

Matrix

Linear Actuator



Read this manual before installing, operating or maintaining this actuator. Failure to follow safety precautions and instructions could cause actuator failure and result in serious injury, death or property damage.





The SKF brand now stands for more than ever before, and means more to you as a valued customer.

While SKF maintains its leadership as the hallmark of quality bearings throughout the world, new dimensions in technical advances, product support and services have evolved SKF into a truly solutions-oriented supplier, creating greater value for customers.

These solutions encompass ways to bring greater productivity to customers, not only with breakthrough application-specific products, but also through leading-edge design simulation tools and consultancy services, plant asset efficiency maintenance programmes, and the industry's most advanced supply management techniques.

The SKF brand still stands for the very best in rolling bearings, but it now stands for much more.

SKF – the knowledge engineering company

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1 General information

1.1 Information on this manual

This manual provides important information on how to work with the actuator (also called 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 the personnel 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.

For better representation of circumstances, the illustrations used are not necessarily to scale and may vary from the actual design of the device.

1.2 Explanation of symbols and signal words

Safety precautions

Warnings are identified by symbols and signal words. These signal words indicate the severity of the hazard.

Adhere to these safety precautions and act cautiously in order to avoid accidents, personal injuries and damage to property.



Note!

Emphasizes useful hints and recommendations as well as information for efficient and trouble-free operation.



CAUTION

Indicates a dangerous situation, which can lead to minor or moderate injury or property damage, if the precautionary measures are ignored.



WARNING

Indicates a dangerous situation, which can lead to severe personal injury or death, if the precautionary measures are ignored.



DANGER

Indicates a dangerous situation, which will lead to death or severe personal injury, if the precautionary measures are ignored.

1.3 Limitation of liability

All information and notes in this manual were compiled under due consideration of valid standards and regulations, the present status of technology and our years of knowledge and experience.

The manufacturer will not be liable for damage resulting from:

- disregarding this manual
- unintended use
- employment of untrained personnel
- unauthorized conversions
- technical modifications
- manipulation or removal of the screws on the device
- use of unapproved spare parts

In case the actuator is customised, the actual product delivered may be different from what is described in the manual. In this case, ask SKF for any additional instructions or safety precautions relevant to these actuators.

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

1.4 Copyright

This Manual is protected by copyright law and exclusively to be used for internal purposes.

Passing this Manual on to third parties, duplication of any kind – even in form of excerpts – as well as the use and/or disclosure of the contents without the written consent of the manufacturer is not permitted, except for internal purposes.

Violations oblige to compensation. The right for further claims remains reserved.

1.5 Spare parts

The Matrix linear actuator is not designed for repair work. All warranty and service claims become void without notice if any screws on the linear actuator have been manipulated.

WARNING

Safety hazard caused by wrong spare parts

Wrong or faulty spare parts can adversely affect safety and cause damage, malfunctions or total failure.

Therefore:

- Use only genuine spare parts from the manufacturer.
- Spare parts in/on the device may only be replaced by the manufacturer.

The device must be dismantled and sent to the manufacturer. The address is listed on the **cover back**.

1.6 Warranty terms

The applicable and effective warranty terms are those contained in the manufacturer's terms and conditions of sale.

1.7 Customer service

SKF Customer Service is always available to provide technical information and answer questions.

See the contact information for SKF Customer Service on the back cover.

2 Safety

This paragraph provides an overview of all important safety aspects for optimal protection of personnel as well as safe and trouble-free operation.

Disregarding this Manual and safety regulations specified therein may result in considerable danger and possible serious injury or death.

2.1 Intended use

The device has been designed and built exclusively for its intended purpose as described in these instructions.

The device is only used for the dynamic centric compression or tensile-loaded lift. It is only intended for interior use and is implemented in medical devices as well as in industrial and construction technology.

WARNING

Risk from misuse

Any utilization of this device beyond its intended purpose may lead to potentially hazardous situations.

Therefore:

- Strictly adhere to all safety precautions and instructions in this operating manual.
- Do not make this device subject to weather conditions, strong UV rays, corrosive or explosive air media as well as other aggressive media.
- Do not modify, retool or change the structural design or individual components of the actuator.
- Never use the device outside of the technical application and operational limits.

Any injury, damage or loss caused by violation of these instructions will be the responsibility of the customer.

2.2 Responsibility of the owner and processor

The device is designed for personal use and is also used in commercial applications by owner or processors.

The processor is the contracting partner of the reseller or the manufacturer. The processor installs the device in a complete system (application).

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

In addition to the safety instructions in this Manual, the owner or processor must do the following concerning these safety and accident prevention guidelines and environmental protection regulations, applicable to the site of the system's installation:

- Inform themselves of applicable industrial safety regulations and determine additional hazards that arise due to the specific working conditions prevailing at the site where the device is installed using risk assessment. The risk assessment must be implemented in the form of work instructions for device operation.
- Must confirm that the work instructions created for the system including the device satisfy current legal requirements and must alter the instructions if they don't.
- Clearly regulate and specify the responsibilities for installation, operation, maintenance, and cleaning.
- Ensure that all employees who deal with the device have read and understood this Manual.
- Provide personnel with the required protective equipment.
- In addition, owner must train personnel at regular intervals and inform personnel of the hazards.

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

- Ensure that the maintenance intervals described in these instructions are complied with.
- Have all safety devices inspected regularly for function and completeness.

2.3 Personnel requirements

WARNING

Improper installation, operation and maintenance can result in serious injury, death or property damage.

Use only qualified, instructed, or trained personnel (as described below) who have read, understand and follow these instructions.

2.3.1 Qualifications

The following qualifications are specified for different areas of activity listed in the manual.

- **An instructed person (Operator)**

has been instructed by the customer in an orientation session on the assigned tasks and possible dangers in case of improper behaviour.

- **Qualified personnel**

based on their professional training, know-how and experience as well as knowledge of the applicable standards and regulations is able to perform assigned work activities and to detect and avoid possible dangers on their own.

- **A professional electrician**

based on his/her professional training, know-how and experience as well as knowledge of the applicable standards and regulations is able to perform work on electrical systems and to detect and avoid possible dangers on his/her own.

The professional electrician has been trained for the special location where he/she works and knows the relevant standards and regulations.

Only persons who are expected to perform their tasks reliably are permitted as personnel. Persons whose reaction capability is impaired, e.g. through drugs, alcohol or medication, are not permitted.

2.4 Specific dangers

The following section lists the residual risks that have been determined by the risk assessment.

- **Heed the safety instructions listed here, and the warnings in subsequent chapters of this Manual, to reduce health hazards and to avoid dangerous situations.**



DANGER

Danger to life caused by electric current

Touching conductive parts causes a direct danger to life.

Damage to insulation or individual components can cause danger to life.

Therefore:

- In the event of damage to insulation, switch off the power supply immediately and have the defective parts repaired.
- Work on the electrical system must be carried out only by skilled electricians.
- De-energize the machine for all work on the electrical system.
- Before maintenance, cleaning or repair work, switch off the power supply and perform lockout procedures so it cannot be turned on again.
- Do not bridge fuses or make them ineffective. When changing fuses, make sure you use the correct amperage.
- Keep moisture away from conductive parts. If you do not, this can cause short circuit.



Electric current

 **WARNING**

Danger of injury caused by moving components

Rotating and/or linearly moving components can cause severe injury.

Therefore:

- Do not work on or place any of your body, hands, or arms near moving components.

Moving components

2.5 Safety equipment

 **WARNING**

Danger due to malfunctioning safety equipment

For safe operation, be sure all safety equipment is in good working order.

Therefore:

- Always check functionality of safety equipment according to the maintenance plan.
- Never disengage safety equipment.
- Safety equipment may never be by-passed or modified.

**Integration in an emergency-stop system required
(for certain applications)**

The device is only intended for installation into an application or system. It does not have its own operating control elements and does not have an independent emergency-stop-function.

Install the device so that it is part of an emergency shut-off system and can be stopped if necessary.

The emergency shut-off system has to be connected in such a way that a disruption of the power supply or the reactivation of the power supply after a power disruption cannot cause a hazardous situation for persons and objects.

The emergency shut-off systems must always be freely accessible.



Note!

The processor decides which applications require the installation of an emergency shut-off system.

The following safety installations may have been installed:

Matrix MAX1/Matrix MAX3

In its standard version the device does not feature an overload safety shut-off and must be turned off via an SKF control unit. MAX11 and MAX31 are exceptions.

Matrix MAX6

The control unit with integrated power shut-off has been installed in the motor housing.

Matrix MAX1/Matrix MAX3

In its standard version the device does not feature a thermal fuse protection and can be destroyed through overheating. An SKF control unit with integrated thermal switch turns the device off in emergencies.

Matrix MAX6

A thermal fuse protection has been integrated in the motor housing.

Overload safety cut-off

Thermal fuse protection

 **CAUTION**

To prevent damage from overheating, do not try to operate actuator until its temperature has fallen below the threshold for the switch to operate.

A ball screw nut converts the rotation of the gear unit into a linear motion. If an overload occurs when the actuator is operating, a ball detent clutch will operate, thus stopping linear motion.

Information concerning emergency lowering function, quick adjustment, electrical pinch protection and mechanical pinch protection can be found in the chapter "Structure and Function".

Overload protection (optional)

Emergency lowering function (optional)

Quick adjustment (optional)

Electric pinch protection (optional)

Mechanical pinch protection (optional)

2.6 Safeguard against restart

DANGER

Life-threatening situation through unauthorized restart

For work in hazard zones, there is a risk that the power supply is turned on without prior authorization. This presents a life-threatening situation for people in the hazard zone.

Therefore:

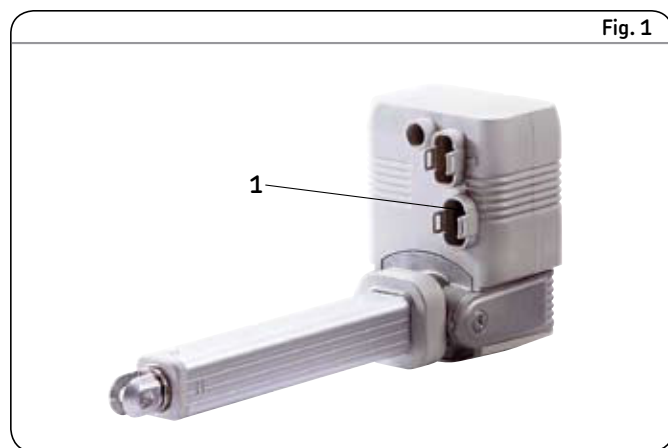
- Follow the information concerning the safeguarding against re-starting of the power supply in the chapters of this operating manual.
- Always follow the process to safeguard against a restart as described below.

Protect MAX1 and MAX3 against a restart.

Pull the power line plug of the SKF control unit out of the power outlet.

Protect MAX6 against restart.

Pull the power line plug (connected with connection (1)) out of the power outlet.



2.7 Modifications on the device

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

2.7.1 Warning labels

The following symbols and information decals can be found in the danger zone. They refer to the immediate vicinity around their location.

WARNING

Danger of injury because of illegible symbols

Over the course of time stickers and decals may become dirty or illegible for some other reason.

Therefore:

- Keep any safety, warning and operation related decals in legible condition at all times.
- Replace damaged decals or stickers immediately.

Do not hold on to the device.

(part number 0120698)

The label will be attached for specific applications, e.g. for patient lifters.

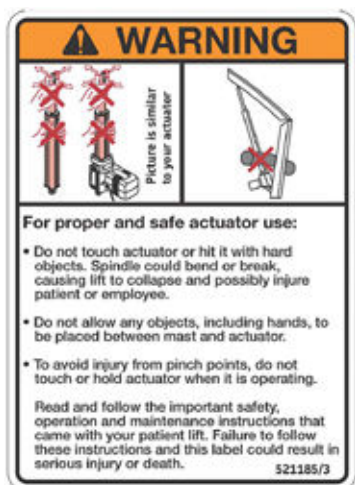
Do not hold on to the actuator or casing tube.

Do not put body parts and objects inbetween moving parts.

Keep body parts or objects away from moving parts.

Adhere to operation instructions and warnings.

Fig. 2

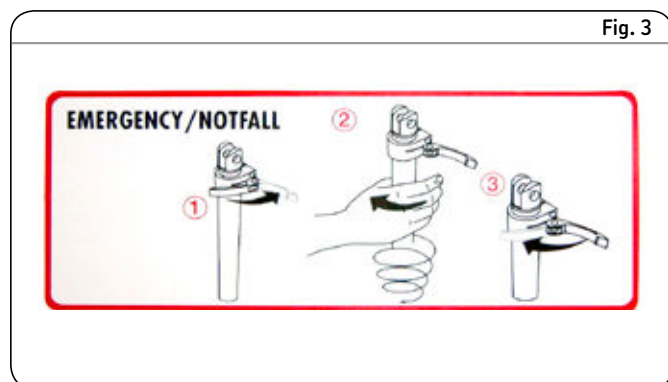


2.7.2 Information labels

Operating label emergency lowering function.

(part number 0112420)

Operation of emergency lowering function (→ Chapter 7.5.2)



3 Technical data



Note!

The technical data (dimensions, weight, output, connection values etc.) can be found in the enclosed drawings and data sheets (→ *Appendix*).

3.1 Operating conditions

Environment

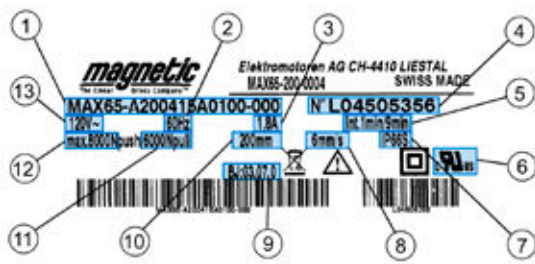
Information	Value	Unit
Temperature range	0 to +40	°C
Relative atmospheric humidity, maximum (no build up of condensation)	up to 85	%

Duration (intermittent)

Information	Value	Unit
Maximum operating time without a break	1	Minutes
Break until next operation	9	Minutes

3.2 Product label

Fig. 4



The product label provides the following information

- 1 Identification of type
- 2 Power frequency
- 3 Power consumption
- 4 Serial number
- 5 Power-on time
- 6 Inspection mark
- 7 IP safety type
- 8 Speed of linear actuator
- 9 Manufacturing date (month/year)
- 10 Extension
- 11 Tractive force
- 12 Compressive force
- 13 Energy

4 Structure and function

4.1 Overview

4.1.1 Matrix MAX1 and MAX3

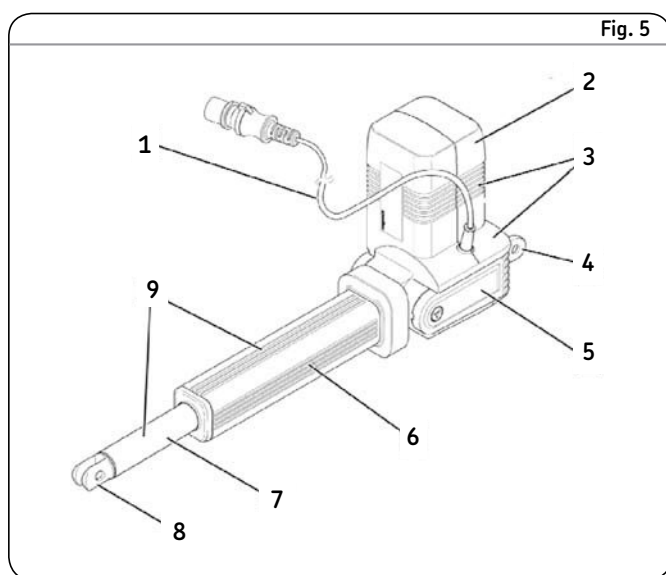


Fig. 5

Matrix MAX1 and MAX3

- 1 Connection cable on control
- 2 Multi-shell plastic housing
- 3 Motor part
- 4 Hinge head
- 5 Bracket
- 6 Casing tube
- 7 Actuator
- 8 Fork head of the actuator
- 9 Linear unit

4.1.2 Matrix MAX6

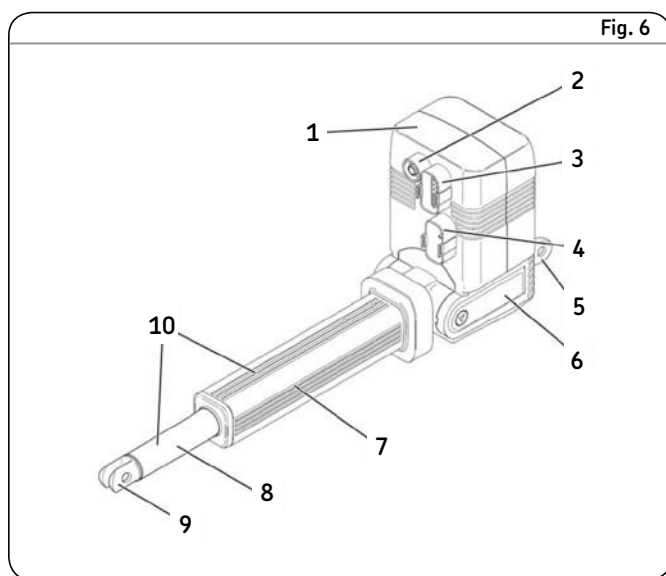
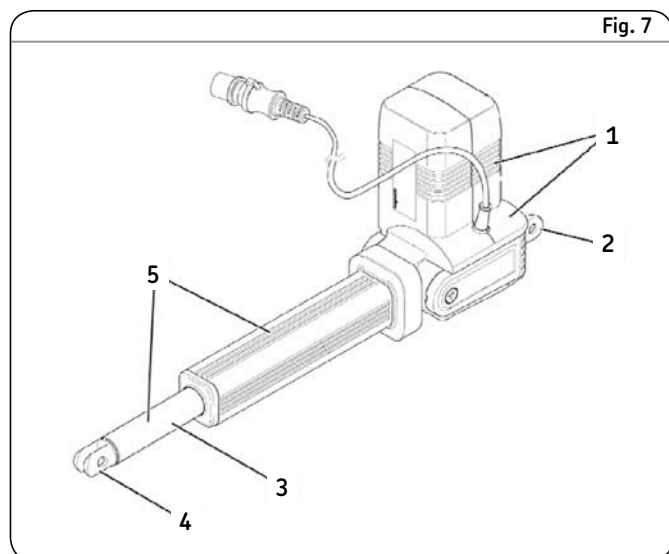


Fig. 6

Matrix MAX6

- 1 Multi-shell plastic housing
- 2 Connection of slave actuator (optional)
- 3 Connection of operation element
- 4 Connection of power line
- 5 Hinge head
- 6 Bracket
- 7 Casing tube
- 8 Actuator
- 9 Fork head of the actuator
- 10 Linear unit

4.2 Brief description



The actuator is implemented in an application and is exclusively for the dynamic centric compression- or tensile-loaded lift.

