab. 5-17: CDB01.1C configuration table

Device function - axis function

Optional modules for axis functions can be configured for **each axis** of the device.

Optional modules for device functions may only be configured **once** per device.

5.4 ADVANCED control sections

5.4.1 ADVANCED - CSH01.1C type code

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						

1. Product
1.1 CSH. . . . . = CSH

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

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

4. Configuration option
4.1 configurable . . . . . = C

5. Communication
5.1 CANopen / DeviceNet mit D-Sub-Stecker = CD
5.2 CANopen / DeviceNet . . . . . = CO
5.3 MultiEthernet . . . . . = ET
5.4 PROFIBUS . . . . . = PB
5.5 Parallel-Interface . . . . . = PL
5.6 Sercos III . . . . . = S3
5.7 Sercos II . . . . . = SE
5.8 not equipped . . . . . = NN

6. Option 1 (X4)
6.1 Encoder HSF / RSF . . . . . = EN1
6.2 Encoder EnDat 2.1 / 1Vss / TTL . . . . . = EN2
6.3 Encoder IndraDyn / Hiperface® / 1 Vss / TTL = ENS
6.4 not equipped . . . . . = NNN

7. Option 2 (X8)
7.1 Encoder HSF / RSF . . . . . = EN1
7.2 Encoder EnDat 2.1 / 1Vss / TTL . . . . . = EN2
7.3 Encoder IndraDyn / Hiperface® / 1 Vss / TTL . . . . = ENS
7.4 analoge I/O extension . . . . . = MA1
7.5 Encoder emulation. . . . . = MEM
7.6 not equipped . . . . . = NNN

DT000013v03_en.FH11

Fig. 5-14: ADVANCED control section type code (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 Encoder HSF / RSF . . . . . = EN1
8.2 Encoder EnDat 2.1 / 1Vss / TTL . . . . . = EN2
8.3 Encoder IndraDyn / Hiperface® / 1Vss / TLL . . . . . = ENS
8.4 analog I/O extension . . . . . = MA1
8.5 digital I/O extension . . . . . = MD1
8.6 digital I/O extension with SSI encoder interface . . . . . = MD2
8.7 Encoder emulator . . . . . = MEM
8.8 not equipped . . . . . = NNN

9. Safety option (X41)
9.1 Safe Torque Off (SIL3 / cat. 3 PL e) . . . . . = L2
9.2 without safety option . . . . . = NN
9.3 Safe Motion (SIL2 / cat. 3 PL d) . . . . . = S2 (1)

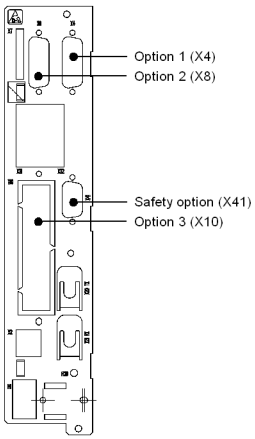
10. Control panel
10.1 Standard control panel . . . . . = S

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 "S2" is only allowed if "Option 1" is equipped with a suitable encoder

Illustration example: CSH01.1



DT000014v03_en.FH11

Fig. 5-15: ADVANCED control section type code (CSH01.1C); (continuation)

5.4.2 ADVANCED - CSH01.2C type code

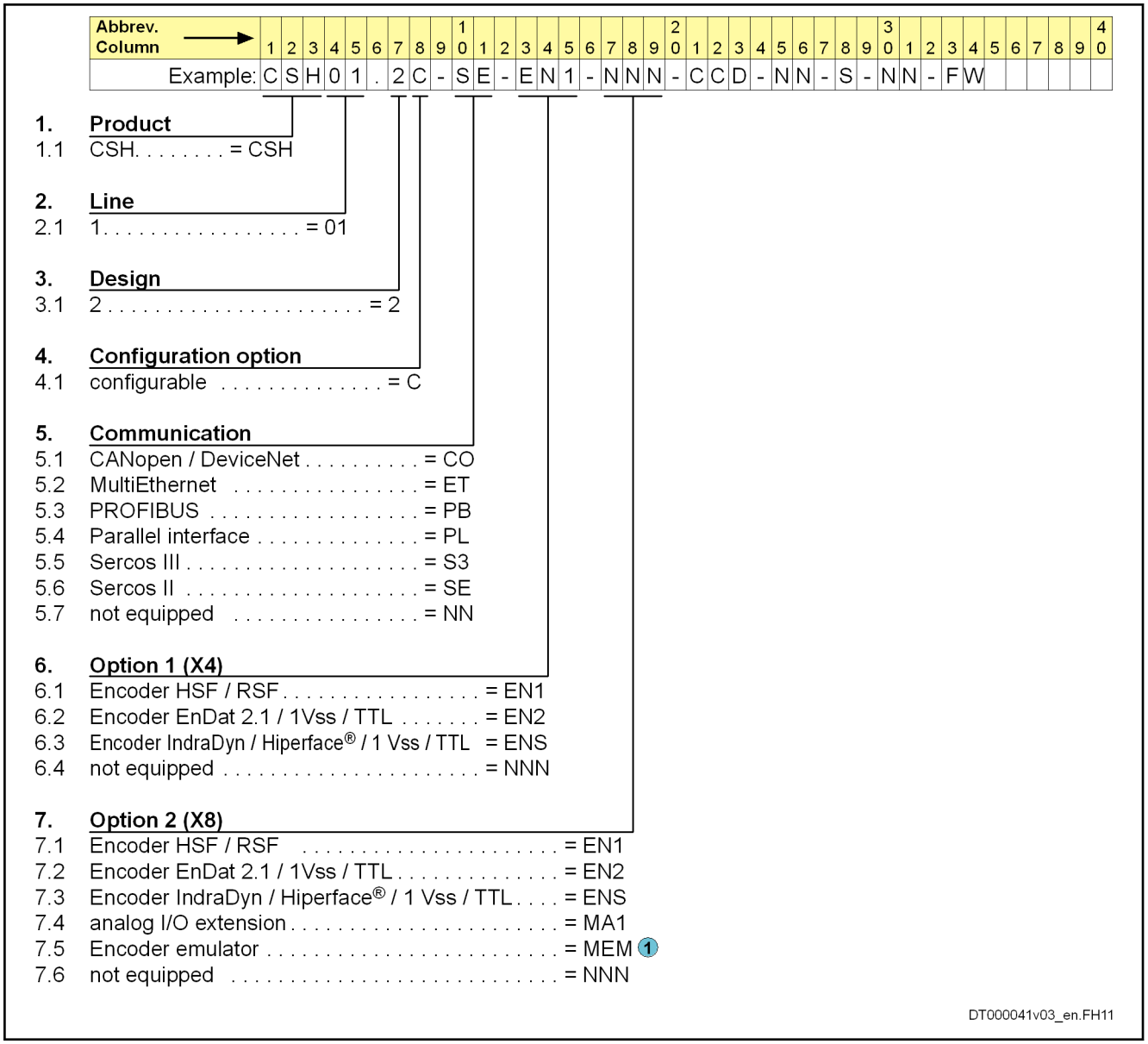


Fig. 5-16: ADVANCED control section type code (CSH01.2C); (to be continued)

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	.	2	C	-	S	E	-	E	N	1	-	N	N	N	-	C	C	D	-	N	N	-	S	-	N	N	-	F	W							

8. Option 3 (X10)
8.1 Cross communication drive . . . . . = CCD

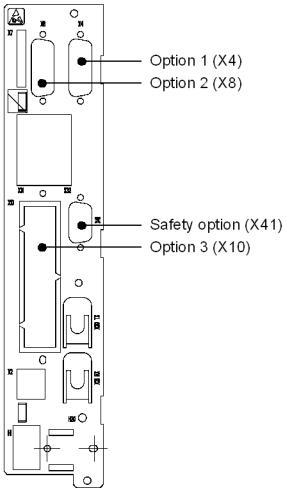
9. Safety option (X41)
9.1 with starting lockout. . . . . = L1
9.2 without safety option. . . . . = NN
9.3 with safety technology I/O . . . . . = S1

10. Control panel
10.1 Standard contrplpanel . . . . . = S

11. Other design
11.1 none . . . . . = NN

12. Firmware
12.1 Denotes that firmware must be ordered separately . . . . . = FW

Illustration example: CSH01.2



DT000042v03_en.FH11

Fig. 5-17: ADVANCED control section type code (CSH01.2C); (continuation)

05 Communication						06 Option 1	07 Option 2	09 Safety option
-	-	-	-	-	-	EN1	EN1	L1
-	-	-	-	-	-			NN
-	-	PB	-	-	-			S1
-	-	PB	-	-	-		EN2	L1
CO	-	PB	PL	-	-			NN
-	-	PB	PL	-	-			S1
-	-	-	-	-	-		ENS	L1
-	-	-	-	-	-			NN
-	-	PB	-	-	-			S1
-	-	-	-	-	-		MA1	L1
-	-	-	PL	-	-			NN
-	-	PB	-	-	-			S1
-	-	-	-	-	-		MEM	L1
-	NN	PB	-	-	SE			NN
-	-	PB	-	-	-			S1
-	NN	PB	-	-	-		NNN	L1
CO	NN	PB	PL	-	SE			NN
-	-	PB	PL	-	SE			S1
-	-	-	-	-	-	EN2	EN1	L1
-	-	-	-	-	-			NN
CO	-	PB	PL	-	SE			S1
-	-	-	-	-	-		EN2	L1
-	NN	PB	PL	-	SE			NN
-	NN	PB	-	-	SE			S1
-	-	-	-	-	-		ENS	L1
-	-	-	-	-	-			NN
-	-	PB	PL	-	-			S1
-	-	-	PL	-	-		MA1	L1
-	NN	PB	PL	-	-			NN
-	-	PB	PL	-	SE			S1
-	NN	PB	PL	-	-		MEM	L1
-	NN	PB	PL	-	-			NN
-	-	PB	PL	-	-			S1
CO	NN	PB	PL	-	-		NNN	L1
CO	NN	PB	PL	-	SE			NN
-	-	PB	PL	-	SE			S1
-	-	PB	-	-	SE	ENS	EN1	L1
CO	NN	PB	PL	-	-			NN
-	-	PB	-	-	SE			S1
CO	NN	PB	PL	-	SE		EN2	L1
CO	NN	PB	PL	S3	SE			NN
CO	NN	PB	PL	S3	SE			S1
-	NN	PB	PL	-	-		ENS	L1
CO	NN	PB	PL	-	-			NN
-	NN	PB	PL	-	-			S1
CO	-	-	PL	-	-		MA1	L1
CO	NN	PB	PL	-	SE			NN
CO	NN	PB	PL	-	SE			S1
CO	NN	PB	-	S3	-		MEM	L1
CO	NN	PB	PL	-	-			NN
CO	NN	PB	PL	-	-			S1
CO	NN	PB	PL	-	SE		NNN	L1
CO	NN	PB	PL	S3	SE			NN
CO	NN	PB	PL	S3	SE			S1
-	-	-	-	-	-	NNN	MA1	L1
-	-	PB	PL	-	-			NN
-	-	-	-	-	-		MEM	-
-	-	-	-	-	-			-
CO	NN	PB	-	-	-		NNN	L1
CO	NN	PB	PL	-	SE			NN

- Not available

DT000121v01_en.tif

Fig. 5-18: ADVANCED control section (CSH01.2C); available combinations

5.4.3 ADVANCED - CSH01.3C type code

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
Example:	C	S	H	0	1	.	3	C	-	S	E	-	E	N	1	-	N	N	N	-	C	C	D	-	N	N	-	S	-	N	N	-	F	W

Product
CSH. . . . . = CSH

Line
1. . . . . = 01

Design
3 . . . . . = 3

Configuration option
configurable . . . . . = C

Communication
CANopen / DeviceNet . . . . . = CO
MultiEthernet . . . . . = ET
PROFIBUS . . . . . = PB
Parallel interface . . . . . = PL
Sercos III . . . . . = S3
Sercos II . . . . . = SE
not equipped . . . . . = NN

Option 1 (X4)
Encoder HSF / RSF . . . . . = EN1
Encoder EnDat 2.1 / 1Vss / TTL . . . . . = EN2
Encoder IndraDyn / Hiperface® / 1 Vss / TTL = ENS
not equipped . . . . . = NNN

Option 2 (X8)
Encoder HSF / RSF . . . . . = EN1
Encoder EnDat 2.1 / 1Vss / TTL . . . . . = EN2
Encoder IndraDyn / Hiperface® / 1 Vss / TTL . . . . = ENS
Analog I/O extension . . . . . = MA1
Encoder emulator . . . . . = MEM (1)
not equipped . . . . . = NNN

Option 3 (X10)
Cross communication drive. . . . . = CCD

Safety option (X41)
Safe Torque Off (SIL3 / cat. 3 PL e) . . . . . = L2
without safety option . . . . . = NN
Safe Motion (SIL2 / cat. 3 PL d) . . . . . = S2

Control panel
Standard control panel. . . . . = S

Other design
none. . . . . = NN

Firmware
Denotes that firmware must be ordered separately . . . . . = FW

Note:
(1) Only with option 1 = "EN1", "EN2" or "ENS"

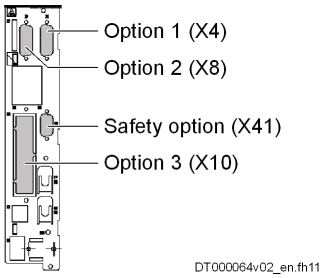


Fig. 5-19: ADVANCED control section type code (CSH01.3C)

06 Option 1	**07** Option 2	**09** Safety option		
EN1	EN1	L2	NN	S2
	EN2	L2	NN	S2
	ENS	-	-	S2
	MA1	L2	NN	S2
	MEM	L2	NN	S2
	NNN	L2	NN	S2
EN2	EN1	-	-	S2
	EN2	L2	NN	S2
	ENS	-	-	S2
	MA1	L2	NN	S2
	MEM	L2	NN	S2
	NNN	L2	NN	S2
ENS	EN1	L2	NN	S2
	EN2	L2	NN	S2
	ENS	L2	NN	S2
	MA1	L2	NN	S2
	MEM	L2	NN	S2
	NNN	L2	NN	S2
NNN	EN1	-	-	-
	EN2	-	-	-
	ENS	-	-	-
	MA1	L2	NN	-
	MEM	-	-	-
	NNN	L2	NN	-

DT000122v01_en.tif

Fig. 5-20: ADVANCED control section (CSH01.3C); available combinations

5.4.4 ADVANCED dimensions

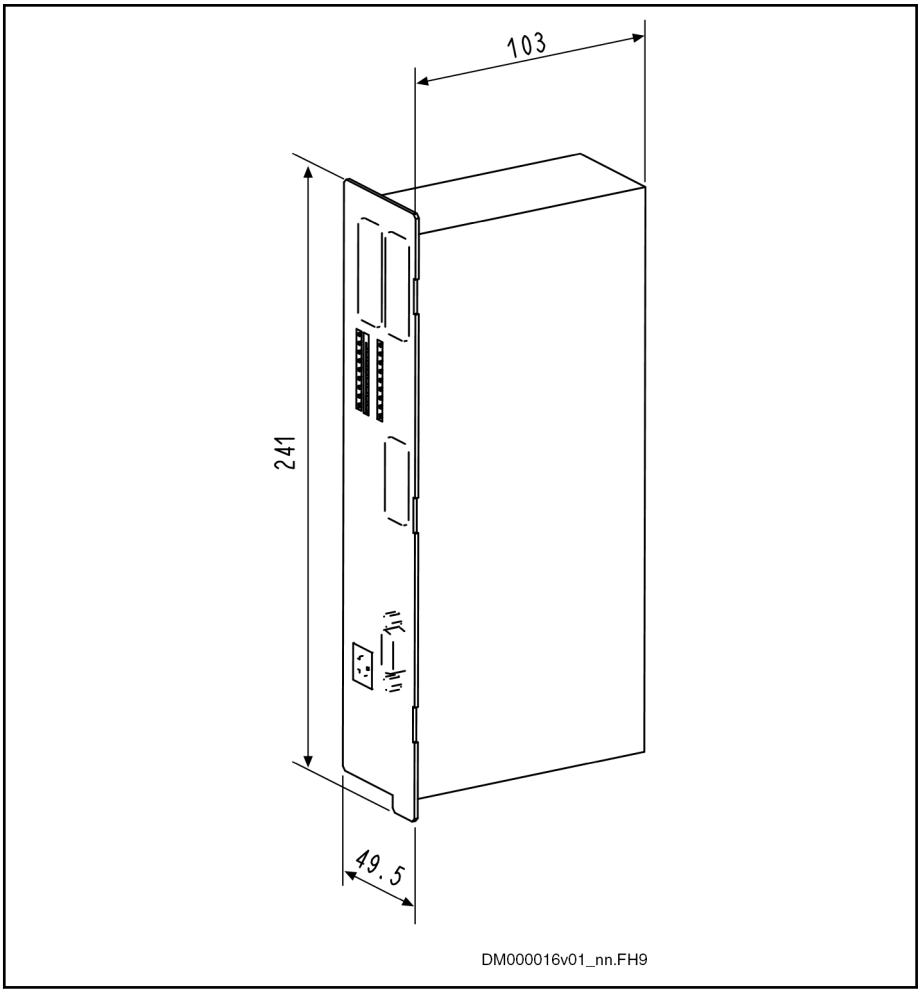
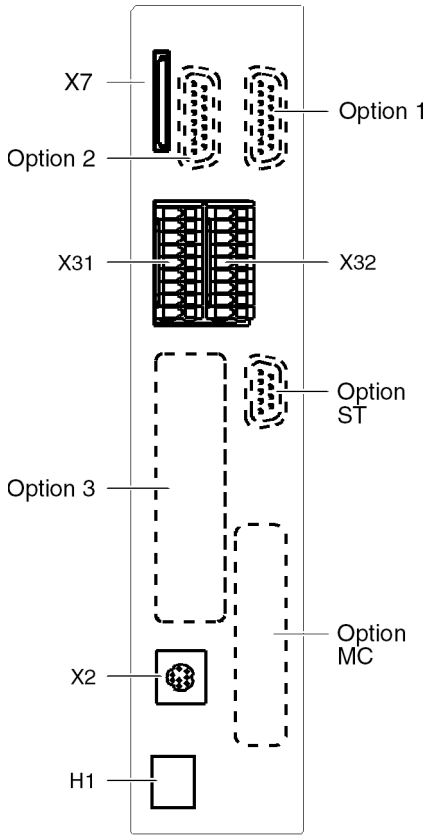


Fig. 5-21: ADVANCED dimensions

5.4.5 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 Coding: X31: 1 X32: 9	0.75-1.5	20-14	-	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 = communication

Tab. 5-18: ADVANCED CSH01.1C connections

Functions and pin assignments

☞ The specified factory settings apply to firmware MPx-04VRS.

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

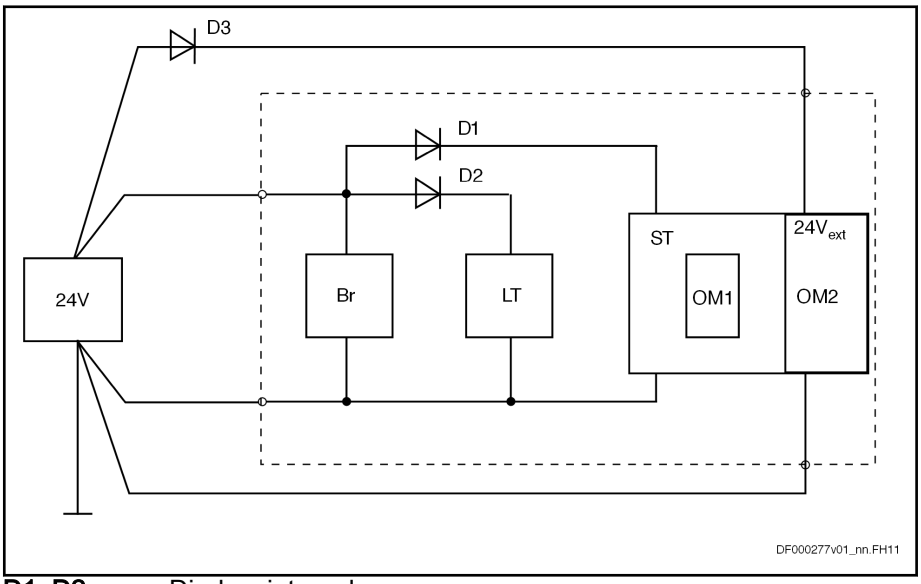
- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

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.



D1, D2	Diodes, internal
D3	Protective diode, external
LT	Power section
BR	Circuit motor holding brake
ST	Control section
OM1	Optional modules
OM2	Optional modules with supply voltage connection, e.g. MA1, MD2

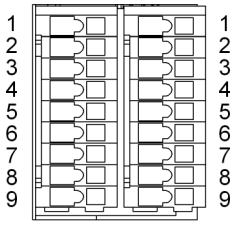
Fig. 5-22: Block Diagram of 24V Supply

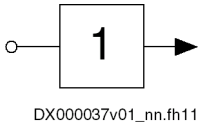
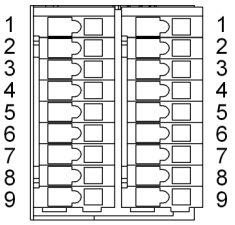
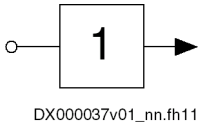
Low input resistance

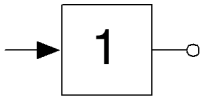
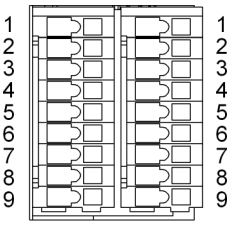
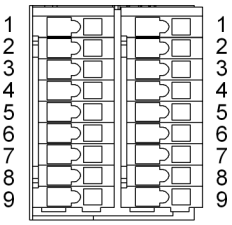
The digital inputs I_6 and I_7 are mounted in parallel to the analog input I_a_1. This reduces the input resistance of the analog input to the value of the digital inputs.

