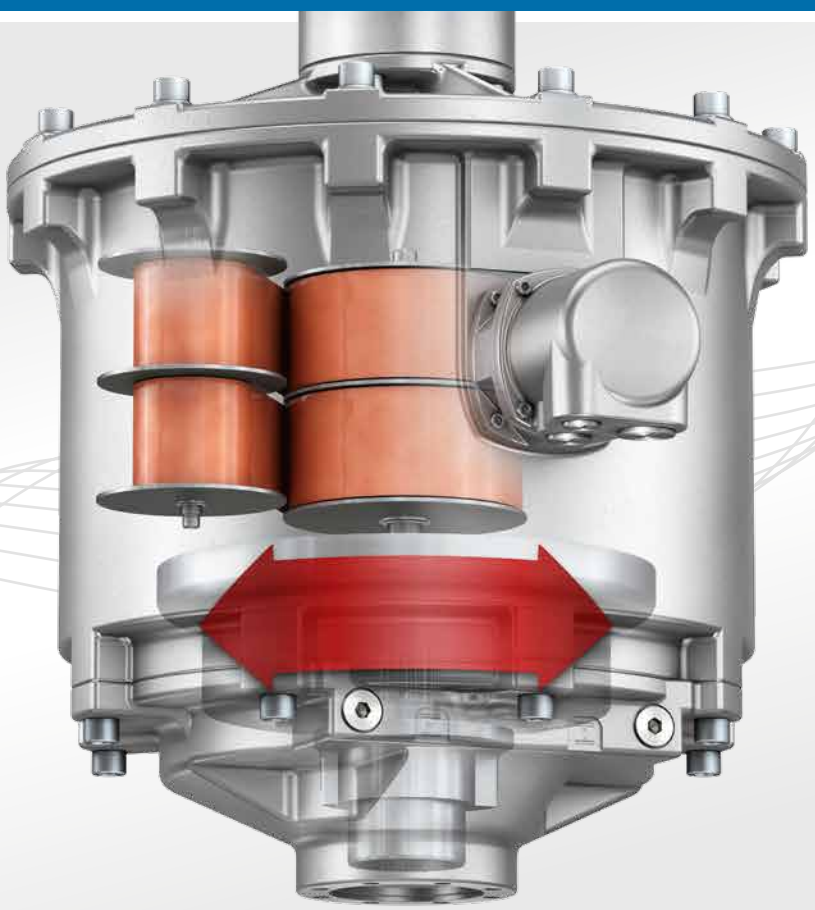
auma®
Solutions for a world in motion

ELECTRIC ACTUATORS WITH FAIL SAFE UNIT

For automatic opening or closing of a valve in the event of an emergency



In recent years, safety requirements in process plants have become increasingly demanding. Even in case of emergency, the system must be safe for persons and the environment. Actuators play a crucial role here, since it is their task to open or close a valve in case of emergency and to ensure that the plant remains in safe condition.

With the FQM fail safe unit, AUMA offers innovative and safe actuator solutions for automatic operation of valves in case of emergencies making use of stored mechanical energy.

The FQM fail safe unit meets the requirements of safety-related applications up to SIL 2/SIL 3 and is virtually maintenance-free. An explosion-proof version is also available.

MECHANICAL SOLUTION FOR UTMOST SAFETY

When relying on safe opening or closing of a valve, mechanical actuator solutions provide top safety. In case of need, the new FQM fail safe unit generates the required torque by means of a constant force spring purely on a mechanical basis. No electrical power is required for fail safe operation.

CONSTANT TORQUE

The constant force spring motor with patent pending provides a constant torque during fail safe operation and this across the complete travel. Thanks to the overriding gear arrangement, the constant force spring is disengaged during normal operation and does not need to be operated. As a consequence, actuator sizing can be relatively small.

VARIABLE OPERATING SPEEDS

The operating speed for the fail safe operation is adjustable. Furthermore, the actuator can operate the valve into the defined end position at reduced speed. This avoids pressure peaks within the pipeline and protects the valve.

