V.ERANSKINA: ERAGINGAILUAK

Product documentation

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Dimming actuator

Order No. 2171 00, 2172 00, 2174 00

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1 Product definition

1.1 Product catalogue

Product name:	Dimming actuator, 1-gang / Dimming actuator, 2-gang / Dimming actuator, 4-gang
Use:	Actuator
Design:	RMD (rail-mounted device)
Order No.	2171 00 / 2172 00 / 2174 00

1.2 Function

The universal dimmer actuator works according to the leading edge phase control or trailing edge phase control dimming principle and makes switching and dimming of HV incandescent lamps, HV halogen lamps and LV halogen lamps with inductive transformers or Tronic-Transformers possible by means of conventional transformers and Tronic-Transformers. When using the application programs with version from "1.2" and onwards in conjunction with devices of the generations "V02" or "V03", it is also possible to activate dimmable HV-LEDs or compact fluorescent lamps. If, in the ETS, Version "1.3" of the application program is used in combination with devices of the "V04" generation or higher, then LV-LEDs can also be activated via electronic or conventional transformers.
The characteristic of the connected load - provided that the load is supported - can be automatically measured separately for each output channel and the appropriate dimming procedure can be set. Alternatively, it is possible to predefine the dimming procedure using the ETS configuration. This procedure is necessary for loads that do not enable automatic calibration (e.g. with compact fluorescent lamps).
There are up to 4 dimming channels available depending on the device variants. To simplify the configuration, all existing dimming channels can be assigned to the same parameters in the ETS and thus configured identically. The number of parameters is thereby reduced in the ETS and applied automatically on all channels.

To increase the channel power, the device variant "4-gang" can be wired in parallel by reducing the number of channel outputs (not with HV/LV-LED lamps or compact fluorescent lamps). The assignment of parallel to wired dimming outputs to the KNX-controllable dimming channels takes place in the ETS.

The device permits the separate feedback of the individual switching and brightness statuses of the connected loads to the KNX. Moreover, a short-circuit and load failure can be signalled separately to the KNX for each dimming channel.

The operating elements (4 pushbuttons) on the front panel of the device allow the dimming channels to be switched on or dimmed by manual operation in parallel with the KNX even without bus voltage or in a non-programmed state. This feature permits fast checking of connected loads for proper functioning.

For project design and commissioning of the device, ETS3.0 from Version "d" onwards, ETS4.1 or more recent or ETS5 is required. The advantages with regard to downloading (shorter loading times) are available only if this ETS versions are used.

The function features that are independently adjustable for every dimming channel by means of the ETS include, for example, separately configurable brightness ranges, extended feedback functions, a disabling function, or alternatively, a forced position function, a logic operation function, separately adjustable dimming behaviour, soft dimming functions, time delays and a staircase function with pre-warning before switching off the lighting.
Furthermore, each dimming channel can be integrated in up to 8 scenes with various brightness values. Central switching of all channels is possible, too. Moreover, the brightness values of the dimming channels in case of bus voltage failure or bus voltage return and after ETS programming, can be preset separately.
The switch-on times of the dimming channels can be detected and evaluated separately by operating hours counters.

Apart from controlling lighting, the universal dimmer actuator 1-gang can be used as a speed controller of single-phase electric motors. This operating mode can be preselected in the ETS and has an effect on the parameter configuration and function of the device.

The device has a mains voltage connection that is independent of the load outputs for supplying the device electronics of the manual operation and integrated bus coupling unit. The device electronics and bus coupling unit are also supplied from the bus coupling unit so that an ETS programming operation or manual operation is also possible even if the mains voltage is not connected or is switched off. As long as the bus voltage is connected and ready for operation, the device's internal power supply unit is switched off to save energy.
The load outputs have separate mains voltage connections for supplying the digital dimmer packs and the connected load.

The device is designed for mounting on DIN-rails in closed compact boxes or in power distributors in fixed installations in dry rooms.

ℹ Different device generations and application program versions are available thus resulting in functional differences - particularly with regard to the activation of HV-LED lamps, LV-LED lamps and compact fluorescent lamps. It is possible to distinguish between the application programs and device generations by means of the version designation . (see page 33).
This product documentation describes the scope of functions of all application programs and device generations and will deal with the functional differences at the appropriate places if necessary.

2 Installation, electrical connection and operation

2.1 Safety instructions

Electrical equipment may only be installed and fitted by electrically skilled persons. The applicable accident prevention regulations must be observed.

Failure to observe the instructions may cause damage to the device and result in fire and other hazards.

Danger of electric shock. Device is not suitable for disconnection from supply voltage. The load is not electrically isolated from the mains even when the device is switched off.

Danger of electric shock. Before working on the device or before exchanging light bulbs, disconnect mains voltage. In so doing, take all the circuit breakers into account, which support dangerous voltages to the device and or load.

Only with application program version "1.1" or device generation without version designation or "V01": Do not connect electronic lamps, e.g. switchable or dimmable compact fluorescent lamps or LED lamps. Otherwise the possibility of a device defect cannot be ruled out.

Only with application program version "1.2" and device generations "V02" and "V03": Do not connect any HV-LED or compact fluorescent lamps that are not specifically suitable for dimming. Device can be damaged.

Only with application program version "1.3" and device generations "V04" and higher: Do not connect any HV-LED, NV-LED (via Tronic transformer or conv. transformer) or compact fluorescent lamps that are not specifically suitable for dimming. Device can be damaged.

Do not connect any luminaire with integrated dimmers.

Do not connect any three-phase motors.

For operation with inductive transformers, each transformer must be fused on the primary side in accordance with the manufacturer's instructions. Only safety transformers according to EN 61558-2-6 may be used.

When extending the load range of an output, only use suitable power boosters. Choose power boosters that are suitable for the dimmer and load! For additional information, please refer to the instructions for the power extensions in question.

Make sure during the installation that there is always sufficient insulation between the mains voltage and the bus. A minimum distance of at least 4 mm must be maintained between bus conductors and mains voltage cores.

Do not open device or operate it beyond the technical specification.

2.2 Device components

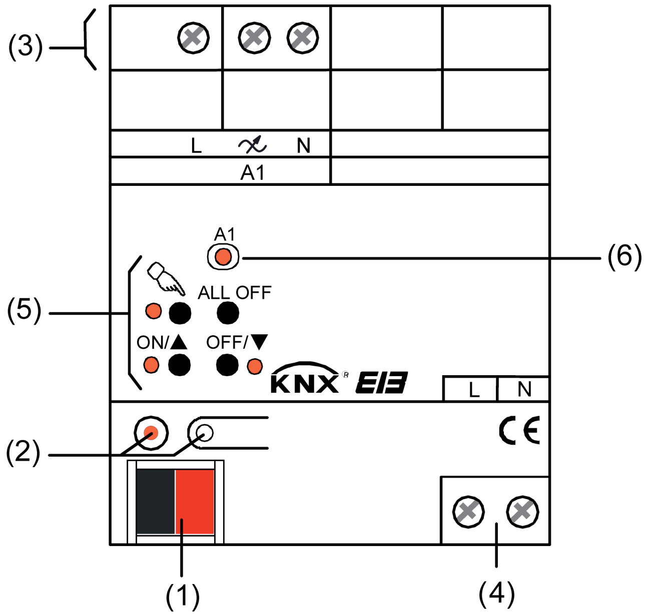

Figure 1: Structure of the 1-gang display variant

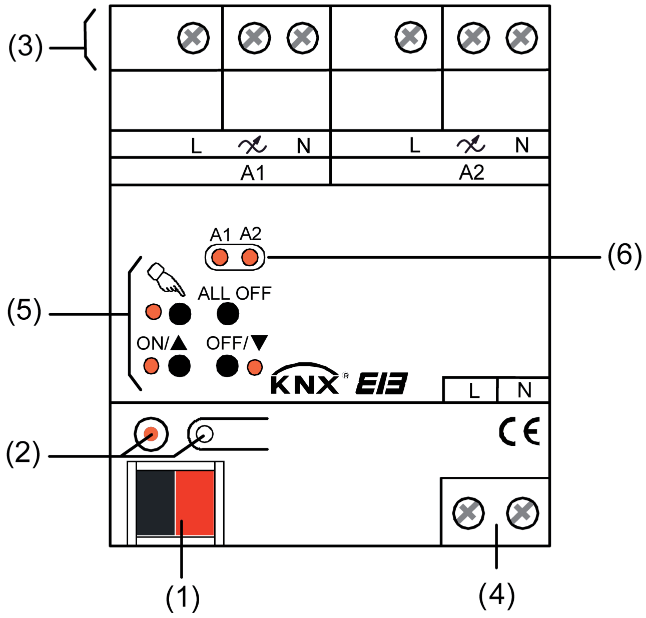

Figure 2: Structure of the 2-gang display variant

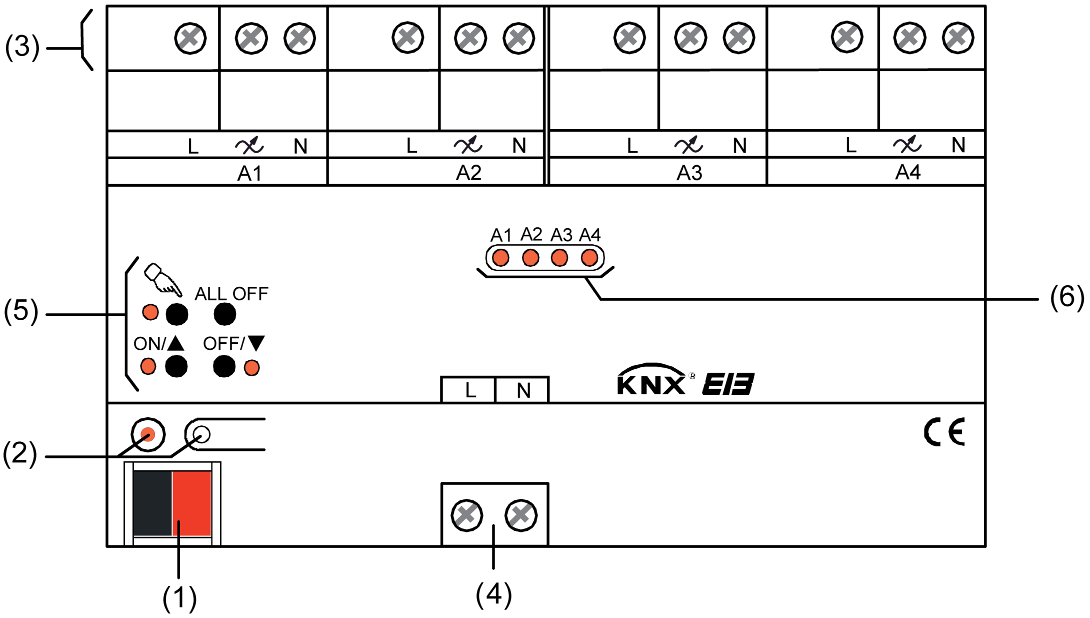

Figure 3: Structure of the 4-gang display variant

(1) KNX bus connection
(2) Programming button and programming LED (red).
(3) Screw terminals (L, ⏚, N) for connection of the load (connection of mains voltage and dimmer outputs).
(4) Screw terminals (L, N) for connection of the mains voltage (device power supply).
(5) Button field for manual control with status LEDs (red)
(6) Status LEDs (red) of the outputs.
LED off: output switched off
LED on: output switched on
LED flashing slowly: output in manual control
LED flashing quickly: output blocked by manual control

2.3 Fitting and electrical connection

⚠ **DANGER!**

Electrical shock when live parts are touched.

Electrical shocks can be fatal.

Before working on the device, disconnect the power supply and cover up live parts in the working environment.

Fitting the device

- Fit the device by snapping it onto a DIN-rail in acc. with EN 60715. The screw terminals for the load connection should be at the top.

ℹ A KNX data rail is not required.

ℹ Observe the temperature range and ensure sufficient cooling, if necessary.

Maintain a distance of 1 module, approx. 18 mm, between the devices when operating multiple dimmers or power boosters within a Sub-distribution unit in order to avoid overheating.

Connecting the power supply for the device electronics and load

Note permitted loads.

Observe the technical connection conditions of the electric power company.

Do not exceed permissible total load including transformer power dissipation.

Operate inductive transformers with at least 85% nominal load.

For mixed loads with inductive transformers at an output: ohmic load max. 50%.

Trouble-free operation is only ensured with electronic transformers manufactured by us or with inductive transformers.

CAUTION!

Danger of destruction from mixed loads.

The dimmer and load may be destroyed.

Do not connect capacitive loads, e.g. electronic transformers, and inductive loads, e.g. inductive transformers, together on the same dimmer output.

Do not connect inductive transformers together with HV LED lamps or compact fluorescent lamps on the same dimmer output.

- Connect the bus, the connection of the power supply and the load according to the connection diagram.(Figure 4).
- Do not switch on the mains voltage yet! First carry out the commissioning (see page 15).

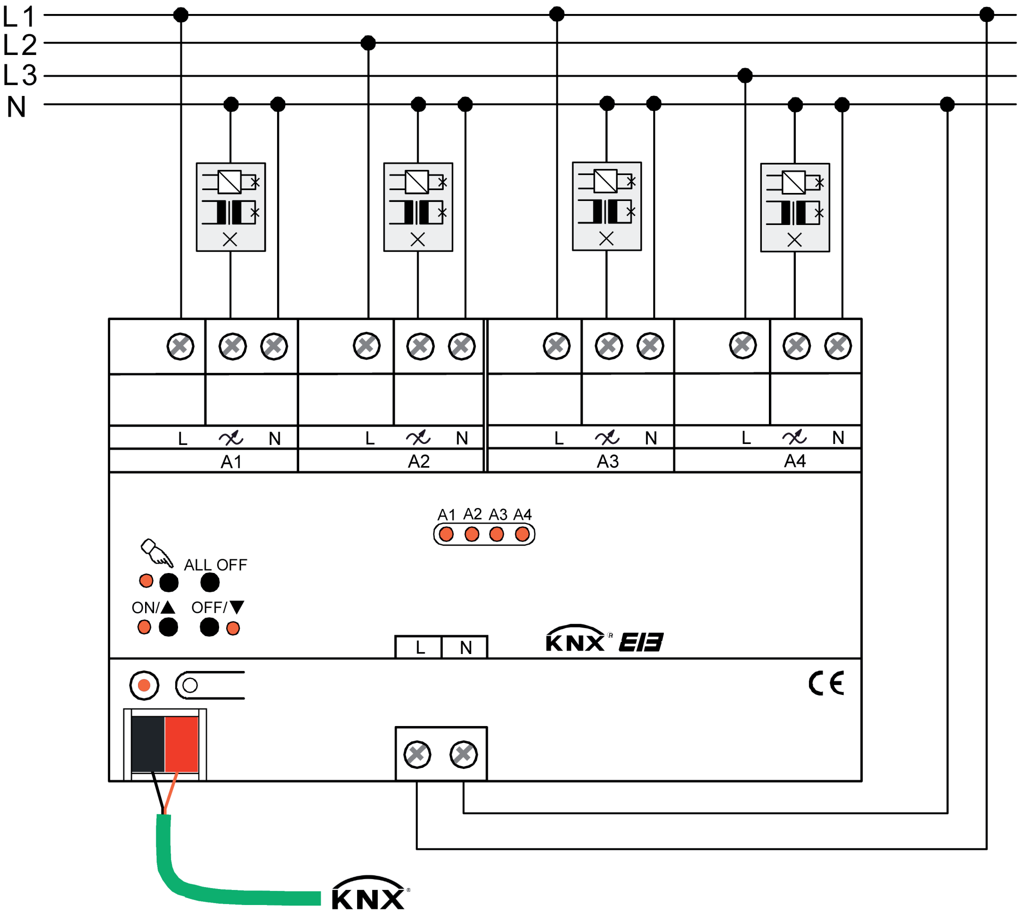

Figure 4: Electrical connection (using the example of the 4gang display variant)

ⓘ The supply of the load outputs and mains voltage of the device (device connection terminal "L") can be connected to various phase conductors (L1, L2, L3).

ⓘ The N terminals for supplying the load outputs (connection required!) are not bridged in the device. Hence, different FI electric circuits can be connected to the device.

ⓘ Power extension possible by means of our own power boosters.
Only for application programs of versions "1.2" and "1.3" in combination with device generations of "V02" or later: If the output power is increased by means of universal power boosters, the configuration of the corresponding channel must be adapted in the ETS (see parameter "Operation with universal power booster ?").
Only with application program version "1.1" and device generation without version designation or "V01": When extending the power of an output by means of universal power boosters, the maximum brightness (ETS parameter) must be reduced to 90 % at most!

ⓘ Flickering of the connected lamps due to undershoot of the specified minimum load or through centralised pulses from the power stations. This does not represent any defect in the device.

ⓘ If the dimming principle should or cannot be universally calibrated, it must be adapted to the connected load (ETS parameter). In the as-delivered state, the load type is set to "universal" for all channels.

ⓘ Only with program version "1.2" and device generations "V02" and "V03":
When connecting dimmable HV-LED and compact fluorescent lamps, the load type that is suitable for this purpose (parameter setting: "LED...") must always be configured in the ETS. Before switching on the mains voltage, commissioning using the ETS is essential in this case (see page 15-16).

ℹ Only with program version "1.3" and device generations from "V04" and onwards:
When connecting dimmable and compact fluorescent lamps, the load type that is suitable for this purpose (parameter setting: "HV-LED...") must always be configured in the ETS. Before switching on the mains voltage, commissioning using the ETS is essential in this case (see page 15-16).
When connecting dimmable HV-LED or LV-LED lamps (with Tronic transformers or conv. transformers), you can choose between the universal dimming principle (as-delivered state) or, alternately, a suitable load type. Observe the lamp manufacturer's instructions.

ℹ Only connect LED lamps and compact fluorescent lamps of one manufacturer and of the same type to a dimming output. Do not connect any other loads.

ℹ HV-LED and compact fluorescent lamps generate high pulsed currents, when they are operated in the leading edge phase control. Depending on the design and power rating of these lamps, the actual connected load of the specified values (label, housing or packaging) could vary.

ℹ Only for device generation without version designation:
It is not possible to operate the device with universal power boosters in conjunction with electronic transformers! Please use Tronic power boosters for power extension when operating electronic transformers.

ℹ Dimming results and dimming quality could vary depending on cable lengths, grid conditions and other influencing factors. Depending on the design and power rating of the lamps, the connected load of the specified values could vary. We do not assume any responsibility for the function, dimming results and dimming quality in connection with HV LED and LV LED and will not accept any liability.

Wire outputs in parallel (only for device variant "4-gang")

To increase the channel power, the device variant "4-gang" can be wired in parallel by reducing the number of channel outputs. The assignment of parallel to wired dimming outputs to the KNX-controllable dimming channels takes place in the ETS. By combining all 4 dimming outputs, the connected load can thereby be increased to a max. of 950 Watt.

⚠ **CAUTION!**

Risk of destruction if a wrong channel effect is configured for parallel wiring of outputs in the ETS.

The dimmer and load may be destroyed.

In the case of parallel switched outputs, check the parameter settings and adjust if necessary before switching on the mains voltage.

⚠ **CAUTION!**

Danger of destruction. 400 V are shorted when outputs switched in parallel are connected to different outer phase conductors.

The device will be destroyed.

Always connect outputs switched in parallel to the same outer phase conductor.

- Wire the corresponding outputs in parallel according to connection diagram (Figure 5).
- Do not switch on the mains voltage yet! First carry out the commissioning (see page 15).

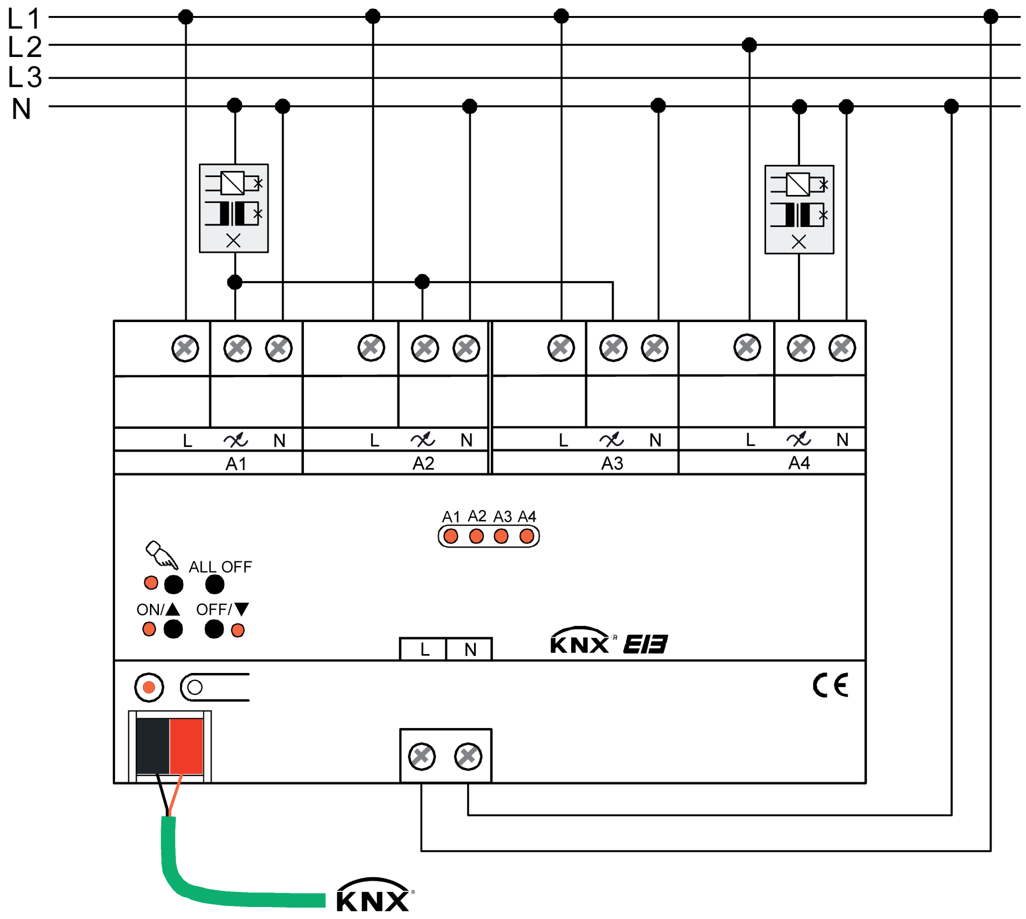

Figure 5: Electrical connection for parallel wiring of outputs (example)

ⓘ The L terminals of the parallel wired outputs must be connected to the same outer conductor!

ⓘ Parallel wired outputs can only be utilized up to a max of 95 % each.
-> 2 outputs in parallel: Maximum connected load 475 W!
-> 3 outputs in parallel: Maximum connected load approx. 710 W!
-> 4 outputs in parallel: Maximum connected load 950 W!

ⓘ In the case of parallel wiring of dimming outputs, it is not permitted to connect additional power extensions to the load outputs concerned!

ⓘ Do not connect any HV-LED, LV-LED (via Tronic transformers or conventional transformers) or compact fluorescent lamps to dimmer outputs switched in parallel.

ⓘ With the "2-gang" device variant the dimming outputs cannot be wired in parallel.

Connecting motors (only for "1-gang" device variant)

Apart from controlling lighting, the universal dimmer actuator 1-gang can be used as a speed controller of single-phase electric motors. This operating mode can be preselected in the ETS and has a considerable effect on the parameter configuration and function of the device.

CAUTION!

Risk of destruction if a wrong operating mode is configured in the ETS when connecting motors.

The dimmer and motor load may be destroyed.

When connecting motors, check the parameter settings and adjust if necessary before switching on the mains voltage.

- Connect single-phase electric motors according to connection diagram (Figure 6).
- Do not switch on the mains voltage yet! First carry out the commissioning (see page 15).

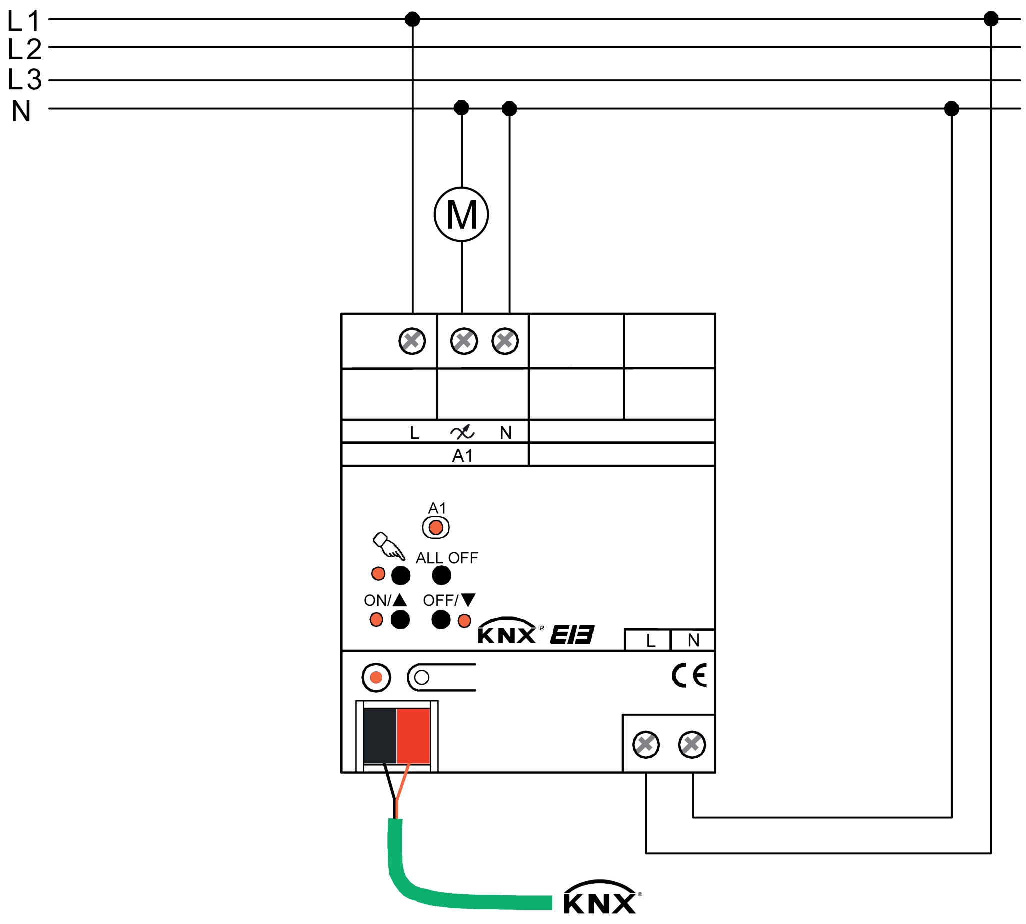

Figure 6: Electrical connection of single-phase electric motors

ℹ Do not connect any three-phase motors!

ℹ When connecting several motors in parallel, observe the maximum output power of the device! Only connect motors of identical type in parallel!

ℹ With the operating mode "speed controller", it is not permitted to connect additional power extensions to the power output!

ⓘ In the as-delivered state of the device, the "lighting control" is preconfigured as operating mode. When connecting a motor, the "speed controller" operating mode must be configured in the ETS.
Before switching on the mains voltage, commissioning using the ETS is essential (see chapter 2.4. Commissioning).

Changing connected load type

If one of the connected loads is changed after the commissioning, another load type can also result due to the load change - for example, when replacing a ceiling luminaire with an incandescent lamp by a low voltage illuminant with a conventional transformer, by HV LED or compact fluorescent lamps. The load type has an influence on the dimming principle to be used (leading edge phase control, trailing edge phase control, universal). The load type and the resulting dimming principle can be configured in the ETS.
If the load type is set to "universal", the dimmer actuator in this case must be recalibrated to the new load. To do this, the mains voltage of the load must first be switched off as well.
It is always necessary to ensure that the load type configured in the ETS matches the connected load!

CAUTION!

Risk of destruction if the preset dimming principle and connected load do not match.

The dimmer and load may be destroyed.

Before changing the dimming principle, observe load type.

Before changing the load type, make sure that the dimming principle is correct.

Before changing the load type, disconnect the mains voltage of the device and the load circuit concerned. Check parameter settings and adjust if necessary.

- Disconnect the mains voltage of the load circuit.
  In this case, depending on the ETS configuration, a load failure telegram can be transmitted to the bus if necessary (see "Load failure detection").
- Connect changed load.
- Put device into operation again (see page 15).

ⓘ Only with program version "1.2" and device generations "V02" and "V03":
When connecting dimmable HV-LED and compact fluorescent lamps, the load type that is suitable for this purpose (parameter setting: "LED...") must always be configured in the ETS.

ⓘ Only with program version "1.3" and device generations from "V04" and onwards:
When connecting dimmable and compact fluorescent lamps, the load type that is suitable for this purpose (parameter setting: "LED...") must always be configured in the ETS.
When connecting dimmable HV-LED or LV-LED lamps (with Tronic transformers or conv. transformers), you can choose between the universal dimming principle (as-delivered state) or, alternately, a suitable load type. Observe the lamp manufacturer's instructions.

ⓘ Operate dimmable HV-LED lamps – depending on the specifications of the lamp manufacturer – preferably in the trailing edge phase control. Only configure the type of load in the ETS to "(HV-)LED leading edge phase control" if the operation of the connected lamps in the trailing edge phase control principle is not satisfactory (e.g. dimming range is too small).

ⓘ In the function as speed controller (only with device variant "1-gang"), the load type and thus the dimming principle is predefined to unalterable in the ETS configuration (leading edge phase control operation).

🛈 If the mains voltage supplies of the load outputs and the actuator are connected to various phase conductor, it is recommended to also install a multipolar circuit breaker for complete enabling.

Installing / removing the protective cap

To protect the bus lines against hazardous voltages in the area of the connecting terminals, a protective cap can be installed.

The cap is installed with the bus terminal in place and the connected bus line led out at the rear.

- To install the cap: slide the cap over the bus terminal until you feel it engage (Figure 7).
- To remove the cap: Remove the cap by pressing the sides slightly and by pulling it out to the front (Figure 7).

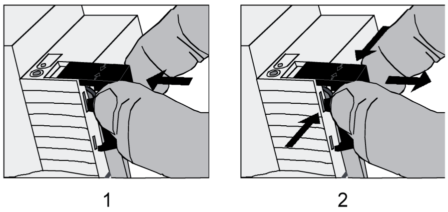

Figure 7: Installing / removing the protective cap for the bus connection

2.4 Commissioning

After installation of the device and connection of the bus line and mains voltage as well as electrical loads, the device can be put into operation. The following procedure is generally recommended...

Commissioning with the ETS

The device must be installed completely and connected to the mains voltage and loads.

🛈 The device has a mains voltage connection that is independent of the load outputs for supplying the device electronics of the manual operation and integrated bus coupling unit. The device electronics and bus coupling unit are also supplied from the bus coupling unit so that an ETS programming operation or manual operation is also possible even if the mains voltage is not connected or is switched off. As long as the bus voltage is connected and ready for operation, the device's internal power supply unit is switched off to save energy.

The mains voltage is switched off completely.

Before programming the application program and parameters using the ETS, it must be ensured that the channel effect parameter configuration (parallel wiring) and the load type (dimming principle) correspond to the electric loads connected to the actuator.

⚠ **DANGER!**

Electrical shock when live parts are touched.

Electrical shocks can be fatal.

Before working on the device, disconnect the power supply and cover up live parts in the working environment.

⚠ **CAUTION!**

Risk of destruction if the preset dimming principle and connected load do not match.

The dimmer and load may be destroyed.

Before changing the dimming principle, observe load type.

Before changing the load type, make sure that the dimming principle is correct.

Before changing the load type, disconnect the mains voltage of the device and the load circuit concerned. Check parameter settings and adjust if necessary.

- Switch on the bus voltage. Make sure that the bus voltage is available interruption free during the commissioning.

  Check: When the programming button is pressed, the red programming LED must light up.
- Configure and program the physical address with the help of the ETS.
- Download the application data with the ETS.
- Switch on mains voltage supplies of the load circuits.

  The device calibrates itself to the loads and selects the appropriate dimming procedure if the load type is set to "universal" in the ETS. The dimming procedure can also be predefined with the parameterization. In this case, the calibration procedure is not necessary.

  Afterwards, the actuator sets the brightness on the outputs that is predefined in the ETS in the "Behaviour after bus or mains voltage return" parameter. During the calibration phase, received operations are executed after completion of the calibration procedure.
- Switch on mains voltage supply of the dimmer actuator (terminal pair "L N").

  The device is ready for operation.

ℹ The calibration procedure becomes noticeable during ohmic loads by a brief flicker and lasts between 1 to 10 seconds depending on the network conditions.

ℹ The mains voltages of the load circuits and the mains voltage supply of the actuator are switched on simultaneously if, for example, all connections are clamped on the same phase conductor via a circuit breaker. If the load outputs and mains voltage of the dimming actuator are supplied by different phase conductor or several circuit breakers, the load circuits should always be switched on before the mains voltage supply of the dimming actuator. This ensures correct calibration of the actuator even for long conducting paths to the load.

ℹ If a short-circuit is detected on a load output during the commissioning, the actuator cannot calibrate to the load. In this case, the fault must first be eliminated and the short-circuit reset (see page 23-24).

ℹ When the mains supply is on, the outputs of the actuator can be switched manually even if there is no bus voltage or if the actuator is not yet programmed. Due to this feature, the loads connected to the individual outputs can be checked for proper functioning already during site operation.

Setting minimum speed (only for "1-gang" device variant in the "speed controller" operating mode)

When deployed as a speed controller, the device must be adapted to the minimum speed of the connected motor.

The ETS commissioning was performed successfully beforehand (see page 15-16).

The device is configured as a "speed controller".

⚠ **CAUTION!**

Connected motors must not stop.

Risk of destruction for motor and controlling device.

Set the minimum speed in such a way that the motor does not stop at a minimum setting.

ℹ The speed of a connected motor (e.g. minimum speed) is configured in the ETS as a percentage value. This value represents the dimming value in percent and is a gauge for the output signal's phase angle of the actuator (leading edge phase control operation).

- Load the connected motor with the maximum load that occurs during operation.
- Switch on device by manual or bus control.

The device switches on the connected motor to the cutting-in speed.

After the set resting time has elapsed, the device sets the currently required speed.

ℹ In the presetting of the device, the cutting-in speed corresponds to the maximum speed of 100 %.

- Slowly reduce the speed setting by means of a dimming procedure, e.g. by manual operation locally on the actuator, until the motor has reached its minimum permitted speed. While doing so, take the motor follow-up into account.
- Ascertain the current speed by determining the current dimmer setting. This can be done, e.g., by selecting the current value of the communication object "Speed feedback" with the help of the ETS.

ℹ The data format of the speed feedback is 1 byte. The actuator transmits dimensionless decimal values 0...255 via this object, which correspond to the percentage value range of 0...100 % and thus the dimming range of the actuator. Any selected value between 0...255 can be easily converted to the percentage value...
"Selected value" divided by "255" multiplied by "100 %"
Example: Selected value = 128 -> Calculation: (128 : 255) · 100 % = 50 %. The decimal places must be ignored.

- Enter the determined value (in percent) as minimum speed in the parameter settings. Round up the value to the predefined values available in the ETS. The decimal values equivalent to the percentage values are displayed in the ETS as a configuration aid.
- Download the application data with the ETS.

2.5 Operation

2.5.1 Manual operation on device

Function

All load outputs of the device have electronic manual operation. The button field with 4 function keys and 3 status LEDs on the front panel of the device can be used for setting the following modes of operation...

- Bus control: operation from touch sensors or other bus devices.
- Temporary manual control: manual control locally with keypad, automatic return to bus control.
- Permanent manual control: local manual control with keypad.

ℹ The operating modes can also be disabled by parameter settings in the ETS.

ℹ When manual control is active, the outputs cannot be controlled via the bus.

ℹ Manual control is possible only while the actuator is supplied with power from the mains or bus. In the event of bus and mains voltage failure, manual operation is terminated.

ℹ The manual operation mode always ends in the event of bus voltage return.

ℹ In manual mode, bus operation can be disabled via a telegram. Manual operation is terminated on activation of the disabling function.

ℹ Further details concerning manual control, especially with respect to the possible parameter settings and the interaction with other functions of the dimmer actuator can be found in chapter 4, "Software description" of the present documentation.

Controls and indicators for manual control

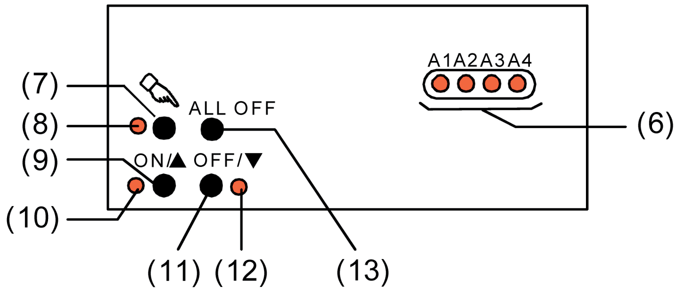

Figure 8: Controls and indicators for manual control
(using the example of the 4gang display variant)

(6) Status LEDs
Indicate the state of the individual outputs. An LED lights up when an output is switched on (brightness: 1…100 %). One of the LEDs flashes when the corresponding output has been selected in manual operation by the button.

(7) Button ☞
Activation / deactivation of manual control.

(8) LED ☞
LED ON indicates permanent manual control.

(9) Button ON/ ▲
Brief press: Output ON / Sustained press: Increase output brightness.

(10) Status LED ON/ ▲
LED ON in manual control indicates a switched-on output (Brightness: 1...100 %).

(11) Button OFF/▼
Brief press: Output OFF / Sustained press: Reduce output brightness.

(12) Status LED OFF/ ▼
LED ON in manual control indicates a switched-off output (Brightness: 0 %).

(13) Button ALL OFF
When pressing, all outputs are switched off (only in permanent manual operation).

Priorities for manual control

The device distinguishes between different functions that can have an effect on an output channel. In order to prevent conflicting output states, each available function has a certain priority. The function with the higher priority overrides the one with the lower priority...

- 1st priority: manual control (highest priority)

- 2nd priority: forced position or disabling function
- 3rd priority: direct operation via the bus ("switching" & "dimming" & "brightness value" objects, scenes, central function)

Features of the device variant 4-gang

To increase the channel power, the device variant "4-gang" can be wired in parallel by reducing the number of channel outputs. The assignment of parallel to wired dimming outputs to the KNX-controllable dimming channels takes place in the ETS.
With a parallel wiring, it is possible in 3-channel operation, for example, to assign the load outputs A1 and A2 to the KNX dimming channel 1. These outputs are then wired in parallel. In this example, the outputs A3 and A4 are then assigned to the dimming channels 2 and 3 and work independently.

The parallel wiring of the outputs has influence on the manual operation. In the example mentioned, the outputs A1 and A2 can only be used simultaneously in manual operation because they are assigned to the same KNX dimming channel. The Status LEDs on the front panel of the device subsequently flash at the same time during manual operation and always indicate the same switching state. This should be taken into account as a special case with device variant "4-gang".

Switching on the temporary manual control

Manual control is enabled in the ETS.

- Press 🖐 button briefly (< 1 s).

  The status LED for output 1 flashes (LED 🖐 remains off).

ℹ After 5 s without a key-press, the actuator returns automatically to bus operation.

Deactivating temporary manual control

Temporary manual control was activated.

- No key-press for 5 s

- or -

- Select all outputs one after another by a brief press of the 🖐 button. Thereafter, press the key once again.

- or -

- induce bus reset (bus voltage return). Temporary manual control is terminated. The status LEDs A1...A4 indicate the status according to bus operation.

ℹ The brightness value set via manual control is not changed when temporary manual control is switched off. If, however, a forced position or disabling function has been activated via the bus before or during manual operation, the actuator executes the disabling or forced reactions for the output channels concerned.

Switching on permanent manual control

Manual control is enabled in the ETS. Bus operation or temporary manual control is active.

- Press the 🖐 button for at least 5 s.

The status LED ✍ is illuminated. The status LED for output 1 flashes. Permanent manual control is active:

Deactivating permanent manual control

Permanent manual control is active.

- Press the ✍ key for at least 5 s.

- or -

- induce bus reset (bus voltage return). The status LED ✍ goes out. The status LEDs A1...A4 indicate the status according to bus operation.

ℹ Depending on the parameterization of the actuator in the ETS, the last predefined brightness values (direct operation, forced position / disabling function) of the outputs will be tracked or there is no reaction when the manual mode is shut off.

Controlling an output manually

Manual control (permanent or temporary) is activated.

- Select the desired output: Press the ✍ key briefly (if necessary, repeatedly).

  The status LED of the selected output A1...A4 flashes. The status LEDs "ON/ ▲" (1...100 %) or "OFF/ ▼" (0 %) indicate the brightness status of the output in the key pad.
- Operate the output by pressing the "ON/ ▲" button or "OFF/ ▼ button.
  Short: switch on/off.
  Long: dim brighter/darker.
  Long and release: Stop dimming.

  The selected output executes the corresponding commands immediately.

ℹ An output cannot be switched on or dimmed if there is a load failure or short-circuit or if the dimmer actuator.

Switching off all outputs

Permanent manual control is active:

- Press "ALL OFF" button.

  All outputs are switching off immediately (Brightness: 0 %). The outputs are not locked. Individual activation is possible again after shutoff.

ℹ The "ALL-OFF" function is not available in temporary manual control.

Disabling bus control of individual outputs manually

Permanent manual control is active:

Disabling of the bus control mode must have been enabled in the ETS.

- Select the output: Press the ✍ key briefly (if necessary, repeatedly).

  The status LED of the selected output A1...A4 flashes. The status LEDs "ON/ ▲" (1...100 %) or "OFF/ ▼" (0 %) indicate the brightness status of the output in the key pad.
- Press the "ON/ ▲" and "OFF/ ▼" buttons simultaneously for at least 5 s.

The concerned output is disabled (no bus operation is possible). The status LED of the selected output A1...A4 flashes quickly.

ℹ To unlock, proceed in the same way.

ℹ An output that has been disabled in manual control can thereafter only be operated in permanent manual control.

ℹ When a disabled output is selected in manual mode, the corresponding status LED flashes twice briefly with a time interval.

2.5.2 Behaviour in the event of problems with the load

Load failure detection

The universal dimming actuator with a lighting control can monitor the electric circuits of its load outputs independent of each other. The actuator detects the mains voltage supply failures (> 15 s) of an output or the interruption of the electric circuit when a load is switched on or off. The load failure detection in case of use must be enabled separately in the ETS for a dimming channel (cf. chapter 4 "Software description").

ℹ No message of a load failure is possible with the device variant "speed controller" operating mode in the "1-gang" and device variant "4-gang" and "parallel wired outputs" (only in application program version "1.1"). No load failure message can be configured in the ETS in this case.

A load failure due to an interruption of the load circuit, – e.g. for checking a lamp – can only be reliably detected when a load that interrupts the circuit completely in the case of a fault is connected to an output. Therefore, a failed lamp can only be clearly detected if ...

- just one incandescent light bulb is connected and is faulty (e.g. broken filament),
- just one high-voltage halogen lamp is connected and is faulty.

Other loads or mixed loads do not normally permit the detection of a failed lamp. It is only possible to detect a faulty lamp if ...

- halogen lamps are connected via conventional or electronic transformers,
- an Incandescent lamp is connected as mixed load to a conventional or electronic transformer,
- several Incandescent lamps or HV halogen lamps are connected in parallel.

ℹ If the load failure detection is enabled in the ETS, a message telegram "Load failure detected – 1" is transmitted from the actuator to the bus approx. 15 ...20 seconds after identification of the load failure.

ℹ A mains voltage failure of the output is always detected as load failure if the mains voltage failure lasts longer than approx. 15 seconds.

ℹ A faulty fuse in the primary circuit of a conventional transformer normally results in a load failure not being detected.

ℹ In the event of a load failure, the actuator sets the switching status of the dimming channel concerned to "OFF" and the status of the brightness value to "0" and transmits these values to the bus if enabled in the ETS.

ⓘ The actuator initialises the objects "Signal load failure / overload" of all dimming channels after an ETS programming operation and after switching on the bus voltage or the mains power supply according to the current status. In this case, it should be noted that the "Delay after bus voltage return" configured in the ETS must have elapsed before load failure message telegrams are transmitted to the bus.

Eliminate load failure

The dimming actuator has detected a load failure on an output.

- Disconnect the mains voltage of the load circuit concerned.
- Ascertain the cause of the load failure and eliminate.
- Switch on mains voltage again of the load circuit.

  The load failure is reset. After resetting the load failure, the dimming channel concerned is switched off and can subsequently be switched on or dimmed again as usual.

ⓘ After eliminating the load failure and switching on the mains voltage again in the load circuit, the load is recalibrated if the load type is set to "universal" in the ETS. The calibration procedure becomes noticeable during ohmic loads by briefly flickering twice and lasts up to 10 seconds depending on the network conditions.

ⓘ At least 15 seconds after switching on the mains voltage, the actuator transmits a message telegram "no load failure – 0" to the bus if the load failure was eliminated. Otherwise, a load failure message is transmitted again. No message telegram is transmitted within the "Delay after bus voltage return".

Mains interruption

The device detects mains interruptions at the load connections, as they are caused by faults in the public low-voltage power supply, for example. If a detected mains interruption on an output only lasts for up to approx. 2 seconds, the dimmer actuator activates the old brightness value for the outputs concerned after mains return and shows no further reaction.

If the mains interruption lasts for more than approx. 2 seconds, the dimming actuator generates a reset for the outputs concerned after mains voltage return. At the same time, the dimmer outputs concerned are reinitialized with the ETS configuration data. The load is also recalibrated if the load type is set to "universal" in the ETS. During the initialization after the mains voltage failure, the outputs affected by the mains failure are switched off. The actuator thereby also transmits switching status and value feedbacks to the bus, if configured in the ETS. Thereafter, the dimming channels can be switched on again as usual. If the mains failure lasts longer than 15 s, a load failure, if used, is also signalled to the bus (see "Load failure detection").

ⓘ In the case of a 'hard mains interruption', which is caused, for example, by disconnection via a circuit breaker, the detection time of the mains failure on the load connections can last for up to 7 seconds (instead of 2 seconds) due to additional debounce delays.

In the case of a bus and mains voltage supply failure of the dimmer actuator (terminal pair "L N" next to the bus connection), the reset is always generated for all outputs after mains voltage return. At the same time, the dimmer outputs concerned are reinitialized with the ETS configuration data. The loads are also recalibrated if the load types are set to "universal" in the ETS. After the initialization, the outputs are set according to the ETS parameter "Behaviour after bus or mains voltage return".
After mains return, no reaction occurs provided that the bus voltage was available interruption free.

Short-circuit and over-temperature detection

Short-circuit protection and overtemperature protection are integrated in the device for each output.
If the device detects a short-circuit, the load is switched off automatically after 7 seconds in trailing edge phase control operation (capacitive and ohmic loads) or after 100 milliseconds in leading edge phase control operation (inductive loads). After switching off, the actuator transmits a message telegram "Short-circuit present – 1" to the bus for the dimming channel concerned, if this message is enabled in the ETS. A short-circuit must be reset (see page 24-25).
If there is an overtemperature in the device, the load is switched off by the temperature control of the device. The actuator, 15 seconds after switching off, transmits a message telegram "Load failure present – 1" to the bus for the dimming channel concerned, if this message is enabled in the ETS. In this state, the dimming channel concerned can no longer be switched on by manual or bus control. To reset such a fault, it might be necessary to switch off the mains voltage supply of the load outputs. Over-temperatures in the device either occur as a result of self-heating (electrical overload) or external influences (ambient temperature in the control cabinet is too high).

ⓘ If an over-temperature switch-off occurs, the installation situation of the device must be checked. If the over-temperature occurs regularly, measures must be taken (e. g. provide cooling, increase distance to surrounding devices, reduce connected load).

ⓘ If the overtemperature protection is activated again shortly after resetting, the device's self-protection takes effect permanently (the device is then apparently faulty). As a result, the device must be replaced.

ⓘ With the device variants "2-gang" and "4-gang, the reaction of the dimming outputs depends on the load situation after an overload-temperature switch-off. The load defines a holding current during an over-temperature switch-off. A dimmer output remains switched off permanently after the over-temperature switch-off if the holding current exceeds a defined threshold. In this case, the over-temperature switch-off must be reset "manually" (see page 25). If the holding current does not exceed the threshold, the dimmer output switches on again automatically after cooling down. At the same time, the outputs concerned pass through a reset whereby they are reinitialized with the ETS configuration data. As a result, the load is also recalibrated if the load type is set to "universal" in the ETS. Thereafter, the dimming outputs execute the reaction after mains voltage return.

ⓘ With the device variant "1-gang", the dimmer output remains switched off permanently after an over-temperature switch-off. In this case, the over-temperature switch-off must always be reset "manually" (see page 25). In the case of a device's self-protection that takes effect continuously, it should be noted that a manual reset of the over-temperature switch-off is not possible. The device must then be replaced.

The device is also protected against electrical overload. Electrical overloads occur when the nominal operation parameters of a dimmer output are exceeded temporarily or continuously. The reaction of a device then depends on how great the electrical overload is and which ambient conditions prevail. If the overload exceeds the defined short-circuit threshold, the device switches off the dimming channel concerned after 7 seconds at the latest, depending on the load type. In this case, the actuator generates a short-circuit message on the bus if this feedback is enabled in the ETS.
If the electrical overload does not exceed the short-circuit threshold, the device heats up continuously. Whether and how rapidly this self-heating occurs depends essentially on how great the overload is and how much the device is thermally influenced from outside. The heating up of the device causes the over-temperature switch-off to take effect from a specific temperature threshold. In this case, the actuator generates a load failure message on the bus if this feedback is enabled in the ETS.
Consequently, the device protects itself constantly by means of short-circuit or over-temperature switch-off even in the case of an electrical overload.

ⓘ Special case "Parallel wired outputs" with the device variant "4-gang".
An over-temperature switch-off is performed selectively for each output, i.e. each load output has its own protection against thermal overload. During a thermal overload, only a few outputs of the dimming channel concerned may switch off because of different temperature conditions in the device.

Reset short-circuit

If the device has detected a short-circuit on an output, this fault must then be eliminated and the output reset before the dimming channel concerned can be switched on again.

The device has detected a short-circuit for an output.

- Disconnect the mains voltage of the load circuit concerned.
- Switch off mains voltage supply of the device (terminal pair "L N" next to the bus connection).
- Ascertain the cause of the short-circuit and eliminate.
- Switch on mains voltage again of the load circuit.
- Switch on the mains supply of the device again.

The short-circuit is reset. The dimming channel can subsequently be switched on or dimmed again as usual.

ⓘ After eliminating the short-circuit and switching on the mains voltage, the load is recalibrated if the load type is set to "universal" in the ETS. The calibration procedure becomes noticeable during ohmic loads by briefly flickering twice and lasts up to 10 seconds depending on the network conditions.

ⓘ After switching on the mains voltage, the actuator transmits a message telegram "no short-circuit – 0" to the bus if the short-circuit was eliminated. Otherwise, a short-circuit message is transmitted again.

ⓘ If the output of a dimming channel was switched off due to a short-circuit, the actuator also transmits switching status and value feedbacks (lighting "OFF") to the bus, if configured in the ETS.

ⓘ In the event of a short-circuit, the actuator handles parallel wired outputs of the device variant "4-gang" identically because the short-circuit occurs at the same time for all load outputs assigned to the dimming channel. The short-circuit is then reported to the bus via the dimming channel concerned.

ⓘ The reset of a short-circuit detection and thus the message that was transmitted to the bus can also be performed by switching off the dimming channel concerned. It is possible to switch off via...
- the "switching" object with the switching command "OFF",
- the "brightness value" object with the value "0",
- a scene recall with the brightness value "0",
- a manual operation with the command "OFF".
A bus voltage failure with subsequent bus voltage return also triggers a short-circuit reset.
The reset of a short-circuit message simply by switching off can be helpful when determining whether the short-circuit situation is still present. If switching on the dimming channel concerned results in a short-circuit message again, there is still a fault in the system.
To eliminate a short-circuit, for safety reasons, the mains voltage supply of the load and dimmer actuator must always be disconnected as described in the operational procedure!

ⓘ The actuator initialises the objects "Signal short-circuit" of all dimming channels after an ETS programming operation and after switching on the bus voltage according to their current status. In this case, it should be noted that the "Delay after bus voltage return" configured in the ETS must have elapsed before short-circuit message telegrams are transmitted to the bus.

Resetting permanent over-temperature switch off

The device has switched off one or more load outputs permanently because over-temperature was detected.

- Switch off the mains voltage supply of the device (terminal pair "L N") and the mains voltage supply of all load outputs.
- Let the device cool down for at least 15 minutes.
- Switch on the mains voltage supply again of the device and mains voltage supply of all load outputs.

  At the same time, the dimmer outputs concerned are reinitialized with the ETS configuration data. The load is also recalibrated if the load type is set to "universal" in the ETS.
- For testing purposes, switch on the dimming channel, which was affected previously due to the over-temperature switch-off, by manual or bus operation.

  The connected load switches on.

ⓘ If a dimming channel was switched off due to an over-temperature, the actuator also transmits switching status and value feedbacks (lighting "OFF") and a load failure message (delayed by 15 seconds) to the bus, if configured in the ETS.

ⓘ After switching on the mains voltage supply, the actuator transmits a message telegram "no load failure – 0" to the bus if the source of the over-temperature was reliably eliminated. Otherwise, the overtemperature may reoccur after a certain period of operation.

ⓘ If an over-temperature switch-off occurs, the installation situation of the device must be checked. If the over-temperature occurs regularly, measures must be taken (e. g. provide cooling, increase distance to surrounding devices, reduce connected load).

ⓘ If the overtemperature protection is activated again shortly after resetting, the device's self-protection takes effect permanently (the device is then apparently faulty). As a result, the device must be replaced.

ⓘ Special case "Parallel wired outputs" with the device variant "4-gang".
An over-temperature switch-off is performed selectively for each output, i.e. each load output has its own protection against thermal overload. During a thermal overload, only a few outputs of the dimming channel concerned may switch off because of different temperature conditions in the device.

Overvoltage detection

The device can detect overvoltage on a dimming output. Overvoltage occurs, for example, if the dimming principle "Phase cut-off" set in the parameters for LED lamps does not match the load. If overvoltage is detected, the device switches off the dimming output affected. This protects the device against destruction. If overvoltage is detected, the load is switched off automatically after 7 seconds in phase cut-off operation and after 100 milliseconds in phase cut-on operation.

After switching off, the actuator transmits a message telegram "Short-circuit/Overload present – 1" - as in the case of a detected short-circuit or overload - to the bus for the dimming channel concerned, if this message is enabled in the ETS. The resetting of a switched-off output due to overvoltage is possible in the same way as the resetting of a short-circuit message (see page 24-25).

3 Technical data

General

Test mark	KNX/EIB
Ambient temperature	-5 ... +45 °C
Storage/transport temperature	-25 ... +70 °C
Housing temperature	75 °C (tc)
Installation position	as desired (preferably top output terminals)
Fitting width	
Order No. 2171 00	72 mm / 4 modules
Order No. 2172 00	72 mm / 4 modules
Order No. 2174 00	144 mm / 8 modules

Terminals for mains supply and outputs

Connection mode	Screw terminal
single stranded	0.5 ... 4 mm²
Finely stranded without conductor sleeve	0.5 ... 4 mm²
Finely stranded with conductor sleeve	0.5 ... 2.5 mm²
Connection torque	max. 0.8 Nm

KNX supply

KNX medium	TP 256
Commissioning mode	S-mode
Rated voltage KNX	DC 21 ... 32 V SELV
Current consumption KNX	15 mA
Connection mode KNX	device connection terminal

External supply

Rated voltage	AC 110 ... 230 V ~
Mains frequency	50 / 60 Hz
Power loss	
Order No. 2171 00	max. 4 W
Order No. 2172 00	max. 4 W
Order No. 2174 00	max. 8 W
Standby power	
Order No. 2171 00	max. 0.5 W
Order No. 2172 00	max. 0.8 W
Order No. 2174 00	max. 1.4 W

outputs

Contact type	ε, MOSFET
Switching voltage	AC 230 V ~
Switching current motors	
Order No. 2171 00	2.3 A
Order No. 2172 00	—
Order No. 2174 00	—
Cable length	max. 100 m

Connected load 230 V AC	
Incandescent lamps	
Order No. 2171 00	20 ... 500 W
Order No. 2172 00	20 ... 300 W
Order No. 2174 00	20 ... 250 W
HV halogen lamps	
Order No. 2171 00	20 ... 500 W

Order No. 2172 00	20 ... 300 W
Order No. 2174 00	20 ... 250 W
Inductive transformers	
Order No. 2171 00	20 ... 500 VA
Order No. 2172 00	20 ... 300 VA
Order No. 2174 00	20 ... 250 VA
Electronic transformers	
Order No. 2171 00	20 ... 500 W
Order No. 2172 00	20 ... 300 W
Order No. 2174 00	20 ... 250 W

Only with program versions "1.3" in combination with device generations from "V04" and onwards:

Inductive transformers with LV-LED	typ. 20 ... 100 VA
Electronic transformers with LV-LED	typ. 20 ... 100 W

Only with program versions "1.2" ans "1.3" in combination with device generations from "V02" and onwards:

HV-LED lamps	
Order No. 2171 00	typ. 3 ... 100 W
Order No. 2172 00	typ. 3 ... 60 W
Order No. 2174 00	typ. 3 ... 50 W

ℹ With setting "LED trailing edge phase control" the connection power for HV-LED lamps and electronic transformers with LV-LED doubles.

Compact fl lamp.	
Order No. 2171 00	typ. 3 ... 100 W
Order No. 2172 00	typ. 3 ... 60 W
Order No. 2174 00	typ. 3 ... 50 W

Only with program version "1.1" or device generations with no release code and "V01":

Compact fluorescent lamps	not permitted

Mixed load 230 V AC	
ohmic-inductive	
Order No. 2171 00	20 ... 500 VA
Order No. 2172 00	20 ... 300 VA
Order No. 2174 00	20 ... 250 VA
ohmic-capacitive	
Order No. 2171 00	20 ... 500 W
Order No. 2172 00	20 ... 300 W
Order No. 2174 00	20 ... 250 W
capacitive-inductive	not permitted

Connected load 110 V AC	
Incandescent lamps	
Order No. 2171 00	20 ... 250 W
Order No. 2172 00	20 ... 150 W
Order No. 2174 00	20 ... 120 W
HV halogen lamps	
Order No. 2171 00	20 ... 250 W
Order No. 2172 00	20 ... 150 W
Order No. 2174 00	20 ... 120 W
Inductive transformers	
Order No. 2171 00	20 ... 250 VA
Order No. 2172 00	20 ... 150 VA
Order No. 2174 00	20 ... 120 VA
Electronic transformers	
Order No. 2171 00	20 ... 250 W
Order No. 2172 00	20 ... 150 W
Order No. 2174 00	20 ... 120 W

Only with program versions "1.3" in combination with device generations from "V04" and onwards:

Inductive transformers with LV-LED	typ. 20 ... 50 VA
Electronic transformers with LV-LED	typ. 20 ... 50 W

Only with program versions "1.2" ans "1.3" in combination with device generations from "V02" and onwards:

HV-LED lamps	
Order No. 2171 00	typ. 3 ... 50 W
Order No. 2172 00	typ. 3 ... 30 W
Order No. 2174 00	typ. 3 ... 24 W

ⓘ With setting "LED trailing edge phase control" the connection power for HV-LED lamps and electronic transformers with LV-LED doubles.

Compact fl lamp.	
Order No. 2171 00	typ. 3 ... 50 W
Order No. 2172 00	typ. 3 ... 30 W
Order No. 2174 00	typ. 3 ... 24 W

Only with program version "1.1" or device generations with no release code and "V01":

Compact fluorescent lamps	not permitted

Mixed load 110 V AC	
ohmic-inductive	
Order No. 2171 00	20 ... 250 VA
Order No. 2172 00	20 ... 150 VA
Order No. 2174 00	20 ... 120 VA
ohmic-capacitive	
Order No. 2171 00	20 ... 250 W
Order No. 2172 00	20 ... 150 W
Order No. 2174 00	20 ... 120 W
capacitive-inductive	not permitted

Total power consumption at 230 V	
Order No. 2171 00	—
Order No. 2172 00	max. 600 W/VA
Order No. 2174 00	—

ⓘ In the case of unbalanced load, an output of the device variant "2-gang" may be loaded with a max of 350 W/VA (230 V) as long as the permissible total power consumption is not exceeded.

Total power consumption at 110 V	
Order No. 2171 00	—
Order No. 2172 00	max. 300 W/VA
Order No. 2174 00	—

ⓘ In the case of unbalanced load, an output of the device variant "2-gang" may be loaded with a max of 175 W/VA (110 V) as long as the permissible total power consumption is not exceeded.

R,L,C,Ⓜ HV-LED

The icons used to label the dimmer load shows the load type that can be connected to a dimmer and the electric behaviour of a load:
R = ohmic, L = inductive, C = capacitive, M = motors,
HV-LED = dimmable HV-LED lamps

ℹ Only for application program versions "1.2" and "1.3" in conjunction with device generations from "V02" and onwards: HV-LED and compact fluorescent lamps generate high pulsed currents, when they are operated in the leading edge phase control. Depending on the design and power rating of these lamps, the actual connected load of the specified values (label, housing or packaging) could vary. The actual connected load of the aforementioned lamps is often higher than the power rating specified. As a result, load outputs of the dimmer actuator are loaded more greatly than power rating.
The connectable power for dimmable HV LEDs and compact fluorescent lamps are specified in this documentation as "typical" since the specified nominal values of the lamps (depending on manufacturer and type) cannot be compared with the connected load or only with difficulty. The actual connected load of the lamps used must not exceed the connected load specified in this documentation!

4 Software description

4.1 Software specification

ETS search paths:	illumination / dimmer / Dimming actuator, 1-gang illumination / dimmer / Dimming actuator, 2-gang illumination / dimmer / Dimming actuator, 4-gang
Configuration:	S-mode standard
PEI type:	"00"$_{\text{Hex}}$ / "0" $_{\text{Dec}}$
PEI connector:	no connector

Application programs for 1-gang device variant

No.	Short description	Name	Version	from mask version
1	Multifunctional control of 1 dimmer output for lighting control. Alternative function as speed controller for controlling the speed of single-phase electric motors.	Dimming 302611	1.1 for ETS 3.0 version d and onwards , ETS4 and ETS5	705
2	Multifunctional control of 1 dimmer output for lighting control incl. control of HV LED and compact fluorescent lamps. Alternative function as speed controller for controlling the speed of single-phase electric motors. Extended scope of functions.	Dimming 302612	1.2 for ETS 3.0 version d and onwards , ETS4 and ETS5	705
3	Multifunctional control of 1 dimmer output for lighting control incl. control of HV LED, LV LED and compact fluorescent lamps. Alternative function as speed controller for controlling the speed of single-phase electric motors. Extended scope of functions.	Dimming 302613	1.3 for ETS 3.0 version d and onwards , ETS4 and ETS5	705

Application programs for 2-gang device variant

No.	Short description	Name	Version	from mask version

1	Multifunctional control of 2 dimmer outputs for lighting control.	Dimming 302311	1.1 for ETS 3.0 version d and onwards , ETS4 and ETS5	705
2	Multifunctional control of 2 dimmer outputs for lighting control incl. control of HV LED and compact fluorescent lamps. Extended scope of functions.	Dimming 302312	1.2 for ETS 3.0 version d and onwards , ETS4 and ETS5	705
3	Multifunctional control of 2 dimmer outputs for lighting control incl. control of HV LED, LV LED and compact fluorescent lamps. Extended scope of functions.	Dimming 302313	1.3 for ETS 3.0 version d and onwards , ETS4 and ETS5	705

Application programs for 4-gang device variant

No.	Short description	Name	Version	from mask version
1	Multifunctional control of up to 4 dimmer outputs for lighting control.	Dimming 302011	1.1 for ETS 3.0 version d and onwards , ETS4 and ETS5	705
2	Multifunctional control of up to 4 dimmer outputs for lighting control incl. control of HV LED and compact fluorescent lamps. Extended scope of functions.	Dimming 302012	1.2 for ETS 3.0 version d and onwards , ETS4 and ETS5	705
3	Multifunctional control of up to 4 dimmer outputs for lighting control incl. control of HV LED, LV LED and compact fluorescent lamps. Extended scope of functions.	Dimming 302013	1.3 for ETS 3.0 version d and onwards , ETS4 and ETS5	705

4.2 Software "Dimming 30201x / 30231x / 30261x"

4.2.1 Scope of functions

General:

- There are up to 4 dimming channels available depending on the device variants.
- To simplify the configuration, all existing dimming channels can be assigned to the same parameters in the ETS and thus configured identically.
- With device variant "4-gang": To increase the channel power, outputs can be wired in parallel by reducing the number of channel outputs (with device generation from "V02" and onwards: not with HV-LED lamps, NV-LED lamps or compact fluorescent lamps). The assignment of parallel to wired dimming outputs to the KNX-controllable dimming channels takes place in the ETS.
- For device variant "1-gang": Apart from controlling lighting, the actuator 1-gang can be used as a speed controller of single-phase electric motors.
- Manual operation of the outputs independently of the bus (also building site operation possible).
- Central switching function for collective control of all dimming channels.
- Delay for actively transmitting feedbacks after bus voltage return.

Channel-oriented:

- Independent control of up to 4 dimmer outputs. Each dimming channel offers the full scope of functions without any restrictions. All channel-oriented functions can be parameterized separately for each dimming channel. This feature permits independent and multi-functional control.
- It is possible to specify the load type and thus define the dimming principle.
- Feedback "switching" and "brightness value" configurable. One active (object transmitting) or passive (object readable) feedback function each is configurable. In the case of an actively transmitting object, the feedback values can be optionally cyclical and transmitted with a delay after a device reset.
  The actuator updates the feedback values only after a change or after each update of the corresponding input objects.
- Setting of the dimmable brightness range is possible ("basic brightness and maximum brightness" or "minimum brightness and maximum brightness").
- Only with application program versions "1.2" and "1.3" and device generations from "V02" and onwards: Automatic setting and scaling of the dimmable brightness range when using Universal power boosters.
- Dimming behaviour (also fading) and dimming characteristics configurable.
- Soft switch-on and soft switch-off function.
- Only with program versions "1.2" and "1.3" and device generations from "V02" and onwards: The response of a dimming channel in the state "OFF" when receiving a relative dimming command can be configured (switch on and dim up or no reaction).
- In the case of a short-circuit and load failure or overload, message telegrams can be transmitted to the bus (load failure/overload message not with "1-gang" device variant in the speed controller" operating mode"). Feedback of the connected load type is also possible.
- Disabling function, or alternatively, forced position function is configurable for each output. During a disabling function, the flashing of connected luminaires is not possible.
- Timing functions (switch-on delay, switch-off delay, staircase lighting timer) With the staircase lighting timer the reaction at the end of the switch-on time can be configured (pre-warning function by means of time-controlled reduction of the lighting or activation of the permanent lighting, e.g. for hallways).
- Logic operation function possible (not with enabled staircase function). In the logic operation function the switching value of an additional object can be linked logically to the "switching" object and the result of the logic operation transmitted to the dimming channel output.
- A dimming channel can be integrated in up to 8 light-scenes.
- The switch-on times can be detected and evaluated by operating hours counters.
- Behaviour in case of bus voltage failure and bus voltage return as well as after ETS programming presettable.

4.2.2 Notes on software

ETS project design and commissioning

For project design and commissioning of the device, ETS3.0 from Version "d" onwards, ETS4 or ETS5 is required. Through use of these ETS version or later versions, advantages are gained with regard to the programming process.

Device generations and using the application programs

There are different application programs available. The use of application programs with the new version together with a specially designated device generation results in functional differences as compared with the combination of older applications and devices. It is possible to distinguish between the application programs and device generations by means of the version designation (see the following table)...

Device variant	Application program	Version:	Use for devices with label
1-gang	Dimming 3026**13**	1.3	from "V04"
2-gang	Dimming 3023**13**	1.3	from "V04"
4-gang	Dimming 3020**13**	1.3	from "V04"
1-gang	Dimming 3026**12**	1.2	"V02", "V03"
2-gang	Dimming 3023**12**	1.2	"V02", "V03"
4-gang	Dimming 3020**12**	1.2	"V02", "V03"
1-gang	Dimming 3026**11**	1.1	without or "V01"
2-gang	Dimming 3023**11**	1.1	without or "V01"
4-gang	Dimming 3020**11**	1.1	without or "V01"

Application programs and device generations

The designation of the device generation is attached on the device label. Depending on the device variant (1-gang, 2-gang or 4-gang) the designation is in different positions (Figure 9).

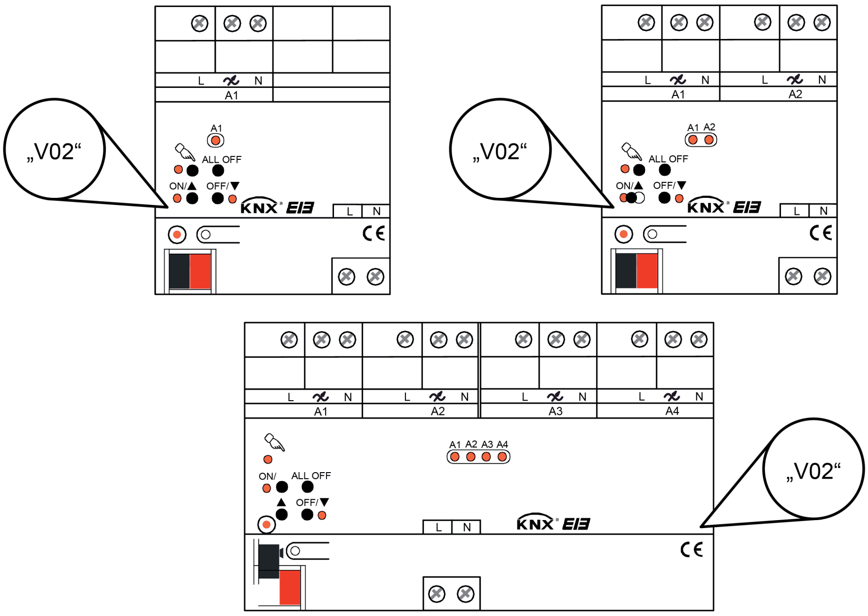

Figure 9: Position of the designation of the device generation

This product documentation describes the scope of functions of all application programs and device generations and will deal with the functional differences at the appropriate places if necessary.

With help of ETS application programs and device generations can be combined with each other in any way required. With combinations of version "1.2" of the application program with the device generations of "V02" or higher, this produces the following extended functions...

- Activation of HV LED and compact fluorescent lamps,
- ON by relative dimming in status OFF configurable ("Switch dimming up channel on" or "Dimming up is ignored").
- Configuration of Universal power boosters.

With combinations of version "1.3" of the application program with the device generations of "V04" or higher, this produces the following extended functions in addition to the above-mentioned extended scope of functions (through Version 1.2 of the application program) ...

- Activation of LV-LEDs (via Tronic transformers or conventional transformers),
- Automatic calibration using the universal dimming principle for HV and LV-LED lamps possible.

Only by combining the old application programs (version "1.1") with the new device generations (from "V02") is the scope of functions of the old application supported (see following table). The programming of more recent application versions (e.g. "1.3") in old devices (up to and including "V03") only allows execution of the scope of functions of old device generations.

G	A	Load type LED / CFL	ON by relative dimming	Configuration of Universal power boosters
---	1.1	no	always ON (standard)	Use of Universal power boosters only possible to a limited extent.
---	1.2	no	always ON (standard)	Use of Universal power boosters only possible to a limited extent.
---	1.3	no	always ON (standard)	Use of Universal power boosters only possible to a limited extent.
V01	1.1	no	always ON (standard)	Use of Universal power boosters possible. Adjustment of the brightness range manual.
V01	1.2	no	always ON (standard)	Use of Universal power boosters possible. Adjustment of the brightness range manual.
V01	1.3	no	always ON (standard)	Use of Universal power boosters possible. Adjustment of the brightness range manual.
V02, V03	1.1	no	always ON (standard)	Use of Universal power boosters possible. Adjustment of the brightness range manual.
V02, V03	1.2	HV-LED, CFL	according to parameter	Use of Universal power boosters possible. Adjustment of the brightness range automatic.
V02, V03	1.3	HV-LED, CFL	according to parameter	Use of Universal power boosters possible. Adjustment of the brightness range automatic.
from V04	1.1	no	always ON (standard)	Use of Universal power boosters possible. Adjustment of the brightness range manual.
from V04	1.2	HV-LED, CFL	according to parameter	Use of Universal power boosters possible. Adjustment of the brightness range automatic.
from V04	1.3	HV-LED, LV-LED, CFL	according to parameter	Use of Universal power boosters possible. Adjustment of the brightness range automatic.

Available functions depending on device generation and application version
D = Device generation
A = Application version
CFL = Compact fluorescent lamps

Safe-state mode

If the device does not work properly - for instance as a result of errors in the project design or during commissioning - the execution of the loaded application program can be halted by activating the safe-state mode. The safe-state mode does not permit controlling the outputs via the bus and by hand. The actuator remains passive since the application program is not being executed (state-of-execution: terminated). Only the system software is still functional so that the ETS diagnosis functions and also programming of the device continue to be possible.

Activating the safe-state mode

- Shut off the bus and the mains voltage supply.
- Press and hold down the programming button.
- Switch on the bus or mains voltage. Release the programming button only after the programming LED starts flashing slowly.

The safe-state mode is activated. With a new brief press of the programming button, the programming mode can be switched on and off as usual also in the safe-state mode. The programming LED will nevertheless continue to flash independently of the programming mode as long as the safe-state mode is active.

ⓘ The safe-state mode can be terminated by switching off the supply voltage (bus and mains) or by programming with the ETS.

Unloading the application program

The application program can be unloaded with the ETS. In this case, manual control as part of the application program is not available either.

4.2.3 Object table

Number of communication objects:	75 (max. object number 74 - gaps in between)
Number of addresses (max):	254
Number of assignments (max):	255
Dynamic table management	no
Maximum table length	255

Channel-independent objects

Function: Manual operation

Object	Function	Name	Type	DPT	Flag
☐⇤ 0	Disabling	Manual operation	1-bit	1,003	C, W, -, (R)[1]

Description 1-bit object for disabling the buttons for manual control on the device. The polarity can be configured.

Function: Manual operation

Object	Function	Name	Type	DPT	Flag
☐⇤ 1	Status	Manual operation	1-bit	1,002	C, -, T, (R)[2]

Description 1-bit object for manual control status transmission. The object is "0", when manual control is deactivated (bus control). The object is "1", when manual control is being activated. You can configure whether the temporary or the permanent manual control will be indicated as status information or not.

1: For reading, the R-flag must be set. The last value written to the object via the bus will be read.

2: For reading, the R-flag must be set. The last value written to the object by the device will be read out.

Function: Central function

Object	Function	Name	Type	DPT	Flag
2	Switching	Central	1-bit	1,001	C, W, -, (R)[1]

Description 1-bit object for central switching of assigned output channels. The polarity can be configured.

Channel-oriented objects
(for "lighting control" operating mode with the device variants "1-gang", "2-gang" and "4-gang")

Function: Channel switching

Object	Function	Name	Type	DPT	Flag
3, 21, 39, 57	Switching	Channel 1...4	1-bit	1,001	C, W, -, (R)[1]

Description 1-bit object for switching the dimming channel on or off ("1" = switch on; "0" = switch off).

Function: Relative dimming of channel

Object	Function	Name	Type	DPT	Flag
6, 24, 42, 60	Dimming	Channel 1...4	4-bit	3,007	C, W, -, (R)[1]

Description 4-bit object for relative dimming of a dimming channel.

Function: Absolute dimming of channel

Object	Function	Name	Type	DPT	Flag
7, 25, 43, 61	Brightness value	Channel 1...4	1 bytes	5,001	C, W, -, (R)[1]

Description 1-byte object for predefining an absolute dimming value (brightness value 0…255) from the bus.

Function: Switching feedback

Object	Function	Name	Type	DPT	Flag
8, 26, 44, 62	Switching feedback	Channel 1...4	1-bit	1,001	C, -, T, (R)[2]

Description 1-bit object for feedback signalling of the switching state ("1" = on / "0" = off) to the bus.

1: For reading, the R-flag must be set. The last value written to the object via the bus will be read.

2: For reading, the R-flag must be set. The last value written to the object by the device will be read out.

Function: Absolute dimming feedback

Object	Function	Name	Type	DPT	Flag
9, 27, 45, 63	Feedback brightness value	Channel 1...4	1 bytes	5,001	C, -, T, (R)[1]

Description 1-byte object for feedback signalling of a set dimming value (brightness value 0…255) to the bus.

Function: Staircase function

Object	Function	Name	Type	DPT	Flag
4, 22, 40, 58	Staircase function start / stop	Channel 1...4	1-bit	1,010	C, W, -, (R)[2]

Description 1-bit object to activate or deactivate the switch-on time of the staircase function of a dimming channel ("1" = switch-on / "0" = switch-off).

Function: Staircase function

Object	Function	Name	Type	DPT	Flag
5, 23, 41, 59	Staircase time factor	Channel 1...4	1 bytes	5,010	C, W, -, (R)[2]

Description 1-byte object to specify a time factor for the switch-on time of the staircase function (value range: 0 ... 255).

Function: Disabling function

Object	Function	Name	Type	DPT	Flag
10, 28, 46, 64	Disabling	Channel 1...4	1-bit	1,003	C, W, -, (R)[2]

Description 1-bit object for disabling a dimming channel (polarity configurable).

Function: Forced position function

Object	Function	Name	Type	DPT	Flag
11, 29, 47, 65	Forced position	Channel 1...4	2-bit	2,001	C, W, -, (R)[2]

Description 2-bit object for the forced position of a dimming channel. The polarity is fixed by the telegram.

1: For reading, the R-flag must be set. The last value written to the object by the device will be read out.

2: For reading, the R-flag must be set. The last value written to the object via the bus will be read.

Function: Scenes

Object	Function	Name	Type	DPT	Flag
12, 30, 48, 66	Scene extension	Channel 1...4	1 bytes	18,001	C, W, -, (R)[1]

Description 1-byte object for recalling scenes or for storing new scene values.

Function: Logic operation function

Object	Function	Name	Type	DPT	Flag
13, 31, 49, 67	Logic operation	Channel 1...4	1-bit	1,002	C, W, -, (R)[1]

Description 1-bit object for the input of the logical link of a dimming channel. After bus voltage return or after programming with the ETS, the object value can be predefined for each parameter.

Function: Short-circuit monitoring

Object	Function	Name	Type	DPT	Flag
14, 32, 50, 68	Signalling short-circuit	Channel 1...4	1-bit	1,005	C, -, T, (R)[2]

Description 1-bit object for signalling short-circuit in relation to a dimming channel. ("1" =short-circuit present, "0" = short-circuit not present).

Function: Load failure / overload monitoring

Object	Function	Name	Type	DPT	Flag
15, 33, 51, 69	Signalling load failure/overl.	Channel 1...4	1-bit	1,005	C, -, T, (R)[2]

Description 1-bit object for signalling a load failure or overload in relation to a dimming channel.
("1" = load failure/overload present / "0" = load failure/overload not present).

Function: Operating hours counter

Object	Function	Name	Type	DPT	Flag
16, 34, 52, 70	Limit value / starting value operating hours counter[3]	Channel 1...4	2 bytes	7,007	C, W, -, (R)[1]

Description 2-byte object for external specification of a limit value / starting value of the operating hours counter of a dimming channel.
Value range: 0... 65535

1: For reading, the R-flag must be set. The last value written to the object via the bus will be read.

2: For reading, the R-flag must be set. The last value written to the object by the device will be read out.

3: Threshold value object or start value object depending on the configured counter type of the operating hours counter.

Function: Operating hours counter

Object	Function	Name	Type	DPT	Flag
□⇤ 17, 35, 53, 71	Restart op. hours counter	Channel 1...4	1-bit	1,015	C, W, -, (R)[1]

Description 1-bit object for resetting the operating hours counter of a dimming channel ("1" = restart, "0" = no reaction).

Function: Operating hours counter

Object	Function	Name	Type	DPT	Flag
□⇤ 18, 36, 54, 72	Value operating hours counter	Channel 1...4	2 bytes	7,007	C, -, T, (R)[2]

Description 2-byte object to transmit or read out the current counter level of the operating hours counter.
If the bus voltage should fail, the value of the communication object is not lost and is actively transmitted to the bus after bus voltage return or an ETS programming operation. In the as-delivered state, the value is "0".

Function: Operating hours counter

Object	Function	Name	Type	DPT	Flag
□⇤ 19, 37, 55, 73	Operating hrs counter elapsed	Channel 1...4	1-bit	1,002	C, -, T, (R)[2]

Description 1-bit object to sign that the operating hours counter has elapsed (forwards counter = limit value reached / backwards counter = value "0" reached). With a message, the object value is actively transmitted to the bus ("1" = message active / "0" = message inactive).
If the bus voltage should fail, the value of the communication object is not lost and is actively transmitted to the bus after bus voltage return or an ETS programming operation.

Function: Load type feedback

Object	Function	Name	Type	DPT	Flag
□⇤ 20, 38, 56, 74	Signalling load type	Channel 1...4	1 bytes	20.xxx	C, -, T, (R)[2]

Description 1-byte object for signalling the set load type of a dimming channel.
"0" = undefined (no calibration possible because mains voltage absent / short-circuit)
"1" = trailing edge phase control (set by parameter)
"2" = leading edge phase control (set by parameter)
"3" = universal, adjusted to capacitive or ohmic load
"4" = universal, adjusted to inductive load
"5 ...255" not used

1: For reading, the R-flag must be set. The last value written to the object via the bus will be read.

2: For reading, the R-flag must be set. The last value written to the object by the device will be read out.

Channel-oriented objects (for the "speed controller" operating mode only for "1-gang" device variant)

Function: Channel switching

Object	Function	Name	Type	DPT	Flag
3	Switching	Channel 1	1-bit	1,001	C, W, -, (R)[1]

Description 1-bit object for switching the dimming channel on or off ("1" = switch on; "0" = switch off).

Function: Channel relative speed adjustment (dimming)

Object	Function	Name	Type	DPT	Flag
6	Dimming	Channel 1	4-bit	3,007	C, W, -, (R)[1]

Description 4-bit object for relative dimming of a dimming channel.

Function: Channel absolute speed adjustment (dimming)

Object	Function	Name	Type	DPT	Flag
7	Speed	Channel 1	1 byte	1,003	C, W, -, (R)[1]

Description 1-byte object for specifying an absolute speed (value 0…255) from the bus.

Function: Switching feedback

Object	Function	Name	Type	DPT	Flag
8	Switching feedback	Channel 1	1-bit	1,001	C, -, T, (R)[2]

Description 1-bit object for feedback signalling of the switching state ("1" = on / "0" = off) to the bus.

Function: Feedback of absolute speed

Object	Function	Name	Type	DPT	Flag
9	Feedback of speed	Channel 1	1 byte	5,001	C, -, T, (R)[2]

Description 1-byte object for feedback signalling of a set speed (value 0…255) to the bus.

1: For reading, the R-flag must be set. The last value written to the object via the bus will be read.

2: For reading, the R-flag must be set. The last value written to the object by the device will be read out.

Function: Staircase function

Object	Function	Name	Type	DPT	Flag
□↤ 4	Staircase function start / stop	Channel 1	1-bit	1,010	C, W, -, (R)[1]

Description 1-bit object to activate or deactivate the switch-on time of the staircase function ("1" = switch-on / "0" = switch-off).

Function: Staircase function

Object	Function	Name	Type	DPT	Flag
□↤ 5	Staircase time factor	Channel 1	1 byte	5,010	C, W, -, (R)[1]

Description 1-byte object to specify a time factor for the switch-on time of the staircase function (value range: 0 ... 255).

Function: Disabling function

Object	Function	Name	Type	DPT	Flag
□↤ 10	Disabling	Channel 1	1-bit	1,003	C, W, -, (R)[1]

Description 1-bit object for disabling the dimming channel (polarity configurable).

Function: Forced position function

Object	Function	Name	Type	DPT	Flag
□↤ 11	Forced position	Channel 1	2-bit	2,001	C, W, -, (R)[1]

Description 2-bit object for the forced position of the dimming channel. The polarity is fixed by the telegram.

Function: Scenes

Object	Function	Name	Type	DPT	Flag
□↤ 12	Scene extension	Channel 1	1 byte	18,001	C, W, -, (R)[1]

Description 1-byte object for recalling scenes or for storing new scene values.

Function: Logic operation function

Object	Function	Name	Type	DPT	Flag
□↤ 13	Logic operation	Channel 1	1-bit	1,002	C, W, -, (R)[1]

Description 1-bit object for the input of the logical link of the dimming channel. After bus voltage return or after programming with the ETS, the object value can be predefined for each parameter.

1: For reading, the R-flag must be set. The last value written to the object via the bus will be read.

Function: Short-circuit monitoring

Object	Function	Name	Type	DPT	Flag
□ 14	Signalling short-circuit	Channel 1	1-bit	1,005	C, -, T, (R) [1]

Description 1-bit object for signalling short-circuit in relation to the dimming channel. ("1" =short-circuit present, "0" = short-circuit not present).

Function: Operating hours counter

Object	Function	Name	Type	DPT	Flag
□ 16	Limit value / starting value operating hours counter [2]	Channel 1	2 byte	7,007	C, W, -, (R) [3]

Description 2-byte object for external specification of a limit value / starting value of the operating hours counter of the dimming channel.
Value range: 0... 65535

Function: Operating hours counter

Object	Function	Name	Type	DPT	Flag
□ 17	Restart op. hours counter	Channel 1	1-bit	1,015	C, W, -, (R) [3]

Description 1-bit object for resetting the operating hours counter of the dimming channel ("1" = restart, "0" = no reaction).

Function: Operating hours counter

Object	Function	Name	Type	DPT	Flag
□ 18	Value operating hours counter	Channel 1	2 byte	7,007	C, -, T, (R) [1]

Description 2-byte object to transmit or read out the current counter level of the operating hours counter.
If the bus voltage should fail, the value of the communication object is not lost and is actively transmitted to the bus after bus voltage return or an ETS programming operation. In the as-delivered state, the value is "0".

1: For reading, the R-flag must be set. The last value written to the object by the device will be read out.

2: Threshold value object or start value object depending on the configured counter type of the operating hours counter.

3: For reading, the R-flag must be set. The last value written to the object via the bus will be read.

Function: Operating hours counter

Object	Function	Name	Type	DPT	Flag
19	Operating hrs counter elapsed	Channel 1	1-bit	1,002	C, -, T, (R)[1]

Description 1-bit object to sign that the operating hours counter has elapsed (forwards counter = limit value reached / backwards counter = value "0" reached). With a message, the object value is actively transmitted to the bus ("1" = message active / "0" = message inactive).
If the bus voltage should fail, the value of the communication object is not lost and is actively transmitted to the bus after bus voltage return or an ETS programming operation.

Function: Load type feedback

Object	Function	Name	Type	DPT	Flag
20	Signalling load type	Channel 1	1 byte	20.xxx	C, -, T, (R)[1]

Description 1-byte object for signalling the set load type of the dimming channel.
"2" = leading edge phase control (preselected dimming principle for the speed controller)
"0, 1, 3...255" not used

4.2.4 Functional description

4.2.4.1 Description of channel-independent functions

4.2.4.1.1 Channel definition

There are up to 4 dimming channels available depending on the device variants. To increase the channel dimmer output power, the "4-gang" device variant in particular can be wired in parallel by reducing the number of channel outputs. The assignment of parallel to wired dimming outputs to the KNX-controllable dimming channels takes place in the ETS.

ℹ The configuration of the dimming channels has influence on the use of the 4 dimmer outputs and thus influence on the load distribution.

In the ETS on the parameter page "Channel definition", the number of dimming channels to be used is selected. The fewer channels that are configured, the more dimming outputs can be assigned to a channel. The assignment of the KNX controllable dimming channels to the dimming outputs is described in the assignment table (Figure 10), which is also stored in the device.
The assignment of dimming channel 1 to the outputs can be configured in 2-channel and 3-channel operation. This then gives rise to the effect of the other channels on the outputs in accordance with the channel assignment table. The "Effect of channel 1" parameter defines the assignment and, irrespective of this, specifies the effect of the other channels.

---

[1] For reading, the R-flag must be set. The last value written to the object by the device will be read out.

<table>
<tr><th>Number of channels</th><th>Output 1</th><th>Output 2</th><th>Output 3</th><th>Output 4</th></tr>
<tr><td>Channel 1...4</td><td>Channel 1</td><td>Channel 2</td><td>Channel 3</td><td>Channel 4</td></tr>
<tr><td>Channel 1...3</td><td colspan="2">Channel 1</td><td>Channel 2</td><td>Channel 3</td></tr>
<tr><td>Channel 1...3</td><td>Channel 1</td><td>Channel 2</td><td colspan="2">Channel 3</td></tr>
<tr><td>Channel 1...2</td><td colspan="2">Channel 1</td><td colspan="2">Channel 2</td></tr>
<tr><td>Channel 1...2</td><td>Channel 1</td><td colspan="3">Channel 2</td></tr>
<tr><td>Channel 1...2</td><td colspan="3">Channel 1</td><td>Channel 2</td></tr>
<tr><td>Channel 1</td><td colspan="4">Channel 1</td></tr>
</table>

Figure 10: Channel assignment table
Options of the channel assignment depending on the number of channels

ℹ Parallel wired outputs can only be utilized up to a max of 95 % each.
-> 2 outputs in parallel: Maximum connected load 475 W!
-> 3 outputs in parallel: Maximum connected load approx. 710 W!
-> 4 outputs in parallel: Maximum connected load 950 W!

ℹ In the case of parallel wiring of dimming outputs, it is not permitted to connect additional power extensions to the load outputs concerned!

ℹ Do not connect any HV-LED lamps, LV-LED lamps or compact fluorescent lamps to dimmer outputs switched in parallel.

ℹ With the "2-gang" device variant the dimming outputs cannot be wired in parallel. Consequently, the parameters for setting the number of channels and the effect in the ETS do not exist for these device variants. The same holds true for the device variant "1-gang since only one dimming channel is available here.

ℹ On the parameter page "Connection help", a summary of the channel assignment and possible connected load of the individual dimming channels is displayed. The information on this page can help the installation engineer to connect the electrical load to the dimming outputs and hence to assign it to the KNX-controllable dimming channels when installing the device.

To simplify the configuration, all existing dimming channels can be assigned to the same parameters in the ETS and thus configured identically. The parameter "Setting of the channel parameters" on the parameter page "Channel definition" specifies whether every dimming channel of the device can be configured individually or whether all channels should be configured by the same parameters.
In the "all channels equal" setting, the number of parameters in the ETS is reduced. The visible parameters are then used on all channels automatically. Only the communication objects can then be configured separately for the channels. This setting should be selected, for example, if all channels behave identically and should only be activated by different group addresses (e.g. in office blocks or in hotel rooms).

ℹ In the "all channels equal" setting, the number of dimming channels can only at least be reduced to the 2-channel operation.

ℹ In the device variant "1-gang", the parameter "Setting of the channel parameters" is not necessary because only one channel must be configured here.

4.2.4.1.2 Manual operation

All outputs of the device have electronic manual operation. The button field with 4 function keys and 3 status LEDs on the front panel of the device can be used for setting the following modes of operation...

- Bus control: operation from touch sensors or other bus devices
- Temporary manual control: manual control locally with keypad, automatic return to bus control,
- Permanent manual control: local manual control with keypad.

The operation of the function keys, the control of the outputs and the status display are described in detail in chapter "Operation" (see page 17-18). The parameterisation, status feedback, disabling via a bus telegram, and interaction with other functions of the device when manual control is activated and deactivated are described in greater detail below.

Manual control is possible while the device is supplied with power from the mains or bus. In the state as supplied the manual control mode is fully enabled. In this unprogrammed state, all outputs can be controlled by the manual operation so that fast function checking of the connected loads (e.g. on the construction site) is possible.

After initial commissioning of the actuator via the ETS, manual control can be enabled or disabled separately for various states of operation. Manual control can, for instance, be disabled during bus operation (bus voltage applied). Another option consists in the complete disabling of the manual control only in case of bus voltage failure. Therefore manual control can be disabled completely, if the bus disable and bus failure disable are active.

Enabling the manual control mode

Manual control for the different states of operation is enabled or disabled by means of the parameters "Manual control in case of bus voltage failure" and "Manual control during bus operation".

- Set the parameter "Manual control in case of bus voltage failure" to "enabled".

  Manual control is then basically enabled when the bus voltage is off. This setting corresponds to the setting of the actuator as delivered.
- Set the parameter "Manual control in case of bus voltage failure" to "disabled".

  Manual control is completely disabled when the bus voltage is off. In this case, bus operation is not possible either so that the outputs of the actuator can no longer be activated.
- Set the parameter "Manual control during bus operation" to "enabled".

  Manual control is then basically enabled when the bus voltage is on. The outputs of the actuator can be activated via the bus or manually. This setting corresponds to the setting of the actuator as delivered.
- Set the parameter "Manual control during bus operation" to "disabled".

  Manual control is completely disabled when the bus voltage is on. In this configuration, the actuator outputs can only be operated via the bus.

ℹ In the case of bus voltage failure, an active manual operation will not be terminated even if "Manual operation in case of bus voltage failure = disabled" is configured. This will be disabled later, only at the end of manual operation.

ℹ Further parameters and communication objects of the manual control are visible only in the configuration "Manual control during bus operation = enabled". For this reason, the disabling function, the status message and bus control disabling can only be configured in the above parameter setting.

Presetting the behaviour at the beginning and at the end of manual control.

The manual control distinguishes the temporary and permanent manual control. The behaviour is different depending on these modes of operation, especially at the end of manual control. It should be noted that the operation via the bus, i.e. control of the outputs by direct operation (switching / dimming / brightness value, scenes, central) or by the disabling or forced position functions is always disabled when the manual control is active. This means that the manual control mode has the highest priority.

Behaviour at the beginning of manual control:
The behaviour at the beginning of manual control does not differ for temporary and permanent manual control. During activation of the manual operation, the brightness statuses of the dimming channels remain unchanged.
Flashing feature during disabling function: The flashing of a disabling function is interrupted at the beginning of the manual operation. The brightness adapts itself to the switch-on brightness. The switching status is indicated as "ON".
Active forced position functions or disabling functions can be overridden by manual control. These functions are reactivated after deactivation of the manual mode unless they have been cancelled via the bus in the meantime.

Behaviour at the end of manual control:
The behaviour at the end of manual control is different for temporary and permanent manual control.
The temporary manual mode is shut off automatically when the last output has been addressed and when the select key ☜ is pressed once more. During a deactivation of the temporary manual operation mode, the actuator goes back to 'normal' bus operation and does not change the brightness or speed states selected by manual operation. If, however, a forced position or disabling function has been activated via the bus before or during manual operation, the actuator executes these functions of a higher priority again for the dimming channels concerned.
The permanent manual control mode is shut off, when the select key ☜ is pressed for more than 5 seconds. Depending on the parameterization of the actuator in the ETS, the outputs will be set to the state last adjusted in the manual mode or to the state internally tracked (direct operation, forced position, disabling) when the permanent manual mode is switched off. The parameter "Behaviour at the end of permanent manual control during bus operation" defines the corresponding reaction.

- Set the parameter "Behaviour at the end of permanent manual control during bus operation" to "no change".

  All telegrams received during an active permanent manual control mode for direct operation (switching, dimming, brightness value, central, scenes) will be rejected. After the end of the permanent manual operation mode, the current brightness or speed state of all channels remains unchanged. If, however, a forced position or disabling function has been activated via the bus before or during manual operation, the actuator executes these functions of a higher priority again for the channels concerned.

- Set the parameter "Behaviour at the end of permanent manual control during bus operation" to "track outputs".

During active permanent manual control all incoming telegrams are tracked internally. At the end of manual operation, the channels are adjusted to the last tracked brightness or speed states. If a forced position or disabling function has been activated via the bus before or during manual control, the actuator executes these functions of a higher priority again for the channels concerned.

ⓘ The behaviour at the end of the permanent manual control when the bus voltage is off (e.g. building site operation) is permanently set to "no change".

ⓘ The control operations triggered in the manual control mode will be transmitted via feedback objects to the bus, if enabled and actively transmitting.

ⓘ On return of bus voltage or after programming with the ETS an activated manual control mode will always be terminated. In this case, the parameterized or predefined behaviour at the end of manual control will not be executed. The actuator executes the parameterized behaviour on bus/mains voltage return or after ETS programming instead.

Presetting a manual control disable

The manual control mode can be separately disabled via the bus, even if it is already active. If the disabling function is enabled, then as soon as a disabling telegram is received via the disabling object of the manual control, the actuator immediately terminates an activated manual control and locks the function keys on the front panel of the device. The telegram polarity of the disabling object is parameterisable.

The manual control mode during bus operation must be enabled.

- Set the parameter "Disabling function manual control ?" on parameter page "Manual control" to "yes".

The disabling function of the manual control mode is enabled and the disabling object is visible.

- Select the desired telegram polarity in the "Polarity of the manual operation disabling object" parameter.

ⓘ If the polarity is "0 = disabled; 1 = enabled", the disabling function is immediately active on return of bus/mains voltage or after an ETS programming operation (object value "0"). To activate the manual control in this case, an enable telegram "1" must first be sent to the disabling object.

ⓘ In case of bus voltage failure, disabling via the disabling object is always inactive (depending on parameterization, the manual control is then either enabled or completely disabled). After return of bus voltage, a disabled state that was active beforehand is always inactive when the polarity of the disabling object is non-inverted.

ⓘ When an active manual control is terminated by a disable, the actuator will also transmit a "Manual control inactive" status telegram to the bus, if the status messaging function is enabled.

Presetting the status message function for the manual control mode

An actuator can transmit a status telegram to the bus via a separate object when the manual operation is activated or deactivated. The status telegram can only be transmitted when the bus voltage is switched on. The polarity of the status telegram can be parameterised.

The manual control mode during bus operation must be enabled.

- Set the parameter "Status manual control ?" on parameter page "Manual control" to "yes".

The status messaging function of manual control is enabled and the status object is visible.

- Specify in the parameter "Status object function and polarity" whether the status telegram is generally a "1" telegram whenever the manual control mode is activated or only in those cases where the permanent manual mode is activated.

- ⓘ The status object is always "0" when the manual control mode is deactivated.
- ⓘ The status is only transmitted actively to the bus ("0") after return of bus voltage when an activated manual control is ended by the bus return during the bus voltage failure. The status telegram is in this case transmitted without delay.
- ⓘ When active manual control is terminated by a disable, the actuator will also transmit a "Manual control inactive" status telegram to the bus.

Setting disabling of the bus control

Individual dimming channels can be disabled locally so that the connected loads can no longer be controlled via the KNX. Such disabling of the bus operation is initiated by local operation in permanent manual operation and is indicated by rapid flashing of the status LEDs on the front panel of the device. The disabled outputs can then only be activated in permanent manual control.

The manual control mode during bus operation must be enabled.

- ■ Set the parameter "Bus control of single channels during bus operation can be disabled?" on parameter page "Manual control" to "yes".

  The function for disabling the bus control is enabled and can be activated locally. Alternatively, this parameter can be set to "no" to prevent disabling of the bus control from being activated in permanent manual operation.
- ⓘ The disabling initiated locally has the highest priority. Thus all other functions of the actuator that can be activated via the bus (e.g. forced position or disabling function) are overridden. Depending on the parameterization of the actuator in the ETS, the groups will be set to the state last adjusted in the manual mode or to the state internally tracked (direct operation, forced position, disabling) when the permanent manual mode is reactivated and subsequently shut off.
- ⓘ Any disabling of the bus control activated locally is not reset after bus voltage return if the mains voltage was switched on interruption free. A failure of the bus and mains voltage or ETS programming operation always deactivates the disabling of the bus control.

4.2.4.1.3 Delay after device reset

To reduce telegram traffic on the bus line after bus voltage activation (bus reset), after connection of the device to the bus line or after programming with the ETS, it is possible to delay all actively transmitted feedback telegrams of the actuator. For this purpose, a channel-independent delay can be specified (parameter "Delay after bus voltage return" on parameter page "General"). Only after the configured time elapses are feedback telegrams for initialisation transmitted to the bus.

It is possible to configure separately which of the channel-oriented feedback telegrams are actually delayed for each dimming output or for each feedback function.

- ⓘ The delay has no effect on the behaviour of the individual dimming channel. Only the feedback telegrams are delayed. The channels can also be activated during the delay after bus voltage return.
- ⓘ A setting of "0" for the delay after bus voltage return deactivates the delaying function altogether. In this case, all feedback telegrams, if actively transmitted, will be transmitted to the bus without any delay.
- ⓘ All actively transmitting objects of the operating hours counter or the message objects "Load failure / overload", "short-circuit" and "Load type" are to be regarded as feedback objects. In this case, however, all feedbacks will always be transmitted with a delay, depending on the parameterisation for "Delay after bus voltage return".

- ℹ After bus voltage return, the message "Manual operation status" will only be transmitted actively to the bus ("0") if a manual operation, activated during a bus voltage failure, is ended by the bus return. The status telegram is in this case transmitted without delay.
- ℹ Depending on the system, there is always a brief delay after programming with the ETS if the "Delay after bus voltage return" is configured to "0".

Delaying a feedback

Only feedbacks that are enabled and set as actively transmitting can be configured with regard to the transmitting behaviour after bus voltage return.

- Set the parameter "Time delay for feedback telegram after bus voltage return" to "Yes". The parameter is on the parameter page of the corresponding switching status or brightness value feedback of a dimming channel.

  In this case, after bus voltage return the feedback telegram is first transmitted to the bus after the end of the delay time. Alternatively (setting "No"), a feedback telegram is transmitted to the bus without time delay immediately after bus voltage return .

4.2.4.1.4 Central function

The actuator offers the possibility of linking selected individual or all dimming channels with a 1-bit central communication object. The behaviour in case of activating a channel via the central function is comparable to a central group address linked with all "Switching" objects.
The dimming channels assigned to the central function are activated in accordance with the central object value received. The polarity of the central telegram can be configured as inverted. The behaviour of the channels is identical with the normal control via the "Switch" objects. (same priority – last switching command is executed). Thus, all 'downstream' functions, such as timing/supplementary functions, are also taken into account (Figure 11).

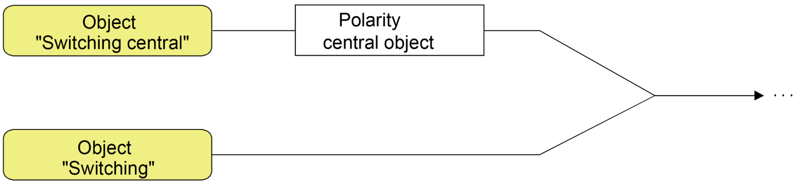

Figure 11: Function diagram "Central switching"

Enabling the central function

- Enable the central function on parameter page "General" by setting the "Central function ?" to "Yes".

  If a function is active, the "Central switching" communication object is visible.

Assigning dimming channels to the central function

Each dimming channel can be assigned independently to the central function.

The central function must have been enabled on parameter page "General". The assignment has otherwise no effect on a channel.

- Set the Parameter "Assignment to central function ?" on parameter page "Kx - General" (x = number of dimming channel 1...4) to "Yes".

  The appropriate dimming channel is assigned to the central function. The connected loads can be switched on or off centrally.

ⓘ The switching state set by the central function is tracked in the feedback objects and also transmitted to the bus, if these are actively transmitting. The switching state set by a central function is not tracked in the "switching" objects.

ⓘ After a bus voltage return or after programming with the ETS, the central function is always inactive (object value "0").

4.2.4.2 Channel-oriented functional description

4.2.4.2.1 Definition of the operating mode

Apart from controlling lighting, the universal dimmer actuator 1-gang can be used as a speed controller of single-phase electric motors. This operating mode can be preselected in the ETS and has a considerable effect on the parameter configuration and function of the device.
In the function as a speed controller, the dimming principle is predefined to "phase cut-on". Consequently, no load type can then be configured in the ETS. Moreover, some parameter and object texts change because the speed of a connected motor is controlled instead of brightness in the "speed controller" operating mode. The speed (e.g. minimum speed) is configured in the ETS as a percentage value. This value represents the dimming value in percent and is a gauge for the output signal's phase angle of the actuator.

The differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode" (see page 109).

ⓘ The operating mode is not adjustable in the device variants "2-gang" and "4-gang". The lighting operation is always intended here.

Presetting the operating mode

The operating mode of the dimming channel is set on the "K1 - General" parameter page .

- Set the "operating mode" parameter to "Lighting control".

  Lighting is connected on the dimmer output. The device permits switching and dimming of HV incandescent lamps, HV halogen lamps and LV halogen lamps with inductive transformers or Tronic-Transformers by means of conventional transformers and Tronic-Transformers. When using the application programs with version from "1.2" and onwards in conjunction with devices of the generations "V02" or "V03", it is also possible to activate dimmable HV-LEDs or compact fluorescent lamps. If, in the ETS, Version "1.3" of the application program is used in combination with devices of the "V04" generation or higher, then LV-LEDs can also be activated via electronic or conventional transformers.
  The appropriate dimming procedure can either be calibrated automatically, or alternatively, configured in the ETS (see "Type of connected load" parameter).

- Set the "operating mode" parameter to "speed controller".

  An electric motor is connected on the dimmer output. The device enables the motor to be started up and switched off as well as the variation of the speed. The appropriate dimming procedure in this case is preselected automatically and cannot be altered.

ℹ In the as-delivered state of the device, the "lighting control" is preconfigured as operating mode. When connecting a motor, the "speed controller" operating mode must be configured in the ETS. After the installation, commissioning using the ETS is essential before switching on the mains voltage supply (see page 15-16).

4.2.4.2.2 Definition of the load type and load type message

The device works according to the leading edge phase control or trailing edge phase control dimming principle and permits switching and dimming of HV incandescent lamps, HV halogen lamps and LV halogen lamps by means of conventional transformers and Tronic-Transformers. When using the application programs with version from "1.2" and onwards in conjunction with devices of the generations "V02" or "V03", it is also possible to activate dimmable HV-LEDs or compact fluorescent lamps. If, in the ETS, Version "1.3" of the application program is used in combination with devices of the "V04" generation or higher, then LV-LEDs can also be activated via electronic or conventional transformers. The "1-gang" device variant can also control single-phase electric motors in the "Speed controller" operating mode.
In lighting operation, the characteristic of the connected load can automatically be calibrated separately for each dimming channel and the appropriate dimming procedure can be set. Alternatively, the dimming procedure can be predefined by a parameter in the ETS without calibration taking place. This procedure is necessary for loads that do not enable automatic calibration.

ℹ In the "Speed controller" operating mode, the dimming principle is preset to "leading edge phase control".

ℹ When selecting the appropriate dimming principle, the specifications of the lamp manufacturer should generally be observed!

Defining load type

The "Type of connected load" parameter on the parameter page "Kx - General" (x = number of dimming channel 1...4) defines the dimming procedure. This parameter is not available in the "speed controller" operating mode for the "1-gang" device variant).

⚠ **CAUTION!**

Risk of destruction if the preset dimming principle and connected load do not match.

The dimmer and load may be destroyed.

Before changing the dimming principle, observe load type.

Before changing the load type, make sure that the dimming principle is correct.

Before changing the load type, disconnect the mains voltage of the device and the load circuit concerned. Check parameter settings and adjust if necessary.

⚠ **CAUTION!**

Danger of destruction from mixed loads.

The dimmer and load may be destroyed.

Do not connect capacitive loads, e.g. electronic transformers, and inductive loads, e.g. inductive transformers, together on the same dimmer output.

Do not connect inductive transformers together with HV LED lamps or compact fluorescent lamps on the same dimmer output.

- Set the parameter to "universal (with calibration procedure)".

The dimming channel calibrates itself universally to the connected load type. After programming in the ETS, after bus voltage return, after mains voltage return on the terminal pair "L N" (without bus voltage) or after switching on the mains voltage supply of a load output, the actuator calibrates itself automatically to the connected load. The calibration procedure becomes noticeable during ohmic loads by a brief flicker and lasts up to 10 seconds depending on the network conditions.

ℹ This setting must not be selected for loads that do not enable automatic calibration. In this case, a suitable dimming principle must be preselected (see following settings).

- Only with application program version "1.1" and "1.2" and device generations up to "V03" and onwards: Set the parameter to "Electronic transformer (capacitive / trailing edge phase control)".

  The dimming channel is preset to trailing edge phase control principle. There is no automatic calibration of the load type. Ohmic loads or electronic transformers can be connected to the output.
- Only with application program version "1.3" and device generations from "V04" and onwards: Set the parameter to "Electr. transformer / LV-LED (capacitive/trailing edge phase control)".

  The dimming channel is preset to trailing edge phase control principle. There is no automatic calibration of the load type. Ohmic loads, electronic transformers or LV-LEDs (via Tronic transformers) can be connected to the output.
- Only with application program version "1.1" and "1.2" and device generations up to "V03" and onwards: Set the parameter to "Conventional transformer (inductive / leading edge phase control)".

  The dimming channel is preset to leading edge phase control principle. There is no automatic calibration of the load type. Conventional transformers can be connected to the output.
- Only with application program version "1.3" and device generations from "V04" and onwards: Set the parameter to "Conv. transformer / LV-LED (inductive/leading edge phase control)".

  The dimming channel is preset to leading edge phase control principle. There is no automatic calibration of the load type. Conventional transformers or LV-LEDs (via conv. transformers) can be connected to the output.
- Only with application program version "1.2" and device generations from "V02" and onwards: Set the parameter to "LED (trailing edge phase control)".

  The dimming channel is preset to an optimized trailing edge phase control principle. There is no automatic calibration of the load type. HV LED or compact fluorescent lamps optimized for this dimming principle can be connected to the output.
- Only with application program version "1.3" and device generations from "V04" and onwards: Set the parameter to "HV-LED (trailing edge phase control)".

  The dimming channel is preset to an optimized trailing edge phase control principle. There is no automatic calibration of the load type. HV LED or compact fluorescent lamps optimized for this dimming principle can be connected to the output.
- Only with application program version "1.2" and device generations from "V02" and onwards: Set the parameter to "LED (leading edge phase control)".

  The dimming channel is preset to an optimized leading edge phase control principle. There is no automatic calibration of the load type. HV LED or compact fluorescent lamps optimized for this dimming principle can be connected to the output.
- Only with application program versions "1.3" and device generations from "V04" and onwards: Set the parameter to "HV-LED (leading edge phase control)".

  The dimming channel is preset to an optimized leading edge phase control principle. There is no automatic calibration of the load type. HV LED or compact fluorescent lamps optimized for this dimming principle can be connected to the output.

ℹ The settings "LED (trailing edge phase control)" and "LED (leading edge phase control)" or "HV-LED (trailing edge phase control)" and "HV-LED (leading edge phase control)" are only available in the application programs with versions "1.2" and "1.3" and are only evaluated by devices that contain a version designation of "V02" or higher on the device label. If the application programs "1.2" or "1.3" is used with these settings in old devices (up to "V01"), no actuation of HV-LED or compact fluorescent lamps is possible! The devices then set themselves to simple trailing edge phase control or leading edge phase control. Application programs with the version "1.1" can be programmed in devices with designation from "V02" and onwards. Actuation of HV LED and compact fluorescent lamps is not possible in this case either!

ℹ In the as-delivered state of the device, the dimming principle is set to "universal" for all outputs.

ℹ When changing a load type on an output, the dimming principle must also be changed if necessary!

The specifications of the lamp manufacturer can be observed in order to obtain the appropriate dimming principle for the connected lamps. The following table shows dimming principle combinations and connected load that are appropriate, not recommended and inappropriate.

ETS parameter	Load			
	Incandes. lamps HV halogen	LV halogen / LV LED via. conv. transf. (inductive)	LV halogen / LV LED via electr. transf. (capacitive)	HV LED „Retrofit“, Compact fluorescent lamps
universal	✓	✓	✓	✓ from V04
elect. transf. / LV LED Phase cut-off	✓	⊗	✓	⊗
conv. transf. / LV LED Phase cut-on	✓	✓	⊗	⊗
(HV) LED Phase cut-off	✓	⊗	⊗	✓
(HV) LED Phase cut-on	✓	⊗	⊗	✓

✓ = Usage possible

⊗ = Usage is not possible (Possible Device damage)

Figure 12: Parameter selection "type of connected load" depending on activated load type
Use of LV-LEDs only with program version "1.3" and
from device version "V04"!

ℹ Dimming results and dimming quality could vary depending on cable lengths, grid conditions and other influencing factors. Depending on the design and power rating of the lamps, the connected load of the specified values could vary. We do not assume any responsibility for the function, dimming results and dimming quality in connection with HV LED and LV LED and will not accept any liability.

Recommendation for the configuration of the dimming principle with HV-LED lamps:
With a device version "V04" or higher, the load detection can also take place automatically with HV-LEDs. As a result, we recommend, with these device versions, configuring the "Type of connected load" in the ETS to "universal" (this dimming principle also corresponds to the as-delivered state of the dimmer actuator). If automatic calibration of the load does not work or produces insufficient dimmer results, it is recommendable to operate HV-LED lamps preferably in the load type "(HV-)LED trailing edge phase control", regardless of the manufacturer's specification. This recommendation also applies to the older device versions up to "V03", which do not permit automatic calibration of HV-LEDs. The advantage of this setting lies in the fact that a dimming output can provide the maximum LED nominal load (see technical data). This is often not possible in leading edge phase control principle. Only configure the type of load in the ETS to "(HV-)LED leading edge phase control" if the operation of the connected lamps in the trailing edge phase control principle is not satisfactory (e.g. dimming range is too small). Protection functions (over-voltage switch-off) ensure that the device is not destroyed if the connected LED lamps are controlled in a dimming principle that the manufacturer has not designed them for (see page 25).

Problem resolution with HV-LED lamps:
Possible problems during operation of HV-LED lamps and their remedial measures are demonstrated in the following...

Parameter setting "(HV-)LED trailing edge phase control" ->
Problems:

- Dimming range too small
- Minimum brightness too high
- Lamps flicker
- Output switches off due to overvoltage

Remedial action:
Check operation in the leading edge phase control, reduce connected load as well if necessary, exchange lamps for another type.

Parameter setting "(HV-)LED leading edge phase control" ->
Problems:

- Lamps flicker
- Dimmer actuator overheats (output switches off due to overtemperature)
- Dimmer actuator hums

Remedial action:
Reduce connected load, check operation in the trailing edge phase control, exchange lamps for another type.

Enabling feedback of the load type

The device permits feedback of the set or calibrated load type to the bus. In this way, it is possible to identify the dimming principle according to which the dimming channel is working, even without knowing the parameter setting in the ETS. In universal operation, it is also possible to detect whether the channel has calibrated itself to leading edge phase control or trailing edge phase control operation.

Feedback of the load type is provided using the 1-byte object "Signal load type" available in each dimming channel. The object has the value encoding shown in the following table.

Object value	Meaning
0	Load type undefined (mains voltage off / short-circuit etc. /no calibration possible)
1	Load type capacitive / ohmic / (HV-)LED trailing edge phase control (set by parameter in the ETS)

2	Load type inductive / (HV-)LED leading edge phase control (set by parameter in the ETS)
3	Load type universal, successful calibration to capacitive or ohmic load
4	Load type universal, successful calibration to inductive load
5...255	Not used

Value encoding of the object "Signal load type"

- Set the parameter "Signal load type ?" on parameter page "Kx - Enabled functions" (x = number of dimming channel 1...4) to "Yes".

  The telegram feedback of the load type is enabled and activated. After bus voltage return, in the case of mains voltage failure on the load and after programming in the ETS, the message telegram is transmitted actively to the bus. With the load type "universal" the telegram is additionally transmitted after each new calibration procedure (e.g. after load failure / overload or short-circuit).

ⓘ It should be noted that after programming in ETS, after switching on the bus voltage or mains voltage supply of the device, the "Delay after bus voltage return" configured in the ETS must have elapsed before a load type message telegram is transmitted to the bus.

ⓘ In the "speed controller" operating mode for the "1-gang" device variant the "inductive" load type is always signalled if the signalling object is enabled.

4.2.4.2.3 Signalling short-circuit

Short-circuit protection is integrated in the device for each output. If the device detects a short-circuit, the load is switched off automatically after 7 seconds in phase cut-off operation (capacitive and ohmic loads) or after 100 milliseconds in phase cut-on operation (inductive loads). After switching off, the actuator transmits a message telegram "Short-circuit present – 1" to the bus for the dimming channel concerned, if this message is enabled in the ETS.

Here, it is described how a short-circuit message is enabled and how the telegram transmission of this message behaves. The chapter "Fitting and electrical connection" describes in detail how to eliminate a short-circuit fault (see page 23-24).

Enabling a short circuit signal

Feedback of a short-circuit is provided using the 1 byte object "Signal short-circuit" available in each dimming channel. Using the "Signal short-circuit ?" parameter, the object can be enabled on parameter page "Kx – Enabled functions" (x = number of the dimming channel 1...4).

- Set the parameter to "Yes".

  The short-circuit message is enabled and activated. After identifying a described fault, a "Short-circuit detected – 1" message telegram is sent to the bus from the actuator.

ⓘ In the event of a short-circuit message, the actuator sets the switching status to "OFF" and the status of the brightness value to "0" and transmits these values to the bus if enabled in the ETS.

ⓘ When switching on the mains voltage on the load after eliminating the fault, the actuator transmits a message telegram "no short-circuit – 0" to the bus after 7 seconds in phase cut-off operation and after 100 milliseconds in phase cut-on operation. Otherwise, a short-circuit message is transmitted again.

ⓘ The actuator initialises the objects "Signal short-circuit" of all dimming channels after an ETS programming operation or after switching on the bus voltage according to their current status. In this case, it should be noted that the "Delay after bus voltage return" configured in the ETS must have elapsed before short-circuit message telegrams are transmitted to the bus.

4.2.4.2.4 Signalling load failure / overload

The device with a lighting control can monitor the electric circuits of its load outputs independent of each other. The actuator detects the mains voltage supply failures (> 15 seconds) of an output or the interruption of the electric circuit when a load is switched on or off. The load failure detection can be enabled separately in the ETS for each dimming channel.

If there is an overtemperature in the device, the load is switched off by the temperature control of the device. The actuator, 15 seconds after switching off, transmits a message telegram "Load failure present – 1" to the bus for the dimming channel concerned, if this message is enabled in the ETS. In this state, the dimming channel concerned can no longer be switched on by manual or bus control. To reset such a fault, it might be necessary to switch off the mains voltage supply of the load outputs. Over-temperatures in the device either occur as a result of self-heating (electrical overload) or external influences (ambient temperature in the control cabinet is too high).

The device is also protected against electrical overload. Electrical overloads occur when the nominal operation parameters of a dimmer output are exceeded temporarily or continuously. The reaction of a device then depends on how great the electrical overload is and which ambient conditions prevail.
If the overload exceeds the defined short-circuit threshold, the device switches off the dimming channel concerned after 7 seconds at the latest, depending on the load type. In this case, the actuator generates a short-circuit message (see page 56) on the bus if this feedback is enabled in the ETS.
If the electrical overload does not exceed the short-circuit threshold, the device heats up continuously. Whether and how rapidly this self-heating occurs depends essentially on how great the overload is and how much the device is thermally influenced from outside. The heating up of the device causes the over-temperature switch-off to take effect from a specific temperature threshold. In this case, the actuator generates a load failure message on the bus if this feedback is enabled in the ETS.
Consequently, the device protects itself constantly by means of short-circuit or over-temperature switch-off even in the case of an electrical overload.

Here, it is described how a load failure/overload message is enabled and how the telegram transmission of this message behaves. The chapter "Fitting and electrical connection" describes in detail which events cause a load failure or overload and how to eliminate these faults (see page 21-22).

ⓘ No message of a load failure is possible with the device variant "speed controller" operating mode in the "1-gang" and device variant "4-gang" and "parallel wired outputs" (only in application program version "1.1"). No load failure message can be configured in the ETS in this case.

Enabling the signalling of a load failure / overload

Feedback of a load failure or overload is provided using the 1 bit object "Signal load failure / overload" available in each dimming channel. Using the "Signal load failure / overload ?" parameter, the object can be enabled on parameter page "Kx – Enabled functions" (x = number of the dimming channel 1...4).

- Set the parameter to "Yes".

The load failure/overload message is enabled and activated. A message telegram "Load failure/overload detected – 1" is transmitted from the actuator to the bus approx. 15 ...20 seconds after identification of a load failure or overload. A mains voltage failure of the output is always detected as load failure if the mains voltage failure lasts longer than approx. 15 seconds.

ℹ In the event of a load failure or overload, the actuator sets the switching status to "OFF" and the status of the brightness value to "0" and transmits these values to the bus if enabled in the ETS.

ℹ The actuator initialises the objects "Signal load failure / overload" of all dimming channels according to their current status after an ETS programming operation or after switching on the bus voltage. In this case, it should be noted that the "Delay after bus voltage return" configured in the ETS must have elapsed before load failure/overload message telegrams are transmitted to the bus.

ℹ At least 15 seconds after switching on the mains voltage, the actuator transmits a message telegram "no load failure / no overload – 0" to the bus if the fault was eliminated. Otherwise, a load failure/overload message is transmitted again. No message telegram is transmitted within the "Delay after bus voltage return".

4.2.4.2.5 Definition of the brightness range

The brightness range, adjustable by switching or dimming procedures, can be limited by defining a lower and upper brightness value. The lower brightness value is either defined by the basic brightness, or alternatively, by the minimum brightness. The upper brightness value is always characterised by the maximum brightness.
The maximum brightness adjustable in the ETS is never exceeded under any circumstances in the switched-on operating state of a dimming channel. Neither when switching on nor when dimming. The maximum brightness value can be reduced for energy saving reasons, for example. In combination with some power boosters, it may also be necessary to reduce the maximum brightness (please observe the documentation of the power boosters and notes in the chapter "Mounting and electrical connection" in this documentation!).
Furthermore, the brightness value, which should be set whenever switching on via the "switching" or "central switching" object or by manual operation on the dimming channel, can be predefined. This switch-on brightness must always be between the upper and lower brightness limit value of the dimming range.
The adjustable characteristics of the lower brightness value in the ETS differ as follows...

- Definition of the lower brightness limit with basic brightness (Figure 13):
  The "basic brightness" parameter of the parameter page "Kx – General" (x = Number of the dimming channel 1...4) predefines the lower brightness threshold by adapting to the lamps. The basic brightness can be set to one of 8 step values and is a gauge for the minimum adjustable residual phase angle of the output signal in relation to the decimal brightness values "1", "2" and "3" (percentage: ~0.4 ... 1 %). The basic brightness can be undershot only by switching off.
  The configurable basic brightness enables the dimming signal to be adjusted in the smallest possible dimming position of the luminaire used. The basic brightness should be set to a step value at which the lamp at the smallest brightness value will still light up at an adequate level of brightness so that it is detected as switched on. A recommendation for incandescent lamps and halogen lamps is given in the ETS as an adjustment aid.

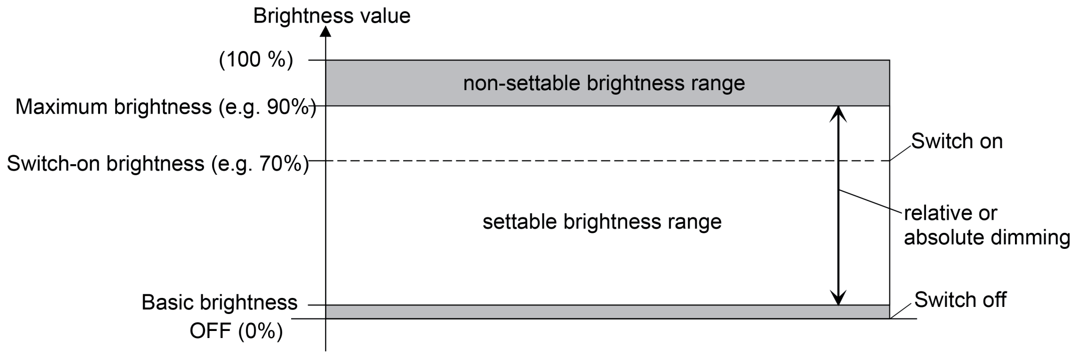

Figure 13: Example of a brightness range with basic brightness

- Definition of the lower brightness limit with minimum brightness (Figure 14):
  The "minimum brightness" parameter of the parameter page "Kx – General" (x = Number of the dimming channel 1...4) predefines a lower brightness threshold in the percentage range 1 % ... 45 % (decimal "3" ... "115") in stages. The minimum brightness cannot be undershot in any switched-on operating state of the dimming channel. An undershot is only possible by switching off.
  The brightness of the controlled lamps can be adapted individually – even to the brightness sensitivity of the human eye - by using the minimum brightness.

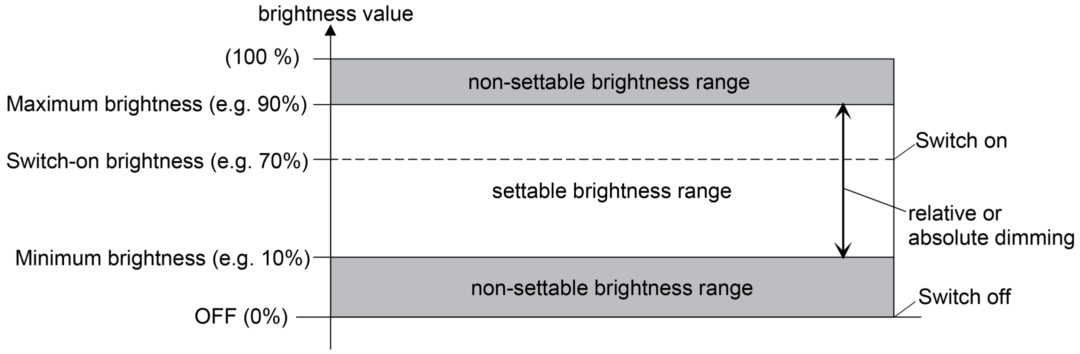

Figure 14: Example of a brightness range with minimum brightness

ⓘ In the "speed controller" operating mode for the "1-gang" device variant - similar to the description of the brightness values for lighting control in this chapter - the minimum speed can be configured in the ETS (Figure 14). The alternative configuration of a basic speed is not provided here for technical reasons. The maximum speed cannot be adjusted by means of a parameter either. It is predefined to 100 %. The cutting-in speed is unalterably preselected to a maximum speed (100 %).
The differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode" (see page 109).

Adjusting basic brightness

The basic brightness can be set separately for each dimming channel.

The "Definition of the brightness range" parameter is configured to "with basic brightness".

- ■ Set the "basic brightness" parameter on parameter page "Kx - General" (x = number of dimming channel 1...4) to the required step value.

The set step value, which is a gauge for the smallest adjustable residual phase angle of the output signal, is set to the decimal brightness values "1", "2" and "3" and therefore cannot be undershot in any switched-on operating state of the dimming channel.

ⓘ The parameter should be set in such a way that the lamp will still light up at the lowest dimmer setting.

ⓘ When operating a Universal Power booster on the dimmer output (see parameter "Operation with universal power booster ?") the level 1" can be set but has no effect. If the parameter should be set to level 1 in this case, the device executes level 2 as basic brightness.

Setting the minimum brightness

The minimum brightness can be set separately for each dimming channel.

The "Definition of the brightness range" parameter is configured to "with minimum brightness".

- Set the "minimum brightness" parameter on parameter page "Kx - General" (x = number of dimming channel 1...4) to the required brightness value.

  The set brightness is not undershot in any switched-on operating state.

