



This manual describes the function of the Switch Actuators SA/S with its application programs Switch, xfyS/1 (x = number of outputs, y = rated current, S = current detection). This manual can be free downloaded under www.abb.de/eib.

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Please inform us of any errors or suggested improvements.

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1 General

This manual provides you with detailed technical information regarding the SA/S – Switch Actuator range including installation and programming details, and explains the use of the switch actuators using examples in actual applications. The SA/S Switch Actuator range consists of modular installation devices in ProM design for installation in distribution boards on 35 mm mounting rails according to EN 60 715.

The switch actuators are used to control switched loads, such as

- Lighting
- Heating control
- Signalling equipment

and other loads via the ABB i-bus® EIB / KNX installation system.

The ability to use and operate the Engineering Tool Software ETS is assumed.

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1.1 Product and functional overview

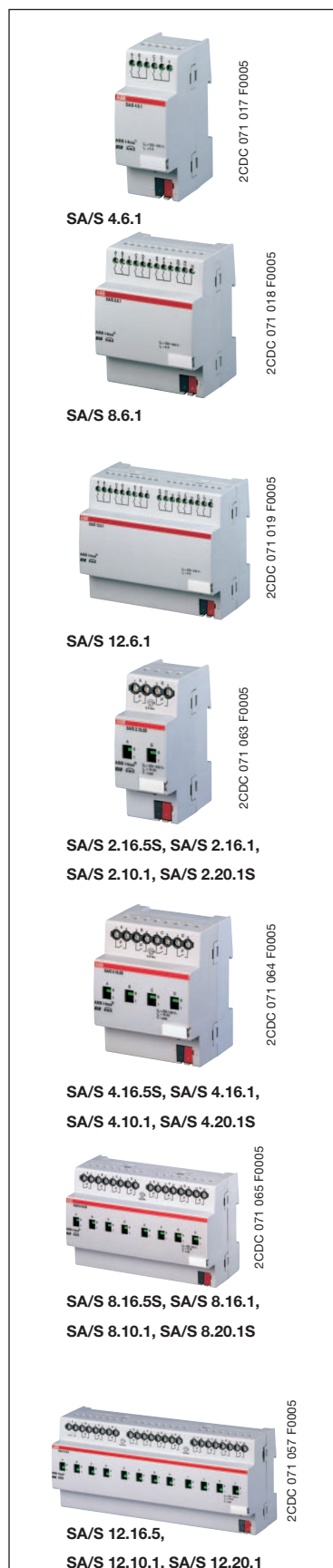


Fig. 1: Range

The ABB i-bus® EIB / KNX Switch Actuators SA/S are modular installation devices with 2 to 12 outputs and a module width of 2 to 12 module widths in ProM design for installation in distribution boards. The connection to the ABB i-bus® is established using the front side Bus Connection Terminal. The SA/S Switch Actuators do not require an additional voltage supply. The assignment of the physical addresses as well as the parameterisation is carried out with Engineering Tool Software ETS (from Version ETS2 V1.3) with a VD2 file. If the ETS3 is used a “.VD3” type file must be imported.

The switch actuators can switch from 2 to 12 independent electrical AC loads or three-phase loads via potential free contacts over the ABB i-bus® EIB / KNX. For selected types (SA/S x.x.xS) it is possible to monitor the load current on every output. The outputs for 10 A, 16 A and 20 A Switch Actuators can be switched ON or OFF manually. The switching states are displayed.

The switch actuators with the highest switching capacity (C-Load) are particularly suitable for switching loads with high inrush-current peaks such as is the case with fluorescent lighting with compensation capacitors or other fluorescent lamp loads (AX) to IEC 60669.

The following functions can be adjusted individually for each output within the same application program:

- Time functions, on/off delay
- Staircase lighting function with warning and adaptable staircase lighting time
- Scene control / presets via 8bit / 1bit commands
- Logic operation AND, OR, XOR, gate function
- Status response
- Forced operation and safety function
- Reaction to threshold functions
- Control of electrothermal valve drives
- Selection of preferred state after bus voltage failure and recovery
- Inversion of the outputs

In addition, the switch actuators with current detection on every output feature a load current detection function with a programmable reaction to two current threshold values. The current value can be sent via the EIB / KNX-bus.

The SA/S range consists of 18 types. The following type code overview should provide a fast and simple overview of the individual switch actuators.

----	SA/S 2.10.1	SA/S 2.16.1	SA/S 2.16.5	S / S 2.20.1S
SA/S 4.6.1	SA/S 4.10.1	SA/S 4.16.1	SA/S 4.16.5S	SA/S 4.20.1S
SA/S 8.6.1	SA/S 8.10.1	SA/S 8.16.1	SA/S 8.16.5S	SA/S 8.20.1S
SA/S 12.6.1	SA/S 12.10.1	-----	SA/S 12.16.5	SA/S 12.20.1
SA/S	- Switch actuator, (Schiene) rail mount			
SA/S x	- x = number of outputs (2, 4, 8 or 12)			
SA/S 8.y	- y = rated current in Ampere (6, 10, 16 or 20 A)			
SA/S 8.16.z	- z = 5 = C-Load (200 µF)			
SA/S 8.16.5S	- S = with current detection			

Table 1: SA/S – designation code overview

2 Technical properties

The technical properties of the ABB i-bus® Switch Actuators are explained in the following sections.

2.1 Technical data
SA/S x.6.1

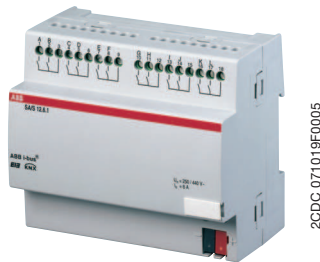


Fig. 2: SA/S 12.6.1

The 6 A Switch Actuators are modular installation devices in proM design for installation in the distribution board on 35 mm mounting rails. The connection to the ABB i-bus® EIB / KNX is implemented via a Bus Connection Terminal.

The device does not require an additional power supply.

The actuators switch up to 12 independent electrical loads via potential free contacts. The outputs are connected using screw terminals in groups of 2 contacts. Each output is controlled separately via the EIB / KNX.

The device is suitable for switching ohmic, inductive and capacitive loads.

Power supply	– Operating voltage	21...30 V DC, made available by the bus		
	– Current consumption EIB / KNX	< 12 mA		
	– Power consumption EIB / KNX	Max. 250 mW		
Output nominal values	– SA/S - type	4.6.1	8.6.1	12.6.1
	– Number (potential free contacts 2 per group)	4	8	12
	– U _n rated voltage	250 / 440 V AC (50/60 Hz)		
	– I _n rated current (per output)	6 A	6 A	6 A
	– Power loss per device at max. load	1.5 W	2.0 W	2.5 W
Output switching currents	– AC3 operation (cosφ = 0.45) EN 60 947-4-1	6 A / 230 V		
	– AC1 operation (cosφ = 0.8) EN 60 947-4-1	6 A / 230 V		
	– Fluorescent lighting load to EN 60 669-1	6 A / 250 V (35 μF) ²⁾		
	– Minimum switching performance	20 mA / 5 V		
		10 mA / 12 V		
		7 mA / 24 V		
	– DC current switching capacity (ohmic load)	6 A / 24 V DC		
Output life expectancy	– Mechanical endurance	> 10 ⁷		
	– Electrical endurance to IEC 60 947-4-1			Operations (state change)
	– AC1 (240 V/cosφ = 0.8)	> 10 ⁵		
	– AC3 (240 V/cosφ = 0.45)	> 1.5 x 10 ⁴		
	– AC5a (240 V/cosφ = 0.45)	> 1.5 x 10 ⁴		
Output switching times¹⁾	– Max. number of relay position changes per output and minute, if all relays are switched simultaneously.	4.6.1	8.6.1	12.6.1
	The position changes should be distributed equally within the minute.	60	30	20
	– Max. number of relay position changes per output and minute only one relay is switched.	240	240	240
Connections	– EIB / KNX	Bus Connection Terminal, 0.8 mm Ø, single core		
	– Load current circuits (1 terminal per contact)	Screw terminal		
	– Phase (1 terminal for 2 contacts)	0.2... 2.5 mm ² finely stranded 0.2...4 mm ² single core		
	– Tightening torque	Max. 0.6 Nm		
EIB / KNX operating and display elements	– LED red and EIB / KNX push button	for assignment of the physical address		
Housing	– IP 20	to EN 60 529		
Safety class	– II	to EN 61 140		
Isolation category	– Overvoltage category	III to EN 60 664-1		
	– Pollution degree	2 to EN 60 664-1		

¹⁾ The specifications apply only after the bus voltage has been applied to the device for at least 10 seconds. The typical elementary delay of the relay is approx. 20 ms.

²⁾ The maximum inrush-current peak (see table 3) may not be exceeded.

