EWELLIX

EWELLIX Linear Actuator

MATRIX

User Manual

We pioneer motion

SCHAEFFLER

Contents

1 About the manual

1.1 Information in this user manual

This manual provides important information on how to work with the device safely and efficiently.

The manual is part of the device, must always be kept in the device's direct proximity and should be available for personnel to read at any time. All personnel working with the device must read and understand this manual before starting any work. Strict compliance with all specified safety notes and instructions is a basic requirement for safety at work.

Moreover, the accident prevention guidelines and general safety regulations applicable at the place of use of the device must also be complied with.

1.2 Symbols

Safety precautions are identified by symbols and signal words as shown. The signal words indicate the severity of the hazard and the chance it could occur. Follow these safety precautions and act cautiously in order to avoid accidents, personal injury and damage to property.

The warning and hazard symbols are defined in accordance with ANSI Z535.6-2011.

1 Warning and hazard symbols

Signs and descriptions	
⚠ DANGER	In case of non-compliance, death or serious injury will occur.
⚠ WARNING	In case of non-compliance, death or serious injury may occur.
⚠ CAUTION	In case of non-compliance, minor or moderate injury may occur.
NOTICE	In case of non-compliance, damage or malfunctions in the product or the adjacent construction may occur.

1.3 Signs

The warning, prohibition, and mandatory signs are defined in accordance with DIN EN ISO 7010 or DIN 4844-2.

2 Warning, prohibition, and mandatory signs

Signs and descriptions	
	General warning
	Electrical voltage warning
	Observe the manual
	General mandatory sign

1.4 Availability

A current version of these instructions is available at:
https://www.schaeffler.de/std/222D

Ensure that this manual is always complete and legible and is available to all persons engaged in transporting, fitting, dismantling, commissioning, operating, or maintaining the product.

Keep the manual in a safe place for immediate reference.

1.5 Legal notices

The information in this manual reflects the status at the time of publication.

Unauthorized modifications to or improper use of the product are not permitted. Schaeffler accepts no liability in these cases.

1.6 Limitation of liability

All information and notes in this manual have been compiled in accordance with the applicable standards and regulations, the present status of technology and our many years of knowledge and experience.

The manufacturer is not liable for any damage resulting from:

- failure to observe this manual
- unintended use
- employment of untrained personnel
- unauthorized conversions
- technical changes
- tampering with or removal of screws on the linear actuator
- use of unapproved spare parts

Where the device has been customized, the actual product delivered may differ from the description provided in this manual. In such cases, please contact Schaeffler, to obtain further instructions or information on safety precautions for these devices.

We reserve the right to make technical modifications to the device to improve usability.

1.7 Copyright

This manual is protected by copyright and may be used exclusively by Schaeffler customers for internal purposes.

Distribution of this manual to third parties, reproduction of any kind, including excerpts, as well as the use or disclosure of its content without the written consent of the manufacturer is not permitted, except for internal purposes.

Any copyright violation may become the subject of a future claim for damages.

1.8 Spare parts

This device is not designed to be repaired by the owner or operator. Any warranty or service claims will be rendered invalid immediately if repairs are not carried out by the manufacturer or by another party authorized by the manufacturer.

If the device cannot be repaired on site by authorized personnel it must be dismantled and sent to the manufacturer.

Safety risk from incorrect spare parts

Incorrect or faulty spare parts can compromise safety and result in damage, malfunctions, or complete failure.

- Only use original spare parts from the manufacturer.
- Spare parts in or on the device may only be replaced by the manufacturer. The device must be dismantled and returned to the manufacturer.

1.9 Customer service

Schaeffler Customer Service is available at any time to assist with technical information and inquiries. The responsible contact person can be reached by telephone, e-mail, or via the Internet, see manufacturer's address on the back cover. Our employees are also always interested in receiving new information and practical experience. This information and experience helps us improve our products.

1.10 Images

The images in this manual may be schematic representations and may differ from the delivered device.

2 General safety regulations

This section provides an overview of all essential safety aspects for optimum personal protection as well as safe and trouble-free operation. Failure to observe this manual and the safety instructions contained herein may result in significant hazards and potentially lead to serious injury or death.

2.1 Usage for the intended purpose

The linear actuator has been developed and manufactured exclusively for the intended use described in this user manual.

The linear actuator may only be used within the rated load specified on the product label, in compression or tension. The manufacturer cannot be held responsible for damage resulting from use of the linear actuator in a manner other than that cited here.

It is intended for indoor use only and is used in medical devices as well as in industrial technology and construction technology.

Any use beyond the intended use or deviating from the above description is considered misuse and may lead to potentially hazardous situations. Please note:

- Strictly observe all safety precautions and instructions in this user manual.
- Do not expose the device to weather conditions, strong UV radiation, corrosive or explosive air media, or other aggressive media.
- Do not alter the structural design or individual components of the linear actuator.
- Never use the device outside of its intended use and specifications.

The linear actuator is only intended for use in the following situations:

- ambient temperature range of 0 °C to +40 °C
- humidity 5 % to 85 %, non-condensing
- air pressure from 700 hPa to 1060 hPa

2.1.1 Service life

The device is designed for a service life of 10 years or 10000 double strokes at a stroke length of 200 mm.

2.1.2 User groups

To ensure safety, we specify requirements for the users of the device that must be adhered to under all circumstances. Only persons who meet these requirements are authorized to use the device.

We define user groups as all persons who operate, commission, further process, or pass on the device for further processing. Since the requirements of these user groups vary considerably depending on their role, we distinguish between the following user groups:

3 User groups

User group	Requirements
operating authority	The operating authority is the contractual partner of the executor or the reseller. The operating authority may be subject to legal conditions when acquiring the product. The operating authority ensures that the user is instructed on the authorized use of the product.
Executing party	The executing party is the contractual partner of the reseller or the manufacturer. They install the product in a system. They are authorized by the manufacturer of the device to use the product in accordance with the regulations and with the necessary technical expertise.
Technician	The technician has the professional technical training to implement the device according to its authorized use. They are familiar with the general safety regulations ➤9|2.
Reseller	The reseller passes the device on.
Operator	We define any other person who uses the device as an operator. The operator must have read the general safety instructions before using the device. In addition, they must be instructed in normal operation by the operating authority ➤9|2.

2.1.3 Operating modes

The device is intended exclusively for intermittent operation.

2.1.4 Hazard areas

We distinguish between 2 hazard areas, which must be observed depending on the user group and persons involved.

4 Hazard areas

Danger zone	Requirements
Persons	The danger zone includes not only the actual users but also third parties (other personnel, visitors, patients, etc.). In the event of damage, liability rests with the operator.
Device	The danger zone is the responsibility of the Executors and Technicians user group and includes the control unit and all attached elements.

2.2 Usage not for the intended purpose

Any use other than for the intended purpose without the manufacturer's written consent shall be considered unauthorized. Operation beyond the technical limits shall also be considered unauthorized.

The technical operating limits can be found in the technical data as well as on the label affixed to the device.

The device is suitable for internal use only and must not be subjected to weather conditions, strong UV radiation, or explosive atmospheric media.

Excluded applications:

- applications involving flammable mixtures of anesthetics and air
- applications involving flammable mixtures of anesthetics and oxygen or nitrous oxide
- applications in environments with elevated radiation levels

2.3 Responsibility of the owner and processor

The device has been developed by the owner or processor for commercial applications. The processor is the contracting partner of the reseller or the manufacturer. The processor installs the device into a complete system (application).

The owner or processor of the system is subject to the requirements of the Occupational Health and Environmental Act.

In addition to the safety instructions in this manual, the owner or processor must observe the following in relation to these safety regulations, accident prevention guidelines, and environmental protection regulations applicable at the system's installation site:

- Familiarize themselves with the applicable occupational health and safety regulations and, by means of a risk assessment, identify any additional hazards arising from the specific working conditions at the device's place of use. Implement the hazard assessment in the form of work instructions for operating the device.
- Confirm that the work instructions created for the system, including the device, comply with current legal requirements, and adapt the instructions accordingly
- Clearly define and assign responsibilities for installation, operation, maintenance, and cleaning.
- Ensure that all personnel handling the device have read and understood this manual..
- Provide personnel with the required protective equipment.
- Train personnel regularly and inform them about the dangers.

In addition, the owner or processors must ensure that the device is in proper working condition. They must do the following:

- Ensure that the maintenance intervals described in this manual are observed.
- Have all safety devices checked regularly to ensure their correct operation and completeness.

2.4 Personnel requirements

Operator duties:

- Ensure that only qualified and authorized personnel carry out the activities described in these instructions.
- Ensure that personal protective equipment is used.

Only persons who can be expected to reliably perform their tasks are permitted. Persons whose ability to react is impaired, e.g., due to drugs, alcohol, or medication, are not permitted.

2.4.1 Qualifications

For the various areas of activity described in this manual, the following qualifications are required:

Operator

The operator has been instructed by the customer on the assigned tasks and possible hazards in the event of improper conduct.

Qualified personnel

Qualified personnel meet the following criteria:

- Product knowledge, e.g. by receiving training on how to use the product
- are fully familiar with the contents of this manual and, in particular, with all of the safety instructions
- are familiar with the relevant country-specific regulations

Qualified personnel, on the basis of their technical training, knowledge, and experience as well as familiarity with the applicable standards and regulations, are capable of performing the work assigned to them and of independently recognizing and avoiding potential hazards.

Electrically skilled person

An electrically skilled person, on the basis of their technical training, knowledge, and experience as well as familiarity with the applicable standards and regulations, is capable of performing work on electrical systems and of independently recognizing and avoiding potential hazards.

The electrically skilled person is trained for the specific place of use and is familiar with the applicable standards and regulations.

2.5 Hazards

This section lists the residual risks identified through the risk assessment.

The manufacturer has minimized the effects of existing hazards through design and protective measures. Pay attention to the residual hazards and potential countermeasures described in the following sections, as well as to the warning notices

Danger to life from electric current

Touching live parts poses an immediate danger to life. Damage to insulation or individual components may pose a danger to life. Therefore, observe the following:

- In an emergency, the linear actuator must be disconnected from the control unit or power supply.
- Applications in which a linear actuator is installed must provide an emergency-stop switch or isolation from the mains supply on all conductors.
- Prevent the linear actuator from being exposed to water spray or coming into contact with hoses during operation.
- If the insulation is damaged, immediately switch off the power supply and have the parts repaired.
- Work on the electrical system may only be performed by professional electricians.
- Before performing any work on the electrical system, disconnect the system from the power supply.
- Before maintenance, cleaning, or repair work, disconnect the power supply and secure it against reconnection.
- Do not bypass or disable fuses. When replacing fuses, ensure the correct current rating is used.
- Keep moisture away from live parts. to prevent short circuits.

Risk of injury due to moving components

Rotating or linearly moving components can cause serious injury. Therefore, observe the following:

- Do not work on moving components.
- Keep your entire body, hands, and arms away from moving components.

Risk of injury due to crushing

Impact against fixed objects may result in injury due to the force exerted.

- Ensure that no persons are in the hazard area during the stroke.
- Ensure that no objects or persons come into contact with the push tube or protection tube at the front and rear mounting points.

Risk of injury from pinching in the fork head

Hand injuries may occur due to pinching in the fork head of the push tube while the motor is running. As long as the fork head is not installed in an application, rotary motion will occur.

- As long as the fork head is not installed in an application, rotary motion will occur. Make sure that no objects or persons come into contact with the fork head of the push tube when the motor is running.
- Hold the linear actuator only by the protection tube.

Risk of injury from pinching

If the linear actuator comes into contact with fixed objects, the driving force may cause personal injury.

- If the linear actuator is left unattended, ensure that the full stroke length is free of obstacles and that no persons are located in the stroke area.
- Alternatively, provide a means of disconnecting all conductors from the mains power supply.

Risk of injury due to damaged housing

Injury due to cracks and related openings in the housing of the linear actuator or its accessories.

- If the housing is damaged due to cracks, breakage or heavy wear, stop using the device and follow the disassembly instructions.

Risk of injury from gap openings

Models MAX6, MAX7 with customized option 249, have an opening in the protection tube. The end user must provide suitable covers in the application to prevent a pinching hazard for the operator. The linear actuator may be damaged if liquids enter the interior of the device. Keep liquids away (IP protection class IP10).

Property damage

- Any lateral force can destroy the linear actuator. Do not tamper with any attachments connected to the actuator during the stroke.
- Impact against fixed objects may result in injury due to the force exerted. Ensure that no fixed objects are in the hazard area during the stroke.
- Risk of damage to the linear actuator caused by static and dynamic overloading of the actuator. Do not use the linear actuator beyond the permissible specifications.

2.6 Safety equipment

⚠ WARNING

Faulty safety equipment

Risk of injury from malfunctioning safety equipment

- To ensure safe operation, all functions must be in perfect working condition.
- Always very the function of the safety equipment in accordance with the maintenance plan
- Never deactivate safety equipment.
- Safety equipment must never be bypassed or modified.

Integration of an emergency stop system (for certain applications)

The linear actuator is intended exclusively for installation in an application. MAX1 and MAX3 do not have their own operating elements and do not have an independent emergency stop function. Observe the following:

- Install the device in such a way that it is part of an emergency stop system and can be stopped if necessary.
- The emergency stop device must be connected in such a way that an interruption of the power supply, or restoration of the power supply after an interruption, does not cause any hazard to persons or property.
- Emergency stop equipment must always be freely accessible.

Information on the emergency lowering function, quick release, electrical anti-pinch protection, and mechanical anti-pinch protection can be found in the section *Product description* ➤29|4.3.

The processor determines which application requires the installation of the following safety systems.

Overload shutdown (MAX1, MAX3)

In the standard version, the device does not feature an overload shutdown and must be switched off via a Schaeffler control unit.

Exceptions are MAX11 and MAX31. These must not be connected to a Schaeffler control unit.

Power cutoff (MAX6, MAX7)

The control unit with integrated power cutoff is installed in the actuator.

Thermal protection (MAX1, MAX3)

In the standard version, the device is not equipped with thermal protection and may be destroyed by overheating. A Schaeffler control unit with an integrated thermoswitch will switch off the device in emergency situations.

NOTICE

Overheating

Destruction of the device due to burnout of the motor windings

- Use a control unit with power interruption or a fuse.

Thermal protection (MAX6, MAX7)

Thermal protection is integrated into the internal control.

To prevent damage due to overheating, do not attempt to operate the linear actuator until its temperature has fallen below the switch trigger threshold.

2.7 Securing against reconnection

When working in hazard zones, there is a risk that the power supply could be turned on without prior authorization. Uncontrolled reconnection represents a potentially life-threatening situation for people within the danger zone.

Observe the following:

- Follow the instructions provided in this user manual on preventing uncontrolled reconnection of the power supply.
- Follow the steps described below to secure against reconnection.

Securing MAX1 and MAX3 against reconnection

1. Unplug the control unit from the mains socket and secure it against being plugged in again.

Securing MAX6 and MAX7 against reconnection

1. Unplug the mains plug connected to connection (1) from the socket and secure it against being plugged in again.

1 Mains cable connection MAX6, MAX7

1	Mains cable connection

2.8 Modifications to the device

To avoid hazardous situations and to ensure optimal performance, do not make any changes or modifications to the device that have not been specifically authorized by Schaeffler.

2.8.1 Warning notices

Symbols and warning signs are located in the hazard zone. They refer to the immediate surroundings.

For the meaning of the symbols and signs, see the chapter About this manual ➤6|1.

Stickers and warning signs may become dirty or illegible over time or for other reasons. Please observe the following:

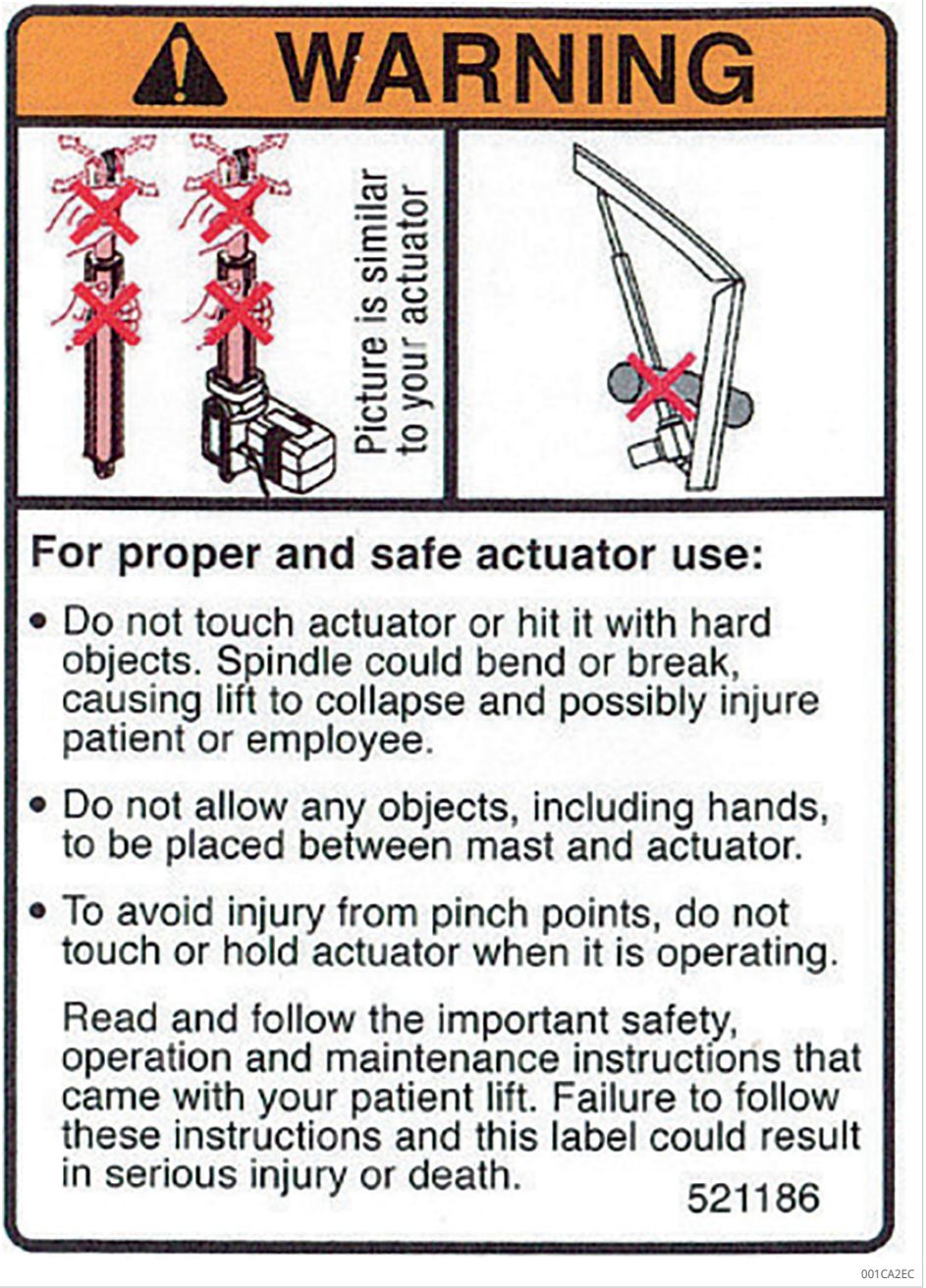
- Ensure that all safety instructions, warning notices, and operating instructions remain legible at all times.
- Replace damaged stickers and warning signs

Contact with the device

The label is applied for certain applications, e.g., patient lifts.

