auma®
Solutions for a world in motion

Multi-turn actuators

TIGRON

TR-M30X – TR-M1000X

TR-MR30X – TR-MR1000X

Operation instructions

Assembly and commissioning

Read operation instructions first.

- Observe safety instructions.
- These operation instructions are part of the product.
- Store operation instructions during product life.
- Pass on instructions to any subsequent user or owner of the product.

Target group:

This document contains information for assembly, commissioning and maintenance staff.

Table of contents

1. Safety instructions

1.1. Prerequisites for the safe handling of the product

Standards/directives

The end user or the contractor must ensure that all legal requirements, directives, guidelines, national regulations and recommendations with respect to assembly, electrical connection, commissioning and operation are met at the place of installation.

They include among others standards and directives such as IEC 60079 “Explosive atmospheres".

- Part 14: Electrical installations design, selection and erection.
- Part 17: Electrical installations inspection and maintenance.

Safety instructions/ warnings

All personnel working with this device must be familiar with the safety and warning instructions in this manual and observe the instructions given. Safety instructions and warning signs on the device must be observed to avoid personal injury or property damage.

Qualification of staff

Assembly, electrical connection, commissioning, operation, and maintenance must be carried out by suitably qualified personnel authorised by the end user or contractor of the plant only.

Prior to working on this product, the staff must have thoroughly read and understood these instructions and, furthermore, know and observe officially recognised rules regarding occupational health and safety.

Work performed in potentially explosive atmospheres is subject to special regulations which have to be observed. The end user or contractor of the plant is responsible for respect and control of these regulations, standards, and laws.

Electrostatic charging

Highly efficient charge generating processes (processes more efficient than manual friction) on the device surface must be excluded at any time, since they will lead to propagating brush discharges and therefore to ignition of a potentially explosive atmosphere.

This also applies to fireproof coatings or covers available as an option.

Ignition dangers

Gearboxes were subjected to an ignition hazard assessment in compliance with the currently applicable standard according to ISO 80079-36/ -37. Hot surfaces, mechanically generated sparks as well as static electricity and stray electric currents were identified and assessed as major potential ignition sources. Protective measures to prevent the likelihood that ignition sources arise were applied to the gearboxes. This includes in particular lubrication of the gearbox, the IP protection codes and the warnings and notes contained in these operation instructions.

Commissioning

Prior to commissioning, imperatively check that all settings meet the requirements of the application. Incorrect settings might present a danger to the application, e.g. cause damage to the valve or the installation. The manufacturer will not be held liable for any consequential damage. Such risk lies entirely with the user.

Operation

Prerequisites for safe and smooth operation:

- Correct transport, proper storage, mounting and installation, as well as careful commissioning.
- Only operate the device if it is in perfect condition while observing these instructions.
- Immediately report any faults and damage and allow for corrective measures.
- Observe recognised rules for occupational health and safety.
- Observe national regulations.
- During operation, the housing warms up and surface temperatures > 60 °C may occur. To prevent possible burns, we recommend checking the surface temperature prior to working on the device using an appropriate thermometer and wearing protective gloves.

Protective measures

The end user or the contractor are responsible for implementing required protective measures on site, such as enclosures, barriers, or personal protective equipment for the staff.

Maintenance

To ensure safe device operation, the maintenance instructions included in this manual must be observed.

Any device modification requires prior written consent of the manufacturer.

1.2. Range of application

AUMA multi-turn actuators TR-M30X – TR-M1000X / TR-MR30X – TR-MR1000X are designed for the operation of industrial valves, e.g. globe valves, gate valves, butterfly valves, and ball valves.

The devices described below are approved for use in the potentially explosive atmospheres of zones 1, 2, 21, and 22.

If temperatures >40 °C are to be expected at the valve flange or the valve stem (e.g. due to hot media), please consult AUMA.

Other applications require explicit (written) confirmation by the manufacturer.

The following applications are not permitted, e.g.:

- Industrial trucks according to EN ISO 3691
- Lifting appliances according to EN 14502
- Passenger lifts according to DIN 15306 and 15309
- Service lifts according to EN 81-1/A1
- Escalators
- Continuous duty
- Buried service
- Continuous underwater use (observe enclosure protection)
- Potentially explosive areas of zones 0 and 20
- Potentially explosive areas of group I (mining)
- Radiation exposed areas in nuclear power plants

No liability can be assumed for inappropriate or unintended use.

Observance of these operation instructions is considered as part of the device's designated use.

These operation instructions are only valid for the “clockwise closing” standard version, i.e. driven shaft turns clockwise to close the valve. For “counterclockwise closing” version, a supplement must be observed in addition to these operation instructions.

Specific conditions of use

The particular conditions of use are listed on the certificates supplied. Among others, this includes the following conditions:

- Refer to page 5, Electrostatic charging for further references to minimise the risk of electrostatic charging within a potentially explosive atmosphere.
- For information regarding the dimensions of the flameproof joints, contact the manufacturer.
- Special fasteners according to IEC 60079-0 to seal flameproof enclosures must have the following strength classes:
  - Minimum A*-70 for screws for fixing electrical connections
  - Minimum A*-80 for all other screws
- For fixing the screws, please also refer to page 69, Tightening torques for screws.
- After tripping of the thermal motor protection (TMS), an acknowledgement (RESET) of the thermal fault is required.

1.3. Warnings and notes

The following warnings draw special attention to safety-relevant procedures in these operation instructions, each marked by the appropriate signal word (DANGER, WARNING, CAUTION, NOTICE).

DANGER	**Indicates an imminently hazardous situation with a high level of risk. Failure to observe this warning results in death or serious injury.**
WARNING	**Indicates a potentially hazardous situation with a medium level of risk. Failure to observe this warning could result in death or serious injury.**
CAUTION	**Indicates a potentially hazardous situation with a low level of risk. Failure to observe this warning could result in minor or moderate injury. May also be used with property damage.**
NOTICE	**Potentially hazardous situation. Failure to observe this warning could result in property damage. Is not used for personal injury.**

Safety alert symbol ⚠ warns of a potential personal injury hazard.

The signal word (here: DANGER) indicates the level of hazard.

1.4. References and symbols

The following references and symbols are used in these instructions:

Information The term **Information** preceding the text indicates important notes and information.

Symbol for CLOSED (valve closed)

Symbol for OPEN (valve open)

➥ **Result of a process step**

Describes the result of a preceding process step.

2. Short description

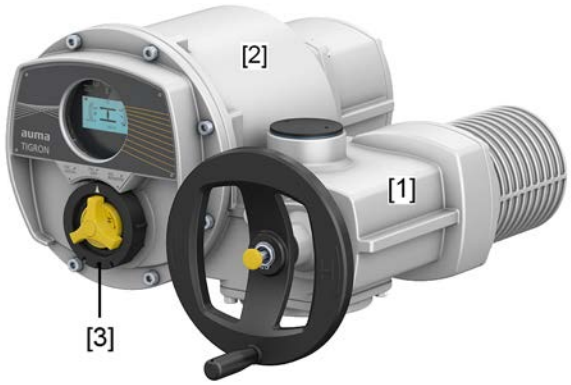
Multi-turn actuator

Definition in compliance with EN 15714-2/EN ISO 5210:

A multi-turn actuator is an actuator which transmits torque to a valve for at least one full revolution.

AUMA multi-turn actuator

Figure 1: AUMA multi-turn actuator TR-M120X



[1] Multi-turn actuator with motor and handwheel

[2] Control with local controls

[3] Combi-Switch: Selector switch/shuttle dial

AUMA multi-turn actuators TR-M30X – TR-M1000X / TR-MR30X – TR-MR1000X are driven by an electric motor. A handwheel is available for setting and emergency operation.

For control in motor operation and for processing the actuator signals, integral controls are provided.

The actuator may be locally operated and parameter settings performed at local controls using the Combi-Switch. The Combi-Switch consists of two elements, ab outer black selector switch and an inner yellow shuttle dial. The display shows information on the actuator as well as the menu settings.

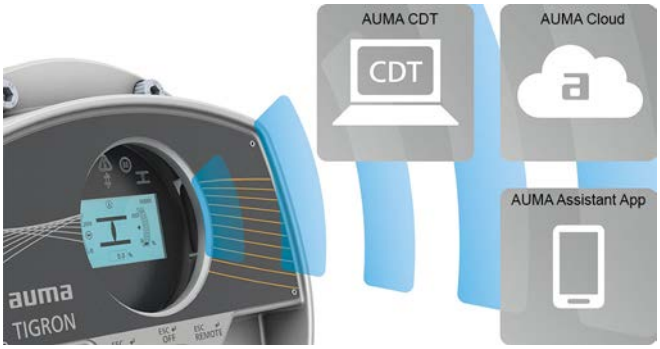
Switching off in end positions may be either by limit or torque seating.

In combination with output drive type A, the actuator is capable of withstanding thrust.

App and software

Using the **AUMA CDT** software for Windows-based computers (notebooks or tablets) and the **AUMA Assistant App**, actuator data can be uploaded and read, settings can be modified and stored. The connection between computer and AUMA actuator is established wireless via Bluetooth interface. With the **AUMA Cloud**, we provide an interactive platform to collect and assess e.g. detailed device data of all actuators within a plant.

Figure 2: Communication via Bluetooth



AUMA CDT

AUMA CDT is a user-friendly setting and operation program for AUMA actuators.

Connection between computer (notebook, tablet) and actuator is wireless via Bluetooth interface.

AUMA CDT software can be downloaded free of charge from our website www.auma.com.

AUMA Cloud

The AUMA Cloud is the driving element of the digital AUMA world, acting as interactive platform for efficient maintenance of AUMA actuators at moderate cost. The AUMA Cloud collects all device data of all actuators within one site and provides a clear overview at a glance. Detailed analysis provides valuable information on potential maintenance requirements. Additional functions foster smooth asset management.

AUMA Assistant App

The AUMA Assistant App enables remote setting and remote diagnostics of AUMA actuators via Bluetooth using either smartphone or tablet.

The AUMA Assistant App can be downloaded free of charge from the Play Store (Android) or App Store (iOS).

Figure 3: Link to AUMA Assistant App

3. Name plate

Figure 4: Name plate (example)

[1] Manufacturer name and address (manufacturer logo: auma)
[2] Type designation
[3] Order number
[4] Actuator serial number
[5] Speed
[6] Torque range in direction CLOSE
[7] Torque range in direction OPEN
[8] Type of lubricant and enclosure protection
[9] Permissible ambient temperature
[10] Current type, mains voltage, mains frequency
[11] Nominal power and power factor cos φ
[12] Rated current
[13] Type of duty
[14] Motor protection (temperature protection)
[15] Insulation class
[16] Terminal plan and wiring diagram
[17] Control
[18] Can be assigned as an option upon customer request
[19] Weight, Data Matrix code

Marking for explosion-proof version:

[20] CE marking (CE), ID number of test authority, Ex symbol
[21] Equipment group, category
[22] Internal marking
[23] Ex certificates (numbers)
[24] Gas explosion protection
[25] Dust explosion protection
[26] Threads for cable entries at electrical connection

Descriptions referring to name plate indications

Type designation

Table 1:

Description of type designation (with the example of TIGRON TR-M250X-F10)					
TIGRON	TR	-M	250X	-F10	
TIGRON					Product name
	TR				Type (short designation **TIG**RON)
		M			Type of movement: Multi-turn actuator Type TR-**M** = Multi-turn actuators for open-close duty Type TR-**MR** = Multi-turn actuators for modulating duty
			250X		Size (≙ max. torque in Nm) These instructions apply to sizes 30, 60, 120, 250, 500, 1000 X = Version in explosion protection
				F10	Flange size

Order number

The product can be identified using this number and the technical data as well as order-related data pertaining to the device can be requested.

Please always state this number for any product inquiries.

On the Internet at **http://www.auma.com** > Service & Support >myAUMA, we offer a service allowing authorised users to download order-related documents such as wiring diagrams and technical data (both in German and English), inspection certificate and the operation instructions when entering the order number.

Actuator serial number

Table 2:

Description of serial number (example of 0520MD12345)			
05	20	MD12345	
05			Positions 1+2: Assembly in week = week 05
	20		Positions 3+4: Year of manufacture = 2020
		MD12345	Internal number for unambiguous product identification

Control

Table 3:

Control examples (indications on actuator controls name plate)	
Input signal	Description
24/48/60 V DC	Control voltage 24/48/60 V DC for OPEN-CLOSE control via digital inputs (OPEN, STOP, CLOSE)
100 – 125 V DC	Control voltage 100 – 125 V DC for OPEN-CLOSE control via digital inputs (OPEN, STOP, CLOSE)
100 – 120 V AC	Control voltage 100 – 120 V AC for OPEN-CLOSE control via digital inputs (OPEN, STOP, CLOSE)
0/4 – 20 mA	Input current for setpoint control via analogue input

Data Matrix code

When registered as authorised user, you may use our **AUMA Assistant App** to scan the Data Matrix code and directly access the order-related product documents without having to enter order number or serial number.

Figure 5: Link to AUMA Assistant App:

For further Service & Support, Software/Apps/... refer to www.auma.com

4. Transport and storage

4.1. Transport

For transport to place of installation, use sturdy packaging.

DANGER

Suspended load!

Death or serious injury.

→ Do NOT stand below suspended load.

→ Attach ropes or hooks for the purpose of lifting by hoist only to housing and NOT to handwheel.

→ Actuators mounted on valves: Attach ropes or hooks for the purpose of lifting by hoist to valve and NOT to actuator.

→ Actuators mounted to gearboxes: Attach ropes or hooks for the purpose of lifting by hoist only to the gearbox using eyebolts and NOT to the actuator.

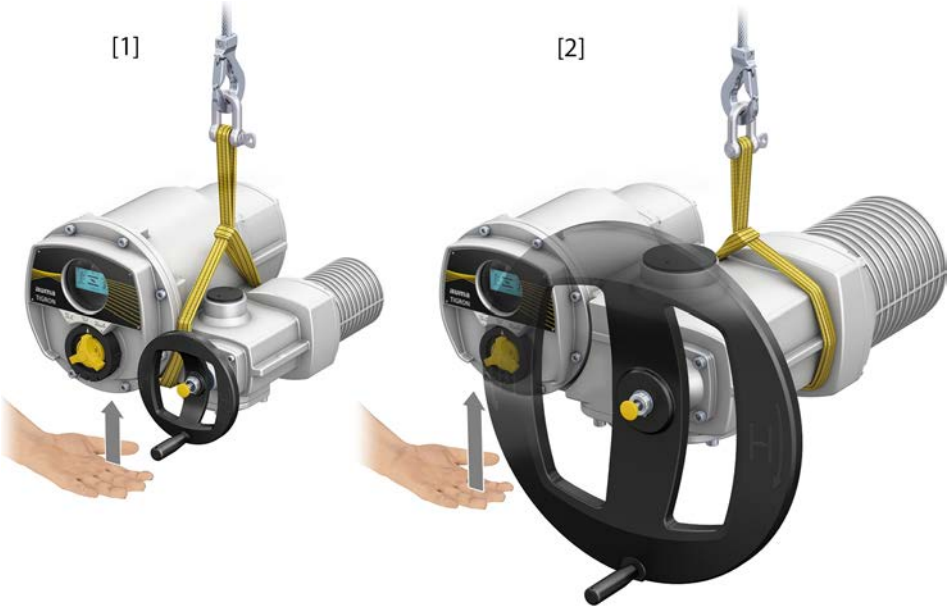
→ Respect total weight of combination (actuator, gearbox, valve)

→ Secure load against falling down, sliding or tilting.

→ Perform lift trial at low height to eliminate any potential danger e.g. by tilting.

Suspension with vertical hollow shaft

Figure 6: Examples left TR-M30X, right TR-M500X



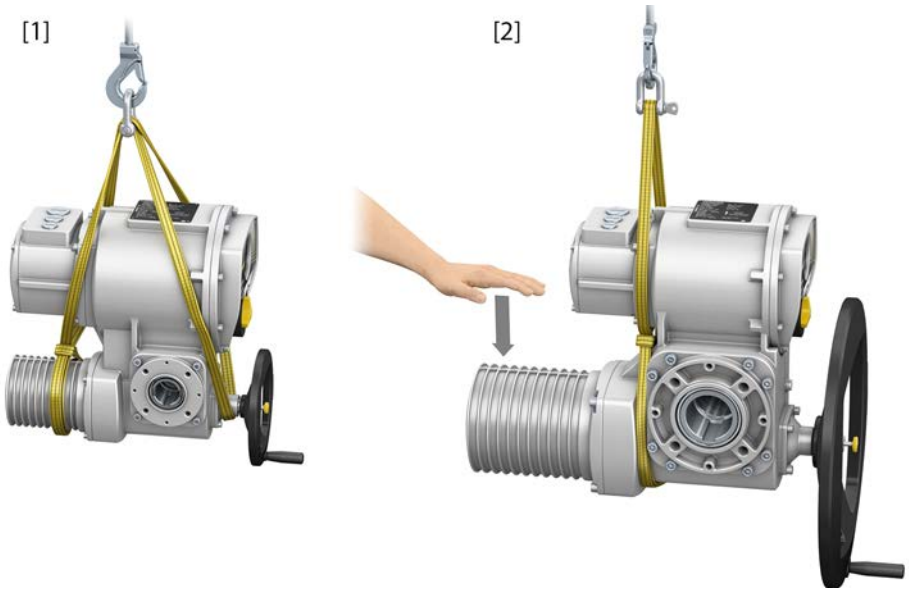
[1] Suspension for sizes 30/60/120

[2] Suspension for sizes 250/500/1000

Depending on the size, slight manual support of controls is required to place the actuator to the desired vertical position.

Suspension with horizontal hollow shaft – controls to top

Figure 7: Examples left TR-M30X, right TR-M500X

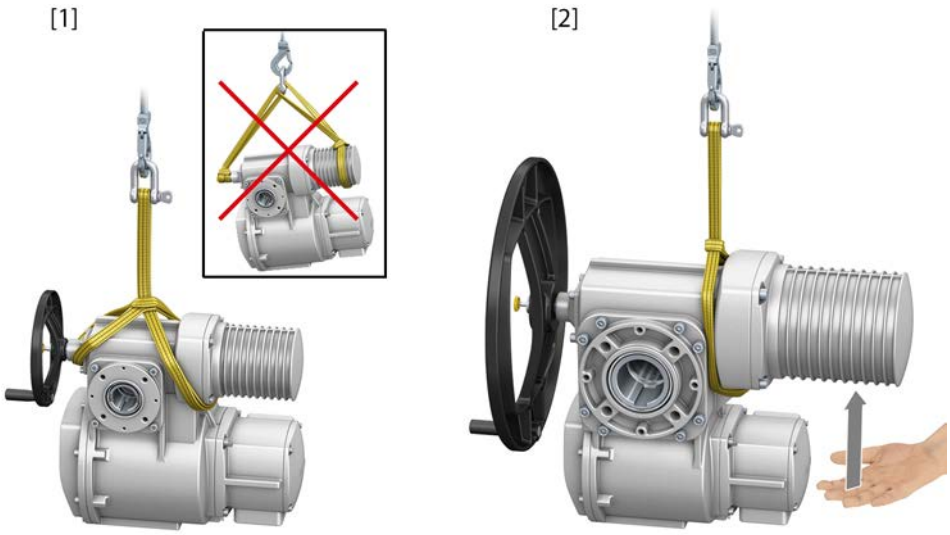


[1] Suspension for sizes 30/60/120
[2] Suspension for sizes 250/500/1000

Depending on the size, slight manual downward pressing of the motor is required to place the actuator to the desired horizontal position.

