

auma[®]

Actuator controls

AUMA MATIC
AM 01.1/ AM 02.1
AMExB 01.1/ AMExC 01.1
Profibus DP



Certificate Registration No.
12 100/104 4269

Short instructions bus connection

Scope of these instructions

These instructions are valid for multi-turn actuators of type ranges SA(R) 07.1 – SA(R) 16.1 and SA(R)ExC 07.1 – SA(R)ExC 16.1 and for part-turn actuators of type ranges SG(R) 05.1 – SG(R) 12.1 and SGExC 05.1 – SGExC 12.1

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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 multi-turn actuator/ 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!

The printed circuit boards are equipped with 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 via the electronic controls AUMA MATIC Profibus DP. The electronic controls are included in the scope of delivery.

3. 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 Profibus DP must be observed for the wiring.

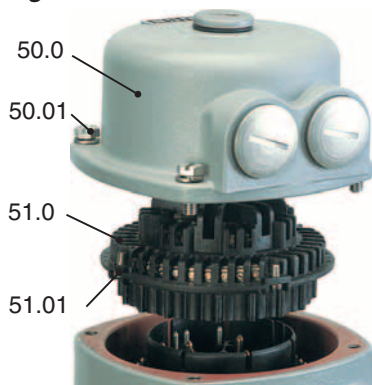
(For literature references, please refer to appendix A)

Make sure to respect electromagnetic compatibility (EMC) when installing cables: Signal and bus cables are susceptible to interference. Electric power cables, in particular motor cables, are interference sources.

- Lay cables being susceptible to interference or sources of interference at the highest possible distance from each other.
- The interference immunity of signal and bus cables increases if the cables are laid close to the ground potential, e.g. in corners of cable duct close to ground surfaces.
- If possible, avoid laying long cables and make sure that they are installed in areas being subject to low interference.
- Avoid long parallel paths with cables being either susceptible to interference or interference sources.

3.1 Power supply (standard)

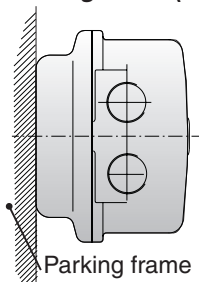
Figure A-1: Connection



For explosion-proof version (type designation: AMExB/ AMExC), please refer to page 8 or page 10.

- Check whether type of current, supply voltage, and frequency comply with 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 plug cover (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.

Figure A-2: Parking frame (accessories)



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).

A special parking frame (figure B-2) for protection against touching the bare contacts and against environmental influences, in case the electrical connection has been removed, is available.

Table 1: Technical data AUMA plug/ socket connector for bus connection

Technical data	Motor power connections ¹⁾	Protective earth	Control terminals
No. of contacts max.	6 (3 are used)	1 (leading contact)	50 pins/sockets
Marking	U1, V1, W1, U2, V2, W2	⊕	1 to 50
Connecting voltage max.	750 V	–	250 V
Nominal current max.	25 A	–	16 A
Type of customer connection	Screws	Screw for ring lug	Screws
Cross section max.	6 mm ²	6 mm ²	2.5 mm ²
Material: Pin/socket carrier	Polyamide	Polyamide	Polyamide
Contacts	Brass (Ms)	Brass (Ms)	Brass, tin plated or gold plated (option)

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

3.2 Bus connection (standard)

For explosion-proof version (type designation: AMExB/ AMExC), please refer to page 8 or page 10.
For version with FO (fibre optics), please refer to separate operation instructions “AUMA MATIC AM 01.1/ AM 02.1 FO connection”.

- Connect bus cable. Refer to figures B-1 to B2.

The termination resistors for channel 1 and channel 2 (options) 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 final device in the Profibus segment.



Only switch on the termination resistors (position ‘ON’) if the actuator is the final device within the Profibus DP segment.

Table 2: Switch positions of S1 and S2

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)

Figure B-1: Connection board (standard)

