Fan Coil Actuator FCA 2

FCA 2	4920210

Contents

1 Function description

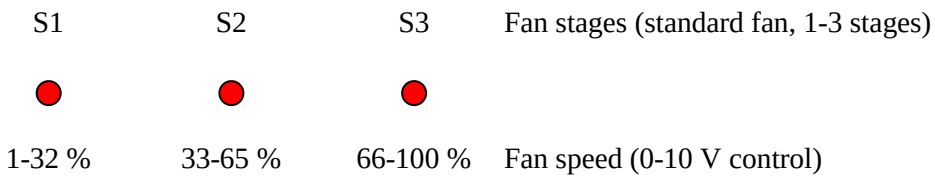
- Fan coil actuator
- For controlling fan coils
- For 2- and 4-pipe systems
- For up to three fan stages
- Fans optionally also with 0-10 V output
- For proportional valves 0-10 V
- Additional relay for electrical heater or cooler bank
- Floating input for window contacts or temperature sensor
- Floating input condensation monitoring
- Display of operation status via 9 LEDs
- Manual operation on device (fan stages, switching between heating and cooling)
- Adjustment of setpoint for cooling in relation to external temperature
- Floating switching contact for either cooler or heater bank
- With emergency program

1.1 Operation and display

FCA 2 is fitted with 9 LEDs and 2 push buttons.

- 3 red LEDs for displaying fan stage/fan speed (see figure 1)
- 1 red LED for heating mode
- 1 blue LED for cooling mode
- 1 red LED for the additional relay (C1)
- 2 red LEDs for inputs 1 and 2 (E1, E2)
- 1 red LED for test mode
- 1 push button for fan stages/fan speed
- 1 push button for heating/cooling mode /

Figure 1: LEDs for displaying fan stages or fan speed



By using the manual button, the fan stages can be switched one after another.

- Standard fan control: Off → stage 1 → stage 2 → stage 3 → Off → stage 1 etc.
- 0-10 V fan control: Off → 33% → 66% → 100% → Off → 33% etc.

1.2 Advantages of the FCA 2

- Operating voltage 100-240 V 50/60 Hz.
- Suitable for 0-10 V valves.
- Optional internal or external temperature controller.
- Can be used in 2- and 4-pipe systems.
- Also suitable for 0-10 V fans.
- Easy start-up via 2 push buttons for fan and heating/cooling mode.
- Additional relay for heating/cooling can also be used as a switch output.
- Change of operating mode by means of presence and window objects.
- Adjustable direction of action of inputs.
- Heating/cooling object addressable as per DPT 1.100 or inverted.

1.2.1 Special features

- Control via external actuating value or with integrated room thermostat.
- Additional relay C1 can also be controlled as switching actuator channel via the bus
- Setpoint in cooling mode can be adjusted in relation to the outdoor temperature
- E1 and E2 can be used as binary inputs if required.

2 Technical Data

Power supply via mains	230 +/-10 VAC 50 Hz
Operating voltage KNX	Bus voltage, ≤ 8 mA
Operating voltage	100 – 240 V AC
Frequency	50 – 60 Hz
Width	4 TE
Type of installation	DIN-rail
Type of contact	NO contact
Switching capacity, additional relay	16 A
Switching capacity, ventilator relay	6 A
Ambient temperature	-5 °C … +45 °C
Protection rating	IP 20
Protection class	II in accordance with EN 60 730-1

3 The application program "FCA 2 Fan Coil Actuator 0-10V"

3.1 Selection in the product database

Manufacturer	Theben AG
Product family	Heating, ventilation, air conditioning
Product type	Fan coil actuators
Program name	FCA 2 Fan Coil Actuator 0-10V

The ETS database can be found on our website: www.theben.de/en/downloads_en

Table 1

Number of communication objects	33
Number of group addresses	64
Number of associations	64

3.2 Parameter pages

Table 2

Function	Description
General	Supported functions, operation, filter change
Fan	Number of fan stages, switch-on thresholds, etc.
Heating valve	Factory settings for heating valve
Cooling valve	Factory settings for cooling valve
Heating/cooling valve	Factory valve settings for 2-pipe systems
Additional relay	Use of additional relay C1
E1.. E2	Settings for inputs E1 and E2
Condensation monitoring	Reaction to condensate and signal source
Setpoint adjustment	Setpoint offset dependent on outdoor temperature
Setpoints	Setpoint after download, values for night, frost mode etc.
Control	Control parameter settings for the internal temperature controller
Operating mode and operation	Factory settings for changing operating modes
Filter monitoring	Basic settings for filter change
Actuating value loss	Monitoring of the actuating value with external controller

3.3 Communication objects

3.3.1 Characteristics of objects

FCA2 features 33 communication objects.
Some objects can assume various functions, depending on their configuration.

