auma®

Solutions for a world in motion

Actuator solutions

in steel constructions for water systems

Industrial sector information

Multi-turn actuator - worm gearbox combinations at a weir in Malaysia

The actuator specialist

AUMA is one of the leading manufacturers of electric actuators, actuator controls and valve gearboxes for the automation of industrial valves worldwide. AUMA has more than 50 years of experience in research & development and manufacture of electric multi-turn and part-turn actuators. AUMA manufactures in two German factories. Three Service Centers, respectively in Cologne, Magdeburg and Munich, have been set up to offer service performance. 2,300 employees belong to the AUMA group worldwide.

AUMA automates...

... gate valves, butterfly valves, weirs and sluices and have to cope with a multitude of requirements from various application areas for all regions worldwide - this is our day-to-day business. The modular AUMA design principle forms the basis of the long-term product policy and offers the required flexibility to adapt our range of actuators to suit customer requirements.

Global presence

For this purpose, you have to know your markets well. Thinking globally means acting regionally. A comprehensive worldwide sales and service network ensures that there is a competent local contact for every customer.

Single source supply

From product development to device testing, to final inspection, AUMA offers continuous manufacturing and quality assurance processes which are subject to constant review.

Since 1964, AUMA has established an excellent brand name in the world of actuators. Reliability and innovation are concepts which are closely linked with AUMA. This is above all to be credited to AUMA's dedicated employees who work devotedly on the future of the actuators.

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Solutions for a world in motion

2015.05.06

Defining steel constructions for water systems requires a high level of knowledge and experience. When subjected to extreme situations in which other machines automatically shut down or enter a safeguarding position, weirs and sluices must guarantee reliable operation. They have to prevent damage to people, animals and assets, even under extreme conditions such as severe ice loads or hundred year floods.

The decisive fact is that closing elements, sluices and wedges must be in perfect operation conditions at all times to satisfactorily solve potentially dangerous situations. This requires reliable and robust actuator solutions.

AUMA looks back on decades of experience in automating steel constructions for water systems. A large number of reference plants in all sizes and various designs give proof that AUMA is capable of supplying tailor-made solutions in steel constructions for water systems.

Due to limitations of space, this brochure is only a representation of some of these solutions. It provides the reader with the basic functions and most important features of AUMA devices.

AUMA engineers within field service and within our subsidiaries can assist you in defining the correct device for the application.

The latest information on the AUMA products can be found on the Internet at www.auma.com. All documents, dimensional drawings, wiring diagrams, technical and electrical data sheets as well as inspection records of supplied actuators are available on the Internet in digital form.

Snow, ice, frost, water and even heat - steel constructions for water systems are intensively and immediately exposed to all elements. They must function reliably under these ambient conditions.

This also applies to AUMA devices. As from the beginning, AUMA has therefore attached great importance to the AUMA devices being resistant against the most adverse environmental impacts. Optimum design, use of high-quality material and implementation of best coating procedures are the ideal prerequisites to withstand forces of nature.

All within a single housing

End position and torque monitoring are integrated within the actuator housing. No expensive and sophisticated external end switch installations nor torque/power sensors are required. The electric motors are ideally designed and do not require additional cooling, e.g. via fan. These are the conditions for high IP enclosure protection.

High class enclosure protection

SA and SQ AUMA actuators are supplied in increased enclosure protection IP68 in compliance with EN 60529. IP68 means protection against continuous immersion up to 8 m head of water for max. 96 hours. During continuous immersion, up to 10 operations are permissible.

Typically, AUMA gearboxes are used in combination with AUMA multi-turn actuators. Gearboxes are also available in enclosure protection IP68. Certain gearboxes are intended for particular applications, e.g. buried service for part-turn actuators or superior immersion levels. For any special characteristics, please contact AUMA for device selection.

Superior enclosure protection

Depending on the device type and combination, deeper immersions and longer submersions are feasible. Please refer to the data sheets of the relevant devices.

Service conditions

Corrosion protection

The efficient AUMA corrosion protection is decisive for a high life endurance level of the devices. The AUMA corrosion protection system is based on a chemical preliminary treatment, followed by a two-layer powder coating of the individual components. In compliance with the corrosivity categories according to EN ISO 12944-2, various AUMA corrosion protection levels are provided to suit the different applications.

Colour

The standard colour is silver-grey (similar to RAL 7037). Other colours are available.

Corrosivity categories according to EN ISO 12944-2 Classification of environments		SA, SQ actuators and AM, AC controls	
		Corrosion protection class	Total film thickness
C1 (very low):	Heated buildings with clean atmospheres	KS	140 µm
C2 (low):	Unheated buildings and rural areas with low level of pollution		
C3 (medium):	Production rooms with humidity and some air pollution. Urban and industrial atmospheres with moderate sulphur dioxide pollution		
C4 (high):	Chemical plants and areas with moderate salinity		
C5-I (very high, industrial):	Industrial areas with almost permanent condensation and with high pollution.		
C5-M (very high, marine):	Coastal and offshore areas with high salinity, almost permanent condensation and with high pollution.		
Corrosivity categories for requirements beyond EN ISO 12944-2			
Extreme (cooling tower):	Coastal and offshore areas with extremely high salinity, permanent condensation and high pollution	KX KX-G (aluminium-free)	200 µm

The AUMA corrosion protection system is certified by TÜV Rheinland.

Ambient temperatures

In their basic version, the devices are suitable for an ambient temperature range between

- –40 °C and +70 °C.

If no electronic components are used within the actuator, temperatures up to +120 ° C are permissible.

As an option, the temperature range can be expanded to –60 °C.

Multi-turn actuators of type range SA are mainly used to satisfy all actuator requirements in water systems applications. Their large torque and speed range can solve a multitude of automation tasks. In combination with the suitable gearbox ranges there is hardly any steel construction for water systems which could not be automated.

Their flexibility is not limited to the mechanical advantages. In combination with integral controls, the devices can be integrated into any conventional DCS.

- Torque range:
  10 Nm – 32,000 Nm
- Speed range:
  4 rpm – 180 rpm

Motor duty types - running times

Actuator motors are not continuously running as they are not equipped with air cooling in order to maintain their high enclosure protection. After an operation they require a certain cooling-down time. If the winding temperature of 140 °C is exceeded, the thermoswitches integrated within the motor winding are activated and the actuator is immediately switched off via the actuator controls.

According to IEC 60034-1, the maximum running time is defined by means of the type of duty. The following types are available:

- S2 - 15 min, short-time duty with a maximum continuous running time of 15 min
- S2 - 30 min, short-time duty with a maximum continuous running time of 30 min
- S2 - 60 min, short-time duty with a maximum continuous running time of 60 min

Weir system in Switzerland.
Combination with an SA multi-turn actuator and AM integral controls, an LMS anti-backdrive device and three GK bevel gearboxes

Manual operation

Electric actuators are always equipped with a handwheel. During commissioning, the actuator is operated manually via the handwheel for the purpose of setting the end positions.

In the event of power supply failure, the actuator can be operated using the handwheel. Manual operation is engaged via a switch-over mechanism. The motor connection is disconnected at the same time. The handwheel does not rotate during motor operation.

If the electric motor is switched on, the manual drive is automatically disconnected, and the transmission of torque between motor and gearing is restored.