The linear actuator consists of a motor part (1) and a linear unit (5), connected with each other by a bayonet joint.

The actuator consists of a direct current motor with worm gear which sets in motion a trapezoidal sliding spindle system with shaft joint (type B and C) or ball bearing spindle system (type A). Via the ball screw mount the trapezoidal sliding spindle or ball bearing spindle system transforms the rotation of the gear into a linear motion of the actuator (3).

The hinge head (2) and the fork head (4) transmit the actuator power to both sides of the application.

4.3 Special features

Fig. 8

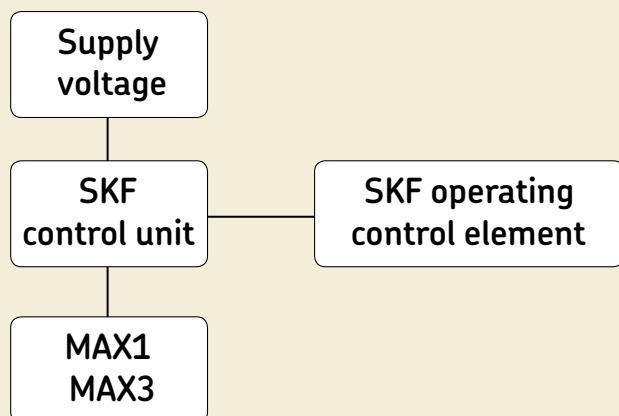
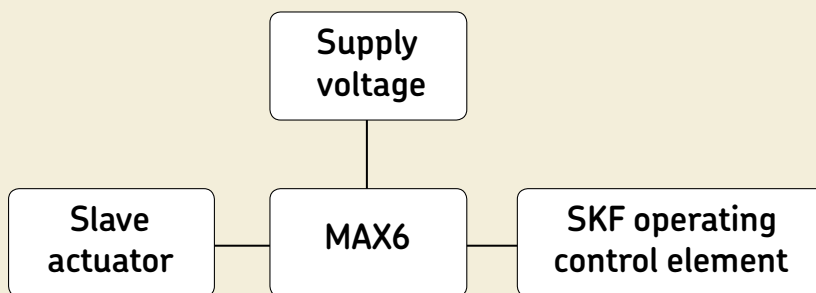


Fig. 9



Matrix MAX1 and MAX3

The device requires an external control unit to power the motor unit. The control unit is connected to the device via a connecting cable. The SKF operating control element is also connected to the control unit, (→ fig. 8).

The difference between the linear actuators of Matrix MAX1 and MAX3 consists in the different outputs (→ Chapter "Technical Data").

Matrix MAX6

The device does not require an external control unit. The control unit is integrated in the multi-shell plastic housing. To power the motor unit, the device is directly connected to the supply voltage via the power line connection. The SKF operating control element can also be connected directly to the device (→ fig. 9).

The Matrix MAX6 linear actuator can be used in a master actuator function with a second DC actuator (slave actuator) with jack plug (→ Chapter "Options").



Note!

Additional differences between the Matrix MAX1, MAX3 and MAX6 linear actuators can be found in the appendix in the Chapters "Safety Features", "Connections", and "Data Sheets". (→ Appendix).

4.4 Construction group description

Motor

The motor is a 24-V-DC, whose motor shaft powers a worm gear. The lift speed depends on the load. The motor unit is surrounded by and fused with the multi-shell plastic housing. The plastic housing cannot be opened. A bracket clasps around the plastic housing.

Brake

The brake is located in the motor unit and takes care of the deceleration of the spindle as well as the stabilization in idle mode.

The maximum self-preservation force of the brake in idle mode can be found in the respective data sheet (→ *Appendix*).

Gear unit

The worm gear is directly powered by the motor shaft, which depending on the version, moves a trapezoidal sliding spindle or ball bearing spindle.

Linear unit

The actuator extends and retracts the push tube. The actuator is surrounded and protected by the casing tube. The footer of the actuator is connected with the threaded spindle via the ball screw nut.

The linear unit is connected with the motor unit via a bayonet joint. The bayonet joint is protected by a plastic cover which also functions as a locking mechanism and which must not be removed.

4.5 Connections

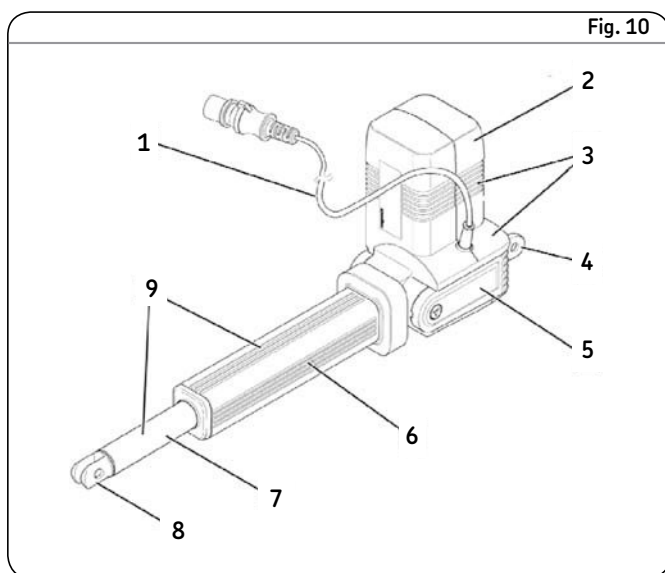


Fig. 10

Matrix MAX1 and MAX3

- 1** Connection to an external control
(jack or DIN-8 plug)
A low voltage plug (1) connects the device to
the power supply via an external SKF control.

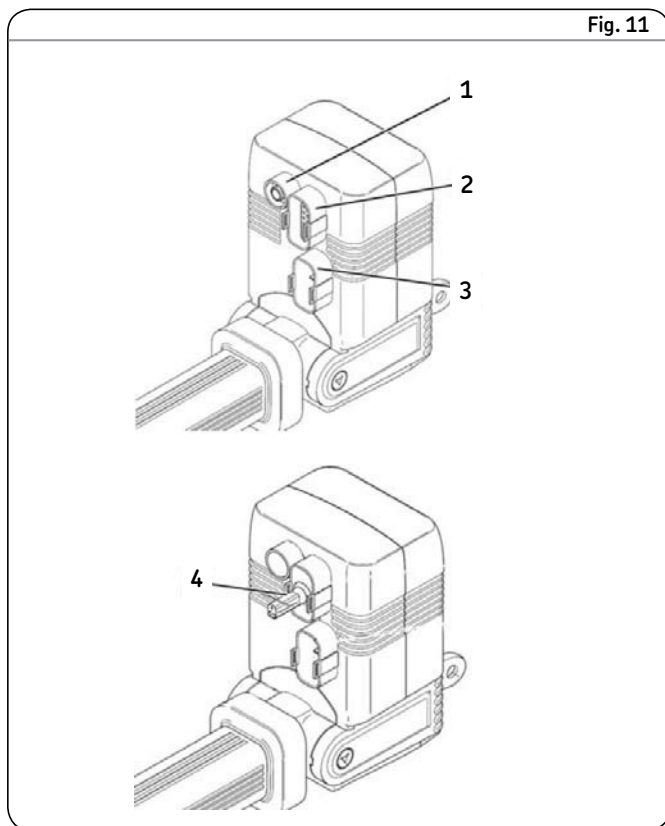


Fig. 11

Matrix MAX6

- 1** Connection slave actuator for jack plug
(optional)*
2 Connection to operation device (electric)
3 Connection power line
4 Connection to operation element (pneumatic)

* → Chapter "Master-Slave Actuator Function"

Connection to operating element

Depending on the version of the linear actuator the Matrix MAX6 is controlled via an electric (2) or pneumatic (4) (→ fig. 11) operating element (→ Chapter "Operating Elements").

Connection to power line

The device is directly connected to the power supply via connection (3) (→ fig. 11).

4.6 Operating elements

Matrix MAX1 and MAX3



Note!

The device does not feature its own operating elements. The operation takes place via a SKF operating element at an external SKF control (→ *Separate operating manual*).

Matrix MAX6



Note!

The device does not feature its own operating elements. The operation takes place via an electric or pneumatic SKF operating element which is connected directly to the device (→ *Separate operating manual*).

4.7 Options

If not specified otherwise, the options listed here are available for the entire series of the Matrix linear actuator (MAX1, MAX3 und MAX6).

4.7.1 Emergency lowering device

The emergency lowering device (1) makes it possible to manually lower the application in case of an emergency (e. g. during power failure or motor malfunctions) (→ *Chapter "Operation"*).

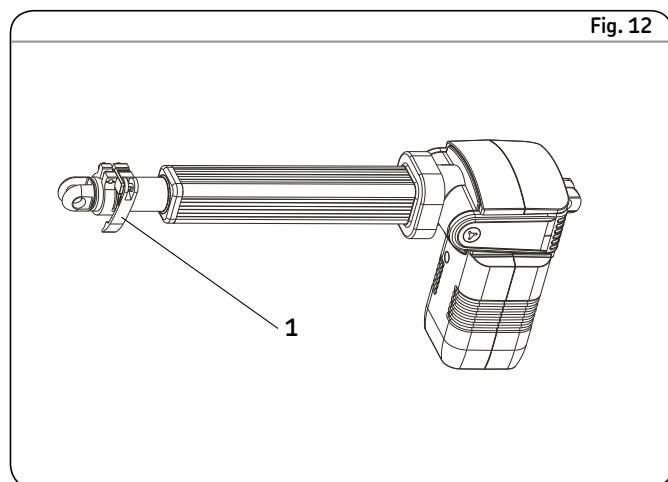


Fig. 12

Emergency lowering device

1 Release handle of the emergency lowering device

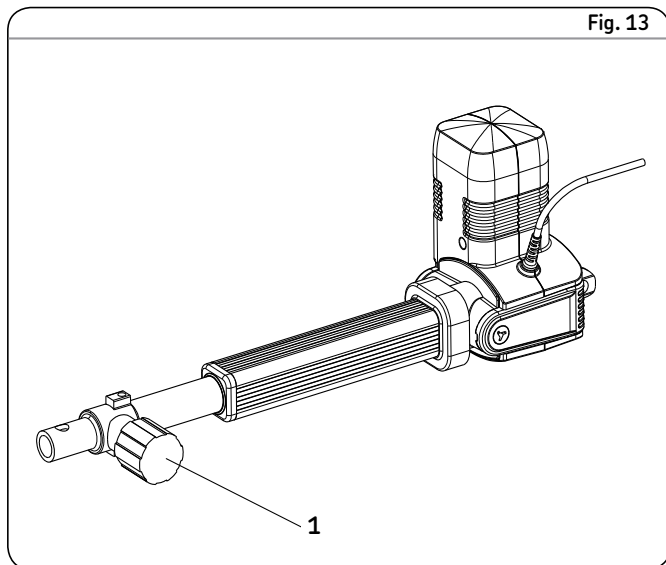
4.7.2 Quick adjustment

In life-threatening situations (e. g. reanimation of a patient) the actuator can be adjusted manually with the quick adjustment function. This makes it possible to lower e.g. the back or foot wedge of a bed.

There are two options for a quick adjustment.

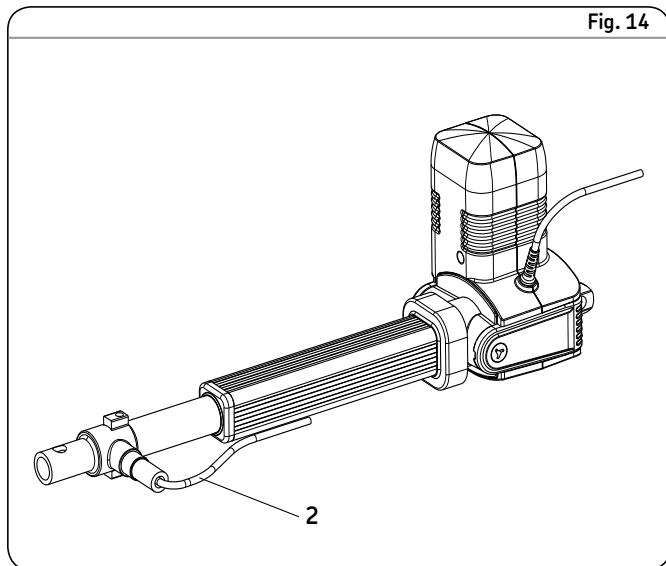
- Quick adjustment via knob
- Quick adjustment via Bowden cable

Fig. 13



Quick adjustment via knob (1)

Fig. 14



Quick adjustment via Bowden cable (2)

Note!

It is recommended that this option is not used in connection with an impulse transmitter. Additional information in conjunction with the quick adjustment feature (→ Chapter "Operation").

4.7.3 Electrical pinch protection

MAX3 and MAX6

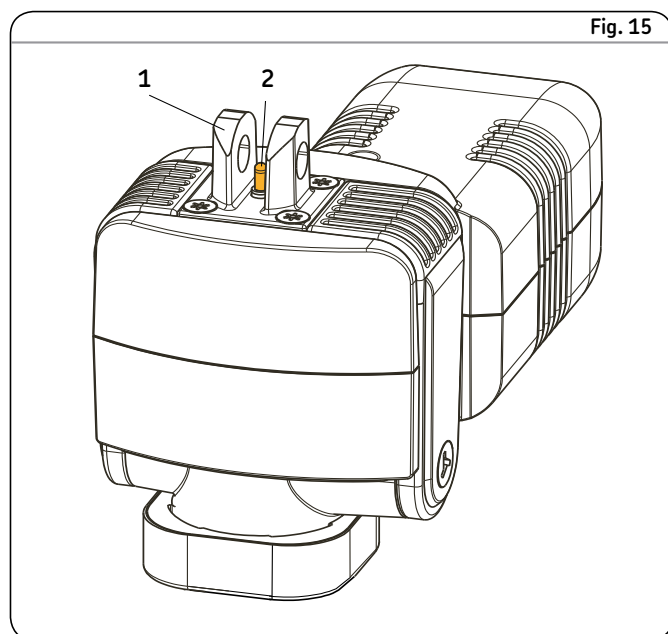


Fig. 15

Electrical pinch protection

The electrical pinch protection consists of a hinge head with an elongated hole (1), an integrated control pin (2) and a micro switch, which turns off the device when it moves against the effective direction. In the event of a jam, the pin is lifted from the fastening bold and triggers the activation of the turn-off function.

If the linear actuator is used in the application as a pressure actuator (extending application), the electrical pinch protection only becomes effective if the upstroke is blocked by an object or a body part.



Note!

Additional information about the electrical pinch protection (→ Chapter "Installation and First Start of Operation").

4.7.4 Life span display

MAX1 and MAX3

The life span display monitors the time of operation of the linear actuator. As soon as the calculated total run time has been reached for the direct current motor (in relation to the life span of the linear actuator), a visual or acoustic signal will be triggered depending on the respective version.

4.7.5 Mechanical pinch protection

The mechanical pinch protection uncouples the ball screw nut from the ball screw spindle in the event of a jam against the effective direction of the linear actuator.

If a linear actuator is utilized as a pressure engine (extending application) in the application, the mechanical pinch protection only works during the retraction of the device.



Note!

It is recommended that this option is not used in connection with an impulse transmitter.

4.7.6 Master slave actuator function

MAX6

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

The second actuator (slave actuator) is controlled via additional buttons on the SKF operating element. A parallel operation is not possible.

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

Note the total power in the master-slave actuator function:
 $\leq 6\text{ A}$ (\rightarrow Chapter 6.5.4).

4.7.7 Impulse transmitter

MAX1 and MAX3

The impulse transmitter gives impulses which are further processed by the external control.

This provides the opportunity that the linear operation can be extended or retracted into one of more defined positions.

4.8 Accessories

Accessories	Type series	Comments
SKF control	MAX1, MAX3	
SKF operating element	MAX6	Electrical or pneumatic operating element
Slave actuator	MAX6	A linear actuator with a nominal voltage of 24 V DC and a connecting cable with jack plug, without integrated control and power supply, which is to be used in combination with a master actuator (→ Chapter "Master Slave Actuator Function").
Power cable	MAX6	Country-specific power cables are not included and must be ordered separately.
Storage inserts for a hinge head and fork head	MAX1, MAX3, MAX6	
Special tool (order no. 0100609)	MAX1, MAX3, MAX6	For the dismantling of the power plug and the plug of the operating element.

5 Transport, packaging and storage

5.1 Safety information for the transport

CAUTION

Damage due to improper transport

Significant material damage can occur in conjunction with improper transport.

Therefore:

- Proceed carefully during the unloading of the packaged items, during the delivery as well as during the transport to its final destination and comply with the symbols and information shown on the packaging.
- Only remove the actuator from its packaging right before installation.
- Note storage requirements for return transport to the manufacturer (→ Chapter "Storage").

Improper transport

5.2 Transport inspection

The Matrix linear actuator is delivered as one packaged unit in a box or on pallets.

Check the delivery for completeness and damage due to transport immediately upon receipt.

Check completeness of delivery:

- A complete actuator unit.
If cracks in the plastic casing were caused during the transport, the protection of accordance with IPX6S (spray water) can no longer be guaranteed. The actuator must be sent back to the manufacturer.
- Installed cable and a low-voltage plug (depending on the version with jack or DIN-8 plug) for the MAX1 and MAX3 line.
- The storage inserts for hinge head and fork head.
- Accessories (optional).

Proceed as follows in conjunction with visible exterior transport damage:

- Do not accept delivery or do so only with reservations.
- Record scope of damage on the transport documents or on the bill of delivery of the shipping company.
- Initiate complaint.



Note!

Report any damage as soon as it has been recognized. Damage claims can only be asserted within the transporter's applicable complaint period.

5.3 Return transportation to the manufacturer

Proceed as follows for the return transport:

- 1 Dismantle the device if necessary (→ *Chapter Dismantling*).
- 2 Pack device in its original packaging. Follow storage conditions (→ *Chapter Storage*).
- 3 Send to manufacturer. The address is listed on the cover back.

5.4 Packaging

For packaging

The individual packaged pieces have been packaged appropriately according to the expected transport conditions. Only environmentally-friendly materials were used for the packaging.

The packaging is supposed to protect the individual components from damage caused by the transport, corrosion and other damage until they are ready for installation. Therefore, do not destroy the packaging and only remove it shortly prior to the installation. Keep packaging for possible return shipment to the manufacturer (→ *Chapter 5.3*).

If the packaging is to be disposed off, please note and adhere to the following:

CAUTION

Environmental damage due to incorrect disposal

Packaging material consists of valuable raw materials and in many cases they can be sensibly recycled and reused.

