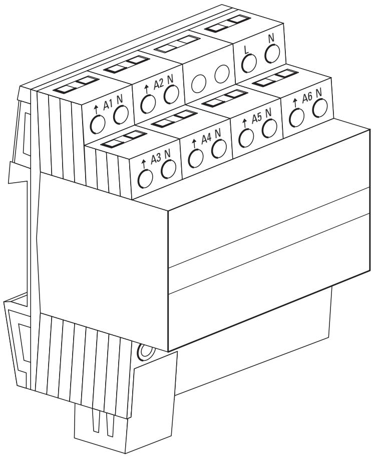
GB

merten

Heating actuator REG-K/6x230/0.05 A

Operating instructions



Art. no. 645129

Safety instructions

Attention!
Electrical appliances must be installed and fitted only by qualified electricians and in observance of the current accident prevention regulations.
Outputs 1 thru 6 are not electrically separated from the mains supply when the device is off. To avoid electric shocks, the device must therefore be disconnected from the power supply during the work (by cutting out the automatic circuit breaker).
Any non-observance of the installation and fitting instructions may cause fire or other hazards.

Function

The heating actuator is designed for controlling electro-thermal servo-drives for heatings and air-conditioning ceilings. The device has 6 electronic outputs permitting noise-free control of electro-thermal servo-drives by means of KNX telegrams. Up to 4 electro-thermal servo-drives (e.g. servo-drives from Heimeier, Sauter, Möhlenhof) can be connected to each output.

The outputs are controlled either by a switching or a PWM signal.

To prevent overloading of the device by strong inrush pulses, the actuator switches its outputs with a time delay (0.5 seconds delay from output to output).

Characteristics

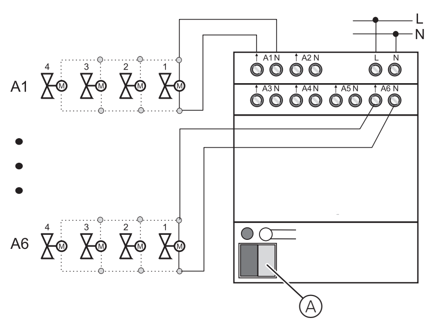
- Outputs suitable for resistive loads of IN = 50 mA at 230 / 240 V.
- Overload/short circuit protection of the outputs ensured by monitoring and shutoff of the corresponding channel with check-back signal to the KNX.
- Output programmable as switching (1 bit) or as permanent (8 bit) PWM signal.
- Emergency operation in the event of bus voltage failure programmable for summer and winter.
- Protection against jamming valves programmable.· Change of direction of the control action programmable.
- Read-out of current object values via the instabus.· PWM manipulated variable approx. 50% on first commissioning.
- Forced-control position programmable
- Cyclic monitoring of the manipulated variables

Instructions

- Do not connect mixed loads, but only actuators of the same type per channel group (channels 1..3 or 4..6). Otherwise risk of overloading.
- In the event of overload, the channels are shut off for at least 6 minutes. Thereafter, the actuator detects the overloaded or short-circuited channel and switches it off permanently.
- Locate and eliminate the cause of the overload shutoff in strict observance of the safety warnings.
- To reset the overload shutoff, the actuator must be disconnected for approximately 5 seconds from the mains supply. After a reset of an overload shutoff it is no longer possible to detect the overloaded channel. If the cause of the overload shutoff is not eliminated, the actuator will shut off again.
- Connect the servo-drives in frost-sensitive rooms to channels 1 and 4 as these channels are the last that are switched off in the event of overload.
- Use the output terminals ↑ and N exclusively for the connection of 4 servo-drives at maximum.
- Connecting the N-conductor of further devices to the output N-terminals is not permitted. Otherwise risk of irreparable damage to the actuator.
- Do not connect capacitive or inductive loads. Otherwise risk of irreparable damage to the actuator.
- The 'programmed response after bus voltage failure' is available only after connection of the bus and the mains.

Connection

Figure ❶:



The device is connected to the KNX at connecting terminal (Figure ❶Ⓐ).

The supply mains is connected to terminals L and N as shown in the schematic diagram.

Attention!
Disconnect the device from the mains before connecting the outputs.

The servo-drives are connected in accordance with the schematic diagram.

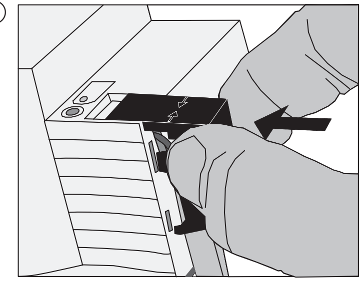
The diagram shows the connection of outputs 1 and 6. Outputs 2 thru 5 are connected in the same way.

Attention!
Output terminals ↑ and N must be exclusively used for the connection of servo-drives. Connecting the N-conductor of the output terminals to further devices may cause irreparable damage to the actuator.

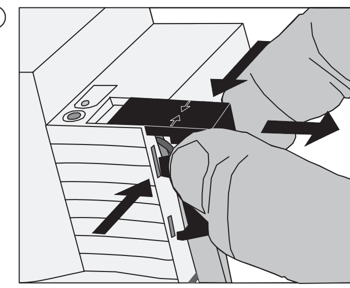
Cap

Figure ❷:

Ⓐ



Ⓑ



- Slide the cap over the bus terminal with the bus line at the bottom (Figure ❷Ⓐ) until it is heard to engage.
- Remove the cap by pressing against the sides and by pulling it out at the same time (Figure ❷Ⓑ).

Technische Daten

KNX supply voltage:	24 V DC (+6 / -4 V)
KNX power consumption:	max. 125 mW
Mains supply:	AC 230/240 V, 50/60 Hz
Overall power dissipation:	approx. 2 W
KNX connection:	KNX connecting terminals
Connection of mains and outputs:	screw terminals 0.2 - 4 mm² single wire or 2 x 0.2 - 2.5 mm² single wire 0.75 - 4 mm² stranded wire without ferrule or 0.5 - 2.5 mm² stranded wire with ferrule
Outputs:	6
Type of contact:	electronic
Switching capacity:	I_N = 50 mA resistive at 230 / 240 V AC
Minimum load per output used:	1 servo-drive
Make current:	max. 1.5 A per output
Number of electro-thermal servo-drives to be connected to an output:	max. 4 per output (depending on type)
Ambient temperature:	-5 °C ... +45 °C
Max. housing temperature:	T_C = 75 °C
Storage temperature:	-25 °C ... +70 °C
Installation width:	72 mm (4 pitch)

Merten GmbH & Co. KG,
Solutions for intelligent buildings
Service Center, Fritz-Kotz-Straße 8,
Industriegebiet Bomig-West
D-51674 Wiehl
Phone: +49 2261 702-204
Fax: +49 2261 702-136
E-Mail: servicecenter@merten.de
Internet: www.merten.de
InfoLine:
Phone: +49 1805 212581* or +49 800 63783640
Fax: +49 1805 212582* or +49 800 63783630
E-Mail: infoline@merten.de

* fee required

Application: 1. Switching PWM 206701
Executable from mask version: 1.2
Number of addresses (max): 29 **Dynamic table management** Yes ☒ No ☐
Number of assignments (max): 29 **Maximum table length** 58
Communication objects: 29

Control values:

Object		Function	Name	Type	Flag
	0 - 5	Control value	Outputs 1 - 6	1 bit ***	C, W, (R) *
	0 - 5	Control value	Outputs 1 - 6	1 byte ***	C, W, (R) *

Status of control values:

Object		Function	Name	Type	Flag
	6 - 11	Status of control value	Outputs 1 - 6	1 bit ***	C, T, (R) **
	6 - 11	Status of control value	Outputs 1 - 6	1 bit ***	C, R **
	6 - 11	Status of control value	Outputs 1 - 6	1 byte ***	C, T, (R) **
	6 - 11	Status of control value	Outputs 1 - 6	1 byte ***	C, R **

Further functions:

Object		Function	Name	Type	Flag
	12 - 17	Forced position	Outputs 1 - 6	1 bit	C, W, (R) *
	18 - 23	Overload / short circuit	Outputs 1 - 6	1 bit	C, T, (R) *
	24	Alarm signal	Mains failure	1 bit	C, T, (R) *
	25	Status of valves	All valves closed	1 bit	C, T, (R) *
	26	Alarm signal	Cyclical monitoring of control values	1 bit	C, T, (R) *
	27	Toggling	Summer / winter	1 bit	C, W, (R) *
	28	Status feedback of control values	Highest control value	1 byte	C, T, (R) *

*: In the cases of objects flagged with (R) the current object status can be read out (set the R flag!).
**: Depending on the general parameter *"Send status of valve position"*, when there is a change in the control value its status is sent automatically (T flag set) or transmitted as an answer to the read telegram only when there is a read request (R flag set).
***: The object size (1 bit or 1 byte) of the control value objects and the control value status objects is dependent on the "Type of control value" parameter for each output.

