Product Manual

ABB i-bus® KNX

Switch Actuator Modules for the Room Controller
SA/M
ES/M

Intelligent Installation Systems

This manual describes the function of the Switch Actuator Modules SA/M 2.6.1 and SA/M 2.16.1 and the Electronical Switch Actuator Modules ES/M 2.230.1 and ES/M 2.24.1 for operation in the Room Controller Basis Device with the application program *Raum-Controller modular, 8f/1.7*.
Subject to changes and errors excepted.

Exclusion of liability:
Despite checking that the contents of this document match the hardware and software, deviations cannot be completely excluded. We therefore cannot accept any liability for this. Any necessary corrections will be inserted in new versions of the manual.
Please inform us of any suggested improvements.

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1 General

The Switch Actuator Modules SA/M 2.6.1 and SA/M 2.16.1 as well as the Electronic Switch Actuator Modules ES/M 2.230.1 and ES/M 2.24.1 are snapped into a module slot of the Room Controller Basis Device RC/A. They are used to control switched loads:

Load type	Suitable module type
Lighting	SA/M
Electrothermal valve drives (heating control)	ES/M
Fan coil units	SA/M
Signalling equipment	ES/M

The Room Controller Basis Device establishes the connection to the ABB i-bus® KNX installation bus.

All the modules have two outputs each. The Switch Actuator Module SA/M switches via relay outputs while the Electronic Switch Actuator Modules ES/M switch via noise-free, wear-resistant electronic semiconductor components.

SA/M 2.6.1 and ES/M 2.230.1 are automatically connected to the incoming supply when they are snapped into the Room Controller Basis Device. The incoming supply of the SA/M 2.16.1 and the ES/M 2.24.1 should be connected directly to the modules.

On the output side, the devices feature screw terminals.

The comprehensive functionality is defined by programming the Room Controller Basis Device with the ETS. It is almost identical for all three devices.

2 Device technology

2.1 SA/M 2.6.1 Switch Actuator Module, 2-fold, 6 AX

The 2-fold Switch Actuator Module can be operated in any module slot of the Room Controller Basis Device. Using relay contacts, it switches two independent groups of electrical loads such as fluorescent lamps. The outputs are distinguished by a high switching current.

Both the incoming supply and the internal voltage are supplied via the Room Controller Basis Device. Contact is automatically established when the modules are snapped in place.

2.1.1 Technical data

Supply / Incoming supply	– Operating voltage	Made available by the Room Controller Basis Device, contact made via contact system on base of module
	– Incoming supply	0…264 V AC, contact established via contact surfaces at the front
Outputs	– 2 load circuits	Relay outputs
	– U_n rated voltage	250/440 V AC
	– I_n rated current	6 AX
Switching currents per output	– AC3 operation (cos φ = 0.45) EN 60 947-4-1	6 A / 230 V
	– AC1 operation (cos φ = 0.8) EN 60 947-4-1	6 A / 230 V
	– Fluorescent lighting load AX to EN 60 669-1	6 A / 250 V (70 µF) [1]
	– Minimum switching performance	100 mA/12 V 100 mA/24 V
	– DC current switching capacity (resistive load)	6 A / 24 V=
Output service life	– Mechanical endurance	3×10^6
	– Electrical endurance to EN 60 947-4-1	
	– AC1(240 V/cosφ = 0.8)	$> 10^5$
	– AC3 (240 V/cosφ = 0.45)	$> 3 \times 10^4$
	– AC5a (240 V/cosφ = 0.45)	$> 3 \times 10^4$
Connections	– Load circuits	2 x three-pole, plug-in screw terminals
	– Connection cross-sections	0.2…2.5 mm^2 stranded 0.2…4.0 mm^2 solid
Ambient temperature range	– Storage	-25 °C … 55 °C
	– Transport	-25 °C … 70 °C
Design	– Type of installation	For snapping into the Room Controller Basis Device
	– Housing, colour	Plastic housing, anthracite, halogen-free
	– Housing dimensions (W x H x D)	49 mm x 42 mm x 93 mm
	– Weight	0.1 kg
CE mark	– in accordance with the EMC guideline and low voltage guideline	

[1] The maximum inrush-current peak (see lamp loads) may not be exceeded.

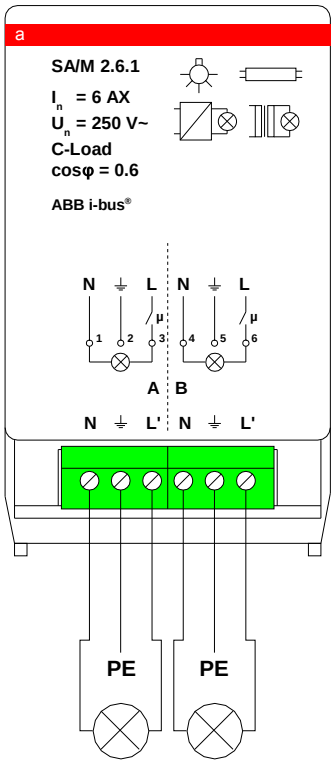
[2] Please note the maximum continuous current of 6 A!

2.1.2 Lamp loads at 230 V AC

Lamps	– Incandescent lamp load	1380 W
Fluorescent lamp T5 / T8	– Uncorrected	1380 W
	– Parallel compensated	1380 W
	– DUO circuit	1380 W
Low-volt halogen lamps	– Inductive transformer	1200 W
	– Electronic transformer	1380 W
	– Halogen lamp 230 V	1380 W
Dulux lamp	– Uncorrected	1100 W
	– Parallel compensated	1100 W
Mercury-vapour lamp	– Uncorrected	1380 W
	– Parallel compensated	1380 W
Switching capacity	– 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 (e.g. ABB EVG 1x18 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.

2.1.3 Circuit diagram



2.1.4 Description of the outputs

The device has two relay outputs A and B. The switched incoming supply is applied at output L'. The PE conductor is brought out from the device to connect the protective conductor.

2.1.5 Assembly and installation

The device is solely intended for operation in the Room Controller Basis Device. It can be snapped into any module slot. The mounting position can be selected as required.

2.2 SA/M 2.6.1 Switch Actuator Module, 2-fold, 16 A, floating

The 2-fold Switch Actuator Module can be operated in any module slot of the Room Controller Basis Device. Using relay contacts, it switches two independent groups of electrical loads such as fluorescent lamps. The outputs are distinguished by a high switching current.

Important: The voltage to be switched must be applied directly to the module.. The device supply is thus independent of the voltage in the Room Controller.

2.2.1 Technical data

Supply / Incoming supply	– Operating voltage	Made available by the Room Controller Basis Device, contact made via contact system on base of module
	– Incoming supply	0…264 V AC, connected directly of the module
Outputs	– 2 load circuits	Relay outputs, floating
	– U_n rated voltage	250/440 V AC
	– I_n rated current	16 A
Switching currents per output	– AC3 operation (cos φ = 0.45) EN 60 947-4-1	8 A / 230 V
	– AC1 operation (cos φ = 0.8) EN 60 947-4-1	16 A / 230 V
	– Fluorescent lighting load AX to EN 60 669-1	16 A / 250 V (70 µF) [1)]
	– Minimum switching performance	100 mA/12 V 100 mA/24 V
	– DC current switching capacity (resistive load)	16 A / 24 V=
Output service life	– Mechanical endurance	3×10^6
	– Electrical endurance to EN 60 947-4-1	
	– AC1(240 V/cosφ = 0.8)	$> 10^5$
	– AC3 (240 V/cosφ = 0.45)	$> 3 \times 10^4$
	– AC5a (240 V/cosφ = 0.45)	$> 3 \times 10^4$
Connections	– Load circuits	2 x 3-pole screw terminals, fixed
	– Connection cross-sections	0.2…2.5 mm^2 stranded
		0.2…4.0 mm^2 solid
Ambient temperature range	– Storage	-25 °C … 55 °C
	– Transport	-25 °C … 70 °C
Design	– Type of installation	For snapping into the Room Controller Basis Device
	– Housing, colour	Plastic housing, anthracite, halogen-free
	– Housing dimensions (W x H x D)	49 mm x 42 mm x 93 mm
	– Weight	0.117 kg
CE mark	– in accordance with the EMC guideline and low voltage guideline	

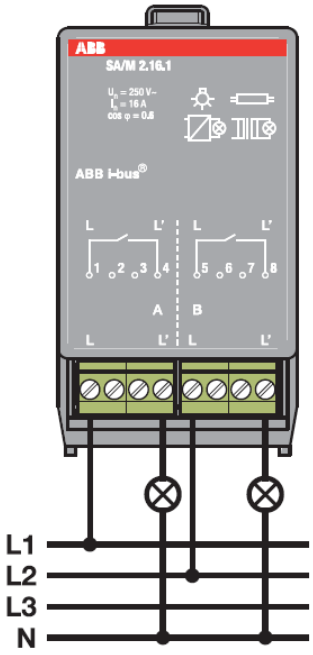
[1)] The maximum inrush-current peak (see lamp loads) may not be exceeded.

2.2.2 Lamp loads at 230 V AC

Lamps	– Incandescent lamp load	2300 W
Fluorescent lamp T5 / T8	– Uncorrected	2300 W
	– Parallel compensated	1500 W
	– DUO circuit	1500 W
Low-volt halogen lamps	– Inductive transformer	1200 W
	– Electronic transformer	1500 W
	– Halogen lamp 230 V	2300 W
Dulux lamp	– Uncorrected	1100 W
	– Parallel compensated	1100 W
Mercury-vapour lamp	– Uncorrected	2000 W
	– Parallel compensated	2000 W
Switching capacity	– 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 (e.g. ABB EVG 1x18 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.

2.2.3 Circuit diagram



2.2.4 Description of the outputs

The device has two relay outputs A and B. The switched voltage is applied at terminal L. The switched voltage is applied at output L'.

The other terminals are not used and isolated from the device. They can be used as auxiliary terminals (e.g. for looping through the N or PE conductor).

2.2.5 Assembly and installation

The device is solely intended for operation in the Room Controller Basis Device. It can be snapped into any module slot. The mounting position can be selected as required.

2.3 ES/M 2.230.1 Electronic Switch Actuator Module, 2-fold, 230 V

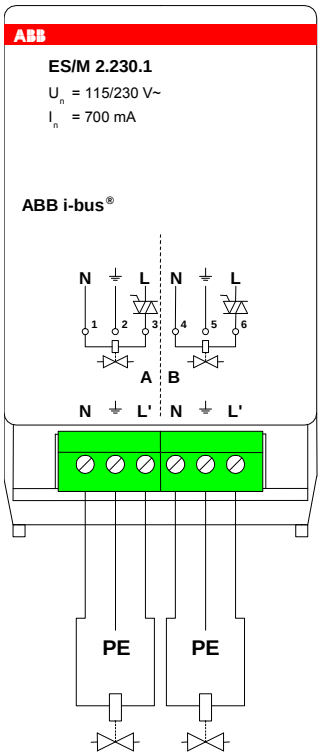
The 2-fold Electronic Switch Actuator Module is snapped into any module slot of the Room Controller Basis Device. Using two semiconductor outputs, it switches two resistive loads such as electrothermal valve drives for heating control. The outputs are noise-free and wear-resistant. The nominal switching voltage is 115 or 230 V.

Both the incoming supply and the internal voltage are supplied via the Room Controller Basis Device. Contact is automatically established when the modules are snapped in place.

2.3.1 Technical data

Supply / Incoming supply	– Internal supply	Made available by the Room Controller Basis Device, contact made via contact system on base of module
	– Incoming supply	90…264 V AC / DC, contact established via contact surfaces at the front
Outputs	– 2 load circuits	Semiconductor outputs for resistive loads Inrush current: max. 1 A Continuous current: Max. 700 mA
Connections	– Load circuits	2 x three-pole, plug-in screw terminals
	– Connection cross-sections	0.2…2.5 mm^2 stranded 0.2…4.0 mm^2 solid
Ambient temperature range	– Storage	-25 °C … 55 °C
	– Transport	-25 °C … 70 °C
Design	– Type of installation	For snapping into the Room Controller Basis Device
	– Housing, colour	Plastic housing, anthracite, halogen-free
	– Housing dimensions (W x H x D)	49 mm x 42 mm x 93 mm
	– Weight	0.08 kg
CE mark	– in accordance with the EMC guideline and low voltage guideline	

2.3.2 Circuit diagram



2.3.3 Description of the outputs

The device has two semiconductor outputs A and B. The switched incoming supply is applied at output L'. The PE conductor is brought out from the device to connect the protective conductor.

2.3.4 Assembly and installation

The device is solely intended for operation in the Room Controller Basis Device. It can be snapped into any module slot. The mounting position can be selected as required.

2.4 ES/M 2.24.1 Electr. Switch Actuator Module, 2-fold, 24 V

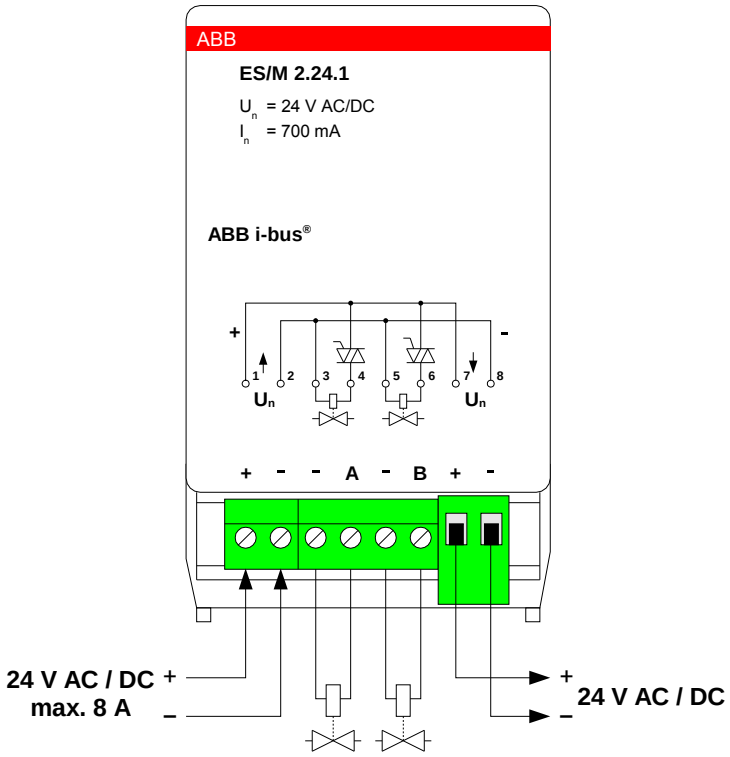
The 2-fold Electronic Switch Actuator Module is snapped into any module slot of the Room Controller Basis Device. Using two semiconductor outputs, it switches two resistive loads such as electrothermal valve drives for heating control. The outputs are noise-free and wear-resistant. The nominal switching voltage is 12 or 24 V.

The internal voltage is supplied via the Room Controller Basis Device. Contact is automatically established when the modules are snapped in place.

2.4.1 Technical data

Supply / Incoming supply	– Internal supply	Made available by the Room Controller Basis Device, contact made via contact system on base of module
	– Incoming supply	10…30 V AC / DC
Outputs	– 2 load circuits	Semiconductor outputs for resistive loads Inrush current: max. 1 A Continuous current: Max. 700 mA
Connections	– Load circuits	1 x four-pole, plug-in screw terminals
	– Incoming supply	1 x two-pole, plug-in screw terminal each for connection and for looping through
	– Connection cross-sections	0.2…2.5 mm^2 stranded 0.2…4.0 mm^2 solid
Ambient temperature range	– Storage	-25 °C … 55 °C
	– Transport	-25 °C … 70 °C
Design	– Type of installation	For snapping into the Room Controller Basis Device
	– Housing, colour	Plastic housing, anthracite, halogen-free
	– Housing dimensions (W x H x D)	49 mm x 42 mm x 93 mm
	– Weight	0,08 kg
CE mark	– In accordance with the EMC guideline and low voltage guideline	

2.4.2 Circuit diagram



2.4.3 Description of the outputs

The output has two switched semiconductor outputs A and B. The incoming supply is fed or looped through to the next module via terminals “+” and “–“.

2.4.4 Assembly and installation

The device is solely intended for operation in the Room Controller Basis Device. It can be snapped into any module slot. The mounting position can be selected as required.