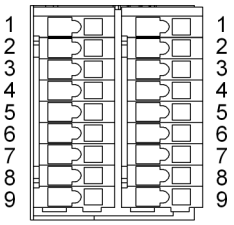
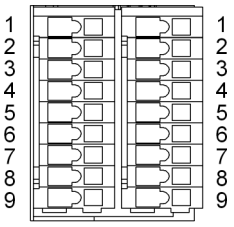
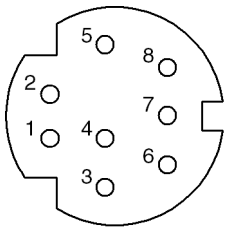
Signal sources with low impedance for a low degree of linearity error

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 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 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 HMS: P-0-0115 HCS02/HCS03: P-0-0861	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 Relay contact type 2 see chapter "Technical data - functions"
		Rel 1	X31.2			

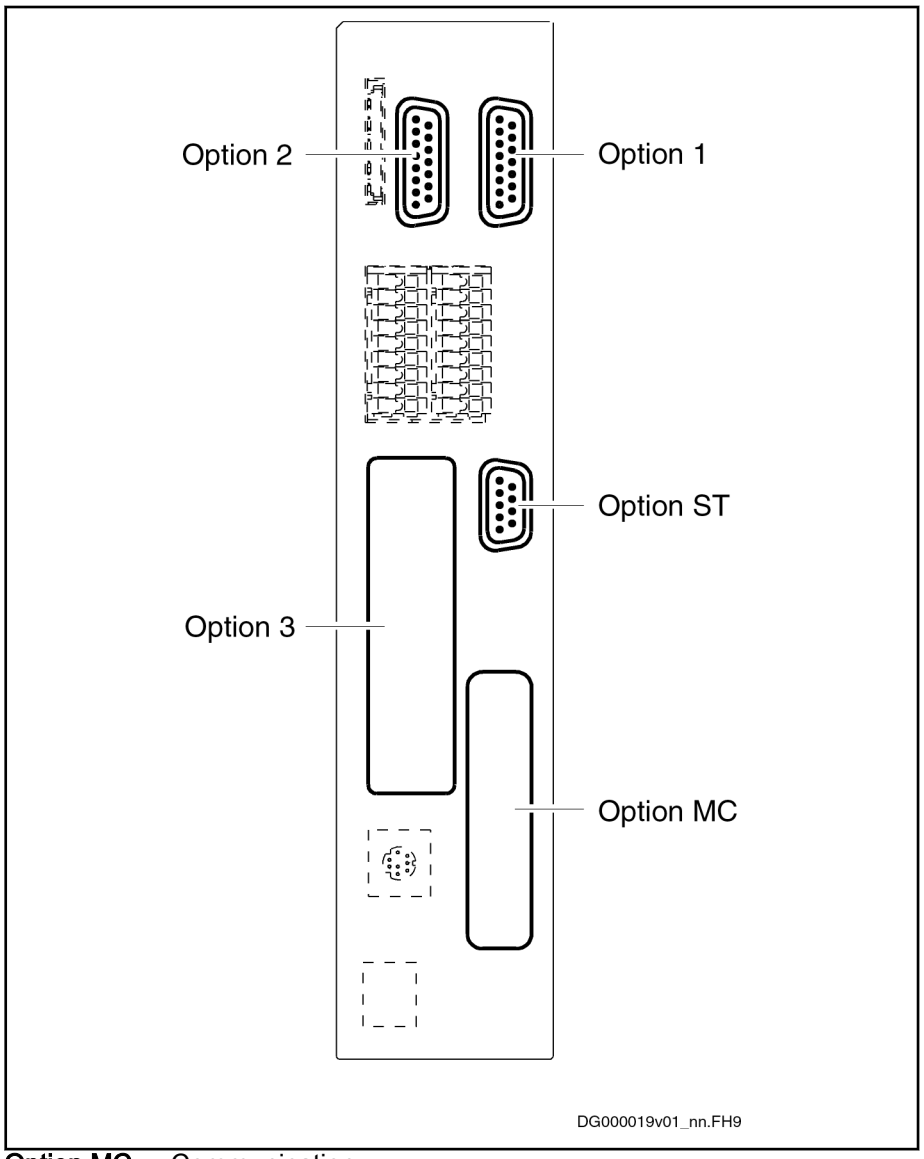
Function			Connection	Factory setting	Nominal data	Figure Data
Digital inputs	 DX000037v01_nn.fh11	I_1 Type B (probe)	X31.3	Probe 1 S-0-0401	can be configured as probe; 24 V 3 mA typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical Data - functions" → "Digital inputs type A" "Digital inputs type B (probe)" "Digital inputs type D"
		I_2 Type B (probe)	X31.4	Probe 2 S-0-0402		
	 DX000037v01_nn.fh11	I_3	X31.5	Travel range limit switch P-0-0222	24V 3 mA	
		I_4	X31.6	Travel range limit switch P-0-0222		
		I_5	X31.7	Home switch S-0-0400		
		I_6 Type D	X32.4	Can also be used as analog input; see I_a_1+		
		I_7 Type D	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 Data
Digital outputs	 DX000038v01_nn.fh11	I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24V 0.5 A	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical data - functions"
		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  DA000051v01_nn.FH9 Analog inputs type 4 see chapter "Technical data - functions" Example of connection see chapter 7-11 "Shield connection X32" on page 171
		I_a_1-	X32.5	Can also be used as digital input I_7		

Function			Connection	Factory setting	Nominal data	Figure Data
Analog outputs	Voltage output	O_a_1	X32.1		5 V 1 mA	X31 I X32  DA000051v01_nn.FH9 Analog outputs type 2 see chapter "Technical data - functions" Example of connection see chapter 7-11 "Shield connection X32" on page 171
		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			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 see chapter "Technical data - functions"
Optional functions	Allowed options: see configuration table					see corresponding optional module

Tab. 5-19: ADVANCED CSH01.1C functions

Optional slots CSH01.1C



Option MC Communication
Option ST Safety technology
Fig. 5-23: Options for ADVANCED CSH01.1C

The 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 (X4)	Option 2 (X8)	Option 3 (X10)	Option ST (X41)	Memory card slot (X7)	Control panel (H1)
SE	■	-	-	-	-	-	-
PB	■	-	-	-	-	-	-
PL	■	-	-	-	-	-	-

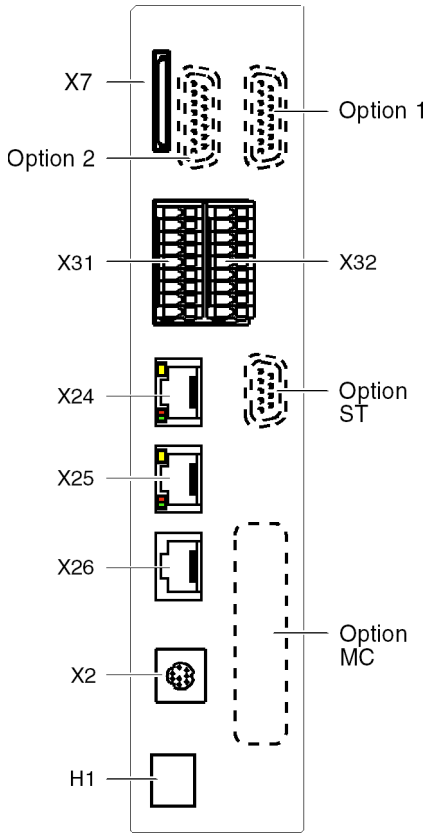
Optional module	Optional slot						
	Option MC	Option 1 (X4)	Option 2 (X8)	Option 3 (X10)	Option ST (X41)	Memory card slot (X7)	Control panel (H1)
CO	■	-	-	-	-	-	-
CD	■	-	-	-	-	-	-
ET	■	-	-	-	-	-	-
S3	■	-	-	-	-	-	-
CCD	-	-	-	-	-	-	-
ENS	-	■	■	■	-	-	-
EN1	-	■	■	■	-	-	-
EN2	-	■	■	■	-	-	-
MEM	-	■	■	■	-	-	-
MA1	-	-	■	■	-	-	-
MD1	-	-	-	■	-	-	-
MD2	-	-	-	■	-	-	-
L1	-	-	-	-	■	-	-
L2	-	-	-	-	■	-	-
S1	-	-	-	-	■	-	-
S2	-	-	-	-	■	-	-
S	-	-	-	-	-	-	■
PFM02	-	-	-	-	-	■	-

■ Allowed optional module at optional slot
- Not allowed

Tab. 5-20: CSH01.1C configuration table

5.4.6 CSH01.2C - 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 Coding: X31: 1 X32: 9	0.75-1.5	20-14	-	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 = communication

Tab. 5-21: ADVANCED CSH01.2 connections

Functions and pin assignments

The specified factory settings apply to firmware MPx-04VRS.

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

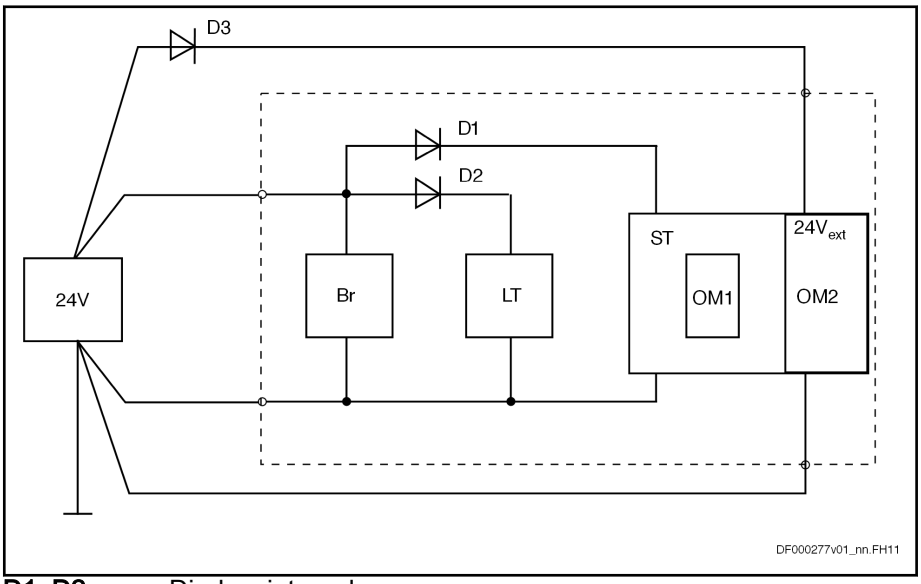
- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

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.



D1, D2	Diodes, internal
D3	Protective diode, external
LT	Power section
BR	Circuit motor holding brake
ST	Control section
OM1	Optional modules
OM2	Optional modules with supply voltage connection, e.g. MA1, MD2

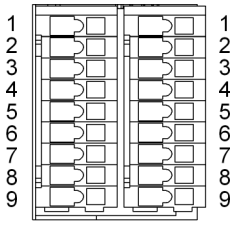
Fig. 5-24: Block Diagram of 24V Supply

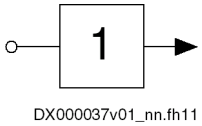
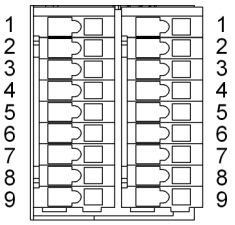
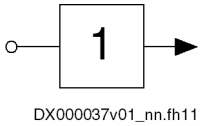
Low input resistance

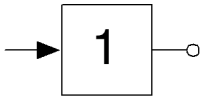
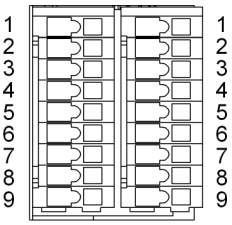
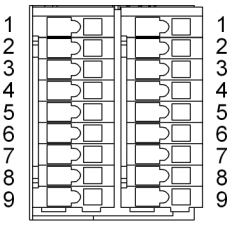
The digital inputs I_6 and I_7 are mounted in parallel to the analog input I_a_1. This reduces the input resistance of the analog input to the value of the digital inputs.

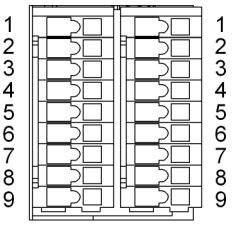
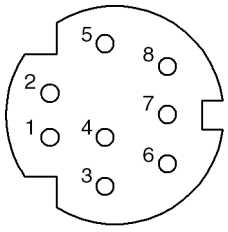
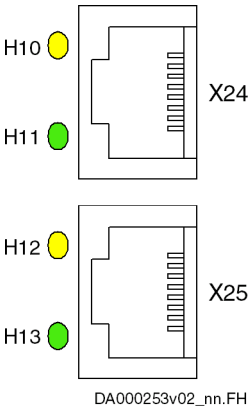
Signal sources with low impedance for a low degree of linearity error

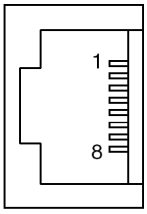
If you need a low degree of linearity error, use signal sources with the lowest possible impedance at the analog input I_a_1. For example, you achieve a linearity error smaller 5% with a 1 kohm potentiometer and smaller 2.5% with a 500 ohm potentiometer.

Function			Connection	Factory setting	Nominal data	Figure 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 HMS: P-0-0115 HCS02/HCS03: P-0-0861	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 Relay contact type 2 see chapter "Technical data - functions"
		Rel 1	X31.2			

Function			Connection	Factory setting	Nominal data	Figure Data
Digital inputs	 DX000037v01_nn.fh11	I_1 Type B (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 see chapter "Technical Data - functions" → "Digital inputs type A" "Digital inputs type B (probe)" "Digital inputs type D"
		I_2 Type B (probe)	X31.4	Probe 2 S-0-0402		
	 DX000037v01_nn.fh11	I_3	X31.5	Travel range limit switch P-0-0222	24V 3 mA	
		I_4	X31.6	Travel range limit switch P-0-0222		
		I_5	X31.7	Home switch S-0-0400		
		I_6 Type D	X32.4	Can also be used as analog input; see I_a_1+		
		I_7 Type D	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		

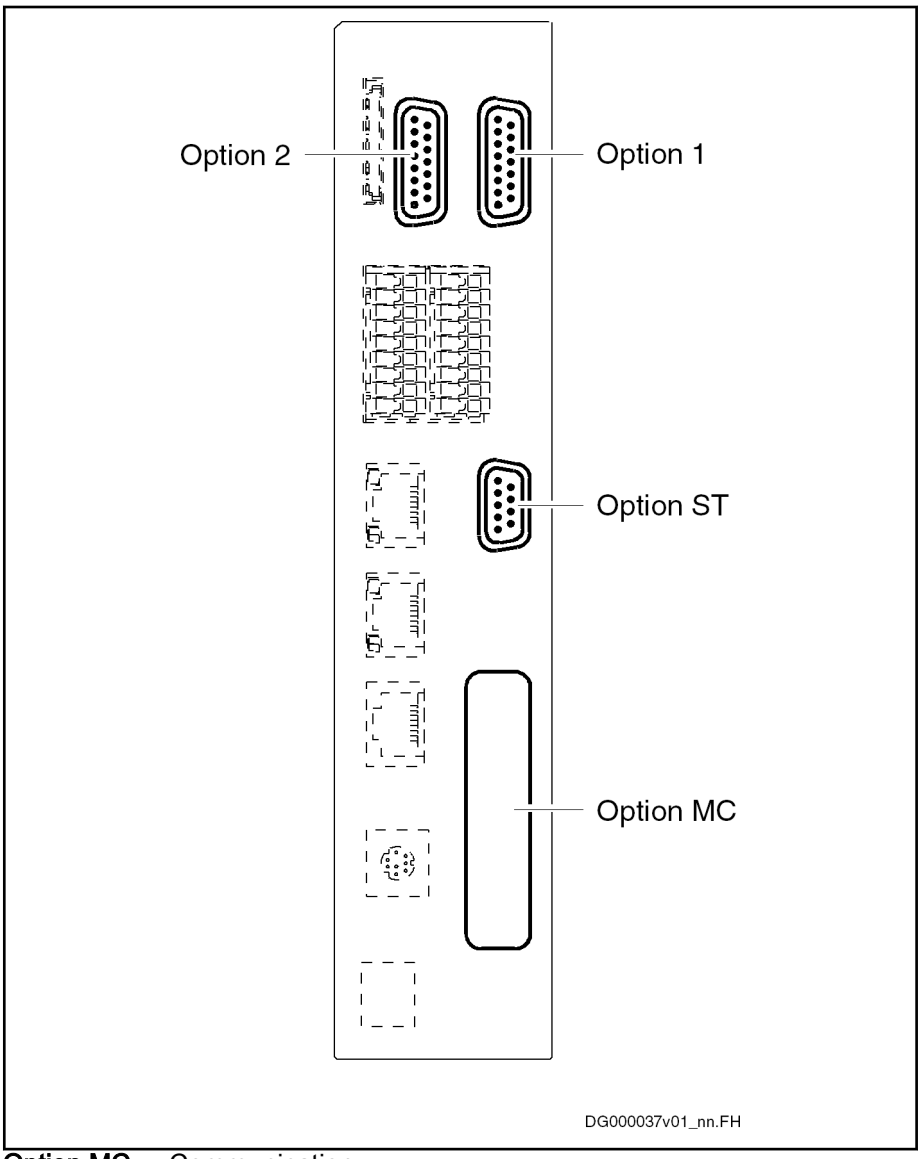
Function			Connection	Factory setting	Nominal data	Figure Data
Digital outputs	 DX000038v01_nn.fh11	I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24V 0.5 A	X31 I X32  DA000051v01_nn.FH9 see chapter "Technical data - functions"
		I/O_9	X32.7	Combined I/O configured as input I/O_9; 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  DA000051v01_nn.FH9 Analog inputs type 4 see chapter "Technical data - functions" Example of connection see chapter 7-11 "Shield connection X32" on page 171
		I_a_1-	X32.5	Can also be used as digital input I_7		

Function			Connection	Factory setting	Nominal data	Figure Data
Analog outputs	Voltage output	O_a_1	X32.1		5 V 1 mA	X31 I X32  DA000051v01_nn.FH9 Analog outputs type 2 see chapter "Technical data - functions" Example of connection see chapter 7-11Shield connection X32, page 171
		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 see chapter "Technical data - functions"
CCD			X24			 DA000253v02_nn.FH see chapter "CCD - cross communication"
CCD			X25			

Function			Connection	Factory setting	Nominal data	Figure Data
Engineering interface	Ethernet-based interface		X26			 DA000041v01_nn.FH see chapter "Technical data - functions"
Optional functions	Allowed options: see configuration table					see corresponding optional module

Tab. 5-22: ADVANCED CSH01.2 functions

Optional slots CSH01.2C



Option MC Communication
Option ST Safety technology
Fig. 5-25: Options for ADVANCED CSH01.2C

The 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 (X4)	Option 2 (X8)	Option 3 (on board)	Option ST (X41)	Memory card slot (X7)	Control panel (H1)
SE	■	-	-	-	-	-	-
PB	■	-	-	-	-	-	-
PL	■	-	-	-	-	-	-

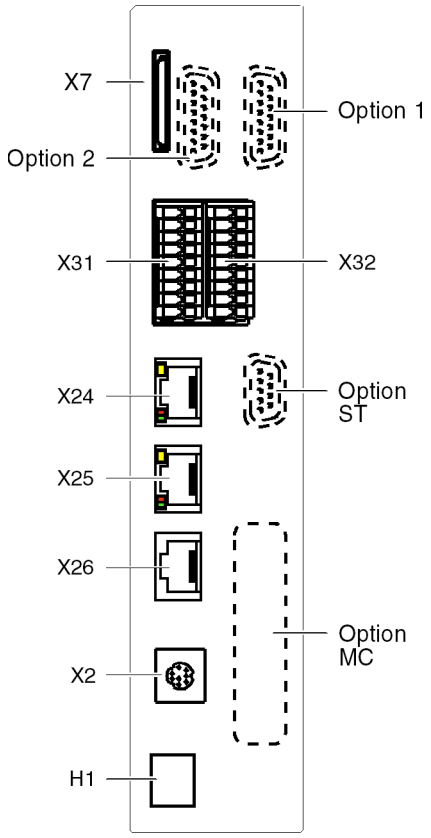
Optional module	Optional slot						
	Option MC	Option 1 (X4)	Option 2 (X8)	Option 3 (on board)	Option ST (X41)	Memory card slot (X7)	Control panel (H1)
CO	■	-	-	-	-	-	-
S3	■	-	-	-	-	-	-
CCD	-	-	-	■	-	-	-
ENS	-	■	■	-	-	-	-
EN1	-	■	■	-	-	-	-
EN2	-	■	■	-	-	-	-
MEM	-	■	■	-	-	-	-
MA1	-	-	■	-	-	-	-
MD1	-	-	-	-	-	-	-
MD2	-	-	-	-	-	-	-
L1	-	-	-	-	■	-	-
L2	-	-	-	-	■	-	-
S1	-	-	-	-	■	-	-
S2	-	-	-	-	■	-	-
S	-	-	-	-	-	-	■
PFM02	-	-	-	-	-	■	-

■ Allowed optional module at optional slot
- Not allowed

Tab. 5-23: CSH01.2C configuration table

5.4.7 CSH01.3C - 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 Coding: X31: 1 X32: 9	0.75-1.5	20-14	-	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 = communication

Tab. 5-24: ADVANCED CSH01.3 connections

Functions and pin assignments

The specified factory settings apply to firmware MPx-04VRS.

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

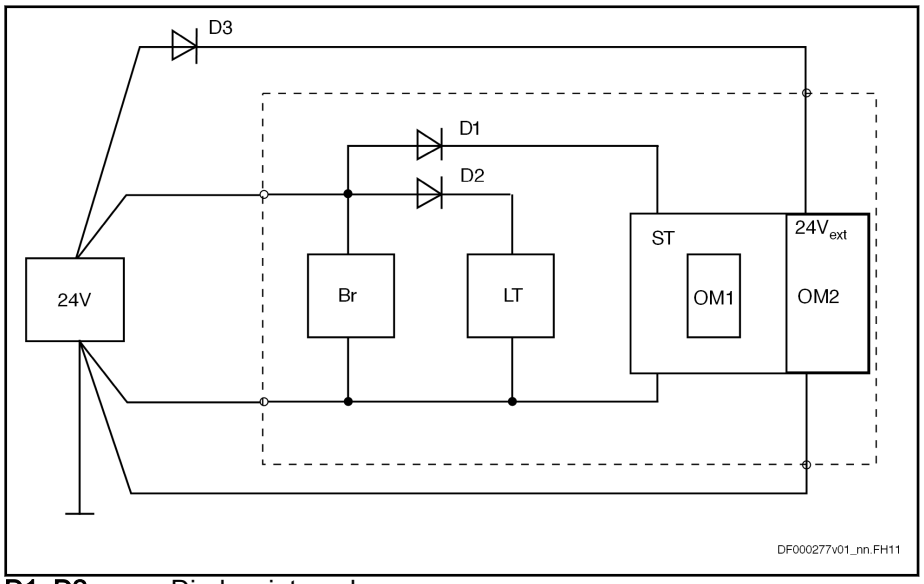
- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

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.



D1, D2	Diodes, internal
D3	Protective diode, external
LT	Power section
BR	Circuit motor holding brake
ST	Control section
OM1	Optional modules
OM2	Optional modules with supply voltage connection, e.g. MA1, MD2

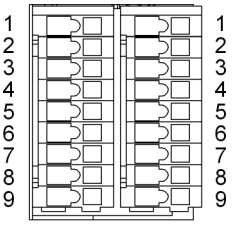
Fig. 5-26: Block Diagram of 24V Supply

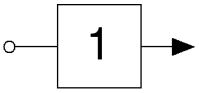
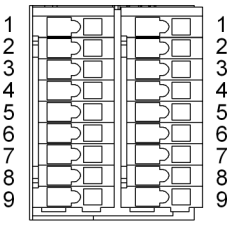
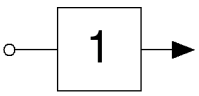
Low input resistance

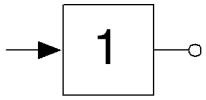
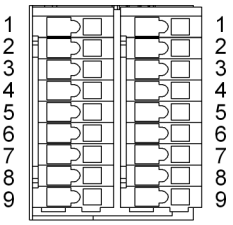
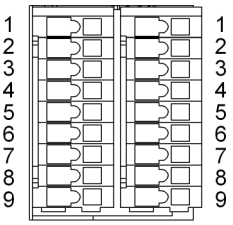
The digital inputs I_6 and I_7 are mounted in parallel to the analog input I_a_1. This reduces the input resistance of the analog input to the value of the digital inputs.

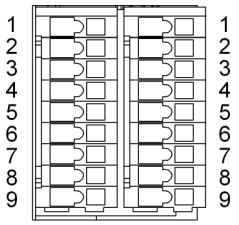
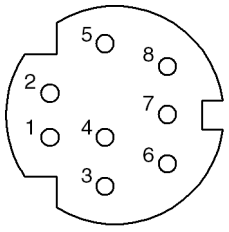
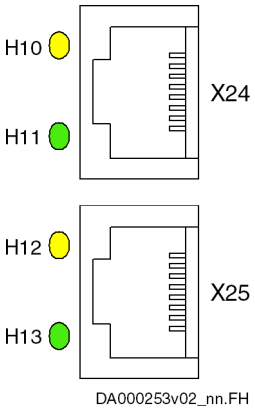
Signal sources with low impedance for a low degree of linearity error

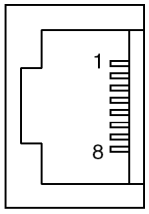
If you need a low degree of linearity error, use signal sources with the lowest possible impedance at the analog input I_a_1. For example, you achieve a linearity error smaller 5% with a 1 kohm potentiometer and smaller 2.5% with a 500 ohm potentiometer.