- Do not hold the linear actuator or the protection tube.
- Do not place any body parts or objects between moving parts.
- Keep body parts and objects away from moving parts.

2 Sticker: WARNING – Shear force

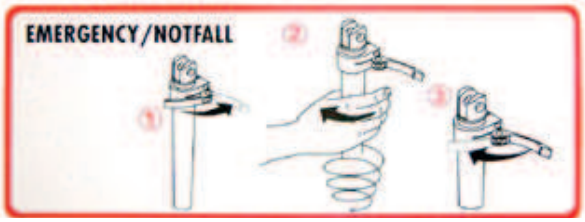


2.8.2 Sticker

Stickers and warning signs may become dirty or illegible over time or for other reasons. Please observe the following:

- Ensure that all safety instructions, warning notices, and operating instructions remain legible at all times.
- Replace damaged stickers and warning signs

3 Sticker emergency lowering



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2.9 Manufacturer's declaration of EMC conformity

IEC 60601-1-2 Medical electrical equipment, Part 1-2: General requirements for basic safety and essential performance – Collateral standard: Electromagnetic disturbances – Requirements and tests.

This section is only valid if the devices are approved and used for medical applications or environments in accordance with DIN EN 60601-1-2.

An EMC declaration of conformity for the device can be provided upon request.

A report is available in accordance with the generic standards DIN EN 61000-6-2 and EN 61000-6-3.

Maintaining safety and performance

Once approval has been granted for the final application, no further modifications are permitted due to EMC considerations.

Do not modify the final application once installed for EMC-related reasons.

This product has been tested under the actual conditions of the radio frequency environment prevailing in Europe.

Final application environment

Depending on the final application and the environment, EMC tests (immunity and emission) are required in order to meet the standards.

Medical electrical equipment

- Emission: DIN EN 60601-1-2
- Immunity: DIN EN 60601-1-2

Industrial environments (generic standards)

- Emission: IEC 61000-4-2
- Immunity: IEC 61000-4-4

Residential, commercial, and light-industrial environments (generic standards)

- Emission: EN 61000-6-3
- Immunity: DIN EN IEC 61000-6-1

2.9.1 General information

Professional healthcare facilities

Physicians' offices, dental practices, clinics, nursing facilities, outpatient surgical centers, freestanding birthing centers, multiple treatment facilities, hospitals (emergency rooms, patient rooms, intensive care, surgery rooms, except in the vicinity of HF surgical equipment, MRI systems outside a room shielded against RF signals, or an ME system for magnetic resonance imaging)

Essential performance characteristics

The essential function of the linear actuator is to hold, position, and move weights and loads.

Risk management (document L5671,0012) identifies the functions of these linear actuators.

All characteristics and functions are performed correctly. Unacceptable risks to patients, operators, or other persons are identified and evaluated in order to prevent or reduce harm.

⚠ WARNING

Stacked with other devices.

Avoid using this device next to or on a stack of other devices, as this may result in improper operation. If the device does need to be used in this way, it and the other devices should be observed to ensure that they function normally.

⚠ WARNING

Use of accessories, sensors, and cables.

The use of accessories, encoders, and cables not specified or supplied by the device manufacturer may result in increased electromagnetic emissions or decreased electromagnetic immunity of this device and may lead to improper operation.

5 Approved power cables

Description	Plug	Type	Drawing number	Length
				m
Power cable, straight	Jack plug	2 × AWG18; 1 × AWG24	952329-1350	1.35
Power cable, straight	Jack plug	2 × AWG18; 1 × AWG24	952329-2650	2.65
Power cable, coiled	Jack plug	2 × AWG18; 1 × AWG24	952376-0001	0.78
Power cable, straight	DIN-8	2 × AWG18; 5 × AWG24	160622-2650	1.50
Power cable, coiled	DIN-8	2 × AWG18	160618	0.78

6 Approved mains power cables

Description	Plug	Country	Drawing number	Length	Comment
				m	
Mains power cable, straight	Schuko	DE	140306-3500	3.5	–
Mains power cable, straight	SEV	CH	140316-3500	3.5	–
Mains power cable, straight	UL	USA	140355-3500	3.5	–
Mains power cable, straight	Hospital grade	USA	140360-3500	3.5	–
Mains power cable, straight	BS 1363	UK	140350-3500	3.5	–
Mains power cable, coiled	Schuko	DE	140342-1500	1.2 / 2.2	–
Mains power cable, straight	SEV	CH	140426-3500	3.5	Polyurethane cable

RF communications equipment

⚠ WARNING

Limited performance

Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm to any part of the ME equipment. The performance of this device could be otherwise impaired.

2.9.2 Technical description

Requirements applicable to all ME equipment and systems for compliance with the individual standards for electromagnetic emissions and immunity.

Emissions guidelines

The MAX1, MAX3, MAX6, and MAX7 linear actuators are intended for use in the electromagnetic environment specified below.

The customer or user of the linear actuator must ensure that it is used in such an environment.

▦7 Emissions guidelines

Linear actuator	Emissions tests	Compliance	Electromagnetic environment – guidance
MAX1, MAX3	Radiated electromagnetic fields CISPR 14 (EN 55014)	Group 1	–
MAX6, MAX7	Radiated electromagnetic fields CISPR 11 (EN 55011-B)	Class B	ME equipment class, class B

- Deviations from standards and tolerances applied for MAX1 and MAX3 ➤20|▦8.
- Instructions for maintaining basic safety and essential performance characteristics over the expected service life

▦8 Deviations from the standard 5.2.2.1b

Standard	Test	Test type	Value	Example	Comment
IEC 60601-1-2:2014	According to report 18-MO-0017.E02	All	–	MAX62, MAX7	Passed (no deviation)
	Conducted emission	Requirement	0 dB		QP margin
		Measurement	−1.8 dB / 154 kHz	MAX 30	Failed
			−0.9 dB / 172 kHz	MAX 30	Failed
	Discontinuous disturbance (clicks)	Emission	High click rate	MAX 11, MAX 30	Failed
				MAX 11, MAX 30 with control unit KOM	Passed
	Immunity to surge voltages	L-L (AC)	±1 kV, ±2 kV	MAX 11, MAX 30	Not applicable
		L-PE (AC)	±1 kV, ±2 kV	MAX 11, MAX 30	Not applicable
		L-L (DC)	±0.5 kV		
		L-PE (DC)	±0.5 kV		
		Measurement	±0.5 kV	MAX 11, MAX 30	Passed (DC)
EN 61000-6-3	Discontinuous disturbance (clicks)	Emission	High click rate	MAX 11, MAX 30	Failed
				MAX 11, MAX 30 with control unit KOM	Passed

Action plan in accordance with the deviations. In the applications, MAX1 and MAX3 are operated with a mains-powered control unit. As a result, the deviations are accepted. The end user must ensure compliance with the applicable EMC requirements.

2.9.3 Electromagnetic immunity (IEC 60601-1-2)

9 Enclosure port

Test	Standard	Immunity test levels	
		Professional healthcare facility	Home healthcare
Electrostatic discharge (ESD)	IEC 61000-4-2	±8 kV contact discharge	±8 kV contact discharge
		±2, ±4, ±8, ±15 kV air discharge	±2, ±4, ±8, ±15 kV air discharge
Radiated RF emission	IEC 61000-4-3	3 V/m	10 V/m
		80 MHz ... 2.7 GHz	80 MHz ... 2.7 GHz
		80 % AM at 1 kHz	80 % AM at 1 kHz
Proximity fields from RF communications equipment	IEC 61000-4-3	➤22|14	➤22|14
Power frequency magnetic field 50/60 Hz	EN 61000-4-8	30 A/m	30 A/m

10 AC power port

Test	Standard	Immunity test levels	
		Professional healthcare facility	Home healthcare
Electrical fast transients/bursts	IEC 61000-4-4	±2 kV	±2 kV
Immunity to surge voltages	IEC 61000-4-5	±0.5, ±1 kV line-to-line	±0.5, ±1 kV line-to-line
		±0.5, ±1, ±2 kV line to earth	±0.5, ±1, ±2 kV line to earth
Conducted disturbances induced by RF fields	IEC 61000-4-6	3 V	3 V
		0.15 MHz ... 80 MHz	0.15 MHz ... 80 MHz
		6 V in ISM bands between 0.15 MHz ... 80	6 V in ISM bands and radio bands between 0.15 MHz ... 80
		80 % AM at 1 kHz	80 % AM at 1 kHz
Voltage dips	IEC 61000-4-11	8 % U_T for 0.5 cycles	8 % U_T for 0.5 cycles
		At 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°	At 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°
		0 % U_T for 1 cycle and 70 % U_T	0 % U_T for 1 cycle and 70 % U_T
		25/30 cycles	25/30 cycles
		Single-phase: at 0°	Single-phase: at 0°
Voltage interruptions	IEC 61000-4-11	0 % U_T for 230/300 cycles	0 % U_T for 230/300 cycles

11 DC power port

Test	Standard	Immunity test levels	
		Professional healthcare facility	Home healthcare
Electrical fast transients/bursts	IEC 61000-4-4	±2 kV	±2 kV
Immunity to surge voltages	IEC 61000-4-5	±0.5, ±1 kV line-to-line	±0.5, ±1 kV line-to-line
		±0.5, ±1, ±2 kV line to earth	±0.5, ±1, ±2 kV line to earth
Conducted disturbances induced by RF fields	IEC 61000-4-6	3 V	3 V
		0.15 MHz ... 80 MHz	0.15 MHz ... 80 MHz
		6 V in ISM bands between 0.15 MHz ... 80 MHz	6 V in ISM bands and radio bands between 0.15 MHz ... 80 MHz
		80 % AM at 1 kHz	80 % AM at 1 kHz
Electrical transients along supply lines	ISO 7637-2	Not applicable	Specified in ISO 7637-2

12 Patient connection

Test	Standard	Immunity test levels	
		Professional healthcare facility	Home healthcare
Electrostatic discharge (ESD)	IEC 61000-4-2	±8 kV contact discharge	±8 kV contact discharge
		±2, ±4, ±8, ±15 kV air discharge	±2, ±4, ±8, ±15 kV air discharge
Conducted disturbances induced by RF fields	IEC 61000-4-6	3 V	3 V
		0.15 MHz ... 80 MHz	0.15 MHz ... 80 MHz
		6 V in ISM bands between 0.15 MHz ... 80 MHz	6 V in ISM bands and radio bands between 0.15 MHz ... 80 MHz
		80 % AM at 1 kHz	80 % AM at 1 kHz

13 Input/output signals

Test	Standard	Immunity test levels	
		Professional healthcare facility	Home healthcare
Electrostatic discharge (ESD)	IEC 61000-4-2	±8 kV contact discharge	±8 kV contact discharge
		±2, ±4, ±8, ±15 kV air discharge	±2, ±4, ±8, ±15 kV air discharge
Electrical fast transients/bursts	IEC 61000-4-4	±1 kV 100 kHz repetition frequency	±1 kV 100 kHz repetition frequency
Immunity to surge voltages	IEC 61000-4-5	±2 kV line to earth	±2 kV line to earth
Conducted disturbances induced by RF fields	IEC 61000-4-6	3 V	3 V
		0.15 MHz ... 80 MHz	0.15 MHz ... 80 MHz
		6 V in ISM bands between 0.15 MHz ... 80 MHz	6 V in ISM bands and radio bands between 0.15 MHz ... 80 MHz
		80 % AM at 1 kHz	80 % AM at 1 kHz

14 Test frequencies for proximity fields from RF communications equipment

Test frequency	Band [1]	Service [1]	Modulation		Maximum power	Distance	Immunity test level
			Pulse [2]	FM [3]			
MHz	MHz	–	Hz	kHz	W	m	V/m
385	380 ... 390	TETRA 400	18	–	1.8	0.3	27
450	430 ... 470	GRMS 460, FRS 460	–	Deviation: ±5 Sine: 1	2	0.3	28
710, 745, 780	704 ... 787	LTE Band 13, 17	217	–	0.2	0.3	9
810, 870, 930	800 ... 960	GSM 800/900, TETRA 800, IDEN 820, CDMA 850, LTE Band 5	18	–	2	0.3	28
1720, 1845, 1970	1700 ... 1990	GSM 1800, CDMA 1900, GSM 1900, DECT LTE Band 5	217	–	2	0.3	28
2450	2400 ... 2570	Bluetooth WLAN 802.11 b/g/n RFID 2450 LTE Band 7	217	–	2	0.3	28
5240, 5500, 5785	5100 ... 5800	WLAN 802.11 a/n	217	–	0.2	0.3	9

1) For some services, only the uplink frequencies are included.

2) The carrier shall be modulated with a square wave signal with a 50 % duty cycle.

3) As an alternative to FM modulation, a 50 % pulse modulation at 18 Hz may be used. While this does not represent actual modulation, it represents the worst-case scenario.

If necessary to achieve the immunity test level, the distance between the transmitting antenna and the medical device or medical system may be reduced to 1 m. A test distance of 1 m is permissible in accordance with IEC 61000-4-3.

3 Scope of delivery

MAX1, MAX3

- Actuator
- User manual
- Installed cable and low-voltage connector as a jack plug or DIN-8 plug
- Bearing inserts for hinge head and fork head
- Optional: accessories

MAX6, MAX7

- Actuator
- User manual
- Bearing inserts for hinge head and fork head
- Optional: accessories

3.1 Check for damage during transit

1. Check the product immediately upon delivery for any damage during transit.
2. Do not accept delivery, or only accept it with reservation, if transport damage is found.
3. Record the extent of damage on the transport documents or the carrier's delivery note.
4. Report any damage during transit promptly as a complaint to the carrier.

Report any damage as soon as it is discovered. Claims for damages can only be made within the applicable claim period stipulated by the transport company.

3.2 Check for defects

1. Check the product immediately upon delivery for any visible defects.
2. Check the product for completeness immediately upon delivery.
3. Report any defects promptly to the distributor of the product.
4. Do not put damaged products into operation.

4 Product description

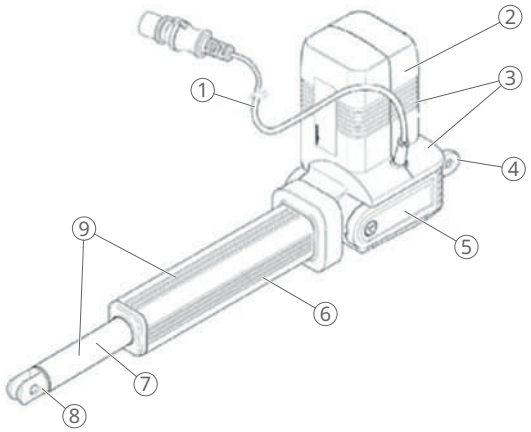
The EWELLIX MATRIX linear actuator is used within an application and is intended exclusively for dynamic axial push or pull loads. The linear actuator consists of a motor unit and a linear unit, which are connected to each other via a bayonet connection.

The linear actuator consists of a DC motor with a worm gear that drives a lead screw with trapezoidal thread (type B and C) or a ball screw (type A). Via the ball screw bracket, the lead screw or ball screw converts the rotational movement of the gear into a linear movement of the linear actuator.

The hinge head and the fork head transmit the force to both sides of the application.

MAX1, MAX3

4 Components MAX1, MAX3



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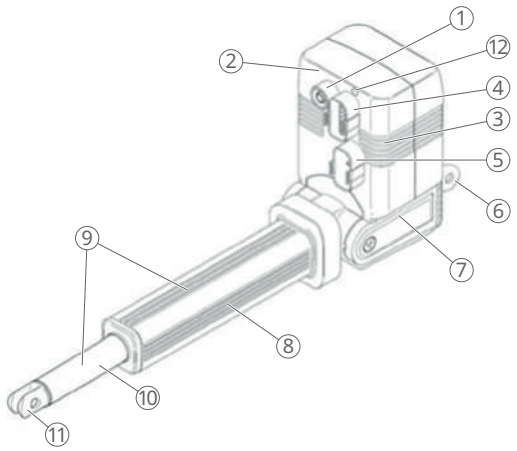
1	Control connection cable	2	Motor housing
3	Motor unit	4	Hinge head or fork head
5	Bracket	6	Protection tube
7	Push tube	8	Fork head
9	Linear unit		

MAX6, MAX7

5 Components MAX6, MAX7



001D6E16

1	Slave linear actuator connection (optional)	2	Motor housing
3	Motor unit	4	Operating element connection
5	Mains cable connection	6	Hinge head or fork head
7	Bracket	8	Protection tube
9	Linear unit	10	Push tube
11	Fork head	12	Operating indicator (MAX7)

4.1 Function

Motor

The motor is a 24 V DC motor whose shaft drives a worm gear. The stroke speed depends on the load. The motor unit is enclosed in a two-part plastic housing. The plastic housing cannot be opened. A mounting bracket encloses the plastic housing.

Brake

The mechanical brake is located in the motor unit and ensures that the actuator maintains its position when at a standstill. The maximum self-locking force of the brake when the actuator is stationary can be found in the technical data.

Gear

The worm gear is driven directly by the motor shaft, which, depending on the version, drives a lead screw or a ball screw.

Linear unit

The push and pull movements are performed by the push tube. The push tube is enclosed and protected by the protection tube.

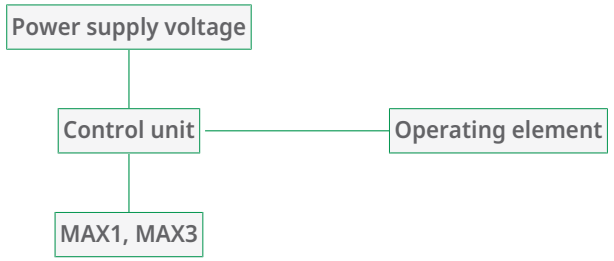
The linear unit is connected to the motor unit via a bayonet connection. The bayonet connection is protected by a plastic cover, which also serves as a locking mechanism and must not be removed.

4.2 Control unit

MAX1, MAX3

To operate the device, a control unit and an operating element are required ➤79|14.2.

