

SIEMENS



Acvatix™ **Actuators SAX.., SAL.. for valves** Basic Documentation

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1 About this documentation

1.1 Navigation / Quick access

Information about a specific actuator is provided throughout the document. The structure of chapters 2 to 4 is as follows:

2 Engineering 2.1 Product description 2.2 Use	device oriented
3 Handling 3.1 Mounting and installation 3.2 Commissioning and operation	handling oriented
4 Functions and Control 4.1 3-position control 4.2 Modulating control	assembly oriented

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Quick access to important information including reference to pages:

Product no.	2 Engineering		3 Handling		4 Function and control		
	Equipment combinations	Accessories	Calibration	Accessories (mounting)	Control	Calibration	Accessories
SAX31.00	Page 10	Page 13	-	Page 24-29	Page 35-36	-	Page 48
SAX31.03			Page 31		Page 37	Page 41	
SAX61.03 ¹⁾			-		Page 35-36	-	
SAX81.00 ¹⁾			-		-	-	
SAX81.03 ¹⁾			-		-	-	
SAL31.00T10	Page 10	Page 13	-	Page 24-29	Page 35-36	-	Page 48
SAL31.03T10			Page 31		Page 37	Page 41	
SAL61.00T10			-		Page 35-36	-	
SAL61.03T10			-		-	-	
SAL81.00T10			-		-	-	
SAL81.03T10	-	-	-	-			

¹⁾ These types of actuator are also available as UL-listed versions (e.g. SAX81.03U)

Note

Glossary and Index are arranged at the end of the document.

1.2 Revision history

Revision	Date	Changes	Chapter
First edition	16.07.2010	-	-
2.0	22.12.2010	Rotary actuator SAL..T10 integrated	-
		Mounting and installation of butterfly valves and slipper valves corrected and expanded	3.1
		New chapter „Position feedback U“	4.6
		Technical data corrected	5

1.3 Reference documents

Type of document		SAX..	SAL..
Data Sheet		N4501	N4502
Mounting Instructions		-	ASK31N: M4502.1 ASK33N: M4502.2
		ASC...: M4040.1	
		ASZ7.5/...: M4040.2	
		AZX61...: M4040.3	
		ASK39...: M4040.3	
		ASZ6.6: M4501.1	-
CE Declaration of Conformity	AC 230 V	T4501X1	T4502X1
	AC/DC 24 V	T4501X2	T4502X2
Environmental Declaration			E4502

1.4 Before you start

1.4.1 Trademarks

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Trademarks	Legal owner
Acvatix™	Siemens Switzerland Ltd

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1.4.2 Copyright

This document may be duplicated and distributed only with the express permission of Siemens, and may be passed on only to authorized persons or companies with the required technical knowledge.

1.4.3 Quality assurance

These documents were prepared with great care.

- The contents of all documents are checked at regular intervals
- All necessary corrections are included in subsequent versions
- Anpassungen bzw. Documents are automatically amended as a consequence of modifications and corrections to the products described

Please make sure that you are aware of the latest document revision date.

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1.5 Scope of this documentation

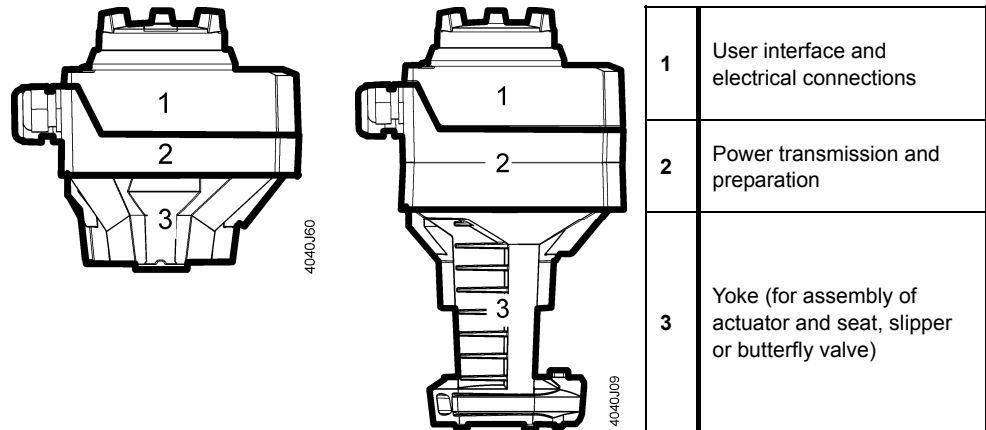
This document shall serve as a source of knowledge. In addition to basic information, it provides general technical information about the actuators used in HVAC plants. It is also targeted at engineering staff, HVAC electrical planners, system integrators and service engineers and provides all information required for planning work, correct installation, commissioning and service.

2 Engineering

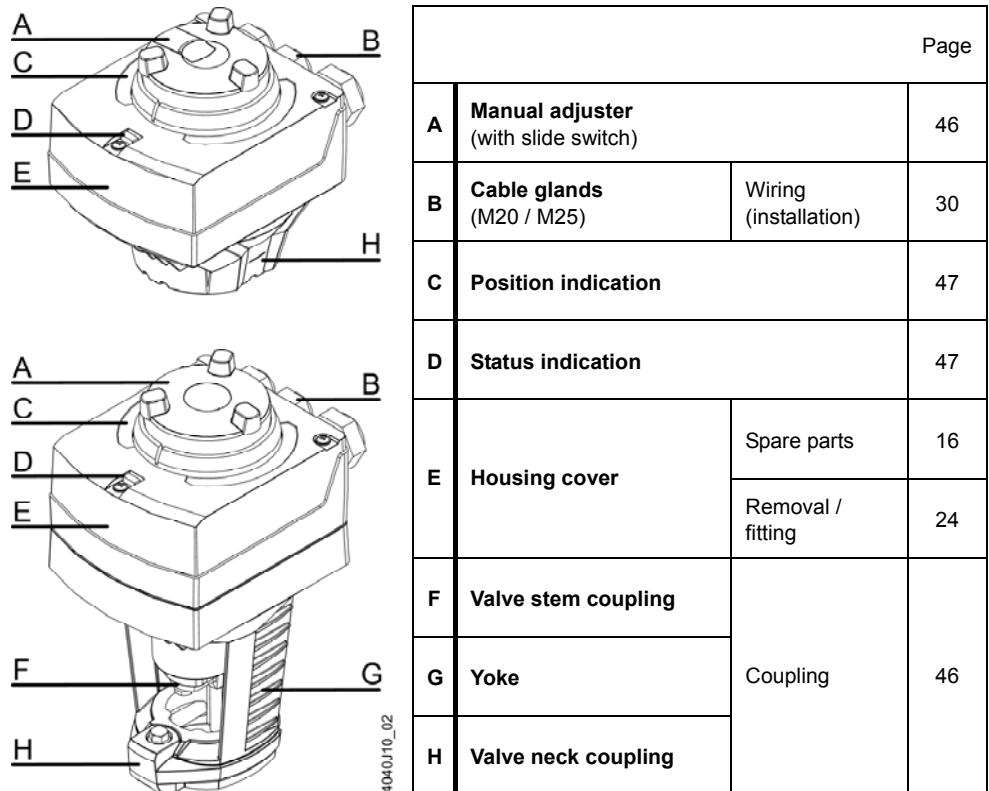
2.1 Product description

The line of large actuators is comprised of stroke actuators SAX.. and rotary actuators SAL...

Mechanical design



Components



2.2 Use

SAX..

For use in connection with Siemens 2-port or 3-port valves with 20 mm stroke, as control or shutoff valves for HVAC plants.

SAL..

For use in connection with Siemens butterfly or slipper valves, as control or shutoff valves for HVAC plants.

Note

When using the actuators outdoors, weather shield ASK39.1 must be fitted.

2.3 Type summary

2.3.1 Stroke actuators

Product no.	Stock no.	Stroke	Pos. force	Operating voltage	Positioning signal	Spr. ret. time	Pos. time	LED	Manual adjuster	Extra functions
SAX31.00	S55150-A105	20 mm	800 N	AC 230 V	3-position	-	120 s	-	Push and fix	-
SAX31.03	S55150-A106			DC 0...10 V DC 4...20 mA 0...1000 Ω	-		30 s	✓		Position feedback, forced control, change of characteristic
SAX61.03 SAX61.03U	S55150-A100 S55150-A100-A100						120 s	-		-
SAX81.00 SAX81.00U	S55150-A102 S55150-A102-A100			AC/DC 24 V	3-position		30 s	-		-
SAX81.03 SAX81.03U	S55150-A103 S55150-A103-A100									

2.3.2 Rotary actuators

Product no.	Stock no.	Ang. rot.	Torque	Operating voltage	Pos. signal	Spr. ret. time	Pos. time	LED	Manual adjuster	Extra functions
SAL31.00T10	S55162-A108	90°	10 Nm	AC 230 V	3-position	-	120 s	-	Push and fix	-
SAL31.03T10	S55162-A109			DC 0...10 V DC 4...20 mA 0...1000 Ω	-		30 s	✓		Position feedback, forced control
SAL61.00T10	S55162-A100						120 s			-
SAL61.03T10	S55162-A101			AC/DC 24 V	3-position		30 s	-		-
SAL81.00T10	S55162-A104						120 s	-		-
SAL81.03T10	S55162-A105						30 s	-		-

2.4 Ordering

Example

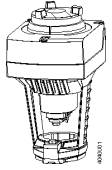





Product no.	Stock no.	Description	Quantity
SAX81.03	S55150-A103	Actuator	1
ASZ7.5/1000	S55845-Z106	Potentiometer	1

Delivery

Actuators, valves and accessories are supplied in individual packs.

2.5 Equipment combinations

2.5.1 Stroke actuators – 3-port valves

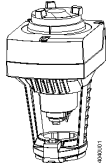






Typical applications	Stroke actuators	Data Sheet	Stroke	20 mm			
			Positioning force	800 N			
<ul style="list-style-type: none"> • Heating plants • Ventilation and air conditioning plants • Heat generation • Heat distribution • District heating plants 	SAX..	N4501					
Valves	Basic Doc. (P4030)						
Valves	Data Sheet	Valve type	DN	k_{vs} [m³/h]	Δp_{max} [kPa]		
PN6  -10...150 °C	N4410	VXF21.22...25 ¹⁾	25	1,9 / 3 / 5 / 7,5	300		
		VXF21.25... ²⁾	25	2,5 / 4 / 6,3 / 10			
		VXF21.39-40	40	12 / 19			
		VXF21.40-... ²⁾	40	16 / 25			
		VXF21.50	50	31	175		
		VXF21.50-40	50	40			
		VXF21.65	65	49	100		
		VXF21.65-63	65	63			
		VXF21.80-78	80	78			
		VXF21.80-100	80	100			
PN10  -10...150 °C	N4420	VXF31.15-... ²⁾	15	2,5 / 4	300		
		VXF31.24...25 ¹⁾	25	5 / 7,5			
		VXF31.25-... ²⁾	25	6,3 / 10			
		VXF31.39...40 ¹⁾	40	12 / 19			
		VXF31.40-... ²⁾	40	16 / 25	175		
		VXF31.50	50	31			
		VXF31.50-40	50	40	100		
		VXF31.65	65	49			
		VXF31.65-63	65	63			
		VXF31.80	80	78			
VXF31.80-100	80	100					
PN16  -10...150 °C	N4430	VXF40.15-... ²⁾	15	1,9 / 2,5 / 3 / 4	300		
		VXF40.25-... ²⁾	20	5 / 6,3 / 7,5 / 10			
		VXF40.40-... ²⁾	40	12 / 16 / 19 / 25	175		
		VXF40.50-... ²⁾	50	31 / 40			
		VXF40.65-... ²⁾	65	49 / 63	100		
VXF40.80-... ²⁾	80	78 / 100					
PN16  -10...150 °C	N4440	VXF41.14...15 ¹⁾	15	1,9 / 3	800		
		VXF41.24...25 ¹⁾	25	5 / 7,5	500		
		VXF41.39...40 ¹⁾	40	12 / 19			
		VXF41.49...50 ¹⁾	50	19 / 31	350		
PN16  -25...150 °C	N4463	-	VXG41.1301 ³⁾	15	1,6	800	
		-	VXG41.1401 ³⁾	15	2,5		
		VXG41.15	VXG41.1501 ³⁾	15	4		
		VXG41.20	VXG41.2001 ³⁾	20	6,3		
		VXG41.25	VXG41.2501 ³⁾	25	10		
		VXG41.32	VXG41.3201 ³⁾	32	16		
		VXG41.40	VXG41.4001 ³⁾	40	25		525
		VXG41.50	VXG41.5001 ³⁾	50	40		300

¹⁾ Insert running number instead of k_{vs} value

²⁾ .. = insert k_{vs} value

³⁾ With tight bypass; VXG41.1301 and VXG41.1401: use only SAX61..., SKD32.50 or SKD82.50.

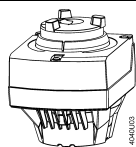
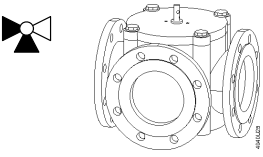
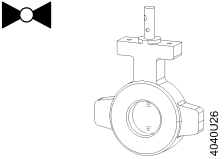
2.5.2 Stroke actuators – 2-port valves

Typical applications	Stroke actuators	Data Sheet	Stroke		20 mm	
			Positioning force		800 N	
<ul style="list-style-type: none"> • Heating plants • Ventilation and air conditioning plants • Heat generation • Heat distribution • District heating plants 	SAX..	N4501				
Valves	Basic Doc. (P4030)					
Valves	Data Sheet	Valve type	DN	k_{vs} [m ³ /h]	Δp_s [kPa]	Δp_{max} [kPa]
PN6  -10...150 °C	N4310	VVF21.22...25 ¹⁾	25	1,9 / 3 / 5 / 7,5	600	300
		VVF21.25-.. ²⁾	25	2,5 / 4 / 6,3 / 10		
		VVF21.39-40	40	12 / 19	500	
		VVF21.40-.. ²⁾	40	16 / 25		
		VVF21.50	50	31	300	
		VVF21.50-40	50	40		
		VVF21.65	65	49	175	
		VVF21.65-63	65	63		
		VVF21.80-78	80	78	100	
VVF21.80-100	80	100				
PN10  -10...150 °C	N4320	VVF31.15-.. ²⁾	15	2,5 / 4	1'000	300
		VVF31.24...25 ¹⁾	25	5 / 7,5		
		VVF31.25-.. ²⁾	25	6,3 / 10	525	
		VVF31.39...40 ¹⁾	40	12 / 19		
		VVF31.40-.. ²⁾	40	16 / 25	325	
		VVF31.50	50	31		
		VVF31.50-40	50	40	175	
		VVF31.65	65	49		
		VVF31.65-63	65	63	100	
		VVF31.80	80	78		
VVF31.80-100	80	100				
PN16  -10...150 °C	N4330	VVF40.15-.. ²⁾	15	1,9 / 2,5 / 3 / 4	1'600	300
		VVF40.25-.. ²⁾	20	5 / 6,3 / 7,5 / 10	1'550	
		VVF40.40-.. ²⁾	40	12 / 16 / 19 / 25	525	
		VVF40.50-.. ²⁾	50	31 / 40	325	
		VVF40.65-.. ²⁾	65	49 / 63	175	
		VVF40.80-.. ²⁾	80	78 / 100	100	
PN16  -10...150 °C	N4340	VVF41.49	50	19	350	300
		VVF41.50	50	31		
PN25  -20...150 °C	N4373	VVF52.15-.. ²⁾	15	0,16 / 0,2 / 0,25	2'500	1'600
		VVF52.15-.. ²⁾	15	0,32 / 0,4 / 0,5		
		VVF52.15-.. ²⁾	15	0,63 / 0,8 / 1		
		VVF52.15-.. ²⁾	15	1,25 / 1,6 / 2		
		VVF52.15-.. ²⁾	15	2,5 / 3,2 / 4		
		VVF52.25-.. ²⁾	25	5 / 6,3 / 8 / 10	1'500	
		VVF52.40-.. ²⁾	40	12,5 / 16 / 20 / 25	500	
PN16  -25...150 °C	N4363	VVG41.11...12 ¹⁾	15	0,63 / 1	1'600	800
		VVG41.13	15	1,6		
		VVG41.14	15	2,5		
		VVG41.15	15	4		
		VVG41.20	20	6,3		
		VVG41.25	25	10	1'550	
		VVG41.32	32	16	875	
		VVG41.40	40	25	525	
VVG41.50	50	40	300			

¹⁾ insert running number instead of k_{vs} value

²⁾ .. = insert k_{vs} value

2.5.3 Rotary actuators – slipper and butterfly valves

Typical applications	Rotary actuators	Data Sheet	Angular rotation		90 °	
			Torque		10 Nm	
<ul style="list-style-type: none"> • Heating plants • Ventilation and air conditioning plants • Heat generation • Heat distribution • District heating plants 	SAL..T10	N4502				
Slipper valves	Data Sheet	Valve type	DN	k_{vs} [m³/h]	Mounting set	Δp_{max} [kPa]
PN6  1 °C...120 °C	N4241	VBF21.40	40	25	-	- ¹⁾
		VBF21.50	50	40	-	- ¹⁾
		VBF21.65	65	63	ASK31N	30
		VBF21.80	80	100	ASK31N	
		VBF21.100	100	160	ASK31N	
		VBF21.125	125	550	ASK31N	
		VBF21.150	150	820	ASK31N	
Butterfly valves					Δp_s [kPa]	
PN16  -10 °C...120 °C	N4131	VKF41.40	40	50	ASK33N	500
		VKF41.50	50	80	ASK33N	
		VKF41.65	65	200	ASK33N	
		VKF41.80	80	400	ASK33N	
		VKF41.100	100	760	ASK33N	300
		VKF41.125	125	1'000	ASK33N	
		VKF41.150	150	2'100	ASK33N	
		VKF41.200	200	4'000	ASK33N	

¹⁾ SAL..T10 rotary actuators only fit on VBF21..., DN65...150. For VBF21..., DN40/50 use SQK34..., SQK84.. or SQK33.00 rotary actuators.

2.6 Accessories

2.6.1 Electrical accessories

Product no.	Auxiliary switch ASC10.51	Potentiometer ASZ7.5/.. ¹⁾	Function module AZX61.1	Stem heating element ASZ6.6
Stock no.	S55845-Z103	S55845-Z104 (ASZ7.5/135) S55845-Z105 (ASZ7.5/200) S55845-Z106 (ASZ7.5/1000)	S55845-Z107	S55845-Z108
		Max. 2		Max. 1
SAX31..	Max. 2	Max. 1	-	Max. 1
SAX61..		-	Max. 1 AZX61.1	
SAX81..		Max. 1	-	
SAL31..	Max. 2	Max. 1	-	-
SAL61..		-		
SAL81..		Max. 1		

¹⁾ Available with 135 Ω, 200 Ω or 1000 Ω

2.6.2 Mechanical accessories

Product no.	Weather shield ASK39.1	Mounting set	
		ASK31N for VBF21..	ASK33N for VKF41..
Stock no.	S55845-Z109	S55845-Z100	S55845-Z101
SAX..	Max. 1	-	-
SAL..	Max. 1	✓	✓

2.7 Product replacements

Replacement of SQX.. / SQL.. actuators by SAX.. / SAL.. actuators.

