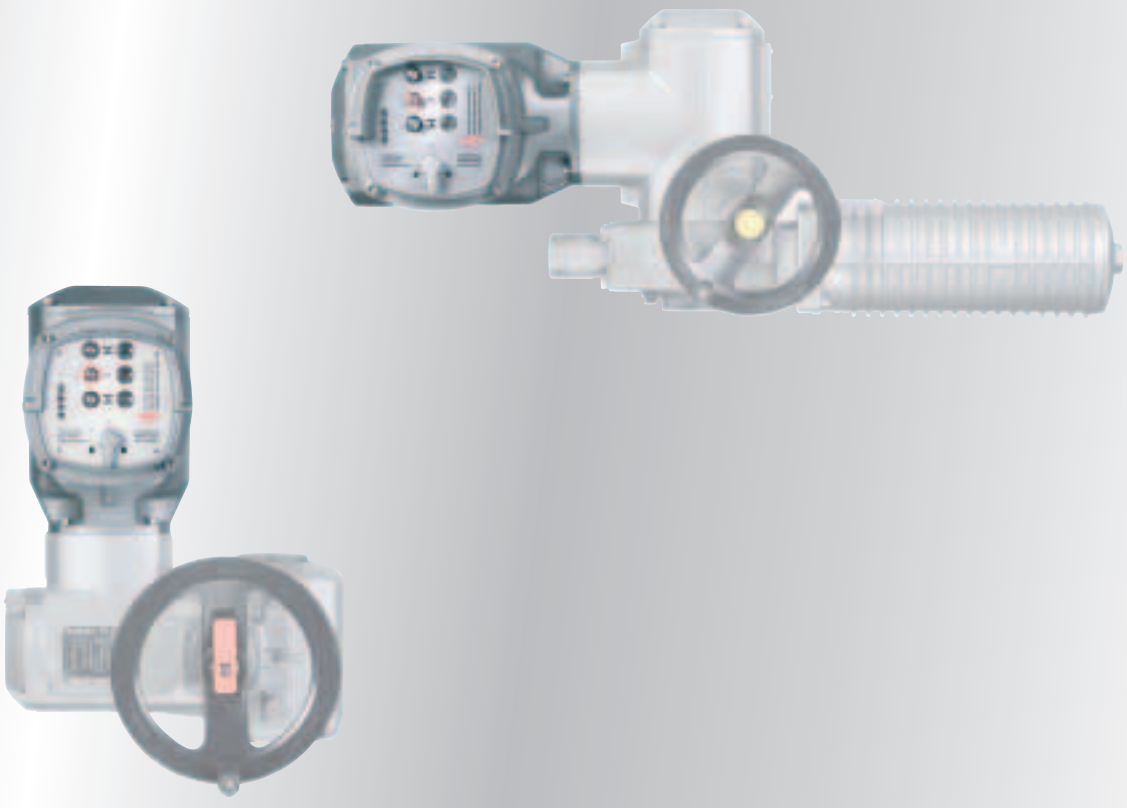
auma®

Solutions for a world in motion

Actuator controls

AUMA MATIC
AM
AMExB
AMExC



Product description

Applications

Electric actuators are used for the automation of industrial valves. A suitable actuator is available for nearly all valve applications.

Integral controls are the ideal interface between the actuator and the DCS. The actuators are perfectly controlled and the integration of the actuator into the DCS is made much simpler.

Power

: Conventional power plants (coal, gas, oil)
: Hydroelectric power plants
: Geothermal power plants
: Solar thermal power plants
: Biogas power plants

Oil & gas

: Exploration, offshore plants
: Refineries
: Distribution
: Gas tanks
: Tank farms

Water sector

: Sewage treatment plants
: Water treatment plants
: Drinking water distribution
: Seawater desalination
: Steel construction for water resources

Industrial and special solutions:

: Air conditioning
: Food industry
: Chemical/pharmaceutical industry
: Vessel and submarine shipbuilding
: Steel mills
: Paper industry
: Cement works
: Mining

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Solutions for a world in motion

2010-09-20

This brochure will provide both the beginner and the expert with an overview of the functions and applications of AUMA MATIC actuator controls. It can be used as a basis to determine whether a device is suitable for the chosen application. Knowledge on the basic functions of electric actuators is a prerequisite for understanding the contents.

For detailed product selection refer to the separate data sheets and price lists. On request, AUMA engineers within field service and within our subsidiaries can help you find the correct device for the application.

In the mid-1970s, the first integral actuator controls were introduced. They replaced the complex actuator controls located in control cabinets and simplified installation, commissioning and connection of the devices to the DCS. The continuously growing market for devices with integral controls proves the success of this concept. 70 % of the actuators delivered by AUMA are equipped with integral controls now.

The latest detailed information on the AUMA MATIC actuator controls can be found on the Internet under www.auma.com. All documents, including dimensional drawings, wiring diagrams and final inspection records for supplied devices are available on the Internet in digital form.

Control concepts

Why do I need controls?

An electric actuator in the classical sense, i.e. without integral controls, consists of the following components:

- an electric motor.
- gearing for the reduction of the motor speed to the required output speed and for the transmission of the motor torque into the output torque.
- a handwheel for manual emergency operation.
- limit switching for measuring the travel.
- torque switching for measuring the torque present at the valve.

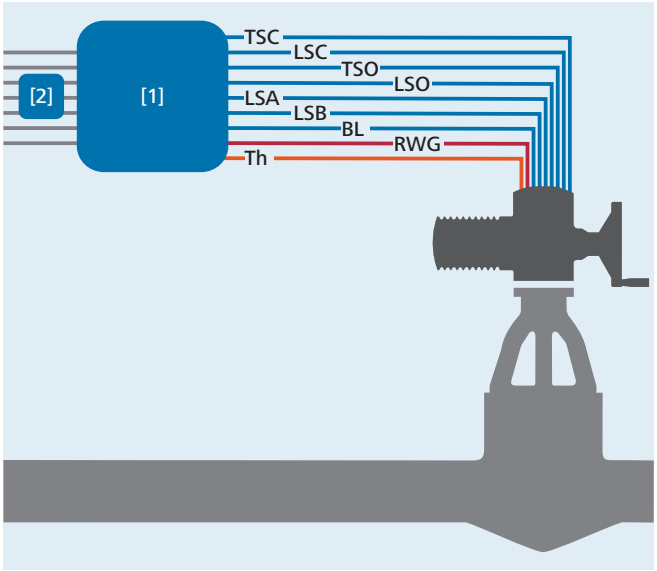
However, there is no switch for switching the device on or off. Nor does this basic actuator have any switchgear for reversing control of the motor as required to operate the actuator in both directions or any logic to process the torque and limit signals.

SA multi-turn actuator and SG part-turn actuator without integral controls

Additional equipment is required, the so-called actuator controls, to be able to control the actuator via the DCS.

Tasks of the actuator controls

- Processing the operation commands from the DCS and appropriate control of the actuator motor
- Providing the signals for the DCS
- Processing the signals from the actuator and automatic switching
- Providing local operation with indication of the device status for commissioning

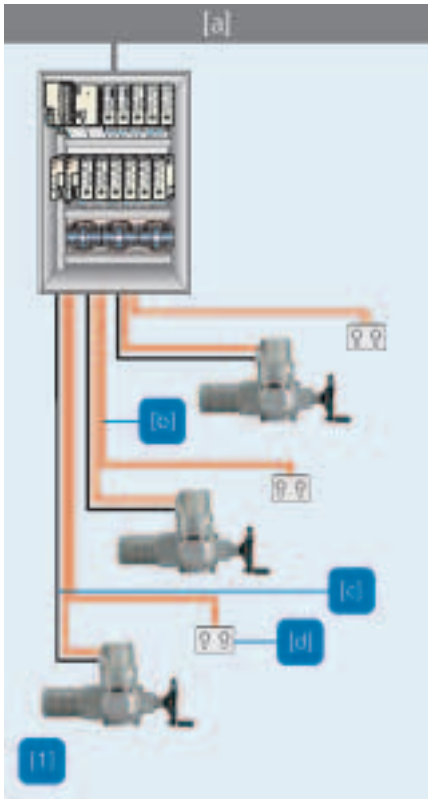


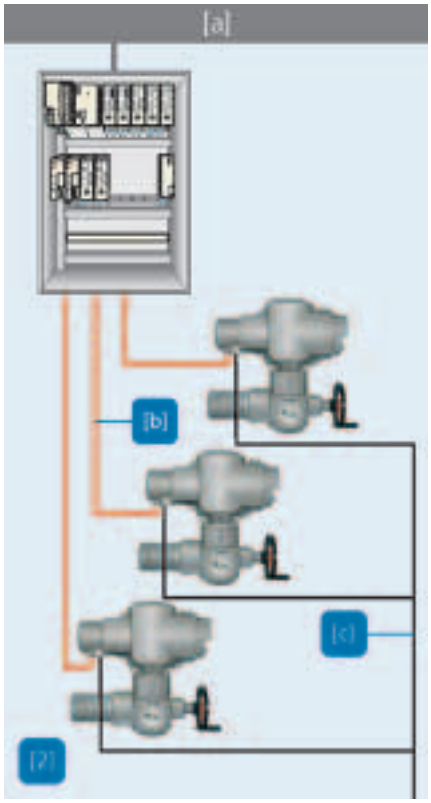
Signals from a fully equipped AUMA actuator

