Electromechanical EWELLIX Linear Actuator

LEMC

User Manual

We pioneer motion

SCHAEFFLER

Contents

1 About the manual

1.1 About the manual

This manual is part of the product and contains important information. Read the manual thoroughly prior to use and ensure that the instructions are strictly observed.

The original language of the manual is German. All other languages are translations from the original language.

1.2 Availability

A current version of this manual is available at:
https://www.schaeffler.de/std/2027

1.3 Legal notices

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

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

1.4 Symbols

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

1 Warning and hazard symbols

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

1.5 Signs

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

2 Warning, prohibition, and mandatory signs

Signs and descriptions	
	General warning
	Electrical voltage warning
	Hot surface warning
	Crush warning
	Hand injury warning

Signs and descriptions	
	Observe the manual
	Wear protective gloves
	Wear safety shoes
	Wear eye protection
	Wear ear protection
	Wear head protection
	General mandatory sign

1.6 Images

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

1.7 Further information

Address any questions on fitting to your local contact at Schaeffler Smart Maintenance Tools.

2 General safety regulations

2.1 Intended use

Electromechanical actuators are based on screw drivers that convert rotary motion into linear motion. The device is designed to provide linear motion in machines.

The device may only be used in accordance with the technical information.

Ensure that all safety instructions, warnings and user manuals on the device are maintained in a legible condition at all times. Replace any damaged or illegible signs or stickers on the device immediately.

Observe the safety data sheets for any hazardous substances used.

Only use original spare parts and accessories supplied by Schaeffler.

Intended use also includes the following:

- compliance with all information in the user manual
- adherence to all safety instructions
- observance of maintenance and service regulations

Unauthorized structural modifications to the device are not permitted. We accept no liability for any resulting damage to machines and persons.

2.2 Unintended use

Unintended use includes the following:

- Modifications to the device
- Operation of the device contrary to the specifications of this user manual
- Use in potentially explosive atmospheres

Unintended use can result in injury to persons and damage to the device.

If you have any questions regarding this, please contact Schaeffler.

2.3 Qualified personnel

Operator duties:

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

Qualified personnel meet the following criteria:

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

2.4 Specific hazards

The following section lists the residual risks determined by a risk assessment.

The manufacturer has constructively, and with protective actions, minimized the impacts of existing hazards. Observe the residual hazards described and possible counter actions, as well as the warnings in the following sections.

DANGER

Serious or fatal injuries or damage to property

Moving, heated and energized components if the information and precautions contained in this LEMC User Manual are not followed.

- All activities associated with transport, installation/assembly (mechanical and electrical), commissioning, maintenance or storage are carried out by qualified personnel in compliance with relevant guidelines.

DANGER

Serious or fatal injuries due to electric shock

Hazardous voltages may be present on some parts of the actuator during and after operation. There is a risk of electric shock and serious or fatal injuries.

- Pay close attention to the safety instructions in this document and in the documents provided with accessories.
- Do not disconnect any connectors from the motor without first switching off the power supply to the associated servoamplifier.
- First disconnect the signal connector and then the power supply. Turning the motor may generate voltage. Do not touch the connector pins.

WARNING

Risk of injury

Moving parts (rotary and/or linear motion) can cause serious injuries.

- Work may not be carried out in the vicinity of moving parts and hands, arms or other parts of the body must be kept away from moving parts.

WARNING

Risk of injury from falling vertical loads

Risk of serious or fatal injuries from crushing due to falling vertical loads. In general, the holding torque of the brake is generated by driving disks and does not provide positive locking.

- If an operator is positioned under the load, a lock or another brake must be used in addition to the motor brake to hold the vertical load.
- Ensure that the vertical load is secured by additional means.

WARNING

Risk of crushing.

Risk of serious or fatal injuries from crushing due to unintentional activation of the device.

- Before carrying out any work on the actuator, disconnect the motor, the brake and the fan (if installed) from the mains.
- Secure against unintentional restart.

WARNING

Risk of burns or fire.

During operation, the device can reach very high temperatures.

- Allow the device to cool down before you start work.

NOTICE

Observe the information provided by the manufacturer.

Components included in the scope of delivery are standard parts and purchased parts. These components are not developed or manufactured by Schaeffler. The user is responsible for reading the manufacturer's user manual for these components before commencing installation or use of the product.

3 Scope of delivery

3.1 Scope of delivery

The scope of delivery of the LEMC electric actuator includes the following components:

- Linear actuator
- Motor power cable
- Motor sensor cable
- Motor controller
- Electronic interface for establishing the connection between a PC and the motor controller

Further information

HA 1 | EWELLIX High-Performance Actuators | Electromechanical linear actuators, servo lifting columns, servo linear actuators |
https://www.schaeffler.de/std/2023

3.2 Check for transport damage

1. Check the product immediately upon delivery for any damage during transit.
2. Report any damage during transit promptly as a complaint to the carrier.

3.3 Check for defects

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

4 Transport and storage

4.1 Transport

Observe the relevant transport regulations during transport.

Only use suitable lifting accessories for transport and assembly.

The weights of the actuator, any gearbox and the motor are indicated on the corresponding type plates. Failing this, consult the technical documentation provided by the respective manufacturer.

4.2 Storage

If the actuator is placed in storage for long periods of time, the following conditions must be observed:

- Horizontal position
- Ambient temperature between +15 °C and +40 °C
- Retracted state
- The actuator must be packed in plastic film with desiccant to protect it from moisture and condensation.
- A actuator that has been stored under the conditions described above for less than one year can be used in accordance with the general recommendations for use ➤21|7.1.
- If the storage time exceeds one year, the actuator must be relubricated before initial commissioning ➤29|9.1.

5 Preparation for mounting

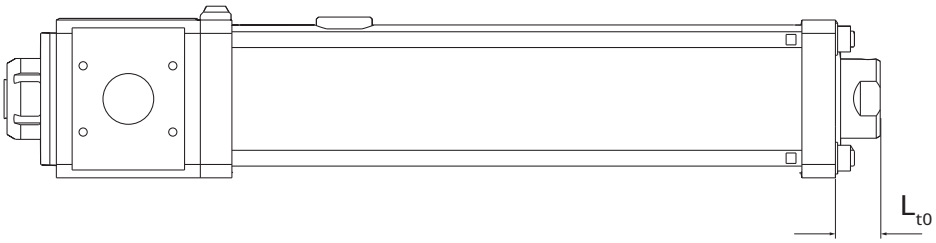
5.1 Visual actuator position, definition of L_{t0} and L_t

During assembly, installation or operation of the actuator, it may be necessary to determine the position of the actuator based on the zero position specified on the actuator drawing.

For this, L_{t0} must first be known.

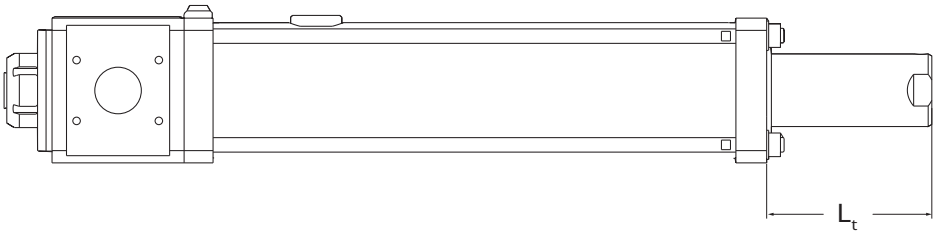
L_{t0} corresponds to the length of the push tube that is visible when the actuator is in the zero position on the actuator drawing.

1 Actuator in zero position L_{t0}



L_t then needs to be measured: Equivalent dimension of L_{t0} when the actuator is in any position.

2 Actuator in any position L_t.



In this case, the position of the actuator in relation to the zero position specified in the actuator drawing is equal to L_t minus L_{t0}.

5.2 Guidelines for mounting

NOTICE

Poor alignment shortens the life of the device.

When assembling the device, check that all parts to which the device is attached are correctly aligned. The test is carried out during the entire stroke.

NOTICE

Damage to the device as a result of impacts.

Avoid impacts to the push tube. Do not hit the push tube with a hammer.

NOTICE

Damage to the limit switch.

If the option has been selected: Take care not to damage the limit switches when handling the device.

NOTICE

Movement of the device.

If the device does not have its own anti-rotation device, it can be retracted and extended by turning the push tube by hand.

The following instructions must be followed before assembly:

1. Make sure that the actuator can move freely and that the entire stroke is free of obstacles.
2. If the LEMC is supplied without a motor, the motor is installed prior to the assembly of the LEMC ➤12|5.3.

5.3 Motor

Consult the technical documentation supplied by the motor manufacturer to obtain all the necessary information for installing the motor.

If you have any questions or if the motor was purchased from Schaeffler, please contact Schaeffler.

5.4 Motor cables

If motor cables are included in the scope of delivery, check the technical documentation for the motor and the servoamplifier for the technical description and connection drawing for the included cables. The motor cable designation can be found on the motor cable itself or on the packaging.

Should you experience any difficulties, please contact your local Schaeffler representative.

