rexroth
A Bosch Company

Smart Function Kit

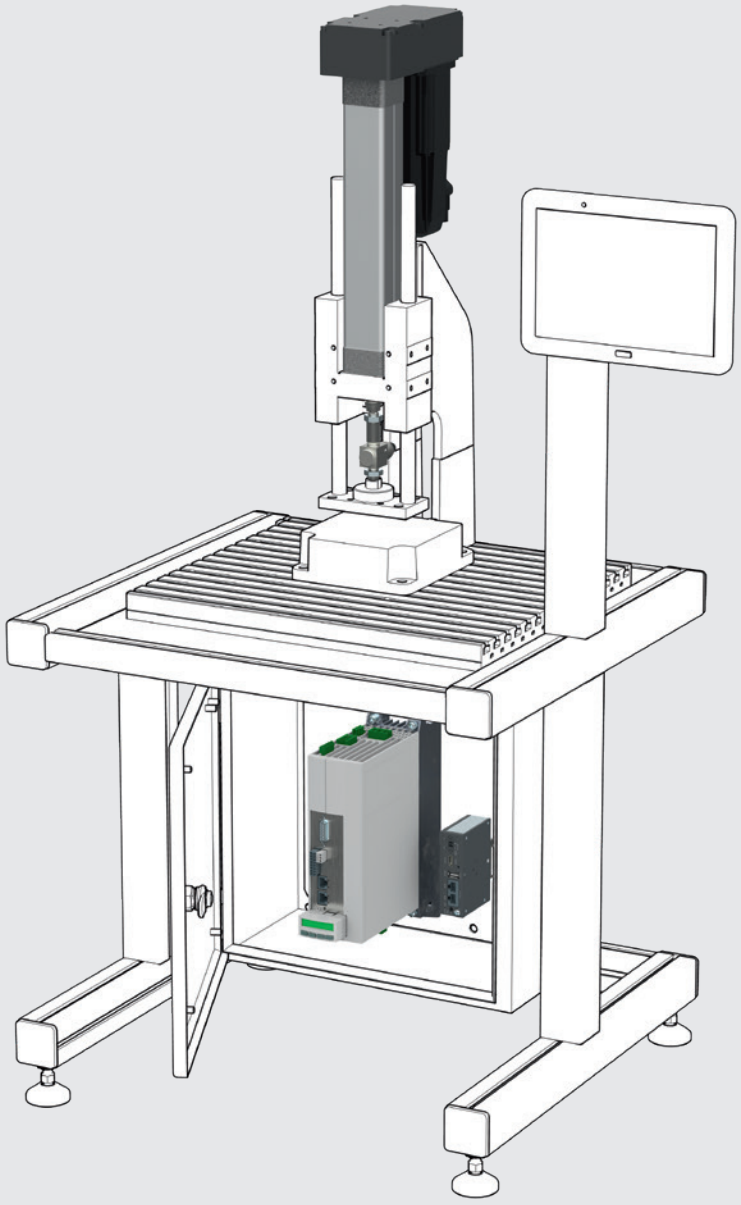
for pressing and joining applications

R320103194/2021-06

EN

Instructions

EN



This data has been provided solely for the purpose of product description. Any references to possible uses are provided merely as a convenience and shall be understood as application examples or suggestions.
Catalog data may not be construed as guaranteed characteristics.
The information given does not release the user from the obligation of own judgment and verification. It should be noted that our products are subject to a natural process of aging and wear.

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It may not be reproduced or given to third parties without our consent.

The title page contains an illustration of a sample configuration. The product as delivered can differ from the illustration.

The original instructions are in German.

Any dissemination of the product must include these instructions.

Die vorliegende Dokumentation ist in folgenden Sprachen verfügbar.
These operating instructions are available in the following languages.

DE German (Original document)

EN English

Contents

EN

1 About this documentation

1.1 Validity of the documentation

This documentation applies to the following products:

- Smart Function Kit as described in the "Smart Function Kit" online catalog.

This documentation is intended for assemblers, installers, operators, service technicians and system owners.

This documentation contains important information for proper and safe installation, transport, and maintenance of the product.

▶ This documentation, especially the chapter "Safety instructions", is to be read completely before working with the product.

1.2 Required and supplementary documentation

▶ Only commission the product once you have obtained the system documentation that is marked with the 📖 and understood and complied with its contents.

Table 1: Required documentation

	Title	Document number	Document type	In scope of delivery
📖	Safety instructions for Linear Motion Systems	R320103152	Safety instructions	✔
📖	Electromechanical Cylinders EMC	R999000473	Catalog	
📖	Instructions for Electromechanical Cylinders EMC	R320103102	Instructions	✔
📖	IndraDrive HCS01 drive control units power units	R911339011	Instructions	
📖	IndraDrive drive components	R911337777	Safety instructions	✔
📖	IndraControl PR21	R911389663	Instructions	
📖	Safety and warning information on control components	R911171137	Safety instructions	✔
📖	Motor MS2N	R911340694	Safety instructions	✔
📖	SMC	R911343864	Manual	
📖	Force sensor		Instructions	✔
📖	Smart Function Kit software	R320103208	Instructions	
📖	Smart Function Kit - Fieldbus	R320103209	Anleitung	
📖	Smart Function Kit - OPC-UA + REST-API	R320103210	Anleitung	

The Rexroth documentation is available for download at www.boschrexroth.com/mediadirectory.

1.3 Presentation of information

To enable users to work rapidly and safely with the product while following these instructions, this documentation uses standardized safety instructions, symbols, terms and definitions, and abbreviations. These are explained in the following sections.

1.3.1 Safety instructions

This documentation contains safety instructions regarding any actions that involve a risk of personal injury or damage to property. The safety precautions described must be adhered to.

Safety instructions are structured as follows:

⚠ SIGNAL WORD

Type and source of hazard!

Consequences if ignored.

▶ Hazard prevention measure.

- Warning sign: draws attention to the hazard
- Signal word: indicates the severity of the hazard
- Type and source of hazard: indicates the type or source of the hazard
- Consequences: describes the consequences that may occur if the hazard avoidance precautions are ignored.
- Hazard prevention measure: indicates how to avoid the hazard

The safety instructions cover the following hazard classes. The hazard class describes the risks involved if the safety instruction is not complied with.

Table 2: Hazard classes according to ANSI Z535.6

Warning sign, signal word	Meaning
⚠ DANGER	Indicates a hazardous situation which will result in death or serious injury if not avoided.
⚠ WARNING	Indicates a hazardous situation which may result in death or serious injury if not avoided.
⚠ CAUTION	Indicates a hazardous situation which may result in minor or moderate injury if not avoided.
NOTICE	Property damage: The product or surroundings may be damaged

1.3.2 Symbols

The following symbols indicate information that is not related to safety but makes the documentation easier to understand.

Table 3: Meaning of the symbols

Symbol	Meaning
	If this information is not observed, the product will not be optimally used / operated.
▶	Single, independent work step
1. 2. 3.	Numbered work steps The numbers indicate the sequence of the work steps.
➠ 7	See section 7
➠ ☒ Fig. 7.1	See figure 7.1
	Screw with strength class ...
⊘	Tightening torque
μ	Friction factor for screws

1.3.3 Abbreviations

The following abbreviations are used in this documentation:

Table 4: Abbreviations and definitions

Abbreviation	Meaning
EMC	**E**lectro**M**echanical **C**ylinder
HCS01	Drive controller
HMI	**H**uman **M**achine **I**nterface (graphical user interface)
PR21	Industrial PC

2 Safety instructions

The general safety instructions for this product can be found in the documentation "Safety instructions for Linear Motion Systems", "Safety instructions for IndraDrive drive components" and "Safety instructions for control components". You must have read and understood these before handling the product.

3 Scope of delivery

The following is included in delivery:

- Smart Function Kit with motor, servo drive and accessories
- Documents ! "Table 1: Required documentation" on page 4 that are indicated

▶ Upon receipt of the delivery, immediately check for completeness against the receipt and notify the carrier or Bosch Rexroth AG if any parts are missing.

3.1 Delivery condition

- Depends on order

3.2 Accessories

The following accessories are available:

- Fastening elements
- Motor attachment (flange coupling, belt side drive)
- Force sensor
- Cable
- 24 V Power supply
- Uninterruptible power supply UPS
- Extensions of the control and drive components
- Isolating transformer and mains filter
- Panel PC VR

Dimensions and part numbers of the accessory parts as well as additional accessories ➠ Product catalogs.

4 Product description

4.1 Performance description

Please refer to the notes, technical data, dimensions and descriptions in the product catalog.

4.2 Device description

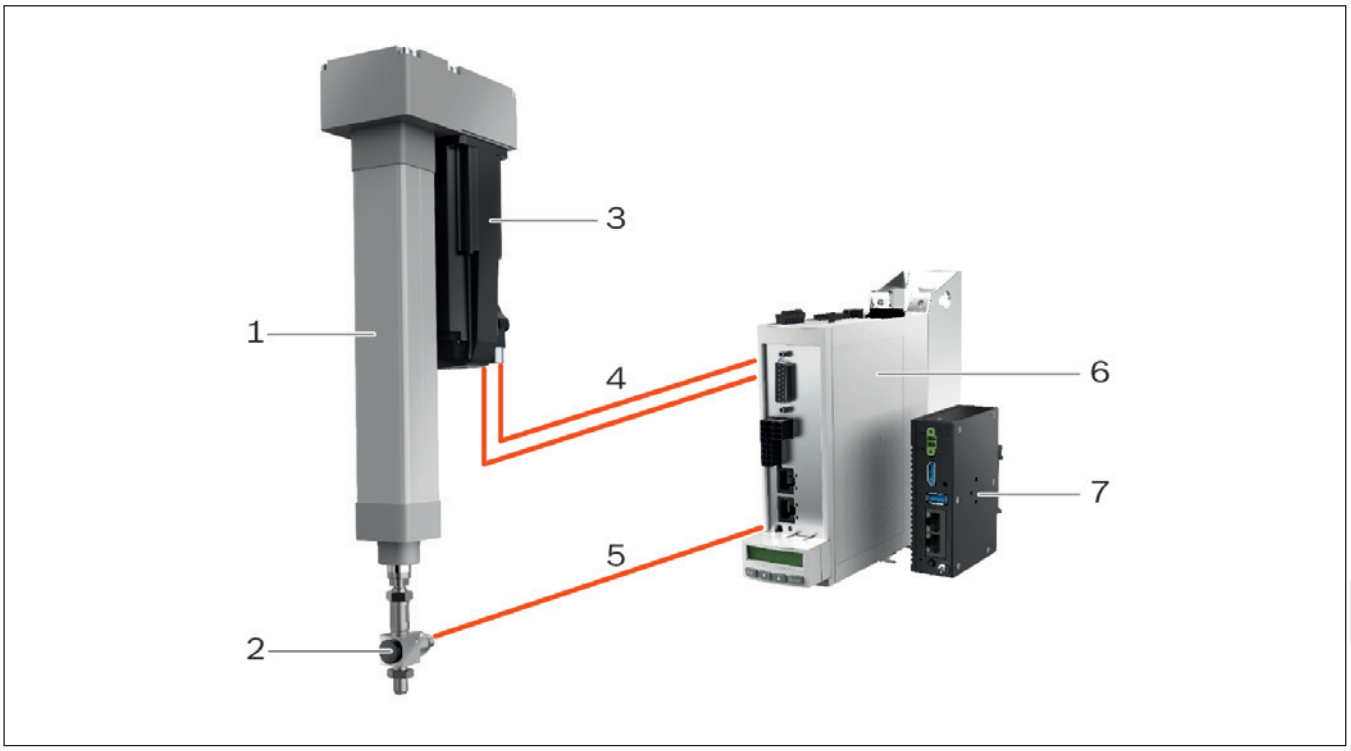

Fig. 1: **Components**

1 Electromechanical Cylinder EMC with freely configurable travel distances. Parallel or axial motor attachment
2 Force sensor: DMS technology for cost-effective and robust force measurement
3 MS2N Servo Motor: Latest generation of motors with absolute encoder and brake
4 Motor and encoder cable
5 Sensor cable
6 IndraDrive HCS01 servo drive with integrated PLC IndraMotion MLD and safety function STO or Safe Motion
7 Industrial PC PR21 with integrated web server and Smart Function Kit HMI software