Therefore:

- Dispose of packaging material in an environmentally correct way.
- Comply with locally applicable disposal regulations.

Handling of packaging materials

5.5 Storage

Pack the device in its original packaging for storage.

- Do not store outside.
- Dry and dust-free storage.
- Keep away from any aggressive media.
- Protect from UV radiation.
- Avoid mechanical vibrations.
- Storage temperature: –20 to 40 °C.
- Relative atmospheric humidity: max. 95% (no build up of condensation).
- For storage for longer than three months, check the general condition of all parts of the packaging on a regular basis. If necessary, refresh or renew the conservation.



Note!

It is possible that there are notices on the packaging concerning the storage, which go beyond the requirements listed here. Follow those accordingly.

6 Installation and first operation

Authorized personnel

- The installation and first start of operation may only be conducted by specially trained experts.
- Work on the electric system may only be performed by trained electricians.

WARNING

Electric shock and moving parts hazards

Serious injury or death can be caused by touching live electrical components and by unexpected movement of the actuator.

Be sure the system's power supply is off and actuator is locked out before installing.



Electrical equipment

WARNING

Danger if restarted without authorization

When correcting faults there is danger of the energy supply being switched on without authorization. This poses a life-threatening hazard for persons in the danger zone.

Therefore:

- Prior to starting work switch off the system and safeguard it from being lockout.



Safeguarding against restart

WARNING

Risk of injury and material damage due to incorrect installation of the optional devices

Therefore:

- Optional devices, in particular components that are part of a retrofitting, may only be installed in accordance with the respective instructions (circuit diagram).
- The electromagnetic compatibility must be tested for the routing and appropriate measures must be carried out if necessary.



Optional devices

6.1 Installation location

- Adhere to the technical data in accordance with operating conditions (→ *chapter 11 Appendix*).
- Install in a location where the actuator is not exposed to strong UV radiation or corrosive or explosive air media.

6.2 Inspections prior to first operation

- Execution by professional electrician

Prior to the first operation, a professional electrician must perform and document the following tests and readings:

- Check visual condition
- Function check of operating features and safety features
- Reading of protective conductor resistance
- Reading of leakage currents
- Reading of insulation resistance



Note!

Additional information concerning inspections and readings (→ *Chapter Maintenance*).

6.3 Installation

- Execution by qualified personnel

WARNING

Risk of injury and material damage due to manipulation of the screws on the device

Manipulation or loosening of the screws on the device or on the options may lead to injuries and material damage during the operation.

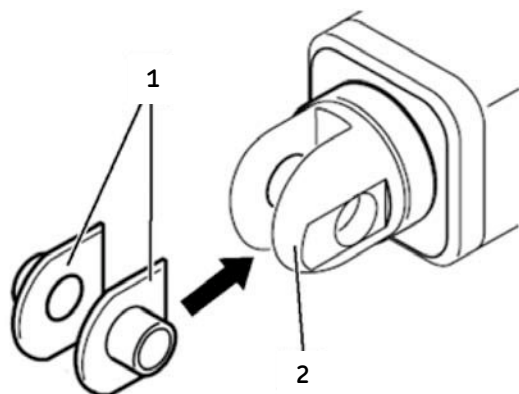
Therefore:

- Never loosen screws on the device or the options.

The Matrix linear actuator is attached to two elements via the fork head and the hinge head.

- 1 Secure elements of the application in between which the linear actuator will be inserted.
- 2 Insert storage inserts (1) at the fork head (2) and the hinge head, if necessary.

Fig. 16

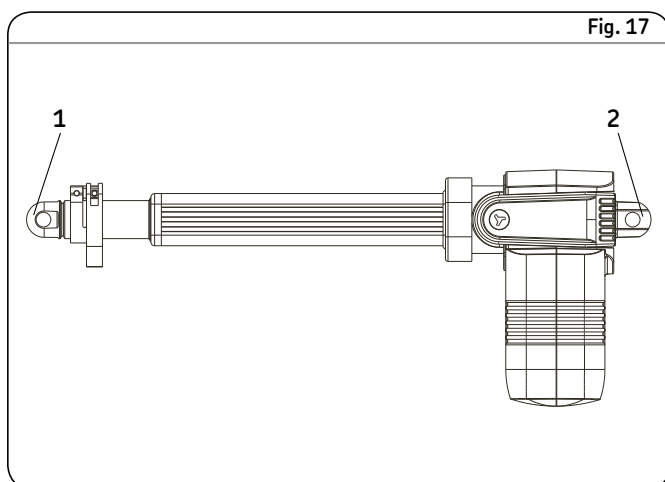


Note!

The storage inserts that are part of the delivery can be installed in the following cases:

- For a bolt diameter of 10 mm
- To reduce electro-magnetic charging
- As an electric insulation
- As an optimization of the storage place, so that metal doesn't rub on metal

- 3 Connect the fork head (1) and the hinge head (2) and the elements of the application with the fastening bolts.



Note!

Information concerning the dimensions of the drill holes for fastening bolts can be found in the respective data sheets. (→ *Appendix*).



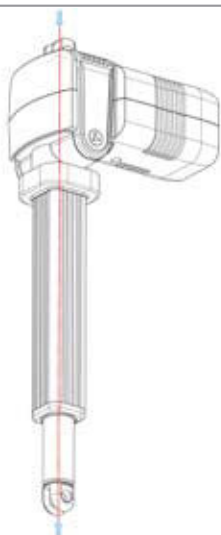
WARNING

Risk of injury and material damage due to insufficient fastening!

Only use fastening bolts and secure them adequately. Do not use screws to install. Never loosen or otherwise manipulate screws on actuator or options.

- 4 Ensure that the applied force is always centrally directed on the actuator. (→ fig. 18).

Fig. 18



⚠ WARNING

Risk of injury and material damage due to incorrect installation!

During installation, do not subject the actuator to side-impact or to turning forces.

- 5 Ensure that the linear actuator is not impacted in its movement over the entire stroke area. Consider collision tests of the application.
- 6 Ensure that the motor cable cannot be squeezed, clamped or pulled.
- 7 Connect linear actuator to control unit if necessary (→ Chapter "Connection to the Control Unit").
- 8 Connect linear actuator to operating element (→ Chapter "Connection to Operating Element").
- 9 Connect linear actuator to power supply. (→ Chapter "Connect to Power Supply").
- 10 Ensure that the power plug is accessible at all times.
- 11 Ensure that none of the supply or control cables can be pinched by the kinematics of the application or by the linear actuator during the extension or retraction.
- 12 Ensure that the installation requirements of the options have been adhered to (→ Chapter "Requirements Concerning the Installation of the Actuators with Options").
- 13 Affix prohibition and warning labels for the application onto the linear actuator, if necessary (→ Chapter "Warning labels").

6.4 Connection to the control unit

All control units which are not approved for the Matrix devices by SKF AG are treated as third party controls.

⚠ CAUTION

Material damage due to third-party control unit

The use of a third-party control unit may lead to material damage. In conjunction with the use of a third-party control unit, the manufacturer does not assume any liability for damage that may be caused

Therefore:

- It is recommended to use the SKF control unit from the manufacturer.
- When using the third-party control unit, the requirements stipulated for the third-party control unit must be adhered to (→ *Requirements for third party control units in the appendix*).

Connect MAX1 and MAX3 to the control

! Note!

A low-voltage plug connects the device to an external control unit. Adhere to the instructions of the operating manual of the SKF Control unit during the connection process.

Depending on the version, the low-voltage plug has been fitted with a jack or DIN-8 plug.

- Special tools required:
 - Special tool from the manufacturer (part no. 0100609)

- 1 Check the sealing ring of the jack plug (arrow) and the plug for damage.

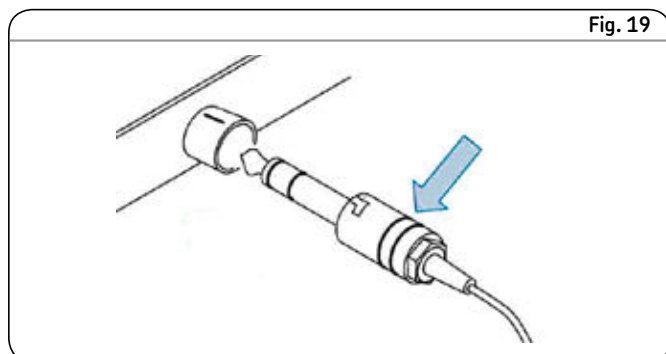


Fig. 19

Connect jack plug to control unit



Note!

Damaged sealing rings and twisted plugs can no longer guarantee protection pursuant to IPX6S. They have to be replaced by the manufacturer (→ Chapter "Transport inspection").

- 2 Sealing ring with Klübersynth VR 69-252 (part no. 0118037), lightly lubricate.

CAUTION

Damage due to wrong lubricants

The use of incorrect additives may cause significant material damage.

Therefore:

- Only use the auxiliary products listed by the manufacturer.

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

Fig. 20

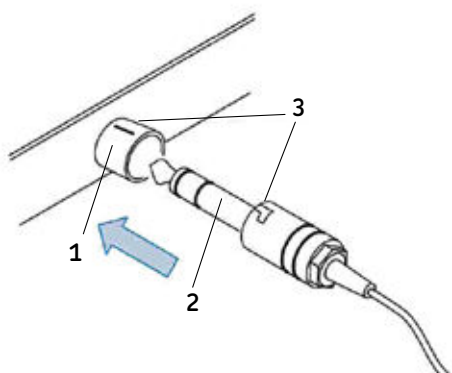
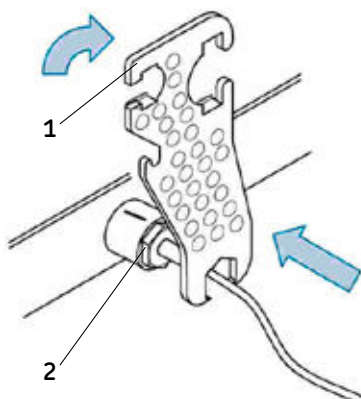


Fig. 21



- 4 Insert special tool (1) in the nut (2) of the jack plug.
5 Turn special tool (1) clockwise until the bayonet joint of the jack plug is locked.

Connect DIN-8 plug to control unit.

The insertion position is dictated by the geometric shape of the plug.
The strain relief for this system is provided via attached components of the respective SKF control unit casing.

- 1 Check the sealing ring of the DIN-8 plug (arrow) and the plug for damage.

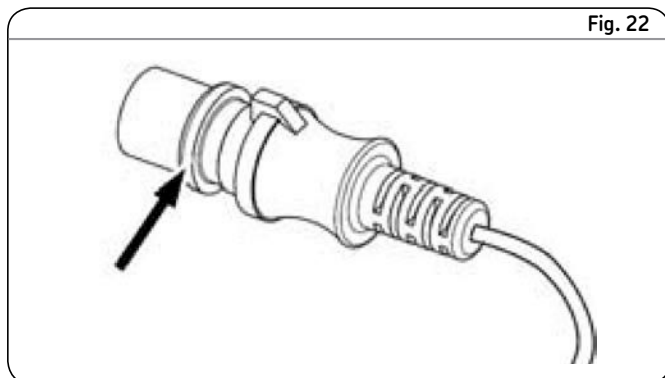


Fig. 22



Note!

Damaged sealing rings and twisted plugs can no longer guarantee protection pursuant to IPX6S. They have to be replaced by the manufacturer (→ Chapter "Transport inspection").

- 2 Sealing ring (arrow) with Klübersynth VR 69-252 (part no. 0118037), lightly apply lubricant.

 **CAUTION**

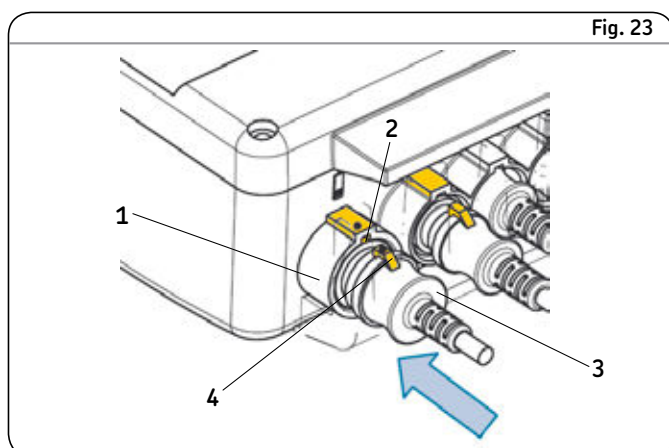
Damage due to wrong lubricants

The use of incorrect additives may cause significant material damage.

Therefore:

- Only use the auxiliary products listed by the manufacturer.

- 3 Insert DIN-8 plug (3) into the connecting socket (1) of the control unit. Ensure correct positioning of the groove (2) and the lug (4).



6.5 Connection to operating element

WARNING

Risk of injury and material damage due to third party operating element

The use of a third party operating element may lead to significant injuries or material damage.

In conjunction with the use of a third-party operating element, the manufacturer does not assume any liability for damage that may be caused.

Therefore:

- Only use the manufacturer's SKF operating element.

6.5.1 Connect MAX1 and MAX3 to operating element

Note!

The device is connected to the operating element via an external control. (→ *Separate operating manual of the control and the operating element*).

6.5.2 Connect MAX6 to operating element



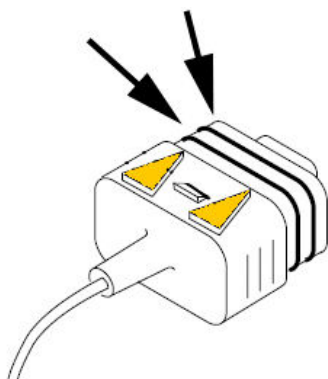
Note!

The device is connected directly to an electric or pneumatic operating element. Adhere to the operating instructions for the operating elements in regard to the connection (→ *Separate operating manual*).

Connect the device to electric operating element:

- 1 Check sealing rings (arrows) of the operating element plug and the plug for damage.

Fig. 24



Note!

Damaged sealing rings and twisted plugs can no longer guarantee protection pursuant to IPX6S. They have to be replaced by the manufacturer (→ *Chapter "Transport Inspection"*).

- 2 Sealing rings (arrow) with Klübersynth VR 69-252 (part no. 0118037), lightly apply lubricant.



CAUTION

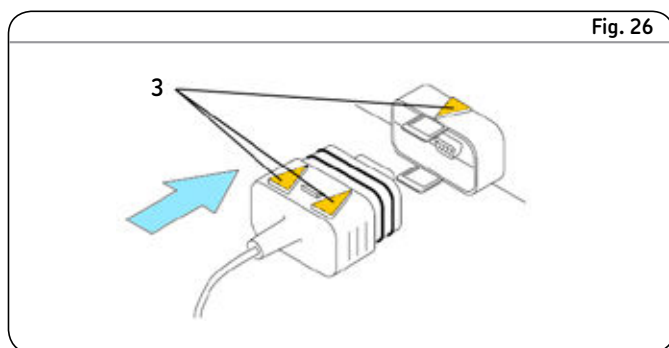
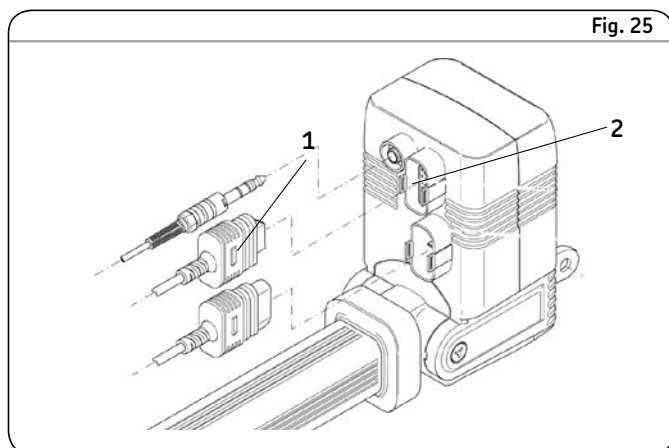
Damage due to wrong lubricants

The use of incorrect additives may cause significant material damage.

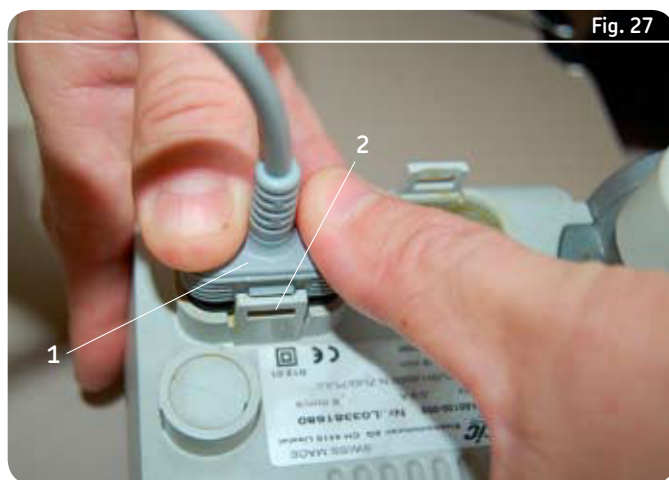
Therefore:

- Only use the auxiliary products listed by the manufacturer.

- 3 Connect plug (1) to the connection of operating element (2) of the device. Ensure the correct position of the arrows (3) on the plug and on the outlet.



- 4 Press plug (1) down into the connection socket until the snaps (2) lock into place on both sides.

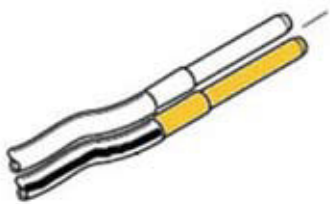


- 5 Ensure that both sides are mechanically locked and sealed.
6 Connect operating element to power supply. (→ *Separate operating manual*).

Connect the device to pneumatic operating element:

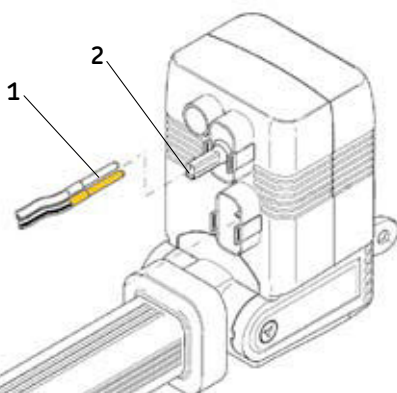
- 1 Check gear pins of pneumatic control line for damage.

Fig. 28



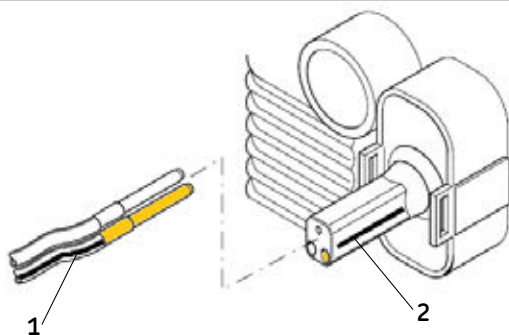
- 2 Insert gear pins (1) into the bore holes of the rubber fitting (2).

