Rexroth
Bosch Group

Rexroth IndraDrive
Drive Controllers - Control Sections
CSB01, CSH01, CDB01

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Project Planning Manual

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Drive Controllers - Control Sections
CSB01, CSH01, CDB01

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Note
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1 Introduction

1.1 Documentation

1.1.1 Changes

Changes in Comparison to Previous Edition

Chapter	Changes
Introduction	Reference documentations updated
Rexroth IndraDrive Control Sections	CSH01.3C (ADVANCED) control sections included Type codes for CDB and CSH control sections updated
Optional Modules for Control Sections	Communications: • ET (Multi-Ethernet) included • CD (DeviceNet/CANopen with D-SUB connection): Pin assignment X61 corrected • S3 (SERCOS III): Recommended cable type and compatibility corrected
	I/O extensions: Optional module AN: Description of pin assignment adjusted
	Safety technology: • L2 (Safe Torque Off) included • S2 (Safe Motion) included • L1 (starting lockout): Note on commissioning added • S1 (Safety technology I/O): Note on commissioning added
	Comfort control panel VCP01 included
	Information on optional MultiMediaCard PFM02.1 included
Technical Data - Functions	X26, Engineering interface: Recommended cable type and compatibility corrected

Fig. 1-1: Changes

1.1.2 Reference Documentations

Drive Systems, System Components

Title Rexroth IndraDrive …	Kind of documentation	Document typecode[1)] DOK-INDRV*-…	Part number R911…
Drive Systems With HMV01/02 HMS01/02, HMD01, HCS02/03	Project Planning Manual	SYSTEM*****-PRxx-EN-P	309636
Mi Drive Systems	Project Planning Manual	KCU+KSM****-PRxx-EN-P	320924
Supply Units, Power Sections HMV, HMS, HMD, HCS02, HCS03	Project Planning Manual	HMV-S-D+HCS-PRxx-EN-P	318790
Drive controllers Control Sections CSB01, CSH01, CDB01	Project Planning Manual	CSH********-PRxx-EN-P	295012

Introduction

Title Rexroth IndraDrive …	Kind of documentation	Document typecode[1)] DOK-INDRV*-…	Part number R911…
Additional Components and Accessories	Project Planning Manual	ADDCOMP****-PRxx-EN-P	306140
C Drive Controllers HCS02.1, HCS03.1	Operating Instructions	FU**********-IBxx-EN-P	314905

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

Fig. 1-2: Documentations – Overview

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

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

Fig. 1-3: Documentations – Overview

Motors

Title Rexroth IndraDyn …	Kind of documentation	Document typecode[1)] DOK-MOTOR*-…	Part number R911…
A Asynchronous Motors MAD / MAF	Project Planning Manual	MAD/MAF****-PRxx-EN-P	295781
H Frameless Synchronous Spindle Motors	Project Planning Manual	MBS-H******-PRxx-EN-P	297895
L Synchronous Linear Motors	Project Planning Manual	MLF********-PRxx-EN-P	293635
S MSK Synchronous Motors	Project Planning Manual	MSK********-PRxx-EN-P	296289
T Synchronous Torque Motors	Project Planning Manual	MBT********-PRxx-EN-P	298798

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

Fig. 1-4: Documentations – Overview

Cables

Title	Kind of documentation	Document typecode[1)] DOK-…	Part number R911…
Rexroth Connection Cables	Selection Data	CONNEC-CABLE*STAND-AUxx-EN-P	282688

1) In the document typecodes, "xx" is a wild card for the current edition of the documentation (example: AU03 is the third edition of the documentation "Selection Data")

Fig. 1-5: Documentations – Overview

Firmware

Title Rexroth IndraDrive …	Kind of documentation	Document typecode[1)] DOK-INDRV*-…	Part number R911…
Firmware for Drive Controllers MPH-07, MPB-07, MPD-07, MPC-07	Functional Description	MP*-07VRS**-FKxx-EN-P	328670
Firmware for Drive Controllers MPH-06, MPB-06, MPD-06, MPC-06	Functional Description	MP*-06VRS**-FKxx-EN-P	326766
Firmware for Drive Controllers MPH-05, MPB-05, MPD-05	Functional Description	MP*-05VRS**-FKxx-EN-P	320182
Firmware for Drive Controllers MPH-04, MPB-04, MPD-04	Functional Description	MP*-04VRS**-FKxx-EN-P	315485
Firmware for Drive Controllers MPH-03, MPB-03, MPD-03	Functional Description	MP*-03VRS**-FKxx-EN-P	308329
Firmware for Drive Controllers MPH-02, MPB-02, MPD-02	Functional Description	MP*-02VRS**-FKxx-EN-P	299223
Drive controllers MPx-02 to MPx-07	Parameter Description	GEN-**VRS**-PAxx-EN-P	297317
MPx-02 to MPx-07 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)

Fig. 1-6: Documentations – Overview

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

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

Fig. 1-7: Documentations – Overview

1.1.3 Box with Project Planning Manuals on Rexroth IndraDrive

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

Introduction

- Rexroth IndraDrive Drive Systems With HMV01/02, HMS01/02, HMD01, HCS02/03
- Rexroth IndraDrive Supply Units, Power Sections, HMV, HMS, HMD, HCS02, HCS03
- Rexroth IndraDrive Drive Controllers, Control Sections CSB01, CSH01, CDB01
- Rexroth IndraDrive Additional Components and Accessories

Order data of the box:

- Part number: R911310293
- Document typecode: DOK-INDRV*-PROJEKTIER*-8202-EN-P

1.1.4 Your Feedback

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

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

Please send your remarks to:

Address for Your Feedback

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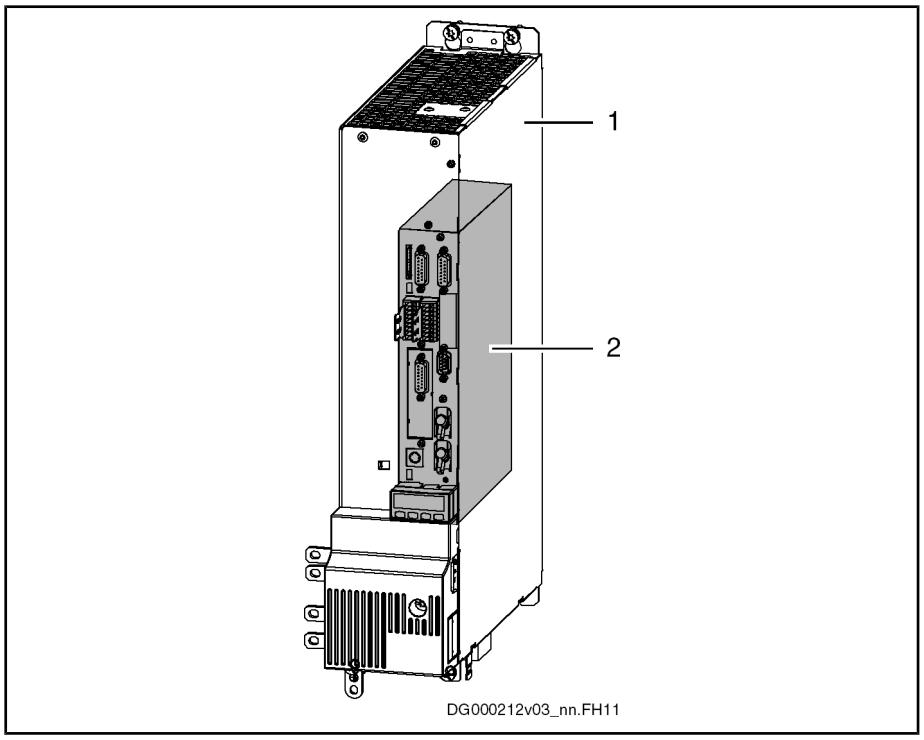
E-mail: dokusupport@boschrexroth.de

1.2 Basic Design of the Rexroth IndraDrive Controllers

1.2.1 General Information



1 Power section
2 Control section
Fig.1-8: Basic Design of a Rexroth 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 complete with control section. In exceptional cases, control sections can be delivered separately.

1.2.3 Mounting and Dismounting the Control Section

General Information

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

Training

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

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

Introduction

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 (ground connection by touching a conductive, grounded object)
- Parts and tools (place them on a conductive support)

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

Limited Number of Plug-In Actions

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

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

2 Important Directions for Use

2.1 Appropriate Use

2.1.1 Introduction

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

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

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

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

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

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

2.1.2 Areas of Use and Application

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

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

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

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

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

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

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

Typical applications include, for example:

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

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

2.2 Inappropriate Use

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

Drive controllers must not be used, if ...

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

☞ Components of the drive system Rexroth IndraDrive are **products of category C3** (with restricted distribution) according to IEC 61800-3. 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 radio interference suppression.

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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: User Guide, Operation Manual, Commissioning Manual, Instruction Manual, Project Planning Manual, Application Manual, 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,

Safety Instructions for Electric Drives and Controls

1) to be trained, instructed or authorized to switch electric circuits and devices safely on and off, to ground them and to mark them

2) to be trained or instructed to maintain and use adequate safety equipment

3) to attend a course of instruction in first aid

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

3.2 General Information

3.2.1 Using the Safety Instructions and Passing Them on to Others

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

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

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

3.2.2 Requirements for Safe Use

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

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

concept in which measures of risk reduction for personal safety depend on electrical, electronic or programmable control systems.

- The information given in the application documentation with regard to the use of the delivered components contains only examples of applications and suggestions.

  The machine and installation manufacturers must

  – make sure that the delivered components are suited for their individual application and check the information given in this application documentation with regard to the use of the components,

  – make sure that their individual application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.

- Commissioning of the delivered components is only allowed once it is sure that the machine or installation in which the components are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only allowed if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the section on EMC in the respective application documentation.

  The machine or installation manufacturer is responsible for compliance with the limit values as prescribed in the national regulations.

- The technical data, connection and installation conditions of the components are specified in the respective application documentations and must be followed at all times.

National regulations which the user must take into account

- 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 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 copper wire of a cross section of at least 10 mm^2 (8 AWG) or additionally run a second equipment grounding conductor of the same cross section as the original equipment grounding conductor.

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 between 5 and 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 Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated by current-carrying conductors or permanent magnets of electric motors represent a serious danger to persons with heart pacemakers, metal implants and hearing aids.

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

- Persons with heart pacemakers and metal implants are not allowed to enter the following areas:
  - Areas in which components of the electric drive and control systems are mounted, commissioned and operated.
  - Areas in which parts of motors with permanent magnets are stored, repaired or mounted.
- If it is necessary for somebody with a heart pacemaker to enter such an area, a doctor must be consulted prior to doing so. The noise immunity of implanted heart pacemakers differs so greatly that no general rules can be given.
- Those with metal implants or metal pieces, as well as with hearing aids, must consult a doctor before they enter the areas described above.

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 slipping.

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 slipping.

☞ 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 Z535.6-2006).

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

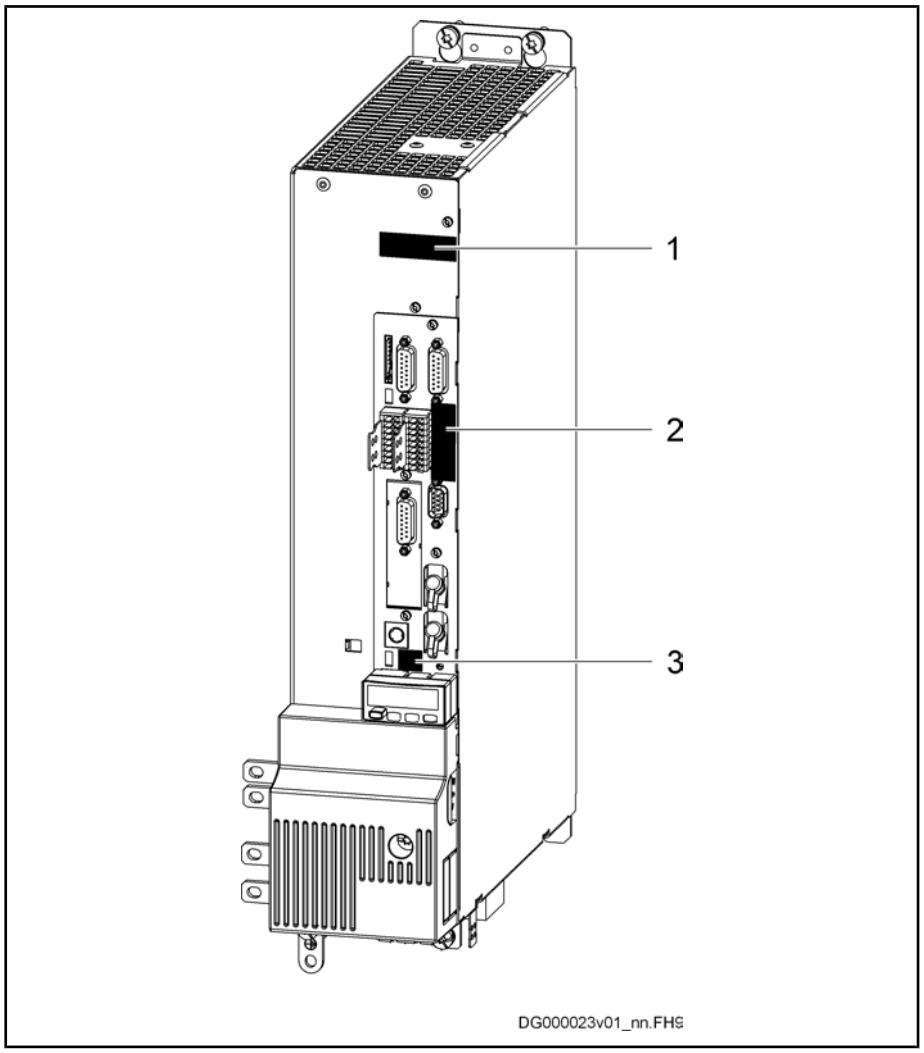
4.1 Type Plates

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



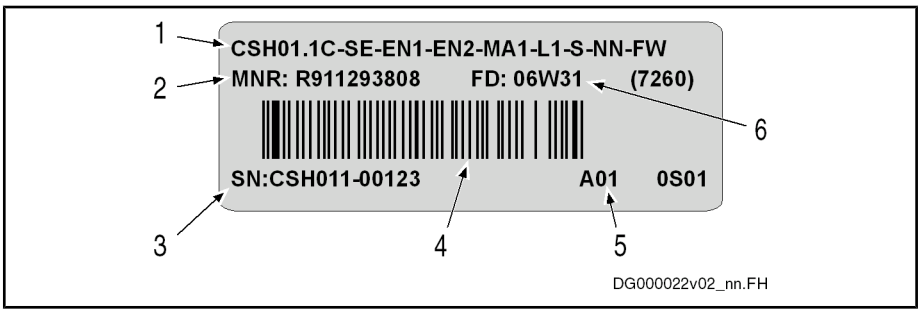
1 Power section type plate
2 Control section type plate
3 Firmware type plate

Fig.4-1: Type Plates at the Drive Controller

Identifying the Control Section

4.1.3 Type Plates at the Control Section

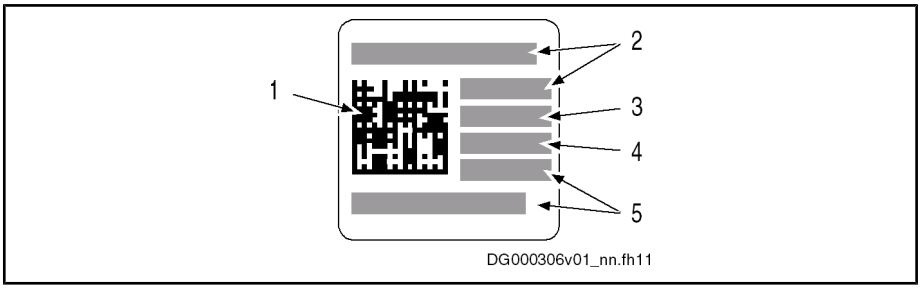
Control Section Type Plate



1 Type
2 Part number
3 Serial number
4 Bar code
5 Hardware index
6 Production week (example: 06W31 means: year 2006, week 31)

Fig.4-2: Control Section Type Plate (Example)

Firmware Type Plate



1 Bar code
2 Type
3 Factory identifier
4 Production week (example: 09W12 means: year 2009, week 12)
5 Serial 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

Fig.5-1: Control Section Overview

5.2 Overview of Functions and Interfaces

The control sections differ with regard to

- their configurability
- the available interfaces
- the cycle times or switching frequencies (pulse frequencies)

The table below contains an overview:

	CSB01.1N-FC	CSB01.1N-SE	CSB01.1N-PB	CSB01.1N-AN	CSB01.1C	CDB01.1C	CSH01.1C CSH01.2C CSH01.3C
Configurable	No	No	No	No	Yes	Yes	Yes
Configuration slots safety technology	0	1 [1]	1 [1]	1 [1]	1	2	1
Operation with comfort control panel VCP01.2	Yes [4]	No	No	No	No	No	No
Serial interface RS232	1	1	1	1	1	1	1
Inputs/outputs:							
Number of dig. inputs, thereof …	8	5–8 [6]	5–8 [6]	5–9 [7]	5–8 [6]	18–22 [7]	7–11 [7]
… probe (dig. input type 2)	0	1	1	0	1	2	2
… probe (dig. input type 3)	0	1	1	0	1	2 [5]	0

Rexroth IndraDrive Control Sections

	CSB01.1N-FC	CSB01.1N-SE	CSB01.1N-PB	CSB01.1N-AN	CSB01.1C	CDB01.1C	CSH01.1C CSH01.2C CSH01.3C
Number of dig. outputs	0	0–3 6)	0–3 6)	0–4 7)	0–3 6)	0–4 7)	0–4 7)
Number of analog inputs	2 voltage; 2 current	0	0	2	0	1 8)	1 8)
Number of analog outputs	2	0	0	0	0	2	2
Number of relay contacts	1 N/O; 2 changeover switches	1 N/O	1 N/O	1 N/O	1 N/O	1 N/O	1 N/O
Cycle times 2):							
Current control	125 µs	125 µs	125 µs	125 µs	125 µs	125 µs	62.5 µs 125 µs
Velocity control	250 µs 500 µs	250 µs 500 µs	250 µs 500 µs	250 µs 500 µs	250 µs 500 µs	250 µs 500 µs	125 µs 250 µs
Position control	500 µs 1000 µs	500 µs 1000 µs	500 µs 1000 µs	500 µs 1000 µs	500 µs 1000 µs	500 µs 1000 µs	250 µs 500 µs
Minimum SERCOS cycle time	-	1000 µs	-	-	1000 µs	1000 µs	250 µs
Switching frequencies 3):							
2 kHz	■	■	■	■	■	■	■
4 kHz	■	■	■	■	■	■	■
8 kHz	■	■	■	■	■	■	■
12 kHz	-	-	-	-	-	-	■
16 kHz	-	-	-	-	-	-	■

1) Option starting lockout can be configured
2) Cycle times depend on firmware version
3) Clock frequencies also depend on power section, see Parameter Description "P-0-0001, Switching frequency of the power output stage"
4) As of firmware version MPB-04V12
5) As of firmware version MPD-05V06
6) There are 3 combined I/Os which can be configured as digital input or as digital output
7) There are 4 combined I/Os which can be configured as digital input or as digital output
8) 2 digital inputs can be used as one analog voltage input

Fig.5-2: Overview of Control Section Functions

For more details on possible configurations, see section "Optional Slots" in the description of the respective control section.

5.3 BASIC Control Sections

5.3.1 Type Codes BASIC and BASIC UNIVERSAL

Type Code BASIC CSB01.1N

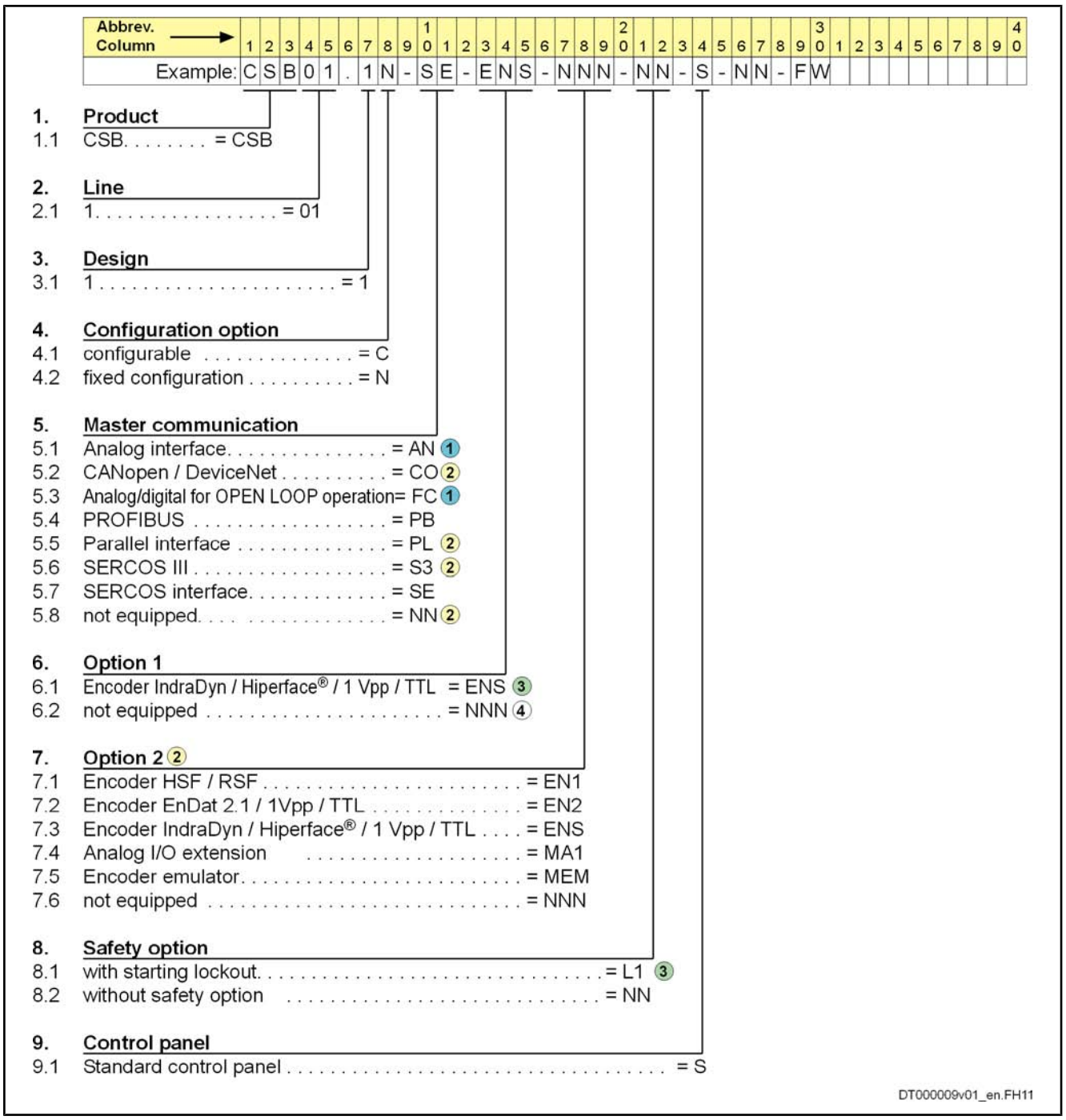


Fig.5-3: Type Code BASIC Control Section (Single-Axis); (to be Continued)

Rexroth IndraDrive Control Sections

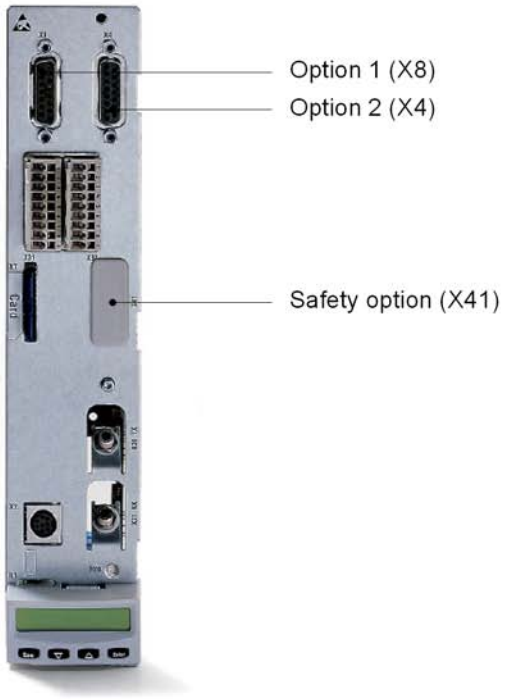
Abbrev. Column →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Example:	C	S	B	0	1	.	1	N	-	S	E	-	E	N	S	-	N	N	N	-	N	N	-	S	-	N	N	-	F	W											

10. Other design
10.1 none . . . . . = NN

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

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

Illustration example: CSB01.1



DT000010v01_en.FH1

Fig.5-4: Type Code BASIC Control Section (Single-Axis); (Continuation)

Type Code BASIC UNIVERSAL Single-Axis CSB01.1C

See type code BASIC CSB01.1N

Type Code BASIC UNIVERSAL Double-Axis CDB01.1C

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. Master communication
5.2 MultiEthernet . . . . . = ET
5.3 PROFIBUS . . . . . = PB
5.4 SERCOS III . . . . . = S3
5.5 SERCOS interface. . . . . = SE

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

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

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

DT000011v03_en.FH

Fig.5-5: Type Code BASIC Control Section (Double-Axis); (to be Continued)

Rexroth IndraDrive Control Sections

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

9. Option 4 (X8.2)

9.1 Encoder HSF / RSF . . . . . = EN1
9.2 Encoder EnDat 2.1 / 1Vpp / TTL . . . . . = EN2
9.3 Encoder IndraDyn / Hiperface® / 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

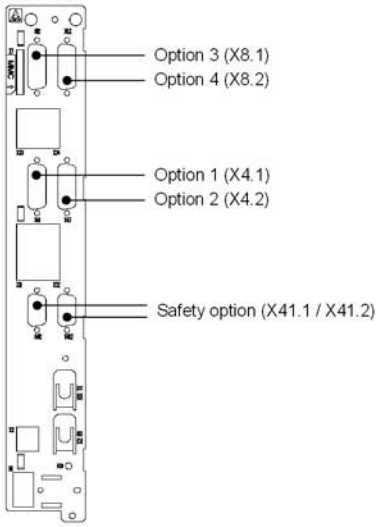
13. Firmware

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



DT000012v02_en.FH11

Fig.5-6: Type Code BASIC Control Section (Double-Axis); (Continuation)

5.3.2 Dimensions BASIC

Dimensions BASIC and BASIC UNIVERSAL Single-Axis

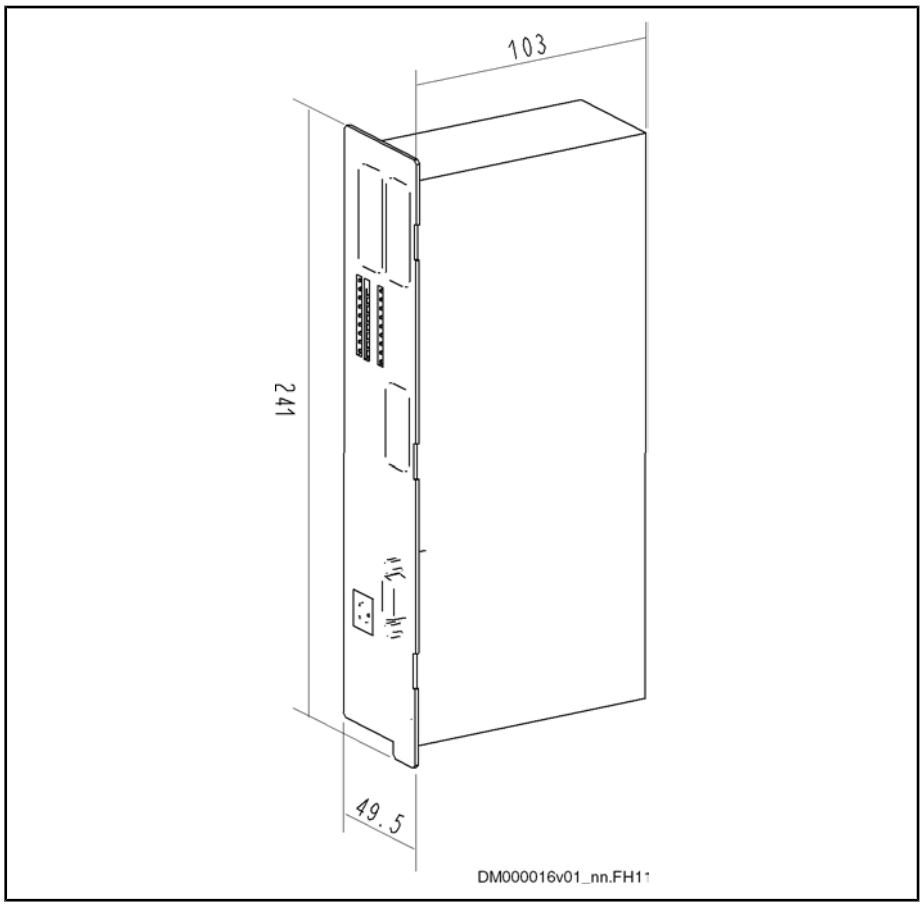


Fig.5-7: Dimensions CSB

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

Rexroth IndraDrive Control Sections

Dimensions BASIC UNIVERSAL Double-Axis

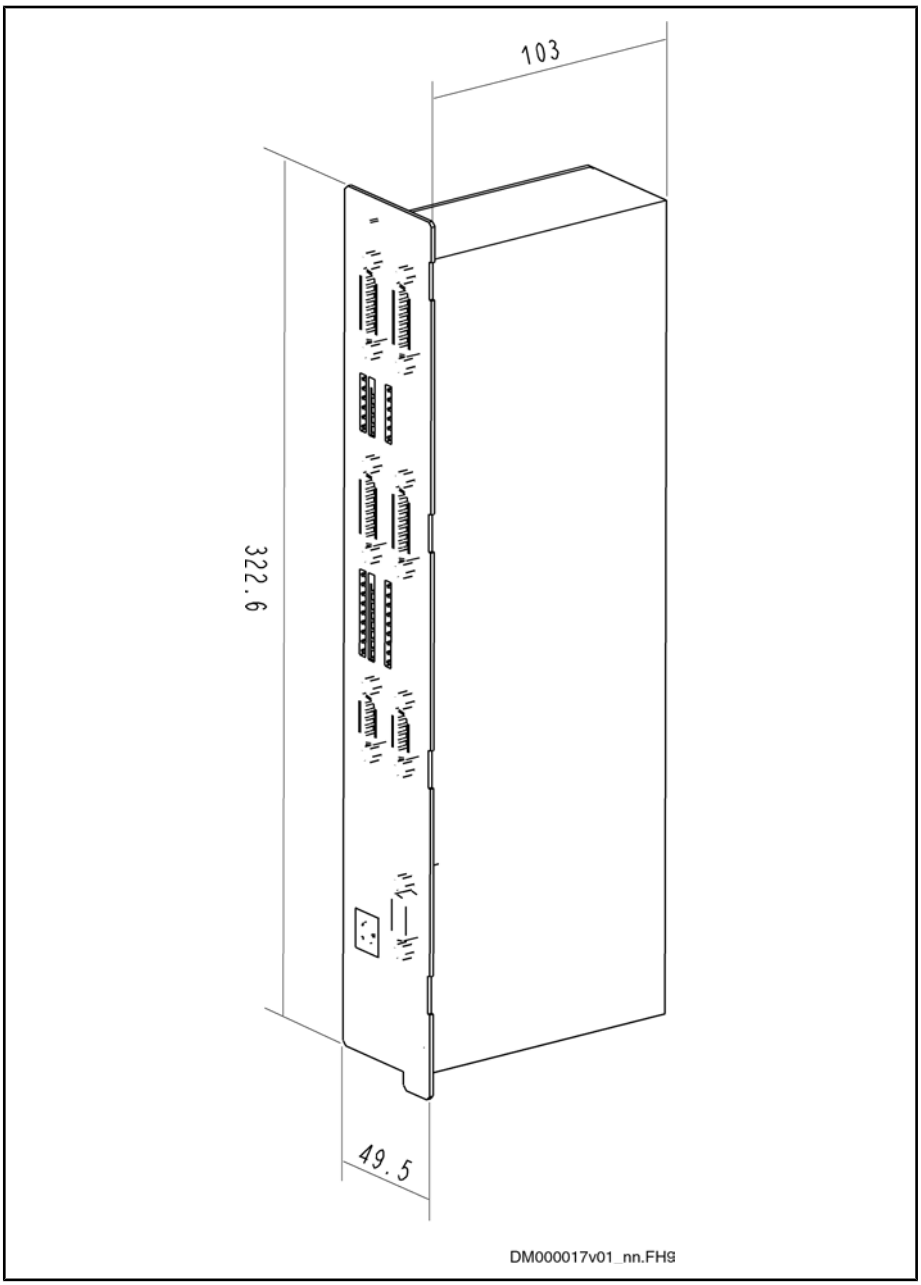


Fig.5-8: Dimensions CDB

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

5.3.3 CSB01.1N-FC - BASIC OPENLOOP

Front View With Connections

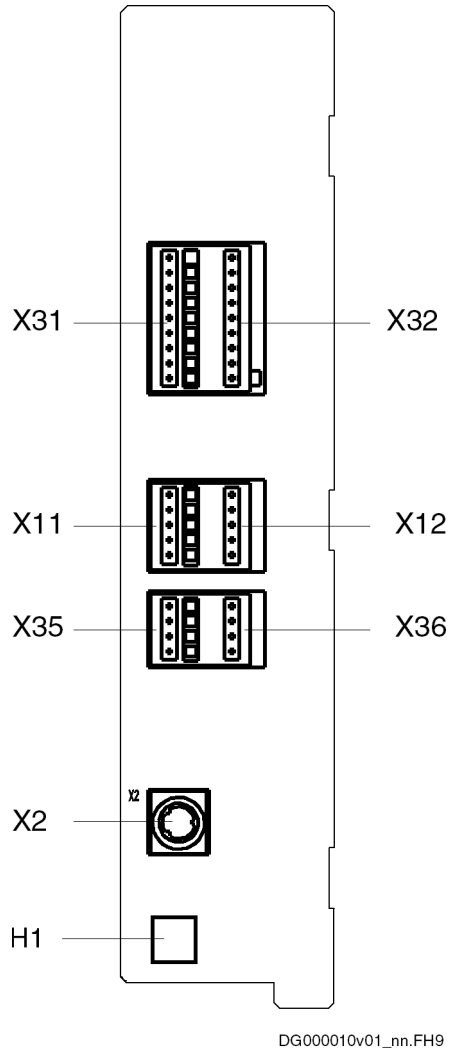
Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	X31 / X32 Coding: X31: 1 X32: 9	0,75–1,5	20–14	-	Digital and analog inputs; analog outputs; voltage input (24V, 0V)
	X11 / X12 Coding: X11: 1 X12: 5	0,75–1,5	20–14	-	Relay contacts
	X35 / X36 Coding: X35: 1 X36: 4	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

Fig.5-9: Connections BASIC OPENLOOP

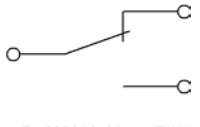
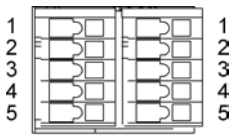
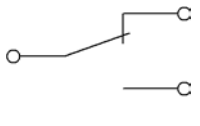
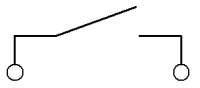
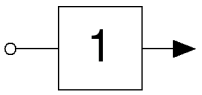
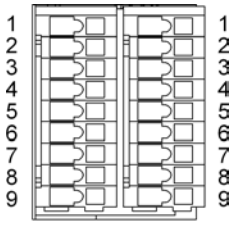
Functions and Pin Assignments

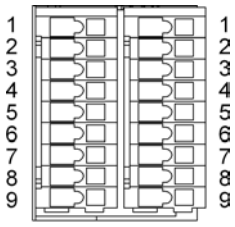
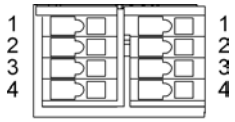
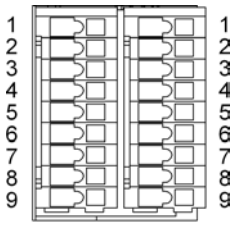
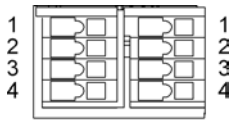
The specified factory settings apply to firmware MPx-04VRS.