Options

- Handwheel extension
- Adapter for connecting a power tool in case of emergency

Self-locking and self-braking

Self-locking

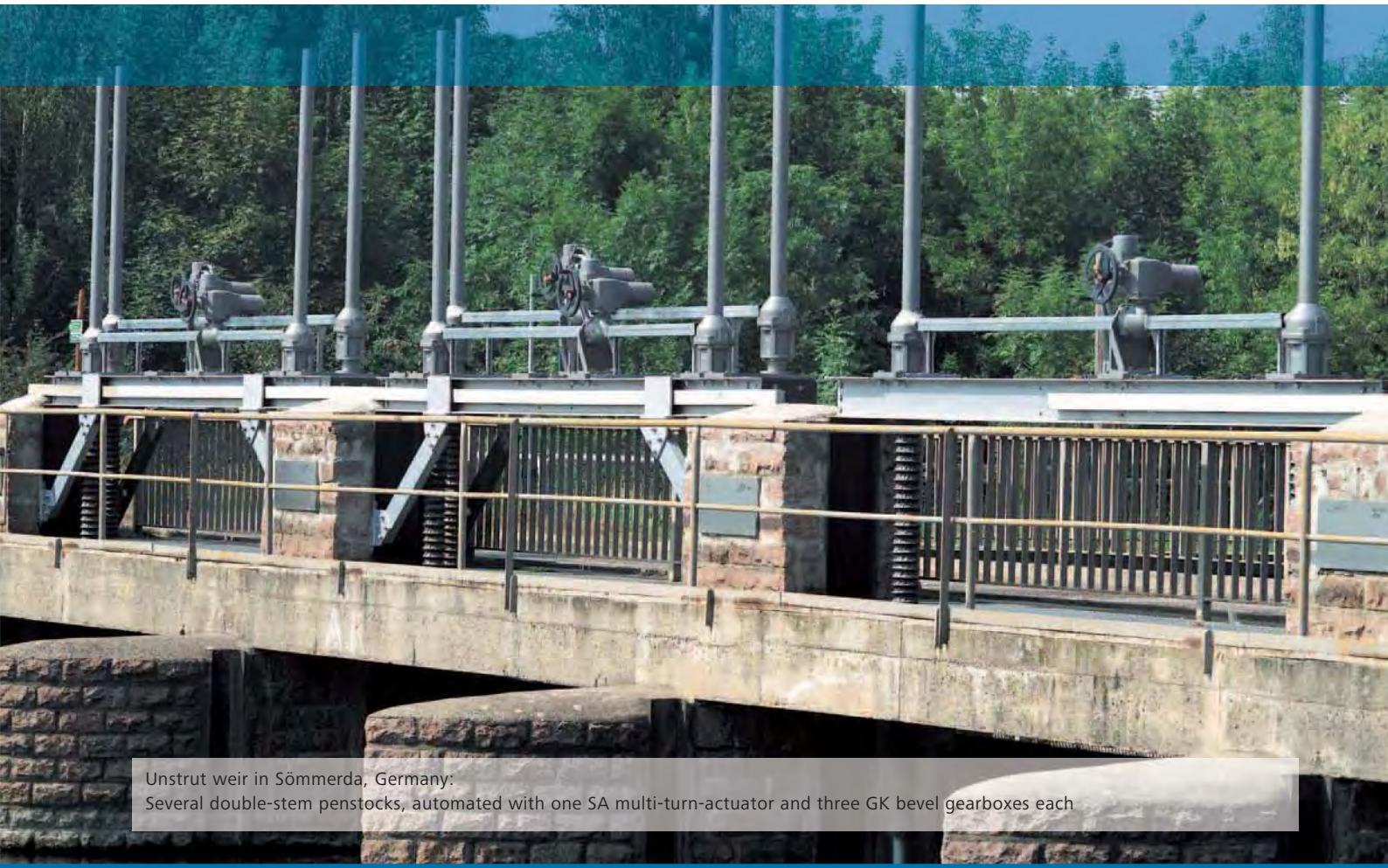
Actuators counteract torques affecting the output side with a load. If this load means that the position of the closing element cannot be moved from standstill when applying force, this is called self-locking.

Most AUMA actuators are self-locking as a standard. This does not apply to actuators with high output speeds and to certain actuator/gearbox combinations. Self-locking can be achieved by fitting an anti-backdrive device.

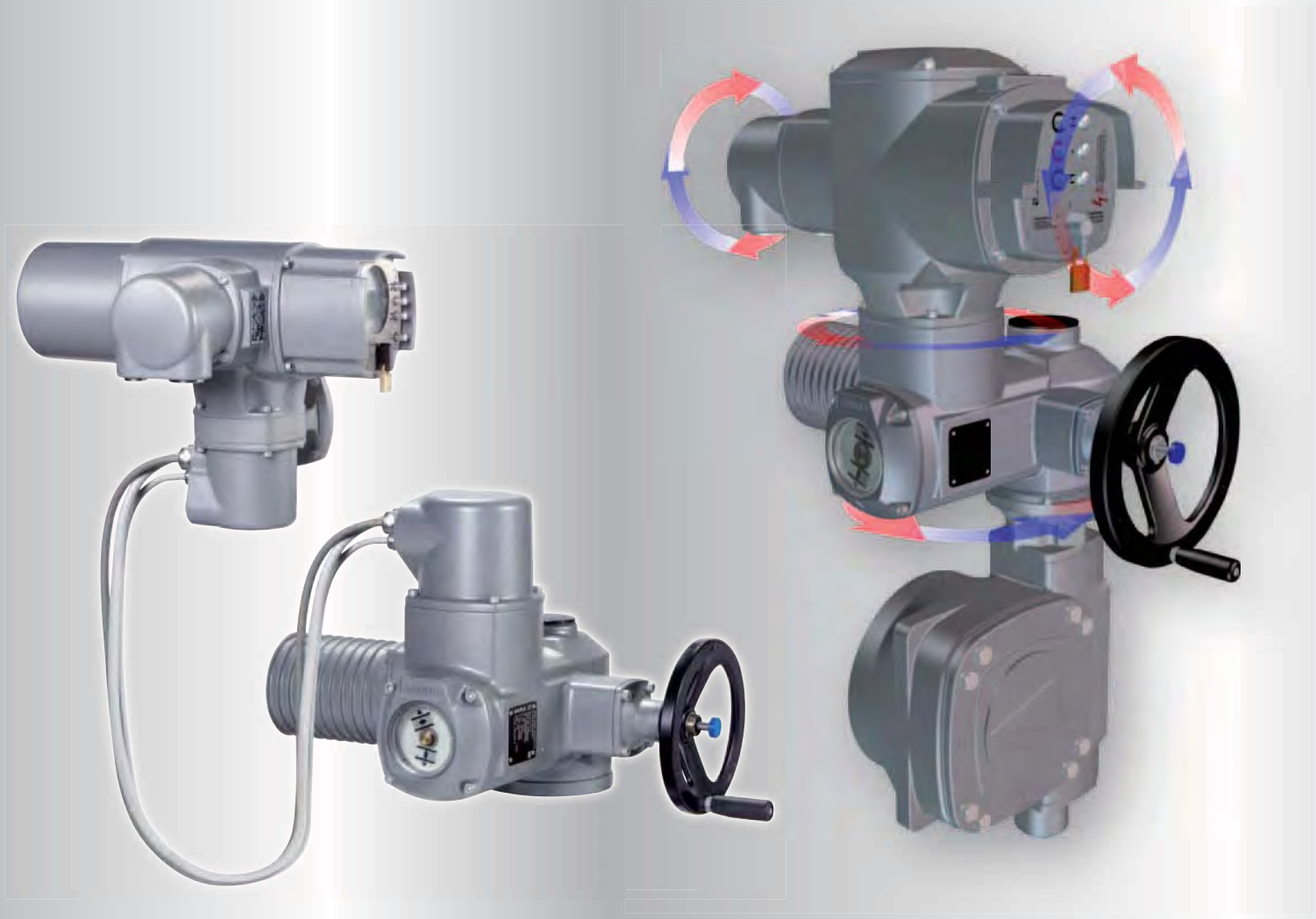
Self-braking

Self-braking means that the closing element reaches absolute standstill after actuator cut-off while in motion.

This requirement can be fulfilled by using an anti-backdrive device or a brake motor.



Unstrut weir in Sömmerda, Germany:
Several double-stem penstocks, automated with one SA multi-turn-actuator and three GK bevel gearboxes each



Particular conditions - Local adaptations possible!

One of the many advantages of a modular design is the ease at which site upgrade can be achieved.

Wall bracket

If access to the actuator is difficult, the controls can be mounted separately from the actuator.

The cable length between actuator and controls may be up to 100 m.

The electrical connections of the basic actuator AUMA NORM and the controls do not differ, whether with or without wall bracket. For this reason, wall bracket retrofitting is possible at any later date.

Customisation of device positioning

The optimum positioning is easily adjustable thus avoiding that the display is upside down, inaccessible operation elements, awkward cable gland alignments, etc. The correct position can easily be chosen.

The following positioning adjustments at 90° increments are possible: controls to actuator, local controls to controls, actuator to gearbox and electrical connection. The plug/socket connections allow easy on-site adjustment of the mounting position.

AUMA actuators comply with global safety standards. For this purpose, they provide the following protective functions.

Correction of the direction of rotation

The automatic correction of the direction of rotation upon wrong phase sequence is an integral feature of both AC and AM controls. If the phases are exchanged at the time of connecting the three-phase supply, the actuator still travels in the correct direction when receiving the respective operation command. Otherwise, there would be the risk to damage downstream components, e.g. stems.

Valve overload protection

The controls switch off the actuator if inappropriate and excessive torque is applied during travel.

Locking manual to motor operation

Under no circumstance do handwheel and motor drives have a mechanical engagement, even under fault conditions. Motor operation is predominant. Even handwheel activation whilst the motor is running does not cause any problems.

Failure behaviour in case of signal loss or in emergency

If a signal required for operation fails or if an emergency signal is activated, the actuator proceeds with a failure behaviour, previously defined. Deactivation of protective actuator mechanisms is possible if such a situation occurs.

Safe and reliable – in any circumstance

Protection against unauthorised operation

Handwheel locking device

Activation of manual operation can be inhibited by means of a locking device.

Remote release of local controls for the AC (option)

Electrical actuator operation via the local controls is not possible without the release signal from the control room.

Lockable selector switch

The switch can be locked in all three positions; the picture below shows the example of the AC.

Lockable protection cover

The picture illustrates the example of the AM.

Password protection for AC device parameters

The AC parameters may only be changed after password entry.

Protected Bluetooth connection with AC

Password entry is required to establish a connection between a laptop or PDA and an actuator with integral controls.

Whereas the mechanical interfaces of actuators have been standardised and stable for decades, there is a large variety of interfaces to the DCS. In spite of efforts for standardisation, communication technology is subject to constant improvements due to continuous developments within the electronics sector.