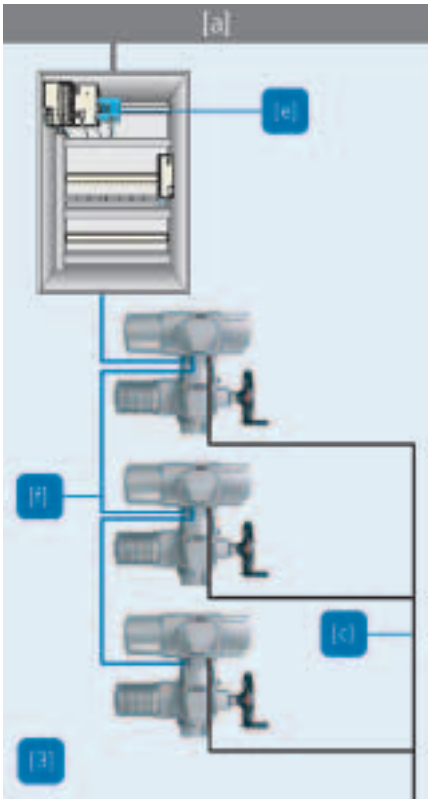
[1] Actuator controls
[2] Control signals from the DCS or feedback signals to the DCS
[TSC] Torque switch signal in direction CLOSE
[LSC] Limit switch signal in end position CLOSED
[TSO] Torque switch signal in direction OPEN
[LSO] Limit switch signal in end position OPEN
[LSA] Intermediate position switch signal in direction CLOSE (option)
[LSB] Intermediate position switch signal in direction OPEN (option)
[BL] Blinker transmitter signal, option for actuators for modulating duty
[RWG] Electronic position transmitter, 0/4 – 20 mA (option)
[Th] Thermoswitch

As explained before, there are several options to implement actuator controls. Depending on the plant configuration, the most favourable solution should be selected. AUMA sales engineers will help you choose the best solution.

Control concepts







[a]: DCS
[b]: Multicore signal cable
[c]: Power supply
[d]: Local controls

[e]: Fieldbus interface
[f]: Fieldbus cable (2-wire cable or fibre optic cable)

[1] External controls

For actuators to be connected to external controls, the following must be considered:

- All actuator signals e.g. limit, torque and thermoswitch signals must be passed on to the external controls in the control cabinet. A separate signal channel is required for each signal.
- The control of the actuators via a reversing contactor combination has to be implemented and installed in the control cabinet.
- The local controls have to be implemented and mounted.
- Depending on the valve type, the signals have to be processed differently (torque/limit seating).

External controls require extensive planning and installation. If mistakes are made during installation, commissioning may be hazardous. The documentation of the controls is extensive.

[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 operating elements on the local controls. The actuator can be set up completely on site; only operation commands and feedback signals are exchanged between the DCS and the actuator. The sensor signals of the actuators are processed internally. Integral protective functions prevent damage during commissioning.

Further advantages

- No extensive wiring in the control cabinet is required
- Reliable and correct processing of the actuator signals.
- Actuator and controls are optimally adapted to each other
- Standard wiring diagrams are available
- Warranty for both actuators and controls

[3] Fieldbus

By using a single data transmission medium for all signals from many devices, the structure of fieldbus systems can be kept very clear and simple. Where the control cabinet of commonly used systems is filled with input and output sub-assemblies, the fieldbus only requires a single interface.
Compared to common installations, the fieldbus systems have expanded functions. This includes setting of the field devices via the DCS.
The integral AUMA actuator controls are available with interfaces to all common fieldbus systems.

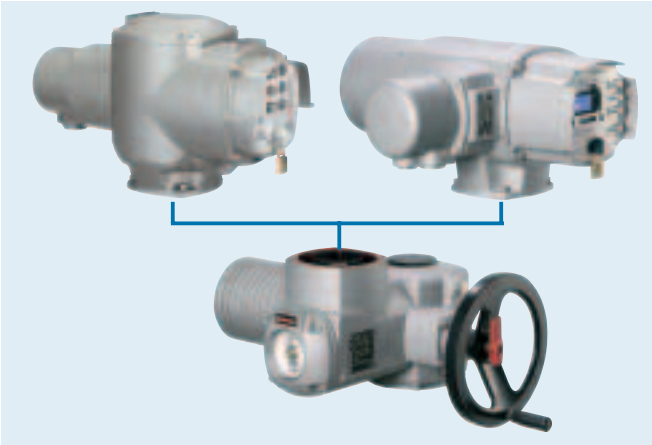
Modular design/versions

Modular design – with suitable controls

Each application has its special requirements. For this reason, AUMA only builds actuators on demand – tailor-made to customer requirements. Due to the modular design of the AUMA product range, different features can be combined. For each actuator type, there are a large number of equipment variants.

One of the central features of AUMA's modular design is the ability to supply or retrofit integral controls onto the basic actuator.

AUMA MATIC or AUMATIC



AUMA SA or SG actuators can be equipped with AUMA MATIC or AUMATIC controls.

In its basic version, the AUMA MATIC is the ideal and most economic controller for simple OPEN - CLOSE applications with conventional signal transmission.

The AUMA MATIC provides end position indication, the selector switch position and a collective fault signal, all as feedback signals.

The behaviour of the AUMA MATIC can be adapted to the application via programming switches, e.g. setting the type of seating.

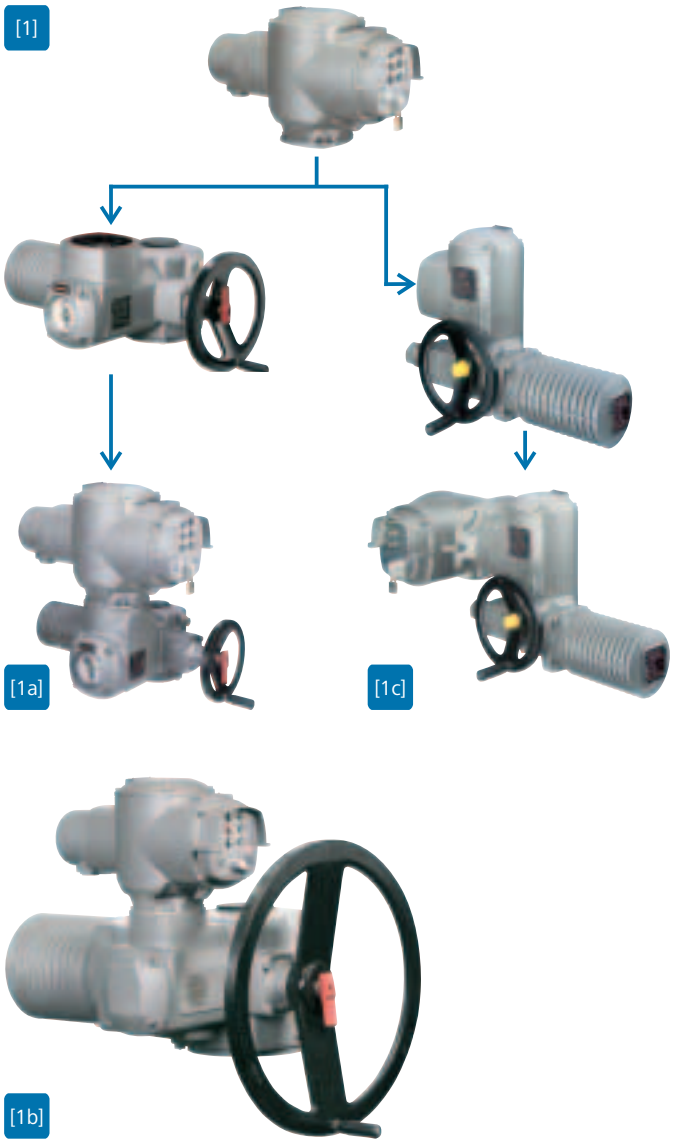
As an option, the device can be used for closed-loop control, and is, furthermore, available with a Profibus DP or a Modbus RTU interface.

