AC 01.2-SIL
Modbus RTU
Technical data Actuator controls in SIL version
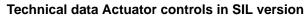
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General information

AC 01.2 actuator controls in SIL version for controlling multi-turn actuators of the SA/SAR type range and part-turn actuators of the SQ/SQR .2 type range with Modbus RTU interface.

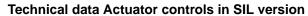### Information on SIL features of AC 01.2-SIL actuator controls

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Features and functions

SIL control	Via digital inputs Safe ESD a,b and/or Safe STOP OPEN/CLOSE
Control voltage/current consumption for inputs of the SIL functions	24 V DC, current consumption: approx. 10 mA per input
SIL status signal	1 potential-free change-over contact (max. 24 V DC/1 A) for SIL collective failure signal
SIL functions - safety functions	Standard: - Safe ESD - Digital inputs (redundant inputs) low active - Reaction can be selected: Run to end position CLOSED (Safe ESD CLOSE, CLOSE), run to end position OPEN (Safe ESD OPEN, OPEN) - Torque monitoring and forced limit seating (OPEN and CLOSE) for Safe ESD can be by-passed - Thermal protection for Safe ESD can be by-passed - Seating types can be set - Forced limit seating in end position (Actuator only stops once end positions OPEN or CLOSED are reached irrespective of the torque applied.) - Limit seating with overload protection (Once the set tripping point in end positions OPEN or CLOSED has been reached, the actuator will be switched off. If excessive torque is applied during travel, the actuator is already switched off prior to reaching the end position.) - Forced torque seating (Actuator only stops when reaching the set end position torque.) Options: - Safe STOP 2 digital inputs (OPEN and CLOSE) low active - Reaction can be selected: STOP in direction OPEN (Safe STOP OPEN) and/or STOP in direction CLOSE (Safe STOP CLOSE) - Combination of Safe ESD and Safe STOP
Local controls	Safety functions are executed irrespective of selector switch position LOCAL - OFF - REMOTE.
SIL monitoring functions	- Actuator operation monitoring, generates SIL fault signal - Monitoring of redundant wiring Safe ESD: In case of incorrect wiring, a SIL fault signal is generated - Internal monitoring of the SIL components of the controls. In case of a fault, a SIL fault signal is generated.
Configuration	Due to the requirements on functional safety, other restrictions with regard to configuration options of the actuator and the actuator controls not listed here do apply.
Actuator version in combination with AC .2-SIL	- The actuator must be equipped with a blinker transmitter. - The actuator is supplied with the motor locked in disengaged position. Motor operation will only be possible once the lock is disabled.

Further options for version with MWG in actuator

SIL limit switches	Forced limit seating in end position
Actuator version in combination with AC .2-SIL	Only actuators in clockwise closing version may be used.

Information on general features of AC 01.2-SIL actuator controls

Features and functions

Power supply	Standard voltages AC:										

3-phase AC Voltages/frequencies											
Volt	220	230	380	380	400	400	415	440	460	480	500
Hz	60	50	50	60	50	60	50	60	60	60	50

Special voltages AC:

3-phase AC Voltages/frequencies								
Volt	220	240	525	575	575	600	660	690
Hz	50	50	50	50	60	60	50	50

Permissible variation of mains voltage: ±10 %
Permissible variation of mains frequency: ±5 %

660 V and 690 V not permissible in combination with thyristors

External supply of the electronics (option)	24 V DC +20 %/–15 % Current consumption: Basic version approx. 250 mA, with options up to 500 mA External power supply must have reinforced insulation against mains voltage in accordance with IEC 61010-1 and may only be supplied by a circuit limited to 150 VA in accordance with IEC 61010-1. The "external supply of electronics" option refers to the components of the standard actuator controls. However, the SIL components of the actuators controls are not supplied.
Current consumption	Current consumption of the actuator controls depending on mains voltage: For permissible variation of mains voltage of ±10 %: 208 to 240 V AC = max. 400 mA 380 to 500 V AC = max. 250 mA 515 to 690 V AC = max. 200 mA
Overvoltage category	Category III according to IEC 60364-4-443
Rated power	Actuator controls are designed for nominal motor power, refer to Electrical data pertaining to the actuator

Switchgear	Open-close duty:	Reversing contactors (mechanically and electrically interlocked) for AUMA power classes A1/A2
	Modulating duty:	Thyristor unit for mains voltage up to 600 V AC (required to meet the safety figures for modulating actuators) for AUMA power classes B1 and B2
	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. For the assignment of AUMA power classes, please refer to Electrical data on actuator	

Control and feedback signals	Via Modbus RTU interface
Redundancy (option)	Redundant line topology with universal redundancy behaviour according to AUMA redundancy I or II Redundant loop topology in combination with SIMA Master Station - Max. number of actuators with actuator controls per redundant loop: 247 units - Max. possible cable length between the actuators equipped with actuator controls without external repeater: 1,200 m - Max. possible total length per redundant ring: approx. 290 km - Automatic commissioning of the redundant ring by means of the SIMA Master Station

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Information on general features of AC 01.2-SIL actuator controls