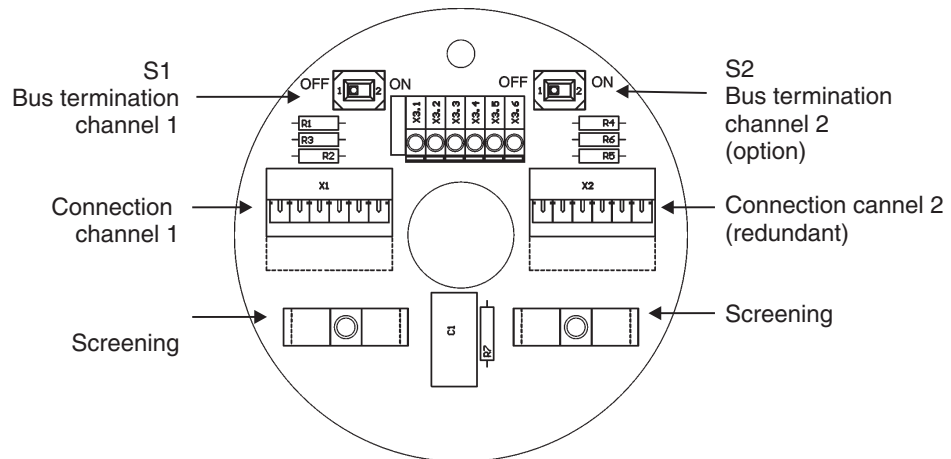


Figure B-2: Connection (standard)

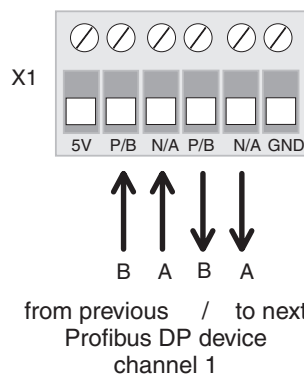


Figure B-3: Connection board (for overvoltage protection)

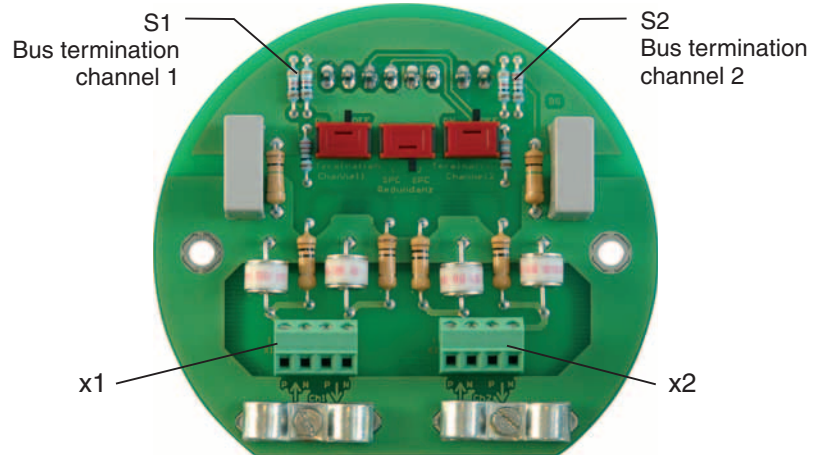


Figure B-4: Connection for overvoltage protection

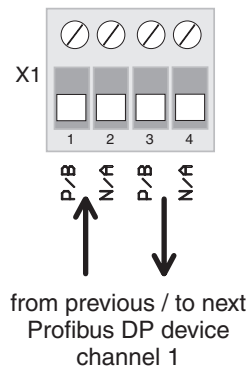


Table 3: Assignment of Profibus cable

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

3.3 Fitting the cover

After 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 plug cover and the 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 plug cover (50.0) and fasten bolts (50.01) evenly crosswise.
- Fasten cable glands with the specified torque to ensure the required enclosure protection.

- 3.4 Remote position transmitter** For the connection of remote position transmitters (potentiometer, RWG) screened cables must be used.

3.5 AUMA MATIC on wall bracket

Figure B-5: AM on wall bracket



Connecting cable to actuator

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

- For the connection of actuator and AUMA MATIC on wall bracket, use suitable flexible and screened connecting cables. (Preconfectioned cables can be obtained from AUMA on request)
- Permissible cable distance between actuator and AUMA MATIC amounts to a max. of 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.

3.6 Test run

Perform test run. Please refer to the operation instructions pertaining to 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 where appropriate.

The settings are described in the operation instructions pertaining to 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 having changed the setting.

Perform reference operation:

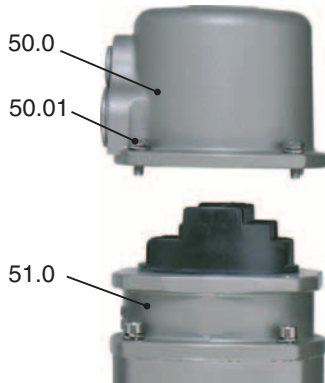
- Run actuator electrically (via the push buttons OPEN and CLOSE of the local controls) once to the end position OPEN and once to the end position CLOSED.
- If no reference operation is performed after changing the limit switching, the feedback signal via the bus is not correct. The bus signals the missing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

3.7 Mains and bus connection for Ex-version with plug/ socket connector/ terminal board (KP)



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”.