4.3 Product identification

The product nameplate bears the following information:

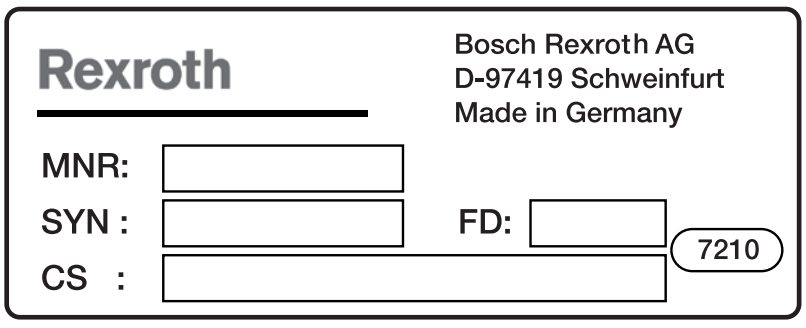

Fig. 2: **Name plate**

Table 5: Information on name plate

Name plate information	Meaning
MNR	Part number
TYP	Type designation and size
CS	Customer order number
FD	Date of manufacture
7210	Manufacturing location

When ordering spare parts, please specify all the data on the nameplate.

5 Transport and storage

Take note of the environmental conditions ➠ 12 and product catalog. For special environmental conditions, please consult us.

5.1 Transporting the Smart Function Kit

⚠ WARNING

Risk of product falling due to inadequate load handling equipment!

Death or serious injury.

- ▶ Use only inspected and suitable load handling equipment.
- ▶ Attach load handling equipment only to the frame or at the designated points.
- ▶ Do not stand under suspended loads.
- ▶ Before hoisting, take note of the weight.

NOTICE

Risk of damage to motor attachment due to motor vibrations/motor breaking off!

Damage to the product.

- ▶ When transporting the product with motor attached, always provide support for the motor.

5.2 Storing the Smart Function Kit

NOTICE

Risk of damage to the drive components due to improper storage!

Damage to the product.

- ▶ Store the drive components in their original packaging, in a dry place, dust-free, vibration-free and protected from light or direct sunlight.

NOTICE

Risk of damage due to improper storage!

Potential corrosion of product parts.

- ▶ Store the product only in dry, covered areas.
- ▶ Protect the product from humidity and corrosive agents.

Elastomer seals accelerate aging.

- ▶ Protect the product from heat and light (UV radiation).

6 Mounting

For dimensions and part numbers of the individual components ➠ See product catalog.

⚠ WARNING

Risk of product falling if installed vertically or suspended due to lack of fall protection!

Death or serious injury.

- ▶ Secure the product against falling.
- ▶ Do not stand under the product in the hazard zone.

▶ Before hoisting the product, note the weight ➠ See product catalog.

NOTICE

Excessive or insufficient tightening torque

Product will be destroyed.

- ▶ Always observe the tightening torque ➠ 12.1

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6.1 Mounting conditions

▶ Take note of the operating conditions ➠ 12 and product catalog. For special operating conditions, please contact us.

NOTICE

Risk of damage due to improper loads!

Damage to the product.

- ▶ Do not place any protruding loads on the product (for maximum values, see product catalog).
- ▶ Do not turn the piston rod.
- ▶ Do not use the housing for attaching other machine elements to absorb forces.
- ▶ Attach only standard Rexroth elements to the housing.

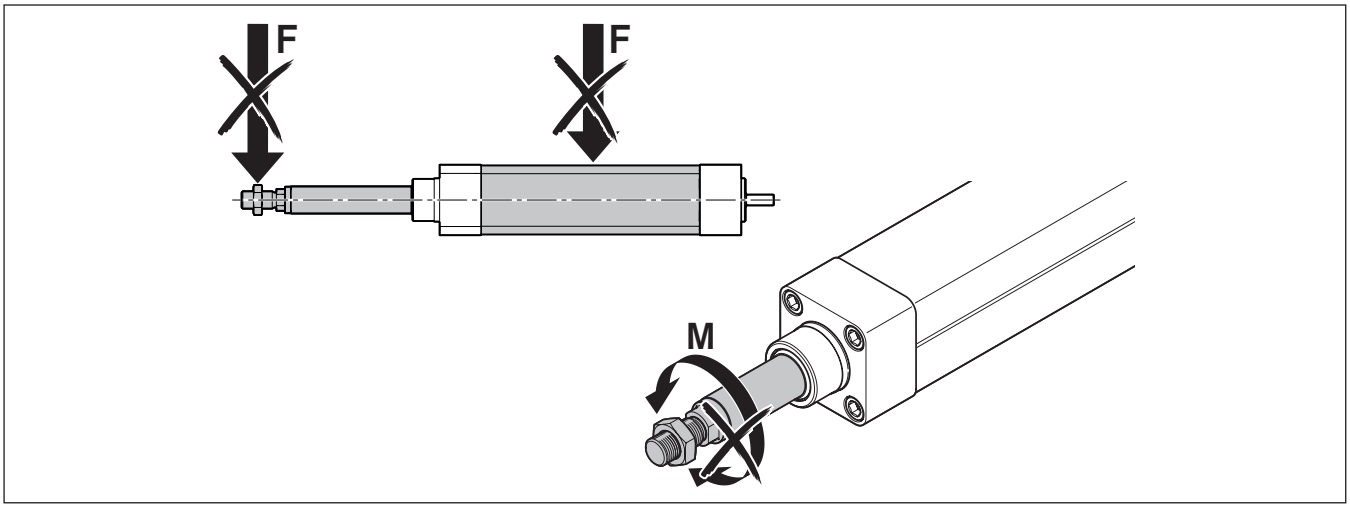

Fig. 3: **Non-permissible loads**

6.2 Mounting position

The EMC can be mounted in any position.

⚠ WARNING

Risk of piston rod crashing down in vertical or slanting installations as the unit is not self-locking or risk of damage to mechanics inside the Electromechanical Cylinder or breakage of toothed belt in case of motor mounting using a belt side drive!

Death or serious injury.

- ▶ In vertical or slanting installations, secure the piston rod against falling.
- ▶ Do not stand under the product in the hazard zone.

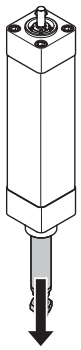

Fig. 4: **Dropping of the piston rod**

6.3 Required accessories

▶ Required mounting accessories ➠ See product catalog, "Fastening elements" section.

6.4 Fastening options

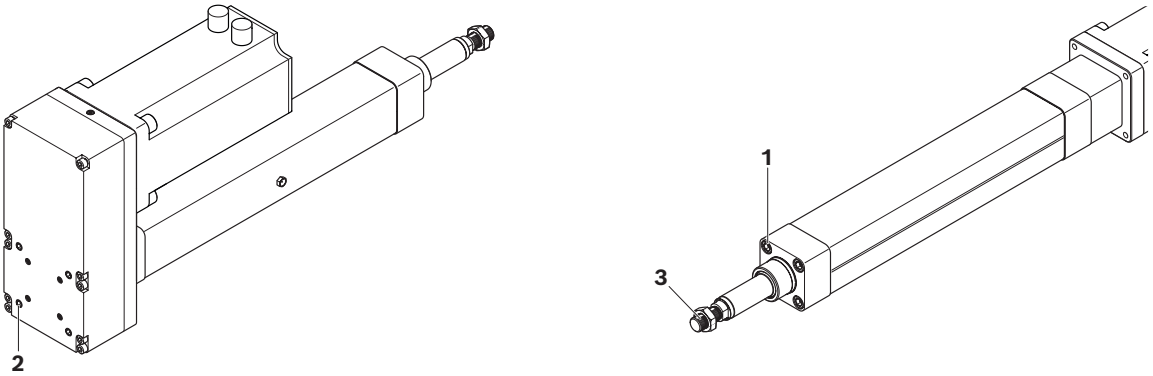

Fig. 5: **Fastening options**

1 By the cover

2 By the belt side drive

3 By the piston rod end

6.4.1 Permissible forces for fastening elements

⚠ CAUTION

Some fastening elements are not approved up to the "Maximum permissible axial force of EMC F_{MAXEMC}".

Risk of injury.

- ▶ Observe the permissible maximum forces F_{max} for fastening elements in the section "Fastening elements" in the product catalog.

6.5 Mounting the force sensor

NOTICE
Damage to the mechanical system inside the cylinder due to the initiation of torques to the product. Damage to the product. ▶ Do not transfer any torque to the piston rod. ▶ Counterhold by means of a wrench flat.
Damage to the sensor due to transverse forces and torsional moments! Damage to the product. ▶ Do not transfer any transverse forces or torque to the sensor. ▶ Counterhold by means of a wrench flat.
Measuring error due to lock nut attached to the sensor body! Measuring error if the lock nut on the workpiece side touches the force sensor ▶ Fix the lock nut with distance to the sensor body ➠ ☒ Fig. 6; Picture 3.