Suspension with horizontal hollow shaft – controls to bottom

Figure 8: Examples left TR-M30X, right TR-M500X



[1] Suspension for sizes 30/60/120
[2] Suspension for sizes 250/500/1000

Depending on the size, slight manual lifting of motor is required to place the actuator to the desired vertical position.

⚠ WARNING

Risk of actuator falling down caused by slipping of straps/slings!

Death or serious injury.

→ DO NOT fix straps/slings with simple choker hitches.

Weights

The actuator weight is indicated on the name plate. ➪ page 10, Name plate The indicated weight includes the actuator weight **including** output drive type B1, **without** handwheel. For other output drive types, consider additional weights.

Table 4:

Weights for output drive type		
Type designation	Flange size	[kg]
A 07.2	F07	1.1
	F10	1.3
A 10.2	F10	2.8
A 14.2	F14	6.8
A 16.2	F16	11.7

Table 5:

Weights for output drive type		
Type designation	Flange size	[kg]
AF 07.2	F10	5.2
AF 07.6	F10	5.2
AF 10.2	F10	5.5
AF 14.2	F14	13.7
AF 16.2	F16	23

4.2. Storage

NOTICE

Danger of corrosion due to inappropriate storage!

→ Store in a well-ventilated, dry room.
→ Protect against floor dampness by storage on a shelf or on a wooden pallet.
→ Cover to protect against dust and dirt.
→ Apply suitable corrosion protection agent to uncoated surfaces.

NOTICE

Risk of damage due to excessively low temperatures!

→ The actuator must may only be stored permanently at temperatures down to –40 °C.
→ On request, the actuator may be transported in specific cases and for short duration at temperatures down to –60 °C. Please contact the factory prior to transport if transport temperatures fall below –40 °C.

Long-term storage

For long-term storage (more than 6 months), observe the following points:

1. Prior to storage:
   Protect uncoated surfaces, in particular the output drive parts and mounting surface, with long-term corrosion protection agent.
2. At an interval of approx. 6 months:
   Check for corrosion. If first signs of corrosion show, apply new corrosion protection.

5. Assembly

5.1. Mounting position

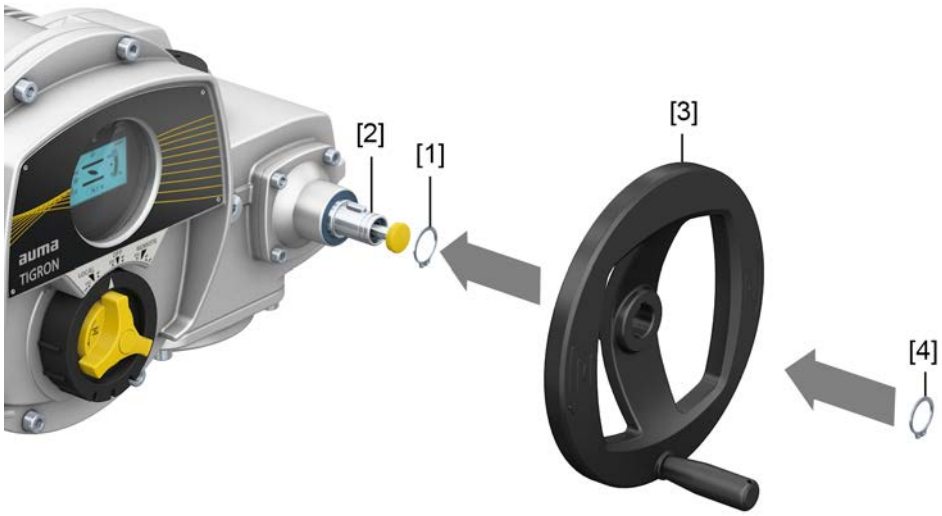
The product described in this document can be operated without restriction in any mounting position.

The indicator glass (display) of local controls should be protected against strong blows or impacts.

5.2. Handwheel fitting

To avoid transport damage, handwheels are supplied separately as appropriate. In this instance, the handwheel must be mounted prior to commissioning.

Figure 9: Handwheel



[1] Spacer
[2] Input shaft
[3] Handwheel
[4] Retaining ring

How to proceed

1. If required, fit spacer [1] on input shaft [2].
2. Slip handwheel [3] onto input shaft.
3. Secure handwheel [3] with retaining ring [4].
   Information: The retaining ring [4] (together with these operation instructions) is stored in a weatherproof bag, which is attached to the device prior to delivery.

5.3. Mount actuator to valve

NOTICE

Corrosion due to damage to paint finish and condensation!

→ Touch up damage to paint finish after work on the device.

→ After mounting, connect the device immediately to electrical mains to ensure that heater minimises condensation.

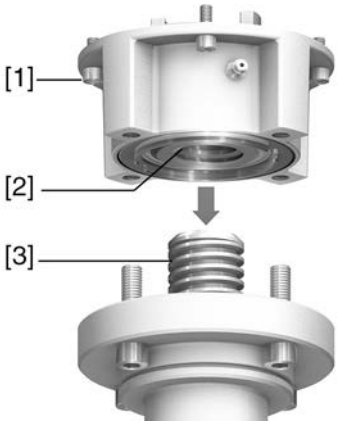
5.3.1. Overview of output drive types

Table 6: Overview on output drive types

Valve attachment	Application	Description	Assembly
A	• for rising, non-rotating valve stem • capable of withstanding thrust • not appropriate for radial forces	➪ page 16, Output drive type A	➪ page 17, Multi-turn actuator with output drive type A: mount
B, B1 – B4 C D	• for rotating, non-rising valve stem • not capable of withstanding thrust	➪ page 20, Output drive types B/C/D	➪ page 21, Multi-turn actuator with output drive type B: mount

5.3.2. Output drive type A

Figure 10: Output drive type A



[1] Output mounting flange
[2] Stem nut
[3] Valve stem

Short description

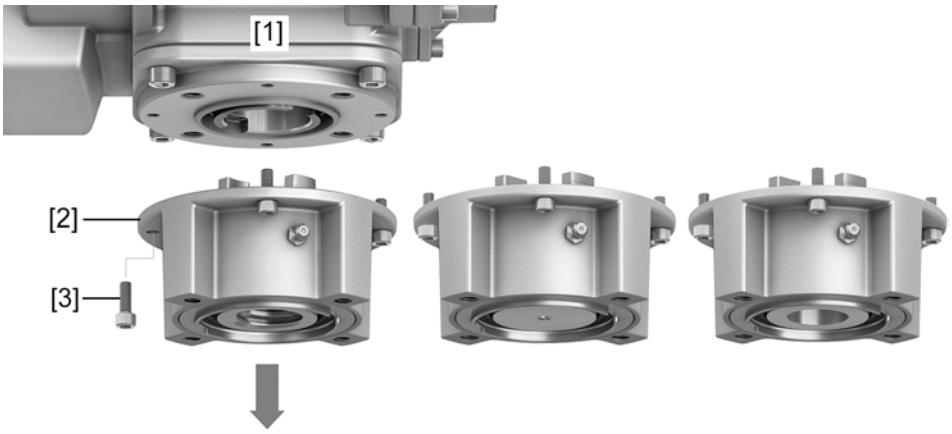
Output drive type A consisting of output mounting flange [1] with axial bearing stem nut [2]. The stem nut transmits the torque from the actuator hollow shaft to the valve stem [3]. Output drive type A can withstand thrusts.

To adapt the actuators to available output drive types A with flanges F10 and F14 (year of manufacture 2009 and earlier), an adapter is required. The adapter can be ordered from AUMA.

5.3.2.1. Multi-turn actuator with output drive type A: mount

1. If output drive type A is already mounted to the multi-turn actuator: Loosen screws [3] and remove output drive type A [2].

   Figure 11: Multi-turn actuator with output drive type A

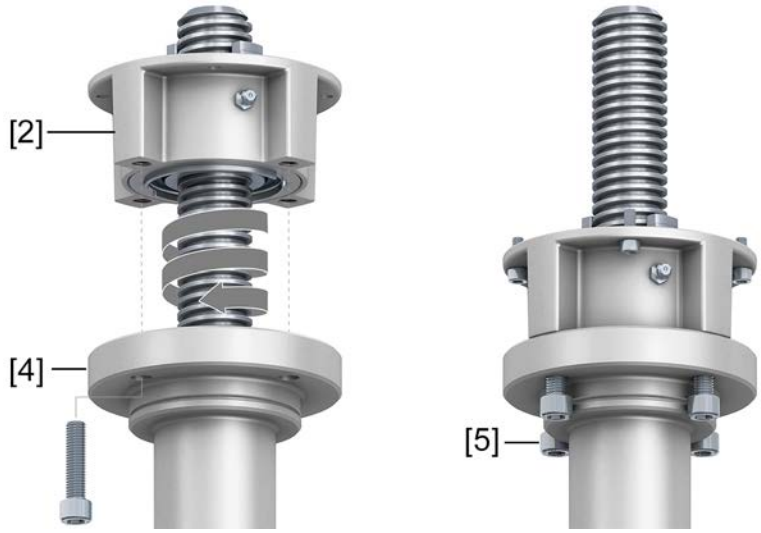


[1] Multi-turn actuator
[2] Output drive type A, from left to right:
with finish-machined, unbored and pilot bore stem nut
[3] Screws to multi-turn actuator

Information For an unbored or pilot bore stem nut, the stem nut must be finish machined prior to mounting valve stem and prior to performing the following steps. ➪ page 19, Stem nut for output drive type A: finish machining

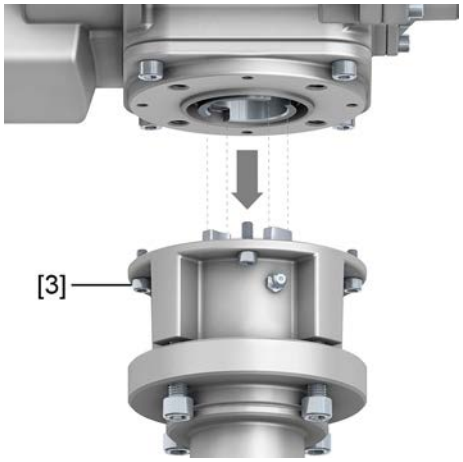
2. Apply a small quantity of grease to the valve stem.
3. Place output drive type A [2] on valve stem and turn until it is [4] flush on the valve flange.
4. Turn output drive type A [2] until alignment of the fixing holes.
5. Fasten screws [5] between valve and output drive type A [2] without completely tightening them.

   Figure 12:



6. Fit multi-turn actuator on the valve stem so that the stem nut dogs engage into the output drive sleeve.

   Figure 13:



➥ The flanges are flush with each other if properly engaged.

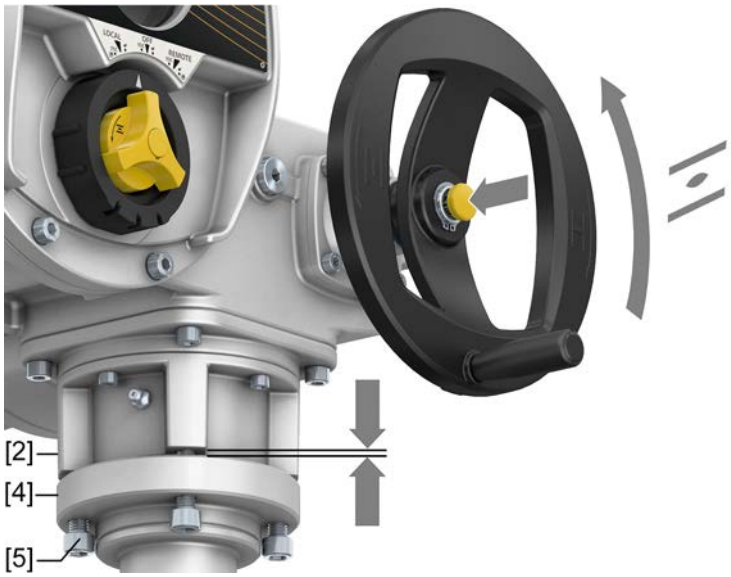
7. Adjust multi-turn actuator until alignment of the fixing holes.
8. Fasten multi-turn actuator with screws [3].
9. Fasten screws [3] crosswise with a torque according to table.

Table 7:

Tightening torques for screws	
Threads	Tightening torque [Nm]
	Strength class A2-80/A4–80
M8	24
M10	48
M16	200
M20	392

10. Turn multi-turn actuator with handwheel in direction OPEN until valve flange [4] and output drive type A [2] are firmly placed together.

    Figure 14:



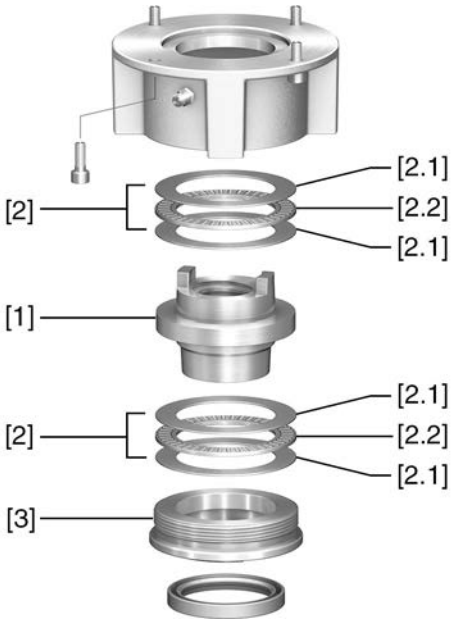
11. Tighten screws [5] between valve and output drive type A crosswise applying a torque according to table.

5.3.2.2. Stem nut for output drive type A: finish machining

This working step is only required if stem nut is supplied unbored or with pilot bore.

Information For exact product version, please refer to the order-related technical data sheet or the AUMA Assistant App.

Figure 15: Output drive type A



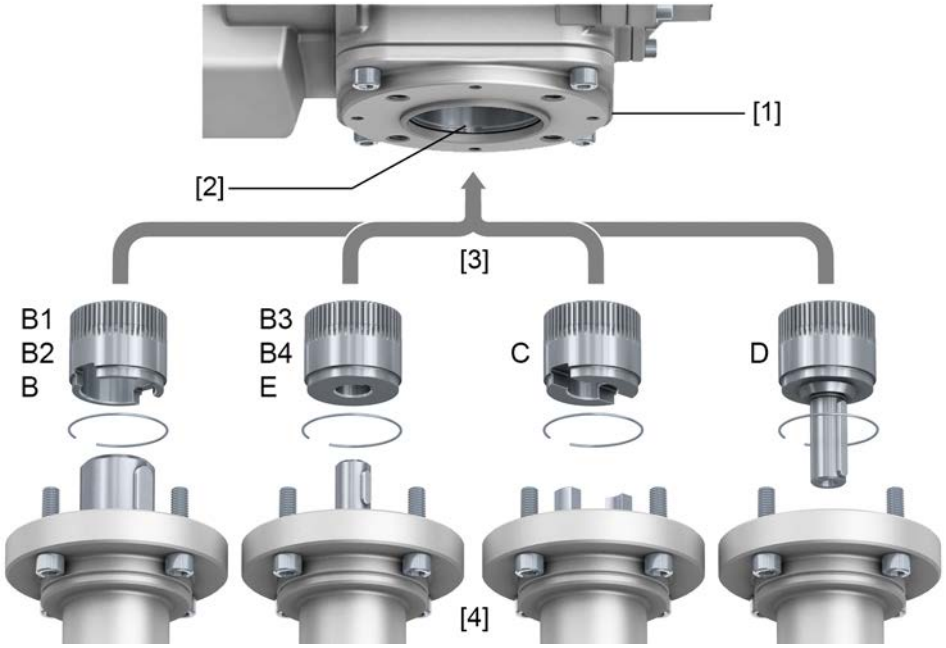
[1] Stem nut
[2] Axial needle roller bearing
[2.1] Axial bearing washer
[2.2] Axial needle roller and cage assembly
[3] Spigot ring

Procedure

1. Remove spigot ring [3] from output drive.
2. Remove stem nut [1] together with axial needle roller bearings [2].
3. Remove axial bearing washers [2.1] and axial needle roller and cage assemblies [2.2] from stem nut [1].
4. Drill and bore stem nut [1] and cut thread.
5. Clean the machined stem nut [1].
6. Apply sufficient Lithium soap EP multi-purpose grease to axial needle roller and cage assemblies [2.2] and axial bearing washers [2.1], ensuring that all hollow spaces are filled with grease.
7. Place greased axial needle roller and cage assemblies [2.2] and axial bearing washers [2.1] onto stem nut [1].
8. Re-insert stem nut [1] with axial needle roller bearings [2] into output drive.
9. Screw in spigot ring [3] until it is firm against the shoulder.

5.3.3. Output drive types B/C/D

Figure 16: Mounting principle



[1] Flange multi-turn actuator (e.g. F07)
[2] Hollow shaft
[3] Output drive sleeve (illustration examples)
[4] Gearbox/valve shaft (example with parallel key)

Short description

Connection between hollow shaft and valve or gearbox via output drive sleeve fixed to the hollow shaft of the multi-turn actuator via retaining ring.

When exchanging the output drive sleeve, later retrofitting to a different output drive type is possible

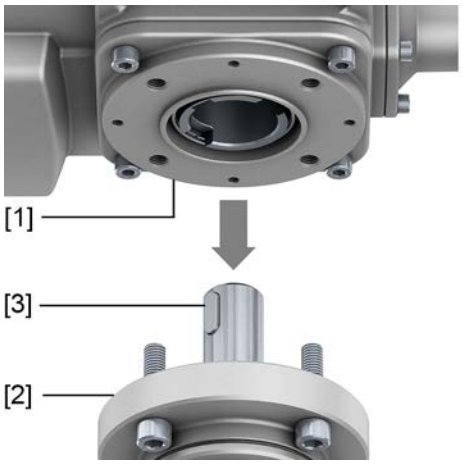
- Output drive type B:
  Output drive sleeve with bore according to DIN 3210
- Output drive types B1/B3:
  Output drive sleeve with bore according to EN ISO 5210
- Output drive types B2/B4:
  Output drive sleeve with bore according to customer order
  B4 including special bores like bores without keyway, square bore, hexagon bore, internal splines
- Output drive type C:
  Output drive sleeve with dog coupling according to EN ISO 5210 or DIN 3338
- Output drive type D:
  Shaft end with key according to EN ISO 5210 or DIN 3210

Information

Spigot at valve flanges should be loose fit.