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

Rexroth IndraDrive Control Sections

Function			Con-nection	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	24 V 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			

Rexroth IndraDrive Control Sections

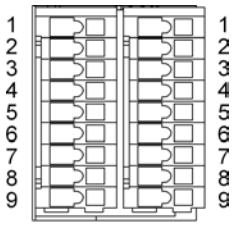
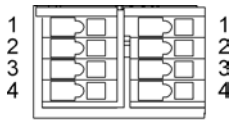
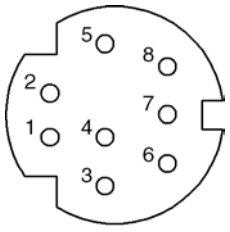
Function			Connection	Factory setting	Nominal data	Figure Data
Input for power supply of digital inputs	Supply of digital inputs	+24V	X31.8			X31 I X32  DA000051v01_nn.FH9 DC 19 … 30 V Max. 0.1 A
		0V	X31.9			
Output (source) for power supply of digital inputs	Connect supply (source) of digital inputs 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"

Fig.5-10: Functions BASIC OPENLOOP

5.3.4 CSB01.1N-SE - BASIC SERCOS

Front View With Connections

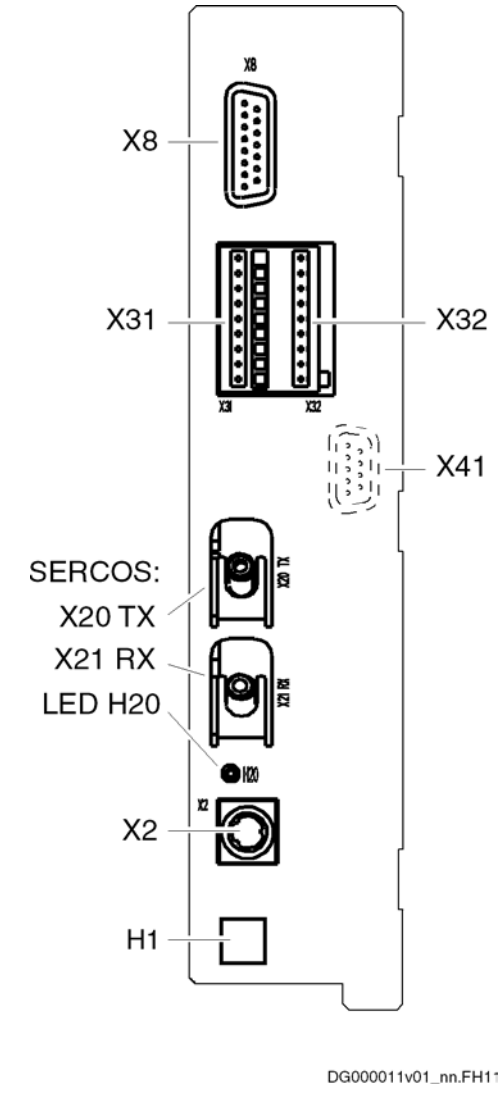
Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	X8	0,25–0,5	-	-	Encoder evaluation ENS
	X31 / X32 Coding: X31: 1 X32: 9	0,75–1,5	20–14	-	Digital inputs/outputs; voltage input (24V, 0V)
	X41	0,25–0,5		-	Optional: Starting lockout
	X20 / X21			0,3	Communication SERCOS
	X2	0,25–0,5	-	-	Serial interface
	H1	-	-	-	Interface for control panel

Fig.5-11: Connections BASIC SERCOS

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

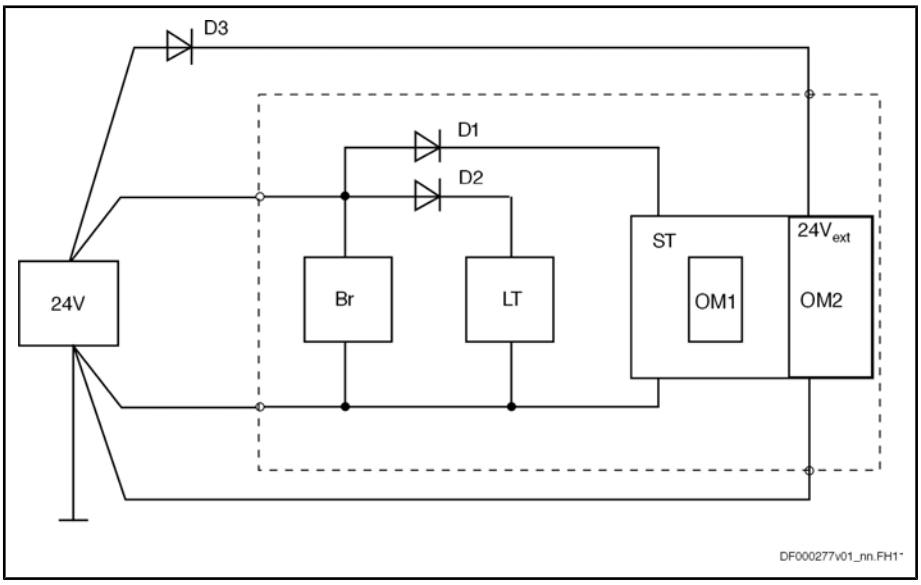
Rexroth IndraDrive Control Sections

External supply required!

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

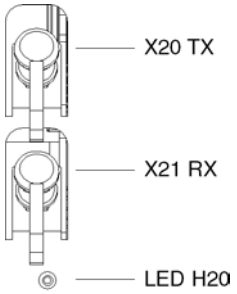
Use protective diode!

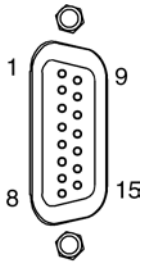
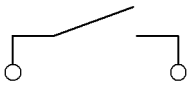
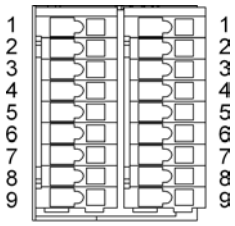
Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.



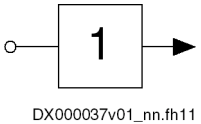
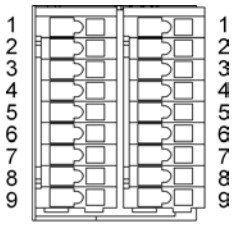
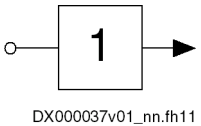
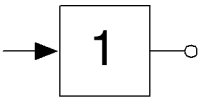
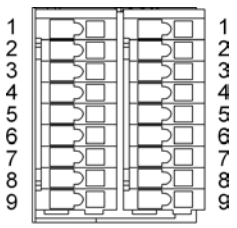
D1, D2	Diodes, internal
D3	Protective diode, external
LT	Power section
BR	Circuit motor holding brake
ST	Control section
OM1	Optional modules
OM2	Optional modules with supply voltage connection, e.g. MA1, MD2

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

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			Con-nection	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"

Rexroth IndraDrive Control Sections

Function			Connection	Factory setting	Nominal data	Figure Data
Digital inputs		I_1 Type 2 (probe)	X31.3	Probe 1 S-0-0401	Can be configured as probe 24 V 3 mA Typ. 1 µs	X31 I X32  See chapter "Technical Data - Functions" → "Digital Inputs Type 1" "Digital Inputs Type 2 (Probe)" "Digital Inputs Type 3 (Probe)"
		I_2 Type 3 (probe)	X31.4		24 V 3 mA	
		I_3	X31.5	Travel range limit switch P-0-0222		
		I_4	X31.6	Travel range limit switch P-0-0222		
		I_5	X31.7	Home switch S-0-0400		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	Combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	Combined I/O configured as input I/O_10; see also P-0-0302		
Digital outputs		I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24 V 0.5 A	X31 I X32  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		

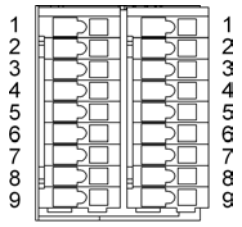
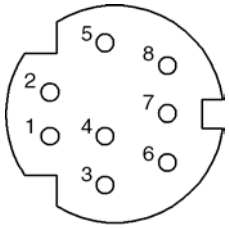
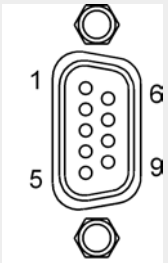
Function			Con-nection	Factory setting	Nominal data	Figure Data
Power supply of digital inputs/outputs		+24V	X31.8			X31 I X32  DA000051v01_nn.FHS DC 19 … 30 V Max. 1.1 A See note on "protective diode"
		0V	X31.9			
Serial interface	RS232		X2			 DA000049v01_nn.FH See chapter "Technical Data - Functions"
Optional: Starting lockout			X41			 DA000054v01_nn.FHS

Fig.5-13: Functions BASIC SERCOS

Rexroth IndraDrive Control Sections

5.3.5 CSB01.1N-PB - BASIC PROFIBUS

Front View With Connections

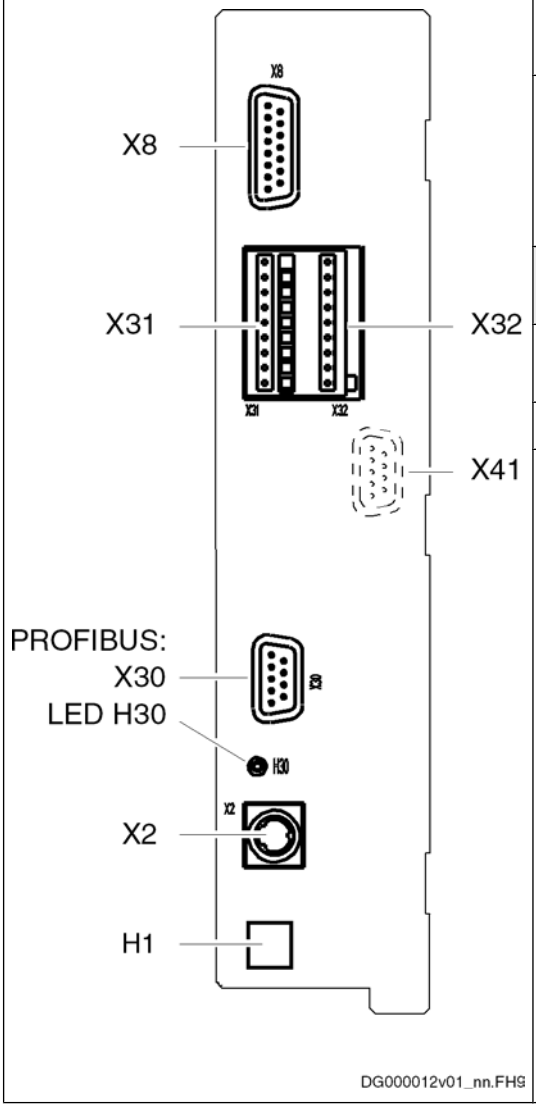
Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	X8	0,25–0,5	-	-	Encoder evaluation ENS
	X31 / X32 Coding: X31: 1 X32: 9	0,75–1,5	20–14	-	Digital inputs/outputs; voltage input (24V, 0V)
	X41	0,25–0,5		-	Optional: Starting lockout
	X30	0,08–0,5	-	-	Communication PROFIBUS
	X2	0,25–0,5	n.s.	-	Serial interface
	H1	-	-	-	Interface for control panel

Fig.5-14: Connections BASIC PROFIBUS

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:

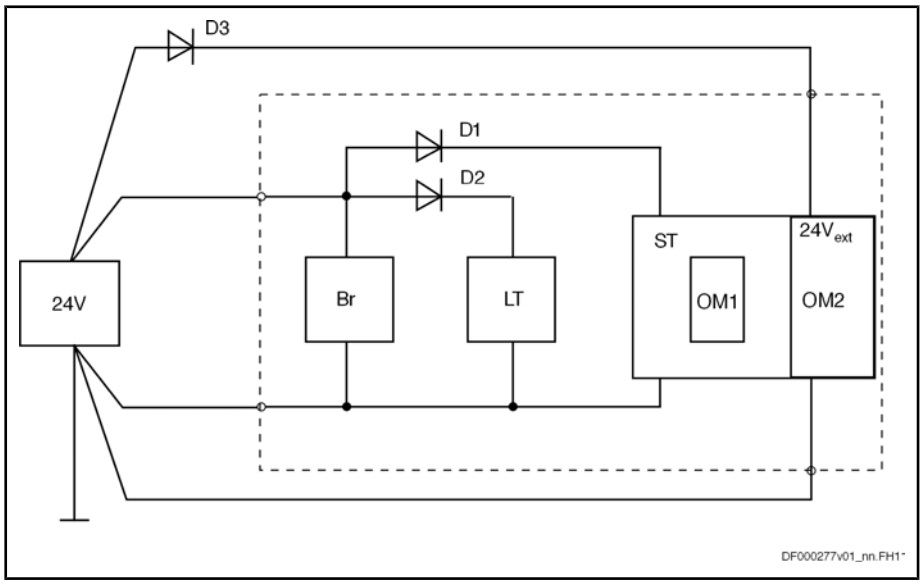
- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

External supply required!

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

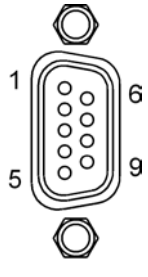
Use protective diode!

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.

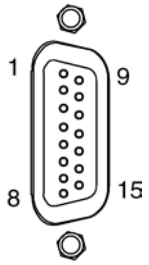
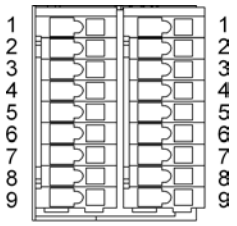


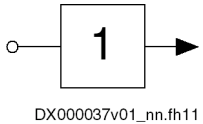
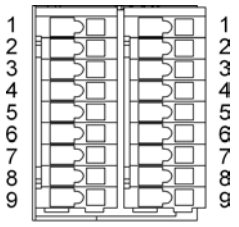
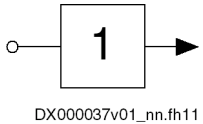
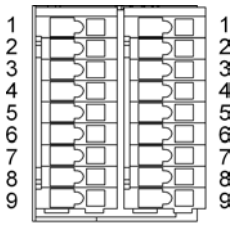
D1, D2	Diodes, internal
D3	Protective diode, external
LT	Power section
BR	Circuit motor holding brake
ST	Control section
OM1	Optional modules
OM2	Optional modules with supply voltage connection, e.g. MA1, MD2

Fig.5-15: 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	

Rexroth IndraDrive Control Sections

Function			Con-nection	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 2 (probe)	X31.3	Probe 1 S-0-0401	Can be configured as probe 24 V 3 mA Typ. 1 µs	X31 I X32  DA000051v01_nn.FHS See chapter "Technical Data - Functions" → "Digital Inputs Type 2 (Probe)"
	 DX000037v01_nn.fh11	I_2 Type 3 (probe)	X31.4		24 V 3 mA	X31 I X32  DA000051v01_nn.FHS See chapter "Technical Data - Functions" → "Digital Inputs Type 1" "Digital Inputs Type 3 (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		

Rexroth IndraDrive Control Sections

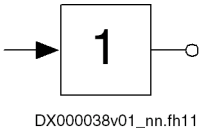
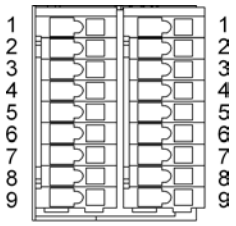
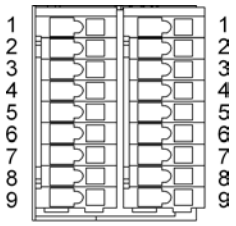
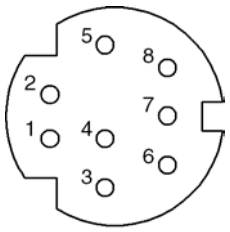
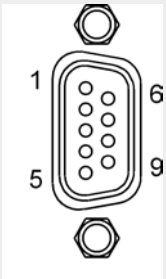
Function			Connection	Factory setting	Nominal data	Figure Data
Digital outputs	 DX000038v01_nn.fh11	I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24 V 0.5 A	X31 I X32  DA000051v01_nn.FHS See chapter "Technical Data - Functions"
		I/O_9	X32.7	Combined I/O configured as input I/O_9; 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.FHS 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.FHS

Fig.5-16: Functions BASIC PROFIBUS

5.3.6 CSB01.1N-AN - BASIC ANALOG

Front View With Connections

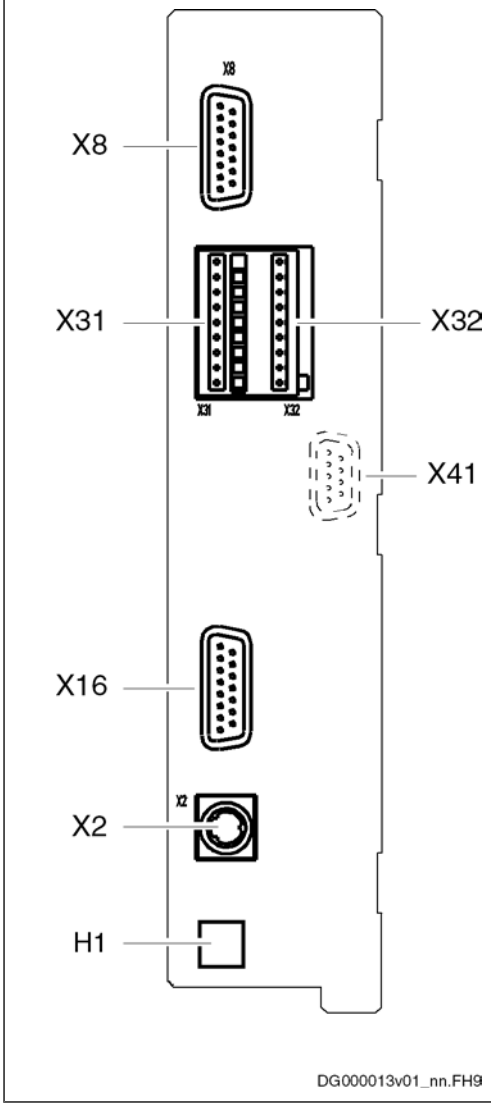
Front view	Connection point	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Description
	X8	0,25–0,5	-	-	Encoder evaluation ENS
	X31 / X32 Coding: X31: 1 X32: 9	0,75–1,5	20–14	-	Digital inputs/outputs; analog inputs; voltage input (24V, 0V)
	X41	0,25–0,5		-	Optional: Starting lock-out
	X16	0,25–0,5	-	-	Encoder emulation MEM
	X2	0,25–0,5	n.s.	-	Serial interface
	H1	-	-	-	Interface for control panel

Fig.5-17: Connections BASIC ANALOG

Functions 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

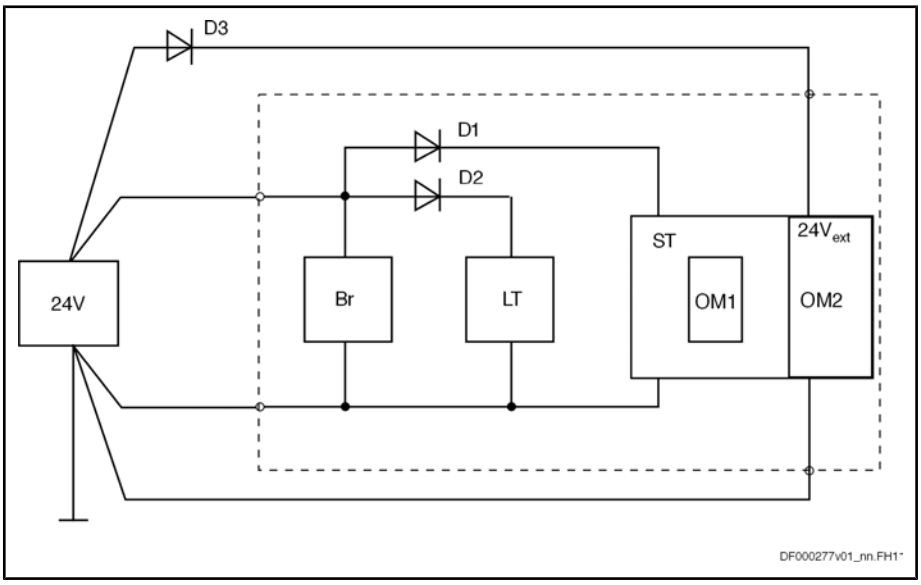
Rexroth IndraDrive Control Sections

External supply required!

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

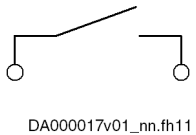
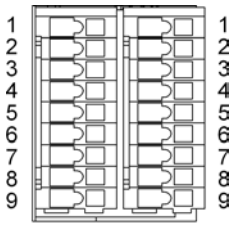
Use protective diode!

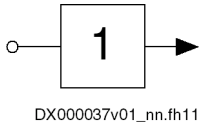
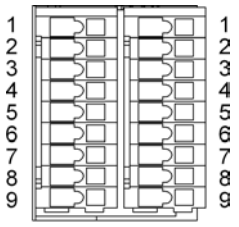
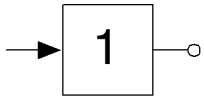
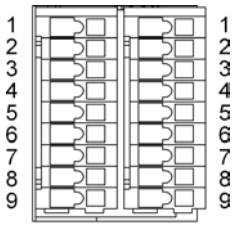
Protect the module against incorrect connection and polarity reversal of the supply voltage, e.g. by using a protective diode (see D3 in figure below) in the power supply at X31.8.



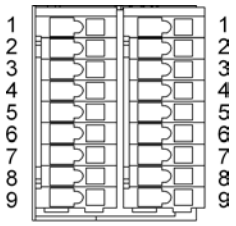
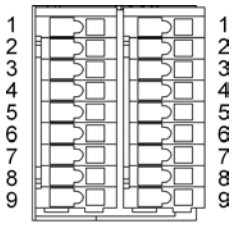
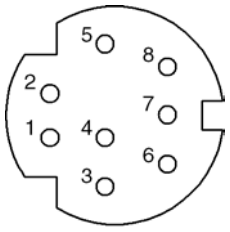
D1, D2	Diodes, internal
D3	Protective diode, external
LT	Power section
BR	Circuit motor holding brake
ST	Control section
OM1	Optional modules
OM2	Optional modules with supply voltage connection, e.g. MA1, MD2

Fig.5-18: 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	24 V 3 mA	X31 I X32  DA000051v01_nn.FHS 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	24 V 0.5 A	X31 I X32  DA000051v01_nn.FHS 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		

Rexroth IndraDrive Control Sections

Function			Con-nection	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 7-17, "Shield Connection X32" on page 168
		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/out-puts		+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"

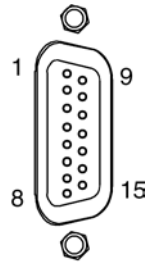
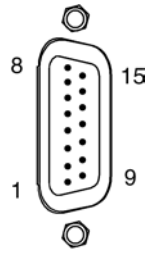
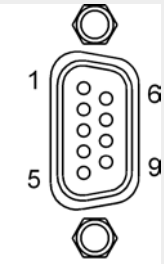
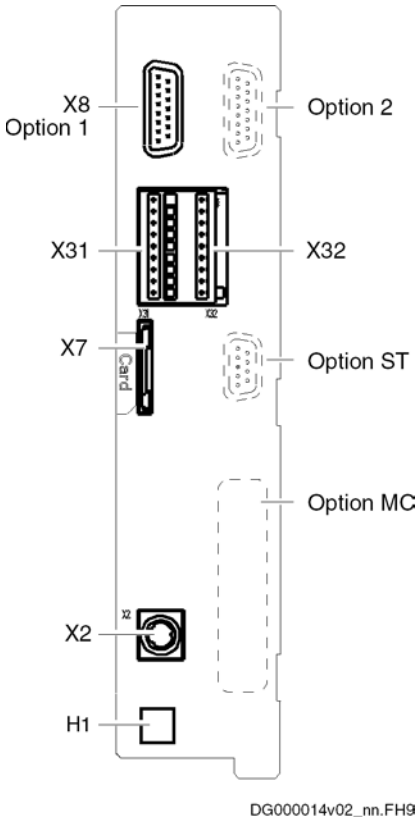
Function			Connection	Factory setting	Nominal data	Figure Data
Encoder interfaces	ENS		X8		DC 11.6 V 300 mA	 DA000053v01_nn.FH9
Encoder emulation	MEM		X16			 DA000056v01_nn.FH9
Optional: Starting lockout			X41			 DA000054v01_nn.FH9

Fig.5-19: Functions BASIC ANALOG

Rexroth IndraDrive Control Sections

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

Fig.5-20: Connections BASIC UNIVERSAL Single-Axis CSB01.1C

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:

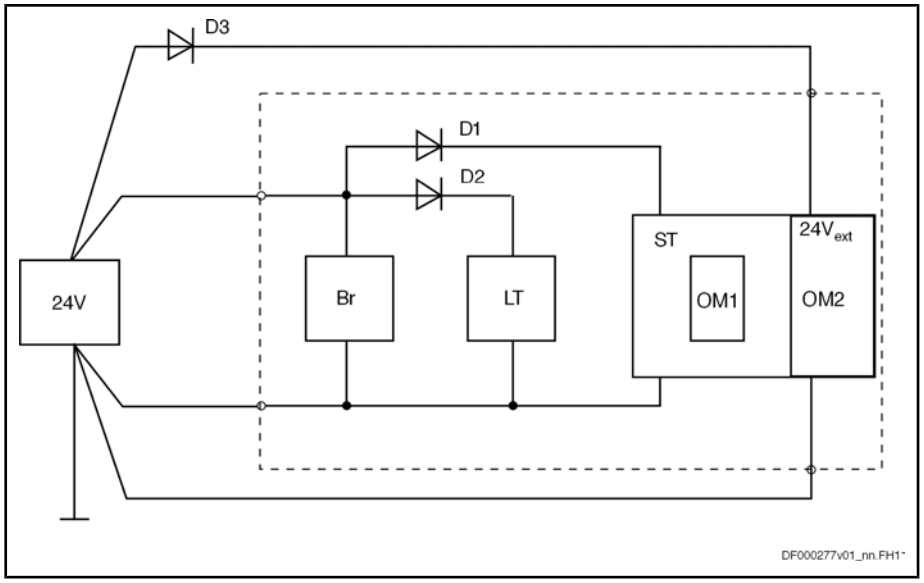
- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

☞ **External supply required!**

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

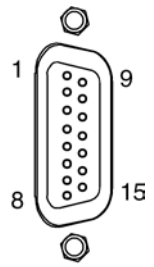
Use protective diode!

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.