Fig. 29



Ensure that the marking on the rubber fitting (1) aligns with the marking on the pneumatic line (2).

Fig. 30



Note!

If the connection has been switched, the linear actuator moves in the opposite direction of the arrows on the operating element.

6.6 Connect to power supply

DANGER

Electrical shock hazard

Incorrect installation can result in serious injuries, death or damage. Only professional electricians should work on electrical systems.



Electrical equipment

6.6.1 Connect MAX1 and MAX3 to power supply



Note!

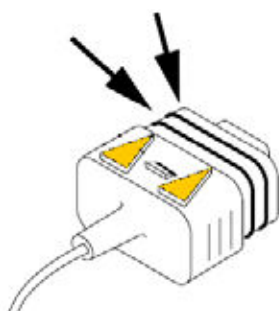
A control unit connects the device to the electric power supply via a low voltage plug. Adhere to the instructions of the operating manual for the control unit during the connection process.

- 1 Connect linear actuator to control unit
(→ Chapter "Connection to the Control Unit").
- 2 Connect control to electric grid
(→ Separate operating manual for control).
- 3 Ensure that the plug of the power line is accessible at all times.

6.6.2 Connect MAX6 to energy supply

- 1 Check the sealing rings (arrows) of the power line plug and the plug for damage.

Fig. 31





Note!

Damaged sealing rings and twisted plugs can no longer guarantee protection pursuant to IPX6S. They have to be replaced by the manufacturer (→ Chapter "Transport Inspection").

- 2 Sealing rings (arrow) with Klübersynth VR 69-252 (part no. 0118037), lightly apply lubricant.

⚠ CAUTION

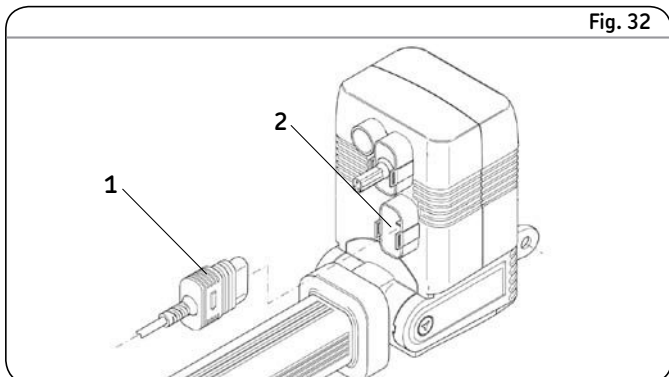
Damage due to wrong lubricants

The use of incorrect additives may cause significant material damage.

Therefore:

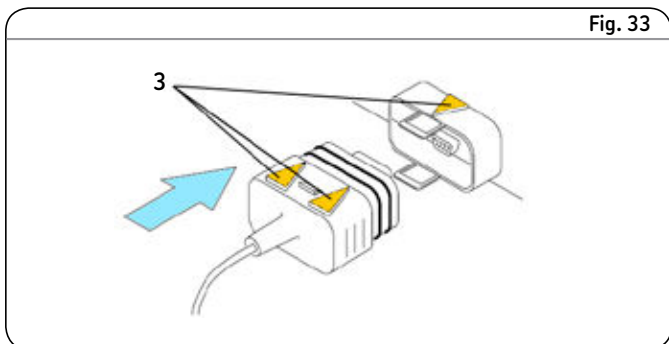
- Only use the auxiliary products listed by the manufacturer.

Fig. 32

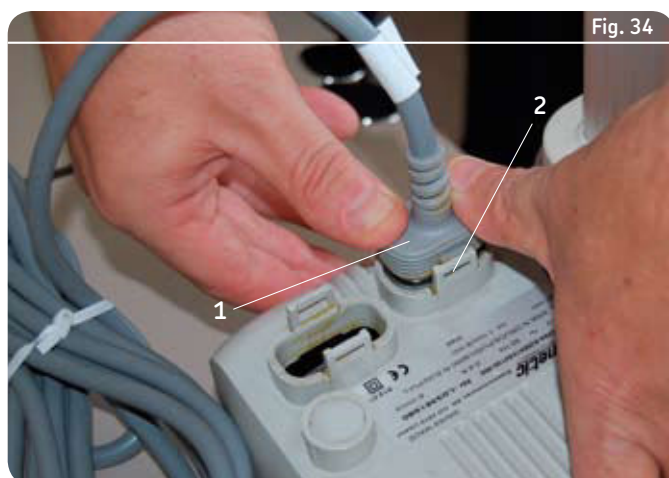


- 3 Connect plug of the electric cord (1) to the connection of the power line (2) of the device.
Ensure the correct position of the arrows (3) on the plug and on the outlet.

Fig. 33



- 4 Press plug (1) down into the connection socket until the snaps (2) lock into place on both sides.



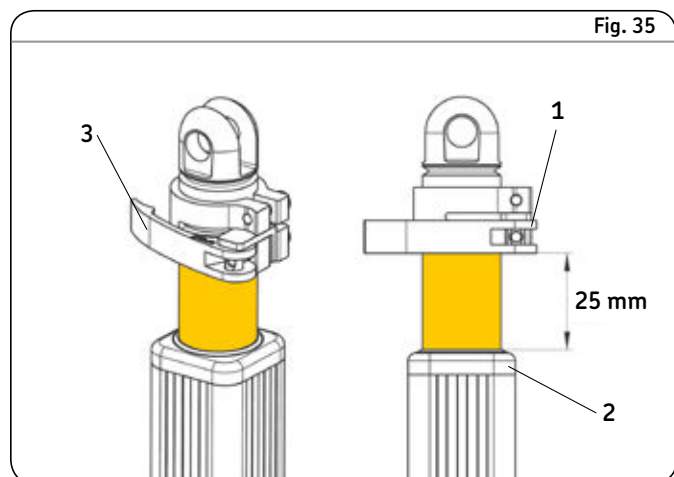
- 5 Ensure that both sides are mechanically locked and sealed.
6 Connect electric cord to power supply.
7 Ensure that the plug of the power line is accessible at all times.

6.7 Requirements concerning the installation of the actuators with options

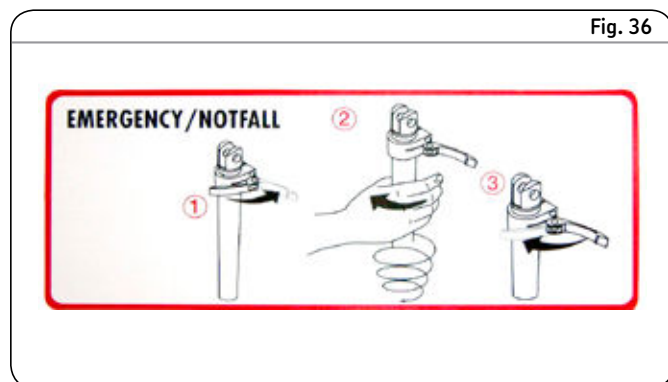
6.7.1 Emergency lowering device

Note the following during the construction of the application kinematics:

- When the linear actuator is retracted, a distance of at least 25 mm must remain between the mechanism of the emergency lowering device (1) and the casing tube (2).
- There must be sufficient room in the area of the emergency lowering device in the application, so that the release handle (3) can be operated easily.



- The operating label for the emergency lowering device "Emergency/Notfall" (parts no. 0112420) must be easily visible and permanently affixed on the actuator or the application.

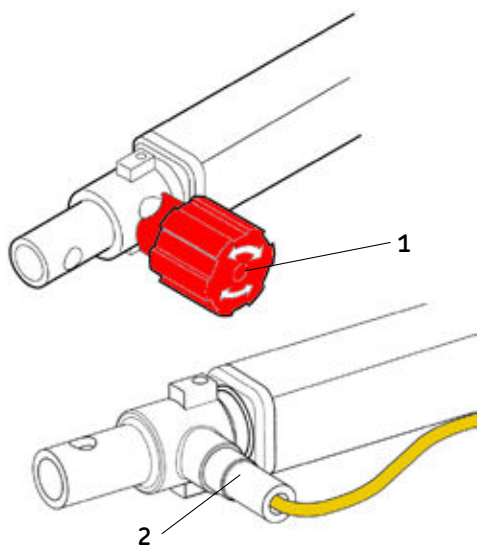


6.7.2 Quick adjustment

Note the following during the construction of the application kinematics:

- In the application there must be enough room in the area of the knob (1) or the Bowden cable (2), so that the two elements can be operated easily.

Fig. 37



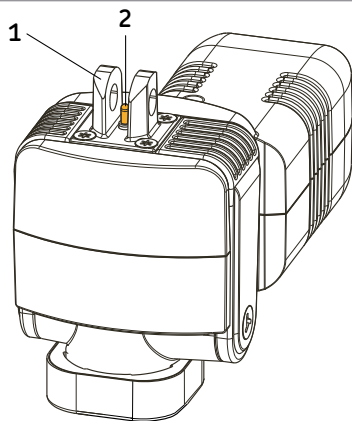
- The Bowden cable between the linear actuator and the operating element has to be installed so that it is not pinched or affected by the movements of the linear actuator.

6.7.3 Electrical pinch protection

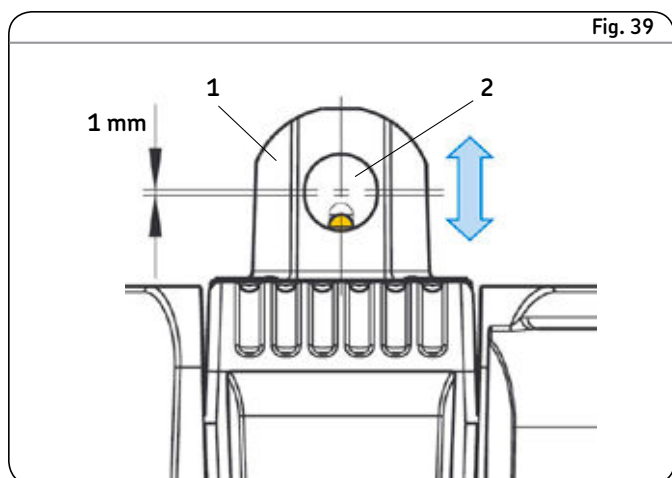
Note the following during the installation of the linear actuator with electric pinch protection.

- The gear pin (2) at the hinge head (1) may not be jammed.
- Use fastening bolts with $\varnothing 12$ h7 for the mounting of the hinge head.

Fig. 38



- Ensure after the installation that the installed linear actuator can be moved inside the elongated hole (2) of the hinge head (1).



6.7.4 Mechanical pinch protection

Adhere to the larger installation measures for the use of a linear actuator with pinch protection.

(→ *Data sheets for linear actuator and accessories in the appendix*).

6.7.5 Master-slave actuator function

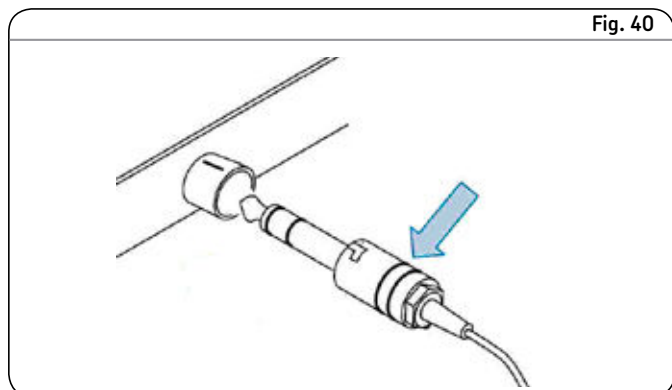
The master-slave actuator function features an additional actuator (slave actuator) which is connected to the Matrix MAX6 linear actuator via a jack plug (e. g. Matrix MAX1 or MAX3). Note the following during the connection:

- Only one linear actuator with a power supply voltage of 24 V DC may be connected.
- When both actuators (master actuator and slave actuator) run together, the total power may not exceed 6 A.

Connect slave actuator to Matrix MAX6

- Special tools required:
 - Special tool from the manufacturer (part no. 0100609)

- 1 Check sealing ring of jack plug (arrow) and the jack plug of the slave actuator for damage.





Note!

Damaged sealing rings and twisted plugs can no longer guarantee protection pursuant to IPX6S. They have to be replaced by the manufacturer (→ Chapter "Transport Inspection").

- 2 Sealing ring (arrow) with Klübersynth VR 69-252 (part no. 0118037) lightly apply grease.

CAUTION

Damage due to wrong lubricants

The use of incorrect additives may cause significant material damage.

Therefore:

- Only use the auxiliary products listed by the manufacturer.

- 3 Insert jack plug with bayonet joint (1) into the connecting sockets (2) of the device (→ fig. 41).
Ensure correct positioning of the groove (3) (→ fig. 42).

Fig. 41

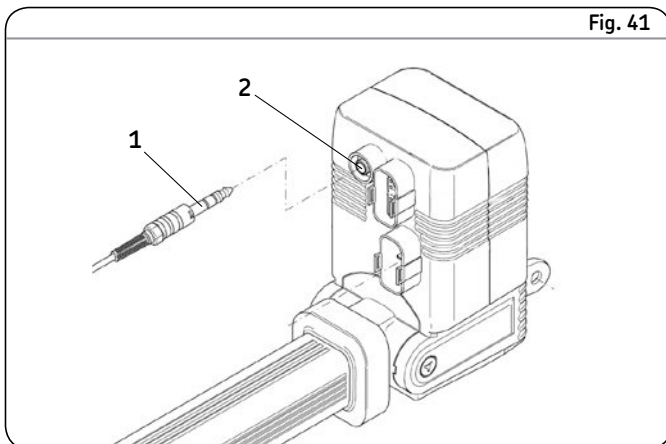
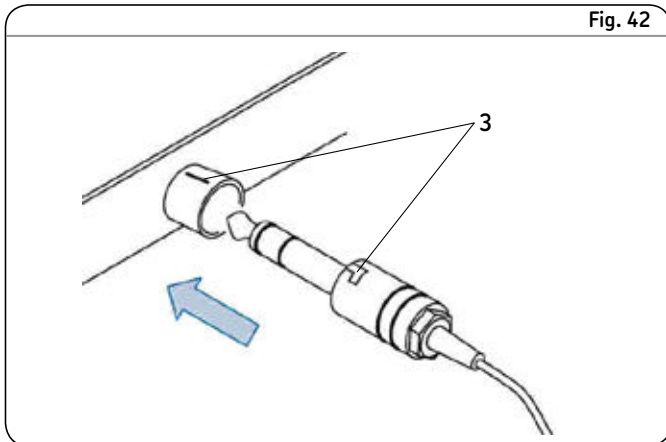
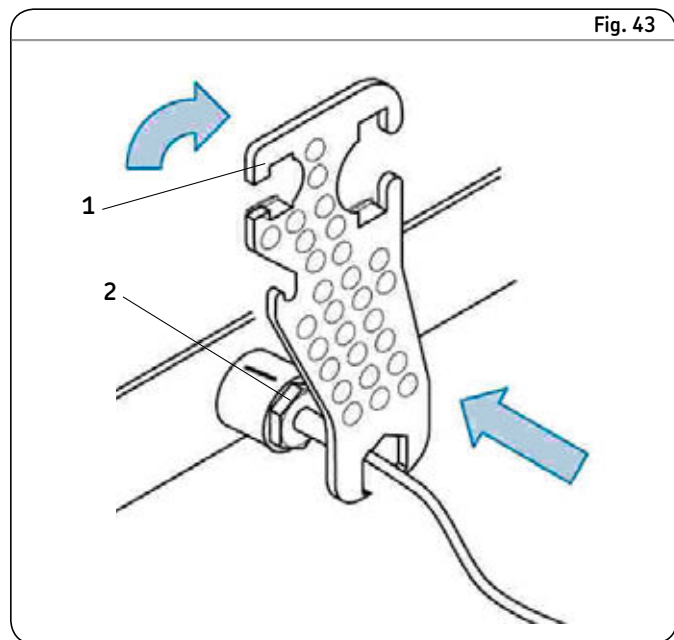


Fig. 42



- 4 Insert special tool (1) in the groove (2) of the jack plug.

- 5 Turn special tool (1) clockwise until the bayonet joint of the jack plug is locked.
- 6 Connect slave actuator to energy supply. (→ Chapter "Connect to Power Supply").



7 Operation

7.1 Safety

DANGER

Risk of crushing

While moving onto solid objects, the force of the device may cause injuries.

Therefore:

- Ensure that there are no persons in the stroke area of the device while in operation.
- Take note of maximum permissible operating data for the device (→ *Data sheets in Chapter 11 Appendix*).
- Never tamper with the elements that are connected to the device while the device is in operation.

CAUTION

Risk of injury through contact with the fork head

Therefore:

- Do not let objects or body parts come in contact with the fork head of the actuator.

CAUTION

Material damage due to static and dynamic overload of the device

Static and dynamic overload can lead to damage and failure of the device.

Therefore:

- Adhere to maximum permissible operating data for the device (→ *Data sheets in the Appendix*).
- Never exceed nominal load.
- Never tamper with the elements that are connected to the device while the device is in operation.

 **CAUTION**

Actuator may be damaged if liquids penetrate the actuator during extension and retraction. Keep liquids away.

 **CAUTION**

Material damage through overheating

An overheating of the device can cause damage.

Therefore:

- Only use control integrated thermal switch.
- Never exceed nominal load.
- Always adhere to idle times and operating times.
(→ Chapter "Technical Data").

7.2 Turn on



Note!

The device does not feature its own operating control elements. The operation takes place via a separate operating element (→ *Separate operating manual*).

7.3 Turn off



Note!

The device does not feature its own operating elements. The operation takes place via a separate operating element (→ *Separate operating manual*).

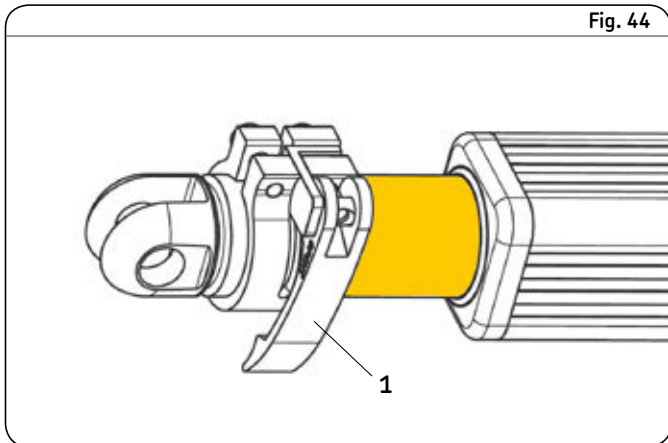
7.4 Action before use

- 1 Ensure that there are no persons or objects in the stroke area of the device.