3 Commissioning

3.1 Overview

The Room Controller has a single application program which is used to set to the device function. Programming requires ETS3 or higher.

Note: Please note that the programming of the device is only possible when the supply voltage is available.

User programs	Max. number of communication objects	Max. number of group addresses	Max. number of associations
RC/A 4.2: Room Controller modular 4f2/1.0	125	254	255
RC/A 8.1: Room Controller modular 8f/2.0	246	254	255
RC/A 8.2: Room Controller modular 8f2/1.0	245	254	255

Note

The programming requires Engineering Software Tool ETS2 V1.3 or higher.

If ETS3 is used a *.VD3 or higher type file must be imported.

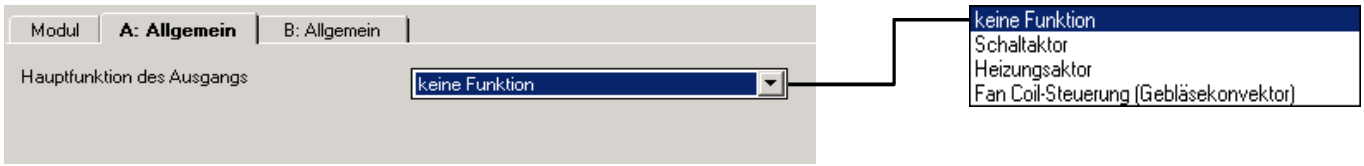
The application program for the ETS product tree can be found at *ABB/Room automation/Room Controller*.

The devices do not support the closing function of a project or the KNX devices in the ETS. If you inhibit access to all devices of the project with a *BA password* (ETS2) or a *BCU code* (ETS3), it has no effect on this device.
Data can still be read and programmed.

3.2 General functions

3.2.1 “General” parameter window

The operating mode of the input is set in the first parameter.



Parameter “Operating mode of output”

The function of the output can be selected here. The options available are “Switch actuator”, “Heating actuator” and “Fan coil control”.

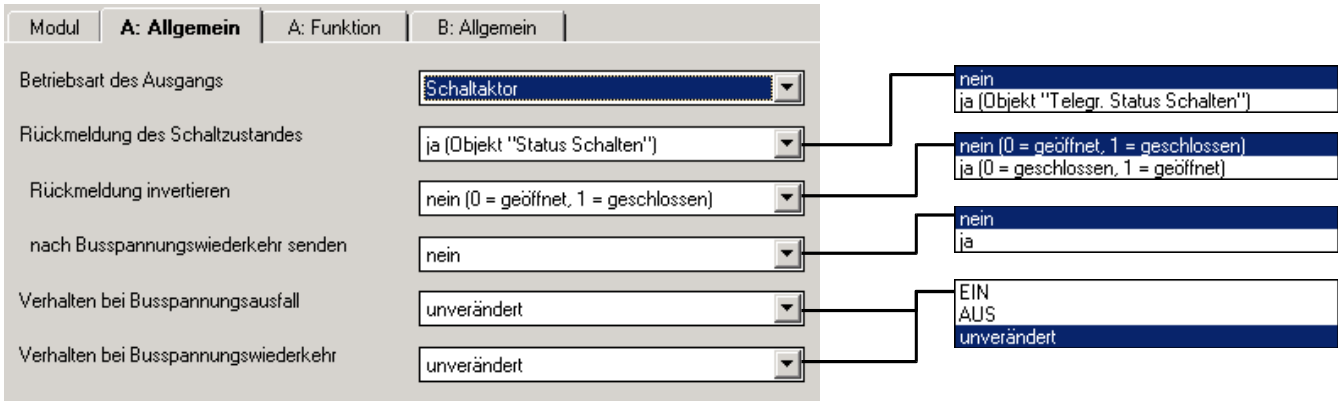
The other parameters are dependent on the selected operating mode.

See section 4 for further explanations about the operating modes.

3.3 Operating mode "Switch actuator"

3.3.1 "General" parameter window

General settings can be carried out in this parameter window such as the reaction during/after bus voltage failure and the status response function.



Parameter "Status response of switching state"

The object "Status switch" is enabled with this parameter. It is used to indicate the current switching state on the bus..

Parameter "Status response inverted"

This parameter is visible if the *"Status response of switching state" is carried out*. If "yes" is entered here, the status response object sends a "1" when the relay contact is open and a "0" when the relay contact is closed. This can be advisable for example when the output is operated as a normally closed contact so that the telegram value "1" is received as a status response after an ON command.

Parameter "sending after bus voltage recovery"

This parameter is visible if a *"Status response of switching state"* is undertaken. Here you can set whether the switching state is updated on the bus after a bus voltage recovery. The update is carried out in connection with the transmission delay of the Room Controller.

Parameter "Reaction on bus voltage failure"

The output can adopt a defined state on bus voltage failure via this parameter.

In the parameter you can set whether the output switches "ON" or "OFF". The contact position can also remain unchanged in the setting "unchanged" (internal function is retained). In this case, the output can still be operated, e.g. via push buttons that are connected to binary inputs of the same device.

Parameter "Reaction on bus voltage recovery"

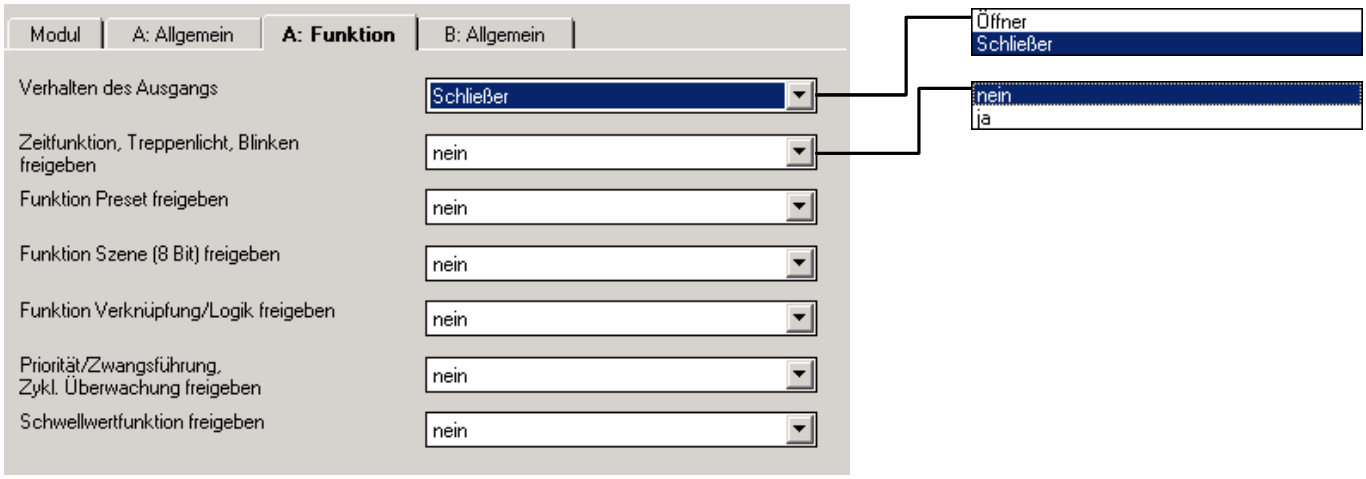
With this parameter, the output can be switched "ON" or "OFF" on recovery of the bus voltage. In the setting "unchanged", the state of the output does not change.

On bus voltage recovery, the output is set once the parameterised initialisation time of the Room Controller has elapsed.

Note: This parameter can be overwritten by the parameters which are enabled in the "Function" parameter window.

3.3.2 Parameter window "Function"

In this parameter window, basic settings for the function of an output are carried out. Additional functions can also be enabled.



Parameter “Reaction of output”

In this parameter you can set whether the output operates as a “Normally closed contact” or “Normally opened contact”.

In the “Normally opened contact” function, an ON command leads to the closing of a contact while an OFF contact causes the contact to be opened. When “Normally closed contact” is selected, the reverse process is carried out.

Parameter: “Enable function ‘time, staircase lighting, flashing”

This parameter enables the function “Time, staircase lighting, flashing” (parameter window “A: Time”)

Parameter: “Enable function ‘presets”

This parameter enables the “Preset” function (parameter window “A: Presets”).

Parameter “Enable function "scene (8 bit)”

The object “8-bit scene” is enabled via this parameter (parameter window “A: Scene”).

Parameter “Enable function ‘logic’”

This parameter enables the function “Logical connection, disable function” (parameter window “A: Logic”).

Parameter: “Enable function ‘priority/forced operation, cyclic monitoring’”

This parameter enables the safety functions “Cyclic monitoring, forced operation” (parameter window “A: Safety”).

Parameter “Enable threshold function”

This parameter enables the ‘Threshold value function” (parameter window “A: Threshold”).

3.3.3 Parameter window “Time”

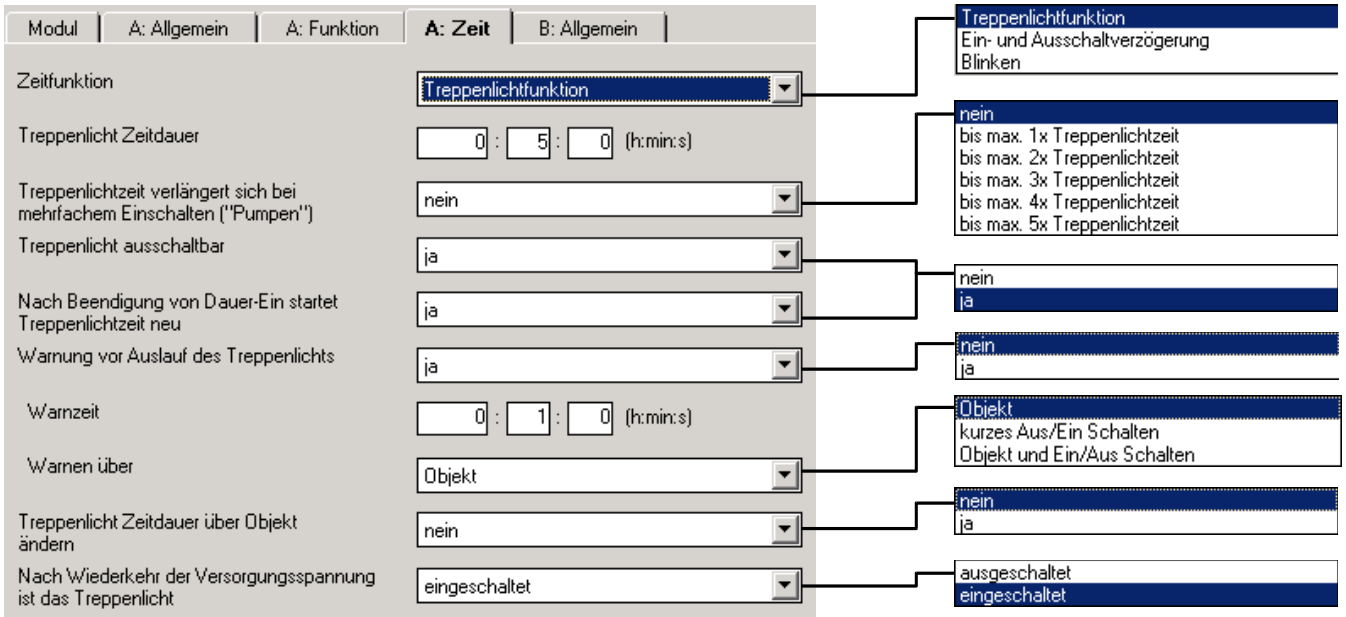
The time functions such as the staircase lighting function, ON/OFF delay and flashing can be set here. The parameter window is enabled under “A: Function”.

Explanations about the time functions can be found in section 4.2.1. Please note the function diagram in section 4.2.6.

Parameter “Time function”

This parameter defines the type of the time function. It is possible to choose between three types: “Staircase lighting”, “ON/OFF delay” and “Flashing”.

Selection “Staircase lighting function”



The staircase light is switched on via an ON telegram. The staircase lighting time is started when the function is activated. It is switched off when the staircase lighting time elapses.

Parameter “Duration of staircase lighting”

The operating time defines how long the staircase lighting remains switched on after an ON command.

Parameter "Extending staircase lighting by multiple operation ("pumping up")

If a further ON telegram is received during the staircase lighting time, the remaining staircase lighting time can be extended by a further period. The maximum time can be set using this parameter.

In the setting “no”, the staircase lighting is reset on receipt of an ON telegram (“retrigger function”).

Parameter “Staircase lighting can be switched off”

Here you can set whether the staircase lighting is switched off prematurely by an OFF telegram (“yes”), or whether the OFF telegram is ignored during the staircase lighting time (“no”).

Note: If the parameter value is “yes”, the staircase lighting can also be switched off via the other following objects, if they lead to a disconnection: “Logical connection”, “Preset”, “Light scene”, “Disable”, “Permanent ON”, “Forced operation”.

Parameter
“Restart of staircase time after end of permanent ON”

This parameter defines how the output is set on receipt of the telegram value “0” on the object “Permanent ON”. The output can switch off immediately (“no”) or remain switched on for the duration of the staircase lighting time.

Parameter “Warning before end of staircase lighting”

The user can be warned before the staircase lighting time elapses for the duration of the “Warning time”. The warning time is contained in the staircase lighting time.

There are two possibilities for issuing a warning: The first one involves setting the object “Warning staircase lighting” to “1”. The other option switches the output off and on again very briefly. Both possibilities can be set together or separately.

Parameter “Warning time”

The above warning time is set in this parameter.

Parameter “Duration of staircase lighting can be changed by object”

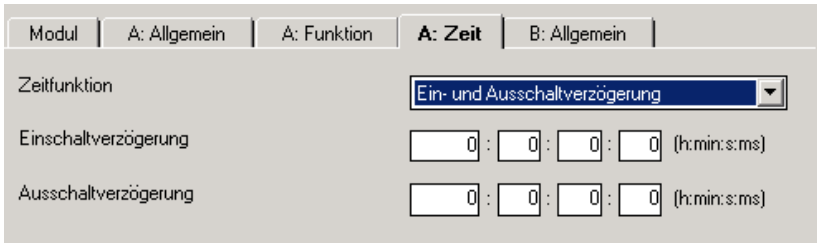
The object “Duration of staircase lighting” is enabled by this parameter. It enables the staircase lighting time to be modified via the bus.

Parameter
“After supply voltage recovery the staircase light is”

Here you can set whether the staircase lighting is “switched on” or “switched off” on recovery of the bus voltage or the supply voltage of the Room Controller. If the option “switched on” is selected, the staircase lighting time restarts after bus voltage recovery.

Selection “ON and OFF delay”

Selection “ON and OFF delay”



Parameter “Switch ON delay”

This parameter sets the delay for switching on the output after an ON command.

Parameter “Switch OFF delay”

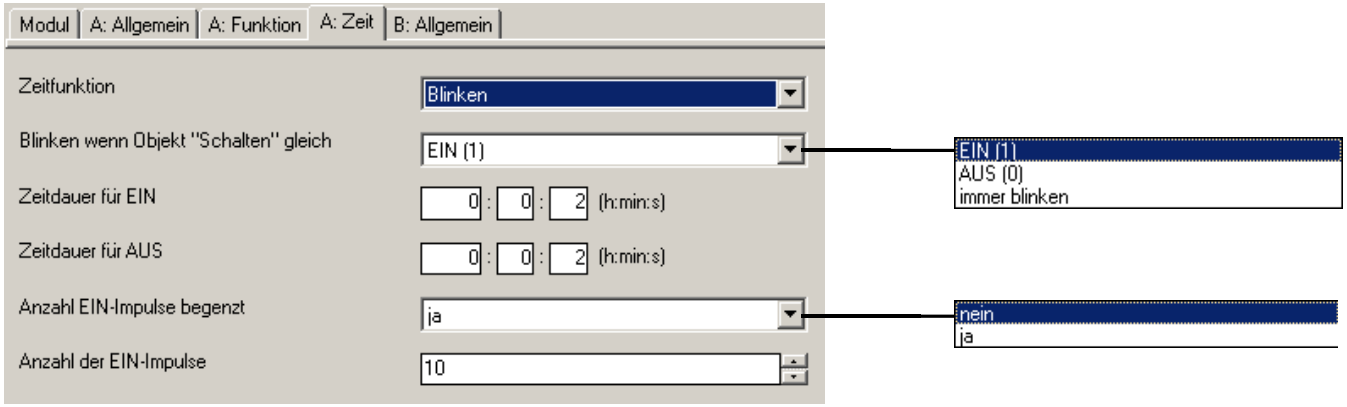
This parameter sets the delay for switching off the output after an OFF command.