Features and functions		

Local controls	Standard:	• Selector switch: LOCAL - OFF - REMOTE (lockable in all three positions)
		• Push buttons OPEN, STOP, CLOSE, RESET
		  - Local STOP
		    The actuator can be stopped via push button STOP of local controls if the selector switch is in position REMOTE. (Not activated when leaving the factory.)
		• 6 indication lights:
		  - End position and running indication CLOSED (yellow), torque fault CLOSE (red), motor protection tripped (red), torque fault OPEN (red), end position and running indication OPEN (green), Bluetooth (blue)
		• Graphic LC display: illuminated

	Option:	• Special colours for the indication lights: - End position CLOSED (green), torque fault CLOSE (blue), torque fault OPEN (yellow), motor protection tripped (violet), end position OPEN (red)
Bluetooth Communication interface	Bluetooth class II chip, version 2.1: With a range up to 10 m in industrial environments, supports the SPP Bluetooth profile (Serial Port Profile). Required accessories: • AUMA CDT (Commissioning and Diagnostic Tool for Windows-based PC) • AUMA Assistant App (Commissioning and Diagnostic Tool for Android devices)	

Application functions	Standard:	• Selectable type of seating, limit or torque seating for end position OPEN and end position CLOSED
		• Torque by-pass: Adjustable duration (with adjustable peak torque during start-up time)
		• Start and end of stepping mode as well as ON and OFF times can be set individually for directions OPEN and CLOSE, 1 to 1,800 seconds
		• Any 8 intermediate positions: can be set between 0 and 100 %, reaction and signal behaviour programmable
		• Running indication blinking: can be set
		• Positioner
		  - Position setpoint via Modbus RTU interface
		  - Programmable behaviour on loss of signal
		  - Automatic adaptation of dead band (adaptive behaviour selectable)
		  - Split range operation
		  - Change-over between OPEN-CLOSE control and setpoint control possible viafieldbus interface

	Options:	• PID process controller: with adaptive positioner, via 0/4 – 20 mA analogue inputs for process setpoint and actual process value
Monitoring functions	• Valve overload protection: adjustable, results in switching off and generates fault signal • Motor temperature monitoring (thermal monitoring): results in switching off and generates fault indication • Monitoring the heater within actuator: generates warning signal • Monitoring of permissible on-time and number of starts: adjustable, generates warning signal • Operation time monitoring: adjustable, generates warning signal • Phase failure monitoring: results in switching off and generates fault signal	
Diagnostic functions	• Electronic device ID with order and product data • Logging of operating data: A resettable counter and a lifetime counter each for: • Time-stamped event report with history for setting, operation and faults • Status signals according to NAMUR recommendation NE 107: "Failure", "Function check", "Out of specification", "Maintenance required"	
Motor protection evaluation	Standard:	Monitoring the motor temperature in combination with thermoswitches within actuator motor
	Option:	PTC tripping device in combination with PTC thermistors within actuator motor
Overvoltage protection (option)	Protection of the actuator and control electronics against overvoltages on the fieldbus cables of up to 4 kV	
Electrical connection	Standard:	AUMA plug/socket connector with screw-type connection
	Options:	• Screw-type or crimp-type connection • Gold-plated control plug (sockets and plugs)
Threads for cable entries	Standard:	Metric threads
	Options:	• Pg-threads, NPT-threads, G-threads • Terminals or crimp-type connection
Wiring diagram (basic version)	TPCCC0G4-1A1-A000 TPA00R1AA-1A1-AB0	

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Further options for Non-intrusive version with MWG in the actuator

Setting of limit and torque switching via local controls	
Torque feedback signal	Via Modbus RTU interface Galvanically isolated analogue output 0/4 – 20 mA (load max. 500 Ω). Option, only possible in combination with output contacts.
Diagnostic function	• Torque characteristics - 3 torque characteristics (torque-travel characteristic) for opening and closing directions can be saved separately. Torque characteristics stored can be shown on the display.
Wiring diagram (basic version)	TPCCC0G4-1A1-A000 TPA00R10A-1I1-AB0

Settings/programming the Modbus RTU interface

Setting the fieldbus address	Baud rate, parity and Modbus address are set via the display of actuator controls

General data of the Modbus RTU interface

Communication protocol	Modbus RTU according to IEC 61158 and IEC 61784
Network topology	• Line (fieldbus) structure. When using repeaters, tree structures can also be implemented. • Coupling and uncoupling of devices during operation without affecting other devices is possible.
Transmission medium	Twisted, screened copper cable according to IEC 61158
Fieldbus interface	EIA-485 (RS-485)
Transmission rate/cable length	Redundant line topology:

Baud rate (kbit/s)	Max. cable length (segment length) without repeater	Possible cable length with repeater (total network cable length)
9.6 – 115.2	1,200 m	approx. 10 km

Redundant ring topology:

Baud rate (kbit/s)	Max. cable length between actuators (without repeater)	Max. possible cable length of redundant loop
9.6 – 115.2	1,200 m	approx. 290 km

