



Fail safe unit

FQM 05.1 – FQM 12.1

FQMEx 05.1 – FQMEx 12.1



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.

Target group:

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

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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: - Standards and directives such as IEC 60079: - Part 14: Electrical installations design, selection and erection - Part 17: Electrical installations inspection and maintenance - 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. 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.
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. Commissioning or setting the FQM when mounted to the valve may be exclusively performed by personnel trained by the AUMA service. All exceptions must be confirmed in writing by AUMA, e.g. if this work is carried out by instructed and trained personnel at the valve manufacturer instead. If the FQM has to be dismantled from the valve for reasons of transport, commissioning shall be performed again by trained personnel, accompanied on-site by the AUMA Service. Failure to observe this instruction will invalidate the warranty in the event of incorrect commissioning.
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	Opening covers or unfastening screws is only permitted if the pertaining description is available in the operation instructions.

Service quotes and service orders

During maintenance intervention on fail safe unit, the references regarding maintenance specified in the operation instructions pertaining to actuator must be obeyed.

Any device modification requires prior written consent of the manufacturer.

Service quotes and service orders can be requested indicating the order numbers and the complete address of the place of deployment. For the contact form and the e-mail addresses, please refer to our website www.auma.com under **Service**.

1.2 Range of application

The FQM fail safe unit is designed for emergency operation of industrial valves, e.g. globe valves, butterfly valves, and ball valves. It is operated with an AUMA part-turn actuator.

Devices of the FQMEx type below are approved for use in potentially explosive atmospheres of zones 1, 2, 21, and 22.

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

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

- Buried service
- Continuous underwater use (observe enclosure protection)
- Radiation exposed areas in nuclear power plants
- pulling loads, such as shutter weirs, fish-belly flap gate, and sluice gates, etc.

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).



Indicates an imminently hazardous situation with a high level of risk. Failure to observe this warning results in death or serious injury.



Indicates a potentially hazardous situation with a medium level of risk. Failure to observe this warning could result in death or serious injury.



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.



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 (e.g. DANGER) indicates the level of hazard.

1.4 References and symbols

The following references and symbols are used in these instructions:



The ⓘ symbol stands for the **Information** concept. This text provides important notes and information.

Information: If the **Information** term is part of instruction, the text will give important notes and information to this 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**.

1.5 Safety instructions for the handwheel

CAUTION

Turning handwheel at actuator following a fail safe operation!

Risk of hand injury for handwheels equipped with ball handle.

→ Do NOT press the push button at the actuator handwheel.

→ Following a fail safe operation, manual operation may only be re-engaged after successful initialisation (FQM FS ready signal).

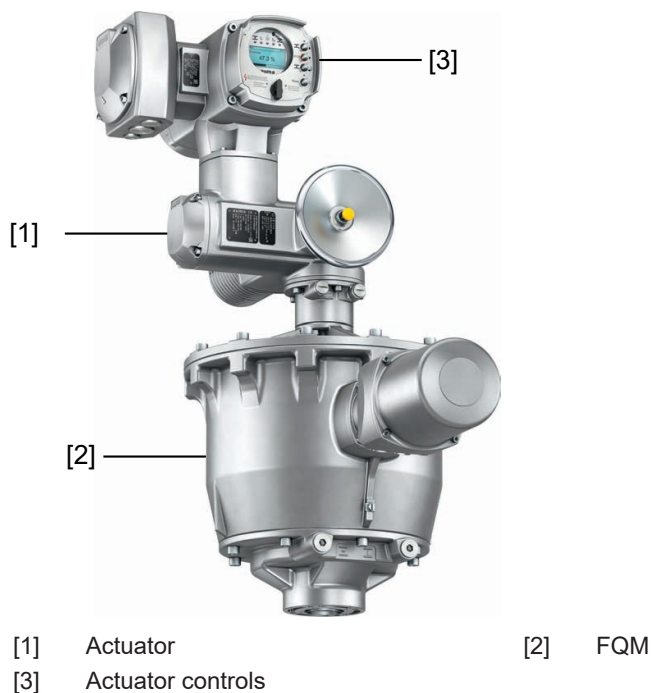


Detect successful initialisation

- Successful initialisation is indicated by the FQM FS ready signal on the actuator display. The ⓘ symbol is displayed in the status bar (top). Refer to [Initialisation](#) [▶ 27].
 - If, during automatic initialisation (start by applying ESD = high level +24 V DC), the maximum initialisation time of 2 minutes is exceeded and if subsequently the ESD high level is still applied AND the actuator display does not indicate the FQM FS ready signal, a fault of the FQM fail safe unit has occurred.
-

2 Short description

Figure 1: AUMA part-turn actuator with FQMEx fail safe unit



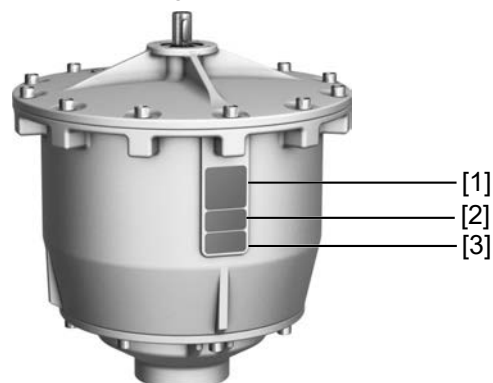
In emergencies, the fail safe unit is capable of closing or opening the valve autonomously relying on mechanical functions. No electrical power is required for such a fail safe operation. The torque required for opening or closing the valve is generated by a constant force spring motor, providing a constant torque across the total travel during fail safe operation. Consequently, the torque value for a fail safe operation is determined by the available torque of the fail safe unit and is independent of the actuator torque range.

For standard valve operation, the FQM fail safe unit is combined with an AUMA SQ part-turn actuator. The required torque is transmitted directly from the actuator through the fail safe unit to the valve. During standard operation, the constant force spring motor of the fail safe unit is disengaged and is not operated.

The operating speed for the fail safe operation can be set in the factory. Furthermore, the actuator operates the valve into the defined end position at reduced speed. This avoids pressure peaks within the pipeline and protects the valve.

3 Name plate

Figure 2: Arrangement of name plates



- | | | | |
|-----|---|-----|---------------------------------|
| [1] | Fail safe unit name plate | [2] | Additional plate e.g. KKS plate |
| [3] | Approval plate in explosion-proof version | | |

Name plate

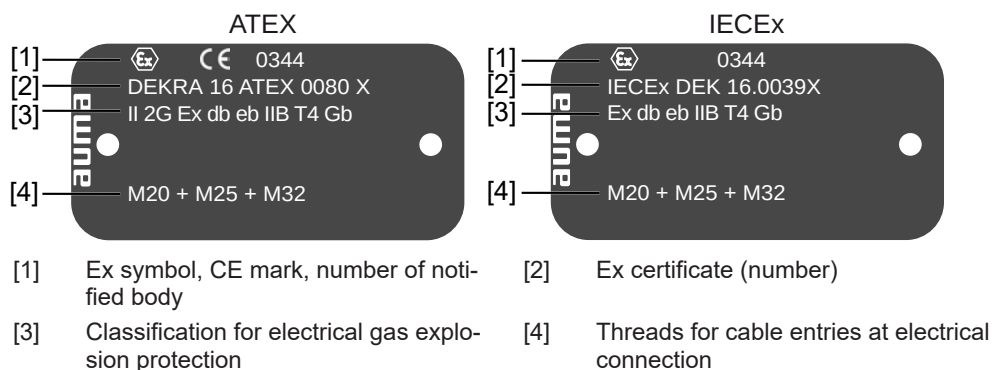
Figure 3: Fail safe unit name plate (example)



- | | | | |
|------|-------------------------------------|------|---|
| [1] | Name of manufacturer | [2] | Address of manufacturer |
| [3] | Type designation | [4] | Order number |
| [5] | Serial number | [6] | Nominal operating time in [s] for a part-turn movement of 90° |
| [7] | Max. torque in direction OPEN/CLOSE | [8] | Type of lubricant |
| [9] | Permissible ambient temperature | [10] | Mains voltage, mains frequency |
| [11] | Control | [12] | Can be assigned as an option upon customer request |
| [13] | Power | [14] | Enclosure protection |
| [15] | FQM fail safe direction | [16] | Year of manufacture |
| [17] | Data Matrix code | | |

Approval plate in explosion-proof version

Figure 4: Approval plates in explosion-proof version (examples)



Type designation **Table 1: Description of type designation with the example of FQM 05.1-F07**

FQM	05.1	F07	
FQM			Type FQM = fail safe actuator
	05.1		Size These instructions apply to sizes: Fail safe unit of FQM type, sizes 05.1, 07.1, 10.1, 12.1 Fail safe unit of FQMEx type, sizes 05.1, 07.1, 10.1, 12.1
		F07	Flange size

Ex marking **Table 2: Description of the Ex marking with the example of /--3--**

-	-	3	-	-	
-					Not used
	-				Not used
		3			Protection type of electrical connection 3 = Terminal compartment Ex e increased safety 4 = Terminal compartment Ex d flameproof enclosure
		-			Not used
		-			Not used

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.