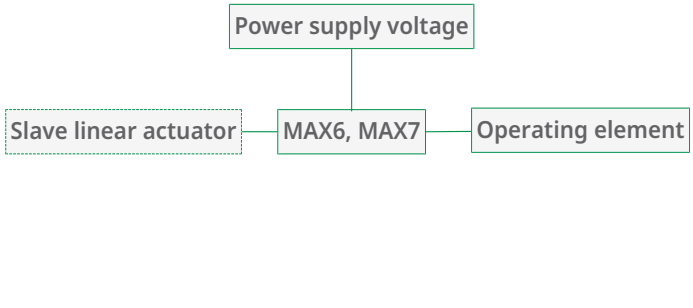
6 Control MAX1, MAX3



MAX6, MAX7

To operate the device, an operating element is required ➤79|14.2.

7 Control MAX6, MAX7



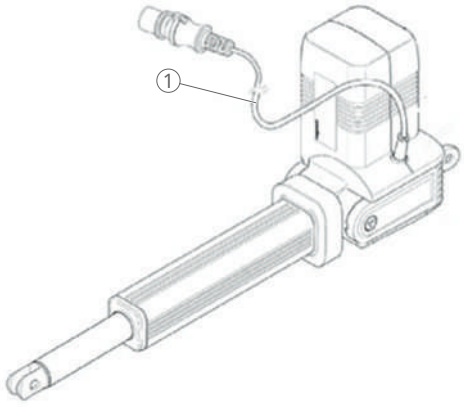
4.2.1 Connections

MAX1, MAX3

The MAX1 and MAX3 linear actuators require an external control unit to supply power to the actuator. The control unit is connected to the device via a connection cable. The operating element is also connected to the control unit.

The difference between the MAX1 and MAX3 linear actuators lies in their different performance levels.

8 Connections MAX1, MAX3



1	Low-voltage plug		

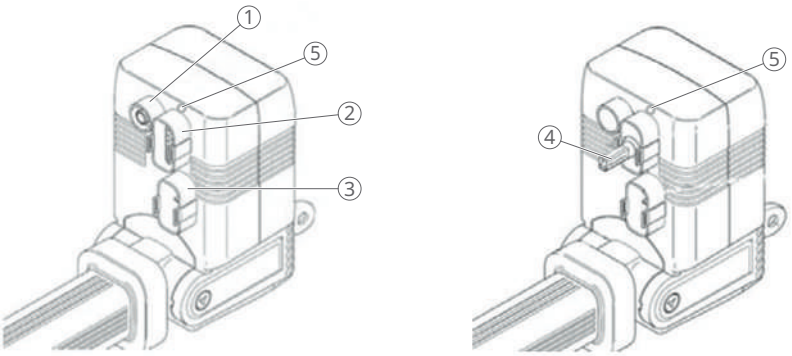
Connection to an external control unit via a jack plug or DIN-8 plug. The low-voltage plug (1) connects the device to the power supply via an external control unit.

MAX6, MAX7

The MAX6 and MAX7 linear actuators do not require an external control unit. The control unit is integrated into the motor housing. For powering the motor unit, the device is connected directly to the supply voltage via the mains connection. The operating element can also be connected directly to the device.

The MAX6 and MAX7 linear actuator can be used in a master actuator function with a second DC linear actuator (slave linear actuator) with a jack plug.

9 Connections MAX6, MAX7



1	Slave linear actuator connection for jack socket (optional)	2	Connection to operating element (electrical)
3	Power line connection	4	Connection to operating element (pneumatic)
5	Operating indicator		

Depending on the version of the linear actuator, the MAX6 or MAX7 is controlled via an electrical or pneumatic operating element.

The device is connected directly to the power supply via the connection (3).

4.2.2 Operating elements

MAX1, MAX3

The device does not have its own operating elements. Operation is performed via a Schaeffler operating element connected to an external Schaeffler control unit. Observe the separate user manuals for these devices.

MAX6, MAX7

The device does not have its own operating elements. Operation is performed via an electrical or pneumatic Schaeffler operating element connected directly to the device.

4.2.3 Requirements for third-party control units

Control units not approved by Schaeffler for MAX1 and MAX3 are referred to as third-party control units.

The use of original Schaeffler control units is strongly recommended for operating the device. If third-party control units are used, well-documented proof must be provided to ensure that the following requirements are met.

- The secondary circuit of third-party control units must be designed as a category 1 overvoltage circuit.
- Third party control units must be fitted with overcurrent cutoff. The maximum current consumption of the linear actuator should not exceed the rated value by more than0.5 A.
- The maximum cutoff value must not exceed the rated value by more than 1 A.
- Example
  - The maximum current consumption is 5 A
  - The recommended cutoff value is 5.5 A
  - The maximum cutoff value is 6 A

The power shut-off must be set differently if the main load direction is in pull mode. The maximum power consumption values for each type can be found in the technical data.

- The third-party control unit must allow the linear actuator to draw currents of up to 25 A for 250 ms following activation (inrush current). The cutoff function for the input power must be temporarily deactivated for this purpose.
- The operating voltage of the linear actuators is DC 24 V to DC 30 V .
- The no-load voltage of DC 36 V must not be exceeded.
- Once the system has been installed, ensure electromagnetic compatibility.

The operating time and duty cycle of the MAX6 and MAX7 linear actuators must not be exceeded.

The third-party power supply must provide separation between the primary and secondary circuits in accordance with 2 MOPP and a non-grounded secondary circuit.

Push-to-run operation (recommended)

The linear actuator operates as long as the switch is pressed. If the operating element has no signals to indicate operation, it is recommended to install a standby indicator in the third-party control unit.

4.3 Options

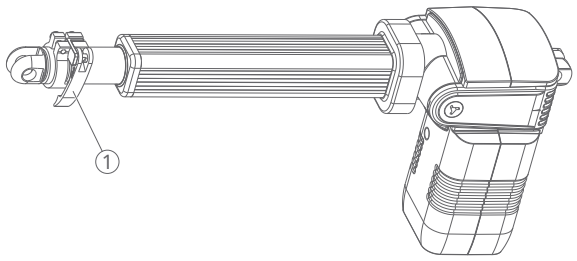
The type designation on the type plate identifies the available options.

Unless otherwise specified, the options listed here are available for the entire MATRIX linear actuator series.

4.3.1 Emergency lowering

Emergency lowering allows the application to be lowered manually in an emergency (e.g., in the event of a power failure or motor ➤55|8.3.3.

10 Emergency lowering



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1	Emergency lowering device

4.3.2 Quick release

In life-threatening situations (e.g., during patient resuscitation), the linear actuator can be adjusted manually using the quick release function. This allows, for example, the backrest or knee break position of a bed to be lowered ➤53|8.3.2.

There are 2 quick release options:

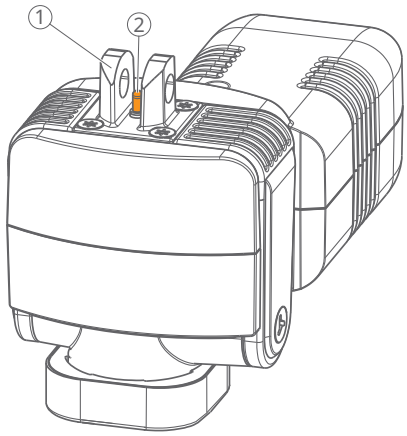
- quick release via clamping lever
- quick release via Bowden cable

It is recommended not to use this option in combination with an encoder, as the position is lost when quick release is activated.

4.3.3 Electrical anti-pinch protection (MAX3, MAX6, MAX7)

Electrical anti-pinch protection is available for MAX3, MAX6, and MAX7.

11 Electrical anti-pinch protection



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1	Hinge head	2	Integrated shutdown pin

The electrical anti-pinch protection consists of a hinge head with a slotted hole (1), an integrated switching pin (2), and a microswitch that switches off the device when it moves opposite to the direction of action. In the event of a blockage, the pin is lifted out off the fastening screw, triggering the shutdown function.

If the linear actuator is used in the application as a compressive actuator (extending application), the electrical anti-pinch protection is only effective if the stroke is blocked by an object or a body part during retraction.

4.3.4 Mechanical anti-pinch protection

The mechanical anti-pinch protection decouples the ball nut from the ball screw if a blockage occurs opposite to the direction of action of the linear actuator. If a linear actuator is used in the application as a compressive actuator (extending application), the mechanical anti-pinch protection only functions during retraction of the device.

It is recommended not to use this option in combination with an encoder, as the position is lost when quick release is activated.

4.3.5 Master-slave function (MAX6, MAX7)

This function is only available in conjunction with the integrated electrical control unit.

The master-slave function can operate a maximum of one additional linear actuator (e.g., MAX1, MAX3, or lifting column) directly via MAX6 or MAX7.

The second linear actuator (slave linear actuator) is controlled via additional buttons on the operating element. Parallel operation is not possible.

Observe the total power in the master-slave function: ≤ 6 A

4.3.6 Encoder (MAX1, MAX3)

The encoder outputs pulses that are processed by the external control.

This enables the linear actuator to be extended or retracted to one or more defined positions.

4.3.7 Optional service life indicator (MAX1, MAX3)

The service life indicator monitors the operating time of the linear actuator. Once the calculated total operating time for the DC motor (with respect to the service life of the linear actuator) has been reached, an optical or acoustic signal is triggered, depending on the version.

4.3.8 Customized special options

Option 252: MAX3 with special motor

The MAX30 with option 252 uses the motor from TLG (DC Telemag).

- function: increase in speed
- characteristics: speed approximately twice as high as the standard version MAX3..C..
- technical data: 25 mm/s at full load (1500 N), 6.5 A

Option 249: MAX7 (MAX6) with specially machined protection tube

The MAX7 (MAX6) with option 249 uses the same components as the standard MAX, with the difference that the front mounting point is located directly on the spindle nut.

- function: This allows the retracted length to be significantly reduced and the final design to be made more compact.
- characteristics: larger guide tube with lateral openings for mounting, use of spindle type A, push force only
- technical data: 25 mm/s at full load (1500 N), 6.5 A
- Technical data: retracted length 227 mm, force 7100 N, all other data as for MAX7 (MAX6)

5 Transport and storage

NOTICE

Damage due to improper transport

Improper transport may cause significant property damage.

- Proceed with care when unloading the packaged goods, upon delivery and during transport to the destination.
- Observe the symbols and instructions on the packaging.
- Do not remove the actuator from the packaging until immediately before installation.
- Observe the storage conditions for return transport to the manufacturer; see the *Safety regulations, transport, and storage* section.

5.1 Transport

Observe the safety regulations for transport.

Observe the safety regulations for storage.

Requirements for packaging

Each individual packaged part must be packed appropriately for the anticipated transport conditions. Only environmentally friendly materials may be used for the packaging.

The packaging is intended to protect the individual components from transport damage, corrosion, and other types of damage until assembly.

1. Do not destroy the packaging and only remove it shortly before assembly.
2. Keep the packaging in case the product needs to be returned to the manufacturer ➤33|5.3.

Packaging material consists of valuable raw materials, most of which can be effectively recycled and reused.

If the packaging is to be disposed of following intact delivery, the following instructions must be observed and complied with:

3. Dispose of packaging material in an environmentally responsible manner.
4. Observe the locally applicable disposal regulations.

5.2 Storage

Observe the safety regulations for the storage.

1. Store the product in its original packaging.
2. Do not store outside.
3. Store in a dry and dust-free environment.
4. Follow any additional storage instructions detailed on the packaging.
5. Keep away from any aggressive substances.
6. Protect from UV radiation.
7. Avoid mechanical vibrations.
8. Storage temperature: –20 °C to +40 °C
9. Relative atmospheric humidity: 95 % (no build-up of condensation)
10. If the storage period is ≥ 3 months, regularly check the general condition of all packaging components. Replace the packaging if necessary.
11. Follow any additional storage instructions detailed on the packaging.

5.3 Return to the manufacturer

Proceed as follows for return transport:

1. Dismantle the device if necessary.
2. Pack the device in its original packaging.
3. Observe the safety instructions for transport and storage.
4. Send to the manufacturer. The address is provided on the back of this operating manual.

6 Mounting

Observe the technical data in accordance with the operating conditions.

Comply with all safety regulations.

Authorized personnel

- Assembly and commissioning may only be carried out by qualified technical personnel.
- Work on the electrical system may only be carried out by trained, electrically skilled persons.

The device requires special precautions with regard to EMC and must be installed and commissioned in accordance with the EMC information contained in this manual.

Do not install the device adjacent to or stacked with other equipment. If installation adjacent to or stacking with other equipment is necessary, observe the device to ensure normal operation in the application.

Safety instructions

DANGER

Risk of serious or fatal injuries from live components and moving parts

Serious or fatal injuries may be caused by contact with live components and by unexpected actuator movements.

- Switch off the power supply and secure it against unintentional reconnection before performing any work on the system.

DANGER

Risk of fatal injury from unauthorized reconnection of the power supply

Risk of fatal injury to persons in the hazard area due to moving parts or electric shock if the power supply is switched on without authorization during work on the system and causes the system to restart.

- Before starting work, switch off the system and secure it against reconnection.

WARNING

Risk of injury and equipment damage due to improper installation of optional devices

Risk of injury and property damage if optional devices are installed improperly.

- Install optional devices, particularly components used in retrofits, only in accordance with the respective instructions (circuit diagram).
- Check the electromagnetic compatibility for the installation and, if necessary, take appropriate measures as described in the user manual for the device.

WARNING

Tampering with or loosening screws on the device or optional devices during operation

Risk of injury and property damage

- Never loosen screws on the device or on optional accessories.

WARNING

Contact with fork head during operation

Risk of injury from pinching in the fork head of the push tube while the motor is running. As long as the fork head has not been installed in a component, rotary motion is possible.

- Ensure that no objects or persons come into contact with the fork head of the push tube during operation.
- Hold the device only by the guide tube.

NOTICE

Risk of equipment damage due to static or dynamic overload

Risk of damage to or failure of the device

- Do not overload the linear actuator or use it outside the permissible operating data; see *Technical data* and product label.
- Do not exceed the rated load.
- Do not tamper with connected components while the device is in operation.
- Ensure that there are no objects are within the travel range of the linear actuator during operation.

6.1 Installation site

Good preparation is part of efficient installation and startup. This includes selecting a suitable installation site and providing a power source.

Observe the technical data in accordance with the operating conditions ➤74|14.

Install the device at a location that complies with the specified ambient conditions ➤80|14.4.

6.2 Inspections before initial startup

A professional electrician must carry out and document the following inspections and measurements before initial startup:

1. Visual inspection of the condition.
2. Check operating and safety functions.
3. Measure protective conductor resistance.
4. Measure leakage currents.
5. Measure insulation resistance.

Further information on inspections and readings can be found in the section ➤64|11.

6.3 Installation

⚠ WARNING

Tampering with or loosening screws on the device or optional devices during operation

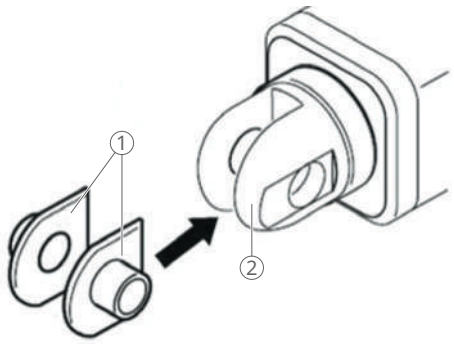
Risk of injury and property damage

- Never loosen screws on the device or on optional accessories.

The linear actuator is fastened to two elements of the application via the fork head and the hinge head. Information on the dimensions of the mounting holes for fastening screws can be found in the technical data ➤74|14.

1. Secure the elements of the application between which the linear actuator is to be installed.
2. If necessary, insert the bearing inserts into the fork head and the hinge head.

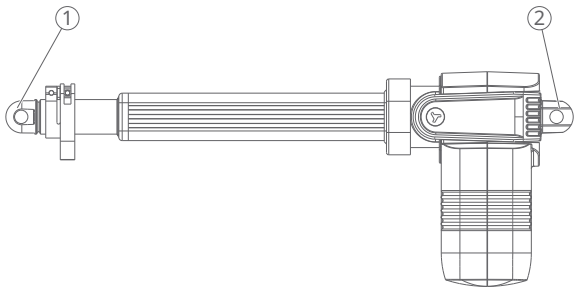
12 Inserting bearing inserts



1	Bearing inserts	2	Fork head

3. Connect the fork head (1) and the hinge head (2) to the elements of the application using the mounting pins.

13 Connecting the linear actuator to the application



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1	Fork head	2	Hinge head

⚠ WARNING

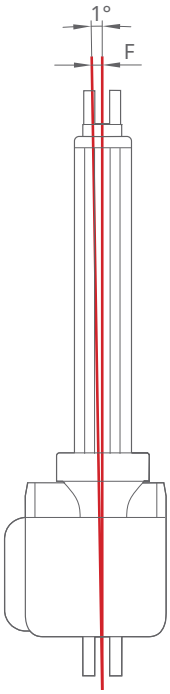
Insufficient fastening

Risk of personal injury and property damage

- Use fastening bolts only.
- Secure fastening bolts properly.
- Do not use screws for assembly.
- Never loosen or otherwise tamper with screws on actuators or options.

4. Ensure that the applied force F is always directed axially onto the linear actuator, with a maximum permissible offset of 1°.

14 Maximum offset



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F	N	Force

⚠ WARNING

Lateral impacts or torques during assembly

Risk of personal injury due to improper assembly of the device

- Do not expose the device to lateral impacts or torques during assembly.

NOTICE

Lateral impacts or torques during assembly

Risk of property damage due to improper assembly of the device

- Do not expose the device to lateral impacts or torques during assembly.

5. Ensure that the linear actuator is not impacted in its movement over the entire stroke area. Take the application's collision tests into account.
6. Ensure that the motor cable cannot be crushed, pinched, or pulled.
7. Connect the linear actuator to the control ➤37|6.4.
8. Connect the operating element to the control unit ➤40|6.5.
9. Connect the control unit to the power supply ➤43|6.6.
10. Ensure that the power plug is accessible at all times.
11. Ensure that none of the supply or control cables can be pinched during the application's motion sequences or when the linear actuator extends and retracts.
12. Ensure that the installation requirements for the options are met ➤45|6.7.
13. Affix prohibition and warning signs to the linear actuator where required by the application ➤16|2.8.

6.4 Connecting the control (MAX1, MAX3)

Control units not approved by Schaeffler for the actuator are considered third-party control units.

⚠ CAUTION

Third-party control units

The use of third-party control units may cause property damage. The manufacturer accepts no liability for any damage incurred as a result of using an external controller.

Schaeffler recommends using the appropriate EWELLIX control unit, see Technical data.

When using an external controller, observe the requirements specified for external controllers.