Note

- When replacing actuators consider positioning force, torque and positioning times.
- Adjust in the controller the parameter "Running time" respectively "Positioning time", to ensure stable control.
- The replacement of accessory items needs to be taken into consideration also. In that case, compatibility is not necessarily ensured.

2.7.1 Stroke actuators SQX.. to SAX..

SQX..		Pos. time [s]	Pos. force [N]	SAX.. ¹⁾		VVF21../VXF21.. VVF31../VXF31.. VVF40../VXF40..	VVF41../VXF41.. VVG41../VXG41..	VVF51.. VVF52..
						DN15...80	DN15...50	DN15...40
SQX31.. ²⁾	SQX31.00	150	500	SAX31.00	120	800	✓	✓
	SQX31.03	35	500	SAX31.03	30	800	✓	✓
SQX61..	SQX61	35	500	SAX61.03	30	800	✓	✓
	SQX61U	35	500	SAX61.03U	30	800	✓	✓
SQX81..	SQX81.00	150	500	SAX81.00	120	800	✓	✓
	SQX81.00U	150	500	SAX81.00U	120	800	✓	✓
	SQX81.03	35	500	SAX81.03	30	800	✓	✓
	SQX81.03U	35	500	SAX81.03U	30	800	✓	✓
SQX32..	SQX32.00	150	700	SAX31.00	120	800	✓	✓
	SQX32.03	35	700	SAX31.03	30	800	✓	✓
SQX62..	SQX62	35	700	SAX61.03	30	800	✓	✓
	SQX62U	35	700	SAX61.03U	30	800	✓	✓
SQX82..	SQX82.00	150	700	SAX81.00	120	800	✓	✓
	SQX82.00U	150	700	SAX81.00U	120	800	✓	✓
	SQX82.03	35	700	SAX81.03	30	800	✓	✓
	SQX82.03U	35	700	SAX81.03U	30	800	✓	✓

¹⁾ SAX81.., SAX61.. are available as UL-listed versions.

²⁾ SQX31.06: Actuator for gas valves. Either replace complete valve-actuator combination or clarify required positioning time and replace only actuator. Consider if mounting set is required.

2.7.2 Rotary actuators SQL.. to SAL..

SQL..		Pos. time [s]	Torque [Nm]	SAL..		Pos. time [s]	Torque [Nm]
SQL31..	SQL31.10	120	12,5	SAL31.00T10	120	10	
SQL32..	SQL32.10	125	12,5	SAL31.00T10	120	10	
	SQL32.12	70	12,5	SAL31.00T10 or SAL31.03T10 ¹⁾	120	10	
	SQL32.13	30	5	SAL31.03T10	30	10	
SQL33..	SQL33.00	125	12,5	SAL31.00T10	120	10	
	SQL33.03	30	10	SAL31.03T10	30	10	
SQL83..	SQL83.00	125	12,5	SAL81.00T10	120	10	
	SQL83.04	30	10	SAL81.03T10	30	10	

¹⁾ SAL.. positioning time differs from that of SQL32.12 and SQL32.13 rotary actuators. Consider positioning time when replacing.

Rotary actuators		SQL..				SAL..
		SQL31..	SQL32..	SQL33.. SQL83..	SQL35.. SQL85..	SAL31.00T10 SAL31.03T10 SAL81.00T10 SAL81.03T10
VBF21..	DN 40 / DN 50 ¹⁾	-	-	ASK32	-	¹⁾
	DN 65...150	-	-	ASK31	-	ASK31N
VBF31..	DN 40 / DN 50 ¹⁾	-	-	ASK32	-	¹⁾
	DN 65...100	-	-	ASK31	-	ASK31N
B3f..	DN 40 / DN 50 ¹⁾	Direct	ASK25	ASK31	-	¹⁾
	DN 65...150	Direct	ASK25	ASK31	-	ASK31N
C1f..	DN 40 / DN 50 ¹⁾	Direct	-	ASK31	-	¹⁾
	DN 65...100	Direct	-	ASK31	-	ASK31N
K1i..	DN 20...32	Direct	ASK24	ASK33	-	ASK33N
K1f..	DN 40...200	Direct	ASK24	ASK33	-	ASK33N
VKF41..	DN 40...125	-	-	ASK33	-	ASK33N
	DN 150 / DN 200	-	-	ASK33	ASK35	ASK33N

¹⁾ Replace with rotary actuators SQK34.., SQK84.. (data sheet N4508) or SQK33.00 (data sheet N4506).

Note

Rotary actuators SAL.. are not suited for mounting sets ASK24, ASK25, ASK31, ASK32, ASK33, ASK35, ASK40 and ASK41.

2.7.3 Electrical accessories

Notes

- If an auxiliary switch is required, its switching point should be indicated on the plant schematic.
- For media below 0 °C the stem heating element ASZ6.6 keeps the valve free from freezing.
- For this case, do not insulate the actuator bracket and the valve stem, as air circulation must be ensured!
- **Non-observance of the above may result in accidents and fires!**
- **Do not touch the hot parts without prior protective measures to avoid burns.**



Stroke actuators		SQX..				SAX..	
		SQX31..	SQX61..	SQX32.. SQX82..	SQX62..	SAX31..	SAX61..
ASZ6.5	Stem heater	ASZ6.5	ASZ6.5	ASZ6.5	ASZ6.5	ASZ6.6	ASZ6.6
ASZ7.4	1 auxiliary switch, 1 potentiometer (1000 Ω)	ASZ7.4	-	ASZ7.4	-	ASC10.51 + ASZ7.5/1000	-
ASC9.4	Double auxiliary switch	ASC9.4	-	ASC9.4	-	2x ASC10.51	-
ASC9.5	Auxiliary switch	ASC9.5	-	ASC9.5	-	ASC10.51	-

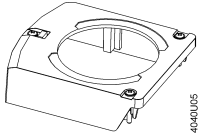
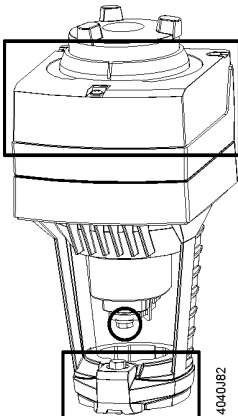

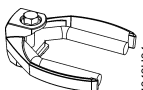
Rotary actuators		SQL..				SAL..
		SQL31..	SQL32..	SQL33.. SQL83..	-	SAL31..T10 SAL81..T10
ASZ7.4	1 auxiliary switch, 1 potentiometer (1000 Ω)	-	-	ASZ7.4	ASZ7.4	ASC10.51 + ASZ7.5/1000
ASC9.4	Double auxiliary switch	-	-	ASC9.4	ASC9.4	2x ASC10.51
ASC9.5	Auxiliary switch	-	-	ASC9.5	ASC9.5	ASC10.51
ASZ8.4	Potentiometer (220 Ω)	ASZ8.4	ASZ8.4	-	-	¹⁾
ASZ9.4	Potentiometer (2800 Ω)	ASZ9.4	ASZ9.4	-	-	¹⁾
ASC1.4	Auxiliary switch	ASC1.4	ASC1.4	-	-	ASC10.51

- ¹⁾ Used auxiliary switches or potentiometer (order accessories additionally were applicable):
- Check used functionality
 - Check compatibility with controller

2.8 Spare parts

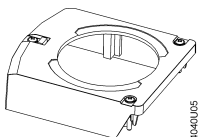
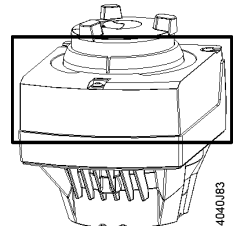


The following spare part sets are available:

SAX..

Stock number 8000060843	Housing cover 	
	Screw (valve stem coupling) 	
	U-bracket 	

Single components from the spare part sets are not available.

SAL..

Stock number 8000060844	Housing cover 	
	2 adapters  1 pc. 14 mm 1 pc. 11 mm	
	4 screws  2 pcs. M5 x 20 mm 2 pcs. M6 x 20 mm	

Single components from the spare part sets are not available.

2.9 Sizing

2.9.1 Parallel operation of actuators

SA..31.. and SA..81..

3-position actuators must have one specific controller each, refer to "Connection diagrams" (page 54).

SA..61..

Up to 10 actuators can drive in parallel on a controller output with a rating of 1 mA. Modulating actuators have an input impedance of 100 kΩ.

2.9.2 Permissible cable lengths and wire cross-sectional areas

Cable lengths and wire cross-sectional areas depend on the following criteria of the actuators:

- Current draw
- Permissible voltage drop across the power supply lines

The control accuracy of the modulating actuators can be improved by using 4-wire connections, thus ensuring that voltage drops on G0 will not distort the positioning signal.

Note

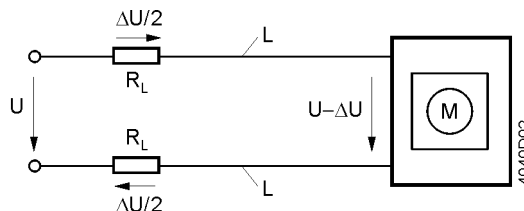
When determining the cable length and the wire cross-sectional area, adherence to the permissible operating voltage tolerance at the actuator is of importance, in addition to the permissible voltage drop across the operating voltage and signal lines (see table below).

Product no.	Operating voltage	Terminal	Max. permissible voltage drop
SA..31..	AC 230 V	N, Y1, Y2	2% each (total of 4%)
SA..61..	AC/DC 24 V	G0, G	4% each (total of 8%)
SA..81..		G0, Y, U	1% each (at DC 0...10 V)
		G, Y1, Y2	4% each (total of 8%)

The following criteria must be considered:

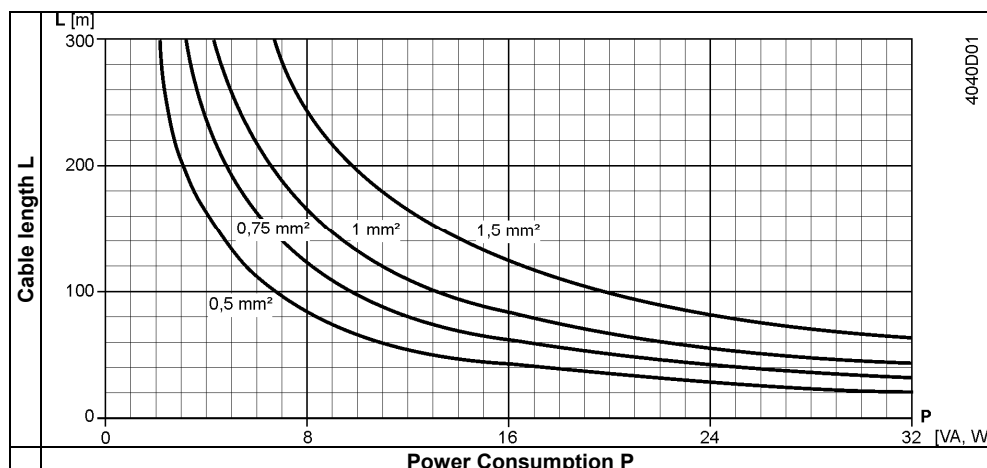
- With modulating control, the permissible positioning signal error must not exceed 1%, the reason being the voltage drop on the G0 wire.
- The voltage drop, caused by charging current peaks in the actuator's DC circuit, must not exceed 2 Vpp.
- If the G0 line is not correctly sized, load changes of the actuator due to changes of the DC voltage drop might lead to self-oscillations.
- The operating voltage drop at AC/DC 24 V may be a maximum of 8% (4% above the G0 wire).

Basic diagram – voltage drop across the power supply cables



The following diagram can be used to determine the cable lengths and wire cross-sectional areas.

L/P-diagram for AC/DC 24 V



Permissible cable length L as a function of power P and cross-sectional area of wire as a parameter

Note

P is the decisive power consumption of all actuators connected in parallel. When operating on AC 24 V, power consumption is in VA; when operating on DC 24 V, in W.

Formulas for wire lengths

Operating voltage	Permissible voltage drop / wire	Formula for wire length
AC 230 V	2% of AC 230 V	$L = 46 \cdot \frac{1313 \cdot A}{P}$ [m]
AC/DC 24 V	4% of AC 24 V	$L = \frac{1313 \cdot A}{P}$ [m]
	1% of DC 10 V	$L = \frac{5.47 \cdot A}{I(\text{DC})}$ [m]

A Cross-sectional area of wire in mm^2

L Permissible wire length in m

P Power consumption in VA (AC) or W (DC) (see actuator's rating plate)

I(DC) DC current part (in A) on G0 wire

2.10 Warranty

The engineering data specified in chapter "Equipment combinations" (page 10) are only guaranteed in connection with the Siemens valves listed.

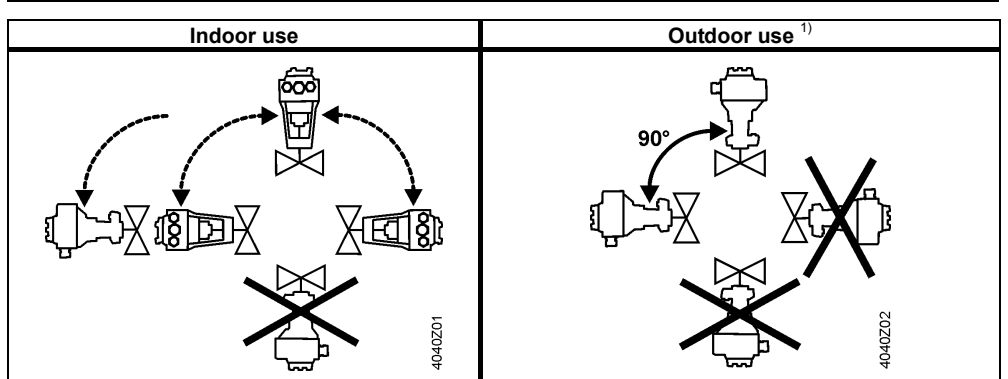
Note

When using the actuators in connection with valves of other manufacture, correct functioning must be ensured by the user, and Siemens will assume no responsibility.

3 Handling

3.1 Mounting and installation

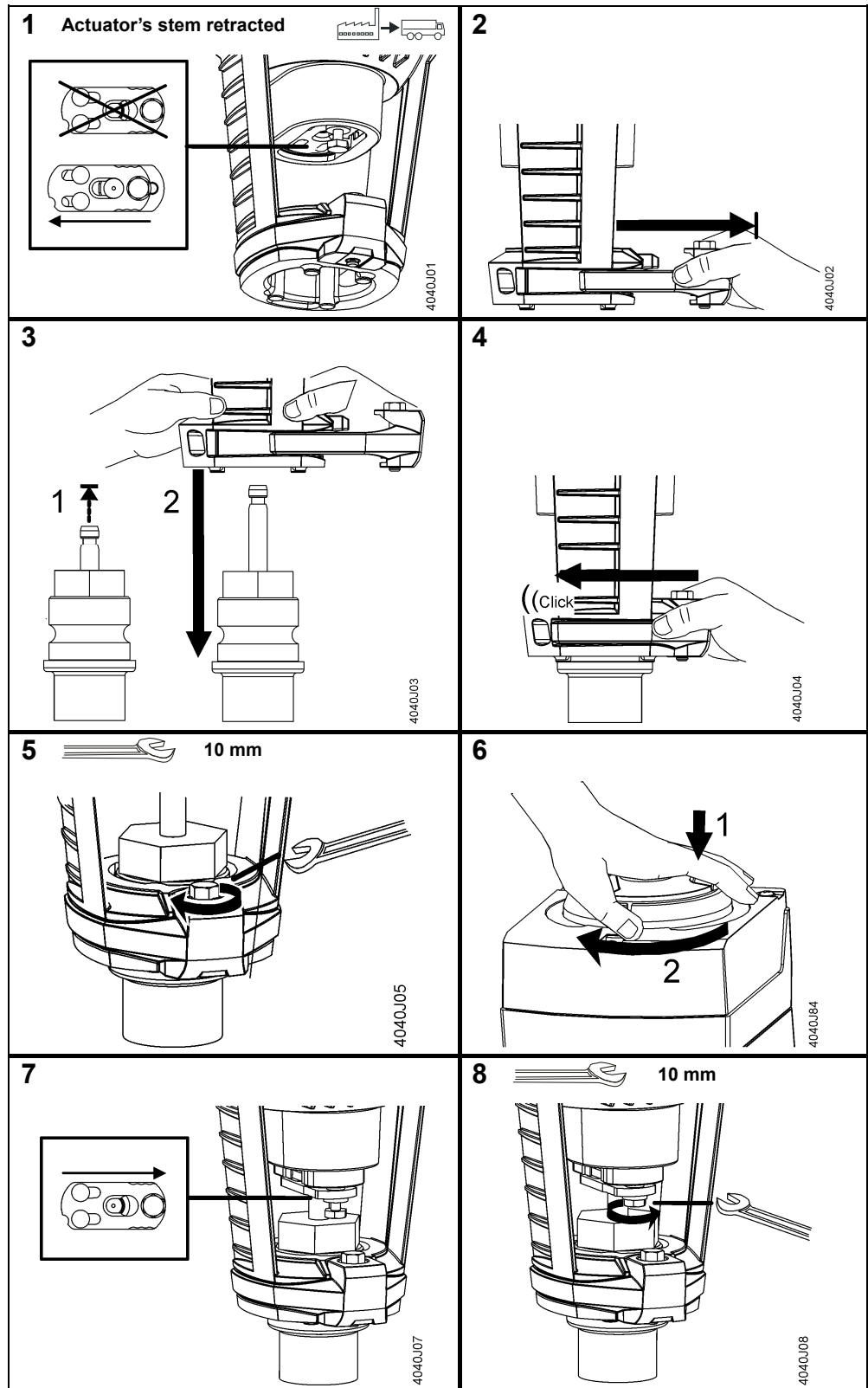
3.1.1 Mounting positions



¹⁾ Only in connection with weather shield ASK39.1

3.1.2 Fitting stroke actuators to seat valves VVF.. / VXF.. or VVG.. / VVG..

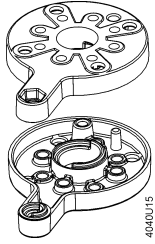
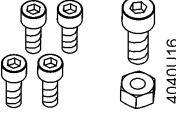

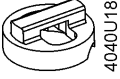
First, observe "Mounting positions" (page 19).