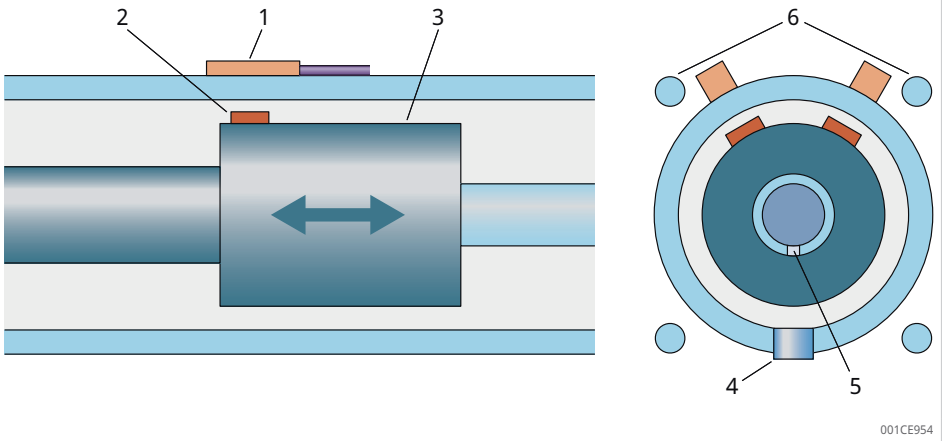
5.5 Limit switches

5.5.1 Function and characteristics

The limit switch sensor signals the position of the nut body in the actuator. It detects the magnet positioned on the moving part and changes the signal when the magnet passes the sensor.

The sensors must be positioned in a specific area to ensure detection: All limit switches must be fitted on the opposite side of the relubrication port.

3 Limit switches



1	Sensor	2	Magnet
3	Nut body	4	Relubrication port and greasing plug
5	Radial bore	6	Linkage

5.5.2 Setup

1. The radial bore at the end of the push tube must be aligned with the relubrication port to match the correct angle of the magnetic field.
2. Mount the sensor in the designated adapter, tighten the clamping screw and attach the sensor and adapter assembly group to the corresponding tie rod.
3. Position the sensor at the point at which you want to detect the position of the nut body.

5.5.3 Electrical connection

1. Disconnect the power supply before connecting the sensor.
2. During connection, strictly observe the information on the type plate. Core colors for devices with cable connection:
   BN = brown, BU = blue, BK = black, WH = white.

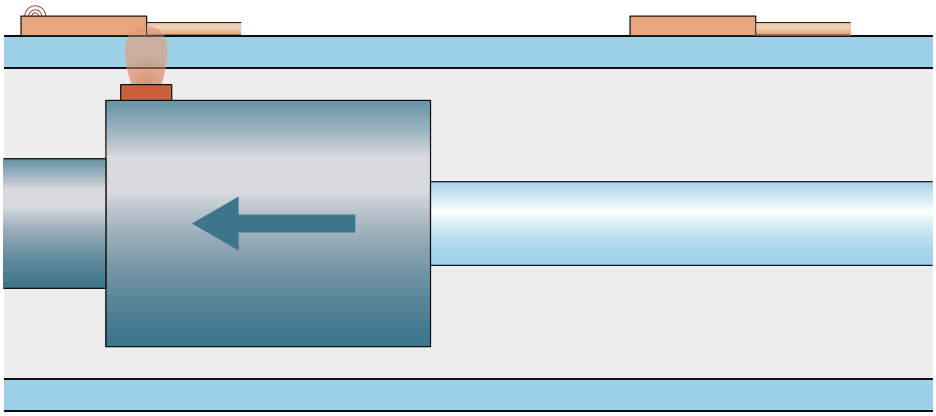
5.5.4 Limit switch in the extended position

1. Set the stroke of the actuator in the detection position.
2. Use the LED display to precisely align the sensor. Pay attention to the position of the magnetic field and the sensor.

› The LED display lights up when the output is switched.

3. Tighten the grub screw to secure the adapter to the tie rod.

4 Limit switch in the extended position



5.5.5 Limit switch in the retracted position

NOTICE

The switching behavior of the sensor is affected.

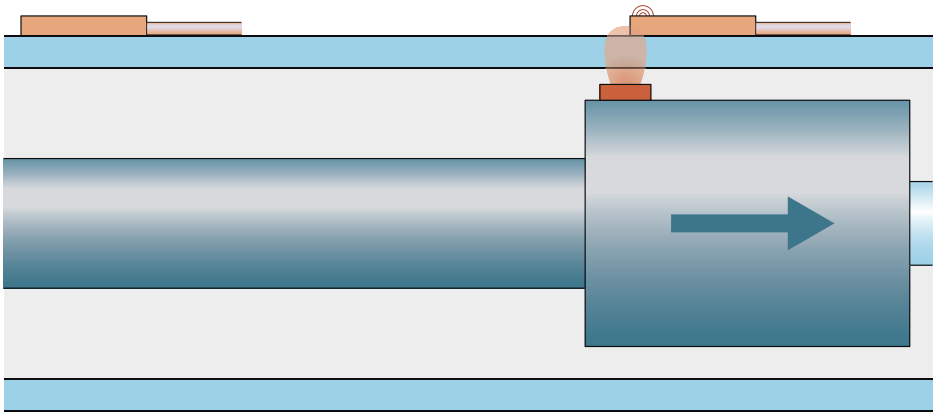
Make sure that no magnetizable components are located in the immediate vicinity of the actuator, as these can influence the switching behavior of the sensor.

1. Set the stroke of the actuator in the detection position.
2. Use the LED display to precisely align the sensor. Pay attention to the position of the magnetic field and the sensor.

› The LED lights up when the output is switched.

3. Tighten the grub screw to secure the adapter to the tie rod.

5 Limit switch in the retracted position



The limit switch must always be searched for using the same method. Define the approach direction for each sensor separately.

4. Retract from an extended position to the limit switch (home sensor).
5. Extend from a fully retracted position to the limit switch (end position sensor).

5.6 Servoamplifier

Consult the technical documentation supplied by the servoamplifier manufacturer to obtain all the necessary information for assembly.

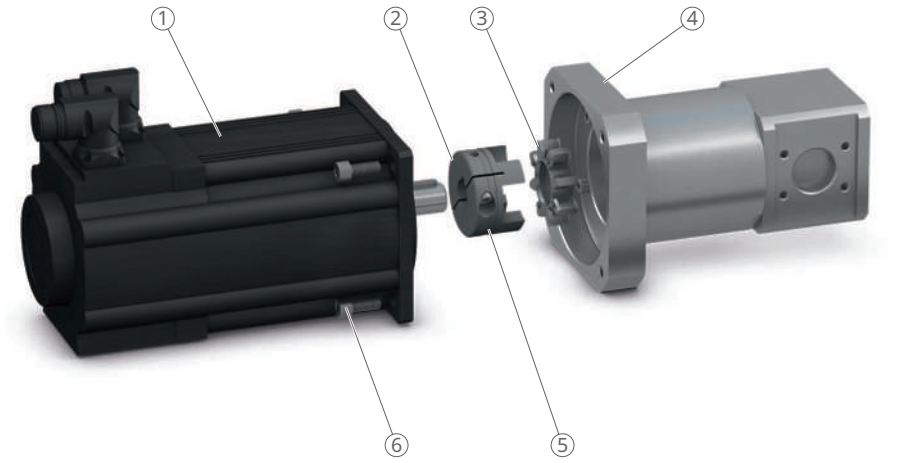
If you have any questions, please contact Schaeffler or the manufacturer.

6 Mounting

6.1 Inline configuration

This chapter contains basic information and instructions for mounting motors on the LEMC with inline configuration.

6 LEMC inline configuration



1	Motor	2	Motor coupling hub
3	Coupling star	4	Motor interface
5	S2	6	S1

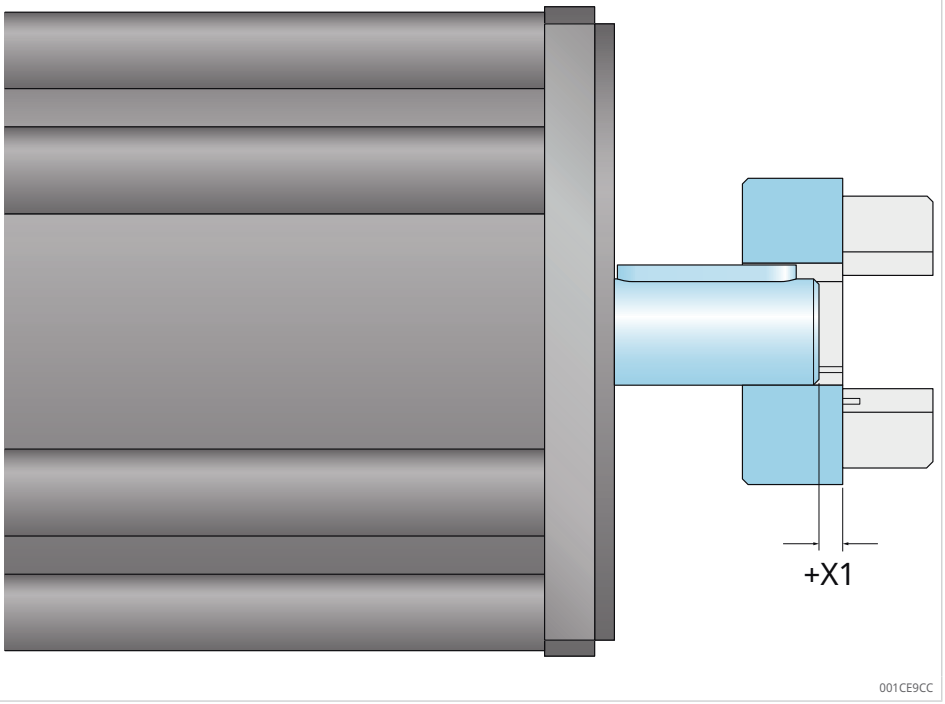
6.1.1 Mounting the coupling on the motor shaft

If an LEMC with motor interface is ordered with inline configuration, the LEMC is supplied with a pre-assembled motor interface. One coupling hub is pre-assembled at the factory on the shoulder of the screw shaft. The coupling hub intended for the motor shaft is not pre-assembled.