5.3.3.1. Multi-turn actuator with output drive type B: mount

Figure 17: Mounting output drive types B



[1] Multi-turn actuator
[2] Valve/gearbox
[3] Valve/gearbox shaft

Procedure

1. Check if mounting flanges fit together.
2. Check if output drive of multi-turn actuator [1] matches the output drive of valve/gearbox or valve/gearbox valve shaft [2/3].
3. Apply a small quantity of grease to the valve or gearbox shaft [3].
4. Place multi-turn actuator [1] and ensure that the spigot fits uniformly in the recess and that the mounting faces are in complete contact.
5. Fasten multi-turn actuator with screws according to table.

   Information: We recommend applying liquid thread sealing material to the screws to avoid contact corrosion.
6. Fasten screws crosswise to a torque according to table.

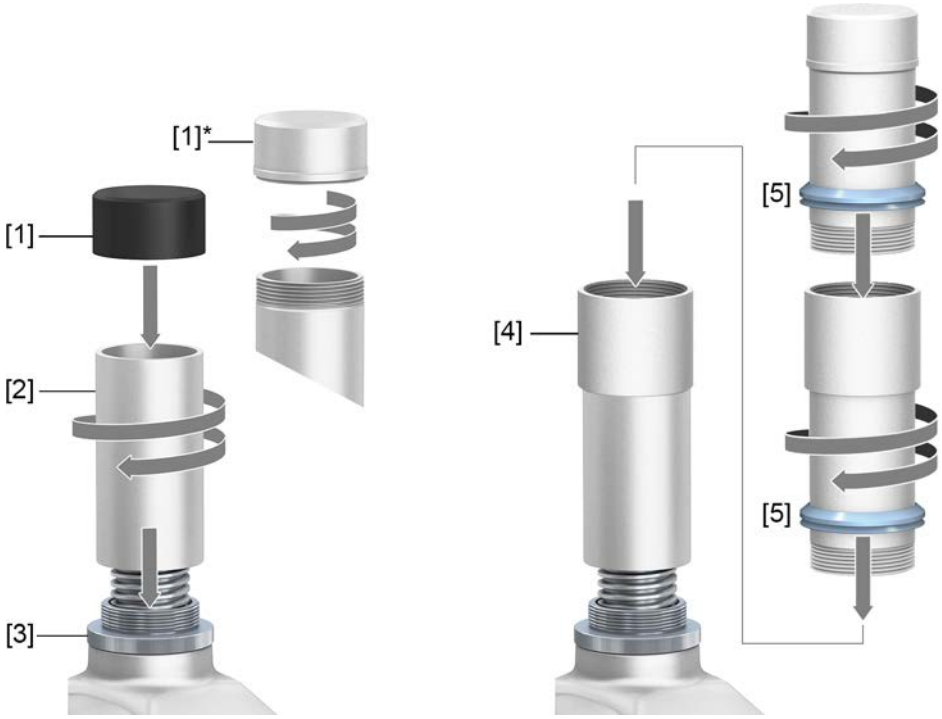
Table 8:

Tightening torques for screws	
Threads	Tightening torque [Nm]
	Strength class A2-80/A4–80
M8	24
M10	48
M16	200
M20	392

5.4. Accessories for assembly

5.4.1. Stem protection tube for rising valve stem

Figure 18: Assembly of the stem protection tube



[1] Protective cap for stem protection tube (fitted)
[1]* Option: Protective cap made of steel (screwed)
[2] Stem protection tube
[3] Stem protection tube adapter
[4] Option: Protection tube made of segments with threaded sleeves
[5] V-seal

How to proceed

1. Screw and tighten stem protection tube [2] on stem protection tube adapter [3]
   Information: A sealing ring is not required. An O-ring is provided underneath the stem protection tube adapter.
2. For stem protection tubes made of two or more segments:
   2.1 Seal threads of segments with hemp, Teflon tape, sealing agent or thread sealing material and fasten tightly.
   2.2 Push segments down to the sleeve (connecting piece).
3. Check whether protective cap [1] for stem protection tube is available, in perfect condition and tightly placed on or screwed to the tube.

NOTICE

Risk of bending or oscillation of protection tubes exceeding a length of 2 m!

Risk of damage at stem and/or protection tube.

→ Secure protection tubes exceeding 2 m by an appropriate support.

Since the connection between stem protection tube and stem protection tube adapter is not separately sealed, this assembly variant is NOT adapted for complete immersion under water or other liquids.

6. Electrical connection

6.1. Basic information

⚠ WARNING

Electric shock due to presence of hazardous voltage!

Failure to observe this warning can result in death, serious injury, or property damage.

→ The electrical connection must be carried out exclusively by suitably qualified personnel.

→ Prior to connection, observe basic information contained in this chapter.

Wiring diagram/terminal plan

The pertaining wiring diagram/terminal plan (in German or English) is attached to the device in a weather-proof bag, together with these operation instructions. It can also be requested from AUMA (state order number, refer to name plate) or downloaded directly from the Internet (http://www.auma.com).

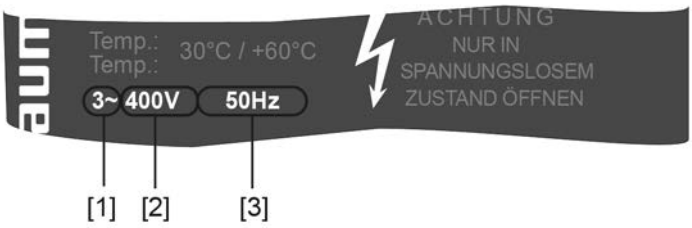
Permissible networks (supply networks)

The actuators are suitable for use in TN and TT networks with directly grounded star point for nominal voltages up to maximum 690 V AC. Use in IT network is permissible for nominal voltages up to maximum 600 V AC. For IT networks, a suitable, approved insulation monitor measuring the pulse code is required.

Current type, mains voltage, mains frequency

Type of current, mains voltage and mains frequency must match the data on the name plate.

Figure 19: Name plate example



[1] Type of current
[2] Mains voltage
[3] Mains frequency

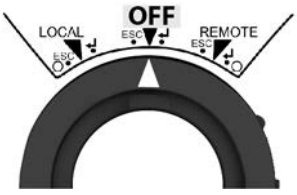
⚠ CAUTION

Risk of immediate actuator operation when connecting to mains!

Risk of personal injuries or damage of the valve.

→ After connection and prior to switching on mains power, set the selector switch to **OFF**.

Figure 20: Selector switch set to OFF



The selector switch is not a mains switch. When positioned to **OFF**, actuator control is prevented. The actuator power supply remains connected.

External supply of the electronics

For external electronics supply, the power supply of integral controls must have an enhanced isolation against mains voltage in compliance with IEC 61010-1 and the output power be limited to 150 VA.

Protection and sizing on site

For short-circuit protection and for disconnecting the actuator from the mains, fuses and disconnect switches have to be provided by the customer.

It is imperative to adapt the switchgear sizing to the max. current (I_{max}) as well as select and set the overcurrent protection device in compliance with the indications in the electrical data sheet.

Table 9:

Maximum permissible protection		
Switchgear (switch gear with power class)[1)]	Rated power	max. protection
Reversing contactor A1	up to 1.5 kW	16 A (gL/gG)
Reversing contactor A2	up to 7.5 kW	32 A (gL/gG)
Thyristor B1	up to 1.5 kW	16 A (g/R) I^2t<1 500A^2s
Thyristor B2	up to 3 kW	32 A (g/R) I^2t<1 500A^2s
Thyristor B3	up to 5.5 kW	63 A (g/R) I^2t<5 000A^2s

1) The AUMA power class (A1, B1, ...) is indicated on the name plate.

Consider the motor starting current (IA) (refer to electrical data sheet) when selecting the circuit breaker. We recommend tripping characteristics D or K for circuit breakers in accordance with IEC 60947-2. For controls equipped with thyristors, we recommend safety fuses instead of circuit breakers. However, the use of circuit breakers is basically permitted.

We recommend refraining from using residual current devices (RCD). However, if an RCD is used within the mains, the residual current device must be of type B.

When equipped with a heating system and external electronics power supply, the fuses for the heating system have to be provided by the customer (refer to wiring diagram F4 ext.).

Table 10:

Fuse for heating system Designation in wiring diagram = F4 ext.		
External power supply	115 V AC	230 V AC
Fuse	2 A T	1 A T

⚠ WARNING

Risk of damage due to excessively low temperatures!

→ The power supply must be available for temperatures below –30 °C.

→ In case power supply failure for the heating system is likely to fail for temperatures bellow –30 °C, please contact the factory.

A failure signal is issued in case of heating failure:

Status indications S0007 or S0011 Failure display a fault.

The fault Details is displayed when selecting Thermal fault.

Further information to fault signals: ➪ page 60, Table 21

If controls are to be mounted separately from actuator (local controls on wall bracket): Consider length and cross section of connecting cable when defining the protection required.

Potential of customer connections

Refer to Technical data for options of isolated potentials.

Safety standards

Safety measures and safety equipment must comply with the respectively valid national on site specifications. All externally connected devices shall comply with the relevant safety standards applicable for the place of installation.

Connecting cables, cable glands, reducers, blanking plugs

- We recommend using connecting cables and connecting terminals according to rated current (I_N) (refer to motor or electrical data sheet).
- For device insulation, appropriate (voltage-proof) cables must be used. Specify cables for the highest occurring rated voltage.

- Use connecting cables, cable glands, reducers, blanking plugs with a minimum temperature range of +80 °C.
- To avoid contact corrosion, we recommend the use of sealing agents for cable glands and blanking plugs made of metal.
- For connecting cables exposed to UV radiation (outdoor installation), use UV resistant cables.
- For the connection of position transmitters, screened cables must be used.
- For connecting fieldbus cables or network cables, respect the cable recommendations for the respective fieldbus connection or network connection. Further information is provided in the short instructions for fieldbus connection or network connection (as far as available).

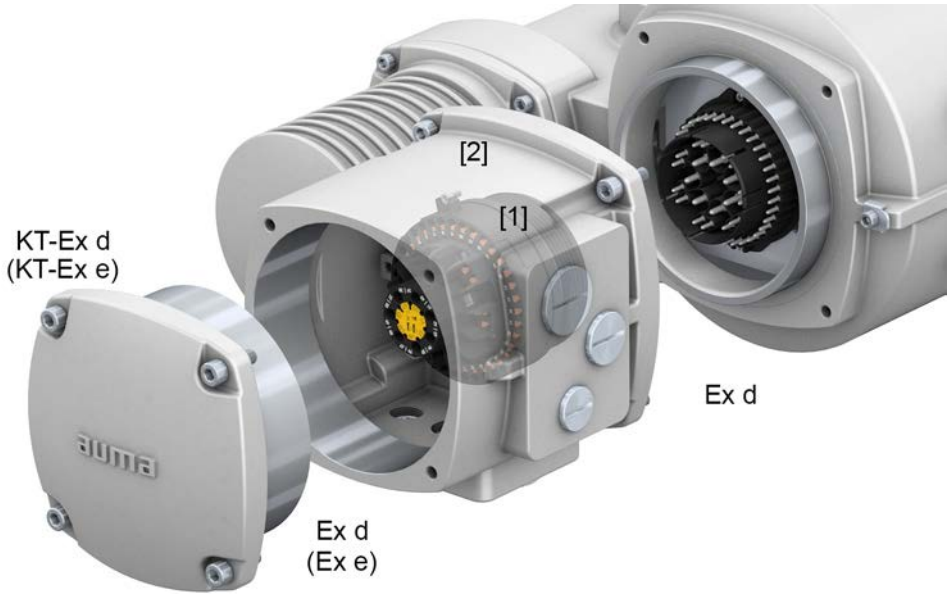
Cable installation in accordance with EMC

Signal and fieldbus cables are susceptible to interference. Motor cables are interference sources.

- Lay cables being susceptible to interference or sources of interference at the highest possible distance from each other.
- The interference immunity of signal and fieldbus cables increases if the cables are laid close to the earth potential.
- If possible, avoid laying long cables and make sure that they are installed in areas being subject to low interference.
- Avoid parallel paths with little cable distance of cables being either susceptible to interference or interference sources.

6.2. KT/KM electrical connection

Figure 21: KT/KM electrical connection



[1] Terminal carrier with screw-type/spring clamp terminals

[2] Connection frame

The illustration shows KT-Ex d version.

Short description

KT plug-in electrical connection with screw-type terminals for power connection and spring clamp terminals for control contacts.

KM version with additional support terminals (terminal blocks) via terminal carrier.

Both versions (KT and KM) are available with terminal compartment in protection type Ex e (increased safety) as well as in protection type Ex d (flameproof enclosure) (refer to Ex marking on name plate).

Plug-in connection is made via the connection frame. For cable connection, simply remove the cover. The connection frame with the cable entries remains within the device. The flameproof interior of the connected devices remains sealed.

Technical data

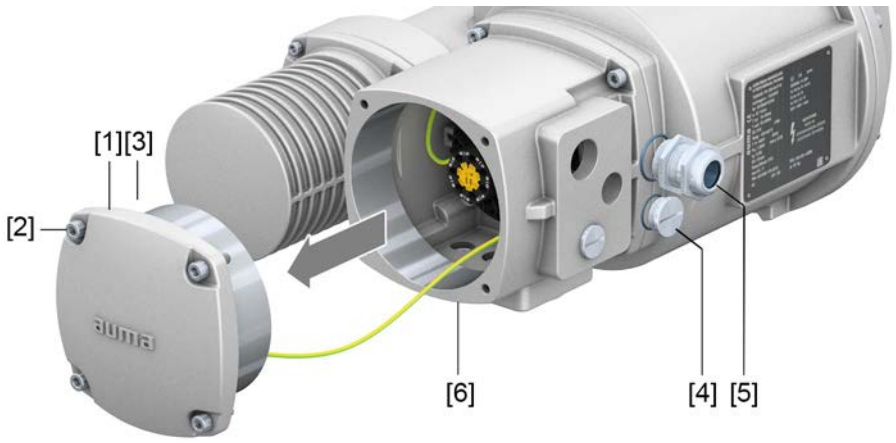
Table 11:

KT/KM/KL electrical connection		
	Power contacts	Control contacts
No. of contacts max.	6 + PE conductors[1)]	50
Designations	U1, V1, W1, U2, V2, W2, ⏚	1 to 36, 37 to 50
Support terminals max.	3	12
Connection voltage max.	1,000 V	250 V
Rated current max.	25 A	5 A[2)]
Type of customer connection	Screw connection PE = Ring lug/U-bracket	Spring clamp terminals
Connection diameter max.	10 mm^2	2.5 mm^2

1) Four protective earth connections within frame
2) The sum of the currents of all control contacts must not exceed 50 A.

6.2.1. Terminal compartment: open

Figure 22: Open terminal compartment



[1] Cover (illustration shows KT version in type of protection Ex d)
[2] Screws for cover
[3] O-ring
[4] Blanking plug
[5] Cable gland (example)
[6] KT-Ex d connection frame

Terminal compartment is designed either in type of protection Ex e (increased safety) or in type of protection Ex d (flameproof enclosure) (refer to Ex marking on name plate). The flameproof interior of the connected device remains closed when removing the cover [1].

Procedure

DANGER

Electric shock due to presence of hazardous voltage!

Failure to observe this warning results in death or serious injury.

→ Disconnect device from the mains before opening.

1. Loosen screws [2] and remove cover [1].

2. Insert cable glands suitable for connecting cables.

   Information: When selecting cable glands observe type of protection (with Ex e or Ex d approval) and enclosure protection IP (refer to name plate).
   The enclosure protection stated on the name plate IP is only ensured if suitable cable glands are used. Thread types and thread sizes are also stated on the name plate.
   Figure 23: Name plate, example with enclosure protection IP68 and M thread

   Information: For shielded cables: Use EMC cable glands.

3. Seal unused cable entries with approved plugs suitable for the required protection type.

6.2.2. Cable connection

Table 12:

Terminal cross sections and tightening torques		
Designation	Terminal cross sections	Connection type
Power contacts (U1, V1, W1, U2, V2, W2) PE connection ⏚	Flexible or solid: 0.25 – 10.0 mm^2 (for one wire per terminal) Flexible: 2 x 0.25 – 4 mm^2 (for two wires per terminal)	Screw-type terminals Tightening torque = 1.2 – 1.5 Nm
Control contacts (1 to 36, 37 to 50)	Flexible or solid: 0.25 – 2.5 mm^2 (for one wire per terminal) 2 x 0.25 – 0.75 mm^2 (for two wires per terminal)	Spring clamp terminals
Protective earth connection within frame (customer connection)	2 x M6 for cables with M6 ring lug or with U-bracket for up to two wires with 1.5 mm^2 – 10 mm^2	Ring lug/U-bracket Tightening torque = 3 – 4 Nm

Procedure

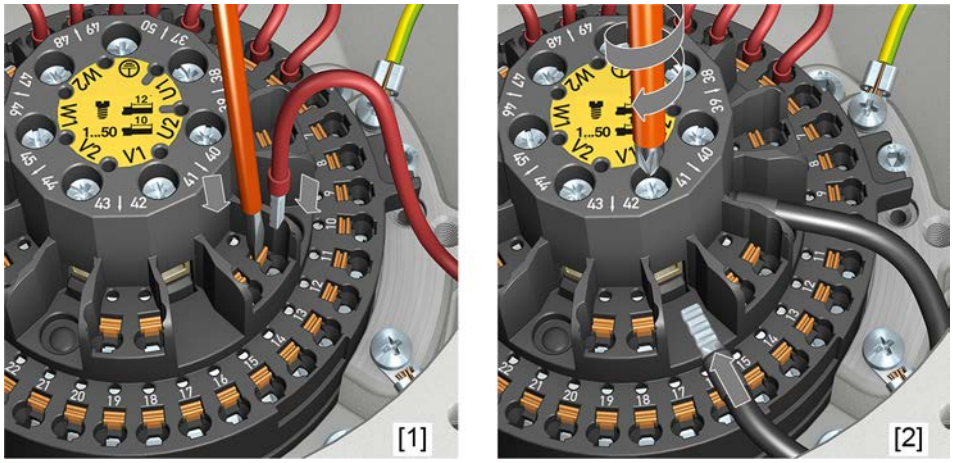
1. Remove cable sheathing in a length of 250 – 300 mm.
2. Insert the wires into the cable glands.
3. Fasten cable glands with the specified torque to ensure required enclosure protection.

   Information: For shielded cables: Link the cable shield end via the cable gland to the housing (earthing).