Function			Connection	Factory setting	Nominal data	Figure Data
Power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	see "Power consumption"	
Relay contact	 DA000017v01_nn.fh11	Rel 1	X31.1	Ready for operation HMS: P-0-0115 HCS02/HCS03: P-0-0861	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 Relay contact type 2 see "Technical Data - functions"
		Rel 1	X31.2			

Function			Connection	Factory setting	Nominal data	Figure Data
Digital inputs	 DX000037v01_nn.fh11	I_1 Type B (probe)	X31.3	Probe 1 S-0-0401	Can be configured as probe 24V 3 mA typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 see "Technical Data - functions" → "Digital inputs type A" "Digital inputs type B (probe)" "Digital inputs type D"
		I_2 Type B (probe)	X31.4	Probe 2 S-0-0402		
	 DX000037v01_nn.fh11	I_3	X31.5	Travel range limit switch P-0-0222	24V 3 mA	
		I_4	X31.6	Travel range limit switch P-0-0222		
		I_5	X31.7	Home switch S-0-0400		
		I_6 Type D	X32.4	Can also be used as analog input; see I_a_1+		
		I_7 Type D	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		

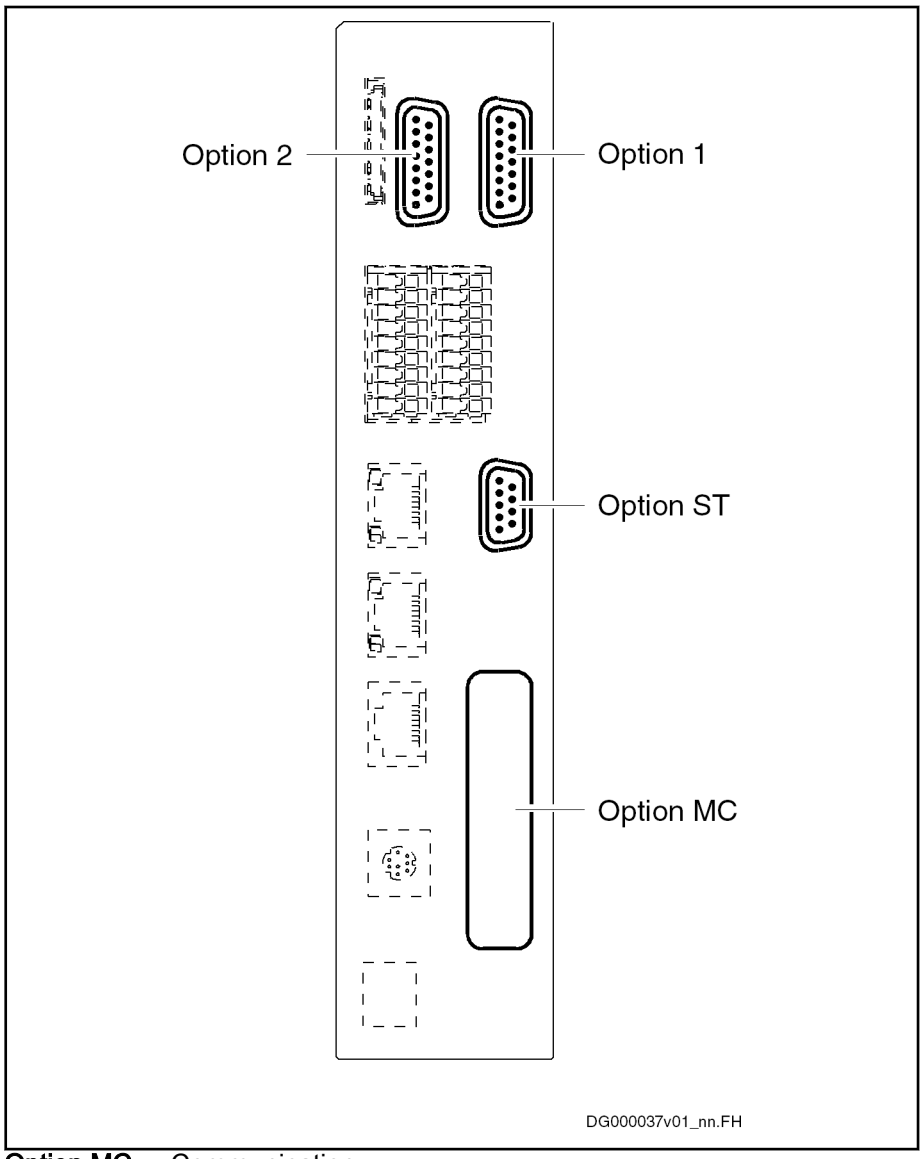
Function			Connection	Factory setting	Nominal data	Figure Data
Digital outputs	 DX000038v01_nn.fh11	I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24V 0.5 A	X31 I X32  DA000051v01_nn.FH9 see "Technical Data - functions"
		I/O_9	X32.7	Combined I/O configured as input I/O_9; see 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  DA000051v01_nn.FH9 Analog inputs type 4 see "Technical Data - functions" Example of connection see chapter 7-11, Shield connection X32, page 171
		I_a_1-	X32.5	Can also be used as digital input I_7		

Function			Connection	Factory setting	Nominal data	Figure Data
Analog outputs	Voltage output	O_a_1	X32.1		5 V 1 mA	X31 I X32  DA000051v01_nn.FH9 Analog outputs type 2 see "Technical Data - functions" Example of connection see chapter 7-11, Shield connection X32, page 171
		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 see "Technical Data - functions"
CCD			X24			 DA000253v02_nn.FH see "CCD - cross communication"
CCD			X25			

Function			Connection	Factory setting	Nominal data	Figure Data
Engineering interface	Ethernet-based interface		X26			 DA000041v01_nn.FH see "Technical Data - functions"
Optional functions	Allowed options: see configuration table					see corresponding optional module

Tab. 5-25: ADVANCED CSH01.3 functions

Optional slots CSH01.3C



Option MC Communication
Option ST Safety technology
Fig. 5-27: Options for ADVANCED CSH01.3C

The 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 (X4)	Option 2 (X8)	Option 3 (on board)	Option ST (X41)	Memory card slot (X7)	Control panel (H1)
SE	■	-	-	-	-	-	-
PB	■	-	-	-	-	-	-
PL	■	-	-	-	-	-	-

Optional module	Optional slot						
	Option MC	Option 1 (X4)	Option 2 (X8)	Option 3 (on board)	Option ST (X41)	Memory card slot (X7)	Control panel (H1)
CO	■	-	-	-	-	-	-
ET	■	-	-	-	-	-	-
S3	■	-	-	-	-	-	-
CCD	-	-	-	■	-	-	-
ENS	-	■	■	-	-	-	-
EN1	-	■	■	-	-	-	-
EN2	-	■	■	-	-	-	-
MEM 1)	-	■	■	-	-	-	-
MA1	-	-	■	-	-	-	-
MD1	-	-	-	-	-	-	-
MD2	-	-	-	-	-	-	-
L1	-	-	-	-	■	-	-
L2	-	-	-	-	■	-	-
S1	-	-	-	-	■	-	-
S2	-	-	-	-	■	-	-
S	-	-	-	-	-	-	■
PFM02	-	-	-	-	-	■	-

1) Only allowed once (device function)
■ Allowed optional module at optional slot
- Not allowed

Tab. 5-26: CSH01.3C configuration table

6 Optional modules for control sections

6.1 Overview

Optional module	Function	Name of optional module Connection point	Remark
Communications	Communication via analog inputs	AN -	CSB01.1N-AN, not configurable
		AN (HCC11)[1)] X39	See optional module "AN - Analog inputs extension"
	Communication via Sercos interface	SE (HCC02) X20; X21	Communication based on fiber optic cables
	Communication via PROFIBUS	PB (HCC03) X30	PROFIBUS field bus
	Communication via DeviceNet	CO (HCC06) X60	Field bus DeviceNet; connection via screw terminal
	Communication via DeviceNet	CD X61	Field bus DeviceNet; connection via D-Sub interface
	Communication via parallel interface	PL (HCC01) X15	Parallel interface
	Communication via CANopen	CO (HCC06) X60	Field bus CANopen; connection via screw terminal
	Communication via CANopen	CD X61	Field bus CANopen; connection via D-Sub interface
	Communication via Multi-Ethernet	ET (HCC20) X22, X23	Ethernet-based communication
	Communication via Sercos III "Slave" for cross communication	S3 (HCC07) X22, X23	Ethernet-based communication
Cross communication	"Master" for cross communication via Sercos III	CCD (HMC01) X24, X25	"Master" for Ethernet-based communication between the drive controllers

Optional module	Function	Name of optional module Connection point	Remark
Encoder evaluations	For encoder systems of IndraDyn motors	ENS (HFI03)	Standard for motors of IndraDyn product range; (S1, M1, S2 and M2 encoder systems) **12 V power supply**
	For resolvers and encoder systems with HSF interface	EN1 (HFI01)	Standard for MKD, MKE and MHD motors (R0, R1, S0 and M0 encoder systems) **8 V power supply**
	For encoder systems with 5 V supply (Sense function required)	EN2 (HFI02)	**5 V power supply** (C0 encoder systems)
	Emulation of absolute and incremental encoders	MEM (HFE01)	Emulation absolute encoder in SSI format
I/O extensions	"Analog inputs" extension	AN (HCC11) X39	4 analog differential input channels
	"Analog inputs/outputs" extension	MA1 (HAS01)	2 analog differential input channels 2 analog output channels
	"Digital inputs/outputs" extension	MD1 (HEA01)	12 digital inputs 8 digital outputs
	"Digital inputs/outputs" extension	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	
	Safe Motion	S2	
	Starting lockout	L1 (HSI01) X41	
	Safe Torque Off	L2	
Control panel	Standard control panel	S	Single-line display
Memory	Exchangeable medium for parameters and firmware	PFM02.1 X7	MultiMediaCard (MMC)

1) (Hxxxx): internal identifier

Tab. 6-1: Available optional modules

6.2 Communication modules

6.2.1 SE - Sercos

NOTICE **Risk of damage!**

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

Description

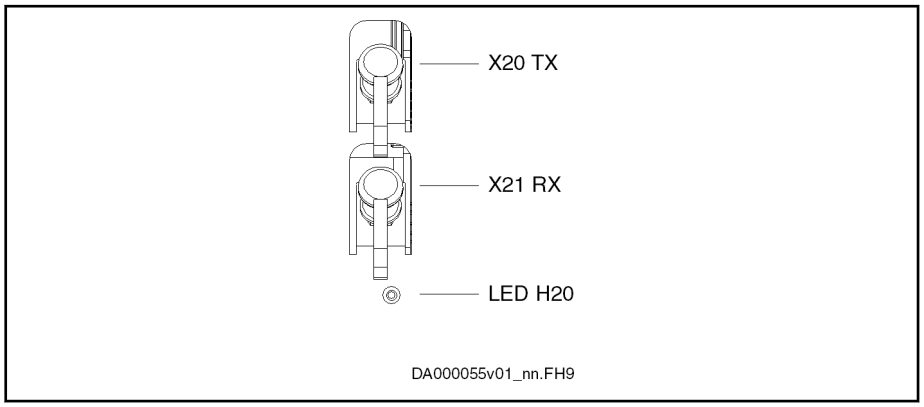


Fig. 6-1: Sercos interface

LED H20 Distortion LED of Sercos interface.

See also Functional Description of firmware, index entry "Sercos interface".

Pin assignment

X20	TX
X21	RX

Tab. 6-2: Pin assignment

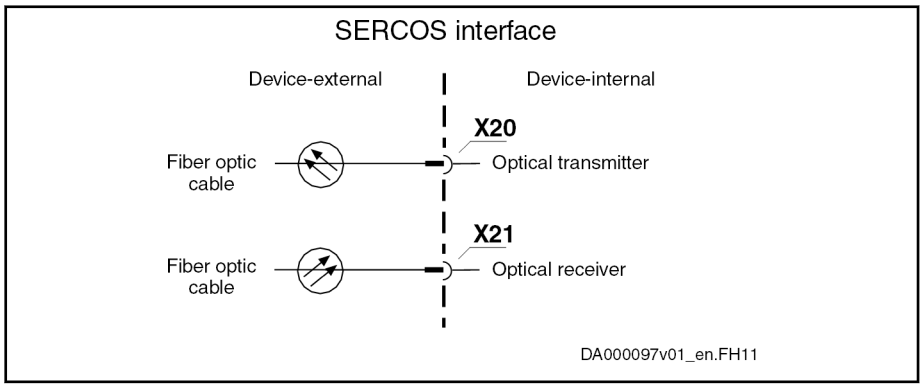


Fig. 6-2: Pin assignment

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 using 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, mat. no.: R911284755). This manual 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

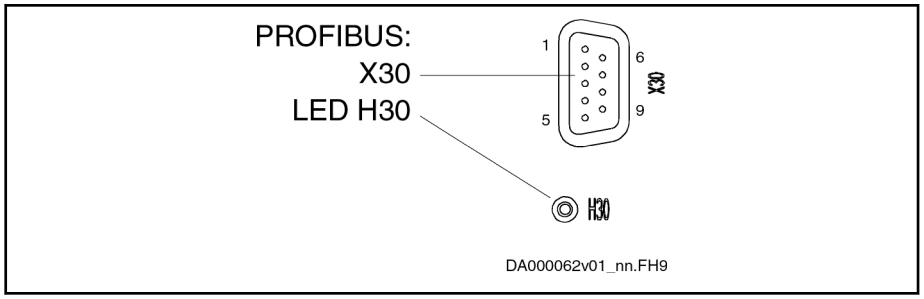
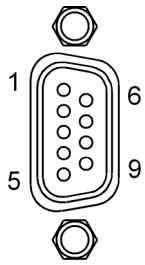


Fig. 6-3: PROFIBUS Interface

View	Identification	Function	
 DA000054v01_nn.FH9	X30	PROFIBUS PB	
D-Sub, 9-pin, female	**Unit**	**Min.**	**Max.**
Connection cable Stranded wire	mm^2	0.08	0.5

Tab. 6-3: Function, pin assignment, properties

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

Tab. 6-4: Signal assignment

Shield connection Via D-Sub mounting 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

Tab. 6-5: Signal specification

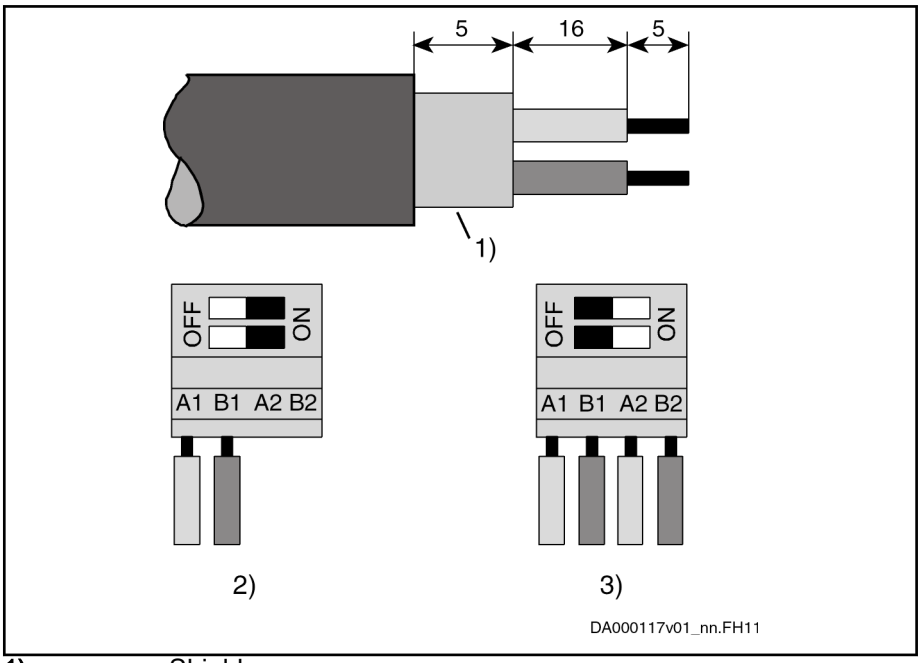
NOTICE **Danger of destroying output "+5V repeater supply" by overload!**

Do not short-circuit the output.

Do not exceed the maximum current.

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

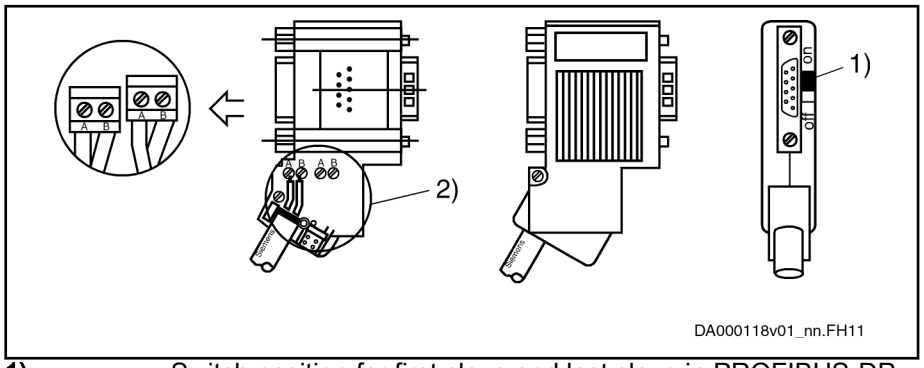
Fig. 6-4: Preparing a cable for connecting a bus connector

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

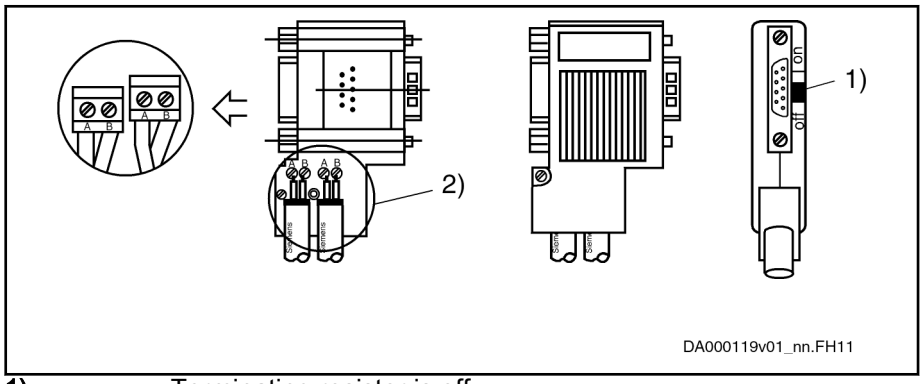
Do not interchange the cores for A and B.

- Press cable sheath between both clamps
- Screw on both cores in screw terminals



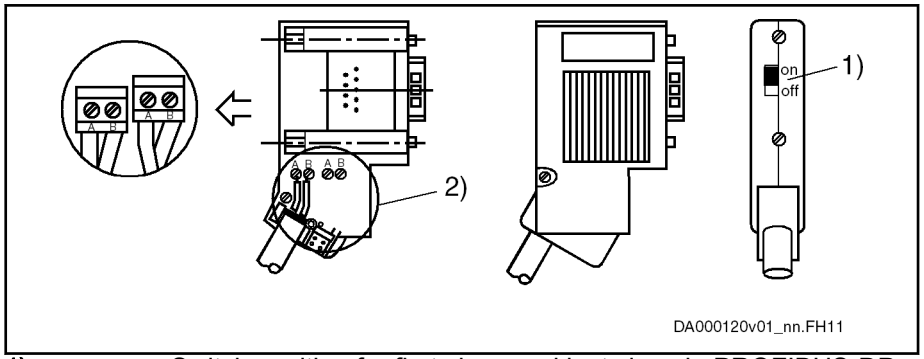
1) Switch position for first slave and last slave in PROFIBUS-DP
2) Cable shield must have direct contact to metal

Fig. 6-5: Bus connection for first and last slave, bus connector with 9-pin D-sub female connector, INS0541



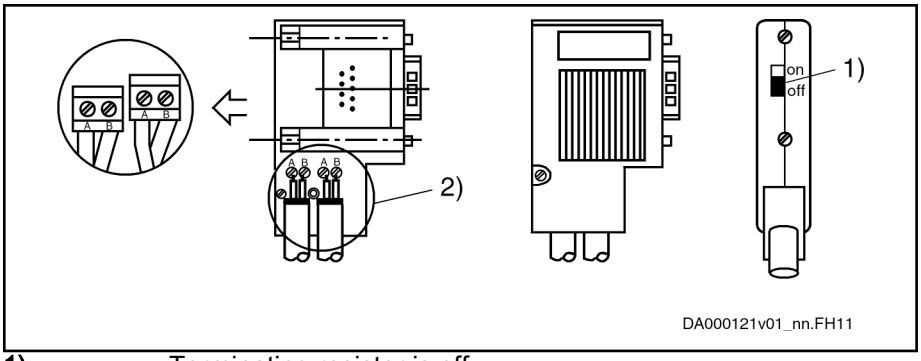
1) Terminating resistor is off
2) Cable shield must have direct contact to metal

Fig. 6-6: 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. 6-7: Bus connection for first 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. 6-8: 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.

Diagnostic displays For the significance of the diagnostic displays, see firmware documentation.

6.2.3 PL - parallel interface

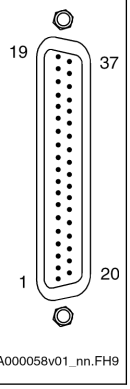
X15, parallel interface - PL

Description

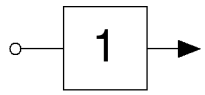
The optional module PL contains 16 digital inputs and 16 digital outputs. The inputs/outputs are combined in groups of 4 inputs and 4 outputs each.

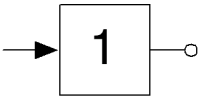
The inputs/outputs are galvanically isolated from the control section and for each input/output group require power which is supplied via the corresponding connection +24V. The power supply of the 4 groups refers to the common connection 0V.

Connection point

Connection point	Type	Number of poles	Type of design	Solid wire [mm²]	Stranded wire [mm²]	Figure
X15	D-Sub	37	Pins at device	-	0.08-0.5	

Tab. 6-6: Connection point

Function	Signal name	Connection X15	Factory setting	
Digital inputs 	Technical data: see "Technical data - functions"			
Input group 0	I_0.0	1	S-0-0145, Signal control word [0]	P-0-4026, Positioning block selection [0]
	I_0.1	20	S-0-0145, Signal control word [1]	P-0-4026, Positioning block selection [1]
	I_0.2	2	S-0-0145, Signal control word [2]	P-0-4026, Positioning block selection [2]
	I_0.3	21	S-0-0145, Signal control word [3]	P-0-4026, Positioning block selection [3]
Input group 1	I_1.0	3	S-0-0145, Signal control word [4]	P-0-4026, Positioning block selection [4]
	I_1.1	22	S-0-0145, Signal control word [5]	P-0-4026, Positioning block selection [5]
	I_1.2	4	S-0-0145, Signal control word [6]	P-0-4060, Positioning block control word [0]
	I_1.3	23	S-0-0145, Signal control word [7]	S-0-0148, C0600 Drive-controlled homing procedure command [0]

Function	Signal name	Connection X15	Factory setting	
Input group 2	I_2.0	5	S-0-0145, Signal control word [8]	S-0-0346, Positioning control word [1]
	I_2.1	24	S-0-0145, Signal control word [9]	S-0-0346, Positioning control word [2]
	I_2.2	6	S-0-0145, Signal control word [10]	P-0-4028, Device control word [15], drive ON
	I_2.3	25	S-0-0145, Signal control word [11]	P-0-4028, Device control word [13], Drive Halt
Input group 3	I_3.0	7	S-0-0145, Signal control word [12]	S-0-0099, C0500 Reset class 1 diagnostics
	I_3.1	26	S-0-0145, Signal control word [13]	Not pre-assigned (S-0-0000)
	I_3.2	8	S-0-0145, Signal control word [14]	Not pre-assigned (S-0-0000)
	I_3.3	27	S-0-0145, Signal control word [15]	Not pre-assigned (S-0-0000)
Digital outputs  DX000038v01_nn.fh11	Technical data: see "Technical data - functions"			
Output group 0	O_0.0	28	S-0-0144, Signal status word [0]	P-0-0115, Device control: status word [1], ready signal
	O_0.1	10	S-0-0144, Signal status word [1]	S-0-0059, Position switch flag parameter [0]
	O_0.2	29	S-0-0144, Signal status word [2]	S-0-0403, Position feedback value status [0]
	O_0.3	11	S-0-0144, Signal status word [3]	S-0-0331, Status 'n_feedback = 0' [0]
Output group 1	O_1.0	12	S-0-0144, Signal status word [4]	P-0-4061, Positioning block status word [4], end position reached
	O_1.1	31	S-0-0144, Signal status word [5]	P-0-0115, Device control: status word [2], warning
	O_1.2	13	S-0-0144, Signal status word [6]	S-0-0437, Positioning status word [12], jog mode active
	O_1.3	32	S-0-0144, Signal status word [7]	S-0-0437, Positioning status word [3], interpolator halted
Output group 2	O_2.0	33	S-0-0144, Signal status word [8]	P-0-4051, Positioning block acknowledgment [0]
	O_2.1	15	S-0-0144, Signal status word [9]	P-0-4051, Positioning block acknowledgment [1]
	O_2.2	34	S-0-0144, Signal status word [10]	P-0-4051, Positioning block acknowledgment [2]
	O_2.3	16	S-0-0144, Signal status word [11]	P-0-4051, Positioning block acknowledgment [3]

Function	Signal name	Connection X15	Factory setting	
Output group 3	O_3.0	17	S-0-0144, Signal status word [12]	P-0-4051, Positioning block acknowledgment [4]
	O_3.1	36	S-0-0144, Signal status word [13]	P-0-4051, Positioning block acknowledgment [5]
	O_3.2	18	S-0-0144, Signal status word [14]	P-0-4051, Positioning block acknowledgment [6]
	O_3.3	37	S-0-0144, Signal status word [15]	P-0-4051, Positioning block acknowledgment [7]
Power supply, shield connection				
For input group 0 and output group 0	+24V	30		DC 19 … 30 V max. 1.2 A
For input group 1 and output group 1	+24V	14		DC 19 … 30 V max. 1.2 A
For input group 2 and output group 2	+24V	35		DC 19 … 30 V max. 1.2 A
For input group 3 and output group 3	+24V	19		DC 19 … 30 V max. 1.2 A
Reference potential for inputs/outputs and power supply	0V	9		max. 5 A
Cable shield connection	shld	Connector housing		

Tab. 6-7: Signal assignment

6.2.4 CO - DeviceNet / CANopen

X60, DeviceNet / CANopen interface - CO

Description

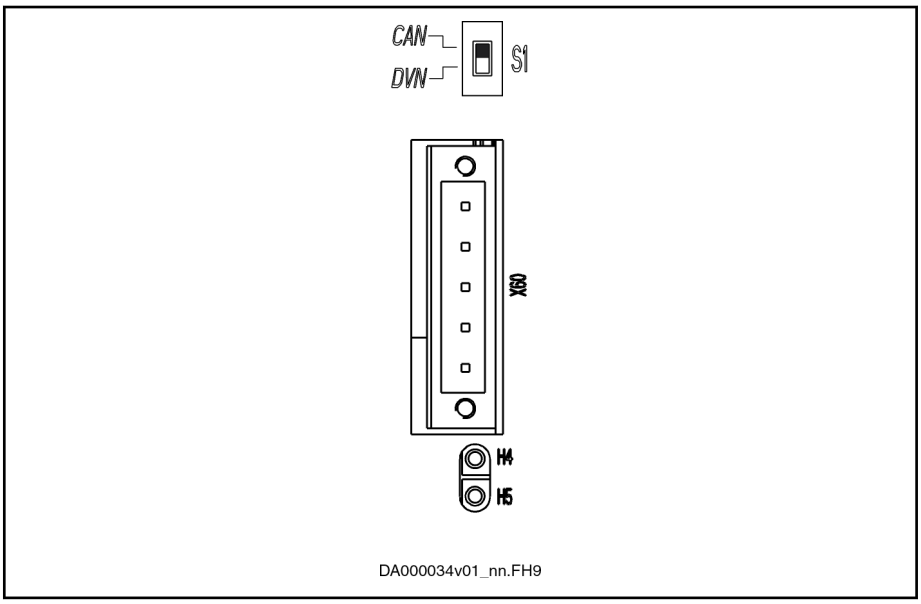
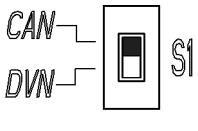


Fig. 6-9: Interface

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

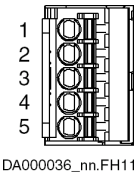
Switch S1

Activate the desired communication with switch S1:

Switch position	Effect	Switch S1
Up (CAN)	CANopen active	
Down (DVN)	DeviceNet active	

Tab. 6-8: Switch S1

Connector

Connection point	Type	Number 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	

Tab. 6-9: Connector

NOTICE **Risk of damage!**

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

Display Elements CANopen

LED	Significance	Color	Description
H4	Run	 Green	Signals operating states; see Functional Description of firmware
H5	Error	 Red	Signals error states; see Functional Description of firmware

Tab. 6-10: Significance of Display Elements for CANopen

Display Elements DeviceNet

LED	Significance	Color	Description
H4	Module status	 Red	Malfunction on module; see Functional Description of firmware
		 Green	Module OK; see Functional Description of firmware
H5	Network status	 Red	Malfunction on network; see Functional Description of firmware
		 Green	Network OK; see Functional Description of firmware

Tab. 6-11: Significance of Display Elements for DeviceNet

X60 assignment

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

Tab. 6-12: Optional module CO signal assignment

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)	connect 120 ohm, 200 mW each at both bus ends	
Transmission medium	2 twisted two-wire lines (4-pin) with shield	

Feature	DeviceNet	CANopen
Max. allowed bus (line) lengths	Depending on bit rate	
Recommended connection cable	Our RKS number or third-party type	

Tab. 6-13: 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

Tab. 6-14: Network Dimension

6.2.5 CD - DeviceNet / CANopen

X61, DeviceNet / CANopen interface - CD

Description

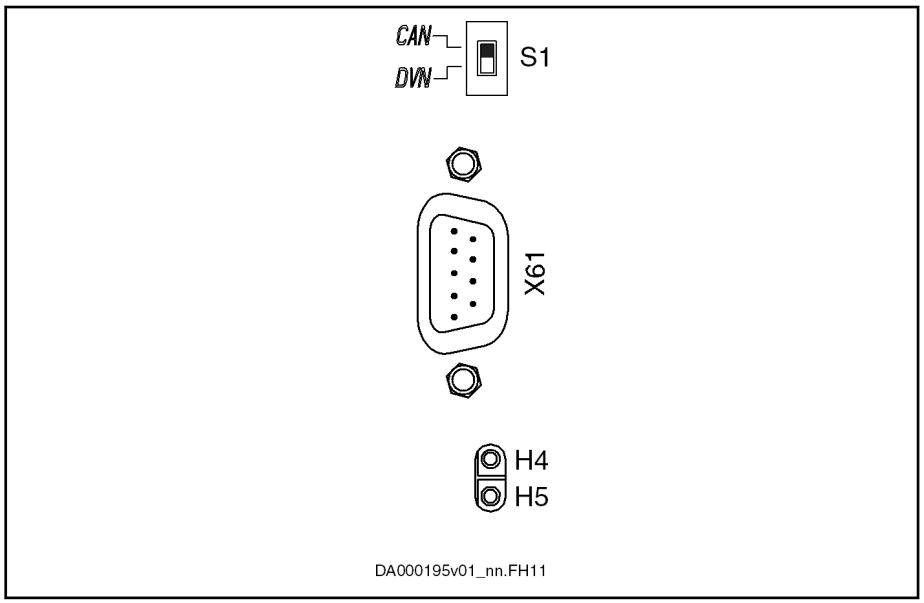
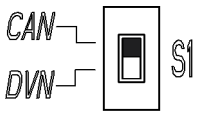


Fig. 6-10: Interface

The DeviceNet and CANopen communications are implemented 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.