We offer the service **myAUMA** on our website www.auma.com: When indicating the order number, authorised users can download the order-related documents like wiring diagrams, technical data (in German and English), the inspection certificate, the operation instructions and further order-related information.

Serial number **Table 3: Serial number, description with the example of 00000-12345**

00000-12345	
00000-12345	Serial number of sales article 11-digit, internal number for unambiguous product identification

FQM fail safe direction Direction of rotation of FQM output drive shaft or the driven valve shaft when safety function is triggered.

- CW = Clockwise rotation
- CCW = Counterclockwise rotation

Fail safe OPEN and Fail safe CLOSE safety functions result from the overall combination of actuator (gearbox), FQM and valve.

Table 4: Safety function

Valve closing direction (actuator) ¹⁾	FQM fail safe direction		Safety function
Clockwise closing	CW	Clockwise	Fail safe CLOSE
Clockwise closing	CCW	Counterclockwise	Fail safe OPEN

Valve closing direction (actuator) ¹⁾	FQM fail safe direction		Safety function
Counterclockwise closing	CW 	Clockwise	Fail safe OPEN
Counterclockwise closing	CCW 	Counterclockwise	Fail safe CLOSE

1) For identical closing direction of valve and actuator

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.
- Check eyebolts for tight seat in housing (verify reach of the screw).
- Observe manufacturer specifications for fixing lifting straps and round slings.
- Respect total weight of combination.
- Secure load against falling, sliding or tilting.
- Perform lift trial at low height to eliminate any potential danger e.g. by tilting.

Figure 6: Example, fixing FQM 07.1 with actuator and actuator controls



Table 5: Weights for fail safe unit

Type	approx. [kg]
FQM 05.1/FQMEx 05.1	61
FQM 07.1/FQMEx 07.1	64
FQM 10.1/FQMEx 10.1	135
FQM 12.1/FQMEx 12.1	137

Table 6: Weights of SQ/SQEx actuators and actuator controls

Type designation	Weight ¹⁾ approx. [kg]
Actuator	
SQ 05.2/SQEx 05.2	21/29
SQ 05.2/SQEx 07.2	21/29
SQ 05.2/SQEx 10.2	26/34
SQ 05.2/SQEx 12.2	35/42
Actuator controls	

Type designation	Weight ¹⁾ approx. [kg]
AC01.2/ACExC01.2	7/12

- 1) Indicated weight includes AUMA NORM part-turn actuator with 3-phase AC motor, electrical connection in standard version, unbored coupling 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:

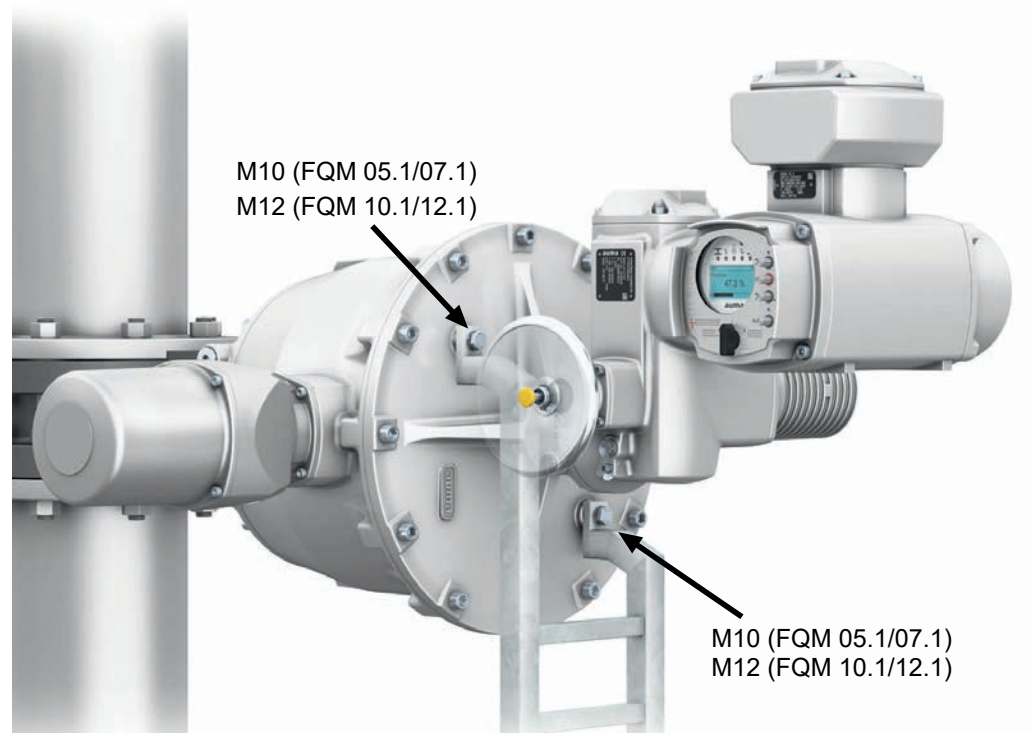
1. Prior to storage: Protect uncoated surfaces, in particular output drive parts and mounting surfaces using long-term corrosion protection agents.
2. At an interval of approx. 6 months: Check uncoated surfaces for corrosion. Should traces of corrosion be detected, renew the corrosion protection.

5 Assembly

5.1 Mounting position

The product described in this document can be operated in vertical and horizontal mounting position. The mounting position pointing downward is not permitted. For horizontal mounting position, the fail safe unit requires reinforcement to relieve the flange connection to the valve.

Figure 7: Reinforcement for horizontal mounting position (example)



The reinforcement is made at both threads provided for transport. For FQM 05.1/07.1 = M10 thread; for FQM 10.1/12.1 = M12 thread.

We recommend glueing the screws using thread sealing material to avoid contact corrosion in the thread.

To compensate for vibration, we recommend using additional all-metal dampers, e.g. available with company Stop-Choc®.

Support by AUMA AUMA offers an own support. The support is fixed at the output drive flange using suitable fastening clamps. It already includes all-metal dampers to compensate for vibration.

Figure 8: Support by AUMA (example)



5.2 Actuators for fail safe units

An AUMA actuator with integral controls combination is required to operate the valve via fail safe unit. On delivery, the AUMA actuator with AUMA actuator controls has already been mounted to the fail safe unit.



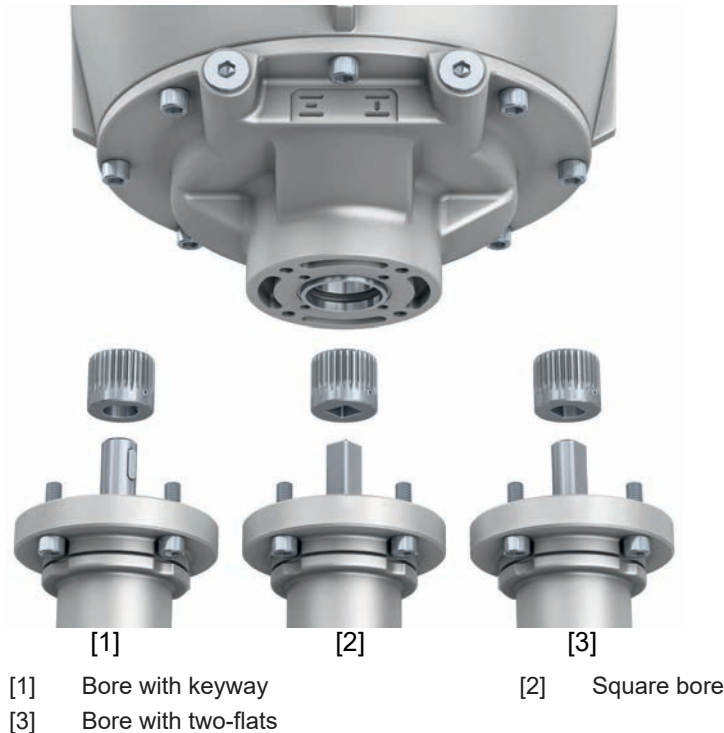
- a) The actuator is exactly aligned with regard to the fail safe unit to ensure safe unit function. In addition, the screws are fastened in the factory with a high torque to avoid any lateral movement. **Assembly or disassembly of the actuator may only be performed by the AUMA Service.**
- b) The mounted SQ part-turn actuator is not equipped with end stops. The part-turn actuator screw plugs do not have any function and may not be opened.

