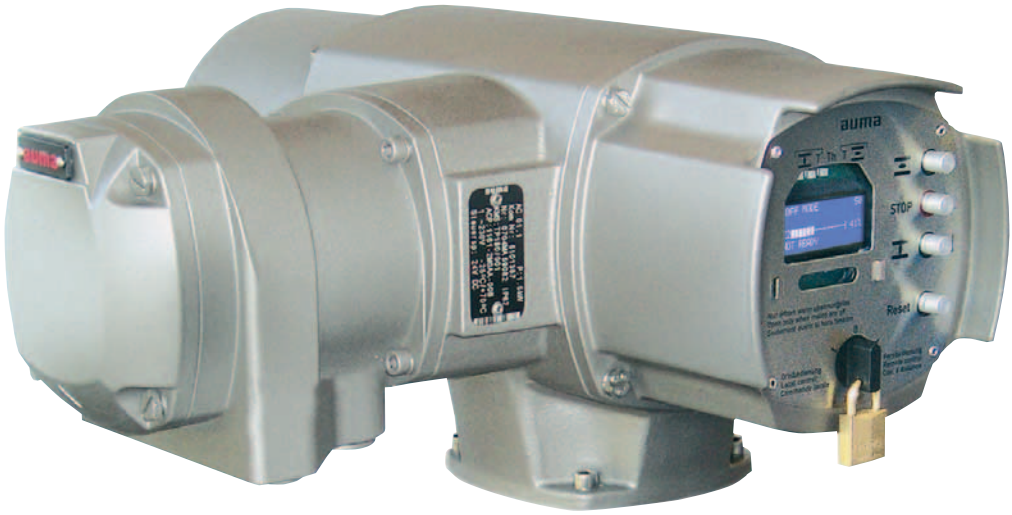
auma®

Actuator controls

AUMATIC
AC 01.1
ACExC 01.1
Modbus



ISO 14001
TÜV SÜD
ISO 9001
Certificate Registration No.
12 100/104 4269

Operation instructions

Scope of these instructions:	These instructions are valid for multi-turn actuators of the type ranges SA(R) 07.1 – SA(R) 16.1 and SA(R)ExC 07.1 – SA(R)ExC 16.1 as well as for part-turn actuators of the type ranges SG 05.1 – SG 12.1 and SGExC 05.1 – SGExC 12.1 with the controls AUMATIC AC 01.1 or ACExC 01.1 with Modbus interface.

Table of contents

1. Safety instructions

1.1 Range of application

AUMA actuators are designed for the operation of industrial valves, e.g. globe valves, gate valves, butterfly valves and ball valves.
For other applications, please consult us. The manufacturer is not liable for any possible damage resulting from use in other than the designated applications. Such risk lies entirely with the user.
Observance of these operation instructions is considered as part of the controls' designated use.

1.2 Commissioning (electrical connection)

During electrical operation certain parts inevitably carry lethal voltages. Work on the electrical system or equipment must only be carried out by a skilled electrician himself or by specially instructed personnel under the control and supervision of such an electrician and in accordance with the applicable electrical engineering rules.

1.3 Maintenance

The maintenance instructions must be strictly observed, otherwise a safe operation of the controls is no longer guaranteed.

1.4 Warnings and notes

Non-observance of the warnings and notes may lead to serious injuries or damage. Qualified personnel must be thoroughly familiar with all warnings and notes in these operation instructions.
Correct transport, proper storage, mounting and installation, as well as careful commissioning are essential to ensure a trouble-free and safe operation.
The following references draw special attention to safety-relevant procedures in these operation instructions. Each is marked by the appropriate pictograph.

This pictograph means: Note!
"Note" marks activities or procedures which have major influence on the correct operation. Non-observance of these notes may lead to consequential damage.

This pictograph means: Electrostatically endangered parts!
If this pictograph is attached to a printed circuit board, it contains parts which may be damaged or destroyed by electrostatic discharges. If the boards need to be touched during setting, measurement or for exchange, it must be assured that immediately before a discharge through contact with an earthed metallic surface (e.g. the housing) has taken place.

This pictograph means: Warning!
"Warning" marks activities or procedures which, if not carried out correctly, can affect the safety of persons or material.

2. Short description

AUMA actuators have a modular design. Motor and gearing are mounted in a common housing.
The actuators are driven by an electric motor and controlled with the electronic controls AUMATIC. The electronic controls are included in the scope of delivery.

3. Transport and storage

- Transport to place of installation in sturdy packing.
- Do not attach ropes or hooks to the handwheel for the purpose of lifting by hoist.
- Store in well-ventilated, dry room.
- Protect against floor dampness by storage on a shelf or on a wooden pallet.
- Cover to protect against dust and dirt.
- Apply suitable corrosion protection agent to bright surfaces.

4. General information about Modbus

For the exchange of information among automation systems and between automation systems and the connected decentral field devices, serial fieldbuses are mainly used today as the communication system. Thousands of applications have proved impressively that cost savings of up to 40 % in wiring, commissioning and maintenance are achieved by using fieldbus technology. Just two wires are needed to transmit all relevant information for the field devices, such as input and output signals, parameters and diagnostics data. While in the past the fieldbuses used were often manufacturer specific and incompatible with other bus systems, the systems employed today are almost exclusively open and standardized. This means that the user is independent of individual suppliers and can choose the best product at the most competitive price.
Modbus is an open standardised fieldbus system which is also used successfully throughout the world. The application range includes automation in the areas of manufacturing, processing and building.
These operation instructions cannot provide a general introduction into Modbus. Refer to the literature references in the appendix (page 63).

4.1 Basic characteristics

Modbus defines the functional features of a serial fieldbus system with which distributed digital automation devices can be interconnected. Modbus distinguishes between master and slave devices.

Master devices control the data exchange on the bus. A master is allowed to send messages without an external request.

Slave devices such as AUMA Modbus actuators are peripheral devices. Typical slave devices are input/output devices, valves, actuators and measuring sensors. They do not have bus access, i.e. they may only, at the request of a master, transmit messages to that master.

4.2 Basic functions of Modbus

Modbus uses a master-slave procedure in which only the master can initiate a transaction. The slaves respond by supplying the requested data via response telegram or by executing the action requested in the query.

The Modbus telegram from the master contains the slave address, a function code defining the requested action, a data field and a CRC field. The Modbus slaves' response telegram contains fields confirming the requested action and possibly the requested data and also a CRC field.
If an error occurs in receipt of the telegram or the slave is unable to perform the requested action, the slave will generate an error message and send it as response to the master.

4.3 Transfer mode

- RS-485 twisted pair cable or fibre optical cable.
- AUMA actuators support baud rates up to 38.4 kBit/s

4.4 Bus access

- Master-slave procedure.
- Mono-master system.
- Master and slave devices: max. 247 devices connected to one bus, without repeaters max. 32 devices.

4.5 Communication

- Master-slave data exchange via query-response cycle (Polling procedure).
- Modbus RTU protocol.

4.6 Protection functions

- Parity check for each telegram byte
- CRC check for each telegram
- Watchdog for AUMA actuators with adjustable safety behaviour.
- Query-response cycle monitoring with configurable timer interval at the master.

4.7 Modbus RTU mode

Data format for a byte.

Coding system:
- 8 bit binary, hexadecimal 0-9, A-F
- 2 hexadecimal characters contained in each 8 bit field of the telegram

Bits per byte:
- 1 start bit
- 8 data bits; least significant bit sent first
- 1 bit for even/odd parity, no bit for no parity
- 1 stop bit if parity is used, 2 stop bits if no parity is used.

5. Technical data

Table 1: Modbus interface for actuator controls AC 01.1

Features and function	
Supply voltage, mains frequency, and current consumption	Standard voltages: **3-ph AC** voltages/ frequencies: Volt 220 230 240 380 400 415 440 460 480 500 / Hz 50 50 50 50 50 50 60 60 60 50 **1-ph AC** voltages/ frequencies: Volt 110,115,120 220,230,240 / Hz 50/60 50/60 Special voltages: **3-ph AC** voltages/frequencies: Volt 525 575 660 690 / Hz 50 50 50 50 **1-ph AC** (only SGExC) voltages/frequencies: Volt 208 / Hz 60 For mains voltage and mains frequency, please refer to name plate at controls and motor Permissible variation of mains voltage: ± 10 % Permissible variation of mains frequency: ± 5 % Motor current consumption: refer to motor name plate Current consumption of actuator controls depending on mains voltage: 100 to 120 V AC = max. 650 mA 208 to 240 V AC = max. 325 mA 380 to 690 V AC = max. 190 mA
External supply of the electronics (option)	24 V DC + 20 %/ – 15 %, Current consumption: basic version approx. 200 mA, with options up to 500 mA
Rated power	Refer to motor name plate The controls is designed for the rated power of the actuator
Overvoltage category	Category III according to IEC 60 644-1
Switch gear	Standard: Reversing contactors[1] (mechanically and electrically interlocked) for motor power up to 1.5 kW, nominal motor current up to 9 A (OPEN - CLOSE duty) or 5.2 A (modulating duty)
	Options: Reversing contactors[1] (mechanically and electrically interlocked) for motor power up to 7.5 kW, nominal motor current up to 20 A (OPEN - CLOSE duty) or 18 A (modulating duty)
Control and output signals	Via Modbus RTU interface
Modbus RTU interface with additional inputs (options)	Modbus interface with 4 free 24 V DC inputs (current consumption approx 5mA/input) and 2 free 0/4 – 20 mA inputs[2]. Signal transmission via fieldbus interface.
	Modbus interface with 24 V DC control inputs (current consumption approx. 5 mA/input) OPEN - CLOSE - EMERGENCY. Selection of control mode via 24 V DC input BUS/REMOTE.
	Modbus interface with 24 V DC control inputs (current consumption approx. 5 mA/input) OPEN - CLOSE and 0/4 – 20 mA input for nominal position value[2] (positioner). Selection of control mode via 24 V DC inputs BUS/REMOTE and MODE.
	Modbus interface with 24 V DC (optional 115 V AC) control inputs OPEN - STOP - CLOSE - EMERGENCY (current consumption approx. 10 mA/input, for 115 V AC approx. 15 mA/input) and 0/4 – 20 mA input for nominal position value[3] (positioner). Selection of control mode via 24 V DC (optional 115 V AC) inputs BUS/REMOTE and MODE. Output signals via 6 programmable signal relays, position feedback 0/4 – 20 mA.
Voltage output	Standard: Auxiliary voltage 24 V DC, max. 100 mA for supply of control inputs, galvanically isolated from internal voltage supply
	Option: Auxiliary voltage 115 V AC, max. 30 mA for supply of control inputs[4], galvanically isolated from internal voltage supply
Component redundancy (option)	AUMATIC is equipped with an additional redundant Modbus interface
Redundancy in loop structure (option)	AUMATIC is equipped with an additional redundant Modbus interface to implement a redundant loop in combination with the SIMA Master Station. Max. number of AUMATIC actuators per redundant loop: 127 units. Max. possible cable length between the AUMATIC actuators without additional external repeaters: 1,200 m. Max. possible total cable length per redundant loop: approx. 150 km

1) The lifetime guaranteed by the manufacturer for OPEN - CLOSE duty amounts to min. 2 million cycles. If a higher number of starts cycles is to be expected, thyristor units with virtually unlimited lifetime should be used.
2) Partly possible in connection with process controller PID, please contact AUMA.
3) Requires position transmitter in actuator.
4) Not possible in combination with PTC tripping device.

Fibre optic connection (option)	F-ST (bayonet type connection) = BFOC connection	
	Channels: (optical)	for line topology : IN1 + OUT1/IN2 + OUT2 for star topology: IN1 + OUT1
	Data rate up to 1.5 MBit/s	
	Glass fibre 62.5 (50)/125 µm, multi-mode	
	Optical budget: 6 dB for 52.5µm, 4 dB for 50 µm fibre	
	Network range:	with 62.5 µm glass fibre: max. 2,000 m with 50 µm glass fibre: max. 1,300 m damping of the FO cable max. 3.0 dB/km with additional damping
	Wave length: 850 nm	
Local controls	Standard:	Selector switch LOCAL - OFF - REMOTE (lockable in all three positions)
		Push buttons OPEN - STOP - CLOSE - RESET
		5 indication lights: End position CLOSED and running indication CLOSE (yellow), torque fault CLOSED (red), motor protection tripped (red), torque fault OPEN (red) end position and running indication OPEN (green)
		LC display, illuminated
		Programming interface
	Options:	Release of the local controls: with or without selector switch LOCAL - OFF - REMOTE Operation of the actuator with push buttons OPEN - STOP - CLOSE - RESET of the local controls can be disabled or released via Modbus
		Special colours for the 5 indication lights: End position CLOSED and running indication CLOSE (green), torque fault CLOSE (blue), torque fault OPEN (yellow), motor protection tripped (white), end position and running indication OPEN (red)
		Protection cover, lockable
		Protection cover with indicator glass, lockable
Functions	Standard:	Seating adjustable Limit or torque seating for end position OPEN and end position CLOSED
		Torque monitoring over the whole travel
		Torque-by-pass, adjustable to up to 5 seconds (no torque monitoring during this time)
		Phase failure monitoring with automatic phase correction
		Programmable behaviour in case of loss of bus
		Running indication via indication lights
		Positioner[3]: Nominal position value via Modbus interface Programmable behaviour on loss of signal Automatic adaptation of the dead band (adaptive behaviour selectable) Change-over between OPEN - CLOSE duty and modulating duty via Modbus
	Options:	Process controller, PID[3]: Nominal process value via Modbus interface Actual process value via 0/4 – 20 mA additional input Programmable behaviour on loss of signal Limitation of the control range Change-over between OPEN - CLOSE duty and modulating duty via Modbus
Monitoring functions	Programmable monitoring of the max. number of cycles, generates warning signal	
	Reaction monitoring for operation command (programmable from 1 to 15 seconds), generates fault signal – results in switching off	
	Operating time monitoring (programmable from 4 to 1,800 seconds), generates warning signal	
Electronic name plate	Order data:	Commission number AUMATIC, commission number actuator, KKS number (definition system for power plants), valve number, plant number
	Product data:	Product name, works number actuator, works number AUMATIC software version logic, hardware version logic, date of final test, wiring diagram, terminal plan
	Project data:	Project name, 2 freely definable customer fields with 19 characters each
	Service data:	Service telephone, Internet address, service text 1, service text 2
Logging of operating data	A resettable counter and a lifetime counter for: Motor running time, number of starts, torque switch trippings in end position CLOSED, limit switch trippings in end position CLOSED, torque switch trippings in end position OPEN, limit switch trippings in end position OPEN, torque faults CLOSED, torque faults OPEN, motor protection trippings	
Motor protection evaluation	Standard:	Monitoring of the motor temperature in combination with thermoswitches in the actuator motor
	Options:	Additional thermal overload relay in the controls in combination with thermoswitches in the actuator
		PTC tripping device in combination with PTC thermistors in the actuator motor

3) Requires position transmitter in actuator

<table>
<tr><td>Electrical connection</td><td>Standard: Ex-plug/socket connector with terminal board
Threads for cable glands:
M-threads: 2 x M 25 x 1.5/4 x M 20 x 1.5
Pg-threads: 2 x Pg 21/4 x Pg 13.5
NPT-threads: 1 x 1" NPT/ 3 x ¾" NPT</td></tr>
<tr><td></td><td>Options: G-threads: 1 x G ¾"/ 4 x G ½"
Special threads, other than standard mentioned above, possible
Gold plated control plug (sockets and pins)
Parking frame for wall mounting of the disconnected plug
Protection cover for plug compartment (when plug is removed)</td></tr>
<tr><td>Overvoltage protection (option)</td><td>Protection of the actuator and control electronics against overvoltages on fieldbus cables up to 4 kV[5)]</td></tr>
<tr><td>Wiring diagram (basic version)</td><td>ACP 11F1-2P0--K000 KMS TP102/001</td></tr>
<tr><td colspan="2">Further options for Non-intrusive version with MWG in the actuator</td></tr>
<tr><td colspan="2">Setting of limit and torque switching via local controls</td></tr>
<tr><td>Electronic timer</td><td>Start and end of stepping mode as well as ON and OFF time (1 to 300 seconds) can be programmed individually for the directions OPEN and CLOSE.</td></tr>
<tr><td>Intermediate positions</td><td>Any 8 intermediate positions between 0 and 100 %. Reaction and signal behaviour programmable</td></tr>
<tr><td colspan="2">Further options for version with potentiometer or RWG in the actuator</td></tr>
<tr><td>Electronic timer</td><td>Start and end of stepping mode as well as ON and OFF time (1 to 300 seconds) can be programmed individually for the directions OPEN and CLOSE.</td></tr>
<tr><td>Intermediate positions</td><td>Any 4 intermediate positions between 0 and 100 %. Reaction and signal behaviour programmable</td></tr>
<tr><td colspan="2">Settings/programming the Modbus RTU interface</td></tr>
<tr><td>Setting the Modbus interface</td><td>Baud rate, parity and Modbus address are set via the display of the local controls</td></tr>
<tr><td colspan="2">Commands and signals of the Modbus RTU interface</td></tr>
<tr><td>Process representation output (command signals)</td><td>OPEN, STOP, CLOSE, nominal position value[3)], RESET</td></tr>
<tr><td>Process representation input (feedback)</td><td>End position OPEN, CLOSED
Actual position value [3)]
Actual torque value [6)]
Selector switch in position LOCAL/REMOTE
Running indication [3)] (directional)
Torque switch OPEN, CLOSED
Limit switch OPEN, CLOSED
Manual operation via handwheel [3)] or local controls
Analogue (2) and digital (4) customer inputs</td></tr>
<tr><td>Process representation input (fault signals)</td><td>Motor protection tripped
Torque switch tripped in mid-travel
One phase missing
Loss of the analogue customer inputs</td></tr>
<tr><td>Behaviour on loss of communication</td><td>The behaviour of the actuator is programmable:
stop in current position
move to end position OPEN or CLOSED
move to any intermediate position[3)]</td></tr>
<tr><td colspan="2">General data Modbus</td></tr>
<tr><td>Communication protocol</td><td>Modbus RTU</td></tr>
<tr><td>Network topology</td><td>– Linear (BUS) structure. Active bus termination at both ends.
– Coupling and uncoupling of devices during operation without affecting other devices is possible.</td></tr>
<tr><td>Transmission medium</td><td>Twisted, screened copper cable according to EN 50 170</td></tr>
<tr><td>Modbus interface</td><td>EIA-485 (RS485)</td></tr>
<tr><td>Transmission rate/cable length</td><td>
<table>
<tr><th>Baudrate (Bit/s)</th><th>Max. cable length (segment length) without repeater</th><th>Possible cable length with repeater (total network cable length)</th></tr>
<tr><td>300</td><td>1,200 m</td><td>approx. 10 km</td></tr>
<tr><td>600</td><td>1,200 m</td><td>approx. 10 km</td></tr>
<tr><td>1,200</td><td>1,200 m</td><td>approx. 10 km</td></tr>
<tr><td>2,400</td><td>1,200 m</td><td>approx. 10 km</td></tr>
<tr><td>4,800</td><td>1,200 m</td><td>approx. 10 km</td></tr>
<tr><td>9,600</td><td>1,200 m</td><td>approx. 10 km</td></tr>
<tr><td>19,200</td><td>1,200 m</td><td>approx. 10 km</td></tr>
<tr><td>38,400</td><td>1,200 m</td><td>approx. 10 km</td></tr>
</table>
</td></tr>
<tr><td>Device types</td><td>Modbus RTU slave, e.g. devices with digital and/or analogue inputs/outputs such as actuators, sensors)</td></tr>
<tr><td>Number of devices</td><td>32 devices in each segment without repeater, with repeaters expandable to 247</td></tr>
<tr><td>Bus access</td><td>Polling between master and slaves (query response).</td></tr>
</table>

3) Requires position transmitter in actuator.
5) Not available for redundancy in loop structure.
6) Requires magnetic limit and torque transmitter (MWG) in actuator.

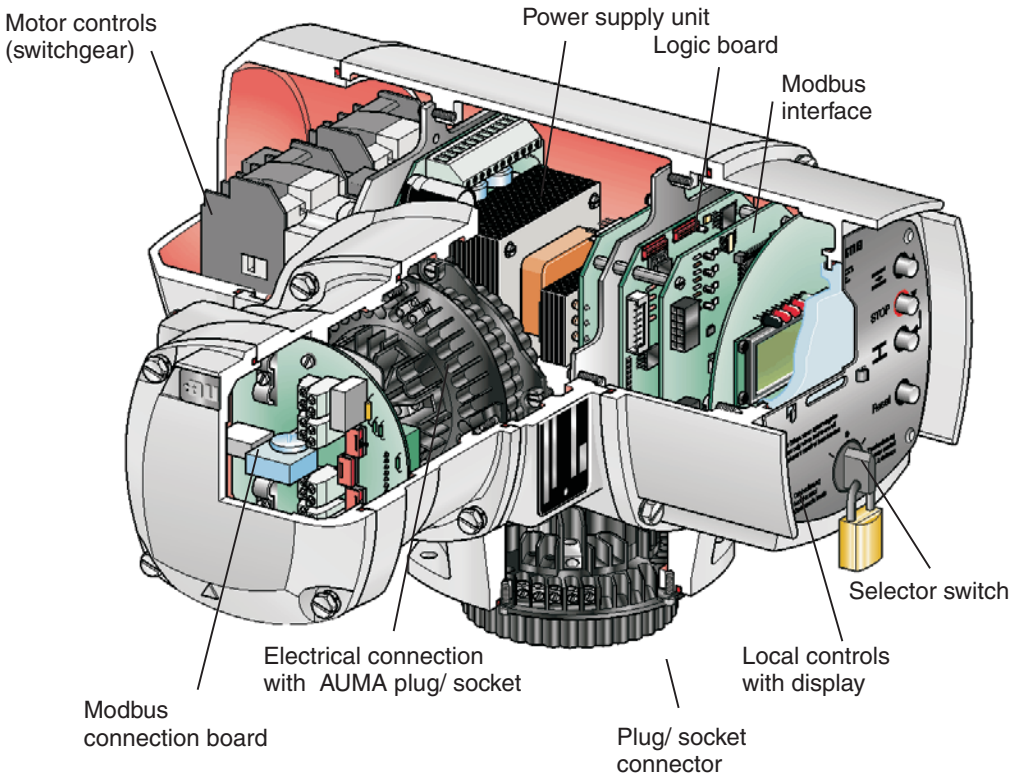
Supported Modbus RTU functions (services)	01	Read Coil Status
	02	Read Input Status
	03	Read Holding Registers
	04	Read Input Registers
	05	Force Single Coil
	15 (0FHex)	Force Multiple Coils
	06	Preset Single Register
	16 (10Hex)	Preset Multiple Registers
	07	Read Exception Status
	17 (11Hex)	Report 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
Service conditions		
Enclosure protection according to EN 60 529	Standard:	IP 67 (when mounted) Terminal compartment additionally sealed against interior (double sealed)
	Options:	IP 68[7)]
Corrosion protection	Standard:	KN Suitable for installation in industrial units, in water or power plants with a low pollutant concentration
	Options:	KS Suitable for installation in occasionally or permanently aggressive atmosphere with a moderate pollutant concentration (e.g. in wastewater treatment plants, chemical industry)
		KX Suitable for installation in extremely aggressive atmosphere with high humidity and high pollutant concentration
Finish coating	Standard:	Two-component iron-mica combination
	Option:	Special primer/special finish coat (customer's choice)
Colour	Standard:	Grey (DB 702, similar to RAL 9007)
	Option:	Other colours than standard colour are possible on request
Ambient temperature	– 20 °C to + 60 °C	
Vibration resistance[8)] according to IEC 60 068-2-6	1 g, for 10 to 200 Hz (Actuator with controls only. Not applicable in combination with gearboxes)	
Weight	7 kg approx. (with AUMA plug/socket connector)	
Accessories		
Wall bracket[9)]	AUMATIC mounted separately from the actuator, including plug/socket connector. Connecting cables on request. Recommended for high ambient temperatures, difficult access or in case of heavy vibrations during service.	
Programming software	COM-AC incl. interface cable	
Special features for application in explosive atmospheres		
Explosion protection	Standard:	II2G EEx de IIC T4
	Option:	II2G EEx d IIC T4
EC type examination certificate	PTB 01 ATEX 1087 or PTB 01 ATEX 1119	
Fibre optic connection (option)	F-SMA fibre optic plug/socket connections	
	Optical budget:	AC: 8 dB for 62.5 µm, 4 dB for 50 µm fibre
	Network range:	with 62.5 µm glass fibre: max. 2,600 m with 50 µm glass fibre: max. 1, 400 m
Overvoltage protection (option)	Only in combination with standard electrical connection ex-plug/socket connector with terminal board,	
Electrical connection	Standard:	Ex plug/socket connector with terminal board
	Options:	Ex plug-in terminal connection
Ambient temperature	– 20 °C to + 60 °C	
Weight	approx. 12 kg (with Ex plug/socket connector and terminal board))	
Further information		
EU Directives	ATEX Directive: (94/9/EC) Electromagnetic Compatibility (EMC): (89/336/EEC) Low Voltage Directive : (73/23/EEC) Machinery Directive: (98/37/EC)	
Reference documents	Product description "Actuator controls AUMATIC AC" Dimensions "Multi-turn/part-turn actuators with integral controls AUMATIC ACExC"	

7) For version in enclosure protection IP 68, higher corrosion protection KS or KX is strongly recommended.
8) Resistant to vibrations during start-up or for failures of the plant. However, a fatigue strength may not be derived from this.
9) Cable length between actuator and AUMATIC max. 100 m. Not suitable for version with potentiometer in the actuator. Instead of the potentiometer, an RWG has to be used. Cable length for Non-intrusive version with MWG in the actuator max. 100 m. Requires separate data cable for MWG. If actuator and AUMATIC are separated at a later date the max. cable length is 10 m.