Table 3

No.	Function	Object name	Type DPT	C	R	W	T
0	*Heating actuating value*	*Receive*	1 byte 5,001	C	R	W	-
	Heating/cooling actuating value	*Receive*		C	R	W	-
	Actuating value for fan	*Receive*		C	R	W	-
	Cooling actuating value	*Receive*		C	R	W	-
	Heating/cooling actuating value	*Send*		C	R	-	T
	Heating actuating value	*Send*		C	R	-	T
	Cooling actuating value	*Send*		C	R	-	T
1	*Enable cooling*	*1 = Enable cooling*	1 bit 1,003	C	R	W	-
	Disable heating	*1 = Heating disabled*	1 bit 1,001	C	R	W	-
	Cooling actuating value	*Receive*	1 byte 5,001	C	R	W	-
	Heating / cooling	*Heating = 0, Cooling = 1*	1 bit 1,001	C	R	W	-
	Heating / cooling	*Heating = 1, Cooling = 0*	1 bit 1,100	C	R	W	-
	Cooling actuating value	*Send*	1 byte 5,001	C	R	-	T
2	*Heating status*	*Report*	1 bit 1,001	C	R	-	T
3	*Cooling status*	*Report*	1 bit 1,001	C	R	-	T
4	*Fan stage*	*Report*	1 byte 5,010	C	R	-	T
	Fan speed	*Report*	1 byte 5,001	C	R	-	T
5	*Additional relay status*	*Report*	1 bit 1,001	C	R	-	T
	Additional relay	*Switching*	1 bit 1,001	C	R	W	-
6	*Block additional ventilation*	*1 = Block*	1 bit 1,001	C	R	W	-
7	*Fan block*	*1 = Block*	1 bit 1,001	C	R	W	-

Continuation:

No.	Function	Object name	Type	C	R	W	T
8	*Fan stage in forced operation*	*Fan control with % value*	1 byte 5,001	C	R	W	-
	Fan stage in forced operation	*Fan control via level*	1 byte 5,010	C	R	W	-
9	*Limitation of fan stage in %*	*0=Fan OFF 1..100%=max.*	1 byte 5,001	C	R	W	-
	Limitation of fan stage in %	*0=Fan OFF 1..100%=max.stage*	1 byte 5,001	C	R	W	-
	Limitation of fan stage (1-2-3)	*0=Fan OFF 1-3=max.stage*	1 byte 5,010	C	R	W	-
10	*Fan off*	*Report*	1 bit 1,001	C	R	-	T
11	*Fan stage 1*	*Report*	1 bit 1,001	C	R	-	T
12	*Fan stage 2*	*Report*	1 bit 1,001	C	R	-	T
13	*Fan stage 3*	*Report*	1 bit 1,001	C	R	-	T
14	*Status of window contact at E1*	*Report*	1 bit 1,019	C	R	-	T
	Actual value at E1	*Report*	2 byte 9,001	C	R	-	T
15	*Fan auto/forced mode*	*Receive: Auto = 1, Forced = 0*	1 bit 1,001	C	R	W	-
	Fan Forced/Auto	*Receive: Forced = 1, Auto = 0*					
16	*Status of condensation monitoring*	*Input*	1 bit 1,001	C	R	W	-
	Status of condensation monitoring	*Report*		C	R	-	T
	Status of window contact at E2	*Report*	1 bit 1,019	C	R	-	T
17	*Dew point alarm*	*Input*	1 bit 1,001	C	R	W	-
18	*Outdoor temperature*	*Input*	2 byte 9,001	C	R	W	-
19	*Adjust setpoint*	*Delta in K*	2 byte 9,002	C	R	-	T
	Adjust setpoint	*Value in °C*	2 byte 9,001	C	R	-	T
20	*Actuating value loss*	*1 = Actuating value loss*	1 bit 1,001	C	R	-	T
	Sensor failure	*Sensor failure*					

Continuation:

No.	Function	Object name	Type	C	R	W	T
21	*Night mode <-> Standby*	*1 = Night mode*	1 bit 1,001	C	R	W	-
	Operating mode preset	*Operating mode preset*	1 byte 20,102	C	R	W	-
22	*Comfort*	*1 = Comfort mode*	1 bit 1,001	C	R	W	-
	Presence	*Input for presence signal*	1 bit 1,018	C	R	W	-
23	*Frost protection*	*1 = Frost protection*	1 bit 1,001	C	R	W	-
	Window	*Input for window contact*	1 bit 1,019	C	R	W	-
24	*Current operating mode*	*Send*	1 byte 20,102	C	R	-	T
25	*Manual offset*	*Receive*	2 byte 9,002	C	R	W	-
26	*Base setpoint*	*Receive*	2 byte 9,001	C	R	W	-
27	*Current setpoint*	*Send*	2 byte 9,001	C	R	-	T
28	*Heating / cooling*	*Heating = 0, Cooling = 1*	1 bit 1,001	C	R	W	-
	Heating / cooling	*Heating = 1, Cooling = 0*	1 bit 1,100	C	R	W	-
29	*No energy medium*	*1 = Wrong energy medium*	1 bit 1,001	C	R	-	T
	Heating mode, but heating blocked	*1 = Heating blocked*					
	Cooling mode, but cooling blocked	*1 = Cooling blocked*					
30	*Fan duty time since last filter change*	*Time in hours*	2 byte 7,007	C	R	-	T
31	*Change filter**	*1 = Change, 0 = Reset*	1 bit 1,001	C	R	W	T
32	*Activate test mode*	*Report*	1 bit 1,003	C	R	-	T

* Also serves as reset input for filter change status.

Key

Flags	Name	Meaning
C	Communication	Object can communicate
R	Read	Object status can be queried
W	Write	Object can receive
T	Transmit	Object can send

3.3.2 Description of objects

- **Object 0** ***"Actuating value for fan" / "Actuating value heating/cooling" transmit or receive.***

The function of the object is connected with the parameters "*Supported function*" and "*Type of controller used*" on the "*General*" parameter page.

Table 4.

Supported function	*Kind of controller used* and *Function of object*		Installation type
	internal controller	*external controller*	
Heating	Transmits the current actuating value of heating valve	Receives the actuating value for the heating valve	4-pipe system or heating only system
Cooling	Transmits the current actuating value of cooling valve	Receives the actuating value for the cooling valve	cooling only system
Heating and cooling	Transmits the current actuating value of the common heating and cooling valve	Receives the actuating value for the common heating and cooling valve	2-pipe system
Fan	receives the actuating value for fan control		Ventilation

- **Object 1** ***"Actuating value cooling", "Heating/cooling", "Block heating", "Enable cooling"***

The function of the object is connected with the parameters "*Supported function*" and "*System type*" on the "*General*" parameter page.

Table 5

<table>
<tr><td rowspan="2">Supported function</td><td colspan="2">Installation type</td></tr>
<tr><td>2-pipe system</td><td>4-pipe system</td></tr>
<tr><td>Heating and cooling</td><td>Change over between heating and cooling mode.
The direction of action is defined by parameter Format object heating/cooling
(see General parameter page).<table><tr><td>DPT 100</td><td>Inverted</td></tr><tr><td>Heating = 1</td><td>Heating = 0</td></tr><tr><td>Cooling= 0</td><td>Cooling= 1</td></tr></table></td><td>With external controller: Receive cooling actuating value.
With internal controller: Send cooling actuating value.</td></tr>
<tr><td>Heating</td><td colspan="2">Block heating:
1 on this object blocks the heating function.
The block can be cleared with a 0.
After reset, object value = 0, i.e. heating permitted</td></tr>
<tr><td>Cooling</td><td colspan="2">Enable cooling:
1 on this object permits cooling function.
0 on this object blocks the cooling function.
After reset, object value = 1, i.e. cooling permitted</td></tr>
</table>

- **Object 2** ***"heating status"***

Sends the current heating status:
1 = Actuating value heating is greater than 0 %, heating is switched on.
0 = Actuating value heating is 0 %, heating is currently switched off

- **Object 3** ***"Cooling status"***

Sends the current cooling status:
1 = Actuating value cooling is greater than 0 %, cooling is switched on.
0 = Actuating value cooling is 0 %, cooling is currently switched off

- **Object 4 *„fan stage“, „fan speed“***

Reports the current fan stage or fan speed.
Depending on the configured *fan controller* (*General* parameter page), the object either sends the current stage (0..3) or the speed in percent.

Table 6: Fan controller.