For options:

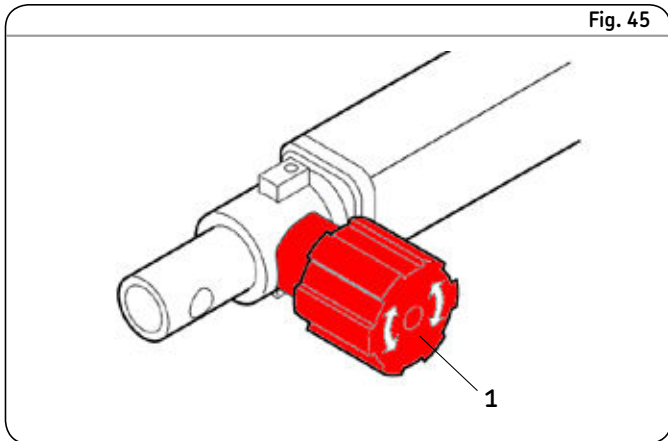
- 2 Ensure that the release handle of the emergency lowering device (1) is closed until it touches the arrester or that the mechanism of the quick adjustment is locked. (→ Chapter "Operate Emergency Lowering Device").

Fig. 44



- 3 Ensure that the mechanism of a quick adjustment (1) is locked (→ Chapter "Operate Quick Adjustment").

Fig. 45



7.5 Action during operation

7.5.1 Normal operation

During the normal operation, the linear actuator lifts and lowers the elements that are connected with the Matrix linear actuator via the fork head and hinge head.

The linear actuator is directly controlled by a directional buttons of an SKF operating element.

The linear actuator extends or retracts as long as the directional button is being pressed or until the linear actuator is completely extended or retracted.



Note!

Additional information for the operation of the linear actuator (→ *Separate operating manual for the operating element*).

7.5.2 Operate emergency lowering device

During a power failure or malfunction of the actuator, the load can also be lowered manually through turning.

 **CAUTION**

Material damage due to incorrect operation of the emergency lowering device!

Incorrect operation may lead to material damage.

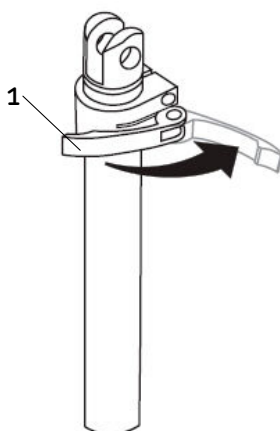
Therefore:

- Only operate the emergency lowering device in an emergency or to test the function.

To engage the emergency lowering device, proceed as follows:

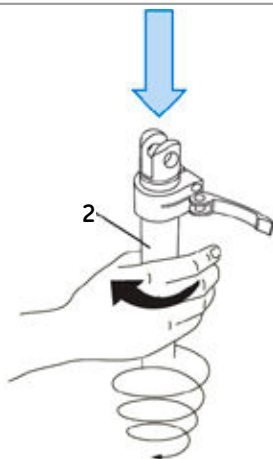
- 1 Open release handle (1).

Fig. 46



- 2 Turn actuator (2) clockwise toward the arrow. The actuator moves downward. The required manually applied force depends on the load.

Fig. 47



⚠ CAUTION

Risk of crashing and material damage due to an unintended lowering

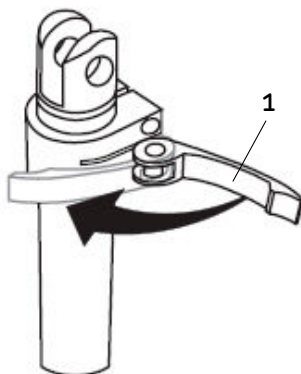
Unintended lowering while carrying a load may cause injuries and material damage.

Therefore:

- Immediately stop the operation in the event of excessive exertion of force or independent lowering and initiate repairs through the manufacturer.

- 3 Little oppositionists reached, close the release handle (3) all the way to the arrester.

Fig. 48



7.5.3 Operate quick adjustment

CAUTION

Material damage due to incorrect operation of the quick adjustment function

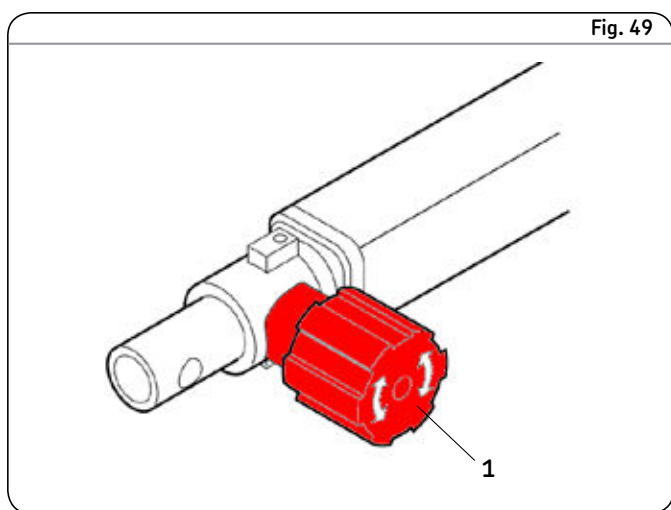
Incorrect operation may lead to material damage.

Therefore:

- Only operate the quick adjustment function in an emergency or to test the function.

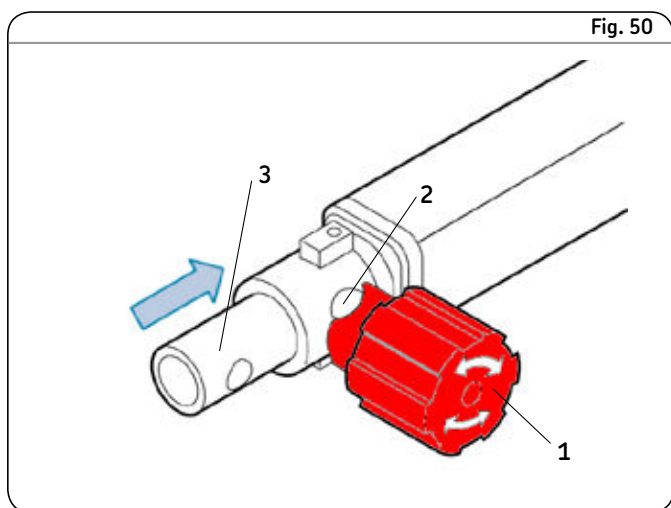
Adjust actuator with the button

- 1 Turn button (1) by 90° and unlock.



- 2 Ensure that the head (1) is in position (2).

- 3 Manually retract actuator (3).



⚠ CAUTION

Risk of crashing and material damage due to an unintended lowering

Depending on the construction and the load, the linear actuator can be quickly retracted. Unintended lowering while carrying a load may cause injuries and material damage

Therefore:

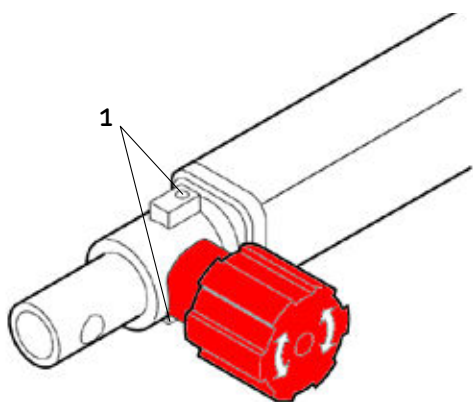
- The part of the application that is to be lowered (e. g. head and foot piece in a bed) must be retained at all cost during the lowering.
- In its retracted position of the application, the portion that is to be lowered must rest on a solid arrester (e. g. bed frame).

4 Turn button (1) by 90° again and unlock

Adjust speed of the lowering device.

1 The speed of the lowering device may be adjusted via two opposing adjusting screws (1).

Fig. 51



⚠ CAUTION

Material damage

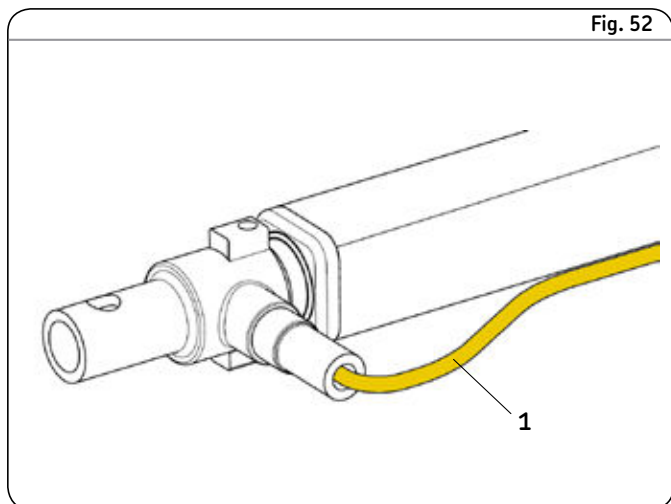
The adjusting screws are not secured and can be entirely unscrewed and can therefore be lost.

Therefore:

- Do not completely unscrew adjusting screws.

Adjust actuator with Bowden cable

For adjustments via the Bowden cable, the Bowden cable (1) is operated via an operating element on the application.



7.6 Disengagement in case of emergency

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

Proceed as follows in hazardous situations:

- 1 Immediately engage emergency shut-off, if present, or cut off power for actuator (→ Chapter "Shut down MAX1 and MAX3", "Shut down MAX6").
- 2 Evacuate people from the hazard zone, initiate first aid measures.
- 3 Notify doctor and fire department, if necessary.
- 4 Notify responsible person on-site.
- 5 Keep access paths open for rescue vehicles. Order specialized staff to repair malfunction.
- 6 Based on severity of emergency, notify the authorities if necessary.
- 7 Order specialized staff to repair malfunction.

After rescue measures

WARNING

Do not restart until all persons are outside the hazard zone.
Check the device and application that uses the device prior to restarting the operation and ensure that all safety equipment is installed and fully functional

- 8 Check the device and application that uses the device prior to restarting the operation and ensure that all safety equipment is installed and fully functional.

7.6.1 Shut down MAX1 and MAX3

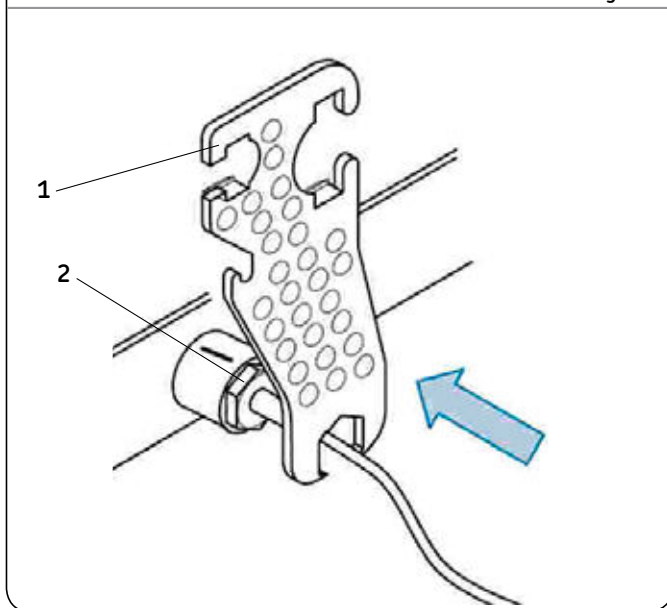
- 1 Pull the power line plug of the control unit out of the power outlet.
- 2 Pull the low-voltage plug (Jack plug or DIN-8 plug) of the cable of the device out of the connecting socket of control unit (→ Refer to paragraph below).

Pull jack plug out of control unit

Proceed as follows to pull jack plug out of the connection outlet of the control unit:

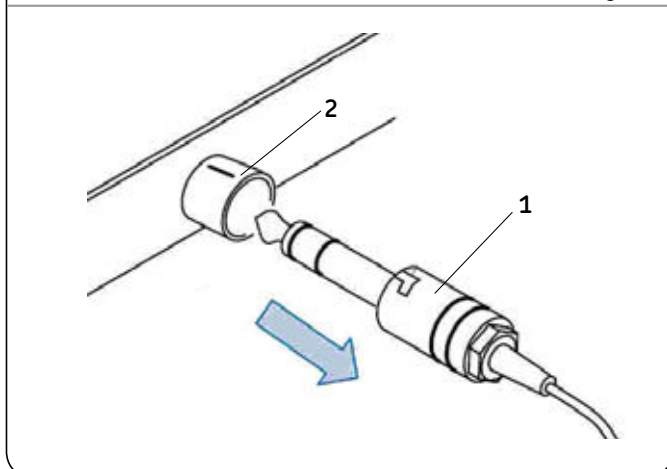
- Special tools required:
 - Special tool from the manufacturer (part no. 0100609)
- 1 Insert special tool (1) in the groove (2) of the jack plug.
 - 2 Turn special key (1) counter-clockwise until the bayonet joint of the jack plug is unlocked.

Fig. 53



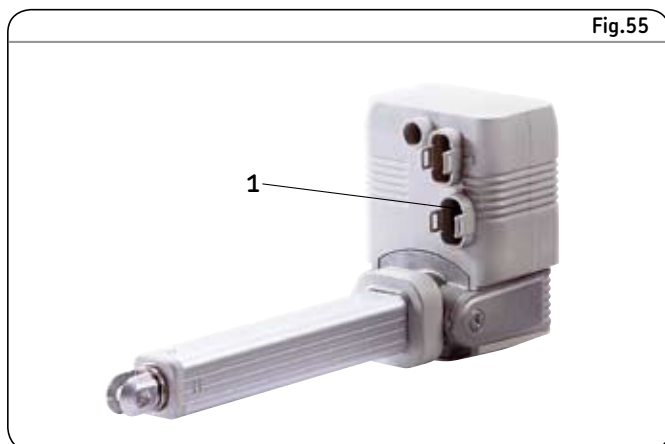
- 3 Pull jack plug (1) out of the connection outlet (2) of the control unit (arrow).

Fig. 54



7.6.2 Shut down MAX6

- 1 Pull the power line plug (connected with connection (1)) out of the power outlet.



7.7 Action after use

Separate the actuator from the power supply.

8 Maintenance

Personnel

- The maintenance work described herein can be performed by the operator unless otherwise indicated.
- Some maintenance tasks should only be executed by especially trained, qualified personnel, or exclusively by the manufacturer; specific reference will be made in each case in the description of the respective maintenance task.
- Only professional electricians should perform work on the electrical equipment.

DANGER

Electrical shock hazard

Incorrect installation can result in serious injuries, death or damage. Only professional electricians should work on electrical systems.



Electrical equipment

DANGER

Danger if restarted without authorization

When correcting faults, there is danger of the energy supply being switched on without authorization. This poses a life-threatening hazard for persons in the danger zone.

Therefore:

- Prior to starting work, switch off the system and safeguard it from being locked out.



Safeguarding against restart

8.1 Maintenance plan

Maintenance tasks that are required for optimal and trouble-free operation are described in the sections below.

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

Linear actuator Matrix maintenance plan

Interval	Maintenance work	To be carried out by
Daily	Check actuator for visible damage (→ Chapter "Check of Visual Condition").	Operator
	Clean off dust and dirt if necessary (→ Chapter "Cleaning").	Operator
Monthly	Function check of operating features and safety features (→ Chapter "Inspections and Readings").	Qualified personnel
	Check tight fit of the device to the fork head and hinge head, correct it if necessary Check connection for tight fit.	Qualified personnel
Annually	Reading of protective conductor resistance (→ Chapter "Inspections and Readings").	Professional electrician
	Reading of leakage currents (→ Chapter "Inspections and Readings").	Professional electrician
	Reading of insulation resistance (→ Chapter "Inspections and Readings").	Professional electrician
	Check labels and warning notices for damage and replace if necessary.	Qualified personnel
	Check plug for tight fit.	Professional electrician
	Check sealing O-rings for damage (→ Chapter "Check Sealing Funktion of Plug").	Professional electrician
Definition through the processor	Conduct visual inspection of the condition of the permanent safeguard and the routing of the supply and control cable within the application. Cable routing elements may not be loose or broken.	
	Options	
Semi-annually	Check options for visible damage	Qualified personnel
	Check functionality of emergency lowering device under nominal load (→ Chapter "Check Options").	Qualified personnel
	Check functionality of electric pinch protection under nominal load (→ Chapter "Check Options").	Qualified personnel
	Check functionality of quick adjustment (→ Chapter "Check Options").	Qualified personnel



Note!

If the linear actuator is used outside of the environmental conditions specified earlier in this manual, check such components once a month for any changes such as oxidation or sedimentation.

8.2 Maintenance work

8.2.1 Cleaning

To be performed by operator.

CAUTION

Damage due to incorrect cleaning

Therefore:

- Do not use any aggressive cleaning agents. Water used for cleaning including the chemical additives must be pH-neutral.
- Liquids must not touch the actuator during the retraction or extension.
- Only use the auxiliary materials listed by the manufacturer.
- Emergency lowering mechanism for quick adjustment system may not be treated with oil, grease or other lubricants.
- No steam jets or pressure washers may be used for cleaning.
- Other cleaning agents or cleaning devices may only be utilized with the manufacturer's approval.

Clean line actuator:

- 1 Separate the device from the energy supply.
- 2 Clean dirty parts with a damp cloth.

Cleaning of emergency lowering device, quick adjustment device:

- 1 Separate the device from the energy supply.
- 2 Clean emergency lowering mechanism or quick adjustment device with a damp cloth and prophyl alcohol.

8.2.2 Inspections and readings

- Execution by professional electrician.
- The inspections and readings must be performed as stipulated by the applicable standards and regulations. The list of the applicable standards can be found in the appendix.
- The inspections must be documented (→ "Service Log").

The external metal parts are not reliably connected with the protective conductor, with the exception of the external protective conductor connection. The separation/insulation takes place either through a double or reinforced insulation or through an intermediate circuit that is connected with a protective conductor within the housing.

A reading of the protective conductor resistance is therefore not possible. Potential connections only take place by accident due to metal parts that touch each other more or less forcefully.

Measuring of the protective conductor resistance (MAX6)

Complete the following entries in the service log:

- Name of the executing body (company, department)
- Names of the staff on duty
- Identification of the device/system (type, serial number, inventory number) and the respective accessories
- Completed inspections and readings
- Scope and results of the inspections
- Measuring method, measuring device, measuring results for readings
- Overall assessment
- Date and signature of the assessing person; personal coding is a viable alternative for IT applications.