6. AUMATIC Modbus design

With the AUMATIC Modbus, AUMA provides the optimal controls for multi-turn actuators of the type range SA and part-turn actuators of the type range SG.

Figure A: AUMATIC Modbus



The integral controls AUMATIC Modbus consist of the following modules:

- Modbus board. Connects the Modbus to the internal electronics
- The logic board links the signals of the actuator with the local controls and the Modbus board and controls the reversing contactors or the thyristors.
- Local controls with selector switch and push buttons, indication lights and display. With the selector, switch the control stations for local control **LOCAL** – **0** – **REMOTE** for remote control are selected. The push buttons (OPEN) – **Stop** – (CLOSE) are used for the electric operation of the actuator on site.
- Plug/socket connectors for easy mounting of the AUMATIC Modbus on the actuators.
- Motor controls: Reversing contactors or thyristors for motor controls.
- Modbus connection board with terminals for two-wire system and termination resistors for the bus termination.

Actuators which have already been installed can be retrofitted for Modbus by exchanging the controls AUMATIC for controls AUMATIC Modbus.

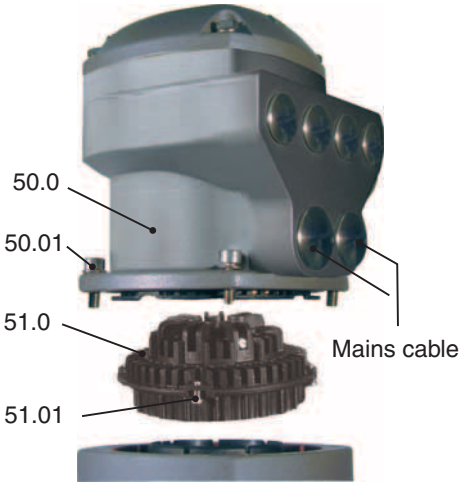
7. Electrical connection

- **Work on the electrical system or equipment must only be carried out by a skilled electrician himself or by specially instructed personnel under the control and supervision of such an electrician and in accordance with the applicable electrical engineering rules.**
- **Installation regulations for RS-485 networks must be observed for the wiring.**
  (for literature references refer to appendix C)

7.1 Power supply (standard)

For explosion-proof version (type designation: ACExC) refer to page 15.

Figure B-1: Mains connection



- Check whether type of current, supply voltage and frequency correspond to motor data (refer to name plate at motor).
- Loosen bolts (50.01) (figure B-1) and remove connection housing.
- Loosen screws (51.01) and remove socket carrier (51.0) from connection housing (50.0).
- Insert cable glands suitable for connecting cables.
  (The enclosure protection stated on the name plate is only ensured if suitable cable glands are used).
- Seal cable entries which are not used with suitable plugs.
- Connect cables according to order related wiring diagram.
  The wiring diagram applicable to the actuator is attached to the handwheel in a weather-proof bag, together with the operation instructions. In case the wiring diagram is not available, it can be obtained from AUMA (state commission no., refer to name plate) or downloaded directly from the Internet (www.auma.com).

Table 2: Technical data AUMA plug/socket connector for bus connection

Technical data	Motor power connections[1)]	Protective earth	Control pins
No. of contacts max.	6 (3 are used)	1 (leading contact)	50 pins/sockets
Marking	U1, V1, W1, U2, V2, W2	according to VDE	1 to 50
Voltage max.	750 V	–	250 V
Current max.	25 A	–	16 A
Type of customer connection	Screws	Screw for ring lug	Screws
Cross section max.	6 mm²	6 mm²	2.5 mm²
Material: Pin/ socket carrier	Polyamide	Polyamide	Polyamide
Material: Contacts	Brass (Ms)	Brass (Ms)	Brass, tin plated or gold plated (option)

1) Suitable for copper wires. For aluminium wires contact AUMA.

7.2 Remote position transmitter

For the connection of remote position transmitters (potentiometer, RWG) screened cables must be used.

7.3 AUMATIC on wall bracket

The AUMATIC can also be mounted separately from the actuator on a wall bracket.

Figure B-2: AUMATIC on wall bracket

- For the connection of actuator and AUMATIC on wall bracket, use suitable flexible and screened connecting cables.
  (Preconfectioned cables can be obtained from AUMA on request)
- The permissible cable length between actuator and AUMATIC amounts to max. 100 m.
- Versions with potentiometer in the actuator are not suitable. Instead of the potentiometer an RWG has to be used in the actuator.
- Connect the wires in correct phase sequence.
  Check direction of rotation before switching on.

7.4 Fitting the connection housing

After mains connection:

- Insert the socket carrier (51.0) into the plug cover (50.0) and fasten it with screws (51.01).
- Clean sealing faces at the connection housing and the actuator housing.
- Check whether O-ring is in good condition.
- Apply a thin film of non-acidic grease (e.g. Vaseline) to the sealing faces.
- Replace connection housing (50.0) and fasten bolts (50.01) evenly cross-wise.
- Fasten cable glands with the specified torque to ensure the required enclosure protection.

7.5 Test run

Perform test run. Refer to the operation instructions for the actuator (multi-turn actuator SA(R) .../ part-turn actuator SG ...).

Check limit and torque switching
Check limit and torque switching, electronic position transmitter RWG or potentiometer (option) and re-set wehre appropriate.
The settings are described in the operation instructions for the actuator (multi-turn actuator SA(R) ... part-turn actuator SG ...).

For actuators with feedback signal (RWG, potentiometer), a reference operation has to be performed after the setting has been changed.

Perform reference operation:

- Run actuator electrically (via push buttons OPEN and CLOSE) of the local controls once to the end position OPEN and once to the end position CLOSED.
- If no reference operation is performed after changing the limit switching, the feedback signal via the bus is not correct. The bus signals the missing reference operation as warning (see page 30).

7.5.1 Bus connection (standard)

For explosion-proof version (type designation: ACExC) refer to page 15.
For version with FO (fibre optics), refer to separate operation instructions “AUMATIC AC 01.1 FO connection”.

Disconnect power before removing the plug cover.

- Loosen and remove plug cover (figure B-3). The connection board (figures C-1, C-2 and C5) is located behind the plug cover.
- Insert cable glands suitable for bus cables
  (The enclosure protection stated on the name plate is only ensured if suitable cable glands are used).
- Seal cable entries which are not used with suitable plugs.
- Connect bus cable. Refer to figures C-1 to C-6.

Figure B-3: AUMATIC bus connection

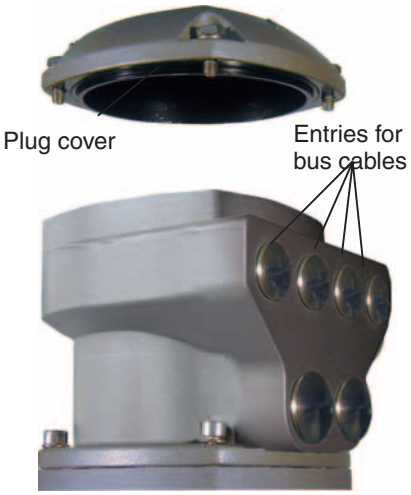


Figure C-1: Connection board (standard)

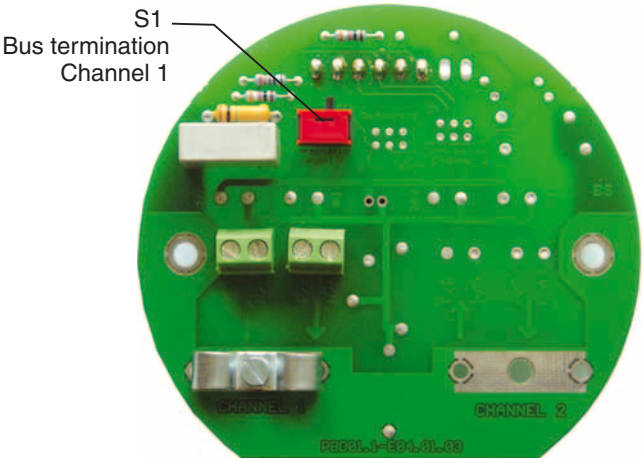


Figure C-2: Connection board (for overvoltage protection)

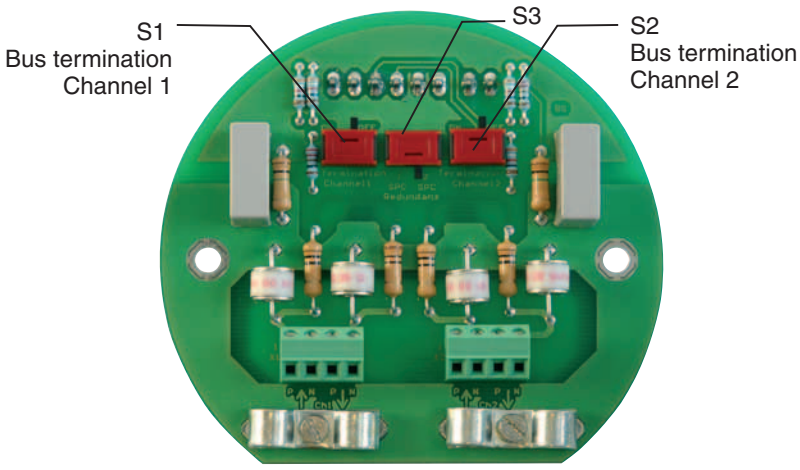


Figure C-3: Connection (Standard)

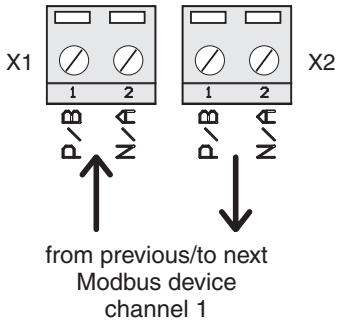


Figure C-4: Connection for overvoltage protection

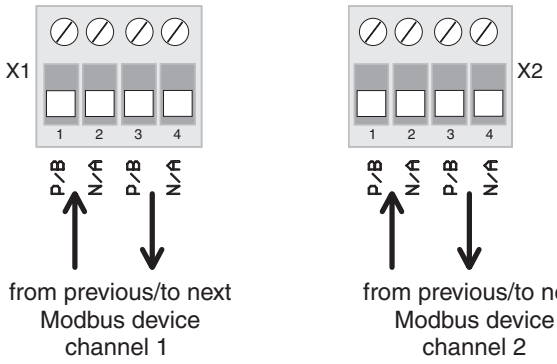


Figure C-5: Connection board (for redundancy)

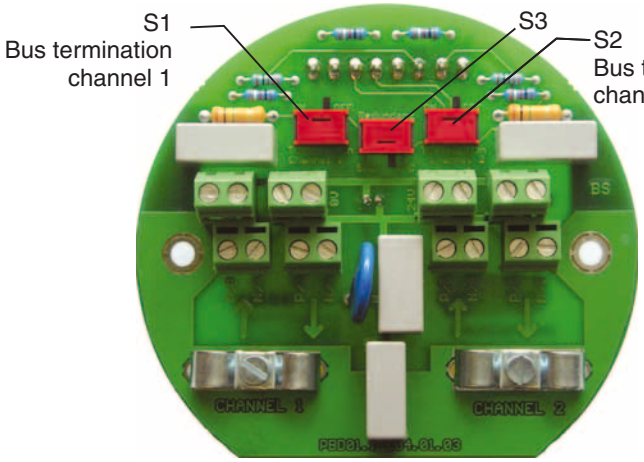
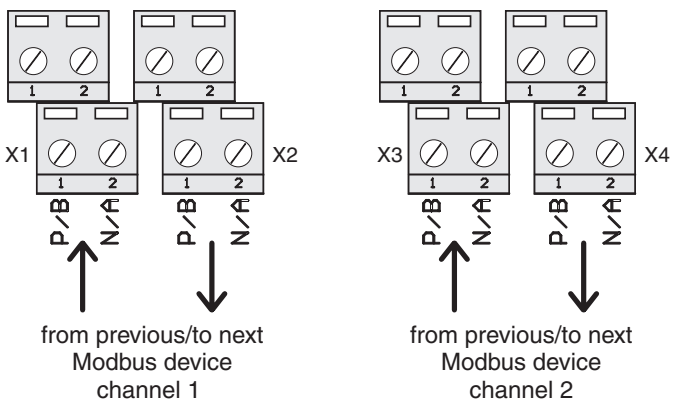


Figure C-6: Connection for redundancy (option)



The termination resistors for channel 1 and channel 2 are switched in via switches (S1) and (S2). Both switches are supplied in position 'OFF'. Only switch on the termination resistors (position 'ON') if the actuator is the last device in the Modbus segment.

As soon as the termination resistors are switched on, the connection to the next Modbus device is automatically interrupted to avoid multiple terminations.

If the actuator must be taken from the valve, e.g. for service purposes, it can be separated from the mains without having to remove the wiring. For this purpose, screws 50.01 are removed and the plug/socket connector is pulled off. As the fieldbus wiring is not removed, the communication ability with the subsequent devices and for removed plug/socket connectors is maintained.

Table 3: Switch positions for S1 – S3

S1	ON	Bus termination channel 1 ON
	OFF	Bus termination channel 1 OFF
S2	ON	Bus termination channel 2 ON (option)
	OFF	Bus termination channel 2 OFF (option)
S3	1SPC	one Modbus board
	2SPC	two Modbus boards (component redundancy) (option)

Table 4: Assignment of the Modbus cable

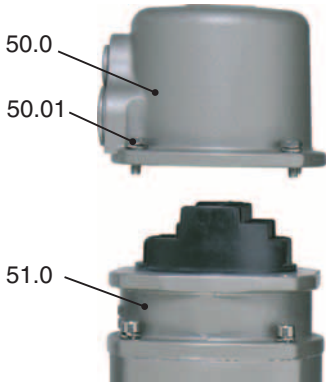
Modbus cable	AUMA labelling at connection	SUB-D 9 connector pin (for other Modbus devices)	Colour
A	N/A	8	green
B	P/B	3	red

7.5.2 Mains and bus connection for explosion-proof version

For version with FO (fibre optics) refer to separate operation instructions “AUMATIC ACExC 01.1 FO connection”.

When working in potentially explosive areas, observe the European Standards EN 60079-14 “Electrical Installations in Hazardous Areas” and EN 60079-17 “Inspection and Maintenance of Electrical Installations in Hazardous Areas”. Work on the electrical system or equipment must only be carried out by a skilled electrician himself or by specially instructed personnel under the control and supervision of such an electrician and in accordance with the applicable electrical engineering rules.

Figure D-1: Connection

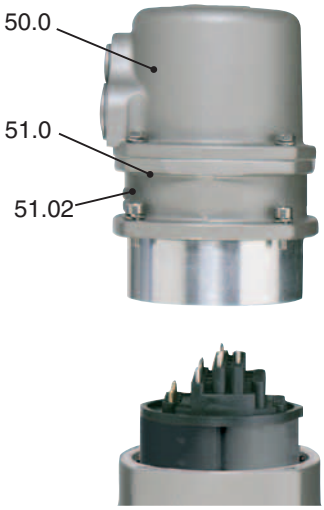


For the Ex-plug/socket connector (figure D-1), the electrical mains connection is made after removing the plug cover (50.0) at the EEx e terminals of the terminal board (51.0). The flameproof compartment (type of protection EEx d) remains hereby closed.

- Check whether type of current, supply voltage and frequency correspond to motor data (refer to name plate at motor).
- Loosen bolts (50.01) (figure D-1) and remove plug cover.

- **Insert cable glands with “EEx e” approval and of size suitable for connecting cables. For the recommended cable glands refer to appendix D, page 66.**
  (The enclosure protection stated on the name plate is only ensured if suitable cable glands are used).
- **Seal cable entries which are not used with suitable plugs.**
- **No more than max. 2 wires with the same cross section may be connected to one terminal.**

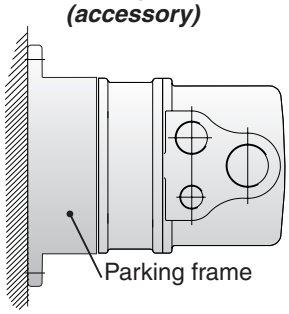
Figure D-2: Disconnection from the mains



- Remove cable sheathing in a length of 120 – 140 mm.
  Strip wires: Controls max. 8 mm, motor max. 12 mm.
  For stranded wires use end-sleeves according to DIN 46228.
- Connect bus cable. Refer to figures (D-4 or D-5).
  The termination resistor for channel 1 is connected through linking the terminals 31 – 33 and 32 – 34 (standard).
  The termination resistor for channel 2 is connected through linking the terminals 35 – 37 and 36 – 38 (component redundancy only).
- Only connect the termination resistors if the actuator is the final station in the Modbus segment.
- Connect screen largely to the cable glands. For the recommended cable glands refer to appendix D, page 66.

If the actuator must be taken from the valve, e.g. for service purposes, it can be separated from the mains without having to remove the wiring (figure D-2). For this, the screws (51.02) are removed and the plug/socket connector is pulled off. Plug cover (50.0) and terminal board (51.0) remain together. As the fieldbus wiring is not removed, the communication ability with the subsequent devices and for removed plug/socket connectors is maintained (except for redundancy in loop structure).

Figure D-3: Parking frame (accessory)



Flameproof enclosure! Before opening, ensure that there is no explosive gas and no voltage.

A special parking frame (figure D-3) for protection against touching the bare contacts and against environmental influences is available.

Figure D-4: Bus connection for channel 1 (standard)

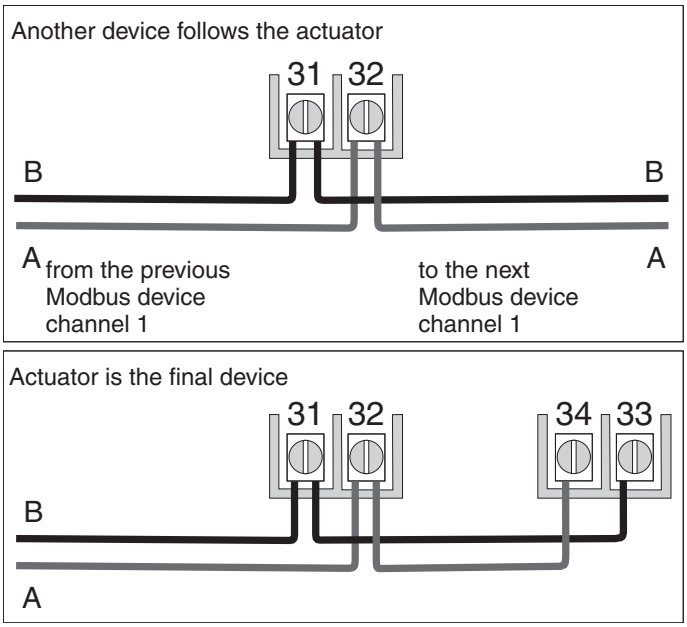


Figure D-5: Bus connection for channel 2 (redundancy only)

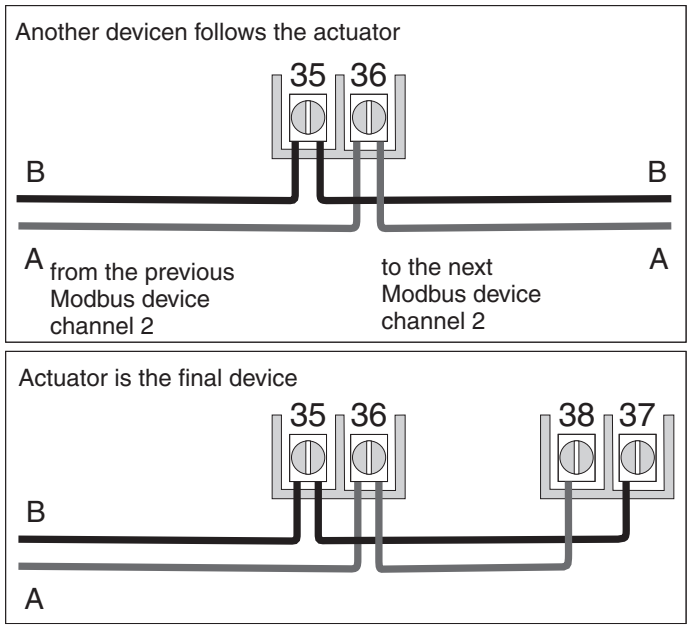


Table 5: Technical data Ex plug/socket connector with terminal board for explosion-proof actuators

Technical data	Motor power connections[1)]	Protective earth	Control pins
No. of contacts max.	3	1 (leading contact)	38 pins/ sockets
Marking	U1, V1, W1	according to VDE	1 to 24, 31 to 50
Voltage max.	550 V	–	250 V
Current max.	25 A	–	10 A
Type of customer connection	Screws	Screws	Screws
Cross section max.	6 mm^2	6 mm^2	1.5 mm^2
Material:Pin/ socket carrier	Araldite/ Polyamide	Araldite/ Polyamide	Araldite/ Polyamide
Contacts	Brass (Ms)	Brass (Ms)	Brass (Ms) tin-plated

1) Suitable for copper wires. For aluminium wires contact AUMA.

7.5.3 Bus cables

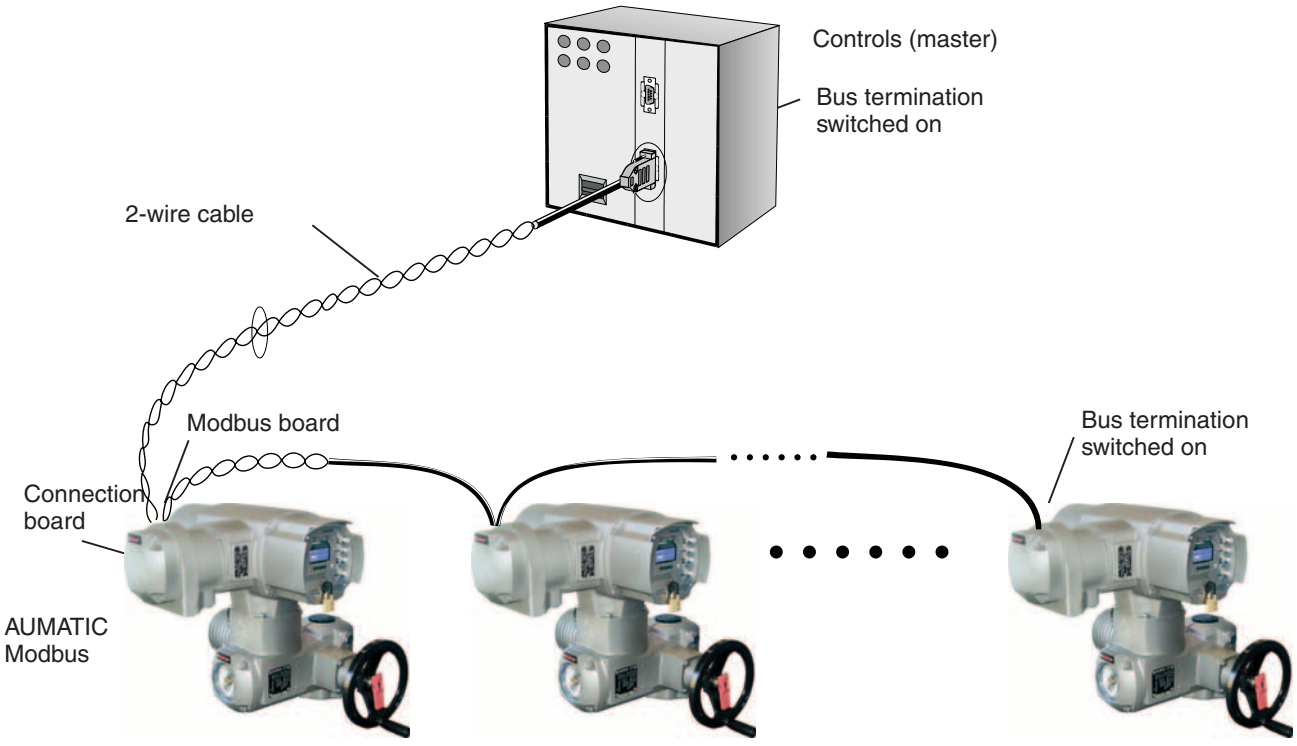
Only cables according to the recommendations of EIA 485 standard should be used for Modbus wiring.

A maximum of up to 32 Modbus devices may be connected in one segment. If more nodes are to be connected to one Modbus network, several segments must be connected with repeaters.
The bus cable must be laid at a distance of at least 20 cm from other cables. It should be laid in a separate, conductive, and earthed cable trunking.
It must be ensured that no potential differences can occur between the individual devices on the Modbus (perform a potential equalisation).