NOTICE

Bent plugs or damaged cables

Risk of property damage to the device.

- Ensure that plugs are freely accessible.
- Ensure that all cables are secured and protected.

NOTICE

Misaligned plug

Risk of property damage to the control unit due to possible ingress of water.

- Insert plugs properly.

A low-voltage plug connects the device to the external control unit. When connecting, follow the instructions in the user manual of the control unit.

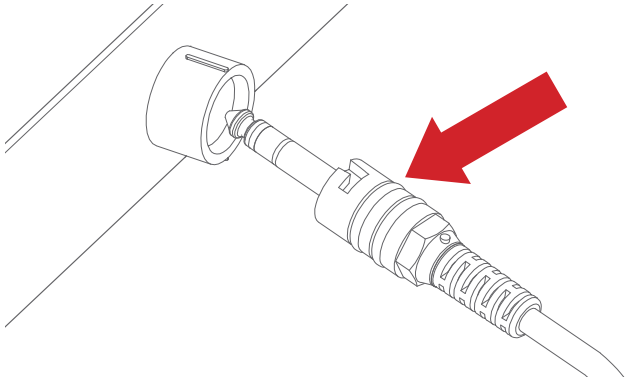
Depending on the version of the device, the power cable is equipped with a jack plug or a DIN-8 plug.

Jack plug

✓ Use a special key.

1. Connect the device's jack plug to the control unit.
2. Check the sealing ring of the jack plug and the plug itself for damage.

15 Checking the sealing ring of the jack plug for damage



3. Lightly lubricate the sealing ring with Klübersynth VR 69-252.
4. Insert the bayonet jack plug (2) into the socket (1) of the control unit. Ensure correct positioning of the groove (3).

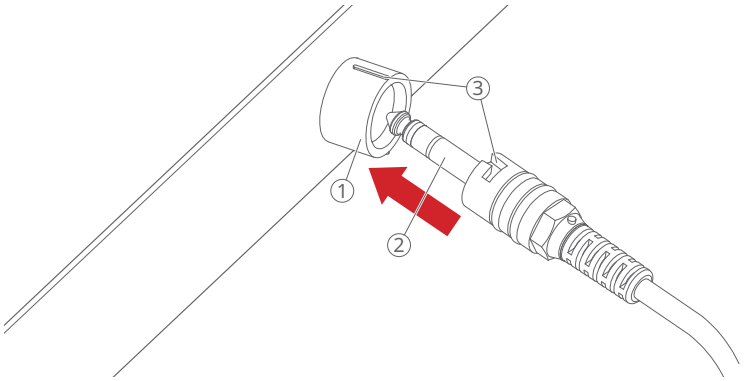
NOTICE

Incorrect lubricant

The use of incorrect additives may cause significant material damage.

- Use only the auxiliary products listed by the manufacturer.

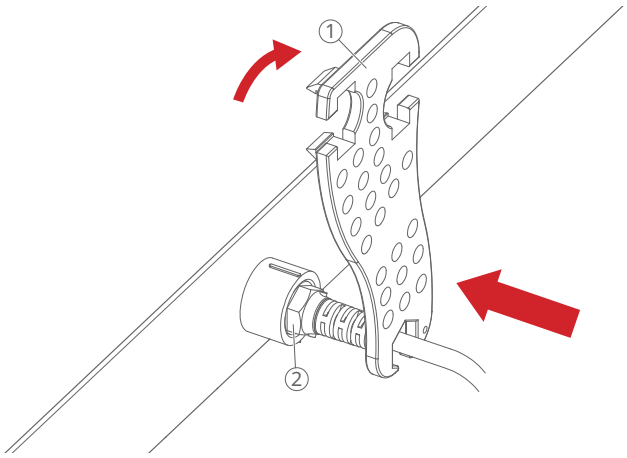
16 Inserting the bayonet jack plug into the control unit socket



1	Socket	2	Jack plug with bayonet
3	Positioning of the groove		

5. Place the special tool (1) on the hexagon nut (2) of the plug housing.
6. Turn the special tool (1) clockwise until the bayonet lock of the jack plug is engaged.

17 Using the special tool



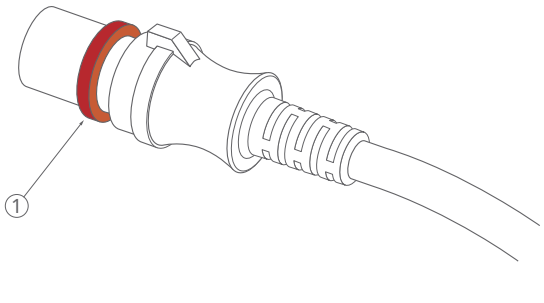
1	Special tool	2	Hexagon nut of the plug housing

DIN-8 plug

The insertion position is determined by the geometric shape of the plug. Strain relief for the power cables must be provided externally within the application.

1. Connect the DIN-8 plug of the linear actuator to the control unit.
2. Check the sealing ring of the DIN-8 plug and the plug itself for damage.

18 Checking the sealing ring of the DIN-8 plug for damage



1	Sealing ring		

3. Lightly lubricate the sealing ring with Klübersynth VR 69-252.

NOTICE

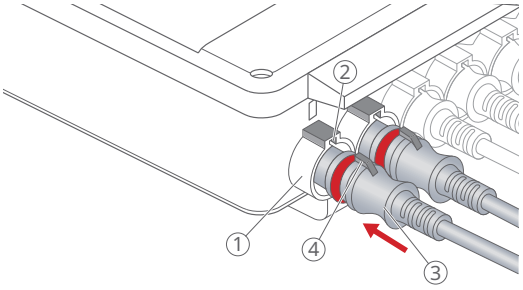
Incorrect lubricant

The use of incorrect additives may cause significant material damage.

- Use only the auxiliary products listed by the manufacturer.

4. Insert the DIN-8-plug into the socket of the control unit. Ensure that the groove and the lug are correctly positioned.

19 Inserting the DIN-8 plug into the connecting socket of the control unit



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1	Connecting socket	2	Groove
3	DIN-8 plug	4	Key

6.5 Connecting the operating element

⚠ WARNING

Third-party operating elements

The use of third-party operating elements may result in serious injury or property damage. The manufacturer accepts no liability for damage resulting from the use of third-party operating elements.

- Always use only suitable EWELLIX operating elements from Schaeffler.
- When using auxiliary devices that do not conform to degree of protection II, the fixation plate must be connected to the protective conductor.

MAX1, MAX3

The operating element is connected directly to the control unit and controls the movement direction of the actuator.

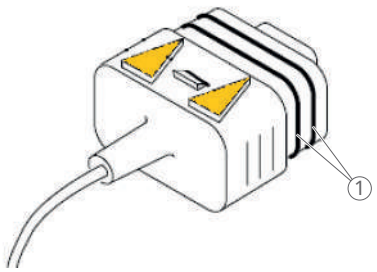
1. Observe the separate user manual for the control unit.
2. Observe the separate user manual for the operating element.

Connecting MAX6, MAX7 to an electrical operating element

The electrical or pneumatic operating element is connected directly to the linear actuator.

1. Observe the separate user manual for the operating element.
2. Check the sealing rings of the plug for damage.
3. Check the plug for damage.

20 Sealing rings



001D6D0D

1	Sealing rings		

⚠ WARNING

Damaged housing

Loss of protection type

- Inspect the housing for damage and replace if necessary.

4. Lightly lubricate the sealing rings with Klübersynth VR 69-252.

NOTICE

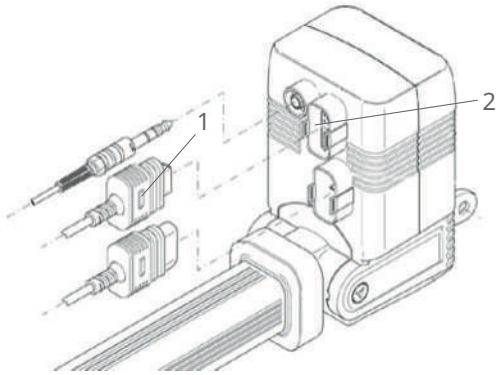
Incorrect lubricant

The use of incorrect additives may cause significant material damage.

- Use only the auxiliary products listed by the manufacturer.

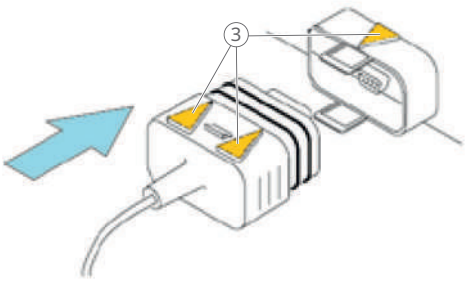
5. Insert the plug (1) into the connection port of the operating element (2) on the device.

21 Connecting the operating element plug



6. Ensure that the arrows (3) on the plug and socket are aligned correctly.

22 Inserting the plug correctly



7. Push the plug (1) into the connection socket until the locking tabs (2) engage on both sides.

23 Engaging the locking tabs in the connection socket

8. Ensure that both locking tabs are mechanically secured and properly sealed.
9. Connecting the linear actuator to the power supply

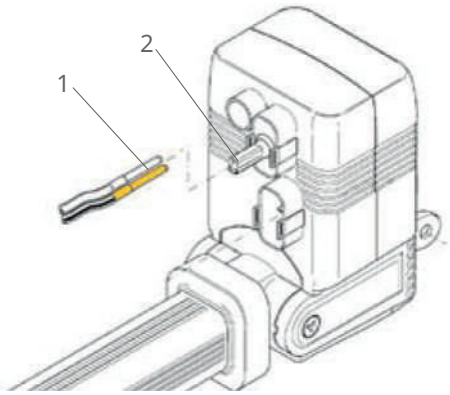
Connecting MAX6, MAX7 to a pneumatic operating element

1. Check the coupling pins and the air hose of the pneumatic control line for damage

24 Coupling pins of the pneumatic control system

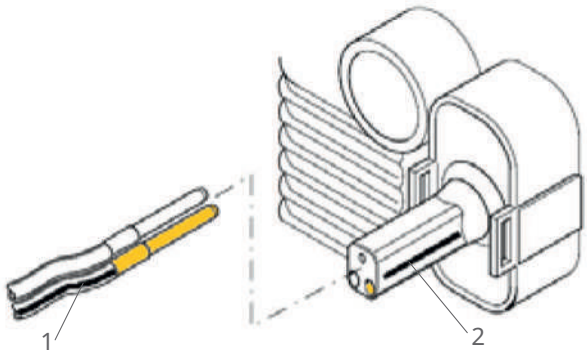
2. Insert the coupling pins (1) into the holes of the rubber connector (2).

25 Inserting coupling pins into the holes



3. Ensure that the marking on the rubber connector (2) matches the marking on the pneumatic line (1).

26 Marking of pneumatic line connection



If the connection is transposed, the linear actuator will move in the opposite direction to the arrows on the operating element.

6.6 Connecting the power supply

DANGER

Improper installation

Electric shock due to contact with live electrical components

- Only qualified electricians are permitted to work on electrical systems.

MAX1, MAX3

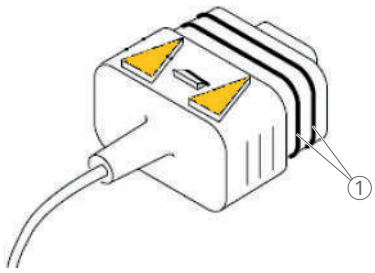
The actuator is connected to the control unit, which is connected directly to the power supply.

1. Observe the separate user manual for the control unit.
2. Connect the linear actuator to the control unit ➤37|6.4.
3. Connect the control to the mains power supply.
4. Ensure that the plug of the power cable is accessible at all times

MAX6, MAX7

1. Check the sealing rings of the plug for damage.
2. Check the plug for damage.

27 Sealing rings



001D6D0D

1	Sealing rings	

⚠ WARNING

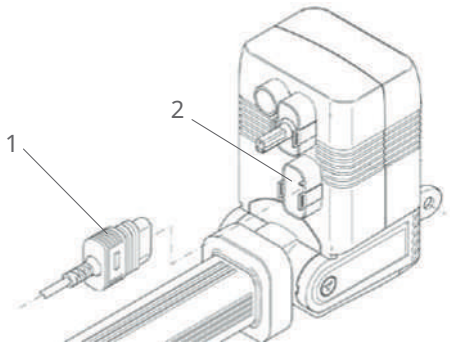
Damaged housing

Loss of protection type

- Inspect the housing for damage and replace if necessary.

3. Lightly lubricate the sealing rings with Klübersynth VR 69-252.
4. Insert the plug of the mains cable (1) into the socket (2) of the device.

28 Connecting the mains cable plug



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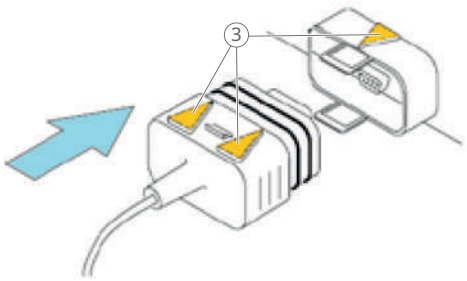
5. Ensure that the arrows (3) on the plug and socket are aligned correctly.

29 Inserting the plug correctly



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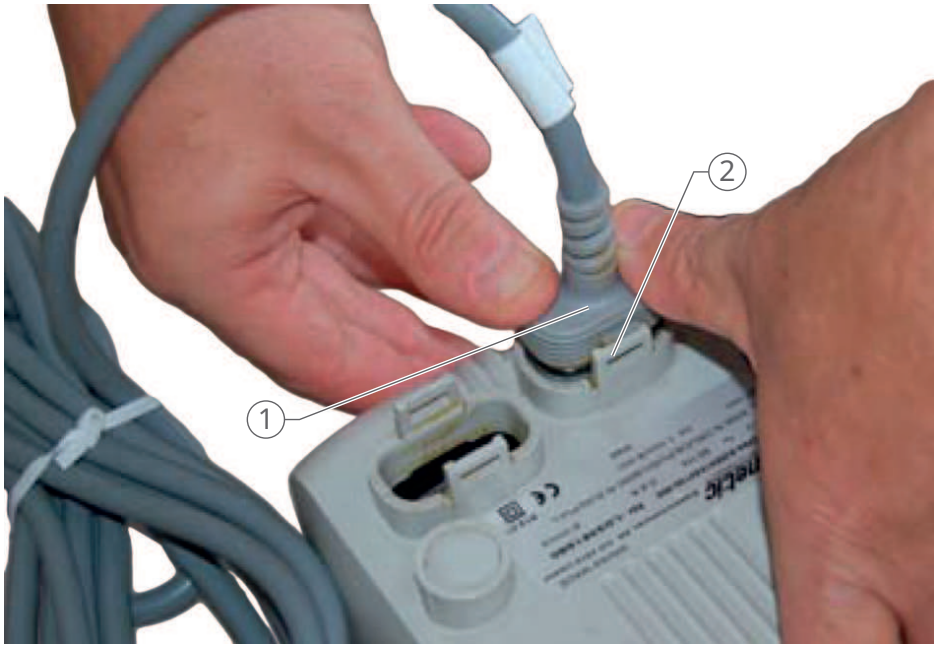
6. Push the plug (1) into the connection socket until the locking tabs (2) engage on both sides.

30 Engaging the plug in the connection socket



7. Ensure that both locking tabs are mechanically secured and properly sealed.
8. Connect the mains cable to the power supply.
9. Ensure that the plug of the power cable is accessible at all times

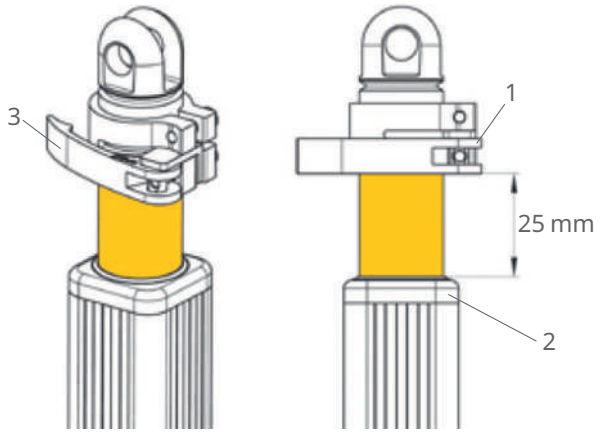
6.7 Requirements for linear actuators with options

- Emergency lowering ➤45|6.7.1
- Quick release ➤46|6.7.2
- Electrical anti-pinch protection ➤46|6.7.3
- Mechanical anti-pinch protection ➤47|6.7.4
- Master-slave function ➤47|6.7.5

6.7.1 Emergency lowering

- When the linear actuator is retracted, a minimum clearance of 25 mm must be maintained between the emergency lowering mechanism (1) and the protection tube (2).
- Sufficient space must be available in the application around the emergency lowering device to ensure that the release lever (3) can be easily actuated.

31 Emergency lowering

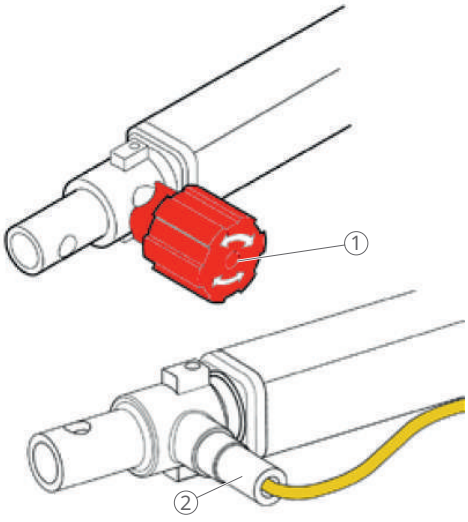


- The “Emergency/Notfall” label for the emergency lowering device must be clearly visible and permanently affixed to the linear actuator or the application ➤17|2.8.2.

6.7.2 Quick release

- Sufficient space must be available in the application around the knob (1) or the Bowden cable (2) to ensure that both elements can be easily operated.
- The Bowden cable between the linear actuator and the operating element must be installed in such a way that it cannot be pinched or impaired by the movements of the linear actuator.