The supplied coupling is designed for mounting on motor shafts with keyway.

1. Remove the motor coupling hub from the rest of the coupling. Do not remove the coupling star from the coupling hub of the screw shaft.
2. Slide the motor coupling hub onto the motor shaft.
3. Align the coupling hub on the motor shaft.
4. Install the radial fastening screw (S2) ➤37|11.6.

7 Mounting the coupling on the motor shaft



3 Motor interface

LEMC	Interface	Motor X1
		mm
21	L1024110L	+1.5
21	L1024110L	−4.5
30	L1019110L	+1.8
30	L1024110L	−4.2
30	L1024130L	+1.5
30	L1028130L	0
30	L1028130L	−1

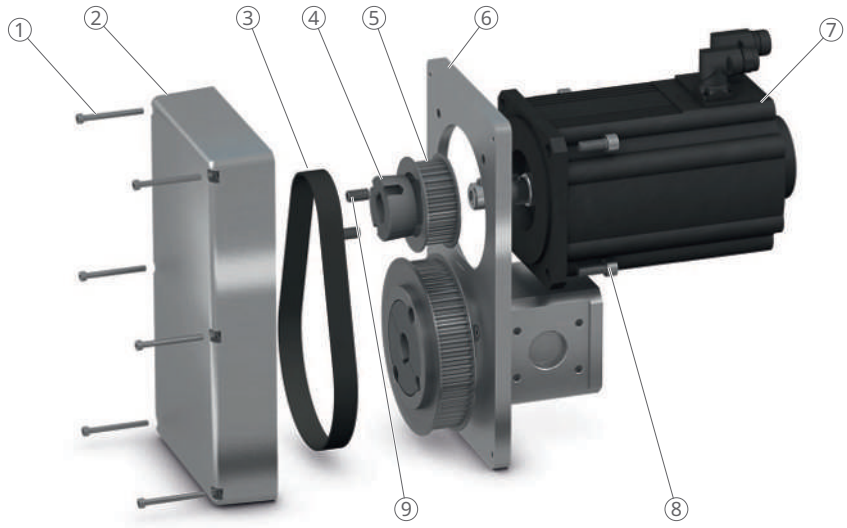
6.1.2 Mounting the motor on the motor interface

1. Mount the motor on the motor interface. During mounting, make sure that the coupling is correctly seated and that each coupling hub is aligned.
2. Tighten the fastening screws (S1) to the specified torque ➤37|11.6.

6.2 Parallel configuration

This chapter contains basic information and instructions for mounting motors on the LEMC with parallel configuration.

8 LEMC parallel configuration



1	S1	2	rear cover
3	belt	4	taper lock
5	pulley	6	motor interface
7	motor	8	S2
9	S3		

6.2.1 Mounting the pulley on the motor shaft

If an LEMC with motor interface is ordered with parallel configuration, the LEMC is supplied with a pre-assembled motor interface.

The pulley for the shoulder of the screw shaft is pre-assembled at the factory. The pulley intended for the motor shaft is not pre-assembled.

The belt is mounted with a fixed axis distance between the pulleys. This means that the belt tension does not need to be adjusted. Please note that all taper locks used are intended for mounting on motor shafts with a keyway.

1. Remove the rear cover from the actuator.
2. Place the taper lock on the pulley and screw on the mounting screws (S3) of the taper lock by hand without tightening them. Further instructions can be found in the assembly instructions supplied with the taper lock.
3. Position the pulley and the taper lock on the motor shaft, aligning the keyway with the groove of the taper lock.
4. Align the pulley with the motor shaft ➤38|11.8.
5. Tighten the screws (S3) ➤38|11.8.

6.2.2 Mounting the belt and the motor on the motor interface plate

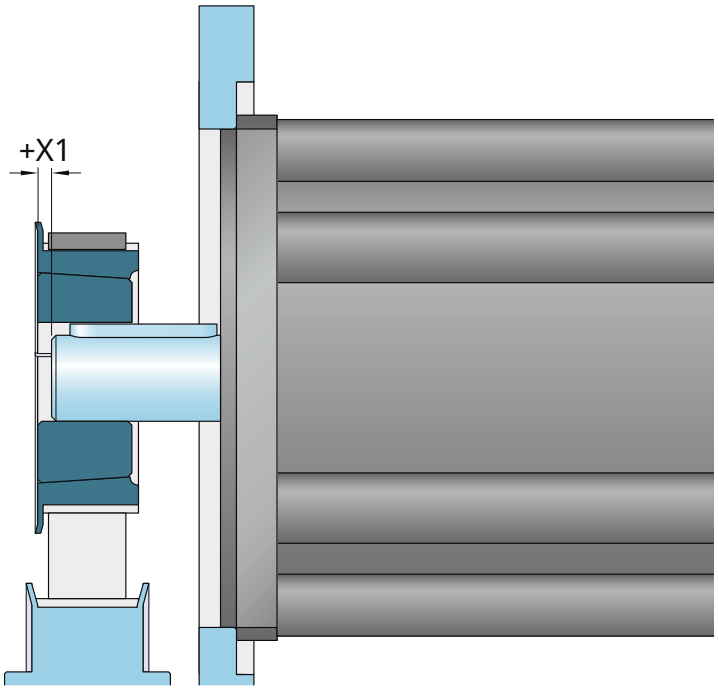
1. Place the belt on the pulley that is already mounted on the actuator shaft.

› The belt must lie in the middle of the pulley.

2. Mount the motor on the motor interface. Start by tilting the motor to allow the pulley and motor to be positioned on the belt.
3. Tighten the mounting screws (S2) ➤38|11.7.
4. Make sure that the belt is in the middle of the pulleys. If not, adjust the position.
5. Refit the rear cover and tighten the screws (S1) ➤38|11.7.

6

9 Mounting the belt and the motor on the motor interface plate



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6.3 SER-SIT taper lock bushing

Mounting using SER-SIT taper lock bushing eliminates play between the hub and the bore.

Make sure that the top of the key does not touch the bottom of the groove of the SER-SIT taper lock bushing. It is recommended to have some play over the top of the key.

Assembly

1. Before installing the SER-SIT taper lock bushing, carefully clean the bore and the surface.
2. Insert the bushing into the pulley. Align the half threaded holes of the pulley with the threadless holes of the bushing, one above the other.
3. Hand tighten the screws.
4. Carefully clean the pulley and install it on the shaft. Position it and tighten the screws alternately.

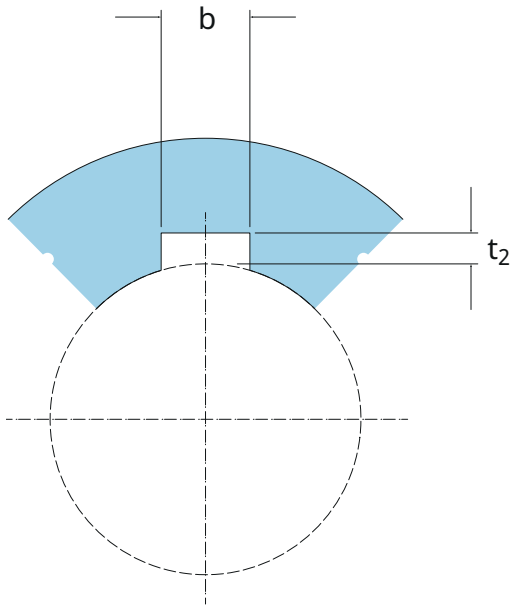
Disassembling

5. Remove the screws then insert a screw into the jacking hole and tighten until the hub comes loose.

4 Key UNI6604-69/DIN6885

Bore diameter	b	t_2	Bore diameter	b	t_2
mm	mm	mm	inch	inch	-
9 ... 10	3	1.4	3/8 ... 1/2	1/8	1/16
11 ... 12	4	1.8	9/16 ... 3/4	3/16	3/32
13 ... 17	5	2.3	13/16 ... 1	1/4	1/8
18 ... 22	6	2.8	1 1/16 ... 1 1/4	5/16	1/8
23 ... 30	8	3.3	1 5/16 ... 1 1/2	3/8	1/8
31 ... 38	10	3.3	1 5/8 ... 1 3/4	7/16	5/32
39 ... 44	12	3.3	1 7/8 ... 2	1/2	5/32
45 ... 50	14	3.8	2 1/8 ... 2 1/2	5/8	7/32
51 ... 58	16	4.3	2 5/8 ... 3	3/4	1/4
59 ... 65	18	4.4	3 1/8 ... 3 1/2	7/8	5/16
66 ... 75	20	4.9	3 3/4 ... 4	1	3/8
76 ... 85	22	5.4	4 1/4 ... 5	1 1/4	7/16
86 ... 95	25	5.4	-	-	-
96 ... 110	28	6.4	-	-	-
111 ... 130	32	7.4	-	-	-

10 Key



Reduced key sizes are only used if the bores indicated below match the max. bore size and only for the bushing types listed.