This brochure provides a detailed description of the AUMA MATIC.

As well as the AUMA MATIC's functionality, the AUMATIC offers some other advantages, e.g.

- Programmable signal relays
- Non-intrusive setting in combination with the MWG control unit in the actuator (option)
- Adaptive positioner (option)
- Fieldbus interfaces for Profibus DP, Modbus RTU, DeviceNet, Foundation Fieldbus (option)
- Monitoring and diagnostics
- Logging of operating data
- Cable-based or wireless programming interface for connecting a programming device

For detailed information on the AUMATIC, refer to the brochure, Actuator controls AUMATIC .



[1] **Modular design 1**
Universal control concept

AUMA actuator controls can be combined with the different actuator types. Even with different actuator types within a plant, a universal concept with regards to the connection to the DCS and device operation/setting can be maintained.

The controls are available for the following actuator ranges:

- Multi-turn actuators for open-close duty
  SA 07.1 – SA 16.1
  SAExC 07.1 – SAExC 16.1
- Multi-turn actuators for modulating duty
  SAR 07.1 – SAR 16.1
  SARExC 07.1 – SARExC 16.1
- Part-turn actuators for open-close duty
  SG 05.1 – SG 12.1
  SGExC 05.1 – SGExC 12.1
  SG 03.3 – SG 04.3
- Part-turn actuators for modulating duty
  SGR 05.1 – SGR 12.1
  SGR 03.3 – SGR 04.3

[1a] Multi-turn actuator of size SA 10.1 (max. 120 Nm)
[1b] Multi-turn actuator of size SA 16.1 (max. 1,000 Nm)
[1c] Part-turn actuator of size SG 05.1 (max. 150 Nm)

[2] **Modular design 2**
Plug/socket connections

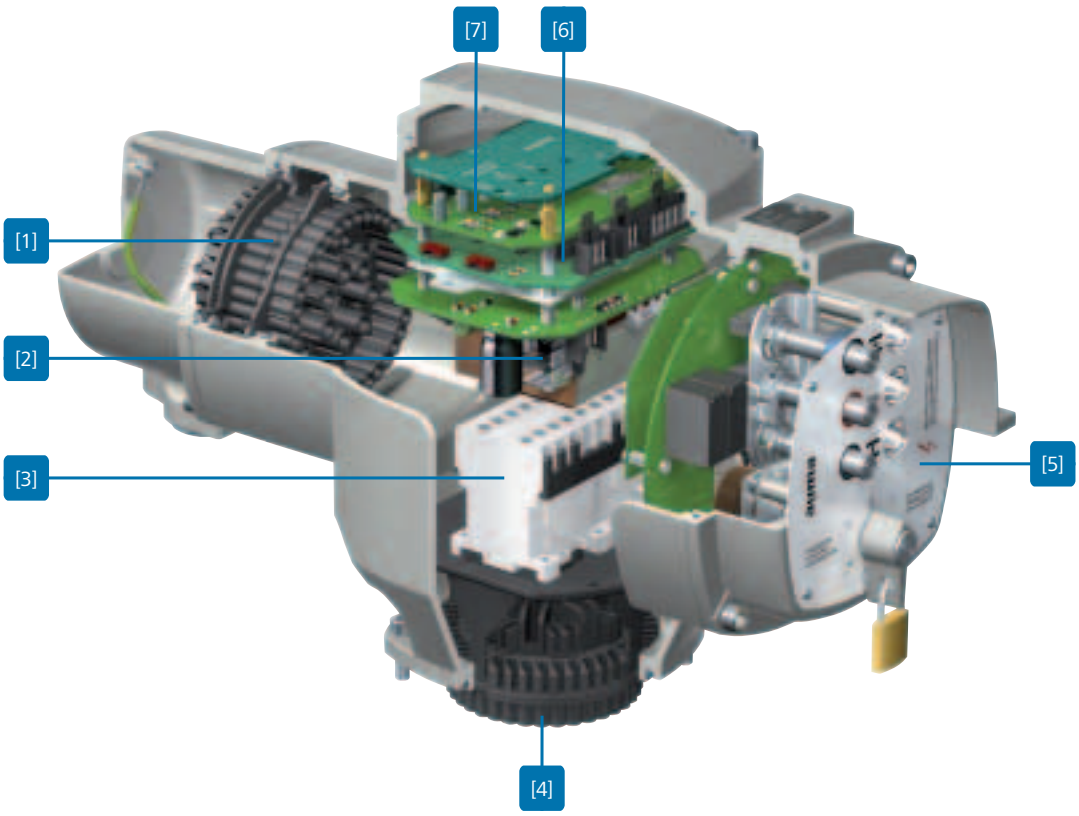
The controls can be mounted on the actuator at 90° intervals, the electrical connection and the local controls can be positioned in the same way. The connections are plug and socket which enables the actuator and controls to be adapted to the installation situation in the plant in no time at all. Further advantages of the plug/socket connection are high ease of service and once electrical connections have been established, they do not have to be separated again.

[3] **Modular design 3**
Wall bracket

The controls can be mounted separately from the actuator on a wall bracket. This is recommended if:

- the actuator is installed in an inaccessible place, e.g. in a shaft.
- high ambient temperatures at the valve may influence the control electronics.
- heavy valve vibration could influence the control electronics.

Design principle



[1] **Electrical connection**

Different plug/socket connectors are available for the electrical connection. The different versions for standard or explosion-proof devices are described on pages 24 and 25.
For maintenance work, the actuator can be disconnected quickly from the power supply and control cables and can easily be reconnected.

[2] **Power supply unit**

The power supply for the internal electronics, the heating system and the position transmitters (option) within the actuator.

[3] **Switchgear**

In the standard version, reversing contactors with a maximum switching power of 7.5 kW are used for motor power switching. For applications requiring a high number of starts, we recommend the use of thyristor units. Apart from a longer lifetime, they have shorter reaction times. Thyristor units are available up to a maximum power of 5.5 kW.

[4] **Plug/socket connector to the actuator**

The electrical connection between the integral controls and the actuator is made by using a plug/socket connector. Four screws are used to attach the controls housing to the actuator. For maintenance purposes the controls can be separated and reconnected to the actuator in no time at all.

[5] **Local controls**

The local controls contain all operating elements required to operate and set the actuator locally. A selector switch is used to select Local operation or Remote operation or to disable all operation commands when set to (0).
In addition, three indication lights show different actuator states (refer also to the Signals/indication section as from page 22).

[6] **Logic**

The logic processes all external and internal signals. The programming switches can be used, e.g., to determine the type of seating in the end positions, to determine whether the operation commands are processed in push-to-run operation or in the self-retaining mode or to program the collective fault signal. In case of faults, e.g. tripping of the motor protection, when reaching an end position or in case of a stop command, the logic switches off the actuator directly and without significant delay time.

[7] **Interface**

The interface forms the link to the process control system. Here, the commands from the process control system are received and signals issued. Depending on the DCS, parallel control with or without positioner or fieldbus, the AUMA MATIC is equipped with the corresponding inputs and outputs.

Summary of applications, functions, and equipment

Standard ● Option ■	AUMA MATIC				
	AM		AMExB/AMExC		
Service conditions	Parallel	Fieldbus	Parallel	Fieldbus	Page
Enclosure protection IP 67	●	●	●	●	10
Enclosure protection IP 68	■	■	■	■	10
Corrosion protection KN	●	●	●	●	10
Corrosion protection KS, KX	■	■	■	■	10
Low temperature versions	■	■	■	■	11
Explosion protection	–	–	●	●	11
Interface					
Parallel interface	●	–	●	–	12
Fieldbus interface	–	●	–	●	13
Operation/setting					
Local operation	●	●	●	●	15
Setting	●	●	●	●	15
Functions					
Limit seating	●	●	●	●	16
Torque seating	●	●	●	●	16
OPEN - STOP - CLOSE control	●	●	●	●	17
Setpoint control (positioning)	■	■	■	■	17
Failure functions					
Automatic phase correction	●	●	●	●	18
Overload protection of the valve	●	●	●	●	19
Protection of the motor against overheating	●	●	●	●	17
Phase failure monitoring	●	●	●	●	20
Failure behaviour on loss of signal	■	■	■	■	20
Protection against unauthorised operation/setting	●	●	●	●	21
Feedback signals/local indication					
Feedback signals for parallel interface	●	●	●	●	22
Feedback signals for fieldbus interface	●	●	●	●	23
Local indication	●	●	●	●	23
Switchgear					
Reversing contactors	●	●	●	●	8
Thyristors	■	■	–	–	8
Electrical connection for non-explosion-proof devices					
Electrical connection with plug/socket	●	●	–	–	24
Expanded connection compartments	■	■	–	–	24
Double sealed	■	■	–	–	24
Protection cover	■	■	–	–	24
Parking frame	■	■	–	–	24
Electrical connection for explosion-proof devices					
Plug/socket connector for explosion-proof actuators	–	–	●	●	25
Plug-in terminal connection for explosion-proof actuators	–	–	■	■	25
Double sealed	–	–	●	●	25
Protection cover	–	–	■	■	25
Parking frame	–	–	■	■	25

Service conditions

AUMA devices are used worldwide; in all climate zones, in industrial plants of all kinds under special local ambient conditions. AUMA devices have to operate reliably and for a long time under any conditions without requiring major maintenance work. For this very reason, AUMA has focussed on making AUMA devices resistant to the most unfavourable conditions and have adapted their protective measures to the state-of-the-art technology.