ⓘ The selection of the adjustable value is upwardly limited to 45 %. Greater values cannot be configured because otherwise the adjustment range of the maximum brightness will be cut (minimum brightness < maximum brightness).

ⓘ The ETS does not check all configured brightness values of a channel during the editing of the minimum brightness (e.g. switch-on brightness, scene values)! If values that are smaller than the configured minimum brightness are predefined by the ETS configuration, the actuator sets the minimum brightness as brightness value later during operation. The same holds true if the actuator receives values via the brightness object during operation, which undershoots the minimum brightness.

Setting the maximum brightness

The maximum brightness can be set separately for each dimming channel.

- Set the "maximum brightness" parameter on parameter page "Kx - General" (x = number of dimming channel 1...4) to the required brightness value.

  The set brightness is not undershot in any switched-on operating state of the dimming channel.

ⓘ The selection of the adjustable value is downwardly limited to 50 % when using a minimum brightness. Smaller values cannot be configured in this case because otherwise the adjustment range of the minimum brightness will be cut (minimum brightness < maximum brightness).

ⓘ The ETS does not check all configured brightness values of a channel during the editing of the maximum brightness (e.g. switch-on brightness, scene values)! If values that are greater than the configured maximum brightness are predefined by the ETS configuration, the actuator sets the maximum brightness as brightness value later during operation. The same holds true if the actuator receives values via the brightness object during operation, which exceed the maximum brightness.

ⓘ When extending the power of an output of a dimming channel from our company by means of universal power boosters, the maximum brightness (ETS parameter) must be reduced to 90 % at most!

Setting the switch-on brightness

The switch-on brightness can be set separately for each dimming channel.

- Set the "switch-on brightness" parameter on parameter page "Kx - General" (x = number of dimming channel 1...4) to the required brightness value.

  The set brightness is set after receipt of an ON telegram via the "Switching" communication object or by switching on by the manual operation on the dimming channel. Furthermore, the configured switch-on brightness is set with the "activated" polarity after receipt of a central telegram.

- Alternatively, set the parameter "Switch-on brightness" to "Memory value (brightness before switching off last time)".

  When switching on, the active and internally saved brightness value prior to switching off last time is set (via the "switching" or "central switching" object). After programming with the ETS, the value is predefined to maximum brightness. Only a bus voltage failure, however, does not delete the memory value.

ℹ If the configured switch-on brightness is greater than the configured maximum brightness, the actuator sets the maximum brightness as the new brightness value for the dimming channel concerned when switching on (minimum brightness < switch-on brightness < maximum brightness).

ℹ A memory value is also then saved internally by a switch-off telegram if the bus-controlled switch-off is overridden, for example, by a disable or forced position function or by a manual operation. In this case, the internally tracked brightness value is saved as memory value.

ℹ If no soft ON function is activated, the brightness value is jumped to when switching on. Once a soft ON function is activated, the switch-on brightness is dimmed according to the dimming speed for the soft ON function.

ℹ The switch-on speed is not configurable in the "speed controller" operating mode for the "1-gang" device variant. Additional differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode" (see page 109).

Operation with universal power booster

To increase the connected load, Universal power boosters can be connected to the device. Universal power boosters are devices that supply themselves with energy directly via components of the dimmer actuator's output signal (no neutral conductor connection available). To ensure failure-free operation, the dimmer actuator output signal must be adapted in such a way that a certain amount of residual phase angle still remains (residual cut-on or off) for the highest dimming position. This residual phase angle must be large enough to enable universal power boosters to supply themselves with energy.

Only for application program versions "1.2" and "1.3" and device generations from "V02" and onwards:
If the output power is increased by means of universal power boosters, the corresponding channel configuration of the dimmer actuator must be adapted in the ETS. Based on the setting of the parameter "Operation with universal power booster ?" the dimmer actuator adjusts the output signal for using universal power boosters automatically.

- Set the parameter to "No".

  No universal power booster is connected to the dimming channel. In the highest dimming position (100 % brightness value), the smallest possible residual phase angle is set on the dimmer output. As a result, the connected lighting is set to the maximum lighting level technically possible.

- Set the parameter to "Yes".

At least one universal power booster is connected to the dimming channel. In the highest dimming position (100 % brightness value), a residual phase angle necessary for universal power boosters is set on the dimmer output. The output signal cut-on or cut-off in this way corresponds to a resulting brightness of approx. 90 % compared to an identically constructed dimming actuator without a power booster. The dimming actuator rescales the adjustable brightness range automatically for the corresponding channel so that a presetting and feedback within a range of 0…100% is still possible.

Only for application program versions "1.1" and device generations without version designation: It is not possible to operate the device with universal power boosters in conjunction with electronic transformers! Please use Tronic power boosters for power extension when operating electronic transformers.
When extending the power of an output by means of universal power boosters, the maximum brightness (ETS parameter) should be reduced to 90 % at most!

Only for application program versions "1.1" and "V01" device generations:
When extending the power of an output by means of universal power boosters, the maximum brightness (ETS parameter) should be reduced to 90 % at most!

ⓘ Power extension possible by means of our own power boosters.

ⓘ Choose power boosters that are suitable for the dimmer and load! For additional information, please always refer to the instructions for the power extensions in question.

ⓘ Visible brightness differences between the lighting on a dimmer actuator output without power booster and a dimming actuator with power booster are possible.

ⓘ When using conventional power boosters for leading edge phase control or trailing edge phase control principle (NV or TRONIC power boosters) it is not normally necessary to adapt the output signal of the dimmer actuator.

ⓘ In the case of parallel wiring of dimming outputs, it is not permitted to connect additional power extensions to the load outputs concerned!

ⓘ With the "1-gang" device variant, it is not permitted to connect additional power extensions to the power output. Consequently, the parameterisation of universal power boosters is not necessary in this case.

ⓘ The parameter "Operation with universal power booster ?" is only available in the application programs with the versions "1.2" and "1.3" and is only evaluated by devices that contain the version designations from "V02" and onwards on the device label (see page 33). If the application program "1.2" or "1.3" with the setting "Operation with universal power booster ? = Yes" is used in old device (no designation or designation "V01"), the actuator does not carry out any automatic adjustment of the residual phase angle! Here, the maximum brightness must be configured manually to a lower brightness value in the parameterisation so that universal power boosters can work failure-free.
Application programs with the version "1.1" can be programmed in devices with designations from "V02" and onwards. In this case, too, the maximum brightness must be configured manually to a lower brightness value in the parameterisation so that universal power boosters can work failure-free.

4.2.4.2.6 Response after a device reset

The switching states or brightness values of the dimming channels after a bus voltage failure, bus or mains voltage return or after ETS programming can be preset separately.

ⓘ In the "speed controller" operating mode for the "1-gang" device variant - similar to the description of the brightness values for lighting control in this chapter - the speed values can be configured in the ETS. The differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode" (see page 109).

Presetting the behaviour after ETS programming

The parameter "Behaviour after ETS programming" is preset separately for each dimming channel on the parameter page "Kx General" (x = number of the dimming channel 1...4). This parameter can be used to configure the brightness behaviour of a channel irrespective of the behaviour after a bus or mains voltage return.

- Set the parameter to "no reaction".

  After an ETS programming operation, the dimming channel shows no response and remains in the switching brightness state currently selected or is switched off.
- Set the parameter to "switch off".

  The dimming channel is switched off after a programming in the ETS.
- Set parameter to a brightness value.

  The dimming channel is set to the predefined brightness value. It is important that the configured value does not undershoot the set minimum brightness (if present) or exceed the maximum brightness.

ⓘ The configured behaviour will be executed after every application or parameter download by the ETS. A simple download of the physical address alone or partial programming of only the group addresses has the effect that this parameter is disregarded and that the configured "Behaviour after bus or mains voltage return" will be executed instead. Furthermore, the behaviour will only then be executed if the bus and mains voltage are switched on after programming.

ⓘ An ETS programming operation can also be performed without mains voltage. The mains voltage supply is not required for an ETS download.

ⓘ The actuator briefly initialises after each ETS programming operation. Dimming channels whose load type is configured to "universal" calibrate themselves to the load. The calibration procedure becomes noticeable during ohmic loads by a brief flicker and lasts up to 10 seconds depending on the network conditions.

ⓘ A switching state and brightness value set after an ETS programming cycle is added to the feedback objects. Actively transmitting feedback objects also only first transmit after an ETS programming cycle when the initialisation has finished and, if necessary, the "delay time after bus voltage return" has elapsed.

ⓘ In the "no reaction" setting: After the programming operation, a brief switch-off occurs during the initialisation phase of the actuator. Afterwards, the brightness value that was active before is then reset again.

ⓘ An active manual mode will be terminated by an ETS programming operation.

ⓘ After an ETS programming operation, the disabling functions and the forced-positions are always deactivated. The brightness values and forced position objects saved in case of the bus voltage failure are deleted.

Setting the behaviour in case of bus voltage failure

The parameter "Behaviour in case of bus voltage failure" can be preset separately for each dimming channel under "Kx - "General" (x = number of dimming channel 1...4).

- Set the parameter to "no reaction".

In case of bus voltage failure, the dimming channel shows no reaction and remains in the currently set brightness state, provided that the mains voltage on the dimming outputs is still switched on.

- Set the parameter to "switch off".

  The dimming channel is switched off in the case of bus voltage failure. It should be noted that the configured OFF command can only be executed if the mains voltage supply of the actuator (terminal pair "L N") is switched on. If the mains voltage is switched off, the actuator in this configuration shows no reaction (the last brightness state remains active provided that the mains voltage on the dimming outputs is still switched on).

- Set parameter to a brightness value.

  The dimming channel is set to the predefined brightness value. It should be noted that the brightness value can only be set if the mains voltage supply of the actuator (terminal pair "L N") is switched on. If the mains voltage is switched off, the actuator in this configuration shows no reaction (the last brightness state remains active provided that the mains voltage on the dimming outputs is still switched on).
  The configured value must not undershoot the set minimum brightness (if present) or exceed the maximum brightness.

ℹ Active disabling functions or forced position functions are cancelled and remain inactive until they are reactivated.

ℹ In case of a bus voltage failure, the current states of the forced-positions are also saved so that they can be tracked on return of bus voltage if necessary (depending on the parameterization of the forced positions).

ℹ In case of a bus voltage failure, the current brightness values of all dimming channels are permanently saved internally so that these brightness values can be reset after bus voltage return or mains voltage return (without bus) if this is configured in the ETS. The data are stored before the reaction parameterized for the case of bus voltage failure takes place and only if one part of the supply (mains or bus) is still present, or if the supply fails completely after the bus / mains voltage has been available before without interruption for at least 20 seconds after the last reset (storage capacitors sufficiently charged for storage purposes). In all other cases nothing is stored (Brightness value = "0")!

The saving process is performed only once after the failure of one part of the supply voltage...
Bus voltage failure -> Data storage -> Then mains voltage failure -> No further data storage.

Because the brightness values are saved only once in the event of bus voltage failure, values that are changed after a bus voltage failure, for example via manual control, are not tracked!

ℹ If the bus voltage fails while a manual operation on the device is activated, the parameter "Behaviour in case of bus voltage failure" is not executed.

Behaviour after bus or mains voltage return presetting

The parameter "Behaviour after bus or mains voltage return" can be preset separately for each dimming channel on the parameter page "Kx General" (x = number of the dimming channel 1...4). This parameter will always be executed on return of bus voltage only if the mains voltage (without bus) is switched on. If the mains voltage is switched on when the bus voltage is present, the actuator does not execute any particular reaction.

- Set the parameter to "no reaction".

  After bus or mains voltage return, the dimming channel shows no response and remains in the brightness state currently selected or is switched off.

- Set the parameter to "switch off".

  The dimming channel is switched off after bus/mains voltage return.

- Set parameter to a brightness value.

  The dimming channel is set to the predefined brightness value. It is important that the configured value does not undershoot the set minimum brightness (if present) or exceed the maximum brightness.
- Set parameter to "brightness value before bus voltage failure".

  After bus or mains voltage return, the brightness value last set before bus voltage failure and internally stored on bus voltage failure will be tracked.
- Set parameter to "Activate staircase function" "Activate time dimmer function".

  The staircase function / time dimmer function is – irrespective of the "Switching" object - activated after bus or mains voltage return. With this setting, make sure that the staircase function / time dimmer function is also enabled in the configuration of the dimming channel. When the function is not enabled, there is no reaction after bus/mains voltage return with this setting.

ℹ In all settings: When the bus voltage is switched on, the brightness value is set to "0 %" if no mains voltage is switch on at the time of bus voltage return on the load outputs.

ℹ Setting "brightness value as before bus/mains voltage failure": An ETS programming operation of the application or the parameter resets the stored switching state to "off - 0".

ℹ In the "No reaction" setting: On return of bus voltage with permanently switched on mains voltage, the corresponding dimming channel shows no response and remains in the brightness state last selected
When the bus voltage is switched on (without switching on the bus voltage), the actuator sets the brightness value "0" on the corresponding channels.

ℹ The actuator briefly initialises after switching on the mains voltage each time. Dimming channels whose load type is configured to "universal" calibrate themselves to the load. The calibration procedure becomes noticeable during ohmic loads by a brief flicker and lasts up to 10 seconds depending on the network conditions.

ℹ A switching state and brightness value set after bus voltage return is tracked in the feedback objects. Actively transmitting feedback objects first transmit, however, after bus or mains voltage return when the initialisation of the actuator has finished, and if necessary the "delay time after bus voltage return" has elapsed.

ℹ In the case of forced position as supplementary function: The communication object of the forced position can be initialised separately after bus voltage return. This has an effect on the reaction of the dimming channel when the forced position is activated. The configured "behaviour in the case of bus or mains voltage return" will only be executed if no forced position on bus voltage return is activated!

ℹ In the case of enabling function as supplementary function: Active disabling functions are always inactive after bus voltage return.

ℹ After return of bus voltage a manual control will be interrupted..

4.2.4.2.7 Feedback for switching status and brightness value

The actuator can track the current switching state and brightness value of a dimming channel via separate feedback objects and can also transmit them to the bus, if the bus voltage is on. The following feedback objects can be enabled independently of each other for each channel ...
- Feedback switching status (1 bit)
- Feedback brightness value (1 byte)

The actuator calculates the object value of the feedback objects during each switching or dimming procedure. The actuator tracks the switching state or brightness value and updates the feedback objects even when a dimming channel is activated by the manual operation or scene function.

The switching status feedback object is updated after the following events...

- Immediately after switching on a dimming channel (if necessary, first after a switch-on delay has elapsed and at the beginning of a soft ON dimming procedure / also after a staircase function).
- After switching off a dimming channel (if necessary, first after a run-on-time has elapsed and at the end of a soft OFF dimming procedure / also after a staircase function).
- Immediately after switching off by means of the automatic switch-off function.
- At the beginning of a dimming procedure when dimming on (relatively high dimming or brightness value = 1…100 %) a dimming channel.
- At the end of a dimming procedure when dimming off (brightness value = 0 %) a dimming channel.
- Only when the switching state changes (therefore not for dimming procedures that do not change the switching state e.g. from 10 % to 50 % brightness).
- During updating of the switching state from "ON" to "ON" when the dimming channel is already switched on.
- During updating of the switching state from "OFF" to "OFF" when the dimming channel is already switched off.
- Always at the start or end of a disabling or forced position function (only if the switching state changes as a result).
- Always after bus voltage return, in the case of mains voltage failure ("OFF") or at the end of any ETS programming process (if necessary also delayed and after calibration of the load).

The brightness value feedback object is updated after the following events...

- At the end of a relative (4-bit) or absolute (1-byte) dimming procedure.
- After switching on a dimming channel, if the switch-on brightness is set (if necessary, first after a switch-on delay has elapsed and at the end of a soft ON dimming procedure / also after a staircase function).
- After switching off a dimming channel (if necessary, first after a run-on-time has elapsed and at the end of a soft OFF dimming procedure / also after a staircase function).
- Immediately after switching off by means of the automatic switch-off function.
- Only if the brightness value changes (if a brightness value specification undershoots the minimum brightness as a result of relative or absolute dimming from outside or exceeds the maximum brightness, the actuator does <u>not</u> update a brightness value feedback according to the minimum brightness or maximum brightness).
- Always at the start or end of a disabling or forced position function (only if the brightness value changes as a result).
- Always after bus voltage return, in the case of mains voltage failure ("0") or at the end of any ETS programming process (if necessary, also delayed and after calibration of the load)

ℹ In the "speed controller" operating mode for the "1-gang" device variant - similar to the description of the brightness values for lighting control in this chapter - the speed values can be configured in the ETS. The differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode" (see page 109).

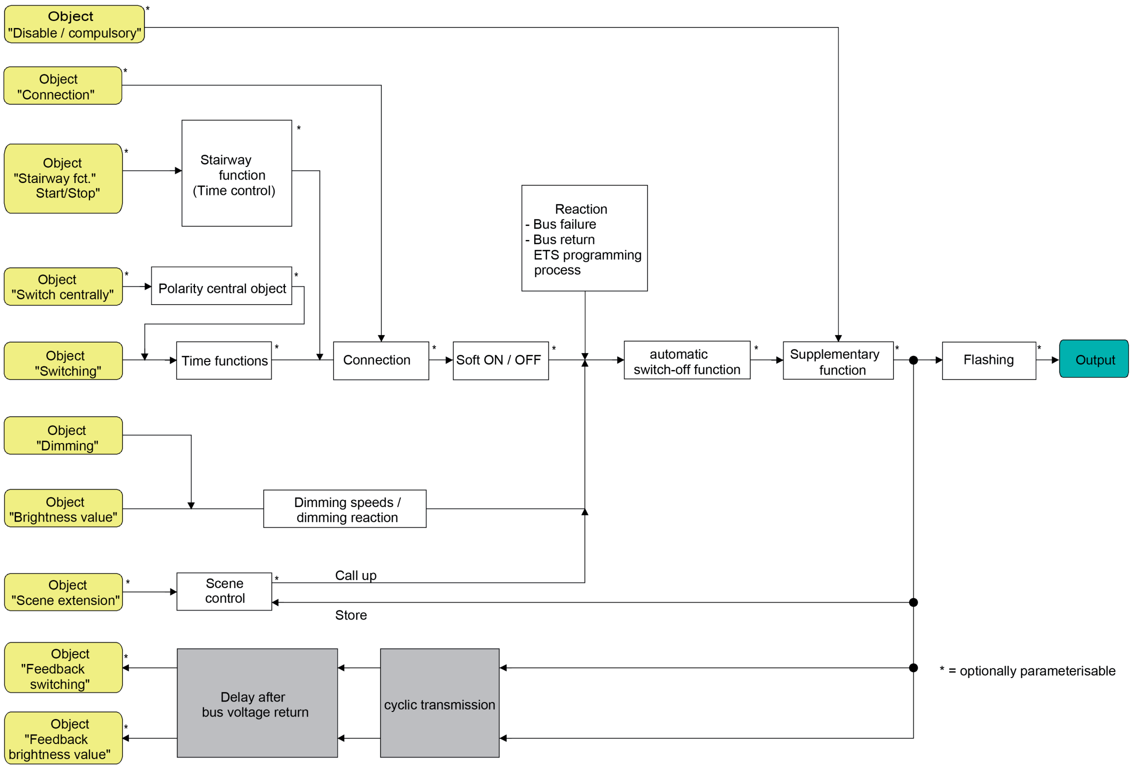

Figure 15: Functional feedback diagram of the feedbacks

i In the case of enabling function as supplementary function: A 'flashing' dimming channel is always signalled back as "switched on" and with switch-on brightness. Switching status feedbacks are also transmitted for disabled channels when the channels are readjusted by a manual operation, for example.

Activate switching status feedback

The switching status feedback can be used as an active message object or as a passive status object. As an active message object, the switching status feedback information is also directly transmitted to the bus whenever the feedback value is updated. As a passive status object, there is no telegram transmission after an update. In this case, the object value must be read out. The ETS automatically sets the object communication flags required for proper functioning. The parameter "Feedback switching status ?" can be preset separately for each dimming channel under "Kx - "feedbacks" (x = number of the dimming channel 1...4).

The feedbacks must be enabled on parameter page "Kx - Enabled functions".

- Set the parameter to "feedback object is active signalling object".

  The "Switching feedback" object is enabled. The switching status is transmitted once the status is updated. An automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS.

- Set the parameter to "feedback object is passive status object".

  The "Switching feedback" object is enabled. The switching status will be transmitted in response only if the feedback object is read out from by the bus. No automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS.

- Set the parameter to "no reaction".

  The switching status feedback is deactivated.

ℹ Feedback of the current switching status via the "switching" object is not possible.

Presetting update of the switching status feedback

In the ETS you can specify when the actuator should update the feedback value for the switching status in case of an actively transmitting communication object. The object value updated by the actuator is then signalled actively to the bus.
The parameter "Upgrade of the object value for feedback of switching status" can be preset separately for each dimming channel on the parameter page "Kx - "feedbacks" (x = number of the dimming channel 1...4).

The feedbacks must be enabled on parameter page "Kx - Enabled functions". In addition, the switching status feedback must either be configured to actively transmitting or passively readable.

- Set the parameter to "after each update obj. 'Switching'/'Central'".

  The actuator updates the feedback value in the object once a new telegram is received on the input objects "Switching" or "Central switching". With an actively transmitting feedback object, a new telegram is also then actively transmitted to the bus each time. The telegram value of the feedback does not necessarily have to change in the process. Hence, a corresponding switching status feedback is also generated on the "Switching" object such as in the case of cyclical telegrams for example.

- Set the parameter to "only if the feedback value changes".

  The actuator only updates the feedback value in the object if the telegram value (e.g. "OFF" to "ON") also changes If the telegram value of the feedback does not change (e.g. in the case of cyclical telegrams to the "Switching" object with the same telegram value), the feedback then remains unchanged. Consequently, with an actively transmitting feedback object, no telegram with the same content will be transmitted repeatedly either. This setting is recommendable, for instance, if the "Switching" and "Switching feedback" objects are linked to an identical group address. This is often the case when activating by means of light scene push-button sensors (recall and storage function).

Activating switching status feedback on return of bus voltage or after programming with the ETS

If used as active message object, the switching status feedback information is transmitted to the bus after bus voltage return or after programming with the ETS. In these cases, the feedback telegram can be time-delayed with the delay being preset globally for all dimming channels together (see page 49-50).

- Set the parameter "Time delay for feedback after bus voltage return ?" on parameter page "Kx - Feedbacks" (x = number of dimming channel 1...4) to "Yes".

  The switching status telegram will be transmitted with a delay after bus voltage return or after programming with the ETS. No feedback telegram is transmitted during a running delay, even if the switching state changes during this delay.

- Set the parameter "Time delay for feedback after bus voltage return ?" on parameter page "Kx - Feedbacks" (x = number of dimming channel 1...4) to "No".

  The switching status telegram will be transmitted immediately after bus voltage return or after programming with the ETS.

ⓘ After programming with the ETS, the switching status feedback is always transmitted with a basic delay of a few seconds (initialisation procedure of the actuator / possibly calibration of the load types). The basic delay is added to the "Delay after bus voltage return" configured in the ETS, if activated.

Presetting the cyclical transmission function for the switching status feedback telegram

The switching status feedback telegram can also be transmitted cyclically via the active message object in addition to the transmission after updating.

- Set the parameter "Cyclical transmission of feedback telegram?" on parameter page "Kx - Feedbacks" (x = number of dimming channel 1...4) to "Yes".

  Cyclical transmission is activated.
- Set the parameter "Cyclical transmission of feedback telegram?" on parameter page "Kx - Feedbacks" (x = number of dimming channel 1...4) to "No".

  Cyclical transmission is deactivated so that the feedback telegram is transmitted to the bus only when updated by the actuator.

ⓘ The cycle time is defined centrally for all dimming channels on the parameter page "Times".

ⓘ During an active delay after bus voltage return no feedback telegram will be transmitted even if a switching state changes.

Activate brightness value feedback

The brightness value feedback can be used as an active message object or as a passive status object. As an active message object, the brightness value feedback information is also directly transmitted to the bus for each update of the feedback value. As a passive status object, there is no telegram transmission after an update. In this case, the object value must be read out. The ETS automatically sets the object communication flags required for proper functioning.
The parameter "Feedback brightness value ?" can be preset separately for each dimming channel under "Kx - "feedbacks" (x = number of the dimming channel 1...4).

The feedbacks must be enabled on parameter page "Kx - Enabled functions".

- Set the parameter to "feedback object is active signalling object".

  The "brightness value feedback" object is enabled. The brightness value is transmitted once this is updated. An automatic telegram transmission of the feedback takes place after bus/mains voltage return or after programming with the ETS.
- Set the parameter "Feedback object is passive status object".

  The "brightness value feedback" object is enabled. The brightness value will be transmitted in response only if the feedback object is read out from by the bus. No automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS.
- Set the parameter to "no reaction".

  The brightness value feedback is deactivated.

ⓘ A feedback of the current brightness value via the "brightness value" object – even if a T-Flag is set – is not possible.

Presetting update of the brightness value feedback

In the ETS you can specify when the actuator should update the feedback value for the brightness value in case of an actively transmitting communication object. The object value updated by the actuator is then signalled actively to the bus.
The parameter "Upgrade of the object value for feedback of brightness value" can be preset

separately for each dimming channel on the parameter page "Kx - "feedbacks" (x = number of the dimming channel 1...4).

The feedbacks must be enabled on parameter page "Kx - Enabled functions". In addition, the brightness value feedback must either be configured to actively transmitting or passively readable.

- Set the parameter to "after each update obj. brightness value feedback".

  The actuator updates the feedback value in the object once a new telegram is received on the input object "brightness value". With an actively transmitting feedback object, a new telegram is also then actively transmitted to the bus each time. The telegram value of the feedback does not necessarily have to change in the process. Hence, a corresponding brightness value feedback is also generated on the "brightness value feedback" object such as in the case of cyclical telegrams for example.
- Set the parameter to "only if the feedback value changes".

  The actuator only updates the feedback value in the object if the telegram value (e.g. "0 %" to "100 %") also changes. If the telegram value of the feedback does not change (e.g. in the case of cyclical telegrams to the "brightness value" object with the same telegram value), the feedback then remains unchanged. Consequently, with an actively transmitting feedback object, no telegram with the same content will be transmitted repeatedly either.
  This setting is recommendable, for instance, if the "brightness value" and "brightness value feedback" objects are linked to an identical group address. This is often the case when activating by means of light scene push-button sensors (recall and storage function).

Activating brightness value feedback on return of bus voltage or after programming with the ETS

If used as active message object, the brightness value feedback information is transmitted to the bus after bus voltage return or after programming with the ETS. In these cases, the feedback telegram can be time-delayed with the delay being preset globally for all dimming channels together (see page 49-50).

- Set the parameter "Time delay for feedback after bus voltage return ?" on parameter page "Kx - Feedbacks" (x = number of dimming channel 1...4) to "Yes".

  The brightness value feedback will be transmitted with a delay after bus voltage return or after programming with the ETS. No feedback telegram is transmitted during a running delay, even if the brightness value changes during this delay.
- Set the parameter "Time delay for feedback after bus voltage return ?" on parameter page "Kx - Feedbacks" (x = number of dimming channel 1...4) to "No".

  The brightness value feedback will be transmitted immediately after bus voltage return or after programming with the ETS.

ℹ After programming with the ETS, the brightness value feedback is always transmitted with a basic delay of a few seconds (initialisation procedure of the actuator / possibly calibration of the load types). The basic delay is added to the "Delay after bus voltage return" configured in the ETS, if activated.

Presetting the cyclical transmission function for the brightness value feedback telegram

The brightness value feedback telegram can also be transmitted cyclically via the active message object in addition to the transmission after updating.

- Set the parameter "Cyclical transmission of feedback telegram?" on parameter page "Kx - Feedbacks" (x = number of dimming channel 1...4) to "Yes".

  Cyclical transmission is activated.

- Set the parameter "Cyclical transmission of feedback telegram" on parameter page "Kx - Feedbacks" (x = number of the dimming channel 1...4) to "No".

  Cyclical transmission is deactivated so that the feedback telegram is transmitted to the bus only when updated by the actuator.

ℹ The cycle time is defined centrally for all dimming channels on the parameter page "Times".

ℹ During an active delay after bus voltage return no feedback telegram will be transmitted even if a brightness value changes.

4.2.4.2.8 Timing functions

Up to two time functions can be preset for each dimming channel independent of each other. The time functions affect the communication objects "switching" or "central switching" only (if a central function is activated for the channel concerned) and delay the object value received depending on the telegram polarity (Figure 16).

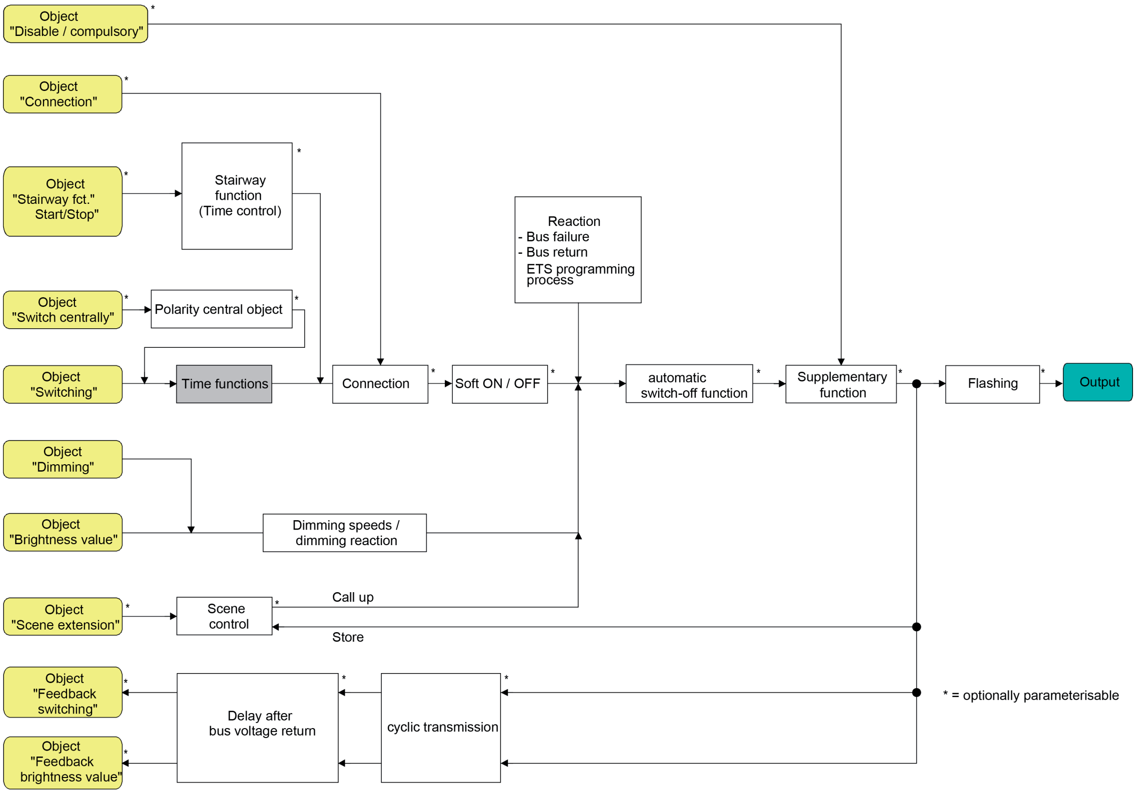

Figure 16: Function diagram of the timing functions

ℹ In the "speed controller" operating mode for the "1-gang" device variant - similar to the description of the brightness values for lighting control in this chapter - the speed values can be configured in the ETS. The differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode"   (see page 109).

Activating switch-on delay

The switch-on delay can be activated separately in the ETS for each dimming channel.

The timing functions must be enabled on parameter page "Kx - Enabled functions".

- On parameter page "Kx – Time delays" (x = Number of the dimming channel 1...4), preset the parameter "Selection of time delay" to "Switch-on delay" or to "switch-on delay and switch-off delay". Configure the desired switch-on delay.

  The switch-on delay is enabled. After reception of an ON telegram via the "switching" object, the configurable time is started. Another ON-telegram triggers the time only when the parameter "Switch-on delay retriggerable " is set to "Yes". An OFF-telegram received during the ON-delay will end the delay and sets the switching status to "OFF".

Activating switch-off delay

The switch-off delay can be activated separately in the ETS for each dimming channel.

The timing functions must be enabled on parameter page "Kx - Enabled functions".

- On parameter page "Kx – Time delays" (x = Number of the dimming channel 1...4), preset the parameter "Selection of time delay" to "Switch-off delay" or to "Switch-on delay and switch-off delay". Configure the desired switch-off delay.

  The switch-off delay is enabled. After reception of an OFF-telegram via the "switching" object, the configurable time is started. Another OFF-telegram triggers the time only when the parameter "switch-off delay retriggerable ?" is set to "Yes". An ON-telegram received during the OFF-delay will end the delay and sets the switching status to "ON".

ℹ Feedback: If a time delay has been preset and if the switching state is changed via the "Switching" object, the time delay must have elapsed before feedback telegrams will be transmitted.

ℹ At the end of a disabling function or forced position function, the brightness state received during the function or adjusted before the function can be tracked. Residual times of time functions are also tracked if these had not yet fully elapsed at the time of the reactivation or forced control.

ℹ The time delays do not influence the staircase function if this is enabled.

ℹ A time delay still in progress will be fully aborted by a reset of the actuator (bus/ mains voltage failure or ETS programming).

4.2.4.2.9 Soft ON/OFF function

The soft-functions permit a dimming channel to be switched on or off at reduced speed when a switching command is received via the "Switching" or "Central switching" communication objects.
If the soft ON function is activated, a dimming procedure is executed until the switch-on brightness when switching on. This also occurs if the dimming channel is already switched on to a brightness value smaller than switch-on brightness. Likewise, with the soft OFF function, a dimming procedure is executed to 0 % brightness after receipt of an OFF telegram (Figure 17).

The dimming speeds can be configured separately in the ETS for the soft ON and soft OFF function. The relative dimming increment time between 2 of 255 dimming increments is configured directly.

The soft ON or soft OFF functions are not retriggerable by the receipt of further switching telegrams while maintaining the switching status. The soft functions can be activated and configured separately in the ETS.

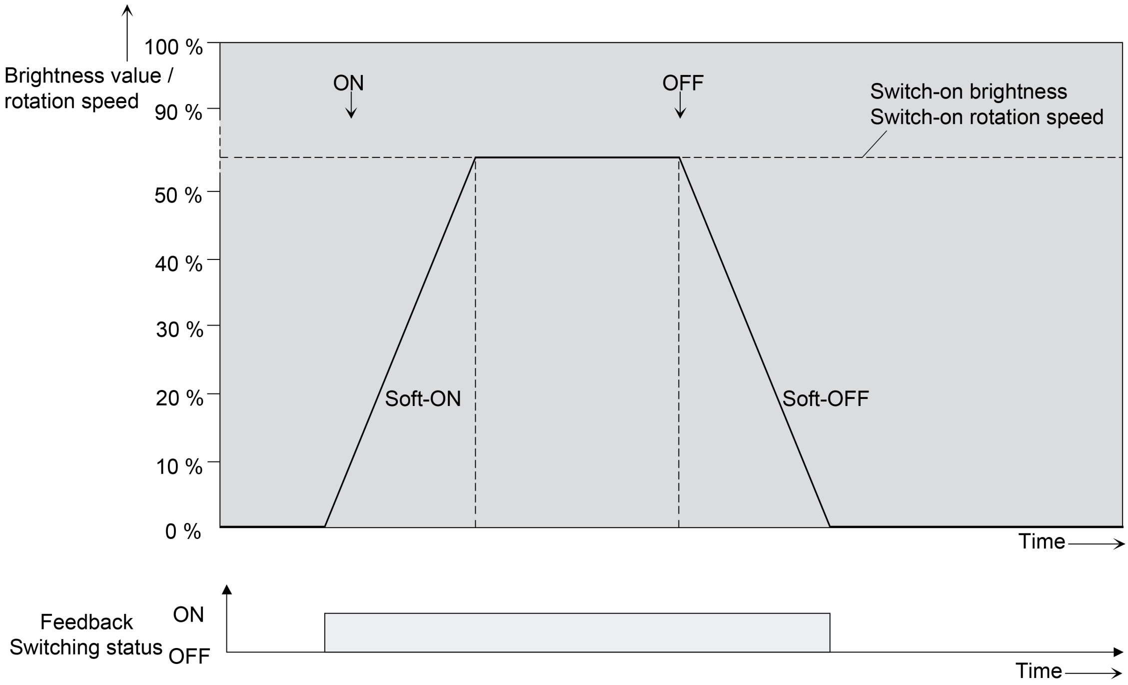

Figure 17: Dimming behaviour of the soft ON/OFF functions (as an example)

ℹ The soft ON function cannot be configured in the "speed controller" operating mode for the "1-gang" device variant. Additional differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode" (see page 109).

The soft functions also have effects on the switching edges of the staircase function (Figure 18).

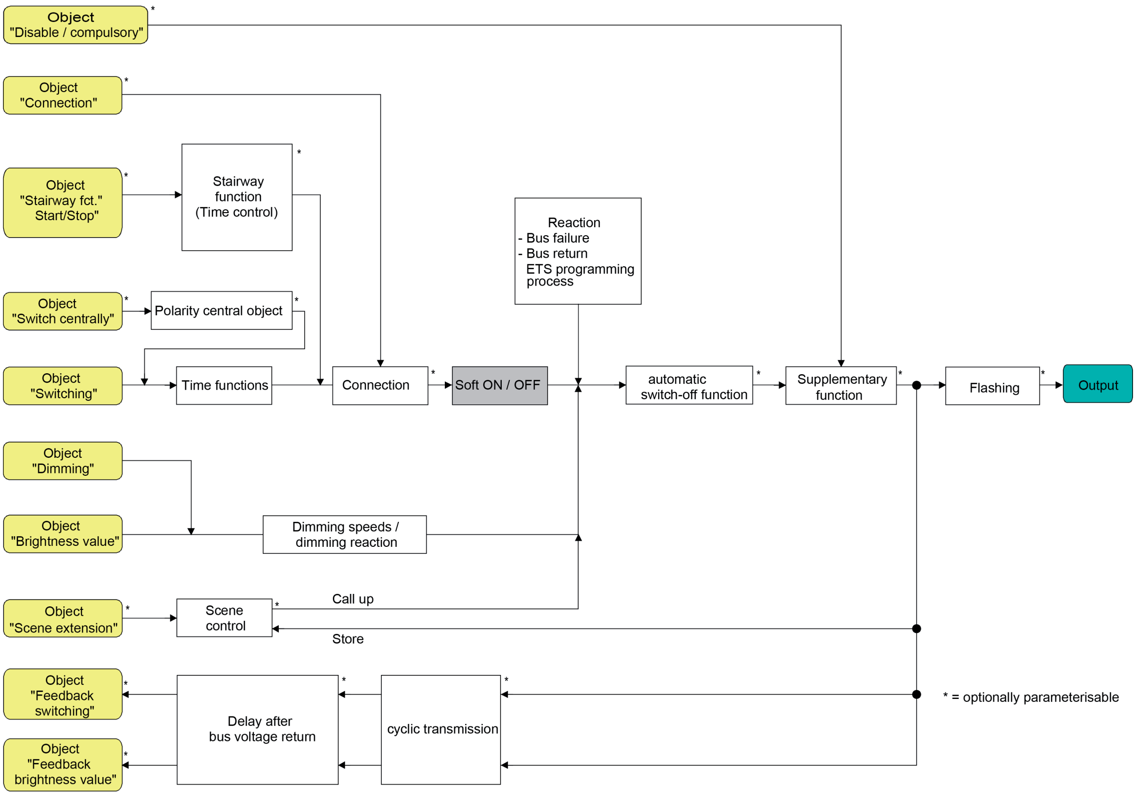

Figure 18: The function diagram of the soft functions

i A dimming channel disabled via the bus can also flash for the disabling function depending on the ETS configuration. Dimming is not executed with the soft functions during ON and OFF flashing.

Enabling and setting soft ON function

The soft ON function can be set separately for each dimming channel in the ETS.

The switch-on/switch-off behaviour on the parameter page "Kx - Enabled functions" (x = number of dimming channel 1...4) must be enabled.

- Set the parameter "Soft ON function ?" on the parameter page "Kx – Switch-on/switch-off behaviour" to "Yes".

  The soft ON function is enabled. The parameter for the dimming increment time (time between 2 of 255 dimming increments) of the soft ON function becomes visible.

- Configure the parameter "Time for dimming increment soft ON" to the required dimming increment time.

Enabling and setting soft OFF function

The soft OFF function can be set separately for each dimming channel in the ETS.

The switch-on/switch-off behaviour on the parameter page "Kx - Enabled functions" (x = number of dimming channel 1...4) must be enabled.

- Set the parameter "Soft OFF function ?" on the parameter page "Kx – Switch-on/switch-off behaviour" to "Yes".

  The soft OFF function is enabled. The parameter for the dimming increment time (time between 2 of 255 dimming increments) of the soft OFF function becomes visible.
- Configure the parameter "Time for dimming increment soft OFF" to the required dimming increment time.

4.2.4.2.10 Automatic switch-off

The switch-off function permits automatic switching of a dimming channel after a brightness value was dimmed or jumped to and this new brightness value is below a switch-off brightness set in the ETS. A time delay can be configured optionally up to switching off.
The switch-off function is activated after reaching a constant brightness value, i.e. after a completed dimming procedure.
The automatic switch-off function, for example, not only makes it possible to set the lighting to basic brightness but to switch off as well by means of relative dimming. A further application is time-controlled 'Good night switch-off' of a dimmed children's room lighting or the automatic switching off of a fan at very low speed (in the "speed controller" operating mode).

ⓘ In the "speed controller" operating mode for the "1-gang" device variant - similar to the description of the brightness values for lighting control in this chapter - the speed values can be configured in the ETS.

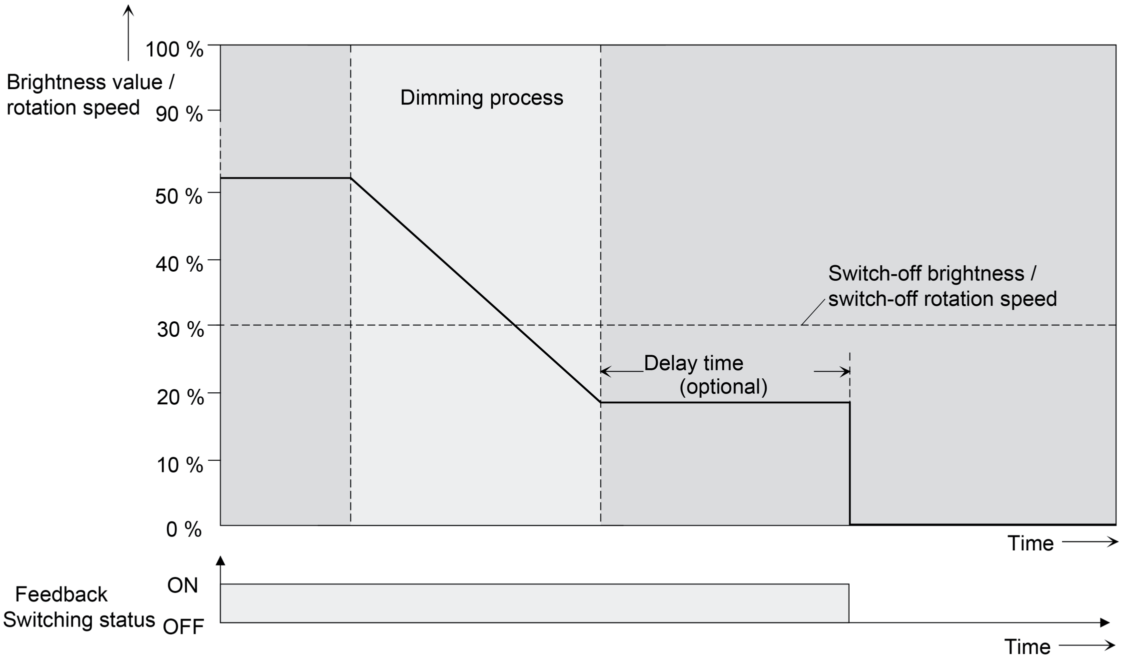

Figure 19: Dimming and switching behaviour of the automatic switch-off function

ⓘ Switching off always takes place without soft OFF function, i.e. jumping.

ℹ The switch-off brightness in the dimmable brightness range can be set between basic and maximum brightness or minimum and maximum brightness. The switch-off function is always active if the switch-off brightness is configured to maximum brightness and the maximum brightness is randomly undershot.

ℹ The feedback objects for switching state and brightness value are updated by the automatic switch-off function after switching off.

The automatic switch-off can firstly be activated by a dimming procedure initiated via the 4-bit ("dimming") or 1-byte ("brightness value") communication object. Secondly, the automatic switch-off can also be activated if a dimming channel is switched on (switch-on brightness < switch-off brightness) or a brightness is set by programming with the ETS or by a bus voltage failure or by bus / mains voltage return. The automatic switch-on can also be activated during a scene recall.
It should be noted that the disabling function or forced position function overrides the switch-off function (Figure 20). If the switch-off function is overridden, the actuator terminates the evaluation of the switch-off brightness.

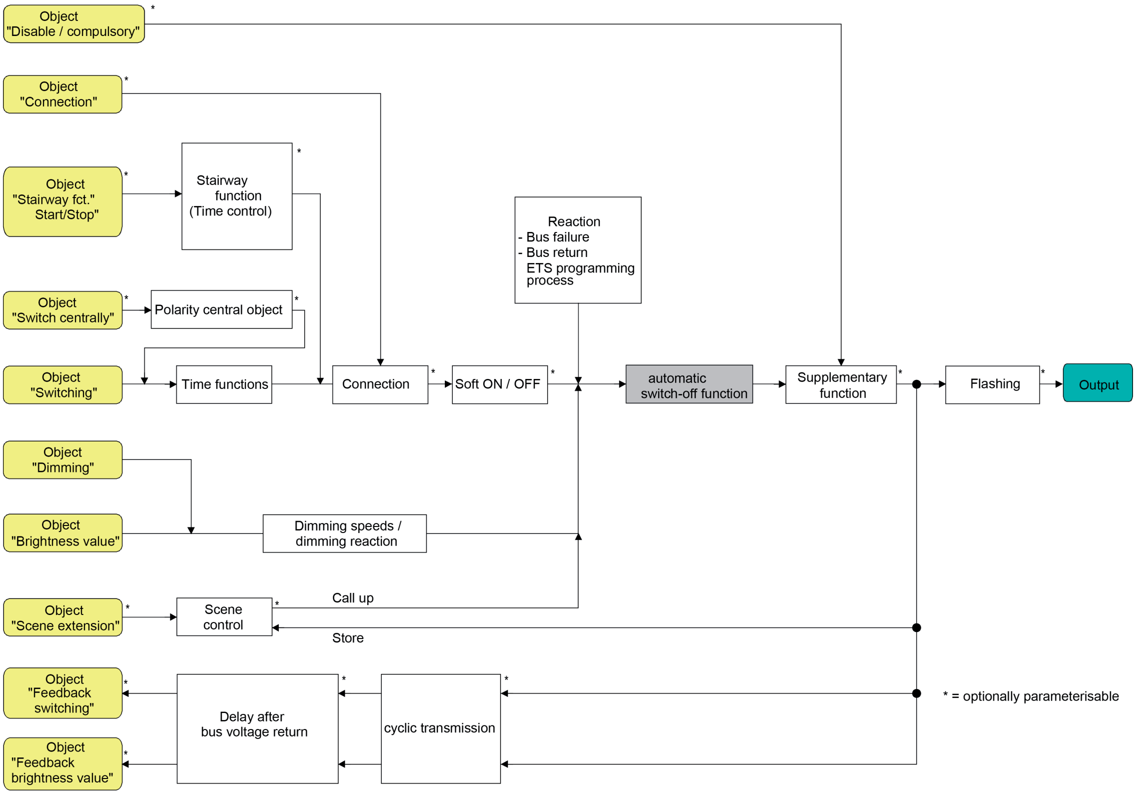

Figure 20: Function diagram of the automatic switch-off function

Enabling automatic switch-off function

The automatic switch-off function can be set separately for each dimming channel in the ETS.

The switch-on/switch-off behaviour on the parameter page "Kx - Enabled functions" (x = number of dimming channel 1...4) must be enabled.

- Set the parameter "Automatic switch-off when undershooting a brightness ?" on the parameter page "Kx – Switch-on/switch-off behaviour" to "Yes".

The automatic switch-off function is enabled and activated. Additional parameters become visible.

Setting the switch-off brightness

The switch-off brightness must be defined for the switch-off function. The switch-off brightness is set separately for each dimming channel in the ETS.

The switch-off function must be enabled in the ETS.

- Set the parameter "Switch off if brightness value is smaller" on parameter page "Kx – Switch-on/switch-off behaviour" to the required brightness value.

  Once a dimming procedure causes a value to fall below the parameterized switch-off brightness and once the brightness has been set to constant, the dimming channel concerned switches off or alternatively starts the delay until switching off.

ⓘ It should be noted that the configured value for the switch-off brightness is greater than any configured minimum brightness and less than the set maximum brightness (minimum brightness < switch-off brightness < maximum brightness)!

ⓘ Using the staircase function with pre-warning/continuous lighting: The reduced brightness of the pre-warning or continuous lighting does not start the switch-off function after reaching or undershooting the switch-off brightness!

Setting the delay of the switch-off function

A delay can be activated before the switch-off function switches-off automatically after undershooting the switch-off brightness at the end of a dimming procedure. The time for the delay can optionally be enabled separately for each dimming channel.

The switch-off function must be enabled in the ETS.

- Configure the parameter "Delay until switching off" on the parameter page "Kx – Switch-on-/Switch-off behaviour" to the required delay time.

  Once a dimming procedure causes a value to fall below the parameterized switch-off brightness and once the brightness has been set to constant, the actuator triggers the delay time. The dimming channel concerned switches off for good once the delay time has elapsed. The delay time can be re-triggered by further dimming procedures.

ⓘ For the "1-gang" device variant in the "speed controller" operating mode it should be noted that the delay time of the switch-off function is set greater than the "dwell time in cutting-in speed" (parameter page "K1 - General")! Otherwise, after the dwell time elapses immediately after switching off a motor, the switch-on function will have no effect because the dwelling in the cutting-in speed has a higher priority.

4.2.4.2.11 Staircase function / "Time dimmer function

The staircase function can be used for implementing time-controlled lighting of a staircase or for function-related applications. The staircase function must be enabled in the ETS on parameter page "Kx - Enabling functions (x = Number of the dimming channel 1...4) in order for the required communication objects and parameters to be visible.

The staircase function is activated via the communication object "staircase function start / stop" and is independent of the "switching" object of a dimming channel (Figure 21). In this way, 'parallel operation' of time and normal control is possible, whereby the command last received is always executed: A telegram to the "switching" object or a scene recall at the time of an active staircase function aborts the staircase time prematurely and presets the switching state according to the received object value (the time delays are also taken into account) or scene value. Likewise, the switching state of the "switching" object can be overridden by a staircase function.

Time-independent continuous light switching can also be implemented in combination with a disabling function because the disabling function has a higher priority and overrides the switching state of the staircase function.
The staircase function can also be extended by means of a supplementary function. At the same time, it is possible activate a time extension. The "time extension" permits retriggering of an activated staircase via the object "Staircase function Start / Stop" n times. Alternatively, the "Time preset via the bus" can be set. With this supplementary function, the configured staircase time can be multiplied by a factor received via the bus, thus it can be adapted dynamically. Furthermore, an extension of the staircase function can be implemented by means of a separate switch-on delay and pre-warning function. During the pre-warning, the brightness of a dimming channel can be reduced. According to DIN 18015-2, the pre-warning should warn persons on the staircase that the light will soon be switched off. As an alternative to the pre-warning at the end of the staircase time, the actuator can activate reduced continuous lighting. In this way, for example, long, dark hallways can have permanent basic lighting.

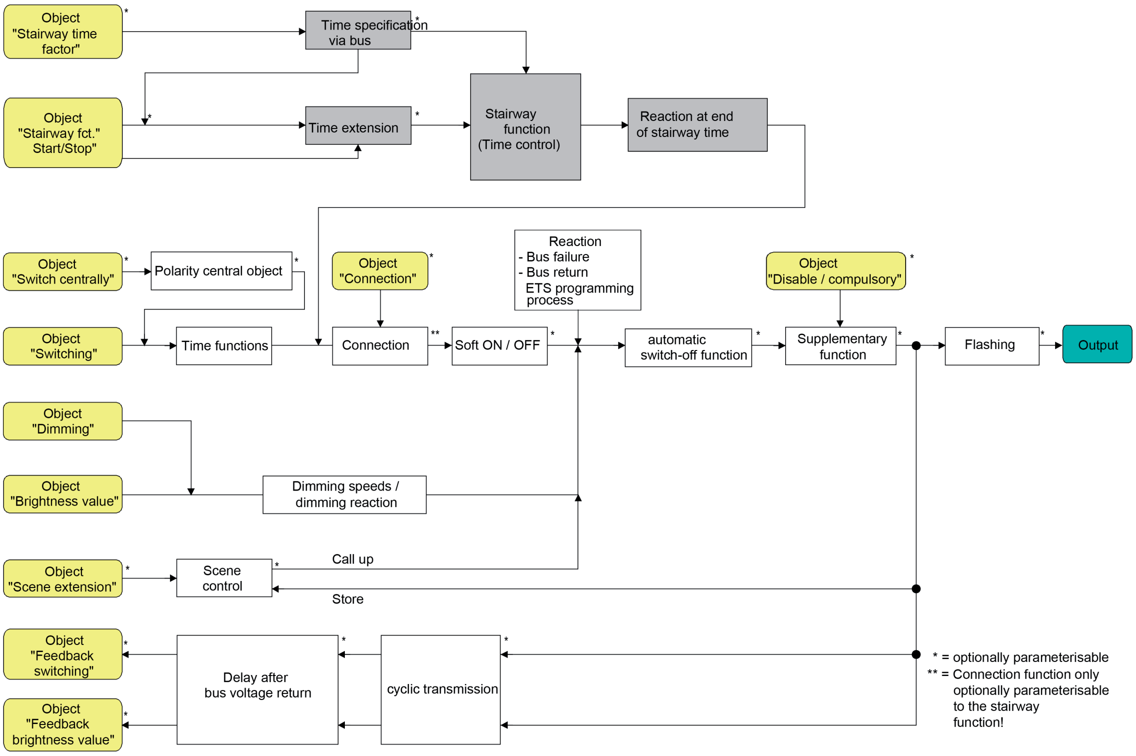

Figure 21: Function diagram of the staircase function

ℹ In the "speed controller" operating mode for the "1-gang" device variant the staircase function is described as a time dimmer function. The supplementary function "time extension" is not necessary in the time dimmer function. Additional differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode" (see page 109).

Specifying switch-on behaviour of the staircase function

An ON telegram to the "staircase function start/stop" object activates the staircase time (T_{EIN}), the duration of which is defined by the "staircase time" parameters. The output switches to switch-on brightness.
At the end of the staircase time, the dimming channel shows the "reaction at the end of the staircase time" configured in the ETS. At the same time, the channel can switch off, optionally activate the pre-warning time ($T_{Vorwarn}$) of the pre-warning function (see page 82-83) or dim to the reduced continuous lighting (application: e.g. long, dark hallways). Taking into account any possible pre-warning function, this gives rise to the example switch-on behaviour of the staircase function (Figure 22).

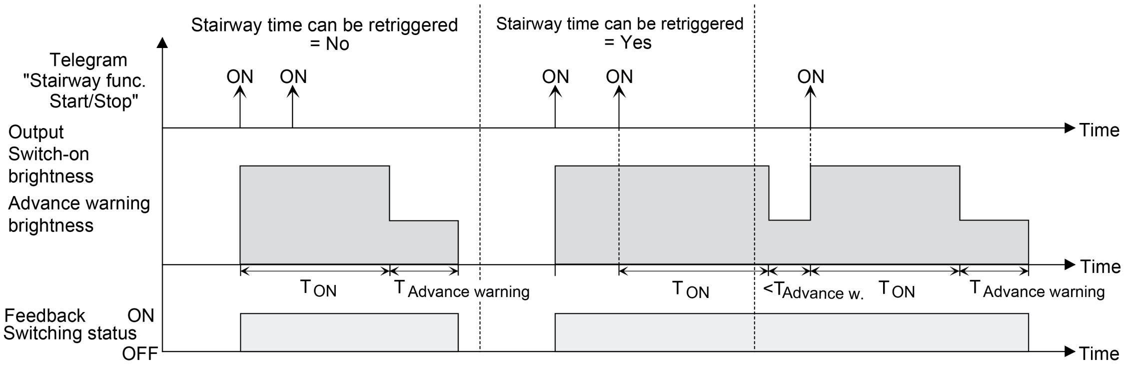

Figure 22: Switch-on behaviour of the staircase function without soft functions

In addition, switching on can be influenced by the soft functions of the actuator. Taking into account any soft ON and soft OFF function, this gives rise to a modified switch-on behaviour of the staircase function (Figure 23).

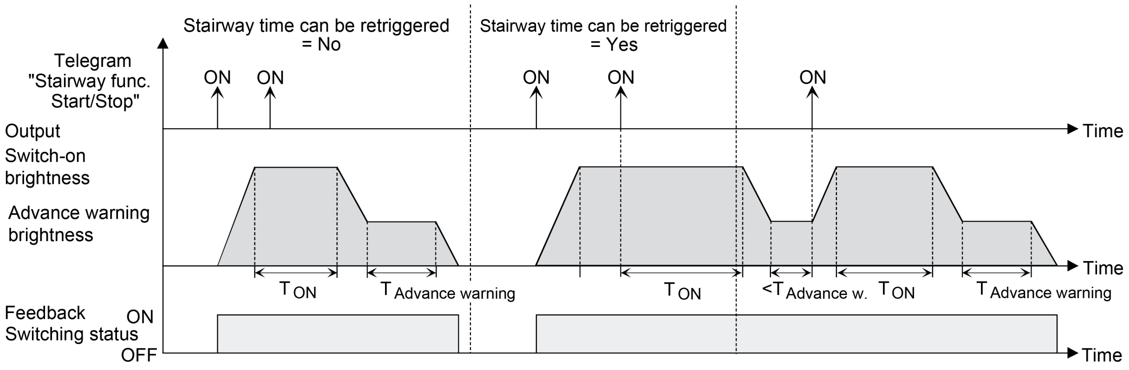

Figure 23: Switch-on behaviour of the staircase function with soft functions
(for example with minimum brightness = 0 %)

- Set the parameter "Staircase function ?" on parameter page "Kx - Enabled functions" (x = number of dimming channel 1...4) to "enabled".

  The staircase function is enabled. Additional parameters become visible on the parameter page "Kx – Staircase function".
- In the "staircase time" parameter on parameter page "Kx – Staircase function", configure the necessary switch-on time of the staircase function.
- Set the parameter "Staircase time retriggerable ?" on the parameter page "Staircase function" to "Yes".

  Every ON telegram received during the ON phase of the staircase time retriggers the staircase time completely.
- The parameter "Staircase time retriggerable ?" is alternatively preset to "no".

  ON telegrams received during the ON phase of the staircase time are rejected. The staircase time is not retriggered.

ⓘ An ON telegram received during the pre-warning time or during the reduced continuous lighting triggers the staircase time independently of the parameter "Staircase time retriggerable ?" always afterwards.

Specifying switch-off behaviour of the staircase function

In the case of a staircase function, the reaction to an OFF telegram can also be configured on the object "staircase function start/stop". At the end of the staircase time, a dimming channel always shows the "reaction at the end of the staircase time" configured in the ETS, without the receipt of an OFF telegram. At the same time, the channel can switch off, optionally activate the pre-warning time ($T_{Vorwarn}$) of the pre-warning function (see page 82-83) or dim to the reduced continuous lighting (application: e.g. long, dark hallways).
If, on the other hand, the dimming channel receives an OFF telegram via the object "Staircase function start/stop", the actuator evaluates the parameter "Reaction to an OFF-telegram". In this case, the channel can react immediately to the OFF telegram and end the staircase time prematurely. Alternatively, the OFF telegram can be ignored.
Taking into account any possible pre-warning function, this gives rise to the example switch-off behaviour of the staircase function (Figure 24).

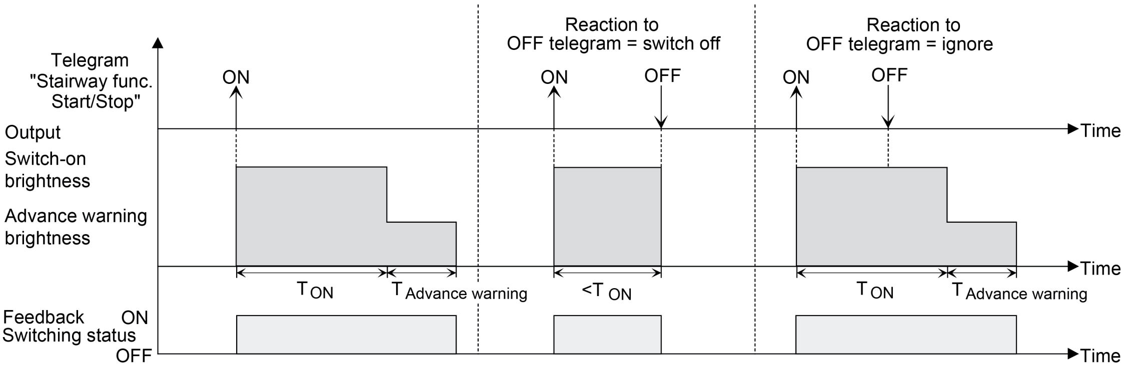

Figure 24: Switch-off behaviour of the staircase function without soft functions

In addition, the switch-off can be influenced by the soft functions of the actuator. Taking into account any soft ON and soft OFF function, this gives rise to a modified switch-off behaviour of the staircase function (Figure 25).

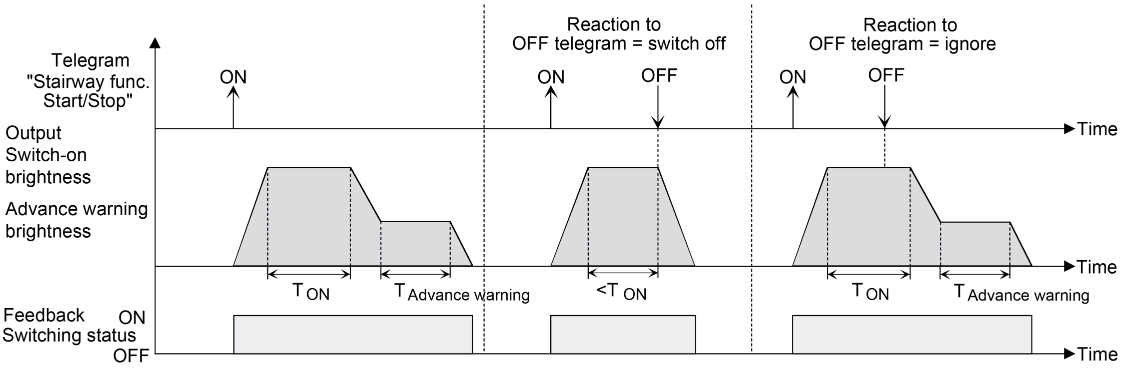

Figure 25: Switch-off behaviour of the staircase function with soft functions
(for example with minimum brightness = 0 %)

The parameter "Reaction to OFF-telegram" on the parameter page "Kx – Staircase function" (x = number of the dimming channel 1...4), defines whether the staircase time (T_{EIN}) of the staircase function can be aborted prematurely.

The staircase function must be enabled in the ETS.

- Set the parameter "Reaction to OFF-telegram" to "switch off".

  Once an OFF telegram is received via the object "Staircase function start/stop" during the ON phase of the staircase time, the dimming channel concerned switches off immediately. If the staircase time is stopped prematurely by such a telegram, there is no pre-warning, i.e. the pre-warning time is not started. It is also not dimmed to a reduced continuous lighting. It is also possible to switch off prematurely during a dimming procedure of a soft function or during a pre-warning or reduced continuous lighting.
- Set the parameter "Reaction to OFF-telegram" to ignore".

OFF telegrams received via the object "staircase function start / stop" during the ON phase of the staircase function are rejected. The staircase time will be executed completely to the end with the configured "behaviour at the end of the staircase time".

Setting the pre-warning function of the staircase function

At the end of the switch-on time of the staircase function, the actuator for the dimming channel concerned shows the "reaction at the end of the staircase time" configured in the ETS. The channel can be set to switch off immediately, alternatively to dim to the reduced continuous lighting (application: e.g. long, dark hallways) or to execute the pre-warning function. If the parameter is configured to "activate pre-warning time", the pre-warning time ($T_{Vorwarn}$) and pre-warning brightness can be configured in the ETS.

The pre-warning should, according to DIN 18015-2, warn persons still on the staircase that the light will soon be switched off. As a pre-warning, a dimming channel can be set to a pre-warning brightness before the channel switches off permanently. The pre-warning brightness is normally reduced in the brightness value compared to the switch-on brightness.
The pre-warning time is added to the staircase time (T_{EIN}) (Figure 26). The pre-warning time influences the values of the feedback objects so that the switching state "OFF" and the value "0" is first tracked after the pre-warning time in the feedback objects has elapsed.

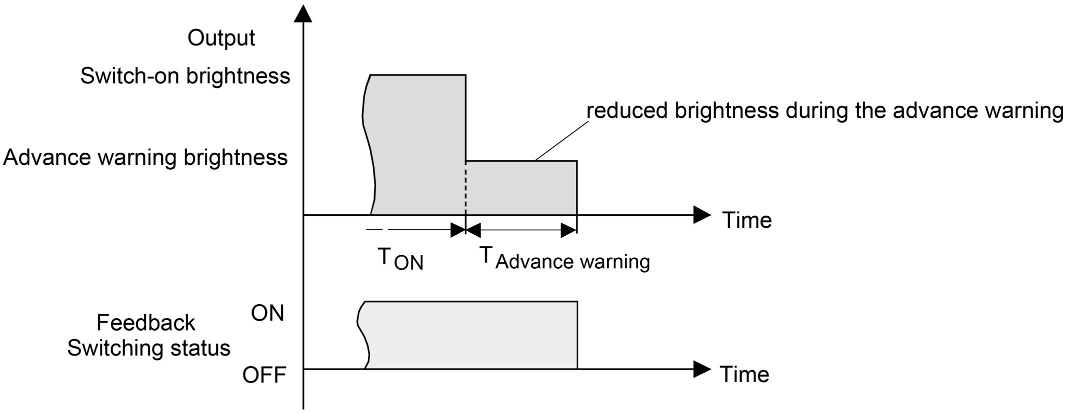

Figure 26: The pre-warning function of the staircase function without soft OFF function

Additionally, the pre-warning function can also be extended by the soft OFF function. Taking into account any soft OFF function, this gives rise to a modified switch-off behaviour of the staircase function after the pre-warning has elapsed (Figure 27).

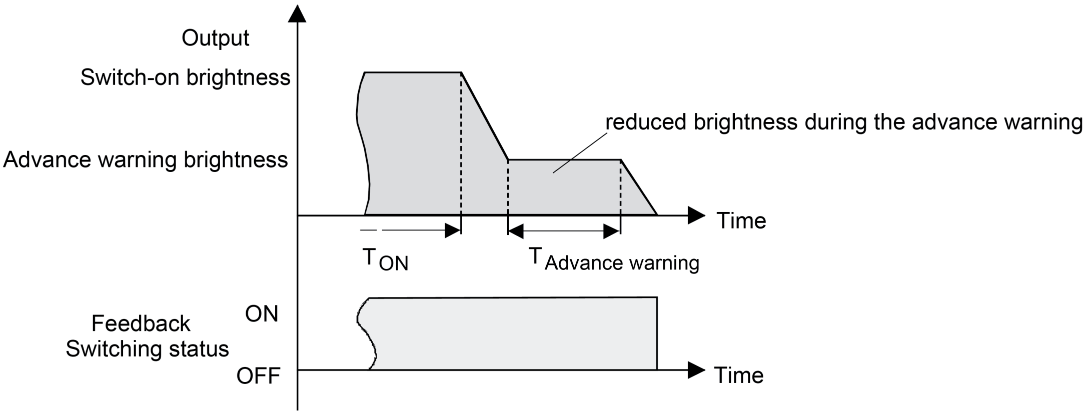

Figure 27: The pre-warning function of the staircase function with soft OFF function
(for example with minimum brightness = 0 %)

ℹ The pre-warning brightness does not necessarily have to be less than the switch-on brightness. The pre-warning brightness can always be configured to values between basic/minimum brightness and maximum brightness.

The staircase function must be enabled.

- Set the parameter "Reaction at the end of the staircase time" on the parameter page "Kx – Staircase function" (x = number of the dimming channel 1...4) to "activate pre-warning time".

  The pre-warning function is enabled. The desired pre-warning time ($T_{Vorwarn}$) can be preset.
- Configure the "pre-warning time".
- Set the parameter "Reduced brightness during the pre-warning time (1...100 %)" to the desired brightness value.

  During the pre-warning time, the dimming channel is set to the configured brightness value.

ℹ The configured value for the reduced brightness must be greater than or equal to the minimum brightness (if configured) or less than or equal to the maximum brightness!

ℹ An ON telegram to the object "Staircase function start/stop" while a pre-warning function is still in progress stops the pre-warning time and always starts (independently of the parameter "Staircase time retriggerable ?") the staircase time anew. Even during the pre-warning time, the parameter "reaction to OFF telegram" is evaluated so that a pre-warning in progress can be terminated early by switching off.

ℹ Using the automatic switch-off function: The reduced brightness of the pre-warning does <u>not</u> start the switch-off function after reaching or undershooting the switch-off brightness!

Setting continuous lighting of the staircase function

At the end of the switch-on time of the staircase function, the actuator for the dimming channel concerned shows the "reaction at the end of the staircase time" configured in the ETS. The channel can be set to switch off immediately, alternatively to execute a pre-warning function, or to dim to reduced continuous lighting. The reduction of the lighting to continuous lighting after the staircase time has elapsed is appropriate, for example, if a certain degree of artificial light should be switched on permanently in long, dark hallways. Switching to switch-on brightness by activating the staircase function normally takes place by additional presence detectors or motion detectors when people are present in the hallway.
If the parameter "Reaction at the end of the staircase time" is configured to "activate reduced

continuous lighting", the brightness for the continuous lighting can be configured in the ETS. The continuous brightness is normally reduced in the brightness value compared to the switch-on brightness (Figure 28).

The continuous lighting remains permanently active after the staircase time has elapsed. Only when an ON telegram is received again via the object "Staircase function start/stop" does the actuator switch back to the switch-on brightness and start counting the staircase time again. The receipt of an OFF telegram via the object "staircase function start/stop" only switches the continuous lighting off if the parameter "Reaction to OFF-telegram" is configured to "switch off".

ⓘ A dimming channel can always be switched on and off via the "switching" object independently of the staircase function. Consequently, continuous lighting will also be overridden if telegrams arrive on the actuator via the "switching" object.
If permanent continuous lighting is desired, which cannot be influenced by the "switching" object nor by the object of the staircase function, the disabling function of the actuator should be used.

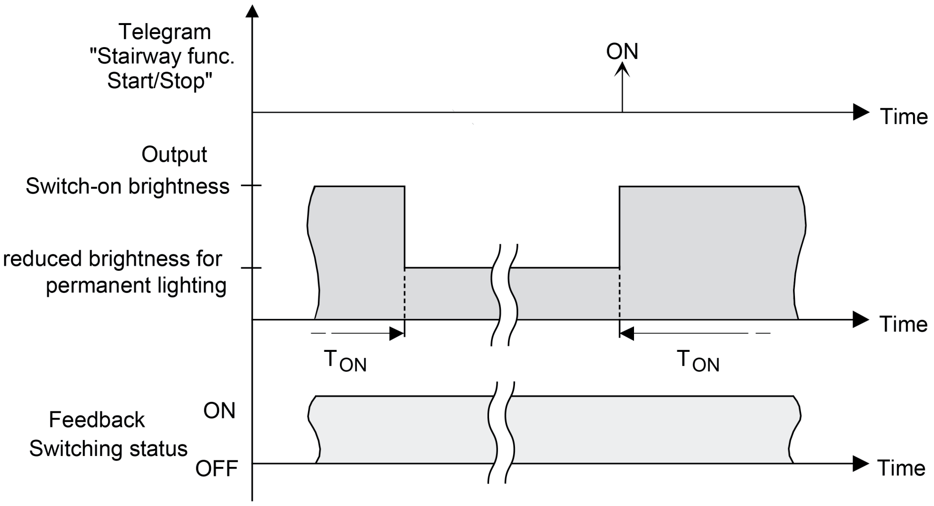

Figure 28: The continuous lighting of the staircase function without soft functions

Additionally, the continuous lighting can also be extended by the soft function. Taking into account any soft ON and soft function, this gives rise to modified continuous lighting behaviour of the staircase function (Figure 29).

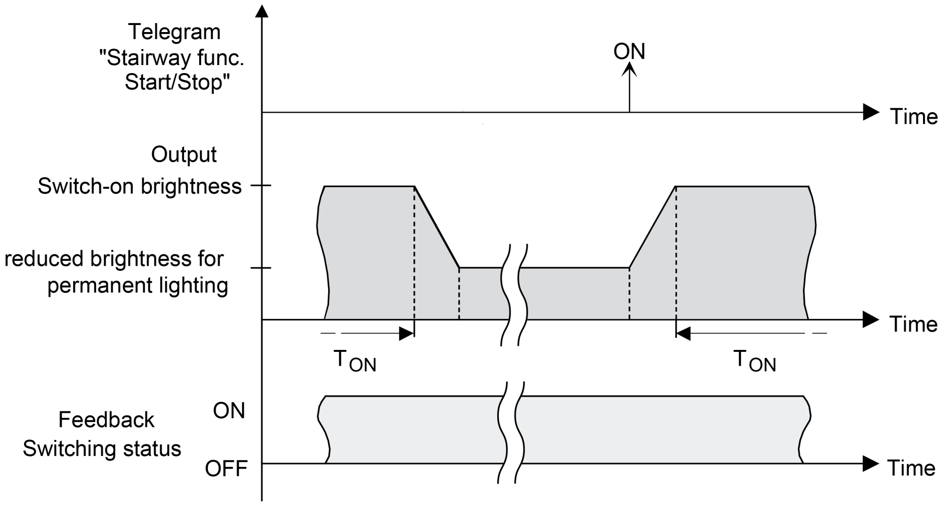

Figure 29: The continuous lighting of the staircase function with soft OFF functions

ⓘ The brightness of the continuous lighting does not necessarily have to be less than the switch-on brightness. The brightness of the continuous lighting can always be configured to values between basic/minimum brightness and maximum brightness.

The staircase function must be enabled.

- Set the parameter "Reaction at the end of the staircase time" on the parameter page "Kx – Staircase function" (x = number of the dimming channel 1...4) to "activate reduced continuous lighting".

  The continuous lighting is enabled. The "reduced brightness for continuous lighting (1...100 %)" can be set to the desired brightness value.

ⓘ The configured value for the reduced brightness must be greater than or equal to the minimum brightness (if configured) or less than or equal to the maximum brightness!

ⓘ An ON telegram to the object "Staircase function start/stop" always starts (independently of the parameter "Staircase time retriggerable ?") the staircase time anew. Even during activated continuous lighting, the parameter "Reaction to OFF telegram" is evaluated so that continuous lighting can be switched off.

ⓘ Using the automatic switch-off function: The reduced brightness of the continuous lighting does not start the switch-off function after reaching or undershooting the switch-off brightness!

Setting supplementary function of the staircase function – time extension

With the time extension function, the staircase time can be retriggered several times (i.e. extended) via the "Staircase function start/stop" object. The duration of the extension is predefined by several operations at the control section (several ON telegrams in succession). The configured staircase time can be extended in this way by the configured factor (a maximum of 5-fold). The time is then always extended automatically at the end of a single staircase time (T_{EIN}).

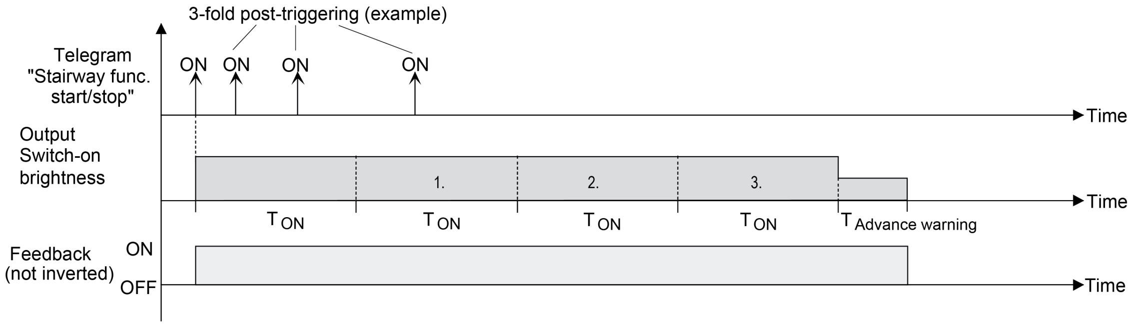

Figure 30: Time extension of the staircase function

With this function, the lighting time in a staircase can be extended (e.g. by a person after shopping) by a defined length without having to retrigger the lighting every time the lighting shuts off automatically.

The staircase function must have been enabled on parameter page "Kx – Enabled functions.

- Set the parameter "Supplementary function for staircase function" on the parameter page "Kx – Staircase function" to "time extension" and set the maximum desired factor on the parameter "maximum time extension".

  The staircase time is retriggered each time an ON telegram is received on the "staircase time start/stop" object after the staircase time has elapsed, depending on the number of telegrams received, but only as often as pre-defined by the configured factor. For example, the "3-fold time" setting means that after the started staircase time has elapsed, it can be retriggered automatically a maximum of three additional times. The time is therefore extended a maximum of four fold (Figure 30).

ℹ A time extension can be triggered during the entire staircase time (T_{EIN}). There is no time limit between two telegrams for the time extension. Telegrams for the time extension are only evaluated during the staircase time. An ON telegram during the pre-warning function or continuous lighting triggers the staircase time as a restart, which means that a new time extension is possible.

ℹ If a time extension was configured as a supplementary function, the parameter "Staircase time retriggerable ?" is preset to "No" because the retriggering takes place by the time extension.

ℹ The time extension cannot be configured in the "speed controller" operating mode for the "1-gang" device variant.

Setting supplementary function of the staircase function – time preset via the bus

With the time preset via the bus, the configured staircase time can be multiplied by an 8-bit factor received via the bus, thus it can be adapted dynamically. With this setting, the factor is derived from the object "staircase time factor". The possible factor value for setting the staircase time is between 1…255.

The entire staircase time arises as a product from factor (object value) and the configured staircase time as a basis as follows...
Staircase time = (staircase time object value) x (staircase time parameter)

Example:
Object value "staircase time factor" = 5; parameter "staircase value" = 10s.
-> set staircase time = 5 x 10s = 50 s

Alternatively, the staircase function parameter can define whether the receipt of a new factor also starts the staircase time of the staircase function at the same time. In this case, the object

"Staircase function start/stop" is not necessary and the received factor value determines the starting and stopping.

The staircase function must have been enabled on parameter page "Kx – Enabled functions.

- Set "supplementary function for staircase function" on the parameter page "Kx – Staircase function" to "time preset via the bus" and set the parameter "staircase function activatable via 'staircase time' object ?" to "No".

  The staircase time can be adapted dynamically by the "staircase time factor" object. A value "0" is interpreted as value "1". The staircase function is started and stopped exclusively via the "staircase function start / stop" object.
- Set "supplementary function for staircase function" on the parameter page "Kx – Staircase function" to "time preset via the bus" and set the parameter "staircase function activatable via 'staircase time' object ?" to "Yes".

  The staircase time can be adapted dynamically by the "staircase time factor" object. In addition, the staircase function is started with the new staircase time (the "staircase function start / stop" is not necessary) after receiving a new factor. A factor value "0" is interpreted as an OFF telegram, whereby in this case, the configured reaction to an OFF telegram is evaluated, too.

  A larger staircase with several floors is an example as an application for the time preset via the bus with automatic starting of the staircase time. On each floor there is a push-button sensor that transmits a factor value to the staircase function. The higher the floor, the greater the factor value transmitted so that the lighting stays switched on longer if the passing through the staircase needs more time. When a person enters a staircase and a pushbutton is pressed, the staircase time is now adjusted dynamically to the staircase time and switches on the lighting at the same time, too.

ⓘ Setting "Staircase function activatable via"Staircase time" object ?" = "Yes":
A factor > 0 received during a warning time triggers the staircase time independently of the parameter "staircase time retriggerable ?" always afterwards.

ⓘ After a reset (bus voltage return or ETS programming) the "staircase time factor" object is always initialised with "1". The staircase function is not started automatically solely as the result of this, however (see page 87-88).

ⓘ The two supplementary functions "time extension" and "time preset via the bus" can only be configured alternatively.

Behaviour of the staircase function after bus or mains voltage return presetting

The staircase function can be started automatically after bus or mains voltage return.

The staircase function must have been enabled on parameter page "Kx – Enabled functions.

- Set the parameter "Behaviour after bus or mains voltage return" on the parameter page "Kx – General" to "activate staircase function".

ⓘ In the "speed controller" operating mode for the "1-gang" device variant, the parameter setting is called "activate time dimmer function".

Immediately after bus or mains voltage return, the staircase time of the staircase function is started.

ⓘ The parameter "behaviour after bus or mains voltage return" will always be executed on return of bus voltage only if the mains voltage (without bus) is switched on. If the mains voltage is switched on when the bus voltage is present, the actuator does not execute any particular reaction.

ⓘ With this setting you should note that the staircase function is also enabled and programmed. When the staircase function is not enabled, there is no reaction after bus/mains voltage return with this setting.

ℹ The configured behaviour will only be executed, if no forced position on bus voltage return is activated.

4.2.4.2.12 Scene function

Up to 8 scenes can be programmed and scene values stored separately in the actuator for each dimming channel. The scene values are recalled or stored via a separate scene extension object by means of extension telegrams. The datapoint type of the extension object permits addressing a maximum of 64 scenes. This means that, in the configuration of a scene, it is possible to specify which scene number (1...64) contacts the internal scene (1...8).

The scene function must be enabled on parameter page "Kx - Enabling functions" for each dimming channel in order for the required communication objects and parameters (on the parameter page "Kx - Scenes") to be visible.

The scene function can be combined together with other functions of a dimming channel, whereby the last received or preset state is always executed:
Telegrams to the "switching", "dimming" or "brightness value" objects, a scene recall or scene storage telegram at the time of an active staircase function aborts the staircase time prematurely and presets the brightness state according to the received object value (time delays are also taken into account) or scene value. Likewise, the brightness state of the dimming channel, which was preset by the "switching", "dimming" or "brightness value" objects or by a scene recall, can be overridden by a staircase function.

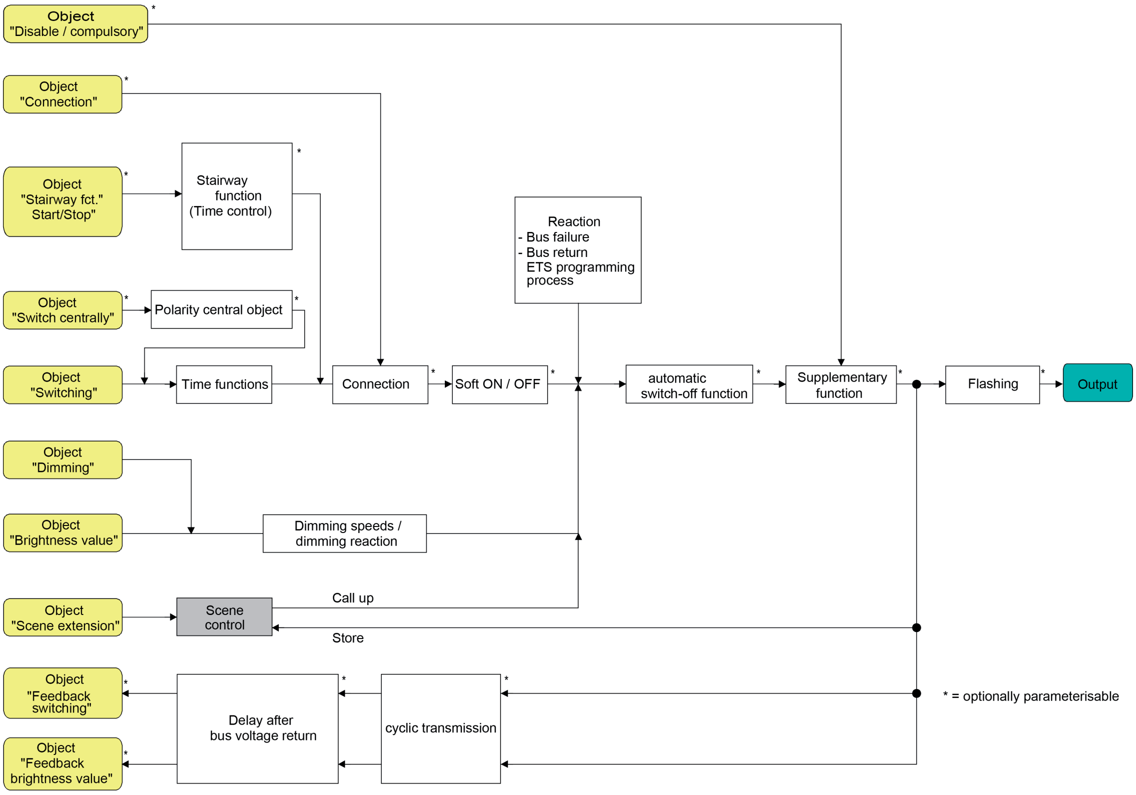

Figure 31: Function diagram of the scene function

ℹ In the "speed controller" operating mode for the "1-gang" device variant - similar to the description of the brightness values for lighting control in this chapter - the speed values can be configured in the ETS. The differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode" (see page 109).

Presetting a scene recall delay for the scene function

Each scene recall of an dimming channel can optionally also be delayed. With this feature, dynamic scene sequences can be configured if several scene output channels are combined with cyclical scene telegrams.

The scene function must be enabled on parameter page "Kx – Enabled functions (x = number of the dimming channel 1...4).

- Set the parameter "Delay scene recall?" to "Yes".

  The delay time is now activated and can be configured separately. The delay only influences the scene recall of the dimming channel. The delay time is started on arrival of a recall telegram. The corresponding scene will be recalled and the brightness value set on the dimmer output only after this time has elapsed.

ℹ Each scene recall telegram restarts the delay time and retriggers it. If a new scene recall telegram is received while a delay is active (scene recall not yet executed), the old (and not yet recalled scene) will be rejected and only the scene last received executed.

ℹ The scene recall delay has no influence on the storage of scene values. A scene storage telegram within a scene recall delay terminates the delay and thus the scene recall.

Setting behaviour when recalling a scene

In the scene configuration of a dimming channel, it is possible to define whether the light intensity instantly jumps or dims to the scene brightness value. When dimming, it can also be predefined whether the dimming procedure should be executed normally by dimming increments or by fading. A scene recall can therefore be executed independent of the set dimming behaviour and dimming characteristic of an output.
The behaviour during a scene recall can be configured separately for each scene.

The scene function must be enabled on parameter page "Kx – Enabled functions (x = number of the dimming channel 1...4).

- Set the parameter "Behaviour when recalling a scene" on parameter page "Kx – Scenes" to "jump to brightness value".

  The scene brightness values are instantly jumped to during a recall.

- Set the parameter "Behaviour when recalling a scene" on parameter page "Kx – Scenes" to "dim to brightness value via dimming increment time". At the same time, define the required "dimming increment time (0...255 ms)" to dim to the scene brightness value.

  The scene brightness values of the scene concerned are dimmed to during a recall. The time in the parameter selection defines the duration of the dimming procedure between 2 of 255 dimming increments.

- Set the parameter "Behaviour when recalling a scene" on parameter page "Kx – Scenes" to "dim to brightness value via fading". At the same time, define the "fading time (0...240 ms)" required to dim to the scene brightness value.

The scene brightness values of the scene concerned are dimmed to during a recall. The dim fading is activated The time in the parameter selection defines the duration of the dimming procedure required to reach the scene brightness value. The brightness value of a dimming channel at which the dimming starts and the configured dimming characteristic have no significance. Thus, the dimming procedure in case of a scene recall always requires the exact predefined time.

ⓘ The parameter setting "dim via fading" is not available in the "speed controller" operating mode for the "1-gang" device variant.

Presetting the ETS download behaviour for the scene function

During storage of a scene, the scene values are stored permanently in the device (see page 91). To prevent the stored values from being replaced during ETS programming of the application or of the parameters by the originally programmed scene brightness values, the actuator can inhibit overwriting of the scene values. As an alternative, the original values can be reloaded into the device during each programming run of the ETS.

The scene function must be enabled on parameter page "Kx – Enabled functions (x = number of the dimming channel 1...4).

- Set the parameter "Overwrite the values stored in the device during ETS download ?" to "Yes".

  During each ETS programming of the application or of the parameters, the scene values parameterized in the ETS for the dimming channel concerned will be programmed into the actuator. Scene values stored in the device by means of a storage function will be overwritten, if any.

- Set the parameter "Overwrite the values stored in the device during ETS download ?" to "No".

  Scene values stored in the device with a storage function will be maintained. If no scene values have been stored, the brightness values last programmed in the ETS remain valid.

ⓘ When the actuator is put into operation for the first time, this parameter should be set to "yes" so that the dimming channel is initialized with valid scene values.

Presetting scene numbers and scene brightness values for scene function

The datapoint type of the scene extension object permits addressing of up to 64 scenes max. For this reason, the scene number (1...64) with which the scene is addressed, i.e. recalled or stored, must be determined for each internal scene (1...8) of the dimming channel. Moreover, the brightness value to be set for the dimming output in case of a scene recall must be specified as well.

The scene function must be enabled on parameter page "Kx – Enabled functions (x = number of the dimming channel 1...4).

- Set the parameter "Scene x activatable by scene number" (x = number of the scene (1…8)) on parameter page "Kx – Scenes" for each scene to the numbers with which the scenes are to be addressed.

  A scene can be addressed with the configured scene number. A setting of "0" deactivates the corresponding scene so that neither recalling nor storage is possible.

ⓘ If the same scene number is parameterized for several scenes, only the scene with the lowest internal scene number (1...8) will be addressed. The other internal scenes will be ignored in this case.

- Set the parameter "brightness value for scene x" (x = number of the scene (1…8)) on parameter page "Kx – Scenes" for each scene to the desired brightness value.

During a scene recall, the parameterized brightness value is recalled and set on the dimming channel.

ⓘ The parameterized brightness value is adopted in the actuator during programming with the ETS only if the parameter "Overwrite values stored in the device during ETS download ?" is set to "Yes".

ⓘ It should be noted that the configured value for the scene brightness is greater than a configured minimum brightness (if applicable) and less than the set maximum brightness!

Presetting the storage behaviour for the scene function

The scene brightness value preset according to the function diagram can be stored internally via the extension object on reception of a scene storage telegram – also during a dimming procedure. In this case, the brightness value can be influenced before the storage by all functions of the dimming channel provided the individual functions have been enabled (e.g. also the disabling function, forced-control position function, manual control, etc.).

The scene function must be enabled on parameter page "Kx – Enabled functions (x = number of the dimming channel 1...4).

- Set the parameter "Storage function for scene x" (x = number of the scene (1…8)) on parameter page "Kx – Scenes" for each scene to "Yes".

  The storage function is activated for the scene in question. On reception of a storage telegram via the "Scene extension" object, the current brightness value will be internally stored.
- Set the parameter "Storage function for scene x" (x = number of the scene (1…8)) on parameter page "Kx – Scenes" for each scene to "No".

  The storage function is deactivated for the scene in question. A storage telegram received via the "scene extension" object will be rejected.

4.2.4.2.13 Operating hours counter

The operating hours counter determines the switch-on time of a dimming channel. A channel is actively on for the operating hours counter if the brightness value is greater than "0", i.e. when current is flowing to the load.
The operating hours counter adds up the determined switch-on time accurately to the minute for switched-on dimming channels in full hours respectively (Figure 32). The totalled operating hours are added in a 2-byte counter and stored permanently in the device. The current counter status can be transmitted cyclically to the bus by the "value operating hours counter" communication object or when there is a change in an interval value.

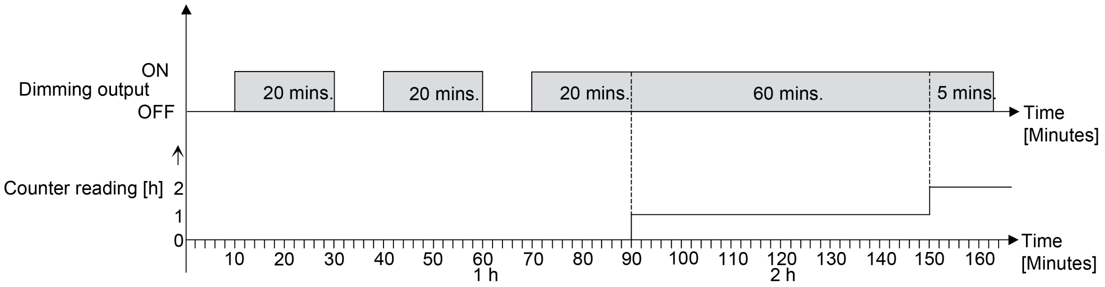

Figure 32: Function of the operating hours counter (using the example of an up-counter)

In the as-delivered state, the operating hour values of all dimming channels is "0". If the operating hours counter is not enabled in the configuration of a dimming channel, no operating hours will be counted for the channel concerned. Once the operating hours counter is enabled, however, the operating hours will be determined and added up by the ETS immediately after commissioning the actuator.
If the operating hours counter is subsequently disabled again in the parameters and the actuator is programmed with this disabling function, all operating hours previously counted for the dimming channel concerned will be deleted. When enabled again, the counter status of the operating hours counter is always on "0".

The operating hours values (full hours) stored in the device will not be lost in case of a bus voltage failure or by ETS programming. Any summed up operating minutes (full hour not yet reached) will be rejected in this case, however.
After bus voltage return or after an ETS download, the actuator passively updates the "value operating hours counter" communication object in each dimming channel. The object value can be read out if the read-flag is set. The object value, depending on the configuration for the automatic transmission, is actively transmitted if necessary to the bus once the parameterized transmit delay has elapsed after bus voltage return (see page 95).

The operating hours counter detects any operation of the dimming channels by the manual operation, which means that switching on a channel also activates the counting of operating hours and the manual switch-off interrupts a counting operation.
No operating hours are counted if the mains voltage supply of the individual load outputs is not switched on.

ℹ If the mains voltage is not switched on (bus voltage switched off / building site operation), summed-up operating hours will not be stored in the event of a mains voltage failure!

Activating the operating hours counter

- Set the parameter "enabling functions" on parameter page "Kx - Operating hours counter" to "enabled".

  The operating hours counter is activated.

Deactivating the operating hours counter

- Set the parameter "enabling functions" on parameter page "Kx - Operating hours counter" to "disabled".

  The operating hours counter is deactivated.

ℹ Disabling of the operating hours counter and subsequent programming with the ETS resets the counter status to "0".

Setting type of counter of the operating hours counter

The operating hours counter can optionally be configured as an up-counter or down-counter. Depending on this type of counter, a limit or start value can be set optionally, whereby, for example, the operating time of a lamp can be monitored by restricting the counter range.

Up-counter:
After activating the operating hours counter by enabling in the ETS or by restarting, the operating hours are counted starting at "0". A maximum of 65535 hours can be counted, after that the counter stops and signals a counter operation via the "Operating hours count. elapsed" object.
A limiting value can be set optionally in the ETS or can be predefined via the communication object "Op. hours counter limit value". In this case, the counter operation is signalled to the bus via the "Op. hours counter elapsed" object if the limiting value is reached, but the counter continues counting - if it is not restarted - up to the maximum value 65535 and then stops. Only a restart initiates a new counting operation.

Down-counter:
After enabling the operating hours counter in the ETS, the counter status is on "0" and the actuator signals a counter operation for the dimming channel concerned after the programming operation or after bus voltage return via the "Op. hours counter elapsed" object. Only after a restart is the down-counter set to the maximum value 65535 the counting operation started.
A start value can be set optionally in the ETS or can be predefined via the communication object "Op. hours counter start value". If a start value is set, the down-counter is initialised with this value instead of the maximum value after a restart. The counter then counts the start value downwards by the hour. When the down-counter reaches the value "0", the counter operation is signalled to the bus via the "Op. hours counter elapsed" and the counting is stopped. Only a restart initiates a new counting operation.

The operating hours counter must have been enabled on parameter page "Kx – Enabled functions (x = number of the dimming channel 1...4).

- Set the parameter "Type of counter" on parameter page "Kx - Operating hours counter" to "up-counter". Set the parameter "Limit value preset ?" to "yes, as parameter" or "yes, as received via object" if it is necessary to monitor the limiting value. Otherwise, reset the parameter to "no". In the "yes, as specified in parameter" setting, specify the required limit value (1…65535 h).

  The counter counts the operating hours forwards starting from "0". If the monitoring of the limiting value is activated, the actuator transmits a "1"-telegram via the object "Operating hours count. elapsed" for the dimming channel concerned once the predefined limiting value is reached. Otherwise, the counter operation is first transmitted when the maximum value 65535 is reached.

- Set the parameter "Type of counter" on parameter page "Kx - Operating hours counter" to "down-counter". Set the parameter "start value preset ?" to "yes, as parameter" or "yes, as received via object" if a start value preset is necessary. Otherwise, reset the parameter to "no". In the "yes, as specified in parameter" setting, specify the required start value (1…65535 h).

  The counter counts the operating hours down to "0" after a restart. With a start value preset, the start value is counted down, otherwise the counting operation starts at the maximum value 65535. The actuator transmits a "1"-telegram via the object "Operating hours count. elapsed" for the dimming channel concerned once the value "0" is reached.

ℹ The value of the communication object "Op. hours counter elapsed" is stored permanently. The object is initialised immediately with the value that was saved before bus voltage return or ETS programming. If an operating hours counter is in this case identified as elapsed, i.e. if the object value is a "1", an additional telegram will be actively transmitted to the bus as soon as the parameterized transmit delay has elapsed after bus voltage return. If the counter has not yet elapsed (object value "0"), no telegram is transmitted on return of bus/mains voltage or after an ETS programming operation.

ℹ With a limiting or start value preset via object: The values received via the object are first validly accepted and permanently saved internally after a restart of the operating hours counter. The object is initialised immediately with the value that was last saved before bus voltage return or ETS programming. The values received will be lost in the case of a bus voltage failure or by an ETS download if no counter restart was executed before. For this reason, when specifying a new start or limiting value it is advisable to always execute a counter restart afterwards as well.
A standard value of 65535 is predefined provided that no limiting value or start value has been received yet via the object. The values received and stored via the object are reset to the standard value if the operating hours counter is disabled in the parameters of the ETS and a ETS download is being performed.

ℹ With a limiting or start value predefined via object: If the start or limiting value is predefined with "0", the actuator will ignore a counter restart to avoid an undesired reset (e.g. in site operation -> hours already counted by manual operation).

ℹ If the counter direction of an operating hours counter is reversed by reconfiguration in the ETS, a restart of the counter should always be performed after programming the actuator so that the counter is reinitialised.

Restarting the operating hours counter

The meter reading of the operating hours can be reset at any time by the communication object "Restart operating hours counter". The polarity of the restart telegram is predefined: "1" = restart / "0" = no reaction.

■ Characterise the communication object "restart operating hours counter" with "1".

In the up-counter the meter is initialised with the value "0" after a restart and in the down-counter initialised with the start value. If no start value was configured or predefined by the object, the start value is preset to 65535.
During every counter restart, the initialised meter reading is transmitted actively to the bus.
During every counter restart, the initialised meter reading is transmitted actively to the bus.
After a restart, the signal of a counter operation is also reset. At the same time, a "0" telegram is transmitted to the bus via the object "Operating hours count. elapsed
In addition, the limiting or start value is initialised.

ℹ If a new limiting or start value was predefined via the communication object, a counter restart should always be performed afterwards, too. Otherwise, the values received will be lost in the case of a bus voltage failure or by an ETS download.

ℹ If a start or limiting value is predefined with "0", there are different behaviours after a restart depending on the principle of the value definition...
Preset as parameter:
The counter elapses immediately after a counter restart.
Preset via object:
A counter restart will be ignored to avoid an undesired reset (e.g. after installation of the devices with hours already being counted by manual operation). A limiting or start value greater than "0" must be predefined in order to perform the restart.

Transmission behaviour of the operating hours counter

The current value of the operating hours counter is always tracked in the communication object "value operating hours counter". After bus voltage return or after an ETS download, the actuator passively updates the "Value operating hours counter" communication object in each dimming channel. The object value can be read out if the read-flag is set.
In addition, the transmission behaviour of this communication object can be set.

The operating hours counter must have been enabled on parameter page "Kx – Enabled functions (x = number of the dimming channel 1...4).

- Set the parameter "Automatic transmission of counting value" on parameter page "Kx - Operating hours counter" to "after change by interval value". Set the "Counting value interval (1…65535 h)" to the desired value.

  The counter status is transmitted to the bus as soon as it changes by the predefined counting value interval. After bus voltage return or after programming in the ETS, the object value is transmitted automatically after "Delay after bus voltage return" has elapsed if the current counter status or a multiple of this corresponds to the counting value interval. A counter status "0" is always transmitted in this case.
- Set the parameter "Automatic transmission of counting value" on parameter page "Kx - Operating hours counter" to "cyclical".

  The counter value is transmitted cyclically. The cycle time is defined independent of the channel on the parameter page "Times". After bus voltage return or ETS programming, the counter status is transmitted to the bus after the configured cycle time has elapsed.

4.2.4.2.14 Supplementary function

Supplementary functions can be enabled for each dimming channel. As a supplementary function, a disabling or alternatively a forced position function can be configured. In this respect, only one of these functions can be enabled for one channel. Additionally, a logic operation function can be parameterized.
The supplementary functions are enabled on parameter page "Kx – Supplementary functions " (x = number of dimming channels 1...4).

ℹ In the "speed controller" operating mode for the "1-gang" device variant - similar to the description of the brightness values for lighting control in this chapter - the speed values can be configured in the ETS. The differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode" (see page 109).

Setting disabling function as supplementary function

During an active disabling function, the KNX bus control of the dimming function concerned is overridden and locked (Figure 33). Continuous light switching, for example, can also be overridden.

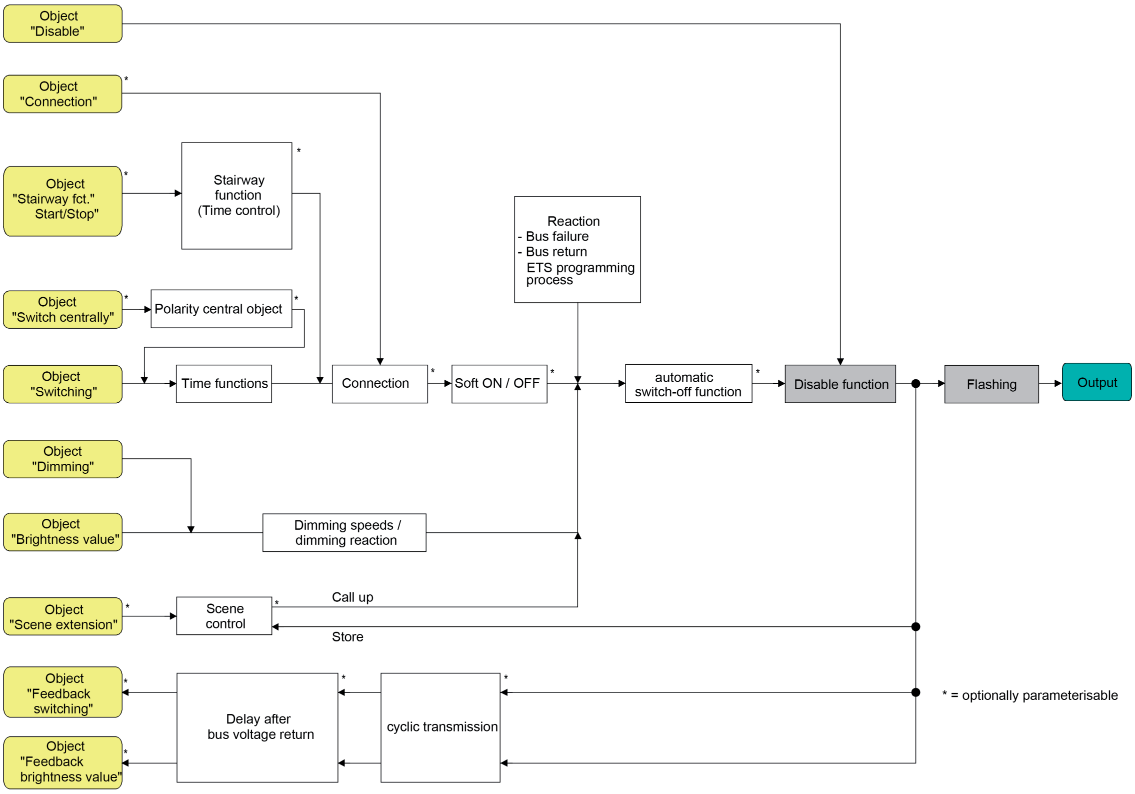

Figure 33: Function diagram of the disabling function

- On the parameter page "Kx - supplementary functions", set the parameter "type of supplementary function" to "disabling function".

  The disabling function is enabled. The communication object "Disable" and the parameters of the disabling function become visible.
- On the parameter page "Kx - supplementary functions", set the parameter "polarity disabling object" to the desired polarity.
- Set the parameter "Behaviour at the beginning of the disabling function" to the required behaviour.

  At the beginning of the disabling function, the configured behaviour will be executed and the bus control of the dimming channel locked. In the "no reaction" setting, the dimming channel shows no response and remains in the brightness state last selected.

  In the "flashing" setting, the dimming channel is switched on and off cyclically during the disabling. The "time for flashing" is generally configured for all channels on the parameter page "General". During flashing, the logical switching state of the dimming channel is signalled back as "switched on 1" and the brightness value as "switch-on brightness". A soft ON/OFF function is not executed during flashing.

  In the "Memory value" setting, the active and internally saved brightness value prior to switching off last time is set (via the "switching" or "central switching" object). After programming with the ETS, the value is predefined to maximum brightness. Only a bus voltage failure, however, does not delete the memory value.

i The "flashing" setting is not configurable in the "speed controller" operating mode for the "1-gang" device variant.

- Set the parameter "setting the behaviour at the end of the disabling function" to the required behaviour.

  At the end of the disabling function, the configured behaviour will be executed and the bus control of the dimming channel enabled again. In the "No reaction" setting ,the dimming channel shows no response and remains in the state last selected by the disabling function

  In "tracked brightness value", the set state received during the disabling function or adjusted before the disabling function can be tracked at the end of the disabling with the appropriate brightness value. Any time functions still in progress will also be taken into account if necessary.

  In the "flashing" setting, the output is switched on and off cyclically after the disabling. The flashing time is configured generally for all dimming channels on the parameter page "General". During flashing, the logical switching state of the channel is fed back as "switched on 1" and the brightness value as "switch-on brightness". A soft ON/OFF function is not executed during flashing. The flashing status remains active until another bus command is received and thereby predefines another brightness status.

  In the "Memory value" setting, the active and internally saved brightness value prior to switching off last time is set (via the "switching" or "central switching" object). After programming with the ETS, the value is predefined to maximum brightness. Only a bus voltage failure, however, does not delete the memory value.

ⓘ The "flashing" setting is not configurable in the "speed controller" operating mode for the "1-gang" device variant.

ⓘ If, at the start or end of the disabling function a brightness value is configured, the selected value must not undershoot the set minimum brightness or exceed the maximum brightness in the ETS!

ⓘ After a bus failure or after programming the application or the parameters with the ETS, the disabling function is always deactivated (object value "0"). With the inverted setting "1 = enabled; 0 = disabled", a telegram update "0" must first be carried out after the initialisation until the disabling is activated.

ⓘ Updates of the disabling object from "activated" to "deactivated do not produce a reaction.

ⓘ A dimming channel disabled via the KNX can be still be operated manually! At the end of a manual operation, the actuator executes the disabling reaction for the channel concerned once again if the disabling function is still activated at this time.

ⓘ In the setting "tracked brightness value": During a disabling function, the overridden functions of the actuator (switching, dimming, brightness value, scenes) continue to be executed internally. Consequently, newly received bus telegrams are evaluated and time functions are triggered as well. At the end of the disabling, the tracked states are set.

Setting forced position function as supplementary function

The forced position function, according to the function diagram, can also be combined with other functions of a dimming channel (Figure 34). With an active forced position the upstream functions are overridden so that the output concerned is locked.
The forced position function possesses a separate 2-bit communication object. The first bit (Bit 0) of the object "Forced position" indicates whether the dimming channel is switched off or switched on by force. If the dimming channel is switched on by force, an ETS parameter defines which brightness value it should be switched on to. The second bit (bit 1) activates or deactivates the forced-position state (see table below).
The behaviour of a dimming channel at the end of the forced-position function can be configured. In addition, the forced object can be initialised on bus voltage return.

Bit 1	Bit 0	Function

0	x	Forced position not active -> normal control
0	x	Forced position not active -> normal control
1	0	Forced position active: switch off
1	1	Forced position active: switch on to predefined brightness value

Bit coding of forced position

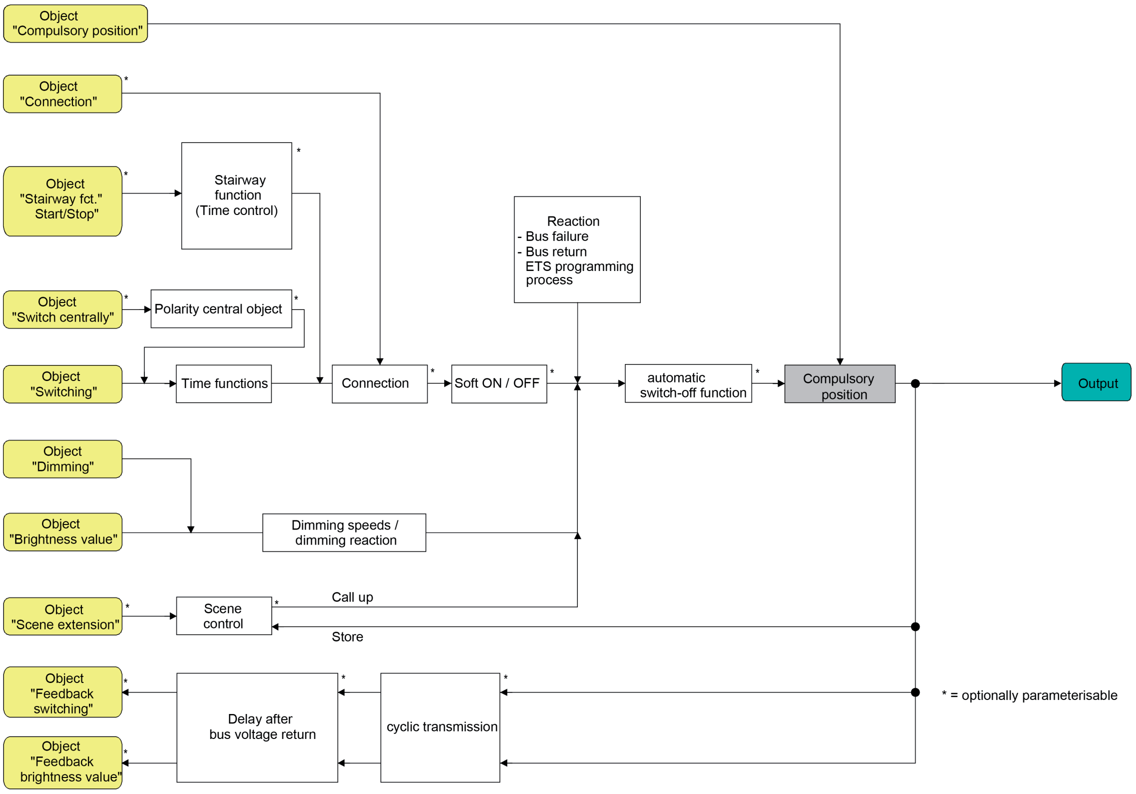

Figure 34: Function diagram of the forced position function

- On the parameter page "Kx - supplementary functions", set the parameter "type of supplementary function" to "forced position".

  The forced position function is enabled. The communication object "forced position" and the parameter of the forced position function become visible.
- On the parameter page "Kx - supplementary functions", configure the parameter "switch on brightness for forced position 'active'" to the required behaviour that should be executed if a forced control is activated via the communication object.

  When setting a brightness value, the dimming channel adjusts itself to the set brightness during a forced-position state. The forced brightness value selected must not exceed the maximum brightness configured in the ETS.

  In the "No reaction" setting, the bus control of the dimming channel is locked, but the channel shows no response and remains in the brightness state last selected.

  In the "Memory value" setting, the active and internally saved brightness value prior to switching off last time is set (via the "switching" or "central switching" object). After programming with the ETS, the value is predefined to maximum brightness. Only a bus voltage failure, however, does not delete the memory value.

- Set the parameter "brightness for forced position end 'inactive'" to the required behaviour.

  At the end of the forced position, the configured behaviour will be executed and the bus control of the dimming channel enabled again. In the "No reaction" setting, the dimming channel shows no response and remains in the brightness state last selected by the forced position.

  In "tracked brightness value", the state received during the forced position function or the brightness value adjusted before the function can be tracked at the end of the forced position. Any time functions still in progress will also be taken into account if necessary.

ⓘ The "switch off brightness for forced position 'active'" is preset to "switch off".

ⓘ Updates of the forced position object from "forced position active" to "forced position active" while maintaining the switching status or from "forced position inactive" to "forced position inactive" show no reaction.

ⓘ A forcibly activated dimming channel via the KNX can be still be operated manually! At the end of a manual operation, the actuator executes the forced reaction for the channel concerned once again if the forced position is still activated at this time.

ⓘ In the setting "tracked brightness value" at the end of the forced position: During a forced position, the overridden functions of the actuator (switching, dimming, brightness value, scenes) continue to be executed internally. Consequently, newly received bus telegrams are evaluated and time functions are triggered as well. At the forced end, the tracked states are set.

ⓘ The current state of the object of the forced position function will be stored in case of bus or mains voltage failure.

- Set the parameter "behaviour after bus voltage return" to the required behaviour.

  After bus voltage return, the configured state is transferred to the "Forced position" communication object. When a forced position is activated, the dimming channel is immediately activated and interlocked accordingly by forced control after bus voltage return until a forced control takes place via the bus. The parameter "Behaviour after bus or mains voltage return" on the parameter page "Kx – General" will, in this case, not be evaluated for the dimming channel concerned.

  In the "state before bus voltage failure" setting, the forced position state last selected and internally stored before bus voltage failure will be tracked after bus voltage return. An ETS programming operation deletes the stored state (reaction in that case same as with "no forced position active").

  If the tracked state corresponds to "no forced position active", the force-independent parameter "Behaviour after bus/mains voltage return" will be executed on return of bus voltage (parameter page "Kx – General"). If the forced position is activated, the dimming channel is switched on to the brightness value predefined by the parameter "switch on brightness for forced position 'active'".

ⓘ After programming the application or parameters with the ETS, the forced position function is always deactivated (object value "0").

Setting logic operation function as supplementary function

A logic function can be parameterized separately for each dimming channel. This function allows the logic operation of the "switching" object state and an additional logic operation object. The state of the communication object for "switching" can also be evaluated with a time delay if a switch-on delay or switch-off delay is set.

The logic operation function , according to the function diagram, can also be combined with other functions of a dimming channel (Figure 35). A combination with the staircase function (time dimmer function for the "speed controller") is not possible, however.

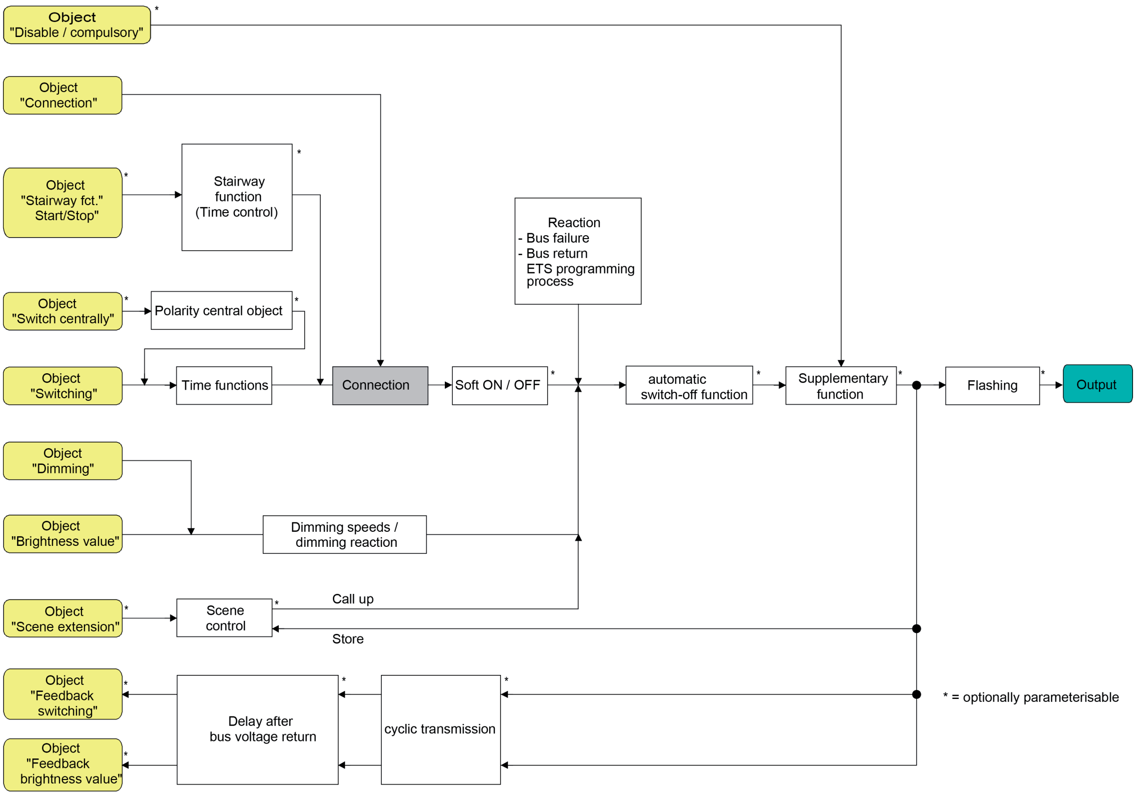

Figure 35: Function diagram of the logic operation function

The following logic operation types are configurable (Figure 36).

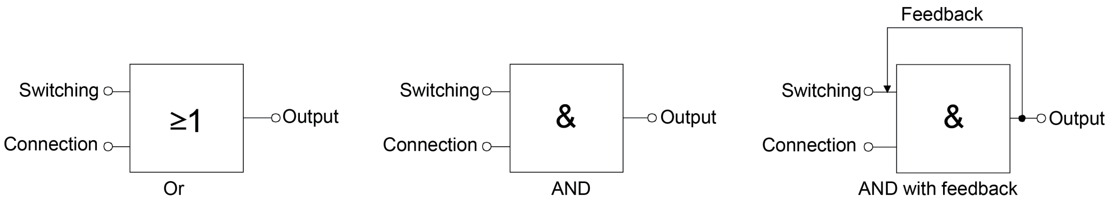

Figure 36: Logic operation types of the logic operation function

i "AND with feedback":
With a logic object = "0", the dimming channel is always "0" (logic AND). In this case, the feedback signal from the output to the "switching" input will directly reset this input when it is being set. The output of the dimming channel can assume the logical state "1" by a newly received "1" on the input "switching" only when the logic object is = "1".

The object "logic operation" can be installed with a preconfigured value after bus voltage return or after programming with ETS so that a correct logic operation result can be determined immediately and set on the output of the dimming channel during a telegram update on the "switching" object.

- On the parameter page "Kx - supplementary functions", set the parameter "Logic operation function" to "Yes". to "Yes".

  The logic operation function is enabled. The communication object "logic operation" and the parameters of the logic operation function become visible.
- Set the parameter "Type of logic operation function" to the desired logic operation type.
- Set the parameters "object value of the logic operation object after bus voltage return" and "object value of the logic operation object after ETS download" to the required initial states.

  The "logic operation" object is initialised immediately with the set switching states after bus voltage return or ETS programming of the application program or parameters.

ℹ The logic operation function after a reset of the actuator (bus voltage return or programming with the ETS) is first executed when at least one input object of the logic operation is updated by a telegram from the bus.

ℹ The states or switching states specified at the end of a disabling function or forced position function, which are set after programming in the ETS, in the case of bus voltage failure or after bus or mains voltage return, override the logic operation function. The configured logic operation is first re-executed and the result set on the output of the dimming channel when at least one input state of the logic operation is changed or updated.

ℹ A mains voltage return does not influence the communication objects of the actuator. The objects remain on the last set state if the bus voltage was connected interruption free.

4.2.4.2.15 Dimming characteristic, dimming behaviour and dimming speeds

A dimming procedure can change the brightness (operating mode "lighting control") or speed (operating mode "speed controller") of the lamps connected to a dimming channel. The limits of the brightness/speed range adjustable by a dimming procedure is defined either by the basic brightness and maximum brightness predefined in the ETS, or alternately, by the combination of minimum brightness and maximum brightness.

ℹ In the "speed controller" operating mode for the "1-gang" device variant - similar to the description of the brightness values for lighting control in this chapter - the speed values can be configured in the ETS. The differences between the "speed controller" operating mode compared to the "lighting control" operating mode can be read in detail in the chapter "Features in the speed controller operating mode"   (see page 109).

A channel can be dimmed by...

- relative dimming:
  Relative dimming can either be triggered by the 4-bit "dimming" communication object available separately in each dimming channel or by a long button-press of the manual operation. The data format of the "dimming" object complies with the KNX standard DPT "3.007", which means that the dimming direction and relative dimming increments can be predefined in the dimming telegram or dimming procedures can also be stopped. In relative dimming by local manual operation on the device, a dimming procedure is executed whilst the appropriate button is pressed. The dimming process ends when the button is released or when the basic/minimum brightness or maximum brightness is reached.

- absolute dimming:
  Absolute dimming is triggered by specifying a brightness value. This value can be predefined by the 1-byte "brightness value" communication object from KNX the, which is available separately in each dimming channel. In addition, brightness values can also be set by a disabling or forced position function or by the scene function. Absolute dimming can also be activated, even in case of bus voltage failure, after bus or mains voltage return or after programming with the ETS, by specifying brightness values.
  When predefining a brightness value via the object or by a scene recall, it is possible to configure in the ETS whether the value is jumped to directly or alternatively whether it is dimmed to via the configured dimming increment time or by fading. In the case of all other absolute dimming functions, the brightness values are always instantly jumped to.

ⓘ It is not possible to dim a speed value via "fading" in the "speed controller" operating mode for the "1-gang" device version.

The dimming speed is identical for a relative dimming procedure or for the dimming of an absolute brightness value (not fading) and can be set in the ETS separately for each dimming channel in the characteristic parameters.

ⓘ Even if brightness values are instantly jumped to, the dimming procedure on connected lamps always takes a very short time as well as when switching without soft ON or soft OFF. This dimming procedure is determined by the system. The brightness value instantly jumped to will be dimmed with the minimum increment of 1 ms. This time cannot be altered.

Configuring dimming characteristic

In the case of the universal dimmer actuator, the technically dimmable brightness range (basic brightness ... 100 %) is subdivided into 255 dimming increments (8-bit brightness value: 1...255 / 0 = switched off). In the as-delivered state of the actuator, the dimming increment times, i.e. the dimming times between 2 of 255 dimming increments, are set to the identical length. This results in a linear characteristic curve over the entire brightness range.

The dimmable brightness range is limited at the upper limit by the maximum brightness configured in the ETS. The lower brightness range is either defined by the basic brightness (brightness values "1", "2" and "3" -> "1 %") or alternatively, by the minimum brightness. The dimming characteristics shown in the following diagrams distinguish these configurations and illustrate the resulting real dimming time of a dimming procedure.

🛈 In the application programs with versions "1.2" and "1.3", the dimmable brightness range can be adjusted automatically to universal power boosters. The parameter "Operation with universal power booster ?" is provided for this purpose. In the "Yes" setting, a residual phase angle necessary for universal power boosters is set on the dimmer output in the highest dimming position (100 % brightness value). The output signal cut-on or cut-off in this way corresponds approx. to a resulting brightness of 90 % compared to an identically constructed dimmer actuator without a power booster. The dimmer actuator then rescales the adjustable brightness range automatically for the corresponding channel so that a setpoint and feedback within a range of 0…100% is still possible (always 255 dimming increments in the dimmable brightness range).