5 Reduced key sizes in mm

Bore diameter	Bushing type	b	t_2
mm	–	mm	mm
24 ... 25	1008	8	1.3
28	1108	8	1.3
35	1310	10	1.3
42	1615	12	2.2
65	2517	18	3.3

6 Reduced key sizes in inch

Bore diameter	Bushing type	b	t_2
inch	–	inch	inch
1	1008	$^1/_4$	$^1/_{16}$
1 $^1/_8$	1108	$^5/_{16}$	$^5/_{64}$
1 $^5/_8$ ... 1 $^3/_4$	1615	$^7/_{16}$	$^1/_8$
3 $^1/_2$	3535	$^7/_8$	$^1/_4$
3 $^3/_4$ ... 4	4040	1	$^1/_4$

7 Commissioning

7.1 Usage recommendations

⚠ WARNING

Risk of injury

The actuator movement must not be stopped by a sharp mechanical interruption. This causes the kinetic energy stored in the internal rotating actuator parts to be stopped very abruptly. This can lead to very high loads inside the actuator, which can damage the actuator and the operating environment.

- Actuator movement must only be stopped at low motor speed (less than or equal to a few percent of the maximum speed) and with actuator force limited to a low value (by determining a limitation of motor current).
- During commissioning, slowly increase the cycle rate of the actuator, taking care to avoid overheating.
- The constant temperature of the actuator must not exceed 80 °C, regardless of which surface the measurement is taken on.

The actuators contain two internal mechanical stops: One in the retracted position and one in the extended position. These stops should only be used manually at slow speed and under low load. They are not designed for the actuator to hit them at extreme speed or under extreme load.

Depending on the cycle rate, the duty cycle (load, speed, acceleration profiles and deceleration profiles) and the ambient conditions, the actuator may heat up significantly.

7.2 Commissioning procedure

The actuator is pre-lubricated at the factory.

✓ The software required to input the servoamplifier parameters is installed on the computer.

✓ The connection between the computer and the servoamplifier is established via the hardware connection.

1. Switch on the servoamplifier with auxiliary voltage or voltage at a low level to allow the servoamplifier parameters to be set.
2. Start the software needed to adjust the servoamplifier parameter settings. Check the connection between the computer and the servoamplifier.
3. Enter the motor selection. If necessary, select the resolver or the encoder and the brake.
4. Enter the actuator movement for each motor revolution.
5. Enter the actuator speed specified for the application.
6. Enter the actuator acceleration specified for the application.
7. Enter the starting test parameters determined.
8. Save the changes to the permanent memory.
9. Before proceeding with the next step, check that the modified or newly entered parameters have been saved correctly in the permanent memory. To do this, switch the servoamplifier off and on again. Then check that the parameter changes have been correctly adopted by the servoamplifier and are present.
10. Switch on the power supply to the servoamplifier. Check the function of the motor brake, e.g. when the torque of the actuator starts, the brake audibly releases. When the torque of the actuator stops, the brake is audibly applied.

11. Perform a short actuator movement, less than the stroke value specified on the actuator drawing, in the positive direction to see the actual direction of the push tube movement.

› The push tube extends when a positive movement is performed. If the push tube does not extend, reverse the direction of rotation of the motor.

12. Check the limit switch in the retracted position by moving the actuator slowly and gradually into this position.
13. Check the limit switch in the extended position by moving the actuator slowly and gradually into this position.
14. If a reference switch is installed, check the reference switch function. The actuator is slowly and gradually moved to the position where the status of the reference switch changes.
15. Determine the zero reference.
16. Measure the two outermost positions of the push tube in the extended and retracted positions within which the actuator moves. Do not actuate the limit switches. The positions are determined in relation to the zero reference.

After all the steps have been performed, slowly move the actuator forward and back over the entire stroke several times. Check the behavior of the position control as the speed and acceleration of the actuator gradually increases.

7.3 Determining the zero reference

The reference switch can be used to determine the zero reference in two ways:

- The reference switch is integrated in the actuator.
- The reference switch is mounted on the machine driven by the actuator.

The limit switches in the servoamplifier need to be enabled. This enablement allows a zero reference search to be performed with the reference switch from any actuator starting position.

The zero reference determined for a specific actuator can be traced. The zero reference differs between actuators. When replacing an old actuator with a new actuator, the positions must be determined again in order to obtain the zero reference as a function of the new actuator.

During initial commissioning, the functioning of the position control must be checked. The test must rule out the risk of a tracking error failure or an overspeed failure. Such failures can cause severe material damage.

7.3.1 Reference switch integrated in the actuator

If the reference switch is integrated in the actuator, the following two options are available for determining the zero reference, depending on the manufacturer:

- The search for the zero reference must always begin in the direction that causes the push tube to move toward the retracted position.
- The search for the zero reference must always begin in the direction that causes the push tube to approach the extended position.

Option 1: Move the push tube to the retracted position

1. Retract the push tube until it reaches the limit switch in the retracted position.
2. Extend the push tube until the reference switch detects the roller screw nut.
3. Start the search for the first zero of the encoder or resolver.
4. Determine the zero reference as soon as the encoder zero or resolver zero is found.

Option 2: Move the push tube to the extended position

1. Extend the push tube until it reaches the limit switch in the extended position.
2. Retract the push tube until the reference switch detects the roller screw nut.
3. Start the search for the first zero of the encoder or resolver. Determine the zero reference as soon as the encoder zero or resolver zero is found.

7.3.2 Reference switch mounted externally on the machine

1. Make sure that the reference switch signal triggering zone is longer than the stroke that the actuator achieves with one motor revolution.
2. Use the zero reference options offered by the servoamplifier to answer all the questions.

NOTICE

There is not always a connection between the zero determined by the zero reference search and the zero position specified in the actuator drawing. It is very often the case that these two values refer to two different actuator positions.

7.4 Determining the behavior of the position control

Depending on which company the servoamplifier was manufactured by, tracking error failures or overspeed failures may result in the torque on the actuator motor being switched off. If the actuator is running at max. speed, the actuator will continue to rotate due to the kinetic energy of the internal rotating parts. It is likely that the actuator will impact the internal mechanical stopper or the mechanical stopper of the machine. This can lead to serious material damage.

To avoid this situation, the behavior of the position control must be checked.

If you have any questions about the determination methods available or special tools, please contact the servoamplifier manufacturer.

7.4.1 Principle of the determination method

The behavior of the position control is estimated by means of measurements performed with the servoamplifier's scope tool as the actuator moves forward and backward.

The scope tool makes it possible to view changes in the control variables as a function of time. For example, it is therefore possible to gain a visual representation of changes in the actuator speed and in the motor current as a function of time.

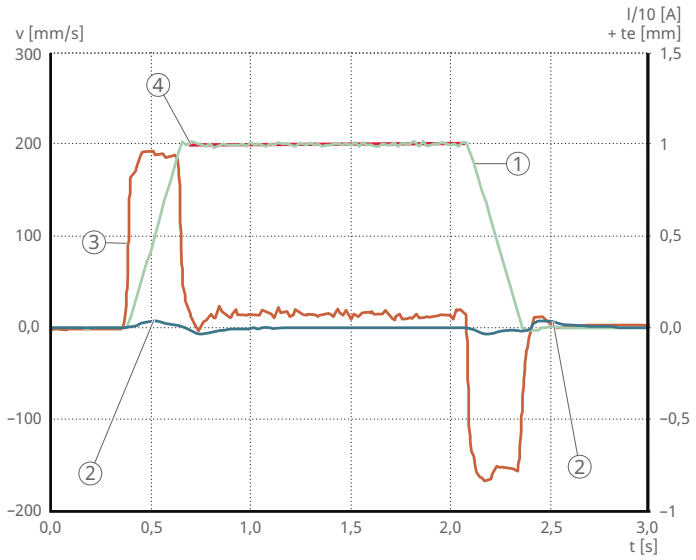
To be able to estimate the behavior of the position control, the speed setpoint, the actual speed, the tracking error failure and the motor current of the actuator need to be checked. Depending on the curves produced, it is possible to estimate, on a scale from no risk to very high risk, the risk of a tracking error failure or overspeed failure occurring.

7.4.2 Description of the determination method

1. Make sure that the actuator is ready for operation. The actuator must be installed in a machine and must be able to perform the work it is intended for.
2. Reduce the max. movement speed, together with the acceleration and deceleration speeds. Set the max. speed to $^1/_{10}$ of the maximum speed determined for this application. Set the acceleration and deceleration speeds to $^1/_{10}$ of the speeds specified for this application.
3. Start with a forward movement of the actuator and then a backward movement. At the same time, record the process using the scope tool.
4. Analyze the resulting diagram and compare it with the examples.
5. From this, you can determine the risk of occurrence of tracking error failures and overspeed failures.
6. If the risk is low, increase the speed, acceleration, and deceleration.
7. Perform another measurement with the scope tool during forward and backward movement of the actuator.
8. Reassess the risk of occurrence of a failure. If the risk remains low, repeat this step until the speed, acceleration and deceleration values specified for the application are reached.
9. If the risk increases, do not increase speed, acceleration, and deceleration any further.
10. Try to reduce the excess speed and the tracking error failure risk.

