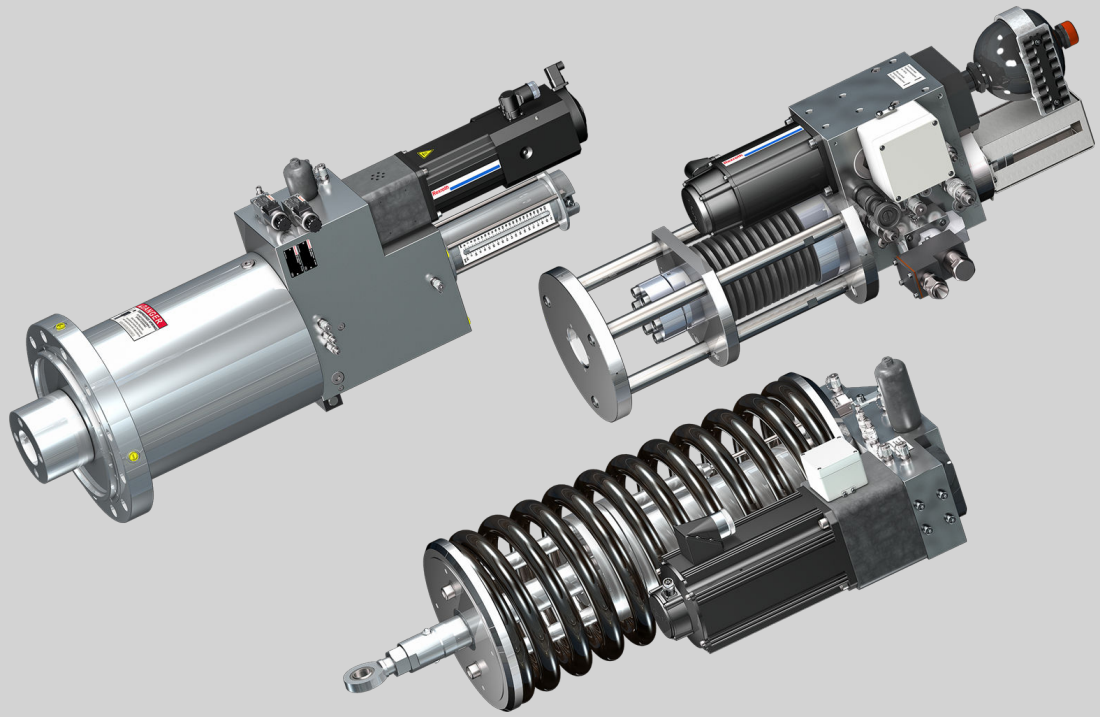
rexroth
A Bosch Company

EMAH Actuator

Type EMAH...1X/...N...

Operating instructions
RE62268-B/11.20

Edition 2



Title	EMAH Actuator Type EMAH...1X/...N...
Type of Documentation	Operating instructions
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Disclaimer The data specified only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. Content of the documentation and availability of products are subject to revision.

The cover shows an example configuration. The product supplied may differ from the solution shown here.

The original operating instructions were prepared in German.

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Zum Eisengießer 1 ■ D-97816 Lohr a. Main

Phone +49 9352 403020

http://www.boschrexroth.com/

E-mail: my.support@boschrexroth.com

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1 About this documentation

1.1 Validity of the documentation

This documentation is valid for the following products:

- EMAH actuator type EMAH...1X/...N...

This documentation is intended for fitters, operators, service technicians, project planners, and plant operators. This documentation contains important information on the safe and proper mounting, transport, commissioning, operation, use, maintenance, demounting and simple troubleshooting of the EMAH actuator. Read this documentation completely and thoroughly, especially chapter chapter 2 "Safety instructions" on page 7, before working with the product.

1.2 Required and supplementary documentation

- Only deal with the product when you have the documentation identified with the book symbol 🕮 at hand and have observed it.

  The relevance of the listed documents may depend on the current product life phase or on the planned work step to be carried out.
- You can find the documentations on the Internet at www.boschrexroth.com/mediadirectory. Here you can enter the title or the document number of the documentation in the "search box".

	Title	Document number	Document type
🕮	System documentation from the system manufacturer		General information on the complete system
🕮	Order confirmation		Shows the scope of supply
🕮	Specification sheet		Contains the technical data of your EMAH actuator
🕮	Project planning guideline		Contains the electrical interfaces of the EMAH actuator to the drive controller (including accessories) that are relevant for the system as well as to the customer interface (relevant only in the case of scope of supply **without** control cabinet)
🕮	Electrical project planning (EPLAN Electric P8)		Contains the electrical circuit diagram, the parts list, the elevation of the mounting plate, etc. of the optional control cabinet. The plan comes with the control cabinet and is provided in the storage compartment of the control cabinet.
🕮	Installation drawing		Layout plan
🕮	Hydraulic circuit diagram		Schematic diagram
🕮	EVC platform software for EMAH actuators, basic functions	62268-FK	Application manual

	Title	Document number	Document type
🕮	EVC platform software for the EMAH actuator, applicative functions		Application manual
🕮	Hydraulic valves for industrial applications	07600-B	Operating instructions
🕮	Control cabinet: Air Conditioning, EMC, Design, IP Code, Electrics, IndraDrive, Rexroth EFC/Fv, Sytronix	R911344988	Project Planning Manual
🕮	Rexroth IndraDrive MPx-16 to MPx-20 and PSB Diagnostic Messages	R911326738	Reference Book
🕮	Rexroth IndraDrive MPx-16 to MPx-20 and PSB Parameters	R911328651	Reference Book
🕮	Rexroth IndraDrive MPx-20 Functions	R911345608	Application manual
🕮	Rexroth IndraDrive Drive Systems with HMV01/02 HMS01/02, HMD01, HCS02/03	R911309636	Project Planning Manual
🕮	Rexroth IndraDrive Supply Units, Power Sections HMV, HMS, HMD, HCS02, HCS03	R911318790	Project Planning Manual
🕮	Rexroth IndraDrive Additional Components and Accessories	R911306140	Project Planning Manual
🕮	IndraDrive Control Sections CSB02, CSE02, CSH02, CDB02	R911338962	Project Planning Manual
🕮	Rexroth IndraDyn S Synchronous Motors MSK	R911296289	Project Planning Manual
🕮	MS2N Synchronous Servomotors	R911347583	Project Planning Manual
🕮	Rexroth Connection Cables IndraDrive and IndraDyn	R911322949	Selection data
🕮	Rexroth IndraControl S20 System and Installation	R911335988	Application manual
🕮	Control cabinet Air Conditioning, EMC, Design, IP Code, Electrics IndraDrive, Rexroth EFC/Fv, Sytronix	R911344988	Project Planning Manual

Tab. 1-1: Required and supplementary documentation

1.3 Representation of information

In order that this documentation allows you to work directly and safely with your product, standardized safety notes, symbols, terms, and abbreviations are used. For a better understanding, they are explained in the following sections.

Safety instructions

In this documentation, safety instructions are contained in chapter 2 "Safety instructions" on page 7 and chapter 3 "General notes on damage to property and damage to the product" on page 15 and wherever sequences of actions or instructions are explained which bear the risk of personal injury or damage to property. The hazard avoidance measures described must be observed.

Safety instructions are structured as follows:

⚠ WARNING **Type and source of danger! and consequences in the case of non-observance**

Hazard avoidance measures

- **Warning symbol:** draws attention to a hazard
- **Signal word:** identifies the degree of hazard
- **Type and source of danger!:** identifies the type and source of hazard
- **Consequences:** describes the consequences in case of non-compliance
- **Precautions:** states, how the hazard can be avoided

⚠ 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.

Definition of terms

The following terms are used in this documentation:

Designation	Meaning
Control actuator	Complete system The control actuator basically consists of the drive unit and the drive controller with accessories.
Drive controller	Equipment The drive controller basically consists of the power section and the control section.
Drive unit	Assembly The drive unit basically consists of the cylinder unit, motor/pump group, control block, position measuring system and accumulator.

Designation	Meaning
EMAH actuator	Complete system General designation of a control or switching actuator
Switching actuator	Complete system The switching actuator basically consists of the drive unit and drive controller with accessories.

Tab. 1-2: Definition of terms

Designations

The following terms are used in this documentation:

Designation	Meaning
CA	*Control actuator*
CC	*Control cabinet*
EMAH	Electromechanical drive with hydrostatic transmission
IGV	*Inlet guide vane*
IndraWorks Ds	Bosch Rexroth service tool for drive commissioning
SA	*Switching actuator*
Trip	Technical term in power plant engineering; refers to the tripping of the emergency function (load shedding)

Tab. 1-3: Designations

Abbreviations used

The following abbreviations are used in this documentation:

Abbreviation	Meaning
ATEX	EU Directive on explosion protection
EN	European Standard
FBS	Feedback signal
GND	*Chassis ground*
HW	Hardware
IEC	*International Electrotechnical Commission*
IO	Inputs / outputs
ISO	*International Organization for Standardization*
L1, L2, L3	Phase conductors
PE	*Protective Earth*
PLC	Programmable Logic Control
SIL	*Safety Integrity Level*
SSI	*Synchronous Serial Interface*
SW	Software
TN-C-S	*Terre Neutre Combiné Séparé* (separated neutral conductor N and protective earthing conductor PE)

Abbreviation	Meaning
VAC	*Volts alternating current*
VDC	*Volts direct current*

Tab. 1-4: Abbreviations

2 Safety instructions

2.1 About this chapter

Observe the general safety instructions in this chapter and the safety instructions and instructions for action in these operating instructions. This helps to avoid personal risks, damage to property and faults.

- Read this documentation completely and thoroughly before working with the product.
- Keep this documentation in a location where it is accessible to all users at all times.
- Always include the required documentation when you pass the product on to third parties.

2.2 Intended use

The control actuator is a drive unit which consists of a cylinder unit with attached variable-speed motor/pump group and a drive controller (including motor power and motor encoder cable and platform software EVC), optionally with control cabinet with integrated drive controller and additional cable set.

The switching actuator is a drive unit which consists of a cylinder unit with attached variable-speed motor/pump group and a drive controller (including motor power and motor encoder cable and platform software EVC), as well as accessories.

For the exact scope of supply of the EMAH actuator ordered by you, please refer to your shipping documents and/or the order confirmation.

You may use the product as follows:

The EMAH actuator is intended for use in the energy sector.

The product is intended exclusively for professional use and not for private usage.

Intended use includes having read and understood this documentation completely, especially chapter 2 "Safety instructions" on page 7.

The EMAH actuator may only be started up when the complete machine or installation fully meets all stipulated safety requirements.

Its operation is permitted only when it is in the original condition, not damaged and completely installed.

The control actuator may only be operated within its specified performance/limit data. Overloading will result in a failure to function properly.

The installation in and removal from the complete machine as well as the replacement of components (within the scope determined in the present operating instructions) may be carried out exclusively by trained specialists (see chapter chapter 2.4 "Qualification of personnel" on page 8) of the customer. Further repairs may only be carried out by the manufacturer.