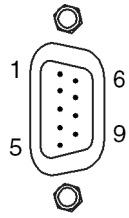
Switch S1

Activate the desired communication with switch S1:

Switch position	Effect	Switch S1
Up (CAN)	CANopen active	
Down (DVN)	DeviceNet active	

Tab. 6-15: Switch S1

Connection point

Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	Figure
X61	D-Sub	9	Pins at device	0.25-0.5	

Tab. 6-16: Connection point

Display Elements CANopen

LED	Significance	Color	Description
H4	Run	 Green	Signals operating states; see Functional Description of firmware
H5	Error	 Red	Signals error states; see Functional Description of firmware

Tab. 6-17: Significance of Display Elements for CANopen

Display Elements DeviceNet

LED	Significance	Color	Description
H4	Module status	 Red	Malfunction on module; see Functional Description of firmware
		 Green	Module OK; see Functional Description of firmware
H5	Network status	 Red	Malfunction on network; see Functional Description of firmware
		 Green	Network OK; see Functional Description of firmware

Tab. 6-18: Significance of Display Elements for DeviceNet

Pin Assignment

Pin	Signal	Function
1	n. c.	-
2	CAN-L	Negated CAN signal (Dominant Low)
3	CAN-GND	Reference potential of CAN signals
4	n. c.	-
5	Drain/Shield	Shield connection
6	GND	Reference potential of device
7	CAN-H	Positive CAN signal (Dominant High)
8	n. c.	-
9	n. c.	-

Tab. 6-19: Signal Assignment

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

Feature	DeviceNet	CANopen
Bus terminator (ISO 11898)	connect 120 ohm, 200 mW each at both bus ends	
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	

Tab. 6-20: 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

Tab. 6-21: Network Dimension

6.2.6 S3 - Sercos III

Description

Sercos III is the Ethernet-based version of Sercos 2. The interface complies with the IEE 802.3 standard.

The optional module S3 is used as a "slave" for cross communication.

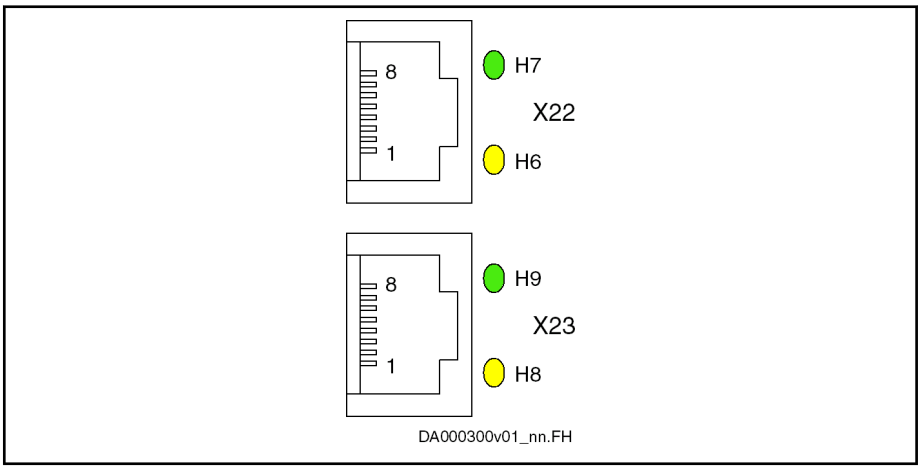
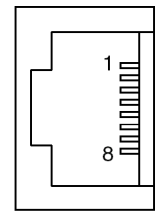


Fig. 6-11: Interface

View	Connection	Signal name	Function
 DA000041v01_nn.FH	1	TD+	Transmit, Differential Output A
	2	TD-	Transmit, Differential Output B
	3	RD+	Receive, Differential Input A
	4	n. c.	-
	5	n. c.	-
	6	RD-	Receive, Differential Input B
	7	n. c.	-
	8	n. c.	-
	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin		

Compatibility	100Base-TX according to IEEE 802.3u
Recommended cable type	• According to **CAT5e**; ITP type of shield (Industrial Twisted Pair) • Ready-made cables that can be ordered: – **RKB0021** Long cables (100 m at maximum) to connect the drive system to the higher-level control unit or remote communication nodes. Minimum bending radius: – 48.75 mm with flexible installation – 32.50 mm with permanent installation Order code for a 30 m long cable: RKB0021/030,0 – **RKB0013** Short cables to connect devices arranged side by side in the control cabinet. 4 lengths available: 0.19 m; 0.25 m; 0.35 m; 0.55 m Order code for a 0.55 m long cable: RKB0013/00,55 Minimum bending radius: 30.75 mm

Tab. 6-22: Function, pin assignment, properties

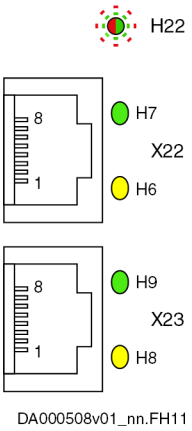
Display elements

LED	Color	Significance	Description
H6, H8	Yellow	Status	Data transmission running
H7, H9	Green	Link	Connection to network available

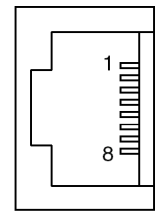
Tab. 6-23: Significance of display elements

6.2.7 ET - Multi-Ethernet

Description With the optional module "ET", drive controllers can be integrated in different Ethernet field bus systems (e.g., Sercos III, EtherCAT, EtherNet/IP or ProfiNet).

 DA000508v01_nn.FH11	H22 (network status) X22 (port 2) X23 (port 1)

Tab. 6-24: ET, connection point

View	Connection	Signal name	Function
 DA000041v01_nn.FH	1	TD+	Transmit, Differential Output A
	2	TD-	Transmit, Differential Output B
	3	RD+	Receive, Differential Input A
	4	n. c.	-
	5	n. c.	-
	6	RD-	Receive, Differential Input B
	7	n. c.	-
	8	n. c.	-
	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin		

Compatibility	100Base-TX according to IEEE 802.3u
Recommended cable type	• According to **CAT5e**; ITP type of shield (Industrial Twisted Pair) • Ready-made cables that can be ordered: – **RKB0021** Long cables (100 m at maximum) to connect the drive system to the higher-level control unit or remote communication nodes. Minimum bending radius: – 48.75 mm with flexible installation – 32.50 mm with permanent installation Order code for a 30 m long cable: RKB0021/030,0 – **RKB0013** Short cables to connect devices arranged side by side in the control cabinet. 4 lengths available: 0.19 m; 0.25 m; 0.35 m; 0.55 m Order code for a 0.55 m long cable: RKB0013/00,55 Minimum bending radius: 30.75 mm

Tab. 6-25: Function, pin assignment, properties

Display Elements

The optional module has one LED display "network status" and 2 LED displays each at both connection points. The significance of "network status" depends on the field bus system.

LED	Significance	Color	Description
even-numbered (H6, H8, …)	Status	 Yellow	Data transmission running
uneven-numbered (H7, H9, …)	Link	 Green	Connection to network available

Tab. 6-26: Significance of Display Elements

Network Status in Field Bus Systems "Ethernet/IP"

LED	Significance	Color	Description
H22	Not active	Off	Interface has been switched off (24V supply) or has no IP address
	Not connected	 Flashing green	Interface has an IP address, but no connection
	Connected	 Green	Connection to network available, data transmission running
	Timeout	 Flashing red	Existing connection was aborted
	Invalid IP address	 Red	Assigned IP address is already used by another device
	Self test	 Flashing red-green	After switching on, interface carries out a self test

Tab. 6-27: Significance of Display Element Network Status

6.2.8 CCD - cross communication

Description The interface complies with the IEEE 802.3 standard.

The optional module is used as a "master" for cross communication.

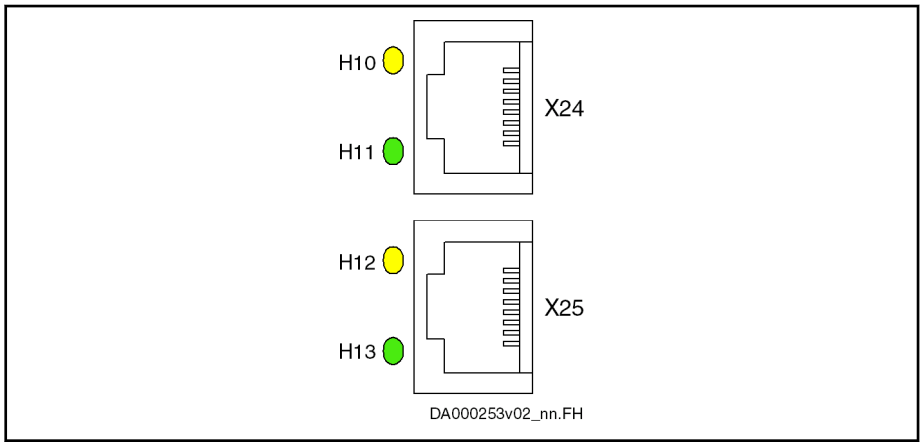
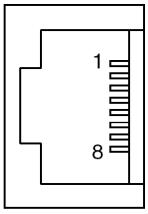


Fig. 6-12: CCD connection points

View	Connection	Signal name	Function
 DA000041v01_nn.FH	1	TD+	Transmit, Differential Output A
	2	TD-	Transmit, Differential Output B
	3	RD+	Receive, Differential Input A
	4	n. c.	-
	5	n. c.	-
	6	RD-	Receive, Differential Input B
	7	n. c.	-
	8	n. c.	-
	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin		

Compatibility	100Base-TX according to IEEE 802.3u
Recommended cable type	• According to **CAT5e**; ITP type of shield (Industrial Twisted Pair) • Ready-made cables that can be ordered: – **RKB0021** Long cables (100 m at maximum) to connect the drive system to the higher-level control unit or remote communication nodes. Minimum bending radius: – 48.75 mm with flexible installation – 32.50 mm with permanent installation Order code for a 30 m long cable: RKB0021/030,0 – **RKB0013** Short cables to connect devices arranged side by side in the control cabinet. 4 lengths available: 0.19 m; 0.25 m; 0.35 m; 0.55 m Order code for a 0.55 m long cable: RKB0013/00,55 Minimum bending radius: 30.75 mm

Tab. 6-28: Function, pin assignment, properties

Display elements

LED	Significance	Color	Description
even-numbered (H6, H8, …)	Status	 Yellow	Data transmission running
uneven-numbered (H7, H9, …)	Link	 Green	Connection to network available

Tab. 6-29: Significance of Display Elements

6.3 Encoder evaluations

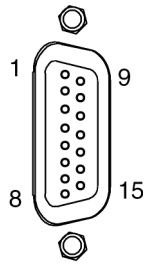
6.3.1 ENS - standard encoder evaluation

ENS standard encoder evaluation interface

Description

For encoders with a supply voltage of **12 volt**:

- Encoder system of IndraDyn S motors (MSK motors)
- Sin-cos encoder 1 V_{pp}; HIPERFACE®
- Sin-cos encoder 1 V_{pp}; EnDat 2.1
- Sin-cos encoder 1 V_{pp}; with reference track
- 5V-TTL square-wave encoder; with reference track
- SHL02.1 Hall sensor box (for position detection of the primary part of IndraDyn L and LSF motors)

Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	Figure
X4, X8 (depends on optional slot at control section)	D-Sub	15	Female (device)	0.25-0.5	

Tab. 6-30: 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

Connection	Signal	Function
14	EncCLK-	Clock negative
15	n. c.	

Tab. 6-31: Pin assignment

ENS properties

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

Tab. 6-32: ENS encoder supply

Input circuit for sine signals A+, A- or B+, B- or R+, R-

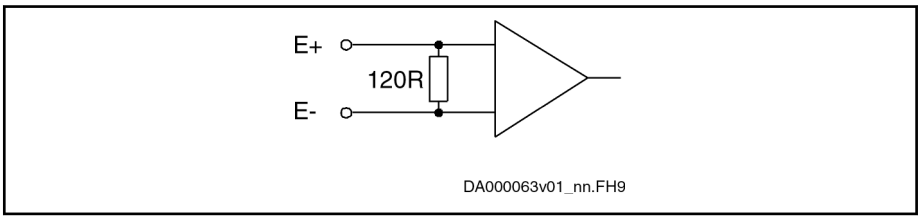


Fig. 6-13: Input circuit for sine signals (block diagram)

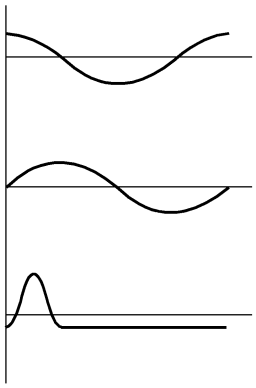
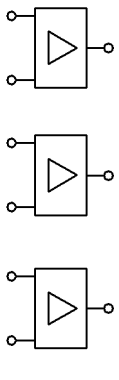
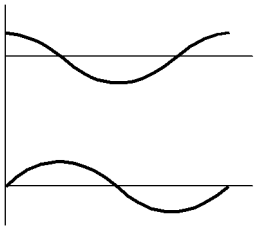
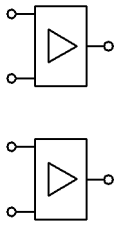
Properties of differential input

Data	Unit	min.	typ.	max.
Amplitude encoder signal ($U_{PPencodersignal}$)	V	0.8	1.0	1.0 + 0.2
Input resistance	ohm		120	
Converter width A/D converter	Bit		12	
Cutoff frequency (-3 dB)	kHz		500	
Input frequency for 5V-TTL signals (square-wave)	kHz			400
Amplitude 5V-TTL signals	V			5.25

Tab. 6-33: Differential input

The input frequency for 5V-TTL signals is lower than the limit frequency, because the differential input is overridden with applied 5V signals.

Signal assignment to the actual position value

Signal assignment [1]	Signal designation	Signal shape	Actual position value (with default setting)
 DK000089v01_nn.FH9	A+ A- B+ B- R+ R-  DF000381v01_nn.FH11	Sine (1 V_{pp}) Without absolute value	Increasing
 DK000088v01_nn.FH9	A+ A- B+ B-  DF000382v01_nn.FH11	Sine (1 V_{pp}) With absolute value	Increasing

1) See following note

Tab. 6-34: Signal assignment to the actual position value

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

- 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).

ENS connection diagrams

ENS with S1 / M1 encoder system

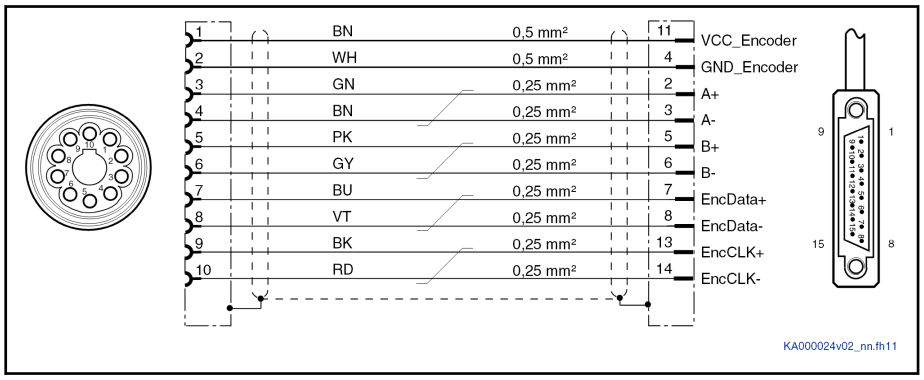


Fig. 6-14: S1 / M1 encoder system connection diagram

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

ENS with S2 / M2 encoder system

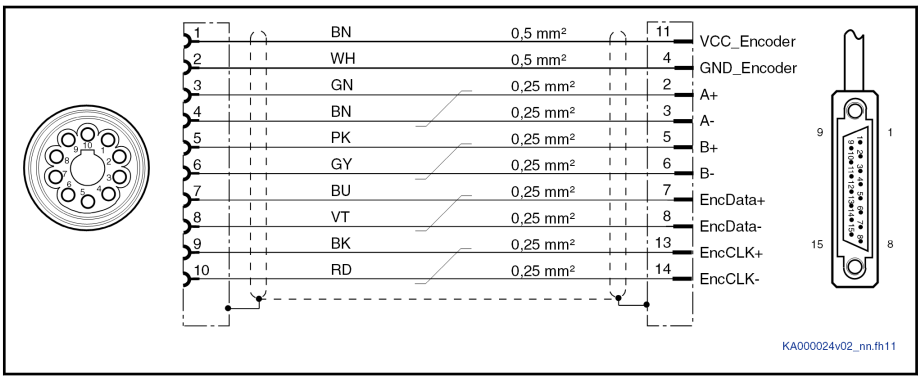


Fig. 6-15: S2 / M2 encoder system connection diagram

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

ENS with SHL02 Hall sensor box

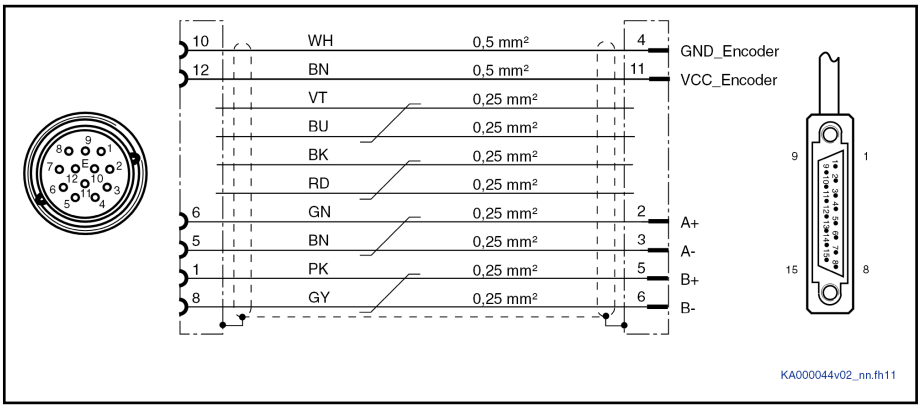


Fig. 6-16: Connection diagram

For **direct** connection to the encoder system use our **RKG0027** cable.