Example: Low risk of occurrence of overspeed or tracking error failures

11 Low risk of occurrence of overspeed or tracking error failures

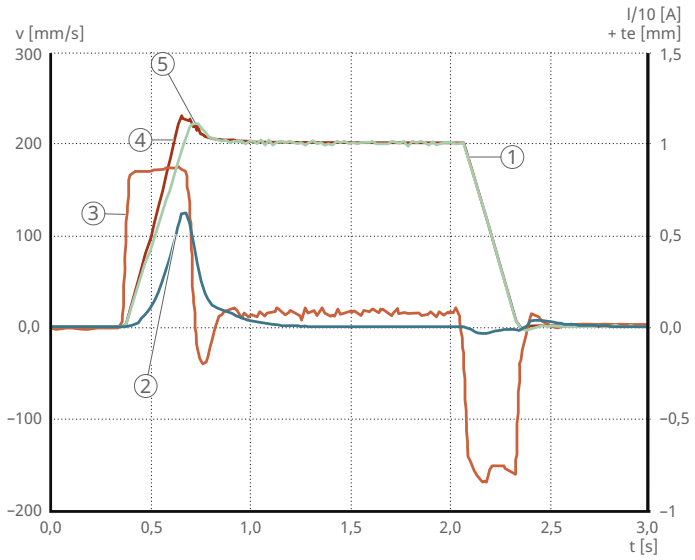


1	actual speed [mm/s]	2	tracking error (2.) [mm]
3	motor current/10 [A]	4	actual speed / speed setpoint (1.) [mm/s]
v	speed [mm/s]	t	time [s]
I/10 + te	motor current/10 [A] and tracking error [mm]		

1. In this example, there is no difference between the speed setpoint and the actual speed. If, for example, at 230 mm/s a level is identified that could lead to an overspeed failure, and if this graph remains the same during multiple forward-reverse movements, the risk of an overspeed failure is very low.
2. The risk of a tracking error failure is low at max. 40 µm If, for example at 0.7 mm a level is identified that could lead to a tracking error failure, and if this diagram remains the same during several forward-reverse movements, then the risk of a tracking error failure is very low.

Example: High risk of occurrence of overspeed or tracking error failures

12 High risk of occurrence of overspeed or tracking error failures



1	actual speed [mm/s]	2	tracking error (2.) [mm]
3	motor current/10 [A]	4	speed setpoint [mm/s]
5	speed overshot (1.) [mm/s]		
v	speed [mm/s]	t	time [s]
I/10 + te	motor current/10 [A] and tracking error [mm]		

1. In this example, there is a big difference between the speed setpoint and the actual speed, resulting in a speed overshoot phenomenon for the max. speed of almost 230 mm/s being necessary to reduce tracking error failures. If, for example, at 230 mm/s a level is identified that could lead to an overspeed failure, the risk of an overspeed failure is very high.
2. The risk of a tracking error failure is high at max. 0.6 mm If, for example, at 0.7 mm a level is identified that could lead to a tracking error failure, the risk of a tracking error failure is very high.

7.5 Information regarding position control parameters

Position control parameters determine not only the dynamics and rigidity of the position control, but also its stability.

In most cases, the parameter setup software and the technical documentation supplied with the servoamplifier allow the control parameter values for the circuit, speed circuit and position circuit to be calculated or evaluated. Generally, the parameters are adjusted so well that the actuator can perform the tasks required by the user without any problems. It is the responsibility of the user to verify that the use actually falls within the scope of their application. For more information, refer to the technical documentation provided by the servoamplifier manufacturer.

Position control that is too dynamic/rigid can cause vibration and instability of control, resulting in excessive noise and adversely affecting the service life of the system.

8 Troubleshooting

If the device malfunctions, it is often not obvious whether this is due to a mechanical or electrical problem.

In the event of certain failures, e. g. if the actuator does not move, the root cause could be mechanical, for example a blocked motor brake, or electrical in nature, for example a lack of electrical power in the servoamplifier. If a malfunction occurs, read through all possible causes to consider all possible remedies.

8.1 Mechanical malfunction

7 Mechanical malfunctions

Malfunction	Possible cause	Possible solution
Actuator does not move	Motor brake blocked	Check the brake connection and supply voltage.
	System moved by the actuator is blocked	Check the freedom of movement of the system moved by the actuator.
Actuator requires a lot of power and/or makes noises when it moves	Motor brake blocked	Check the brake connection and supply voltage.
	System moved by the actuator is blocked	Check the freedom of movement of the system moved by the actuator.
Actuator is too hot	Overload	Measure the effective torque value over a complete cycle (including the rest time before a new cycle is started). Send this information to Schaeffler for analysis.
	Ambient temperature is too high	Observe the permissible temperature range.

8.2 Electrical malfunction

8 Electrical malfunctions

Malfunction	Possible cause	Possible solution
Actuator does not move	Incorrect motor connection	Check the motor connections.
	Incorrect resolver connection	Check the motor connections.
	No current at the motor	Check the voltage and condition of the main switch and the fuses via the servoamplifier. Check that the servoamplifier allows the actuator movement and that the motor torque is applied.
	Incorrect determination of the actuator movement	Check that all motion parameters such as target position, speed and acceleration have been determined correctly in the servoamplifier.
	Servoamplifier failure	Read the technical documentation for the servoamplifier. Appropriate solutions are suggested based on the error numbers.

Malfunction	Possible cause	Possible solution
Actuator moves slightly, then stops immediately with a servoamplifier failure	Incorrect motor connection	Check the motor connections.
	Incorrect resolver connection	Check the motor connections.
	Servoamplifier failure	Read the technical documentation for the servoamplifier. Appropriate solutions are suggested based on the error numbers.
Actuator does not move in the correct direction	Incorrect motor connection or resolver connection or faulty servoamplifier parameters	Check the motor connections or change the direction of movement in the servoamplifier parameters.
Actuator vibrates in stop position	Position control parameters not adapted to the application	Optimize the determination of position control parameters in connection with the application.

9 Maintenance

9.1 Lubrication

For dynamic applications, check the operation of the actuator and the condition of its lubrication on a regular basis.

The following sections provide recommendations on the type, frequency and amount of grease to be used for actuator parts, that need to be relubricated regularly.

The lubrication instructions should be checked and adapted to the specific conditions of the application under the following conditions:

- Change in ambient temperature
- Change of speed, acceleration, load and cycle rate of a duty cycle
- Change to the actuator's heat dissipation

All surfaces of the actuator must be kept at a constant temperature of no more than +80 °C(+176 °F) .

If you have any questions, please contact Schaeffler for technical assistance.

9.1.1 Lubricant

For catalog and standard items beginning with serial number AR36860-xxxx or AR36870-xxxx, the following lubricants should be used:

9 Lubricant options

Lubricant	Viscosity	NLGI classification	Base oil	Soap
Klüberplex BEM34-132	130 cSt bei +40 °C 5.5 cSt bei +100 °C	2	Blended oil [1)]	Calcium complex soap

1) Blend of synthetic and mineral oil

NOTICE

Clean working

Excessive or contaminated lubricant generates heat inside the actuator.

- Do not use lubricant contaminated by other products or particles.
- Avoid introducing air bubbles into the lubrication paths.

9.1.2 Roller screw

The relubrication interval is every 4000 h (6 months) for duty cycle of less than 20 %. The relubrication interval depends on a number of parameters and can be adjusted on a case-by-case basis. LEMCs should be lubricated at least once a year.

The recommended lubricant quantity for each stroke length is given in cm^3.

For different work cycles (X %), the recommended lubrication interval is calculated as follows:
4000 · 20 % ÷ X %

It is better to apply the recommended quantity of lubricant in smaller quantities over the same period.

10 Lubricant quantity

	Stroke length							
	100 mm	**200 mm**	**300 mm**	**400 mm**	**500 mm**	**600 mm**	**700 mm**	**800 mm**
LEM-C21xx	7 cm^3	8 cm^3	9 cm^3	10 cm^3	11 cm^3	12 cm^3	NA	NA
LEM-C30xx	17 cm^3	18.5 cm^3	20 cm^3	21.5 cm^3	23 cm^3	24.5 cm^3	25 cm^3	27.5 cm^3

9.1.3 Front guide (option: anti-rotation device)

The recommended lubrication interval is every 4000 h (6 months) for duty cycles of less than 20 %. LEMCs should be lubricated at least once a year.

The recommended lubricant quantity is 2 cm^3.

For different work cycles (X %), the recommended lubrication interval is calculated as follows:
4000 · 20 % ÷ X %

9

9.1.4 Bearing assemblies

The bearing assemblies are lubricated for life.

9.1.5 Rod spherical plain bearing

The rod spherical plain bearing is maintenance-free and from the SAxxC series.

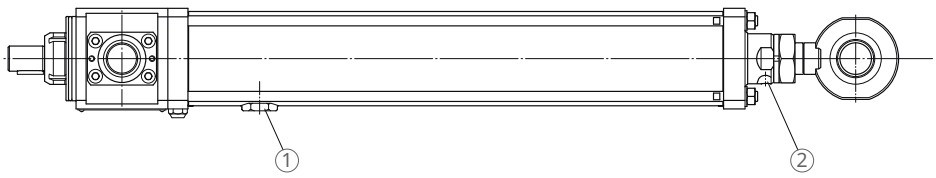
9.1.6 Process

1. Position the actuator in the lubrication position with a stroke of 0 mm.
2. Make sure that the radial hole at the end of the push tube is aligned with the relubrication port.
3. Remove the greasing plug to gain access to the grease nipple of the roller screw.
4. Apply half of the required quantity of lubricant through the grease nipple of the roller screw and the grease nipple of the front guide (anti-rotation option).
5. Slowly perform 10 double strokes over the entire stroke to distribute the lubricant along the screw shaft.
6. Repeat steps 2, 3, and 5.
7. Replace the greasing plug.
8. Monitor the temperature of the actuator to ensure that it does not overheat, especially when operating at high speed.