Recommended cable specification for Modbus

Impedance:	135 to 165 Ohm, at a frequency of 3 to 20 MHz.
Cable capacity:	< 30 pF per metre
Cable diameter	> 0.64mm
Cross section:	> 0.34 mm², conforms to AWG 22
Loop resistance:	< 110 Ohm per km
Screening:	CU shielding braid or shielding braid and shielding foil

Figure E: Example: Modbus with one segment

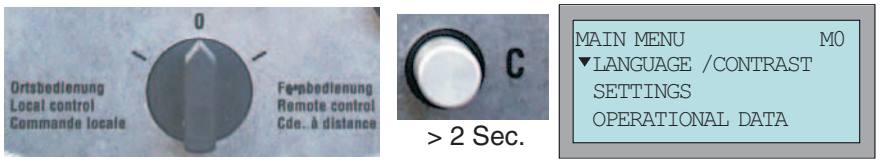


7.6 Setting the Modbus interface

In this section only the setting of the baud rate, the parity, and the slave address will be described.
For further detailed instructions on the indication, operation and setting of the AUMATIC refer to the operation instructions of the actuator (multi-turn actuator SA(R) .../ part-turn actuator SG ... with AUMATIC AC ...).

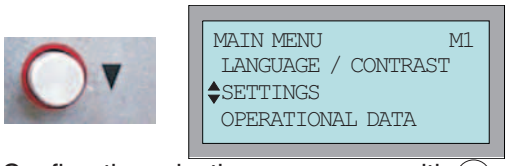
- Set selector switch at the AUMATIC to position **OFF** (0), figure F-1.
- Switch on supply voltage.
- Select menu indication M0:
  Press push button Ⓒ in one of the status indications (S0, S1, S2, S3, or S4) longer than 2 seconds:

Figure F-1



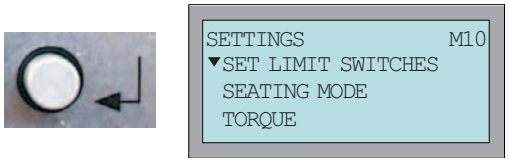
- Select SETTINGS with push button ▼:

Figure F-2



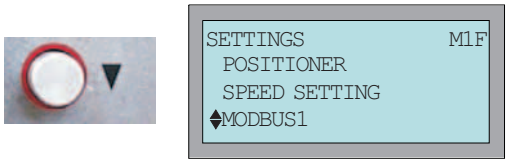
- Confirm the selection SETTINGS with Ⓔ:

Figure F-3



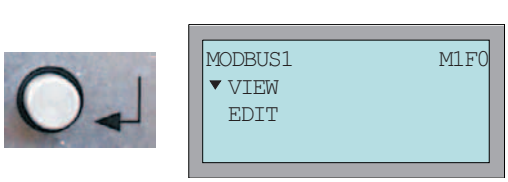
- Select MODBUS1 by pushing ▼ several times:

Figure F-4



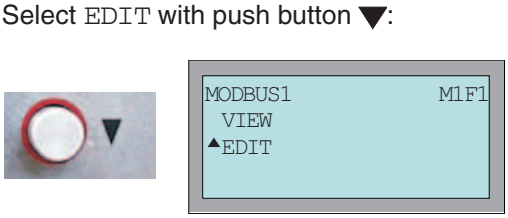
- Confirm the selection MODBUS1 with Ⓔ .

Figure F-5



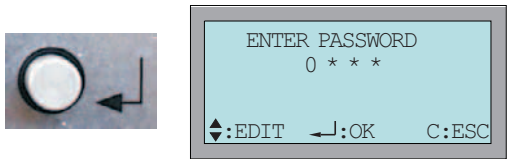
- Select EDIT with push button ▼:

Figure F-6



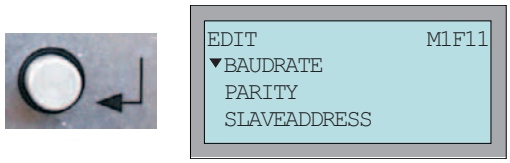
Confirm the selection EDIT with ↵ :

Figure F-7



- The value of the selected position may be changed using push buttons ▲ and ▼ .
- To accept the input and move to the next digit, press ↵, proceed until all password digits are entered. When accepting the last digit, the entered password is checked (default password: 0000). If it is valid, the following indication appears:

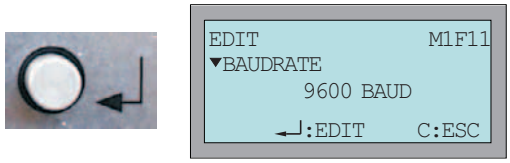
Figure F-8



7.6.1 Setting the baud rate

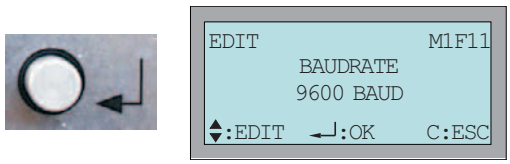
- Confirm BAUDRATE with ↵:

Figure F-9



- Change to edit mode with ↵ :

Figure F-10



Now baud rates from 300 to 38,400 BAUD may be set.

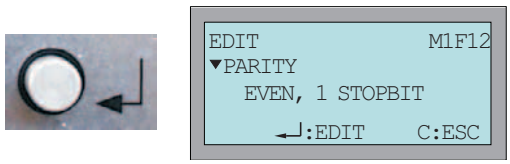
The baud rate setting must correspond to the setting at the master.

- With the push buttons ▲ and ▼ the value can be changed.
- Pressing push button ↵ accepts the input and validates it immediately.
- To return to the previous indication without accepting the entered value press the C .

7.6.2 Setting the parity

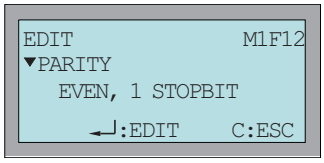
- Select PARITY with ▼.
- Confirm PARITY with push button ↵.

Figure F-9



- Change to edit mode with ↵ :

Figure F-10



Now you can use push buttons ▲ and ▼ to set the parity to the following values:

EVEN, 1 STOP BIT
ODD, 1 STOP BIT
NO, 2 STOP BITS

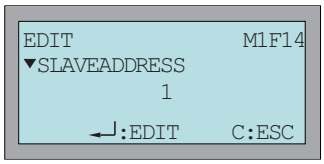
The parity setting must correspond to the setting at the master.

- Pressing ↵ accepts the input and validates it immediately.
- To return to the previous indication without accepting the entered value press push button C .

7.6.3 Setting the slave address

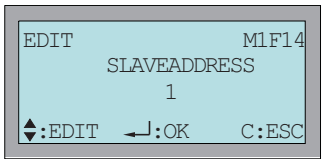
- Select SLAVE ADDRESS with ▼.
- Confirm SLAVE ADDRESS with push button ↵.

Figure F-9



- Change to edit mode with ↵ :

Figure F-10



Now you can use push buttons ▲ and ▼ to set the slave address from 1 to 247:

- Pressing push button ↵ accepts the input and validates it immediately.
- To return to the previous indication without accepting the entered value press push button C .

7.6.4 Further parameters of the Modbus interface

The Modbus interface of the AUMATIC has further parameters which can be set in the same way:

Connection control time

This time should exceed the cycle time of the Modbus data transmission to all connected devices. If no valid Modbus telegram was received within this time, the “DATA EX” status (see page 56) is lost and the failure behaviour (page 39) or the change-over of the communication channel (page 47) is initiated, if enabled.

Menu structure:

```
MAIN MENU (M)
    SETTINGS (M1)
        MODBUS1 (M1F)
            CONNECT-CONTROL TIME (M1FX3)
```

Standard value:
CONNECT-CONTROL TIME: 3.0 S
(This value can be adapted from software version Z031.922/06xxx)

Parameter for setting the cable redundancy

The parameters CABLE REDUNDANCY and CHANNEL CHECK TIME define the behaviour for cable redundancy (page 46).

Standard values:
CABLE REDUNDANCY: OFF
CHANNEL CHECK TIME: 5.0 s

8. Commissioning using the controls

8.1 Introduction

To commission a Modbus slave, a special configuration of the master using a configuration file is usually not required.

The Modbus RTU transmission is based on a simple protocol containing the slave address, a function code with offset address, the process data and a checksum.

8.2 Overview over the Modbus functions for data transmission

Function	Function code (decimal)	Description
Force Single Coil	05	Sets an individual bit in the slave to ON or OFF
Force Multiple Coils	15	Sets several consecutive bits in the slave to ON or OFF
Read Coil Status	01	Reads out the status of individual output bit information from the slave
Read Input Status	02	Reads out the status of individual input bit information from the slave
Preset Single Register	06	Writes data to individual Holding Registers (16 bit) of the slave
Preset Single Register	16	Writes data into consecutive Holding Registers
Read Input Register	04	Reads out the contents of the Input Data Registers (16 bit) from the slave
Read Holding Register	03	Reads out the contents of the Holding Registers from the slave

8.3 Modbus function and corresponding offset addresses of the AUMATIC

Action	Permissible function/ function code (decimal)	Permissible offset addresses (decimal)	Permissible offset addresses (hexadecimal)
Read or write process representation output data (write or read master outputs)	Force Single Coil (05) Force Multiple Coils (15) Read Coil Status (01)	0 to 511	0x0000 to 0x01FF
	Preset Single Register (06) Preset Multiple Register (16) Read Holding Register (03)	1 000 to 1 031	0x03E8 to 0x0407
Read process representation input data (master inputs)	Read Input Status (02)	0 to 511	0x0000 to 0x01FF
	Read Input Register (04)	1 000 to 1031	0x03E8 to 0x0407
Read or write AUMATIC parameters	Preset Single Register (06) Preset Multiple Register (16) Read Holding Register (03)	0 to 999	0x0000 to 0x03E7

9. Input data

9.1 Reading the actuator signals from the actuator using register functions

Function to be used:
Read Input Register (04)
Grey bits are collective signals. They contain the results of a disjunction (OR operation) of other information.

<table>
<tr><th>Offset (hexadecimal)</th><th>Offset (decimal)</th><th>Register contents
(description see subclause 10.2)</th></tr>
<tr><td>0x03E8</td><td>1000</td><td>Byte1: Logical signals
<table><tr><td>Fault ind.</td><td>Warning ind.</td><td>Running CLOSE</td><td>Running OPEN</td><td>Not ready ind.</td><td>Setpoint reached</td><td>Closed position</td><td>Opem position</td></tr><tr><td>Bit 15</td><td>Bit 14</td><td>Bit 13</td><td>Bit 12</td><td>Bit 11</td><td>Bit 10</td><td>Bit 9</td><td>Bit 8</td></tr></table>Byte 2: Actuator signals
<table><tr><td>TSC (DSR)</td><td>TSO (DOEL)</td><td>LSC (WSR)</td><td>LSO (WOEL)</td><td>Local sw. position</td><td>Remote sw. position</td><td>Loss of phase</td><td>Thermal fault</td></tr><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr></table></td></tr>
<tr><td>0x03E9</td><td>1001</td><td>Byte 3: E2 Actual position (high byte) Byte 4: E2 Actual position (low byte)</td></tr>
<tr><td>0x03EA</td><td>1002</td><td>Byte 5: Configured byte
<table><tr><td>Fault 3</td><td>Not ready ind.</td><td>Loss of phase</td><td>Torque fault (Open)</td><td>Torque fault (Close)</td><td>Remote sw. position</td><td>Open position</td><td>Closed positiom</td></tr><tr><td>Bit 15</td><td>Bit 14</td><td>Bit 13</td><td>Bit 12</td><td>Bit 11</td><td>Bit 10</td><td>Bit 9</td><td>Bit 8</td></tr></table>Byte 6: Physical operation
<table><tr><td>Runs from Local</td><td>Runs from Remote</td><td>Runs via handwheel</td><td>Actuator moving</td><td>- -</td><td>Start stepping mode</td><td>Proportional operatiom</td><td>Operation pause</td></tr><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr></table></td></tr>
<tr><td>0x03EB</td><td>1003</td><td>Byte 7: Options part 1
<table><tr><td>MD1 dig. input 4</td><td>MD1 dig. input 3</td><td>MD1 dig. input 2</td><td>MD1 dig. input 1</td><td>Intermed. position 4</td><td>Intermed. position 3</td><td>Intermed. position 2</td><td>Intermed. position 1</td></tr><tr><td>Bit 15</td><td>Bit 14</td><td>Bit 13</td><td>Bit 12</td><td>Bit 11</td><td>Bit 10</td><td>Bit 9</td><td>Bit 8</td></tr></table>Byte 8: Options part 2
<table><tr><td>- -</td><td>- -</td><td>- -</td><td>- -</td><td>- -</td><td>- -</td><td>- -</td><td>- -</td></tr><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr></table></td></tr>
<tr><td>0x03EC</td><td>1004</td><td>Byte 9: Analogue input 1 (high byte) Byte 10: Analogue input 1 (low byte)</td></tr>
<tr><td>0x03ED</td><td>1005</td><td>Byte 11 and Byte 12 E4 (torque)</td></tr>
<tr><td>0x03EE</td><td>1006</td><td>Byte 13: Not ready ind.
<table><tr><td>External controls</td><td>(reserved)</td><td>Emerg. operartion active</td><td>Emergency stop active</td><td>--</td><td>(reserved)</td><td>Selector not remote</td><td>Wrong command</td></tr><tr><td>Bit 15</td><td>Bit 14</td><td>Bit 13</td><td>Bit 12</td><td>Bit 11</td><td>Bit 10</td><td>Bit 9</td><td>Bit 8</td></tr></table>Byte 14: Fault signals
<table><tr><td>--</td><td>Internal fault</td><td>Torque fault (CLOSED)</td><td>Torque fault (OPEN)</td><td>Loss of phase</td><td>Thermal fault</td><td>--</td><td>Config. fault</td></tr><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr></table></td></tr>
</table>

<table>
<tr><th>Offset (hexadecimal)</th><th>Offset (decimal)</th><th>Register contents
(description see subclause 10.2)</th></tr>
<tr><td>0x03EF</td><td>1007</td><td>Byte 15: Warning signals part 1
<table><tr><td>Operation time</td><td>Starts/ run</td><td>No reference operation</td><td>Internal warning</td><td>I/O1 Analog In2 Loss</td><td>I/O1 Analog In1 Loss</td><td>(reserved)</td><td>P-Feedback E4 Loss</td></tr><tr><td>Bit 15</td><td>Bit 14</td><td>Bit 13</td><td>Bit 12</td><td>Bit 11</td><td>Bit 10</td><td>Bit 9</td><td>Bit 8</td></tr></table>Byte 16: Warning signals part 2
<table><tr><td>Analog In1 MD1 Loss</td><td>Analog In2 MD1 Loss</td><td>--</td><td>--</td><td>Setpoint E1 loss</td><td>feedback E2 loss</td><td>(resevied)</td><td>Torque E6 loss</td></tr><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr></table></td></tr>
<tr><td>0x03F0</td><td>1008</td><td>Byte 17: MD1 Analogue input 2 (high byte) and Byte 18: MD1 Analogue input 2 (low byte)</td></tr>
<tr><td>0x03F1</td><td>1009</td><td>Reserved</td></tr>
<tr><td>0x03F2</td><td>1010</td><td>Reserved</td></tr>
<tr><td>0x03F3</td><td>1011</td><td>Byte 23: Feedback
<table><tr><td>In intermediate position</td><td>--</td><td>--</td><td>--</td><td>Intermed. Pos. 8</td><td>Intermed. pos. 7</td><td>Intermed. pos. 6</td><td>Intermed. pos. 5</td></tr><tr><td>Bit 15</td><td>Bit 14</td><td>Bit 13</td><td>Bit 12</td><td>Bit 11</td><td>Bit 10</td><td>Bit 9</td><td>Bit 8</td></tr></table>Byte 24: Reserved
<table><tr><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr></table></td></tr>
</table>

9.2 Description of the input data

Byte 1: Logical signals

Bits 3, 6 and 7 are collective signals.
Bits 5 and 4 of the logical signals (byte1) indicate a logical operation of the actuator, i.e. they are set when the actuator has the command to perform an electrical operation (also present when e.g. the actuator happens to be in a stepping pause during stepping mode or waits for the end of the dead time)

Bit	Designation	Value	Description
0	**Open position** Limit seating in end position OPEN	1	Limit switch in direction OPEN operated
		0	other
	Open position Torque seating in end position OPEN	1	Torque switch and limit switch in direction OPEN operated.
		0	other
1	**Closed position** Limit seating in end position CLOSED	1	Limit switch in direction CLOSE operated
		0	other
	Closed position Torque seating in end position CLOSED	1	Torque switch and limit switch in direction CLOSE operated.
		0	other
2	**Setpoint reached**	1	Nominal position value is within max. error variable (outer dead band). Signal occurs only if Modbus master has set the Remote SETPOINT bit.
		0	other
3	**Not ready ind.**	1	Collective signal: Contains the result of a disjunction (OR-operation) of all bits of the byte “Not ready ind.” (page 29)
		0	No signal is active in byte “Not ready ind.” (page 29).
4	**Running OPEN**	1	Run command (OPEN or SETPOINT) from Modbus in direction OPEN is executed. For operation in stepping mode, this signal is also active during an off-time, the dead time and the reversing prevention.
		0	No such command is carried out via the Modbus.
5	**Running CLOSE**	1	Run command (CLOSE or SETPOINT) from Modbus in direction CLOSE is executed. For operation in stepping mode, this signal is also active during an off-time, the dead time and the reversing prevention.
		0	No such command is carried out via the Modbus.
6	**Warning ind.**	1	Collective signal: Contains the result of a disjunction (OR operation) of all bits of the two bytes “Warning signals.” (page 30).
		0	No warnings are active (all bits of the byte “Warning signals” cancelled).
7	**Fault ind.**	1	Collective signal: Contains the result of a disjunction (OR-operation) of all bits of the byte “Fault signals” (page 29).
		0	No faults are active (all bits cancelled of the byte “Fault signals” cancelled).

Byte 2: Actuator signals

Bit	Designation	Value	Description
0	**Thermal fault**	1	A thermal fault (motor protection) has occurred.
		0	No thermal fault has occurred.
1	**Loss of phase**	1	One phase missing.
		0	All phases are present.
2	**Remote sw. position**	1	Selector switch in position REMOTE.
		0	Selector switch not in position REMOTE.
3	**Local sw. position**	1	Selector switch in position LOCAL.
		0	Selector switch not in position LOCAL.
4	**LSO (WOEL)**	1	Limit switch OPEN left operated.
		0	Limit switch OPEN left not operated.
5	**LSC (WSR)**	1	Limit switch CLOSE right operated.
		0	Limit switch CLOSE right not operated.
6	**TSO (DOEL)**	1	Torque switch OPEN left operated (storing).
		0	Torque switch OPEN left not operated.
7	**TSC (DSR)**	1	Torque switch CLOSE right operated (storing).
		0	Torque switch CLOSE right not operated.

Byte 3: E2 (actual position) high byte
Byte 4: E2 (actual position) low byte

Byte 3 and Byte 4 transmit the current position of the actuator (requires position transmitter in the actuator).
The actual position is transmitted as a value between 0 to 1,000 per mil.

Byte 5:
Configured Byte 1

The configuration is set in the factory and can not be changed.

Bit	Designation	Value	Description
0	**Closed position**	1	see page 25
		0	other
1	**Open position**	1	see page 25
		0	other
2	**Remote sw. position**	1	Selector switch in position REMOTE
		0	other
3	**Torque fault CLOSE**	1	Torque fault in CLOSE direction (storing)
		0	other
4	**Torque fault OPEN**	1	Torque fault in OPEN direction (storing)
		0	other
5	**Loss of phase**	1	One phase is missing
		0	other
6	**Not ready ind.**	1	see page 25, logical signals
		0	other
7	**Fault ind.**	1	see page 25. logical signals
		0	other

Byte 6:
Physical operation

This is where the information about the actual movement of the actuator is stored.
The configuration is set in the factory and can not be changed.

Bit	Designation	Value	Description
0	**Operation pause**	1	Indicates the passing of operation pauses (reversing prevention time, dead time, pause times in stepping mode)
		0	other
1	**Proportional operation**	1	only for adjustable output speed actuators
		0	
2	**Start stepping mode**	1	Indicates that the actuator has entered the set stepping range while in stepping mode
		0	other
3	**—**	1	reserved for extensions
		0	
4	**Actuator moving**	1	Collective signal: contains the result of a disjunction (OR-operation) of bit 7, bit 6, and bit 5
		0	other
5	**Runs via handwheel**	1	Indicates a movement at the output drive without electrical operation command
		0	other
6	**Runs from REMOTE**	1	Indicates the movement of the output drive during electrical operation from REMOTE
		0	other
7	**Runs from LOCAL**	1	Indicates the movement of the output drive during electrical operation from LOCAL
		0	other

Byte 7: Options part 1

In the Options part 1 the additional freely available inputs and the possibly activated signals of the intermediate positions are located.

Bit	Designation	Value	Description
0	**Intermed. pos. 1**	1	Intermediate position 1 is signalled
		0	other
1	**Intermed. pos. 2**	1	Intermediate position 2 is signalled
		0	other
2	**Intermed. pos. 3**	1	Intermediate position 3 is signalled
		0	other
3	**Intermed. pos. 4**	1	Intermediate position 4 is signalled
		0	other
4	**MB1 dig. input 1**	1	A 24 V signal is present at the digital input 1
		0	other
5	**MB1 dig. input 2**	1	A 24 V signal is present at the digital input 2
		0	other
6	**MB1 dig. input 3**	1	A 24 V signal is present at the digital input 3
		0	other
7	**MB1 dig. input 4**	1	A 24 V signal is present at the digital input 4
		0	other

Byte 8: Options part 2

The contents of Options part 2 are reserved for future extensions.

Byte 9: MD1 analogue input 1 high byte
Byte 10: MD1 analogue input 1 low byte

Byte 9 and byte 10 transmit the value of the first additional free analogue current input of the Modbus interface. The start and end values can be set at the AUMATIC via the push buttons and the display. (For the operation see appropriate operation instructions for the multi-turn actuator/part-turn actuator).
If the measuring values are 0.3 mA below the initial value, a loss of signal is indicated. (refer to warning signals 2, byte 16).
The input current is transmitted as a value between 0 to 1,000 per mil.

Byte 11: Torque high byte
Byte 12: Torque low byte

Byte 11 and byte 12 transmit the current torque of the actuator (requires MWG in the actuator). The torque is transmitted as a value between 0 to 1,000 per mil.
The value transmitted is the current torque in percent or per mil of the nominal torque of the actuator. The torque zero point is at 500, for 100.0 % of the actuator torque in direction OPEN the value 1000 is transmitted, for 100.0 % of the torque in direction CLOSE the value 0 is transmitted.

Byte 13: Not ready ind.

The data byte Not ready ind. contains the indication of causes why the actuator can not be operated from Remote.

Bit	Designation	Value	Description
0	**Wrong command**	1	Indicates the fact that several run commands were received simultaneously via the Modbus (e.g. REMOTE OPEN and REMOTE CLOSE simultaneously or REMOTE CLOSE/REMOTE OPEN and REMOTE SETPOINT (nominal) simultaneously) or that the max. value for a nominal position has been exceeded (nominal position 1000).
		0	Run commands are ok
1	**Selector not Remote**	1	Selector switch: Position LOCAL or OFF
		0	Selector switch: Position REMOTE
2	**(reserved)**	1	Reserved for extensions
		0	
3	**- -**	1	Reserved for extensions
		0	
4	**Emergency STOP active**	1	The EMERGENCY STOP button (option) has been operated (see page 44).
		0	The EMERGENCY STOP button has not been operated (normal operation).
5	**Emergency mode**	1	Emergency function is active and at the same time 0 V are applied at the EMERGENCY input.
		0	Normal operation
6	**(reserved)**	1	
		0	
7	**External control**	1	External operation (option). As soon as the bus/external input is connected with 24 V DC (or 115 V AC), the AC will only react to operation commands by the conventional inputs I/O (OPEN-STOP-CLOSE or MODE and 0/4 – 20 mA) (see page 41 or page 43).
		0	Normal operation

Byte 14: Fault signals

The fault signals contain the causes why the actuator can not be operated.

Bit	Designation	Value	Description
0	**Config. fault**	1	Indicates a faulty configuration, i.e. the current setting of the AUMATIC is not valid, the exact cause can be determined from a diagnosis indication (D4) on the display
		0	AUMATIC is correctly configured
1	**- -**	1	Reserved for extensions
		0	
2	**Thermal fault**	1	Motor protection tripped; help: Cool down or perform a reset with the push button “Reset” of the local controls after cooling down. Check fuse F4.
		0	other

Bit	Designation	Value	Description
3	**Loss of phase**	1	One phase missing; help: Connect phase. When externally supplied with 24 V DC, the complete AC power supply might be missing, check and connect if necessary.
		0	other
4	**Torque fault (OPEN)**	1	Torque fault OPEN occurred (only torque or torque before limit, according to type of seating); help: Reset with counter command, or with push button “Reset” of the local controls.
		0	other
5	**Torque fault (CLOSE)**	1	Torque fault CLOSE occurred (only torque or torque before limit, according to type of seating); help: Reset with counter command, or with push button “Reset” of the local controls.
		0	other
6	**Internal fault**	1	The internal diagnostics of the AUMATIC have detected a fault (the exact cause can be determined on the diagnosis page D2 and DQ of the display).
		0	other
7	–	1	Reserved for extensions
		0	

Byte 15: Warning signals part 1

The two data bytes 15 and 16 contain warning signals. The warning signals serve only information purposes and do not interrupt or cancel an operation (as opposed to faults).