Selection “Flashing”

When the flashing function is activated, the output starts to flash as soon as the object “Switch” receives the corresponding value. The flashing rate can be set in the parameters (“Time for ON” or “Time for OFF”). At the start of the flash rate, the output is always switched on. On receipt of a new value at the object “Switch”, the flashing rate starts from the beginning (except if the flashing has stopped).

As soon as the flashing stops, the output switches off immediately. The flashing can be inverted whereby the output is operated as a “Normally closed contact”.

Note: If the status response “Status switch” is active, it also indicates the current state of the relay during the flashing. With a rapid flashing rate, this can lead to a high bus load.



Parameter “Flashing if object ‘Switching’ is”

Here you set the value of the object *Switch* at which the output flashes. You can also set that the output always flashes.

Parameter “Time for ON” or “Time for OFF”

This parameter defines how long the output is switched on or off during a flashing period. The smallest value each time is a second; a rapid flashing period is not advisable due to the maximum switching frequency of the relay (contact endurance).

Parameter “Limited number of ON-impulses”

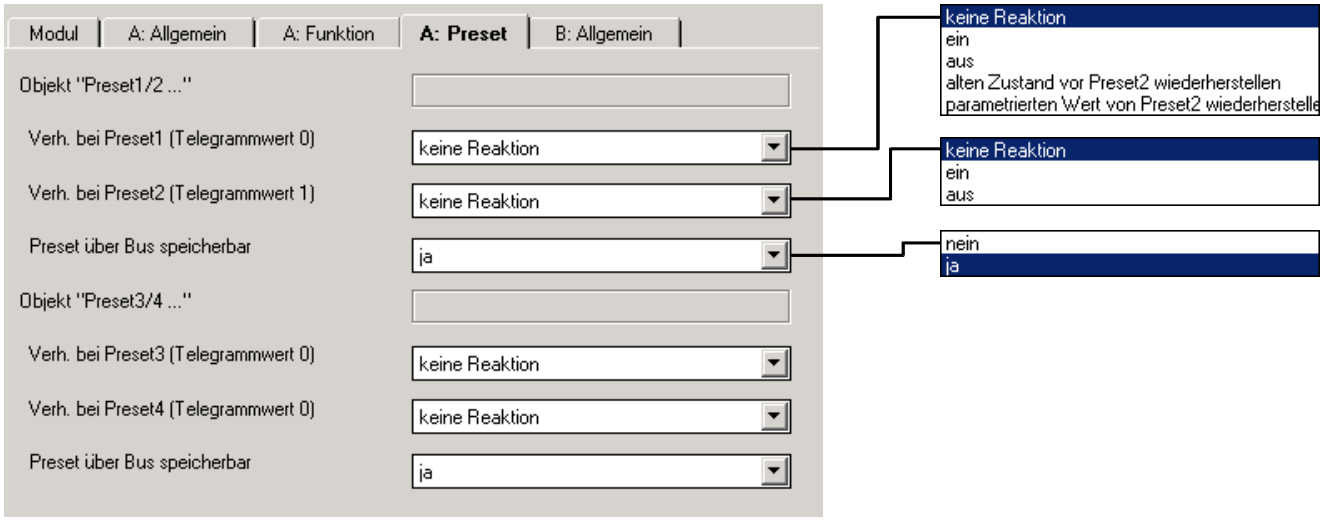
The number of flashing pulses can be limited here. After the output has been switched on and off for an adjustable **“**Number of ON impulses**”**, it will be switched off permanently.

3.3.4 Parameter window “Preset”

The preset function is used to retrieve a parameterised value, e.g. in order to implement lightscenes. In addition, the output value that is currently set can be saved as a new preset value. The parameter window is enabled under “A: Function”.

There are two objects available for retrieving and storing presets. The parameters for the objects “Preset 1/2” and “Preset 3/4” are identical; the objects “Preset 1/2” are described in the following section by way of example.

Explanations about the preset functions can be found in section 0. Please note the function diagram in section 4.2.6.



Parameter “Reaction on preset 1 (telegr. value 0)”

Preset 1 is retrieved if the object “Call preset 1/2” receives the telegram value “0”. In this case, the output can trigger a defined state (“ON”, “OFF” or “no reaction”).

One of the following functions can also be selected.

“Restore old value before Preset 2” recreates the state before the last retrieval of Preset 2.

Example: With preset 2, the lighting in a conference room is retrieved for a presentation. When the presentation is finished, the lighting is restored via preset1 to the state it was in beforehand.

“Restore parameterised value of preset 2” resets Preset 2 to the parameterised value. This can be advisable if the preset can be stored via the bus (see below).

Parameter “Reaction on preset 2 (telegr. value 1)”

This parameter sets which contact position is selected if the object “Call preset …” receives the telegram value “1”.

Parameter “Preset can be set via the bus”

The object “Set preset 1/2” is enabled via this parameter (parameter value “yes”). It is used to store the current contact position as a preset value.

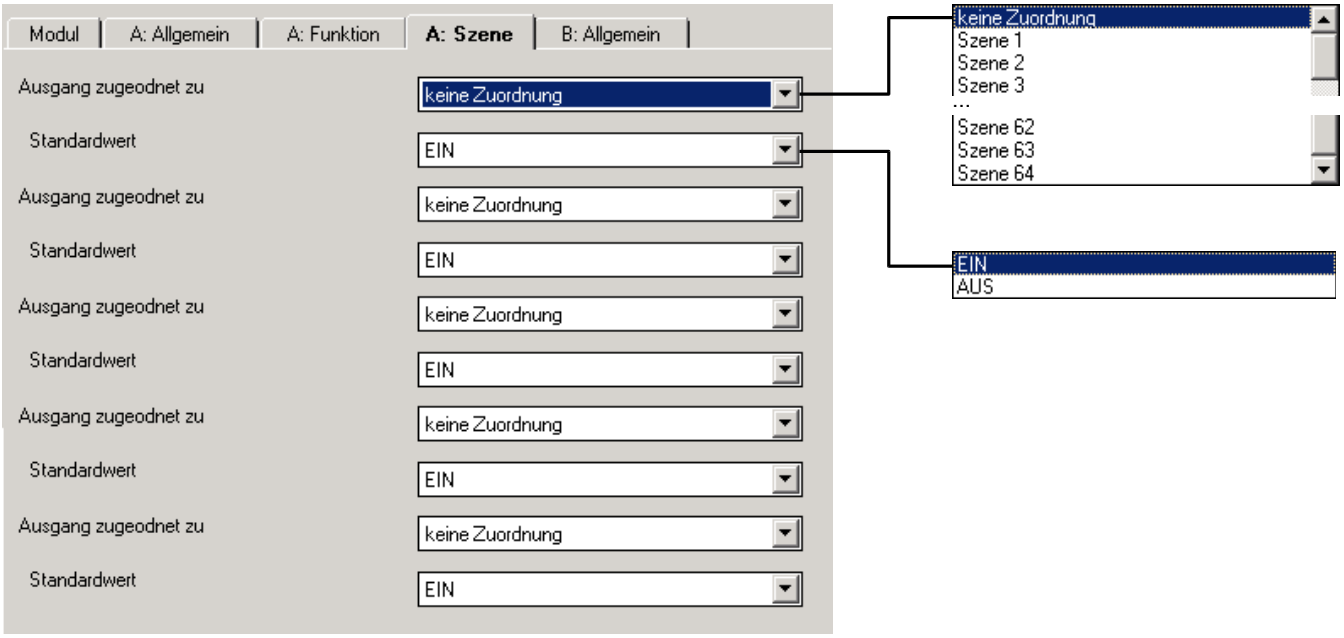
Telegram value “0” stores preset 1 while telegram value “1” stores preset 2.

If the special function *“restore old value before preset 2”* or “*restore parameterised value of preset 2”* has been assigned to preset 1, the telegram value “0” is ignored.

3.3.5 Parameter window “Scene”

In the 8-bit scene, a push button sends a scene number which causes the actuator to trigger a defined output state. The parameter window is enabled under “A: Function”.

Please note the function diagram in section 4.2.6.



Parameter “Output is assigned to”

Max. 64 different scenes (1…64) can be addressed via a group address. The output can be assigned to a maximum of 5 scenes.

Parameter “Standard value”

This parameter sets which state the output adopts when the scene is retrieved.

By storing a scene, the user has the opportunity to modify the programmed value. After programming or after a supply voltage failure, the value that is parameterised here is restored.

Note: When a scene is retrieved
- the time functions are restarted
- the logic operations are re-evaluated

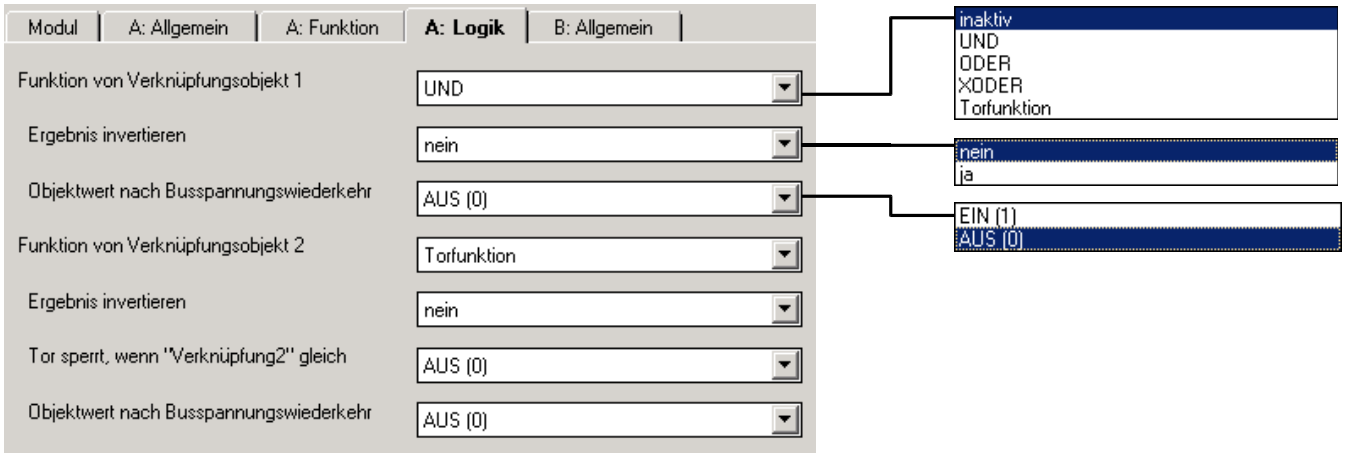
3.3.6 Parameter window “Logic”

The logic function makes up to two logic objects available for each output. These objects are logically linked with the object “Switch”. The parameter window is enabled under “A: Function”.

The logic is always re-calculated when an object value is received. The object “Logical connection 1” is first evaluated together with the object “Switch”. The result is then liked with object “Logical connection 2”.

The parameters are identical for both logic objects. The function is described in the following section using the example of object “Logical connection 1”.

Explanations about the logic function can be found in section 0. Please note the function diagram in section 4.2.6.



Parameter: “Function of object ‘Logical connection …’”

The logic function of the object “Logical connection …” is defined here. All three standard operators are possible (AND, OR, XOR). The gate function is also available which can block switching commands.

Parameter “Result is inverted”

The result of the logic operation can be inverted via this parameter: If the logic result is “0”, it is converted into a “1” (and vice versa).

Parameter: “Gate disabled, if ‘Logical connection …’ is”

This parameter is visible if the “Gate function” has been selected. It defines at which object value the gate is disabled, i.e. telegrams to the object “Switch” are ignored.

Parameter: “Object value after bus voltage recovery”

This parameter defines which value is assigned to the object “Logical connection 1” or “Logical connection 2” on bus voltage recovery.

3.3.7 Parameter window “Safety”

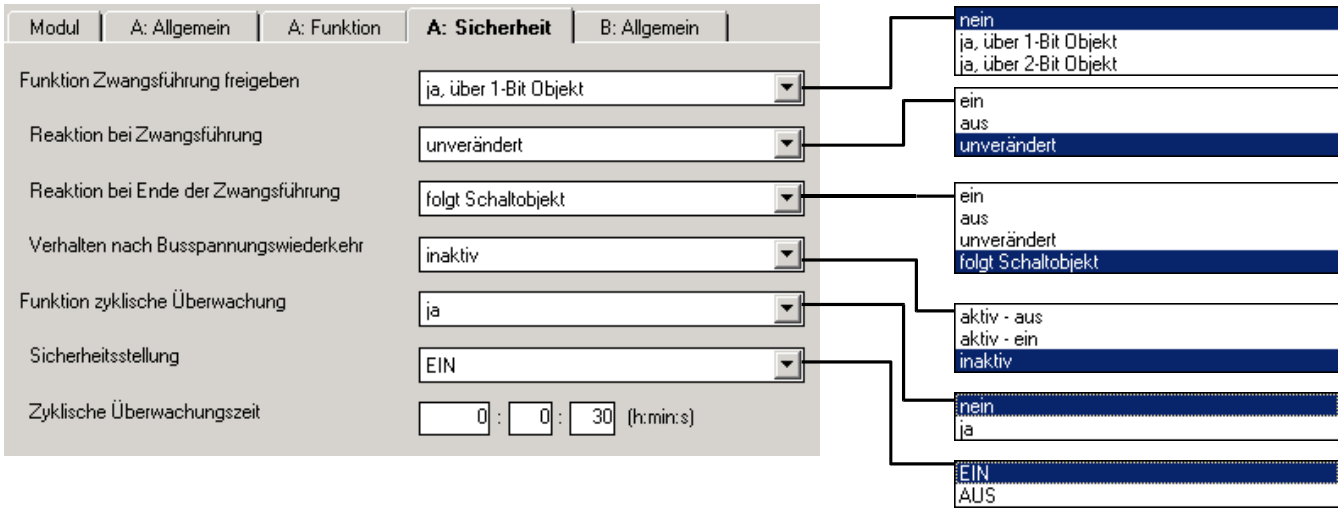
The safety functions enable a forced operation and the cyclical monitoring of the object “Switch”. The parameter window is enabled under “A: Function”.

The forced operation sets the output to a defined state which cannot be modified while the forced operation is active. Only the reaction on bus voltage failure/recovery has a higher priority.

The forced operation can take place via a 1 bit or 2 bit object. When using the 2 bit object, the output state is defined via the object value. At the end of the forced operation, the output always follows the state of the switch object.

When using the 1-bit forced operation, the output state is fixed. The reaction at the end of the forced operation can also be parameterised.

Please note the function diagram in section 4.2.6.



Parameter: “Enable function ‘forced operation’”

The forced operation function can be enabled via this parameter. It can be carried out via a 1 bit or 2 bit object.

Parameter “Reaction on forced operation”

This parameter sets which state the output adopts during a forced operation. It is only visible for 1 bit forced operation.

Parameter: “Reaction when forced operation ends”

This parameter is visible if forced operation is carried out via a 1 bit object.

The state of the relay at the end of the forced operation is defined here. The output can open, close, follow the switch object or remain unchanged.

Parameter: “After bus voltage recovery the forced operation is”

You set here whether forced operation is active or inactive after bus voltage recovery. If forced operation is active, the status of the output can be defined. If forced operation is inactive, the output normally follows the settings in the “General” parameter window.

Parameter: “Enable cyclic monitoring of object ‘Switch’”

The cyclic monitoring of the object “Switch” can be enabled here. If the device does not receive any telegrams via the object “Switch” for an adjustable period, the output is set to the safety position. The telegram value can be “0” or “1”.

This function is useful if the sensor sends the object “Switch” cyclically on the bus. It is recommended that the monitoring period is set slightly higher than three times the transmission cycle time.

Parameter: “Safety state”

The state which the relay adopts while the safety position is active is set here. The safety position is automatically cancelled as soon as the device again receives a telegram at the object “Switch”.