For the end user of the plant, transmission of required operation commands and feedback signals for his or her special application is decisive - irrespective of the technological basis.

The modular product range offers maximum flexibility: Many levels are feasible, starting with the AUMA NORM actuator without integral controls right through to the actuator equipped with AC controls with parameterization facility via fieldbus directly from the control room. Later upgrading of AUMA actuators for integration into new DC systems is possible.

Whatever your requirements, AUMA is able to support you with the ideal actuator integration into the DCS. This support includes identification, selection, DCS planning and final implementation.

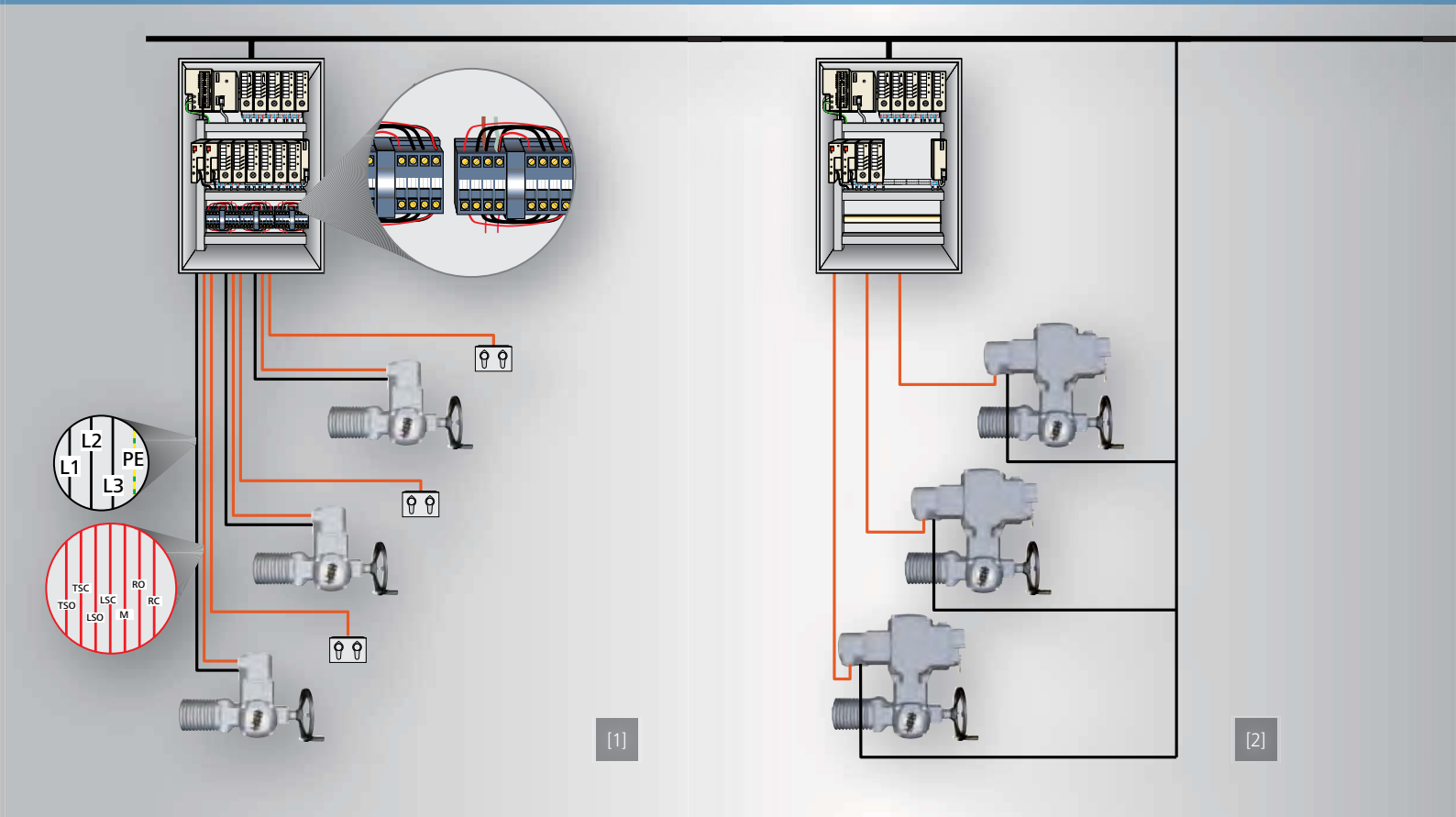
Parallel signal transmission to the DCS - AM controls

All inputs and outputs of integral controls AM are hard wired. Please refer to the terminal plan for respective assignment.

- Three binary inputs for the OPEN, STOP, CLOSE control commands
- Five binary outputs with the following assignments: End position CLOSED, end position OPEN, selector switch in REMOTE, selector switch in LOCAL, collective fault signal
- Alternatively to the control inputs, an analogue 0/4 – 20 mA input for positioner control
- As an option, an analogue 0/4 – 20 mA output for remote position indication.

The binary inputs and outputs are potential-free, the analogue output is galvanically isolated.

Integration into the DCS - parallel, fieldbus



Parallel signal transmission to the DCS - AC controls

Compared to the AM, integral actuator controls, AC supplies a far larger number of feedback signals. The plant operator decides which signals are to be transmitted. The same is valid for input definition. Assignment of inputs and outputs can be modified at a later date with the AC device setting.

Depending on the version, the AC provides:

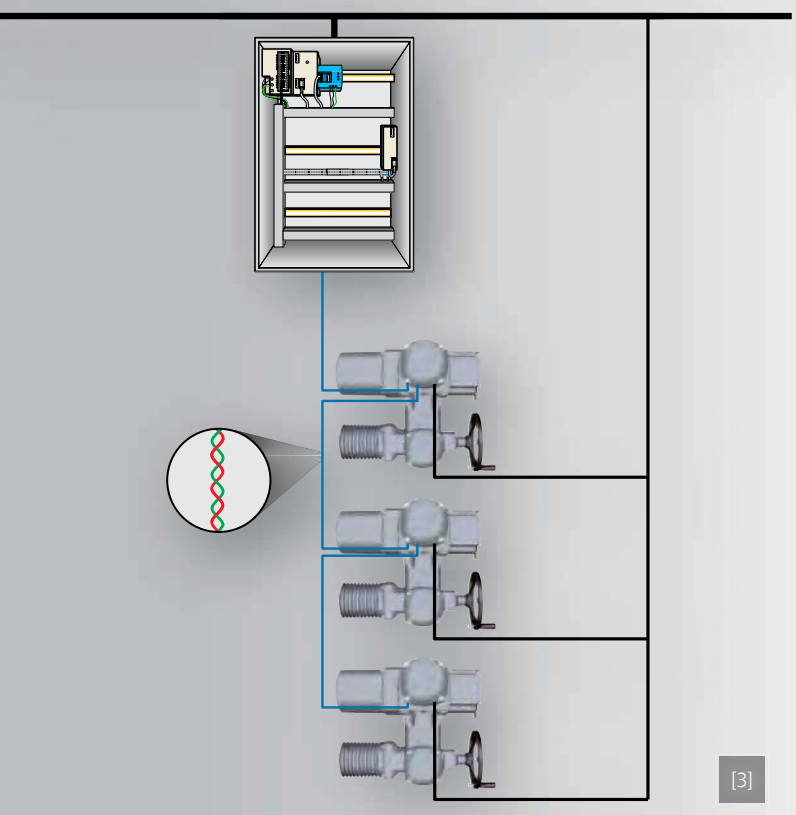
- Up to ten binary inputs
  e.g. operation commands OPEN, STOP, CLOSE; intermediate position control; release signals for the local controls, emergency commands, etc.
- Up to twelve binary outputs
  e.g. for feedback of end position, intermediate positions, selector switch position, failures, etc.
- Up to two analogue inputs (0/4 – 20 mA)
  e.g. a setpoint for controlling the positioner
- Up to two analogue outputs (0/4 – 20 mA)
  e.g. for feedback of valve position or torque

AUMA fieldbus devices

Many different fieldbus systems are available on the market. Certain preferences have evolved on a regional level or specific to certain plant applications. Since AUMA actuators are implemented in all types of process plants around the globe, they are available with any fieldbus system established in this industry.

- Profibus DP
- Modbus RTU
- Foundation Fieldbus
- HART

Overall, AUMA devices are available with binary and analogue inputs to connect additional sensors to the fieldbus.



[3]

[1] **External controls, AUMA NORM**

All actuator signals, e.g. limit switch signals are processed with the PLC. Switchgears for motor control are installed in the control cabinet. If local controls are required, they have to be installed and programmed accordingly within the PLC.

[2] **Integral controls**

Actuators with integral controls are immediately ready for use. As soon as the power supply has been established, the actuator can be operated via the local controls. Only operation commands and feedback signals are still exchanged between the control system and the actuator.

[3] **Integral controls - fieldbus**

One single data transmission medium for all signals coming from many different devices - creates a clear structure for fieldbus systems. The fieldbus only requires one single interface within the control cabinet. Digitization of all data allows for comprehensive exchange of signals and indications.