Object description

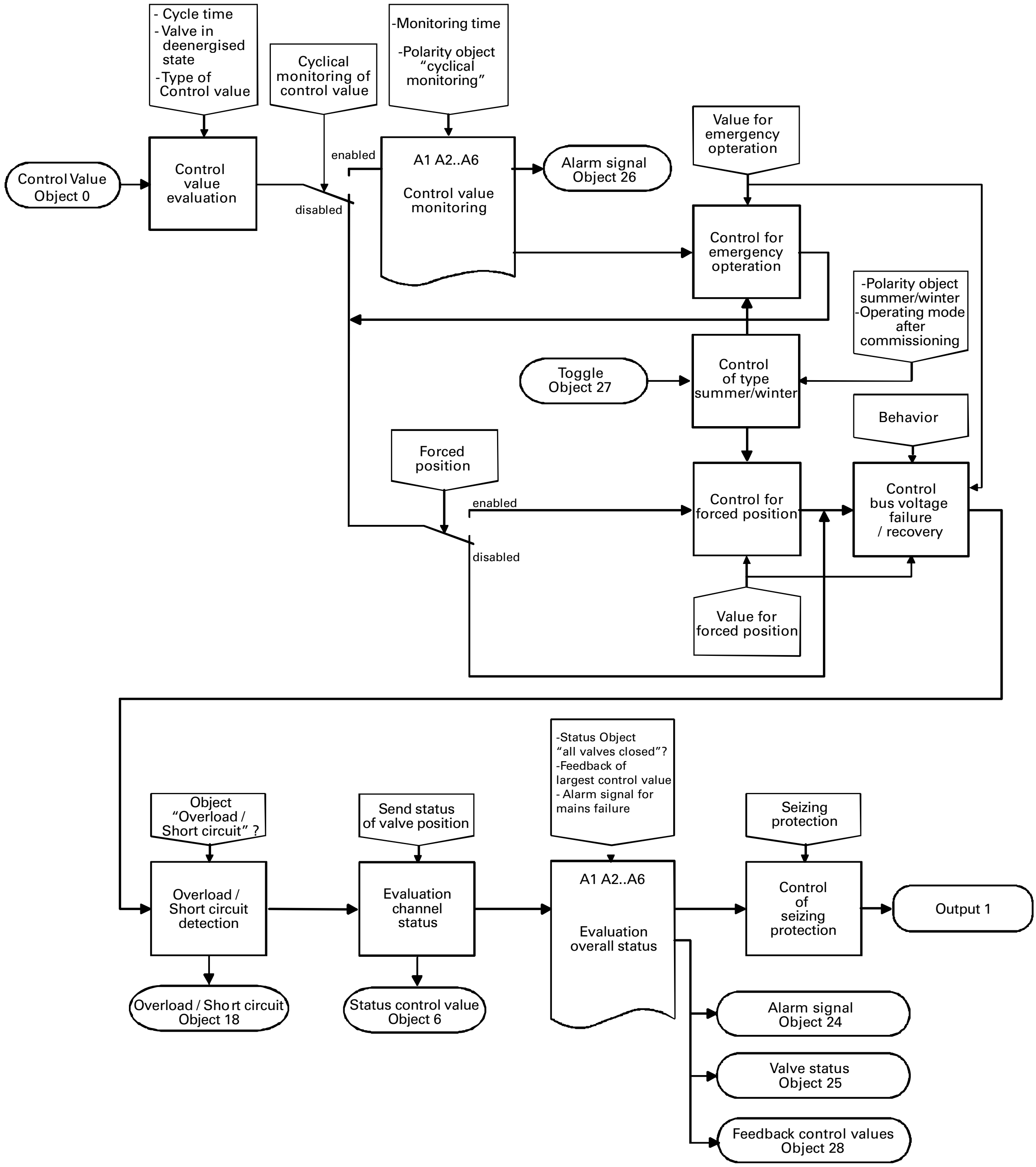
0 - 5	Control value:	1-bit object for receiving control value telegrams (ON, OFF)
0 - 5	Control value:	1-byte object for receiving control value telegrams (0 - 255)
6 - 11	Status of control value:	1-bit object for sending or reading status telegrams about control value (ON, OFF)
6 - 11	Status of control value:	1-byte object for sending or reading status telegrams about control value (0 - 255)
12 - 17	Forced position:	1-bit object for sustained forcing of parameterisable outputs (1 = forced position active / 0 = forced position inactive).
18 - 23	Overload / short circuit:	1-bit object for overload or short-circuit signal from an output to the bus. The object remains active (polarity parameterisable) until the overload or short circuit has been corrected. To reset the overload or short-circuit signal the device must be disconnected from the mains. The overload / short-circuit signal will not reset until the mains voltage has been restored.
24	Alarm signal:	1-bit object for signalling a mains voltage failure on the bus (polarity parameterisable).
25	Status of valves:	1-bit object for displaying that all control values are OFF or 0 and all valves are thus closed (polarity parameterisable).
26	Alarm signal:	1-bit object for signalling that control values of parameterisable outputs have not appeared within the monitoring time and that emergency operation has been activated for the outputs in question (polarity parameterisable).
27	Toggling:	1-bit object for toggling between summer and winter modes (polarity parameterisable).
28	Status feedback Control values	1-byte object for status feedback of the highest 1-byte control value held in the actuator for an output.

Function scope

- 6 mutually independent outputs which can as desired be controlled by a 1 -bit or a 1 -byte control value.
- In the case of the 1 -byte control value the outputs are controlled by a pulse width modulator (PWM). Here the cycle time of the output signals is generally parameterisable.
- Status response (1 bit or 1 byte) from each output is possible automatically or with a read request.
- Valve control can be parameterised for each output (de-energised open / closed).
- Summer and winter modes can be selected via an object (polarity parameterisable).
- Cyclical monitoring of the control value of each output can be set taking into account a universally parameterisable monitoring time for all outputs. If a control-value telegram has not appeared within the specified monitoring time, the output in question will switch to emergency operation and an alarm signal sent via an object to the bus (polarity parameterisable).
- Each output can be locked into a forced position. Here different values can be parameterised for summer and winter modes.
- Behaviour upon bus voltage recovery or failure can be parameterised separately for each output. Possible settings: "Valve closes", "Valve opens", "Forced position", "Emergency operation", 'No reaction" (only in case of bus voltage failure).
- Overload or short-circuit signal via an object can be set separately for each output (polarity parameterisable).
- Mains failure signal via an object is possible (polarity parameterisable).
- If the control values of all valves are OFF or 0, a "group signal" can be sent via an object (polarity parameterisable). In this way a signal is sent that all valves are closed.
- The highest 1 -byte control value held in the actuator can be sent via a separate object to the bus.

Function diagram

For Output 1, for example:



Function description

Control of the outputs / pulse width modulator (PWM)

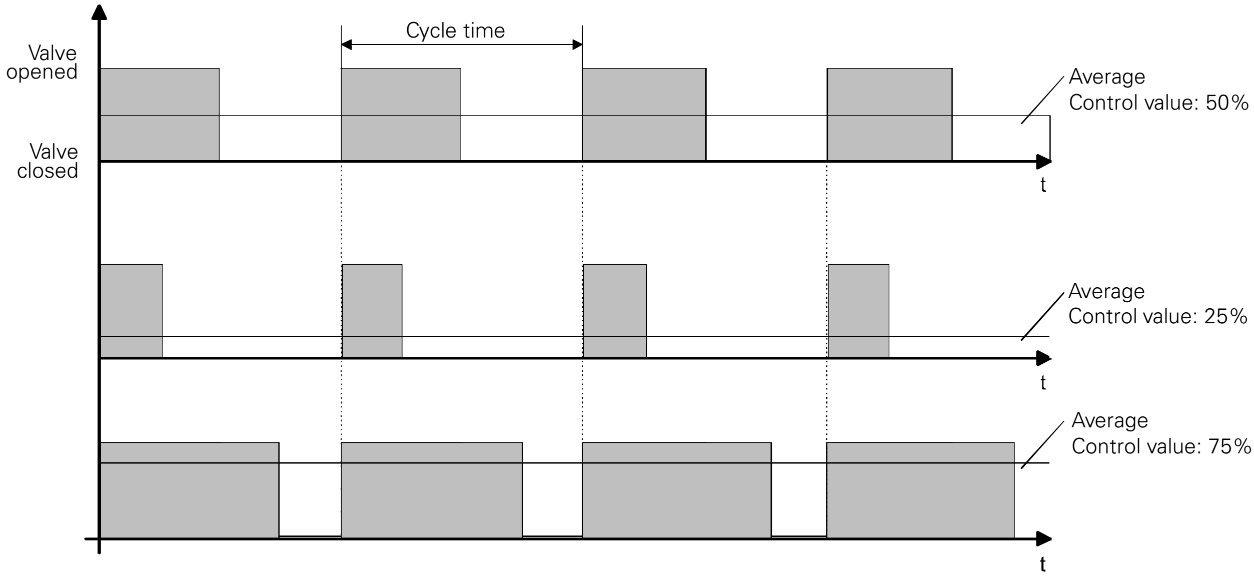
All outputs can be controlled independently of each other either by a 1 -bit telegram (switching) or by a 1 -byte telegram (continuous). In either case these telegrams can be transmitted to the actuator by, for example, a KNX room temperature control unit. Here the control unit determines the room temperature and with the aid of a control algorithm generates the control-value telegrams.
It should be noted that the actuator itself does not carry out any temperature regulation.

1 -bit control value (switching)

In the case of the 1 -bit control value, in normal operation the switching telegram received via the "Output X" object is sent on directly to the corresponding output of the actuator while taking into consideration the parameter "Valve in de-energised state". In this way, when an ON telegram is received, the valve will be opened fully (current applied to output when "Valve in de-energised state = "closed" / no current applied to output when "Valve in de-energised state = "open").
When an "OFF" telegram is received, the valve will be closed fully (current not applied to output when "Valve in de-energised state = "closed" / current applied to output when "Valve in de-energised state = "open").
When a forced position is active, emergency operation is active or when there is bus voltage recovery or failure, a continuous nominal value (0 % to 100 % in 10 % steps) can be parameterised and activated even with a 1 -bit control value. In this case the nominal value is set at the output in question by a pulse width modulator while taking into account the "Cycle time" parameter (cf. "1 -byte control value").