3.1.3 Fitting rotary actuators to butterfly valves VKF41..

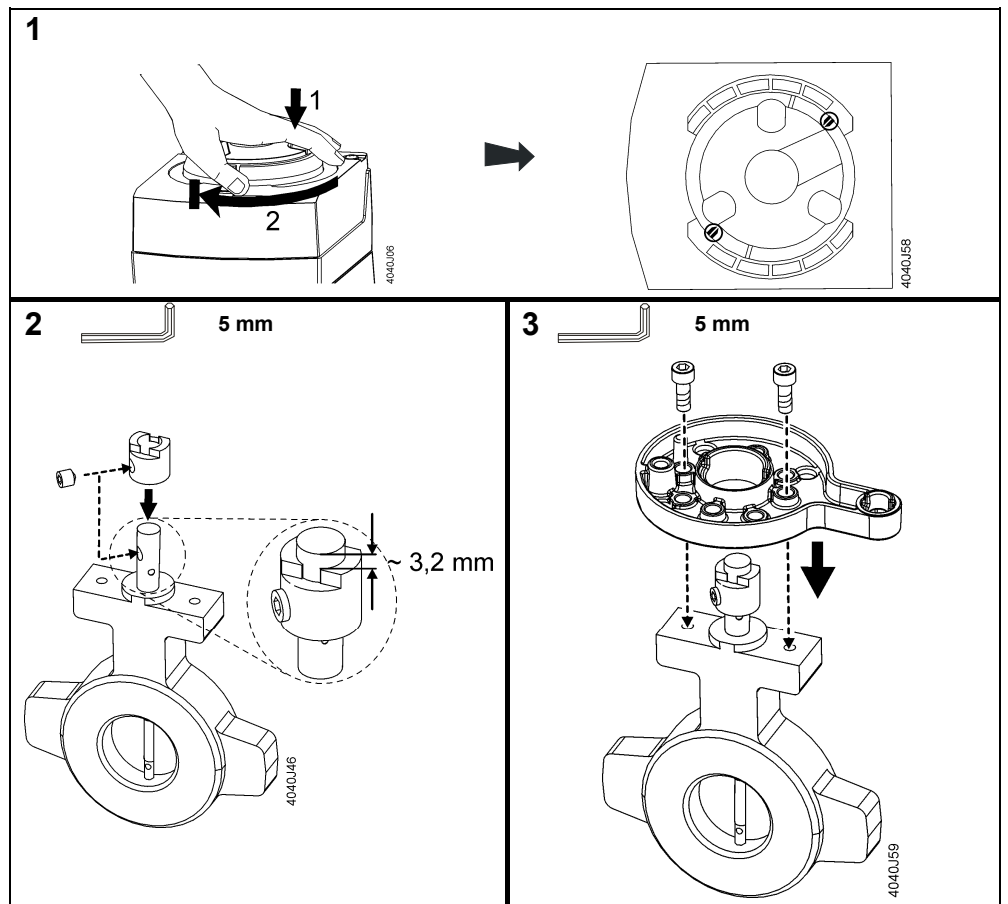
First, observe "Mounting positions" (page 19).

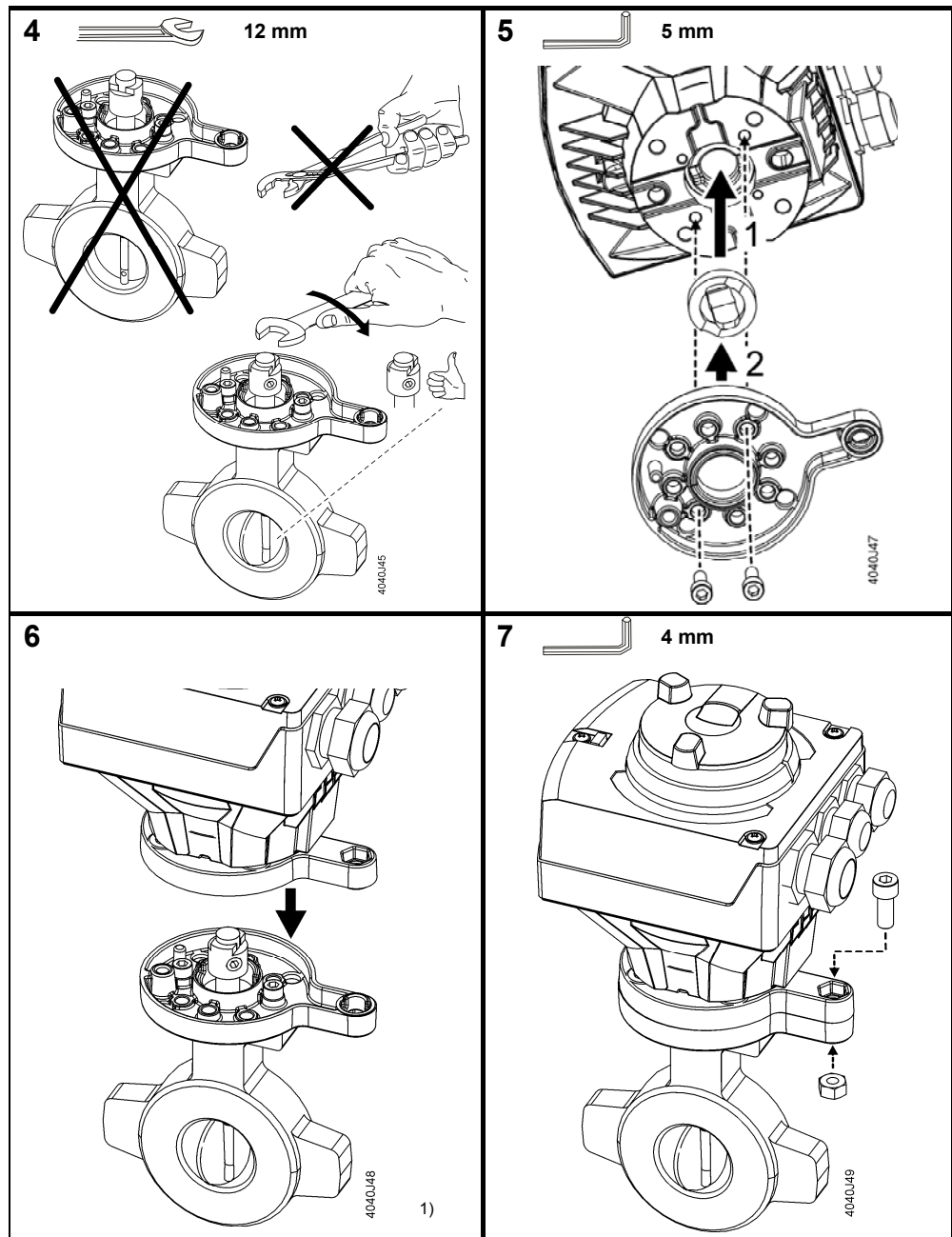
Mounting set ASK33N

Scope of delivery			
Mounting set (2 parts)	5 screws	1 adapter inc. fixing screw	1 adapter
	4 pcs. M6 x 16 mm 1 pc. M5 x 20 incl. nut 		

Note

Actuators SAL.. are not compatible with mounting sets ASK31, ASK32, ASK33, ASK35, ASK40, and ASK41.





¹⁾ Angle position errors between actuator shaft and valve stem must be corrected via manual control (refer to "Manual adjuster" page 46).

3.1.4 Fitting rotary actuators to slipper valves VBF21..

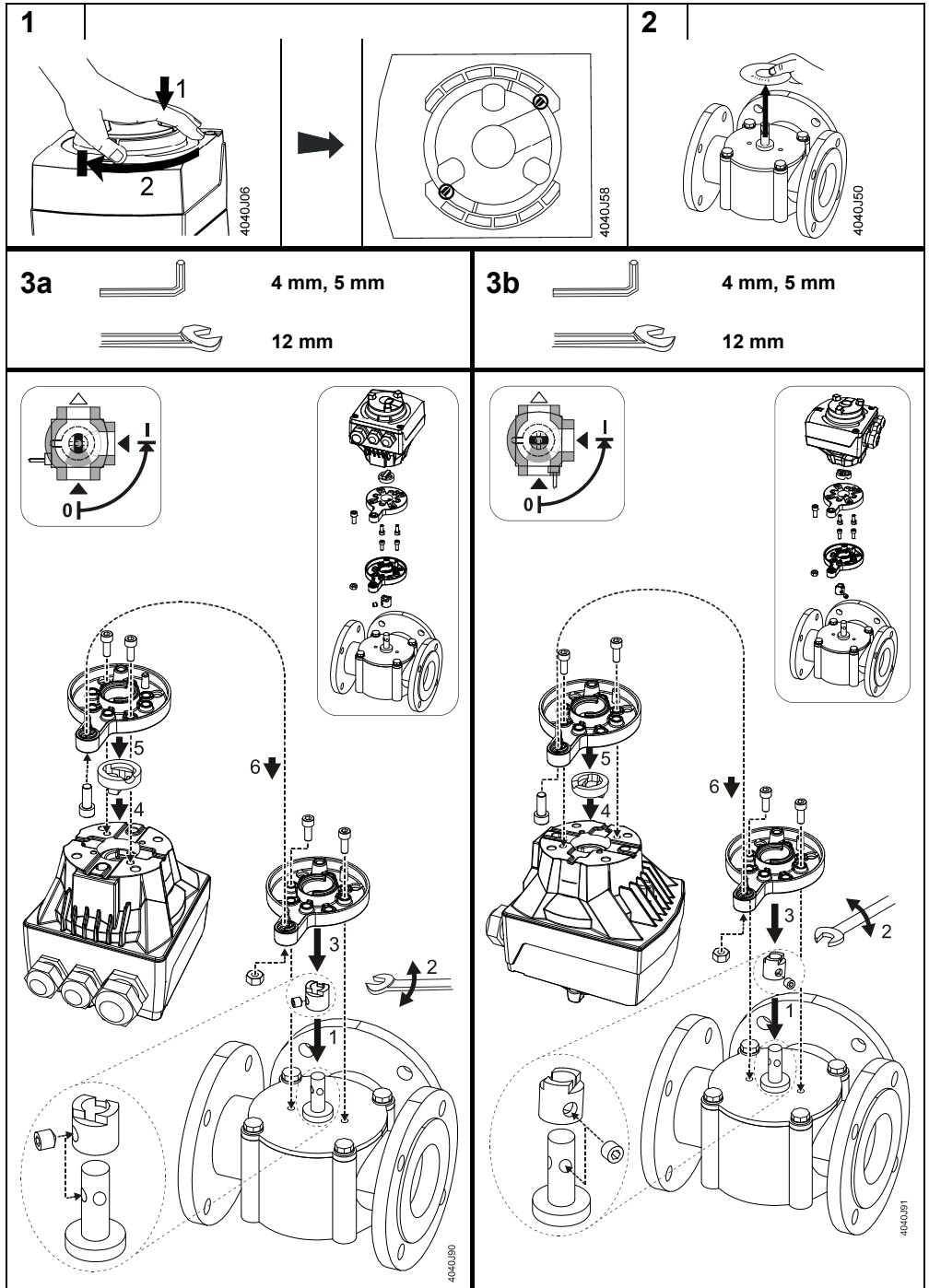
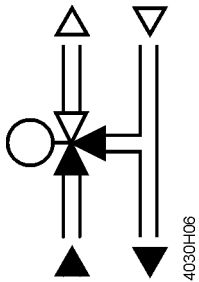
First, observe "Mounting positions" (page 19).

Mounting set ASK31N

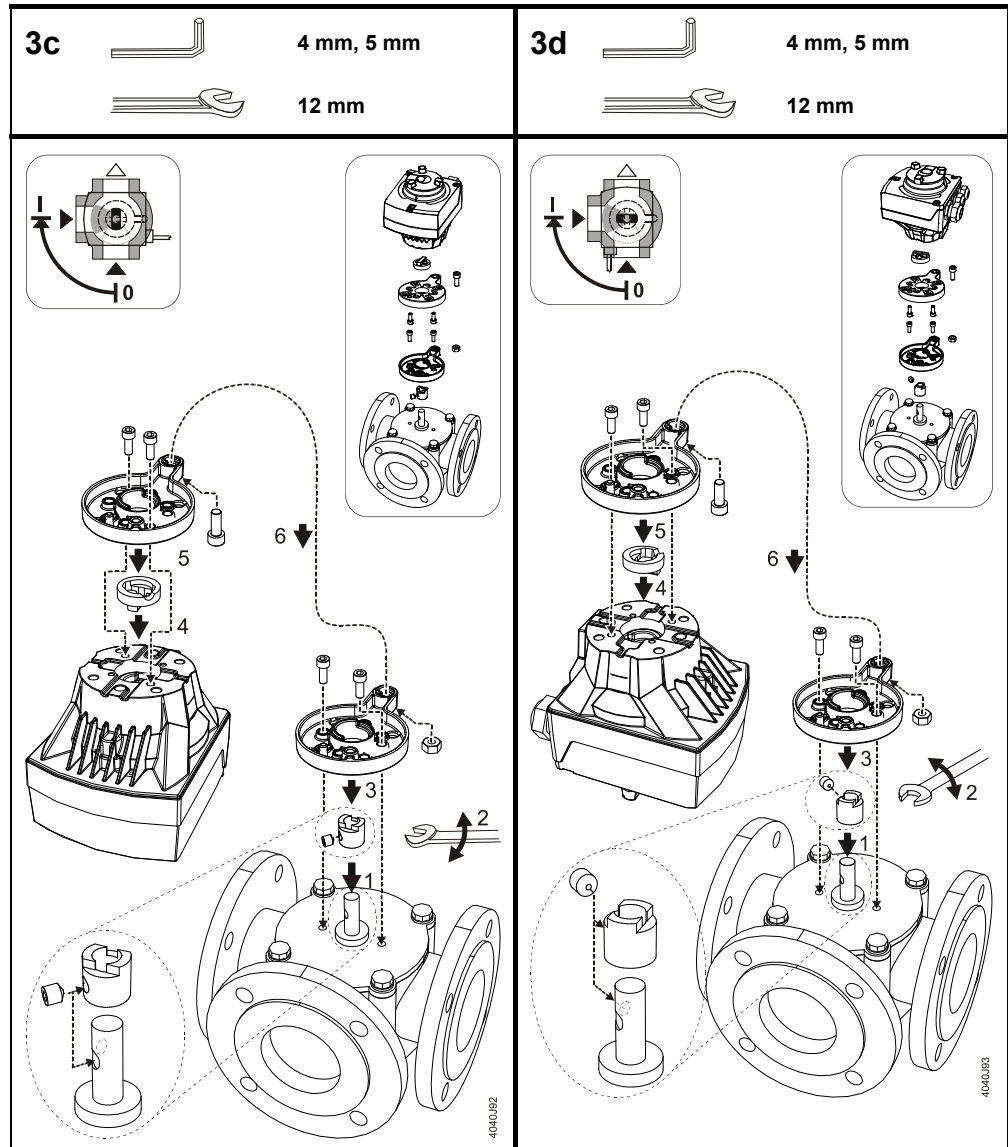
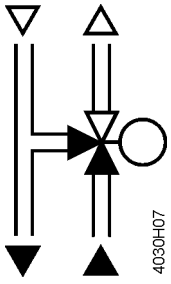
Scope of delivery			
Mounting set (2 parts)	5 screws	1 adapter inc. fixing screw	1 adapter
<p>4040U15</p>	<p>4 pcs. M6 x 16 mm 1 pc. M5 x 20 mm incl. nut</p> <p>4040U16</p>	<p>4040U17</p>	<p>4040U18</p>

SAL..T10 rotary actuators only fit on VBF21..., DN65...150. For VBF21..., DN40/50 use SQK34..., SQK84.. or SQK33.00 rotary actuators.
 With VBF21.. (e.g. DN 125), the following steps must be performed prior to fitting the mounting set.

Opening counterclockwise



Opening clockwise



For further mounting positions of VBF 21.. and routing of the connection cables the rotary actuators and adapters must be mounted according to the sketches above.

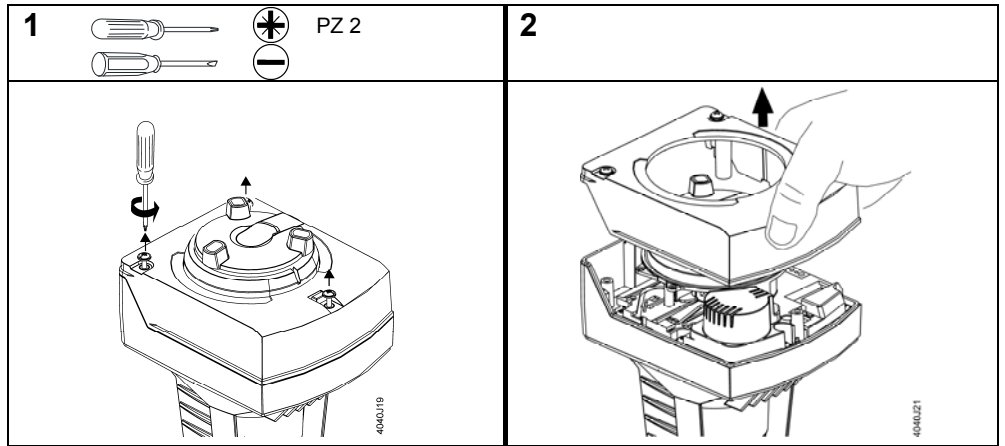
3.1.5 Accessories

Special notes on mounting

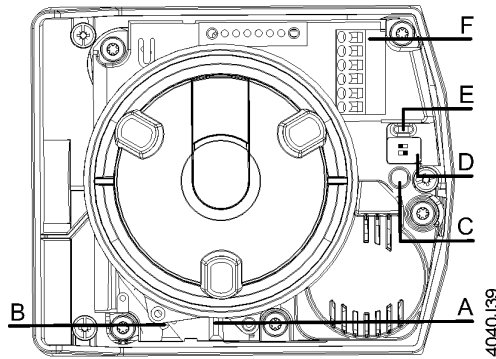


Before fitting the accessory items shown below, the following steps must be performed:

1. Actuator is mechanically connected to a Siemens valve.
2. Observe compatibility and choice of combinations. Refer to "Accessories" (page 13).
3. Disconnect actuator from power. **Attention if AC 230 V connected danger of life!**
4. Only required with actuators without fail safe function: Using the manual adjuster, drive the actuator's stem to the fully retracted position and fix the coupling. See "Manual operation" and "Fixing coupling" (page 45).
5. When mounting two different accessories watch out for correct plug-in space A or B (see below).
6. To fit an auxiliary switch, potentiometer or function module, the housing cover must be removed.

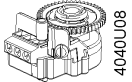


Interior view of setting elements and plug-in spaces



	Plug-in space for...
A	<ul style="list-style-type: none"> • Potentiometer ASZ7.5/.., or • Auxiliary switch ASC10.51
B	Plug-in space for... <ul style="list-style-type: none"> • Function module AZX61.1, or • Auxiliary switch ASC10.51
C	LED
D	DIL switches
E	Calibration slot
F	Connection terminals

Potentiometer ASZ7.5/..