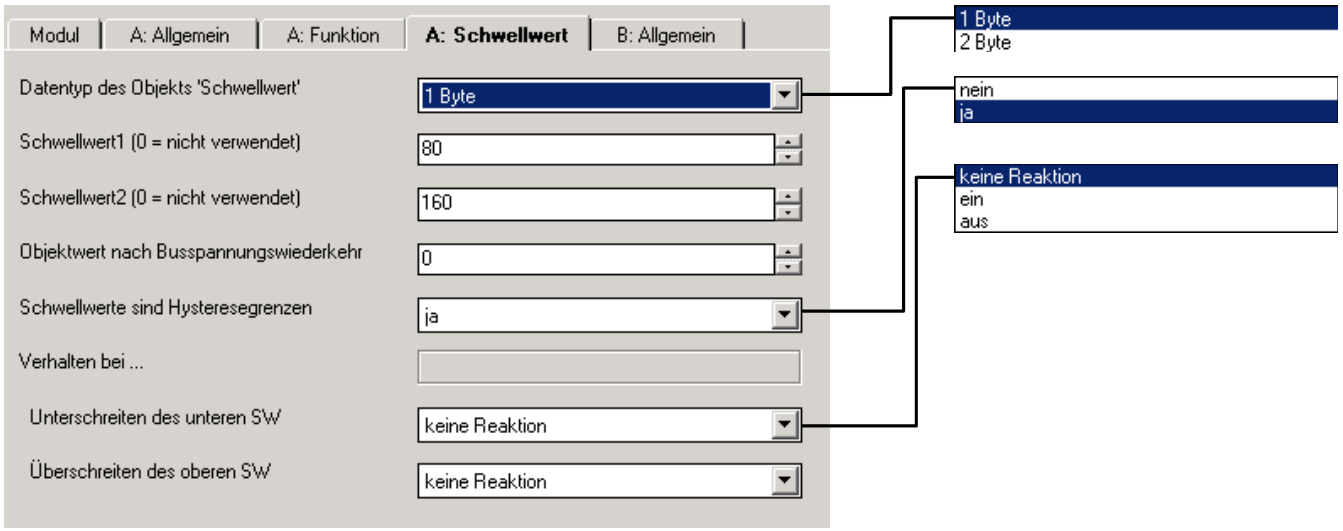
Parameter: “Cyclic monitoring time”

The monitoring time with which the object “Switch” is observed is set here.

3.3.8 Parameter window: “Threshold”

The threshold value function enables the evaluation of a 1 byte or 2 byte object. As soon as the object value falls below or exceeds a threshold value, a switching operation can be triggered. Up to two independent threshold values are available in total. The parameter window is enabled under “A: Function”.

Explanations about the function threshold value can be found in section 0. Please note the function diagram in section 4.2.6.



Parameter: “Data type of object ‘Threshold value’”

The data type of the object “Threshold value” can be defined here. It is possible to choose between a 1 byte integer value and a 2 byte floating point value.

Parameter: “Threshold value 1” and “Threshold value 2”

Two threshold values can be defined here. If they are not required, it is possible to enter zero here. The value range is dependent on the data type.

Parameter: “Object value after bus voltage recovery”

The value of the object “Threshold value” after bus voltage recovery can be defined here.

Note: When a threshold value is exceeded
- the time functions are restarted
- the logic operations are re-evaluated

Parameter: “Threshold values define hysteresis”

This parameter defines whether the 1st and 2nd threshold values should be interpreted as hysteresis limits. The hysteresis can reduce unwanted violations of the threshold value if the input value fluctuates around one of the threshold values.

Parameter: “Object value < lower threshold”

Parameter: “Lower thrsh. <= object < upper thrsh.”

Parameter: “Object value >= upper threshold”

These parameters are visible if the threshold values are not hysteresis limits. They define the reaction dependent on the threshold value.

The possible reaction of the output is: ON / OFF / no reaction

Parameter: “Reaction on exceeding upper threshold”

Parameter: “Reaction on falling below lower threshold”

These parameters are visible if the threshold values are interpreted as hysteresis limits. They define the reaction of the output if the object value “Threshold value” exceeds or falls below the upper or lower threshold. A reaction only occurs if the object value was previously smaller or larger than the lower or upper threshold value. Further explanations can be found in section 0.

3.3.9 Communication objects

3.3.9.1 Overview of the objects

General objects

No.	Function	Object name	Data type	Flags
0/15	**Switch**	**Output A**	**1 bit (EIS 1) DPT 1.001**	**C, W**
Switches the output on and off (switch command). If the output is programmed as a normally open contact, the relay is closed with telegram value “1” and opened with telegram value “0” (the inverse is true should the output be programmed as a “normally closed” contact).				
1/16	**Status switch**	**Output A**	**1 bit (EIS 1) DPT 1.001**	**C, R, T**
This object reports the current state of the output. Displays the current state of the output. It can be inverted by parameters. Telegram value: Default: 0: relay opened 1: relay is closed Inverted: 0: relay is closed 1: relay is opened The object is visible provided the parameter “Status response of switching state” has the value “yes”. It is sent when a value changes. Note: This object may have an incorrect value after mains voltage failure if the behaviour for both bus voltage failure as well as bus voltage recovery is set to “unchanged”.				
29	**Status byte**	**Output A…B**	**1 byte non DPT**	**C, R, T**
This object provides further information about the operating state of the device (only Electronic Switch Actuator Modules ES/M 2.230.1 and ES/M 2.24.1). **Bit** **Meaning** 0 Overload (e.g. short circuit) on output A 1 Overload (e.g. short circuit) on output B 2 not used, always “0” 3 not used, always “0” 4 not used, always “0” 5 not used, always “0” 6 Incoming supply voltage available 7 Supply voltage type: 0 = AC; 1 = DC A detailed table for encoding the object value can be found in section 5.				

Additional function “Time, staircase lighting, flashing”

No.	Function	Object name	Data type	Flags
2/17	**Permanent ON**	**Output A**	**1 bit (EIS1) DPT 1.001**	**C, W**
For continuous activation of the output in the staircase lighting function. If this object receives the value “1”, the output is switched on permanently should the function *Staircase lighting* be used. The behaviour can be parameterised when Permanent ON is ended (telegram value “0”).				
3/18	**Warning staircase lighting**	**Output A**	**1 bit (EIS1) DPT 1.005**	**C, T**
Used to provide a warning before the staircase lighting time times out. This object can be enabled in the time function “Staircase lighting” via a parameter. During the warning time before the staircase lighting time elapses, the object will receive the value “1”. Thus, for example, the user can be warned by actuation of the push button LED.				

No.	Function	Object name	Data type	Flags
4/19	**Duration of staircase lighting**	**Output A**	**2 Byte DPT 7.005**	**C, R, W**

Modifies the duration of staircase lighting (in seconds).

The staircase lighting time (t_{ON}) can be changed via this object. The time is defined in seconds. The object value is set by the original parameterised value after supply voltage recovery.

This object is visible if the parameter "*Duration of staircase lighting change via bus"* is equal to "yes".

Note:
The duration of the staircase lighting time may not be less than the warning time. The warning "via short switch on/off" is always undertaken.

Additional function "Preset"

No.	Function	Object name	Data type	Flags
5/20 7/22	**Call preset 1 and 2 *and* Call preset 3 and 4**	**Output A**	**1 bit (EIS1) DPT 1.017**	**C, W**

Retrieves a parameterised output state.

0: retrieves preset1 or preset
1: retrieves preset2 or preset4.

For "Preset1" or. "Preset3" it is possible to parameterise as a further option that the state before recall of "Preset2" or "Preset4" is restored, or that the switch state is reset to the parameterised value. This is useful if Preset2 or Preset4 is stored.

6/21 8/23	**Set preset 1/2 *and* Set preset 3/4**	**Output A**	**1 bit (EIS1) DPT 1.017**	**C, W**

Stores the currently set switching state of the output as a new preset value.

"0" stores preset1 or preset3
"1" stores preset2 or preset4

If the special function *"restore old value before preset 2"* or "*restore parameterised value of preset 2"* has been assigned to preset 1, the telegram value "0" is ignored.

Additional function "Scene (8 bit)"

No.	Function	Object name	Data type	Flags
9/24	**8 bit scene**	**Output A**	**1 Byte DPT 18.001**	**C, W**

Integrates the actuator in a scene. The object value contains a scene number as well as the instruction as to whether a scene should be retrieved or the current output state should be stored as a new scene value.

A scene number (0…63, complies with Scene Nos. 1…64) is received via this object, as well as the information whether a scene is recalled or whether the current brightness should be stored in the scene.

Bit by bit telegram code: MxSSSSSS
M: 0 – scene is called
1 – Scene is stored
x not used
S: number of the scene (1…64)

The following object values result:	
0: Call scene 1	128: Store scene 1
1: Call scene 2	129: Store scene 2
…	…
63: Call scene 64	191: Store scene 64

Other values are ignored.

Additional function “Connection/logic”

No.	Function	Object name	Data type	Flags
10/25 11/26	**Logical connection 1 *and* Logical connection 2**	**Output A**	**1 bit (EIS1) DPT 1.002**	**C, W**
For logic operation of the object “Switch”. The logic function can be parameterised. First of all the object “Switch” is linked to “Logical connection 1”. The result is then liked with object “Logical connection 2”. The type of logical connection involved is defined in the parameters.				

Additional function “Priority/forced operation, cyclic monitoring”

No.	Function	Object name	Data type	Flags
12/27	**Priority/forced operation**	**Output A**	**1 bit (EIS1) DPT 1.003 *or* 2 bit (EIS8) DPT 2.001**	**C, W**
Sets the output to a defined state and disables it. Once the forced operation has finished, the output reverts to the state that would have been set without forced operation. The output can be forcibly operated via this object (e.g. by a higher-level control). *Forced operation via 1-bit object:* If this object contains the value “1”, the output is forcibly set to a parameterised position (e.g. by a higher-level control). The output state cannot be changed until forced operation has ended (object value “0”). Telegram value 0: forced operation inactive 1: forced operation active *Forced operation via 2-bit object* At the end of forced operation, the state which would be present without forced operation is restored. During forced operation, the device operates normally in the background but the output is not changed. The object is visible if in parameter “Enable function "forced operation” = “yes, via 2 bit object” is set. Telegram value 0, 1 Forced operation cancelled 2 Forced operation cancelled 2 Switch on by force				

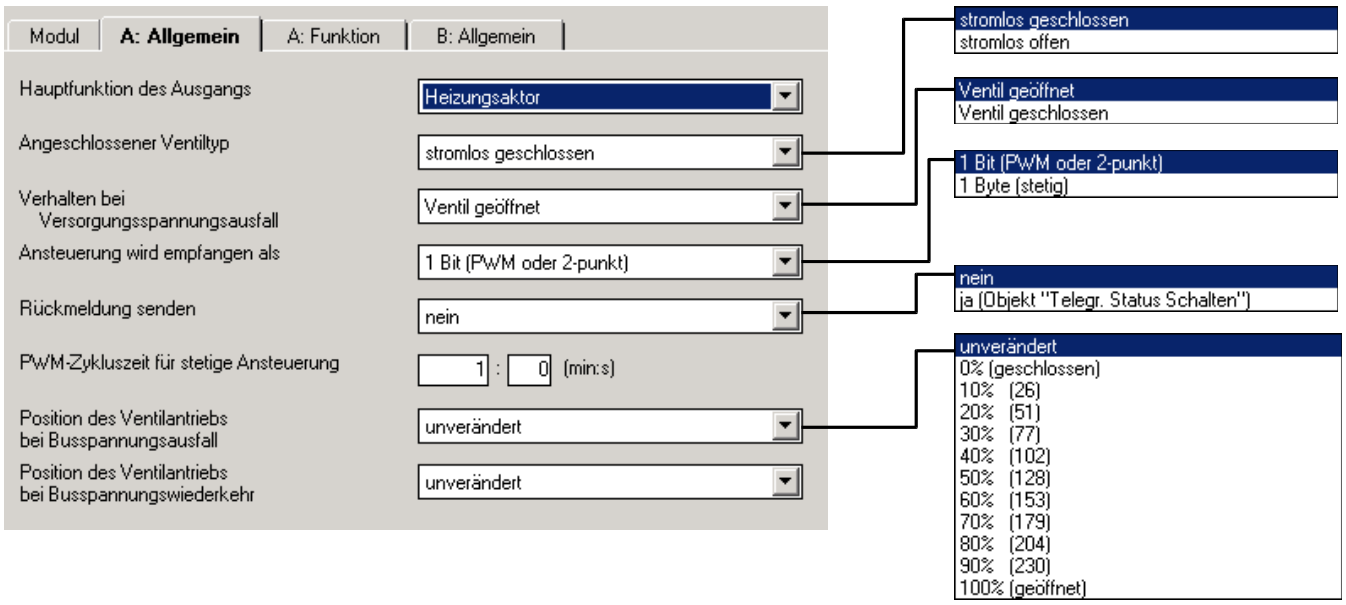
Additional function “Threshold value”

No.	Function	Object name	Data type	Flags
13/28	**Threshold value**	**Output A**	**1 byte (EIS6) DPT 5.010 *or* 2 byte (EIS5) DPT 7.001**	**C, W**
If the object value exceeds a parameterisable threshold value, a switching operation can be executed. The output of a value can be received via this object. If the object value exceeds a parameterisable upper or lower threshold value, a switching operation can be executed. A 1 byte whole integer value or a 2 byte floating point value are possible as data types (can be set in the parameters).				

3.4 Operating mode "Heating actuator"

The function “Heating actuator” switches an electronic relay which is generally used to control an electrothermal valve drive. The device is normally controlled by a room thermostat. Various types of control are possible (e.g. continuous-action control).

3.4.1 Parameter window “General”



Parameter: “Connected valve type”

In this parameter, you can set whether a valve should be controlled as “normally closed” or “normally open”. If the valve is normally closed, the OPENING of the valve is achieved via the closing of the relay. If the valve is normally open, the opening of the valve is achieved by the opening of the relay.

Parameter: “Reaction on supply voltage failure”

On failure of the supply voltage, the Room Controller does not function. With this parameter, the output can be set to a defined state.

This parameter is only visible for the Switch Actuator Module SA/M. The Electronic Switch Actuator Modules ES/M 2.xx.1 always switch off on failure of the supply voltage (high-resistance).

Parameter: “Control signal is received as”

The heating actuator can either be controlled via the 1 bit object “Switch” or the 1 byte object “Control value (PWM)”.

In 1 bit control, the heating actuator functions in a similar way to a standard switch actuator: The room thermostat controls the heating actuator via standard switching commands. A 2-step control or pulse width modulation of the control value can be implemented in this way.

For 1 byte control, a value of 0…255 (corresponds to 0 %…100 %) is preset by the room thermostat. This process is also known as “continuous-action control”. At 0 %, the valve is closed and at 100 % it is fully opened. The heating actuator controls intermediate values via pulse width modulation (see graphics above).

Parameter “Send status response”

This parameter enables the object “Status switch” and defines its function. The object can have various functions depending on whether the actuator is controlled via a 1 bit or 8 bit object. The following table provides an overview:

1 bit (PWM or 2-step)	Object value is identical to the value of the object “Switch”
1 byte (continuous)	*Setting “0% = OFF, otherwise = ON”:* If the valve is fully closed, the object has the value “0”, otherwise it has the value “1”. *Setting “current status of the output”:* The object value corresponds to the current control of the valve. If the value is “ON”, the valve is open. If the value is “OFF”, the valve is closed. **Please note that this setting may result in an increased bus load!**

Parameter: “PWM cycle time for continuous control”

The interpulse period of the pulse width modulation for continuous-action control is set here (corresponds to t_{CYC} in section 4.3).

For 2-step control (1 bit control), the pulse width modulation is only used in fault mode, during forced operation and directly after bus voltage recovery.

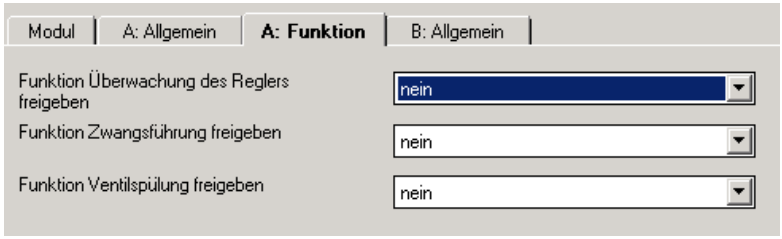
Parameter: “Position of the valve drive on bus voltage failure”

This parameter sets how the valve drive is triggered on failure of the bus voltage. The programmed value is used as the PWM cycle time.