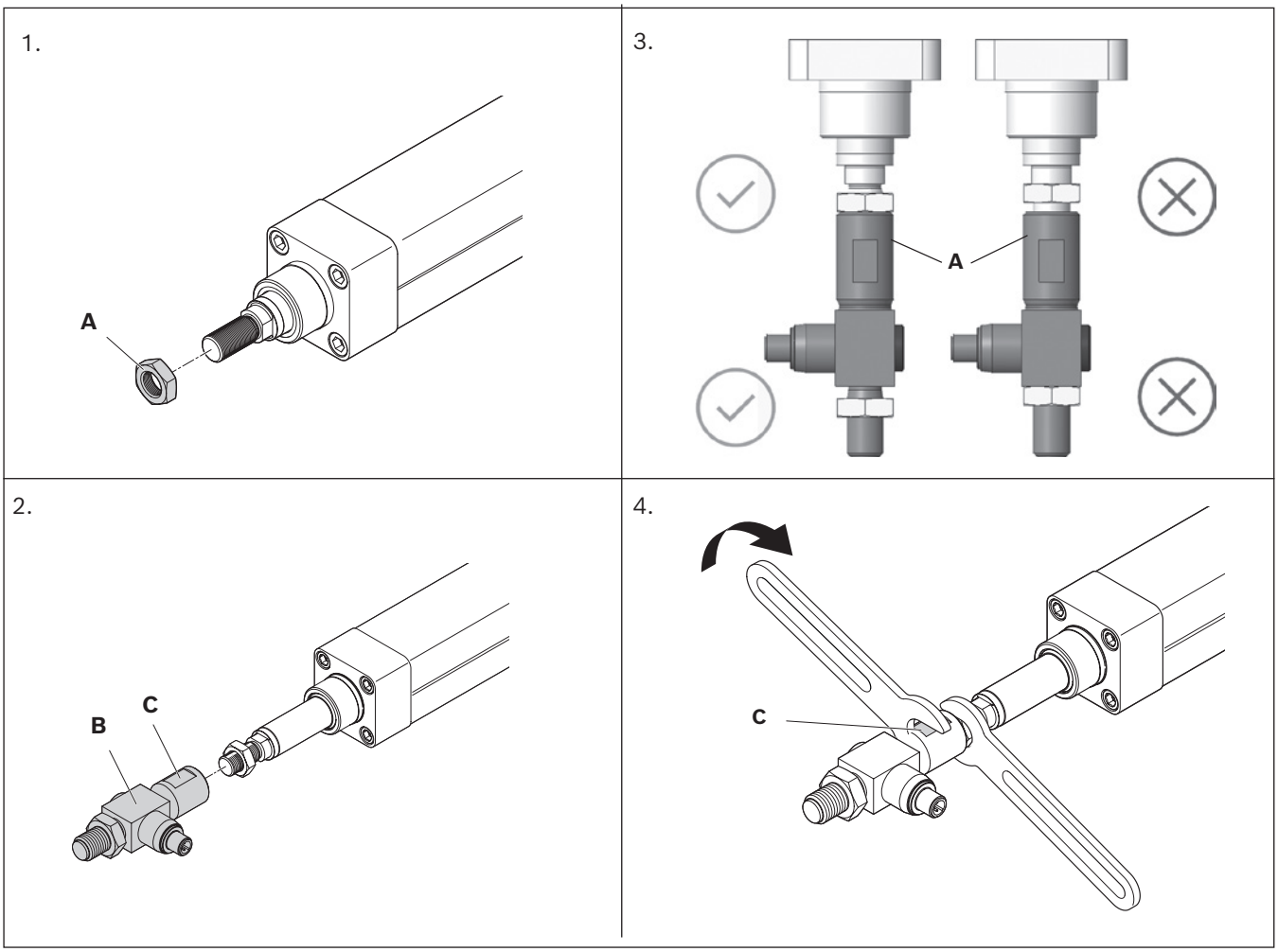

Fig. 6: **Fastening the force sensor**

1. Screw the lock nut (**A**) to the threaded mounting interface of the EMC.
2. Screw the force sensor (**B**) onto the threaded mounting interface.
3. Secure the position of the force sensor using the lock nut (**A**) (note the position of the lock nut).
4. Mounting the force sensor For this, counterhold the open-end wrench by means of the wrench flat (**C**) so that the sensor is not loaded by torsional moments.

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6.6 Mounting the EMC

NOTICE
Function failure of product due to incorrect mounting (distortive stress)! Damage to the product. ▶ Install the EMC so it is free of distortive stresses!

1. Bring the EMC into position.
2. Tighten the fastening screws evenly. Take care not to exceed the maximum permitted tightening torques M_A ➠ 12.1 Tightening torques.

7 Installation

⚠ WARNING
Risks related to moving parts! Moderate injury, including severe flesh wounds, puncture wounds and severe bruising. ▶ Never reach into moving parts.
Unexpected movement of the product! Risk of injury due to impact or bruising. ▶ Before working on the electrical equipment, switch off the power supply and secure it against being switched on again.
Risk of electrical shocks through touching live parts! Death or serious injury. ▶ Before working on the electrical equipment, switch off the power supply and secure it against being switched on again. ▶ Allow drive components to discharge before accessing them. ▶ Always operate the drive components with a permanently installed protective conductor.

7.1 General installation instructions

- ▶ Observe the required minimum distances during mounting (see technical data or dimension sheets).
- ▶ Rear mounting (rear side of the device is directly on the mounting surface in the control cabinet) is the standard and should be applied.
- ▶ Lay all lines in loops. Use strain reliefs for all lines.
- ▶ Do not lay signal-carrying cables parallel to motor cables or other strong interferers over long distances, as the signal transfer may otherwise be interfered. If possible, keep great distance to interference sources.

7.2 Installation of the HCS01 Servo Drive

7.2.1 IndraDrive HCS01 device overview

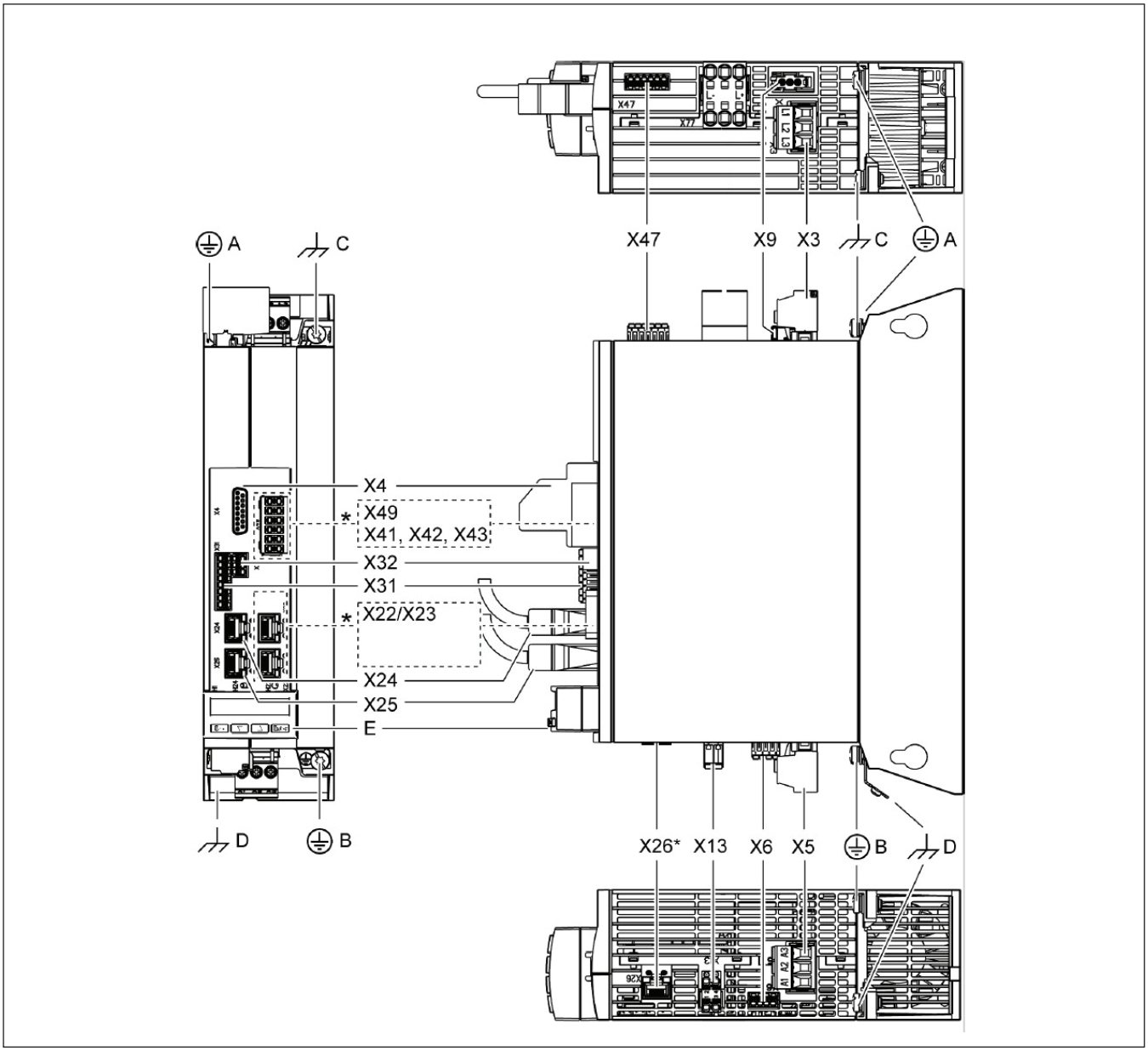

Fig. 7: **IndraDrive HCS01**

A	Connection point of equipment grounding conductor, mains
B	Connection point of equipment grounding conductor, motor
C	Control line shield connection
D	Motor cable shield connection
E	Control panel
X3	Mains connection
X4	Motor encoder
X5	Motor connection
X6	Motor temperature monitoring, motor holding brake
X9	Integrated/external braking resistor
X13	X13 24V supply (control voltage)
X22/X23	Multi-Ethernet communication (ET option)
X24/X25	sercos III master
X26	Engineering interface (only available at A-CC ADVANCED devices
X31	Digital inputs, digital output
X32	Analog input
X41, X42, X43	Safety technology (S4, S5 option: Safe Motion)
X47	X47 Bb relay contact, module bus (module bus at HCS01.1EW00xx-x-03 devices only)
X49	Safety technology (L3 option: Safe Torque Off; L4 option: Safe Torque Off, Safe Brake Control)

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7.2.2 Wire connection

- Connect the equipment grounding conductor of the mains or motor cable with to device housing via the M5 thread ⏚ (identification; tightening torque: 5 Nm). The required screws M5x12 are part of the scope of delivery.
- The equipment grounding conductor is connected directly to the device and not via the connection point X3 (see description of the wire connection).

7.2.3 X3, Mains connection

- Measure the required cross section of the connection cables according to the determined phase current ILN and the mains fuse.
- For single-phase mains connection (phase conductor and neutral conductor):
  Connection via X3 can be made via L1, L2 or L3.
- Ensure that the connection terminals of the device in the control cabinet are strain-relieved.
- Observe the notes in the configuration description R911322209 for the use of line filters and other measures to minimize interference.