AUMA actuators at work – in Siberia and in the Sahara

Enclosure protection

IP 67

AUMA devices conform to enclosure protection IP 67 according to EN 60 529. IP 67 means protection against immersion up to max. 1 m head of water for max. 30 minutes.

IP 68

On request, AUMA devices are available with improved enclosure protection IP 68 according to EN 60 529. IP 68 means protection against submersion up to 6 m head of water for max. 72 hours. During submersion up to 10 operations are permissible.

In order to guarantee the enclosure protection IP 68, suitable cable glands must be used. They are not part of the standard supply, but can be provided by AUMA on request.

Ambient temperatures

	Versions	Temperature range
AUMA MATIC AM	Standard Low temperature Extreme low temperature[1]	–25 °C … +70 °C –40 °C … +70 °C –60 °C … +70 °C
Explosion-proof AUMA MATIC AMExB	Standard	–20 °C … +40 °C/60 °C[2]
Explosion-proof AUMA MATIC AMExC	Standard Low temperature Extreme low temperature[1]	–20 °C … +40 °C/60 °C[2]/70 °C[3] –40 °C … +40 °C/60 °C[2] –50 °C … +40 °C/60 °C[2]

Some of the permissible ambient temperature ranges of AUMA actuators differ from those of the AUMA MATIC. This has to be observed during sizing.

[1] Device includes heating system for connection to external power supply 230 V AC or 115 V AC.
[2] For the temperature range up to +60 °C, special sizing of the actuator is required for temperature class T4.
[3] +70 °C in combination with explosion group IIB and temperature class T3

Corrosion protection/colour

Standard (KN)

The standard AUMA corrosion protection KN is a high quality coating. This is suitable for outdoor installation and for slightly aggressive atmospheres with a low level of pollution.

KS

AUMA recommends this corrosion protection class for installation in occasionally or permanently aggressive atmospheres with a moderate pollutant concentration.

KX

AUMA recommends this corrosion protection class for installation in aggressive atmosphere with high humidity and a high pollutant concentration.

Colour

The standard colour of the finish coating is silver-grey (similar to RAL 7037). Other colours are available on request.

Explosion protection

For the installation of actuators in potentially hazardous or explosive areas, special protective measures are required. These are stipulated in the European Standards EN 50 014, 50 018, and 50 019. The PTB (Physikalisch Technische Bundesanstalt, the German national test authority) and the BVS (German Mining Test Facility) as European test authorities have certified the conformity of the equipment with the mentioned standards.

Explosion protection classes

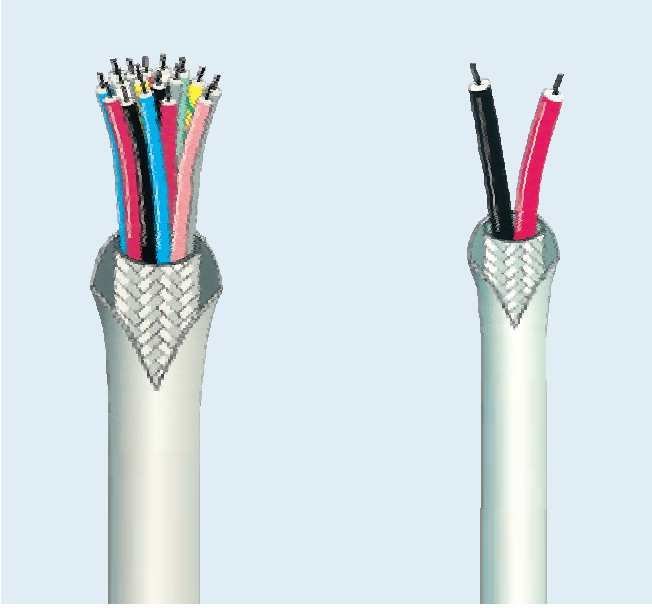
Types	Classification
Multi-turn actuators SAExC 07.1 – SAExC 16.1 SARExC 07.1 – SARExC 16.1 with AMExB or AMExC	■ II2G EEx de IIC T3 or T4 ■ II2G c IIC T4 ■ II2D Ex tD A21 IP6X T130°C
Part-turn actuators SGExC 05.1 – SGExC 12.1 with AMExC	■ II2G EEx de IIC T4 ■ II2G c IIC T4 ■ II2D Ex tD A21 IP6X T130°C

Certificates of Conformity from national test authorities in other countries, such as USA, Canada, CIS, Brazil, Japan, etc., are also available.

Interfaces

While the mechanical interface between actuator and valve is defined by a few standards worldwide, there is a large variety of connections from the actuator to the DCS. Selecting the proper connection is not just reduced to deciding between conventional parallel control or fieldbus, it is also a question of redundancy concepts, transmission media, etc.

Whatever the requirements, AUMA keeps track of the latest developments: not only with regards to the devices but also regarding the know-how of our sales engineers or within our quotations department. Here you can find your competent partners who will support you in finding the solution to rather complex questions on the connection to the DCS.

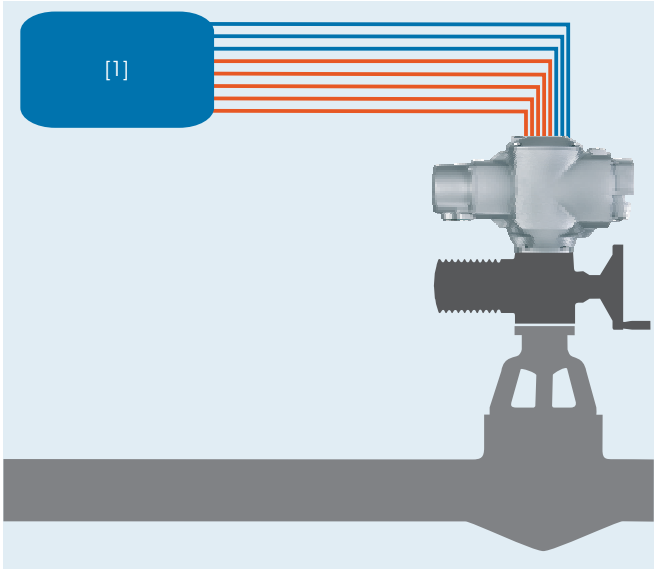


Parallel wiring or fieldbus with 2-wire technology is no longer the only question. Fieldbus enables much more comprehensive data exchange and therefore a more intensive integration of the actuators into the process.

Parallel interface

For systems with parallel signal transmission, discrete signals such as operation commands are transmitted as 24 V DC signals (alternatively 115 V AC). Continuous signals such as nominal or actual position values are exchanged as 4 – 20 mA signals.

Each signal requires a separate signal channel and a separate input or output at the controls.



Even in the basic version, the AUMA MATIC with parallel interface exchanges up to 10 discrete signals with a PLC [1]:

- Three binary inputs for the OPEN, STOP, and CLOSE commands
- Five binary outputs, one reserved for collective fault signal, the remaining four with signals for end position CLOSED reached, end position OPEN reached, AUMA MATIC in local control, and AUMA MATIC in remote control.
- Frequently, an optional analogue output for the transmission of the valve position if a positioner is included in the actuator.

Depending on the functions of the controls, the AUMA MATIC might have different configurations. For example, the optional positioner requires an analogue input for the position setpoint.

Fieldbus interface

In fieldbus systems, all signals for all devices connected to the bus are transmitted via a common signal channel. In general, this is a 2-wire cable. The number of cables connected to the AUMA MATIC does not depend on the number of functions available for the device.