ELECTRIC PART-TURN ACTUATORS WITH FQM FAIL SAFE UNIT

EASY INTEGRATION

Actuators with FQM fail safe unit are integrated into systems in the same way as standard AUMA actuators. The fail safe unit seamlessly adapts to the modular AUMA product design. It is combined with AUMA SQ part-turn actuators.

Integration into the DCS is made as for the standard devices by means of AC integral actuator controls. Operating concept, interfaces and communication remain homogeneous across all valves installed within the plant.

EASY RETROFITTING

Thanks to their identical interfaces, the fail safe unit can be retrofitted within existing plants. For example, if the safety requirements for an application have intensified.

VERSATILE IMPLEMENTATION

AUMA actuators with FQM fail safe unit are particularly suited to automate butterfly valves as well as ball and plug valves at a swing angle of 90°. They are the perfect choice if part-turn actuators require safe opening or closing in case of emergencies.

Industrial applications

Fail safe actuators are used in all markets and applications. for example, within water reservoirs they prevent leakage in the case of burst pipes. In cooling system, they prevent overheating of ovens for example in case of conventional cooling system failure. Steam generating boilers in power plants and fire protection measures in road and railway tunnels are further typical examples.

Applications in the oil & gas industry

The oil & gas industry imposes highest quality standards not least due to the superior danger of potential explosions. The explosion-proof fail safe unit caters for the required safety level. Overfill protections in tank farms, drainage protection in tanks and pipelines or use in gas regulating and metering stations are merely a few of the versatile implementations in the oil & gas industry.

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FUNCTION

FQM fail safe unit
AUMA part-turn actuators with fail safe unit ensure that the valve is operated to a safe position in the event of an emergency. This is exclusively performed with mechanical energy as to ensure valve operation even in the event of power failure. Selection can be made whether the valve is to be operated into position OPEN or CLOSED.

Standard operation
All AUMA actuator functions are available as usual in standard operation. The torque is transmitted directly from the actuator through the fail safe unit to the valve.

Fail safe operation
During a fail safe operation, the required torque is exclusively mechanically generated via the energy stored in the constant force spring.

The constant force spring is activated during fail safe operation and transmits the generated torque to the valve by means of a planetary gearing. During the complete fail safe operation, the spring provides a virtually constant torque.

The cases in which a fail safe operation will be initiated depend on the selected version of the fail safe unit. The following criteria for initiating a fail safe operation are possible:

> ESD (Emergency Shutdown) signal at the ESD input
> Mains failure
> ESD signal or mains failure

1 Constant force spring motor
The core of the fail safe unit is a mechanical constant force spring motor providing the required torque to open or close the valve in case of an emergency.

When connecting the actuator to the mains and after release by the DCS, the fail safe unit is initialised and the constant force spring is fully wound by means of an electric motor. For this, the spring is wound in opposite direction on a drum.

During the fail safe operation, the integrated electric motor additional acts as brake and slows down the spring. allowing setting of various operating speeds during fail safe operation.

2 Solenoid with toggle lever
In standard operation, the solenoid retains the spring in the fully wound position by means of a toggle lever. Once a fail safe operation is initiated, the solenoid releases the spring.

Electric part-turn actuator
The FQM fail safe unit is used in combination with AUMA SQ part-turn actuators. The electric actuator can thus be individually and perfectly adjusted to the application requirements. The combinations with the following versions are possible:

> SQ part-turn actuators for open-close duty
> SQR part-turn actuators for modulating duty
> SQEx and SQREx part-turn actuators for potentially explosive atmospheres

AC integral actuators controls
AC integral actuator controls assume communication control between DCS and actuator. Actuator controls are available with various interfaces to the DCS – allowing both parallel signal transmission and fieldbus communication. Supported are, for example, Profibus DP, Modbus RTU and Foundation Fieldbus as well as HART and WirelessHART.

Advanced diagnostic functions enable preventive maintenance and integration of actuators into asset management systems. Integral local controls also allow for local actuator operation.

3 Planetary gearing
The planetary gearing acts as overriding gear arrangement. In standard operation it transmits the drive shaft movement directly to the part-turn movement of the valve. During standard operation, the constant force spring is disengaged and is not operated by the actuator.

During the fail safe operation, the planetary gearing transmits the energy stored in the spring to the valve. Here, the actuator is inactive.