4. Strip wires:
   - 4.1 Remove wire sheathing of control cables (1...50) in a length of approx. 10 mm
   - 4.2 Remove wire sheathing of motor cables (U, V, W) in a length of approx. 12 mm

5. Connect cables according to order-related wiring diagram.
   Information: For connecting fieldbus cables, please also refer to fieldbus connection short instructions.

   Figure 24: Connect cables to terminal carrier



[1] Fitting control cables into spring clamp terminals
[2] Tightening power terminals

Information For service purposes, each spring clamp terminal is equipped with a test contact located above the numbering.

Information For flexible cables: for screw-type terminals, use wire end sleeves according to DIN 46228. For spring clamp terminals, connection is possible without wire end sleeves.

WARNING

In case of a fault: Hazardous voltage while protective earth conductor is NOT connected!

Risk of electric shock.

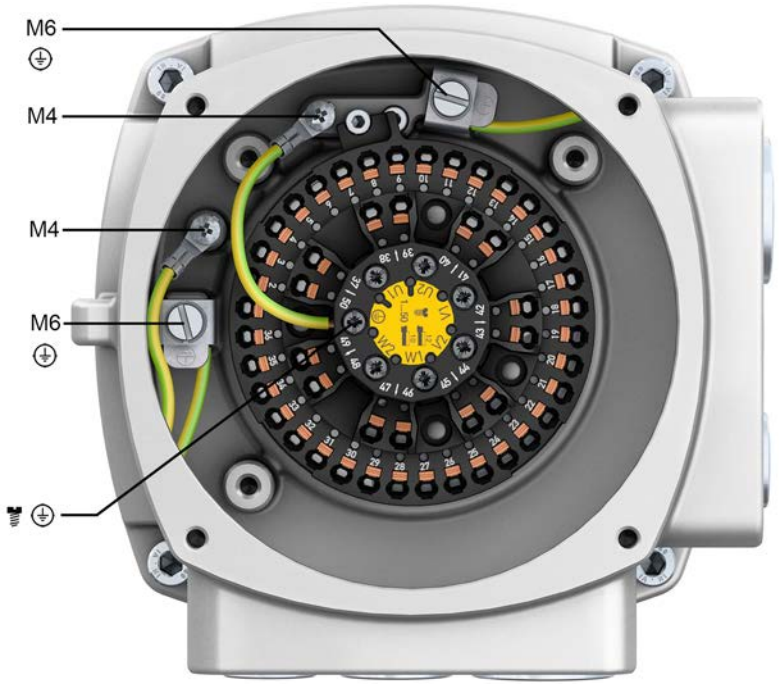
→ Connect all protective earth conductors.

→ Connect PE connection to external protective earth conductor of connecting cables.

→ Start running the device only after having connected the protective earth conductor.

6. Firmly tighten protective earth to PE connection (M6 ⏚).

Figure 25: Protective earth connections within connection frame



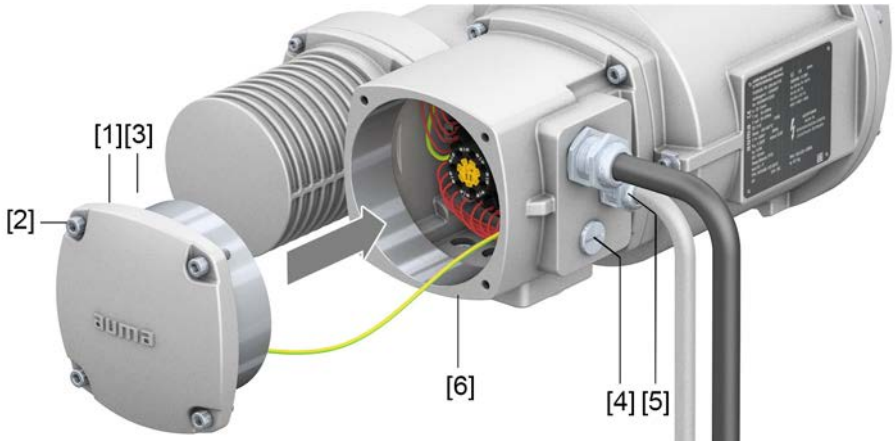
M6 Customer protective earth connection for M6 ring lug or with U-bracket for up to two wires.

M4 Internal protective earth connections via M4 ring lug (to cover and terminal carrier) connected in the factory

⏚ Protective earth connection to terminal carrier (power terminals); connected in the factory.

6.2.3. Terminal compartment: close

Figure 26: Terminal compartment: close



[1] Cover (illustration shows KT version in type of protection Ex d)
[2] Screws for cover
[3] O-ring
[4] Blanking plug
[5] Cable gland (example)
[6] KT-Ex d connection frame

Procedure

1. Clean sealing faces of cover [1] and connection frame [6].
2. For design in flameproof enclosure (Ex d): Preserve joint surfaces with an acid-free corrosion protection agent.
3. Check whether O-ring [3] is in good condition, replace if damaged.
4. Apply a thin film of non-acidic grease (e.g. petroleum jelly) to the O-ring and insert it correctly.
5. Fit cover [1] and fasten screws [2] evenly crosswise.

   For design in flameproof enclosure (Ex d):

WARNING

Flameproof enclosure, danger of explosion!

Risk of death or serious injury.

→ Handle cover and housing parts with care.
→ Joint surfaces must not be damaged or soiled in any way.
→ Do not jam cover during fitting.

---

6. Fasten cable glands and blanking plugs applying the specified torque to ensure the required enclosure protection.

6.3. External earth connection

Figure 27: Earth connection

Figure 28: Earth connection of separately mounted controls

Application External earth connection (U-bracket) for connection to equipotential compensation.

Table 13:

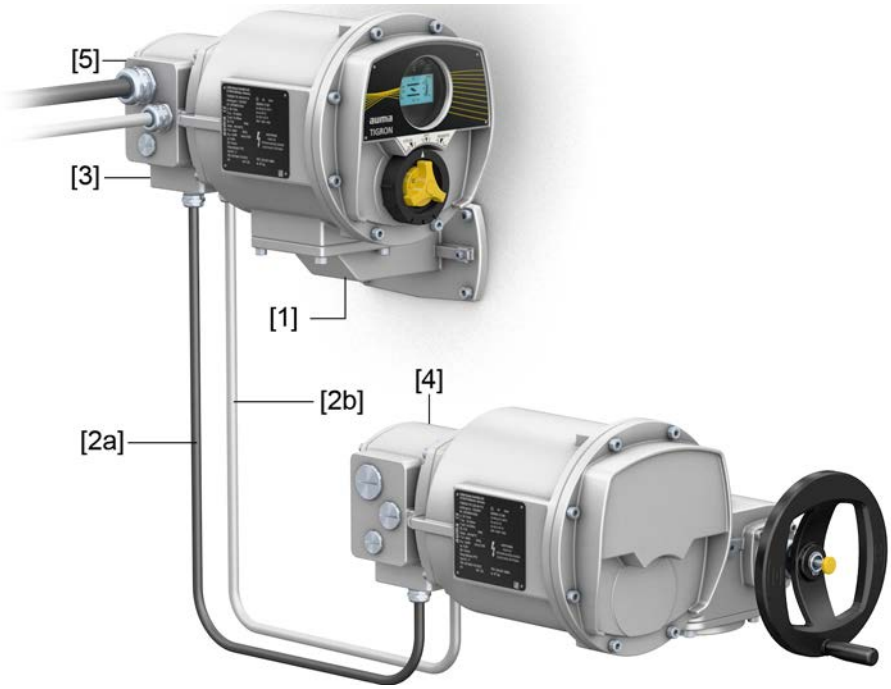
Terminal cross sections and earth connection tightening torques		
Conductor type	Terminal cross sections	Tightening torques
Solid wire and stranded	2.5 mm² to 6 mm²	3 – 4 Nm
Fine stranded	1.5 mm² to 4 mm²	3 – 4 Nm
For fine stranded (flexible) wires, connection is made via cable lugs/ring terminals. When connecting two individual wires with a U-bracket, cross sections have to be identical.		

6.4. Accessories for electrical connection

6.4.1. Separately mounted controls

Design

Figure 29: Separately mounted controls (example with wall bracket version)



[1] Wall bracket
[2a] Motor connection/motor control
[2b] Feedback signals from actuator
[3] Electrical connection of separately mounted controls (XM)
[4] Electrical connection of actuator (XA)
[5] Electrical connection (XK) – customer connection

Application

The controls can be mounted separately from the actuator.

- If the actuator cannot be accessed safely.
- If the actuator is subjected to high temperatures.
- In case of heavy vibration of the valve.

Information on installation with wall bracket

- The permissible cable length between separately mounted controls and the actuator amounts to 100 m maximum.
- We recommend using the AUMA cable set “LS”.
- If the AUMA cable set is not used:
  - Use suitable flexible and screened connecting cables.
  - For voltage supply and connection, refer to wiring diagram.

6.4.2. Parking frame

Figure 30: PAFEx 01.1 parking frame

Application

Parking frame for safe storage of a disconnected plug or cover.

For protection against touching the bare contacts and against environmental influences.

⚠ WARNING

Explosion hazard!

Risk of death or serious injury.

→ Prior to opening the device (removing the plug) ensure that the device is free of gas and voltage!

→ Do NOT switch on voltage in potentially explosive atmospheres.

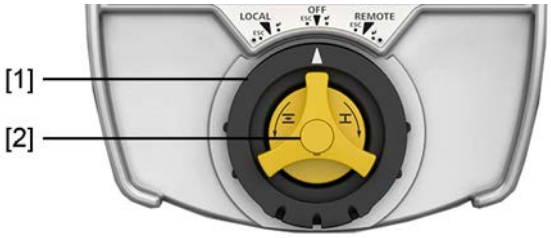
For PAFEx 01.1, separate operation instructions are available.

7. Menu navigation

This section describes the basic information with regard to menu and indication operation via the display.

7.1. Combi-Switch operation elements

Figure 31: Combi-Switch (selector switch and shuttle dial)



[1] Selector switch (outside, black ring)
[2] Shuttle dial (inside yellow)

[1] Selector switch latching function

Select operation modes LOCAL, OFF or REMOTE.

Figure 32:

For this, turn selector switch until it latches in one of the positions (LOCAL, OFF or REMOTE).

[1] Selector switch toggle function

ESC (Escape) back/abort process or ↵ (Enter) confirm menu/value.

Figure 33:

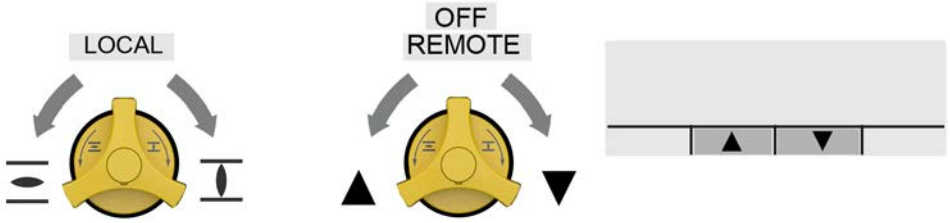
For this, turn selector switch briefly to the left or right and release again. The selector switch toggles back into its initial position.

The toggle function is available for all three selector switch positions (LOCAL, OFF, REMOTE) provided the respective symbol ESC/↵ is displayed in the bottom row.

[2] Shuttle dial

The shuttle dial function depends on the selector switch position.

Figure 34:



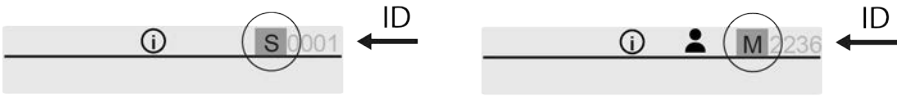
- In selector switch position LOCAL: ▬/▮ Execute operation commands OPEN/CLOSE.
- In selector switch position OFF/REMOTE: ▲▼ Scroll within the menu/between the display values or change values, e.g. 1, 2, 3, ...

The display in the bottom line indicates the direction available for scrolling (▲▼).

7.2. Device menu and status indications

All pages which are shown in the display are marked by an ID. The ID is displayed in the top right corner of the display.

Figure 35: Marking of a page by an ID in the display



- ID starting with S... = Status indication
- ID starting with M... = Menu (in device menu)
- ID starting with PRM... = Parameter (in device menu)
- ID starting with CMD... = Command (command prompt in device menu)

7.2.1. Open device menu

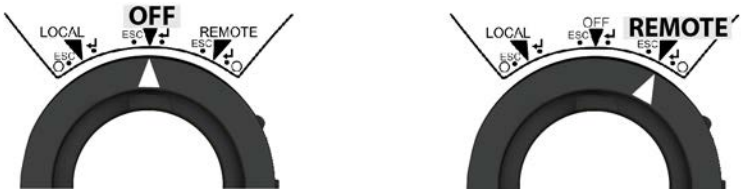
If the display indicates a status indication, i.e. the ID of the displayed page starts with S..., you may change to the device menu.

Figure 36:

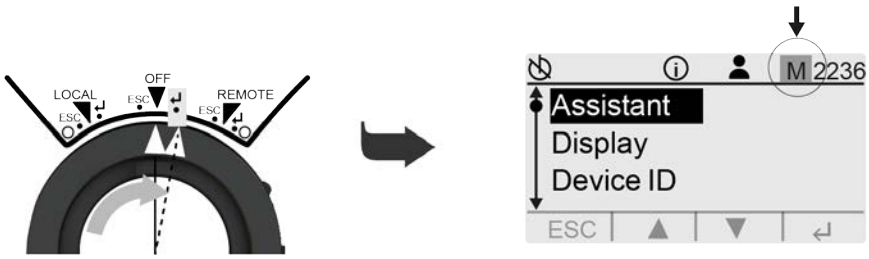
If the ID of the indicated page starts with M, PRM, ..., you have already entered the device menu.

How to proceed

1. Set selector switch to position **OFF** or **REMOTE** .
   Figure 37:



2. Turn selector switch briefly towards the right in direction of ↵ (Enter) and release again.
   Figure 38:



➥ You are in the device menu if the ID of the displayed page starts with M....

Information

Settings and parameters up to user level (4) can only be read in selector switch position **REMOTE** and not be modified.

After 10 minutes without operating an operation element, the display returns to the status indications.

7.2.2. Exit device menu (display status indications)

You may exit the device menu from all menu levels.

How to proceed

1. Set selector switch to position **OFF** or **REMOTE** .
2. Toggle the selector switch several times to the left (ESC) until the display enters a status indication.

   Figure 39:

➥ You are in the status indication if the ID of the displayed page starts with S....

7.2.3. Directly open menu page by entering the ID

If the ID of a menu page is known, the menu can be directly displayed by entering the ID.

Information

Local actuator settings are made using the Combi-Switch.

- Operate the yellow shuttle dial of the Combi-Switch to scroll within the menu ▲▼.
- Operate the black selector switch (outer ring), either to confirm the selected menu ↵ or to go one step back (ESC).

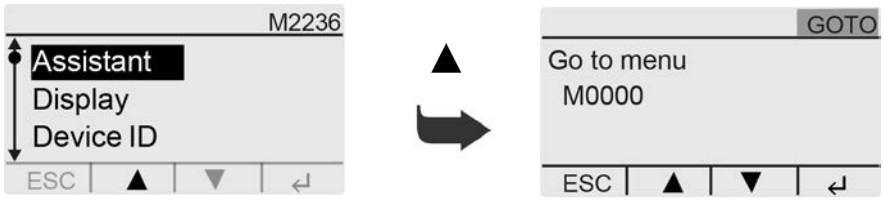
How to proceed

1. Open device menu.

   Information: If the ID of the indicated page starts with M, PRM, ..., you have already entered the device menu. For further information, refer to: ➪ page 35, Open device menu
2. Select menu GOTO with ▲.

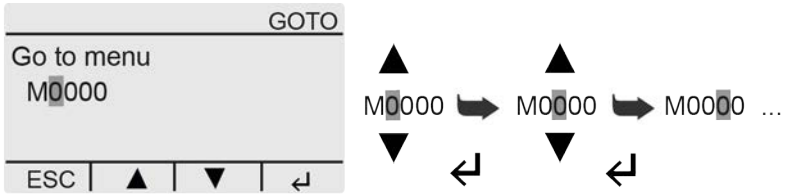
➥ The menu GOTO is one menu level above menu Assistant.

Figure 40:



3. Enter digits (0 through 9) of the 4-digit ID with ▲▼.

   Figure 41: Enter ID



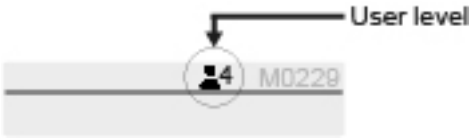
4. Confirm digit with ↵ (Enter).
5. Repeat steps 3 and 4 for all further digits of the ID.
6. To abort the process: Briefly toggle selector switch to the left (ESC).

7.3. User, user level, password

User levels (1), (2), (3), ... define which menu menus or parameters can be displayed or modified by the active user.

6 different users/user levels are available. User level (1), (2), (3), ... is indicated in the top display row.

Figure 42: User level display (example)



A specific password is assigned to each user level and allows different actions.

Table 14:

User levels and authorisations	
User (user level)	Authorisation/password
Observer (1)	Verify settings No password required
Operator (2)	Change settings Factory password: 000000
Maintenance (3)	Reserved for future use
Specialist (4)	Change device configuration e.g. type of seating, assignment of output contacts Factory password: 000000
Service (5)	Service staff Change configuration settings
AUMA (6)	AUMA administrator

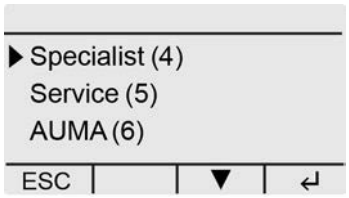
Unauthorised access is made easier due to insecure password!

→ We urgently recommend changing the password during initial commissioning.

7.3.1. Change user level

You are requested to change the user level if menu selection or parameter change cannot be executed with the current user level. For this, the display indicates the lowest required user level for performing changes:

Figure 43: Change user level, example: at least level (4) required



How to proceed

1. If the request “Change user level” appears: Select user level with ▲▼.
   Information: The black triangle ▸ shows the saved value. A white triangle ▹ shows the selected value which has not yet been saved.
2. Confirm selected user level with ↵.

➥ Display indicates: Password 0*****

3. Enter digits 0 through 9 with ▲▼.
4. Confirm first position of password with ↵.
5. Repeat steps 3 and 4 for all further digits.

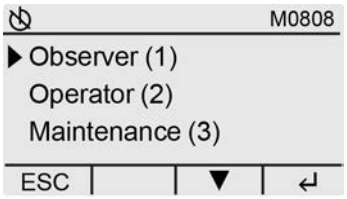
➥ Having confirmed the last digit with ↵, access to all parameters within the selected user level is possible, provided the password entry is correct.