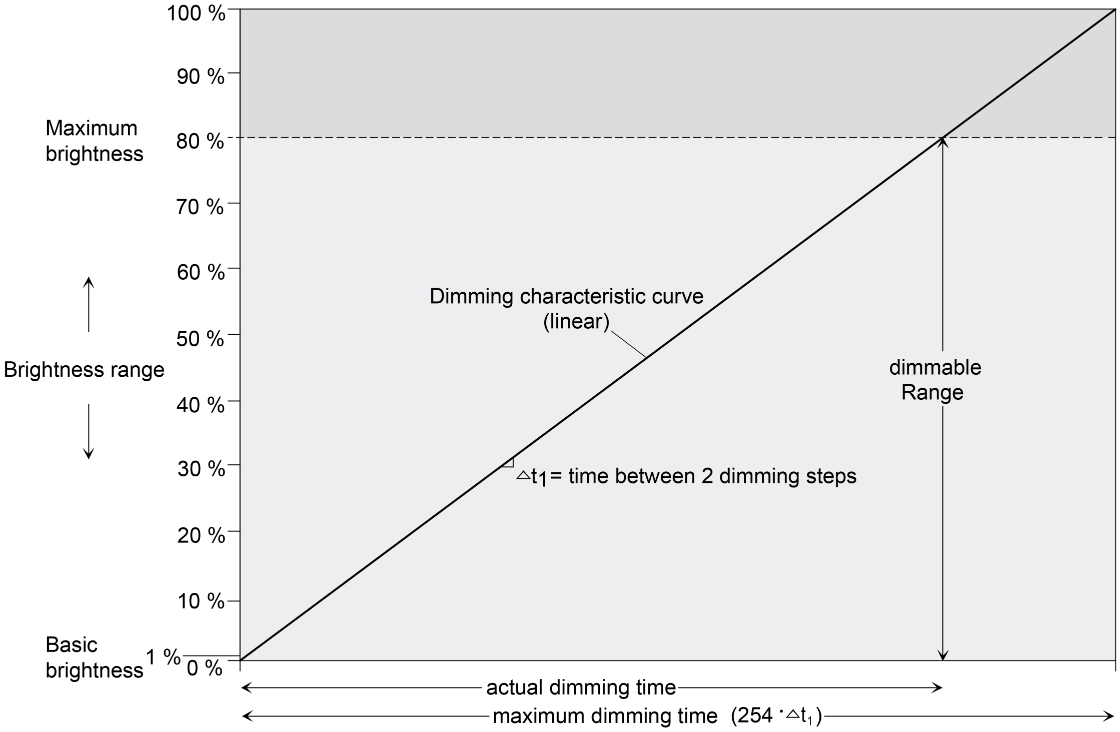

Figure 37: Linear dimming characteristic as an example with basic brightness and maximum brightness

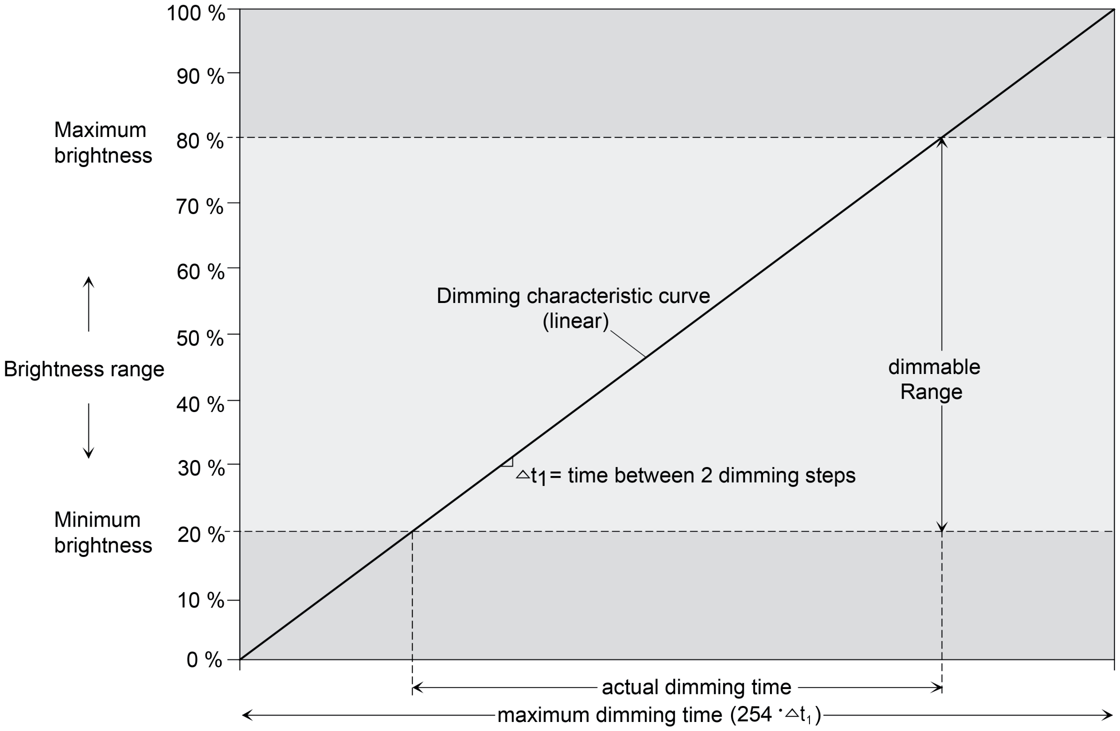

Figure 38: Linear characteristic dimming curve as an example with minimum brightness > 0 % and maximum brightness

In some practical applications, a linear dimming characteristic is not optimal. Hence, the actuator in the ETS alternatively permits a user-defined adjustment of the dimming progress. In this way, for example, brightness changes can be adjusted to the brightness sensitivity of the human eye when dimming by subdividing the brightness range in up to three sections with different dimming increment times.

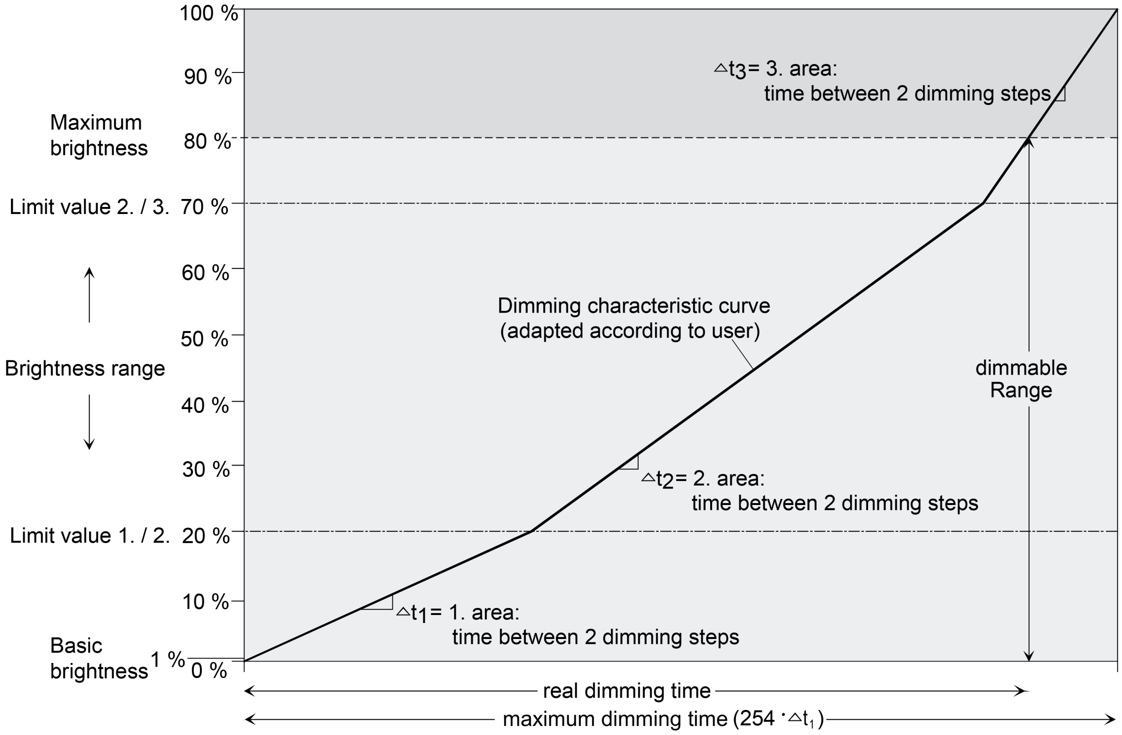

Figure 39: User-defined dimming characteristic as an example with basic brightness and maximum brightness

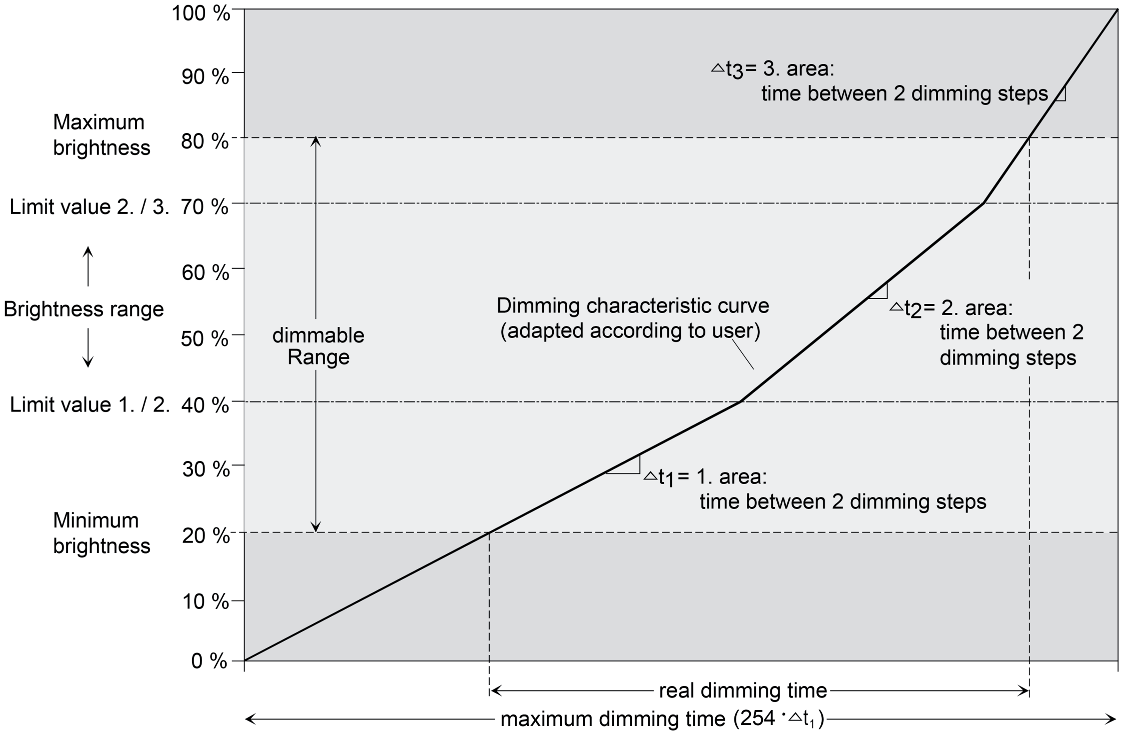

Figure 40: User-defined dimming characteristic as an example with minimum brightness and maximum brightness

As an additional option, it is possible to set predefined dimming characteristics for incandescent lamps or for halogen lamps in the characteristic parameterization. In this way, the dimming progress can be optimised for the named lamp loads. In this case, the dimming actuator works with fixed implemented brightness sections and dimming increment times.
In the "speed controller" operating mode for the "1-gang" device variant, the load-optimised characteristic settings are available in the ETS.

ℹ An increase of the brightness value in the dimmer actuator causes a time decrease of the residual phase angle. Likewise, a decrease of the brightness value on the dimmer output causes a time decrease of the residual phase angle. The residual phase angle determines, among other things, the dark phase of the connected lamps.

- Set the parameter "characteristic curve" on parameter page "Kx - dimming characteristic" (x = number of the dimming channel 1...4) to "linear".

  A linear dimming characteristic curve is set. A dimming increment time can also be configured for the entire brightness range in the ETS.
- Set the parameter "characteristic curve" to "user-defined".

  A user-defined dimmer characteristic curve is set. Another two limiting values and three dimming increment times can be defined for the definition of three brightness sections.
- Set the parameter "characteristic curve" to "adapted for incandescent lamps".

  A specially adapted dimming characteristic curve is set for incandescent lamps. It is not necessary to carry out any further settings for the dimming characteristic.

ℹ This setting is not available in the "speed controller" operating mode for the "1-gang" device variant.

- Set the parameter "characteristic curve" to "adapted for halogen lamps".

  A specially adapted dimming characteristic curve is set for halogen lamps. It is not necessary to carry out any further settings for the dimming characteristic.

ⓘ This setting is not available in the "speed controller" operating mode for the "1-gang" device variant.

Setting dimming increment time

The dimming increment speed is identical for a relative dimming procedure or for the dimming of an absolute brightness value (not fading) and can be set in the ETS separately for each dimming channel in the characteristic parameters.
The configuration of a dimming increment time is only necessary if the characteristic curve is set to "linear" or to "user-defined".

The parameter "characteristic curve" is set to "linear".

- Set the parameter "time between two dimming increments " on parameter page "Kx - dimming characteristic" to the necessary dimming increment time.

  During every relative or absolute dimming procedure, the entire brightness range is dimmed with the configured dimming increment speed.

The parameter "characteristic curve" is set to "user-defined".

- First define the brightness limit values. For this purpose, on the parameter page "Kx – Dimming characteristic" set the parameter "brightness limiting value 1. area / 2. area (1...100 %)" and "brightness limiting value 2. area / 3. area (1...100 %)" to the necessary section limits. While doing so, take care that the brightness limiting value of area 1. / 2. is smaller than the limiting value of area 2. / 3.! Otherwise, there is the risk of malfunction.

  The dimmable brightness range is divided into three sections. In the following, the dimming increment speeds for these three areas can be set separately.

ⓘ In the configuration of the limiting value, care must be taken to ensure that the maximum brightness is not exceeded, or if necessary, the configured minimum brightness is not undershot.

- The parameters "... time between two dimming increments (1...255 ms)" on parameter page "Kx - dimming characteristic" are set to the necessary dimming increment times for each of the three areas.

  The dimming characteristic is defined ready. The lighting is dimmed at the specified dimming increment speeds for each of the three sections.

ⓘ The scene dimming increment speed for the dimming of scene values is defined separately in the scene parameters of an output (see page 89-90).

Setting dimming behaviour for absolute dimming

The dimming behaviour for the absolute dimming can be set separately in the ETS for each dimming channel via the "brightness value" or "speed" object.

- Set the parameter "dimming behaviour after receipt of a brightness value" on parameter page "Kx - General" (x = number of dimming channel 1...4) to "dim".

  Once a new brightness value is received, it is set by means of the configured dimming increment time (see page 107) based on the predefined dimming characteristic.

- Set the parameter "dimming behaviour after receipt of a brightness value" to "jump to".

  As soon as a new brightness value is received it will be instantly jumped to.

- Set the parameter "dimming behaviour after receipt of a brightness value" to "fading". In addition, on the parameter "Time for brightness value via fading", define the necessary fading time for dimming the scene brightness value.

  Newly received brightness values will be dimmed. The dim fading is activated The fading time defines the duration of the dimming procedure required to reach the new brightness value. The brightness value of a dimming channel on which the dimming starts and the configured dimming characteristic have no significance. The dimming procedure thus always requires the exact predefined time when specifying a new brightness value.

ℹ The parameter setting "fading" is not available in the "speed controller" operating mode for the "1-gang" device variant.

ℹ Brightness values can also be set by a disabling or forced position function. Absolute dimming can also be activated, even in case of bus voltage failure, after bus or mains voltage return or after programming with the ETS, by specifying brightness values. In the case of these absolute dimming functions, the brightness values are always instantly jumped to. During a scene recall, the dimming behaviour can be configured separately (see page 89-90).

Setting dimming behaviour in OFF state for relative dimming (only for program versions "1.2" and "1.3" and device generations from "V02" and onwards)

A relative dimming process can be triggered by the 4-bit "dimming" communication object available separately in each dimming channel or by a long button-press of the manual operation. The data format of the "dimming" object complies with the KNX standard DPT "3.007", which means that the dimming direction and relative dimming increments can be predefined in the dimming telegram or dimming procedures can also be stopped. A relative dimming process is executed via the object until the configured basic minimum or maximum brightness of the dimming channel is set, the dimming value reaches the dimming increment predefined in the telegram or a stop telegram is received. A relative dimming process allows a brightness value to be changed constantly and always starts from the brightness that is set stationary or dynamically at the time of the incoming dimming telegram.
A relative dimming telegram can also switch on a dimming channel if this is in the "OFF" state. In some applications, it may be necessary, however, for a switched off dimming channel to remain off until a relative dimming telegram is received. This is interesting when using light scenes, for instance:
Several dimming channels are set to a defined brightness value via a light scene. Other channels are switched off by the scene. Only the brightness of channels not switched off by the scene recall should be changed by dimming up afterwards. Here, it is necessary for dimming channels not to react to a relative dimming operation and thus not to switch on.
The parameter "Behaviour when OFF by relative dimming" defines whether or not a dimming channel in the "OFF" state reacts to a relative dimming telegram. This parameter is only available in the application programs with the versions "1.2" and "1.3".

- Set the parameter to "Dimming up switches channel ON (Standard)".

  The dimming channel always reacts to a relative dimming telegram and executes a dimming process. In the "OFF" state, the channel switches on with a "dim up" telegram.

- Set the parameter to "Dimming up is ignored (channel remains OFF)".

  The dimming channel only reacts to a relative dimming telegram when it is switched on. In the "OFF" state, the channel ignores a "dim up" telegram.

ℹ In manual operation on the device, it is possible in the "OFF" state to always switch on and increase brightness by a long press of the button. The parameter "Behaviour when OFF by relative dimming" thus has no effect on manual operation.

ⓘ The parameter "Behaviour when OFF by relative dimming" is only available in the application programs with the versions "1.2" and "1.3" and is only evaluated by devices that contain the version designations from "V02" and onwards on the device label (see page 33). If the application programs "1.2" and "1.3" with the setting "Behaviour when OFF by relative dimming = Dimming up is ignored" is used in old devices (no designation or designation "V01"), the actuator does not carry out the configure behaviour. Old devices always switch on the dimming channel if a relative dimming telegram "Dim up" is received in the OFF state.
Application programs with the version "1.1" can be programmed in devices with designation from "V02" and onwards. Even in this case, a relative dimming telegram "Dim up" always causes the dimming channel in the OFF state to be switched on.

4.2.4.2.16 Special features of the speed controller operating mode

Apart from controlling lighting, the universal dimmer actuator 1-gang can be used as a speed controller of single-phase electric motors. This operating mode can be preselected in the ETS and has a considerable effect on the parameter configuration and function of the device.
In the function as speed controller, some parameters and object texts change because the speed of a connected motor is controlled in the "speed controller" operating mode instead of brightness. The speed (e.g. minimum speed) is configured in the ETS as a percentage value. This value represents the dimming value in percent and is a gauge for the output signal's phase angle of the actuator.

The differences between the "speed controller" operating mode compared to the "lighting control" operating mode will be described in more detail in the following...

Load type:
In the "Speed controller" operating mode, the dimming principle is preset to "phase cut-on". If the signalling object for load type is enabled, the actuator for the dimming channel always transmits the load type "inductive".

Cutting-in speed:
When changing from the "motor switched off" to "motor switched on" status via switching or dimming commands or after a device reset, the actuator first always sets the cutting-in speed. The cutting-in speed should ensure that the motor starts up optimally (e.g. reliable start-up of the fan motor through transfer of a higher torque, and thus a higher fan speed).
The dwell time that can be configured in the ETS determines how long the actuator allows the cutting-in speed to be active. The actuator changes to the predefined required speed only after the "dwell time in cutting-in speed" has elapsed. This change always occurs rapidly without a dimming procedure. If the required speed already corresponds to the cutting-in speed (100 %), there is no change.
If the motor should be switched off while the cutting-in speed is set, the actuator interrupts the dwell time and switches off the dimming channel immediately. This occurs rapidly without a dimming procedure. As a result, soft OFF functions configured optionally in the ETS will not be executed in this case.

🛈 Required speed: The required speed results directly from switching commands via switching telegrams or via the manual operation. The required speed is then the cutting-in speed (Figure 41). Alternatively, the required speed is specified immediately via telegrams to the speed object or via speed specifications of the scene function or disabling and forced position functions (Figure 42).
In relative dimming via a 4-bit dimming telegram, the increment of the telegram specifies the dimming target and thus the required speed. If a relative dimming command is stopped via a stop telegram (e.g. pushbutton is released early), the point in time of the stop telegram decides which speed should be set as the required speed (Figure 43). If the stop telegram is received on the actuator during the dwell time of the cutting-in speed, the actuator will take into account the speed that was tracked and dimmed up in the background at the time of stopping as the required speed. If, however, the stop telegram arrives at the actuator after the dwell time of the cutting-in speed has elapsed, the actuator sets the speed predefined by the increment of the dimming telegram as the required speed. The stop telegram is rejected in this special case.
Push-buttons in the standard configuration normally transmit dimming increments of 100 %. The stop telegram then decides when a relative dimming procedure is aborted prematurely. If relative dimming is used in the "speed controller" operating mode and a relatively short dwell time is configured for the cutting-in speed, push-buttons should be reconfigured to smaller dimming increments with telegram repetition. This has the advantage that stop telegrams do not have to be transmitted in order to dim intermediate values of the possible dimming area.

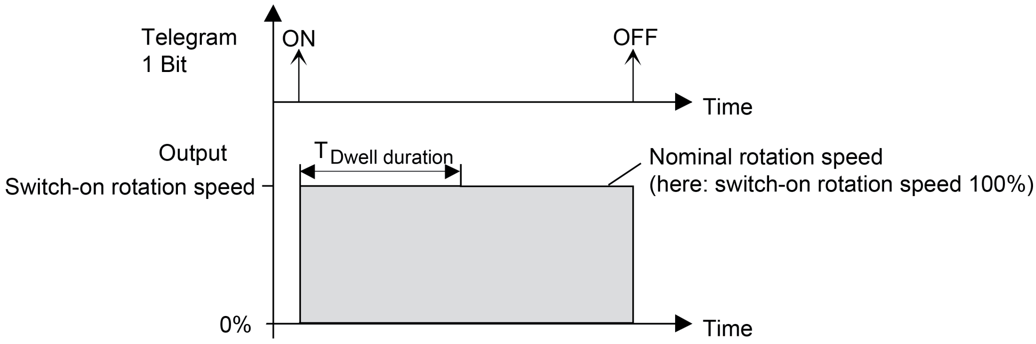

Figure 41: Cutting-in speed and required speed for switching commands

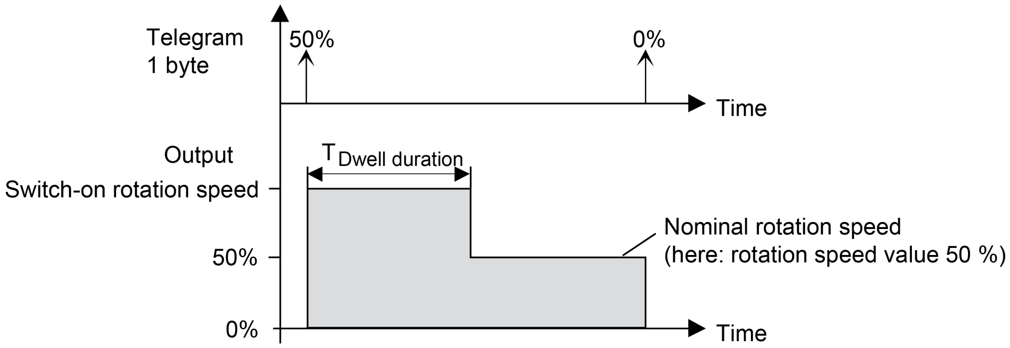

Figure 42: Cutting-in speed and required speed for value commands

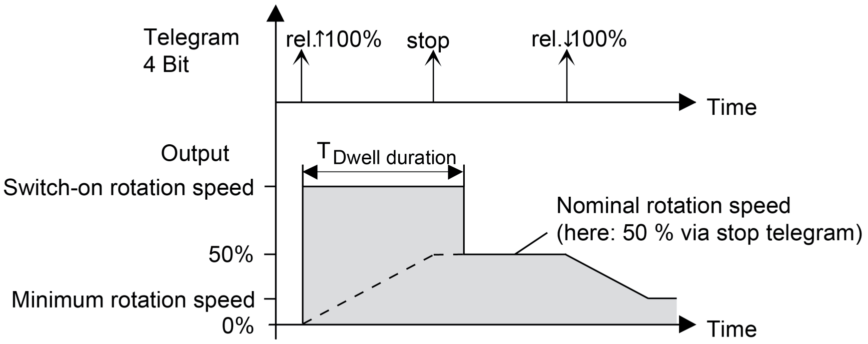

Figure 43: Cutting-in speed and required speed for relative dimming commands

ℹ For the "1-gang" device variant in the "speed controller" operating mode it should be noted that the delay time of the switch-off function is set greater (see page 77) than the "dwell time in cutting-in speed"! Otherwise, after the dwell time elapses immediately after switching off a motor, the switch-on function will have no effect because the dwelling in the cutting-in speed has a higher priority.

Unnecessary settings:
In the "speed controller" operating mode, some configuration options are not necessary in the ETS owing to changed technical features of the load. The following parameter settings are modified as compared to the "lighting control" operating mode...

- The maximum speed cannot be adjusted by means of a parameter. It is preset to 100 %.
- The load failure message cannot be configured.
- In the "dimming behaviour after receipt of a speed value" parameter, the "fading" setting is not necessary.
- In the scene configuration, the "dim speed via fading" setting is not necessary.
- In the switch-on/switch-off behaviour, the "soft ON function" is not necessary.
- In the disabling function, the "flashing" reaction cannot be configured.
- The supplementary function "time extension" is not necessary in the time dimmer function.
- In the "linear dimming characteristic curve" the settings "adapted for incandescent lamps" and "adapted for halogen lamps" are not necessary.

4.2.4.3 Delivery state

In the state as delivered, the device is passive, i.e. no telegrams are transmitted to the bus. The connected loads can, however, be operated by manual operation on the device if the mains voltage is on. In the manual control mode, no feedback telegrams are sent to the bus. Other functions of the device are deactivated.
The device can be programmed and put into operation via the ETS. The physical address is preset to 15.15.255

Moreover the device has been configured at the factory with the following characteristics...

- Operating mode: lighting control
- Channel definition: 4 separate dimming channels
- Dimming principle: universal
- Time between two dimming increments manual operation: 12 milliseconds
- Basic brightness: level 5 (standard halogen)
- Maximum brightness: 100 %
- Switch-on brightness: 100 %
- Behaviour in case of bus voltage failure: no reaction

- Behaviour after bus voltage return: last brightness value.
- Behaviour on the load outputs after mains voltage return: The device calibrates itself to the load outputs. This procedure depends on the features of the power supply can last up to 10 seconds. The outputs switch off afterwards.
- Operating hours counter: deactivated.
- Behaviour at the end of manual control: no change.

The as-delivered state can be restored at any time by loading the application program with the aid of the ETS. The manual operation remains activatable in this case.

ℹ When connecting a motor "speed controller" operating mode only for "1-gang" device variant) or parallel wired dimming outputs (for "4-gang" device variant), after the installation, commissioning using the ETS is essential before switching on the mains voltage (see page 15-16) so that the as-delivered state is replaced by the necessary parameter configuration!

4.2.5 Parameters

Description	Values	Comment
☐↵ Channel definition		
Setting the channel parameters	all channels equal **each channel individual**	To simplify the configuration, all existing dimming channels can be assigned to the same parameters in the ETS and thus configured identically. This parameter stipulates whether every dimming channel of the device can be configured individually or whether all channels should be configured by the same parameters. In the "all channels equal" setting, the number of parameters in the ETS is reduced. The visible parameters are then used on all channels automatically. Only the communication objects can then be configured separately for the channels. This setting should be selected, for example, if all channels behave identically and should only be activated by different group addresses (e.g. in office blocks or in hotel rooms). In the "each channel individual" setting, all dimming channels of the device can be configured autonomously.
		To increase the channel dimmer output power, the "4-gang" device variant in particular can be wired in parallel by reducing the number of channel outputs. The assignment of parallel to wired dimming outputs to the KNX-controllable dimming channels takes place in the ETS. The following parameters define how many dimming channels should be used. The fewer channels that are

		configured, the more dimming outputs can be assigned to a channel by the parameter "effect".
Use dimming channel 1?	**Yes** No	Define whether the first dimming channel should be used. This parameter is also preset to "Yes" because a dimming channel is always available. This parameter is only visible in the device variant "4-gang".
Use dimming channel 2?	**Yes** No	Define whether the second dimming channel should be used. If the setting is "Yes", the second dimming channel is available. If the setting is "No", the dimming channels 2...4 are not available. The actuator then works as a 1-channel device. This parameter is always preset to "Yes" if the parameter configuration in the ETS is identical (see parameter "Setting the channel parameters"). This parameter is only visible in the device variant "4-gang".
Use dimming channel 3?	**Yes** No	Define whether the third dimming channel should be used. If the setting is "Yes", the third dimming channel is available. The actuator then works as a 3-channel device at least. If the setting is "No", the dimming channels 3 & 4 are not available. The actuator then works as a 2-channel device, if the parameter "use dimming channel 2?" is set to "Yes". This parameter is only visible in the device variant "4-gang".
Use dimming channel 4?	**Yes** No	Define whether the fourth dimming channel should be used. If the setting is "Yes", the fourth dimming channel is available. The actuator then works as a 4-channel device. If the setting is "No", dimming channel 4 is not available. The actuator then works as a 1, 2 or 3-channel device, depending on how the parameters "use dimming channel 2?" and "use dimming channel 3? are set. This parameter is only visible in the device variant "4-gang".
		The assignment of the KNX controllable dimming channels to the dimming

outputs is described in the assignment table for the device variant "4-gang", which is stored in the device. The assignment of dimming channel 1 to the outputs can only be configured in 2-channel and 3-channel operation. This then gives rise to the effect of the other channels on the outputs. The "Effect of channel 1" parameter defines the assignment and, irrespective of this, specifies the effect of the other channels.

ℹ The configuration of the effect has influence on the parallel wiring of the 4 dimmer outputs and thus has influence on the load distribution. The effect cannot be configured with the device variants "1-gang" and "2-gang". The assignment of dimming channels to the outputs must be predefined directly by the channel number.

Effect of channel 1	**Output 1 (max. 250 W)** Outputs 1-2 (max. 500 W) Outputs 1-3 (max. 750 W) Outputs 1-4 (max. 1,000 W)	Define which outputs the first dimming channel affects. The outputs assigned here to dimming channel 1 can be wired in parallel if more than one output was assigned. The choice of parameter is limited if necessary, depending on the number of dimming channels available.
Effect of channel 2	**Output 2 (max. 250 W)** Output 3 (max. 250 W) Output 4 (max. 250 W) Outputs 2-4 (max. 750 W) Outputs 3-4 (max. 500 W)	Define which outputs the second dimming channel affects. The outputs assigned here to dimming channel 2 can be wired in parallel if more than one output was assigned. This parameter presetting depends on the effect of the first dimming channel.
Effect of channel 3	**Output 3 (max. 250 W)** Output 4 (max. 250 W) Outputs 3-4 (max. 500 W)	Define which outputs the third dimming channel affects. The outputs assigned here to dimming channel 3 can be wired in parallel if more than one output was assigned. This parameter presetting depends on the effect of the first dimming channel.
Effect of channel 4	**Output 4 (max. 250 W)**	Define which output the fourth dimming channel affects. If all 4 dimming channels are used, channel 4 can only affect output 4.

ⓘ On the parameter page "Connection help", a summary of the channel assignment and possible connected load of the individual dimming channels is displayed. The information on this page can help the electrician to connect the electrical load to the dimming outputs and hence to assign it to the KNX-controllable dimming channels when installing the device.

□↵ General

Delay after bus voltage return Minutes (0...59)	**0**...59	To reduce telegram traffic on the bus line after bus voltage activation (bus reset), after connection of the device to the bus line or after programming with the ETS, it is possible to delay all active feedback telegrams of the actuator. The parameter specifies in this case a delay valid for all devices. Only after the time configured here has elapsed are feedback telegrams for initialisation transmitted to the bus. Setting the delay time minutes.
Seconds (0...59)	0...**17**…59	Setting the delay time seconds.
Central function for blind outputs?	Yes **No**	Setting "yes" enables the central function and thus the "Central switching" object. An assignment of individual dimming channels to the central function is only possible if the function is enabled.
Central object polarity	**0 = deactivated; 1 = activated** 0 = activated; 1 = deactivated	This parameter defines the polarity of the central object. This parameter is visible only if the central function is enabled.
Blinking rate	**1 sec** 2 sec 3 sec 10 sec	At the start and end of the "disable" supplementary function, a dimming channel can flash. The flash cycle time is generally set here for all dimming channels concerned. This parameter is not visible in the "speed controller" operating mode for the "1-gang" device variant.

□↵ Times

Time for cycl. transmission of feedback Hours (0...23)	**0**...23	The transmitting feedback telegrams of the actuator can, depending on the parameterisation, also transmit their state cyclically to the bus. The parameter "Time for cyclical transmission of feedback tel." generally defines the cycle time for all dimming channels. Setting the cycle time hours.
Minutes (0...59)	0…**2**...59	Setting the cycle time minutes.
Seconds (10...59)	**10**...59	Setting the cycle time seconds.
Time for cycl. transmission of operating hours Hours (0...23)	0...**23**	The operating hours counters - depending on the parameterisation - can also transmit their counter value cyclically to the bus. The parameter "Time for cyclical transmission of feedback tel." Generally defines the cycle time for all dimming channels. Setting the cycle time hours.
Minutes (0...59)	**0**...59	Setting the cycle time minutes.
Seconds (10...59)	**10**...59	Setting the cycle time seconds.

□↵ Manual operation

Manual control in case of bus voltage failure	disabled **enabled**	This parameter can be used for programming whether manual control is to be possible or deactivated in case of bus voltage failure.
Manual control during bus operation	disabled **enabled**	This parameter can be used for programming whether manual control is to be possible or deactivated during bus operation (bus voltage on).
Disabling function ?	Yes **No**	Manual control can be disabled via the bus, even if it is already active. For this purpose, the disabling object can be enabled here. This parameter is only visible if manual control is enabled during bus operation.
Polarity of disable object	**0 = enabled; 1 = disabled** 0 = disabled; 1 = enabled	This parameter sets the polarity of the disabling object. This parameter is only visible if manual control is enabled during bus operation.

Transmit status ?	Yes **No**	The current state of manual control can be transmitted to the bus via a separate status object, if bus voltage is available (setting: "Yes"). This parameter is only visible if manual control is enabled during bus operation.
Status object function and polarity		This parameter defines the information contained in the status object. The object is always "0", when the manual control mode is deactivated. This parameter is only visible if manual control is enabled during bus operation.
	0 = inactive; 1 = man.contr.active	The object is "1" when the manual control mode is active (temporary or permanent).
	0 = inactive; 1 = perman. man. control active	The object is "1" only when the permanent manual control is active.
Behaviour at the end of permanent manual control during bus operation		The behaviour of the actuator at the end of permanent manual control depends on this parameter. This parameter is only visible if manual control is enabled during bus operation.
	no change	All telegrams received during an active permanent manual control mode for direct operation (switching, dimming, brightness value, scenes) will be rejected. After the end of the permanent manual control mode, the current state of all outputs remains unchanged. If, however, a forced position or disabling function has been activated before or during manual operation, the actuator resets the reaction configured for this function for the dimming channels concerned.
	Output tracking	During active permanent manual control all incoming telegrams are tracked internally. At the end of the manual operation, the outputs will be set according to the last command or state received before manual operation.
Bus control of single channels during bus operation can be disabled	Yes **No**	Individual outputs can be disabled locally during permanent manual control, so that the disabled outputs can no longer be controlled via the bus. Disabling via manual control is only permitted if this parameter is set to "Yes".

ℹ This parameter is only visible if manual control is enabled during bus operation.

□↲ Kx - General

Operating mode		Apart from controlling lighting, the actuator "1-gang" device variant can be used as a speed controller of single-phase electric motors. The operating mode is preselected by this parameter and has a considerable effect on the parameter configuration and function of the device. ℹ The operating mode is not adjustable with the device variants "2-gang" and "4-gang". The lighting operation is always intended here.
	Lighting control	In the "Lighting control" function, the dimming principle can be selected in the ETS. Lighting systems in leading edge phase control or trailing edge phase control are then activated by switching or dimming commands and brightness values.
	Speed controller	In the function as a "speed controller", the dimming principle is predefined to leading edge phase control. Some parameter and object texts change because in the "speed controller" operating mode the speed of a connected motor is controlled instead of brightness. The speed (e.g. minimum speed) is configured in the ETS as a percentage value. This value represents the dimming value in percent and is a gauge for the output signal's phase angle of the actuator.
Type of connected load		The dimming principle of the dimming channel is specified here. This parameter is preset to "Motor (inductive / leading edge phase control)" in the "speed controller" operating mode for the "1-gang" device variant).
	universal (with calibration procedure)	The dimming channel calibrates itself universally to the connected load type. After programming with the ETS, after bus voltage return (without mains voltage), after mains voltage return on the terminal pair "L N" (without bus voltage) or after switching on the mains voltage supply of a load output, the actuator calibrates itself automatically to the connected load. The calibration procedure becomes noticeable during

	ohmic loads by a brief flicker and lasts up to 10 seconds depending on the network conditions.
electronic transformer (capacitive / trailing edge phase control)	This setting is only available in Versions "1.1" and "1.2" of the application programs and, as described, only effective with device generations up to "V03". The dimming channel is preset to trailing edge phase control principle. There is no automatic calibration of the load type. Ohmic loads or electronic transformers can be connected to the output.
electr. transformer / LV-LED (capacitive / trailing edge phase control)	This setting is only available in Version "1.3" of the application program and, as described, only effective with device generations from "V04". The dimming channel is preset to trailing edge phase control principle. There is no automatic calibration of the load type. Ohmic loads, electronic transformers or LV-LEDs (via Tronic transformers) can be connected to the output.
Conventional transformer (inductive / leading edge phase control)	This setting is only available in Versions "1.1" and "1.2" of the application programs and, as described, only effective with device generations up to "V03". The dimming channel is preset to leading edge phase control principle. There is no automatic calibration of the load type. Conventional transformers can be connected to the output.
conv. transformer / LV-LED (inductive / leading edge phase control)	This setting is only available in Version "1.3" of the application program and, as described, only effective with device generations from "V04". The dimming channel is preset to leading edge phase control principle. There is no automatic calibration of the load type. Conventional transformers or LV-LEDs (via conv. transformers) can be connected to the output.
LED (trailing edge phase control)	This setting is only available in Version "1.2" of the application program and, as described, only effective with device generations from "V02". The dimming channel is preset to an optimized trailing edge phase control principle. There is no automatic calibration of the load type. HV LED or compact fluorescent lamps optimized for this dimming principle can be connected to the output.
HV-LED (trailing edge phase control)	This setting is only available in Version "1.3" of the application program and, as described, only effective with device

		generations from "V04". The dimming channel is preset to an optimized trailing edge phase control principle. There is no automatic calibration of the load type. HV LED or compact fluorescent lamps optimized for this dimming principle can be connected to the output.
	LED (leading edge phase control)	This setting is only available in Version "1.2" of the application program and, as described, only effective with device generations from "V02". The dimming channel is preset to an optimized leading edge phase control principle. There is no automatic calibration of the load type. HV LED or compact fluorescent lamps optimized for this dimming principle can be connected to the output.
	HV-LED (leading edge phase control)	This setting is only available in Version "1.3" of the application program and, as described, only effective with device generations from "V04". The dimming channel is preset to an optimized leading edge phase control principle. There is no automatic calibration of the load type. HV LED or compact fluorescent lamps optimized for this dimming principle can be connected to the output
Operation with universal power booster ?		If the output power is increased by means of universal power boosters, the corresponding channel configuration of the dimmer actuator must be adapted here. The dimmer actuator adapts the output signal automatically for using universal power boosters based on the setting of this parameter. This parameter is only available in the application programs with the versions "1.2" and "1.3" and only functions in combinations with device generations "V02" or higher.
	Yes	At least one universal power booster is connected to the dimming channel. In the highest dimming position (100 % brightness value), a residual phase angle necessary for universal power boosters is set on the dimmer output. The output signal cut-on or cut-off in this way corresponds to a resulting brightness of approx. 90 % compared to an identically constructed dimmer

		actuator without a power booster. The dimmer actuator rescales the adjustable brightness range automatically for the corresponding channel so that a presetting and feedback within a range of 0…100% is still possible.
	No	No universal power booster is connected to the dimming channel. In the highest dimming position (100 % brightness value), the smallest possible residual phase angle is set on the dimmer output. As a result, the connected lighting is set to the maximum lighting level technically possible.
Definition of the brightness range	**with basic brightness** with minimum brightness	The brightness range, adjustable by switching or dimming procedures, can be limited by defining a lower and upper brightness value. The lower brightness value is either defined by the basic brightness, or alternatively, by the minimum brightness. The upper brightness value is always characterised by the maximum brightness. The maximum brightness adjustable in the ETS is never exceeded under any circumstances in the switched-on operating state of a dimming channel. Neither when switching on nor when dimming. This parameter defines whether the adjustable brightness range at the lower limit will be limited by the basic brightness or by a minimum brightness. This parameter is visible only in the "lighting control" operating mode.
Basic brightness	Level 1 Level 2 Level 3 (Incandescent lamps) Level 4 **Level 5 (standard halogen)** Level 6 Level 7 Level 8	The step value set here is a gauge for the minimum adjustable residual phase angle of the output signal and is set to the decimal brightness values "1", "2" and "3". The step value cannot be undershot in any switched-on operating state of the dimming channel. This parameter is visible only if the "definition of the brightness range" includes the "basic brightness" and the "lighting control" operating mode is also predefined.
Minimum brightness	**1 %** 5 % 10 % 15 %	The brightness set here is not undershot in any switched-on operating state. This parameter is visible only if the "definition of the brightness range"

	20 % 25 % 30 % 35 % 40 % 45 %	includes the "minimum brightness" and the "lighting control" operating mode is also predefined.
Minimum speed	**1 % (decimal 3)** 5 % (decimal 13) 10 % (decimal 26) 15 % (decimal 38) 20 % (decimal 51) 25 % (decimal 64) 30 % (decimal 77) 35 % (decimal 89) 40 % (decimal 102) 45 % (decimal 115)	The speed set here is not undershot in any switched-on operating state. During the initial commissioning, the device must be adapted to the minimum speed of the connected motor by this parameter. This parameter is visible only if the "speed controller" operating mode is predefined.
Maximum brightness	Basic brightness 5 % 10 % 15 % ... 95 % **100 %**	The brightness set here is not undershot in any switched-on operating state. The selection of the adjustable value is downwardly limited to 50 % when using a minimum brightness. Smaller values cannot be configured in this case because otherwise the adjustment range of the minimum brightness will be cut (minimum brightness < maximum brightness). This parameter is visible only in the "lighting control" operating mode. In the "speed controller" operating mode the maximum speed is unalterably preselected to 100 %.
Cutting-in speed	**100 %**	The parameter is only visible in the "speed controller" operating mode for the "1-gang" device variant. When changing from the "motor switched off" to "motor switched on" status via switching or dimming commands or after a device reset, the actuator first always sets the cutting-in speed. The cutting-in speed should ensure that the motor starts up optimally (e.g. reliable start-up of the fan motor through transfer of a higher torque, and thus a higher fan speed). The cutting-in speed is unalterably predefined as 100 %.
Dwell time in cutting-in speed Seconds (0...59)	0...**2**...59	The parameter is only visible in the "speed controller" operating mode for the "1-gang" device variant. The dwell time that can be configured

		here determines how long the actuator allows the cutting-in speed to be active. The actuator changes to the predefined required speed only after the dwell time for the cutting-in speed has elapsed. This change always occurs rapidly without a dimming procedure. If the required speed already corresponds to the cutting-in speed (100 %), there is no change. If the motor should be switched off while the cutting-in speed is set, the actuator interrupts the dwell time and switches off the dimming channel immediately. This occurs rapidly without a dimming procedure. As a result, soft OFF functions configured optionally in the ETS will not be executed in this case.
		Sets the dwell time seconds.
Milliseconds (5...9 * 100)	**5**...9	Sets the dwell time milliseconds.
Behaviour after ETS programming		The actuator permits setting the brightness value separately for each dimming channel after programming with the ETS.
	switch off	The dimming channel is switched off.
	Basic brightness 5 % 10 % 15 % ... 95 % 100 %	The dimming channel is set to the predefined brightness value or speed (pay attention to configured minimum and maximum brightness!). The "basic brightness" setting is only available if the dimming range is limited to the lower limit by the basic brightness. Furthermore, this setting is not available in the "speed controller" operating mode.
	No reaction	After programming with the ETS, the dimming channel shows no response and remains in the switching brightness value currently selected.
Behaviour in case of bus voltage failure		The actuator permits setting the brightness value separately for each dimming channel in case of bus voltage failure.
	switch off	The dimming channel is switched off. It should be noted that the configured OFF command can only be executed if the mains voltage supply of the actuator (terminal pair "L N") is switched on. If the mains voltage is switched off, the actuator in this configuration shows no reaction (the last brightness state

		remains active provided that the mains voltage on the dimming outputs is still switched on).
	Basic brightness 5 % 10 % 15 % ... 95 % 100 %	The dimming channel is set to the predefined brightness value or speed (pay attention to configured minimum and maximum brightness!). It should be noted that the brightness value or speed can only be set if the mains voltage supply of the actuator (terminal pair "L N") is switched on. If the mains voltage is switched off, the actuator in this configuration shows no reaction (the last brightness state remains active provided that the mains voltage on the dimming outputs is still switched on). The "basic brightness" setting is only available if the dimming range is limited to the lower limit by the basic brightness. Furthermore, this setting is not available in the "speed controller" operating mode.
	No reaction	In case of bus voltage failure, the dimming channel shows no reaction and remains in the currently set brightness value, provided that the mains voltage on the dimming outputs is still switched on.
Behaviour after bus or mains voltage return		The actuator allows the brightness value or speed to be set separately for each dimming channel after bus voltage return. This parameter also defines the behaviour after mains voltage return if there is no bus voltage on the actuator at the time of mains return (on the terminal pair "L N"). If there is bus voltage at the time of mains return, the parameter will not be executed!
	switch off	The dimming channel is switched off.
	Basic brightness 5 % 10 % 15 % ... 95 % 100 %	The dimming channel is set to the predefined brightness value or speed (pay attention to configured minimum and maximum brightness!). The "basic brightness" setting is only available if the dimming range is limited to the lower limit by the basic brightness. Furthermore, this setting is not available in the "speed controller" operating mode.
	Brightness value / speed before bus voltage failure	After bus or mains voltage return, the value last set before bus voltage failure and internally stored on bus voltage failure will be tracked.
	No reaction	

		After bus or mains voltage return, the dimming channel shows no response and remains in the state currently selected.
	Activating staircase function	The staircase function is – irrespective of the 'Switching' object - activated after bus or mains voltage return. With this setting, make sure that the staircase function is also enabled. When the staircase function is not enabled, there is no reaction after bus/mains voltage return with this setting. In the "speed controller" operating mode for the "1-gang" device variant, this parameter setting is called "activate time dimmer function".
Switch-on brightness	Basic brightness 5 % 10 % 15 % ... 95 % **100 %**	This parameter specifies the brightness value, which should be set whenever switching on via the "switching" or "central switching" object or by manual operation on the dimming channel. The switch-on brightness must always be between the upper and lower brightness limit value of the dimming range. The selection of "basic brightness" is not necessary when using a minimum brightness. This parameter is visible only in the "lighting control" operating mode.
	Memory value (brightness before switching off last time)	In the "Memory value" setting, the active and internally saved brightness value prior to switching off last time is set when switching on (via the "switching" or "central switching" object).
Dimming behaviour after receipt of a brightness value	**jumping to** dimming to fading	A parameter is used here to define whether a brightness value received via the bus is instantly jumped to (absolute dimming), or whether the brightness is dimmed to via the set dimming characteristic. Fading is also possible as an alternative. When fading, the received brightness value is reached in the exact configured fading time irrespective of the dimming characteristic and irrespective of which brightness value the dimming procedure was started at. Thus, for example, several dimming outputs can be set to the same brightness at the same time. It is not possible to dim a speed value via "fading" in the "speed controller" operating mode for the "1-gang" device version. Hence, this setting is not necessary in the operating mode

		mentioned.
Time for brightness value via fading Seconds (0...59)	0...**20**…59	The fading time is set here if fading is predefined in the dimming behaviour. A dimming procedure via fading lasts for the exact configured time. If "0" is set, the brightness value is jumped to directly.
Behaviour by relative dimming when OFF		This parameter defines whether or not a dimming channel in the "OFF" state reacts to a relative dimming telegram. This parameter is only available in the application programs with the versions "1.2" and "1.3" and only functions in combinations with device generations "V02" or higher.
	Dimming up switches channel ON (Standard)	The dimming channel always reacts to a relative dimming telegram and executes a dimming process. In the "OFF" state, the channel switches on with a "dim up" telegram.
	Dimming up is ignored (channel remains OFF)	The dimming channel only reacts to a relative dimming telegram when it is switched on. In the "OFF" state, the channel ignores a "dim up" telegram.
Assignment to central function ?	Yes **No**	This parameter determines the assignment of the dimming channel to the central function. This parameter is visible only if the central function is enabled (parameter page "General").

☐↵ Kx - Enabled functions

Feedback telegrams	**disabled** enabled	This parameter can be used to disable or to enable the feedback functions. When the function is enabled, the required parameters will be displayed under "Kx –Feedbacks".
Time delays	**disabled** enabled	This parameter can be used to disable or to enable the time delays. When the function is enabled, the required parameters will be displayed under "Kx –Time delays".
Staircase function	**disabled** enabled	This parameter can be used to disable or to enable the staircase function. When the function is enabled, the corresponding parameters will be

		displayed under "Kx Staircase function" and the necessary object enabled. In the "speed controller" operating mode for the "1-gang" device variant, this parameter setting is called "time dimmer function".
Switch-on/switch-off behaviour	**disabled** enabled	The functions that influence the switch-on and switch-off behaviour of the dimming channel can be disabled or enabled here. When the functions are enabled, the required parameters will be displayed under "Kx –Switch-on/switch-off behaviour".
Scene function	**disabled** enabled	This parameter can be used disable or to enable the scene function. When the function is enabled, the corresponding parameters will be displayed under "Kx - Scenes" and the necessary object enabled.
Operating hours counter	**disabled** enabled	The operating hours counter can be disabled or enabled here. When the function is enabled, the corresponding parameters will be displayed under "Kx - Operating hours counter" and the necessary object enabled. ℹ If the operating hours counter is disabled, any operating hours that may have been counted previously will be deleted and any limiting or start values predefined via the object for the dimming channel concerned will be reset!
Signal short-circuit ?	Yes **No**	This parameter can be used to enable the short-circuit message. The corresponding communication object becomes visible when enabled.
Signal load failure / overload ?	Yes **No**	This parameter can be used to enable the load failure or overload message. The corresponding communication object becomes visible when enabled. The parameter for the load failure/overload message is not available in the "speed controller" operating mode for the "1-gang" device variant.

Signal load type ?	Yes **No**	This parameter can be used to enable feedback of the load type. The corresponding communication object becomes visible when enabled.

☐↵ Kx - Feedbacks

Feedback switching status ?		The current switching state of the dimming channel can be signalled back separately to the bus.
	no feedback	No feedback object available for the switching status. Switching status feedback deactivated.
	feedback object is active signalling object	The "Switching feedback" object is enabled. The switching status is transmitted once the status is updated. An automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS.
	feedback object is passive status object	The "Switching feedback" object is enabled. The switching status will be transmitted in response only if the feedback object is read out from by the bus. No automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS.
Updating the object value for switching status feedback		Here you can specify when the actuator should update the feedback value for the switching status in case of an actively transmitting communication object. The object value updated by the actuator is then signalled actively to the bus.
	after each update obj. "Switching"/"Central"	The actuator updates the feedback value in the object once a new telegram is received on the input objects "Switching" or "Central switching". With an actively transmitting feedback object, a new telegram is also then actively transmitted to the bus each time. The telegram value of the feedback does not necessarily have to change in the process. Hence, a corresponding switching status feedback is also generated on the "Switching" object such as in the case of cyclical telegrams for example.
	only if the feedback value changes	The actuator only updates the feedback value in the object if the telegram value (e.g. "OFF" to "ON") also changes If the telegram value of the feedback does not change (e.g. in the case of cyclical

		telegrams to the "Switching" object with the same telegram value), the feedback then remains unchanged. Consequently, with an actively transmitting feedback object, no telegram with the same content will be transmitted repeatedly either. This setting is recommendable, for instance, if the "Switching" and "Switching feedback" objects are linked to an identical group address. This is often the case when activating by means of light scene push-button sensors (recall and storage function). This parameter is only visible in case of an actively transmitting feedback.
Time delay for feedback telegram after bus voltage return ?	**Yes** No	The feedback telegram can be transmitted to the bus with a delay after bus voltage return or after programming with the ETS. Setting "Yes" activates the delay time of the feedback in case of bus voltage return. The delay time is configured on the parameter page "General". This parameter is only visible in case of an actively transmitting feedback.
Cyclical transmission of the feedback ?		The switching status feedback telegram can also be transmitted cyclically via the active message object in addition to the transmission after updating.
	Yes	Cyclical transmission is activated.
	No	Cyclical transmission is deactivated so that the feedback telegram is transmitted to the bus only when updated by the actuator. This parameter is only visible in case of an actively transmitting feedback.
Feedback brightness value / speed ?		The current brightness or speed value of the dimming channel can be signalled back separately to the bus.
	no feedback	No feedback object is available for the brightness value or speed. Brightness value / speed feedback deactivated.
	feedback object is active signalling object	The "brightness value feedback" object or "feedback of speed" is enabled. The value is transmitted once this it updated. An automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS.

	feedback object is passive status object	The "brightness value feedback" object or "feedback of speed" is enabled. The value will be transmitted in response only if the feedback object is read out from by the bus. No automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS.
Updating the object value for brightness value / speed feedback		You can specify here when the actuator should update the feedback value for the brightness value or speed in case of an actively transmitting communication object. The object value updated by the actuator is then signalled actively to the bus.
	after each update obj. "brightness value" / obj. "speed"	The actuator updates the feedback value in the object once a new telegram is received on the input "brightness value / speed" object. With an actively transmitting feedback object, a new telegram is also then actively transmitted to the bus each time. The telegram value of the feedback does not necessarily have to change in the process. Hence, a corresponding brightness value feedback is also generated on the "brightness value / speed" object such as in the case of cyclical telegrams for example.
	only if the feedback value changes	The actuator only updates the feedback value in the object if the telegram value (e.g. "0 %" to "100 %") also changes. If the telegram value of the feedback does not change (e.g. in the case of cyclical telegrams to the "brightness value" object with the same telegram value), the feedback then remains unchanged. Consequently, with an actively transmitting feedback object, no telegram with the same content will be transmitted repeatedly either. This setting is recommendable, for instance, if the "brightness value / speed" and "brightness value feedback / speed feedback" objects are linked to an identical group address. This is often the case when activating by means of light scene push-button sensors (recall and storage function). This parameter is only visible in case of an actively transmitting feedback.
Time delay for feedback telegram after bus	**Yes** No	The feedback telegram can be transmitted to the bus with a delay after bus voltage return or after programming

voltage return ?		with the ETS. Setting "Yes" activates the delay time of the feedback in case of bus voltage return. The delay time is configured on the parameter page "General". This parameter is only visible in case of an actively transmitting feedback.
Cyclical transmission of the feedback ?		The brightness value feedback telegram can also be transmitted cyclically via the active message object in addition to the transmission after updating. This parameter is only visible in case of an actively transmitting feedback.
	Yes	Cyclical transmission is activated.
	No	Cyclical transmission is deactivated so that the feedback telegram is transmitted to the bus only when updated by the actuator.
☐↵ Kx - Time delays		
Selection of time delay	**no time delay** Switch-on delay Switch-off delay ON delay and OFF delay	The "switching" communication object can be evaluated with a time delay. By this setting the desired function of the time delay is selected and the additional parameters of the delay enabled.
Switch-on delay Minutes (0...59)	**0**…59	This parameter is used for setting the duration of the switch-on delay. Sets the switch-on delay minutes.
Seconds (0...59)	0...**10**…59	Sets the switch-on delay seconds.
Switch-on delay retriggerable ?	Yes **No**	A switch-on delay still in progress can be retriggered (setting "Yes") by another "1" telegram. Alternatively, the retriggering time can be suppressed (setting "No"). The parameters for the switch-on delay are only visible if switch-on delay or switch-on and switch-off delay are activated.
Switch-off delay Minutes (0...59)	**0**…59	This parameter is used for setting the duration of the switch-off delay. Sets the switch-off delay minutes.

Seconds (0...59)	0...**10**…59	Sets the switch-off delay seconds.
Switch-off delay retriggerable ?	Yes **No**	A switch-off delay still in progress can be retriggered (setting "Yes") by another "0" telegram. Alternatively, the retriggering time can be suppressed (setting "No"). The parameters for the switch-off delay are only visible if switch-on delay or switch-on and switch-off delay are activated.

□↵ Kx - Staircase function / K1 - Time dimmer function

Staircase time / Time dimmer Hours (0...23)	**0**...23	This parameter is used for programming the duration of the staircase / time dimmer function. Switch-on time hours setting.
Minutes (0...59)	0...**3**...59	Switch-on time minutes setting.
Seconds (0...59)	**0**...59	Switch-on time seconds setting.
		ⓘ In the "speed controller" operating mode for the "1-gang" device variant the staircase function is called a "time dimmer function".
Staircase time / Time dimmer retriggerable ?	**Yes** No	An active switch-on time can be retriggered (setting "Yes"). Alternatively, the retriggering time can be suppressed (setting "No"). This parameter is preset to "No" if the supplementary function "Time extension" is configured. Re-triggering will not be possible.
Reaction to OFF-telegram		An active switch-on time can be aborted prematurely by switching off the staircase / time dimmer function.
	switch off	The switch-on time is aborted after receipt of an OFF telegram on the object "Staircase time start/stop" / "Time dimmer start/stop". With the supplementary function "Time preset via the bus" and the setting "staircase function / time dimmer function via object 'staircase time' activatable ? = Yes", the switch-on time can also be prematurely ended by a factor of "0".

	ignore	OFF Telegrams or "0" factors are ignored. The switch-on time will be executed completely to the end.
Supplementary function for staircase function / time dimmer function		The staircase function can be extended by the two supplementary functions "time extension" and "time processes via bus", which should be used alternatively. The time dimmer function in the "speed controller" operating mode can optionally be supplemented by the "time processes via bus" only. This parameter enables the desired supplementary function and thereby activates the necessary parameters or objects.
	no supplementary function	No supplementary function is enabled.
	Time extension	The time extension is activated. This function permits retriggering an activated staircase lighting time spann-times via the object "Staircase function start/stop. The "Time extension" supplementary function is not necessary in the "speed controller" operating mode for the "1-gang" device variant.
	Time preset via the bus	The time preset via the bus is activated. With this supplementary function, the configured switch-on time can be multiplied by a factor received via the bus, thus it can be adapted dynamically.
Maximum time extension	**1-fold time** 2-fold time 3-fold time 4-fold time 5-fold time	In case of a time extension (retriggering the lighting time n-times via the object "Staircase function start/stop), the parameterized staircase lighting time will be extended by the value programmed in this parameter. "1-fold time" means that after the started staircase time has elapsed, it can be retriggered a maximum of one more time. The time is therefore extended two fold. The other settings behave in a similar manner. This parameter is visible only if the supplementary function "time extension" is set.
Staircase function activatable via"Staircase time / Time dimmer" object ?	Yes **No**	A time preset via the bus can specify here whether the receipt of a new time factor also starts the switch-on time (setting "Yes"). At the same time, the object "Staircase function start/stop /

		"time dimmer start/stop" is hidden. If the setting is "No", the switch-on time can be activated exclusively via the object "Staircase function start/stop / "time dimmer start/stop". This parameter is visible only if the supplementary function "Time preset via the bus" is set.
Reaction at the end of the staircase time / time dimmer function		At the end of the switch-on time, the actuator for the dimming channel concerned displays the configured behaviour here. The channel can be set to switch off immediately, alternatively to execute the pre-warning function or to dim to a reduced continuous lighting (application: long, dark hallways), or to activate a continuous speed (e.g. basic ventilation).
	switch off	At the end of the switch-on time, the actuator switches off the dimming channel concerned. If the soft OFF function is configured, switching off takes place via a dimming procedure.
	activate pre-warning time	At the end of the switch-on time, the dimming channel can generate a pre-warning (reduction of brightness / speed) prior to switching off. The pre-warning, for example, should warn any person still on the staircase that the light will soon be switched off.
	activate reduced continuous lighting / activate reduced continuous speed (basic ventilation)	At the end of the switch-on time, the actuator activates the reduced continuous lighting / continuous speed for the dimming channel concerned. The reduction of the lighting to continuous lighting is appropriate, for example, if a certain degree of artificial light should be switched on permanently in long, dark hallways. Switching to switch-on brightness by activating the staircase function normally takes place by additional presence detectors or motion detectors when people are present in the hallway. The continuous lighting / continuous speed remains permanently active after the switch-on time has elapsed. Only when an ON telegram is received again via the object "Staircase function start/stop" / "Time dimmer start / stop" does the actuator switch back to the switch-on brightness/ switch-on speed and start counting the switch-on time again.

Pre-warning time Minutes (0...59)	**0**...59	This parameter is used for setting the duration of the pre-warning time. The pre-warning time is added to the switch-on time. The reduced brightness / speed is set during the time configured here. Sets the pre-warning time in minutes.
Seconds (0...59)	0...**30**...59	Sets the pre-warning time in seconds. These parameters are visible only if the pre-warning function is enabled.
Reduced brightness / speed during the pre-warning time (1…100 %)	1...**50**...100	This parameter defines the reduced brightness that is set for pre-warning. This parameter is visible only if the pre-warning function is enabled.
Reduced brightness / speed for continuous lighting / continuous speed (1…100 %)	1...**50**...100	This parameter defines the reduced brightness or speed that is set for continuous lighting or continuous speed. This parameter is visible only if the continuous function is enabled.
		ℹ The brightness or speed of the continuous lighting does not necessarily have to be less than the switch-on brightness / switch-on speed. These brightness values or speed values can always be configured to values in the defined dimming range.

□↵ Kx - Switch-on/switch-off behaviour

Soft ON function ?	Yes **No**	The soft ON function permits the dimming channel to be switched on more slowly. If this function (setting "Yes") is activated, a dimming procedure to the switch-on brightness is executed after receiving a switch-on telegram via the "switching" or "central switching" object. No soft ON function is possible for the "1-gang" device variant in the "speed controller" operating mode.
Time for soft ON dimming increment Seconds (0...59)	**0**…59	These parameters set the soft ON function for the dimming increment time. Setting of the seconds of the dimming increment time for soft ON.
Milliseconds (1…99 * 10)	**1**…99	Milliseconds setting of the dimming increment time for soft ON.

		The parameters for the soft ON function are visible only if the soft ON function is enabled.
Soft OFF function ?	Yes **No**	The soft OFF function permits the dimming channel to be switched off more slowly. If this function (setting "Yes") is activated, a dimming procedure to the brightness "0 %" is executed after receiving a switch-off telegram via the "switching" or "central switching" object.
Time for soft OFF dimming increment Seconds (0...59)	**0**…59	These parameters set the soft OFF function for the dimming increment time. Seconds setting of the dimming increment time for soft OFF.
Milliseconds (1…99 * 10)	**1**…99	Milliseconds setting of the dimming increment time for soft OFF. The parameters for the soft OFF function are visible only if the soft OFF function is enabled.
Automatic switch-off if a brightness / speed is undershot?	Yes **No**	The automatic switch-off function of the dimming channel can be activated here. If this function is activated, the connect load will switch off completely when a configurable brightness or speed is undershot at the end of a dimming procedure, and if necessary, after a delay time has elapsed.
Switch-off if brightness value / speed value is smaller than	**5 %** 10 % 15 % ... 95 % 100 %	This parameter defines the brightness or speed, which if undershot, will cause the dimming channel to be switched off at the end of a dimming procedure, or if necessary, after a delay time has elapsed. This parameter is only visible if the switch-off function is activated.
Delay time until switching off Hours (0...23)	**0**...23	This parameter sets the delay time of the switch-off function. If the switch-off brightness or speed is undershot at the end of a dimming procedure, the dimming channel is switched off after the time set here has elapsed. Setting the delay time hours.

Minutes (0...59)	**0**...59	Setting the delay time minutes.
Seconds (0...59)	0...**30**...59	Setting the delay time seconds. The parameters for the time delay are visible only if the switch-off function is enabled. ℹ If the switch-off brightness was undershot because of a disabling or forced position function or the pre-warning function or continuous lighting of the staircase function, the switch-off function is not executed!

□↵ Kx - Scenes

Delay scene recall ?	Yes **No**	A scene is recalled via the scene extension object. If needed, the scene recall on the actuator can be made with a delay after reception of a recall telegram (setting: "Yes"). The recall is alternatively made immediately on reception of the telegram (setting: "No"). ℹ A recall delay has no influence on the storage of scene values.
Delay time Minutes (0...59)	**0**...59	This parameter is used for setting the duration of the scene delay time. Sets the scene delay time in minutes.
Seconds (0...59)	0...**10**...59	Sets the scene delay time in seconds. ℹ The delay time parameters are only visible, if the parameter "Delay scene recall ?" is configured to "Yes".
Behaviour when recalling a scene	Jumping to brightness value / speed **Dimming to brightness value / speed via dimming increment time** Dimming brightness value via fading	When recalling a scene, the configured or stored scene value is set for the dimming channel concerned. This parameter setting can define whether the brightness value or speed can be instantly jumped to or dimmed to or is set via fading. When fading, the brightness value to be set is reached in the exact configured fading time irrespective of the dimming characteristic of a channel and irrespective of which brightness value the dimming procedure was started at.

		Thus, for example, several dimming channels can be set to the same brightness at the same time. It is not possible to dim a speed value via "fading" in the "speed controller" operating mode for the "1-gang" device version. Hence, this setting is not necessary in the operating mode mentioned.
Dimming increment time (0...255 ms)	0…**5**…255	Setting of the dimming increment time if the brightness value / speed value of a scene should be dimmed. This parameter is visible only if the parameter "behaviour when recalling a scene" is set to "dim to brightness value / speed via dimming increment time".
Fading time (0...240 s)	0…**2**…240	Setting of the fading time if the brightness value of a scene should be dimmed to via fading. This parameter is visible only if the parameter "behaviour when recalling a scene" is set to "dim to brightness value via fading".
Overwrite values stored in the device during ETS download ?	**Yes** No	During storage of a scene, the scene values (current states of the dimming channels concerned) are stored internally in the device. To prevent the stored values from being replaced during an ETS programming operation by the originally programmed scene values, the actuator can inhibit overwriting of the scene values (setting: "No"). As an alternative, the original values can be reloaded into the device during each ETS programming operation (setting: "Yes").
Scene X activatable by scene number (scene number "0" = scene deactivated) X = depending on the scene (1...8)	0...**1***...64 *: The predefined scene number is dependent on the scene (1...8).	The actuator distinguishes between up to 8 different scenes which are recalled via the scene extension object or stored. The datapoint type of the extension object, however, permits addressing a maximum of 64 scenes. This parameter defines the scene number (1...64) which is used to address the internal scene (1...8). A setting of "0" deactivates the corresponding scene.
Brightness value / speed for scene X	switch off Basic level of brightness (if	This parameter is used for configuring the brightness value which is set when the scene is recalled.

X = depending on the scene (1...8)	configured) 5 % 10 % 15 % ... 95 % 100 %	The "basic brightness" setting may only be configured if the dimmable brightness range is limited to the lower limit by the basic brightness "see parameter page "Kx - General"). Furthermore, this setting is not available in the "speed controller" operating mode. The preset value depends on the scene.
Storage function for scene X X = depending on the scene (1...8)	Yes **No**	Setting "yes" enables the storage function of the scene. If the function is enabled, the current brightness value can be stored internally via the extension object on receipt of a storage telegram. If "no" is selected, the storage telegrams are rejected.

□↵ Kx - Operating hours counter

Operating hours counter ?	**no** yes	The operating hours counter can be enabled here. If the operating hours counter is not enabled in the configuration of a DALI group or a single device, no operating hours will be counted for the DALI group or single device concerned. Once the operating hours counter is enabled, however, the operating hours will be determined and added up by the ETS immediately after commissioning the DALI Gateway. If the operating hours counter is subsequently disabled again in the parameters and the Gateway is programmed with this disabling function, all operating hours previously counted for the DALI group or the single device concerned will be deleted. When enabled again, the meter reading of the operating hours counter is always on "0 h".
Type of counter	**Up-counter** Down-counter	The operating hours counter can be configured as an up-counter or down-counter. The setting here influences the visibility of the other parameters and objects of the operating hours counter.
Start/Limiting value presetting ?	**no** yes, as received via object	If the down-counter is used, a start value can optionally be predefined. If the up-counter is used, a limiting value can

	yes, as specified in parameter	optionally be predefined. This parameter defines whether the start or limiting value can be set via a separate parameter or adapted individually by a communication object from the bus. The setting "No" deactivates the start / limiting value.
Start/limiting value (0...65535 hrs.)	0...**65535**	The start value of the down-counter or the limiting value of the up-counter is set here. This parameter is only visible if the parameter "Start / limiting value specification ?" is set to "Yes like the parameter".
Automatic transmitting of the counter value		The current counter status of the operating hours counter can be transmitted actively to the bus via the "OHC value" communication object.
	cyclical	The meter reading is transmitted cyclically to the bus and when there is a change. The cycle time is generally configured in the parameter node "General -> Status and feedback".
	after change by interval value	The meter reading is transmitted to the bus only when there is a change.
Counting value interval (1…65535 h)	1...**65535**	The interval of the counter value is set here for automatic transmission. The current meter reading is transmitted to the bus after the time value configured here. This parameter is only visible if the parameter "Automatic transmission of the number value" is set to "Change on interval value".

□↵ Kx - Supplementary functions

Selection of supplementary function	**No supplementary function** Disabling function Forced position	The supplementary function can be defined and enabled here. The disabling function is only configurable as an alternative to the forced position function.
Polarity of the disabling object	**0 = disabled; 1 = enabled** 1 = enabled; 0 = disabled	This parameter defines the polarity of the disabling object. This parameter is visible only if the disabling function is enabled.

Behaviour at the beginning of the disabling function		The behaviour of the dimming channel at the beginning of the disabling function can be configured.
	switch off	At the beginning of the disabling function, the dimming channel is switched off and locked.
	Basic brightness (if configured) 5 %...100 %	At the start of the disabling function, the dimming channel is set to the predefined brightness value or to the set speed and locked (pay attention to configured minimum and maximum brightness!). The "basic brightness" setting may only be configured if the dimmable brightness range is limited to the lower limit by the basic brightness "see parameter page "Kx - General"). Furthermore, this setting is not available in the "speed controller" operating mode.
	Memory value (brightness / speed before switching off the last time)	At the start of the disabling function, the active and internally saved value prior to switching off last time is set (via the "switching" or "central switching" object).
	no reaction	At the beginning of a disabling function, the dimming channel shows no reaction and remains in the current set state. Bus control of the dimming channel is then locked.
	flashing	The dimming channel flashes on and off during the disabling function and the bus control is locked during this time. The flashing time is configured generally for all channels on the parameter page "General". During the flashing, the logical switching state is "on 1" and the switch-on brightness is signalled back as brightness. A soft ON/OFF function is ignored during flashing. The "flashing" setting is not available in the "speed controller" operating mode. This parameter is visible only if the disabling function is enabled. ℹ The "flashing" setting cannot be selected in the "speed controller" operating mode for the "1-gang" device variant.
Behaviour at the end of the disabling function		The behaviour of the dimming channel at the end of the disabling function can be configured.

	switch off	At the end of the disabling function, the dimming channel is switched off and enabled again.
	Basic brightness (if configured) 5 %...100 %	At the start of the disabling function, the dimming channel is set to the predefined brightness value or to the set speed and locked (pay attention to configured minimum and maximum brightness!). The "basic brightness" setting may only be configured if the dimmable brightness range is limited to the lower limit by the basic brightness "see parameter page "Kx - General"). Furthermore, this setting is not available in the "speed controller" operating mode.
	Memory value (brightness / speed before switching off the last time)	At the end of the disabling, the active and internally saved brightness / speed value prior to switching off last time is set (via the "switching" or "central switching" object).
	tracked brightness value / tracked speed	At the end of the disabling, the state received during the disabling function or adjusted before the disabling function can be tracked with the appropriate brightness / speed value. Any time functions still in progress will also be taken into account if necessary.
	no reaction	At the end of a disabling, the dimming channel shows no reaction and remains in the current set state. Bus control of the dimming channel is enabled again.
	flashing	The dimming channel is always enabled again for the bus control at the end of the disabling and flashes on and off. The flashing time is configured generally for all channels on the parameter page "General". During the flashing, the logical switching state is "on 1" and the switch-on brightness is signalled back as brightness. A soft ON/OFF function is ignored during flashing. The flashing status remains active until another bus command is received and specifies another status. The "flashing" setting is not available in the "speed controller" operating mode. This parameter is visible only if the disabling function is enabled.
Brightness / speed for forced position "switch on, active"		If the forced position is activated and forced-position state is "ON", you can define here how the dimming channel should behave.

	Basic brightness (if configured) 5 %...**100 %**	The dimming channel is set to the predefined brightness value or speed (pay attention to configured minimum and maximum brightness!). The "basic brightness" setting may only be configured if the dimmable brightness range is limited to the lower limit by the basic brightness "see parameter page "Kx - General"). Furthermore, this setting is not available in the "speed controller" operating mode.
	Memory value (brightness / speed before switching off the last time)	The active and internally saved brightness / speed value prior to switching off last time is set (via the "switching" or "central switching" object).
	no reaction	The dimming channel shows no reaction and remains in the current set state. This parameter is only visible when the forced position function is enabled.
Brightness / speed for forced position "active, switch off"	**0 %**	If the forced position is activated and forced-position state is "OFF", the dimming channel is always switched off. This parameter cannot be edited. This parameter is only visible when the forced position function is enabled.
Brightness / speed for forced position end "inactive"		The behaviour of the dimming channel at the end of the forced-position can be configured here.
	no reaction	At the end of a forced position, the dimming channel shows no reaction and remains in the current set state. Bus control of the dimming channel is enabled again.
	tracked brightness value / tracked speed	At the end of a forced position, the state received during the forced position function or adjusted before the function can be tracked with the appropriate brightness value. Any time functions still in progress will also be taken into account if necessary. Bus control of the dimming channel is enabled again. This parameter is only visible when the forced position function is enabled.
Behaviour after bus voltage return		The forced position communication object can be initialised after bus voltage return. The brightness status of the dimming channel can be influenced

		when the forced position function is activated.
	no forced position	No forced position is activated after bus voltage return. Reaction of the dimming channel according to the parameter "Behaviour after bus or mains voltage return".
	Forced position active, switch on	The forced position is activated. The dimming channel is switched on to the brightness / speed value predefined by the parameter "switch on brightness / speed for forced position 'active'".
	Forced position active, switch off	The forced position is activated. The dimming channel is switched off under forced control.
	State before bus voltage failure	After bus voltage return, the state of the forced position is set as it was stored permanently at the time of the bus or mains failure. After programming the application or parameters with the ETS, the value is set internally to "not active". If the forced position is activated, the dimming channel is switched on to the brightness / speed value predefined by the parameter "switch on brightness / speed for forced position 'active'". This parameter is only visible when the forced position function is enabled.
Logic operation function ?	Yes **No**	This parameter can be used to enable the logic operation function (setting "Yes"). The parameter is preset to "No" if the staircase function / time dimmer function is enabled.
Type of logic operation function	**OR** AND AND with feedback	This parameter defines the logical type of the logic operation function. The object "logic operation" is linked to the logic switching state of the dimming channel (object "switching" after evaluation of configured time delays if necessary) using the logic operation function set here. This parameter is only visible when the logic operation function is enabled.
Object value of logic operation obj. after bus voltage return	**0 (OFF)** 1 (ON)	After bus voltage return, the object value of the logic operation object is initialised here with the preset value. This parameter is only visible when the logic operation function is enabled.

Object value of logic operation obj. after ETS download	**0 (OFF)** 1 (ON)	After programming the application or the parameters in the ETS, the object value of the logic operation object is initialised here with the preset value. This parameter is only visible when the logic operation function is enabled.

☐↵ Kx - dimming characteristic

Characteristic curve		The dimming characteristic curve of the dimming channel can be set here. The lamp used can thus be adapted to the brightness sensitivity of the human eye.
	linear	The brightness curve of basic brightness (decimal brightness value "1") up to 100 % (decimal brightness value "255") is linear.
	adapted for incandescent lamps	The characteristic is adapted to incandescent lamp load.
	adapted for halogen lamps	The characteristic is adapted to halogen lamp load.
	user-defined	The brightness curve between basic brightness / minimum brightness and maximum brightness can be adapted individually. For this purpose, the brightness range is subdivided in up to three sections. Each section can be configured with an independent dimming speed.
		ⓘ The settings "adapted for incandescent lamps" and "adapted for halogen lamps" cannot be selected in the "speed controller" operating mode for the "1-gang" device variant.
Time between two dimming increments (1...255 ms)	1…**10**…255	In the case of a linear characteristic curve, the dimming increment speed is set here (time between two dimming values).
1st area: Time between two dimming increments (1...255 ms)	1…**20**…255	In the case of a user-defined characteristic curve, the dimming increment speed (time between two dimming values) of the first section is set here. Only visible if "characteristic curve = "user-defined"!

Brightness / speed limiting value 1st area / 2nd area (1…100 %)	1…**20**…100	The first brightness / speed limiting value is parameterised here. This limiting value defines the boundary between the first and second section. Only visible if "characteristic curve = "user-defined"!
2nd area: Time between two dimming increments (1...255 ms)	1…**10**…255	In the case of a user-defined characteristic curve, the dimming increment speed (time between two dimming values) of the second section is set here. Only visible if "characteristic curve = "user-defined"!
Brightness / speed limiting value 2nd area / 3rd area (1…100 %)	1…**80**…100	The second brightness / speed limiting value is parameterised here. This limiting value defines the boundary between the second and third section. Only visible if "characteristic curve = "user-defined"!
3rd area: Time between two dimming increments (1...255 ms)	1…**5**…255	In the case of a user-defined characteristic curve, the dimming increment speed (time between two dimming values) of the third section is set here. Only visible if "characteristic curve = "user-defined"!

ℹ When setting the brightness limiting value, care must be taken to ensure that the values are greater than a configured minimum brightness, if necessary, and less than the set maximum brightness! When setting the speed limiting values, the minimum speed must be observed!

5 Appendix

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1 Information on the product

1.1 Product catalogue

Product name:	Heating actuator 6-gang with controller
Use:	Actuator
Design:	RMD (rail-mounted device)
Order no.	2139 00

1.2 Function

General

The heating actuator is used for the activation of electrothermal actuators (ETA) for heating or cooling systems. It possesses 6 electronic outputs, each of which can silently activate up to 4 (AC 230 V) or 2 (AC 24 V) actuators. Both deenergised closed and deenergised opened actuators can be connected.
In addition, the actuator contains up to 12 room temperature controllers (RTC), which are integrated in the device software and which work independently of the process. The command value outputs of these controllers can be linked to the electronic valve outputs of the actuator, meaning that temperature control and valve activation can take place using just one bus device, if required. The use of external room temperature controllers (e.g. push-button sensors with RTC) is thus not absolutely essential, but is possible as the valve outputs can be activated individually via the KNX. The integrated controllers can also activate other heating actuators or fan coil actuators. The room temperature is made available to the integrated controllers via separate communication objects. All the controller functions (e.g. setpoint temperature specification, operating mode switchover, switchover of the operating mode) are controlled via KNX communication objects (object controller without its own operating elements), meaning that controller operation is possible via controller extensions or visualisations.

Functions of the electronic valve outputs

The heating actuator receives 1-bit or 1-byte command value telegrams, transmitted, for example, by external KNX room temperature controllers or by one of the internal controllers. The actuator controls its valve outputs either in switching form or with a PWM signal, according to the data format of the command values and the configuration in the ETS. The cycle time for constant PWM output signals can be configured separately for each valve output of the heating actuator. This allows individual adaptation to different actuator types.
On activation with constant command values, an optional command value limit can be configured, which allows the limitation of received command values at the "Minimum" and "Maximum" limits. A minimum command value can be used, for example, for the implementation of basic heating or cooling. A maximum command value allows the limitation of the effective command value range, which usually has a positive influence on the lifespan of actuators.

The heating actuator possesses a heat requirement and pump controller. This produces a positive impact on the energy consumption of a housing or commercial building through the transmission and evaluation of the largest command value in the heating or cooling system. The information on the largest active command value can be made available to suitable calorific furnaces with integrated KNX controller directly via a KNX telegram (1-byte constant), for example, to determine the optimum flow temperature. Alternatively or additionally, the heating actuator can even evaluate the command values of its outputs and make general heat requirement information available in the form of limiting value monitoring with hysteresis (1-bit, switching). Using a KNX switch actuator, this allows the energy-efficient activation of burner and boiler controllers with suitable control inputs (e.g. requirement-orientated switchover between the reduction and comfort setpoint in a central combi boiler).
The heating actuator also allows switching activation of the circulation pump of the heating or cooling circuit via a 1-bit KNX telegram. When using pump control, the pump is only switched on by the actuator when at least one command value of the outputs exceeds a limiting value with hysteresis defined in the ETS. The pump is switched off when the limiting value is reached or undershot again. This saves electrical energy, as the pump is only activated by sufficiently large, and thus effective, command values. Optional cyclical anti-sticking protection prevents the sticking of the pump, if it has not been switched on by the command value evaluation for a longer period of time.

To prevent calcification or sticking of a valve which has not been activated for some time, the actuator has an automatic valve rinsing function. Valve rinsing can be executed cyclically or using a bus command, causing the activated valves to run through the full valve stroke for a preset period of time. If necessary, the intelligent valve rinsing can be enabled. In so doing, cyclical rinsing using the full stroke is only executed when a defined minimum command value limiting value was not exceeded during actuator operation.

Cyclical monitoring of the command values can be performed as an option. If, during active cyclical monitoring, there are no command value telegrams during a preset time, then emergency operation is activated for the affected valve output, for which a configurable constant PWM command value can be preset. In addition, it is possible to activate a forced position separately for each output using a 1-bit KNX object. A defined PWM command value is set at the appropriate output.
Emergency operation and forced position can also be activated automatically in case of bus voltage failure, after bus voltage return or after an ETS programming operation. If necessary, the command values for emergency operation and the forced position can be influenced by the summer and winter mode of the actuator, allowing the activation of different heating or cooling levels according to the season. The actuator permits switchover between summer and winter mode at any time using a 1-bit object.

The heating actuator possesses comprehensive status functions. The active command value can be made available as status information, separately for each valve output.
The actuator is able to detect an overload or a short-circuit at the valve outputs and, in consequence, to protect them against destruction. Outputs which have experienced a short-circuit or a constant load are deactivated after an identification period.

In this case, a short-circuit or overload signal can be transmitted via a KNX communication object. The actuator can also signal a failure of the valve voltage on the KNX.

The switch-on times of the valve outputs can be detected and evaluated separately by operating hours counters. In addition, service operation is available, which, during maintenance or installation, can move all assigned valve drives to a defined position (completely opened or completely closed) and can lock them against activation by command value telegrams. Both service mode and the locking status are preset by a 2-bit forced operation telegram.

Function of the room temperature controller

There are 12 controllers integrated into the device's software that can be used for individual room temperature control. This allows the temperature to be set in up to 12 rooms or room areas to specified setpoints through independent control processes. Depending on the operating mode, current setpoint temperature and room temperature, using a controller means that a command value for heating or cooling control can be transmitted to the KNX for the control circuit or be forwarded internally to a valve output. The controller distinguishes between different operating modes (Comfort, Standby, Night, Frost/heat protection) each with their own temperature setpoints for heating or cooling. For heating and cooling functions, you can select continuous or switching PI or switching 2-point feedback control algorithms.

In addition to the basic level heating or cooling, activating an additional level enables an additional heating or cooling unit to be used. In this connection, you can set the temperature setpoint difference between the basic and the additional level by a parameter in the ETS. For major deviations between the temperature setpoint and the actual temperature, you can activate this additional level to heat up or cool down a room faster. You can assign different control algorithms to the basic and additional levels.

The room temperatures are recorded per controller by one or optionally by two external KNX temperature sensors (e.g. push-button sensors with temperature measurement).

Logic functions

In addition, the device has 8 internal logic functions. Using these functions, logic gates (e.g. AND, OR, exclusive OR, each with up to 4 inputs) can be set up and thus switching and status information can be linked and evaluated. Alternatively, a 1-bit to 1-byte converter and a disabling element with filter and time functions can be configured for each logic function. As a further option, comparators or limit value switches with hysteresis can be set as a logic function.
The logic functions have their own KNX communication objects and can process telegrams of the actuator or of other bus devices.

Update capability

The device can be updated. Firmware can be easily updated with the Gira ETS Service App (additional software).

KNX Data Secure

The device is KNX Data Secure capable. KNX Data Secure offers protection against manipulation in building automation and can be configured in the ETS project. Detailed technical knowledge is required. A device certificate, which is attached to the device, is required for safe commissioning. During mounting, it is recommended to remove the certificate from the device and to store it securely.

ETS versions

Planning, installation and commissioning of the device are carried out with the aid of the ETS5, version 5.7.7 or higher or of the ETS6, version 6.0.3 or higher.

Operation

The operating elements (4 push-buttons) on the front panel of the device permit influencing of the electronic outputs of the actuator through manual operation, even without KNX bus voltage or in a non-programmed state (switch on and off / PWM). This feature permits a fast function check of the connected actuators. Moreover, the statuses of the outputs in case of bus voltage failure or bus voltage return and after ETS programming can be set separately.

Mounting and electrical connection

The device electronics and the bus coupler are supplied from the bus voltage. The valve outputs possess a separate connection for the supply of the connected actuators (AC 24 V or AC 230 V).

The device is designed for mounting on DIN rails in closed compact boxes or in distributors in fixed installations in dry interior rooms.

ⓘ We recommend using electrothermal actuators of make Gira or, alternatively, models of make Möhlenhoff (AA2004, AA4004) or Sauter (MTX). Always observe the technical data of the actuators and compare them with the technical properties of the heating actuator.

1.3 Device components

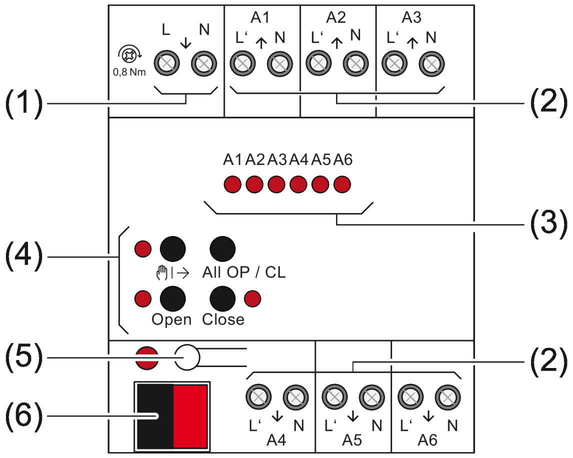


Figure 1: Front view

(1)	Supply of electrothermal valve drives
(2)	Connection of electrothermal valve drives (A1 to A6)
(3)	Status LEDs for outputs
(4)	Button field for manual operation
(5)	Programming button and LED
(6)	Bus connection

i If all of the status LEDs (3) are flashing (2 Hz), the device is indicating that there is no power supply to the electrothermal valve drives (1).

1.4 Technical data

KNX	
KNX medium	TP256
Commissioning mode	S mode
Rated voltage KNX	DC 21 ... 32 V SELV
Current consumption KNX	4.5 ... 10 mA
Heating outputs	
Contact type	Semi-conductor (Triac), ε
Switching voltage	AC 24 / 230 V ~
Mains frequency	50 / 60 Hz
Switching current	5 ... 160 mA
Switch-on current	max. 1.5 A (2 s)
Switch-on current	max. 0.3 A (2 min)
Number of drives per output	
230 V drives	max. 4
24 V drives	max. 2
Housing	
Installation width	72 mm / 4 HP
Clampable cable cross-sections	(see figure 2)
Ambient conditions	
Ambient temperature	-5 ... +45°C
Storage/transport temperature	-25 ... +70°C
Connection torque for screw terminals	Max. 0.8 Nm

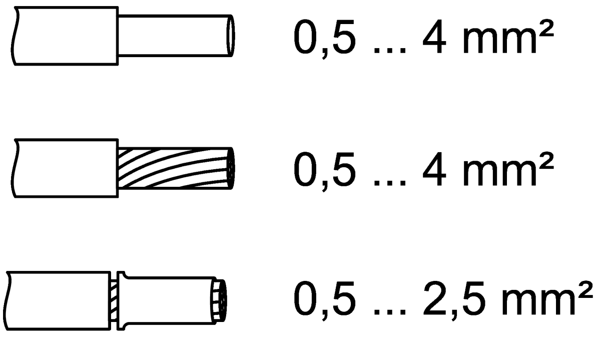


Figure 2: Clampable conductor cross-section

2 Safety instructions

Electrical devices may be mounted and connected only by electrically skilled persons.

Serious injuries, fire or property damage are possible. Please read and follow the manual fully.

Danger of electric shock. Device is not suitable for disconnection from supply voltage because mains potential even is applied on the load when the output is switched off. Always disconnect before carrying out work on the device or load. To do so, switch off all associated circuit breakers.

Danger of electric shock. Always disconnect before carrying out work on the device or load. In so doing, take all the circuit breakers into account, which support dangerous voltages to the device and or load.

Danger of electrical shock. Make sure there is always sufficient insulation between the mains voltage and the bus during the installation. A minimum distance of at least 4 mm must be maintained between bus conductors and mains voltage cores.

3 Mounting and electrical connection

DANGER!

Electric shock when live parts are touched.

Electric shocks can be fatal.

Always disconnect before carrying out work on the device or load. To do so, switch off all corresponding circuit breakers, secure them against being switched on again and check that there is no voltage. Cover up any adjacent live parts.

Mount device

- Enter or scan the device certificate and add it to the project. A high resolution camera should be used to scan the QR code.
- The device certificate should be removed from the device during mounting.
- Document all passwords and keep them safe.

Observe ambient temperature. Ensure adequate cooling.

- Mount device on DIN rail.

Connect device

Connect either AC 230 V or AC 24 V valve drives to all the outputs.

Only connect valve drives with the same characteristics to each output (deenergised closed/opened).

Do not connect any other loads.

Connect valve drives for frost-sensitive rooms to outputs A1 and A4. These are switched off last in the event of overload.

Do not exceed maximum number of valve drives per output .

Observe the technical data of the valve drives used.

Do not connect the neutral conductor from the output terminals through to additional devices.

- Connect AC 230 V valve drives according to the connection diagram .

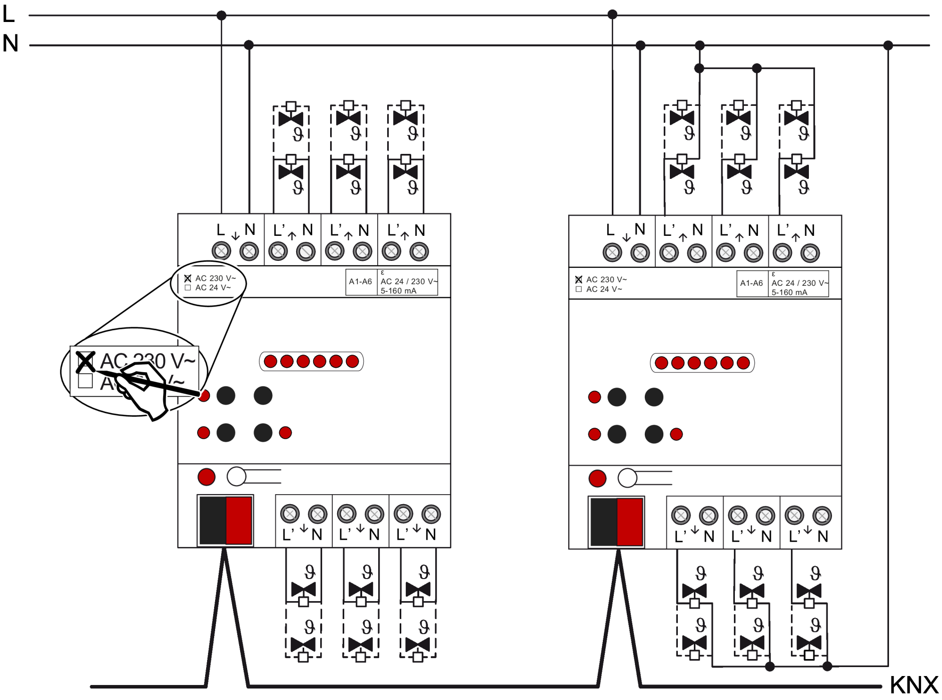


Figure 3: Connection for AC 230 V actuators (connection examples)
Left: Neutral conductor of the actuators run separately to the actuator /
Right: Shared neutral conductor for actuators

- Connect AC 24 V valve drives according to the connection diagram .

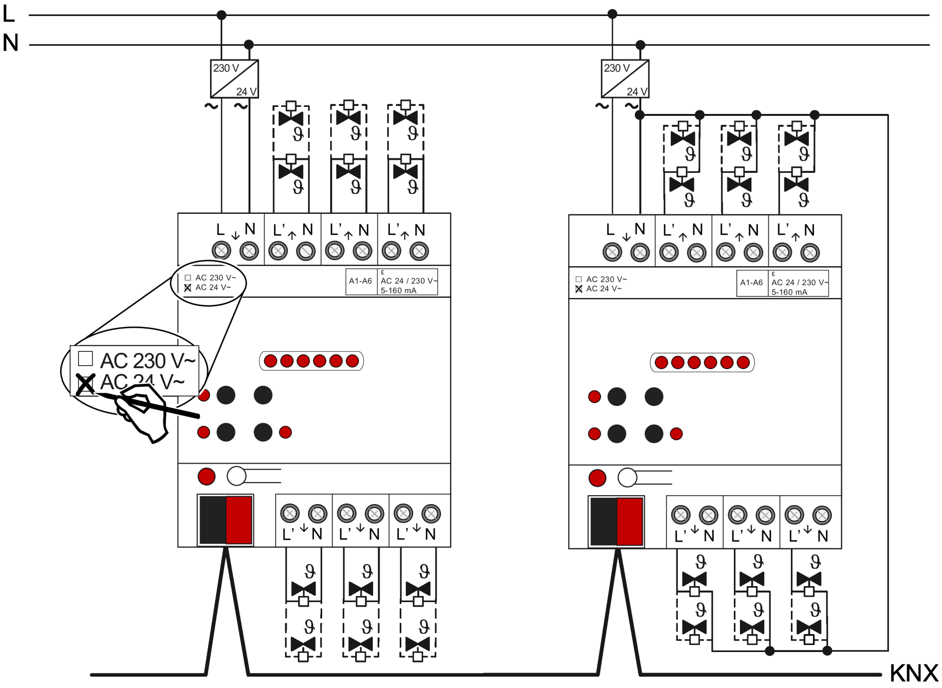


Figure 4: Connection for actuators AC 24 V
Left: Isolated connection of the actuators, separately on the actuator /
Right: Shared conductor for actuators

- Connect the supply for the valve drives to the terminals ↓(L) and ↓(N) (1).
- Connect bus line with device connection terminal observing the correct polarity.

- Attach the cover cap to the bus connection as protection against hazardous voltages.

4 Commissioning

The device is put into operation

The device is put into operation

- for the KNX system with the ETS version 5.7.7 onwards
  or
- for the Gira One system with the Gira Project Assistant (GPA) version 5 onwards.

Safe-state mode

The safe-state mode stops the execution of the loaded application program.

ℹ Only the system software of the device is still functional. ETS diagnosis functions and programming of the device are possible. Manual operation is not possible.

Activating safe-state mode

- Switch off the bus voltage or remove the KNX device connection terminal.
- Wait about 15 s.
- Press and hold down the programming button.
- Switch on the bus voltage or attach the KNX device connection terminal. Release the programming button only after the programming LED starts flashing slowly.

  The safe-state mode is activated.

  By briefly pressing the programming button again, the programming mode can also be switched on and off in the safe-state mode as usual. If the programming mode is active, the programming LED stops flashing.

Deactivating safe-state mode

- Switch off bus voltage (wait approx. 15 s) or carry out ETS programming.

Master reset

The master reset restores the default device settings (physical address 15.15.255, firmware is retained). The device must then be recommissioned with the ETS. Manual operation is possible.

In secure operation: A master reset deactivates the device security. The device can then be recommissioned with the device certificate.

Performing a master reset

Prerequisite: Safe-state mode is activated.

- Press and hold down the programming button for > 5 s.

The programming LED flashes quickly.

The device performs a master reset, restarts and is ready for operation again after approx. 5 s.

Restoring the device to factory settings

Devices can be reset to factory settings with the Gira ETS Service App. This function uses the firmware contained in the device that was active at the time of delivery (delivered state). Restoring the factory settings causes the devices to lose their physical address and configuration.

5 Application programs

ETS search paths:	heating, air condition / valves / Heating actuator, 6-gang with controller

Application:

Name	Heating actuator 6-gang 20E021
Version	2.1 for ETS5 version 5.7.7 or higher and ETS6 version 6.0.3 or higher
from mask version	SystemB (07B0)
Summarized description	Multifunctional heating actuator application: Activation of up to 6 valve outputs for electrothermal actuators. Optionally with room temperature control through 12 integrated room temperature controllers. With logic functions and manual operation. KNX Data Secure capable.

6 Scope of functions

Valve outputs

- 6 independent electronic valve outputs.
- Valve activation (deenergised opened / closed) can be configured for each output.
- Command value evaluation as "Switching, 1-bit", "Constant, 1-byte" or "Constant, 1-byte with command value limiting value and hysteresis".
- With a 1-byte command value, the outputs are activated by pulse width modulation (PWM). The cycle time can be configured for each valve output.
- Status feedback (1-bit or 1-byte) of each output possible automatically or on read request.
- Failure signal of the valve operating voltage can be configured (1-bit).
- Overload and short-circuit signal can be set separately via a 1-bit object for each valve output (polarity can be configured). Global reset of all short-circuit / overload signals possible.
- Heat requirement and pump control, for positive influencing of the energy consumption of a housing or commercial building. Provision of the largest active command value directly via KNX telegram (1-byte constant). Alternatively or additionally, evaluation of the actuator command values for provision of the general heat requirement information in the form of limiting value monitoring with hysteresis (1-bit switching). Activation of a circulation pump of the heating or cooling circuit via a 1-bit KNX telegram with limiting value evaluation. Optional cyclical anti-sticking protection prevents the sticking of the pump.
- Summer or winter mode can be selected via an object (polarity configurable).
- Each valve output can be locked in a forced position with bus control. Different command values can be configured for summer and winter mode.
- Cyclical monitoring of the command value of each output can be set, taking into account a configurable monitoring time. If no command value telegram is received within the preset monitoring time, the valve output concerned switches to emergency operation. Different command values can be configured for summer and winter mode. The fault telegram is configurable.
- On activation with constant command values, an optional command value limit can be configured, which allows the limitation of received command values at the "Minimum" and "Maximum" limits.
- Automatic valve rinsing to prevent calcification or sticking of a valve which has not been activated for some time.
- Operating hours counter to record the switch-on times of the valve outputs.
- Service mode for the maintenance or installation of valve drives (locking of the valve outputs in a defined state). Both service mode and the locking status are preset by a 2-bit forced operation telegram.

- Manual operation of outputs independent of the KNX (for instance, construction site mode) with LED status indicators. Separate status feedback to the KNX for manual operation. Manual operation can also be disabled via the KNX. Own cycle time and PWM setting for manually-operated valve outputs. Central activation of all valve outputs (0% / 100%).
- Behaviour in case of bus voltage failure and bus voltage return as well as after ETS programming settable for each valve output.
- Various actively transmitting status signals can be delayed globally after bus voltage return or after an ETS programming operation.
- The parameters of the outputs can be set individually (each valve output possesses its own parameters) or alternatively like valve output 1.

Room temperature controller

- Up to 12 independent room temperature controllers.
- Individual control of a controller using communication objects.
- Various operating modes can be activated: Comfort, Standby, Night and Frost/heat protection
- Each operating mode can be assigned its own temperature setpoints (for heating and/or cooling).
- Configuring the temperature setpoints as relative (derived from basic setpoint) or absolute (independent setpoint temperatures for each operating mode).
- Comfort extension possible using presence button in Night or Frost/heat protection mode. Configurable duration of the comfort extension.
- The operating modes are switched over via 1-byte objects according to the KNX specification.
- Status feedback telegrams can be configured.
- Frost/heat protection switchover via window status or by automatic frost protection.
- Operating modes "Heating", "Cooling", "Heating and cooling" each with or without additional level. The temperature setpoints for the additional level are derived via a configurable level offset from the values of the basic level.
- Various control types can be configured for each heating or cooling level: PI control (permanent or switching PWM) or 2-point feedback control (switching).
- Control parameter for PI controller (if desired: proportional range, reset time) and 2-point controller (hysteresis) adjustable.
- Automatic or object oriented switchover between "heating" and "cooling".
- A temporary or permanent setpoint shift for a relative setpoint specification through communication objects is possible (e.g. via a controller extension).
- Configurable step width of the setpoint shift (0.1 K / 0.5 K).
- Deactivating the feedback control or the additional level possible using separate 1-bit objects.

- Room temperature measurement via up to two external KNX temperature sensors. Calibration of the temperature values possible and measured value formation of the external sensors can be configured. Settable polling time of the externally received temperature values.
- The actual and setpoint temperatures can be output on the bus if a configurable deviation is detected (also periodically).
- Separate or shared command value output in heating and cooling mode. This produces one or two command value objects for each level.
- Normal or inverted command value output configurable
- Automatic transmission and cycle-time for command value output configurable
- Command value limit possible.
- Floor temperature limit possible in cooling mode and heating mode. Thus temperature-controlled switch-off of underfloor heating and cooling as protective function.
- Setpoint temperature limit possible in cooling mode. If necessary, the controller limits the setpoint temperature to specific values and prevents an adjustment beyond statutory limits.
- Setpoint temperature increase possible in heating mode. If necessary, the controller raises the setpoint temperature in accordance with the outdoor temperature.

7 Notes on software

Unloading the application program

The application program can be unloaded with the ETS. In this case, all valve outputs of the product are switched off. Manual operation is possible.

ETS project design and commissioning

For project design and commissioning of the device, ETS5 version 5.7.7 or higher or ETS6 version 6.0.3 or higher is required.

Safe-state mode

If the device does not work properly - for instance as a result of errors in the project design or during commissioning - the execution of the loaded application program can be halted by activating the safe-state mode. In safe-state mode, activation of the valve outputs via the KNX or manual operation is not possible. The room temperature controllers also have no function. The actuator remains passive in safe-state mode, since the application program is not being executed (state of execution: Terminated). Only the system software is still functional so that the ETS diagnosis functions and also programming of the device continue to be possible.

8 Operation and indication

8.1 Button operation and indication functions

(3) **A1...A6**: status LED outputs (LEDs light up when outputs are energised)

(7) ✋|→ button: activation / deactivation of manual operation

LED - On: permanent manual operation mode active

(8) **Open** button: open valve (configured valve direction of action is taken into account)

LED – On: valve opened, manual operation mode

(9) **Close** button: close valve (configured valve direction of action is taken into account)

LED – On: valve closed, manual operation mode

(10) **ALL OP / CL** button: central operating function for all valve outputs. Open and close all the valves alternately.

ℹ **Open** (8) and **Close** (9) LEDs: The LEDs light up statically during manual operation, showing the valve status set or to be set (valve is closed or closing / valve is opened or opening). Even on valve outputs working with an 8-bit command value (PWM), the LEDs display the logical valve state statically in the same way. The LEDs do not signal the dynamic switch-on and switch-off phases of the pulse width modulation.
If no valve voltage is connected or switched on at the terminals **↓(L)** and **↓(N)**, then the LEDs are also always switched off, even if bus voltage is available, as the valve outputs cannot be energised.

Status indication

The status LEDs **A1...A6** (3) show whether the current flow is switched on or switched off at the appropriate output. The connected heating or cooling valves open and close according to their characteristics.

Valve drive	LED ON	LED OFF
Deenergised closed	Output energised Valve opened / Opening phase Active heating or cooling	Output not energised Valve closed / Closing phase
Deenergised opened	Output energised Valve closed / Closing phase	Output not energised Valve opened / Opening phase Active heating or cooling

- LED flashes slowly: output in manual operation mode
- LED flashes quickly: output disabled via permanent manual operation mode

ℹ In the case of valve outputs working with an 8-bit command value (PWM), the LEDs dynamically display the switch-on and switch-off phases of the pulse width modulation.

ℹ If no valve voltage is connected or switched on at the terminals **↓L** and **↓N** (1), then all status LEDs are also always switched off, even if bus voltage is available, as the valve outputs cannot be energised.

ℹ On the LED status display, the valve direction of action configured for each output in the ETS is not taken into account. As a result, the LEDs do not immediately display the valve state (opened / closed). Inversion of the status display according to the valve direction of action thus does not take place.

The manual operation of the actuator distinguishes between the following operating modes:

- Bus operation: Operation via room temperature controllers, push-button sensors, or other bus devices,
- Temporary manual operation mode: manual operation locally with keypad, automatic return to bus control,
- Permanent manual operation mode: exclusively manual operation on the device (e.g. construction site mode, commissioning phase).

ℹ When manual operation mode is active, the outputs cannot be controlled via the bus.

ℹ In case of bus voltage failure, manual operation mode is not possible.

ℹ In manual operation mode, bus operation can be disabled via a telegram. Manual operation mode is terminated on activation of the disabling function.

ℹ No manual operation of the device is possible if the actuator is programmed by the ETS with an incorrect application program or if the application program was unloaded. In the as-delivered state of the actuator, manual operation can be used even before commissioning via the ETS (construction site mode).

ℹ Further details concerning manual operation, especially with respect to the possible parameter settings and the interaction with other functions of the actuator can be found in the chapter "Valve outputs" of the present documentation.

Switching on temporary manual operation mode

Manual operation is enabled in the ETS and not blocked.

- ■ Press the ✋|→ button briefly.

  Temporary manual operation mode is active.

  The status LED **A1** flashes. The LED ✋|→ flashes.

ℹ After temporary manual operation mode has been switched on, the most recently set states of the outputs initially remain active. For opened valve outputs, the pulse width modulation is not adjusted to the preset value of manual operation. This only takes place when the valves are first closed and then reopened, in the course of brief manual operation.

ℹ After 5 seconds without a button actuation, the actuator returns automatically to bus operation.

Switching off temporary manual operation mode

The device is in temporary manual operation mode.

- No button has been actuated for 5 seconds.

  - or -

- Select all outputs one after another by a brief press of the ✋|→ button. Thereafter, press the button again,

  - or -

- switch off the bus voltage.

  - or -

  Bus operation is active. LEDs **A1...A6** no longer flash, but rather indicate the output status.

ℹ Manual operation is always exited after an ETS programming operation.

ℹ The state of all outputs set via manual operation is not changed when temporary manual operation mode is switched off. If, however, a function with a priority higher than that of normal operation (e.g. forced position, safety operation) was activated for the valve outputs via the bus before or during manual operation, the actuator executes the function with the higher priority for the outputs concerned.

Switching on permanent manual operation mode

Manual operation is enabled in the ETS and not blocked.

Bus operation or temporary manual operation mode is active.

- Press the ✋|→ button for at least 5 seconds.

  Permanent manual operation mode is active and the LED ✋|→ is illuminated. The status LED **A1** flashes. The two status LEDs **Open** and **Close** show the current status of A1.

ℹ After permanent manual operation mode has been switched on, the states of the outputs last set initially remain active. However, for opened valve outputs, the pulse width modulation is automatically adjusted to the preset value of manual operation.

Switching off permanent manual operation mode

The device is in permanent manual operation mode.

- Press the ✋|→ button for at least 5 seconds.

  - or -

- switch off the bus voltage.

  - or -

- Block manual operation via the corresponding disabling object,

  - or -

  Bus operation is active. LEDs **A1...A6** no longer flash, but rather indicate the output status.

ℹ Manual operation is always exited after an ETS programming operation.

ℹ Depending on the configuration of the actuator in the ETS, the outputs will be set to the state last adjusted in manual operation or to the state internally tracked (e.g. forced position, service operation) when permanent manual operation mode is switched off.

Operating the outputs

In manual operation mode the outputs can be operated instantly. The outputs are always activated with pulse width modulation by manual operation with the **Open** command. The cycle time of the PWM signal for a valve output activated by manual operation is configured centrally on the parameter page "Manual operation" in the ETS. The **Close** command closes the valves completely (0%).

The device is in permanent or temporary manual operation mode.

- Press the ✋|→ button briefly, < 1 s, as many times as necessary until the desired output is selected.

  The LED of the selected output **A1...A6** flashes. Additionally, the status of the selected output is indicated by the LED **Open** or **Close**.

- Press the **Open** button.

  The valve opens (configured valve direction of action is taken into account).

- Press the **CLOSE** button.

  The valve closes (configured valve direction of action is taken into account).

  The LEDs **Open** and **Close** display the valve status.

ℹ Temporary manual operation mode: After running through all of the outputs, the device exits manual operation mode after the ✋|→ button is briefly pressed again.

ℹ Executing the Open command when valves are already opened causes no reaction. The cycle time of a PWM signal is not restarted. On previously closed valves, pressing the Close button also does not produce a reaction.

ℹ Depending on the parameter configuration in the ETS, feedback telegrams are transmitted to the bus via the status objects of an output during operation, as necessary.

Operating all outputs simultaneously

All the valve outputs of the actuator can be activated at the same time. In contrast to the operating function using the Open or Close buttons, the actuator always activates the valve outputs with a constant signal (0% or 100%), when they are activated simultaneously. This causes the valves to close or open completely. No pulse width modulation is executed.
This operating function is particularly practical for performing the First Open function of deenergised closed valves during first commissioning.

The device is in permanent manual operation mode.

- Press the ALL OP / CL button.

  Each time the button is pressed, the valves open and close alternately, depending on the status of the valve output currently selected (all open -> all close -> all open...). The configured valve direction of action is taken into account.

ℹ Executing the Open central command when valves are already opened causes PWM to be terminated. The command value switches to 100%. The cycle time of a PWM signal is not restarted. On previously closed valves, executing the Close central command does not produce a reaction.

ℹ The ALL OP / CL button has no function in temporary manual operation mode. In this case pressing this button produces no reaction.

Disabling bus control of individual outputs via manual operation

It is possible to use manual operation to disable selected valve outputs in such a way that they can no longer be activated via the bus.

The device is in permanent manual operation mode.

Disabling of the bus control mode must have been enabled in the ETS.

- Press the button ✋|→ briefly as many times as necessary until the desired output is selected.

  The status LED of the selected output A1...A6 flashes. The two status LEDs Open and Close show the current status of the selected output.

- Press the Open and Close buttons simultaneously for at least 5 seconds.

The selected valve output is disabled (activation via the bus no longer possible). The status LED of the disabled output flashes quickly and constantly (even with manual operation deactivated).

ℹ An output that has been disabled in manual operation can thereafter only be operated in permanent manual operation mode.

Cancelling the disabling of bus control of individual outputs via manual operation

The device is in permanent manual operation mode.

Bus control of a valve output has been disabled previously in permanent manual operation mode.

- Press the button ✋|→ briefly as many times as necessary until the desired output is selected.

  The status LED of the selected output **A1...A6** flashes quickly. The two status LEDs **Open** and **Close** show the current status of the selected output.

- Press the **Open** and **Close** buttons simultaneously for at least 5 seconds.

  Selected output is enabled.

  The selected valve output is re-enabled (activation via the bus is possible again after manual operation has been deactivated).

  The status LED of the enabled output flashes slowly.

8.2 ETS configuration

8.2.1 Manual operation

All outputs of the device have electronic manual operation. The button field with 4 function buttons and 3 status LEDs on the front panel of the device can be used for setting the following modes of operation:

- Bus operation: operation via push-button sensors or other bus devices
- Temporary manual operation mode: manual operation locally with button field, automatic return to bus operation
- Permanent manual operation mode: local manual operation with keypad

Manual operation is possible while the device is supplied with power from the bus supply voltage. In the as-delivered state, manual operation is fully enabled. In this unprogrammed state, all the outputs can be controlled by manual operation, so that fast function checking (e.g. on the construction site) is possible.

After initial commissioning of the actuator via the ETS, manual operation can be enabled or completely disabled.

Disabling manual operation permanently

Manual operation is enabled in the as-delivered state. If the parameter of the same name is deactivated on the "Manual operation" parameter page, no parameters and communication objects for manual operation are available. The outputs can then only be controlled via the bus.

In the case of a temporary status indication, the status LEDs continue to indicate the status of the outputs when the "Manual operation" button is pressed.

Disabling manual operation temporarily

Manual operation can be separately disabled via the bus, even if it is already active. If the disabling function is enabled, then as soon as a disabling telegram is received via the disabling object, the actuator immediately terminates any activated manual operation and locks the function keys on the front panel of the device. The telegram polarity of the disabling object is parameterisable.

Manual operation must be enabled.

■ Activate the parameter "Disabling function" on the "Manual operation" parameter page.

The disabling function of manual operation is enabled and the disabling object becomes visible.

■ Select the desired telegram polarity in the parameter "Object polarity".

ℹ If the polarity is "0 = disabled / 1 = enabled", the disabling function is immediately active on bus voltage return or after an ETS programming operation (object value "OFF"). To activate manual operation in this case, an enable telegram "ON" must first be sent to the disabling object.

ℹ After bus voltage return, a disabled state that was active beforehand is always inactive when the polarity of the disabling object is non-inverted.

ℹ When an active manual operation is terminated by a disable, the actuator will also transmit a "Manual operation inactive" status telegram to the bus, if the status messaging function is enabled.

Presetting the behaviour at the beginning and at the end of manual operation

Manual operation distinguishes between the temporary and permanent manual operation modes. The behaviour is different depending on these operating modes, especially at the end of manual operation. It should generally be noted that bus operation is always disabled while the manual operation mode is active. This means that manual operation has the highest priority.

Behaviour at the beginning of manual operation:
The behaviour at the beginning of manual operation does not differ for temporary and permanent manual operation modes. On activation of manual operation mode, the most recently set states of the outputs initially remain active. Active functions such as forced position, valve rinsing, and service operation can be overridden by manual operation. These functions are reactivated after deactivation of the manual operation mode unless they have been cancelled in the meantime via the KNX. Then the function with the higher priority is always executed.

Behaviour at the end of manual operation:
The behaviour at the end of manual operation is different for temporary and permanent manual operation modes. The temporary manual operation mode is shut off automatically when the last output has been addressed and when the selection button ✋|→ is pressed once more. During deactivation of the temporary manual operation mode, the actuator returns to 'normal' bus operation and does not change the states selected by manual control. If, however, a function such as forced position, valve rinsing or service operation has been activated via the KNX before or during manual operation, the actuator executes these functions with higher priority again for the affected outputs.
The permanent manual operation mode is shut off when the selection button ✋|→ is pressed for more than 5 seconds. Depending on the configuration of the actuator in the ETS, the outputs will be set to the state last adjusted in manual operation or to the state internally tracked when permanent manual operation mode is switched off. The parameter "At end of permanent manual operation" defines the corresponding reaction.

- Set the parameter "At end of permanent manual operation" to "no change".

  All telegrams received during active permanent manual operation for direct operation will be rejected. After the end of permanent manual operation, the current state of all outputs remains unchanged. If, however, a forced position, a valve rinsing or a service operation has been activated via the KNX before or during manual operation, the actuator executes these functions with a higher priority for the affected outputs.

- Set the parameter "At end of permanent manual operation" to "track outputs".

During active permanent manual operation, all incoming telegrams are tracked internally. At the end of manual operation, the outputs will be set to the tracked states or to the positions last set before the permanent manual operation. The individual priorities of the functions with respect to one another are taken into account here. Only the function with the greater priority is executed.

ℹ The operations triggered during manual operation update the states of the feedback and status objects. Telegrams are also transmitted to the KNX, if the signal objects concerned are enabled in the ETS and are configured as actively transmitting.

ℹ During an ETS programming operation, an activated manual operation mode will always be terminated. In this case, the parameterised or predefined behaviour at the end of manual operation will not be executed. The actuator executes the configured behaviour after ETS programming instead.

Presetting the status message function for manual operation

An actuator can transmit a status telegram to the KNX via a separate object when the manual operation is activated or deactivated. The status telegram can only be transmitted when the bus voltage is switched on. The polarity of the status telegram can be parameterised.

Manual operation must be enabled.

- Activate the parameter "Status object" on the "Manual operation" parameter page.

  The status messaging function of manual operation is enabled and the status object is visible.

- Specify in the parameter "Function" whether the status telegram is generally an "ON" telegram whenever manual operation is activated or only in those cases where permanent manual operation is activated.

ℹ The status object is always "OFF" when the manual operation is deactivated.

ℹ The "inactive" status is transmitted automatically to the bus after bus voltage return or an ETS programming operation.

ℹ When active manual operation is terminated by a disable, the actuator will also transmit a "Manual operation inactive" status telegram to the bus.

Setting disabling of the bus control

Individual outputs can be disabled locally by manual operation on the device so that the connected valves can no longer be controlled via the KNX. Such disabling of the bus operation is initiated by operation in permanent manual operation mode and is indicated by rapid flashing of the status LEDs on the front panel of the device. The disabled outputs can then only be activated in permanent manual operation.

Manual operation must be enabled.

- Activate the parameter "Disable bus control of individual outputs" on the parameter page "Manual operation".

  The function for disabling the bus control is enabled and can be activated locally. Alternatively, deactivating the parameter prevents disabling of the bus control from being activated in permanent manual operation mode.

ℹ The disabling initiated locally has the highest priority. Thus all other functions of the actuator that can be activated via KNX (e.g. forced position, valve rinsing or service operation) are overridden. The bus-disabled output remains in the state last set in permanent manual operation mode.
Depending on the configuration of the actuator in the ETS, the groups will be set to the state most recently set or internally tracked after the disabling and subsequent deactivation of permanent manual operation mode.

ℹ The disabling function of manual operation does not influence bus-disabled outputs.

ℹ A failure of the bus voltage or an ETS programming operation deactivates disabling of the bus control.

8.2.2 Status indication

The status LEDs on the front of the device can indicate the current status of the outputs permanently or temporarily.

– Continuous status indication:
  The parameter "Indicate status temporarily" on the "Status indication" parameter page is deactivated. In the case of a continuous status indication, the status LEDs always indicate the current status of the outputs.
– Temporary status indication:
  The parameter "Indicate status temporarily" on the "Status indication" parameter page is activated. During temporary indication, the status indication is activated by pressing the "Manual operation" button. The display length is set in the ETS.
  If manual operation is enabled in the ETS, pressing the "Manual operation" button also activates the temporary or permanent manual operation mode. The status indication always remains active during manual operation. At the end of manual operation mode, the display length of the temporary status indication is restarted. The status LEDs then go out after the configured time has elapsed.
  If manual operation is not enabled in the ETS, all status LEDs only show the status of the outputs when the "Manual operation" button is pressed, depending on the duration of the display.

ℹ In the as-delivered state, the continuous status indication is preset.

If the parameter "Control via object" is activated, the "Temporary status indication" communication object is available in the ETS. This object is bidirectional and can firstly signal the status of the temporary status indication, and secondly, activate the status display. If a temporary status indication has been activated by pressing the "Manual operation" button, the object transmits the value "ON". If the object receives a telegram with the value "OFF" or "ON", the status LEDs indicate the status of the outputs according to the display length. Manual operation is not activated in this case.

By linking the "Temporary status indication" objects of several actuators using a common group address, the indication functions of the status LED can be synchronized with one another. It is thus possible to activate the status indications of all actuators in a control cabinet at the same time if manual operation is triggered on one actuator only - e.g. for service or maintenance purposes.
In addition, the "Temporary status display" object could be controlled, for example, by a magnetic contact connected to the KNX, so that the status indications of all actuators are activated by opening the control cabinet door. If the door is closed, the status indications for energy saving remain switched off.

ℹ During a running display length, the "Temporary status indication" object does not transmit any new telegrams if the "Manual operation" button is pressed again.

8.3 Operation and indication parameters

Manual operation

Manual operation	Checkbox (**yes** / no)
Manual operation is possible while the device is supplied with power from the bus supply voltage. This parameter defines whether manual operation is to be possible or deactivated permanently.	

PWM cycle time	0.5 minutes 1 minute 1.5 minutes 2 minutes ... 19.5 minutes **20 minutes**
During manual operation, all the valve outputs are activated with a pulse-width modulation (PWM) using the OPEN button, irrespective of the configured command value data format (1-bit or 1-byte). The cycle time of the PWM signal for a valve output activated by manual operation is configured by this parameter. In consequence, manual operation locally on the device can allow the use of a different cycle time than in normal operation of the actuator (activation via KNX telegrams). The CLOSE command always closes the valves completely (0%). An exception is the central operating function of all valve outputs with the ALL OP / CL button. Here, the actuator always activates the valve outputs with a constant signal (0% or 100%).	

PWM command value	5...**50**...100 %
This parameter specifies the pulse-pause ratio of the pulse width modulation of the manual operation for opened valve outputs.	

Disabling function	Checkbox (yes / **no**)
Manual operation can be disabled via the KNX, even if it is already active. For this purpose, the disabling object can be enabled here. This parameter is only visible if manual operation is enabled.	

Object polarity	**0 = enabled / 1 = disabled** 0 =disabled/ 1 = enabled
This parameter sets the polarity of the disabling object. This parameter is only visible if the disabling function is enabled.	

Status object	Checkbox (yes / **no**)
An actuator can transmit a status telegram to the KNX via a separate object when the manual operation is activated or deactivated. This parameter is only visible if manual operation is enabled.	

Function	**0 = inactive; 1 = manual operation active** 0 = inactive; 1 = permanent manual operation active
This parameter defines the information contained in the status object. The object is always "OFF" when manual operation is deactivated. 0 = inactive; 1 = manual operation active: The object is "ON" when manual operation is active (temporary or permanent). 0 = inactive; 1 = permanent manual operation active: The object is only "ON" when permanent manual operation is active. This parameter is only visible if the status function is enabled.	

At end of permanent manual operation	**No change** Output tracking
The behaviour of the actuator at the end of permanent manual operation depends on this parameter. This parameter is only visible if manual operation is enabled. no change: All telegrams received during active permanent manual operation for direct operation (switching, long-time/short-time, positioning, central, scenes, command value telegrams) will be rejected. After the end of the permanent manual operation, the current state of all outputs which was most recently active in manual operation remains unchanged. If, however, a forced position, a disabling function, a safety function or a sun protection function (independent of priority) has been activated via the KNX before or during manual operation, the actuator executes these functions with a higher priority for the outputs concerned. Track outputs: During active permanent manual operation, all incoming telegrams (blinds operation exception: short-time telegrams – step/stop) are internally tracked. At the end of the manual operation, the outputs will be set to the tracked states or to the positions last set before the permanent manual operation for Venetian blind outputs. The individual priorities of the functions with respect to one another are taken into account here. Only the function with the greater priority is executed. Long time operation is not tracked in Venetian blind operation if the corresponding Venetian blind output is already in the appropriate end position. This parameter is only visible if manual operation is enabled.	

Bus control of individual outputs can be disabled	Checkbox (yes / **no**)
Individual outputs can be disabled locally during permanent manual operation, so that the disabled outputs can no longer be controlled via the KNX. Disabling via manual operation is only permitted if this parameter is activated. This parameter is only visible if manual operation is enabled.	

Status indication

Indicating status temporarily	Checkbox (yes / **no**)
The status LEDs on the front of the device can indicate the current status of the outputs permanently or temporarily. Parameter deactivated: Continuous status indication. In this case, the status LEDs always indicate the current status of the outputs. Parameter activated: Temporary status indication. In this case, the status indication is activated by pressing the "Manual operation" button. The display length is set in the ETS. If manual operation is enabled in the ETS, pressing the "Manual operation" button also activates the temporary or permanent manual operation mode. The status indication always remains active during manual operation. At the end of manual operation mode, the display length of the temporary status indication is restarted. The status LEDs then go out after the configured time has elapsed.	

Display length	6 ... **10** ... 255 s
This parameter defines the display length if the temporary status indication is activated.	

Control via object	Checkbox (yes / **no**)
If the parameter "Control via object" is activated, the "Temporary status indication" communication object is available in the ETS. This object is bidirectional and can firstly signal the status of the temporary status indication, and secondly, activate the status display. If a temporary status indication has been activated by pressing the "Manual operation" button, the object transmits the value "ON". If the object receives a telegram with the value "OFF" or "ON", the status LEDs indicate the status of the outputs according to the display length. Manual operation is not activated in this case.	

8.4 Operation and indication object list

Object no.	Function	Name	Type	DPT	Flag
1	Disabling	Manual operation - Input	1-bit	1,003	C, (R), W, -, A
1-bit object for disabling manual operation on the device. The polarity can be configured.					

Object no.	Function	Name	Type	DPT	Flag
2	Status	Manual operation - Output	1-bit	1,002	C, R, -, T, A
1-bit object for manual operation status transmission. The object is "OFF" when manual operation is deactivated (bus control). The object is "ON" when manual operation is activated. You can configure whether temporary or permanent manual operation will be indicated as status information or not.					

Object no.	Function	Name	Type	DPT	Flag
3	Temporary status indication	Manual operation - Input/Output	1-bit	1,002	C, (R), W, T, A
1-bit object to signal and activate the temporary status indication. This object is bidirectional and can firstly signal the status of the temporary status indication, and secondly, activate the status display. If a temporary status indication has been activated by pressing the "Manual operation" button, the object transmits the value "ON". If the object receives a telegram with the value "OFF" or "ON", the status LEDs indicate the status of the outputs according to the display length. Manual operation is not activated in this case. The object is only visible if the temporary status indication is activated					

9 Valve outputs

9.1 Priorities for valve outputs

The heating actuator distinguishes between various functions and events, which either affect all of some of the assigned valve drives globally, or only specifically affect individual outputs. Because these functions and events cannot be executed simultaneously, there must be priority control. Each global or output-orientated function and each incoming event possesses a priority. The function or the event with the higher priority overrides the lower-priority functions and events.

The following priorities are defined...

- Overload / short-circuit (highest priority)
- Manual operation
- Behaviour after ETS programming
- Response to bus voltage return
- Service mode
- Valve rinsing
- forced position
- Command value limit
- Emergency operation (through cyclical monitoring of the command value)
- Normal operation (activation using command value telegrams)

ℹ The behaviour after an ETS programming operation is only executed if there have been changes in the configuration of the device. If just an application download is executed with a project design already located in the actuator, then the actuator will executed the behaviour after bus voltage return.

In manual operation and in service mode, a parameter separately defines the behaviour of each of the valve outputs at the end of these functions. The heating actuator only then executes the configured behaviour if, at the time of enabling, no function with a lower priority is active. Should a lower-level function be active (e.g. forced position), then the actuator will execute the behaviour of this function again.

ℹ Special case: A function with a higher priority (e.g. manual operation) is active. Before this, a function with a lower priority (e.g. service mode) was active. This function is deactivated whilst the higher-level function remains active. At the end of the higher-priority function, the state of the outputs should be tracked. The actuator then evaluates the command value of the lower-level function and checks how the behaviour is preset or configured here. The actuator then executes the command value presetting of the lower-level function. If tracking is also preset or configured for this function, the actuator will still go one layer lower and evaluate the behaviour configured there.

Example 1: Service mode is active (valve completely opened / 100% command value). A value of 10% was most recently preset via a command value telegram (normal operation). No other functions are active. Service mode is

configured in such a way that the starting state should be tracked at the end of this function.
Permanent manual operation is now activated. The actuator assumes the command value of manual operation (e.g. 50%). Whilst manual operation is active, service mode is deactivated via the KNX. The actuator remains in manual operation until this is exited via the button field. As no more lower-level functions are active, the heating actuator evaluates the parameter "Behaviour at the end of permanent manual operation during bus operation". As this parameter is set to "Track outputs", the actuator now evaluates the command value to be tracked. For this, it checks how the behaviour at the end of service mode is preset. Here too, the state should be tracked. Thus, the actuator evaluates the other lower-level functions. As no other functions were and are activated, the actuator sets the last command value presetting at the valve output using the KNX telegram (here 10%).

Example 2: Service mode is active (valve completely opened / 100% command value). A value of 10% was most recently preset via a command value telegram (normal operation). No other functions are active. Service mode is configured in such a way that no change should be executed at the end of this function.
Permanent manual operation is now activated. The actuator assumes the command value of manual operation (e.g. 50%). Whilst manual operation is active, service mode is deactivated via the KNX. The actuator remains in manual operation until this is exited via the button field. As no more lower-level functions are active, the heating actuator evaluates the parameter "Behaviour at the end of permanent manual operation during bus operation". As this parameter is set to "Track outputs", the actuator now evaluates the command value to be tracked. For this, it checks how the behaviour at the end of service mode is preset. There, the configuration states that there should be no change. Thus, the heating actuator for the affected valve output assumes the command value of service mode (here 100%) and sets this at the output. In this case, the actuator no longer evaluates other lower-level functions.

9.2 Channel configuration

To simplify project design, all valve outputs can be activated or deactivated individually in the ETS. Parameters and communication objects of the deactivated channels are hidden.

To simplify further, the valve outputs can be assigned to the same parameters and thus configured identically. The parameter "Parameterisation" stipulates whether every valve output of the device can be configured individually or whether the parameters of valve output 1 are to be applied.