2.3 Improper use

Any use deviating from the intended use is improper and thus not admissible.

Bosch Rexroth AG does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

The installation or use of inappropriate products in safety-relevant applications could result in unintended operating states in the application which in turn could cause personal injuries and/or damage to property. Therefore, please only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product. For example, in explosion-protection areas or in safety-related parts of a control (functional safety).

Improper use of the product includes:

- non-compliance with the technical data, operating conditions and performance limits according to the documentation as well as the operating limits according to chapter 9.2 "Operating conditions" on page 47.
- incorrect installation
- improper storing
- improper handling and transport
- lack of cleanliness during storage, assembly, and operation
- non-observance of prescribed maintenance intervals
- unauthorized modification, maintenance, and repair work

2.4 Qualification of personnel

The activities described in this documentation require knowledge of mechanics, electrics and hydraulics as well as knowledge of the appropriate technical terms. For transporting and handling the product, additional knowledge of how to handle lifting gear and the necessary attachment devices is required. In order to ensure safe use, these activities may only be carried out by an expert in the respective field or an instructed person under the direction and supervision of an expert.

Experts are those who are able to recognize potential hazards and apply the appropriate safety measures due to their professional training, knowledge and experience, as well as their understanding of the relevant requirements pertaining to the work to be undertaken. An expert must observe the relevant specific professional rules and have the necessary expert knowledge. Expert knowledge means for example:

- Being able to read and completely understand hydraulic and electrical circuit diagrams
- Completely understanding the correlations regarding safety equipment
- Having knowledge of the function and set-up of electro-hydraulic components and converter technology
- Having basic knowledge of control technology
- Having knowledge of the IndraDrive firmware and the operation of IndraWorks Ds
- Having knowledge of parameterizing the software
- Having knowledge of the function, the structure and the work to be carried out on the EMAH actuator.

Bosch Rexroth offers training courses that support your qualification in specific fields. You can find an overview of the training contents on the Internet at: www.boschrexroth.com

2.5 General safety instructions

- Observe the valid regulations on accident prevention and environmental protection.
- Observe the safety regulations and provisions of the country in which the product is used/applied.
- Exclusively use Rexroth products in technically perfect condition.
- Observe all notices on the product.
- Persons who install, commission, operate, demount or maintain Rexroth products must not consume any alcohol, drugs or pharmaceuticals that may affect their ability to respond.
- Only use original Bosch Rexroth accessories and spare parts in order to prevent any hazard to persons due to unsuitable spare parts.
- Comply with the technical data and ambient conditions specified in the product documentation.
- The installation or use of inappropriate products in safety-relevant applications could result in unintended operating states in the application which in turn could cause personal injuries and/or damage to property. Therefore, only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product, e.g. in explosion protection zones or in safety-related parts of control systems (functional safety).
- Do not commission the product until you can be sure that the end product (for example a machine or system) into which the Bosch Rexroth products are installed complies with the country-specific provisions, safety regulations and standards of the application.

2.6 Product-specific safety instructions

The following safety instructions apply to chapters 6 to 14.

⚠ WARNING **Exceedance of the maximum temperatures!**

Using the EMAH actuator outside the approved temperature ranges may lead to malfunction or increased surface temperatures.

Only use the EMAH actuator within the specified ambient and hydraulic fluid temperature range, see specification sheet.

⚠ WARNING **Non-compliance with functional safety!**

In case of mechanical and electrical faults, e.g. failure of energy supply, persons may be caught by the system, kicked away or crushed.

- When setting up your circuit, observe the requirements for functional safety according to ISO 13849 or IEC 61508.
- Do not reach into the range of the cylinder unit.

⚠ WARNING **Harmful hydraulic fluid!**

Danger of poisoning and risk of injury (e.g. eye injuries, skin lesions, poisoning due to inhalation and ingestion).

- Check the lines for wear and damages before any commissioning.
- Use personal protective equipment, see chapter 2.7 "Personal protective equipment" on page 13.
- Avoid contact with hydraulic fluids.
-
- If nevertheless hydraulic fluid comes into contact with the eyes or penetrates the skin, consult a doctor immediately.
- When handling hydraulic fluids, strictly observe the safety notes of the hydraulic fluid manufacturer.

⚠ WARNING **Hot surface on the EMAH actuator!**

Risk of burning. The drive unit heats up considerably during operation. Individual components of the drive unit can get so hot (> 80 °C) during operation that you may burn yourself.

- Let the drive unit cool down before touching it.
- Protect yourself by wearing heat-resistant protective clothing, e.g. gloves.
- Observe the protective measures of the final machine manufacturer.
- Ensure a sufficient clearance between the drive unit and inflammable system parts, other objects and materials.

⚠ WARNING **Danger due to pressurized drive unit!**

Risk of injury! Severe injury when working on systems that have not been shut down or on extended drive unit (spring position “open”)! Damage to property!

Even after the EMAH actuator was disconnected from the electrical power supply the system is still under pressure!

- Observe the specifications of the system manufacturer and the system end-user.
- Make sure that the drive is in its basic position, that is, the spring is released.
- Do not disconnect line connections, plumbing connections or components as long as the drive unit is under pressure or the spring is tensioned.
- Switch off all power-transmitting components and connections (electrical, pneumatic, hydraulic) according to the manufacturer’s instructions and secured them against being switched on again. If possible, remove the main fuse of the system.

⚠ WARNING	Danger due to magnetic and electro-magnetic fields in the area of the EMAH actuator! Magnetic and electro-magnetic fields existing in the direct vicinity of electrical equipment may represent a serious danger to persons with heart pacemakers, metal implants and hearing aids. Persons with heart pacemakers and metal implants are not allowed to access the following areas: • Areas, in which electrical equipment and parts are assembled, operated or commissioned • Areas, in which motor parts 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 heart pacemakers already implanted or to be implanted in the future differs so greatly that no general rules can be given.
- Persons with metal implants or metal splinters or hearing aids have to consult a doctor before entering such an area, because health impairments have to be expected.

⚠ WARNING **Serious personal injury and damage to property due to improper, incorrect use of optional remote maintenance!**

If the optional remote maintenance feature is used improperly and incorrectly, unauthorized third parties may get access! This may seriously impair the integrity, confidentiality and availability of the system. The unauthorized infiltration of malware and deliberate manipulation of the machine control can lead to the failure of entire plant sections and thus to serious damage to property and personal injury. In addition, there is a risk of unnoticed, unauthorized transmission of data, especially of operating data, to third parties.

- Generally, everyone involved has to be well aware of IT Security.
- Only trustworthy persons may have possession of the control cabinet key. The control cabinet must always be locked.
- With regard to the remote maintenance module, no protection can be offered against insufficient security awareness of anybody involved in the remote maintenance process. Implement rules that force the use of strong passwords.
- Check the module for updates at regular intervals, but in any case before using the remote maintenance function. Otherwise, the remote maintenance function cannot be safely executed. Observe the **Application Note** *"Update and Flash FL/TC MGUARD"* on the website of the module manufacturer. Follow the instructions regarding the installation or update of the firmware via the SD card of your remote maintenance module.
- For all aspects of remote maintenance, see the Project Planning Manual “Security Manual Electric Drives and Controls”, R911342562.
- It is recommended that you conduct a risk assessment with regard to the impairment of your present IT and control infrastructure by remote maintenance of the EMAH actuator.
- If the EMAH actuator is used in accordance with the regulations valid in the country or at the place of operation within a critical infrastructure, check in particular whether the utilization of remote maintenance is permitted. Its utilization may be not allowed!
- It is not permitted to connect further components, which are not included in the scope of delivery of the system supplied by Bosch Rexroth and are not provided for it, to the remote maintenance system.

☞ For further notes on dealing with remote maintenance, please refer to chapter 12 "Disposal" on page 59.

⚠ CAUTION **Uncontrolled system behavior!**

Risk of injury! The failure of individual components can lead to malfunction of the EMAH actuator and therefore to unforeseeable behavior!

- Immediately have defective components exchanged.

⚠ CAUTION	Leaking hydraulic fluid! Damage to the EMAH actuator! Slip hazard due to oily surfaces or leaking hydraulic fluid!

- Identify the cause of leakage and contact Bosch Rexroth.
- Immediately remove leaking hydraulic fluid.
- Never try to stop or seal the leakage or the oil jet with a cloth.
- Never get caught in a jet of oil ejected at high pressure.
- Secure and mark the danger zone.
- Use an oil binding agent in order to contain and secure spilled or excess hydraulic fluid.
- Wear your personal protective equipment such as safety shoes and gloves.
- Contact Bosch Rexroth for proper refilling of the drive unit.
- Visually inspect the EMAH actuator and oil-containing components for leakage at regular intervals.

2.7 Personal protective equipment

Personal protective equipment for users of the product consists of:

- Safety goggles, protective gloves, protective helmet, safety shoes a for any work to be carried out on the EMAH actuator.

All parts of the personal protective equipment must be fully functional.

2.8 Obligations of the machine end-user

The machine end-user of the Bosch Rexroth EMAH actuator is responsible that

- the EMAH actuator is only used according to the intended purpose as defined in these operating instructions.
- the EMAH actuator is only stored, operated and maintained according to the specified operating and environmental conditions, in particular that the specified limit values are not exceeded.
- the operating personnel are instructed at regular intervals.
- a danger zone is marked, if required.
- the safety precautions for the specific intended use of the EMAH actuator are complied with.

IT Security

The operation of installations, systems and machines basically requires the implementation of a holistic IT security concept which is state-of-the-art in terms of technology. Accordingly, Bosch Rexroth products and their properties must be considered as components of installations, systems and machines for their holistic IT security concept. Unless otherwise documented, Bosch Rexroth products are designed for operation in local, physically and logically secured networks with access restrictions for authorized persons, and they are not classified according to IEC 62443-4-2.

3 General notes on damage to property and damage to the product

The warranty only applies to the delivered configuration.

- Warranty claims will be rejected in the case of improper installation, commissioning and operation as well as in the case of use not in accordance with the intended purpose and/or improper handling.
- The following safety instructions apply to chapters 6 to 14.

NOTICE	**Welding and painting work!**
	Risk of damage! Electrostatic charging can destroy the electronics.

- Avoid electrostatic charging of electronic components.

NOTICE	**Paint coating!**
	Risk of damage! Contact surfaces may be damaged. Risk of overheating due to insufficient heat dissipation and impairment of function of measuring systems.

- Never paint-coat measuring systems, cooling and contact surfaces.

NOTICE	**Inadmissible mechanical load!**
	Risk of damage! Impact or similar forces may damage or even destroy the EMAH actuator.

- Avoid impacts against the attachment parts of the EMAH actuator.
- Do not place/put the drive unit onto the attachment parts.
- Never use the drive unit to sit or step on. Do not place/put any objects on top of it.
- Protect fitted components and electrical connections such as connectors and mating connectors against mechanical stress.