Bit	Designation	Value	Description
0	**P-feedback E4 loss**	1	Signal interruption of the actual process value E4 (only if PID controller is available and active).
		0	other
1	**(reserved)**	1	
		0	
2	**Anlog In1 I/O1 loss**	1	Loss of signal of the analogue input 1 of the parallel interface (only for Modbus in combination with parallel interface).
		0	other
3	**Anlog In2 I/O1 loss**	1	Loss of signal of the analogue input 2 of the parallel interface (only for Modbus in combination with parallel interface).
		0	other
4	**Internal warning**	1	The internal diagnostics of the AUMATIC have detected a warning (the exact cause can be determined on the diagnosis page D3 of the display).
		0	other
5	**Internal feedback**	1	Indicates that the position transmitter has not been adjusted to the limit end positions yet. To adjust the actuator: Operate the actuator to the end positions OPEN or CLOSED via the push buttons on the local controls.
		0	other
6	**Starts/run**	1	Indicates an exceeding of the set limits of the starts/run monitoring, indication is deleted automatically.
		0	other
7	**Warning Oper. time**	1	Indicates that the set operating time for an operation from one end position to the other has been exceeded, the next new operation command deletes this indication.
		0	other

Byte 16: Warning signals part 2

The warning signals part 2 contain the wire break signals of the different inputs.

Bit	Designation	Value	Description loss of signal
0	**Torque E6 loss**	1	A loss of signal has occurred during torque measurement
		0	other
1	**(reserved)**	1	Reserved for extensions
		0	
2	**Feedback E2 loss**	1	A loss of signal has occurred in the actual position.
		0	other
3	**Setpoint E1 loss**	1	A loss of signal has occurred in the nominal position.
		0	other
4	–	1	Reserved for extensions
		0	
5	–	1	Reserved for extensions
		0	
6	**Analog IN2 MB1 loss**	1	A loss of signal has occurred in the analogue input 2.
		0	other
7	**Analog IN1 MB1 loss**	1	A loss of signal has occurred in the analogue input 1.
		0	other

Byte 17: MD1 analogue input 2 high byte
Byte 18: MD1 analogue input 2 low byte

Byte 17 and byte 18 transmit the value of the second additional free analogue current input of the interface.
The start and end values can be set at the AUMATIC via the push buttons and the display. (For information about the operation see operation instructions for the multi-turn actuator/ part-turn actuator).
If the measuring values are 0.3 mA below the initial value a loss of signal is indicated.
The input current is transmitted as a value between 0 to 1,000 per mil.

Byte 19 - 22 : Reserved

The contents of bytes 19 to 22 are reserved for future extensions.

Byte 23: Additional data

Feedback signals of the intermediate positions

Bit	Designation	Value	Description loss of signal
0	**Intermed. pos. 5**	1	Intermediate position 5 is signalled.
		0	other
1	**Intermed. pos. 6**	1	Intermediate position 6 is signalled.
		0	other
2	**Intermed. pos.** 7	1	Intermediate position 7 is signalled.
		0	other
3	**Intermed. pos. 8**	1	Intermediate position 8 is signalled.
		0	other
4	**(reserved)**	1	
		0	
5	**(reserved)**	1	
		0	
6	**(reserved)**	1	
		0	
7	**In intermediate position**	1	Is set if the actuator does not perform a run command and is neither in end position OPEN nor end position CLOSED
		0	

Byte 24: Reserved

The contents of byte 24 are reserved for future extensions.

9.3 Reading the feedback signals from the actuator using status functions

Functions to be used:
Read Input Status (02)

Offset (hexadecimal)	Offset (decimal)	Contents (description see subclause 10.2)
0x0000	0	Open position
0x0001	1	Closed position
0x0002	2	Setpoint reached
0x0003	3	Not ready ind. 1) (see page 29, byte 13)
0x0004	4	Running OPEN
0x0005	5	Running CLOSE
0x0006	6	Warning ind. 1) (see page 30, bytes 15 and 16)
0x0007	7	Fault ind. 1) (see page 29, byte 14)
0x0008	8	Thermal fault
0x0009	9	Loss of phase
0x000A	10	Remote sw. position
0x000B	11	Local sw. position
0x000C	12	LSO (WOEL)
0x000D	13	LSC (WSR)
0x000E	14	TSO (DOEL)
0x000F	15	TSC (DSR)
0x0010 - 0x0017	16 to 23	Actual position positioner (high byte)
0x0018 - 0x001F	24 to 31	Actual position positioner (low byte)
0x0020	32	Closed position

1) Bits shaded in grey are collective signals. They contain the results of a disjunction (OR operation) of other information.

Offset (hexadecimal)	**Offset (decimal)**	**Contents** (description see subclause 10.2)
0x0021	33	Open position
0x0022	34	Remote sw. position
0x0023	35	Torque fault (CLOSE)
0x0024	36	Torque fault (OPEN)
0x0025	37	Loss of phase
0x0026	38	Not ready ind.[1)] (see page 29, byte 13)
0x0027	39	Fault ind.[1)] (see page 29, Byte 14)
0x0028	40	Operation pause
0x0029	41	Proportional operation
0x002A	42	Start stepping mode
0x002B	43	- -
0x002C	44	Actuator moving[1)] (see page 27, byte 6)
0x002E	45	Runs via handwheel
0x002F	46	Runs from Remote
0x0030	47	Runs from Local
0x0031	48	Intermed. pos. 1
0x0032	49	Intermed. pos. 2
0x0033	50	Intermed. pos. 3
0x0034	51	Intermed. pos. 4
0x0035	52	MB1 dig. input 1
0x0036	53	MB1 dig. input 2
0x0037	54	MB1 dig. input 3
0x0038	55	MB1 dig. input 4
0x0039 - 0x003F	56 to 63	Options part 2 (reserved)
0x0040 - 0x0047	64 to 71	MB1 analogue input (high byte)
0x0048 - 0x004F	72 to 79	MB1 analogue input (low byte)
0x0050 - 0x0057	80 to 87	E4 torque (high-byte)
0x0058 - 0x005F	88 to 95	E4 torque (low-byte)
0x0060	96	Wrong command
0x0061	97	Selector not remote
0x0062	98	(reserved)
0x0063	99	- -
0x0064	100	Emergency STOP active
0x0065	101	Emergency mode
0x0066	102	- -
0x0067	103	External control
0x0068	104	Config. fault
0x0069	105	- -
0x006A	106	Thermal fault
0x006B	107	Loss of phase
0x006C	108	Torque fault (OPEN)
0x006D	109	Torque fault (CLOSE)
0x006E	110	Internal fault
0x006F	111	- -
0x0070	112	P-Feedback E4 loss

1) Bits shaded in grey are collective signals. They contain the results of a disjunction (OR operation) of other information.

Offset (hexadecimal)	**Offset (decimal)**	**Contents** (description see subclause 10.2)
0x0071	113	(reserved)
0x0072	114	Anlog In1 I/O1 loss
0x0073	115	Anlog In2 I/O1 loss
0x0074	116	Internal warning
0x0075	117	Internal feedback
0x0076	118	Warning starts/run
0x0077	119	Warning oper. time
0x0078	120	Torque E6 loss
0x0079	121	(reserved)
0x007A	122	Feedback E2 loss
0x007B	123	Setpoint E1 loss
0x007C	124	- -
0x007D	125	- -
0x007E	126	Analog IN2 MB1 loss
0x007F	127	Analog IN1 MB1 loss
0x0080 - 0x0087	128 to135	MB1 Analogue input 2 (high-byte)
0x0088 - 0x008F	136 to 143	MB1 Analogue input 2 (low-byte)
0x0090 - 0x00AF	144 to 175	(reserved)
0x00B0	176	Intermed. pos. 5
0x00B1	177	Intermed. pos. 6
0x00B2	178	Intermed. pos. 7
0x00B3	179	Intermed. pos. 8
0x00B4	180 to 182	(reserved)
0x00B7	183	In intermediate position

10. Output data

The master (control) can control the slave (actuator) via the process representation output.

10.1 Transmitting operation commands to or reading out from the actuator using register functions

Functions to be used:
Preset Single Register (06)
Preset Multiple Register (16)
Read Holding Register (03)

Offset (hexadecimal)	Offset (decimal)	Register Contents
0x03E8	1000	Byte 1: Commands (High byte) — Bit 15: —; Bit 14: —; Bit 13: —; Bit 12: —; Bit 11: Reset; Bit 10: Remote SETPOINT; Bit 9: Remote CLOSE; Bit 8: Remote OPEN Byte 2: E3 (Reserve) (Low byte) — Bit 7: —; Bit 6: —; Bit 5: —; Bit 4: —; Bit 3: —; Bit 2: —; Bit 1: —; Bit 0: —
0x03E9	1001	Byte 3: E1 Nominal position (high byte) Byte 4: E1 Nominal position (low byte)
0x03EA	1002	Byte 5: Additional commands — Bit 15: —; Bit 14: —; Bit 13: Channel 2; Bit 12: Channel 1; Bit 11: —; Bit 10: LOCAL sw. position; Bit 9: OFF sw. position; Bit 8: REMOTE sw. position Byte 6: Run commands for multiport valve function[1] — Bit 7: Intermed. position 8; Bit 6: Intermed. position 7; Bit 5: Intermed. position 6; Bit 4: Intermed. position 5; Bit 3: Intermed. position 4; Bit 2: Intermed. position 3; Bit 1: Intermed. position 2; Bit 0: Intermed. position 1

1) The multiport valve function is optional (see Short instructions AUMATIC with multiport valve function)

10.2 Description of the output data

Byte 1: Commands (high byte)

With the bits 0 – 2 the operation commands are transmitted to the actuator. Only one of these bits may be set at any given time. If Remote SETPOINT (remote nominal) is set, the value of the nominal position (byte 3 and byte 4) is used.
Bits 4 – 7 are reserved for future extensions and must remain set to 0.
As soon as these bits are written via coil functions, the contents of the respective Holding Registers for the operation commands will change.
If the Coil Remote SETPOINT is used, the respective setpoint has to be entered on the register for the setpoint.

Bit	Designation	Value	Description
0	**Remote OPEN**	1	Run OPEN
		0	Do not run OPEN
1	**Remote CLOSE**	1	Run CLOSE
		0	Do not run CLOSE
2	**Remote SETPOINT**	1	Run to setpoint Can only be set if position transmitter e. g. potentiometer/ RWG (options) is available.
		0	Do not run to setpoint
3	**RESET**	1	Certain indications of the AUMATIC can be reset (e.g. PTC tripping device and torque fault). The function of this bit equals the push button Reset of the local controls in the selector switch position LOCAL.
		0	other
4	- -	1	
		0	
5	- -	1	
		0	
6	- -	1	
		0	
7	- -	1	
		0	

Byte 2: Reserved (low byte)

For additional extensions.

Byte 3: E1 setpoint (high byte)
Byte 4: E1 setpoint (low byte)

The nominal position has to be transmitted as a value between 0 to 1,000 per mil. When these limits are exceeded the actuator stops and signals the fault "WRONG COMMAND".

Byte 3: High byte of value 0..1000

Value
High byte of value 0..1,000

Byte 4: Low Byte von Value 0..1000

Value
Low byte of value 0..1,000

Byte 5: Additional commands

Bit	Designation	Value	Description
0	**REMOTE sw. position**[1]**)**	1	Selector switch position REMOTE is released
		0	Selector switch position REMOTE is locked
1	**OFF sw. position**[1)]	1	Selector switch position OFF is released
		0	Selector switch position OFF is locked)
2	**LOCAL sw. position**[1)]	1	Selector switch position LOCAL is released
		0	Selector switch position LOCAL is locked
3	–	1	
		0	
4	**Channel 1**[2)]	1	Switch-over to Modbus communication channel 1
		0	No switch-over
5	**Channel 2**[2)]	1	Switch-over to Modbus communication channel 2[2)]
		0	No switch-over
6	–	1	
		0	
7	–	1	
		0	

1) Releasing the local controls (page 40, clause 14.) (only available when function 'Enable local controls' is activated)
2) Only available if 2 Modbus communication channels are connected. page 46, clause 18.).

Byte 6: Run commands for multiport valve function

The multiport valve function is an optional function (refer to Short instructions AUMATIC with multiport valve function).

Bit	Designation	Value	Description
0	**Intermed. position 1**	1	Actuator is to approach intermediate position 1.
		0	other
1	**Intermed. position 2**	1	Actuator is to approach intermediate position 2
		0	other
2	**Intermed. position 3**	1	Actuator is to approach intermediate position 3
		0	other
3	**Intermed. position4**	1	Actuator is to approach intermediate position 4
		0	other
4	**Intermed. position 5**	1	Actuator is to approach intermediate position 5
		0	other
5	**Intermed. position 6**	1	Actuator is to approach intermediate position 6
		0	other
6	**Intermed. position7**	1	Actuator is to approach intermediate position 7
		0	other

10.3 Transmission of operation commands to the actuator using coil functions

Functions to be used:
Force Single Coil (05)
Force Multiple Coils (15)
Read Coil Status(01)

Offset (hexadecimal)	**Offset (decimal)**	Content (Description see subclause 10.2)
0x0000	0	Remote OPEN
0x0001	1	Remote CLOSE
0x0002	2	Remote SETPOINT
0x0003	3	RESET
0x0004 - 0x001F	4 to 31	- -
0x0020	32	REMOTE sw. position
0x0021	33	OFF sw. position
0x0022	34	LOCAL sw. position
0x0023	35	- -
0x0024	36	Channel 1
0x0025	37	Channel 2
0x0026	38	- -
0x0027	39	- -
0x0028	40	Intermediate position 1
0x0029	41	Intermediate position 2
0x0030	42	Intermediate position 3
0x0031	43	Intermediate position 4
0x0032	44	Intermediate position 5
0x0033	45	Intermediate position 6
0x0034	46	Intermediate position 7

11. Operation parameters of the actuator

To provide a clear overview, the programming of the AUMATIC AC 01.1 via Modbus (Modbus function codes, offset addresses, parameter descriptions as well a the read/write access rights) is described in appendix E (page 66).

Functions to be used:

The parameters of the AUMATIC can be written or read using the following functions:
Preset Single Register (06),
Preset Multiple Register (16) or
Read Holding Register (03)

12. Description of actuator functions

12.1 Operation commands for OPEN/CLOSE operation

Operation commands are determined by the operation command bits and the nominal value (setpoint) of the Modbus process representation output. Only one command bit may be set at any given time. If several command bits are set, no operation is performed and the fault signal 'Wrong command' is given.
To avoid placing too much strain on the mechanics, the actuator is equipped with a (programmable) delay when changing direction (reversing prevention).

The following operation command bits are required for OPEN/CLOSE operation:
Remote OPEN
Remote CLOSE

Remote operation OPEN/STOP

Remote OPEN = 1 The actuator runs in direction OPEN.
Remote OPEN = 0 The actuator stops.
The actuator is switched off automatically if the end position OPEN is reached (limit switch LSO is set for limit seating or LSO and TSO for torque seating).
Faults (thermal protection, phase failure, torque) stop the operation.

Remote operation CLOSE/STOP

Remote CLOSE = 1 The actuator runs to position CLOSED.
Remote CLOSE = 0 The actuator stops.
The actuator is switched off automatically if the final position CLOSED is reached (limit switch LSC (WSR) for limit seating or LSC (WSR) and TSC (DSR) for torque seating). Faults (thermal protection, phase failure, torque) stop the operation.

Remote operation to nominal position (SETPOINT)/STOP

The positioner can only function when the actuator is equipped with a position transmitter, e.g. potentiometer/ RWG/MWG (option).

Remote SETPOINT = 1 The actuator moves to the set nominal value.
Remote SETPOINT = 0 The actuator stops.
The nominal position has to be set in % or ‰.
Faults (thermal protection, phase failure, torque) stop the operation via the positioner.

With a setpoint of 0 % (0 ‰) the actuator runs to the end position CLOSED
With a setpoint of 100 % (1000 ‰) the actuator runs to the end position OPEN. In case the set point is more than 1000 ‰ , no operation is performed and the fault signal `WRONG COMMAND` is given.

12.2 Positioner

The positioner is activated via the bit 'Remote SETPOINT'.
The positioner is a three-position-controller. Via the 'NOMINAL' position (setpoint) in the process representation input, the nominal value of the position is transmitted to the actuator as nominal variable.

For further information about the positioner refer to the operation instructions (multi-turn actuator SA(R) . . ./ part-turn actuator SG . . . with AUMATIC AC . .).

12.3 Stepping mode

Stepping mode requires a position transmitter (option).
The stepping mode lengthens the operating time for a part or for the whole travel.

For further information on the stepping mode refer to the operation instructions for actuator (multi-turn actuator SA(R) . . ./ part-turn actuator SG . . . with AUMATIC AC . .).

13. Failure function

The failure function permits the start of failure operations in case of special events, e.g. when the communication between the actuator and the master is interrupted. This function can be set via the parameter FAILURE MODE (refer to the operation instructions to the actuator (multi-turn actuator SA(R) . . ./ part-turn actuator SG . . . with AUMATIC AC . . .).

If the actuator is in the failure function, the set failure position is approached via a failure operation.
If the actuator is then moved to another position (e.g. by manual operation), it will try to perform the set failure action while the selector switch is in position REMOTE.

To prevent a new approach to the failure position during manual operation, the selector switch (local controls) must be switched to position 'LOCAL' or 'OFF' before operating the handwheel.

The following events can trigger the failure function:

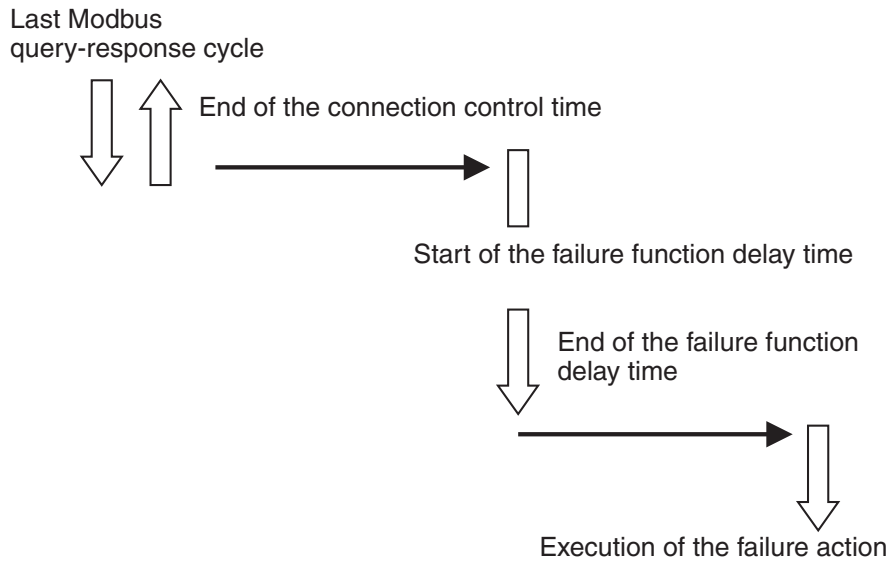
- The connection to the master is interrupted (connection control time has expired, see page 21).
- The master sends no messages to the actuator.

As soon as the cause for triggering the failure function is eliminated (connection restored), the run commands from the master may be executed again.

The last operation command which has been transmitted to the actuator remains stored in the actuator and is executed again when communication is resumed. To ensure a defined behaviour, a valid run command must be transmitted to the actuator upon resuming communication.

Time behaviour of the failure function

The connection control time is started with the last Modbus query-response cycle before communication failure (see page 21).
If no valid Modbus telegram has been received within this connection control time, the failure function will be initiated with the start of the failure function delay time. At the end of the failure function delay time, the failure action will be executed.



14. The release function of the local controls

The AUMATIC can be set in such a way that the AUMATIC internal selector switch position is additionally determined by 3 Bits in the process representation output (see output data description, page 35 et seqq.).
This makes it possible to release (enable) or disable a certain selector switch position from REMOTE via the Modbus. In addition, an automatic release can programmed for the event of loss of communication.

The parameter ENABLE LOCAL is set in the factory according to the order details.

Menu structure

```
MAIN MENU (M)
    CONFIGURATION (M4)
        SETUP (M41)
            SELECTOR SWITCH (M410V)
            ENABLE LOCAL MODE (M410W)
```

Table 6: Release functions of the local controls

Parameter ENABLE LOCAL MODE[1]		Selector switch at the local controls			
		is available (Parameter SELECTOR SWITCH = AVAILABLE)		is not available (Parameter SELECTOR SWITCH = NOT AVAILABLE)	
Value	Display text	Modbus communication to the master		Modbus communication to the master	
		is available	is not available	is available	is not available
0	NOT ACTIVE	SS	SS	OFF	OFF
1	BUS	Bits & SS	OFF	Bits	OFF
2	BUS,AUTO.LOCAL	Bits & SS	SS = LOCAL or OFF	Bits	LOCAL <> OFF
3	BUS,AUTO.REMOTE	Bits & SS	WS = REMOTE or OFF	Bits	REMOTE <> OFF
4	BUS AUTO	Bits & SS	SS	Bits	OFF

SS	The AUMATIC-internal selector switch position is the same as the selector switch position at the local controls (LOCAL, OFF or REMOTE).
Bits	The status is determined by the bits in the process representation (LOCAL sw. position, OFF sw. position OFF or REMOTE sw. position)
Bits & SS	The status is determined by an AND connection of the bits in the process representation with the selector switch position. Only in case they do correspond, the release is given (LOCAL, OFF or REMOTE). If the selector switch position does not correspond with the release bits, the release is not given. In this case the local controls remains disabled (Indication in the LCD on the status page S0: RESTRICTED)
REMOTE <> OFF	The underlined value will be assumed for the selector switch position within the AUMATIC if the bus communication fails. Special setting via push button may be necessary to set the address: To change over between REMOTE and OFF, enter the following key sequence: 1. Press STOP button 2. Then hold down STOP button and press the OPEN button 5 times in a row within two seconds[1].
LOCAL <> OFF	The underlined value will be assumed for the selector switch position within the AUMATIC if the bus communication fails. Special setting via push button may be necessary to set the address: To change over between REMOTE and OFF, enter the following key sequence: 1. Press STOP button 2. Then hold down STOP button and press the OPEN button 5 times in a row within two seconds.[2].
WS = REMOTE or OFF	Only selector switch positions REMOTE or OFF are possible (enabled).
SS = LOCAL or OFF	Only selector switch positions REMOTE or OFF are possible (enabled).

1) If the release function of the local controls is required, the parameter ENABLE LOCAL MODE is set to BUS,AUTO.LOCAL in the factory the other setting options reduce the function during loss of communication and are therefore provided only for special applications.

2) The following special setting is required for software versions up to Z031.922/05-xx (see diagnosis page D6):
1. Press RESET button 2. press the STOP button within 2 seconds, 3. press both the OPEN and the CLOSE button within two seconds.

15. Additional control inputs (option)

The digital and analogue input signals of the Modbus interface can be interpreted as additional operation commands. Through this, an additional operation command channel is available (four digital inputs or one analogue 0/4 – 20 mA input). Irrespective of the signal assignment of these inputs, the fieldbus communication with the DCS is maintained.

Menu structure

```
MAIN MENU (M)
    CONFIGURATION (M4)
        SETUP (M41)
            ADDITIONAL INPUTS BUS (M410G)
```

Possible settings of the parameter ADDITIONAL INPUTS BUS:

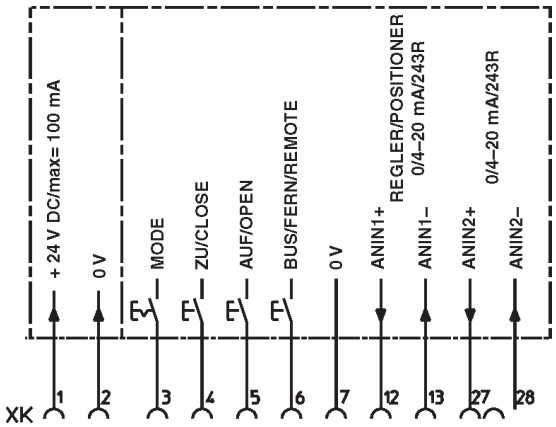
STANDARD

The signals of the four digital inputs and the analogue inputs are transmitted by the fieldbus to the process control system. They do not influence the operation behaviour of the actuator.

OPEN CLOSE CONTROL

Conventional control of the actuator is both possible in OPEN - CLOSE duty and in modulating duty (setpoint of 0/4 – 20 mA).
Generally, the bus communication has priority, i.e. in case of unconnected I/O inputs, the AUMATIC reacts only to operation commands which are received by the fieldbus interface.