Plug & play - Actuator controls AM and AC

The integral controls evaluate the actuator signals and operation commands and automatically perform the required switching procedures without delay, using the installed switchgear, reversing contactors or thyristors.

After analysis, the controls supply the actuator signals as feedback signals to the host level.

The integral controls allow for local actuator operation.

AM and AC controls are compatible with other AUMA actuator series. From the DCS point of view, a uniform appearance is created for different valve and actuator types.

AM 01.1 and AM 02.1

AM controls with simple design and defined features are the perfect choice when using parallel signal transmission and if a relatively low number of feedback signals is required.

Several parameters can be defined via DIP switches during commissioning, e.g. type of seating in end positions.

Actuator control is made via operation commands OPEN, STOP, CLOSE. Reaching an end position and collective fault signals are reported back to the DCS as feedback signals. These signals are visually displayed at the local controls via the indication lights. As an option, the valve position can be transmitted as 0/4 – 20 mA signal to the DCS.

AC 01.2

For the following requirements, the AC is the perfect choice of integral controls: the application requires torque by-pass to unseat jammed closing elements; logging of operating data is desired; the user interface must be configurable; valve and actuator must be implemented into a life cycle management system via intelligent diagnostics.

AC controls are equipped with a parallel interface for free configuration and/or interfaces to fieldbus systems as used within process automation.

The diagnostic functions comprise a time-stamped event report, torque characteristics logging, continuous recording of temperatures and vibration within the actuator and, furthermore, counting the number of starts and motor running times.

With the development of the AC 01.2, particular emphasis was laid on user-friendliness and the ease of integration of actuators into the DCS. The large graphic display is used to perform menu-controlled programming of the controls, optionally using AUMA CDT via wireless Bluetooth connection. For fieldbus connections, AC programming can be performed from the control room.

[1]

[2]

Modular design - Tailor-made solutions

The sector of steel construction for water systems offers various solution principles for task requirements which seem identical at first glance. The response by AUMA: Actuators, gearboxes, output drive types and controls can be combined to ideally adapted solutions due to their modular design.

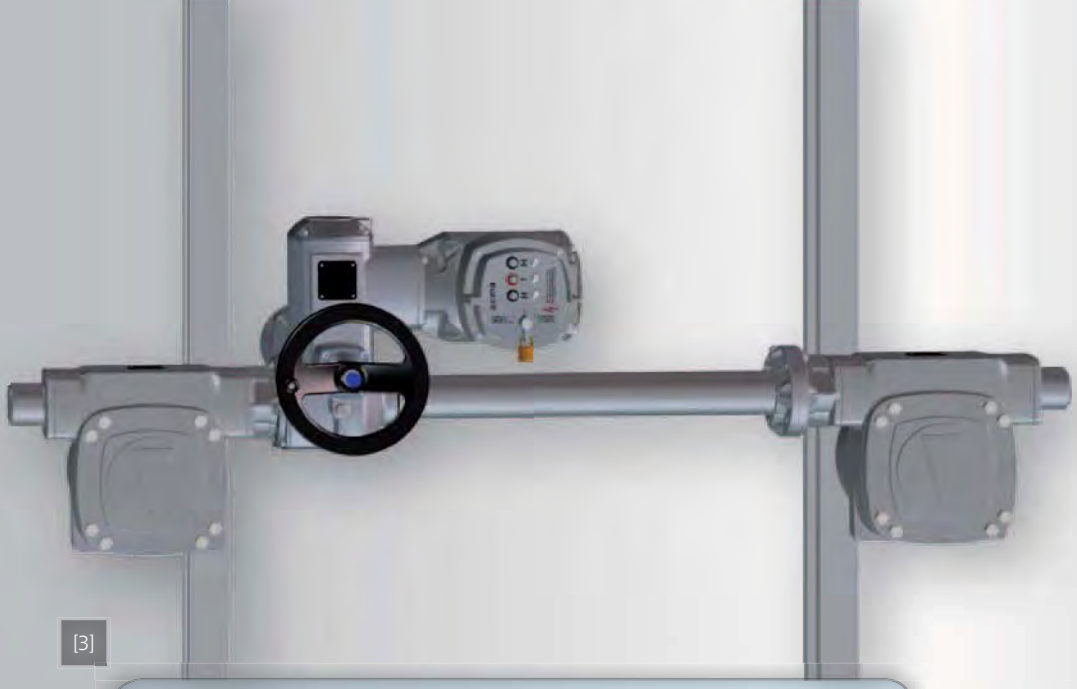
There is no need to develop costly special designs. The user is supplied with standard and proven devices.

The illustrated configurations show three basic types. The actual number of possible and feasible actuator solutions is considerably higher.

[1] **Multi-turn actuator SA with integral controls AC** with the example of a single suspended stem gate valve

[2] **Multi-turn actuator SA NORM and two bevel gearboxes GK .2** with the example of a double-stem gate valve. Due to this type of arrangement, both stems are operated synchronously.

[3] **Multi-turn actuator SA .2 with integral controls AM and two worm gearboxes GS .3** With the example of a gate valve and two pinion drives. Again in this example, absolute synchronisation is guaranteed by the central arrangement of the actuator. The worm gearboxes are available with differing rotary directions and reflected geometrical arrangement. This multiplies the number of combination possibilities.



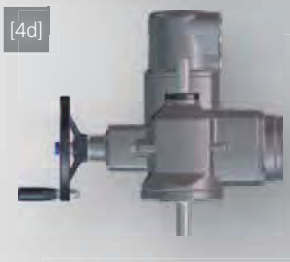
[3]

[4a]

[4b]

[4c]

[4d]



[5]

[4] **Output drive types**

The plug sleeve is integrated within the hollow shaft of the actuator. The plug sleeve has respective bores to suit the output drive types B1, B2, B3 or B4. These output drive types are not appropriate for e.g. non-rising stems.

Output drive type A [4b] transmits the torque to rising stems. Upon request, the integral stem nut can be supplied by the factory with the thread as required.

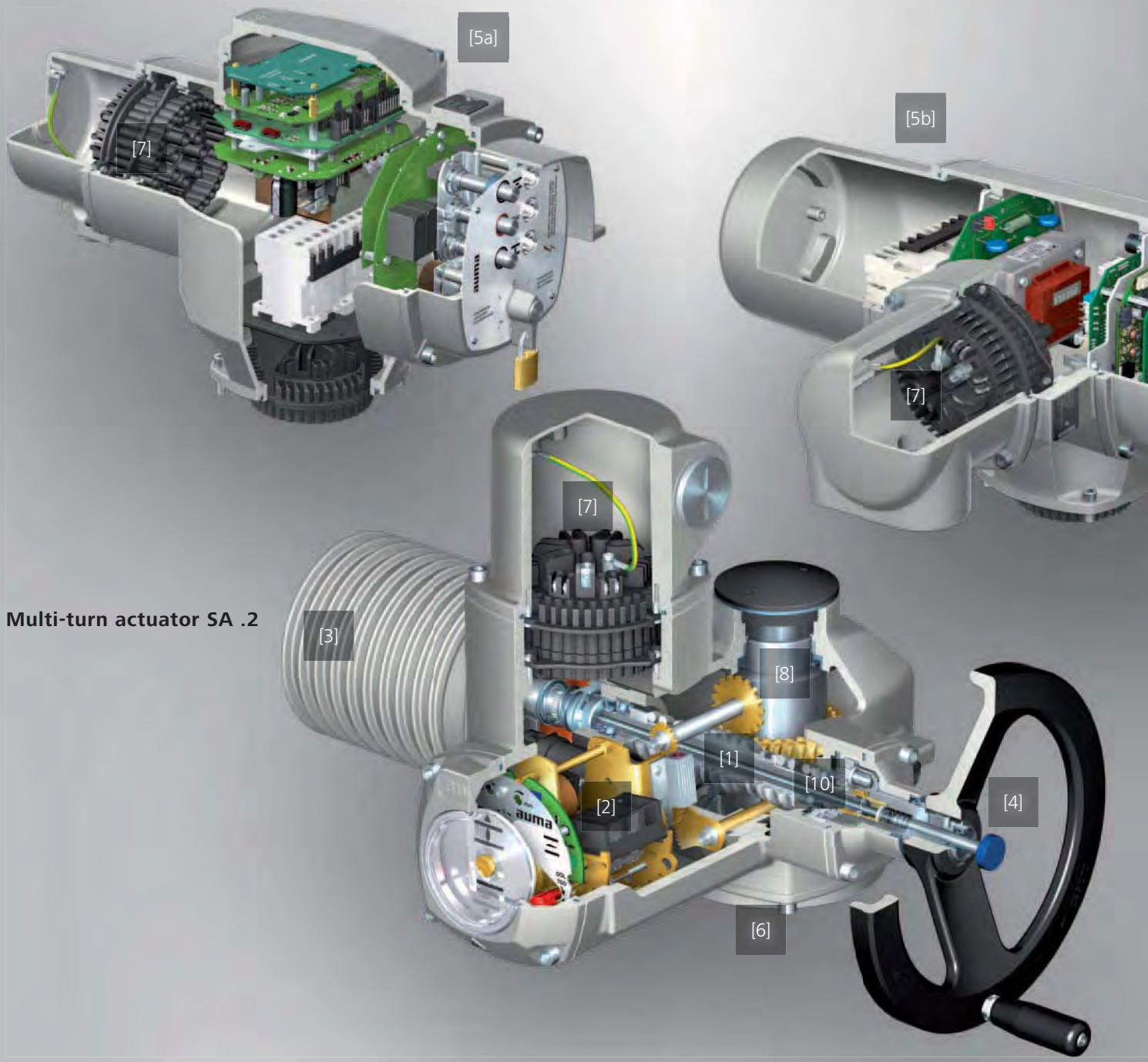
AK [4c] is equipped with a pendular stem nut. This version allows to compensate stem deflections. As an option, a pressurised dispenser for stem lubrication can be fitted to these output drive types.