4 End stops with integral end position switches
The internal end stops limit the swing angle of the valve. The end position switches are automatically set during the setting procedure of end positions OPEN and CLOSED and do not require separate adjustment.

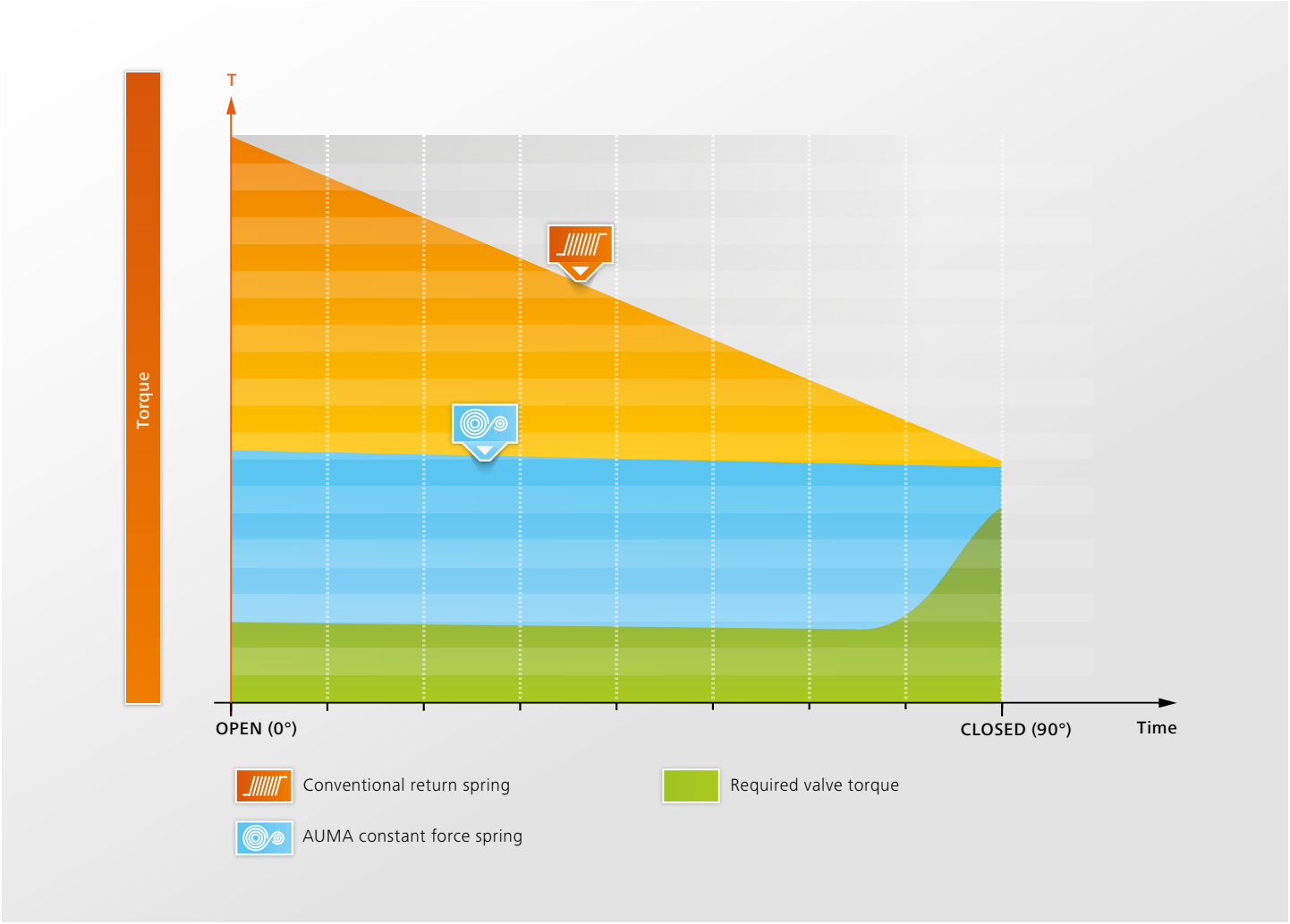
5 Valve attachment
The interface to the valve is made in compliance with EN ISO 5211. The torque is transmitted from the output drive shaft to the valve by means of a splined coupling. which is available in different versions: unbored, with square bore, two-flat or as bore with keyway.