Standard (1-3 stages)	0-10 V
2 formats can be selected: - 1 byte number between 0 and 3. - Percentage value See parameter *Format and cycle time fan stage object*	The fan speed is sent as a percentage value.

- **Object 5 *"Additional relay", "additional relay status"***

The function of this object is dependent on the "*Switching on additional relay*" parameter on the "*Additional relay*" parameter page.

Using the *"via object* setting, the additional relay can be controlled externally via the bus with object 5.
With all other settings, object 5 reports the current status of the additional relay.

- **Object 6 *"Blocking additional ventilation"***

Block object for the "additional ventilation" function if it is activated.
1 = Block
0 = Cancel block

- **Object 7 *"Fan block"***

Block object for fan control.
1 = Block fan (fan off)
0 = Automatic operation

- **Object 8** ***"Fan stage in forced operation"***

Via this object, the desired fan stage in forced operation is either defined as a percentage value between 0 % and 100 % or as a stage (1-3).
See parameter *Format of forced operation and limitation* on *Fan* parameter page.

With 0-10 V fan control, only the percentage value format is permitted.

The specification fan stage can either be made with the button at the room thermostat RAM 713 FC or via a KNX sensor (e.g. push button), which is configured for this purpose. Forced operation is activated by Object 15.

Example of percentage value:
Recommended forced telegrams for the following settings on the *"Fan"* parameter page:
Switch-on threshold for fan stage 1 = 10 %
Switch-on threshold for fan stage 2 = 40 %
Switch-on threshold for fan stage 3 = 70 %

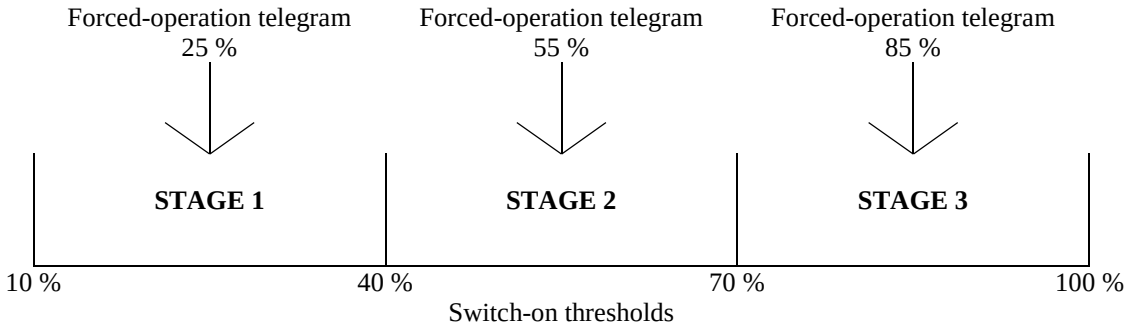


Figure 2

- **Object 9 "*Limitation of fan stage in %*", "*Limitation of fan stage (1-2-3)*"**

This object can be used to set the maximum permitted actuating value and the associated maximum fan stage, either as a percentage value or as stage (1-3).[1]

With 0-10 V fan control, only the percentage value format is permitted.

The following values are used.

Table 7

Value	Highest permissible fan stage
0 %	The fan is not switched on
1 % .. 99 %	Maximum permissible fan speed for normal and forced operation
100 %	No limit, automatic operation (= object value after reset)

Example of percentage value:
Configured switch-on thresholds:
Fan stage 1, or switch-on threshold (at 0-10 V) = 10 %
Fan stage 2 = 40 % (only with standard)
Fan stage 3 = 70 % (only with standard)

Table 8: Standard fan controller.

Received value on object 9	Maximum fan stage
0 % .. 9 % [2]	The fan is not switched on
10 % .. 39 %	1
40 % .. 69 %	2
70 % .. 100 % [3]	3

Table 9: 0-10 V Fan controller.

Received value on object 9	Maximum fan speed
0 % .. 9 % [2]	The fan is not switched on
10 % .. 99 %	Value from object 9

- **Object 10 *"Fan off"***

Report object for the fan status.
Sends a 1 if the fan is switched off.

[1] See parameter *Format of forced operation and limitation* on Fan parameter *page.*
[2] The value is under the switch-on threshold for stage 1, the fan cannot be switched on.
[3] The value is greater/equal to the switch-on threshold for stage 3, i.e. no limitation.

- **Object 11** ***"Fan stage 1"***

Only available if *fan controller = standard*.
Report object for the fan status.
Sends a 1 if the fan is switched to stage 1.