Figure C-1: Connection



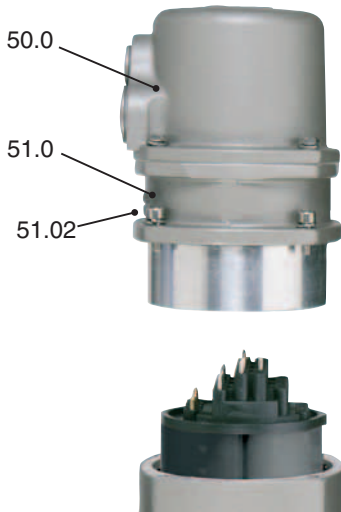
For the Ex-plug/ socket connector (figure D-1), the electrical mains connection is made after removing the plug cover (50.0) at the EEx e terminals of the terminal board (51.0). The flameproof compartment (type of protection EEx d) remains hereby closed.

- 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 B, page 18. (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.**
- **Maximum 2 wires with the same cross section may be connected to one terminal.**

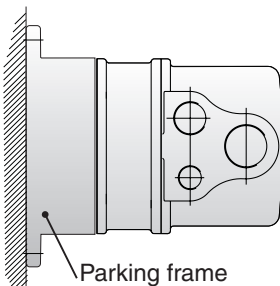
Figure C-2: Disconnection from mains



- 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 figure (C-4). The termination resistor for channel 1 is connected through linking the terminals 1 – 4 and 3 – 2 (standard). Only connect the termination resistor if the actuator is the final device in the Profibus segment.
- Connect screen largely to the cable glands. For the recommended cable glands refer to appendix B, page 18.

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 C-2). For this purpose, 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.

Figure C-3: Parking frame (accessories)



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

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

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

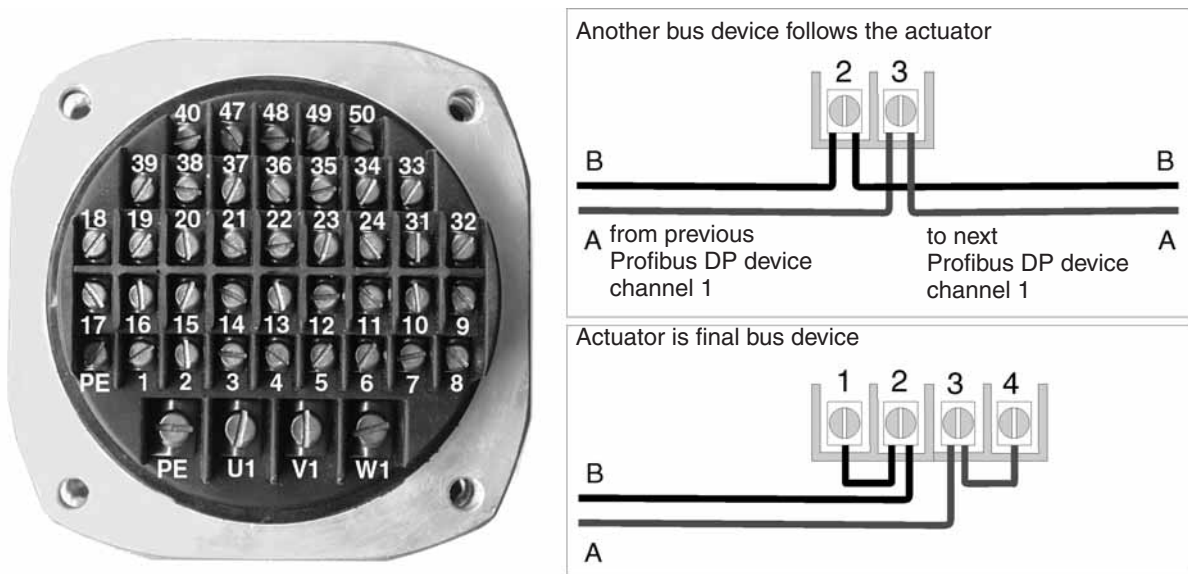


Table 4: Technical data Ex plug/ socket connector with terminal board for explosion-proof actuators

Technical data	Motor power connections ¹⁾	Protective earth	Control terminals
No. of contacts max.	3	1 (leading contact)	38 pins/sockets
Marking	U1, V1, W1	⊕	1 to 24, 31 to 50
Connecting voltage max.	550 V	–	250 V
Nominal 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, please contact AUMA.			

3.8 Mains and bus connection for Ex-version with plug-in terminal connection (KES)



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”.