Alternative procedure

The user levels can also be changed directly and without request via menu M0808:

Display M0009
Navigation M0807
Select level M0808

Figure 44: Change user level

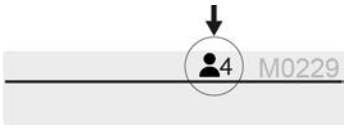


7.3.2. Change passwords

Passwords may only be changed as of user level Specialist (4) or higher.

The top line in the display indicates the currently selected user level, e.g. Specialist (4):

Figure 45: Example: User level 4



Only the passwords of same or lower access level may be changed.

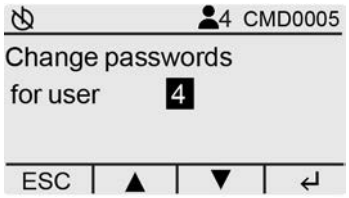
Information

Local actuator settings are made using the Combi-Switch.

- Operate the yellow shuttle dial of the Combi-Switch to scroll within the menu ▲▼.
- Operate the black selector switch (outer ring), either to confirm the selected menu ↵ or to go one step back (ESC).

How to proceed

1. Open device menu.
   Information: If the ID of the indicated page starts with M, PRM, ..., you have already entered the device menu. For further information, refer to: page 35, Open device menu
2. Set user level 4 or higher: page 37, Change user level
3. Select menu Change passwords M0229.
   Device configuration M0053
   Service functions M0222
   Change passwords M0229
4. Select user level 1, 2, 3, 4, 5, or 6 using ▲▼.
   Figure 46: Example of user level 4



5. Confirm with ↵ (Enter).
6. Enter current password when Password 0***** is displayed.
7. Enter the new password when Password (new) 0***** is displayed.
8. Select next user level with ▲▼ or abort the procedure via ESC (Escape).

7.4. Language change in the display

Information

Local actuator settings are made using the Combi-Switch.

- Operate the yellow shuttle dial of the Combi-Switch to scroll within the menu ▲▼.
- Operate the black selector switch (outer ring), either to confirm the selected menu ↵ or to go one step back (ESC).

How to proceed

1. Open device menu.

   Information: If the ID of the indicated page starts with M, PRM, ..., you have already entered the device menu. For further information, refer to: page 35, Open device menu

2. Select menu Language M0049.

   Display M0009
   Language M0049

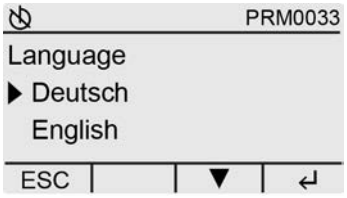
➥ Display indicates the selected language, e.g.: ▸ Deutsch

3. Confirm the selected value (e.g. Deutsch) using ↵.

   → If required, select user level and enter the password. For further information, refer to: page 37, Change user level.

➥ The display indicates parameter PRM0033 for selecting further languages.

Figure 47: Example



4. Use ▲▼ to select a new language.

   Information: The black triangle ▸ shows the saved value. A white triangle ▹ shows the selected value which has not yet been saved.

5. Use ↵ (Enter) to save the selected language.

➥ The display changes to the new language.

8. Commissioning

To correctly commission the device, you require the necessary basic knowledge for menu operation. If you do not have basic knowledge, make sure you familiarise yourself with the basics prior to commissioning.

For further information, refer to: page 34, Menu navigation

Commissioning can be made using the Commissioning Assistant or via manual setting of individual functions.

page 40, Start Commissioning Assistant

page 40, Perform manual commissioning

8.1. Start Commissioning Assistant

The Commissioning Assistant facilitates commissioning thanks to a structured navigation through the device menu. Setting the commissioning functions like type of seating, torque switches and limit switches are easy and intuitive.

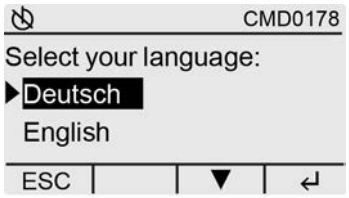
Information

Local actuator settings are made using the Combi-Switch.

- Operate the yellow shuttle dial of the Combi-Switch to scroll within the menu ▲▼.
- Operate the black selector switch (outer ring), either to confirm the selected menu ↵ or to go one step back (ESC).

How to proceed

1. Open device menu.
   Information: If the ID of the indicated page starts with M, PRM, ..., you have already entered the device menu. For further information, refer to: page 35, Open device menu
2. Select menu Assistant M2236.
3. If required, select user level and enter the password. For further information, refer to: page 37, Change user level
4. Select language and confirm with ↵ (Enter).
   Figure 48:



   ➥ The assistant is started and the actuator changes to commissioning operation mode (symbol ⚙).
5. Follow the instructions issued by the assistant.

8.2. Perform manual commissioning

For manual commissioning, the following commissioning functions can be individually checked and set:

1. Type of seating
   page 41, Type of seating setting via the device menu
2. Torque switching
   page 42, Torque seating setting via the device menu
3. Limit switching
   page 43, Limit switching setting via the device menu

8.2.1. Type of seating setting via the device menu

NOTICE

Valve damage due to incorrect setting!

→ The type of seating setting (limit or torque seating) must match the selection for the valve.

→ Only change the setting with prior consent of the valve manufacturer.

Information

Local actuator settings are made using the Combi-Switch.

- Operate the yellow shuttle dial of the Combi-Switch to scroll within the menu ▲▼.
- Operate the black selector switch (outer ring), either to confirm the selected menu ↵ or to go one step back (ESC).

How to proceed

1. Open device menu.

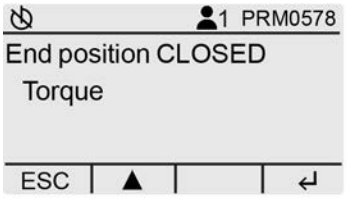
   Information: If the ID of the indicated page starts with M, PRM, ..., you have already entered the device menu. For further information, refer to: page 35, Open device menu

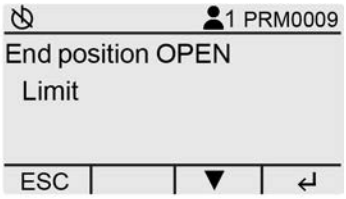
2. Select menu M0086 or M0087:

   Customer settings M0041
   Type of seating M0012
   End position CLOSED M0086
   End position OPEN M0087

➥ The display shows parameter PRM0578 or PRM009.

Figure 49: For user levels 1–3 (read parameters only):

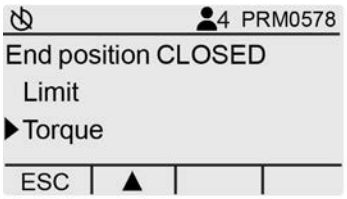


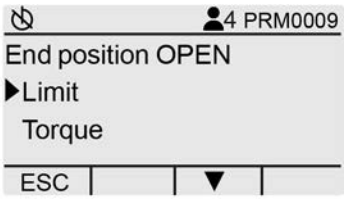


Information

Use ↵ (Enter) to change from user levels 1–3 to a higher user level. For further information, refer to: page 37, Change user level

Figure 50: For user levels 4–6 (settings can be changed):





Change settings

3. Select new value via ▲▼. (At least user level 4 required.)
   → Limit = Limit seating
   → Torque = Torque seating

   Information: The black triangle ▸ shows the saved value. A white triangle ▹ shows the selected value which has not yet been saved.

4. Save selected value with ↵ (Enter)..

➥ The display shortly indicates Value saved!. The type of seating is set for the end position.

5. Press ESC (Escape) to return for further parameter setting.

8.2.2. Torque seating setting via the device menu

If the set tripping torque is specified for the indicated operation direction, the actuator switches off (overload protection of the valve).

Information The torque switches may also trip during manual operation.

NOTICE

Valve damage due to excessive tripping torque limit setting!

→ The tripping torque must suit the valve.

→ Only change the setting with the consent of the valve manufacturer.

Information Local actuator settings are made using the Combi-Switch.

- Operate the yellow shuttle dial of the Combi-Switch to scroll within the menu ▲▼.
- Operate the black selector switch (outer ring), either to confirm the selected menu ↵ or to go one step back (ESC).

How to proceed

1. Open device menu.

   Information: If the ID of the indicated page starts with M, PRM, ..., you have already entered the device menu. For further information, refer to: ➪ page 35, Open device menu

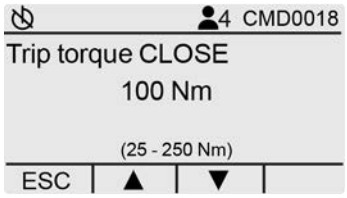
2. Select menu M0088 or M0089:

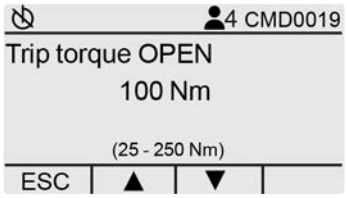
   Customer settings M0041
   Torque switching M0013
   Trip torque CLOSE M0088
   Trip torque OPEN M0089

   Information: If required, change user level. For performing settings, at least user level 4 is required. For further information, refer to: ➪ page 37, Change user level

➥ The display indicates the command prompt CMD0018 or CMD0019.

Figure 51:





Change settings

3. Enter the new value for the tripping torque in direction CLOSE or OPEN with ▲▼.

   Information: The adjustable torque range is shown in round brackets.

4. Save new value via ↵ (Enter).

➥ The display shortly indicates Value saved!. The tripping torque for the operation direction is set.

5. Press ESC (Escape) to return for further parameter setting.

Information If the set torque is reached **prior** to reaching the end position, a fault signal is issued: Torque fault OPEN or Torque fault CLOSE

The fault can be eliminated by an operation command in the opposite direction (for Torque fault OPEN: operation command in direction CLOSE; for Torque fault CLOSE: operation command in direction OPEN) or via the selector switch in **LOCAL** with ESC (Escape).

Further information to fault signals: ➪ page 60, Table 21

8.2.3. Limit switching setting via the device menu

NOTICE

Valve damage at valve/gearbox due to incorrect setting!

→ When setting with motor operation: Interrupt operation in time **prior** to reaching the end stop (swing shuttle dial in the direction of operation).

→ For limit seating, provide for sufficient backlash between end position and mechanical end stop due to potential overrun.

Information

Local actuator settings are made using the Combi-Switch.

- Operate the yellow shuttle dial of the Combi-Switch to scroll within the menu ▲▼.
- Operate the black selector switch (outer ring), either to confirm the selected menu ↵ or to go one step back (ESC).

How to proceed

1. Open device menu.

   Information: If the ID of the indicated page starts with M, PRM, ..., you have already entered the device menu. For further information, refer to: ➪ page 35, Open device menu

2. Select menu M0084 or M0085:

   Customer settings M0041
   Limit switches M0010
   Set end pos.CLOSED? M0084
   Set end pos. OPEN? M0085

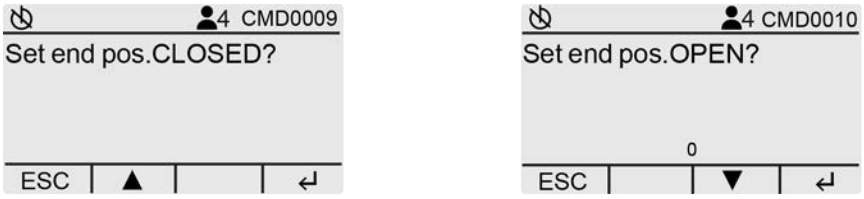
   Figure 52:

Information

If required, change user level. For performing settings, at least user level 4 is required. For further information, refer to: ➪ page 37, Change user level

➥ The display now indicates the command prompt CMD0009 or CMD0010.

Figure 53:



3. If the valve is already in the end position:
   → For end position CLOSED, continue with step 7 (set end position CLOSED).
   → For end position OPEN, continue with step 10 (set end position OPEN).
4. If the valve is NOT already in the selected end position:
   → Continue with steps 5 + 6 (approach end position).
   → If the valve CANNOT be operated, continue with step 13 (set end position via stroke).

   Information: For all applications not allowing to operate the valve during commissioning, the second end position can only be set via the stroke.

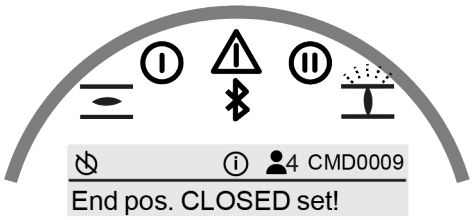
Approach end position

5. For large strokes, approach the valve end position in motor operation:
   5.1 Set selector switch to **LOCAL**.
   5.2 For operation in direction CLOSE: turn yellow shuttle dial in direction ⊥.
   5.3 For operation in direction OPEN: turn yellow shuttle dial in direction ⎓.
   Information: To avoid damage, abort operation in time **prior** to reaching the end stop (turn shuttle dial to the opposite direction of operation).
   5.4 Set selector switch to position **OFF**.
6. Engage manual drive and turn handwheel until the valve is closed.
   → When selecting limit seating, turn back the handwheel (by approx. ½ turn prior to reaching the end position) to allow for potential overrun.
   → For end position CLOSED, continue with step 7 (set end position CLOSED).
   → For end position OPEN, continue with step 10 (set end position OPEN).

Set end position CLOSED in the current position CMD0009

7. Use ↵ (Enter) to save the current valve position as new “end position CLOSED”.
   ➥ The display indicates End pos. CLOSED set! and the right LED (standard version) is illuminated. Now, the end position CLOSED of the limit switching is set.

Figure 54:

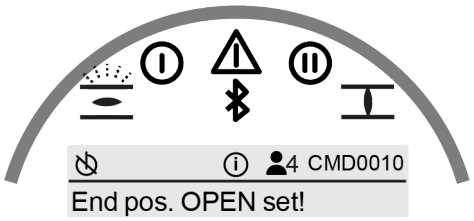


8. If the setting must be corrected: Reset settings with ↵ (Enter). The LED goes out again.
   → Approach “again” the end position (steps 5 + 6) and reset the end position CLOSED.
9. If the end position OPEN has been correctly set: Exit the menu with ESC (Escape).
   → Then, proceed with the setting of end position OPEN (step 2).

Set end position OPEN in the current position CMD0010

10. Use ↵ (Enter) to save the current valve position as new “end position OPEN”.
    ➥ The display indicates End pos. OPEN set! and left LED (standard version) is illuminated. Now, the end position OPEN of the limit switching is set.

Figure 55:



11. If the setting must be corrected: Reset settings with ↵ (Enter). The LED goes out again.
    → Approach “again” the end position (steps 5 + 6) and reset the end position OPEN.
12. If the end position OPEN has been correctly set: Exit the menu with ESC (Escape).
    → Then, proceed with the setting of end position CLOSED (step 2).

End position setting via stroke

Information: To allow the setting of an end position via stroke, the other end position must be set via the position.

13. Calculate the setting value for stroke setting: For this, multiply the “value per turn” by the stroke.

Table 15:

Actuator	Value per turn
TR-M30X/TR-M60X	118.108
TR-M120X	120.461
TR-M250X/TR-M500X	120.041
TR-M1000X	120.461

➥ Example: Stroke = 5 turns; value per turn = 120.461

➥ Setting value = 5 x 120.461 = **600**

14. Set the value using ▲▼:

Figure 56:

15. Save new end position via ↵ (Enter).

➥ The signal End pos. OPEN set! or End pos. CLOSED set! is displayed and the respective LED is illuminated. Thus, the end position is set via the stroke.

16. If the setting must be corrected: Reset settings with ↵ (Enter). The LED goes out again.

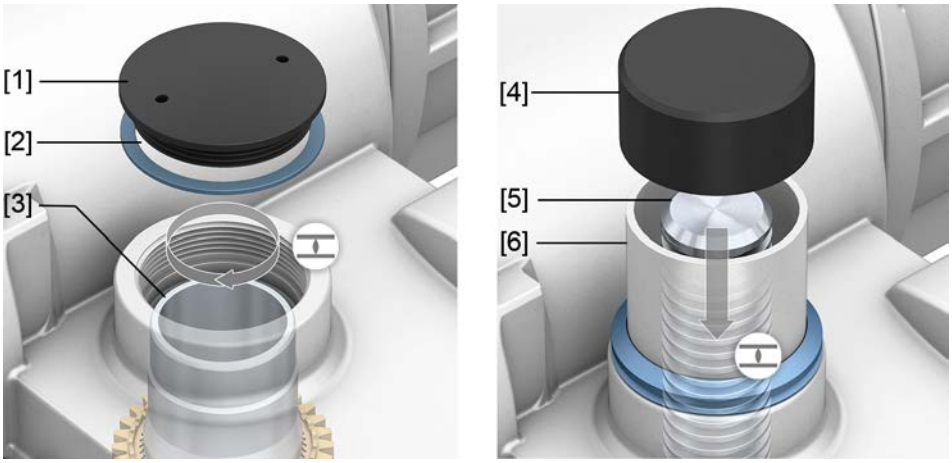
→ Enter the value again using ▲▼ and save via ↵ (Enter).

17. If the end position OPEN has been correctly set: Exit the menu with ESC (Escape).

8.3. Test run

8.3.1. Direction of rotation at hollow shaft/stem: check

Figure 57: Direction of rotation of the hollow shaft/stem for operation in direction CLOSE (“clockwise closing” version)



[1] Threaded plug
[2] Seal
[3] Hollow shaft
[4] Protective cap for stem protection tube
[5] Stem
[6] Stem protection tube

NOTICE

Valve damage due to incorrect direction of rotation!

→ If the direction of rotation is wrong, switch off immediately (turn selector switch to **OFF**).

→ Eliminate cause, i.e. correct phase sequence for cable set wall bracket.

→ Repeat test run.

Check direction of rotation

1. Move actuator manually to intermediate position or to sufficient distance from end position.
2. Depending on the version: Unscrew threaded plug [1] with seal [2], protective cap [4] or stem protection tube [6].
3. Switch on actuator in direction CLOSE and observe direction of rotation at hollow shaft [3] or stem [5]:

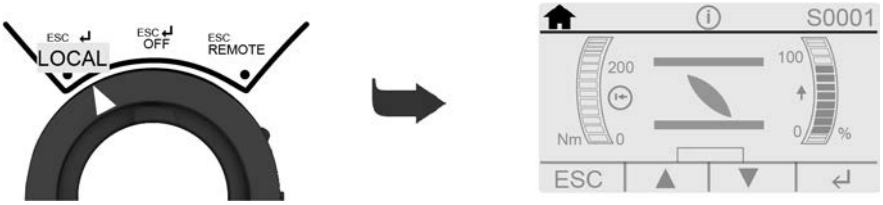
➥ The direction of rotation is correct if the actuator moves in direction **CLOSE** and the hollow shaft in **clockwise** direction, or the stem moves downward.

4. Correctly fit/screw on threaded plug [1] with seal [2], protective cap [4] for stem protection tube [6], fasten thread.