Table 2 – Part 1: 6 A Switch Actuator SA/S x.6.1, technical data

EIB / KNX voltage	– SELV 24 V DC (safety extra low voltage)		
Temperature range	– Operation	– 5 °C ... + 45 °C	
	– Storage	– 25 °C ... + 55 °C	
	– Transport	– 25 °C ... + 70 °C	
Design	– Modular DIN-Rail Component (MDRC)	Modular installation device, ProM	
	– SA/S - type	4.6.1	8.6.1 12.6.1
	– Dimensions (H x W x D)	90 x W x 64	
	– Width W in mm	36	72 108
	– Mounting width (modules at 18 mm)	2	4 6
	– Mounting depth	64	64 64
Weight	– In kg	0.13	0.24 0.3
Installation	– On 35 mm mounting rail	EN 60 715	
Mounting position	– As required		
Housing, colour	– Plastic housing, grey		
Approvals	– EIB / KNX nach EN 50 090-2-2	Certification	
CE mark	– In accordance with the EMC guideline and low voltage guideline		

Table 2 – Part 2: 6 A Switch Actuator SA/S x.6.1, technical data

Lamp loads

Lamps	– Incandescent lamp load	1200 W
Fluorescent lamp T5 / T8	– Uncompensated luminaire	800 W
	– Parallel compensated	300 W
	– DUO circuit	350 W
Low-volt halogen lamps	– Inductive transformer	800 W
	– Electronic transformer	1000 W
	– Halogen lamp 230V	1000 W
Dulux lamp	– Uncompensated luminaire	800 W
	– Parallel compensated	800 W
Mercury-vapour lamp	– Uncompensated luminaire	1000 W
	– Parallel compensated	800 W
Switching performance (switching contact)	– Max. peak inrush-current I_p (150 μ s)	200 A
	– Max. peak inrush-current I_p (250 μ s)	160 A
	– Max. peak inrush-current I_p (600 μ s)	100 A
Number of electronic ballasts (T5/T8, single element) ¹⁾	– 18 W (ABB EVG 1x58 CF)	10
	– 24 W (ABB EVG-T5 1x24 CY)	10
	– 36 W (ABB EVG 1x36 CF)	7
	– 58 W (ABB EVG 1x58 CF)	5
	– 80 W (Helvar EL 1x80 SC)	3

¹⁾ For multiple element lamps or other types the number of electronic ballasts must be determined using the peak inrush current of the electronic ballasts. See section 2.7 for example

Table 3: Lamp load for SA/S x.6.1

Application programs

Type	Name	Max. number of communication objects	Max. number of group addresses	Max. number of associations
SA/S 4.6.1	Switch, 4f6/1	64	254	254
SA/S 8.6.1	Switch, 8f6/1	124	254	254
SA/S 12.6.1	Switch, 12f6/1	184	254	254

Table 4: Application programs SA/S x.6.1

Note: The programming requires the EIB Software Tool ETS2 V1.3 or higher. If the ETS3 is used a “.VD3” type file must be imported.

The application program is located within the ETS2 / ETS3 in the category ABB/output/Binary output, x-fold/switch, xf6/1 (x = 4, 8 or 12, number of outputs).

2.1.1 Wiring diagram
SA/S x.6.1

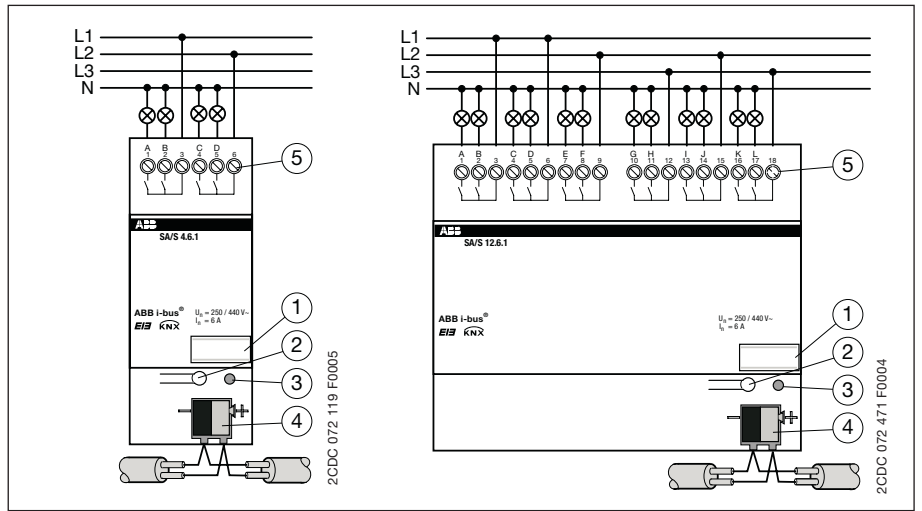
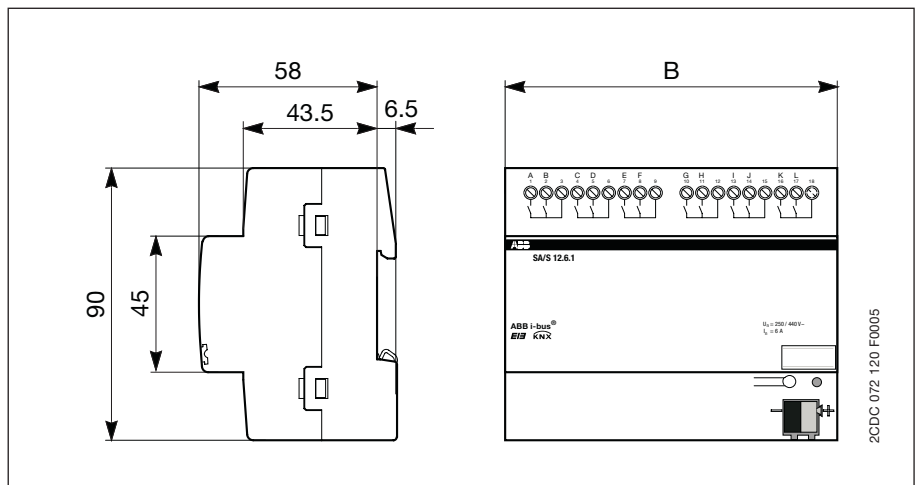


Fig. 3: Wiring diagram of the 6 A Switch Actuator SA/S x.6.1

- | | |
|---|--|
| <ul style="list-style-type: none"> 1 Label carrier 2 Programming button 3 Programming LED 4 Bus Connection Terminal | <ul style="list-style-type: none"> 5 Load current circuit <ul style="list-style-type: none"> 1 screw terminal per contact 1 screw terminal for every 2 contacts for the phase connection |
|---|--|

Note: All-pole disconnection must be observed in order to avoid dangerous contact voltage which can develop via loads in other phases.

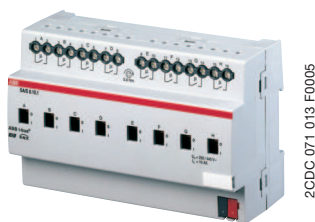
2.1.2 Dimension drawings
SA/S x.6.1



	SA/S 4.6.1	SA/S 8.6.1	SA/S 12.6.1
B	36 mm 2 module widths	72 mm 4 module widths	108 mm 6 module widths

Fig. 4: Dimension drawings SA/S x.6.1

2.2 Technical data
SA/S x.10.1



2CDBC 071 013 F0005

Fig. 5 :SA/S 8.10.1

The 10 A Switch Actuators are modular installation devices in proM design for installation in the distribution board on 35 mm mounting rails. The connection to the ABB i-bus® EIB / KNX is implemented via a Bus Connection Terminal.

The device does not require an additional power supply.

The actuators switch up to 12 independent electrical loads via potential free contacts. The outputs are connected using screw terminals with combination drive head screws. Each output is controlled separately via the EIB / KNX.

The switch actuators can be manually operated via an operating element which simultaneously indicates the switch status. The actuators are particularly suitable for switching ohmic loads, inductive and capacitive loads as well as fluorescent lamp loads (AX) according to EN 60669.

Power supply	– Operating voltage	21...30 V DC, made available by the bus			
	– Current consumption EIB / KNX	< 12 mA			
	– Power consumption EIB / KNX	Max. 250 mW			
Output nominal values	– SA/S - type	2.10.1	4.10.1	8.10.1	12.10.1
	– Number of contacts (potential free)	2	4	8	12
	– U _n rated voltage	250 / 440 V AC (50/60 Hz)			
	– I _n rated current	10 AX	10 AX	10 AX	10 AX
	– Power loss per device at max. load	1.5 W	2.5 W	4.5 W	6.5 W
Output switching currents	– AC3 operation (cosφ = 0.45) EN 60 947-4-1	8 A / 230 V			
	– AC1 operation (cosφ = 0.8) EN 60 947-4-1	10 A / 230 V			
	– Fluorescent lighting load AX to EN 60669-1	10 AX / 250 V (140 μF) ²⁾			
	– Minimum switching performance	100 mA / 12 V			
		100 mA / 24 V			
	– DC current switching capacity (ohmic load)	10 A / 24 V DC			
Output life expectancy	– Mechanical endurance	> 3 x 10 ⁶			
	– Electrical endurance to IEC 60 947-4-1			Operations (state change)	
	– AC1 (240 V/cosφ = 0.8)	> 10 ⁵			
	– AC3 (240 V/cosφ = 0.45)	> 3 x 10 ⁴			
	– AC5a (240 V/cosφ = 0.45)	> 3 x 10 ⁴			
Output switching times¹⁾	– Max. number of relay position changes per output and minute, if all relays are switched simultaneously. The position changes should be distributed equally within the minute.	2.10.1	4.10.1	8.10.1	12.10.1
		60	30	15	10
	– Max. number of relay position changes per output, and minute if only one relay is switched	120	120	120	120
Connections	– EIB / KNX	Bus Connection Terminal, 0.8 mm Ø, single core			
	– Load current circuits (2 terminals per contact)	Screw terminal with universal head (PZ 1) 0.2...4 mm ² finely stranded, 2x (0.2 – 2.5 mm ²) 0.2...6 mm ² single core, 2x (0.2 – 4 mm ²)			
	– Tightening torque	Max. 0.8 Nm			
Operating and display elements	– Red LED and EIB / KNX push button	for assignment of the physical address			
	– Contact position indication	Relay lever			
Housing	– IP 20	to EN 60 529			
Safety class	– II	to EN 61 140			
Isolation category	– Overvoltage category	III to EN 60 664-1			
	– Pollution degree	2 to EN 60 664-1			

¹⁾ The specifications apply only after the bus voltage has been applied to the device for at least 30 seconds. The typical elementary delay of the relay is approx. 20 ms

²⁾ The maximum inrush-current peak (see table 6) may not be exceeded.

