

General information

ACExC 01.2 actuator controls in SIL version for controlling multi-turn actuators of the SAEx/SAREx .2 type range and part-turn actuators of the SQEx/SQREx .2 type range with Modbus RTU interface.

Information on SIL features of ACExC 01.2 – SIL actuator controls

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:	<ul style="list-style-type: none"> • Safe ESD <ul style="list-style-type: none"> - 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 <ul style="list-style-type: none"> - 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:	<ul style="list-style-type: none"> • Safe STOP <ul style="list-style-type: none"> - 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 (in this case, Safe ESD has priority)
Local controls	Safety functions are executed irrespective of selector switch position LOCAL - OFF - REMOTE.	
SIL monitoring functions	Standard:	<ul style="list-style-type: none"> • 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.
	Option:	<ul style="list-style-type: none"> • Safe end position feedback
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 ACExC .2-SIL	<ul style="list-style-type: none"> • 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 seating type in end position
Actuator version in combination with ACExC .2-SIL	Only actuators in clockwise closing version may be used.

Technical data Actuator controls in SIL version

Information on general features of ACExC 01.2-SIL actuator controls

Features and functions																																																													
Explosion protection	<p>Standard: II2G Ex de IIC T4 or T3 II2D Ex tb IIIC T130 °C or T190 °C Db IP6x</p> <p>Option: II2G Ex d IIC T4 or T3</p>																																																												
EC type test certificate	<p>In combination with SAEx: DEKRA 11ATEX0008 X</p> <p>In combination with SQEx: DEKRA 13ATEX00016 X</p>																																																												
Power supply	<p>Standard voltages AC:</p> <table border="1"> <thead> <tr> <th colspan="12">3-phase AC current Voltages/frequencies</th> </tr> <tr> <th>Volt</th> <td>220</td> <td>230</td> <td>380</td> <td>380</td> <td>400</td> <td>400</td> <td>415</td> <td>440</td> <td>460</td> <td>480</td> <td>500</td> </tr> <tr> <th>Hz</th> <td>60</td> <td>50</td> <td>50</td> <td>60</td> <td>50</td> <td>60</td> <td>50</td> <td>60</td> <td>60</td> <td>60</td> <td>50</td> </tr> </thead> </table> <p>Special voltages AC:</p> <table border="1"> <thead> <tr> <th colspan="8">3-phase AC current Voltages/frequencies</th> </tr> <tr> <th>Volt</th> <td>220</td> <td>440</td> <td>525</td> <td>575</td> <td>600</td> <td>660</td> <td>690</td> </tr> <tr> <th>Hz</th> <td>50</td> <td>50</td> <td>50</td> <td>60</td> <td>60</td> <td>50</td> <td>50</td> </tr> </thead> </table> <p>Permissible variation of mains voltage: ±10 % Permissible variation of mains frequency: ±5 % 660 V and 690 V not permissible in combination with thyristors</p>	3-phase AC current 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	3-phase AC current Voltages/frequencies								Volt	220	440	525	575	600	660	690	Hz	50	50	50	60	60	50	50
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External supply of the electronics (option)	<p>24 V DC: +20 %/-15 %, Current consumption: Basic version approx. 250 mA, with options up to 500 mA</p> <p>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.</p> <p>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.</p>																																																												
Current consumption	<p>Current consumption of controls depending on mains voltage: For permissible variation of mains voltage of ±10 %:</p> <ul style="list-style-type: none"> • 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	<p>Open-close duty: Reversing contactors (mechanically and electrically interlocked) for AUMA power classes A1/A2</p> <p>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</p> <p>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.</p>																																																												
Control and feedback signals	Via Foundation Fieldbus H1 interface																																																												
Redundancy (option)	Redundant FF H1 interface in accordance with AUMA redundancy I																																																												
Local controls	<p>Standard:</p> <ul style="list-style-type: none"> • Selector switch: LOCAL - OFF - REMOTE (lockable in all three positions) • Push buttons: OPEN, STOP, CLOSE, RESET <ul style="list-style-type: none"> - 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: <ul style="list-style-type: none"> - 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 <p>Option:</p> <ul style="list-style-type: none"> • Special colours for the indication lights: <ul style="list-style-type: none"> - End position CLOSED (green), torque fault CLOSE (blue), torque fault OPEN (yellow), motor protection tripped (violet), end position OPEN (red) 																																																												

We reserve the right to alter data according to improvements made. Previous documents become invalid with the issue of this document.