DD [4d], double shaft end is required if the actuator torque needs to be transmitted to a separately mounted gearbox via a shaft.

BD [without illustration]. On the flange side, the actuator is equipped with a plug sleeve with B1, B2, B3 or B4 at the flange end. The opposite side is a free shaft end.

[5] **Anti-backdrive device**

To be used when self-locking is essential e.g. for high speed actuators. The anti-backdrive device inhibits any valve displacement in case external forces act upon the closing element. This way, the use of brake motors is not required. Ideally, the unit is mounted at the output of the actuator or at the gearbox input. If required, it can also be fitted to the gearbox output.



Multi-turn actuator SA .2

[5] **Integral controls (option)**

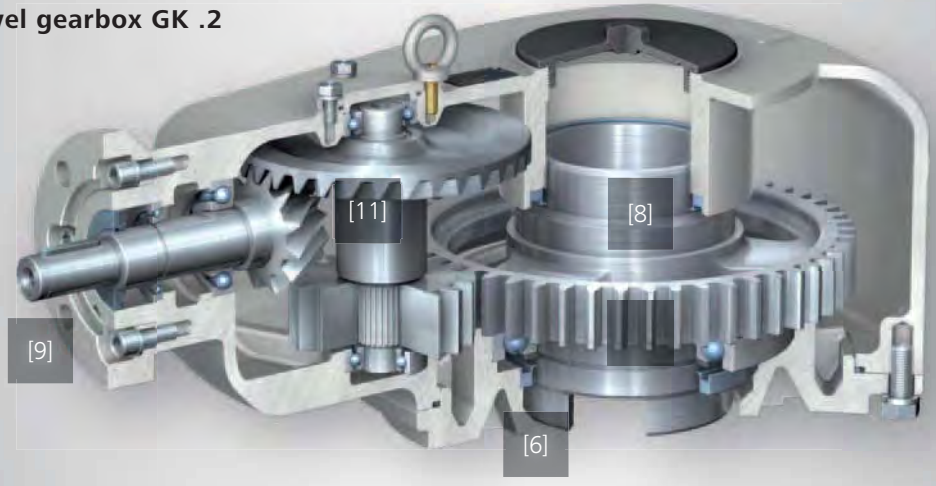
In contrast to NORM actuators, actuators with integral controls (AM [5a] or AC [5b] are immediately operational. The integral controls contain switchgear units, power supply unit, interface to the DCS and the ability to process control commands and actuator feedback signals. The actuator is operated on site via the local controls.

The electrical connection between integral controls and actuator is made by using a quick release plug/socket connector.

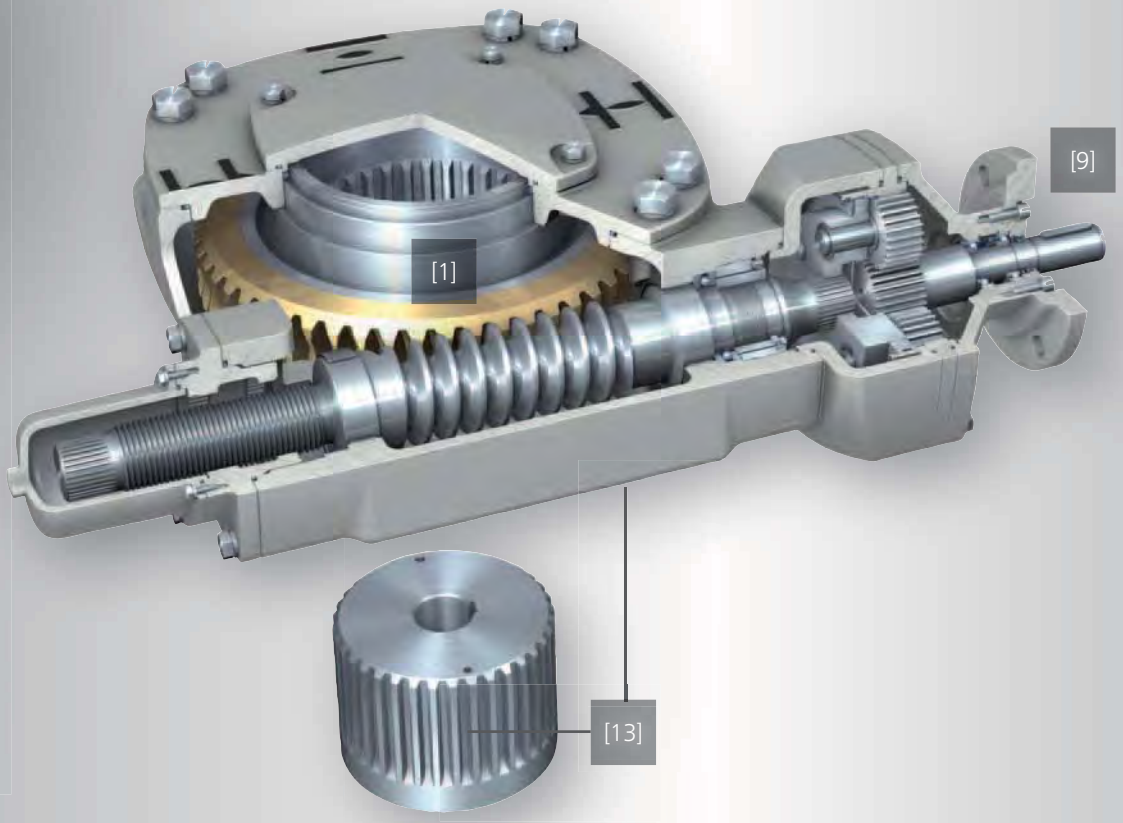
[6] **Flange with output drive**

The flange for mounting the actuator or the gearbox is made in compliance with EN ISO 5210 or DIN 3210. The same applies to the torque transmitting output drive types which are available in a large variety of versions.

Bevel gearbox GK .2



Worm gearbox GS .3



[7] **Electrical plug/socket connection**

Identical principle for all actuator configurations, irrespective whether an integral controls is available or not. During maintenance work, the wiring remains undisturbed; electrical connections can be quickly removed and reconnected.

This reduces down times and avoids wiring faults when reconnecting.

[1] **Optimised gearing components**

Mechanical loads in steel construction applications for water systems are extremely high. For these applications, AUMA uses particularly robust and proven gearing components. They include the enhanced ball bearings, polished drive worms, special lubricants and worm wheels made of bronze for GS gearboxes.

[2] **Control unit**

Determining the valve position and setting the valve end positions/torque recording to protect the valve against overload. Depending on customer specification, a control unit is installed either as electromechnical or electronic version.

■ Control unit - electromechanical version

Travel and torque are mechanically recorded; microswitches are operated when reaching the tripping points. The tripping points for both end positions and the tripping torques for both directions are mechanically set.

As an option, the valve position can be transmitted as continuous signal to the control room.

■ Control unit - electronic version

High-resolution magnetic transmitters replace the switching units; they are analysed with the AC controls. Valve settings are made via the control panel without opening the housing. Valve position and torque are transmitted as continuous signal.

The electronic control unit requires the use of integral controls AC.

[3] **Motor**

Specially designed 3-ph AC, 1-ph AC and DC motors with high starting torques. Thermal protection is ensured by thermoswitches or PTC thermistors.

A dog coupling for torque transmission and an internal motor plug-socket connector makes a fast motor change possible, e.g. to modify the output speed.

[4] **Handwheel**

Handwheel for emergency operation in the event of power failure. Handwheel activation and handwheel operation require only little effort. Single-handed activation is possible.

Handwheel activation can be signalled to the controls via a microswitch.

The self-locking effect is maintained even during manual operation.

[8] **Hollow shaft**

The rising stem can be passed through the hollow shaft.

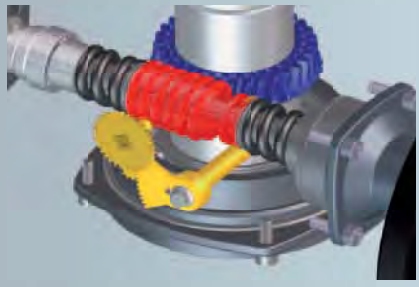
[9] **Flange for mounting the multi-turn actuator**

The flange complies with EN ISO 5210 or DIN 3210.