8.3.2. Limit switching: check

Procedure

1. Set selector switch to **LOCAL**.



➥ The symbol ⌂ is indicated top left on the display.

2. Operate actuator using the yellow shuttle dial ▲▼.

➥ The limit switching is correctly set if (standard signalling):

- the yellow indication light/LED1 is illuminated in end position CLOSED
- the green indication light/LED5 is illuminated in end position OPEN
- the indication lights go out after travelling into the opposite direction.

➥ The limit switching is set incorrectly if:

- the actuator comes to a standstill before reaching the end position
- one of the red indication lights/LEDs is illuminated (torque fault)
- the status indication S0007 in the display signals a fault.

3. If the end position setting is incorrect: Reset limit switching.

9. Operation and control of actuator

CAUTION

Hot surfaces, e.g. possibly caused by high ambient temperatures or strong direct sunlight!

Risk of burns

→ Verify surface temperature and wear protective gloves.

9.1. Manual operation

For purposes of setting and commissioning, in case of motor or power failure, the actuator may be operated manually. Manual operation is engaged by an internal change-over mechanism.

Manual operation is automatically disengaged when motor is started again. The handwheel does not rotate during motor operation.

9.1.1. Manual valve operation

CAUTION

Damage at the manual change-over mechanism/motor coupling due to faulty operation!

→ Engage manual operation only during motor standstill.

→ Do NOT use extensions as lever for operation.

Procedure

1. Press push button.
2. Turn handwheel in desired direction.

Figure 58:

➥ The valve closing and opening directions are marked on the handwheel.

Table 16: Example for clockwise closing

→ For valve closing, turn handwheel in direction of the arrow with the symbol.	→ For valve opening, turn handwheel in direction of the arrow with the symbol.
	
Drive shaft (valve) turns **clockwise** in direction CLOSE.	Drive shaft (valve) turns **counterclockwise** in direction OPEN.

Overload protection for manual operation

To protect the valve, an overload protection is available as option for manual operation. If the torque applied at the handwheel exceeds a certain value (refer to order-related technical data sheet), the shear pins will rupture and thus protect the valve from damage. The handwheel can no longer transmit the torque (= handwheel is spinning). Motor operation is still possible. In case of shear pin rupture due to overload, imperatively replace the safety hub.

Figure 59: Handwheel without/with overload protection

[1] Handwheel without overload protection (standard)
[2] Handwheel with overload protection/safety hub (option)

9.2. Motor operation

In motor operation, the actuator is electrically driven. For this, the actuator may either be manually operated (via selector switch/shuttle dial) at local controls or electronically controlled from Remote, e.g. from a DCS.

➪ page 49, Operation commands from Local
➪ page 50, Actuator control from Remote

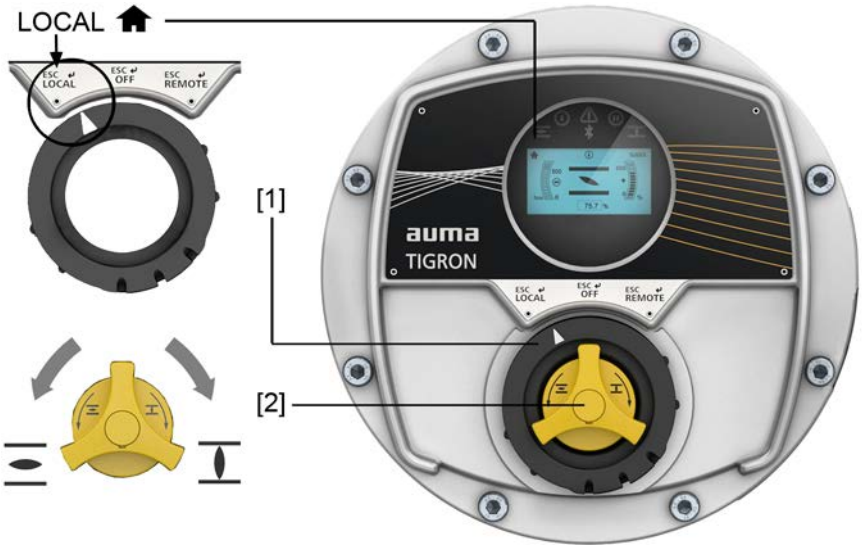
NOTICE

Valve damage due to incorrect basic setting!

→ Prior to electric actuator operation, perform the basic settings for “type of seating” and “torque switching”.

9.2.1. Operation commands from Local

Figure 60: Local controls with selector switch in position LOCAL



Symbol for operation mode Local
[1] Selector switch LOCAL-OFF-REMOTE
[2] Shuttle dial for operation commands OPEN/CLOSE (for selector switch position LOCAL)

How to proceed

1. Set selector switch [1] to **LOCAL**.

➥ The actuator changes to operation mode Local.

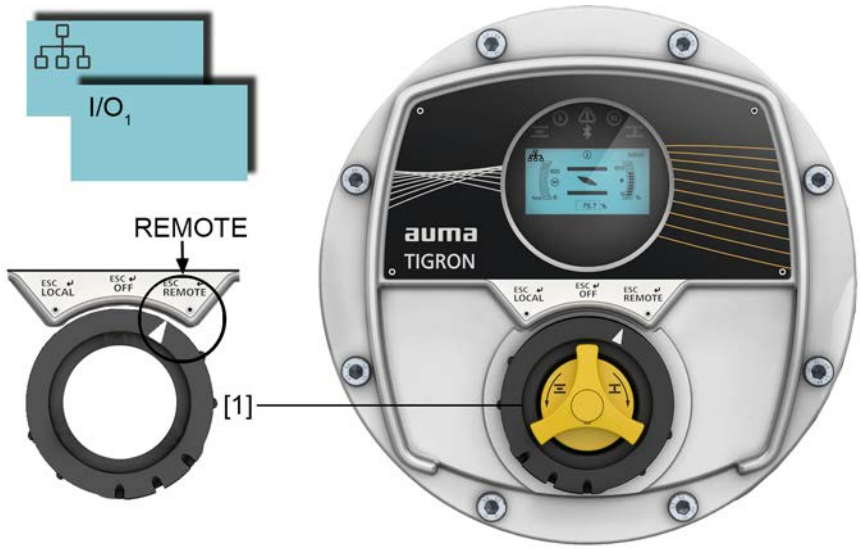
➥ The symbol is indicated on the display.

2. For operation command in direction OPEN: Turn shuttle dial [2] in direction .
3. For operation command in direction CLOSE: Turn shuttle dial [2] in direction .
4. Stop actuator:
   → For push-to-run operation: Release shuttle dial [2].
   → For self-retaining: Briefly toggle shuttle dial [2] in direction of the current operation direction.

Information The OPEN and CLOSE operation commands can be given either in push-to-run or in self-retaining operation mode. In self-retaining mode, the actuator runs to the defined end position following brief toggle of shuttle dial, unless another command has been received beforehand. For further information, please refer to the Manual (Operation and setting).

9.2.2. Actuator control from Remote

Figure 61: Local controls with Combi-Switch



[1] Selector switch LOCAL-OFF-REMOTE
I/O$_1$ Symbol for operation mode Remote via I/O interface
Symbol for operation mode Remote via fieldbus channel 1

CAUTION

Risk of immediate actuator operation when switching on!

Risk of personal injuries or damage to the valve

→ If the actuator starts unexpectedly: Immediately turn selector switch to **OFF**.
→ Check input signals and functions.

How to proceed

→ Set selector switch [1] to **REMOTE**.

➥ The actuator changes to operation mode Remote.

➥ Operation mode Remote is indicated by a symbol in the display, e.g. I/O or . Further information regarding the symbols: ⇨ page 51, Indications and symbols in the display

➥ Now, the actuator can be controlled from Remote. Depending on the setting or configuration, control is made either via digital control inputs (OPEN, STOP, CLOSE), by means of an analogue input (e.g. position setpoint 0 – 20 mA), or via a fieldbus or communication interface.

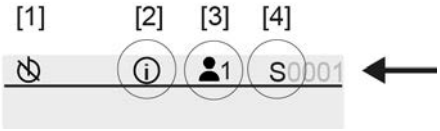
Use the shuttle dial [2] to select between status indication S0001 through S0012, to display various actuator details.

10. Indications

10.1. Indications and symbols in the display

Status bar

Figure 62: Information in the status bar (top)



[1] Operation mode
[2] Status
[3] User level
[4] ID status indication / Menu page

Table 17: Symbols

[1] Operation mode	
	Commissioning
	Local
	Off
I/O1 I/O2	Remote via I/O interface 1/2
1 2	Remote via fieldbus channel 1/2
	Priority REMOTE
	Interlock
	Enable Local
	Local controls disabled
	Setpoint control
	EMERGENCY
	Failure behaviour (fail safe)
PID	PID
	Service
[2] Status	
	Information (Warnings / Out of specification)
	Fault / Failure
[3] User	
	User level 1 – 6
[4] ID number of current indication	
S...	ID number of status indication
M ...	ID number of menu page

Navigation support

Figure 63: Information in the navigation bar (bottom)

The display shows the functions of the operation elements (Combi-Switch magnetic pen) for operation modes **OFF** and **REMOTE** in the bottom line. If no operation

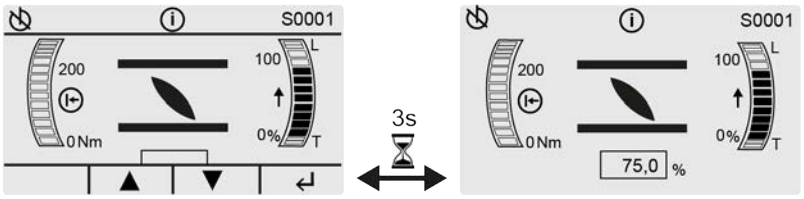
element is operated during 3 seconds, the line disappears. The navigation support is shown again once an operation element is operated.

10.1.1. Feedback signals from actuator and valve

Display indications depend on the actuator version.

Valve status (S0001)

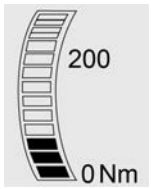
Figure 64:



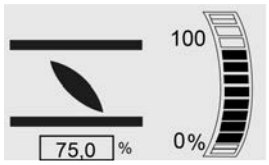
After approx. 3 seconds ⧗ without operating the selector switch/shuttle dial, the navigation line is masked at the bottom of the display.

The display S0001 shows the following information on the valve:

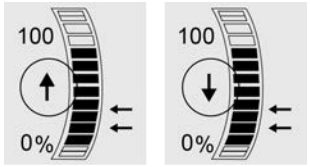
- The applied **torque** appears as bar chart (left). Standard unit = Nm, selection available between ft-lb and % via menu Torque unit M0051.



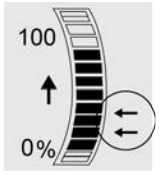
- **Valve position** between 0 – 100 % of travel. As bar chart (right) and as number in the middle below.
  Running and position indication via symbol ⊥.



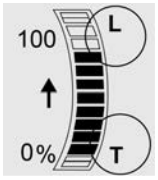
- **Operation direction indication**: The direction of the active or the last operation command is indicated by an arrow next to the bar chart:
  ↑ = Operation command OPEN; ↓ = Operation command CLOSE



- **Pivot points** (intermediate positions) by arrows to the right of the valve position bar chart:

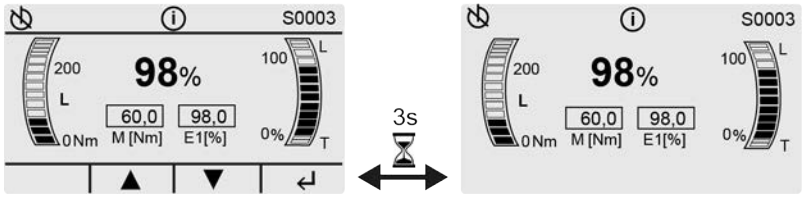


- The **type of seating** at the bar chart (right), with the letters **L** (**L**imit) = limit seating and **T** (**T**orque) = torque seating. At 0 % for end position CLOSED and at 100 for end position OPEN.



Operation commands (S0003)

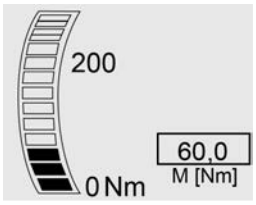
Figure 65:



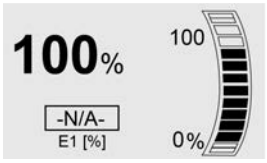
After approx. 3 seconds ⌛ without operating the selector switch/shuttle dial, the navigation line is masked at the bottom of the display.

The display S0003 shows the following information on operation commands:

- The applied **torque** M as bar chart (left) and as figure
  Standard unit = Nm, selection available between ft-lb and % via menu Torque unit M0051.

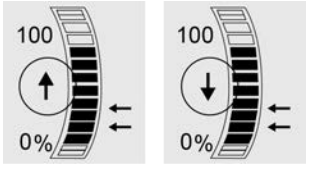


- **Valve position** or actual value E2 between 0 – 100 % of travel as bar chart (right) or as figure in the middle.

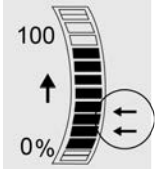


  For setpoint control (if positioner is enabled and activated), the setpoint position E1 is displayed, or-N/A-.

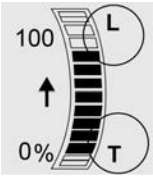
- **Operation direction indication**: The direction of the active or the last operation command is indicated by an arrow next to the bar chart:
  ↑ = Operation command OPEN; ↓ = Operation command CLOSE



- **Pivot points** (intermediate positions) by arrows to the right of the valve position bar chart:



- The **type of seating** at the bar chart (right), with the letters **L** (**L**imit) = limit seating and **T** (**T**orque) = torque seating. At 0 % for end position CLOSED and at 100 for end position OPEN.



10.1.2. Status indications according to AUMA classification

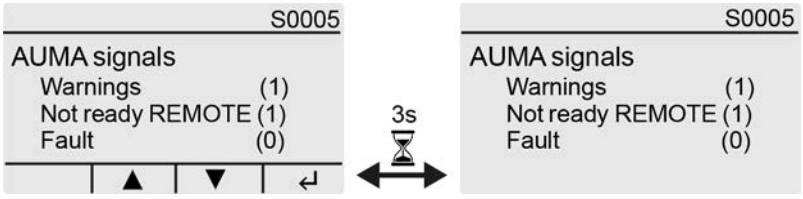
These indications are available if parameter Diagnostic classific. M0539 is set to AUMA.

Warnings and faults

Display S0005 indicates:

- the number of warnings occurred
- the number of the warnings Not ready REMOTE occurred
- the number of faults occurred

Figure 66: AUMA status signals



After approx. 3 seconds ⧗ without operating the selector switch/shuttle dial, the navigation line is masked at the bottom of the display.

For further information on status indications, refer to page 58, Fault indications and warning indications.

10.1.3. Status indications according to NAMUR recommendation

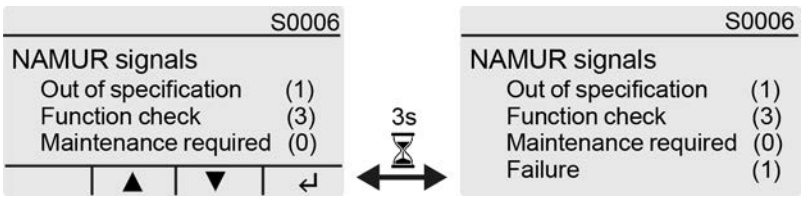
These indications are available if parameter Diagnostic classific. M0539 is set to NAMUR.

NAMUR status (S0006)

The S0006 indication shows out of specification indications according to the NAMUR recommendation NE 107.

- the number of indications occurred

Figure 67: NAMUR status signals

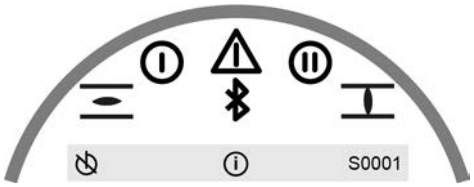


After approx. 3 seconds ⧗ without operating the selector switch/shuttle dial, the navigation line is masked at the bottom of the display.

For further information on status indications, refer to page 58, Fault indications and warning indications.

10.2. Indication lights of local controls

Figure 68: Arrangement and signification of indication lights



End position OPEN reached (blinking: operation in direction OPEN)

Torque fault OPEN

General fault signal, e.g. motor protection tripped

Torque fault CLOSE

End position CLOSED reached (blinking: operation in direction CLOSE)

Bluetooth connection

Indication lights (indications); modify

Different indications can be assigned to LEDs 1 – 5.

M ▷ Device configuration M0053
Local controls M0159
Indication light 1 (left) M0093
Indication light 2 M0094
Indication light 3 M0095
Indication light 4 M0096
Indicat. light 5 (right) M0097
Signal interm. pos. M0167

Default values (Europe):
Indication light 1 (left) = End p. OPEN, blink
Indication light 2 = End p. CLOSED, blink
Indication light 3 = Thermal fault
Indication light 4 = Torque fault OPEN
Indicat. light 5 (right) = Torque fault CLOSE
Signal interm. pos. = OPEN/CLOSED = Off

Further setting values:

Refer to Manual (Operation and setting).

11. Signals (output signals)

11.1. Status signals via output contacts (digital outputs)

Output contacts are used to send status signals (e.g. reaching the end positions, selector switch position, faults...) as binary signals to the control room.

Status signals only have two states: active or inactive. Active means that the conditions for the signal are fulfilled.

Information If equipped with a digital communication interface (fieldbus/Industrial Ethernet/HART), these signals are only available if an additional parallel interface is available.

11.1.1. Assignment of outputs

The output contacts (outputs DOUT 1 – 6) can be assigned to various signals.

Required user level: Specialist (4) or higher.

Device menu: Device configuration M0053
I/O interface M0139
Digital outputs M0110
Signal DOUT 1 M0109

Default values:

Signal DOUT 1 = Fault
Signal DOUT 2 = End position CLOSED
Signal DOUT 3 = End position OPEN
Signal DOUT 4 = Selector sw. REMOTE
Signal DOUT 5 = Torque fault CLOSE
Signal DOUT 6 = Torque fault OPEN

11.1.2. Output coding

The output signalsCoding DOUT 1 – Coding DOUT 12 can be set either to high active or low active.

- High active = output contact closed = signal active
- Low active = output contact open = signal active

Signal active means that the conditions for the signal are fulfilled.

Required user level: Specialist (4) or higher.