Figure G-1: Pin assignment for OPEN - CLOSE modulating duty (Wiring diagram extract)

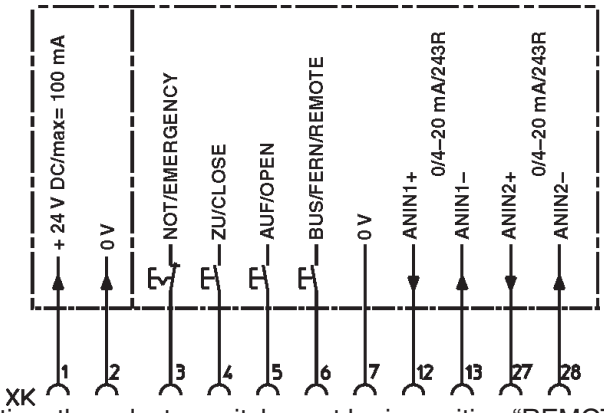


As soon as the ‘BUS/REMOTE’ input (figure G-1) is supplied with 24 V DC (or 115 V AC as an option), the AUMATIC will only react to operation commands which are read in via these digital inputs (OPEN - CLOSE or MODE and 0/4 – 20 mA nominal value). Self-retaining is not available for the OPEN - CLOSE commands.
In case of an unconnected MODE input (or MODE input connected to 0 V), the input signal of the analogue input 1 is interpreted as nominal position signal. The measuring range of this analogue input is programmable. Furthermore, the failure function (see page 39) can be tripped in case a signal loss of this nominal value was detected (Parameter: FAILURE SOURCE = SETPOINT E1).
For this function, the selector switch must be in position “REMOTE”.

OPEN CLOSE ESD

Parallel control is possible in the open-close duty (OPEN-CLOSE-EMERGENCY). The analogue inputs ANIN1 and ANIN2 have no function.
In this configuration, the EMERGENCY function has the highest priority. The polarity of the EMERGENCY input is identical to the standard AUMATIC version (equipped with an I/O interface). This means that the actuator will perform the programmed EMERGENCY operation if 0 V is applied at the EMERGENCY input (or the EMERGENCY input is unconnected) independently from the “BUS/REMOTE” input and from the operation commands received via fieldbus. As long as this EMERGENCY signal is present, the actuator can neither be operated by the digital input signals of the fieldbus interface nor via the Modbus.
The EMERGENCY function is set via the parameters for the operation mode EMERGENCY. Refer to the operation instructions to the actuator (multi-turn actuator SA(R) .../part-turn actuator SG . . . with AUMATIC AC . . .).
As soon as the EMERGENCY signal is no longer present (EMERGENCY input at 24 V DC or 115 V AC as an option), run commands which are transferred via Modbus are immediately executed, while OPEN/CLOSE run commands which are present at the additional control inputs are deleted and have to be reconnected.

Figure G-2: Pin assignment for OPEN - CLOSE - EMERGENCY (wiring diagram extract)



For this function, the selector switch must be in position “REMOTE”.

OPEN CLOSE STOP

Conventional control is possible in the open-close duty (OPEN - CLOSE - STOP). The analogue inputs ANIN1 and ANIN2 have no function.
Generally, the bus communication has priority, i.e. in case of unconnected I/O inputs, the AUMATIC reacts only to operation commands which are received by the fieldbus interface.
As soon as the ‘BUS/REMOTE’ input is supplied with 24 V DC (115 V AC as an option), the AUMATIC will only react to operation commands which were received via these digital inputs (OPEN - CLOSE - STOP). In this case, self-retaining is active and there is no possibility to operate the actuator via an analogue setpoint signal.
For this function, the selector switch must be in position “REMOTE”.

Feedback signals via AUMATIC display or via Modbus

Feedback signals on the display			Modbus	Note
S3	NOT READY IND.	EXTERNAL CONTROL	Bit 13.7 = 1 (page 29)	Operation via additional control inputs (i.e. BUS/REMOTE connected to 24 V DC or 115 V AC as an option)
		EMERGENCY MODE	Bit 13.5 = 1 (page 29)	Emergency mode is active (the EMERGENCY function is active and 0 V are applied at the EMERGENCY input).

16. Combination fieldbus/standard interface (option)

The AUMATIC can also be equipped with an additional interface. Thus, an additional operation command channel (digital inputs or an analogue 0/4 – 20 mA output) is available and furthermore, the available feedback possibilities of the I/O interface (relay contacts, analogue feedbacks) can be used, in addition to the feedback signals transmitted via fieldbus. Irrespective of the signal assignment of these inputs, the fieldbus communication with the DCS is maintained.

The settings for the I/O interface and the fieldbus interface are performed via the following menus:

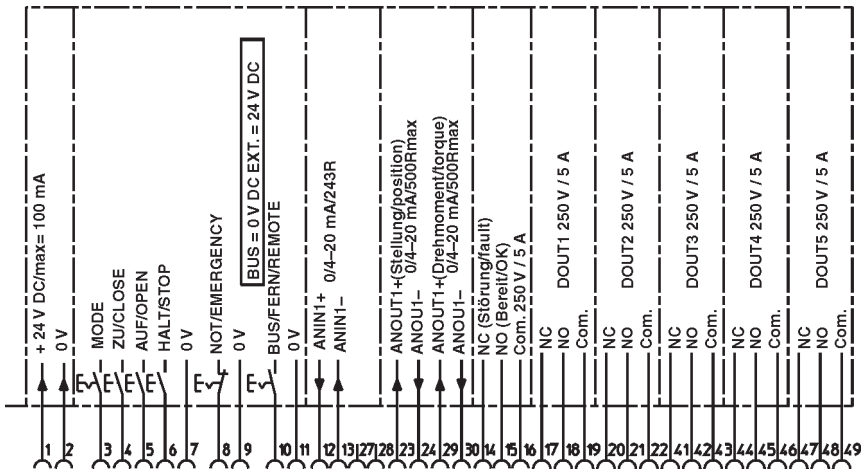
Menu structure

```
MAIN MENU (M)
    SETTINGS (M1)
        I/O 1 (M14)
        MODBUS 1 (M1F)
```

Standard application

Generally, the bus communication has priority, i.e. in case of unconnected I/O inputs, the AUMATIC reacts only to operation commands which are received by the fieldbus interface. At the same time, the programmed feedback signals of the I/O interface (relay output and analogue outputs) are available.

Figure H: Pin assignment with parallel interface (wiring diagram extract)



As soon as the 'BUS/REMOTE' (figure H-2) input is supplied with 24 V DC (or 115 V AC), the AUMATIC will only react to operation commands which are received via the conventional I/O interface (OPEN - CLOSE or MODE and 0/4 – 20 mA nominal value).
In case of an unconnected MODE input (or MODE input connected to 0 V), the input signal of the analogue input 1 is interpreted as nominal value signal. If the failure behaviour is accordingly programmed (see page 39), a failure position can be approached, in case of interruption of the nominal value signal (parameter: `FAILURE SOURCE = SETPOINT E1`).

Application with EMERGENCY function active:

The EMERGENCY function has the highest priority. The polarity of the EMERGENCY input is identical to the standard AUMATIC version (equipped with an I/O interface). This means that the actuator will perform the programmed EMERGENCY operation if 0 V is applied at the EMERGENCY input (or the EMERGENCY input is unconnected) irrespective of the "BUS/REMOTE" input and of the operation commands received via fieldbus. As long as this EMERGENCY signal is present, the actuator can neither be operated by the digital input signals of the parallel interface nor via the fieldbus.
The EMERGENCY function is defined via the parameters for the operation

mode EMERGENCY. Refer to the operation instructions to the actuator (multi-turn actuator SA(R) .../ part-turn actuator SG . . . with AUMATIC AC . . .).
If the actuator is to be operated via fieldbus or the inputs of the I/O, the selector switch has to be in position “REMOTE”.
As soon as the EMERGENCY signal is no longer present (EMERGENCY input at 24 V DC or 115 V AC as an option), operation commands which are transferred via Modbus are immediately executed, while OPEN/CLOSE operation commands which are present at the additional control inputs are deleted and have to be reapplied.

Note:
There is no automatic change-over to the I/O in case of an interruption of the bus communication!

Feedback signals via AUMATIC display or Modbus

Feedback signals on the display			Modbus	Note
S3	NOT READY IND.	EXTERNAL CONTROL	Bit 13.7 = 1 (page 29)	Operation via parallel interface (i.e. BUS/REMOTE on 24 V DC or optional 115 V AC)
		EMERGENCY MODE	Bit 13.5 = 1 (page 29)	Emergency mode is active (the EMERGENCY function is active and 0 V are applied at the EMERGENCY input).

17. EMERGENCY STOP function (option)

As an option, the AUMATIC can also be equipped with an EMERGENCY STOP mushroom button. When engaged, this EMERGENCY STOP interrupts the control voltage of the contactors.

Figure J: AUMATIC with EMERGENCY-STOP mushroom button

Restrictions

- The EMERGENCY STOP function is not available for ACExC, but only for the weatherproof versions of the AUMATIC!

Function

As soon as this EMERGENCY STOP button is engaged, several steps are performed in the AUMATIC.
- The 24 V AC control voltage of the AUMATIC contactors is interrupted.
- Switching-off the operation command and cancelling of a possibly set self-retaining mode.
- Indication of the EMERGENCY STOP status by setting a bit in the process representation output (byte 13 – Not ready ind., bit 4 – Emcy STOP active).
- Optional: Indication of the operation status of the EMERGENCY STOP button by activating a signal relay.
- Optional: Indication of the operation status of the EMERGENCY STOP button by lighting up of a local control LED.
- Indication of the EMERGENCY STOP status in the display showing the entry ‘EMCY STOP ACTIVE’ in the diagnosis page S3 “NOT READY IND.”
- EMERGENCY STOP status indication in the status indication S0: Operation status “EMERGENCY STOP”

After having unlocked the EMERGENCY STOP button, a possibly active operation command will **not immediately** be re-activated. This will be done once the user has confirmed the command. The EMERGENCY STOP status is then reset.
For confirmation, the RESET button of the local controls in selector switch position LOCAL has to be pressed so that the controls will be reset into normal operation. After this, operation commands can be performed right away, also emergency and failure operations.
The confirmation can be done either via the RESET button or via the RESET bit of the process representation output (when selector switch is in position REMOTE).

Feedback signals via AUMATIC display or Modbus

Feedback signals on the display			Modbus	Note
S0	1st line (only if EMERGENCY STOP button was operated)	EMER-GENCY STOP		The EMERGENCY STOP button has been operated and has put the AUMATIC into the EMERGENCY STOP status. This status can only be cancelled by unlocking the EMERGENCY-STOP button and a subsequent RESET command.
S3	NOT READY IND.	EMCY STOP ACTIVE	Bit 13.4 = 1 (page 29)	

Setting the feedback signals via output relay (at the local controls)

Menu structure

```
MAIN MENU (M)
   SETTINGS (M1)
        I/O 1 (M14)
             OUTPUT RELAY X
```

OUTPUT RELAY X = EMCY STOP BUTTON

The selected output relay is activated, once the EMERGENCY-STOP button was operated.
This signal can be cancelled by unlocking the EMERGENCY-STOP button.

Setting the feedback signals via LED's (at the local controls)

Menu structure

```
MAIN MENU (M)
   SETTINGS (M1)
        LOCAL CONTROLS (M14)
             LED X LOCAL CONTROLS
```

LED X LOCAL CONTROLS = EMCY STOP BUTTON

The selected LED is illuminated, once the EMERGENCY STOP button was operated.
This signal can be cancelled by unlocking the EMERGENCY STOP button.

18. Redundant bus connection

A redundant connection between the AUMATIC and the DCS can be established by using a second fieldbus cable.
Three options are available:
1) Cable redundancy with a single Modbus interface
2) Component redundancy with two Modbus interfaces in a single AUMATIC.
For the bus connection refer to page 13 et seqq.
3) Redundancy in loop structure

18.1 Cable redundancy with a single Modbus interface

When two Modbus cables are connected to one Modbus component, the change-over between the channels takes place if one channel has not received a valid telegram to its own address during the waiting time. Thus the change-over is done with a time delay (see “channel check time”). Additionally the communication can not be carried out on both channels simultaneously.

Cable redundancy is only to be used with the DCS after successful completion of an integration test. In cases of doubt, the component redundancy is to be preferred.

18.1.1 Settings for Modbus component 1 using the cable redundancy

The behaviour of the cable redundancy can be adapted via the parameters CABLE REDUNDANCY and CHANNEL CHECK TIME in the AUMATIC display.
Access to the parameters is performed in the same way as for the setting of the baud rate (see pages 18 et seqq.) and via the following menus:

Menu structure

```
MAIN MENU (M)
   SETTINGS (M1)
        MODBUS 1 (M1F)
             BAUDRATE (M1FX1)
             PARITY (M1FX2)
             CONNECT-CONTROL TIME (M1FX3)
             SLAVE ADDRESS (M1FX4)
             CABLE REDUNDANCY (M1FX5)
             CHANNEL CHECK TIME (M1FX6)
```

Description of the parameter settings for cable redundancy

This parameter may be used to determine the behaviour of a second redundant Modbus cable, where connected:

NONE

A second connected Modbus channel is ignored (default setting).

ON,TX:ACTIVE CHANNEL:

Response telegrams are only sent via the active Modbus channel. In case of loss of communication on the active Modbus cable, there will be an automatic change-over to the second Modbus cable after the channel check time has elapsed.

ON,TX:BOTH CHANNELS:

Response telegrams are sent via both connected Modbus channels. This permits monitoring of the inactive channel by monitoring the slave reply messages. In case of loss of communication on the active Modbus channel, there will be an automatic change-over to the second Modbus channel after the channel check time has elapsed.

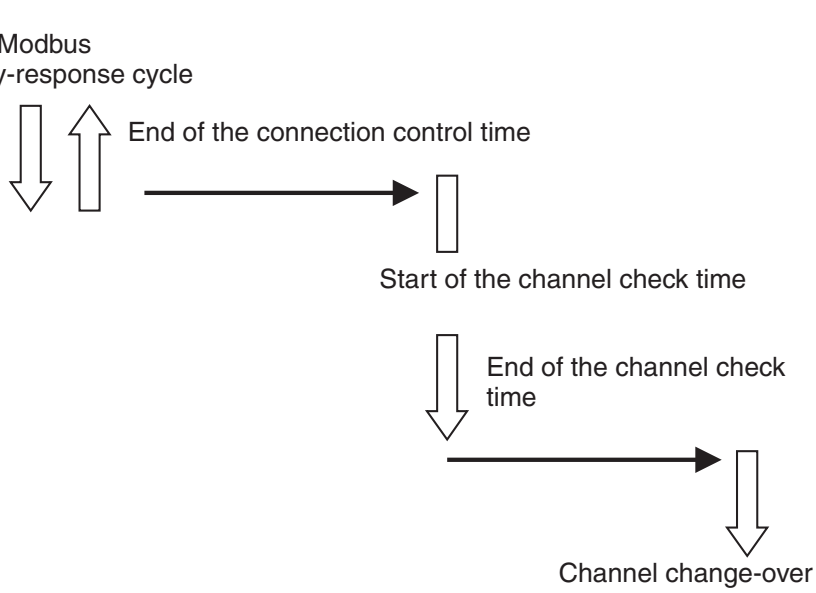
Description of the parameter settings for the channel check time

Standard value: 5.0s
Setting range: 0.0 to 25.5 seconds

This time is used to set the waiting time for the change of the Modbus channel.
As soon as the time has expired since the AUMATIC has not received a valid Modbus telegram on the active channel (connection to the master interrupted or master no longer available) a change of the Modbus channel is initiated.

18.1.2 Time behaviour of the cable redundancy

The connection control time is started with the last Modbus query-response cycle before communication failure (see page 21).
If no valid Modbus telegram has been received within this connection control time, the change-over procedure will be initiated with the start of the channel check time. At the end of the channel check time, the change-over is performed on the other channel:



18.2 Redundant bus connection with component redundancy (option)

The AUMATIC can be equipped with a second (redundant) Modbus interface. In this version, communication to the actuator can be established simultaneously through both Modbus interfaces. If one of the Modbus components fails, e. g. through cable break, those operation commands, which are sent via the other Modbus component, are executed.
If there is a communication to the master available via both Modbus interfaces, the operation commands of the interface which first established a communication to the master will be executed.
For the bus connection refer to page 13 et seqq..

18.2.1 Settings for the redundant Modbus interface 2 (component redundancy)

The redundant Modbus component 2 is set in the same way as the setting for the Modbus component 1 (see page 18 et seqq.) and via the following menus:

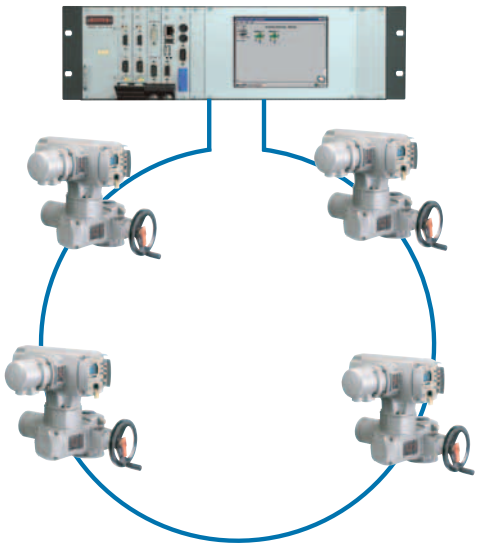
Menu structure

```
MAIN MENU (M)
   SETTINGS (M1)
       MODBUS 2 (M1G)
            BAUDRATE (M1GX1)
            PARITY (M1FX2)
            CONNECT-CONTROL TIME (M1GX3)
            SLAVE ADDRESS (M1GX4)
```

In case of component redundancy, the parameter CABLE REDUNDANCY of both Modbus components must be set to OFF (this corresponds to the factory setting).

18.3 Redundant bus connection for loop structure redundancy (option)

As an option, the AUMATIC can be equipped with Modbus RTU interface, allowing the structuring of redundant Modbus RTU fieldbus systems in loop topology when combined with the SIMA Master Station.



Only a two-wire fieldbus cable is required between the actuators as fieldbus cable (refer to subclause 7.5.3 Bus cable).
Modbus RTU is used as data protocol. Each AUMATIC is equipped with two Modbus RS-485 interfaces for which the setting is done in the same way as for the component redundancy (refer to subclause 18.2.1).
The settings of the following parameters must be identical for both Modbus RTU interfaces:
BAUDRATE (M1FX1 or M1GX1)
PARITY (M1FX2 or M1GX1)
CONNECT-CONTROL TIME (M1FX2 or M1GX3)
SLAVE ADDRESS (M1FX4 or M1GX4)
Please refer to subclause 7.6 for instructions on parameter setting.

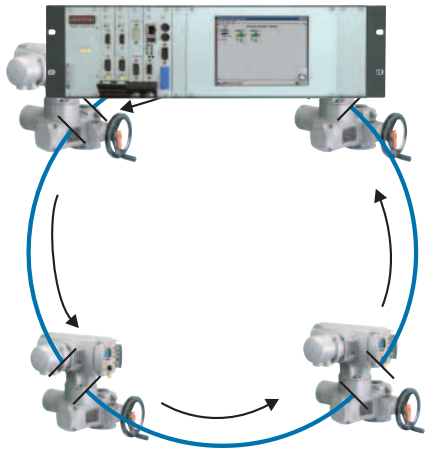
The Modbus slave addresses of the AUMATIC actuator controls must be assigned in ascending order, starting at port 1 of the SIMA Master Station.

For loop structure redundancy, the CABLE REDUNDANCY parameter must be set to OFF (this corresponds to the setting ex works).

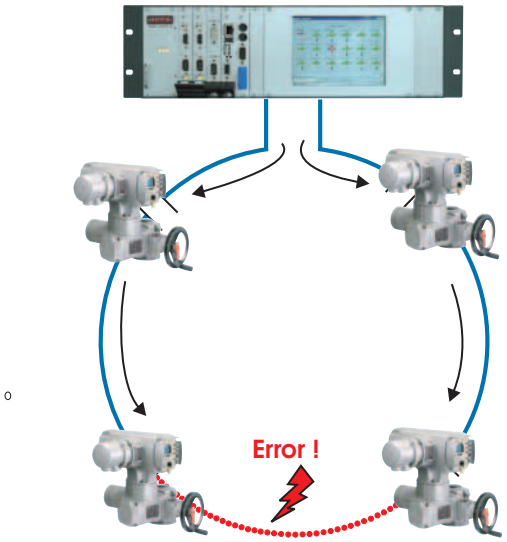
Please refer to the separate operation instructions “SIMA Master Station with AUMATIC Modbus” for further information regarding the setting and operation of the SIMA Master Station made by AUMA.

Special features of the loop structure

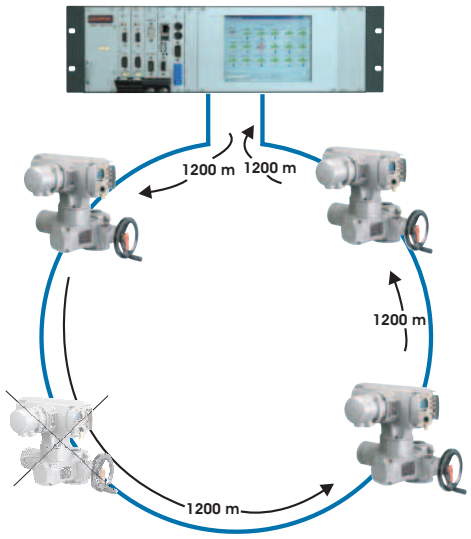
The two interfaces of the AUMATIC are galvanically isolated from each other. The Modbus RTU data telegrams from the SIMA Master Station are received by the AUMATIC via an interface and are forwarded to the next device by means of the repeater function of the second interface.
The master will only receive a response if the data telegram received via the first interface was sent to the pre-set address; otherwise the telegrams are merely forwarded.
The galvanic isolation generates RS-485 loop segments with a maximum admissible cable length of 1,200 m per SIMA Master Station; consequently, 127 AUMATIC actuators can be connected to one loop. In theory, Modbus RTU networks with cable lengths of up to 150 km may be implemented.



The Modbus communication to the actuators is maintained in the event of a cable fault as the galvanic isolation prevents the transmission of a fault from one loop segment to the neighbouring loop segment. As long as only one loop segment fails, the communication to the other actuators is maintained via the remaining segments.



The maximum cable length of one loop segment between the actuators amounts to 1,200 m (without any additional external repeater).
In the event of a power failure of an AUMATIC, the neighbouring loop segments are automatically connected to each other in order to maintain the integrity of the loop structure. This cancels the galvanic isolation between both RS-485 connections, and a new, longer loop segment is created.



During the configuration, special attention should be paid to ensure that two neighbouring loop segments do not exceed a total cable length of 1,200 m; otherwise, external repeaters should be provided.

18.4 External change-over of the communication channels

A communication channel can be selected via the change-over bits channel 1 and channel 2 in the process representation output (page 35).

Bit 5 Channel 2	Bit 4 Channel 1	Designation
0	0	No channel selected, change-over does not take place. The previous channel is retained.
0	0 → 1	Change-over to channel 1 (A) is started.
0	1	Channel 1 (A) remains selected
0	1 → 0	Channel 1 (A) remains selected.
0	0	Channel is retained.
0 → 1	0	Change-over to channel 2 (B) is started.
1	0	Channel 2 (B) remains selected.
1 → 0	0	Channel 2 (B) remains selected.
0	0	Channel is retained.
0 → 1	0 → 1	No change-over.
1	0 → 1	No change-over.
0 → 1	1	No change-over.
1	1	Channel is retained.
0 → 1	1 → 0	Change-over to channel 2 (B) is started.
1 → 0	0 → 1	Change-over to channel 1 (A) is started.

18.4.1 Details of the change-over

- The change-over is only executed in response to transition of these bits, i.e. the change-over is initiated by the transition 0 → 1.
- If the bit for channel changing is set, the addition of the second bit does not have any effect.
- Transition from one channel to the other is supported, i.e. bits can be changed simultaneously (e.g. channel A: 1 → 0 and channel B: 0 → 1).
- In case of cable redundancy without a second Modbus component, the redundant bus cable of the installed Modbus component is selected.
- In case of component redundancy with two Modbus components, the redundant Modbus component is selected.

18.4.2 Behaviour for cable redundancy

- A change-over to the redundant channel can be started if communication is not established via the second channel.
- The Modbus component changes the channel when the bits are set. The previous connection is terminated, at the same time the channel check time starts.
- If a connection to a master could be established during the channel check time, the connection on the new communication channel is retained.
- If no connection could be established, the system switches back to the previous communication channel.

18.4.3 Behaviour in case of component redundancy (two Modbus components installed)

In this case the change-over is only performed if the bits in the process representation input are set accordingly and both components communicate with the master.

18.4.4 Behaviour in case of redundancy in loop structure (option)

In case of redundancy in loop structure, a Modbus RTU interface is used for communicating with the actuator, the second interface forwards the data telegram to the next device. Switching to the second interface is done as soon as the switching bits are set. Within the communication control time, a valid telegram must have been received via the second interface, otherwise the AUMATIC signalises the loss of Modbus communication (the message DATA EX of the display diagnosis page for the interface concerned will be deleted).

19. Indication and programming of the AUMATIC

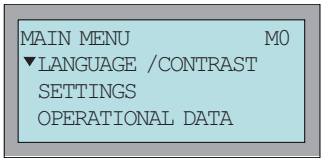
19.1 Software parameters of the Modbus interface

To get to the display indications and to the software parameters:

- Set selector switch to position **OFF** (0), figure L-1.
- Switch on voltage supply.
- Select menu indication M0 :
  Press push button (C) in one of the status indications longer than 2 seconds:

Figure L-1

> 2 Sec.



- Select the sub-items required with push buttons ▲ and ▼ .
- Confirm the selection with (↵) .