As an alternative to the flange, the gearboxes can also be supplied with a shaft to fit the handwheel. Consequently, they are ideal for manually operated weirs and sluices.

[10] **Torque measurement**

The torque measurement is performed on the basis of the sliding worm principle. The sliding worm (red) moves axially on the worm shaft and is embedded with springs (black) on both sides. If counteract torques are detected within the valve, they are transmitted to the worm via the hollow shaft and the worm wheel (blue). The worm shifts against the spring force. The axial deviation is converted into a swivel movement via a lever/toothing arrangement and transferred to the control unit. This swivel movement is analysed by the control unit either on a mechanical or electronic basis.



[11] **Intermediate stage GK**

From size 30.2, all GK gearboxes are equipped with an intermediate stage. Depending on the bevel gear arrangement, the rotary direction at the gearbox output might be reversed.

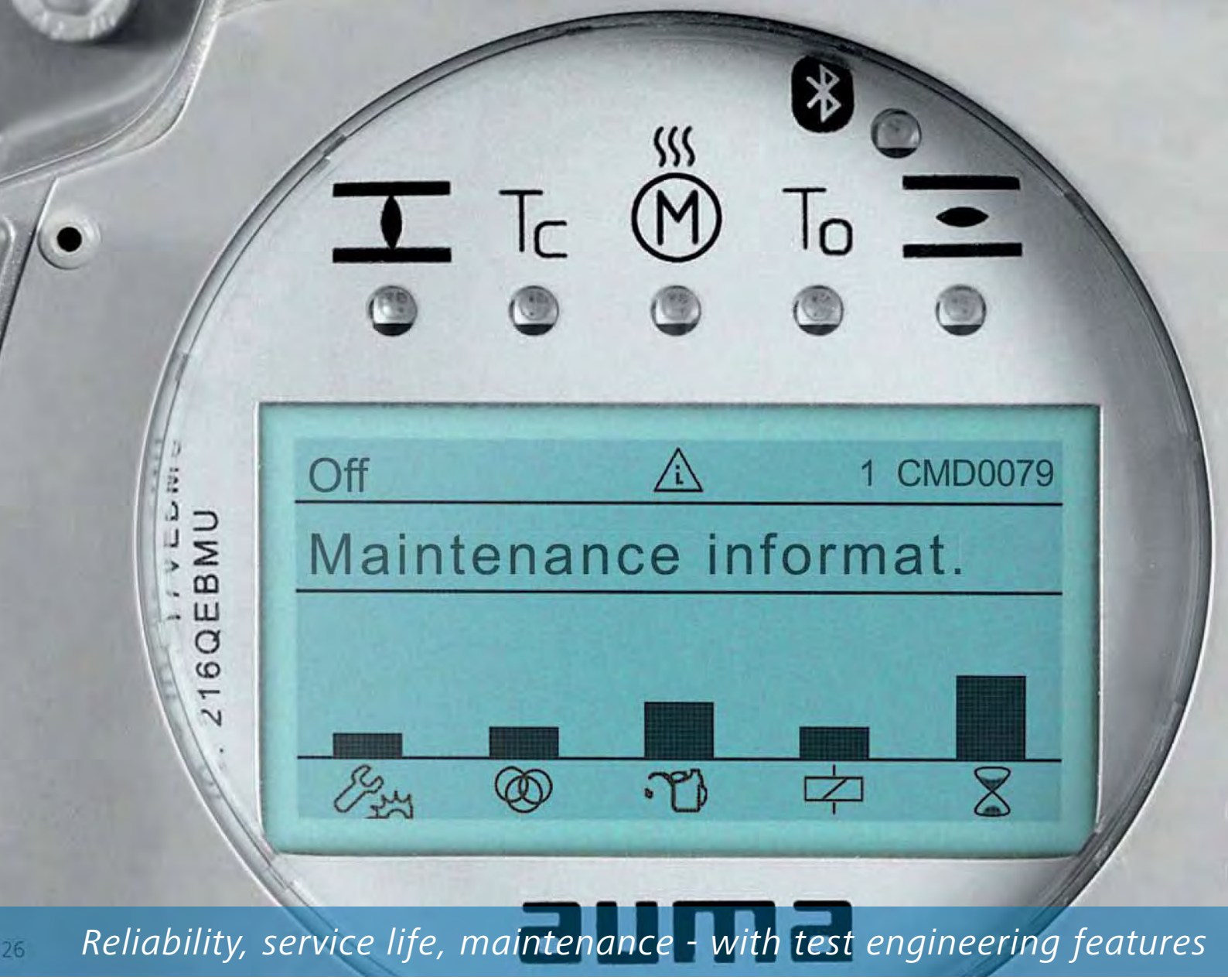
[12] **Primary reduction gearing (option)**

By means of an additional primary reduction gearing, the torque requirement at the input shaft of the GS worm gearbox can be reduced. If the running speed can be reduced, it will then be possible to select and fit a smaller and more cost-effective multi-turn actuator.

[13] **Mounting flange and separate coupling**

for GS worm gearboxes. Dimensions comply with ISO 5211.

On request, the coupling is supplied with matching bore. The coupling with bore is placed on the valve shaft and secured against axial movement. Then, the gearbox is mounted and fastened to the flange.



Reliability, service life, maintenance - with test engineering features

Actuators are expected to offer long service life, long maintenance intervals and straightforward maintenance procedures. These factors are important in contributing to reducing plant operation costs.

Consequently, emphasis was laid on integrating advanced diagnostic abilities for development enhancements of AUMA devices.

Maintenance - when required

Running times, switching frequency, torque, ambient temperature - impacts which vary from actuator to actuator requiring individual maintenance schedules for each device. These factors are continually recorded and assessed in the following four maintenance status categories: O-rings, lubricant, reversing contactors, and mechanics. The maintenance requirements are shown on the display as bar chart. When reaching a limit, the actuator signals the respective maintenance requirement. It is also possible to monitor specified intervals by means of a maintenance plan.

Out of specification - correct potential failure causes prior to occurrence

Plant operators receive anticipated information about potential problems. The signal indicates that the actuator is subjected to out of range operational conditions, for example excessive ambient temperatures which might lead to a failure in case of frequent and longer occurrence.

[1]

[2]

[3]

[4]

Diagnostic classification according to NAMUR NE 107

The objective of NAMUR NE 107 recommendation is to issue uniform and clear symbols and inform the operator about the device status.

[1] **Failure**

Due to functionality failures within the actuator or the peripherals, the actuator might not be controlled from the control room.

[2] **Function check**

Due to ongoing work on the actuator, the device cannot be controlled from the control room at that very moment.

[3] **Out of specification**

Deviations from the permissible application conditions determined by the actuator itself through self-monitoring. The actuator can still be controlled from the control room.

[4] **Maintenance required**

The actuator can still be controlled from the control room. The device must be inspected by a device specialist to avoid any unscheduled standstill.

Plant Asset Management

If one of the two before mentioned signals are indicated, timely corrective actions can be introduced - the key to Plant Asset Management. Actions will be taken either by the service staff on site, or by AUMA service technicians, offering appropriate warranty on the basis of the repair or maintenance work.

AUMA service can propose maintenance agreements,and complete all required actions following signal indications.

Time-stamped event report/ operating data logging

Setting procedures, switching procedures, warning signals, failures, and running times are recorded in the time-stamped event report. The event report is a distinct component of the diagnostic features of the AC.

Valve diagnostics

AC controls are capable of recording torque characteristics at different times. The comparison of data sets allows assessment of any changes in valve characteristics.

Assessment - easy to handle

NAMUR NE 107 with the easy and clear diagnostic classification supply valuable support for plant operators. Data relating to diagnostics can be requested via device display, via fieldbus or AUMA CDT.

AUMA actuators with fieldbus interface also support standardised concepts for remote diagnostics from the control room.

The technical data shown below is an extract of available data sheets. They provide a rough outline on the performance of AUMA devices. Please refer to the Internet for further data sheets or contact us to receive printed or digital copies.

Applications

Wear and load on steel structures for water systems differ depending on the application. The definition of standard applications is a basis for actuator specification.

	Application class 1	Application class 2	Application class 3
Desired lifetime	35 years	35 years	35 years
Load sluice/number or sluice operations	low	medium	high
Application profile for sluice gates	Touristic use in summer	Commercial use during ice-free months 12 h/d	Commercial use throughout the year 24 h/d
Application profile for weirs	Retention of floodwater	Roughly maintaining the level	Retention of sluice gates

Multi-turn actuators SA

The following data is valid for actuators with 3-phase AC motors operated in the S2 - 15 min type of duty. For detailed information, restrictions for actuators with high output speeds as well as data on other motor types and types of duty, refer to separate technical and electrical data sheets.