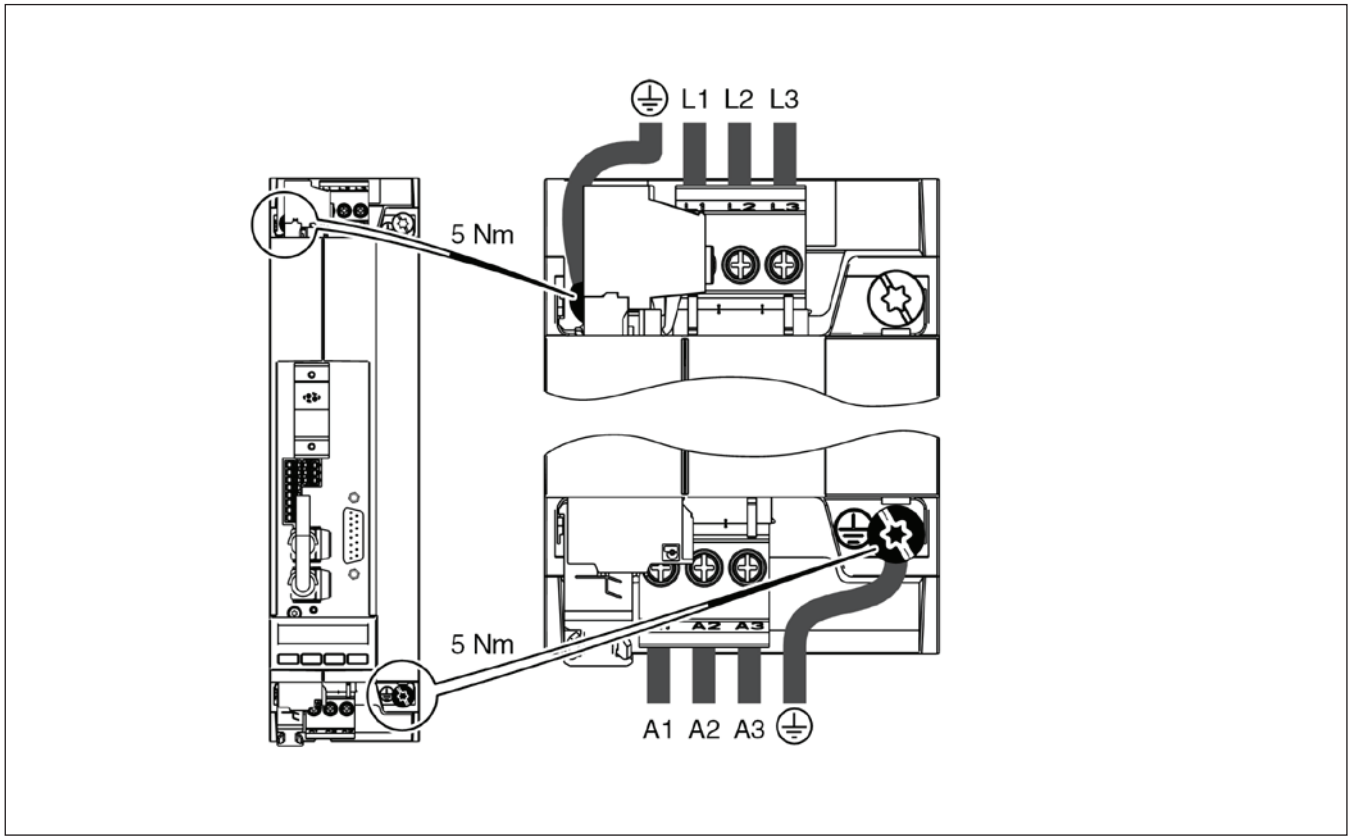


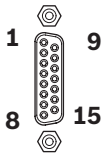
Fig. 8: **X3, Mains connection**

L1, L2, L3 Mains connection
A1, A2, A3 Motor connection

7.2.4 X4, Motor encoder connection

▶ For connection between the servo drive and the motor, preferably use the supplied motor encoder cable.

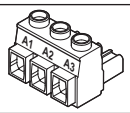
Table 6: X4

	**X4**	Motor encoder connector

7.2.5 X5, Motor connection

▶ For an optimum shield connection of the motor power cable, use the supplied accessories HAS09.

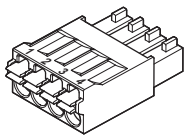
Table 7: X5

	**A1**	for line terminal U1 at the motor
	A2	for line terminal V1 at the motor
	A3	for line terminal W1 at the motor

7.2.6 X6, Motor temperature monitoring and motor holding brake

- Via an integrated switching device (BR), the power unit switches the voltage of the external 24 V power supply to the output for controlling the motor holding brake.

Table 8: X6

	**1**	MotTemp+	Motor temperature monitoring input
	2	MotTemp-	
	3	+24 VBr	Output for controlling the motor holding brake
	4	0 VBr	

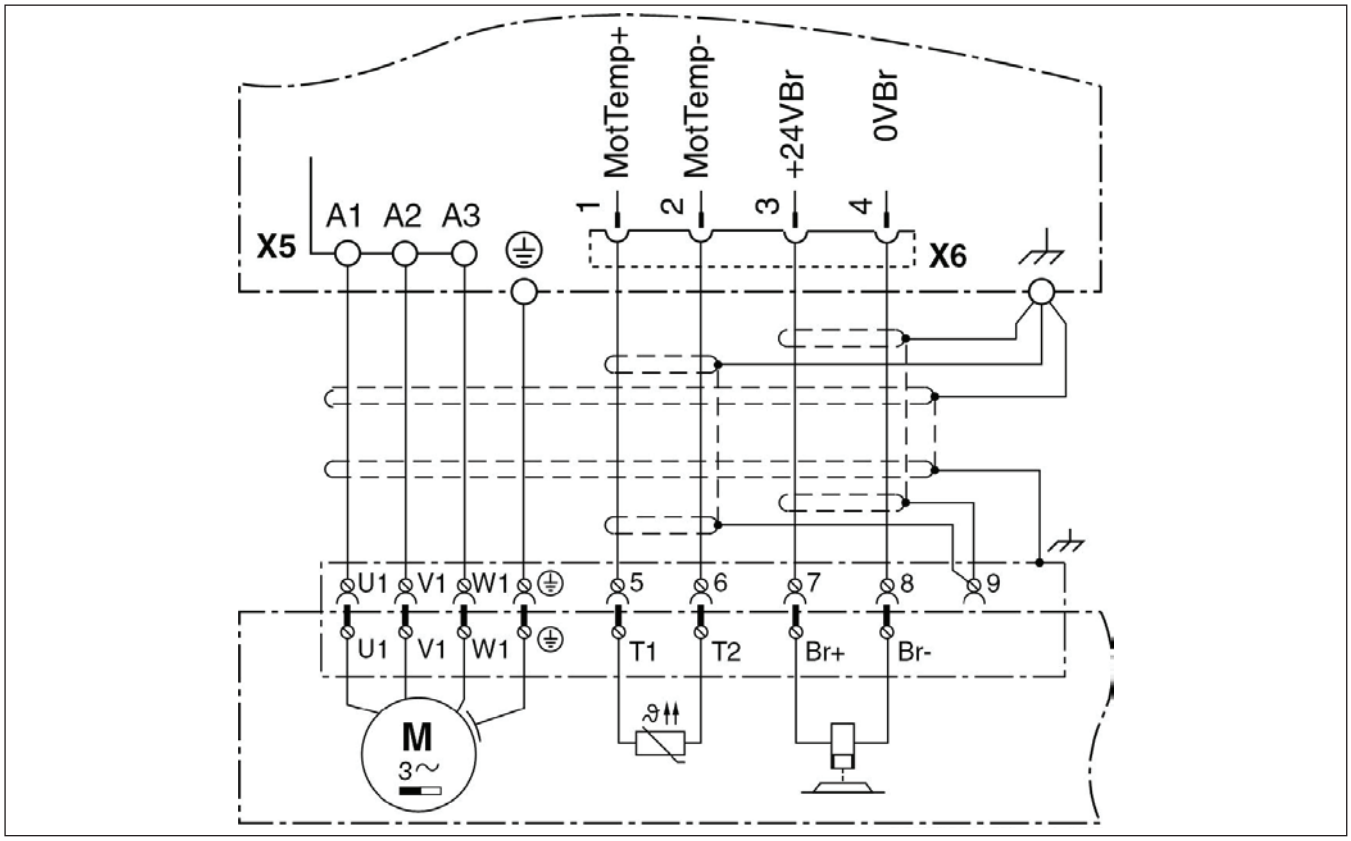


Fig. 9: **Motor temperature monitoring**

7.2.7 X9, Integrated brake resistor

- X9 is used to connect the integrated brake resistor (HRL).

▶ Only operate the device with the attached connection plugs (even if there are no lines connected to the connection plugs).

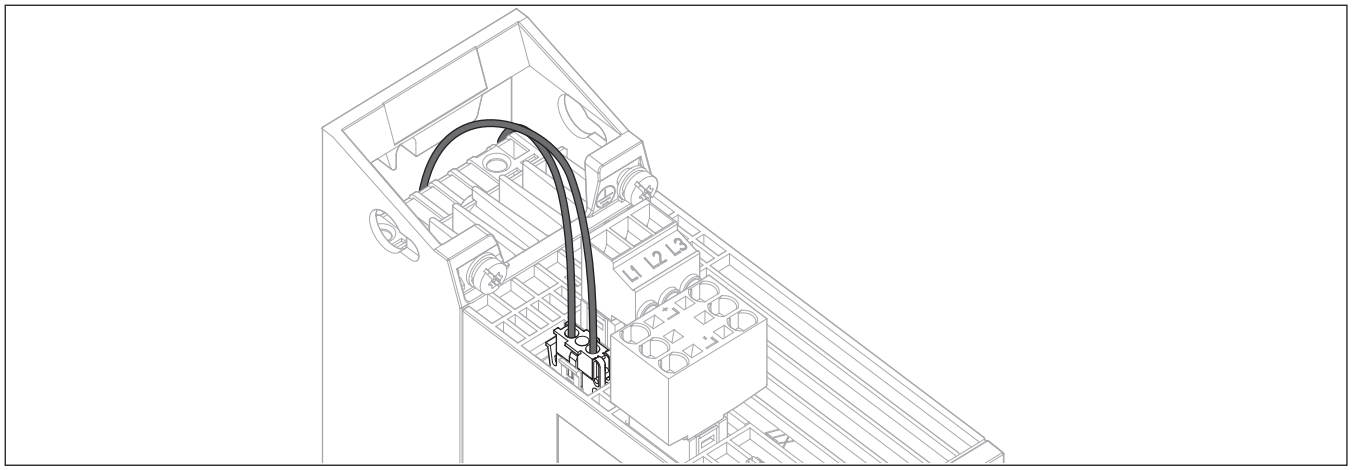


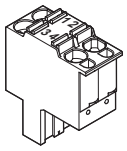
Fig. 10: **Integrated brake resistor**

7.2.8 X13, 24 V Power supply (control voltage)

The external 24V supplied via connection point X13 for

- the controller and servo amplifier of the drive control unit
- the brake control according to X6
- the digital inputs and the digital output according to X31 / X32

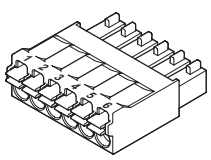
Table 9: X13

	**1**	0 V	Reference potential for the power supply
	2	0 V	
	3	+24 V	Power supply
	4	+24 V	

7.2.9 X31, Digital inputs / outputs

- The reference potential of all inputs refers to the reference potential of the control voltage supply at connection X13.
- Connection 8 can optionally be used as a digital input or output.
- The output current of the digital output (connection 8) is max. 500 mA.
- The configuration of the digital inputs / outputs can be changed in the Smart Function Kit software.
- Connection 3 is pre-assigned as an E-Stop and can be deactivated in the software if required after installation.