The bus connection is realised via terminals (figure D-1) The terminal compartment is designed for explosion protection “EEx e” (increased safety). The controls AUMA MATIC (type of protection EEx d) remain closed.

- Loosen bolts (1) (figure D-1) and remove terminal cover.



- Insert cable glands with “EEx e” approval and of size suitable for connecting cables. For the recommended cable glands refer to appendix B, page 18. (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.

Cross sections for connection:

Control cables: max. 2.5 mm²,
Motor connection: max. 10 mm²,
Suitable bus cables, see page 12.

- Connect bus cable to channel 1 according to configuration of the terminals (figure D-2).
The termination resistor for channel 1 is connected through linking the terminals 1 – 2 and 3 – 4.
- Only connect the termination resistors if the actuator is the final device in the Profibus segment.

Figure D-2: Terminal configuration for Ex connection (KES)

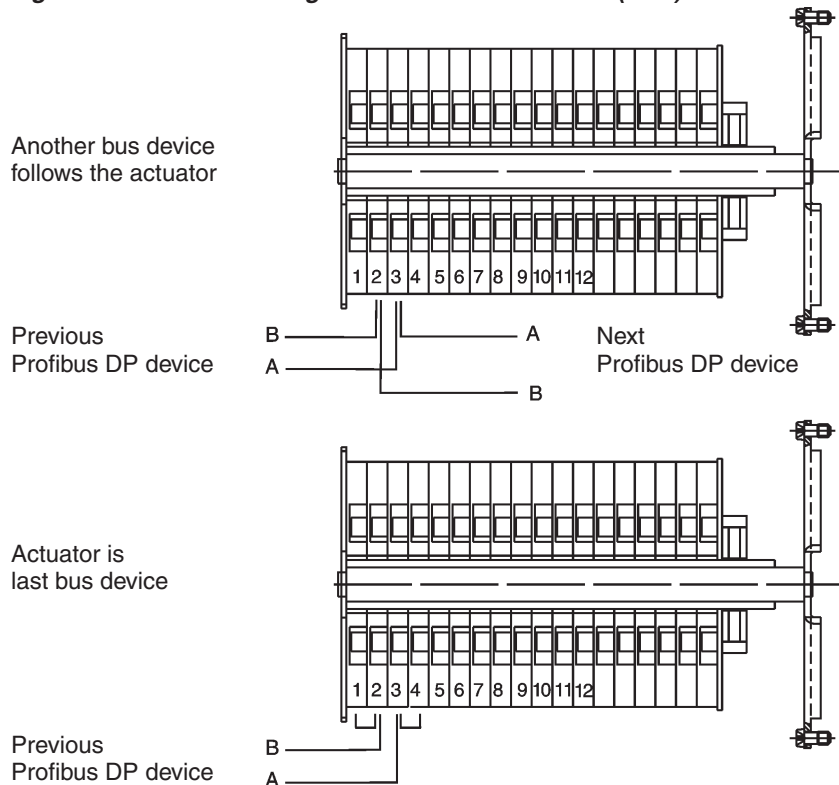
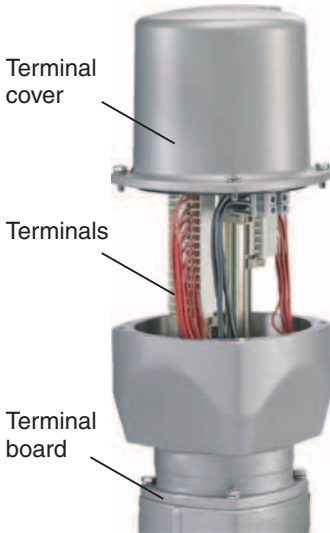


Figure D-1: Plug in terminal connection



3.9 Redundant bus connection

AUMA Profibus DP devices can be connected with a second (redundant) Profibus cable. If the bus on channel 1 fails, e. g. through cable break, the slave automatically switches to channel 2.



This cable redundancy may only be applied after previous integration test using the desired process control system!

- **For versions with AUMA plug/ socket connector (subclause 3.2):**
Connect redundant bus cable to channel 2 in the same way as channel 1 (refer to connection diagram figure B-2).
- **For Ex-version with plug/ socket connector / terminal board (KP) (subclause 3.7):**
Connect cable B to terminal 6, cable A to terminal 7.
The termination resistor for channel 2 is connected through linking the terminals 5 – 6 and 7 – 8.
- **For Ex-version with plug-in terminal connection KES) (subclause 3.8):**
Connect cable B to terminal 6, cable A to terminal 7 (figure D-2).
The termination resistor for channel 2 is connected through linking the terminals 5 – 6 and 7 – 8.