ENS with third-party encoder, connection diagrams

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

ENS with HIPERFACE® third-party encoder, 12V supply voltage

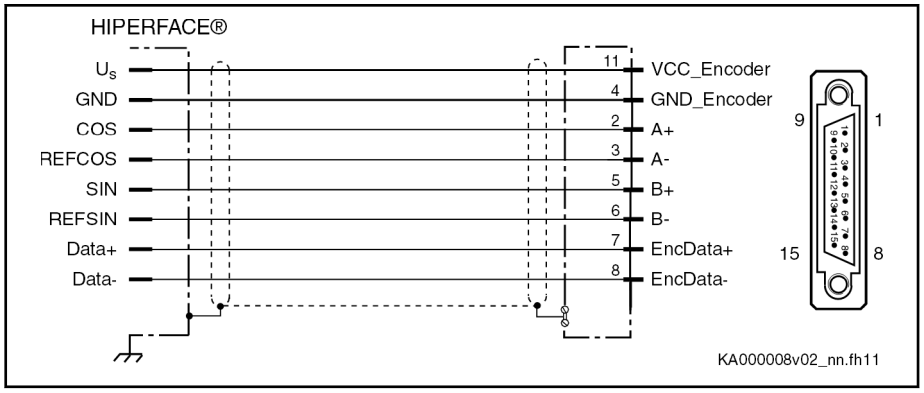


Fig. 6-17: HIPERFACE® third-party encoder connection diagram

ENS with EnDat 2.1 third-party encoder, 12V supply voltage

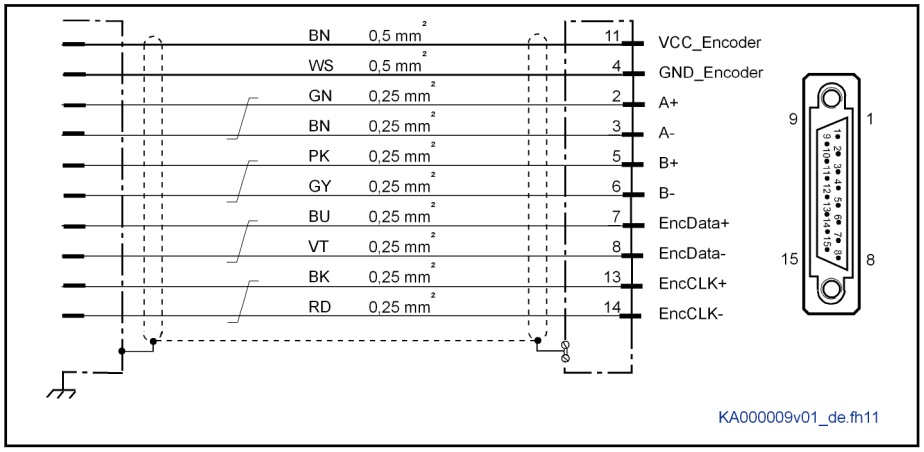


Fig. 6-18: EnDat 2.1 third-party encoder connection diagram

ENS with 1Vpp third-party encoder, 12V supply voltage

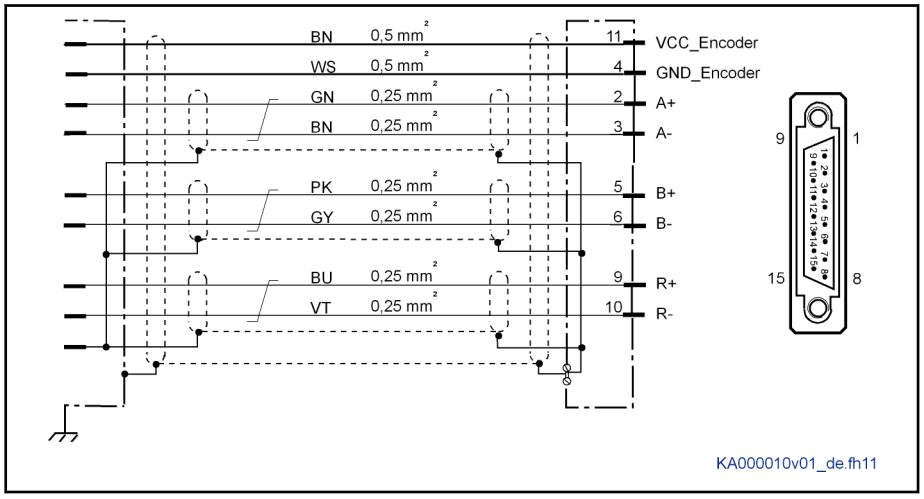


Fig. 6-19: 1Vpp third-party encoder connection diagram

ENS with 5V-TTL third-party encoder, 12V supply voltage

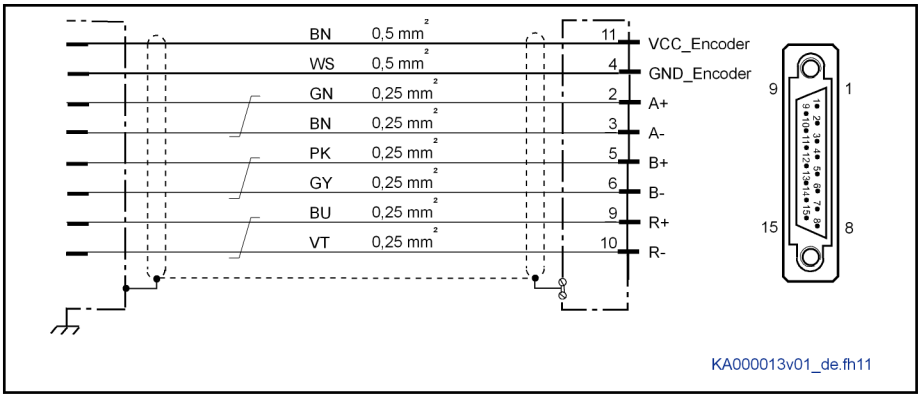
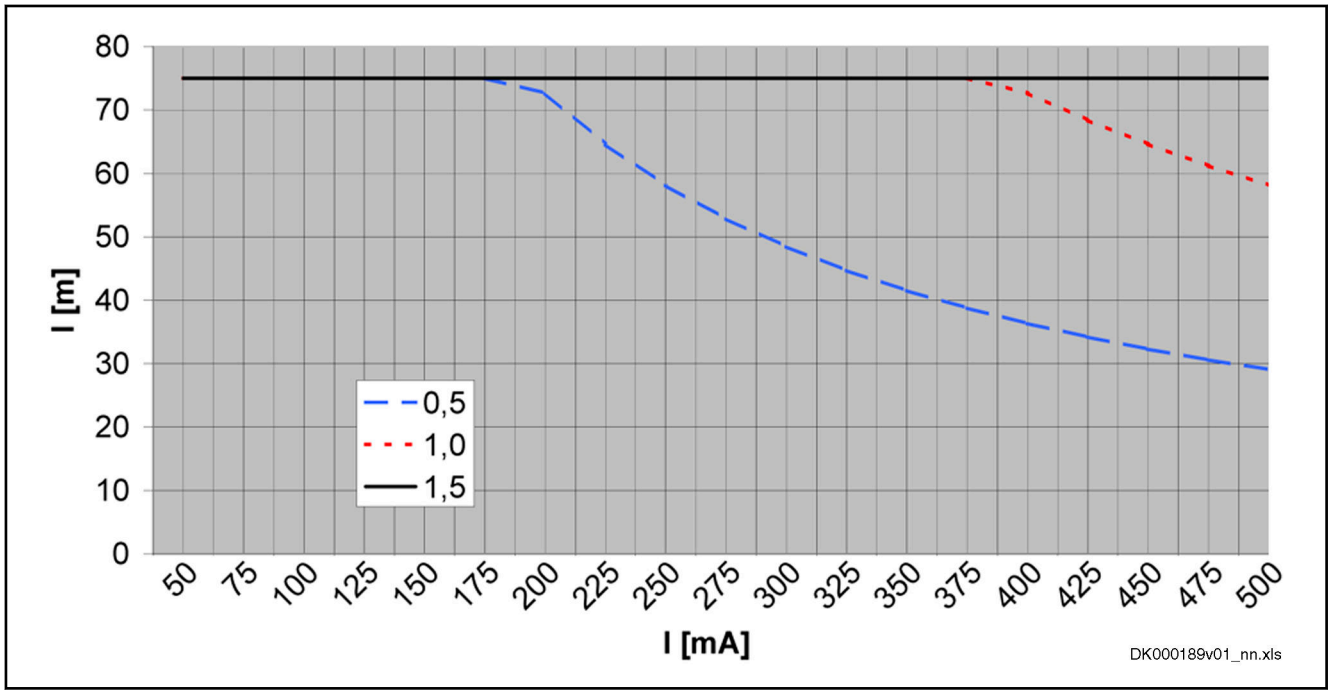


Fig. 6-20: 5V-TTL third-party encoder connection diagram

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
I [m] Cable length
0.5; 1.0; 1.5 Cable cross sections in mm2

Fig. 6-21: 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.

LinCoder® With a LinCoder® used as encoder, the maximum allowed encoder cable length is **50 m**.

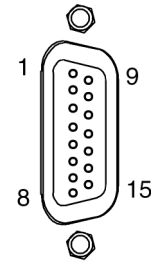
6.3.2 EN1 - resolver and HSF encoder evaluation

EN1 resolver and HSF encoder evaluation interface

Description

For encoder systems with a supply voltage of **DC 8 V** or AC 18.2 V peak-peak:

- Digital servo feedback by Rexroth (HSF encoder interface 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	Number of poles	Type of design	Stranded wire [mm²]	Figure
-	D-Sub	15	Female (device)	0.25-0.5	 DA000053v01_nn.FH9

Tab. 6-35: 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

Tab. 6-36: Pin assignment

EN1 properties

Resolver encoder supply

Data	Unit	min.	typ.	max.
AC output voltage VVC_Encoder (peak-peak value)	V		18.2 [1)]	
Output frequency sine	kHz		4	
Output current	mA			70
D.C. resistance of load	ohm	35		

1) DC 8 V are applied in the switch-on phase.

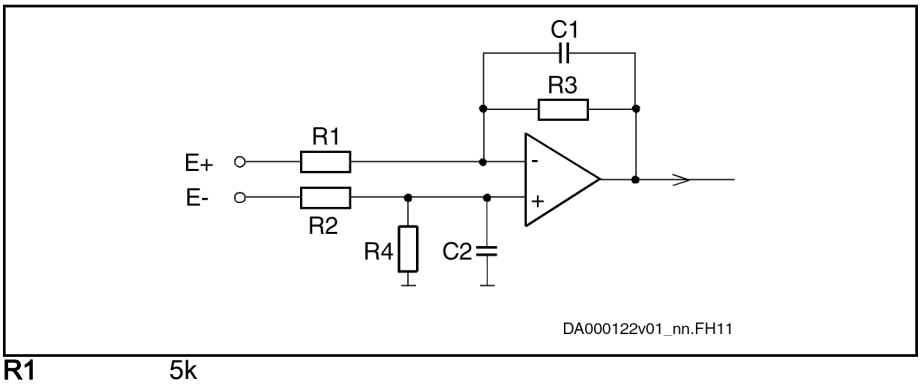
Tab. 6-37: Resolver encoder supply

Digital servo feedback encoder supply

Data	Unit	min.	typ.	max.
DC output voltage VVC_Encoder	V	7.8	8	8.2
Output current	mA			250

Tab. 6-38: HSF encoder supply

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. 6-22: 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	
Cutoff frequency (-3 dB)	kHz		100	

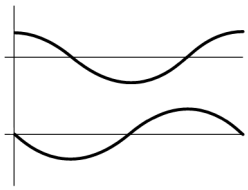
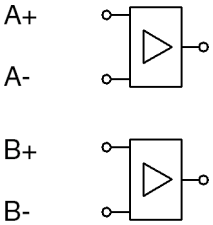
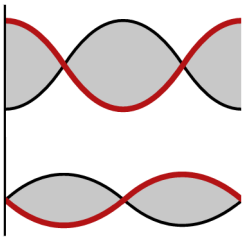
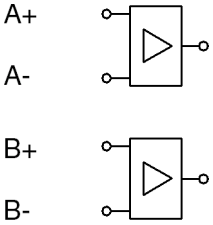
Tab. 6-39: HSF input data

Differential input for resolver operation

Data	Unit	min.	typ.	max.
Amplitude encoder signal sine	V			9.0
Input resistance	kohm	9.5	10	10.5
Converter width A/D converter	Bit		12	
Cutoff frequency (-3 dB)	kHz		18	

Tab. 6-40: Resolver operation input data

Signal assignment to the actual position value

Signal assignment	Signal designation	Signal shape	Actual position value (with default setting)
 DK000086v02_nn.FH11	 DF000382v01_nn.FH11	HSF (sine 1 V_{pp} without 120 ohm terminating resistor, I^2C bus)	**Rotary motor:** Increasing actual position values with clockwise motor motion (when viewed from the front toward the A-side shaft end) **Linear Rexroth motor:** Increasing actual position values with motor motion in the direction of cable outlet
 DK000327v02_nn.FH11 Amplitude-modulated signal	 DF000382v01_nn.FH11	Resolver	

Tab. 6-41: Signal assignment to the actual position value

EN1 connection diagrams

EN1 with encoder systems R0 and R1

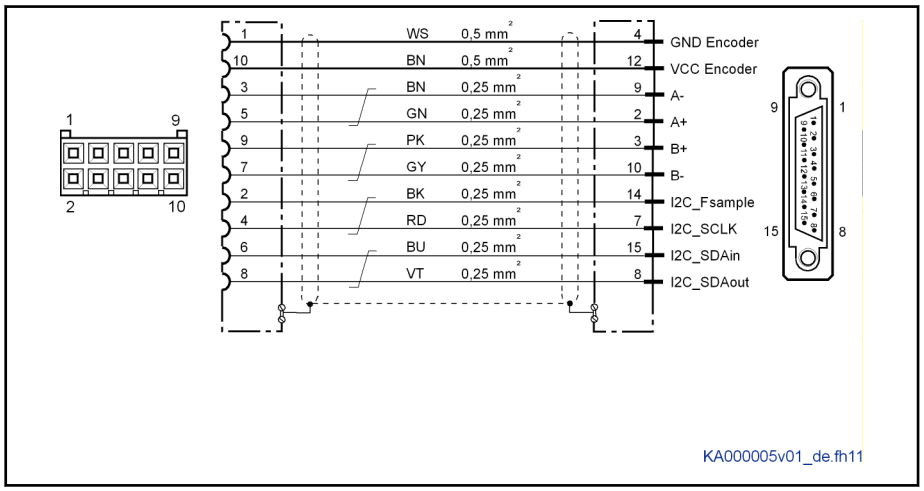


Fig. 6-23: Connection diagram

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

EN1 with encoder systems S0 and M0

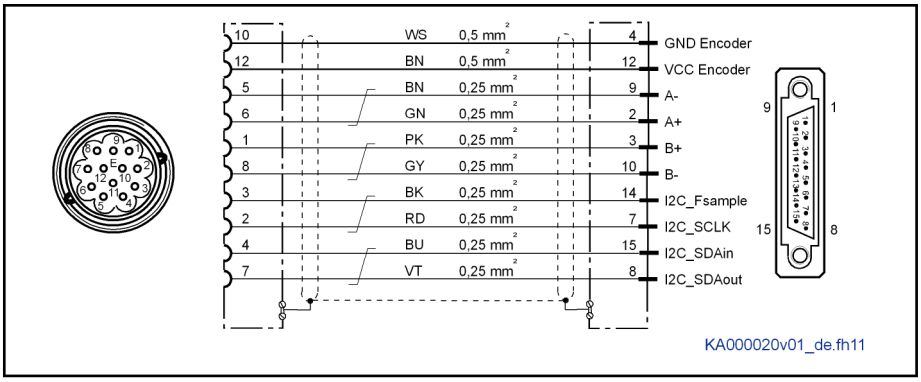


Fig. 6-24: Connection diagram

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

EN1 with SHL01, SHL02 Hall sensor boxes

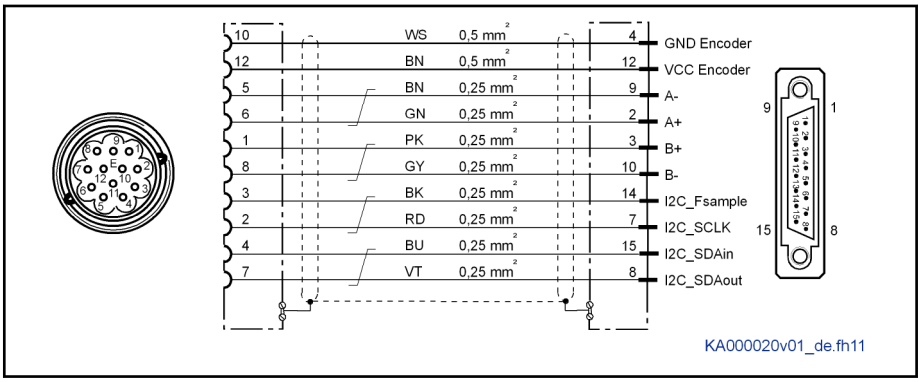


Fig. 6-25: Connection diagram

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

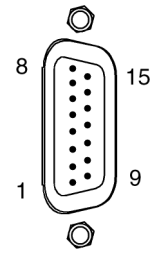
6.3.3 EN2 - encoder evaluation

EN2 encoder evaluation interface

Description

For encoders with a supply voltage of **5 volt**:

- Sin-cos encoder1 V_{pp}; EnDat 2.1; with Sense lines
- Sin-cos encoder 1 V_{pp}; with reference track
- 5V-TTL square-wave encoder; with reference track

Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	Figure
-	D-Sub	15	Pins at device	0.25-1.0	 DA000056v01_nn.FH9

Tab. 6-42: Connection

Pin assignment

Connection	Signal	Function
1	Sense+	Return of supply voltage
2	Sense-	Return of supply voltage
3	R-	Reference track negative
4	R+	Reference track positive
5	B-	Track B negative
6	B+	Track B positive
7	A+	Track A positive
8	A-	Track A negative
9	EncData+	Data transmission
10	GND_Encoder	Power supply reference potential
11	EncCLK+	Clock positive
12	VCC_Encoder	Power supply
13	EncCLK-	Clock negative
14	GND_shld	Connection for signal shields
15	EncData-	Data transmission

Tab. 6-43: Pin assignment

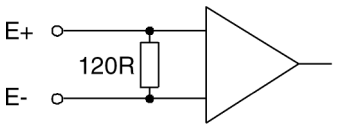
EN2 properties

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		

Tab. 6-44: EN2 encoder supply

Input circuit for sine signals A+, A- or B+, B- or R+, R-



DA000063v01_nn.FH9

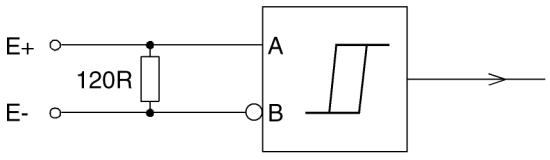
Fig. 6-26: Input circuit for sine signals (block diagram)

Properties of differential input for sine signals

Data	Unit	min.	typ.	max.
Amplitude of encoder signal peak-peak ($U_{PPencodersignal}$)	V	0.8	1.0	1.2
Cutoff frequency (-3 dB)	kHz		500	
Converter width A/D converter	Bit		12	
Input resistance	ohm		120	

Tab. 6-45: Differential input, sine

Input circuit for square-wave signals



DA000064v01_nn.FH9

Fig. 6-27: 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			250…300
Input resistance	ohm		120	

Tab. 6-46: Differential input square-wave signals

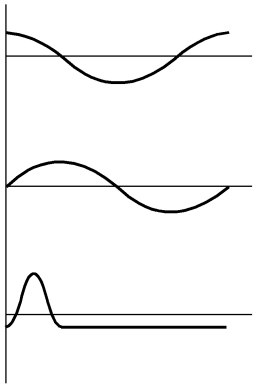
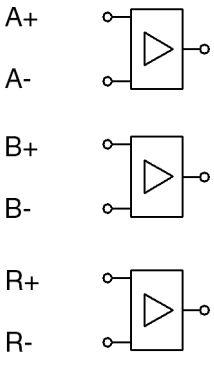
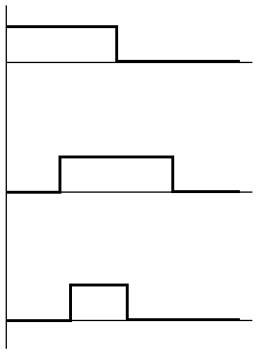
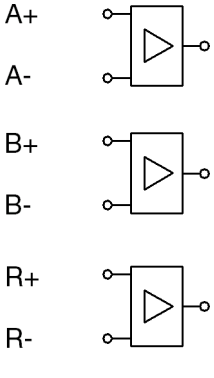
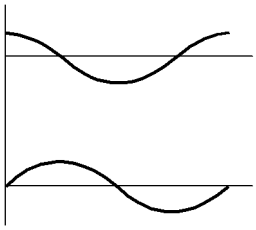
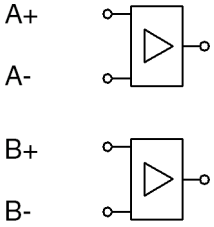
Sense+, Sense-

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

Signal assignment to the actual position value

Signal assignment [1]	Signal designation	Signal shape	Actual position value (with default setting)
 DK000089v01_nn.FH9	 A+ A- B+ B- R+ R- DF000381v01_nn.FH11	Sine (1 V_{pp}) Without absolute value	Increasing
 DK000090v01_nn.FH9	 A+ A- B+ B- R+ R- DF000381v01_nn.FH11	Square-wave (TTL) Without absolute value	Increasing
 DK000088v01_nn.FH9	 A+ A- B+ B- DF000382v01_nn.FH11	Sine (1 V_{pp}) With absolute value (e.g., EnDat)	Increasing

1) See following note

Tab. 6-47: Signal assignment to the actual position value

The encoder signal assignment to the inputs is based on clockwise rotation (front view toward 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

EN2 connection diagrams

EN2 with encoder system C0

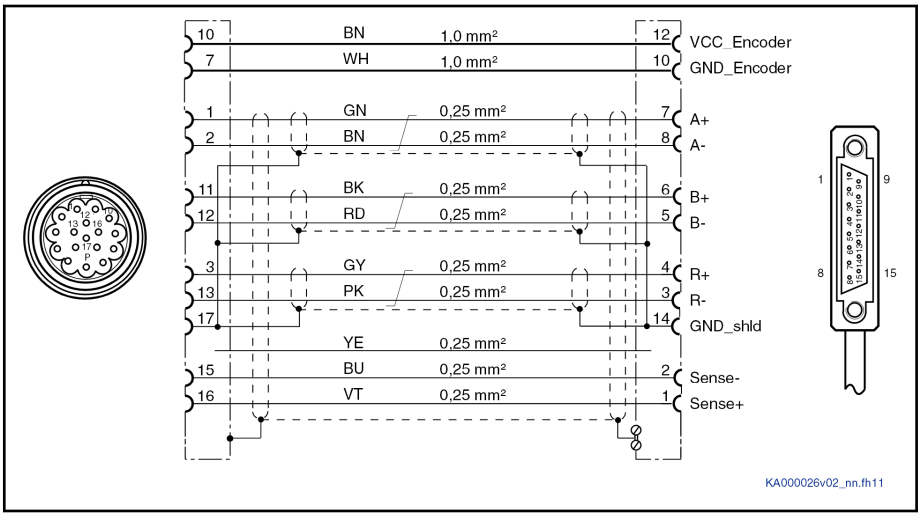


Fig. 6-28: EN2 with encoder system C0, connection diagram

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

EN2 with EnDat2.1 third-party encoder (according to Heidenhain standard) and Sense lines, 5V supply

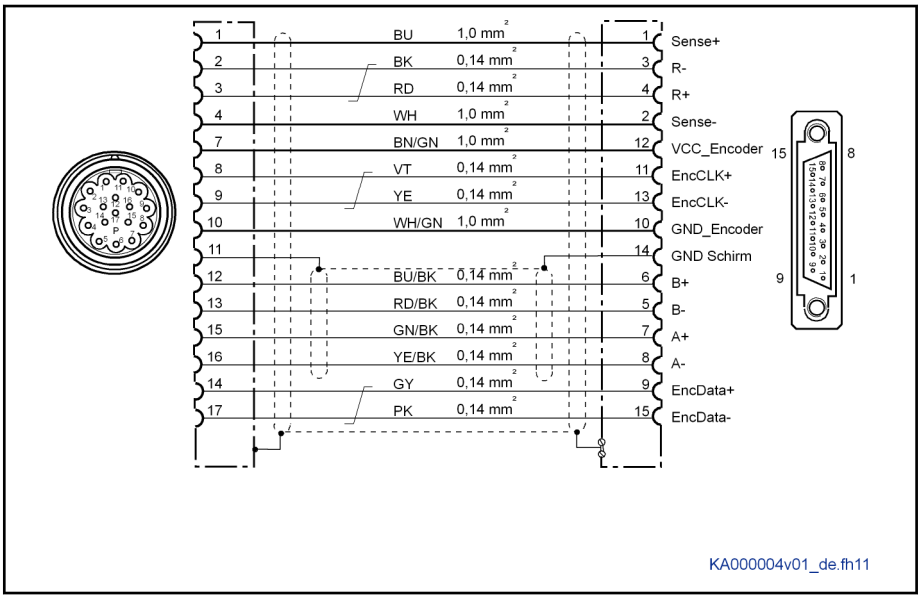


Fig. 6-29: EN2 with EnDat2.1 third-party encoder (according to Heidenhain standard), connection diagram

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

EN2 with 1 Vpp third-party encoder, 5V supply

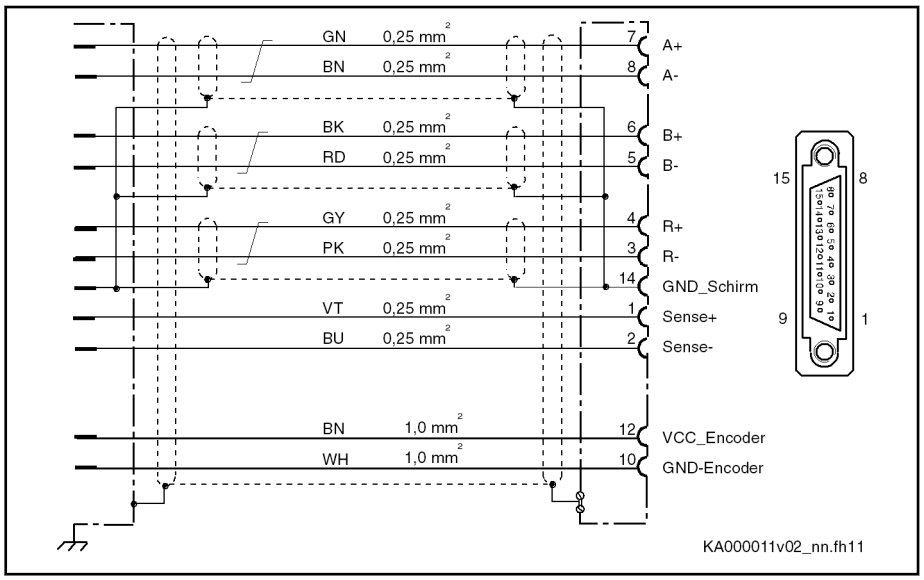


Fig. 6-30: EN2 with 1 Vpp third-party encoder, 5V supply, connection diagram

EN2 with square-wave third-party encoder, 5V supply

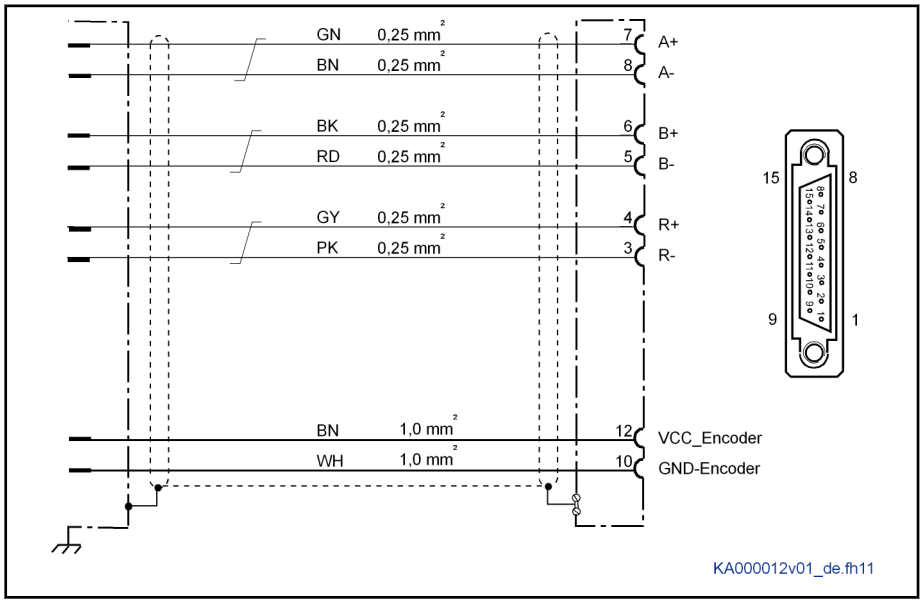


Fig. 6-31: EN2 with square-wave third-party encoder, 5V supply, connection diagram

Allowed encoder cable lengths at EN2

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

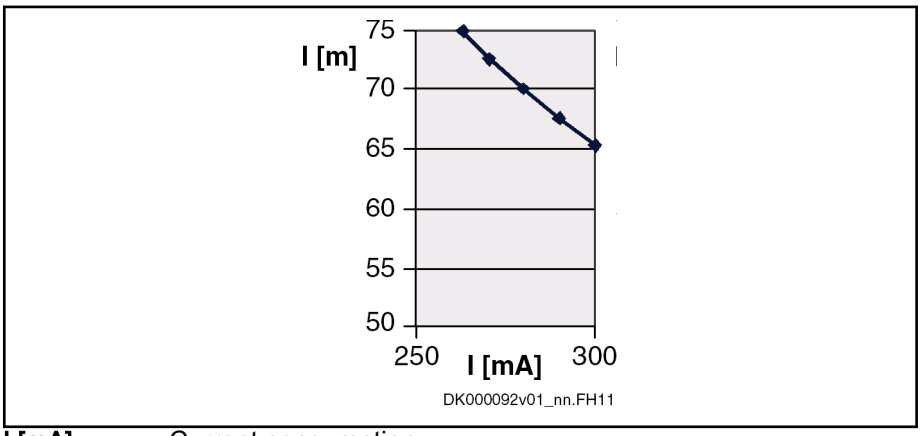
The drive controller can influence the voltage for encoder supply (VCC_Encoder). For this purpose, the actual voltage value at the encoder can be detected with the Sense lines.