Table 10: X31

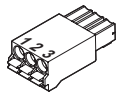
	**1**	I_1	
	2	I_2	
	3	I_3	preconfiguration E-Stop
	4	I_4	Digital input
	5	I_5	
	6	I_6	
	7	I_7	
	8	I/O_8	Digital input / output

The E-Stop function is used to shut down the drive with a selectable drive reaction via a digital input of the drive controller. The polarity of the input cannot be selected. It is always active when the signal = 0 V. This means that 0 V at the digital input causes the E-Stop to trigger. ➠ 7.2.12.

7.2.10 X32, Analog input

- For the connection "Analog input" ➠ 7.4 Installation of the force sensor" on page 26

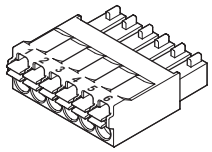
Table 11: X32

	Permissible input voltage	**V**	-30	+30
	Working range input voltage	**V**	-10	+10
	Bandwidth	**kHz**	1.3	
	Resolution	**Bit**	14	
	Cable		Use only shielded cables for cable lengths > 30 m.	

7.2.11 X47, Bb relay contact

▶ Wire the relay contact Bb (connection 1 and 2) in the control circuit of the mains connection. If the contact opens, the mains contactor must interrupt the power supply.

Table 12: X47

	**1**	Rel1	Relay contact Bb
	2	Rel2	Relay contact Bb

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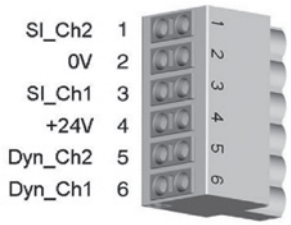
7.2.12 X49, Safety technology L3 / Safe Torque Off

Table 13: X49

	1	SI_Ch2	Input for selection of channel 2
	2	0V	GND reference of inputs and outputs
	3	SI_Ch1	Input for selection of channel 1
	4	+24V	Dynamization outputs power supply
	5	Dyn_Ch2	Channel 2 dynamization output
	6	Dyn_Ch1	Channel 1 dynamization output

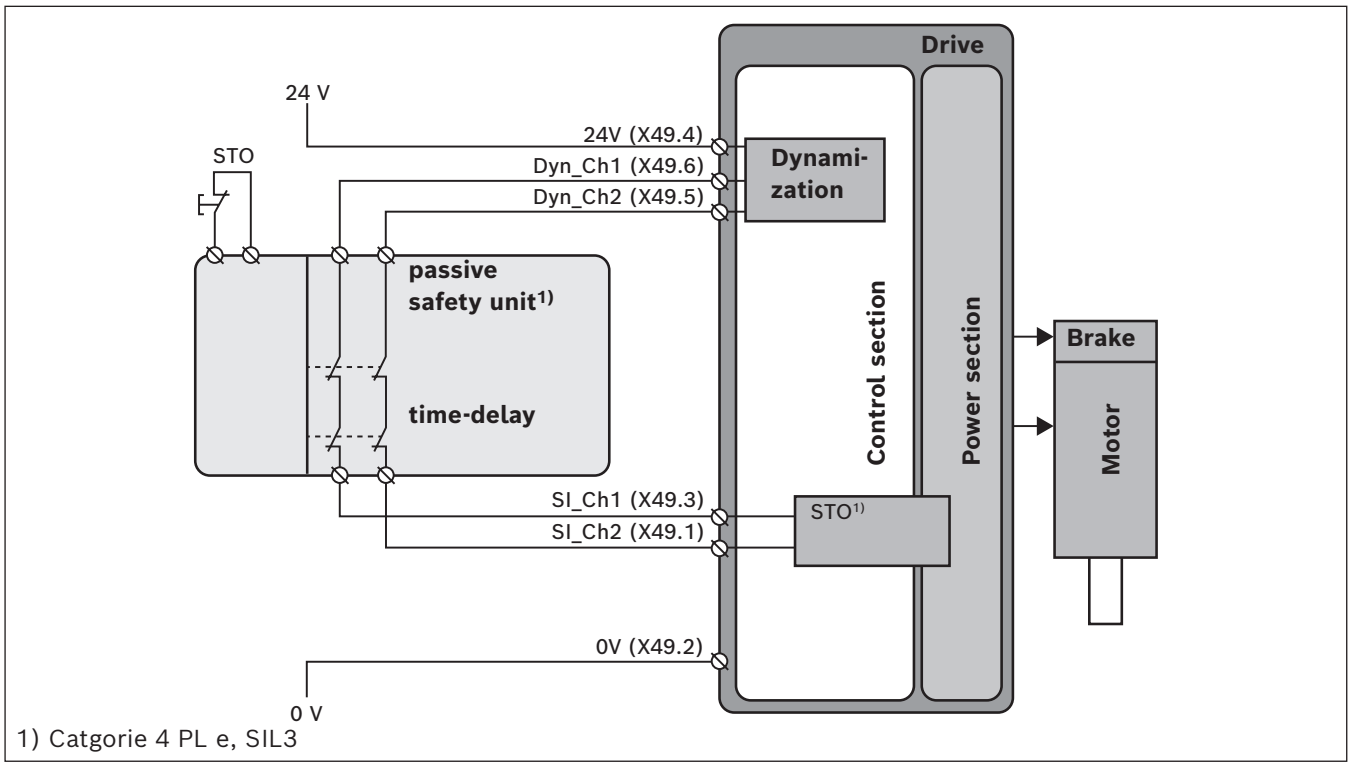
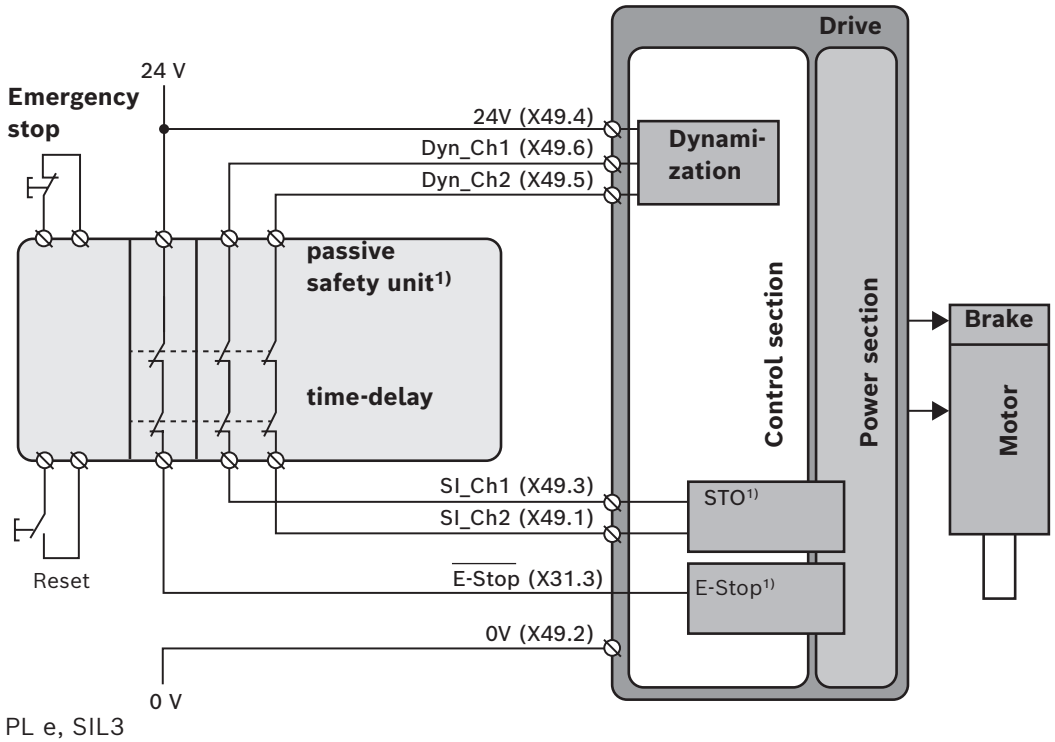


Fig. 11: **Application example: STO function with dual-channel wiring and passive safety unit**

Using the E-Stop function of the drive (or the NC stop of the control unit), the STO function can be extended to obtain the “Safe stop 1 (Emergeny stop)” function. For this purpose, the selecting safety unit (active or passive) first has to shut down the drive by means of the E-Stop function (or the NC stop of the control unit) and select the STO function after a fixed time that has been set is over. The selection always has to take place after the time that has been set, independent of the axis state.

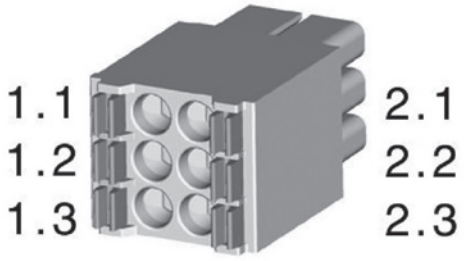


1) Catgorie 4 PL e, SIL3

Fig. 12: **Application example for Safe stop 1 function with dual-channel wiring and passive safety unit**

7.2.13 X41, Safety technology S4 / Safe Motion

Table 14: X41

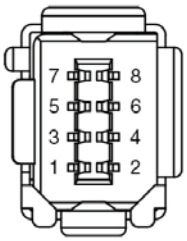
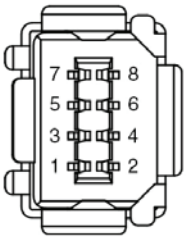


1.1	SI_Out_Ch2	Safe output channel 2
1.2	0V	Power supply of inputs/outputs (U_{ext})
1.3	SI_Out_Ch1	Safe output channel 1
2.1	SI_In_Ch2	Input 2
2.2	24V	Power supply of inputs/outputs (U_{ext})
2.3	SI_In_Ch1	Input 1

7.2.14 X42, X43 Safety technology S4 / Safe Motion

The safety functions of Safe Motion can be selected via the safe inputs of the safety zone module “HSZ01”. For this purpose, the safety zone module “HSZ01” has to be connected to the axis of the safety zone via the zone bus (X42, X43). The “HSZ01” safety zone module makes available 2 x 8 digital inputs for dual-channel collective selection, or 16 inputs for single-channel selection of the safety zone (see chapter 7.5 “Installation of the “HSZ01” safety zone module).

Table 15: X42/X43

X42: 	X43: 	X42 X43	Connection points for connecting the HSZ01[1)] safety zone module and the safety zone nodes: X42: Input X43: Output

1) For more information see project planning description "IndraDrive additional components and accessories (R911306139 chapter 18).