Table 5 – Part 1: 10 A Switch Actuator SA/S x.10.1, technical data

EIB / KNX voltage	– SELV 24 V DC (safety extra low voltage)			
Temperature range	– Operation	– 5 °C ... + 45 °C		
	– Storage	– 25 °C ... + 55 °C		
	– Transport	– 25 °C ... + 70 °C		
Design	– Modular DIN-Rail Component (MDRC)	Modular installation device, ProM		
	– SA/S - type	2.10.1	4.10.1	8.10.1 12.10.1
	– Dimensions (H x W x D)	90 x W x 64		
	– Width W in mm	36	72	144 216
	– Mounting width (modules at 18 mm)	2	4	8 12
	– Mounting depth in mm	64	64	64 64
Weight	– In kg	0.15	0.25	0.46 0.65
Installation	– On 35 mm mounting rail	EN 60 715		
Mounting position	– As required			
Housing, colour	– Plastic housing, grey			
Approvals	– EIB / KNX nach EN 50 090-2-2	Certification		
CE mark	– In accordance with the EMC guideline and low voltage guideline			

Table 5 – Part 2: 10 A Switch Actuator SA/S x.10.1, technical data

Lamp loads

Lamps	– Incandescent lamp load	2330 W
Fluorescent lamp T5 / T8	– Uncompensated luminaire	2300 W
	– Parallel compensated	1500 W
	– DUO circuit	1500 W
Low-volt halogen lamps	– Inductive transformer	1200 W
	– Electronic transformer	1500 W
	– Halogen lamp 230V	2300 W
Dulux lamp	– Uncompensated luminaire	1100 W
	– Parallel compensated	1100 W
Mercury-vapour lamp	– Uncompensated luminaire	2000 W
	– Parallel compensated	2000 W
Switching performance (switching contact)	– Max. peak inrush-current I_p (150 µs)	400 A
	– Max. peak inrush-current I_p (250 µs)	320 A
	– Max. peak inrush-current I_p (600 µs)	200 A
Number of electronic ballasts (T5/T8, single element) ¹⁾	– 18 W (ABB EVG 1x58 CF)	23
	– 24 W (ABB EVG-T5 1x24 CY)	23
	– 36 W (ABB EVG 1x36 CF)	14
	– 58 W (ABB EVG 1x58 CF)	11
	– 80 W (Helvar EL 1x80 SC)	10

¹⁾ For multiple element lamps or other types the number of electronic ballasts must be determined using the peak inrush current of the electronic ballasts. See section 2.7 for example

Table 6: Lamp load for SA/S x.10.1

Application programs

Type	Name	Max. number of communication objects	Max. number of group addresses	Max. number of associations
SA/S 2.10.1S	Switch, 2f10/1	24	254	254
SA/S 4.10.1S	Switch, 4f10/1	64	254	254
SA/S 8.10.1S	Switch, 8f10/1	124	254	254
SA/S 12.10.1	Switch, 12f10/1	184	254	254

Table 7: Application programs SA/S x.10.1

Notes: The programming requires the EIB Software Tool ETS2 V1.3 or higher. If the ETS3 is used a “.VD3” type file must be imported.
The application program is located within the ETS2 / ETS3 in the category ABB/output/Binary output, x-fold/switch, xf10/1 (x = 2, 4, 8 or 12, number of outputs).

2.2.1 Wiring diagram SA/S x.10.1

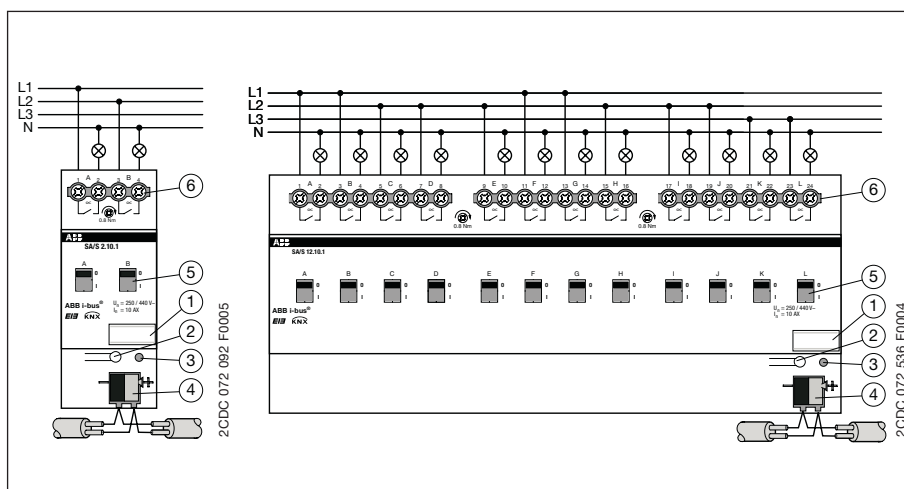
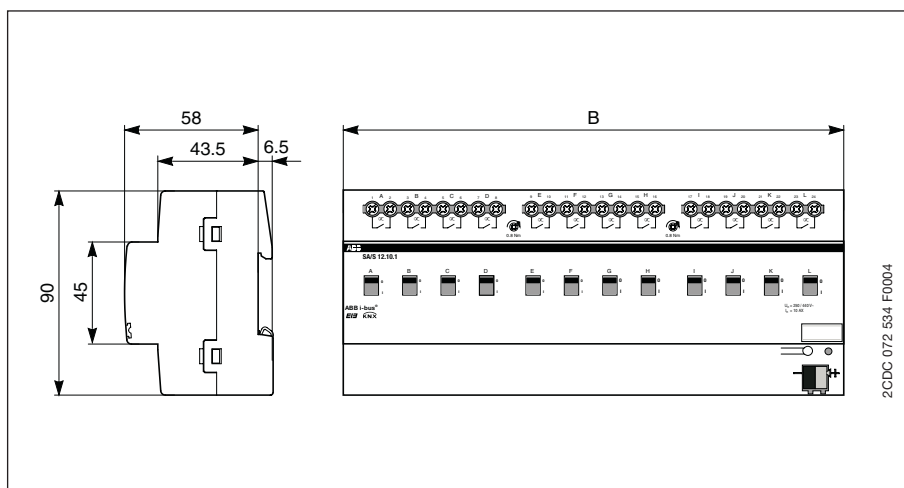


Fig. 6: Wiring diagram of the 10 AX Switch Actuator SA/S x.10.1

- | | |
|---------------------------|---|
| 1 Label carrier | 5 Contact position indication and manual operation |
| 2 Programming button | 6 Load current circuits, per circuit 2 connection terminals |
| 3 Programming LED | |
| 4 Bus Connection Terminal | |

Note: All-pole disconnection must be observed in order to avoid dangerous contact voltage which can develop via loads in other phases.

2.2.2 Dimension drawings SA/S x.10.1



	SA/S 2.10.1	SA/S 4.10.1	SA/S 8.10.1	SA/S 12.10.1
B	36 mm 2 module widths	72 mm 4 module widths	144 mm 8 module widths	216 mm 12 module widths

Fig. 7: Dimension drawings SA/S x.10.1

**2.3 Technical data
SA/S x.16.1**



Fig. 8 SA/S 8.16.1

The 16 A AC1 Switch Actuators are modular installation devices in proM design for installation in the distribution board on 35 mm mounting rails. The connection to the ABB i-bus® EIB / KNX is implemented via Bus Connection Terminals.

The device does not require an additional power supply.

The actuators switch up to 8 independent electrical loads via potential free contacts. The outputs are connected using screw terminals with combination drive head screws. Each output is controlled separately via the EIB / KNX.

The switch actuators can be manually operated via an operating element which simultaneously indicates the switch status.

The actuators are particularly suitable for switching ohmic loads.