Technical data Actuator controls in SIL version

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: <ul style="list-style-type: none"> • AUMA CDT (Commissioning and Diagnostic Tool for Windows-based PC) • AUMA Assistant App (Commissioning and Diagnostic Tool for Android devices) 	
Application functions	Standard:	<ul style="list-style-type: none"> • 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 between 0 and 100 %, reaction and signal behaviour programmable • Running indication blinking: can be set • Positioner: <ul style="list-style-type: none"> - Position setpoint via fieldbus interface - Automatic adaptation of dead band (adaptive behaviour selectable) - Change-over between OPEN-CLOSE control and setpoint control via fieldbus
	Option:	<ul style="list-style-type: none"> • PID process controller: With adaptive positioner, via 0/4 – 20 mA analogue inputs and Profibus for process setpoint and actual process value
Monitoring function	<ul style="list-style-type: none"> • 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 function	<ul style="list-style-type: none"> • Electronic device ID with order and product data • Logging of operating data: A resettable counter and a lifetime counter each • 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:	PTC tripping device in combination with PTC thermistors within actuator motor
	Option:	Thermal overload relay in controls combined with thermostats within actuator
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 Ex plug/socket connector with screw-type terminals (KP)
	Options:	<ul style="list-style-type: none"> • AUMA Ex plug/socket connector with terminal blocks (KES), increased safety Ex e • AUMA Ex plug/socket connector with terminal blocks (KES), flameproof enclosure Ex d
Threads for cable entries	Standard:	Metric threads
	Options:	Pg-threads, NPT-threads, G-threads
Wiring diagram (basic version)	TPCCF0G4-1A1-A410 TPA00R2AA-1A1-AB0	

Further options for version with MWG in actuator

Setting of limit and torque switching via local controls

Torque feedback signal	Via fieldbus interface
Diagnostic functions	<ul style="list-style-type: none"> • Torque characteristics <ul style="list-style-type: none"> - 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)	TPCCF0G4-1A1-A410 TPA00R20A-1I1-AB0

Setting/programming the Foundation Fieldbus interface

Setting the fieldbus address	The address is set via Foundation Fieldbus while using the provided system management services and a configuration software for Foundation Fieldbus (e.g. NI-FBUS).
Configurable feedback signals	The feedback signals of the "Analog Input" (AI) and "Discrete Input" (DI) function blocks may be configured according to the requirements using channels and the appropriate transducer blocks. Configuration is made via Foundation Fieldbus while using the device description and a configuration software for Foundation Fieldbus (e.g. NI-FBUS)

Technical data Actuator controls in SIL version

Programming of user functions	User functions (e.g. stepping mode, intermediate positions, ...) may either be programmed via display or via Foundation Fieldbus using the device description and a configuration software for Foundation Fieldbus (e.g. NI-FBUS).
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General data of the Foundation Fieldbus interface	
Communication protocol	Foundation Fieldbus H1 (31.25 kbit/s) in accordance with IEC 61158 and IEC 61784-1
Physical Layer	Separate supply, standard data transmission
Network topology	Line, star and tree structures (trunks combined with spurs) are supported. Internal drop line length of ACExC 01.2-SIL is 0.27 m.
Transmission medium	Two-wire copper cable with data transmission and voltage supply on the same wire pair in accordance with: <ul style="list-style-type: none"> ISA S50.02-1992 ISA Physical Layer Standard or IEC 61158-2:2000 (ed. 2.0), Fieldbus standard for use in industrial control systems, Part 2: Physical Layer specification and service definition Recommendation: Use cable type A (screened and twisted)
Current consumption	Approx. 13 mA at +24 V DC
Transmission rate	31.25 kbit/s
Cable length	Max. 1,900 m (only when using the recommended A type cable); with repeaters (4 units max.) expandable up to a max. of 9.5 km
Number of devices	<ul style="list-style-type: none"> Max. 32 devices per segment; all in all max. 240 devices can be addressed Typical number of devices: approx. 6 – 15 devices per segment
Communication services	<ul style="list-style-type: none"> Publisher/subscriber communication for the transmission of process data Client/server communication for programming and configuration Report distribution for transmission of alarm signals
Supported Foundation Fieldbus functions	ACExC 01.2-SIL is a Link Master device. Link Master devices can take over the Link Active Scheduler (LAS) function for bus communication coordination.
Permissive connection	ACExC 01.2-SIL controls offer an automatic polarity detection and polarity correction of the Foundation Fieldbus cable.

