auma®
Solutions for a world in motion

Multi-turn actuators
SA 07.2 – SA 16.2
SAR 07.2 – SAR 16.2
AUMA NORM actuator (without controls)

Operation instructions
Assembly and commissioning

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

Read operation instructions first.
- Heed 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.

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.

Depending on the device version, this includes:

- Configuration guidelines for the respective fieldbus or network applications.

Safety instructions/warnings

All personnel working with this device must be familiar with the safety and warning instructions in this manual and heed 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.

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.
- Heed recognised rules for occupational health and safety.
- Heed 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 using an appropriate thermometer and wearing protective gloves, prior to working on the device.

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 SA/SAR are designed for the operation of industrial valves, e.g. globe valves, gate valves, butterfly valves, and ball valves.
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 atmospheres
- 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.

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.**

The ⚠ safety 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:

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

Information The term **Information** is part of an instruction and gives important notes and information with regard to an action step.

Symbol for CLOSED (valve closed)

Symbol for OPEN (valve open)

⇨ **Result of a process step**

Describes the result of a preceding process step.

→ **Action step**

Describes one single action step.

▶ **Reference to the page number**

Refers to the page number for further information. To return from the target to the previous view, it is possible to jump back to the previous view within PDF documents: When using Adobe Acrobat via **Menu | Previous view**, or using the key combination **Alt + left**.

2 Short description

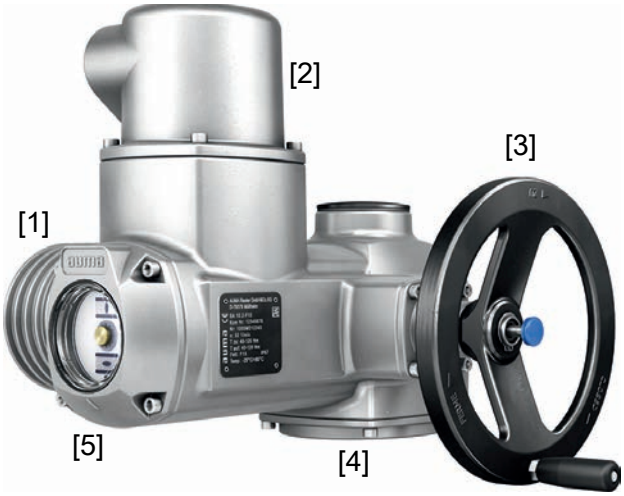
Multi-turn actuator

Definition according to EN 15714-2/EN ISO 5210 or EN ISO 22153:

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

AUMA multi-turn actuator

Figure 1: Example: AUMA SA 10.2 multi-turn actuator



[1]	Motor	[2]	Electrical connection
[3]	Handwheel	[4]	Valve attachment
[5]	Mechanical position indicator		

AUMA SA/SAR multi-turn actuators are driven by an electric motor. A handwheel is available for setting and emergency operation.

Actuator controls are required to operate or process the actuator signals.

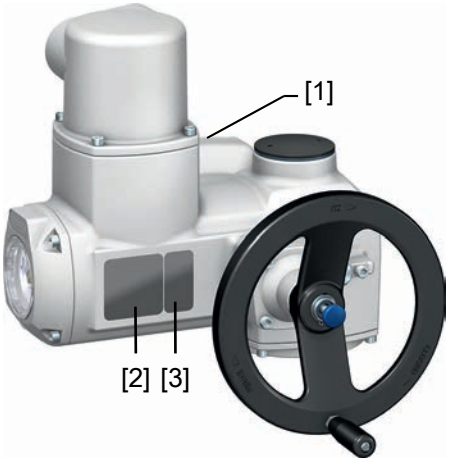
Actuators without controls can be equipped with AUMA actuator controls at a later date. For any queries, please state our order number. The order number is available on the name plate. (Refer to Actuator name plate [▶ 8].)

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.

3 Name plate

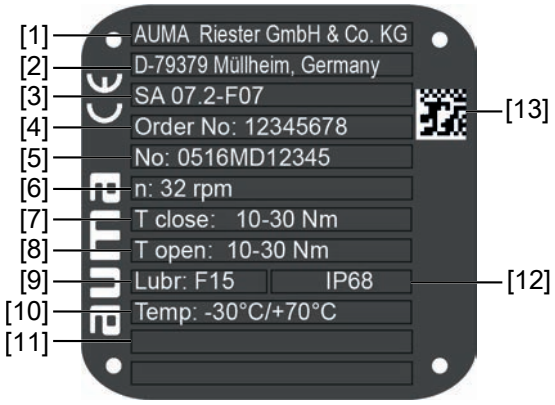
Figure 2: Arrangement of name plates



[1]	Motor name plate	[2]	Actuator name plate
[3]	Additional plate, e.g. KKS plate (Power Plant Classification System)		

Actuator name plate

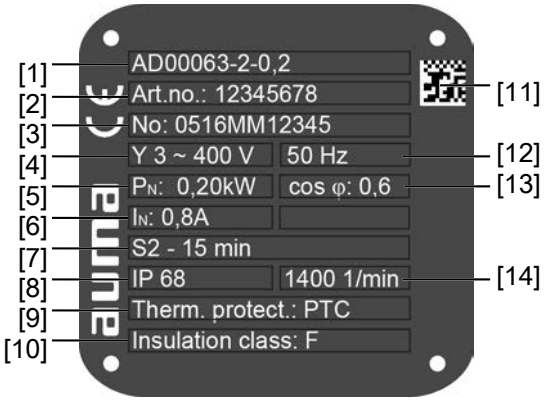
Figure 3: Actuator name plate (example)



[1]	Name of manufacturer	[2]	Address of manufacturer
[3]	Type designation	[4]	Order number
[5]	Serial number	[6]	Speed
[7]	Torque range in direction CLOSE	[8]	Torque range in direction OPEN
[9]	Type of lubricant	[10]	Permissible ambient temperature
[11]	Can be assigned as an option upon customer request	[12]	Enclosure protection
[13]	Data Matrix code		

Motor name plate

Figure 4: Motor name plate (example)



[1]	Motor type	[2]	Motor article number
[3]	Serial number	[4]	Current type, mains voltage
[5]	Nominal power	[6]	Nominal current
[7]	Type of duty	[8]	Enclosure protection
[9]	Motor protection (temperature protection)	[10]	Insulation class
[11]	Data Matrix code	[12]	Mains frequency
[13]	Power factor cos phi	[14]	Speed

Descriptions referring to name plate indications

Type designation

Table 1: Description of type designation with the example of SA 07.2-F10

SA	07.2	-F10	
SA			Type SA = Multi-turn actuators for open-close duty Type SAR = Multi-turn actuators for modulating duty
	07.2		Size These instructions apply to sizes 07.2, 07.6, 10.2, 14.2, 14.6, 16.2
		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 our website at **http://www.auma.com**, via **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: Serial number until 2023, description with the example of 0523MD12345

05	23	MD12345	
05			Positions 1+2: Assembly in week = week 05
	23		Positions 3+4: Year of manufacture = 2023
		MD12345	Internal number for unambiguous product identification

Table 3: Serial number as from 2024, description with the example 0000-00101-2024

00000-00101	–	2024	
00000-00101			Serial number of sales article 11-digit, internal number for unambiguous product identification
		2024	Year of manufacture = 2024

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

Actuator

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.

Figure 6: Example: Lifting the actuator

Weights

Table 4: Weights for SA/SAR multi-turn actuators with 3-phase motors

Type designation Actuator	Motor type[1]	Weight[2] approx. [kg]
SA 07.2/ SAR 07.2	VD...	19
	AD...	20
SA 07.6/ SAR 07.6	VD...	20
	AD...	21
SA 10.2/ SAR 10.2	VD...	22
	AD...	25
SA 14.2/ SAR 14.2	VD...	44
	AD...	48
SA 14.6/ SAR 14.6	VD...	46
	AD...	53
SA 16.2/ SAR 16.2	VD...	67
	AD...	83

1) Refer to motor name plate

2) Indicated weight includes AUMA NORM multi-turn actuator with 3-phase AC motor, electrical connection in standard version, output drive type B1 and handwheel. For other output drive types, consider additional weights.

Table 5: Weights for SA/SAR multi-turn actuators with 1-phase motors

Type designation Actuator	Motor type[3]	Weight[4]
		approx. [kg]
SA 07.2/ SAR 07.2	VB...	21
	VE...	21
	AE...	28
SA 07.6/ SAR 07.6	VB...	21
	VE...	25
	AE...	28
	AC...	37
SA 10.2/ SAR 10.2	VE...48-4...	28
	VE...48-2...	31
	AC... 56-4...	40
	AC... 56-2...	43
SA 14.2/ SAR 14.2	VE...	59
	VC...	61
	AC...	63
SA 14.6/ SAR 14.6	VE...	63
	VC...	66

Table 6: Weights for SA/SAR multi-turn actuators with DC motors

Type designation Actuator	Motor type[5]	Weight[6]
		approx. [kg]
SA 07.2/ SAR 07.2	FN... 63-...	29
	FN... 71-...	32
SA 07.6/ SAR 07.6	FN... 63-...	30
	FN... 80-...	44
SA 10.2/ SAR 10.2	FN... 63-...	33
	FN... 71-...	36
	FN... 90-...	56
SA 14.2/ SAR 14.2	FN... 71-... / FN... 80-...	68
	FN... 90-...	100
SA 14.6/ SAR 14.6	FN... 80-... / FN... 90-...	76
	FN... 112-...	122
SA 16.2/ SAR 16.2	FN... 100-...	123

Table 7: Weights of output drive types A

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

3) Refer to motor name plate

4) Indicated weight includes AUMA NORM multi-turn actuator with 1-phase AC motor, electrical connection in standard version, output drive type B1 and handwheel. For other output drive types, consider additional weights.

5) Refer to motor name plate

6) Indicated weight includes AUMA NORM multi-turn actuator with DC motor, electrical connection in standard version, output drive type B1 and handwheel. For other output drive types, consider additional weights.

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.