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 the following aspects into account:

- The **cross section of the lines** 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 5V ±5%

With Sense connection in the encoder line

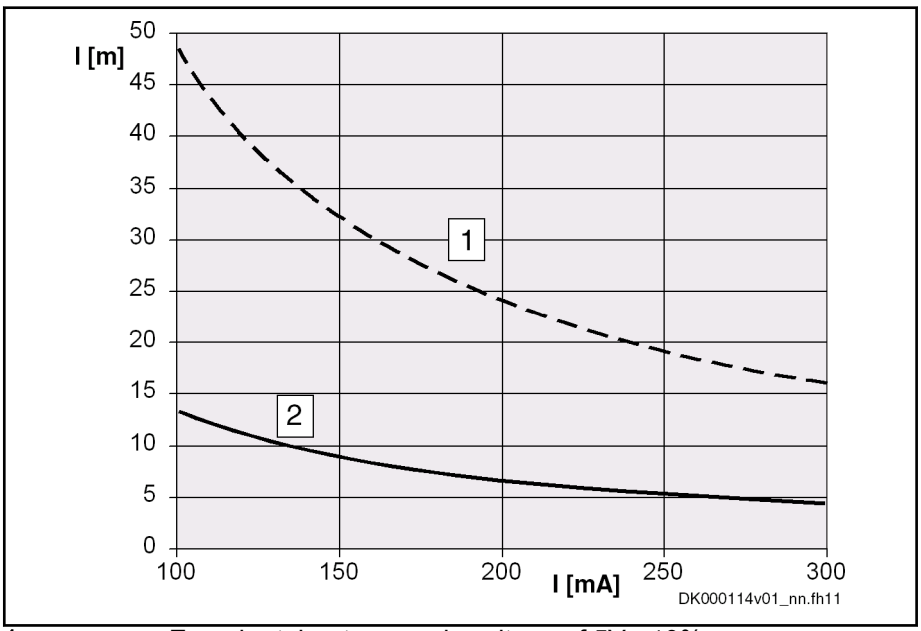


I [mA] Current consumption
I [m] Length

Fig. 6-32: 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. 6-33: Encoder cable lengths without Sense connection

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

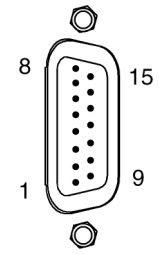
Smaller cross sections (e.g., of original Heidenhain cables) reduce the allowed cable length.

6.4 Encoder emulation - MEM

6.4.1 Interface

Description

Emulation of absolute value and incremental encoder signals 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	Number of poles	Type of design	Stranded wire [mm²]	Figure
X8.1 [1)] X8.2 [2)] X10 [3)] X16 [4)]	D-Sub	15	Pins at device	0.25-0.5	 DA000056v01_nn.FH9

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

Tab. 6-48: 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.

Connection	Signal	Function
13	UA1-	Incremental encoder: Track A1 Absolute encoder: n. c.
14	UA2+	Incremental encoder: Track A2 Absolute encoder: n. c.
15	UA2-	Incremental encoder: Track A2 Absolute encoder: n. c.

Tab. 6-49: Pin assignment

Line data

Data	Unit	min.	typ.	max.
Allowed length	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)		

Tab. 6-50: Line at MEM

NOTICE **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.

6.4.2 Incremental encoder emulation

Connection of incremental encoder emulation

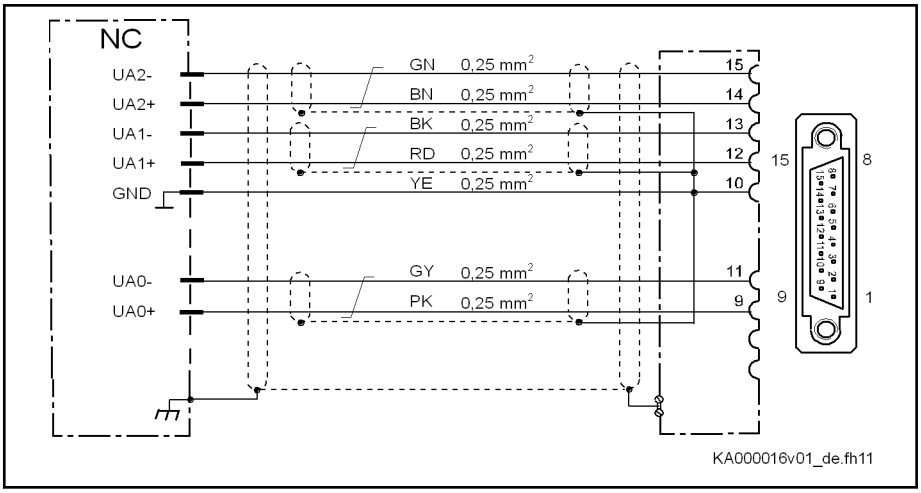


Fig. 6-34: Connection of incremental actual position value output

Differential outputs of incremental encoder emulation

Data	Unit	min.	typ.	max.
Output voltage "high"	V	2.5		5
Output voltage "low"	V	0		0.5

Data	Unit	min.	typ.	max.
Output current I_{out}	mA			I 20 I
Load capacitance between output and 0 V	nF			10
Output frequency f	MHz			1
Overload protection			Present	

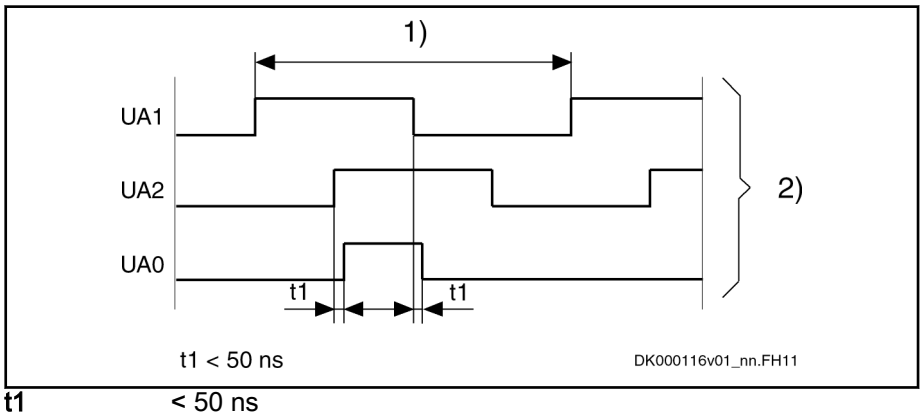
Tab. 6-51: Differential outputs

Accessories

To adjust the output voltage levels, there is the accessory "**HAS05.1-003** , signal level converter for encoder emulation".

For a detailed description of this accessory, see Project Planning Manual "Rexroth IndraDrive Additional Components and Accessories".

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. 6-35: 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. 6-36: 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 filtering 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.

6.4.3 Absolute encoder emulation (SSI format)

Connection of absolute encoder emulation

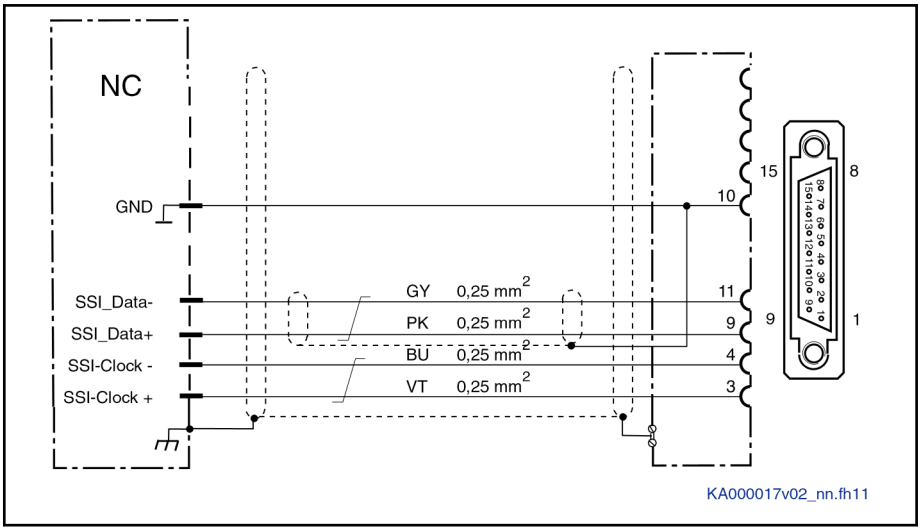


Fig. 6-37: Output of absolute actual position values according to SSI format

Differential input circuit, absolute encoder emulation

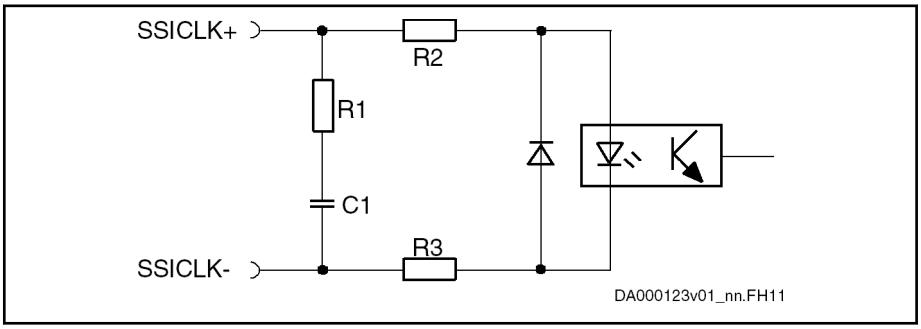


Fig. 6-38: Differential input circuit (block diagram)

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		

Tab. 6-52: Differential inputs

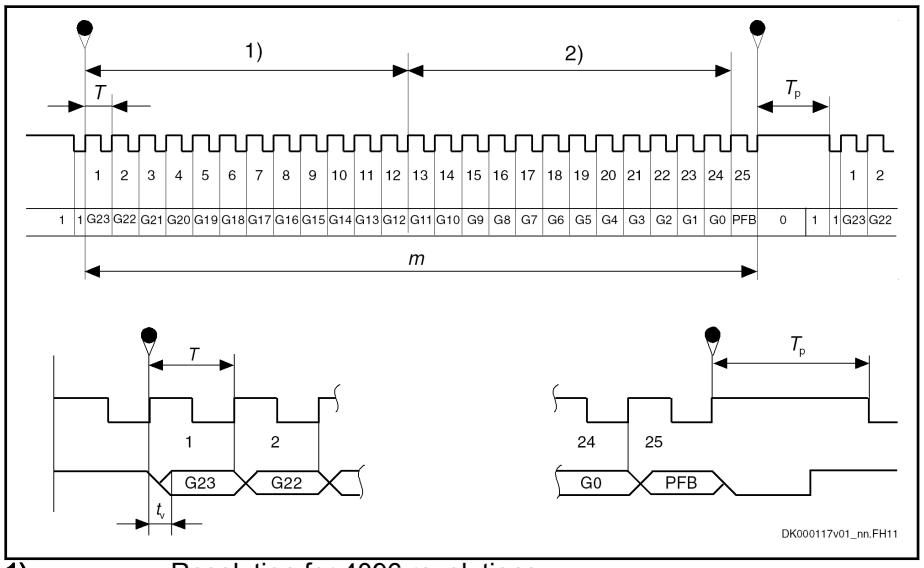
Differential outputs, absolute encoder emulation

Data	Unit	min.	typ.	max.
Output voltage "high"	V	2.5		5
Output voltage "low"	V	0		0.5
Output current Iout	mA			I 20 I
Load capacitance between output and 0 V	nF			10

Data	Unit	min.	typ.	max.
Output frequency f	MHz			1
Overload protection		Present		
Terminating resistor at load	ohm	150-180		

Tab. 6-53: Differential outputs

The differential output corresponds to the RS422 specifications. On the control side, a line terminating resistor has to 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. 6-39: Pulse diagram with absolute actual position value output (SSI format)

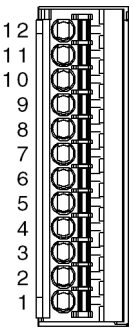
6.5 I/O extensions

6.5.1 AN - analog inputs extension

Description

The option increases the number of analog channels.

The option provides 4 differential analog input channels ±10V.

Connection point	Type	Number of poles	Solid wire [mm²]	Stranded wire [mm²]	AWG	Figure
X39	Spring terminal Female (connector)	12	0,25-2,5	0,25-1,5	24-16	 DG000202v01_nn.FH11

Tab. 6-54: Connections

Pin assignment

Function	Signal	Connection	Technical data
GND connection to analog source AE4	GND_{100}	12	Analog input type 5 see "Technical data - functions"
Analog differential input 6	I_a_6-	11	
	I_a_6+	10	
GND connection to analog source AE3	GND_{100}	9	Analog input type 5 see "Technical data - functions"
Analog differential input 5	I_a_5-	8	
	I_a_5+	7	
GND connection to analog source AE2	GND_{100}	6	Analog input type 5 see "Technical data - functions"
Analog differential input 4	I_a_4-	5	
	I_a_4+	4	
GND connection to analog source AE1	GND_{100}	3	Analog input type 5 see "Technical data - functions"
Analog differential input 3	I_a_3-	2	
	I_a_3+	1	

Tab. 6-55: Pin assignment

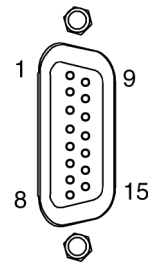
6.5.2 MA1 - analog I/O extension

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 bit)
- 2 analog output channels ±10V (resolution: 12 bit)

Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	Figure
X4 [1)] X8 [2)] X8.1 [3)] X8.2 [3)] X10 [4)]	D-Sub	15	Female (device)	0.08-0.5	 DA000053v01_nn.FH9

1) See also control section CSB01.1C configuration table: Option 2
2) See also control sections CSH01.1C, CSH01.2C, CSH01.3C configuration table: Option 2
3) See also control section CDB01.1C configuration table: Option 3, option 4
4) See also control section CSH01.1C configuration table: Option 3

Tab. 6-56: MA1 connection point

Pin assignment

Function	Signal	Pin[1)]	Technical data
GND connection to analog source AE1	GND_{100}	1	Analog input type 2 see "Technical Data - functions"
Analog differential input 1	I_a_1+	2	
	I_a_1-	9	
GND connection to analog source AE2	GND_{100}	3	
Analog differential input 2	I_a_2+	4	
	I_a_2-	11	

Function	Signal	Pin[1)]	Technical data
Analog output 1	O_a_1	5	Analog output type 3 see "Technical Data - functions"
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	
Analog output 2	O_a_2	14	
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

Tab. 6-57: Pin assignment

For notes on function and commissioning, see Functional Description of firmware in sections **Analog outputs** and **Analog inputs**.

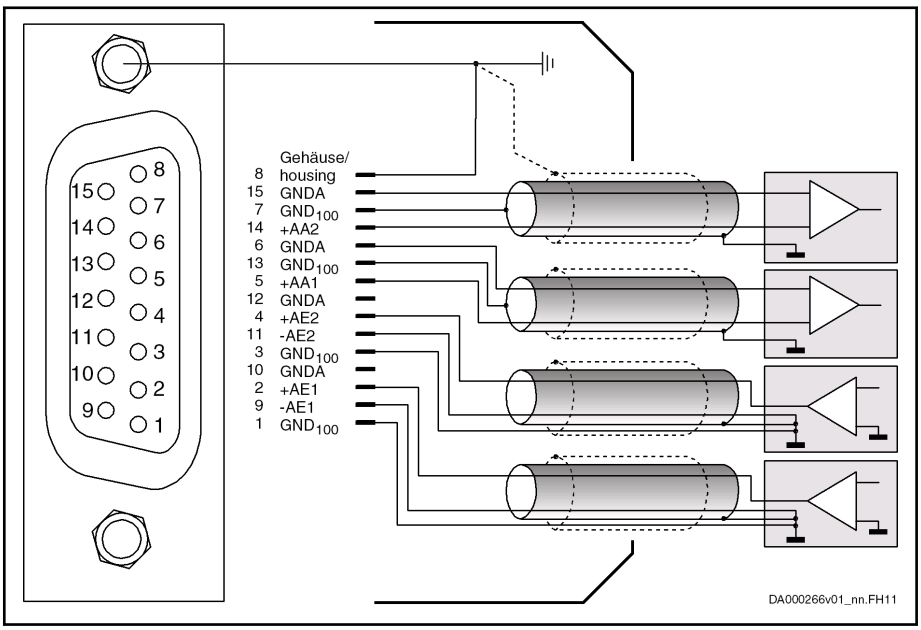
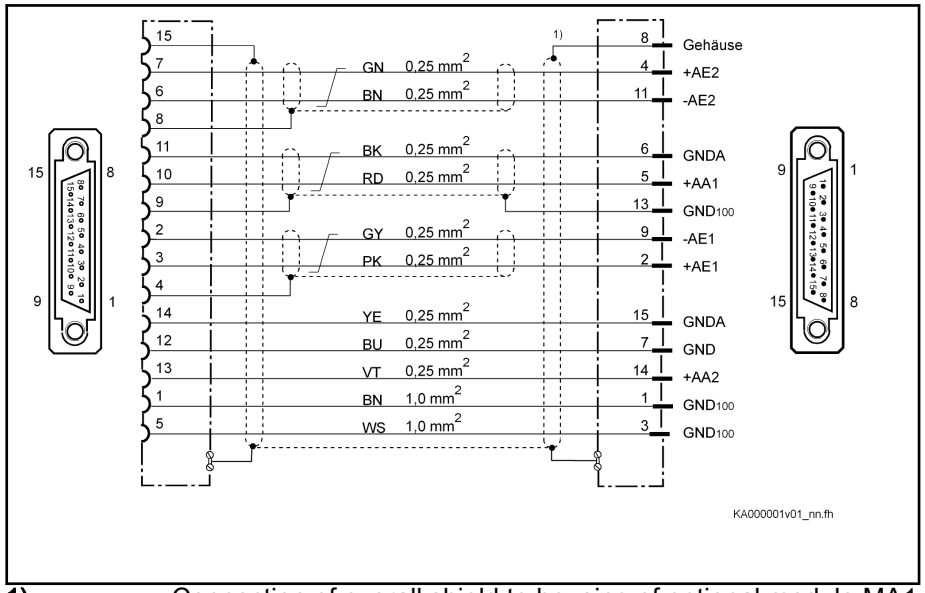


Fig. 6-40: Basic wiring

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.



MA 1 interconnection diagram with UM 45 distribution box

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

Fig. 6-41: RKS 0003 interconnection diagram

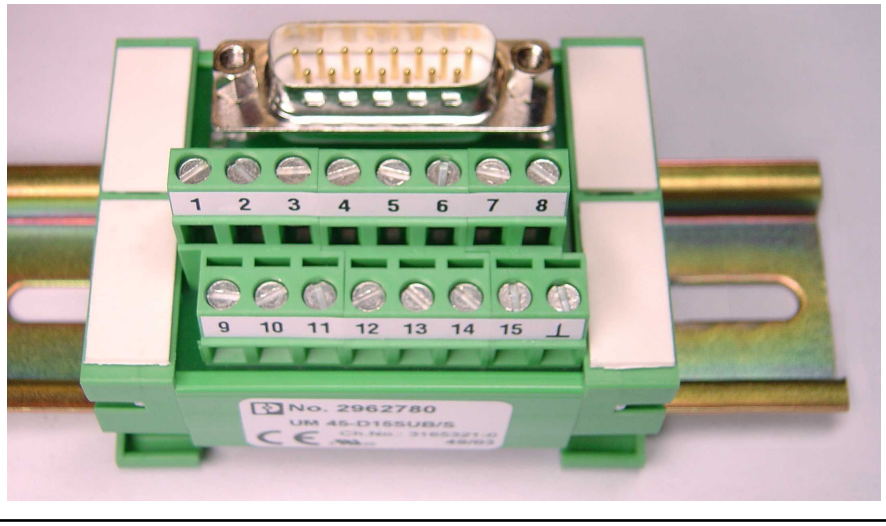


Fig. 6-42: UM 45-D15SUB/S distribution box (Phoenix Contact)

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.

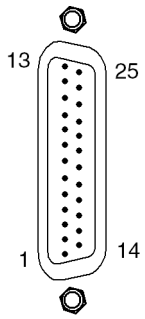
6.5.3 MD1 - digital I/O extension

Description

This option is an extension for IndraDrive control sections.

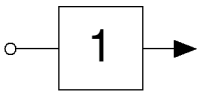
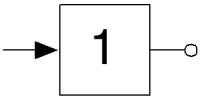
The option makes available the following functions:

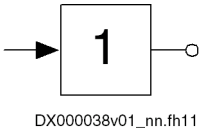
- 12 digital 24 V inputs
- 8 digital 24 V outputs

Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	Figure
X10	D-Sub	25	Pins at device	0.08-0.5	 DA000057v01_nn.FH9

Tab. 6-58: Connection

Pin assignment

Function	Signal	Connection	Technical data
 DX000037v01_nn.fh11 Digital input group 0	I_0.0	14	24 V 3 mA see "Technical Data - functions"
	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
 DX000038v01_nn.fh11 Digital output group 0	O_0.0	1	24 V 0.5 A see "Technical Data - functions"
	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
 DX000038v01_nn.fh11 Digital output group 1	O_1.0	9	24 V 0.5 A see "Technical Data - functions"
	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	

Tab. 6-59: Signal assignment

📖 For notes on function and commissioning, see Functional Description of firmware in section **Digital inputs/outputs**.

6.5.4 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

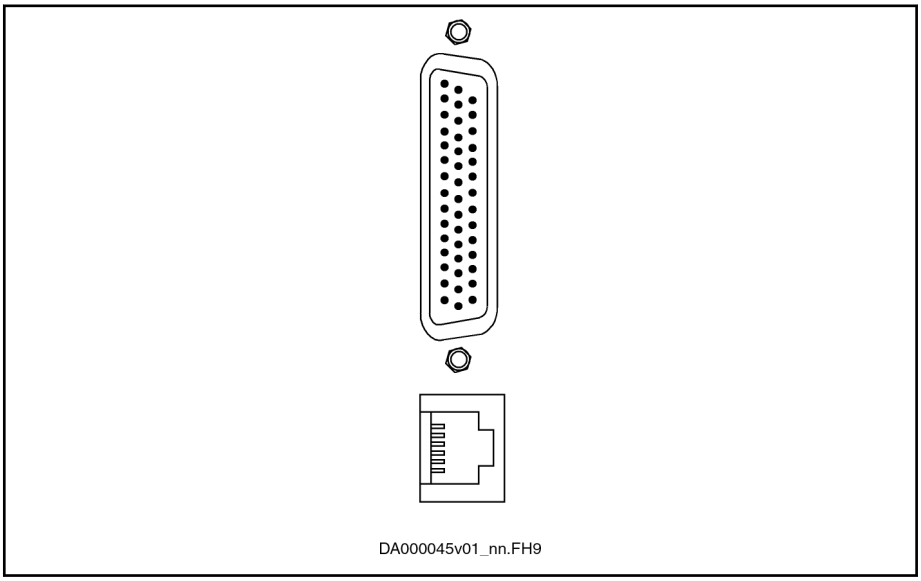
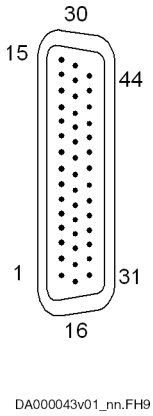


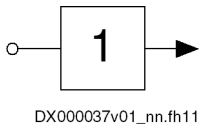
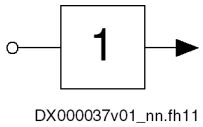
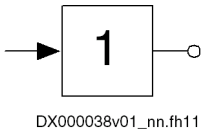
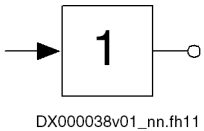
Fig. 6-43: MD2

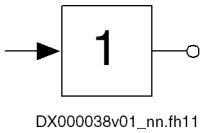
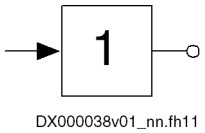
X17, digital I/O extension at MD2

Connection point	Type	Number of poles	Description	Figure
X17	D-Sub (High Density)	44	I/O extension	

Tab. 6-60: Connection

X17 I/O extension pin assignment

Function	Signal	Connection	Technical data
 DX000037v01_nn.fh11 Digital input group 0	I_0.0	7	24 V 3 mA see "Technical Data - functions"
	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	
Power supply for input group 0	+24V	36	DC 19 … 30 V max. 1.1 A
	0V	35	
 DX000037v01_nn.fh11 Digital input group 1	I_1.0	3	24 V 3 mA see "Technical Data - functions"
	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 max. 1.1 A
	0V	33	
 DX000038v01_nn.fh11 Digital output group 0	O_0.0	15	24 V 0.5 A see "Technical Data - functions"
	O_0.1	30	
	O_0.2	14	
	O_0.3	29	
Power supply for output group 0	+24V	44	DC 19 … 30 V max. 1.1 A
	0V	43	
 DX000038v01_nn.fh11 Digital output group 1	O_1.0	13	24 V 0.5 A see "Technical Data - functions"
	O_1.1	28	
	O_1.2	12	
	O_1.3	27	
Power supply for output group 1	+24V	42	DC 19 … 30 V max. 1.1 A
	0V	41	

Function	Signal	Connection	Technical data
 DX000038v01_nn.fh11 Digital output group 2	O_2.0	11	24 V 0.5 A see "Technical Data - functions"
	O_2.1	26	
	O_2.2	10	
	O_2.3	25	
Power supply for output group 2	+24V	40	DC 19 … 30 V max. 1.1 A
	0V	39	
 DX000038v01_nn.fh11 Digital output group 3	O_3.0	9	24 V 0.5 A see "Technical Data - functions"
	O_3.1	24	
	O_3.2	8	
	O_3.3	23	
Power supply for output group 3	+24V	38	DC 19 … 30 V max. 1.1 A
	0V	37	
Cable shield connection	shld	Connector housing	

Tab. 6-61: Pin assignment

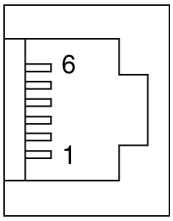
For notes on function and commissioning, see Functional Description of firmware in section **Digital inputs/outputs**.