» The condition of the lubricant is visible and the quantity and interval for relubrication can be adjusted to the actual operating conditions (temperature, speed, load, etc.).

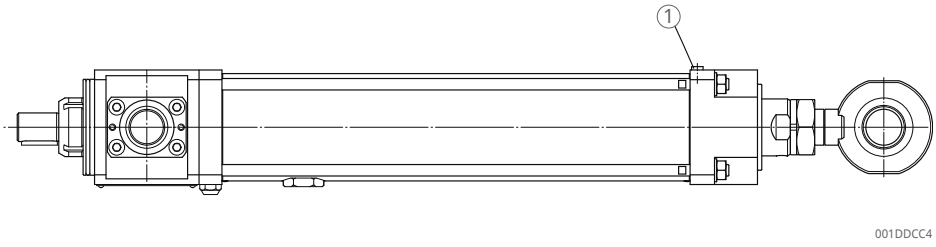
This is a closed system. When relubricating, the old lubricant takes up free space in the actuator. When the free space is filled, the actuator will overheat more quickly.

13 Alignment of relubrication port and radial hole (end of push tube)



1	Relubrication port	2	Radial hole

14 Grease nipple of the front guide



1	Grease nipple of the front guide		

9.2 Inspecting the toothed belts

If the actuator is equipped with a pulley system, perform a visual inspection of the toothed belts during regular maintenance work.

The surfaces of the toothed belt must not show any signs of damage.

10 Disposal

Observe the local regulations for disposal.

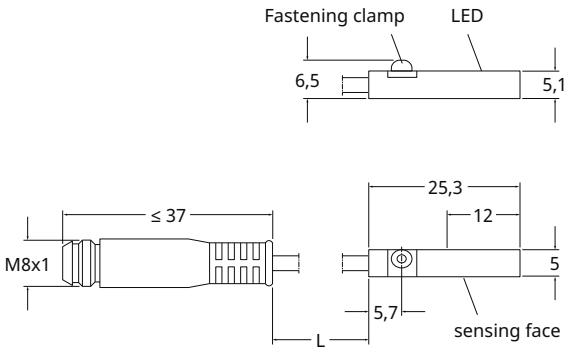
11 Technical data

11.1 Technical information for MK5155 Actuator Sensor with AMR Cell

11 Technical data MK5155

Technical information	
Actuator sensor with AMR cell	
Plastic housing for T-groove actuators	
Cable with plug	
Can be flush-mounted	
Magnetic sensitivity	2.0 mT
Mean sliding speed	> 10 m/s
Electrical specifications	
Technology	DC PNP
Supply voltage	DC 10 V ... DC 30 V
Current consumption	< 10 mA
Protection class	III
Reverse polarity protection	available
Switch-on delay	< 30 ms
outputs	
Type	opener
Voltage drop	< 2.5 V
Rated current	100 mA
Short-circuit protection	available
Overload protection	available
Switching frequency	6000 Hz
Range	
Magnetic sensitivity	2.0 mT
Travel speed	> 10 ms
Accuracy and deviation	
Hysteresis	1.0 mm
Reproducibility	< 0.2 mm
Environment	
Ambient temperature	–25 °C ... +85 °C
Degree of protection	IP65 / IP67

15 MK5155 actuator Sensor with AMR Cell

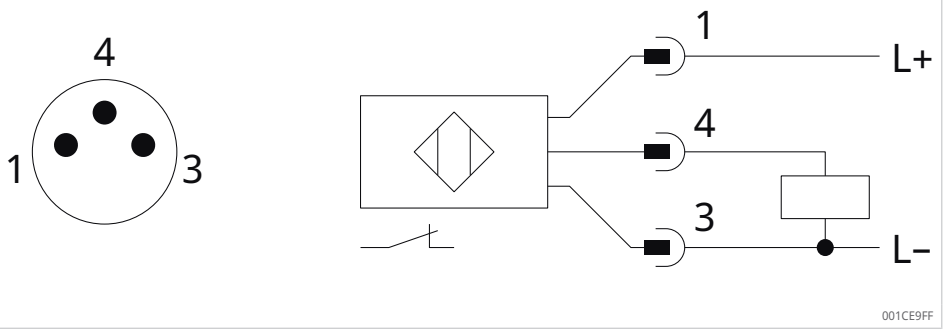


11.2 Certifications for MK5155 Actuator Sensor with AMR Cell

12 Certifications MK5155

Certifications		
EMC	EN 61000-4-2 ESD	-CD / 8 kV AD
	EN 61000-4-3 HF radiated	10 V/m (80 MHz ... 2000 MHz)
	EN 61000-4-4 bursts	2 kV
	EN 61000-4-6 HF conducted	10 V (0.15 MHz ... 80 MHz)
	EN 55011	Class B
MTTF	2076 a	
Mechanical data		
Assembly	Flush mountable	
Housing materials: Housing	PA (polyamide); Mounting bracket: Stainless steel	
Mass	0.012 kg	
Displays/operating elements		
LED to display output status	yellow	
Electrical connection		
Cable	PUR cable / 0.3 m with M8 plug (snap-on type)	
Accessories		
Scope of delivery	Rubber placeholder: cable clip	
Further information		
Comments	cULus: class 2 source required Clamping screw with combined slot / hexagon head AF 1.5	
Quantity per pack	1	

16 MK5155 Actuator Sensor with AMR Cell

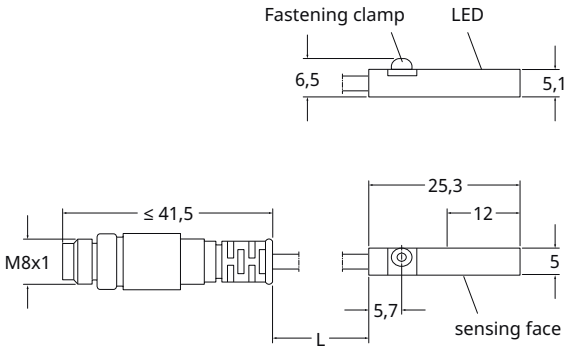


11.3 Technical information for MK5159 Actuator Sensor with AMR Cell

13 Technical data MK5159

Technical information	
Actuator sensor with AMR cell	
Plastic housing for T-groove actuators	
Cable with plug	
Can be flush-mounted	
Magnetic sensitivity	2.0 mT
Mean sliding speed	> 10 m/s
Electrical specifications	
Technology	DC PNP
Supply voltage	DC 10 V ... DC 30 V
Current consumption	< 10 mA
Protection class	III
Reverse polarity protection	available
Switch-on delay	< 30 m/s
Outputs	
Type	closer
Voltage drop	< 2.5 V
Rated current	100 mA
Short-circuit protection	available
Overload protection	available
Switching frequency	6000 Hz
Range	
Magnetic sensitivity	2.0 mT
Travel speed	> 10 m/s
Accuracy and deviation	
Hysteresis	1.0 mm
Reproducibility	< 0.2 mm
Environment	
Ambient temperature	–25 °C ... +85 °C
Degree of protection	IP65 / IP67

17 MK5159 Actuator Sensor with AMR Cell

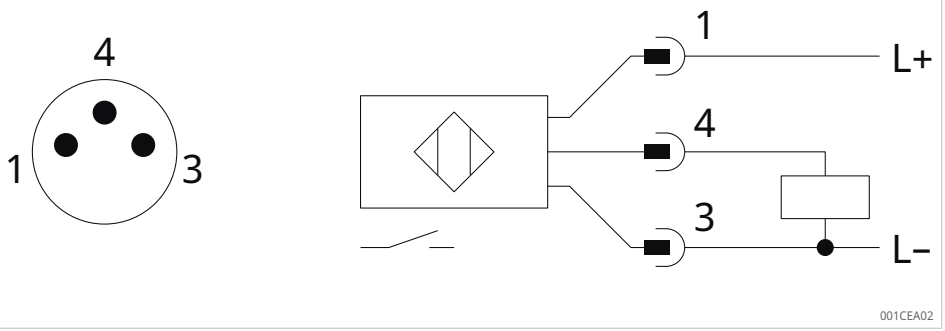


11.4 Certifications for MK5159 Actuator Sensor with AMR Cell

14 Certifications MK5159

Certifications		
EMC	EN 61000-4-2 ESD	-CD / 8 kV AD
	EN 61000-4-3 HF radiated	10 V/m (80 MHz ... 2000 MHz)
	EN 61000-4-4 bursts	2 kV
	EN 61000-4-6 HF conducted	10 V (0.15 MHz ... 80 MHz)
	EN 55011	Class B
MTTF	2064 a	
Mechanical data		
Assembly	flush mountable	
Housing materials: Housing	PA (polyamide); Mounting bracket: Stainless steel	
Mass	0.015 kg	
Displays and operating elements		
LED to display output status	yellow	
Electrical connection		
Cable	PUR cable / 0.3 m; with M8 plug (with rotating union nut)	
Accessories		
Scope of delivery	Rubber placeholder: cable clip	
Further information		
Comments	cULus: class 2 source required Clamping screw with combined slot/hexagon head AF 1.5	
Quantity per pack	1	