A list of other parameters is included in the operation instructions for the actuator (multi-turn actuators SA(R) . . ./ part-turn actuators SG . . .).

19.1.1 Menu indications

Parameters with the wild card “x” in the submenu can be indicated and changed:
x = 0 : indicate only (grey background)
x = 1 : indicate and change (white background)
(only possible in selector switch position OFF)

To change a parameter, a password must first be entered (for information on how to enter a password see operation instructions of the actuator).

	Subgroup	Parameter Name	Sub menu	Standard value	Min/ Max	Valuetext	Note
M1	**SETTINGS**						
M1F	MODBUS 1	BAUDRATE	M1FX1	5	0	300 BAUD	Modbus 1: Baudrate selection
					1	600 BAUD	
					2	1200 BAUD	
					3	2400 BAUD	
					4	4800 BAUD	
					5	9600 BAUD	
					6	19200 BAUD	
					7	38400 BAUD	
		PARITY	M1FX2	1	0	NO, 2 STOPBITS	Modbus 1: Parity selection
					1	EVEN, 1 STOPBIT	
					2	ODD, 1 STOPBIT	
M1F	MODBUS 1	CONNECT-CONTROL TIME	M1FX3	3,0	1,0		Modbus 1: connection control time (in s)
					25,5		
		SLAVE ADDRESS	M1FX4	247	1		Modbus 1: Slave address
					247		
		CABLE REDUNDANCY	M1FX5	0	0	OFF	Modbus 1: Redundancy behaviour
					1	ON,TX:ACTIVE CHANNEL	
					2	ON,TX: BOTH CHANNELS	
		CHANNEL CHECK TIME	M1FX6	5,0	0,0		Modbus 1: Channel check time (in s)
					25,5		
M1G	MODBUS 2	Menu and parameter structure identical to MODBUS 1 (option, only available for component redundancy)					
M4	**CONFIGURATION**						
M41	SETUP	MB1 ANLOG IN1 START	M41XX	0	0		Analogue input 1: (Modbus-1) Start value and end value (in mA);
					20,0		
		MB1 ANLOG IN1 END	M41XY	20,0	0		
					20,0		
		MB1 ANLOG IN2 START	M41XZ	0	0		Analogue input 2: (Modbus-1) Start value and end value (in mA);
					20,0		
		MB1 ANLOG IN2 END	M41XA	20,0	0		
					20,0		

20. Description of the Modbus interface

Figure M: Modbus interface

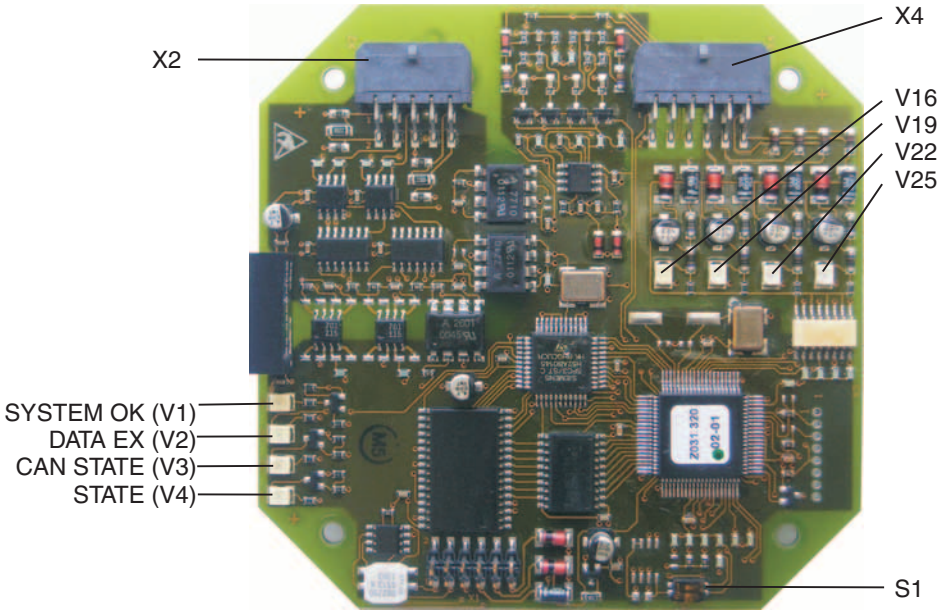


Table 7: DIP switch S1: Configuration of the Modbus board

S1-1	Only one Modbus interface available	OFF
	Two Modbus interfaces available	1st Modbus interface: OFF 2nd Modbus interface: ON
S1-2	Spare	OFF

V1 to V4
Description see page 65.

V16, V19, V22, V25
LEDs of the digital customer inputs (option); they are illuminated when + 24 V DC are applied to the inputs.

20.1 Assignment of the customer inputs of the Modbus interface (option)

X4 This plug provides pins for 4 digital customer inputs and 2 analogue customer inputs.

Table 8: Digital inputs (galvanically isolated)

Pin	Description	LED
3	R1: digital input 1	V 16
4	R2: digital input 2	V 19
5	R3: digital input 3	V 22
6	R4: digital input 4	V 25
7	0 V	

These signals are freely available inputs, which the microcontroller transmits into the process representation input (OPTIONS part 1, bits 4 – 7). The inputs are galvanically isolated and internally connected to 0 V via pull-down resistors. In an unconnected state a logical zero is transmitted. To set an input to logical one, + 24 V DC must be applied.

Table 9: Analogue inputs

Pin	Description
2	AN1: Analogue signal (0 – 20 mA)
13	GND (Systemground)
25	AN2: Analogue signal (0 – 20 mA)
28	GND (Systemground)

Via these inputs external 0/4 – 20mA sensors for transmitting the measured values through the Modbus can be connected.

- **Proposed wiring diagrams (appendix C of the operation instructions) for these signals must be observed.**
- **The bounce time of the connected switches should not be more than 1 ms.**
- **The inputs AN1 and AN2 do not have galvanic isolation via opto-isolator.**

The measuring range of the analogue inputs can be set (see page 50, CONFIGURATION).

20.2 Modbus connection assignment

X2 On this plug the bus signals and the galvanically isolated voltage supply for the bus termination, as well as the bus termination resistors on the Modbus board, are connected.

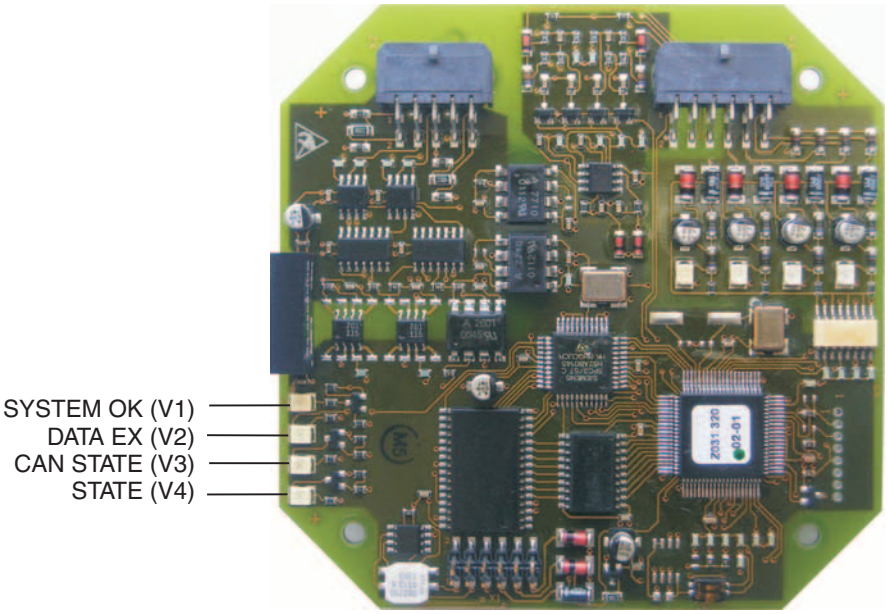
Table 10: Pin assignment X2

Pin	Description
1	Channel 1: B-cable bus termination
2	Channel 1: A-cable bus termination
3	Channel 1: B-cable Modbus
4	Channel 1: A-cable Modbus
8	Channel 2: A-cable Modbus (cable redundancy only)
7	Channel 2: B-cable Modbus (cable redundancy only)
9	Channel 2: B-cable bus termination (cable redundancy only)
10	Channel 2: A-cable bus termination (cable redundancy only)

21. Trouble shooting and corrective actions

21.1 Optical signals during operation

Figure N: Modbus interface



LED 'SYSTEM OK' (V1) (green)

This LED shows the correct voltage supply to the Modbus board.

Is continuously illuminated:	Voltage connected to Modbus interface.
Is blinking:	Microcontroller defective.
Is not illuminated:	No voltage at the Modbus interface.

LED 'DATA EX' (V2) (green)

When LED is illuminated, the Modbus interface has entered 'Data Exchange' state. Only in this state can the actuator be controlled by the Modbus master and the state of actuator be read.

LED 'CAN STATE' (V3) (red)

Is illuminated or blinking:	Communication to logic is faulty
Is not illuminated:	Communication with logic is ok

LED 'STATE' (V4) (green)

Is illuminated or not illuminated:	Modbus interface not ready
Is blinking:	Program on the Modbus interface is being executed.

Regular blinking of the LED during operation indicates correct operation of the Modbus interface.

21.2 Status indications in the display

The status indications (Group S) in the display show the current operation mode as well as faults and warnings. For detailed notes regarding the indication and operation see the appropriate operation instructions of the actuator.

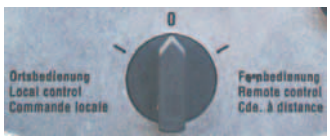
21.3 Modbus diagnosis indication in the display

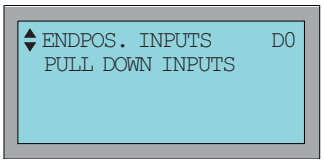
The information contained in the diagnosis indication (Group D) is only provided for the AUMA service and for enquiries in the factory. In the subgroup DR, DS, DT, DU, DV status information can be requested of Modbus.

To go to the Modbus diagnosis indications:

- Set selector switch at the AUMATIC to position **OFF** (0), figure R-1.
- Switch on supply voltage.
- Press push button Ⓒ and hold it until the group D0 appears (menu indications M are hereby skipped).

Figure P



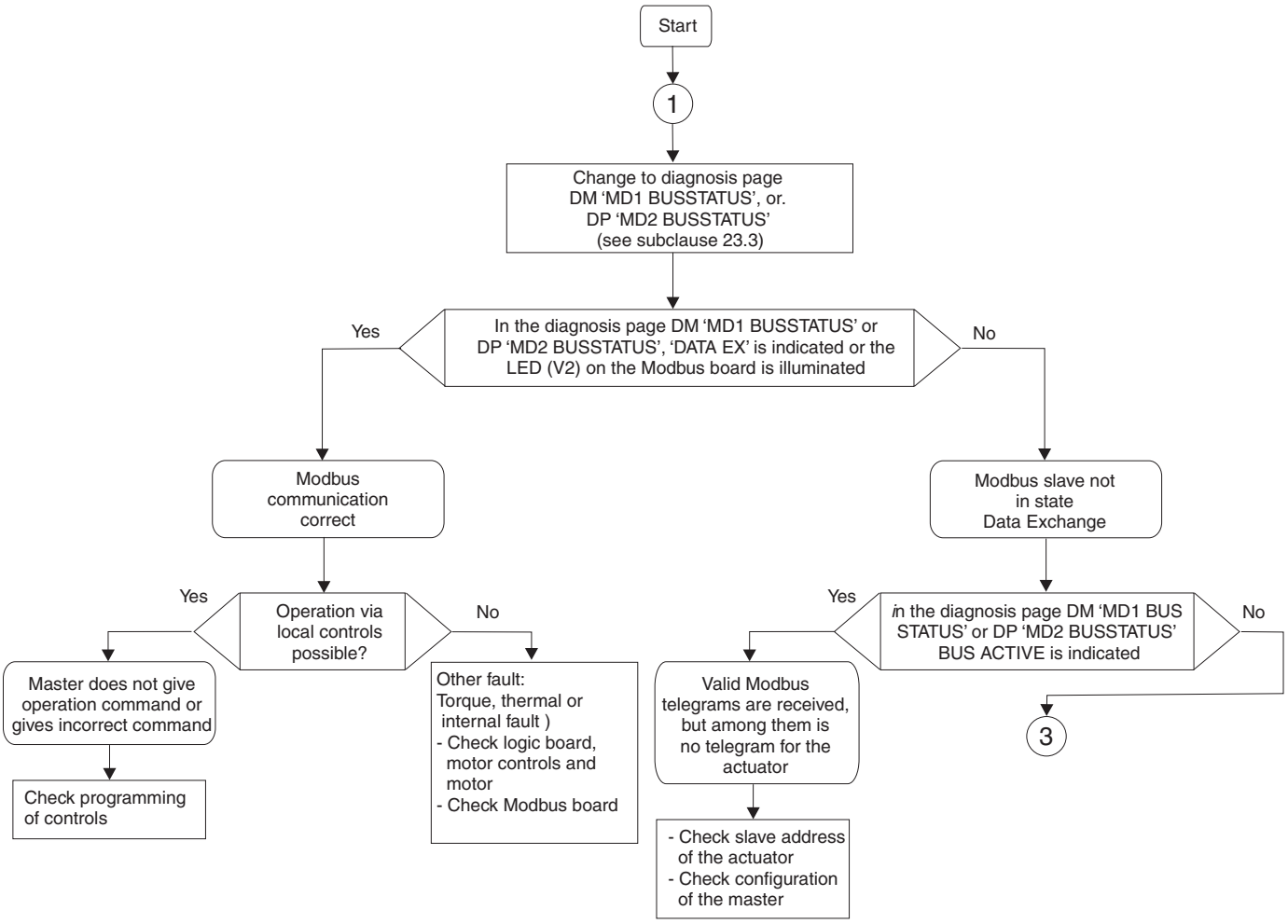


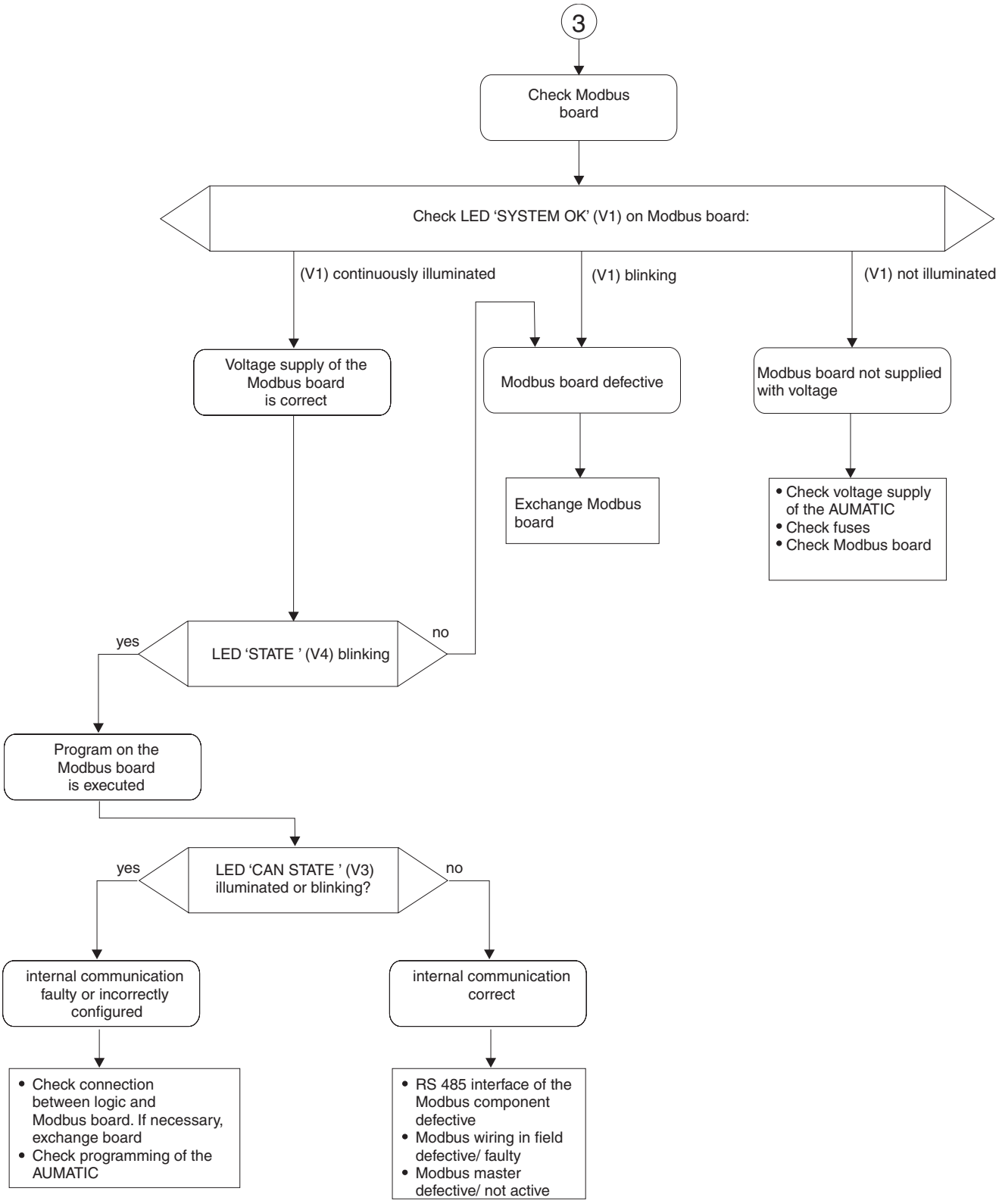
- Select the sub-items required with the push buttons ▲ and ▼.
- To go back to the status indication:
  Press push button Ⓒ briefly once.

Menu		Abbreviation in the display	Note
DK	**MD1 HRDWR.VER.**		Hardware version of the Modbus interface 1
DL	**MD1 SFTWR. VER.**		Software version of the Modbus interface 1
DM	**MD1 BUS STATUS** (Status of the Modbus interface 1)		
		DATA EX	The Modbus interface is currently exchanging data with the master
		BUS ACTIVE	The Modbus interface receives valid Modbus telegrams
		CHANNEL 2 ACTIVE	The Modbus interface communicates via the second channel
DN	**MD2 HRDWR. VER.**[1)]		Hardware version of the Modbus interface 2
DO	**MD2 SFTWR. VER.**[1)]		Software version of the Modbus interface 2
DP	**MD2 BUS STATUS**[1)] (Status of the Modbus interface 2)		
		DATA EX	The Modbus interface is currently exchanging data with the master
		BUS ACTIVE	The Modbus interface receives valid Modbus telegrams
		CHANNEL 2 ACTIVE	The Modbus interface communicates via the second channel

1) Option, only available for component redundancy

21.4 Actuator can not be controlled via Modbus

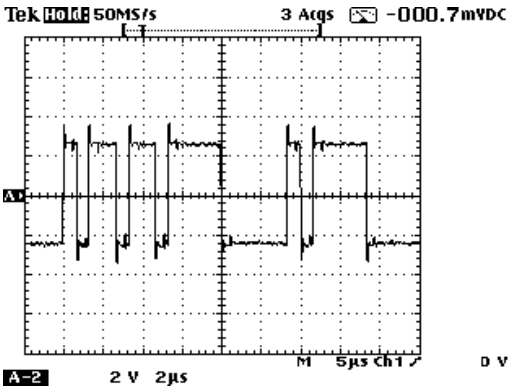



3
Check Modbus board
Check LED 'SYSTEM OK' (V1) on Modbus board:
(V1) continuously illuminated
(V1) blinking
(V1) not illuminated
Voltage supply of the Modbus board is correct
Modbus board defective
Modbus board not supplied with voltage
Exchange Modbus board
• Check voltage supply of the AUMATIC
• Check fuses
• Check Modbus board
yes
LED 'STATE ' (V4) blinking
no
Program on the Modbus board is executed
yes
LED 'CAN STATE ' (V3) illuminated or blinking?
no
internal communication faulty or incorrectly configured
internal communication correct
• Check connection between logic and Modbus board. If necessary, exchange board
• Check programming of the AUMATIC
• RS 485 interface of the Modbus component defective
• Modbus wiring in field defective/ faulty
• Modbus master defective/ not active

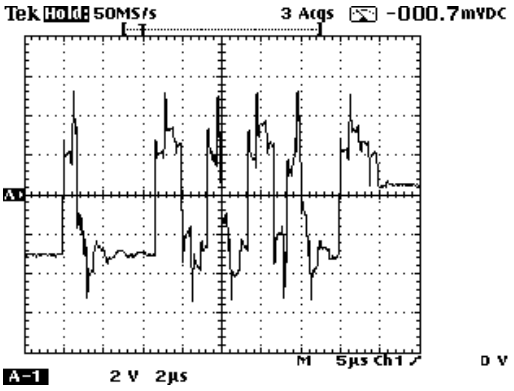
21.5 Measuring the Modbus signals with an oscilloscope

On the connection board the signal from Modbus channel 1 on plug (X1 Modbus, see page 14) pin 2 (N/A) and pin 1 (P/B) can be checked with a digital oscilloscope.
The off-load voltage between pin 1 (+) and pin 2 (-) must be positive and in the range between 0.8 V and 1.4 V.

Example of a correct Modbus signal

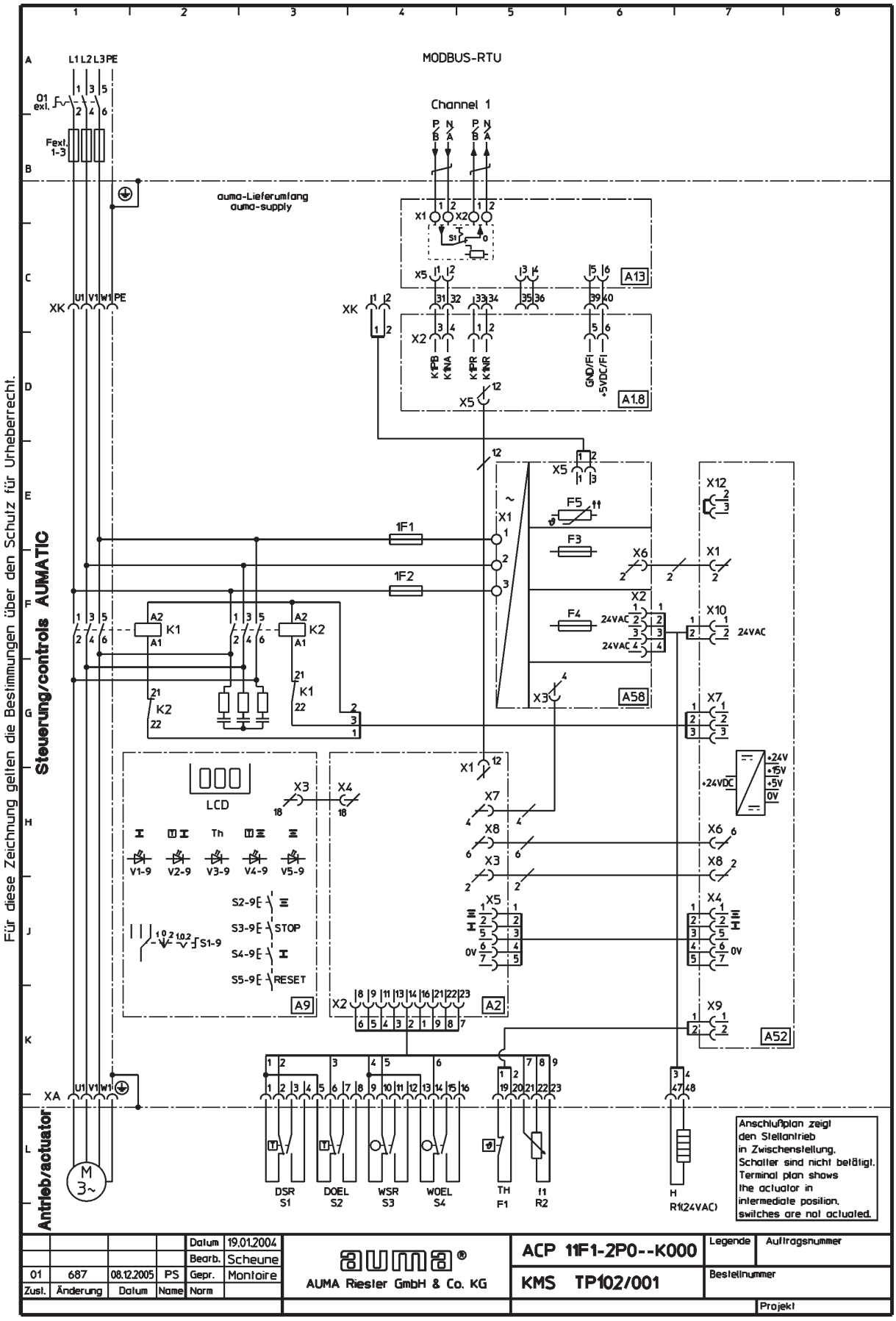


Example of an incorrect Modbus signal (bus only connected on one side):