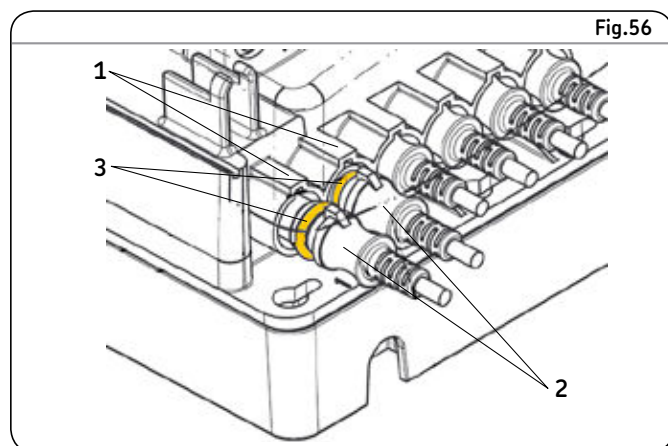
Service log

8.2.3 Check sealing function of plug

To be performed by professional electrician

Check sealing function of DIN-8 plug

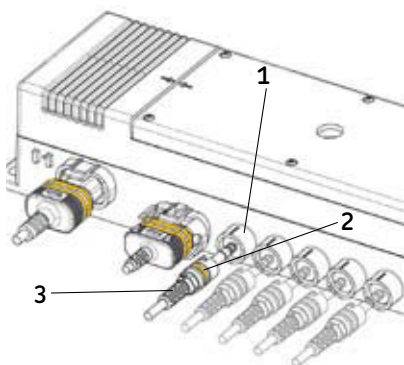
- 1 Separate the device from the energy supply.
- 2 Check sealing O-ring (3) of the DIN-8 plug (2) for damage.
- 3 Ensure that there is no irregular gap between the DIN-8 plug (2) and the connection outlet (1) of the housing.
- 4 If sealing O-rings (3) are damaged, have the manufacturer replace them.
- 5 If there is no damage, reconnect the device with the energy supply.



Check sealing function of jack plug

- 1 Separate the device from the energy supply.
- 2 Check sealing O-ring (2) of the jack plug (3) for damage.
- 3 Ensure that there is no irregular gap between the jack plug (3) and the connection outlet (1) of the housing.
- 4 If sealing O-rings (2) are damaged, have the manufacturer replace them.
- 5 If there is no damage, reconnect the device with the energy supply.

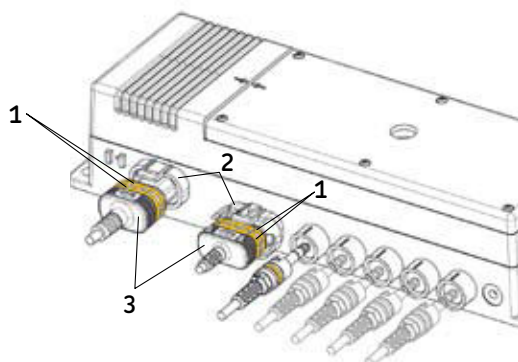
Fig.57



Check sealing function of manual switch

- 1 Separate the device from the energy supply.
- 2 Check sealing O-ring (2) of the manual switch (3) for damage.
- 3 Ensure that there is no irregular gap between the manual switch (3) and the connection outlet (2) of the housing.
- 4 If sealing O-rings (1) are damaged, have the manufacturer replace them.
- 5 If there is no damage, reconnect the device with the energy supply.

Fig.58



⚠ CAUTION

Material damage due to damage or wrong sealing rings

Damaged or wrong sealing rings cannot guarantee protection pursuant to IPX6S.

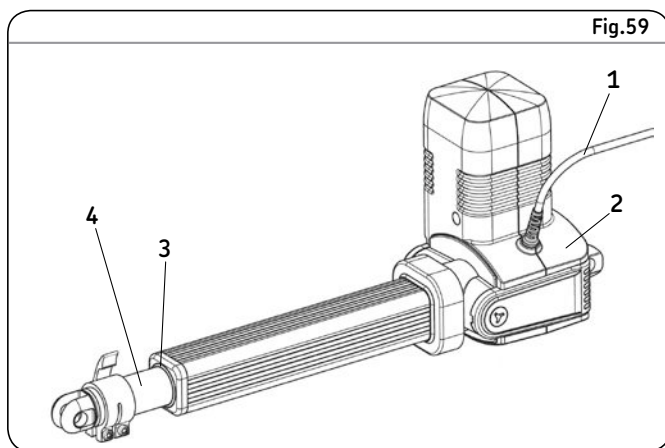
Therefore:

- Ask the manufacturer to replace the damaged sealing rings immediately.

8.2.4 Check of visual condition

To be performed by qualified personnel

- 1 Separate the device from the energy supply.
- 2 Check the following structural components for visual external damage:



- 1 Check connecting cables for cracks, cuts and pinched sections
- 2 Check multi-shell plastic housing for cracks and gaps
- 3 Check dirt removal ring for cracks, gaps and broken pieces
- 4 Check casing tube for scratches and indentations
- 5 Notify processor or manufacturer in case of damage
- 6 If there is no damage and the processors/manufacturer has not communicated any concerns, reconnect the device to the power supply.

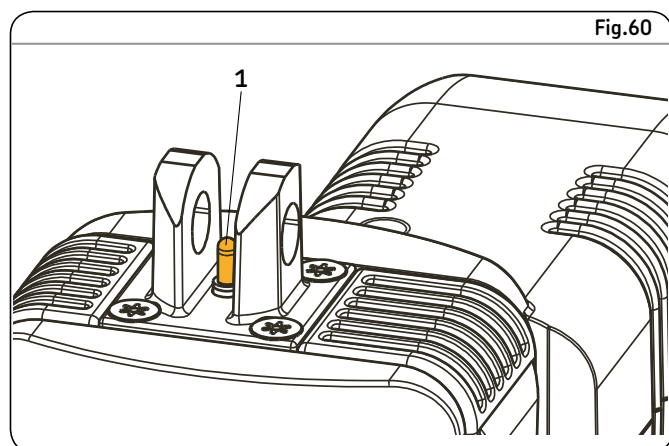
8.2.5 Check options

Check functionality of emergency lowering device, quick adjustment

- Ensure that there is no excessive application of force, extremely slick movement (independent downward movement of the actuator after opening the release handle) under nominal load (→ Chapter "Operation" → "Operate Emergency Lowering Device", "Operate Quick Adjustment").

Check functionality for electrical pinch protection

- Ensure that the gear pin (1) is lifted in the backload direction to turn off the actuator.



Note!

Inform the manufacturer in case of damage or malfunction.

8.3 Measures after completed maintenance

Upon completion of the maintenance work, the following steps have been executed prior to restarting the device.

- 1 Check all previously loosened screw connections for a tight fit.
- 2 Ensure that all used tools, materials and other equipment have been removed from the work area.
- 3 Clean work area and remove potential spills such as e. g. liquids, processing material or similar.
- 4 Ensure that all safety measures of the system work without a problem.
- 5 Check functions.
- 6 Document the inspections in the service log.

9 Malfunctions

The following chapter describes potential causes for disruptions and the work that is necessary to restore operation.

In the event of more frequent malfunctions, shorten the maintenance intervals according to the actual load.

Contact the manufacturer concerning malfunctions which are not solved by the subsequent notices; see service address on the back cover.

Personnel

- Unless indicated otherwise, the work described herein to solve malfunctions may be performed by the operator.
- Some work may only be carried out by qualified personnel, which is specifically indicated in the description of the individual malfunction.
- Work on the electric system may only be performed by professional electricians.

DANGER

Electric shock and moving parts hazards

Serious injury or death can be caused by touching live electrical components and by unexpected movement of the actuator.

Be sure power supply is off and actuator is locked out before installing.



Electrical equipment

DANGER

Danger if restarted without authorization

When correcting faults, there is danger of the energy supply being switched on without authorization. This poses a life-threatening hazard for persons in the danger zone.

Therefore:

- Prior to starting work, switch off the system and safeguard it from being lockout.



Safeguarding against restart

 **DANGER**

Risk of injury and material damage due to incorrect repair of malfunction

The Matrix linear actuator is not designed for repair work. Incorrect repair of a malfunction may lead to personal injury or material damage.

Therefore:

- Never loosen the screws on the linear actuator or try to open the linear actuator.
- In the event of a malfunction that cannot be fixed by adhering to the subsequent notices, dismantle the device and send it to the manufacturer for repair. (→ Chapter "Transport, Packaging and Storage").



Incorrect repair of malfunction

Behavior during malfunctions

In principle:

- 1 In the event of a malfunction that may present an immediate danger to persons or assets, turn off the actuator or control unit immediately and safeguard against a restart.
- 2 Determine cause of malfunction.
- 3 Depending on the type of a malfunction, have it repaired by qualified personnel.
- 4 Inform responsible party on-site concerning malfunction.



Note!

The following malfunction table provides information as to who is authorized to perform the repair.

9.1 Malfunction table

9.1.1 Matrix MAX1 and MAX3

Malfunction	Possible cause	Repair malfunction	To be repaired by
Linear actuator doesn't move	No supply voltage.	Check power supply.	Professional electrician.
	Lack of plug contact or plug has not been inserted properly.	Plug contacts: Device control unit, control of voltage network. Check control operating element.	Operator.
	Defective network cable or power plug.	Supply cable and plug of the lines: Check device control unit, control of voltage network control operating element for damage, if necessary replace defective elements.	Professional electrician.
	Obstacle in the stroke area of the linear actuator.	Remove all obstacles in the stroke area.	Operator.
	Incorrect load.	Measure static and dynamic load and compare with information concerning the product label. If the load capacity is exceeded, check the nominal load and install stronger actuator if necessary.	Qualified personnel.
	Defective control unit/operating element.	Identification of defect concerning the SKF control unit; if necessary replace defective control, operating element.	Qualified personnel.
	Lifespan of the device is exceeded.	If the actuator is older than 10 years and has performed more than 10 000 double strokes with a 200 mm hub, the actuator needs to be replaced.	Qualified personnel.
	Linear actuator cannot be set in motion by any of the above listed measures.	Exchange device.	Qualified personnel.
Linear actuator cannot be lifted	Obstacle in the stroke area of the linear actuator.	Remove all obstacles in the stroke area.	Operator.
	Incorrect load.	Remove all loads that are on the elements.	Operator.
	Defective screw nut.	Exchange device.	Qualified personnel.
Significantly reduced speed	Obstacle in the stroke area of the linear actuator.	Remove all obstacles in the stroke area.	Operator.
	Incorrect load.	Remove all loads that are on the elements.	Operator.
	Defective motor, gear or screw nut	Exchange device.	Qualified personnel.
Significantly increase of noises during operation	Obstacle in the stroke area of the linear actuator.	Remove all obstacles in the stroke area.	Operator.
	Incorrect load.	Remove all loads that are on the elements.	Operator.
	Defective motor, gear or ball screw nut.	Exchange device.	Qualified personnel.

9.1.2 Matrix MAX6

Malfunction	Possible cause	Repair malfunction	To be repaired by
Linear actuator doesn't move	No supply voltage.	Check power supply.	Professional electrician.
	Lack of plug contact or plug has not been inserted properly.	Plug contacts: Device-electric grid, check device-operating element.	Operator.
	Defective network cable or power plug.	Supply cable and plug of the lines: Device-electric grid, check for damage on device-operating element, if necessary replace defective elements.	Professional electrician.
	Obstacle in the stroke area of the linear actuator.	Remove all obstacles in the stroke area.	Operator.
	Incorrect load.	Measure static and dynamic load and compare with information on the type label. If the load capacity is exceeded, replace the device.	Qualified personnel.
	Lifespan of the device is exceeded.	If the actuator is older than 10 years and has performed more than 10 000 double strokes with a 200 mm hub, the actuator needs to be replaced.	Qualified personnel.
	Linear actuator cannot be set in motion by any of the above listed measures.	Exchange device.	Qualified personnel.
Linear actuator cannot be operated	Incorrect operating element.	Compare the information on the type label of the operating element with the information on the type sign of the device. If the manufacturer of the operating element is not authorized for the Matrix actuator, replace incorrect operating element through SKF operating element authorized by the manufacturer.	Qualified personnel.
	Defective SKF operating element.	Conduct malfunction identification of the SKF operating element, if necessary replace operating element.	Qualified personnel.
	Defective screw nut.	Exchange device.	Qualified personnel.
Linear actuator cannot be lifted	Obstacle in the stroke area of the linear actuator.	Remove all obstacles in the stroke area.	Operator.
	Incorrect load.	Remove all loads that are on the elements.	Operator.
	Defective ball screw nut.	Exchange device.	Qualified personnel.
Significantly reduced speed	Obstacle in the stroke area of the linear actuator.	Remove all obstacles in the stroke area.	Operator.
	Incorrect load.	Remove all loads that are on the elements.	Operator.
	Defective motor, gear or ball screw nut.	Exchange device.	Qualified personnel.
Significantly increase noises during operation	Obstacle in the stroke area of the linear actuator.	Remove all obstacles in the stroke area.	Operator.
	Incorrect load.	Remove all loads that are on the elements.	Operator.
	Defective motor, gear or ball screw nut.	Exchange device.	Qualified personnel.

9.2 Start of operation after fixing malfunction

After the malfunction has been fixed, perform the steps from the Installations chapter prior to restart.

10 Dismantling

Personnel

- The dismantling may only be carried out by specifically qualified personnel.
- Work on the electric system may only be performed by professional electricians.

DANGER

Electric shock and moving parts hazards

Serious injury or death can be caused by touching live electrical components and by unexpected movement of the actuator.

Be sure power supply is off and actuator is locked out before installing.



Electrical equipment

WARNING

Risk of injury due to incorrect dismantling

Stored residual power, sharp-edged components, pins and corners on the individual components or at the required tools can cause serious injuries.

Therefore:

- Ensure there is ample of space for the dismantling prior to starting with the work.
- Use caution when working with open, sharp-edged structural components.
- Ensure order and cleanliness at the dismantling site! Loosely stacked structural components or structural components and tools on the floor may present a source for accidents.
- Dismantle structural components professionally pursuant to applicable local regulations.
- Secure structural components in a way so they would not be able to fall or tip over.
- Contact the manufacturer if you have any questions or concerns.



Basic Information

10.1 Dismantling

- Special tools required:
- Special tool from the manufacturer (part no. 0100609)

10.1.1 Dismantling of MAX1 and MAX3

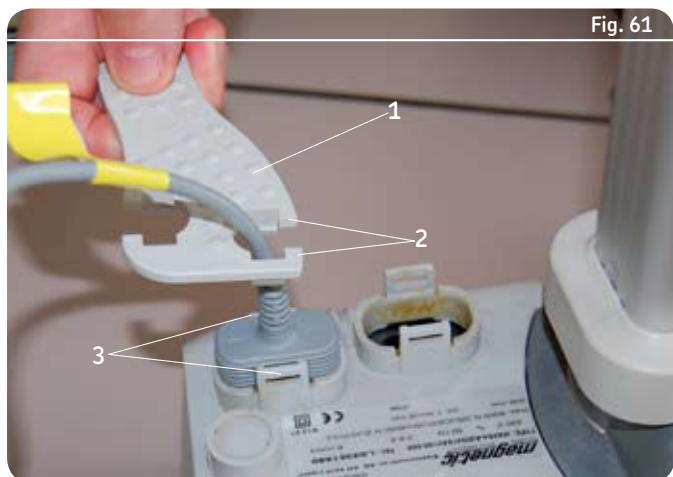
- 1 Separate device from energy supply (→ Chapter "Operation" → "Shut down MAX1 and MAX3").
- 2 Secure elements of the application in such a fashion, that no loads can impact the fork and the hinge head.
- 3 Loosen and remove fastening bolts from the mounting strap of the fork and the hinge head.
- 4 Separate linear actuator from application elements.
- 5 Clean device.
- 6 Carefully package for shipment to the manufacturer. For disposal, disassemble device according to applicable local occupational health and environmental regulations.

10.1.2 Dismantling of MAX6

- 1 Separate device from energy supply (→ Chapter "Operation" → "Shut down MAX6").

Separate device from operating element:

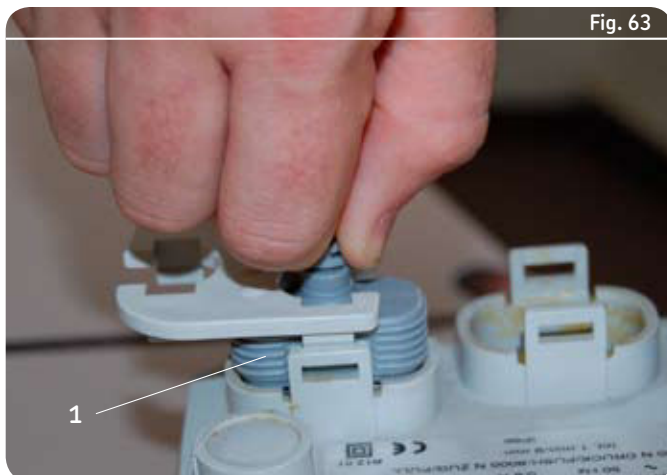
- 2 Place special tool (1) onto the plug of the operating element, so that the form-fitted edges (2) snap into the grooves (3).



- 3 Push down special tool until the locking mechanism on the plug is opened.

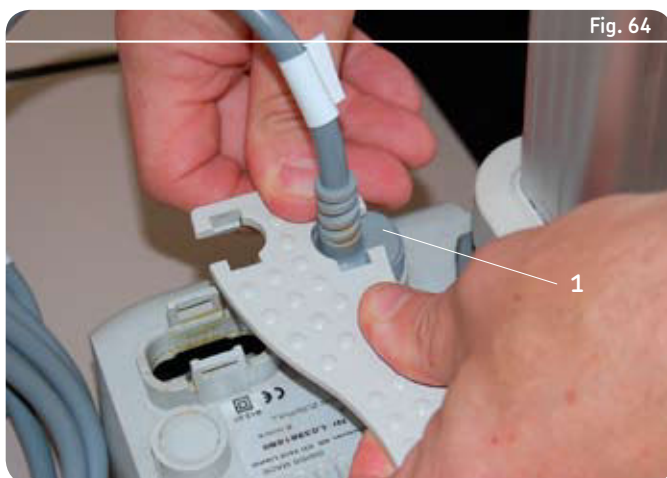


- 4 Pull out plug (1).