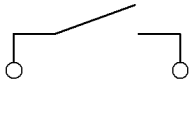
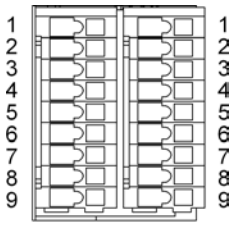
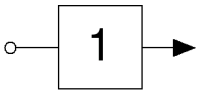
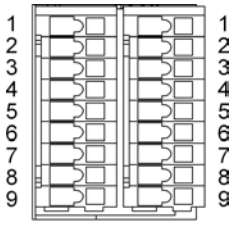
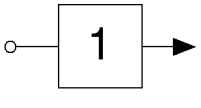


D1, D2	Diodes, internal
D3	Protective diode, external
LT	Power section
BR	Circuit motor holding brake
ST	Control section
OM1	Optional modules
OM2	Optional modules with supply voltage connection, e.g. MA1, MD2

Fig.5-21: Block Diagram of 24V Supply

Function			Con-nection	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	

Rexroth IndraDrive Control Sections

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 2 (probe)	X31.3	Probe 1 S-0-0401	Can be configured as probe 24 V 3 mA Typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 See chapter "Technical Data - Functions" → "Digital Inputs Type 1" "Digital Inputs Type 2 (Probe)" "Digital Inputs Type 3 (Probe)"
	 DX000037v01_nn.fh11	I_2 Type 3 (probe)	X31.4		24 V 3 mA	
		I_3	X31.5	Travel range limit switch P-0-0222		
		I_4	X31.6	Travel range limit switch P-0-0222		
		I_5	X31.7	Home switch S-0-0400		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	Combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	Combined I/O configured as input I/O_10; see also P-0-0302		

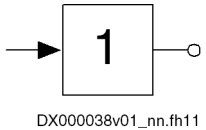
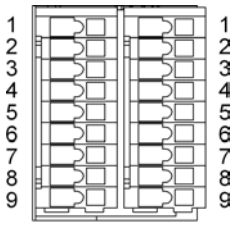
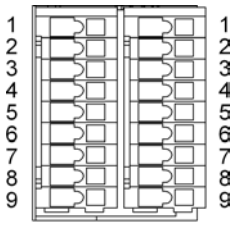
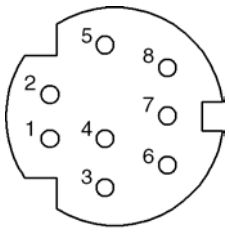
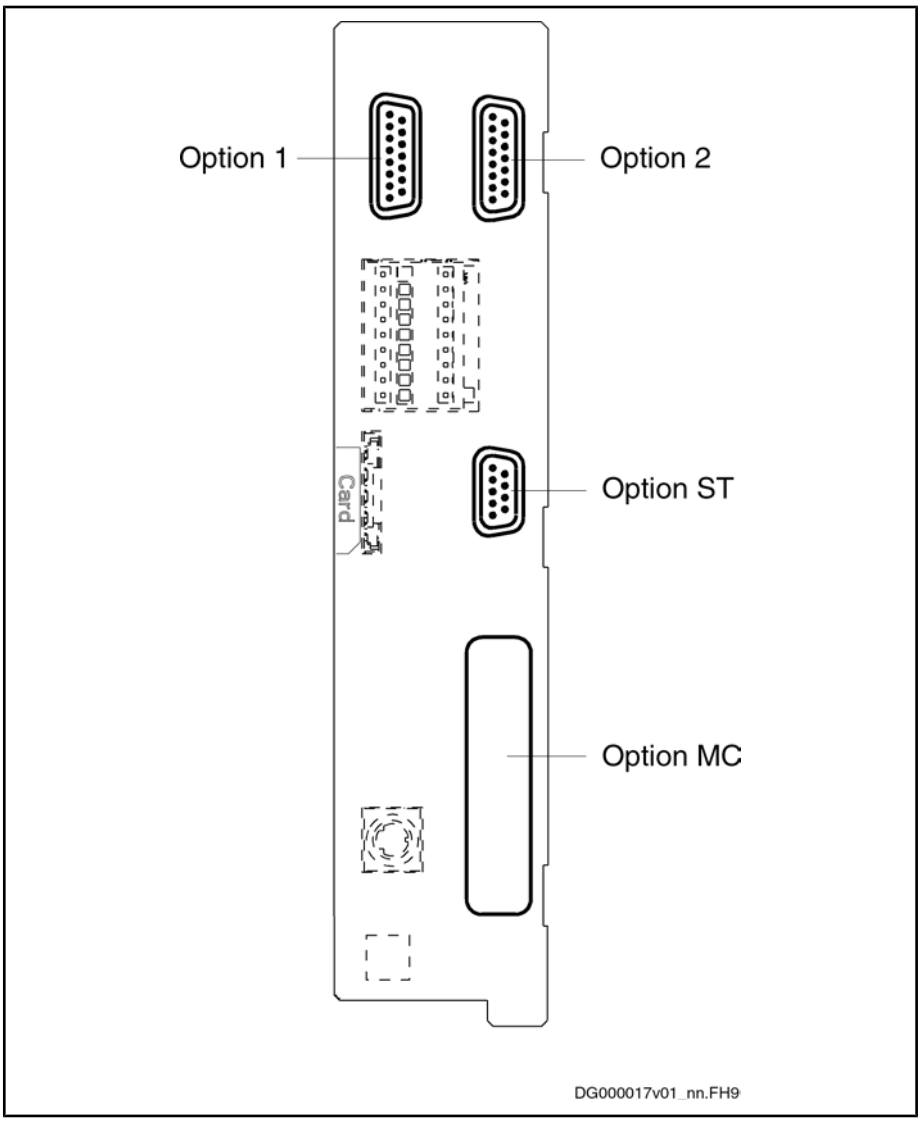
Function			Connection	Factory setting	Nominal data	Figure Data
Digital outputs	 DX000038v01_nn.fh11	I/O_8	X32.6	Combined I/O configured as input I/O_8; see also P-0-0302	24 V 0.5 A	X31 I X32  DA000051v01_nn.FHS See chapter "Technical Data - Functions"
		I/O_9	X32.7	Combined I/O configured as input I/O_9; 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.FHS 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

Fig.5-22: Functions BASIC UNIVERSAL Single-Axis CSB01.1C

Rexroth IndraDrive Control Sections

Optional Slots



Option MC Communication
Option ST Safety technology
Fig.5-23: 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	-	-	-	-	■	-

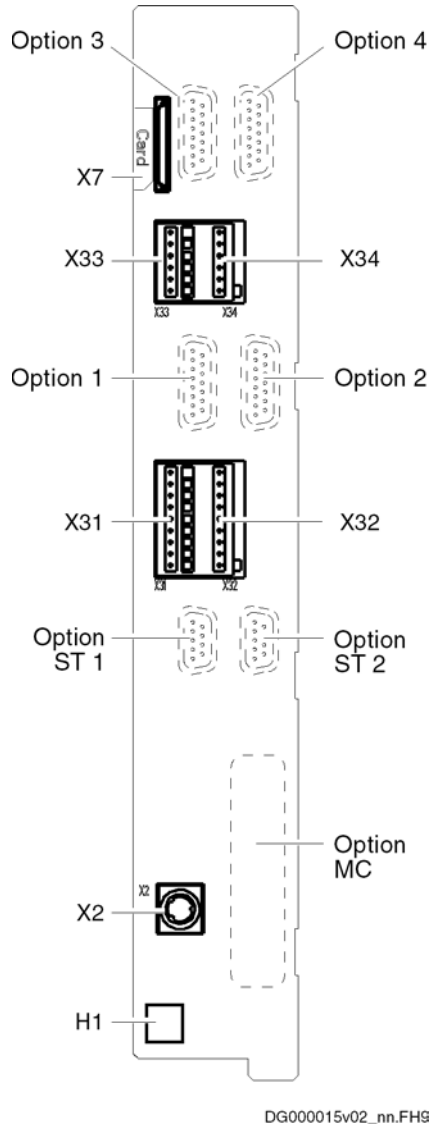
■ Allowed optional module on optional slot
- Not allowed

Fig.5-24: Configuration Table CSB01.1C

Rexroth IndraDrive Control Sections

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

Fig.5-25: Connections BASIC UNIVERSAL Double-Axis

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:

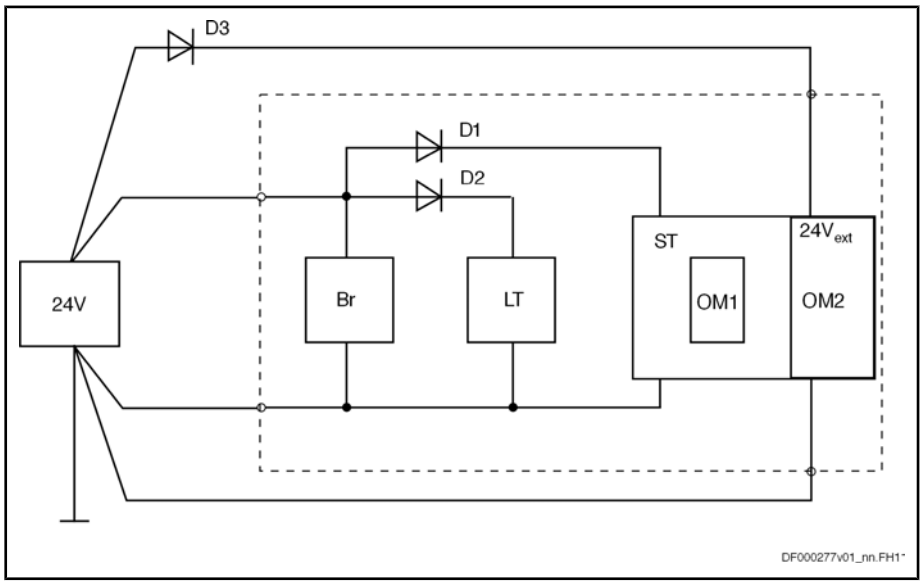
- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

☞ **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.

Rexroth IndraDrive Control Sections

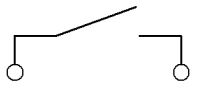
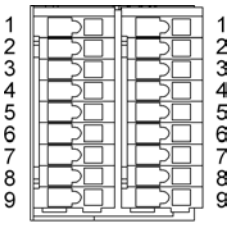
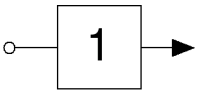
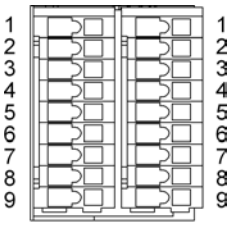
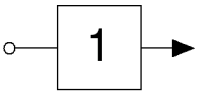
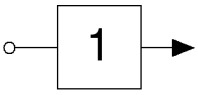
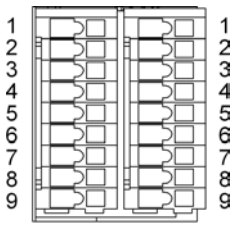
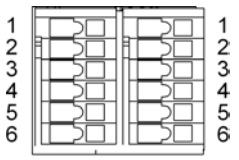
Function			Con-nection	Factory setting	Nominal data	Figure Data
Power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	See section "Power Consumption"	
Communication	Configurable					
Relay contact	 DA000017v01_nn.fh11	Rel 1	X31.1	Ready for operation P-0-0115	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9 Relay Contact Type 2 See chapter "Technical Data - Functions"
		Rel 1	X31.2			
Digital inputs	 DX000037v01_nn.fh11	I_1 Type 2 (probe)	X31.3	Axis 1: Probe 1 S-0-0401	Can be configured as probe; 24 V 3 mA Typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 See chapter "Technical Data - Functions" → "Digital Inputs Type 1" "Digital Inputs Type 2 (Probe)"
	 DX000037v01_nn.fh11	I_2 Type 2 (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	24 V 3 mA	
		I_4	X31.6	Axis 1: Travel range limit switch P-0-0222		
		I_5	X31.7	Axis 1: Home switch S-0-0400		
		I_6	X32.4	Can also be used as analog input; see I_a_1+		
		I_7	X32.5	Can also be used as analog input; see I_a_1-		

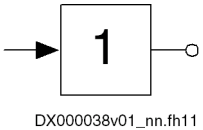
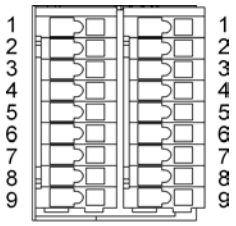
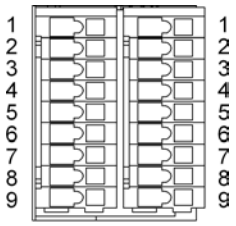
Fig.5-27: Functions BASIC UNIVERSAL Double-Axis CDB01.1C

Function			Con-nection	Factory setting	Nominal data	Figure Data
		I/O_8	X32.6	Axis 1, axis 2: E-Stop P-0-0223		X31 I X32  DA000051v01_nn.FHS X33 I X34  DA000059v01_nn.FHS See chapter "Technical Data - Functions" → "Digital Inputs Type 1" "Digital Inputs Type 3 (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 3 (probe[1])	X33.5			
		I_17	X33.6			
		I_18	X34.1			
		I_19	X34.2			
		I_20	X34.3			
		I_21	X34.4			
		I_22 Type 3 (probe[2])	X34.5			
	Reference potential for digital inputs	0V	X34.6			

1) *As of FWA-…-MPD05V06*

2) *As of FWA-…-MPD05V06*

Rexroth IndraDrive Control Sections

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	24 V 0.5 A	X31 I X32  DA000051v01_nn.FHS 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.FHS Analog Inputs Type 4 See chapter "Technical Data - Functions" Example of connection see chapter 7-17, "Shield Connection X32" on page 168
		I_a_1-	X32.5	Can also be used as digital input I_7		

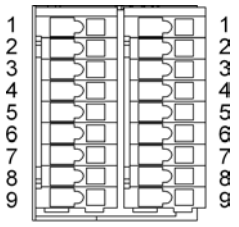
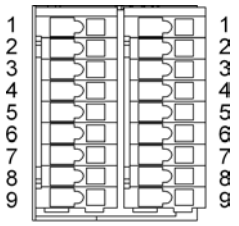
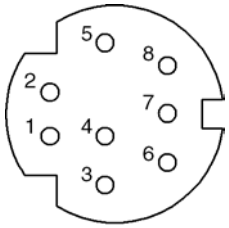
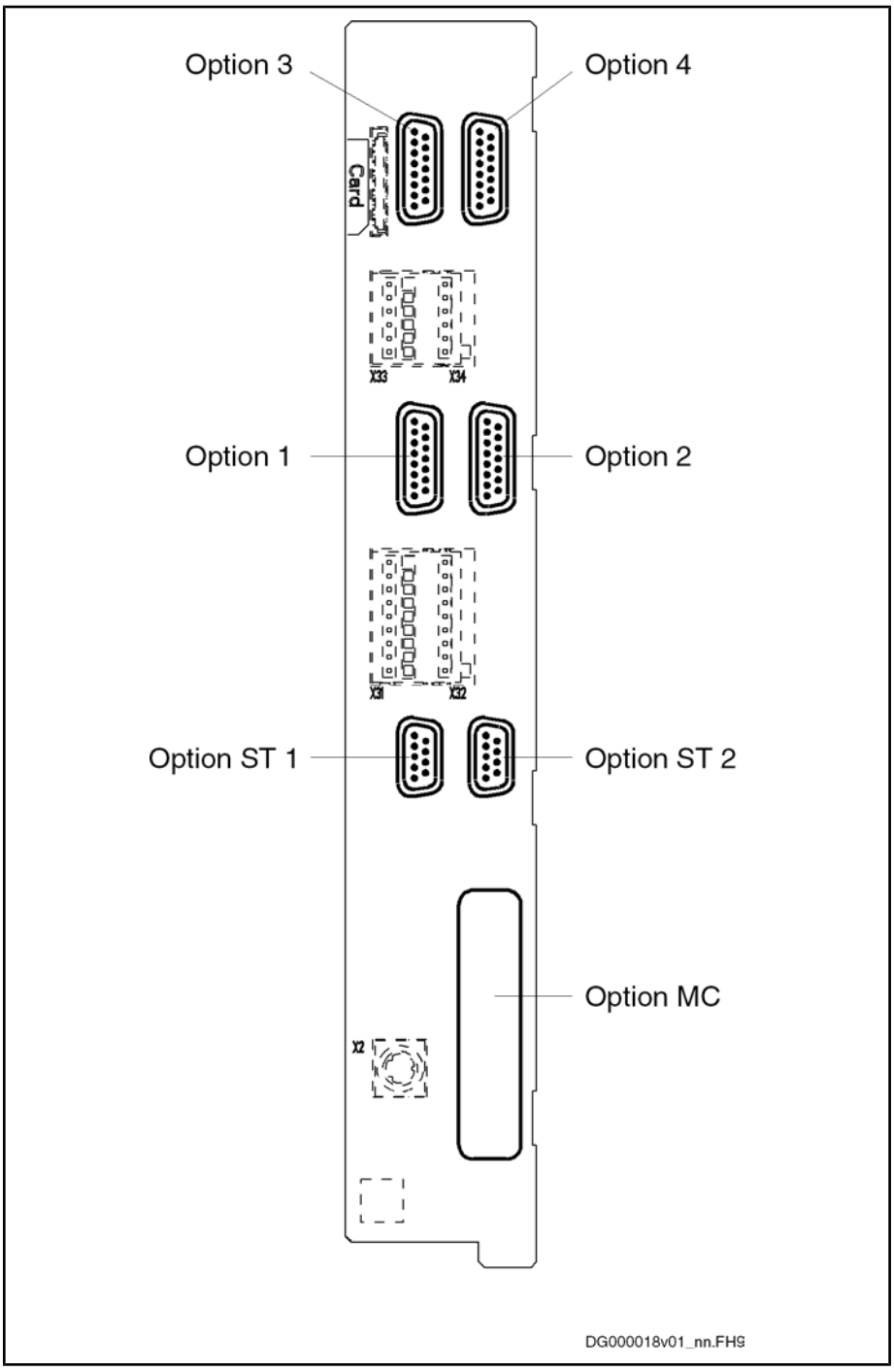
Function			Con-nection	Factory setting	Nominal data	Figure Data
Analog outputs	Voltage output	O_a_1	X32.1		5 V 1 mA	X31 I X32  DA000051v01_nn.FH9 Analog Outputs Type 2 See chapter "Technical Data - Functions" Example of connection see chapter 7-17, "Shield Connection X32" on page 168
		O_a_2	X32.2			
	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

Fig.5-28: Functions BASIC UNIVERSAL Double-Axis CDB01.1C

Rexroth IndraDrive Control Sections

Optional Slots



Option MC Communication
Options ST1 and ST2 Safety technology

Fig.5-29: 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 2)	-	■	■	■	■	-	-	-	-
EN1 2)	-	■	■	■	■	-	-	-	-
EN2 2)	-	■	■	■	■	-	-	-	-
MEM 1)	-	-	-	■	■	-	-	-	-
MA1 2)	-	-	-	■	■	-	-	-	-
MD1	-	-	-	-	-	-	-	-	-
MD2	-	-	-	-	-	-	-	-	-
L1 3)	-	-	-	-	-	■	■	-	-
S1 3)	-	-	-	-	-	■	■	-	-
S	-	-	-	-	-	-	-	-	■
C	-	-	-	-	-	-	-	-	■
PFM02	-	-	-	-	-	-	-	■	-

1) Device function, only allowed twice with optional module "AN"
2) Axis function, allowed twice
3) Device function
■ Allowed optional module on optional slot
- Not allowed

Fig.5-30: Configuration Table CDB01.1C

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.

Rexroth IndraDrive Control Sections

5.4 ADVANCED Control Sections

5.4.1 Type Code ADVANCED - CSH01.1C

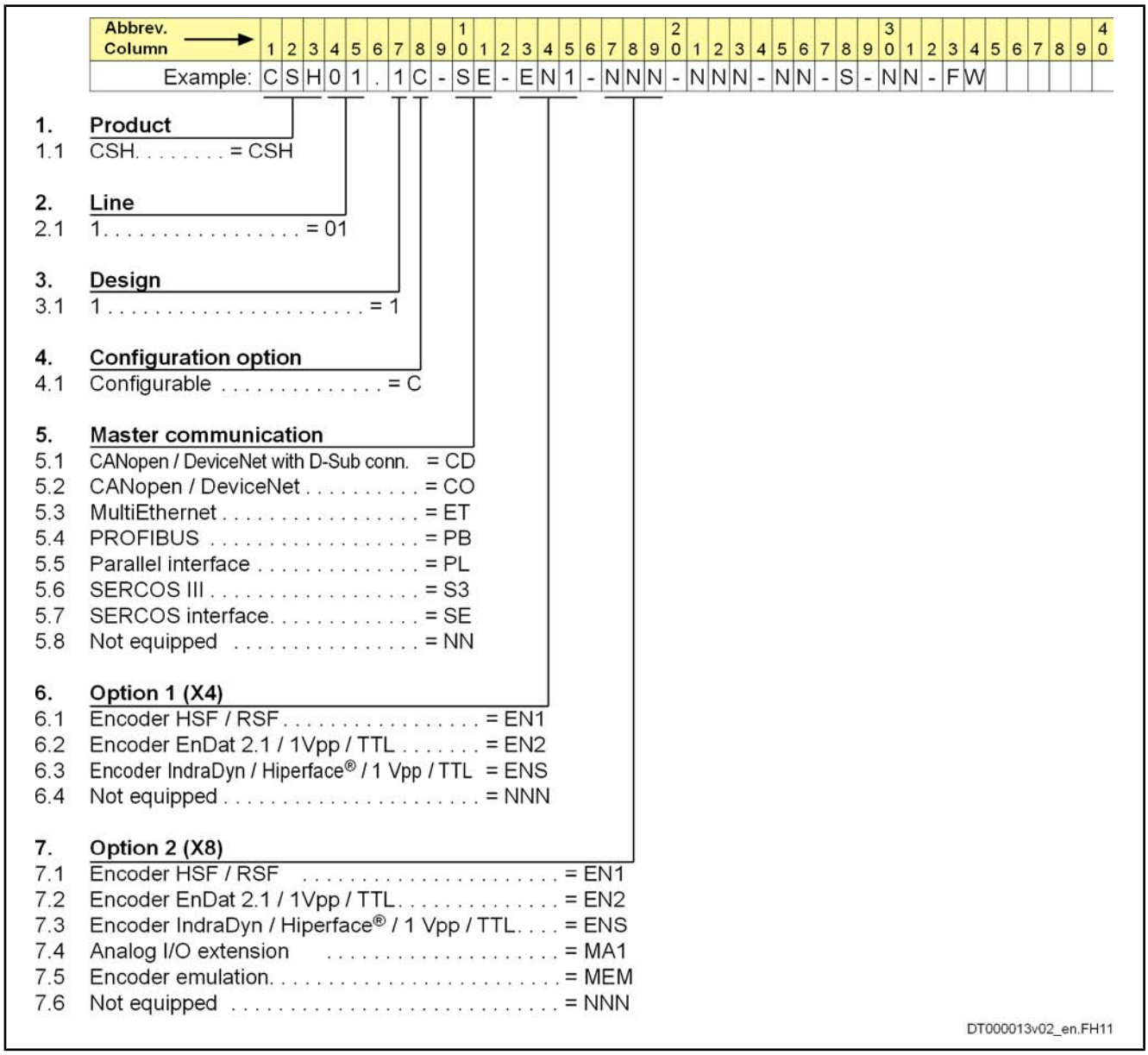


Fig.5-31: Type Code ADVANCED Control Section (CSH01.1C); (to be Continued)

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 / 1Vpp / TTL	= EN2
8.3	Encoder IndraDyn / Hiperface® / 1 Vpp / TTL	= 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 emulation	= MEM
8.8	Not equipped	= NNN

9. Safety option (X41)

9.1	With starting lockout	= L1
9.1	Safe Torque Off (SIL3 / cat. 3 PL e)	= L2
9.2	Without safety technology	= NN
9.3	With safety technology I/O	= S1 (1)
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

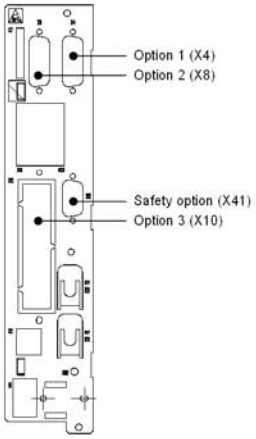
12. Firmware

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

Note:

(1) Safety options "S1" or "S2" are only allowed if "Option 1" is equipped with a suitable encoder

Illustration example: CSH01.1



DT000014v02_en.FH11

Fig.5-32: Type Code ADVANCED Control Section (CSH01.1C); (Continuation)

Rexroth IndraDrive Control Sections

5.4.2 Type Code ADVANCED - CSH01.2C

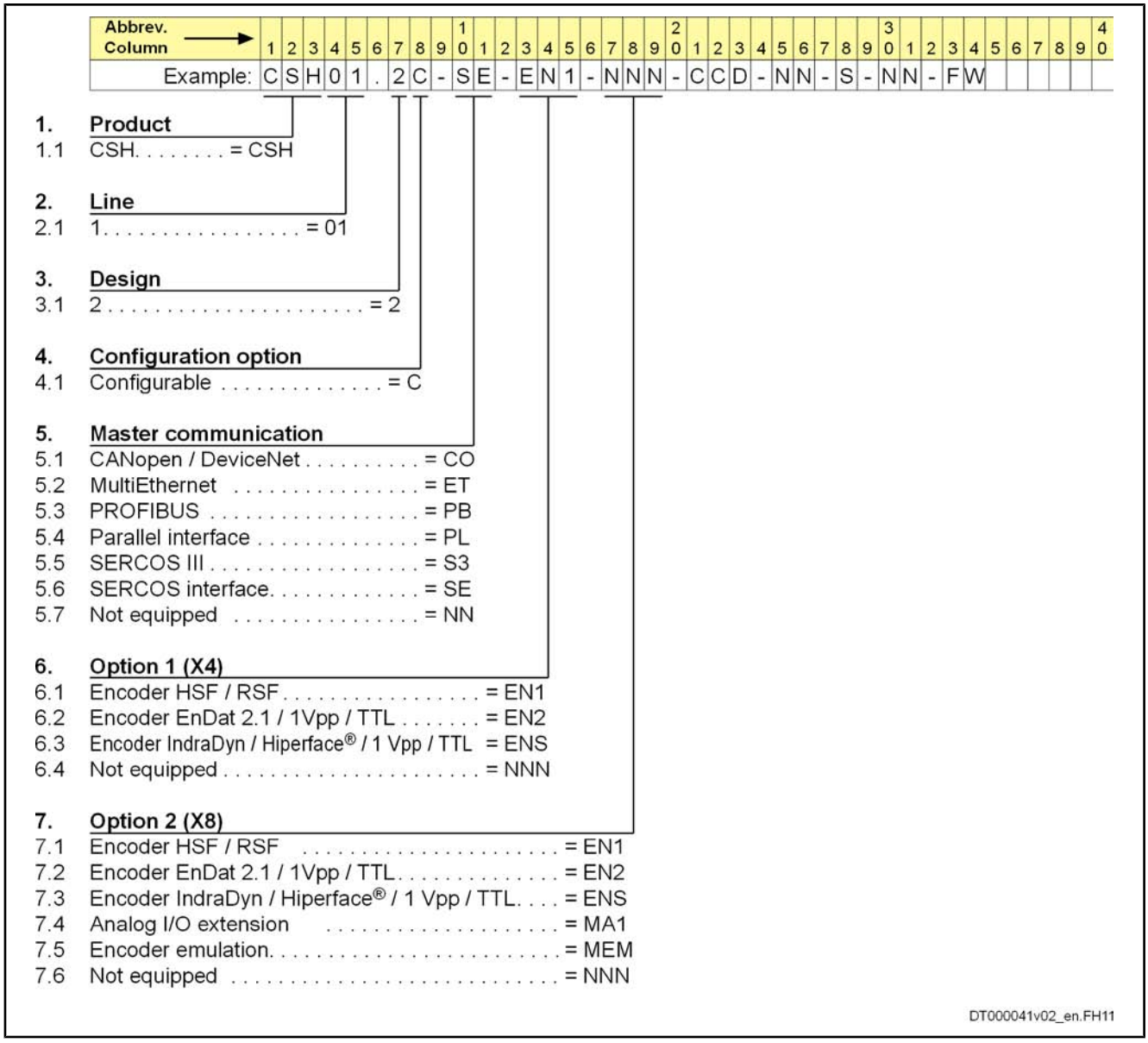


Fig.5-33: Type Code ADVANCED Control Section (CSH01.2C); (to be Continued)

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. . . . . = CCD

9. Safety option (X41)
9.1 With starting lockout . . . . . = L1
9.2 Safe Torque Off (SIL3 / cat. 3 PL e) . . . . . = L2
9.3 Without safety technology . . . . . = NN
9.4 With safety technology I/O. . . . . = S1 (1)
9.5 Safe Motion (SIL2 / cat. 3 PL d) . . . . . = S2 (1)

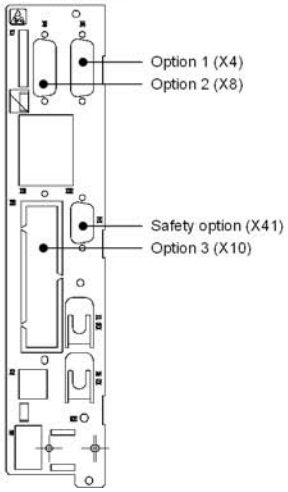
10. Control panel
10.1 Standard control panel . . . . . = S

11. Other design
11.1 None. . . . . = NN

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

Note
(1) Safety options "S1" or "S2" are only allowed if "Option 1" is equipped with a suitable encoder

Illustration example CSH01.1



DT000042v02_en.FH11

Fig.5-34: Type Code ADVANCED Control Section (CSH01.2C); (Continuation)

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

Rexroth IndraDrive Control Sections

5.4.3 Type Code ADVANCED - CSH01.3C

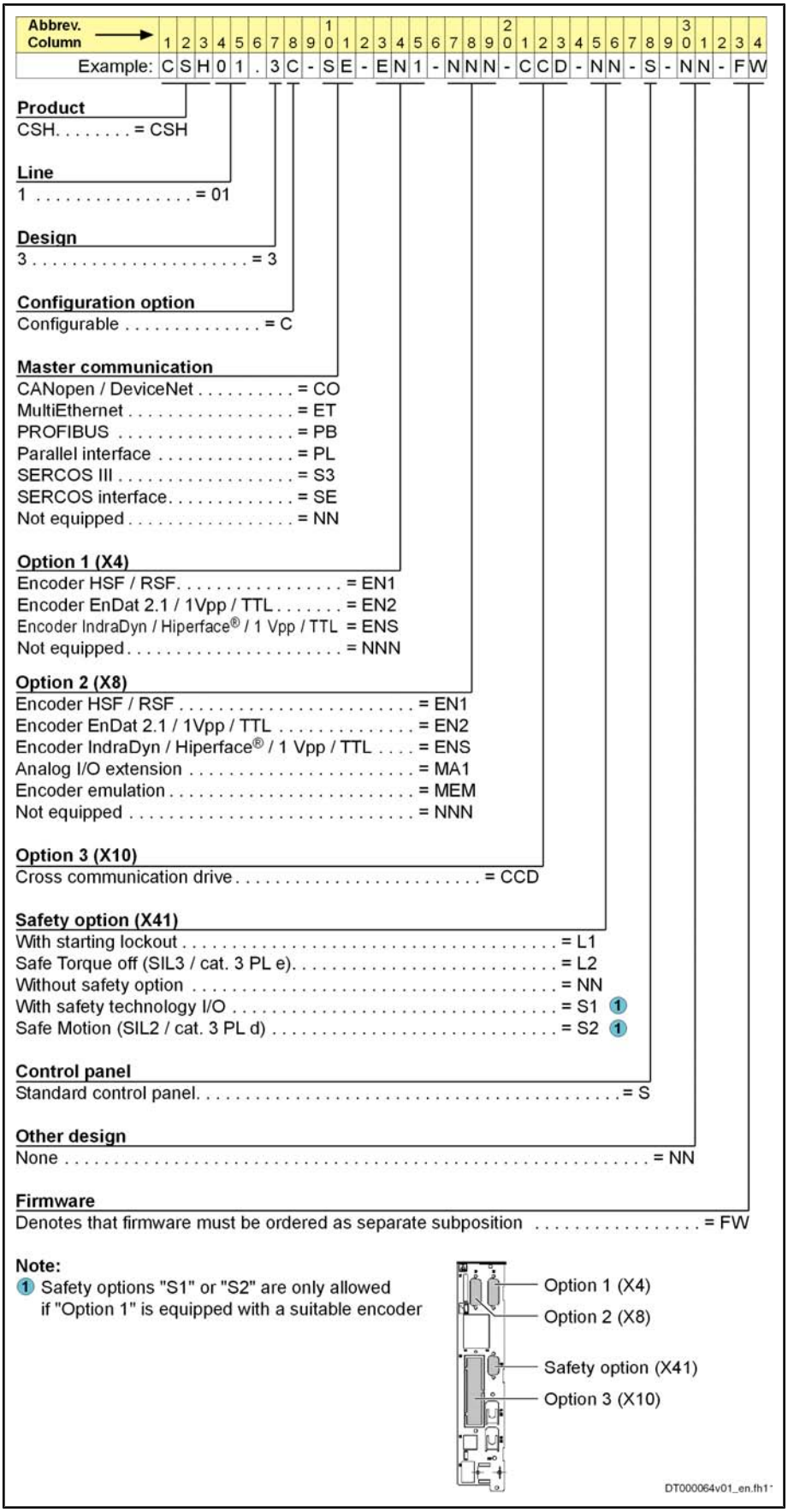


Fig.5-35: Type Code ADVANCED Control Section (CSH01.3C)

5.4.4 Dimensions ADVANCED

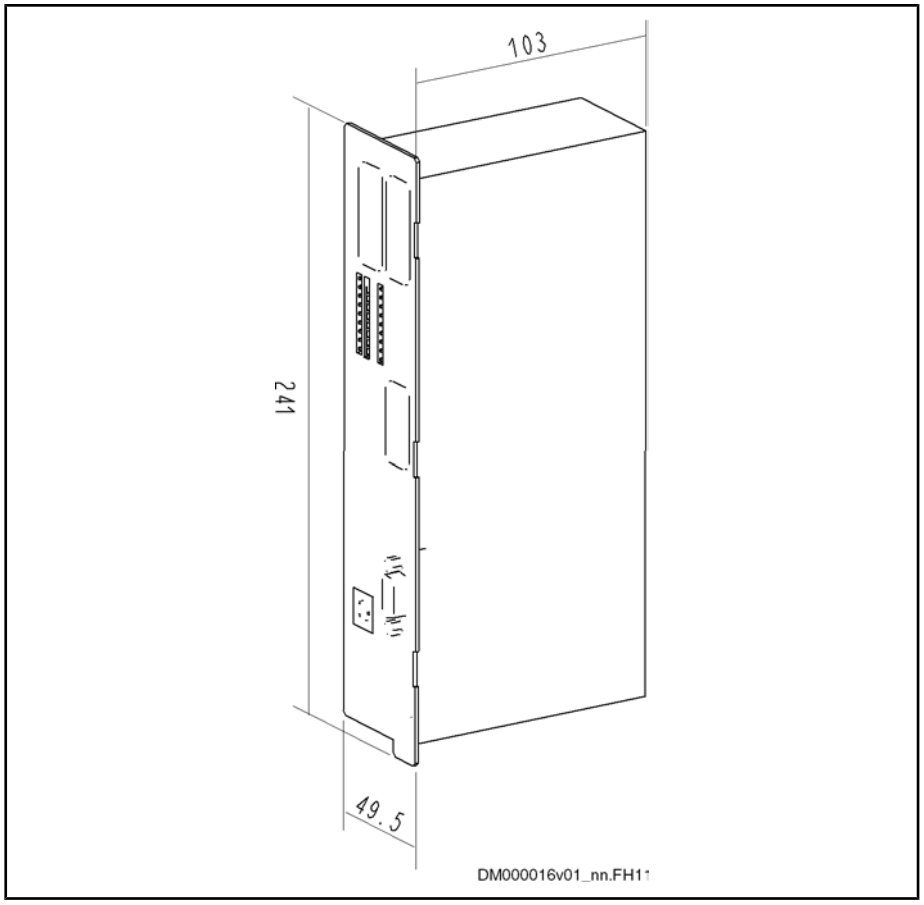
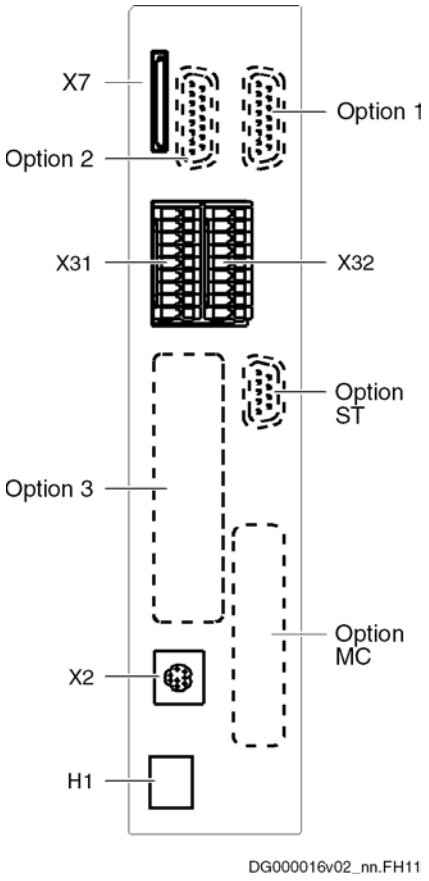


Fig.5-36: Dimensions ADVANCED

Rexroth IndraDrive Control Sections

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

Fig.5-37: Connections ADVANCED CSH01.1C

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:

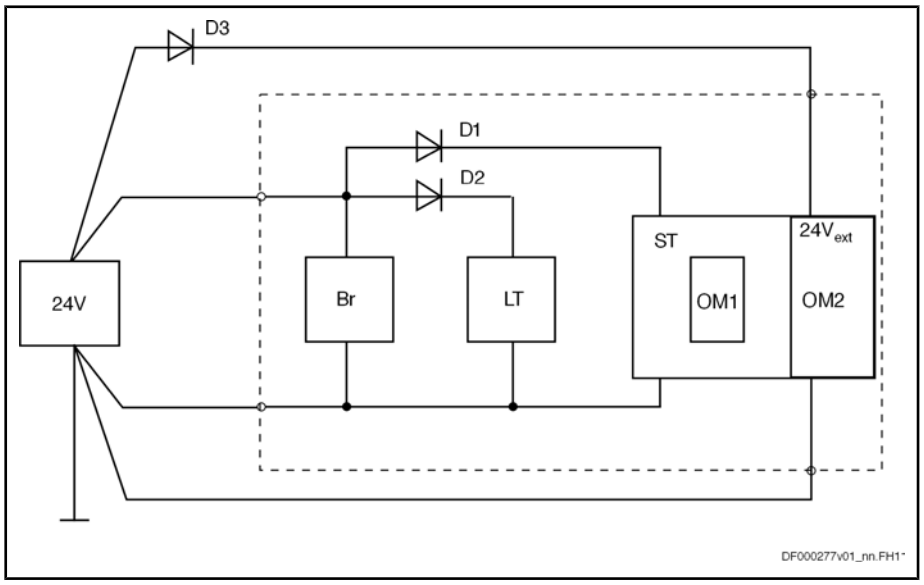
- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

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.5-38: Block Diagram of 24V Supply

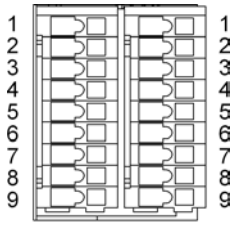
Low input resistance

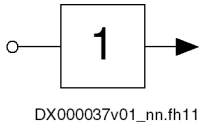
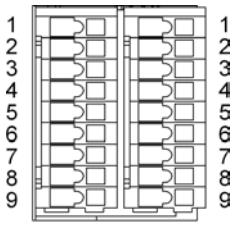
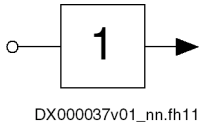
The digital inputs I_6 and I_7 are mounted in parallel to the analog input I_a_1. This reduces the input resistance of the analog input to the value of the digital inputs.