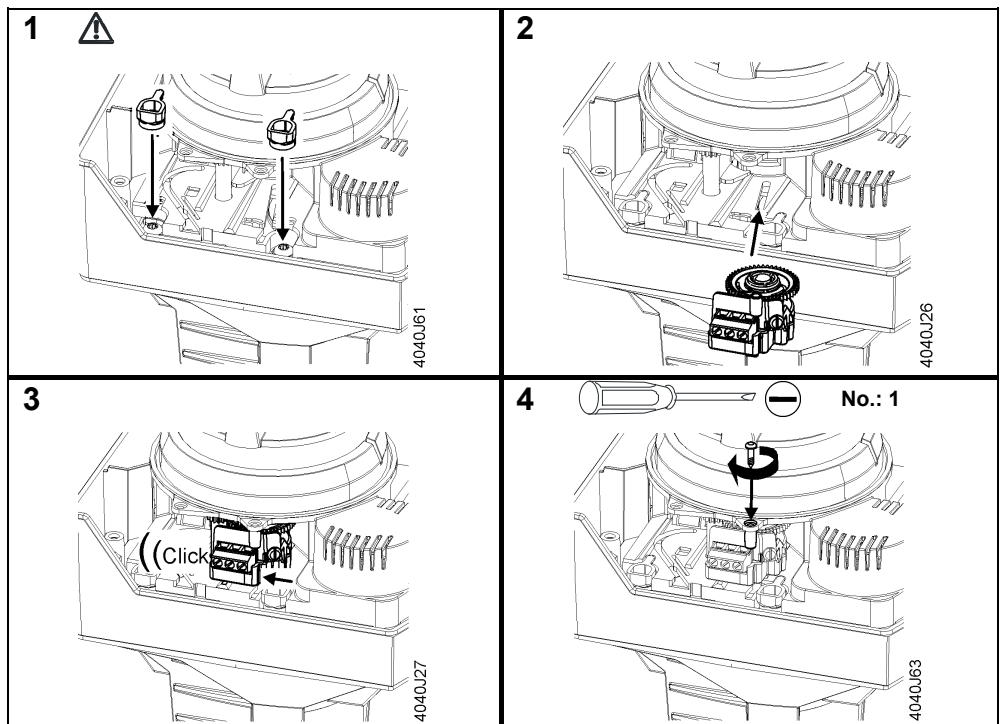


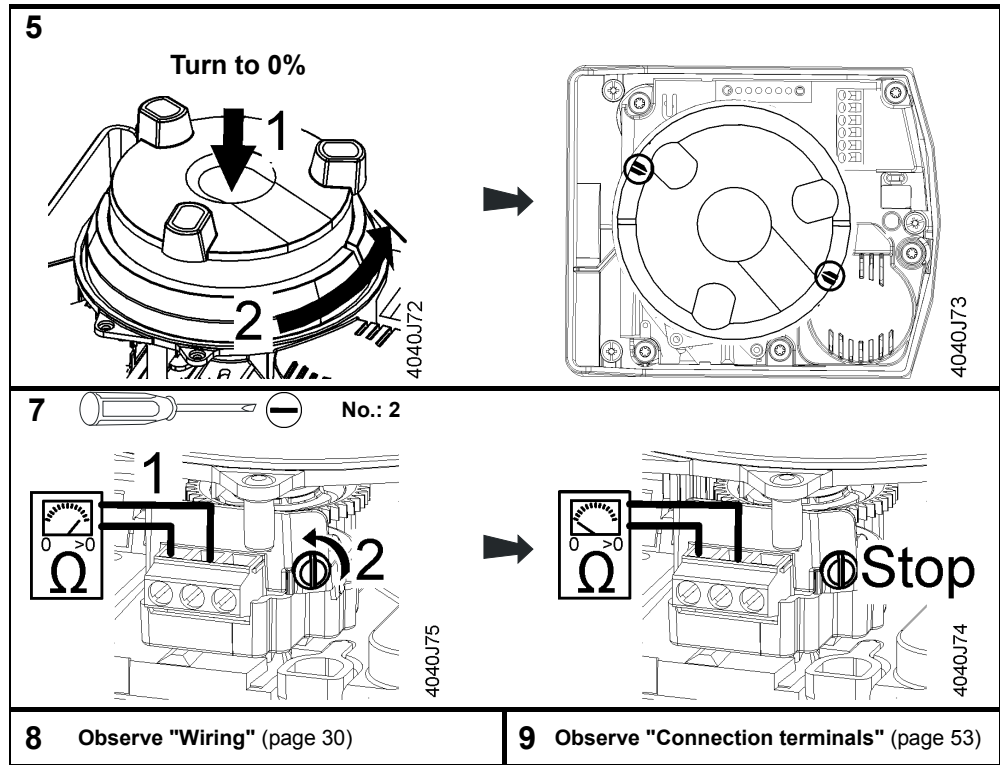
Scope of delivery		
1 potentiometer ASZ7.5/..	1 screw	2 screw covers
4040U08	1 pc. 	



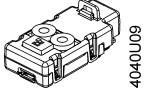
- First, observe "Special notes on mounting" (page 24).
- **Fit the screw covers first – otherwise danger of life!**

Plug-in space A



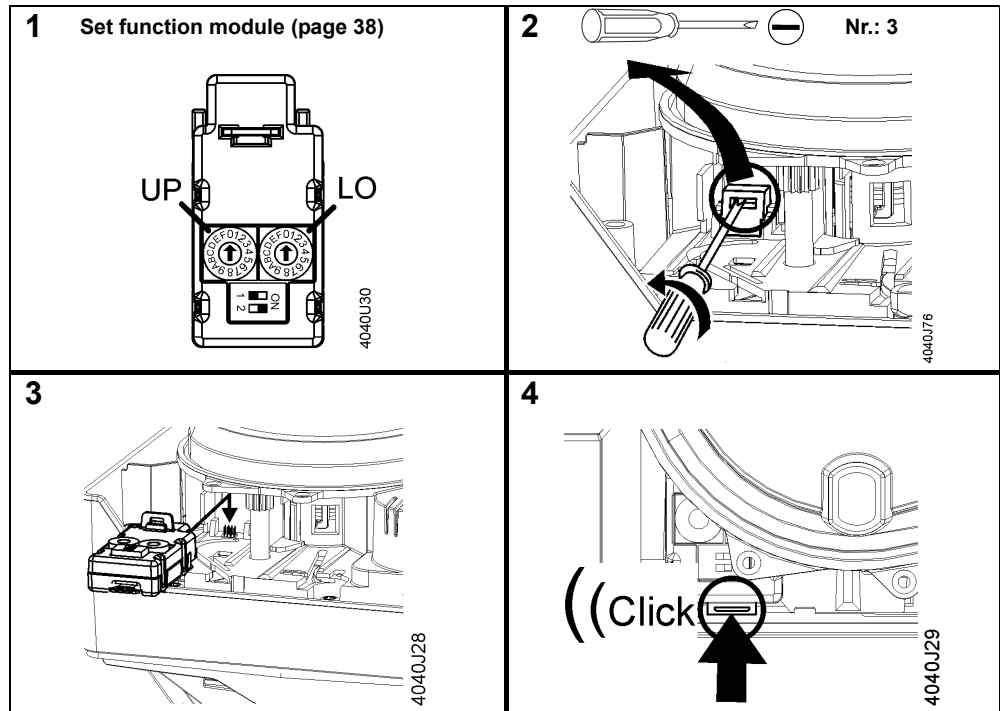


**Function module
AZX61.1**

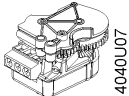


Plug-in space B

First, observe "Special notes on mounting" (page 24).



**Auxiliary switch
ASC10.51**

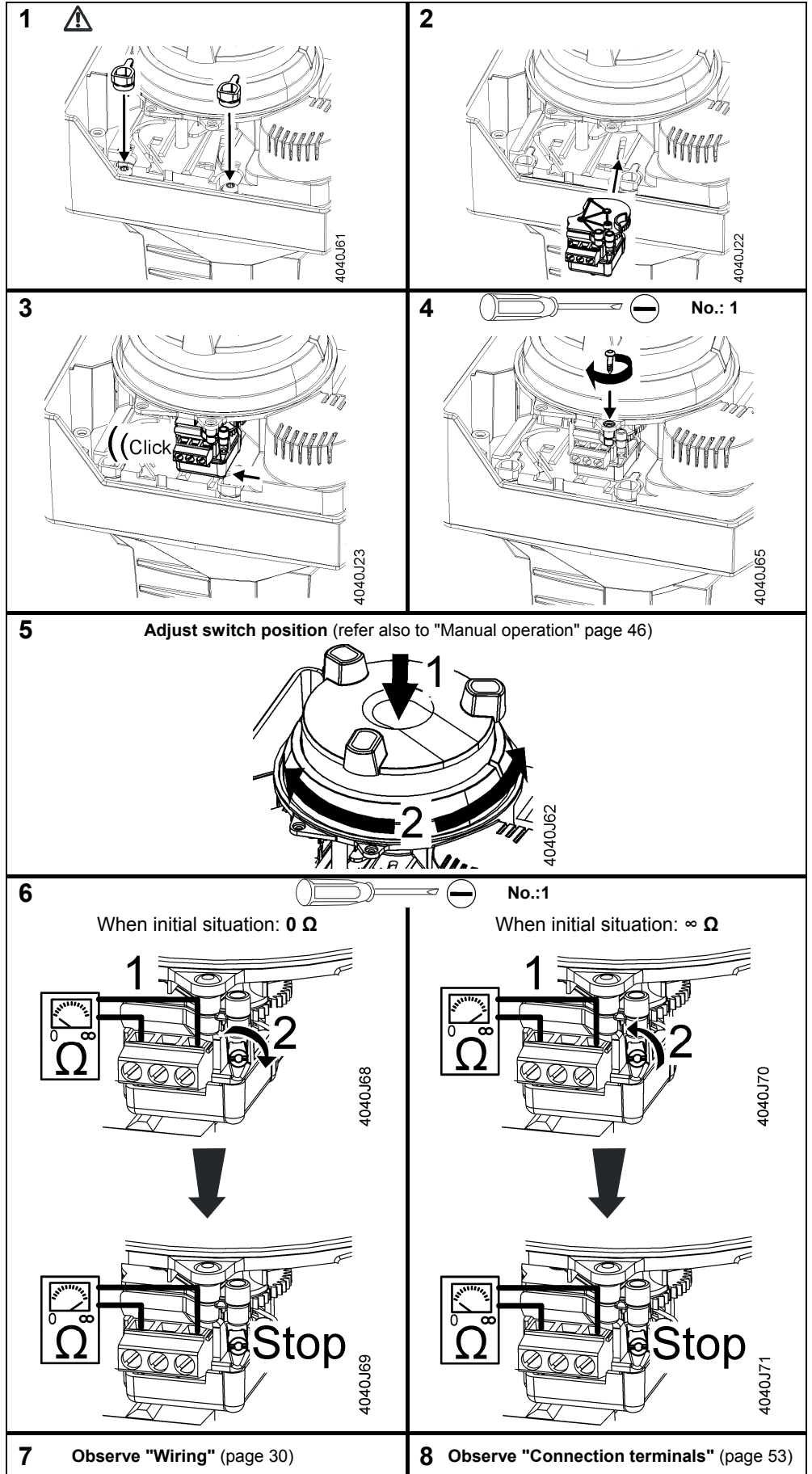


Scope of delivery		
1 auxiliary switch ASC10.51	1 screw	2 screw covers
4040U07	1 pc. 4040U28	4040U29

Plug-in space A

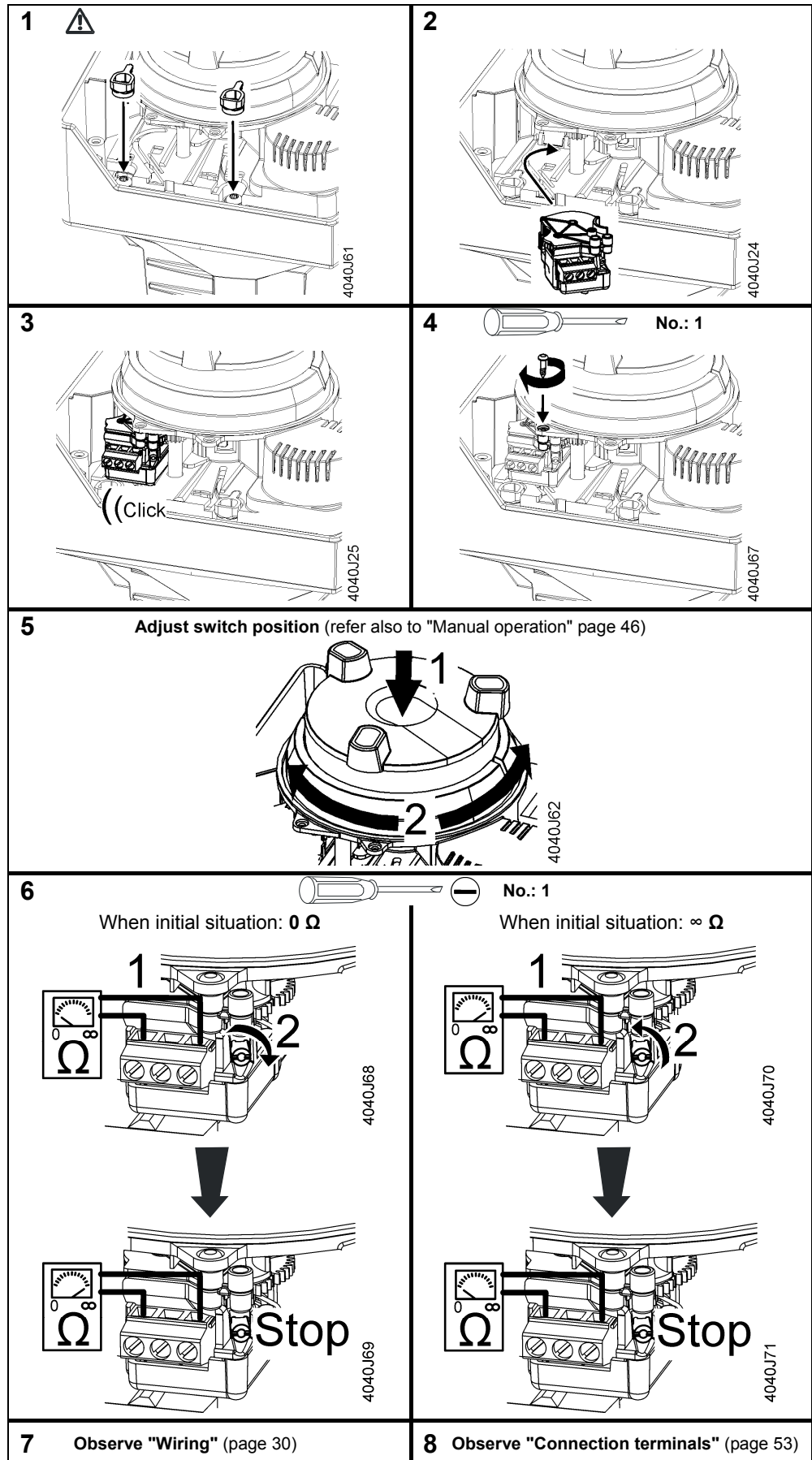


- First, observe "Special notes on mounting" (page 24).
- **Fit the screw covers first– otherwise danger of life!**

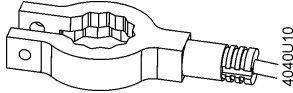


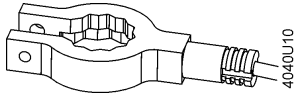
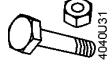


- First, observe "Special notes on mounting" (page 24).
- **First, fit the screw covers – otherwise danger of life!**



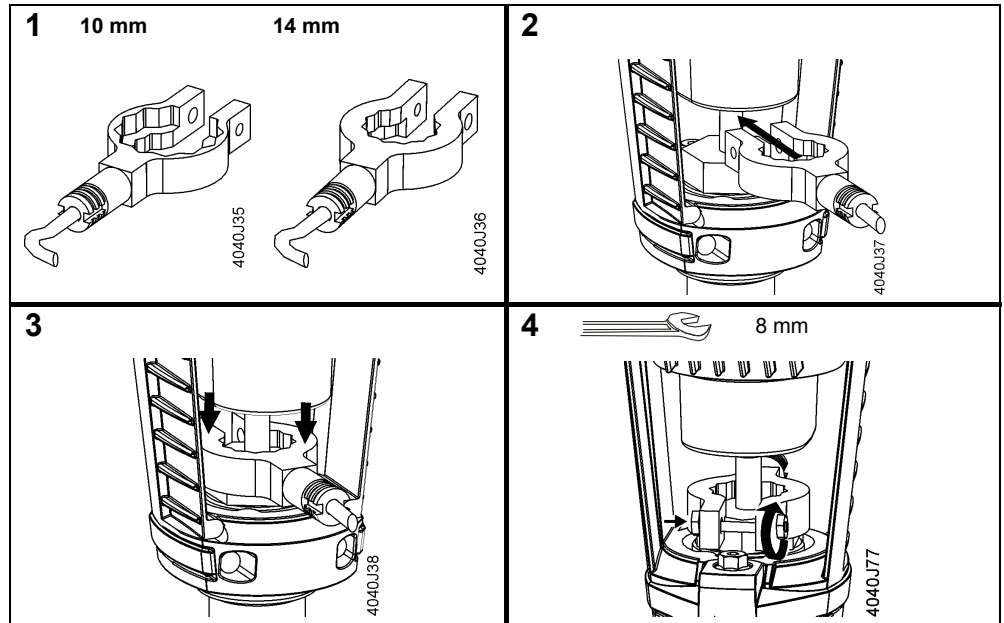
**Stem heating element
ASZ6.6**



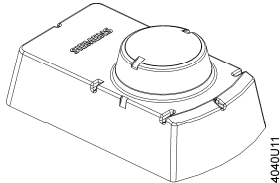
Scope of delivery	
1 stem heating element ASZ6.6	1 screw
	1 pc. M4 x 30 incl. nut 

When fitting the stem heating element, stroke actuator and valve must be assembled. The stem heating element is powered separately.

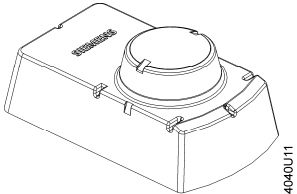

First, observe "Special notes on mounting" (page 24).



**Weather shield
ASK39.1**

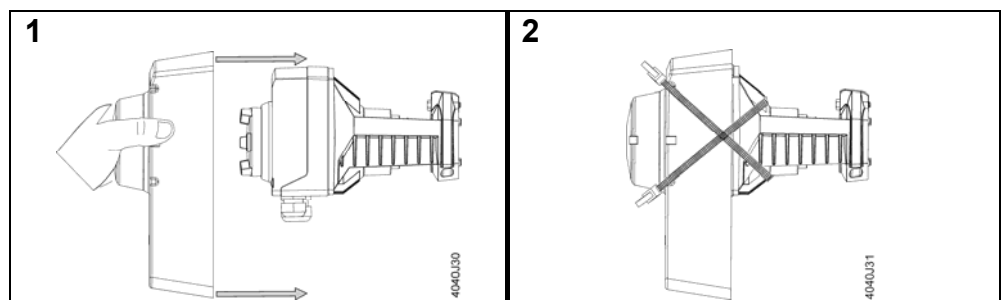


First, observe "Special notes on mounting" (page 24).

Scope of delivery	
Weather shield ASK39.1	2 UV-proof cable ties
	

Notes

- To protect the actuator when used outdoors, the weather shield must always be fitted.
- If fitted several times, 2 UV-proof cable ties (800 x 4 mm) must be used.
- The manual adjuster can not be used when the weather shield is mounted.

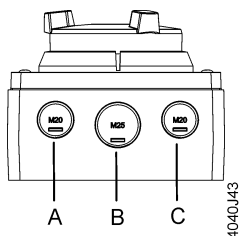
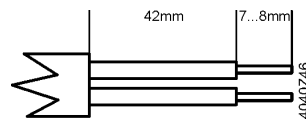


3.1.6 Wiring (installation)


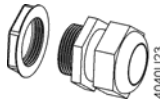

Conduct the electrical connections in accordance with local regulations on electrical installations as well as the "Connection diagrams" on page 53.