22. Appendix A Wiring diagram

Standard wiring diagram AUMATIC Modbus



22.1 Legend for wiring diagram AUMATIC Modbus

A1.0		Interface-Platine / Interface board
K1-1.0...K6-1.0		Meldung/Output 1-5: programmierbare Melderelais/programmable output relays
A1.8		MODBUS-Platine
A2		Logik-Platine / Logic board
A4		Varistor-Platine / Varistor board
R1, R2, R3, R4		Varistoren / Varistors
A5		Thyristor-Platine / Thyristor board
A9		Ortssteuerstelle / Local controls
S1-9		Wahlschalter ORT-AUS-FERN / Selector switch LOCAL-OFF-REMOTE
S2-9		Drucktaster AUF / Push-button OPEN
S3-9		Drucktaster HALT / Push-button STOP
S4-9		Drucktaster ZU / Push-button CLOSE
S5-9		Drucktaster RESET / Push-button RESET
V1-9		Leuchtmelder Endlage ZU / Indication light end position CLOSE
V2-9		Leuchtmelder Drehmomentfehler ZU / Indication light torque error in direction CLOSE
V3-9		Leuchtmelder Motorschutz / Indication light motor protection
V4-9		Leuchtmelder Drehmomentfehler AUF / Indication light torque error in direction OPEN
V5-9		Leuchtmelder Endlage AUF / Indication light end position OPEN
A11		Kaltleiter Auslöse-Platine / Thermistor tripping board
A13		Bus-Anschluß-Platine / Bus connection board
A52		Steuerplatine / Control board
A58		Netzteil / Power supply
F3, F4, F5		Sekundärsicherungen / Secondary fuses
1F1, 1F2		Primärsicherungen Netzteil / Primary fuses for power supply board
2F1, 2F2		Sicherungen für Thyristoren und Netzteil / Fuses for thyristors and power supply board
K1, K2		Wendeschütze / Reversing contactors
XK		Anschluß für Kunden / Connections for customer
XA		Anschluß für Antrieb / Connections for actuator
XM		Anschluß für AUMATIC (Wandhalter) Connections for AUMATIC (wall bracket)
S1	DSR	Drehmomentschalter, Schließen, Rechtslauf Torque switch, closing, clockwise rotation
S2	DOEL	Drehmomentschalter, Öffnen, Linkslauf Torque switch, opening, counter-clockwise rotation
S3	WSR	Wegschalter, Schließen, Rechtslauf / Limit switch, closing, clockwise rotation
S4	WOEL	Wegschalter, Öffnen, Linkslauf / Limit switch, opening, counter-clockwise rotation
S1/2	DSR1	Drehmomentschalter in Tandemanordnung mit DSR/DOEL
S2/2	DOEL1	Torque switch, in tandem operation with DSR/DOEL
S3/2	WSR1	Wegschalter in Tandemanordnung mit WSR/WOEL
S4/2	WOEL1	Limit switch, in tandem operation with WSR/WOEL
B2	RWG	Elektronischer Stellungsgeber / Electronic position transmitter
B6	MWG	Magnetische Weg- und Drehmomenterfassung / Magnetic travel and torque sensor
F1	TH	Thermoschalter / Thermoswitches
R1	H	Heizung / Heater
R2	f1	Potentiometer / Potentiometer
R3	PTC1	Kaltleiter / PTC-thermistor

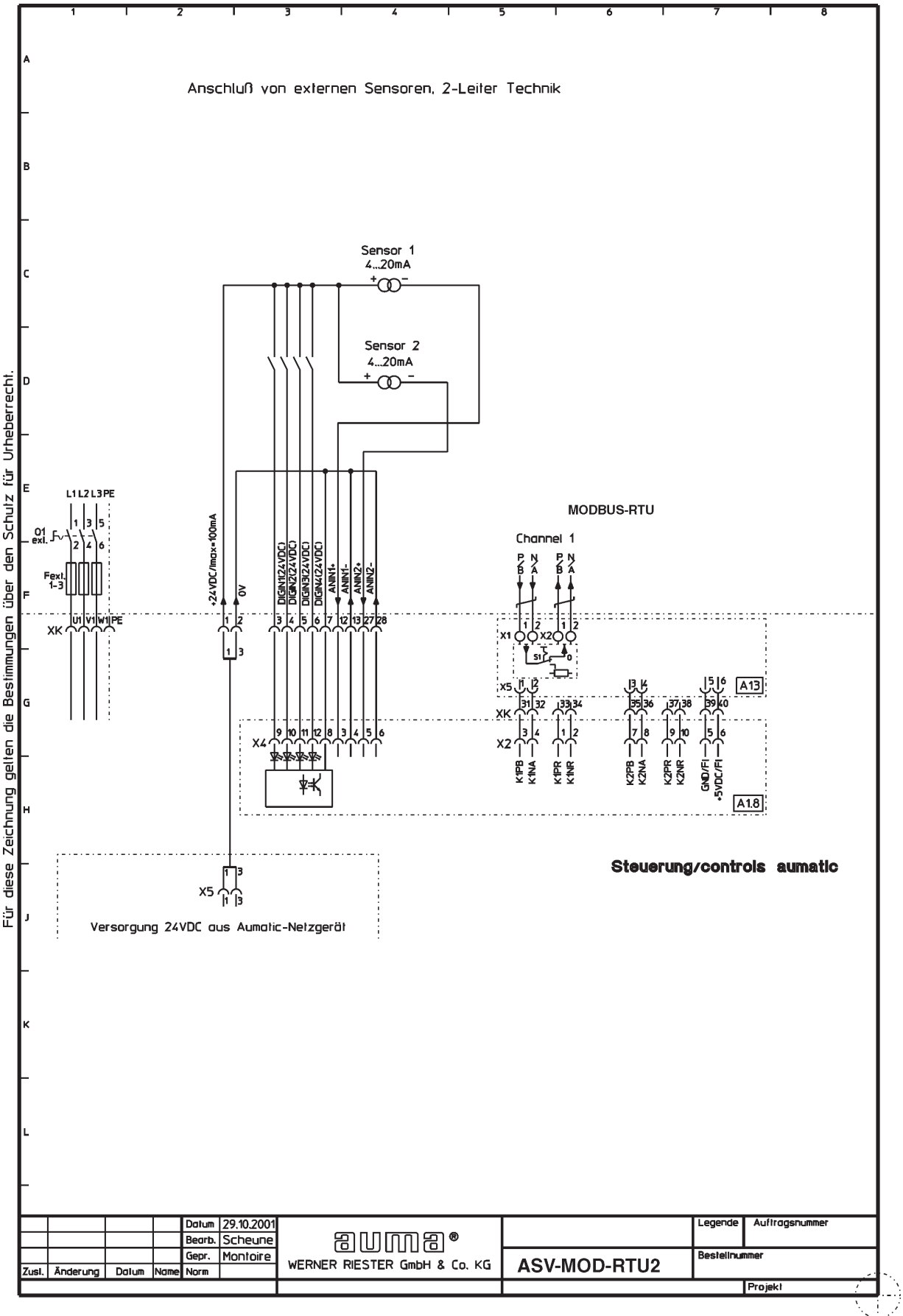
Schaltplan zeigt den Stellantrieb in Zwischenstellung, Schalter sind nicht betätigt.
Wiring diagram shows the actuator in intermediate position, switches are not actuated.

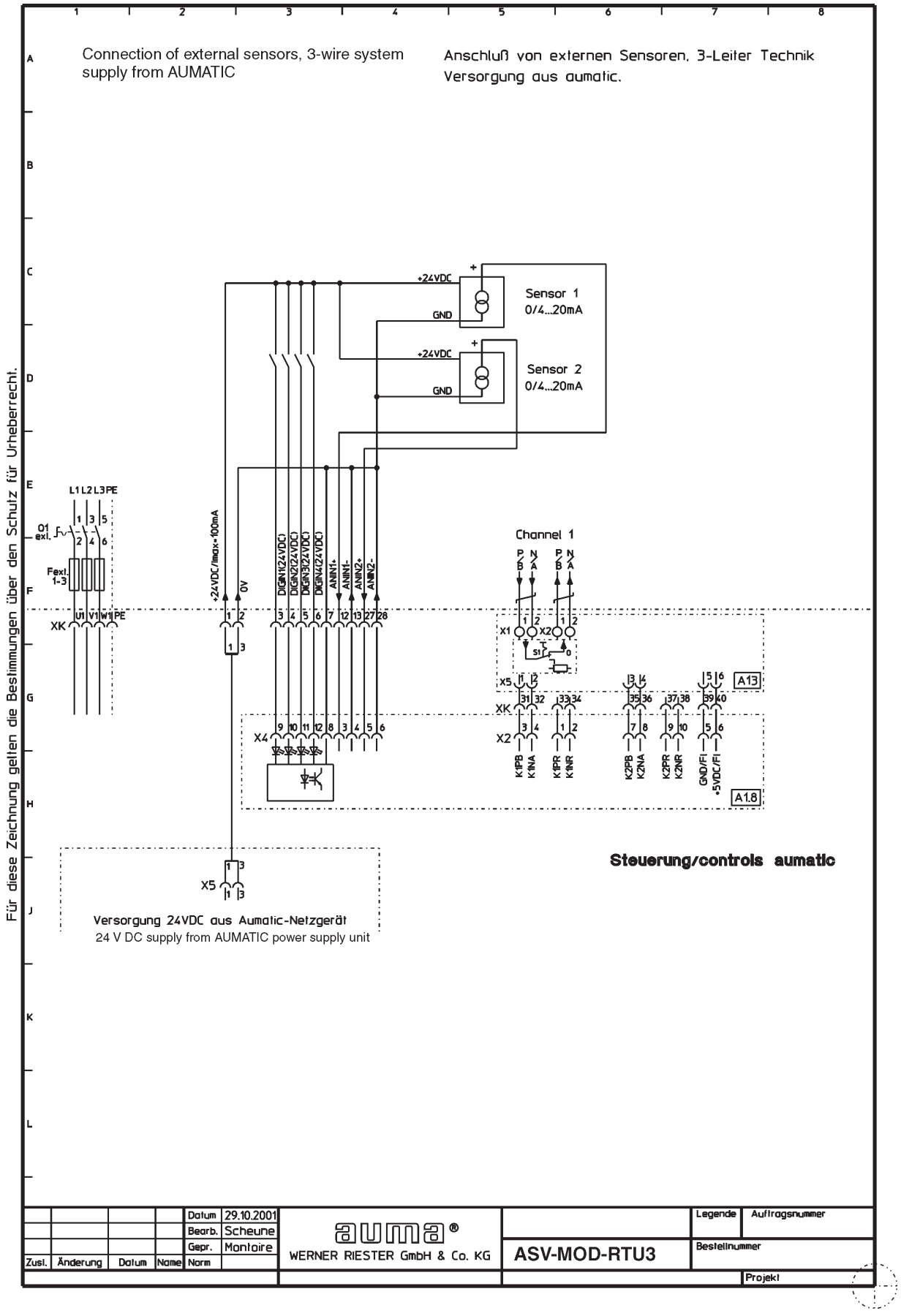
				Datum	
				Bearb.	
				Gepr.	
Zust.	Änderung	Datum	Name	Norm	

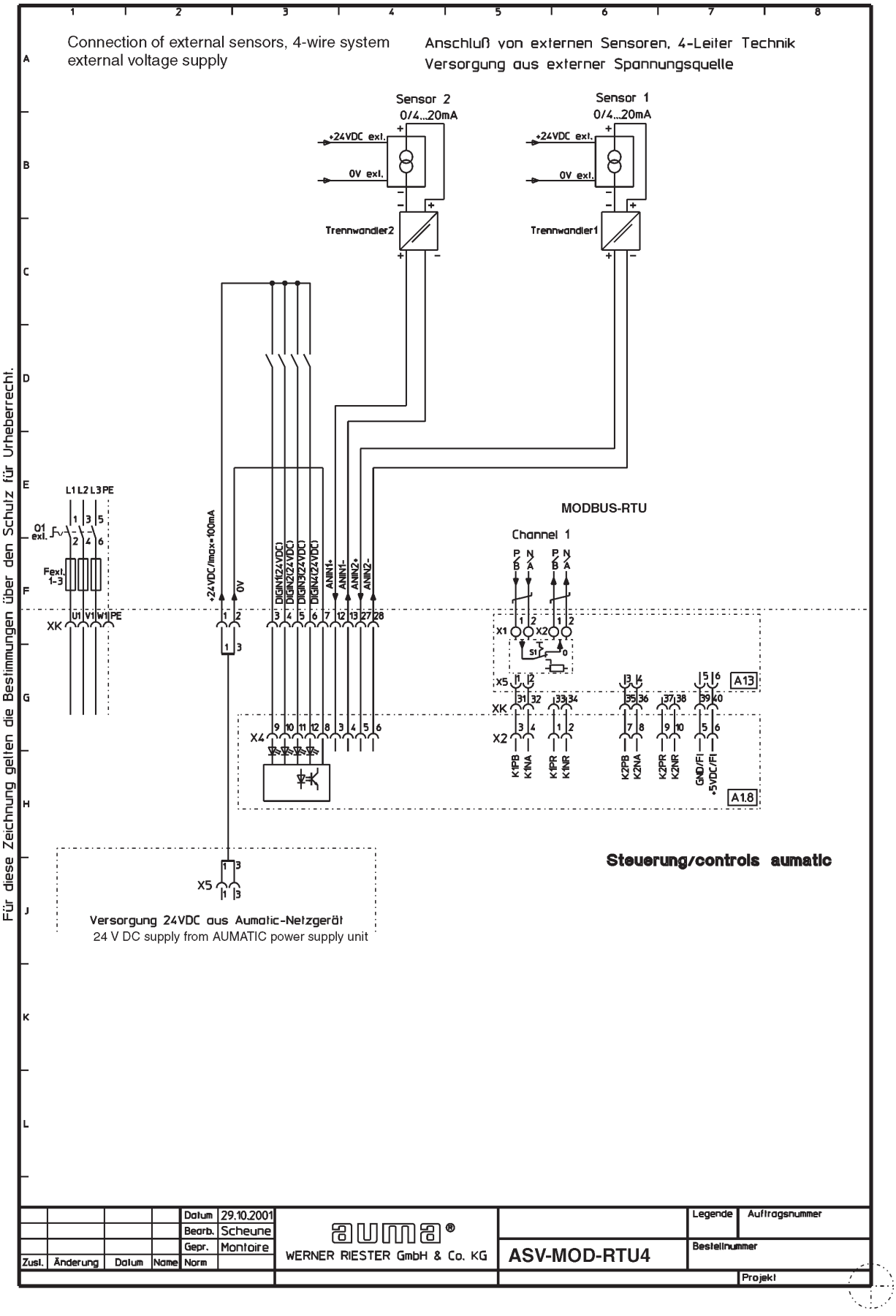
auma®
WERNER RIESTER GmbH & Co. KG

Legende	Auftragsnummer
	Bestellnummer
	Projekt

23. Appendix B Proposed wiring diagram




Connection of external sensors, 3-wire system
supply from AUMATIC
Anschluß von externen Sensoren, 3-Leiter Technik
Versorgung aus aumatic.
Sensor 1
0/4...20mA
Sensor 2
0/4...20mA
+24VDC
GND
Channel 1
L1 L2 L3 PE
XK
X4
X5
X1
X2
A13
A1.8
Versorgung 24VDC aus Aumatic-Netzgerät
24 V DC supply from AUMATIC power supply unit
Steuerung/controls aumatic
Für diese Zeichnung gelten die Bestimmungen über den Schutz für Urheberrecht.
Datum 29.10.2001
Bearb. Scheune
Gepr. Montoire
Norm
Zusl. Änderung Datum Name
WERNER RIESTER GmbH & Co. KG
ASV-MOD-RTU3
Legende
Auftragsnummer
Bestellnummer
Projekt


Connection of external sensors, 4-wire system
external voltage supply
Anschluß von externen Sensoren, 4-Leiter Technik
Versorgung aus externer Spannungsquelle
Sensor 2
0/4...20mA
Sensor 1
0/4...20mA
+24VDC ext.
0V ext.
Trennwandler2
Trennwandler1
MODBUS-RTU
Channel 1
L1 L2 L3 PE
Q1
ext.
Fext.
1-3
XK
+24VDC/Imax=100mA
0V
DIGIN1(24VDC)
DIGIN2(24VDC)
DIGIN3(24VDC)
DIGIN4(24VDC)
ANIN1+
ANIN1-
ANIN2+
ANIN2-
X4
X5
X1
X2
S1
A13
A1.8
K1PB
K1NA
K1PR
K1NR
K2PB
K2NA
K2PR
K2NR
GND/FI
+5VDC/FI
Steuerung/controls aumatic
Versorgung 24VDC aus Aumatic-Netzgerät
24 V DC supply from AUMATIC power supply unit
Für diese Zeichnung gelten die Bestimmungen über den Schutz für Urheberrecht.
Datum 29.10.2001
Bearb. Scheune
Gepr. Montoire
Norm
Zust. Änderung Datum Name
auma®
WERNER RIESTER GmbH & Co. KG
ASV-MOD-RTU4
Legende
Auftragsnummer
Bestellnummer
Projekt

24. Appendix C Literature references

1. Modicon Protocol:
Reference Guide PI-MBUS-300

2. http:/ www.modbus.org
Modbus Application Protocol Specification
Modbus over serial line specification and implementation guide

25. Appendix D Connection of the screen for AUMATIC ACExC 01.1

The screen of the fieldbus cable should be extensively connected with the respective PG-threads.

Recommended threads, e.g. WAZU-EMV/EX by Hugro
(refer to www.hugro-gmbh.de).

26. Appendix E: Parameters

The present appendix contains notes on the parameterization of the AUMATIC via Modbus RTU in the form of a table (Modbus function codes, offset addresses, parameter descriptions as well as the read/write access codes).

Parameters shaded in grey in the table may be read only.

The parameters listed in the following table can be read or written with the following Modbus functions.
Preset Single Register (06),
Preset Multiple Register (16)
Read Holding Register (03)

Due to the AUMATIC parameter structure, only one parameter can be read or written for each Modbus request telegram. If several parameters are to be read or written, several request telegrams have to be used. The data lengths indicated in the table must be taken into consideration.

Table: Parameters of the actuator

Offset (hexadec.)	Offset (decimal)	Parameterl ength[1)]	Parameter name (indication in dsiplay)	Standard value	Min/Max	Value text in display	Note
0x0005	5	1	FAILURE BEHAVIOUR	0	0	OFF	Safety operation behaviour
					1	GOOD SIGNAL FIRST	
					2	FAIL IMMEDIATE	
0x0006	6	1	DELAY TIME	30	0		Time until safety operation is initiated (0.1s)
					12 000		Only possible in combination with bus interface
0x0007	7	1	FAILURE POSITION	0	0	FAIL AS IS	Type of safety operation
					1	FAIL CLOSE	
					2	FAIL OPEN	
					3	FAIL TO POSITION	
0x0008	8	1	PRESET POSITION	0	0		Safety position in per mil
					1 000		
0x000A	10	1	DEAD TIME (T-OFF)	5	0		Dead time positioner (0.1s)
					600		
0x000B	11	1	OPENING STOP BAND	5	0		Overrun dir. Open (per mil)
					99		
0x000C	12	1	CLOSING STOP BAND	5	0		Overrun dir. Close (per mil)
					99		
0x000D	13	1	OUTER DEADBAND	10	1		max. error in per mil
					100		
0x0018	24	1	FAILURE SOURCE	10	0	SETPOINT E1	Failure source
					1	E1 OR E2 FEEDBACK	
					2	BUSINTERFACE	
0x0019	25	1	DIRECTION OPEN	0	0	OFF	StpOpen
					1	REMOTE ONLY	
					2	LOCAL ONLY	
					3	REMOTE AND LOCAL	
0x001A	26	1	ON TIME OPEN	10	10		StpOpen runn. time (0.1s)
					3 000		
0x001B	27	1	OFF TIME OPEN	50	10		StpOpen pause time (0.1s)
					3 000		
0x001C	28	1	START STEP OPEN	0	0		StpOpen start (per mil)
					999		
0x001D	29	1	STOP STEP OPEN	1 000	1		StpOpen end (per mil)
					1 000		
0x001E	30	1	DIRECTION CLOSE	0	0	OFF	StpClose
					1	REMOTE ONLY	
					2	LOCAL ONLY	
					3	REMOTE AND LOCAL	
0x001F	31	1	ON TIME CLOSE	10	10		StpClose runn. time (0.1s)
					3 000		
0x0020	32	1	OFF TIME CLOSE	50	10		StpClose pause time (0.1s)
					3 000		
0x0021	33	1	START STEP CLOSE	1 000	1		StpClose start (per mil)
					1 000		
0x0022	34	1	STOP STEP CLOSE	0			StpClose end (per mil)
					999		

1) Number of data registers required for complete read-out/writing of the parameter

Offset (hexadec.)	Offset (decimal)	Parameterl ength[1)]	Parameter name (indication in dsiplay)	Standard value	Min/Max	Value text in display	Note
0x0023	35	1	MAX. STARTS/HOUR	1 200	0		Monitoring starts per hour
					1 800		
0x0024	36	1	MAX. DUTY CYCLE	0	0	15 MIN	Monitoring max. running time per hour
					1	30 MIN	
					2	24 MIN	
0x0025	37	1	MAX. RUN TIME	900	4		Max. operating time (s)
					36 000		
0x0027	39	1	MAINTAINED LOCAL	3	0	OFF	Self-retaining local
					1	OPEN	
					2	CLOSE	
					3	OPEN + CLOSE (STOP)	
					4	OPEN + CLOSE (NO STOP)	
0x0028	40	1	LCD CONTRAST	80	0		LCD contrast (percent)
					100		
0x0029	41	1	OPEN POSITION	0	0	LIMIT	Seating in end p osition OPEN
					1	TORQUE	
0x002A	42	1	MONITOR TRIGGERS	1	0	FUNCTION NOT ACTIVE	Monitoring (starts and operating time)
					1	FUNCTION ACTIVE	
0x002B	43	1	OPENING	100	5		Tripping torque OPEN in percent
					110		
0x002C	44	1	CLOSING	100	5		Tripping torque CLOSE in percent
					110		
0x002F	47	1	MAINTAINED REMOTE	0	0	OFF	Self-retaining Remote
					1	OPEN	
					2	CLOSE	
					3	OPEN + CLOSE (STOP)	
					4	OPEN + CLOSE (NO STOP)	
0x0033	51	1	CLOSED POSITION	0	0	LIMIT	Switching off in end position Closed
					1	DREHMOMENT	
0x003B	59	1	PASSWORD	0	0		Password
					1 999		
0x003C	60	1	LANGUAGE	0	0	GERMAN	LCD language
					1	ENGLISH	
0x003D	61	1	POSITIONER	0	0	FUNCTION NOT ACTIVE	Positioner
					1	POSITIONER ENABLED	
0x003E	62	1	OPERATIONAL DATA	1	0	VIEW NOT ENABLED	Logging of operating data ON/ OFF
					1	VIEW ENABLED	
0x003F	63	1	EL. NAME PLATE	1	0	VIEW NOT ENABLED	El.name plate ON/OFF
					1	VIEW ENABLED	
0x0041	65	1	FULL OPEN ADJUST	1 000	950		End position tolerance OPEN (per mil)
					1 000		
0x0042	66	1	FULL CLOSE ADJUST	0	0		End position tolerance CLOSE (per mil)
					50		
0x0043	67	1	BY-PASS DURATION	0	0		Torque by-pass time (0.1s)
					50		
0x0044	68	1	POS.1	0	0		Interm. pos. 1 (per mil)
					1 000		

1) Number of data registers required for complete read-out/writing of the parameter