NOTICE	**Mixing of hydraulic fluids!**
	Mixing of hydraulic fluids of different make or different types of the same make is not permitted!

- Observe the notes given by the fluid manufacturers of the hydraulic fluids used.

NOTICE	**Hydraulic fluids harmful to the environment!** **Leaking hydraulic fluid leads to environmental pollution.**

- Immediately remedy any leakage. Use an oil binding agent in order to bind spilled hydraulic fluid.
- Dispose of the hydraulic fluid in accordance with the national regulations in your country.
- Please immediately contact Bosch Rexroth Service. Refer to chapter chapter 16.1 "Service and support" on page 69.

4 Scope of delivery

For the exact scope of supply of the EMAH actuator ordered by you, please refer to your shipping documents and/or the order confirmation.

- Check the scope of delivery for completeness.
- Inspect the scope of delivery for any transport damage.

☞ In case of complaints, please contact Bosch Rexroth, see chapter 16.1 "Service and support" on page 69.

5 About this product

5.1 Performance description

The EMAH actuator is intended for use in the energy sector.

The control actuator is a drive solution which generally consists of a drive unit, a drive controller and platform software EVC, optionally with control cabinet with integrated drive controller and additional cable set.

The switching actuator as drive solution consists of a drive unit.

For the technical data, operating conditions and operating limits, please refer to the installation drawing, the data sheets of the EMAH actuator and the documentations from chapter 1.2 "Required and supplementary documentation" on page 1.

5.2 Product description

5.2.1 Drive unit

The drive unit basically consists of the following components:

Accumulator The drive unit is a closed hydraulic system. The accumulator absorbs the differential volume caused by temperature variations and compression.

Cylinder unit The cylinder unit of the drive unit translates flow and pressure into a linear movement with force. The cylinder positions are sensed by the position measuring system fitted.

Control block including attached parts All the hydraulic switching and diagnostic elements are located in the control block

Motor/pump group The motor/pump group makes hydraulic power available in the form of a flow in line with demand.

Position measuring system The position of the cylinder piston is sensed with the help of an integrated, absolute position measuring system. The switching actuator usually employs position switches.

Spring A mechanical compression spring (wire-centered disc springs or helical compression spring) assumes the closing function (failsafe principle).

5.2.2 Drive controller

Drive controller The drive controller represents the central control unit for the EMAH actuator. It provides open- and closed-loop controlling and monitoring of the operation of the drive unit. When erroneous states are recognized, they are reported and responses are triggered as defined. This can result in a shutdown of the EMAH actuator.

With the help of the PC-based engineering tool IndraWorks Ds (IW Ds) the parameters of the EMAH actuator can be accessed. Depending on the master communication used, IndraWorks is either connected via the service interface of the control and instrumentation technology level or directly to the drive controller.

The Application Manual (Rexroth IndraDrive, MPx-20, Functions), Parameter Description (Rexroth IndraDrive, MPx-16 to MPx-20 and PSB, Parameters) and Description of Diagnostic Messages (Rexroth IndraDrive, MPx-16 to MPx-20 and PSB, Diagnostic Messages) of the drive controller can be found in the supplementary documentation of Bosch Rexroth, see also chapter chapter 1.2 "Required and supplementary documentation" on page 1.

Operating panel of the drive controller

The drive controller includes an operating panel. The display shows operational states, diagnostic command and error messages, as well as any present warnings. Using the keys, settings can be made, information can be viewed and some commands can be triggered.

A functional description of the control panel can be found in the Application Manual (Rexroth IndraDrive MPx-20, Functions), see chapter 1.2 "Required and supplementary documentation" on page 1.

Platform software EVC

With the help of the platform software EVC the functions for up to two axes, i.e. for one control actuator and one switching actuator, can be activated. The software is integrated in the drive-integrated control section (MLD) and provides the elaborate functions based on the fundamental functionality of the firmware.

Service interface

In connection with the PC-based IndraWorks Ds service and commissioning tool, setting, process and diagnostic data can be read in and out and software updates can be performed via the service interface. The connection to the PC can be established using a standard RJ45 Ethernet cable.

5.2.3 Control cabinet (optional)

The control cabinet is used for accommodating the electric and electro-mechanical operating equipment involved in the process based on the customer's requirements. The control cabinet protects the operating equipment against dirt, humidity and excessively high or low ambient temperatures.

For further information on the **control cabinet** and **electrical interfaces**, please refer to the documentation "Electrical project planning", see also chapter 1.2 "Required and supplementary documentation" on page 1.

5.2.4 Cable set (optional)

For further information on the **cable set** and **electrical interfaces**, please refer to the documentation "Electrical project planning", see also chapter 1.2 "Required and supplementary documentation" on page 1.

5.3 Identification of the product

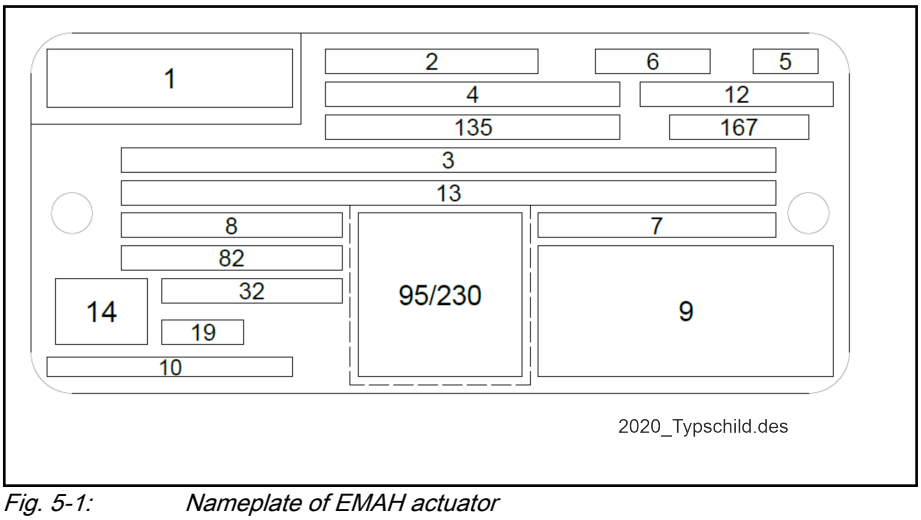


Fig. 5-1: Nameplate of EMAH actuator

1	Word mark Rexroth
2	Material number
3	Type designation
4	Serial number
5	Manufacturer's factory number
6	Date of manufacture (year and week)
7	Maximum pressure
8	Ambient temperature range
9	Fluid symbol
10	Designation of origin
12	Customer job order number
13	Customer material number
14	CE conformity mark
32	Weight
95	Bosch Rexroth data matrix code
135	Customer serial number
167	Supplier number/supplier code
230	Bosch Rexroth QR code

☞ The description of the nameplates of further components such as

- Motor
- Cylinder
- Drive controller

can be found in the relevant documentations, see chapter 1.2 "Required and supplementary documentation" on page 1.

☞ For queries with regard to the EMAH actuator you must have the material number and the fabrication number at hand. You should preferably take photographs of the nameplates and send them to Bosch Rexroth.

5.4 Type code

01	02	03	04	05	06	07		08		09	10	11	12	13	14
EMAH							**/**		**-**			**1X**			

01	**Electrohydraulic linear axis**	**EMAH**
02	**Construction kit for valves/application**	
	Steam turbine (ST)	**1**
	Gas turbine (GT)	**2**
	Industrial steam turbine (IT)	**3**
	Process technology (PT)	**4**
03	**Type of drive**	
	Control actuator	**R**
	Switching actuator	**S**
04	**Size**	
	01...99	**01...99**

05	**Mechanical interface**	
	Flange mounting	**F**
	Spherical plain bearing/swivel eye	**P**
	Rear mounting	**S**
	Trunnion	**T**
06	**Direction of spring action**	
	Retracting	**E**
	Extending	**A**
	Without	**N**
07	**Nominal force in kN (system pressure), opening force**	
	200 = 200 kN (example)	**200**
08	**Min. spring force in kN (F1min), closing force**	
	60 = 60 kN (example)	**60**
	Without spring, smaller or equal nominal force in kN	
	200 = 200 kN (example)	
09	**Working stroke in mm**	
	.35 = 35 mm (example)	**.35**
10	**Architecture (for triggering of trip function)**	
	1oo1	**A**
	1oo2	**B**
	2oo3	**C**
	2oo2	**D**
	Without	**W**
11	**Series**	
	1X (starting with 10)	**1X**
12	**Motor size**	
	K071 = MSK071	**K071**
	2N07 = MS2N07	**2N07**
	A080 = asynchronous motor type 80	**A080**
13	**Explosion protection**	
	N = without	**N**
	A = explosion protection according to ATEX	**A**
	U = explosion protection according to NEC/UL	**U**
	I = explosion protection according to IECEx	**I**
14	**Consecutive number defined via specification data sheet**	**E00001**

Tab. 5-1: Type code of EMAH actuator

5.5 Technical interfaces

5.5.1 Mechanical interface

The mechanical interface of the drive unit is the coupling to the customer valve; see also chapter 7.7.1 "Installing the drive unit mechanically" on page 31 and the installation drawing.

5.5.2 Electrical interfaces

☞ For further information on the **electrical interfaces**, please refer to the documentation "Electrical project planning" and the documentations from chapter 1.2 "Required and supplementary documentation" on page 1.

5.5.3 Software interfaces

☞ Information on **signals** and **parameters** can be found in the application manual "EVC platform software for EMAH actuators", see also chapter 1.2 "Required and supplementary documentation" on page 1.

5.5.4 Hydraulic interfaces

☞
- Since the EMAH actuator is a **self-contained** system, no hydraulic interface is to be provided on the customer side.
- Observe the notes in chapter 7.7.2 "Installing the drive unit hydraulically" on page 38.

For diagnosis and measurement purposes and for filling, discharging and bleeding, a separate Minimess® connection is provided at each chamber/line run on the drive unit. The individual locations are shown on the hydraulic circuit diagram.

6 Transport and storage

6.1 Transport

⚠ WARNING **Heavy weight and sharp edges!**

The assemblies of the EMAH actuator are heavy (>100 kg, the relevant weight is indicated on the nameplate and/or the installation drawing). In case of inappropriate handling, they may fall down and cause serious injuries and/or crush injuries as the assemblies of the axis may e.g. be sharp-edged, heavy, oily, loose or bulky.

- Transport the assemblies by means of a forklift truck or suitable lifting gear at the points provided for this purpose, observing the safety instructions.
- Ensure a stable position during transport to the place of installation.
- Make sure that the load-carrying capacity of your fork lift truck or lifting gear is sufficient.
- Wear personal protective equipment for transporting the unit.
- Observe national laws and regulations for accident prevention and safety and health at work during transport.

⚠ CAUTION **No stability!**

Risk of injury and crushing.

- Transport and store the assemblies only in appropriate packaging.
- Place the assemblies on a suitable surface.