- **Object 12** ***"Fan stage 2"***

Only available if *fan controller = standard*.
Report object for the fan status.
Sends a 1 if the fan is switched to stage 2.

- **Object 13** ***"Fan stage 3"***

Only available if *fan controller = standard*.
Report object for the fan status.
Sends a 1 if the fan is switched to stage 3.

- **Object 14** ***"Actual value at E1", "Window contact status at E1"***

The object function depends on the "*Function of E1*" parameter on the "*E1*" parameter page.

Table 10

Parameters *"Function of E1"*	Meaning
E1 = Window contact	Sends the current status of the window contact to the bus. → Only available when using an external controller.
E1 = Actual value sensor	Sends the currently measured room temperature to the bus. → Fixed setting when using an internal controller.

- **Object 15** ***"Fan forced/ auto", "fan auto/forced"***

This object is used to activate or leave the forced operation of the fan.
The desired fan stage or speed for forced operation is set by Object 8.
The direction of action of the forced object is adjustable on the *General* parameter page.
The forced operation of the fan has no effect on valve control.

- **Object 16** ***"Condensation monitoring status"***

The function of this object depends on the "*Source for drip condensation monitoring*" parameter on the "*Condensation monitoring*" page.

Table 11

Parameters *„Source for condensation monitoring“*	Function
E2	Sends the status of the condensation monitoring
Object 16	Receives the status of the condensation monitoring from the bus

- **Object 17** ***"Dew point alarm“***

Receives the dew point alarm telegrams.
1 = Alarm
Note: The behaviour is identical with the behaviour set for condensation monitoring.

- **Object 18** ***"Outside temperature"***

Receives the outdoor temperature for setpoint adjustment

- **Object 19** ***"Adjust setpoint"***

Reports the current setpoint correction as an amount or as a differential.
The *format of the correction value* is set on the *setpoint adjustment* parameter page.

Table 12

Format of correction value	Function	Example
Absolute	Sends the amount: *Unadjusted base setpoint* + *setpoint correction* as setpoint for additional temperature controllers.	*Unadjusted base setpoint* = 20 ºC. *Setpoint correction* = +2 K The object sends: 22 ºC*
Relative	Calculated setpoint correction (in Kelvin) based on outside temperature.	*Unadjusted base setpoint* = 20 ºC. *Setpoint correction* = +2 K The object sends: 2 K*

***Important:** If the *Use setpoint adjustment for regulation* parameter is set on "*yes*", the *base setpoint after reset* (i.e. setpoint for the internal controller) is also adjusted.
In our example it is raised by 2 K in both cases.

- **Object 20** ***"Actuating value loss" / "sensor failure"***

The function of the object depends on the "*Type of controller used*" parameter on the "*General*" parameter page.

Table 13

„Type of controller used“	Function
Internal controller	Reports error if the temperature sensor connection is interrupted or shorted.
*External controller**	Reports whether the actuating value is being received at regular intervals. 1 = Actuating value loss 0 = Actuating value OK

* Sensor errors are only reported when using the internal controller.

- **Object 21** ***"Operating mode preset" / "Night mode <-> Standby"***

The object function depends on the "*Object for operating mode preset*" parameter on the "*Operating mode and operation*" parameter page.

Table 14

"*Objects for determining the operating mode*"	Function
new: operating mode, presence, window status	1 byte object. One of 4 operating modes can be directly activated * 1 = Comfort, 2 = Standby, 3 = Night, 4 = Frost protection (heat protection) The details in brackets refer to cooling mode.
old: comfort, night, frost	With this setting, the object is a 1 bit object. It can be used to activate the operating mode Night or Standby. 0=Standby 1=Night

*Only the values 1 to 4 are permissible.

- **Object 22 *"Comfort" / "Presence"***

The object function depends on the "*Object for operating mode preset*" parameter on the "*Operating mode and operation*" parameter page.

Table 15

"*Objects for determining the operating mode*"	Function
new: operating mode, presence, window status	**Presence:** The status of a presence detector (e.g. push button, motion detector) can be received via this object. 1 on this object activates the comfort operating mode.
old: comfort, night, frost	**Comfort:** 1 on this object activates the comfort operating mode. This operating mode takes priority over night and standby modes. Comfort mode is disabled again by sending a 0 to the object.