Power supply	– Operating voltage	21...30 V DC, made available by the bus		
	– Current consumption EIB / KNX	< 12 mA		
	– Power consumption EIB / KNX	Max. 250 mW		
Output nominal values	– SA/S - type	2.16.1	4.16.1	8.16.1
	– Number of contacts (potential free)	2	4	8
	– U _n rated voltage	250 / 440 V AC (50/60 Hz)		
	– I _n rated current	16 A	16 A	16 A
	– Power loss per device at max. load	2.0 W	4.0 W	8.0 W
Output switching currents	– AC1 operation (cosφ = 0.8) EN 60 947-4-1	16 A / 230 V		
	– Fluorescent lighting load AX to EN 60669-1	16 A / 250 V (70 μF) ²⁾		
	– Minimum switching performance	100 mA / 12 V		
		100 mA / 24 V		
	– DC current switching capacity (ohmic load)	16 A / 24 V DC		
Output life expectancy	– Mechanical endurance	> 3 x 10 ⁶		
	– Electrical endurance to IEC 60 947-4-1	Operations (state change)		
	– AC1(240 V/cosφ = 0.8)			
Output switching times¹⁾	– Max. number of relay position changes per output and minute, if all relays are switched simultaneously.	2.16.1	4.16.1	8.16.1
	The position changes should be distributed equally within the minute.	60	30	15
	– Max. number of relay position changes per output, and minute if only one relay is switched	120	120	120
Connections	– EIB / KNX	Bus Connection Terminal, 0.8 mm Ø, single core		
	– Load current circuits (2 terminals per contact)	Screw terminal with universal head (PZ 1) 0.2...4 mm ² finely stranded, 2x (0.2 – 2.5 mm ²) 0.2...6 mm ² single core, 2x (0.2 – 4 mm ²)		
	– Tightening torque	Max. 0.8 Nm		
Operating and display elements	– Red LED and EIB / KNX push button	for assignment of the physical address		
	– Contact position indication	Relay lever		
Housing	– IP 20	to EN 60 529		
Safety class	– II	to EN 61 140		
Isolation category	– Overvoltage category	III to EN 60 664-1		
	– Pollution degree	2 to EN 60 664-1		

¹⁾ The specifications apply only after the bus voltage has been applied to the device for at least 30 seconds. The typical elementary delay of the relay is approx. 20 ms.

²⁾ The maximum inrush-current peak (see table 9) may not be exceeded.

Table 8 – Part 1: 16 A Switch Actuator SA/S x.16.1, technical data

EIB / KNX voltage	– SELV 24 V DC (safety extra low voltage)		
Temperature range	– Operation	– 5 °C ... + 45 °C	
	– Storage	– 25 °C ... + 55 °C	
	– Transport	– 25 °C ... + 70 °C	
Design	– Modular DIN-Rail Component (MDRC)	Modular installation device, ProM	
	– SA/S - type	2.16.1	4.16.1 8.16.1
	– Dimensions (H x W x D)	90 x W x 64	
	– Width W in mm	36	72 144
	– Mounting width (modules at 18 mm)	2	4 8
	– Mounting depth in mm	64	64 64
Weight	– In kg	0.15	0.25 0.46
Installation	– On 35 mm mounting rail	EN 60 715	
Mounting position	– As required		
Housing, colour	– Plastic housing, grey		
Approvals	– EIB / KNX nach EN 50 090-2-2	Certification	
CE mark	– In accordance with the EMC guideline and low voltage guideline		

Table 8 – Part 2: 16 A Switch Actuator SA/S x.16.1, technical data

Lamp loads

Lamps	– Incandescent lamp load	2330 W
Fluorescent lamp T5 / T8	– Uncompensated luminaire	2300 W
	– Parallel compensated	1500 W
	– DUO circuit	1500 W
Low-volt halogen lamps	– Inductive transformer	1200 W
	– Electronic transformer	1500 W
	– Halogen lamp 230V	2300 W
Dulux lamp	– Uncompensated luminaire	1100 W
	– Parallel compensated	1100 W
Mercury-vapour lamp	– Uncompensated luminaire	2000 W
	– Parallel compensated	2000 W
Switching performance (switching contact)	– Max. peak inrush-current I_p (150 μ s)	400 A
	– Max. peak inrush-current I_p (250 μ s)	320 A
	– Max. peak inrush-current I_p (600 μ s)	200 A
Number of electronic ballasts (T5/T8, single element) ¹⁾	– 18 W (ABB EVG 1x58 CF)	23
	– 24 W (ABB EVG-T5 1x24 CY)	23
	– 36 W (ABB EVG 1x36 CF)	14
	– 58 W (ABB EVG 1x58 CF)	11
	– 80 W (Helvar EL 1x80 SC)	10

¹⁾ For multiple element lamps or other types the number of electronic ballasts must be determined using the peak inrush current of the electronic ballasts. See section 2.7 for example

Table 9: Lamp load for SA/S x.16.1

Application programs

Type	Name	Max. number of communication objects	Max. number of group addresses	Max. number of associations
SA/S 2.16.1	Switch, 2f16/1	34	254	254
SA/S 4.16.1	Switch, 4f16/1	64	254	254
SA/S 8.16.1	Switch, 8f16/1	124	254	254

Table 10: Application programs SA/S x.16.1

Note: The programming requires the EIB Software Tool ETS2 V1.3 or higher. If the ETS3 is used a “.VD3” type file must be imported.

The application program is located within the ETS2 / ETS3 in the category ABB/output/Binary output, x-fold/switch, xf16/1 (x = 2, 4 or 8, number of outputs).

2.3.1 Wiring diagram
SA/S x.16.1

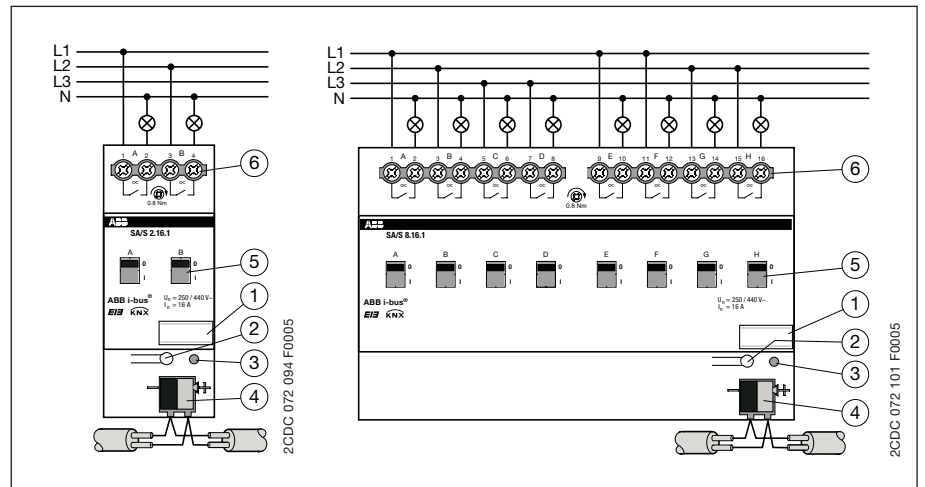
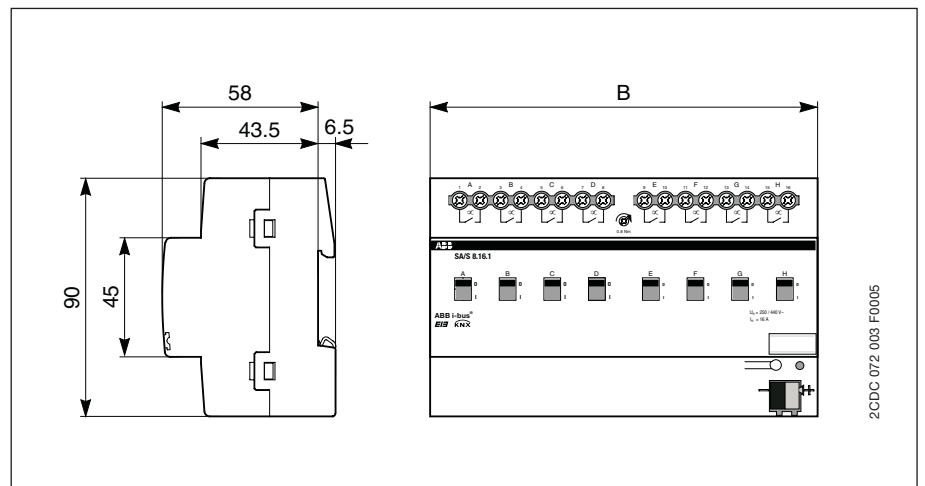


Fig. 9: Wiring diagram of the 16 A AC1 Switch Actuator SA/S x.16.1

- | | |
|---|--|
| <ul style="list-style-type: none"> 1 Label carrier 2 Programming button 3 Programming LED 4 Bus Connection Terminal | <ul style="list-style-type: none"> 5 Contact position indicator and manual operation 6 Load current circuits, per circuit 2 connection terminals |
|---|--|

Note: All-pole disconnection must be observed in order to avoid dangerous contact voltage which can develop via loads in other phases.

2.3.2 Dimension drawings
SA/S x.16.1



	SA/S 2.16.1	SA/S 4.16.1	SA/S 8.16.1
B	36 mm 2 module widths	72 mm 4 module widths	144 mm 8 module widths

Fig. 10: Dimension drawings SA/S x.16.1

2.4 Technical data
SA/S x.16.5S

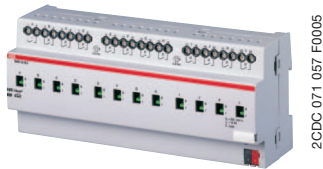


Fig. 11: SA/S 12.16.5

The 16 A Switch Actuators are modular installation devices in proM design for installation in the distribution board on 35 mm mounting rails. The connection to the ABB i-bus® EIB / KNX is implemented via a Bus Connection Terminal.

The 2-, 4- and 8-fold switch actuators feature a load current detection on every output. A separate external voltage supply for the actuator is not required.

The actuators switch up to 12 independent electrical loads via potential free contacts. The outputs are connected using screw terminals with combination drive head screws. Each output is controlled and monitored separately via the EIB / KNX.

The switch actuators can be manually operated via an operating element which simultaneously indicates the switch status.