1 -byte control value (continuous)

A 1 -byte control value received in normal operation via the "Output X" object will be converted by the actuator into an equivalent pulse-width-modulated switching signal at the outputs. The output signal's mean value resulting from this modulation is - taking into consideration the cycle time which can be set in the actuator - a measure of the averaged valve position of the actuating valve and thus a reference for the room temperature set. Shifting the mean value and thus changing the heating output is achieved by changing the pulse duty factor of the ON and OFF pulses of the output signal. The pulse duty factor is continuously set by the actuator as a function of the control value received (normal operation) or of the activated control value (forced position, normal operation, bus voltage failure / recovery).



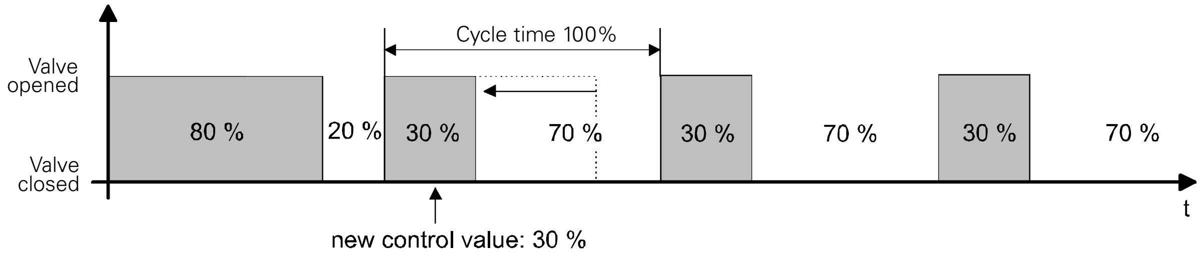
Taking into account the "Valve in de-energised state" parameter for each output, current is either applied or not applied to the corresponding outputs depending on the valve position desired. Here the pulse duty factor is automatically inverted in the case of a de-energised open drive. This does not therefore result in any unwanted shift of the mean value, depending on the valve type used.
Example: Control value: 60 % → - Pulse duty factor de-energised closed: 60 % ON, 40 % OFF,
- Pulse duty factor de-energised open: 40 % ON, 60 % OFF

Control-value adjustment

Control loops are frequently subject to discontinuous changes in nominal value input (for example, frost protection, night operation, and so on) or to briefly effective disturbances (for example, measured-value fluctuations due to windows or doors near the sensors being open for a short time).
In these cases, even when a relatively long cycle time has been set, the actuator employs a special procedure for continuous control-value adjustment so as to enable the pulse duty factor of the desired control value to be set quickly and correctly without impairing the reaction time of the control loop.
Here the following cases are taken into consideration:

Case 1:

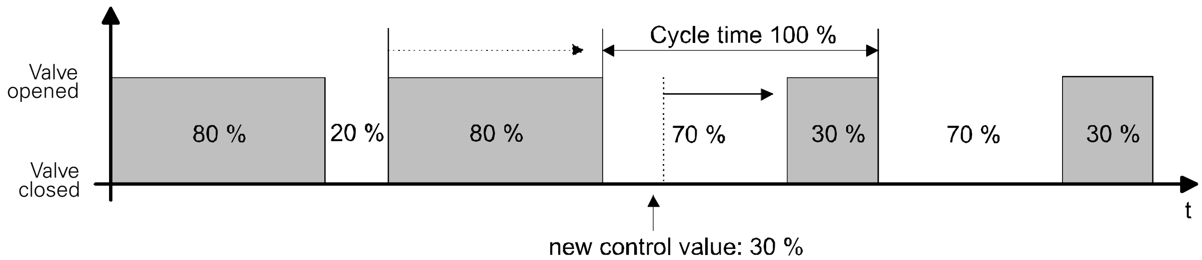
Control value change, from 80 % to 30 %, for example, during the valve opening phase.



Before the new control value (30 %) was received, the old nominal value (80 %) was active. The new control value is now received during the valve opening phase. At this point the actuator sees that it is still possible to shorten the opening phase to make it correspond to the new control value (30 %). The cycle time remains unaffected by this process.
The new duty pulse factor is set immediately the new control value is received.

Case 2:

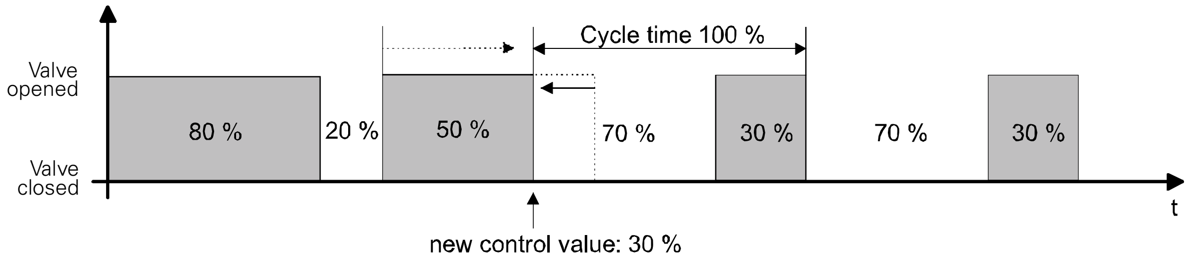
Control value change, from 80 % to 30 %, for example, during the valve closing phase.



Before the new control value (30 %) was received, the old nominal value (80 %) was active. The new control value is now received during the valve closing phase. At this point the actuator sees that it is still possible to lengthen the closing phase to make it correspond to the new control value (30 %). The cycle time remains unaffected but its starting time is shifted automatically.
The new duty pulse factor is set immediately the new control value is received.

Case 3:

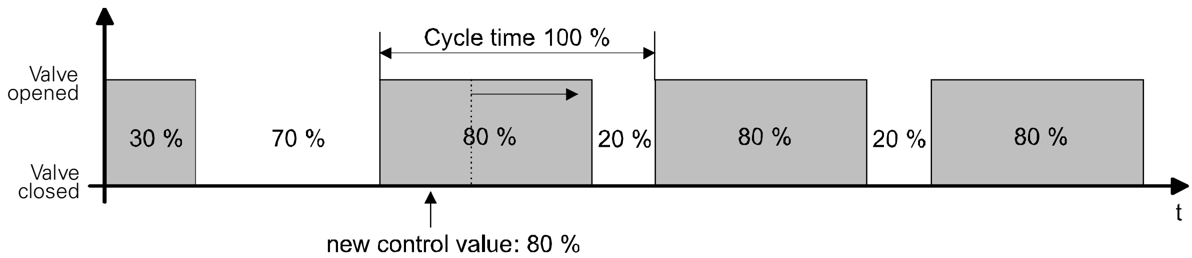
Control value change, from 80 % to 30 %, for example, during the valve opening phase (opening phase too long):



Before the new control value (30 %) was received, the old nominal value (80 %) was active. The new control value is now received during the valve opening phase. At this point the actuator sees that it is necessary to abort the opening phase immediately and to close the valve so that the pulse duty factor corresponds to the new control value (30 %). The cycle time remains unaffected but its starting time is shifted automatically.
The new duty pulse factor is set immediately the new control value is received.

Case 4:

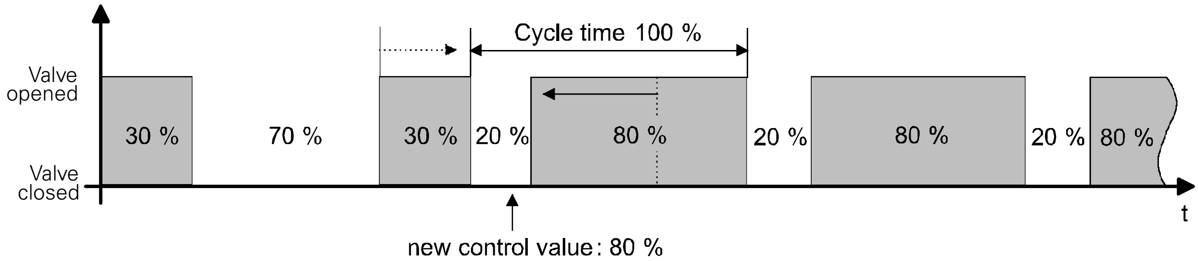
Control value change, from 30 % to 80 %, for example, during the valve opening phase:



Before the new control value (80 %) was received, the old nominal value (30 %) was active. The new control value is now received during the valve opening phase. At this point the actuator sees that it is still possible to lengthen the opening phase to make it correspond to the new control value (80 %). The cycle time remains unaffected by this process.
The new duty pulse factor is set immediately the new control value is received.

Case 5:

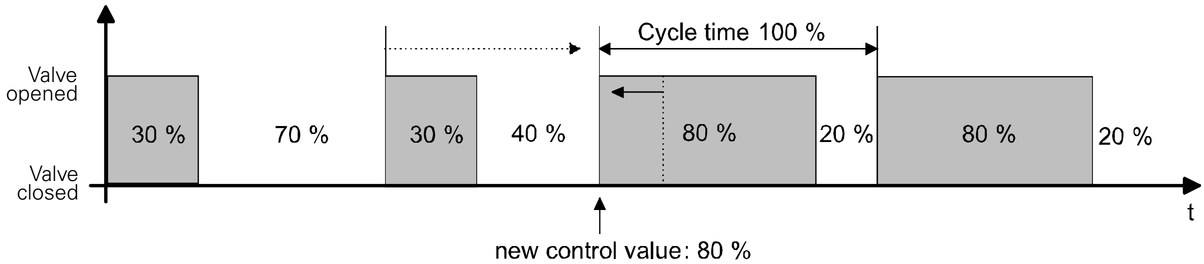
Control value change, from 30 % to 80 %, for example, during the valve closing phase:



Before the new control value (80 %) was received, the old nominal value (30 %) was active. The new control value is now received during the valve closing phase. At this point the actuator sees that it is still possible to shorten the closing phase to make it correspond to the new control value (80 %). The cycle time remains unaffected but its starting time is shifted automatically.
The new duty pulse factor is set immediately the new control value is received.