EN

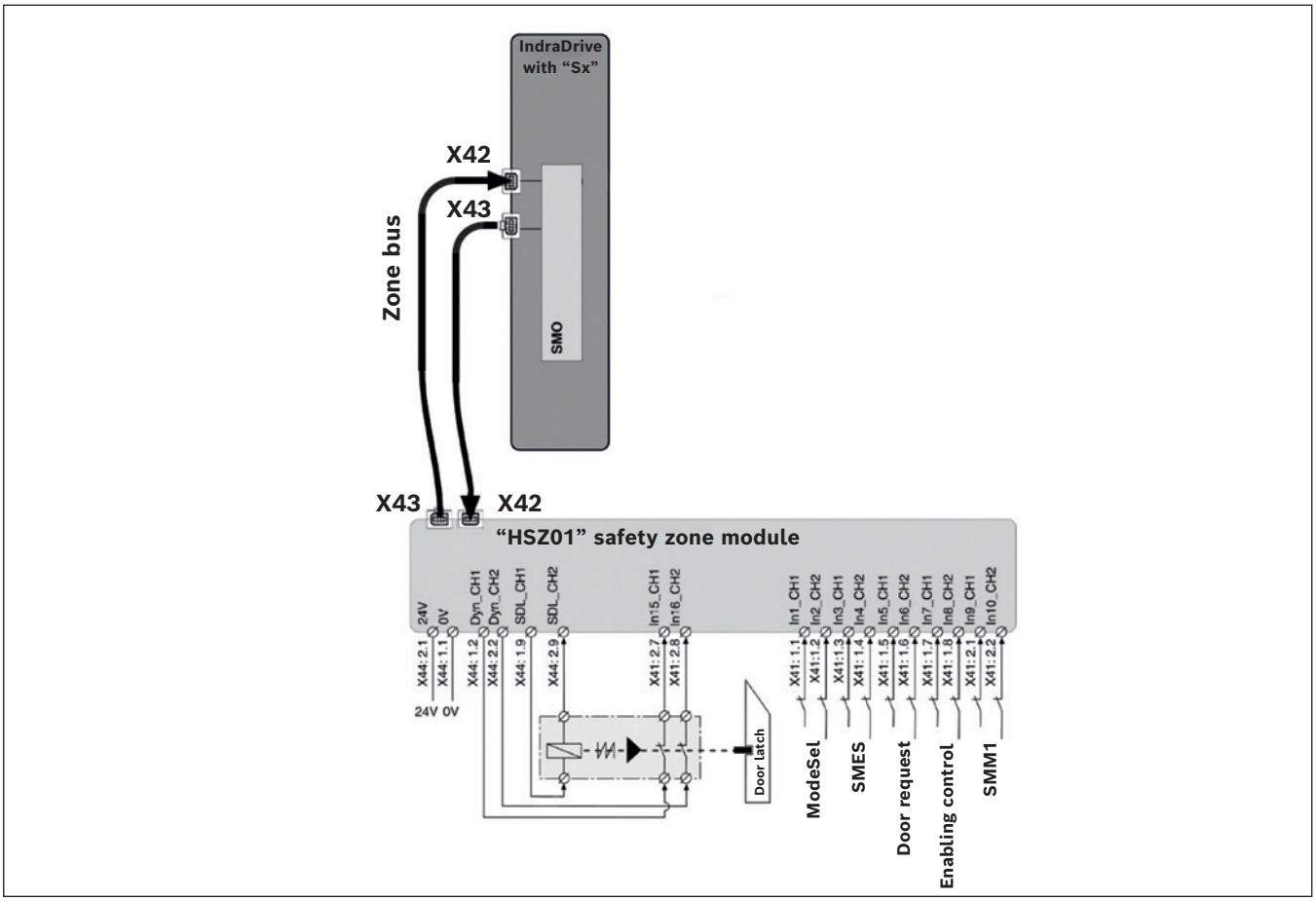


Fig. 13: Example of zone setup with door locking

7.2.15 Installation of the HZS01 safety zone module

For more information see project planning description "IndraDrive additional components and accessories (R911306139 chapter 18).

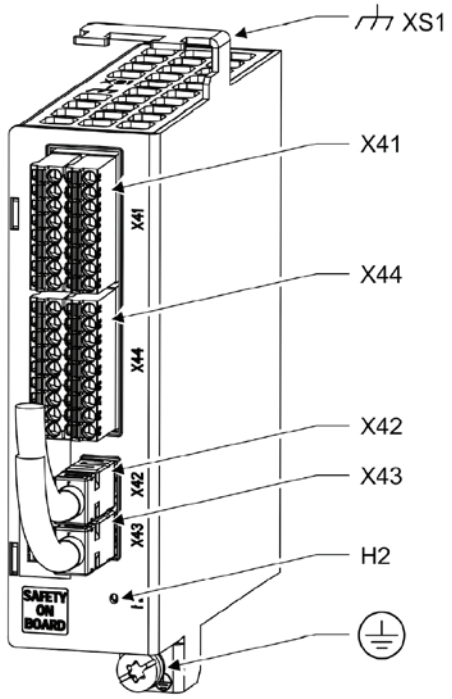
Table 16: HSZ01

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

Features:

- 2 × 8 digital inputs for dual-channel collective selection of the safetyfunctions at the safety zone nodes or 16 inputs for single-channel selection.
- 2 × 1 digital dynamized output (1 output pair) for safety zone acknowl-edge, if all safety zone nodes signal safety.
- 2 × 1 digital dynamized output (1 output pair) for safety zone error, if atleast one safety zone node signals an error.
- 2 × 1 digital dynamized output (1 output pair) for monitoring the wiring.
- 2 × 1 digital output (1 output pair) for controlling the safe door locking
- Galvanic isolation exists between the inputs and outputs of the safetyzone module and the other nodes of a safety zone.

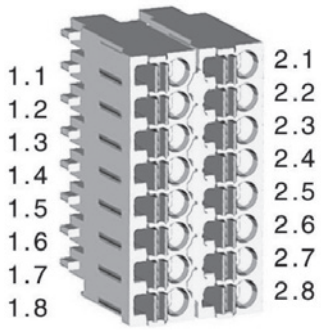
Table 17: Connection points



XS1	Shield connection
X41	Digital inputs
X42	Communication input
X43	Communication output
X44	Digital outputs Control voltage supply connection
⏚	Equipment grounding conducto
H2 (LED)	Status display (bicolor LED)

7.2.16 X41, Digital inputs

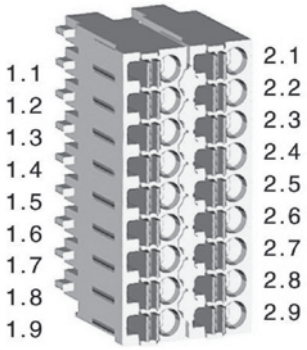
Table 18: X41, igital inputs

	X41	Safe Motion

Connection	Signal name	Function	Dynamization	Input pair
1.1	In_1	Input 1	DYN_Ch1	1
1.2	In_2	Input 2	DYN_Ch2	
1.3	In_3	Input 3	DYN_Ch1	2
1.4	In_4	Input 4	DYN_Ch2	
1.5	In_5	Input 5	DYN_Ch1	3
1.6	In_6	Input 6	DYN_Ch2	
1.7	In_7	Input 7	DYN_Ch1	4
1.8	In_8	Input 8	DYN_Ch2	
2.1	In_9	Input 9	DYN_Ch1	5
2.2	In_10	Input 10	DYN_Ch2	
2.3	In_11	Input 11	DYN_Ch1	6
2.4	In_12	Input 12	DYN_Ch2	
2.5	In_13	Input 13	DYN_Ch1	7
2.6	In_14	Input 14	DYN_Ch2	
2.7	In_15	Input 15	DYN_Ch1	8
2.8	In_16	Input 16	DYN_Ch2	

7.2.17 X41, Digital outputs

Table 19: X41, Digital outputs

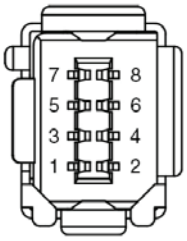
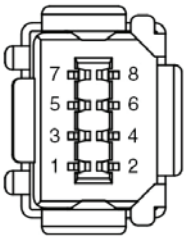
	X44	Safe Motion

Function	Connection	Signal name	Technical data
Power supply	2.1	24V	Voltage: DC 19,2 ... 30 V[1)]
Power supply	1.1	0V	Reference potential of power supply
Channel 1 zone error output	1.7	SZE_Ch1	• High on both outputs:All nodes are without error • Low on both outputs:At least one node has an error
Channel 2 zone error output	2.7	SZE_Ch2	
Channel 1 zone safety output	1.8	SZA_Ch1	• High on both outputs: All nodes are safe • Low on both outputs: At least one node is not safe
Channel 2 zone safety output	2.8	SZA_Ch2	
Safe door locking output, channel 1	1.9	SDL_Ch1	Output pair for controlling a door locking device. When the door latch is correctly controlled,SDL_Ch1 = High and SDL_Ch2 = Low.
Safe door locking output, channel 2	2.9	SDL_Ch2	
Channel 1 dynamization output	1.2	DYN_Ch1	One output pair for dynamization of the external wiring. To simplify the wiring, the connection of the output pairexists several times.
Channel 2 dynamization output	2.2	DYN_Ch2	
Channel 1 dynamization output	1.3	DYN_Ch1	
Channel 2 dynamization output	2.3	DYN_Ch2	
Channel 1 dynamization output	1.4	DYN_Ch1	
Channel 2 dynamization output	2.4	DYN_Ch2	
Channel 1 dynamization output	1.5	DYN_Ch1	
Channel 2 dynamization output	2.5	DYN_Ch2	
Channel 1 dynamization output	1.6	DYN_Ch1	
Channel 2 dynamization output	2.6	DYN_Ch2	

1) If the door locking device requires a tighter tolerance of thevoltage, the power supply unit used has to comply with the tol-erance of the door locking device.

7.2.18 X42 and X43, Safety technology Safe Motion (communication)

Table 20: X42 and X43

X42: 	X43: 	X42 X43	Connection points for connecting the HSZ01[1)] safety zone module and thesafety zone nodes: X42: Input X43: Output

1) For more information see project planning description "IndraDrive additional components and accessories (R911306139).

7.2.19 LED H2

Table 21: LED H2

LED	Color	Description
H2	 aus	• Power supply missing • Device defective
	 Permanently litgreen	Device functions without error
	 Flashing red	Errors present: See diagnostic display (e. g. F3152) on the drive controller- Fixing: See firmware documentation "Diag. Messages“
	 Permanently litred	• Hardware error • Firmware error • Communication error; Diagnostic display: F7033

EN

7.2.20 Shield connection

- Special plates are used for the shield connection for cables that are connected to the device. The sheets are part of the scope of delivery and are screwed to the device.
- The shield connection is not used for relieving the strain on the cables. Install a separate strain relief near the servo drive unit.