AUMA MATIC actuator controls are available with the following fieldbus interfaces:

- Profibus DP
- Modbus RTU

Functionality

Compared to the AUMA MATIC with conventional interface, the AUMA MATIC with fieldbus interface has expanded functions. Thus, the AUMA MATIC field bus version can be controlled via discrete OPEN - CLOSE commands or a continuous setpoint. Selection between the two modes is made by an additional mode signal.

Expanded fieldbus functions with the AUMATIC Bus.

Since 2003, AUMA has used the AUMATIC AC as a development base for fieldbus technology. Further developments of existing fieldbus interfaces and implementation of new interfaces are solely focussed on the AUMATIC.

Furthermore, the AUMATIC is availabe with

- DeviceNet
- Foundation Fieldbus
- Component redundancy
- DTM for remote parameter setting
- ....

AUMATIC Bus controls are ideal for sophisticated fieldbus solutions.

Further literature

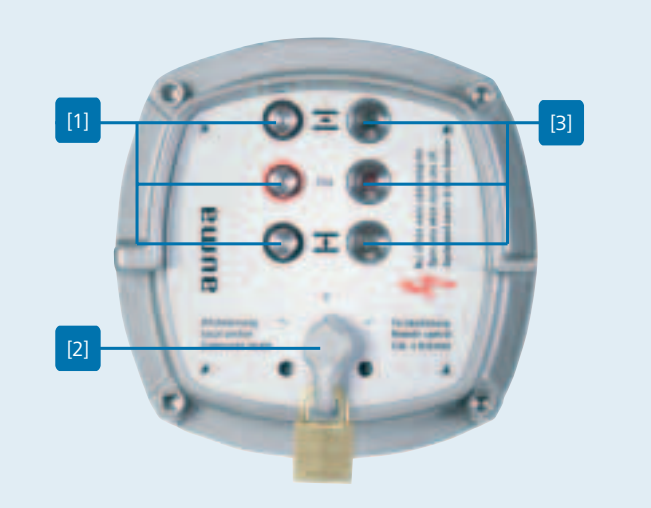
For detailed information refer to the brochure: Electric actuators with fieldbus interfaces.

Operation/setting

The integral local controls allow immediate electric operation after connection to the power supply.

This is not only an advantage during operation but, above all, facilitates commissioning. All settings can be made and checked before actually connecting the actuator to the DCS.

Operating and indication elements of the AUMA MATIC



[1] **Push buttons**
To operate or to stop the actuator.

[2] **Selector switch**
The selector switch is used to activate either remote or local control; no electrical operation is possible when set to 0. To prevent unauthorised operation, the selector switch can be locked with a padlock.

[3] **Indication lights**
See page 23

A number of double-stem gate valves in a sewage treatment plant. The combination between SA multi-turn actuators and GK multi-turn gearboxes are each controlled by one AUMA MATIC.

Local operation

If the selector switch is in the local position, the actuator can be operated with the OPEN - STOP - CLOSE push buttons. It can be determined for each direction of operation, whether the actuator is run in push-to-run operation or self-retaining. In push-to-run operation, the actuator stops immediately when releasing the push button. If self-retaining is set, the actuator runs into one of the end positions or until the STOP push button is operated.

Setting

End positions and tripping torques as well as positioners, if available, are set at the actuator.

The processing mode of the actuator and DCS signals is then set at the AUMA MATIC. This particularly includes the type of seating when reaching an end position, either limit or torque seating.

All further settings depend on the features of the respective AUMA MATIC controls. Therefore, it is crucial whether the AUMA MATIC is equipped with a standard interface for OPEN - STOP - CLOSE commands, a positioner for processing a setpoint signal, or a fieldbus interface. For all versions, the setting elements, the DIP switches and the potentiometer are easily accessible when removing the housing cover.

SG part-turn actuators with AUMA MATIC within a combined cycle power plant in Spain.

Functions

The AUMA MATIC evaluates all actuator signals to ensure safe operation of both actuator and valve, irrespective of the DCS programming. This includes correct tripping after reaching an end position, but also failure functions such as the overload protection.

The AUMA MATIC offers several control options, as described below.

Switching off in the end positions

If one of the valve end positions is reached the controls automatically switch off the actuator.

Depending on the valve type, the actuator is switched off according to the following procedure:

- Limit seating, i.e. at one of the set switching positions
- Torque seating, i.e. with a defined torque

AUMA actuators include two independent measuring systems, the limit switching and the torque switching.

The type of seating is determined by the way the controls process the limit and torque signals.

- If the controls are set to limit seating, the controls switch off the actuator as soon as a limit signal is received.
- If the controls are set to torque seating, the controls switch off the actuator as soon as the set torque limit has been exceeded. The torque limit is specified by the valve manufacturer. Due to the additional limit signal the controls recognise that the actuator has regularly been tripped in one of the end positions.

The type of seating can be set independently for either end position.

Extreme conditions: Heat combined with salty maritime air. SG part-turn actuators with AUMA MATIC within an industrial plant in Qatar.

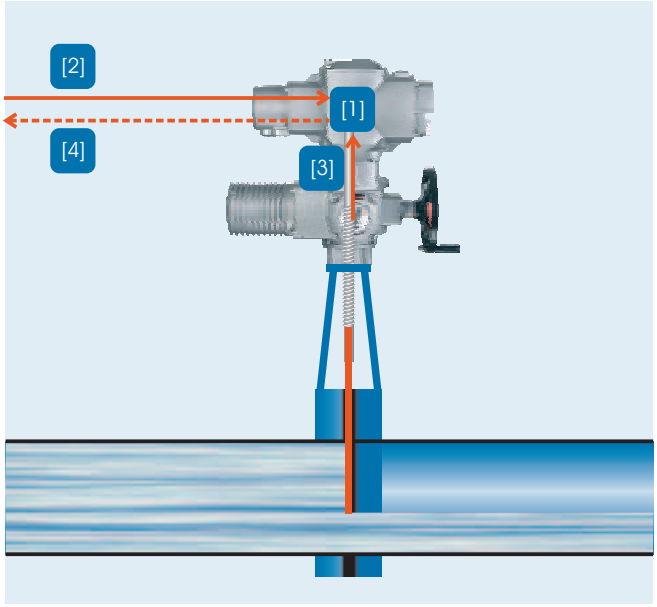
OPEN - STOP - CLOSE control

Shut-off valves are generally either fully opened or closed. For remote operation, the OPEN, STOP and CLOSE operation commands of the AUMA MATIC are supplied. The OPEN - STOP - CLOSE control is also called self-retaining. If the actuator receives an operation command, the actuator runs until receiving a stop command or a switch-off condition occurs, e.g. the end position is reached.

The OPEN - CLOSE operation (without STOP command), the so-called push-to-run operation, is contrary to this. The actuator stops as soon as an operation command is cancelled. This type of control is required if the actuator is controlled by an external positioner.

The AUMA MATIC can be set to self-retaining or push-to-run operation independently in each operation direction.

Setpoint control/positioning (option)



The positioner [1] within the AUMA MATIC controls positions the valve according to the externally supplied setpoint [2]. Depending on the interface, the setpoint may take the form of a 4 – 20 mA signal or be transmitted as a digital signal via the fieldbus. The positioner requires the current valve position [3] for closed-loop control. The valve position can also be transmitted to the DCS.

The internal positioner removes the need for an external positioning device. In combination with a modulating actuator mounted on a modulating valve, you obtain an ideally adapted unit, which can be integrated into the DCS.

Extreme weather conditions at the polar sea. SA multi-turn actuators with AUMA MATIC in a tank farm near Arkhangelsk in the North of Russia.

Failure functions

During all stages of the actuator's life, from installation and commissioning right through to operation, external conditions may disturb normal operation. The conditions may be caused due to mistakes during commissioning but also due to foreign matter within the valve.

AUMA actuator controls therefore include a variety of failure functions which either eliminate the faults or switch off the actuator before any damage can be incurred.

Your great advantage: There is no need for worst case assessments and the respective programming within your controls to account for these events.

And if such an event occurs, the integral diagnostic functions will indicate the cause of the fault.