NOTICE **Strong magnetic fields! Destruction of the position measuring system!**

Do not lift the drive unit using a magnet!

Please observe the following points for transporting:

- Properties of the load (e.g. weight, center of gravity, mounting and attachment points).
- Way of attaching or picking up the load.

The product may only be transported if the requirements listed in this chapter are observed. Only the load attachment points shown in the installation drawing may be used.

For transporting in a proper and safe manner, use lifting accessories which are appropriate for the weight.

Inspect the lifting equipment and lifting points for flawless condition.

Lifting accessories are not included in the scope of delivery.

6.2 Storage

NOTICE **Risk of damage of some components due to long-term storage!**

Some components contain electrolytic capacitors which may deteriorate during storage.

When storing the following components for a longer period of time, run them once a year for at least one hour:

- Converters and supply units: Operation with mains voltage U_{LN}
- Inverters and DC bus capacitor units: Operated with DC bus voltage U_{DC}

The assemblies should preferably be stored in the unopened original packaging.

The storage time for storage in the unopened original packaging is 6 month max.

If the assemblies are to be stored longer than 6 months, provide preservation like for storage after its demounting (see "Following demounting" on page 26).

Requirement

- Do not store the assemblies outdoors but in a well-ventilated room.
- Provide for 100 % UV protection.
- Adhere to the storage temperature.
- Protect the assemblies against humidity, particularly ground humidity. Store the assemblies on a shelf or on a pallet.
- Ensure that no ozone formation takes place near the storage location.
- Avoid intense light.
- Store the assemblies in packaging in order to protect them from dust and dirt.
- Store the assemblies protected against impacts and sliding.
- After the transport packaging was opened, it must be closed properly again for storage. Use the original packaging for storage.
- Moreover, observe the Project Planning Manuals for the individual components, see chapter 1.2 "Required and supplementary documentation" on page 1.

Procedure after expiration of the maximum storage time of 6 months

1. Check the assemblies for damage and corrosion prior to their installation.
2. Check the assemblies for proper function and leaks during a test run.

☞ After expiry of the maximum storage time, we recommend having the product checked by your competent Bosch Rexroth Service.

Following demounting

If the assemblies are to be stored, they have to be preserved for the time of storage to protect them against corrosion.

Bosch Rexroth recommends the following procedure:

1. Clean the filter assemblies, see chapter 10.2 "Cleaning and care " on page 49.
2. Plug all ports air-tight.

3. Moisten the unpainted external metal surfaces using an appropriate corrosion protection agent.
4. Pack the assemblies air-tight together with a desiccant in an anti-corrosion foil.
5. Store the assemblies protected against impacts. For further conditions, see "Requirement" on page 26.

In each case, please observe any applicable provisions and laws regarding the handling of substances hazardous to water or to health.

7 Installation

7.1 General notes on mounting

⚠ CAUTION **Danger of crushing at the spring package and at the position measuring system during mounting!**

Risk of injury!

Observe the mounting instructions in these operating instructions.

NOTICE **Missing seals and plugs!**

Liquids and foreign particles may penetrate and damage the product.

- Before starting the installation make sure that all seals and plugs of the connections are tight.

NOTICE **Insufficient installation space!**

Risk of damage to components! Insufficient accessibility may make the installation or the exchange of components more difficult or impossible. Components cannot be properly mounted or might be damaged.

- Make sure that the installation space is sufficient. The dimensions of the EMAH actuator can be found on the installation drawing.

Prior to the installation, make sure the documents required according to chapter 1.2 "Required and supplementary documentation" on page 1 are at hand.

7.2 Unpacking

⚠ CAUTION **Parts falling out!**

Risk of injury! If the packaging is opened improperly, parts may fall out and cause injuries or damage to the parts.

- Put the packaging on level, bearing ground.
- Only open the packaging from the top.

Dispose of the packaging in accordance with the national regulations of your country. See also chapter 12 "Disposal" on page 59.

7.3 Installation conditions

7.3.1 Drive unit

- The components mounted to the drive unit must not be subjected to any mechanical loading (e.g. impact). Plugs and mating connectors must be protected against such loads.

- Make sure that the drive unit and particularly the attached components are not damaged during the installation.
- When installing the drive unit, always observe the specified ambient conditions.
- The dimensions are shown on the installation drawing. When determining the required space, take the installation orientation into account.
- Please ensure during installation that in later operation sufficient air circulation will be provided to prevent overheating.
- The drive unit must be mounted on a ground with sufficient load bearing capacity.
- The cable lengths to the (optional) control cabinet must be observed.

7.3.2 Drive controller

The drive controller and its accessory components have to be mounted according to the project planning description of Rexroth IndraDrive systems. You can find the corresponding documents under chapter 1.2 "Required and supplementary documentation" on page 1.

☞ Generally, the drive controller produces an increased leakage current. If the drive controller is to be operated with a residual-current circuit breaker, type B or type B+ should be used. Otherwise, spontaneous tripping may occur.

7.3.3 Control cabinet (optional)

- The environment must be free from electrically conductive contamination (acid, bases, corrosive agents, salts, metal vapors, etc.) and the control cabinet must not be exposed to these substances.
- Observe the applicable protection class at the place of installation or use and when installing the control cabinet.

☞ Further **installation conditions** can be found in the data sheets of the control cabinet, see chapter 1.2 "Required and supplementary documentation" on page 1.

7.3.4 Cable set (optional)

☞ Information on the **installation conditions** of the cable set and the motor power and motor encoder cable is provided in chapter "Installing signal/control and power cables" on page 40.

7.4 Installation orientation

☞
- Information about the drive unit can be found in the installation drawing.
- Information about the installation orientation of the drive controller and the control cabinet (optional) is contained in the documentations from chapter 1.2 "Required and supplementary documentation" on page 1.

7.5 Accessories

With regard to accessories, contact Bosch Rexroth Service for clarification, see chapter 16.1 "Service and support" on page 69.

7.6 Before installation

7.6.1 Preparing the installation

1. Check the scope of delivery for completeness and damage in transit.
2. Compare the material number with the details in the order confirmation.

If the material numbers or denominations of the drive unit and of the drive controller do not correspond to those given in the order confirmation, contact the Bosch Rexroth service for clarification, see chapter 16.1 "Service and support" on page 69.

7.7 Installing the EMAH actuator

7.7.1 Installing the drive unit mechanically

General notes on the mechanical installation of the drive unit

⚠ WARNING

Improper mounting!

Insufficient fixation or insufficient stability may cause the drive unit to become loose and fall down.

Consequently, hydraulic fluid may leak and lead to personal injuries and/or damage to property. Drive units of heavy weight may bruise or strike persons dead.

- Completely mount the drive unit according to the mounting specifications using suitable mounting aids.

⚠ WARNING

Accidental movement of the drive unit while it is being installed!

Risk of injury! Danger of crushing! Damage to property!

- Keep the drive unit in a stable and secured position until it is fixedly mounted to the mounting face provided at the customer's end.
- Be careful when installing the unit.

The drive unit has to be installed so that it is free from transverse forces as far as possible. Any transverse forces have to be eliminated by the customer by providing guides and making corresponding adjustments.

The piston rod and the customer valve have to be mounted in alignment.

Stroke length, loading and mounting have to be taken into account in order to keep bending to a minimum.

- Mount the drive unit so that the load acts axially on the center line of the cylinder.

- The mounting faces and elements on the customer equipment have to be capable of absorbing the forces that occur.

The drive unit should be installed complying with the mounting and setting instructions of the customer.

- Work carefully.
- Check that the machine element, to which the drive unit is mounted, is secured against tilting.
- Check whether the connection bores fit.

Variant 1: Mechanical installation of a drive by means of flange-mounting and coupling halves

⚠ CAUTION **Unintended motion of the EMAH actuator during mounting!**

Risk of injury! Danger of crushing! Damage to property!

- Keep the EMAH actuator in a stable and secured position until it is fixedly mounted to the industrial valve.
- Be careful when installing the unit.

1. Install the customer-side coupling piece to the valve spindle and align it with the drive coupling according to the mounting instructions of the valve manufacturer.

☞ In case of doubt or queries, please contact Bosch Rexroth.

2. Insert the actuator in the seat/fit of the industrial valve.
3. Tighten the screws of the flange evenly crosswise and, while doing so, pretension the spring.

   In this way, the actuator is mounted to the industrial valve and, at the same time, it is brought from the stroke end position to the “system 0” position (industrial valve closed).
4. Tighten the mounting screws on the coupling:

☞ Observe the information regarding the tightening torque given in the mounting instructions of the valve manufacturer.

Variant 2: Mechanical installation of a drive by means of flange-mounting and coupling halves with valve spindle nut

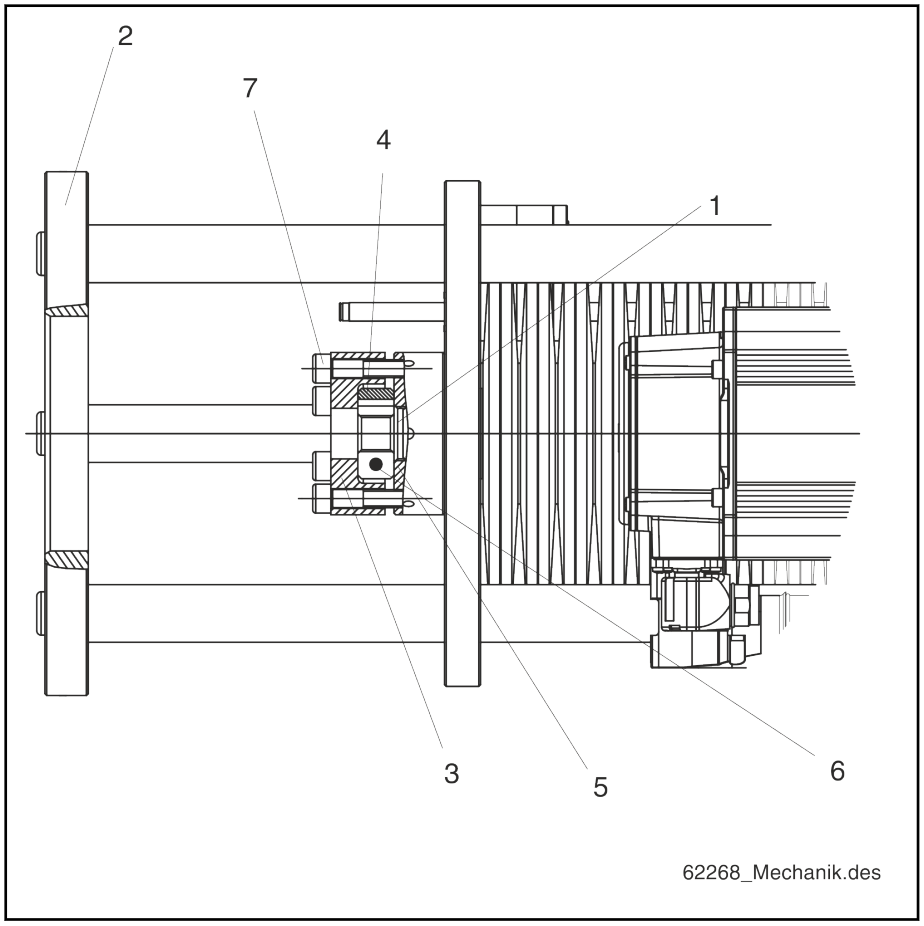


Fig. 7-1: Mounting the spindle of the drive unit to the spindle of the customer valve.