The actuators are particularly suitable for switching loads with high peak inrush currents such as fluorescent lighting with compensation capacitors or fluorescent lamp loads (AX) according to EN 60669.

Power supply	– Operating voltage	21...30 V DC, made available by the bus			
	– Current consumption EIB / KNX	< 12 mA			
	– Power consumption EIB / KNX	Max. 250 mW			
Output nominal values	– SA/S - type	2.16.5S	4.16.5S	8.16.5S	12.16.5
	– Current detection	yes	yes	yes	no
	– Number of contacts (potential free)	2	4	8	12
	– U _n rated voltage	250 / 440 V AC (50/60 Hz)			
	– I _n rated current	16 AX, C-Load			
	– Power loss per device at max. load	2.0 W	4.0 W	8.0 W	12.0 W
Output switching currents	– AC3 operation (cosφ = 0.45) EN 60 947-4-1	16 A / 230 V			
	– AC1 operation (cosφ = 0.8) EN 60 947-4-1	16 A / 230 V			
	– Fluorescent lighting load AX to EN 60669-1	16 AX / 250 V (200 μF) ²⁾			
	– Minimum switching performance	100 mA / 12 V			
		100 mA / 24 V			
	– DC current switching capacity (ohmic load)	16 A / 24 V DC			
Output life expectancy	– Mechanical endurance	> 10 ⁶			
	– Electrical endurance to IEC 60 947-4-1				Operations (state change)
	– AC1 (240 V/cosφ = 0.8)	> 10 ⁵			
	– AC3 (240 V/cosφ = 0.45)	> 3 x 10 ⁴			
	– AC5a (240 V/cosφ = 0.45)	> 3 x 10 ⁴			
Current detection (load current) SA/S 2.16.5S, SA/S 4.16.5S, SA/S 8.16.5S	– Detection range (sine r.m.s. value)	0.1 A ... 16 A			
	– Accuracy	+/- 8 % of current value (sine) and +/- 100 mA			
	– Frequency	50/60 Hz			
	– Resolution 1-Byte / 2-Byte	100 mA / 1 mA			
	– Detection speed limited by low-pass filter with τ	100 ms			
Output switching times ¹⁾	– Max. number of relay position changes per output and minute, if all relays are switched simultaneously. The position changes should be distributed equally within the minute.	2.16.5S	4.16.5S	8.16.5S	12.16.5
		30	15	7	5
	– Max. number of relay position changes per output, and minute if only one relay is switched	60	60	60	60

¹⁾ The specifications apply only after the bus voltage has been applied to the device for at least 30 seconds. The typical elementary delay of the relay is approx. 20 ms.

²⁾ The maximum inrush-current peak (see table 12) may not be exceeded.

Table 11 – Part 1: 16 A, AC3, C-Load Switch Actuator SA/S x.16.5S, technical data

Connections	– EIB / KNX	Bus Connection Terminal, 0.8 mm Ø, single core
	– Load current circuits (2 terminals per contact)	Screw terminal with universal head (PZ 1) 0.2...4 mm ² finely stranded, 2 x (0.2 – 2.5 mm ²) 0.2...6 mm ² single core, 2 x (0.2 – 4 mm ²)
	– Tightening torque	Max. 0.8 Nm
Operating and display elements	– Red LED and EIB / KNX push button – Contact position indication	for assignment of the physical address Relay lever
Housing	– IP 20	to EN 60 529
Safety class	– II	to EN 61 140
Isolation category	– Overvoltage category	III to EN 60 664-1
	– Pollution degree	2 to EN 60 664-1
EIB / KNX voltage	– SELV 24 V DC (safety extra low voltage)	
Temperature range	– Operation	– 5 °C ... + 45 °C
	– Storage	– 25 °C ... + 55 °C
	– Transport	– 25 °C ... + 70 °C
Design	– Modular DIN-Rail Component (MDRC)	Modular installation device, ProM
	– SA/S - type	2.16.5S 4.16.5S 8.16.5S 12.16.5
	– Dimensions (H x W x D)	90 x W x 64
	– Width W in mm	36 72 144 216
	– Mounting width (modules at 18 mm)	2 4 8 12
Weight	– In kg	64 64 64 64
		0.2 0.34 0.64 0.8
Installation	– On 35 mm mounting rail	EN 60 715
Mounting position	– As required	
Housing, colour	– Plastic housing, grey	
Approvals	– EIB / KNX to EN 50 090-2-2	Certification
CE mark	– in accordance with the EMC guideline and low voltage guideline	

Table 11 – Part 2: 16 A, AC3, C-Load Switch Actuator SA/S x.16.5S, technical data

Lamp loads

Lamps	– Incandescent lamp load	3680 W
Fluorescent lamps T5 / T8	– Uncompensated luminaire	3680 W
	– Parallel compensated	2500 W
	– DUO circuit	3680 W
Low-volt halogen lamps	– Inductive transformer	2000 W
	– Electronic transformer	2500 W
	– Halogen lamp 230V	3680 W
Dulux lamp	– Uncompensated luminaire	3680 W
	– Parallel compensated	3000 W
Mercury-vapour lamp	– Uncompensated luminaire	3680 W
	– Parallel compensated	3680 W
Switching performance (switching contact)	– Max. peak inrush-current I_p (150µs)	600 A
	– Max. peak inrush-current I_p (250µs)	480 A
	– Max. peak inrush-current I_p (600µs)	300 A
Number of electronic ballasts (T5/T8, single element) ¹⁾	– 18 W (ABB EVG 1x58 CF)	26 ²⁾
	– 24 W (ABB EVG-T5 1x24 CY)	26 ²⁾
	– 36 W (ABB EVG 1x36 CF)	22
	– 58 W ABB EVG 1x58 CF)	12 ²⁾
	– 80 W (Helvar EL 1x80 SC)	10 ²⁾

¹⁾ For multiple element lamps or other types the number of electronic ballasts must be determined using the peak inrush current of the electronic ballasts. See section 2.7 for example

²⁾ Limited by protection with a B16 miniature circuit breaker

Table 12: Lamp Load for SA/S x.16.5S

Application programs

Type	Name	Max. number of communication objects	Max. number of group addresses	Max. number of associations
SA/S 2.16.5S	Switch, 2f16S/1	40	254	254
SA/S 4.16.5S	Switch, 4f16S/1	76	254	254
SA/S 8.16.5S	Switch, 8f16S/1	152	254	254
SA/S 12.16.5	Switch, 12f16/1	220	254	254

Table 13: Application programs SA/S x.16.5S

Note: The programming requires the EIB Software Tool ETS2 V1.3 or higher. If the ETS3 is used a “.VD3” type file must be imported.

The application program is located within the ETS2 / ETS3 in the category ABB/output/Binary output, x-fold/switch, xf16S/1 (x = 2, 4, 8 or 12, number of outputs, S = current detection).

2.4.1 Wiring diagram SA/S x.16.5S

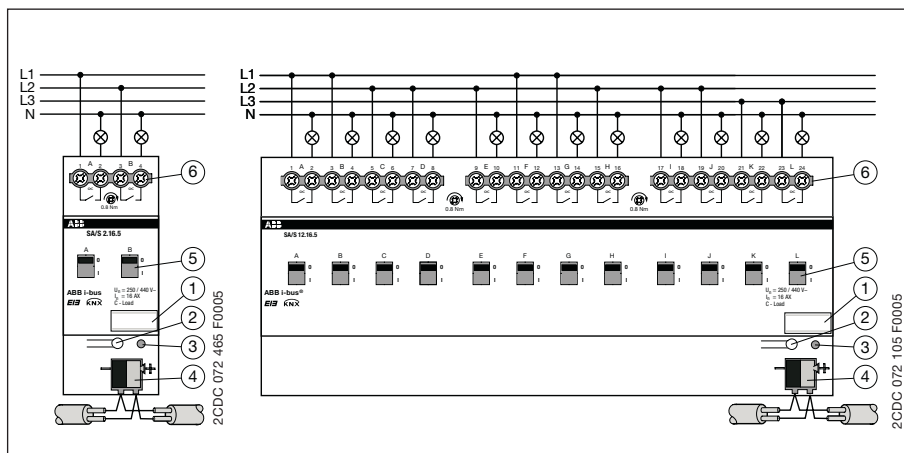
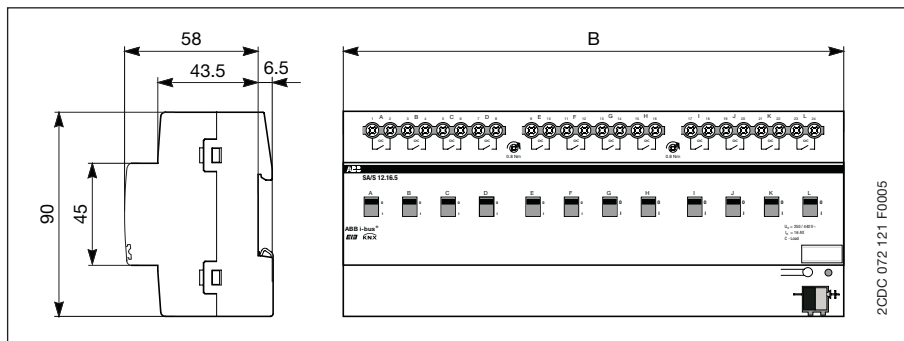


Fig. 12: Wiring diagram of the 16 A, C-Load Switch Actuators SA/S x.16.5S

- 1 Label carrier
- 2 Programming button
- 3 Programming LED
- 4 Bus Connection Terminal
- 5 Contact position indicator and manual operation
- 6 Load current circuits, per circuit 2 connection terminals

Note: All-pole disconnection must be observed in order to avoid dangerous contact voltage which can develop via loads in other phases.