5.3 Mount fail safe unit to valve

The fail safe unit is mounted to the valve using a coupling placed onto the valve shaft.

5.3.1 Overview on coupling variants

Arrangement *Figure 9: Valve attachment via coupling*



- Application
- For valve attachments according to EN ISO 5211
 - For rotating, non-rising valve stem

5.3.1.1 Mount fail safe unit to valve

Unbored couplings or couplings with pilot bore must be machined to match the valve shaft prior to mounting the fail safe unit to the valve, e.g. with bore and keyway, two-flat or square bore.

NOTICE

Risk of damage to end stop if setting screw is turned against the spring force.

In the long run, the device might be damaged.

→ Do NOT unscrew setting screw **clockwise** against the spring force (fastening).



Risk of setting screw falling out!

- a) Avoid excessive unscrewing of settings screws. Observe dimension $T_{min.}$!

- Assembly steps
- ✓ Assemble valve and fail safe unit in the same end position (OPEN/CLOSED).
 - ✓ Only mount fail safe unit with unwound constant force spring. Make sure that unit is not live.
 - ✓ While constant force spring is unwound, the fail safe unit is set to the end position of the fail safe direction indicated on the name plate:
CW $\triangleq$ end position CLOSED (for clockwise rotating valve)
CCW $\triangleq$ end position OPEN (for clockwise rotating valve)
1. Clean and thoroughly degrease mounting surfaces of output mounting flanges.
 2. Apply a small quantity of grease to the valve shaft [2].
 3. Place coupling [1] onto valve shaft [2] and secure against axial slipping by using a grub screw [3] or a washer and a screw [4]. Thereby, ensure that dimensions X, Y or L are observed (refer to figures and table below).

Figure 10: Examples: Fit coupling

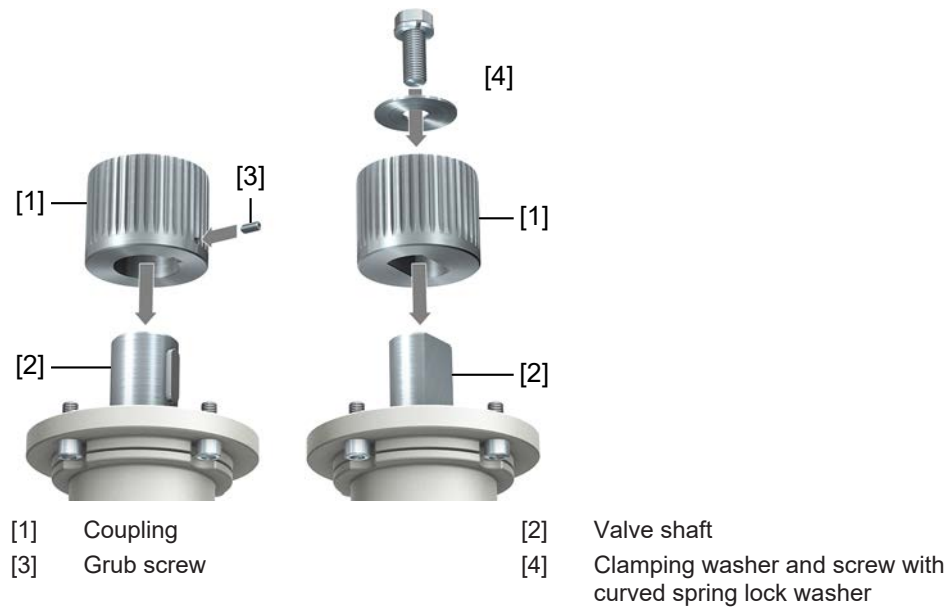


Figure 11: Mounting positions for coupling

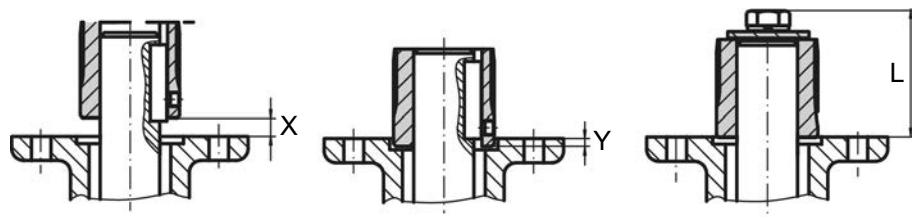


Table 7: Mounting position of the coupling within fitting dimensions according to AUMA definition

Dimensions [mm]	FQM 05.1	FQM 07.1	FQM 10.1	FQM 12.1
EN ISO 5211	F07	F07	F10	F10
X max.	5	5	5	6
Y max.	5	5	5	10
L max.	45	45	45	100

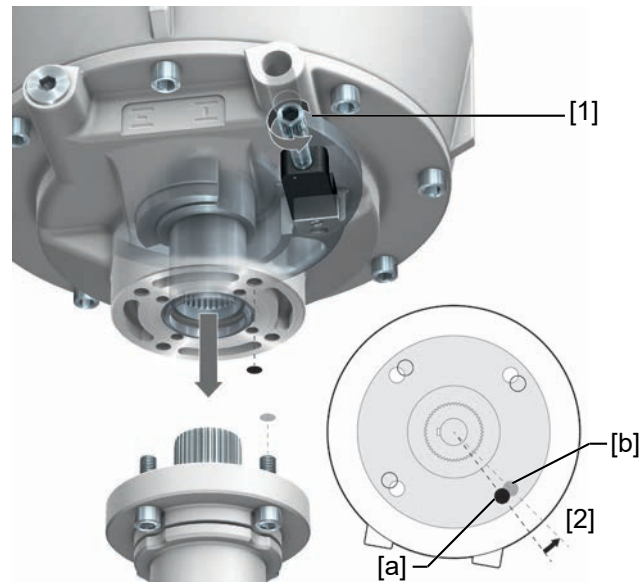
4. Apply non-acidic grease at splines of coupling (e.g. Gleitmo by Fuchs).
5. Place fail safe unit onto valve coupling and make sure that the screws match the bores provided.

- 5.1 For CW version, the FQM bores [●] should overlap the bores of the valve flange [●] rather **in clockwise** direction.

NOTICE! Risk of damage to end stop if setting screw is turned against the spring force.

Information: Avoid excessive unscrewing of settings screws. Observe dimension $T_{min.}$!

Figure 12: Place FQM on valve coupling (CW version)



[1] Setting screw

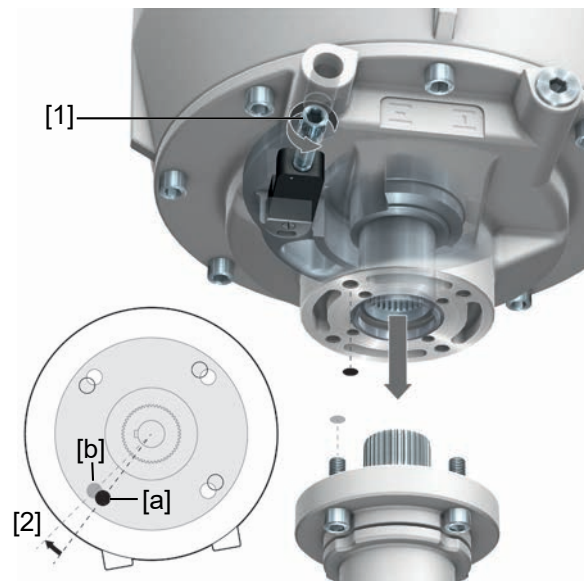
[2] View on valve flange and rotary movement of FQM when unfastening the setting screw.