Case 6:

Control value change, from 30 % to 80 %, for example, during the valve closing phase (closing phase too long):



Before the new control value (80 %) was received, the old nominal value (30 %) was active. The new control value is now received during the valve closing phase. At this point the actuator sees that it is necessary to abort the closing phase immediately and to open the valve so that the pulse duty factor corresponds to the new control value (80 %). The cycle time remains unaffected but its starting time is shifted automatically.
The new duty pulse factor is set immediately the new control value is received.

Cycle time

The general parameter "Cycle time" is active solely for pulse-width-modulated outputs.
The cycle time defines the switching frequency of the pulse-width-modulated signal and thus permits adaptation to the adjustment cycle times (the travel time the drive needs to adjust the valve from the fully closed to the fully open position) of the valve drives used. In addition to the adjustment cycle time, the dead time (time in which the valve drives show no reaction as they switch on or off) also has to be taken into consideration. When different drives with different adjustment cycle times are used, the longest of the times should be used.

Basically two examples of setting the cycle time can be examined:

Case 1:

Cycle time > 2 x adjustment cycle time of the drives used (ETA)

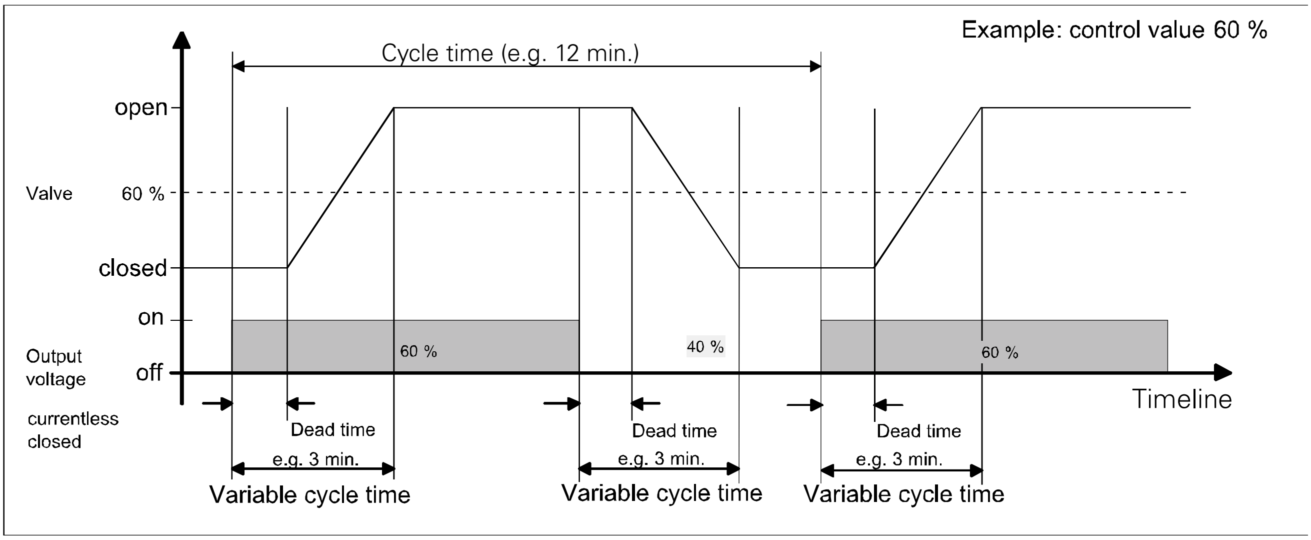
In this case the ON and OFF times of the actuator are long enough to leave the drives enough time to fully open or close within one period.

Advantages:
The mean value desired for the control value and thus the room temperature required is set relatively precisely, even when several drives are operated simultaneously.

Disadvantages:
It should be noted that the expected service life of the drives can fall due to the fact that the valves have to travel their full stroke every time. Under certain circumstances when cycle times are very long (> 15 minutes) and the system has a fast response time, the heat output to the room in the vicinity of the radiators can be uneven and perceived as bothersome.

This setting for the cycle time is recommended for slow, relatively sluggish heating systems (such as underfloor heating). Even with a relatively large number of controlled - and possibly different - drives, this setting is recommended as it makes it easier to average the travels of the valves.

Idealised plot of the valve stroke taking the example of a control value of approx. 60 % for a de-energised closed valve:



Case 2:

Cycle time < adjustment cycle time of the drives used (ETA)

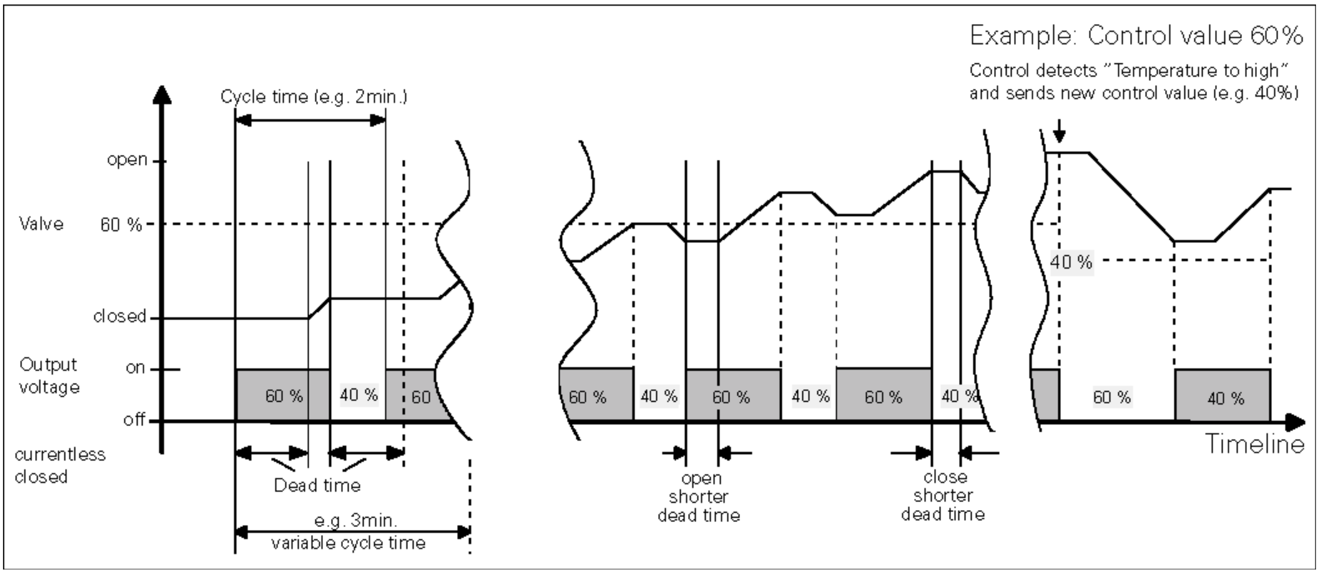
In this case the ON and OFF times of the actuator are so brief that the drives are not left enough time to fully open or close within one period.

Advantages:
This setting ensures a continuous flow of water through the radiators and thus makes an even output of heat to the room possible.
If only one valve drive is being controlled, the controller will be able, by continuously adjusting the control value, to compensate for the mean-value shift caused by the short cycle time and thus set the room temperature desired.

Disadvantages:
If several drives are being operated simultaneously, the mean value desired for the control value and thus the room temperature required will be set only very roughly or with relatively large deviations.

This setting for the cycle time is recommended for relatively fast-responding heating systems (such as radiators).

Idealised plot of the valve stroke, taking the example of a control value of initially approx. 60 % for a de-energised closed valve:



Due to the continuous flow of water through the valve and thus the constant heating up of the drive, the dead times of the drives will vary or change during the opening or closing phases. Due to the short cycle time and taking the dead times into account, the control value desired (mean value) will only be set with a deviation which under certain circumstances may be relatively large. To enable the room temperature to be kept at a constant value after a certain period of time, the controller will have to compensate for the mean-value shift caused by the short cycle time. It does so by continuously adjusting the control value. Normally the control algorithm (PI-control) implemented in the controller ensures that system deviations are evened out.

Depending on the drives used it may be necessary to apply current to them for a relatively long time when they are first started up (control value = 100%) to ensure that the drives are ready for operation (note the instructions of the drive manufacturers).

Operating states

Each output of the actuator may remain in different operating states which under certain circumstances can be activated by separate objects. Possible operating states are listed below.

Normal operation

In this case the 1-bit or 1-byte control values received at the inputs are passed directly on to the corresponding outputs as switching commands or as pulse width modulation. Depending on the "Valve in de-energised state" parameter the control values may be inverted.

Forced position

With the "Forced position" parameter, a forced-position function can basically be released ("Yes") or blocked ("No") for each output of the actuator. The forced position is activated in the released state via the assigned forced-position object (the polarity of the object can be parameterised).
For the forced position of an output, a constant forced value (0 % to 100 % in 10 % steps) can be parameterised in the actuator and be adopted as a control value setpoint when the forced position is activated. The forced value can be set differently for summer and winter modes.
Even with a 1-bit control value, a constant forced value can be assigned in forced position operation. In this case it is set at the output by a pulse width modulator.
Control values received when a forced position is active are saved. The control value last received here is adopted as control value setpoint when forced position mode terminates (changeover to normal operation). A forced position function activated via the forced position objects before bus voltage failure will always be deactivated following bus voltage recovery.
In the event of bus voltage failure and following bus voltage recovery, the forced value can be adopted as control value setpoint, provided this has been parameterised. This means that even when forced position has not been enabled the forced value or the forced values for summer and winter operation will be visible and can be set.