Parameter: “Position of the valve drive on bus voltage recovery”

This parameter sets how the valve drive is triggered after bus voltage recovery until the first switching or positioning command is received from the room thermostat. The programmed value is used as the PWM cycle time.

3.4.2 Parameter window "Function"



Parameter “Enable monitoring of the thermostat”

The cyclic monitoring of the room thermostat can be enabled here. The failure of the thermostat can thus be detected. The output switches to fault mode and moves to a defined position.

Parameter: “Enable function ‘forced operation’”

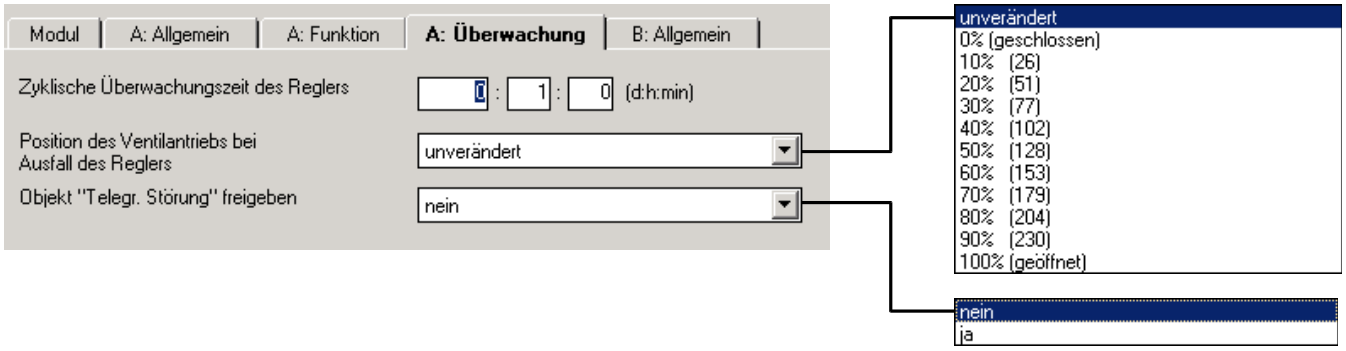
The forced operation of the output can be enabled here in order to move the outputs to a specific position, e.g. for inspection purposes.

Parameter: “Enable function ‘valve purge’”

The cyclic valve purge can be enabled here to prevent deposits from forming in the valves.

3.4.3 Parameter window: “Monitoring”

This parameter window is visible if the value *yes* has been entered in the parameter *Enable cyclic monitoring time of room thermostat* in the parameter window “x: Function”.



Parameter: “Cyclic monitoring time of room thermostat”

The telegrams of the room thermostat are transferred to the electronic actuator at specific intervals. If one or more of the consecutive telegrams is omitted, this can indicate a communications fault or a malfunction in the room thermostat. If there are no telegrams to the objects “Switch” or “Control value (PWM)” during the period defined in this parameter, the actuator switches to fault mode and triggers a safety position. The fault mode is ended as soon as a telegram is received.

Note: If this parameter window is visible, the room thermostat must send the control value cyclically, otherwise no function is possible. The monitoring time should be greater than the cyclic transmission time (recommended: factor 2).

Parameter: “Position of the valve drive on failure of the room thermostat”

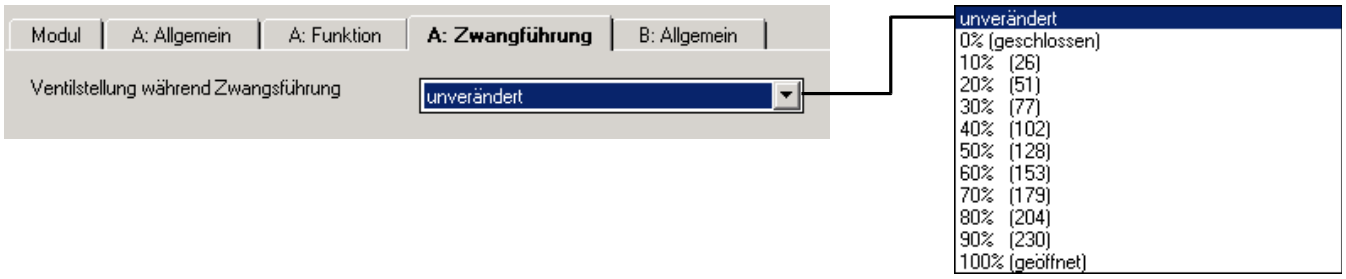
The safety position which is triggered by the actuator in fault mode is defined here. The switch cycle time t_{CYC} of the control is defined in the parameter “*PWM cycle time for continuous control*”.

Parameter “Enable object "Telegr. Thermostat fault”

The object “Telegr. fault thermostat” that can display the failure of the room thermostat can be enabled in this parameter.

3.4.4 Parameter window “Forced operation”

The function can be activated and deactivated via the object “Forced operation”. During a forced operation, the actuator triggers a freely adjustable forced position, which can no longer be changed. This has the highest priority, i.e. it is not modified by a valve purge or safety position.

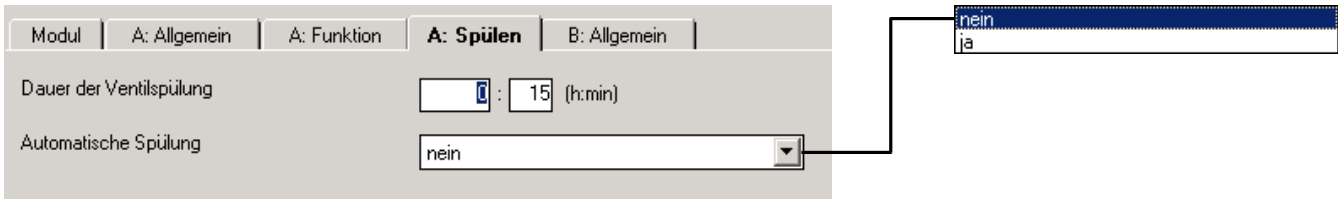


Parameter: “Valve position during forced positioning”

The valve position triggered by the actuator during the forced operation is defined in this parameter. The switch cycle time t_{CYC} of the control is defined in the parameter “*PWM cycle time for continuous control*”.

3.4.5 Parameter window: “Valve purge”

Regular purging of a heating valve can prevent deposits from forming in the valve area and restricting the valve function. This is particularly important at times when the valve position does not change very much. The valve is opened to the maximum during a valve purge. It can be triggered via the object “Trigger valve purge” and/or automatically at adjustable intervals.



Parameter: “Time of valve purge”

The duration of a valve purge is set here.

Parameter: “Automatic valve purge”

If “yes” is entered in this parameter, the valve is automatically purged at adjustable intervals.

Parameter: “Period between valve purges”

This parameter is only visible with Automatic valve purge. It defines the interval between two valve purges.

3.4.6 Communication objects

3.4.6.1 Overview of the objects

No.	Function	Object name	Data type	Flags
0/15	**Switch**	**Output A**	**1 bit (EIS1) DPT 1.001**	**C, W**
This object is visible if the control of the heating actuator is implemented via a 1 bit object. It is used for switching the output. “0”: close valve “1”: open valve The output is controlled directly depending on if the valve is a "normally open" or "normally closed" type.				
0/15	**Control value (PWM)**	**Output A**	**1 byte (EIS6) DPT 5.001**	**C, W**
Determines the control value of the valve via the interpulse ratio (pulse width modulation) of the output. This object is visible if the control of the heating actuator is implemented via an 8 bit object, e.g. within a continuous control. At object value 0, the valve is closed and at object value 255 it is fully opened. Telegram value: 0 valve closed … 255 valve fully opened				
1/16	**Status switch**	**Output A**	**1 bit (EIS1) DPT 1.001**	**C, T**
Reports the switching state of the valve control (valve opens / closes). The object is visible if the feedback is activated in the parameter settings. It indicates the switching state of the output. The object value is sent with changes. The response of the object can be set when controlling a heating actuator via an 8 bit object in the parameter “Send status response”: *current status of the output:* 0: Valve will be closed 1: Valve will be opened *0% = 0, otherwise = 1* 0: Valve is closed (0%) 1: Valve is not closed (1% … 100%)				
3/18	**Forced operation**	**Output A**	**1 bit (EIS1) DPT 1.003**	**C, W**
Sets the output to a defined state and disables it. This object is visible if the 1 bit forced operation is enabled in the parameters. If the value "1" is received, forced operation is activated and the output controls the set valve position. If the value "0" is received, forced operation ends. The output remains unchanged until a new control value is received (via object “Switch” or “Control value PWM”).				
4/19	**Trigger valve purge**	**Output A**	**1 bit (EIS1) DPT 1.010**	**C, W**
This object is visible if the purge function is enabled in the parameters. If the value "1" is received, the valve is opened for the duration of the valve purge. If the value "0" is received, the valve purge ends.				
5/20	**Status valve purge**	**Output A**	**1 bit (EIS1) DPT 1.001**	**C, T**
Indicates that valve purge is active. This object indicates that valve purge is active. 0: valve purge is not active: 1: valve purge is active				

No.	Function	Object name	Data type	Flags
11/26	**Thermostat fault**	**Output A**	**1 bit (EIS1) DPT 1.005**	**C, T**

Indicates a possible thermostat fault.

This object indicates a possible fault in the room thermostat. The object "Switch" or "Control value (PWM)" can be cyclically monitored. If the object value is not received for a programmable time, the device assumes that the room thermostat has failed and signals a fault.

0: no fault
1: fault

No.	Function	Object name	Data type	Flags
29	**Status byte**	**Output A…B**	**1 byte non DPT**	**C, R, T**

This object provides further information about the operating state of the device (only Electronic Switch Actuator Modules ES/M 2.x.1).

This object is only visible with the Electronic Switch Actuator Modules ES/M 2.x.1. It provides more detailed information about the operating state of the device. The object value is sent with changes.

Bit	Meaning
0	Overload (e.g. short circuit) on output A
1	Overload (e.g. short circuit) on output B
2	Incoming supply voltage available
3	Supply voltage type: 0 = AC; 1 = DC
4	not used, always “0”
5	not used, always “0”
6	not used, always “0”
7	not used, always “0”

A detailed table for encoding the object value can be found in section 5.

3.5 Operating mode: “Fan coil control (blower convection unit)”

The application provides the opportunity of controlling a fan coil air-conditioning device (blower convection unit).

If this operating mode is selected, this output has the master function in fan coil control. On the one hand, it controls fans speed 1 directly, while on the other hand it controls further outputs of switch actuator modules via communication objects that switch valves and other fan speeds. These outputs are parameterised as a “Slave” function.

3.5.1 What is a fan coil unit?

A fan coil unit consists of one or two cooling or heating circuits which are controlled via valves. The valves are controlled via the outputs of the switch actuator (on/off). There is also a fan which blows on the heat exchanger. It can be controlled in stages (generally 3 speeds):

Control value (example)	Fan speed	Output 1	Output 2	Output 3
0…30%	Speed 1	ON	OFF	OFF
30…60%	Speed 2	OFF	ON	OFF
e.g. 60…100%	Speed 3	OFF	OFF	ON

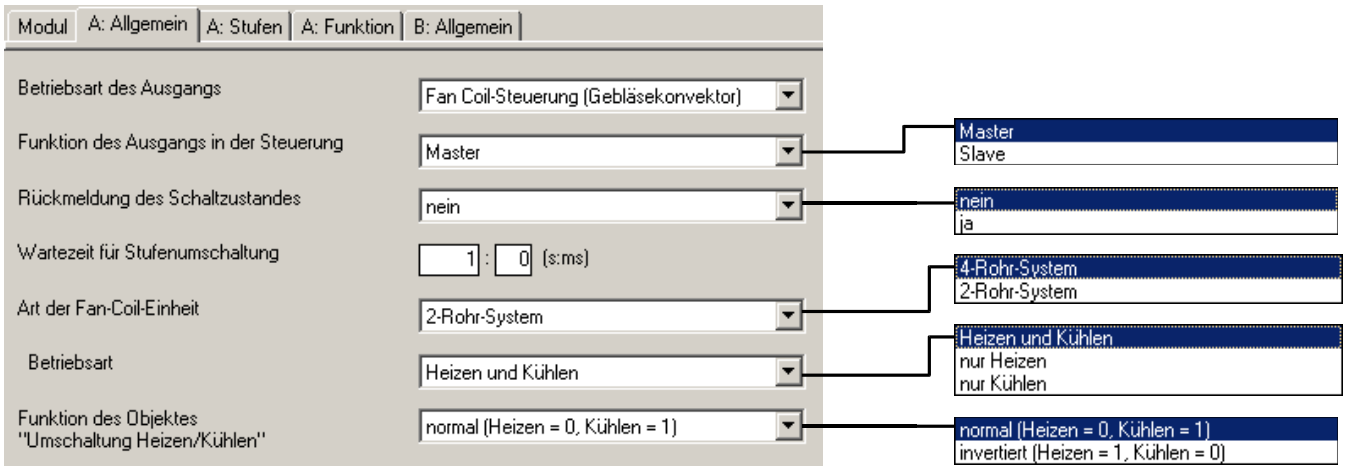
2-pipe system

With a 2-pipe system, only hot or cold water flows through the fan coil unit. The device therefore only has one heat exchanger.

4-pipe system

In a 4-pipe system, the fan coil unit has separate connections for hot and cold water. The device thus has two heat exchangers.

3.5.2 Parameter window “General”



Parameter “Function of output when control is active”

Here you can set whether the output operates as a “Master” or “Slave” in fan coil control mode.

There can only be one output with the master function per fan coil unit. This output controls fan speed 1. The master controls valve drives or further fan speeds via communication objects. These outputs must then be parameterised with the “Slave” function.

Note: Outputs with the slave function should be parameterised as such. If parameterised, e.g. as a “Switch actuator”, there is a danger that more than one output is closed under unfavourable conditions. The fan motor for example can be damaged as a result.

Outputs with the slave function are only controlled via the object “Fan coil slave”. The following parameters are only visible in the “Master” setting.

Parameter “Status response of switching state”

The object “Status switch” can be enabled via this parameter if the status of the output is reported on the bus.

Parameter “Waiting time for switching between two speeds”

The operating time is delayed to enable an idle period when switching over the motor or valve, or to prevent the period that they are switched on/off from being too short. The value range can be set between 500 ms and 1 min.

Parameter: “Type of fan coil unit”

The type of fan coil unit can be chosen here.

In a *2-pipe system*, only hot or cold water flows through the fan coil unit and the device therefore only has one heat exchanger. In a *4-pipe system*, the fan coil unit has separate connections for hot and cold water. The device thus has two heat exchangers.

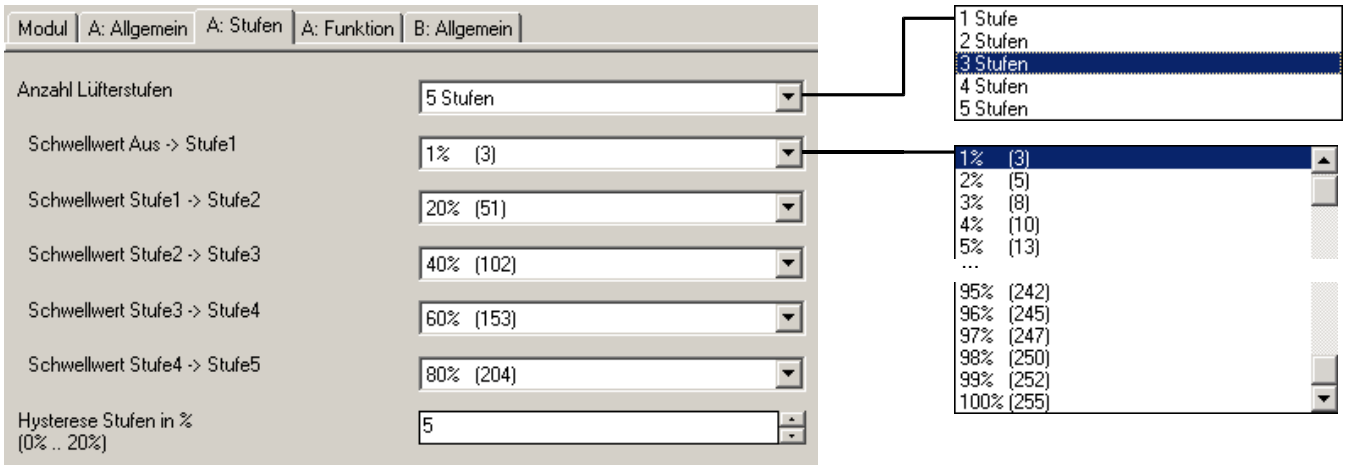
Parameter: “Operating mode”

A two-pipe system can be used for “heating”, “cooling” or both “heating and cooling”. In latter case, the object "Toggle between heat and cool" is released, which the building control uses to indicate whether hot or cold water is supplied.