1. Lift the drive unit above the customer valve observing chapter 6 "Transport and storage" on page 25 and then lower it carefully. While lowering the drive unit, insert the valve spindle carefully through the hole in the mounting flange **(item 2)**.

☞ The mounting faces have to be clean and free from contamination.

WARNING! Risk of injury due to heavy components! Due to the weight and size of the drive unit it can tip over from the mounting face and cause personal injury or damage to the components.

- Provide for a stable position of the drive unit during the installation.
- Use the provided lifting eyes and suitable lifting gear for installing the unit.

2. Loosen the coupling half on the customer side **(item 3)** by removing the mounting screws **(item 7)**.
3. Place the valve securing nut (depending on the valve design) and the customer-side coupling half **(item 3)** over the valve spindle.
4. Place the valve spindle nut **(item 4)** over the valve spindle and turn it until the valve spindle visibly protrudes from the valve spindle nut.

5. Carefully lower the drive unit with the mounting flange **(item 2)** onto the customer valve.
6. Align the energy actuator according to the mounting instructions of the customer.

☞ The distance between the end of the valve spindle and the coupling half on the cylinder side **(item 5)** should be 1 to 4 mm. If this is not the case, please contact Bosch Rexroth.

7. Tighten the valve mounting elements (depending on the variant) to fasten the drive unit to the customer valve.

   Use suitable mounting screws (strength class 10.9). The required information can be found on the installation drawing.
8. Ensure that the mounting screws are tightened to the specified tightening torque according to VDI 2230. Tighten the screws alternately crosswise using a suitable torque wrench.
9. Screw the valve spindle nut **(item 4)** towards the drive unit until it is in contact with the coupling half on the cylinder side **(item 5)**.
10. Tighten the clamping screw **(item 6)** of the valve spindle nut.
11. Now fasten the customer-side coupling half **(item 3)** by means of the mounting screws **(item 7)**.
12. If provided **(depending on variant)**, remove the two setscrews (M10 x 35), which held the cylinder in "position 0" during transport.

Variant 3: Mechanical mounting of an actuator with spherical plain bearing

1. Lift the drive unit according to chapter 6 "Transport and storage" on page 25 to the position where it will be installed later.
2. Introduce the bolt provided by the customer or a load measurement axis, which is included in the scope of supply **(depending on the variant)** into the bore, see installation drawing. Pay attention to the dimensional accuracy of the bolt. Also observe the connection line to the load measurement axis which is already connected at the "terminal box (signals)" **(depending on the variant)**.

   Ensure that the drive unit is installed stress-free and the lever system is functional.
3. Attach the anti-rotation feature to the installed bolt or the load measurement axis.

Variant 4: Mechanical installation of an actuator with rear mounting

NOTICE **Damage to the position measuring system in case of lateral mounting!**

Damage to property!

- Make sure that the piston rod is not distorted when the coupling is installed.

1. Lift the drive unit according to chapter 6 "Transport and storage" on page 25 to the position where it will be installed later.
2. Align the drive unit with the mounting face for receiving the drive unit according to the installation drawing.

3. Screw the drive unit down using the fitting elements provided for that purpose.
4. Now, pin the flange plate (if required) to the mounting face via the bores provided for this purpose.
5. Mount the coupling on the piston rod.

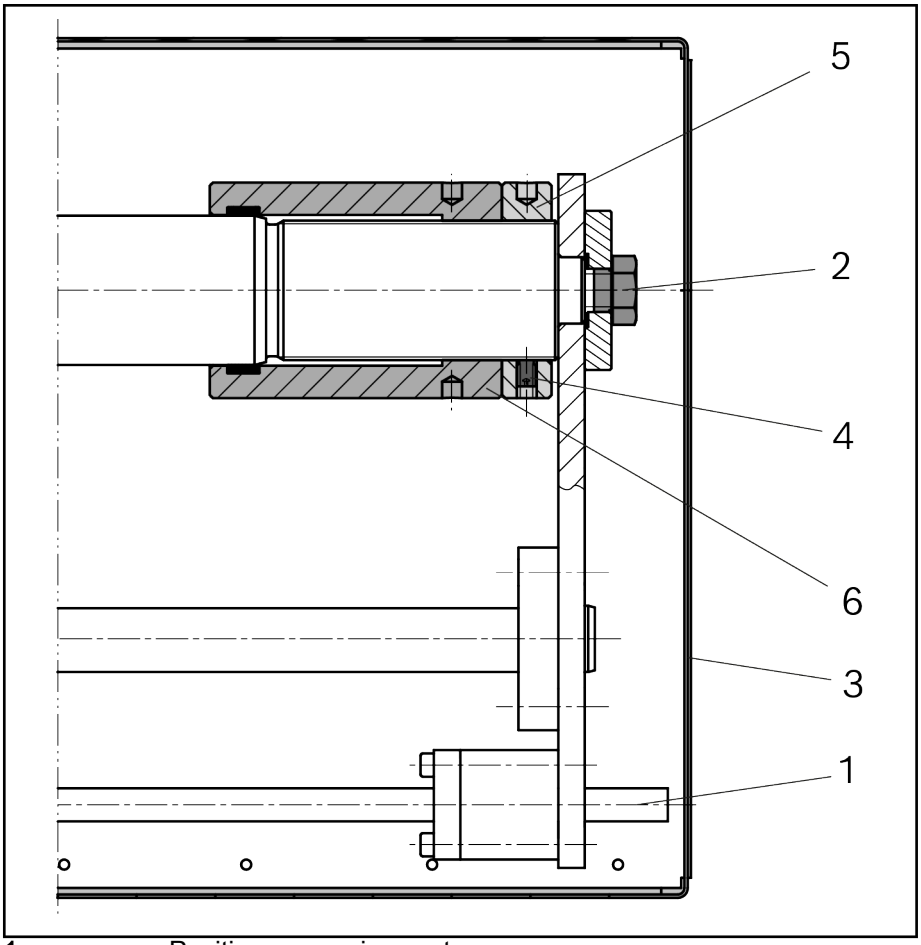
   For tightening, use the wrench flats directly behind the thread of the piston rod.

In case a position measuring system fitted at the side (fig. 7-2 "Stroke adjustment feature (with position measuring system fitted at the side)" on page 36 **item 1**), loosen the screw (fig. 7-2 "Stroke adjustment feature (with position measuring system fitted at the side)" on page 36 / **item 2**) at the piston rod end before mounting the coupling in order to allow the piston rod to move slightly and the coupling to align, since there is no anti-rotation device provided for the piston rod. After having mounted the coupling, re-tighten this screw.

The relevant tightening torque is stated in the installation drawing. The permissible maximum torque, see installation drawing, must not be exceeded at the wrench flat of the piston rod. The coupling is not included in the scope of delivery.

Stroke adjustment

The following figure illustrates the stroke adjustment feature with position measuring system fitted at the side.



1 Position measuring system
2 Screw
3 Protective tube
4 Set screw
5 Lock nut
6 Stroke nut

Fig. 7-2: Stroke adjustment feature (with position measuring system fitted at the side)

You can adjust the stroke as follows:

- Remove the protective tube (fig. 7-2 "Stroke adjustment feature (with position measuring system fitted at the side)" on page 36 / **item 3**) by loosening and removing the mounting screws.
- Keep the mounting screws.

The piston rod of the actuator has to be retracted to the end position. The stroke nut (**item 6**) must not be at the limit stop.

- Carefully pull the cable gland out of the groove.
- Remove the set screw (**item 4**) from the locknut (**item 5**).
- Loosen the lock nut (**item 5**).
- Now, carefully adjust the stroke according to the customer-specific requirements.

The adjustment is made by turning the stroke nut (**item 6**).

- Re-tighten the lock nut (**item 5**).
- Secure the lock nut by installing the set screw (**item 4**).
- Carefully slide the protective tube (**item 3**) over.
  - When doing so, pay attention to a correct cable routing. The cable must not be pinched.
  - Carefully insert the cable gland in the groove.
- Now fasten the protective tube (**item 3**) by means of the mounting screws.

Adjust the proximity switches in X-direction.

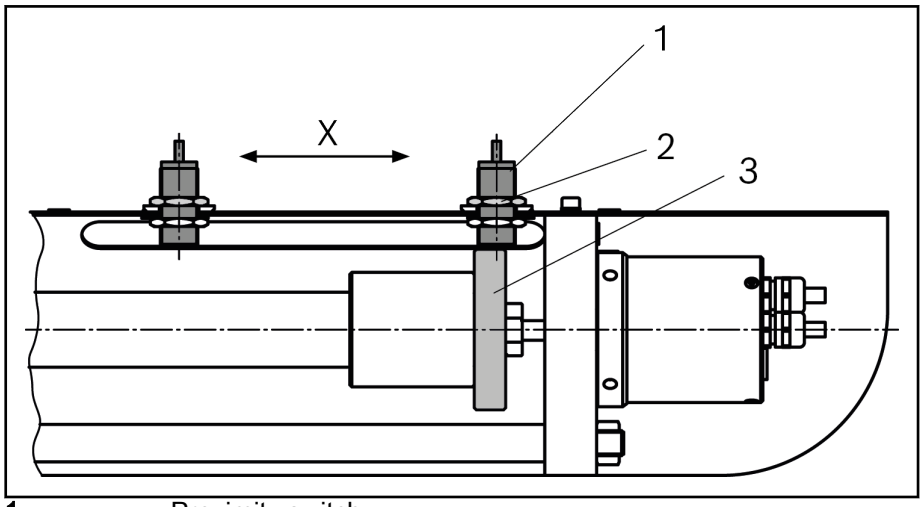
NOTICE

Risk of collision when setting the proximity switches!

Damage to property!

- Observe the permissible setting range on the installation drawing. If the proximity switches are turned in too deep, there is a risk of collision with the lock nut (fig. 7-3 "Setting the proximity switches" on page 37 / **item 3**)!

The following figure shows the proximity switches for setting the cylinder stroke:



1 Proximity switch
2 Upper lock nut
3 Lock nut

Fig. 7-3: Setting the proximity switches

It is possible to adjust the proximity switches in X-direction within the range of the cylinder stroke.

- Loosen the upper locknuts (**item 2**) of the proximity switches (**item 1**).
- Shift the proximity switches in X-direction to the desired position.

Check and strictly observe the permissible adjustment range (see installation drawing). It has been selected so that the distance corresponds to half of the permissible maximum switching distance. The inspection windows in the protective sheet serve as additional checking option. In order to exclude mutual influencing of two identical sensors, adhere to the minimum distance according to the data sheet (see order-specific documentation).