18 MK5159 Actuator Sensor with AMR Cell

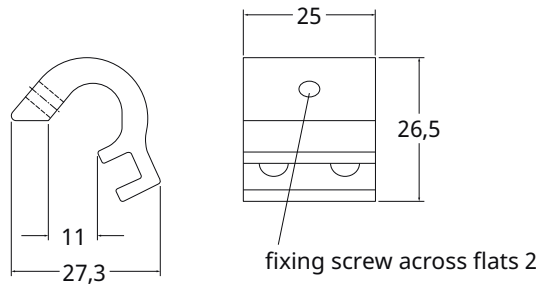


11.5 Technical data for E12231 Linkage/Sensor Mounting

15 Technical data E12231

Product characteristics	
Sensor mounting for type MKT	
Mechanical data	
Design	For MKT versions (T-groove actuator sensors)
Bracket material	Aluminum; screws: stainless steel
Fixing diameter	5 mm ... 11 mm
Mass	0.017 kg
Further information	
Quantity per pack	1

19 E12231 Linkage/Sensor Mounting



11.6 Inline motor interface tightening torques M_A

16 Inline motor interface tightening torques M_A

LEMC	Interface	S1 motor		S2 coupling	
		Screw	M_A	Screw	M_A
–	–	–	Nm	–	Nm
21	L1019110L	M8×20	25	M6	10
21	L1024110L	M8×20	25	M6	10
30	L1019110L	M8×20	25	M6	10
30	L1024110L	M8×20	25	M6	10
30	L1024130L	M10×30	49	M8	25
30	L1028130L	M10×30	49	M8	25
30	L1032130L	M10×30	49	M8	25

11.7 Parallel configuration of tightening torques M_A

17 Parallel configuration of tightening torques M_A

LEMC	Interface	S1 Rear cover		S2 motor	
		Screw	M_A	Screw	M_A
–	–	–	Nm	–	Nm
21	Pxx19110L	M5×50	6	M8×20	25
21	Pxx24110L	M5×50	6	M8×20	25
30	Pxx19110L	M5×50	6	M8×20	25
30	Pxx19110H	M5×50	6	M8×20	25
30	Pxx24110L	M5×50	6	M8×20	25
30	Pxx24110H	M5×50	6	M8×20	25
30	Pxx24130L	M5×50	6	M10×25	49
30	Pxx24130H	M5×50	6	M10×25	49
30	Pxx28130L	M5×50	6	M10×25	49
30	Pxx28130H	M5×50	6	M10×25	49
30	Pxx32130L	M5×50	6	M10×25	49
30	Pxx32130H	M5×50	6	M10×25	49

11

11.8 Parallel motor interface taper lock

18 Parallel motor interface taper lock

LEMC	Interface	Motor brand	Motor X1	Taper lock	S3 (from Taper lock)	
					No.	M_A
–	–	–	mm	–	–	Nm
21	P1019110L	Lenze / MCS12	+2.9	1610 D19	2	20
		Kollmorgen / AKM5x	+2.9	1610 D19	2	20
21	P1024110L	Siemens / 1FK706	−7.1	1610 D24	2	20
		Parker / NX6	−7.1	1610 D24	2	20
		Kollmorgen / AKM5x	−7.1	1610 D24	2	20
		Rockwell – AB / MPL-A/B45x	−7.1	1610 D24	2	20
21	P1519110L	Lenze / MCS12	+2.9	1108 D19	2	5.5
		Kollmorgen / AKM5x	+2.9	1108 D19	2	5.5
21	P1524110L	Siemens / 1FK706	−7.1	1108 D24	2	5.5
		Parker / NX6	−7.1	1108 D24	2	5.5
		Kollmorgen / AKM5x	−7.1	1108 D24	2	5.5
		Rockwell – AB / MPL-A/B45x	−7.1	1108 D24	2	5.5
21	P2019110L	Lenze / MCS12	+5.3	1008 D19	2	5.5
		Kollmorgen / AKM5x	+5.3	1008 D19	2	5.5
21	P2024110L	Siemens / 1FK706	−4.7	1008 D24 [1)]	2	5.5
		Parker / NX6	−4.7	1008 D24 [1)]	2	5.5
		Kollmorgen / AKM5x	−4.7	1008 D24 [1)]	2	5.5
		Rockwell – AB / MPL-A/B45x	−4.7	1008 D24 [1)]	2	5.5
30	P1019110L	Lenze / MCS12	0	1610 D19	2	20
		Kollmorgen / AKM5x	0	1610 D19	2	20
30	P1024110L	Siemens / 1FK706	−10	1610 D24	2	20
		Parker / NX6	−10	1610 D24	2	20
		Kollmorgen / AKM5x	−10	1610 D24	2	20
		Rockwell – AB / MPL-A/B45x	−10	1610 D24	2	20
30	P1024130L	Lenze / MCS14	−7	1610 D24	2	20
		Kollmorgen / AKM6x	−7	1610 D24	2	20
30	P1024130H	Lenze / MCS14	−7	1610 D24	2	20
		Kollmorgen / AKM6x	−7	1610 D24	2	20
30	P1028130L	Rockwell – AB / MPL-A/B52x	−12	1610 D28	2	20
	P1028130H	Rockwell – AB / MPL-A/B52x & 45x & 56x	−12	1610 D28	2	20

LEMC	Interface	Motor brand	Motor X1	Taper lock	S3 (from Taper lock)	
					No.	M_A
–	–	–	mm	–	–	Nm
30	P1032130L	Siemens / 1FK708	−15	1610 D32	2	20
		Parker / NX8	−15	1610 D32	2	20
		Kollmorgen / AKM6x	−15	1610 D32	2	20
30	P1032130H	Siemens / 1FK708	−15	1610 D32	2	20
		Parker / NX8	−15	1610 D32	2	20
		Kollmorgen / AKM6x	−15	1610 D32	2	20
30	P1519110L	Lenze / MCS12	0	1610 D19	2	20
		Kollmorgen / AKM5x	0	1610 D19	2	20
30	P1524110L	Siemens / 1FK706	−10	1610 D24	2	20
		Parker / NX6	−10	1610 D24	2	20
		Kollmorgen / AKM5x	−10	1610 D24	2	20
		Rockwell – AB / MPL-A/B45x	−10	1610 D24	2	20
30	P1524130H	Lenze / MCS14	0	1610 D24	2	20
		Kollmorgen / AKM6x	0	1610 D24	2	20
30	P1528130H	Rockwell – AB / MPL-A/B52x & 45x & 56x	−5	1610 D28	2	20
30	P1532130H	Siemens / 1FK708	−8	1610 D32	2	20
		Parker / NX8	−8	1610 D32	2	20
		Kollmorgen / AKM6x	−8	1610 D32	2	20
30	P2019110L	Lenze / MCS12	0	1108 D19	2	5.5
		Kollmorgen / AKM5x	0	1108 D19	2	5.5
30	P2019110H	Lenze / MCS12	+7	1610 D19	2	20
		Kollmorgen / AKM5x	+7	1610 D19	2	20
30	P2024110L	Siemens / 1FK706	−10	1108 D24	2	5.5
		Parker / NX6	−10	1108 D24	2	5.5
		Kollmorgen / AKM5x	−10	1108 D24	2	5.5
		Rockwell – AB / MPL-A/B45x	−10	1108 D24	2	5.5
30	P2024110H	Siemens / 1FK706	−3	1610 D24	2	20
		Parker / NX6	−3	1610 D24	2	20
		Kollmorgen / AKM5x	−3	1610 D24	2	20
		Rockwell – AB / MPL-A/B45x	−3	1610 D24	2	20
30	P2024130H	Lenze / MCS14	0	1610 D24	2	20
		Kollmorgen / AKM6x	0	1610 D24	2	20
30	P2028130H	Rockwell – AB / MPL-A/B52x & 45x & 56x	−5	1610 D28	2	20
30	P2032130H	Siemens / 1FK708	−8	1610 D32	2	20
		Parker / NX8	−8	1610 D32	2	20
		Kollmorgen / AKM6x	−8	1610 D32	2	20