Parameter: “Function of object ‘Toggle between heat and cool’”

The object “Toggle between heat and cool” can be inverted via this parameter. This is preset by the room thermostat.

3.5.3 Parameter window: “Speeds”



Parameter: “Number of fan speeds”

Here you can set the number of fan speeds that the Fan Coil unit has. It is possible to set between “1 speed” and “5 speeds”. The corresponding objects “Speed 2” to “Speed 5” are enabled.

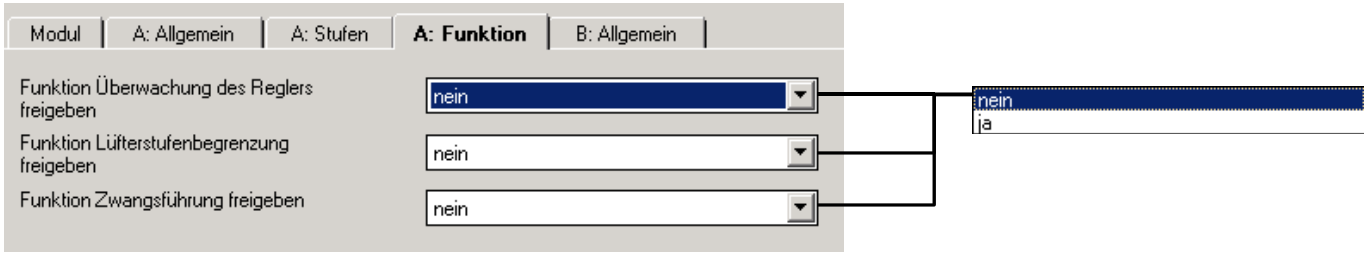
Parameter: “Threshold OFF → speed1” to “… speed4 → speed5”

These parameters become visible depending on the number of fan speeds selected. The threshold values of the control value from which a fan switches up or down must be entered here.

Parameter: “Hysteresis between fan speeds in %”

If a fan value fluctuates around a fan speed, the ventilation would be switched on and off continually. This can be prevented by setting a hysteresis.

3.5.4 Parameter window "Function"



Parameter “Enable monitoring of the thermostat”

The cyclic monitoring of the room thermostat can be enabled here. The failure of the thermostat can thus be detected. The output switches to fault mode and moves to a defined position.

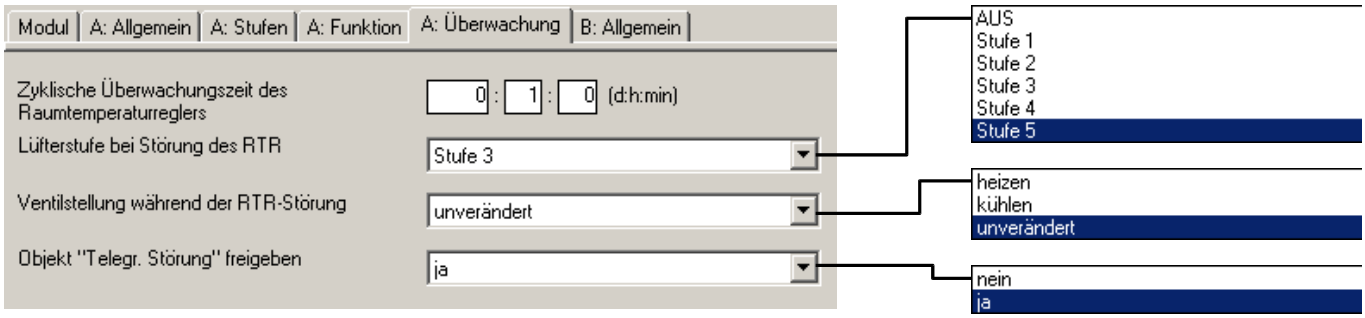
Parameter: “Enable function "fan speed limitation”

This function enables, e.g. noise reduction via the bus during operation at night.

Parameter: “Enable function ‘forced operation’”

The forced operation of the fan speed and the valve position can be enabled here in order to move the outputs to a specific position, e.g. for inspection purposes.

3.5.5 Parameter window: “Monitoring”



The cyclic monitoring of the room thermostat can be enabled here via the objects “Control value heating” and “Control value cooling”. As soon as the objects are not received for a certain period, the device switches to fault mode (object “Fault” = “1”).

Cyclic monitoring may only be enabled if the room thermostat sends the objects “Heating” and/or “Cooling” cyclically.

Parameter “Cyclic monitoring time of room thermostat”

This parameter is visible if cyclic monitoring has been enabled. The cyclic monitoring time is set here.

Parameter “Fan speed during fault of thermostat”

This parameter is visible if cyclic monitoring has been enabled. It defines which fan speed and valve position are triggered during fault mode.

Parameter “Valve position during fault of room thermostat”

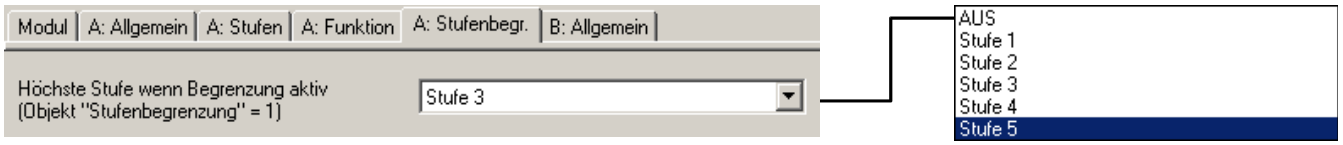
Here you can set whether heating or cooling should be carried out in fault mode, or whether the current setting should be maintained.

The parameter is visible, if a 4-pipe system is used.

Parameter “Enable object "Telegr. Thermostat fault”

The object “Telegr. fault thermostat” that can display the failure of the room thermostat can be enabled in this parameter.

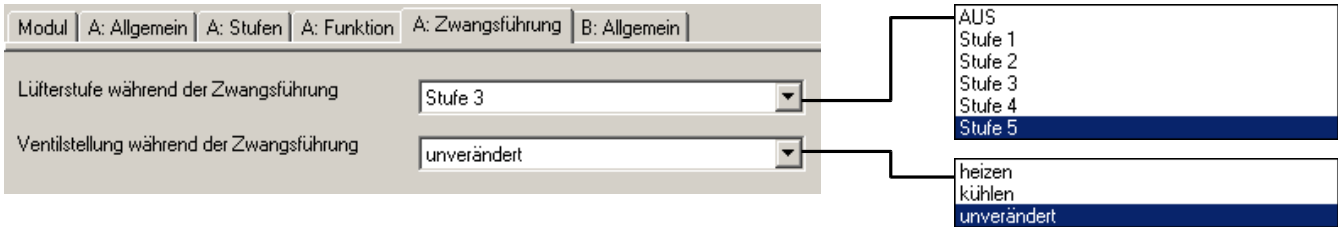
3.5.6 Parameter window "Step limiting"



Parameter “Highest speed during active limitation”

The highest fan speed during active speed limitation is set here (see object “Speed limitation”).

3.5.7 Parameter window “Forced operation”



During a forced operation, the actuator triggers a freely adjustable forced position. This has the highest priority, i.e. it is not modified by a valve purge or safety position. The forced operation can be activated via the object “Forced operation” = ON and deactivated via “Forced operation” = OFF.

Parameter “Valve position during forced operation”

This parameter defines which fan speed and valve position are triggered during the forced operation.

Parameter: “Valve position during forced positioning”

The valve position triggered by the actuator during the forced operation is defined in this parameter. The switch cycle time t_{CYC} of the control is defined in the parameter “*PWM cycle time for continuous control*”.

3.5.8 Communication objects

3.5.8.1 Overview of the objects

Communication object for the function “Master”

No.	Function	Object name	Data type	Flags
0/15	**Control value heating**	**Output A, Master**	**1 byte (EIS6) DPT 5.001**	**C, W**
The heat output is preset via this object. The object value is sent, e.g. from a room thermostat. 0: no heating output … 255: maximum heating output				
1/16	**Control value cooling**	**Output A, Master**	**1 byte (EIS6) DPT 5.001**	**C, W**
The cooling output is preset via this object. The object value is sent, e.g. from a room thermostat. 0 no cooling output … 255 maximum cooling output				
2/17	**Step limiting**	**Output A, Master**	**1 bit (EIS1) DPT 1.002**	**C, W**
Using this object, the fan speed can be limited to a maximum value. This prevents, for example, that the fan does not exceed a certain speed (at night to prevent noise). 0: Step limiting not active 1: Step limiting active				
3/18	**Forced operation**	**Output A, Master**	**1 bit (EIS1) DPT 1.003**	**C, W**
Using this object, the Fan-Coil control is forced to use a predefined fan speed and valve position and the control is inhibited. The fan speed and valve position can be parameterised. 0: Forced operation not active 1: Forced operation active				
4/19	**Toggle between heat and cool**	**Output A, Master**	**1 bit (EIS1) DPT 1.001**	**C, W**
This object is visible with operating mode “2-pipe system, heating and cooling”, i.e. the Fan Coil unit features a connection for the supply of hot and cold water. The device receives the information whether hot or cold water is required from the building control via this object. The object “Control value heating” or “Control value cooling” is evaluated accordingly. The object can be inverted. *Default:* 0: Heating 1: Cooling *Inverted:* 0: Cooling 1: Heating				
5/20 **6/21** **7/22** **8/23**	**Slave fan speed 2** **Slave fan speed 3** **Slave fan speed 4** **Slave fan speed 5**	**Output A, Master**	**1 bit (EIS1) DPT 1.001**	**C, R, T**
The master output controls further outputs via these objects which are used to control the ventilation. These outputs must be parameterised as “Slaves”. 0: fan speed off 1: fan speed on				

No.	Function	Object name	Data type	Flags
9/24	**Slave valve**	**Output A, Master**	**1 bit (EIS1) DPT 1.001**	**C, R, T**
This object is visible when controlling a 2-pipe system, i.e. there is only one valve. The object controls a further output that controls the valve. The output must be parameterised as a “Slave”. As soon as the fan operates with at least the first speed, the object value = “1”, otherwise it is “0”. 0: valve closed 1: valve opened				
9/24 10/25	**Slave valve heating Slave valve cooling**	**Output A, Master**	**1 bit (EIS1) DPT 1.001**	**C, R, T**
With these objects, the master controls two switch outputs for control of the heating and cooling valves. “Slave valve heating” has the value “1”, if the room thermostat has issued the command for heating via the object “Control value heating” (“Control value heating“ ≥ threshold for fan speed 1). “Slave valve cooling” has the value “1”, if the room thermostat has issued the command for heating via the object “Control value cooling” (“Control value cooling“ ≥ threshold for fan speed 1). Either “Slave valve heating“ or “Slave valve cooling“ can have the value “1”. Should a simultaneous command (malfunction) from the thermostat be received for both heating and cooling, heating has priority. 0 valve closed 1 valve opened These objects are visible when controlling a 4-pipe system, i.e. there are two valves for heating and cooling.				
11/26	**Thermostat fault**	**Output A, Master**	**1 bit (EIS1) DPT 1.005**	**C, T**
This object indicates a possible fault in the room thermostat. Should the object value “Control value heating” or “Control value cooling” remain absent for a programmable time, a fault is assumed in the room thermometer and the Fan Coil control reports a fault and moves to the safety position. 0: no fault 1: fault				
12/27	**Status switch**	**Output A**	**1 bit (EIS 1) DPT 1.001**	**C, T**
Displays the current state of the output. 0: relay opened 1: relay is closed				
29	**Status byte**	**Output A…B**	**1 byte non DPT**	**C, R, T**
This object is only visible with the Electronic Switch Actuator Modules ES/M 2.x.1. It provides more detailed information about the operating state of the device. The object value is sent with changes. **Bit Meaning** 0 Overload (e.g. short circuit) on output A 1 Overload (e.g. short circuit) on output B 2 Incoming supply voltage available 3 Supply voltage type: 0 = AC; 1 = DC 4 not used, always “0” 5 not used, always “0” 6 not used, always “0” 7 not used, always “0” A detailed table for encoding the object value can be found in section 5.				

Object for the function “Slave”

No.	Function	Object name	Data type	Flags
0/15	**Fan Coil slave**	**Output A**	**1 Bit** **DPT 1.001**	**C, W**
This object is used for control of the output by the master.				

4 Planning and application

4.1 The three operating modes

It is possible to choose between three operating modes for each output:

1. **Switch actuator**
   This function is used for normal switching, e.g. of lighting. The output is controlled directly via the object “Switch”. A large number of additional functions are possible. See section 3 for more details.

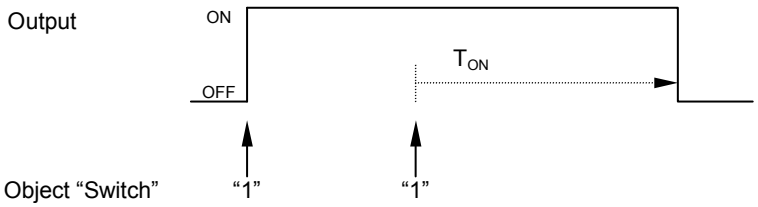
2. **Heating actuator**
   In this function, the output is used to control heating valves, e.g. in an individual room temperature control system. A room thermostat sends a control value which the output uses to control the valve (e.g. as PWM or 2-step control). See section 4.3 for more details.

3. **Fan coil control**
   This function is used to control a fan coil unit for air conditioning in a room, e.g. in an individual room temperature control system.
   The function is as follows: An external room thermostat determines the setpoint value (0…255). The fan speed and the setpoint value of the fan coil unit are to be controlled depending on this setpoint value. Several outputs are required for control and the output therefore controls further outputs (“Slaves”) as a “Master” via the bus. The master output itself controls fan speed 1. See section 4.4 for more detailed information.

4.2 Operating mode "Switch actuator"

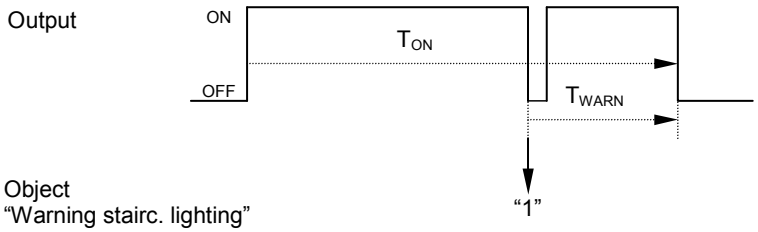
4.2.1 Time functions

Staircase lighting



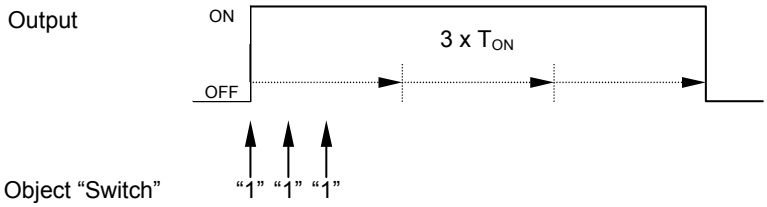
The output switches off automatically after the staircase lighting time T_{ON}. With each “1” telegram, the time restarts (“retrigger function”).

A **warning function** enables the user to be warned in good time before the staircase lighting time elapses. The warning can be carried out by switching the output on/off briefly or by sending an object.



The output is switched off briefly for the period “T_{WARN}” before the staircase lighting time “T_{ON}” elapses and the object “Warning stairc. lighting” is sent. Push button LEDs for example can flash to indicate a warning.

With **pumping up**, the user can adapt the staircase lighting time to the current requirements by pressing the push button several times in succession. The maximum duration of the staircase lighting time can be set in the parameters.