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

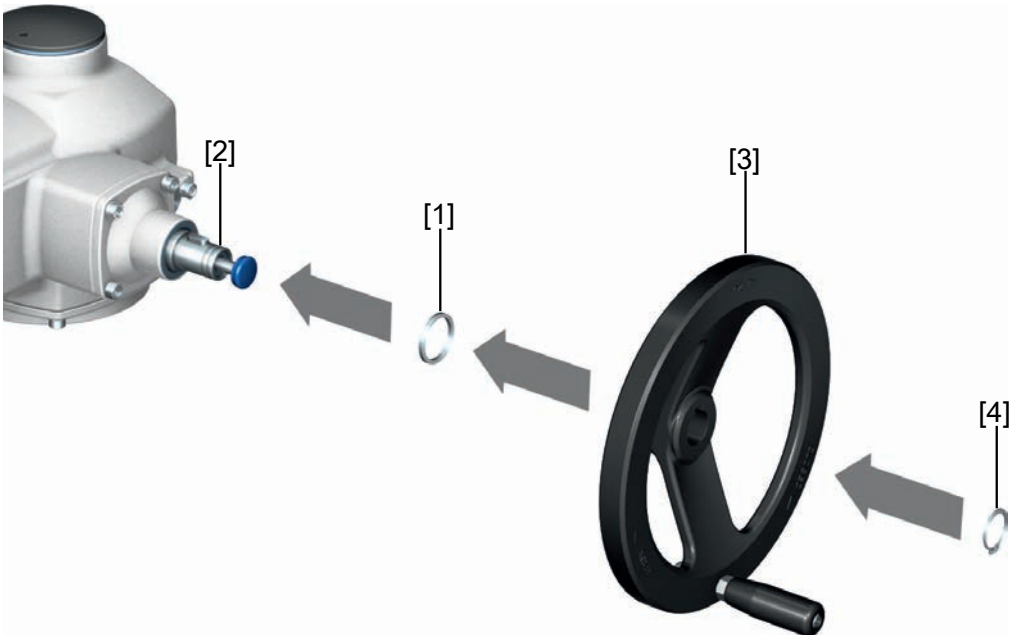
When using grease as lubricant, the product described herein can be operated in any mounting position.

When using oil instead of grease within the actuator gear housing, perpendicular mounting position is specified whereby the flange is pointing downward. The type of lubricant used is indicated on the actuator name plate (short designation **F**...= grease; **O**...= oil).

5.2 Fit handwheel

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

Figure 7: 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.

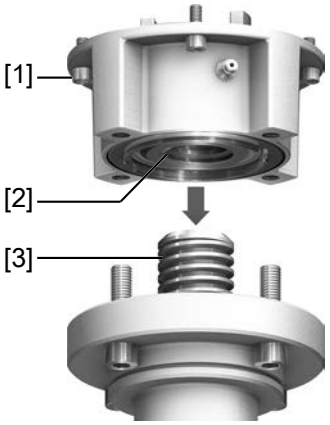
5.3.1 Overview of output drive types

Table 8: Overview on output drive types

Valve attachment	Application	Further information
Output drive type A	Threads • for rising, non-rotating valve stem • For transmission of torques and thrusts • Not appropriate for withstanding radial forces	Output drive type A [▶ 15]
	Bore with keyway, square bore, hexagon bore • for rotating, non-rising valve stem • For transmission of torques and thrusts • Not appropriate for withstanding radial forces	
Output drives B, B1 – B4 C, D, E	Valve shaft, gearbox shaft • Only for transmission of torques • Not appropriate for withstanding thrust	Output drive types B/C/D/E [▶ 19]

5.3.2 Output drive type A

Figure 8: Design of 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 with AUMA.

5.3.2.1 Mount multi-turn actuator with output drive type A

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 9: Multi-turn actuator with output drive type A

[1] Multi-turn actuator

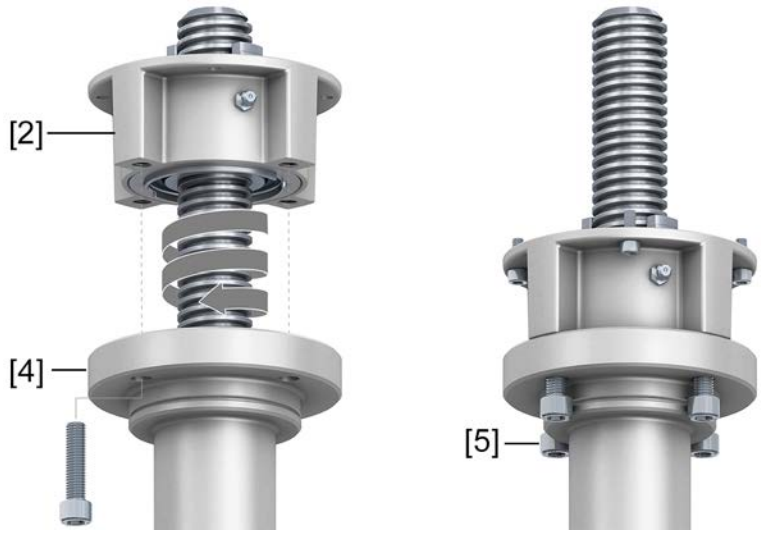
[2] Output drive type A, from left to right: with machined, unbored and pilot bore stem nut

[3] Screws to multi-turn actuator

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: Finish machining of stem nut for output drive type A [▶ 17]

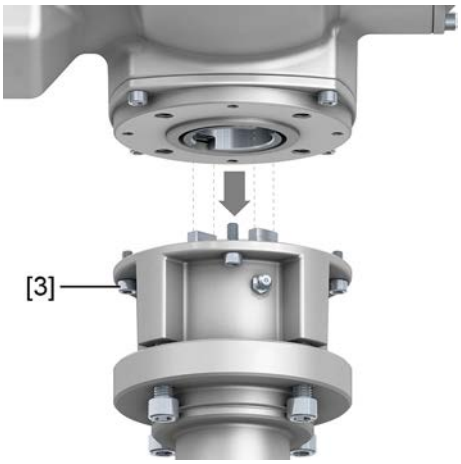
2. Apply a small quantity of grease to the valve stem.
3. Place output drive type A [2] on valve stem and turn until output drive type A [2] is flush on the valve flange [4].
4. Turn output drive type A [2] until alignment of the fixing holes.
5. Fasten screws [5] between valve and output drive type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

Figure 10:



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

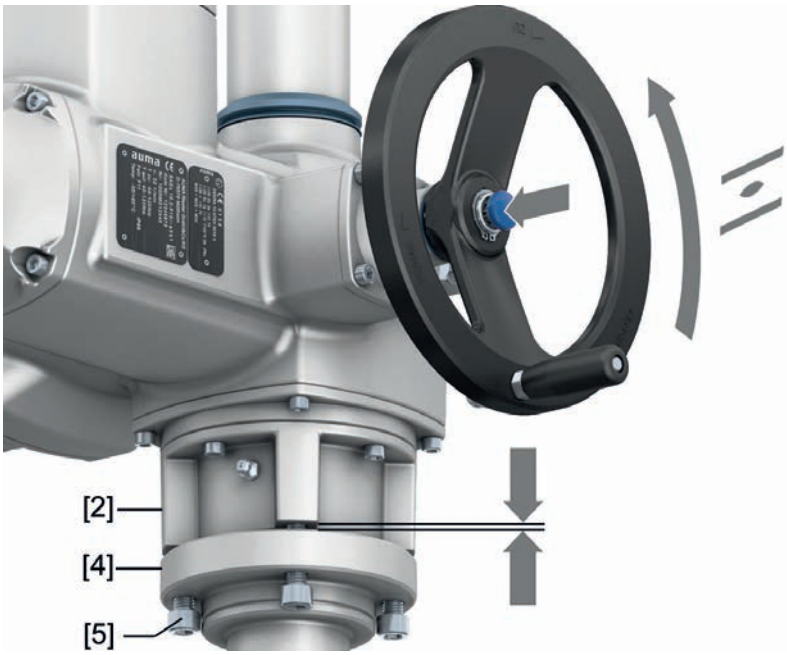
Figure 11:



⇨ 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 Tightening torques for screws [▶ 51].
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 12: Tighten flange



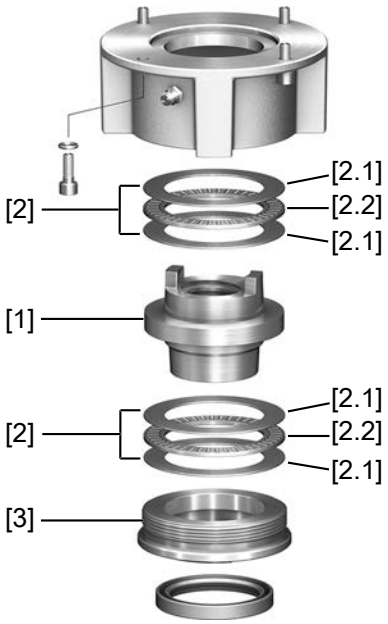
11. Tighten screws [5] between valve and output drive type A crosswise applying a torque according to table Tightening torques for screws [▶ 51].

5.3.2.2 Finish machining of stem nut for output drive type A

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

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

Figure 13: Output drive type A



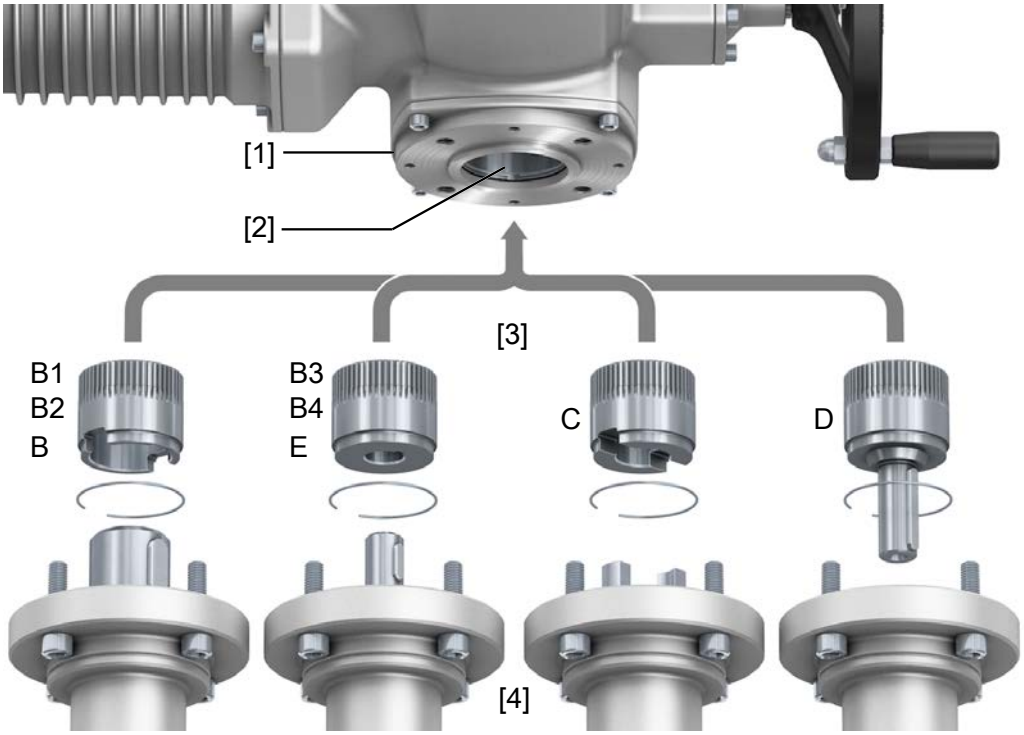
[1] Stem nut
[2] Axial needle roller bearing
[2.1] Axial bearing washer
[2.2] Axial needle roller and cage assembly
[3] Spigot ring

How to proceed

1. Remove spigot ring [3] from output drive.
2. Remove stem nut [1] together with axial needle roller bearing [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 firm seat against the shoulder.