32 Quick release

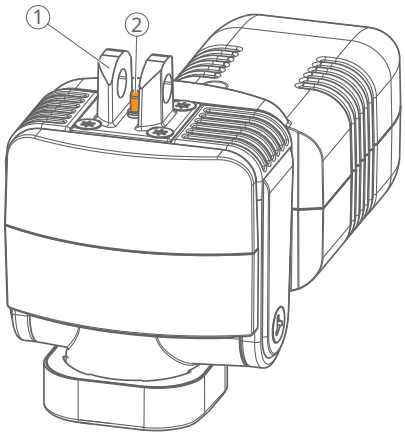


1	Rotary knob	2	Bowden cable

6.7.3 Electrical anti-pinch protection

- The shutdown pin (2) on the hinge head (1) must not be blocked.
- To fasten the hinge head, use a mounting pin with M12h7

33 Electrical anti-pinch protection

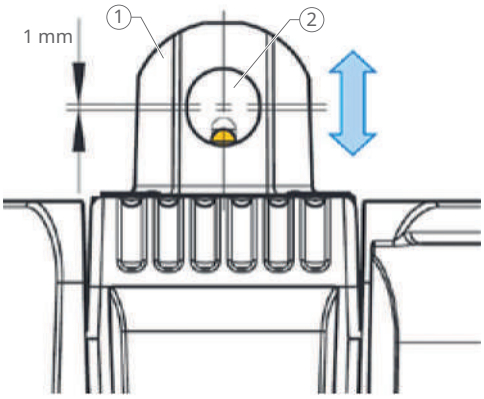


001D6CED

1	Hinge head	2	Integrated shutdown pin

- After installation, ensure that the installed linear actuator can move within the slotted hole (2) of the hinge head (1).

34 Freedom of movement after installation



001D6D46

6.7.4 Mechanical anti-pinch protection

Observe the increased installation dimensions when using a linear actuator with anti-pinch protection.

6.7.5 Master-slave function (MAX6, MAX7)

The master-slave function includes an additional linear actuator (slave linear actuator), which is connected to the MAX6 or MAX7 linear actuator via a jack plug (e.g., MAX1 or MAX3).

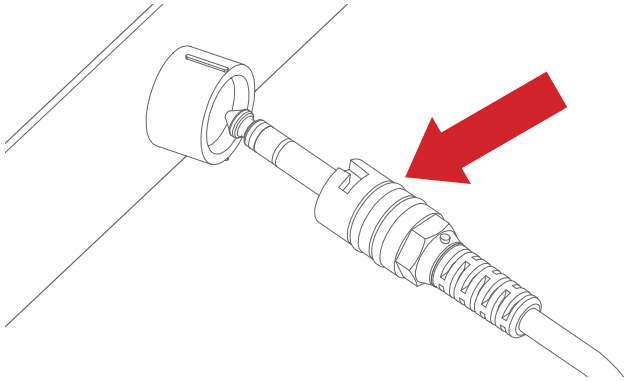
Observe the following when connecting:

- Only one linear actuator with a supply voltage of 24 V DC may be connected.
- If both linear actuators (master linear actuator and slave linear actuator) are operated simultaneously, the total current must not exceed 6 A.

✓ Use a special key.

1. Check the sealing ring of the jack plug and the plug itself for damage.

35 Checking the sealing ring of the jack plug for damage



001CA430

⚠ WARNING

Damaged sealing ring

Loss of protection type

- Check the sealing ring for damage and replace if necessary.

2. Lightly lubricate the sealing ring with Klübersynth VR 69-252.

NOTICE

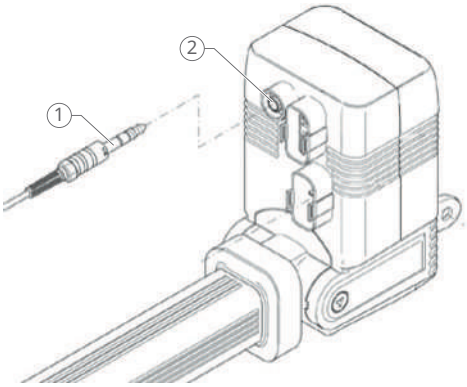
Incorrect lubricant

The use of incorrect additives may cause significant material damage.

- Use only the auxiliary products listed by the manufacturer.

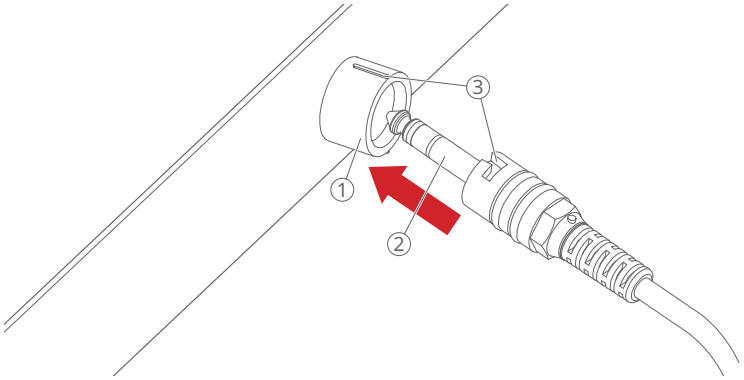
3. Insert the bayonet jack plug (2) into the socket (1) of the control unit. Ensure correct positioning of the groove (3).

36 Connecting the jack plug



001D6D36

37 Inserting the bayonet jack plug into the control unit socket

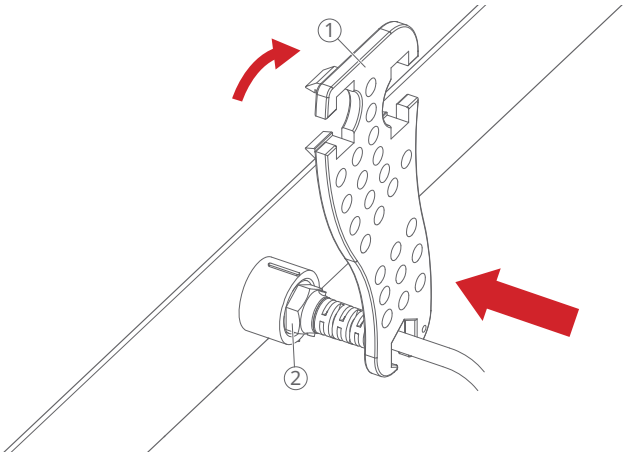


001CA57F

1	Socket	2	Jack plug with bayonet
3	Positioning of the groove		

4. Place the special tool (1) on the hexagon nut (2) of the plug housing.
5. Turn the special tool (1) clockwise until the bayonet lock of the jack plug is engaged.

38 Using the special tool



1	Special tool	2	Hexagon nut of the plug housing

6. Connect the slave linear actuator to the power supply.

7 Commissioning

Authorized personnel

- Assembly and commissioning may only be carried out by qualified technical personnel.
- Work on the electrical system may only be carried out by trained, electrically skilled persons.

7.1 Initial start-up

Before initial start-up, check that the following points have been dealt with:

- All installation instructions have been followed.
- The resistance of the protective earth conductor and the leakage currents have been checked in accordance with the owner's specified thresholds.
- No inadmissibly high lateral forces are acting on the protection tube.
- No persons or obstructions are in the vicinity of movement.
- All cables are secured against crushing and pinching and are properly connected.
- The power supply is secured.
- The operating element is connected to the control unit.

✓ Inspections prior to initial startup have been completed by a professional electrician ➤35|6.2.

✓ The installation check has been completed

✓ The green operating indicator LED is illuminated

‣ Press the corresponding control button on the operating element

8 Operation

⚠ WARNING

Static or dynamic overloading of the device

Crush hazard due to collision with fixed objects

- Ensure that no persons or fixed objects are in the hazard area during the stroke.
- Observe the maximum permissible operating data of the device, see Technical data.
- Do not exceed the nominal load.
- Do not tamper with connected components while the device is in operation.
- Observe the information on the type plate.
- Ensure that operating elements cannot be activated in a protected standby position.

⚠ WARNING

Contact with the fork head

Risk of injury from contact with the fork head

- Ensure that no objects or body parts come into contact with the fork head of the actuator.

NOTICE

Risk of equipment damage due to static or dynamic overload

Risk of damage to or failure of the device

- Do not overload the linear actuator or use it outside the permissible operating data; see *Technical data* and product label.
- Do not exceed the rated load.
- Do not tamper with connected components while the device is in operation.
- Ensure that there are no objects are within the travel range of the linear actuator during operation.

NOTICE

Ingress of liquids during extension and retraction

Risk of damage to or failure of the device

- Do not allow liquids to come into contact with the device.

NOTICE

Overheating

Device failure due to damage to the electronics

- Only use the integrated thermal switch of the control system.
- Never exceed the rated load, see *Technical Information*.
- Observe the max. operating time and break until the next operation sequence, see *Technical Information*.

8.1 Operation

MAX1, MAX3

- The linear actuator is controlled via a control unit.
- The control unit is operated using an operating element.

MAX6, MAX7

- The linear actuator is controlled directly via an electrical or pneumatic operating element.

8.1.1 Switching on

The device has no operating element of its own. The device is operated via a separate operating element. Observe the user manual for the operating element.

8.1.2 Switching off

The device has no operating element of its own. The device is operated via a separate operating element. Observe the user manual for the operating element.

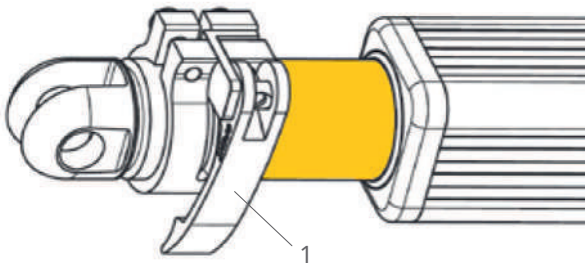
8.2 Measures before use

- Ensure that no persons or objects are within the stroke area of the device.

For options

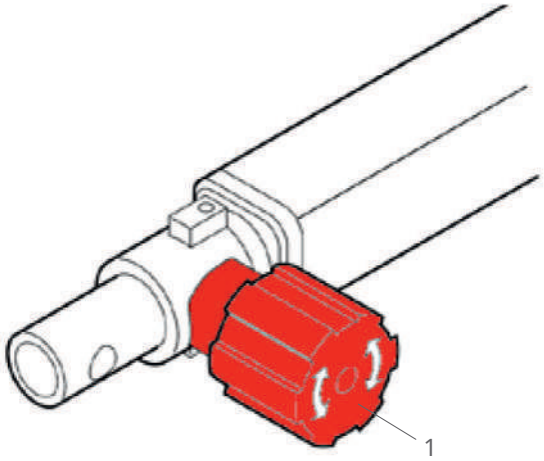
- Ensure that the clamping lever of the emergency lowering mechanism (1) is closed up to the stop, or that the quick release mechanism is locked.

39 Clamping lever of the emergency lowering device



- Ensure that the quick release mechanism is locked

40 Quick release locked



8.3 Measures during operation

8.3.1 Normal operation

During normal operation, the linear actuator raises and lowers the elements connected to it via the fork head and the hinge head.

The linear actuator is controlled directly using the direction buttons on an operating element. The linear actuator extends or retracts as long as the direction button is pressed or until the linear actuator is fully extended or retracted.

- UP button: the linear actuator extends.
- DOWN button: the linear actuator retracts.

The LED on the operating element (e.g., hand switch) and the green operating indicator LED are two green LEDs that indicate normal operation.

If this is not obvious to the operator from the normal operating position, indicator lights must be provided to show that the medical device is ready for normal operation.

Additional information on operating the operating element can be found in the operating element manual.

8.3.2 Actuating quick release

NOTICE

Property damage due to improper actuation of the quick release

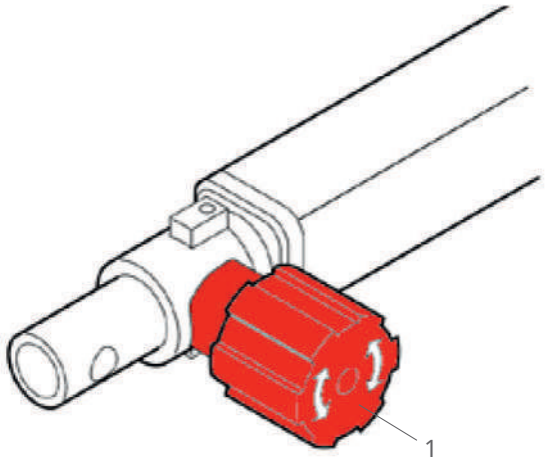
Property damage

- Only actuate emergency lowering in an actual emergency or for functional testing

8.3.2.1 Quick release with knob

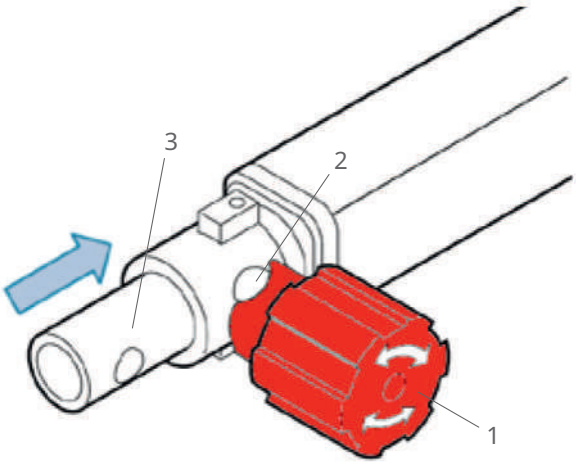
1. Rotate the knob (1) by 90° to unlock it.

41 Quick release locked



2. Ensure that the knob (1) is in the unlocked position (2).
3. Manually retract the push tube (3).

42 Manually retracting the push tube



⚠ CAUTION

Risk of crushing due to unintended lowering

Unintended lowering under load may cause injury

- The part of the application to be lowered (e.g., head section or foot section of a bed) must be firmly supported during lowering.
- When the application is in a retracted state, the part to be lowered must rest on a solid stop (e.g., bed frame).

NOTICE

Property damage due to unintended lowering

Unintended lowering under load may cause property damage

- The part of the application to be lowered (e.g., head section or foot section of a bed) must be firmly supported during lowering.
- When the application is in a retracted state, the part to be lowered must rest on a solid stop (e.g., bed frame).

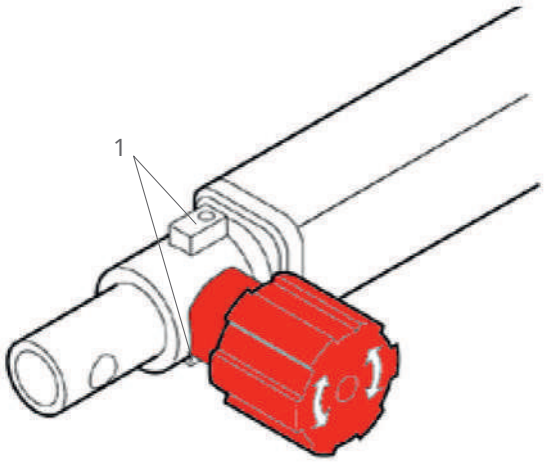
4. Rotate the knob (1) by 90° to lock it in place.

8

Adjusting the lowering speed

1. The lowering speed can be adjusted using the two opposing set screws (1).

43 Set screws

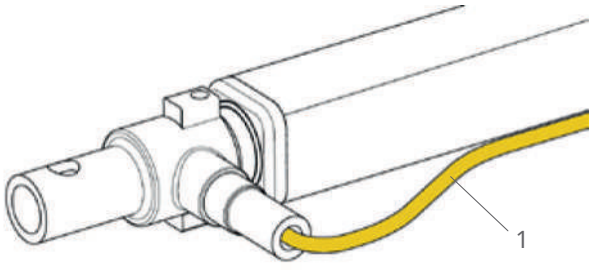


The set screws are not secured against being completely unscrewed and may be lost. Do not fully unscrew the set screws

8.3.2.2 Quick release with Bowden cable

For adjustments using the Bowden cable, the Bowden cable (1) is actuated via a lever on the application.

44 Bowden cable



8.3.3 Actuating emergency lowering

In the event of a power failure or actuator malfunction, the load can be lowered manually by rotating the push tube.

NOTICE

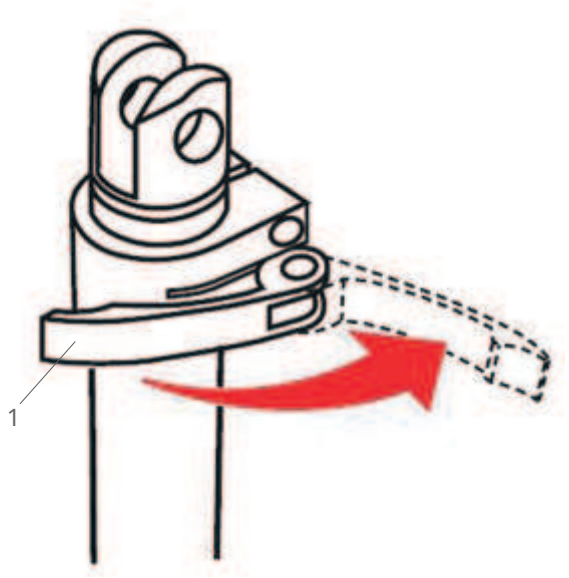
Property damage due to improper actuation of emergency lowering

Property damage

- Only actuate emergency lowering in an actual emergency or for functional testing

1. Opening the clamping lever (1)

45 Opening the clamping lever



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2. Rotate the push tube (2) clockwise. The force to be applied depends on the load.

› The push tube moves downward

⚠ CAUTION

Risk of crushing due to unintended lowering

Unintended lowering under load may cause injury

- If excessive force is required, stop operation immediately and have repairs carried out by the manufacturer.
- If the actuator performs a downward movement on its own, stop operation immediately and have repairs carried out by the manufacturer.

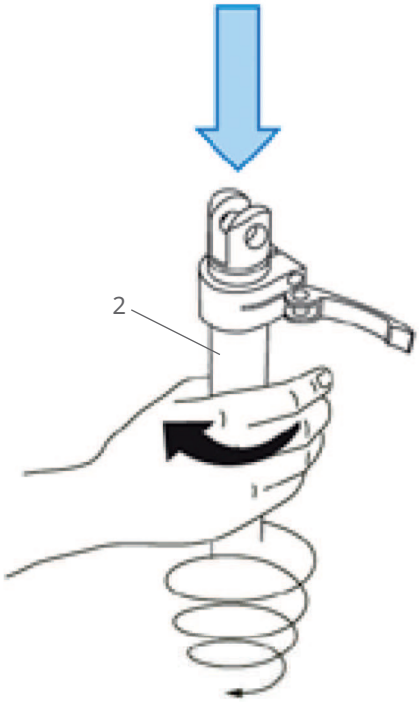
NOTICE

Property damage due to unintended lowering

Unintended lowering under load may cause property damage

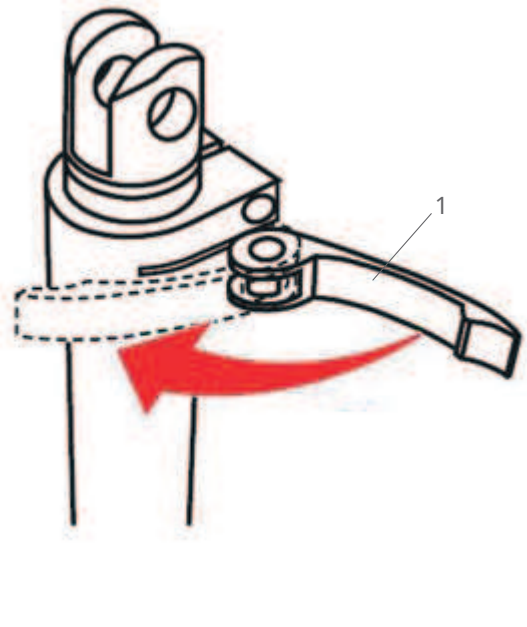
- If excessive force is required, stop operation immediately and have repairs carried out by the manufacturer.
- If the actuator performs a downward movement on its own, stop operation immediately and have repairs carried out by the manufacturer.