Emergency operation

If control values are being monitored cyclically for the arrival of new values (cf. "Cyclical monitoring of control values" on p. 23) and a value is missing, emergency operation will be activated. In addition, emergency operation can be activated in the event of bus voltage failure or recovery. The resulting assignments of the 6 outputs to emergency operation are shown on the "Emergency operation" parameter card.
For emergency operation of an output, a constant emergency value (0 % to 100 % in 10 % steps) in the actuator can be parameterised on the "Emergency operation" parameter card. This will be adopted as a control value setpoint when emergency operation is activated. The emergency value can be set differently for summer and winter modes.
Even with a 1-bit control value, a constant emergency value can be assigned in the case of emergency operation. It is set at the output by a pulse width modulator.
Emergency operation terminates immediately a control value telegram is received via the control value object of the output in question (changeover to normal operation).
A forced position has a higher priority than emergency operation. If a forced position was active before emergency operation or if a forced position is activated during emergency operation, the actuator will adopt the forced value as a control value setpoint for the output in question. Following bus voltage recovery, the emergency value can be adopted as control value setpoint, provided this has been parameterised. This applies even when a forced position was active before bus voltage failure.

Overload / short circuit

The actuator has a short-circuit or overload detector with which multiple shorted or overloaded outputs can be deactivated after a detection period. When an output channel is in the ON state (current applied to output), the short-circuit / overload detector is always active. In addition, with the "'Overload / short circuit'? object" parameter it can be specified separately for each output whether a short-circuit / overload signal should be sent via an object to the bus.

Detection of an overload or short circuit:
Short-circuit / overload detection basically takes place in two output groups. Outputs 1 to 3 form one group, Outputs 4 to 6 the other. In the event of a fault the actuator initially detects a short circuit or overload only with respect to a group.

When there is a fault the output groups will affect each other, depending on the time, duration and magnitude of the overload or short circuit. For example, with a 'hard' short circuit at an output, detection of an overload / short circuit can be expected in both groups, although the other outputs are obviously not affected.
On the other hand, in the case of a 'weak' overload at just one output, detection can be expected to occur only in the output group directly affected by it.
For these reasons, when a short-circuit or overload is detected it will not be possible to narrow it down immediately and unambiguously to the outputs actually affected. This is why the actuator then executes a special test cycle which ensures reliable detection of one or more overloaded output channels. Not until the overloaded or shorted outputs have been precisely identified can short-circuit / overload detection signals be output to the bus.

Following detection of a fault in a group, all outputs in this group or in both groups (depending on the time, duration and magnitude of the overload) will immediately be deactivated for 6 minutes (turn-off rest phase / outputs not energised). During this period of time the fault detection circuit resets itself. For the time being the other output group's outputs, which may not be affected, continue to operate 'normally'.
Should a fault be detected in one output group while the other is undergoing a 6-minute turn-off rest phase, the shared rest phase will be prolonged by another 6 minutes.

Test cycle

Not until the test cycle which follows will **all** 6 outputs of the actuator be deactivated.
Here, by timeshifted step-by-step enabling and deactivation of each output of the affected group(s) it is ascertained which outputs are overloaded or shorted and which thus caused switching off in response to the fault.

Should a 'weak' overload occur, for example, at just one output, it may be possible that during individual testing of the output within a test cycle no overload is detected during the ON phase due to the overload not being large enough. It may therefore be necessary to run several test cycles until the overloaded output is clearly detected.
Every output group is equipped with a counter which stores the number of test cycles so far initiated for a group. The counter is incremented one step every time a test cycle fails to detect an output channel as being clearly overloaded or shorted. Should a fresh fault be detected in an output group which has already been tested unsuccessfully for an overload or short circuit (counter > 0), in the new test cycle power will be applied to the outputs for a longer ON time. The counter reading is stored only in the device and cannot be accessed. During the first test cycle the ON time is 1 second, in the second cycle it is 10 seconds, in the third 1 minute and in the fourth 4 minutes.

In the case of a group overload, the various 'weak' overloads, which may be at different outputs, accumulate into a 'stronger' total overload. With a group overload it may be the case that even after four test cycles it is not possible to clearly identify any output as overloaded. If this is so, after the fourth cycle the actuator will deactivate individual output channels of an output group until no overload is detected (cf. "The test cycle in detail" on the next page).

The test cycle in detail:

1 - An overload or short circuit has been detected in a group or in both output groups (depending on the time, duration and magnitude of the overload). The actuator deactivates the outputs of the group(s) affected. The turn-off rest phase (6 minutes) is started. For the time being the other output group's outputs, which may not be affected, continue to operate 'normally'. Should a test cycle already be running in the other output group during the 6-minute turn-off rest phase, the actuator will wait until testing of the other group has finished (turn-off rest phase >= 6 minutes).

2 - **All** outputs of the actuator are switched off (outputs not energised).

3 - The first output of the group(s) affected (Output 1 or Output 2) switches on for about 1 second unless this output has not already been deactivated by a preceding test cycle. If the output has already been deactivated, the actuator switches the following output on (Output 2 or Output 4, and so on).

3 a - If an overload or short circuit is not detected during the enabling phase due to the overload or short circuit being at a different output or not being large enough ('weak' overload), the output will be switched off again. Go to Step 4.

3 b- If an overload or short circuit is detected at the tested output, a forced turn-off of this output channel takes place immediately. The output is deactivated. A 6-minute turn-off rest phase is then started in which the fault detection circuit is reset. During this period of time the output group concerned remains switched off. The other group continues to operate 'normally' unless a short-circuit / overload signal had been generated and the group is thus also in the test cycle. Go to Step 4.

4 - **All** outputs of the actuator are switched back on. The output test started in Step 3 is continued in the same way for the next not already deactivated output of the group(s) affected. A gap of about 4 seconds is left between output tests, and the testing continues until the last output in the group or in both groups has been tested.

5 - The test cycle does not finally end until all of the outputs of one or both groups have been tested.

5 a - Outputs identified during the test cycle as overloaded or shorted will from now on be left disabled and cannot be switched back on until a reset takes place (cf. "2.4.3 Resetting deactivated outputs" on the next page). The test cycle counter is cleared. All unaffected outputs are once again controlled 'normally'.

5 b - If no outputs are identified during the test cycle as being overloaded or shorted (probably a 'weaker' overload), the test cycle counter for this group or groups will be incremented so that during the next cycle all affected outputs will be tested with an extended ON time to permit detection of even weaker overloads.
Exception: If the test cycle just finished was the fourth in succession to run without detecting a fault, the actuator will assume that there is a group overload at several outputs. In this case the actuator will automatically deactivate an output of the affected group(s) on a prioritised basis (Output 3 and/or Output 6). Here, as with a normal instance of a fault being detected, the test cycle counter is cleared and in the next cycle testing once again uses an ON time of 1 second. If once again 4 cycles are now run without any output being identified as overloaded or shorted, the actuator once again assumes there is a group overload and automatically deactivates permanently the next outputs of the group(s) (Output 2 and/or Output 5 first, and then after four more cycles, Output 1 and/or Output 4).

Valve drives for rooms sensitive to frost should be connected to Outputs 1 or 4 since these outputs are the last to be deactivated in the event of a group overload.

6 - All outputs which have not been deactivated during the test cycles will then continue to operate 'normally'.

For information on resetting deactivated outputs, see "Resetting deactivated outputs" on the next page.

Resetting deactivated outputs

Telegrams are only sent for outputs which have been deactivated on a prioritised basis following detection of a fault or after a group overload. A condition of this is that the "Overload / short circuit" objects have been enabled (polarity parameterisable) in the ETS.

To reset a short-circuit signal or to return one or more deactivated outputs to service, it will be necessary to switch off the power supply to the actuator. In this case a mains failure telegram can be sent to the bus immediately after mains failure, provided this has been enabled
(cf. "3.1 Mains failure signal" on p. 23). At this time the short-circuit signal will not yet have been reset.
Not until the power supply has been restored will the short-circuit signal be reset and the mains failure signal cancelled as well (in either case telegrams are sent to the bus). After this the corrected control value setpoint of the previously shorted outputs will be implemented.
If there are still overloaded or shorted outputs after restoration of the mains voltage, the actuator will detect the overload or short circuit and start the test cycle again as described.

An active short-circuit signal (signal due to mains voltage restoration not yet reset) will not be discarded in the event of a bus voltage failure. For each output an overload / short-circuit signal will be saved in non-volatile memory so that when the bus voltage returns it will be possible to ascertain whether a short circuit disappeared when the bus voltage failed or whether it is still present.
The actuator therefore sends an inverted reset signal (no short circuit) to the bus when the bus voltage returns if a previously reported short circuit was corrected during bus voltage outage and the mains voltage was then also switched off and back on again. If the short circuit was not corrected, a new signal will not be sent to the bus following bus voltage recovery. The signal will not be reset until the power supply has been switched off and back on again.

Even an output switched off via the bus (output not energised) can be energised during the short-circuit / overload detection phase. A valve which has been fully opened by short circuit / overload (de-energised open) will not be included in the determination of the "highest control value".