Device menu: Device configuration M0053
I/O interface M0139
Digital outputs M0110
Coding DOUT 1 M0102

Default values:

Coding DOUT 1 = Low active
Coding DOUT 2–Coding DOUT 6 = High active

11.2. Analogue signals (analogue outputs)

Valve position Signal: E2 = 0/4 – 20 mA (galvanically isolated)

Designation in the wiring diagram: AOUT1 (position)

Torque feedback signal (option) Signal: E6 = 0/4 – 20 mA (galvanically isolated)

Designation in the wiring diagram: AOUT2 (torque)

Information If equipped with a digital communication interface (fieldbus/Industrial Ethernet/HART), these signals are only available if an additional parallel interface is available.

11.3. Data via communication interface

When equipped with a digital communication interface (fieldbus/Industrial Ethernet/HART), different input and output data are available via the respective interface.

Please refer to www.auma.com for more information on the different communication systems. On the internet, the respective general station description files for device integration are available for freed download. The input and output files are described in the respective Manual “Device integration”.

12. Corrective action

12.1. Faults during commissioning

Table 18:

Faults during operation/commissioning		
Faults	Description/cause	Remedy
In spite of correct setting of mechanical limit switching, actuator operates into the valve or actuator end position.	The overrun was not considered when setting the limit switching. The overrun is generated by the inertia of both the actuator and the valve and the delay time of the electronics.	• Determine overrun: Overrun = travel covered from switching off until complete standstill. • Set limit switching again considering the overrun. (Turn handwheel back by the amount of the overrun)
Handwheel rotates on the shaft without transmitting torque.	Actuator in version with overload protection for manual operation: Shear pin rupture due to excessive torque at handwheel.	Dismount handwheel. Replace overload protection and remount handwheel.

12.2. Fault indications and warning indications

Faults interrupt or prevent the electrical actuator operation. In the event of a fault, the display backlight is red.

Warnings have no influence on the electrical actuator operation. They only serve for information purposes. The display remains white.

Collective signals include further indications. These indications can be displayed by turning the selector switch in direction ↵ Details. The display remains white.

Table 19:

Faults and warnings via status indications in the display		
Indication on display	Description/cause	Remedy
S0001	Instead of the valve position, a status text is displayed.	For a description of the status texts, refer to Manual (Operation and setting).
S0005 Warnings	Collective signal 02: Indicates the number of active warnings.	For indicated value > 0: Toggle selector switch in direction ↵. For details, refer to page 59, Table 20.
S0006 Not ready REMOTE	Collective signal 04: Indicates the number of active signals.	For indicated value > 0: Toggle selector switch in direction ↵. For details, refer to page 61, Table 22.
Fault	Collective signal 03: Indicates the number of active faults. The actuator cannot be operated.	For indicated value > 0: Toggle selector switch in direction ↵ to display a list of detailed indications. For details, refer to page 60, Table 21.
Out of specification	Collective signal 07: Signal according to NAMUR recommendation NE 107: Actuator is operated outside the normal operation conditions.	For indicated value > 0: Toggle selector switch in direction ↵. For details, refer to page 59, Table 20.
Function check	Collective signal 08: Signal according to NAMUR recommendation NE 107: The actuator is being worked on; output signals are temporarily invalid.	For indicated value > 0: Toggle selector switch in direction ↵. For details, refer to page 61, Table 22.
Maintenance required	Collective signal 09: Signal according to NAMUR recommendation NE 107: Recommendation to perform maintenance.	For indicated value > 0: Toggle selector switch in direction ↵ to display a list of detailed indications.
Failure	Collective signal 10: Signal according to NAMUR recommendation NE 107: Actuator function failure, output signals are invalid	For indicated value > 0: Toggle selector switch in direction ↵ to display a list of detailed indications. For details, refer to page 60, Table 21.

Table 20:

Warnings and Out of specification		
Indication on display	Description/cause	Remedy
Config. warning	Collective signal 06: Possible cause: Configuration setting is incorrect. The device can still be operated with restrictions.	Toggle selector switch in direction ↵ to display the individual indications. For a description of the individual signals, refer to Manual (Operation and setting).
Internal warning	Collective signal 15: Device warnings The device can still be operated with restrictions.	Toggle selector switch in direction ↵ to display the individual indications. For a description of the individual signals, refer to Manual (Operation and setting).
24 V DC external	The external 24 V DC voltage supply of the internal controls has exceeded the power supply limits.	Check 24 V DC voltage supply.
Wrn op.mode run time	Warning on time max. running time/h exceeded	• Check modulating behaviour of actuator. • Check parameter Perm. run time M0356, re-set if required.
Wrn op.mode starts	Warning on time max. number of motor starts (starts) exceeded	• Check modulating behaviour of actuator. • Check parameter Permissible starts M0357, re-set if required.
Failure behav. active	The failure behaviour is active since all required setpoints and actual values are incorrect.	Check signals: • Setpoint E1 • Actual value E2 • Actual process value E4 • For Profibus DP, Profinet, Modbus or Ethernet: Check connection to master. • For Profibus DP or Profinet: Check (clear) status of master.
Wrn setpoint position	Warning: Loss of signal setpoint position Possible causes: For an adjusted setpoint range of e.g. 4 – 20 mA, the input signal is 0 (signal loss) For a setpoint range of 0 – 20 mA , monitoring is not possible.	Check setpoint signal.
Op. time warning	The set time (parameter Perm.op. time, manual M0570) has been exceeded. The preset operating time is exceeded for a complete travel from end position OPEN to end position CLOSED.	The warning indications are automatically cleared once a new operation command is executed. • Check valve. • Check parameter Perm.op. time, manualM0570.
Wrn controls temp.	Temperature within actuator controls housing too high.	Measure/reduce ambient temperature.
Time not set	Real time clock has not yet been set.	Set time.
RTC voltage	Voltage of RTC button cell too low.	Replace button cell.
PVST fault	Partial Valve Stroke Test (PVST) could not be successfully completed.	Check actuator (PVST settings).
PVST abort	Partial Valve Stroke Test (PVST) was aborted or could not be started.	Perform RESET or restart PVST.
Wrn no reaction	No actuator reaction to operation commands within the set reaction time.	• Check movement at actuator. • Check parameter Reaction timeM0634.
Wrn FOC[1)]	Optical receiving signal (channel 1) incorrect (no or insufficient Rx receive level) or RS-485 format error.	Check/repair FO cables.
Wrn FO cable budget[1)]	Warning: FO cable system reserve reached (critical or permissible Rx receive level)	Check/repair FO cables.
Wrn FOC connection[1)]	Warning FO cable connection is not available.	Fit FO cable connection.
Torque wrn OPEN	Limit value for torque warning in direction OPEN exceeded.	Check parameter Wrn torque OPEN M0768, re-set if required.

Warnings and Out of specification		
Indication on display	Description/cause	Remedy
Torque wrn CLOSE	Limit value for torque warning in direction CLOSE exceeded.	Check parameter Wrn torque CLOSE M0769, reset if required.
PVST required	Execution of PVST (Partial Valve Stroke Tests) is required.	
Maintenance required	Maintenance is required.	

1) For actuators with FOC connection

Table 21:

Faults and Failure		
Indication on display	Description/cause	Remedy
Configuration error	Collective signal 11: Configuration error has occurred.	Toggle selector switch in direction ↵ to display the individual indications. For a description of the individual signals, refer to Manual (Operation and setting).
Config. error REMOTE	Collective signal 22: Configuration error has occurred.	Toggle selector switch in direction ↵ to display the individual indications. For a description of the individual signals, refer to Manual (Operation and setting).
Internal error	Collective signal 14: Internal error has occurred.	AUMA service Toggle selector switch in direction ↵ to display the individual indications. For a description of the individual signals, refer to Manual (Operation and setting).
Torque fault CLOSE	Torque fault in direction CLOSE	Perform one of the following measures: • Issue operation command in direction OPEN. • Position selector switch to **LOCAL** and reset fault signal by toggling the selector switch in direction **ESC**. • For control via fieldbus: Execute reset command via fieldbus.
Torque fault OPEN	Torque fault in direction OPEN	Perform one of the following measures: • Issue operation command in direction CLOSE. • Position selector switch to **LOCAL** and reset fault signal by toggling the selector switch in direction **ESC**. • For control via fieldbus: Execute reset command via fieldbus.
Phase fault	• When connecting to a 3-phase AC system and with internal 24 V DC supply of the electronics: Phase 2 is missing. • When connecting to a 3-phase AC system and external 24 V DC supply of the electronics: One of the phases L1, L2 or L3 is missing.	Test/connect phases.
Incorrect phase seq	The phase conductors L1, L2 and L3 are connected in the wrong sequence. Only applicable if connected to a 3-ph AC system.	Correct the sequence of the phase conductors L1, L2 and L3 by exchanging two phases.
Thermal fault	• Motor overheating: Motor protection (thermal monitoring) has tripped • Temperature limits have been exceeded or fallen short of: Temperature monitoring of electronics has tripped	• When overheating or falling short of temperature limits: Cooling down If the fault indication display persists after cooling down: - Position selector switch to **LOCAL** and reset fault signal by toggling the selector switch in direction **ESC**. - For control via fieldbus: Execute reset command via fieldbus. • Check fuses.
Fault no reaction	No actuator reaction to operation commands within the set reaction time.	Check movement at actuator.
Wrn input AIN 1	Loss of signal analogue input 1	Check wiring.

Faults and Failure		
Indication on display	Description/cause	Remedy
Incorrect rotary direct.	Contrary to the configured direction of rotation and the active operation command, the motor turns into the wrong direction.	Check operation command control. For 3-phase AC current mains, activate phase monitoring (parameter Adapt rotary dir. M0171). Check device configuration setting (parameter Closing rotation M0176). To delete the fault indication: Disconnect actuator from the mains and perform a reboot.
DMF fault OPEN[1)]	The torque in direction OPEN, measured at the output drive shaft using the torque measurement flange is too high.	Check DMF trip torque OP parameter. Check DMF fault level parameter.
DMF fault CLOSE[1)]	The torque in direction CLOSE, measured at the output drive shaft using the torque measurement flange is too high.	Check DMF trip torque CL parameter. Check DMF fault level parameter.

1) For actuators equipped with torque measurement flange (DMF)

Table 22:

Not ready REMOTE and Function check (collective signal 04)		
Indication on display	Description/cause	Remedy
Wrong oper. cmd	Collective signal 13: Possible causes: • Several operation commands (e.g. OPEN and CLOSE simultaneously, or OPEN and SETPOINT operation simultaneously) • A setpoint is present and the positioner is not active	• Check operation commands (reset/clear all operation commands and send one operation command only). • Set parameter Positioner to Function active. • Check setpoint. Toggle selector switch in direction ↵ to display the individual indications.
Sel. sw. not REMOTE	Selector switch is not in position REMOTE.	Set selector switch to REMOTE.
Service active	Operation via service interface (Bluetooth) and AUMA CDT service software.	Exit service software.
Disabled	The actuator is in operation mode Disabled.	Check setting and status of function <Enable local controls>.
EMCY stop active	The EMERGENCY stop switch has been operated. The motor control power supply (contactors or thyristors) is disconnected.	• Enable EMERGENCY stop switch. • Reset EMERGENCY stop state by means of Reset command.
EMCY behav. active	Operation mode EMERGENCY is active (EMERGENCY signal was sent). 0 V are applied at the EMERGENCY input.	• Detect cause for EMERGENCY signal. • Verify failure source. • Apply +24 V DC at EMERGENCY input.
I/O interface	The actuator is controlled via the I/O interface (parallel).	Check I/O interface.
Handwheel active	Manual operation is activated.	Start motor operation.
FailState fieldbus	Fieldbus connection available, however no process data transmission by the master.	Verify master configuration.
Local STOP	A local STOP is active. Push button STOP of local controls is operated.	Release push button STOP.
Interlock	An interlock is active.	Check interlock signal.
Interlock by-pass	By-pass function is interlocked.	Check states of main and by-pass valve.
PVST active	Partial Valve Stroke Test (PVST) is active.	Wait until PVST function is complete.

12.3. Fuses

12.3.1. Fuses used

F1/F2

Table 23:

Primary fuses F12/F13		
G fuse	F12/F13	AUMA art. no.
Size	6.3 x 32 mm	
F12 Primary circuit fuse protection phase L1	1 A T; 500 V	K006.901
F13 Primary circuit fuse protection phase L3	1 A T; 500 V	K006.901

F1

Table 24:

Secondary fuse F1		
G fuse according to IEC 60127-2/III	F1	AUMA art. no.
Size	5 x 20 mm	
Voltage output power supply unit 24 V DC SAFETY Power supply for MWG and TMS	0.8 A T; 250 V	K004.328

F4/F8

Table 25:

Secondary fuses F4/F8		
G fuse according to IEC 60127-2/III	F4/F8	AUMA art. no.
Size	5 x 20 mm	
F4 voltage output power supply unit 24 V DC Power supply of local controls, plug-in boards and system voltages	1.6 A T; 250 V	K005.759
F8 voltage output power supply unit 24 V AC Voltage output for controlling contactors	1.6 A T; 250 V	K005.759

F6

Table 26:

Secondary fuse F6		
G fuse according to IEC 60127-2/III	F6	AUMA art. no.
Size	10.4 x 16 mm	
Voltage output power supply unit 24 V Short-circuit resistance of customer voltage. Is also used for AOUT.	0.75 A T; 60 V	K005.430

12.3.2. Motor protection (thermal monitoring)

In order to protect against overheating and impermissibly high surface temperatures at the actuator, PTC thermistors or thermoswitches are embedded in the motor winding. Motor protection trips as soon as the max. permissible winding temperature has been reached.

If the inside temperature limits are exceeded or fallen short of, the temperature monitoring of electronics trips.

The actuator is switched off and the following fault signals are issued:

- LED 3 (motor protection tripped) on the local controls is illuminated.
- Status indications S0007 or S0011 Failure display a fault.
  The fault Details is displayed when selecting Thermal fault.

After thermal motor tripping, a thermal fault signal is issued. The reason for the fault must be checked and remedied. Once the reason for the fault is remedied, the fault must be acknowledged (RESET).

Information

For active operation commands, the command is directly executed following acknowledgement.

Manual acknowledgement can be made:

- By toggling the selector switch in direction **ESC** when selector switch is set to **LOCAL**.

- In selector switch position **REMOTE** via a digital (I/O interface) with the RESET command if a digital input is configured for RESET signal.

Proof-test motor protection

Test correct function of the motor protection as described hereafter. Perform the functional test at the latest within the framework of maintenance (refer to chapter <Servicing and maintenance>).

The test is performed by simulating the motor protection signal via the menu:

Required user level: Specialist (4) or higher.

Diagnostics M0022
TMS proof test M1950

Test procedure:

1. Set selector switch to **OFF**.
2. Return to the main menu and select the simulation value in parameter TMS proof test M1950: Select Thermal test.
3. Activate motor protection simulation: Toggle selector switch in direction ↵. The safety function is correct if no fault signal is displayed.
4. Reset simulation: Toggle selector switch in direction ↵ (exit the simulation menu) and turn the selector switch to the initial position.

13. Servicing and maintenance

CAUTION

Damage caused by inappropriate maintenance!

→ Servicing and maintenance must be carried out exclusively by suitably qualified personnel having been authorised by the end user or the contractor of the plant. Therefore, we recommend contacting our service.

→ Only perform servicing and maintenance tasks when the device is switched off.

AUMA Service & Support

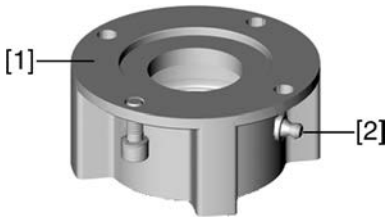
AUMA offers extensive service such as servicing and maintenance as well as customer product training. For the contact addresses, refer to our website (www.auma.com).

13.1. Preventive measures for servicing and safe operation

The following actions are required to ensure safe device operation:

6 months after commissioning and then once a year

- Carry out visual inspection:
  Cable entries, cable glands, blanking plugs, etc. have to be checked for correct fit and sealing. If required, tighten cable glands and blanking plugs with torque in compliance with the manufacturer's specifications.
  Check actuator for damage as well as for grease or oil leakage.
  The seals must be replaced in case of leakage.
- When deployed in areas where dust formation represents a potential explosion hazard, perform visual inspection for deposit of dirt or dust on a regular basis. Clean devices if required.
- Check fastening screws between actuator and gearbox/valve for tightness. If required, fasten screws while applying the tightening torques as indicated in chapter <Assembly>.
- When rarely operated: Perform test run.
- For devices with output drive type A: Press in Lithium soap EP multi-purpose grease on mineral oil base at the grease nipple with a grease gun.
  Figure 69: Output drive type A



[1] Output drive type A
[2] Grease nipple

- Lubrication of the valve stem must be done separately.
  Exception: For output drive type A in version with stem lubrication (option), the stem is lubricated together with the output drive. If the valve manufacturer interval specifications are shorter for lubricating the valve, the shorter lubrication intervals of the valve manufacturer apply.

Table 27:

Grease quantities for bearing of output drive type A				
Output drive type	A 07.2	A 10.2	A 14.2	A 16.2
Quantity [g] 1)	1.5	3	5	10

1) For grease with density r = 0.9 kg/dm³

13.2. Maintenance

Maintenance intervals

In compliance with EN 60079-17, Ex certified products either require repeated testing at an interval of 3 years or continuous monitoring by trained personnel.

Manual operation

During maintenance, the mechanical parts of the handwheel activation, in particular motor coupling and retaining spring, must be checked. Replace the parts in case of visible wear.

Lubrication

- The gear housing is filled with oil in the factory.
- Oil change is performed during maintenance
  - Generally after 4 to 6 years for modulating duty.
  - Generally after 6 to 8 years if operated frequently (open-close duty).
  - Generally after 10 to 12 years if operated infrequently (open-close duty).
- We recommend exchanging the seals when changing the oil.
- Additional lubrication of the gear housing is not required during operation.

Notes relating to maintenance

- Perform visual inspection of actuator and mounted accessories. Ensure that no outside damage, changes or leakage of grease and oil are visible.
- Check actuator for unusual running or grinding noise or vibration which might be an indication of bearing or gear damage.
- Electrical connection cables must be placed properly and in perfect condition.
- Thoroughly touch up any possible damage to painting to prevent corrosion. Original paint in small quantities can be supplied by AUMA.
- Cable entries, cable glands, plugs etc. have to be checked for correct tightness and sealing. Consider torques according to manufacturer's details. If required, replace the components. Only use components having an own EU type examination certificate or IECEx certification.
- Check whether Ex connections are fastened correctly.
- Take care of possible discolouration of the terminals and wires. This would indicate an increased temperature.
- For Ex housings, pay special attention to a possible collection of water. This may originate from “breathing” due to severe temperature variations (e. g. change of night and day), from damaged seals etc. Remove any water immediately.
- The process temperature range must be within the range of the specified ambient temperature.
- Check the flame path gaps of flameproof enclosures for dirt and corrosion.
- Since the dimensions of all flameproof joints are strictly defined and inspected, no mechanical work (such as grinding) shall be performed on them. The joint surfaces have to be cleaned chemically (e. g. with Esso-Varsol).
- Consult manufacturer for indications regarding flameproof joints.
- Repair interventions on flameproof joints is not permitted.
- Prior to fitting, preserve joint surfaces with an acid-free corrosion protection agent (e. g. Esso Rust-BAN 397).
- Ensure that all housing covers are handled carefully and that the seals are checked.
- All cable and motor protection components have to be checked.
- If defects impairing the safety are detected during maintenance, repair measures have to be initiated without delay.
- Any kind of surface coating for the joint surfaces is not permitted.
- When replacing parts, sealing elements, etc. only original spare parts shall be used.