- Tighten the loosened lock nuts to the required tightening torque.

The tightening torque is stated in the installation drawing of the order-specific documentation.

7.7.2 Installing the drive unit hydraulically

⚠ WARNING **Risk of damage to property and personal injuries!**

Any modifications to or work on the hydraulic system, e.g. changing of pipework, opening of fittings (except for the fittings provided at the drive unit for measuring purposes), which are not described in these operating instructions or were not agreed with Bosch Rexroth, can lead to personal injury and damage to property!

- You may only carry out work on the EMAH actuator that is described in these operating instructions.
- Any modifications may exclusively be carried out by Bosch Rexroth or by qualified and trained personnel of a specialized company that was authorized by Bosch Rexroth.
- The mounting and installation instructions have to be strictly observed.

Since the drive unit is a **self-contained** system, the customer needs not to provide a hydraulic interface. All work (adjustment work, inspection for leakage, etc.) is performed by Bosch Rexroth before dispatch.

7.7.3 Installing the EMAH actuator electrically

General information

⚠ WARNING **Missing equipotential bonding!**

Electrostatic processes, an incorrect earthing concept or missing equipotential bonding may lead to malfunctions or uncontrolled movements at the machine!

All components of or parts attached to the EMAH actuator must be electrically conductive and integrated in equipotential bonding.

⚠ WARNING **High electrical voltage!**

Touching parts with voltages greater than 50 V can be dangerous to people and lead to electric shock. When the drive unit and the drive controller are operated, certain parts are inevitably under voltage.

- Installation, operation, maintenance and/or repair of components of the drive unit and of the drive controller may only be performed by qualified personnel; refer to chapter 2.4 "Qualification of personnel" on page 8.
- Please observe the general installation and safety regulations when working on high-voltage systems.
- Before switching on, check all electrical components for firm connection of the protective earthing conductor according to the connection diagram.
- Never operate electrical equipment, even for short-time measurements or tests, if the protective earthing conductor is not permanently connected to the components at points provided for this purpose.
- Disconnect the electrical components from the mains or from the voltage source before accessing parts with voltages exceeding 50 V. Secure electrical components against restarting.
- After switching off, you should generally wait for 30 minutes before you touch an electrical component in order to allow the live capacitors in the drive controllers to discharge. Measure the electrical voltage of live parts before beginning work in order to avoid hazards caused by contact.
- Before switching on, attach the covers and protective devices provided for contact protection.
- Do not touch the electrical connection points of the components while the system is activated.
- Do not disconnect or connect the connectors under voltage.

⚠ WARNING **High housing voltage and high working current!**

Due to the high housing voltage and the high working current, touching can lead to electric shocks and thus to severe injuries.

- Connect the equipment grounding conductor of the components firmly and permanently to the main power supply at all times. The leakage current is greater than 3.5 mA.
- Observe the minimum cross-section of the protective earthing connection.

Installing signal/control and power cables

General information

⚠ CAUTION **Interference emissions!**

Risk of injury due to malfunction and uncontrolled movements!

- Eliminate sources of interference in the area of the signal and control cables!
- Ensure an installation in line with EMC requirements.

The achievable operating time of the cables is to a great extent determined by the type of installation and environmental influences at the place of use. Due to the large variety of application conditions, the listed basic recommendations for the handling of cables can, however, only serve as an aid to ensure a long and fault-free operation of the cables.

- Lay cables and lines so that they cannot be damaged and no one can trip over them.
- Never subject cables to pulling stress or torsion. Mechanically fix the cable ends in place after no more than approx. 30 cm (e.g. cable clip, cable binder, etc.)
- Do not kink cables. Do not fall below the bending radii. The value of the bending radius should be at least 5-6 times the diameter of the cable.
- Do not subject cables to large temperature differences and extreme weather influences. Always store cables in a dry place.
- Always unroll cables completely.
- Never use damaged cables. In case of damage, shut the system down and replace the cables.
- Do not use any silicone-containing sealants, adhesives or insulating agents.
- Ensure a maintenance-friendly installation, i.e. simple access to the connection lines. Ensure free access to the connection side.

Cable routing

- Install signal and control lines with a minimum clearance of 100 mm, preferably 200 mm, or using a grounded partition plate to separate them from the power cables. Installation in separate cable ducts is the optimum. Whenever possible, introduce signal lines only at one place into the control cabinet in which the drive controller is installed.
- Renew cable markings and warning notes on cable connections which have become illegible or were lost.

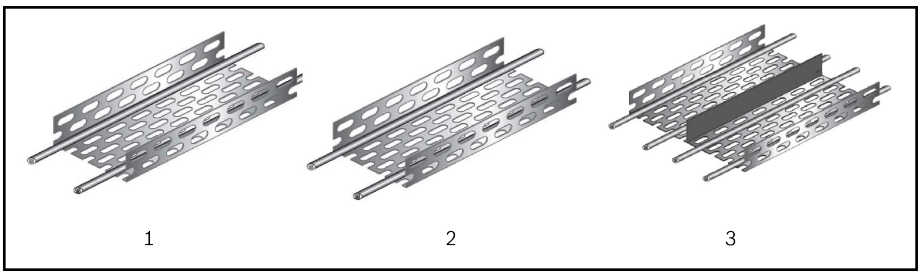


Fig. 7-4: Cable routing

1 Signal and control cables in the same cable duct
2 Power cables in the same cable duct
3 Common installation in one cable duct, separated by a metal partition wall

- If signal lines and power cables cross, install them at an angle of 90° to prevent interference coupling.

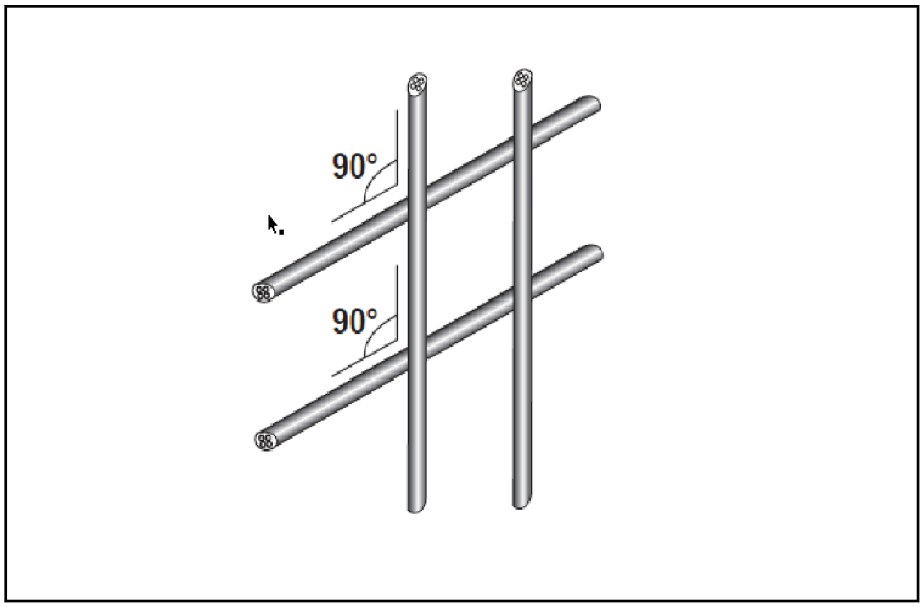


Fig. 7-5: Routing of signal lines and power cables

- Earth unused and unconnected spare cables at both ends to prevent them from having an antenna effect.
- Avoid unnecessary line lengths and shorten the cables.
- Install the cables sealed and on grounded metal surfaces (reference potential). Grounded and closed cable channels or metal pipes are the ideal solution.
- Avoid freely suspended lines and lines installed on plastic supports. They act as receiving antennas (immunity to interference) and also as transmitting antennas (interference radiation).

Shielding

- Connect the cable shield with a short cable length directly to the devices and ground it over a large surface area.
- Connect the shield of analog signal cables over a large surface area on one end, usually in the control cabinet.
- Connect the shield of digital signal cables with short length and a large area on both sides. In the case of potential differences between the beginning and the end of the line, install an additional equipotential bonding conductor in parallel. In this way you prevent equalizing currents from flowing via the shield. The standard value for the cross-section is 10 mm^2.
- Equip any disconnectable connections with connectors and couplings with grounded metal housing.
- Twist the supply and return conductors of unshielded lines of an electric circuit.

Electrical wiring of the control actuator

⚠ WARNING **Hot surface!**

The surface temperatures at the drive unit may be high. Electrical lines which were installed in close proximity to the drive unit can be overloaded, thus heating up inadmissibly, and in the worst case suffer an insulation fault.

- Install lines at a sufficient distance to hot surfaces or prevent overheating by proper installation of the lines.

- Before starting to install the cabling of the EMAH actuator, the following work must have been completed:
  - Mechanical installation of the drive unit.
  - The control cabinet is fixedly installed at its place of installation or use. Please observe chapter 7.3 "Installation conditions" on page 29. The position of or the distance between the individual assemblies (drive unit, control cabinet) is significantly influenced by the length of the cable set.
- Wire the individual components of the scope of supply according to the documentation "electrical project planning" and relevant documentations from chapter 1.2 "Required and supplementary documentation" on page 1.

When planning the control cabinet (optional) and when installing drive controllers in the control cabinet, observe the documentations listed below:

	Title	Document number	Document type
🕮	Rexroth IndraDrive Drive Systems with HMV01/02 HMS01/02, HMD01, HCS02/03	R911309636	Project Planning Manual
🕮	Rexroth IndraDrive Supply Units, Power Sections HMV, HMS, HMD, HCS02, HCS03	R911318790	Project Planning Manual
🕮	Rexroth IndraDrive Additional Components and Accessories	R911306140	Project Planning Manual
🕮	Rexroth IndraControl S20 System and Installation	R911335988	Application manual
🕮	Control cabinet Air Conditioning, EMC, Design, IP Code, Electrics IndraDrive, Rexroth EFC/Fv, Sytronix	R911344988	Project Planning Manual
🕮	Electrical project planning (EPLAN Electric P8)		Contains the electrical circuit diagram, the parts list, the elevation of the mounting plate, etc. of the optional control cabinet. It accompanies the control cabinet.

Tab. 7-1: Documentation for installing the drive controller for project planning of the control cabinet.

☞ Avoid continuous temperatures > 40 °C inside the control cabinet, since this will lead to faster aging of the operating equipment.

Connection of equipotential bonding at the drive unit

The drive unit is equipped with a connection point for establishing equipotential bonding. It has to be connected before commissioning.

Equipotential bonding has to be executed to comply with national regulations and standards.

8 Commissioning

8.1 General notes on commissioning

⚠ WARNING **Working in the danger zone!**

Serious injury by improper working.

- Pay attention to potential sources of danger and remove them before starting up the EMAH actuator.
- Nobody may stand in the danger zone of the drive unit.
- Do not reach into the range of the cylinder unit.
- Electrical commissioning must be carried out or attended by a qualified electrician.