The setting of the redundant bus connection is realised via the parameters 4 and 5 (refer to page 16).

3.10 Bus cables

Only cables according to standard DIN 19245 or EN 50170-2, cable type A, may be used for Profibus DP wiring.

A maximum of up to 32 Profibus devices may be connected in one segment. If more devices are to be connected to one Profibus 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 there are no potential differences between the individual devices on the Profibus (perform a potential compensation).

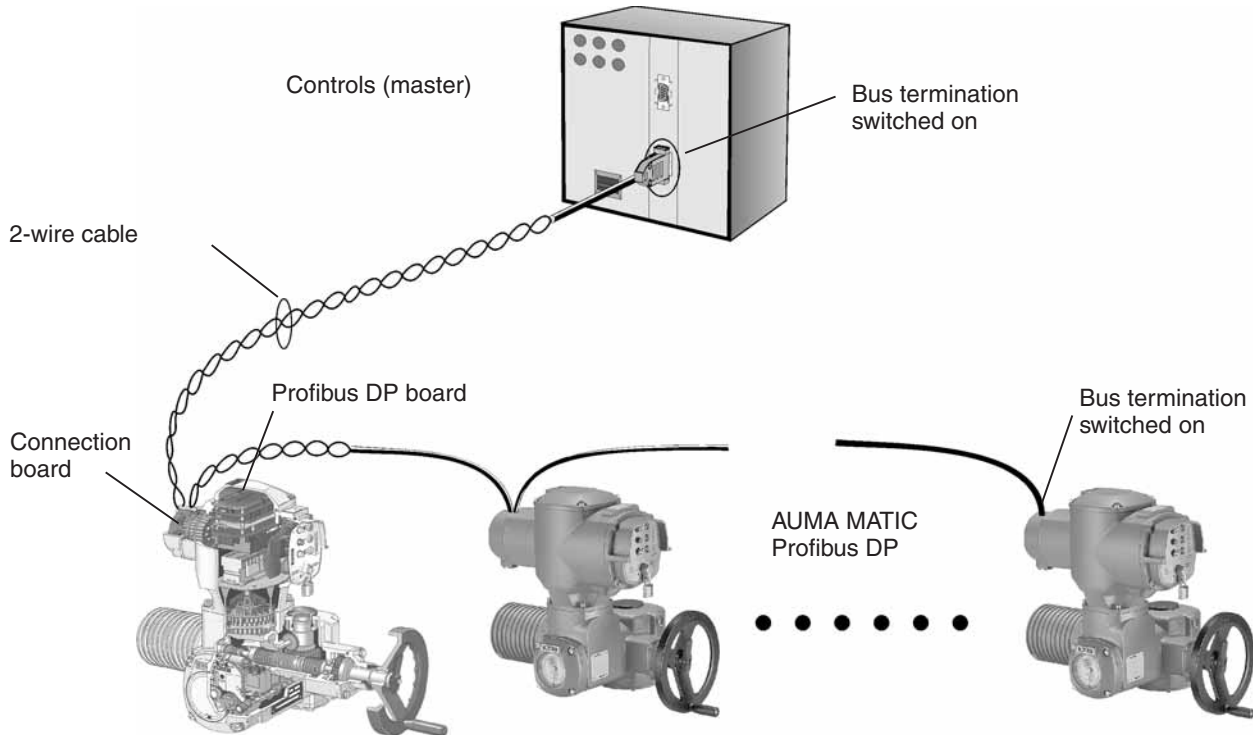
Table 5

Transmission rate in kBit/s	≤ 93.75	187.5	500	1500
Maximum segment length in m	1200	1000	400	200

Cable specification cable type A for Profibus DP

Characteristic impedance: 135 to 165 Ohm, at a frequency of 3 to 20 Mhz.
 Cable capacity: < 30 pF per meter
 Core diameter > 0.64 mm
 Core cross section: > 0.34 mm², corresponds to AWG 22
 Loop resistance: < 110 Ohm per km
 Screening: Copper shielding braid or shielding braid and shielding foil

Figure E: Example: Profibus with one segment

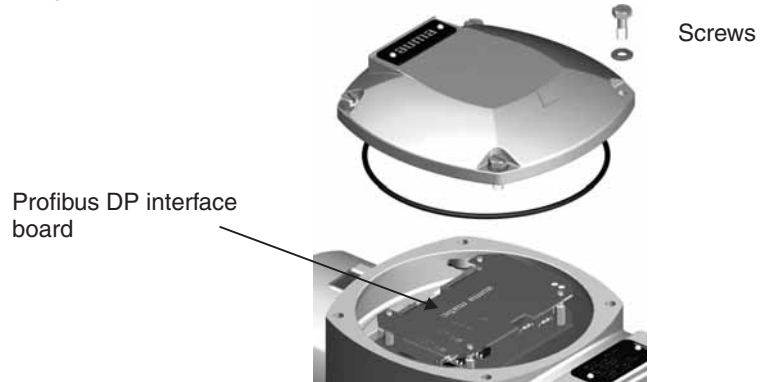


3.11 Setting the Profibus DP address

The bus address is set on the Profibus DP interface board.