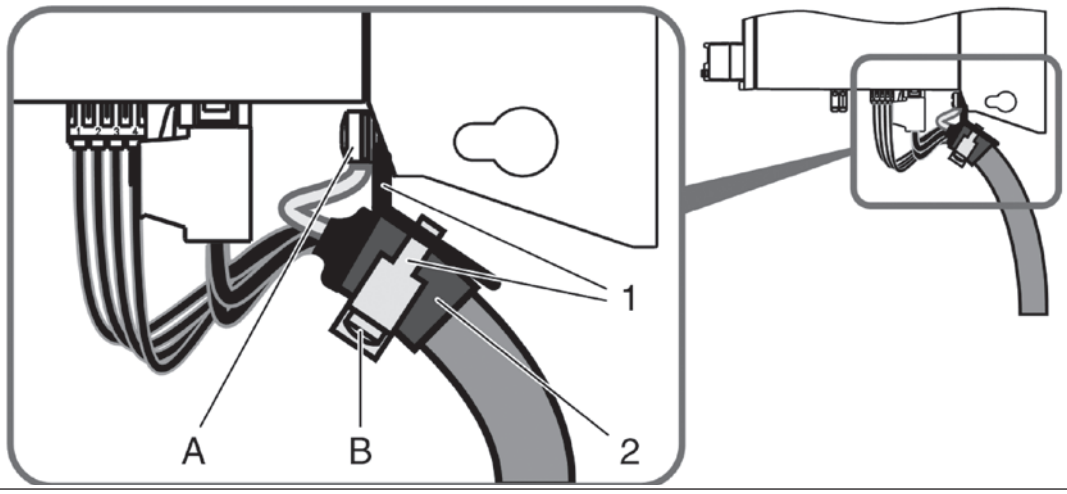


Fig. 14: **Shield connection**

1 Plates
2 Shield of the motor cable
3 Screw (M5x12 or M5x16); tightening torque 5 Nm
4 Screw (M5x30); tightening torque 1 Nm

7.2.21 Control panel and SD card

- The control panel on HCS01 shows operating states, command and error diagnoses and pending warnings.
- The system only works with the attached operating panel.
- Only use the supplied microSD card.
- Insert the microSD card only when the system is switched off at the side of the operating panel.
- The system only works with the inserted microSD card.

Fig. 15: **Operating panel**

⚠ CAUTION

Changes to the contents of the microSD card.

Restriction of the system function.

- Do not change the contents and structure of the microSD card manually.

7.3 Installation of the industrial PC PR21

7.3.22 Industrial PC PR21 device overview

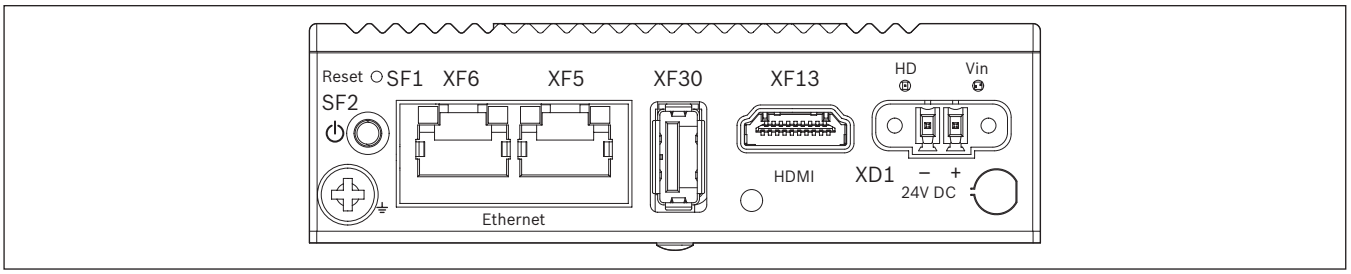


Fig. 16: **Connection**

XD1	Power supply
SL1	Grounding conductor connection
XF5/XF6	Ethernet port
XF13	HDMI monitor port
XF30	USB 3.0 port

EN

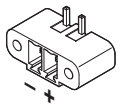
7.3.23 SL1, Grounding conductor connection

- Connect a grounding conductor to connection SL1 in the industrial PC PR21. Use a cable lug on the protective conductor.

7.3.24 XD1, 24 V Power supply (control voltage)

- For connection of the 24 V power supply, use the supplied 24 V connection terminal.

Table 22: X13

	①	+24 V supply voltage
	②	0 V supply voltage

7.3.25 XF5, Connection between HCS01 servo drive and industrial PC PR21

- For the network connection between industrial PC PR21 and HCS01 drive controller, use a Cat5e network cable.
- The connection can optionally be established directly or via an intermediate switch.
- On PR21, use connector XF5.
- On HCS01, use connector X26.

7.4 Installation of the force sensor

- Do not place the connection cable parallel to the power and control lines.
- Do not place the connection cable near transformers, motors and contactors.
- Connect all devices (force sensor and drive controller HCS01) to the same grounding conductor.
- Use the supplied connection cable. If this is not possible, use a suitable low-capacity connection cable with shielding.
- Connect the shielding of the sensor cable to ground

Table 23: Analog input connection

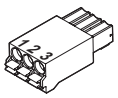
	Connection			Cable color	Assignment
	**2**	I_a_1–	Analog input connection 2	BU	S-
	3	I_a_1+	Analog input connection 3	BK	S+

Table 24: Force sensor contact assignment

	Power supply	Output	GND
Force sensor, female connector M12x1	Pin 1/BN	Pin 4/BK	Pin 3/BU

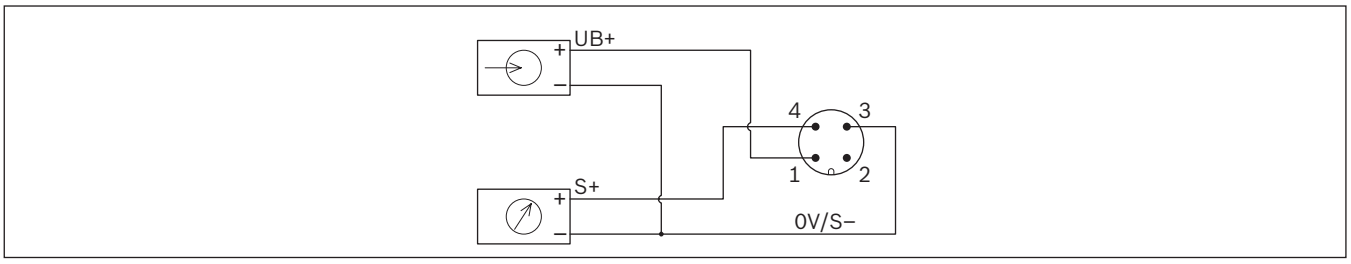


Fig. 17: **Force sensor contact assignment**

- Connect pin 1 of the force sensor with the +24 V power supply.

7.5 Connection of the HMI terminal device

7.5.1 Requirements

The Smart Function Kit provides an intuitive, web-based HMI for commissioning, configuration and programming of the system.

The following requirements apply for the required customer-supplied HMI device (e.g. notebook, tablet):

- Web browser with HTML5 and Java Script support e.g. Firefox version 52 or higher, Chrome version 74 or higher
- Screen resolution 1280 x 720 px or higher
- Recommended screen size 10 inches (format 16:9) or larger

7.5.2 Direct connection to the Smart Function Kit

- For the network connection between industrial PC PR21 and the HMI device, use a Cat5e network cable.
- On PR21, use connector XF6.
- There must be a valid TCP / IP network connection between the HMI device and industrial PC PR21 (observe the network settings on the HMI device and adjust if necessary).

7.5.3 Setting the IP addresses

The system is configured with the following network settings by default:

- XF5 192.168.1.100
- X26 192.168.1.1
- XF6 192.168.0.1 (access to HMI)

- Subnet mask 255.255.255.0

The IP address for access to HMI (interface XF6) can be changed on the interface of the Smart Function Kit. The address section 192.168.1.x cannot be used.

7.6 Connection of a higher-level control system

The Smart Function Kit can be connected with a higher level control system via a field bus and then be controlled and monitored by it. In this configuration, the Smart Function Kit is the field bus slave and the higher-level control system is the field bus master.

The system supports the following field bus protocols:

- Sercos III
- EtherCAT
- Ethernet/IP
- Profinet

Use the Multi-Ethernet connector X22/X23 on HCS01 for connection with a higher-level control system. For connection between the devices, use a Cat5e network cable.

The field bus IP address of the system can be changed via the display on HCS01. The address section 192.168.1.x cannot be used.

For further information on the integration of the field bus ➠ See "Smart Function Kit software" instructions.

7.7 Connection to the IT infrastructure

⚠ CAUTION

Unauthorized access to the product via network connection.

From malfunctions and data loss to damage to the product.

- ▶ Protect the network against unauthorized access by using a firewall or a Virtual Private Network (VPN), for example.
- ▶ Take appropriate measures to prevent internet connection.

For integration into an IT system, the Smart Function Kit must be integrated in the corresponding network.

For this connection, use interface XF6 on PR21.

The IP address for interface XF6 can be changed on the interface of the Smart Function Kit. The address section 192.168.1.x cannot be used.

The operation of installations, systems and machines requires the implementation of an integral concept for state-of-the-art IT security. Bosch Rexroth products are part of this integral concept.
Bosch Rexroth product characteristics have to be taken into consideration in an integral IT security concept.
The relevant characteristics are documented in the IT security guideline (R911342562).

8 Commissioning / operation

⚠ WARNING

Risks related to moving parts!

Moderate injury, including severe flesh wounds, puncture wounds and severe bruising.

- Never reach into moving parts.

Risk of break-up during operation!

Death or serious injury.

- Do not expose the product to any mechanical loads under any circumstances.

Risk of electrical shocks through touching live parts!

Death or serious injury.

- Before working on the electrical equipment, switch off the power supply and secure it against being switched on again.

The Smart Function Kit must not be put into service until it has been verified that the final product (for example a machine or system) into which the Rexroth product has been installed complies with the country-specific requirements, safety regulations and standards for the application.

⚠ CAUTION

Hot surfaces with temperatures above 60 °C.

Risk of burns

- Do not touch hot surfaces.
- If required, install a guard to prevent accidental contact.
- Protect from burns by wearing appropriate protective clothing, e.g. heat-resistant gloves.

Increased noise build-up!

Continuous exposure can lead to damage to hearing.

- If excessive noise is generated, wear ear protectors and check for any damage.

Slipping on escaping lubricants!

Slipping.

- Take suitable precautions to collect any escaping lubricant and dispose of it in the proper way.

Commissioning for the first time

The system must be fully wired and switched on when commissioning it for the first time. After switching on the system, it takes approx. 100 seconds to start up completely.

- Ensure that your HMI device or a commissioning PC is connected with the network of the Smart Function Kit (➠ 7.5 "Connection of the HMI terminal device").
- Check the network settings of your HMI device (➠ 7.5 "Connection of the HMI terminal device").
- Open your web browser and enter the IP address of the Smart Function Kit (standard: 192.168.0.1). The web browser will now automatically connect to the Smart Function Kit.
- Depending on the security settings of your web browser and on the browser, a security warning to be confirmed will appear during connection establishment.
- Depending on the configuration of the browser, it may be necessary to delete its cache.

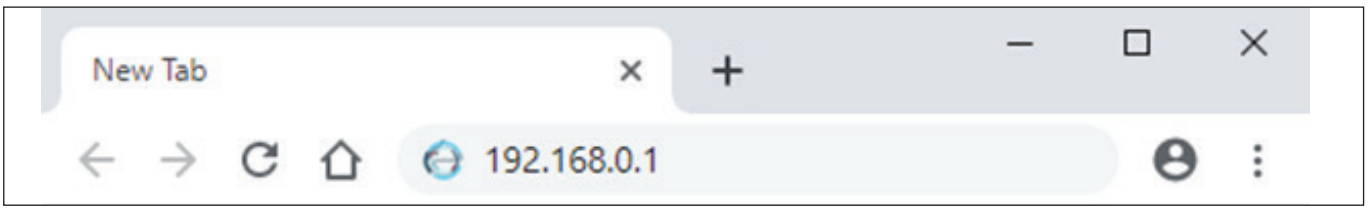


Fig. 18: **Entering the IP address**

8.1 Checking the operating conditions

Observe ambient temperature, load, speed and stroke ➠ chapter "Operating conditions".