[a] FQM bore

[b] Valve flange bore

5.2 For CCW version, the FQM bores [●] should overlap the bores of the valve flange [●] rather **in counterclockwise** direction.

Figure 13: Place FQM on valve coupling (CCW version)



[1] Setting screw

[2] View on valve flange and rotary movement of FQM when unfastening the setting screw.

[a] FQM bore

[b] Valve flange bore

6. Should the bores for the screws not align: Remove screw plug and **slightly** unfasten setting screw [1] for end stop OPEN/CLOSED at fail safe unit **counterclockwise** until bores [●] line up. When unfastening the setting screw, the FQM moves back in direction of the valve flange bore [●].

7. Fasten fail safe unit with screws.

Information: We recommend glueing the screws using thread sealing material (e.g. LOCTITE 243) to avoid thread contact corrosion and to ensure vibration resistance.

8. Fasten screws crosswise to a torque according to table. Refer to [Tightening torques for screws \[► 38\]](#)
9. If the bores [●●] are not yet aligned for dimension $T_{min.}$, the mounting procedure must be aborted. Perform the following steps:
 1. Remove fail safe unit from valve.
 2. Establish electrical connection and connect to power supply. Once the power supply is connected, initialisation is started provided all prerequisites are fulfilled. ⇨ [Initialisation \[► 27\]](#)
 3. After initialisation, screw the setting screw to dimension $T_{(at\ 90)}$ (without tolerance margin indicated). ⇨ [End stops in the fail safe unit \[► 28\]](#)
 4. Then, switch off power supply again (de-energize). The actuator performs a fail safe operation and moves to the configured fail safe end position.
 5. Now, re-place the valve onto the fail safe unit and mount to the valve as described in the present chapter. When mounting the fail safe unit onto the valve coupling, select splines as to ensure that bores of the screws for the FQM and the valve flange are as close as possible.

6 Electrical connection

6.1 Basic information



WARNING

Electric shock due to the 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 (www.auma.com).

Protection on site

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

The current values for respective sizing are derived from the current consumption of the motor (refer to electrical data sheet), the current consumption of the actuator controls, plus the current consumption of the fail safe unit. Please refer to the operation instructions pertaining to the actuator for information on the current consumption of actuator controls.

When providing joint protection for actuator, actuator controls and fail safe unit, the maximum power consumption of 360 W for the fail safe unit has to be accounted for. In case separate power supply for the fail safe unit is provided, 360 W have to be accounted for FQM protection.

Consider increased power supply starting current when selecting the circuit breaker characteristic. We recommend tripping characteristics D or K for circuit breakers in accordance with IEC 60947-2. To avoid spurious action, fuses with values below 2 A are not recommended.

6.2 Electrical connection/actuator controls

The customer connection for valve control during standard operation (power connection and signal cables) is made via the electrical connection of the actuator or the actuator controls. Any procedures for opening/closing the terminal compartment and for connecting the cables are described in the Operation instructions pertaining to the actuator.

6.3 Electrical connection for fail safe unit

On delivery, the electrical connection of the fail safe unit is already equipped with the power supply cable for FQM and the signal cable for actuator controls.

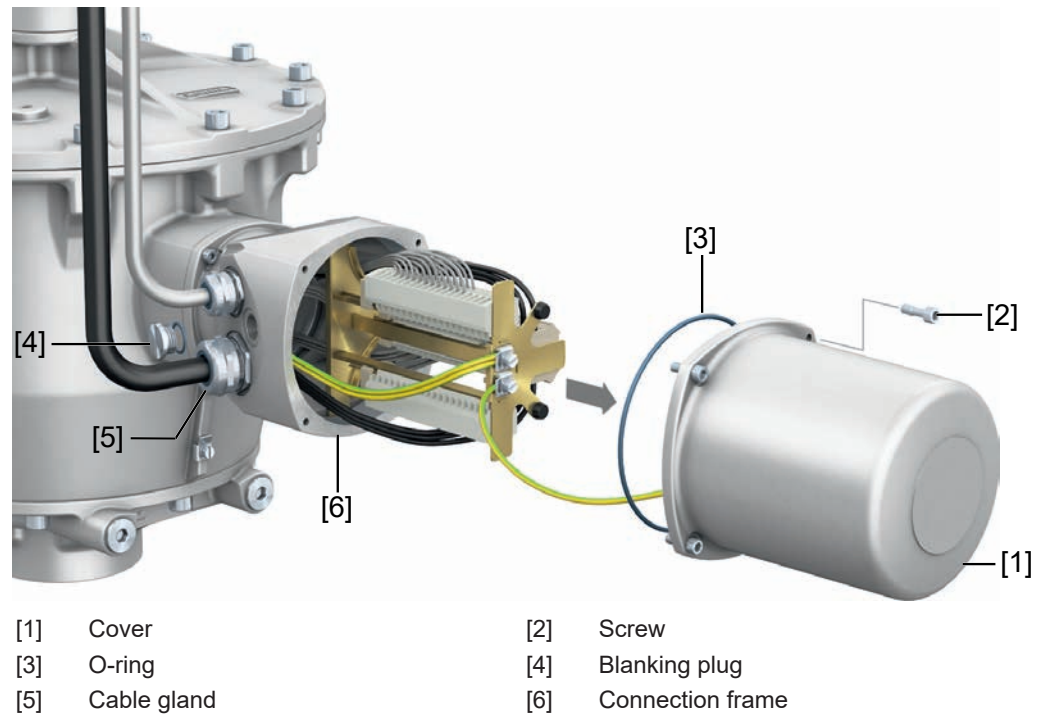
The tripping signal (ESD) for a fail safe operation as well as direct feedback signals (e.g. LSO/LSC end position switch signals) have to be connected in compliance with the wiring diagram at the customer's.

Depending on the application, either an S type electrical connector (weatherproof environment) or a KES type electrical connector (explosion-proof environment) will be provided.

6.3.1 KES electrical connection

6.3.1.1 Open terminal compartment

Figure 14: Open terminal compartment



⚠ DANGER

Electric shock due to the presence of hazardous voltage!

Death or serious injury.

→ Disconnect from mains before opening.

⚠ WARNING

Risk of explosion in case of non-respect of the protection type!

Risk of death or serious injury!

→ During commissioning, replace supplied blanking plugs with cable glands or blanking plugs with Ex approval, suitable for the type of protection. Thread types and thread sizes are specified on the approval plate.

NOTICE

Corrosion by ingress of humidity when using unsuitable cable glands/ blanking plugs!

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



For shielded cables: Use EMC cable glands.

How to proceed

1. Loosen screws [2] and remove cover [1].
2. Insert cable glands [5] suitable for connecting cables.
3. Seal unused cable entries with approved blanking plugs [4] suitable for the required protection type.
4. Tighten cable glands [5] and blanking plugs [4] at the housing. Respect torques according to manufacturer's specifications.

6.3.1.2 Cable connection

Table 8: Terminal cross sections and terminal tightening torques

Designation	Terminal cross sections	Tightening torques
Power contacts (U, V, W)	max. 10 mm ² (flexible or solid)	1.5 – 1.8 Nm
PE connection	max. 10 mm ² (flexible or solid)	3.0 – 4.0 Nm
Control contacts (1 to 50)	max. 2.5 mm ² (flexible) or max. 4 mm ² solid	0.6 – 0.8 Nm

WARNING

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

Electrical shock, risk of injuries or death.

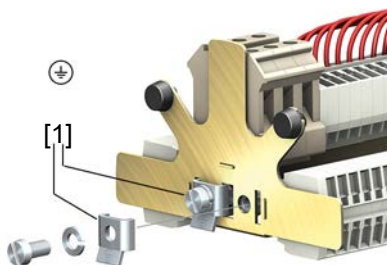
- Connect all protective earth conductors.
- Connect PE connection to external protective earth conductor of connection cable.
- Power the device only once the protective earth conductor has been connected.

How to proceed

1. Remove cable sheathing and insert the wires into the cable glands.
2. Fasten cable glands with the specified torque to ensure required enclosure protection. For shielded cables: Link the cable shield end via the cable gland to the housing (earthing).
3. Strip wires.
4. For flexible cables: Use wire end sleeves according to DIN 46228.
5. Connect cables according to order-related wiring diagram.
6. Firmly tighten protective earth to PE connection (symbol ⊕).