⚠ WARNING **Uncontrolled system behavior!**

Electrical connections which are not connected may cause malfunctions that could lead to injuries.

Commission the EMAH actuator only when it is completely installed.

NOTICE **Condensed water in electrical components!**

Risk of short-circuit!

- Let the electrical components acclimatize themselves for several hours, since otherwise, condensed water may cause problems.

The individual partial steps for commissioning are:

1. Inspection of the mechanical and electrical installation and cabling work.

☞
- Visually inspect the drive unit as well as connected operating equipment in the control cabinet **(optional)** for obvious visible defects.
- Eliminate any defects found.
- Check whether guards against direct touching of active parts are available, and that the protective guards are not faulty in the case of indirect touching. Check the cross-section, routing, connection and the marking of protective, earthing and equipotential bonding conductors.
- Inspect the interface activation on the EMAH actuator side and on the side of the customer system.
- Testing and measuring of electrical components is to ensure that all limit values or requirements (as given in the currently valid regulations) are complied with. Measurements may only be taken using suitable testing equipment.

  Measuring and test devices have to meet the requirements of standards, e.g. VDE 0411, 0413, 0403, 0404, and have to be listed in the test report. Only calibrated measuring and test devices may be used.

2. Measurement / quality control of the supply voltages
3. Inspection of emergency stop equipment, insulation monitoring, protective guards as well as signaling and display devices.
4. Controlled commissioning of the EMAH actuator by stepwise switching on or activation of switching circuits in the control cabinet.
5. Check for functionality and correct connection of valve technology, sensors, position measuring system, etc.
6. Conducting a system validation:
   - Command/actual value comparison of the requirements list
   - Compliance with voltage drops
   - Power measurement to determine the electrical connection values in normal and peak load operation.
   - Creation of a "good condition fingerprint" based on the measured signals, e.g. noise measurement

☞ The stepwise re-commissioning of the EMAH actuator after malfunction was rectified must always be agreed with Bosch Rexroth.

☞ After having completed the activities described in this chapter, continue with the instructions from "chapter 4, Commissioning" of the application manual "EVC platform software for EMAH actuators", see also chapter 1.2 "Required and supplementary documentation" on page 1.

9 Operation

9.1 General notes on operation

⚠ CAUTION **Noise!**

In certain operating situations, increased noise emission by the drive unit is possible. This may impair the wellbeing of persons in close proximity.

- If required, provide suitable structural noise protection measures.
- Use suitable hearing protection, if required.

On the EMAH actuator, no adjustments or modifications are required during operation. Only use the product within the performance range for which the EMAH actuator is designed. The system manufacturer is responsible for correct project planning of the system and its control.

9.2 Operating conditions

Observe the following data, unless different values are given in the order-specific documents:

Designation	Range
Operating pressure	Up to max. 200 bar
Velocity	Up to max. 3 m/s
Frequency	Up to max. 2 Hz
Ambient temperature range	According to specification sheet, see chapter 1.2 "Required and supplementary documentation" on page 1

Tab. 9-1: Operating conditions

The control system has to determine the stroke in such a way that a sufficient lubricating film and thus low-wear operation for the seals is achieved. Continuous operation in the short-stroke range leads to wear on seals and damage to the mating surfaces. Especially the operation with short strokes that are performed at higher frequencies can lead to significantly shorter replacement intervals than recommended in the maintenance schedule. Regular checks are therefore required! The maximum values given in the table above should therefore not be reached simultaneously.

9.3 Operating states and monitoring functions of the EMAH actuator/error management

☞ The relevant **operating states** and **monitoring functions** of your EMAH actuator are described in the application manual "EVC platform software for EMAH actuators", see also chapter 1.2 "Required and supplementary documentation" on page 1.

In addition, you can find **warning and error events (error management)** in the application manual of your EMAH actuator.

9.4 Field data acquisition

The program package (FDA – Field Data Acquisition) allows process data of an electrohydraulic linear actuator in the field to be recorded. The acquired data describe the load of the axis components in the field and simplify diagnostics and fault detection if servicing or repairs have to be carried out. The data are stored on the local storage medium of the control system.

For evaluating the data the generated files have to be copied from the storage medium of the control system and made available to Bosch Rexroth Service for evaluation. In the case of an IndraDrive the data are stored in the “User” folder (see figure below) on the µSD card that is inserted in the slot of the control panel.

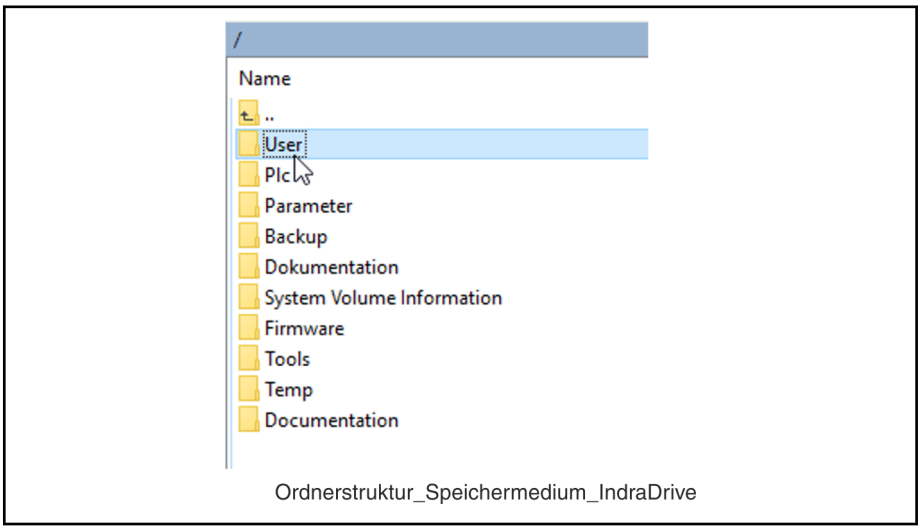


Fig. 9-1: Fig.: Folder structure on the storage medium of IndraDrive

10 Maintenance and repair

10.1 General notes on maintenance and repair

⚠ WARNING **Dangerous voltages and risk of electric shock!**

In order to avoid injuries when working on electrical systems you should take the following precautions in the order listed:

- Disconnect completely
- Secure against re-connection. Observe the discharge time of the converters!
- Verify that the installation is dead
- Carry out earthing and short-circuiting
- Cover or shield against adjacent live parts

10.2 Cleaning and care

⚠ WARNING **Systems that are still running!**

Risk of injury! The work steps described in this chapter may only be performed on shut down systems. Before beginning work:

- Make sure that the drive motor cannot be switched on.
- Ensure that all force-transmitting components and connections are (electrically) switched off and secured against restarting according to the manufacturer's instructions. If possible, remove the main fuse of the system. Verify with the help of tested measuring equipment that there is no voltage applied.

NOTICE **Solvents and aggressive cleaning agents!**

Aggressive cleaning agents can damage the seals of the drive unit and make them age faster.

- Never use solvents or aggressive cleaning agents.

NOTICE **Ingress of dirt and liquids!**

Reliable operation is thus no longer ensured.

- When carrying out any work, observe strictest cleanliness.
- Do not use a high-pressure washers or hose water.

For cleaning and care, please observe the following:

- Plug all openings with suitable protective caps/devices.
- Check whether all seals and plugs of the plug-in connections are securely seated to ensure that no moisture can enter the system during cleaning.

- Remove external coarse dirt and keep sensitive and important parts clean.
- Use lint-free cloths for cleaning.

10.3 Maintenance and inspection schedule

⚠ WARNING **Improper maintenance or repair!**

Improper maintenance and repair or wear may lead to malfunctions.

- Carry out the prescribed maintenance work at the time intervals specified in the operating instructions.
- Check regularly that equipotential bonding is always connected on the drive unit.
- After having carried out any work on the drive unit, check that equipotential bonding has been re-connected.

⚠ WARNING **Uncontrolled machine movements!**

Risk of injury due to maintenance work on an activated system.

- Unless otherwise stipulated ensure that during maintenance work the EMAH actuator is in a state in which no uncontrolled machine movement can occur.

If used according to the intended purpose, the EMAH actuator requires little maintenance.

To ensure that the EMAH actuator functions reliably for a long time, Bosch Rexroth advises to check the EMAH actuator regularly. The time intervals mainly depend on the operating conditions and the external environmental conditions (e.g. dirt, temperature, vibration). The individual maintenance steps are described in the next chapter.

Maintenance and inspection schedule

When?	Where?	What?	Comments
Every 3 months	All components	Visual inspection Remove any contamination and leakage.	Remove any dust accumulations. This allows for better identification, observation and removal of leakage as necessary. In the long run, leakage may result in standstill of the EMAH actuator. When detecting any leakage, immediately inform Bosch Rexroth.
	Mounting elements and fittings	Visual inspection	
	Electrical connections, cables, plugs and mating connectors	Visual inspection	In case of damage or visible signs of aging, have them replaced without delay. Ensure correct fastening. Do not exchange components under load or during operation.
	Clogging indicators on filters, if provided	Visual inspection	If the clogging indicator at a filter responds, the filter element is exhausted and must be replaced.
	All components	Check for noise emission	Check the EMAH actuator for noise generation. The generation of noise or an increase in the noise level can indicate a possible failure of one or several components at an early time and thus help avoid consequential damage.
Every 24-36 months	Complete system	Take fluid samples Read out acquired field data	The customer may take the fluid samples according to the instructions using a Service Kit. Read field data, see also chapter 9.4 "Field data acquisition" on page 48
As required	Hydraulic fluid and filters	Change the hydraulic fluid and the filter element	The change may only be carried out by a certified Bosch Rexroth Service Center. The hydraulic fluid and the filter element have to be replaced only as required when oil analyses indicate excessive aging.

When?	Where?	What?	Comments
Every 24 months [1]	Complete system	Functional test, analysis on site	
	Valves	Check the switching times and the function.	
	Position measuring system	Check the function.	
	Proximity switch	Check the function.	
	Spring package, spring forces and guides (if existent)	Check the condition and perfect function.	The change may only be carried out in a certified Bosch Rexroth Service Center.
	Electrical connections, cables, distributors, plugs and mating connectors, all electrical components, equipotential bonding, grounding	Check according to checklist	In case of damage (or visible signs of aging), have them replaced without delay. Ensure correct fastening.
	Mounting elements and fittings	Check the mounting elements and fittings for tight seat.	All mounting elements and fittings must be checked for proper fit when the system is switched off and has cooled down.
Every 5 years [2]	Complete system	All seals, filter element, hydraulic fluid and accumulator (if provided)	The change may only be carried out in a certified Bosch Rexroth Service Center.

Tab. 10-1: Maintenance schedule

[1] Every 36 months at the latest. Additionally, the same scope as for "Every 3 months"

[2] Every 6 years at the latest. Additionally, the same scope as for "Every 24 months"

[3] as required

For maintenance and repair work we offer a comprehensive selection of service tools (e.g. oil kit, tools for taking oil samples, WIFF unit (maintenance, service, filling and filter unit)). If required, contact Bosch Rexroth Service, see chapter 16.1 "Service and support" on page 69.