2.4.2 Dimension drawings SA/S x.16.5S



	SA/S 2.16.5S	SA/S 4.16.5S	SA/S 8.16.5S	SA/S 12.16.5
B	36 mm 2 module widths	72 mm 4 module widths	144 mm 8 module widths	216 mm 12 module widths

Fig. 13: Dimension drawings SA/S x.16.5S

2.5 Technical data
SA/S x.20.1S

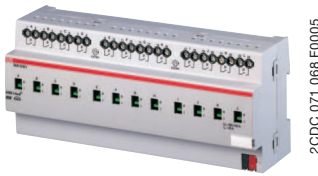


Fig. 14: SA/S 12.20.1

The 20 AX Switch Actuators are modular installation devices in proM design for installation in the distribution board on 35 mm mounting rails. The connection to the ABB i-bus® EIB / KNX is implemented via a screwless Bus Connection Terminal.

The 2-, 4- and 8-fold switch actuators feature a load current detection on every output. A separate external voltage supply for the actuator is not required.

The actuator switches up to 12 independent electrical loads via potential free contacts. The outputs are connected using screw terminals with combination drive head screws. Each output is controlled and monitored separately via the EIB / KNX.

The switch actuators can be manually operated via an operating element which simultaneously indicates the switch status.

The actuators are particularly suitable for switching loads with high peak inrush currents such as fluorescent lighting with compensation capacitors or fluorescent lamp loads (AX) according to EN 60669.

Power supply	<ul style="list-style-type: none"> – Operating voltage – Current consumption EIB / KNX – Power consumption EIB / KNX 	21...30 V DC, made available by the bus < 12 mA Max. 250 mW																																			
Output nominal values	<ul style="list-style-type: none"> – SA/S - type – Current detection – Number of contacts (potential free) – U_n rated voltage – I_n rated current – Power loss per device at max. load 	<table border="1"> <thead> <tr> <th></th> <th>2.20.1S</th> <th>4.20.1S</th> <th>8.20.1S</th> <th>12.20.1</th> </tr> </thead> <tbody> <tr> <td>– SA/S - type</td> <td>2.20.1S</td> <td>4.20.1S</td> <td>8.20.1S</td> <td>12.20.1</td> </tr> <tr> <td>– Current detection</td> <td>yes</td> <td>yes</td> <td>yes</td> <td>no</td> </tr> <tr> <td>– Number of contacts (potential free)</td> <td>2</td> <td>4</td> <td>8</td> <td>12</td> </tr> <tr> <td>– U_n rated voltage</td> <td colspan="4">250 / 440 V AC (50/60 Hz)</td> </tr> <tr> <td>– I_n rated current</td> <td colspan="4">20 AX</td> </tr> <tr> <td>– Power loss per device at max. load</td> <td>3.0 W</td> <td>5.5 W</td> <td>11.0 W</td> <td>16.0 W</td> </tr> </tbody> </table>		2.20.1S	4.20.1S	8.20.1S	12.20.1	– SA/S - type	2.20.1S	4.20.1S	8.20.1S	12.20.1	– Current detection	yes	yes	yes	no	– Number of contacts (potential free)	2	4	8	12	– U _n rated voltage	250 / 440 V AC (50/60 Hz)				– I _n rated current	20 AX				– Power loss per device at max. load	3.0 W	5.5 W	11.0 W	16.0 W
	2.20.1S	4.20.1S	8.20.1S	12.20.1																																	
– SA/S - type	2.20.1S	4.20.1S	8.20.1S	12.20.1																																	
– Current detection	yes	yes	yes	no																																	
– Number of contacts (potential free)	2	4	8	12																																	
– U _n rated voltage	250 / 440 V AC (50/60 Hz)																																				
– I _n rated current	20 AX																																				
– Power loss per device at max. load	3.0 W	5.5 W	11.0 W	16.0 W																																	
Output switching currents	<ul style="list-style-type: none"> – AC3 operation (cosφ = 0.45) EN 60 947-4-1 – AC1 operation (cosφ = 0.8) EN 60 947-4-1 – Fluorescent lighting load AX to EN 60669-1 – Minimum switching performance – DC current switching capacity (ohmic load) 	16 A / 230 V 20 A / 230 V 20 AX / 250 V (140 μF) ²⁾ 100 mA / 12 V 100 mA / 24 V 20 A / 24 V DC																																			
Output life expectancy	<ul style="list-style-type: none"> – Mechanical endurance – Electrical endurance to IEC 60 947-4-1 <ul style="list-style-type: none"> – AC1 (240 V/cosφ = 0.8) – AC3 (240 V/cosφ = 0.45) – AC5a (240 V/cosφ = 0.45) 	> 10 ⁶ > 10 ⁵ > 3 x 10 ⁴ > 3 x 10 ⁴ Operations (state change)																																			
Current detection (load current) SA/S 2.16.5S, SA/S 4.16.5S, SA/S 8.16.5S	<ul style="list-style-type: none"> – Detection range (sine r.m.s. value) – Accuracy – Frequency – Resolution 1-Byte / 2-Byte – Detection speed limited by low-pass filter with τ 	0.1 A ... 20 A +/- 8 % of current value (sine) and +/- 100 mA 50/60 Hz 100 mA / 1 mA 100 ms																																			
Output switching times ¹⁾	<ul style="list-style-type: none"> – Max. number of relay position changes per output and minute, if all relays are switched simultaneously. The position changes should be distributed equally within the minute. – Max. number of relay position changes per output, and minute if only one relay is switched 	<table border="1"> <thead> <tr> <th></th> <th>2.20.1S</th> <th>4.20.1S</th> <th>8.20.1S</th> <th>12.10.1</th> </tr> </thead> <tbody> <tr> <td>– Max. number of relay position changes per output and minute, if all relays are switched simultaneously. The position changes should be distributed equally within the minute.</td> <td>30</td> <td>15</td> <td>7</td> <td>5</td> </tr> <tr> <td>– Max. number of relay position changes per output, and minute if only one relay is switched</td> <td>60</td> <td>60</td> <td>60</td> <td>60</td> </tr> </tbody> </table>		2.20.1S	4.20.1S	8.20.1S	12.10.1	– Max. number of relay position changes per output and minute, if all relays are switched simultaneously. The position changes should be distributed equally within the minute.	30	15	7	5	– Max. number of relay position changes per output, and minute if only one relay is switched	60	60	60	60																				
	2.20.1S	4.20.1S	8.20.1S	12.10.1																																	
– Max. number of relay position changes per output and minute, if all relays are switched simultaneously. The position changes should be distributed equally within the minute.	30	15	7	5																																	
– Max. number of relay position changes per output, and minute if only one relay is switched	60	60	60	60																																	

¹⁾ The specifications apply only after the bus voltage has been applied to the device for at least 30 seconds. The typical elementary delay of the relay is approx. 20 ms.

²⁾ The maximum inrush-current peak (see table 15) may not be exceeded

Table 14 – Part 1: 20 AX Switch Actuator SA/S x.20.1S, technical data

Connections	– EIB / KNX	Bus Connection Terminal, 0.8 mm Ø, single core
	– Load current circuits (2 terminals per contact)	Screw terminal with universal head (PZ 1) 0.2...4 mm ² finely stranded, 2 x (0.2 – 2.5 mm ²) 0.2...6 mm ² single core, 2 x (0.2 – 4 mm ²)
	– Tightening torque	Max. 0.8 Nm
Operating and display elements	– Red LED and EIB / KNX push button	for assignment of the physical address
	– Contact position indication	Relay lever
Housing	– IP 20	to EN 60 529
Safety class	– II	to EN 61 140
Isolation category	– Overvoltage category	III to EN 60 664-1
	– Pollution degree	2 to EN 60 664-1
EIB / KNX voltage	– SELV 24 V DC (safety extra low voltage)	
Temperature range	– Operation	– 5 °C... + 45 °C
	– Storage	– 25 °C... + 55 °C
	– Transport	– 25 °C... + 70 °C
Design	– Modular DIN-Rail Component (MDRC)	Modular installation device, ProM
	– SA/S - type	2.20.1S 4.20.1S 8.20.1S 12.20.1
	– Dimensions (H x W x D)	90 x W x 64
	– Width W in mm	36 72 144 216
	– Mounting width (modules at 18 mm)	2 4 8 12
	– Mounting depth in mm	64 64 64 64
Weight	– In kg	0.2 0.34 0.64 0.8
Installation	– On 35 mm mounting rail	EN 60 715
Mounting position	– As required	
Housing, colour	– Plastic housing, grey	
Approvals	– EIB / KNX to EN 50 090-2-2	Certification
CE mark	– in accordance with the EMC guideline and low voltage guideline	