- Loosen screws and remove cover (figure F-1)

Figure F-1



- Set the required bus address using rotary switches S2 and S3 (figure F-2). (Factory setting: slave address 2)

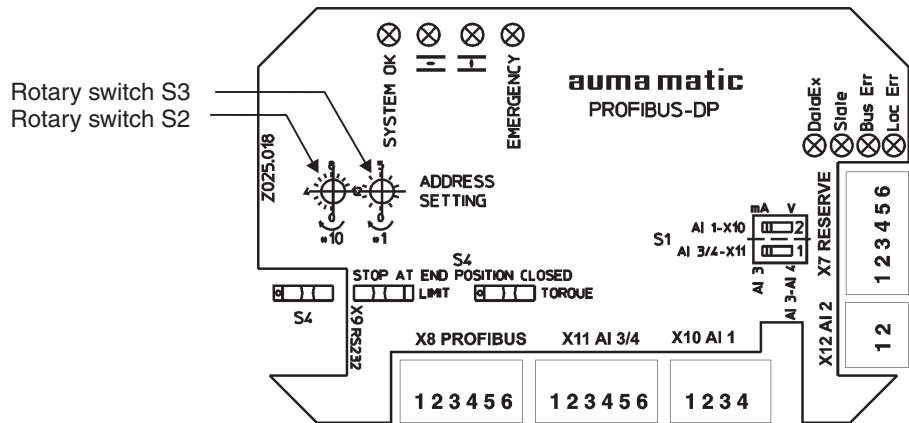
Switch (S2) for setting the units digit.
Switch (S3) for setting the tens digit.

Example: The address '65' is set as follows:

(S2) to position 5 = (5 * 1 = 5)

(S3) to position 6 = (6 * 10 = 60)