With the setting "like VO 1", the parameter pages in the ETS are reduced. The visible parameters of the first valve output are then automatically also applied to this valve output. Only the communication objects can then be configured separately for the outputs. This setting should be selected, for example, if all the actuators behave identically and should only be activated by different group addresses (e.g. in office

blocks or in hotel rooms).
In the parameter setting "individually", each valve output possesses its own parameter pages in the ETS.

9.2.1 Channel configuration parameters

General -> Configuration

VO x (x = 1 ... 6) Use	Checkbox (yes / **no**)
Valve outputs that are not required can be activated or deactivated. If the following parameter "Parameterisation" is set to "like VO 1" for one of the following valve outputs, valve output 1 is activated automatically.	

VO x (x = 1 ... 6) Parameterisation	**individually** / like VO 1
To simplify the configuration, all the valve outputs can be assigned to the same parameters in the ETS and thus configured identically. This parameter stipulates whether a valve output of the device can be configured individually or whether the parameters of valve output 1 are to be applied. For valve output 1, the parameter is permanently set to "individually".	

9.3 Channel-independent functions

The heating actuator possesses a number of channel-independent functions that can be used for all valve outputs. To be able to use these functions, they must be enabled on the "General valve outputs" parameter page. The parameters of these channel-independent functions are set on parameter pages of their own.

In addition to the general enabling of the channel-independent functions, the individual valve outputs must also, in some cases, be assigned to the functions on the parameter pages "VOx - General -> Assignments".

9.3.1 Heat requirement

Heat requirement control

The heating actuator possesses heat requirement control. Here, the actuator continuously evaluates the command values of assigned outputs and makes general heat requirement information available as a 1-bit control value in the form of limiting value monitoring with hysteresis. Using a KNX switch actuator, this allows the energy-efficient activation of burner and boiler controllers with suitable control inputs (e.g. requirement-orientated switchover between the reduction and comfort setpoint in a central combi boiler).
A heat requirement is only signalled by the actuator via the object of the same name when at least one command value of the assigned outputs exceeds a limiting value with hysteresis defined in the ETS. A heat requirement signal is retracted when the limiting value is reached or undershot again (see figure 5). The telegram polarity of the heat requirement information can be configured.

ℹ In addition, valve outputs, which receive preset command values via the data format "Switching (1-bit)" and "Switching (1-byte) with command value limiting value", influence the heat requirement control. In the case of "Switching (1-bit)", an "OFF" command value is interpreted as "0%" and an "ON" command value as "100%". In the case of "Switching (1-byte) with command value limiting value", the actuator evaluates the converted switching output signal in the same way ("OFF" is interpreted as "0%", "ON" is interpreted as "100%").

ℹ With some functions and events, valve outputs, which are configured to the command value data formats "Switching (1-bit)" and "Switching (1-byte) with command value limiting value", are always activated via a constant command value through pulse width modulation (PWM), providing that command values not equal to 0% or 100% are to be set (after bus voltage return, after an ETS programming operation, during manual operation, with an active forced position and with active emergency operation). PWM keeps being executed until the named functions have been exited or, after the named events, no more lower-level functions are active and a new command value telegram is received via the bus, overriding the constant command value on the valve output.
In this case, the constant command value set by the PWM is also included in the heat requirement control.

ℹ After bus voltage return and an ETS programming operation, the actuator always first transmits the status "No heat requirement" without a delay. The actuator then updates the status to "Heat requirement", providing that the condition for this has been fulfilled and an optionally configured "Heat requirement ACTIVE" has elapsed.

ℹ A valve output affected by a short-circuit / overload (valve completely closed on deenergised closed or completely opened on deenergised opened) does not influence the heat requirement control.

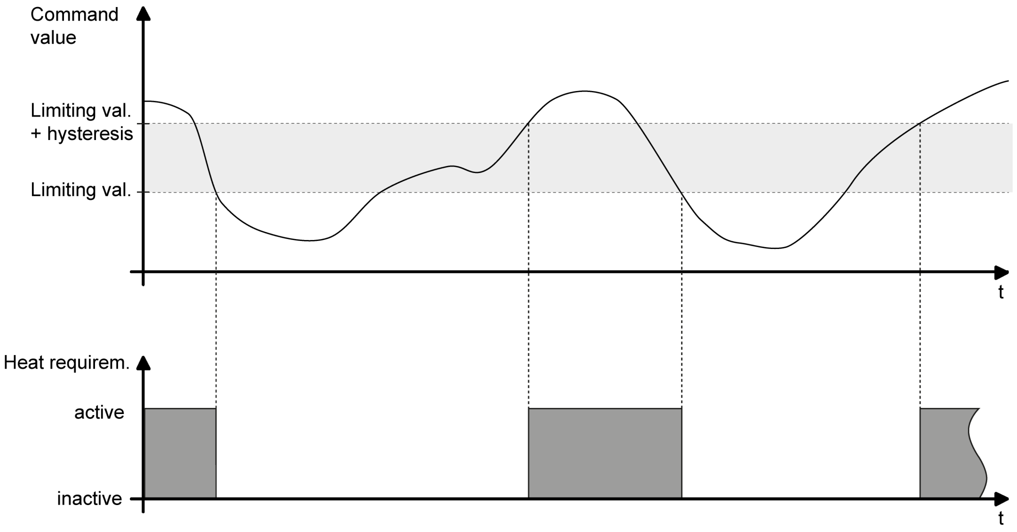


Figure 5: Heat requirement information with sample command value characteristic

Optionally, the actuator can evaluate an external telegram for heat requirement information (e.g. from another heating actuator). This allows the cascading of multiple actuators with a heat requirement signal. The local heating actuator links the 1-bit telegram value of "External heat requirement" object with the internal state of its own heat requirement logically as OR and outputs the result of this link via the object "Heat requirement". The telegram polarity of the external object is fixed:
"0" = Heat requirement INACTIVE, "1" = Heat requirement ACTIVE.

The actuator only outputs the telegram of an active heat requirement after determination when the delay time defined by the parameter "Delay heat requirement INACTIVE" has elapsed. No heat requirement request is transmitted if the actuator no longer determines a heat requirement within the preset time.
The actuator only retracts heat requirement information after determination when the delay time defined by the parameter "Delay heat requirement INACTIVE" has elapsed. The heat requirement information is not retracted if the actuator no longer determines a new heat requirement within the preset time.

Enabling and configuring the "Heat requirement" function

The heat requirement function must first be enabled on the parameter page "General valve outputs" so that it can be used during actuator operation. The remaining parameters are set on the parameter page "Heat requirement". Additionally, the parameter pages of the individual valve outputs are relevant.

- Configure the parameter "Object polarity" to the required telegram polarity. In addition, define the minimum command value and hysteresis.

  Heat requirement control is activated. The heat requirement information becomes active according to the set telegram polarity, if at least one command value of the assigned valve outputs exceeds the configured limiting value plus hysteresis. The heat requirement becomes inactive when the limiting value is reached or undershot again.
  The valve outputs must be assigned to the heat requirement control individually on the parameter pages "VOx General -> Assignments" so that they are included in the requirement determination.

- Deactivate the "Heat requirement" checkbox.

  Heat requirement control is not available.

Enabling detection of an external heat requirement

Optionally, the actuator can evaluate an external telegram for heat requirement information (e.g. from another heating actuator). This allows the cascading of multiple actuators with a heat requirement signal.
The object must be enabled for an external heat requirement to be recorded.

- Activate the checkbox "Detect external heat requirement via object".

  The "Heat requirement - External" object is enabled. The local heating actuator links the 1-bit telegram value of this object with the internal state of its own heat requirement logically as OR and outputs the result of this link via the object "Heat requirement - Status".

- Deactivate the checkbox "Detect external heat requirement via object".

  Detection of an external heat requirement is not possible. The actuator only determines the heat requirement information itself.

ℹ Cyclical telegrams to the object "Heat requirement - External" with an identical telegram polarity (ON -> ON, OFF -> OFF) cause no reaction.

ℹ After a device reset, there is no polling of the current status of the object "Heat requirement - External". Only when a bus telegram is received does the actuator take this status into account during evaluation of the heat requirement.

9.3.1.1 Heat requirement parameters

Enabling the heat requirement function

General valve outputs -> Enabled functions

Heat requirement	Checkbox (yes / **no**)
The heating actuator can even evaluate the command values of its outputs and make general heat requirement available in the form of limiting value monitoring with hysteresis (1-bit, switching). Using a KNX switch actuator, this allows the energy-efficient activation of burner and boiler controllers with suitable control inputs (e.g. requirement-orientated switchover between the reduction and comfort setpoint in a central combi boiler). Here, the heat requirement control of the actuator can be enabled centrally. The valve outputs must be assigned to the heat requirement control individually on the parameter pages "VOx General -> Assignments" so that they are included in the requirement determination.	

Setting the heat requirement function

General valve outputs -> Heat requirement

Minimum command value	0 ... **5**...100 %
The actuator only signals a heat requirement when at least one command value of the assigned outputs exceeds the limiting value defined here plus the hysteresis (see next parameter). A heat requirement signal is retracted when the limiting value is reached or undershot again. This parameter is visible only if the heat requirement function is enabled.	

Hysteresis of the minimum command value	1...**10**...20 %
This parameter specifies the hysteresis of the limiting value of the minimum command value of the heat requirement control. The actuator signals a heat requirement when a command value exceeds the defined limiting value plus the hysteresis defined here. This parameter is visible only if the heat requirement function is enabled.	

<table>
<tr><td>Switch-on delay (heat requirement)</td><td>0...23 h
0...5...59 min
0…59 s</td></tr>
<tr><td colspan="2">The actuator only outputs the telegram of an active heat requirement after determination when the delay time defined here has elapsed. No heat requirement request is transmitted if the actuator no longer determines a heat requirement within the time preset here. This parameter is visible only if the heat requirement function is enabled.
Definition of the hours, minutes and seconds of the delay time.</td></tr>
</table>

<table>
<tr><td>Switch-off delay (no heat requirement)</td><td>0...23 h
0...5...59 min
0…59 s</td></tr>
<tr><td colspan="2">The actuator only retracts heat requirement information after determination when the delay time defined here has elapsed. The heat requirement information is not retracted if the actuator no longer determines a new heat requirement within the preset time. This parameter is visible only if the heat requirement function is enabled.
Definition of the hours, minutes and seconds of the delay time.</td></tr>
</table>

<table>
<tr><td>Object polarity</td><td>1 = heat requirement / 0 = no heat requirement
0 = heat requirement / 1 = no heat requirement</td></tr>
<tr><td colspan="2">This parameter defines the telegram polarity of the "Heat requirement - Status" object. It is visible only if the heat requirement function is enabled.</td></tr>
</table>

<table>
<tr><td>Detect external heat requirement via object?</td><td>Checkbox (yes / no)</td></tr>
<tr><td colspan="2">The actuator is able to evaluate an external heat requirement (e.g. from another heating actuator). The local heating actuator links the external telegram with the internal status of its own heat requirement logically as OR and outputs the result of this link via the object "Heat requirement".
In the "yes" setting, this parameter will enable the object "Heat requirement - External". It is visible only if the heat requirement function is enabled.</td></tr>
</table>

9.3.1.2 Objects for heat requirement

Object no.	Function	Name	Type	DPT	Flag
10	Heat requirement - Status	General valve outputs - Output	1-bit	1,002	C, R, -, T, -

1-bit output object for the transmission of general heat requirement information to suitable burner and boiler controllers. A heat requirement is only signalled by the actuator when at least one command value of the assigned outputs exceeds a limiting value with hysteresis defined in the ETS. A heat requirement signal is retracted when the limiting value is reached or undershot again. In addition, the actuator can optionally evaluate an external telegram (object 11).
The telegram polarity can be configured. After bus voltage return and an ETS programming operation, the actuator always first transmits the status "No heat requirement" without a delay. The actuator then updates the status to "Heat requirement", providing that the condition for this has been fulfilled and an optionally configured "Heat requirement ACTIVE" has elapsed.

Object no.	Function	Name	Type	DPT	Flag
11	Heat requirement - External	General valve outputs - Input	1-bit	1,002	C, (R), W, -, -

1-bit input object for the cascading of multiple actuators with a heat requirement signal. The transmitting object of a heat requirement signal of another heating actuator can be connected to this object. The local heating actuator links the external telegram with the internal status of its own heat requirement logically as OR and outputs the result of this link via the object 10.
In this case, the telegram polarity is fixed: "0" = Heat requirement INACTIVE, "1" = Heat requirement ACTIVE.
Cyclical telegrams to this object with an identical telegram polarity (ON -> ON, OFF -> OFF) produce no reaction. After a device reset, there is no polling of the current status of this object. Only when a bus telegram is received does the actuator take this status into account during evaluation of the heat requirement.

9.3.2 Pump control

The heating actuator allows switching activation of the circulation pump of the heating or cooling circuit via a 1-bit KNX telegram. When using the pump controller, the pump is only switched on by the actuator via the "Pump control - Switch" object if at least one command value of the assigned outputs exceeds a limiting value with hysteresis defined in the ETS. The pump is switched off when the limiting value is reached or undershot again (see figure 6). This saves electrical energy, as the pump is only activated by sufficiently large, and thus effective, command values.
Optional cyclical anti-sticking protection prevents the sticking of the pump, if it has not been switched on by the command value evaluation for a longer period of time.
The telegram polarity of the pump control can be configured.

i In addition, valve outputs, which receive preset command values via the data format "Switching (1-bit)" and "Switching (1-byte) with command value limiting value", influence the pump control. In the case of "Switching (1-bit)", an "OFF" command value is interpreted as "0%" and an "ON" command value as "100%". In the case of "Switching (1-byte) with command value limiting value", the actuator evaluates the converted switching output signal in the same way ("OFF" is interpreted as "0%", "ON" is interpreted as "100%").

i With some functions and events, valve outputs, which are configured to the command value data formats "Switching (1-bit)" and "Switching (1-byte) with command value limiting value", are always activated via a constant command value through pulse width modulation (PWM), providing that command values not equal to 0% or 100% are to be set (after bus voltage return, after an ETS programming operation, during manual operation, with an active forced position and with active emergency operation). PWM keeps being executed until the named functions have been exited or, after the named events, no more lower-level functions are active and a new command value telegram is received via the bus, overriding the constant command value on the valve output.
In this case, the constant command value set by the PWM is also included in the pump control.

i After bus voltage return and an ETS programming operation, the actuator always first transmits the status "Pump OFF" without a delay. The actuator then updates the status to "Pump ON", providing that the condition for this has been fulfilled and an optionally configured "Pump delay ACTIVE" has elapsed.

i A valve output affected by a short-circuit / overload (valve completely closed on deenergised closed or completely opened on deenergised opened) does not influence the pump control.

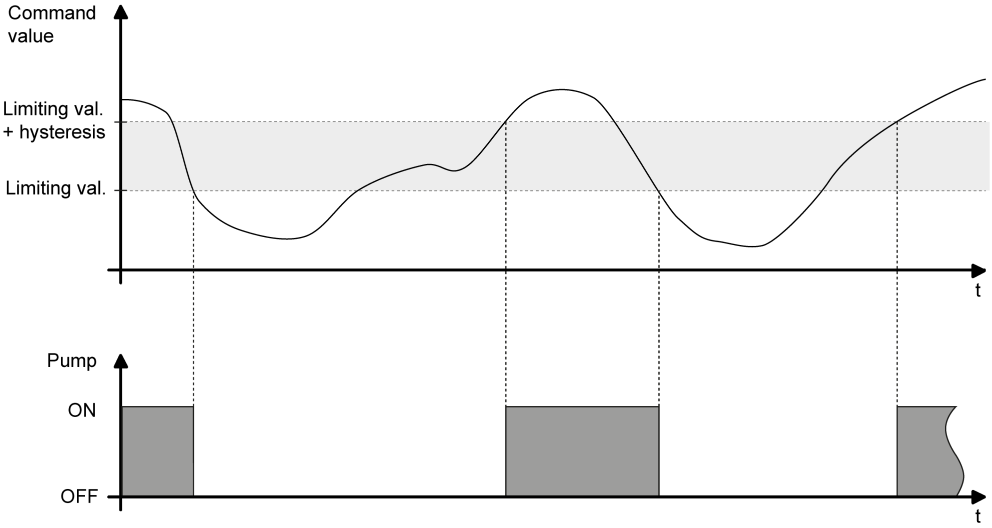


Figure 6: Pump control with sample command value characteristic

Optionally, the actuator can evaluate an external pump control signal (e.g. from another heating actuator). This allows the cascading of multiple actuators with pump control. The local heating actuator links the 1-bit telegram value of the "Pump control - External" object with the internal state of the pump logically as OR and outputs the result of this link via the "Switch pump" object. The telegram polarity of the external object is fixed: "0" = Pump OFF, "1" = Pump ON.

The actuator only outputs the ON telegram to the pump after determination when the defined delay time has elapsed. The pump is not switched on when the actuator determines within the preset time that the pump must remain switched off, due to a limiting value plus hysteresis again being undershot.
The actuator only outputs the OFF telegram to the pump after determination when the defined delay time has elapsed. The pump is not switched on when the actuator determines within the preset time that the pump must remain switched off, due to a limiting value again being exceeded.
The delay times of the pump controller can be used as an example to match the running time of the pump to the reaction time of the actuated actuators. Thus, a pump should only switch on when the actuators actually open after electrical activation by the actuator (match pump ACTIVE delay with the dead time of the actuators). The same applies to the closing of the valve drives.

If pump control is enabled, optional cyclical anti-sticking protection can prevent the sticking of the pump, if it has not been switched on by the command value evaluation for a longer period of time (e.g. in the case of heating systems in the summer months). When anti-sticking protection is enabled, the parameter "Cyclical switching on" defines the weekly interval of the protection function. If the pump is not switched on at least once during the set time by the pump controller, then the actuator will execute anti-sticking protection, if necessary on a regular basis. The cycle time is reset and restarted on each actuation of the pump by the pump control. The cycle time is started for the first time after a device reset.
When anti-sticking protection is enabled, the parameter "Switch-on time" defines how long the pump should run for the cyclical protection function. The actuator then switches the pump on for the set time without interruption, assuming that anti-sticking protection must be executed.

Enabling and configuring the pump control function

The "Pump control" function must first be enabled on the parameter page "General valve outputs" so that it can be used during actuator operation. The remaining parameters are set on the parameter page "Pump control". Additionally, the parameter pages of the individual valve outputs are relevant.

- Configure the parameter "Object polarity" to the required telegram polarity. In addition, define the minimum command value and hysteresis.

  Pump control is activated. The pump is switched on according to the set telegram polarity if at least one command value of the assigned valve outputs exceeds the configured minimum command value plus hysteresis. The pump is switched off when the minimum command value is reached or undershot again.
  The valve outputs must be assigned to the pump control individually on the parameter pages "VOx - General -> Assignments" so that they are included in the command value evaluation.

- Deactivate the parameter "Pump control".

  Pump control is not available.

Enabling detection of an external pump control

Optionally, the actuator can evaluate an external telegram for pump control (e.g. from another heating actuator). This allows the cascading of multiple actuators with pump control.
The object must be enabled for an external pump control signal to be detected.

- Activate the checkbox "Detect external pump control via object".

  The "Pump control - External" object is enabled. The local heating actuator links the 1-bit telegram value of this object with the internal state of its own pump control logically as OR and outputs the result of this link via the "Switch pump" object.

- Deactivate the checkbox "Detect external pump control via object".

  Recording of an external pump control signal is not possible. The actuator only controls the pump itself.

ℹ Cyclical telegrams to the "Pump control - External" object with an identical telegram polarity (ON -> ON, OFF -> OFF) cause no reaction.

ℹ After a device reset, there is no polling of the current status of the "Pump control - External" object. Only when a bus telegram is received does the actuator take this status into account when controlling the pump.

Configuring the anti-sticking protection of the pump controller

If pump control is enabled, optional cyclical anti-sticking protection can prevent the sticking of the pump, if it has not been switched on by the command value evaluation for a longer period of time. The anti-sticking protection must first be enabled on the parameter page "Pump control" so it is executed during actuator operation.

- Activate the checkbox. In addition, define the interval of the protection function in the parameter "Cyclical switching on". Configure the parameter "Switch-on time" to the required length of the pump run.

  Anti-sticking protection is activated. If the pump is not switched on at least once during the set time by the pump controller, then the actuator will execute anti-sticking protection, if necessary on a regular basis. The actuator then switches the pump on for the preset switch-on time.

- Deactivate checkbox.

  Anti-sticking protection is deactivated.

ℹ Once started, the anti-sticking protection always runs through to the end. It cannot be cancelled prematurely through the reception of new command values and the resulting restart of the cycle time.

9.3.2.1 Pump control parameters

Enabling the pump control function

General valve outputs -> Enabled functions

Pump control	Checkbox (yes / **no**)
The heating actuator allows switching activation of the circulation pump of a heating or cooling circuit via a 1-bit KNX telegram. Here, the pump control of the actuator can be enabled centrally ("yes" setting). The valve outputs must be assigned to the pump control individually on the parameter pages "Ax - Assignments", so that they are included in the control.	

Setting the pump control function

General valve outputs -> Pump control

Minimum command value	**0**...100 %
The actuator only switches the pump on when at least one command value of the assigned outputs exceeds the defined limiting value plus the hysteresis defined here (see next parameter). The pump is switched off when the limiting value is reached or undershot again. This parameter is visible only if the pump control is enabled.	

Hysteresis of the minimum command value	**1**...20 %
This parameter specifies the hysteresis of the limiting value of the minimum command value of the pump control. The actuator only switches the pump on when a command value exceeds the defined limiting value plus the hysteresis defined here. This parameter is visible only if the pump control is enabled.	

Anti-sticking protection

Activate	Checkbox (yes / **no**)
If pump control is enabled, optional cyclical anti-sticking protection can prevent the sticking of the pump, if it has not been switched on by the command value evaluation for a longer period of time. In the "Yes" setting, this parameter enables cyclical anti-sticking protection.	

Cyclical switching on	**1**...26 weeks
When anti-sticking protection is enabled, the length of protection function is defined here. If the pump is not switched on by the pump controller at least once during the time set here, then the actuator will execute anti-sticking protection, if necessary on a regular basis.	

Switch-on time	1...**5**...15 minutes
When anti-sticking protection is enabled, the length of pump running for the cyclical protection function must be preset here. The actuator then switches the pump on for the time set here without interruption, assuming that anti-sticking protection must be executed.	

Delay times

Switch-on delay (pump requirement)	**0**...59 min 0...**10**...59 s
The actuator only outputs the ON telegram to the pump after determination when the delay time defined here has elapsed. The pump is not switched on when the actuator determines within the time preset here that the pump must remain switched off, due to a limiting value plus hysteresis again being undershot. This parameter is visible only if the pump control is enabled. Definition of the minutes and seconds of the delay time.	

Switch-off delay (no pump requirement)	**0**...23 h 0...**10**...59 min **0**…59 s
The actuator only outputs the OFF telegram to the pump after determination when the delay time defined here has elapsed. The pump is not switched on when the actuator determines within the time preset here that the pump must remain switched off, due to a limiting value again being exceeded. This parameter is visible only if the pump control is enabled. Definition of the hours, minutes and seconds of the delay time.	

Object polarity	**0 = Switch off pump / 1 = Switch on pump** 1 = Switch off pump / 0 = Switch on pump
This parameter defines the telegram polarity of the "Pump control" object. It is visible only if the pump control is enabled.	

Detect external pump control via object	Checkbox (yes / **no**)
The actuator is able to evaluate an external pump control signal (e.g. from another heating actuator). The local heating actuator links the external telegram with the internal status of the pump logically as OR and outputs the result of this link via the object "Switch pump". This parameter will enable the object "External pump control" in the "Yes" setting. It is visible only if the pump control is enabled.	

9.3.2.2 Objects for pump control

Function: Pump control

Object no.	Function	Name	Type	DPT	Flag
6	Pump control - Switch	General valve outputs - Output	1-bit	1,001	C, R, -, T, -
1-bit output object for direct activation of a circulation pump of the heating or cooling system. The pump is only switched on by the actuator when at least one command value of the assigned outputs exceeds a limiting value with hysteresis defined in the ETS. The pump is switched off when the limiting value is reached or undershot again. In addition, the actuator can optionally evaluate an external telegram (object 7). The telegram polarity can be configured. After bus voltage return and an ETS programming operation, the actuator always first transmits the status "Pump OFF" without a delay. The actuator then updates the status to "Pump ON", providing that the condition for this has been fulfilled and an optionally configured "Pump delay ACTIVE" has elapsed.					

Function: Pump control

Object no.	Function	Name	Type	DPT	Flag
7	Pump control - External	General valve outputs - Input	1-bit	1,001	C, (R), W, -, -
1-bit input object for the cascading of multiple actuators with pump control. The transmitting operation for the pump control of another heating actuator can be connected to this object. The local heating actuator links the external telegram with the internal status of the pump logically as OR and outputs the result of this link via the object 6. In this case, the telegram polarity is fixed: "0" = Pump OFF, "1" = Pump ON. Cyclical telegrams to this object with an identical telegram polarity (ON -> ON, OFF -> OFF) produce no reaction. After a device reset, there is no polling of the current status of this object. Only when a bus telegram is received does the actuator take this status into account when activating the pump.					

9.3.3 Largest command value

Largest command value

Through evaluation and determination of the largest command value in the heating or cooling system, the actuator allows influencing of the energy consumption of a housing or commercial building. The information on the largest active 1-byte command value can be made available to suitable calorific furnaces with integrated KNX controller directly via a KNX telegram, for example, to determine the optimum flow temperature. If the function is enabled, the heating actuator evaluates all the active 1-byte command values of the valve outputs and transmits the externally received largest command value if there is a change by the interval preset in the ETS or cyclically via the object "Largest command value - Status".

ℹ In the case of valve outputs configured in the ETS to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value", there is no evaluation of the command values preset via the bus. Exception: It may also occur with such command value outputs that a constant command value is active (after bus voltage return, after an ETS programming operation, during manual operation, with an active forced position and with active emergency operation). In this case, this constant command value is also included in the calculation of the largest command value until the named functions with a higher priority are exited or a new command value telegram is received via the bus, overriding the constant command value at the valve output.

ℹ After bus voltage return and an ETS programming operation, the actuator transmits the current value of the largest command value without a delay, providing that automatic transmission on change is configured. After a full device reset, the actuator does not transmit automatically, when all the command values are set to 0%.
After a device reset, the actuator immediately starts the time for cyclical transmission (if configured), so that the object value effective after the reset is transmitted cyclically.

ℹ A valve output affected by a short-circuit / overload (valve completely closed on deenergised closed or completely opened on deenergised opened) does not influence the evaluation of the largest command value.

Optionally, the actuator can evaluate an external telegram for the largest command value (e.g. from another heating actuator). This allows the cascading of multiple actuators with a command value signal. The local heating actuator compares the 1-byte telegram value of the object "External largest command value" with its own largest command value and outputs the largest value via the object "Largest command value".

Enabling the "Largest command value" function

The "Largest command value" function must first be enabled on the "General valve outputs" parameter page, so that it can be used during actuator operation. The remaining parameters are set on the parameter page "Largest command value". Additionally, the parameter pages of the individual valve outputs are relevant.

- Set the parameter "Transmit" to "on change" and/or "cyclical" and set the corresponding criteria.

  The "Largest command value" function is activated. The actuator always compares the 1-byte command values of assigned valve outputs and signals the largest command value via the communication object of the same name.

- Deactivate the checkbox "Largest command value".

  The function for transferring the largest command value is not available.

Enabling recording of an external largest command value

Optionally, the actuator can evaluate an external telegram for the largest command value (e.g. from another heating actuator). This allows the cascading of multiple actuators with a command value signal.
The object must be enabled for an external largest command value to be recorded.

- Activate the checkbox "Record external largest command value via object".

  The "Largest command value - External" object is enabled. The local heating actuator compares the 1-byte telegram value of this object with its own largest command value and outputs the largest value via the object "Largest command value".

- Deactivate the checkbox "Record external largest command value via object".

  Recording of an external largest command value is not possible. The actuator independently determines the largest command value of the valve outputs assigned to it.

i Cyclical telegrams to the "Largest command value - External" object with the same telegram value cause no reaction.

i After a device reset, there is no polling of the current status of the "Largest command value - External" object. Only when a bus telegram is received does the actuator take this value into account during evaluation of the largest command value.

9.3.3.1 Largest command value parameters

Enabling the "Largest command value" function

General valve outputs -> Enabled functions

Largest command value	Checkbox (yes / **no**)
The actuator can determine the largest constant command value and forward it to another bus device (e.g. suitable calorific furnaces with integrated KNX control or visualisation). In the "Yes" setting, the heating actuator evaluates all the active 1-byte command values of the valve outputs and, optionally, the externally received largest command value (object "External largest command value") and transmits the largest command value via the "Largest command value" object. In the case of valve outputs configured in the ETS to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value", there is no evaluation of the command values preset via the bus. Exception: It may also occur with such command value outputs that a constant command value is active (e.g. after bus/mains voltage return or a forced position and emergency operation or manual operation). In this case, this constant command value is also included in the calculation of the largest command value until the named functions with a higher priority are exited or a new command value telegram is received via the bus, overriding the constant command value at the valve output.	

Setting the "Largest command value" function

General valve outputs -> Largest command value

Transmit	**on change** cyclical on change and cyclical
The largest command value determined by the heating actuator is actively transmitted to the bus. This parameter decides when a telegram is transmitted via the "Largest command value" object. This parameter is visible only if the "Largest command value" function is enabled. On change: A telegram is only transmitted when the largest command value changes. Cyclical: The actuator only transmits the "Largest command value - Status" telegram cyclically. The cycle time is defined globally for all feedback on the parameter page "General". On change and cyclical: The actuator transmits the "Largest command value - Status" telegram when the object value changes and also cyclically.	

Transmit on change by	0.3 %, 0.5 %, 1...**3**...20 %
Here, the change interval of the largest command value for automatic transmission is defined. The actuator only transmits a new telegram value when the largest command value has changed by the interval preset here since the last transmission operation. This parameter is visible only if the "Largest command value" function is enabled.	

Detect external largest command value via object	Checkbox (yes / **no**)
The actuator is able to evaluate an external largest command value (e.g. from another heating actuator). The local heating actuator monitors the external telegram with its own active constant command values and outputs the largest of all command values via the object "Largest control value - Status". This parameter will enable the object "Largest command value - External" in the "yes" setting. It is only available when the "Largest command value" function is enabled.	

9.3.3.2 Objects for largest command value

Function: Evaluation of the largest command value

Object no.	Function	Name	Type	DPT	Flag
8	Largest command value - Status	General valve outputs - Output	1-byte	5,001	C, R, -, T, -
1-byte output object for transmission of the largest constant command value of the heating actuator to another bus device (e.g. suitable calorific furnaces with integrated KNX controller or visualisation). The heating actuator evaluates all the active 1-byte command values of the valve outputs and, optionally, the externally received largest command value (object 9) and transmits the largest command value via this object. In the case of valve outputs configured in the ETS to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value", there is no evaluation of the command values preset via the bus. Exception: It may also occur with such command value outputs that a constant command value is active (e.g. after bus/mains voltage return or a forced position and emergency operation or manual operation). In this case, this constant command value is also included in the calculation of the largest command value until the named functions with a higher priority are exited or a new command value telegram is received via the bus, overriding the constant command value at the valve output. After bus voltage return and an ETS programming operation, the actuator transmits the current value of the largest command value without a delay, providing that automatic transmission on change is configured. After a full device reset, the actuator does not transmit automatically, when all the command values are set to 0%. After a device reset, the actuator immediately starts the time for cyclical transmission (if configured), so that the object value effective after the reset is transmitted cyclically.					

Function: Evaluation of the largest command value

Object no.	Function	Name	Type	DPT	Flag
9	Largest command value - External	General valve outputs - Input	1-byte	5,001	C, (R), W, -, -
1-bit input object for the cascading of multiple actuators with evaluation of the largest constant command value. The transmitting object of a largest command value of another heating actuator can be connected to this object. The local heating actuator monitors the external telegram with its own active constant command values and outputs the largest of all command values via object 8. Cyclical telegrams to this object with the same value cause no reaction. After a device reset, there is no polling of the current status of this object. Only when a bus telegram is received does the actuator take this status into account during evaluation.					

9.3.4 Summer / winter mode switchover

The actuator possesses a summer / winter switchover. Depending on the season, this allows the setting of different command value setpoints for a valve output for emergency operation or forced position. Summer or winter mode is directly preset by the 1-bit communication object "Summer / winter switchover". The telegram polarity can be configured in the ETS.

The "Summer" or "Winter" state preset via the object is stored internally in the device and is restored after a device reset. In the ETS, it is possible to configure whether, after an ETS programming operation, the saved value is restored or, alternatively, if a defined operation (summer or winter) is activated.

It is also possible to switch the operating mode during active emergency operation (if called by command value monitoring) or during an active forced position (if activated via the object). In this case, the value belonging to the operating mode is activated immediately after the switchover. If the value for emergency operation or the forced position is polled on a bus/mains voltage return or after an ETS programming operation, the command values do not change when the operating mode is switched over.

Enabling summer / winter switchover

The summer / winter switchover must first be enabled on the "General valve outputs" parameter page, so that it is possible to switch between summer and winter mode during actuator operation. The remaining parameters are set on the parameter page "Summer / winter mode switchover". Additionally, the parameter pages of the individual valve outputs are relevant.

- Configure the parameter "Object polarity" to the required telegram polarity.

  The summer / winter switchover is enabled. The communication object "Summer / winter switchover" becomes visible in the ETS. On the parameter pages of the individual valve outputs, summer and winter command values can be configured for emergency operation and for a forced position.

- Deactivate the checkbox "Summer / winter mode" on the parameter page "Valve outputs -> General valve outputs".

  The summer / winter switchover is not available. For the valve outputs, only one command value can be configured separately for emergency operation or a forced position.

Defining the behaviour after of the summer / winter switchover during an ETS programming operation

The "Summer" or "Winter" state preset via the object "Summer / winter switchover" is stored internally in the device and is restored after bus voltage return. The parameter "After ETS programming" on the parameter page "Summer / winter mode switchover" also defines which operating mode is active after ETS commissioning.

- Set the parameter to "Summer mode".

  In this setting, the actuator activates summer operation after an ETS programming operation. This overwrites the value saved internally in the device.

- Set the parameter to "winter mode".

  In this setting, the actuator activates winter mode after an ETS programming operation. This overwrites the value saved internally in the device.

- Set the parameter to "No change (saved operating mode)".

In this configuration, the actuator activates the most recently saved operating mode.

ℹ The operating mode tracked after bus voltage return or preset after an ETS programming operation is not tracked in the communication object "Summer / winter switchover" by the actuator.

9.3.4.1 Summer / winter switchover parameters

Enabling the summer / winter mode function

General valve outputs -> Enabled functions

Summer / winter mode	Checkbox (yes / **no**)
The device possesses a summer / winter switchover. Depending on the season, this allows the setting of different command value setpoints for the valve output for emergency operation or forced position. Activated: The summer / winter switchover is enabled. The communication object "Summer / winter switchover" becomes visible. Summer and winter command values can be configured for emergency operation and a forced position for the valve output. Deactivated: The summer / winter switchover is not available. For the valve output, only one command value can be configured separately for emergency operation or a forced position.	

Setting the summer / winter mode function

General valve outputs -> Summer / winter mode

Object polarity	**1 = Winter / 0 = Summer** 1 = Summer / 0 = Winter
This parameter sets the telegram polarity of the "Summer / winter mode" object.	

after ETS programming operation	Summer mode Winter mode **no change (saved operating mode)**
The "Summer" or "Winter" state preset via the object "Summer / winter mode" is stored internally in the device and is restored after a device reset (mains voltage return). The parameter "After ETS programming operation" defines which operating mode is active after ETS commissioning. Summer operation: In this setting, the device activates summer operation after an ETS programming operation. This overwrites the value saved internally in the device. Winter operation: In this setting, the device activates winter operation after an ETS programming operation. This overwrites the value saved internally in the device. no change (saved operating mode): In this configuration, the device activates the most recently saved operating mode.	

9.3.4.2 Objects for summer / winter switchover

Function toggling of the Summer / Winter operating mode

Object no.	Function	Name	Type	DPT	Flag
12	Summer / winter mode	General valve outputs - Input	1-bit	1,002	C, (R), W, -, -
1-bit input object to switch over between summer and winter mode. The telegram polarity can be configured. The status is stored internally in the device if there is a bus or mains voltage failure and is restored after a device reset. Cyclical telegrams to this object with an identical telegram polarity (ON -> ON, OFF -> OFF) produce no reaction.					

9.3.5 Service mode

Service mode allows the bus-controlled locking of all or some valve outputs for maintenance or installation purposes. If service mode is active, actuators can be moved to a defined position (completely open or closed) and locked against activation by command value telegrams. Both service mode and the locking state are preset by a 2-bit forced operation telegram, according to KNX DPT 2.001.
The first bit (bit 0) of the object "Service mode - Activate / deactivate input" directly specifies the locking state. The second bit (bit 1) of the object activates or deactivates service mode. The locking state in the telegram is only evaluated by the actuator, when bit 1 plans for active service mode. Otherwise, bit 0 is ignored.

i The valves activated by service mode open or close completely and statically. No pulse width modulation is executed. The configured valve direction of action is taken into account in the electrical activation of the outputs.

Bit 1	Bit 0	Function
0	x	Service mode not active -> normal control according to priority rule
0	x	Service mode not active -> normal control according to priority rule
1	0	Service mode active: Close valves
1	1	Service mode active: Open valves

Bit coding of service mode

Service mode influences the status signals of the affected valve outputs. Depending on the configured command value data format, the following command values are assumed when service mode is active...

- Switching (1-bit):
  Valve closed = OFF
  Valve opened = ON
- Constant (1-byte) with pulse width modulation (PWM):
  Valve closed = 0%
  Valve opened = 100%

- Constant (1-byte) with command value limiting value:
  Valve closed = OFF
  Valve opened = ON

ℹ The command value preset by an active service mode is also included in the determination of heat requirements and the largest command value. In addition, service mode has an influence on pump control.

The behaviour of the assigned valve outputs at the end of service mode can be configured. In addition, a 1-bit status object can signal when service mode is active or not.

ℹ Updates of the object from "Service mode active" to "Service mode active" while maintaining the forced valve status or from "Service mode inactive" to "Service mode inactive" produce no change in the behaviour of the value outputs. However, the status telegram of the service mode is retransmitted on each update.

ℹ Valve outputs locked by service mode can still be activated in manual operation. At the end of a manual operation, the actuator executes the service reaction for the appropriate valve outputs once again if service mode is still activated at this time.

Enabling service mode

Service mode must first be enabled on the "General valve outputs" parameter page, so that it can be activated and deactivated via the KNX during actuator operation.

■ Activate the checkbox "Service mode".

Service mode is enabled. The communication objects "Valve outputs service mode - Activate / Deactivate" und "Valve outputs service mode - Status" become visible. Valve outputs can be assigned on the parameter pages "VOx - General -> Assignments".

■ Deactivate the checkbox "Service mode".

Service mode is not available. No valve outputs can be assigned to service mode in the ETS.

Assigning outputs to service mode

For a valve output to be influenced by service mode, an assignment must take place. On the parameter pages "VOx - General -> Assignments", it is possible to define the assignment to service mode separately for each valve output.

■ Activate the checkbox "Service mode".

The appropriate valve output is assigned to service mode. It is locked according to the object value when service mode is active.

■ Deactivate the checkbox "Service mode".

The valve output is not assigned to service mode. Activation and deactivation of the service function does not influence the output.

ℹ Assignments can only be made on the parameter pages "VOx - General -> Assignments" if service mode is enabled on the "General valve outputs" parameter page.

Defining the behaviour at the end of service mode

When service mode is deactivated, the assigned valve outputs are enabled again. Activation of these outputs using command value telegrams or other functions with a lower priority is then possible. The parameter "Behaviour at the end" on the parameter page "General valve outputs - Service mode" specifies the state to which the affected valve outputs are set after enabling.

ℹ At the end of service mode, the actuator only then executes the configured behaviour if, at the time of enabling, no function with a lower priority is active. Should such a function be active (e.g. forced position), then the actuator will execute it.

- Set the parameter to "No change".

  In this setting, assigned valve outputs show no reaction at the end of service mode. They remain in the most recently set state, until a new command value presetting is implemented.

- Set the parameter to "Close output completely".

  In this setting, all the assigned valve outputs close completely. Here too, the actuators remain in this state until a new command value presetting is implemented.

- Set the parameter to "Open output completely".

  In this setting, all the assigned valve outputs open completely. The actuators remain in this state until a new command value presetting is implemented.

- Set the parameter to "Track state".

  In this configuration, the valve state received during the service function or preset by the function is tracked at the end of service mode.

Status function of service mode

An active service mode can optionally be displayed by a 1-bit status object. A telegram with the value "1" displays an active service mode. A telegram with the value "0" displays a deactivated service function.
As soon as service mode is enabled in the ETS, the status communication object is also available.

ℹ Updates of the 2-bit input object from "Service mode active" to "Service mode active" or from "Service mode inactive" to "Service mode inactive" always causes retransmission of the status telegram.

ℹ The object value of the status function is not transmitted automatically to the bus after a device reset (ETS programming operation, mains voltage return).

9.3.5.1 Service mode parameters

The following parameters are parameterised on the parameter page "General -> General - Valve outputs -> Enabled functions".

Service mode	Checkbox (yes / **no**)
Service mode allows the bus-controlled locking of the valve output in case of maintenance or installation. If service mode is active, actuators can be moved to a defined position (completely open or closed) and locked against activation by command value telegrams. Active: Service mode is enabled. The communication object "Service mode - Deactivate / activate input" becomes visible. Inactive: Service mode is not available.	

The following parameters are parameterised on the parameter page "General -> General - Valve outputs -> Service mode".

Behaviour at the end	No change Close output completely Open output completely **Track state**
This parameter specifies the state which the valve output goes into on when service mode is deactivated.	

Restore last status after bus voltage return	Checkbox (yes / **no**)
This parameter defines whether the previous service mode state is automatically restored after bus voltage return.	

9.3.5.2 Objects for service mode

Function: Activate / deactivate service mode

Object no.	Function	Name	Type	DPT	Flag
16	Service mode - Activate / deactivate	General valve outputs - Input	2-bit	2,001	C, (R), W, -, -
2-bit input object for activating and deactivating service mode. With the value "1", bit 1 of the telegram activates service mode. The assigned valve outputs are then locked in the status preset by bit 0 ("0" = Closed / "1" = Opened). The configured valve direction of action is taken into account. The value "0" in bit 1 deactivates service mode again. 0x = Service mode deactivated 10 = Service mode activated, valves closed 11 = Service mode activated, valves opened					

Function: Service mode status

Object no.	Function	Name	Type	DPT	Flag
17	Service mode status	Service mode - output	1-bit	1,002	C, R, -, T, -
1-bit output object for status signalling of whether the service mode is active or not. In this case, the telegram polarity is fixed: "0" = Service mode inactive, "1" = Service mode active. The object value is not transmitted automatically after a device reset (ETS programming operation, bus voltage return).					

9.3.6 Failure of the valve operating voltage

To activate the valve drives, the actuator requires a separate operating voltage supply (AC 24 V or AC 230 V). Valve outputs can only be electrically activated when the valve operating voltage supply is switched on. If there is no valve voltage supply, then the drives will move to their idle position (deenergised opened / closed). To prevent a failure of the valve voltage supply at the actuator from going undetected, a 1-bit fault signal can be optionally transmitted to the bus via the object "Failure of operating voltage". The telegram polarity of this fault signal can be configured.
If the actuator detects that there is no valve voltage, then the failure telegram ("Voltage failed") is transmitted immediately. Only when the valve voltage has been reconnected will the actuator retract the fault signal ("Voltage available").

A valve which has been completely opened (deenergised opened) by the failure of the valve operating voltage is not include in the determination of heat requirement or the "Largest command value" and has no influence on the pump control.

Enabling the signal "Operating voltage status"

If the valve operating voltage failure signal is to be used, the parameter "Status" on the parameter page "Valve outputs - General valve outputs" must first be activated. This enables the parameter page "Status". The status of the operating voltage can be activated there.

- Activate the checkbox. Configure the parameter "Object polarity" to the required telegram polarity.

  The failure signal is enabled. The actuator actively transmits a "Voltage failed" telegram when it detects a failed or switched-off valve voltage supply, when the bus voltage supply is still switched on. The actuator transmits a "Voltage available" telegram as soon as the valve voltage supply is available again and the bus voltage is switched on.

- Deactivate the checkbox.

  The failure signal is not available.

Setting the behaviour of the failure signal on bus voltage return

The object for the transmission of a failure of the valve operating voltage can actively transmit the feedback information after a bus voltage return and an ETS programming operation. As an option, it is possible to configure in the ETS whether active

telegram transmission should take place after a device reset or not.
After a device reset, the failure signal of the valve operating voltage can be optionally time-delayed with the delay being set globally for all feedback together on the parameter page "General - Valve outputs".

- Set the parameter "Delay after bus voltage return" to "yes".

  The feedback "Failure of operating voltage" will be transmitted with a delay after bus voltage return or after an ETS programming operation. No feedback is transmitted during a running time delay, even if a valve state changes.

- Set the parameter "Delay after bus voltage return" to "no".

  The feedback "Failure of operating voltage" will be transmitted immediately after bus voltage return or after an ETS programming operation.

Setting cyclical transmission of the failure signal

The signal telegram "Failure of operating voltage" can be transmitted cyclically, should the actuator determine a failed valve operating voltage. If the valve operating voltage exists, then transmission is generally not cyclical.

- Set the parameter "Cyclical transmission" to "yes".

  The actuator repeats the signal telegram "Failure of operating voltage", should a failed valve operating voltage have been determined. The cycle time is defined for all feedback on the parameter page "General - Valve outputs".

- Set the parameter "Cyclical transmission" to "no".

  The signal telegram "Failure of operating voltage" is generally not repeated cyclically.

ℹ During a delay after bus/mains voltage return or an ETS programming operation, transmission is not cyclical.

9.3.6.1 Valve voltage status parameters

Activate	**no** / yes
The actuator monitors the voltage supply of the valve drives. On a failure, a 1-bit signal telegram can be transmitted. This parameter enables the feedback function.	

Object polarity	**0 = Voltage failed / 1 = Voltage present** 1 = Voltage failed / 1 = Voltage present
This parameter sets the telegram polarity of the signal telegram for the transmission of a failure of the valve operating voltage. It is only visible with the status message activated.	

Transmit after bus voltage return	**no** / yes
The object for the transmission of a failure of the valve operating voltage can actively transmit the feedback information after a bus voltage return and an ETS programming operation. This parameter specifies whether active telegram transmission should take place after a device reset or not. It is only visible with the status message activated.	

Delay after bus voltage return	**no** / yes
The feedback "Failure of operating voltage" will be transmitted to the bus after bus voltage return or after an ETS programming operation. In these cases, the feedback can be time-delayed with the time delay being preset globally for all device feedback together on the "General" parameter page. This parameter is only visible if the signal function is enabled and transmission after bus voltage return is enabled. no: The feedback "Failure of operating voltage" is transmitted immediately after bus / mains voltage return or after an ETS programming operation. yes: The feedback "Failure of operating voltage" will be transmitted with a delay after bus voltage return or after an ETS programming operation. No feedback is transmitted during a running time delay, even if the state changes.	

Cyclical transmission	**no** / yes
The signal telegram "Failure of operating voltage" can be transmitted cyclically, should the actuator determine a failed valve operating voltage. This parameter specifies whether cyclical telegram transmission should take place or not. If the valve operating voltage exists, then transmission is generally not cyclical. This parameter is only visible with the status message activated.	

9.3.6.2 Objects for valve voltage status

Function: monitoring of the valve operating voltage

Object no.	Function	Name	Type	DPT	Flag
5	Failure of operating voltage - Status	General valve outputs - Output	1-bit	1,005	C, R, -, T, -
1-bit output object to signal a failure of the operating voltage (AC 24 V or AC 230 V) of the valve outputs. The telegram polarity can be configured.					

9.4 Valve output - General

9.4.1 Name

Optional names can be assigned for each valve output. The names should clarify the use of the output (e.g. "living room floor"). The names are only used in the ETS in the text of the parameter pages and communication objects.

9.4.2 Data formats for command values

The heating actuator receives 1-bit or 1-byte command value telegrams, transmitted, for example, by KNX room temperature controllers. Usually, the room temperature controller determines the room temperature and generates the command value telegrams using a control algorithm. The actuator controls its valve outputs either in switching form or with a PWM signal, according to the data format of the command values and the configuration in the ETS. The cycle time for constant PWM output signals can be configured separately for each valve output of the heating actuator. This allows individual adaptation to different actuator types.

It should be noted that the valve outputs do not carry out temperature control themselves. The actuator converts received command value telegrams or command value presets (e.g. from the internal room temperature controllers of the heating actuator) into constant or switching output signals using device functions.

The "Data format" parameter, which is available separately for each valve output on the parameter pages "VOx - General", specifies the input format of the command value objects.

Data format of the command value input "Switching (1-bit)"

In the case of a 1-bit command value, the telegram received via the command value object is forwarded directly to the appropriate output of the actuator, taking the configured valve direction of action into account. This means that, if an "ON" telegram is received, the is valve completely opened. The output is then energised for energised closed valves and the output is deenergised for energised opened valve drives. The valve is closed completely when an "OFF" telegram is received. The valve output is then not energised for deenergised closed valves and energised for deenergised opened valve drives.

In the functions and events listed below, valve outputs configured to the command value data formats "Switching (1-bit)" are always activated by a constant command value with pulse width modulation (PWM), provided that command values not equal to 0% or 100% are to be set...

- Active forced position,
- Active emergency operation,
- After bus voltage return,
- After an ETS programming operation,
- During a manual operation.

PWM keeps being executed until the named functions have been exited or, after the named events, no more lower-level functions are active and a new command value telegram is received via the bus, overriding the constant command value on the valve output.

In the named cases, the constant command value is also included in the calculation of the largest command value and that of the heat requirement and pump control (optional functions).

i Valve outputs, which receive preset command values via the data format "Switching (1-bit)", influence the heat requirement and pump control. Here, an "OFF" command value is interpreted as "0%" and an "ON" command value as "100%".

Data format of the command value input "Constant (1-byte) and activation with pulse width modulation (PWM)"

Command values corresponding to the data format "Constant (1-byte)" are implemented by the actuator with an equivalent pulse-width-modulated switch signal at the valve outputs. Taking the cycle time settable in the actuator for each output into account, the average output signal resulting from this modulation is a measure of the centred valve position of the control valve and thus a reference for the set room temperature. A shift of the mean value, and thus a change in the heating capacity, can be obtained by changing the duty factor of the switch-on and switch-off pulses of the output signal (see figure 7). The duty factor is adapted constantly by the actuator, depending on the command value received (normal operation) or by active device functions (e.g. manual operation, forced position, emergency operation).

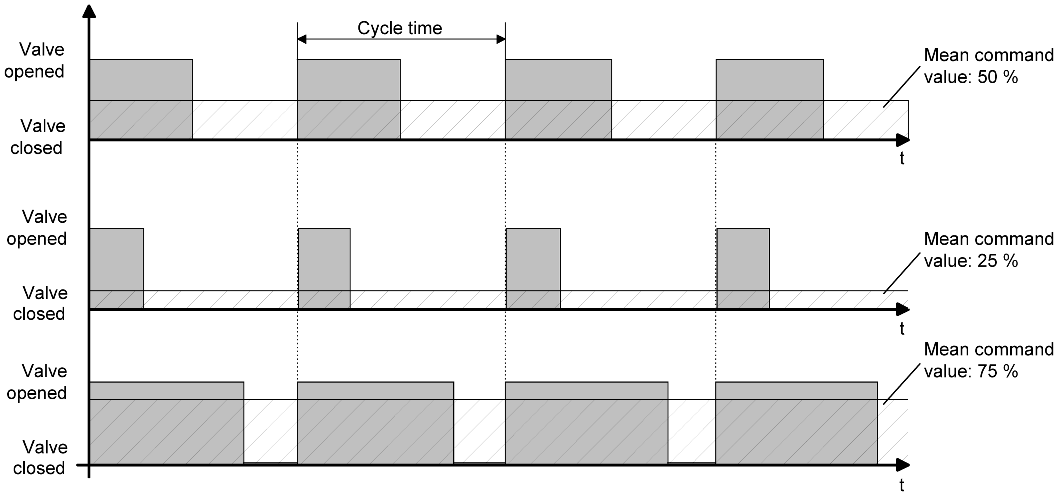


Figure 7: Resulting mean value through variable duty factor with pulse width modulation

In accordance with the configured valve direction of action, the appropriate outputs are either energised or deenergised, depending on the valve position to be approached. In so doing, the duty factor is inverted automatically for a deenergised opened drive. Thus, depending on the valve type used, there is no unintended mean value shift.

Example: Command value: 60% ->

- Duty factor, deenergised closed: 60% ON, 40% OFF,
- Duty factor, deenergised opened: 40% ON, 60% OFF.

Example: Command value: 100% ->

- Duty factor, deenergised closed: Permanently ON,
- Duty factor, deenergised opened: Permanently OFF.

Often, control circuits are subject to non-constant changes in the setpoint presetting (e.g. frost protection, night operation, etc.) or short-time interference (e.g. measured value deviations due to brief opening of windows or doors near the sensor). For the setting of the scanning ratio of the required command value to take place as quickly and correctly in these cases, even with a longer set cycle time, without any negative impact on the reaction time of the control section, the actuator uses a special method for continuous command value adjustment.

The following cases are taken into account...

– Case 1
  Command value change, e.g. from 80% to 30%, during the opening phase of the valve (see figure 8).
  Before the reception of the new command value (30%), the old setpoint (80%) was active. The new command value is received during the opening phase of the valve. At this point, the actuator detects that it is still possible to shorten the opening phase, so that it corresponds to the new command value (30%). The cycle time is not affected by this operation.
  The new duty factor is set immediately after the reception of the new command value.

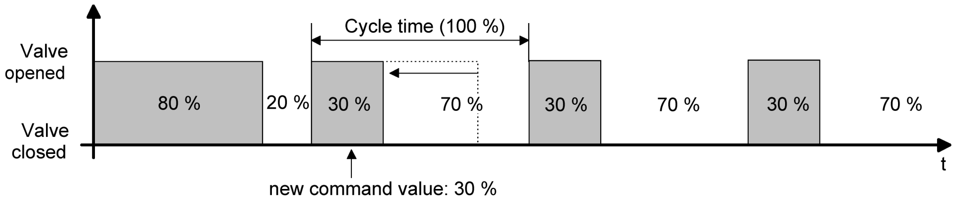


Figure 8: Example of a command value change 80% -> 30% during the opening phase of the valve

– Case 2
  Command value change, e.g. from 80% to 30%, during the closing phase of the valve (see figure 9).
  Before the reception of the new command value (30%), the old setpoint (80%) was active. The new command value is received during the closing phase of the valve. At this point, the actuator detects that it is still possible to extend the closing phase, so that it corresponds to the new command value (30%). The cycle time remains unchanged, but the starting time of the period is shifted automatically.
  The new duty factor is set immediately after the reception of the new command value.

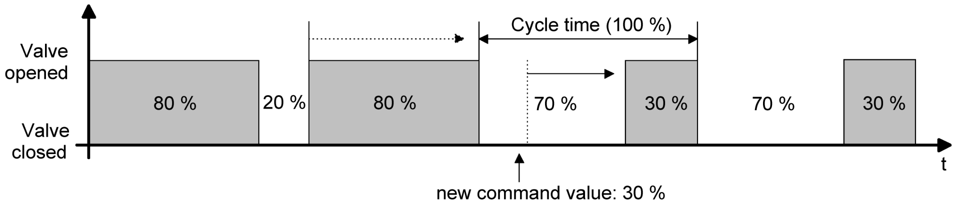


Figure 9: Example of a command value change 80% -> 30% during the closing phase of the valve

- Case 3
  Command value change, e.g. from 80% to 30% during the opening phase of the valve (opening phase too long) (see figure 10).
  Before the reception of the new command value (30%), the old setpoint (80%) was active. The new command value is received during the opening phase of the valve. At this point, the actuator detects that it is necessary to cancel the opening phase immediately and close the valve, so that the duty factor corresponds to the new command value (30%). The cycle time remains unchanged, but the starting time of the period is shifted automatically.
  The new duty factor is set immediately after the reception of the new command value.

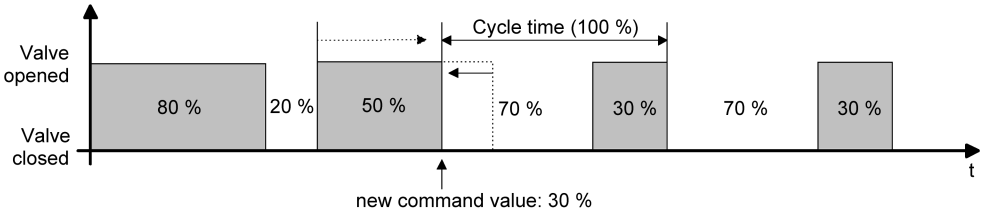


Figure 10: Example of a command value change 80% -> 30% during the opening phase of the valve (opening phase too long)

- Case 4
  Command value change, e.g. from 30% to 80%, during the opening phase of the valve (see figure 11).
  Before the reception of the new command value (80%), the old setpoint (30%) was active. The new command value is received during the opening phase of the valve. At this point, the actuator detects that it is still possible to extend the open phase, so that it corresponds to the new command value (80%). The cycle time is not affected by this operation.
  The new duty factor is set immediately after the reception of the new command value.

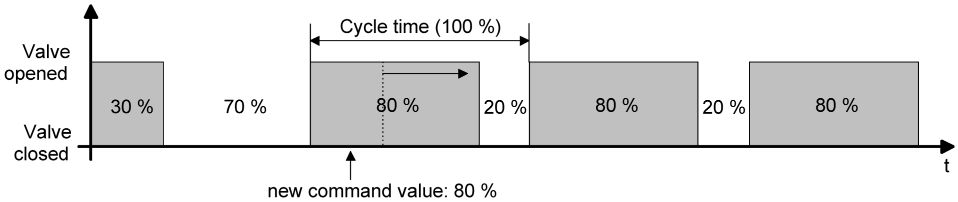


Figure 11: Example of a command value change 30% -> 80% during the opening phase of the valve

- Case 5
  Command value change, e.g. from 30% to 80%, during the closing phase of the valve (see figure 12).
  Before the reception of the new command value (80%), the old setpoint (30%) was active. The new command value is received during the closing phase of the valve. At this point, the actuator detects that it is still possible to reduce the closing phase, so that it corresponds to the new command value (80%). The cycle time remains unchanged, but the starting time of the period is shifted

automatically.
The new duty factor is set immediately after the reception of the new command value.

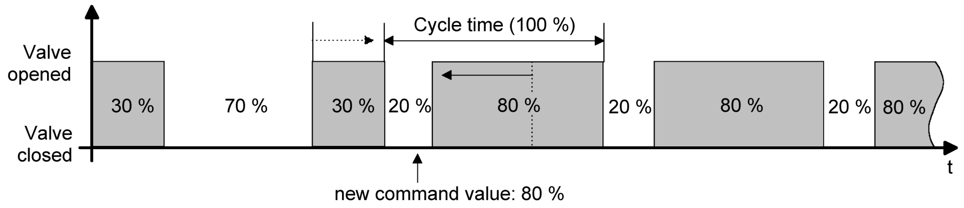


Figure 12: Example of a command value change 30% -> 80% during the closing phase of the valve

– Case 6
Command value change, e.g. from 30% to 80%, during the closing phase of the valve (closing phase too long) (see figure 13).
Before the reception of the new command value (80%), the old setpoint (30%) was active. The new command value is received during the closing phase of the valve. At this point, the actuator detects that it is necessary to cancel the closing phase immediately and open the valve, so that the duty factor corresponds to the new command value (80%). The cycle time remains unchanged, but the starting time of the period is shifted automatically.
The new duty factor is set immediately after the reception of the new command value.

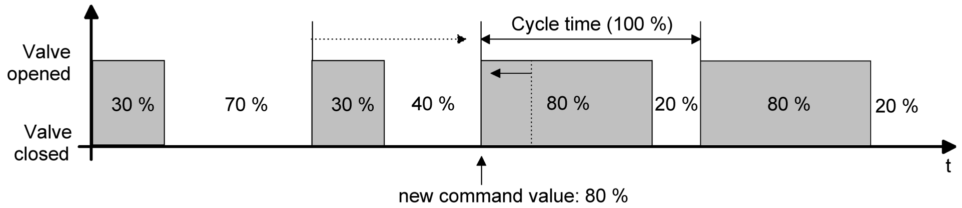


Figure 13: Example of a command value change 30% -> 80% during the opening phase of the valve (opening phase too long)

Data format of the command value input "Constant (1-byte) and activation with command value limiting value"

The data format with limiting value evaluation can be used as an alternative to the conversion of a 1-byte command value into constant pulse width modulation at a valve output. Here, the received constant command value is converted into a switching output signal, depending on the configured limiting value. The valve drive opens when the command value reaches the limiting value or exceeds it (see figure 14). A hysteresis is also evaluated to prevent constant closing and opening of the actuator for command values in the area of the limiting value. The valve drive only closes when the command value undershoots the limiting value minus the configured hysteresis.

The 1-byte data format with limiting value evaluation allows the conversion of constant feedback control by the heating actuator into a two-point controller. This principle is particularly suitable for underfloor heating, in which constant valve activation does not produce the desired heating reaction, on account of the sluggishness. With sluggish underfloor heating systems, small constant command values (only short switch-on phases of the PWM) frequently do not produce any significant level of heating. With large constant command values, the short switch-off phases of a PWM usually have no effect on underfloor heating systems or comparable heating systems. Here, two-point feedback control offers a simple, effective alternative. The valves open or close completely. During activation, unnecessary constant valve positions are avoided using command value telegrams. In addition, the service life of the electrothermal actuators is increased.

The conversion of the constant input signal into a switching command value takes place internally in the device. During processing, the actuator evaluates the converted command value as if it were a received 1-bit command value. It forwards the status directly to the appropriate output, taking the configured valve direction of action into account. Thus, on a "Open valve" command (received command value >= limiting value), the valve is opened completely. The output is then energised for energised closed valves and the output is deenergised for energised opened valve drives. On a "Close valve" command (received command value < limiting value - hysteresis), the valve is closed completely. The valve output is then not energised for deenergised closed valves and energised for deenergised opened valve drives.

As with a 1-bit input command value, in the functions and events listed below, valve outputs configured to the command value data formats "Constant (1-byte) and activation with command value limiting value" are always activated by a constant command value with pulse width modulation (PWM), provided that command values not equal to 0% or 100% are to be set...

- Active forced position,
- Active emergency operation,
- After bus voltage return,
- After an ETS programming operation,
- During a manual operation.

PWM keeps being executed until the named functions have been exited or, after the named events, no more lower-level functions are active and a new command value telegram is received via the bus, overriding the constant command value on the valve output.

ℹ In the named cases, the constant command value is also included in the calculation of the largest command value and that of the heat requirement and pump control (optional functions).

ℹ Valve outputs which receive preset command values via the data format "Switching (1-byte)" influence the heat requirement and pump control. Here, the actuator evaluates the converted switching output signal in the same way ("OFF" is interpreted as "0%", "ON" is interpreted as "100%").

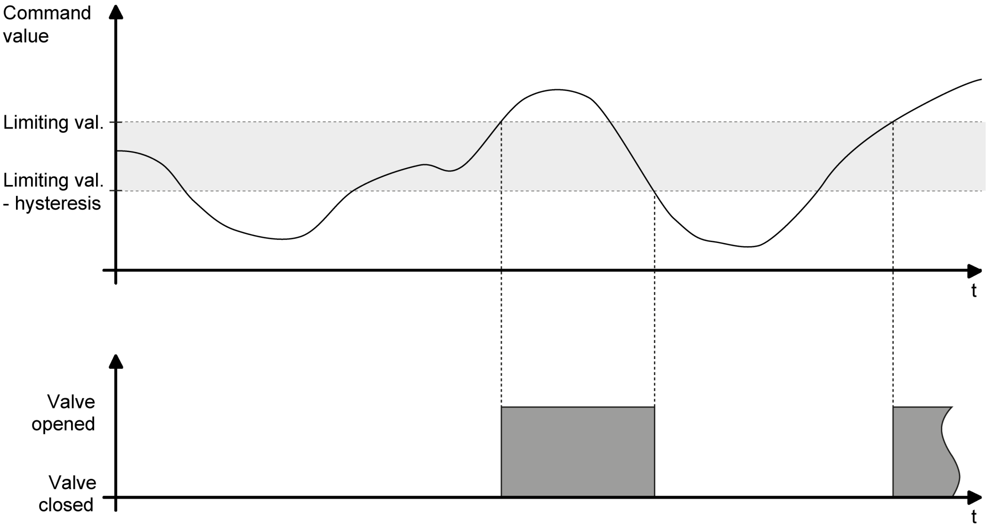


Figure 14: Example of command value evaluation with limiting value

9.4.3 PWM cycle time

The "PWM cycle time" parameter specifies the period length of the pulse-width-modulated output signal of a valve output. It allows adaptation to the adjusting cycle times (the adjusting time it takes the drive to bring the valve from its completely closed to its completely opened position) of the valve drives used. In addition to the adjusting cycle time, take account of the dead time (the time in which the valve drives do not show any response when being switched on or off). If different actuators with different adjusting cycle times are used at an output, take account of the longest of the times.

i The "PWM cycle time" parameter is also available for valve drives whose command value data format is configured to "Switching (1-bit)" or "Constant (1-byte) with command value limiting value". For such valve outputs, pulse width modulation can also be executed during an active forced position, emergency operation, manual operation, after bus voltage return or after an ETS programming operation, for which, as a result, the presetting of a cycle time is required.

Generally, two different options of how to set the cycle time can be identified:

Case 1
Cycle time > 2 x Adjusting cycle time of the drives used (ETA)

In this case, the switch-on and switch-off times of the actuator are long enough for the actuators to have sufficient time to fully open and fully close within a given period (see figure 15).

– Advantage:
  The desired mean value for the command value and thus for the required room temperature will be set relatively precisely, even for several actuators triggered at the same time.

- Disadvantage:
  It should be noted, that, due to the full valve lift, the life expectancy of the actuators can diminish. For very long cycle times (> 15 minutes) with less sluggishness in the system, the heat emission into the room, for example, in the vicinity of the radiators, can possibly be non-uniform and be found disturbing.

ℹ This cycle time setting is recommended for slower, more sluggish heating systems (such as underfloor heating).

ℹ Even for a bigger number of triggered actuators, maybe of different types, this setting can be recommended to be able to obtain a better mean value of the adjusting travels of the valves.

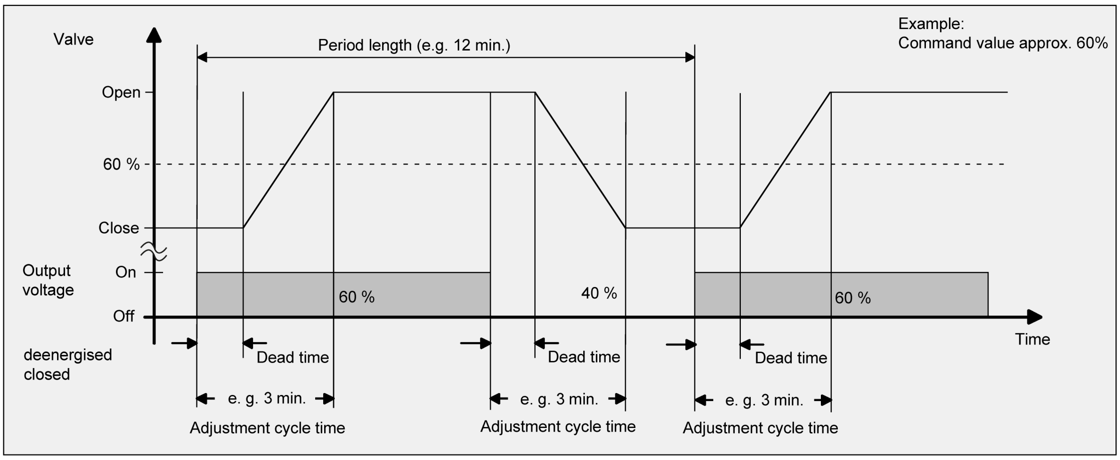


Figure 15: Ideal course of the valve stroke for a
Cycle time > 2 x Adjusting cycle time

Case 2
Cycle time < Adjusting cycle time of the drives used (ETA)

In this case, the switch-on and switch-off times of the actuator are too short for the actuators to have enough time to fully open and fully close within a given period (see figure 16).

- Advantage: This setting ensures continuous water flow through the radiators, thus facilitating uniform heat emission into the room. If only one valve drive is triggered the controller can continuously adapt the command value to compensate the mean value shift caused by the short cycle time, thus setting the desired room temperature.
- Disadvantage: If more than one drive is activated at the same time, the desired mean value will become the command value, which will result in a very poor adjustment of the required room temperature, or in adjustment of the latter with major deviations, respectively.

ℹ This setting is recommended for quicker heating systems (such as radiators).

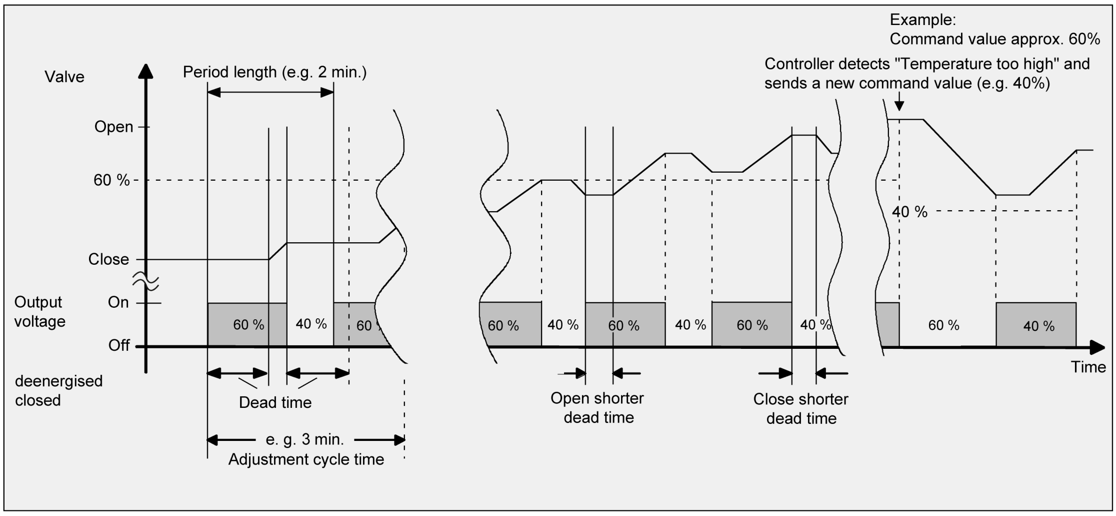


Figure 16: Ideal course of the valve stroke for a
Cycle time < Adjusting cycle time

The continuous flow of water through the valve, and thus the continuous heating of the drives causes variations and changes to the dead times of the drives during the opening and closing phase. The short cycle time and the dead times means that the required command value (mean value) is only set with a possibly large deviation. For the room temperature to be regulated constantly after a set time, the controller must continually adjust the command value to compensate for the mean value shift caused by the short cycle time. Usually, the control algorithm implemented in the controller (PI control) ensures that control deviations are compensated.

9.4.4 Valve direction of action

The heating actuator possesses 6 electronic outputs, each of which can silently activate up to 4 (AC 230 V) or 2 (AC 24 V) actuators. Both deenergised closed and deenergised opened actuators can be connected. The parameter "In voltage-free state (direction of action)" on the parameter pages "VOx - General" specifies which drive type is connected to a valve output.

ℹ Only valve drives with the same characteristics may be connected to each valve output (deenergised closed/opened). The drive type must match the configuration.

The configured valve direction of action is taken into account in each valve activation. With 1-byte command values and deenergised closed valves, the switch-on time is derived directly from the configured PWM and the cycle time.
Example: PWM = 30%, cycle time = 10 minutes -> Switch-on time = 3 minutes, switch-off time = 7 minutes.
In the case of 1-byte command values and deenergised opened valves, the switch-on time is inverted. Example: PWM = 30%, cycle time = 10 minutes -> Switch-on time = 7 minutes, switch-off time = 3 minutes.
On deenergised closed valve drives, command values are not inverted, in accordance with the 1-bit data format. Example: Command value ON -> Output switched on, Command value OFF -> Output switched off.

By contrast, switching command values are inverted for deenergised opened valve drives. Example: Command value ON -> Output switched off, Command value OFF -> Output switched on.

ℹ On the LED status display, the valve direction of action configured for each output in the ETS is not taken into account. As a result, the LEDs do not immediately display the valve state (opened / closed). Inversion of the status display according to the valve direction of action thus does not take place.

ℹ In the as-delivered state, the valve direction of action for all the valve outputs is set to "deenergised closed".

9.4.5 Reset behaviour

The states of the valve outputs after bus voltage return or after an ETS programming operation can be set separately.

Setting the behaviour after bus voltage return

The parameter "After bus voltage return" is available separately for each valve output on the parameter page "VOx - General".

- Set the parameter to "Preset command value".

  The actuator sets the command value preset for the valve output by the parameter "Command value". For valve outputs configured in the ETS to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value", a constant command value can also be preset using the parameter "Command value". In this case, a pulse width modulation (5% ... 95%) is executed for the affected command value outputs. In the "0%" and "100%" presettings, the valve outputs are activated continuously. The preset PWM remains active until other functions have been executed or a new command value telegram is received via the bus, overriding the constant command value on the valve output.

- Set the parameter to "Activate command value according to forced position".

  For the valve output, the actuator polls the command value preset for the forced position, as configured in the ETS. Here, the active operating mode (summer / winter) is taken into account, providing that a summer / winter change-over is configured. Ensure that, in this setting, the forced position function is not executed! The actuator only polls the command value preset for the forced position.

- Set the parameter to "Activate command value according to emergency operation".

  For the valve output, the actuator polls the emergency operation command value, as configured in the ETS. Here, the active operating mode (summer / winter) is taken into account, providing that a summer / winter change-over is configured. Ensure that, in this setting, emergency operation is not executed (as would be the case if there was a faulty command value found in the course of command value monitoring)! The actuator only polls the command value preset for emergency operation.

- Set the parameter to "Command value as before voltage failure".

  After bus voltage return, that command value is set at the valve output which was active at the moment of the last bus voltage failure. If there is a bus voltage failure, the actuator saves the active command value internally in the device, so that the command value can be restored when the device power supply returns.

ℹ A valve state set after bus voltage return is added to the command value status objects. The status objects also only transmit after bus voltage return when the initialisation is complete and, if applicable, the "delay after mains voltage return" has elapsed.

Presetting the behaviour after ETS programming

The parameter "After ETS programming" is available separately for each valve output on the parameter page "VOx - General". This parameter can be used to configure the behaviour of an output, irrespective of the behaviour after bus voltage return.

- Set the parameter "Command value as after mains voltage return".

  After an ETS programming operation, the valve output will behave in the manner defined in the parameter "After bus voltage return". If the behaviour there is configured to "Command value as before bus voltage failure", then that command value is also set after an ETS programming operation which was active at the time of the last bus voltage failure. An ETS programming operation does not overwrite the saved command value.

- Set the parameter to "Preset command value".

  The actuator sets the command value preset for the valve output by the parameter "Command value after ETS programming operation". For valve outputs configured in the ETS to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value", a constant command value can also be preset using the parameter "Command value after ETS programming operation". In this case, a pulse width modulation (5% ... 95%) is executed for the affected command value outputs. In the "0%" and "100%" presettings, the valve outputs are activated continuously. The preset PWM remains active until other functions have been executed or a new command value telegram is received via the bus, overriding the constant command value on the valve output.

- Set the parameter to "Activate command value according to forced position".

  For the valve output, the actuator polls the command value preset for the forced position, as configured in the ETS. Here, the active operating mode (summer / winter) is taken into account, providing that a summer / winter change-over is configured. Ensure that, in this setting, the forced position function is not executed! The actuator only polls the command value preset for the forced position.

- Set the parameter to "Activate command value according to emergency operation".

  For the valve output, the actuator polls the emergency operation command value, as configured in the ETS. Here, the active operating mode (summer / winter) is taken into account, providing that a summer / winter change-over is configured. Ensure that, in this setting, emergency operation is not executed (as would be the case if there was a faulty command value found in the course of command value monitoring)! The actuator only polls the command value preset for emergency operation.

ℹ The behaviour after an ETS programming operation is only executed if there have been changes in the configuration of the device. If just an application download is executed with a project design already located in the actuator, then the actuator will execute the configured "Behaviour after bus voltage return".

ℹ A valve state set after an ETS programming operation is added to the command value status objects. The feedback objects also only first transmit after an ETS programming operation when the initialisation has finished and, if necessary, the "delay time after bus voltage return" has elapsed.

ℹ An active manual operation mode will be terminated by an ETS programming operation.

9.4.6 "Valve output - General" parameters

Valve output x - General

Name of valve output	Free text
The text entered in this parameter is applied to the name of the communication objects and is used to label the valve output in the ETS parameter window (e.g. "Underfloor heating living room"). The text is not programmed in the device.	

Command value input

Data format	Switching (1-bit) **Constant (1-byte)**
The actuator can optionally be controlled via a 1-bit object or a 1-byte object. Switching (1-bit): In the case of a 1-bit command value, the telegram received internally in the device is forwarded directly to the output of the actuator, taking the configured valve direction of action into account. Constant (1-byte): In the case of a 1-byte command value, the following parameter "Activation with" determines the type of processing of the command value.	

Valve output

Activation with	**Pulse Width Modulation (PWM)** Command value limiting value
Pulse width modulation (PWM): Command values are implemented by the actuator with an equivalent pulse-width-modulated switch signal at the valve output. Command value limiting value: The constant command value is converted into a switching output signal, depending on a configured limiting value.	

Open valve from a command value limiting value of	1...**10**...100 %
In the 1-byte command value data with limiting value evaluation, the received constant command value is converted into a switching output signal, depending on the limiting value configured here. The valve drive opens when the command value reaches the limiting value or exceeds it. This parameter is only available in the case of "activation with command value limiting value".	

Close valve if command value limiting value (hysteresis) falls below	1...**5**...10 %
In the 1-byte command value data with limiting value evaluation, the received constant command value is converted into a switching output signal. A hysteresis is also evaluated to prevent constant closing and opening of the actuator for command values in the area of the limiting value. The valve drive only closes when the command value undershoots the limiting value minus the configured hysteresis. This parameter is only available in the case of "activation with command value limiting value".	

PWM cycle time	0.5 minutes 1 minute 1.5 minutes ... **15 minutes** ... 20 minutes
The "PWM cycle time" parameter specifies the switching frequency of the pulse-width-modulated output signal of the valve output. It allows adaptation to the adjusting cycle times (the adjusting time it takes the drive to bring the valve from its completely closed to its completely opened position) of the valve drives used. In addition to the adjusting cycle time, take account of the dead time (the time in which the actuators do not show any response when being switched or off). If different actuators with different adjusting cycle times are used at an output, take account of the longest of the times. The "PWM cycle time" parameter is always available, irrespective of the data format and the activation type, because, in the case of an active forced position, emergency operation, after mains voltage return or after an ETS programming operation, the output is controlled with pulse width modulation for which, as a result, the specification of a cycle time is required.	

Valve

In voltage-free state (direction of action)	**closed** open
Valve drives that are closed or open when deenergised can be connected. On each electrical activation of the valve outputs, the actuator takes the valve direction of action configured here into account, so that the command value presettings (Valve closed OFF, 0% / Valve opened ON, 1...100%) can be executed in the correct direction of action. The valve outputs are no longer energised if the valve voltage supply fails or if there is a short-circuit or overload. The actuator takes this state into account and also influences the command value feedback, according to the configured valve direction of action.	

Reset behaviour

After bus voltage return	**Specify command value** Activate command value acc. to forced position Activate command value acc. to emergency operation Command value as before power failure

After bus or mains voltage return, the valve outputs perform the configured reaction at this point.

Specify command value: The actuator sets the command value preset in the ETS for the valve output by the following parameter "Command value".

Activate command value according to forced position: For the valve output, the actuator polls the command value preset for the forced position, as configured in the ETS. Here, the active operating mode (summer / winter) is taken into account, providing that a summer / winter change-over is configured.
Ensure that, in this setting, the forced position function is not executed! The actuator only polls the command value preset for the forced position.

Activate command value according to emergency operation: For the valve output, the actuator polls the emergency operation command value, as configured in the ETS. Here, the active operating mode (summer / winter) is taken into account, providing that a summer / winter change-over is configured.
Ensure that, in this setting, emergency operation is not executed (as would be the case if there was a faulty command value found in the course of command value monitoring)! The actuator only polls the command value preset for emergency operation.

Command value as before voltage failure: After bus or mains voltage return, that command value is set at the valve output which was active at the moment of the last bus voltage failure. If there is a bus voltage failure, the actuator saves the active command value internally in the device, so that the command value can be restored when the device power supply returns. Saving only takes place after a previous device reset (ETS programming operation, bus voltage return) when the reset is longer than 30 seconds previously. Otherwise the actuator does not save the current command value! In that case, an old value remains valid, as was previously saved by the actuator on the bus voltage failure.

Command value	**0 %** ... 100 %

The command value to be set on bus voltage return is defined here. This parameter is only visible on "Behaviour after bus voltage return" = "Preset command value".
For valve outputs configured in the ETS to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value", a constant command value can also be preset using this parameter. In this case, a pulse width modulation (5% ... 95%) is executed for the affected command value outputs. In the "0%" and "100%" presettings, the valve outputs are activated continuously. The preset PWM remains active until other functions have been executed or a new command value telegram is received via the bus, overriding the constant command value on the valve output.

<table>
<tr><td>after ETS programming operation</td><td>Command value as after voltage return
Specify command value
Command value according to forced position
Command value according to emergency operation</td></tr>
<tr><td colspan="2">After an ETS programming operation, the valve outputs perform the configured reaction at this point.
Command value as after voltage return: After an ETS programming operation, the valve output behaves in the manner defined in the parameter "After bus voltage return". If the behaviour there is configured to "Command value as before voltage failure", then that command value is also set after an ETS programming operation which was active at the time of the last bus voltage failure. An ETS programming operation does not overwrite the saved command value.
Specify command value: The actuator sets the command value preset in the ETS for the valve output by the following parameter "Command value".
Command value according to forced position: For the valve output, the actuator polls the command value preset for the forced position, as configured in the ETS. Here, the active operating mode (summer / winter) is taken into account, providing that a summer / winter change-over is configured.
Ensure that, in this setting, the forced position function is not executed! The actuator only polls the command value preset for the forced position.
Command value according to emergency operation: For the valve output, the actuator polls the emergency operation command value, as configured in the ETS. Here, the active operating mode (summer / winter) is taken into account, providing that a summer / winter change-over is configured.
Ensure that, in this setting, emergency operation is not executed (as would be the case if there was a faulty command value found in the course of command value monitoring)! The actuator only polls the command value preset for emergency operation.</td></tr>
</table>

Command value	**0 %** 5 % 10 % ... 90 % 95 % 100 %
The command value to be set after an ETS programming operation is defined here. This parameter is only visible on "Behaviour after ETS programming operation" = "Preset command value". For valve outputs configured in the ETS to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value", a constant command value can also be preset using this parameter. In this case, a pulse width modulation (5% ... 95%) is executed for the affected command value outputs. In the "0%" and "100%" presettings, the valve outputs are activated continuously. The preset PWM remains active until other functions have been executed or a new command value telegram is received via the bus, overriding the constant command value on the valve output.	

9.4.7 Objects for "Valve output - General"

Function command value presetting

Object no.	Function	Name	Type	DPT	Flag
20, 35, 50, 65, 80, 96	Command value	VOx - Input (x = 1...6)	1-bit	1,001	C, (R), W, -, -
1-bit input object for the presetting of a switching command value, e.g. of a KNX room temperature controller. In this case, the telegram polarity is fixed: "0" = Close valve, "1" = Open valve. The configured valve direction of action is taken into account in the electrical activation of the valve. This object is only available for valve outputs configured in the ETS to the command value data format "Switching (1-bit)".					

Function command value presetting

Object no.	Function	Name	Type	DPT	Flag
21, 36, 51, 66, 81, 96	Command value	VOx - Input (x = 1...6)	1-byte	5,001	C, (R), W, -, -
1-byte input object for the presetting of a constant command value, e.g. of a KNX room temperature controller (0...100% -> 0...255). This object is only available for valve outputs configured in the ETS to the command value data formats "Constant (1-bit) with pulse width modulation (PWM)" or "Constant (1-byte) with command value limiting value". With the command value format "Constant (1-byte) with pulse width modulation (PWM)", the telegram value is implemented by the actuator with an equivalent pulse-width-modulated switch signal at the valve outputs. The duty factor is adapted constantly by the actuator, depending on the command value received. The cycle time can be configured in the ETS. In accordance with the configured valve direction of action, the output is either energised or deenergised, depending on the valve position to be approached. In so doing, the duty factor is inverted automatically for a deenergised opened drive. In the command value format "Constant (1-byte) with command value limiting value", the received constant command value is converted into a switching output signal, depending on a configured limiting value. The valve drive opens when the command value reaches the limiting value or exceeds it. A hysteresis is also evaluated to prevent constant closing and opening of the actuator for command values in the area of the limiting value. The valve drive only closes when the command value undershoots the limiting value minus the configured hysteresis. The conversion of the constant input signal into a switching command value takes place internally in the device. During processing, the actuator evaluates the converted command value as if it were a received 1-bit command value. It forwards the status directly to the appropriate output, taking the configured valve direction of action into account.					

9.5 Cyclical command value monitoring / emergency operation

If necessary, cyclical monitoring of the command values can be performed. If, during active cyclical monitoring, there are no command value telegrams during a preset time, then emergency operation is activated for the affected valve output, for which a configurable constant PWM command value can be preset in the ETS.
The command value of emergency operation is always constant and is configured individually in the ETS (0...100% in 10% steps). The command value is executed electrically at the output using a pulse width modulation (PWM).

ℹ When emergency operation is active, valve outputs configured to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value" are always activated by a constant command value with pulse width modulation. In this case, this constant command value is also included in the calculation of the largest command value (optional function) until the emergency operation is exited and no other function with a constant command value presetting (e.g. forced position, manual operation) is active.

ℹ The configured valve direction of action (deenergised closed / deenergised opened) is taken into account in the electrical activation of the outputs by emergency operation. With deenergised closed valves, the switch-on time is derived directly from the configured PWM and the cycle time. In the case of deenergised opened valves, the switch-on time is inverted.

The actuator possesses a summer / winter switchover. Depending on the season, this allows the setting of different command value setpoints for a valve output for emergency operation Summer/winter switch-over for valve outputs. It is also possible to switch over the operating mode during active emergency operation. In this case, the value belonging to the operating mode is activated immediately after the switchover.
If no summer / winter switchover is planned in the actuator, then only a command value can be configured in the ETS for emergency operation.

If command value monitoring is enabled, then the actuator will check the arrival of telegrams on the command value object during a settable time period. The time period is defined separately for each valve output by the "Monitoring cycle" parameter. The time set there should be at least double the time for the cyclical transmission of the command value of the controller, in order to ensure that at least one telegram is received within the monitoring time. Cyclical command value monitoring takes place continuously. The actuator retriggers the monitoring time automatically on each command value telegram received and after a device reset. If there are no command value telegrams during the monitoring time, then the actuator will activate emergency operation.

ℹ If the bus control of a valve output was disabled during permanent manual operation, then no command value monitoring is performed for the affected output. This exits active emergency operation. When bus control is enabled by a permanent manual operation, the actuator restarts the monitoring time and checks for incoming command value telegrams.

According to the priority control, active command value monitoring can be overridden by other device functions with a higher priority (e.g. service mode, manual operation). At the end of a higher priority function, the actuator executes emergency operation for the valve outputs concerned once again, if it is still activated by missing command value telegrams.
Optionally, the command value of emergency operation can also be activated after bus voltage return or after an ETS programming operation. This is only the recall of the configured command value and not the activation of emergency operation, as takes place during command value monitoring.

ℹ The command value preset by active emergency operation is also included in the determination of heat requirement. In addition, the command value of emergency operation has an influence on the pump control.

At the end of emergency operation (new input command value received), the behaviour of a valve output is permanently defined. If no function with a higher priority is active, the actuator always tracks the state for the affected valve outputs most recently preset by normal bus operation (activation by command value telegrams).

ℹ After a device reset (bus voltage return, ETS programming operation), the command value objects first contain the value "0".

ℹ The state or emergency operation (active or inactive) is saved internally in the device after a bus voltage failure and is restored automatically after a bus voltage return. After a bus voltage return, the actuator activates emergency operation, if the tracked state allows this.

The actuator makes the 1-bit status telegram "Command value fault" available. As soon as a command value telegram is missing on a monitored valve output, and thus emergency operation is activated, then the actuator transmits a fault signal via this status object. The telegram polarity can be configured. Only after at least one command value telegram has been received for the monitored valve output does the actuator retract the fault signal for cyclical monitoring. Optionally, the fault telegram can also be transmitted cyclically during active emergency operation.

ℹ Immediately after the bus voltage return or an ETS programming operation, the object "Command value - Fault - Status" does not transmit the status automatically. A faulty command value must be detected again (expiry of the monitoring time without a command value telegram) for the object value to be transmitted. This is also the case if a saved emergency operation was restored after a device reset.

Enabling cyclical command value monitoring

Cyclical command value monitoring can only be used if it has been enabled in the ETS.

- Activate the checkbox "Command value monitoring" on the "VOx - General - Enable functions" parameter page. Configure the "Monitoring cycle" of the command value monitoring.

  Cyclical command value monitoring is activated. If there are no command value telegrams during the monitoring cycle preset by the parameter of the same name, then emergency operation is activated for the affected valve output, for which the actuator sets a constant PWM command value. This command value is defined on the parameter page "VOx - General - Emergency operation" by the parameter "Command value" (separately for summer and winter if required).

- Deactivate the checkbox "Command value monitoring".

  Cyclical command value monitoring is deactivated.

Configuring the fault signal for cyclical command value monitoring

If a command value fault is identified, then the actuator can optionally transmit a fault telegram via the object "Command value fault".

- Set the parameter "Object polarity" on the parameter page "VOx - General - Command value monitoring" to the required telegram polarity.

As soon as a command value telegram is missing on a monitored valve output, and thus emergency operation is activated, then the actuator transmits a fault signal via the object "Command value - Fault - Status" according to the configured telegram polarity. Only after at least one command value telegram has been received for the monitored valve output does the actuator retract the fault signal for cyclical monitoring.

- Activate the checkbox "Cyclical transmission in the case of faulty command value".

  If a command value fault is identified, then the actuator transmits the fault telegram cyclically. The cycle time is defined for all cyclical status and feedback functions on the parameter page "General - Valve outputs".

- Deactivate the checkbox "Cyclical transmission in the case of faulty command value".

  If a command value fault is identified, then the actuator transmits the fault telegram only once.

9.5.1 Command value monitoring / emergency operation parameters

Enabling the function "Command value monitoring"

VOx - General -> Enabled functions

Command value monitoring	Checkbox (yes / **no**)
Here, cyclical monitoring of the command values can be enabled as an option ("Yes" setting). If, in active cyclical monitoring, there are no command value telegrams during the monitoring time preset by the parameter of the same name, then emergency operation is activated for the affected valve output, for which a configurable constant PWM command value can be preset.	

Setting the function "Command value monitoring"

VOx - General -> Command value monitoring

Monitoring cycle	0...**20**...59 min **0**…59 s
This parameter specifies the monitoring cycle of the command value monitoring. The actuator must receive at least one command value telegram within the time frame specified here. If there is no command value telegram, then the actuator will assume a fault and will activate emergency operation for the affected valve output. This parameter is only available if command value monitoring is enabled. Presetting of the monitoring time minutes and seconds.	

Object polarity	**1 = fault / 0 = no fault /** 0 = fault / 1 = no fault
If a command value fault is identified, then the actuator can optionally transmit a fault telegram via the object "Command value - Fault - Status". This parameter defines the telegram polarity of the fault telegram. This parameter is only available if command value monitoring is enabled.	

Cyclical transmission in the case of faulty command value	Checkbox (yes / **no**)
If a command value fault is identified, then the actuator can optionally transmit the fault telegram cyclically. Here, the cyclical transmission of the fault telegram can be enabled as required ("Yes" setting). This parameter is only available if command value monitoring is enabled.	

9.5.2 Objects for command value monitoring / emergency operation

Function: Command value monitoring

Object no.	Function	Name	Type	DPT	Flag
25, 40, 55, 70, 85, 100	Command value - Fault - Status	VO x - Output (x = 1...6)	1-bit	1,005	C, R, -, T, -
1-bit output object to signal a faulty command value (with active command value monitoring, no command value telegram was received within the monitoring time). The telegram polarity can be configured. Immediately after the bus voltage return or an ETS programming operation, the object "Command value fault" does not transmit the status automatically. A faulty command value must be detected again (expiry of the monitoring time without a command value telegram) for the object value to be transmitted. This is also the case if a saved emergency operation was restored after a device reset.					

9.6 Command value limit

Enabling the command value limit

The command value limit can only be used if it has been enabled in the ETS.

- Set the parameter "Command value limit" on the parameter page "VOx - General - Enabled functions" to "yes".

  The command value limit is enabled. The "Activation" parameter defines whether the limiting function can be activated or deactivated as required via a communication object. Alternatively, the command value limit can be permanently active.

- Set the parameter "Command value limit" to "no".

  The command value limit is not available.

Setting the activation of the command value limit

The "Activation" parameter on the parameter page "VOx - General - Command value monitoring" defines the type of action of the limiting function.

The command value limit must be enabled.

- Set the parameter to "via object".

  The command value limit can only be activated using the 1-bit communication object "Command value limit - Activate / Deactivate" ("1" telegram) or deactivated ("0" telegram). The behaviour of the command value limit is definable separately after a device reset (bus voltage return, ETS programming operation).

- Set the parameter to "permanently active".

  The command value limit is permanently active. It cannot be influenced via an object. Command values preset via the KNX or via emergency operation are always limited.

Setting the initialisation behaviour of the command value limit

The command value limit can either be activated or deactivated using the 1-bit communication object "Command value limit - Activate / Deactivate" or be permanently active. When controlling via the object, it is possible to have the actuator activate the command value limit automatically after bus voltage return or an ETS programming operation. The parameters "Activate after bus voltage return" and "Activate after ETS programming operation" define the initialisation behaviour.

i With a permanently active command value limit, the initialisation behaviour cannot be configured after bus voltage return or an ETS programming operation, as the limit is always active. In this case, no object is available.

The command value limit must be enabled.

- Set the parameter "Active after bus voltage return" to "no".

  The command value limit is not activated automatically after bus voltage return. A "1" telegram must first be received via the "Command value limit" object for the limiting function to be activated.

- Set the parameter "Active after bus voltage return" to "yes".

  In this setting, the actuator does not activate the command value limit automatically after bus voltage return. To deactivate the limit a "0" telegram must be received via the "Command value limit" object. The limit can be switched on or off at any time using the object.

- Set the parameter "Active after ETS programming operation" to "no".

  The command value limit is not activated automatically after an ETS programming operation. A "1" telegram must first be received via the "Command value limit" object for the limiting function to be activated.

- Set the parameter "Active after ETS programming operation" to "yes".

In this setting, the actuator activates the command value limit automatically after an ETS programming operation. To deactivate the limit a "0" telegram must be received via the "Command value limit" object. The limit can be switched on or off at any time using the object.

ℹ The status of the command value limit is not automatically tracked in the communication object after a device reset.

ℹ It is to be noted that, on account of priority control, the actuator executes the behaviour configured by the parameters "Behaviour after bus voltage return" and "Behaviour after an ETS programming operation" on the parameter page "VOx - General" after bus voltage return and an ETS programming operation. The command values preset via configuration after a device reset are not influenced by a command value limit. A command value limit only influences the input command values preset via the bus or emergency operation command values during command value monitoring.

9.6.1 Command value limit parameters

Enabling the function "Command value limit"

VOx - General -> Enabled functions

Command value limit	Checkbox (yes / **no**)
This parameter enables the command value limit. The command value range is defined by a configurable smallest and a configurable largest command value.	

Setting the function "Command value limit"

VOx - General -> Command value limit

Activation	**via object** permanently active
This parameter decides whether the limit of the command values can either be activated and deactivated by the "Command value limit" object or whether the command value limit is permanently active.	

Active after bus voltage return	Checkbox (yes / **no**)
This parameter decides whether the command value limit is activated or inactive after voltage return.	

Active after ETS programming operation	Checkbox (yes / **no**)
This parameter decides whether the command value limit is activated or inactive after an ETS programming operation.	

Minimum command value	**0** ... 50%
The minimum command value that is valid when the command value limit is activated is defined here.	

Maximum command value	55 ... 100%
The maximum command value that is valid when the command value limit is activated is defined here.	

9.6.2 Objects for command value limit

Function: Command value limit

Object no.	Function	Name	Type	DPT	Flag
26, 41, 56, 71, 86, 101	Command value limit - Activate / Deactivate	VO x - Input (Xx = 1...6)	1-bit	1,002	C, (R), W, -, -
1-bit input object for requirement-orientated activating and deactivating of a command value limit. The telegram polarity is fixed: "0" = Command value limit inactive, "1" = Command value limit active. Updates of the object from "1" to "1" or "0" to "0" do not produce a reaction. If required, this object is only available for valve outputs configured in the ETS to the command value data format "Constant (1-byte) with pulse width modulation (PWM)". It is possible to have the actuator activate the command value limit automatically after bus voltage return or an ETS programming operation. The status of the command value limit is not then automatically tracked in the communication object.					

9.7 forced position

A forced position can be configured separately for each valve output and activated according to requirements. If a forced position is active, a defined command value is set at the output. Affected valve outputs are then locked so that they can no longer be activated using functions subject to the forced position (including activation by command value telegrams).
The command value of the forced position is always constant and is configured individually in the ETS (0...100% in 10% steps). The command value is executed electrically at the output using a pulse width modulation (PWM).

ℹ When a forced position is active, valve outputs configured to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value" are always activated by a constant command value with pulse width modulation. In this case, this constant command value is also included in the calculation of the largest command value (optional function) until the forced position is exited and no other function with a constant command value presetting (e.g. emergency operation, manual operation) is active.

ℹ The configured valve direction of action (deenergised closed / deenergised opened) is taken into account in the electrical activation of the outputs by a forced position. With deenergised closed valves, the switch-on time is derived directly from the configured PWM and the cycle time. In the case of deenergised opened valves, the switch-on time is inverted.

The actuator possesses a summer / winter switchover. Depending on the season, this allows the setting of different command value setpoints for a valve output for forced position Summer/winter switch-over for valve outputs. It is also possible to switch over the operating mode during an active forced position. In this case, the value belonging to the operating mode is activated immediately after the switchover. If no summer / winter switchover is planned in the actuator, then only a command value can be configured in the ETS for the forced position.

For each valve output, the forced position is activated and deactivated via a separate 1-bit object. The telegram polarity can be configured. According to the priority control, an active forced position can be overridden by other device functions with a higher priority (e.g. service mode, manual operation). At the end of a higher priority function, the actuator executes the forced reaction for the valve outputs concerned once again if the forced position is still activated at this time.
Optionally, the command value of the forced position can also be activated in case of bus voltage failure, after bus/mains voltage return or after an ETS programming operation. This is only the recall of the configured command value and not the activation of the forced position as takes place via the 1-bit object.

ℹ The command value preset by an active forced position is also included in the determination of heat requirement. In addition, the command value of the forced position has an influence on the pump control.

At the end of a forced position, the behaviour of a valve output is permanently defined. For the affected valve outputs, the actuator always tracks the state most recently preset by functions with a lower priority (emergency operation) or by normal bus operation (activation by command value telegrams).

ℹ After a device reset (bus voltage return, ETS programming operation), the command value objects first contain the value "0".

Enabling the forced position object and configuring the forced position

For the forced position to be used as a locking function, it must first be enabled in the ETS on the parameter page "VOx - General - Enabled functions". This switches the parameter page "VOx - General - Forced position" to visible. The remaining parameters are set there.

- Set the parameter "Forced position controllable via object" to "yes". Define the parameter "Object polarity" to the required telegram polarity. In addition, configure the required command values (optional for summer and winter mode).

  The forced position object is enabled. The affected valve output is locked by a telegram according to the "Forced operation active" polarity at the defined command value (optional according to the most recently preset operating mode).

- Set the parameter "Forced position controllable via object" to "no".

  The forced position object is not enabled. The forced position for locking the valve output is not possible. Only the command values can be configured, so that a state for the reset behaviour of the valve output can be optionally defined.

ℹ Updates of the object from "Forced position active" to "Forced position active" or from "Forced position inactive" to "Forced position inactive" produce no reaction.

ℹ The status preset via the forced position object is stored internally in the device after a bus voltage failure and is restored automatically after a bus voltage return. After a bus voltage return, the actuator activates the forced position, if the tracked state allows this. However, when presetting the command values, only that behaviour is significant, according to the priority sequence, which the parameter "After bus voltage return" defines (the command value of the forced position is not activated).
The tracked state of the forced position is not then automatically tracked in the communication object by the actuator.

ℹ After an ETS programming operation, a forced position is always deactivated and the forced position object is "0". In the polarity "0" = Forced position active / "1" = No forced position, a "0" telegram must first be received to activate the forced position.
If, after a bus voltage return, the previously stored object value "0" is restored, then actuator will also activate the forced position in the polarity "0 = Forced position active / 1 = No forced position", thus locking the output.

ℹ If the forced position object is not enabled, then only the command value parameters are available, so that valid preset values are available for the actuator reset behaviour, as required ("Activate command value according to forced position").

9.7.1 "Forced position" parameters

VOx - General -> Forced position

Command value	0 % 10 % ... **30 %** ... 90 % 100 %
When forced operation is activated via a 1-bit object, after voltage return or after an ETS programming operation, it is possible to set the forced command value configured here as the active command value. When the command value of the forced position is recalled, the valve output configured to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value" is always activated by a constant command value with pulse width modulation.	

Command value (summer)	0 % 10 % ... **30 %** ... 90 % 100 %

When forced operation is activated via a 1-bit object, after voltage return or after an ETS programming operation, it is possible to set the forced command value configured here as the active command value. The command value preset here is only applied if summer operation is activated.

When the command value of the forced position is recalled, the valve output configured to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value" is always activated by a constant command value with pulse width modulation.

Command value (winter)	0 % 10 % ... **70 %** ... 90 % 100 %

When forced operation is activated via a 1-bit object, voltage return or after an ETS programming operation, it is possible to set the forced command value configured here as the active command value. The command value preset here is only applied if winter mode is activated.

When the command value of the forced position is recalled, the valve output configured to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value" is always activated by a constant command value with pulse width modulation.

Forced position controllable via object	Checkbox (yes / **no**)

This parameter enables the "Forced position - Activate / Deactivate" object.

- Yes: The object "Forced position - Activate / Deactivate" is visible. The forced position is activated and deactivated via a separate 1-bit object.
- No: The configured forced command values are used for the reset behaviour after voltage return and after ETS programming operation. A forced position cannot be activated.

Object polarity	**1 = forced position active / 0 = no forced position** 0 = forced position active / 1 = no forced position
The telegram polarity of the "Forced position - Activate / Deactivate" object is defined here when the forced position object is enabled.	

Status object	Checkbox (yes / **no**)
This parameter enables the "Forced position - Status" object. – Yes: The "Forced position - Status" object is visible. The polarity of the object is defined: 1 = forced position active / 0 = no forced position – No : The "Forced position - Status" object is not visible.	

9.7.2 Objects for forced position

Object no.	Function	Name	Type	DPT	Flag
24, 39, 54, 69, 84, 99	Forced position - Activate / Deactivate	VO x - Input	1-bit	1,003	C, -, W, -, U
1-bit input object for activating and deactivating of a forced position. The telegram polarity can be configured. ℹ Updates of the object from "Forced position active" to "Forced position active" or from "Forced position inactive" to "Forced position inactive" produce no reaction. ℹ The status preset via the forced position object is stored internally in the device after voltage failure and is restored automatically after voltage return.					

Object no.	Function	Name	Type	DPT	Flag
32, 47, 62, 77, 96, 107	Forced position - Status	VO x - Output	1-bit	1,003	C, R, -, T, A
1-bit output object for status message of a forced position. The polarity of the object is defined: 1 = forced position active / 0 = no forced position					

9.8 Command value status

Command value status

A status object can be optionally enabled for each valve output. The status object makes the active command value of a valve output available either actively transmitting or passively (object can be read out). In the status message, the actuator takes all the functions into account which have an influence on the command value implemented at the output. Depending on the configured data format of the input command value, the status object will possess the data formats named below...

– Input command value "Switching (1-bit)":
  Data format of status object "1-bit",

- Input command value "Constant (1-byte) with pulse width modulation (PWM)": Data format of status object "1-byte",
- Input command value "Constant (1-byte) command value limiting value": Data format of status object "1-bit".

The status objects will assume different status values, depending on the input data formats of the command values and the state of operation of a valve output.

i The actuator distinguishes between different functions and events that can have an effect on the valve outputs. Because these functions and events cannot be executed simultaneously, there is priority control. Each global or output-orientated function and each incoming event possesses a priority Priorities for valve outputs. The function or the event with the higher priority overrides the lower-priority functions and events.
Priority control also influences the status objects. That state is always transmitted as the status which is currently set at a valve output. If a function with a high priority is exited, then the status objects assume the command value of functions with a lower priority, providing that they are active.

Status value for input command value "Switching (1-bit)"...

- State of operation "Normal operation"
  -> Status value = Most recently received input command value ("0" or "1"),
- State of operation "Emergency operation" (0...100%)
  -> Status value = Emergency operation command value ("0" at 0%, "1" at 1...100%),
- State of operation "Forced position" (0...100%)
  -> Status value = Forced command value ("0" at 0%, "1" at 1...100%),
- State of operation "Valve rinsing" (0%, 100%)
  -> Status value = Current command value in rinsing operation ("0" when valve closed, "1" when valve opened),
- State of operation "Service mode" (0%, 100%)
  -> Status value = Service command value ("0" when valve forcibly closed, "1" when valve forcibly opened),
- State of operation "After device reset" (0...100%)
  -> Status value = According to presetting by parameter "Behaviour after bus or mains voltage return" or "Behaviour after ETS programming operation" ("0" at 0%, "1" at 1...100%),
- State of operation "Manual operation" (5...100%)
  -> Status value = Manual operation mode command value ("0" at 0% CLOSE, "1" at 5...100% OPEN),
- State of operation "Valve voltage failure" (0%, 100%)
  -> Status value = Command value according to valve direction of action ("0" when deenergised closed, "1" when deenergised opened),
- State of operation "Short-circuit / overload" (0%, 100%)
  -> Status value = Command value according to valve direction of action ("0" when deenergised closed, "1" when deenergised opened).

Status value for input command value "Constant (1-byte) with pulse width modulation (PWM)"...

- State of operation "Normal operation" -> Status value = Most recently received input command value (0...100%),
- State of operation "Emergency operation" (0...100%) -> Status value = Emergency operation command value (0...100%),
- State of operation "Forced position" (0...100%) -> Status value = Forced command value (0...100%),
- State of operation "Valve rinsing" (0%, 100%) -> Status value = Current command value in rinsing operation ("0%" when valve closed, "100%" when valve opened),
- State of operation "Service mode" (0%, 100%) -> Status value = Service command value ("0%" when valve forcibly closed, "100%" when valve forcibly opened),
- State of operation "After device reset" (0...100%) -> Status value = According to presetting by parameter "Behaviour after bus or mains voltage return" or "Behaviour after ETS programming operation" ("0" at 0%, "1" at 1...100%),
- State of operation "Manual operation" (5...100%) -> Status value = Manual operation mode command value (0% CLOSE, 5...100% OPEN),
- State of operation "Valve voltage failure" (0%, 100%) -> Status value = Command value according to valve direction of action (0% when deenergised closed, 100% when deenergised opened),
- State of operation "Short-circuit / overload" (0%, 100%) -> Status value = Command value according to valve direction of action (0% when deenergised closed, 100% when deenergised opened).

Status value for input command value "Constant (1-byte) command value limiting value"...

- State of operation "Normal operation" -> Status value = According to evaluation of the input command value by limiting value and hysteresis ("0" for command value < limiting value - hysteresis or "1" for command value >= limiting value),
- State of operation "Emergency operation" (0...100%) -> Status value = Emergency operation command value ("0" at 0%, "1" at 1...100%),
- State of operation "Forced position" (0...100%) -> Status value = Forced command value ("0" at 0%, "1" at 1...100%),
- State of operation "Valve rinsing" (0%, 100%) -> Status value = Current command value in rinsing operation ("0" when valve closed, "1" when valve opened),
- State of operation "Service mode" (0%, 100%) -> Status value = Service command value ("0" when valve forcibly closed, "1" when valve forcibly opened),

- State of operation "After device reset" (0...100%)
  -> Status value = According to presetting by parameter "Behaviour after bus or mains voltage return" or "Behaviour after ETS programming operation"
  ("0" at 0%, "1" at 1...100%),
- State of operation "Manual operation" (5...100%)
  -> Status value = Manual operation mode command value ("0" at 0% CLOSE, "1" at 5...100% OPEN),
- State of operation "Valve voltage failure" (0%, 100%)
  -> Status value = Command value according to valve direction of action ("0" when deenergised closed, "1" when deenergised opened),
- State of operation "Short-circuit / overload" (0%, 100%)
  -> Status value = Command value according to valve direction of action ("0" when deenergised closed, "1" when deenergised opened).

Activating the command value status function

The status message of the valve command value is a function of the valve outputs and can be enabled on the parameter pages "VOx - General -> Status".

- Set the "Valve command value" parameter to "yes".

  Status feedback is enabled. The status object of the valve output becomes visible in the ETS.

- Set the parameter to "no".

  Status feedback is deactivated. No status object is available.

The feedback telegram is transmitted as soon as the status changes. An automatic telegram transmission of the feedback takes place after bus voltage return, if the supply voltage of the actuators fails and returns or after an ETS programming operation (possibly with a delay).

i The status object does not transmit if the status does not change after the activation or deactivation of device functions or new input command values. Transmission only ever takes place after changes to the command value.

Setting the time delay of the command value status feedback

The state of the status message is not transmitted automatically to the bus after bus voltage return or an ETS programming operation. In these cases, feedback can be time-delayed with the time delay being preset globally for all valve outputs together on the "General" parameter page.

- Set the parameter "Delay after bus voltage return" to "yes".

  The status message is transmitted with a delay after bus voltage return or after an ETS programming operation. No feedback is transmitted during a running time delay, even if the valve state changes during this delay.

- Set the parameter "Delay after bus voltage return" to "no".

  The status message is transmitted immediately after bus voltage return or after an ETS programming operation.

ℹ If the supply voltage of the actuators fails and returns, then the status message is always transmitted without a delay, providing that the bus voltage supply is switched on.

Setting cyclical transmission of the command value status message

The status message telegram can also be transmitted cyclically via the object in addition to the transmission after changes.

- Set the parameter "Transmit on" to "change and cyclical".
  Cyclical transmission is activated.
- Set the parameter "Transmit on" to "change".
  Cyclical transmission is deactivated so that the status is transmitted to the bus only when changed by the actuator.

ℹ The cycle time is defined centrally for all the valve outputs on the parameter page "General".

ℹ There is no cyclical transmission during an active time delay after bus voltage return or an ETS programming operation.

9.8.1 Status parameters

Valve output x - General -> Enabled functions

Status	Checkbox (yes / **no**)
This parameter generally enables the feedback functions. The feedback functions are configured on the "Status" parameter page.	

Valve output x - General -> Status

Valve command value	Active **Inactive**
This parameter enables the status object "Command value - Status". The data point type corresponds to the input object "Command value" The status object makes the active command value of the valve output available. All functions are taken into account that have an influence on the command value implemented at the output.	

Transmit on	**Change** Change and cyclical
The status feedback telegram can also be transmitted cyclically via the active signal object in addition to the transmission after changes. This parameter is only visible in case of enabled status feedback. Change: Cyclical transmission is deactivated so that the feedback telegram is transmitted to the bus only when the status is changed by the actuator. Change and cyclical: Cyclical transmission is activated. The cycle time is defined centrally for all the valve outputs on the parameter page "General valve outputs". There is no cyclical transmission during an active time delay after voltage return or an ETS programming operation.	

Delay after bus voltage return	Checkbox (yes / **no**)
If used as active signal object, the state of the status feedback information is transmitted to the bus after voltage return or after an ETS programming operation. In these cases, feedback can be time-delayed with the time delay being preset globally for all valve outputs together on the "General valve outputs" parameter page. This parameter is only visible in case of enabled status feedback. Active: The status feedback is transmitted with a delay after voltage return or after an ETS programming operation. No feedback is transmitted during a running time delay, even if the valve state changes during this delay. Inactive: The status feedback is transmitted without delay after voltage return or after an ETS programming operation.	

9.8.2 Objects for status

Function: Valve status

Object no.	Function	Name	Type	DPT	Flag
22, 37, 52, 67, 82, 97	Status command value	VO x - Output (x = 1...6)	1-bit	1,001	C, R, -, T, -
1-bit output object to feed back the active switching command value of a valve output. In this case, the telegram polarity is fixed: "0" = Valve closed, "1" = Valve opened. This object is only available for valve outputs configured in the ETS to the command value data formats "Switching (1-bit)" or "Constant (1-byte) with command value limiting value". It may also occur with such command value outputs that a constant command value (PWM at the output) is active (e.g. after bus/mains voltage return or a forced position and emergency operation or manual operation). In this case, the status object feeds back a "0" if the command value corresponds to "0%". The object returns a "1" when the set command value corresponds to "1...100%". The object transmits the current status after bus voltage return and an ETS programming operation, possibly after a transmission delay (configurable) has elapsed.					

Object no.	Function	Name	Type	DPT	Flag
23, 38, 53, 68, 83, 98	Status command value	VO x - Output (x = 1...6)	1-byte	5,001	C, R, -, T, -
1-byte output object to feed back the active constant command value of a valve output (0...100% -> 0...255). This object is only available for valve outputs configured in the ETS to the command value data format "Constant (1-byte) with pulse width modulation (PWM)". The object transmits the current status after bus voltage return and an ETS programming operation, possibly after a transmission delay (configurable) has elapsed.					

9.9 Short-circuit and overload detection

The actuator is able to detect an electrical overload or a short-circuit at the valve outputs and to protect them against destruction by switching off. Outputs which have experienced a short-circuit or a constant load are deactivated after an identification period. Optionally, in this case short-circuit/overload signals can be transmitted via separate 1-bit communication objects.
Short-circuit / overload detection is always active when a valve output is switched on (output energised) and always occurs in two output groups. Here, outputs 1 to 3 and outputs 4 to 6 each form a group. If there is an error, the actuator will only detect an overload / a short-circuit in a group at first. Therefore, the actuator then executes a special testing cycle, which guarantees safe detection of the valve outputs which are actually electrically overloaded. Only after overloaded or short-circuited valve outputs have been accurately determined is it possible to output overload/short-circuit signals to the bus. After error detection in a group, all the outputs in this group are immediately deactivated for 6 minutes (switch-off idle phase / outputs not energised). During this time, the error detection circuit resets thermally.

Testing cycle

During the testing cycle, the actuator applies stepped, time-offset switch-on and deactivation of each valve output of the affected group to determine the outputs which are overloaded or shorted and which thus led to the error switch-off. In the case of a weak overload at, for example, one valve output, it may occur during the testing cycle that, during the individual testing of the output during the switch-on phase, no overload is detected, as the overload is too slight. This means that it may be necessary to start multiple testing cycles, until the overloaded output can be identified clearly.
Each output group is equipped with a meter, which saves the number of testing cycles started for a group up to that point. Each time it is not possible to determine clearly if a valve output is overloaded or short-circuited during a testing cycle, then the counter will meter upwards by one increment. If another error is detected in an output group unsuccessfully tested for overload / short-circuit (meter reading > "0"), then the outputs will be energised with a longer switch-on time in the new testing cycle. In the first testing cycle, the switch-on time is 1 second, in the 2nd cycle 10 seconds, in the 3rd cycle 1 minute and, in the 4th cycle, 4 minutes.
The meter reading is only saved in the device and cannot be read out.

If there is a collective overload, various weak overloads, possibly at multiple outputs, have collected into a stronger overall overload. If there is a collective overload, it may occur that, even after four testing cycles, no output can be clearly identified as overloaded. In this case, after the fourth cycle, the actuator will deactivate individual valve outputs of an output group, until no overload exists.

Here is the testing cycle for the identification of overloaded or short-circuited valve outputs in detail...

- 1.
  An overload or short-circuit was detected in a group. The actuator deactivates all the valve outputs of the affected group. The switch-off idle phase (6 minutes) is started.
- 2.
  The first valve output of the affected group (output 1 or output 4) switches on for approx. 1 second, if this output was not previously deactivated by a previous testing cycle. If the output was previously deactivated, then the actuator switches the next output on (output 2 or output 5, etc.).
- 2. a
  If, during the switch-on time, no overload or no short-circuit is detected because the overload / the short-circuit is pending at another output or is too slight (weak overload), then the output will be switched off again. Continue with Step 3.
- 2. b
  If, at the tested valve output, an overload or a short-circuit is detected, then a forced switch-off takes place immediately at this output. The output is deactivated. Then a switch-off idle phase of 6 minutes is started, during which the error detection circuit resets thermally. During this time, the affected output group remains completely switched off.
- 3.
  The output test started under Step 2 is continued with the next output, which has not been deactivated, in the appropriate group in the same fashion, with a time gap of approx. 4 seconds from output test to output test, until the last valve output of the group or both groups has been processed.
- 4.
  The testing cycle is then finally exited when all the valve outputs or both groups have been processed.
- 4. a
  The valve outputs detected as overloaded or having shorted in the testing cycle of the group(s) now remain deactivated and cannot be switched on again until the reset. The testing cycle counter is deleted. All the unaffected valve outputs are again activated normally.
- 4. b
  If, during the testing cycle, no output was detected as being overloaded or having shorted (probable weaker overload), then the testing cycle counter for this/these group(s) will count upwards, so that, in the next cycle, all the affected valve outputs are tested with an extended switch-on time, in order to detect weaker overloads.

Exception: If the previously executed testing operation was the 4th sequence in succession without any error detection, then the actuator will assume that this is a collective overload at multiple outputs. In this case, the actuator will automatically deactivate one output of the affected group (output 3 or output 6), according to the priority. In so doing, the testing cycle counter will be deleted as for regular identification of an error, and testing again occurs with a 1 s switch-on time in the next cycle. If 4 cycles again occur after this, without outputs being detected as overloaded or having shorted during the individual test, then the actuator will again assume a collective overload and will automatically permanently deactivate the next outputs of the group(s) (firstly output 2 and/or output 5, then, after four more cycles, output 1 and/or output 4).

– 5.
All the valve outputs not deactivated in the testing cycles then continue to work normally.

ℹ If possible, connect actuators for environments with increased fail-safety requirements to the outputs 1 and 4. During overload detection, these are switched off last, as described.

ℹ Signal telegrams, if configured for a valve output in the ETS, are only generated for those valve outputs which were forcibly deactivated by priority in the testing cycle, after the detection of an error or a collective overload.

ℹ The resetting of an overload or a short-circuit during a testing cycle is ignored.

ℹ To give less weight to detected overloads caused by rare, extreme interference, such as strong electromagnetic coupling into the low-voltage network (lightning strike close by), the cycle counter is reduced by 1 after a period of 28 days without the detection of a further overload or a new short-circuit. This ensures that, after long periods of time, valve outputs are not simply switched off after the 4th cycle without identification of a clear overload or a short-circuit.

ℹ A valve output switched off via the bus (output not energised) can also be energised during the overload or short-circuit detection phase for the period of time defined in the testing cycle.

A short-circuit or an overload influences the command value status of the valve outputs of an output group. Even at the beginning of a short-circuit / overload identification phase, the actuator will set the command value status, according to the valve direction of action, either to "OFF" / "0%" (for deenergised closed) or to "ON" / "100%" (for deenergised opened). This valve status remains intact during the entire length of the identification phase and for valve outputs identified as having short-circuited or being overloaded. Energisation phases during the testing cycles do not influence the command value status.

ℹ The command value status contained in the combined valve status is not influenced by a short-circuit or an overload.

A valve output affected by a short-circuit / overload (valve completely closed on deenergised closed or completely opened on deenergised opened) does not influence the evaluation of the calculation of the "Largest command value" or the heat requirement and pump control.

Examples of overload / short-circuit detection...

Example 1
Error case = Short-circuit at valve output 4.

A short-circuit generates a short-circuit/overload signal in output group A4...A6. This produces the following sequence...

Test time	Outputs						KNX message						Comment
	1	2	3	4	5	6	1	2	3	4	5	6	
6min	N	N	N	0	0	0	-	-	-	-	-	-	Overload only affects one group!
<1s	N	N	N	1	0	0	-	-	-	T	-	-	Check output 4 4 s later → Short-circuit
6min	N	N	N	0	0	0	-	-	-	-	-	-	Switch-off idle phase. Short-circuit message
1s	N	N	N	0	1	0	-	-	-	-	-	-	Check output 5 → No error
1s	N	N	N	0	0	1	-	-	-	-	-	-	Check output 6 4 s later → No error
---	N	N	N	0	N	N	-	-	-	-	-	-	Output 4 remain deactivated 4 s later! All the other outp. contin. to work "normally"!

Figure 17: Short-circuit at valve output 4

"0"	Output not energised
"1"	Output energised
"N"	Normal operation of the valve output
"T"	Short-circuit / overload identified (signal telegram is cancelled if configured)

On next error detection in group 4-6: Test switch-on time: 10 s

Example 2
Error case = Weak overload at valve output 2.

The overload is so weak that a switch-on time of 1 second does not lead to error detection. In the case of a weak overload, it should be expected that the overload/short-circuit signal only affects the directly affected output group (here: Outputs 1 to 3). This produces the following sequence...

Test time	**Outputs**						**KNX message**						**Comment**
	1	2	3	4	5	6	1	2	3	4	5	6	
6min	0	0	0	N	N	N	-	-	-	-	-	-	Overload only affects one group!
1s	1	0	0	N	N	N	-	-	-	-	-	-	Check output 1 → No error
1s	0	1	0	N	N	N	-	-	-	-	-	-	Check output 2 4 s later → No error
1s	0	0	1	N	N	N	-	-	-	-	-	-	Check output 3 4 s later → No error
---	N	N	N	N	N	N	-	-	-	-	-	-	4 s later: All outputs working normally.

Figure 18: Weak overload at valve output 2 / first testing cycle

On next error detection in group 1...3: Test switch-on time: 10 s
It should be expected that, in normal operation, an overload will again be detected in the previously affected output group...

Test time	Outputs						KNX message						Comment
	1	2	3	4	5	6	1	2	3	4	5	6	
6min	0	0	0	N	N	N	-	-	-	-	-	-	Overload only affects one group!
10s	1	0	0	N	N	N	-	-	-	-	-	-	Check output 5 → No error
<10s	0	1	0	N	N	N	-	T	-	-	-	-	Check output 2 4 s later → Overload
6min	0	0	0	N	N	N	-	-	-	-	-	-	Switch-off idle phase. Overload message
10s	0	0	1	N	N	N	-	-	-	-	-	-	Check output 3 4 s later → No error
---	N	0	N	N	N	N	-	-	-	-	-	-	Output 2 remain deactivated 4 s later! All the other outputs continue to work "normally"!

Figure 19: Weak overload at valve output 2 / second testing cycle

On next error detection in group 1...3: Test switch-on time: 1 s

<u>Example 3</u>
Error = Total overload in output group "Output 1 to 3".

The overload of individual valve outputs is so weak that, during the testing cycles, no output can be clearly identified as overloaded or having shorted during a test switch-on time of 4 minutes. This produces the following sequence...

Test time	Outputs						KNX message						Comment
	1	2	3	4	5	6	1	2	3	4	5	6	
6min	0	0	0	N	N	N	-	-	-	-	-	-	Overload only affects one group!
1s	1	0	0	N	N	N	-	-	-	-	-	-	Check output 1 → No error
1s	0	1	0	N	N	N	-	-	-	-	-	-	Check output 2 4 s later → No error
1s	0	0	1	N	N	N	-	-	-	-	-	-	Check output 3 4 s later → No error
---	N	N	N	N	N	N	-	-	-	-	-	-	4 s later: All outputs working normally.

Figure 20: Total overload in output group 1...3 / first testing cycle

On next error detection in group 1...3: Test switch-on time: 10 s
It should be expected that, in normal operation, an overload will again be detected in the previously affected output group...

Test time	Outputs						KNX message						Comment
	1	2	3	4	5	6	1	2	3	4	5	6	
6min	0	0	0	N	N	N	-	-	-	-	-	-	Overload only affects one group!
10s	1	0	0	N	N	N	-	-	-	-	-	-	Check output 1 → No error
10s	0	1	0	N	N	N	-	-	-	-	-	-	Check output 2 4 s later → No error
10s	0	0	1	N	N	N	-	-	-	-	-	-	Check output 3 4 s later → No error
---	N	N	N	N	N	N	-	-	-	-	-	-	4 s later: All outputs working normally.

Figure 21: Total overload in output group 1...3 / second testing cycle

On next error detection in group 1...3: Test switch-on time: 1 min.
It should be expected that, in normal operation, an overload will again be detected in the previously affected output group...

Test time	Outputs						KNX message						Comment
	1	2	3	4	5	6	1	2	3	4	5	6	
6min	0	0	0	N	N	N	-	-	-	-	-	-	Overload only affects one group!
1min	1	0	0	N	N	N	-	-	-	-	-	-	Check output 1 → No error
1min	0	1	0	N	N	N	-	-	-	-	-	-	Check output 2 4 s later → No error
1min	0	0	1	N	N	N	-	-	-	-	-	-	Check output 3 4 s later → No error
---	N	N	N	N	N	N	-	-	-	-	-	-	4 s later: All outputs working normally.

Figure 22: Total overload in output group 1...3 / third testing cycle

On next error detection in group 1...3: Test switch-on time: 4 min.
It should be expected that, in normal operation, an overload will again be detected in the previously affected output group...

Test time	**Outputs**						**KNX message**						**Comment**
	1	2	3	4	5	6	1	2	3	4	5	6	
6min	0	0	0	N	N	N	-	-	-	-	-	-	Overload only affects one group!
4min	1	0	0	N	N	N	-	-	-	-	-	-	Check output 1→ No error
4min	0	1	0	N	N	N	-	-	-	-	-	-	Check output 2 4 s later → No error
4min	0	0	1	N	N	N	-	-	-	-	-	-	Check output 3 4 s later → No error
---	N	N	0	N	N	N	-	-	T	-	-	-	4 s later: Output 3 is deactivated autom. according to the priority. All the other outputs continue to work "normally"!

Figure 23: Total overload in output group 1...3 / fourth testing cycle

On next error detection in group 1-3: Test switch-on time: 1 s

Short-circuit / overload signal telegrams

Signal telegrams, are only transmitted for the outputs which were deactivated by priority in the testing cycle, after the detection of an error or a collective overload. The precondition is that the signal telegram on the parameter page "VOx - General - Status" is enabled by the "Short-circuit / overload signal" parameter with the setting "yes". The telegram polarity of the status telegram can be configured.
An active short-circuit / overload signal remains intact after a device reset by bus voltage return. In this case as well, the short-circuit / overload signal must first be reset (see "Resetting a short-circuit / overload" below). If, before the bus voltage failure, no short-circuit and no overload was identified, then the actuator will first transmit a signal telegram "No short-circuit / no overload" after bus voltage return. Should, after bus/mains voltage return, a short-circuit or an overload occur, then the actuator will start a new identification phase.
After an ETS programming operation, short-circuit / overload signals are always deactivated. Here, in the case of shorted or overloaded valve outputs, the actuator will first perform an identification phase again, in order to detect faulty valve outputs.