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

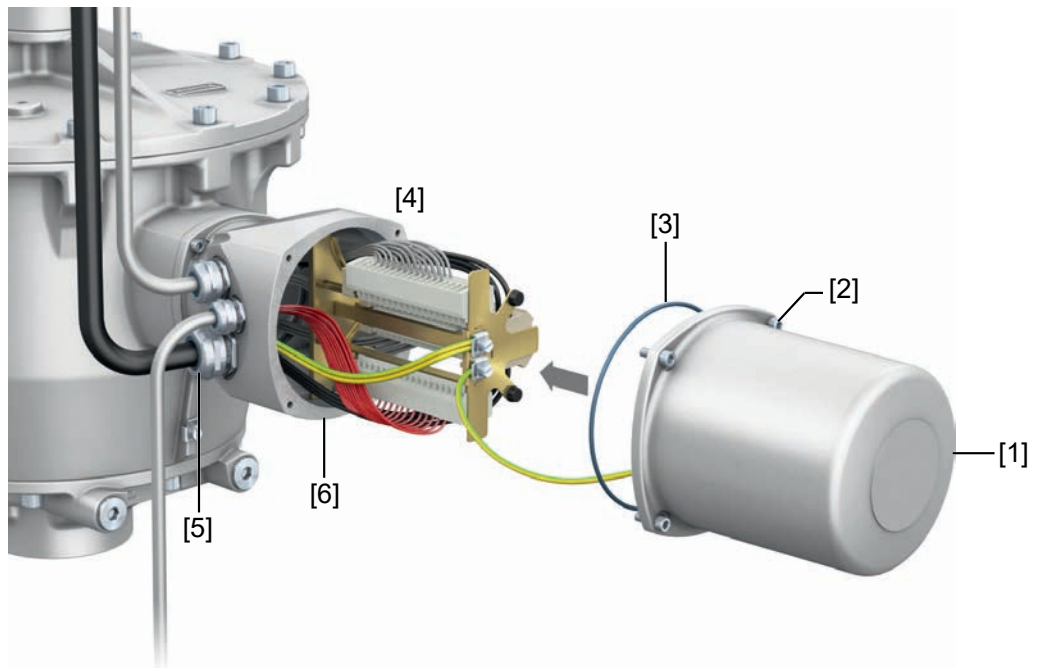
Figure 15: PE connection



[1] U-bracket for PE connection

6.3.1.3 Close terminal compartment

Figure 16: Close terminal compartment



- | | | | |
|-----|-------------|-----|------------------|
| [1] | Cover | [2] | Screw |
| [3] | O-ring | [4] | Blanking plug |
| [5] | Cable gland | [6] | Connection frame |

For version in flameproof enclosure (Ex d), heed the following:

WARNING

Risk of explosion in case of damage to flameproof enclosure!

Risk of death or serious injury

- Covers and housing parts must be free of damage.
- Flameproof joints must neither be damaged nor soiled in any way.
- Do not jam cover during fitting.

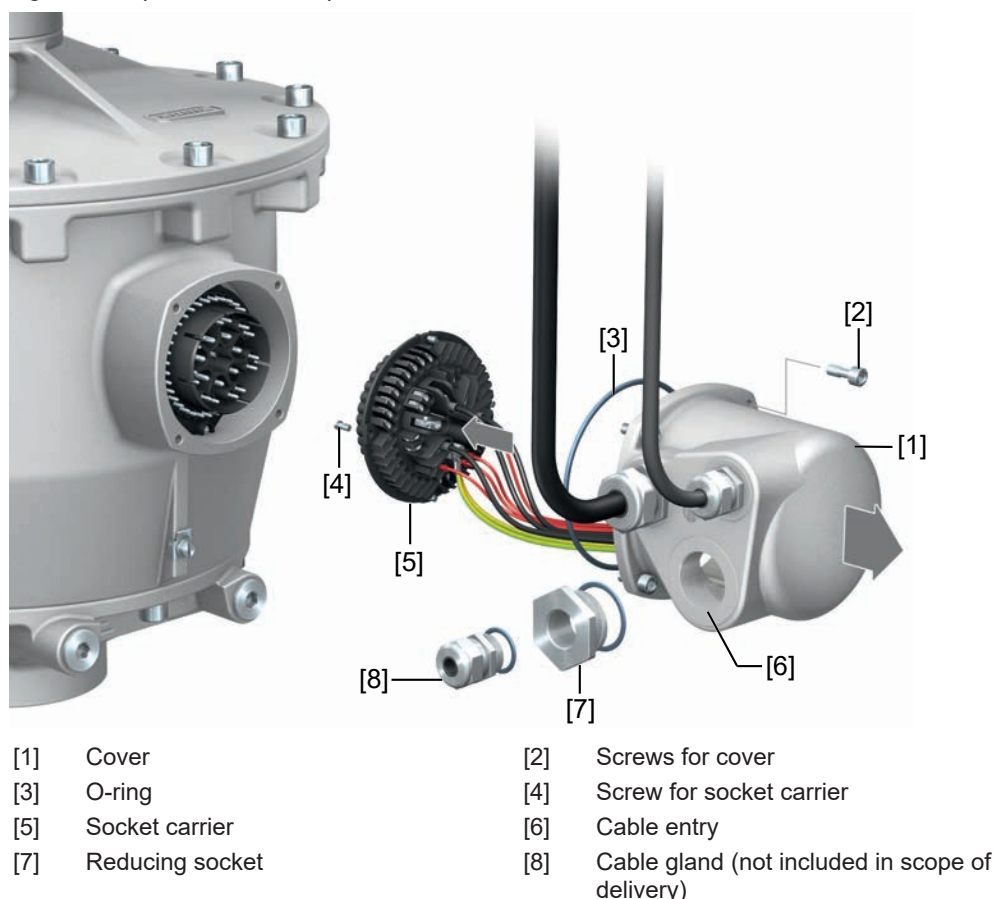
How to proceed

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 by new O-ring if damaged.
4. Slightly grease the O-ring with acid-free grease (e.g. petroleum jelly) and insert them correctly.
5. Fit cover [1] and fasten screws [2] evenly crosswise.
6. Fasten cable glands [5] and blanking plugs [4] applying the specified torque to ensure the required enclosure protection.

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

6.3.2.1 Open terminal compartment

Figure 17: Open terminal compartment



DANGER

Electric shock due to the presence of hazardous voltage!

Death or serious injury.

→ Disconnect from mains before opening.

NOTICE

Corrosion by ingress of humidity when using unsuitable cable glands/ blanking plugs!

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

Figure 18: 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.

- 5. Tighten cable glands [8] and blanking plugs at the housing. Respect torques according to manufacturer's specifications.

6.3.2.2 Cable connection

Table 9: Terminal cross sections and terminal tightening torques

Designation	Terminal cross sections	Tightening torques
Power contacts (U1, V1, W1, U2, V2, W2)	1.0 – 6 mm ² (flexible)	1.2 – 1.5 Nm
	1.5 – 10 mm ² (solid)	
PE connection	1.0 – 6 mm ² (flexible) with ring lugs	1.2 – 2.2 Nm
	1.5 – 10 mm ² (solid) with loops	
Control contacts (1 to 50)	0.25 – 2.5 mm ² (flexible)	0.5 – 0.7 Nm
	0.34 – 2.5 mm ² (solid)	



WARNING

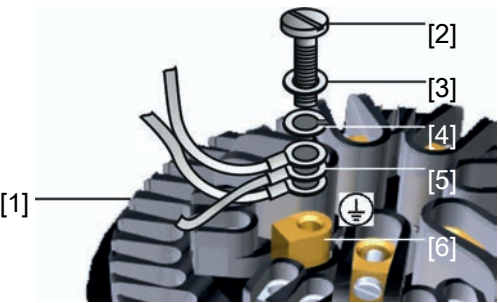
In case of a fault: Hazardous voltage while protective earth conductor is NOT connected!

Electrical shock, risk of injuries or death.

- 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.

- 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).