46 Rotating the push tube clockwise



3. When the lower position is reached, close the clamping lever (3).

47 Closing the clamping lever



8.4 Emergency switch off

In hazardous situations, all movements of the application must be stopped as quickly as possible and the power supply turned off.

In hazardous situations, proceed as follows:

- If necessary, activate the emergency shut-off immediately or interrupt the power supply.
- Evacuate persons from the danger zone.
- Initiate first aid measures.
- Inform the responsible person on site.
- Keep access routes for emergency vehicles clear.
- Depending on the severity of the emergency, notify the authorities if necessary.
- Assign qualified personnel to carry out repairs.

Safety instructions

⚠ WARNING

Malfunction of the device or non-functional safety equipment

- Ensure that all safety devices are installed and fully functional.
- Before restarting, check the actuator and the application that uses the actuator.
- Before restarting, make sure that all persons are outside the danger zone.

8.4.1 MAX1, MAX3

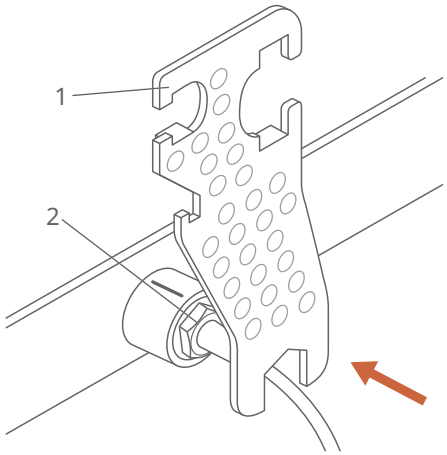
1. Remove the power plug of the control unit from the socket.
2. Remove the low-voltage plug (jack plug or DIN-8 plug) of the power cable from the control socket.

Disconnecting the jack plug

✓ Use a special key.

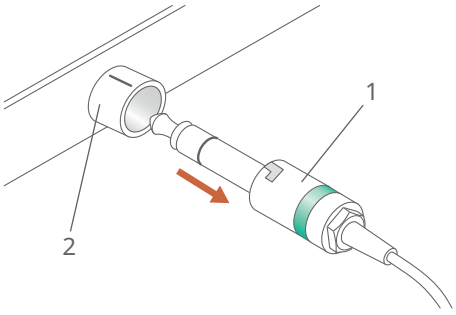
3. Place the special tool (1) on the hexagon nut (2) of the plug housing.

48 Attaching the special key



4. Rotate the special key (1) counterclockwise until the bayonet lock of the jack plug is released.
5. Remove the jack plug (1) from the connection socket (2).

49 Removing the jack plug from the connection socket



8.4.2 MAX6, MAX7

- Disconnect the device from the power supply. Disconnect the power plug from the socket to disconnect the power supply.

9 Decommissioning

- Disconnect the linear actuator from the power supply.

10 Dismounting

Comply with all safety regulations.

Authorized personnel

- Disassembly may only be carried out qualified technical personnel.
- Work on the electrical system may only be carried out by trained, electrically skilled persons.

Safety instructions

DANGER

Risk of serious or fatal injuries from live components and moving parts

Serious or fatal injuries may be caused by contact with live components and by unexpected actuator movements.

- Switch off the power supply and secure it against unintentional reconnection before performing any work on the system.

WARNING

Risk of severe injury from improper disassembly

Stored residual energy, sharp-edged components, pins, and corners on individual parts or on the required tools can cause severe injuries if disassembly is performed improperly.

- Ensure sufficient space for disassembly before starting work.
- Exercise caution when working with exposed, sharp-edged components.
- Ensure that the disassembly area is clean and tidy. Avoid loosely stacked components or parts and tools lying on the floor which may pose a hazard.
- Disassemble components properly in accordance with applicable local regulations.
- Secure components to prevent them from falling or tipping over.
- Contact Schaeffler with any questions or concerns.

10.1 MAX1, MAX3

1. Decommission the linear actuator ➤59|9.
2. Secure the application elements so that no loads can act on the fork head and hinge head.
3. Loosen the mounting pins from the mounting brackets of the fork head and hinge head.
4. Remove the mounting pins.
5. Disconnect the linear actuator from the application.
6. Clean the device
7. Carefully pack the device for shipping to the manufacturer.
8. Disassemble the device in accordance with locally applicable occupational safety and environmental protection regulations.

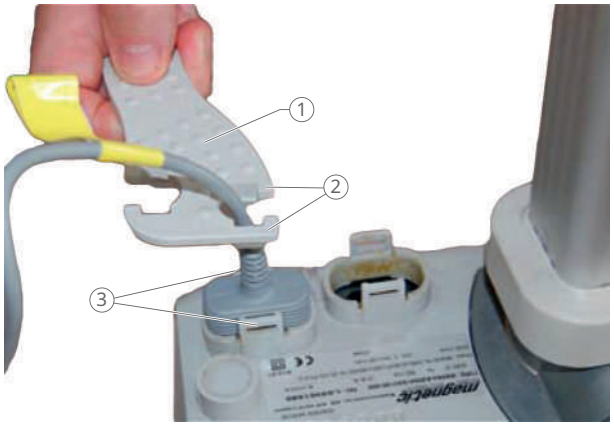
10.2 MAX6, MAX7

1. Decommission the linear actuator ➤59|9.

Disconnecting the linear actuator from the operating element

1. Apply the special key (1) to the plug of the operating element so that the lugs (2) engage in the slots (3).

50 Applying the special key to the operating element plug



001D6FB1

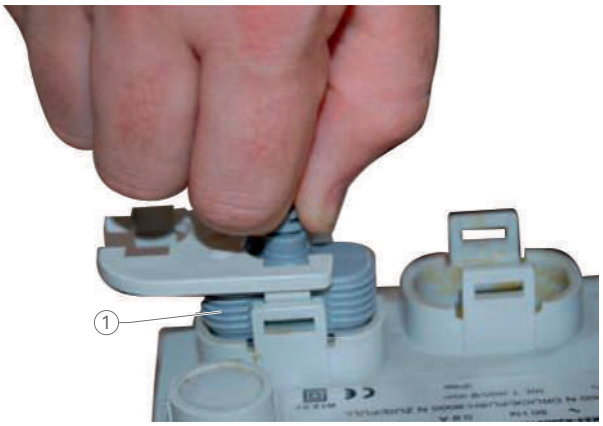
2. Press the special key downward until the locking mechanism on the plug is released.

51 Pressing the special key downward

001D6FB2

3. Pulling out the plug (1)

52 Pulling out the plug

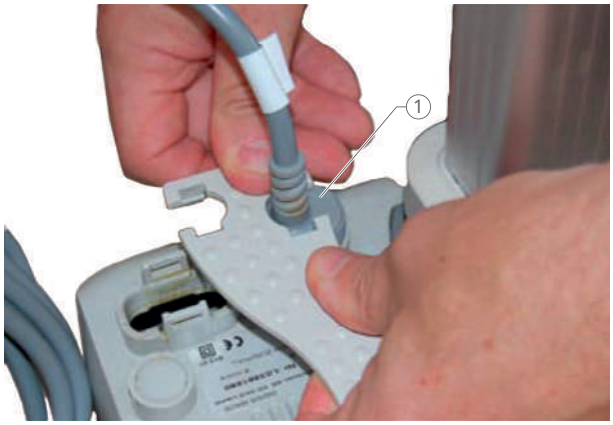


001D6FB4

Disconnecting the mains cable from the linear actuator

1. Apply the special key to the mains plug (1) of the linear actuator so that the lugs (2) engage in the slots (3).
2. Press the special key downward until the locking mechanism on the plug is released.
3. Pulling out the plug

53 Applying the special key to the mains plug



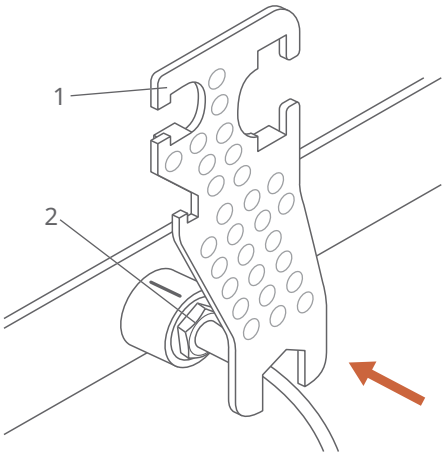
001D6FB7

Disconnecting the connection to the slave linear actuator, if present

✓ Use a special key.

1. Place the special tool (1) on the hexagon nut (2) of the plug housing.

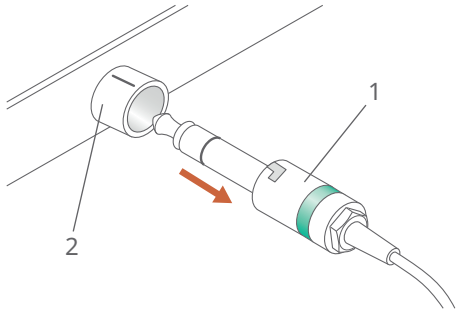
54 Attaching the special key



001D6D78

2. Rotate the special key (1) counterclockwise until the bayonet lock of the jack plug is released.
3. Remove the jack plug (1) from the connection socket (2).

55 Removing the jack plug from the connection socket



4. Secure the application elements so that no loads can act on the fork head and hinge head.
5. Loosen the mounting pins from the mounting brackets of the fork head and hinge head.
6. Remove the mounting pins.
7. Disconnect the linear actuator from the application.
8. Clean the device
9. Carefully pack the device for shipping to the manufacturer.
10. Disassemble the device in accordance with locally applicable occupational safety and environmental protection regulations.

11 Maintenance

Maintenance work and repairs may only be carried out by qualified personnel.

1. Disconnect the power supply for the actuator before maintenance work and repairs.
2. Make sure that the actuator is not under load or voltage.
3. Use suitable safety equipment.

DANGER

Electric shock

Risk of serious injury or death due to improper maintenance

- Work on electrical systems may only be carried out by professional electricians.

DANGER

Risk of fatal injury from unauthorized reconnection of the power supply

Risk of fatal injury to persons in the hazard area due to moving parts or electric shock if the power supply is switched on without authorization during work on the system and causes the system to restart.

- Before starting work, switch off the system and secure it against reconnection.

11.1 Maintenance plan

The following sections describe the maintenance work required for optimum and trouble-free operation.

If increased wear is detected during regular inspections, shorten the maintenance intervals according to the actual signs of wear.

If the linear actuator is used in conditions other than the ambient conditions specified in this manual, check the components once a month for changes such as oxidation or deposits.

15 Maintenance plan

Maintenance interval	Maintenance work	Carried out by
Daily	▸ Check device for visible damage. ▸ Remove dust and dirt if necessary ➤65|11.2.1.	Operator
Monthly	▸ Check operating and safety functions. ▸ Check the device is securely fitted at the front and rear fork head and adjust if necessary. ▸ Check connections for secure fit.	Qualified person
Every six months	▸ Check device for visible damage ➤68|11.2.4. ▸ Test emergency lowering mechanism under rated load. ▸ Test anti-pinch protection under rated load. ▸ Check the quick release function.	Qualified personnel
Annually	▸ Check labels and warning notices for damage; replace if necessary.	Qualified personnel
	▸ Measure protective conductor resistance ➤65|11.2.2. ▸ Measure leakage currents. ▸ Measure insulation resistance. ▸ Check plugs for secure fit. ▸ Check sealing O-rings for damage ➤66|11.2.3.	Professional electrician
To be defined by the processor	▸ Visually inspect the condition of the permanent safety device and the routing of all cables within the application ➤68|11.2.4. ▸ Cable routing materials must not be loose or damaged. ▸ Check options ➤69|11.2.5	Processor

11.2 Maintenance work

11.2.1 Cleaning

To be performed by the operator

If contaminated, clean the product immediately to prevent the buildup of residue.

The device must never be washed in a washing machine or similar appliance unless the actuator, control unit, and power cable are properly connected. Ingress of liquids may cause irreparable damage to the system.

NOTICE

Damage due to improper cleaning

Improper cleaning of the device may cause damage to the device.

- Do not use aggressive cleaning agents. Wash water, including chemical additives, must be pH-neutral.
- Only use cleaning agents specified by the manufacturer.
- Do not use steam cleaners or high-pressure cleaners.
- Other cleaning agents or cleaning devices may only be used with the manufacturer's approval.
- When retracting or extending, the actuator must not come into contact with liquids.

Observe the following points when cleaning

- Disconnect the device from the power supply.
- Clean contaminated parts immediately.
- Use a damp cloth for cleaning. The water used for cleaning, including any chemical additives, must be pH-neutral.
- Disinfect only by wiping with isopropyl alcohol.

Cleaning of the emergency lowering mechanism and quick release device

- Disconnect the device from the power supply.
- Disinfect and clean the emergency lowering mechanism only with propyl alcohol.
- The emergency lowering mechanism must not be treated with oil, grease, or other lubricants.

Damage due to improper cleaning

- Do not use aggressive cleaning agents. The water used for cleaning, including any chemical additives, must be pH-neutral. Acidic or alkaline wash water can destroy metal and plastic parts.
- Liquids must not come into contact with the push tube during extension or retraction.
- Use only auxiliary agents specified by the manufacturer.
- Do not use steam cleaners or high-pressure cleaners for cleaning.
- Other cleaning agents or cleaning devices may only be utilized with the manufacturer's approval.

11.2.2 Checks and readings

Performed by a qualified electrician.

Observe the following for checks and readings:

- All checks and readings must be carried out in accordance with the applicable standards and regulations.
- All checks must be documented in a maintenance log.

MAX6, MAX7: Measuring protective conductor resistance

With the exception of the external protective conductor connection, the external metal parts are not reliably connected to the protective conductor. Insulation is provided either by double or reinforced insulation or by an intermediate circuit connected to the protective conductor within the housing. For this reason, it is not possible to measure the protective conductor resistance. Possible connections occur only incidentally through metal parts that come into contact to a lesser or greater degree.

Service log

The following entries must be made in the service log:

- name of the executing body (company, department)
- names of the personnel on duty
- identification of the device/system (type, serial number, inventory number) and the respective accessories
- inspections and measurements performed
- scope and results of the inspections
- measuring method, measuring equipment, measurement results for readings
- overall assessment
- date and signature of the assessor; personal coding is a viable alternative for IT applications

11.2.3 Checking plug tightness

Performed by a qualified electrician.

NOTICE

Risk of property damage due to damaged or incorrect sealing rings

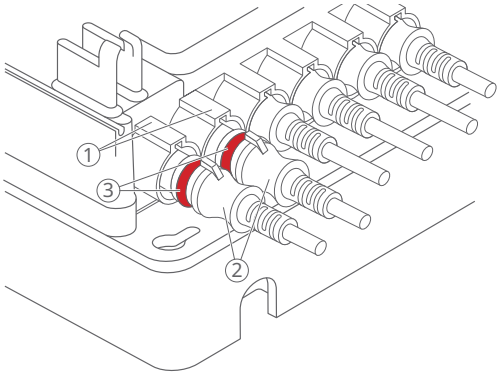
Loss of protection type

- ▸ Arrange for damaged sealing rings to be replaced by the manufacturer without delay.

Check the sealing function of the DIN-8 plug

1. Disconnect the device from the power supply.
2. Check sealing O-ring (3) of the DIN-8 plug (2) for damage.
3. Ensure that there is no irregular gap between the DIN-8 plug (2) and the housing socket (1).
4. Arrange for any damaged sealing O-rings (3) to be replaced by the manufacturer.
5. If no damage is detected and neither the processor nor the manufacturer has raised concerns, reconnect the device to the power supply.

56 Plug seals



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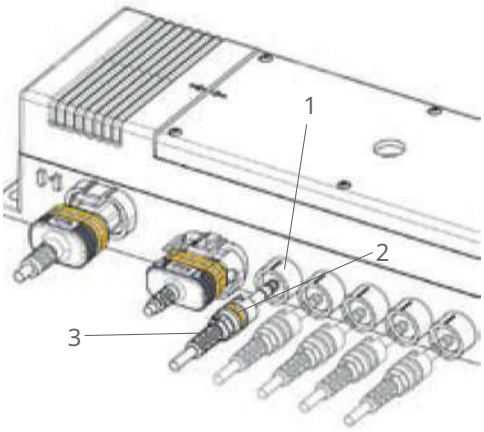
1	Housing socket	2	DIN-8 plug
3	Sealing O-ring		

Checking the sealing function of the jack plug

1. Disconnect the device from the power supply.
2. Check the sealing O-ring (2) of the jack plug (3).
3. Ensure that there is no irregular gap between the jack plug (3) and the connection socket (1) of the housing
4. Arrange for any damaged sealing O-rings to be replaced by the manufacturer.
5. If no damage is detected and neither the processor nor the manufacturer has raised concerns, reconnect the device to the power supply.

57 Checking the jack plug seals



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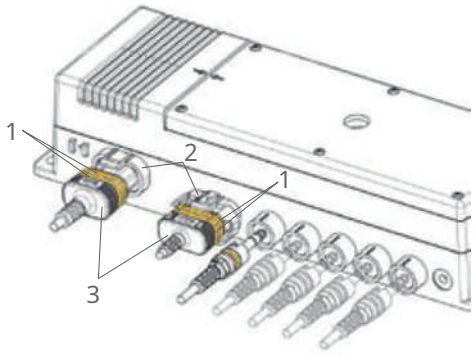
Checking the sealing function of the hand switch

1. Disconnect the device from the power supply.
2. Check the sealing O-ring (1) of the hand switch plug (3) for damage.
3. Ensure that there is no irregular gap between the hand switch plug (3) and the connection socket (2) of the housing
4. Arrange for any damaged sealing O-rings to be replaced by the manufacturer.
5. If no damage is detected and neither the processor nor the manufacturer has raised concerns, reconnect the device to the power supply.