8.2 Commissioning (trial run, running in)

NOTICE

Malfunction of the product!

Damage to the product.

- ▶ Only start up the product after running successful tests under simulated production conditions.
- ▶ Move at low speed over the entire travel distance.
- ▶ Optimize the interaction of the mechanical system and the electronics.

8.3 Operation

NOTICE

Escaping lubricants and anti-corrosion medium

Damage to the environment.

- ▶ Take suitable precautions to collect any escaping lubricant and dispose of it in the proper way.

For further information for operation of the system ➠ See "Smart Function Kit software" instructions.

9 Maintenance and care

9.1 Regular maintenance work

- Check all plug and clamping connections of the components at least once a year for proper fit and damage.
- Check for possible cable breaks and crushed lines.
- Damaged parts must be exchanged immediately.

9.2 CMOS battery industrial PC PR21

The CMOS battery has a service life of 5 to 7 years.

For battery change, observe the instructions in the PR21 product manual.

9.3 Maintenance of the force sensor

The force sensor is maintenance-free.

The technical specifications of the sensor are valid for 10 million measurement cycles.
The manufacturer may check and calibrate the sensor. In this case, please contact the Bosch Rexroth service.

9.4 Lubrication of the Electromechanical Cylinder EMC

For lubrication, observe ➠ the instructions in the "Electromechanical Cylinder EMC" product manual.

⚠ CAUTION

Contact with escaping lubricants and anti-corrosion medium.

Irritation or redness of the affected skin area

- Use appropriate protective equipment to protect against contact with any lubricants or anti-corrosion medium.
- Observe safety data sheet of the lubricant used.

Lubrication of the Smart Function Kit is restricted to lubrication of the Ball Screw Assembly using a conventional manual grease gun or for greasing option LCF with a central lubrication system with semi-fluid grease.

Basic lubrication is carried out by the manufacturer. Initial lubrication is only necessary for greasing option LPG.

For lubrication, observe ➠ the instructions in the “Electromechanical Cylinder EMC” product manual.

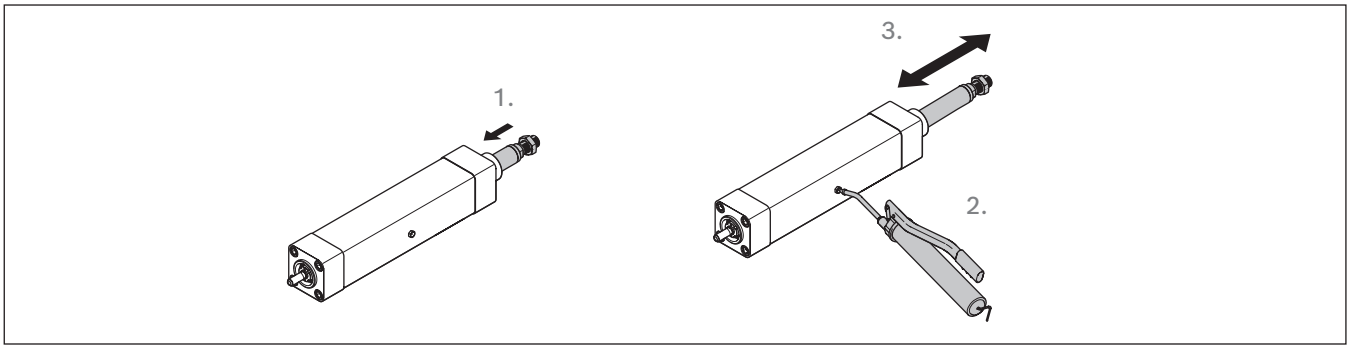


Fig. 19: **Lubrication of the EMC**

1. In order to reach lubrication position L_{Lub}, move to position S_1 as per table.
2. Apply grease to the Ball Screw Assembly via the lube nipple. Apply the entire relubrication quantity in one go as per table.
3. Extend and retract the piston rod over its entire travel range for three full cycles.

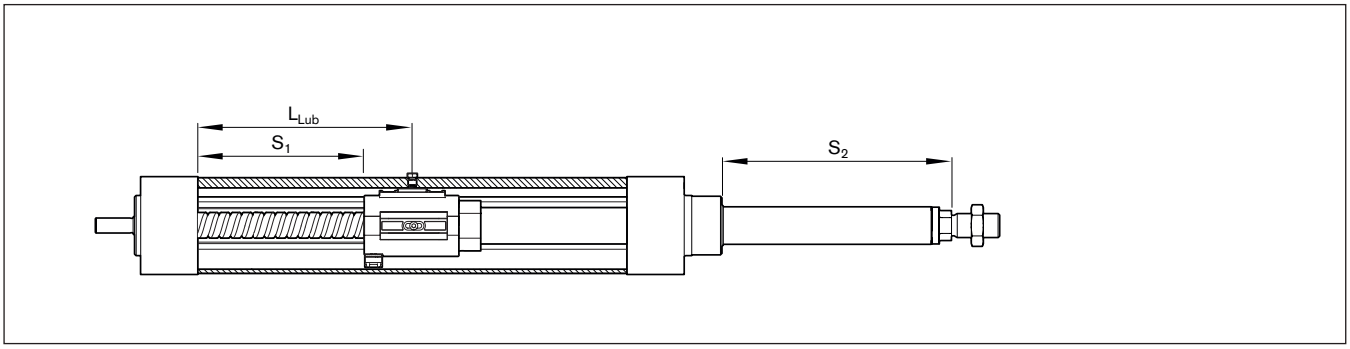


Fig. 20: **Lubrication position**

Table 25: Relubrication

EMC	P (mm)	S_1 (mm)	Relubrication interval (km)	Relubrication quantity (cm^3)
32	5	18.5 + $s_{max}/2$	250	0.4
	10	15.5 + $s_{max}/2$	500	0.4
40	5	13.1 + $s_{max}/2$	250	0.8
	10	14.5 + $s_{max}/2$	500	1.1
	16	12.0 + $s_{max}/2$	800	1.5
50	5	7.0 + $s_{max}/2$	250	1.2
	10	7.0 + $s_{max}/2$	500	1.9
	20	7.0 + $s_{max}/2$	1,000	3.0
63	5	7.0 + $s_{max}/2$	250	1.9
	10	7.0 + $s_{max}/2$	500	2.3
	25	7.0 + $s_{max}/2$	1,250	4.2
80	5	7.0 + $s_{max}/2$	250	2.7
	10	4.5 + $s_{max}/2$	500	3.8
	20	4.5 + $s_{max}/2$	1,000	4.3
	32	4.5 + $s_{max}/2$	1,600	6.7
100	5	4.9 + $s_{max}/2$	250	3.7
	10	7.5 + $s_{max}/2$	500	8.2
	20	1.5 + $s_{max}/2$	1,000	10.6
	40	1.5 + $s_{max}/2$	2,000	17.5
100XC	10	12.3 + $s_{max}/2$	100	13.2
	20	15.4 + $s_{max}/2$	200	12.4

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10 Disposal

10.1 Redemption

Products manufactured by Bosch Rexroth can be returned free-of-charge for disposal. However, a prerequisite for this is that there are no objectionable films such as oil, grease or other contamination on the device. Moreover, the device must be free of inordinate foreign materials and / or components.

Please send the products carriage paid to the following address:

Bosch Rexroth AG
Linear Motion Technologies
Ernst-Sachs-Straße 100
97424 Schweinfurt

10.2 Packaging

Packaging materials consist of cardboard, wood, and expanded polystyrene. They can be easily recycled at any point of acceptance. For ecological reasons, please refrain from returning the packaging.

10.3 Product

The product and its components must be disposed of correctly and in compliance with all applicable national and international guidelines and regulations. Collect any leaking lubricant and dispose of it properly.

10.4 Batteries and accumulators

Batteries and accumulators can be marked with this symbol. The symbol of the crossed-out waste bin on wheels indicates that batteries are to be collected separately. Within the EU, the end user is legally obliged to return used batteries. The relevant regulations must be observed outside of the validity of the EU Directive 2006/66/EC. Used batteries may contain toxic substances that can harm the environment or human health if not stored or disposed of properly. The batteries or accumulators contained in Rexroth products are to be properly disposed after use, according to the country-specific return systems.

10.5 Recycling

Due to the high metal content, the products can mostly be recycled. To achieve an optimum metal recovery, dismantling into individual assemblies is required.

11 Service and support

We have a dense global service network for fast and optimal support. Our experts will be happy to assist you in any way they can. You can reach us 24/7 – even on weekends and holidays.

Service Germany

You can reach our service hotline and our service helpdesk under:

Phone: +49 9352 40 5060

Fax: +49 9352 18 4941

E-mail: service.svc@boschrexroth.de

Internet: http://www.boschrexroth.com

Supplementary notes on service, repair work

(e.g. delivery addresses) and training can be found on our Internet pages.

Worldwide service

If you are located outside of Germany, please contact your contact person first. Hotline numbers can be found with the sales addresses in the Internet.

Information preparation

We will be able to help you quickly and efficiently if you have the following information ready:

- A detailed description of the malfunction and conditions
- Information on the name plate of the affected product, particularly the type code and serial numbers
- Your contact information (phone and fax number and email address)

12 Operating conditions

Observe the information on the environmental and operating conditions as stated in the product catalogs. Otherwise, a function and safety warranty cannot be assumed generally. For special environmental conditions, please consult us.

Table 26: Normal operating conditions

Operating conditions	Value (max.)	Unit
Storage ambient temperature	-20 ... +55	°C
Operation ambient temperature:		°C
- EMC cylinder	-10 ... +50	
- Force sensor	-10 ... +50	
- MS2N motor	0 ... +50 (loss of performance from +40)	
- HCS01 drive controller	0 ... +50 (loss of performance from +40)	
- PR21 industrial PC	0 ... +50	
Travel speed	0.3 – 0.5 (depending on the version)	m/s
Acceleration	12 ... 50 (see EMC catalog)	m/s^2
Minimum travel range	> s_{min} (see EMC catalog)	mm
Maximum travel range	400 (optionally up to 1,500 possible)	mm
IP protection class:		
- EMC cylinder	IP54 (IP65 as an option)	
- Force sensor	IP67 (only with connected cable)	
- MS2N motor	IP64	
- HCS01 drive controller	IP20	
- PR21 industrial PC	IP40	

12.1 Tightening torques

Bolts of strength class 8.8 are used as standard. Any deviations are marked accordingly.

Table 27: Tightening torques

8.8	M2	M2.5	M3	M4	M5	M6	M8	M10	M12
$M_{A\ max}$ (Nm) μ = 0.125	0.4	0.7	1.3	2.7	5.5	9.5	23	46	80

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