[1] Taper lock with reduced key

11.9 SER-SIT taper lock bushing

19 SER-SIT taper lock bushing

Type [1]	Bore diameter	Bushing		Screws				
		Length	max. diameter	Quantity	Thread	Length	Width across flats	M_A
mm (inch)	mm inch	mm	mm	–	–	mm	–	Nm
1008	9, 10, 11, 12, 14, 15, 16, 18, 19, 20, 22, 24 [2) 3)], 25 [2) 3)]	22.3	35	2	1/4	13	3	5.5
(25.20)	3/8, 1/2, 5/8, 3/4, 7/8, 1 [2) 3)]							
1108	9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 22, 24, 25, 26, 27 [3)], 28 [2) 3)]	22.3	38	2	1/4	13	3	5.5
(28.20)	3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/8 [3)]							
1210	11, 12, 14, 15, 16, 18, 19, 20, 22, 24, 25, 26, 28, 30 [3)], 32 [3)]	25.4	47	2	3/8	16	5	20
(28.20)	1/2, 5/8, 3/4, 7/8, 1, 1 1/8, 1 1/4 [3)], 1 1/2 [3)]							
1215	11, 12, 14, 15, 16, 18, 19, 20, 22, 24, 25, 26, 28, 30 [3)], 32 [3)]	38.1	47	2	3/8	16	5	20
(30.40)	1/2, 5/8, 3/4, 7/8, 1, 1 1/8, 1 1/4 [3)]							
1310	12, 14, 15, 16, 18, 19, 20, 22, 24, 25, 28, 30, 32, 35 [2) 3)]	25.4	52	2	3/8	16	5	20
(35.25)	1/2, 5/8, 3/4, 7/8, 1, 1 1/8, 1 1/4, 1 3/8 [3)]							
1610	12, 14, 15, 16, 18, 19, 20, 22, 24, 25, 26, 28, 30, 32, 35, 38, 40 [3)], 42 [3)]	25.4	57	2	3/8	16	5	20
(40.25)	3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/8, 1 1/4, 1 3/8, 1 1/2, 1 5/8 [3)]							
1615	12, 14, 15, 16, 18, 19, 20, 22, 24, 25, 28, 30, 32, 35, 38, 40 [3)], 42 [2) 3)]	38.1	57	2	3/8	16	5	20
(40.40)	1/2, 5/8, 3/4, 7/8, 1, 1 1/8, 1 1/4, 1 3/8, 1 1/2, 1 5/8 [2) 3)], 1 3/4 [2) 3)]							
2012	14, 15, 16, 18, 19, 20, 22, 24, 25, 26, 28, 30, 32, 35, 38, 40, 42, 45, 48, 50 [3)]	31.8	70	2	7/16	22	5	30
(50.30)	5/8, 3/4, 7/8, 1, 1 1/8, 1 1/4, 1 3/8, 1 1/2, 1 5/8, 1 3/4, 1 7/8, 2 [3)]							
2517	16, 18, 19, 20, 22, 24, 25, 28, 30, 32, 35, 38, 40, 42, 45, 48, 50, 55, 60, 65 [2) 3)]	44.5	85	2	1/2	25	6	50
(65.45)	3/4, 7/8, 1, 1 1/8, 1 1/4, 1 3/8, 1 1/2, 1 5/8, 1 3/4, 1 7/8, 2, 2 1/8, 2 1/4, 2 3/8, 2 1/2							
3020	22, 25, 28, 30, 32, 35, 38, 40, 42, 45, 48, 50, 55, 57, 60, 65, 70, 75 [3)]	50.8	108	2	5/8	32	8	90
(75.50)	1 1/4, 1 3/8, 1 1/2, 1 5/8, 1 3/4, 1 7/8, 2, 2 1/8, 2 1/4, 2 3/8, 2 1/2, 2 5/8, 2 3/4, 2 7/8 [3)], 3 [3)]							
3030	25, 28, 30, 32, 35, 38, 40, 42, 45, 47, 48, 50, 55, 60, 65, 70, 75 [3)]							
(75.75)	1 1/4, 1 3/8, 1 1/2, 1 5/8, 1 3/4, 1 7/8, 2, 2 1/8, 2 1/4, 2 3/8, 2 1/2, 2 5/8, 2 3/4, 2 7/8 [3)], 3 [3)]							
3535	25, 28, 30, 32, 35, 38, 40, 42, 45, 48, 50, 55, 60, 65, 70, 75, 80, 85, 90	88.9	127	3	1/2	38	10	115
(90.90)	1 1/2, 1 5/8, 1 3/4, 1 7/8, 2, 2 1/8, 2 1/4, 2 3/8, 2 1/2, 2 5/8, 2 3/4, 2 7/8, 3, 3 1/8, 3 1/4, 3 3/8, 3 1/2 [2)]							

Type [1]	Bore diameter	Bushing		Screws				
		Length	max. diameter	Quantity	Thread	Length	Width across flats	M_A
mm (inch)	mm inch	mm	mm	–	–	mm	–	Nm
4040	40, 42, 45, 48, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100	101.6	146	3	$^5/_8$	44	14	170
(100.100)	$1\ ^3/_4$, 2, $2\ ^1/_2$, $2\ ^3/_4$, $3\ ^1/_2$, $3\ ^3/_4$ [2], 4 [2]							
4545	55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110	114.3	162	3	$^3/_4$	51	14	195
(115.115)	3, $3\ ^1/_2$, 4							
5050	50, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125	127	178	3	$^7/_8$	57	17	275
(125.125)	$3\ ^1/_2$, 4							

1) The first pair of numbers indicates the max. bore diameter, the second the nominal length.

2) Reduced key size

3) Clamping bush is made of steel

12 Replacement parts

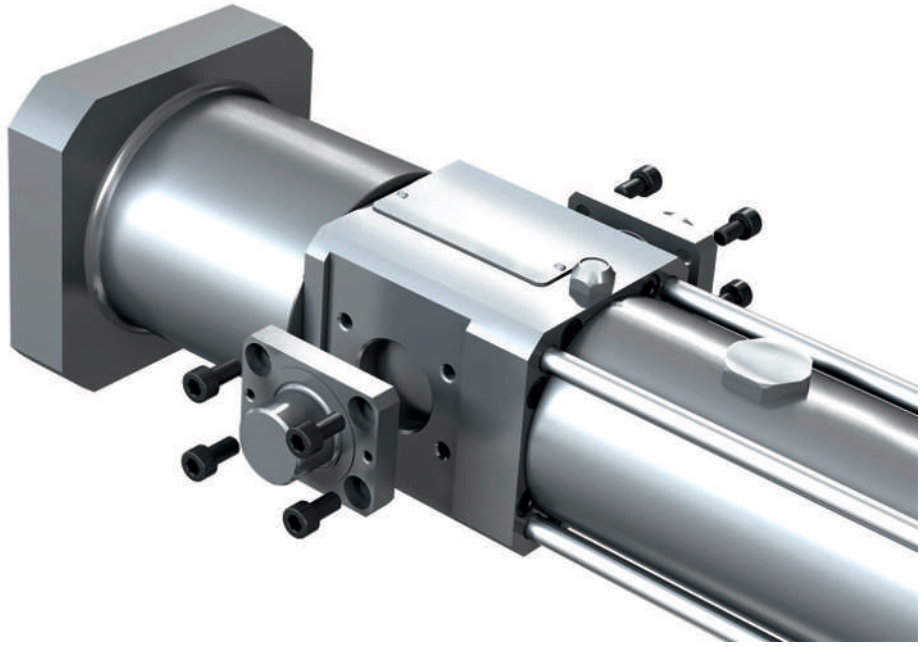
20 Replacement parts

Designation	Description	Order number
LEMC reference switch kit	Reference switch + sensor holder	116 4927
LEMC limit switch kit	Limit switch + sensor bracket	116 4926
LEMC-21 rod spherical plain bearing adapter kit	SA25C rod spherical plain bearing + adapter for mounting on the push tube	116 6528
LEMC-30 rod spherical plain bearing adapter kit	SA30C rod spherical plain bearing + adapter for mounting on the push tube	116 4795
LEMC-21 push tube external thread adapter kit	Thread reducing fitting + adapter for mounting on the push tube	116 6530
LEMC-30 push tube external thread adapter kit	Thread reducing fitting + adapter for mounting on the push tube	116 6531
LEMC-21 trunnion mounting kit	Trunnion mount pair + screws	116 6532
LEMC-30 trunnion mounting kit	Trunnion mount pair + screws	116 6533
LEMC-21 front plate mounting kit	Front plate + screws	116 6534
LEMC-30 front plate mounting kit	Front plate + screws	116 6535

21 Screws and tightening torques

LEMC	S1 trunnion mount		S2 front plate	
	Screw	M_A	Screw	M_A
	-	Nm	-	Nm
21	(8 ×) M6×12	16.4	(8 ×) M6×16	16.4
30	(8 ×) M8×16	40	(8 ×) M8×20	40

20 Trunnion mount screws



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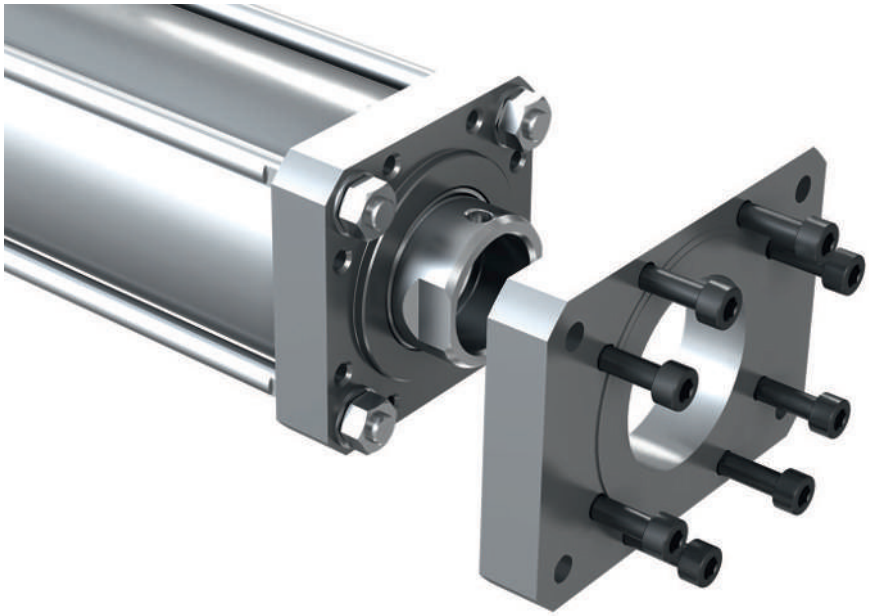
21 Front plate screws



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