Figure F-2: Profibus DP interface board



4. Description Profibus DP interface

Figure G: Profibus DP interface board

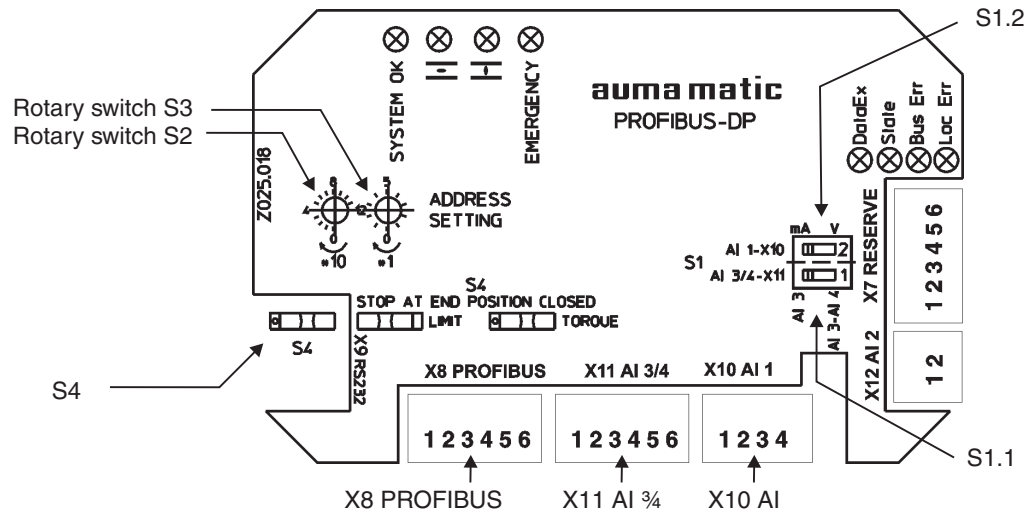


Table 6: Standard setting of Profibus DP interface board

S1.1	S1.2		S2	S3
AI 3	V (with potentiometer)	mA (with RWG)	0	2

- S1.1** When using the external analogue input X11 AI 3/4, the switch S1.1 must be in position AI 3.
- S1.2** Switch for setting the position feedback via position transmitter potentiometers/ RWG (option).
S1.2 = V: If the actuator is equipped with a potentiometer without RWG, this switch must be in position 'V'.
S1.2 = mA: Switch may only be in this position if an RWG is installed in the actuator.
 If the actuator is equipped with an RWG (0 – 20 mA or 4 – 20 mA), this switch must be in position 'mA'.
- S2/S3** Rotary switches for Profibus address setting.
 These two switches are used to set the address of the actuator within the Profibus DP network. Only addresses from 0 to 125 may be allocated.
- S2** Rotary switch for setting the unit digit.
S3 Rotary switch for setting the tens digit.
- S4** Switch for setting the end position seating in end position CLOSED. (In end position OPEN, switching off is always via limit seating)
 This switch is used to inform the Profibus DP board about the type of seating is to be used to operate the actuator in end position CLOSED (limit seating or torque seating). The end position seating is set in the factory according to the details given in the order.



The setting of the end position seating in end position CLOSED must be the same on the Profibus DP board (switch S4) and on the logic board (switch S1-2, figure H, page 17).

S4 = LIMIT: If the switch is in position 'LIMIT' (left, no dot visible), the actuator is in limit seating for end position CLOSED.

S4 = TORQUE: If the switch is in position 'TORQUE' (right, dot visible), the actuator is in torque seating for end position CLOSED.

4.1 Assignment of the customer inputs of the Profibus DP interface (option)

X7 spare This plug provides pins for 4 digital customer inputs.

Table 7: Digital inputs

Pin	Description
1	R1: digital input 1
2	R2: digital input 2
3	R3: digital input 3
4	R4: digital input 4
5	+ 24 V
6	+ 24 V

These signals are freely available inputs, which the micro-controller transmits into the process representation input (byte 8, bits 0 – 3). The inputs are 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 (pins 5 or 6).



- **Proposed external wiring diagrams (appendix B of the operation instructions) for these signals must be observed.**
- **The bounce time of the connected switches should not be more than 1 ms.**

X12 First analogue customer input (analogue 2).
An external 0/4 – 20mA sensor for transmitting the measured values via the Profibus can be connected to this input.

Table 8: Analogue inputs at plug X12 AI 2

Pin	Description
1	AN 2: analogue signal 0 – 20 mA
2	GND (system ground)

X11 Second analogue customer input (analogue 3/4)
A 0/4 – 20mA sensor for transmitting the measured values via the Profibus can be connected to this input.

Table 9: Analogue inputs at plug X11 AI 3/4

Pin	Description
1	+ 24 V
2	GND (system ground)
3	GND (system ground)
4	AN 3+: analogue signal 0 – 20 mA (plus)
5	AN 4–: analogue signal 0 – 20 mA (minus)
6	GND (system ground)

If the switch S1.1 is on the left side in position AI 3, the pin 5 (AN 4) is connected to GND. Input AN 3 can be used in the same way as AN 2. If the switch is on the right side in position AI 3-AI 4, a differential measurement between AN 3 and AN 4 can be performed.



- **Potential-free differential measurement is not possible.**
- **There is always a GND connection.**
- **Proposed external wiring diagrams (appendix B of operation instructions) observed.**
- **The inputs AN2, AN3, and AN4 do not have galvanic isolation via opto-isolator. The maximum load of the 24 V through the sensors must not exceed 40 mA.**

4.2 Assignment Profibus DP connection

X8 PROFIBUS The bus signals and the galvanically isolated voltage supply for the bus termination, as well as the bus termination resistors located on the Profibus DP board are connected on this plug.

Table 10: Assignment for plug X8

Pin	Description
1	Channel 1: B cable bus termination
2	Channel 1: A cable bus termination
3	Channel 2: A cable Profibus (redundant channel)
4	Channel 2: A cable Profibus (redundant channel)
5	GND float (Profibus ground)
6	+ 5 V float (Profibus + 5 V)

4.3 Assignment positioner connections

X10 AI 1 The signals required for the position transmitter potentiometer/ potentiometer with RWG are connected on this plug.