Examples of overload / short-circuit detection
Example 1: Fault = 'hard' short circuit at Output 4.
A 'hard' short circuit will generate a short-circuit / overload signal in both output groups. This results in the following sequence:

Test time	Outputs 1	2	3	4	5	6	Bus signal 1	2	3	4	5	6	Comment
6 min	0	0	0	0	0	0	-	-	-	-	-	-	Short-circuit signal affects both groups!
1 s	**1**	0	0	0	0	0	-	-	-	-	-	-	Test Output 1 → no fault.
1 s	0	**1**	0	0	0	0	-	-	-	-	-	-	4 s later test Output 2 → no fault
1 s	0	0	**1**	0	0	0	-	-	-	-	-	-	4 s later test Output 3 → no fault
<1 s	0	0	0	**1**	0	0	-	-	-	**T**	-	-	4 s later test Output 4 → short circuit
6 min	0	0	0	0	0	0	-	-	-	-	-	-	Turn-off rest phase. Short-circuit signal
1 s	0	0	0	0	**1**	0	-	-	-	-	-	-	Test Output 5 → no fault
1 s	0	0	0	0	0	**1**	-	-	-	-	-	-	4 s later test Output 6 → no fault
—	**N**	**N**	**N**	0	**N**	**N**	-	-	-	-	-	-	4 s later test Output 4 remains deactivated! All other outputs continue to operate 'normally'!

"1"/"0" = output energised/not energised / "N" = 'normal' operation of the output / "T" = active overload / short-circuit signal (if enabled) In the next fault detection run
in Group 1-3: test ON time: 10 s
in Group 4-6: test ON time: 1 s

Example 2: Fault = 'weak' overload at Output 2.
The overload is so weak that an ON time of 1 second does not result in fault detection. With a 'weak' overload, it can be expected that the overload / short-circuit signal only acts on the output group directly affected (here: Outputs 1 to 3). This results in the following sequence:

Test	**Outputs**						**Bus signal**						**Comment**
time	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	
6 min	0	0	0	**N**	**N**	**N**	-	-	-	-	-	-	Overload affecting only one group!
1 s	**1**	0	0	0	0	0	-	-	-	-	-	-	Test Output 1 → no fault.
1 s	0	**1**	0	0	0	0	-	-	-	-	-	-	4 s later test Output 2 → no fault
1 s	0	0	**1**	0	0	0	-	-	-	-	-	-	4 s later test Output 3 → no fault
—	**N**	**N**	**N**	**N**	**N**	**N**	-	-	-	-	-	-	4 s later: all outputs operating 'normally'.

"1"/"0" = output energised/not energised / "N" = 'normal' operation of the output / "T" = active overload / short-circuit signal (if enabled)

In the next fault detection run in Group 1-3: test ON time: 10 s
in Group 4-6: test ON time: 1 s

It is to be expected that in 'normal operation' an overload will once again be detected in the output group previously affected:

Test	**Outputs**						**Bus signal**						**Comment**
time	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	
6 min	0	0	0	**N**	**N**	**N**	-	-	-	-	-	-	Overload affecting only one group!
10 s	**1**	0	0	0	0	0	-	-	-	-	-	-	Test Output 1 → no fault.
<10 s	0	**1**	0	0	0	0	-	**T**	-	-	-	-	4 s later test Output 2 → overload
6 min	0	0	0	**N**	**N**	**N**	-	-	-	-	-	-	Turn-off rest phase. Overload signal
10 s	0	0	**1**	0	0	0	-	-	-	-	-	-	4 s later test Output 3 → no fault
—	**N**	0	**N**	**N**	**N**	**N**	-	-	-	-	-	-	4 s later test Output 2 remains deactivated! All other outputs continue to operate 'normally'!

In the next fault detection run in Group 1-3: test ON time: 1 s
in Group 4-6: test ON time: 1 s

Example 3: Fault = group overload in "Outputs 1 to 3" output group.
The overload on individual outputs may be so weak that even during test cycles with a test ON time of 4 minutes it is still not possible to clearly identify any output as overloaded or shorted. This results in the following sequence:

Test	**Outputs**						**Bus signal**						**Comment**
time	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	
6 min	0	0	0	**N**	**N**	**N**	-	-	-	-	-	-	Overload affecting only one group!
1 s	**1**	0	0	0	0	0	-	-	-	-	-	-	Test Output 1 → no fault.
1 s	0	**1**	0	0	0	0	-	-	-	-	-	-	4 s later test Output 2 → no fault
1 s	0	0	**1**	0	0	0	-	-	-	-	-	-	4 s later test Output 3 → no fault
—	**N**	**N**	**N**	**N**	**N**	**N**	-	-	-	-	-	-	4 s later: all outputs operating 'normally'.

"1"/"0" = output energised/not energised / "N" = 'normal' operation of the output / "T" = active overload / short-circuit signal (if enabled)

In the next fault detection run in Group 1-3: test ON time: 10 s / in Group 4-6: test ON time: 1 s

It is to be expected that in 'normal operation' an overload will once again be detected in the output group previously affected:

Test	**Outputs**						**Bus signal**						**Comment**
time	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	
6 min	0	0	0	**N**	**N**	**N**	-	-	-	-	-	-	Overload affecting only one group!
10 s	**1**	0	0	0	0	0	-	-	-	-	-	-	Test Output 1 → no fault.
10 s	0	**1**	0	0	0	0	-	-	-	-	-	-	4 s later test Output 2 → no fault
10 s	0	0	**1**	0	0	0	-	-	-	-	-	-	4 s later test Output 3 → no fault
—	**N**	**N**	**N**	**N**	**N**	**N**	-	-	-	-	-	-	4 s later: all outputs operating 'normally'.

In the next fault detection run in Group 1-3: test ON time: 1 min / in Group 4-6: test ON time: 1 s

It is to be expected that in 'normal operation' an overload will once again be detected in the output group previously affected:

Test	**Outputs**						**Bus signal**						**Comment**
time	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	
6 min	0	0	0	**N**	**N**	**N**	-	-	-	-	-	-	Overload affecting only one group!
1 min	**1**	0	0	0	0	0	-	-	-	-	-	-	Test Output 1 → no fault.
1 min	0	**1**	0	0	0	0	-	-	-	-	-	-	4 s later test Output 2 → no fault
1 min	0	0	**1**	0	0	0	-	-	-	-	-	-	4 s later test Output 3 → no fault
—	**N**	**N**	**N**	**N**	**N**	**N**	-	-	-	-	-	-	4 s later: all outputs operating 'normally'.

In the next fault detection run in Group 1-3: test ON time: 4 min / in Group 4-6: test ON time: 1 s

It is to be expected that in 'normal operation' an overload will once again be detected in the output group previously affected:

Test	**Outputs**						**Bus signal**						**Comment**
time	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**	
6 min	0	0	0	**N**	**N**	**N**	-	-	-	-	-	-	Overload affecting only one group!
4 min	**1**	0	0	0	0	0	-	-	-	-	-	-	Test Output 1 → no fault.
4 min	0	**1**	0	0	0	0	-	-	-	-	-	-	4 s later test Output 2 → no fault
4 min	0	0	**1**	0	0	0	-	-	-	-	-	-	4 s later test Output 3 → no fault
—	**N**	**N**	0	**N**	**N**	**N**	-	-	**T**	-	-	-	4 s later: Output 3 is deactivated automatically on a prioritised basis! All other outputs continue to operate 'normally'!

In the next fault detection run in Group 1-3: test ON time: 1 s / in Group 4-6: test ON time: 1 s

Monitoring

To be able to ensure uninterrupted operation of the actuator, the functions dealt with below have been provided.

Mains failure signal

To control the valve drives the actuator needs mains voltage at the outputs. If this is lacking, the drives will move to their rest position (de-energised open / closed). To prevent a mains voltage failure at the actuator remaining undetected, a mains failure signal can be sent to the bus via the "Alarm signal mains failure" object. This alarm signal can be enabled on the "Monitoring" parameter card by means of the "Alarm signal upon mains failure? = Yes" parameter. If the function is enabled, the "'Mains failure' object polarity" parameter will become visible. With this you can specify what telegram polarity the mains failure telegram should have (telegram upon mains failure = 1 or 0).

If the mains voltage is absent, the mains failure telegram will be sent immediately. Not until the mains voltage has been switched back on will the actuator cancel the alarm signal and send the inverted reset telegram (no mains voltage failure).

Following the return of the bus voltage the current status of the mains voltage (mains voltage present / not present) will be continuously transmitted.

A valve which is fully open due to mains voltage failure (de-energised open) will not be included in the determination of the "highest control value".

Cyclical monitoring of control values

The actuator is able to monitor the control-value telegrams sent to it by, for example, a room temperature control unit (1 bit or 1 byte). This monitoring function can basically be enabled on the "Monitoring" parameter card by means of the "Enable monitoring of control values? = Yes" parameter. When this function is enabled, the "Alarm signal cyclical monitoring of control values" object becomes visible and an alarm signal can now be sent when control-value telegrams fail to arrive. The polarity of this object can be parameterised by the "'Cyclical monitoring of control values' object polarity" on the "Monitoring" parameter card.

When this function is enabled each output can be separately linked to the monitoring of its control value. This assignment is defined by the "Cyclical monitoring of control value = enabled" parameter on the "Output X" parameter card. As soon as an output has been assigned to monitoring, the actuator will check the control-value object(s) for the arrival of telegrams, doing so within a definable time window. The time window is parameterised for all outputs collectively by the "Monitoring time with cyclical monitoring of control values" on the "Monitoring" parameter card. The time specified here should be the same as the time for cyclical transmission of the control value of the controller. To ensure that at least one telegram is received within the monitoring period the actuator automatically adds an offset of about 33 seconds to the parameterised time.