The digital inputs/outputs are galvanically isolated from the control section.

Connect connection point X17 to the terminal strip in the control cabinet using our **RKS0004** cable. The RKS0004 cable is up to 10 m long. See also example of connection MD2.

X16, SSI encoder evaluation at 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	Number of poles	Description	Figure
X16	RJ11	6	SSI encoder evaluation	 DA000044v01_nn.FH9

Tab. 6-62: Connection

X16 SSI interface pin assignment

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 max. 0.2 A
6	0V	Reference potential	
Connector housing	shld	Cable shield connection	

Tab. 6-63: Pin assignment

Maximum line length

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

Tab. 6-64: Line length and SSI_CLK frequency

MD2, schematic example of connection

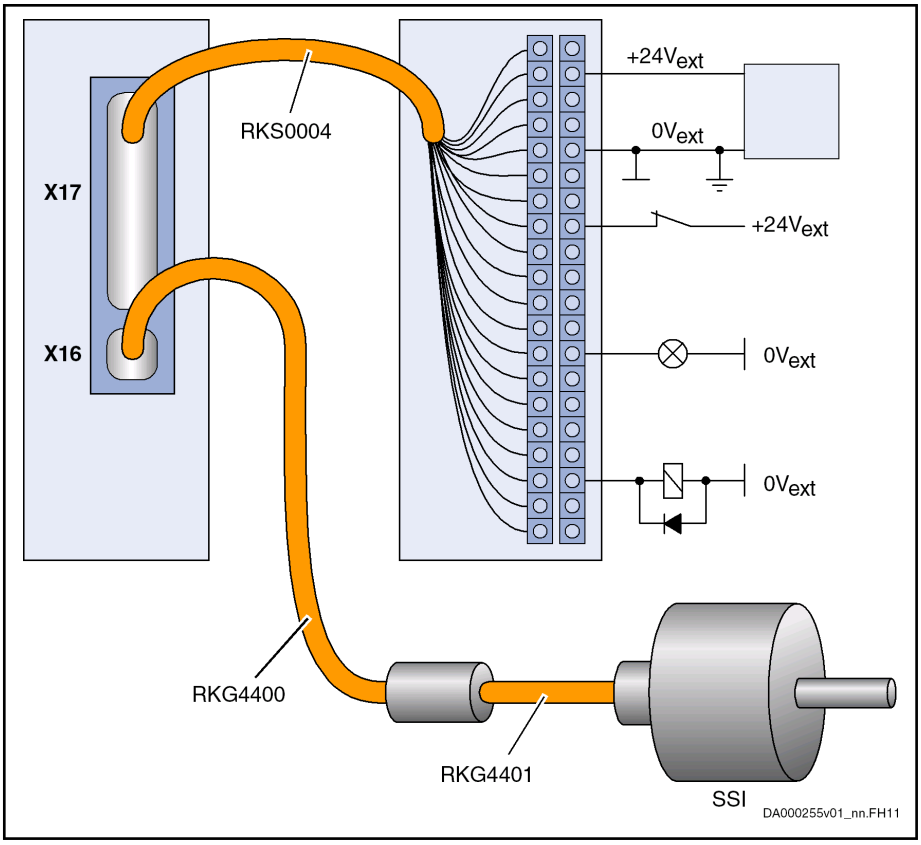


Fig. 6-44: MD2 I/O extension, example of connection

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

- **RKG4400** cable 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 by Stegmann, use our **RKG4401** cable.

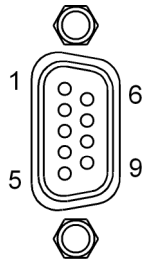
6.6 Safety technology

6.6.1 L1 - starting lockout

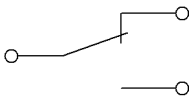
Description

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

X41, starting lockout L1 connection point

Connection point	Type	Number of poles	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Figure
X41	D-Sub, female (device)	9	0.25-0.5	-	-	 DA000054v01_nn.FH9

Tab. 6-65: Connection

Function	Signal	Connection	Nominal data	Technical data
Control signal starting lockout assignment A	AS A	1	24 V / 3 mA	see Digital inputs type A (standard), page 166
Inverted control signal starting lockout	AS n	2		
Control signal starting lockout assignment B	AS B	3		
Supply for acknowledgment potential	ASQ	4	DC 24 V / 1 A	see Relay contact type 3, page 166  DA000016v01_nn.FH11
Acknowledgment	ASQ1	5		
Inverted acknowledgment	ASQ2	6		
n. c.	-	7	-	-
Power supply of **isolated** inputs and outputs "AS A"; "AS B"; "AS n"	+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		

Tab. 6-66: Pin assignment

Function

AS	ASn	State	ASQ1	ASQ2
1	0	Starting lockout active	= ASQ	Open
0	1	Starting lockout not active	Open	= ASQ

AS	ASn	State	ASQ1	ASQ2
0	0	Error when selecting starting lockout	Open	= ASQ
1	1			

Tab. 6-67: Function

Connection accessory, starting lockout L1

The bus wiring is **not** suited for multiple "starting lockout L1" options.

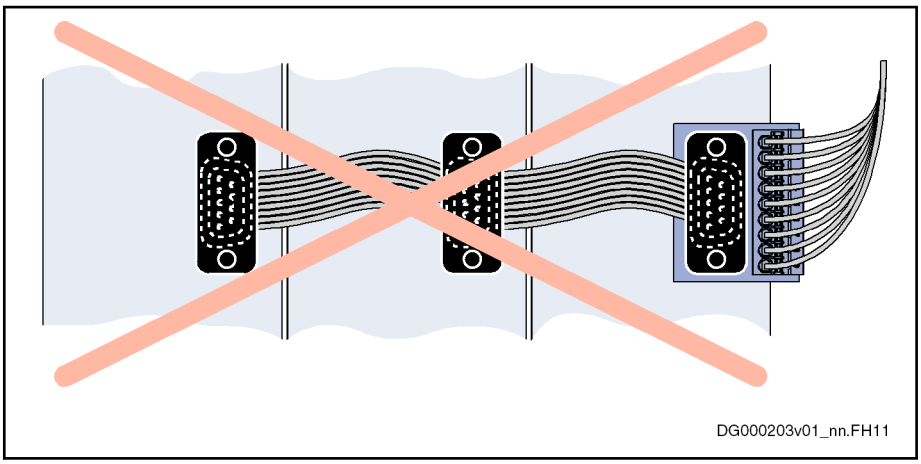


Fig. 6-45: No bus wiring for multiple L1 options

For wiring with single cores, use the ready-made cable **RKS0001** (D-Sub connector for single wire ends) or the **HAS05.1-007-NNR** adapter.

Commissioning information

Via the ribbon cable, the signals of all involved connection points X41 are connected in parallel. Differentiated evaluation is impossible with N/O contacts (ASQ, ASQ2) connected in parallel.

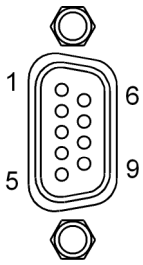
Feedback for all N/C contacts (ASQ, ASQ1) connected in parallel is allowed via one channel, if the "supply for acknowledgment potential" (ASQ) signal has been designed in dynamized form.

6.6.2 L2 - Safe Torque Off

Description

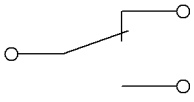
The optional module is used for the safety function "Safe torque off".

X41, connection point "Safe Torque Off" L2

View	Identification	Function
 DA000054v01_nn.FH9	X41	"Safe Torque Off" L2

D-Sub, 9-pin, female	Unit	min.	max.
Connection cable Stranded wire	mm^2	0.25	0.5

Tab. 6-68: Function, pin assignment, properties

Function		Signal	Connection	Nominal data	Technical data
Inverted acknowledgment	 DA000016v01_nn.FH11	STO Q2	6	DC 24 V / 1 A	Relay contact type 3 [1]
Supply for acknowledgment potential		STO Q	4		
Acknowledgment		STO Q1	5		
Control signal "Safe Torque Off" assignment A		STO A	1	24 V / 3 mA	Digital inputs type A (standard) [2]
Inverted control signal "Safe Torque Off"		STO n	2		
Control signal "Safe Torque Off" assignment B		STO B	3		
Reference voltages of the isolated inputs "STO A", "STO B", "STO n"		+24V	8	DC 24 V	DC 19.2 … 30 V Min. 0.1 A
		0VE	9		
n. c.			7		

1) See index entry "Relay contact → Type 3"
2) See index entry "Digital inputs → Technical data"

Tab. 6-69: Pin assignment

Function

STO	STO n	State	STO Q1	STO Q2
1	0	"Safe torque off" active	= STO Q	Open
0	1	"Safe torque off" not active	Open	= STO Q
0	0	Selection error "Safe torque off"	Open	= STO Q
1	1			

Tab. 6-70: Function

Connection accessories

The bus wiring is **not** suited for multiple "L2" options.

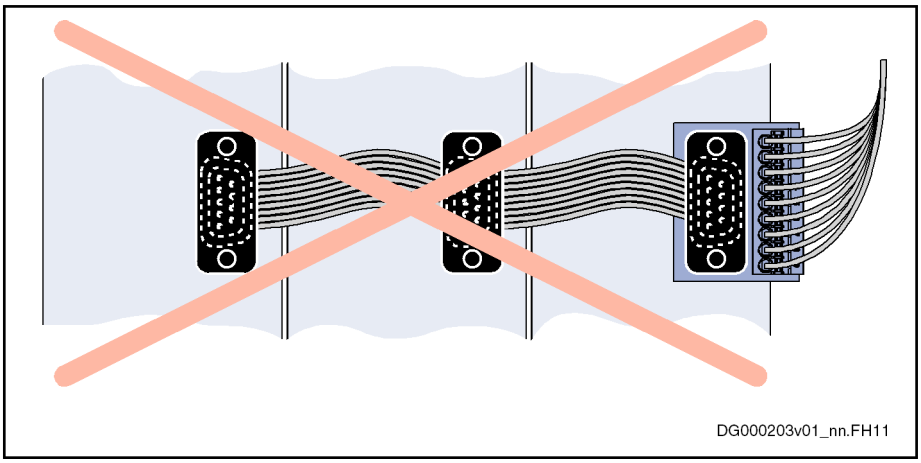


Fig. 6-46: No bus wiring for multiple L2 options

For wiring with single cores, use the ready-made cable **RKS0001** (D-Sub connector for single wire ends) or the adapter **HAS05.1-007-NNR** .

Commissioning information

Via the ribbon cable, the signals of all involved connection points X41 are connected in parallel. Differentiated evaluation is impossible with N/O contacts (STO Q, STO Q1) connected in parallel.

Feedback for all N/C contacts (STO Q, STO Q2) connected in parallel is allowed via one channel, if the "supply for acknowledgment potential" (STO Q) signal has been designed in dynamized form.

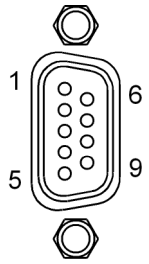
6.6.3 S1 - safety technology I/O

Safety technology S1 description

The option allows for different application-related safety functions, such as Safe standstill, Safe drive interlock, Safely-reduced speed, Safe direction, etc.

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

X41, safety technology S1 connection point

Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Figure
X41	D-Sub	9	Female (device)	0.25-0.5	-	-	 DA000054v01_nn.FH9

Tab. 6-71: Connection

Function		Signal	Connection	Nominal data	Technical data
Input/output forced dynamization	Digital input	IO30	1	24 V / 3 mA	see Digital inputs type A (standard), page 166
	Digital output			24 V / 0.5 A	see Digital outputs, page 170
Input/output acknowledgment	Digital input	IO20	2	24 V / 3 mA	see Digital inputs type A (standard), page 166
	Digital output			24 V / 0.5 A	see Digital outputs, page 170
Input/output / relay contact diagn. message / door locking	Digital input	IO10n	3	24 V / 3 mA	see Digital inputs type A (standard), page 166
	Digital output			24 V / 0.5 A	see Digital outputs, page 170
	N/O contact			DC 24 V / 1A	see Relay contact type 3, page 166
Digital inputs	Operation mode selection	I1n	4	24 V / 3 mA	see Digital inputs type A (standard), page 166
		I2n	5		
		I3n	6		
		I4n	7		

Function		Signal	Connection	Nominal data	Technical data
Power supply of **isolated** inputs and outputs [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 IO10n, IO20 and IO30 (3 × 0.5 A + 0.1 A = 1.6 A).

Tab. 6-72: Pin assignment

Accessories

For the connection X41, there is the accessory **HAS05.1-007** "adapter from D-Sub to terminal connector".

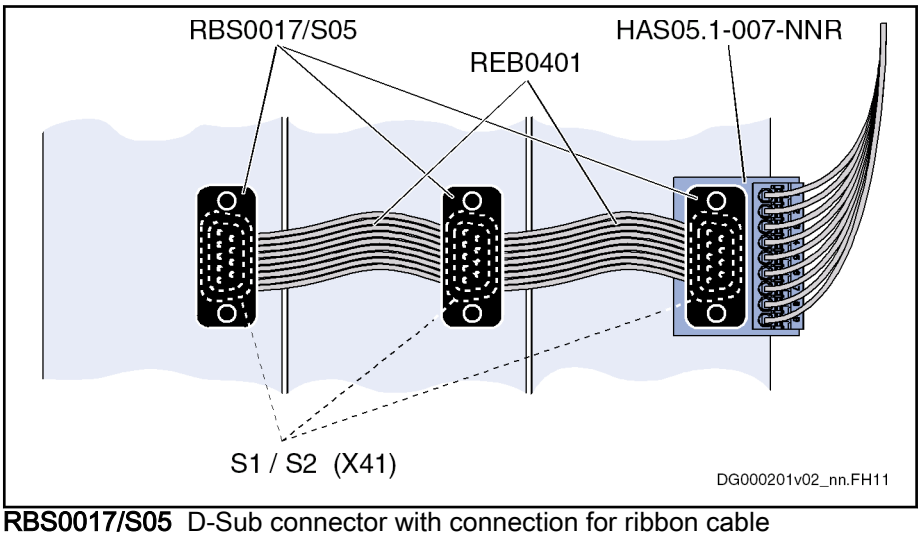
For a detailed description of this accessory, see Project Planning Manual "IndraDrive Additional Components and Accessories".

For the connections of involved X41 via ribbon cable, there are the accessories

- **RBS0017/S05**, D-Sub connector for ribbon cable
- **REB0401**, ribbon cable

Wiring Example With HAS05.1-007-NNR

HAS05.1-007-NN**R** is the preferred adapter for the bus connection of several optional modules S1 or S2.



RBS0017/S05 D-Sub connector with connection for ribbon cable
REB0401 Ribbon cable

Fig. 6-47: HAS05.1-007-NNR

At CSH01.1C control sections, the adapter HAS05.1-007-NN**L** can only be used at the left end of the bus connection, when option 3 has not been equipped.

Note on Commissioning

If you wire the connection X41 via ribbon cable, you must deactivate the "safe feedback for channel 2" for the slave axes.

See also Parameter Description "P-0-3210, Safety technology configuration".

6.6.4 S2 - Safe Motion

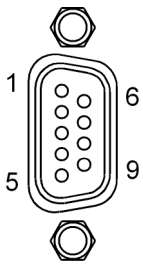
Description S2

The optional module allows different application-related safety functions, such as

- Safe stop 1 (Emergency stop)
- Safe stop 1
- Safe stop 2
- Safe maximum speed
- Safely-limited speed
- Safely-limited increment
- Safe direction
- Safely-monitored position
- Safely-limited position
- Safely-limited position, positive
- Safely-limited position, negative
- Safe homing procedure
- Safe braking and holding system
- Safely-monitored deceleration
- Safe communication
- Safe door locking
- Safe diagnostic outputs
- Safe inputs/outputs
- Safe parking axis
- Single-axis acknowledgment
- Safe stop 1 (braked)
- Safe stop 1 (braked Emergency stop)

☞ It is only possible to use the option in conjunction with an encoder (at slot X4 or X4.1 and X4.2).

X41, connection point safety technology S2

View	Identification	Function
 DA000054v01_nn.FH9	X41	Safety technology S2

D-Sub, 9-pin, female	Unit	Min.	Max.
Connection cable Stranded wire	mm^2	0.25	0.5

Tab. 6-73: Function, pin assignment, properties

Function		Signal	Connection	Nominal data	Technical data
Input/output forced dynamization	Digital input	IO30	1	24 V / 3 mA	Digital inputs type A (standard) [2]
	Digital output			24 V / 0.5 A	Digital outputs [3]
Input/output acknowledgment	Digital input	IO20	2	24 V / 3 mA	Digital inputs type A (standard) [2]
	Digital output			24 V / 0.5 A	Digital outputs [3]
Input/output / relay contact diagn. message / door locking	Digital input	IO10n	3	24 V / 3 mA	Digital inputs type A (standard) [2]
	Digital output			24 V / 0.5 A	Digital outputs [3]
	N/O contact			DC 24 V / 1A	Relay contact type 3 [4]
Digital inputs	Operation mode selection	I1n	4	24 V / 3 mA	Digital inputs type A (standard) [2]
		I2n	5		
		I3n	6		
		I4n	7		
Power supply of **isolated** inputs and outputs [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 IO10n, IO20 and IO30 (3 × 0.5 A + 0.1 A = 1.6 A).
2) See index entry "Digital inputs → Technical data"
3) See index entry "Digital outputs → Technical data"
4) See index entry "Relay contact → Type 3"

Tab. 6-74: Pin assignment

Accessories

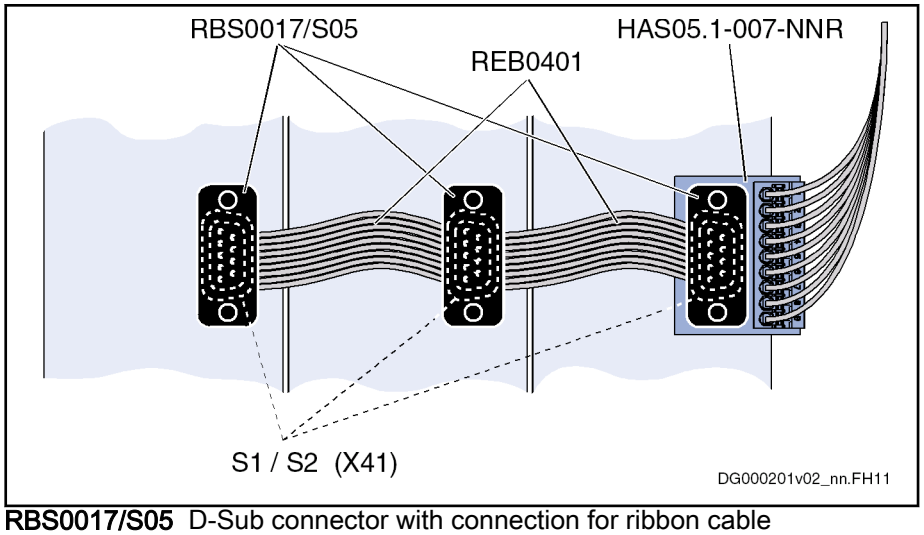
For the connection X41, there is the accessory "**HAS05.1-007**, adapter from D-Sub to terminal connector" .

For the connections of involved X41 via ribbon cable, there are the accessories

- **RBS0017/S05**, D-Sub connector for ribbon cable
- **REB0401**, ribbon cable

Wiring Example With HAS05.1-007-NNR

HAS05.1-007-NN**R** is the preferred adapter for the bus connection of several optional modules S1 or S2.



RBS0017/S05 D-Sub connector with connection for ribbon cable
REB0401 Ribbon cable
Fig. 6-48: HAS05.1-007-NNR

At CSH01.1C control sections, the adapter HAS05.1-007-NN**L** can only be used at the left end of the bus connection, when option 3 has not been equipped.

Note on Commissioning

If you wire the connection X41 via ribbon cable, you must deactivate the "safe feedback for channel 2" for the slave axes.

See also Parameter Description "P-0-3210, Safety technology configuration".

6.7 Control panels

6.7.1 Standard control panel

For a detailed description of the standard control panel and its performance, see the documentation "Application Manual" (Functions) of the firmware used (index entry "Control panels").

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. 6-49: Standard control panel

- 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 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

6.8 Memory

6.8.1 MultiMediaCard PFM02.1

Description Optional MultiMediaCard PFM02.1 used for reading and storing data (firmware, drive parameters, operating data).

There are two variants of PFM02.1:

- "PFM02.1-016-NN-**F**W" with loaded firmware
- "PFM02.1-016-NN-**N**W" preformatted for easy parameter transmission

X7 is the slot for the MultiMediaCard at the control section.

For a description of how to handle the MultiMediaCard, see the Functional Description of the firmware used.

7 Technical data - functions

7.1 Relay contacts

7.1.1 Relay contact type 1

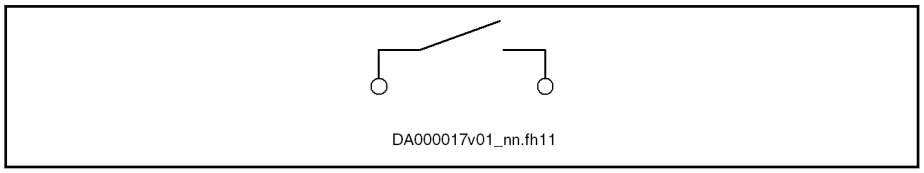


Fig. 7-1: Relay contact

Data	Unit	min.	typ.	max.
Current carrying capacity	A			DC 1 AC 2
Voltage load capacity	V			DC 30 AC 250
Minimum load of the contacts	mA	10		
Contact resistance at minimum current	mΩ			1000
Switching actions at maximum 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

Tab. 7-1: Relay contacts type 1

7.1.2 Relay contact type 2

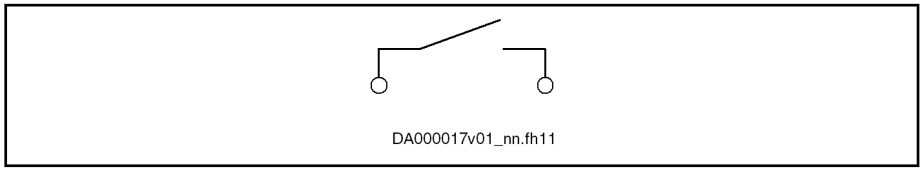


Fig. 7-2: Relay contact

Data	Unit	min.	typ.	max.
Current carrying capacity	mA	10		1000
Voltage load capacity	V			30
Contact resistance at minimum current	mΩ			1000
Switching actions at max. time constant of load			1×10^6	
Number of mechanical switching cycles			1×10^8	

Data	Unit	min.	typ.	max.
Time constant of load	ms		ohmic	
Pick up delay	ms			10
Drop out delay	ms			10

Tab. 7-2: Relay contacts type 2

7.1.3 Relay contact type 3

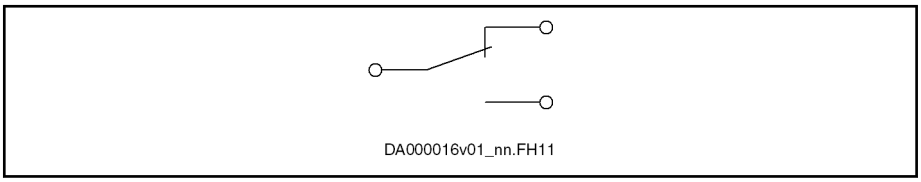


Fig. 7-3: Relay contact

Data	Unit	min.	typ.	max.
Current carrying capacity	A			DC 1
Voltage load capacity	V			DC 30
Minimum load of the contacts	mA	10		
Contact resistance at minimum current	mΩ			1000
Switching actions at maximum electric load[1)]			1×10^6	
Number of mechanical switching cycles			1×10^7	
Pick up delay	ms			10
Drop out delay	ms			10

1) Only the number of mechanical switching cycles is relevant to the relays of the optional safety technology modules

Tab. 7-3: Relay contacts type 3

7.2 Digital inputs/outputs

7.2.1 General information

The digital inputs/outputs (standard, probe) 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 A (standard)

The digital inputs correspond to IEC 61131.