Automatic phase correction

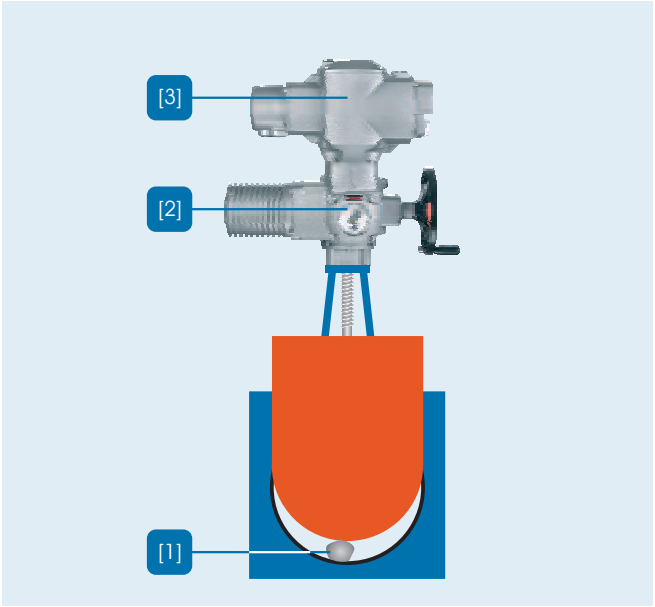
Most actuators are driven by three-phase asynchronous motors. The three phases of the power supply have to be connected in the correct sequence to make sure these robust motors run in the right direction. Otherwise, the actuator would run in direction CLOSE for an OPEN command and vice versa. In this case, the switch-off features would not take effect and the valve may be damaged or even be destroyed.

The automatic phase correction prevents this. The control of the motor is automatically adapted to the 3-phase rotating field. Even if the phases were crossed over during installation the actuator will still run in the direction CLOSE for a CLOSE command.

Multi-turn actuator/worm gearbox combination in a water treatment plant in Australia.

Overload protection of the valve

Excessive torque puts an extreme load on the valve; this may cause damage and can, in the worst case, destroy the valve. The torque switching integrated in the actuator is therefore not only used for regular torque seating in one of the end positions: the actuator controls also monitor the torque switching over the whole travel. If the set torque limit is exceeded, the controls immediately trip the actuator and signal a torque fault.

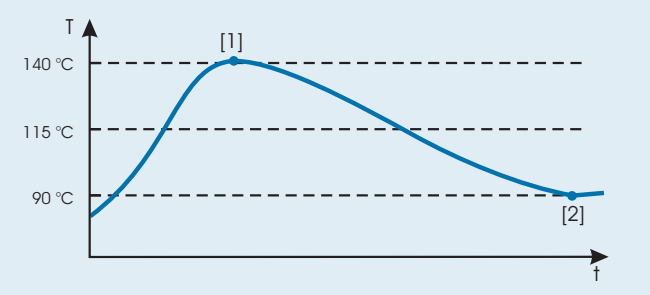


Foreign matter [1] may cause excessive torque. If there was no overload protection available, the actuator would act with its maximum torque upon the foreign matter and therefore upon the valve, only restricted by the maximum stall torque of the motor. This is prevented by the tripping of the torque switching in the actuator [2] and the switching off via the controls [3].

Protection of the motor against overheating

The windings of the 3-phase AC and 1-phase AC motors contain thermoswitches or PTC thermistors which trip as soon as the temperature within the motor exceeds 140 °C.

Thermoswitches or PTC thermistors offer far better protection than thermal overload relays, since the temperature rise is directly measured at the motor winding.



Motor temperature curve against time
When reaching the tripping temperature [1], the AUMA MATIC automatically trips the actuator and prevents the motor from being damaged due to overheating. When using thermoswitches, the AUMA MATIC automatically switches to the ready state once the motor has cooled down to restart temperature [2]; when using PTC thermistors, the fault has to be acknowledged.

Failure functions

Phase failure monitoring

Actuators are generally driven by 3-phase AC motors. A 3-phase AC supply is required to power these actuators.

The electronics within the AUMA MATIC is supplied using two of the three phases. If one of the two phases fails, the actuator can no longer be operated.

If the remaining phase fails, the controls remain fully operable. The two motor windings which are still supplied would try to compensate for the torque loss caused by the failure of the third winding and would therefore overheat. As another consequence, the motor protection would be tripped (see page 17) and the actuator be switched off.

To prevent this chain reaction and to quickly identify the cause of the fault, the AUMA MATIC monitors this third phase. The controls stop the actuator in case of a loss of phase and send the loss of phase fault signal.

Failure behaviour on loss of signal

If the AUMA MATIC is equipped with a positioner or with a bus interface, nominal and actual position values or the bus signal must be permanently available to ensure regular AUMA MATIC operation.

If one of these signals fails, e.g. due to a loss of the master or if a cable is cut through, the process can no longer be reliably monitored.

In these cases, the AUMA MATIC triggers a defined failure behaviour. During commissioning, you have to determine the most favourable valve position in case of a fault.

The AUMA MATIC can be set to:

- fail as is
  The actuator remains in the current position.
- fail open
  Actuator moves the valve to end position OPEN.
- fail close
  Actuator moves the valve to end position CLOSED.

SA/GK multi-turn combinations with AUMA MATIC actuator controls integrated in a historical weir in East Germany.

Protection against unauthorised operation

The selector switch for selecting the control mode can be protected against unauthorised operation, e.g. starting the actuator via the local controls, in any of the three positions by means of a padlock.

Lockable protection cover (option)

The lockable protection cover offers increased protection, even against damage to the local controls.

Central installation of several AUMA MATIC controls within a control cabinet using the wall bracket facility is also feasible.

Signals/indication

Signals are the foundation for controlling a process flow. For this reason, actuators provide a number of signals which indicate the operational status of the actuator and the valve.

Many applications require that the actuator or the valve status can be provided locally. Depending on the equipment, the actuator offers various possibilities.

The AUMA MATIC evaluates the signals from the sensors within the actuator. This includes the discrete signals of the limit and torque switching, if required continuous valve position and torque signals, as well as the motor protection.

The AUMA MATIC uses these signals to generate signals for transmission to the DCS.

Feedback signals for parallel interface

Discrete signals

Discrete signals include end position signals, status signals, fault signals, and all signals which can be transmitted directly via a binary output to the control room.

The AUMA MATIC when equipped with standard interface has five output contacts. One of these contacts is reserved for the collective fault signal. The five contacts are assigned in the factory as follows:

- End position OPEN
- End position CLOSED
- Selector switch in REMOTE
- Selector switch in LOCAL
- Collective fault signal (torque fault, thermal fault and/or phase failure)

Continuous signals

If you require remote position indication, the actuator is equipped with a position transmitter. The position transmitter provides the valve position as a continuous signal. This signal can be transmitted as 0/4 – 20 mA to the control room via an analogue output. If the AUMA MATIC is equipped with a positioner, this output is always available. This version requires switches with a second switching level for end position and selector switch signal transmission.

Explosion-proof SAExC/GS multi-turn/part-turn actuator combinations with AUMA MATIC mounted on a butterfly valve within a tank farm in the Azores.

Feedback signals for fieldbus interface

Both discrete and analogue signals are digitised in order to transfer them via the bus. By configuring the fieldbus telegrams you can define which of the signals is transferred to the control room. A lot more signals can be transferred than for devices with a parallel interface. For example, the faults contained within the collective fault signal are transmitted as individual signals. For the most extensive process representation of AUMA MATIC Profibus DP, 37 discrete and three continuous signals are transmitted.

As a rule, the number of signals transferred should be reduced to the absolute minimum required for the process. Otherwise, the data flow slows down the bus communication and extends the reaction times.

SAExC multi-turn actuators with AMExC controls within the kerosene distribution system of Chubu airport in Japan.

Local indication

Indication lights

The three indication lights on the local controls give the following signals, from top to bottom:

- End position OPEN reached
- Collective fault signal
- End position CLOSED reached

Depending on the version, the middle indication light can be additionally assigned a blinking signal for running indication.