Preparation of wire endings

The cable endings must be prepared before as follows.




A	EU: M20 US: 1/2"	Standard	Connection actuator
B	EU: M25 US: 1/2"	Ground cable for outdoor installation	
C	EU: M20 US: 1/2"		Connection accessories

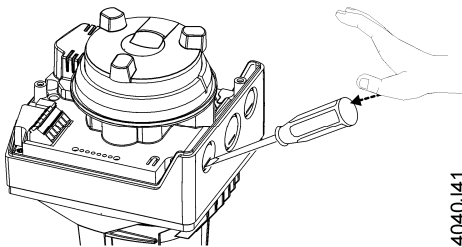
Cable glands (not contained in scope of delivery)		
Metric	Metric	Inch thread
M20	M25	1/2"
		

Prior to installation, the following preconditions must be satisfied:

- Actuator is mechanically connected to a Siemens valve.
- Housing cover is removed (step 6 "Special notes on mounting", page 24).

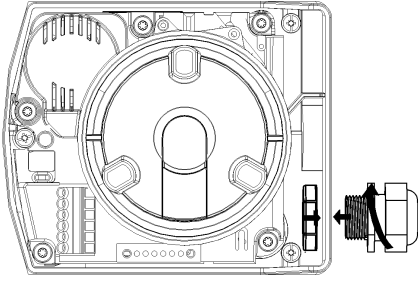
Actuator

1  No.: 4



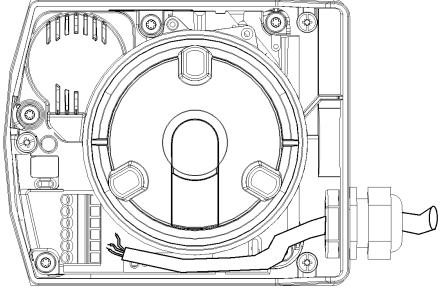
4040J41

2



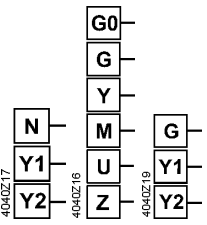
4040J42

3

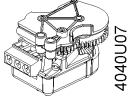


4040J78

4 Observe "Connection terminals" (page 53)

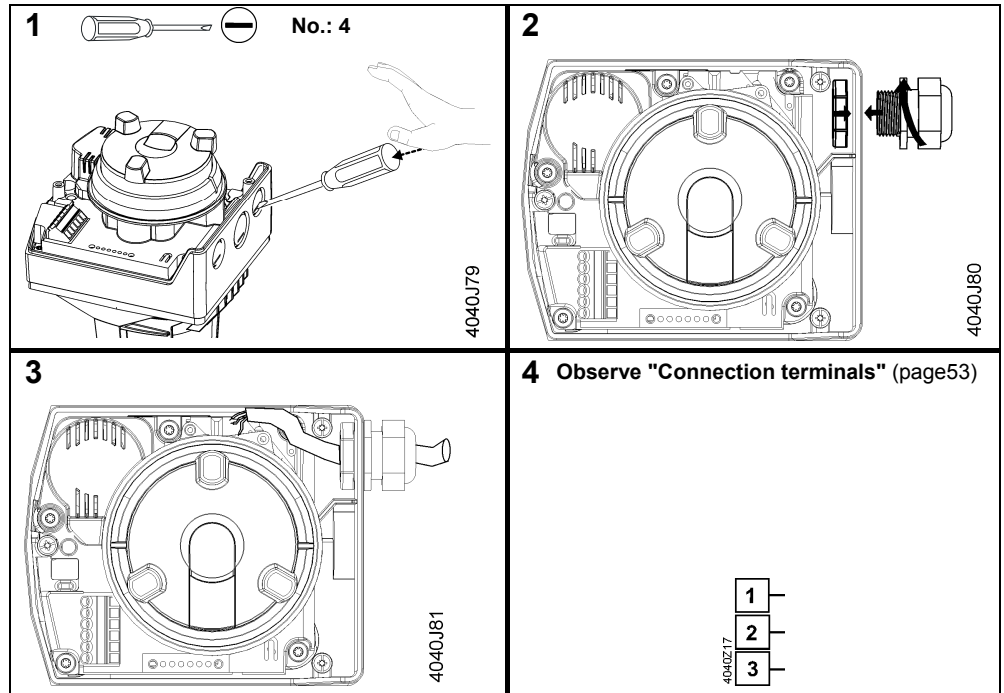
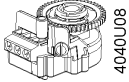


**Auxiliary switch
ASC10.51**



and

**Potentiometer
ASZ7.5/..**



3.2 Commissioning and operation

3.2.1 Function check and Calibration

Mechanically

Before making the function check, the following preconditions must be satisfied:

- "Environmental conditions" specified in chapter "Technical data" (page 50)
- Actuator is mechanically connected to a Siemens valve
- ⚠ **Actuator is in "Manual operation" mode** (page 46).

The actuator can be operated with the help of the "Manual adjuster" (see page 46).

Manual adjuster	Stroke actuator	Rotary actuator	Control path valve A→AB	Bypass valve B → AB
Turning in clockwise direction	Actuator's stem extends	Actuator's spindle turns in clockwise direction	Opening	Closing
Turning in counter-clockwise direction	Actuator's stem retracts	Actuator's spindle turns in counterclockwise direction	Closing	Opening

Notes

- Ensure that the actuator's and valve's stem, or actuator's and valve's spindle are securely connected in all positions.
- If the actuator is forced to travel beyond its end positions, overload protection responds.
- Observe information given in chapter "Acting direction and flow characteristic" on page 41.

Electrically

Before making the function check, the following preconditions must be satisfied:

- "Environmental conditions" specified in chapter "Technical data" (page 50).
- Actuator is mechanically connected to a Siemens valve.
- ⚠ **Actuator is in "Automatic" mode** (page 46).
- Actuator and, if required, accessories are correctly fitted and connected. Also refer to "Connection terminals" (page 53).
- Power is applied.

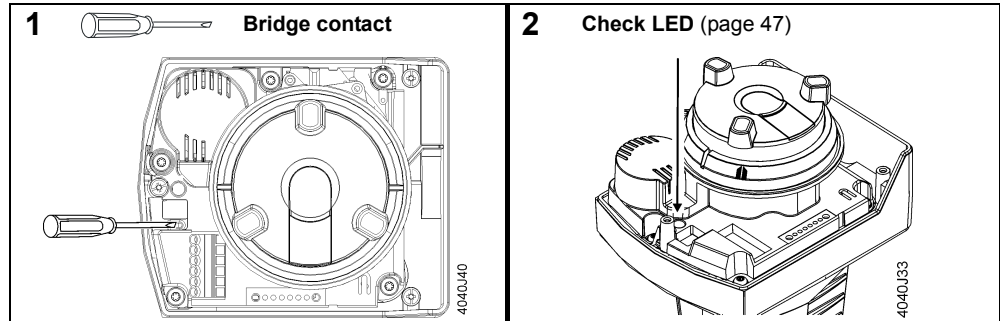
SA..61..

Calibration is required with modulating actuators and SA..61.. before the function check.

General notes on calibration

Before making the calibration, the following preconditions must be satisfied:

- A description of the calibration function is given in chapter "Calibration" (page 41).
- Housing cover is removed (step 6 "Special notes on mounting", page 24).



If required, calibration can be repeated any number of times.

Make the function check for modulating actuators after the calibration with a point test according to the following table:

Connection terminals	Stroke actuator	Rotary actuator	Control path valve A → AB	Bypass valve B → AB	Position feedback U
Y 6 V 13.6 mA	Actuator's stem extends (60%)	Actuator's spindle turns in clockwise direction (60 %)	Opening	Closing	6 V
Y 5 V 12 mA	Actuator's stem retracts (50%)	Actuator's spindle turns in counterclockwise direction (50 %)	Closing	Opening	5 V
"Z" connected to "G"	Actuator's stem extends	Actuator's spindle turns in clockwise direction	Opening	Closing	10 V
"Z" connected to "G0"	Actuator's stem retracts	Actuator's spindle turns in counterclockwise direction	Closing	Opening	0 V

SA..31.. and SA..81..

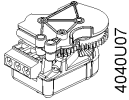
Make the function check for 3-position actuators according to the following table:

Connection terminals	Stroke actuator	Rotary actuator	Control path valve A → AB	Bypass valve B → AB
Voltage at Y1	Actuator's stem extends	Actuator's spindle turns in clockwise direction	Opening	Closing
Voltage at Y2	Actuator's stem retracts	Actuator's spindle turns in counterclockwise direction	Closing	Opening
No voltage at Y1 and Y2	Actuator's stem maintains the position	Actuator's spindle maintains the position	Maintains the position	

Notes

- If function module AZX61.1 is used, observe information given in chapter "Changeover of acting direction" (page 39).
- Observe information given in chapter "Acting direction and flow characteristic" on page 41.

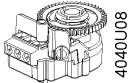
Auxiliary switch ASC10.51



Make the function check for mounted auxiliary switches according to the following table – example switching point at 25% position:

Connection terminals		Stroke actuator	Rotary actuator	Terminal S1 – S3	Terminal S1 – S2
Voltage at Y2	Y = 0 V	Actuator's stem retracts (until end position is reached)	Actuator's spindle turns in counter-clockwise direction (until end position is reached)	-	-
No voltage at Y1 und Y2	Y = 0 V	Actuator's stem maintains the position	Actuator's spindle maintains the position		
Voltage at Y1 for desired valve position % + 2% x positioning time Example: SAX31.00 = 27% x 120 sec = 32.5 sec	Valve position % + 2% Y = 2.7 V	Actuator's stem extends to desired position (27%)	Actuator's spindle turns in clockwise direction to desired position (27%)		
Check switching point with voltmeter		Actuator's stem maintains the position	Actuator's spindle maintains the position	-	-

Potentiometer ASZ7.5



Make the function check for mounted potentiometer according to the following table (Example values for ASZ7.5/1000):

Connection terminals		Stroke actuator	Rotary actuator	Terminal P1 – P2	Terminal P2 – P3
Voltage at Y2		Actuator's stem retracts (until end position is reached)	Actuator's spindle turns in counter-clockwise direction (until end position is reached)	-	-
No voltage at Y1 und Y2		Actuator's stem maintains the position	Actuator's spindle maintains the position	< 1 Ω	> 996 Ω
Voltage at Y1 for desired valve position % positioning time Example: SAX31.00 = 75% x 120 sec = 90 sec		Actuator's stem extends to desired position (75%)	Actuator's spindle turns in clockwise direction to desired position (75%)	-	-
Check position value with ohmmeter		Actuator's stem maintains the position	Actuator's spindle maintains the position	~ 560 Ω	~ 436 Ω
Voltage at Y2 for desired change of valve position % x positioning time Example: SAX31.00 = 10% x 120 sec = 12 sec		Actuator's stem retracts to desired position (65%)	Actuator's spindle turns in counter-clockwise to desired position (65%)	-	-
Check position value with ohmmeter		Actuator's stem maintains the position	Actuator's spindle maintains the position	~ 485 Ω	~ 511 Ω

3.2.2 Maintenance

The actuators are maintenance-free.

3.2.3 Disposal



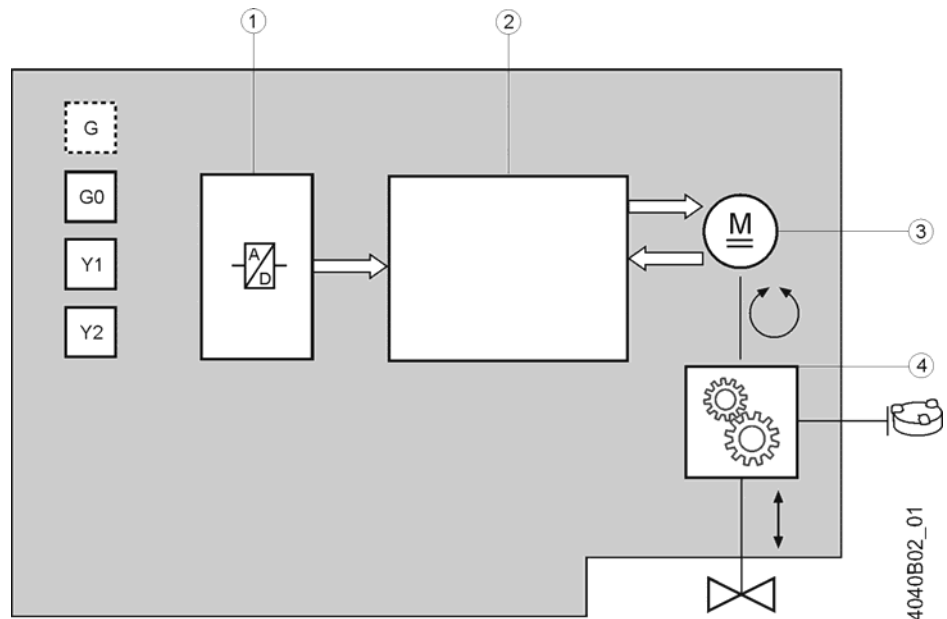
The products contain electrical and electronic components and must not be disposed of together with domestic waste. This applies in particular to the printed circuit board.

Legislation may demand special handling of certain components, or it may be sensible from an ecological point of view.

Observe all local and currently valid legislation.

4 Functions and control

4.1 3-position control



A 3-position signal drives the actuator via connection terminals Y1 or Y2. The required position is transferred to the valve.

1	A/D conversion	
2	Control functions	Identification of seat
		Control of direction
		Motor control
		Manual adjustment
3	Brushless DC motor	
4	Gear train	
	Manual adjuster	

Positioning signal	Stroke actuator	Rotary actuator	Control path valve A → AB	Bypass valve B → AB
Voltage at Y1	Actuator's stem extends	Actuator's spindle turns in clockwise direction	Opening	Closing
Voltage at Y2	Actuator's stem retracts	Actuator's spindle turns in counter-clockwise direction	Closing	Opening
No voltage at Y1 and Y2	Actuator's stem maintains the position	Actuator's spindle maintains the position	Maintains the position	

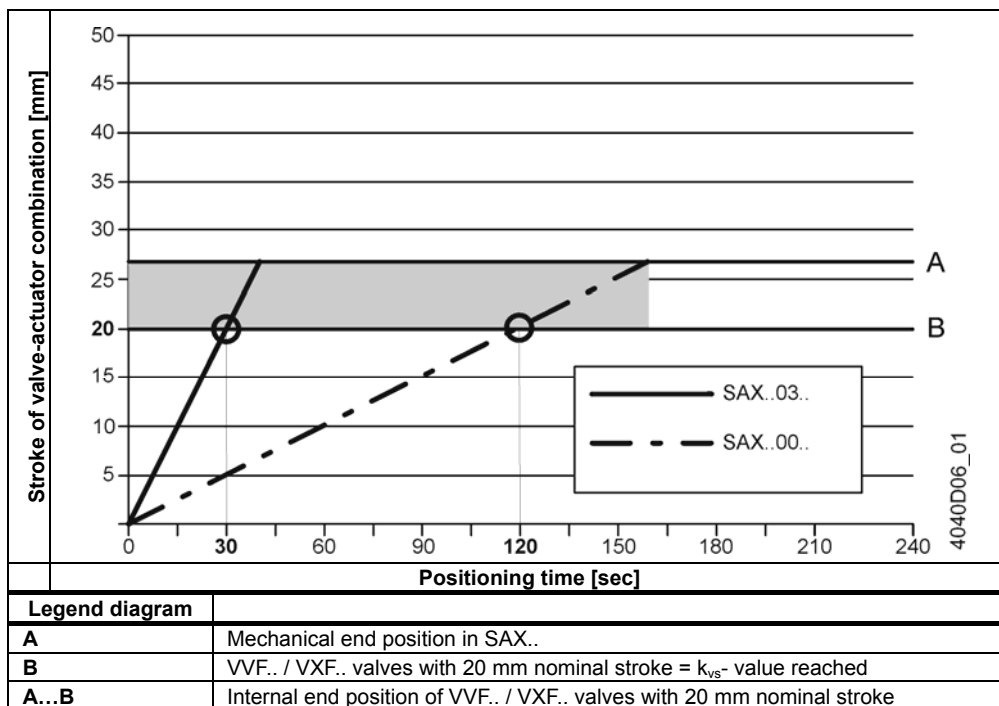
Note

Observe information given in chapter "Acting direction and flow characteristic" on page 41.

Internal control ensures very constant positioning times and determination of the actuator's position.

Positioning times stroke model

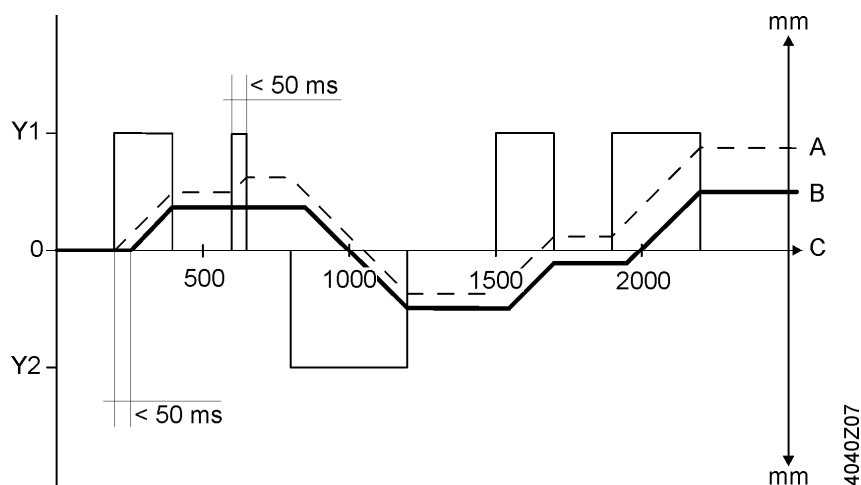
The specified positioning times refer to the respective nominal stroke / nominal angular rotation. Since the end positions of rotary actuators are inside the actuator, the following remarks refer to stroke actuators. The resulting effective strokes vary, depending on the type of valve, resulting in shorter or longer actuator positioning times.



Notes

Deviations occur...