Type	Output speeds at 50 Hz	Setting range tripping torque	Running torque in Nm for the application			Mounting flange	
	rpm	Nm	Application class 1	Application class 2	Application class 3	EN ISO 5210	DIN 3210
SA 07.2	4 – 180	10 – 30	12	8	6	F07 or F10	G0
SA 07.6	4 – 180	20 – 60	25	18	12	F07 or F10	G0
SA 10.2	4 – 180	40 – 120	50	36	24	F10	G0
SA 14.2	4 – 180	100 – 250	100	75	50	F14	G1/2
SA 14.6	4 – 180	200 – 500	175	135	100	F14	G1/2
SA 16.2	4 – 180	400 – 1,000	350	270	200	F16	G3
SA 25.1	4 – 90	630 – 2,000	700	550	400	F25	G4
SA 30.1	4 – 90	1,250 – 4,000	1,400	1,100	800	F30	G5
SA 35.1	4 – 45	2,500 – 8,000	2,800	2,000	1,400	F35	G6
SA 40.1	4 – 32	5,000 – 16,000	5,600	4,000	2,800	F40	G7

Lifetime

Type	Application class 1	Application class 2	Application class 3
	Number of turns at output drive in million*		
SA 07.2 – SA 14.2	1.2	5.0	10.0
SA 14.6 – SA 16.2	0.9	4.0	8.0
SA 25.1 – SA 30.1	0.6	2.5	5.0
SA 35.1 – SA 40.1	0.3	1.0	2.0

* for load with running torque and even load distribution in OPEN and CLOSE directions

GK bevel gearboxes

Type	Reduction ratio	Max. torque	Running toque	Input for max. torque	Input for run-ning torque	Mounting flange	
		Nm	Nm	Nm	Nm	EN ISO 5210	DIN 3210
GK 10.2	1 : 1 2 : 1	120	60	135 67	66 33	F10	G0
GK 14.2	2 : 1 2.8 : 1	250	125	139 100	69 50	F14	G1/2
GK 14.6	2.8 : 1 4 : 1	500	175	198 139	70 49	F14	G1/2
GK 16.2	4 : 1 5.6 : 1	1,000	350	278 198	97 70	F16	G3
GK 25.2	5.6 : 1 8 : 1	2,000	700	397 278	140 97	F25	G4
GK 30.2	8 : 1 11 : 1	4,000	1,400	556 404	194 141	F30	G5
GK 35.2	11: 1 16 : 1	8,000	2,800	808 556	283 194	F35	G6
GK 40.2	16 : 1 22 : 1	16,000	5,600	1,111 808	389 283	F40	G7*

* without spigot

Lifetime

Type	Number of turns at output drive in million
GK 10.2	1.2
GK 14.2 – GK 16.2	0.9
GK 25.2 – GK 30.2	0.6
GK 35.2 – GK 40.2	0.3

* for load with running torque and even load distribution in OPEN and CLOSE directions

For higher requirements to lifetime, the torques (running torques) have to be reduced accordingly. Refer to separate data sheets for more detailed information.

Combination possibilities bevel gearboxes with multi-turn actuators

Gearbox type	Reduction ratio	Mounting flange	Suitable AUMA multi-turn actuator
GK 10.2	1 : 1 2 : 1	F10/F14 F10	SA 14.2 SA 10.2
GK 14.2	2 : 1 2.8 : 1	F10/F14 F10	SA 14.2 SA 10.2
GK 14.6	2.8 : 1 4 : 1	F14 F10/F14	SA 14.2 SA 14.2
GK 16.2	4 : 1 5.6 : 1	F14 F14	SA 14.6 SA 14.2
GK 25.2	5.6 : 1 8 : 1	F14 F14	SA 14.6 SA 14.6
GK 30.2	8 : 1 11 : 1	F14/F16 F14	SA 16.2 SA 14.6
GK 35.2	11: 1 16 : 1	F16 F14/F16	SA 16.2 SA 16.2
GK 40.2	16 : 1 22 : 1	F16/F25 F16	SA 25.1 SA 16.2

GS worm gearboxes with Bronze worm wheel

Type	Primary reduction gearings	Reduction ratios	Max.torque	Running torque	Input for max. torque	Input for running torque	Mounting flange
			Nm	Nm	Nm	Nm	EN ISO 5211
GS 100.3	– VZ 2.3 VZ 3.3 VZ 4.3	52:1 126:1 160:1 208:1	2,000	1,000	99 45 36 26	50 23 18 13	F14/F16
GS 125.3	– VZ 2.3 VZ 3.3 VZ 4.3	52:1 126:1 160:1 208:1	4,000	2,000	192 88 69 52	96 44 35 26	F16/F25
GS 160.3	– GZ 4:1 GZ 8:1	54:1 218:1 442:1	8,000	4,000	353 97 48	176 48 24	F25/F30
GS 200.3	– GZ 4:1 GZ 8:1 GZ 16:1	53:1 214:1 434:1 864:1	16,000	8,000	718 197 97 52	359 98 48 26	F30/F35
GS 250.3	– GZ 4:1 GZ 8:1 GZ 16:1	52:1 210:1 411:1 848:1	32,000	16,000	1,462 401 205 105	731 200 103 53	F35/F40
GS 315	– GZ 30.1 8:1 GZ 30.1 16:1 GZ 30.1 32:1	53:1 424:1 848:1 1,696:1	63,000	32,000	2,423 354 177 88	1,231 180 90 45	F40
GS 400	– GZ 35.1 8:1 GZ 35.1 16:1 GZ 35.1 32:1	54:1 432:1 864:1 1,728:1	125,000	63,000	4,717 691 344 172	3,377 348 174 87	F48
GS 500	– GZ 40.1 16:1 GZ 40.1 32:1 GZ 40.1/GZ 16.1 64:1	52:1 832:1 1,664:1 3,328:1	250,000	125,000	9,804 714 358 203	4,902 357 179 101	F60
GS 630.3	– GZ 4:1 GZ 8:1 GZ 16:1 GZ 32:1 GZ 64:1 GZ 133:1	52:1 210:1 425:1 848:1 1,718:1 3,429:1 6,939:1	480,000	240,000	24,242 6 646 3,299 1,838 908 505 249	12,121 3,338 1,649 919 454 252 125	F60 AUMA

Lifetime

Note: max. 10 turns output drive/stroke, then cooling down is necessary

Type	Number of turns at output drive*
GS 100.3 – GS 200.3	15,000
GS 250.3	10,000
GS 315	4,700
GS 400 – GS 500	2,500
GS 630.3	1,500

* for load with running torque and even load distribution in OPEN and CLOSE directions

Electromechanical control unit

Settings ranges of the limit switching

	Turns per stroke
Standard	2 – 500
Option	2 – 5,000

Limit and torque switches

Versions		
	Application/description	**Type of contact**
Single switch	Standard	1 NC and 1 NO
Tandem switch (option)	For switching two different potentials. The switches have two compartments with galvanically isolated switches in a common sealed housing. The two switches are operated together; one switch is leading and should be used for signalisation.	Two NC and two NO contacts
Triple switches (option)	For applications where three different potentials are to be switched. The switch consists of one single and one tandem switch.	Three NC and three NO contacts

Rated power	
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 j = 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) 7 A at 30 V (resistive load) 5 A at 30 V (inductive load, L/R = 3 µs)

Rated power	
Gold plated contacts (option)	
U min.	5 V
U max.	50 V
I min.	4 mA
I max.	400 mA

Switches - other features	
Operation	Lever
Contact element	Two snap action contacts

Blinker transmitter for running indication

Rated power	
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 j ≈ 0,8)
I max. DC current	0.25 A at 250 V (resistive load)

Blinker transmitter - other features	
Operation	Segment washer
Contact element	Snap action contact
Type of contact	Change-over contact

Remote position transmitter

Precision wire potentiometer		
	Single	Tandem
Linearity	≤ 1 %	
Power	1.5 W	
Resistance (standard)	0.2 kΩ	0.2/0.2 kΩ
Resistance (option) further variants on request	0.1 kΩ, 0.5 kΩ, 1.0 kΩ, 2.0 kΩ, 5.0 kΩ	0.5/0.5 kΩ, 1.0/1.0 kΩ, 5.0/5.0 kΩ, 0.1/5.0 kΩ, 0.2/5.0 kΩ
Max. wiper current	30 mA	
Lifetime	100,000 cycles	

Electronic position transmitter EWG		
	2-wire	3-wire/4-wire
Output signal	4 – 20 mA	0/4 – 20 mA
Power supply	24 V DC (18 – 32 V)	

Electronic remote position transmitter RWG		
	2-wire	3/4-wire
Output signal	4 – 20 mA	0/4 – 20 mA
Power supply	14 V DC + (I x R_B), max. 30 V	24 V DC (18 – 32 V)

Supply voltages/mains frequencies

Hereafter, please find the listing on standard supply voltages (other voltages upon request). Not all actuator versions or sizes are available with all motor types or voltages/frequencies. For detailed information, refer to the separate sheets on electrical data.