Position indicator

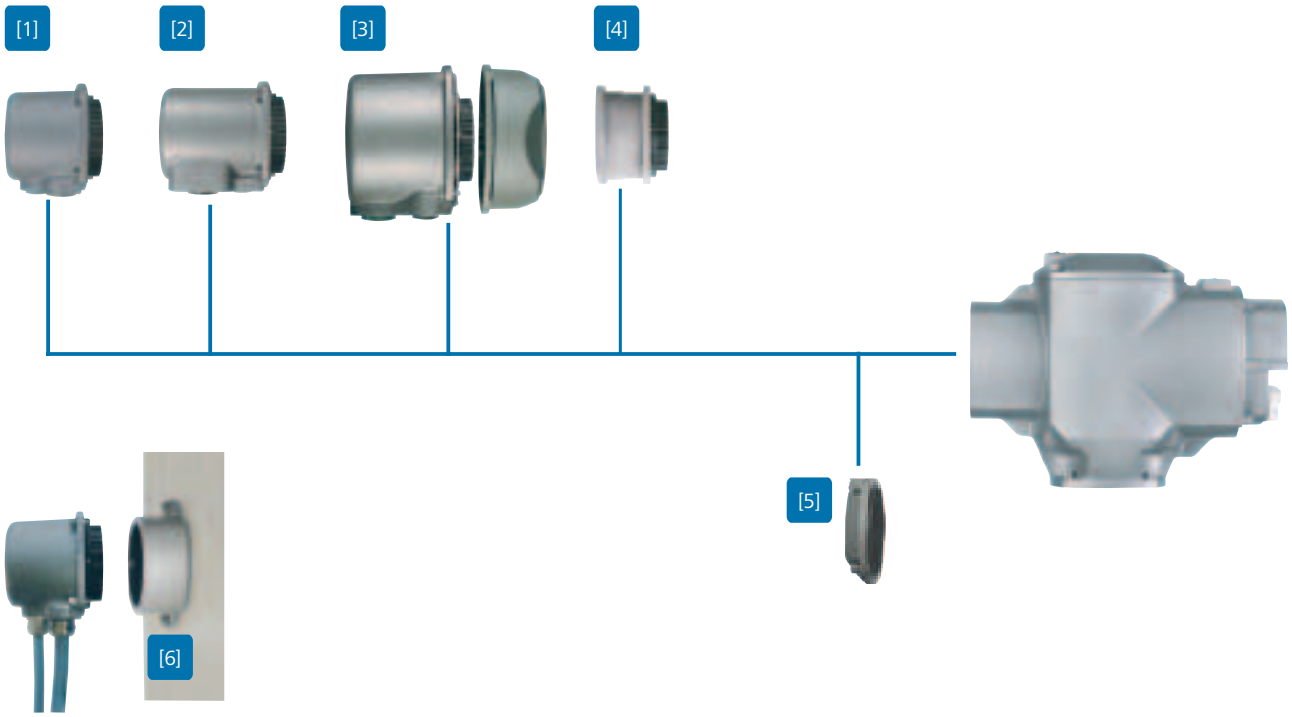
The AUMA MATIC has no elements for valve position indication. However, AUMA part-turn actuators, as a standard, and multi-turn actuators, as an option, are equipped with a position indicator allowing the valve position to be read on site.

Electrical connection for non-explosion-proof actuators

AUMA non-explosion-proof actuators use a “plug-in” type electrical connection. This applies to both power supply and signal cables. The wiring made during installation remains undisturbed, even if the actuator has to be disconnected from the mains or the DCS, e.g. for maintenance purposes. The actuator can be quickly reconnected, wiring errors are avoided.

The electrical connection is available in different sizes. The number of cable entries may vary. The cable entries usually have metric threads, Pg- or NPT-threads are also available.

The electrical connections can be used for actuators with or without controls.



All electric connections are based on the AUMA plug/socket connector with 50 screw-type terminals for connecting the signal cables and three screw-type connections for connecting the supply voltage.

[1] **Standard S**
with three cable entries. The diameter is 100 mm.

[2] **Enlarged terminal compartment SH (option)**
with up to six cable entries

[3] **Enlarged terminal compartment SE (option)**
with three cable entries. The diameter is 135 mm. An intermediate frame is required for adapting to the actuator housing.

[4] **Double sealed intermediate frame (option)**
When removing the plug cover or due to leaky cable glands, ingress of dust and water into the housing is possible. This is prevented by inserting the double sealed intermediate frame between the electrical connection and actuator housing. The enclosure protection, IP 67 or IP 68, will not be affected, even if the electrical connection is removed. The double sealed intermediate frame can be combined with any of the illustrated electrical connections.

[5] **Protection cover**
for protecting the plug compartment when plug is removed.

[6] **Parking frame**
for safe mounting of a disconnected plug.

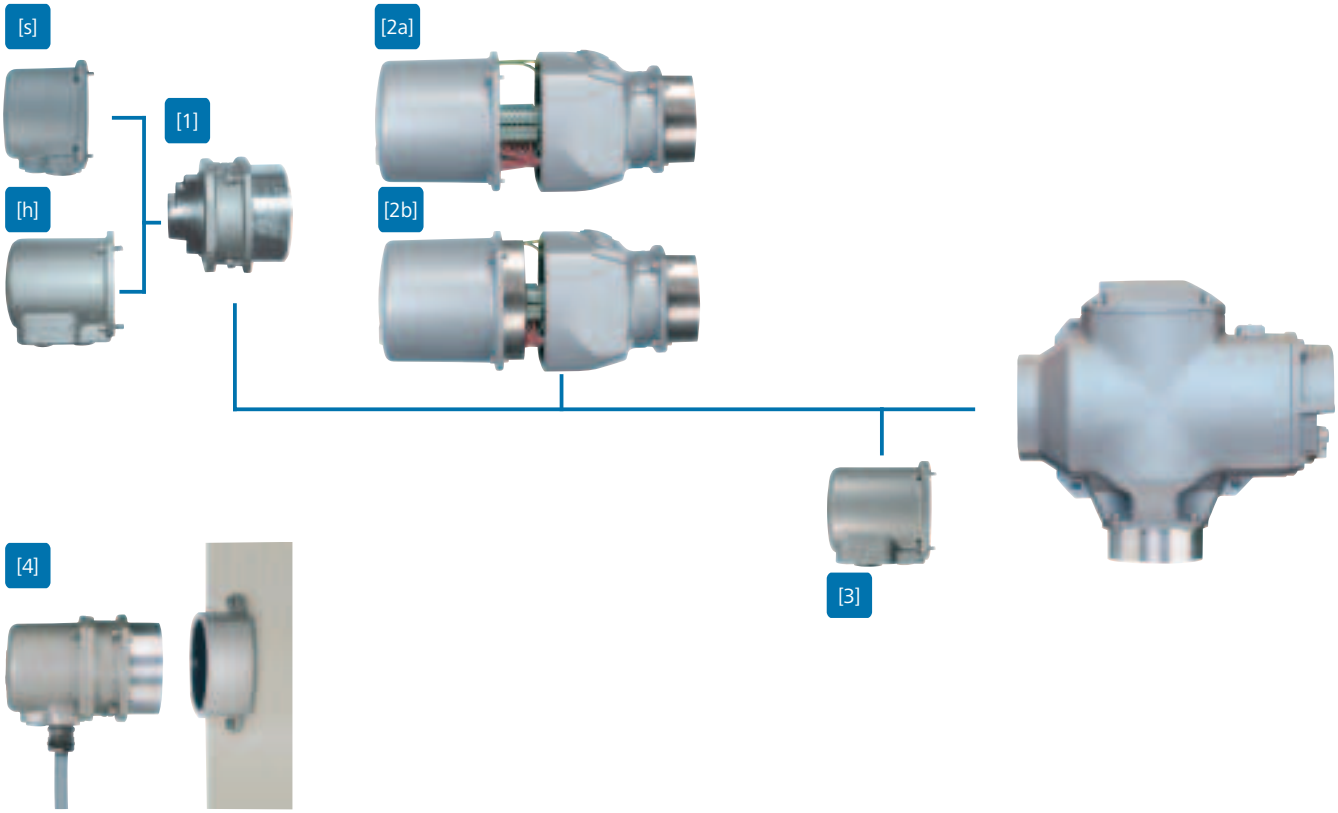
Electrical connection for explosion-proof actuators

AUMA explosion-proof actuators use a “plug-in” type electrical connection. This applies to both power supply and signal cables. The wiring made during installation remains undisturbed, even if the actuator has to be disconnected from the mains or the DCS, e.g. for maintenance purposes. The actuator can be quickly reconnected and wiring errors are avoided.

Explosion-proof connections are always double sealed: The flameproof enclosure inside the actuator remains intact even after removing the plug cover.

The electrical connection is either designed in the protection type “Increased safety” or “Flameproof enclosure”.

The electrical connections can be used for actuators with or without controls.



[1] **Plug/socket connector with screw-type terminals KP**

with 38 screw-type connections for the signal cables. This connection type is the standard connection for explosion-proof actuators, even for those with a fieldbus interface. The connection can be supplied with a standard plug cover (s) with three cable entries or with a high (h) plug cover with up to six cable entries.
The connection with the high (h) cover is also used for devices with integral controls and fieldbus interface.

[2] **Plug/socket connector with spring cage terminal blocks KES**

with up to 50 spring-cage terminal blocks for connecting signal cables. Used with operating voltages exceeding 525 V and/or if a large number of terminals are required. The electrical connection has up to 6 cable entries.
The connection is available in protection type “Increased safety” [2a] or “Flameproof enclosure’”[2b].