58 Checking the hand switch seals



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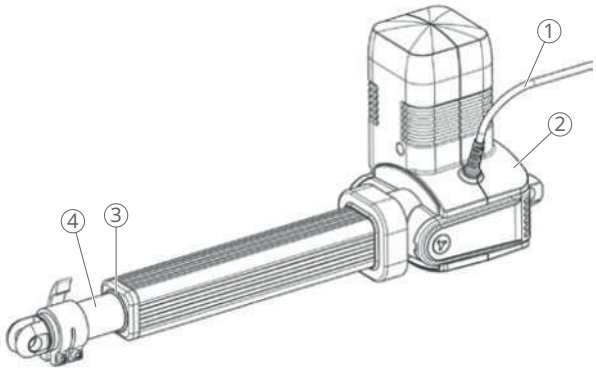
11.2.4 Visual inspection of the condition

To be performed by qualified personnel.

59 Components for visual inspection of the condition



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1	Power cable	2	Motor housing
3	Debris wiper(s)	4	Protection tube

1. Disconnect the device from the power supply.
2. Check power cables for visible external damage such as cracks, cuts, and crushing.
3. Check plastic parts for visible external damage such as cracks, gaps, and fractures.
4. Check debris wipers for cracks, gaps, and broken parts.
5. Check the protection tube for visible external damage such as scratches and dents.
6. In the event of damage, notify the manufacturer.
7. If no damage is detected and the manufacturer has not raised any concerns, reconnect the device to the power supply.

11.2.5 Checking options

Checking the emergency lowering and quick release function

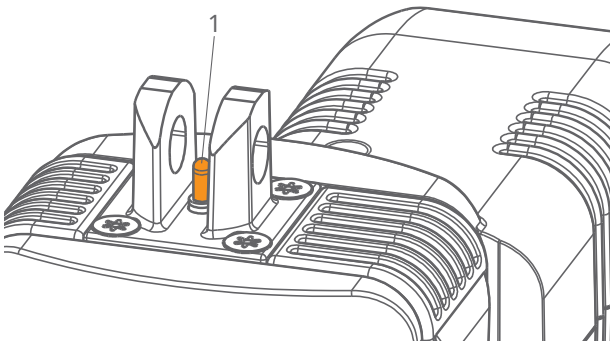
Ensure that no excessive force and no excessively smooth movement (independent downward movement of the linear actuator after opening the clamping lever) occur under rated load.

1. Checking the emergency lowering function ➤55|8.3.3
2. Checking the quick release function ➤53|8.3.2

Checking the electrical anti-pinch protection function

Ensure that the switching pin (1) lifts in the direction opposite to the load and switches off the linear actuator.

60 Switching pin – electrical anti-pinch protection



If an option is damaged or malfunctions, inform the manufacturer.

11.3 Actions to carry out after maintenance

After completing maintenance work, carry out the following steps before returning the product to service:

1. Check that all previously loosened screw connections are securely tightened.
2. Ensure that all tools, materials, and other equipment used have been removed from the work area.
3. Clean the work area and remove any contamination such as liquids, processing materials, or similar substances.
4. Ensure that all safety features of the system are functioning satisfactorily.
5. Check all functions against the product specifications.
6. Document the inspections in the maintenance log.

12 Troubleshooting

The following section describes possible causes of malfunctions and the necessary measures for restoring functionality.

If malfunctions occur frequently, shorten the maintenance intervals.

If a malfunction cannot be rectified with the measures described, contact Schaeffler Service.

Authorized personnel

- The measures described here may be carried out by the operator unless otherwise specified.
- Some tasks may only be performed by qualified personnel; this will be explicitly stated in the relevant fault description.
- Work on the electrical system may only be carried out by trained, electrically skilled persons.

Safety instructions

DANGER

Risk of serious or fatal injuries from live components and moving parts

Serious or fatal injuries may be caused by contact with live components and by unexpected actuator movements.

- Switch off the power supply and secure it against unintentional reconnection before performing any work on the system.

DANGER

Risk of fatal injury from unauthorized reconnection of the power supply

Risk of fatal injury to persons in the hazard area due to moving parts or electric shock if the power supply is switched on without authorization during work on the system and causes the system to restart.

- Before starting work, switch off the system and secure it against reconnection.

DANGER

Risk of injury and property damage due to improper troubleshooting

The device is not designed for repair work. Improper troubleshooting may result in injury or property damage.

- Do not loosen screws on the device.
- Do not open the device.
- If malfunctions cannot be resolved by following the instructions below, disassemble the actuator and return it to Schaeffler for repair.

Procedure in the event of malfunctions

As a general rule:

1. In the event of malfunctions that could pose a direct danger to persons or property: Switch off the actuator or the control system immediately and secure it against being switched back on.
2. Determine cause of malfunction.
3. Depending on the type of malfunction: Have the malfunction rectified by qualified personnel.
4. Inform the persons responsible on site about the malfunction.

Refer to the *Troubleshooting* table to determine who is authorized to remedy the malfunction.

12.1 MAX1, MAX3

16 Troubleshooting

Error	Possible cause	Remedy	To be carried out by
Linear actuator does not move.	No mains voltage available	▸ Check the mains supply.	Professional electrician
	Poor plug contact or plug not properly inserted	▸ Insert the power cable of the linear actuator into the control unit. ▸ Insert the mains plug of the control unit into a socket.	Operator
	Power cable defective	▸ Check power cable for crushing, cracks, or other damage. ▸ If the power cable is defective, contact Schaeffler.	Professional electrician
	Obstacle in the stroke area of the linear actuator	▸ Remove all obstacles from the stroke area.	Qualified personnel
	Incorrect load	▸ Measure the static and dynamic load and compare it with the information on the product label. ▸ If the load is exceeded, replace the device.	Qualified personnel
	Control or operating element defective	▸ Troubleshoot the control unit. ▸ Identify any defect in the control unit. ▸ Replace the control unit if required.	Qualified personnel
	Device service life exceeded.	▸ If the device is more than 10 years old or has performed ≥ 20000 double strokes: replace the device.	Qualified personnel
	The device cannot be set in motion by any of the above measures.	▸ Replace the device.	Qualified personnel
Linear actuator does not move	Obstacle in the stroke area of the linear actuator	▸ Remove all obstacles from the stroke area.	Operator
	Excessive load	▸ Remove loads from the linear actuator.	Operator
	Spindle nut defective	▸ Replace the device.	Qualified personnel
	Device service life exceeded.	▸ If the device is more than 10 years old or has performed ≥ 20000 double strokes: replace the device.	Qualified personnel
Markedly reduced speed	Obstacle in the stroke area of the linear actuator	▸ Remove all obstacles from the stroke area.	Operator
	Excessive load	▸ Remove loads from the linear actuator.	Operator
	Motor, gearbox, or spindle nut defective	▸ Replace the device.	Qualified personnel
Significantly increased running noise	Obstacle in the stroke area of the linear actuator	▸ Remove all obstacles from the stroke area.	Operator
	Excessive load	▸ Remove loads from the linear actuator.	Operator
	Motor, gearbox, or spindle nut defective	▸ Replace the device.	Qualified personnel

12.2 MAX6, MAX7

17 Troubleshooting

Error	Possible cause	Remedy	To be carried out by
Linear actuator does not move	Obstacle in the stroke area of the linear actuator	▸ Remove all obstacles from the stroke area.	Operator
	Excessive load	▸ Remove loads from the linear actuator.	Operator
	Spindle nut defective	▸ Replace the device.	Qualified personnel
	Device service life exceeded.	▸ If the device is more than 10 years old or has performed ≥ 20000 double strokes: replace the device.	Qualified personnel
Markedly reduced speed	Obstacle in the stroke area of the linear actuator	▸ Remove all obstacles from the stroke area.	Operator
	Excessive load	▸ Remove loads from the linear actuator.	Operator
	Motor, gearbox, or spindle nut defective	▸ Replace the device.	Qualified personnel
Significantly increased running noise	Obstacle in the stroke area of the linear actuator	▸ Remove all obstacles from the stroke area.	Operator
	Excessive load	▸ Remove loads from the linear actuator.	Operator
	Motor, gearbox, or spindle nut defective	▸ Replace the device.	Qualified personnel
Linear actuator cannot be operated	Incorrect operating element	▸ Check product label. ▸ If the operating element is not from Schaeffler and not approved for the device, replace the operating element.	Qualified personnel
	Operating element defective	▸ Carry out fault diagnosis on the operating element ▸ Replace the operating element if necessary	Qualified personnel
	Spindle nut defective	▸ Replace the device.	Qualified personnel
Linear actuator does not move.	No mains voltage available	▸ Check the mains supply.	Professional electrician
	Poor plug contact or plug not properly inserted	▸ Insert the power cable of the linear actuator into the control unit. ▸ Insert the mains plug of the control unit into a socket.	Operator
	Power cable defective	▸ Check power cable for crushing, cracks, or other damage. ▸ If the power cable is defective, contact Schaeffler.	Professional electrician
	Obstacle in the stroke area of the linear actuator	▸ Remove all obstacles from the stroke area.	Qualified personnel
	Incorrect load	▸ Measure the static and dynamic load and compare it with the information on the product label. ▸ If the load is exceeded, replace the device.	Qualified personnel
	Device service life exceeded.	▸ If the device is more than 10 years old or has performed ≥ 20000 double strokes: replace the device.	Qualified personnel
	The device cannot be set in motion by any of the above measures.	▸ Replace the device.	Qualified personnel

12.3 Startup after correcting a malfunction

The device is not designed to be repaired by the customer. In any case, please contact Schaeffler.

Once the malfunction has been corrected:

- Before restarting, carry out the steps described in the Assembly and Commissioning sections.

13 Disposal

If no return or disposal agreement is in place, disassembled components must be recycled.

⚠ CAUTION

Improper disposal

environmental damage

- Electronic waste, electronic components, lubricants, and other additives are subject to hazardous waste regulations and may only be disposed of by authorized specialist companies.

Observe the local regulations for disposal.

For information on environmentally sound disposal, contact your local authorities or specialist companies.

1. Dispose of metal and plastic parts at an appropriate recycling facility.
2. Sort remaining components by material and dispose of them in accordance with locally applicable occupational safety and environmental protection regulations.

14 Technical data

MAX1

18 Technical data MAX1

Feature	Unit	MAX1..-A	MAX1..-B	MAX1..-C
Rated push force	N	4000	2000	1500
Rated pull force	N	4000	2000	1500
min. speed (full load)	mm/s	5	6	13
max. speed (no load)	mm/s	7	9	18
min. stroke S	mm	50	50	50
max. stroke S	mm	700	700	700
Retracted length L	mm	S + 195 / 260 [1)]	S + 195 / 260 [1)]	S + 195 / 260 [1)]
Voltage	V DC	24	24	24
Power consumption	W	120	120	120
Current consumption	A	5	5	5
Duty cycle	%	10 ($^1/_9$)	10 ($^1/_9$)	10 ($^1/_9$)
min. ambient temperature	°C	0	0	0
max. ambient temperature	°C	+40	+40	+40
Protection code (IP)	–	IP66S	IP66S	IP66S
Weight (at 200 mm stroke)	kg	4	3.7	3.6
Color	–	Gray	Gray	Gray

1) For S ≤ 350 mm: L = 195 + S
For S > 350 mm: L = 260 + S

MAX3

19 Technical data MAX3

Feature	Unit	MAX3..-A	MAX3..-B	MAX3..-C
Rated push force	N	8000	4000	3000
Rated pull force	N	6000 [2)]	4000	3000
min. speed (full load)	mm/s	5	6	13
max. speed (no load)	mm/s	7	9	18
min. stroke S	mm	50	50	50
max. stroke S	mm	700	700	700
Retracted length L	mm	S + 215 / 280 [3)]	S + 215 / 280 [3)]	S + 215 / 280 [3)]
Voltage	V DC	12 / 24	12 / 24	12 / 24
Power consumption	W	120	120	120
Current consumption	A	5	5.2	5.2
Duty cycle	%	10 ($^1/_9$)	10 ($^1/_9$)	10 ($^1/_9$)
min. ambient temperature	°C	0	0	0
max. ambient temperature	°C	+40	+40	+40
Protection code (IP)	–	IP66S	IP66S	IP66S
Weight (at 200 mm stroke)	kg	4.5	4.2	4
Color	–	Gray	Gray	Gray

2) The max. load for medical applications is 5000 N.

3) For S ≤ 350 mm: L = 215 + S
For S > 350 mm: L = 280 + S

MAX7

20 Technical data MAX7

Feature	Unit	MAX7..-A	MAX7..-B	MAX7..-C
Rated push force	N	8000	4000	3000
Rated pull force	N	6000 [4)]	4000	3000
min. speed (full load)	mm/s	6	8	13
max. speed (no load)	mm/s	7.5	10	18
min. stroke S	mm	50	50	50
max. stroke S	mm	700	700	700
Retracted length L	mm	S + 215 / 280 [5)]	S + 215 / 280 [5)]	S + 215 / 280 [5)]
Voltage	V AC	100 ... 240 at 50/60 Hz	100 ... 240 at 50/60 Hz	100 ... 240 at 50/60 Hz
Power consumption	W	180	180	180
Current consumption at AC 100 V	A	3.2	3.2	3.2
Current consumption at AC 240 V	A	1.6	1.6	1.6
Duty cycle	%	10 ($^1/_9$)	10 ($^1/_9$)	10 ($^1/_9$)
min. ambient temperature	°C	0	0	0
max. ambient temperature	°C	+40	+40	+40
Protection code (IP)	–	IP66S	IP66S	IP66S
Weight (at 200 mm stroke)	kg	4.8	4.5	4.2
Color	–	Gray	Gray	Gray

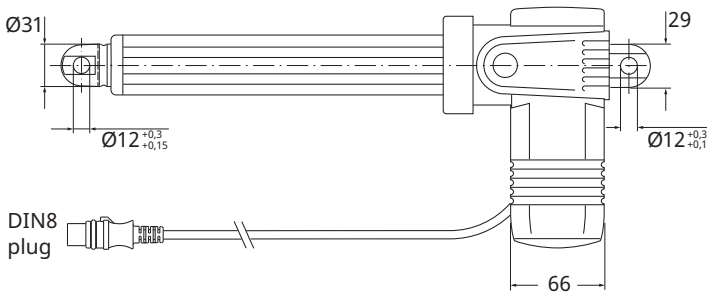
4) The max. load for medical applications is 5000 N.

5) For S ≤ 350 mm: L = 215 + S
For S > 350 mm: L = 280 + S

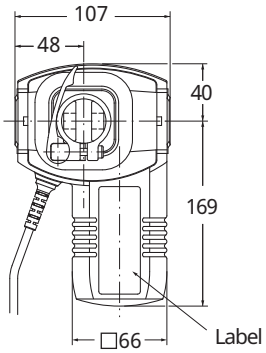
14.1 Geometric data

MAX1

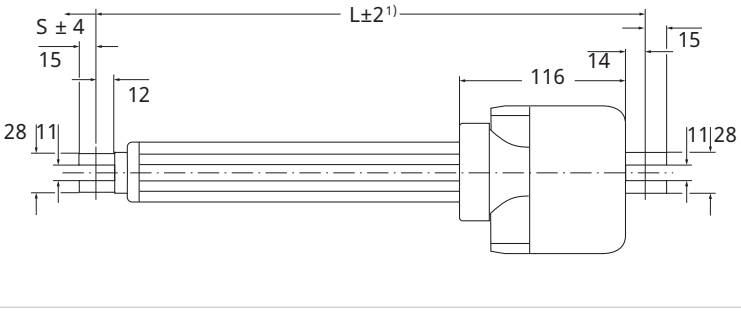
61 Side view



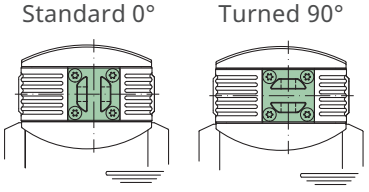
62 Front view



63 Top view

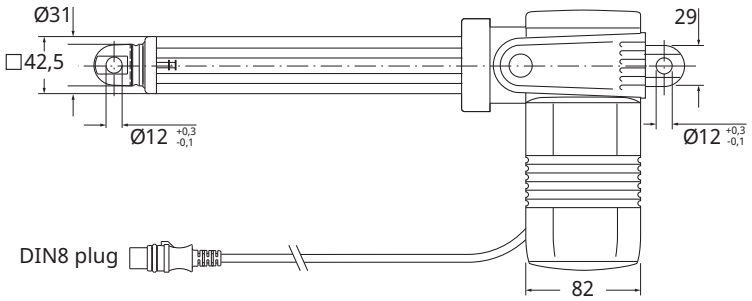


64 Rear mounting



MAX3

65 Side view



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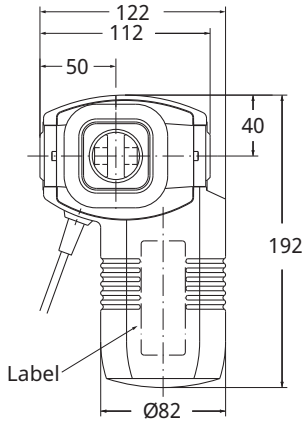
66 Front view



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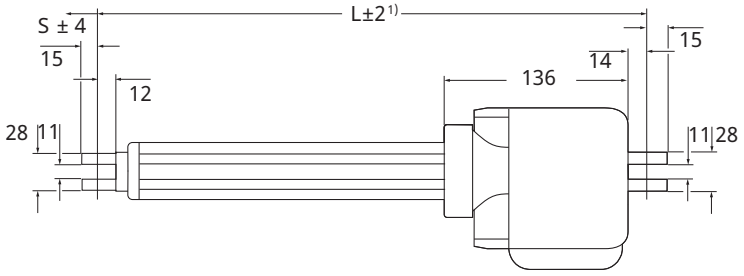
67 Top view



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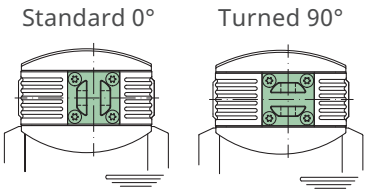
68 Rear mounting



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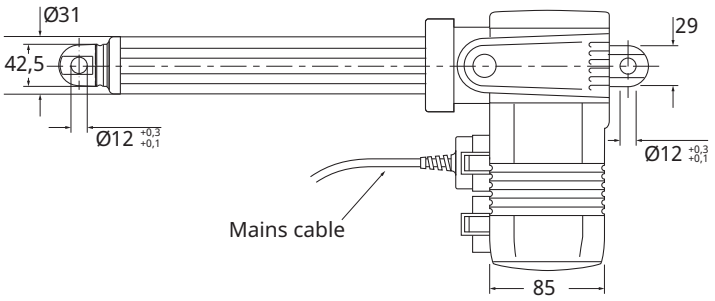
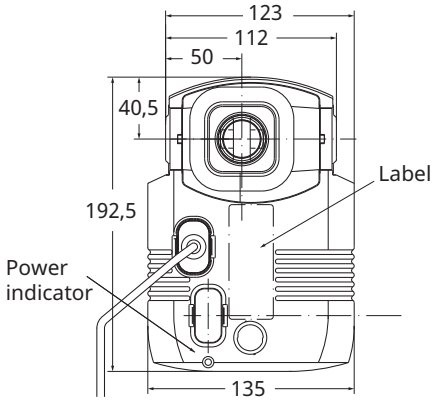
MAX7