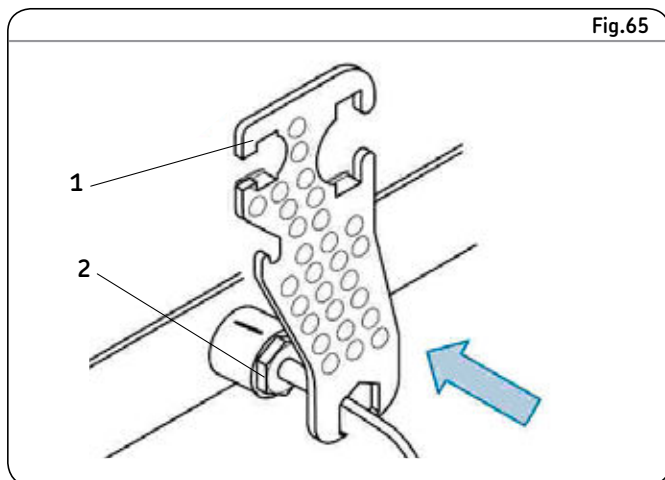
Separate electric cord from the actuator:

- 5 Carry out steps 2 to 4 for the plug of the power line (1).

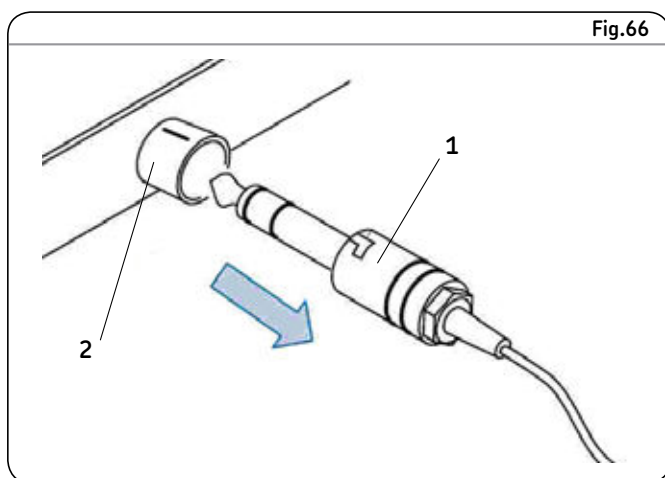


Sever connection to the slave actuator, if it exists:

- 6 Place special tool (1) onto the nut (2) of the jack plug.
- 7 Turn special tool (1) counter-clockwise until the bayonet joint of the jack plug is unlocked.



- 8 Pull jack plug (1) out of the connection outlet (2) of the actuator.



- 9 Secure elements of the application in such a fashion, that no loads can impact the fork and the hinge head.
- 10 Loosen and remove fastening bolts from the mounting strap of the fork and the hinge head.
- 11 Separate linear actuator from application elements.
- 12 Clean actuator.
- 13 Careful packaging for shipment to the manufacturer. For disposal, disassemble device according to applicable local occupational health and environmental regulations.

10.2 Disposal

To the extent that no take-back or disposal agreement has been put in place, disassembled components should be recycled.

- Dispose of metals and plastic components at an appropriate recycling centre.
- Sort remaining components based on the respective material and dispose of according to applicable local occupational health and environmental regulations.

CAUTION

Damage can be caused to the environment due to incorrect disposal

Electronic waste, electronic components, lubricants and other additives are subject to special waste treatment regulations and may only be disposed of by approved specialized companies!

The local municipal authorities or specialized waste management companies can provide information concerning environmentally appropriate disposal.

11 Appendix

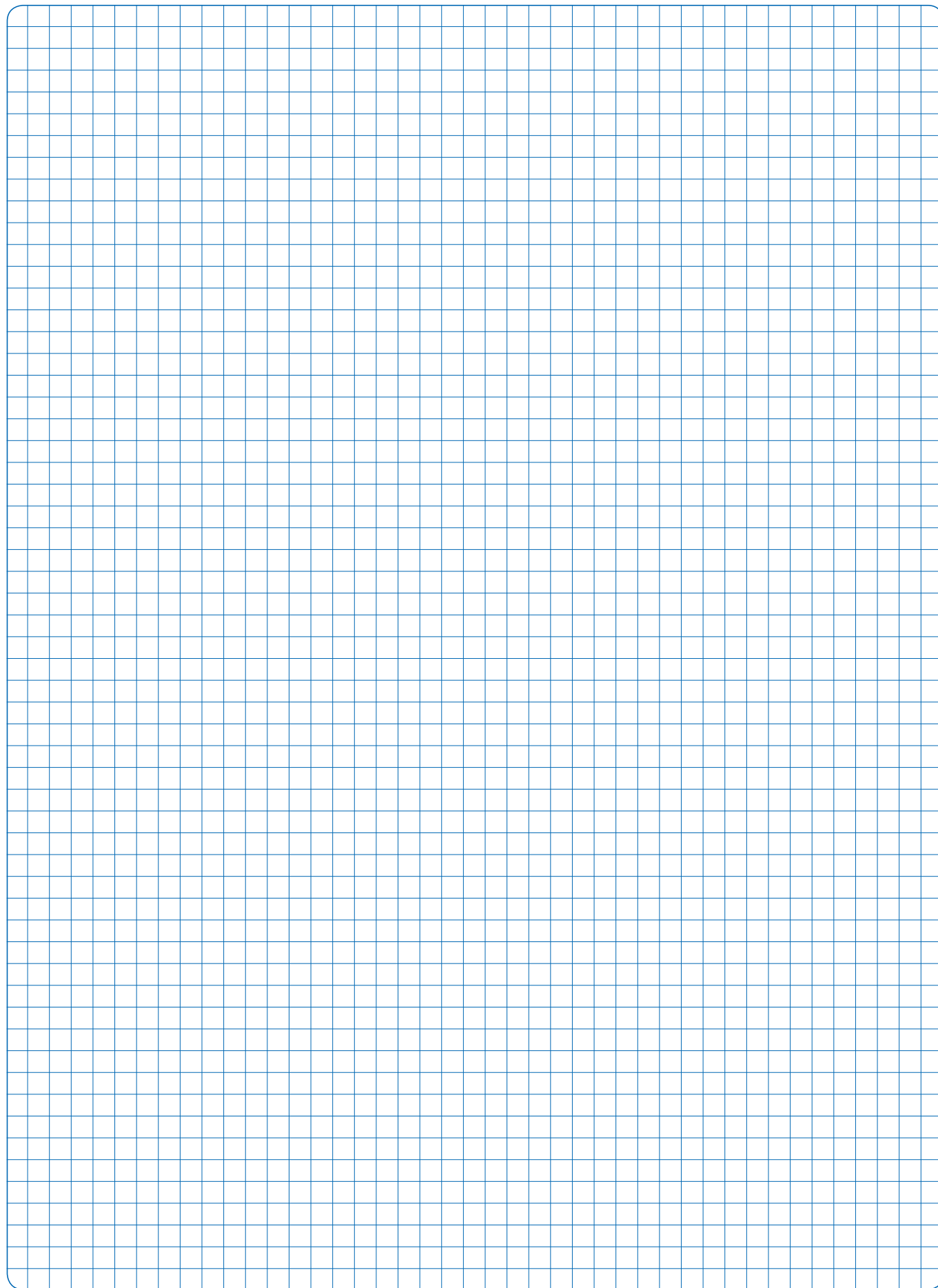
Technical data sheets

The following 12 pages are a reprint from

PUB L5321,2510 EN • May 2010

PUB L5321,2520 EN • May 2010

PUB L5321,2532 EN • May 2010



Linear actuator

Matrix 1

Benefits

- Silent operation
- Full system with control unit, operating switch and accessories
- Synchronization possible
- Compact and aesthetic
- Back-up nut as standard

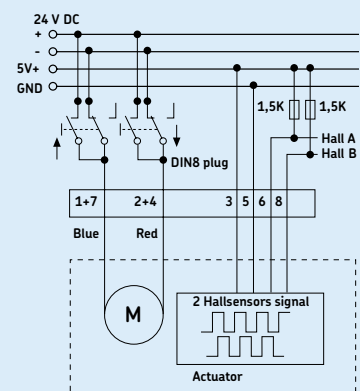


Suitable control units and accessories

Control units		SCU 1	SCU 5	SCU 9	VCU 5	VCU 8	VCU 9	BCU 5	BCU 8	MCU
MAX 1		●	●	●	●	●	●	●	●	●
	EHA 1									●
	EHA 3	●	●	●	●	●	●	●	●	●
	STJ	●	●	●	●	●	●	●	●	●
	STA									●
	STE	●	●	●	●	●	●	●	●	●

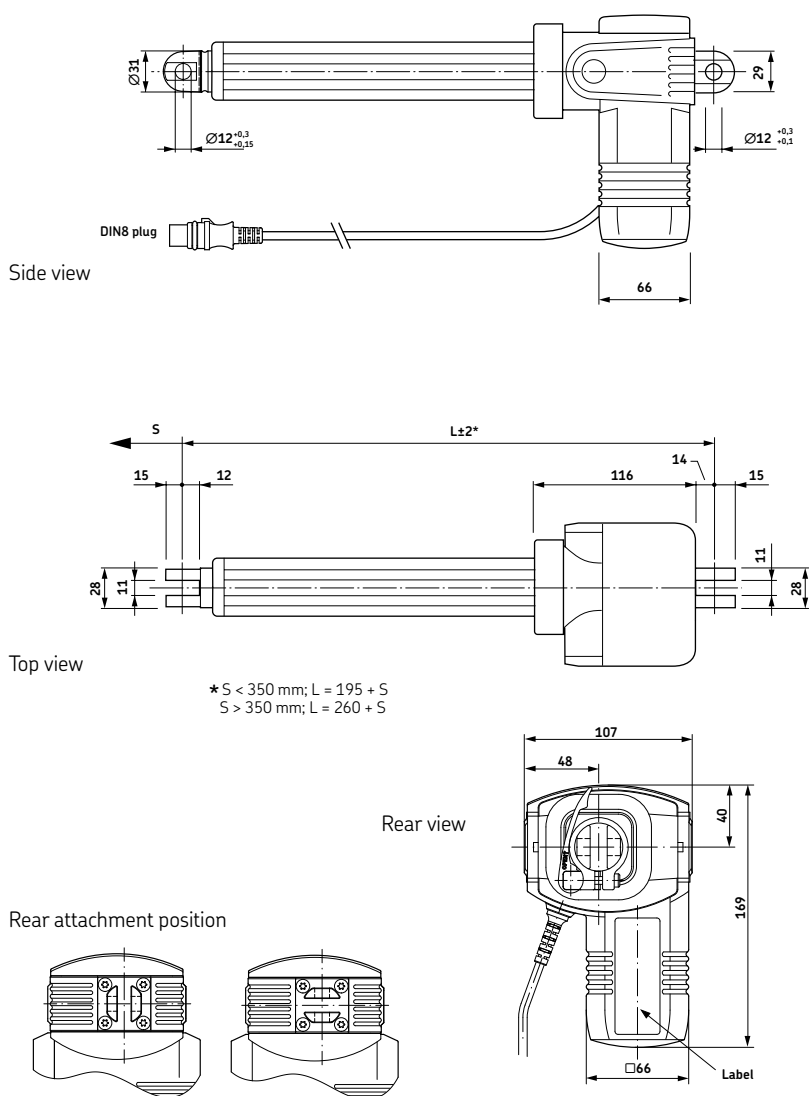
Hand switch
 Foot switch
 Desk switch

Connecting diagram*



* Only valid for MAX 11. MAX 10 must be operated by a BCU, MCU, SCU or VCU control unit.

Dimensional drawing

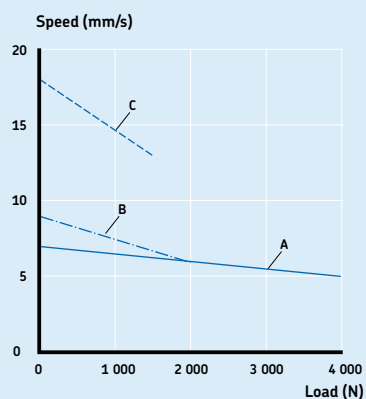


Technical data

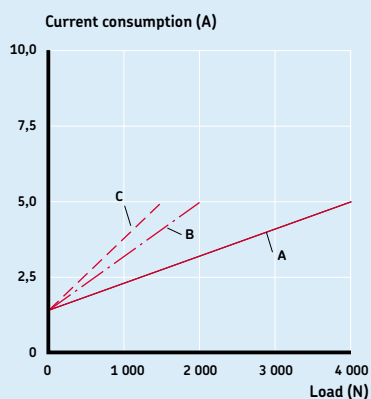
	Unit	MAX 1..A..	MAX 1..B..	MAX 1..C..
Rated push load	N	4 000	2 000	1 500
Rated pull load	N	4 000	2 000	1 500
Speed (full load to no load)	mm/s	5 to 7	6 to 9	12,7 to 18
Stroke	mm	50 to 700	50 to 700	50 to 700
Retracted length	mm	$S + 195/260^*$	$S + 195/260^*$	$S + 195/260^*$
Voltage	V DC	24	24	24
Power consumption	W	120	120	120
Current consumption	A	5	5	5
Duty cycle	%	10 (1/9)	10 (1/9)	10 (1/9)
Ambient temperature	°C	0 to +40	0 to +40	0 to +40
Type of protection	IP	66S	66S	66S
Weight (at 200 mm stroke)	kg	4,0	3,7	3,6
Color	—	Grey	Grey	Grey

* $S < 350 \text{ mm}$, $L = 195 + S$
 $S > 350 \text{ mm}$, $L = 260 + S$

Performance diagrams

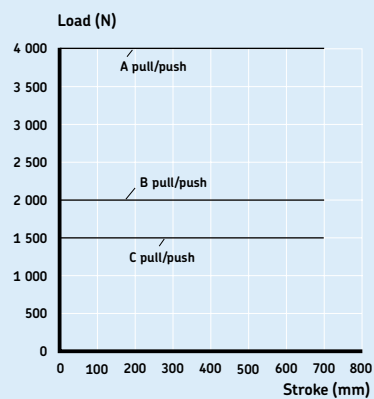


Speed-load diagram

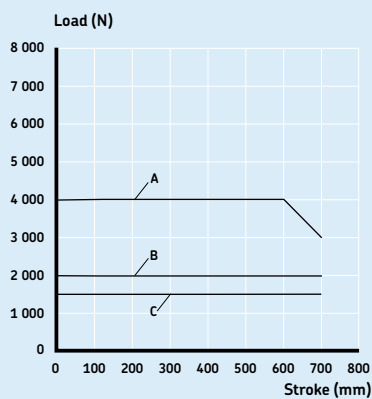


Current-load diagram

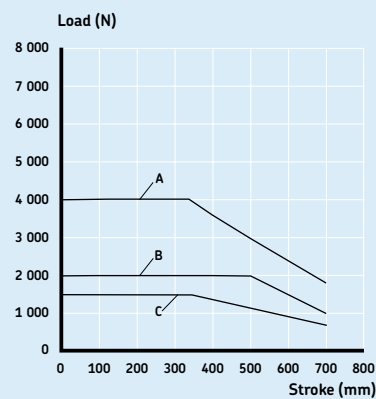
Safety factor load conditions



Push load reduction static
 Safety factor S=1



Push load reduction static
 Safety factor S=2



Push load reduction static
 Safety factor S=4 (EN60601)

Ordering key

MAX1 - [] [] [] [] [] [] A [] [] [] [] [] 000

Type

Voltage:

24 V DC
24 V DC with integrated current cut-off

0

1

Load:

4 000 N
2 000 N
1 500 N

A

B

C

Stroke (S):

50 mm	050 245
100 mm	100 295
150 mm	150 345
200 mm	200 395
250 mm	250 445
300 mm	300 495
350 mm	350 545
400 mm	400 660
450 mm	450 710
500 mm	500 760
550 mm	550 810
600 mm	600 860
650 mm	650 910
700 mm	700 960

Other stroke lengths; 50<S<700 mm

--- ---

Cable / Connecting plug:

Coiled, 0,75 m (not stretched) / DIN8 plug
Straight, 2,5 m / DIN8 plug
Special cable length on request

0B

C5

--

Orientation of rear attachment:

No fork head (customized option)
Standard (as drawing)
Turned 90°

0

1

2

Option 1:

No option, only valid for actuator "A" (push and pull)
Quick-release +EKZm, push, fork head bore parallel to button (for actuator design "C" is L= +115 mm)*
Quick-release +EKZm, push, fork head bore 90° to button (for actuator design "C" is L= +115 mm)*
Mechanical anti-pinching, motor direction pull, no fixing in term. position (for load "A", L= +45 mm; "B" and "C", L= +30 mm)
Mechanical anti-pinching, motor direction push, no fixing in term. position (for load "A", L= +45 mm; "B" and "C", L= +30 mm)
Push load, for actuator version "B" and "C"
Pull load, for actuator version "B" and "C"

O
E
F
I
J
M
N

EKZm: mechanical anti-pinching *min. stroke 150 mm up to 300 mm

Option 2:

No option
2-Hall encoder, DIN8 plug
Lifetime monitoring
Lifetime monitoring, 2-Hall encoder, DIN8 plug

O
F
M
P

Option 3:

No option
Emergency lowering, fork head bore parallel to clamping lever (for actuator design "A", L+30 mm)
Emergency lowering, fork head bore 90° to clamping lever (for actuator design "A", L+30 mm)

-
V
W

Options shown in italics are only available on demand. Contact SKF for more information on minimum quantities and additional costs.