[3] **Protection cover**

for protecting the plug compartment when the plug is removed.

[4] **Parking frame**

for safe mounting of a disconnected plug. The parking frame with mounted plug is protected against the ingress of both dust and water.

Technical data

For detailed information refer to the separate data sheets

	AM	AM Bus	AMExB/AMExC	AMExB/ AMExC Bus
Voltage supply	3-phase AC 50 Hz: 220 V; 230 V; 240 V; 380 V; 400 V; 415 V; 500 V			
	3-phase AC 60 Hz: 440 V; 460 V; 480 V			
	1-phase AC[1] 50 Hz: 220 V; 230 V; 240 V 1-phase AC[1] 60 Hz: 110 V; 115 V; 120 V			
External supply of the electronics (option)	24 V DC +20 %/–15 % Current input: Basic version approx. 200 mA, with options up to 500 mA			
Switchgear (standard)	Reversing contactors[2)] (mechanically and electrically interlocked) for motor power up to 1.5 kW			
Switchgear (options)	Reversing contactors[2)] (mechanically and electrically interlocked) for motor power up to 7.5 kW			
	Thyristor unit (recommended for modulating actuators)		–	–
	for motor power up to 1.5 kW, 500 V AC, with internal fuses		–	–
	for motor power up to 3.0 kW, 500 V AC, with internal fuses		–	–
	for motor power up to 5.5 kW, 500 V AC, external fuses required		–	–
Control	Standard Control inputs 24 V DC, OPEN - STOP - CLOSE (via opto-isolator, one common), current consumption: observe approx. 10 mA minimum pulse duration per input for modulating actuators	via bus	Standard Control inputs 24 V DC, OPEN – STOP - CLOSE (via opto-isolator, one common), current consumption: observe approx. 10 mA minimum pulse duration per input for modulating actuators	via bus
	Option Same as standard with 115 V AC, current consumption: approx. 15 mA per input		Option Same as standard with 115 V AC, current consumption: approx. 15 mA per input	
Feedback signals	5 output relays with gold-plated contacts: 4 NO contacts with one common: max. 250 V AC, 0.5 A (resistive load) Standard configuration: end position CLOSED, end position OPEN, selector switch REMOTE, selector switch LOCAL 1 potential-free change-over contact, max. 250 V AC, 0,5 A (resistive load) for collective fault signal: torque fault, phase failure, motor protection tripped	via bus	5 output relays with gold-plated contacts: 4 NO contacts with one common, max. 250 V AC, 0.5 A (resistive load) Standard configuration: end position CLOSED, end position OPEN, selector switch REMOTE, selector switch LOCAL 1 potential-free change-over contact, max. 250 V AC, 0.5 A (resistive load) for collective fault signal: torque fault, phase failure, motor protection tripped	via Bus
	Option (in combination with positioner) End position OPEN, end position CLOSED (requires tandem switch within actuator) Selector switch REMOTE, selector switch LOCAL via selector switch 2nd level 1 potential-free change-over contact, max. 250 V AC, 0.5 A (resistive load)		Option (in combination with positioner) End position OPEN, end position CLOSED (requires tandem switch within actuator) Selector switch REMOTE, selector switch LOCAL via selector switch 2nd level 1 potential-free change-over contact, max. 250 V AC 0.5 A (resistive load)	
Position feedback signal (option)	Analogue output E2 = 0/4 – 20 mA (load max. 500 Ohm)	via bus	Analogue output E2 = 0/4 – 20 mA (load max. 500 Ohm)	via bus
Voltage output	Standard Auxiliary voltage 24 V DC, max. 50 mA for supply of the control inputs, galvanically isolated from internal voltage supply			
	Option Auxiliary voltage 115 V AC, max. 30 mA for supply of the control inputs, galvanically isolated from internal voltage supply			

1 The explosion-proof versions AMExC with 1-phase AC supply can only be used in combination with SGExC part-turn actuators.

2 The reversing contactors are designed for a lifetime of 2 million starts. For applications requiring a high number of starts, we recommend the use of thyristor units.

Certificates

EU Directives

Declaration of Incorporation in compliance with the Machinery Directive and Declaration of Conformity according to the ATEX, 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 ATEX, 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

To prove the suitability of the devices for special applications, notified bodies perform type tests on the devices. One example are the tests to which explosion-proof devices are subjected. If a device has passed the test, this is recorded in a certificate. For all explosion-proof 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 website around the clock; some of them are password protected.

- www.auma.com

SIL Functional safety

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

The actuator specialist

At AUMA, everything revolves around the electric actuator. In a world where industrial processes have become increasingly complex, concentration is an asset – while still being able to see the bigger picture.

AUMA has to cope with a multitude of requirements from the most different applications and from every corner of the world - this is our daily business. We rise to this challenge by pursuing a clear but flexible product policy – supplying the ideal actuator to every customer.

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

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 actuator.

Quality is not just a matter of trust

Actuators must be reliable and dependable. They determine the steps of accurately 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 conscientious production using highly sophisticated machinery in clearly controlled and supervised steps, while keeping in mind the environment.

The importance of environmentally sound production is reflected in our certifications according to ISO 9001 and ISO 14001. At AUMA, quality management is not considered as a single and static matter but is monitored on a daily basis. Numerous customer and independent audits confirm these high standards.

Further literature/Index

Further literature

Brochures

- Information
  Electric actuators and valve gearboxes according to ATEX directive 94/9/EC for the use in potentially explosive atmospheres
- Information
  Electric actuators with fieldbus interfaces
- Product description
  Actuator controls AUMATIC
- Product description
  Electric multi-turn actuators SA 07.1 – SA 48.1
- Product description
  Electric part-turn actuators SG 05.1 - SG 12.1

Technical data

- Actuator controls AUMA MATIC AM 01.1 – 02.1
- Actuator controls AUMA MATIC AMExB 01.1
- Actuator controls AUMA MATIC AMExC 01.1
- Actuator controls AUMA MATIC
  AM 01.1 – 02.1 Profibus DP
- Actuator controls AUMA MATIC AMExB 01.1
  Profibus DP
- Actuator controls AUMA MATIC AMExC 01.1
  Profibus DP
- Actuator controls AUMA MATIC
  AM 01.1 – 02.1 Modbus
- Actuator controls AUMA MATIC
  AMExB 01.1 Modbus
- Actuator controls AUMA MATIC AMExC 01.1
  Modbus

Furthermore, there are dimension sheets and wiring diagrams available.

The latest issues of all documentation can be downloaded as PDF files from www.auma.com.

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auma®

Solutions for a world in motion

[1] Multi-turn actuators
SA 07.2 – SA 16.2/SA 25.1 – SA 48.1
Torques from 10 to 32,000 Nm
Output speeds from 4 to 180 rpm

[2] Multi-turn actuators SA/SAR
with controls AUMATIC
Torques from 10 to 1,000 Nm
Output speeds from 4 to 180 rpm

[3] Linear actuators SA/LE
Combination of multi-turn actuator SA
with linear thrust unit LE
Thrusts from
4 kN to 217 kN
Strokes up to 500 mm
Linear speeds
from 20 to 360 mm/min

[4] Part-turn actuators
SG 05.1 – SG 12.1
Torques from 100 to 1,200 Nm
Operating times for 90° from 4 to 180 s

[5] Part-turn actuators SA/GS
Combination of multi-turn actuator SA with
part-turn gearbox GS
Torques up to 675,000 Nm

[6] Bevel gearboxes
GK 10.2 – GK 40.2
Torques up to 16,000 Nm

[7] Spur gearboxes
GST 10.1 – GST 40.1
Torques up to 16,000 Nm

[8] Worm gearboxes with base and lever
GF 50.3 – GF 250.3
Torques up to 32,000 Nm

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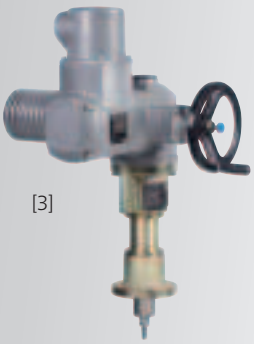
[1]

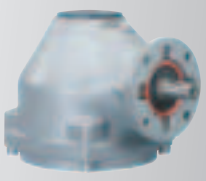
[2]



[3]

[4]

[5]



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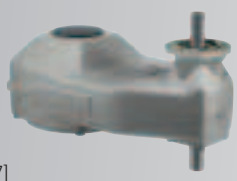

[7]

[8]

Y000.041/002/en/1.10