69 Side view



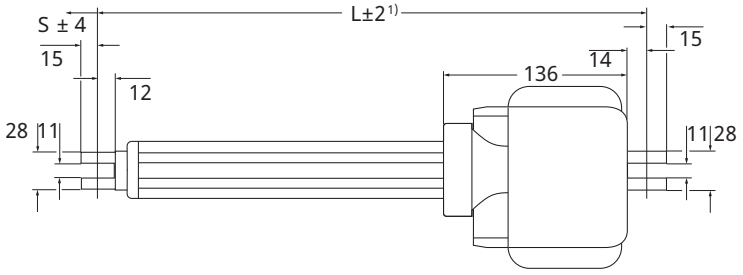
001C130E

70 Front view



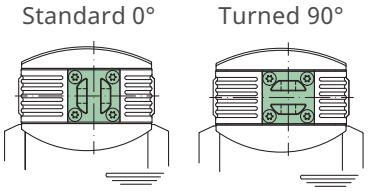
001C12FE

71 Top view



001C12CD

72 Rear mounting



001C106D

14.2 Operating elements and control units

MAX1, MAX3

21 Suitable operating elements and control units

Operating elements	Switches	Control unit			
		SCU	VCU	BCU	MCU
EHA1	M	–	–	–	✓
EHA3	M	✓	✓	✓	–
STJ	F	✓	✓	✓	–
STF	F	–	–	–	✓
STE	T	✓	✓	✓	–
STA	T	–	–	–	✓

M Hand switch
F Foot switch
T Desk switch
✓ suitable
– not suitable

MAX7

22 Suitable operating elements and control units

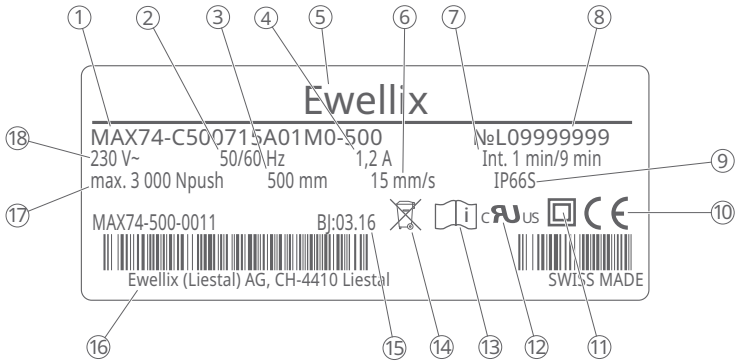
Operating elements	Switches	MAX70	MAX72/74
EHA1	M	–	✓
PHC	M	✓	–
STF	F	–	✓
PFP	F	✓	–
STA	T	–	✓
PAM	T	✓	–

M Hand switch
F Foot switch
T Desk switch
✓ suitable
– not suitable

14.3 Product label

The type plate contains the following Information:

73 Product label MATRIX



1	Type key	2	Mains frequency
3	Stroke	4	Current consumption
5	Manufacturer	6	Speed
7	Duty cycle (on/off time)	8	Serial number
9	Degree of protection	10	CE
11	Class II	12	UL
13	Observe the manual	14	Disposal information
15	Date of manufacture (month/year)	16	Manufacturer's address
17	Push force	18	Input voltage

14.4 Ambient conditions

The product may only be operated under the following ambient conditions:

- indoor use only
- temperature from 0 °C to +40 °C
- humidity 5 % to 85 %, non-condensing
- Install in a location where the actuator is not exposed to strong UV radiation or corrosive or explosive air media.

14.5 Duty cycle

The permissible load depends on the duty factor, i.e., the load must be reduced if the duty factor is increased. The duty factor is defined as the time running under load in relation to the total cycle time.

1 Determining the duty factor

$$D = \frac{N}{N+R} \cdot 100$$

D	%	Duty factor
N	s	Time running under load
N+R	s	Total cycle time
R	s	Rest time

NOTICE

Duty factor exceeded

Material damage to the actuator due to overheating

- ▸ Reduce running under load
- ▸ Extend rest time

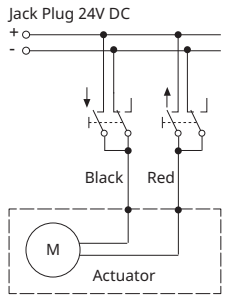
23 Duty factor intermittent

Information	Parameter	Time
Time running under load	N	1 min
Rest time	R	9 min

14.6 Wiring diagrams

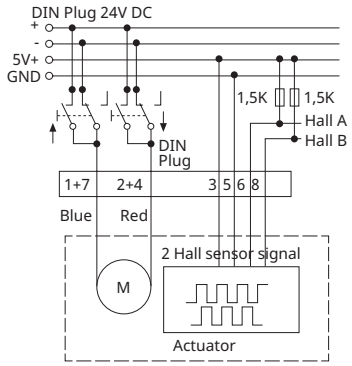
MAX1

74 Jack plug DC 24 V



001C102D

75 DIN-8 plug DC 24 V

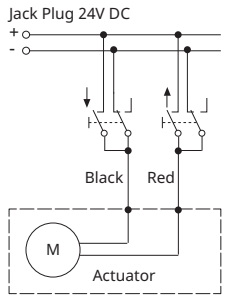


001C103D

Valid for MAX 11 only. MAX 10 must be operated using a BCU, VCU, SCU, or MCU control unit.

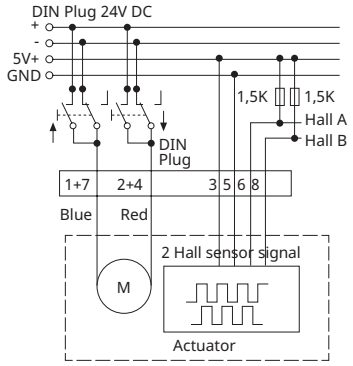
MAX3

76 Jack plug DC 24 V



001C102D

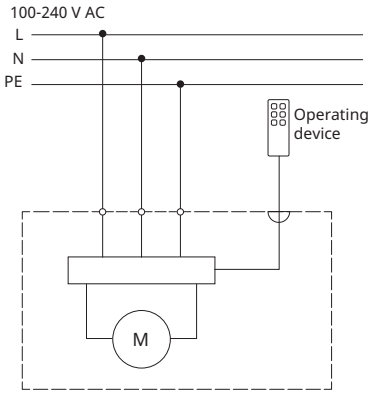
77 DIN-8 plug DC 24 V



Valid for MAX 31 only. MAX 30 must be operated using a BCU, VCU, SCU, or MCU control unit.

MAX7

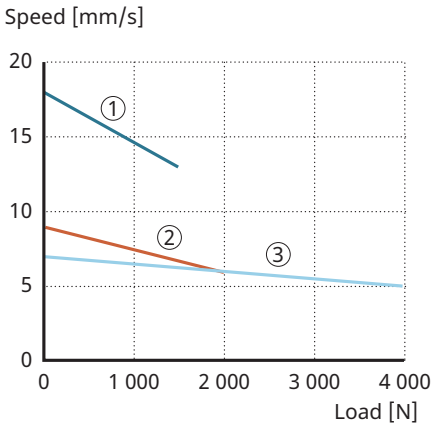
78 Connection diagram AC 100 ... 240 V



14.7 Performance diagrams

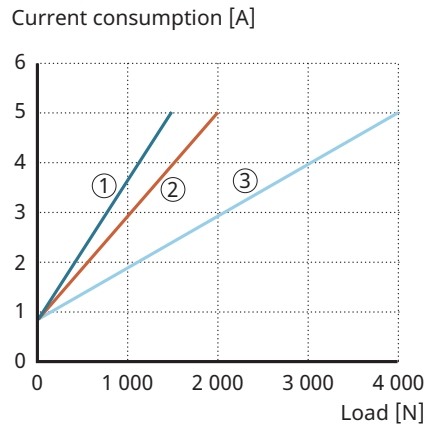
MAX1

79 Speed-load diagram



1	MAX1..-C	2	MAX1..-B
3	MAX1..-A		

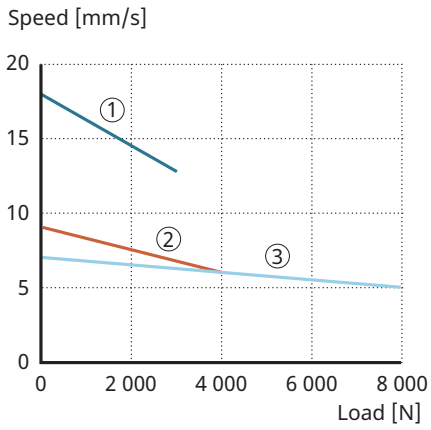
80 Current-load diagram



1	MAX1..-C	2	MAX1..-B
3	MAX1..-A		

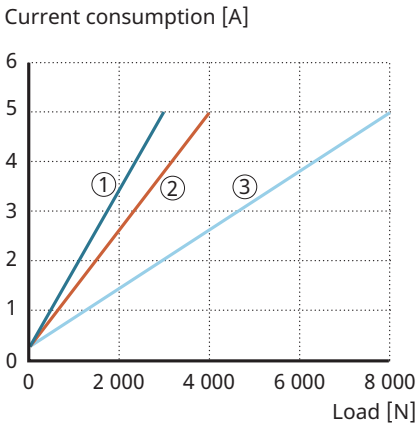
MAX3

81 Speed-load diagram



1	MAX3..-C	2	MAX3..-B
3	MAX3..-A		

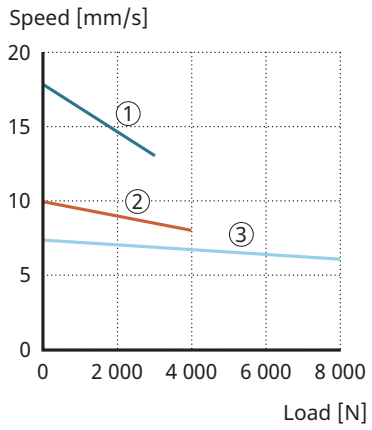
82 Current-load diagram



1	MAX3..-C	2	MAX3..-B
3	MAX3..-A		

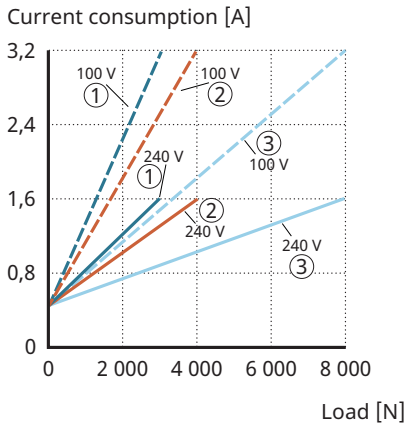
MAX7

83 Speed-load diagram



1	MAX7..-C	2	MAX7..-B
3	MAX7..-A		

84 Current-load diagram

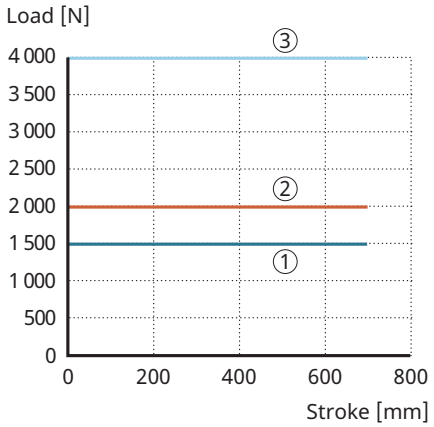


1	MAX7..-C	2	MAX7..-B
3	MAX7..-A		

14.8 Load limit

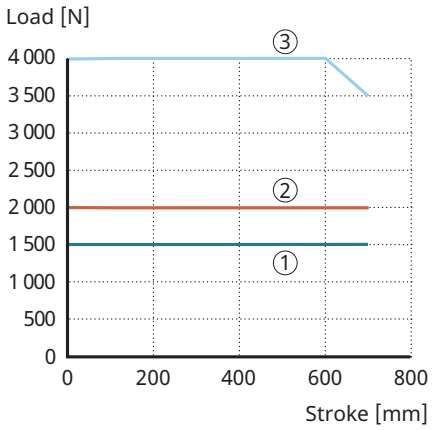
MAX1

85 Load limit (push and pull) for safety factor SF =1



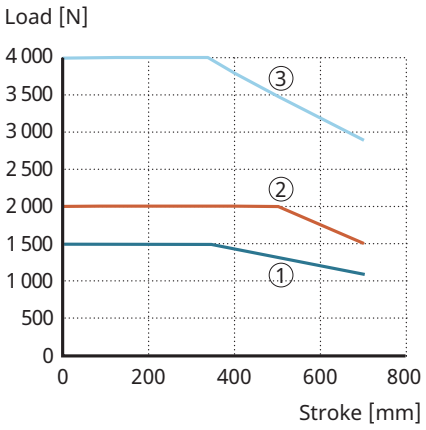
1	MAX1..-C	2	MAX1..-B
3	MAX1..-A		

86 Load limit (push and pull) for safety factor SF =2



1	MAX1..-C	2	MAX1..-B
3	MAX1..-A		

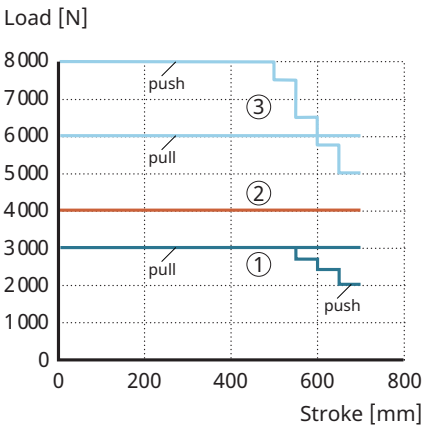
87 Load limit (push and pull) for safety factor SF = 4 (EN 60601)



1	MAX1..-C	2	MAX1..-B
3	MAX1..-A		

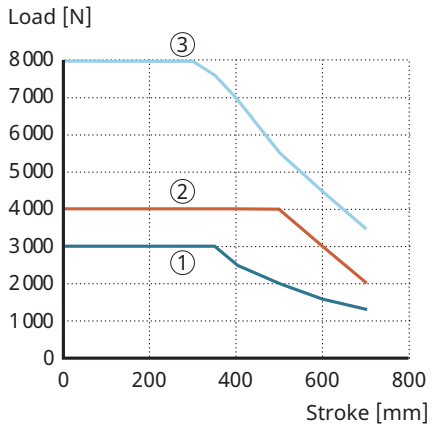
MAX3

88 Load limit (push and pull) for safety factor SF =1



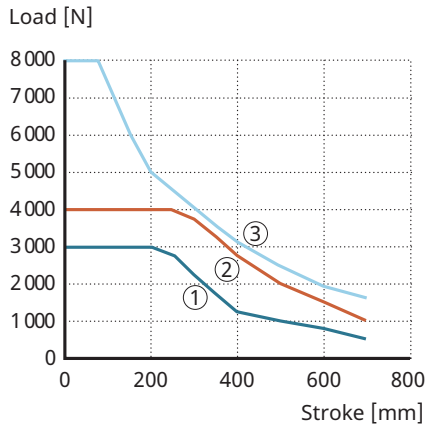
1	MAX3..-C	2	MAX3..-B
3	MAX3..-A		

89 Load limit (push and pull) for safety factor SF =2



1	MAX3..-C	2	MAX3..-B
3	MAX3..-A		

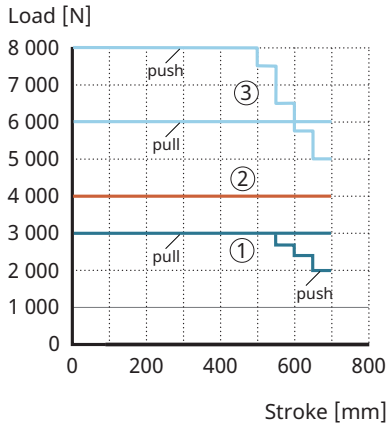
90 Load limit (push and pull) for safety factor SF = 4 (EN 60601)



1	MAX3..-C	2	MAX3..-B
3	MAX3..-A		

MAX7

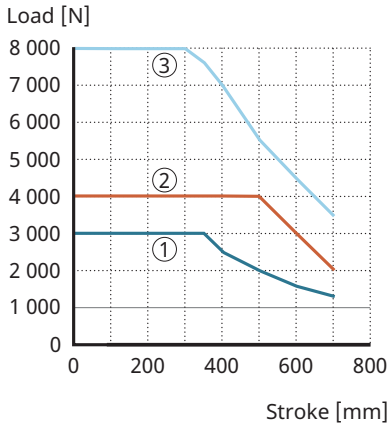
91 Load limit (push and pull) for safety factor SF =1



001C139E

1	MAX7..-C	2	MAX7..-B
3	MAX7..-A		

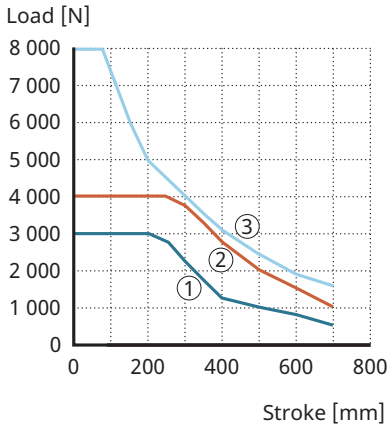
92 Load limit (push and pull) for safety factor SF =2



001C13AE

1	MAX7..-C	2	MAX7..-B
3	MAX7..-A		

93 Load limit (push and pull) for safety factor SF = 4 (EN 60601)



001C13BE

1	MAX7..-C	2	MAX7..-B
3	MAX7..-A		

15 Accessories

Accessories	Type	Comment
Control unit	MAX1, MAX3	–
Operating element	MAX6, MAX7	Electrical or pneumatic operating element
Slave linear actuator	MAX6, MAX7	A linear actuator with a rated voltage of 24 V DC and a power cable with jack plug, without integrated control unit and power supply, intended for use in combination with a master linear actuator.
Power cable	MAX6, MAX7	Country-specific power cables are not included in the scope of delivery and must be ordered separately.
Bearing inserts for one hinge head and one fork head	MAX1, MAX3, MAX6, MAX7	–
Special key	MAX1, MAX3, MAX6, MAX7	–

Further information

LA 1 | Lifting and Actuating Systems |
https://www.schaeffler.de/std/222A

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