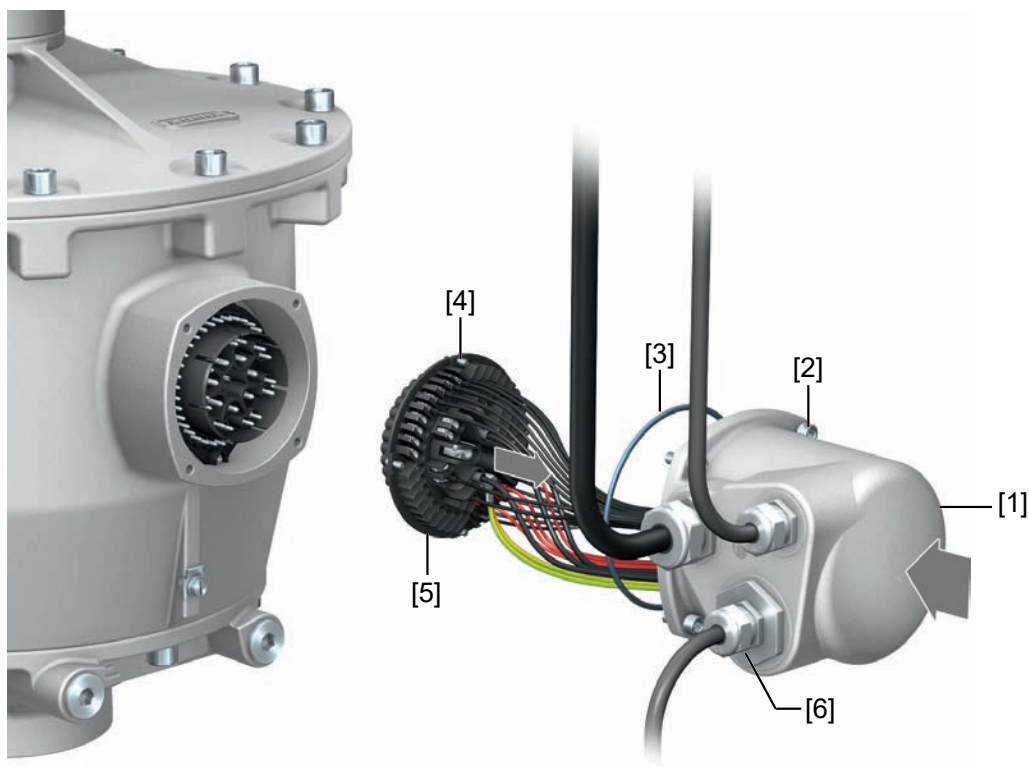
Figure 19: Protective earth connection



- | | | | |
|-----|------------------------------------|-----|-----------------------------|
| [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).

6.3.2.3 Close terminal compartment

Figure 20: Close terminal compartment



- | | | | |
|-----|----------------|-----|--------------------------|
| [1] | Cover | [2] | Screws for cover |
| [3] | O-ring | [4] | Screw for socket carrier |
| [5] | Socket carrier | [6] | Cable gland |

⚠ WARNING

Short-circuit due to pinching of cables!

Risk of electrical shock and malfunctions.

→ Carefully insert socket carrier to avoid pinching of wires.

- 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 by new O-ring 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.

Once the power supply is connected, initialisation is started provided all prerequisites are fulfilled.

6.3.3 External earth connection

Figure 21: External earth connection



Application External earth connection (U-bracket) for connection to equipotential compensation. The contact surface must be metallic uncoated.

Table 10: Terminal cross sections and earth connection tightening torques

Conductor type	Terminal cross sections		Tightening torques
	mm²	AWG	Nm
Solid wire and stranded	2.5 – 6	14 – 10	3 – 4
Fine stranded	1.5 – 4	16 – 12	3 – 4

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 Commissioning

- Prerequisites
- The fail safe unit was mounted to the valve: [Assembly](#) [► 13]
 - All electrical cables are connected: [Electrical connection](#) [► 19]
 - The type of seating (limit or torque seating) and the tripping torque (torque switching) have been set in the actuator to suit the mounted valve.
 - For detailed information on the customer-specific version, refer to the order-related data sheet.
 - The “Type of seating” and “Torque switching” settings are described in the operation instructions pertaining to the actuator.

Commissioning of the overall combination of actuator (gearbox), FQM and valve is made as follows:

1. Perform initialisation: [Initialisation](#) [► 27].
2. Set end stops: [End stops in the fail safe unit](#) [► 28].
3. Perform reference operation (adaptive end position setting): [Reference operation \(adaptive end position setting\)](#) [► 30].

7.1 Initialisation

If all prerequisites starting the initialisation phase are fulfilled, initialisation starts automatically to put the combination consisting of actuator (gearbox), FQM and valve in ready for operation state. Further information: [Indications during and after initialisation](#) [► 32].

Prerequisite for starting initialisation:

- Power supply applied.
- Actuator controls are ready for operation (booted after power supply connection).
- +24 V DC is applied at ESD input (refer to wiring diagram).
- Actuator controls are in operation mode Local or Remote (selector switch position on **Local control** or **Remote control**).
- The fail safe unit is in the configured fail safe end position.
(The end position switch LSO/LSC of fail safe end position must be operated.)

Procedure of the initialisation

A constant force spring is wound within the fail safe unit thanks to the electric motor acting as mechanical energy buffer for the fail safe operation. Simultaneously, the actuator runs into the configured fail safe end position to make sure that both actuator and FQM fail safe unit are in the same position as the valve.



- a) Clicking noises during initialisation or the fail safe operation are normal and do not represent a fault.
- b) For repeated FQM tripping (fail safe operation), a pause of minimum 15 minutes must be obeyed after the fourth fail safe operation to allow motor cool down.



Detect successful initialisation

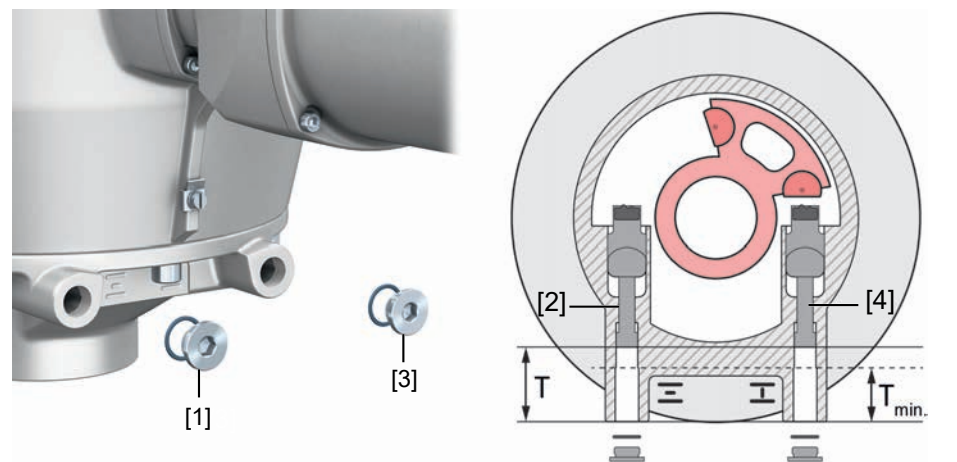
- Successful initialisation is indicated by the **FQM FS ready** signal on the actuator display. The **FS** symbol is displayed in the status bar (top). Refer to [Initialisation](#) [27].
- If, during automatic initialisation (start by applying ESD = high level +24 V DC), the maximum initialisation time of 2 minutes is exceeded and if subsequently the ESD high level is still applied AND the actuator display does not indicate the **FQM FS ready** signal, a fault of the FQM fail safe unit has occurred.

After successful initialisation, the FQM fail safe unit is ready for further commissioning, for standard operation as well as for fail safe operation.

Once a fault has been detected, the system has to be checked immediately and the installation has to be put in a safe state.

7.2 End stops in the fail safe unit

Figure 22: FQM end stops



[1/3] Screw plugs

[4] Setting screw for end stop CLOSED

[2] Setting screw for end stop OPEN

Table 11: Dimension T

Dimension T in [mm] ¹⁾	FQM 05.1/FQM 07.1	FQM 10.1/FQM 12.1
T (for 90°)	55 ±9	31 ±13
T _{min.}	46	18

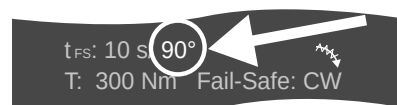
1) $\Delta T = 1 \text{ mm} \approx 1.0^\circ$ (one turn at setting screw $\approx 1.5^\circ$)

FQM end stops limit the swing angle. They are used as limit switches and protect the valve in the event of a fail safe operation.