3-ph AC current

Voltages	Frequency
[V]	[Hz]
220; 230; 240; 380; 400; 415; 500; 525; 660; 690	50
440; 460; 480; 575; 600	60

Permissible fluctuations of mains voltage and frequency

- Standard for SA, AM and AC
  Mains voltage ± 10 %
  Frequency: ± 5 %
- Option for AC
  Mains voltage: – 30 %
  Requires special sizing when selecting the actuator

Electrical connection

AUMA plug/socket connector			
	Motor contacts	Protective earth	Control contacts
No. of contacts max.	6 (3 are used)	1 (leading contact)	50 pins/sockets
Designation	U1, V1, W1, U2, V2 , W2	PE	1 to 50
Connecting voltage max.	750 V	–	250 V
Type of customer connection	Screw	Screw for ring lug	Screw, crimping (option)
Cross section max.	6 mm²	6 mm²	2.5 mm²
Material - pin socket carrier	Polyamide	Polyamide	Polyamide
Material - contacts	Brass	Brass	Brass, tin plated or gold plated (option)

Thread dimensions of cable entries (selected choice)		
	Plug cover S	Plug cover SH
M-threads (standard)	1 x M20 x 1.5; 1 x M25 x 1.5; 1 x M32 x 1.5	1 x M20 x 1.5; 2 x M25 x 1.5; 1 x M32 x 1.5
Pg-threads (option)	1 x Pg 13.5; 1 x Pg 21; 1 x Pg 29	1 x Pg 13.5; 2 x Pg 21; 1 x Pg 29
NPT-threads (option)	2 x ¾" NPT; 1 x 1¼" NPT	1 x ¾" NPT; 2 x 1" NPT; 1 x 1¼" NPT
G-threads (option)	2 x G ¾"; 1 x G 1¼"	1 x G ¾"; 2 x G 1"; 1 x G 1¼"

AM and AC – parallel interface to the DCS

AM	AC
Input signals	
Standard Control inputs +24 V DC: OPEN, STOP, CLOSE via opto-isolator, one common	Standard Control inputs +24 V DC: OPEN, STOP, CLOSE, EMERGENCY, via optocoupler, OPEN, STOP, CLOSE with one common
Option As standard, with additional EMERGENCY input	Option As standard, with additional inputs for MODE and ENABLE
Option Control inputs at 115 V AC	Option Control inputs at 115 V AC, 48 V DC, 60 V DC, 110 V DC
Auxiliary available voltage for input signals	
24 V DC, max. 50 mA	24 V DC, max. 100 mA
115 V AC, max. 30 mA	115 V AC, max. 30 mA
Setpoint control	
	Analogue input 0/4 – 20 mA
Output signals	
Standard 5 output contacts, 4 NO contacts with one common, max. 250 V AC, 0.5 A (resistive load) Default configuration: End position CLOSED, end position OPEN, selector switch REMOTE, selector switch LOCAL 1 potential-free change-over contact, max. 250 V AC, 5 A (resistive load) for collective fault signal (torque fault, phase failure, motor protection tripped)	Standard 6 output contacts per parameter, to be assigned as desired, 5 NO contacts with one common, max. 250 V AC, 1 A (resistive load), 1 potential-free change-over contact, max. 250 V AC, 5 A (resistive load) Default configuration: End position CLOSED, end position OPEN, selector switch REMOTE, torque fault CLOSE, torque fault OPEN, collective fault signal (torque fault, phase failure, motor protection tripped)
	Option 12 output contacts can be assigned as desired using parameters, 10 NO contacts with one common, max. 250 V AC, 1 A (resistive load), 2 potential-free change-over contacts for collective fault signal max. 250 V AC, 5 A (resistive load)
	Option Change-over contacts without common, max. 250 V AC, 5 A (resistive load)
Permanent position feedback signal	
Position feedback signal, 0/4 – 20 mA	Position feedback signal, 0/4 – 20 mA

AC- serial interface to the DCS

	Profibus	Modbus	Foundation Fieldbus	HART	Wireless
General information	Exchange of all discrete and continuous operation commands, feedback signals, status requests between actuators and DCS, as digital information				
Supported protocols	DP-V0, DP-V1, DP-V2	Modbus RTU	FF H1	HART	Wireless
Maximum number of participants	126 (125 field devices and one Profibus DP master) without repeater; i.e. max. 32 devices per Profibus DP segment	247 field devices and one Modbus RTU master Without repeater, i.e. max. 32 devices per Modbus segment	240 field devices including linking device. A maximum of 32 devices can be connected to a single Foundation Fieldbus segment.	64 field devices when implementing multi-drop technology	250 per gateway
Max. cable lengths without repeater	Max. 1,200 m (for baud rates < 187.5 kbit/s), 1,000 m at 187.5 kbit/s, 500 m at 500 kbit/s, 200 m at 1.5 Mbit/s	Max. 1,200 m	Max. 1,900 m	approx 3,000 m	Distance covered Outside approx. 200 m, Inside buildings approx. 50 m
Max. cable lengths with repeater	Approx. 10 km (only applies to baud rates < 500 kbit/s), Approx. 4 km (at 500 kbit/s) Approx 2 km (at 1.5 Mbit/s) The maximum possible cable length depends on type and number of repeaters. Typically, maximum 9 repeaters can be used in one Profibus DP system.	Approx. 10 km The maximum possible cable length depends on type and number of repeaters. Typically, maximum 9 repeaters can be used in one Modbus system.	Approx. 9.5 km The maximum cable length which can be implemented depends on the number of repeaters. For FF, cascading of max. 4 repeaters possible.	Use of repeaters possible, max. cable length corresponds to conventional 4 – 20 mA wiring.	Each device acts as repeater. Subsequently arranged devices are used to cover large distances.
Overvoltage protection (option)	Up to 4 kV			–	not required

Data transmission via fibre optic cables					
Supported topologies	Line, star, ring	Line, star	–	–	–
Cable length between 2 actuators	Multi-mode: up to 2.6 km at 62.5 µm glass fibre		–	–	–
	Single-mode: up to 15 km		–	–	–

Service

The reliability of actuators is crucial to the safety of sluice gates and weirs. Therefore it is imperative to choose an appropriate configuration of actuators and to optimally integrate the actuator into the process control system.

At AUMA, specialists are available as competent contacts during every phase of the project and assist you with the device collection if desired. If necessary, one of our sales engineers will visit you. Urgent matters are directly answered via phone or electronic mail. Comprehensive planning documents - data sheets, dimensional drawings or 3D models - can be made available electronically. Most documents are ready for download round the clock at www.auma.com.

Installation, commissioning, maintenance and corrective actions

To react quickly and competently to customer requirements around the globe, AUMA has established a worldwide network of subsidiaries and representatives.

If required, AUMA engineers assist you for installation and commissioning of actuators or even for device integration into the DCS and considerably contribute to a fault-free operation, as from the start.

And with a maintenance contract, the long-term conservation of the value of AUMA products can be ensured.

Ideally equipped with service units and special tools, the AUMA engineers can eliminate faults efficiently and as quickly as possible.

AUMA devices have proven their compliance with standards and their ability to conform to the many international applications by going through numerous qualification procedures.

The available certificates provide you with the confidence that the purchased device can be easily integrated into its environment and will work without incident over a long time period.

EU Directives

Declaration of Incorporation in compliance with the Machinery Directive and Declaration of Conformity according to the Low Voltage and EMC Directives

According to the Machinery Directive, AUMA actuators and actuator controls are considered as partly completed machinery. This means that a Declaration of Conformity in accordance with this Directive will not be issued by AUMA. AUMA's Declaration of Incorporation confirms that during the design stage of the devices, the fundamental safety requirements stipulated in the Machinery Directive were applied.

AUMA actuators fulfil the requirements of the Low Voltage and EMC Directives. This has been proved in extensive tests. Therefore, AUMA issues a Declaration of Conformity.

The declarations of incorporation and conformity form a joint certificate, also integrated within the operation instructions.

According to the Low Voltage and EMC directives, the devices are labelled with the CE mark.

CE

Final inspection record

After assembly, all actuators are thoroughly tested according to AUMA's inspection specification and the torque switches are calibrated. The procedure is recorded on the final inspection record.

Certificates

Notified bodies perform type tests on the instruments to determine whether the devices are suitable for specially defined applications. One example are the tests to prove electrical safety for the North American market. If a device has passed the test, this is recorded in a certificate. For all devices mentioned in this brochure, the relevant certificates can be provided.

Where can I get the certificates?

All certificates and records are provided by AUMA on request either as a hard or digital copy.

The documents can be downloaded from the AUMA homepage, 24/24 hours; some of them are password protected.

- www.auma.com

SIL Functional safety

AUMA has performed a risk analysis and a risk assessment for all devices in compliance with EN 61508. Upon request, the results can be supplied.

Quality is not just a matter of trust

Actuators must be reliable and dependable. They determine the cycle of precisely defined work processes. Reliability does not begin during commissioning. It begins with a well thought out design and careful selection of materials. This continues with reliable production using state-of-the-art machine tools. This is done in clearly controlled and supervised production steps whilst keeping in mind the environment.

The importance of environmentally sound production is reflected in our certifications according to ISO 9001 and ISO 14001. However, quality management is no one-time or static matter. It has to be proven day by day. Numerous audits by our customers and independent institutes confirm these high standards.

auma®

Solutions for a world in motion

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For detailed information on AUMA products, refer to the Internet: www.auma.com