Table 14 – Part 2: 20 AX Switch Actuator SA/S x.20.1S, technical data

Lamp loads

Lamps	– Incandescent lamp load	3680 W
Fluorescent lamps T5 / T8	– Uncompensated luminaire	3680 W
	– Parallel compensated	2500 W
	– DUO circuit	3680 W
Low-volt halogen lamps	– Inductive transformer	2000 W
	– Electronic transformer	2000 W
	– Halogen lamp 230V	3680 W
Dulux lamp	– Uncompensated luminaire	3680 W
	– Parallel compensated	3000 W
Mercury-vapour lamp	– Uncompensated luminaire	3680 W
	– Parallel compensated	3680 W
Switching performance (switching contact)	– Max. peak inrush-current I _p (150µs)	600 A
	– Max. peak inrush-current I _p (250µs)	480 A
	– Max. peak inrush-current I _p (600µs)	300 A
Number of electronic ballasts (T5/T8, single element)¹⁾	– 18 W (ABB EVG 1x58 CF)	26 ²⁾
	– 24 W (ABB EVG-T5 1x24 CY)	26 ²⁾
	– 36 W (ABB EVG 1x36 CF)	22
	– 58 W ABB EVG 1x58 CF)	12 ²⁾
	– 80 W (Helvar EL 1x80 SC)	10 ²⁾

¹⁾ For multiple element lamps or other types the number of electronic ballasts must be determined using the peak inrush current of the electronic ballasts. See section 2.7 for example

²⁾ Limited by protection with a B16 miniature circuit breaker

Table 15: Lamp load for SA/S x.20.1S

Application programs

Type	Name	Max. number of communication objects	Max. number of group addresses	Max. number of associations
SA/S 2.20.1S	Switch, 2f20S/1	40	254	254
SA/S 4.20.1S	Switch, 4f20S/1	76	254	254
SA/S 8.20.1S	Switch, 8f20S/1	152	254	254
SA/S 12.20.1	Switch, 12f20/1	220	254	254

Table 16: Application programs SA/S x.20.1S

Note: The programming requires the EIB Software Tool ETS2 V1.3 or higher. If the ETS3 is used a “.VD3” type file must be imported.

The application program is located within the ETS2 / ETS3 in the category ABB/output/Binary output, x-fold/switch, xf20S/1 (x = 2, 4, 8 or 12, number of outputs, S = current detection).

2.5.1 Wiring diagram SA/S x.20.1S

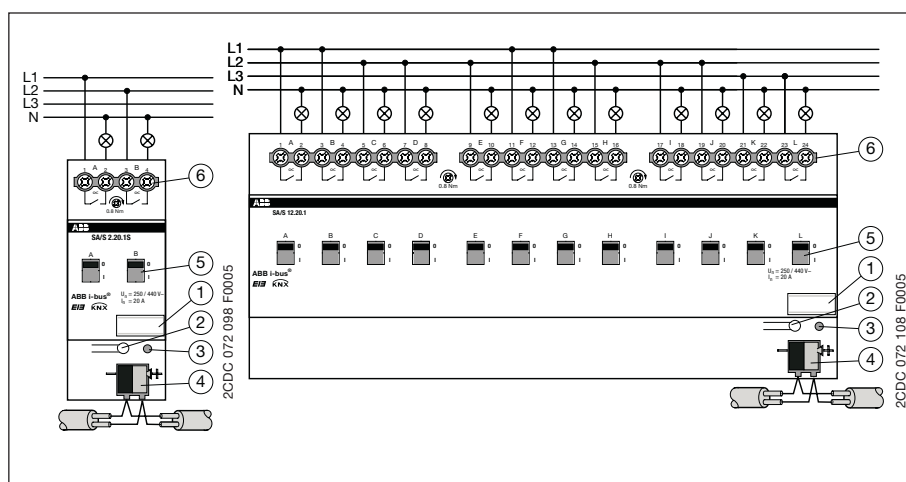
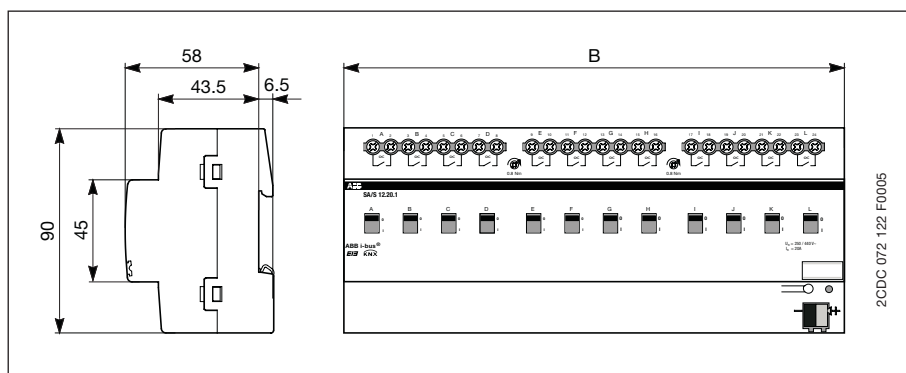


Fig. 15: Wiring diagram of the 20 AX Switch Actuator SA/S x.20.1S

- 1 Label carrier
- 2 Programming button
- 3 Programming LED
- 4 Bus Connection Terminal
- 5 Contact position indication and manual operation
- 6 Load current circuits, per circuit 2 connection terminals

Note: All-pole disconnection must be observed in order to avoid dangerous contact voltage which can develop via loads in other phases.

2.5.2 Dimension drawings SA/S x.20.1S



	SA/S 2.20.1S	SA/S 4.20.1S	SA/S 8.20.1S	SA/S 12.20.1
B	36 mm 2 module widths	72 mm 4 module widths	144 mm 8 module widths	216 mm 12 module widths

Fig. 16: Dimension diagrams SA/S x.20.1S

2.6 Overview of switching performance

The following table provides an overview of the switching performance, lamp loads or the number of lamps which can be connected to a output.

	SA/S 4.6.1 SA/S 8.6.1 SA/S 12.6.1	SA/S 2.10.1 SA/S 4.10.1 SA/S 8.10.1 SA/S 12.10.1	SA/S 2.16.1 SA/S 4.16.1 SA/S 8.16.1	SA/S 2.16.5S SA/S 4.16.5S SA/S 8.16.5S SA/S 12.16.5	SA/S 2.20.1S SA/S 4.20.1S SA/S 8.20.1S SA/S 12.20.1
I _n nominal current / A	6 A	10 AX	16 A	16 AX C-Load	20 AX
U _n rated voltage / V	250/440 V AC	250/440 V AC	250/440 V AC	250/440 V AC	250/440 V AC
AC1-operation (cosφ = 0.8) EN 60947-4-1	6 A	10 A	16 A	16 A	20 A
AC3-operation (cosφ = 0.45) EN 60947-4-1	6 A	8 A	–	16 A	16 A
Fluorescent lighting load AX EN 60669-1	6 A (35 μF) ³⁾	10 AX (140 μF) ³⁾	16 A (70 μF) ³⁾	16 AX (200 μF) ³⁾	20 AX (140 μF) ³⁾
Minimum switching performance	10 mA/12 V	100 mA/12 V	100 mA/12 V	100 mA/12 V	100 mA/12 V
DC current switching capacity (ohmic load)	7 A/24 V DC	10 A/24 V DC	16 A/24 V DC	16 A/24 V DC	20 A/24 V DC
Mechanical endurance	10 ⁷	3x10 ⁶	3x10 ⁶	10 ⁶	10 ⁶
Electrical endurance ⁴⁾ to DIN IEC 60947-4-1					
Rated current AC1 (240 V/0.8)	100.000	100.000	100.000	100.000	100.000
Rated current AC3 (240 V/0.45)	15.000	30.000	–	30.000	30.000
Rated current AC5a (240 V/0.45)	15.000	30.000	–	30.000	30.000
Incandescent lamp load	1200 W	2500 W	2500 W	3680 W	3680 W
Fluorescent lamp T5 / T8					
Uncompensated luminaire	800 W	2500 W	2500 W	3680 W	3680 W
Parallel compensated	300 W	1500 W	1500 W	2500 W	2500 W
DUO circuit	350 W	1500 W	1500 W	3680 W	3680 W
Low-volt halogen lamps					
Inductive transformer	800 W	1200 W	1200 W	2000 W	2000 W
electronic transformer	1000 W	1500 W	1500 W	2500 W	2500 W
Halogen lamp 230 V	1000 W	2500 W	2500 W	3680 W	3680 W
Dulux lamp					
Uncompensated luminaire	800 W	1100W	1100W	3680 W	3680 W
Parallel compensated	800 W	1100W	1100W	3000 W	3000 W
Mercury-vapour lamp					
Uncompensated luminaire	1000 W	2000 W	2000 W	3680 W	3680 W
Parallel compensated	800 W	2000 W	2000 W	3000 W	3000 W
Sodium-vapour lamp					
Uncompensated luminaire	1000 W	2000 W	2000 W	3680 W	3680 W
Parallel compensated	800 W	2000 W	2000 W	3000 W	3000 W
Max. peak inrush-current I _p (150 μs)	200 A	400 A	400 A	600 A	600 A
Max. peak inrush-current I _p (250 μs)	160 A	320 A	320 A	480 A	480 A
Max. peak inrush-current I _p (600 μs)	100 A	200 A	200 A	300 A	300 A
Number of electronic ballasts (T5/T8, single element) ²⁾					
18 W (ABB EVG 1x58 CF)	10	23	23	26 ¹⁾	26 ¹⁾
24 W (ABB EVG-T5 1x24 CY)	10	23	23	26 ¹⁾	26 ¹⁾
36 W (ABB EVG 1x36 CF)	7	14	14	22	22
58 W (ABB EVG 1x58 CF)	5	11	11	12 ¹⁾	12 ¹⁾
80 W (Helvar EL 1x80 SC)	3	10	10	10 ¹⁾	10 ¹⁾

¹⁾ Limited by protection with a B16 miniature circuit breaker

²⁾ For multiple element lamps or other types the number of electronic ballasts must be determined using the peak inrush current of the electronic ballasts.