Table 11: Assignment for plug X10 AI 1

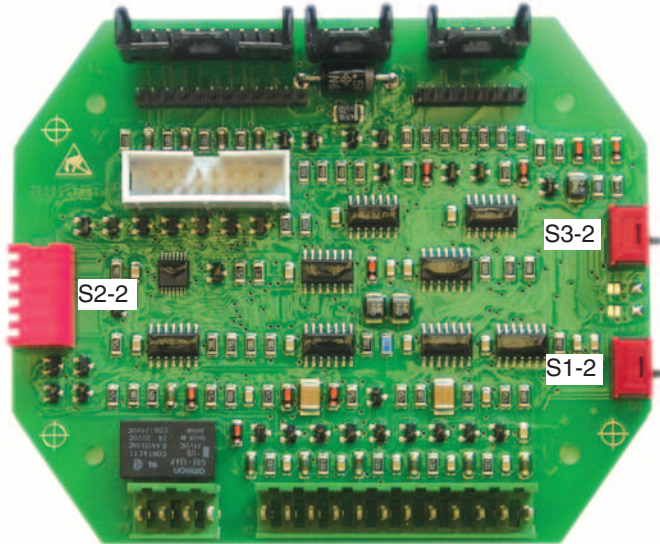
Pin	Description
1	+ 5 V for potentiometer
2	AN 1: analogue signal from position transmitter
3	GND (system ground)
4	+ 24V for RWG

4.4 Checking/ setting the switches on the logic board



The settings on the logic board are already made in the factory, according to the order details.
The logic board is located below the Profibus DP board.

Figure H: Logic board



- S3-2 S3-2: Switching-off in end position OPEN. Switch position has no influence. When controlling via Profibus DP, switching-off is always realised by limit seating in en position OPEN
- S3-2 S3-2: Switching-off in end position OPEN. Switch position has no influence. When controlling via Profibus DP, switching-off is always realised by limit seating in en position OPEN
- S1-2 S1-2: Position 1: Switching-off by limit seating in end position CLOSED
- S1-2 S1-2: Position 2: Switching-off by torque seating in end position CLOSED



The setting of the end position seating in end position CLOSED must be the same on the Profibus DP board (switch S4, figure G, page 14) and on the logic board (switch S1-2).

Table 12

DIP switch S2-2	Programming (ON = pressed)	
	Direction CLOSE	Direction OPEN
Self-retaining REMOTE	Self-retaining REMOTE may not be used!	
Push-to-run operation REMOTE	OFF ON	OFF ON
Self-retaining LOCAL	OFF ON	OFF ON
Push-to-run operation LOCAL	OFF ON	OFF ON
Blinker transmitter (option)	Blinker transmitter must be deactivated!	Blinker transm. deact. OFF ON
Torque error: torque switch tripping (in mid-travel) contained in collective fault signal (insignificant for fieldbus interface)	included	not included
	OFF ON	OFF ON

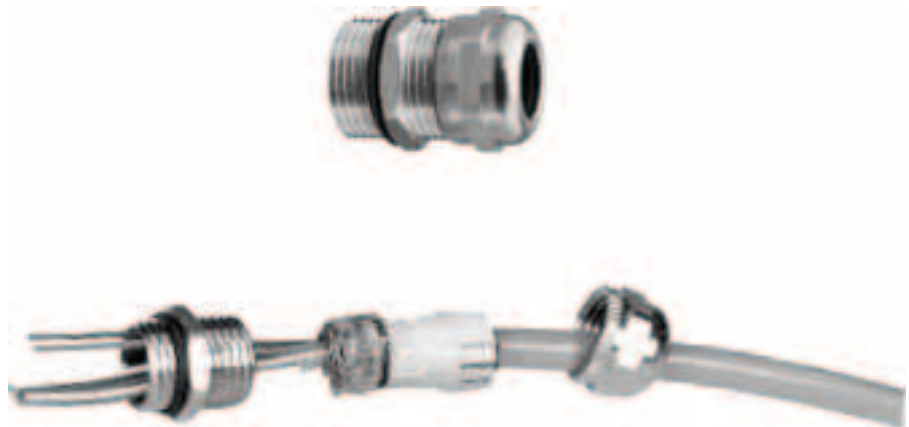
5. Appendix A Literature references

1. As an introduction into Profibus DP:
Manfred Popp: Profibus DP, Grundlagen, Tips und Tricks für Anwender.
Hüthig Verlag, ISBN 3-7785-2676-6
2. Guidelines for the electrician:
Aufbaurichtlinien Profibus DP/FMS Order No. 2.111
Available from:
Profibus Nutzerorganisation Haid-und Neu-Str. 7
D-76131 Karlsruhe
Phone +49-721 / 96 58 590
Fax +49-721 / 96 58 589
Http:/ www.profibus.com

6. Appendix B Connecting the cable shield for AUMA MATIC AMExB/ AMExC 01.1

The shield of the fieldbus cable should be largely connected with the respective threads.

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



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Wiring diagram, GSD-file, inspection records and further actuator information can be downloaded directly from the Internet by entering the order no. or COMM no. (refer to name plate).
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Certificate Registration No.
12 100/104 4269

2009-01-01

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Y000.423/003/en/1.09