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

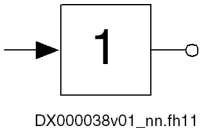
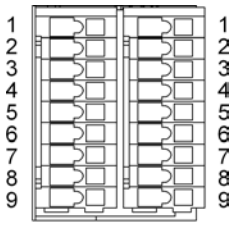
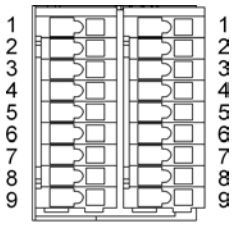
If you need a low degree of linearity error, use signal sources with the lowest possible impedance at the analog input I_a_1. For example, you achieve a linearity error smaller 5% with a 1 kohm potentiometer and smaller 2.5% with a 500 ohm potentiometer.

Rexroth IndraDrive Control Sections

Function			Con-nection	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 2 (probe)	X31.3	Probe 1 S-0-0401	Can be configured as probe; 24 V 3 mA Typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 See chapter "Technical Data - Functions" → "Digital Inputs Type 1" "Digital Inputs Type 2 (Probe)"
		I_2 Type 2 (probe)	X31.4	Probe 2 S-0-0402		
	 DX000037v01_nn.fh11	I_3	X31.5	Travel range limit switch P-0-0222	24 V 3 mA	
		I_4	X31.6	Travel range limit switch P-0-0222		
		I_5	X31.7	Home switch S-0-0400		
		I_6	X32.4	Can also be used as analog input; see I_a_1+		
		I_7	X32.5	Can also be used as analog input; see I_a_1-		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	Combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	Combined I/O configured as input I/O_10; see also P-0-0302		
		I/O_11	X32.9	Combined I/O configured as input I/O_11; see also P-0-0302		

Rexroth IndraDrive Control Sections

Function			Con-nection	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	24 V 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 7-17, "Shield Connection X32" on page 168
		I_a_1-	X32.5	Can also be used as digital input I_7		

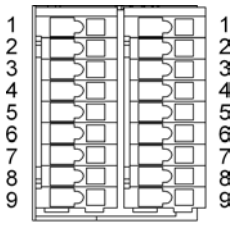
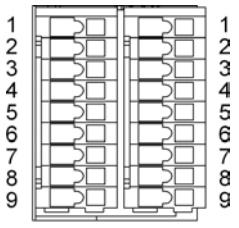
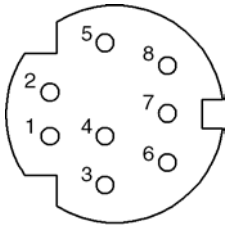
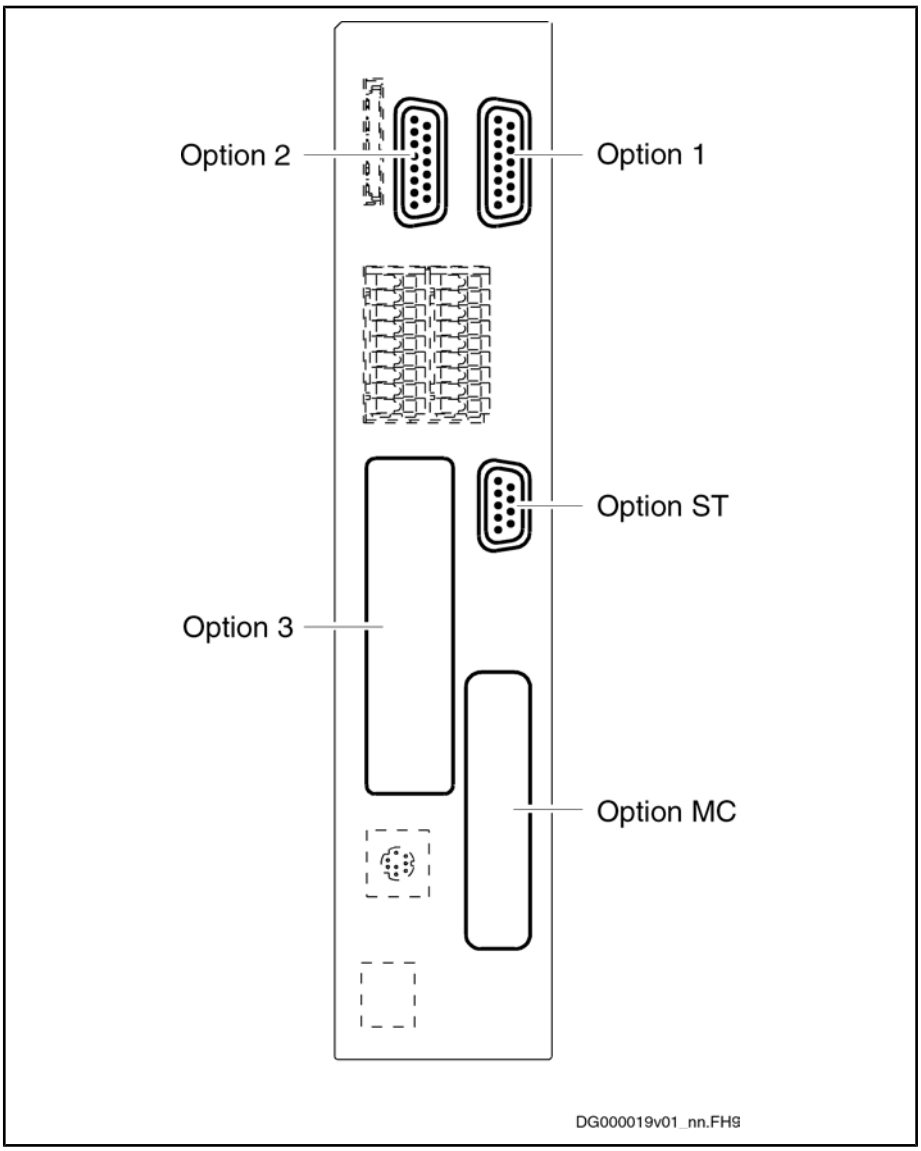
Function			Connection	Factory setting	Nominal data	Figure Data
Analog outputs	Voltage output	O_a_1	X32.1		5 V 1 mA	X31 I X32  DA000051v01_nn.FH9 Analog Outputs Type 2 See chapter "Technical Data - Functions" Example of connection see chapter 7-17, "Shield Connection X32" on page 168
		O_a_2	X32.2			
	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

Fig.5-39: Functions ADVANCED CSH01.1C

Rexroth IndraDrive Control Sections

Optional Slots CSH01.1C



Option MC Communication
Option ST Safety technology
Fig.5-40: 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	-	-	-	-	-	■	-

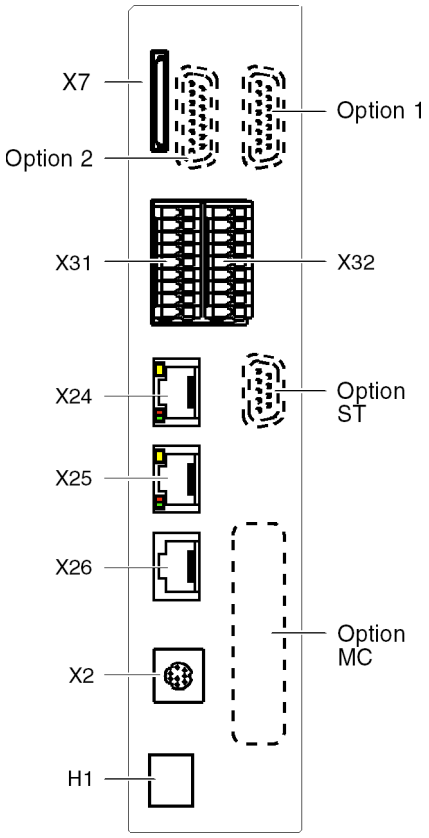
■ Allowed optional module on optional slot
- Not allowed

Fig.5-41: Configuration Table CSH01.1C

Rexroth IndraDrive Control Sections

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

Fig.5-42: Connections ADVANCED CSH01.2

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:

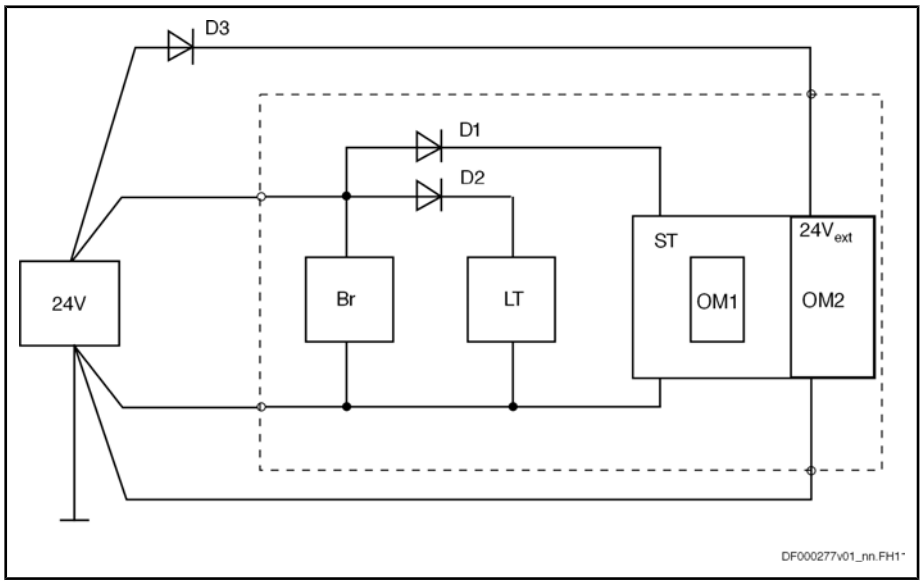
- Analog Outputs
- Analog Inputs
- Digital Inputs/Outputs

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.5-43: Block Diagram of 24V Supply

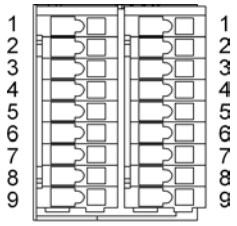
Low input resistance

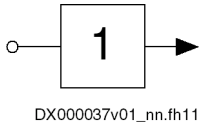
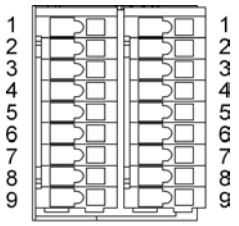
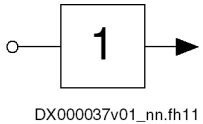
The digital inputs I_6 and I_7 are mounted in parallel to the analog input I_a_1. This reduces the input resistance of the analog input to the value of the digital inputs.

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

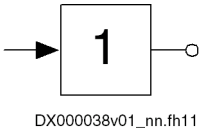
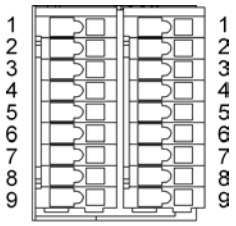
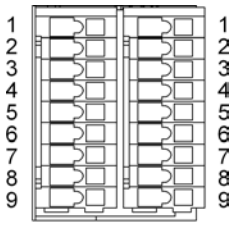
If you need a low degree of linearity error, use signal sources with the lowest possible impedance at the analog input I_a_1. For example, you achieve a linearity error smaller 5% with a 1 kohm potentiometer and smaller 2.5% with a 500 ohm potentiometer.

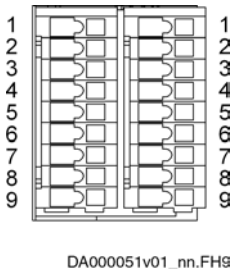
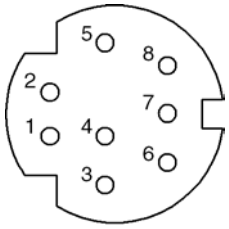
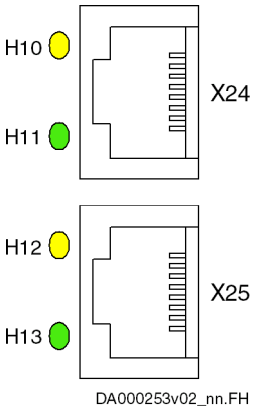
Rexroth IndraDrive Control Sections

Function			Con-nection	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 2 (probe)	X31.3	Probe 1 S-0-0401	Can be configured as probe 24 V 3 mA Typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 See chapter "Technical Data - Functions" → "Digital Inputs Type 1" "Digital Inputs Type 2 (Probe)"
		I_2 Type 2 (probe)	X31.4	Probe 2 S-0-0402		
	 DX000037v01_nn.fh11	I_3	X31.5	Travel range limit switch P-0-0222	24 V 3 mA	
		I_4	X31.6	Travel range limit switch P-0-0222		
		I_5	X31.7	Home switch S-0-0400		
		I_6	X32.4	Can also be used as analog input; see I_a_1+		
		I_7	X32.5	Can also be used as analog input; see I_a_1-		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	Combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	Combined I/O configured as input I/O_10; see also P-0-0302		
		I/O_11	X32.9	Combined I/O configured as input I/O_11; see also P-0-0302		

Rexroth IndraDrive Control Sections

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	24 V 0.5 A	X31 I X32  DA000051v01_nn.FHS 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.FHS Analog Inputs Type 4 See chapter "Technical Data - Functions" Example of connection see chapter 7-17, "Shield Connection X32" on page 168
		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 7-17Shield Connection X32, page 168
		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			

Rexroth IndraDrive Control Sections

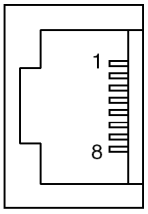
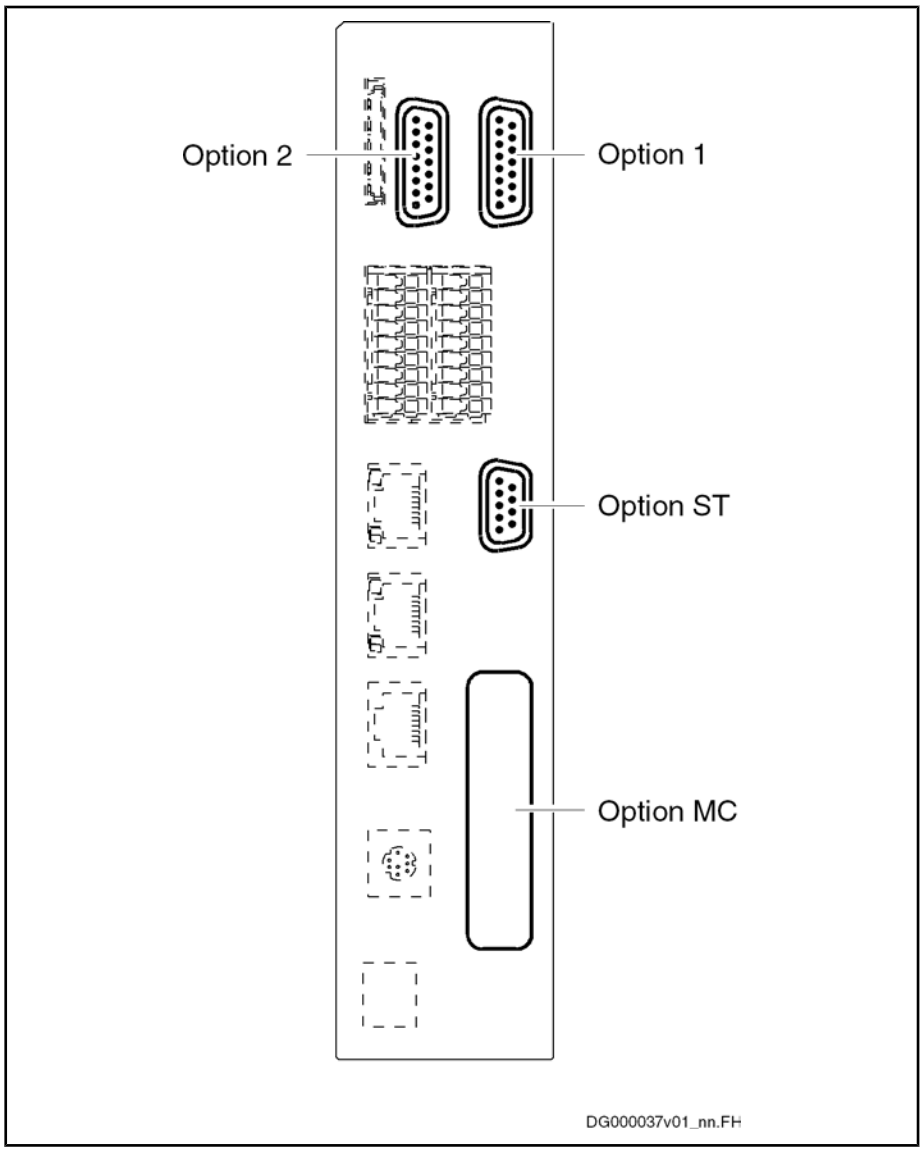
Function			Connection	Factory setting	Nominal data	Figure Data
Engineering interface	Ethernet-based interface		X26			 DA000041v01_nn.FH See chapter "Technical Data - Functions"
Optional functions	Allowed options: See configuration table					See corresponding optional module

Fig.5-44: Functions ADVANCED CSH01.2

Optional Slots CSH01.2C



Option MC Communication
Option ST Safety technology
Fig.5-45: 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	■	-	-	-	-	-	-

Rexroth IndraDrive Control Sections

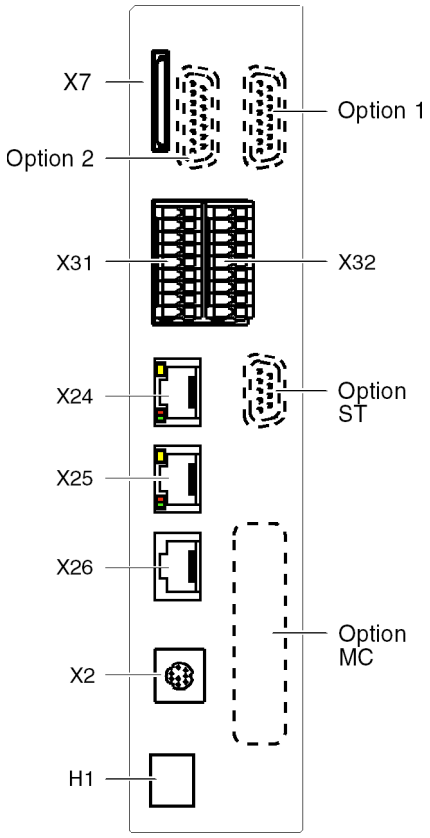
Optional module	Optional slot						
	Option MC	Option 1 (X4)	Option 2 (X8)	Option 3 (on board)	Option ST (X41)	Memory card slot (X7)	Control panel (H1)
CO	■	-	-	-	-	-	-
ET	■	-	-	-	-	-	-
S3	■	-	-	-	-	-	-
CCD	-	-	-	■	-	-	-
ENS	-	■	■	-	-	-	-
EN1	-	■	■	-	-	-	-
EN2	-	■	■	-	-	-	-
MEM	-	■	■	-	-	-	-
MA1	-	-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

■ Allowed optional module on optional slot
- Not allowed

Fig.5-46: Configuration Table CSH01.2C

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

Fig.5-47: Connections ADVANCED CSH01.3

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

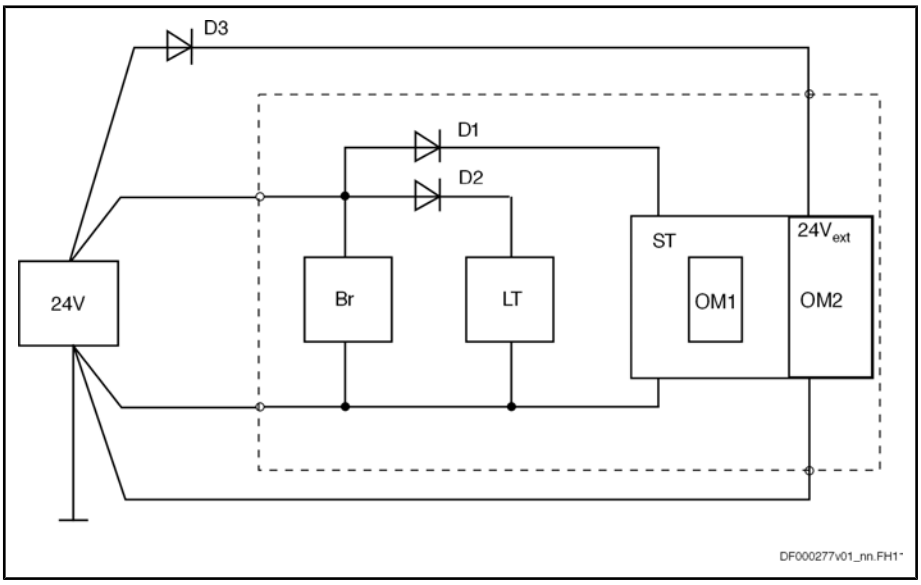
Rexroth IndraDrive Control Sections

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

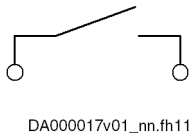
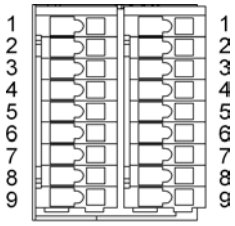
Fig.5-48: Block Diagram of 24V Supply

Low input resistance

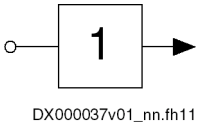
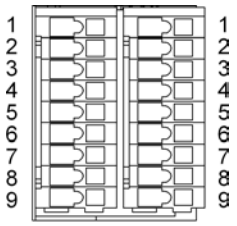
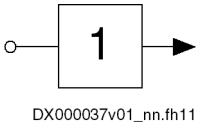
The digital inputs I_6 and I_7 are mounted in parallel to the analog input I_a_1. This reduces the input resistance of the analog input to the value of the digital inputs.

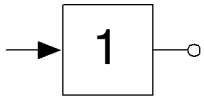
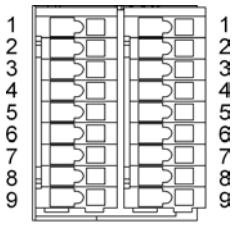
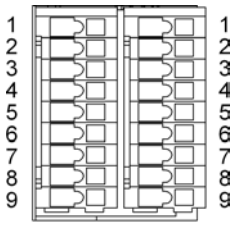
Signal sources with low impedance for a low degree of linearity error

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.

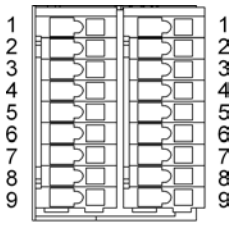
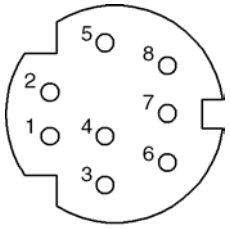
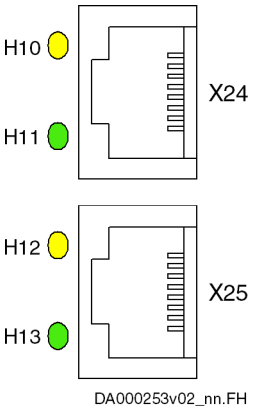
Function			Con-nection	Factory setting	Nominal data	Figure Data
Power consumption from 24V supply; connection at power section X13 or +24V/0V			-	-	See "Power Consumption"	
Relay contact	 DA000017v01_nn.fh11	Rel 1	X31.1	Ready for operation HMS: P-0-0115 HCS02/HCS03: P-0-0861	DC 24 V 1 A	X31 I X32  DA000051v01_nn.FH9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

Rexroth IndraDrive Control Sections

Function			Connection	Factory setting	Nominal data	Figure Data
Digital inputs	 DX000037v01_nn.fh11	I_1 Type 2 (probe)	X31.3	Probe 1 S-0-0401	Can be configured as probe 24 V 3 mA Typ. 1 µs	X31 I X32  DA000051v01_nn.FH9 See "Technical Data - Functions" → "Digital Inputs Type 1" "Digital Inputs Type 2 (Probe)"
		I_2 Type 2 (probe)	X31.4	Probe 2 S-0-0402		
	 DX000037v01_nn.fh11	I_3	X31.5	Travel range limit switch P-0-0222	24 V 3 mA	
		I_4	X31.6	Travel range limit switch P-0-0222		
		I_5	X31.7	Home switch S-0-0400		
		I_6	X32.4	Can also be used as analog input; see I_a_1+		
		I_7	X32.5	Can also be used as analog input; see I_a_1-		
		I/O_8	X32.6	E-Stop P-0-0223		
		I/O_9	X32.7	Combined I/O configured as input I/O_9; see also P-0-0302		
		I/O_10	X32.8	Combined I/O configured as input I/O_10; see also P-0-0302		
		I/O_11	X32.9	Combined I/O configured as input I/O_11; see also P-0-0302		

Function			Connection	Factory setting	Nominal data	Figure 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	24 V 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 7-17, Shield Connection X32, page 168
		I_a_1-	X32.5	Can also be used as digital input I_7		

Rexroth IndraDrive Control Sections

Function			Con-nection	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 7-17, Shield Connection X32, page 168
		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			

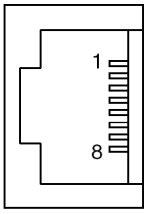
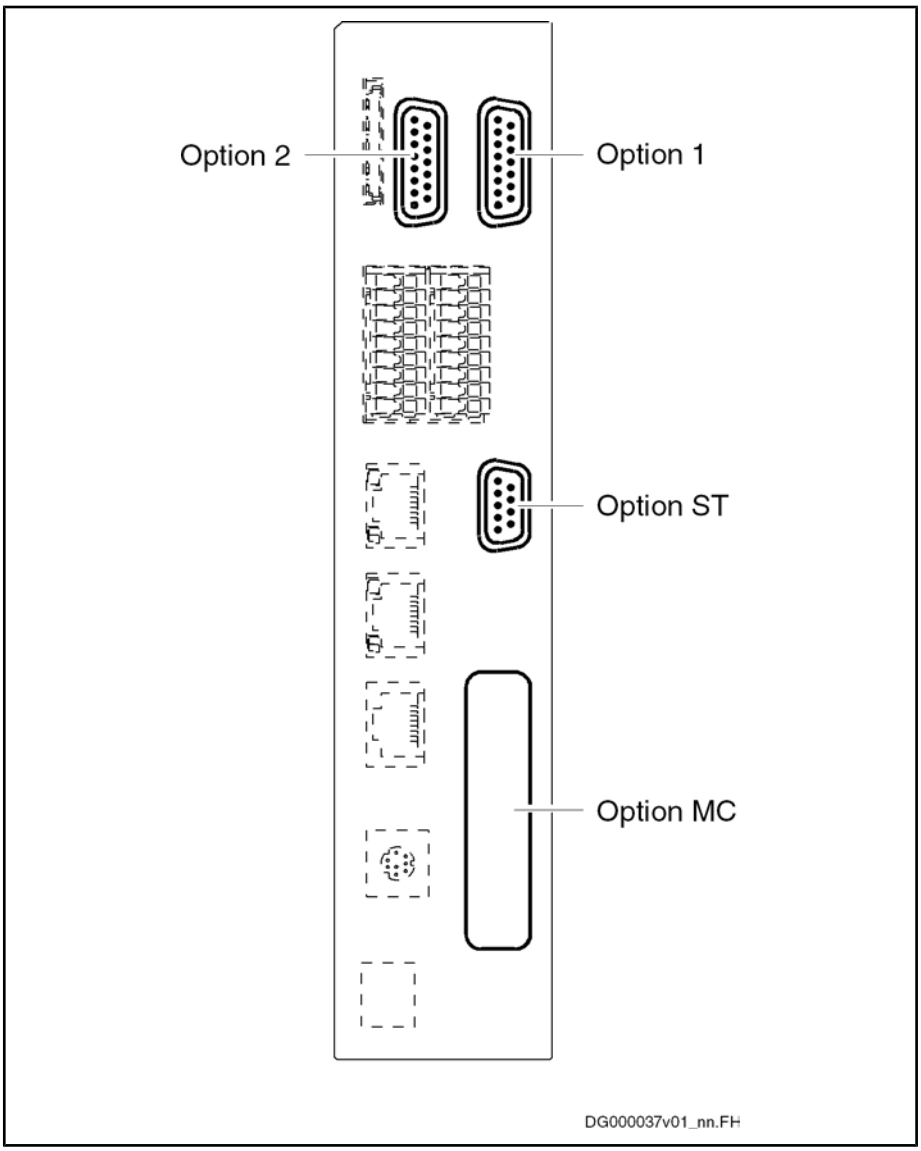
Function			Connection	Factory setting	Nominal data	Figure Data
Engineering interface	Ethernet-based interface		X26			 DA000041v01_nn.FH See "Technical Data - Functions"
Optional functions	Allowed options: See configuration table					See corresponding optional module

Fig.5-49: Functions ADVANCED CSH01.3

Rexroth IndraDrive Control Sections

Optional Slots CSH01.3C



Option MC Communication
Option ST Safety technology
Fig.5-50: 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 on optional slot
- Not allowed

Fig.5-51: Configuration Table CSH01.3C

6 Optional Modules for Control Sections

6.1 Overview

Optional module	Function	Name of optional module Connection point	Notes
Communications	Communication via analog inputs	AN -	CSB01.1N-AN, not configurable
		AN (HCC11)[1)] X39	See optional module "AN - Extension analog inputs"
	Communication via SERCOS interface	SE (HCC02) X20; X21	Communication based on fiber optic cables
	Communication via PROFIBUS	PB (HCC03) X30	Field bus PROFIBUS
	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) X24, X25	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 Modules for Control Sections

Optional module	Function	Name of optional module Connection point	Notes
Encoder evaluations	For encoder systems of IndraDyn motors	ENS (HFI03)	Standard for motors of IndraDyn product range ; (encoder systems S1, M1, S2 and M2) **12 V power supply**
	For resolvers and encoder systems with HSF interface	EN1 (HFI01)	Standard for MKD, MKE and MHD motors (encoder systems R0, R1, S0 and M0) **8 V power supply**
	For encoder systems with 5 V supply (Sense function required)	EN2 (HFI02)	**5 V power supply** (encoder systems C0)
	Emulation of absolute and incremental encoders	MEM (HFE01)	Emulation absolute encoder in SSI format
I/O extensions	Extension "analog inputs"	AN (HCC11) X39	4 analog differential input channels
	Extension "analog inputs/outputs"	MA1 (HAS01)	2 analog differential input channels 2 analog output channels
	Extension "digital inputs/outputs"	MD1 (HEA01)	12 digital inputs 8 digital outputs
	Extension "digital inputs/outputs"	MD2 (HEA02) X17, X16	16 digital inputs in 2 groups 16 digital outputs in 4 groups SSI encoder evaluation
Safety technology	I/O for safety technology	S1 (HSI11) X41	
	Safe Motion	S2	
	Starting lockout	L1 (HSI01) X41	
	Safe Torque Off	L2	
Control panel	Standard control panel	S	Single-line display
	Comfort control panel	C	Multi-line display; separate component "VCP01"; can be used for commissioning simple applications
Memory	Exchangeable medium for parameters and firmware	PFM02.1 X7	MultiMediaCard (MMC)

1) (Hxxxx): Internal identifier

Fig.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

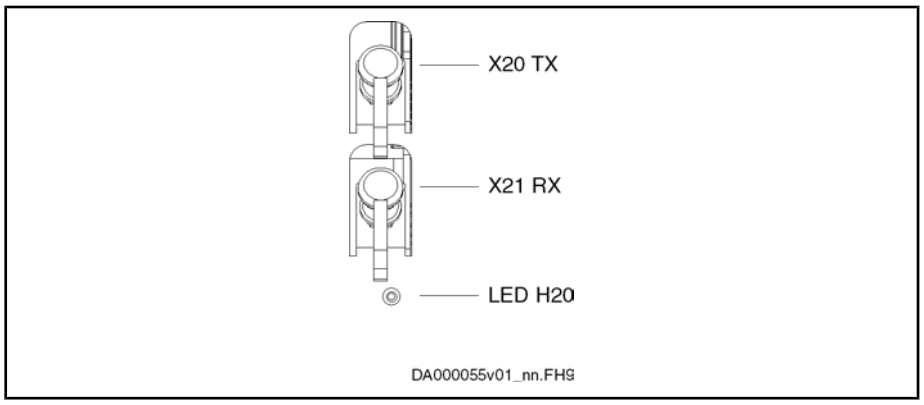


Fig.6-2: SERCOS interface

LED H20

Distortion LED of SERCOS interface.