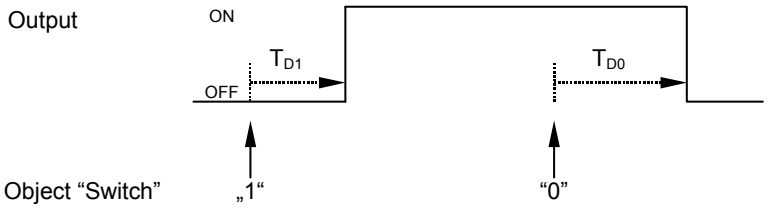


If the device receives a further ON command when the staircase lighting is switched on, the staircase lighting time is added to the remaining period. In this case, the time does not restart (no retrigger).

Application: Lighting control on staircases, monitoring of telegrams

ON/OFF delay

The switching ON / OFF delay delays switch on or switch off of the output.



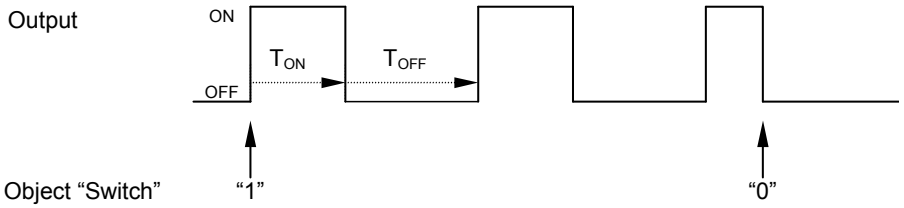
The delay time T_{D1} or T_{D0} starts after a switch command, and after it has timed out, the output executes the switch command.

Note: If the device receives an OFF command during the ON delay period T_{D1}, the ON command is rejected.

Application: e.g. dynamic lightscene, in which luminaires are connected in sequence

Flashing

The output can flash when the output is switched on and off periodically.

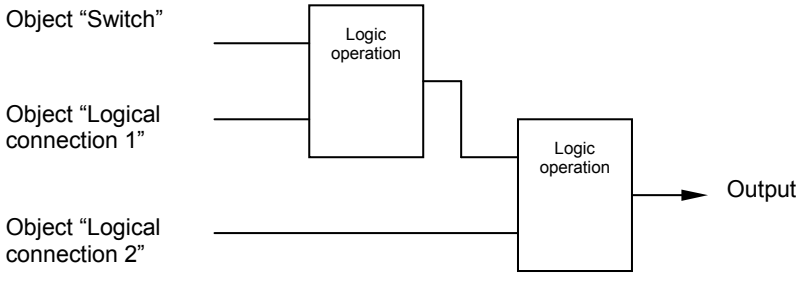


The switch on time (T_{ON}) and switch off time (T_{OFF}) during flashing can be programmed.

Note: Please note that the maximum number of switching operations is limited for the Switch Actuator Module SA/M. The number of switching operations is unlimited for the Electronic Switch Actuator.

4.2.2 Connection/logic

With the function “Connection/Logic”, it is possible to connect the switching of the output with certain conditions. Two connection objects are available:



First, the object “Switch” is evaluated together with the object “Logical connection 1”. The result is then liked with “Logical connection 2”.

The following logic functions are possible:

	Object values			
Logic function	Switch	Logical connection	Result	**Explanation**
AND	0 0 1 1	0 1 0 1	0 0 0 1	The result is 1 if both input values are 1.
OR	0 0 1 1	0 1 0 1	0 1 1 1	The result is 1 if one of both input values is 1.
XOR	0 0 1 1	0 1 0 1	0 1 1 0	The result is 1 when both input values have a different value.
Gate function	0 0 1 1	0 1 0 1	- 0 - 1	The object “Switch” is only allowed through if the GATE is open. Otherwise the receipt of the object “Switch” is ignored. *Example shown here: Disable if “0” (OFF)*

The logic function is always re-calculated when an object value is received.

Example: The gate function is parameterised with “Block if, 0 (OFF)”..
The logical connection object has the value “0”.
The object “Switch” receives the value “1”
→ No reaction of the output. .
Logic object receives the value “1” (gate open)
→ No reaction of the output.
The object “Switch” receives the value “1”
→ The output switches on.

Application: Disable the switching of the lighting.
Only switch the lighting on under certain conditions.

4.2.3 Presets

A parameterisable switching state can be retrieved with the help of presets. Lightscenes can therefore be implemented for example.

Retrieve preset

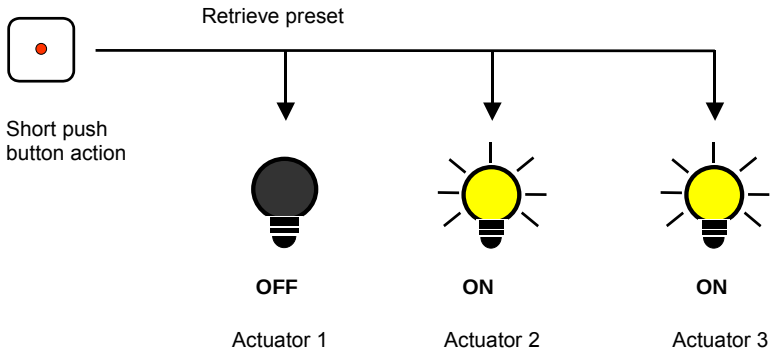


Fig. 1: Controlling light scenes via presets

Switch states (“preset values”) can be retrieved via the object “Call Preset”. A maximum of 4 preset values are available for each output:

Action	Telegram
Retrieve preset1	Object “Call preset 1/2” = 0
Retrieve preset2	Object “Call preset 1/2” = 1
Retrieve preset3	Object “Call preset 3/4” = 0
Retrieve preset4	Object “Call preset 3/4” = 1

Store preset

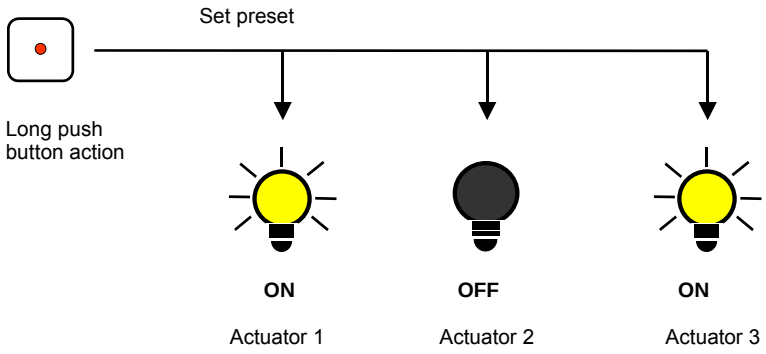


Fig. 2: Storing the current output state as the new preset value

The current switching state is stored as a new preset value via the object “Set preset …”. The user can for example adapt a lightscene in this way. The presets are stored via the following values:

Action	Telegram
Store preset1	Object “Set preset 1/2” = 0
Store preset2	Object “Set preset 1/2” = 1
Store preset3	Object “Set preset 3/4” = 0
Store preset4	Object “Set preset 3/4” = 1

Special function: Restore state

A useful special function can also be assigned to preset1 and preset3, which is used to recreate the brightness level that was present before retrieving preset2 or preset4. The following diagram clarifies this:

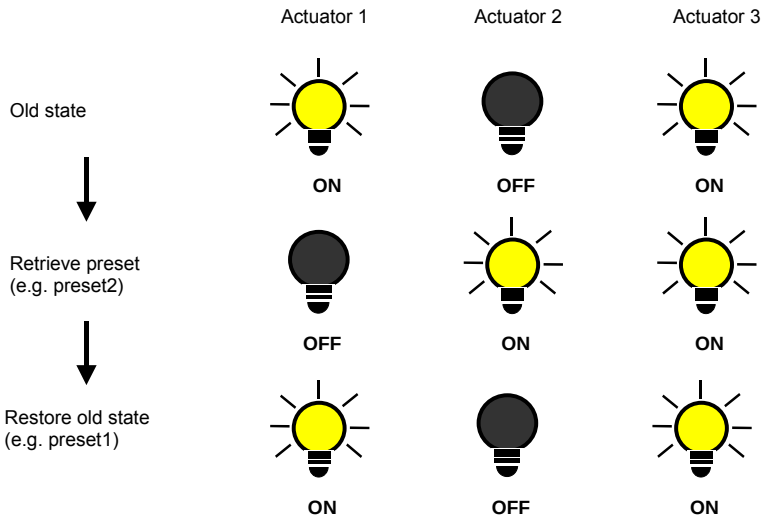


Fig. 3: Restoring the old brightness state (example)

This function can be used for example after a presentation to restore the lighting to the state it was in beforehand.

4.2.4 8 bit scene

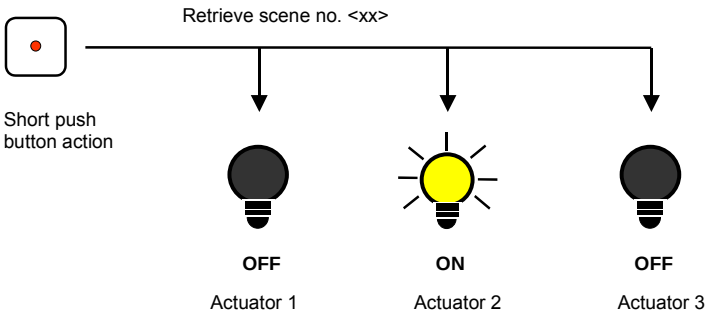


Fig. 4: Retrieve scene, 8-bit scene

With the 8 bit scene, the push button issues the instruction to call a scene. The scene is not stored in the push button but rather in the actuator. All actuators are addressed using the same group address. It is thus sufficient to send just a single telegram to recall the scene.

A scene number is sent with the telegram value that must correspond with the scene number in the parameters of the actuator.

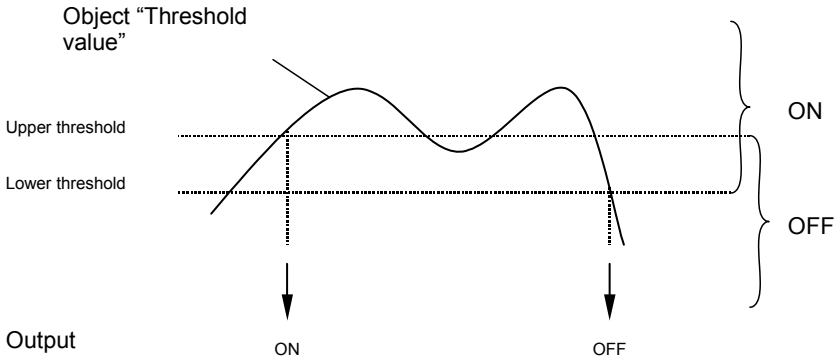
After a long push button action (for example), the actuators receive a save command that causes them to store the current value issued by the actuator as a new scene value.

Up to 64 different scenes are managed via a single group address. An 8 bit scene telegram contains the following information:
- Number of the scene (1…64)
- Retrieve scene / store scene

4.2.5 Threshold value function

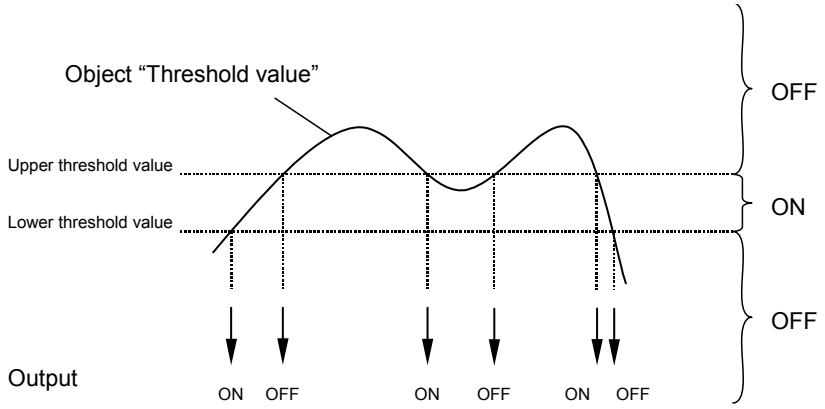
The threshold function monitors a 1 byte or 2 byte value. As soon as this value exceeds or falls below a threshold value, the output can be switched. The threshold values can be interpreted as hysteresis values:

Threshold values are hysteresis values



When the value exceeds the upper threshold or falls below the lower threshold, the output is switched.

Threshold values are not hysteresis values



When the value exceeds or falls below any threshold value, the output is switched.

Note: If the object “Threshold value” receives a value, which does not exceed or fall below any of the threshold values when compared to the old value, no switching operations are triggered.

4.2.6 Function chart

The following illustration indicates the sequence in which the functions are processed.

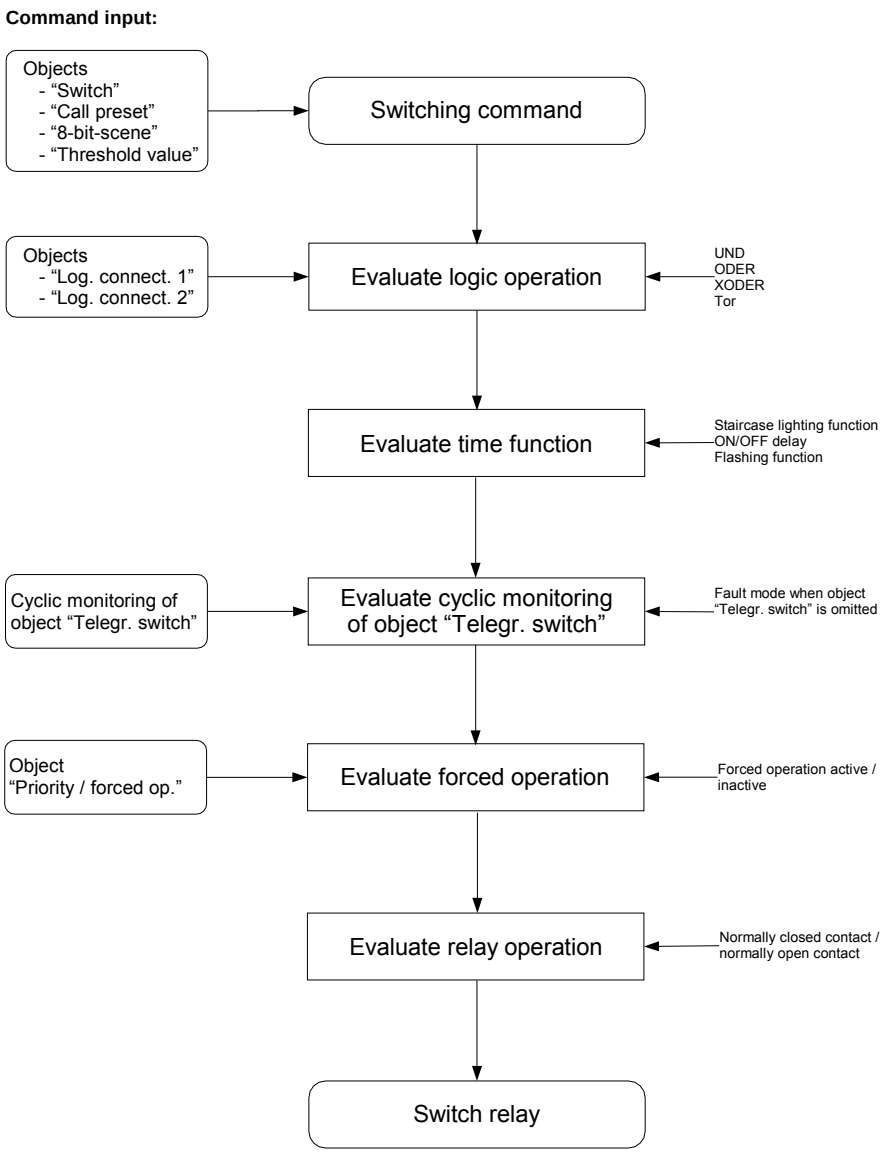


Fig. 5: Interdependence and priority of the functional groups

Example: On receipt of a “Logical connection” object, the linking logic is evaluated first of all. The result is analysed by the time function; when the staircase lighting function is active, this can result in the staircase lighting being switched on.

The forced operation has the highest priority as it is evaluated last of all the functions.

4.3 Operating mode "Heating actuator"

The “Heating actuator” function is normally used to control an electrothermal valve drive. The output receives its control value from a room thermostat.