ℹ The object always transmits the current status after bus voltage return and an ETS programming operation after a delay, providing that a delay after bus voltage return has been configured on the parameter page "General - Valve outputs".

ℹ The states "Short-circuit" and "Overload" are also fed back in the combined valve status .

Resetting a short-circuit / overload

Valve outputs, identified as having shorted or being overloaded, are detected by the actuator. In this case, affected valve outputs can no longer be activated by any functions of the actuator. The cause of the error must be eliminated and the "Short-circuit / overload" state also be reset, so that the outputs can be activated again.

There are two alternative options for the recommissioning of one or more deactivated valve outputs...

– Global reset of all overload / short-circuit states:
  All the overload / short-circuit states of the actuator can be reset jointly. For this, the 1-bit communication object "Reset short-circuit / overload" is available, which can be enabled on the parameter page "Valve / pump", using the "Global reset of all 'Short-circuit / overload' signals?" parameter in the "Yes"

setting. As soon as the actuator receives a "1" telegram via this object, all the overload / short-circuit states will be reset immediately. The actuator then deactivates the overload / short-circuit state of each valve output and also retracts the overload / short-circuit signals. Should all or some of the valve outputs still be shorted or overloaded at this time, then a new identification phase will begin.
A "0" telegram to the "Reset short-circuit / overload" object produces no reaction.

ℹ The global resetting of an overload or a short-circuit during a testing cycle is always ignored.

– Resetting by switching off the valve voltage supply:
Overload / short-circuit states can be reset by switching off the valve voltage supply. The following procedure is required for this:

a) Switch-off of the valve voltage supply. After this, the actuator immediately transmits a signal telegram "Failure of operating voltage", provided that this function is globally enabled in the ETS and the bus voltage is still switched on. In addition, all the overload / short-circuit signals of the valve outputs are reset immediately. If, at this time, no bus voltage is switched on, then the actuator will reset the overload / short-circuit signals after the bus voltage is switched on again.

b) Elimination of the cause of the overload / short-circuit

c) Switch-on of the valve voltage supply. The valves can then be activated again normally. When the valve voltage supply is switched on, the actuator also retracts the "Failure of operating voltage" signal, provided that this function is globally enabled in the ETS.

d) Should all or some of the valve outputs still be shorted or overloaded after the return of the valve voltage supply, then a new identification phase will begin.

ℹ Switching off the valve voltage during a testing cycle only causes a reset of existing overload / short-circuit signals. The testing cycle is not cancelled.

9.9.1 Short-circuit and overload detection parameters

Short-circuit / overload	Checkbox (yes / **no**)
The actuator is able to detect an overload or a short-circuit at the valve outputs and, in consequence, to protect them against destruction. Outputs which have experienced a short-circuit or a constant load are deactivated after an identification period. In this case, a short-circuit or overload signal can be transmitted via a KNX communication object. In the "yes" setting, this parameter enables the object "Short-circuit / overload - Status".	

Object polarity	**1 = short-circuit/overload / 0 = no short-circuit/overload** 0 = short-circuit / overload / 1 = no short-circuit / overload
When the object for short-circuit / overload messaging is enabled, the telegram polarity of the "Short-circuit / overload - Status" object is defined here.	

9.9.2 Objects for short-circuit and overload detection

Function overload / short-circuit identification

Object no.	Function	Name	Type	DPT	Flag
29, 44, 59, 74, 89, 104	Short-circuit / overload - Status	VO x - Output (x = 1...6)	1-bit	1,005	C, R, -, T, -
1-bit output object to signal an identified overload or a short-circuit at the affected valve output. The telegram polarity can be configured. The object always transmits the current status after bus voltage return and an ETS programming operation after a delay, providing that a delay after bus voltage return has been configured on the parameter page "General - Valve outputs".					

9.10 Valve rinsing

To prevent calcification or sticking of a valve which has not been activated for some time, the actuator has an automatic valve rinsing function. Valve rinsing can be executed cyclically or using a bus command, causing the activated valves to run through the full valve stroke for a preset period of time. During valve rinsing, the actuator activates a command value of 100% without interruption for the affected valve output for half of the configured "Valve rinsing time". For this, the valves open completely. After half the time, the actuator switches to a command value of 0%, causing the connected valves to close completely.
If necessary, the intelligent valve rinsing can be enabled. In so doing, cyclical rinsing using the full stroke is only executed when a defined minimum command value limiting value was not exceeded during actuator operation.

ℹ During valve rinsing, the actuator executes the command values "1" (corresponds to "100%" - open completely) and "0" (corresponds to "0%" - close completely) for valve outputs configured with a command value limiting value for the data formats "Switching (1-bit)" or "Constant (1-byte)".

ℹ The actuator takes the valve direction of action configured in the ETS into account in the electrical activation of the valve output.

At the end of valve rinsing, the actuator automatic sets the tracked command value according to the priority control Priorities for valve outputs.

ℹ The actuator does not execute valve rinsing if a higher-priority function is active. Nonetheless, the actuator internally starts the rinse length, as soon as the device receives a command for valve rinsing (cyclically or via bus command).

If, during an active rinsing time, higher-priority functions are exited, then the actuator will execute the remaining residual time of the rinse function. If the rinsing time continuous to elapse during a function with a higher priority, then there is no residual time. Thus, the actuator will not execute the previously started valve rinsing.

ℹ If the bus control of individual valve outputs is disabled as part of a permanent manual operation, then the actuator will save the start commands of a valve rinsing operation in the background. In this case, the actuator will start the rinse time immediately after the lifting of the disabling function. If, after this, the manual operation is exited after the rinse time has started (and no other higher-priority functions are active), then the actuator will also execute valve rinsing actively.

ℹ The actuator also executes valve rinsing by starting the rinse time, even if the valve voltage supply has been switched off. A bus voltage failure immediately interrupts an active rinsing operation. When the bus/mains voltage returns, a previously interrupted rinsing operation is not executed again.

ℹ Valve rinsing influences the status feedback of the active command value.

Valve rinsing possesses a separate 1-bit status object. Optionally, this object can be used, for example, to display a KNX visualisation that valve rinsing is taking place (rinse operation time running). The status telegram can be used, for example, to disable a KNX room temperature controller for the length of the valve rinsing. Particularly in the case of long rinsing times, the disabling of the room temperature controller, possibly in combination with the disabling of the controller operation, can make a positive contribution to the suppression of the oscillation behaviour of the controller. The telegram polarity of the status object is fixed: "0" = Valve rinsing inactive, "1" = Valve rinsing active.

ℹ The object transmits the current status after bus and mains voltage return and after an ETS programming operation without a delay.

Enabling valve rinsing

Valve rinsing can only be used if it has been enabled in the ETS.

- Set the parameter "Valve rinsing" on the parameter page "VOx - Enabled functions" to "yes". Using the "Valve rinsing time" parameter on the parameter page "VOx - General - Valve rinsing", configure for how long the rinse function (100% -> 0%) is to be executed.

  Valve rinsing is enabled. Additional parameters become visible in the ETS, presetting whether the valve rinsing is to be activated cyclically and / or with bus control.

ℹ Set the length of the valve rinsing to the adjusting cycle time of the electrothermal actuators in such a way that they open and close completely. This is usually guaranteed by configuring the rinsing length to double the adjusting cycle time.

- Set the "Valve rinsing" parameter to "no".

Valve rinsing is not available.

Configuring cyclical valve rinsing

The actuator can perform valve rinsing cyclically, if necessary. When using the cyclical valve rinsing, a rinse operation can be started automatically after a configurable cycle time (1...26 weeks). Here too, the valve rinsing length configured in the ETS defines the time for the once-only, complete opening and closing of the activated valve drives. At the end of a rinsing operation, the actuator always restarts the cycle time.

Valve rinsing must be enabled and a valid rinsing time configured.

- Set the "Cyclical valve rinsing" parameter to "yes". In the case of the "Repeat all" parameter, configure how often valve rinsing is to be performed automatically.

  Cyclical valve rinsing is enabled.

- Set the "Cyclical valve rinsing" parameter to "No".

  Cyclical valve rinsing is completely disabled. Valve rinsing can only be started by the communication object (if enabled).

i Each ETS programming operation resets the cycle time. The first rinsing operation with cyclical valve rinsing takes place after an ETS programming operation after the first time cycle has elapsed.
If there is a bus voltage failure, the actuator saves the remaining residual time of the current time cycle. The residual cycle time is restarted after bus voltage return.
A bus voltage failure immediately interrupts an active rinsing operation. After bus voltage return, a previously interrupted rinsing operation is not executed again. The actuator then starts a new time cycle for cyclical valve rinsing.

Optionally, intelligent cyclical valve rinsing can be additionally activated. Here, valve rinsing is only executed repeatedly, if, in the current time cycle, a minimum command value limiting value, configurable in the ETS, was not exceeded. It the active command value exceeds the limiting value, then the actuator will stop the cycle time. The actuator only restarts the cycle time if, in the further course of the command value change, a command value of "0%" or "OFF" (completely closed) is set
(see figure 24). This prevents valve rinsing if the valve has already run through a sufficiently defined stroke.
If, after exceeding the configured limiting value, the value was not completely closed at least once (command value "0%" or "OFF"), then no further cyclical valve rinsing will take place.

Use of the intelligent cyclical valve rinsing means that rinsing operations over the entire valve stroke are only then used when this is sensible and actually required. For example, in the summer months, the use of heating power is lower. In consequence, the valves are activated less frequently by command values, meaning that valve rinsing should be performed as anti-sticking protection. In the winter months, it is frequent necessary to activate heating valves using normal command value telegrams. The intelligent valve rinsing ensures that no redundant valve rinsing is not performed in the winter. In the summer, the intelligent control performs valve rinsing cyclically.

ℹ The cycle time is always started after an ETS programming operation. This also occurs when the active command value exceeds the configured limiting value after the download.

ℹ The combination of intelligent valve rinsing with a command value limit with a minimum command value limiting value. If a minimum limiting value of the command value limit exists, then the active command value of the affected valve output is never "0%". In consequence, the actuator would never restart the cycle time as part of intelligent valve rinsing.

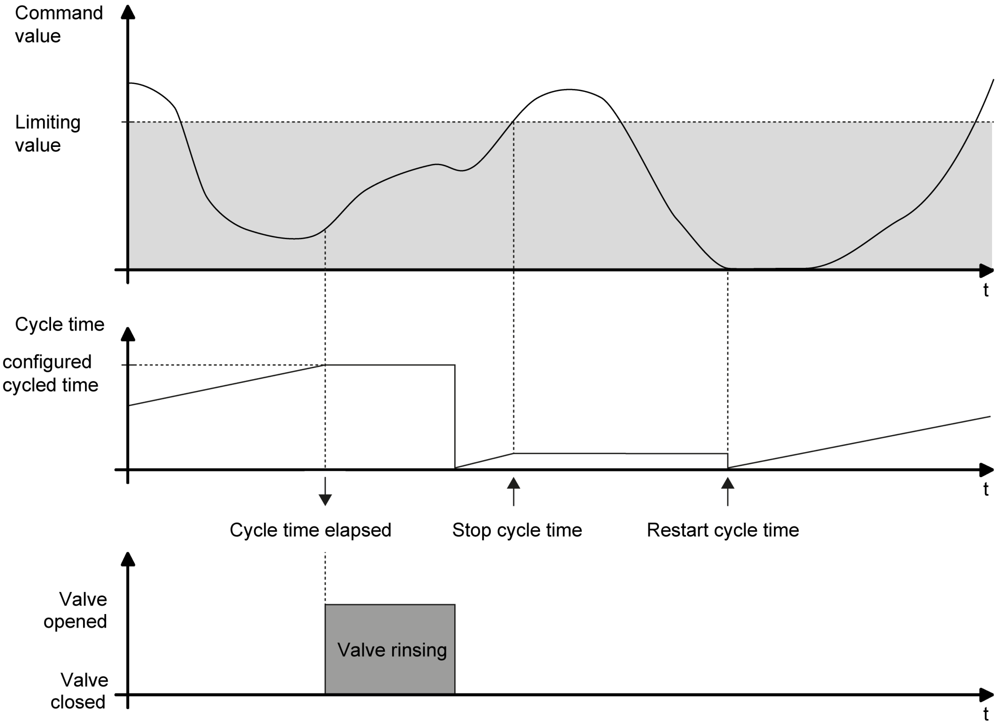


Figure 24: Example of a minimum command value limiting value for intelligent valve rinsing

- Set the parameter "Take command values of last cycle time into account" to "yes". Define the command value limiting value via the parameter "Stop valve rinsing from command value of".

  Intelligent cyclical valve rinsing is activated. Valve rinsing is only executed when the configured limiting value was exceeded at least once in the previous time cycle and, consequently, the valve was run to the "0%" command value.

- Set the parameter "Take command values of last cycle time into account" to "no".

  Intelligent cyclical valve rinsing is deactivated. Valve rinsing always takes place as soon as the set cycle time has expired.

ⓘ Valve rinsing can optionally be started and, if required, stopped using a communication object. If valve rinsing was started by the object, then the actuator will stop the cycle time of the cyclical valve rinsing operation. The cycle time is only restarted after the rinsing operation has been fully executed without interruption or a stop command was received via the object.

Configuring bus-controlled valve rinsing via an object

If necessary, valve rinsing can be started and, optionally, stopped using its own 1-bit communication object. This means that it is possible to activate a rinsing operation of the valve controlled by time or an event. It is also possible, for example, to cascade multiple heating actuators, so that they perform valve rinsing simultaneously (link of the individual status objects to the input objects of the valve rinsing).
Bus control can only be used if it has been enabled in the ETS.

Valve rinsing must be enabled and a valid rinsing time configured.

- Set the parameter "Valve rinsing controllable via object" to "yes". In the case of the parameter "Object polarity", configure the telegram polarity, thus presetting whether the bus-controlled starting and stopping, or, alternatively, only starting, is to be possible.

  Bus-controlled valve rinsing is enabled. The communication object is visible. The name of the object is aligned to the setting of the permitted telegram polarity ("Start / stop valve rinsing" or "Start valve rinsing"). When a start command is received, the actuator immediately starts the configured time for a rinsing operation. The actuator also actively executes valve rinsing if no higher-priority function is active. If bus-controlled stopping is permitted, then the actuator will also react to stop commands by immediately interrupting running rinsing operations.

- Set the parameter "Valve rinsing controllable via object" to "no".

  Bus-controlled valve rinsing is not available. Valve rinsing can only take place cyclically.

ⓘ Updates of the object from "Start" to "Start" or "Stop" to "Stop" do not produce a reaction. The length of an elapsing valve rinsing operation or the cycle time of a cyclical valve rinsing operation are not restarted by this.

ⓘ Bus-controlled valve rinsing via the object can be combined with a cyclical valve rinsing operation. If valve rinsing was started by the object, then the actuator will stop the cycle time of the cyclical valve rinsing operation. The cycle time is only restarted after the rinsing operation has been fully executed without interruption or a stop command was received via the object.

9.10.1 Valve rinsing parameters

Valve output x - General -> Enabled functions

Valve rinsing	Checkbox (yes / **no**)
To prevent calcification or sticking of a valve which has not been activated for some time, the actuator has an automatic valve rinsing function. Valve rinsing can be executed cyclically or using a bus command, causing the activated valves to run through the full valve stroke for a preset period of time. During valve rinsing, the actuator activates a command value of 100% without interruption for half of the configured "Valve rinsing time". For this, the valves open completely. After half the time, the actuator switches to a command value of 0%, causing the connected valves to close completely. In the "Active" setting, this parameter enables valve rinsing.	

"Valve output 1 - General -> Valve rinsing" configured.

Length of valve rinsing	1...**5**...59 min
Here, preset for how long the rinse function (100% -> 0%) is to be executed. Set the length of the valve rinsing to the adjusting cycle time of the electrothermal actuators in such a way that they open and close completely. This is usually guaranteed by configuring the rinsing length to double the adjusting cycle time.	

Cyclical valve rinsing	Checkbox (**yes** / no)
The actuator can perform valve rinsing cyclically, if necessary. When using the cyclical valve rinsing, a rinse operation can be started automatically after a configurable cycle time (1...26 weeks). Here too, the valve rinsing length configured in the ETS defines the time for the once-only, complete opening and closing of the activated valve drives. At the end of a rinsing operation, the actuator always restarts the cycle time. Yes: Cyclical valve rinsing is enabled. Each ETS programming operation resets the cycle time. The first rinsing operation with cyclical valve rinsing takes place after an ETS programming operation after the first time cycle has elapsed. If there is a power failure, the actuator saves the remaining residual time of the current time cycle. The residual cycle time is restarted after mains voltage return. A power failure immediately interrupts an active rinsing operation. After mains voltage return, a previously interrupted rinsing operation is not executed again. The actuator then starts a new time cycle for cyclical valve rinsing. No: Cyclical valve rinsing is completely disabled. Valve rinsing can only be started by the communication object (if enabled).	

Repeat all	**1**...26 week(s)
This parameter defines how often cyclical valve rinsing is to be performed automatically.	

Take command values of last cycle time into account	Checkbox (yes / **no**)
Optionally, intelligent cyclical valve rinsing can be additionally activated here. Here, valve rinsing is only executed repeatedly, if, in the current time cycle, a configured minimum command value limiting value was not exceeded. It the active command value exceeds the limiting value, then the actuator will stop the cycle time. The actuator only restarts the cycle time if, in the further course of the command value change, a command value of "0%" or "OFF" (completely closed) is set. This prevents valve rinsing if the valve has already run through a sufficiently defined stroke. If, after exceeding the configured limiting value, the value was not completely closed at least once (command value "0%" or "OFF"), then no further cyclical valve rinsing will take place.	

Stop valve rinsing from command value of	10...**50**...100 %
This parameter defines the minimum command value limiting value of the intelligent valve rinsing. Intelligent valve rinsing is only executed repeatedly, if, in the current time cycle, a minimum command value limiting value configured here was not exceeded. It the active command value exceeds the limiting value, then the actuator will stop the cycle time.	

Valve rinsing controllable via object	Checkbox (yes / **no**)
If necessary, valve rinsing can be started and, optionally, stopped using its own 1-bit communication object. This means that it is possible to activate a rinsing operation of the valve controlled by time or an event. It is also possible, for example, to cascade multiple heating actuators, so that they perform valve rinsing simultaneously (link of the individual status objects to the input objects of the valve rinsing). Bus control can only be used if it has been enabled here.	

Object polarity	**1 = start / 0 = stop** 1 = stop / 0 = start 1 = start (stop not possible) / 0 = ---
This parameter sets the telegram polarity of the object for external valve rinsing. The name of the object is aligned to the setting of the permitted telegram polarity ("Start / stop valve rinsing" or "Start valve rinsing"). When a start command is received, the actuator immediately starts the configured time for a rinsing operation. The actuator also actively executes valve rinsing if no higher-priority function is active. If bus-controlled stopping is permitted, then the actuator will also react to stop commands by immediately interrupting running rinsing operations.	

9.10.2 Objects for valve rinsing

Function: Valve rinsing

Object no.	Function	Name	Type	DPT	Flag
27, 42, 57, 72, 87, 102	Valve rinsing - Start Valve rinsing - Start / Stop	VOx - Input (x = 1...6)	1-bit	1,003	C, (R), W, -, -

1-bit input object for starting and stopping valve rinsing. Valve rinsing can be activated by time or an event using this object. It is also possible, for example, to cascade multiple heating actuators, so that they perform valve rinsing simultaneously (link of the individual status objects to the input objects of the valve rinsing).
The telegram polarity can be configured. Stopping can be prevented via the object as an option.
The time of cyclical valve rinsing is restarted as soon as an externally started valve rinsing operation is stopped by a Stop telegram or by the expiry of the rinsing time.
Updates of the object from "Start" to "Start" or "Stop" to "Stop" do not produce a reaction. The length of an elapsing valve rinsing operation or the cycle time of the cyclical valve rinsing are not restarted by this.

Object no.	Function	Name	Type	DPT	Flag
28, 43, 58, 73, 88, 103	Valve rinsing - Status	VO x - Output (x = 1...6)	1-bit	1,002	C, R, -, T, -

1-bit output object for status feedback of a valve rinsing operation. The telegram polarity is fixed: "0" = Valve rinsing inactive, "1" = Valve rinsing active.
The object transmits the current status after bus and mains voltage return and after an ETS programming operation without a delay.

9.11 Operating hours counter

The operating hours counter determines the switch-on time of a valve output. For the operating hours counter, an output is actively on, when it is energised, i.e. when the status LED on the front panel of the device. As a result, the operating hours counter determines the time during which deenergised closed valves are opened or deenergised opened valves are closed.
The operating hours counter can either be configured as a second counter or alternatively as an hour counter.

- Second counter
  The actuator adds up the determined switch-on time accurately to the second for an energised output. The totalled operating seconds are added in a 4-byte counter and stored permanently in the device. The current meter reading can be transmitted cyclically to the KNX by the "Operating hours counter - Meter reading - Status" communication object or when there is a change in an interval value in accordance with DPT 13.100.
- Hour counter
  The actuator adds up the determined switch-on time accurately to the minute for an energised output in full operating hours (see figure 25). The totalled operating hours are added in a 2-byte meter and stored permanently in the device. The current meter reading can be transmitted cyclically to the KNX by the "Operating hours counter - Meter reading - Status" communication object or when there is a change in an interval value in accordance with DPT 7.007.

ℹ During pulse width modulation (PWM) at a valve output, the operating hours counter only evaluates the switch-on time of the PWM signal.

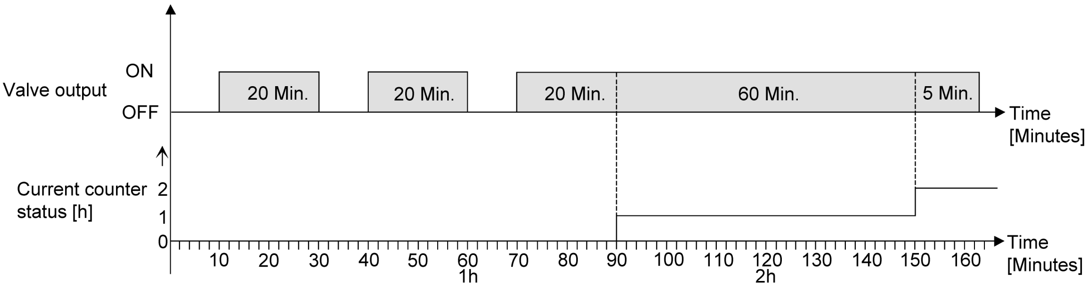


Figure 25: Function of the operating hours counter (using the example of an up-counter)

In the as-delivered state, the operating hour values of all valve outputs of the actuator is "0". If the operating hours counter is not enabled in the configuration of an output, no operating hours will be counted for the valve concerned. Once the operating hours counter is enabled, however, the operating hours will be determined and added up by the ETS immediately after commissioning the actuator.
If the operating hours counter is subsequently disabled again in the parameters and the actuator is programmed with this disabling function, all the operating hours previously counted for the valve output concerned will be deleted. When enabled again, the meter reading of the operating hours counter is always on "0 h".

The operating hours values (full hours) or operating seconds stored in the device will not be lost in case of a bus voltage failure or by ETS programming.
On the hour counter: Any summed up operating minutes (full hour not yet reached) will be rejected in this case, however.

After bus voltage return or after an ETS programming operation, the actuator passively updates the "Value operating hours counter" communication object in each output. The object value can be read out if the read-flag is set. The object value, depending on the configuration for the automatic transmission, is actively transmitted if necessary to the KNX once the configured transmission delay has elapsed after bus voltage return (see "Set transmission behaviour of the operating hours counter").

The operating hours counter detects any operation of the valve outputs in manual operation, which means that switching on an output also activates a counting operation and the manual switch-off interrupts a counting operation.
No operating hours are counted if the supply voltage of the valves is not switched on.

Activating the operating hours counter

The operating hours counter only counts the operating hours of a valve output if it was activated in the ETS.

- Set the parameter "Operating hours counter" on the parameter page "VOx - General -> Enabled functions" to "yes".

  The operating hours counter is activated.

- Set the parameter "Operating hours counter" on the parameter page "VOx - General -> Enabled functions" to "no".

The operating hours counter is deactivated.

i Deactivation of the operating hours counter and subsequent programming with the ETS resets the counter status to "0".

Setting type of counter of the operating hours counter

The operating hours counter can optionally be configured as an up-counter or down-counter. Depending on this type of counter, a limit or start value can be set optionally, whereby, for example, the operating time of an actuator can be monitored by restricting the counter range.

Up-counter:
After activating the operating hours counter by enabling in the ETS or by restarting, the operating hours are counted starting at "0". A maximum of 65,535 hours or 2147483647 can be counted (corresponds to approx. 66 years), after that the counter stops and signals a counter operation via the "Operating hours count. elapsed" object.
A limiting value can be set optionally in the ETS or can be predefined via the communication object "Limiting value operating hours counter". In this case, the counter operation is signalled to the bus via the "Operating hours count. elapsed" object if the limiting value is reached, but the meter continues counting - if it is not restarted - up to the maximum value 65535 and then stops. Only a restart initiates a new counting operation.

Down-counter:
After enabling the operating hours counter in the ETS, the meter reading is on "0 h" and the actuator signals a counter operation for the output concerned after the programming operation or after bus voltage return via the "Operating hours count. elapsed" object. Only after a restart is the down-counter set to the maximum value of 65,535 hours or 2147483647 seconds (corresponds to approx. 66 years) and the counter operation is started.
A start value can be set optionally in the ETS or can be predefined via the communication object "start value operating hours counter". If a start value is set, the down-counter is initialised with this value instead of the maximum value after a restart. The meter then counts the start value downwards by the hour. When the down-counter reaches the value "0", the counter operation is signalled to the bus via the "Operating hours count. elapsed" and the counting is stopped. Only a restart initiates a new counting operation.

The use of the operating hours counter must be set on the parameter page "Ax – Operating hours counter".

- Set the parameter "Counting direction" to "Forward". Set the parameter "Specify signal value" to "via parameter" or "via object" if it is necessary to monitor the limiting value. Otherwise, reset the parameter to "no". In the "via parameter" setting, configure the required limit value (1 ... 2147483647 s or 1 ... 65535 h).

The meter counts the operating hours forwards starting from "0 h". If the monitoring of the limiting value is activated, the actuator transmits a "1" telegram via the object "Operating hours count. elapsed" for the valve output concerned once the predefined limiting value is reached. Otherwise, the counter operation is first transmitted when the maximum value is reached.

■ Set the parameter "Counting direction" to "Backward". Set the parameter "Specify start value" to "via parameter" or "via object" if it is necessary to specify a start value. Otherwise, reset the parameter to "no". In the "via parameter" setting, configure the required start value (1 ... 2147483647 s or 1 ... 65535 h).

The meter counts the operating hours down to "0 h" after a restart. With a start value preset, the start value is counted down, otherwise the counting operation starts at the maximum value. The actuator transmits a "1" telegram via the object "Operating hours count. elapsed" for the valve output concerned once the value "0" is reached.

i The value of the communication object "Operating hours counter - Counter elapsed - Status" is permanently stored internally. The object is initialised immediately with the value that was saved before bus voltage return or ETS programming. If an operating hours counter is in this case identified as having elapsed, i.e. if the object value is a "1", an additional telegram will be actively transmitted to the bus. If the counter has not yet elapsed (object value "0"), no telegram is transmitted on bus voltage return or after an ETS programming operation.

i With a signal value or start value preset via object: The values received via the object are first validly accepted and permanently saved internally after a restart of the operating hours counter. The object is initialised immediately with the value that was last saved before bus voltage return or ETS programming. The values received will be lost in the case of a bus voltage failure or by an ETS download if no counter restart was executed before. For this reason, when specifying a new start or limiting value it is advisable to always execute a counter restart afterwards as well.
A standard value is predefined provided that no signal value or start value has been received yet via the object. The values received and stored via the object are reset to the standard value if the operating hours counter is disabled in the parameters of the ETS and a ETS download is being performed.

i With a signal value or start value predefined via object: If the signal value or start value is predefined with "0", the actuator will ignore a counter restart to avoid an undesired reset (e.g. in construction site mode -> hours already counted by manual operation).

i If the counter direction of an operating hours counter is reversed by reconfiguration in the ETS, a restart of the meter should always be performed after programming the actuator so that the meter is reinitialised.

Restarting the operating hours counter

The meter reading of the operating hours can be reset at any time by the communication object "Operating hours counter - Restart". The polarity of the reset telegram is predefined: "1" = Restart / "0" = No reaction.

- Write "1" to the communication object "Operating hours counter - Restart".

  In the up-counter the meter is initialised with the value "0" after a restart and in the down-counter initialised with the start value. If no start value was configured or predefined by the object, the start value is preset to 65,535 hours or 2147483647 seconds.
  During every counter restart, the initialised meter reading is transmitted actively to the bus. After a restart, the signal of a counter operation is also reset. At the same time, a "0" telegram is transmitted to the bus via the object "Operating hours count. elapsed".
  In addition, the limiting or start value is initialised.

ℹ If a new limiting or start value was predefined via the communication object, a counter restart should always be performed afterwards, too. Otherwise, the values received will be lost in the case of a bus voltage failure or by an ETS download.

ℹ If a start or limiting value is predefined with "0", there are different behaviours after a restart, depending on the principle of the value definition...
Preset as parameter:
The counter elapses immediately after a counter restart.
Preset via object:
A counter restart will be ignored to avoid an undesired reset (e.g. after installation of the devices with hours already being counted by manual operation). A limiting or start value greater than "0" must be predefined in order to perform the restart.

Transmission behaviour of the operating hours counter

The current value of the operating hours counter is always tracked in the communication object "Operating hours counter - Meter reading - Status". After bus voltage return or after an ETS download, the actuator passively updates the "Operating hours counter - Meter reading - Status" communication object in each valve output. The object value can be read out if the read-flag is set.
In addition, the transmission behaviour of this communication object can be set.

The use of the operating hours counter must be set on the parameter page "VOx – General -> Enabled functions".

- Set the parameter "Transmission behaviour" to "on change by interval value". Set the parameter "Counting interval" to the desired value.

  The meter reading is transmitted to the bus as soon as it changes by the predefined counting value interval. After bus voltage return or after an ETS programming operation, the object value is automatically transmitted immediately if the current meter reading corresponds to the counting interval or a multiple thereof. A meter reading "0" is always transmitted in this case.

- Set the parameter "Transmission behaviour" to "cyclical".

  The counter value is transmitted cyclically. The cycle time is defined on the parameter page "General valve outputs". After bus voltage return or ETS programming, the meter reading is transmitted to the KNX after the configured cycle time has elapsed.

9.11.1 Operating hours counter parameters

Valve outputs - General valve outputs - VOx General - Enabled functions

Operating hours counter	Checkbox (yes / **no**)
The operating hours counter can be enabled here. The operating hours counter determines the switch-on time of a valve output. For the operating hours counter, an output is actively on, when it is energised, i.e. when the status LED on the front panel of the device. As a result, the operating hours counter determines the time during which deenergised closed valves are opened or deenergised opened valves are closed. If the operating hours counter is not enabled, no operating hours will be counted for the valve output concerned. Once the operating hours counter is enabled, however, the operating hours will be determined and added up by the ETS immediately after commissioning the actuator. If the operating hours counter is subsequently disabled again in the parameters and the actuator is programmed with this disabling function, all operating hours previously counted will be deleted. When enabled again, the meter reading of the operating hours counter is always on "0 h".	

Valve outputs - General valve outputs - VOx General - Operating hours counter

Counting method	**seconds** hours
The operating hours counter can either be configured as a second counter or alternatively as an hour counter. Second counter: The actuator adds up the determined switch-on time accurately to the second for a switched-on valve output. The totalled operating seconds are added in a 4-byte counter and stored permanently in the device. The current meter reading can be transmitted cyclically to the KNX by the "Operating hours counter - Meter reading - Status" communication object or when there is a change in an interval value in accordance with DPT 13.100. Hour counter: The actuator adds up the determined switch-on time accurately to the minute for a switched-on valve output in full operating hours. The totalled operating hours are added in a 2-byte meter and stored permanently in the device. The current meter reading can be transmitted cyclically to the KNX by the "Operating hours counter - Meter reading - Status" communication object or when there is a change in an interval value in accordance with DPT 7.007.	

<table>
<tr><td>Counting direction</td><td>**forward**
backward</td></tr>
<tr><td colspan="2">The operating hours counter can be configured as an up-counter or down-counter. The setting here influences the visibility of the other parameters and objects of the operating hours counter.</td></tr>
</table>

<table>
<tr><td>Specify signal value</td><td>Checkbox (yes / **no**)</td></tr>
<tr><td colspan="2">If the up-counter is used, a signal value can optionally be predefined. The "No" setting deactivates the limiting value.
This parameter is only visible in the "Up-counter" counter type.</td></tr>
</table>

<table>
<tr><td>Preset value</td><td>via parameter
via object</td></tr>
<tr><td colspan="2">This parameter defines whether the signal value can be set via a separate parameter or adapted individually by a communication object from the bus.
This parameter is only visible in the "Up-counter" counter type.</td></tr>
</table>

<table>
<tr><td>Signal value</td><td>0...**2147483647***
0...**65535****</td></tr>
<tr><td colspan="2">The limiting value of the up-counter is set here. Once the limiting value is reached, an "ON" telegram is transmitted via the object "Operating hours counter - Counter elapsed". The counter itself continues until the maximum counter status is reached and then stops.
*: With second counter
**: With hour counter
This parameter is only visible if the parameter "Preset value" is set to "via parameter".</td></tr>
</table>

<table>
<tr><td>Specify start value</td><td>Checkbox (yes / **no**)</td></tr>
<tr><td colspan="2">If the down-counter is used, a start value can optionally be predefined. This parameter defines whether the start value can be set via a separate parameter or adapted individually by a communication object from the bus. The setting "No" deactivates the start value.
This parameter is only visible in the "Down-counter" counter type.</td></tr>
</table>

<table>
<tr><td>Preset value</td><td>via parameter
via object</td></tr>
<tr><td colspan="2">This parameter defines whether the signal value can be set via a separate parameter or adapted individually by a communication object from the bus.
This parameter is only visible in the "Up-counter" counter type.</td></tr>
</table>

Start value	0...**2147483647*** 0...**65535****
The start value of the down-counter is set here. *: With second counter **: With hour counter This parameter is only visible in the "Down-counter" counter type and then only if the parameter "Preset value" is set to "via parameter".	

Cycle time	**0**...23 h 0...**15**...59 min **0**…59 s
This parameter defines the cycle time for the cyclical transmission. Setting the cycle time hours, minutes and seconds.	

Counting interval	0...**3600**...2147483647 s * 0...**1**...65535 h **
The interval of the counter value is set here for automatic transmission. The current meter reading is transmitted to the KNX after the interval configured here. *: With second counter **: With hour counter This parameter is only visible if the parameter "Transmission behaviour" is set to "on change by interval value".	

9.11.2 Objects for operating hours counter

Object no.	Function	Name	Type	DPT	Flag
112, 119, 126, 133, 140, 147	Operating hours counter - Restart	VO x ... - Input	1-bit	1,015	C, (R), W, -, A
1-bit object for resetting the operating hours counter of a valve output ("1" = Restart, "0" = No reaction).					

Object no.	Function	Name	Type	DPT	Flag
113, 120, 127, 134, 141, 148	Operating hours counter - Counter reading - Status	VO x ... - Output	4-byte	13,100	C, (R), -, T, A
4-byte object to transmit or read out the current counter level of the operating hours counter of a valve output. Value range: 0...2147483647 seconds If the bus voltage should fail, the value of the communication object is not lost and is actively transmitted to the bus after bus voltage return or an ETS programming operation. In the as-delivered state, the value is "0". This object is only available with the second counter.					

Object no.	Function	Name	Type	DPT	Flag
114, 121, 128, 135, 142, 149	Operating hours counter - Counter reading - Status	VO x ... - Output	2-byte	7,007	C, (R), -, T, A

2-byte object to transmit or read out the current counter level of the operating hours counter of a valve output.
Value range: 0...65,535 hours

If the bus voltage should fail, the value of the communication object is not lost and is actively transmitted to the bus after bus voltage return or an ETS programming operation. In the as-delivered state, the value is "0".

This object is only available with the hour counter.

Object no.	Function	Name	Type	DPT	Flag
115, 122, 129, 136, 143, 150	Operating hours counter - Counter elapsed	VO x ... - Output	1-bit	1,002	C, (R), -, T, A

1-bit object to sign that the operating hours counter has elapsed (forwards counter = signal value reached / backwards counter = value "0" reached). With a message, the object value is actively transmitted to the KNX ("1" = message active / "0" = message inactive).

If the bus voltage should fail, the value of the communication object is not lost and is actively transmitted to the bus after bus voltage return or an ETS programming operation.

Object no.	Function	Name	Type	DPT	Flag
110, 117, 124, 131, 138, 145	Operating hours counter - Signal value / Start value	VO x ... - Input	4-byte	13,100	C, (R), W, -, A

4-byte object for external presetting of a signal value / start value of the operating hours counter of a valve output.
Value range: 0...2147483647 seconds

This object is only available with the second counter.

Object no.	Function	Name	Type	DPT	Flag
111, 118, 125, 132, 139, 146	Operating hours counter - Signal value / Start value	VO x ... - Input	2-byte	7,007	C, (R), W, -, A

2-byte object for external presetting of a signal value / start value of the operating hours counter of a valve output.
Value range: 0...65,535 hours

This object is only available with the hour counter.

10 Room temperature controller

There are 12 controllers integrated into the device's software that can be used for individual room temperature control. This allows the temperature to be set in up to 12 rooms or room areas to specified setpoints through independent control processes. The command value outputs of these controllers can be linked to the electronic valve outputs of the actuator, meaning that temperature control and valve activation can take place using just one bus device, if required. The use of external room temperature controllers (e.g. push-button sensors with RTC) is thus not absolutely essential, but is possible as the valve outputs can also be activated individually via the KNX. The integrated controllers can also transmit command value telegrams to the KNX and thus activate other heating actuators or fan coil actuators.

The integrated controllers of the device always work as the main controller. All the controller functions (e.g. setpoint temperature specification, operating mode switchover, switchover of the operating mode) are controlled via KNX communication objects (object controller without its own operating elements), meaning that controller operation is possible via controller extensions or visualisations. The room temperature is made available to the integrated controllers via separate communication objects.

10.1 Channel configuration

To simplify project design, all room temperature controllers can be activated or deactivated individually in the ETS. Parameters and communication objects of the deactivated channels are hidden.

To simplify further, the room temperature controllers can be assigned to the same parameters and thus configured identically. The parameter "Parameterisation" stipulates whether every room temperature controller of the device can be configured individually or whether the parameters of room temperature controller 1 are to be applied.

With the setting "like RTC 1", the parameter pages in the ETS are reduced. The visible parameters of the first room temperature controller are then automatically also used on this room temperature controller. Only the communication objects can then be configured separately for the controllers. This setting should be selected, for example, if all room temperature controllers behave identically and should only be activated by different group addresses (e.g. in office blocks or in hotel rooms).
In the parameter setting "individually", each room temperature controller possesses its own parameter pages in the ETS.

10.1.1 Channel configuration parameters

General -> Parameterisation

RTC x (x = 1 ... 12) Use	Checkbox (yes / **no**)
Room temperature controllers that are not required can be activated or deactivated. If the following parameter "Configuration" is set to "like RTC 1" for one of the following valve outputs, room temperature controller 1 must be activated.	

RTC x (x = 1 ... 12) Parameterisation	**individually** / like RTC 1
To simplify the configuration, all the room temperature controllers can be assigned to the same parameters in the ETS and thus configured identically. This parameter stipulates whether a room temperature controller of the device can be configured individually or whether the parameters of room temperature controller 1 are to be applied. For room temperature controller 1, the parameter is permanently set to "individually".	

10.2 Room temperature controller - General

10.2.1 Name

Optional names can be assigned for each room temperature controller. The names should clarify the use of the output (e.g. "heating living room" or "cooling ceiling office 1"). The names are only used in the ETS in the text of the parameter pages and communication objects.

10.2.2 Operating mode

Introduction

A room temperature controller distinguishes between two different operating modes. The operating modes specify whether you want the controller to use its command value to trigger heating systems ("heating" single operating mode) or cooling systems ("cooling" single operating mode). You can also activate mixed operation, with the controller being capable of changing over between "Heating" and "Cooling" either automatically or, alternatively, controlled by a communication object.
In addition, you can establish two-level control operation to control an additional heating or cooling unit. For two-level feedback control, separate command values will be calculated as a function of the temperature deviation between the setpoint and the actual value for the basic and additional levels. Parameter "Operating mode" in the parameter branch "Room temperature controller -> RTCx - General" sets the operating mode and, if necessary, enables the additional level(s).

"Heating" or "cooling" single operating modes

In the single "Heating" or "Cooling" operating modes without any additional level, the controller will always work with one command value. Alternatively, when the additional level is enabled, it will use two command values in the configured operating mode. Depending on the room temperature determined and on the specified setpoint temperatures of the operating modes, the room temperature controller will automatically decide whether heating or cooling energy is required and calculates the command value for the heating or cooling system.

"Heating and cooling" mixed operating mode

In the "Heating and cooling" mixed operating mode, the controller is capable of triggering heating and cooling systems. In this connection, you can set the change-over behaviour of the operating modes...

- Parameter "Heating/cooling switchover" in the parameter branch "Room temperature controller -> RTCx - General" set to "automatic via RTC".
  In this case, a heating or cooling mode is automatically activated, depending on the determined room temperature and on the specified setpoint temperature. If the room temperature is within the preset deadband neither heating nor cooling will take place (both command values = "0"). The communication object "Setpoint temperature" displays the most recently active setpoint for heating or cooling. If the room temperature is higher than the cooling setpoint temperature, cooling will take place. If the room temperature is higher than the heating setpoint temperature, heating will take place.
  When the operating mode is changed over automatically, the information can be actively sent to the bus via the object "Operating mode - Status" to indicate whether the controller is working in the heating mode ("1" telegram) or in the cooling mode ("0" telegram). In this case, a telegram will be transmitted immediately on changing from heating to cooling (object value = "0") or from cooling to heating (object value = "1"), respectively.
  The "Cyclical transmission" parameter enables cyclical transmission (factor setting > "0 min") and specifies the cycle time.
  With an automatic operating mode change-over, it should be noted that under certain circumstances there will be continuous change-over between heating and cooling if the deadband is too small. For this reason, you should, if possible, not set the deadband (temperature difference between the setpoint temperatures for the comfort heating and cooling modes) below the default value (2 K).
- Parameter "Heating/cooling switchover" in the parameter branch "Room temperature controller x -> RTCx - General" set to "via object".
  In this case, the operating mode is controlled via the "Operating mode" object, irrespective of the deadband. This type of change-over can, for example, become necessary if both heating and cooling should be carried out through a one-pipe system (heating and cooling system). For this, the temperature of the medium in the single-pipe system must be changed via the system control. Afterwards the heating/cooling operating mode is set via the object (often the single-pipe system uses cold water for cooling during the summer, hot water for heating during the winter).
  The "Operating mode" object has the following polarities: "1": heating; "0": cooling. After a reset, the object value will be "0", and the "Operating mode after reset" set in the ETS will be activated. The parameter "Operating mode after reset" can be used to determine which operating mode is activated after a reset. For the "Heating" or "Cooling" settings, the controller will activate the

configured heating/cooling operating mode immediately after the initialisation phase. In case of parameterisation "Operating mode before reset" the operating mode which was selected before the reset will be activated.

ℹ Setpoint temperatures can be specified for each operating mode in the ETS as part of configuration. It is possible to configure the setpoints for the "Comfort", "Standby" and "Night" modes directly (absolute setpoint presetting) or relatively (derivation from basic setpoint). With absolute setpoint presetting there is no basic setpoint and also no deadband in the mixed operating mode "Heating and cooling" (if necessary also with additional level). Consequently, the room temperature controller cannot control the switchover of the operating mode automatically, which is why, in this configuration, the setting for the parameter "Heating/cooling switchover" is fixed in the ETS to "via object".

10.2.3 Type of control

Introduction

To facilitate convenient temperature control in living or business spaces a specific control algorithm which controls the installed heating or cooling systems is required. Taking account of the preset temperature setpoints and the actual room temperature, the controller thus determines command values which trigger the heating or the cooling system. The control system (control circuit) consists of a room temperature controller, a valve drive or an actuator with switching output signals (e.g. heating actuator when ETD electrothermal drives are used), the actual heating or cooling element (e.g. radiator or cooling ceiling) and of the room. This results in a controlled system (see figure 26).

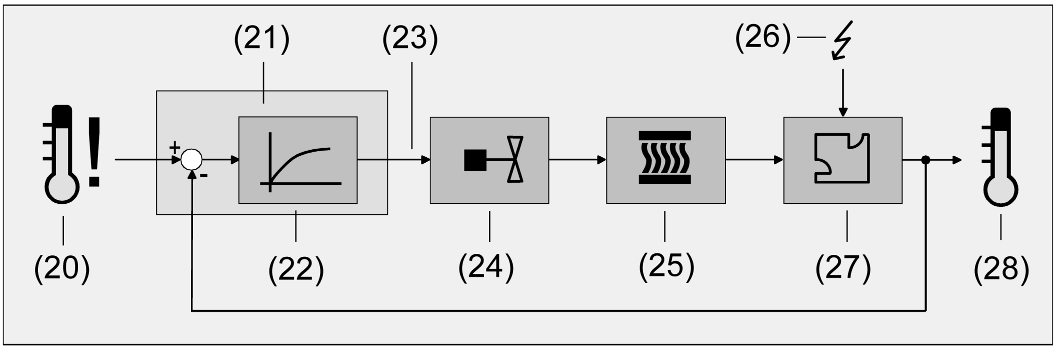


Figure 26: Controlled system of single-room temperature control

(20) Setpoint temperature specification
(21) Room temperature controller
(22) Control algorithm
(23) Command value
(24) Valve control (valve drive, ETD, heating actuator, ...)
(25) Heat / cold exchanger (radiator, cooling ceiling, FanCoil, ...)
(26) Fault variable (sunlight penetration, outdoor temperature, illumination systems, ...)
(27) Room

(28) Actual temperature (room temperature)

The controller evaluates the actual temperature (28) and compares it with the specified setpoint temperature (20). With the aid of the selected control algorithm (22), the command value (23) is then calculated from the difference between the actual and the setpoint temperature. The command value controls valves or fans for heating or cooling systems (24), meaning that heating or cooling energy in the heat or cold exchangers (25) is passed into the room (27). Regular readjustment of the command value means that the controller is able to compensate for setpoint / actual temperature differences caused by external influences (26) in the control circuit. In addition, the flow temperature of the heating or cooling circuit influences the control system which necessitates adaptations of the variable.

The room temperature controller facilitates either proportional/integral (PI) feedback control as a continuously working or switching option, or, alternatively, switching 2-point feedback control. In some practical cases, it can become necessary to use more than one control algorithm. For example, in bigger systems using floor heating, one control circuit which solely triggers the floor heating can be used to keep the latter at a constant temperature. The radiators on the wall, and possibly even in a side area of the room, will be controlled separately by an additional level with its own control algorithm. In such cases, distinction must be made between the different types of control, as floor heating systems, in most cases, require control parameters which are different to those of radiators on the wall, for example. It is possible to configure up to four independent control algorithms in two-level heating and cooling operation.

The command values calculated by the control algorithm are output via the "Heating command value" or "Cooling command value" communication objects. Depending on the control algorithm selected for the heating and/or cooling mode, the format of the command value objects is, among other things, also specified. In this way, 1-bit or 1-byte command value objects can be created. The control algorithm is specified by the parameters "Type of heating control" or "Type of cooling control" in the "Room temperature control -> RTCx - General" parameter branch and, if necessary, also with a distinction of the basic and additional stages.

Continuous PI control

PI control is an algorithm which consists of a proportional part and an integral part. Through the combination of these control properties, you can obtain room temperature control as quickly and precisely as possible without or only with low deviations. When you use this algorithm, the room temperature controller will calculate a new continuous command value in cycles of 30 seconds and transmit it to the bus via a 1-byte value object if the calculated command value has changed by a specified percentage. The parameter "on change by (0 = inactive)" in the parameter branch "Room temperature controller -> RTCx - General -> Command value output" specifies the change interval in percent.

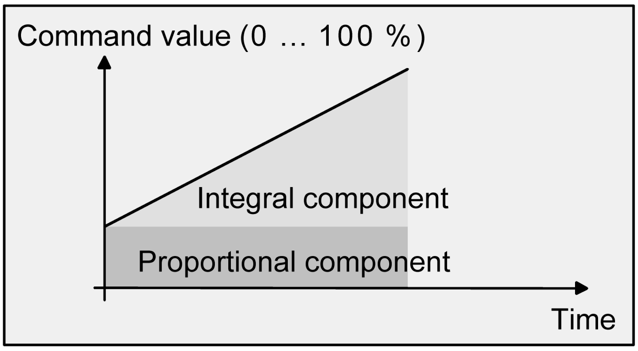


Figure 27: Continuous PI control

An additional heating or cooling stage as PI control works in the same way as the PI control of the basic stage, with the exception that the setpoint will shift, taking account of the parameterized step width.

Switching PI control

With this type of feedback control, the room temperature will also be kept constant by the PI control algorithm. Taking the mean value for a given time, the same behaviour of the control system will result as you would obtain with a continuous controller. The difference compared with continuous feedback control is only the way how the command value is output. The command value calculated by the algorithm in cycles of every 30 seconds is internally converted into a pulse-width-modulated (PWM) command value signal and sent to the bus via a 1-bit switching object. Taking into account the cycle time settable using the parameter "PWM cycle time" in the parameter branch "Room temperature controller x -> RTCx - General -> Command value output", the mean value of the command signal resulting from this modulation is a measure for the centred valve position of the control valve and thus a reference for the set room temperature.
A shift of the mean value, and thus a change in the heating capacity, can be obtained by changing the duty factor of the switch-on and switch-off pulses of the command value signal.

If the command value is changed, the current PWM cycle is adapted as required so that the duty factor corresponds as directly as possible to the new command value. This adaptation is carried out in the same way as during activation of the valve outputs (see figure 8).

For a command value of 0% (permanently off) or of 100% (permanently on), a command value telegram corresponding to the command value ("0" or "1") will always be sent after a cycle time has elapsed.
For switching PI control, the controller will always use continuous command values for internal calculation. Such continuous values can additionally be sent to the bus via a separate 1-byte value object, for example, as status information for visualisation purposes (if necessary, also separately for the additional levels). The status value objects will be updated at the same time as the command value is output. The parameters "On change by (0 = inactive)" and "Cyclical (0 = inactive)" have no function here. An additional heating or cooling stage as switching PI control works in the

same way as the PI control of the basic stage, with the exception that the setpoint will shift, taking account of the parameterized step width. All PWM control options will use the same cycle time.

Cycle time:

The pulse-width-modulated command values are mainly used for activating electrothermal drives (ETD). In this regard, the room temperature controller transmits the switching command value telegrams to an actuator equipped with semiconductor switching elements to which the drives are connected (e.g. heating actuator). By setting the cycle time of the PWM signal on the controller, you can adapt the feedback control to the drives used. The cycle time sets the switching frequency of the PWM signal and allows adaptation to the adjusting cycle times of the valve drives used (the adjusting time it takes the drive to bring the valve from its completely closed to its completely opened position). In addition to the adjusting cycle time, take account of the dead time (the time in which the valve drives do not show any response when being switched on or off). If different actuators with different adjusting cycle times are used, take account of the longest of the times. Always note the information given by the manufacturers of the actuators.

During cycle time configuration, a distinction can always be made between two cases...

Case 1: Cycle time > 2 x adjusting cycle time of the electrothermal drives used (ETA)

In this case, the switch-on or switch-off times of the PWM signal are long enough for the actuators to have sufficient time to fully open or fully close within a given time period.

Advantages:
The desired mean value for the command value and thus for the required room temperature will be set relatively precisely, even for several actuators triggered at the same time.

Disadvantages:
It should be noted, that, due to the full valve lift to be continuously 'swept', the life expectancy of the actuators can diminish. For very long cycle times (> 15 minutes) with less sluggishness in the system, the heat emission into the room, for example, in the vicinity of the radiators, can possibly be non-uniform and be found disturbing.

ℹ This setting is recommended for sluggish heating systems (such as underfloor heating).

ℹ Even for a bigger number of triggered actuators, maybe of different types, this setting can be recommended to be able to obtain a better mean value of the adjusting travels of the valves.

Case 2: Cycle time < adjusting cycle time of the electrothermal drives used (ETA)

In this case, the switch-on or switch-off times of the PWM signal are too short for the actuators to have enough time to fully open or fully close within a given period.

Advantages:
This setting ensures continuous water flow through the radiators, thus facilitating uniform heat emission into the room.
If only one valve drive is triggered the controller can continuously adapt the command value to compensate the mean value shift caused by the short cycle time, thus setting the desired room temperature.

Disadvantages:
If more than one drive is triggered at the same time the desired mean value will become the command value, which will result in a very poor adjustment of the required room temperature, or in adjustment of the latter with major deviations, respectively. The continuous flow of water through the valve, and thus the continuous heating of the drives causes changes to the dead times of the drives during the opening and closing phase. The short cycle time and the dead times means that the required command value (mean value) is only set with a possibly large deviation. For the room temperature to be regulated constantly after a set time, the controller must continually adjust the command value to compensate for the mean value shift caused by the short cycle time. Usually, the control algorithm implemented in the controller (PI control) ensures that control deviations are compensated.

ℹ This setting is recommended for quick-reaction heating systems (such as surface radiators).

Adapting the PI control

In a building, different systems can be installed which heat up or cool down a room. One option is to uniformly heat or cool the surroundings via heat transfer media (preferably water or oil) in connection with room air convection. Such systems are used, for example, with wall mounted heaters, underfloor heating or cooling ceilings. Alternatively or additionally forced air systems may heat or cool rooms. In most cases such systems are electrical forced hot air systems, forced cool air systems or refrigerating compressors with fan. Due to the direct heating of the room air such heating and cooling systems work quite swiftly.
The control parameters need to be adjusted so that the PI control algorithm may efficiently control all common heating and cooling systems thus making the room temperature control work as fast as possible and without deviation. Certain factors can be adjusted with a PI control that can influence the control behaviour quite significantly at times. For this reason, the room temperature controller can be set to predefined control parameters for the most common heating and cooling systems. In case the selection of a corresponding heating or cooling system does not yield a satisfactory result with the default values, the adaptation can optionally be optimised using control parameters.
Predefined control parameters for the heating or cooling stage and, if applicable, also for the additional stages are adjusted via the "type of heating" or "type of cooling" parameters. These fixed values correspond to the practical values of a properly planned and executed air conditioning system and will result in an ideal behaviour of the temperature control. The heating and cooling types shown in the following tables can be set for heating and cooling operation.

Type of heating	Proportional range (preset)	Reset time (preset)	Recommended PI control type	Recommended PWM cycle time
Heat water heating	1 Kelvin	830 minutes	Continuous / PWM	15 min.
Underfloor heating	1.5 Kelvin	1000 minutes	PWM	15-20 min.
Electrical heating	1 Kelvin	830 minutes	PWM	10-15 min.
Fan coil unit	1 Kelvin	500 minutes	Continuous	---
Split unit (split climate control unit)	1 Kelvin	500 minutes	PWM	10-15 min.

Predefined control parameters and recommend control types for heating systems

Cooling type	Proportional range (preset)	Reset time (preset)	Recommended PI control type	Recommended PWM cycle time
Cooling ceiling	1 Kelvin	830 minutes	PWM	15-20 min.
Fan coil unit	1 Kelvin	500 minutes	Continuous	---
Split unit (split climate control unit)	1 Kelvin	500 minutes	PWM	10-15 min.
Underfloor cooling	1.5 Kelvin	1000 minutes	PWM	15-20 min.

Predefined control parameters and recommend control types for cooling systems

If the "Type of heating" or "Type of cooling" parameters are set to "Via control parameters", it is possible to adjust the control parameters manually. The feedback control may be considerably influenced by presetting the proportional range for heating or for cooling (P component) and the reset time for heating or for cooling (I component).

ℹ Even small adjustments of the control parameters will lead to noticeable different control behaviour.

ℹ The adaptation should start with the control parameter setting for the corresponding heating or cooling system according to the specified fixed values mentioned in the above tables.

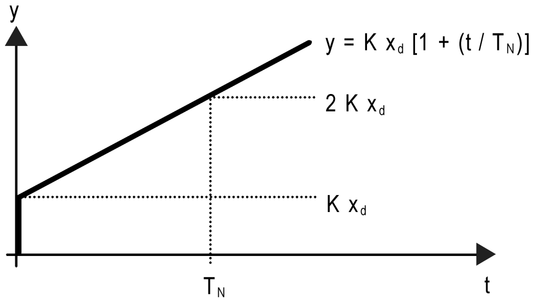


Figure 28: Function of the command value of a PI control

y: Command value
x_d: control difference ($x_d = x_{set} - x_{act}$)
P = 1/K : Configurable proportional band
K = 1/P : Gain factor
T_N: parameterisable reset time

PI control algorithm: Command value $y = K x_d [1 + (t / T_N)]$

Deactivation of the reset time (setting = "0") ->
P control algorithm: Command value $y = K x_d$

Parameter setting	Effect
P: Small proportional range	large overshoot in case of setpoint changes (possibly permanently), quick adjustment to the setpoint
P: Large proportional range	no (or small) overshooting but slow adjustment
T_N: Short reset time	Fast compensation of control deviations (ambient conditions), risk of permanent oscillations
T_N: Long reset time	Slow compensation of control deviations

Effects of the settings for the control parameters

2-point feedback control

2-point feedback control represents a very simple temperature control. For this type of feedback control, two hysteresis temperature values are set. The actuators are triggered by the controller via switch-on and switch-off command value commands (1-bit type). A constant command value is not calculated for this type of control.
The room temperature is also evaluated by this type of control in cycles every 30 seconds. Thus the command values change, if required, only at these times. The disadvantage of a continuously varying temperature as a result of this feedback control option is in contrast with the advantage of this very simple 2-point room temperature control. For this reason, quick-reaction heating or cooling systems should not be

triggered by a 2-point feedback control system, for this can lead to very high overshooting of the temperature, thus resulting in loss of comfort. When presetting the hysteresis limiting values, you should distinguish between the operating modes.

"Heating" or "cooling" single operating modes:

In heating mode, the controller will turn on the heating when the room temperature has fallen below a preset limit. In heating mode, the feedback control will only turn off the heating once a preset temperature limit has been exceeded. In cooling mode, the controller will turn on the cooling system when the room temperature has exceeded a preset limit. The control system will only turn off the cooling system once the temperature has fallen below a preset limit. In this connection, the command value "1" or "0" will be output, depending on the switching status, if the temperature exceeds or falls below the hysteresis limits.
The hysteresis limits of both operating modes can be configured in the ETS.

The following two images each show a 2-point feedback control for the individual operating modes "Heating" (see figure 29)or "Cooling" (see figure 30). The images take two temperature setpoints, one-stage heating or cooling and non-inverted command value output into account.

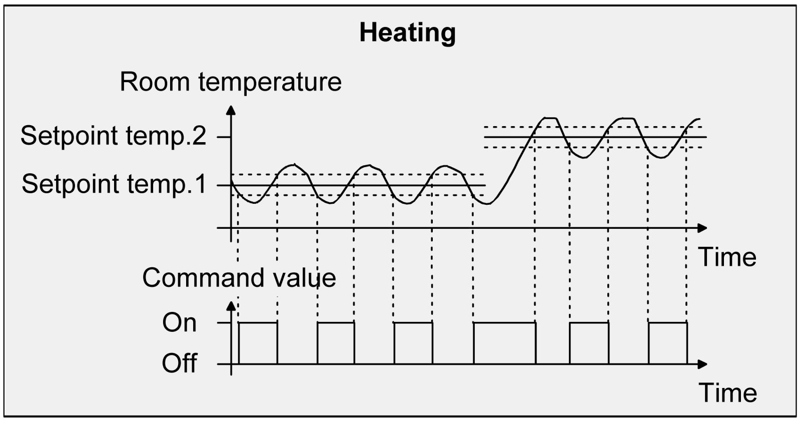


Figure 29: 2-point feedback control for the single "Heating" operating mode

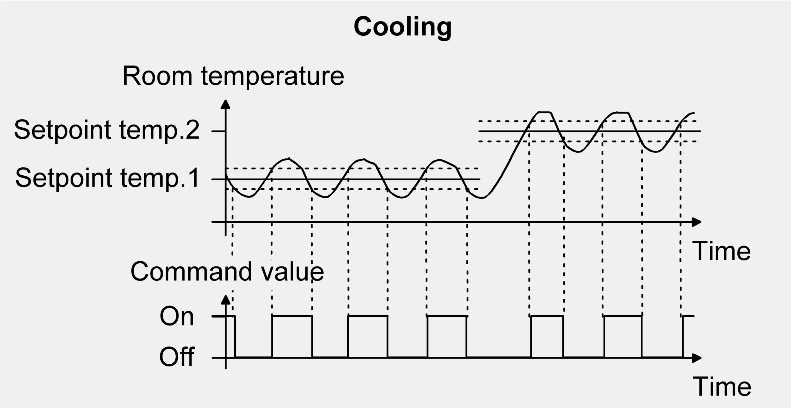


Figure 30: 2-point feedback control for the single "Cooling" operating mode

An additional 2-point feedback control heating or cooling level works exactly the same as the 2-point feedback control of the basic level. The difference is that the setpoint and the hysteresis values will shift by taking into account the configured level offset.

<u>"Heating and cooling" mixed operating mode:</u>

In mixed operation, a distinction is made whether the change-over between heating and cooling is to be effected automatically or in a controlled way through the object...

- With automatic operating mode change-over, in the heating mode the controller will turn on the heating when the room temperature has fallen below a preset hysteresis limit. In this case, as soon as the room temperature exceeds the setpoint of the current operating mode, the feedback control will turn off the heating in the heating mode. In the same way, in cooling mode, the controller will turn on the cooling system when the room temperature has exceeded a preset hysteresis limit. As soon as the room temperature falls below the setpoint of the current operating mode, the feedback control will turn off the cooling system in the cooling mode. Thus, in mixed operation, there is no upper hysteresis limit for heating or no lower one for cooling, respectively, for these values would be in the deadband. Within the deadband, neither heating nor cooling will take place.
- With an operating mode switchover via the object, in heating mode, the controller will turn on the heating when the room temperature has fallen below a preset hysteresis limit. The feedback control will only turn off the heating in the heating mode once the preset upper hysteresis limit has been exceeded. In the same way, in cooling mode, the controller will turn on the cooling system when the room temperature has exceeded a preset hysteresis limit. The feedback control will only turn off the cooling system in the cooling mode once the temperature has fallen below the preset lower hysteresis limit. As with the individual operating modes of heating or cooling, there are two hysteresis limits per operating mode. Although there is a deadband for the calculation of the temperature setpoints for cooling, it has no influence on the calculation of the two-point command value, as the operating mode is switched over "manually" through the corresponding object. Within the hysteresis spans, it thus will be possible to request heating or cooling energy for temperature values that are located within the deadband.

The following two images show 2-point feedback control for the mixed operating mode "Heating and cooling", distinguishing between heating mode (see figure 31) and cooling mode (see figure 32). The images take two temperature setpoints, a non-inverted command value output and an automatic operating mode switchover into account. When the operating mode is switched over via the object, an upper hysteresis for heating and a lower hysteresis for cooling are active.

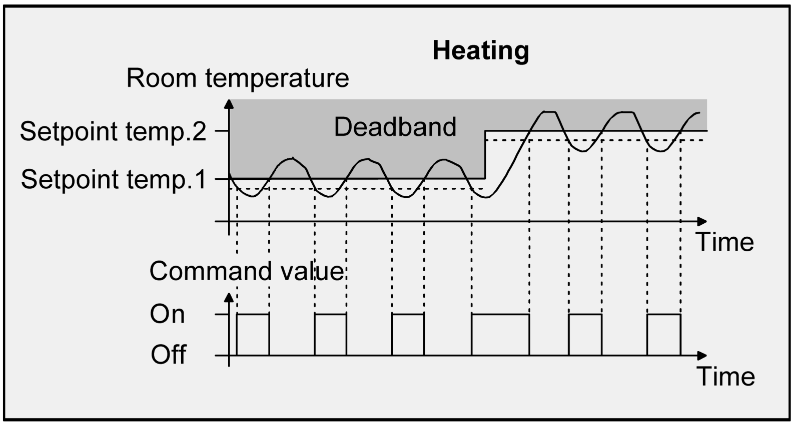


Figure 31: 2-point feedback control for mixed "Heating and cooling" mode with active heating mode

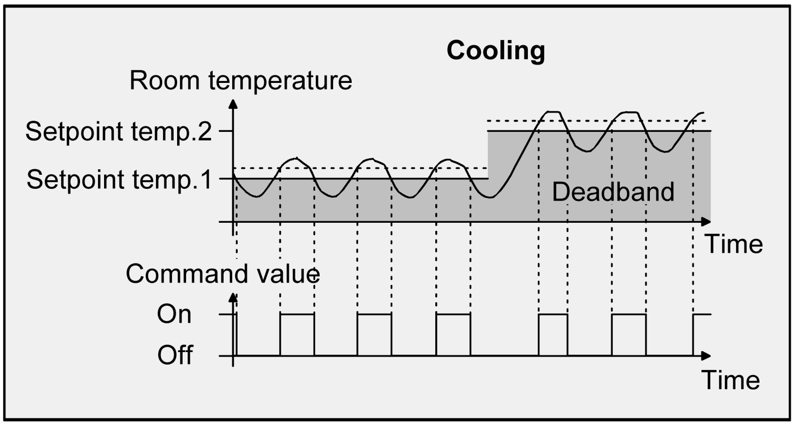


Figure 32: 2-point feedback control for mixed "Heating and cooling" mode with active cooling operation

The command value "1" or "0" will be output, depending on the switching status, if the temperature exceeds or falls below the hysteresis limits or the setpoints.

An additional 2-point feedback control heating or cooling level works exactly the same as the 2-point feedback control of the basic level. The difference is that the set-point and the hysteresis values will shift by taking into account the configured level offset.

Adapting the 2-point feedback control

2-point feedback control represents a very simple temperature control. For this type of feedback control, two hysteresis temperature values are set. The upper and lower temperature hysteresis limits can be adjusted via parameters. It has to be considered that…

- A small hysteresis will lead to smaller temperature variations but to a higher KNX bus load.
- A large hysteresis switches less frequently but will cause uncomfortable temperature variations.

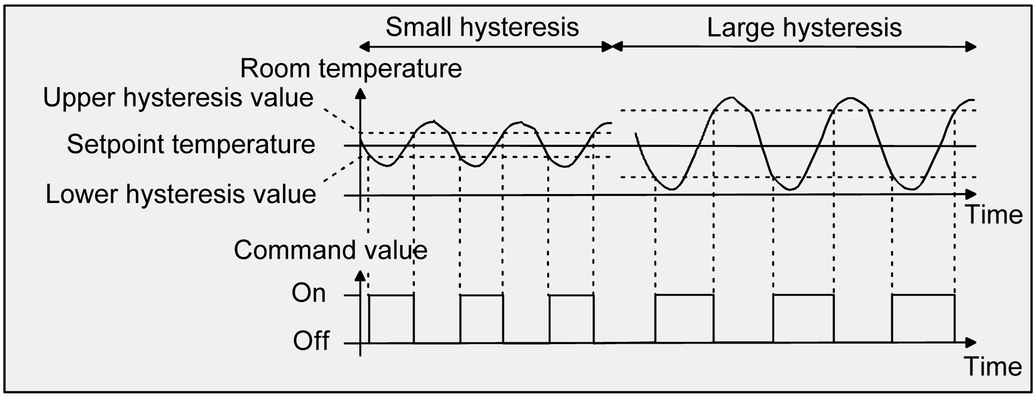


Figure 33: Effects of the hysteresis on the switching behaviour of a 2-point feedback control command value

10.2.4 Disabling functions

Disable controller

Certain operation conditions may require the deactivation of the room temperature control. For example, the controller can be switched-off during the dew point mode of a cooling system or during maintenance work on the heating or cooling system. When set to "yes", the parameter "Controller output disabling object" in the parameter node "Room temperature controller -> RTCx - General" enables the 1-bit object "Command value outputs - Disable". In addition, the controller disable function can be switched off when set to "No".

In case a "1" telegram is received via the enabled disable object, the room temperature control will be completely deactivated. In this case, all the command values are equal to "0"/"OFF" (wait 30 s for update interval of the command values). The controller, however, can be operated in this case via the communication objects.

Disable additional level

The additional stage can be separately disabled when in two-stage heating or cooling mode. When set to "yes", the parameter "Additional level disabling object" in the parameter node "Room temperature controller -> RTCx - General" enables the 1-bit object "Command value outputs - Additional level - Disable". In addition, the disable function of the additional level can be switched off when set to "No". In case a "1" telegram is received via the enabled disable object, the room temperature control is completely deactivated by the additional level. The command value of the additional level is "0" while the basic level continues to operate.

ℹ Disabling operation is always inactive after a device reset (bus voltage return, ETS programming operation).

10.2.5 Reset behaviour

Additional information on the operating mode after a reset

In the ETS, it is possible to use the parameter "Operating mode after reset" in the parameter node "Room temperature controller -> RTCx - General" to set which operating mode is to be activated after bus voltage returns or after an ETS programming operation. The following settings are possible here...

- "Comfort" -> The Comfort mode will be activated after the initialisation phase.
- "Standby" -> The standby mode will be activated after the initialisation phase.
- "Night" -> The Night mode will be activated after the initialisation phase.
- "Frost/heat protection" -> The frost/heat protection mode will be activated after the initialisation phase.
- "Restore operating mode before reset" -> The mode set before a reset according to the operating mode objects will be restored after the initialisation phase of the device. Operating modes set by a function with a higher priority before the reset (Forced, Window status, Presence status) are not effected.

10.2.6 "Room temperature controller - General" parameters

Name of controller	40-character free text
The text entered in this parameter is used to label the controller in the ETS parameter window (e.g. "Kitchen control", "Bathroom temperature"). The text is not programmed in the device.	

Operating mode	**Heating** Cooling Heating and cooling Basic and additional heating Basic and additional cooling Basic and additional heating and cooling
The room temperature controller distinguishes between two different operating modes. The operating modes specify whether you want the controller to use its command value to trigger heating systems ("heating" single operating mode) or cooling systems ("cooling" single operating mode). You can also activate mixed operation, with the controller being capable of changing over between "Heating" and "Cooling" either automatically or, alternatively, controlled by a communication object. In addition, you can establish two-level control operation to control an additional heating or cooling unit. For two-level feedback control, separate command values will be calculated as a function of the temperature deviation between the setpoint and the actual value and transmitted to the bus for the basic and additional levels. This parameter specifies the operating mode and, if necessary, enables the additional level(s).	

Command values for heating and cooling	**to separate objects (4-pipe / 2 circuits)** to shared object (2-pipe / 1 circuit)
If the parameter is set to "Yes", the command value will be transmitted to a shared object during heating or cooling. This function is used, if the same heating system is used to cool the room in the summer and used to heat the room in the winter. This parameter is only visible with "Heating and cooling" mixed operating mode.	

Additional separate command value objects	Checkbox (yes / **no**)
If the parameter is set to "yes", two separate objects "Command value heating" and "Command value cooling" are displayed in addition to the shared object "Command value heating/cooling". These objects are for both visualisation purposes and also rooms with, for example, combined wall heating/cooling and separate underfloor heating. This parameter is only visible in the mixed "Heating and cooling" operating mode with output of the command values to a shared object.	

Type of heating control (if applicable, for basic and additional level)	**continuous PI control** switching PI control (PWM) switching 2-point feedback control
Selecting a feedback control algorithm (PI or 2-point) with data format (1-byte or 1-bit) for the heating system.	

Type of heating (if applicable, for basic and additional level)	**Hot water heater (1.0 K / 830 min)** Underfloor heating (1.5 K / 1000 min) Electric heating (1.0 K / 830 min) Fan coil unit (1.0 K / 500 min) Split unit (1.0 K / 500 min) via control parameter
Adapting the PI algorithm to different heating systems using predefined values for the proportional range and reset time control parameters. With the "Using control parameters" setting, it is possible to set the control parameters in a manner deviating from the predefined values within specific limits. This parameter is only visible if "Type of heating control = Continuous PI control".	

Proportional range	1...**5**...12.7 K
Separate setting of the "Proportional range" control parameter. This parameter is only visible if "Type of heating = via control parameter" and the heating control type "PI control".	

Reset time (0 = inactive)	0...**830**...2550 min
Separate setting of the "Reset time" control parameter. This parameter is only visible if "Type of heating = via control parameter" and the heating control type "PI control".	

Lower hysteresis limit	-12.8...**-0.5** K
Definition of bottom hysteresis (switch-on temperatures) of the heating. This parameter is only visible if "Type of heating control = Switching 2-point feedback control (ON/OFF)".	

Upper hysteresis limit	**0.5**...12.7 K
Definition of top hysteresis (switch-off temperatures) of the heating. This parameter is only visible if "Type of heating control = Switching 2-point feedback control".	

Type of control (if applicable, for basic and additional level)	**continuous PI control** switching PI control (PWM) switching 2-point feedback control
Selecting a feedback control algorithm (PI or 2-point) with data format (1-byte or 1-bit) for the cooling system	

Type of cooling (if applicable, for basic and additional level)	**Cooling ceiling (1.0 K / 830 min)** Fan coil unit (1.0 K / 500 min) Split unit (1.0 K / 500 min) Floor cooling (1.5 K / 1000 min) via control parameter
Adapting the PI algorithm to different cooling systems using predefined values for the proportional range and reset time control parameters. With the "Using control parameters" setting, it is possible to set the control parameters in a manner deviating from the predefined values within specific limits. This parameter is only visible if "Type of cooling control = PI control".	

Proportional range	1...**5**...12.7 K
Separate setting of the "Proportional range" control parameter. This parameter is only visible if "Type of cooling = via control parameter" and the cooling control type "PI control".	

Reset time (0 = inactive)	0...**830**...2550 min
Separate setting of the "Reset time" control parameter. This parameter is only visible if "Type of cooling = via control parameter" and the cooling control type "PI control".	

Lower hysteresis limit	-12.8...**-0.5** K
Definition of bottom hysteresis (switch-off temperatures) of the cooling. This parameter is only visible if "Type of cooling control = Switching 2-point control".	

Upper hysteresis limit	**0.5**...12.7 K
Definition of top hysteresis (switch-on temperatures) of the cooling. This parameter is only visible if "Type of cooling control = Switching 2-point control".	

Heading/cooling switchover	automatic via RTC via object

In a configured mixed mode it is possible to switch over between heating and cooling.
With "automatic via RTC": Depending on the operating mode and the room temperature, the switchover takes place automatically.
With "via object": The switchover takes place only via the object "Operating mode".

Additional level disabling object	Checkbox (yes / **no**)

The additional stages can be separately disabled via the bus. The parameter enables the disable object as necessary.
This parameter is only visible in two-level heating and cooling operation.

Controller output disabling object	Checkbox (yes / **no**)

This parameter enables the "Disable command value outputs" object. If the controller is disabled, there is no feedback control until enabled (command values = 0).

Operation mode after reset	Restore operating mode before reset Comfort **Standby** Night Frost/heat protection

This parameter specifies which operating mode is set immediately after a device reset.
With "Restore operation mode before reset": The mode set before a reset according to the operating mode object will be restored after the initializing phase of the device. Operating modes set by a function with a higher priority before the reset (Forced, Window status, Presence status) are not effected.

10.2.7 Objects for command value output disabling

Object no.	Function	Name	Type	DPT	Flag
933, 975, 1017, 1059, 1101, 1143, 1185, 1227, 1269, 1311, 1353, 1395	Command value outputs - Disabling	RTC x - Input	1-bit	1,001	C, -, W, -, U

1-bit object used to disable the command value outputs.

In case a "1" telegram is received via the enabled disable object, the room temperature control will be completely deactivated. In this case, all the command values are equal to "0"/"OFF" (wait 30 s for update interval of the command values).

Object no.	Function	Name	Type	DPT	Flag
934, 976, 1018, 1060, 1102, 1144, 1186, 1228, 1270, 1312, 1354, 1396	Command value outputs - Additional value - Disabling	RTC x - Input	1-bit	1,001	C, -, W, -, U
1-bit object used to disable the command value outputs of the additional level. In case a "1" telegram is received via the enabled disable object, the room temperature control is completely deactivated by the additional level. The command value of the additional level is "0" while the basic level continues to operate.					

10.3 Operating mode and setpoints

Introduction - Operating modes

The room temperature controller has various operating modes. The selection of these modes will, for example, facilitate the activation of different temperature setpoints, depending on the presence of a person, on the state of the heating or cooling system, on the time of the day, or on the day of the week. The following operating modes can be distinguished:

- Comfort

  Comfort mode is usually activated if persons are in a room, and the room temperature should, for this reason, be adjusted to an adequately convenient value. The switchover to this operating mode can take place either by specifying an operating mode via the operating mode switchover or with presence control, for example, using a PIR presence detector on the wall or a ceiling mounted presence detector.

- Standby

  If a room is not used during the day because persons are absent, you can activate the Standby mode. Thereby, you can adjust the room temperature on a standby value, thus to save heating or cooling energy, respectively.

- Night

  During the night hours or during the absence of persons for a longer time, it mostly makes sense to adjust the room temperature to lower values for heating systems (e.g. in bedrooms). In this case, cooling system can be set to higher temperature values, if air conditioning is not required (e.g. in offices). For this purpose, you can activate the Night mode.

- Frost/heat protection

  Frost protection will be required if, for example, the room temperature must not fall below critical values while the window is open. Heat protection can be required where the temperature rises too much in an environment which is always warm, mainly due to external influences. In such cases, you can activate the Frost/heat protection operating mode and prescribe some temperature setpoint of its own for either option, depending on whether "Heating" or "Cooling" has been selected, to prevent freezing or overheating of the room.

– Comfort extension (temporary Comfort mode)

You can activate the comfort extension from the Night or Frost/heat protection mode (not triggered by the "Window status" object) and use it to adjust the room temperature to a comfort value for some time if, for example, there are people in the room during the night hours. This mode can exclusively be activated via the presence object. The comfort extension option will be automatically deactivated after a definable time has elapsed, or by receiving a presence object value = "0". You cannot retrigger this extension.

ℹ You can assign your own setpoint temperature to the "Heating" or "Cooling" operating modes for each operating mode.

Operating mode switchover

The operating mode is switched by the "Operating mode - Preset" object.

During the running time, the operating mode can be changed over through this value object immediately after the receipt of only one telegram. In this connection, the value received will set the operating mode. In addition, a second 1-byte object is available which, by forced control and through a higher level, can set an operating mode, irrespective of any other switchover options.

Taking the priority into account, a specific switchover hierarchy will result from the operating mode switchover by the objects, a distinction being made between presence detection by the presence button (see figure 34) or the presence detector (see figure 35). In addition, the status of the windows in the room can be evaluated using the "Frost/heat protection - Window contact - Status" object, meaning that, when a window is open, the controller can switch to frost/heat protection mode, irrespective of the set operating mode, in order to save energy .

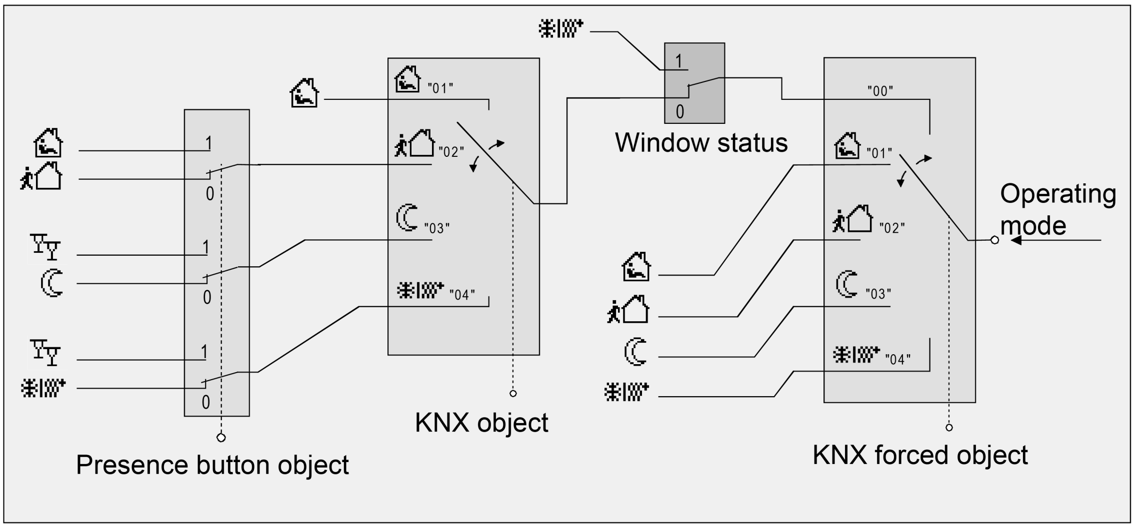


Figure 34: Operating mode switchover through KNX object with presence button

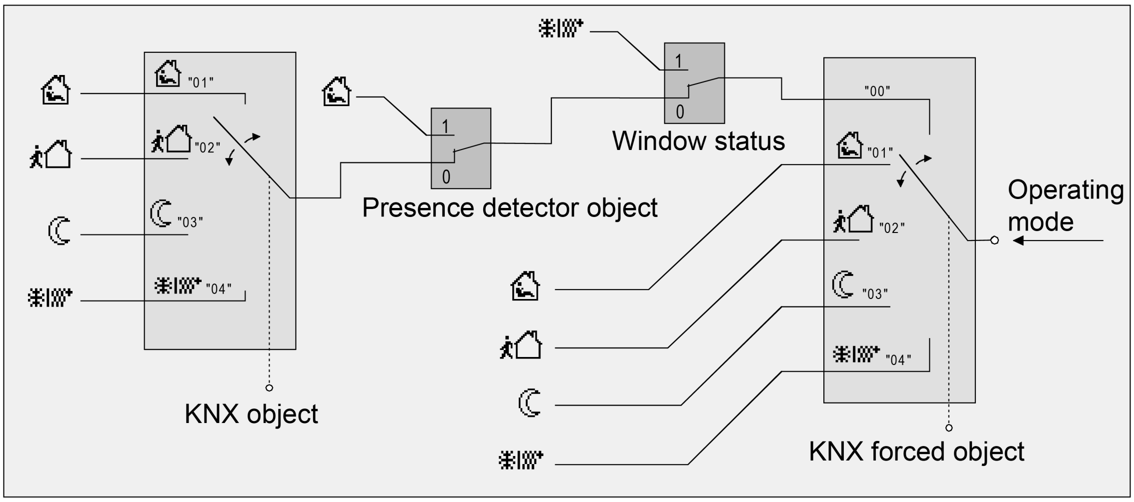


Figure 35: Operating mode switchover through KNX object with presence detector

Object value Operating mode	Object value Forced object Oper.m.	object Window status	Presence button	Presence detector	Resulting operating mode
00	00	0	X	0	No modification
01	00	0	0	-	Comfort
02	00	0	0	-	Standby
03	00	0	0	-	Night
04	00	0	0	-	Frost/heat protection
01	00	0	1	-	Comfort
02	00	0	1	-	Comfort
03	00	0	1	-	Comfort extension
04	00	0	1	-	Comfort extension
01	00	0	-	0	Comfort
02	00	0	-	0	Standby
03	00	0	-	0	Night
04	00	0	-	0	Frost/heat protection
X	00	0	-	1	Comfort
X	00	1	-	X	Frost/heat protection
X	00	1	X	-	Frost/heat protection
X	01	X	X	X	Comfort
X	02	X	X	X	Standby
X	03	X	X	X	Night

Object value Operating mode	Object value Forced object Oper.m.	object Window status	Presence button	Presence detector	Resulting operating mode
X	04	X	X	X	Frost/heat protection

Status of the communication objects and the resulting operating mode

X: Status irrelevant
-: Not possible

i After voltage return or after an ETS programming operation, the value corresponding to the set operating mode is actively transmitted to the bus if the "Transmit" flag is set.

i In parameterisation of a presence button: the presence object will be active ("1") for the period of an active comfort extension. The presence object will be automatically deleted ("0") if the comfort extension is stopped after the extension time has elapsed, or if the operating mode has been changed by an operation through the switchover objects or a forced operating mode is deactivated by the KNX forced object (forced object -> "00"). The controller therefore automatically resets the status of the presence button when an object value is received via the operating mode objects or the forced object is reset.

Additional information on the presence function / comfort extension

With presence detection, the room temperature controller can quickly switch over to a comfort extension upon push-button actuation using a presence button or, using a presence detector, switch to Comfort mode when movement by a person in the room is detected.

The parameter "Presence detection" in the parameter node "RTCx - General -> Enabled functions" enables the parameter page "Presence detection". The remaining parameters can be set there.

In this regard, the parameter "Presence detection" determines whether presence detection is movement-controlled by a presence detector or done manually using a presence button:

– Presence detection by the presence button

The 1-bit communication object "Presence detection - Presence button" is enabled. An "ON" telegram to this object makes it possible to switch to the comfort extension if Night or Frost/heat protection mode (not activated by the "Window status" object!) is active. The extension will be automatically deactivated as soon as the configured "Length of comfort extension" time has elapsed. A comfort extension can be deactivated in advance if an "OFF" telegram is received via the object of the presence button. You cannot re-trigger such extension time.

If you have set the length of comfort extension to "0" in the ETS, you cannot activate a comfort extension from the Night or Frost/heat protection mode. In this case, the operating mode will not be changed, although the presence function has been activated.

If the standby mode is active, actuation on a presence object value = "ON" allows a switchover to the Comfort mode. This will also be the case if you have configured the length of comfort extension to "0". Comfort mode will remain active as long as the presence function remains active, or until another operating mode is specified.

The presence function will always be deleted whenever a switchover to a different operating mode takes place, or after a forced operating mode has been deactivated (associated with KNX forced switchover). In the event of a device reset (voltage failure, ETS programming operation), an active presence function is always deleted.

ℹ If, during an active comfort extension and with a frost/heat protection switchover being configured "via window status", a window is opened, then the controller will activate frost/heat protection immediately. The comfort extension remains active in the background and the configured time continues to elapse. If the time elapses and the window remains open, the presence is reset and an appropriate telegram is sent to the bus. However, if the window is closed again before the time has elapsed, then the comfort extension is executed again with the remaining run time.

– Presence detection by the presence detector

Two 1-bit communication objects "Presence detection - Presence object" are enabled. With this objects it is possible to integrate presence detectors into room temperature control. If a movement is detected ("ON" telegram), the controller will switch to Comfort mode. In this connection, it is irrelevant what has been set by the switchover objects. Only a window contact or the KNX forced object are of higher priority.

Both objects form an "Or" link of two presence detectors. In larger rooms, the use of two presence detectors can be useful. As long as one of the two detectors detects a presence, the controller remains in Comfort mode.

After the delay time has elapsed in the presence detector after a detected movement ("OFF" telegram), the controller will return to the mode which was active before presence detection, or it will compensate the telegrams of the operating mode objects received during presence detection, respectively.

In the event of a device reset (voltage failure, ETS programming operation), an active presence function is always deleted. In this case, the presence detector must transmit a new "1"-telegram to the controller to activate the presence function.

Additional information on the window status and the automatic frost protection

The room temperature controller offers various options to change over into the Frost/heat protection mode. In addition to switching over by means of the corresponding operating mode switchover object, frost/heat protection can be activated by a window contact, or alternatively, the frost protection can be activated by an automatic temperature function. The window contact or the automatic function has higher priority. The "Frost/heat protection" parameter determines how the switchover to forced frost/heat protection takes place:

– Frost/heat protection switchover "via window contact (frost and heat protection)"

  The 1-bit object "Window contact" is enabled. A telegram having the value of = "ON" (open window) and sent to this object will activate the frost/heat protection mode. If this is the case, the operating mode cannot be deactivated by the switchover objects (except for the KNX forced object) or the presence function. Only a telegram with the value = "OFF" (closed window) will reset the window status and deactivate the frost/heat protection mode. After this, the operating mode set before the opening of the window or that mode carried by the bus while the window was open will be activated.

  You can optionally configure a delay for the evaluation of the window status. Such delay can make sense if short ventilation of the room by opening the window is not supposed to change the operating mode. The delay time is set by the "Delay time" parameter and can be between 1 and 255 minutes. The window status will only be changed and thus the frost/heat protection mode activated after this parameterized time has elapsed. A setting of "0" will effect the immediate activation of the frost/heat protection mode when the window is open. The window status will be in effect in the heating and in the cooling mode. After a voltage failure or ETS programming operation, the window status is always inactive.

– Frost protection mode switchover "via temperature drop (frost protection only)"

  For this setting, automatic switchover to the frost protection mode can be made at times, depending on the room temperature determined.

  If there are no window contacts, this setting can prevent unnecessary heating up of a room when windows or external doors are open.

  With this function, a quick temperature drop can be detected by measuring the actual temperature every 4 minutes as is the case when a window is open in the winter months, for example. You can use the "Temperature drop detection from" parameter to set the maximum temperature drop in K / 4 min for switching over to the frost protection mode. If the controller detects that the room temperature has changed by at least the configured temperature jump within four minutes, frost protection is activated. After the time specified by the "Frost protection period" parameter has elapsed, the controller again automatically switches to the operating mode which was set before frost protection or which was tracked during automatic operation. It is not possible to retrigger an elapsing frost protection period.

ℹ An activated automatic frost protection is cancelled by a setpoint shift, a setpoint change or an increase in the room temperature by 1 Kelvin.

ℹ The KNX override object has a higher priority than the automatic frost protection mode and can interrupt the latter.

ℹ The automatic frost protection mode only acts on heating for temperatures below the set value temperature of the operating mode selected. Thus, no automatic switchover to frost protection can take place at room temperatures in the deadband or in the active cooling mode if the "Heating and cooling" operating mode is on. Automatic heat protection activation is not intended with this parameterization.

ℹ Frequent draughts in a room can cause unintentional activation/deactivation of frost protection when the automatic frost protection mode is active and if the set temperature decrease is too low. Therefore switching into the frost/heat protection mode by window contacts should generally be preferred to the automatic option.

Setpoint temperature presetting

Setpoint temperatures can be specified for each operating mode in the ETS as part of configuration. It is possible to configure the setpoints for the "Comfort", "Standby" and "Night" modes directly (absolute setpoint presetting) or relatively (derivation from basic setpoint). The setpoint temperatures can later be adapted during regular operation by KNX communication objects if desired.

ℹ The "Frost/heat protection" operating mode allows the separate configuration of two temperature setpoints for heating (frost protection) and cooling (heat protection) solely in the ETS. These temperature values cannot be changed later during controller operation.

The "Setpoint specification" parameter on the parameter page "Room temperature controller -> RTCx - General -> Setpoints" defines the way the setpoint temperature is specified...

- Setting "relative"
  When presetting the set-temperatures for Comfort, Standby and Night mode, attention has to be paid to the fact that all setpoints depend on each other as all values are derived from the basic temperature (basic setpoint). The parameter "Setpoint temperature - Basic value" on the parameter page "Room temperature controller -> RTCx - General -> Setpoints" determines the basic setpoint, which is loaded as a preset value when the device is programmed via the ETS. Taking into account the "Standby" and "Night" parameters under the header "Temperature shift via operating mode", the temperature setpoints for the standby and night mode are derived from this value depending on the heating or cooling operating mode. The deadband will be additionally considered for the "Heating and cooling" operating mode.
  The 2-byte object "Basic setpoint" provides the option of changing the basic temperature, and thus all the dependent setpoint temperatures during device operation. A change via the object must always be enabled in the ETS by configuring the parameter "Approve activations via bus" to "yes". If the basic setpoint adjustment via the bus is disabled, the "Basic setpoint" object will be hidden. The controller rounds the temperature values received via the object to the specified "Step width of the setpoint shift" (0,1 K or 0,5 K).

– Setting "absolute"
The setpoint temperatures for Comfort, Standby and Night mode are independent of each other. Depending on the operating mode and heating/cooling mode, various temperature values can be specified in the ETS within the range +7.0 °C to +40.0 °C. The ETS does not validate the temperature values. It is thus possible, for example, to select smaller setpoint temperatures for cooling mode than for heating mode, or to specify lower temperatures for Comfort mode than for Standby mode.
After commissioning using the ETS the setpoint temperatures can be changed via the bus by means of temperature telegrams. This can be done using the communication object "Setpoint temperature - Active operating mode". When the controller receives a telegram via this object, it immediately sets the received temperature as the new setpoint of the active operating mode, and operates from then on with this setpoint. In this manner it is possible to adapt the setpoint temperatures of all operating modes separately for eating and cooling mode. The frost or heat protection temperature programmed using the ETS cannot be changed in this manner.

i With absolute setpoint presetting there is no basic setpoint and, in the mixed operating mode "Heating and cooling" (if necessary also with additional level), also no deadband. Consequently, the room temperature controller cannot control the switchover of the operating mode automatically, which is why, in this configuration, the setting for the parameter "Heating/cooling switchover" is fixed in the ETS to "via object".
Furthermore, setpoint shifting does not exist for absolute setpoint presetting.

i In two-level control mode, all set-temperatures of the additional level are derived from the setpoint temperatures of the basic level. The setpoint temperature of the additional level are determined by subtracting the "Difference between basic and additional levels", which is permanently configured in the ETS, from the setpoints of the basic level in heating mode or by adding the setpoints in cooling mode. If the temperature setpoints of the basic level are changed, the setpoint temperatures of the additional level will be automatically changed as well. Both levels will heat or cool with the same command value at the same time when the level distance is "0".

The temperature setpoints programmed in the room temperature controller by the ETS during commissioning can be changed via communication objects. In the ETS, the parameter "Overwrite setpoints in the device during ETS programming" on the parameter page "Room temperature controller -> RTCx - General -> Setpoints" can be used to determine whether the setpoints that are present in the device and may have been subsequently changed are overwritten during an ETS programming operation and thus replaced again by the values configured in the ETS. If this parameter is "Yes", then the setpoint temperatures are deleted in the device during a programming operation and replaced by the values of the ETS. If this parameter is configured to "No", then setpoints present in the device remain unchanged. The setpoint temperatures entered in the ETS then have no significance.

ℹ During initial commissioning of the device the parameter "Overwrite setpoints in device during ETS programming" must be set to "yes" in order to perform valid initialisation of the memory slots in the device. The setting "Yes" is also necessary if essential controller properties (operating mode, setpoint specification, etc.) are changed in the ETS through new parameter configurations.

Setpoint temperatures for relative setpoint presetting

Depending on the operating mode, different cases should be distinguished when specifying the relative setpoint temperature, which then have an impact on the temperature derivation from the basic setpoint.

Setpoints for operating mode "Heating"

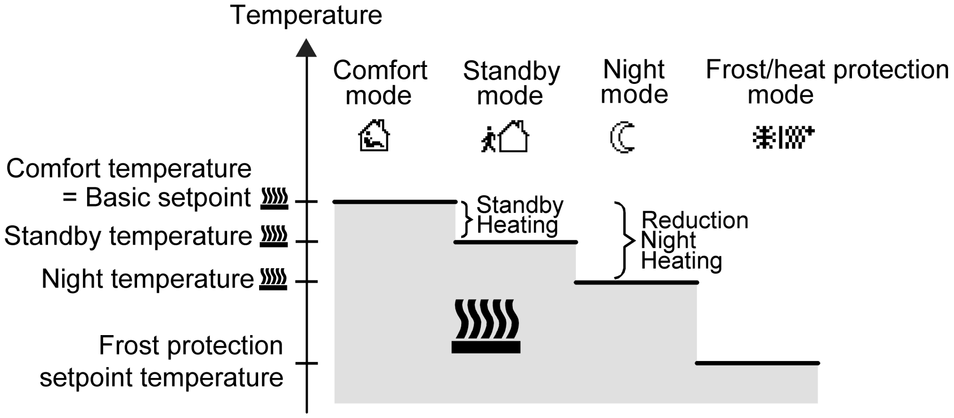


Figure 36: Setpoint temperatures in the operating mode "Heating"

The setpoint temperatures for Comfort, Standby and Night mode exist in this operating mode and the frost protection temperature can be preset (see figure 36). The following applies…

$T_{\text{Standby setpoint heating}} \leq T_{\text{Comfort setpoint heating}}$

or

$T_{\text{Night setpoint heating}} \leq T_{\text{Comfort setpoint heating}}$

The Standby and Night setpoint temperatures are derived from the reduction temperatures configured in the ETS from the comfort setpoint temperature (basic setpoint).
The frost protection is supposed to prevent the heating system from freezing. For this reason, the frost protection temperature (default: +7 °C) should be set to a lower value than the night temperature. In principle, however, it is possible to select frost protection temperature values between +7.0 °C and +40.0 °C. The possible range of values for a setpoint temperature is bounded by the frost protection temperature in the lower range.
The level offset configured in ETS will be additionally considered in a two-level heating mode (see figure 37).

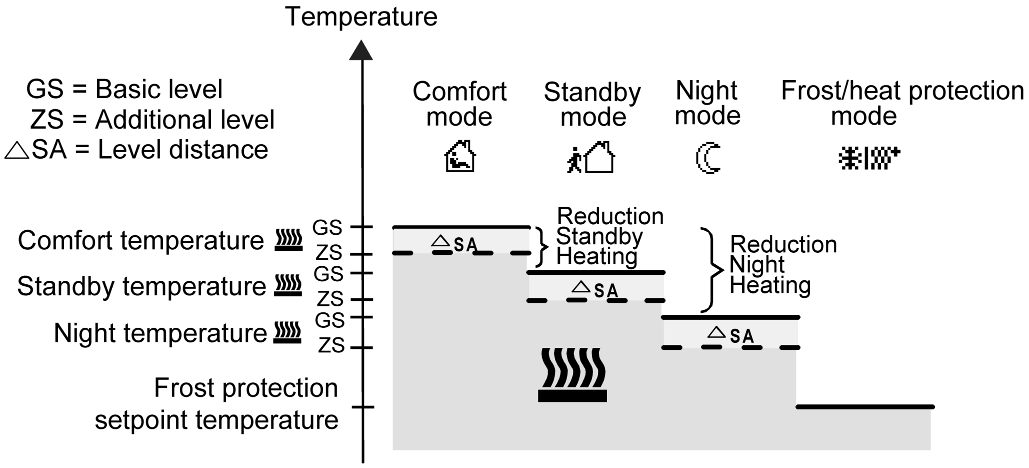


Figure 37: Setpoint temperatures in the operating mode "Basic and additional heating"

$T_{\text{Comfort setpoint additional level heating}} \leq T_{\text{Comfort setpoint basic level heating}}$
$T_{\text{Standby setpoint additional level heating}} \leq T_{\text{Standby setpoint basic level heating}}$
$T_{\text{Standby setpoint heating}} \leq T_{\text{Comfort setpoint heating}}$

or

$T_{\text{Comfort setpoint additional level heating}} \leq T_{\text{Comfort setpoint basic level heating}}$
$T_{\text{Night setpoint additional level heating}} \leq T_{\text{Night setpoint basic level heating}}$
$T_{\text{Night setpoint heating}} \leq T_{\text{Comfort setpoint heating}}$

Setpoints for the "cooling" operating mode

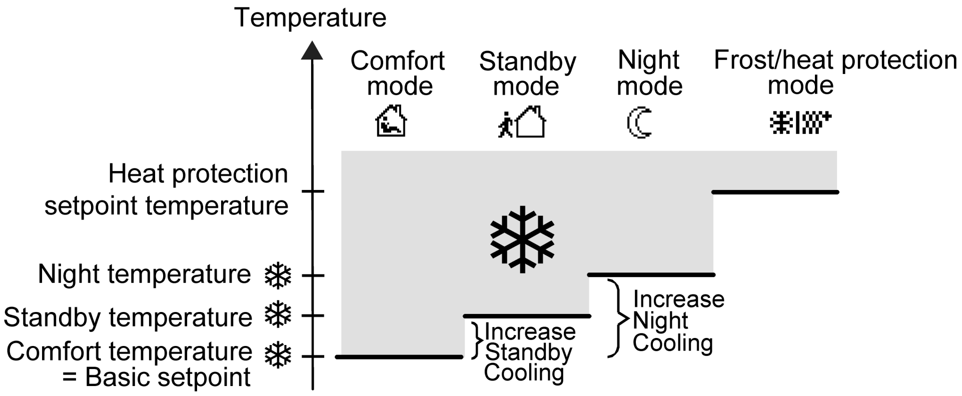


Figure 38: Setpoint temperatures in the operating mode "Cooling"

The setpoint temperatures for Comfort, Standby and Night mode exist in this operating mode and the heat protection temperature can be preset (see figure 38).
The following applies…

$T_{\text{Comfort setpoint cooling}} \leq T_{\text{Standby setpoint cooling}}$

or

$T_{\text{Comfort setpoint cooling}} \leq T_{\text{Night setpoint cooling}}$

The standby and night set-temperatures are derived after the parameterized increase-temperatures from the comfort set-temperature (basic setpoint). The heat protection is intended to ensure that the temperature does not exceed the maximum permissible room temperature in order to protect system components. For this reason, the heat protection temperature (default: +35 °C) should be set to a higher value than the night temperature. In principle, however, it is possible to select heat protection temperature values between +7.0 °C and +45.0 °C. The possible range of values for a setpoint temperature is bounded by the heat protection temperature in the upper range.

The level offset configured in ETS will be additionally considered in a two-level cooling mode (see figure 39).

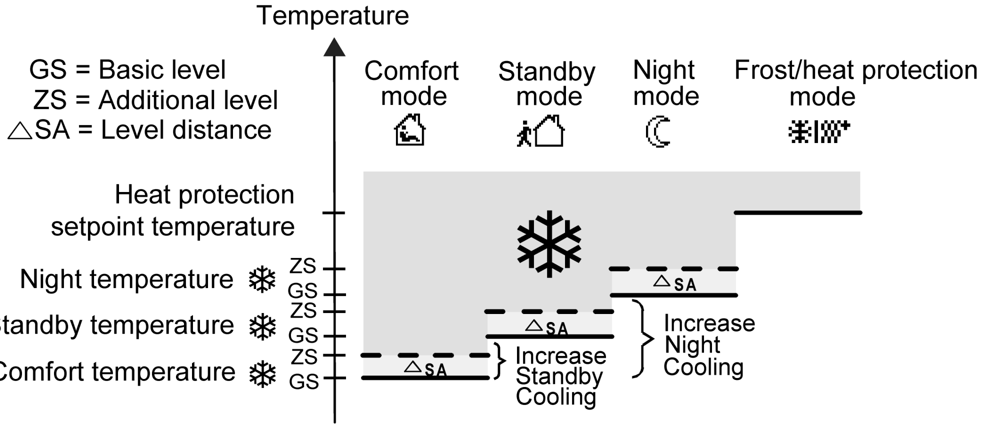


Figure 39: Setpoint temperatures in the operating mode "Basic and additional cooling"

$T_{\text{Comfort setpoint basic level cooling}} \leq T_{\text{Comfort setpoint additional level cooling}}$
$T_{\text{Standby setpoint basic level cooling}} \leq T_{\text{Standby setpoint additional level cooling}}$
$T_{\text{Comfort setpoint cooling}} \leq T_{\text{Standby setpoint cooling}}$

or

$T_{\text{Comfort setpoint basic level cooling}} \leq T_{\text{Comfort setpoint additional level cooling}}$
$T_{\text{Night setpoint basic level cooling}} \leq T_{\text{Night setpoint additional level cooling}}$
$T_{\text{Comfort setpoint cooling}} \leq T_{\text{Night setpoint cooling}}$

Setpoints for the "heating and cooling" operating mode

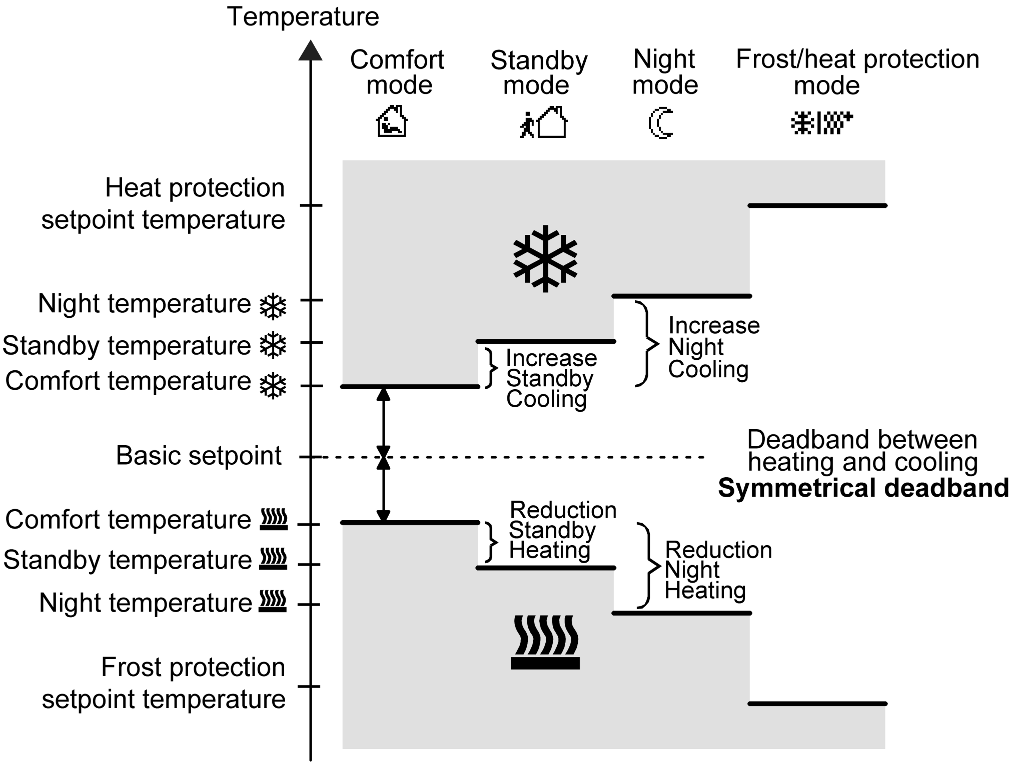


Figure 40: Setpoint temperatures in the operating mode "Heating and cooling" with symmetrical deadband

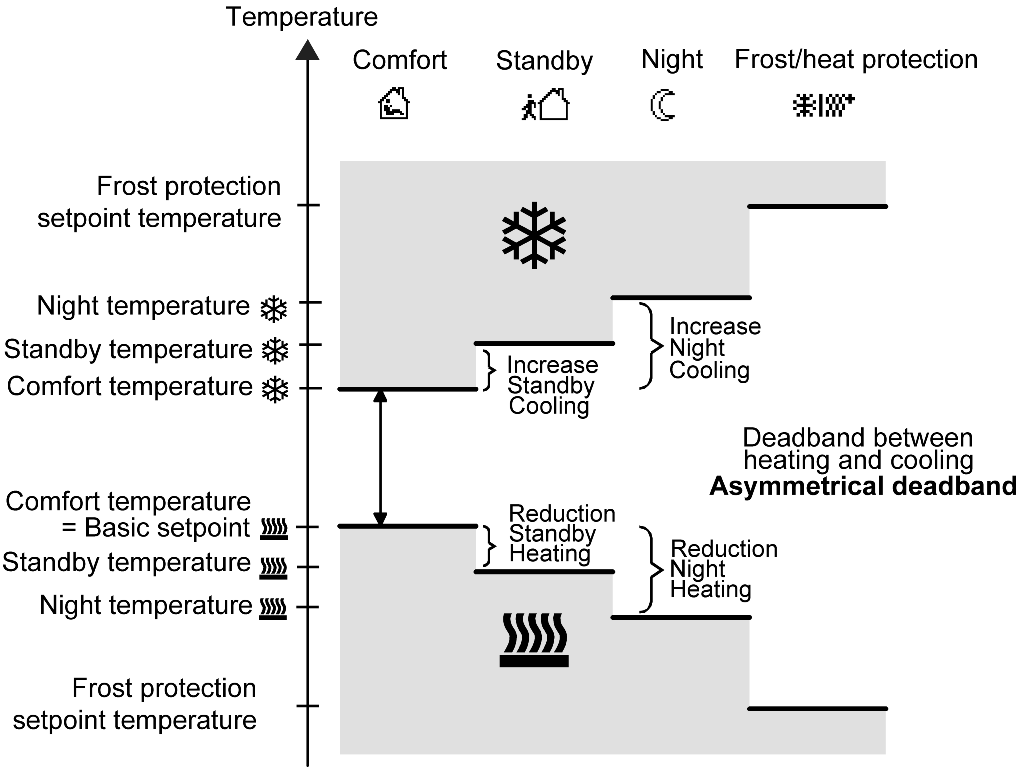


Figure 41: Setpoint temperatures in the operating mode "Heating and cooling" with asymmetrical deadband

For this heating/cooling operating mode, the setpoint temperatures of both heating/ cooling modes exist for the Comfort, Standby and Night operating modes as well as the deadband. A distinction is made in the deadband position with combined heating

and cooling. A symmetrical (see figure 40) or an asymmetrical (see figure 41) deadband position can be configured. In addition, the frost protection and the heat protection temperatures can be preset.
The following applies…

$T_{\text{Standby setpoint heating}} \leq T_{\text{Comfort setpoint heating}} \leq T_{\text{Comfort setpoint cooling}} \leq T_{\text{Standby setpoint cooling}}$

or

$T_{\text{Night setpoint heating}} \leq T_{\text{Comfort setpoint heating}} \leq T_{\text{Comfort setpoint cooling}} \leq T_{\text{Night setpoint cooling}}$

The standby and night setpoint temperatures are derived from the comfort setpoint temperatures for heating or cooling. The temperature increase (for cooling) and the temperature decrease (for heating) of both operating modes can be preset in ETS. The comfort temperatures themselves are derived from the deadband and the basic setpoint. The frost protection is supposed to prevent the heating system from freezing. For this reason, the frost protection temperature (default: +7 °C) should be set to a lower value than the night temperature for heating. In principle, however, it is possible to select frost protection temperature values between +7.0 °C and +40.0 °C. The heat protection is intended to prevent the temperature from exceeding the maximum permissible room temperature in order to protect system components. For this reason, the heat protection temperature (default: +35 °C) should be set to a higher value than the night temperature for cooling. In principle, however, it is possible to select heat protection temperature values between +7.0 °C and +45.0 °C. The possible range of values for a setpoint temperature ("heating and cooling") lies between +7.0 °C and +45.0 °C and is bounded by the frost protection temperature in the lower range and by the heat protection temperature in the upper range.

The level offset configured in ETS will be additionally considered in a two-level heating or cooling mode.

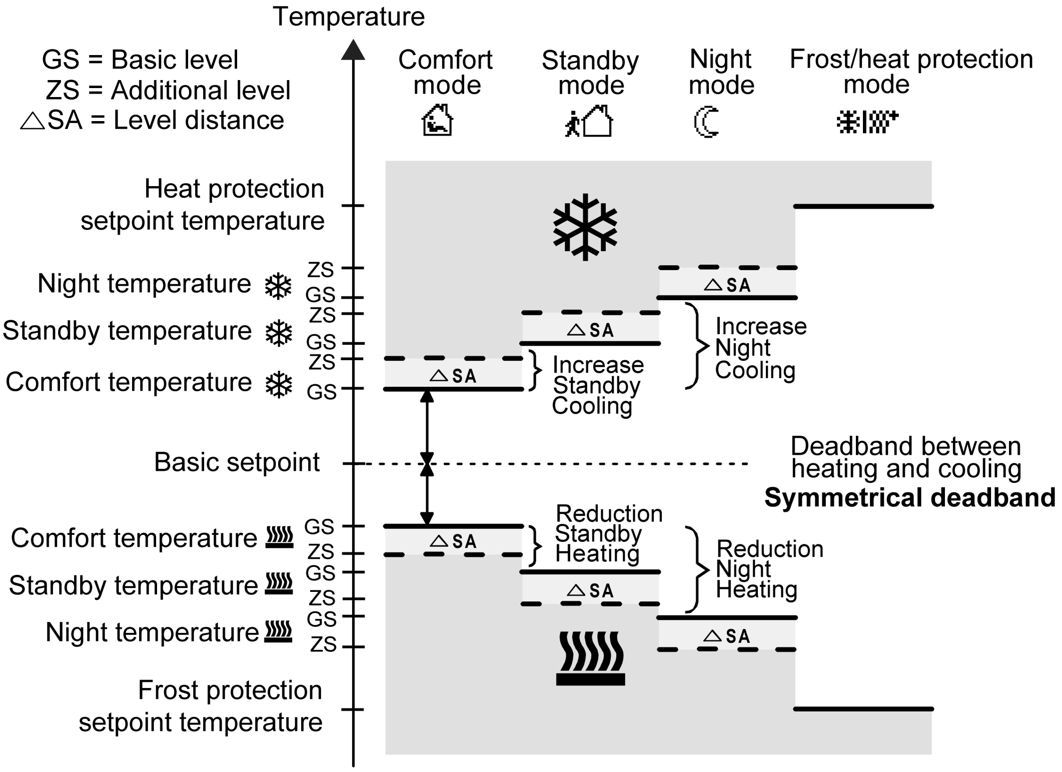


Figure 42: Setpoint temperatures in the operating mode "Basic and additional heating and cooling" with symmetrical deadband

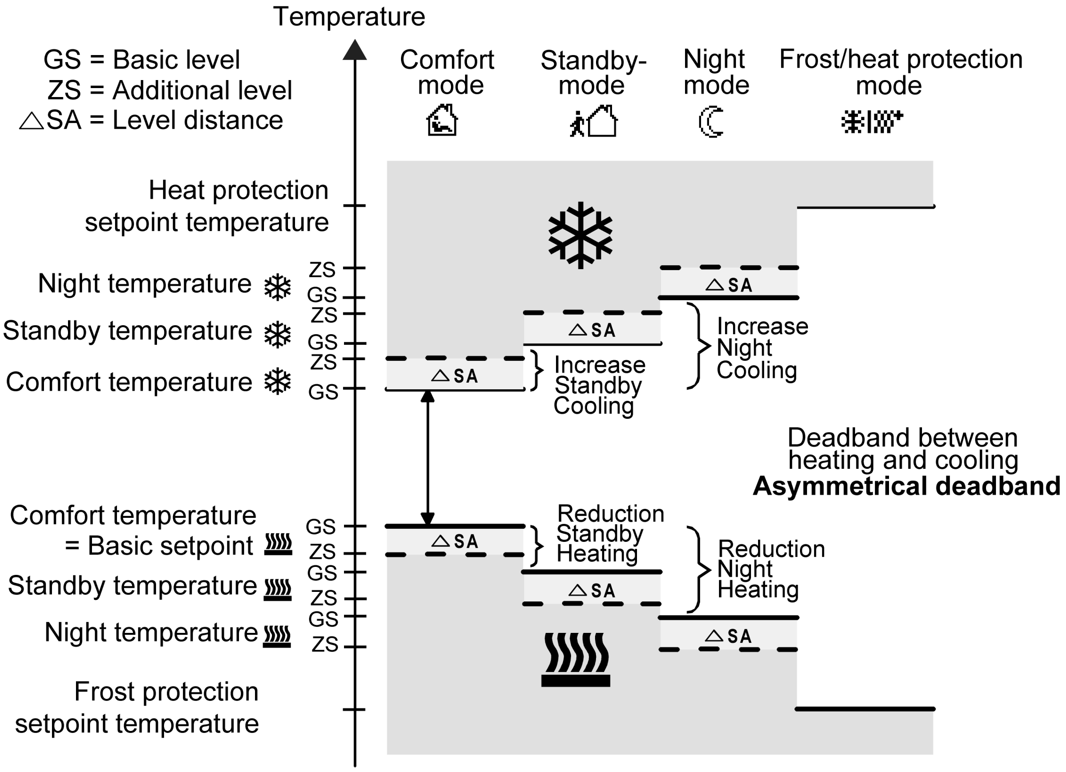


Figure 43: Setpoint temperatures in the operating mode "Basic and additional heating and cooling" with asymmetrical deadband

$T_{\text{Comfort setpoint add. level Heating}} \leq T_{\text{Comfort setpoint basic level Heating}} \leq T_{\text{Comfort setpoint basic level Cooling}} \leq T_{\text{Comfort setpoint add. level Cooling}}$
$T_{\text{Standby setpoint add. level Heating}} \leq T_{\text{Standby setpoint basic level Heating}} \leq T_{\text{Standby setpoint basic level Cooling}} \leq T_{\text{Standby setpoint add. level Cooling}}$
$T_{\text{Standby setpoint heating}} \leq T_{\text{Comfort setpoint heating}} \leq T_{\text{Comfort setpoint cooling}} \leq T_{\text{Standby setpoint cooling}}$

or

$T_{\text{Comfort setpoint add. level Heating}} \leq T_{\text{Comfort setpoint basic level Heating}} \leq T_{\text{Comfort setpoint basic level Cooling}} \leq T_{\text{Comfort setpoint add. level Cooling}}$
$T_{\text{Night setpoint add. level Heating}} \leq T_{\text{Night setpoint basic level Heating}} \leq T_{\text{Night setpoint basic level Cooling}} \leq T_{\text{Night setpoint add. level Cooling}}$
$T_{\text{Night setpoint heating}} \leq T_{\text{Comfort setpoint heating}} \leq T_{\text{Comfort setpoint cooling}} \leq T_{\text{Night setpoint cooling}}$

ℹ In the case of switching 2-point feedback control, the hysteresis values must additionally be taken into account.

Deadband and deadband positions in the combined heating and cooling operating mode

With relative setpoint presetting, the comfort setpoint temperatures for heating and cooling are derived from the basic setpoint in consideration of the set deadband. The deadband (temperature zone for which there is neither heating nor cooling) is the difference between the comfort setpoint temperatures. This deadband does not exist for absolute setpoint presetting.

The parameters "Deadband between heating and cooling", "Allocation of deadband" and "Basic setpoint temperature" are specified in the ETS configuration. One distinguishes between the following settings...

- Allocation of deadband = "symmetrical"
  The deadband preset in the ETS is divided into two parts at the basic setpoint. Based on the resulting half deadband, the comfort setpoint temperatures are derived directly from the basic setpoint.
  The following applies...
  $T_{\text{Basic setpoint}} - ½T_{\text{Deadband}} = T_{\text{Comfort setpoint heating}}$
  and

  $T_{\text{Basic setpoint}} + ½T_{\text{Deadband}} = T_{\text{Comfort setpoint cooling}}$
  -> $T_{\text{Comfort setpoint cooling}} - T_{\text{Comfort setpoint heating}} = T_{\text{Deadband}}$
  -> $T_{\text{Comfort setpoint cooling}} \geq T_{\text{Comfort setpoint heating}}$
- Allocation of deadband = "asymmetrical"
  With this setting the comfort setpoint temperature for heating equals the basic setpoint. The deadband preset in the ETS is effective only from the basic setpoint in the direction of comfort temperature for cooling. Thus the comfort setpoint temperature for cooling is derived directly from the comfort setpoint for heating.
  The following applies...
  $T_{\text{Basic setpoint}} = T_{\text{Comfort setpoint heating}}$
  -> $T_{\text{Basic setpoint}} + T_{\text{Deadband}} = T_{\text{Comfort setpoint cooling}}$
  -> $T_{\text{Comfort setpoint cooling}} - T_{\text{Comfort setpoint heating}} = T_{\text{Deadband}}$
  -> $T_{\text{Comfort setpoint cooling}} \geq T_{\text{Comfort setpoint heating}}$

10.3.1 Operating mode and setpoint parameters

<table>
<tr><td>Overwrite setpoints in device during ETS programming operation</td><td>Checkbox (**yes** / no)</td></tr>
<tr><td colspan="2">The setpoint temperatures programmed in the room temperature controller by the ETS during commissioning can be changed via communication objects. This parameter can be used to define whether the setpoints present in the device, which may have been changed subsequently, are overwritten during an ETS programming operation and thus replaced again by the values parameterised in the ETS. If this parameter is "Yes", then the setpoint temperatures are deleted in the device during a programming operation and replaced by the values of the ETS. If this parameter is configured to "No", then setpoints present in the device remain unchanged. The setpoint temperatures entered in the ETS then have no significance.</td></tr>
</table>

<table>
<tr><td>Setpoint presetting</td><td>**absolute**
relative</td></tr>
<tr><td colspan="2">It is possible to configure the setpoints for the "Comfort", "Standby" and "Night" modes directly (absolute setpoint presetting) or relatively (derivation from basic setpoint). This parameter defines the way the setpoint temperature is preset.
With "Relative": All temperature setpoints are derived from the basic temperature (basic setpoint).
With "Absolute": The setpoint temperatures are independent of each other. Different temperature values can be specified for each operating mode and heating/cooling mode.</td></tr>
</table>

Setpoint temperatures via operating mode for absolute setpoint presetting

Heating

<table>
<tr><td>Comfort</td><td>**21.0**</td></tr>
<tr><td colspan="2">With absolute setpoint presetting the setpoint temperatures for Comfort, Standby and Night mode are independent of each other. Depending on the operating mode and heating/cooling mode, various temperature values can be specified in the ETS within the range +7.0 °C to +40.0 °C. The ETS does not validate the temperature values. It is thus possible, for example, to select smaller setpoint temperatures for cooling mode than for heating mode, or to specify lower temperatures for Comfort mode than for Standby mode. After commissioning using the ETS the setpoint temperatures can be changed via the bus by means of temperature telegrams. This can be done using the communication object "Setpoint temperature - Active operating mode".
Presetting of the setpoint temperature for the Comfort heating mode.
These parameters are only visible with absolute setpoint presetting!</td></tr>
</table>

<table>
<tr><td>Standby</td><td>7 ... **19.0** ... 40°C</td></tr>
<tr><td colspan="2">Presetting of the setpoint temperature for Standby mode (heating).</td></tr>
</table>

<table>
<tr><td>Night</td><td>7 ... **17.0** ... 40°C</td></tr>
<tr><td colspan="2">Presetting of the setpoint temperature for night mode (heating).</td></tr>
</table>

Frost protection	**7.0** ... 40°C
Presetting of the setpoint temperature for frost protection mode (heating).	

Cooling

Comfort	7 ... **23.0** ... 40°C
Presetting of the setpoint temperature for Standby mode (cooling).	

Standby	7 ... **25.0** ... 40°C
Presetting of the setpoint temperature for Standby mode (cooling).	

Night mode	7 ... **27.0** ... 40°C
Presetting of the setpoint temperature for night mode (cooling).	

Heat protection	7 ... **35.0** ... 45°C
Presetting of the setpoint temperature for heat protection mode (cooling).	

Accept change permanently via bus	Checkbox (yes / **no**)
One has to distinguish between two cases, defined by this parameter, if the setpoint has been modified via the object. This parameter is only visible with absolute setpoint presetting! When "Yes": If, with this setting, the setpoint temperature is adjusted, the controller saves the value permanently to the permanent storage. The newly adjusted value will overwrite the initial value, i.e. the absolute setpoint temperature originally loaded using the ETS. The changed values are also retained after a device reset, after a switchover of the operating mode or after a switchover of the heating/cooling mode (with absolute setpoint specification individually for each operating mode for heating and cooling). When "No": The setpoints received via the object remain active only temporarily. In case of a bus voltage failure, after a switchover to another operating mode (e.g. Comfort to Standby, or also Comfort to Comfort), or after a switchover of the operating mode (e.g. Heating to Cooling), the last setpoint changed will be discarded and replaced by the initial value.	

Difference between basic and additional level	0 ...**2**...12.7 K
In a two stage control mode it is necessary to determine the temperature difference to the basic stage with which the additional stage is to be incorporated into the control. This parameter defines the level spacing. The parameter can only be seen in two-level control operation.	

Setpoint temperatures via operating mode for relative setpoint presetting

Basic setpoint temperature	7 ... **21.0** ... 40°C
This parameter defines the temperature value to be applies as the basic setpoint after commissioning by the ETS. All the temperature setpoints are derived from the basic setpoint. This parameter is only visible with relative setpoint presetting!	

Approve change via bus	Checkbox (yes / **no**)
Here, it is possible to specify if it is possible to change the basic setpoint via the bus. This parameter is only visible with relative setpoint presetting!	

Accept permanently	Checkbox (yes / **no**)
In addition to specifying individual setpoint temperatures by the ETS or basic setpoint object, the user can shift the basic setpoint in a specific range via a communication object. Whether a basic setpoint shifting only affects the currently active operating mode or whether it influences all other setpoint temperatures of the remaining operating modes is determined by this parameter. In the "yes" setting, the shift of the basic setpoint carried out affects all operating modes. The shift is maintained even after a switchover of the operating mode or the heating/cooling mode or adjusting the basic setpoint. The changed values are also retained after a device reset, after a switchover of the operating mode or after a switchover of the heating/cooling mode. In the "no" setting, the basic setpoint shift carried out is in effect for only as long as the operating mode or heating/cooling mode has not changed or the basic setpoint is maintained. Otherwise the setpoint shift will be reset to "0". This parameter is only visible with relative setpoint presetting!	

Temperature shift via operating mode for relative setpoint presetting

Heating

Standby	-10...**-2**...0 K
The value by which the standby setpoint temperature for heating is lowered compared to the heating comfort temperature. The parameter is only visible in the "Heating" or "Heating and cooling" operating mode (if necessary with additional levels) and only with relative setpoint presetting.	

Night	-10...**-4**...0 K
The value by which the night temperature for heating is lowered compared to the heating comfort temperature. The parameter is only visible in the "Heating" or "Heating and cooling" operating mode (if necessary with additional levels) and only with relative setpoint presetting.	

Frost protection	**7.0** ... 40°C
This parameter specifies the setpoint temperature for frost protection. The parameter is only visible in "Heating" or "Heating and cooling" operating modes (if necessary with additional levels).	

Cooling

Standby	0...**20**...10 K
The value by which the standby setpoint temperature for cooling is raised compared to the cooling comfort temperature. The parameter is only visible in the "Heating" or "Heating and cooling" operating mode (if necessary with additional levels) and only with relative setpoint presetting.	

Night mode	0...**4**...10 K
The value by which the night temperature for cooling is raised compared to the cooling comfort temperature. The parameter is only visible in the "Heating" or "Heating and cooling" operating mode (if necessary with additional levels) and only with relative setpoint presetting.	

Heat protection	7 ... **35.0** ... 45°C
This parameter specifies the setpoint temperature for heat protection. The parameter is only visible in "Cooling" or "Heating and cooling" operating modes (if necessary with additional levels).	

Difference between basic and additional level	0...**2**...12.7 K
In a two stage control mode it is necessary to determine the temperature difference to the basic stage with which the additional stage is to be incorporated into the control. This parameter defines the level spacing. The parameter can only be seen in two-level control operation.	

Target temperature shift

Maximum shift upwards	0 K + 1 K + 2 K + 3 K + 4 K + 5 K + 6 K + 7 K **+ 8 K** + 9 K + 10 K
This is used to define the maximum range in which the basic setpoint temperature can be adjusted upwards. This parameter is only visible with relative setpoint presetting!	