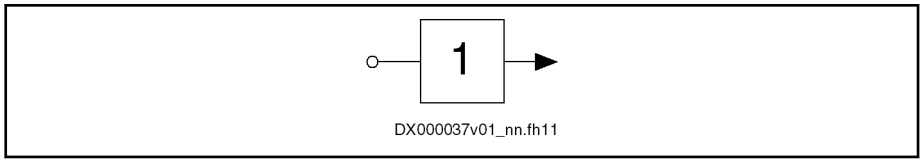


Fig. 7-4: Symbol

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 time	µs	20		100 + 1 cycle time of position control

Tab. 7-4: Digital inputs type A

Digital inputs - probe

Digital inputs type B (probe)

Function

See "Probe" in the Functional Description of the firmware.

Technical data

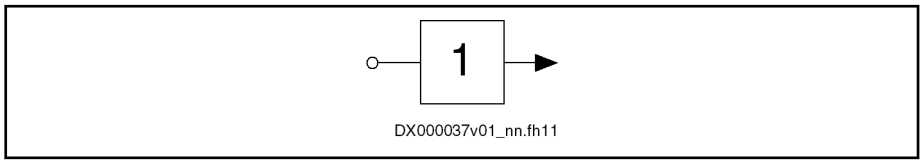
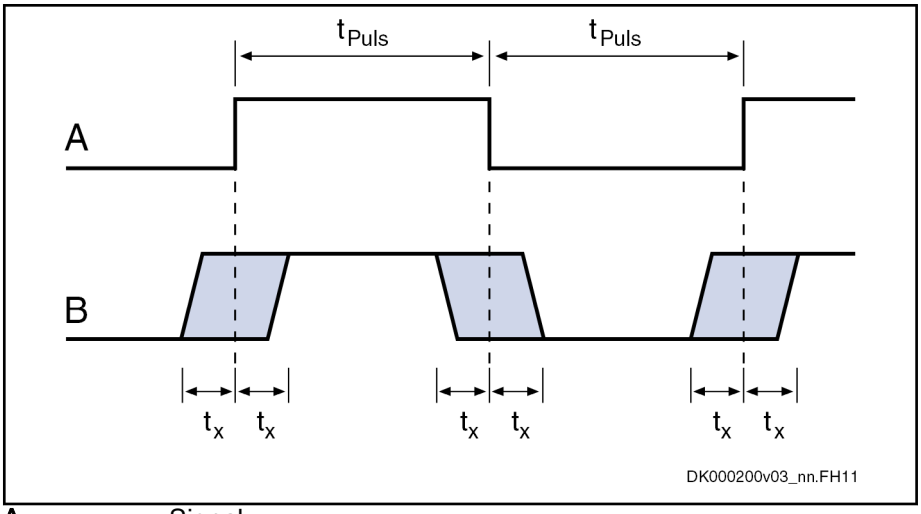


Fig. 7-5: Symbol

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_p of the positive signal edge	µs			1
Measuring accuracy t_n of the negative signal edge	µs			1

Tab. 7-5: Digital inputs type B



A Signal
B Signal detection at probe input
t_{Puls} Pulse width
t_x Measuring accuracy of the signal edges

Fig. 7-6: Signal detection at probe input

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

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

Digital inputs type C (probe)

Function See "Probe" in the Functional Description of the firmware.

Technical data

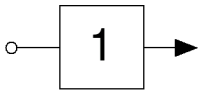
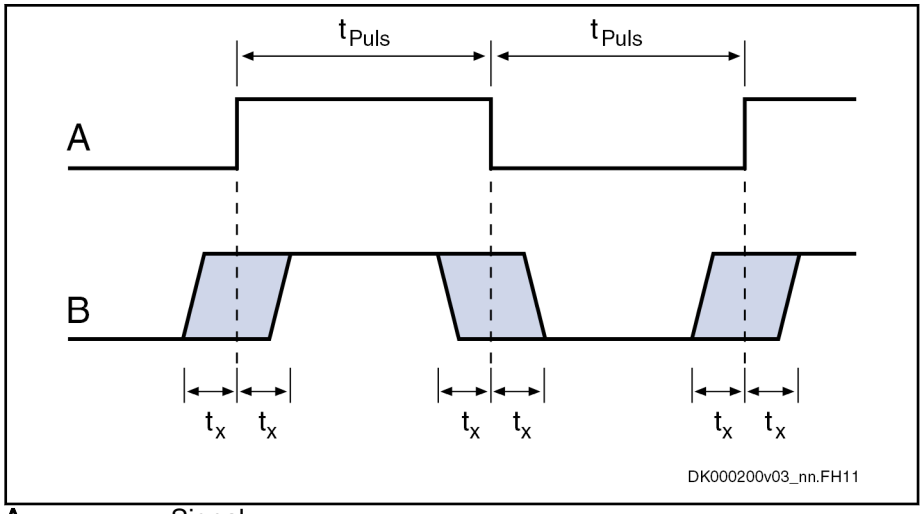


Fig. 7-7: Symbol

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_p of the positive signal edge	µs			6
Measuring accuracy t_n of the negative signal edge	µs			50

Tab. 7-6: Digital inputs type C



A	Signal
B	Signal detection at probe input
t_{Puls}	Pulse width
t_x	Measuring accuracy of the signal edges

Fig. 7-8: Signal detection at probe input

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

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

Digital inputs type D

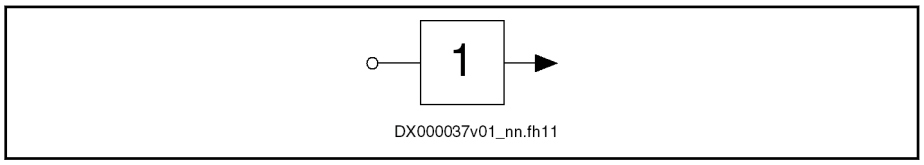


Fig. 7-9: Symbol

Data	Unit	min.	typ.	max.
Allowed input voltage	V	-3		30
On	V	17.5		
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 time	µs	20		100 + 1 cycle time of position control

Tab. 7-7: Digital inputs type D

7.2.3 Digital outputs

The digital outputs are compatible with digital inputs of types A, B and C (IEC 61131).

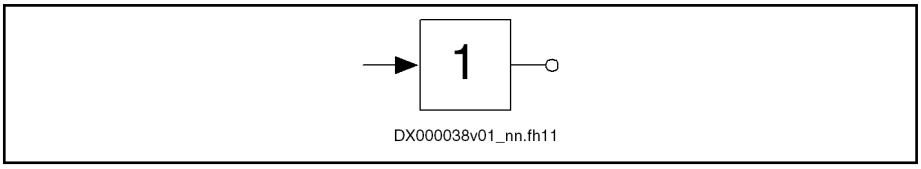


Fig. 7-10: Symbol

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 in total or per group	mA			1000
Update interval	ns	Depending on firmware		
Short circuit protection		Present		
Overload protection		Present		
Allowed energy content of connected inductive loads, e.g. relay coils; only allowed as single pulse	mJ			400

Tab. 7-8: Digital outputs

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

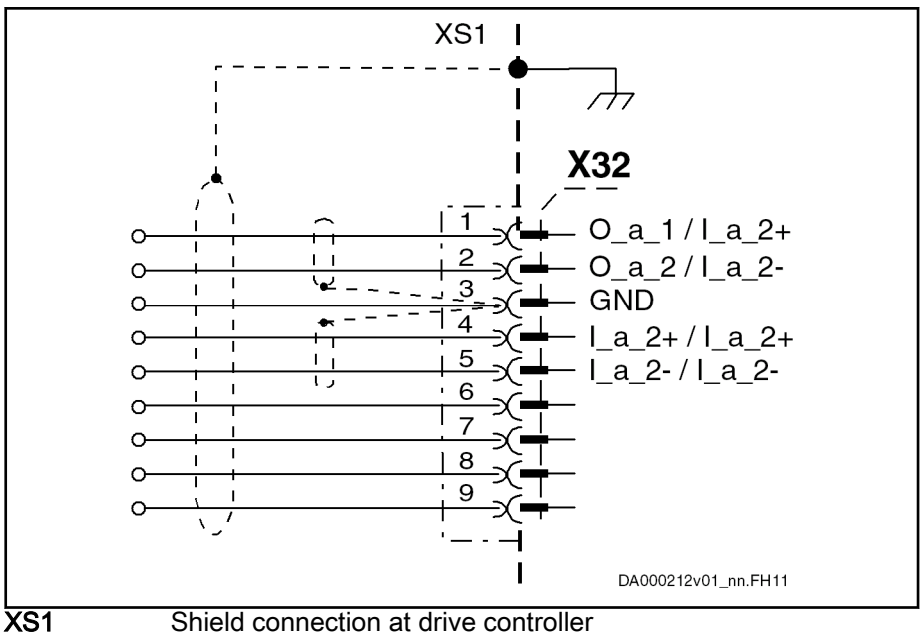
☞ The energy absorption capacity of the outputs is used to limit voltage peaks caused when inductive loads are switched off.

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. 7-11: Shield connection X32

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

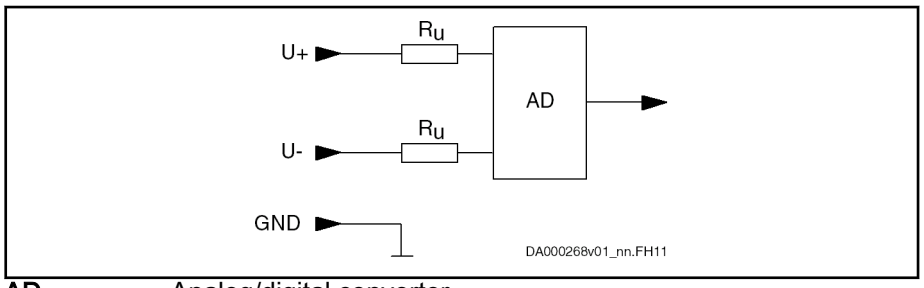
At the drive controller, connect the cable shield at connection XS1.

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

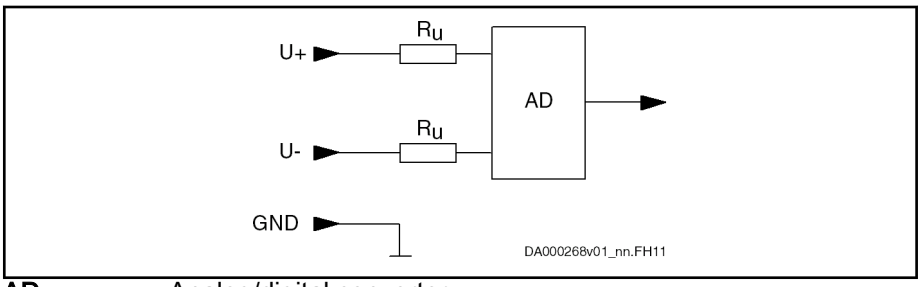
Fig. 7-12: Analog voltage inputs

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	

Data	Unit	min.	typ.	max.
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	
Resulting resolution	mV/inc		2	
Cyclic conversion	µs	n.s.		
Conversion time	µs	n.s.		

Tab. 7-9: Analog voltage inputs

Analog input type 2



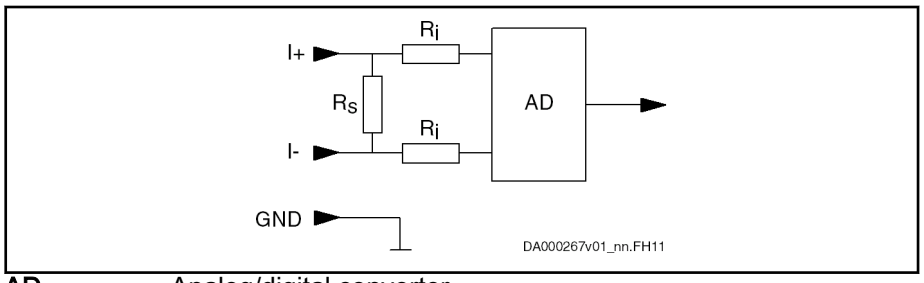
AD Analog/digital converter

Fig. 7-13: 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		1000	
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	
Resulting resolution	mV/inc		2	
Cyclic conversion	µs	n.s.		
Conversion time	µs	n.s.		

Tab. 7-10: Analog voltage inputs

Analog input type 3



AD Analog/digital converter

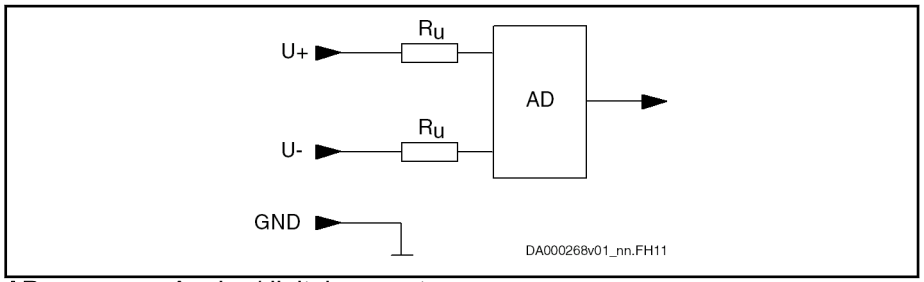
Fig. 7-14: Analog current inputs

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

Tab. 7-11: Analog current inputs

Analog input type 4



AD Analog/digital converter

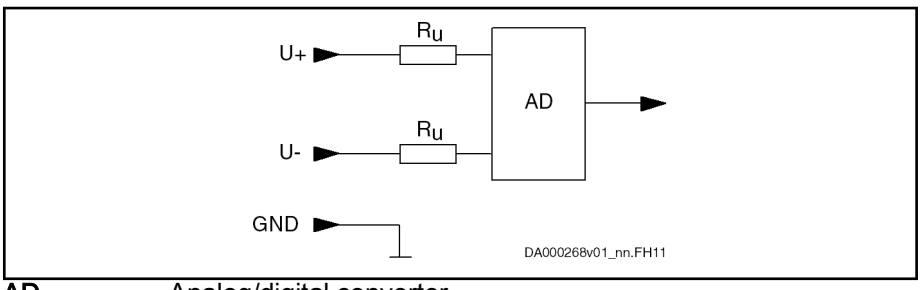
Fig. 7-15: Analog voltage inputs

Data	Unit	min.	typ.	max.
Allowed input voltage	V	-10 or -30 1)		+30
Working range input voltage U_{on_work}	V	-10		+10
Input resistance voltage input	kΩ		160	
Input bandwidth	kHz		1.4 (FD: 07W38 and above)	
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	
Resulting resolution	mV/inc		2	
Cyclic conversion	µs	n.s.		
Conversion time	µs	n.s.		

1) -30 V applies to: CSH01.2, CSH01.3, CSH01.1 with hardware index A16 and above, CDB01.1 with hardware index A12 and above

Tab. 7-12: Analog voltage inputs

Analog input type 5



AD Analog/digital converter

Fig. 7-16: Analog voltage inputs

Data	Unit	min.	typ.	max.
Allowed input voltage	V	-50		+50
Working range input voltage U_{on_work}	V	-10		+10
Input resistance	kΩ		240	
Input bandwidth (-3 dB)	kHz		1.5	
Common-mode range	V	-50		+50
Common-mode rejection	dB	50		

Data	Unit	min.	typ.	max.
Relative measuring error at 90% U_{on_work}	%	-1		+1
Converter width A/D converter incl. polarity sign	Bit		12	
Oversampling			8-fold	
Resulting resolution	mV/inc		2	
Cyclic conversion	µs	n.s.		
Conversion time	µs	n.s.		

Tab. 7-13: 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		

Tab. 7-14: 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

Tab. 7-15: 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		+10
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	

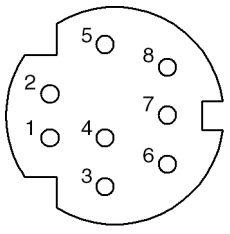
1) FMR: Final value of measuring range

Tab. 7-16: 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 diagnostics during commissioning and servicing.

Connection point	Type	Number of poles	Stranded wire [mm²]	Description	Figure
X2	MiniDin, female (device)	8	0.25-0.5	Serial interface	 DA000049v01_nn.FH

Tab. 7-17: Connections

Pin assignment

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

Tab. 7-18: Pin assignment of serial interface

Features

Feature	Unit	min.	typ.	max.
Number of nodes				1
Allowed cable length	m			15
Transmission rates	kBaud	9.6		115
Connection		Galvanically connected to control section supply		
Allowed voltage difference between reference potentials of control section and data end device	V			1

Tab. 7-19: Features of serial interface

Accessories

For conversion from RS232 to RS485, there is the accessory **HAS05.1-005** "Signal level converter RS232/RS485".

For a detailed description of this accessory, see Project Planning Manual "IndraDrive Additional Components and Accessories".

7.4.2 Connection diagrams

Serial interface to PC with 9-pin D-SUB

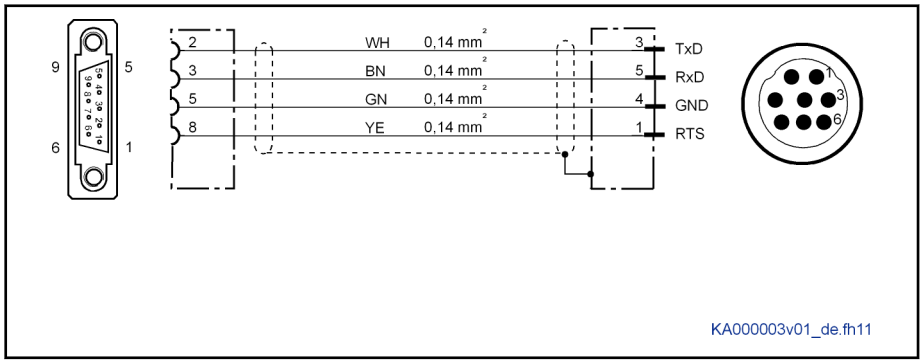


Fig. 7-17: Connection of serial interface to PC with 9-pin D-SUB

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

Serial interface to PC with 25-Pin D-SUB

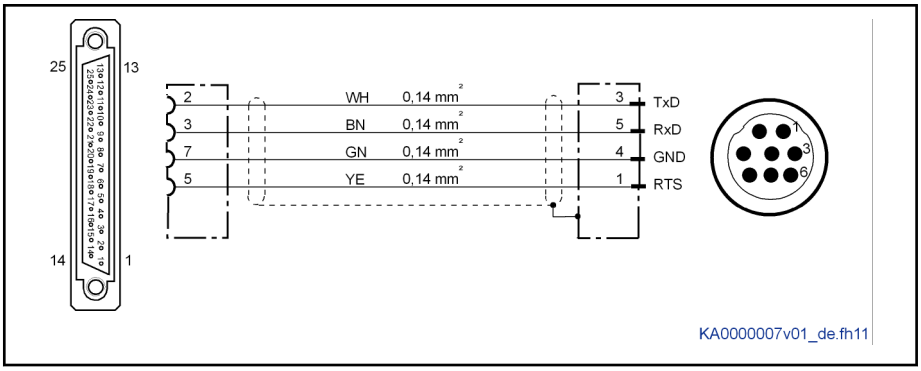
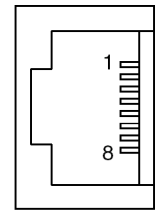


Fig. 7-18: Connection of serial interface to PC with 25-pin D-SUB

7.5 X26, Engineering interface

View	Connection	Signal name	Function
 DA000041v01_nn.FH	1	TD+	Transmit, Differential Output A
	2	TD-	Transmit, Differential Output B
	3	RD+	Receive, Differential Input A
	4	n. c.	-
	5	n. c.	-
	6	RD-	Receive, Differential Input B
	7	n. c.	-
	8	n. c.	-
	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin		

Compatibility	100Base-TX according to IEEE 802.3u
Recommended cable type	• According to **CAT5e**; ITP type of shield (Industrial Twisted Pair) • Ready-made cables that can be ordered: – **RKB0021** Long cables (100 m at maximum) to connect the drive system to the higher-level control unit or remote communication nodes. Minimum bending radius: – 48.75 mm with flexible installation – 32.50 mm with permanent installation Order code for a 30 m long cable: RKB0021/030,0 – **RKB0013** Short cables to connect devices arranged side by side in the control cabinet. 4 lengths available: 0.19 m; 0.25 m; 0.35 m; 0.55 m Order code for a 0.55 m long cable: RKB0013/00,55 Minimum bending radius: 30.75 mm

Tab. 7-20: Function, pin assignment, properties

Display elements

LED	Significance	Color	Description
H15	Status	Yellow	Data transmission running
H16	Link	Green	Connection to network available

Tab. 7-21: Significance of display elements

8 Technical data - other

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 has to be added. This does not change the data for inrush current and pulse width.

Description	Power consumption P_{N3} at U_{N3} = DC 24 V [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
CSH01.3C-…	8.5 2) 3)	4	100

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

Tab. 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} [2)] [W]
AN	Analog I/O extension	2
CCD	Sercos III cross communication	1
CO	DeviceNet and CANopen communication	1
EN1	HSF, resolver	6
EN2	EnDat2.1 / 1 V_{pp} / 5 V TTL	6
ENS	IndraDyn, HIPERFACE®, 1 V_{pp}	6
ET	Multi-Ethernet	2.2
L1	Starting lockout	2
L2	Safe Torque Off	2
MA1	Analog I/O extension	2
MD1	Digital I/O extension	1
MD2	Digital I/O extension and SSI encoder evaluation	1
MEM	Encoder emulator	2
PB	PROFIBUS-DP communication	2
PFM	MultiMediaCard	1
PL	Parallel interface communication	1
S	Standard control panel	1
S1	Safety technology I/O	1
S2	Safe Motion	1
S3	Sercos III communication	1
SE	Sercos communication	2

1) See type codes of the control sections
2) At maximum allowed output load, plus circuits to be supplied externally

Tab. 8-2: Power consumption of optional modules

8.2 Connections

8.2.1 General information

The connection points at 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 the stripped length of the wire ends is 10 mm
- that all strands of a stranded wire are placed in the funnel of the terminal connector
- not to use solid wires, where possible
- to use appropriate crimping tools for the wire ends with ferrules

8.2.3 Connections with screw terminal blocks

At 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

For control sections, there are the following accessories:

- **Fiber optic cable connections**

  To connect fiber optic cables to the sercos interface

- **HAS05.1-003, signal level converter for encoder emulation**

  Adjusts the voltage level at the output of the optional module MEM to the voltage range 5-30 V

- **HAS05.1-005, signal level converter RS232/RS485**

  Converts the serial interface (X2) from RS232 standard to RS485 standard

- **HAS05.1-007, adapter from D-Sub to terminal connector**

  Universal adapter for safety technology

📖 See also Project Planning Manual "IndraDrive, Additional Components and Accessories".

10 Environmental protection and disposal

10.1 Environmental protection

Production processes

The products are manufactured in energy- and resource-optimized production processes which allow re-using and recycling the resulting waste. We regularly try to replace pollutant-loaded raw materials and supplies by more environment-friendly alternatives.

No release of hazardous substances

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

Significant components

Significant components of our products are:

Electronic devices
- Steel
- Aluminum
- Copper
- Plastics
- Electronic components

Motors
- Steel / Stainless steel
- Aluminum
- Copper
- Brass
- Magnetic materials
- Elektronic components

10.2 Disposal

Return of products

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

Furthermore, the products returned for disposal may not contain any undue foreign material or foreign components.

Deliver the products "free domicile" to the following address:

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

Packaging

Packaging materials consist of cardboard, wood and polystyrene They can be recycled anywhere without any problem.

For ecological reasons, please refrain from returning the empty packages to us.

Batteries and accumulators

Batteries and accumulators can be labeled with this symbol.

The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin.

End users in the EU are legally bound to return used batteries and accumulators. Outside the validity of the EU Directive 2006/66/EC, the particularly applicable regulations must be followed.

Batteries and accumulators can contain hazardous substances which can harm the environment or people's health when improperly stored or disposed of.

After use, the batteries or accumulators contained in Rexroth products must be properly disposed of according to the country-specific collection systems.

Recycling

Most of the products can be recycled due to their high content of metal. In order to recycle the metal in the best possible way, the products must be disassembled into individual assemblies.

Metals contained in electric and electronic assemblies can also be recycled by means of special separation processes.

Plastic parts of the products may contain flame retardants. These plastic parts are labeled according to EN ISO 1043. They have to be recycled separately or disposed of according to the applicable legal provisions.

11 Service and support

Our worldwide service network provides an optimized and efficient support. Our experts offer you advice and assistance should you have any queries. You can contact us **24/7**.

Service Germany

Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the **Service Hotline** and **Service Helpdesk** under:

Phone:	**+49 9352 40 5060**
Fax:	**+49 9352 18 4941**
E-mail:	service.svc@boschrexroth.de
Internet:	http://www.boschrexroth.com

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide

Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information

To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

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