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

Pin Assignment

X20	TX
X21	RX

Fig.6-3: Pin Assignment

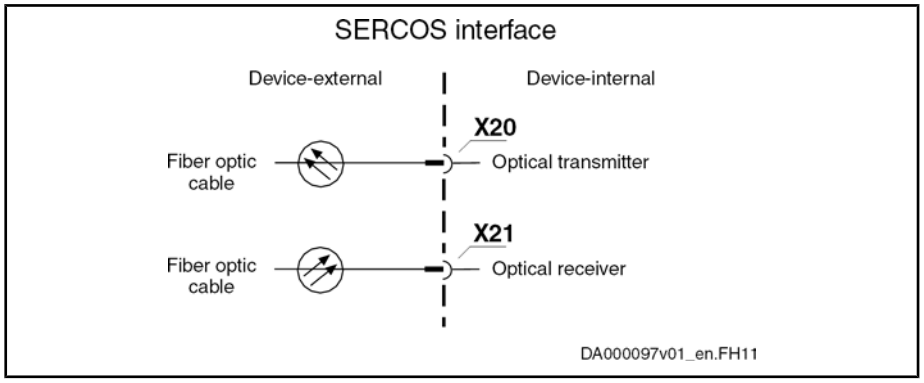


Fig.6-4: Pin Assignment

Data Rate, Transmission Power

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

Fiber optic cables:

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

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

For more detailed information on the subject of "fiber optic cables", see application manual "Rexroth Connection System, fiber optic cables" (DOK-

CONNEC-CABLE*LWL**-AWxx-EN-P, part. no. R911284755). This 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

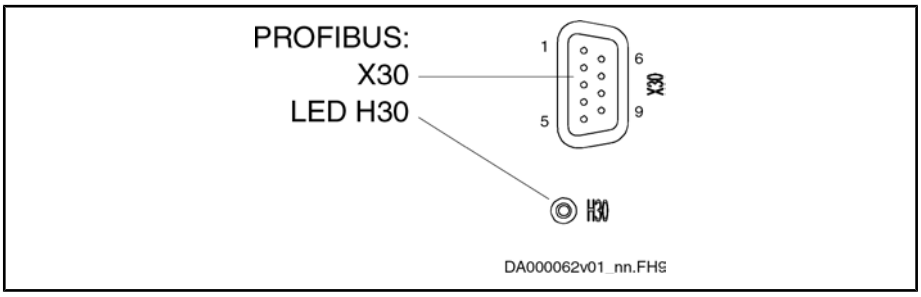
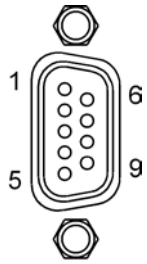


Fig.6-5: PROFIBUS Interface

View	Identification	Function
	X30	PROFIBUS PB

D-Sub, 9-pin, female	Unit	Min.	Max.
Connection cable Stranded wire	mm^2	0,08	0,5

Fig.6-6: 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.

Pin	DIR	Signal	Function
8	I/O	RS485-	Receive/transmit data-negative
9		0V	0 V

Fig.6-7: 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

Fig.6-8: Signal Specification

NOTICE

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

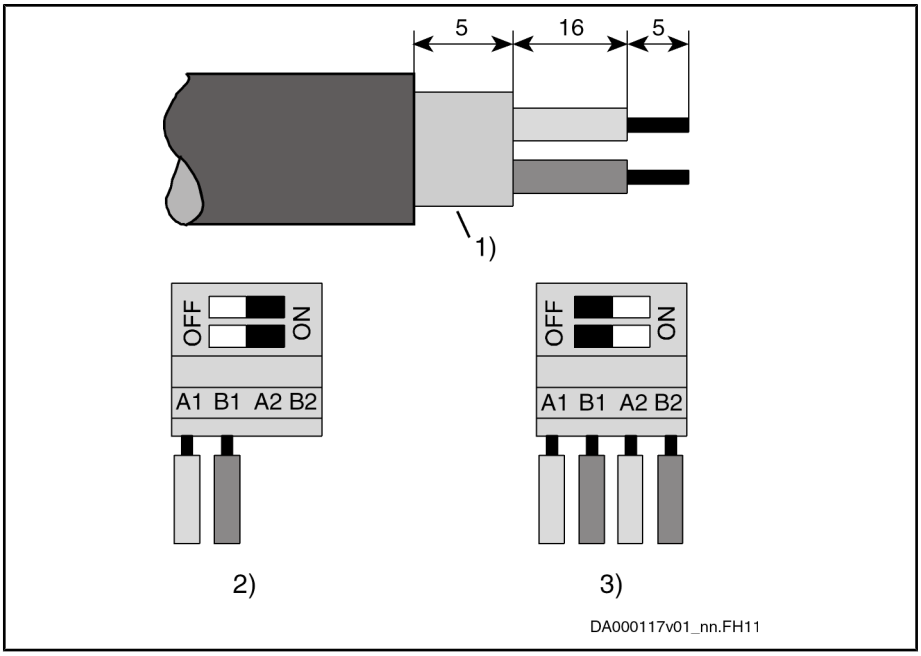
Do not short-circuit the output.

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.

Optional Modules for Control Sections



1) Shield
2) Bus connection and switch position for first node and last node
3) Bus connection and switch position for all other nodes

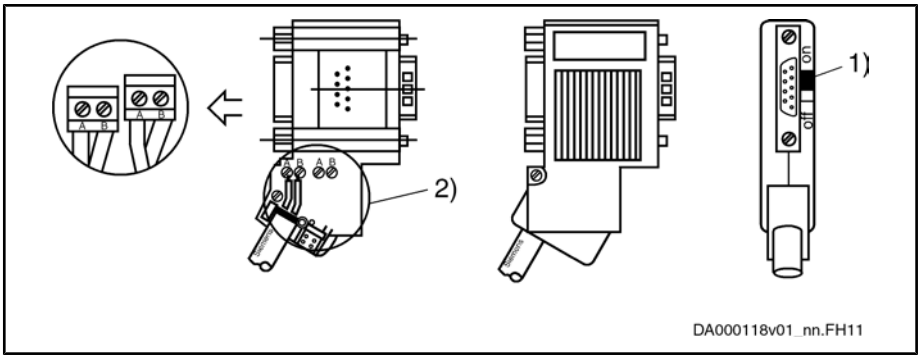
Fig.6-9: Preparing a Cable for Connecting a Bus Connector

To assemble the bus cable, proceed as follows:

- Use cable according to DIN EN50170 / 2 edition 1996
- Strip cable (see figure above)
- Insert both cores into screw terminal block

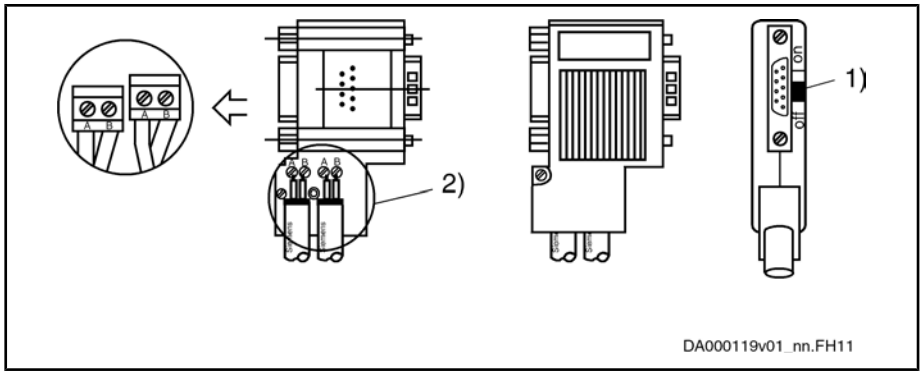
☞ Do not interchange the cores for A and B.

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



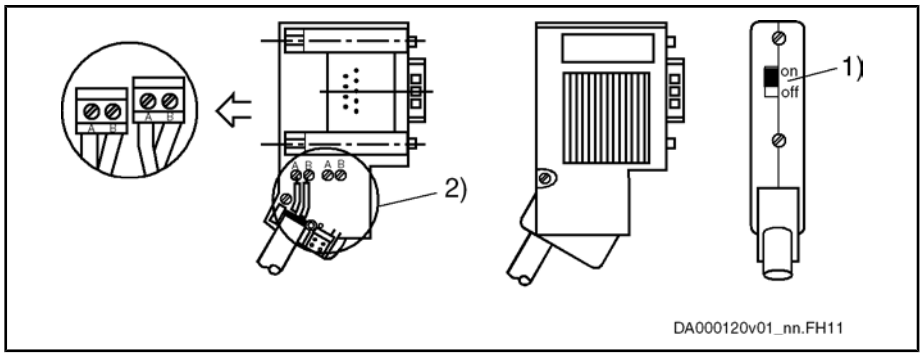
1) Switch position for first slave and last slave in PROFIBUS-DP
2) Cable shield must have direct contact to metal

Fig.6-10: Bus Connection for First and Last Slave, Bus Connector With 9-pin D-Sub Female Connector, INS0541



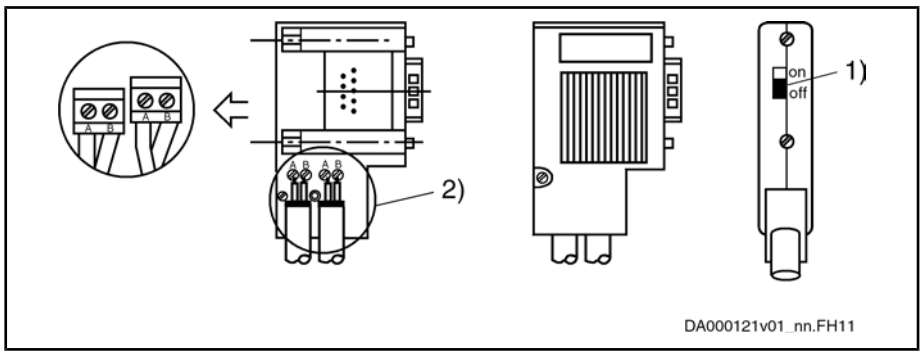
1) Terminating resistor is off
2) Cable shield must have direct contact to metal

Fig.6-11: Bus Connection for all Other Slaves, Bus Connector With 9-pin D-Sub Female Connector, INS0541



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

Fig.6-12: Bus Connection for First and Last Slave, Without 9-pin D-Sub Female Connector, INS0540



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

Fig.6-13: Bus Connection for all Other Slaves, Without 9-pin D-Sub Female Connector, INS0540

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

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.

Optional Modules for Control Sections

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

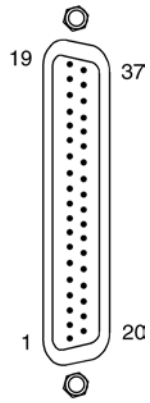
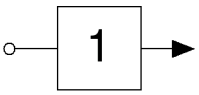
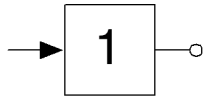
Connection point	Type	Number of poles	Type of design	Solid wire [mm²]	Stranded wire [mm²]	Figure
X15	D-Sub	37	Pins on device	-	0,08–0,5	

Fig.6-14: Connection Point

Function	Signal name	Connection X15	Factory setting	
Digital inputs  DX000037v01_nn.fh11	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	Con-nection 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 preassigned (S-0-0000)
	I_3.2	8	S-0-0145, Signal control word [14]	Not preassigned (S-0-0000)
	I_3.3	27	S-0-0145, Signal control word [15]	Not preassigned (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], inter-polator 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]

Optional Modules for Control Sections

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		

Fig.6-15: Signal Assignment

6.2.4 CO - DeviceNet / CANopen

X60, DeviceNet / CANopen Interface - CO

Description

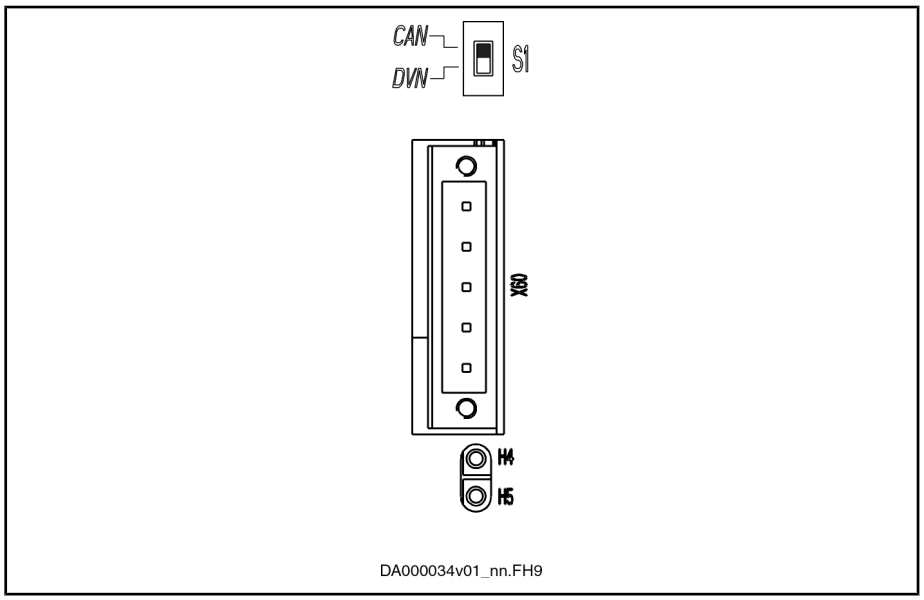


Fig.6-16: Interface

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

Switch S1

Activate the desired communication with switch S1:

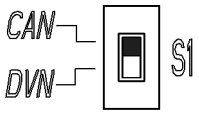
Switch position	Effect	Switch S1
Up (CAN)	CANopen active	
Down (DVN)	DeviceNet active	

Fig.6-17: Switch S1

Connector

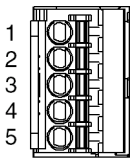
Connection point	Type	Number of poles	Solid wire [mm²]	Stranded wire [mm²]	AWG	Figure
X60	Spring terminal Female (connector)	5	0,25–2,5	0,25–1,5	24–16	

Fig.6-18: Connector

NOTICE **Risk of damage!**

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

Optional Modules for Control Sections

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

Fig.6-19: 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

Fig.6-20: Significance of Display Elements for DeviceNet

Assignment X60

Pin	Signal	Function
1	VP-	0 V potential 24 V supply voltage
2	CAN_L	Bidirectional data signal CAN_L
3	Drain/Shield	Shield connection
4	CAN_H	Bidirectional data signal CAN_H
5	VP+	24 V supply voltage – plus

Fig.6-21: Signal Assignment Optional Module CO

Main Features

Feature	DeviceNet	CANopen
Compatibility	According to DIN EN 50325-2	According to EN 50325-4
Max. possible number of nodes	64 nodes	127 nodes
Bus topology	Line topology	Line topology
Bus terminator (ISO 11898)	124 ohm each, 1%, 200 mW; connect at both bus ends to X60.2 and X60.4	
Transmission medium	2 twisted two-wire lines (4-pin) with shield	

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

Fig.6-22: Main Features

Bus Lengths Depending on Bit Rates

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

Fig.6-23: Network Dimension

6.2.5 CD - DeviceNet / CANopen

X61, DeviceNet / CANopen Interface - CD

Description

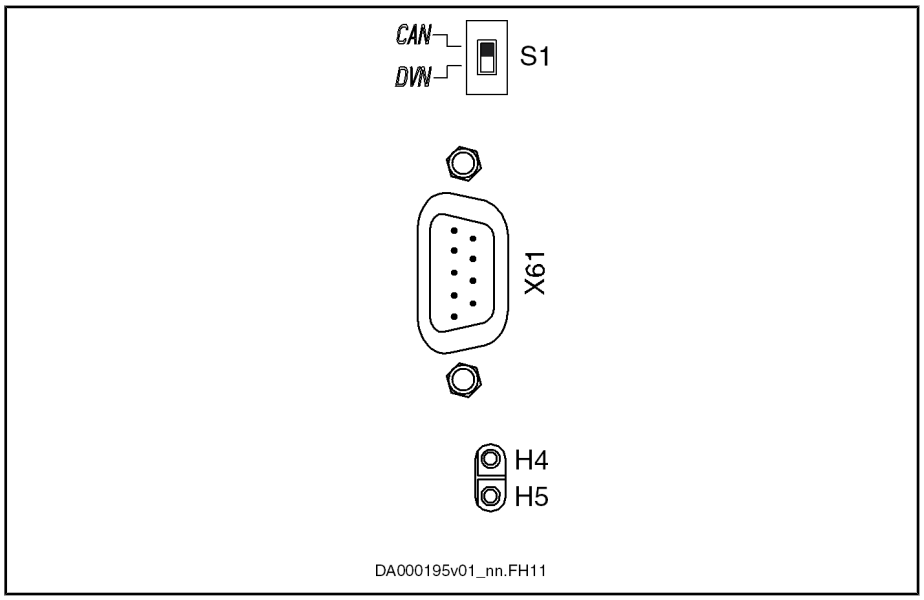


Fig.6-24: Interface

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

Switch S1 Activate the desired communication with switch S1:

Optional Modules for Control Sections

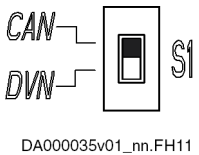
Switch position	Effect	Switch S1
Up (CAN)	CANopen active	 DA000035v01_nn.FH11
Down (DVN)	DeviceNet active	

Fig.6-25: Switch S1

Connection Point

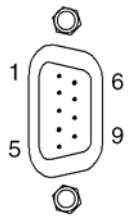
Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	Figure
X61	D-Sub	9	Pins on device	0,25–0,5	 DA000194v01_nn.FH11

Fig.6-26: 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

Fig.6-27: 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

Fig.6-28: Significance of Display Elements for DeviceNet

Assignment X61

Pin	Signal	Function
1	n. c.	-
2	CAN_L	Bidirectional data signal CAN_L
3	VP-	0 V potential 24 V supply voltage
4	n. c.	-
5	Drain/Shield	Shield connection
6	VP-	0 V potential 24 V supply voltage
7	CAN_H	Bidirectional data signal CAN_H
8	n. c.	-
9	VP+	24 V supply voltage – plus

Fig.6-29: 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)	124 ohm each, 1%, 200 mW; connect at both bus ends to X60.2 and X60.4	
Transmission medium	2 twisted two-wire lines (4-pin) with shield	
Max. allowed bus (line) lengths	Depending on bit rate	
Recommended connection cable	Our RKS number or third-party type	

Fig.6-30: Main Features

Bus Lengths Depending on Bit Rates

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

Fig.6-31: Network Dimension

Optional Modules for Control Sections

6.2.6 S3 - SERCOS III

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

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

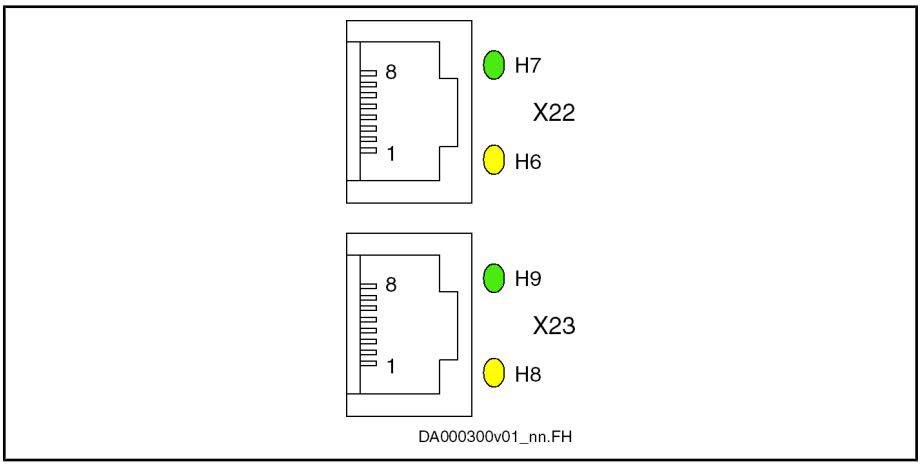
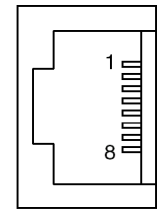


Fig.6-32: Interface

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**; type of shield ITP (Industrial Twisted Pair) • Ready-made cables which can be ordered: – **RKB0011** Long cables (100 m at maximum) to connect the drive system to the higher-level control unit. Minimum bending radius: – 48.75 mm with flexible installation – 32.50 mm with permanent installation Order code for a 30 m long cable: RKB0011/030,0 – **RKB0013** Short cables to connect devices arranged side by side in the control cabinet. Order code for a 0.55 m long cable: RKB0013/00,55 Minimum bending radius: 120.50 mm

Fig.6-33: Function, Pin Assignment, Properties

Display Elements

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

Fig.6-34: 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 or ProfiNet).

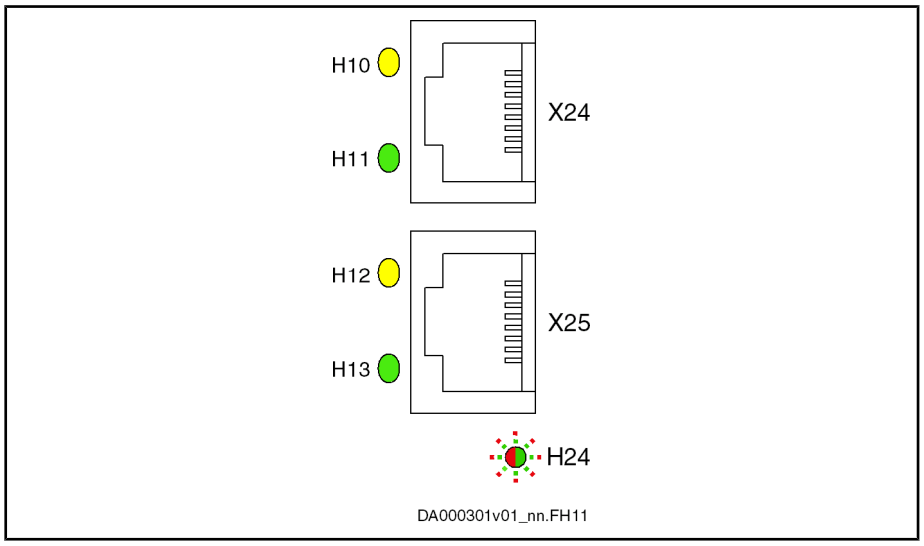


Fig.6-35: ET, Connection Point X24, X25

Optional Modules for Control Sections

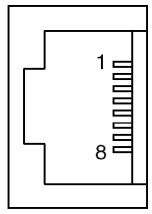
View	Connection	Signal name	Function
 DA000041v01_nn.FH	1	TD+	Transmit, Differential Output A
	2	TD-	Transmit, Differential Output B
	3	RD+	Receive, Differential Input A
	4	n. c.	-
	5	n. c.	-
	6	RD-	Receive, Differential Input B
	7	n. c.	-
	8	n. c.	-
	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin		
Compatibility	100Base-TX according to IEEE 802.3u		
Recommended cable type	• According to **CAT5e**; type of shield ITP (Industrial Twisted Pair) • Ready-made cables which can be ordered: – **RKB0011** Long cables (100 m at maximum) to connect the drive system to the higher-level control unit. Minimum bending radius: – 48.75 mm with flexible installation – 32.50 mm with permanent installation Order code for a 30 m long cable: RKB0011/030,0 – **RKB0013** Short cables to connect devices arranged side by side in the control cabinet. Order code for a 0.55 m long cable: RKB0013/00,55 Minimum bending radius: 120.50 mm		

Fig.6-36: 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
H10, H12	Status	Yellow	Data transmission running
H11, H13	Link	Green	Connection to network available

Fig.6-37: Significance of Display Elements

Network Status in Field Bus Systems "Ethernet/IP"

LED	Significance	Color	Description
H24	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

Fig.6-38: Significance of Display Element Network Status

6.2.8 CCD - Cross Communication

Description

The interface corresponds to standard IEEE 802.3.

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

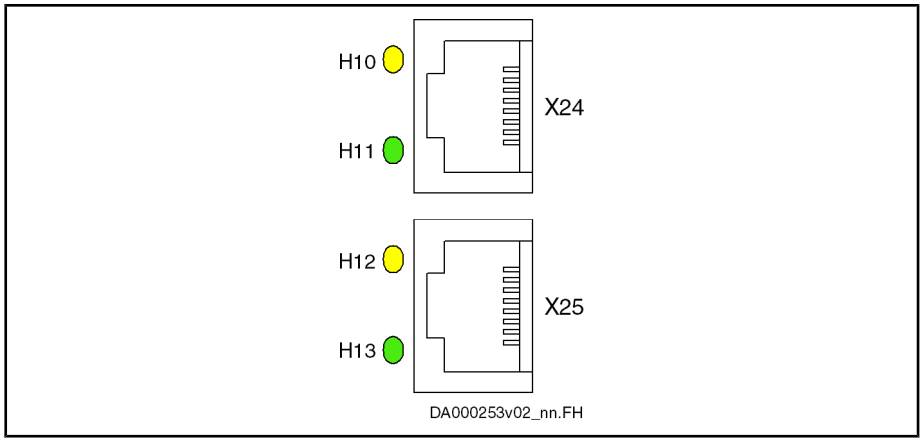


Fig.6-39: CCD Connection Points

Optional Modules for Control Sections

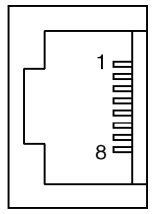
View	Connection	Signal name	Function
 DA000041v01_nn.FH	1	TD+	Transmit, Differential Output A
	2	TD-	Transmit, Differential Output B
	3	RD+	Receive, Differential Input A
	4	n. c.	-
	5	n. c.	-
	6	RD-	Receive, Differential Input B
	7	n. c.	-
	8	n. c.	-
	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin		
Compatibility	100Base-TX according to IEEE 802.3u		
Recommended cable type	• According to **CAT5e**; type of shield ITP (Industrial Twisted Pair) • Ready-made cables which can be ordered: – **RKB0011** Long cables (100 m at maximum) to connect the drive system to the higher-level control unit. Minimum bending radius: – 48.75 mm with flexible installation – 32.50 mm with permanent installation Order code for a 30 m long cable: RKB0011/030,0 – **RKB0013** Short cables to connect devices arranged side by side in the control cabinet. Order code for a 0.55 m long cable: RKB0013/00,55 Minimum bending radius: 120.50 mm		

Fig.6-40: Function, Pin Assignment, Properties

Display Elements

LED	Significance	Color	Description
H10, H12	Status	Yellow	Data transmission running
H11, H13	Link	Green	Connection to network available

Fig.6-41: Significance of Display Elements

6.3 Encoder Evaluations

6.3.1 ENS - Standard Encoder Evaluation

Interface Standard Encoder Evaluation ENS

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

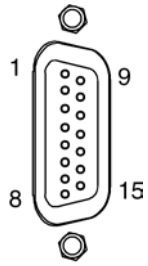
Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	Figure
X4, X8 (depends on optional slot at control section)	D-Sub	15	Female (device)	0,25–0,5	

Fig.6-42: Connection

Pin Assignment

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

Fig.6-43: Pin Assignment

Optional Modules for Control Sections

Properties of ENS

Voltage for Encoder Supply VCC_Encoder

Data	Unit	Min.	Typ.	Max.
Voltage for encoder supply VCC_Encoder	V	11,15	11,6	12,3
Output current	mA			500

Fig.6-44: Encoder Supply ENS

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

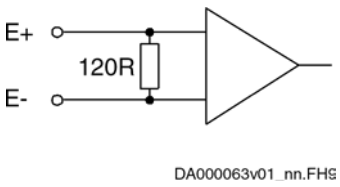


Fig.6-45: Input Circuit for Sine Signals (Block Diagram)

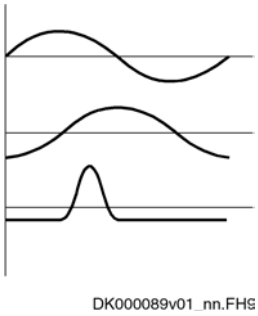
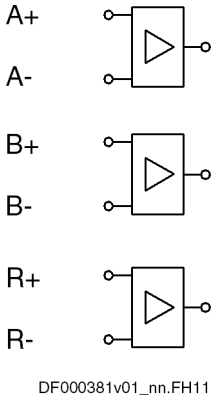
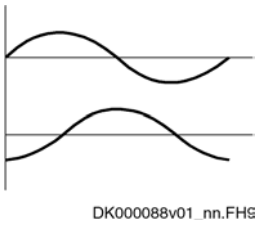
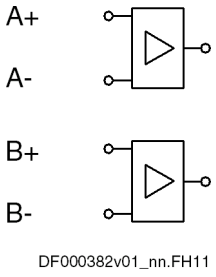
Properties of Differential Input

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	
Cut-off frequency (-3 dB)	kHz		500	
Input frequency for 5V-TTL signals (square-wave)	kHz			400
Amplitude 5V-TTL signals	V			5,25

Fig.6-46: 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.FHS	 A+ A- B+ B- R+ R- DF000381v01_nn.FH11	Sine (1 V_{pp}) Without absolute value	Increasing
 DK000088v01_nn.FHS	 A+ A- B+ B- DF000382v01_nn.FH11	Sine (1 V_{pp}) With absolute value	Increasing