<table>
<tr><td>Maximum shift downwards</td><td>0 K
- 1 K
- 2 K
- 3 K
- 4 K
- 5 K
- 6 K
- 7 K
- 8 K
- 9 K
- 10 K</td></tr>
<tr><td colspan="2">This is used to define the maximum range in which the basic setpoint temperature can be adjusted downwards.
This parameter is only visible with relative setpoint presetting!</td></tr>
</table>

<table>
<tr><td>Type of shift</td><td>Via counter value x step width
Via relative temperature value</td></tr>
<tr><td colspan="2">Depending on the setting of the parameter "Type of shift", the shift takes place via a 2-byte communication object (acc. to KNX DPT 9.002) or via a 1-byte communication object (acc. to KNX DPT 6.010).
This parameter is only visible with relative setpoint presetting!</td></tr>
</table>

<table>
<tr><td>Accept changes permanently via bus</td><td>Checkbox (yes / **no**)</td></tr>
<tr><td colspan="2">In addition to specifying individual setpoint temperatures by the ETS or basic setpoint object, the user can shift the basic setpoint in a specific range using the sensor buttons or a communication object. Whether a basic setpoint shifting only affects the currently active operating mode or whether it influences all other setpoint temperatures of the remaining operating modes is determined by this parameter.
In the "yes" setting, the shift of the basic setpoint carried out affects all operating modes. The shift is maintained even after a switchover of the operating mode or the heating/cooling mode or adjusting the basic setpoint.
In the "no" setting, the basic setpoint shift carried out is in effect for only as long as the operating mode or heating/cooling mode has not changed or the basic setpoint is maintained. Otherwise the setpoint shift will be reset to "0".</td></tr>
</table>

Value adjustment

Step width	0.1 K **0.5 K**
This parameter defines the value of a level of the setpoint shift. With a setpoint shift, the basic setpoint (with relative setpoint specification) is changed by the temperature value configured here when there is an adjustment by one step in a positive or negative direction. The controller module rounds the temperature values received via the "Setpoint temperature - Basic value" object and matches the values to the step width configured here. The parameter is only available if the shift has the setting "Via counter value x step width". In combination with the function "Setpoint heating temperature increase", the setpoint temperature can also be modified in smaller steps, even with a step width of 0.5 K.	

Deadband between heating and cooling

Allocation of deadband	**symmetrical** asymmetrical
With relative setpoint presetting, the comfort setpoint temperatures for the operating mode "Heating and cooling" are derived from the basic setpoint in consideration of the set deadband. The deadband (temperature zone for which there is neither heating nor cooling) is the difference between the comfort setpoint temperatures. Symmetrical setting: The deadband preset in the ETS plug-in is divided in two parts at the basic setpoint. Based on the resulting half deadband, the comfort setpoint temperatures are derived directly from the basic setpoint (Basic setpoint - 1/2 deadband = Heating comfort temperature or Basic setpoint + 1/2 deadband = Cooling comfort temperature). Asymmetrical setting: With this setting the comfort setpoint temperature for heating equals the basic setpoint! The preset deadband is effective only from the basic setpoint in the direction of comfort temperature for cooling. Thus the comfort setpoint temperature for cooling is derived directly from the comfort setpoint for heating. The parameter is only visible in the "Heating and cooling" operating mode (if necessary with additional levels) and only with relative setpoint presetting!	

Size	0.1...**1**...25.5 K
With relative setpoint presetting, the comfort setpoint temperatures for heating and cooling are derived from the basic setpoint in consideration of the set deadband. The deadband (temperature zone for which there is neither heating nor cooling) is the difference between the comfort setpoint temperatures. It is set using this parameter. The parameter is only visible in the "Heating and cooling" operating mode (if necessary with additional levels) and only with relative setpoint presetting.	

Setpoint temperature transmission behaviour

on change by	0...**0.1**...25.5 K
Determines the size of the value change required to transmit the current value automatically to the bus via the "Setpoint temperature" object. In the "0" setting, the setpoint temperature is not transmitted automatically when there is a change.	

Cyclical (0 = inactive)	**0**...255 min
This parameter determines whether the setpoint temperature is to be transmitted cyclically via the "Setpoint temperature" object. Definition of the cycle time by this parameter. In the "0" setting, the setpoint temperature is not transmitted cyclically.	

10.3.2 Objects for operating mode and setpoints

Object no.	Function	Name	Type	DPT	Flag
334, 384, 434, 484, 534, 584, 634, 684, 734, 784, 834, 884	Operating mode - Preset	RTC x - Input	1-byte	20,102	C, -, W, T, -
1-byte object for change-over of the operating mode of the controller according to the KNX specification. After voltage return or an ETS programming operation, the current operating mode is transmitted via this object.					

Object no.	Function	Name	Type	DPT	Flag
335, 385, 435, 485, 535, 585, 635, 685, 735, 785, 835, 885	Operating mode - Forced	RTC x - Input	1-byte	20,102	C, -, W, T, U
1-byte object for forced change-over (highest priority) of the operating mode of the controller according to the KNX specification.					

Object no.	Function	Name	Type	DPT	Flag
336, 386, 436, 486, 536, 586, 636, 686, 736, 786, 836, 886	Presence detection - Presence button	RTC x - Input	1-bit	1,001	C, -, W, T, U

1-bit object through which an external presence button (e.g. from a controller extension) can be linked to the controller (polarity: Presence exists = "1", no presence exists = "0").

Presence allows permanent switching to Comfort mode (starting in Standby mode) or temporary switching to this comfort extension (starting from Night mode or Frost/heat protection mode).

Presence in Standby mode: If there is a presence, the controller activates Comfort mode. As soon as the object no longer signals a presence, the controller switches back to Standby mode.

Presence in Night mode or Frost/heat protection mode: If there is a presence, the controller activates the comfort extension. After the configured length of the comfort extension has elapsed, the system automatically switches back to Night mode or Frost/heat protection mode. In this case, the object value is reset automatically.

After a mains voltage return or an ETS programming operation (controller reset), the presence function is always inactive.

This object is only visible when presence detection is configured to "Presence button".

Object no.	Function	Name	Type	DPT	Flag
336, 386, 436, 486, 536, 586, 636, 686, 736, 786, 836, 886	Presence detection - Presence object 1	RTC x - Input	1-bit	1,001	C, -, W, -, -
342, 392, 442, 492, 542, 592, 642, 692, 742, 792, 842, 892	Presence detection - Presence object 2	RTC x - Input	1-bit	1,001	C, -, W, -, -

1-bit object through which an external KNX presence detector can be linked to the controller (polarity: Presence exists = "1", no presence exists = "0").

If there is a presence, the controller activates Comfort mode, provided that no higher-level function (e.g. window status) is active. The controller switches to the last specified operating mode as soon as the presence detector ceases to signal a presence.

After a mains voltage return or an ETS programming operation (controller reset), the presence function is always inactive.

These objects are only visible when presence detection is configured to "Presence detector".

Object no.	Function	Name	Type	DPT	Flag
337, 387, 437, 487, 537, 587, 637, 687, 737, 787, 837, 887	Frost/heat protection - Window contact	RTC x - Input	1-bit	1,019	C, -, W, -, U

1-bit object for the coupling of window contacts.

Polarity: Window open = "1", window closed = "0".

Object no.	Function	Name	Type	DPT	Flag
381, 431, 481, 531, 581, 631, 681, 731, 781, 831, 881, 931	Frost protection - Temperature drop - Status	RTC x - Output	1-bit	1,011	C, R, -, T, A

1-bit object to signal a detected temperature drop.

Polarity: temperature drop detected = "1", no temperature drop detected = "0".

Object no.	Function	Name	Type	DPT	Flag
343, 393, 443, 493, 543, 593, 643, 693, 743, 793, 843, 893	Setpoint temperature - Active operating mode - Status	RTC x - Output	2-byte	9,001	C, R, -, T, A

2-byte object for the output of the current temperature setpoint. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature.

The temperature value is always output in the format "°C".

After mains voltage return or an ETS programming operation (controller reset), the current setpoint temperature is transmitted via this object.

Function: absolute setpoint temperature specification

Object no.	Function	Name	Type	DPT	Flag
333, 383, 433, 483, 533, 583, 633, 683, 733, 783, 833, 883	Setpoint temperature - Active operating mode	RTC x - Input	2-byte	9,001	C, -, W, -, U

2-byte object for external setting of a setpoint for absolute setpoint presetting. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature. The controller rounds the temperature values received via the object to 0.1 K.

The temperature value must always be specified in the format "°C".

Function: relative setpoint temperature specification, basic value

Object no.	Function	Name	Type	DPT	Flag
333, 383, 433, 483, 533, 583, 633, 683, 733, 783, 833, 883	Setpoint temperature - Basic value	RTC x - Input	2-byte	9,001	C, -, W, -, U

2-byte object for external specification of the basic setpoint for relative setpoint specification. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature. The controller rounds the temperature values received irrespective of the configured value of the of the setpoint shift (0.1 K or 0.5 K).

The temperature value must always be specified in the format "°C".

Object no.	Function	Name	Type	DPT	Flag
343, 393, 443, 493, 543, 593, 643, 693, 743, 793, 843, 893	Setpoint temperature - Basic value - Status	RTC x - Output	2-byte	9,001	C, R, -, T, A
2-byte object for the output of the current basic setpoint. Depending on the operating mode, the possible range of values is limited by the configured frost protection and/or heat protection temperature. The temperature value is always output in the format "°C". After mains voltage return or an ETS programming operation (controller reset), the current basic setpoint temperature is transmitted via this object.					

Function: relative setpoint temperature shift via direct temperature value

Object no.	Function	Name	Type	DPT	Flag
346, 396, 446, 496, 546, 596, 646, 696, 746, 796, 846, 896	Setpoint temperature - Shift	RTC x - Input	2-byte	9,002	C, -, W, -, U
2-byte object for setting a basic setpoint shifting, e.g. via a controller extension. The value of a counter value in the communication object is dependent on the configured setpoint shift value (0.1 K or 0.5 K). The value "0" means that no shift is active . The value is depicted in a double complement in the positive and negative direction. In case the limits of the value range are exceeded by the preset external value, the controller will automatically reset the received value to the minimum and maximum limits.					

Object no.	Function	Name	Type	DPT	Flag
345, 395, 445, 495, 545, 595, 645, 695, 745, 795, 845, 895	Setpoint temperature - Shift - Status	RTC x - Output	2-byte	9,002	C, R, -, T, A
2-byte object for giving feedback on the current setpoint shift for evaluation, e.g. by a controller extension. The value "0" means that no shift is active . The value is depicted in a double complement in the positive and negative direction. After mains voltage return or an ETS programming operation (controller reset), the current value for the basic setpoint shift is transmitted via this object. Since the value for the basic setpoint shift is stored exclusively in volatile memory, the shift is always "0" immediately after a mains voltage return or an ETS programming operation.					

Function: relative setpoint temperature shift via counter value x step width

Object no.	Function	Name	Type	DPT	Flag
346, 396, 446, 496, 546, 596, 646, 696, 746, 796, 846, 896	Setpoint temperature - Shift	RTC x - Input	1-byte	6,010	C, R, -, T, A
1-byte object for setting a basic setpoint shifting, e.g. via a controller extension. The value of a counter value in the communication object is dependent on the configured setpoint shift value (0.1 K or 0.5 K). The value "0" means that no shift is active . The value is depicted in a double complement in the positive and negative direction. In case the limits of the value range are exceeded by the preset external value, the controller will automatically reset the received value to the minimum and maximum limits.					

Object no.	Function	Name	Type	DPT	Flag
345, 395, 445, 495, 545, 595, 645, 695, 745, 795, 845, 895	Setpoint temperature - Shift - Status	RTC x - Output	1-byte	6,010	C, R, -, T, A
1-byte object for giving feedback on the current setpoint shift for evaluation, e.g. by a controller extension. The value of a counter value in the communication object is dependent on the configured setpoint shift value (0.1 K or 0.5 K). The value "0" means that no shift is active . The value is depicted in a double complement in the positive and negative direction. After mains voltage return or an ETS programming operation (controller reset), the current value for the basic setpoint shift is transmitted via this object. Since the value for the basic setpoint shift is stored exclusively in volatile memory, the shift is always "0" immediately after a mains voltage return or an ETS programming operation.					

10.4 Command value output and command value limit

Automatic transmission

On automatic transmission of the command value telegrams, a distinction is made with regard to the type of control...

- Continuous PI control:
  In the case of continuous PI control, the room temperature controller calculates a new command value cyclically every 30 seconds and outputs it to the bus via a 1-byte value object. In so doing, the parameter "On change by (0 = inactive)" in the parameter node "Room temperature controller x -> RTCx - General -> Command value output" can be used to specify the change interval of the command value in percent, according to which a new command value is to be output to the bus. The change interval can be configured to "0" so that a change in the command value will not result in an automatic transmission.

In addition to the command value output following a change, the current command value may be periodically transmitted. In addition to the times when changes are to be expected, other command value telegrams will be output according to the active value after a configurable cycle time. This ensures that, during cyclical security monitoring of the command value in valve drive or in the addressed switch actuator, telegrams are received within the monitoring time. The time interval defined by the parameter "Cyclical (0 = inactive)" should correspond to the monitoring time in the actuator (cycle time in the controller is preferably to be configured smaller). The "0" setting will deactivate the periodic transmission of the command value.
With continuous PI control it must be noted that if the cyclical and the automatic transmission are both deactivated, no command value telegrams will be transmitted in case of a change!

- Switching PI control (PWM):
  In case of a switching PI control (PWM), the room temperature controller calculates a new command value internally every 30 seconds. The parameter "PWM cycle time" defines the cycle time of the PWM command value signal.

  If the command value is changed, the current PWM cycle is adapted as required so that the duty factor corresponds as directly as possible to the new command value. This adaptation is carried out in the same way as during activation of the valve outputs (see figure 8).
- 2-point feedback control:
  In case of a 2-point feedback control, the room temperature and thus the hysteresis values are evaluated periodically every 30 seconds, so that the command values, if required, will change solely during these times. As, with this control algorithm, no continuous command values are calculated, the parameter "On change by (0 = inactive)" has no effect with this control algorithm.
  In addition to the command value output following a change, the current command value may be periodically transmitted on the bus. In addition to the times when changes are to be expected, other command value telegrams will be output according to the active value after a configurable cycle time. This ensures that, during cyclical security monitoring of the command value in valve drive or in the addressed switch actuator, telegrams are received within the monitoring time. The time interval defined by the parameter "Cyclical (0 = inactive)" should correspond to the monitoring time in the actuator (cycle time in the controller is preferably to be configured smaller). The "0" setting will deactivate the periodic transmission of the command value.

Command value limit

Optionally a command value limit can configured in the ETS. The command value limit allows the restriction of calculated command values to the range limits "Minimum command value" and "Maximum command value". The limits are permanently set in the ETS and, if command value limitation is active, can be neither undershot or exceeded during device operation. It is possible, if available, to specify various limiting values for the basic and additional stages and for heating and cooling.

The "Activation" parameter on the parameter page "Room temperature controller -> RTCx - General -> Command value limit" defines the type of action of the limiting function. The command value limit can either be activated or deactivated using the 1-bit communication object "Command value limit", or be permanently active. When controlling via the object, it is possible to have the controller activate the command value limit automatically after bus voltage return or an ETS programming operation. Here, the "Active after reset" parameter defines the initialisation behaviour. In the "no" setting, the command value limit is not automatically activated after a device reset. A "1" telegram must first be received via the "Command value limit" object for the limit to be activated. In the "yes" setting, the controller activates the command value limit automatically after a device reset. To deactivate the limit a "0" telegram must be received via the "Command value limit - Activate / Deactivate" object. The limit can be switched on or off at any time using the object.
With a permanently active command value limit, the initialisation behaviour cannot be configured separately after a device reset, as the limit is always active. In this case it is also not possible to configure any object.

As soon as the command value limit is active, calculated command values are limited according to the limiting values from the ETS. The behaviour with regard to the minimum or maximum command value is then as follows...

- Minimum command value:
  The "Minimum command value" parameter specifies the lower command value limiting value. The setting can be made in 5% increments in the range 5% ... 50% can be made. With an active command value limit, the set minimum comma
  0% command value if no more heating or cooling energy has to be demanded.
- Maximum command value:
  The "Maximum command value" parameter specifies the upper command value limiting value. The setting can be made in 5% increments in the range 55% ... 100% can be made. With an active command value limit, the set maximum command value is not exceeded. If the controller calculates larger command values, it sets the configured maximum command value.

If the limit is removed, the device automatically repositions the most recently calculated command value to the unlimited values when the next calculation interval for the command values (30 seconds) has elapsed.

ℹ An active command value limit has a negative effect on the control result when the command value range is very restricted. A control deviation must be expected.

Special case for command value 100% (Clipping mode)

If with a PI control the calculated command value of the controller exceeds the physical limits of the actuator, in other words if the calculated command value is greater than 100%, then the command value is set to the maximum value (100%) and thus limited. This special, necessary control behaviour is also called "clipping". With PI control the command value can reach the value "100%" if there is a large deviation of the room temperature from the setpoint temperature or the controller requires a long time to adjust to the setpoint with the heating or cooling energy that is being applied. The controller evaluates this state in a particular manner.

The controller maintains the maximum command value only as long as it is necessary. After that it adjusts the command value downwards according to the PI algorithm. The advantage of this control characteristic is the fact that the room temperature does not exceed the setpoint temperature at all, or only slightly. It should be mentioned that this necessary control principle increases the tendency to oscillate about the setpoint.

ℹ Clipping may also occur when a command value limit is active (maximum command value). In this case, if the internally calculated command value reaches 100%, then the controller only transmits to the bus the maximum command value according to the ETS configuration.

10.4.1 Command value output parameters

Command value output

PWM cycle time	1 ... **15** ... 255 min
This parameter specifies the cycle time for the pulse width modulated command value (PWM).	

Polarity of the command values

Heating	**normal (under current, this means opened)** inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for heating is output normally or in inverted form. This parameter is only visible if the operating mode "Heating" or "Heating and cooling" is configured and not two-level operation.	

Basic level heating	**normal (under current, this means opened)** inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for the basic level heating is output normally or in inverted form. This parameter is only visible if the operating mode "Heating" or "Heating and cooling" is configured along with two-level operation.	

Additional level heating	**normal (under current, this means opened)** inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for the additional level heating is output normally or in inverted form. This parameter is only visible if the operating mode "Heating" or "Heating and cooling" is configured along with two-level operation.	

Cooling	**normal (under current, this means opened)** inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for cooling is output normally or in inverted form. This parameter is only visible if the operating mode "Cooling" or "Heating and cooling" is configured and not two-level operation.	

Basic level cooling	**normal (under current, this means opened)** inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for the basic level cooling is output normally or in inverted form. This parameter is only visible if the operating mode "Cooling" or "Heating and cooling" is configured along with two-level operation.	

Additional level cooling	**normal (under current, this means opened)** inverted (under current, this means closed)
At this point, it is possible to specify whether the command value telegram for the additional level cooling is output normally or in inverted form. This parameter is only visible if the operating mode "Cooling" or "Heating and cooling" is configured along with two-level operation.	

Transmission behaviour

On change by (0 = inactive)	0...**3**...100 %
This parameter determines the size of the command value change that will automatically transmit continuous command value telegrams via the command value objects. Thus this parameter only affects command values which are configured to "Continuous PI control" and to the 1-byte additional command value objects of the "Switching PI control (PWM)".	

Cyclical	0...**10**...255 min
This parameter determines the time interval for the cyclical transmission of the command values via all command value objects.	

10.4.2 Command value limit parameters

Activation	**via object** permanently active
The command value limit allows the restriction of calculated command values to the range limits "minimum" and "maximum". The limits are permanently set in the ETS and, if command value limitation is active, can be neither undershot or exceeded during device operation. The "Activation" parameter defines the type of action of the limiting function. The command value limit can either be activated or deactivated using the 1-bit communication object "Command value limit - Activate / Deactivate" or be permanently active.	

Active after reset	Checkbox (yes/**no**)
When controlling via the object, it is possible to have the controller activate the command value limit automatically after bus voltage return or an ETS programming operation. This parameter defines the initialisation behaviour here. In the "Deactivated" setting, the command value limit is not automatically activated after a device reset. A "1" telegram must first be received via the "Command value limit - Activate/Deactivate" object for the limit to be activated. In the "Activated" setting, the controller activates the command value limit automatically after a device reset. To deactivate the limit a "0" telegram must be received via the "Command value limit - Activate / Deactivate" object. The limit can be switched on or off at any time using the object. This parameter is only visible if the command value limit can be activated via object.	

Heating (also for basic level or additional level)

Minimum command value for heating	**5%**, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, 50%
The "Minimum command value" parameter specifies the lower command value limiting value for heating. With an active command value limit, the set minimum command value is not undershot by command values. If the controller calculates smaller command values, it sets the configured minimum command value. The controller transmits a 0% command value if no more heating or cooling energy has to be demanded.	

Maximum command value	55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, **95%**, 100%
The "Maximum command value" parameter specifies the upper command value limiting value for heating. With an active command value limit, the set maximum command value is not exceeded. If the controller calculates larger command values, it sets the configured maximum command value.	

Cooling (also for basic level or additional level)

Minimum command value	**5%**, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, 50%
The "Minimum command value" parameter specifies the lower command value limiting value for cooling. With an active command value limit, the set minimum command value is not undershot by command values. If the controller calculates smaller command values, it sets the configured minimum command value. The controller transmits a 0% command value if no more heating or cooling energy has to be demanded.	

Maximum command value	55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, **95%**, 100%
The "Maximum command value" parameter specifies the upper command value limiting value for cooling. With an active command value limit, the set maximum command value is not exceeded. If the controller calculates larger command values, it sets the configured maximum command value.	

10.4.3 Objects for command value output and command value limit

Object for heating command value output and combined valve heating/cooling

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
935, 977, 1019, 1061, 1103, 1145, 1187, 1229, 1271, 1313, 1355, 1397	Command value - Heating / Command value basic level heating	RTC x - Output	1-byte	5,001	C, (R), -, T, -
966, 1008, 1050, 1092, 1134, 1176, 1218, 1260, 1302, 1344, 1386, 1428 *	Command value - Heating / Command value basic level heating	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-byte object to output the continuous command value of the heating mode. In two-level heating mode, command value output for the basic heating. This object is only available in this way if the type of feedback control is configured to "Continuous PI control". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
935, 977, 1019, 1061, 1103, 1145, 1187, 1229, 1271, 1313, 1355, 1397	Command value - Heating / Command value basic level heating	RTC x - Output	1-bit	1,001	C, (R), -, T, -
966, 1008, 1050, 1092, 1134, 1176, 1218, 1260, 1302, 1344, 1386, 1428 *	Command value - Heating / Command value basic level heating	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the PWM command value of the heating mode. In two-level heating mode, command value output for the basic heating. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Object no.	Function	Name	Type	DPT	Flag
939, 981, 1023, 1065, 1107, 1149, 1191, 1233, 1275, 1317, 1359, 1401	Command value - Heating - Status / Command value basic level heating - Status	RTC x - Output	1-byte	5,001	C, (R), -, T, -
970, 1012, 1054, 1096, 1180, 1222, 1264, 1306, 1348, 1390, 1432 *	Command value - Heating - Status / Command value basic level heating - Status	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-byte object for additional continuous output for the PWM command value of the heating mode. In two-level heating mode, command value output for the basic heating. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
935, 977, 1019, 1061, 1103, 1145, 1187, 1229, 1271, 1313, 1355, 1397	Command value - Heating / Command value, basic heating	RTC x - Output	1-bit	1,001	C, (R), -, T, -
966, 1008, 1050, 1092, 1134, 1176, 1218, 1260, 1302, 1344, 1386, 1428 *	Command value - Heating / Command value, basic heating	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the switching command value of the heating mode. In two-level heating mode, command value output for the basic heating. This object is only available in this way if the type of feedback control is configured to "Switching 2-point feedback control". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
935, 977, 1019, 1061, 1103, 1145, 1187, 1229, 1271, 1313, 1355, 1397	Command value - Heating/Cooling / Command value basic level heating/cooling	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-byte object to output the combined continuous command value of the heating and cooling mode. In two-level heating/cooling mode, command value output for the basic level. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Continuous PI control".					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
935, 977, 1019, 1061, 1103, 1145, 1187, 1229, 1271, 1313, 1355, 1397	Command value - Heating/Cooling / Command value basic level heating/ cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the combined PWM command value of the heating and cooling mode. In two-level heating/cooling mode, command value output for the basic level. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Switching PI control (PWM)".					

Object no.	Function	Name	Type	DPT	Flag
939, 981, 1023, 1065, 1107, 1149, 1191, 1233, 1275, 1317, 1359, 1401	Command value - Heating/Cooling - Status / Command value basic level heating/cooling - Status	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-byte object for additional continuous output for the PWM command value of the heating and cooling mode. In two-level heating and cooling mode, command value output for basic heating / basic cooling. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)".					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
935, 977, 1019, 1061, 1103, 1145, 1187, 1229, 1271, 1313, 1355, 1397	Command value - Heating/Cooling / Command value basic level heating/ cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the combined switching command value of the heating and cooling mode. In two-level heating/cooling mode, command value output for the basic level. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Switching 2-point feedback control".					

Object for command value output, additional heating and combined valve additional heating/cooling

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
936, 978, 1020, 1062, 1104, 1146, 1188, 1230, 1272, 1314, 1356, 1398	Command value - Additional level heating	RTC x - Output	1-byte	5,001	C, (R), -, T, -
967, 1009, 1051, 1093, 1135, 1177, 1219, 1261, 1345, 1387, 1429 *	Command value - Additional level heating	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-byte object to output the continuous command value for additional heating in two-level operation. This object is only available in this way if the type of feedback control is configured to "Continuous PI control". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
936, 978, 1020, 1062, 1104, 1146, 1188, 1230, 1272, 1314, 1356, 1398	Command value - Additional level heating	RTC x - Output	1-bit	1,001	C, (R), -, T, -
967, 1009, 1051, 1093, 1135, 1177, 1219, 1261, 1345, 1387, 1429 *	Command value - Additional level heating	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the continuous PWM command value for additional heating in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Object no.	Function	Name	Type	DPT	Flag
940, 982, 1024, 1066, 1108, 1150, 1192, 1234, 1276, 1318, 1360, 1402	Command value - Additional level heating - Status	RTC x - Output	1-byte	5,001	C, (R), -, T, -
971, 1013, 1055, 1097, 1139, 1181, 1223, 1265, 1307, 1349, 1391, 1433 *	Command value - Additional level heating - Status	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-bit object for additional continuous output for the PWM command value for additional heating in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
936, 978, 1020, 1062, 1104, 1146, 1188, 1230, 1272, 1314, 1356, 1398	Command value - Additional level heating	RTC x - Output	1-bit	1,001	C, (R), -, T, -
967, 1009, 1051, 1093, 1135, 1177, 1219, 1261, 1345, 1387, 1429 *	Command value - Additional level heating	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the switching command value for additional heating in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching 2-point feedback control".					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
936, 978, 1020, 1062, 1104, 1146, 1188, 1230, 1272, 1314, 1356, 1398	Command value - Additional level heating/cooling	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-byte object to output the combined continuous command value for additional level in two-level operation. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Continuous PI control".					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
936, 978, 1020, 1062, 1104, 1146, 1188, 1230, 1272, 1314, 1356, 1398	Command value - Additional level heating/cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the combined switching PWM command value for additional level in two-level operation. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Switching PI control (PWM)".					

Object no.	Function	Name	Type	DPT	Flag
940, 982, 1024, 1066, 1108, 1150, 1192, 1234, 1276, 1318, 1360, 1402	Command value - Additional level heating/cooling - Status	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-bit object for additional continuous output of the combined command value for additional level in two-level operation. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Switching PI control (PWM)".					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
936, 978, 1020, 1062, 1104, 1146, 1188, 1230, 1272, 1314, 1356, 1398	Command value - Additional level heating/cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the combined switching command value for additional level in two-level operation. This object is only available in this way if the command values for heating and cooling mode are output to a shared object (parameter-dependent). The type of feedback control must also be configured to "Switching 2-point feedback control".					

Object for command value output, cooling

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
937, 979, 1021, 1063, 1105, 1147, 1189, 1231, 1273, 1315, 1357, 1399	Command value - Cooling / Command value basic level cooling	RTC x - Output	1-byte	5,001	C, (R), -, T, -
968, 1010, 1052, 1094, 1136, 1178, 1262, 1304, 1346, 1388, 1430 *	Command value - Cooling / Command value basic level cooling	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-byte object to output the continuous command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "Continuous PI control". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
937, 979, 1021, 1063, 1105, 1147, 1189, 1231, 1273, 1315, 1357, 1399	Command value - Cooling / Command value basic level cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
968, 1010, 1052, 1094, 1136, 1178, 1262, 1304, 1346, 1388, 1430 *	Command value - Cooling / Command value basic level cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the PWM command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Object no.	Function	Name	Type	DPT	Flag
941, 983, 1025, 1067, 1109, 1151, 1193, 1235, 1277, 1319, 1361, 1403	Command value - Cooling - Status / Command value basic level cooling - Status	RTC x - Output	1-byte	5,001	C, (R), -, T, -
972, 1014, 1056, 1098, 1140, 1182, 1224, 1266, 1308, 1350, 1392, 1434 *	Command value - Cooling - Status / Command value basic level cooling - Status	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-bit object for additional continuous output of the PWM command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
937, 979, 1021, 1063, 1105, 1147, 1189, 1231, 1273, 1315, 1357, 1399	Command value - Cooling / Command value basic level cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
968, 1010, 1052, 1094, 1136, 1178, 1262, 1304, 1346, 1388, 1430 *	Command value - Cooling / Command value basic level cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the switching command value of the cooling mode. In two-level cooling mode, command value output for the basic cooling. This object is only available in this way if the type of feedback control is configured to "Switching 2-point feedback control". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Object for command value output, additional cooling

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
938, 980, 1022, 1064, 1106, 1148, 1190, 1232, 1274, 1316, 1358, 1400	Command value - Additional level cooling	RTC x - Output	1-byte	5,001	C, (R), -, T, -
969, 1011, 1053, 1095, 1137, 1179, 1221, 1263, 1305, 1347, 1389, 1431 *	Command value - Additional level cooling	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-byte object to output the continuous command value for additional cooling in two-level operation. This object is only available in this way if the type of feedback control is configured to "Continuous PI control". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
938, 980, 1022, 1064, 1106, 1148, 1190, 1232, 1274, 1316, 1358, 1400	Command value - Additional level cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
969, 1011, 1053, 1095, 1137, 1179, 1221, 1263, 1305, 1347, 1389, 1431 *	Command value - Additional level cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the continuous PWM command value for additional cooling in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Object no.	Function	Name	Type	DPT	Flag
942, 984, 1026, 1068, 1110, 1152, 1194, 1236, 1278, 1320, 1362, 1404	Command value - Additional level cooling - Status	RTC x - Output	1-byte	5,001	C, (R), -, T, -
973, 1015, 1057, 1099, 1141, 1183, 1225, 1267, 1309, 1351, 1393, 1435 *	Command value - Additional level cooling - Status	RTC x - Output	1-byte	5,001	C, (R), -, T, -
1-byte object for additional continuous output of the PWM command value for additional cooling in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching PI control (PWM)". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

Function: Command value

Object no.	Function	Name	Type	DPT	Flag
938, 980, 1022, 1064, 1106, 1148, 1190, 1232, 1274, 1316, 1358, 1400	Command value - Additional level cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
969, 1011, 1053, 1095, 1137, 1179, 1221, 1263, 1305, 1347, 1389, 1431 *	Command value - Additional level cooling	RTC x - Output	1-bit	1,001	C, (R), -, T, -
1-bit object to output the switching command value for additional cooling in two-level operation. This object is only available in this way if the type of feedback control is configured to "Switching 2-point feedback control". * These objects are only visible if, with combined heating/cooling command value, separate command value objects are also displayed.					

10.4.4 Objects for command value limit

Object no.	Function	Name	Type	DPT	Flag
943, 985, 1027, 1069, 1111, 1153, 1195, 1237, 1279, 1321, 1363, 1405	Command value limit - Activate / Deactivate	RTC x - Input	1-bit	1,001	C, -, W, -, U
1-bit object for activating or deactivating the command value limit.					

10.5 Room temperature measurement

Basic principles

The controller detects the room temperatures using one or possibly two external KNX temperature sensors (e.g. push-button sensors with temperature measurement). Temperature detection is configured on the parameter page "Room temperature controller -> RTCx - General -> Room temperature measurement". Depending on the configuration, the 2-byte objects "Room temperature - Measured value 1" and optionally, the additional "Room temperature - Measured value 2", are enabled.

ℹ According to KNX DPT 9.001, the temperature values must be made available to the controller in the format "°C".

When choosing the mounting location of the external temperature sensor, the following points must be considered...

- The temperature sensor should not be used in multiple combinations, especially together with flush-mounted dimmers.
- Do not install the temperature sensor in the area of large electrical consumers (avoid heat influences).
- Installation in the vicinity of radiators or cooling systems is not advisable.
- The temperature sensor should not be exposed to direct sun.
- The installation of sensors on the inside of an outside wall might have a negative impact on the temperature measurement.
- Temperature sensors should be installed at least 30 cm away from doors, windows or ventilation devices and at least 1.5 m above the floor.

Temperature detection and measured value formation

The "Temperature detection of the room controller by" parameter in the parameter node "Room temperature controller -> RTCx - General -> RTCx - Room temperature measurement" specifies how many external KNX sensors detect the room temperature. The following settings are possible for temperature detection...

- "Temperature input 1"
  The actual temperature is determined solely via an external temperature value. In this case, the KNX temperature sensor is connected to the controller via the 2-byte object "Room temperature - Measured value 1".
  The controller can request the current temperature value cyclically. For this purpose, the parameter "Cyclical polling of the temperature values" must be set to a value > "0". The request interval can be configured within the limits of 1 minute to 255 minutes.
  After a device reset, the controller will first wait for a valid temperature telegram until the feedback control starts and a command value, if applicable, is output.
- "Temperature input 1 and 2"
  The actual temperature is determined using two external temperature values. The selected temperature sources are combined. In this case, the KNX temperature sensors are connected to the controller via the two
  2-byte objects "Room temperature - Measured value 1" and
  "Room temperature - Measured value 2".
  When evaluating, the real actual temperature is made up of the two temperature values provided. The weighting of the temperature values is defined by the parameter "Weighting of temperature inputs 1 and 2". Depending on the different locations of the sensors or non-uniform heat distribution inside the room, it is thus possible to adjust the actual temperature measurement. Temperature sensors that are subject to negative external influences (for example, unfavourable location because of exposure to sun or radiator or door/window in the immediate vicinity) are often weighted less heavily.

  Example: A temperature sensor has been installed next to the entrance door. An additional temperature sensor has been mounted on an inner wall in the middle of the room below the ceiling.
  Sensor 1: 21.5 °C

Sensor 2: 22.3 °C
Determination of measured value: 30% to 70%

-> $T_{Result\ 1} = T_1 = 21.5\ °C \cdot 0.3 = 6.45\ °C$,
-> $T_{Result\ 2} = T_2 = 22{,}3\ °C \cdot 0{,}7 = 15{,}61\ °C$
-> $T_{Result} = T_{Result\ 1} + T_{Result\ 2} = \underline{22{,}06\ °C}$

The controller can request both current temperature values cyclically. For this purpose, the parameter "Polling time of the temperature values" must be set to a value > "0". The request interval can be configured within the limits of 1 minute to 255 minutes.
After a device reset, the controller will first wait for valid temperature telegrams to both objects until control starts and a command value, if applicable, is output.

Calibrating the measured values

In some cases during room temperature measurement, it may be necessary to adjust the external KNX temperature values. Adjustment becomes necessary, for example, if the temperature measured by the sensors stays permanently below or above the actual temperature in the vicinity of the sensor. To determine the temperature deviation, the actual room temperature should be detected with a reference measurement using a calibrated temperature measuring device.
Using the parameters "Adjust temperature input 1 by" and "Adjust temperature input 2 by", it is possible to configure the positive (temperature increase, factors: 1 ... 127) or negative (temperature decrease, factors -128... -1) temperature calibration in levels of 0.1 K. Thus, the calibration is made only once statically and is the same for all operating modes of the controller.

ℹ The measured value has to be increased, if the value measured by the sensor lies below the actual room temperature. The measured value has to be decreased, if the value measured by the sensor lies above the actual room temperature.

ℹ During room temperature control, the device always uses the adjusted temperature value to calculate the command values. The adjusted temperature value is transmitted to the bus via the "Room temperature - Actual value - Status" object. When determining the measured value using both external sensors, the calibrated values are also used to calculate the actual value.

ℹ Temperature adjustment only affects the room temperature measurement.

Transmission of the actual temperature

The determined actual temperature can be actively transmitted to the bus via the 2-byte object "Room temperature - Actual value - Status". Parameter "On change by (0 = inactive)" specifies the temperature value by which the actual value has to change in order to have the actual temperature value automatically transmitted via the object. Possible temperature value changes lie within a range of 0.1 K and 25.5 K. Setting to "0" at this point will deactivate the automatic transmission of the actual temperature.

In addition, the actual value can be transmitted periodically. The parameter "Cyclical (0 = inactive)" specifies the cycle time (1 to 255 minutes). The value "0" will deactivate the periodical transmission of the actual temperature value. If the "Read" flag is set on the "Actual temperature" object, this makes it possible to read out the current actual value at any time over the bus. It has to be pointed out that with deactivated periodical transmission and deactivated automatic transmission, no more actual-temperature telegrams will be transmitted".

Following the return of bus voltage or after programming via the ETS, the object value will be updated according to the current actual temperature value and transmitted as soon as all the external temperature values of the KNX sensors have been received. If no external temperature values have been received after a reset, then the value "0" will be seen in the "Actual temperature" object. For this reason, all the external temperature sensors should always transmit their current measured temperature value after a reset.

During room temperature control, the controller always uses the calibrated temperature values to calculate the command values. The calibrated temperature values can be actively transmitted to the bus via the "Actual temperature" object.

Monitoring the actual temperature

The cyclical actual temperature monitoring can be activated or deactivated via parameter. The parameter "Cyclical monitoring of the temperature inputs" on the parameter page "Room temperature controller -> RTCx - General -> Room temperature measurement" activates or deactivates this function. When cyclical actual temperature monitoring is active, the device cyclically checks whether the configured input objects "Room temperature - Measured value 1" and "Room temperature - Measured value 2" have received new values. The cycle time can be configured by parameter and applies equally to all temperature inputs.

If the value is not updated within the cycle time on one of the configured temperature sensors, the controller signals this error via the KNX-compliant controller status RHCC. Correspondingly, bit 0 ("0" = No error / "1" = Error) of the status telegram (object "Controller status RHCC - KNX-compliant) can be evaluated.

The controller remains active even when no input temperature values are received. The basic levels and the additional levels work with the last received temperature value and continue outputting command values.

The error status is cancelled when all configured temperature inputs are updated within a cycle period. Then the status telegram is also updated and transmitted.

10.5.1 Temperature measurement parameters

Room temperature measurement

Room temperature source	**Temperature input 1** Temperature input 1 and 2
The controller detects the room temperatures using one or possibly two external KNX temperature sensors (e.g. push-button sensors with temperature measurement). Depending on the configuration, the 2-byte objects "Room temperature - Measured value 1" and, optionally, the additional "Room temperature - Measured value 2", are enabled. After a device reset, the controller will first wait for valid temperature telegrams to both objects until control starts and a command value, if applicable, is output. Setting "Temperature input 1": The actual temperature is determined solely via an external temperature value. In this case, the KNX temperature sensor is connected to the controller via the 2-byte object "Room temperature - Measured value 1". Setting "Temperature input 1 and 2": The actual temperature is determined using two external temperature values. The selected temperature sources are combined. In this case, the KNX temperature sensors are connected to the controller via the two 2-byte objects "Room temperature - Measured value 1" and "Room temperature - Measured value 2".	

Weighting of temp. inputs 1 and 2	10% to 90% 20% to 80% 30% to 70% 40% to 60% **50% to 50%** 60% to 40% 70% to 30% 80% to 20% 90% to 10%
The weighting of the temperature values of the two external KNX temperature sensors is specified here. That results in an overall value, which will be used for the further interpretation of the room temperature. This parameter is only visible when the temperature detection system requires two external temperature sensors.	

Cyclical monitoring of the temperature values	Checkbox (yes / **no**)
Here, cyclical monitoring of the temperature values can be enabled as an option ("yes" setting). If, during active cyclical monitoring, there are no temperature values during the cycle time defined by the parameter of the same name, emergency operation will be activated.	

Cycle time	1 ... **10**... 255
The polling time for the external temperature value(s) is specified here.	

Cycle time	**0** ... 4 h 1 ... **20** ... 59 min
Presetting of the monitoring time hours and minutes.	

Cyclical polling of the temperature values	Checkbox (yes / **no**)
This setting determines whether the controller polls the temperature value(s) cyclically. In the "no" setting, the temperature value is not automatically polled by the controller. In this case the communication partner (e.g. controller extension) must transmit its temperature value itself.	

Cycle time	1 ... **10**... 255
The polling time for the external temperature value(s) is specified here.	

Temperature calibration

Adjust temperature input 1 by	-12.8...**0**...12.7 K
Specifies the value by which the room temperature measured value of the first external KNX temperature sensor is adjusted.	

Adjust temperature input 2 by	-12.8...**0**...12.7 K
Specifies the value by which the room temperature measured value of the second external KNX temperature sensor is adjusted.	

Room temperature transmission behaviour

On change by (0 = inactive)	0...**0.5**...25.5 K
This parameter specifies the temperature value by which the actual value has to change in order to have the actual temperature value transmitted automatically via the object. The "0" setting deactivates the automatic transmission of the actual temperature.	

Cyclical (0 = inactive)	0...**15**...255 min
This parameter specifies whether and when the determined room temperature is output cyclically via the "Actual temperature" object.	

10.5.2 Objects for temperature measurement

Object no.	Function	Name	Type	DPT	Flag
1437, 1447, 1457, 1467, 1477, 1487, 1497, 1507, 1517, 1527, 1537, 1547	Room temperature - Actual value - Status	RTC x - Output	2 bytes	9,001	C, R, -, T, -
2-byte object for the display of the actual temperature active in the controller (room temperature). The possible temperature range is specified by the received temperature values and corresponds to the range specified by the KNX DPT 9.001. The temperature value is always output in the format "°C".					

Object no.	Function	Name	Type	DPT	Flag
1438, 1448, 1458, 1468, 1478, 1488, 1498, 1508, 1518, 1528, 1538, 1548	Room temperature - Measured value 1	RTC x - Input	2 bytes	9,001	C, -, W, T, U
2-byte object for coupling an external KNX temperature sensor (e.g. push-button sensor with temperature measurement) for room temperature detection. The possible temperature range is specified by the KNX DPT 9.001. The temperature value must always be specified in the format "°C".					

Object no.	Function	Name	Type	DPT	Flag
1439, 1449, 1459 1469, 1479, 1489, 1499, 1509, 1519, 1529, 1539, 1549	Room temperature - Measured value 2	RTC x - Input	2 bytes	9,001	C, -, W, T, U
2-byte object for coupling an external KNX temperature sensor (e.g. push-button sensor with temperature measurement) for room temperature detection. The possible temperature range is specified by the KNX DPT 9.001. The temperature value must always be specified in the format "°C".					

10.6 Controller status

Heating/cooling message

Depending on the set operating mode, separate objects can be used to indicate whether the controller is currently demanding heating or cooling energy and is thus actively heating or cooling. As long as the heating command value is > "0", a "1" telegram will be transmitted via the object "Heating status object". The signal telegram is only reset when the command value is "0" ("0" telegram is transmitted). The same applies to the object "Cooling status object".

The signal objects can be enabled by the "Heating status object" or "Cooling status object" parameters in the parameter branch "Room temperature controller x -> RTCx - General -> Status". The control algorithm controls the signal objects. Please note that the command values are recalculated every 30 s, thus updating the signal objects.

Controller status

The room temperature controller can transmit its current status to the KNX. A choice of data formats is available for this. The parameter "Status" in the parameter node "RTCx - General -> Enabled functions" enables the parameter page "Status". The different status objects can be activated there individually.

- The KNX-compliant controller status feedback is harmonised on a manufacturer-independent basis.
- The objects "Controller status RHCC - KNX compliant", "Controller status RTC - KNX compliant" and "Controller status RTSM - KNX compliant" display elementary basic functions of the controller.
- These objects are supplemented by the two 1-byte objects "Operating mode status" and "Forced operating mode status" (DPT 20.102), which report back the operating mode actually set at the controller. The last two objects mentioned above are generally used to enable controller extensions to display the controller operating mode correctly in the KNX compliant status display. Therefore, these objects should be connected with controller extensions if the KNX-compliant status feedback is not configured.

Bit coding of the 2-byte object "Controller status RHCC - KNX compliant" (DPT 22.101)

Bit of the status telegram	Meaning on "1"	Meaning on "0"
0	Error	No error
1	not used (permanent "0")	
2	not used (permanent "0")	
3	not used (permanent "0")	
4	not used (permanent "0")	
5	not used (permanent "0")	
6	not used (permanent "0")	
7	not used (permanent "0")	
8	"Heating" operating mode	"Cooling" operating mode
9	not used (permanent "0")	
10	not used (permanent "0")	
11	not used (permanent "0")	

Bit of the status telegram	Meaning on "1"	Meaning on "0"
12	Controller disabled (dew point operation)	Controller enabled
13	Frost alarm (frost protection temperature undershot)	No frost alarm (frost protection temperature exceeded)
14	Heat alarm (heat protection temperature exceeded)	No heat alarm (heat protection temperature undershot)
15	not used (permanent "0")	

Bit coding of the 2-byte object "Controller status RTC - KNX compliant" (DPT 22.103)

Bit of the status telegram	Meaning on "1"	Meaning on "0"
0	Error	No error
1	"Heating" operating mode	"Cooling" operating mode
2	Controller disabled (dew point operation)	Controller enabled
3	Frost alarm (frost protection temperature undershot)	No frost alarm (frost protection temperature exceeded)
4	Heat alarm (heat protection temperature exceeded)	No heat alarm (heat protection temperature undershot)
5	Controller inactive (deadband)	Controller active
6	not used (permanent "0")	
7	"Heating" operating mode enabled	"Heating" operating mode disabled
8	"Cooling" operating mode enabled	"Cooling" operating mode disabled
9	not used (permanent "0")	
10	not used (permanent "0")	
11	not used (permanent "0")	
12	not used (permanent "0")	
13	not used (permanent "0")	
14	not used (permanent "0")	
15	not used (permanent "0")	

Bit coding of the 1-byte object "Controller status RTSM - KNX compliant" (DPT 21.107)

Bit of the status telegram	Meaning on "1"	Meaning on "0"
0	Window opened (For "Frost/heat protection = Automatic frost protection":	No window opened (For "Frost/heat protection = Automatic frost protection":

Bit of the status telegram	Meaning on "1"	Meaning on "0"
	– The bit is active if the automatic frost protection of the temperature drop detection is active. For "Frost/heat protection = via window status": – The bit is active if at least one window is open after the delay time has elapsed.)	– The bit is inactive if the automatic frost protection of the temperature drop detection is inactive. For "Frost/heat protection = via window status": – The bit is inactive if all windows are closed.)
1	Presence (Presence detector)	No presence (Presence detector)
2	Presence (Presence button)	No presence (Presence button)
3	Comfort extension active	Comfort extension inactive
4	Forced operating mode active	Forced operating mode inactive
5	not used (permanent "0")	
6	not used (permanent "0")	
7	not used (permanent "0")	

ℹ Bit 0 of the 1-byte object "Controller status RTSM - KNX compliant" (DPT 21.107) becomes active, depending on the setting of the parameter "Frost/heat protection".

10.6.1 Status output parameters

Heating / Cooling (depending on the operating mode of the controller)

Status object - Heating	Checkbox (yes/**no**)
Depending on the set operating mode, a separate object can be used to signal whether the controller is currently demanding heating energy and is thus actively heating. The "Yes" setting here enables the message function for heating.	

Status object - Cooling	Checkbox (yes/**no**)
Depending on the set operating mode, a separate object can be used to signal whether the controller is currently demanding cooling energy and is thus actively cooling. The "Yes" setting here enables the message function for cooling.	

Controller status

Status objects - Operating mode	Checkbox (**yes**/no)
The room temperature controller can transmit its current status to the KNX. If the parameter is activated, the objects "Operating mode - Preset - Status", "Operating mode - Active mode - Status" and "Operating mode - Forced - Status" are visible.	

Status object - RHCC	Checkbox (**yes**/no)
The room temperature controller can transmit its current status to the KNX. If the parameter is activated, the object "Controller status RHCC" is visible.	

Status object - RTC	Checkbox (**yes**/no)
The room temperature controller can transmit its current status to the KNX. If the parameter is activated, the object "Controller status RTC" is visible.	

Status object - RTSM	Checkbox (**yes**/no)
The room temperature controller can transmit its current status to the KNX. If the parameter is activated, the object "Controller status RTSM" is visible.	

10.6.2 Objects for controller status

Object no.	Function	Name	Type	DPT	Flag
339, 389, 439, 489, 539, 589, 639, 689, 739, 789, 839, 889	Operating mode - Preset - Status	Controller x - Output	1-byte	20,102	C, -, -, T, -
1-byte object used by the controller to output the current operating mode. This object is generally used to enable controller extensions to display the controller operating mode correctly in the KNX compliant status display. Therefore this object should be connected with controller extensions if the KNX compliant status feedback is not configured. After voltage return or an ETS programming operation, the current status is transmitted via this object. This object is only available if the parameter "Status objects - Operating mode" is activated.					

Object no.	Function	Name	Type	DPT	Flag
340, 390, 440, 490, 540, 590, 640, 690, 740, 790, 840, 890	Operating mode - Active mode - Status	Controller x - Output	1-byte	20,102	C, -, -, T, -
1-byte object used by the controller to output the current operating mode, taking the forced position, presence status and window status into account. This object is only available if the parameter "Status objects - Operating mode" is activated.					

<table>
<tr><th>Object no.</th><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>348, 398, 449, 498, 548, 598, 648, 698, 748, 798, 848, 898</td><td>Operating mode - Forced - Status</td><td>Controller x - Output</td><td>1-byte</td><td>20,102</td><td>C, -, -, T, -</td></tr>
<tr><td colspan="6">1-byte object used by the controller to output the operating mode in the event of forced position. This object is generally used to enable controller extensions to display the controller operating mode correctly in the KNX compliant status display. Therefore this object should be connected with controller extensions if the KNX compliant status feedback is not configured.
After voltage return or an ETS programming operation, the current status is transmitted via this object. This object is only available if the parameter "Status objects - Operating mode" is activated.</td></tr>
</table>

<table>
<tr><th>Object no.</th><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>347, 397, 447, 497, 547, 597, 647, 697, 747, 797, 847, 897</td><td>Controller status RHCC - KNX-compliant</td><td>RTC x - Output</td><td>2 bytes</td><td>22,101</td><td>C, R, -, T, A</td></tr>
<tr><td colspan="6">2-byte object that the controller uses to display elementary basic functions in a KNX-harmonised manner (RHCC).
After voltage return or an ETS programming operation, the current status is transmitted via this object.</td></tr>
</table>

<table>
<tr><th>Object no.</th><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>379, 429, 479, 529, 579, 629, 679, 729, 779, 829, 879, 929</td><td>Controller status RTSM - KNX-compliant</td><td>RTC x - Output</td><td>1 bytes</td><td>21,107</td><td>C, R, -, T, A</td></tr>
<tr><td colspan="6">2-byte object that the controller uses to display elementary basic functions in a KNX-harmonised manner (RTSM).
After voltage return or an ETS programming operation, the current status is transmitted via this object.</td></tr>
</table>

Object no.	Function	Name	Type	DPT	Flag
965, 1007, 1049, 1091, 1133, 1175, 1217, 1259, 1301, 1343, 1385, 1427	Controller status RTC - KNX-compliant	RTC x - Output	2 bytes	22,103	C, R, -, T, A
2-byte object that the controller uses to display elementary basic functions in a KNX-harmonised manner (RTC). After voltage return or an ETS programming operation, the current status is transmitted via this object.					

Object no.	Function	Name	Type	DPT	Flag
949, 991, 1033, 1075, 1117, 1159, 1201, 1243, 1285, 1327, 1369, 1411	Heating - Status	RTC x - Output	1-bit	1,001	C, R, -, T, A
1-bit object for the controller to report a request for heating energy. Object value = "1": energy request, object value = "0": no energy request.					

Object no.	Function	Name	Type	DPT	Flag
950, 992, 1034, 1076, 1118, 1160, 1202, 1244, 1286, 1328, 1370, 1412	Cooling - Status	RTC x - Output	1-bit	1,001	C, R, -, T, A
1-bit object for the controller to report a request for cooling energy. Object value = "1": energy request, object value = "0": no energy request.					

10.7 Boost function

The boost function can be used temporarily to heat or cool a room intensively. If the boost function is activated via the "Boost - Activate / Deactivate" object, the command value is set to maximum (ON or 100%) in the standard parameterisation for a duration of 5 minutes. After the time has elapsed, the boost switches off again automatically.

Once the boost function has elapsed, the controller checks the current actual temperature and the setpoint temperature. The command values set to maximum by the boost function are not switched off until the corresponding temperature limits are exceeded in heating mode and undershot in cooling mode.

The parameter "Boost function" in the parameter node "RTCx - General -> Enabled functions" enables the parameter page "Boost function". The remaining parameters can be set there.

The current status of the boost function and the residual time of a current boost can be sent to the bus.

ℹ The boost function cannot be retriggered.

ℹ The boost function can be aborted at any time.

ℹ The controller calculates the command values cyclically every 30 seconds. This can delay the adoption of the command value by a maximum of 30 s. As this delay affects switching on and off, the duration of the boost function remains unchanged.

10.7.1 Boost function parameters

Effect on	**Heating** Cooling Heating and cooling
The boost function can optionally be used for heating only, for cooling only or for both heating and cooling. The options available for this parameter depend on the operating mode set on the parameter page "RTC x - General".	

In heating mode, effect on	**Basic level heating** Additional level heating Basic and additional level heating
In the case of heating with the basic and additional levels, the boost function can optionally have an effect on the basic level only, the additional level only or both the basic and additional levels.	

In cooling mode, effect on	**Basic level cooling** Additional level cooling Basic and additional level cooling
In the case of cooling with the basic and additional levels, the boost function can optionally have an effect on the basic level only, the additional level only or both the basic and additional levels.	

Heating

Boost period	1 ... **5** ... 60 min
The device performs the boost according to the configuration of this parameter for a period of 1 to 60 minutes.	

Boost - Command value	0 ... **100 %**
For the configured duration, the command value is set to the value parameterised here, e.g. maximum (ON or 100%).	

Cooling

Boost period	1 ... **5** ... 60 min
The device performs the boost according to the configuration of this parameter for a period of 1 to 60 minutes.	

Boost - Command value	0 ... **100 %**
For the configured duration, the command value is set to the value parameterised here, e.g. maximum (ON or 100%).	

Transmission behaviour

Cyclical transmission of residual time (0 = inactive)	**0**...59 min 0 ... **10**…59 s
If the boost function is activated, the object "Boost - Remaining run time" can cyclically transmit the residual time of the running boost function in seconds.	

10.7.2 Objects for boost function

Object no.	Function	Name	Type	DPT	Flag
962, 1004, 1046, 1088, 1130, 1172, 1214, 1256, 1298, 1340, 1382, 1424	Boost - Activate / Deactivate	RTC x - Input	1-bit	1,010	C, -, W, -, -
1-bit input object for requirement-orientated activation and deactivation of the boost function. The telegram polarity is fixed: "0" = boost inactive, "1" = boost active. Updates of the object from "1" to "1" or "0" to "0" do not produce a reaction.					

Object no.	Function	Name	Type	DPT	Flag
963, 1005, 1047, 1089, 1131, 1173, 12151257, 1299, 1341, 1383, 1425	Boost function - Status	RTC x - Output	1-bit	1,011	C, R, -, T, -
1-bit object via which the controller outputs the current status of the boost function. When the boost function is activated, the status object is set to the value "1". When the boost function is deactivated, the status object is set to the value "0". After a reset, the status message object value is "0". The status object is only sent when there is a change.					

Object no.	Function	Name	Type	DPT	Flag
964, 1006, 1048, 1090, 1132, 1174, 1216, 1258, 1300, 1342, 1384, 1426	Boost function - Remaining run time	RTC x - Output	2-byte	7,005	C, R, -, T, -
2-byte object via which the controller outputs the period of the boost function. The residual time of the boost function is transmitted via the object in 10 second increments.					

10.8 Floor temperature monitoring

The cyclical monitoring of the floor temperature can be activated in the controller in order to influence the minimum or maximum temperature of a floor heating system. If the monitoring is enabled in the ETS, the controller continuously monitors the floor temperature. If the floor temperature exceeds a specified limiting value during heating or falls below a specified limiting value during cooling, the controller switches off the corresponding command value for heating or cooling. This switches off the heating or cooling and the system cools down or heats up. The controller will only set the most recently calculated command value again when the temperature exceeds / falls below the limiting value minus a hysteresis of 1 K.

ℹ With a pulse width-modulated command value, the temperature limit only switches off the command value when the current PWM time cycle has elapsed.

ℹ Depending on the configuration, the temperature may have a strong impact on the controller behaviour. Poor parameterisation of the limit temperature (limit temperature near to the room/setpoint temperature) means that it is possible that the specified setpoint temperature for the room can never be reached!

ℹ The cyclical monitoring of the floor temperature is used to increase the comfort behaviour of the heating/cooling system and must not be used as a safety-relevant protection function (immediate forced switch-off of the heating/cooling performance).

Which operating mode the cyclical monitoring should be applied to can be set in the ETS. It is possible to limit the minimum and / or the maximum floor temperature by the parameter "Monitoring of". In two-level heating or cooling mode, it is also possible to set whether the floor temperature limit applies to the basic level only, the additional level only or both the basic and additional levels.

The underfloor heating temperature to be monitored is fed into the controller via the KNX communication object "Floor temperature - Measured value". This object can be used to inform the controller of the current floor temperature using suitable temperature value telegrams from other bus devices (e.g. analogue input with temperature sensor, etc.).

The minimum and maximum limit temperatures the underfloor heating system is permitted to reach are specified in the ETS via the parameters "Maximum permissible floor temperature" and "Minimum permissible floor temperature". The temperatures can be set to a value between 10 ... 45 °C. If the limit temperature is exceeded in heating mode or fallen below in cooling mode, the controller switches the floor heating system off via the command value. As soon as the floor temperature has fallen 1 K below the limit temperature in heating mode or risen 1 K above the limit temperature in cooling mode, the controller switches the command value on again, assuming this is provided for in the control algorithm. The hysteresis 1 K is fixed.

ℹ The cyclical monitoring does not affect the "Heating" or "Cooling" message telegrams. If the floor temperature exceeds or falls below the limiting value, only the command value is switched off. In this case, the "Heating" or "Cooling" message remains active.

ℹ Depending on the configuration, the temperature limiting can have a strong impact on the controller behaviour. Poor parameterisation of the limit temperature (limit temperature near to the room/setpoint temperature) means that it is possible that the specified setpoint temperature for the room can never be reached.

ℹ The limiting temperatures for minimum and maximum are not checked for plausibility. The following generally applies: "Minimum permissible floor temperature" < allowed floor temperature range < "Maximum permissible floor temperature".

10.8.1 Floor temperature monitoring parameters

Monitoring of	**Maximum floor temperature** Minimum floor temperature Maximum and minimum floor temperature
This parameter determines which operating mode the cyclical floor temperature monitoring should be applied to. The monitoring can be limited to heating (maximum floor temperature), cooling (minimum floor temperature), or heating and cooling.	

Effect on	Basic level Additional level **Basic and additional level**
Depending on which heating or cooling circuit is used for the floor, this parameter defines which level is affected by the floor temperature monitoring.	

Heating

Maximum permissible floor temperature	10 ... **35** ... 45°C
The maximum limit temperature which the floor may reach in heating mode is specified here. If this temperature is exceeded, the controller switches the underfloor heating system off using the command value. As soon as the floor temperature has fallen 1 K under the limit temperature, the controller switches the command value on again, assuming that this is provided for in the control algorithm.	

Cooling

Minimum permissible floor temperature	**10** ... 45°C
The minimum limit temperature which the floor may reach in cooling mode is specified here. If the temperature falls below this value, the controller switches the underfloor cooling system off using the command value. As soon as the floor temperature has risen 1 K above the limit temperature, the controller switches the command value on again, assuming that this is provided for in the control algorithm.	

10.8.2 Objects for floor temperature monitoring

Object no.	Function	Name	Type	DPT	Flag
944, 986, 1028, 1070, 1112, 1154, 1196, 1238, 1280, 1322, 1364, 1406	Floor temperature - Limiting value exceeded/undershot - Status	RTC x - Output	1-bit	1,011	C, R, -, T, A
1-bit object for the status output of the monitoring of the configured limiting values of the floor temperature. If the monitoring is enabled in the ETS, the controller continuously monitors the floor temperature. If the floor temperature exceeds a specified limiting value during heating or falls below a specified limiting value during cooling, the controller switches off the corresponding command value for heating or cooling. This switches off the heating or cooling. The controller will only set the most recently calculated command value again when the temperature exceeds / falls below the limiting value minus a hysteresis of 1 K again.					

Object no.	Function	Name	Type	DPT	Flag
945, 987, 1029, 1071, 1113, 1155, 1197, 1239, 1281, 1323, 1365, 1407	Floor temperature - Measured value	RTC x - Input	2-byte	9,001	C, -, W, -, U
2-byte object for coupling an external temperature sensor for floor temperature monitoring. The temperature value must always be specified in the format "°C".					

10.9 Setpoint temperature limit, cooling

In accordance with statutory requirements in Germany and elsewhere, the temperature at the workplace should be a maximum of 26 °C, or at least 6 K below outdoor temperatures higher than 32 °C. Exceeding these limits is only permissible in exception circumstances. To meet these requirements, the room temperature controller offers a setpoint temperature limit, which is only effective in cooling mode. If necessary, the controller limits the setpoint temperature to specific values and prevents an adjustment beyond the limits.

The parameter "Limitation type" in the parameter node "Room temperature controller -> RTC xx - General -> Setpoint temperature limit, cooling" can activate the limit and specify its function. The following settings are possible:

– Setting "Only difference to outdoor temperature"
  In this setting, the outdoor temperature is monitored and compare to the active setpoint temperature. The desired maximum temperature difference to the outdoor temperature can be specified in the range between 1 K and 15 K. The specification is made using the parameter "Difference between setpoint temperature and outdoor temperature of". The value can be set in step widths of 1 K.
  If the outdoor temperature rises above the value of the parameter "Limit above outdoor temperature of", then the controller activates the setpoint temperature limit. It then permanently monitors the outdoor temperature and raises the setpoint temperature so that is beneath the outdoor temperature by the amount configured. Should the outdoor temperature continue rise, the controller raises the setpoint temperature until the required difference to the outdoor temperature is achieved. It is then not possible to undershoot the raised setpoint, e.g. by changing the basic setpoint change.
  The change to the setpoint temperature limit is temporary. It only applies for as long as the outdoor temperature exceeds the value of the parameter "Limit above outdoor temperature of".
  With the setpoint temperature limit, the configured temperature difference relates to the setpoint temperature of the Comfort mode for cooling. In other operating modes, the temperature distance to Comfort mode must be taken into account.

  Example:
  In the ETS, the difference between the setpoint temperature and the outdoor temperature is set to 6 K. The standby setpoint temperature is configured to 2 K higher than the comfort setpoint temperature. The result of this is that, for command value limiting, the setpoint temperature in Standby mode may only be a maximum of 4 K below the outdoor temperature. The setpoint temperature limit applies to Night mode in the same way.

ℹ The automatic raising of the setpoint temperature by the setpoint temperature limit goes only as far as the configured heat protection temperature. Therefore the heat protection temperature can never be exceeded.

ℹ A basic setpoint shift never affects an active setpoint temperature limit with differential measurement to the outdoor temperature. In this case, the setpoint temperature limit only works with the unshifted basic setpoint. A setpoint shift active before the limitation is restored after the limitation, if it was not reset in another way, e.g. by an operating mode switchover.

ℹ If the setpoint temperature limit is active, the difference between the basic cooling and additional cooling levels is not taken into account. The command values for both levels are identical. Only when the temperature falls below the limit temperature is the difference between the levels considered again.

- Setting "only maximum setpoint temperature"
  In this setting, no setpoint temperatures that are greater than the maximum setpoint temperature configured in the ETS are permitted in cooling mode for the Comfort, Standby and Night modes. The maximum setpoint temperature is specified in the parameter "Maximum setpoint temperature in cooling mode" and can be configured within the limits 20 °C to 35 °C in steps of 1 °C.
  With an active limit, no larger setpoint can be set in cooling operation, e.g. by a basic setpoint change or a setpoint shift. However, heat protection is not influenced by the setpoint temperature limit.
  The maximum setpoint temperature configured in the ETS generally relates to the comfort setpoint temperature of cooling mode. In other operating modes, the temperature distance to Comfort mode must be taken into account. Example...
  The maximum setpoint temperature is configured to 26 °C. The standby setpoint temperature is configured to 2 K higher than the comfort setpoint temperature. The result of this is that, for command value limiting, the setpoint temperature in Standby mode is limited to 28 °C. The setpoint temperature limit applies to Night mode in the same way.
- Setting "Maximum setpoint temperature and difference to outdoor temperature"
  This setting is a combination of the two above-mentioned settings. In the downward direction, the setpoint temperature is limited by the maximum outdoor temperature difference, whilst in the upward direction, the limit is made by the maximum setpoint.
  The maximum setpoint temperature has priority over the outdoor temperature difference. This means that the controller keeps on raising the setpoint temperature according to the difference to the outdoor temperature configured in the ETS until the maximum setpoint temperature or the heat protection temperature is exceeded. Then the setpoint is limited to the maximum value.

A setpoint limit enabled in the ETS can be activated or deactivated as necessary using a 1-bit object. For this, the parameter "Activation" can be set to "via object". In this case, the controller only takes the setpoint limit into account if it has been enabled via the object "Setpoint temperature limit - Activate / Deactivate" ("1" telegram). If the limitation is not enabled ("0" telegram), the cooling setpoint temperatures are not limited. After a device reset (bus voltage return, ETS programming operation), the object value is "0", meaning that the setpoint limit is inactive.

ℹ The setpoint limit has no function in Heating mode.

Status message of the setpoint temperature limit

If a setpoint temperature limit is active, this is signalled to the bus via the object "Setpoint temperature limit - Status". This makes it possible for the user to recognise a changed temperature setpoint. After a reset, the status message object value is "0". This corresponds to the normal setpoint of the operating modes "Comfort", "Standby" and "Night". The setpoint temperature status is only sent when there is a change.

10.9.1 Setpoint temperature limit parameters

Limitation type	Only difference to outdoor temperature Only maximum setpoint temperature **Maximum setpoint temperature and difference to outdoor temperature**
The variable on which the setpoint temperature limit depends can be defined here. "Only difference to outdoor temperature": In this setting, the outdoor temperature is monitored and compared with the active setpoint temperature. The specification of the maximum temperature difference to the outdoor temperature is made using the "Difference to outdoor temperature in cooling mode" parameter. If the outdoor temperature rises above 32 °C, then the controller activates the setpoint temperature limit. It then permanently monitors the outdoor temperature and raises the setpoint temperature so that is beneath the outdoor temperature by the amount configured. Should the outdoor temperature continue rising, the controller raises the setpoint temperature until the required difference to the outdoor temperature is reached, or, at most, the heat protection temperature. It is then not possible to undershoot the raised setpoint, e.g. by changing the basic setpoint change. The change to the setpoint temperature limit is temporary. It only applies for as long as the outdoor temperature exceeds 32 °C. "Only maximum setpoint temperature": In this setting, no setpoint temperatures that are greater than the maximum setpoint configured in the ETS are permitted in cooling mode for the Comfort, Standby and Night modes. The maximum temperature setpoint is specified by the "Max. setpoint temperature in cooling operation" parameter. With an active limit, no larger setpoint can be set in cooling operation, e.g. by a basic setpoint change or a setpoint shift. However, heat protection is not influenced by the setpoint temperature limit. "Maximum setpoint temperature and difference to outdoor temperature": This setting is a combination of the two above-mentioned settings. In the downward direction, the setpoint temperature is limited by the maximum outdoor temperature difference, whilst in the upward direction, the limit is made by the maximum setpoint. The maximum setpoint temperature has priority over the outdoor temperature difference. This means that the controller keeps on raising the setpoint temperature according to the difference to the outdoor temperature configured in the ETS until the maximum setpoint temperature or the heat protection temperature is exceeded. Then the setpoint is limited to the maximum value.	

Limit from an outdoor temperature of	20...**32**...45 °C
This parameter defines the outdoor temperature at which limitation of the setpoint temperature becomes active in cooling mode.	

Difference between setpoint temperature and outdoor temperature of	1 ...**6** ...15 K
This parameter defines the maximum difference between the setpoint temperature in Comfort mode and the outdoor temperature with an active setpoint temperature limit. This parameter is visible only if setpoint temperature monitoring is enabled. However, this is only if the parameter "Setpoint temperature limit in cooling operation" is then set to "Only difference to outdoor temperature" or "Max. setpoint temperature and difference to outdoor temperature".	

Maximum setpoint temperature	20°C...**26°C**...35°C
This parameter defines the maximum setpoint temperature in Comfort mode with an active setpoint temperature limit. This parameter is visible only if setpoint temperature monitoring is enabled. However, this is only if the parameter "Setpoint temperature limit in cooling operation" is then set to "Only max. setpoint temperature" or "Max. setpoint temperature and difference to outdoor temperature".	

Activation	**via object** permanently active
A setpoint limit enabled in the ETS can be activated or deactivated as necessary using a 1-bit object. For this, this parameter can be set to "Yes". In this case, the controller only takes the setpoint limit into account, if it has been enabled via the object "Cooling setpoint temperature limit" ("1" telegram). If the limitation is not enabled ("0" telegram), the cooling setpoint temperatures are not limited. This parameter is visible only if setpoint temperature monitoring is enabled.	

10.9.2 Objects for setpoint temperature limit

Object no.	Function	Name	Type	DPT	Flag
364, 414, 464, 514, 564, 614, 664, 714, 764, 814, 864, 914	Setpoint temperature limit - Activate / Deactivate	RTC x - Input	1-bit	1,001	C, -, W, -, U

1-bit object for activation or deactivation of a setpoint temperature limit.

- "0" = deactivate raising of setpoint
- "1" = activate raising of setpoint

If the setpoint limit is permanently activated, the communication object is not visible.

Object no.	Function	Name	Type	DPT	Flag
364, 414, 464, 514, 564, 614, 664, 714, 764, 814, 864, 914	Setpoint temperature limit - Status	RTC x - Output	1-bit	1,011	C, R, -, T, A
1-bit object for signalling an active setpoint temperature limit. – "0" = raising of setpoint not active – "1" = raising of setpoint active					

10.10 Setpoint temperature increase, heating

The room temperature controller offers a setpoint temperature increase, which is only effective in heating mode.

The comfort and standby setpoints are raised gradually as the outdoor temperature falls. This counteracts the radiative cooling from outdoor walls in winter, increasing the sense of well-being. The working range can be configured and is defined via the parameter "Raise from difference between setpoint temperature and outdoor temperature of".

The following values are used for calculation of the setpoint temperature increase:

- Setpoint temperature (before increase)
- Current outdoor temperature
- Configured difference between setpoint temperature and outdoor temperature
- Increase factor

These values are used in the following formula:

Setpoint temperature increase = Setpoint temperature + (Setpoint temperature - (Outdoor temperature +
Difference between setpoint temperature and outdoor temperature)) x Increase factor

Example for setpoint temperature increase: - Heating Comfort mode setpoint temperature = Specified setpoint temperature = 21 °C - Difference between setpoint temperature and outdoor temperature = 10 K - Increase factor = 10
Outdoor temperature = 11 °C, Preset setpoint + (Preset setpoint (Outdoor temperature + Difference between setpoint temperature and outdoor temperature) x Factor) = 21.0 °C -> Set setpoint temperature = Specified setpoint temperature = 21 °C
Outdoor temperature = 10 °C, Preset setpoint + (Preset setpoint (Outdoor temperature + Difference between setpoint temperature and outdoor temperature) x Factor) = 21.1 °C -> Set setpoint temperature = Calculated setpoint temperature = 21.1 °C

Example for setpoint temperature increase: - Heating Comfort mode setpoint temperature = Specified setpoint temperature = 21 °C - Difference between setpoint temperature and outdoor temperature = 10 K - Increase factor = 10
Outdoor temperature = 9 °C, Preset setpoint + (Preset setpoint (Outdoor temperature + Difference between setpoint temperature and outdoor temperature) x Factor) = 21.2 °C -> Set setpoint temperature = Calculated setpoint temperature = 21.2 °C
Outdoor temperature = 8 °C, Preset setpoint + (Preset setpoint (Outdoor temperature + Difference between setpoint temperature and outdoor temperature) x Factor) = 21.3 °C -> Set setpoint temperature = Calculated setpoint temperature = 21.3 °C

If the value of the shifted outdoor temperature (grey characteristic line) falls below the value of the specified setpoint temperature (green characteristic line), the calculated setpoint temperature (blue characteristic line) becomes active. When setpoint temperature increase is activated, the calculated setpoint is then set as the setpoint temperature. Correspondingly, the specified setpoint temperature is reactivated when the calculated setpoint temperature value falls below the specified setpoint temperature.

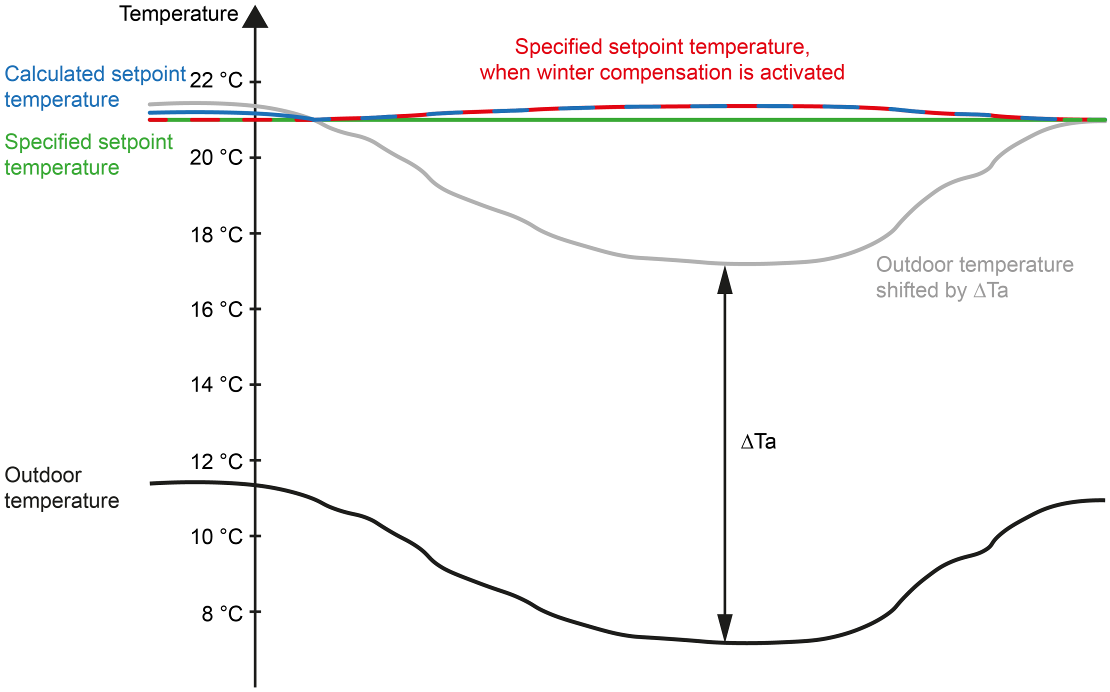


Figure 44: Example for winter compensation

∆Ta Configured difference between setpoint temperature and outdoor temperature

Additional information about setpoint temperature increase, heating

- The precondition for "setpoint temperature increase, heating" is reception of a valid outdoor temperature.

- Setpoints shifted by "setpoint temperature increase, heating" are checked against the frost and heat protection temperatures and if they fall below or exceed them respectively, they are restricted to these values.
- The "setpoint temperature increase, heating" only works in the operating modes Comfort and Standby.
- Switching between heating and cooling changes the operating mode; which is the corresponding precondition for "setpoint temperature increase, heating".
- "Cooling" mode switches "setpoint temperature increase, heating" to inactive and sets its offset to the value "0".
- An operating mode switchover to Comfort or Standby operating mode does not affect the "setpoint temperature increase, heating". By contrast, the Night and Frost/heat protection modes switch the "setpoint temperature increase, heating" to inactive.

Status message of setpoint temperature increase, heating

If "setpoint temperature increase, heating" is active, this is signalled to the bus via the object "Setpoint temperature increase - Status". This makes it possible for the user to recognise a changed temperature setpoint. After a reset, the status message object value is "0". This corresponds to the normal setpoint of the operating modes "Comfort", "Standby" and "Night". The setpoint temperature status is only sent when there is a change.

10.10.1 Setpoint temperature increase parameters

Increase beyond difference between setpoint temperature and outdoor temperature of	10 ...**15** ...20 K
This parameter defines the difference between the setpoint temperature and the outdoor temperature beyond which the setpoint temperature increase gradually takes effect.	

Increase factor	**0**...0.2
This parameter defines the intensity of the setpoint temperature increase.	

10.10.2 Objects for setpoint temperature increase

Object no.	Function	Name	Type	DPT	Flag
363, 413, 463, 513, 563, 613, 663, 713, 763, 813, 863, 913	Setpoint temperature increase - Status	RTC x - Output	1-bit	1,011	C, R, -, T, A
1-bit object for signalling an active setpoint temperature increase. – "0" = raising of setpoint not active – "1" = raising of setpoint active					

10.11 Scenes

Up to 64 scenes can be created for the room temperature controller and scene values (operating mode) stored. The scene values are recalled or stored via a separate scene extension object. The data point type of the extension object permits addressing of all scenes.

The scene function must be enabled on the parameter page "Room temperature controller -> RTCx - General -> Enabled functions" so that the required communication objects and parameters (on the parameter page "Room temperature controller -> RTCx - General -> Scenes") become visible.

The scene configuration selected in the parameterization decides whether the number of scenes is either variable (1 ... 64) or alternatively fixed to the maximum (64).

- Scene configuration = "variable (1 ... 64 scenes)"
  With this setting, the number of scenes used can be selected anywhere in the range 1 to 64. The parameter "Number of scenes" decides how many scenes are visible in the ETS and can therefore be used. It is possible to specify which scene number (1 ... 64) controls each scene.
- Scene configuration = "fixed (64 scenes)"
  With this setting, all scenes are always visible and can therefore be used. The scenes are controlled via permanently assigned scene numbers (1 ... 64) (scene number 1 -> scene 1, scene number 2 -> scene 2 ...). If necessary, individual scenes can be deactivated.

The scene function can be combined together with other functions of the room temperature controller, whereby the last received or set state is always executed.

Presetting a scene recall delay

Each scene recall of the room temperature controller can also be optionally delayed. With this feature, dynamic scene sequences can be configured if several scene outputs are combined with cyclical scene telegrams.

Precondition
The scene function must be enabled on the parameter page "Room temperature controller -> RTCx - General -> Enabled functions".

- On the parameter page "Room temperature controller -> RTCx - General -> Scenes", activate the parameter "Delay scene recall".

  The delay time is now activated and can be configured separately. The delay only affects the scene recall of the room temperature controller. The delay time is started on arrival of a recall telegram. Only after the time has elapsed is the corresponding scene called up and the operating mode set.

ℹ Each scene recall telegram restarts the delay time and retriggers it. If a new scene recall telegram is received while a delay is active (scene recall not yet executed), the old (and not yet recalled scene) will be rejected and only the scene last received executed.

ℹ The scene recall delay has no influence on the storage of scene values. A scene storage telegram within a scene recall delay terminates the delay and thus the scene recall.

Presetting the behaviour during ETS programming

When saving a scene, the operating modes are stored internally in the device in a non-volatile manner. To ensure that the stored values are not replaced by the originally programmed scene operating modes during an ETS programming operation of the application program or the parameters, the actuator can prevent the operating modes from being overwritten. As an alternative, the original values can be reloaded into the device during each programming run of the ETS.

Precondition
The scene function must be enabled on the parameter page "Room temperature controller x -> RTCx - General -> Enabled functions".

- Activate the parameter "Overwrite values stored in the device during the ETS programming operation" on the parameter page "Room temperature controller x -> RTCx - General -> Scenes".

  With each ETS programming operation of the application program or the parameters, the scene operating modes configured in the ETS are programmed into the actuator. This may overwrite the scene operating modes stored in the device by means of a storage function.

- Deactivate the parameter "Overwrite values stored in the device during the ETS programming operation".

  Scene operating modes that may have been stored in the device by means of a storage function are maintained. If no scene switching states have been stored, the last operating modes programmed in by the ETS remain valid.

ℹ When commissioning the actuator for the first time, the parameter should be activated so that the operating mode is initialised to valid scene operating modes.

Presetting scene numbers and scene operating modes

The presetting of the scene number can be defined for each scene of the room temperature controller, by which scene number (1...64) the scene is addressed, i.e. called up or stored.
The data point type of the scene extension object permits addressing of up to 64 scenes max.

In addition to defining the scene number, it must be defined which scene command (Comfort mode, Standby mode, Night mode, Frost/heat protection) is to be set when a scene is called up on the room temperature controller.

Precondition
The scene function must be enabled on the parameter page "Room temperature controller x -> RTCx - General -> Enabled functions".

- On the parameter page "Room temperature controller x -> RTCx - General -> Scenes", set the parameter "Scene number" for each scene to the number by which the scenes are to be addressed.

  A scene can be addressed with the configured scene number. A setting of "0" deactivates the corresponding scene so that neither recalling nor storage is possible.

i If the same scene number is configured for several scenes, only the scene with the lowest sequential number will be addressed. The other scenes will be ignored in this case.

- On the parameter page "Room temperature controller RTC -> RTC - General -> Scenes", set the "Operating mode" parameter for each scene to the desired operating mode.

  With a scene recall, the configured operating mode is recalled and set at the room temperature controller.

i The configured operating mode is adopted in the actuator during an ETS programming operation only if the parameter "Overwrite values stored in the device during the ETS programming operation" is activated.

Presetting storage behaviour

The operating mode set on the room temperature controller can be stored internally when a scene storage telegram is received via the extension object. The operating mode can be influenced by all functions of the room temperature controller before storage, provided that the individual functions are also enabled.

Precondition
The scene function must be enabled on the parameter page "Room temperature controller x -> RTCx - General -> Enabled functions".

- On the parameter page "Room temperature controller x -> RTCx - General -> Scenes", activate the "Storage function" parameter for each scene.

The storage function is activated for the scene in question. When a storage telegram is received via the "Scene extension" object, the current operating mode is stored internally.

- Deactivate the parameter "storage function" for each scene.

  The storage function is deactivated for the scene in question. A storage telegram received via the "scene extension" object will be rejected.

Configuring extended scene recall

The extended scene recall allows calling of up to 64 scenes of a room temperature controller in sequence. Here, scene recall takes place via the 1-bit communication object "Extended scene recall". Each ON telegram received via this object recalls the next of the available scenes in the configuration. Each OFF telegram received recalls the previous scene.
With the extended scene recall, the controller always recalls the neighbouring scene - starting with the scene most recently recalled via the extended recall. It is irrelevant whether the scene is active (scene number = "1...64" or scene active) or inactive (scene number = "0" or scene inactive). If an inactive scene is recalled via the extended scene recall, the room temperature controller will not react.
Only the scenes available in the scene configuration can be selected via the extended scene recall (with "variable" defined by the parameter "number of scenes", with "fixed" always all 64 scenes). After a reset (bus voltage return, ETS programming operation), an ON or OFF telegram always recalls scene 1 first.

i Recall of a scene via the 1-byte extension object does not influence the scene sequence of the extended scene recall. The two recall functions work independently of each other.

- On the parameter page "Room temperature controller -> RTCx - General -> Scenes", activate the parameter "Extended scene recall".

  The object "Extended scene recall" is available. Each ON telegram recalls the next scene. Each OFF telegram recalls the previous scene.

- Deactivate the parameter "Extended scene recall".

  The extended scene recall is deactivated. A scene recall can only take place via the 1-byte scene extension object.

The extended scene recall can take place with or without an overflow at the scene limits. An overflow occurs when the last scene of the selected configuration is reached when counting up or scene 1 when counting down and an additional telegram in the last counting direction is received by the actuator. The overflow behaviour is defined in the ETS.

- Activate the parameter "with overflow".

  After reaching the last scene of the selected configuration, a further ON telegram of the overflow is executed and scene 1 is recalled. Similarly, after reaching scene 1, the overflow is executed by further OFF telegram and the last scene of the selected configuration is recalled.

- Deactivate the parameter "With overflow".

A scene overflow is not possible. After reaching the last scene of the selected configuration, further ON telegrams of the extended scene recall are ignored. In the same way, the actuator ignores further OFF telegrams if scene 1 was recalled last.

10.11.1 Scene parameters

Room temperature controller RTC -> RTC - General -> Enabled functions

Scenes	Checkbox (yes / **no**)
This parameter can be used disable or to enable the scene function.	

Room temperature controller RTC -> RTC - General -> Scenes

Delay scene recall	Checkbox (yes / **no**)
A scene is recalled via the scene extension object. If required, the scene recall can be delayed on reception of a recall telegram (parameter activated). The recall is alternatively made immediately on reception of the telegram (parameter deactivated).	

Delay time minutes (0...59)	**0**...59
This parameter specifies the length of the scene delay time. Sets the scene delay time in minutes.	

Seconds (0...59)	0...**10**...59
Sets the scene delay time in seconds. The delay time parameters are only visible, if the parameter "Delay scene recall" is activated.	

Overwrite values stored in the device during the ETS programming operation	Checkbox (**yes** / no)
During storage of a scene, the scene values are stored internally to memory in the device. To prevent the stored values from being replaced during ETS programming by the originally programmed scene values, the actuator can inhibit overwriting of the scene values (parameter deactivated). As an alternative, the original values can be reloaded into the device during each programming run of the ETS (parameter activated).	

Extended scene recall	Checkbox (yes / **no**)
The extended scene recall allows calling of up to 64 scenes of a controller in sequence. Here, scene recall takes place via the 1-bit communication object "Extended scene recall". Each ON telegram received via this object recalls the next scene. Each OFF telegram received recalls the previous scene. This parameter enables extended scene recall, if required.	

With overflow	Checkbox (yes / **no**)
The extended scene recall can take place with or without an overflow at the scene limits. An overflow occurs when the last scene of the selected configuration is reached when counting up or scene 1 when counting down and an additional telegram in the last counting direction is received by the actuator. Parameter activated: After reaching the last scene of the selected configuration, a further ON telegram of the overflow is executed and scene 1 is recalled. Similarly, after reaching scene 1, the overflow is executed by further OFF telegram and the last scene of the selected configuration is recalled. Parameter deactivated: A scene overflow is not possible. After reaching the last scene of the selected configuration, further ON telegrams of the extended scene recall are ignored. In the same way, the actuator ignores further OFF telegrams if scene 1 was recalled last. This parameter is only visible when the extended scene recall is used.	

Scene configuration	**variable (1...64 scenes)** fixed (64 scenes)
The scene configuration selected here decides whether the number of scenes is either variable (1 ... 64) or alternatively fixed to the maximum (64). variable (1...64 scenes): With this setting, the number of scenes used can be selected anywhere in the range 1 to 64. The parameter "Number of scenes" decides how many scenes are visible for the switching output in the ETS and can therefore be used. It is possible to specify which scene number (1 ... 64) controls each scene. fixed (64 scenes): With this setting, all scenes are always visible and can therefore be used. The scenes are controlled via permanently assigned scene numbers (1 ... 64) (scene number 1 -> scene 1, scene number 2 -> scene 2 ...). If necessary, individual scenes can be deactivated.	

Number of scene assignments	1...**10**...64
This parameter defines how many scenes are visible for the room temperature controller in the ETS and can therefore be used.	

Scene number	0...**1***...64 *: The predefined scene number is dependent on the scene (1...64).
It is possible to preset which scene number (1 ... 64) controls each scene. A setting of "0" deactivates the corresponding scene so that neither recalling nor storage is possible. If the same scene number is configured for several scenes, only the scene with the lowest sequential number will be addressed. The other scenes will be ignored in this case.	

Operating mode	Comfort mode Standby mode Night mode Frost/heat protection mode
This parameter is used for configuring the´operating mode which is set when the scene is recalled.	

Memory function	Checkbox (yes / **no**)
If the parameter is activated, the storage function of the scene is enabled. The current operating mode can then be stored internally via the extension object on receipt of a storage telegram. If the parameter is deactivated, the storage telegrams are rejected.	

10.11.2 Objects for scenes

Object no.	Function	Name	Type	DPT	Flag
1557, 1560, 1563, 1566, 1569, 1572, 1575, 1578, 1581, 1584, 1587, 1590	Scenes - Extension	RTC x - Input	1-byte	18,001	C, -, W, -, U
1-byte object for polling or saving a scene.					

Object no.	Function	Name	Type	DPT	Flag
1558, 1561, 1564, 1567, 1570, 1573, 1576, 1579, 1582, 1585, 1588, 1591	Scenes - Extended scene recall	RTC x - Input	1-bit	1,001	C, (R), W, -, A
1-bit object for extended scene recall. Each ON telegram received recalls the next scene of a controller in sequence. Each OFF telegram received recalls the previous scene. After a reset (bus voltage return, ETS programming operation), an ON or OFF telegram always recalls scene 1 first.					

11 Logic functions

The device contains up to 8 logic functions. Simple or complex logical operations in a KNX installation can be performed using these functions. Linking of input and output objects allows the networking of logic functions, permitting the execution of complex operations.

Enabling and configuring the number of logic functions

To be able to use logic functions, they must be enabled centrally on the "General" parameter page.

- ■ Activate the parameter "Logic functions".

  The logic functions can be used. The "Logic functions" parameter node becomes available, which contains additional parameter pages. The configuration of the logic functions takes place in this parameter node.

Logic functions can be enabled in steps so that the number of visible functions and, in consequence, the available parameters and communication objects are visible in the ETS. The number of available logic functions can be defined on the "Logic functions" parameter page.

- ■ Configure the "Number of logic functions" parameter to the desired value.

  As many logic functions are created as have been selected.

ℹ The application program deletes existing logic functions from the configuration if the number of available functions is reduced.

Up to two time functions can be preset for each switching output, independently of each other. The time functions affect the communication objects "Switching" and delay the object value received depending on the telegram polarity .

ℹ At the end of a disabling function, the switching state received during the function or set before the function can be tracked. At the same time, residual times of time functions are also tracked if these had not yet fully elapsed at the time of the reactivation.

ℹ The time delays do not influence the staircase function if this is enabled.

ℹ A time delay still in progress will be fully aborted by a reset of the actuator (bus voltage failure or ETS programming).

11.1 Logic functions parameters

General

Logic functions	Checkbox (yes/**no**)
This parameter enables the logic functions globally. If the parameter is activated, the "Logic functions" parameter node becomes available, which contains additional parameter pages. The configuration of the logic functions takes place in this parameter node.	

Number of logic functions (1...8)	**1**...8
The number of required logic functions is defined here.	

Logic functions -> Logic function...

Name of logic function	Free text
The text entered in this parameter is applied to the name of the communication objects and is used to label the logic function in the ETS parameter window (e. g. "limit value switch outside temperature", disabling of venetian blind garden door). The text is not programmed in the device.	

Type of logic function	**Logic gate** Converter (1-bit -> 1-byte) Disabling element (Filtering/Time) Comparator Limit value switch with hysteresis

It is possible to be define which logical operation is to be executed for each logic function. This parameter is only visible if the logic functions have been enabled on the "General" parameter page.

Logic gate: The logic function works as a Boolean logic gate with optionally 1 ... 4 inputs and one output.

Converter (1-bit -> 1-byte): The logic function is configured as a converter. The converter has a 1-bit input and a 1-byte output and also a disabling object. ON / OFF telegrams can be converted to preconfigured values. The disabling object is able to deactivate the converter.

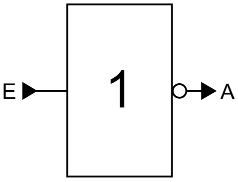
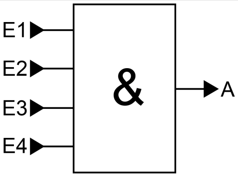
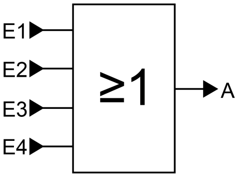
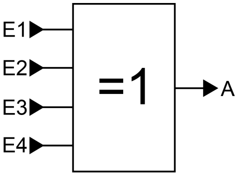
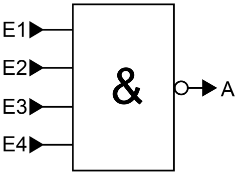
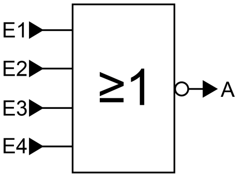
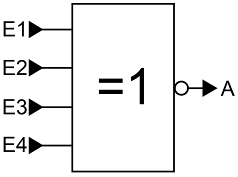
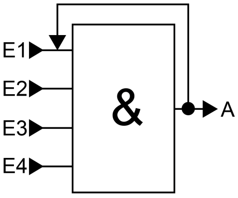
Disabling element (Filtering/Time): The logic function is configured as a disabling element. The disabling element has a 1-bit input and a 1-bit output. This logic function can delay input signals depending on the state (ON or OFF) and output them filtered at the output. A disabling object is also available, which can be used to deactivate the disabling element.

Comparator: The logic function works as a comparator with an input whose data format can be parameterised, and with a 1-bit output to output the result of the comparison operation. The reference function and the reference value are configured in the ETS.

Limit value switch with hysteresis: The logic function acts like a limit switch with hysteresis. An input with a configurable data format and a 1-bit output are available. The hysteresis is determined by an upper and lower threshold. The threshold values can be parameterised in the ETS. The input value is compared with the threshold values. The command at the output (ON / OFF) upon exceeding or falling below the configured threshold values can be configured.

11.2 Logic gate

A logic gate has up to 4 Boolean inputs (1-bit) and one logic output (1-bit). In consequence, a logic operation only supports the 1-bit data format. The following table shows configurable comparison operations Logic gate and explains their function.

Logic gate	Description	Icon
Invert (NOT)	The logic gate has only one input. The input is forwarded to the gate output inverted.	
AND (AND)	Logic gate has 4 inputs. The output is "1" if all inputs are "1". Otherwise the output is "0".	
OR (OR)	Logic gate has 4 inputs. The output is "0" if all inputs are "0". Otherwise the output is "1".	
Exclusive OR (XOR)	Logic gate has 4 inputs. The output is "1" if only one input is "1". Otherwise the output is "0".	
Inverted AND (NAND)	Logic gate has 4 inputs. The output is "0" if all inputs are "1". Otherwise the output is "1".	
Inverted OR (NOR)	Logic gate has 4 inputs. The output is "1" if all inputs are "0". Otherwise the output is "0".	
Inverted Exclusive OR (NXOR)	Logic gate has 4 inputs. The output is "0" if only one input is "1". Otherwise the output is "1".	
AND with feedback (ANDR)	Logic gate has 4 inputs. The output is fed back to the first input of the gate. The output is "1" if all inputs are "1". Otherwise the output is "0". If input 1 is set to "1" and the output is still "0", the feedback of input 1 is also reset to "0". Only when	

Logic gate	Description	Icon
	inputs 2 ... 4 are "1" will a newly received "1" at input 1 cause the output to assume the logical state "1". Application: Switch light manually only at twilight -> Switch on input 1, twilight sensor on input 2 -> The manual switching signal is ignored for as long as the twilight sensor has not issued an enabling signal. The manual switching sign is only executed at twilight.	

Inputs of a logic gate can be activated or deactivated separately. This allows gates with an individual number of inputs (1 ... 4) to be implemented. As an option, it is possible to invert inputs.

The transmission behaviour of the gate output can be configured.

11.2.1 Logic gate parameters

Logic functions -> Logic function...

Selection logic gate	Invert (NOT) **AND (AND)** OR (OR) Exclusive OR (XOR) Inverted AND (NAND) Inverted OR (NOR) Inverted Exclusive OR (NXOR) AND with feedback (ANDR)
This parameter defines the function of the logic gate and is only visible if "Type of logic function = logic gate". Invert (NOT): The inverter is configured. The gate has one input and one output. The Boolean data value of the input is forwarded to the output inverted. And (AND): An AND gate is configured. The gate has 1...4 inputs and one output. The inputs are logically AND-linked. The result is forwarded to the output. OR (OR): An OR gate is configured. The gate has 1...4 inputs and one output. The inputs are logically OR-linked. The result is forwarded to the output. Exclusive-OR (XOR): An exclusive-OR gate is configured. The gate has 1...4 inputs and one output. The inputs are logically Exclusive-OR-linked. The result is forwarded to the output. Inverted AND (NAND): An AND gate is configured. The gate has 1...4 inputs and one output. The inputs are logically AND-linked. The result is forwarded to the output inverted. Inverted OR (NOR): An OR gate is configured. The gate has 1...4 inputs and one output. The inputs are logically OR-linked. The result is forwarded to the output inverted. Inverted Exclusive OR (NXOR): An inverted Exclusive OR gate is configured. The gate has 1...4 inputs and one output. The inputs are logically Exclusive-OR-linked. The result is forwarded to the output inverted. AND with feedback (ANDR): An AND gate with feedback is configured. The gate has 1...4 inputs and one output. The output is fed back to the first input of the gate.	

Input 1	deactivated **Input object**
Inputs of a logic gate can be activated or deactivated separately. This allows gates with an individual number of inputs (1 ... 4) to be implemented. This parameter defines whether the first input of the gate should be used. This parameter is only visible if "Type of logic function = logic gate".	

Input 2	deactivated **Input object**

Inputs of a logic gate can be activated or deactivated separately. This allows gates with an individual number of inputs (1 ... 4) to be implemented. This parameter defines whether the second input of the gate should be used.

This parameter is only visible if "Type of logic function = logic gate".

Input 3	**deactivated** Input object

Inputs of a logic gate can be activated or deactivated separately. This allows gates with an individual number of inputs (1 ... 4) to be implemented. This parameter defines whether the third input of the gate should be used.

This parameter is only visible if "Type of logic function = logic gate".

Input 4	**deactivated** Input object

Inputs of a logic gate can be activated or deactivated separately. This allows gates with an individual number of inputs (1 ... 4) to be implemented. This parameter defines whether the fourth input of the gate should be used.

This parameter is only visible if "Type of logic function = logic gate".

Invert input	Checkbox (yes/**no**)

It is possible to invert inputs of the logic gate as an option. This parameter is available for each input of the gate and defines whether the respective input should be evaluated unchanged or inverted.

This parameter is only visible if "Type of logic function = logic gate".

Transmission criteria	**always transmit when the input is updated** transmit only if the output changes transmit cyclically

The transmission behaviour of the output can be configured here.

Always transmit when the input is updated: The output transmits the current object value to the KNX with every telegram that is received at the input.

Transmit only if the output changes: The output only transmits the current object value if the object value has changed compared to the last transmission process. During the first telegram to an input after bus voltage return or after an ETS programming operation, the output always transmits to an input.

Transmit cyclically: With this setting, the output transmits the current object value to the KNX cyclically. After bus voltage return or after an ETS programming operation, the cyclical transmission is only started once the first telegram has been received at the input. The output also transmits as soon as a new telegram is received at the input. At the same time, the cycle time for cyclical transmission is restarted!

Transmission delay for sending the hours result (0...99)	**0**...99
An optional delay before result transmission (telegram at output) can be configured. With the setting "always transmit when the input is updated": Telegrams at the output are only transmitted after the trigger when the delay has elapsed. The delay time is restarted by each telegram at the input. With the setting "only transmit if the output changes": Telegrams are only sent when the object value changes at the output if the delay has expired. If the logic function is reprocessed by a new telegram at the input within the delay time and the object value changes again, then the delay restarts. If the object value of the output does not change due to new input telegrams, the delay does not restart. This parameter defines the hours of the delay time.	

Minutes (0...59)	**0**...59
This parameter defines the minutes of the delay time.	

Seconds (0...59)	**0**...59
This parameter defines the seconds of the delay time. The parameters for the transmission delay are only visible for "Transmission criteria" = "Always transmit when the input is updated" and "Only transmit when the output changes".	

Cycle time hours (0...99)	**0**...99
During cyclical transmission of the output, this parameter defines the cycle time. Setting the cycle time hours.	

Minutes (0...59)	0...**5**...59
This parameter defines the minutes of the cycle time.	

Seconds (0...59)	**0**...59
This parameter defines the seconds of the cycle time. The parameters for the cycle time are only visible if "transmission criteria" = "transmit cyclically".	

11.2.2 Logic gate object list

<table>
<tr><th>Object no.</th><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>1294,
1298 ...</td><td>Logic gate...
Input 1</td><td>Logic... - Input</td><td>1-bit</td><td>1,002</td><td>C, -, W, -, U</td></tr>
<tr><td colspan="6">1-bit object as input 1 of a logic gate (1...8). The input status can be inverted optionally.
This object is only available if the type of logic function is configured to "logic gate" and input 1 is used.</td></tr>
</table>

<table>
<tr><th>Object no.</th><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>1295,
1299 ...</td><td>Logic gate...
Input 2</td><td>Logic... - Input</td><td>1-bit</td><td>1,002</td><td>C, -, W, -, U</td></tr>
<tr><td colspan="6">1-bit object as input 2 of a logic gate (1...8). The input status can be inverted optionally.
This object is only available if the type of logic function is configured to "logic gate" and input 2 is used.</td></tr>
</table>

<table>
<tr><th>Object no.</th><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>1296,
1300 ...</td><td>Logic gate...
Input 3</td><td>Logic... - Input</td><td>1-bit</td><td>1,002</td><td>C, -, W, -, U</td></tr>
<tr><td colspan="6">1-bit object as input 3 of a logic gate (1...8). The input status can be inverted optionally.
This object is only available if the type of logic function is configured to "logic gate" and input 3 is used.</td></tr>
</table>

<table>
<tr><th>Object no.</th><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>1297,
1301 ...</td><td>Logic gate...
Input 4</td><td>Logic... - Input</td><td>1-bit</td><td>1,002</td><td>C, -, W, -, U</td></tr>
<tr><td colspan="6">1-bit object as input 4 of a logic gate (1...8). The input status can be inverted optionally.
This object is only available if the type of logic function is configured to "logic gate" and input 4 is used.</td></tr>
</table>

<table>
<tr><th>Object no.</th><th>Function</th><th>Name</th><th>Type</th><th>DPT</th><th>Flag</th></tr>
<tr><td>1382,
1384 ...</td><td>Logic gate output</td><td>Logic... - Output</td><td>1-bit</td><td>1,002</td><td>C, R, -, T, A</td></tr>
<tr><td colspan="6">1-bit object as output of a logic gate (1...8).
This object is only available if the type of logic function is configured to "logic gate".</td></tr>
</table>

11.3 Converter (1-bit -> 1-byte)

The converter has a 1-bit input and a 1-byte output and also a disabling object. ON / OFF telegrams can be converted to preconfigured values. The disabling object is able to deactivate the converter.

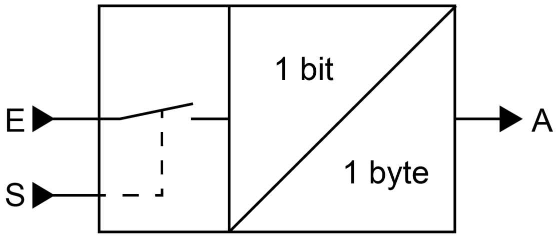


Figure 45: Converter (1-bit -> 1-byte)

The converter can react differently to input states. The parameter "Reaction at input to" defines whether the converter responds to ON and OFF commands or alternatively only processes ON or OFF telegrams.
A concrete 1-byte output value can be assigned to each 1-bit input status. The two output values can be configured anywhere in the range 0 ... 255 as required. The data format of the converter output object is set to DPT 5.001 (0...100%).

The disabling object can be deactivated via the converter. A deactivated converter no longer processes input states and consequently does not convert any new output values (the last value is retained and transmitted cyclically, if necessary). At the end of a disabling function, the converter is enabled again. The converter then waits for the next telegram at the input.
The telegram polarity of the disabling object can be configured.

The transmission behaviour of the converter output can be configured.

11.3.1 Converter parameters

Logic functions -> Logic function...

Reaction at input to	**ON and OFF telegrams** ON telegrams OFF telegrams
The converter can react differently to input states. It is defined here whether the converter responds to ON and OFF commands or alternatively only processes ON or OFF telegrams.	

Polarity of the disabling object	**0 = enabled / 1 = disabled** 0 =disabled/ 1 = enabled
This parameter defines the polarity of the disabling object.	

Output value for ON (0...255)	0...**255**
A concrete 1-byte output value can be assigned to each 1-bit input status. This parameter defines the output value for ON telegrams. This parameter is only visible when the input should react to ON telegrams.	

Output value for OFF (0...255)	**0**...255
A concrete 1-byte output value can be assigned to each 1-bit input status. This parameter defines the output value for OFF telegrams. This parameter is only visible when the input should react to OFF telegrams.	

Transmission criteria	**always transmit when the input is updated** transmit only if the output changes transmit cyclically
The transmission behaviour of the output can be configured here. Always transmit when the input is updated: The output transmits the current object value to the KNX with every telegram that is received at the input. Transmit only if the output changes: The output only transmits the current object value if the object value has changed compared to the last transmission process. During the first telegram to an input after bus voltage return or after an ETS programming operation, the output always transmits to an input. Transmit cyclically: With this setting, the output transmits the current object value to the KNX cyclically. After bus voltage return or after an ETS programming operation, the cyclical transmission is only started once the first telegram has been received at the input. The output also transmits as soon as a new telegram is received at the input. At the same time, the cycle time for cyclical transmission is restarted!	

Transmission delay for sending the hours result (0...99)	**0**...99
An optional delay before result transmission (telegram at output) can be configured. With the setting "always transmit when the input is updated": Telegrams at the output are only transmitted after the trigger when the delay has elapsed. The delay time is restarted by each telegram at the input. With the setting "only transmit if the output changes": Telegrams are only sent when the object value changes at the output if the delay has expired. If the logic function is reprocessed by a new telegram at the input within the delay time and the object value changes again, then the delay restarts. If the object value of the output does not change due to new input telegrams, the delay does not restart. This parameter defines the hours of the delay time.	

Minutes (0...59)	**0**...59
This parameter defines the minutes of the delay time.	

Seconds (0...59)	**0**...59
This parameter defines the seconds of the delay time. The parameters for the transmission delay are only visible for "Transmission criteria" = "Always transmit when the input is updated" and "Only transmit when the output changes".	

Cycle time hours (0...99)	**0**...99
During cyclical transmission of the output, this parameter defines the cycle time. Setting the cycle time hours.	

Minutes (0...59)	0...**5**...59
This parameter defines the minutes of the cycle time.	

Seconds (0...59)	**0**...59
This parameter defines the seconds of the cycle time. The parameters for the cycle time are only visible if "transmission criteria" = "transmit cyclically".	

11.3.2 Converter object list

Object no.	Function	Name	Type	DPT	Flag
970, 974, 978, 982, 986, 990, 994, 998	Converter Input	Logic... - Input	1-bit	1,002	C, (R), W, -, A
1-bit object as input of a converter. It is possible to configure whether the converter responds to ON and OFF commands or alternatively processes only ON or only OFF telegrams. This object is only available if the type of logic function is configured to "converter".					

Object no.	Function	Name	Type	DPT	Flag
971, 975, 979, 983, 987, 991, 995, 999	Converter Disabling function	Logic... - Input	1-bit	1,002	C, (R), W, -, A
1-bit object as disabling input of a converter. A disabled converter no longer processes input states and consequently does not convert any new output values (the last value is retained and transmitted cyclically, if necessary). The telegram polarity can be configured. This object is only available if the type of logic function is configured to "converter".					

Object no.	Function	Name	Type	DPT	Flag
1106, 1107, 1108, 1109, 1110, 1111, 1112, 1113	Converter Output	Logic... - Output	1-byte	5,001	C, (R), -, T, A
1-byte object as value output of a converter. This object is only available if the type of logic function is configured to "converter".					

11.4 Disabling element (Filtering/Time)

The disabling element has a 1-bit input and a 1-bit output as well as a disabling object. Input states (ON/OFF) can be delayed independently of one another and filtered at the output before output. The filter makes it possible to invert the states of the output (e.g. ON -> OFF) or to suppress it completely
(e.g. OFF -> ---, OFF is not transmitted). If the filter is not used, the disabling element only works with the time functions if required. Alternatively, it is possible to use only the filter (without delays).
The disabling object is able to deactivate the disabling element.

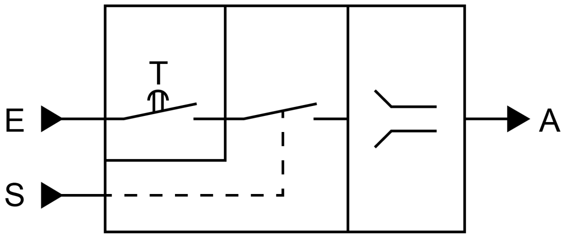


Figure 46: Disabling element (Filtering/Time)

The parameter "Time function" defines whether ON or OFF telegrams or both states are evaluated with a delay after reception at the input. If a delay is provided, the delay time can be configured separately for ON and OFF telegrams. A delay is only effective if the delay time is set to greater than "0". Each telegram received at the input re-triggers the receptive delay time.
If no delay is configured, the input telegrams go directly into the filter.

ℹ Special feature when using the delays: If no telegram is received at the input, a configured delay time (time > 0) acts like an automatic cyclic trigger of the filter. The most recently received input status is then forwarded to the filter automatically and repeatedly after the delay has elapsed. This then works according to its configuration and forwards the result to the output of the disabling element. Consequently, the output then also transmits telegrams depending on the transmission criteria set. If the cyclical transmission of the output is not desired due to the automatic triggering of the filter, the transmission criterion should be set to "only transmit if the output changes".
If no delay is provided, the filter is only triggered automatically via the received telegrams and thus not automatically.

ℹ After bus voltage return or after an ETS programming operation, the delays are triggered automatically.

The filter is set by the parameter "Filter function" according to the following table.

Filter function	Result
ON -> ON / OFF -> OFF	Input telegrams are forwarded to the output unchanged. Filter deactivated.
ON -> --- / OFF -> OFF	ON telegrams are filtered and not forwarded to the output. OFF telegrams are forwarded to the output unchanged.

Filter function	Result
ON -> ON / OFF -> ---	OFF telegrams are filtered and not forwarded to the output. ON telegrams are forwarded to the output unchanged.
ON -> OFF / OFF -> ON	ON telegrams are converted to OFF telegrams and OFF telegrams are converted to ON telegrams and are forwarded to the output.
ON -> --- / OFF -> ON	ON telegrams are filtered and not forwarded to the output. OFF telegrams are converted to ON telegrams and forwarded to the output.
ON -> OFF / OFF -> ---	OFF telegrams are filtered and not forwarded to the output. ON telegrams are converted to OFF telegrams and forwarded to the output.

The disabling element can be deactivated by the disabling object. A deactivated disabling element no longer forwards any input states to the filter and consequently does not convert any new output values (the last value is retained and transmitted cyclically, if necessary). However, the input states are still evaluated (even with effective delays). At the end of a disabling function, the disabling element is enabled again. The disabling element waits for the next telegram at the input or for the next cycle of the configured delay times.
The telegram polarity of the disabling object can be configured.

The transmission behaviour of the disabling element output can be configured.

11.4.1 Disabling element parameters

Logic functions -> Logic function...

Time function	**no delay** Delay only ON telegrams Delay only OFF telegrams Delay ON and OFF telegrams

This parameter defines whether ON or OFF telegrams or both states are evaluated with a delay after reception at the input. If a delay is provided, the delay time can be configured separately for ON and OFF telegrams. If no delay is configured, the input telegrams go directly into the filter.

Delay for ON telegrams Minutes (0...59)	**0**...59

The delay for ON telegrams is configured here. A delay is only effective if the delay time is set to greater than "0". Each ON telegram received at the input re-triggers the delay time.

Special feature when using the delays: If no telegram is received at the input, a configured delay time (time > 0) acts like an automatic cyclic trigger of the filter. The most recently received input status is then forwarded to the filter automatically and repeatedly after the delay has elapsed. This then works according to its configuration and forwards the result to the output of the disabling element. Consequently, the output then also transmits telegrams depending on the transmission criteria set. If the cyclical transmission of the output is not desired due to the automatic triggering of the filter, the transmission criterion should be set to "only transmit if the output changes".
After bus voltage return or after an ETS programming operation, the delays are triggered automatically.

Setting the ON delay time minutes.

Seconds (0...59)	0...**10**...59

Setting the seconds of the ON delay time.

The parameters for the ON delay are only available if the parameter "Time function" is set to "only delay ON telegrams" or "delay ON and OFF telegrams".

Delay for OFF telegrams Minutes (0...59)	**0**...59
The delay for OFF telegrams is configured here. A delay is only effective if the delay time is set to greater than "0". Each OFF telegram received at the input re-triggers the delay time. Special feature when using the delays: If no telegram is received at the input, a configured delay time (time > 0) acts like an automatic cyclic trigger of the filter. The most recently received input status is then forwarded to the filter automatically and repeatedly after the delay has elapsed. This then works according to its configuration and forwards the result to the output of the disabling element. Consequently, the output then also transmits telegrams depending on the transmission criteria set. If the cyclical transmission of the output is not desired due to the automatic triggering of the filter, the transmission criterion should be set to "only transmit if the output changes". After bus voltage return or after an ETS programming operation, the delays are triggered automatically. Setting the OFF delay time minutes.	

Seconds (0...59)	0...**10**...59
Setting the OFF delay time seconds. The parameters for the OFF delay are only available if the parameter "Time function" is set to "only delay OFF telegrams" or "delay ON and OFF telegrams".	

Polarity of the disabling object	**0 = enabled / 1 = disabled** 0 =disabled/ 1 = enabled
This parameter defines the polarity of the disabling object.	

Filter function	ON -> ON / OFF -> OFF ON -> --- / OFF -> OFF ON -> ON / OFF -> --- ON -> OFF / OFF -> ON ON -> --- / OFF -> ON ON -> OFF / OFF -> ---
This parameter defines the function of the filter. ON -> ON / OFF -> OFF: Input telegrams are forwarded to the output unchanged. Filter deactivated. ON -> --- / OFF -> OFF: ON telegrams are filtered and not forwarded to the output. OFF telegrams are forwarded to the output unchanged. ON -> ON / OFF -> ---: OFF telegrams are filtered and not forwarded to the output. ON telegrams are forwarded to the output unchanged. ON -> OFF / OFF -> ON: ON telegrams are converted to OFF telegrams and OFF telegrams are converted to ON telegrams and forwarded to the output. ON -> --- / OFF -> ON: ON telegrams are filtered and not forwarded to the output. OFF telegrams are converted to ON telegrams and forwarded to the output. ON -> OFF / OFF -> ---: OFF telegrams are filtered and not forwarded to the output. ON telegrams are converted to OFF telegrams and forwarded to the output.	

Transmission criteria	**always transmit when the input is updated** transmit only if the output changes transmit cyclically
The transmission behaviour of the output can be configured here. Always transmit when the input is updated: The output transmits the current object value to the KNX with every telegram that is received at the input. In addition, transmission at the output is repeated if no telegram was received at the input when the delay times were used and the configured time has expired. Transmit only if the output changes: The output only transmits the current object value if the object value has changed compared to the last transmission process. After bus voltage return or an ETS programming operation, the output always transmits. Transmit cyclically: With this setting, the output transmits the current object value to the KNX cyclically. After bus voltage return or after an ETS programming operation, the cyclical transmission is only started once the first telegram has been received at the input. If the ON / OFF delay is used, after bus voltage return or after an ETS programming, operation cyclical transmission starts automatically once the delay time has expired. The output also transmits as soon as a new telegram is received at the input. At the same time, the cycle time for cyclical transmission is restarted!	

Cycle time hours (0...99)	**0**...99
During cyclical transmission of the output, this parameter defines the cycle time. Setting the cycle time hours.	

Minutes (0...59)	0...**5**...59
This parameter defines the minutes of the cycle time.	

Seconds (0...59)	**0**...59
This parameter defines the seconds of the cycle time. The parameters for the cycle time are only visible if "transmission criteria" = "transmit cyclically".	

11.4.2 Disabling element object list

Object no.	Function	Name	Type	DPT	Flag
970, 974, 978, 982, 986, 990, 994, 998	Disabling element Input	Logic... - Input	1-bit	1,002	C, (R), W, -, A
1-bit object as input of a disabling element. This object is only available if the type of logic function is configured to "disabling element".					

Object no.	Function	Name	Type	DPT	Flag
971, 975, 979, 983, 987, 991, 995, 999	Disabling element Disabling function	Logic... - Input	1-bit	1,002	C, (R), W, -, A
1-bit object as disabling input of a disabling element. A disabled disabling element no longer forwards any input states to the filter and consequently does not convert any new output values (the last value is retained and transmitted cyclically, if necessary). The telegram polarity can be configured. This object is only available if the type of logic function is configured to "disabling element".					

Object no.	Function	Name	Type	DPT	Flag
1058, 1060, 1062, 1064, 1066, 1068, 1070, 1072	Disabling element Output	Logic... - Output	1-bit	1,002	C, (R), -, T, A
1-bit object as output of a disabling element. This object is only available if the type of logic function is configured to "disabling element".					

11.5 Comparator

The comparator works with an input whose data format can be parameterised, and with a 1-bit output to output the result of the comparison operation. The comparator compares the value received at the input with a configured reference value and evaluates whether the reference is correct (result = true) or not (result = false) according to the specified reference function.
The reference function and the reference value are configured in the ETS.

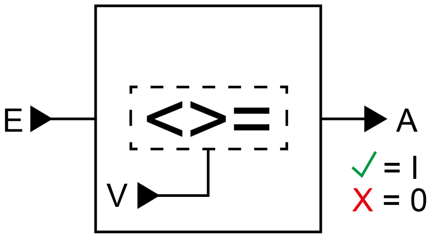


Figure 47: Comparator

The parameter "data format" defines the size and format of input object according to the following table. The output object is preset to 1-bit (DPT 1.002) and outputs the result of the comparison operation (ON = true / OFF = false). The reference value that can be set in the ETS adapts to the input data format.

Data format	KNX DPT
4-bit dimming	3.007
1-byte operating mode switchover	20,102
1-byte scene extension	18.001
1-byte value 0...255	5.010
1-byte brightness value 0...100%	5.001
2-byte value 0...655535	7.001
2-byte value -32768...32767	8.001
2-byte floating-point number	9.0xx
4-byte value -2147483648...2147483647	13.001

The following table shows the possible reference functions (I = input value, R = reference value).

Reference function	Function
equal (E = V)	The comparator output is "ON" (true) if the input is equal to the reference value. Otherwise the output is "OFF" (false).
unequal (E ≠ V)	The comparator output is "ON" (true) if the input is unequal to the reference value. If the input value is equal to the reference value, the output is "OFF" (false).
greater than (E > V)	The comparator output is "ON" (true) if the input is greater than the reference value. If the input value is less than or equal to the reference value, the output switches "OFF" (false).

Reference function	Function
greater than or equal to (E ≥ V)	The comparator output is "ON" (true) if the input is greater than the reference value or equal to the reference value. If the input value is less than the reference value, the output switches "OFF" (false).
less than (E < V)	The comparator output is "ON" (true) if the input is less than the reference value. If the input value is greater than or equal to the reference value, the output switches "OFF" (false).
less than or equal to (E ≤ V)	The comparator output is "ON" (true) if the input is less than the reference value or equal to the reference value. If the input value is greater than the reference value, the output switches "OFF" (false).
Range testing less than (V1 < E < V2)	There are two reference values. The comparator output is "ON" (true) if the input is greater than the first reference value or less than the second reference value. If the input value is less than the first reference value or equal to the first reference value or greater than the second reference value or equal to the second reference value, the output switches "OFF" (wrong).
Range testing less than or equal to (V1 ≤ E ≤ V2)	There are two reference values. The comparator output is "ON" (true) if the input is greater than or equal to the first reference value and less than or equal to the second reference value. If the input value is less than the first reference value or greater than the second reference value, the output switches "OFF" (false).

The transmission behaviour of the comparator output can be configured.

11.5.1 Comparator parameters

Logic functions -> Logic function...

Data format	4-bit dimming (DPT 3.007) 1-byte operating mode switchover (DPT 20.102) 1-byte scene extension (DPT 18.001) **1-byte value 0...255 (DPT 5.010)** 1-byte brightness value 0...100% (DPT 5.001) 2-byte value 0...655535 (DPT 7.001) 2-byte value -32768...32767 (DPT 8.001) 2-byte floating-point number (DPT 9.0xx) 4-byte value -2147483648...2147483647 (DPT 13.001)
This parameter defines the size and format of input object. The output object is preset to 1-bit (DPT 1.002) and outputs the result of the comparison operation (ON = true / OFF = false).	

Reference function	**equal (E = V)** unequal (E ≠ V) greater than (E > V) greater than or equal to (E ≥ V) less than (E < V) less than or equal to (E ≤ V) Range testing less than (V1 < E < V2) Range testing less than or equal to (V1 ≤ E ≤ V2)

The comparator compares the value received (I) at the input with a configured reference value (R) and evaluates whether the comparison is correct (result = true) or not (result = false) according to the specified reference function here.

equal (E = V): The comparator output is "ON" (true) if the input is equal to the reference value. Otherwise the output is "OFF" (false).

unequal (E ≠ V): The comparator output is "ON" (true) if the input is unequal to the reference value. If the input value is equal to the reference value, the output is "OFF" (false).

greater than (E > V): The comparator output is "ON" (true) if the input is greater than the reference value. If the input value is less than or equal to the reference value, the output switches "OFF" (false).

greater than or equal to (E ≥ V): The comparator output is "ON" (true) if the input is greater than the reference value or equal to the reference value. If the input value is less than the reference value, the output switches "OFF" (false).

less than (E < V): The comparator output is "ON" (true) if the input is less than the reference value. If the input value is greater than or equal to the reference value, the output switches "OFF" (false).

less than or equal to (E ≤ V): The comparator output is "ON" (true) if the input is less than the reference value or equal to the reference value. If the input value is greater than the reference value, the output switches "OFF" (false).

Range testing less than (V1 < E < V2): There are two reference values. The comparator output is "ON" (true) if the input is greater than the first reference value or less than the second reference value. If the input value is less than the first reference value or equal to the first reference value or greater than the second reference value or equal to the second reference value, the output switches "OFF" (wrong).

Range testing less than or equal to (V1 ≤ E ≤ V2): There are two reference values. The comparator output is "ON" (true) if the input is greater than or equal to the first reference value and less than or equal to the second reference value. If the input value is less than the first reference value or greater than the second reference value, the output switches "OFF" (false).

Reference value (V)	**dimming darker, stop (0)** dimming darker, 100% (1) dimming darker, 50% (2) dimming darker, 25% (3) dimming darker, 12.5% (4) dimming darker, 6% (5) dimming darker, 3% (6) dimming darker, 1.5% (7) increase brightness, stop (8) increase brightness, 100% (9) increase brightness, 50% (10) increase brightness, 25% (11) increase brightness, 12.5% (12) increase brightness, 6% (13) increase brightness, 3% (14) increase brightness, 1.5% (15)
This parameter specifies the internal reference value (R) for the reference function. This parameter is only available if the "data format" is set to "4-bit dimming (DPT 3.007)".	

Reference value (V)	**Automatic (0)** Comfort mode (1) Standby mode (2) Night mode (3) Frost/heat protection (4)
This parameter specifies the internal reference value (R) for the reference function. This parameter is only available if the "data format" is set to "1-byte operating mode switchover (DPT 20.102)".	

Reference value (V)	**Recall scene 1 (0)** Recall scene 2 (1) ... Recall scene 64 (63) Save scene 1 (128) Save scene 2 (129) ... Save scene 64 (191)
This parameter specifies the internal reference value (R) for the reference function. This parameter is only available if the "data format" is set to "1-byte scene extension (DPT 18.001)".	

Reference value (V) (0...255)	**0**...255
This parameter specifies the internal reference value (R) for the reference function. This parameter is only available if the "data format" is set to "1-byte value -0...255 (DPT 5.010)".	

Reference value (V) (0...100%)	**0**...100
This parameter specifies the internal reference value (R) for the reference function. This parameter is only available if the "data format" is set to "1-byte brightness value 0...100% (DPT 5.001)".	

Reference value (V) (0...65535)	**0**...65535
This parameter specifies the internal reference value (R) for the reference function. This parameter is only available if the "data format" is set to "2-byte value 0...65535 (DPT 7.001)".	

Reference value (V) (-32768...32767)	-32768...**0**...32767
This parameter specifies the internal reference value (R) for the reference function. This parameter is only available if the "data format" is set to "2-byte value -32768...32767 (DPT 8.001)".	

Reference value (V) (-671088...670760)	-671088...**0**...670760
This parameter specifies the internal reference value (R) for the reference function. This parameter is only available if the "data format" is set to "2-byte floating point value (DPT 9.0xx)".	

Reference value (V) (-2147483648...2147483647)	-2147483648...**0**...2147483647
This parameter specifies the internal reference value (R) for the reference function. This parameter is only available if the "data format" is set to "4-byte value -2147483648...2147483647 (DPT 13.001)".	

Two reference values (R1 & R2) can be configured if the range testing is configure as "reference function". In this case, the setting options are identical.

Transmission criteria	**always transmit when the input is updated** transmit only if the output changes transmit cyclically

The transmission behaviour of the output can be configured here.

Always transmit when the input is updated: The output transmits the current object value to the KNX with every telegram that is received at the input.

Transmit only if the output changes: The output only transmits the current object value if the object value has changed compared to the last transmission process. During the first telegram to an input after bus voltage return or after an ETS programming operation, the output always transmits to an input.

Transmit cyclically: With this setting, the output transmits the current object value to the KNX cyclically. After bus voltage return or after an ETS programming operation, the cyclical transmission is only started once the first telegram has been received at the input. The output also transmits as soon as a new telegram is received at the input. At the same time, the cycle time for cyclical transmission is restarted!

Transmission delay for sending the hours result (0...99)	**0**...99

An optional delay before result transmission (telegram at output) can be configured.

With the setting "always transmit when the input is updated": Telegrams at the output are only transmitted after the trigger when the delay has elapsed. The delay time is restarted by each telegram at the input.

With the setting "only transmit if the output changes": Telegrams are only sent when the object value changes at the output if the delay has expired. If the logic function is reprocessed by a new telegram at the input within the delay time and the object value changes again, then the delay restarts. If the object value of the output does not change due to new input telegrams, the delay does not restart.

This parameter defines the hours of the delay time.

Minutes (0...59)	**0**...59

This parameter defines the minutes of the delay time.

Seconds (0...59)	**0**...59

This parameter defines the seconds of the delay time.

The parameters for the transmission delay are only visible for "Transmission criteria" = "Always transmit when the input is updated" and "Only transmit when the output changes".

Cycle time hours (0...99)	**0**...99

During cyclical transmission of the output, this parameter defines the cycle time.

Setting the cycle time hours.

Minutes (0...59)	0...**5**...59

This parameter defines the minutes of the cycle time.

Seconds (0...59)	0...59
This parameter defines the seconds of the cycle time. The parameters for the cycle time are only visible if "transmission criteria" = "transmit cyclically".	