14. Technical data

Information The following tables include standard and optional features. For detailed information on the customer-specific version, refer to the order-related data sheet. The technical data sheet can be downloaded from the Internet in both German and English at **http://www.auma.com** (please state the order number).

14.1. Technical data Multi-turn actuators

Features and functions		
Explosion protection	Refer to name plate	
Product certificates	DEKRA 19 ATEX 0091 X IECEx DEK 19.0055 X	
Type of duty	Standard:	Short-time duty S2 - 15 min, classes A and B according to EN 15714-2
	Option:	Short-time duty S2 - 30 min, classes A and B according to EN 15714-2
	For nominal voltage and +40 °C ambient temperature and at run torque load.	
Type of duty	Standard:	Intermittent duty S4 - 25 %, class C according to EN 15714-2
	Option:	Intermittent duty S4 - 50 %, class C according to EN 15714-2
	For nominal voltage and +40 °C ambient temperature and at modulating torque load.	
Motors	3-phase AC asynchronous squirrel-cage motor, type IM B9 according to IEC 60034-7, IC410 cooling procedure according to IEC 60034-6	
Mains voltage, mains frequency	Standard voltages:	

3-phase AC Voltages/frequencies										
Volt	380	380	400	400	415	440	440	460	480	500
Hz	50	60	50	60	50	50	60	60	60	50

Special voltages:

3-phase AC Voltages/frequencies							
Volt	220	220	230	525	575	600	660
Hz	50	60	50	50	60	60	50

Further voltages on request
Permissible variation of mains voltage: ±10 %
Permissible variation of mains frequency: ±5 %

Overvoltage category	Category III according to IEC 60364-4-443	
Insulation class	Standard:	F, tropicalized
	Option:	H, tropicalized
Motor protection	PTC thermistors (according to DIN 44082)	
Self-locking	Self-locking: Output speeds up to 90 rpm. (50 Hz) or 108 rpm (60 Hz) NOT self-locking: Output speeds from 125 rpm. (50 Hz) or 150 rpm (60 Hz) Multi-turn actuators are self-locking if the valve position cannot be changed from standstill while torque acts upon the output drive.	
Self-locking	Yes, multi-turn actuators are self-locking, if the valve position cannot be changed from standstill while torque acts upon the output drive.	
Motor heater (option)	Voltages:	110 – 120 V AC, 220 – 240 V AC or 380 – 480 V AC
	Power depending on the size 12.5 – 25 W	
Manual operation	Manual drive for setting and emergency operation, handwheel does not rotate during electrical operation	
	Options:	Handwheel lockable Handwheel stem extension Power tool for emergency operation with square 30 mm or 50 mm
Indication for manual operation (option)	Signal for manual operation active/not active	

Features and functions		
Electrical connection	Standard:	AUMA Ex plug/socket connector (KT, KM), screw-type motor terminals, push-in type control terminals
	Option:	AUMA Ex plug/socket connector (KT, KM), with additional support terminals in plug/socket connector
Threads for cable entries	Standard:	Metric threads
	Options:	NPT threads, G threads
Valve attachment	Standard:	B1 according to EN ISO 5210
	Options:	A, B2, B3, B4, C, D according to EN ISO 5210 A, B, D, E according to DIN 3210 C according to DIN 3338
	Special valve attachments: AF, AK, AG, B3D, ED, DD, IB1, IB3, A prepared for permanent lubrication of stem	
Position sensing	Absolute encoder, magnetic for position sensing (MWG) Turns per stroke: 2 to 500 (standard) or 20 to 5,000 (option)	
Torque sensing	AUMA torque sensor; resolution ± 2 %, referring to maximum adjustable torque.	
External supply of the electronics (option)	24 V DC: +20 %/–15 % For external electronics supply, the power supply of integral controls must have an enhanced isolation against mains voltage in compliance with IEC 61010-1 and the output power be limited to 150 VA.	
Rated power	The rated power is the nominal motor power, refer to Electrical data.	
Switchgear	Standard:	Reversing contactors (mechanically and electrically interlocked) for AUMA power classes A1 and A2
	Options:	Thyristor unit for mains voltage up to 500 V AC for AUMA power classes B1, B2 and B3
	For the assignment of AUMA power classes, please refer to Electrical data.	
Digital input	Standard:	4 digital inputs: OPEN, STOP, CLOSE, EMERGENCY (via opto-coupler with one common).
	Option:	6 digital inputs, e.g. OPEN, STOP, CLOSE, EMERGENCY, MODE, Enable LOCAL
Analogue input	With positioner option: Input of actuator position setpoint as continuous value from 0/4 – 20 mA	
Control voltage/current consumption for digital control inputs	Standard:	24 V DC, current consumption: approx. 10 mA per input
	All input signals must be supplied with the same potential.	
Status signals (output signals)	Standard:	• 6 programmable output contacts: - 5 potential-free NO contacts with one common, max. 250 V AC, 1 A (resistive load) - 1 potential-free change-over contact, max. 250 V AC, 5 A (resistive load) • Analogue output signal for position feedback - Galvanically isolated position feedback 0/4 – 20 mA (load max. 500 Ohm)
	Options:	• 6 programmable output contacts: - 5 change-over contacts with separate common, max. 250 V AC, 1 A (resistive load), 1 potential-free change-over contact, max. 250 V AC, 5 A (resistive load) • 1 further analogue output, e.g. torque output as continuous value from 0/4 – 20 mA
Voltage output	Standard:	Auxiliary voltage 24 V DC: max. 100 mA for supply of control inputs, galvanically isolated from internal voltage supply.
	Option:	Auxiliary voltage 115 V AC: max. 30 mA for supply of control inputs, galvanically isolated from internal voltage supply
Local controls	Standard:	• Combi-Switch with the following functions: - Selector switch: LOCAL-OFF-REMOTE, ESC, ENTER, (RESET) - Shuttle dial: OPEN, CLOSE, (STOP) • Selector switch: lockable in all three positions • 6 indication lights: - End position and running indication OPEN (green), torque fault OPEN (red), motor protection tripped (red), torque fault CLOSE (red), end position and running indication CLOSE (yellow), Bluetooth communication (blue) • Graphic LC display: illuminated For display of all essential actuator data like travel position, torque, type of seating, etc.
	Option:	• Colours and functions of indication lights to be selected via the menu according to operation instructions

Features and functions		
Bluetooth module	Deactivation/activation from remote	
Application functions	Standard:	• Type of seating: limit or torque seating respectively for end positions OPEN and CLOSED • Torque by-pass • Stepping mode • Any 8 intermediate positions: can be set between 0 and 100 %, reaction and signal behaviour programmable • Running indication blinking: adjustable
	Options:	• Positioner: - Position setpoint via analogue input 0/4 – 20 mA - Programmable behaviour on loss of signal - Automatic adaptation of dead band (adaptive behaviour selectable) - Split range operation - MODE input for selecting between OPEN-CLOSE and setpoint control
Safety functions	Standard:	• EMERGENCY operation (behaviour to be selected) - Tripping: Digital input: Low active - Reaction: Stop, end position CLOSED, end position OPEN, setpoint position - Torque monitoring can be by-passed during EMERGENCY operation
	Options:	• Enabling local controls via digital input "Enable LOCAL": Actuator operation via local controls can be enabled or disabled • Interlock function: Enabling the operation commands OPEN or CLOSE from Remote via two digital inputs • PST (Partial Stroke Test): Programmable to check the function of the actuator
Monitoring function	• Valve overload protection: Torque limit value adjustable, results in switching off and generates fault signal • Motor temperature monitoring: results in switching off and generates fault signal • Monitoring the heater within actuator (if available): generates warning signal • Monitoring of permissible operation mode: adjustable, generates warning signal • Operation time monitoring: adjustable, generates warning signal • Phase failure monitoring: results in switching off and generates fault signal • Rotary direction monitoring: results in switching off and generates fault signal	
Diagnostic function	• Electronic device ID with order and product data • Logging of operating data: A resettable counter and a lifetime counter each for: - e.g. motor running time, number of starts, torque switch trippings in end position CLOSED, limit switch trippings in end position CLOSED, torque switch trippings in end position OPEN, limit switch trippings in end position OPEN, torque faults CLOSE, torque faults OPEN, motor protection trippings • Time-stamped event report with history for setting, operation and faults • Status signals according to NAMUR recommendation NE 107: “Failure", "Function check", "Out of specification", "Maintenance required" • Torque profile: - Various reference operations can be executed (e.g. for commissioning) - Torque values can be stored as reference profile. - Comparison operation can be executed at any time (e.g. for plant control). - Tolerance values can be flexibly defined for travel. - Values outside the permissible range generate configurable signals to the DCS.	
Wiring diagram (basic version)	TPC T-0A1AAB11-000	

Service conditions	
Use	Indoor and outdoor use permissible
Mounting position	Any position
Installation altitude	≤ 2,000 m above sea level
	> 2 000 m above sea level on request
Ambient temperature	Refer to name plate
Humidity	Up to 100 % relative humidity across the entire permissible temperature range

Enclosure protection in accordance with IEC 60529	IP68 with AUMA 3-phase AC motor Terminal compartment additionally sealed against interior of actuator (double sealed)	
	According to AUMA definition, enclosure protection IP68 meets the following requirements: • Depth of water: maximum 8 m head of water • Continuous immersion in water: maximal 96 hours • Up to 10 operations during immersion • Modulating duty is not possible during immersion.	
Pollution degree according to IEC 60664-1	Pollution degree 4 (when closed), pollution degree 2 (internal)	
Vibration resistance according to IEC 60068-2-6	2 g, 5 to 200 Hz Resistant up to maximum 2g to vibration during start-up or for failures of the plant. Resistance against frequent or continuously occurring vibration cannot be derived from this. Not valid in combination with gearboxes. Detailed information on request.	
Corrosion protection	Standard:	KS: Suitable for use in areas with high salinity, almost permanent condensation, and high pollution.
	Options:	KX: Suitable for use in areas with extremely high salinity, permanent condensation, and high pollution.
Coating	Double layer powder coating	
Colour	Standard:	AUMA silver-grey (similar to RAL 7037)
	Options:	Available colours on request
Lifetime	AUMA multi-turn actuators meet or exceed the lifetime requirements of EN 15714-2. Detailed information can be provided on request.	
Sound pressure level	< 72 dB (A)	

Accessories	
Wall mount controls (wall mounted version)	Wall mount controls including local controls separately mounted from actuator, connecting cables on request. Recommended when difficult to access or heavy operational vibration occurring on site. Cable length between actuator and separately mounted local controls amounts to max. 100 m.
Software tool (via Bluetooth connection)	AUMA CDT (Commissioning and Diagnostic Tool for Windows-based PC/notebook)

Further information	
EU Directives	ATEX Directive 2014/34/EU Machinery Directive 2006/42/EC Low Voltage Directive 2014/35/EU EMC Directive 2014/30/EU RoHS Directive 2011/65/EU
Reference documents	Dimensions Multi-turn actuators TR-M30X – TR-M1000X/TR-MR30X – TR-MR1000X Electrical data Multi-turn actuators TR-MR30X – TR-MR1000X

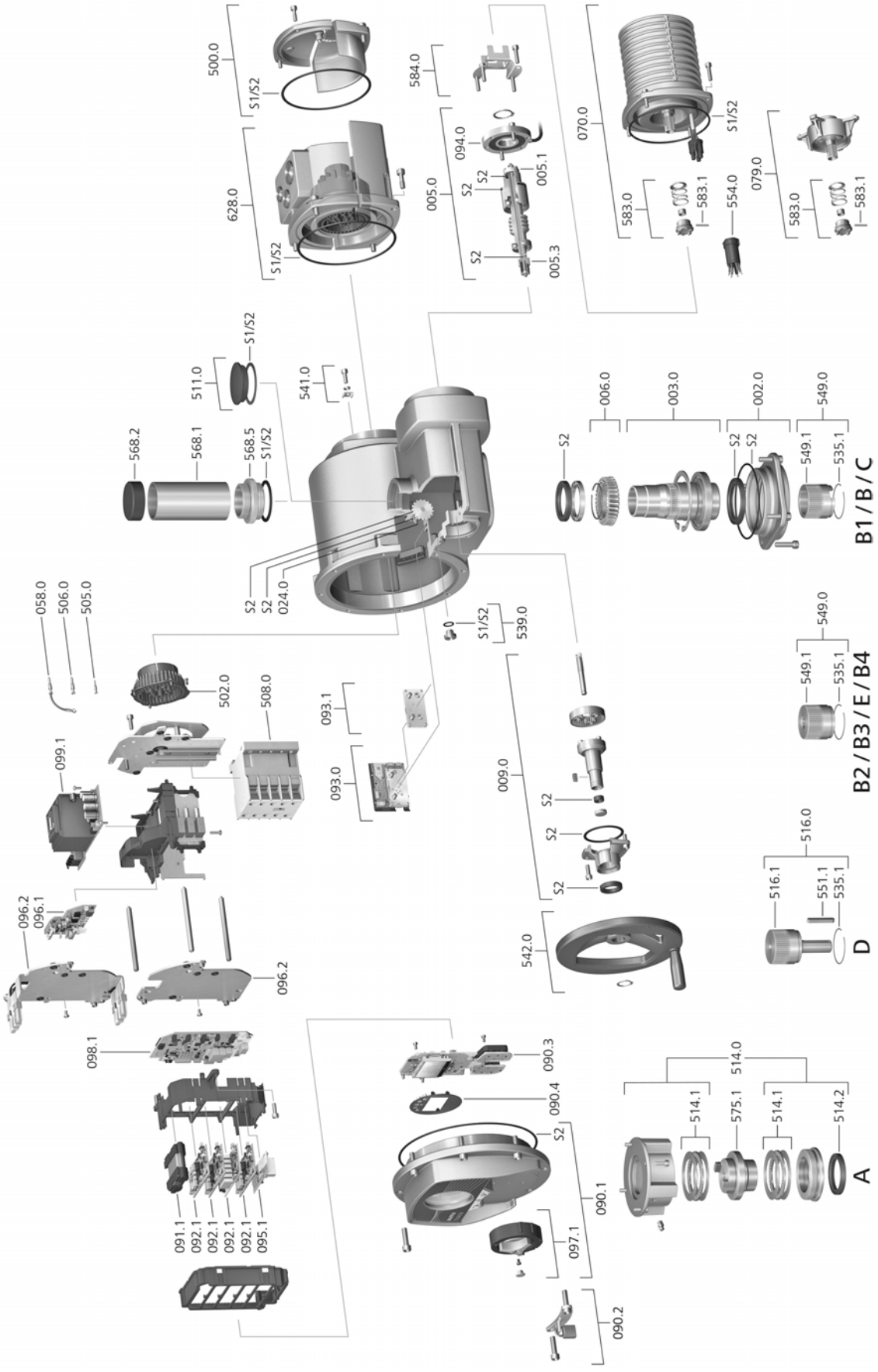
14.2. Tightening torques for screws

Table 28:

Tightening torques for screws		
Threads	Tightening torque [Nm]	
	Strength class	
	A2-70/A4-70	A2-80/A4-80
M6	7.4	10
M8	18	24
M10	36	48
M12	61	82
M16	150	200
M20	294	392
M30	1,015	1,057
M36	1,769	2,121

15. Spare parts

15.1. Multi-turn actuators TR-M30X – TR-M1000X / TR-MR30X – TR-MR1000X



Please state device type and our order number (see name plate) when ordering spare parts. Only original AUMA spare parts should be used. Failure to use original spare parts voids the warranty and exempts AUMA from any liability. Representation of spare parts may slightly vary from actual delivery.

Ref. no.	Designation	Type	Ref. no.	Designation	Type
002.0	Bearing flange	Sub-assembly	502.0	Pin carrier without pins	Sub-assembly
003.0	Hollow shaft	Sub-assembly	505.0	Pin for controls	Sub-assembly
005.0	Drive shaft	Sub-assembly	506.0	Pin for motor	Sub-assembly
005.1	Motor coupling		508.0	Switchgear	
005.3	Manual drive coupling		511.0	Threaded plug	Sub-assembly
006.0	Worm wheel		514.0	Output drive type A (without stem nut)	Sub-assembly
009.0	Manual gearing	Sub-assembly	514.1	Axial needle roller bearing	Sub-assembly
024.0	Travel signal conduit with drive wheel for limit switching	Sub-assembly	514.2	Radial seal for output drive type A	
058.0	Cable for protective earth	Sub-assembly	516.0	Output drive type D	Sub-assembly
070.0	Motor (for V... motors incl. ref. no. 079.0)	Sub-assembly	516.1	Output drive shaft D	
079.0	Planetary gearing for motor drive (only for V… motors)	Sub-assembly	535.1	Snap ring	
090.1	Cover for local controls assy	Sub-assembly	539.0	Screw plug	Sub-assembly
090.2	Locking device assy	Sub-assembly	541.0	External earth connection	Sub-assembly
090.3	Local controls board		542.0	Handwheel with ball handle	Sub-assembly
090.4	Face plate for display		549.0	Output drive types (B1/B2/B3/B4/C/E)	Sub-assembly
091.1	Battery module		549.1	Output drive sleeve (B1/B2/B3/B4/C/E)	
092.1	I/O module, fieldbus module		551.1	Parallel key	
093.0	Position sensing	Sub-assembly	554.0	Socket carrier for motor plug/socket connector with cable harness	Sub-assembly
093.1	Reduction gearing for position sensing for 5,000 turns/stroke (option)	Sub-assembly	568.1	Stem protection tube (without cap)	
094.0	Torque sensor		568.2	Protective cap for stem protection tube	
095.1	TMS tripping device		568.5	Stem protection tube adapter	
096.1	Heater sub-assembly (option)	Sub-assembly	575.1	Stem nut A (without thread)	
096.2	Support plate		583.0	Motor coupling on motor shaft	Sub-assembly
096.2	Support plate for heater (option)		583.1	Pin for motor coupling	
097.1	Combi-Switch assy	Sub-assembly	584.0	Retaining spring for motor coupling	Sub-assembly
098.1	Logic board		628.0	Ex plug/socket connector with terminal connection (KT)	Sub-assembly
099.1	Power supply unit		S1	Seal kit, small	Set
500.0	Cover	Sub-assembly	S2	Seal kit, large	Set

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