No end stops are provided within the AUMA part-turn actuator when combined with an FQM. The end stops of the fail safe unit exclusively limit the swing angle.

The swing angle set in the factory is indicated on the name plate of the fail safe unit:

Figure 23: Name plate (example)





Exposed, rotating parts (discs/balls) at the valve!

Pinching and damage by valve or actuator.

- End stops should be set by suitably qualified personnel only.
- Never completely remove the setting screws [2] and [4] to avoid grease leakage.
- Observe dimension $T_{min..}$

The setting sequence depends on the application. As a general rule, the end position of the fail safe function (fail safe position) is set first.

- Recommendation for safety function Fail safe CLOSED:
 - Set first end stop CLOSED via  symbol.
- Recommendation for safety function Fail safe OPEN:
 - Set first end stop OPEN via  symbol.

7.2.1 Set end stop CLOSED

1. Operate valve in mid-position, respectively in sufficient distance from the end position.
2. Remove screw plug next to  symbol.
3. Unscrew setting screw **counterclockwise** until reaching dimension $T_{min..}$
4. Operate the valve in end position CLOSED to ensure that valve is safely closed.
Information: In motor operation: Interrupt travel in time prior to reaching the end stop and continue the last fraction of the travel in manual operation to prevent damage.
5. Turn setting screw in **clockwise** direction until end position switch LSC signals that the FQM has reached end position CLOSED:
 - ⇒ **FQM end pos. CL** signal or LED  on the local controls is illuminated.
6. Check settings: Use motor operation to operate the valve with actuator a fraction of travel back in direction OPEN. Then operate until end position in direction CLOSE.
 - ⇒ The end position CLOSED is correctly set if the end position switch LSC signals that the FQM has reached end position CLOSED: **FQM end pos. CL** signal or LED  on the local controls is illuminated.
7. Check O-ring in screw plug and replace if damaged.
8. Fit screw plug next to  symbol and tighten.

7.2.2 Set end stop OPEN

1. Operate valve in mid-position, respectively in sufficient distance from the end position.
2. Remove screw plug next to  symbol.
3. Unscrew setting screw **counterclockwise** until reaching dimension $T_{min..}$
4. Move valve to end position OPEN.
Information: In motor operation: Interrupt travel in time prior to reaching the end stop and continue the last fraction of the travel in manual operation to prevent damage.
5. Turn setting screw in **clockwise** direction until end position switch LSO signals that the FQM has reached end position OPEN:
 - ⇒ **FQM end pos. OP** signal or LED  on the local controls is illuminated.
6. Check settings: Use motor operation to operate the valve with actuator a fraction of travel back in direction CLOSED. Then operate until end position in direction OPEN.

⇒ The end position OPEN is correctly set if the end position switch LSO signals that the FQM has reached end position OPEN: FQM end pos. OP signal or LED  on the local controls is illuminated.

7. Check O-ring in screw plug and replace if damaged.
8. Fit screw plug next to  symbol and tighten.

7.3 Reference operation (adaptive end position setting)



After first initialisation and after end stop setting in the fail safe unit, each end position must be approached and left during standard operation to make sure that the actuator adopts these end positions. Imperatively perform this “reference operation” whenever an end stop resetting has been performed in the fail safe unit.



In standard operation, the ESD signal (+24 V DC) must be applied at **ESD** input (refer to wiring diagram). The valve can be operated via the actuator (handwheel) or via actuator controls (motor operation).

8 Fail safe operation and standard operation



The fail safe operation is an emergency function. Depending on the fail safe trigger via ESD or via power failure, an initialisation operation is required. In standard operation, the valve is electrically operated via the part-turn actuator.

Trigger signal for fail safe operation

A fail safe operation is triggered if the **ESD** (Emergency Shut Down) input is open (0 V DC).

Switching behaviour of ESD input:

- ESD input = low level (0 V DC or input open)
= fail safe operation is being executed
- ESD input = high level (+24 V DC)
= the valve can be operated in standard mode via actuator

Depending on the configuration, the fail safe operation can be initiated by power loss at actuator controls. The factory configuration of the fail safe unit is configured at assembly and is specified in the order-related technical data sheet.

Operating time configuration for fail safe operation

The operating time is preset in the factory. In order to modify the operating time, 4 different operating speeds can be selected via the **FS speed configuration** input (refer to wiring diagram) (level 1 – level 4).



Contact the AUMA Service prior to modifying the operating time for a fail safe operation.

After a fail safe operation

CAUTION

Turning handwheel at actuator following a fail safe operation!

Risk of hand injury for handwheels equipped with ball handle.

- Do NOT press the push button at the actuator handwheel.
- Following a fail safe operation, manual operation may only be re-engaged after successful initialisation (FQM FS ready signal).

9 Indications

9.1 Indications on display

The indications described hereafter exclusively apply to the functions of the fail safe unit. For further indications of actuator controls, refer to the operation instructions pertaining to the actuator or to the Manual (Operation and setting) pertaining to actuator controls.

9.1.1 Indications during and after initialisation

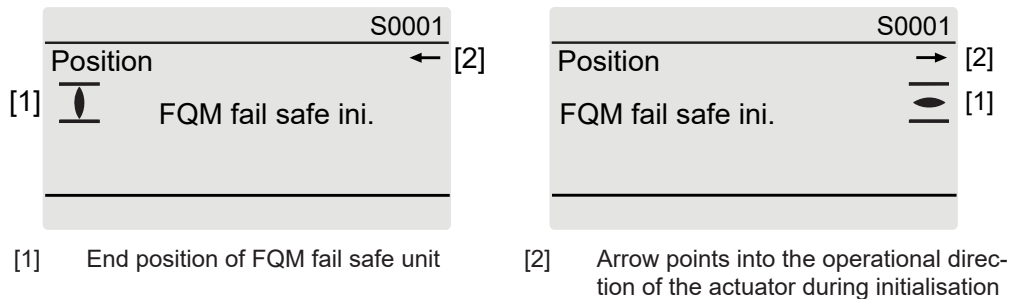


Actuator controls cannot be actuated during initialisation.

FQM fail safe ini.

During initialisation, the display of the actuator controls shows the following message in status indication [S0001]: **FQM fail safe ini.**

Figure 24: Example left: Fail safe CLOSE, right: Fail safe OPEN



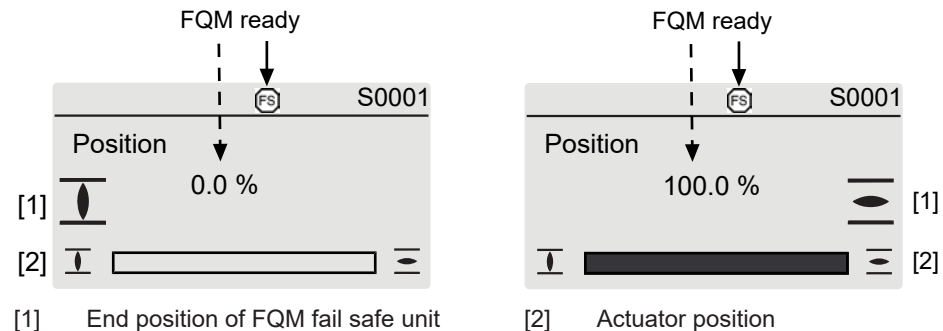
⏏ FQM (valve) is in end position CLOSED

⏏ FQM (valve) is in end position OPEN

FQM FS ready

After successful initialisation, actuator and valve are in the same end position. In the status line (top), the **FS** symbol is displayed, i.e. the constant force spring is wound, the FQM is ready for fail safe operation. At the same time, the display indicates the actuator position as figure (default setting %). For valve operation, the actuator is now ready to operate in standard mode.

Figure 25: Example of standard operation



⏏ FQM (valve) is in end position CLOSED

⏏ FQM (valve) is in end position OPEN

Bar chart empty = Actuator is in end position CLOSED (0.0 %)

Bar chart black = Actuator is in end position OPEN (100 %)



The **FQM fail safe ini.** and **FS FQM FS ready** indications can also be supplied as signals via digital outputs.