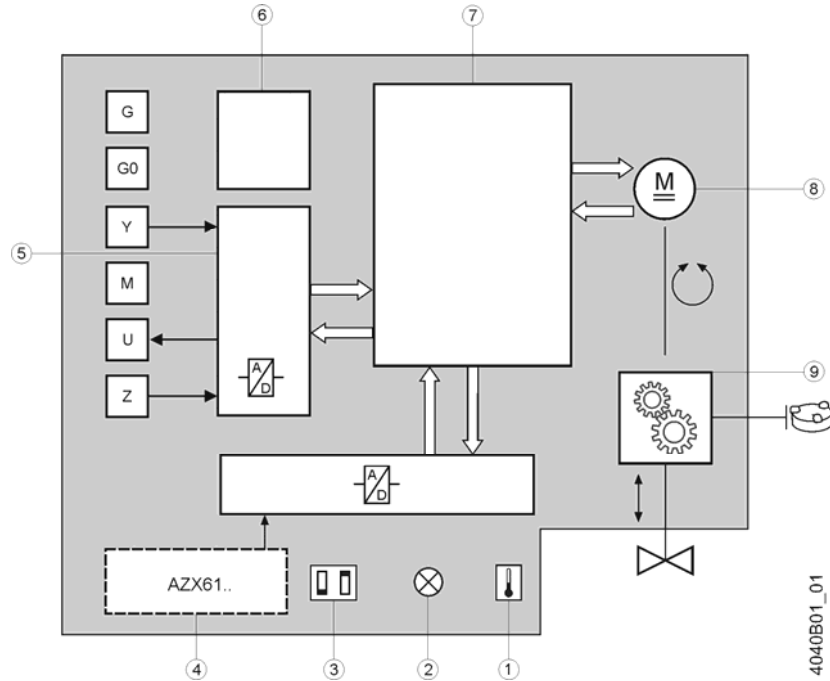
- after several positioning signals Y1 and Y2 in the same direction since the stroke movement starts with a delay of 50 ms.
- when positioning signals Y1 and Y2 are active for less than 50 ms since the stroke movement cannot be made in that case.



A	B	C	Y1	Y2	0
Calculated position	Actual position	Positioning time [ms]	Positioning signals (power applied)		No power applied

Accurate position feedback is made possible with the help of a potentiometer (page 48).

4.2 Modulating control



The modulating positioning signal drives the actuator steplessly. The positioning signal range (DC 0...10 V / DC 4...20 mA, 0...1000 Ω) corresponds in a linear manner to the positioning range (fully closed...fully open, or 0...100 % stroke).

The actuator is driven via connection terminal Y or forced control Z (page 44). The required stroke / rotation is transferred to the valve's stem / spindle.

1	Calibration slot	
2	LED (2 colors)	
3	DIL switches	Changeover of characteristic
		Positioning signal
4	Function module	
5	A/D conversion	
6	Power supply	
7	Control functions	Identification of seat
		Position control
		Motor control
		Detection of foreign bodies
		Calibration
		Forced control
		Characteristics function
Manual adjustment		
8	Brushless DC motor	
9	Gear train	
	Manual adjuster	

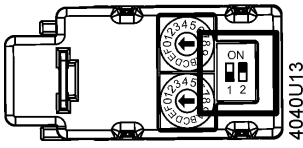
Positioning signal	Stroke actuator	Rotary actuator	Control path valve A→AB	Bypass valve B → AB
Signal Y, Z increasing	Actuator's stem extends	Actuator's spindle turns in clockwise direction	Opening	Closing
Signal Y, Z decreasing	Actuator's stem retracts	Actuator's spindle turns in counterclockwise direction	Closing	Opening
Signal Y, Z constant	Actuator's stem maintains the position	Actuator's spindle maintains the position	Maintains the position	





Notes

- If function module AZX61.1 is used, observe the information given in chapter "Changeover of acting direction" (page 39).
- Observe the information given in chapter "Acting direction and flow characteristic" on page 41.

4.3 Function module AZX61.1

DIL switches




	Acting direction	Sequence control
OFF ¹⁾	 Direct acting positioning signal Y or Z	 Sequence control not active
ON ¹⁾	 Reverse acting positioning signal Y or Z	 Sequence control (signal adaptation)

¹⁾ Factory setting: All switches set to OFF

4.3.1 Sequence control (signal adaptation)

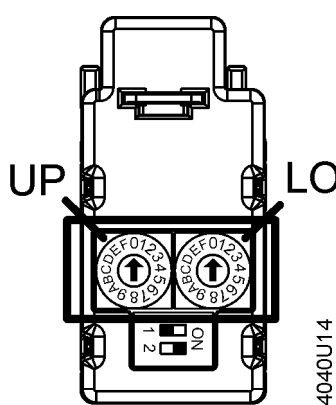
DIL switches

	Sequence control
ON ¹⁾	 Sequence control (signal adaptation)

¹⁾ Factory setting: All switches set to OFF

HEX switches

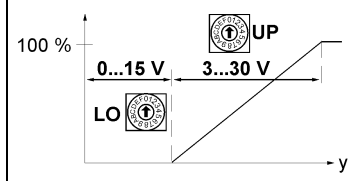
Nr.: 1



4040U14

Setting sequence control			
Rotary switches LO and UP are used to set the starting point or working range of a sequence.			
Position "LO"	Starting point	Position "UP"	Working range
0	0,3 V	0	9,4 V
1	1 V	1	3 V
2	2 V	2	4 V
3	3 V	3	5 V
4	4 V	4	6 V
5	5 V	5	7 V
6	6 V	6	8 V
7	7 V	7	9 V
8	8 V	8	10 V
9	9 V	9	12 V
A	10 V	A	14 V
B	11 V	B	16 V
C	12 V	C	18 V
D	13 V	D	20 V
E	14 V	E	25 V
F	15 V	F	30 V

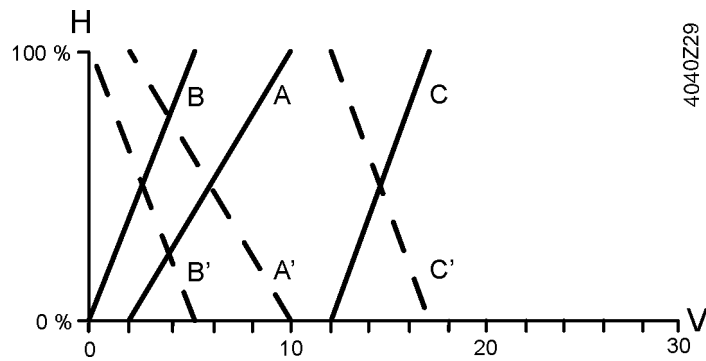
Invalid HEX switches combinations																
LO	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
UP		F	F	F	F	F	F	F	F	F	F	D	D	C	C	B
UP							E	E	E	E	E	E	E	D	D	C
UP												F	F	E	E	D
UP														F	F	E
UP																F



Notes

- Can only be used with voltage input.
- Maximum input voltage is DC 30 V. If the configuration is invalid, the actuator operates on DC 0...10 V.

Examples



4040Z29

Legend diagram	Positioning signal range	Position LO	Position UP	Position feedback U
A	DC 2...10 V	2	6	DC 0...10 V
B	DC 0...5 V	0	3	DC 0...10 V
C	DC 12...17 V	C	3	DC 0...10 V
H	Stroke or rotary angle			
	Acting direction: Direct (A, B, C)			
	Acting direction: Reverse (A', B', C')			

4.3.2 Changeover of acting direction

DIL switches

Acting direction	
OFF ¹⁾ Direct acting positioning signal Y or Z	ON ¹⁾ Reverse acting positioning signal Y or Z

¹⁾ Factory setting: All switches set to OFF

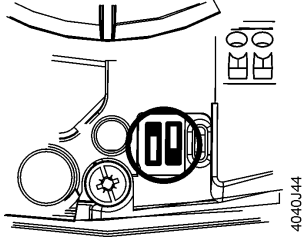
Selecting the acting direction



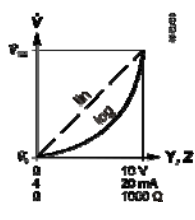


- With valves whose stem is extended in the fully closed position, "direct acting" means that the valve is fully closed (0 %) when positioning signal Y = 0 V resp. Z = 0 Ω. This applies to all Siemens valves according to "Equipment combinations" (page 10).
- With valves whose stem is retracted in the fully closed position, "direct acting" means that the valve is fully open (100 %) when positioning signal Y = 0 V resp. Z = 0 Ω.

		Direct acting	Reverse acting
		Positioning signal Y: DC 0...10 V	DC 0...10 V
		Positioning signal Z: 4...20 mA	4...20 mA
		Positioning signal Z: 0...1000 Ω	0...1000 Ω
Y, Z	Positioning signal		
V	Volumetric flow		
	Acting direction: Direct		
	Acting direction: Reverse		

4.4 Positioning signal and flow characteristic selection

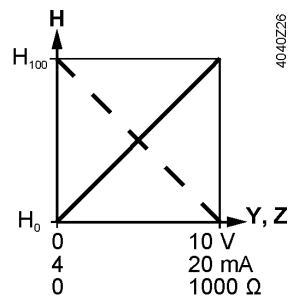
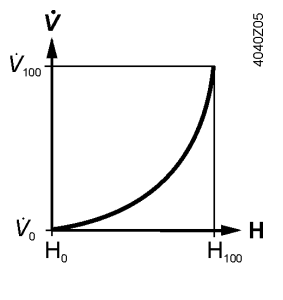
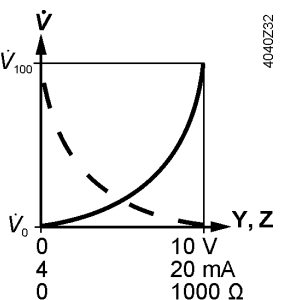
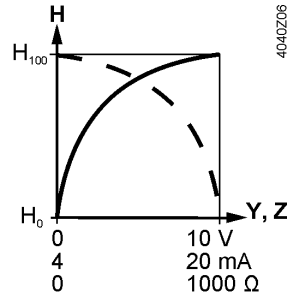
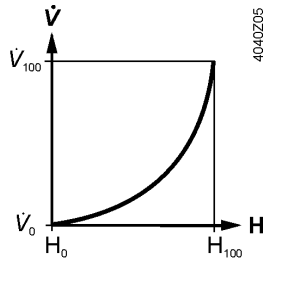
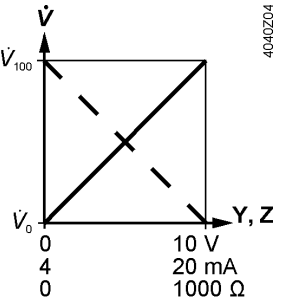
DIL switches



	Positioning signal "Y"	Position feedback "U"	Flow characteristic	
OFF ¹⁾	 DC 0...10 V <small>4040Z10</small>	DC 0...10 V	 log = equal-percentage <small>4040Z12</small>	
ON	 DC 4...20 mA <small>4040Z09</small>	DC 0...10 V	 lin = linear <small>4040Z11</small>	

¹⁾ Factory setting: All DIL switches set to OFF Ω

Flow characteristic

	Actuator	Valve	Totally
log	 <small>4040Z26</small>	 <small>4040Z05</small>	 <small>4040Z32</small>
lin	 <small>4040Z06</small>	 <small>4040Z05</small>	 <small>4040Z04</small>
Y, Z	Positioning signal		
H	Stroke		
V	Volumetric flow		
—————	Acting direction: Direct		
- - - - -	Acting direction: Reverse		

4.5 Acting direction and flow characteristic

The selection of changeover of acting direction and characteristic with the DIL switches depends on the type of actuator (with or without fail safe function) and the associated type of valve (valve characteristic, push to open, pull to open).

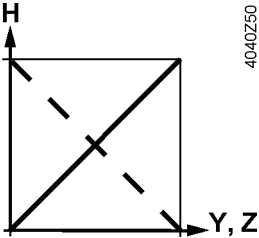
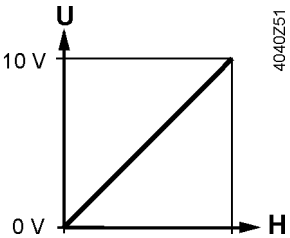
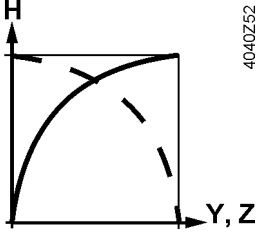
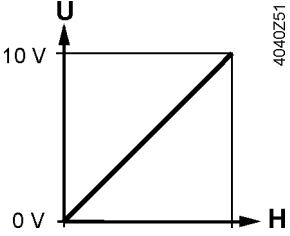
When the positioning signal increases (DC 0...10 V, DC 4...20 mA, 0...1000 Ω), the objective is to have the valve's volumetric flow V rising, but to fully open the valve, $V = 100\%$ (NO = normally open), or to fully close it, $V = 0\%$ (NC = normally closed) in the event of a power failure.

	DIL switches	Acting direction	Direct		Reverse	
		Flow characteristic	Linear	Equal-percentage	Linear	Equal-percentage
	Without fail safe function	No power applied	Maintains the position			

4.6 Position Feedback U

The position feedback U (DC 0...10 V) is always proportional to stroke H of the actuator's stem.

	Actuator Positioning signal Y, Z	Actuator Position feedback U
 4040Z12 log = equal-percentage	 4040Z50	 4040Z51
 4040Z11 lin = linear	 4040Z52	 4040Z51

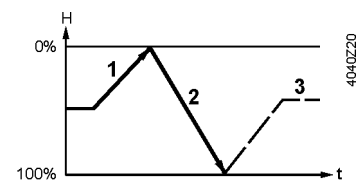
	Actuator Positioning signal Y, Z	Actuator Position feedback U
Direct acting	 4040Z50	 4040Z51
Reverse acting	 4040Z52	 4040Z51
Y, Z	Positioning signal	
H	Stroke	
U	Position feedback	
—————	Acting direction: direct	
- - - - -	Acting direction: reverse	

4.7 Calibration

To match the actuator to production-related mechanical tolerances of the individual valves, accurate positioning and position feedback must be ensured, if calibration is performed when the plant is commissioned (page 31). During commissioning, the actuator detects the valve's end positions and files the exact stroke in its internal memory.

Calibration takes place in the following phases:

- Actuator drives to H_0 (1), valve closes. Detection of upper end position.
- Actuator drives to H_{100} (2), valve opens. Detection of lower end position.
- The detected values are stored (3). Then the actuator follows the positioning signal.




Note

- Observe status indication (LED) during and after calibration (page 47).
- If the actuator does not detect the second end position within an appropriate stroke range (max. 25 mm), the first end stop will be adopted and the actuator operates with a working range of 20 mm.

4.8 Signal priorities

The actuators are controlled via different interlinked positioning signal paths (positioning signal "Y", forced control input "Z", manual adjuster). The signal paths are assigned the following priorities:

Priority	Description	
1 (highest)	The manual adjuster always has priority 1, thus overriding all signals active at "Z" or "Y", independent of whether or not power is applied.	
2	Only SA..61...: As soon as a valid positioning signal is active at input "Z", the position is determined via positioning signal "Z" (forced control). Prerequisite: The manual adjuster is not used.	Z
3 (lowest)	The position is determined via positioning signal "Y". The manual adjuster is not used and on Z there is no active signal.	Y

Examples

Manual adjuster	Forced control (Z)	Positioning signal (Y)	Stroke actuator	Rotary actuator
Automatic mode	Not connected	5 V	Actuator's stem travels to position (50%)	Actuator's spindle travels to position (50%)
Automatic mode	G	3 V	Actuator's stem extends	Actuator's spindle turns in clockwise direction
Automatic mode	G0	3 V	Actuator's stem retracts	Actuator's spindle turns in counter-clockwise direction
Operated (30%) and engaged	G	8 V	Actuator's stem retracts manual (to 30%)	Actuator's spindle turns manual in counterclock-wise direction (to 30%)

Bold printing = positioning signal currently active

4.9 Detection of valve seat

The actuators feature force-dependent valve seat detection. After calibration, the exact valve stroke is filed in the actuator's memory. When the actuator reaches the respective end of stroke, it does not hit the valve's seat at full speed, but stops for 5 seconds at about 1% before the stored position is reached. If the positioning signal stays at 0% or 100%, the actuator travels to the calculated end position at reduced positioning speed and builds up the required nominal force.

This function extends the actuator's service life since the dynamic forces are reduced when approaching the valve seat and there will be less strain on the gear train.

In addition, the actuator's oscillations in the case of instable control are suppressed.

If no force is built up in the calculated end position (e.g. in the event of temperature effects for instance), the actuator continues to operate at a reduced positioning speed until the nominal positioning force is restored. This ensures that the valve always fully closes.

After a power failure, valve seat identification is not active – the actuators define their stroke position on power resoration to be at 50%. From now on, the actuator follows the positioning signal.

When the valve plug reaches its seat for the first time, the actuator readjusts its stroke model.

Example

The supposed position is 50%, Y = 2 V, the actuator travels 30% of the stored valve stroke in the direction of "Actuator's stem retracted".

If the actuator reaches the seat within this 30% travel, it interprets the position as "Valve fully closed" and shifts the position of the valve's stroke accordingly without changing the extent of travel.

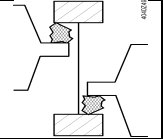
From now on, the actuator follows the changed valve stroke position.

This means: New position 0%, Y = 2 V, actuator travels 20% of the stored valve stroke in the direction "Actuator's stem extended".

4.10 Detection of foreign bodies

The actuator detects when the valve is clogged and adjusts its operational behavior accordingly to prevent damage to itself or the valve.

If the actuator hits an obstacle within the calibrated stroke and is not able to overcome it with its nominal positioning force, it stores the position at which the obstacle was hit. Depending on the direction of travel, as ...

<ul style="list-style-type: none"> "Lower limit of valve clogging", if the clogging was detected when traveling in the direction of "Actuator's stem retracting". 	
<ul style="list-style-type: none"> "Upper limit of valve clogging", if the clogging was detected when traveling in the direction of "Actuator's stem extending". 	

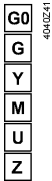
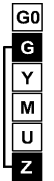
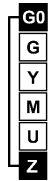
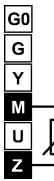
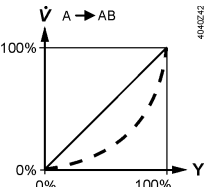
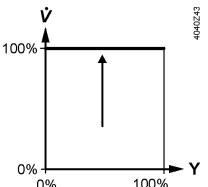
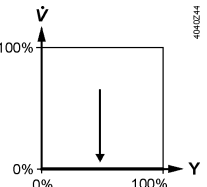
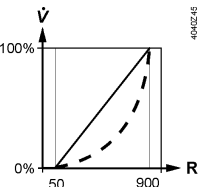
Now, the status LED blinks green and the actuator only follows the positioning signal between the positions "Actuator's stem retracted" and "Upper limit of valve clogging" or "Actuator's stem extended" and "Lower limit of valve clogging".

After detection of clogging, 3 attempts are made to overcome clogging by traveling about 15% in the opposite direction and then trying again to overcome the position of clogging. If the attempts made are unsuccessful, the actuator continues to follow the positioning signal within the restricted range only and the LED continues to blink green (refer to "Indicators" on page 47).

4.11 Forced control Z

SA..61.. only

Forced control is affected by changeover of acting direction. It uses the following operating modes:

		Z-mode			
		No function	Fully open	Fully closed	Overriding positioning signal "Y" by 0...1000 Ω
Connections					
	Transmission				
		Equal-percentage or linear characteristic			Equal-percentage or linear characteristic
		Contact "Z" not connected, valve follows positioning signal "Y"	Contact "Z" is connected directly to "G", positioning signal "Y" has no impact	Contact "Z" is connected directly to "G0", positioning signal "Y" has no impact	Contact "Z" is connected to "M" via resistor "R", starting point at 50 Ω, end point at 900 Ω, positioning signal "Y" has no impact

Note

The operating modes "Z" shown are based on factory setting "direct acting" and a "push to open" valve.