10.4 Repair

⚠ WARNING **Improper repair!**

- For repair the EMAH actuator may only be disassembled to the extent described in these operating instructions.
- Defective parts may only be replaced by new, interchangeable, tested components in original equipment quality.
- Repairs may only be performed by authorized, skilled and instructed staff.

Bosch Rexroth has an extensive service offer regarding repairs.

10.5 Spare parts

With regard to spare parts, contact Bosch Rexroth Service for clarification, see chapter 16.1 "Service and support" on page 69.

In addition, observe the safety instructions in these operating instructions when working on the EMAH actuator.

10.6 Replacement of components

For the replacement of defective components and in case of questions or doubt, please contact the Bosch Rexroth Service, see chapter 16.1 "Service and support" on page 69.

11 Demounting and removal

11.1 General notes on demounting and removal

⚠ WARNING **Systems that are still running!**

Risk of injury! The work steps described in this chapter may only be performed on shut down systems. Before beginning work:

- Make sure that the drive motor cannot be switched on.
- Ensure that all force-transmitting components and connections are (electrically) switched off and secured against restarting according to the manufacturer's specifications. If possible, remove the main fuse of the system. Verify with the help of tested measuring equipment that there is no voltage applied.

⚠ WARNING **An incompletely demounted drive unit may fall down!**

An incompletely demounted drive unit may drop and cause serious injuries.

When demounting the drive unit secure it against falling down.

⚠ WARNING **Dangerous voltages and risk of electric shock!**

In order to avoid injuries when working on electrical systems you should take the following precautions in the order listed:

- Disconnect completely
- Secure against re-connection. Observe the discharge time of the converters!
- Verify that the installation is dead
- Carry out earthing and short-circuiting
- Cover or shield against adjacent live parts

⚠ WARNING **Pretensioned spring package!**

Risk of injury due to parts being catapulted!

- The drive unit may only be demounted by specifically trained personnel and with the help of special tools.

⚠ WARNING **Risk of injury due to parts or oil being ejected!**
Risk of injury! Damage to property!

- Make sure that the drive unit is depressurized.
- Depressurize hydraulic accumulators, if provided, on the oil side.
- Relieve external forces on the drive unit.
- Observe the specifications of the system manufacturer and the system end-user.

⚠ WARNING **Components catapulted due to unintended release of the spring.**
Danger to life, risk of injury, serious personal injury

- Observe the demounting instructions in these operating instructions
- Make sure that the drive unit is not damaged during demounting

⚠ CAUTION **Danger of crushing at the spring package and at the position measuring system during demounting!**
Risk of injury!

Observe the demounting instructions in these operating instructions.

11.2 Preparing demounting

1. Decommission the entire system as described in the general instructions for the machine or system.
2. Before starting work on live components: Disconnect the EMAH actuator from the supply voltages at the system side and secure it against restarting.

11.3 Demounting

☞ Ensure during all these steps that no dirt can get into the openings.

To demount the drive unit proceed as follows:

1. Check that the drive unit has sufficiently cooled down so that it can be removed without any risks.
2. Disconnect the electric lines according to the documentation "Electrical project planning". See also chapter 7.7.3 "Installing the EMAH actuator electrically" on page 38.
3. Remove the drive unit. Use suitable lifting gear for this. Refer to the reverse order from chapter chapter 7.7.1 "Installing the drive unit mechanically" on page 31.

11.4 Preparing the EMAH actuator for storage or further use

Proceed as described in chapter 6 "Transport and storage" on page 25.

11.5 Replacement of components

⚠ WARNING **Pretensioned spring package in the piston type accumulator!**

Risk of injury!

- Do not open the piston type accumulator at the drive unit.

You may only replace the components of the EMAH actuator that are listed in these operating instructions and the replacement of which is described in these operating instructions.

12 Disposal

☞ **When decommissioning the control actuator use the following functions to clear or reset remote maintenance and or its parameters:**

- If the actuator has to be decommissioned, restore the remote maintenance module to factory settings. Observe the **Application Note** *"Update and Flash FL/TC MGUARD"* on the website of the module manufacturer. For a factory reset also follow the instructions in the manual of the specific equipment installed in your system. If required, please contact Bosch Rexroth Service.
- **IndraDrive:** For final commissioning, restore to factory settings. For further information, see Application Manual “IndraDrive Mpx-21 Functions”, R911385758. Take the SD card out and clear it. If required, please contact Bosch Rexroth Service.

12.1 Environmental protection

Careless disposal of the EMAH actuator and the hydraulic fluid may lead to environmental pollution.

- Thus, dispose of the product and the hydraulic fluid in accordance with the national regulations in your country.
- Dispose of hydraulic fluid residues according to the applicable safety data sheets for these hydraulic fluids.
- Please observe the following information for the environmentally friendly disposal of the EMAH actuator.

12.2 Return to Bosch Rexroth

The hydraulic products manufactured by us can be returned to us for disposal purposes at no costs. When returned, the products must not contain any inappropriate foreign substances or third-party components. The components have to be sent carriage paid to the following address:

Bosch Rexroth AG

Service Industriehydraulik

Bürgermeister-Dr.-Nebel-Strasse 8

97816 Lohr am Main

Germany

12.3 Packaging

Upon request, reusable systems can be used for regular deliveries.

The materials for disposable packaging are mostly cardboard, wood, and expanded polystyrene. They can be recycled without any problems. For ecological reasons, disposable packaging should not be used for returning products to Bosch Rexroth.

12.4 Materials used

Hydraulic components from Bosch Rexroth do not contain any hazardous materials that could be released during intended use. In the normal case, no

negative effects on human beings and on the environment have to be expected.

12.5 Recycling

Due to the high metal share, hydraulic products can mostly be recycled. In order to achieve an ideal metal recovery, disassembly into individual assemblies is required.

13 Extension and modification

⚠ WARNING **Loss of warranty! Personal injury and damage to property!**

Modifications exceeding the extent described in these operating instructions are **not** permitted.

14 Troubleshooting

14.1 General notes on troubleshooting

⚠ WARNING **Hazardous movements!**

In the case of fault, dangerous motions of the drive unit may occur. This means that there is a risk of injury.

- Keep out of the range of motion of the drive unit and other moving system parts during troubleshooting.
- Prevent unintended access of persons (e.g. by fencing off, covering).
- Before accessing or entering the danger zone bring the EMAH actuator safely to a standstill.

- Before starting work at live components: Disconnect the EMAH actuator at the system side from the supply voltages and secure the shut-down device against unintended or unauthorized restarting.
- After switching off the supply voltages, wait until the discharge time of the link of the drive controller of at least 30 minutes has passed.
- Check that the voltage has fallen below 50 V before touching live parts!

☞ It is possible to make a backup of parameters. For information on creating and reading parameter backups, please see the Application Manual of MPx, chapter 1.2 "Required and supplementary documentation" on page 1.

In the event of a fault, a further parameter backup has to be made. A comparison with the parameter set stored last (during operation) simplifies troubleshooting and helps you to quickly restore the configuration.

14.2 How to proceed for troubleshooting

- Troubleshooting may only be performed by authorized, skilled and instructed specialists. Moreover, training is required with regard to IndraDrive and the EMAH actuators.

Bosch Rexroth offers training courses that support your qualification in specific fields. You can find an overview of the training contents on the Internet at: www.boschrexroth.com

- Always work systematically and purposefully, even when under time pressure. Random and imprudent disassembly and changing of settings can result in the inability to determine the original cause of error.
- First obtain a general overview of how your product works in conjunction with the entire system.
- Try to find out whether the product has functioned properly in conjunction with the overall system before the error occurred first.
- Try to determine any changes of the overall system in which the product is integrated:

- Were there any changes to the product's operating conditions or operating range?
- Were there any changes (e.g. retrofit) or repairs carried out on the complete system (machine/system, electrics, control) or on the product? If yes: What were they?
- Was the product or machine used as intended?
- How did the fault become apparent?

- Try to get a clear idea of the cause of error. If possible, ask the direct (machine) operator.
- If you cannot rectify the error, contact Bosch Rexroth, see chapter 16.1 "Service and support" on page 69.

14.3 General list of faults

Fault	Possible cause	Remedy
High temperatures	Reduced cooling power with insufficient air circulation at the drive	Ensure sufficient ventilation and bleeding
Thermal shutdown in normal operation with reduction of performance and increased noise development	Significant system leakage	Localize defective components Contact Bosch Rexroth Service
	Defective components	Localize defective components Contact Bosch Rexroth Service
Malfunction or destruction of electronic components	Incorrect wiring	Check the wiring and the electrical signals with the help of measuring devices Contact Bosch Rexroth Service
Vibrations at the drive	Vibrations at the drive too high	Comply with the admissible vibration load Contact Bosch Rexroth Service
Drive does not move or moves in an uncontrolled manner or vibrates	Incorrect installation of electronics and wiring	Check for proper installation and wiring with the help of the documentation "Electrical project planning" Contact Bosch Rexroth Service
	Electrical signals are not received	Check the electronics installation and wiring Contact Bosch Rexroth Service
	Wrong gas pressure in the hydraulic accumulator	Check gas pressure Contact Bosch Rexroth Service
Drive does not run smoothly	Faults in the system	Contact Bosch Rexroth Service

Tab. 14-1: General error list

☞ General errors are not recognized by the software and will therefore not result in a direct system reaction.

14.4 Diagnostic messages

The software monitors the operation of the EMAH actuator in all operational states. Incorrect EMAH actuator functions are recognized and treated and signaled according to their error category.

Information on **error management (event management) and diagnostic messages** can be found in the application manual "EVC platform software for EMAH actuators", see also chapter 1.2 "Required and supplementary documentation" on page 1.

15 Technical data

The **technical data** can be found in the installation drawing, the data sheets of the EMAH actuator and the documentations from chapter 1.2 "Required and supplementary documentation" on page 1.

16 Annex

16.1 Service and support

Service Germany

You can reach our **Service Helpdesk & Hotline** at:

Phone:	**+49 9352 405060**
E-mail:	service@boschrexroth.de
Internet:	http://www.boschrexroth.com

Our websites provide supplementary information on service, repair (e.g. delivery addresses) and training.

Service worldwide

Outside Germany, please first get in touch with your personal contact. The hotline numbers can be found in the contact information on the Internet.

Required information

We can provide fast and efficient assistance, if you have the following information at hand:

- Detailed description of the fault and the circumstances
- Details on the nameplate of the affected products, especially type code and serial number
- Your contact details (phone and fax number, e-mail address)

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Notes

rexroth
A Bosch Company

Bosch Rexroth AG
Industrial Hydraulics
Zum Eisengießer 1
97816 Lohr a.Main, Germany
Phone +49 9352 403020
my.support@boschrexroth.de
www.boschrexroth.com

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Operating instructions