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mail@indpart.ru, 8(495)223-07-69



Linear actuator

Matrix 3

Benefits

- Silent operation
- Full system with control unit, operating switch and accessories
- Synchronization possible
- Compact and aesthetic
- Back-up nut as standard



Matrix 3

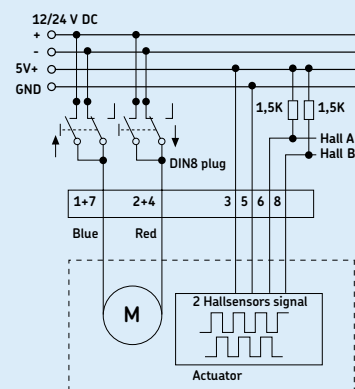
Linear actuators DC versions

Suitable control units and accessories

Control units		SCU 1	SCU 5	SCU 9	VCU 5	VCU 8	VCU 9	BCU 5	BCU 8	MCU
MAX 3		•	•	•	•	•	•	•	•	•
Hand switch	EHA1									•
Foot switch	EHA3	•	•	•	•	•	•	•	•	•
Desk switch	STJ	•	•	•	•	•	•	•	•	•
	STA	•	•	•	•	•	•	•	•	•
	STE	•	•	•	•	•	•	•	•	•

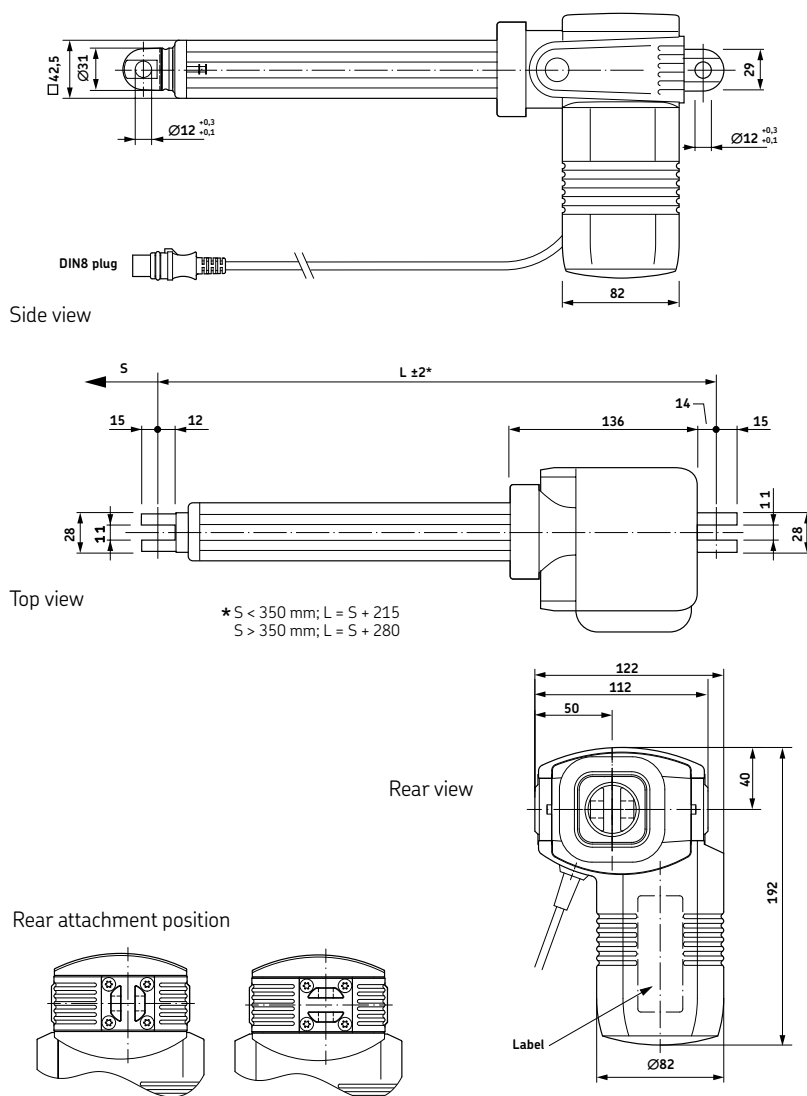
Hand switch
 Foot switch
 Desk switch

Connecting diagram*



* Only valid for MAX 31. MAX 30 must be operated by a BCU, MCU, SCU or VCU control unit.

Dimensional drawing



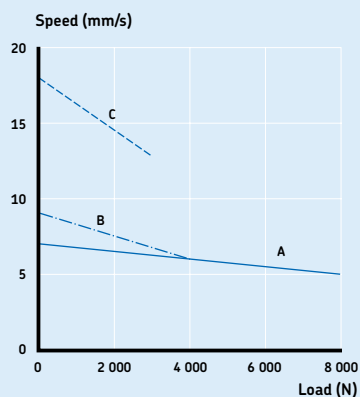
Technical data

	Unit	MAX 3..A..	MAX 3..B..	MAX 3..C..
Rated push load	N	8 000	4 000	3 000
Rated pull load	N	6 000 ¹⁾	4 000	3 000
Speed (full load to no load)	mm/s	5 to 7	6 to 9	12,7 to 18
Stroke	mm	50 to 700	50 to 700	50 to 700
Retracted length	mm	$S + 215/280$ ²⁾	$S + 215/280$ ²⁾	$S + 215/280$ ²⁾
Voltage	V DC	12 or 24	12 or 24	12 or 24
Power consumption	W	120	120	120
Current consumption	A	5,0	5,0	5,0
Duty cycle	%	10 (1/9)	10 (1/9)	10 (1/9)
Ambient temperature	°C	0 to +40	0 to +40	0 to +40
Type of protection	IP	66S	66S	66S
Weight (at 200 mm stroke)	kg	4,5	4,2	4,0
Color	—	Grey	Grey	Grey

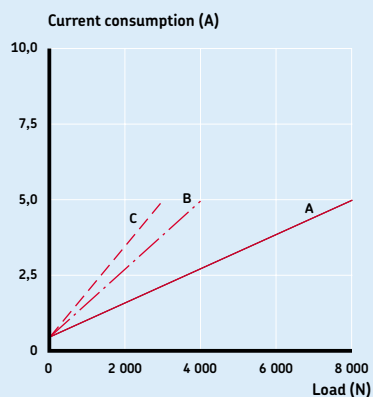
¹⁾ Max load for medical application is 5 000 N

²⁾ $S < 350 \text{ mm}; L = S + 215$
 $S > 350 \text{ mm}; L = S + 280$

Performance diagrams

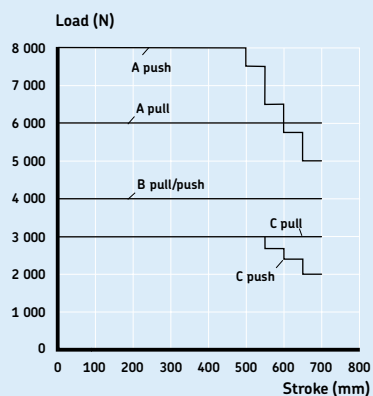


Speed-load diagram

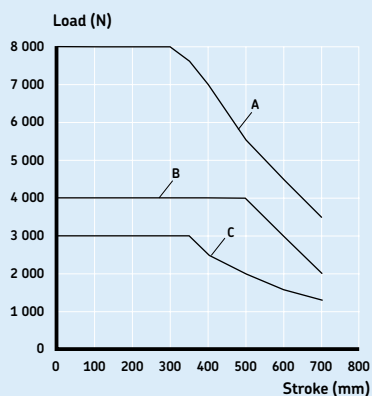


Current-load diagram

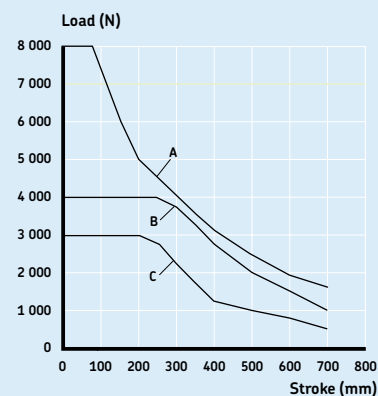
Safety factor load conditions



Push load reduction static
Safety factor $S=1$



Push load reduction static
Safety factor $S=2$



Push load reduction static
Safety factor $S=4$ (EN60601)

Ordering key

MAX3 - [] [] [] [] [] [] A [] [] [] [] [] 000

Type

Voltage:

24 V DC 0
24 V DC with integrated current cut-off 1
12 V DC 2

Load:

8 000 N A
4 000 N B
3 000 N C

Stroke (S):

50 mm 050 265
100 mm 100 315
150 mm 150 365
200 mm 200 415
250 mm 250 465
300 mm 300 515
350 mm 350 565
400 mm 400 680
450 mm 450 730
500 mm 500 780
550 mm 550 830
600 mm 600 880
650 mm 650 930
700 mm 700 980

Other stroke lengths; 50 < S < 700 mm --- ---

Cable / Connecting plug:

Coiled, 0,75 m (not stretched) / DIN8 plug 0B
Straight, 2,5 m / DIN8 plug C5
Special cable length on request --

Orientation of rear attachment:

No fork head (customized option) 0
Standard (as drawing) 1
Turned 90° 2

Option 1:

No option, only valid for actuator "A" (push and pull)
Quick-release +EKZm, push, fork head bore parallel to button (for actuator design "C" is L= +115 mm)*
Quick-release +EKZm, push, fork head bore 90° to button (for actuator design "C" is L= +115 mm)*
Electrical anti-pinching protection, motor direction pull
Electrical anti-pinching protection, motor direction push
Push load, for actuator version "B" and "C"
Pull load, for actuator version "B" and "C"

EKZm: mechanical anti-pinching *min. stroke 150 mm up to 300 mm

0
E
F
K
L
M
N

Option 2:

No option
2-Hall encoder, DIN8 plug
Lifetime monitoring
Lifetime monitoring, 2-Hall encoder, DIN8 plug

0
F
M
P

Option 3:

No option
Emergency lowering, fork head bore parallel to clamping lever (for actuator design "A", L+30 mm)
Emergency lowering, fork head bore 90° to clamping lever (for actuator design "A", L+30 mm)

-
V
W

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Linear actuator

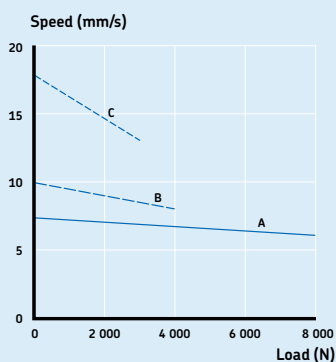
Matrix 6

Benefits

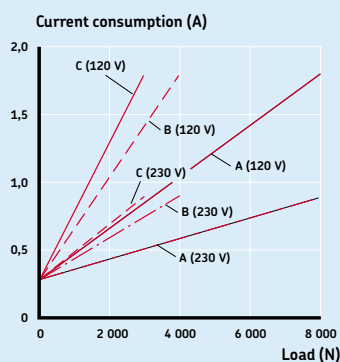
- Silent operation
- Full system with integrated control unit and accessories
- Synchronization possible
- Compact and aesthetic
- Back-up nut as standard



Performance diagrams

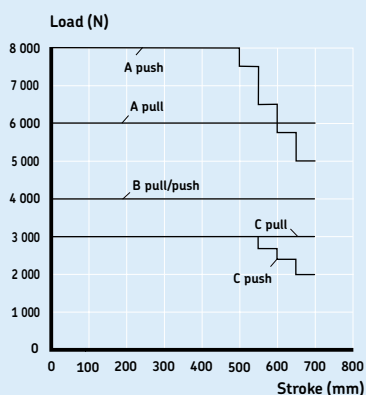


Speed-load diagram

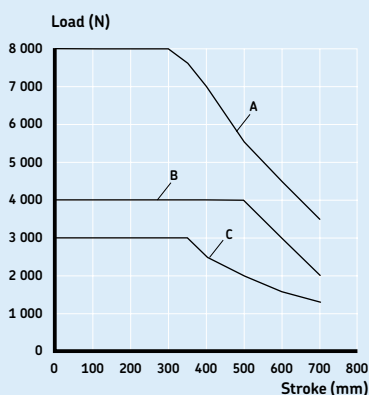


Current-load diagram

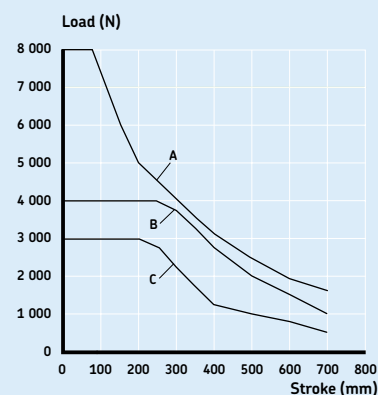
Safety factor load conditions



Push load reduction static
Safety factor S=1



Push load reduction static
Safety factor S=2



Push load reduction static
Safety factor S=4 (EN60601)

Accessories

Description	Plug	Country	Designation	Order number
Straight cable 3,5 m	Schuko	DE	ZKA-140306-3500	M/0121723
Straight cable 3,5 m	SEV	CH	ZKA-140316-3500	M/0121737
Straight cable 3,5 m	UL	USA	ZKA-140355-3500	M/0121724
Straight cable 3,5 m	Hospital grade	USA	ZKA-140360-3500	M/0121732
Straight cable 3,5 m	British standard	UK	ZKA-140350-3500	M/0121743
Coiled cable 1,2 m / 2,2 m	Schuko	DE	ZKA-140342-1500	M/0121728
Coiled cable 1,2 m / 2,2 m	SEV	CH	ZKA-140378-1200	M/0121738
Straight polyurethane cable 3,5 m	SEV	CH	ZKA-140422-3500	M/0121739
Straight polyurethane cable 3,5 m	Schuko	DE	ZKA-140426-3500	M/0121740
Strain relief for mains cable			ZUB-952253	M/0102848
Tool for plugs (Jack/D-Sub/Mains)			ZWS-140375	M/0125322

Ordering key

MAX 6 - A 0 0 0

Type

Voltage:

230 V AC/50 Hz, integrated pneumatic control
120 V AC/60 Hz, integrated pneumatic control
230 V AC/50 Hz, integrated low voltage control with additional 24 V output
120 V AC/60 Hz, control +1 channel with additional 24 V output
230 V AC/50 Hz, integrated low voltage
120 V AC/60 Hz, integrated low voltage

0
1
2
3
4
5

Load:

8 000 N
4 000 N
3 000 N

A
B
C

Stroke (S):

50 mm
100 mm
150 mm
200 mm
250 mm
300 mm
350 mm
400 mm
450 mm
500 mm
550 mm
600 mm
650 mm
700 mm
Other stroke lengths; 50<S<700 mm

050 265
100 315
150 365
200 415
250 465
300 515
350 565
400 680
450 730
500 780
550 830
600 880
650 930
700 980
--- ---

Cable/Connecting plug:

No cable

0

Orientation of rear attachment:

No fork head (customized option)
Standard (as drawing)
Turned 90°

0
1
2

Option 1:

No option, only valid for actuator "A"
Quick-release +EKZm, push, fork head bore parallel to button (for actuator design "C" is L= +115 mm)*
Quick-release +EKZm, push, fork head bore 90° to button (for actuator design "C" is L= +115 mm)*
Electrical anti-pinching protection, motor direction pull
Electrical anti-pinching protection, motor direction push
Push load, for actuator version "B" and "C"
Pull load, for actuator version "B" and "C" EKZm: mechanical anti-pinching *min. stroke 150 mm up to 300 mm

O
E
F
K
L
M
N

Option 2:

No option
Lifetime monitoring

0
M

Option 3:

No option
Emergency lowering, fork head bore parallel to clamping lever (for actuator design "A", L+30 mm)
Emergency lowering, fork head bore 90° to clamping lever (for actuator design "A", L+30 mm)

-
V
W

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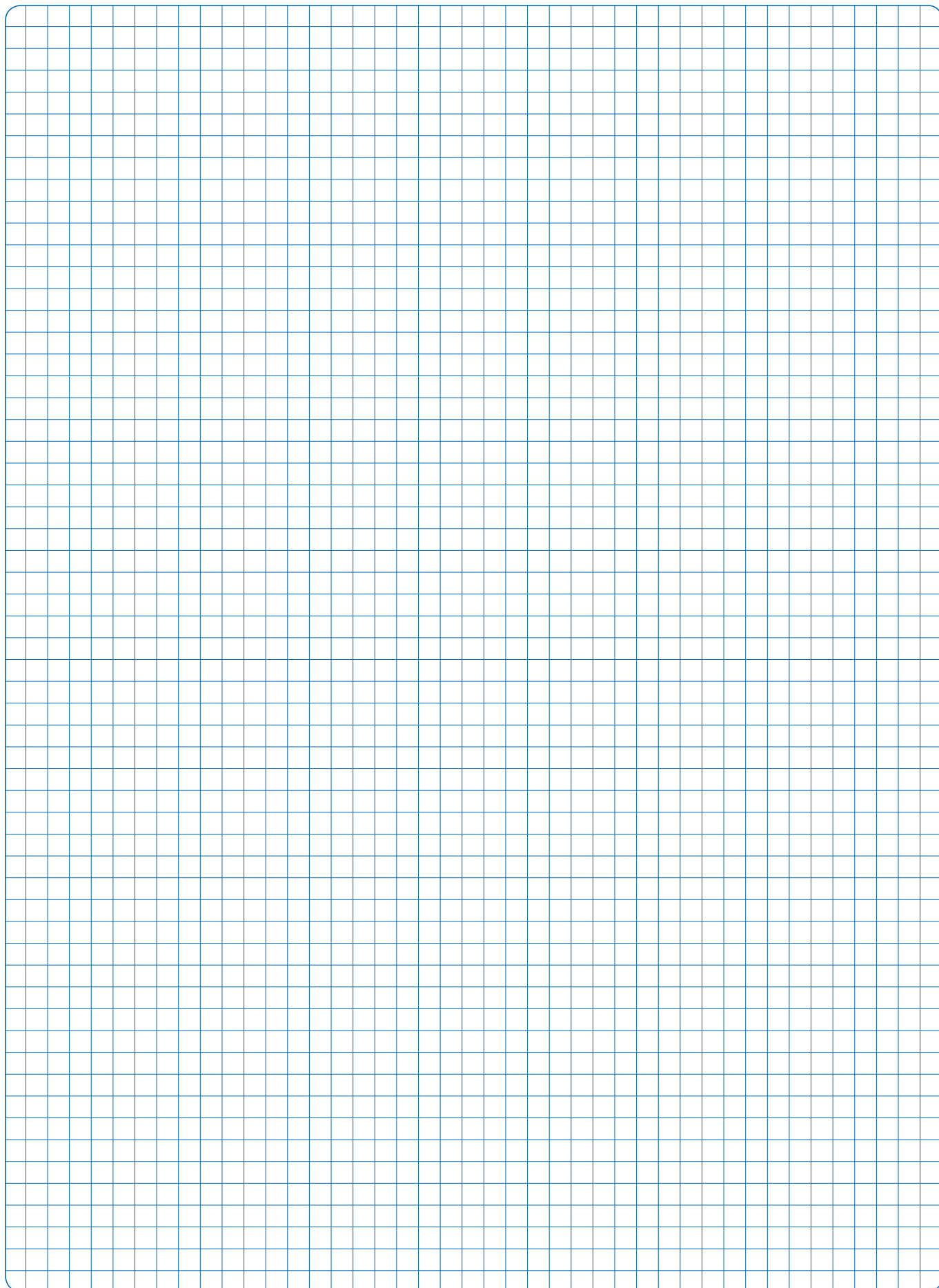
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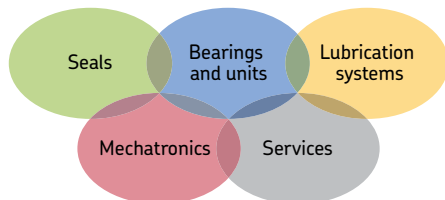
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Drawing on five areas of competence and application-specific expertise amassed over more than 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems. A global presence provides SKF customers uniform quality standards and worldwide product availability.

Please contact:

SKF Actuation System (Liestal) AG

Oristalstrasse 97
4410 Liestal
Switzerland

Tel.: +41 61 925 4111

Fax: +41 61 921 3704

actuators@skf.com

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