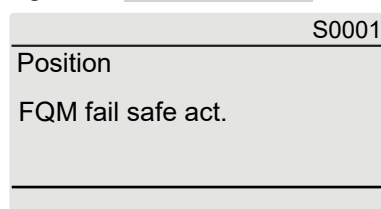
9.1.2 Indications during fail safe operation



Actuator controls cannot be actuated during fail safe operation.

FQM fail safe act. If a fail safe operation is triggered by ESD signal failure, the display of the actuator controls indicates the following message in status indication [S0001]: **FQM fail safe act.**

Figure 26: FQM fail safe act.

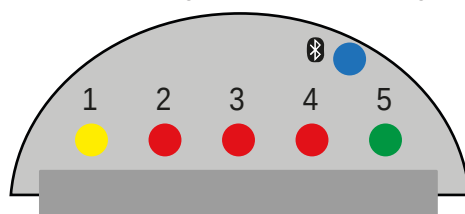


FQM fail safe act. = Fail safe unit operates to configured end position

9.2 Indication lights of local controls

Different indications can be assigned to LEDs 1 – 5.

Figure 27: Arrangement of indication lights



In combination with a fail safe unit, additional setting values (indications) are available.

9.2.1 Modify indication lights (indications)

Required user level: **Specialist (4)** or higher.

M> **Device configuration** [M0053]
Local controls [M0159]
Indication light 1 (left) [M0093]
...
Indicat. light 5 (right) [M0097]

Possible setting values for fail safe function:

FQM FS ready	The constant force spring is wound, the FQM is ready for fail safe operation.
FQM ESD req.	The FQM (fail safe) fail safe function is requested (ESD requested).
FQM end pos. OP	FQM (valve) is in end position OPEN
FQM end pos. CL	FQM (valve) is in end position CLOSED

We recommend refraining from changing indication lights **Indication light 1 (left)** [M0093] and **Indicat. light 5 (right)** [M0097]. When leaving the factory, the setting is made to indicate the end positions of the FQM fail safe unit.

We recommend assigning two indication lights with **FQM FS ready** and **FQM ESD req.** signals to detect the state of the fail safe unit.

For further setting values, refer to the operation instructions pertaining to the actuator or to the Manual (Operation and setting) pertaining to actuator controls.

10 Signals (output signals)

10.1 Status signals via output contacts (digital outputs)

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

In combination with a fail safe unit, additional setting values (signals) are available.

10.1.1 Configuration of outputs

Required user level: **Specialist (4)** or higher.

M▷ **Device configuration** [M0053]
I/O interface [M0139]
Digital outputs [M0110]
Signal DOUT 1 [M0109]
 ...
Signal DOUT 12

Possible setting values for fail safe function:

FQM FS ready	The constant force spring is wound, the FQM is ready for fail safe operation.
FQM ESD req.	The FQM (fail safe) fail safe function is requested (ESD requested).
FQM end pos. OP	FQM (valve) is in end position OPEN
FQM end pos. CL	FQM (valve) is in end position CLOSED

We recommend assigning two outputs with **FQM FS ready** and **FQM ESD req.** signals to detect the state of the fail safe unit.

For further setting values, refer to the operation instructions pertaining to the actuator or to the Manual (Operation and setting) pertaining to actuator controls.

10.1.2 Direct feedback signals from the fail safe unit

These feedback signals can be directly issued by the fail safe unit and transmitted to the control room, for example.

Table 12: Feedback signals

Feedback signal	Designation in the wiring diagram	
FQM end position OPEN/ CLOSED reached	LSC	End position switch, closing, clockwise rotation
	LSO	End position switch, opening, counterclockwise rotation
	1 NC and 1 NO (standard) each Automatic setting when setting the end stops within the fail safe unit	
Fail safe function ready	FS ready	
	1 NC and 1 NO (standard)	



The precise version is indicated in the wiring diagram or on the order-related technical data sheet.

All output signals must be supplied with the same potential.

11 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.

11.1 Maintenance intervals

Recommendation for plants subject to strong vibration

- For plants subject to strong vibration, 6 months after commissioning and then once a year: Check fastening screws between fail safe unit and valve for tightness. If required, fasten screws while applying the indicated [Tightening torques for screws](#) [► 38].
- In case supports are mounted, we recommend checking all support screws for fast tightening. This action is not required for screws which are glued with e.g. thread sealing material.

Recommendation for areas with explosion hazards:

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.

Recommendation for maintenance:

- In standard operation (valve opening/closing via the part-turn actuator), no further actions are required during operation, e.g. grease change. The maintenance intervals in standard operation depend on the overall combination of actuator (gear-box), FQM and valve. Thus, heed the maintenance instructions of the operation instructions of the components installed.
- After 10 years, carry out visual inspection: Cable entries, cable glands, blanking plugs, etc. have to be checked for correct tightness and sealing. If required, tighten cable glands and blanking plugs with torque in compliance with the manufacturer's specifications. Replace seals if required. We recommend calling the AUMA Service for maintenance.
- Replace constant force springs after 500 fail safe initialisations.

11.2 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.

12 Technical data



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

12.1 Technical data Fail safe unit

Features and functions		
Explosion protection	Refer to name plate	
Certificates	Certificates are attached to the device. All standards applied and their respective issues are indicated on these certificates.	
Type of duty	Open-close duty:	Short-time duty S2 - 15 min., classes A and B according to EN ISO 22153
	Modulating duty:	Intermittent duty S4 - 25 %, class C according to EN ISO 22153 (not available in SIL version)
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	
ESD input	24 V DC, current consumption: approx. 1 A Permissible voltage variation: +20%/-15%	
Status signal	Single switch (1 NC and 1 NO) for each end position, galvanically isolated for OPEN and CLOSED: max. 0.1 A at 30 V DC Output contact for Fail safe function ready signal: max. 0.1 A at 30 V DC	
Swing angle	Adjustable between 80° and 96°	
Electrical connection	Standard:	FQM: AUMA plug/socket connector with screw-type connection FQMEx: AUMA Ex plug/socket connector with terminal blocks (KES-e)
	Option:	FQM: Terminals or crimp-type connection FQMEx: AUMA Ex plug/socket connector with terminal blocks (KES-d)
Threads for cable entries	Standard:	Metric threads
	Option:	NPT threads, G threads
Terminal plan	Terminal plan according to order number enclosed with delivery	
Splined coupling for connection to the valve shaft	Standard:	Coupling without bore
	Options:	Machined coupling with bore and keyway, square bore or bore with two-flats according to EN ISO 5211
Valve attachment	Dimensions according to EN ISO 5211 without spigot	
Service conditions		
Use	Indoor and outdoor use permissible	
Mounting position	Vertical and horizontal position (for horizontal mounting position, a support is required) The mounting position pointing downward is not permitted.	
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	For exact version, refer to actuator 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	FQM/FQMEx 05.1 – FQM/FQMEx 07.1 with valve attachment F07 = 0.3 g, 10 – 200 Hz FQM/FQMEx 05.1 – FQM/FQMEx 07.1 with valve attachment F10 = 0.5 g, 10 – 200 Hz FQM/FQMEx 10.1 – FQM/FQMEx 12.1 with valve attachment F10 = 0.3 g, 10 – 200 Hz FQM/FQMEx 10.1 – FQM/FQMEx 12.1 with valve attachment F12 = 0.5 g, 10 – 200 Hz Resistant to vibration during startup or for plant failures. However, a fatigue strength may not be derived from this.	

Service conditions		
Corrosion protection	Standard:	KS Suitable for use in areas with high salinity, almost permanent condensation, and high pollution.
	Option:	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)
	Option:	Available colours on request
Lifetime	500 fail safe operation (ESD cycles) AUMA fail safe units meet or even exceed the lifetime requirements of EN 15714-2 in motor operation. Detailed information can be provided on request.	
Further information		
EU Directives	Machinery Directive 2006/42/EC EMC Directive 2014/30/EU ATEX Directive 2014/34/EU (for FQME _x only)	

12.2 Tightening torques for screws

Table 13: Tightening torques for screws

Threads	Tightening torque [Nm]	
	Strength class	
	A2-70/A4-70	A2-80/A4-80
M4	2.2	3
M5	4.3	5.7
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

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Solutions for a world in motion

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