- **Object 23 *"Window" / "frost protection"***

Table 16

"*Objects for determining the operating mode*"	Function
new: operating mode, presence, window status	**Window setting:** The status of a window contact can be received via this object. 1 on this object activates the frost / heat protection operating mode.
old: comfort, night, frost	**Frost/heat protection:** 1 on this object activates the frost protection operating mode. During cooling mode, the heat protection operating mode is activated. The frost/heat protection operating mode has highest priority. Frost/heat protection mode remains active, until it is cleared again by a 0.

- **Object 24** ***"Current operating mode"***

Sends the current operating mode as a 1 byte value (see below: Coding of operating modes).
The transmission behaviour can be set on the "Operating mode" parameter page.

Table 17: Coding of HVAC operating modes:

Value	Operating mode
1	*Comfort*
2	*Standby*
3	*Night*
4	*Frost protection/heat protection*

- **Object 25** ***"Manual adjustment"***

Only available with internal controller.
The object receives a temperature difference as DPT 9.002.
The desired room temperature (current setpoint)
can be adjusted against the *base setpoint* by this difference.

New setpoint (heating) = Current setpoint + manual adjustment.
New setpoint (cooling) = Current setpoint + manual adjustment + dead zone + setpoint adjustment.

Values outside the configured range (see *Limitation of manual adjustment* on the *Operating mode and operation* parameter page) are limited to the highest or lowest value.

- **Object 26** ***"Base setpoint"***

The base setpoint is first specified via the application at start-up and stored in the *"base setpoint"* object.
Afterwards, it can be specified again at any time using *Object 26* (limited by the minimum or maximum valid setpoint).
In case of a bus voltage failure, this object will be saved. With the restoration of the bus voltage, the last value will be restored.
The object can be written to without restriction.

- **Object 27** ***"Current setpoint"***

Sends the current setpoint valid for control as DPT 9.001.

- **Object 28** ***"Heating/cooling"***

Only available in 4-pipe system when switching via object (internal controller).
Is used if automatic change over between heating and cooling is not desired or not possible.

The direction of action is defined by parameter *Format object heating/cooling*
(see *Control* parameter page).

Table 18

Format object heating/cooling	
DPT 100	Inverted
Heating = 1	Heating = 0
Cooling= 0	Cooling= 1

- **Object 29** ***"No energy medium" / "heating required but heating blocked" / "cooling required but cooling blocked"***

Error reporting object:
An error is reported in the following cases:

Case 1: Heating mode was forced via the *heating/cooling* object, however the room temperature is so far above the set temperature that cooling is required.

Case 2: Cooling mode was forced via the *heating/cooling* object, however the room temperature is so far below the set temperature that heating is required.

- **Object 30** ***"Fan duty time since last filter change"***

This object is available if the *Should filter change be reported* parameter is set to *yes* .

If selected, the object sends the current status of the internal fan operating hour counter.
The fan runtime is sent as DPT 7.007 in hours.

The counter is reset via object 31.

- **Object 31** ***"Change filter "***

This object is available if the "*Should a filter change be reported*" parameter is set to "*yes*".

This object has 2 functions:

1. As sending object:
   Sends a 1 once the configured operating time of the fan has been reached.
   See "*Report filter change after fan operation (1..127 weeks)*" on the "*Filter monitoring*" parameter page.

2. As receiving object:
   Reset for the *Filter change* status and the fan operating our counter (object 30).
   0 = Reset.

- **Object 32** ***"Test mode"***

Sends a telegram if the device is set to test mode
(1 = Test mode).
See also: Test mode in the Start-up chapter.

3.4 Parameters

The standard values are **in bold**.

3.4.1 Parameter page *General*

Different parameters are displayed, depending on the selection of the supported function.

Table 19

Designation	Values	Meaning
Supported function	*Fan* *Heating* *Cooling* ***Heating and cooling***	Available system
Heating system	***Fan coil*** *Convector*	Type of heating system
Cooling system	***Fan coil*** *Convector*	Type of cooling system
Heat exchanger type	***Fan coil*** *Convector*	Type of heat exchanger
Installation type	*2-pipe system* ***4-pipe system***	There is one single water circuit that is filled with cooling or heating medium according to the season. The system consists of 2 separate water circuits for heating and cooling.
Type of controller used	*Internal controller* ***External controller***	The FCA 2 measures and controls the room temperature itself. The FCA 2 receives its actuating value from an external controller and behaves as an actuator.
Format object heating/cooling	***DPT100 (Heating=1/Cooling=0)*** *Inverted (Heating=0/Cooling=1)*	KNX standard. Inverted (compatible with RAM 713 Fan Coil).
Test mode	*activated* ***blocked***	After reset, the user can change to *test mode* by pressing a button. See also: The test mode *Test mode* is not permitted.