5.3.3 Output drive types B/C/D/E

Figure 14: Mounting principle



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

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/E:

  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:

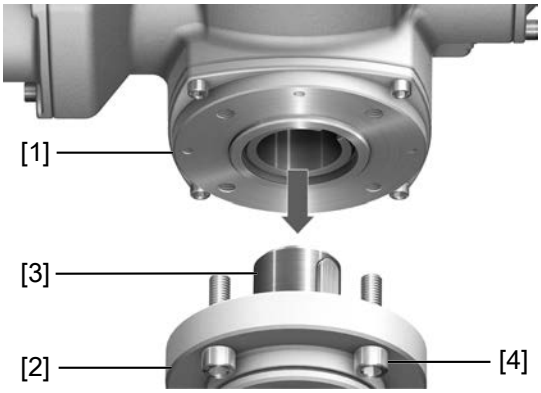
  Output drive sleeve with dog coupling according to EN ISO 5210 or DIN 3338
- Output drive type D:

  Shaft end with key according to EN ISO 5210 or DIN 3210

Spigot at valve flanges should be loose fit.

5.3.3.1 Mount multi-turn actuator with output drive type B

Figure 15: Mounting output drive types B



[1]	Multi-turn actuator	[2]	Valve/gearbox
[3]	Valve/gearbox shaft	[4]	Screw

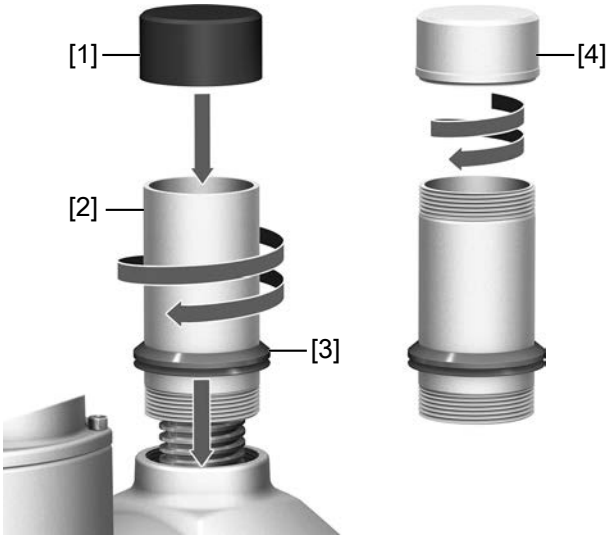
How to proceed

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 stem [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 [4].
   Information: We recommend applying liquid thread sealing material to the screws to avoid contact corrosion.
6. Fasten screws [4] crosswise with a torque according to table Tightening torques for screws [▶ 51].

5.4 Accessories for assembly

5.4.1 Stem protection tube for rising valve stem

Figure 16: Assembly of the stem protection tube



[1]	Protective cap for stem protection tube (fitted)	[2]	Stem protection tube
[3]	V-seal	[4]	Option: Protective cap made of steel (screwed)

NOTICE

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

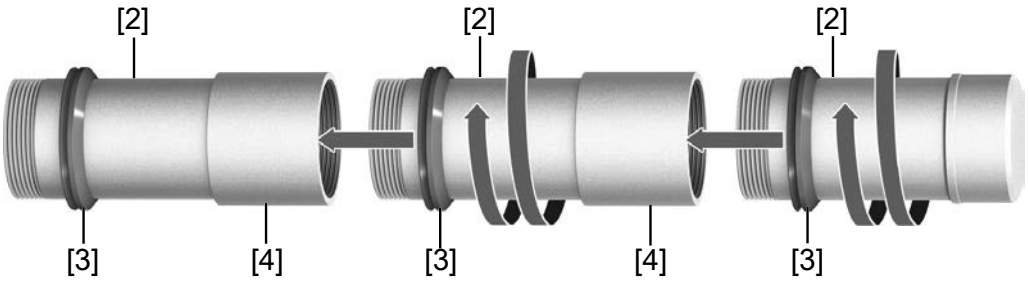
Risk of damage at stem and/or protection tube.

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

How to proceed

1. Seal all threads with hemp, Teflon tape, sealing agent or thread sealing material.
2. Screw stem protection tube [2] into thread and tighten it firmly.
   Information: For stem protection tubes made of two or more segments, all parts have to be thoroughly screwed together.

Figure 17: Protection tube made of segments with threaded sleeves (> 900 mm) (only applicable for sizes 25.1 and 30.1)



[2] Segment of stem protection tube
[3] V-seal
[4] Threaded sleeve

3. Push down the sealing ring [3] onto the housing.
   Information: For mounting segments, push down seals of segments down to the sleeve (connecting pieces).
4. Check whether protective cap [1] for stem protection tube is available, in perfect condition and tightly placed on or screwed to the tube.

6 Electrical connection

6.1 Basic information

WARNING

Electric shock due to presence of hazardous voltage!

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

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

→ Prior to connection, heed 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 when indicating the order number (refer to name plate) or downloaded directly from our Website (http://www.auma.com).

NOTICE

Valve damage when connecting to actuator controls!

→ NORM actuators require actuator controls: Connect motor via actuator controls only (reversing contactor circuit).

→ Respect the type of seating specified by the valve manufacturer.

→ The torque switches also serve the purpose of valve overload protection and must, therefore, also be connected for limit seating.

→ Heed wiring diagram.

Delay time

The delay time is the time from the tripping of the limit or torque switches to the motor power being switched off. To protect the valve and the actuator, we recommend a delay time < 50 ms. Longer delay times are possible provided operating time, output drive type, valve type, and type of installation are considered. We recommend switching off the corresponding contactor directly by limit or torque switch.

Limit and torque switches

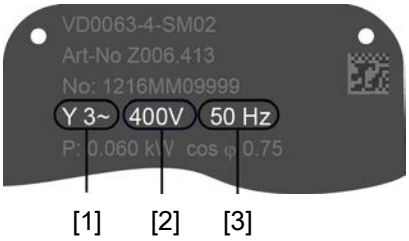
Limit and torque switches can be provided as single, tandem, or triple switches. Only the same potential can be switched on the two circuits (NC/NO contact) of each single switch. If different potentials are to be switched simultaneously, tandem switches or triple switches are required. When using tandem/triple switches:

- For signalling use the leading contacts DSR1/TSC1, DOEL1/TSO1, WSR1/LSC1, WOEL1/LSO1.
- For switching off use the lagging contacts DSR/TSC, DOEL/TSO, WSR/LSC, WOEL/LSO.

Current type, mains voltage, mains frequency

Type of current, mains voltage and mains frequency must match the data on the motor name plate. Refer to Motor name plate [▶ 9].

Figure 18: Motor name plate (example)



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

Protection and sizing on site

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

The current value for sizing the protection is derived from the current consumption of the motor (refer to Motor name plate [▶ 9]).

We recommend adapting the switchgear sizing to the max. current (I_{max}) and selecting and setting the overcurrent protection device in compliance with the indications in the electrical data sheet.

Safety standards

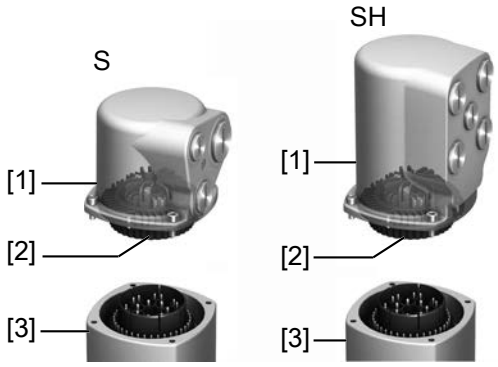
Safety measures and safety equipment must comply with the respectively valid national on site specifications. All externally connected devices shall comply with the relevant safety standards applicable for the place of installation.

Connecting cables, cable glands, reducers, blanking plugs

- We recommend using connecting cables and connecting terminals according to nominal current (I_N). (Refer to Motor name plate [▶ 9] or electrical data sheet.)
- For device insulation, appropriate (voltage-proof) cables must be used. Specify cables for the highest occurring rated voltage.
- To avoid contact corrosion, we recommend the use of sealing agents for cable glands and blanking plugs made of metal.
- Use connecting cable with appropriate minimum rated temperature.
- For connecting cables exposed to UV radiation (outdoor installation), use UV resistant cables.
- For the connection of position transmitters, screened cables must be used.

6.2 S/SH electrical connection (AUMA plug/socket connector)

Figure 19: S and SH electrical connection



[1] Cover

[2] Socket carrier with screw-type terminals, with crimp connection as an option

[3] Actuator housing with pin carrier

Short description

Plug-in electrical connection with screw-type terminals for pins for motors and pins for controls. Control contacts also available as crimp-type connection as an option.

S version (standard) with three cable entries. SH version (enlarged) with additional cable entries. For cable connection, remove the AUMA plug/socket connector and the socket carrier from cover.