4.12 Technical and mechanical design

4.12.1 Transmission of power

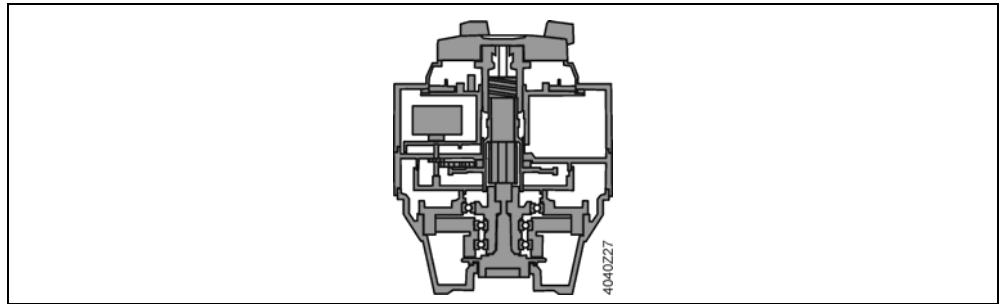
Function principle

Incoming positioning signals are translated to positioning commands for the motor.

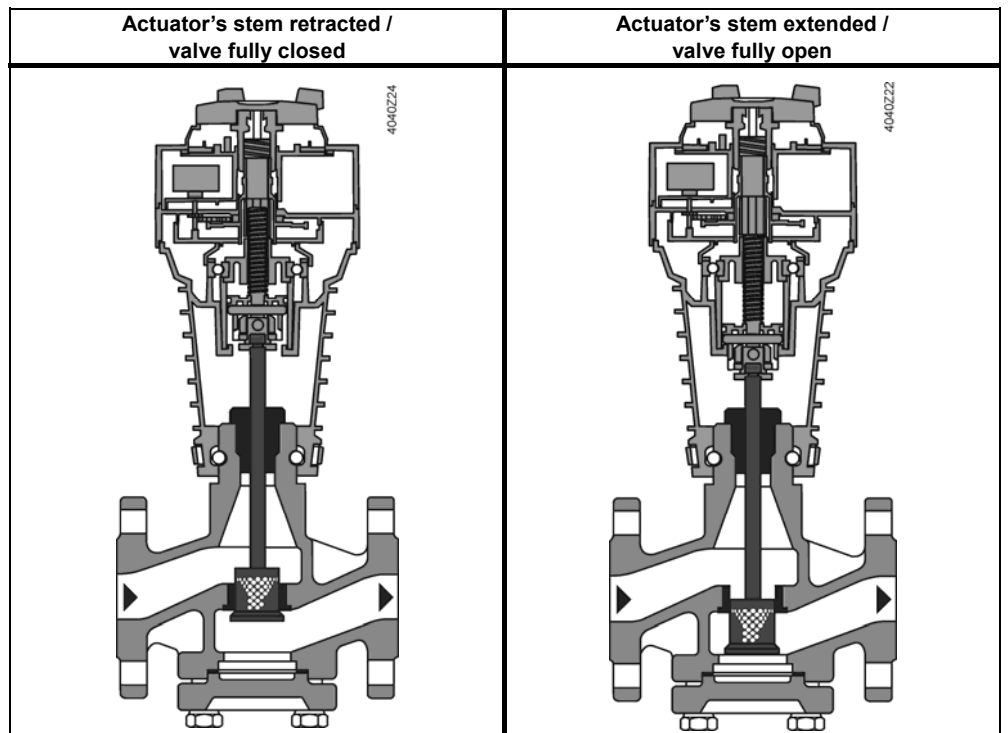
A gear train transmits the motor's positioning steps to the output stage (valve coupling). Attached to the gear train are the electrical and mechanical accessory items and the manual adjuster.

In the case of the rotary actuators, the adjustment to the required torque is made in the output stage. With the stroke actuators, the translation from rotary to stroke movement takes place in the output stage.

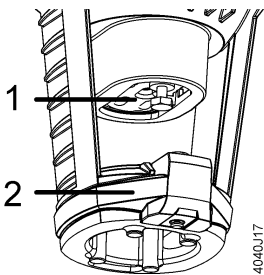
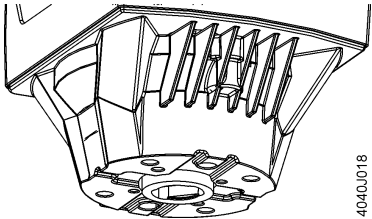
SAL..



SAX..

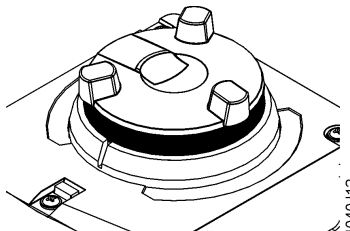


4.12.2 Coupling

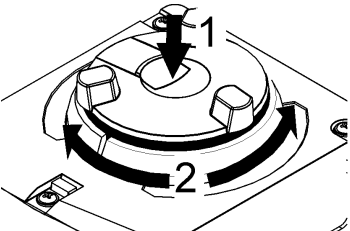
SAX..., SAV..	SAL..
 <p>4040J17</p>	 <p>4040J18</p>
<p>The stem coupling (1) and neck coupling (2) ensures full backward compatibility with all types of Siemens large-stroke valves produced since 1975.</p>	<p>Mounting sets are available for use with butterfly and slipper valves.</p>

4.12.3 Manual adjuster

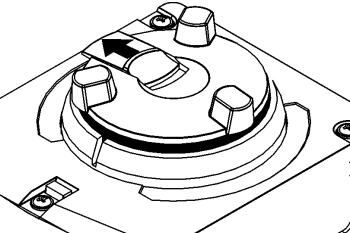
Automatic

 <p>4040J12</p>	<p>When the motor drives the manual adjuster turns. Thus in automatic mode, the manual adjuster is used for indication of travel. If the manual adjuster is held firm in this mode, there is no transmission of power to the gear train.</p>
---	--

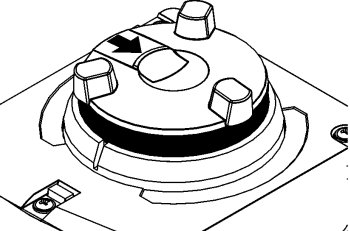
Manual operation

 <p>4040J14</p>	<p>When pushing the manual adjuster down (1), it engages and the actuator can be manually operated.</p> <p>Stroke actuator: When turning the manual adjuster in clockwise / counterclockwise direction (2), the actuator's stem retracts / extends.</p> <p>Rotary actuator: The actuator spindle turns in the same direction.</p> <p>An overload protection prevents damage to the manual adjuster</p>
--	--

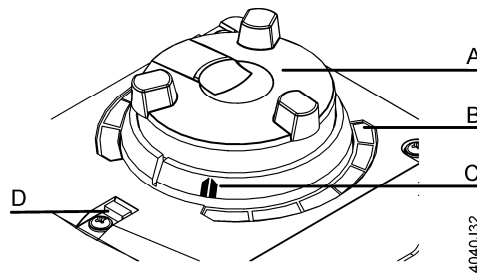
Fixing the position

 <p>4040J16</p>	<p>Upon actuation and locking the slide switch, the manual adjuster remains engaged.</p> <p>When in this mode, do not turn the manual adjuster.</p>
--	---

Disengaging the fixing

 <p>4040J20</p>	<p>When resetting the slide switch, the manual adjuster returns to automatic mode.</p>
--	--

4.12.4 Indicators



A	Indication of travel	
B	Scale	Position indication
C	Indicator	
D	LED Status indication	

Operational status indication

In Automatic mode, the manual adjuster serves for the indication of travel. See "Automatic" (page 46).

Position indication

Position indication is on 2 opposite sides. When turning the manual adjuster, the indicator moves in the same direction.

The scale indicates the stroke. When reaching the stops, the valve is either fully open or fully closed.

Status indication (LED)

Housing cover fitted	Housing cover removed
<p>4040J34</p>	<p>4040J33</p>
When the housing cover is fitted, the LED can be viewed through a light conductor.	When the housing cover is removed, the LED can be viewed through a hole.

The status indication informs about the operational state of the actuator.

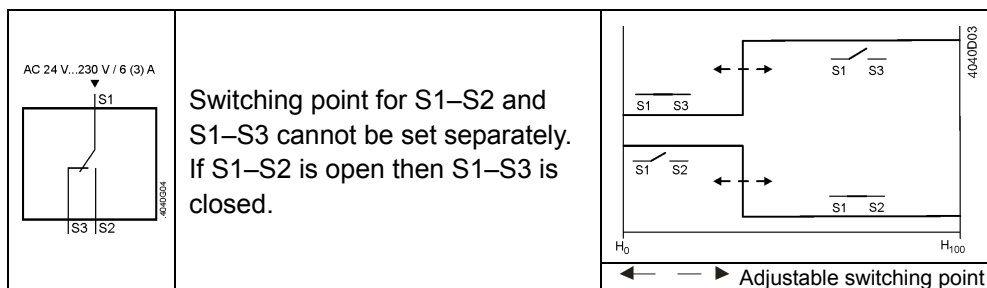
LED	Indication	Operating state	Remarks, troubleshooting
Green	On	Automatic mode	Normal operation
	Blinking	Calibration (page 31).	Wait until calibration is finished (then green or red light)
		In manual mode	Manual adjuster in MAN position
		Detection of foreign bodies (page 44)	Check valve / actuator
Red	On	Calibration error	Start calibration again (page 31)
	Blinking	Clogged valve	Check valve
Dark	Dark	No power or electronics faulty	Check operating voltage

4.12.5 Electrical accessories

Auxiliary switch ASC10.51



The auxiliary switch ASC10.51 switches on or off when a certain position is reached. The switching point can be set between 0...100%.



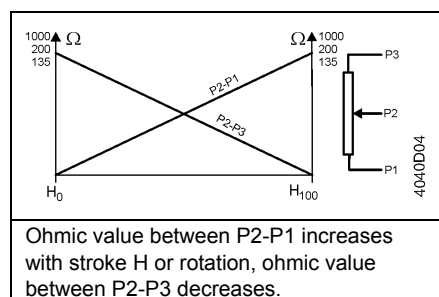
Application example:

When using an auxiliary switch, position feedback can trigger an automatic stop of the circulating pump in the end position "Fully closed".

Potentiometer ASZ7.5/..



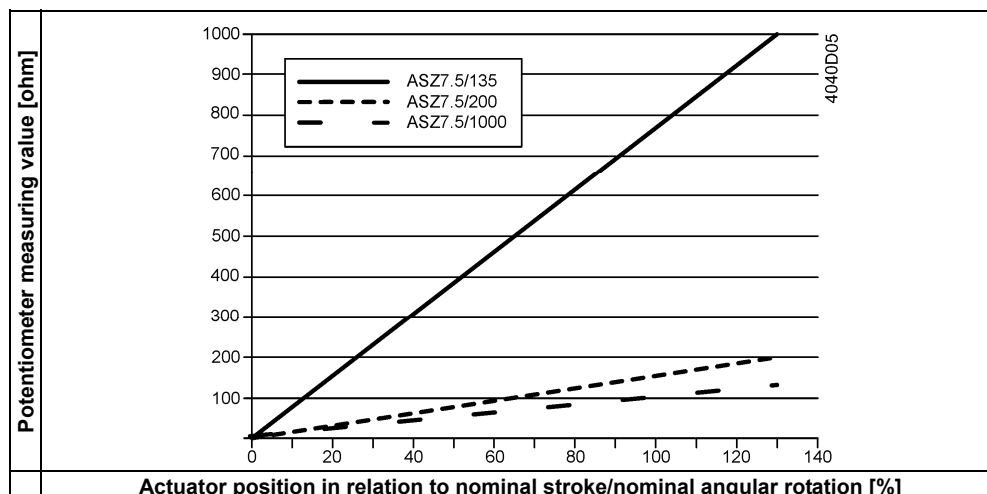
Potentiometer ASZ7.5/.. (1000 Ω, 200 Ω, 135 Ω) delivers an ohmic value to the controller giving the exact position of the actuator (continuous position feedback). A slip clutch prevents damage to the potentiometer in the mechanical end positions. This is also used for accurate balancing of the potentiometer in the fully closed position.



Flow characteristic

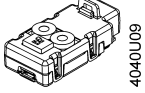
The end values of the potentiometers refer to the maximum stroke / maximum angular rotation of the actuators. For this reason, the resulting values in operation deviate, depending on the type of valve used in combination with the actuator. The potentiometer's starting point can be very accurately adjusted during installation (refer page 25).

	ASZ7.5/135	ASZ7.5/200	ASZ7.5/1000
	101 Ohm at nominal stroke/nominal angular rotation	149 Ohm at nominal stroke/nominal angular rotation	746 Ohm at nominal stroke/nominal angular rotation
	$R = 0 + 1.01 \text{ Ohm} \times \text{nominal stroke/nominal angular rotation (\%)}$	$R = 0 + 1.49 \text{ Ohm} \times \text{nominal stroke/nominal angular rotation (\%)}$	$R = 0 + 7.46 \text{ Ohm} \times \text{nominal stroke/nominal angular rotation (\%)}$
SAX..	$R = 0 + 5.03 \text{ Ohm} \times \text{stroke (mm)}$	$R = 0 + 7.46 \text{ Ohm} \times \text{stroke (mm)}$	$R = 0 + 37.3 \text{ Ohm} \times \text{stroke (mm)}$
SAL..	$R = 0 + 1.06 \text{ Ohm} \times \text{rotary angle (°)}$	$R = 0 + 1.57 \text{ Ohm} \times \text{rotary angle (°)}$	$R = 0 + 7.84 \text{ Ohm} \times \text{rotary angle (°)}$



Function module

AZX61.1

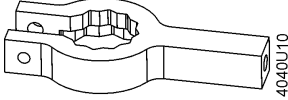


Function module AZX61.1 offers the following choices for changing control:

- Changeover of acting direction (page 39)
- Connection terminals (page 53)
- Sequence control (page 38)

Stem heating element

ASZ6.6



Stem heating element ASZ6.6 prevents the formation of ice on the stem when medium temperatures drop below 0 °C. It is suited for universal use with valves having a stem diameter of 10 or 14 mm.

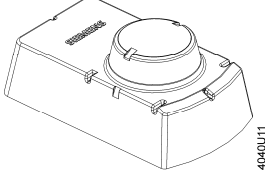


The stem heating element heats up to 120 °C.

4.12.6 Mechanical accessories

Weather shield

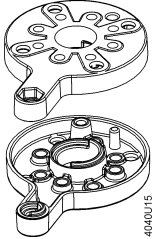
ASK39.1



Weather shield ASK39.1 protects the actuator when installed outdoors. This does not lead to a change of IP class (IP54).

Mounting sets

ASK3..N



Mounting sets ASK31N and ASK33N enable the actuators to be fitted to slipper valves VBF21..., DN65...150 and butterfly valves VKF41.. (page 21).

5 Technical data

		SAX..	SAL..
Power supply	Operating voltage SA..31.. SA..61.. SA..81..	AC 230 V ± 15 % AC 24 V ± 20 % / DC 24 V + 20 % / -15% AC 24 V ± 20 % / DC 24 V + 20 % / -15%	
	Frequency	45...65Hz	
	Fusing of supply lines	Max. 10 A slow	Max. 10 A slow
	Power consumption at 50 Hz		
	SAX31.00 Stem retracts / extends	3,5 VA / 2 W	-
	SAX31.03 Stem retracts / extends	6 VA / 3,5 W	-
	SAX61.03.. Stem retracts / extends	8 VA / 3,75 W	-
	Holding state	8 VA / 3,75 W	-
	SAX81.00.. Stem retracts / extends	3,5 VA / 2,25 W	-
	SAX81.03.. Stem retracts / extends	5 VA / 3,75 W	-
Holding state	8 VA / 3,75 W	-	
SAL31.00T10 Rotary actuator turns	-	3,5 VA / 2 W	
SAL31.03T10 Rotary actuator turns	-	6,5 VA / 2,75 W	
SAL61.00T10 Rotary actuator turns	-	4 VA / 2 W	
SAL61.03T10 Rotary actuator turns	-	8,5 VA / 3,5 W	
SAL81.00T10 Rotary actuator turns	-	4 VA / 2 W	
SAL81.03T10 Rotary actuator turns	-	4 VA / 3 W	
Function data	Positioning times with specified nominal stroke / nominal angular rotation	SAX..00, SAL..00 SAX..03, SAL..03	120 s 30 s
	Positioning force	SAL..T10	800 N
	Torque		-
	Nominal stroke		20 mm
	Angular rotation		-
Signal inputs	Positioning signal "Y" SA..31.., SA..81..	3- position	
	SA..31.. Voltage	AC 230 V ± 15 %	
	SA..81.. Voltage	AC 24 V ± 20 % / DC 24 V + 20 % / -15%	
	SA..61.. (DC 0...10 V) Current draw	≤ 0,1 mA	
	SA..61.. (DC 4...20 mA) Current draw	DC 4...20 mA ± 1 %	
Parallel operation	SA..61..	≤ 10 (depending on controller output)	
	Forced control	Positioning signal "Z" SA..61.. R = 0...1000 Ω Z connected to G Z connected to G0 Voltage Current draw	R = 0...1000 Ω, G, G0 Stroke / rotation proportional to R Max. stroke 100% ¹⁾ 90° ¹⁾ Min. stroke 0% ¹⁾ 0° ¹⁾ Max. AC 24 V ± 20 % Max. DC 24 V + 20 % / -15% ≤ 0,1 mA
Position feedback	Position feedback U SA..61.. Load impedance Load	DC 0...10 V ± 1 % >10 kΩ res. Max. 1 mA	
Connecting cable	Wire cross-sectional areas	0.13...1.5 mm ² , AWG 24...16 ²⁾	
	Cable entries SA.. SA..U	EU: 2 entries Ø 20.5 mm (for M20) 1 entry Ø 25.5 mm (for M25) US: 3 entries Ø 21.5 mm for ½" tube connection	
Degree of protection	Housing from vertical to horizontal	IP54 as per EN 60529 ³⁾	
	Insulation class	As per EN 60730	
	Actuators SA..31.. AC 230 V Actuators SA..61.. AC / DC 24 V Actuators SA..81.. AC / DC 24 V	II III III	
Environmental conditions	Operation	IEC 60721-3-3	
	Climatic conditions	Class 3K5	
	Mounting location	Indoors (weather-protected)	
	Temperature General with spindle heating element ASZ6.6	-5...55 °C -15...55 °C	
	Humidity (noncondensing)	-15...55 °C not applicable	
Transport	IEC 60721-3-2		
Climatic conditions	Class 2K3		
Temperature	-25...70 °C		
Humidity	<95 % r.h.		
Storage	IEC 60721-3-1		
Temperature	-15...55 °C		
Humidity	5...95 % r.h.		
Max. media temperatur when mounted on valve	150 °C		
			120°