11.5.2 Comparator object list

Object no.	Function	Name	Type	DPT	Flag
1002, 1003, 1004, 1005, 1006, 1007, 1008, 1009	Comparator Input	Logic... - Input	4-bit	3,007	C, (R), W, -, A
4-bit object as input of a comparator. This object is only available if the type of logic function is configured to "comparator" and the data format is configured to "4-bit dimming (DPT 3.007)".					

Object no.	Function	Name	Type	DPT	Flag
1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025	Comparator Input	Logic... - Input	1-byte	20,102	C, (R), W, -, A
1-byte object as input of a comparator. This object is only available if the type of logic function is configured to "comparator" and the data format is configured to "1-byte operating mode switchover (DPT 20.102)".					

Object no.	Function	Name	Type	DPT	Flag
1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025	Comparator Input	Logic... - Input	1-byte	18,001	C, (R), W, -, A
1-byte object as input of a comparator. This object is only available if the type of logic function is configured to "comparator" and the data format is configured to "1-byte scene extension (DPT 18.001)".					

Object no.	Function	Name	Type	DPT	Flag
1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025	Comparator Input	Logic... - Input	1-byte	5,010	C, (R), W, -, A
1-byte object as input of a comparator. This object is only available if the type of logic function is configured to "comparator" and the data format is configured to "1-byte value 0...255 (DPT 5.010)".					

Object no.	Function	Name	Type	DPT	Flag
1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025	Comparator Input	Logic... - Input	1-byte	5,001	C, (R), W, -, A
1-byte object as input of a comparator. This object is only available if the type of logic function is configured to "comparator" and the data format is configured to "1-byte brightness value 0...100% (DPT 5.001)".					

Object no.	Function	Name	Type	DPT	Flag
1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041	Comparator Input	Logic... - Input	2-byte	7,001	C, (R), W, -, A
2-byte object as input of a comparator. This object is only available if the type of logic function is configured to "comparator" and the data format is configured to "2-byte value 0...65535 (DPT 7.001)".					

Object no.	Function	Name	Type	DPT	Flag
1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041	Comparator Input	Logic... - Input	2-byte	8,001	C, (R), W, -, A
2-byte object as input of a comparator. This object is only available if the type of logic function is configured to "comparator" and the data format is configured to "2-byte value -32768...32767 (DPT 8.001)".					

Object no.	Function	Name	Type	DPT	Flag
1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041	Comparator Input	Logic... - Input	2-byte	9,xxx	C, (R), W, -, A
2-byte object as input of a comparator. This object is only available if the type of logic function is configured to "comparator" and the data format is configured to "2-byte floating point value (DPT 9.0xx)".					

Object no.	Function	Name	Type	DPT	Flag
1050, 1051, 1052, 1053, 1054, 1055, 1056, 1057	Comparator Input	Logic... - Input	4-byte	13,001	C, (R), W, -, A
4-byte object as input of a comparator. This object is only available if the type of logic function is configured to "comparator" and the data format is configured to "4-byte value -2147483648...2147483647 (DPT 13.001)".					

Object no.	Function	Name	Type	DPT	Flag
1058, 1060, 1062, 1064, 1066, 1068, 1070, 1072	Comparator Output	Logic... - Output	1-bit	1,002	C, (R), -, T, A
1-bit object as output of a comparator. The output object is preset to 1-bit (DPT 1.002) and outputs the result of the comparison operation (ON = true / OFF = false). This object is only available if the type of logic function is configured to "comparator".					

11.6 Limit value switch

The limit value switch works with an input whose data format can be configured, and with a 1-bit output to output the result of the threshold evaluation. The limit value switch compares the value received at the input with two configurable hysteresis threshold values. Once the upper threshold value (H2) is reached or exceeded, the output can transmit a switching telegram (e.g. ON = true). If the value falls below the lower threshold value (H1), the output can transmit another switching telegram (e.g. OFF = false).
The switching telegrams can always be configured in the ETS when the threshold values are exceeded and undershot.

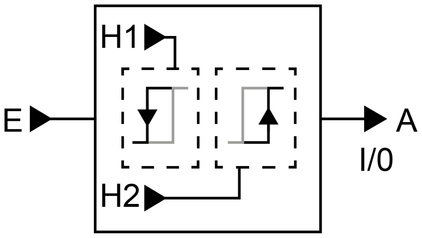


Figure 48: Limit value switch

The two threshold values define a hysteresis. The hysteresis prevents frequent switching back and forth of the output, provided that the input value changes continuously in small intervals. Only when the change in value at the input exceeds the hysteresis as a whole, does the output switch the status.

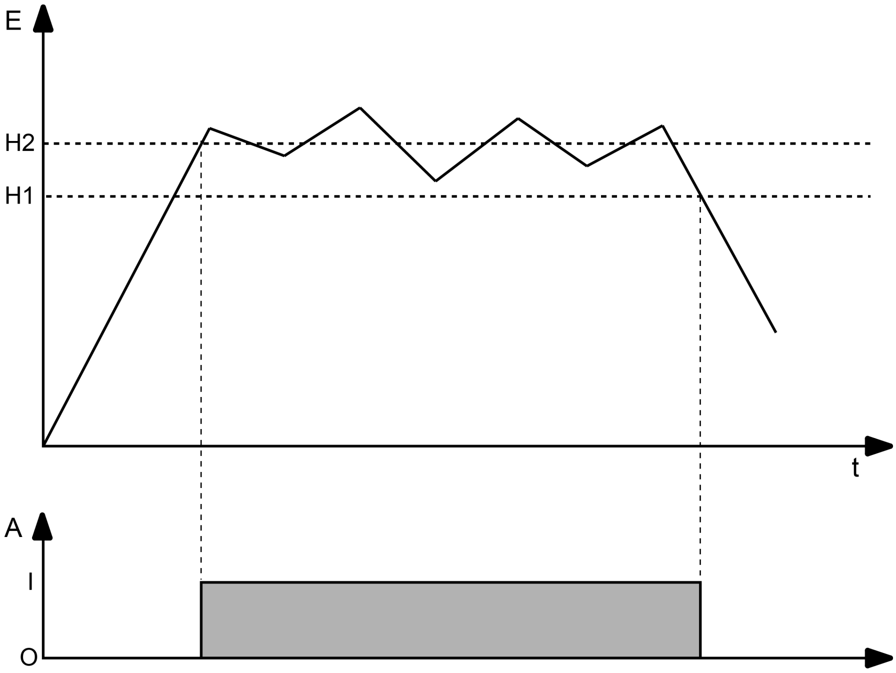


Figure 49: Example of a hysteresis evaluation by upper and lower threshold value

ℹ The two threshold values can be freely configured in the ETS. Make sure that the upper threshold value is greater than the lower one!

i After bus voltage return or after an ETS programming operation, the output always transmits a telegram when the first value has been received at the input. The telegram depends on whether the value reaches or exceeds the upper threshold (H2) or not. If the value is less than the upper threshold, a telegram is transmitted in accordance with "Telegram upon not reaching the lower threshold". Otherwise the output transmits the "telegram on exceeding the upper threshold value".

The parameter "data format" defines the size and format of input object according to the following table. The output object is preset to 1-bit (DPT 1.002) and outputs the result of the threshold evaluation (ON = true / OFF = false). The threshold values that can be set in the ETS adapt to the input data format.

Data format	KNX DPT
4-bit dimming	3.007
1-byte operating mode switchover	20.102
1-byte scene extension	18.001
1-byte value 0...255	5.010
1-byte brightness value 0...100%	5.001
2-byte value 0...655535	7.001
2-byte value -32768...32767	8.001
2-byte floating-point number	9.0xx
4-byte value -2147483648...2147483647	13.001

The transmission behaviour of the limit value switch can be configured.

11.6.1 Limit value switch parameters

Logic functions -> Logic function...

Data format	4-bit dimming (DPT 3.007) 1-byte operating mode switchover (DPT 20.102) 1-byte scene extension (DPT 18.001) **1-byte value 0...255 (DPT 5.010)** 1-byte brightness value 0...100% (DPT 5.001) 2-byte value 0...655535 (DPT 7.001) 2-byte value -32768...32767 (DPT 8.001) 2-byte floating-point number (DPT 9.0xx) 4-byte value -2147483648...2147483647 (DPT 13.001)
This parameter defines the size and format of input object. The output object is preset to 1-bit (DPT 1.002) and outputs the result of the threshold evaluation (ON = true / OFF = false).	

Lower threshold value (H1)	**dimming darker, stop (0)** dimming darker, 100% (1) dimming darker, 50% (2) dimming darker, 25% (3) dimming darker, 12.5% (4) dimming darker, 6% (5) dimming darker, 3% (6) dimming darker, 1.5% (7) increase brightness, stop (8) increase brightness, 100% (9) increase brightness, 50% (10) increase brightness, 25% (11) increase brightness, 12.5% (12) increase brightness, 6% (13) increase brightness, 3% (14) increase brightness, 1.5% (15)
This parameter defines the lower threshold value (H1) of the limit value switch. This parameter is only available if the "data format" is set to "4-bit dimming (DPT 3.007)".	

Lower threshold value (H1)	**Automatic (0)** Comfort mode (1) Standby mode (2) Night mode (3) Frost/heat protection (4)
This parameter defines the lower threshold value (H1) of the limit value switch. This parameter is only available if the "data format" is set to "1-byte operating mode switchover (DPT 20.102)".	

Lower threshold value (H1)	**Recall scene 1 (0)** Recall scene 2 (1) ... Recall scene 64 (63) Save scene 1 (128) Save scene 2 (129) ... Save scene 64 (191)
This parameter defines the lower threshold value (H1) of the limit value switch. This parameter is only available if the "data format" is set to "1-byte scene extension (DPT 18.001)".	

Lower threshold value (H1) (0...255)	**0**...255
This parameter defines the lower threshold value (H1) of the limit value switch. This parameter is only available if the "data format" is set to "1-byte value -0...255 (DPT 5.010)".	

Lower threshold value (H1) (0...100%)	**0**...100
This parameter defines the lower threshold value (H1) of the limit value switch. This parameter is only available if the "data format" is set to "1-byte brightness value 0...100% (DPT 5.001)".	

Lower threshold value (H1) (0...65535)	**0**...65535
This parameter defines the lower threshold value (H1) of the limit value switch. This parameter is only available if the "data format" is set to "2-byte value 0...65535 (DPT 7.001)".	

Lower threshold value (H1) (-32768...32767)	-32768...**0**...32767
This parameter defines the lower threshold value (H1) of the limit value switch. This parameter is only available if the "data format" is set to "2-byte value -32768...32767 (DPT 8.001)".	

Lower threshold value (H1) (-671088...670760)	-671088...**0**...670760
This parameter defines the lower threshold value (H1) of the limit value switch. This parameter is only available if the "data format" is set to "2-byte floating point value (DPT 9.0xx)".	

Lower threshold value (H1) (-2147483648...2147483647)	-2147483648...**0**...2147483647
This parameter defines the lower threshold value (H1) of the limit value switch. This parameter is only available if the "data format" is set to "4-byte value -2147483648...2147483647 (DPT 13.001)".	

Upper threshold value (H2)	**dimming darker, stop (0)** dimming darker, 100% (1) dimming darker, 50% (2) dimming darker, 25% (3) dimming darker, 12.5% (4) dimming darker, 6% (5) dimming darker, 3% (6) dimming darker, 1.5% (7) increase brightness, stop (8) increase brightness, 100% (9) increase brightness, 50% (10) increase brightness, 25% (11) increase brightness, 12.5% (12) increase brightness, 6% (13) increase brightness, 3% (14) increase brightness, 1.5% (15)
This parameter defines the upper threshold value (H2) of the limit value switch. This parameter is only available if the "data format" is set to "4-bit dimming (DPT 3.007)".	

Upper threshold value (H2)	**Automatic (0)** Comfort mode (1) Standby mode (2) Night mode (3) Frost/heat protection (4)
This parameter defines the upper threshold value (H2) of the limit value switch. This parameter is only available if the "data format" is set to "1-byte operating mode switchover (DPT 20.102)".	

Upper threshold value (H2)	**Recall scene 1 (0)** Recall scene 2 (1) ... Recall scene 64 (63) Save scene 1 (128) Save scene 2 (129) ... Save scene 64 (191)
This parameter defines the upper threshold value (H2) of the limit value switch. This parameter is only available if the "data format" is set to "1-byte scene extension (DPT 18.001)".	

Upper threshold value (H2) (0...255)	**0**...255
This parameter defines the upper threshold value (H2) of the limit value switch. This parameter is only available if the "data format" is set to "1-byte value -0...255 (DPT 5.010)".	

Upper threshold value (H2) (0...100%)	**0**...100
This parameter defines the upper threshold value (H2) of the limit value switch. This parameter is only available if the "data format" is set to "1-byte brightness value 0...100% (DPT 5.001)".	

Upper threshold value (H2) (0...65535)	**0**...65535
This parameter defines the upper threshold value (H2) of the limit value switch. This parameter is only available if the "data format" is set to "2-byte value 0...65535 (DPT 7.001)".	

Upper threshold value (H2) (-32768...32767)	-32768...**0**...32767
This parameter defines the upper threshold value (H2) of the limit value switch. This parameter is only available if the "data format" is set to "2-byte value -32768...32767 (DPT 8.001)".	

Upper threshold value (H2) (-671088...670760)	-671088...**0**...670760
This parameter defines the upper threshold value (H2) of the limit value switch. This parameter is only available if the "data format" is set to "2-byte floating point value (DPT 9.0xx)".	

Upper threshold value (H2) (-2147483648...2147483647)	-2147483648...**0**...2147483647
This parameter defines the upper threshold value (H2) of the limit value switch. This parameter is only available if the "data format" is set to "4-byte value -2147483648...2147483647 (DPT 13.001)".	

Telegram on reaching or exceeding the upper threshold value	**ON telegram** OFF telegram
The telegram of the output upon reaching or exceeding the upper threshold can be configured here.	

Telegram on falling below the lower threshold value	ON telegram **OFF telegram**
The telegram of the output upon not reaching the lower threshold can be configured here.	

Transmission criteria	**always transmit when the input is updated** transmit only if the output changes transmit cyclically
The transmission behaviour of the output can be configured here. Always transmit when the input is updated: The output transmits the current object value to the KNX with every telegram that is received at the input. Transmit only if the output changes: The output only transmits the current object value if the object value has changed compared to the last transmission process. During the first telegram to an input after bus voltage return or after an ETS programming operation, the output always transmits to an input. Transmit cyclically: With this setting, the output transmits the current object value to the KNX cyclically. After bus voltage return or after an ETS programming operation, the cyclical transmission is only started once the first telegram has been received at the input. The output also transmits as soon as a new telegram is received at the input. At the same time, the cycle time for cyclical transmission is restarted!	

Transmission delay for sending the hours result (0...99)	**0**...99
An optional delay before result transmission (telegram at output) can be configured. With the setting "always transmit when the input is updated": Telegrams at the output are only transmitted after the trigger when the delay has elapsed. The delay time is restarted by each telegram at the input. With the setting "only transmit if the output changes": Telegrams are only sent when the object value changes at the output if the delay has expired. If the logic function is reprocessed by a new telegram at the input within the delay time and the object value changes again, then the delay restarts. If the object value of the output does not change due to new input telegrams, the delay does not restart. This parameter defines the hours of the delay time.	

Minutes (0...59)	**0**...59
This parameter defines the minutes of the delay time.	

Seconds (0...59)	**0**...59
This parameter defines the seconds of the delay time. The parameters for the transmission delay are only visible for "Transmission criteria" = "Always transmit when the input is updated" and "Only transmit when the output changes".	

Cycle time hours (0...99)	**0**...99
During cyclical transmission of the output, this parameter defines the cycle time. Setting the cycle time hours.	

Minutes (0...59)	0...**5**...59
This parameter defines the minutes of the cycle time.	

Seconds (0...59)	**0**...59
This parameter defines the seconds of the cycle time. The parameters for the cycle time are only visible if "transmission criteria" = "transmit cyclically".	

11.6.2 Limit value switch object list

Object no.	Function	Name	Type	DPT	Flag
1002, 1003, 1004, 1005, 1006, 1007, 1008, 1009	Limit value switch Input	Logic... - Input	4-bit	3,007	C, (R), W, -, A
4-bit object as input of a limit value switch. This object is only available if the type of logic function is configured to "limit value switch" and the data format is configured to "4-bit dimming (DPT 3.007)".					

Object no.	Function	Name	Type	DPT	Flag
1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025	Limit value switch Input	Logic... - Input	1-byte	20,102	C, (R), W, -, A
1-byte object as input of a limit value switch. This object is only available if the type of logic function is configured to "limit value switch" and the data format is configured to "1-byte operating mode switchover (DPT 20.102)".					

Object no.	Function	Name	Type	DPT	Flag
1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025	Limit value switch Input	Logic... - Input	1-byte	18,001	C, (R), W, -, A
1-byte object as input of a limit value switch. This object is only available if the type of logic function is configured to "limit value switch" and the data format is configured to "1-byte scene extension (DPT 18.001)".					

Object no.	Function	Name	Type	DPT	Flag
1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025	Limit value switch Input	Logic... - Input	1-byte	5,010	C, (R), W, -, A
1-byte object as input of a limit value switch. This object is only available if the type of logic function is configured to "limit value switch" and the data format is configured to "1-byte value 0...255 (DPT 5.010)".					

Object no.	Function	Name	Type	DPT	Flag
1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025	Limit value switch Input	Logic... - Input	1-byte	5,001	C, (R), W, -, A
1-byte object as input of a limit value switch. This object is only available if the type of logic function is configured to "limit value switch" and the data format is configured to "1-byte brightness value 0...100% (DPT 5.001)".					

Object no.	Function	Name	Type	DPT	Flag
1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041	Limit value switch Input	Logic... - Input	2-byte	7,001	C, (R), W, -, A
2-byte object as input of a limit value switch. This object is only available if the type of logic function is configured to "limit value switch" and the data format is configured to "2-byte value 0...65535 (DPT 7.001)".					

Object no.	Function	Name	Type	DPT	Flag
1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041	Limit value switch Input	Logic... - Input	2-byte	8,001	C, (R), W, -, A
2-byte object as input of a limit value switch. This object is only available if the type of logic function is configured to "limit value switch" and the data format is configured to "2-byte value -32768...32767 (DPT 8.001)".					

Object no.	Function	Name	Type	DPT	Flag
1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041	Limit value switch Input	Logic... - Input	2-byte	9,xxx	C, (R), W, -, A
2-byte object as input of a limit value switch. This object is only available if the type of logic function is configured to "limit value switch" and the data format is configured to "2-byte floating point value (DPT 9.0xx)".					

Object no.	Function	Name	Type	DPT	Flag
1050, 1051, 1052, 1053, 1054, 1055, 1056, 1057	Limit value switch Input	Logic... - Input	4-byte	13,001	C, (R), W, -, A
4-byte object as input of a limit value switch. This object is only available if the type of logic function is configured to "limit value switch" and the data format is configured to "4-byte value -2147483648...2147483647 (DPT 13.001)".					

Object no.	Function	Name	Type	DPT	Flag
1058, 1060, 1062, 1064, 1066, 1068, 1070, 1072	Limit value switch Output	Logic... - Output	1-bit	1,002	C, (R), -, T, A
1-bit object as output of a limit value switch. The output object is preset to 1-bit (DPT 1.002) and outputs the result of the threshold evaluation (ON = true / OFF = false). This object is only available if the type of logic function is configured to "limit value switch".					

12 As-delivered state

In the as-delivered state, the actuator is passive, i.e. no telegrams are transmitted to the bus. The outputs can, however, be activated by manual operation on the device if the bus voltage and the valve voltage supply are on. In manual operation, no feedback telegrams are sent to the bus. Other functions of the actuator, such as the room temperature controllers, are deactivated.
The device can be programmed and put into operation via the ETS. The physical address is preset to 15.15.255

Furthermore, the device has been configured at the factory with the following characteristics (all valve outputs)...

- Valve direction of action: deenergised closed
- Pulse width modulation on "Open valve": 50%
- Cycle time: 20 minutes
- Behaviour in case of bus voltage failure: All the valve outputs switch OFF.
- Behaviour after bus voltage return: All valve outputs switch OFF.

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KNX
Product documentation

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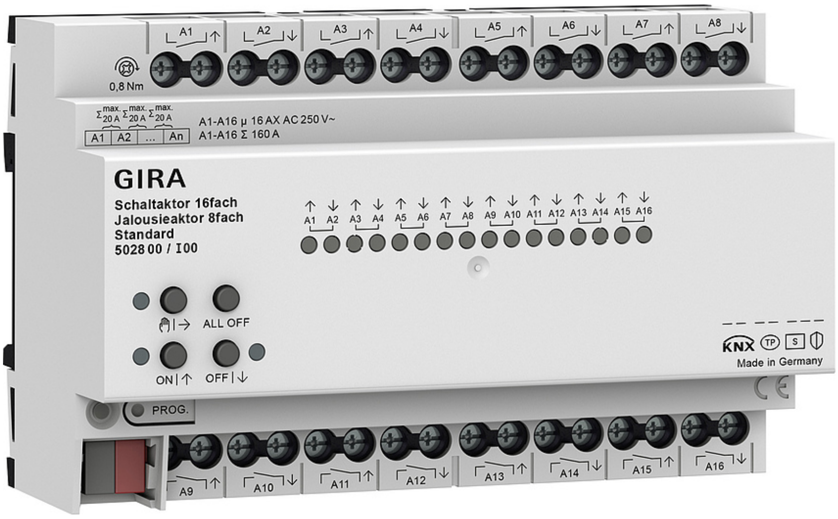
GIRA

Switching actuator / blind actuator 16 A Standard
Order no. 5023 00, 5028 00, 5030 00



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1 Information on the product

1.1 Product catalogue

Product name:	Switching actuator / blind actuator 16 A Standard
Use:	Actuator
Design:	RMD
Order no.	5023 00, 5028 00, 5030 00

1.2 Function

The switch/blind actuator receives telegrams from sensors or other controls via the KNX and switches electrical loads. The relay outputs of the actuator can be set in the ETS either to Venetian blind operation (2 relay outputs per channel) or alternatively (1 relay output per channel) to switching operation; mixed operation of these two operating modes is also possible on the device.

In Venetian blind operation the actuator can be used with its relay contacts to control electrically driven Venetian blinds, shutters, awnings, roof windows, venting louvers or similar blinds/shutters that are suitable for mains voltage. Alternatively, the actuator in switching operation switches electrical loads, such as lighting systems or door openers.
Each relay output has bus-powered bistable switching relays, which allows defined preferred positions in the event of bus voltage failure/recovery and after an ETS programming operation.

The buttons on the front panel of the device permit switching the relays on and off by hand in parallel during KNX operation or activated in a non-programmed state. This feature permits fast checking of connected loads for proper functioning.

The functionalities that can be preset in the ETS in Venetian blind operation include, for instance, independently parameterisable travel times, extended feedback functions, assignment to up to 5 different safety functions, an extensive sun protection function, and incorporation into scenes and disabling functions.

In switching operation the functionalities NC contact or NO contact include, for example, extensive time functions, logic operations, scenes and disabling functions. In addition, the switching status of a relay output can be signaled back.

The device can be updated. Firmware can be easily updated with the Gira ETS Service App (additional software).

The device is KNX Data Secure capable. KNX Data Secure offers protection against manipulation in building automation and can be configured in the ETS project. Detailed specialist knowledge is required. A device certificate, which is attached to the device, is required for safe commissioning. During mounting, it is recommended to remove the certificate from the device and to store it securely.

Planning, installation and commissioning of the device are carried out with the aid of the ETS, version 5.7.3 and above or of the ETS6.

The device electronics are supplied exclusively from the bus voltage. The device is designed for mounting on DIN-rails in closed compact boxes or in power distributors in fixed installations in dry rooms.

1.3 Device components

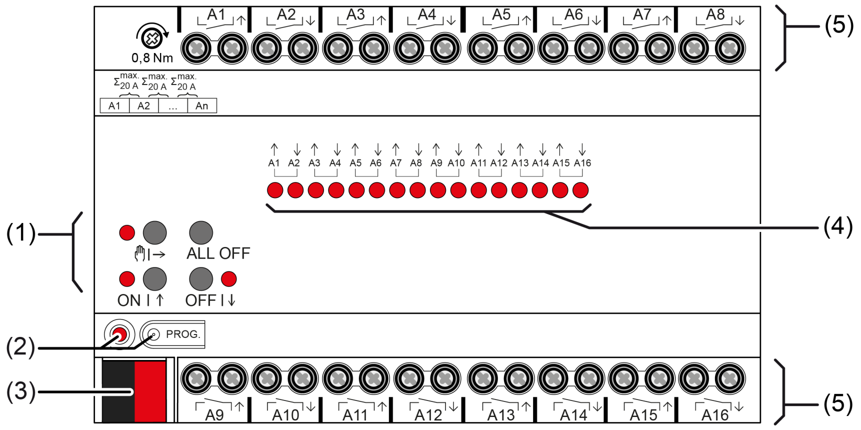

Image 1: Device components

(1)	Button field for manual operation
(2)	Programming button and LED
(3)	KNX connection
(4)	Status LEDs for outputs
(5)	Load connections (relay outputs)

1.4 Technical data

Ambient conditions	
Ambient temperature	-5 ... +45 °C
Storage/transport temperature	-25 ... +70 °C
KNX	
KNX medium	TP256
Commissioning mode	S-mode
Rated voltage KNX	DC 21 ... 32 V SELV
Current consumption KNX	
Order no. 5023 00, 5028 00	5 ... 18 mA
Order no. 5030 00	5 ... 24 mA
Outputs	
Switching voltage	AC 250 V ~
Switching current AC1	16 A
Fluorescent lamps	16 AX
Current carrying capacity	
Neighbouring outputs	Σ 20 A
Loads per output	
Ohmic load	3000 W
Capacitive load	max. 16 A (140 µF)
Motors	1380 VA
Switch-on current 200 µs	max. 800 A
Switch-on current 20 ms	max. 165 A
Lamp loads 230 V	
Incandescent lamps	2300 W
HV halogen lamps	2300 W
HV-LED lamps	max. 400 W
LV halogen lamps with electronic transformers	1500 W
LV halogen lamps with inductive transformer	1200 VA
Fluorescent lamps T5/T8	
uncompensated	1000 W
parallel compensated	1160 W (140 µF)
twin-lamp circuit	2300 W (140 µF)
Compact fluorescent lamps	
uncompensated	1000 W

parallel compensated	1160 W (140 µF)
Mercury vapour lamps	
uncompensated	1000 W
parallel compensated	1160 W (140 µF)
Fitting width	
Order no. 5023 00	72 mm / 4 module
Order no. 5028 00	144 mm / 8 module
Order no. 5030 00	216 mm / 12 module
Weight	
Order no. 5023 00	approx. 230 g
Order no. 5028 00	approx. 500 g
Order no. 5030 00	approx. 740 g
Clampable conductor cross-section	
single stranded	0.5 ... 4 mm²
Finely stranded without conductor sleeve	0.5 ... 4 mm²
Finely stranded with conductor sleeve	0.5 ... 2.5 mm²
Connection torque screw terminals	Max. 0.8 Nm

2 Safety instructions

Electrical devices may only be mounted and connected by electrically skilled persons.

Danger of electric shock. Device is not suitable for disconnection from supply voltage.

Danger of electric shock on the SELV/PELV installation. Do not connect loads for mains voltage and SELV/PELV together to the device.

Serious injuries, fire or property damage possible. Please read and follow manual fully.

Do not connect any three-phase motors. Device can be damaged.

For parallel connection of several motors to an output it is essential to observe the corresponding instructions of the manufacturers, and to use a cut-off relay if necessary. The motors may be destroyed.

Use only venetian blind motors with mechanical or electronic limit switches. Check the limit switches for correct adjustment. Observe the specifications of the motor manufacturers. Device can be damaged.

The device may not be opened or operated outside the technical specifications.

These instructions are an integral part of the product, and must remain with the end customer.

3 Fitting and electrical connection

DANGER!

Mortal danger of electric shock.

Disconnect the device. Cover up live parts.

DANGER!

Overloading the device leads to excessive heating.

Damage to the device and the connected cables may result.

Do not exceed the maximum current carrying capacity.

Fitting the device

In secure operation (preconditions):

- Secure commissioning is activated in the ETS.
- Device certificate entered/scanned or added to the ETS project. A high resolution camera should be used to scan the QR code.
- Document all passwords and keep them safe.

Observe ambient temperature. Ensure adequate cooling.

- Mount device on DIN rail.
- In secure operation: The device certificate must be removed from the device and stored securely.

4 Commissioning

Safe-state mode

The safe state mode stops the execution of the loaded application program.

ℹ Only the system software of the device is still functional. ETS diagnosis functions and programming of the device are possible. Manual operation is not possible.

Activating the safe-state mode

- Switch off the bus voltage or remove the KNX device connection terminal.
- Wait about 15 s.
- Press and hold down the programming button.
- Switch on the bus voltage or attach the KNX device connection terminal. Release the programming button only after the programming LED starts flashing slowly.

  The safe-state mode is activated.

  With a new brief press of the programming button, the programming mode can be switched on and off as usual also in the safe-state mode. If Programming mode is active, the programming LED stops flashing.

Deactivating safe-state mode

- Switch off bus voltage (wait approx. 15 s) or carry out ETS programming.

Master reset

The master reset restores the basic device setting (physical address 15.15.255, firmware remains in place). The device must then be recommissioned with the ETS. Manual operation is possible.

During secure operation: A master reset deactivates device security. The device can then be recommissioned with the device certificate.

Performing a master reset

Precondition: The safe-state mode is activated.

- Press and hold down the programming button for > 5 s.

  The programming LED flashes quickly.

  The device performs a master reset, restarts and is ready for operation again after approx. 5 s.

Restoring the device to factory settings

Devices can be reset to factory settings with the Gira ETS Service App. This function uses the firmware contained in the device that was active at the time of delivery (delivery state). Restoring the factory settings causes the devices to lose their physical address and configuration.

5 Application programs

ETS search paths:	- Output / Binary output mix / Switching actuator, 6-gang/ blind actuator, 3-gang Standard - Output / Binary output mix / Switching actuator, 16-gang/ blind actuator, 8-gang Standard - Output / Binary output mix / Switching actuator, 24-gang/ blind actuator, 12-gang Standard
Name	Switching, shutter/blind 20DA22 Switching, shutter/blind 20DB22 Switching, shutter/blind 20DC22
Version:	2.2 for ETS5 from Version 5.7.3 onwards and ETS6
Mask version	SystemB (07B0)
Summarized description	Multifunctional switching/blind applications with logic functions and manual control for Standard devices. KNX Data Secure capable. Replaces the application program 2.1.

6 Scope of functions

General

- Blinds or switching operation parameterizable. In blind operation, the adjacent outputs A1/A2, A3/A4...) are combined into single Venetian blind outputs. Mixed operation on an actuator (for example A1 & A2 Venetian blind, A3 & A4 Venetian blind, A5 switching, A6 switching) is possible.
- Actively transmitting feedback or status messages can be delayed globally after bus voltage return or after ETS programming.
- Manual operation of outputs independent of the KNX (for instance, construction site mode) with LED status indicators.

Venetian blind outputs

- Operating mode configurable: control of blinds with slats, shutters, awnings, roof windows or venting louvers.
- Separately configurable blind travelling times with travelling time extension for moves into the upper end position.
- For blinds with slats, a slat moving time can be independently configured
- Travel direction change-over time and the times for short-time and long-time operation (step, move) presettable.
- Reaction in case of bus voltage return and after an ETS programming operation is permanently set to "stop".
- Blind/shutter or slat position feedback telegram. In addition, an invalid blind position or an invalid travel movement can be reported back. Active (transmitting after changes or cyclically to the bus) or passive (object readout) feedback functions.
- Assigning of outputs to up to 5 different safety functions (3 wind alarms, 1 rain alarm, 1 frost alarm) optionally with cyclical monitoring. The safety functions (objects, cycle times, priority) are programmed device-oriented and in common for all outputs. The assignment of individual outputs to the safety functions and the safety measures can be configured for each channel.
- An sun protection function with fixed and variable blind or slat positions at the beginning and at the end of the function can be activated separately for each output. Dynamic slat offset for slatted blinds included.
- Disabling function can be implemented for each Venetian blind output.
- Up to 16 internal scenes configurable per output.

Switching outputs

- Independent switching of the switching outputs.
- Operation as NO or NC contacts.
- Switching feedback mode: Active (transmitting after changes or cyclically to the bus) or passive (object readout) feedback function.

- Reaction in case of bus voltage failure and bus voltage return as well as after ETS programming is permanently set to "no reaction".
- Logic function individual for each output.
- Disabling function can be parameterized for each channel.
- Timing functions (switch-on delay, switch-off delay, staircase lighting timer, also with pre-warning function)
- Incorporation into light moods: up to 16 internal scenes parameterizable per output.

7 Notes on software

Unloading the application program

The application program can be unloaded with the ETS. In this case the device is without function. Manual operation is no longer possible.

ETS project design and commissioning

For project design and commissioning of the device, ETS5 from Version 5.7.3 onwards or ETS6 is required. Project designing and commissioning of the device using ETS2, ETS3 or ET4 is not possible.

8 Operation and indication

8.1 Button operation and indication functions

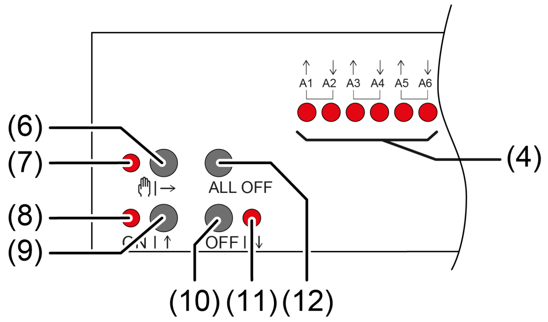

Image 2: Operating elements

(4) Status LEDs for outputs
ON: Relay output closed
OFF: Relay output opened
Flashes slowly: Output in manual mode selected.
Flashes quickly: Output disabled via continuous manual mode

(6) Button ✋|→
Manual operation

(7) LED ✋|→
ON: Continuous manual mode active/Flashing: Temporary manual mode active

(8) LED **ON|↑**
ON: Relay outputs closed, manual mode active

(9) Button **ON|↑**
Short: Switch on, drive stop
Long: Move blind/shutter upwards

(10) Button **OFF|↓**
Short: Switch off, drive stop
Long: Move blind/shutter downwards

(11) LED **OFF|↓**
ON: Relay outputs opened, manual mode active

(12) Button ALL OFF
Open all relay outputs, stop drives

In operation with the button field the device distinguishes between a short and a long press.

- Short: Pressing for less than 1 s
- Long: Pressing for between 1 and 5 s

ℹ In switching operation, the device distinguishes between the "NO contact" and "NC contact" operating modes. The buttons (9 + 10) switch the switching state when actuated:

NO contact: Switch on = close relay, Switch off = open relay
NC contact: Switch on = open relay, Switch off = close relay
The LED (4 + 8 + 11) always indicate the relay state.

ℹ The LEDs (4) optionally indicate the states of the outputs only temporarily (parameter-dependent).

Operating modes

- Bus operation: Operation via push-button sensors or other bus devices
- Temporary manual control: manual control locally with keypad, automatic return to bus control
- Continuous manual mode: Exclusively manual operation on the device

ℹ No bus operation is possible in manual mode.

ℹ After a bus failure and restoration the device switches to bus operation.

Switching on the temporary manual control

Operation using the button field is programmed and not disabled.

- Press button ✋|→ (6) briefly.

  LED ✋|→ (7) flashes, LEDs **A1...** (4) of the first configured output or output pair flash.

  Short-time manual operation is switched on.

ℹ After 5 s without a key-press, the actuator returns automatically to bus operation.

Switching off temporary manual operation

The device is in short-term manual mode.

- No button-press for 5 s.

  - or -

- Press ✋|→ (6) button briefly as many time as necessary until the actuator leaves the short-time manual mode.

  Status LEDs **A1...** (4) no longer flash, but rather indicate the relay status.

  Short-time manual operation is switched off.

  Switching outputs: depending on the programming, the output relays switch to the position that is active after the manual mode is switched off, e.g. logic function.

  Blind/shutter outputs: depending on the programming, the hangings move to the position that is active after the manual mode is switched off, e.g. to safety or sun protection position.

Switching on permanent manual control

Operation using the button field is programmed and not disabled.

- Press the ✋|→ (6) button for at least 5 s.

  LED ✋|→ (7) lights up, LEDs **A1...** (4) of the first configured output or output pair flash.

  Continuous manual mode is switched on.

Switching off permanent manual control

The device is in continuous manual mode.

- Press the ✋|→ (6) button for at least 5 s.

  LED ✋|→ (7) is off.

  Continuous manual mode is switched off. Bus operation is switched on.

  Switching outputs: depending on the programming, the output relays switch to the position that is active after the manual mode is switched off, e.g. logic function.

  Blind/shutter outputs: depending on the programming, the hangings move to the position that is active after the manual mode is switched off, e.g. to safety or sun protection position.

Operating an output in manual mode

- Activate short-term or permanent manual operation.
- Press button ✋|→ (1) repeatedly until LED **A1...** (4) of the desired output or output pair flashes.
- Press button **ON**|↑ (9) or **OFF**|↓ (10).
  Short: Switch on/off, drive stop
  Long: Move blind/shutter upwards/downwards

  LED **ON**|↑ (3) ON: Relay output closed

  LED **OFF**|↓ (6) OFF: Relay output opened

ℹ Short-term manual operation: After running through all of the outputs the device exits manual mode after another brief press.

Switching off all outputs / Stopping all hangings

The device is in continuous manual mode.

- Press the **ALL OFF** button (7).

  Switching outputs: All outputs switch off (NO operating mode: relay output opened/NC operating mode: relay output closed).

  Venetian blind outputs: All blinds/shutters stop.

Disabling outputs

The device is in continuous manual mode. The bus control can be disabled (ETS parameter).

- Press button ✋|→ (6) repeatedly until LED **A1...** (4) of the desired output or output pair flashes.
- Press the/ **ON**|↑ (9) and / **OFF**|↓ (10) buttons simultaneously for approx. 5 s.

  Selected output is disabled.

  The status LED **A1...** (4) of the selected output or output pair flashes quickly.

ℹ A disabled output can be operated in manual mode.

Re-enabling outputs

The device is in continuous manual mode. One or more outputs were disabled in manual mode.

- Press button ✋|→ (6) repeatedly until the output to be unlocked or the output pair is selected.
- Press the/ **ON**|↑ (9) and / **OFF**|↓ (10) buttons simultaneously for approx. 5 s.

  Disabling is deactivated.

  The LED **A1...** (4) of the selected output or output pair flashes slowly.

8.2 ETS-Configuration

8.2.1 Manual operation

All outputs of the device have electronic manual operation. The button field with 4 function buttons and 3 status LEDs on the front panel of the device can be used for setting the following modes of operation:

- Bus operation: Operation via push-button sensors or other bus devices
- Short-term manual operation: Manual operation locally with button field, automatic return to bus operation.
- Permanent manual control: local manual control with keypad

Manual control is possible while the device is supplied with power from the bus supply voltage. In the state as supplied the manual control mode is fully enabled. In this unprogrammed state, all outputs are set to blinds operation and can be controlled by the manual operation so that fast function checking of the connected loads (e.g. on the construction site) is possible

After initial commissioning of the actuator via the ETS, manual control can be enabled or completely disabled.

Disabling manual control permanently

Manual operation is enabled in the as-delivered state. If the parameter of the same name is deactivated on the "Manual control" parameter page, no parameters and communication objects for manual control are available. The outputs can then only be controlled via the bus.

In the case of a temporary status indication, the status LEDs continue to indicate the status of the outputs when the "Manual control" button is pressed.

Presetting the behaviour at the beginning and at the end of manual control

The manual control distinguishes the temporary and permanent manual control. The behaviour is different depending on these modes of operation, especially at the end of manual control. It should be noted that the operation via the bus, i.e. control of the outputs by direct operation (switching / moving / scenes) or by the disabling function is always disabled when the manual control is active. This means that the manual control mode has the highest priority.

Behaviour at the beginning of manual control:
The behaviour at the beginning of manual control does not differ for temporary and permanent manual control. When manual control is activated, all travel movements that were started beforehand by bus control for the venetian blind outputs will still be completed unless the travel movement in question is stopped by hand. Switching states of switching outputs will be maintained. Active disabling, safety and sun protection functions can be overridden by manual operation. These functions are reactivated after deactivation of the manual operation unless they have been cancelled in the meantime via the KNX. Then the function with the higher priority is always executed.

Behaviour at the end of manual control:
The behaviour at the end of manual control is different for temporary and permanent manual control. The temporary manual mode is shut off automatically when the last output has been addressed and when the select key ☜ is pressed once more. During deactivation of the temporary manual operation mode, the actuator returns to 'normal' bus operation and does not change the states selected by manual control. If, however, a disabling function, a safety function or a sun protection function (independent of priority) has been activated via the KNX before or during manual control, the actuator executes these functions with a higher priority again for the outputs concerned.
The permanent manual control mode is shut off, when the select key ☜ is pressed for more than 5 seconds. Depending on the parameterization of the actuator in the ETS, the outputs will be set to the state last adjusted in the manual mode or to the state internally tracked (direct operation, disabling, safety or sun protection position) when the permanent manual mode is switched off. The parameter "End of permanent manual control" defines the corresponding reaction.

- Set the parameter "End of permanent manual control" to "no change".

  All telegrams received during an active permanent manual control mode for direct operation (switching, long-time/short-time, positioning, scenes) are be rejected. After the end of the permanent manual control mode, the current state of all outputs remains unchanged. If, however, a disabling function, a safety function or a sun protection function (independent of priority) has been activated via the KNX before or during manual control, the actuator executes these functions with a higher priority again for the outputs concerned.

- Set the parameter "End of permanent manual control" to "track outputs".

  During an active permanent manual control, all incoming telegrams (blinds operation exception: short-time telegrams – step/stop) are internally tracked. At the end of the manual operation, the outputs will be set to the tracked states or to the positions last set before the permanent manual operation for Venetian blind outputs. The individual priorities of the functions with respect to one another are taken into account here. Only the function with the greater priority is executed. Long time operation is not tracked in Venetian blind operation if the corresponding Venetian blind output is already in the appropriate end position.

ⓘ The operations triggered during manual operation update the states of the feedback and status objects. Telegrams are also transmitted to the KNX, if the signal objects concerned are enabled in the ETS and are configured as actively transmitting.

ⓘ During an ETS programming operation, an activated manual operation mode will always be terminated. In this case, the parameterised or predefined behaviour at the end of manual control will not be executed. The actuator executes the configured behaviour after ETS programming instead.

Setting disabling of the bus control

Individual switching or Venetian blind outputs can be disabled locally by manual operation on the device, so that the connected loads can no longer be activated via the KNX telegram. Such disabling of the bus operation is initiated by operation in permanent manual operation and is indicated by rapid flashing of the status LEDs on the front panel of the device. The disabled outputs can then only be activated in permanent manual control.

The manual control mode must be enabled

- Activate the parameter "Disable bus control of individual outputs" on the parameter page "Manual control".

  The function for disabling the bus control is enabled and can be activated locally. Alternatively, deactivating the parameter prevents disabling of the bus control from being activated in permanent manual operation.

ℹ The disabling initiated locally has the highest priority. Thus all other functions of the actuator that can be activated via the KNX (e.g. disabling or safety function) are overridden. The bus-disabled output remains in the state last set in permanent manual control.
Depending on the parameterization of the actuator in the ETS, the outputs will be set to the state last adjusted in the manual mode or to the state internally tracked (direct operation, disabling, safety or sun protection position) when the permanent manual mode is reactivated and subsequently shut off.

ℹ A failure of the bus voltage or an ETS programming operation deactivates disabling of the bus control.

8.2.2 Status indication

The status LEDs on the front of the device can indicate the current status of the switching and Venetian blind outputs permanently or temporarily.

- Continuous status indication:
  The parameter "Indicate status temporarily" on the "Status indication" parameter page is deactivated In the case of a continuous status indication, the status LEDs always indicate the current status of the outputs.
- Temporary status indication:
  The parameter "Indicate status temporarily" on the "Status indication" parameter page is activated During temporary indication, the status indication is activated by pressing the "Manual control" button. The display length is set in the ETS.
  If manual control is enabled in the ETS, pressing the "Manual control" button also activates short-temporary or permanent manual control. The status indication always remains active during manual operation. At the end of manual operation, the display length of the temporary status indication is restarted. The status LEDs then go out after the configured time has elapsed.

If manual control is not enabled in the ETS, all status LEDs only show the status of the outputs when the "Manual control" button is pressed, depending on the duration of the display.

ℹ In the as-delivered state, the continuous status indication is preset.

If the parameter "Control via object" is activated, the "Temporary status indication" communication object is available in the ETS. This object is bidirectional and can firstly signal the status of the temporary status indication, and secondly, activate the status display. If a temporary status indication has been activated by pressing the "Manual control" button, the object sends the value "ON". If the object receives a telegram with the value "OFF" or "ON", the status LEDs indicate the status of the outputs according to the display length. The manual control is not activated in this case.

By linking the "Temporary status indication" objects of several actuators using a common group address, the indication functions of the status LED can be synchronized with one another. It is thus possible to activate the status indications of all actuators in a control cabinet at the same time if the manual control only on one actuator - e.g. for service or maintenance purposes - is triggered.
In addition, the "Temporary status display" object could be controlled, for example, by a magnetic contact connected to the KNX, so that the status indications of all actuators are activated by opening the control cabinet door. If the door is closed, the status indications for energy saving remain switched off.

ℹ During a running display length, the "Temporary status indication" object does not send any new telegrams if the "Manual control" button is pressed again.

8.3 Operation and indication parameter

Manual operation

Manual operation	Checkbox (**yes** / no)
Manual control is possible while the device is supplied with power from the bus supply voltage. This parameter defines whether manual operation is to be possible or deactivated permanently.	

End of permanent manual control	**no change** Output tracking
The behaviour of the actuator at the end of permanent manual control depends on this parameter. This parameter is only visible if manual control is enabled. no change: all telegrams received during an active permanent manual control mode for direct operation (switching, long-time/short-time, positioning, scenes) are be rejected. After the end of the permanent manual operation, the current state of all outputs which was most recently active in manual operation remains unchanged. If, however, a forced position, a disabling function, a safety function or a sun protection function (independent of priority) has been activated via the KNX before or during manual operation, the actuator executes these functions with a higher priority for the outputs concerned. Track outputs: During an active permanent manual control, all incoming telegrams (blinds operation exception: short-time telegrams – step/stop) are internally tracked. At the end of the manual operation, the outputs will be set to the tracked states or to the positions last set before the permanent manual operation for Venetian blind outputs. The individual priorities of the functions with respect to one another are taken into account here. Only the function with the greater priority is executed. Long time operation is not tracked in Venetian blind operation if the corresponding Venetian blind output is already in the appropriate end position. This parameter is only visible if manual control is enabled.	

Bus control of individual outputs can be disabled	Checkbox (yes / **no**)
Individual outputs can be disabled locally during permanent manual control, so that the disabled outputs can no longer be controlled via the KNX. Disabling via manual operation is only permitted if this parameter is activated. This parameter is only visible if manual control is enabled.	

Status indication

Indicating status temporarily	Checkbox (yes / **no**)
The status LEDs on the front of the device can indicate the current status of the switching and Venetian blind outputs permanently or temporarily. Parameter deactivated: Continuous status indication. In this case, the status LEDs always indicate the current status of the outputs. Parameter activated: Temporary status indication. In this case, the status indication is activated by pressing the "Manual control" button. The display length is set in the ETS. If manual control is enabled in the ETS, pressing the "Manual control" button also activates short-temporary or permanent manual control. The status indication always remains active during manual operation. At the end of manual operation, the display length of the temporary status indication is restarted. The status LEDs then go out after the configured time has elapsed.	

Display length (6...255)	6 ... **10** ... 255
This parameter defines the display length if the temporary status indication is activated.	

Control via object	Checkbox (yes / **no**)
If the parameter "Control via object" is activated, the "Temporary status indication" communication object is available in the ETS. This object is bidirectional and can firstly signal the status of the temporary status indication, and secondly, activate the status display. If a temporary status indication has been activated by pressing the "Manual control" button, the object sends the value "ON". If the object receives a telegram with the value "OFF" or "ON", the status LEDs indicate the status of the outputs according to the display length. The manual control is not activated in this case.	

8.4 Object list operation and indication

Object no.	Function	Name	Type	DPT	Flag
3	Temporary status indication	Manual operation - Input/Output	1-bit	1,017	C, (R), W, T, A
1-bit object to signal and activate the temporary status indication. This object is bidirectional and can firstly signal the status of the temporary status indication, and secondly, activate the status display. If a temporary status indication has been activated by pressing the "Manual control" button, the object sends the value "ON". If the object receives a telegram with the value "OFF" or "ON", the status LEDs indicate the status of the outputs according to the display length. The manual control is not activated in this case. The object is only visible if the temporary status indication is activated					

9 Channel configuration

CAUTION!

Incorrect control of the load in case of incorrect device configuration in the ETS!

Danger of destruction of the connected blind drives.
Adapt the device configuration (channel definition) in the ETS to the connected load!

CAUTION!

Operating the actuator outside its technical specification (see Technical Data) can cause relay contacts to melt.

Risk of destruction of the connected drive motors from melted relay contacts and resulting simultaneous energising of both travel directions.
Only ever operate the actuator within its technical specification!

Configuring channel definition

The device is used to activate electrical loads of up to two different building units that are typically used in a residential or office spaces or in a hotel room. The device has up to 24 potential-free relay outputs for this, depending on the variant. Two outputs together form a pair which can be configured in the ETS either for Venetian blind operation (combined outputs for UP and DOWN) or, alternatively, to switching operation (separate outputs).
The pair formation of the relay outputs allows mixed operation of the named operating modes. By combining the functions of the relay outputs, in many cases it is possible to plan and execute electrical installations on a room-specific basis.

A mechanical locking of the travel directions is not implemented since the outputs must be controllable separately in switching operation.

- Set the desired functions for the output pairs in the channel definition on the "General" parameter page.

  Venetian blind: The appropriate output pair is configured to Venetian blind operation. Both outputs are combined into one blind channel. Suitable slatted Venetian blinds, shutters, awnings, roof windows or venting louvers can be controlled.

  Switching: The appropriate output pair is configured to switching operation. Both outputs are programmed separately as two switching channels.

It is possible to deactivate output pairs by deselecting the parameter "Use" (e.g. as a reserve for future applications). Deactivated output pairs have no parameters or communication objects and cannot be controlled even with manual operation.

i The parameter and object configurations of the individual outputs depend on the parameters on the "General" page and are readjusted by the ETS when the channel definition is changed. Consequently, parameter settings or group address assignments to objects can be lost. For this reason, the channel definition should be reset when beginning the parameterization of the actuator.

10 shutter/blinds operation

10.1 Priorities

The actuator in blinds operation distinguishes between different functions that can have an effect on an output. In order to prevent conflicting states, each available function has a certain priority. The function with the higher priority overrides the function with the lower priority.

For blinds operation there are the following priorities...

- 1st priority: manual control (highest priority)
- 2nd priority: safety function(s)

Priority levels 3 and 4 can be configured in the ETS. The options are then...

- 3th priority: sun protection function
- 4th priority: direct bus operation

or...

- 3th priority: direct bus operation
- 4th priority: sun protection function

or...

- 3th priority: sun protection function and direct bus operation

ℹ Direct bus operation includes: short-time/long-time operation, positioning, scenes, reset behaviour, fabric stretching.

The behaviour of some functions can be configured at the end (e.g. the behaviour at the end of a safety function or the behaviour at the end of the sun protection function). These predefined reactions are only executed if the actuator can then immediately switch to direct operation (lowest priority).

If another function with a lower priority (e.g. sun protection) has been activated during a function with a high priority (e.g. safety), the actuator executes the behaviour at the beginning of the function with the next lower priority (e.g. sun protection). The behaviour at the end of the function with the higher priority (e.g. safety) is then not executed!

10.2 General settings

10.2.1 Reset behaviour

Delay after bus voltage return

To reduce telegram traffic on the KNX line after bus voltage activation (bus reset), after connection of the device to the bus line or after programming with the ETS, it is possible to delay all actively transmitted feedback telegrams of the actuator outputs. For this purpose, a channel-independent delay can be specified (parameter "Delay after bus voltage return" on parameter page "General blind outputs"). Only after the configured time elapses are feedback telegrams for initialisation transmitted to the KNX.
Which of the telegrams are actually delayed and which are not can be specified for each Venetian blind output and for status function separately.

ℹ The delay has no effect on the behaviour of the outputs. Only the bus telegrams for status or feedback are delayed. The outputs can also be activated during the delay after bus voltage return.

ℹ A setting of "0" for the delay after bus voltage return deactivates the delaying function altogether. In this case, any messages, if actively transmitted, will be transmitted to the KNX without any delay.

10.2.1.1 Reset behaviour parameter

General -> General Venetian blind outputs

Delay after bus voltage return Minutes (0...59)	**0**...59
To reduce telegram traffic on the KNX line after bus voltage switch-on (bus reset), after connection of the device to the KNX line or after programming with the ETS, it is possible to delay various actively transmitting feedback telegrams of the Venetian blind function. For this purpose, a delay time can be defined here. Only after the configured time elapses are delayed feedback telegrams for initialisation transmitted to the KNX. Setting the delay time minutes.	

Seconds (0...59)	0...**17**…59
Setting the delay time seconds.	

10.2.2 Safety functions

The actuator can handle up to five different safety functions. Each safety function has a communication object of its own so that the functions can be activated or deactivated independently of one another.
There are three different wind alarms available. These alarms , for instance, can be used to protect Venetian blinds or awnings from wind and gusts on several building facades. In addition or as an alternative, a rain alarm, for instance, as a protection for awnings, and a frost alarm as a protection against mechanical damage to lowered Venetian blinds in low temperatures can be activated and used. The telegram polarity of the safety objects is fixed: "0" = No alarm / "1" = Alarm.
Usually, weather stations, which record temperature, wind speed and rain via the sensors, control the communication objects of the safety function.

The safety functions are configured in common for all Venetian blind outputs. The different outputs of the actuator can be separately assigned to all or to individual safety functions. Only assigned outputs respond to a change in the state of the safety objects. The reactions at the beginning of an alarm message ("1" telegram) or at the end of an alarm message ("0" telegram) can be parameterized for each channel.
Because outputs are also assigned to multiple safety alarms, the priority of incoming alarm signals can be preset for several channels. Thus, the three wind alarms have the same priority with respect to one another (logic OR). The order of priority of the wind alarms with respect to the frost alarm or to the rain alarm can be configured.

The communication objects for the safety alarms can be monitored for the arrival of cyclical telegrams. If there are no telegrams within a settable monitoring time, the device activates the safety movement for the output. The safety function is terminated as soon as a new "0" telegram is received.
Different monitoring times can be selected separately in the ETS for the wind alarms, rain alarm and frost alarm. A shared time is configured for the wind alarms. Each wind alarm has its own time control, so that the wind objects are checked separately for telegram updates.

Enabling the safety functions

The safety functions must first be globally enabled before they can be configured and used. After global enabling, the individual safety alarms can be enabled or disabled independently of one another.

- Activate the parameter "Safety functions" on the "General -> General Venetian blind outputs" parameter page.

  The safety functions are enabled globally and the other parameters become visible.

- Activate the parameters "Wind alarm 1", "Wind alarm 2", "Wind alarm 3", "Rain alarm" and "Frost alarm" depending on functional requirements.

  The necessary safety alarms are now enabled. The safety objects are visible and can be linked with group addresses.

ℹ An update of the safety objects ("ON" to "ON" or "OFF" to "OFF") shows no reaction.

ℹ After failure of the bus voltage or after programming with the ETS, the safety functions are always deactivated.

Presetting the safety priorities

If several safety alarms are assigned to an output, it is important to preset the priority of the incoming safety telegrams. In so doing, an alarm with a higher priority overrides the alarms with the lower priorities. When safety alarm with the higher priority has ended, the safety alarm with the lower priority is executed on condition that it is active.

The safety functions must have been globally enabled.

- Set the parameter "Priority of safety alarms" on the "General ->"General Venetian blind outputs" parameter page to the required order of priority.

ℹ The three wind alarms have the same priority with respect to one another (logic OR). The last telegram update to the wind alarm objects decides which of the wind alarms will be executed. The wind alarm is completely deactivated for an assigned output only after all three objects are inactive ("0").

Presetting cyclical monitoring

If cyclical telegram monitoring of the safety objects is necessary, the individual monitoring functions must be activated separately. The monitoring functions must be enabled and the monitoring times preset on the
"General -> General Venetian blind outputs" parameter page.

The safety functions must have been globally enabled.

- If monitoring of the wind alarms is to be activated, the parameter "Monitoring", which is immediately below the wind alarms must be activated.

  The monitoring function for the wind alarm objects is now activated. As soon as the monitoring function is activated, telegrams must be transmitted cyclically to all enabled wind alarm objects. If only one of the wind alarm telegrams is missing within the monitoring period, the wind alarm reaction will be executed for the output concerned.

- Specify the required monitoring time for the wind alarm objects in the "cycle time" parameters.
- If monitoring of the rain alarm is to be activated, the parameter "Monitoring", which is immediately below the rain alarm must be activated.

  The monitoring function for the rain alarm object is now activated. As soon as the monitoring function is activated, telegrams must be transmitted cyclically to the rain alarm object.

- Specify the required monitoring time for the rain alarm object in the "cycle time" parameters.
- If monitoring of the frost alarm is to be activated, the parameter "Monitoring", which is immediately below the frost alarm must be activated.

The monitoring function for the frost alarm object is now activated. As soon as the monitoring function is activated, telegrams must be transmitted cyclically to the frost alarm object.

■ Specify the required monitoring time for the frost alarm object in the "cycle time" parameters.

ℹ The cycle time of the transmitters should be shorter than the monitoring time configured in the actuator in order to ensure that at least one telegram can be received during the monitoring time.

10.2.2.1 Safety functions parameter

General -> General Venetian blind outputs

Safety functions	Checkbox (yes / **no**)
When the safety functions of the actuator, which can number up to 5, are used and should thus be configurable, the channel-independent enabling of the function must take place here.	

Priority of safety alarms	**wind -> rain -> frost** wind -> frost -> rain rain -> wind -> frost rain -> frost -> wind frost -> rain -> wind frost -> wind -> rain
This parameter defines the priority ranking of the individual safety alarms. Interpretation: high -> medium -> low. The three wind alarms have the same priority with respect to one another. This parameter is only visible when the safety functions are enabled.	

Wind alarm 1	Checkbox (yes / **no**)
Here, the parameter can be used to enable the first wind alarm and thus to enable the communication object.	

Wind alarm 2	Checkbox (yes / **no**)
Here, the parameter can be used to enable the second wind alarm and thus to enable the communication object.	

Wind alarm 3	Checkbox (yes / **no**)
Here, the parameter can be used to enable the third wind alarm and thus to enable the communication object.	

Monitoring	Checkbox (yes / **no**)
If the enabled wind alarms are to be monitored cyclically for incoming telegrams to the safety objects, the monitoring function must be enabled here. Otherwise, there is no cyclical monitoring of the objects. As soon as the monitoring function is activated here, telegrams must be transmitted cyclically to all enabled wind alarm objects.	

Cycle time hours (0...23)	**0**...23
The wind alarm monitoring time is configured here. Sets the monitoring time hours.	

Minutes (1...59)	1...**25**...59
Sets the monitoring time minutes.	

Rain alarm	Checkbox (yes / **no**)
Here, the parameter can be used to enable the rain alarm and thus to enable the communication object.	

Monitoring	Checkbox (yes / **no**)
If the enabled rain alarm is to be monitored cyclically for incoming telegrams to the safety object, the monitoring function must be enabled here. Otherwise, there is no cyclical monitoring of the object. As soon as the monitoring function is activated, telegrams must be transmitted cyclically to the enabled rain alarm object.	

Cycle time hours (0...23)	**0**...23
The rain alarm monitoring time is configured here. Sets the monitoring time hours.	

Minutes (1...59)	1...**25**...59
Sets the monitoring time minutes.	

Frost alarm	Checkbox (yes / **no**)
Here, the parameter can be used to enable the frost alarm and thus to enable the communication object.	

Monitoring	Checkbox (yes / **no**)
If the enabled frost alarm is to be monitored cyclically for incoming telegrams to the safety object, the monitoring function must be enabled here. Otherwise, there is no cyclical monitoring of the object. As soon as the monitoring function is activated, telegrams must be transmitted cyclically to the enabled frost alarm object.	

Cycle time hours (0...23)	**0**...23
The frost alarm monitoring time is configured here. Sets the monitoring time hours.	

Minutes (1...59)	1...**25**...59
Sets the monitoring time minutes.	

10.2.2.2 Object list safety functions

Object no.	Function	Name	Type	DPT	Flag
11	Wind alarm 1	Venetian blind - Safety - Input	1-bit	1,005	C, (R), W, -, A
1-bit object for central activation or deactivation of the first wind alarm ("0" = wind alarm deactivated / "1" = wind alarm activated).					

Object no.	Function	Name	Type	DPT	Flag
12	Wind alarm 2	Venetian blind - Safety - Input	1-bit	1,005	C, (R), W, -, A
1-bit object for central activation or deactivation of the second wind alarm ("0" = wind alarm deactivated / "1" = wind alarm activated).					

Object no.	Function	Name	Type	DPT	Flag
13	Wind alarm 3	Venetian blind - Safety - Input	1-bit	1,005	C, (R), W, -, A
1-bit object for central activation or deactivation of the third wind alarm ("0" = wind alarm deactivated / "1" = wind alarm activated).					

Object no.	Function	Name	Type	DPT	Flag
14	Rain alarm	Venetian blind - Safety - Input	1-bit	1,005	C, (R), W, -, A
1-bit object for central activation or deactivation of the rain alarm ("0" = rain alarm deactivated / "1" = rain alarm activated).					

Object no.	Function	Name	Type	DPT	Flag
15	Frost alarm	Venetian blind - Safety - Input	1-bit	1,005	C, (R), W, -, A
1-bit object for central activation or deactivation of the frost alarm ("0" = frost alarm deactivated / "1" = frost alarm activated).					

10.2.3 Name of a Venetian blind output

Here, you can optionally assign a name for each Venetian blind output. The name is intended to illustrate the use of the output (e.g. "Venetian blind living room", "shutter bathroom"). The names are only used in the ETS in the text of the parameter pages and communication objects.

10.2.3.1 Parameter name

Relay outputs... -> VBO... - General

Name of shutter/blinds output	Free text
The text entered in this parameter is applied to the name of the communication objects and is used to label the Venetian blind output in the ETS parameter window (e.g. "Venetian blind, living room", "Shutter, bathroom"). The text is not programmed in the device.	

10.3 Operating mode

Each venetian blind output of the actuator can be independently configured for the drive type connected by defining the operating mode. The device permits the controlling of slatted Venetian blinds, shutters and awnings, or as a third alternative, roof windows. Depending on the preset operating mode, the ETS adapts the parameters and communication objects for all functions of an output.
For example, in the "Venetian blind" with slat" operating mode, there are also parameters and objects for slat control. There is no slat control in the "shutter/awning" operating mode, but a fabric stretching function can be configured for awning use. In the "Venting louver/roof window" operating mode, a distinction is made between the "opening" and "closing" drive movements, instead of an up or down movement for Venetian blinds or shutters
In this documentation, Venetian blinds, roller shutters or awnings are also designated with the term "blind", if the text does not explicitly refer to a particular function (e.g. slat control).
In all modes it is possible to specify positions.

Presetting the operating mode

The parameter "operating mode" exists separately for each venetian blind output on the parameter page "Relay outputs... -> VBO... - General".

- Select the required operating mode in the "Operating mode" parameter.

ⓘ The "Operating mode" parameter has an influence on many channel-oriented parameters and communication objects. When the operating mode is changed in the ETS, the parameters are adapted dynamically so that settings already made or links between group addresses can be reset. For this reason, the required operating mode should be configured at the beginning of the channel-oriented device configuration.

ⓘ Venting louvers and roof windows must be connected to the outputs in such a way that they are opened in travel direction "UP" and closed in travel direction "DOWN".

ⓘ An awning travels upwards when it is rolled up.

10.3.1 Operating mode parameter

Relay outputs... -> VBO... - General

Operating mode	**Venetian blind with slat** Shutter / awning Venting louver/roof window
The actuator can control various drive systems. This parameter defines which type of curtain is connected to the output. The ETS adapts all of the following parameters (designations, visible/non visible, etc.) dynamically to the respective "operating mode" parameter. For this reason, the "Operating mode" parameter should be adjusted before all other parameters of an output.	

10.4 Reset and initialisation behaviour

Behaviour after ETS programming

The relay behaviour of the output after an ETS programming operation is permanently set to "stop". After programming with the ETS, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

ℹ After programming with the ETS, the safety functions and the sun protection function are always deactivated.

Behaviour in case of bus voltage failure

In case of bus voltage failure, the actuator always switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.
The configured behaviour will not be adopted, if a manual control mode is active at the time of bus failure.

ℹ When there is a bus voltage failure, the current position data of the outputs is permanently saved internally, so that these position values can be accurately tracked after bus voltage return, should this be configured. The data will not be stored, if the position data is unknown. The following rules apply for the position data to be stored:
The current blind, slat, venting louver and roof window positions are stored. With Venetian blinds, the height to be stored is always referred to a slat position of 100 % (cf. "Calculating the slat position"). Positions temporarily approached will be stored also for those outputs that are involved in a travel movement at the time of data storage. On account of the fact that position data is stored as integer percentage values (0...100), a minor deviation from the positions reported back later during bus voltage return (number range 0..255) cannot be avoided.

In case of ETS programming, the saved position data is not lost.

ℹ In case of bus voltage failure, the current states of the slat offsets of the sun protection positions are stored as well.

Behaviour after bus voltage return

After bus voltage return, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

ℹ The Venetian blind operation is set as the default in the unprogrammed delivery state of the device. In this state, the relays are switched to the "stop" state when the bus voltage is applied in order to initialise the relays. This short switching operation can be perceived acoustically.

10.4.1 Reset and initialisation behaviour parameter

Relay outputs... -> VBO... - General

After ETS programming operation	**stop**
The behaviour of the actuator after ETS programming is specified as a fixed value, and cannot be adjusted. The actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.	

In case of bus voltage failure	**stop**
The behaviour of the actuator is predefined in case of bus voltage failure. The actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.	

after bus voltage return	**stop**
The behaviour of the actuator after bus voltage return is fixed. The actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.	

10.5 Short-time / Long-time operation, travelling times

10.5.1 Short-time / Long-time operation

Determining and configuring short-time and long-time operation

The short-time operation (Step) permits adjusting the slat tilting angle of a Venetian blind or the 'slit opening width' of a shutter. In most cases, short-time operation is activated by pressing a Venetian blind pushbutton sensor permitting manual intervention in the blind controller. When the actuator receives a short-time command while the Venetian blind, shutter, awning or louver is in motion, the travel movement is stopped immediately by the actuator.
A long-time operation (Move) is determined by the travel time of the connected Venetian blind, shutter/awning or louver and must therefore not be preset separately. The movement time must be measured manually and entered into the ETS parameters.
The control of an output by means of a long-time or a short-time telegram is also designated as 'direct operation'.

To ensure that the curtain or the louver has definitely reached its end position at the end of long time operation, the actuator always prolongs the long time movement by 20 % of the configured or learnt movement time. The parameterized travelling time extension will moreover be taken into account by the actuator for all upward travels or all travel movements into the open position as the drive motors are then generally no so fast due to the weight of the curtains or to external physical influences (e.g. temperature, wind, etc.). Thus, it is ensured that the upper end position is always reached even in case of uninterrupted long time travel movements.

ℹ A long time or a short time operation can be retriggered by a new incoming long time or short time telegram.

ℹ A travel movement activated in the manual control mode or by a safety function is always a long-time operation. The "raising" or "lowering" commands configured in the ETS will equally activate the long time operation.

Presetting the short time operation

Short-time operation is configured separately for each output and independent of the travel time of the blind/shutter or louver/roof window. It is possible to specify in the ETS whether the output executes only a "stop" for a travel movement on reception of a short time telegram or whether the output is activated for a specific duration.

- Set the parameter "Short time operation" on the parameter page "Relay outputs... -> VBO... - General -> Times" to"yes".

  The actuator activates the output concerned for the time specified under "Duration of short-time operation" when a short-time telegram is received and when the output is not in the process of executing a travel movement. If the output is executing a travel movement at the time of telegram reception, the output will only just stop.

- Set the "Short time operation" parameter to "no (only stop)"..

The actuator will only stop the output on reception of a short time telegram, if the output is in the process of executing a travel movement. There will be no reaction, if the output is not executing a movement at the time of telegram reception.

ℹ The configured "Duration of short time operation" for a Venetian blind should correspond to approx. ¼ of the complete slat travel time and for a shutter to the full travel time needed for opening a shutter.

ℹ The short time operation is always executed without a movement time extension.

10.5.2 Setting the travel time

Determining and configuring travel times (manual entry of travel times)

For computing positions and also for executing long time operation, the actuator needs the exact travel time of the connected Venetian blind, shutter/awning or louver/roof window. The movement times must be measured manually and entered into the ETS configuration. It is important to determine the movement time accurately to permit positions to be approached with good precision. Therefore, it is recommended to make several time measurements, then to take the average of the measured values and enter them in the corresponding parameters. The travel time corresponds to the duration of a travel movement from the completely open position
(upper end position / awning rolled up) to the completely closed position
(lower end position / awning completely unrolled). Not vice-versa! The movement times are to be determined as a function of the different types of drives.

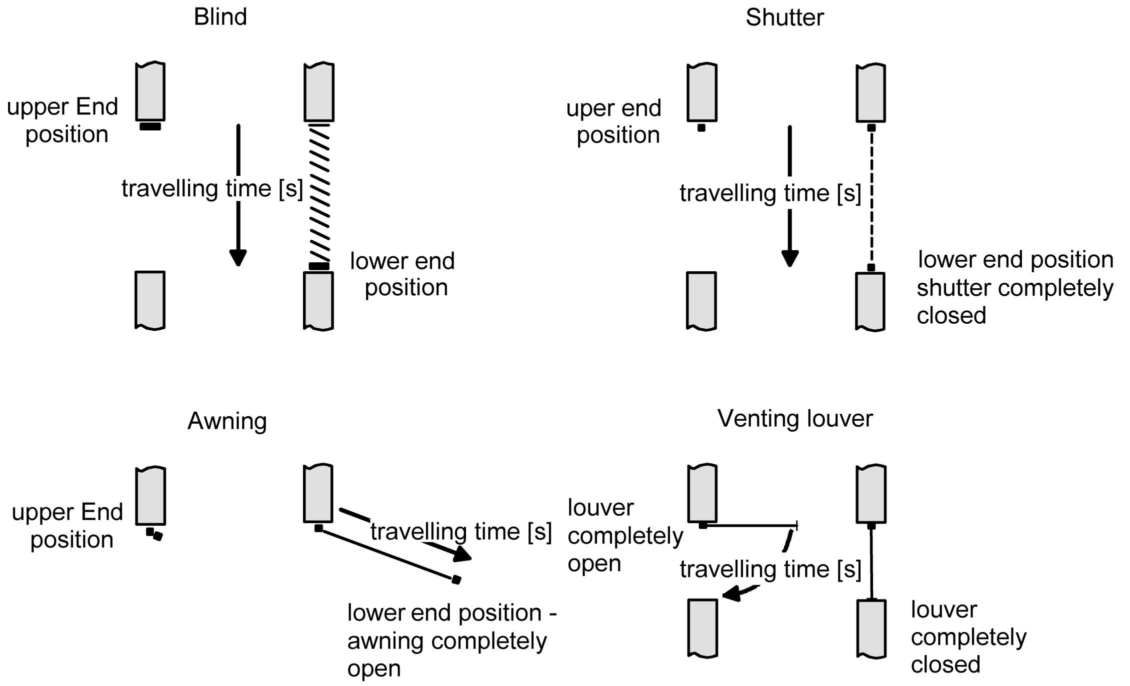

Image 3: Determining the movement time according to the drive type

Setting the travel time of Venetian blinds, shutters/awnings and louvers

- Enter the exact travel times determined in the course of the commissioning procedure into the "Venetian blind travel time" or "Shutter/awning travel time" or "Venting louver/roof window travel time" parameters. The maximum travelling time is '19 minutes 59 seconds. The working principle does not allow longer movement times.

i The parameterized travelling time extension will moreover be taken into account by the actuator for all upward travels or all travel movements into the open position as the drive motors are then generally no so fast due to the weight of the curtains or to external physical influences (e.g. temperature, wind, etc.).

10.5.3 Setting slat travel times (with slatted Venetian blinds)

Determining and configuring the slat moving time (only with slatted Venetian blinds)

If Venetian blinds are controlled, the slats can be positioned independently. To enable the actuator to compute slat positions and to report them back to the bus, it is necessary that the actuator gets precise information about the time required for a slat rotation. The slat moving time must in each case be determined manually and entered into the parameters.
The actuator is designed in such a way that it can control single-motor Venetian blind drives without a working position. In this drive mode, the slats are directly adjusted by way of mechanical linkage when the height of the Venetian blind is changed. The actuator assumes that the slats are completely closed when the Venetian blind moves downwards. The actuator assumes that the slats are completely closed when the Venetian blind moves downwards .

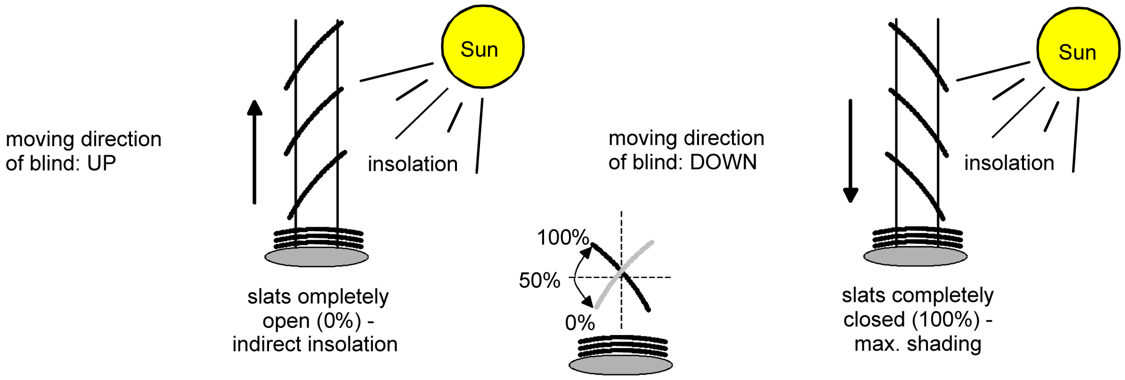

Image 4: Type 1 - Slatted Venetian blinds with oblique slat position in both travel directions

There are also single-motor Venetian blind systems without a working position the slats of which are horizontal during an upward travel and oblique during a downward travel. Such blind types can also be connected to the actuator, in which case a completely open slat position corresponds to the slats in horizontal position.

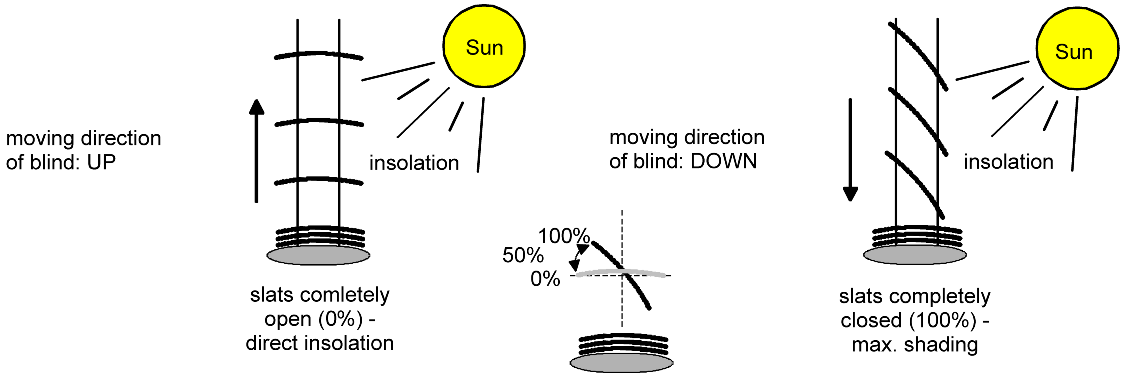

Image 5: Type 2 - Slatted Venetian blinds with oblique and horizontal slat position

Presetting the slat moving time

- Set the parameter "Slat travel time" on the parameter page "Relay outputs... -> VBO... - General -> Times" exactly to the value determined in the course of the commissioning procedure.

i The slat moving time must be shorter than the preset or learnt blind travelling time.

i The configured movement time extension will also be taken into account when slats are moved into the completely open position (upward movement).

10.5.4 Presetting the travel time extension and switchover time

Presetting the movement time extension

- In the parameter "Travel time extension for upward travel" on the parameter page "relay outputs... -> VBO... - General -> Times" enter the determined travel time extension (by rounding up the determined extension value if necessary)

Presetting the switchover time for movement direction changes

- Set the parameter "Switchover time for travel direction change" on the parameter page "Relay outputs... -> VBO... - General -> Times" to the required switchover interval.

i In the as-delivered state of the actuator, the switchover time is generally preset to 1 s.

10.5.5 Short-time / Long-time operation, travel times parameter

Relay outputs... -> VBO... - General -> Times

Venetian blind travel time minutes (0...19)	0...**1**...19
This parameter defines the travelling time of the Venetian blind. The time needed for a complete travel from the upper into the lower end position must be determined. Sets the minutes of the Venetian blind travelling time. This parameter is only visible in the venetian blind operating mode.	

Seconds (0...59)	**0**...59
Sets the seconds of the Venetian blind travelling time. This parameter is only visible in the venetian blind operating mode.	

Shutter/awning travel time minutes (0...19)	0...**1**...19
This parameter defines the travelling time of the shutter or awning. The time needed for a complete travel from the upper into the lower end position must be determined. Sets the minutes of the shutter/awning moving time. This parameter is only visible in the shutter/awning operating mode.	

Seconds (0...59)	**0**...59
Sets the seconds of the shutter/awning moving time. This parameter is only visible in the shutter/awning operating mode.	

Venting louver travel time minutes (0...19)	0...**1**...19
This parameter defines the travelling time of the venting louver. The time needed for a complete travel from the completely open into the completely closed position must be determined. Sets the minutes of the venting louver travelling time. This parameter is visible only in the venting louver operating mode.	

Seconds (0...59)	**0**...59
Sets the seconds of the venting louver travelling time. This parameter is visible only in the venting louver operating mode.	

Slat travel time minutes (0...19)	**0**...19
This parameter defines the travelling time of the slats. The time needed for a complete movement from the completely open slat position into the completely closed slat position (travel movement DOWN) must be determined. Sets the minutes of the slat moving time. This parameter is only visible in the venetian blind operating mode.	

Seconds (0...59)	0...**2**...59
Sets the seconds of the slat moving time. This parameter is only visible in the venetian blind operating mode.	

Milliseconds (0...900)	**0**...100...900
Sets the milliseconds of the slat moving time. This parameter is only visible in the venetian blind operating mode.	

Short time operation	no (only stop) **yes**
This parameter can be used to configure the reaction to a received short time telegram. no (only stop): The drive will only be stopped if it is executing a movement at the time of telegram reception. There is no reaction if no movement is in progress. yes: Short-time operation is started on reception of a short-time telegram when the drive is stationary. If the drive is in motion at the time of telegram reception, it will be stopped.	

Duration of short time operation seconds: (0...59)	**0**...59
This parameter defines the duration of short-time operation. Sets the monitoring time seconds. This parameter is only visible, if the parameter "Short-time operation" is set to "yes".	

Milliseconds (0...990)	0...10...**500**...990
Sets the monitoring time milliseconds. The duration of short time operation should in no case exceed half the slat adjusting time. This parameter is only visible, if the parameter "Short-time operation" is set to "yes".	

Switchover time for travel direction change	0.5 s **1 s** 2 s 5 s
This parameter specifies the break in a travel direction change (switchover time).	

Travel time extension for upward travel	none 0.5% 1% 1.5% **2%** 3% 4% 5% 6% 7% 8% 9% 10% 12.5% 15% 30%
The actuator extends all the up movements or all venting louver/roof window movements into the opened position using the extension configured here. The time extension expressed in percent is the difference between the measured travel time needed to reach the lower end position (completely closed position) and the time needed to reach the upper end position (completely open position).	

10.5.6 Object list Short-time / Long-time operation, travel times

Object no.	Function	Name	Type	DPT	Flag
20, 44...	Long-time operation	Venetian blind... - Input	1-bit	1,008	C, (R), W, -, A
1-bit object for activation of long time operation					

Object no.	Function	Name	Type	DPT	Flag
24, 45...	Short time operation	Venetian blind...- Input	1-bit	1,007	C, (R), W, -, A
1-bit object for activation of short time operation or for stopping a drive movement.					

10.6 Position calculation, position presetting and feedbacks

10.6.1 Position calculation and position presetting

Calculating the curtain height or the louver position

The actuator has a comfortable and accurate positioning function. The actuator calculates the current position of the connected Venetian blind, shutter, awning or venting louver or roof window whenever these elements are adjusted either by manual or bus control. The calculated position value is a measure of the height of the blind/ shutter or of the opening width of the venting louver/roof window.

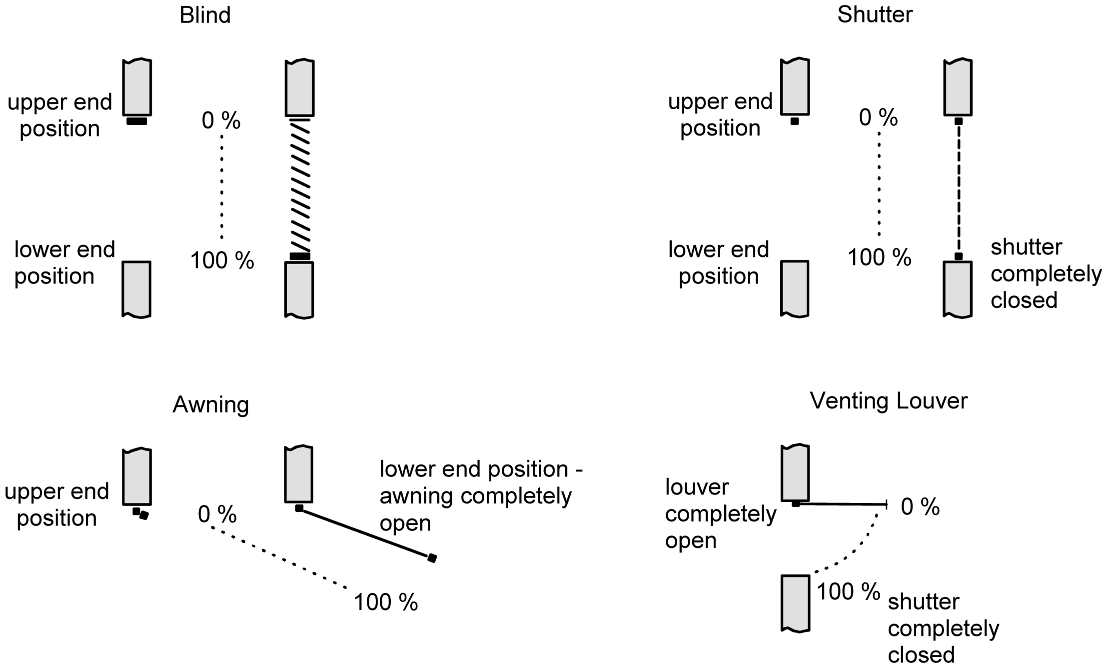

Image 6: Positions defined as a function of the type of movement

The actuator derives the positions from the configured travelling time since conventional drives do not provide feedback about their positions. Thus, the travel time configured or learned separately for each venetian blind output is the reference for all position approaches and of basic importance for the accuracy of the position calculations. For this reason, the travelling times should be determined with great accuracy in order to achieve the best possible positioning results.

For positioning purposes, the actuator calculates the movement time required as a function of the current position.

Example 1
The shutter connected to the certain output has an overall travel time of 20 s. The shutter is in its upper end position (0 %). It is to be positioned at 25 %. The actuator calculates the travel time required for approaching the desired position: 20 s · 0.25$_{(25 \%)}$ = 5 s. The output will then lower the shutter for 5 s and thus position the blind at height of 25 %.

Example 2

The shutter at an output has an overall travel time of 20 s. The shutter is in the 25 % position. It is to be positioned at 75 %. The difference between the positions is 50 %. The actuator calculates the travel time required for bridging the difference between the positions: $20\ \text{s} \cdot 0.5_{(50\ \%)} = 10\ \text{s}$. The output will then lower the shutter for 10 s and thus position the blind at height of 75 %.

With all the upward movements, the configured movement time extension is automatically added to the calculated movement time.

Example 3

The shutter at an output has an overall travel time of 20 s. The shutter is in the 75 % position. It is to be positioned at 25 %. The difference between the positions is 50 %. The actuator calculates the non-extended travel time required for bridging the difference between the positions:
$20\ \text{s} \cdot 0.5_{(50\ \%)} = 10\ \text{s}$. Taking the travel time extension into account (e.g. 10 %) the actual raising time is:: $10\ \text{s} \cdot ((100\ \% + 10\ \%_{(\text{travel time extension})}) : 100\ \%) = 10\ \text{s} \cdot 1.1 = 11\ \text{s}$. The output will then raise the shutter for 11 s and thus position it at a blind height of 25 %.

When the lower or upper end positions (0 % or 100 %) are approached, the movement time is always 20 % longer than the overall movement time.

Example 4

The shutter at an output has an overall travel time of 20 s. The shutter is in the 50 % position. It is to be positioned at 100 %. The difference between the positions is 50 %. The actuator calculates the travel time required for bridging the difference between the positions: $20\ \text{s} \cdot 0.5_{(50\ \%)} = 10\ \text{s}$. As the movement is a limit position movement, the actuator adds 20 % of the total travel time:
$10\ \text{s} + (20\ \% : 100\ \%) \cdot 20\ \text{s} = 14\ \text{s}$. The output will then lower the shutter for 14 s and thus positions it safely at a blind height of 100 %.

Example 5

The shutter at an output has an overall travel time of 20 s. The shutter is in the 50 % position. It is to be positioned at 0 %. The difference between the positions is 50 %. The actuator calculates the non-extended travel time required for bridging the difference between the positions: $20\ \text{s} \cdot 0.5_{(50\ \%)} = 10\ \text{s}$. As the movement is a limit position movement, the actuator additionally adds 20 % of the total travel time:
$10\ \text{s} + (20\ \% : 100\ \%) \cdot 20\ \text{s} = 14\ \text{s}$.
Taking the travel time extension into account (e.g. 10 %) the actual raising time is:
$14\ \text{s} \cdot ((100\ \% + 10\ \%_{(\text{travel time extension})}) : 100\ \%) = 14\ \text{s} \cdot 1.1 = 15.4\ \text{s}$. The output will then raise the shutter for 15.4 s and thus position safely at 0 %.

ℹ The actuator executes position approaches only if a new position deviating from the current position is preset.

ℹ The actuator stores the blind or venting louver/roof window positions temporarily. The actuator can approach newly preset positions only if the current positions are known. For this purpose, each output must be given the opportdevicey to synchronise itself whenever the bus voltage is switched on or after every ETS programming run (physical address, application program, partial download). This synchronisation is performed by means of a reference movement.

i Position approaches in progress will be aborted in case of bus voltage failure. In case of bus voltage failure, the configured behaviour will be executed.

Calculating the slat position (only with blinds)

In the "blinds" operating mode, the actuator always calculates the slat position so that the opening angle and thus the amount of light admitted into the room by the blind can be adjusted. A new position approach by a Venetian blind will always be followed by a positioning movement of the slats. Thus, the slat positions last selected will be tracked or readjusted to a new value if a position change has taken place.
In case of single-motor Venetian blind systems without a working position, the slats will be readjusted directly by a change of the Venetian blind height. For this reason, an adjustment of the slat position will always have an influence on the position of the blind itself .

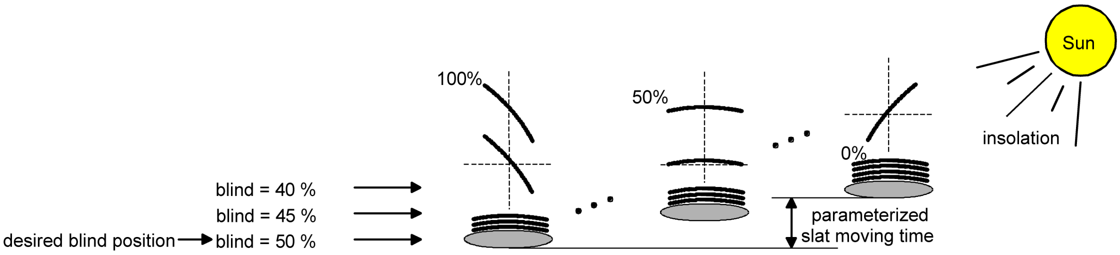

Image 7: Example of slat positioning affecting the position of the Venetian blind (typical of slat type 1; analogous reaction for type 2)

Since a preset slat position is to remain constant until the next change, the actuator will not change the height of the Venetian blind, if the calculated movement time required for a change of position lies within the configured slat moving time. Similarly, the actuator accounts for the ratio of the moving times of slat and Venetian blind and – in case of slat position changes – always recalculates the resulting Venetian blind position. If the position feedback objects are used (cf. "Position feedback"), the actuator transmits the blind positions changed by the adaptation also to the bus.

Example (see figure 7)
The Venetian blind position is preset to 50 %. A change of the slat angle (100 %...0 %) initiates the calculation of a new Venetian blind position which is also tracked in the position feedback objects. If the actuator is to approach a new blind position of, let's say 47 % in this case, the actuator will not perform a travel movement as the calculated travelling time lies within the parameterized slat moving time and therefore coincides with the slat movement. A change of the Venetian blind position to 55 % in this case triggers a Venetian blind movement as the change does not lie within the slat movement (0 to 100 %).

In each position operation, the Venetian blind setpoint position refers to a slat position of 100 %. In the event of a slat repositioning movement (0 to 100 %), the system will therefore report a Venetian blind position below the desired position.

Exception: The Venetian blind setpoint position of 0 % (upper end position) is assigned to the slat position of 0 %. The readjustment of the slat position will result also in this case in a change of the Venetian blind height (brief downward movement). Only in this case will the actuator report back a blind position above the desired blind position . With slat type 1, the slats are generally horizontal when the Venetian blind is in its upper end position. For this reason, the calculated slat position with a slat type 1 corresponds to the actual opening angle only after the first slat is completely extended (100%).

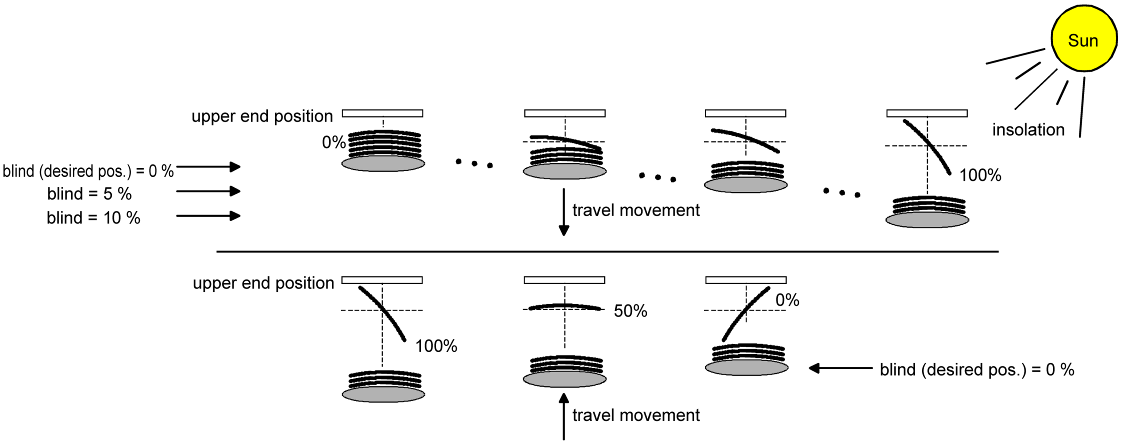

Image 8: Example of slat positioning with the Venetian blind in upper end position (typical of slat type 1.)

Example (see figure 8)
The Venetian blind position is preset to 0 %. After an extended movement, the Venetian blind is safely in the upper end position. A change of the slat angle (0 %...100 %) initiates the calculation of a new Venetian blind position which is also tracked in the position feedback objects. If the actuator is to approach a new blind position of, let's say 5 % in this case, the actuator will not perform a travel movement as the calculated travelling time lies within the parameterized slat moving time and therefore coincides with the slat movement. A change of the Venetian blind position to 15 % in this case triggers a Venetian blind movement as the change does not lie within the slat movement (0 to 100 %).

i The actuator executes slat position adjustments only if a new position deviating from the current slat position is preset.

i The actuator stores the slat positions temporarily. The actuator can approach newly preset slat positions only if the current position is known. For this purpose, each output must be given the opportdevicey to synchronise itself whenever the bus voltage is switched on or after every ETS programming run (physical address, application program, partial download). This synchronisation is performed by means of a reference movement for the slat or the Venetian blind.

ℹ When positioning the Venetian blind height, the slats are always positioned afterwards. After reactivation of the bus voltage of after ETS programming, the actuator will in this case generally move the slats into the 100 % position, if no position has been preset for the slats.

ℹ The smaller the ratio between slat moving time and Venetian blind travelling time, the more precise the position approaches and the less marked the influence of the slat angle adjustment on the height of the Venetian blind.

Presetting the position

The following ways of presetting positions can be distinguished…

- Direct positioning via the positioning objects (direct operation),
- Positioning by activating the sun protection function,
- Positioning by a scene recall.

Positioning via the positioning objects:
Each Venetian blind, shutter, awning, venting louver or each roof window can be positioned directly using the Position ..." object" which is separate for each output. An independent positioning object exists for each of the slats. The position approached is always the position last received. The actuator does not show a reaction when the set or to be approached position value is received several times in succession.
Like the operation via short time, long time or scene recall, this form of control is also designated as 'direct operation'. Positioning via the objects therefore has the same priority.

A position approach effected by the communication objects can be interrupted at any time by a short- or long-time or by a scene recall. The direct operation can be overridden by a function with a higher priority, e.g. manual control, safety or also sun protection (configurable).
The position telegrams must correspond to the 1 byte data format according to KNX datapoint type 5.001 (Scaling). The actuator converts the value received (0...255) linearly into a position (0...100 %).

Received value (0...255)	Position derived from value (0…100 %)
0	0 % (upper end position / slat or venting louvre opened)
↓	↓ (all intermediate values rounded off to 1 % increments)
255	100 % lower end position / slat or louvre closed)

Data format of positioning objects with conversion into percentage position values

It is possible that new positioning telegrams are being received while a position approach is in progress. In this case, the actuator immediately reverses the direction of travel, if the new position to be approached lies in the opposite direction. If a slat positioning command is received during a running Venetian blind position approach, the device finishes first the Venetian blind position approach before positioning the slat. If a blind positioning command is received during a slat positioning movement, the actuator interrupts the slat positioning movement and approaches the new blind position. Only then does the actuator switch to the most recently received slat position.

In case of Venetian blind positioning, slat positioning will always be executed later. After switching on the bus voltage or after programming with the ETS, it may be the case that the slat position is unknown, if no long time command for the upward or downward movement with a duration of at least the configured slat moving time has been received or no slat positioning has taken place (no slat reference movement). In this case, the slat is moved during a Venetian blind position approach into the completely closed position (100 %). The slat position is then considered as calibrated.

i Optionally, the sun protection function offers the possibility of receiving the instruction of the blind height, venting louver/roof window position or slat position to be adopted during sunshine via separate communication objects and to preset these values variably. This form of variable position preset in the sun protection function is identical to presetting the positions via communication objects in direct operation. The priority of the incoming telegrams in direct operation with the sun protection activated can be additionally configured in the ETS.

Positioning by the sun protection function or by a scene recall:
In case of the actuator functions mentioned, the positions to be approached are configured directly in the ETS depending on the operating mode. The position values can be specified between 0 % and 100 % in 1 % increments.
With Venetian blinds, the height of the Venetian blind is positioned first in these cases. The configured slat position is adjusted only thereafter.

i Important notes for all positioning movements: Using the connected drives frequently for position approaches (for instance several times a day) can result after some time in positioning inaccuracies. These deviations from the setpoint position are mostly due to external physical influences. To achieve accurate positioning in operation it is recommended to perform the reference movement at least once every day. This can be achieved for instance by a central raising command transmitted to the long time object.

Reference movement

After ETS programming (physical address, application program, partial download) or after bus voltage failure all current position data are unknown. Before the actuator can approach new positions after bus voltage return or after programming, the positioning system must at first be calibrated. A position calibration is possible by executing the reference movement.
A reference movement is the time required for a travel movement into the upper end position increased by 20 % and additionally by the configured travel time extension.
A reference travel is not retriggerable.

Reference movements can be executed by the following commands...

- Uninterrupted long time operation (including also a terminated safety movement) into the upper end position activated via the corresponding communication object,
- an approach of the 0 % position,
- a manually controlled movement into the upper end position.

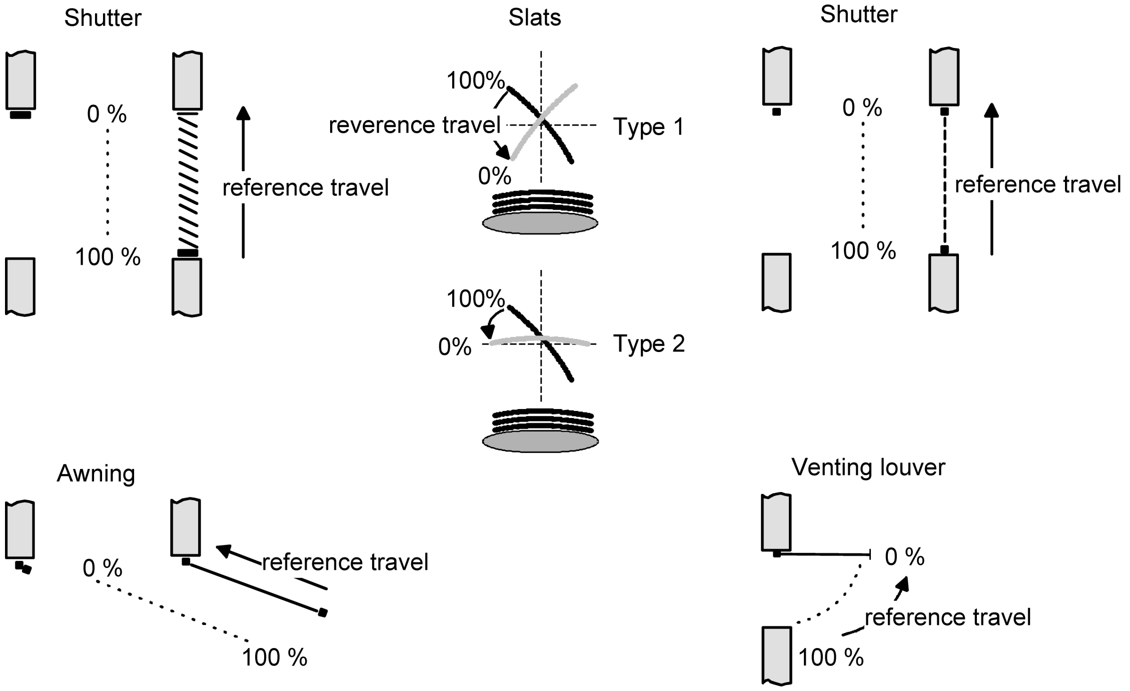

Image 9: Reference movement

In the event of slat positioning via the corresponding communication objects after bus voltage return or after programming, a slat reference movement becomes necessary if the Venetian blind has not been moved beforehand in the up or down directions for at least the configured slat moving time. During a slat reference movement, the actuator always moves the slats for the parameterized slat moving time into the completely open position (0 %) and then to the desired position. The slat position is also considered as calibrated when the Venetian blind has been moved by a long-time command in the up or down direction during at least the configured slat moving time.

ℹ A terminated reference movement of the Venetian blind will also calibrate the slat position.

ℹ If the reference movement is interrupted for instance by a short-time operation, the position is still unknown as before.

ℹ A long-time travel into the lower end position activated via the corresponding communication object also calibrates the reference position.

ℹ With the sun protection function it is moreover possible to force the actuator to perform a reference movement before each sun protection travel even if the positions are known. Thus, it is ensured that in case of sun protection the configured sun protection position is always precisely approached even after repeated position approaches.

i Using the connected drives frequently for position approaches (for instance several times a day) can result after some time in positioning inaccuracies. These deviations from the setpoint position are mostly due to external physical influences. To achieve accurate positioning in operation it is recommended to perform the reference movement at least once every day. This can be achieved for instance by a central raising command transmitted to the long-time object.

10.6.2 Feedback telegrams

Position feedback messages

In addition to presetting positions via positioning objects, the actuator can track the current positions values via separate feedback objects and also transmit them to the KNX, if the bus voltage is on. Thus, the preset setpoint position can be distinguished from the true actual position of the drives activated.

The following feedback telegrams can be preset for each output depending on the parameterized mode of operation...

- Feedback (1 byte) of the Venetian blind, shutter, awning or venting louver/roof window positions,
- Feedback (1 byte) of the slat position (only with Venetian blinds).

The individual position feedback messages can be enabled in the ETS independent of one another and have communication objects of their own. For each travel movement the actuator calculates the current position and tracks it in the position feedback objects. The positions are tracked and the feedback objects updated even when an output has been activated via short-time or long-time telegrams or by manual control on condition that the bus voltage is on.

The feedback objects are updated after the following events...

- at the end of a travel movement – including a slat positioning movement in a Venetian blind – when the drive stops and when the new position is reached,
- with a movement to an end position already at the time the end position is theoretically reached, i.e. before the 20 % extension and the travel time extension have elapsed,
- cyclically even during a travel movement, provided that cyclical transmission is active.

The feedback objects are not updated, if the position last reported back has not changed after a movement (for instance, when the Venetian blind is repositioned, the unchanged slat position will not be reported back a second time). The actuator cannot calculate a feedback position, if the current position data after switch-on of the bus voltage or after ETS programming are still unknown. In these cases, the system must first perform a reference movement so that the position can be calibrated. In case of unknown positions, the actuator automatically performs reference travels, if new positions are preset and if these positions are to be approached. As long as a position is unknown, the value of the feedback objects is "0".

Presetting position feedback for Venetian blind, shutter, awning or venting louver/roof window positions

The feedback functions can be enabled and programmed independently for each output. When feedback is enabled, the ETS adapts the parameter texts depending on the preset operating mode ("Venetian blind position feedback", "Shutter/awning position feedback" or "Venting louver/roof window position"). The feedback can be used as an active message object or as a passive status object. As an active signalling object, the position feedback information is transmitted to the bus whenever a position value changes. As a passive status object, there is no telegram transmission after a change. In this case, the object value must be read out. The ETS automatically sets the object communication flags required for proper functioning.

In case of an actively transmitting signalling object, the current position can be transmitted to the KNX after bus voltage return, if the position value differs from the one last transmitted. When the position data are known, the feedback telegram can in this case be transmitted with a time delay to reduce the bus load, with the delay being preset globally and in common for all outputs.

The feedback functions of an output must be enabled on the parameter page "Relay outputs... "Relay outputs... -> VBO... - General -> Enabled". Only then are the parameters for the feedback functions visible.

- Set the parameter "Venetian blind position feedback", "shutter/awning position feedback" or "Venting louver/roof window position" to "Feedback object is active signalling object".

  The feedback object is enabled. The position value is transmitted as soon as it changes. No value will be actively transmitted, if the position is unknown.

- Set the parameter "Venetian blind position feedback", "shutter/awning position feedback" or "Venting louver/roof window position" to "Feedback object is active signalling object".

  The feedback object is enabled. The position value will be transmitted in response only if the feedback object is read out from by the KNX. If the position is unknown, a value of "0" will be reported back after readout.

The feedback must be set as actively transmitting.

- If a delay after bus voltage return or after ETS programming should be necessary, activate the parameter
  Time delay for feedback after bus voltage return" on the parameter page ".

  The position feedback is transmitted with a delay after bus voltage return or after an ETS programming operation, provided that the position is known (reference movement performed). After the end of the delay, the position last adjusted statically will be transmitted to the KNX. No feedback telegram is transmitted during a running delay, even if a position value changes during this delay.

The feedback must be set as actively transmitting.

- If cyclical transmission is required during active movement, activate the parameter of the same name and configure the required cycle time.

The position feedback is transmitted cyclically during a running travel movement. The parameter "Time for cyclical transmission" specifies the cycle time.

ℹ The cyclical transmission only takes place if the position data is known (reference movement completed).

ℹ If, after a bus voltage return or an ETS programming operation, the position data is unknown, the feedback objects are initialised with "0". The object values are then not transmitted to the KNX.

ℹ In case of Venetian blind operation, any position change of the Venetian blind within the limits of the slat adjustment (0 to 100 %) does not cause a movement and therefore no change of the feedback position data either.

Presetting the position feedback for slat positions (only with Venetian blinds)

The feedback functions for the slat positions can be enabled and programmed independently for each output. As with the position feedback of the Venetian blind height, the feedback can be used as an active message object or as a passive status object. In case of an actively transmitting signalling object, the current slat position can be transmitted to the bus after bus voltage return, if the position value differs from the one last transmitted. When the position data are known, the feedback telegram can in this case be transmitted with a time delay to reduce the bus load, with the delay being preset globally and in common for all outputs.

The feedback functions of an output must be enabled on the parameter page "Relay outputs... "Relay outputs... -> VBO... - General -> Enabled". Only then are the parameters for the slat position feedback functions visible.

- Set the parameter "Slat position feedback" to
  "feedback object is active signalling object".

  The feedback object is enabled. The position value is transmitted as soon as it changes. No value will be actively transmitted, if the position is unknown.

- Set the parameter "Slat position feedback" to
  "feedback object is passive status object".

  The feedback object is enabled. The position value will be transmitted in response only if the feedback object is read out from by the KNX. If the position is unknown, a value of "0" will be reported back after readout.

The feedback must be set as actively transmitting.

- If a delay after bus voltage return or after ETS programming should be necessary, activate the parameter
  Time delay for feedback after bus voltage return" on the parameter page ".

  The position feedback is transmitted with a delay after bus voltage return or after an ETS programming operation, provided that the position is known (reference movement performed). After the end of the delay, the position last adjusted statically will be transmitted to the KNX. During a running delay the affected feedback object is updated but no feedback is transmitted actively, even if a position value changes during this delay.

The feedback must be set as actively transmitting.

- If cyclical transmission is required during active movement, activate the parameter of the same name and configure the required cycle time.

  The position feedback is transmitted cyclically during a running travel movement. The parameter "Time for cyclical transmission" specifies the cycle time.

i The cyclical transmission only takes place if the position data is known (reference movement completed). The feedback object of the slat position also transmits cyclically during a blind/shutter movement (e.g. Venetian blind position approach).

i If, after a bus voltage return or an ETS programming operation, the position data is unknown, the feedback objects are initialised with "0". The object values are then not transmitted to the KNX.

i In case of Venetian blind operation, any position change of the Venetian blind within the limits of the slat adjustment (0 to 100 %) does not cause a movement and therefore no change of the feedback position data either.

'Unknown position' feedback and travel movement

In addition to position data feedback, the actuator can also report back enlarged 1-bit status information messages and transmit them actively to the KNX, if the bus voltage is on.

The following status feedback messages can be separately preset for each output…

- Feedback of an invalid position,
- Drive movement feedback,

Feedback of an invalid position:
After switch-on of the supply voltage or after programming with the ETS, all the position data of an output is unknown. In this case, the actuator can update the feedback object Invalid position" (object value "ON"), which will then signal that the object values of the 1-byte position feedback objects are invalid.
An invalid position feedback will only be reversed (object value
" (object value "OFF"), after the position data for the Venetian blind, shutter, awning, venting louver or roof window have been calibrated by means of a reference movement The calibration of the slat position in a Venetian blind alone will not result in the reversal of an 'invalid position "invalid position".
As an option, the object value of the status feedback message can be actively transmitted to the KNX in case of a value change.

Drive movement feedback:
The actuator can report back via a separate 1-bit communication object per output whether the connected drive is moving, i.e. whether the output is supplying current for any travel direction. The feedback object has the object value "ON", when current is flowing from the output to the drive. Similarly, "OFF" is written into the object if the output concerned remains in a stop position In this case, the operation by which the output was activated (short-time or long-time operation, positioning, manual control, etc.) is of no importance.

As an option, the object value of the status feedback message can be actively transmitted to the KNX in case of a value change.
The state of the feedback is only derived from the relay state of the actuator. This means that if a drive is blocked or already in its end position, the value reported back does not correspond to the actual state of the travel movement.

Setting feedback of an invalid position

The feedback of an invalid position can be enabled and programmed independently for each output. When feedback is enabled, the ETS adapts the parameter texts depending on the preset operating mode ("invalid Venetian blind position feedback", "invalid shutter/awning position feedback" or
"invalid venting louver/roof window position").
The feedback can be used as an active message object or as a passive status object. As an active signalling object, the status feedback information is transmitted to the KNX whenever a position value changes. As a passive status object, there is no telegram transmission after a change. In this case, the object value must be read out. The ETS automatically sets the object communication flags required for proper functioning.
If the object is an actively transmitting signalling object, the feedback telegram can be transmitted after bus voltage return with a time delay to reduce the bus load, with the delay being preset globally and in common for all outputs.

The feedback functions of an output must be enabled on the parameter page "Relay outputs... "Relay outputs... -> VBO... - General -> Enabled". Only then are the parameters for the feedback functions visible.

- Set the parameter "invalid Venetian blind position feedback",
  "invalid shutter/awning position feedback" or
  "invalid venting louver/roof window position" to
  "Feedback object is active signalling object".

  The feedback object is enabled. A telegram is transmitted as soon as there is a change (e.g. after ETS programming, after switch-on of the bus voltage or after a reference movement).

- Set the parameter "invalid Venetian blind position feedback",
  "invalid shutter/awning position feedback" or
  "invalid venting louver/roof window position" to
  "Feedback object is passive status object".

  The feedback object is enabled. A telegram will be transmitted in response only if the feedback object is read out by the bus.

The feedback must be set as actively transmitting.

- If a delay after bus voltage return should be necessary, activate the parameter "Time delay for feedback after bus voltage return" on the parameter page "Relay outputs... -> VBO... - General -> Feedback telegrams".

The feedback of an invalid position will be transmitted with a delay after bus voltage return. After the end of the delay, the object value state last adjusted will be transmitted to the KNX. No feedback telegram is transmitted during a running delay, even if a position value becomes known during this delay, for example through a reference movement.

i Automatic transmission after bus voltage return only takes place if there has been an internal change to the object state (for example through a reference run during manual operation).

Setting drive movement feedback

The feedback of a drive movement can be enabled and programmed independently for each output. The feedback can be used as an active message object or as a passive status object. As an active signalling object, the status feedback information is transmitted to the KNX whenever a position value changes. As a passive status object, there is no telegram transmission after a change. In this case, the object value must be read out. The ETS automatically sets the object communication flags required for proper functioning.
If the object is an actively transmitting signalling object, the feedback telegram can be transmitted after bus voltage return with a time delay to reduce the bus load, with the delay being preset globally and in common for all Venetian blind outputs.

The feedback functions of an output must be enabled on the parameter page "Relay outputs... "Relay outputs... -> VBO... - General -> Enabled". Only then are the parameters for the feedback functions visible.

- Set the parameter "Slat position feedback" to "Feedback object is active signalling object".

  The feedback object is enabled. A telegram is transmitted when the connected drive starts moving or stops.

- Set the parameter "Slat position feedback" to "Feedback object is passive status object".

  The feedback object is enabled. A telegram representing the current travel movement will be transmitted in response only if the feedback object is read out by the KNX.

The feedback must be set as actively transmitting.

- If a delay after bus voltage return should be necessary, activate the parameter "Time delay for feedback after bus voltage return" on the parameter page "Relay outputs... -> VBO... - General -> Feedback telegrams".

  The feedback of a travel movement is transmitted after a delay on bus voltage return, for example, when the drive starts moving on account of the set behaviour after bus voltage return. After the end of the delay, the object value state last adjusted will be transmitted to the KNX. No feedback is transmitted during a running delay, even if the drive stops or starts moving.

ℹ Automatic transmission only takes place after a bus voltage return when the drive starts moving on bus voltage return or if the bus failure has caused a change to the travel movement.

10.6.3 Parameter position calculation, position presetting and feedbacks

Relay outputs... -> VBO... - General -> Enabled functions

Feedback telegrams	Checkbox (**yes** / no)
This parameter can be used to enable the feedback functions of the Venetian blind output.	

Relay outputs... -> VBO... - General -> Feedback telegrams

Venetian blind position	no feedback **feedback object is active signalling object** feedback object is passive status object
The current Venetian blind position of the output can be reported separately back to the KNX. no feedback: There is no feedback object available for the output. feedback deactivated Feedback object is an active signalling object: The feedback and the object are activated. The object transmits actively. Feedback object is a passive status object: The feedback and the object are activated. The object is passive (telegram transmission only as a response to 'Read' request). This parameter is only visible in the venetian blind operating mode.	

Position of shutter/awning	no feedback **feedback object is active signalling object** feedback object is passive status object
The current roller shutter or awning position of the output can be reported separately back to the KNX. no feedback: There is no feedback object available for the output. feedback deactivated Feedback object is an active signalling object: The feedback and the object are activated. The object transmits actively. Feedback object is a passive status object: The feedback and the object are activated. The object is passive (telegram transmission only as a response to 'Read' request). This parameter is only visible in the shutter/awning operating mode.	

<table>
<tr><td>Venting louver/roof window positions</td><td>no feedback
feedback object is active signalling object
feedback object is passive status object</td></tr>
<tr><td colspan="2">The current venting louver/roof window positions of the output can be reported separately back to the KNX.
no feedback: There is no feedback object available for the output. feedback deactivated
Feedback object is an active signalling object: The feedback and the object are activated. The object transmits actively.
Feedback object is a passive status object: The feedback and the object are activated. The object is passive (telegram transmission only as a response to 'Read' request).
This parameter is only visible in the "venting louver/roof window" operating mode.</td></tr>
</table>

<table>
<tr><td>Delay after bus voltage return</td><td>Checkbox (yes / no)</td></tr>
<tr><td colspan="2">The feedback telegram can be transmitted to the KNX with a delay after bus voltage return or after programming with the ETS. The delay time is configured under "General -> General Venetian blind outputs".
This parameter is only visible in case of an actively transmitting feedback object.</td></tr>
</table>

<table>
<tr><td>Cyclical transmission during active movement</td><td>Checkbox (yes / no)</td></tr>
<tr><td colspan="2">If cyclical transmission of the blind/shutter position is required during active movement, this parameter can be activated. The position feedback is then transmitted cyclically during a running travel movement. The cyclical transmission only takes place if the position data is known (reference movement completed).
This parameter is only visible in case of an actively transmitting feedback object.</td></tr>
</table>

<table>
<tr><td>Time for cyclical transmission seconds</td><td>2...5...59</td></tr>
<tr><td colspan="2">This parameter specifies the cycle time for the cyclical transmission of the blind/shutter position and is only available if cyclical transmission is activated.</td></tr>
</table>

<table>
<tr><td>Slat position</td><td>no feedback
feedback object is active signalling object
feedback object is passive status object</td></tr>
<tr><td colspan="2">The current slat position of the output can be reported separately back to the KNX.
no feedback: There is no feedback object available for the output. feedback deactivated
Feedback object is an active signalling object: The feedback and the object are activated. The object transmits actively.
Feedback object is a passive status object: The feedback and the object are activated. The object is passive (telegram transmission only as a response to 'Read' request).
This parameter is only visible in the venetian blind operating mode.</td></tr>
</table>

Delay after bus voltage return	Checkbox (yes / **no**)
The feedback telegram can be transmitted to the KNX with a delay after bus voltage return or after programming with the ETS. The delay time is configured under "General -> General Venetian blind outputs". This parameter is only visible in case of an actively transmitting feedback object.	

Cyclical transmission during active movement	Checkbox (yes / **no**)
If cyclical transmission of the slat position is required during active movement, this parameter can be activated. The position feedback is then transmitted cyclically during a running travel movement. The feedback object of the slat position also transmits cyclically during a blind/shutter movement (e.g. Venetian blind position approach). The cyclical transmission only takes place if the position data is known (reference movement completed). This parameter is only visible in case of an actively transmitting feedback object.	

Time for cyclical transmission seconds	**1**...59
This parameter specifies the cycle time for the cyclical transmission of the slat position and is only available if cyclical transmission is activated.	

Invalid Venetian blind position	**no feedback** feedback object is active signalling object feedback object is passive status object
The actuator can report to the KNX that the current blind position is unknown (e.g. after an initialisation, when no reference travel has been executed as yet). no feedback: There is no feedback object available for the output. feedback deactivated Feedback object is an active signalling object: The feedback and the object are activated. The object transmits actively. Feedback object is a passive status object: The feedback and the object are activated. The object is passive (telegram transmission only as a response to 'Read' request). This parameter is only visible in the venetian blind operating mode.	

Invalid shutter/awning position	**no feedback** feedback object is active signalling object feedback object is passive status object

The actuator can report to the KNX that the current roller shutter/awning position is unknown (e.g. after an initialisation, when no reference travel has been executed as yet).

no feedback: There is no feedback object available for the output. feedback deactivated

Feedback object is an active signalling object: The feedback and the object are activated. The object transmits actively.

Feedback object is a passive status object: The feedback and the object are activated. The object is passive (telegram transmission only as a response to 'Read' request).
This parameter is only visible in the shutter/awning operating mode.

Invalid venting louver/roof window position	**no feedback** feedback object is active signalling object feedback object is passive status object

The actuator can report to the KNX that the current venting louver/roof window position is unknown (e.g. after an initialisation, when no reference travel has been executed as yet).

no feedback: There is no feedback object available for the output. feedback deactivated

Feedback object is an active signalling object: The feedback and the object are activated. The object transmits actively.

Feedback object is a passive status object: The feedback and the object are activated. The object is passive (telegram transmission only as a response to 'Read' request).
This parameter is only visible in the "venting louver/roof window" operating mode.

Delay after bus voltage return	Checkbox (yes / **no**)

The feedback telegram can be transmitted to the KNX with a delay after bus voltage return or after programming with the ETS. The delay time is configured under "General -> General Venetian blind outputs".
This parameter is only visible in case of an actively transmitting feedback object.

Drive movement feedback	**no feedback** feedback object is active signalling object feedback object is passive status object
The actuator can report to the KNX that the connected drive is active, i.e. the output is supplying power to the drive for a travel direction. no feedback: There is no feedback object available for the output. feedback deactivated Feedback object is an active signalling object: The feedback and the object are activated. The object transmits actively. Feedback object is a passive status object: The feedback and the object are activated. The object is passive (telegram transmission only as a response to 'Read' request).	

Delay after bus voltage return	Checkbox (yes / **no**)
The feedback telegram can be transmitted to the KNX with a delay after bus voltage return or after programming with the ETS. The delay time is configured under "General -> General Venetian blind outputs". This parameter is only visible in case of an actively transmitting feedback object.	

10.6.4 Object list position calculation, position presetting and feedbacks

Object no.	Function	Name	Type	DPT	Flag
22, 46...	Position...	Venetian blind... - Input	1 bytes	5,001	C, (R), W, -, A
1-byte object for presetting a position value (0…255) for the height of the Venetian blind or shutter or the venting louver/roof window position in direct operation.					

Object no.	Function	Name	Type	DPT	Flag
23, 47...	Slat position	Venetian blind... - Input	1 bytes	5,001	C, (R), W, -, A
1-byte object for presetting a slat position value (0…255) in direct operation.					

Object no.	Function	Name	Type	DPT	Flag
38, 62...	Feedback ...position	Venetian blind... - Output	1 bytes	5,001	C, R, -, T, A
1-byte object for position feedback of the Venetian blind or shutter height or venting louver/roof window position (0…255).					

Object no.	Function	Name	Type	DPT	Flag
39, 63...	Slat position feedback	Venetian blind... - Output	1 bytes	5,001	C, R, -, T, A
1-byte object for position feedback of the slat position (0…255) if one shutter is controlled.					

Object no.	Function	Name	Type	DPT	Flag
40, 64...	Invalid position feedback	Venetian blind... - Output	1-bit	1,002	C, R, -, T, A
1-bit object for reporting back an invalid position of the Venetian blind or roller shutter height or louver position ("0" = position valid / "1" = position invalid).					

Object no.	Function	Name	Type	DPT	Flag
41, 65...	Drive movement feedback	Venetian blind... - Output	1-bit	1,002	C, R, -, T, A
1-bit object for feedback of an active travel movement (output energised - UP or DOWN). ("0" = no drive movement / "1" = drive movement).					

10.7 Safety functions

The actuator can handle up to five different safety functions:
3 x wind alarm, 1 x rain alarm, 1 x frost alarm. Each safety function has a communication object of its own so that the functions can be activated or deactivated independently of one another. The safety functions are programmed and configured in common for all shutter/blind outputs.
The different outputs of the actuator can be separately assigned to all or to individual safety functions. Only assigned outputs respond to a change in the state of the safety objects. The reactions at the beginning of an alarm ("ON" telegram) can be configured for each alarm separately whereas the reaction at the end of an alarm ("OFF" telegram) can be configured in common for all alarms.

An output can be assigned independently to the wind alarms, the rain alarm and the frost alarm. If an output is associated with several alarms, the preset priority decides which of the alarms will prevail and be executed. In so doing, an alarm with a higher priority overrides the alarms with the lower priorities. When safety alarm with the higher priority has ended, the safety alarm with the lower priority is executed on condition that it is active.
The order of priority of the wind alarms with respect to the frost alarm or to the rain alarm can be configured for several channels on the parameter page
"General -> General Venetian blind outputs". The three wind alarms have the same priority with respect to one another (logic OR). The last telegram update to the wind alarm objects decides which of the wind alarms will be executed. The wind alarm is completely deactivated only after all three objects are inactive (" ("OFF").
An output in the active safety alarm state is locked, i.e. the control of the output concerned via the KNX by direct operation (short-time, long-time telegram, scenes, positioning) or by a sun protection function is prevented. Only a forced position and a manual control locally on the device itself have a higher priority so that these functions may override a safety interlock. At the end of a forced position or of a manual control, the safety reaction is re-executed if an assigned safety alarm is still active.

Assigning safety alarms

The individual safety alarms can be assigned separately for each output. The channels are assigned on the parameter page
"Relay outputs... -> VBO... - General -> Safety".

The safety functions must be globally enabled on
the "General blind outputs -> Safety" parameter page before the output assignments are configured.

The safety function of an output must be enabled on the parameter page
"Relay outputs... -> VBO... - General -> Enabled". Only then are the channel-related parameters for the safety function visible.

- If an assignment to the wind alarms is necessary, activate the parameter "Assignment to wind alarm X" (X = 1...3).

  The output is assigned to the specified wind alarms.

- If an assignment to the rain alarm is necessary, activate the parameter "Assignment to rain alarm".

  The output is assigned to the rain alarm.

- If an assignment to the frost alarm is necessary, activate the parameter "Assignment to frost alarm".

  The output is assigned to the frost alarm.

Presetting the behaviour at the beginning of a safety alarm

The behaviour of an output at the beginning of a safety alarm can be parameterized separately for each alarm (wind alarms in common, rain and frost alarms separately). The alarm behaviour is preset on the parameter page
"Relay outputs... -> VBO... - General -> Safety". At the beginning of a safety alarm, the actuator locks the outputs concerned, i.e. control via the KNX by direct operation (short time, long time telegram, scenes, positioning) or by a sun protection function is prevented.
Depending on the selected operating mode, the ETS adapts the designations of the parameter settings ("raising" ↔ "opening" / "lowering" ↔ "closing").

The safety functions must be globally enabled on the parameter page
"General -> General Venetian blind outputs".

The safety function of an output must be enabled on the parameter page
"Relay outputs... -> VBO... - General -> Enabled". Only then are the channel-related parameters for the safety function visible.

The behaviour in case of a safety alarm can only be adjusted, if the output concerned has been assigned to the corresponding alarm. Since there is no difference between the alarm-dependent configurations, the selection of the parameters is only described below for the wind alarm as an example.

- Set the parameter "For wind alarm" to "no reaction".

  At the beginning of the alarm, the output is locked and the relay of the output shows no reaction. Any movements still in progress at this instant will still be completely finished.

- Set the parameter "For wind alarm …" to "raising" or "opening".

  The actuator raises the blind/shutter or opens the venting louver/roof window at the beginning of the alarm and then locks the output.

- Set the parameter "For wind alarm …" to "lowering" or "closing".

  The actuator lowers the blind/shutter or closes the venting louver/roof window at the beginning of the alarm and then locks the output.

- Set the parameter "For wind alarm …" to "stop".

  At the beginning of the alarm, the actuator switches the relays of the output to "stop" and locks the output. A travel movement, if any, will be interrupted.

ℹ The safety travel time required by an output to move the drive into the end positions is determined by the parameter "Travel time" on the parameter page "Relay outputs... -> VBO... - General -> Times". Like the long-time operation, a safety movement is derived from the movement time. Downward movement: movement time + 20 %; Upward movement: movement time + 20 % + configured movement time extension. Safety movements are not retriggerable.

ℹ Slats of blinds are not repositioned at the end of safety movements to end positions.

Setting the behaviour at the end of all safety alarms

The actuator ends the safety interlock of an output only after all safety alarms assigned to the output have become inactive. Afterwards, the output concerned shows the configured "End of safety". The behaviour is configured on the parameter page "Relay outputs... -> VBO... - General -> Safety" in common for all alarms.
Depending on the selected operating mode, the ETS adapts the designations of the parameter settings ("raising" ↔ "opening" / "lowering" ↔ "closing").

The safety functions must be globally enabled on the parameter page
"General -> General Venetian blind outputs".

The safety function of an output must be enabled on the parameter page
"Relay outputs... -> VBO... - General -> Enabled". Only then are the channel-related parameters for the safety function visible.

- Set the parameter "end of safety" to "no reaction".

  At the end of all safety alarms, the output is released and the relay of the output shows no reaction. Any travel movements still in progress at this instant will still be finished.

- Set the parameter "end of safety" to "raising" or "opening".

  The actuator enables the output at the end of all safety alarms and raises the blind/shutter or opens the venting louver/roof window.

- Set the parameter "end of safety" to "lowering" or "closing".

  The actuator enables the output at the end of all safety alarms and lowers the blind/shutter or closes the venting louver/roof window.

- Set the parameter "end of safety" to "stop".

  At the end of all safety alarms, the output is released and the actuator switches the relays of the output to "stop". A travel movement, if any, will be interrupted.

- Set the parameter "end of safety" to "tracking the position".

  At the end of all safety alarms, the output will be set to the state last adjusted statically before the safety function or to the state tracked and internally stored during the safety function. The position objects, the long-time object and the scene function are tracked.

i Parameter setting "Position tracking": The actuator can track absolute positions after safety release (position telegram, scene value) only if the position data are known and if the positions have been predefined. In all other cases, no reaction takes place on release of safety.
Position data can be tracked, if the output was in a defined position before the safety function or if a new position telegram was received via the position objects during the safety interlock. In the latter case, a reference movement will be executed when the safety function is enabled, if the position before or during the safety interlock was unknown.
Known slat positions will also be tracked as described. This is also the case, when the height of the Venetian blind is unknown.
Long time movements (movements without position preset) will, however, always be tracked.

i The preset "Behaviour at the "end of safety" will only be executed, if the output passes over to direct operation at the end of all safety alarms. If a sun protection function is activated (independent of the preset priority with respect to direct operation), it will be also executed.