Function blocks of the AUMATIC Foundation Fieldbus interface	
Function blocks of the output signals	<ul style="list-style-type: none"> 8 Discrete Output (DO) function blocks for discrete output signals, e.g.: <ul style="list-style-type: none"> OPEN, STOP, CLOSE RESET EMERGENCY Interlock OPEN/CLOSE Enable Local Intermediate positions Digital customer outputs 2 Analog Output (AO) function blocks for analogue output signals, e.g.: <ul style="list-style-type: none"> Setpoint position Analogue customer outputs
Function blocks for input signals	<ul style="list-style-type: none"> 10 Discrete Input (DI) function blocks for discrete feedback signals, e.g.: <ul style="list-style-type: none"> End positions OPEN/CLOSED Selector switch in position LOCAL/REMOTE Running indication (directional) Torque switches OPEN, CLOSED Limit switches OPEN, CLOSED Manual operation by handwheel or via local controls Intermediate positions Digital customer inputs 4 Analog Input (AI) function blocks for analogue feedback signals, e.g.: <ul style="list-style-type: none"> Actual position Torque Analogue 0 – 20 mA customer inputs

Technical data Actuator controls in SIL version

Further function blocks	<ul style="list-style-type: none"> • 1 Signal Characterizer function block (SC) for conversion of analogue signals • 1 Input Selector (IS) function block for the selection of analogue input signals • 1 Process controller (PID) block as function block for modulating applications • Resource Block (RB) for defining characteristic Foundation Fieldbus device data • 4 Transducer Blocks (AOTB, DOTB, AITB, DITB) as connection blocks for discrete and analogue input and output signals • 1 Transducer Block (PTB) as connection block for control • 1 Transducer Block (AUMACTB) for configuration and programming • 1 Transducer Block (AUMACTB) for monitoring and diagnostics
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Special features of the AUMATIC Foundation Fieldbus interface

Manufacturer ID	0x0A01FF
Device type	0x0001
Device revision	0x01 or 0x02
Device ID	0A01FF0001-(serial number of ACEXC 01.2-SIL-x)-(serial number FF module)
Baud rate	31.25 kbit/s
Polarity	No polarity (automatic polarity detection and correction)

Segment information

Standard	FF H1
Link master (LAS) function	Yes
Current consumption	13 mA
FF connection current	< 20 mA
Device voltage min/max	9 – 32 V DC
FISCO ic characteristics	FF capacity: $C_i < 5 \text{ nF}$, FF inductivity: $L_i < 10 \text{ } \mu\text{H}$, Minimum input current: $I_i = 380 \text{ mA}$, Minimum input voltage: $U_i = 17.5 \text{ V}$, Minimum input power: $P_i = 5.32 \text{ W}$
Jitter tolerance range	< $\pm 8 \text{ } \mu\text{s}$
Min. transmission level ($V_p\text{-}t\text{-}p$)	> 0.75 V
Available server VCRs	23
Available source VCRs	23
Available publisher VCRs	23
Available subscriber VCRs	23
DD revision	0x01
CFF revision	020101
ITK revision	6.1.2

Available channels

Analog Output (AO) function blocks	0, 1, 3, 20, 21
Discrete Output (DO) function blocks	0, 2, 4 – 19
Analog Input (AI) function blocks	0, 67, 68, 69, 70
Discrete Input (DI) function blocks	0, 22 – 66, 71

Number of function blocks with the respective execution times [ms]

8 Discrete Output (DO) function blocks	30
2 Analog Output (AO) function blocks	30
10 Discrete Input (DI) function blocks	20
4 Analog Input (AI) function blocks	30

Technical data Actuator controls in SIL version

1 Signal Characterizer (SC) function block	40
1 Input Selector (IS) function block	30
1 Proportional/Integral/Differential (PID) function block	40
1 Proportional/Integral/Differential (PID) function block	40

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 +40 °C/+60 °C
	Options: -60 °C to +40 °C/+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	IP68
	According to AUMA definition, enclosure protection IP68 meets the following requirements: <ul style="list-style-type: none"> • Depth of water: maximum 8 m head of water • Duration of continuous immersion in water: Max. 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.
	Options: 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	Actuator controls separately mounted from the actuator, including plug/socket connector. Connecting cable on request. Recommended for high ambient temperatures, difficult access, or in case of 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. 12 kg (including Ex-plug/socket connector with screw-type terminals)
Directives	Functional safety of electrical/electronic/programmable electronic safety-related systems: (IEC 61508) ATEX Directive: (2014/34/EU) Electromagnetic Compatibility (EMC): (2014/30/EU) Low Voltage Directive: (2014/35/EU) Machinery Directive: (2006/42/EC)

Reference documents

Brochure Electric actuators for the automation of valves in the oil and gas industry

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