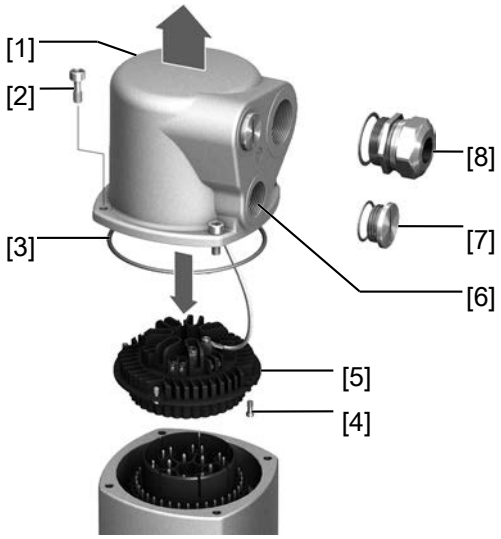
Technical data

Table 9: Electrical connection via AUMA plug/socket connector

	Power contacts	Control contacts
No. of contacts max.	6 (3 equipped) + protective earth conductor (PE)	50 pins/sockets
Designations	U1, V1, W1, U2, V2, W2, PE	1 to 50
Connection voltage max.	750 V	250 V
Nominal current max.	25 A	16 A
Type of customer connection	Screw connection	Screw connection, crimp-type (option)
Connection diameter max.	6 mm^2 (flexible) 10 mm^2 (solid)	2.5 mm^2 (Flexible or solid)

6.2.1 Open terminal compartment

Figure 20: Open terminal compartment



[1]	Cover (figure shows S version)	[2]	Screws for cover
[3]	O-ring	[4]	Screws for socket carrier
[5]	Socket carrier	[6]	Cable entry
[7]	Blanking plug	[8]	Cable gland (not included in scope of delivery)

DANGER

Electric shock due to presence of hazardous voltage!

Death or serious injury.

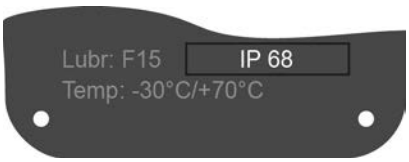
→ Disconnect device from the mains before opening.

NOTICE

Corrosion by ingress of humidity when using unsuitable cable glands!

→ Use suitable cable glands according to the IP enclosure protection specified on the name plate.

Figure 21: Example: Name plate for enclosure protection IP68



How to proceed

1. Loosen screws [2] and remove cover [1].
2. Loosen screws [4] and remove socket carrier [5] from cover [1].
3. Insert cable glands [8] suitable for connecting cables.
4. Seal unused cable entries [6] with suitable blanking plugs [7].

6.2.2 Cable connection

Table 10: Terminal cross sections and terminal tightening torques

Designation	Terminal cross sections	Tightening torques
Power contacts (U1, V1, W1, U2, V2, W2)	1.0 – 6 mm² (flexible) 1.5 –10 mm² (solid)	1.2 – 1.5 Nm
PE connection	1.0 – 6 mm² (flexible) with ring lugs 1.5 – 10 mm² (rigid) with loops	1.2 – 2.2 Nm
Control contacts (1 to 50)	0.25 – 2.5 mm² (flexible) 0.34 – 2.5 mm² (rigid)	0.5 – 0.7 Nm

⚠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 connection cable.

→ Power the device only once the protective earth conductor has been connected.

NOTICE

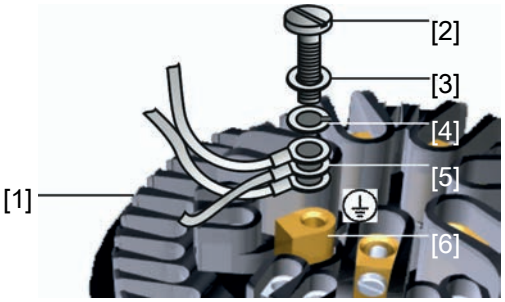
Danger of motor damage if PTC thermistors or thermoswitches are not connected!

→ Connect PTC thermistors or thermoswitches to external controls.

How to proceed

1. Remove cable sheathing.
2. Insert the wires into the cable glands.
3. Fasten cable glands with the specified torque to ensure required enclosure protection.
4. Strip wires: Controls approx. 6 mm, motor approx. 10 mm.
5. For flexible cables: Use wire end sleeves according to DIN 46228.
6. Connect cables according to order-related wiring diagram.
7. Tighten PE conductors firmly to PE connection using ring lugs (flexible cables) or loops (solid cables).

Figure 22: Protective earth connection

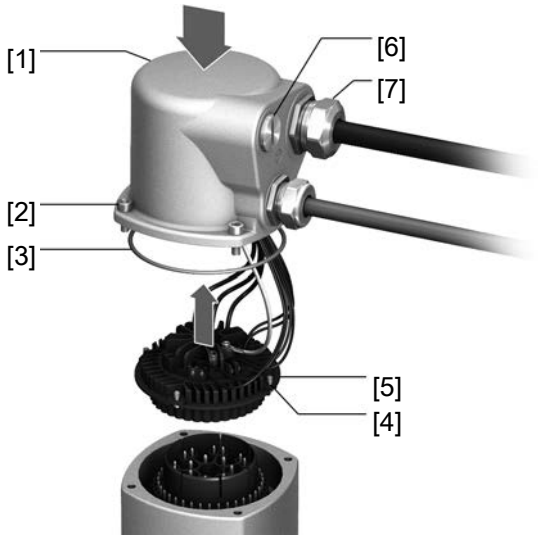


[1]	Socket carrier	[2]	Screw
[3]	Washer	[4]	Lock washer
[5]	PE conduction with ring lugs/loops	[6]	Protective earth connection

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

6.2.3 Close terminal compartment

Figure 23: Close terminal compartment



[1]	Cover (figure shows S version)	[2]	Screws for cover
[3]	O-ring	[4]	Screws for socket carrier
[5]	Socket carrier	[6]	Blanking plug
[7]	Cable gland (not included in scope of delivery)		

⚠WARNING

Short-circuit due to pinching of cables!

Risk of electric shock and functional failures.

→ Carefully fit socket carrier to avoid pinching the cables.

How to proceed

1. Insert the socket carrier [5] into the cover [1] and fasten with screws [4].
2. Clean sealing faces of cover [1] and housing.
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.
6. Fasten cable glands and blanking plugs applying the specified torque to ensure the required enclosure protection.

6.3 Accessories for electrical connection (option)

6.3.1 Parking frame

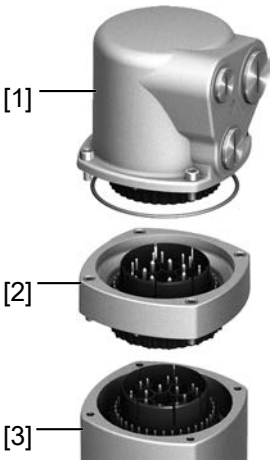
Figure 24: Parking frame, example with S plug/socket connector and cover

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

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

6.3.2 DS intermediate frame for double sealing

Figure 25: Electrical connection with DS intermediate frame



[1] Electrical connection
[2] DS intermediate frame
[3] Actuator housing

Application When removing the electrical connection or due to leaky cable glands, there is a potential risk for ingress of dust and water into the housing. This is prevented effectively by inserting the double sealed intermediate frame [2] between the plug/socket connector [1] and the housing of the device. The enclosure protection of the device (IP68) will not be affected, even if the electrical connection [1] is removed.

6.3.3 External earth connection

Figure 26: Earth connection for multi-turn actuator

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

Table 11: 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.		

7 Operation

7.1 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.

Manual operation under load

For non-self-locking actuators, the handwheel activation under load is not permitted.

⚠CAUTION

Automatic handwheel rotation for non-self-locking actuators!

Risk of injury at hand and fingers.

→ Do NOT engage manual operation under load.

NON-self-locking are actuators with output speeds from 125 rpm (50 Hz), 150 rpm (60 Hz). Refer to speed specification on Actuator name plate [▶ 8].

7.1.1 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.

How to proceed

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

Figure 27: Engage manual operation

⇨ The closing direction is marked on the handwheel:

Table 12: Handwheel marking (examples)

→ **For valve closing, turn handwheel in direction of the arrowhead.**	
	
Clockwise closing	Counterclockwise closing
Drive shaft (valve) turns **clockwise** in direction CLOSE.	Drive shaft (valve) turns **counterclockwise** in direction CLOSE.

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 28: Handwheel without/with overload protection

[1] Handwheel without overload protection (standard)

[2] Handwheel with overload protection/ safety hub (option)

7.2 Motor operation

NOTICE

Valve damage due to incorrect setting!

→ Perform all commissioning settings and the test run prior to motor operation.

Actuator controls are required to operate an actuator during motor operation. An additional local control unit must be provided if local actuator operation is required.

How to proceed

1. Switch on the power supply.
2. To close the valve, switch on motor operation in direction CLOSE.
   ⇨ Valve shaft turns counterclockwise in direction CLOSE.

8 Indications (option)

8.1 Mechanical position indication via indicator mark

Figure 29: Mechanical position indicator

[1] End position OPEN reached
[2] End position CLOSED reached
[3] Indicator mark at cover

Properties
- Independent of power supply
- Used as running indication: Indicator disc rotates during actuator operation and continuously indicates the valve position
  (For “clockwise closing” version, the symbols ⊼/⊻ rotate in counterclockwise direction for operations in direction CLOSE)
- Indicates that end positions (OPEN/CLOSED) have been reached
  (Symbols ⊼ (OPEN)/ ⊻ (CLOSED) point to the indicator mark ▲ at cover)

9 Signals (output signals)

9.1 Feedback signals from actuator

The switches can be provided as single switches (1 NC and 1 NO), as tandem switches (2 NC and 2 NO) or as triple switches (3 NC and 3 NO). The precise version is indicated in the terminal plan or on the order-related technical data sheet.

Table 13: Feedback signals from actuator

Feedback signal	Type and designation in wiring diagram	
End position OPEN/CLOSED reached	Setting via limit switching Switches: 1 NC and 1 NO (standard)	
	WSR/LSC	Limit switch, closing, clockwise rotation
	WOEL/LSO	Limit switch, opening, counterclockwise rotation
Intermediate position reached (option)	Setting via DUO limit switching Switches: 1 NC and 1 NO (standard)	
	WDR/LSA	DUO limit switch, clockwise rotation
	WDL/LSB	DUO limit switch, counterclockwise rotation
Torque OPEN/CLOSED reached	Setting via torque switching Switches: 1 NC and 1 NO (standard)	
	DSR/TSC	Torque switch, closing, clockwise rotation
	DOEL/TSO	Torque switch, opening, counterclockwise rotation
Motor protection tripped	Also thermoswitches or PTC thermistors, depending on the version	
	F1, Th	Thermoswitch
	R3	PTC thermistor
Running indication (option)	Switches: 1 NC (standard)	
	S5, BL	Blinker transmitter
Position feedback signal (option)	Depending on version either with potentiometer or electronic position transmitter EWG/RWG	
	R2	Potentiometer
	R2/2	Potentiometer in tandem arrangement (option)
	B1/B2, EWG/RWG	3-wire or 4-wire system (0/4– 20 mA)
	B3/B4, EWG/RWG	2-wire system (4 – 20 mA)
Manual operation engaged (option)		Switches

10 Commissioning (basic settings)

10.1 Open switch compartment

The switch compartment must be opened to perform the following settings.