1) See following note

Fig.6-47: Signal Assignment to the Actual Position Value

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

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

Connection Diagrams ENS

ENS With Encoder System S1 / M1

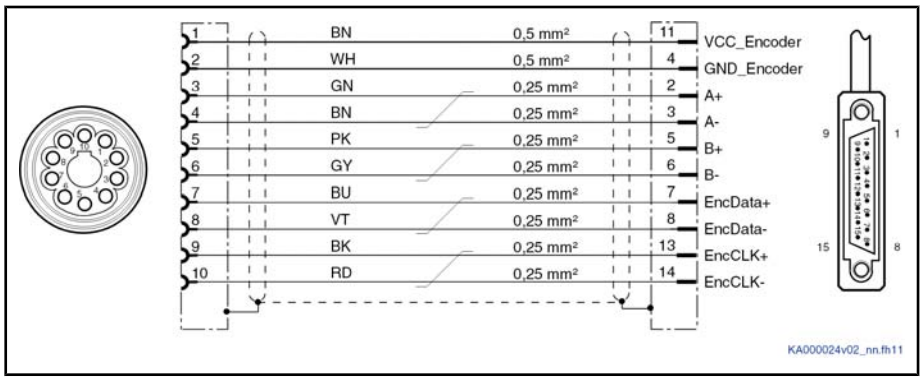


Fig.6-48: Connection Diagram Encoder System S1 / M1

Optional Modules for Control Sections

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

ENS With Encoder System S2 / M2

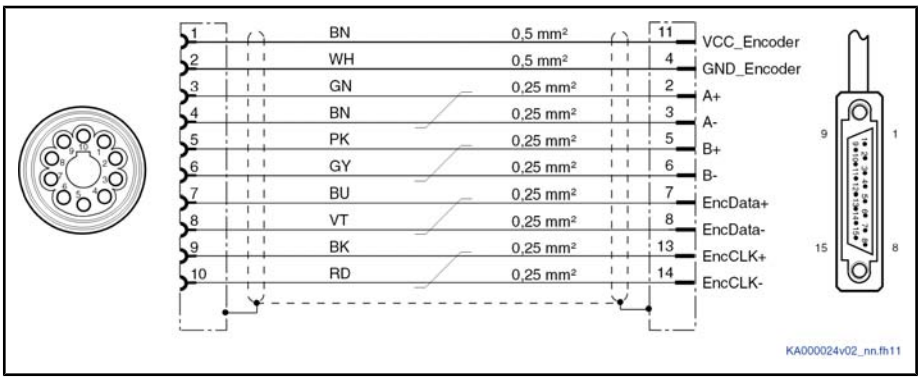


Fig.6-49: Connection Diagram Encoder System S2 / M2

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

ENS With Hall Sensor Box SHL02

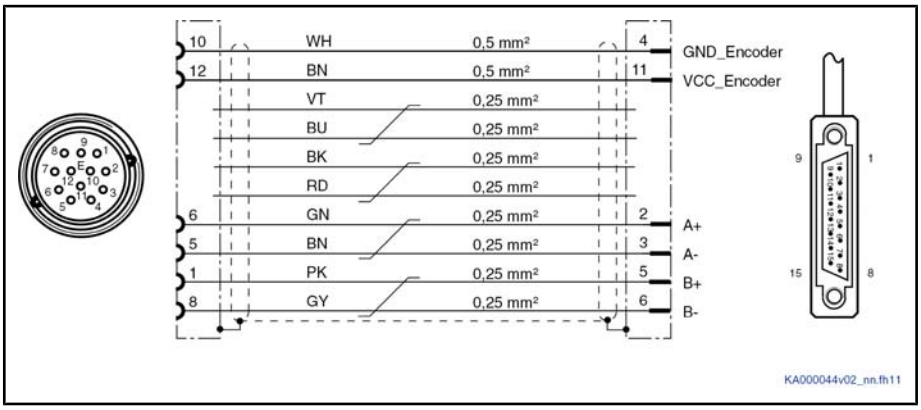


Fig.6-50: Connection Diagram

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

Connection Diagrams ENS With Third-Party Encoder

☞ 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 Third-Party Encoder HIPERFACE®, 12V Supply Voltage

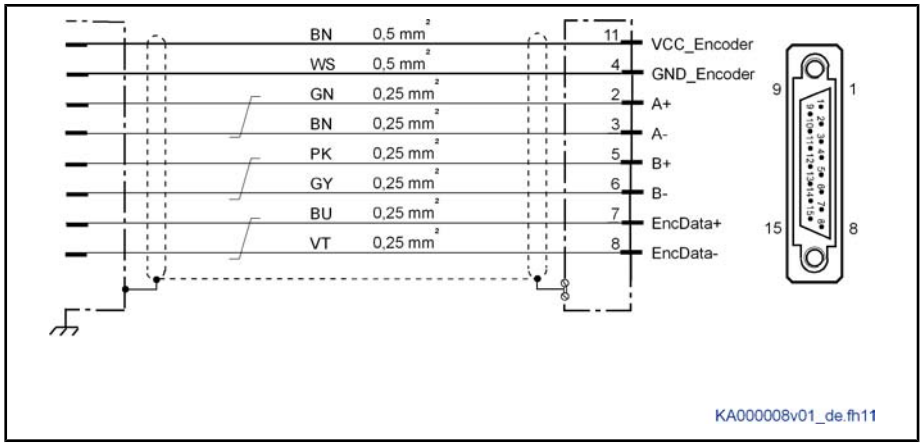


Fig.6-51: Connection Diagram Third-Party Encoder HIPERFACE®

ENS With Third-Party Encoder EnDat 2.1, 12V Supply Voltage

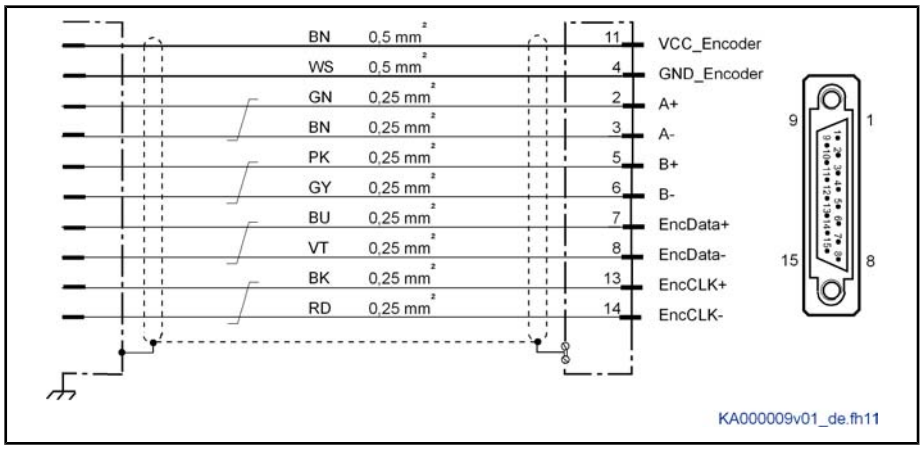


Fig.6-52: Connection Diagram Third-Party Encoder EnDat 2.1

ENS With Third-Party Encoder 1Vpp, 12V Supply Voltage

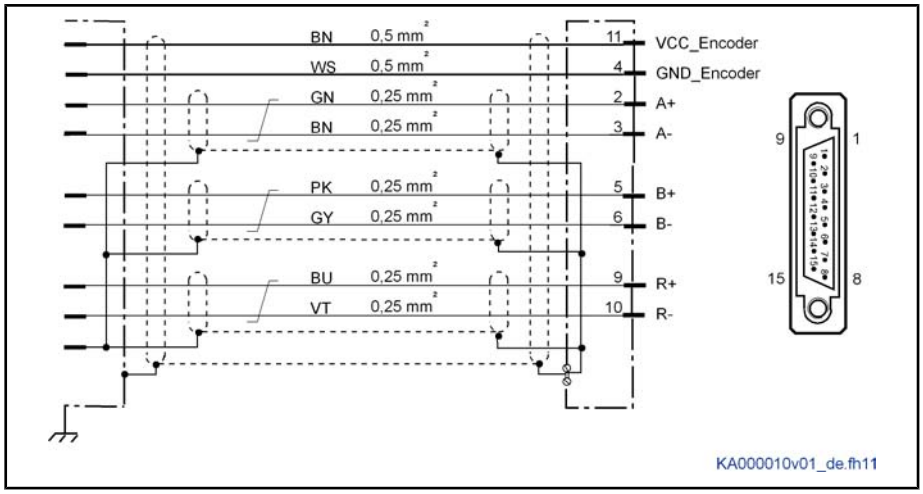


Fig.6-53: Connection Diagram Third-Party Encoder 1Vpp

Optional Modules for Control Sections

ENS With Third-Party Encoder 5V-TTL, 12V Supply Voltage

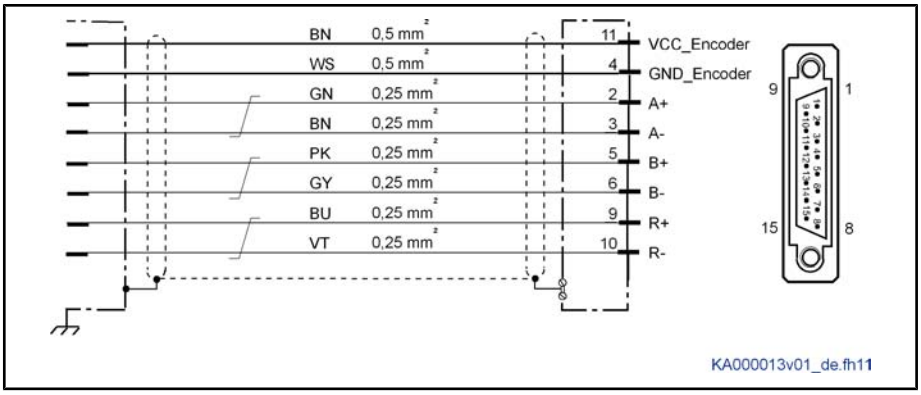
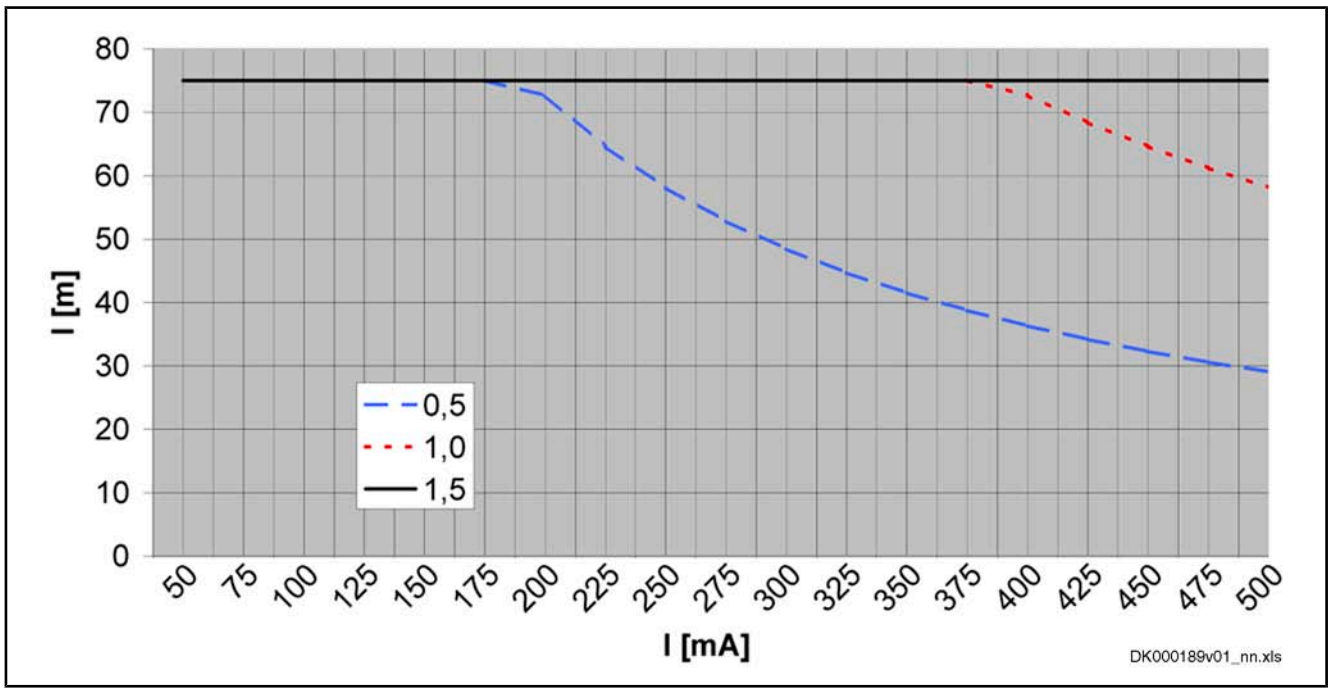


Fig.6-54: Connection Diagram Third-Party Encoder 5V-TTL

Allowed Encoder Cable Lengths at ENS

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



I [mA]	Current consumption
I [m]	Cable length
0,5; 1,0; 1,5	Cable cross sections in mm2

Fig.6-55: 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

Interface Resolver and HSF Encoder Evaluation EN1

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

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

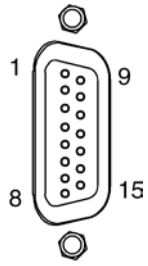
Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	Figure
-	D-Sub	15	Female (device)	0,25–0,5	

Fig.6-56: Connection

Pin Assignment

Connection	Signal	Function
1	GND_shld	Connection for signal shields
2	A+	Track A positive
3	B+	Track B positive
4	GND_Encoder	Power supply reference potential
5	n. c.	n. c.
6	n. c.	n. c.
7	I2C_SCLK	Clock line for I²C interface
8	I2C_SDAout	Data transmission to encoder
9	A-	Track A negative
10	B-	Track B negative
11	n. c.	n. c.
12	VCC_Encoder	Power supply
13	n. c.	n. c.
14	I2C_Fsample	Data request
15	I2C_SDAin	Data transmission from encoder

Fig.6-57: Pin Assignment

Properties EN1

Encoder Supply Resolver

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

Optional Modules for Control Sections

Data	Unit	Min.	Typ.	Max.
Output current	mA			70
D.C. resistance of load	ohm	35		

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

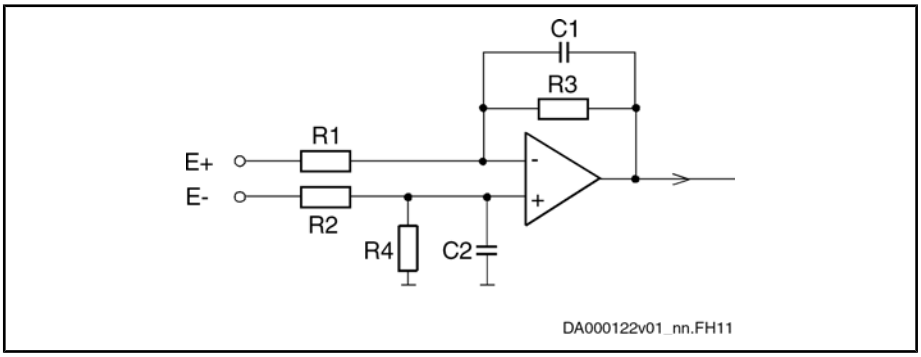
Fig.6-58: Encoder Supply Resolver

Encoder Supply Digital Servo Feedback

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

Fig.6-59: Encoder Supply HSF

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



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

Fig.6-60: 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	
Cut-off frequency (-3 dB)	kHz		100	

Fig.6-61: Input Data HSF

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	
Cut-off frequency (-3 dB)	kHz		18	

Fig.6-62: Input Data Resolver Operation

Signal Assignment to the Actual Position Value

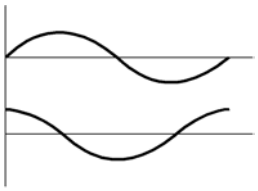
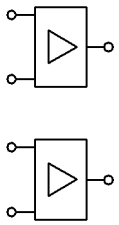
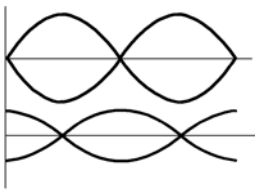
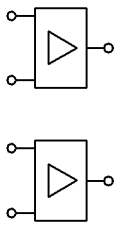
Signal assignment	Signal designation	Signal shape	Actual position value (with default setting)
 DK000086v01_nn.FH9	A+ A- B+ B-  DF000382v01_nn.FH11	HSF (sine 1 V_{pp} without 120 ohm terminating resistor, I^2C bus)	Increasing
 DK000087v01_nn.FH9 Amplitude-modulated signal	A+ A- B+ B-  DF000382v01_nn.FH11	Resolver	Increasing

Fig.6-63: Signal Assignment to the Actual Position Value

Connection Diagrams EN1

EN1 With Encoder System R0 and R1

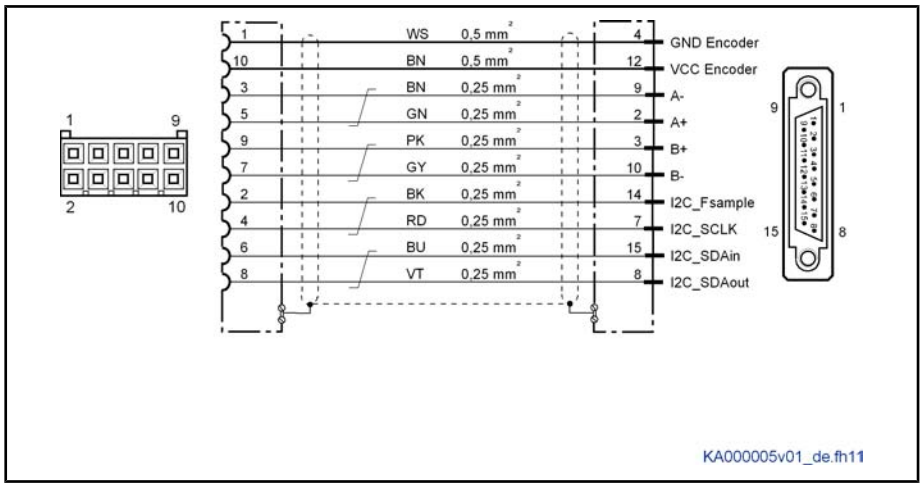


Fig.6-64: Connection Diagram

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

Optional Modules for Control Sections

EN1 With Encoder System S0 and M0

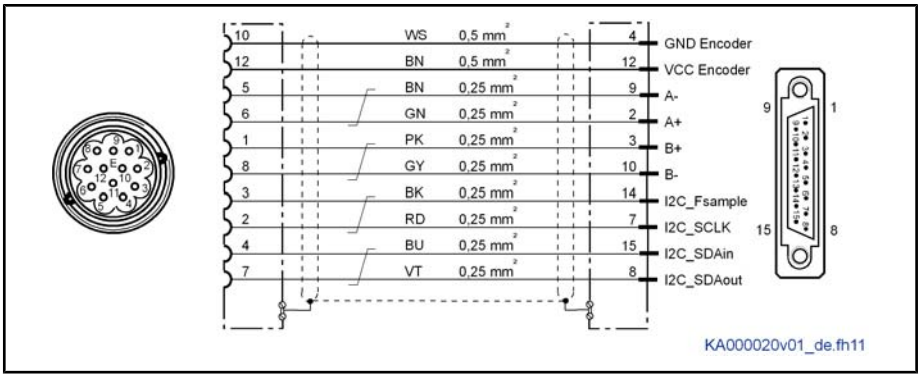


Fig.6-65: Connection Diagram

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

EN1 With Hall Sensor Box SHL01, SHL02

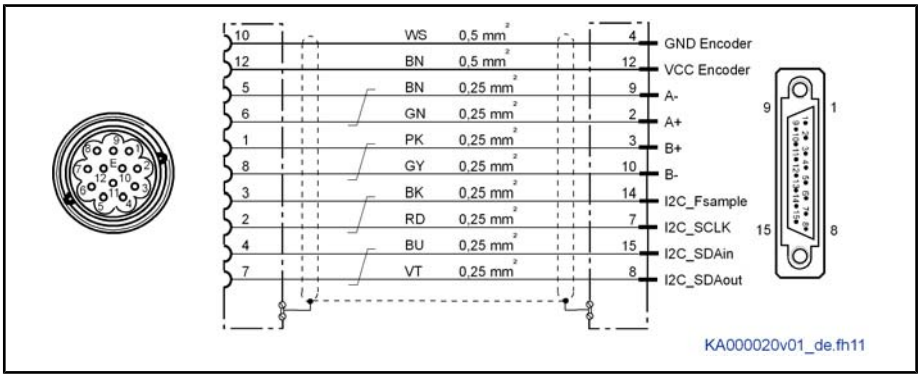


Fig.6-66: Connection Diagram

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

6.3.3 EN2 - Encoder Evaluation

Interface Encoder Evaluation EN2

Description

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

- Sin-cos encoder 1 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

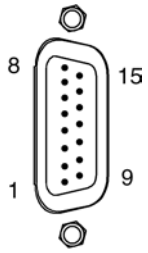
Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	Figure
-	D-Sub	15	Pins on device	0,25–1,0	

Fig.6-67: 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

Fig.6-68: Pin Assignment

Properties EN2

VCC_Encoder (Encoder Supply)

Data	Unit	Min.	Typ.	Max.
DC output voltage VCC_Encoder **with** voltage return (Sense)	V	4,75	5,0	5,25
DC output voltage VCC_Encoder **without** voltage return (Sense)	V	4,85	5,1	5,35
Output current	mA			350
D.C. resistance of load	ohm	35		

Fig.6-69: Encoder Supply EN2

Optional Modules for Control Sections

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

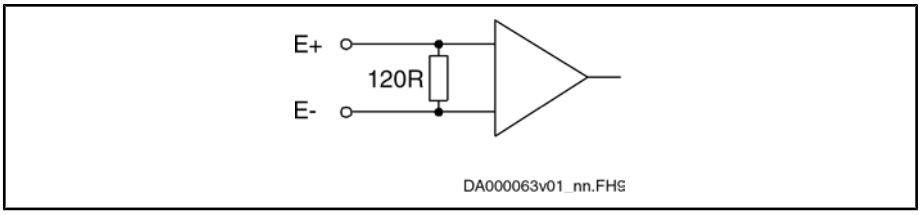


Fig.6-70: Input Circuit for Sine Signals (Block Diagram)

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
Cut-off frequency (-3 dB)	kHz		500	
Converter width A/D converter	Bit		12	
Input resistance	ohm		120	

Fig.6-71: Differential Input Sine

Input Circuit for Square-Wave Signals

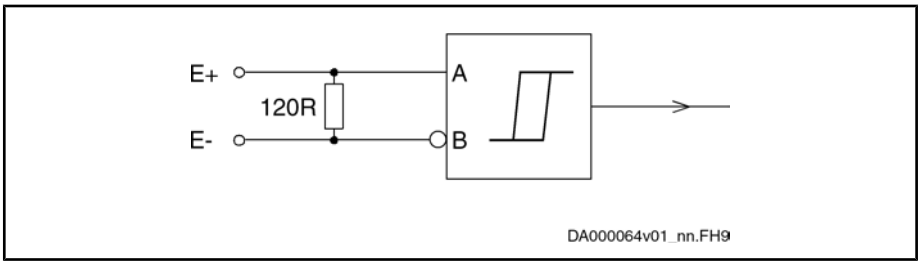


Fig.6-72: Input Circuit for Square-Wave Signals (Block Diagram)

Properties of Differential Input for Square-Wave Signals

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

Fig.6-73: Differential Input Square-Wave Signals

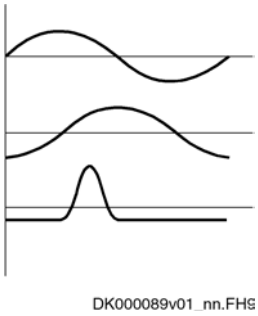
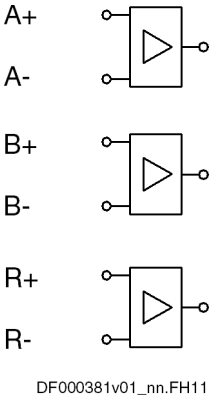
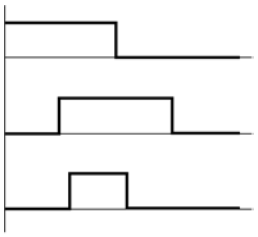
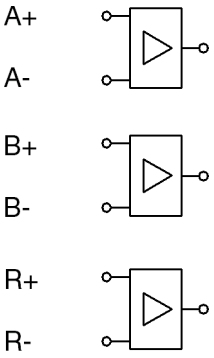
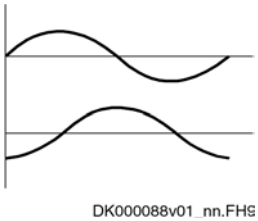
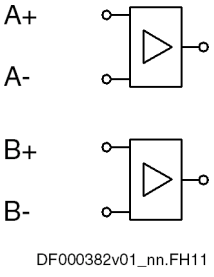
Sense+, Sense-

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.FHS	 A+ A- B+ B- R+ R- DF000381v01_nn.FH11	Sine (1 V_{pp}) Without absolute value	Increasing
 DK000090v01_nn.FHS	 A+ A- B+ B- R+ R- DF000381v01_nn.FH11	Square-wave (TTL) Without absolute value	Increasing
 DK000088v01_nn.FHS	 A+ A- B+ B- DF000382v01_nn.FH11	Sine (1 V_{pp}) With absolute value (e.g. EnDat)	Increasing

1) See following note

Fig.6-74: Signal Assignment to the Actual Position Value

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

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

Standard setting: See Functional Description of firmware

Optional Modules for Control Sections

Connection Diagrams EN2

EN2 With Encoder System C0

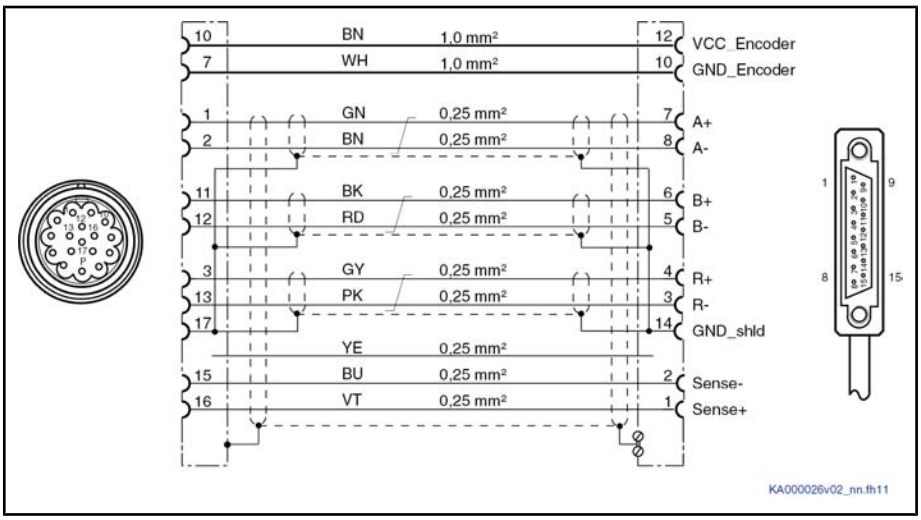


Fig.6-75: Connection Diagram EN2 With Encoder System C0

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

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

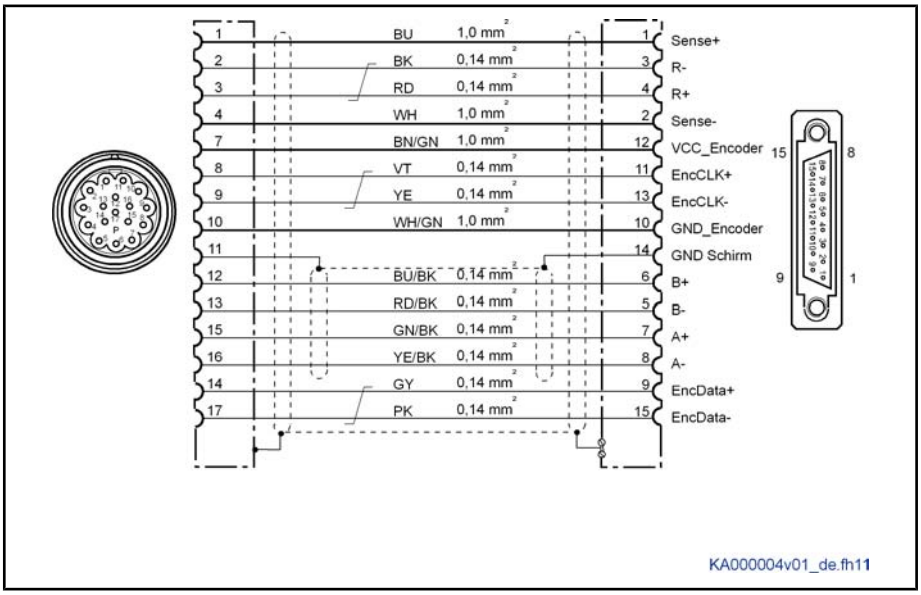


Fig.6-76: Connection Diagram EN2 With Third-Party Encoder EnDat2.1 (According to Heidenhain Standard)

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

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

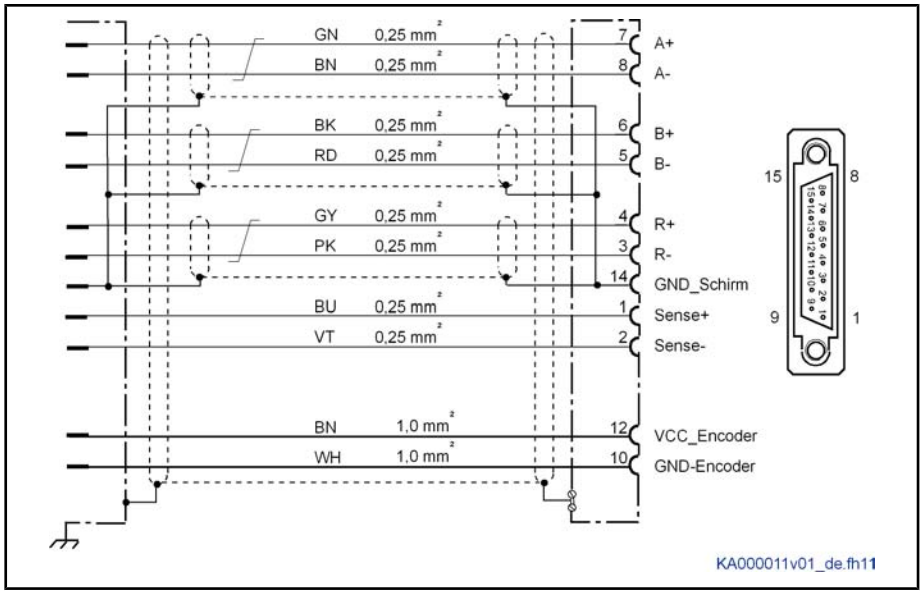


Fig.6-77: Connection Diagram EN2 With Third-Party Encoder 1 Vpp, 5V Supply

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

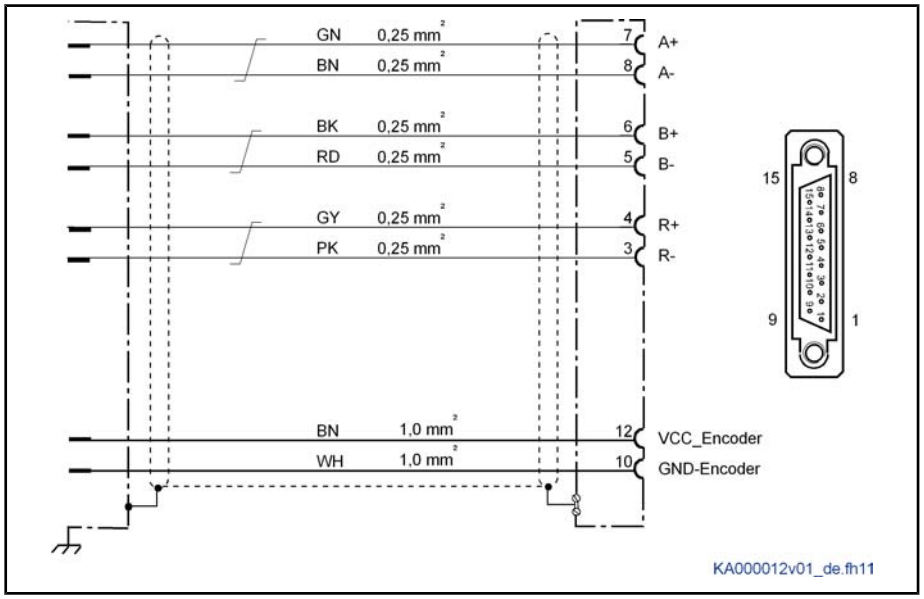


Fig.6-78: Connection Diagram EN2 With Third-Party Encoder Square-Wave, 5V Supply

Allowed Encoder Cable Lengths at EN2

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

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

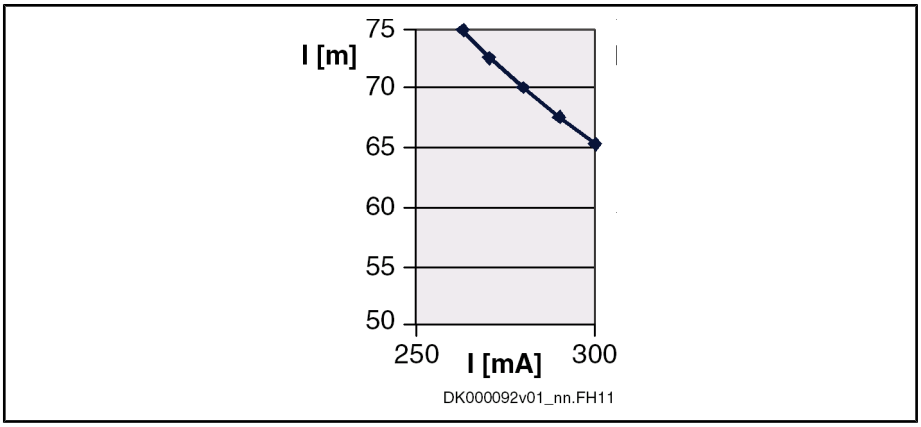
If the cable and the encoder system have connections for the Sense+/Sense- signals, this value is transmitted from the encoder to the drive controller.