Continuation:

Designation	Values	Meaning
Should a filter change be reported	***No*** *yes*	Activates the *„Filter monitoring“* parameter page.
Should the actuating value be monitored	***No*** *Yes*	See in the appendix: Monitoring of actuating value
Switch fan between auto and forced	***via object forced/auto, forced = 1*** *via object auto/forced, forced = 0*	The forced operation is started with 1 and ended with 0 via object 15. Forced operation is started as soon as object 8 receives an actuating value. Forced operation is ended with 1 on object 15.

3.4.2 Parameter page *Fan*

3.4.2.1 Fan controller = standard (1-3 stages)

IMPORTANT: The difference between the 2 switch-on thresholds must be **at least 15 %**.

Table 20

Designation	Values	Meaning
Fan controller	***standard (1-3 stages)***	A standard fan with up to 3 stages is used. (Connectors S1, S2, S3 and N).
	0-10 V	A fan with 0-10 V controller is used (Connectors F+ and GND).
Number of fan stages	*1 stage* *2 stages* ***3 stages***	Available number of fan stages.
Switch-on threshold for fan stage 1	*0.4 %, 5 %,* ***10 %****, 15 %, 20 %, 25 %, 30 % 35 %, 40 %*	Determines from which actuating value stage 1 should switch on.
Switch-on threshold for fan stage 2	*0 %, 10 %, 20 % 30 %,* ***40 %****, 50 % 60 %, 70 %, 80 % 90 %, 100 %*	Determines at which actuating value stage 1 should change to stage 2.
Switch-on threshold for fan stage 3	*0 %, 10 %, 20 % 30 %, 40 %, 50 % 60 %,* ***70 %****, 80 % 90 %, 100 %*	Determines at which actuating value stage 2 should change to stage 3.

Continuation:

Designation	Values	Meaning
Fan starting strategy	***directly***	The fan should start directly at the configured fan stage.
	via stage 1, 5 s *via stage 1, 10 s* *via stage 1, 15 s* *via stage 1, 20 s* *via stage 1, 25 s* *via stage 1, 30 s*	The fan should always start at the lowest level and switch to the configured stage after a delay.
	via maximum stage, 5 s *via maximum stage, 10 s* *via maximum stage, 15 s* *via maximum stage, 20 s* *via maximum stage, 25 s* *via maximum stage, 30 s* *via maximum stage, 40 s* *via maximum stage, 50 s* *via maximum stage, 60 s*	The fan should always start at the highest level and switch to the configured stage after a delay. This fan starting strategy must be selected if this is recommended by the fan manufacturer. **Important:** **The starting fan stage will neither be displayed nor sent during operation.**
Minimum time to stay within a fan stage	*none,* *1 min,* ***2 min****, 3 min* *4 min, 5 min, 6 min, 7 min* *8 min, 9 min, 10 min, 11 min* *12 min, 13 min, 14 min, 15 min*	Avoids too frequent a change between fan stages if the actuating value suddenly changes.
Additional ventilation	***no***	no additional ventilation
	every 30 min for 3 min stage 1 *every 30 min for 5 min stage 1* *every 30 min for 3 min stage 3* *every 30 min for 5 min stage 3* *every 60 min for 3 min stage 1* *every 60 min for 5 min stage 1* *every 60 min for 3 min stage 3* *every 60 min for 5 min stage 3*	The fan should regularly switch on for the configured time independently of the actuating value.
	permanent ventilation stage 1 *permanent ventilation stage 2* *permanent ventilation stage 3*	Regardless of the actuating value, the fan should permanently run at the selected stage.

Continuation:

Designation	Values	Meaning
Warm start	***no warm start***	The fan starts as soon as the valve is opened.
	30 s, 1 min, 1 min 30 s, *2 min, 2 min 30 s, 3 min,* *3 min 30 s, 4 min, 4 min 30 s,* *5 min, 5 min 30 s, 6 min,* *6 min 30 s, 7 min,* *7 min 30 s*	The valve is opened first. The fan only starts after the configured time has elapsed, to prevent cold air from being blown into the room. See in the appendix: Time between heating and cooling and overrun time
Overrun time for utilisation of remaining energy	***No fan overrun***	The fan is turned off immediately when the valve is closed.
	30 s, 1 min, 2 min, 3 min *4 min, 5 min, 6 min, 7 min* *8 min, 9 min, 10 min, 15 min* *20 min, 30 min,* *until valve is closed*	When the valve is closed, the fan will carry on running for the set time to feed the remaining energy in the device into the room.