How to proceed

1. Loosen screws [2] and remove cover [1] from the switch compartment.

Figure 30: Open switch compartment

[1] Cover
[2] Screws for cover
[3] Indicator disc

2. If indicator disc [3] is available: Remove indicator disc [3] using a spanner (as a lever).
   Information: To avoid damage to the paintwork, place a soft object, e.g. a cloth, under the spanner.

Figure 31: Pull off indicator disc

10.2 Set torque switching

Once the set tripping torque is reached, the torque switches are tripped (overload protection of the valve).

NOTICE

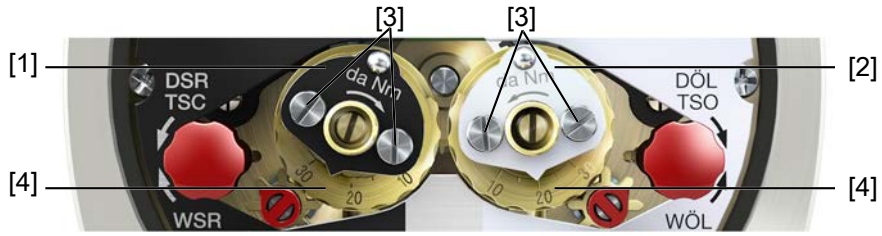
Valve damage due to excessive tripping torque limit setting!

→ The tripping torque must suit the valve.

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

The torque switches may also trip during manual operation.

Figure 32: Torque switching heads



[1]	Torque switching head black in direction CLOSE	[2]	Torque switching head white in direction OPEN
[3]	Lock screws	[4]	Torque dials

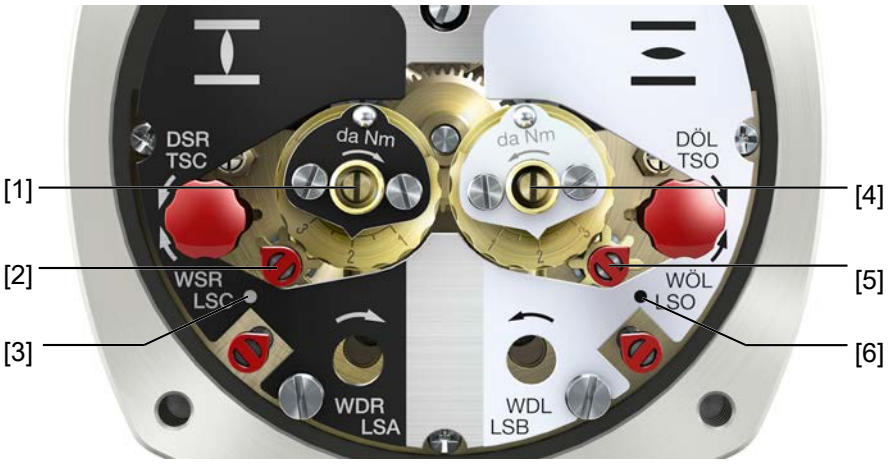
How to proceed

1. Loosen both lock screws [3] at the indicator disc.
2. Turn torque dial [4] to set the required torque (1 da Nm = 10 Nm). Example:
   - ⇨ Black torque switching head set to approx. 25 da Nm ≙ 250 Nm for direction CLOSE.
   - ⇨ White torque switching head set to approx. 20 da Nm ≙ 200 Nm for direction OPEN
3. Fasten lock screws [3] again.
   Information: Maximum tightening torque: 0.3 – 0.4 Nm
   - ⇨ The torque switch setting is complete.

10.3 Set limit switching

The limit switching records the travel. When reaching the preset position, switches are operated.

Figure 33: Setting elements for limit switching



[1]	Setting spindle: End position CLOSED (black section)	[2]	Pointer: End position CLOSED (black section)
[3]	Mark: End position CLOSED set (black section)	[4]	Setting spindle: End position OPEN (white section)
[5]	Pointer: End position OPEN (white section)	[6]	Mark: End position OPEN set (white section)

10.3.1 Set end position CLOSED (black section)

How to proceed

1. Engage manual operation.
2. Turn handwheel clockwise until valve is closed.
3. Turn handwheel by approximately half a turn (overrun) in the opposite direction.

4. **Press down** and turn setting spindle [1] with screwdriver in direction of the arrow and observe the pointer [2]: While a ratchet click is felt and heard, the pointer [2] moves 90° every time.
5. As soon as the pointer [2] is 90° from mark [3]: Continue turning slowly.
6. As soon as the pointer [2] moves to mark [3]: Stop turning and release setting spindle.
   ⇨ The end position CLOSED setting is complete.
7. If you override the tripping point inadvertently (ratchet click is heard after the pointer has snapped): Continue turning the setting spindle in the same direction and repeat setting process.

10.3.2 Set end position OPEN (white section)

How to proceed

1. Engage manual operation.
2. Turn handwheel counterclockwise until valve is open.
3. Turn handwheel by approximately half a turn (overrun) in the opposite direction.
4. **Press down** and turn setting spindle [4] with screwdriver in direction of the arrow and observe the pointer [5]: While a ratchet click is felt and heard, the pointer [5] moves 90° every time.
5. As soon as the pointer [5] is 90° from mark [6]: Continue turning slowly.
6. As soon as the pointer [5] moves to mark [6]: Stop turning and release setting spindle.
   ⇨ The end position OPEN setting is complete.
7. If you override the tripping point inadvertently (ratchet click is heard after the pointer has snapped): Continue turning the setting spindle in the same direction and repeat setting process.

10.4 Test run

Perform test run only once all settings previously described have been performed.

The direction of rotation can be checked at the position indicator if available. (Chapter Check direction of rotation at mechanical position indicator [▶ 35])

The direction of rotation must be checked at the hollow shaft/stem if no mechanical position indicator is available. (Chapter Check direction of rotation at hollow shaft/stem [▶ 36])

10.4.1 Check direction of rotation at mechanical position indicator

NOTICE

Valve damage due to incorrect direction of rotation!

→ If the direction of rotation is incorrect, switch off immediately.

→ Correct phase sequence.

→ Repeat test run.

Switch off before reaching the end position.

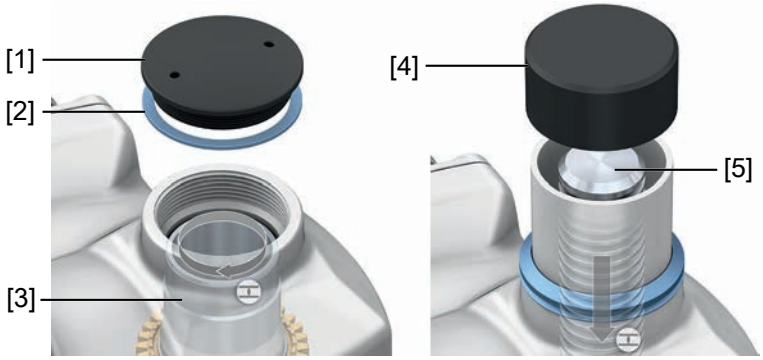
How to proceed

1. Move actuator manually to intermediate position or to sufficient distance from end position.
2. Switch on actuator in direction CLOSE and observe the direction of rotation on the mechanical position indication:
   For mechanical position indication via indicator mark:
   ⇨ The direction of rotation is correct if the actuators operates in direction **CLOSE** and the symbols (▼/▲) turn **counterclocwise**:

Figure 34: Direction of rotation ⇒/⇓ (for version “clockwise closing”)

10.4.2 Check direction of rotation at hollow shaft/stem

Figure 35: 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 (plastic material)
[5] stem

NOTICE

Valve damage due to incorrect direction of rotation!

→ If the direction of rotation is incorrect, switch off immediately.
→ Correct phase sequence.
→ Repeat test run.

How to proceed

1. Move actuator manually to intermediate position or to sufficient distance from end position.
2. Depending on the version: Remove threaded plugs [1] with seal [2] or protective cap [4].
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 operates in direction **CLOSE** and the hollow shaft in **clockwise** direction, or the stem moves downward.
4. Correctly place/fasten threaded plugs [1] with seal [2], protective cap [4]. Tighten the thread firmly.

10.4.3 Check limit switching

How to proceed

1. Manually operate actuator into both valve end positions.
2. The limit switching is set correctly if:
   ⇨ WSR/LSC contact trips in end position CLOSED
   WOEL/LSO contact trips in end position OPEN

⇨ the switches release the contacts after turning back the handwheel

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

10.5 Close switch compartment

If options (such as potentiometer, position transmitter) are available: Only close switch compartment once all optional equipment has been successfully set.

NOTICE

Corrosion due to damage to paint finish!

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

How to proceed

1. Clean sealing faces of housing and cover.
2. Check whether O-ring [3] is in good condition, replace if damaged.
3. Apply a thin film of non-acidic grease (e.g. petroleum jelly) to the O-ring and insert it correctly.

Figure 36: Close switch compartment

4. Place cover [1] on switch compartment.
5. Fasten screws [2] evenly crosswise.

11 Commissioning (optional equipment settings)

11.1 Potentiometer

The potentiometer is used as travel sensor and records the valve position.

Setting elements

The potentiometer is housed in the actuator switch compartment. The switch compartment must be opened to perform any settings. Refer to Open switch compartment [▶ 33].

Setting is made via potentiometer [1].

Figure 37: View of control unit

[1] Potentiometer

11.1.1 Potentiometer setting

Due to the ratio of the reduction gearing, the complete resistance range/stroke is not always covered. Therefore, external adjustment (setting potentiometer) must be provided.

How to proceed

1. Move valve to end position CLOSED.
2. Turn potentiometer [1] clockwise to the stop.
   - ⇨ End position CLOSED corresponds to 0 %.
   - ⇨ End position OPEN corresponds to 100 %.
3. Turn potentiometer [1] slightly in opposite direction.
4. Perform fine-tuning of the zero point at external setting potentiometer (for remote indication).