As soon as a control-value telegram is missing for a monitored output, the actuator sends a single alarm signal via the "Alarm signal cyclical monitoring of control values" object and activates emergency operation for the output(s) concerned (cf. "2.3 Emergency operation", p. 17).
The actuator will not cancel the cyclical monitoring alarm signal until control-value telegrams are once again being received for all monitored outputs. Emergency operation of an output is deactivated immediately control-value telegrams are once again being received for this output.

It should be noted that cyclical monitoring is active even during different operating states than in normal operation (for example, forced position, mains voltage failure, overload / short circuit).

Behaviour upon bus voltage failure / bus voltage recovery

The behaviour of the actuator when bus voltage failure occurs or after bus voltage recovery can be parameterised separately for each output.

It therefore possible to specify whether the drive should open or close upon bus voltage failure / recovery. Depending on the "Valve in de-energised state" parameter the outputs will either be energised or not energised so as to produce the parameterised response.
In addition, in the event of bus voltage failure or recovery it is possible to activate the values for forced position operation or for emergency operation as control-value setpoints. Here the actuator accesses for the affected outputs the values parameterised for forced position (separately for each output) or for emergency operation (collectively for all outputs). A distinction is drawn here between the values for summer and winter operation provided toggling operating modes has been enabled (cf. "7. Operating modes" p. 28). Neither the forced position function nor emergency operation are themselves activated here! With 1-bit control values, the continuous value for forced position or for emergency operation is set at the outputs by a pulse width modulator.

A forced position function activated via the forced position objects before bus voltage failure or an emergency operation function activated before bus voltage failure will always be deactivated following bus voltage recovery. Only in the case of bus voltage failure can "No reaction" actually be parameterised. Here the control value setpoint which was active before bus voltage failure will remain set at the outputs for the outputs affected. In addition, following the return of the bus voltage the current status of the mains voltage (mains voltage present / not present) and the status telegrams of the outputs will be transmitted, provided automatic transmission has been activated (cf. "5.1 Status objects" on this page).
After bus voltage recovery the "highest control value" (cf. "5.3 Status feedback of 'highest control value'", p. 27) will be automatically transmitted, if enabled, via the "Status feedback of control values" object, provided it is > 0. Following bus voltage recovery, the status message "All valves closed"
(cf. "5.2 'All valves closed' status object", p. 27) will, if enabled, be automatically transmitted as a function of the evaluation of all valve positions and of the "Behaviour upon bus voltage recovery" parameters of all outputs.

An active short-circuit signal (signal due to mains voltage recovery not yet reset) will not be discarded in the event of a bus voltage failure. For each output a short-circuit signal will be saved in non-volatile memory so that when the bus voltage returns it will be possible to ascertain whether a short circuit at bus voltage failure has been corrected or whether it is still present. The actuator therefore sends an inverted reset signal (no short circuit) to the bus when the bus voltage returns if a previously reported short circuit was corrected during bus voltage outage and the mains voltage was then also switched off. If the short circuit was not corrected, the signal will not be cancelled until the mains voltage has been switched off.

Status responses

Status objects

For each output there exists a status object by means of which the current output control value can in any operating state be sent automatically to the bus or read on demand. The general parameter "Transmit status of valve position" here defines the pattern which will apply to the status response. The parameter has the following possible settings:

- "No status": The status response is fully deactivated. With this setting (preset) the status objects are hidden.
- "Via read request only": The output status will only be transmitted when there is an externally received read request from another bus device. With this setting the read flags ("R flags") of the status objects are set as presets.
- "Upon change": The output status is transmitted automatically when there is a change in the output control value. In addition, status is transmitted for all outputs upon bus voltage recovery.

The contents of the status objects vary depending on the operating state which is active. This is dealt with in more detail in the tables on the next two pages.

1-byte control value:

Operating state	Contents of control value object	Contents of status object	Comment
Normal operation	Last external value	Control value setpoint (last external value)	---
Forced position	Last external value	Forced value	After forced position mode terminates, the control value last received externally is adopted and written to the status object.
Emergency operation	Emergency value (until external value is received)	Emergency value (forced value, see Comment)	A forced position has a higher priority than emergency operation. If a forced position was active before emergency operation, the status object will hold the forced value. After emergency operation terminates, the control value last received externally is adopted and written to the status object provided no forced position is active.
Overload / short circuit	Last external value	"255" when "de-energised open"; "0" when "de-energised closed"	The output is deactivated. A valve which has been fully opened due to short circuit / overload (de-energised open) will not be included in the determination of the "highest control value" (cf. "5.3 Status feedback of 'Highest control value'", p. 27).
Mains failure	Last external value	"255" when "de-energised open"; "0" when "de-energised closed"	A valve which has been fully opened due to mains voltage failure (de-energised open) will not be included in the determination of the "highest control value" (cf. "5.3 Status feedback of 'Highest control value'", p. 27).
Bus voltage recovery	"0" (waits for external value)	Control value setpoint according to "Behaviour upon bus voltage recovery" parameter	---
Seizing protection	Last external value	No effect!	---

1-bit control value:

Operating state	Contents of control value object	Contents of status object	Comment
Normal operation	Last external value	Control value setpoint (last external value)	---
Forced position	Last external value	Forced value 0 at 0% 1 at > 0%	After forced position mode terminates, the control value last received externally is adopted and written to the status object.
Emergency operation	Emergency value 0 at 0% 1 at > 0% (until external value is received)	Emergency value 0 at 0% 1 at > 0% (forced value, see Comment)	A forced position has a higher priority than emergency operation. If a forced position was active before emergency operation, the status object will hold the forced value. After emergency operation terminates, the control value last received externally is adopted and written to the status object provided no forced position is active.
Overload / short circuit	Last external value	"1" when "de-energised open"; "0" when "de-energised closed"	The output is deactivated.
Mains failure	Last external value	"1" when "de-energised open"; "0" when "de-energised closed"	---
Bus voltage recovery	"0" (waits for external value)	Control value setpoint according to "Behaviour upon bus voltage recovery" parameter	---
Seizing protection	Last external value	No effect!	---

"All valves closed" status object

In order to inform a heating system control unit (a pump controller, for example) that no heating energy is required the actuator can output to the bus the information that all valves are closed. This can also be done for visualisation purposes.
To enable this status function the "'All valves closed'? status object" parameter should be set to "enabled" on the "General" parameter card. If all valves are closed (all control value setpoints are 0) a message in the form of a 1-bit telegram can be sent via the "Status of valves" object with parameterisable polarity. As soon as the control value setpoint of an output (1 bit or 1 byte) changes to values > 0, the actuator will cancel the signal (inverted reset telegram).

Even valves which have been fully opened (de-energised open) or fully closed (de-energised closed) by short circuit / overload or mains voltage failure will have an effect on the status function.

Following bus voltage recovery and provided the status function has been enabled, the status message "All valves closed" will be automatically transmitted as a function of the evaluation of all valve positions and of the "Behaviour upon bus voltage recovery" parameters of all outputs.

Status feedback of "highest control value"

With some condensing boilers, information about the highest heating control value in the heating circuit may be needed for determining the best flow temperature in the heating circuit.
Here the actuator always identifies the highest active 1-byte control value and can transmit it actively via a separate "Status feedback of control values" object. This response function can be enabled by the "Status feedback of 'highest control value'?" parameter being set to "enabled" on the "General" parameter card.
Transmission takes place when there is a change in the highest value, depending on the operating state (in normal operation, for example, when a control value is received). The highest control value will not be transmitted after bus voltage recovery unless it is > 0.
Control values for switching purposes (1 bit) are not used in determining the highest control value.

A valve which has been fully opened by short circuit / overload (de-energised open / value = 255) will not be included in the determination of the "highest control value".

Seizing protection

To prevent a valve seizing or furring up which has not been operated for a relatively long period of time the actuator has been provided with a seizing protection capability.
If seizing protection has been enabled via the "Seizing protection" parameter being set to "Yes" on the "General" parameter card, the actuator will apply current to all outputs simultaneously (with a switching offset of about 0.5 seconds) for a period of about 5 minutes every 6 days irrespective of the operating mode set at that time Following this ON phase, the actuator deactivates all outputs again for about 5 minutes. This ensures that all valves, whether they are de-energised closed or de-energised open, have been nearly fully opened and closed and the entire valve travel thereby traversed once. Following execution of seizing protection the actuator once again operates the outputs in accordance with the operating state set.
Seizing protection always runs in the background, independently of the bus voltage, and is not signalled on the bus.

Six days must pass following return of the mains voltage before seizing protection automatically makes its first run.

Operating modes

The actuator has an operating mode toggle function enabling different control value setpoints to be set under emergency operation or forced position mode, depending on the season of the year.
Here the actuator can toggle between summer and winter modes via the 1-bit "Toggle" object (polarity can be set). Depending on the operating mode this activates, under emergency operation or in forced position mode the values parameterised for summer or winter operation will be adopted as control value setpoints.
Operating mode toggling can be enabled by the "Toggle between summer / winter operation?" parameter being set to "Yes" on the "General" parameter card. Following programming of the actuator or the bus voltage recovery, the preset operating mode can be specified by the "Operating mode after start-up" parameter.

It is possible to toggle between operating modes even during activated emergency operation or during an activated forced position. In this case the value corresponding to the operating mode will be activated immediately after toggling takes place.