Offset (hexadec.)	Offset (decimal)	Parameterl ength[1)]	Parameter name (indication in dsiplay)	Standard value	Min/Max	Value text in display	Note
0x0045	69	1	POS.1 BEHAVIOUR	0	0	NO STOP	Intermed. pos. 1 operation behaviour
					1	STOP OPENING DIR.	
					2	STOP CLOSING DIR.	
					3	STOP BOTH DIR.	
0x0046	70	1	POS.1 SELECTOR SW.	0	0	OFF	Intermed. pos. 1 enable
					1	REMOTE ONLY	
					2	LOCAL ONLY	
					3	REMOTE AND LOCAL	
0x0047	71	1	POS.1 CONTROL	0	0	NOT USED	Intermed. pos. 1 signal behaviour
					1	C_____POS——O	
					2	C——POS_____O	
					3	C_____POS_____O	
0x0048	72	1	POS.2	0		like POS1	Interm. pos. 2 (per mil)
0x0049	73	1	POS.2 BEHAVIOUR	0		like POS1: BEHAVIOUR	Intermed. pos. 2 operation behaviour
0x004A	74	1	POS.2 SELECTOR SW.	0		like POS1: SELECTOR SW.	Intermed. pos. 2 enable
0x004B	75	1	POS.2 CONTROL	0		like POS1:CONTROL	Intermed. pos. 2 signal behaviour
0x004C	76	1	POS.3	0		like POS1	Interm. pos. 3 (per mil)
0x004D	77	1	POS.3 BEHAVIOUR	0		like POS1: BEHAVIOUR	Intermed. pos. 3 operation behaviour
0x004E	78	1	POS.3 SELECTOR SW.	0		like POS1: SELECTOR SW.	Intermed. pos. 3 enable
0x004F	79	1	POS.3 CONTROL	0		like POS1:CONTROL	Intermed. pos. 3 signal behaviour
0x0050	80	1	POS.4	0		like POS1	Interm. pos. 4 (per mil)
0x0051	81	1	POS.4 BEHAVIOUR	0		like POS1: BEHAVIOUR	Intermed. pos. 4 operation behaviour
0x0052	82	1	POS.4 SELECTOR SW.	0		like POS1: SELECTOR SW.	Intermed. pos. 4 enable
0x0053	83	1	POS.4 CONTROL	0		like POS1:CONTROLL	Intermed. pos. 4 signal behaviour
0x0112	274	1	POS.5	0		like POS1	Interm. pos. 2 (per mil)
0x0113	275	1	POS.5 BEHAVIOUR	0		like POS1: BEHAVIOUR	Intermed. pos. 2 operation behaviour
0x0114	276	1	POS.5 SELECTOR SW.	0		like POS1: SELECTOR SW.	Intermed. pos. 2 enable
0x0115	277	1	POS.5 CONTROL	0		like POS1:CONTROL	Intermed. pos. 2 signal behaviour
0x0116	278	1	POS.6	0		like POS1	Interm. pos. 3 (per mil)
0x0117	279	1	POS.6 BEHAVIOUR	0		like POS1: BEHAVIOUR	Intermed. pos. 2 operation behaviour
0x0118	280	1	POS.6 SELECTOR SW.	0		like POS1: SELECTOR SW.	Intermed. pos. 3 enable
0x0119	281	1	POS.6 CONTROL	0		like POS1:CONTROL	Intermed. pos. 3 signal behaviour
0x011A	282	1	POS.7	0		like POS1	Interm. pos. 4 (per mil)
0x011B	283	1	POS.7 BEHAVIOUR	0		like POS1: BEHAVIOUR	Intermed. pos. 4 operation behaviour
0x011C	284	1	POS.7 SELECTOR SW.	0		like POS1: SELECTOR SW.	Intermed. pos. 4 enable
0x011D	285	1	POS.7 CONTROL	0		like POS1:CONTROL	Intermed. pos. 4 signal behaviour
0x011E	286	1	POS.8	0		like POS1	Interm. pos. 4 (per mil)
0x011F	287	1	POS.8 BEHAVIOUR	0		like POS1: BEHAVIOUR	Intermed. pos. 4 operation behaviour
0x0120	288	1	POS.8 SELECTOR SW.	0		like POS1: SELECTOR SW.	Intermed. pos. 4 enable
0x0121	289	1	POS.8 CONTROL	0		like POS1:CONTROL	Intermed. pos. 3 signal behaviour

1) Number of data registers required for complete read-out/writing of the parameter

Offset (hexadec.)	Offset (decimal)	Parameterl ength[1)]	Parameter name (indication in dsiplay)	Standard value	Min/Max	Value text in display	Note
0x0054	84	1	STEPPING MODE	0	0	VIEW NOT ENABLED	Stepping mode ON/ OFF
					1	VIEW ENABLED	
0x0055	85	1	INTERMED. POSITION	0	0	VIEW NOT ENABLED	Intermediate positions ON/ OFF
					1	VIEW ENABLED	
0x0057	87	1	ADAPTIVE BEHAVIOUR	1	0	OFF	Positioner type
					1	ON	
0x0058	88	1	BLINKER	2	0	ON	Blinker type
					1	LIT IN MIDPOSITION	
					2	OFF IN MIDPOSITION	
0x0059	89	1	I/O ANLOG IN1 START	0	0		Start I/O-stack analogue 1 (0.1mA)[2)]
					200		
0x005A	90	1	I/O ANLOG IN1 END	200	0		End I/O-stack analogue 1 (0.1mA)[2)]
					200		
0x005B	91	1	I/O ANLOG IN2 START	0	0		Start I/O-stack analogue 2 (0.1mA)[2]
					200		
0x005C	92	1	I/O ANLOG IN2 END	200	0		End I/O-stack analogue 2 (0.1mA)[2)]
					200		
0x0064	100	2	TOTAL MOTOR RUNTIME	0	0		Motor running time in the complete lifetime
0x0065	101	2	MOTOR RUNTIME	0	0		reset to 0 possible
0x0066	102	2	TOTAL STARTS	0	0		Number of cycles in the complete lifetime
0x0067	103	2	STARTS	0	0		reset to 0 possible
0x0068	104	2	TOTAL TSC STOPS	0	0		Number of torque switch trippings in direction CLOSE
0x0069	105	2	TSC STOPS	0	0		reset to 0 possible
0x006A	106	2	TOTAL LSC STOPS	0	0		Number of limit switch trippings in direction CLOSE
0x006B	107	2	LSC STOPS	0	0		reset to 0 possible
0x006C	108	2	TOTAL TSO STOPS	0	0		Number of torque switch trippings in direction OPEN
0x006D	109	2	TSO STOPS	0	0		reset to 0 possible
0x006E	110	2	TOTAL LSO STOPS	0	0		Number of limit switch trippings in direction OPEN
0x006F	111	2	LSO STOPS	0	0		reset to 0 possible
0x0070	112	2	TOTAL TSC FAULTS	0	0		Number of torque faults in direction CLOSE
0x0071	113	2	TSC FAULTS	0	0		reset to 0 possible
0x0072	114	2	TOTAL TSO FAULTS	0	0		Number of torque faults in direction OPEN
0x0073	115	2	TSO FAULTS	0	0		reset to 0 possible
0x0074	116	2	TOTAL THERMAL FLT.	0	0		Number of thermal faults (motor protection)
0x0075	117	2	THERMAL FAULTS	0	0		reset to 0 possible
0x0076	118	2	TOTAL PE FAULTS	0	0		Total PE faults
0x0077	119	2	PE FAULT	0	0		reset to 0 possible
0x0078	120	2	TOT.WRN. STARTS/RUN 1	0	0		Total of all time sections during which a starts/running time warning was signalled
0x0079	121	2	WRN. STARTS/RUN 1	0	0		reset to 0 possible
0x007A	122	2	TOTAL NO. POWER ON	0	0		Number of starts in the complete lifetime
0x007B	123	2	NO. POWER ON	0	0		reset to 0 possible

11) Number of data registers required for complete read-out/writing of the parameter
2) Only available if a second I/O stack is installed in addition to the Modbus interface.

Offset (hexadec.)	Offset (decimal)	Parameterl ength[1)]	Parameter name (indication in dsiplay)	Standard value	Min/Max	Value text in display	Note
0x007C	124	2	TOT.WRN. STARTS/RUN 2	0	0		Max. time section during which a starts/running time warning was signalled
0x007D	125	2	WRN. STARTS/RUN 2	0	0		reset to 0 possible
0x007E	126	10	COMMISS NO. AUMATIC		0		Commission no. AUMATIC, set in the factory
0x007F	127	10	KKS. NO.		0		KKS number, set in the factory
0x0080	128	10	VALVE NO.		0		Valve number
0x0081	129	10	PLANT NO.		0		Plant number
0x0082	130	10	PRODUCT TYPE		0		Product type, set in the factory
0x0083	131	10	WORKS NO. ACTUATOR		0		Works number actuator, set in the factory
0x0084	132	10	WORKS NO. AUMATIC		0		Works number AUMATIC, set in the factory
0x0085	133	10	LOGIC SFTWR. VER.		0		Software version of logic, set in the factory
0x0086	134	10	DATE OF FINAL TEST		0		Date of final test
0x0087	135	10	WIRING DIAGRAM		0		Wiring diagram, set in the factory
0x0088	136	10	TERMINAL PLAN		0		Terminal plan, set in the factory
0x0089	137	10	PROJECT NAME		0		Project name
0x008A	138	10	CUSTOMER FIELD 1		0		Customer field 1
0x008B	139	10	CUSTOMER FIELD 2		0		Customer field 2
0x008C	140	10	SERVICE PHONE		0		Service phone, set in the factory
0x008D	141	10	INTERNET ADDRESS		0		Internet address, set in the factory
0x008E	142	10	SERVICE TEXT 1		0		Service text 1, can only be changed by service personnel
0x008F	143	10	SERVICE TEXT 2		0		Service text 2, can only be changed by service personnel
0x0090	144	10	LOGIC HRDWR. VER		0		Hardware version of logic, set in the factory
0x0091	145	1	ALARM CONTACT	2	0	FAULT GROUP1	Assignment output contacts[2)]
					1	FAULT GROUP 2	
					2	FAULT GROUP 3	
					3	FAULT GROUP 4	
					4	FAULT GROUP 5	
					5	FAULT GROUP 6	
					6	FAULT GROUP 7	
					7	FAULT GROUP 8	
					8	FAULT GROUP 9	
					9	FAULT GROUP10	

Offset (hexadec.)	Offset (decimal)	Parameterl ength[1)]	Parameter name (indication in dsiplay)	Standard value	Min/Max	Value text in display	Note
0x0092	146	1	OUTPUT CONTACT 1	2	0	NOT USED	Assignment output contact1[2)]
					1	CLOSED POSITION	
					2	OPEN POSITION	
					3	RUNNING CLOSE	
					4	RUNNING OPEN	
					5	ACTUATOR MOVING	
					6	LSC (WSR)	
					7	LSO (WOEL)	
					8	TSC (DSR)	
					9	TSO (DOEL)	
					10	THERMAL FAULT	
					11	TORQUE FAULT (CLOSE)	
					12	TORQUE FAULT (OPEN)	
					13	TORQUE FAULT (GEN)	
					14	SETPOINT E1 LOSS	
					15	FEEDBACK E2 LOSS	
					16	SPEED E3 LOSS	
					17	TORQUE E6 LOSS	
					18	WARNING OPER. TIME	
					19	WARNING STARTS/RUN	
					20	LOCAL SW. POSITION	
					21	REMOTE SW. POSITION	
					22	OFF SW. POSITION	
					23	REMOTE MODE	
					24	SETPOINT MODE	
					25	INTERMED. POS. 1	
					26	INTERMED. POS. 2	
					27	INTERMED. POS. 3	
					28	INTERMED. POS. 4	
					29	STEPPING MODE	
					30	CLOSING BLINK	
					31	OPENING BLINK	
					32	FAULT IND.	
					33	WARNING IND.	
					34	NOT READY IND.	
					35	SETPOINT REACHED	
					36	LOSS OF PHASE	
					37	I/O ANLOG IN2 LOSS	
					38	I/O ANLOG IN1 LOSS	
					39	SELECTOR NOT REMOTE	
					40	WRONG COMMAND	
					41	INTERNAL FAULT	
					42	PE FAULT	
					43	INTERNAL FEEDBACK	
					44	INTERNAL WARNING	
					45	CHANNEL 2 ACTIVE	
0x0093	147	1	OUTPUT CONTACT 2	1		like OUTPUT CONTACT1	Assignment Output contact 1[2)]

1) Number of data registers required for complete read-out/writing of the parameter
2) Only available if a second I/O stack is installed in addition to the Modbus interface.

Offset (hexadec.)	Offset (decimal)	Parameterl ength[1)]	Parameter name (indication in dsiplay)	Standard value	Min/Max	Value text in display	Note
0x0094	148	1	OUTPUT CONTACT 3	21		like OUTPUT CONTACT1	Assignment output contact 1[2)]
0x0095	149	1	OUTPUT CONTACT 4	11		like OUTPUT CONTACT1	Assignment output contact 1[2)]
0x0096	150	1	OUTPUT CONTACT 5	12		like OUTPUT CONTACT1	Assignment output contact 1[2)]
0x009F	159	1	EMERGENCY POSITION	0	0	FAIL AS IS	Emergency operation behaviour[2)]
					1	FAIL CLOSE	
					2	FAIL OPEN	
					3	FAIL TO PRESET	
0x00A0	160	1	EMERGENCY BY-PASS	0	0	NONE	TH and TRQ By-pass of thermo and torque signal during an emergency operation
					1	THERMAL	
					2	TORQUE	
					3	THERMAL AND TORQUE	
0x00A1	161	1	PRESET POSITION	0	0		Emergency position 0 ... 1,000 per mil
					1 000		
0x00A4	164	1	I/O1 ANALOG OUT1 TYPE	0	0	0-20mA	Range I/O stack int. analogue out1, range 0–20 or 4-20 mA[2)]
					1	4-20mA	
0x00A6	166	1	I/O1 ANLOG OUT2 TYPE	0	0	0-20mA	Range I/O stack int. analogue out2, range 0–20 or 4–20 mA[2)]
					1	4-20mA	
0x00A9	169	1	EMERGENCY BEHAVIOUR	0	0	OFF	Emergency operation type
					1	GOOD SIGNAL FIRST	
					2	ACTIVE IMMEDIATE	
0x00AA	170	1	EMERG.SEL.SW.POS	0	0	REMOTE ONLY	Emergency operation only from REMOTE or also from LOCAL
					1	REMOTE AND LOCAL	
0x00CD	205	1	REACTION MONITORING			FUNCTION NOT ACTIVE	Reaction monitoring on/off
					1	FUNCTION ACTIVE	
0x00CE	206	1	REACTION TIME	70	1		Reaction monitoring time (0.1 s)
					150		
0x00CF	207	1	SELECTOR SWITCH	0	0	AVAILABLE	Selector switch installed/not installed
					1	NOT AVAILABLE	
0x00D0	208	1	ENABLE LOCAL MODE	0	0	NOT ACTIVE	Selector switch release
					1	BUS	
					2	BUS, AUTO LOCAL	
					3	BUS, AUTO REMOTE	
					4	BUS, AUTO	
					5	I/O	
0x00D1	209	1	BAUDRATE	5	0	300 BAUD	Modbus1: Baud rate selection
					1	600 BAUD	
					2	1200 BAUD	
					3	2400 BAUD	
					4	4800 BAUD	
					5	9600 BAUD	
					6	19200 BAUD	
					7	38400 BAUD	
0x00D2	210	1	PARITY	1	0	NO, 2 STOPBITS	Modbus1: Parity selection
					1	EVEN, 1 STOPBIT	
					2	ODD, 1 STOPBIT	
0x00D4	212	1	CONNECT-CONTROL TIME	30	1		Modbus1: Connection control time (0,1 s)
					255		

1) Number of data registers required for complete read-out/writing of the parameter
2) Only available if a second I/O stack is installed in addition to the Modbus interface.

Offset (hexadec.)	Offset (decimal)	Parameterl ength[1)]	Parameter name (indication in dsiplay)	Standard value	Min/Max	Value text in display	Note
0x00D5	213	1	SLAVE ADDRESS	247	1		Modbus1: Slave address
					247		
0x00D6	214	1	CABLE REDUNDANCY	0	0	OFF	Modbus1: Redundancy behaviour
					1	ON,TX:ACTIVE CHANNEL	
					2	ON,TX:BOTH CHANNELS	
0x00D7	215	1	CHANNEL CHECK TIME	50	0		Modbus1: Channel check time (0,1 s)
					255		
0x00DB	219	1	BAUDRATE	5	0	300 BAUD	Modbus2: Baud rate selection
					1	600 BAUD	
					2	1200 BAUD	
					3	2400 BAUD	
					4	4800 BAUD	
					5	9600 BAUD	
					6	19200 BAUD	
					7	38400 BAUD	
0x00DC	220	1	PARITY	1	0	NO, 2 STOPBITS	Modbus2: Parity selection
					1	EVEN, 1 STOPBIT	
					2	ODD, 1 STOPBIT	
0x00DE	222	1	CONNECT-CONTROL TIME	30	1		Modbus2: Connection control time (0.1 s)
					255		
0x00DF	223	1	SLAVE ADDRESS	247	1		Modbus2: Slave address
					247		
0x00E5	229	1	MB1 ANLOG IN1 START	0	0		Start MB1 analogue 1 (0.1mA)
					200		
0x00E6	230	1	MB1 ANLOG IN1 END	200	0		End Modbus Analog 1 (0.1mA)
					200		
0x00E7	231	1	MB1 ANLOG IN2 START	0	0		Start Modbus Analog 2 (0.1mA)
					200		
0x00E8	232	1	MB1 ANLOG IN2 END	200	0		End Modbus Analog 2 (0.1mA)
					200		

Offset (hexadec.)	Offset (decimal)	Parameterlength[1])	Parameter name (indication in dsiplay)	Standard value	Min/Max	Value text in display	Note
0x00ED	237	1	LED 1 (LEFT HAND)	30	0	NOT USED	Assignment local controls LED 1
					1	CLOSED POSITION	
					2	OPEN POSITION	
					3	RUNNING CLOSE	
					4	RUNNING OPEN	
					5	ACTUATOR MOVING	
					6	LSC (WSR)	
					7	LSO (WOEL)	
					8	TSC (DSR)	
					9	TSO (DOEL)	
					10	THERMAL FAULT	
					11	TORQUE FAULT (CLOSE)	
					12	TORQUE FAULT (OPEN)	
					13	TORQUE FAULT (GEN)	
					14	SETPOINT E1 LOSS	
					15	FEEDBACK E2 LOSS	
					16	SPEED E3 LOSS	
					17	TORQUE E6 LOSS	
					18	WARNING OPER. TIME	
					19	WARNING STARTS/RUN	
					20	LOCAL SW. POSITION	
					21	REMOTE SW. POSITION	
					22	OFF SW. POSITION	
					23	REMOTE MODE	
					24	SETPOINT MODE	
					25	INTERMED. POS. 1	
					26	INTERMED. POS. 2	
					27	INTERMED. POS. 3	
					28	INTERMED. POS. 4	
					29	STEPPING MODE	
					30	CLOSING BLINK	
					31	OPENING BLINK	
					32	FAULT IND.	
					33	WARNING IND.	
					34	NOT READY IND.	
					35	SETPOINT REACHED	
					36	LOSS OF PHASE	
					37	I/O ANLOG IN2 LOSS	
					38	I/O ANLOG IN1 LOSS	
					39	SELECTOR NOT REMOTE	
					40	WRONG COMMAND	
					41	INTERNAL FAULT	
					42	PE FAULT	
					43	INTERNAL FEEDBACK	
					44	INTERNAL WARNING	
					45	CHANNEL 2 ACTIVE	

Parameters (in alphabetical order)

Notes

Index

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Europe

AUMA Riester GmbH & Co. KG
Factory Müllheim
DE-79373 Müllheim
Tel +49 7631 809 - 0
riester@auma.com
www.auma.com

Factory Ostfildern-Nellingen
DE-73747 Ostfildern
Tel +49 711 34803 - 0
riester@wof.auma.com

Service Centre Cologne
DE-50858 Köln
Tel +49 2234 2037 - 9000
Service@sck.auma.com

Service Centre Magdeburg
DE-39167 Niederndodeleben
Tel +49 39204 759 - 0
Service@scm.auma.com

AUMA Armaturenantriebe GmbH
AT-2512 Tribuswinkel
Tel +43 2252 82540
office@auma.at
www.auma.at

AUMA (Schweiz) AG
CH-8965 Berikon
Tel +41 566 400945
RettichP.ch@auma.com

AUMA Servopohony spol. s.r.o.
CZ-10200 Praha 10
Tel +420 272 700056
auma-s@auma.cz
www.auma.cz

OY AUMATOR AB
FI-02270 Espoo
Tel +35 895 84022
auma@aumator.fi

AUMA France
FR-95157 Taverny Cédex
Tel +33 1 39327272
stephanie.vatin@auma.fr
www.auma.fr

AUMA ACTUATORS Ltd.
GB- Clevedon North Somerset BS21 6QH
Tel +44 1275 871141
mail@auma.co.uk
www.auma.co.uk

AUMA ITALIANA S.r.l. a socio unico
IT-20023 Cerro Maggiore (MI)
Tel +39 0331 51351
info@auma.it
www.auma.it

AUMA BENELUX B.V.
NL-2314 XT Leiden
Tel +31 71 581 40 40
office@benelux.auma.com
www.auma.nl

AUMA Polska Sp. z o.o.
PL-41-310 Dabrowa Górnicza
Tel +48 32 26156 68
R.Ludzien@auma.com.pl
www.auma.com.pl

OOO Priwody AUMA
RU-141400 Moscow region for mail:
124365 Moscow a/ya 11
Tel +7 495 221 64 28
aumarussia@auma.ru
www.auma.ru

ERICHS ARMATUR AB
SE-20039 Malmö
Tel +46 40 311550
info@erichsarmatur.se
www.erichsarmatur.se

GRØNBECH & SØNNER A/S
DK-2450 København SV
Tel +45 33 26 63 00
GS@g-s.dk
www.g-s.dk

IBEROPLAN S.A.
ES-28027 Madrid
Tel +34 91 3717130
iberoplan@iberoplan.com

D. G. Bellos & Co. O.E.
GR-13671 Acharnai Athens
Tel +30 210 2409485
info@dgbellos.gr

SIGURD SØRUM A. S.
NO-1301 Sandvika
Tel +47 67572600
post@sigurd-sorum.no

INDUSTRA
PT-2710-297 Sintra
Tel +351 2 1910 95 00
jpalhares@tyco-valves.com

MEGA Endüstri Kontrol Sistemieri Tic. Ltd. Sti.
TR-06460 Övecler Ankara
Tel +90 312 472 62 70
megaendustri@megaendustri.com.tr

CTS Control Limited Liability Company
UA-02099 Kiyiv
Tel +38 044 566-9971, -8427
v_polyakov@cts.com.ua

Africa

AUMA South Africa (Pty) Ltd.
ZA-1560 Springs
Tel +27 11 3632880
aumasa@mweb.co.za

A.T.E.C.
EG- Cairo
Tel +20 2 3599680 - 3590861
atec@intouch.com

America

AUMA ACTUATORS INC.
US-PA 15317 Canonsburg
Tel +1 724-743-AUMA (2862)
mailbox@auma-usa.com
www.auma-usa.com

AUMA Chile Respresentative Office
CL- Buin
Tel +56 2 821 4108
aumachile@adsl.tie.cl

LOOP S. A.
AR-C1140ABP Buenos Aires
Tel +54 11 4307 2141
contacto@loopsa.com.ar

Asvotec Termoindustrial Ltda.
BR-13190-000 Monte Mor/ SP.
Tel +55 19 3879 8735
atuador.auma@asvotec.com.br

TROY-ONTOR Inc.
CA-L4N 5E9 Barrie Ontario
Tel +1 705 721-8246
troy-ontor@troy-ontor.ca

MAN Ferrostaal de Colombia Ltda.
CO- Bogotá D.C.
Tel +57 1 401 1300
dorian.hernandez@manferrostaal.com
www.manferrostaal.com

PROCONTIC Procesos y Control Automático
EC- Quito
Tel +593 2 292 0431
info@procontic.com.ec

IESS DE MEXICO S. A. de C. V.
MX-C.P. 02900 Mexico D.F.
Tel +52 55 55 561 701
informes@iess.com.mx

Corsusa S.A.C.
PE- Miralflores - Lima
Tel +511444-1200/ 0044/ 2321
corsusa@corsusa.com
www.corsusa.com

PASSCO Inc.
PR-00936-4153 San Juan
Tel +18 09 78 77 20 87 85
Passco@prtc.net

Suplibarca
VE- Maracaibo Estado, Zulia
Tel +58 261 7 555 667
suplibarca@intercable.net.ve

Asia

AUMA Actuators (Tianjin) Co., Ltd.
CN-300457 Tianjin
Tel +86 22 6625 1310
mailbox@auma-china.com
www.auma-china.com

AUMA (INDIA) PRIVATE LIMITED
IN-560 058 Bangalore
Tel +91 80 2839 4655
info@auma.co.in
www.auma.co.in

AUMA JAPAN Co., Ltd.
JP-210-0848 Kawasaki-ku, Kawasaki-shi
Kanagawa
Tel +81 44 329 1061
mailbox@auma.co.jp

AUMA ACTUATORS (Singapore) Pte Ltd.
SG-569551 Singapore
Tel +65 6 4818750
sales@auma.com.sg
www.auma.com.sg

Al Ayman Industrial. Eqpts
AE- Dubai
Tel +971 4 3682720
auma@emirates.net.ae

PERFECT CONTROLS Ltd.
HK- Tsuen Wan, Kowloon
Tel +852 2493 7726
joeip@perfectcontrols.com.hk

DW Controls Co., Ltd.
KR-153-803 Seoul Korea
Tel +82 2 2113 1100
sichoi@actuatorbank.com
www.actuatorbank.com

AL-ARFAJ Eng. Company W. L. L.
KW-22004 Salmiyah
Tel +965 4817448
arfaj@qualitynet.net

Petrogulf W.L.L
QA- Doha
Tel +974 4350 151
pgulf@qatar.net.qa

Sunny Valves and Intertrade Corp. Ltd.
TH-10120 Yannawa Bangkok
Tel +66 2 2400656
sunnyvalves@inet.co.th
www.sunnyvalves.co.th/

Top Advance Enterprises Ltd.
TW- Jhonghe City Taipei Hsien (235)
Tel +886 2 2225 1718
support@auma-taiwan.com.tw
www.auma-taiwan.com.tw

Australia

BARRON GJM Pty. Ltd.
AU-NSW 1570 Artarmon
Tel +61 294361088
info@barron.com.au
www.barron.com.au

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AUMA Riester GmbH & Co. KG
P.O. Box 1362
79373 Müllheim, Germany
Tel +49 7631 - 809-0
Fax +49 7631 - 809 1250
riester@auma.com
www.auma.com

AUMA Riester GmbH & Co. KG
P. O. Box 1151
D - 73747 Ostfildern
Tel +49 (0)711 / 34803 0
Fax +49 (0)711 / 34803 34
riester@wof.auma.com
www.auma.com

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