		SAX..	SAL..
Standards	CE conformity As per EMC directive Immunity Emmissions	2004/108/EC EN 61000-6-2:[2005] Industrial ⁴⁾ EN 61000-6-3:[2007] Residential	
	Electrical safety	EN 60730-1	
	Low-voltage directive	AC 230 V C-tick	2006/95/EC N 474
	UL conformity	AC 230 V AC/DC 24 V	- UL 873
Environmental compatibility		ISO 14001 (environment) ISO 9001 (quality) SN 36350 (environment-compatible products) RL 2002/95/EG (RoHS)	
Dimensions		See "Dimensions" (page 55)	
Weight	Excl. packaging	See "Dimensions" (page 55)	
Accessories	Potentiometer ASZ7.5/135	Voltage Current rating	0...135 Ω ± 5% DC 10 V < 4 mA
	Potentiometer ASZ7.5/200	Voltage Current rating	0...200 Ω ± 5% DC 10 V < 4 mA
	Potentiometer ASZ7.5/1000	Voltage Current rating	0...1000 Ω ± 5% DC 10 V < 4 mA
	Auxiliary switch ASC10.51	Switching capacity	AC 24...230 V, 6 A res., 3 A ind.
	Stem heating element ASZ6.6		AC 24 V, 30 W

¹⁾ Observe acting direction of DIL switches

²⁾ AWG = American wire gauge

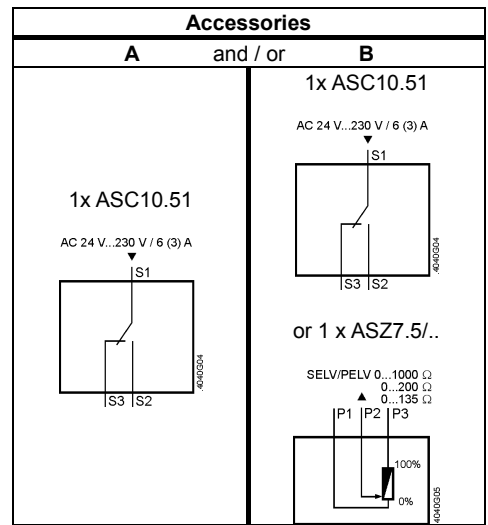
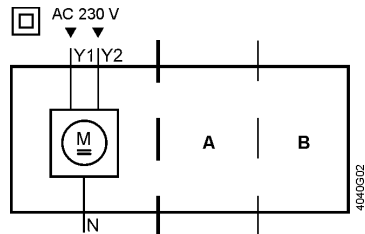
³⁾ Also with weather shield ASK39.1

⁴⁾ Transformer 160 VA (e.g. Siemens 4AM 3842-4TN00-0EAO) for actuators operating on AC 24 V

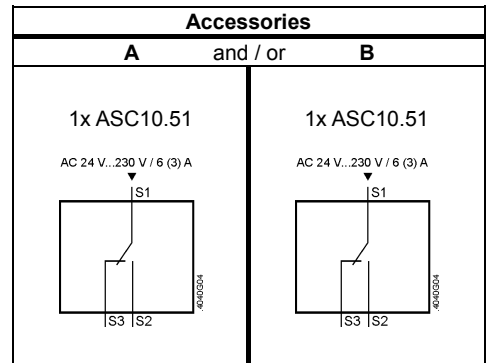
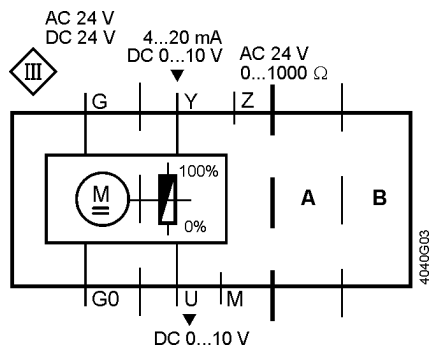
6 Connection diagrams and dimensions

6.1 Internal diagrams

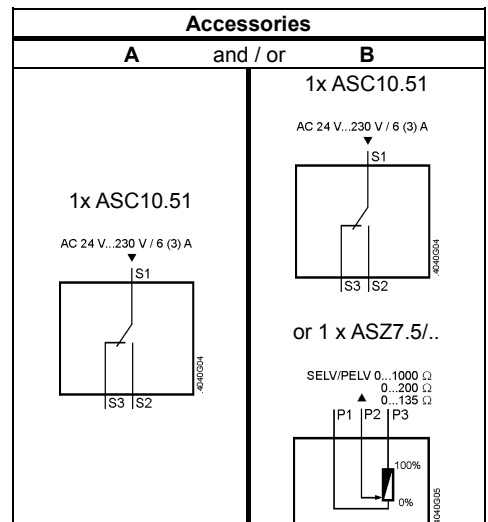
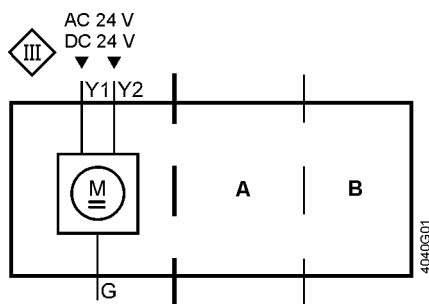
SA..31..



SA..61..



SA..81..



6.2 Connection terminals

6.2.1 Actuators

SA..31..

AC 230 V, 3-position

N	System neutral (SN)
Y1	Positioning signal (actuator's stem extends / actuator's spindle turns clockwise)
Y2	Positioning signal (actuator's stem retracts / actuator's spindle turns counter-clockwise)

SA..61..

AC/DC 24 V, DC 0...10 V / 4...20 mA / 0...1000 Ω

G0	System neutral (SN)
G	System potential (SP)
Y	Positioning signal for DC 0...10 V / 4...20 mA
M	Measuring neutral
U	Position feedback DC 0...10 V
Z	Positioning signal forced control AC/DC ≤ 24 V, 0...1000 Ω

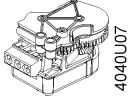
SA..81..

AC/DC 24 V, 3-position

G	System potential (SP)
Y1	Positioning signal (actuator's stem extends / actuator's spindle turns clockwise)
Y2	Positioning signal (actuator's stem retracts / actuator's spindle turns counter-clockwise)

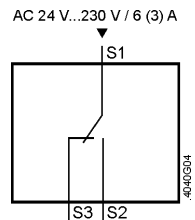
6.2.2 Electrical accessories

Auxiliary switch ASC10.51

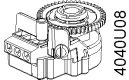


Adjustable switching points, AC 24...230 V

1	System potential (SP)
2	Closing (actuator's stem extends / actuator's spindle turns clockwise)
3	Opening (actuator's stem retracts / actuator's spindle turns counter-clockwise)



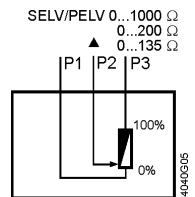
Potentiometer ASZ7.5/..



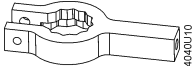
Adjustment of zero point, DC 10 V

1	Measuring neutral
2	0...x Ω
3	x...0 Ω

x = 135 Ω, 200 Ω; 1000 Ω



Stem heating element ASZ6.6

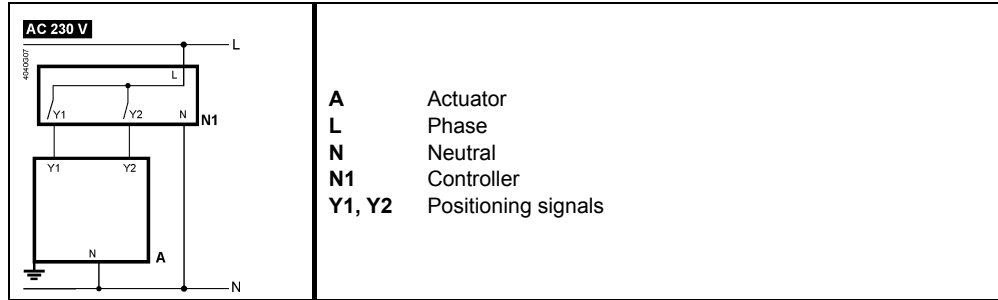


AC 24 V / 30 W

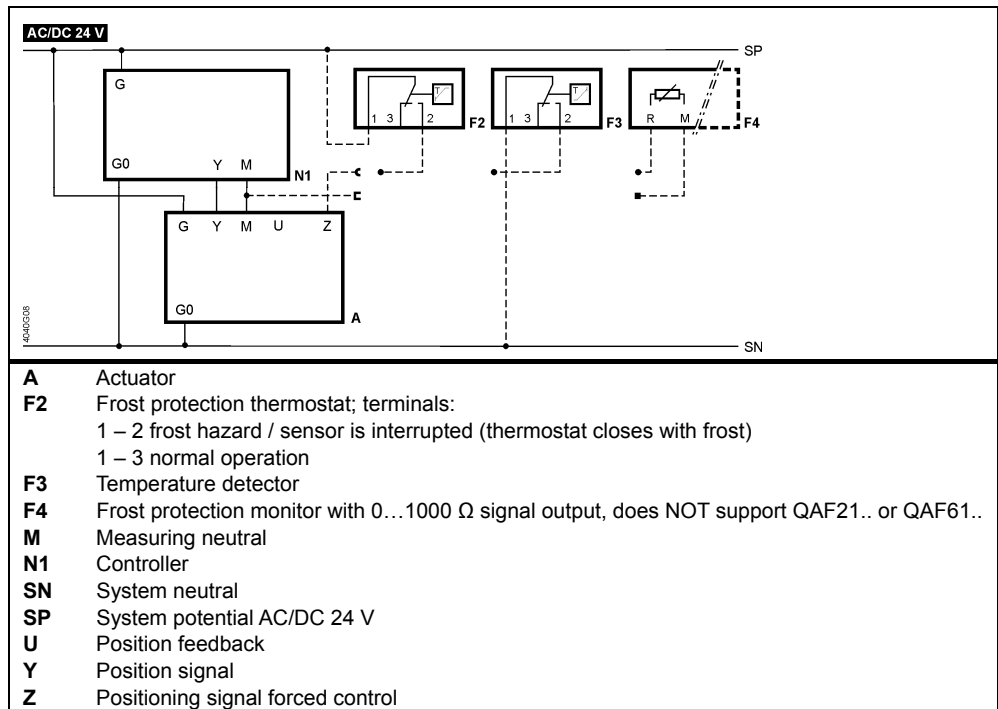
1	System neutral (SN) (red)
2	System potential (SP) (black)

6.3 Connection diagrams

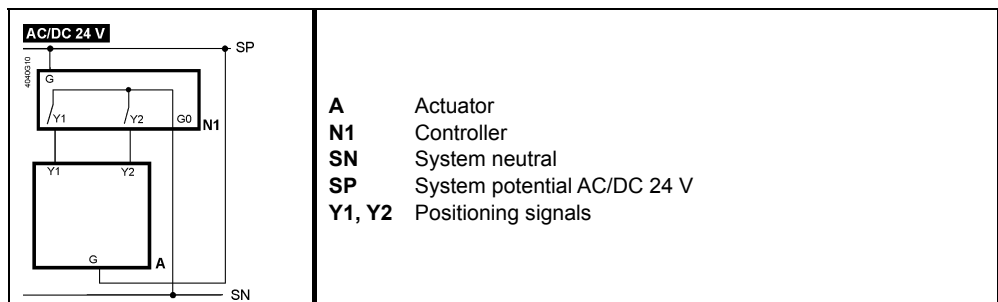
SA..31..



SA..61..



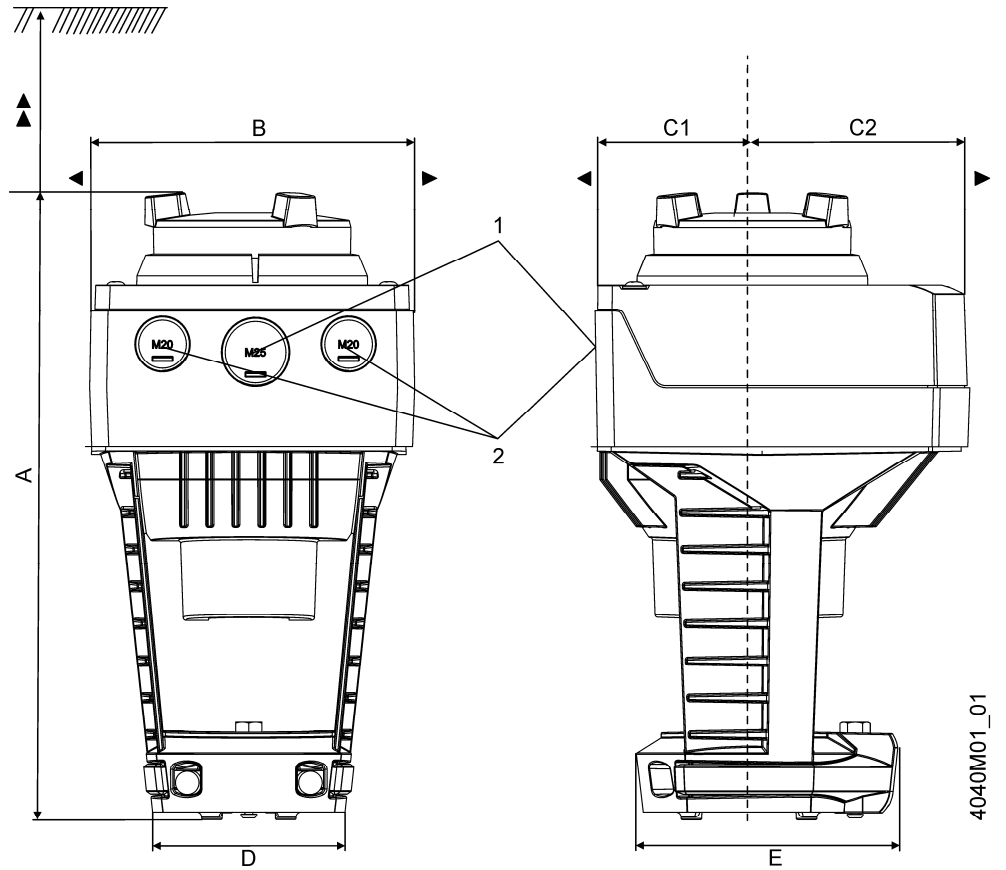
SA..81..



6.4 Dimensions

6.4.1 Stroke actuators

Dimensions in mm



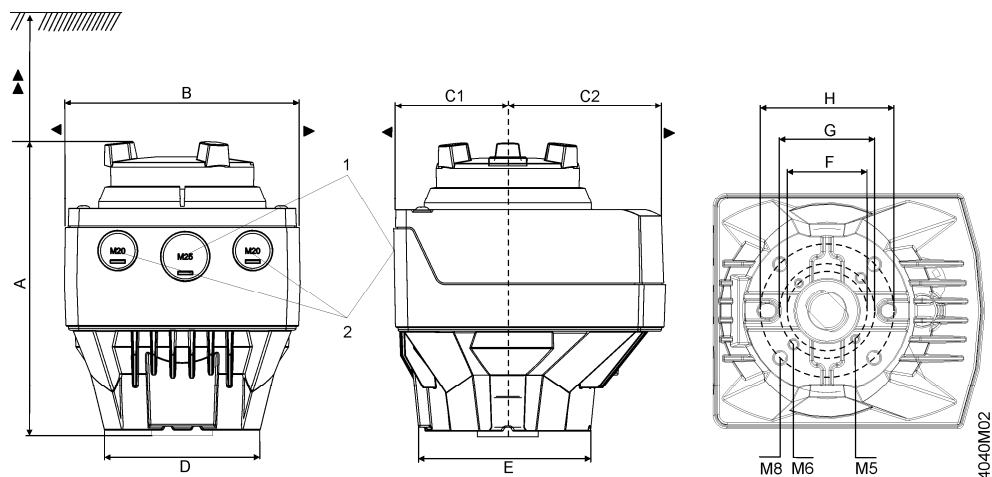
4040M01_01

- 1 SAX...: M25
SAX..U: ½" (Ø 21.5 mm)
- 2 SAX...: M20
SAX..U: ½" (Ø 21.5 mm)

Type	A	B	C	C1	C2	D	E	▶	▶▶
SAX..00 and SAX..03	242	124	150	68	82	80	100	100	200
With ASK39.1	+25	154	300	200	100	-	-	-	-

6.4.2 Rotary actuators

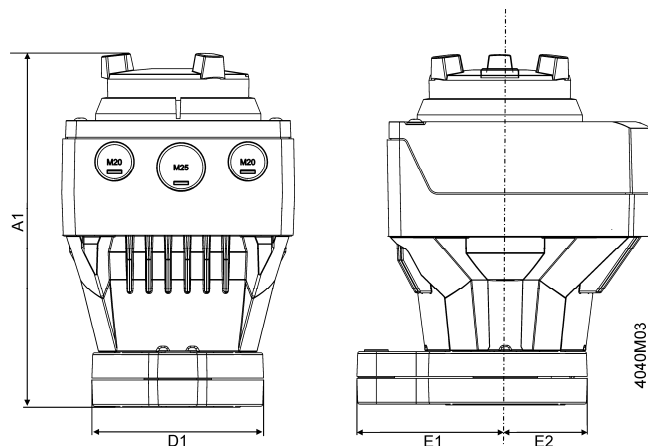
Dimensions in mm



- 1 SAL..: M25
- 2 SAL..: M20

Type	A	B	C	C1	C2	D	E	F	G	H	▶	▶▶
SAL..	160	124	150	68	82	82	88	42	50	70	100	200
With ASK39.1	+25	154	300	200	100	-	-	-	-	-	-	-

With mounting set
ASK3..N



Type	A1	D1	E1	E2
SAL.. with ASK3..N	188	88	80	44
With ASK39.1	+25	-	-	-

7 Revision numbers

Product no.	Valid from rev. no.	Product no.	Valid from rev. no.
SAX31.00	..A	SAL31.00T10	..A
SAX31.03	..A	SAL31.03T10	..A
-	-	SAL61.00T10	..A
SAX61.03..	..A	SAL61.03T10	..A
SAX81.00..	..A	SAL81.00T10	..A
SAX81.03..	..A	SAL81.03T10	..A

8 Glossary

8.1 Symbols



Caution, general danger – read the notes!



Caution, hot surface – read the notes!



Condition as supplied to customer



Crosstip screwdriver (Pozidriv)



Slotted screwdriver



Screw wrench



Allen key

8.2 Terms

DIL switches

A DIL switch shows the switching choices in the form of a place value system (dual in line) in relation to basis 2 (on and off).

DN

Nominal size: Characteristic for matching parts of the piping system.

Forced control

Forced control serves for overriding automatic mode and is implemented in the structure.

HEX switches

A HEX switch shows the switching choices in the form of a place value system (hexadecimal system) in relation to basis 16 (0...9 and A...F).

kPa

Unit of pressure: 100 kPa = 1 bar = 10 mWS.

k_{vs}

Nominal flow rate: Nominal flow rate of cold water (5...30 °C) through the fully open valve (H_{100}) at a differential pressure of 100 kPa (1 bar).

LED

Light emitting diode.

PN

PN class: Characteristic relating to the combination of mechanical und dimensional properties of a component in the piping system.

Position feedback

Signal used to acquire the position, fed back via an input.

Spring return facility

Refer "fail safe function".

$\Delta p_{max} / \Delta p_{maxV}$

Maximum permissible differential pressure across the valve's control path, valid for the entire actuating range of the motorized valve (V = diverting mode).

Δp_s

Maximum permissible differential pressure at which the motorized valve will close securely against the pressure (close off pressure).

Index

3-position control	35	DN	10, 11, 12
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Electrical accessories	13	Engineering	8
Mechanical accessories	13	Equipment combinations	10
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