10.7.1 Safety functions parameter

Relay outputs... -> VBO... - General -> Enabled functions

Safety functions	Checkbox (yes / **no**)
This parameter can be used to enable the Venetian blind output.	

Relay outputs... -> VBO... - General -> Safety

Assignment to wind alarm 1	Checkbox (yes / **no**)
This parameter defines whether the Venetian blind output responds to the first wind alarm.	

Assignment to wind alarm 2	Checkbox (yes / **no**)
This parameter defines whether the Venetian blind output responds to the second wind alarm.	

Assignment to wind alarm 3	Checkbox (yes / **no**)
This parameter defines whether the Venetian blind output responds to the third wind alarm.	

For wind alarm	**no reaction** raising / opening lowering / closing stop
This parameter defines the behaviour of the output at the beginning of a wind alarm. no reaction: At the beginning of the wind alarm or wind alarms, the output is interlocked and the relay of the output shows no reaction. Any movements in progress at this instant will still be completely finished. raising / opening: The actuator raises the blind/shutter or opens the venting louver/roof window at the beginning of the wind alarm or wind alarms and then locks the output. lowering / closing: The actuator lowers the blind/shutter or closes the venting louver/roof window at the beginning of the wind alarm or wind alarms and then locks the output. stop: At the beginning of the wind alarm or wind alarms, the actuator switches the relays of the output to the "stop" position and locks the output. A travel movement, if any, will be interrupted. This parameter is only visible if the output has been assigned to at least one wind alarm.	

Assignment to rain alarm	Checkbox (yes / **no**)
This parameter defines whether the output responds to the rain alarm.	

For rain alarm	**no reaction** raising / opening lowering / closing stop
This parameter defines the behaviour of the output at the beginning of the rain alarm. no reaction: At the beginning of the rain alarm, the output is locked and the relay of the output shows no reaction. Any movements in progress at this instant will still be completely finished. raising / opening: The actuator raises the blind/shutter or opens the venting louver/ roof window at the beginning of the rain alarm and then locks the output. lowering / closing: The actuator lowers the blind/shutter or closes the venting louver/ roof window at the beginning of the rain alarm and then locks the output stop: At the beginning of the rain alarm, the actuator switches the relays of the output to the "stop" position and locks the output. A travel movement, if any, will be interrupted. This parameter is only visible, if the output has been assigned to the rain alarm.	

Assignment to frost alarm	Checkbox (yes / **no**)
This parameter defines whether the output responds to the frost alarm.	

For frost alarm	**no reaction** raising / opening lowering / closing stop
This parameter defines the behaviour of the output at the beginning of the frost alarm. no reaction: At the beginning of the frost alarm, the output is interlocked and the relay of the output shows no reaction. Any movements in progress at this instant will still be completely finished. raising / opening: The actuator raises the blind/shutter or opens the venting louver/ roof window at the beginning of the frost alarm and then locks the output. lowering / closing: The actuator lowers the blind/shutter or closes the venting louver/ roof window at the beginning of the frost alarm and then locks the output stop: At the beginning of the frost alarm, the actuator switches the relay of the output to the "stop" position and locks the output. A travel movement, if any, will be interrupted. This parameter is only visible, if the output has been assigned to the frost alarm.	

End of safety (wind, rain, frost)	no reaction raising / opening lowering / closing stop **tracking the position**
This parameter defines the behaviour of the output at the end of all safety functions. no reaction: At the end of the safety functions, the output is enabled and the relay of the output shows no reaction. Any travel movements still in progress at this instant will still be finished. raising / opening: The actuator enables the output at the end of all safety alarms and raises the blind/shutter or opens the venting louver/roof window. lowering / closing: The actuator enables the output at the end of the safety functions and lowers the blind/shutter or closes the venting louver/roof window. stop: At the end of the safety functions, the output is enabled and the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted. tracking the position: At the end of safety, the output will be set to the state last adjusted before the safety function or to the state tracked and internally stored during the safety function. The position objects, the long-time object and the scene function are tracked. The behaviour preset in this parameter will only be executed, if the output passes over to direct operation at the end of safety. Direct operation will be executed when a sun protection function is active.	

10.7.2 Object list safety functions

The safety functions only have global communication objects that are used for all Venetian blind outputs (siehe Kapitel "Object list safety functions" ▸ Page 38).

10.8 Sun protection function

Introduction

Each venetaian blind output of the actuator can be separately configured for the execution of a sun protection function. Sun protection is generally realized with blinds, shutters or awnings and offers an intelligent method of shading rooms, terraces or balconies during sunshine depending on the
altitude of the sun in the sky and on the intensity of the sunlight

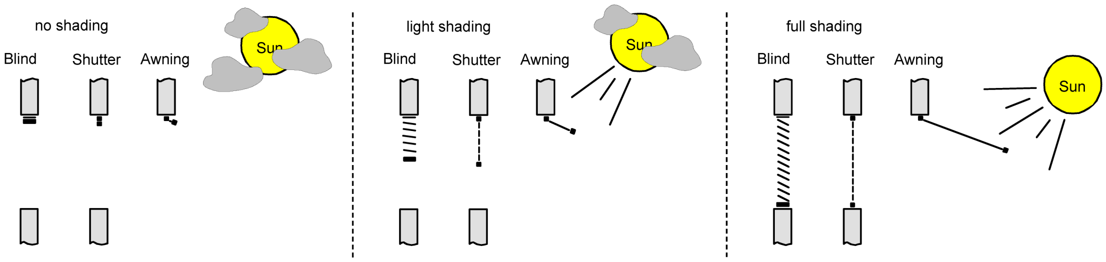

Image 10: Sun protection principles (example)

The sun protection functions of the actuator can be adapted many different applications. In simple applications as, for instance, in case of direction-dependent measurement of the sun's intensity by means of a brightness sensor, the curtains controlled can be closed partly or completely to prevent being disturbed by direct sunlight. In these applications, the sun protection function merely evaluates the 1-bit sun signal from the brightness or a similar sensor (e.g. weather station with limit value monitoring) and makes a drive open or close the controlled curtains by moving them into fixed configured positions or into variable positions preset via the bus.

Already simple sun protection applications are sufficient to permit a fixed or variable re-adjustment of the positions of Venetian blind slats for adapting the curtain to individual shading requirements. For this purpose, it is possible to set a static slat offset in the ETS configuration, for instance, for adapting the reflection of sunlight depending on the building situation, or additionally, via a KNX communication object, e.g. for manual re-adjustment of the slat opening by people in the room or otherwise by a central building services control system.

In all cases, the priority between an incoming sunshine telegram and the direct operation of an output (short-time, long-time telegram, scenes, positioning) can also be preset in the ETS. This way, a sun protection position can, for instance, be influenced by a manual operation of a touch sensor in the room and the sun protection function be interrupted. Alternatively, sun protection mode can therefore not be interrupted by a direct operation, i.e. the output is locked.
A sun protection function can be overridden by a safety function or also by a manual control locally on the device itself, as these functions of the actuator invariably have a higher priority. At the end of one of the mentioned functions with a higher priority, the same reaction as the one at the beginning of sun protection will be re-executed, if the sun protection function is still active at this time.

Simple sun protection

In simple sun protection, shading against sunlight is activated and deactivated via the 1-bit communication object "Sunshine". The polarity of this object can be selected in the ETS. The sun protection is activated as soon as "sunshine" is signalled to the object depending on the preset polarity. After ETS programming or after switch-on of the supply voltage, the object must at first have data written into it by the KNX also in case of inverted polarity before the sun protection can be activated.

A newly received object value (sunshine beginning or sunshine end) can optionally be evaluated with a time delay. This feature permits suppressing brief brightness variations caused, for instance, by passing clouds or by a thunderstorm. An update (from activated to activated) of the "Object "sunshine" causes the sun protection to be reactivated if it had been influenced and possibly re-enabled beforehand by a direct operation in acc. with the preset priority.

The reaction of a specific output at the beginning of shading can be preset in the ETS. Amongst other things, this setting permits approaching fixed configured positions or positions preset via the KNX and thus variable. Variable positions for sun protection purposes can be preset, for instance, by means of pushbutton sensors or visualisations. In addition, it is possible in case of a defined sun protection positioning movement to have a reference travel executed by forced control. This ensures that identical blind positions are approached synchronously by different outputs in case of a sun protection positioning movement.
The reaction at the end of a shading task can be preset as well. In this situation, the curtain can pass into an end position, be stopped or shown no special reaction. Tracking of positions is possible as well.

A priority setting in the ETS configuration makes it possible to specify whether the sun protection function can be influenced by direct operation or whether the corresponding output is locked by a telegram "Sunshine" in the sun protection position. Basically, the "Manual control", "Forced position" and "Safety" functions have a higher priority so that these functions can override, but not terminate a sun protection. Thus, the sun protection function is re-executed at the end of a function with a higher priority, if the Object "sunshine" continues to signal the presence of sunshine.

ℹ The following rules must be observed for the extended sun protection: After an ETS programming operation, the sun protection function including automatic operation is always deactivated.

The schematic diagram of the simple sun protection and an example of how sensor components can be integrated into a simple sun protection configuration.

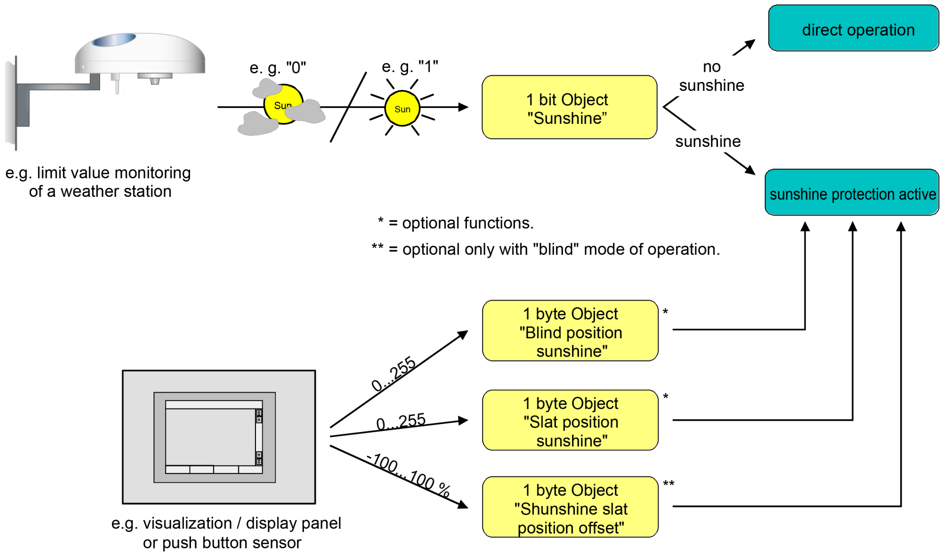

Image 11: Schematic diagram illustrating the simple sun protection configuration

The function diagram shows all possible functions of the simple sun protection. For reasons of clarity, the functions with a higher priority (manual control, safety function) are not shown in the diagram.

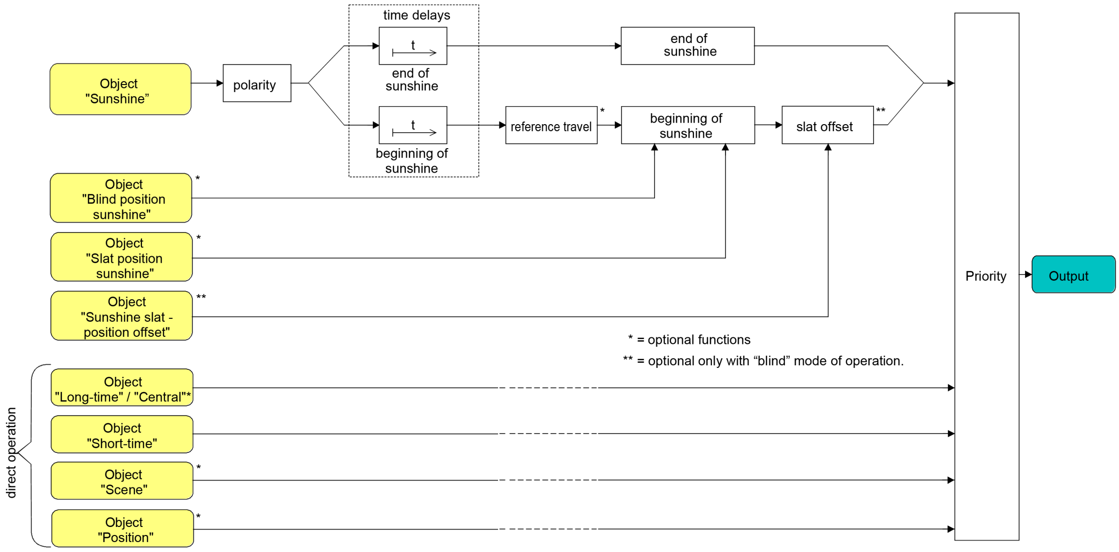

Image 12: Function diagram illustrating the simple sun protection

Presetting the priority of the sun protection

The priority of the sun protection function can be set separately for each venetian blind output. In the sun protection, the priority between the "Sunshine" object and the objects of direct operation (short-time, long-time or position telegram, scene recall) must be configured.

The sun protection function must be enabled on the parameter page "Relay outputs... -> VBO... -General -> Enabled" in order for the sun protection parameters to be visible.

- Set the parameter
  "Priority of sun protection operation with respect to direct operation" on the parameter page "Relay outputs... -> VBO... General -> Sun protection" to "Same priority".

  The sun protection mode can be overridden at any time by direct operation. Similarly, the sun protection overrides the direct operation, when a new "sunshine" telegram is received via the object of the same name and when a configured time delay, if any, has elapsed. If the sun protection function is overridden by a direct operation, the preset behaviour "at the end of sunshine" will not be executed.

- Set the parameter
  "Priority of sun protection operation with respect to direct operation" to "Higher priority".

  An active sun protection will override a direct operation. The sun protection mode can therefore not be interrupted by a direct operation. Direct operation will be possible again only after the sun protection function is terminated.

- Set the parameter
  "Priority of sun protection operation with respect to direct operation" to "Lower priority".

  A direct operation can at any time override the sun protection mode. If the sun protection function is overridden by a direct operation the preset behaviour "at the end of sunshine" will not be executed. The sun protection function can only be reactivated after an enabling movement controlled by a direct operation has been effected and after a new "sunshine" telegram has been received via the "sunshine" object. Attempts to activate the sun protection function are ignored for as long as the enabling movement has not taken place.

  On the enabling movement:
  An enabling movement is an accomplished long-time movement into the upper end position which has been initiated by the object "Long time operation". A manual operation, an upward movement after bus voltage return, a position approach to "0 %" or an upward movement after enabling of safety functions have no enabling effect.
  The sun protection is not enabled if the enabling movement has been interrupted. The sunshine protection function will be also be disabled if the output has been readjusted again by a direct operation after an accomplished enabling movement.
  After an ETS programming operation or switch-on of the supply voltage, the sunshine protection function is always enabled.

i Manual local operation on the device itself and the safety functions have a fixed priority higher than that of the sun protection. The sun protection is overridden – but not terminated – by a function with a higher priority. After the end of the function with the higher priority the reaction at the beginning of sun protection will therefore be executed again, if the sun protection is still active at this time.

i With the settings "same priority" or "lower priority", the sun protection can be overridden by a direct operation only if the direct control action can be executed at once. A direct operation will therefore not override the sun protection during a manual control locally on the device or an active safety function.

i Parameter setting "same priority" or "lower priority": A variable preset of blind/shutter and slat positions or of a slat offset via the KNX at the beginning of sunshine shows no reaction at the output, if the sun protection was overridden by direct operation. However, the position data or offsets received are stored internally so that the new positions will be approached on reactivation of the sun protection.

Presetting the polarity of the "Sunshine" object

The telegram polarity of the "Sunshine" object can be preset separately for each output. This means that an adaptation to the signals from existing sensors or weather stations is possible in the simple and also in the extended sun protection mode.

The sun protection function must be enabled on the parameter page "Relay outputs... -> VBO... -General -> Enabled" in order for the sun protection parameters to be visible.

- Set the parameter "Polarity of 'Automatic' object" on the parameter page ""Relay outputs... -> VBO... General -> Sun protection" to the required telegram polarity.

  The sunshine signal is evaluated in accordance with the preset priority.

i In the sun protection an update (from activated to activated) of the "Sunshine" object causes the sun protection to be reactivated if it had been influenced and possibly re-enabled beforehand by a direct operation in acc. with the preset priority.

Presetting a time delay for beginning and end of sunshine

The telegram received via the "sunshine" object for activation or deactivation of shading (depending on polarity) can be evaluated with a time delay separately for each output. The preset delay times are always evaluated in the simple as well as in the extended sun protection mode.

The sun protection function must be enabled on the parameter page "Relay outputs... -> VBO... -General -> Enabled" in order for the sun protection parameters to be visible.

- Set the parameter "Delay at the beginning of sunlight" on the parameter page "Relay outputs... -> VBO... General -> Sunshine -> Set Sun protection start" to the required delay time.

  The telegram for activation of the sun shading will be evaluated with a delay corresponding to the setting.

- Set the parameter "Delay at the end of sunlight" on the parameter page "Relay outputs... -> VBO... General -> Sunshine -> Set Sun protection end" to the required delay time.

The telegram for deactivation of the sun protection will be evaluated with a delay corresponding to the setting.

ℹ A setting of "0" in the parameters deactivates the respective delay time. In this case, the state of the sunshine signal is evaluated immediately.

ℹ An update (from activated to activated) of the "Sunshine" object causes the sun protection to be reactivated in consideration of the delay time, if the sun protection had been influenced or aborted beforehand by a direct operation because of the same or a lower priority.

Presetting the reaction at the beginning of sunshine

The behaviour of the output at the beginning of sunshine / shading – if applicable, after the end of the delay time – can be configured in the ETS separately for each output. In the sun protection mode, the behaviour will be executed, when the sun protection function is activated after receiving a new sunshine signal. The reaction will not be executed if a function with a higher priority is active at the time the sun shading is received.
The reaction for the beginning of sunlight is set on the parameter page "Relay outputs... -> VBO... General -> Sunshine -> Sun protection start".

The sun protection function must be enabled on the parameter page "Relay outputs... -> VBO... -General -> Enabled" in order for the sun protection parameters to be visible.

- Set the parameter "at the beginning of sunshine" to "no reaction".

  At the beginning of shading, the output switches over to sun protection while the relays of the output show no reaction. Any travel movements still in progress at this instant will still be finished.

- Set the parameter "at the beginning of sunshine" to "raising" or "opening".

  At the beginning of shading, the actuator raises the blind/shutter or opens the venting louver/roof window.

- Set the parameter "at the beginning of sunshine" to "lowering" or "closing".

  At the beginning of shading, the actuator lowers the blind/shutter or closes the venting louver/roof window.

- Set the parameter "at the beginning of sunshine" to "stop".

  At the beginning of shading, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

- Set the parameter "at the beginning of sunshine" to "internal scene recall". Configure the internal scene to be recalled (parameter "internal scene").

  At the beginning of shading, the actuator recalls the position value for the output concerned which was preset in the scene configuration. This is not a scene recall as in direct operation, but only an approach to the corresponding scene position value.

- Set the parameter "at the beginning of sunshine" to "fixed position".

At the beginning of shading, the actuator recalls a fixed position value for the output concerned.

ℹ In the "Venetian blind" operating mode, the "fixed position" setting can be selected separately for the height of the blind and for the slat position. For this reason, the ETS adapts the parameter selection and enlarges the setting options in this operating mode.

- "Fixed position" only: Set the parameter "Fixed position of Venetian blind", "Fixed position of roller shutter/awning" or "Fixed position of venting louver" to "as specified by parameter". Thereafter, set the parameter
"Position of Venetian blind (0…100%)",
"Position of roller shutter/awning (0…100%)" or
"Position of venting louver (0…100%)" to the desired position.

  At the beginning of shading, the output invariably approaches the configured position value.

- "Fixed position" only: Set the parameter "Fixed position of Venetian blind", "Fixed position of roller shutter/awning" or "Fixed position of venting louver" to "no change of current position".

  At the beginning of shading, the last set position of the Venetian blind height, shutter, awning or venting louver will be maintained.

- "Fixed position" and operating mode = "Venetian blind" only: Set the parameter "Fixed slat position (0…100%)" to the desired position value.

  At the beginning of shading, the output invariably moves the slats to the configured position after the height of the Venetian blind has been adjusted.

- Set the parameter "at the beginning of sunshine" to "variable position".

  At the beginning of shading, the actuator recalls the variably specified position value for the output concerned. The variable position of the Venetian blind height, of the shutter, awning or venting louver position is preset via the separate communication object "sun protection - ...position" (in the "Venetian blind" operating mode for the slats as well as via the separate
object "sun protection - slat position").

ℹ In the "Venetian blind" operating mode, the "variable position" setting can be selected separately for the Venetian blind height and for the slat position. For this reason, the ETS adapts the parameter selection and enlarges the setting options in this operating mode.

ℹ The behaviour preset in this parameter will only be executed, if no function with a higher priority (e.g. safety) is activated at the time of shading.

ℹ "internal scene recall" setting: For this setting, the scene function of the output must be enabled in the ETS. Otherwise, the positions approached at the beginning of sun shading are undefined positions. The scene position values stored in the actuator by a scene storage function will be approached as well. A delay configured for scene recalls has no influence on the recall of the scene value by the sun protection function.

ℹ "Variable position" setting: After an ETS programming operation or after switch-on of the supply voltage the objects "sun protection - ...position" and "sun protection - slat position" must receive position values from the KNX. Otherwise the actuator does not position itself at the start of sun shading as it does not have any valid position data.
When the actuator is in operation, the position data can be updated at any time via the KNX even if the sun protection is active (e.g. by a weather station for the purpose of sun position tracking). The actuator will then immediately approach the newly received positions if sun shading is active. If a function with a higher priority is active, the actuator stores the newly received position values and approaches them during a later shading operation.
The position data last received are not lost in a bus voltage failure.

Presetting a forced reference movement in the sun protection mode

If needed, a reference movement can be executed by forced-control in the sun protection mode at the beginning of a shading cycle, if fixed or variable position values or scene positions are to be approached or a scene is recalled. The execution of a reference movement by forced control at the beginning of shading can be used in a sun protection positioning operation to ensure that the curtains or slats are moved synchronously by different outputs to identical positions (e.g. in a long row of windows). Without the execution of reference travel by forced control, there might otherwise be positioning inaccuracies with a negative effect on the overall appearance of a building facade with the blinds let down.
A reference movement by forced control will always be executed in the simple sun protection mode, when the beginning of shading is signaled via the "sunshine" object. Updates of the object from "Sun is shining" to "Sun is shining" do not initiate a reference movement if, at this time, the output is still in the sun protection position.

A reference movement by forced control will be executed in the extended sun protection mode, when the beginning of shading is signaled via the "Sun shading facade" object "sunshine" object. Updates of the object from "Sun is shining" to
"Sun is shining" will never initiate a reference movement. In this case, the sunshine signal must first change from 'sun is not shining' to 'sun is shining' before a new reference movement can take place.
A reference movement by forced control will always be executed for synchronisation purposes as described and also in such cases where the position data of the blind or the slats are known. No reference movement by forced control will be executed at the end of shading.

The sun protection function must be enabled on the parameter page
"Relay outputs... -> VBO... -General -> Enabled" in order for the sun protection parameters to be visible.

- Activate the parameter
"reference movement before every sun protection positioning operation" on the parameter page
"Relay outputs... -> VBO... General -> Sunshine -> Sun protection start".

At the beginning of shading there is always a reference movement by forced control as described. The preset position will be approached after the end of the reference movement.

- Deactivate the parameter
  "reference movement before every sun protection positioning operation".

  A reference movement at the beginning of sun protection will only be executed, if the position data are unknown, for instance, after an ETS programming operation or after switch-on of the power supply. In all other cases, the preset shading position will be approached immediately.

ℹ A reference movement is the time required for a travel movement into the upper end position increased by 20 % and additionally by the configured travel time extension. A reference travel is not retriggerable.

ℹ Variable position preset: No reference movement will be executed, if new position values are preset via the KNX while the sun protection is active.

ℹ "Venetian blind" operating mode: A terminated reference travel for the height of the blind also synchronizes the slat position at the same time.

Slat offset in the sun protection mode (only "Venetian blind" operating mode)

An offset can be specified for the slat position at the start of sun shading separated for each venetian blind output, if fixed or variable slat position values are to be approached. If necessary, the slat offset can correct the fixed or variable nominal slat position and thus allow the creation of an individual shading situation, when the sun protection is active. The offset can be preset in two ways...

- The slat offset can be configured statically in the ETS. The configuration of a statical offset value allows to vary the degree of shading in those parts of the building that are not exposed to full sunshine due to objects in front of the building. The variable slat angle adjusted by the sun protection control or the fixed angle specified in a parameter can thus be overridden so that the slats are always opened a bit wider than originally preset. Alternatively, the slats can also be closed completely by means of the static offset if too much sunlight is reflected into the room.
- The slat offset can additionally be adapted by the KNX via the separate communication object "sunshine protection - slat position offset . In this way, the desired slat offset can also be adjusted during an active shading cycle and independent of a direct operation as, for instance, the short time mode. Thus, it is possible, for instance, that persons in a room can correct the slat angle at any time 'manually' and individually by selecting another preset value at a touch sensor or a visualisation. An offset preset via the object overwrites the value configured in the ETS.

The preset offset is taken into account in the sun protection mode for each positioning move during an active shading cycle (beginning of sunshine) and added to the predefined nominal slat position. The offset value can be varied within a range from

-100 % … 0 … 100 % so that the slats can be moved in both directions into the slat end positions. At an offset of "0 %", the actual slat position is always identical with the predefined nominal slat position for sun protection purposes.

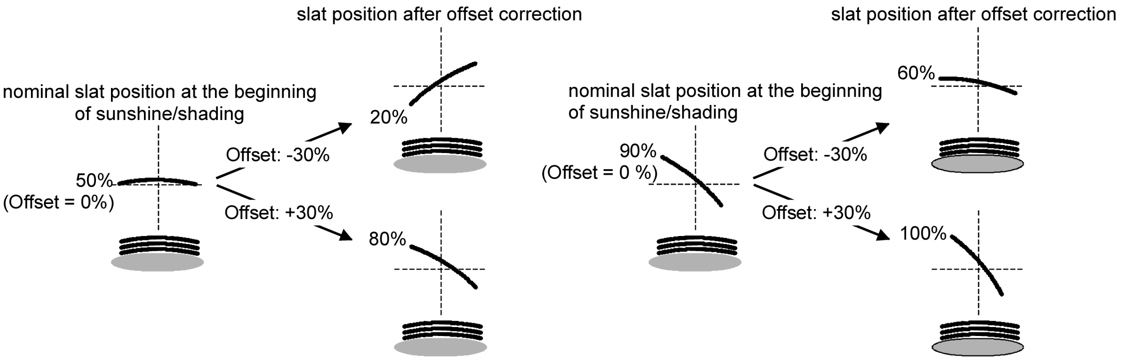

Image 13: Functional principle of slat offset
(example showing slat type 1 / slat type 2 identical)

The position value actually adjusted with the offset after adding the slat position value is always between 0 and 100 %. Minimum and maximum position are thus determined by the slat end positions. These limits cannot be exceeded by specifying an greater offset. Example...
Slat position at the beginning of sunshine = 90 %
Sunshine offset slat position = +30 %
-> The resulting slat position is 100% as the end position is reached.

In acc. with the KNX data point type 6.001 (DPT_Percent_V8) the data format of the communication object "sun protection slat position offset" permits presetting positive and negative values in a range of -128 … 0 … +127. The actuator interprets the value received directly as an offset in %. Values below 100 or above +100 are limited to the minimum (-100 %) and maximum offset (+100 %) and evaluated accordingly.

An offset preset via the object overwrites the value configured in the ETS. In the event of a bus voltage failure, an offset value received via the communication object can be stored internally in a non-volatile memory so that the offset value last received is not lost even in case the power supply fails. As an alternative, the offset preset via the KNX can be reset (0 %) in the event of a power supply failure with the result that the value configured in the ETS is again used in operation. The offset reaction preset in the event of bus voltage failure can be configured in the ETS.

Configuring the slat offset in the sun protection mode (only "Venetian blind" operating mode)

The sun protection function must be enabled on the parameter page "Relay outputs... -> VBO... -General -> Enabled" in order for the sun protection parameters to be visible.

The function must be configured for the "Venetian blind" operating mode.

The reaction at the beginning of sunshine must be configured to a fixed or variable position preset.

- Set the parameter "Offset the slat position during sunshine" on the parameter page
  "Relay outputs... -> VBO... General -> Sun protection -> Beginning of sun protection" to "no offset".

  Offset correction is deactivated. During shading (beginning of sunshine), the fixed or variable slat position will be approached without offset correction. The other parameters relating to offset configuration are hidden.

- Set the parameter "offset of the slat position during sunshine" to "offset as parameter".

  The static offset correction based on the parameter specification in the ETS is activated. During every shading operation (beginning of sunshine), the nominal slat position is always corrected by the configured offset value.

- Set the parameter "offset of the slat position during sunshine" to "offset as parameter and via object".

  The offset correction based on the parameter specification in the ETS and specification via the object is activated. The slat offset is preset by a fixed value configured in the ETS and can be adapted dynamically with a separate communication object. During every shading operation (beginning of sunshine), the nominal slat position is always corrected by the preset offset value.

- Set the parameter "Slat offset position (-100 … 100 %)" to the desired offset value.

  The configured value defines the static offset correction of the slat position. The configured value can be re-adjusted via the "sun protection - offset slat position object" if the communication object has been enabled.

- Deactivate the parameter "store in case of bus voltage failure".

  The value received via the object will only be stored temporarily in volatile memory. The received value only replaces the configured value until the actuator is reinitialised. After the initialisation, the offset value configured in the ETS will be used again.

- Activate the parameter "store in case of bus voltage failure".

  The value received via the object will be stored in case of bus voltage failure in a non-volatile memory of the actuator. The originally configured offset value is definitely overwritten in the process. Only a new ETS programming operation sets the offset back to the configured value.

ℹ An offset value received via the KNX is stored temporarily or permanently in the actuator and taken into account during the next shading operation. The reception of an offset value during an active shading phase (beginning of sunshine active) results in immediate and visible correction of the offset angle by the output.

ℹ After an ETS programming operation, the offset is always set to the value configured in the ETS.

The slat offset has no influence on the behaviour of an output at the end of a shading phase (end of sunshine).

Presetting the reaction at the end of sunshine

At the end of the shading phase – if applicable, after the end of the delay time – the output concerned will show the preset reaction, if no function with a higher priority is active at the time of deactivation. The preset reaction will also not be executed at the end of sun shading, if the sunshine signal is overridden on account of priority settings by a direct operation.
The reaction for the beginning of sunlight is set on the parameter page "Relay outputs... -> VBO... General -> Sun protection -> Sun protection end".

The sun protection function must be enabled on the parameter page "Relay outputs... -> VBO... -General -> Enabled" in order for the sun protection parameters to be visible.

- Set the parameter "at the end of sunshine" to "no reaction".

  At the end of shading, the relay of the output shows no reaction. Any travel movements still in progress at this instant will still be finished.

- Set the parameter "at the end of sunshine" to "raising" or "opening".

  The actuator raises the blind/shutter or opens the venting louver/roof window at the end of shading.

- Set the parameter "at the end of sunshine" to "lowering" or "closing".

  The actuator lowers the blind/shutter or closes the venting louver/roof window at the end of shading.

- Set the parameter "at the end of sunshine" to "stop".

  At the end of shading, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

- Set the parameter "at the end of sunshine" to "tracking the position".

  At the end of shading, the output will be set to the state last adjusted statically before sun protection or to the state tracked and internally stored during sun protection. The position objects, the long-time object and the scene function are tracked.

The behaviour preset in this parameter will only be executed, if no function with a higher priority (e.g. safety) is activated when the sun protection is enabled or when a direct operation has not overridden the sunshine signal on account of priority settings.

Parameter setting "Position tracking": The actuator can track absolute positions (position telegram, scene value) at the end of sun protection only if the position data are known and if the positions have been predefined. There is otherwise no reaction at the end of sun shading.
Position data can be tracked, if the output was in a defined position before the sun protection function or if a new position telegram was received via the posi-

tion objects during the sun protection. In the latter case, a reference movement will be executed at the end of sun protection, if the position before or during the sun protection was unknown.
Known slat positions will also be tracked as described. This is also the case, when the height of the Venetian blind is unknown.
Long time travel movements (movements without position preset) will always be tracked.

10.8.1 Sun protection function parameter

Relay outputs... -> VBO... - General -> Enabled functions

Sun protection function	Checkbox (yes / **no**)
The sun protection function of the Venetian blind output can be enabled here.	

Relay outputs... -> VBO... - General -> Sun protection

Priority of sun protection with respect to direct operation	**same priority** higher priority lower priority
This parameter defines the priority of the sun protection function with respect to direct operation. same priority: The sun protection can be overridden by direct operation and vice versa. Only after the next reception of a "sun is shining" signal will the sun protection mode be activated again. higher priority: The sun protection has the higher priority and cannot be aborted by a direct operation. lower priority: The direct operation has the higher priority and cannot be aborted by sun protection. The sun protection can be activated only after an enabling movement into the upper end position initiated by a direct operation has occurred without interruption. Direct operation = long-time/short-time operation, positioning via objects, scenes.	

Object polarity "sunshine"	**sunshine = 1; no sunshine = 0** sunshine = 0; no sunshine = 1
This parameter defines the polarity of the input object "sunshine".	

Relay outputs... -> VBO... General -> Sunshine -> Sun protection start

Delay at the beginning of sunshine Minutes (0...59)	**0**...59
The telegram received via the object "Sunshine" for activation of shading (depending on polarity) can be evaluated with a time delay. Setting the delay time minutes.	

Seconds (0...59)	0...**30**...59
Setting the delay time seconds. A time setting of "0" in the parameters deactivates the respective delay time. In this case, the state of shading is evaluated immediately.	

<table>
<tr><td>At the beginning of sunshine</td><td>no reaction
raising
lowering
stop
internal scene recall
venetian blind or slat position fixed
venetian blind position fixed / slat position variable
slat position fixed / Venetian blind position variable
Venetian blind and slat position variable</td></tr>
<tr><td colspan="2">This parameter defines the behaviour of the output at the beginning of shading – if applicable, after the end of the delay time.
no reaction: At the beginning of shading, the output switches over to sun protection while the relays of the output show no reaction. Any travel movements still in progress at this instant will still be finished.
raising: At the beginning of shading, the actuator raises the blind/shutter.
lowering: At the beginning of shading, the actuator lowers the blind/shutter.
stop: At the beginning of shading, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.
Internal scene recall: At the beginning of shading, the actuator recalls the position values for the affected output which were preset in the scene configuration. This is not a scene recall as in direct operation, but only an approach of the corresponding scene position values.
Venetian blind or slat position fixed: At the beginning of shading, the output moves to a configured fixed Venetian blind and slat position.
venetian blind position fixed / slat position variable: At the beginning of shading, the output controls the approach to a configured fixed Venetian blind position and to slat position preset by a separate object and thus variable.
slat position fixed / Venetian blind position variable: At the beginning of shading, the output controls the approach to a configured fixed slat position and to a Venetian blind position preset by a separate object and thus variable.
Venetian blind and slat position variable: At the beginning of shading, the output controls the approach to the Venetian blind and slat positions preset by two separate objects and thus variable.
This parameter is only visible in the venetian blind operating mode.</td></tr>
</table>

At the beginning of sunshine	no reaction raising lowering stop internal scene recall **fixed position** variable position
This parameter defines the behaviour of the output at the beginning of shading – if applicable, after the end of the delay time. no reaction: At the beginning of shading, the output switches over to sun protection while the relays of the output show no reaction. Any travel movements still in progress at this instant will still be finished. raising: At the beginning of shading, the actuator raises the blind/shutter. lowering: At the beginning of shading, the actuator lowers the blind/shutter. stop: At the beginning of shading, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted. Internal scene recall: At the beginning of shading, the actuator recalls the position values for the affected output which were preset in the scene configuration. This is not a scene recall as in direct operation, but only an approach of the corresponding scene position values. fixed position: At the beginning of shading, the output controls the approach to a configured fixed position. variable position: At the beginning of shading, the output controls the approach to a position preset by a separate object and thus variable. This parameter is only visible in the shutter/awning operating mode.	

At the beginning of sunshine	no reaction open close stop internal scene recall **fixed position** variable position

This parameter defines the behaviour of the output at the beginning of shading – if applicable, after the end of the delay time.

no reaction: At the beginning of shading, the output switches over to sun protection while the relays of the output show no reaction. Any travel movements still in progress at this instant will still be finished.

open: At the beginning of shading, the actuator opens the venting louver/roof window.

close: At the beginning of shading, the actuator closes the venting louver/roof window.

stop: At the beginning of shading, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

Internal scene recall: At the beginning of shading, the actuator recalls the position values for the affected output which were preset in the scene configuration. This is not a scene recall as in direct operation, but only an approach of the corresponding scene position values.

fixed position: At the beginning of shading, the output controls the approach to a configured fixed position.

variable position: At the beginning of shading, the output controls the approach to a position preset by a separate object and thus variable.
This parameter is only visible in the "venting louver/roof window" operating mode.

Internal scene	**Scene 1** Scene 2 ... Scene 64

This parameter defines the internal scene which is recalled at the beginning of shading.
This parameter is only visible, if the parameter "At the beginning of sunshine" is set to "internal scene recall".

Fixed Venetian blind position	**same as configured value** no change in current position
The fixed Venetian blind position at the beginning of shading can either be preset statically by a separate parameter or basically adjusted to the value prevailing at the time of shading activation, i.e. remain unchanged. same as configured value: At the beginning of shading, the configured Venetian blind position will be approached. no change in current position: At the beginning of shading, the current Venetian blind position will be maintained. In this case, the output behaves as if only the slat were positioned as a result of shading. This parameter is only visible, if the Venetian blind is to approach a fixed position at the beginning of shading. This parameter is only visible in the "Venetian blind with slat" operating mode.	

Position of blind (0...100 %)	0...**50**…100
This parameter sets the fixed position of the Venetian blind to be approached at the beginning of shading. This parameter is only visible, if the parameter "Fixed position of Venetian blind" is set to "as specified by parameter". This parameter is only visible in the "Venetian blind with slat" operating mode.	

Fixed position of slat (0...100 %)	0...**50**…100
This parameter sets the fixed position of the slat to be approached at the beginning of shading and, as the case may be, after positioning of the Venetian blind. This parameter is only visible, if the slat is to approach a fixed position at the beginning of shading. This parameter is only visible in the "Venetian blind with slat" operating mode.	

Fixed roller shutter / awning position	**same as configured value** no change in current position
The fixed position of the roller shutter or awning at the beginning of shading can either be preset statically by a separate parameter or basically adjusted to the value prevailing at the time of shading activation, i.e. remain unchanged. same as configured value: At the beginning of shading, the configured shutter or awning position will be approached. no change in current position: At the beginning of shading, the current shutter or awning position will be maintained. Any movements in progress at the time of shading activation will be finished. This parameter is only visible when the shutter or awning should approach a fixed position value at the beginning of sun shading. This parameter is only visible in the shutter/awning operating mode.	

Position of shutter/awning (0...100 %)	0...**50**…100
This parameter sets the fixed position of the shutter or awning to be approached at the beginning of shading. This parameter is only visible, if the parameter "Fixed position of shutter / awning" is set to "as specified by parameter". This parameter is only visible in the shutter/awning operating mode.	

Fixed position of venting louvre	**same as configured value** no change in current position
The fixed venting louvre position at the beginning of shading can either be preset statically by a separate parameter or basically adjusted to the value prevailing at the time of shading activation, i.e. remain unchanged. same as configured value: At the beginning of shading, the configured venting louver position will be approached. no change in current position: At the beginning of shading, the current venting louver position will be maintained. Any movements in progress at the time of shading activation will be finished. This parameter is only visible if the venting louvre is to approach a fixed position at the beginning of shading. This parameter is only visible in the "venting louver/roof window" operating mode.	

Position of venting louver (0...100 %)	0...**50**…100
This parameter sets the fixed position of the venting louvre to be approached at the beginning of shading. This parameter is only visible, if the parameter "Fixed position of venting louver" is set to "as specified by parameter". This parameter is only visible in the "venting louver/roof window" operating mode.	

Reference travel before every sun protection positioning operation	Checkbox (yes / **no**)
A forced reference travel of the drive is performed before sun protection positioning. A reference movement is a positioning movement into the upper end position or into the completely open position. By means of a forced reference movement, drives connected to different outputs can be synchronised. If no synchronising movement is forced, the actuator performs a reference movement only once after return of the power supply.	

Offset of the slat position during sunshine	**no offset** offset as configured offset as configured and via object
For manual adjustment of the slat angle during a shading or sun position tracking operation, a slat offset can be preset. The offset corrects the preset slat angle in positive or in negative direction. The lighting conditions in a room can thus be individually adapted by persons present in the room. no offset: Offset correction is deactivated. Offset as parameter: The slat offset is statically preset by means of a fixed parameter value. Offset as parameter and via object: The slat offset is preset by a fixed parameter value and can be dynamically adapted via a separate communication object. This parameter is only visible, if the slat is to approach a fixed or a variable position at the beginning of shading. This parameter is only visible in the "Venetian blind with slat" operating mode.	

Offset slat position (-100..100 %)	-100…**0**...100
This parameter is used for setting the slat offset. The value specified in this parameter is added at the beginning of shading to the current slat angle. Even with offset correction, the 0...100% slat position limits cannot be overstepped. It should be noted that the configured offset value can be overwritten by the object after reception of a dynamic value. This parameter is only visible, if the parameter "offset with fixed and variable slat position" is set to "offset as configured" or to "offset as configured and via object". This parameter is only visible in the "Venetian blind with slat" operating mode.	

Store in case of bus voltage failure	Checkbox (**yes** / no)
If the offset is preset via the object, this parameter defines whether the received value is to be stored in the actor's NV memory. Parameter activated: The value received via the object will be stored permanently in the actuator in case of bus voltage failure. The originally configured offset value is definitely overwritten in the process. Parameter deactivated: The value received via the object will only be stored temporarily in volatile memory. This only replaces the configured value until the actuator is reinitialised (return of bus voltage). After the initialisation, the offset value configured in the ETS will be used again. This parameter is only visible, if the parameter "Offset with fixed and variable slat position" is set to "offset as configured and via object". This parameter is only visible in the "Venetian blind with slat" operating mode.	

Relay outputs... -> VBO... - General -> Sunshine -> Sun protection end

Delay at the end of sunshine Minutes (0...59)	**0**...59
The telegram received via the object "Sunshine" for deactivation of shading (depending on polarity) can be evaluated with a time delay. Setting the delay time minutes.	

<table>
<tr><td>Seconds (0...59)</td><td>0...30...59</td></tr>
<tr><td colspan="2">Setting the delay time seconds.
A time setting of "0" in the parameters deactivates the respective delay time. In this case, the state of shading is evaluated immediately.</td></tr>
</table>

<table>
<tr><td>At the end of sunshine</td><td>no reaction
raising / opening
lowering / closing
stop
tracking the position</td></tr>
<tr><td colspan="2">This parameter defines the behaviour of the output at the end of shading – if applicable, after the end of the delay time.
no reaction: At the end of shading, the output quits the sun protection mode and the relays of the output show no reaction. Any travel movements still in progress at this instant will still be finished.
raising / opening: The actuator raises the blind/shutter or opens the venting louver/roof window at the end of shading.
lowering / closing: The actuator lowers the blind/shutter or closes the venting louver/roof window at the end of shading.
stop: At the end of shading, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.
tracking the position: At the end of shading, the output will be set to the state last adjusted before sun protection or to the state tracked and internally stored during sun protection. The position objects, the long-time object and the scene function are tracked.
The behaviour preset in this parameter will only be executed if no function with a higher priority (e.g. safety) is activated at the end of shading.</td></tr>
</table>

<table>
<tr><td>Internal scene</td><td>Scene 1
Scene 2
...
Scene 64</td></tr>
<tr><td colspan="2">This parameter defines the internal scene which is recalled at the end of shading.
This parameter is only visible, if the parameter "At the end of sunshine" is set to "internal scene recall".</td></tr>
</table>

Fixed Venetian blind position	**same as configured value** no change in current position

The fixed Venetian blind position at the end of shading can either be preset statically by a separate parameter or basically remain at the value set or tracked by the shading operation.

same as configured value: At the end of shading, the configured Venetian blind position will be approached.

no change in current position: At the end of shading, the current Venetian blind position will be maintained. In this case, the output behaves as if only the slat were positioned as a result of the end of shading.
This parameter is only visible, if the Venetian blind is to approach a fixed position at the end of shading.
This parameter is only visible in the venetian blind operating mode.

Position of blind (0...100 %)	0...**50**…100

This parameter sets the fixed position of the Venetian blind to be approached at the end of shading.
This parameter is only visible, if the parameter "Fixed position of Venetian blind" is set to "as specified by parameter".
This parameter is only visible in the "Venetian blind with slat" operating mode.

Fixed position of slat (0...100 %)	0...**50**…100

This parameter sets the fixed position of the slat to be approached at the end of shading and, as the case may be, after positioning of the Venetian blind.
This parameter is only visible, if the slat is to approach a fixed position at the beginning of shading.
This parameter is only visible in the "Venetian blind with slat" operating mode.

Fixed roller shutter / awning position	**same as configured value** no change in current position

The fixed position of the roller shutter or awning at the end of shading can either be preset statically by a separate parameter or basically adjusted to the value prevailing at the time of shading activation, i.e. remain unchanged.

same as configured value: At the end of shading, the configured shutter or awning position will be approached.

no change in current position: At the end of shading, the current shutter or awning position will be maintained. Any movements in progress at the time of shading activation will be finished.
This parameter is only visible, if the shutter or awning is to approach a fixed position at the end of shading.
This parameter is only visible in the shutter/awning operating mode.

Position of shutter/awning (0...100 %)	0...**50**…100
This parameter sets the fixed position of the shutter or awning to be approached at the end of shading. This parameter is only visible, if the parameter "Fixed position of shutter / awning" is set to "as specified by parameter". This parameter is only visible in the shutter/awning operating mode.	

Fixed position of venting louvre	**same as configured value** no change in current position
The fixed venting louver position at the end of shading can either be preset statically by a separate parameter or basically adjusted to the value prevailing at the time of shading activation, i.e. remain unchanged. same as configured value: At the end of shading, the configured venting louver position will be approached. no change in current position: At the end of shading, the current venting louver position will be maintained. Any movements in progress at the time of shading activation will be finished. This parameter is only visible if the venting louver is to approach a fixed position at the end of shading. This parameter is only visible in the "venting louver/roof window" operating mode.	

Position of venting louver (0...100 %)	0...**50**…100
This parameter sets the fixed position of the venting louver to be approached at the end of shading. This parameter is only visible, if the parameter "Fixed position of venting louver" is set to "as specified by parameter". This parameter is only visible in the "venting louver/roof window" operating mode.	

10.8.2 Object sun protection function

Object no.	Function	Name	Type	DPT	Flag
32, 56...	Sunshine	Venetian blind... - Input	1-bit	1,001	C, (R), W, -, A
1-bit object for activation or deactivation of sun shading in the simple or extended sun protection mode (sun / no sun). The polarity can be configured.					

Object no.	Function	Name	Type	DPT	Flag
33, 57...	Sun protection - ...position	Venetian blind... - Input	1 bytes	5,001	C, (R), W, -, A
1-byte object for presetting a variable position value (0…255) for the height of the Venetian blind or shutter or the venting louver/roof window position in direct operation when the sun protection is active.					

Object no.	Function	Name	Type	DPT	Flag
34, 58...	Sun protection - slat position	Venetian blind... - Input	1 bytes	5,001	C, (R), W, -, A
1-byte object for presetting a variable slat position value (0…255) when the sun protection is active.					

Object no.	Function	Name	Type	DPT	Flag
35, 59...	Sun protection - offset slat position	Venetian blind... - Input	1 bytes	6,001	C, (R), W, -, A
1-byte object for presetting a slat position angle (- 100 % … +100 % / smaller or larger position angles are treated as + or – 100 %) for 'manual' readjustment of the slat position when the sun protection is active.					

10.9 Scene function

An actuator can hold up to 16 scenes for each output and store scene position values for the height of a Venetian blind, shutter or awning or the venting louver/roof window position. In the 'Venetian blinds' operating mode, the user can also preset slat positions. The scene values are recalled or stored via a separate scene extension object. The data point type of the extension object permits addressing of all scenes.

The scene function must be enabled on the parameter page "Relay outputs... -> VBO... - General -> Enabled functions" for each Venetian blind output, in order for the required communication objects and parameters (on the parameter page "Relay outputs... -> VBO... - General -> Scenes") to become visible.

The number of scenes used can be selected anywhere in the range 1 to 16. The parameter "Number of scenes" decides how many scenes are visible for the switching output in the ETS and can therefore be used. It is possible to specify which scene number (1 ... 64) controls each scene.

Like the output control via short time, long time or position telegrams, the scene function should be assigned to direct operation. For this reason, a recalled scene position can at any time be overridden by a manual control or a safety function. The scene position last recalled can also be readjusted by other telegrams of the direct operation mode. The priority of direct operation and also of the scene function can be configured with respect to the sun protection function (cf. "Sun protection function").

Presetting a scene recall delay

Each scene recall of an output can optionally also be delayed. With this feature, dynamic scene sequences can be configured if several scene outputs are combined with cyclical scene telegrams.

Precondition
The scene function must be enabled on the parameter page "Relay outputs... -> VBO... - General -> Enabled functions".

■ On the parameter page "Relay outputs... -> VBO... - General -> Scenes" activate the parameter "Delay scene recall".

The delay time is now activated and can be configured separately. The delay only influences the scene recall of the switching output. The delay time is started on arrival of a recall telegram. The corresponding scene will be recalled and the output set to the respective scene position value only after this time has elapsed.

ℹ Each scene recall telegram restarts the delay time and retriggers it. If a new scene recall telegram is received while a delay is active (scene recall not yet executed), the old (and not yet recalled scene) will be rejected and only the scene last received executed.

ℹ The scene recall delay has no influence on the storage of scene values. A scene storage telegram within a scene recall delay terminates the delay and thus the scene recall.

Presetting the behaviour during ETS programming

When a scene is saved, the scene position values are stored permanently in the device. To prevent the stored values from being replaced during ETS programming of the application or of the parameters by the originally programmed scene position values, the actuator can inhibit overwriting of the scene values. As an alternative, the original values can be reloaded into the device during each programming run of the ETS.

Precondition
The scene function must be enabled on the parameter page "Relay outputs... -> VBO... - General -> Enabled functions".

- On the parameter page "Relay outputs... -> VBO... - General -> Scenes", activate the parameter "Overwrite values stored in the device during the ETS programming operation".

  During each ETS programming of the application or of the parameters, the scene position values configured in the ETS for the output concerned will be programmed into the actuator. Scene values stored in the device by means of a storage function will be overwritten, if any.

- Deactivate the parameter "Overwrite values stored in the device during the ETS programming operation".

  Scene position values stored in the device with a storage function will be maintained. If no scene values have been stored, the position values last programmed in the ETS remain valid.

ℹ When the actuator is commissioned for the first time, this parameter should be activated so that the output is initialised to valid scene position values.

Presetting scene numbers and scene positions

The scene number (1...64) with which the scene is addressed, i.e. recalled or stored, must be determined for each internal scene of the output. The data point type of the scene extension object permits addressing of all scenes.

In addition to specifying the scene number, it must be defined which position is to be set for the output in case of a scene recall. In the "Venetian blind with slat" operating mode, two position values must be defined for the Venetian blind position and slat position.

Precondition
The scene function must be enabled on the parameter page "Relay outputs... -> VBO... - General -> Enabled functions".

- On the parameter page "Relay outputs... -> VBO... - General -> Scenes", set the parameter for each scene to the numbers with which the scenes are to be addressed.

  A scene can be addressed with the configured scene number. A setting of "0" deactivates the corresponding scene so that neither recalling nor storage is possible.

ℹ If the same scene number is configured for several scenes, only the scene with the lowest sequential number will be addressed. The other scenes will be ignored in this case.

- On the parameter page "Relay outputs... -> VBO... General -> Scenes" for each scene set the parameters "position of Venetian blind", "position of shutter/awning", "position of venting louver/roof window"and "position of slat " to the desired position value ((0...100%)

  During a scene recall, the configured scene position is recalled and set on the output.

ℹ The configured scene positions are then adopted in the actuator during programming with the ETS only if the parameter "Overwrite values stored in the device during ETS download" is activated.

ℹ Before approaching the required scene position, the actuator may perform a reference movement, if the current position data is unknown (e.g. after an ETS programming operation or after switch-on of the bus voltage).

Presetting storage behaviour

The current position value of a Venetian blind, shutter, awning, venting louver and also of a slat can be stored internally via the extension object on reception of a scene storage telegram. The position value can be influenced before storage by all functions of the output (e.g. short-time and long-time operation, scene recall telegram, safety and sun protection function and manual control).

Precondition
The scene function must be enabled on the parameter page "Relay outputs... -> VBO... - General -> Enabled functions".

- On the parameter page "Relay outputs... -> VBO... - General -> Scenes" activate the parameter "storage function" for each scene.

  The storage function is activated for the scene in question. On reception of a storage telegram via the "Scene extension" object, the current position value will be internally stored.

- Deactivate the parameter "storage function" for each scene.

  The storage function is deactivated for the scene in question. A storage telegram received via the "scene extension" object will be rejected.

Optionally, a visual feedback via the output can be signaled when executing a storage command. As feedback, the drive connected to the output moves for the configured travel time of the visual feedback in the opposite direction to the last travel command and then back again. This enables the system operator to determine locally whether the desired scene position has been saved correctly in the actuator.

ℹ The visual feedback is only available in the "Venetian blind with slat" and "shutter/awning" operating modes.

- On the parameter page "Relay outputs... -> VBO... - General -> Scenes" activate the parameter "visual feedback for storage function". Set the duration of the travel movement for the directional travel of the visual feedback for the parameters "Venetian blind travel time" or "shutter/awning travel time".

  When a storage function is executed, the visual feedback is activated immediately. The output travels in the opposite direction of the last move command and then back again for the duration of the configured travel time.

- Deactivate the parameter "visual feedback for storage function".

  When storing a scene, the visual feedback is not executed. The actuator adopts the current position value of the output without special feedback.

ℹ The visual feedback is only executed if no other function with a higher priority (e.g. safety function) is active in the moment when the memory function is active.

10.9.1 Parameter scene function

Relay output... -> VBO... - General -> Enabled functions

Scene function	Checkbox (yes / **no**)
This parameter can be used disable or to enable the scene function.	

Relay output... -> VBO... - General: -> Scenes

Delay scene recall	Checkbox (yes / **no**)
A scene is recalled via the scene extension object. If required, the scene recall can be delayed on reception of a recall telegram (parameter activated). The recall is alternatively made immediately on reception of the telegram (parameter deactivated)	

Delay time minutes (0...59)	**0**...59
This parameter specifies the length of the scene delay time. Sets the scene delay time in minutes.	

Seconds (0...59)	0...**10**...59
Sets the scene delay time in seconds. The delay time parameters are only visible, if the parameter "Delay scene recall" is activated.	

Visual feedback for storage function	Checkbox (yes / **no**)
Optionally, a visual feedback via the output can be signaled when executing a storage command. As feedback, the drive connected to the output moves for the configured travel time of the visual feedback in the opposite direction to the last travel command and then back again. Parameter activated: When a storage function is executed, the visual feedback is activated immediately. The output travels in the opposite direction of the last move command and then back again for the duration of the configured travel time. Parameter deactivated: When storing a scene, the visual feedback is not executed. The actuator adopts the current position value of the output without special feedback. This parameter is only available in the "Venetian blind with slat" and "shutter/awning" operating modes.	

Venetian blind travelling time Seconds (1...59)	1...**2**...59
Setting the travel time for the visual feedback. This parameter is only available if the visual feedback is used and the operating mode is set to "Venetian blind with slat".	

Shutter/awning travelling time Seconds (1...59)	1...**2**...59
Setting the travel time for the visual feedback. This parameter is only available if the visual feedback is used and the operating mode is set to "shutter/awning".	

Overwrite values stored in the device during the ETS programming operation	Checkbox (**yes** / no)
During storage of a scene, the scene position values are stored internally to memory in the device. To prevent the stored values from being replaced during ETS programming by the originally programmed scene position values, the actuator can inhibit overwriting of the scene values (parameter deactivated). As an alternative, the original values can be reloaded into the device during each programming run of the ETS (parameter activated).	

Number of scenes (1...16)	1...**10**...16
This parameter defines how many scenes are visible for the output in the ETS and can therefore be used.	

Scene number	0...**1***...64 *: The predefined scene number is dependent on the scene (1...16).
The number of scenes used can be selected anywhere in the range 1 to 16. It is then possible to preset which scene number (1 ... 64) controls each scene. A setting of "0" deactivates the corresponding scene so that neither recalling nor storage is possible. If the same scene number is configured for several scenes, only the scene with the lowest sequential number will be addressed. The other scenes will be ignored in this case.	

Position of Venetian blind (%)	0*...100 *: The predefined position is dependent on the scene (1...16).
This parameter is used for configuring the position of the Venetian blind, which is set when the scene is recalled. This parameter is only available in the "Venetian blind with slat" operating mode.	

Slat position (%)	0*...100 *: The predefined position is dependent on the scene (1...16).
This parameter is used for configuring the position of the slat, which is set when the scene is recalled. This parameter is only available in the "Venetian blind with slat" operating mode.	

Shutter/awning position (%)	0*...100 *: The predefined position is dependent on the scene (1...16).
This parameter is used for configuring the position of the shutter or awning , which is set when the scene is recalled. This parameter is only available in the "Shutter/awning" operating mode.	

Position of venting louver/roof window (%)	0*...100 *: The predefined position is dependent on the scene (1...16).
This parameter is used for configuring the position of the venting louver or roof window, which is set when the scene is recalled. This parameter is only available in the "venting louver/roof window" operating mode.	

Memory function	Checkbox (yes / **no**)
If the parameter is activated, the storage function of the scene is enabled. The current position value can then be stored internally via the extension object on receipt of a storage telegram. If the parameter is deactivated, the storage telegrams are rejected.	

10.9.2 Object list scene function

Object no.	Function	Name	Type	DPT	Flag
24, 48...	Scene extension	Venetian blind... - Input	1 bytes	18,001	C, (R), W, -, A
1-byte object for polling or saving a scene.					

10.10 disabling function

Presetting disabling function

During an active disabling function, the KNX control of the output concerned is overridden and locked. The disabling function has the second highest priority after manual control. Therefore, an active disabling function overrides the sun protection function and the direct operation (short-time, long-time telegram, scenes, positioning). Permanent locking for service purposes (drive stop) or as lockout protection (raising Venetian blind), for example, can also be overridden.

The deactivation of the disabling function can optionally take place using an additional 1-bit acknowledgement object. This prevents the deactivation of the disabling function by the disabling object.

- On the parameter page "Relay outputs... -> VBO... - General -> Enabled functions" activate the parameter "Disabling function".

  The disabling function is enabled. The communication object "Disable" and the parameters of the disabling function on the parameter page "Relay output... -> VBO... - General -> Disabling function" become visible. The polarity of the disabling object is predefined (1 = output disabled, 0 = output enabled).

- Set the parameter "Beginning of the disabling function" to the required behaviour.

  At the beginning of the disabling function (ON telegram to the disabling object), the configured behaviour will be executed and the bus control of the output locked.

  no reaction: The relay of the output shows no reaction and remains in the position last set.

  stop: At the beginning of the disabling function, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

  raising / opening: The actuator raises the blind or opens the venting louver/ roof window.

  lowering / closing: The actuator lowers the blind/shutter or closes the venting louver/roof window.

  Approach position: At the beginning of the disabling function, the connected drive can approach a position (0…100 %) specified by further parameters. If Venetian blinds are controlled with the device, the slats can be positioned independently. The actuator performs a reference movement before the position approach, because the current position at the time of the disabling function is unknown.

For disabling function without acknowledgement object...

- Deactivate the parameter "Use acknowledgment".

No additional acknowledgement object is available. The disabling function is deactivated via the disabling object by means of an "OFF" telegram.

- Set the parameter "End of the disabling function" to the required behaviour.

  At the end of the disabling function, the configured behaviour will be executed and the bus control of the output enabled again.

  no reaction: The relay of the output shows no reaction and remains in the position last set.

  stop: At the end of the disabling function, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

  raising / opening: The actuator raises the blind or opens the venting louver/ roof window.

  lowering / closing: The actuator lowers the blind/shutter or closes the venting louver/roof window.

  Tracking the position: The last switching state received during the disabling function or the last position set before the disabling function (terminated travel movement) will be tracked.

For disabling function with acknowledgement object...

- Activate the parameter "Use acknowledgment"

  The acknowledgement object is available. The disabling function can only be deactivated using the acknowledgement object by an ON telegram. OFF telegrams to the disabling object or to the acknowledgement object are ignored by the actuator.

- Set the parameter "End of the disabling function after acknowledgement" to the required behaviour.

  After an acknowledgement, the configured behaviour will be executed and the bus operation of the output enabled again.

  no reaction: The relay of the output shows no reaction and remains in the position last set.

  stop: At the end of the disabling function, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

  raising / opening: The actuator raises the blind or opens the venting louver/ roof window.

  lowering / closing: The actuator lowers the blind/shutter or closes the venting louver/roof window.

  Tracking the position: The last switching state received during the disabling function or the last position set before the disabling function (terminated travel movement) will be tracked.

- ℹ After a bus failure or after programming the application or the parameters with the ETS, the disabling function is always deactivated (object value "0").

- ℹ Updates of the disabling object from "activated" to "deactivated do not produce a reaction.

- ℹ The relay of a dimming channel disabled output via the KNX can still be operated manually.

10.10.1 Parameter disabling function

Relay outputs... -> VBO... - General -> Enabled functions

disabling function	Checkbox (yes / **no**)
With this parameter, the disabling function of the device can be activated.	

Relay outputs... -> VBO... - General -> Disabling function

Acknowledgment	Checkbox (yes / **no**)
The deactivation of the disabling function can optionally take place using an additional 1-bit acknowledgement object. This prevents the deactivation of the disabling function by the disabling object. Alternatively, the acknowledgement object is not available. In this case, disabling is deactivated via the disabling object. Parameter activated: The acknowledgement object is available. The disabling function can only be deactivated using the acknowledgement object by an ON telegram. OFF telegrams to the disabling object are ignored by the actuator. Parameter deactivated: No additional acknowledgement object is available. The disabling function can be deactivated via the disabling object by means of an "OFF" telegram.	

Beginning of the disabling function	no reaction stop raising lowering approaching a position
The behaviour of the output at the beginning of the disabling function can be configured. This parameter is visible only if the disabling function is enabled. no reaction: The relay of the output shows no reaction and remains in the position last set. stop: At the beginning of the disabling function, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted. raising: The actuator raises the blind/shutter. lowering: The actuator lowers the blind/shutter. Approach position: At the beginning of the disabling function, the connected drive can approach a position (0…100 %) specified by further parameters. If Venetian blinds are controlled with the device, the slats can be positioned independently. The actuator performs a reference movement before the position approach, because the current position at the time of the disabling function is unknown. This parameter is only available in the "Venetian blind with slat" and "shutter/awning" operating modes.	

Beginning of the disabling function	no reaction stop open close approaching a position
The behaviour of the output at the beginning of the disabling function can be configured. This parameter is visible only if the disabling function is enabled. no reaction: The relay of the output shows no reaction and remains in the position last set. stop: At the beginning of the disabling function, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted. open: The actuator opens the venting louver/ roof window. close: The actuator closes the venting louver/ roof window. Approach position: At the beginning of the disabling function, the connected drive can approach a position (0…100 %) specified by further parameters. If Venetian blinds are controlled with the device, the slats can be positioned independently. The actuator performs a reference movement before the position approach, because the current position at the time of the disabling function is unknown. This parameter is only available in the "venting louver/roof window" operating mode.	

Position of Venetian blind (0...100%)	0…100
This parameter sets the position value of the Venetian blind to be approached at the beginning of the disabling function. This parameter is only visible if the parameter "beginning of the disabling function" is set to "approach position". This parameter is only visible in the "Venetian blind with slat" operating mode.	

Slat position (0...100%)	0…100
This parameter sets the position value of the slat to be approached at the beginning of the disabling function and, as the case may be, after positioning of the Venetian blind. This parameter is only visible if the parameter "beginning of the disabling function" is set to "approach position". This parameter is only visible in the "Venetian blind with slat" operating mode.	

Shutter/awning position (0...100%)	0…100
This parameter sets the position value of the shutter or awning to be approached at the beginning of the disabling function. This parameter is only visible if the parameter "beginning of the disabling function" is set to "approach position". This parameter is only visible in the shutter/awning operating mode.	

Position of venting louver/roof window (0...100 %)	0…100
This parameter sets the position value of the venting louver or roof window to be approached at the beginning of the disabling function. This parameter is only visible if the parameter "beginning of the disabling function" is set to "approach position". This parameter is only visible in the "venting louver/roof window" operating mode.	

End of the disabling function	no reaction stop raising lowering tracking the position
The behaviour of the output at the end of the disabling function can be configured. This parameter is visible only if the disabling function is enabled and acknowledgement is not used. no reaction: The relay of the output shows no reaction and remains in the position last set. stop: At the end of the disabling function, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted. raising: The actuator raises the blind/shutter. lowering: The actuator lowers the blind/shutter. Tracking the position: The last switching state received during the disabling function or the last position set before the disabling function (terminated travel movement) will be tracked. This parameter is only available in the "Venetian blind with slat" and "shutter/awning" operating modes.	

End of the disabling function	no reaction stop open close tracking the position

The behaviour of the output at the end of the disabling function can be configured. This parameter is visible only if the disabling function is enabled and acknowledgement is not used.

no reaction: The relay of the output shows no reaction and remains in the position last set.

stop: At the end of the disabling function, the actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

open: The actuator opens the venting louver/ roof window.

close: The actuator closes the venting louver/ roof window.

Tracking the position: The last switching state received during the disabling function or the last position set before the disabling function (terminated travel movement) will be tracked.

This parameter is only available in the "venting louver/roof window" operating mode.

End of the disabling function after acknowledgement	no reaction stop raising lowering tracking the position

The behaviour of the output at the end of the disabling function can be configured. This parameter is visible only if the disabling function is enabled and acknowledgement is used.

no reaction: The relay of the output shows no reaction on acknowledgement and remains in the position last set.

stop: On acknowledgement, The actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

raising: The actuator raises the blind/shutter on acknowledgement.

lowering: The actuator lowers the blind/shutter on acknowledgement.

Tracking the position: The last switching state received during the disabling function or the last position set on acknowledgement (terminated travel movement) will be tracked.

This parameter is only available in the "Venetian blind with slat" and "shutter/awning" operating modes.

End of the disabling function after acknowledgement	no reaction stop open close tracking the position

The behaviour of the output at the end of the disabling function can be configured. This parameter is visible only if the disabling function is enabled and acknowledgement is used.

no reaction: The relay of the output shows no reaction on acknowledgement and remains in the position last set.

stop: On acknowledgement, The actuator switches the relays of the output to the "stop" position. A travel movement, if any, will be interrupted.

open: The actuator opens the venting louver/ roof window on acknowledgement.

close: The actuator closes the venting louver/ roof window on acknowledgement.

Tracking the position: The last switching state received during the disabling function or the last position set on acknowledgement (terminated travel movement) will be tracked.

This parameter is only available in the "venting louver/roof window" operating mode.

10.10.2 Object list disabling function

Object no.	Function	Name	Type	DPT	Flag
27, 51...	Disabling	Venetian blind... - Input	1-bit	1,003	C, (R), W, -, A
1-bit object for disabling an active Venetian blind output ("1" = disabling function active, "0" = disabling function inactive).					

Object no.	Function	Name	Type	DPT	Flag
28, 52...	Disabling acknowledgment	Venetian blind... - Input	1-bit	1,016	C, (R), W, -, A
1-bit object to acknowledge an active disabling function of a Venetian blind output. This object is only visible if the acknowledgement is to be used with the disabling function ("1" = Disabling function is deactivated / "0" = disabling function remains active).					

10.11 fabric stretching

fabric stretching

In the "Shutter/awning operating mode, the "Fabric stretching" function can be activated. The Fabric stretching function permits stretching the fabric of an awning tight after lowering.
If activated in the ETS parameters, fabric stretching is executed during each downward movement into any position after stopping and after the configured switchover delay has elapsed. The curtain is then 'stretched' by moving briefly into the opposite travel direction .

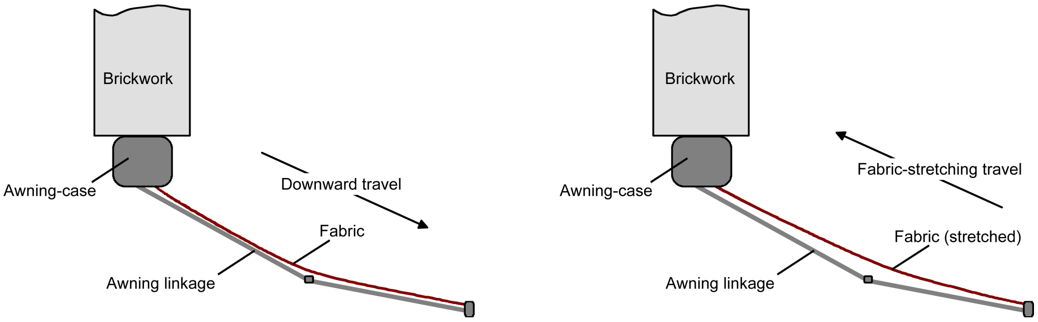

Image 14: Fabric stretching in an awning

The downward travel can be triggered by any of the following events: Long-time, short-time or position telegram, forced position, safety or sun protection function, central telegram or scene recall and also the manual control.
Fabric stretching is never effected in upward movements (retraction of the awning).

ℹ Fabric stretching affects the determination of positions and the position feedback since a fabric stretching movement changes the position of a shutter or an awning. After a positioning movement, the position value reported back after the fabric stretching operation will always be a smaller one.

Activating the fabric stretching function

The Fabric stretching function can be activated independently for each Venetian blind or shutter on the parameter page
"Relay outputs... -> VBO... - General -> Enabled functions".

The operating mode must be set to "Shutter/awning".

- Activate the "Fabric stretching" parameter.

  The parameter page
  "Relay outputs... -> VBO... - General -> Fabric stretching" is enabled and the Fabric stretching function is activated.

Set fabric stretching function

The Fabric stretching function can be activated independently for each shutter or awning output using the parameter "Fabric stretching" on the parameter page "Relay outputs... -> VBO... - General -> Enabled functions". If the function is enabled, the parameter page "Relay outputs... -> VBO... - General -> - Fabric stretching" appears in the ETS.

The Fabric stretching function must be enabled.

■ Select the desired value for the "Time for fabric stretching" parameter.

After the end of a downward movement, the blind stops and – after the switchover time has elapsed – moves in the opposite direction for a period corresponding to the configured fabric stretching time.

ℹ Set the time for fabric stretching to less than the predefined travel time of the shutter or awning. Otherwise, there is the risk of malfunction.

ℹ Fabric stretching will only be effected if the downward movement lasts longer than the configured fabric stretching time.

10.11.1 Fabric stretching parameters

Relay outputs... -> VBO... - General -> Enabled functions

fabric stretching	Checkbox (yes / **no**)
At this point the fabric stretching can be enabled. The fabric stretching can only be selected in the "Shutter/awning" operating mode.	

Relay outputs... -> VBO... - General -> Fabric stretching

Time for fabric stretching Seconds (0...59)	0...**1**...59
This parameter can be used to specify the time for fabric stretching. After the end of a downward movement, the awning stops and – after the switchover time has elapsed – moves in the opposite direction for a period corresponding to the fabric stretching time configured here. Setting of the seconds of the fabric stretching time.	

Milliseconds (0...900)	**0**...900
Setting of the milliseconds of the fabric stretching time. The time for fabric stretching must be less than the travel time of the shutter/awning. The parameters regarding the time for the fabric stretching are only available in the operating mode "shutter/awning".	

11 Switching operation

11.1 Priorities

The actuator in switching operation distinguishes between different functions that can have an effect on an output. In order to prevent conflicting states, each available function has a certain priority. The function with the higher priority overrides the function with the lower priority.

For switching operation there are the following priorities...

- 1st priority: manual control (highest priority),
- 2nd priority: Disabling function,
- 3th priority: Logical operation function & Staircase function,
- 4th priority: direct bus operation ("switching" object, scenes, reset behaviour)

The behaviour of some functions can be configured at the end (e.g. the behaviour at the end of a manual operation or the behaviour at the end of the disabling function). These predefined reactions are only executed if the actuator can then immediately switch to direct operation (lowest priority).

If another function with a lower priority (e.g. manual operation) has been activated during a function with a high priority (e.g. disabling function), the actuator executes the behaviour at the beginning of the function with the next lower priority (e.g. disabling function). The behaviour at the end of the function with the higher priority (e.g. manual operation) is then not executed!

11.2 General settings

11.2.1 Reset behaviour

Delay after bus voltage return

To reduce telegram traffic on the KNX bus line after bus voltage activation (bus reset), after connection of the device to the bus line or after an ETS programming operation, it is possible to delay all actively transmitted status or feedback telegrams of the switching function. For this purpose, a channel-independent delay can be specified (parameter "Delay after bus voltage return" on the parameter page "General -> General switching outputs"). Only after the configured time elapses are feedback telegrams for initialisation transmitted to the KNX.
Which of the telegrams is actually delayed and which is not can be set for each switching output and for status function separately.

ℹ The delay has no effect on the behaviour of the outputs. Only the bus telegrams for status or feedback are delayed. The outputs can also be activated during the delay after bus voltage return.

ℹ A setting of "0" for the delay after bus voltage return deactivates the delaying function altogether. In this case, any messages, if actively transmitted, will be transmitted to the KNX without any delay.

11.2.1.1 Reset behaviour parameter

General -> General switching outputs

Delay after bus voltage return Minutes (0...59)	**0**...59
To reduce telegram traffic on the KNX bus line after bus voltage activation (bus reset), after connection of the device to the KNX line or after an ETS programming operation, it is possible to delay all actively transmitted status or feedback telegrams of the switching function. For this purpose, a delay time can be defined here. Only after the configured time elapses are feedback telegrams for initialisation transmitted to the KNX. Setting the delay time minutes.	

Seconds (0...59)	0...**17**…59
Setting the delay time seconds.	

11.2.2 Name of a switching output

Here, you can optionally assign a name for each switching output. The name is intended to illustrate the use of the output (e.g. "light kitchen", "wall lamp living room"). The names are only used in the ETS in the text of the parameter pages and communication objects.

11.2.2.1 Parameter name

Relay outputs... -> SO... - General

Name of switching output	Free text
The text entered in this parameter is applied to the name of the communication objects and is used to label the switching output in the ETS parameter window (e.g. "light kitchen", "wall lamp living room"). The text is not programmed in the device.	

11.3 Operating mode

The relay of a switching output can be configured as NO or NC contacts. In this way, the inversion of switching states is possible.

The parameter "Operating mode" exists separately for each switching output on the parameter page "Relay output... -> SO... - General".

- Set the operating mode to "NO contact".

  The relay works as an NO contact. The logical switching state of the switching output is not forwarded to the relay in inverted form.
  Switching state = OFF ("0") -> relay contact open,
  Switching state = ON ("1") -> relay contact closed.

- Set the operating mode to "NC contact".

  The relay works as an NC contact. The logical switching state of the switching output is forwarded to the relay in inverted form.
  Switching state = OFF ("0") -> relay contact closed,
  Switching state = ON ("1") -> relay contact open.

i The logic switching state "ON" or "OFF" is set by the communication object "Switching" and influenced by the functions that can be optionally activated (e.g. timing/staircase functions, logic operations, disabling functions, scenes).

i The 1-bit feedbacks always feed back the logical switching state of the switching outputs. Depending on the configured relay operating mode and an inverted or non-inverted evaluation, a status feedback has the following meanings:
NO contact not inverted: Feedback = "ON" -> Relay closed, feedback = "OFF" -> Relay opened
NO contact inverted: Feedback = "ON" -> Relay opened, feedback = "OFF" -> Relay closed
NC contact not inverted: Feedback = "ON" -> Relay opened, feedback = "OFF" -> Relay closed
NC contact inverted: Feedback = "ON" -> Relay closed, feedback = "OFF" -> Relay opened

i Feedback of the current switching status via the "switching" object is not possible.

11.3.1 Operating mode parameter

Relay output... -> SO... - General

Operating mode	**NO contact** NC contact
The relay of a switching output can be configured as NO or NC contacts. In this way, the inversion of switching states is possible. NO contact: Switching state = OFF ("0") -> Relay contact opened Switching state = ON ("1") -> Relay contact closed NC contact: Switching state = OFF ("0") -> Relay contact closed Switching state = ON ("1") -> Relay contact opened	

11.3.2 Object list operating mode

Object no.	Function	Name	Type	DPT	Flag
322, 342...	Switching	Switching... - Input	1-bit	1,001	C, (R), W, -, A
1-bit input object to activate a switching output ("1" = Switch on / "0" = Switch off; "NO contact" or "NC contact" operating mode can be configured).					

11.4 Reset and initialisation behaviour

Behaviour after ETS programming

The relay behaviour of the output after an ETS programming operation is permanently set to "no reaction". After ETS programming, the relay of the output shows no response and remains in the switching state last selected. The internal logical switching state is not lost by the ETS programming operation.

ℹ A switching state set after an ETS programming operation is added to the feedback object. Actively transmitting feedback objects also only first transmit after an ETS programming cycle when the initialisation has finished and, if necessary, the "delay after bus voltage return" has elapsed.

ℹ After an ETS programming operation, the disabling functions are always deactivated.

Behaviour in case of bus voltage failure

In case of bus voltage failure, the relay of the output shows no reaction and remains in the switching state last selected.

ℹ Active disabling functions are cancelled and remain inactive until they are reactivated after a bus voltage return.

Behaviour after bus voltage return

After bus voltage return, the relay of the output shows no reaction and remains in the switching state last selected.

ℹ A switching state set after bus voltage return is tracked in the feedback objects. Actively transmitting feedback objects first transmit, however, after bus voltage return, when the initialisation of the actuator has finished, and if necessary the "Delay after bus voltage return" has elapsed.

ℹ Active disabling functions are always inactive after bus voltage return.

11.4.1 Reset and initialisation behaviour parameter

Relay output... -> SO... - General

After ETS programming operation	**no reaction**
The behaviour of the actuator after ETS programming is specified as a fixed value, and cannot be adjusted. The relay of the output shows no reaction and remains in the switching state last selected. The internal logical switching state is not lost by the ETS programming operation.	

In case of bus voltage failure	**no reaction**
The behaviour of the actuator is predefined in case of bus voltage failure. The relay of the output shows no reaction and remains in the switching state last selected.	

after bus voltage return	**no reaction**
The behaviour of the actuator after bus voltage return is fixed. The relay of the output shows no reaction and remains in the switching state last selected.	

11.5 Feedback switching status

The actuator can track the current switching state of a switching output via a feedback object and can also transmit them to the KNX. On each switching operation, the actuator determines the object value of the feedback. The actuator tracks the switching state and updates the feedback object even when a switching output, for example, is activated by a disabling function or scene function.

The switching status feedback object is updated after the following events...

- Immediately after switch-on of a switching output (if necessary, first after a switch-on delay has elapsed / also after a staircase function).
- After switch-off of a switching output (if necessary, only after a switch-off delay has elapsed / also after a staircase function).
- During updating of the switching state from "ON" to "ON" or "OFF" to "OFF" when the switching output is already switched on or off. However, only if the parameter "Update of the object value" is configured to "On each update of object 'Switching'".
- At the start or end of a disabling function, if a state changes as a result.
- Always on bus voltage return or at the end of any ETS programming process (if necessary, also delayed).

i A disabled and "flashing" switching channel is always reported as "switched on".

Activate switching status feedback

The switching status feedback can be used as an active message object or as a passive status object. As an active message object, the switching status feedback information is also directly transmitted to the KNX whenever the feedback value is updated. As a passive status object, there is no telegram transmission after an update. In this case, the object value must be read out. The ETS automatically sets the object communication flags required for proper functioning.
Optionally, the actuator can also feed back the status of an independent switching output in inverted form.
The parameter "switching status" exists separately for each switching output on the parameter page "Relay output... -> SO... - General -> Feedback telegrams". Feedback takes place via the "Switching feedback" object.

Precondition:
The feedbacks must be enabled on the parameter page "Relay output... -> SO... - General -> Enabled" functions.

- Set the parameter to "no inversion, active signalling object".

  A switching status is transmitted as soon as it is updated. An automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS. The switching status is written to the object in non-inverted form.

- Set the parameter to "no inversion, active signalling object".

A switching status will be transmitted in response only if the feedback object is read out from by the KNX. No automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS. The switching status is written to the object in non-inverted form.

- Set the parameter to "Invert, active signalling object".

  A switching status is transmitted as soon as it is updated. An automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS. The switching status is written to the object in inverted form.

- Set the parameter to "Invert, passive status object".

  A switching status will be transmitted in response only if the feedback object is read out from by the KNX. No automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS. The switching status is written to the object in inverted form.

- Set the parameter to "no reaction".

  The switching status feedback of the affected switching output is deactivated.

ℹ Depending on the configured relay operating mode and an inverted or non-inverted evaluation, a status feedback has the following meanings:
NO contact not inverted: Feedback = "ON" -> Relay closed, feedback = "OFF" -> Relay opened
NO contact inverted: Feedback = "ON" -> Relay opened, feedback = "OFF" -> Relay closed
NC contact not inverted: Feedback = "ON" -> Relay opened, feedback = "OFF" -> Relay closed
NC contact inverted: Feedback = "ON" -> Relay closed, feedback = "OFF" -> Relay opened

ℹ Feedback of the current switching status via the "switching" object is not possible.

Set update of "Switching feedback"

In the ETS, you can specify when the actuator should update the feedback value for the switching status (object "Switching feedback") in case of an actively transmitting communication object. The object value updated by the actuator is then signalled actively to the KNX.
The parameter "Update of the object value" can be preset separately for each switching output on the parameter page "Relay output... -> SO... - General -> Feedback telegrams".

Precondition:
The feedbacks must be enabled on the parameter page "Relay output... -> SO... - General -> Enabled" functions. In addition, the switching status feedback must be configured to actively transmitting.

- Set the parameter to "after each update object 'Switching'".

The actuator updates the feedback value in the object once a new telegram is received on the input objects "Switching" or the switching state changes internally (e.g. through a time function). With an actively transmitting feedback object, a new telegram is also then actively transmitted to the KNX each time. The telegram value of the feedback does not necessarily have to change in the process. Hence, a corresponding switching status feedback is also generated on the "Switching" object such as in the case of cyclical telegrams for example.

- Set the parameter to "Only if the feedback value changes".

  The actuator only updates the feedback value in the object if the telegram value (e.g. "OFF" to "ON") also changes or the switching state changes internally (e.g. through a time function). If the telegram value of the feedback does not change (e.g. in the case of cyclical telegrams to the "Switching" object with the same telegram value), the actuator does not transmit any feedback. Consequently, with an actively transmitting feedback object, no telegram with the same content will be transmitted repeatedly either.
  This setting is recommendable, for instance, if the "Switching" and "Switching feedback" objects are linked to an identical group address. This is often the case when activating by means of light scene push-button sensors (recall and storage function).

Setting switching status feedback on bus voltage return or after programming with the ETS

If used as active message object, the switching status feedback states are transmitted to the KNX after bus voltage return or after programming with the ETS. In these cases, the feedback telegram can be time-delayed, with the delay being preset globally for all switching outputs together.

- Activate the parameter "Delay after bus voltage return" on the parameter page "Relay output... -> SO... - General ->Feedback telegrams".

  The switching status telegram is transmitted with a delay after bus voltage return or after an ETS programming operation. No feedback telegram is transmitted during a running delay, even if the switching state changes during this delay.

- Deactivate the parameter.

  The switching status telegram is transmitted immediately after bus voltage return or after an ETS programming operation.

Setting cyclical transmission of the switching status feedback telegram

The switching status feedback telegrams can, if active, also be transmitted cyclically, in addition to the transmission after updating.

- Activate the parameter "cyclical transmission" on the parameter page "Relay output... -> SO... - General ->Feedback telegrams".

Cyclical transmission is activated. The cycle time for the switching status feedback can be configured separately for the parameter "Time for cyclical transmission".

- Deactivate the parameter.

  Cyclical transmission is deactivated so that the feedback is transmitted to the KNX only when updated by the actuator.

11.5.1 Parameter feedback switching status

Relay output... -> SO... - General -> Enabled functions

Feedback telegrams	Checkbox (**yes** / no)
This parameter can be used to disable or to enable the feedback functions.	

Relay output... -> SO... - General -> Feedback telegrams

switching status	no feedback **no inversion, active signalling object** no inversion, passive status object inversion, active signalling object inversion, passive status object
The current switching state of the switching output can be reported separately back to the KNX. no feedback: The switching status feedback of the affected switching channel is deactivated. no inversion, active signalling object: A switching status is transmitted as soon as it is updated. An automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS. The switching status is written to the object in non-inverted form. no inversion, passive status object: A switching status will be transmitted in response only if the feedback object is read out from by the KNX. No automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS. The switching status is written to the object in non-inverted form. inversion, active signalling object: A switching status is transmitted as soon as it is updated. An automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS. The switching status is written to the object in inverted form. inversion, passive status object: A switching status will be transmitted in response only if the feedback object is read out from by the bus. No automatic telegram transmission of the feedback takes place after bus voltage return or after programming with the ETS. The switching status is written to the object in inverted form.	

<table>
<tr><td>Updating of the object value</td><td>after each update object "Switching"
only if the feedback value changes</td></tr>
<tr><td colspan="2">Here, you can specify when the actuator should update the feedback value for the switching status (object "Switching feedback") in case of an actively transmitting communication object. The object value updated by the actuator is then signalled actively to the KNX.
This parameter is only visible in case of an actively transmitting feedback.
after each update object "Switching": The actuator updates the feedback value in the object once a new telegram is received on the input objects "Switching" or the switching state changes internally (e.g. through a time function). With an actively transmitting feedback object, a new telegram is also then actively transmitted to the KNX each time. The telegram value of the feedback does not necessarily have to change in the process. Hence, a corresponding switching status feedback is also generated on the "Switching" object such as in the case of cyclical telegrams for example.
only if the feedback value changes: The actuator only updates the feedback value in the object if the telegram value (e.g. "OFF" to "ON") also changes or the switching state changes internally (e.g. through a time function). If the telegram value of the feedback does not change (e.g. in the case of cyclical telegrams to the "Switching" object with the same telegram value), the actuator does not transmit any feedback. Consequently, with an actively transmitting feedback object, no telegram with the same content will be transmitted repeatedly either.</td></tr>
</table>

<table>
<tr><td>Delay after bus voltage return</td><td>Checkbox (yes / **no**)</td></tr>
<tr><td colspan="2">The states of the switching status feedback can be transmitted to the KNX with a delay after bus voltage return or after an ETS programming operation. The activated parameter causes a delay on bus voltage return. The delay time is configured for all outputs on the parameter page "General -> General switching outputs".
This parameter is only visible in case of an actively transmitting feedback.</td></tr>
</table>

<table>
<tr><td>Cyclical transmission</td><td>Checkbox (yes / **no**)</td></tr>
<tr><td colspan="2">The switching status feedback telegrams can, if actively transmitting, also be transmitted cyclically, in addition to the transmission after updating.
This parameter is only visible in case of an actively transmitting feedback.
Parameter activated: Cyclical transmission is activated.
Parameter deactivated: Cyclical transmission is deactivated so that the feedback is transmitted to the KNX only when updated by the actuator.</td></tr>
</table>

<table>
<tr><td>Time for cyclical transmission hours (0...23)</td><td>**0**...23</td></tr>
<tr><td colspan="2">This parameter defines the time for the cyclical transmission of the switching status feedback.
Setting the cycle time hours. This parameter is only available if cyclical transmission is activated.</td></tr>
</table>

Minutes (0...59)	0...**2**...59
Setting the cycle time minutes. This parameter is only available if cyclical transmission is activated.	

Seconds (0...59)	**0**...59
Setting the cycle time seconds. This parameter is only available if cyclical transmission is activated.	

11.5.2 Object list feedback switching status

Object no.	Function	Name	Type	DPT	Flag
323, 343...	Switching feedback	Switching... - Output	1-bit	1,001	C, R, -, T, A
1-bit object for feedback signalling of a switching state of a switching output ("1" = on / "0" = off) to the bus. Depending on the configured relay operating mode, the feedback value should be interpreted differently: NO contact operating mode: Feedback = "0" -> Relay open, feedback = "1" -> Relay closed NC contact operating mode: Feedback = "0" -> Relay closed, feedback = "1" -> Relay opened					

11.6 Time delays

Up to two time functions can be preset for each switching output, independently of each other. The time functions affect the communication objects "Switching" and delay the object value received depending on the telegram polarity .

ℹ At the end of a disabling function, the switching state received during the function or set before the function can be tracked. At the same time, residual times of time functions are also tracked if these had not yet fully elapsed at the time of the reactivation.

ℹ The time delays do not influence the staircase function if this is enabled.

ℹ A time delay still in progress will be fully aborted by a reset of the actuator (bus voltage failure or ETS programming).

Activating switch-on delay

The switch-on delay can be activated separately in the ETS for each switching output.

Precondition:
The time delays must be enabled on the parameter page "Relay output... -> SO... - General -> Enabled" functions.

- Set the parameter "Selection of time delay" to "Switch-on delay" or to "Switch-on delay and switch-off delay". Configure the desired switch-on delay.

  The switch-on delay is enabled. After reception of an ON telegram via the "switching" or "central switching" object, the configurable time is started. Another ON-telegram triggers the time only when the parameter "Switch-on delay retriggerable" is activated. An OFF-telegram received during the ON-delay will end the delay and sets the switching status to "OFF".

Activating switch-off delay

The switch-off delay can be activated separately in the ETS for each switching output.

Precondition:
The time delays must be enabled on the parameter page "Relay output... -> SO... - General -> Enabled" functions.

- Set the parameter "Selection of time delay" to "Switch-off delay" or to "Switch-on delay and switch-off delay". Configure the desired switch-off delay.

  The switch-off delay is enabled. After reception of an OFF telegram via the "switching" or "central switching" object, the configurable time is started. Another OFF-telegram triggers the time only when the parameter "switch-off delay retriggerable" is activated. An ON-telegram received during the OFF-delay will end the delay and sets the switching status to "ON".

11.6.1 Parameter time delays

Relay output... -> SO... - General -> Enabled functions

Time delays	Checkbox (yes / **no**)
This parameter can be used to disable or to enable the time delays. The parameter is deactivated if cyclical monitoring is enabled.	

Relay output... -> SO... - General -> Time delays

Selection of time delay	**no time delay** Switch-on delay Switch-off delay ON delay and OFF delay
The communication objects "Switching" or "Central switching" can be evaluated after a time delay. By this setting the desired function of the time delay is selected and the additional parameters of the delay enabled.	

Switch-on delay minutes (0…59)	**0**…59
This parameter is used for setting the duration of the switch-on delay. Sets the switch-on delay minutes.	

Seconds (0...59)	0...**10**…59
Sets the switch-on delay seconds.	

Switch-on delay retriggerable	Checkbox (yes / **no**)
A switch-on delay still in progress can be retriggered by another "ON" telegram (parameter activated). Alternatively, the retriggering time (parameter deactivated) can be suppressed. The parameters for the switch-on delay are only visible if switch-on delay or switch-on and switch-off delay are activated.	

Switch-off delay minutes (0…59)	**0**…59
This parameter is used for setting the duration of the switch-off delay. Sets the switch-off delay minutes.	

Seconds (0...59)	0...**10**…59
Sets the switch-off delay seconds.	

Switch-off delay retriggerable	Checkbox (yes / **no**)
A switch-off delay still in progress can be retriggered (parameter activated) by another "OFF" telegram. Alternatively, the retriggering time (parameter deactivated) can be suppressed. The parameters for the switch-off delay are only visible if switch-on delay or switch-on and switch-off delay are activated.	

11.7 Staircase function

The staircase function can be used for implementing time-controlled lighting of a staircase or for function-related applications. The staircase function must be enabled in the ETS on parameter page "Relay output... -> SO... - General -> Enabled functions", in order for the required communication objects and parameters to be visible.

The staircase function is activated via the communication object "Staircase function start / stop" and is independent of the "switching" object of a switching output. In this way, parallel operation of time and normal control is possible, whereby the command last received is always executed: A telegram to the "switching" object or a scene recall at the time of an active staircase function aborts the staircase time prematurely and presets the switching state according to the received object value (the time delays are also taken into account) or scene value. Likewise, the switching state of the "switching" object can be overridden by a staircase function.

Time-independent continuous light switching can also be implemented in combination with a disabling function because the disabling function has a higher priority and overrides the switching state of the staircase function.
Furthermore, an extension of the staircase function can be implemented by means of a separate switch-on delay and pre-warning function. The pre-warning should, according to DIN 18015-2, warn any person still on the staircase that the light will soon be switched off.

Specifying switch-on behaviour of the staircase function

An ON telegram to the "Staircase function start/stop" object activates the staircase time (T_{ON}), the duration of which is defined by the parameters"Staircase time". In addition, a switch-on delay (T_{Delay}) can be activated (see "presetting switch-on delay of the staircase function"). At the end of the staircase time, the output switches off or activates optionally the pre-warning time ($T_{Prewarn}$) of the pre-warning function (see "presetting pre-warning function of the staircase function"). Taking into account any possible switch-on delay and pre-warning function, this gives rise to the switch-on behaviour of the staircase function as shown in the following diagram.

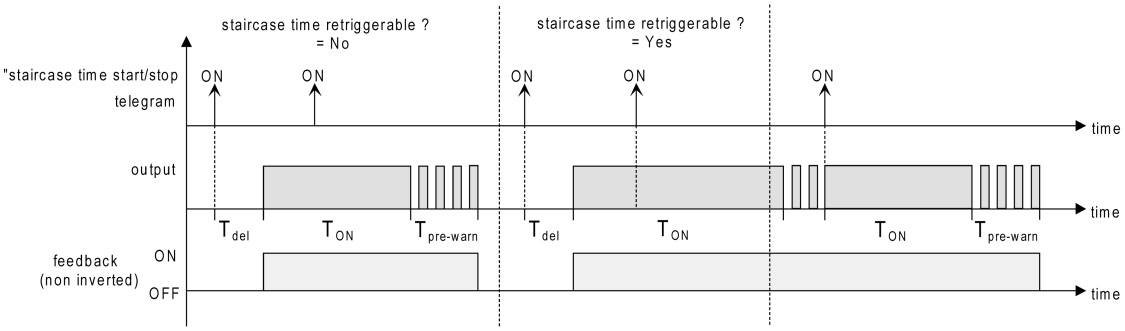

Image 15: Switch-on behaviour of the staircase function

The parameter "Staircase time retriggerable" specifies whether the staircase time can be retriggered.

Precondition:
The staircase function must be enabled on parameter page "Relay output... -> SO... - General -> Enabled functions".

- Activate parameter "Staircase time retriggerable".

  Every ON telegram received during the ON phase of the staircase time retriggers the staircase time completely.

- Deactivate parameter "Staircase time retriggerable".

  ON telegrams received during the ON phase of the staircase time are rejected. The staircase time is not retriggered.

i An ON telegram received during the pre-warning time always retriggers the staircase time independently of the parameter "Staircase time retriggerable".

Specifying switch-off behaviour of the staircase function

In the case of a staircase function, the reaction to an OFF telegram can also be configured on the object "Staircase function start/stop". Without the receipt of an OFF telegram the output switches off after the pre-warning time elapses, if necessary Taking into account any possible switch-on delay and pre-warning function, this gives rise to the switch-off behaviour of the staircase function as shown in the following diagram.

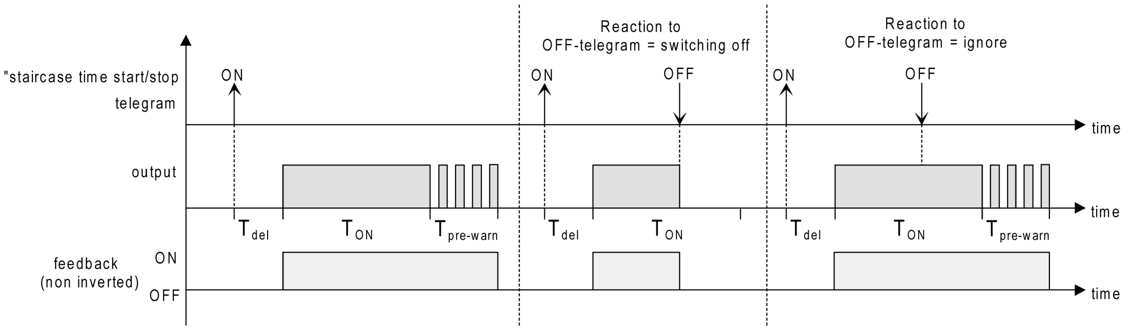

Image 16: Switch-off behaviour of the staircase function

The parameter "reaction to OFF-telegram" defines whether the staircase time (T_{ON}) of the staircase function can be aborted prematurely.

Precondition:
The staircase function must be enabled on parameter page "Relay output... -> SO... - General -> Enabled functions".

- Set parameter "Reaction to OFF-telegram" to "switch off".

  As soon as an OFF telegram is received via the object "Staircase function start/stop" during the ON phase of the staircase time, the output switches off immediately. If the staircase time is stopped prematurely by such a telegram, there is no pre-warning, i.e. the pre-warning time is not started.

- Set parameter "Reaction to OFF-telegram" to ignore".

OFF telegrams received during the ON phase of the staircase time are rejected. The staircase time will be executed completely to the end with pre-warning if necessary.

ℹ The parameter "Reaction to OFF telegram" does not influence the reception and the evaluation of OFF telegrams via the "Switching" object.

Setting the switch-on delay of the staircase function

An ON telegram for activation of the staircase function can also be evaluated with a time delay. This switch-on delay can be activated separately for the staircase function and has no influence on the configurable time delays for the object "switching".

Precondition:
The staircase function must be enabled on parameter page "Relay output... -> SO... - General -> Enabled functions".

- On the parameter page "Relay output... -> SO... - General -> Staircase function" deactivate the parameter "Switch-on delay".

  The switch-on delay is deactivated. After reception of an ON telegram on the object "Staircase function start/stop", the staircase time is activated immediately and the output switched on.

- Activate the parameter "switch-on delay".

  The switch-on delay for the staircase function is enabled. The desired switch-on delay time can be specified. After reception of an ON telegram on the object "Staircase function start/stop", the switch-on delay is started. Another ON-telegram triggers the time only when the parameter "Switch-on delay retriggerable" is activated. The staircase time is activated and the output is switched on only after the time delay has elapsed.

ℹ An OFF telegram via the object "Staircase function start/stop" during the switch-on delay only terminates the delay if the parameter "Reaction to OFF-telegram" is set to "switch off". Otherwise, the OFF telegram is ignored.

Setting the pre-warning function of the staircase function

The pre-warning should, according to DIN 18015-2, warn persons still on the staircase that the light will soon be switched off. The lighting connected on the output is briefly switched off repeatedly as a pre-warning, before the output is switched off permanently. At the same time, the pre-warning time ($T_{Prewarn}$), the duration of the interruptions during the pre-warning($T_{Interrupt}$) and the number of pre-warning interruptions are configurable(see figure 17). The pre-warning time is added to the staircase time (T_{ON}). The pre-warning time influences the value of the feedback object so that the value "OFF" (in the case of non-inverted transmission) is first tracked after the pre-warning time in the object has elapsed.

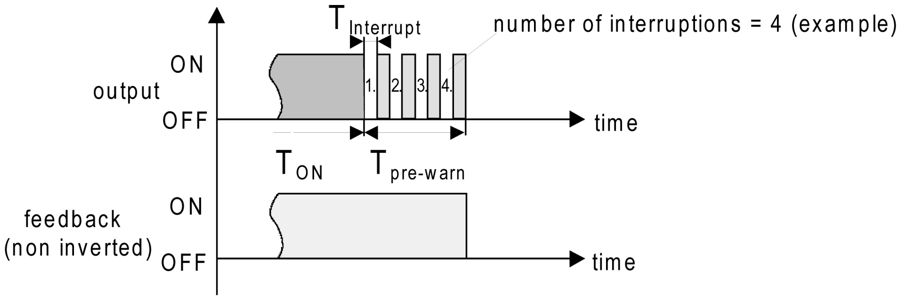

Image 17: The pre-warning function of the staircase function (example)

Precondition:
The staircase function must be enabled on parameter page "Relay output... -> SO... - General -> Enabled functions".

- On the parameter page "Relay output... -> SO... - General -> Staircase function" set the parameter "At the end of the staircase time" to "activate pre-warning time".

  The pre-warning function is enabled. The desired pre-warning time ($T_{Prewarn}$) can be preset.

- Set the parameter "Number of pre-warnings" to the desired value (1…10).

  Within the pre-warning time, the lighting connected on the output is switched off just as often as configured here. The 1st pre-warning is always executed at the beginning of the entire pre-warning time.

- Set the parameters "Time for pre-warning interruptions" to the desired value.

  An interruption ($T_{Interrupt}$) during the pre-warning time is just as long as configured here. The adjustable interruption time allows the switch-off phase of the lighting to be adapted individually to the lamps used.

It should be noted that the "number of pre-warnings" and the "time for pre-warning interruptions" must be attuned to the duration of the entire "pre-warning time". Hence, the entire switch-off phase during a pre-warning ("number of pre-warnings" + "time for pre-warning interruptions") must not be set longer than the pre-warning time! Otherwise, malfunctions can be expected.

An ON telegram to the object "Staircase function start/stop" while a pre-warning function is still in progress stops the pre-warning time and always restarts the staircase time (independently of the parameter "Staircase time retriggerable"). Even during the pre-warning time, the parameter "reaction to OFF telegram" is evaluated so that a pre-warning in progress can be terminated early by switching off.

11.7.1 Parameter Staircase function

Relay output... -> SO... - General -> Enabled functions

Staircase function	Checkbox (yes / **no**)
This parameter can be used to disable or to enable the staircase function.	

Relay output... -> SO... - General -> Staircase function

Staircase time hours (0...23)	**0**...23
This parameter is used for programming the duration of the switch-on time for a scene recall. Switch-on time hours setting.	

Minutes (0...59)	0...**3**...59
Switch-on time minutes setting.	

Seconds (0...59)	**0**...59
Switch-on time seconds setting.	

Staircase time retriggerable	Checkbox (yes / **no**)
An active switch-on time can be retriggered (parameter activated). Alternatively, the retriggering time (parameter deactivated) can be suppressed.	

Switch-on delay	Checkbox (yes / **no**)
The staircase function enables the activation of an own switch-on delay. This switch-on delay affects the trigger result of the staircase function and thus delays the switch-on. activated: The switch-on delay for the staircase function is enabled. After reception of an ON telegram on the object "Staircase function start/stop", the switch-on delay is started. Another ON-telegram triggers the time only when the parameter "Switch-on delay retriggerable" is activated. The staircase time is activated and the output is switched on only after the time delay has elapsed. deactivated: The switch-on delay is deactivated. After reception of an ON telegram on the object "Staircase function start/stop", the staircase time is activated immediately and the output switched on.	

Switch-on delay hours (0...23)	**0**...23
This parameter is used for setting the duration of the switch-on delay. Sets the switch-on delay hours.	

Minutes (0...59)	**0**...59
Sets the switch-on delay minutes.	

Seconds (0...59)	0...**30**...59
Sets the switch-on delay seconds.	

Switch-on delay retriggerable	Checkbox (yes / **no**)

An active switch-on delay can be retriggered (parameter activated). Alternatively, the retriggering time (parameter deactivated) can be suppressed.

The parameters for the switch-on delay are only visible when the switch-on delay is used.

Reaction to OFF-telegram	**switch off** ignore

An active switch-on time can be aborted prematurely by switching off the staircase function.

switch off: The switch-on time is aborted after receipt of an OFF telegram on the object "Staircase time start/stop".

ignore: OFF Telegrams or "0" factors are ignored. The switch-on time will be executed completely to the end.

At the end of the staircase time	**switch off** activate pre-warning time

At the end of the staircase time, the actuator for the switching output concerned displays the configured behaviour here. The output can be set to switch off immediately or alternatively to execute a pre-warning function.

switch off: At the end of the staircase time, the actuator switches off the switching output concerned.

Activate pre-warning time: At the end of the staircase time, the switching output can generate a pre-warning prior to switching off. The pre-warning, for example, should warn any person still on the staircase that the light will soon be switched off.

Pre-warning time minutes (0...59)	**0**...59

This parameter is used for setting the duration of the pre-warning time. The pre-warning time is added to the switch-on time. Sets the pre-warning time in minutes.

Seconds (0...59)	0...**30**...59

Sets the pre-warning time in seconds.
These parameters are visible only if the pre-warning function is enabled.

Time for early warning interruptions seconds (0...59)	**0**...59

This parameter defines the duration of a pre-warning interruption, i.e. how long the switching output is to remain off during a pre-warning interruption. The time should be customized individually to the switch-off behaviour of the lamp used. Sets the pre-warning interruption seconds.

Milliseconds (0...900)	0...**500**...900

Sets the pre-warning interruption milliseconds (in 100-ms increments).

Number of pre-warnings(1...10)	1...**3**..10
This parameter defines how often the switching output is to switch off within the pre-warning time. i.e. how many pre-warnings will be generated.	

11.7.2 Object list staircase function

Object no.	Function	Name	Type	DPT	Flag
332, 352...	Staircase function start/stop	Switching... - Input	1-bit	1,010	C, (R), W, -, A
1-bit object to activate or deactivate the switch-on time of the staircase function of a switching output ("1" = switch-on / "0" = switch-off).					

11.8 Scene function

Up to 16 scenes can be programmed and scene values stored separately for each switching output. The scene values are recalled or stored via a separate scene extension object. The data point type of the extension object permits addressing of all scenes.

The scene function must be enabled on parameter page "Relay output... -> SO... - General ->Enabled functions" for each switching output, in order for the required communication objects and parameters (on the parameter page "Relay output... -> SO... - General -> Scenes") to become visible.

The number of scenes used can be selected anywhere in the range 1 to 16. The parameter "Number of scenes" decides how many scenes are visible for the switching output in the ETS and can therefore be used. It is possible to specify which scene number (1 ... 64) controls each scene.

The scene function can be combined together with other functions of a switching output, whereby the last received or preset state is always executed:
Telegrams to the "Switching" objects, a scene recall or scene storage telegram at the time of an active staircase function aborts the staircase time prematurely and presets the switching state according to the received object value (time delays are also taken into account) or scene value.
Similarly, the state of the switching output, which was preset by the "Switching", "Dimming" or "Brightness value" objects or by a scene recall, can be overridden by a staircase function.

Presetting a scene recall delay

Each scene recall of a switching output can optionally also be delayed. With this feature, dynamic scene sequences can be configured if several scene outputs are combined with cyclical scene telegrams.

Precondition
The scene function must be enabled on parameter page "Relay output... -> SO... - General -> Enabled functions".

- On the parameter page "Relay output... -> SO... - General -> Scenes" activate the parameter "Delay scene recall".

  The delay time is now activated and can be configured separately. The delay only influences the scene recall of the switching output. The delay time is started on arrival of a recall telegram. The corresponding scene will be recalled and the switching channel set to the switching state value only after this time has elapsed.

ℹ Each scene recall telegram restarts the delay time and retriggers it. If a new scene recall telegram is received while a delay is active (scene recall not yet executed), the old (and not yet recalled scene) will be rejected and only the scene last received executed.

ℹ The scene recall delay has no influence on the storage of scene values. A scene storage telegram within a scene recall delay terminates the delay and thus the scene recall.

Presetting the behaviour during ETS programming

When a scene is saved, the switching states are saved permanently in the device. To prevent the stored values from being replaced during ETS programming of the application or parameters by the originally programmed scene switching states, the actuator can inhibit overwriting of the switching states. As an alternative, the original values can be reloaded into the device during each programming run of the ETS.

Precondition
The scene function must be enabled on parameter page "Relay output... -> SO... - General -> Enabled functions".

- On the parameter page "Relay output... -> SO... - General -> Scenes", activate the parameter "Overwrite values stored in the device during the ETS programming operation".

  During each ETS programming operation of the application or of the parameters, the scene switching states configured in the ETS for the switching output concerned will be programmed into the actuator. Scene switching states stored in the device by means of a storage function will be overwritten, if any.

- Deactivate the parameter "Overwrite values stored in the device during the ETS programming operation".

  Scene switching states stored in the device with a storage function will be maintained. If no scene switching states have been stored, the switching states last programmed in the ETS remain valid.

ℹ When the actuator is commissioned for the first time, this parameter should be activated so that the switching output is initialised with valid scene switching states.

Setting scene numbers and scene switching states

The scene number (1...64) with which the scene is addressed, i.e. recalled or stored, must be determined for each internal scene of the switching output. The data point type of the scene extension object permits addressing of all scenes.

In addition to specifying the scene number, it is necessary to define which scene command (ON, OFF) should be set on the switching output during a scene recall.

Precondition
The scene function must be enabled on parameter page "Relay output... -> SO... - General -> Enabled functions".

- On the parameter page "Relay output... -> SO... - General -> Scenes", set the parameter for each scene to the numbers with which the scenes are to be addressed.

A scene can be addressed with the configured scene number. A setting of "0" deactivates the corresponding scene so that neither recalling nor storage is possible.

ℹ If the same scene number is configured for several scenes, only the scene with the lowest sequential number will be addressed. The other scenes will be ignored in this case.

- On the parameter page "Relay output... -> SO... - General -> Scenes" set the parameter "Switching state for each scene to the desired switching command.

  During a scene recall, the configured switching state is recalled and set on the switching output.

ℹ The configured switching state is adopted in the actuator during programming with the ETS only if the parameter "Overwrite values stored in the device during ETS download" is activated.

Presetting storage behaviour

The switching state set for the switching output can be stored internally via the extension object on reception of a scene storage telegram. In this case, the switching state can be influenced before the storage by all functions of the switching output provided that the individual functions have been enabled (e.g. also the disabling function, forced-control position function etc.).

Precondition
The scene function must be enabled on parameter page "Relay output... -> SO... - General -> Enabled functions".

- On the parameter page "Relay output... -> SO... - General -> Scenes" activate the parameter "storage function" for each scene.

  The storage function is activated for the scene in question. On reception of a storage telegram via the "Scene extension" object, the current switching state will be internally stored.

- Deactivate the parameter "storage function" for each scene.

  The storage function is deactivated for the scene in question. A storage telegram received via the "scene extension" object will be rejected.

Optionally, a visual feedback via the switching output can be signaled when executing a storage command. The channel flashes once as feedback in the configured flashing time. This enables the system operator to determine locally whether the desired scene switching state has been saved correctly in the actuator. A switching state feedback on the KNX is not generated.

- On the parameter page "Relay output... -> SO... - General -> Scenes" activate the parameter "visual feedback for storage function". In the parameter "Flashing time", set the time in which the visual feedback is to be executed.

  When a storage function is executed, the visual feedback is activated immediately. The output switches to the opposite switching state for the duration of the configured flashing time and then back to the saved scene command.

- Deactivate the parameter "visual feedback for storage function".

  When storing a scene, the visual feedback is not executed. The actuator adopts the current switching state of the output without special feedback.

ℹ The visual feedback is only executed if no other function with a higher priority (e.g. disabling function) is active in the moment when the memory function is active.

11.8.1 Parameter scene function

Relay output... -> SO... - General -> Enabled functions

Scene function	Checkbox (yes / **no**)
This parameter can be used disable or to enable the scene function.	

Relay output... -> SO... - General: -> Scenes

Delay scene recall	Checkbox (yes / **no**)
A scene is recalled via the scene extension object. If required, the scene recall can be delayed on reception of a recall telegram (parameter activated). The recall is alternatively made immediately on reception of the telegram (parameter deactivated)	

Delay time minutes (0...59)	**0**...59
This parameter specifies the length of the scene delay time. Sets the scene delay time in minutes.	

Seconds (0...59)	0...**10**...59
Sets the scene delay time in seconds. The delay time parameters are only visible, if the parameter "Delay scene recall" is activated.	

Visual feedback for storage function	Checkbox (yes / **no**)
Optionally, a visual feedback via the switching output can be signaled when executing a storage command. The channel flashes once as feedback in the configured flashing time. Parameter activated: When a storage function is executed, the visual feedback is activated immediately. The output switches to the opposite switching state for the duration of the configured flashing time and then back to the saved scene command. Parameter deactivated: When storing a scene, the visual feedback is not executed. The actuator adopts the current switching state of the output without special feedback.	

Flashing time (0...10)	0...**5**...10
The flashing time in which the visual feedback is to be executed is set here. This parameter is only visible when visual feedback is used.	

Overwrite values stored in the device during the ETS programming operation	Checkbox (**yes** / no)
During storage of a scene, the scene values (current states of the switching outputs concerned) are stored internally in the device. To prevent the stored values from being replaced during ETS programming by the originally programmed scene values, the actuator can inhibit overwriting of the scene values (parameter deactivated). As an alternative, the original values can be reloaded into the device during each programming run of the ETS (parameter activated).	

Number of scenes (1...16)	1...**10**...16
This parameter defines how many scenes are visible for the switching output in the ETS and can therefore be used.	

Scene number	0...**1***...64 *: The predefined scene number is dependent on the scene (1...16).
The number of scenes used can be selected anywhere in the range 1 to 16. It is then possible to preset which scene number (1 ... 64) controls each scene. A setting of "0" deactivates the corresponding scene so that neither recalling nor storage is possible. If the same scene number is configured for several scenes, only the scene with the lowest sequential number will be addressed. The other scenes will be ignored in this case.	

Switching state	ON **OFF**
This parameter is used for configuring the switching state which is set when the scene is recalled.	

Memory function	Checkbox (yes / **no**)
If the parameter is activated, the storage function of the scene is enabled. The current switching state can then be stored internally via the extension object on receipt of a storage telegram. If the parameter is deactivated, the storage telegrams are rejected.	

11.8.2 Object list scene function

Object no.	Function	Name	Type	DPT	Flag
328, 348...	Scene extension	Switching... - Input	1 bytes	18,001	C, (R), W, -, A
1-byte object for polling or saving a scene.					

11.9 disabling function

Presetting disabling function

During an active disabling function, the KNX operation of the switching output concerned is overridden and locked. Continuous light switching, for example, can also be overridden. The deactivation of the disabling function can optionally take place using an additional 1-bit acknowledgement object. This prevents the deactivation of the disabling function by the disabling object.

- On the parameter page "Relay output... -> SO... - General -> Enabled functions" Set the parameter "disabling function / forced position" to "disabling function".

  The disabling function is enabled. The communication object "Disable" and the parameters of the disabling function on the parameter page "Relay output... -> SO... - General -> Disabling function" become visible.

- Set the parameter "Polarity disabling object" to the desired polarity.
- Set the parameter "Beginning of the disabling function" to the required behaviour.

  At the beginning of the disabling function, the configured behaviour will be executed and bus operation of the switching output locked.

  When the setting "No change of switching state" is selected, the relay of the output shows no reaction and remains in the switching state last set (switching state in acc. with last non-inverted feedback telegram).

  In the "Flashing" setting, the switching output is switched on and off cyclically during the disabling. The "Time for flashing the disabling functions" is generally configured for all outputs on the parameter page General -> "General switching outputs". During flashing, the logical switching state of the switching output is fed back as "Switched on".

For disabling function without acknowledgement object...

- Deactivate the parameter "Use acknowledgment".

  No additional acknowledgement object is available. The disabling function is deactivated by the disabling object according to the set polarity.

- Set the parameter "End of the disabling function" to the required behaviour.

  At the end of the disabling function, the configured behaviour will be executed and the bus operation of the switching output enabled again.

  In the "No change of switching state" setting, the relay of the output shows no reaction and remains in the state last set by the disabling function.

  In "Set tracked state", the last switching state received during the disabling function or the switching state set before the disabling function will be tracked. Any time functions still in progress will also be taken into account if necessary.

In the "Flashing" setting, the switching output is switched on and off cyclically after the disabling. The time for flashing is generally configured for all outputs on the parameter page "General -> General switching outputs". During flashing, the logical switching state of the output is fed back as "Switched on". The flashing state remains active until another KNX command is received and thereby predefines another switching state.

For disabling function with acknowledgement object...

- Activate the parameter "Use acknowledgment"

  The acknowledgement object is available. The disabling function can only be deactivated using the acknowledgement object by an ON telegram. Telegrams to the disabling object according to the "Deactivate disabling" polarity are ignored by the actuator.

ℹ "OFF" telegrams to the acknowledgement object do not product a reaction.

- Set the parameter "End of the disabling function after acknowledgement" to the required behaviour.

  After an acknowledgement, the configured behaviour will be executed and the bus operation of the switching output enabled again.

  In the "No change of switching state" setting, the relay of the output shows no reaction and remains in the state last set by the disabling function.

  On acknowledgement in "Set tracked state", the last switching state received during the disabling function or the switching state set before the disabling function will be tracked. Any time functions still in progress will also be taken into account if necessary.

  In the "Flashing" setting, the switching output is switched on and off cyclically after the acknowledgement. The time for flashing is generally configured for all outputs on the parameter page "General -> General switching outputs". During flashing, the logical switching state of the output is fed back as "Switched on". The flashing state remains active until another KNX command is received and thereby predefines another switching state.

ℹ After a bus failure or after programming the application or the parameters with the ETS, the disabling function is always deactivated (object value "0"). With the inverted setting "1 = enabled; 0 = disabled", a telegram update "0" must first be carried out after the initialisation until the disabling is activated.

ℹ Updates of the disabling object from "activated" to "deactivated do not produce a reaction.

ℹ The relay of a switching output disabled via the KNX can still be operated manually.

i In the setting "Set tracked state": During a disabling function, the overridden functions of the actuator (switching, scenes) continue to be executed internally. Consequently, newly received bus telegrams are evaluated and time functions are triggered as well. At the end of the disabling, the tracked states are set.

11.9.1 Parameter disabling function

General -> General switching outputs

Time for flashing the disabling functions	**1 s** 2 s 5 s 10 s
Switching outputs can flash in the disabled state (cyclical switching on and off). The flashing time is generally configured here.	

Relay output... -> SO... - General -> Enabled functions

disabling function	Checkbox (yes / **no**)
With this parameter, the disabling function of the device can be activated.	

Relay output... -> SO... - General -> Disabling function

Acknowledgment	Checkbox (yes / **no**)
The deactivation of the disabling function can optionally take place using an additional 1-bit acknowledgement object. This prevents the deactivation of the disabling function by the disabling object. Alternatively, the acknowledgement object is not available. In this case, disabling is deactivated via the disabling object. Parameter activated: The acknowledgement object is available. The disabling function can only be deactivated using the acknowledgement object by an ON telegram. Telegrams to the disabling object according to the "Deactivate disabling" polarity are ignored by the actuator. Parameter deactivated: No additional acknowledgement object is available. The disabling function is deactivated by the disabling object according to the set polarity.	

Polarity of the disabling object	**0 = disabled; 1 = enabled** 1 = enabled; 0 = disabled
This parameter defines the polarity of the disabling object. This parameter is visible only if the disabling function is enabled.	

Beginning of the disabling function	no change to the switching state switch off **switch on** flashing

The behaviour of the switching output at the beginning of the disabling function can be configured.
This parameter is visible only if the disabling function is enabled.

no change of switching state: The relay of the output shows no reaction and remains in the switching state last set (switching state in acc. with last non-inverted feedback telegram).

Switch off: At the beginning of the disabling function, the switching output is switched off and locked.

Switch on: At the beginning of the disabling function, the switching output is switched on and locked.

Flash: The switching output is switched on and off cyclically during the disabling. The "time for flashing" is generally configured for all outputs on the parameter page "General switching outputs". During flashing, the logical switching state of the switching output is fed back as "Switched on".

End of the disabling function	no change to the switching state switch off switch on **set tracked state** flashing

The behaviour of the switching output at the end of the disabling function can be configured.
This parameter is visible only if the disabling function is enabled and acknowledgement is not used.

no change of switching state: The relay of the output shows no reaction and remains in the state last set by the disabling function.

Switch off: At the end of the disabling function, the switching output is switched off and enabled again.

Switch on: At the end of the disabling function, the switching output is switched on and enabled again.

Set tracked state: The last switching state received during the disabling function or the switching state set before the disabling function will be tracked. Any time functions still in progress will also be taken into account if necessary.

Flash: The switching output is switched on and off cyclically after the disabling. The time for flashing is generally configured for all outputs on the parameter page "General -> General switching outputs". During flashing, the logical switching state of the output is fed back as "Switched on". The flashing state remains active until another KNX command is received and thereby predefines another switching state.

End of the disabling function after acknowledgement	no change to the switching state switch off switch on **set tracked state** flashing

The behaviour of the switching output at the end of the disabling function after acknowledgement can be configured.
This parameter is visible only if the disabling function is enabled and acknowledgement is used.

no change of switching state: The relay of the output shows no reaction on acknowledgement and remains in the state last set by the disabling function.

Switch off: On acknowledgement, the switching output is switched off and enabled again.

Switch on: On acknowledgement, the switching output is switched on and enabled again.

Set tracked state: On acknowledgement, the last switching state received during the disabling function or the switching state set before the disabling function will be tracked. Any time functions still in progress will also be taken into account if necessary.

Flash: The switching output is switched on and off cyclically after the acknowledgement. The time for flashing is generally configured for all outputs on the parameter page "General -> General switching outputs". During flashing, the logical switching state of the output is fed back as "Switched on". The flashing state remains active until another KNX command is received and thereby predefines another switching state.

11.9.2 Object list disabling function

Object no.	Function	Name	Type	DPT	Flag
330, 350...	Disabling	Switching... - Input	1-bit	1,003	C, (R), W, -, A
1-bit object for disabling a switching output (polarity configurable).					

Object no.	Function	Name	Type	DPT	Flag
338, 358...	Disabling acknowledgment	Switching... - Input	1-bit	1,016	C, (R), W, -, A
1-bit object to acknowledge an active disabling function of a switching output. This object is only visible if the acknowledgement is to be used with the disabling function ("1" = Disabling function is deactivated / "0" = disabling function remains active).					

11.10 Logic operation function

A logic function can be configured separately for each switching output. This function allows the logic operation of the "Switching" object state and an additional logic operation object. The state of the communication object for "switching" can also be evaluated with a time delay if a switch-on delay or switch-off delay is set.
The logic function can also be combined with other functions of a switching output. A combination with the staircase function is not possible, however.

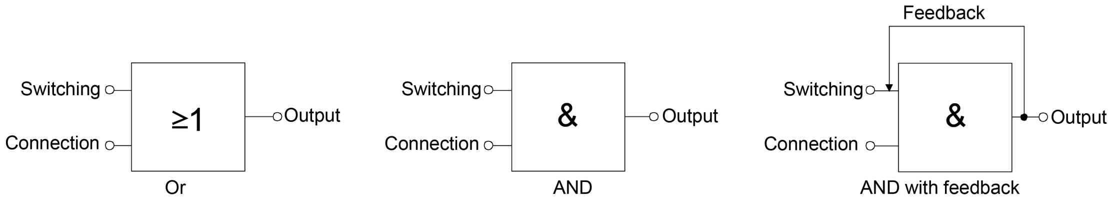

Image 18: Logic operation types of the logic operation function

ℹ "AND with feedback":
With a logic object = "0", the switching output is always "0" (logic AND). In this case, the feedback signal from the output to the "switching" input will directly reset this input when it is being set. The output of the switching output can assume the logical state "1" by a newly received "1" on the input "switching" only when the logic object is = "1".

The object "Logic operation" can be initialised with a configured value after bus voltage return or after an ETS programming operation so that a correct logic operation result can be determined immediately and set on the output of the switching output during a telegram update on the "Switching" object.

- On the parameter page "Relay output... -> SO... - General -> Enabled functions" activate the "logic operation function".

  The logic operation function is enabled. The communication object "logic operation" and the parameters of the logic operation function on the parameter page "Relay output... -> SO... - General -> Logic operation function" become visible.

- Set the parameter "Type of logic operation function" to the desired logic operation type.
- Set the parameters "object value after bus voltage return" and "object value after ETS programming" to the required initial states.

  The "logic operation" object is initialised immediately with the set switching states after bus voltage return or ETS programming of the application program or parameters.

ℹ The logic operation function after a reset of the actuator (bus voltage return or ETS programming operation) is first executed when the switching object is updated as the input of the logic operation by at least one telegram.

ℹ The states or switching states specified at the end of a disabling function, which are set after programming in the ETS, in the case of bus voltage failure or after bus or mains voltage return, override the logic operation function. The configured logic operation is first re-executed and the result set on the switching output when the switching object is updated as the input of the logic operation by at least one telegram.

11.10.1 Parameter logic operation function

Relay output... -> SO... - General -> Enabled functions

Logic operation function	Checkbox (yes / **no**)
The logic operation function can be enabled here. The parameter is deactivated and unchangeable if the staircase function is enabled.	

Relay output... -> SO... - General -> Logic operation function

Type of logic operation function	**OR** AND AND with feedback
This parameter defines the logical type of the logic operation function. The object "logic operation" is linked to the logic switching state of the switching output (object "switching" after evaluation of configured time delays if necessary) using the logic operation function set here. This parameter is only visible when the logic operation function is enabled.	

Object value after bus voltage return	**0 (OFF)** 1 (ON)
After bus voltage return, the object value of the logic operation object is initialised here with the preset value. This parameter is only visible when the logic operation function is enabled.	

Object value after ETS download	**0 (OFF)** 1 (ON)
After programming the application or the parameters in the ETS, the object value of the logic operation object is initialised here with the preset value. This parameter is only visible when the logic operation function is enabled.	

11.10.2 Object list logic operation function

Object no.	Function	Name	Type	DPT	Flag
324, 344...	Logic operation	Switching... - Input	1-bit	1,002	C, (R), W, -, A
1-bit object as input of the logical link of an switching output. After bus voltage return or after programming with the ETS, the object value can be predefined for each parameter.					

12 Delivery state

In the as-delivered state, the actuator is passive, i.e. no telegrams are transmitted to the KNX. All relay outputs are set to Venetian blind operation. The outputs can, however, be activated by manual operation on the device, if the bus voltage is on. In the manual control mode, no feedback telegrams are sent to the KNX.
The device can be programmed and put into operation via the ETS. The physical address is preset to 15.15.255

Moreover the device has been configured at the factory with the following characteristics...

– Travel time (continuous run): 1 minute, 0 seconds extended by 20%
– Movement time extension: 2 %
– Break during movement direction changeover: 1 s
– Behaviour in case of bus voltage failure: Stop
– Behaviour in case of bus voltage return: Stop
– Status indication: permanent

ℹ The as-delivered state cannot be restored by unloading the application program with the aid of the ETS. When the application program is removed, all the outputs remain permanently switched off. The manual operation remains without function in this case.

ℹ In the as-delivered state, the relays are switched to the "stop" state when the bus voltage is applied in order to initialise the relays. This short switching operation can be perceived acoustically.

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