11.2 RWG electronic position transmitter

RWG electronic position transmitter records the valve position. On the basis of the actual position value measured by the potentiometer (travel sensor), it generates a current signal between 0 – 20 mA or 4 – 20 mA.

Technical data

Table 14: RWG 4020

Data	3-wire and 4-wire systems	2-wire system
Output current I_a	0 – 20 mA, 4 – 20 mA	4 – 20 mA
Power supply U_V [7)]	24 V DC (18 – 32 V)	14 V DC + (I x R_B), max. 30 V
Max. current consumption	24 mA at 20 mA output current	20 mA
Max. load R_B	600 Ω	(U_V – 14 V)/20 mA
Impact of power supply	0.1 %/V	0.1 %/V
Load influence	0.1 %/(0 – 600 Ω)	0.1 %/100 Ω
Temperature impact	< 0.3 ‰/K	

7) Power supply possible via: AC, AM actuator controls or external power supply

Data	3-wire and 4-wire systems	2-wire system
Ambient temperature[8)]	–60 °C to +80 °C	
Transmitter potentiometer	5 kΩ	

Setting elements

The RWG is housed in the actuator switch compartment. The switch compartment must be opened to perform any settings. Refer to Open switch compartment [▶ 33].

Setting is made via three potentiometers [1], [2] and [3].

Figure 38: View on control unit when switch compartment is open

[1] Potentiometer (travel sensor)
[2] Potentiometer min. (0/4 mA)
[3] Potentiometer max. (20 mA)
[4] Measuring point (+) 0/4 – 20 mA
[5] Measuring point (–) 0/4 – 20 mA

The output current (measuring range 0 – 20 mA) can be checked at measuring points [4] and [5].

11.2.1 Set measuring range

For setting, voltage must be applied at the position transmitter.

How to proceed

1. Move valve to end position CLOSED.
2. Connect measuring equipment for 0 – 20 mA to measuring points [4] and]5]. If no value can be measured:
   Check whether external load is connected to customer connection XK (for standard wiring: terminals 23/24). Consider maximum load R_B.
   Or connect link across customer connection XK (for standard wiring: terminals 23/24).
3. Turn potentiometer [1] clockwise to the stop.
4. Turn potentiometer [1] slightly in opposite direction.
5. Turn potentiometer [2] clockwise until output current starts to increase.
6. Turn potentiometer [2] in opposite direction until the following value is reached:
   at 0 – 20 mA approx. 0.1 mA
   at 4 – 20 mA approx. 4.1 mA
   ⇨ This ensures that the signal remains above the dead and live zero point.
7. Move valve to end position OPEN.
8. Set potentiometer [3] to end value 20 mA.
9. Approach end position CLOSED anew and check minimum value (0.1 mA or 4.1 mA). Correct if required.

If the maximum value cannot be reached, the selection of the reduction gearing must be checked.

8) Depending on temperature range of the actuator: refer to name plate

11.3 EWG 01.1 electronic position transmitter

EWG 01.1 electronic position transmitter signals the remote position or the valve position. On the basis of the actual valve position sensed by hall sensor, a current signal between 0 – 20 mA or 4 – 20 mA is generated.

Technical data

Table 15: EWG 01.1

Data	3-wire and 4-wire systems	2-wire system
Output current I_a	0 – 20 mA, 4 – 20 mA	4 – 20 mA
Power supply U_V[9)]	24 V DC (18 – 32 V)	24 V DC (18 – 32 V)
Max. current consumption	LED off = 26 mA, LED on = 27 mA	20 mA
Max. load R_B	600 Ω	(U_V – 12 V)/20 mA
Impact of power supply	0.1 %	
Load influence	0.1 %	
Temperature impact	< 0.1 ‰/K	
Ambient temperature[10)]	–60 °C to +80 °C	

Setting elements

The EWG is housed in the actuator switch compartment. The switch compartment must be opened to perform any settings. Refer to Open switch compartment [▶ 33].

All settings are made via the two push buttons [S1] and [S2].

Figure 39: View on control unit when switch compartment is open

[S1] Push button: Set 0/4 mA
[S2] Push button: Set 20 mA
LED Optical aid for setting
[1] Measuring point (+) 0/4 – 20 mA
[2] Measuring point (–) 0/4 – 20 mA

The output current (measuring range 0 – 20 mA) can be checked at measuring points [1] and [2].

Table 16: Short overview on push button functions

Push buttons	Function
[S1] + [S2]	→ press simultaneously for 5 s: Activate setting mode
[S1]	→ press in setting mode for 3 s: Set 4 mA → press in setting mode for 6 s: Set 0 mA (only possible for 3-/4-wire version) → press in operation for 3 s: Switch on/off LED end position signalling → touch in end position: Reduce current value by 0.02 mA
[S2]	→ press in setting mode for 3 s: Set 20 mA → press in operation for 3 s: Switch on/off LED end position signalling → touch in end position: Increase current value by 0.02 mA

11.3.1 Set measuring range

For setting, voltage must be applied at the electronic position transmitter.

For output current verification, connect a test device for 0 – 20 mA to measurement points (+/–) (for 2-wire systems, connecting a test device is imperatively required).

9) Power supply possible via: AC, AM actuator controls or external power supply

10) Depending on temperature range of the actuator: refer to name plate

a) Measuring range 0/4 – 20 mA as well as measuring range 20 – 0/4 mA (inverse operation) can be set.
During setting process, the measuring range (normal or inverse operation) is assigned to the end positions by push button S1/S2 assignment.

b) For 2-wire systems, switch off LED end position signalling prior to setting the measuring range. Refer to Switch on/off LED end position signalling [▶ 42].

c) Setting mode activation clears the settings in both end positions and sets the output current to a value of 3.5 mA. After activation, both end values (0/4 mA and 20 mA) need to be reset.

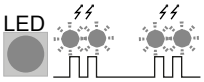
d) In case of inadvertent incorrect adjustment, the settings can always be reset by renewed activation of the setting mode (simultaneous pressing of [S1] and [S2]).

For 2-wire systems read current values at test device.

Activate setting mode

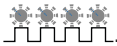
1. Press both push buttons [S1] and [S2] and hold down for 5 seconds:

⇨ By pulsing double flashes, the LED indicates that the setting mode is correctly activated:



⇨ For any other LED flash sequence (single/triple flashing): refer to Faults during operation/commissioning [▶ 45].

Set measuring range

2. Operate valve in one of the end positions (OPEN/CLOSED).
3. Set desired output current (0/4 mA or 20 mA):
   ⇨ for **4 mA**: Hold down [S1] for approx. 3 seconds,
   until **LED is blinking slowly**  .
   ⇨ for **0 mA**: Hold down [S1] for approx. 6 seconds (only possible for 3-/4-wire version)
   until **LED is blinking fast**  .
   ⇨ for **20 mA**: Hold down [S2] for approx. 3 seconds
   until **LED is illuminated**  .
4. Operate valve into opposite end position.
   ⇨ The value set in end position (0/4 mA or 20 mA) does not change during travel in setting mode.
5. Perform setting in the second end position following the same steps.
6. Approach both end positions again to check the setting.
   ⇨ If the measuring range cannot be set: refer to Faults during operation/commissioning [▶ 45].
   ⇨ If the current values (0/4/20 mA) are incorrect: refer to Adjust current values [▶ 41].
   ⇨ If the current value fluctuates (e.g. between 4.0 – 4.2 mA): Switch off LED end position signalling. Refer to Switch on/off LED end position signalling [▶ 42].

11.3.2 Adjust current values

The current values (0/4/20 mA) set in end positions can be adjusted at any time. Typical values are 0.1 mA (instead of 0 mA) or 4.1 mA (instead 4 mA).

If the current value fluctuates (e.g. between 4.0 – 4.2mA), the Switch on/off LED end position signalling [▶ 42] must be switched off for current adjustment.

How to proceed

1. Operate valve in desired end position (OPEN/CLOSED).
2. Reduce current value: Press push button [S1].
   (The current is reduced by 0.02 mA every time the push button is pressed.)
3. Increase current value: Press push button [S2].
   (The current is increased by 0.02 mA every time the push button is pressed.)

11.3.3 Switch on/off LED end position signalling

The LED behaviour for end position reached can be set as follows: blinking/continuous illumination or no illumination. During setting mode, end position signalling is switched on.

How to proceed

1. Operate valve in one of the end positions (OPEN/CLOSED).
2. Hold down push buttons [S1] or [S2] for approx. 3 seconds.
   ⇨ End position signalling is switched on or off.

Table 17: LED behaviour when end position signalling is switched on

Set output current	LED behaviour in end position
4 mA	LED is blinking slowly
0 mA	LED is blinking fast
20 mA	LED is illuminated

11.4 Set intermediate positions

Actuators equipped with DUO limit switching are equipped with two intermediate position switches. One intermediate position may be set for each running direction.

Figure 40: Setting elements for limit switching

[1]	Setting spindle: Running direction CLOSE (black section)	[2]	Pointer: Running direction CLOSE (black section)
[3]	Mark: Intermediate position CLOSED set (black section)	[4]	Setting spindle: Running direction OPEN (white section)
[5]	Pointer: Running direction OPEN (white section)	[6]	Mark: Intermediate position OPEN set (white section)

After 177 turns (control unit for 2 – 500 turns/stroke) or 1,769 turns (control unit for 2 – 5,000 turns/stroke), the intermediate switches release the contact.

11.4.1 Set running direction CLOSE (black section)

How to proceed

1. Move valve in direction CLOSE to desired intermediate position.
2. If you override the tripping point inadvertently: Move valve in opposite direction and approach intermediate position again in direction CLOSE (always approach the intermediate position in the same direction as in later electrical operation).
3. **Press down** and turn setting spindle [1] with screwdriver in direction of the arrow and observe the pointer [2]: While a ratchet click is felt and heard, the pointer [2] moves 90° every time.
4. As soon as the pointer [2] is 90° from mark [3]: Continue turning slowly.
5. As soon as the pointer [2] moves to mark [3]: Stop turning and release setting spindle.

   ⇨ The intermediate position setting in running direction CLOSE is complete.
6. If you override the tripping point inadvertently (ratchet click is heard after the pointer has snapped): Continue turning the setting spindle in the same direction and repeat setting process.