Device types	Modbus slave, e.g. devices with digital and/or analogue inputs/outputs such as actuators, sensors
Number of devices	32 devices in each segment without repeater, with repeaters expandable to 247
Fieldbus access	Polling between master and slaves (query response)
Supported Modbus functions (services)	01 Read Coil Status 02 Read Input Status 03 Read Holding Registers 04 Read Input Registers 05 Force Single Coil 15 (0FHex) Force Multiple Coils 06 Preset Single Register 16 (10Hex) Preset Multiple Registers 17 (11Hex) Report Slave ID 08 Diagnostics: • 00 00 Loopback • 00 10 (0AHex) Clear Counters and Diagnostic Register • 00 11 (0BHex) Return Bus Message Count • 00 12 (0CHex) Return Bus Communication Error Count • 00 13 (0DHex) Return Bus Exception Error Count • 00 14 (0EHex) Return Slave Message Count • 00 15 (0FHex) Return Slave No Response Count • 00 16 (10Hex) Return Slave NAK Count • 00 17 (11Hex) Return Slave Busy Count • 00 18 (12Hex) Return Character Overrun Count

Commands and signals of the Modbus RTU interface

Process representation output (command signals)	OPEN, STOP, CLOSE, position setpoint, RESET, EMERGENCY operation command, enable LOCAL, Interlock OPEN/CLOSE
Process representation input (feedback signals)	• End position OPEN, CLOSED • Actual position value • Actual torque value, requires MWG in actuator • Selector switch in position LOCAL/REMOTE • Running indication (directional) • Torque switch OPEN, CLOSED • Limit switch OPEN, CLOSED • Manual operation by handwheel or via local controls • Analogue (2) and digital (4) customer inputs
Process representation input (fault signals)	• Motor protection tripped • Torque switch tripped in mid-travel • One phase missing • Loss of the analogue customer inputs
Behaviour on loss of communication	The behaviour of the actuator is programmable: • Stop in current position • Travel to end position OPEN or CLOSED • Travel to any intermediate position • Execute last received operation command

Service conditions

Use	Indoor and outdoor use permissible	
Mounting position	Any position	
Installation altitude	≤ 2 000 m above sea level > 2,000 m above sea level, on request	
Ambient temperature	Standard:	–25 °C to +70 °C
	Options:	–60 °C to +60 °C, extreme low temperature version
		Low temperature versions with heating system only
Humidity	Up to 100 % relative humidity across the entire permissible temperature range	
Enclosure protection according to EN 60529	Standard:	IP68
	Option:	Terminal compartment additionally sealed against interior of actuator controls (double sealed)
	According to AUMA definition, enclosure protection IP68 meets the following requirements: • Depth of water: Maximum 8 m head of water • Duration of continuous immersion in water: Maximum 96 hours	
Pollution degree according to IEC 60664-1	Pollution degree 4 (when closed), pollution degree 2 (internal)	
Vibration resistance according to IEC 60068-2-6	1 g, from 10 Hz to 200 Hz Resistant to vibration during start-up or for failures of the plant. However, a fatigue strength may not be derived from this. (Not valid in combination with gearboxes)	
Corrosion protection	Standard:	KS: Suitable for use in areas with high salinity, almost permanent condensation, and high pollution.
	Option:	KX: Suitable for use in areas with extremely high salinity, permanent condensation, and high pollution.
Coating	Double layer powder coating Two-component iron-mica combination	
Colour	Standard:	AUMA silver-grey (similar to RAL 7037)
	Option:	Available colours on request

Accessories	
Wall bracket	For actuator controls mounted separately from the actuator, including plug/socket connector. Connecting cable on request.
	Recommended for high ambient temperatures, difficult access, or heavy vibration during service.
	Cable length between actuator and actuator controls is max. 100 m (Not suitable for version with potentiometer in the actuator). Instead of the potentiometer, the actuator has to be equipped with an electronic position transmitter. (MWG requires a separate data cable.)
Programming software	AUMA CDT (Commissioning and Diagnostic Tool for Windows-based PC)
	AUMA Assistant App (Commissioning and Diagnostic Tool for Android devices)

Further information	
Weight	Approx. 7 kg (with AUMA plug/socket connector)
EU Directives	Functional safety of electrical/electronic/programmable electronic safety-related systems: (IEC 61508)
	Electromagnetic Compatibility (EMC): (2014/30/EU)
	Low Voltage Directive: (2014/35/EU)
	Machinery Directive: (2006/42/EC)
Reference documents	Brochure Electric actuators for industrial valve automation
	Dimensions Multi-turn actuators with AUMATIC integral controls
	Dimensions Part-turn actuators with AUMATIC integral controls
	Manual Functional Safety Actuators SA 07.2 – SA 16.2/SAR 07.2 – SAR 16.2/SAEx 07.2 – SAEx 16.2/SAREx 07.2 – SAREx 16.2, SQ 05.2 – SQ 14.2/ SQR 05.2 – SQR 14.2/ SQEx 05.2 – SQEx 14.2/ SQREx 05.2 – SQREx 14.2 with actuator controls AC 01.2/ACExC 01.2 in SIL version

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