The electrothermal valve drive can be triggered via two-step control or pulse width modulation. With pulse width modulation, the control is implemented by a variable mark-space ratio. The following example clarifies this:

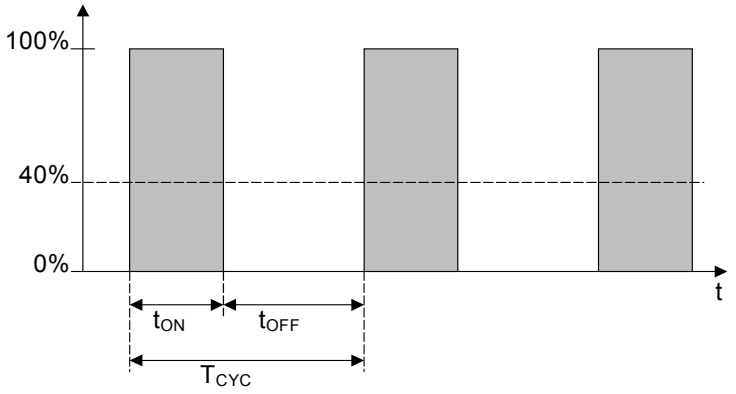


Fig. 6: Pulse width modulation (example)

During t_{ON}, the valve is triggered with OPEN (“ON phase”). During t_{OFF} the valve is triggered with CLOSE (“OFF phase”). Due to t_{ON} = 0.4 x T_{CYC}, the valve is set at approx. 40%. T_{CYC} is the so-called PWM cycle time for continuous control.

Important: Pulse width modulation leads to frequent switching of the outputs. Consider the limited number of switching cycles for standard switch actuators! The use of electronic switch actuators should be the preferred method.

Special functions

The actuator can trigger specific special positions during “Forced positioning”, “Valve purge” and “Safety position”. The following diagram provides an overview of the priority of the special positions:

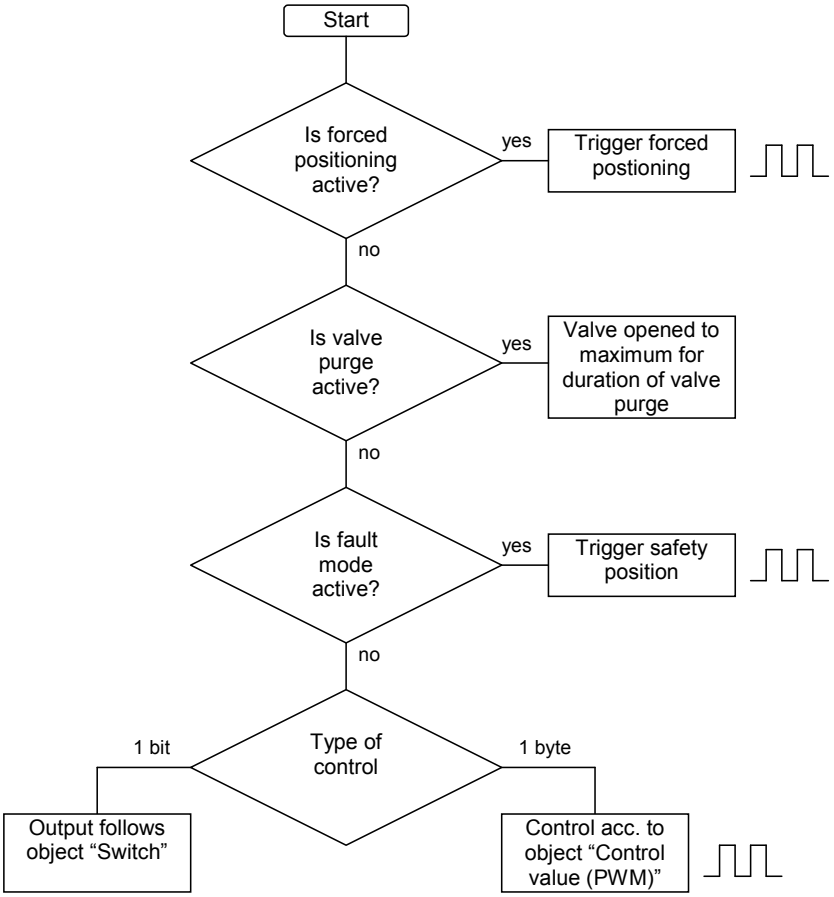


Fig. 7: Priority of the special functions (flow chart)

4.4 Operating mode: “Fan coil control”

4.4.1 Terms

Fan Coil unit is a term used for a valve convector or blower convection unit. The Fan Coil unit is connected to a central heating and cooling water supply and generates the desired temperature for the room. A room can be heated, cooled and ventilated using a Fan Coil unit.

4.4.2 Configuration of a HVAC system with Fan Coil units

A HVAC system with Fan Coil units (HVAC = heating, ventilation, air-conditioning) consists of a central heating and cooling water system. The Fan Coil units are installed in rooms and directly connected to the heating and cooling circuit.

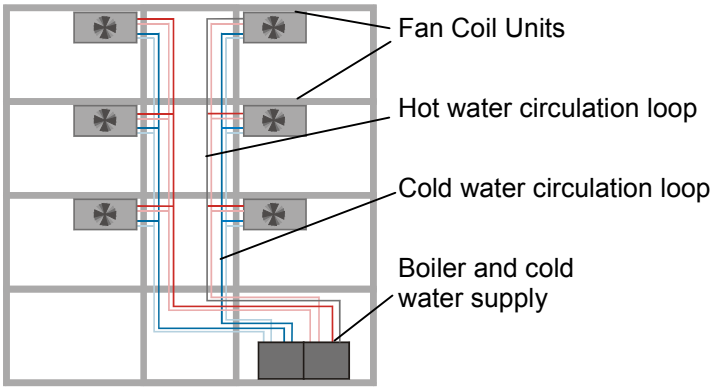


Fig. 8: Configuration of a HVAC system with Fan Coil units

4.4.3 Design of a Fan Coil unit

The heat exchanger and the fan are the most important components of a Fan Coil unit. Heating or cooling water flows in the heat exchanger depending on the desired room temperature. The flow of water through the heat exchanger is controlled via the valves.

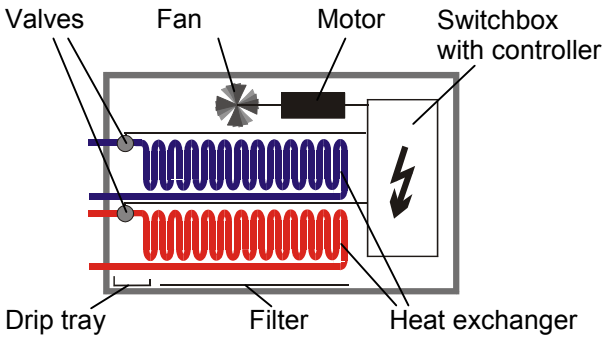


Fig. 9: Design of a Fan Coil unit

The fan blows air past the heat exchanger and into the room through a filter. The air is heated or cooled in the heat exchangers and thus generates the desired room temperature. The fan is driven by a motor. The motor and the valves are controlled by a Fan Coil Controller FC/S 1.1.

The water condensation which results during cooling collects in a condensation water trough.

4.4.4 Variants

Pipe systems

A Fan Coil unit can be configured as a 2, 3 or 4-pipe system.

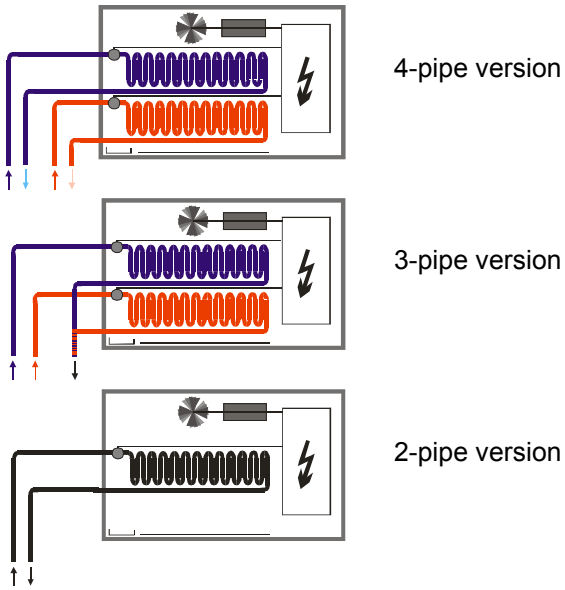


Fig. 10: Pipe systems of fan coil units

In the 4-pipe version, separate water circulation loops are used for hot and cold water. There are thus also two separate heat exchangers for heating and cooling which are each triggered via a valve in the Fan Coil unit.

The 3-pipe version functions in a similar way to the 4-pipe version. In the 3-pipe version there is also a separate inlet for heating and cooling water as well as two separate heat exchangers with one valve each. In contrast to a 4 pipe version, the 3 pipe version has a common return for heating and cooling water.

The 2-pipe version consists of just a single water circuit which is heated or cooled alternately to suit the season. In a 2-pipe Fan Coil unit there is only one heat exchanger with a valve.

In some HVAC systems cooling is undertaken exclusively with a 2-pipe Fan Coil unit. The heating function is undertaken by a conventional heater or an electrical heater.

4.4.5 Connection

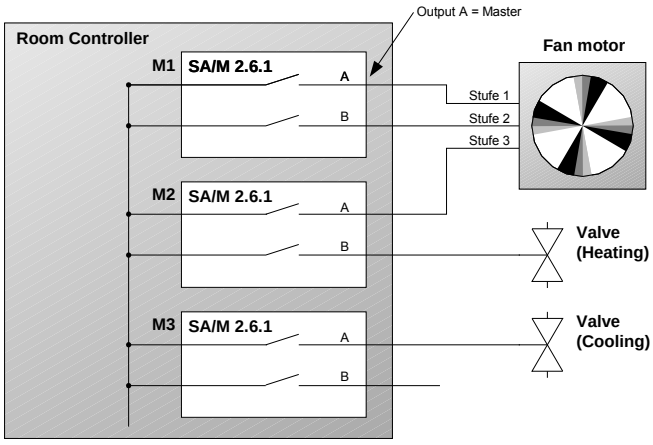


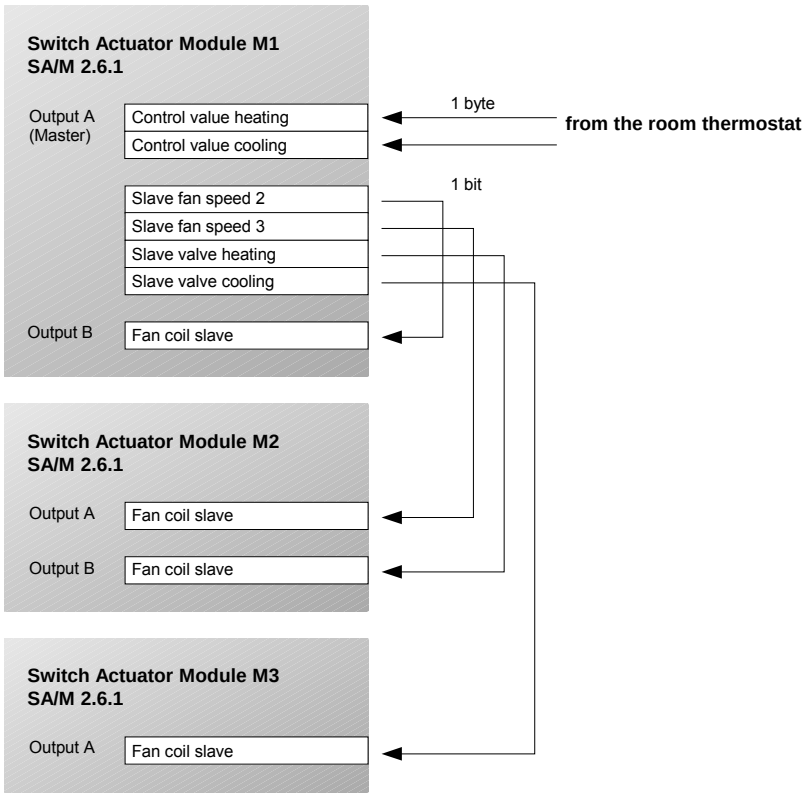
Fig. 11: Connection of a fan coil unit (example)

The diagram shows the control of a fan coil unit, consisting of a fan drive (3 speed) and two valves for a cooling or heating circuit. The device is therefore a 3 or 4-pipe version.

Five switch outputs are required for control which is why three switch actuator modules are necessary. The free output can be used elsewhere.

Switch output A of the switch actuator at the top controls fan speed 1 and simultaneously adopts the function of the “master”. These outputs must be parameterised as a “Slave”. The master controls the slaves via the normal group address assignment.

Allocation of group addresses



Variations

If the Fan Coil unit only cools or heats (2-pipe-version), only one valve is required and two switch actuator modules are sufficient.

When using electrothermal valve drives for valve control, the use of Electronic Switch Actuator Modules (ES/M) is recommended.

4.5 Reaction on voltage failure and recovery

Reaction on bus voltage failure

The behaviour of the outputs on bus voltage failure can be parameterised. The function of the Room Controller is retained provided that the supply voltage (115 / 230 V AC or 12 V DC auxiliary voltage) is available.

If it has been set in the parameters, the Room Controller can thus continue to keep the functions in the room maintained.

In the “Heating actuator” operating mode, any neutral position of the valve can be triggered. In the “Fan coil control” operating mode, the master and slave outputs are switched off (high-resistance). Fan speed 0 is thus triggered.

Example: Conventional push buttons are connected to a Room Controller via binary input modules. The Room Controller also regulates the lighting in the room. After bus voltage failure, the lighting can still be operated since the Room Controller is not supplied by the bus.

Reaction on bus voltage recovery

The behaviour of the outputs is programmable. In the master “Fan coil control” function, the outputs remain switched off until a new control value is received.

Reaction on supply voltage failure

The supply voltage has failed if there is a failure of both the 115/230 V AC supply and the 12 V DC auxiliary supply. The Room Controller has no function in this case.

For the *Switch Actuator Module SA/M*, the status of the relay outputs can be parameterised so that a defined state can be established. The setting is carried out in the parameter “Reaction on bus voltage failure”.

In the “Heating actuator” operating mode, it can be set whether the valve should be fully open or closed during the supply voltage failure. In the “Fan coil control” operating mode, the master and slave outputs are opened. Fan speed 0 is thus triggered.

For the *Electronic Switch Actuator Modules ES/M*, the outputs always switch off during the supply voltage failure (high-resistance).

Note: The preset and scene values that have been changed by the user are lost on failure of the supply voltage. They are overwritten by the parameterised default values.

Reaction on supply voltage recovery

The behaviour of the outputs is identical to the behaviour on bus voltage recovery. It can be parameterised for each output (except for fan coil control).

4.6 Behaviour after programming

After programming, the device behaves in the same way as after bus voltage recovery (parameterisable).

5 Appendix

5.1 Table of values of object "Status byte"

The object shows the initial state of the electronic switch actuator modules:

Status value		DC supply voltage (otherwise: AC)	Supply voltage OK	Overload (e.g. short circuit) Output B	Overload (e.g. short circuit) Output A
0	00				
1	01				■
2	02			■	
3	03			■	■
4	04		■		
5	05		■		■

Status value		DC supply voltage (otherwise: AC)	Supply voltage OK	Overload (e.g. short circuit) Output B	Overload (e.g. short circuit) Output A
6	06		■	■	
7	07		■	■	■
8	08	■			
9	09	■			■
10	0A	■		■	

Status value		DC supply voltage (otherwise: AC)	Supply voltage OK	Overload (e.g. short circuit) Output B	Overload (e.g. short circuit) Output A
11	0B	■		■	■
12	0C	■	■		
13	0D	■	■		■
14	0E	■	■	■	
15	0F	■	■	■	■

5.2 Ordering information

Designation	Type	Order No.	bbn 40 16779 EAN	Price 1 pc. [EURO]	Price group	Weight 1 pc. [kg]	Packaging [pc.]
Switch Actuator Module, 2-fold, 6 AX	SA/M 2.6.1	2CDG 110 002 R0011	583145		26		1
Switch Actuator Module, 2-fold, 16 A	SA/M 2.16.1	2CDG 110 100 R0011	681582		26		1
Electronic Switch Actuator Module, 2-fold, 230 V AC	ES/M 2.230.1	2CDG 110 013 R0011	583619		26		1
Electronic Switch Actuator Module, 2-fold, 24 V DC	ES/M 2.24.1	2CDG 110 014 R0011	583626		26		1

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