The diagrams below take the following aspects into account:

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

Optional Modules for Control Sections

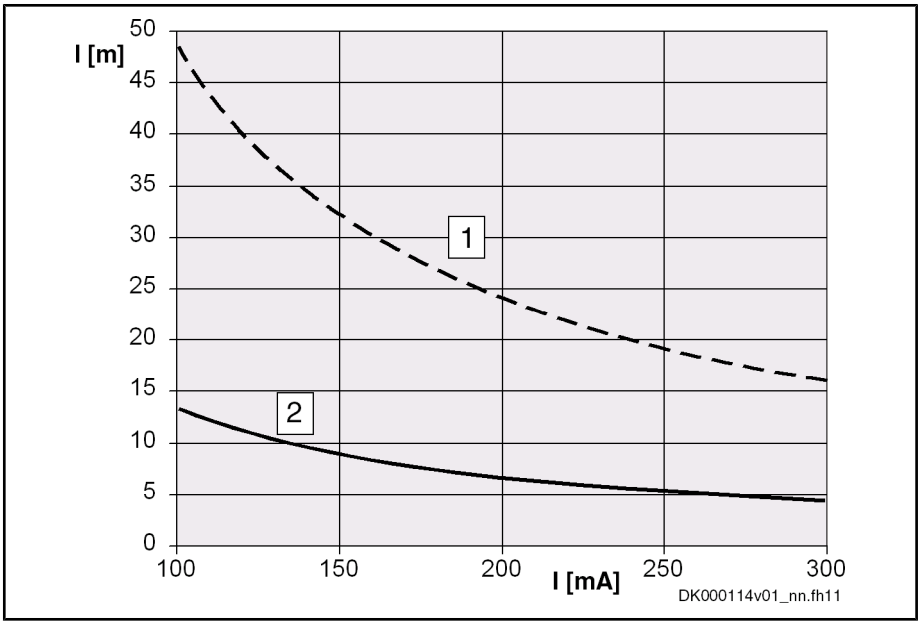
With Sense Connection in the Encoder Line



I [mA] Current consumption
l [m] Length
Fig.6-79: 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.6-80: Encoder Cable Lengths Without Sense Connection

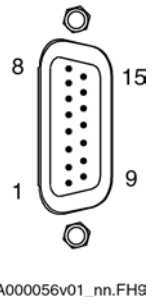
The maximum allowed length of cables **without** Sense lines is 50 m.

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

6.3.4 MEM - Encoder Emulation

Interface Encoder Emulation MEM

Description Emulation of absolute value and incremental 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 on device	0,25–0,5	

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

3) See also control section CSH01.1C configuration table: Option 3

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

Fig.6-81: Connection

Pin Assignment

Connection	Signal	Function
1	n. c.	n. c.
2	n. c.	n. c.
3	SSI_CLK+	Incremental encoder: n. c. Absolute encoder: Clock pos.
4	SSI_CLK-	Incremental encoder: n. c. Absolute encoder: Clock neg.
5	n. c.	n. c.
6	n. c.	n. c.
7	n. c.	n. c.
8	n. c.	n. c.
9	UA0+ / SSI_Data+	Incremental encoder: Reference track Absolute encoder: Data transmission
10	0V	Reference potential
11	UA0- / SSI_Data-	Incremental encoder: Reference track Absolute encoder: Data transmission
12	UA1+	Incremental encoder: Track A1 Absolute encoder: n. c.
13	UA1-	Incremental encoder: Track A1 Absolute encoder: n. c.
14	UA2+	Incremental encoder: Track A2 Absolute encoder: n. c.
15	UA2-	Incremental encoder: Track A2 Absolute encoder: n. c.

Fig.6-82: Pin Assignment

Optional Modules for Control Sections

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)		

Fig.6-83: 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.

Incremental Encoder Emulation

Connection Incremental Encoder Emulation

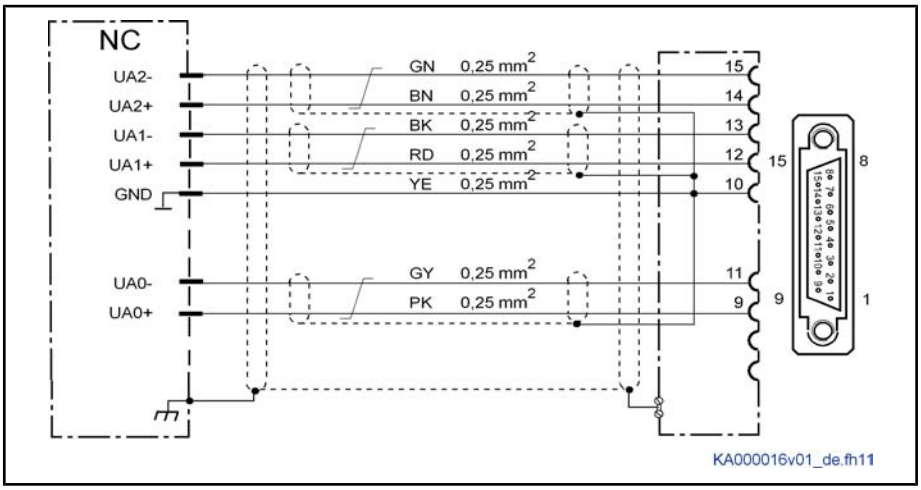


Fig.6-84: Connection of Incremental Actual Position Value Output

Differential Outputs Incremental Encoder Emulation

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

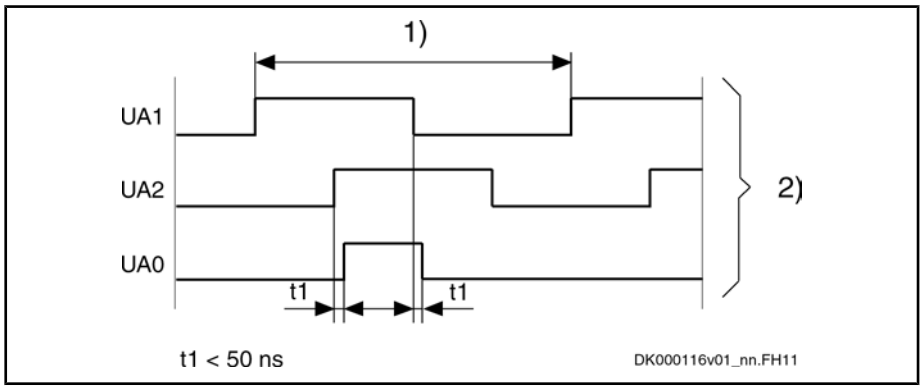
Fig.6-85: Differential Outputs

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.6-86: 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.6-87: Calculating the Output Frequency f

☞ The output frequency results from the respective parameter setting.

See also Functional Description of firmware: Encoder Emulation.

Control-Side Signal Filter for UA1 and UA2

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

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

- With $f_{out} \geq 500$ kHz: $f_{filter} \geq 1$ MHz
- With $f_{out} < 500$ kHz: $f_{filter} \geq 2 \times f_{out}$

Speed Measurement

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

Optional Modules for Control Sections

Absolute Encoder Emulation (SSI Format)

Connection Absolute Encoder Emulation

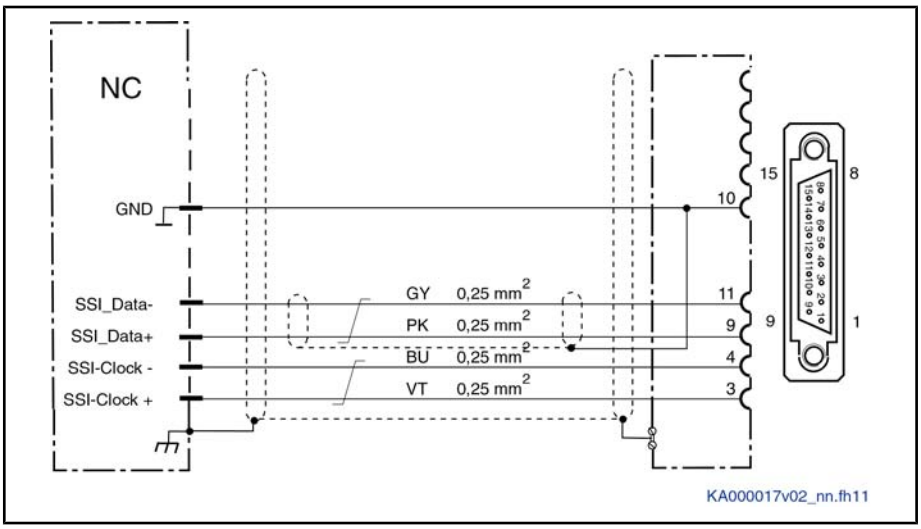


Fig.6-88: Output of Absolute Actual Position Values According to SSI Format

Differential Input Circuit Absolute Encoder Emulation

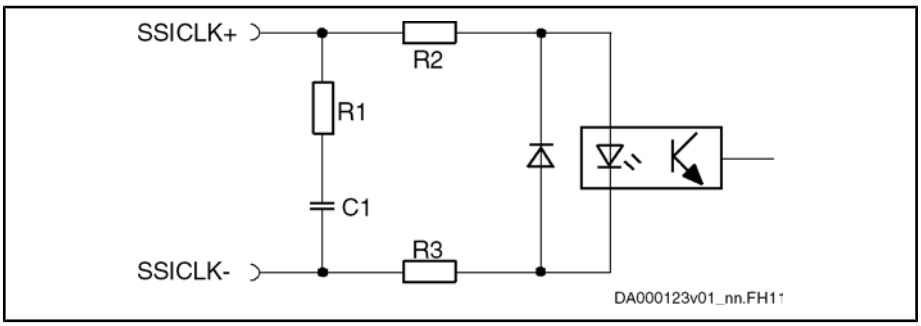


Fig.6-89: Differential Input Circuit (Block Diagram)

Differential Inputs Absolute Encoder Emulation

Data	Unit	Min.	Typ.	Max.
Input voltage "high"	V	2,5		5
Input voltage "low"	V	0		0,5
Input resistance	ohm	Approx. 150 (see circuit)		
Clock frequency f	kHz	100–1000		
Polarity reversal protection		Within the allowed input voltage range		
Galvanic isolation		Signals from circuit board		

Fig.6-90: Differential Inputs

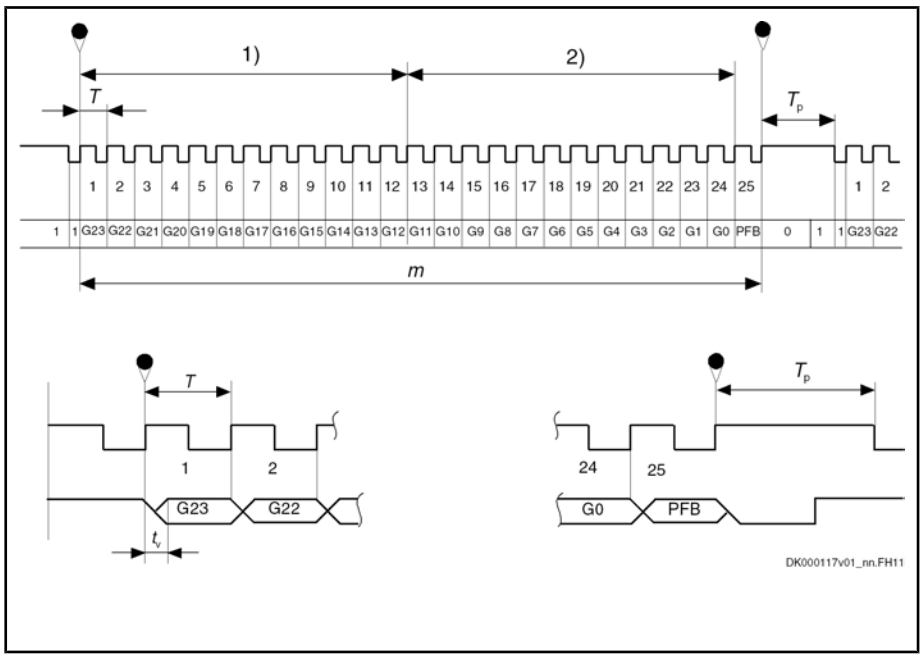
Differential Outputs Absolute Encoder Emulation

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
Output frequency f	MHz			1

Data	Unit	Min.	Typ.	Max.
Overload protection			Available	
Terminating resistor at load	ohm		150–180	

Fig.6-91: Differential Outputs

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



1)	Resolution for 4096 revolutions
2)	Resolution for 1 revolution
G0	Least significant bit in Gray code
G23	Most significant bit in Gray code
m	Stored parallel information
T	Clock time
T_p	Clock break ≥ 20 µs
t_v	Delay time max. 650 ns
PFB	Power failure bit (not used and always logically LOW)

Fig.6-92: Pulse Diagram With Absolute Actual Position Value Output (SSI Format)

6.4 I/O Extensions

6.4.1 AN - Extension Analog Inputs

Description The option increases the number of analog channels.

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

Optional Modules for Control Sections

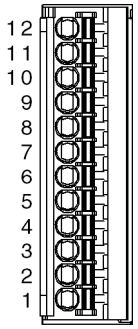
Connection point	Type	Number of poles	Solid wire [mm²]	Stranded wire [mm²]	AWG	Figure
X39	Spring terminal Female (connector)	12	0,25–2,5	0,25–1,5	24–16	 DG000202v01_nn.FH11

Fig.6-93: 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	

Fig.6-94: Pin Assignment

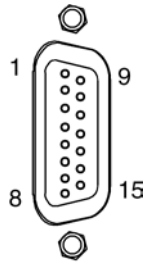
6.4.2 MA1 - Analog I/O Extension

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

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	

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

Fig.6-95: Connection Point MA1

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	
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	

Function	Signal	Pin[1)]	Technical data
Unassigned GNDA pin (reference potential for analog output)	GND_a	10	
Unassigned GNDA pin (reference potential for analog output)	GND_a	12	

1) Applies to all connection points X8, X10

Fig.6-96: Pin Assignment

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

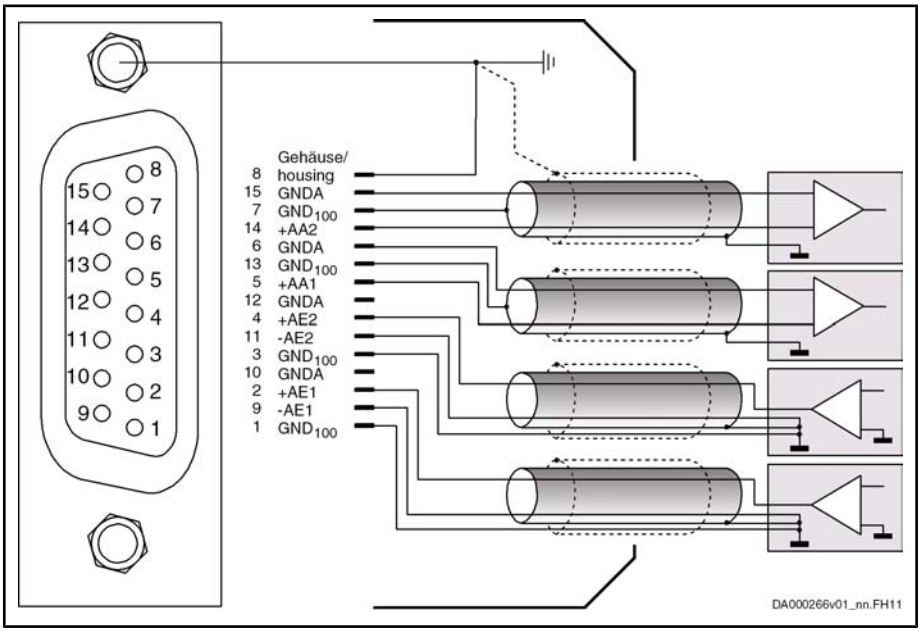


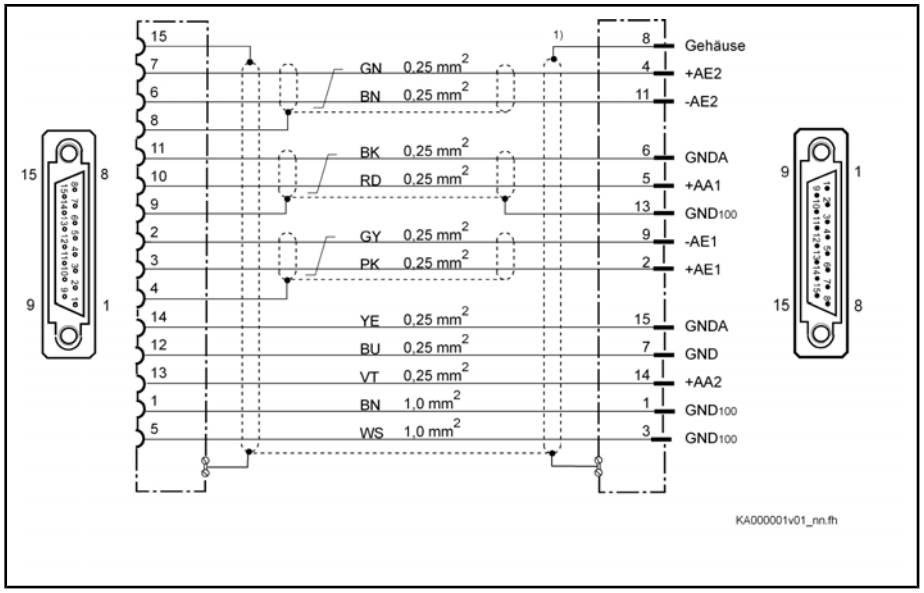
Fig.6-97: Basic Wiring

For applications only using one or two analog I/Os, you can also wire the individual cables directly at the D-Sub connector (see basic wiring above). Observe that several individual cables in the connector housing and in the cable entry take more space than one overall cable only. Use D-Sub connectors with metallized housings.

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

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

Interconnection Diagram MA 1 With Distribution Box UM 45



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

Fig.6-98: Interconnection Diagram RKS 0003

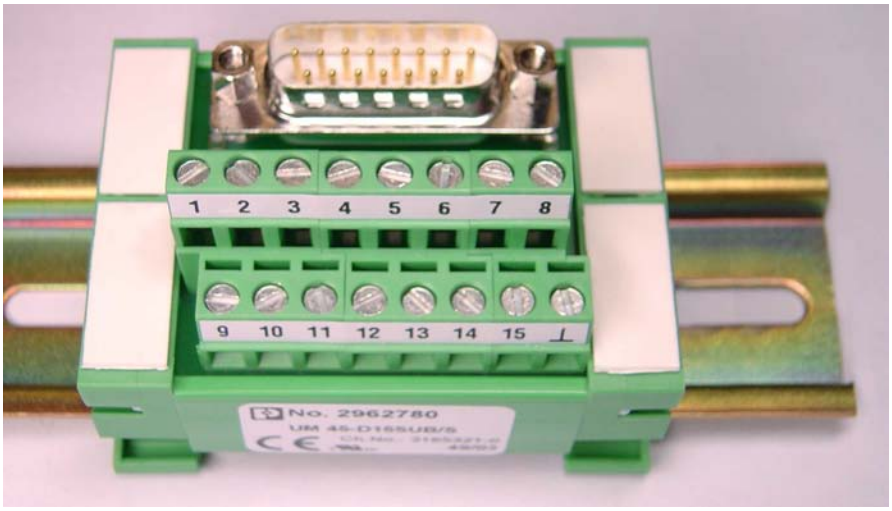


Fig.6-99: Distribution Box UM 45-D15SUB/S (Phoenix Contact)

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

6.4.3 MD1 - Digital I/O Extension

Description

This option is an extension for Rexroth IndraDrive control sections.

The option makes available the following functions:

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

Optional Modules for Control Sections

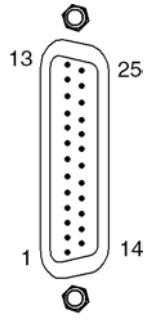
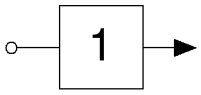
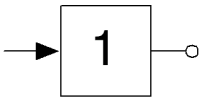
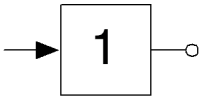
Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	Figure
-	D-Sub	25	Pins on device	0,08–0,5	

Fig.6-100: Connection

Pin Assignment

Function	Signal	Connection	Technical data
 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
 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	
Power supply for output group 0	+24V	3	DC 19 … 30 V Max. 1.2 A
 Digital output group 1	O_1.0	9	24 V 0.5 A See "Technical Data - Functions"
	O_1.1	10	
	O_1.2	12	
	O_1.3	13	

Function	Signal	Connection	Technical data
Power supply for output group 1	+24V	11	DC 19 … 30 V Max. 1.2 A
Reference potential for input/output groups and power supply	0V	8, 6	Max. 2.5 A
Cable shield connection	shld	Connector housing	

Fig.6-101: Signal Assignment

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

6.4.4 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

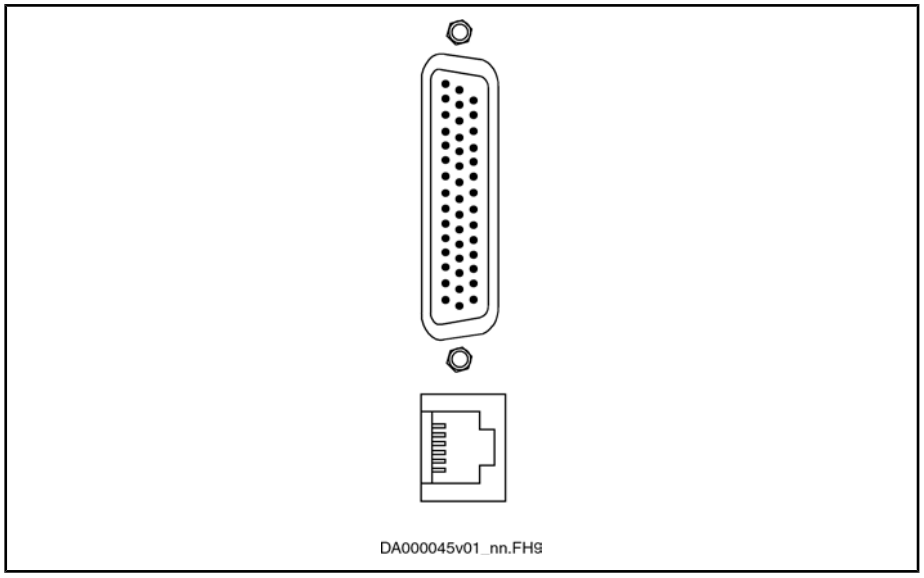


Fig.6-102: MD2

Optional Modules for Control Sections

X17, Digital I/O Extension on MD2

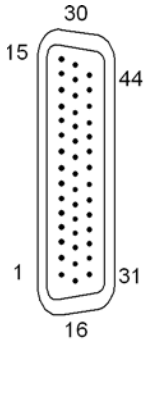
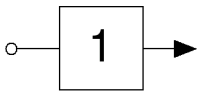
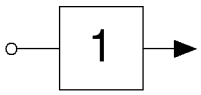
Connection point	Type	Number of poles	Description	Figure
X17	D-Sub (High Density)	44	I/O extension	

Fig.6-103: Connection

Pin Assignment X17 I/O Extension

Function	Signal	Connection	Technical data
 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	
 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	

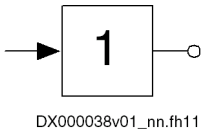
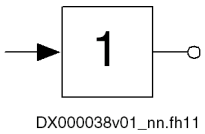
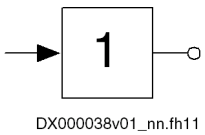
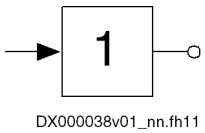
Function	Signal	Connection	Technical data
 Digital output group 0	O_0.0	15	24 V 0.5 A See "Technical Data - Functions"
	O_0.1	30	
	O_0.2	14	
	O_0.3	29	
Power supply for output group 0	+24V	44	DC 19 … 30 V Max. 1.1 A
	0V	43	
 Digital output group 1	O_1.0	13	24 V 0.5 A See "Technical Data - Functions"
	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	
 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	
 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	

Fig.6-104: Pin Assignment

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

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

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

X16, SSI Encoder Evaluation on MD2

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

Optional Modules for Control Sections

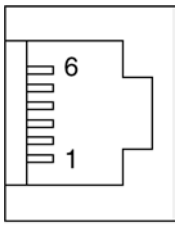
Connection point	Type	Number of poles	Description	Figure
X16	RJ12	6	SSI encoder evaluation	 DA000044v01_nn.FH9

Fig.6-105: Connection

Pin Assignment X16 SSI Interface

Connection	Signal	Function	Technical data
1	SSI_CLK-	Clock neg.	
2	SSI_CLK+	Clock pos.	
3	SSI_Data+	Data transmission positive	
4	SSI_Data-	Data transmission negative	
5	+24V	Supply voltage encoder	U_{N3} - 1 V
6	0V	Reference potential	Max. 0.2 A
Connector housing	shld	Cable shield connection	

Fig.6-106: Pin Assignment

Maximum Line Length

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

Fig.6-107: Line Length and SSI_CLK Frequency

Example of Connection Principle MD2

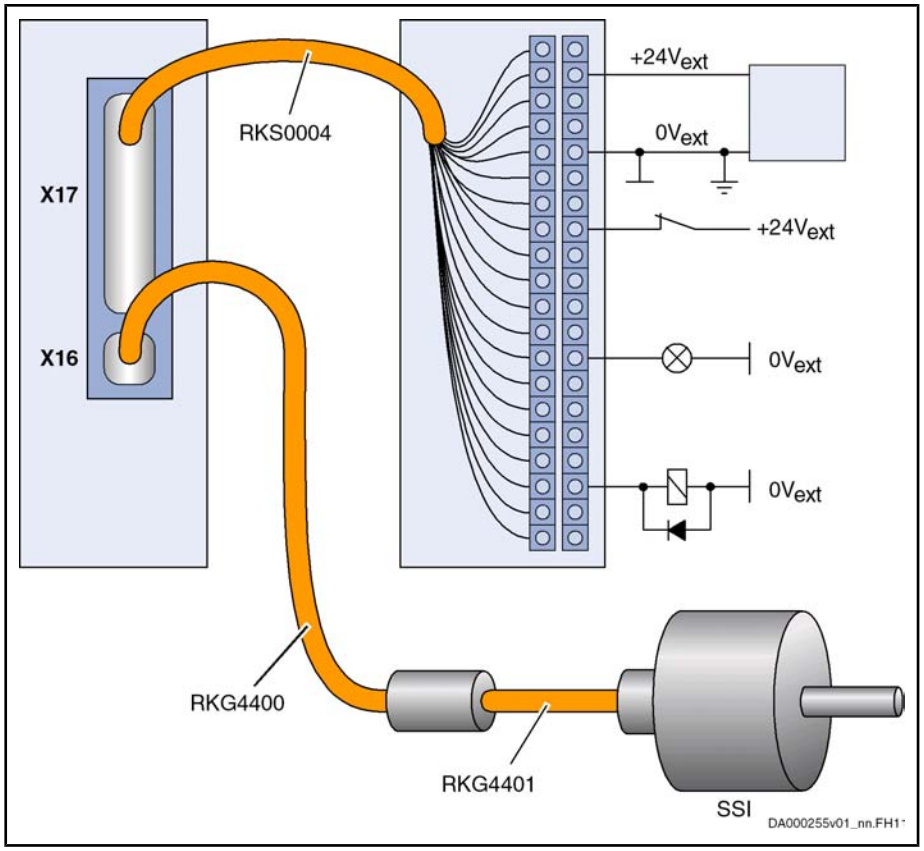


Fig.6-108: Example of Connection I/O Extension MD2

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

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

6.5 Safety Technology

6.5.1 L1 - Starting Lockout

Description

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

Optional Modules for Control Sections

X41, Connection Point Starting Lockout L1

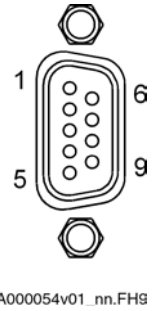
Connection point	Type	Number of poles	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Figure
X41	D-Sub, female (device)	9	0,25–0,5	-	-	

Fig.6-109: Connection

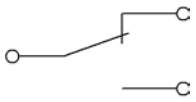
Function	Signal	Connection	Nominal data	Technical data
Control signal starting lockout assignment A	AS A	1	24 V / 3 mA	See Digital Inputs Type 1 (Standard), page 165
Inverted control signal starting lockout	AS n	2		
Control signal starting lockout assignment B	AS B	3		
Supply for acknowledgment potential	ASQ	4	DC 24 V / 1 A	See Relay Contact Type 3, page 164 
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		

Fig.6-110: Pin Assignment

Function

AS	ASn	Status	ASQ1	ASQ2
1	0	Starting lockout active	= ASQ	Open
0	1	Starting lockout not active	Open	= ASQ
0	0	Error when selecting starting lockout	Open	= ASQ
1	1			

Fig.6-111: Function

Connection Accessory, Starting Lockout L1

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

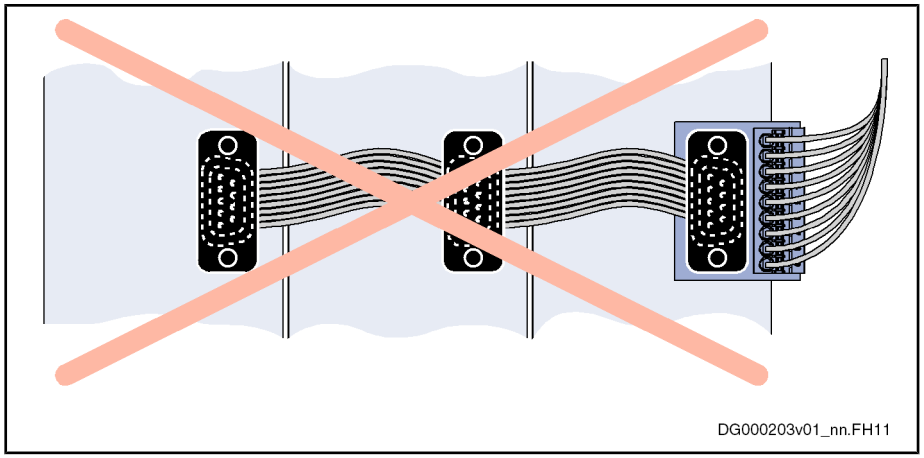


Fig.6-112: No Bus Wiring for Several L1 Options

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**.

Notes on Commissioning

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.

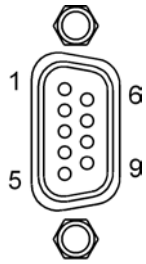
Feedback by means of all N/C contacts (ASQ, ASQ1) connected in parallel is allowed via one channel, if the signal "supply for acknowledgment potential" (ASQ) has been realized in dynamized form.

6.5.2 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

Fig.6-113: Function, Pin Assignment, Properties

Optional Modules for Control Sections

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 1 (Standard) [2)]
Inverted control signal "Safe Torque Off"		STO n	2		
Control signal "Safe Torque Off" assignment B		STO B	3		
Power supply of **isolated** inputs and outputs "STO A", "STO B", "STO 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		
n. c.			7		

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

Fig.6-114: Pin Assignment

Function

STO	STO n	Status	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			

Fig.6-115: Function

Connection Accessories

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

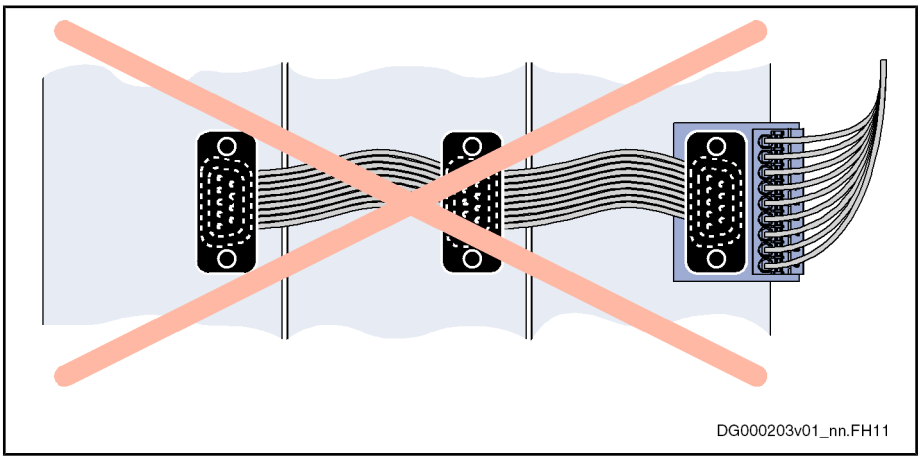


Fig.6-116: No Bus Wiring for Several L2 Options

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** .

Note on Commissioning

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 Q2) connected in parallel.

Feedback by means of all N/C contacts (STO Q, STO Q1) connected in parallel is allowed via one channel, if the signal "supply for acknowledgment potential" (STO Q) has been realized in dynamized form.

6.5.3 S1 - Safety Technology I/O

Description Safety Technology S1

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

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

X41, Connection Point Safety Technology S1

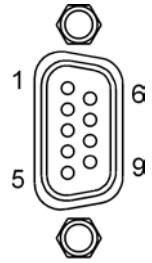
Connection point	Type	Number of poles	Type of design	Stranded wire [mm²]	AWG	Tightening torque [Nm]	Figure
X41	D-Sub	9	Female (device)	0,25–0,5	-	-	

Fig.6-117: Connection

Function		Signal	Connection	Nominal data	Technical data
Input/output forced dynamization	Digital input	EA30	1	24 V / 3 mA	See Digital Inputs Type 1 (Standard), page 165
	Digital output			24 V / 0.5 A	See Digital Outputs, page 167
Input/output acknowledgment	Digital input	EA20	2	24 V / 3 mA	See Digital Inputs Type 1 (Standard), page 165
	Digital output			24 V / 0.5 A	See Digital Outputs, page 167

Optional Modules for Control Sections

Function		Signal	Connection	Nominal data	Technical data
Input/output / relay contact diagn. message / door locking	Digital input	EA10n	3	24 V / 3 mA	See Digital Inputs Type 1 (Standard), page 165
	Digital output			24 V / 0.5 A	See Digital Outputs, page 167
	N/O contact			DC 24 V / 1A	See Relay Contact Type 3, page 164
Digital inputs	Operation mode selection	E1n	4	24 V / 3 mA	See Digital Inputs Type 1 (Standard), page 165
		E2n	5		
		E3n	6		
		E4n	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 EA10n, EA20 and EA30 (3 × 0.5 A + 0.1 A = 1.6 A).