11.4.2 Set running direction OPEN (white section)

How to proceed

1. Move valve in direction OPEN to desired intermediate position.
2. If you override the tripping point inadvertently: Move valve in opposite direction and approach intermediate position again in direction OPEN (always approach the intermediate position in the same direction as in later electrical operation).
3. **Press down** and turn setting spindle [4] with screwdriver in direction of the arrow and observe the pointer [5]: While a ratchet click is felt and heard, the pointer [5] moves 90° every time.
4. As soon as the pointer [5] is 90° from mark [6]: Continue turning slowly.
5. As soon as the pointer [5] moves to mark [6]: Stop turning and release setting spindle.

   ⇨ The intermediate position setting in running direction OPEN is complete.
6. If you override the tripping point inadvertently (ratchet click is heard after the pointer has snapped): Continue turning the setting spindle in the same direction and repeat setting process.

11.5 Set mechanical position indicator

How to proceed

1. Fit indicator disc onto shaft.
2. Move valve to end position CLOSED.
3. Turn lower indicator disc until symbol ⊥ (CLOSED) is in alignment with the ▲ mark on the cover.

Figure 41: Indication: CLOSE

4. Operate actuator to end position OPEN.
5. Hold lower indicator disc in position and turn upper disc with symbol ⊤ (OPEN) until it is in alignment with the ▲ mark on the cover.

Figure 42: Indication: OPEN

6. Move valve to end position CLOSED again.
7. Check settings: If the symbol ⊤ (CLOSED) is no longer in alignment with ▲ mark on the cover: Repeat setting procedure.
   7.1 Check whether the appropriate reduction gearing has been selected, if required.

12 Corrective actions

12.1 Faults during operation/commissioning

Table 18: Faults during operation and commissioning

Faults	Description/cause	Remedy
Mechanical position indicator cannot be set.	Reduction gearing is not suitable for turns/stroke of the actuator.	Exchange reduction gearing.
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 actuator controls.	• 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)
No value can be measured at measuring points of the RWG.	Current loop across RWG is open. (Position feedback 0/4 – 20 mA is only possible if the current loop is closed across the RWG.)	• Connect link across RWG to XK (terminals 23/24). • Connect external load to XK, e.g. remote indication. • Observe maximum load R_B.
Measuring range 0/4 – 20 mA or maximum value 20 mA at position transmitter cannot be set or supplies an incorrect value.	Reduction gearing is not suitable for turns/stroke of the actuator.	Exchange reduction gearing.
The measuring range 0/4 – 20 mA at EWG position transmitter cannot be set.	The LED on the EWG either flashes in setting mode a) single flash or b) triple flash:  a) EWG is not calibrated. b) Magnet positions of EWG are not aligned.	Request AUMA Service.
Limit and/or torque switches do not trip.	Switch is defective or switch setting is incorrect.	Check setting, if required, reset end positions. Refer to Switch check [▶ 45], or replace switches, if required.
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.
Actuator operation is either too fast or to slow.	Speed setting is incorrect.	Change speed.
Actuator suddenly stops in end positions.	Speed reduction switched off or incorrectly set before reaching end positions.	Set speed reduction.

Switch check

The red test buttons [1] and [2] are used for manual operation of the switches:

Figure 43: Test buttons

1. Turn test button [1] in direction of the DSR/TSC arrow (clockwise closing): Torque switch CLOSE trips.
2. Turn test button [2] in direction of the DÖL/TSO arrow (counterclockwise opening): Torque switch OPEN trips.

If the actuator is equipped with DUO limit switching (option), the intermediate position switches WDR/LSA and WDL/LSB will be operated at the same time as the torque switches.

1. Turn test button [1] in direction of the WSL/LSC arrow (clockwise closing): Limit switch CLOSED trips.
2. Turn test button [2] in direction of the WÖL/LSO arrow: Limit switch OPEN trips.

12.2 Motor protection (thermal monitoring)

PTC thermistors or thermoswitches are provided in the motor winding to monitor the motor winding temperature. Motor protection trips as soon as the max. permissible winding temperature has been reached.

Possible causes: Overload, running time exceeded, max. number of starts exceeded, max. ambient temperature exceeded.

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. We recommend contacting our service for any interventions.

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

Service & Support

AUMA offers extensive service such as servicing and maintenance as well as customer product training. Contact addresses are indicated on our website (www.auma.com).

13.1 Preventive measures for servicing and safe operation

The following actions are required to ensure safe device function during operation:

6 months after commissioning and then once a year

- Carry out visual inspection:

  Cable entries, cable glands, threaded plugs, 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.
- 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 Tightening torques for screws [▶ 51] chapter.
- 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 44: Output drive type A

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

- 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 19: Grease quantities per axial needle roller bearing output drive type A

Valve attachment	A 07.2	A 10.2	A 14.2	A 16.2
Quantity [g] [11)]	1.5	3	5	10

For enclosure protection IP68

After immersion:

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

- Check actuator.
- In case of ingress of water, locate leaks and repair. Dry device correctly and check for proper function.

13.2 Maintenance

Manual operation

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

Lubrication

- In the factory, the gear housing is filled with grease.
- Additional lubrication of the gear housing is not required during operation.
- Grease 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 replacing the seals when changing the grease.

13.3 Disposal and recycling

Our devices have a long service life. However, they have to be replaced at one point in time. The devices have a modular design and may therefore easily be disassembled, separated, and sorted according to materials, i.e.:

- Electronic scrap
- Various metals
- Plastic materials
- Greases and oils

The following generally applies:

- Generally, greases and oils are hazardous to water and must not be released into the environment.
- Arrange for controlled waste disposal of the disassembled material or for separate recycling according to materials.
- Heed the national regulations for waste disposal.

14 Technical data

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 our website at **http://www.auma.com** in both German and English (please state the order number).

14.1 Technical data Multi-turn actuators

Features and functions		
Certificates and standards	Certificates are attached to the device. All standards applied and their respective issues are indicated on these certificates.	
Type of duty (Multi-turn actuators for open-close duty)	Standard:	Short-time duty S2 - 15 min, classes A and B according to EN ISO 22153
	Option:	Short-time duty S2 - 30 min, classes A and B according to EN ISO 22153
	For nominal voltage and +40 °C ambient temperature and at run torque load.	
Type of duty (Multi-turn actuators for modulating duty)	Standard:	Intermittent duty S4 - 25 %, class C according to EN ISO 22153
	Option:	Intermittent duty S4 - 50 %, class C according to EN ISO 22153 Intermittent duty S5 - 25 % (insulation class H required), class C according to EN ISO 22153
	For nominal voltage and +40 °C ambient temperature and at modulating torque load.	
Motors	Standard:	3-phase AC asynchronous squirrel-cage motor, type IM B9 according to IEC 60034-7, IC410 cooling procedure according to IEC 60034-6
	Option:	1-phase AC motor with permanent split capacitor (PSC), type IM B9 according to IEC 60034-7, IC410 cooling procedure according to IEC 60034-6 1-phase AC motor with integral starting capacitor and solid state switch (CSIR) type IM B9 according to IEC 60034-7, IC410 cooling procedure according to IEC 60034-6
Mains voltage, mains frequency	Refer to motor name plate Permissible variation of mains voltage: ±10 % Permissible variation of mains frequency: ±5 % (for 3-phase and 1-phase AC current)	
Overvoltage category	Category III according to IEC 60364-4-44	
Insulation class	Standard:	F, tropicalized
	Option:	H, tropicalized (with 3-phase AC motor)
Motor protection	Standard:	PTC thermistors (according to DIN 44082) PTC thermistors additionally require a suitable tripping device in the actuator controls.
	Option:	Thermoswitches (NC) According to EN 60079-14, a thermal overcurrent protection device (e.g. motor protection switch) must be installed for explosion-proof actuators in addition to the thermoswitches.
Self-locking	Self-locking: Output speeds up to 90 rpm (50 Hz), 108 rpm (60 Hz) NOT self-locking: Output speeds from 125 rpm (50 Hz), 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.	
Motor heater (option)	Voltages: 110 – 120 V AC, 220 – 240 V AC or 380 – 480 V AC	
	Power depending on the size 12.5 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)	Indication whether manual operation is active/not active via single switch (1 change-over contact)	
Electrical connection	Standard:	AUMA plug/socket connector with screw-type connection
	Options:	Terminals or crimp-type connection Gold-plated control plug (sockets and pins)
Threads for cable entries	Standard:	Metric threads
	Option:	Pg threads, NPT threads, G threads
Terminal plan	Terminal plan according to order number enclosed with delivery	

Features and functions		
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	
Electromechanical control unit		
Limit switching	Counter gear mechanism for end positions OPEN and CLOSED Turns per stroke: 2 to 500 (standard) or 2 to 5,000 (option)	
	Standard:	Single switch (1 NC and 1 NO) for each end position, not galvanically isolated
	Options:	Tandem switch (2 NC and 2 NO) for each end position, switch galvanically isolated Triple switch (3 NC and 3 NO) for each end position, switch galvanically isolated Intermediate position switches (DUO limit switching), adjustable for each direction of operation
Torque switching	Torque switching adjustable for directions OPEN and CLOSE	
	Standard:	Single switch (1 NC and 1 NO) for each direction, not galvanically isolated
	Option:	Tandem switch (2 NC and 2 NO) for each direction, switch galvanically isolated
Switch contact materials	Standard:	Silver (Ag)
	Option:	Gold (Au), recommended for low voltage actuator controls
Position feedback signal, analogue (options)	Potentiometer or 0/4 – 20mA (electronic position transmitter)	
Mechanical position indicator (option)	Continuous indication, adjustable indicator disc with symbols OPEN and CLOSED	
Running indication	Blinker transmitter (option for modulating actuators)	
Heater in switch compartment	Standard:	Self-regulating PTC heater, 5 – 20 W, 110 – 250 V AC/DC
	Options:	24 – 48 V AC/DC or 380 – 400 V AC
	A resistance type heater of 5 W, 24 V AC is installed in the actuator in combination with AM or AC actuator controls.	
Service conditions		
Use	Indoor and outdoor use permissible	
Mounting position	As required for grease use as lubricant (standard). When using oil instead of grease within the actuator gear housing, perpendicular mounting position is specified whereby the flange is pointing downward.	
Installation altitude	≤ 2,000 m above sea level > 2,000 m above sea level on request	
Ambient temperature	Refer to actuator 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, with AUMA 1-phases AC motors of types AE..., VE..., AC..., VC...and with AUMA 1-phases AC motors of types AE..., VE... 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. • For exact version, refer to actuator controls name plate.	
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, 10 to 200 Hz (AUMA NORM), 1 g, 10 to 200 Hz (for actuators with AM or AC actuator controls) Resistant to vibration during start-up or for failures of the plant. Valid for multi-turn actuators-turn actuators in version AUMA NORM and in version with actuator controls, each with AUMA plug/socket connector. Not valid in combination with gearboxes.	
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. KX-G: Same as KX, however aluminium-free version (outer parts)