Parameters

Description:	Values:	Comment:
General		
Seizing protection		To prevent a valve seizing or furring up which has not been operated for a relatively long period of time the actuator has been provided with a seizing protection capability.
	Yes	Seizing protection activated.
	No	Seizing protection deactivated.
Status object "All valves closed"?		In order to inform a heating system control unit (a pump controller, for example) that no heating energy is required the actuator can output to the bus the information that all valves are closed. This can also be done for visualisation purposes.
	Enabled	"All valves closed" status function enabled.
	Blocked	"All valves closed" status function blocked.
Object polarity "All valves closed"	**Object value when "All valves closed" = 0** Object value when "All valves closed" = 1	Specifies the polarity of the "Status of valves" object. Only when "'All valves closed'? status object" = "Enabled".
Transmit status of valve positions		For each output there exists a status object by means of which the current output control value can in any operating state be sent automatically to the bus or read on demand. The parameter here defines the pattern which will apply to the status response.
	No status	The status response is fully deactivated (status objects hidden).
	Via read request only	The output status will only be transmitted when there is an externally received read request from another bus device. With this setting the read flags ("R flags") of the status objects are set as presets.
	Upon change	The output status is transmitted automatically when there is a change in the output control value. In addition, status is transmitted for all outputs upon bus voltage recovery.

Toggling Summer / winter operation		Different control value setpoints can be specified by two different operating modes under emergency operation or forced position mode, depending on the season of the year. This parameter enables operating mode toggling.
	Yes	Operating mode toggling is enabled. It is possible to toggle between summer and winter modes.
	No	Operating mode toggling is deactivated. In each case only one value must be specified for emergency operation or for forced position mode.
Polarity of "Summer / winter toggle" object	Summer = 1 / winter = 0 **Summer = 0 / winter = 1**	Specifies the polarity of the "Toggle" object. Only when "Toggle summer / winter operation" = "Yes".
Operating mode after start-up		Following programming of the actuator or return of the bus voltage, the preset operating mode can be specified by this parameter.
	Winter operation	Winter operation is activated following start-up.
	Summer operation	Summer operation is activated following start-up. Only when "Toggle summer / winter operation" = "Yes".
Status feedback of "highest control value"? (8-bit control values only)		With some condensing boilers, information about the highest heating control value in the heating circuit may be needed for determining the best flow temperature in the heating circuit. Here the highest active 1-byte control value is always identified and transmitted to the bus if the status feedback function has been enabled.
	Yes	Status feedback of "highest control value" is enabled.
	No	Status feedback of "highest control value" is blocked.

Cycle time (pulse width modulation of the outputs) (8-bit control values only)	0.5 min 1 min 1.5 min 2 min (for example, with only one radiator) 2.5 min 3 min 3.5 min 4 min 4.5 min 5 min 5.5 min 6 min 6.5 min 7 min 7.5 min 8 min 8.5 min 9 min	9.5 min 10 min 11 min 12 min 13 min 14 min **15 min (for example, underfloor heating / several radiators)** 16 min 17 min 18 min 19 min 20 min	The "Cycle time" parameter is active solely for pulse-width-modulated outputs. The cycle time defines the switching frequency of the pulse-width-modulated signal and thus permits adaptation to the adjustment cycle times (the travel time the drive needs to adjust the valve from the fully closed to the fully open position) of the valve drives used. In addition to the adjustment cycle time, the dead time (time in which the valve drives show no reaction as they switch on or off) also has to be taken into consideration. When different drives with different adjustment cycle times are used, the longest of the times should be taken into consideration. (cf. "1. Control of the outputs / pulse width modulator (PWM) - cycle time", p. 11)
Monitoring			
Enable monitoring of control values?			The actuator is able to monitor the control-value telegrams sent to it by, for example, a room temperature control unit (1 bit or 1 byte). This parameter basically enables the monitoring function.
	Enabled		The monitoring function and thus the "Cyclical monitoring of control values" object is enabled.
	Blocked		The monitoring function is blocked. The "Cyclical monitoring of control values" object is deactivated.
Monitoring time with cyclical monitoring of control values	33 s 1 min 2.2 min 4.4 min 5.5 min 7.7 min	**11 min** 16 min 22 min 30 min 45 min 60 min	Monitoring time with cyclical monitoring of control values. The time specified here should be the same as the time for cyclical transmission of the control value of the controller. Only when "Enable monitoring of control values?" = "Enabled"!
Polarity of "Cyclical monitoring of control values" object	Object value in absence of control values = 0 **Object value in absence of control values = 1**		Specifies the polarity of the "Cyclical monitoring of control values" object. Only when "Enable monitoring of control values?" = "Enabled"!

Alarm signal upon mains failure?		To control the valve drives the actuator needs mains voltage at the outputs. If this is lacking, the drives will move to their rest position (de-energised open / closed). To prevent a mains voltage failure at the actuator remaining undetected, a mains failure signal can be sent to the bus via the "Alarm signal mains failure" object.
	Yes	The alarm signal upon mains failure and thus the "Alarm signal mains failure" object is enabled.
	No	The alarm signal upon mains failure is blocked. The "Alarm signal mains failure" object is deactivated.
Polarity of "Mains failure" object	Object value upon mains failure = 0 **Object value upon mains failure = 1**	Specifies the polarity of the "Mains failure" object. Only when "Alarm signal upon mains failure?" = "Yes"!

Emergency operation

Value during emergency operation Summer* *: "Summer" only when operating mode toggling is enabled!	0 %, 10 %, 20 %, 30 %, 40 %, **50 %**, 60 %, 70 %, 80 %, 90 %, 100 %	Specifies the control value setpoint when emergency operation activated (in summer mode).* *: Only when operating mode toggling is enabled!
Value during emergency operation Winter	0 %, 10 %, 20 %, 30 %, 40 %, **50 %**, 60 %, 70 %, 80 %, 90 %, 100 %	Specifies the control value setpoint when emergency operation activated in winter mode. Only when operating mode toggling is enabled!

Output 1

Valve in de-energised state	**Closed** Open	Specifies whether the controlled drive is closed (NC) or open (NO) in the de-energised state.
Type of control value		Specifies the size of the control value object.
	Switching (1 bit)	In normal operation the switching telegram received via the "Output 1" object is sent on directly to Output 1 of the actuator while taking into consideration the parameter "Valve in de-energised state".
	Continuous (1 byte)	A control value received in normal operation via the "Output 1" object will be converted by the actuator into an equivalent pulse-width-modulated switching signal at the output.

Cyclical monitoring of control value			Output 1 can be assigned to cyclical monitoring of the control value provided monitoring is basically enabled ("Enable monitoring of control values?" parameter set to "Enabled" on the "Monitoring" parameter card.
	Enabled		Output 1 is assigned to cyclical monitoring of the control value.
	Blocked		Output 1 is not assigned to cyclical monitoring of the control value.
Forced position?			Output 1 can be assigned to the forced position function.
	Enabled		Output 1 is assigned to the forced position function. The "Forced position" object is enabled.
	Blocked		Output 1 is not assigned to the forced position function. The "Forced position" object is deactivated.
Value during forced position mode Summer* *: "Summer" only when operating mode toggling is enabled!	0 % 10 % 20 % 30 % **40 %** 50 %	60 % 70 % 80 % 90 % 100 %	Specifies the control value setpoint when forced position is activated (in summer mode).* This parameter is always visible independently of the "Forced position?" parameter since the value during forced position (summer)* can be activated even during bus voltage failure or after bus voltage recovery. *: Only when operating mode toggling is enabled!
Value during forced position mode Winter	0 % 10 % 20 % 30 % **40 %** 50 %	60 % 70 % 80 % 90 % 100 %	Specifies the control value setpoint when forced position is activated in winter mode. This parameter is always visible independently of the "Forced position?" parameter since the value during forced position in winter can be activated even during bus voltage failure or after bus voltage recovery. Only when operating mode toggling is enabled!

Behaviour upon bus voltage failure		The behaviour upon bus voltage failure can be parameterised.
	No effect	The control value setpoint which was active for Output 1 before bus voltage failure (forced position or emergency operation also) will remain set even after bus voltage failure.
	Valve closes	Depending on the "Valve in de-energised state" parameter, Output 1 will either be energised or not energised so as to close the controlled drive.
	Valve opens	Depending on the "Valve in de-energised state" parameter, Output 1 will either be energised or not energised so as to open the controlled drive.
	Value for forced position	The value which will be adopted as control value setpoint is the value parameterised under "Value during forced position" as a function of the operating mode set.
	Value for emergency operation	The value which will be adopted as control value setpoint is the value parameterised under "Value during emergency operation" on the "Emergency operation" parameter card as a function of the operating mode set.
Behaviour upon bus voltage recovery		The behaviour upon bus voltage failure can be parameterised.
	Valve closes	Depending on the "Valve in de-energised state" parameter, Output 1 will either be energised or not energised so as to close the controlled drive.
	Valve opens	Depending on the "Valve in de-energised state" parameter, Output 1 will either be energised or not energised so as to open the controlled drive.
	Value for forced position	The value which will be adopted as control value setpoint is the value parameterised under "Value during forced position" as a function of the operating mode set.
	Value for emergency operation	The value which will be adopted as control value setpoint is the value parameterised under "Value during emergency operation" on the "Emergency operation" parameter card as a function of the operating mode set.

"Overload / short circuit"? object		The actuator has a short-circuit or overload detector with which a shorted or permanently overloaded output can be deactivated after a detection period. When an output channel is in the ON state, the short-circuit / overload detector is always active. In addition, with this parameter it can be specified separately for Output 1 whether a short-circuit / overload signal should be sent via the "Overload / short circuit" object to the bus.
	Enabled	The overload / short-circuit signal is enabled for Output 1.
	Blocked	The overload / short-circuit signal is blocked for Output 1.
Polarity of "Overload / short circuit" object	**Object value with overload / short circuit = 0** Object value with overload / short circuit = 1	Specifies the polarity of the "Overload / short circuit" object. Only when "'Overload / short circuit'? object" = "Enabled"!

- Output 2, see Output 1
- Output 3, see Output 1
- Output 4, see Output 1
- Output 5, see Output 1
- Output 6, see Output 1