Fig.6-118: Pin Assignment

Accessories

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

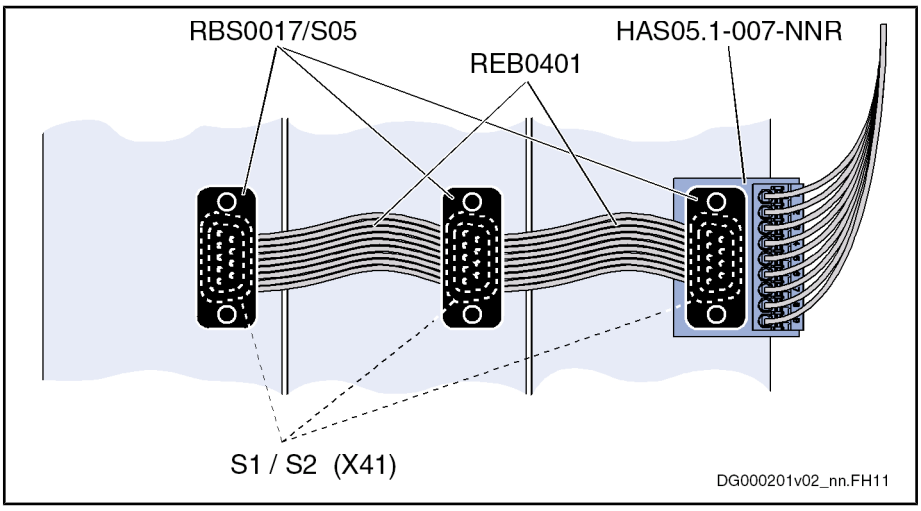
For a detailed description of this accessory, see Project Planning Manual "Rexroth IndraDrive, Additional Components and Accessories".

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.6-119: HAS05.1-007-NNR

At CSH01.1C control sections, the adapter HAS05.1-007-NNL 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".

6.5.4 S2 - Safe Motion

Description S2

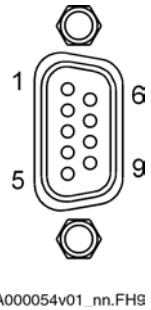
The optional module allows different application-related safety functions, such as

- 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)

You can only use the option in conjunction with an encoder (at slot X4 or X4.1 and X4.2).

Optional Modules for Control Sections

X41, Connection Point Safety Technology S2

View	Identification	Function
	X41	Safety technology S2

D-Sub, 9-pin, female	Unit	Min.	Max.
Connection cable Stranded wire	mm^2	0,25	0,5

Fig.6-120: Function, Pin Assignment, Properties

Function		Signal	Connection	Nominal data	Technical data
Input/output forced dynamization	Digital input	EA30	1	24 V / 3 mA	Digital Inputs Type 1 (Standard) [2]
	Digital output			24 V / 0.5 A	Digital Outputs [3]
Input/output acknowledgment	Digital input	EA20	2	24 V / 3 mA	Digital Inputs Type 1 (Standard) [2]
	Digital output			24 V / 0.5 A	Digital Outputs [3]
Input/output / relay contact diagn. message / door locking	Digital input	EA10n	3	24 V / 3 mA	Digital Inputs Type 1 (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	E1n	4	24 V / 3 mA	Digital Inputs Type 1 (Standard) [2]
		E2n	5		
		E3n	6		
		E4n	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
		0 VE	9		Min. 0.1 A Max. 1.6 A (depending on load of outputs)

1) The maximum current consumption depends on the required current at the outputs EA10n, EA20 and EA30 (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"

Fig.6-121: Pin Assignment

Accessories

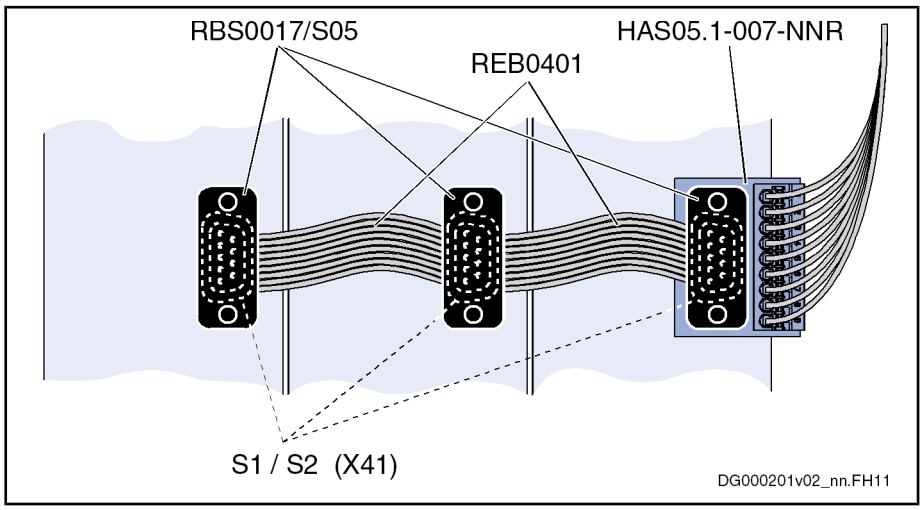
For the connection X41, there is the accessory "**HAS05.1-007**, adapter from D-Sub to terminal connector" .

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.6-122: 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 Control Panels

6.6.1 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").

Optional Modules for Control Sections

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.6-123: 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

6.6.2 Comfort Control Panel

Fig.6-124: Comfort Control Panel

☞ The comfort control panel

- can be used at **CSB01.1N-FC** control sections
- must have been **plugged in when** the drive controller **is switched on** so that it can be recognized
- is **suited for hot plug**, i.e. you may disconnect it when the drive controller has been switched on
- requires at least the firmware FWA-INDRV*-MPB-**04V12**
- only supports the **voltage-controlled open-loop operation** (U/f control)
- has a **graphics display** with a resolution of 128 × 64 pixels
- has to be ordered as a separate component **VCP01** (e.g., VCP01.2BWA-TS-NN-FW)

Compared to the standard control panel, the comfort control panel, due to the fact that it can be programmed, provides additional settings, as well as additional display and command functions.

Possibilities of Display of Comfort Control Panel

Additional possibilities of display of the comfort control panel (compared to the standard control panel), for example:

- Cyclic parameter display
- Measured value of motor temperature sensor
- Message threshold or shutdown threshold for motor temperature
- Active switching frequency (PWM)

☞ For the function "cyclic parameter display", you need comfort control panels of the version VCP01.**2**BWA-TS-NN-FW (see type plate of comfort control panel), as well as the firmware version FWA-INDRV*-MPB-**04**VRS.

Possible Settings With Comfort Control Panel

Additional possible settings with the comfort control panel (compared to the standard control panel), for example:

- Language setting
- Setting/changing single parameters
- Inputting motor data according to type plate data for asynchronous third-party motors

Command Activation With Comfort Control Panel

Activation of further commands with the comfort control panel (compared to the standard control panel), for example:

- **C3200 Command Calculate motor data**

The comfort control panel particularly supports the commissioning of asynchronous third-party motors – another commissioning tool is **not** required for this purpose. The required steps are given by the display, the corresponding input is made by means of the keys of the control panel.

6.7 Memory

6.7.1 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:

Optional Modules for Control Sections

- "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

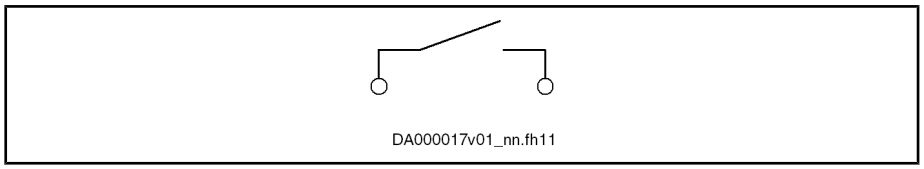


Fig.7-1: Relay Contact

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

Fig.7-2: Relay Contacts Type 1

7.1.2 Relay Contact Type 2

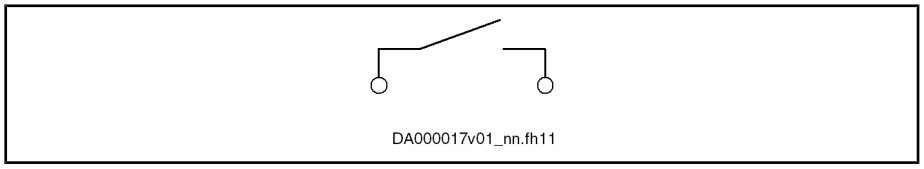


Fig.7-3: Relay Contact

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 max. time constant of load			1×10^6	

Technical Data - Functions

Data	Unit	Min.	Typ.	Max.
Number of mechanical switching cycles			1×10^8	
Time constant of load	ms	ohmic		
Pick up delay	ms			10
Drop out delay	ms			10

Fig.7-4: Relay Contacts Type 2

7.1.3 Relay Contact Type 3

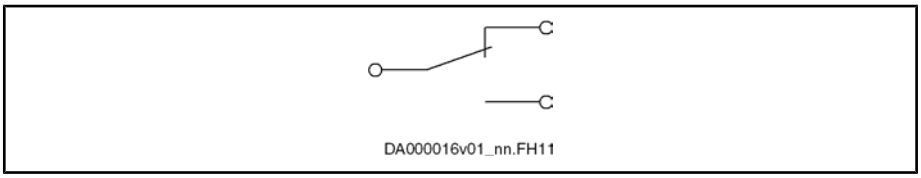


Fig.7-5: Relay Contact

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

Fig.7-6: Relay Contacts Type 3

7.2 Digital Inputs/Outputs

7.2.1 General Information

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

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

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

7.2.2 Digital Inputs

Digital Inputs Type 1 (Standard)

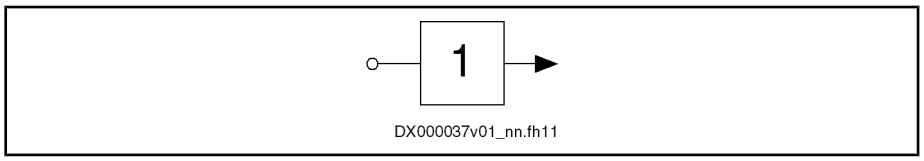


Fig.7-7: Symbol

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		
Sampling frequency	kHz	Depending on firmware		
Control delay	µs	20		100 + 1 cycle time of position control

Fig.7-8: Digital Inputs Type 1

Digital Inputs - Probe

Digital Inputs Type 2 (Probe)

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

Technical Data

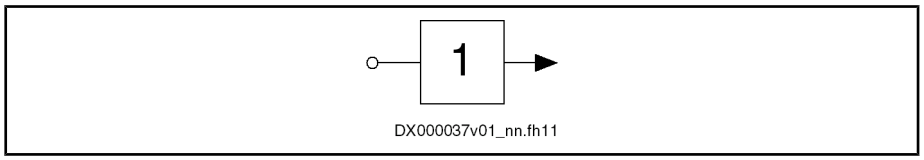


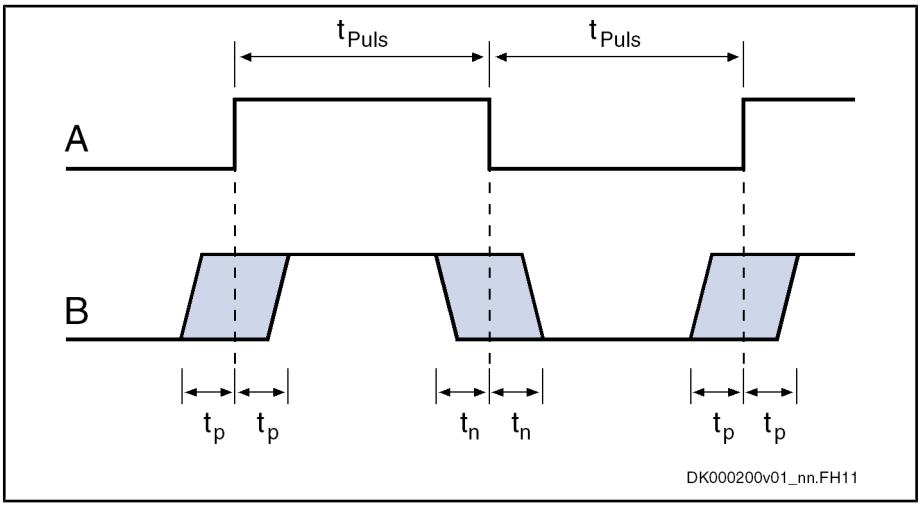
Fig.7-9: Symbol

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		

Technical Data - Functions

Data	Unit	Min.	Typ.	Max.
Measuring accuracy t_p of the positive signal edge	µs			1
Measuring accuracy t_n of the negative signal edge	µs			1

Fig.7-10: Digital Inputs Type 2



A Signal
B Signal detection at probe input
t_{Puls} Pulse width
t_p Measuring accuracy of the positive signal edge
t_n Measuring accuracy of the negative signal edge

Fig.7-11: Signal Detection at Probe Input

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

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

Digital Inputs Type 3 (Probe)

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

Technical Data

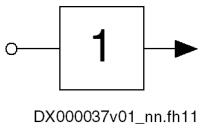
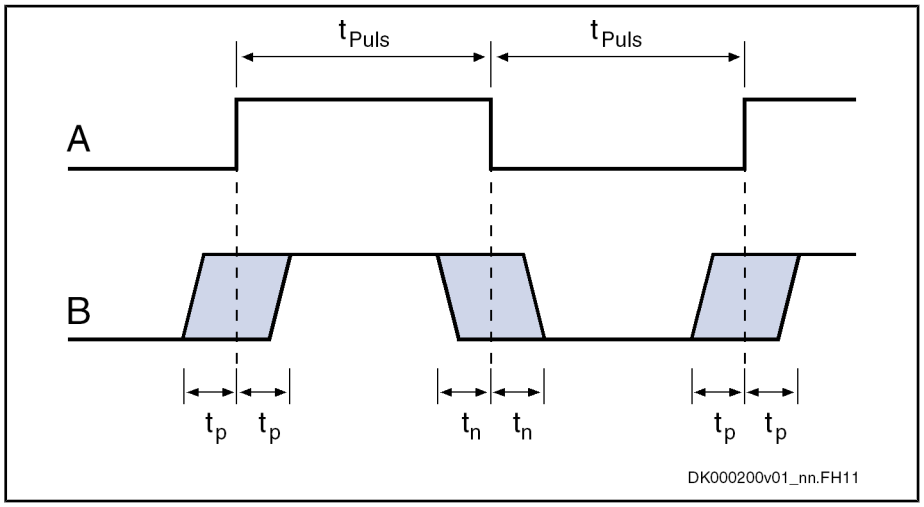


Fig.7-12: Symbol

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		

Data	Unit	Min.	Typ.	Max.
Measuring accuracy t_p of the positive signal edge	µs			6
Measuring accuracy t_n of the negative signal edge	µs			50

Fig.7-13: Digital Inputs Type 3



A	Signal
B	Signal detection at probe input
t_{Puls}	Pulse width
t_p	Measuring accuracy of the positive signal edge
t_n	Measuring accuracy of the negative signal edge

Fig.7-14: Signal Detection at Probe Input

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

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

7.2.3 Digital Outputs

The digital outputs correspond to IEC 61131.

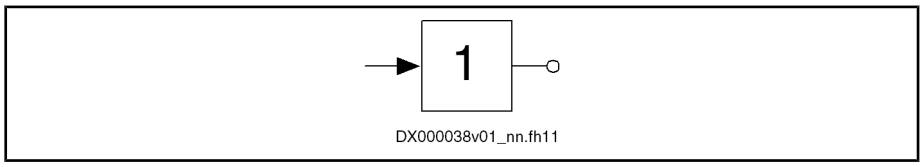


Fig.7-15: Symbol

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

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

Fig.7-16: Digital Outputs

☞ The digital outputs have been realized 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.

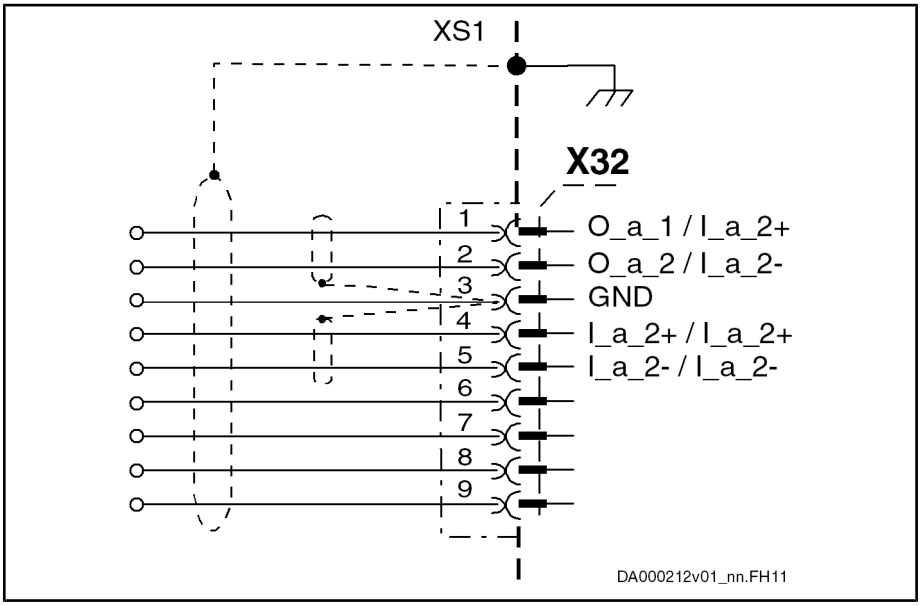
Limit voltage peaks by using free-wheeling diodes directly at the relay coil.

7.3 Analog Inputs/Outputs

7.3.1 General Information

The analog inputs correspond to IEC 61131.

7.3.2 Connection Diagram - Example



XS1 Shield connection at drive controller
Fig.7-17: Shield Connection X32

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

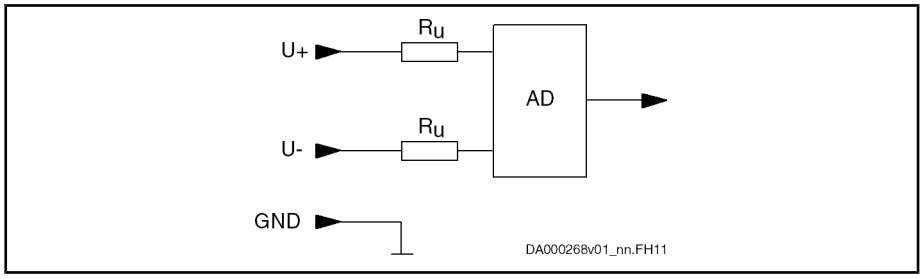
At the drive controller, connect the cable shield at connection XS1.

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

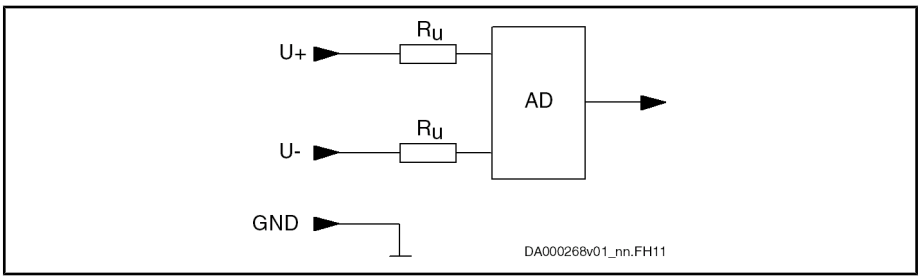
Fig.7-18: Analog Voltage Inputs

Data	Unit	Min.	Typ.	Max.
Allowed input voltage	V	-30		+30
Working range input voltage U_{on_work}	V	-10		+10
Input resistance	kΩ		180	
Input bandwidth	kHz		2	
Common-mode range	V	-20		+20
Common-mode rejection	dB	48		
Relative measuring error at 90% U_{on_work}	%	-1		+1
Converter width A/D converter incl. polarity sign	Bit		12	
Oversampling			8-fold	
Dynamic converter width with oversampling	Bit		14	
Resulting resolution	mV/inc		5,5	
Cyclic conversion	µs	n.s.		
Conversion time	µs	n.s.		

Fig.7-19: Analog Voltage Inputs

Technical Data - Functions

Analog Input Type 2

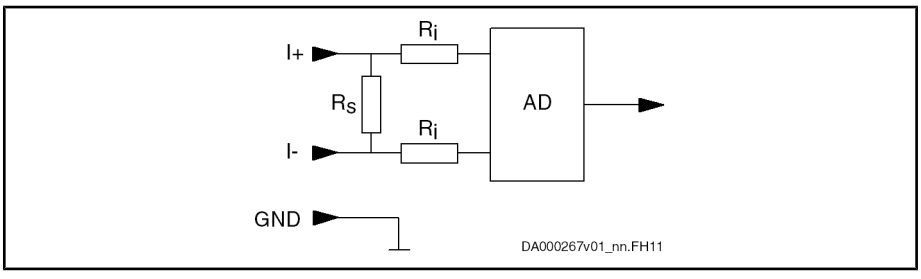


AD Analog/digital converter
Fig.7-20: Analog Voltage Inputs

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	
Dynamic converter width with oversampling	Bit		14	
Resulting resolution	mV/inc		5	
Cyclic conversion	µs	n.s.		
Conversion time	µs	n.s.		

Fig.7-21: Analog Voltage Inputs

Analog Input Type 3

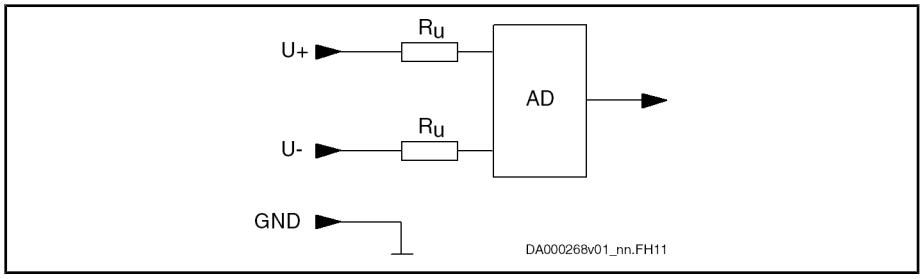


AD Analog/digital converter
Fig.7-22: Analog Current Inputs

Data	Unit	Min.	Typ.	Max.
Allowed input current	mA	0		+20
Working range input current I_{on_work}	mA	0		+20
Input resistance	Ω		200	
Input bandwidth	kHz		2	
Common-mode range	V	-26		+26
Common-mode rejection	dB	48		
Relative measuring error at 90% I_{on_work}	%	-1		+1
Converter width A/D converter incl. polarity sign	Bit		12	
Oversampling			8-fold	
Dynamic converter width with oversampling	Bit		14	
Resulting resolution	µA/inc		10,7	
Cyclic conversion	µs	n.s.		
Conversion time	µs	n.s.		

n.s. Not specified
Fig.7-23: Analog Current Inputs

Analog Input Type 4



AD Analog/digital converter
Fig.7-24: Analog Voltage Inputs

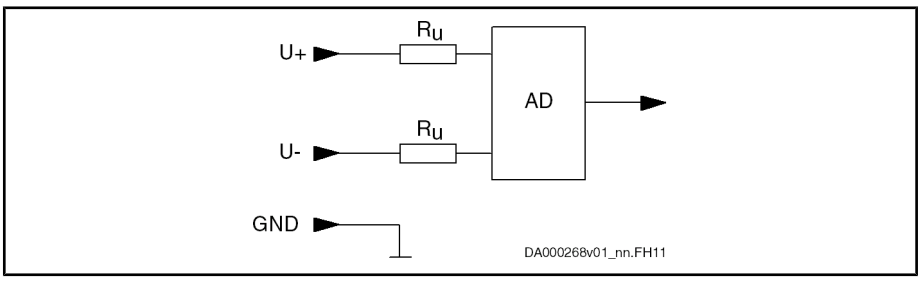
Data	Unit	Min.	Typ.	Max.
Allowed input voltage	V	-10		+30
Working range input voltage U_{on_work}	V	-10		+10
Input resistance voltage input	kΩ		160	
Input bandwidth	kHz		1,4 (As of FD: 07W38 [production week 38 of year 2007])	

Technical Data - Functions

Data	Unit	Min.	Typ.	Max.
Common-mode range	V	-20		+20
Common-mode rejection	dB	48		
Relative measuring error at 90% U_{on_work}	%	-1		+1
Converter width A/D converter incl. polarity sign	Bit		12	
Oversampling			8-fold	
Dynamic converter width with oversampling	Bit		14	
Resulting resolution	mV/inc		1,23	
Cyclic conversion	µs		n.s.	
Conversion time	µs		n.s.	

Fig.7-25: Analog Voltage Inputs

Analog Input Type 5



AD Analog/digital converter
Fig.7-26: 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		
Relative measuring error at 90% U_{on_work}	%	-1		+1
Converter width A/D converter incl. polarity sign	Bit		12	
Oversampling			8-fold	
Dynamic converter width with oversampling	Bit		14	
Resulting resolution	mV/inc		1,23	

Data	Unit	Min.	Typ.	Max.
Cyclic conversion	µs		n.s.	
Conversion time	µs		n.s.	

Fig.7-27: Analog Voltage Inputs

7.3.4 Analog Outputs

Analog Output Type 1

Data	Unit	Min.	Typ.	Max.
Output voltage	V	0		+10
Output load	kΩ	2		
Output current	mA	0		+5
Converter width digital/analog converter incl. polarity sign	Bit		10	
Resolution	mV/inc		9,8	
Conversion time (incl. response time)	µs		10	
Cyclic conversion			Depending on firmware	
Short circuit protection			Present	
Overload protection			Present	

Fig.7-28: 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	
Short circuit protection			Present	
Overload protection			Present	

1) FMR: Final value of measuring range

Fig.7-29: Analog Outputs Type 2

Technical Data - Functions

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

Fig.7-30: Analog Outputs Type 3

7.4 X2, Serial Interface (RS232)

7.4.1 General Information

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

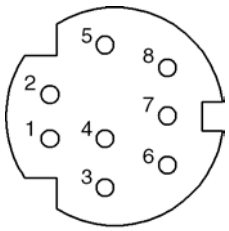
Connection point	Type	Number of poles	Stranded wire [mm²]	Description	Figure
X2	MiniDin, female (device)	8	0,25–0,5	Serial interface	

Fig.7-31: 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

Pin	Signal	Function
6	V_{cc}	Supply voltage
7	n. c.	n. c.
8	n. c.	n. c.

Fig.7-32: Pin Assignment of Serial Interface

Features

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

Fig.7-33: 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 "Rexroth IndraDrive, Additional Components and Accessories".

7.4.2 Connection Diagrams

Serial Interface to PC With 9-Pin D-Sub

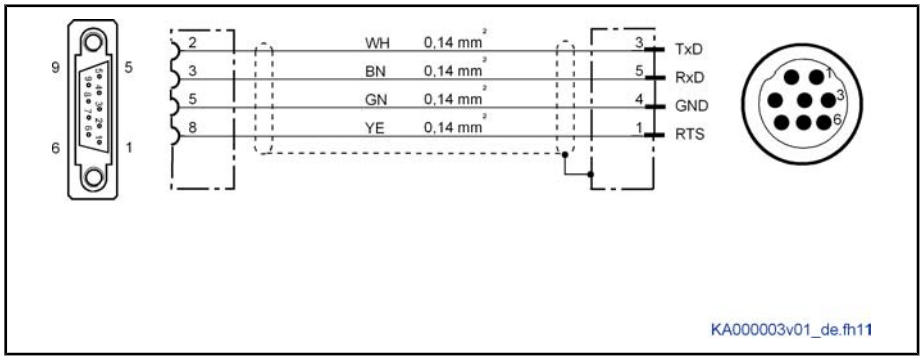


Fig.7-34: Connection Serial Interface to PC With 9-Pin D-Sub

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

Technical Data - Functions

Serial Interface to PC With 25-Pin D-Sub

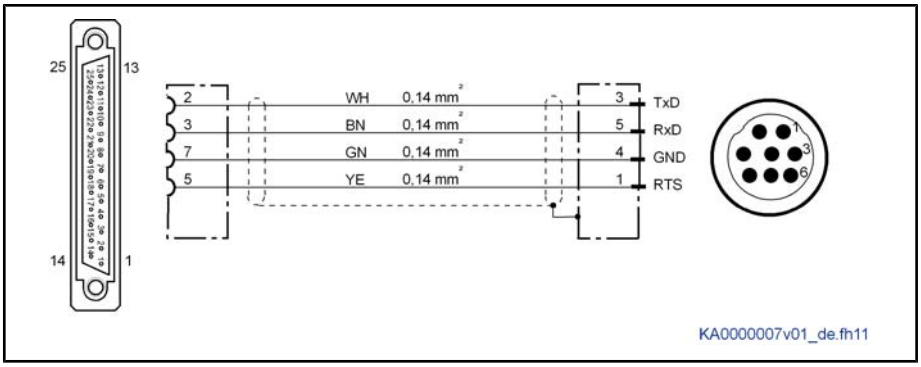


Fig.7-35: Connection Serial Interface to PC With 25-Pin D-Sub

7.5 X26, Engineering Interface

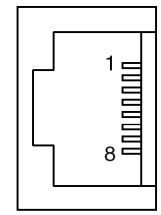
View	Connection	Signal name	Function
 DA000041v01_nn.FH	1	TD+	Transmit, Differential Output A
	2	TD-	Transmit, Differential Output B
	3	RD+	Receive, Differential Input A
	4	n. c.	-
	5	n. c.	-
	6	RD-	Receive, Differential Input B
	7	n. c.	-
	8	n. c.	-
	Housing		Shield connection
Properties			
Standard	• Ethernet • Type: RJ-45, 8-pin		
Compatibility	100Base-TX according to IEEE 802.3u		
Recommended cable type	• According to **CAT5e**; type of shield ITP (Industrial Twisted Pair) • Ready-made cables which can be ordered: – **RKB0011** Long cables (100 m at maximum) to connect the drive system to the higher-level control unit. Minimum bending radius: – 48.75 mm with flexible installation – 32.50 mm with permanent installation Order code for a 30 m long cable: RKB0011/030,0 – **RKB0013** Short cables to connect devices arranged side by side in the control cabinet. Order code for a 0.55 m long cable: RKB0013/00,55 Minimum bending radius: 120.50 mm		

Fig.7-36: Function, Pin Assignment, Properties

Display Elements

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

Fig.7-37: 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. encoder interface "ENS", corresponding communication and control panel "C" or "S"
2) Incl. MultiMediaCard "PFM" and control panel "C" or "S"
3) At maximum allowed output load, plus power consumption of optional modules
4) Incl. encoder emulation "MEM" and control panel "C" or "S"

Fig.8-1: Power Consumption of Control Sections

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

Technical Data - Other

8.1.3 Optional Modules

Option[1)]	Optional module	Power consumption P_{N3} [2)] [W]
AN	Analog I/O extension	2
C	Comfort control panel	1
CCD	Cross communication SERCOS III	1
CO	Communication DeviceNet and CANopen	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
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	Communication PROFIBUS-DP	2
PFM	MultiMediaCard	1
PL	Communication parallel interface	1
S	Standard control panel	1
S1	Safety technology I/O	1
S3	Communication SERCOS III	1
SE	Communication SERCOS	2

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

Fig.8-2: Power Consumption of Optional Modules

8.2 Connections

8.2.1 General Information

The connection points at 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

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

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

9 Accessories

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 "Rexroth IndraDrive, Additional Components and Accessories".

10 Environmental Protection and Disposal

10.1 Environmental Protection

Production Processes

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

Prohibited Substances

We guarantee that our products include no substances according to the chemicals-ban-decree. We furthermore declare that our products are free of mercury, asbestos, PCB and chlorinated hydrocarbons.

No Release of Hazardous Substances

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

Significant Components

Basically, our products contain the following components:

Electronic devices
- Steel
- Aluminum
- Copper
- Synthetic materials
- Electronic components and modules

Motors
- Steel
- Aluminum
- Copper
- Brass
- Magnetic materials
- Electronic components and modules

10.2 Disposal

Return of Products

Our products can be returned to our premises free of charge for disposal. It is a precondition, however, that the products are free of oil, grease or other dirt.

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

Send the products ”free domicile” to the following address:

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

Packaging

The packaging materials consist of cardboard, wood and polystyrene. These materials can be recycled anywhere without any problem.

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

Recycling

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

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

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

11 Service and Support

Our service helpdesk at our headquarters in Lohr, Germany and our worldwide service will assist you with all kinds of enquiries. You can reach us **around the clock - even on weekend and on holidays**.

	Helpdesk	Service Hotline Worldwide
Phone	+49 (0) 9352 40 50 60	Outwith Germany please contact our sales/service office in your area first. For hotline numbers refer to the sales office addresses on the Internet.
Fax	+49 (0) 9352 40 49 41	
E-mail	service.svc@boschrexroth.de	
Internet	http://www.boschrexroth.com You will also find additional notes regarding service, maintenance (e.g. delivery addresses) and training.	

Preparing Information

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

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

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