Advantages of the AUMA scheme

The main drawbacks of conventional solutions using simple return springs are that the spring transmits the highest torque at the start of the travel. Towards the end of the travel, the applied torque is reduced when it is needed most to ensure safe valve seating. Hence, the springs have to be oversized to ensure that the required torque is still supplied towards the end of the travel.

With the constant force spring with patent pending by AUMA, the wrapped constant force spring drum supplies a virtually constant torque. across full travel. Consequently, constant force spring motor sizing is lower than for conventional springs.

Further advantage: Thanks to the overriding gear arrangement, the spring must not be operated during standard operation and remains completely wound. This allows selection of smaller actuators. Furthermore, premature spring fatigue can be prevented and the valve is protected against excessive torques.



SERVICE CONDITIONS

AUMA actuators with FQM fail safe unit are designed to highest reliability and long product life and fulfil their automation tasks in most severe and harsh environments.

ENCLOSURE PROTECTION IP68

Like the actuators, the FQM fail safe unit is available with increased enclosure protection IP68 in compliance with IEC 60529. The permissible immersion height of 8 m head of water is specified for a max. duration of 96 hours.

AMBIENT CONDITIONS

The standard version of the FQM fail safe unit is suitable for temperatures of –30 C to +70 °C. Further temperature ranges are available on request.

CORROSION PROTECTION

The AUMA corrosion protection system with the two-layer powder coating is certified by the TÜV and provides top-quality mechanical and chemical resistance.

Actuators equipped with FQM fail safe units are suitable for environmental conditions C5 in compliance with EN ISO 12944-2. They comply the requirements for use in areas with high salinity, almost permanent condensation, and high pollution.

EXPLOSION PROTECTION

Both actuators and FQM fail safe units were tested and certified in close collaboration with national and international certification bodies. Approvals have been obtained from authorities worldwide for use in potentially explosive atmospheres, including ATEX (Europe), IECEx (international), FM (USA) and ROSTECHNADSOR/EAC (TR-CU) (Russia).

> Explosion protection according to ATEX:
  II2G Ex db eb IIB T4 Gb
> Explosion protection according to FM:
  Class I, Div. 1, Groups C, D T4
  Class I, Zone 1, Group IIB T4

FIREPROOF VERSION

AUMA actuators with FQM fail safe units are available in fireproof version to ensure safe closing and opening of valves even in the event of a fire. Devices fitted with K-MASS™ fire protection coating preserve functionality at temperatures as high as 1,100 °C. Consequently, they fulfil the requirements in compliance with UL 1709.

SIL

The FQM fail safe unit is available in SIL version. This version was certified by exida in compliance with IEC 61508 and may be used for safety related applications up to SIL 2 for single-channel system architecture and up to SIL3 for redundant system architecture.

Safety functions:

> Safe OPENING/Safe CLOSING
> Safe end position feedback

TECHNICAL DATA

Type	Operating time fail safe operation	Torque	Swing angle	Suitable part-turn actuator	Valve attachment
	[s]	[Nm]			EN ISO 5211
FQM 05.1 FQMEx 05.1	9 - 34	150	Adjustable between 80° – 100°	SQ 05.2 SQEx 05.2	F07 F10
FQM 07.1 FQMEx 07.1	8 – 26	300		SQ 07.2 SQEx 07.2	F07 F10
FQM 10.1 FQMEx 10.1	15 – 54	600		SQ 10.2 SQEx 10.2	F10 F12
FQM 12.1 FQMEx 12.1	13 – 39	1,200		SQ 12.2 SQEx 12.2	F12 F14
Mains voltage	3-phase AC current: 200 V – 240 V/380 V – 690 V, 50 Hz/60 Hz 1-phase AC current: 100 V – 240 V, 50 Hz/60 Hz				
Criterion for initiating fail safe operation	> 24 V DC ESD signal > Mains failure > 24 V DC ESD signal or mains failure The criterion for initiation must be defined when placing the order and cannot be changed at a later date.				

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