Service conditions		
Coating	Double layer powder coating Two-component iron-mica combination	
Colour	Standard:	AUMA silver-grey (similar to RAL 7037)
	Option:	Available colours on request
Lifetime	AUMA multi-turn actuators meet or exceed the lifetime requirements of EN ISO 22153. Detailed information can be provided on request.	
Sound pressure level	< 72 dB (A)	
Further information		
EU Directives	Machinery Directive 2006/42/EC Low Voltage Directive 2014/35/EU EMC Directive 2014/30/EU RoHS Directive 2011/65/EU	
Reference documents	Dimensions SA 07.2 – SA 16.2/SAR 07.2 – SAR 16.2 Electrical data SA 07.2 – SA 16.2	
Technical data for limit and torque switches		
Mechanical lifetime	2 x 10^6 starts	
Silver plated contacts:		
U min.	24 V AC/DC	
U max.	250 V AC/DC	
I min.	20 mA	
I max. AC current	5 A at 250 V (resistive load) 3 A at 250 V (inductive load, cos phi = 0.6)	
I max. DC current	0.4 A at 250 V (resistive load) 0.03 A at 250 V (inductive load, L/R = 3 µs) 5 A at 30 V (resistive load) 5 A at 30 V (inductive load, L/R = 3 µs)	
Gold plated contacts:		
U min.	5 V	
U max.	50 V	
I min.	4 mA	
I max.	400 mA	
Technical data for blinker transmitter		
Mechanical lifetime	10^7 starts	
Silver plated contacts:		
U min.	10 V AC/DC	
U max.	250 V AC/DC	
I max. AC current	3 A at 250 V (resistive load) 2 A at 250 V (inductive load, cos phi ≈ 0.8)	
I max. DC current	0.25 A at 250 V (resistive load)	
Technical data for handwheel activation switches		
Mechanical lifetime	10^6 starts	
Silver plated contacts:		
U min.	12 V DC	
U max.	250 V AC	
I max. AC current	3 A at 250 V (inductive load, cos phi ≈ 0.8)	
I max. DC current	3 A at 12 V (resistive load)	

14.2 Tightening torques for screws

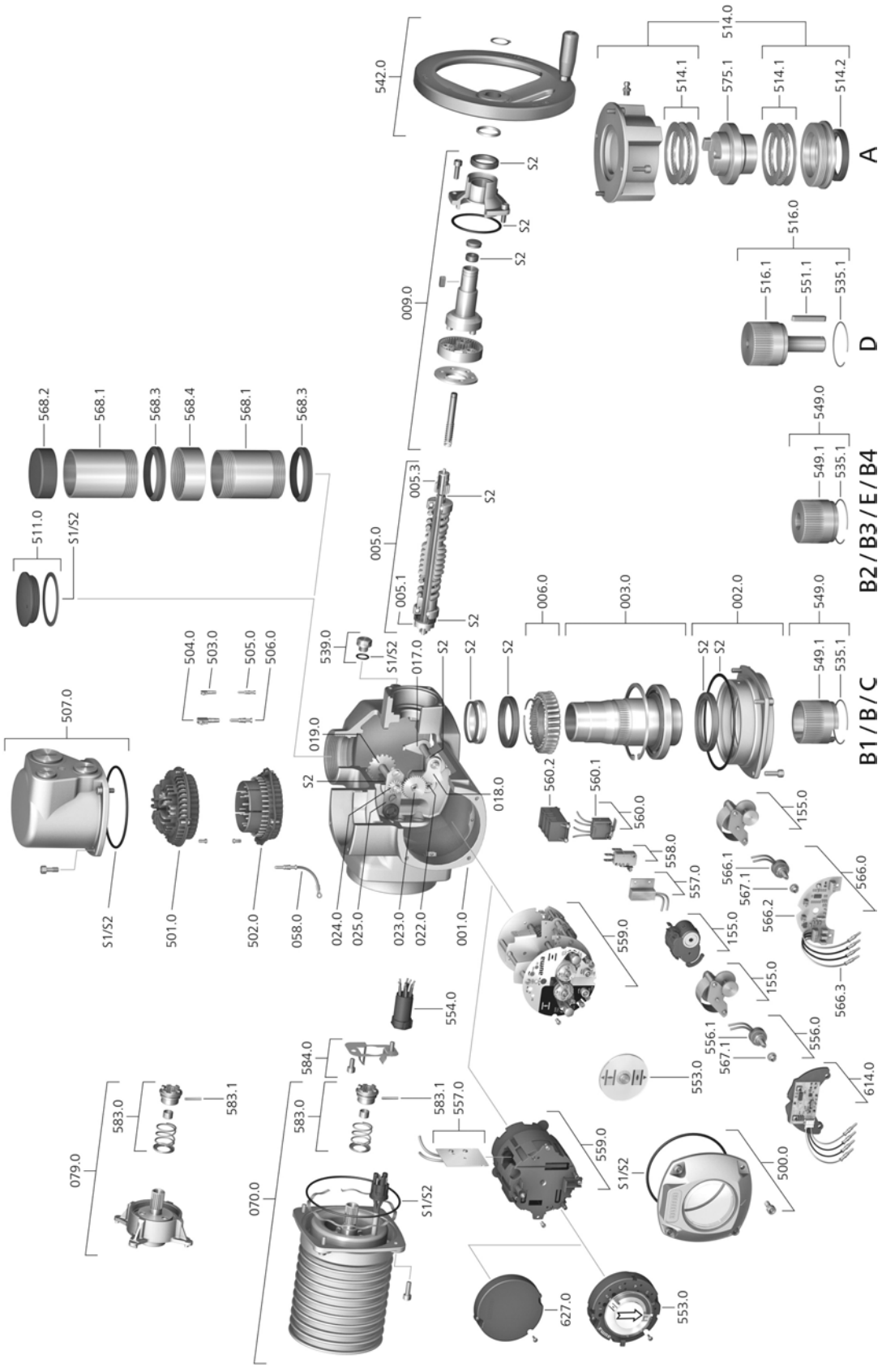
Table 20: Tightening torques for screws

Threads	**Tightening torque [Nm]**	
	Strength class	
	A2-70/A4-70	**A2-80/A4-80**
M6	7.4	10
M8	18	24

Threads	Tightening torque [Nm]	
	Strength class	
	A2-70/A4-70	A2-80/A4-80
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 list

15.1 Multi-turn actuators SA 07.2 – SA 16.2 S / SAR 07.2 – SAR 16.2 S



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
001.0	Housing	Sub-assembly
002.0	Bearing flange	Sub-assembly
003.0	Hollow shaft	Sub-assembly
005.0	Drive shaft	Sub-assembly
005.1	Motor coupling	–
005.3	Manual drive coupling	–
006.0	Worm wheel	–
009.0	Manual gearing	Sub-assembly
017.0	Torque lever	Sub-assembly
018.0	Gear segment	–
019.0	Crown wheel	–
022.0	Drive pinion II for torque switching	Sub-assembly
023.0	Output drive wheel for limit switching	Sub-assembly
058.0	Cable for protective earth	Sub-assembly
070.0	Motor (only for V... motors incl. ref. no. 079.0)	Sub-assembly
079.0	Planetary gearing for motor drive (only for V… motors)	Sub-assembly
155.0	Reduction gearing	Sub-assembly
500.0	Cover	Sub-assembly
501.0	Socket carrier (complete with sockets)	Sub-assembly
502.0	Pin carrier without pins	Sub-assembly
503.0	Socket for controls	Sub-assembly
504.0	Socket for motor	Sub-assembly
505.0	Pin for controls	Sub-assembly
506.0	Pin for motor	Sub-assembly
507.0	Cover for electrical connection	Sub-assembly
511.0	Threaded plug	Sub-assembly
514.0	Output drive type A (without stem nut)	Sub-assembly
514.1	Axial needle roller bearing	Sub-assembly
514.2	Radial seal for output drive type A	–
516.0	Output drive type D	Sub-assembly
516.1	Output drive shaft D	–
535.1	Snap ring	–
539.0	Screw plug	Sub-assembly

Ref. No.	Designation	Type
542.0	Handwheel with ball handle	Sub-assembly
549.0	Output drive types (B/B1/B2/B3/B4/C/E)	Sub-assembly
549.1	Output drive sleeve (B/B1/B2/B3/B4/C/E)	Sub-assembly
553.0	Mechanical position indicator	Sub-assembly
554.0	Socket carrier for motor plug/socket connector with cable harness	Sub-assembly
556.0	Potentiometer as position transmitter	Sub-assembly
556.1	Potentiometer without slip clutch	Sub-assembly
558.0	Blinker transmitter including pins at wires (without impulse disc and insulation plate)	Sub-assembly
559.0-1	Electromechanical control unit with switches, including torque switching heads	Sub-assembly
559.0-2	Electronic control unit with magnetic limit and torque transmitter (MWG)	Sub-assembly
560.0-1	Switch stack for direction OPEN	Sub-assembly
560.0-2	Switch stack for direction CLOSE	Sub-assembly
560.1	Switch for limit/torque	Sub-assembly
560.2-1	Switch case for direction OPEN	–
560.2-2	Switch case for direction CLOSE	–
566.0	RWG position transmitter	Sub-assembly
566.1	Potentiometer for RWG without slip clutch	Sub-assembly
566.2	Position transmitter board for RWG	Sub-assembly
566.3	Cable set for RWG	Sub-assembly
567.1	Slip clutch for potentiometer	Sub-assembly
568.1	Stem protection tube (without cap)	–
568.2	Protective cap for stem protection tube	–
568.3	V-seal	–
568.4	Threaded sleeve	–
575.1	Stem nut for output drive type A	–
583.0	Motor coupling on motor shaft	Sub-assembly
583.1	Pin for motor coupling	–
584.0	Retaining spring for motor coupling	Sub-assembly
614.0	EWG position transmitter	Sub-assembly
627.0	MWG 05.03 cover	–
S1	Seal kit, small	Set
S2	Seal kit, large	Set

Index

S

T

V

W

Y

Solutions for a world in motion

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Y004.750/003/en/1.23

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