³⁾ The maximum peak inrush-current peak may not be exceeded

⁴⁾ Operations (state change)

Table 17: SA/S - switching performance overview

2.7 Electronic ballast calculation

The electronic ballast is a device for operating gas discharge lamps, e.g., fluorescent lamps. During normal operation the electronic ballast converts the mains voltage to an optimum operating voltage for the gas discharge lamps. Furthermore, the electronic ballast enables the gas discharge lamps to ignite (start) via capacitor circuitry.

With the original choke/starter circuitry the lamps switched on consecutively, with the electronic ballast all fluorescent lamps switch on practically simultaneously. If switch on occurs at the mains voltage peak, the buffer capacitor of the electronic ballast cause a high but very short current pulse. If multiple electronic ballasts are used in the same circuit, simultaneous charging of the capacitors can allow very high system inrush currents to flow.

This peak inrush current I_p is to be considered when designing the switch contacts as well as by the selection of the respective circuit protection. In the following the effects of the electronic ballast peak inrush current and the associated limitation of the number of electronic ballasts in the switch actuators are examined.

The inrush current of the electronic ballast depends not only on the wattage but also on the type, the number of elements (lamps) and on the manufacturer. For this reason the given maximum number of connectible electronic ballasts on every output can only relate to a defined type of electronic ballast.

For a different type this value can only be assumed to be an estimation.

In order to properly estimate the number of electronic ballasts, the peak inrush current I_p with the respective pulse width of the electronic ballast must be known. In the meantime, these values are stated by the manufacturer in the technical data or are available on request.

Typical values for single element electronic ballasts with T5/T8 lamps are:

Peak inrush current 15 A to 50 A with a pulse time of 120 µs to 200 µs.

The relays of the switch actuators have the following maximum starting values:

	SA/S 4.6.1 SA/S 8.6.1 SA/S 12.6.1	SA/S 2.10.1 SA/S 4.10.1 SA/S 8.10.1 SA/S 12.10.1	SA/S 2.16.1 SA/S 4.16.1 SA/S 8.16.1	SA/S 2.16.5S SA/S 4.16.5S SA/S 8.16.5S SA/S 12.16.5	SA/S 2.20.1S SA/S 4.20.1S SA/S 8.20.1S SA/S 12.20.1
Max. peak inrush-current I_p (150 µs)	200 A	400 A	400 A	600 A	600 A
Max. peak inrush-current I_p (250 µs)	160 A	320 A	320 A	480 A	480 A
Max. peak inrush-current I_p (600 µs)	100 A	200 A	200 A	300 A	300 A

Table 18: Peak inrush currents

If these limit values are exceeded the relay will be destroyed (i.e. the contacts will weld).

Example: ABB EVG 1x58 CF

Peak inrush current $I_p = 33.9$ A (147.1 µs)

For the SA/S 4.16.5S Switch Actuator this results in:

Maximum number of electronic ballast on every output
= 600 A/34 A = 17 electronic ballast

This number has been limited to 12 electronic ballasts in conjunction with a B16 miniature circuit breaker. If more electronic ballasts are connected the miniature circuit breaker may trip during switch on.

For the SA/S 4.6.1S Switch Actuator this results in:

Maximum number of electronic ballast on every output = 200 A / 34 A = 5 electronic ballasts

**2.8 AC1, AC3, AX,
C-Load specifications**

Depending on the special area of application, differing switching capacities and performance specifications have set the tone in the industrial field and the domestic (building engineering) field. These performance specifications are defined in the respective national and international standards. The tests are defined to accommodate typical applications, e.g. motor loads (industrial) or fluorescent lamps (buildings).

The AC1 and AC3 specifications are switching capacities which have become the accepted standard in the industrial field.

AC1 – relates to the switching of ohmic loads. ($\cos \phi = 0.8$)

AC3 – relates to a (inductive) motor load ($\cos \phi = 0.45$)

These switching capacities are defined in the standard EN 60947-4-1 “Contactors and motor-starters; Electromechanical contactors and motor-starters”. This standard describes motor starters and/or contactors which were previously used primarily in industrial applications.

The designation AX has established itself in the field of building engineering.

AX – relates to (capacitive) fluorescent lamp loads Switchable capacitive loads (200 μF , 140 μF , 70 μF or 35 μF) are referred to in conjunction with fluorescent lamp loads.

This switching capacity refers to the standard EN 60669 “Switches for household and similar fixed electrical installations”, which deals primarily with applications in building engineering. For 6 A devices a test with 70 μF is demanded and for devices exceeding 6 A, a test with 140 μF is demanded. The switching capacity specifications AC and AX are not directly comparable. However, the following switching capacity quality can still be determined:

The lowest switching capacity corresponds with the specification

AC1 – mainly for ohmic loads

The following switching capacity should be rated higher

AX – fluorescent lamp loads (According to the standard: 70 μF (6 A), 140 μF (10 A, 16 A).

The highest switching capacity is designated by

– AC3 – motor loads

– C-Load – fluorescent lamp loads (200 μF)

Both specifications are almost equivalent. This means that a device which has fulfilled the test for AC3 to IEC 60947 will most probably fulfil the tests according to EN 60669 with 200 μF .

Finally, the following can be stated:

- Users or customers who are primarily involved with industrial applications will refer to AC3 switching capacities.
- Users who are involved with building or lighting technology will more often than not refer to an AX switching capacity or C-Load (200 μF loads).

The switching capacity differences must be considered with type selection.

2.9 Current detection specifications

The switch actuators with current detection are recognisable by an “S” at the end of the type designation (e.g. SA/S 2.16.5S).

These are switch actuators with integrated load current recognition. Each output features its own current detection with evaluation electronics which can be parameterised separately. For individual parameterisation refer to section 3.4.1.8.

The current recognition detects sinusoidal load currents with a frequency range from 45 Hz to 60 Hz. The measured load currents are available as r.m.s. values. Non-sinusoidal currents (e.g. phase angle varied) can cause a measurement error depending on the curve type. If a DC current is superimposed, the output value may drop to 0 A. Phase angle varied currents are generated for example, by a current rectifier.

Only currents exceeding 100 mA can be displayed for technical reasons. Interference is suppressed by a low-pass filter and the display values are stabilised. The filter has a time constant τ of about 100 ms. Thus, a current change can only be detected after 100 ms at the earliest and can be sent on the bus if required.

The following technical data applies for the current detection:

Detection range:	0.1 A – 20 A
Accuracy:	+/- 8 % of the current value plus +/- 100 mA.
Time constant:	100 ms
Load current $I_{load AC}$:	0...20 A, sinusoidal
$I_{load DC}$:	not detected
Frequency range:	45...65 Hz
Ambient temperature:	- 5 °C...+ 40 °C

Example:

Detected current value	Max. Inaccuracy
300 mA	+/- 124 mA
2 A	+/- 0.26 A
16 A	+/- 1.38 A
20 A	+/- 1.70 A

Table 19 Current detection inaccuracy

For every channel the determined current values can be represented via a 1byte value or 2byte value output object. With a 1byte output value, currents with a resolution of $I_d = 100 \text{ mA}$ (0.1 A) are represented. With a 2byte value a resolution of $I_d = 1 \text{ mA}$ is possible.

It is possible to parameterise two threshold values for every channel. A 1bit telegram is sent on the bus if the threshold value goes above or falls below the current threshold value. Thus, malfunction of equipment can be detected and displayed. A significant enough current change to be registered will only be generated for fluorescent lighting with a minimum rating $P_{min} = 40 \text{ W}$.

For example for dimensioning a malfunction display:

A circuit with 4 x 40 W incandescent lamps should be operated and malfunction of a lamp should be displayed. The threshold value should be defined for a current which corresponds to the rated current of 3.5 lamps!

$$I_{\text{threshold}} = I_{\text{typ}} \times (n-0.5)/n = P_{\text{rated}}/U_{\text{rated}} \times (n-0.5)/n$$

n = number of connected devices

I_{typ} = typical current

P_{rated} = total power of the connected devices

U_n = rated Voltage

It results in:

$$I_{\text{typ}} = 4 \times 40 \text{ W} / 230 \text{ V} = 0.696 \text{ A}$$

$$I_{\text{threshold}} = I_{\text{typ}} \times (n-0.5)/n = 0.696 \text{ A} \times 3.5/4 = 0.609 \text{ A}$$

Fault examination:

A 40 W incandescent lamp has an operating current of 174 mA at 230 V. Four lamps have an operating current of 696 mA. The maximum measuring error is 156 mA (8 % x 696 mA +/- 100 mA). This error is less than the operating current of a 40 W incandescent lamp. Thus, when operation four 40 W incandescent lamps the malfunction of a lamp can be detected.

With 6 x 40 watt lamps an operating current of 1.043 A and a measuring error 183 mA results. This error is larger than the malfunction of a 40 watt (174 mA) lamp. Thus with 6 x 40 watt lamps a lamp failure can no longer be reliably detected.

Voltage fluctuations and current changes on the operation device (e.g. through temperature influences) must be considered and can lead in certain circumstances to an incorrect display of measured values.