Continuation:

Designation	Values	Meaning
Format and cycle time of fan stage object		Object 4 sends the current fan stage as a number between 0 and 3.
	Format counter value, do not send cyclically	Only at change.
	Format counter value, Cycle time 3 min … 60 min	Cyclically and at change
	Format percentage, do not send cyclically	Object 4 sends the configured threshold for the current stage as a percentage: Only at change.
	Format percentage, Cycle time 3 min … 60 min	cyclically and at change
		Example: Configured thresholds: Fan stage 1 = 10 % Fan stage 2 = 40%. Fan stage 3 = 70 % If fan stage 2 is active, object 4 sends the value 40 % Cycle time can be set between 3 and 60 minutes.

3.4.2.2 Fan controller = 0-10 V

Table 21

Designation	Values	Meaning
Fan controller	***standard (1-3 stages)***	A standard fan with up to 3 stages is used. (Connectors S1, S2, S3 and N).
	0-10 V	A fan with 0-10 V controller is used (Connectors F+ and GND).
Switched threshold	*0.4 %, 5 %,* ***10 %****, 15 %, 20 %, 25 %, 30 % 35 %, 40 %*	Determines from which actuating value the fan should start.
Switch-on delay (for split air conditioners)	***None (Fan/Fan Coil)***	For fans and Fan Coils: A switch-on delay is not necessary.
	1 min, 2 min, 3 min, 4 min 5 min, 6 min, 7 min	**Important for split air conditioners:** Defined waiting time between switching off and switching the device on again, defined by the manufacturer.
Additional ventilation	***no***	no additional ventilation
	every 30 min for 3 min *every 30 min for 5 min* *every 60 min for 3 min* *every 60 min for 5 min*	The fan should regularly switch on for the configured time independently of the actuating value.
	permanent ventilation stage 1 *permanent ventilation stage 2* *permanent ventilation stage 3*	Regardless of the actuating value, the fan should permanently run.
Value for supplementary ventilation	*0 %, 10 %,* ***20 %****, 30 % 40 %, 50 %, 60 %, 70 % 80 %, 90 %, 100 %*	Desired fan speed for the *additional ventilation* function.

Continuation:

Designation	Values	Meaning
Warm start	***no warm start***	The fan starts as soon as the valve is opened.
	30 s, 1 min, 1 min 30 s, *2 min, 2 min 30 s, 3 min,* *3 min 30 s, 4 min, 4 min 30 s,* *5 min, 5 min 30 s, 6 min,* *6 min 30 s, 7 min,* *7 min 30 s*	The valve is opened first. The fan only starts after the configured time has elapsed, to prevent cold air from being blown into the room. See appendix: Time between heating and cooling and overrun phase
Overrun time for utilisation of remaining energy	***No fan overrun***	The fan is turned off immediately when the valve is closed.
	30 s, 1 min, 2 min, 3 min *4 min, 5 min, 6 min, 7 min* *8 min, 9 min, 10 min, 15 min* *20 min, 30 min,* *until valve is closed*	When the valve is closed, the fan will carry on running at 40 % for the set time, to feed the remaining energy contained in the device into the room.
Cycle time object of fan	***Do not send cyclically***	Send fan speed only at change.
	Cycle time 3 min … 60 min	Send fan speed cyclically and at change.

3.4.3 Parameter page *Heating valve*

Table 22

Designation	Values	Meaning
Time for closing the valve	*0 min, 1 min, 2 min,* ***3 min****,* *4 min, 5 min, 6 min, 7 min,* *8 min, 9 min, 10 min, 15 min,* *20 min, 30 min*	Adjustment to the used actuator. Prevents the cooling valve to be opened too early.
Repositioning at change by	*0 %,* *1 %, 2 %, 3 %,* *4 %,* ***5 %****, 6 %, 7 %* *8 %, 9 %, 10 %, 11 %* *12 %, 13 %, 14 %, 15 %*	The valve will be repositioned at each change of the actuating value. The valve will only be repositioned if the actuating value has changed by more than the set value, compared to the last positioning. This avoids unnecessary repositioning.
*Open from actuating value**	***0.4 %*** *5 %, 10 %* *15 %, 20 %, 25 %* *30 %, 35 %, 40 %*	Valve is opened even with minimum actuating value. Valve is only opened once the actuating value has reached the set value. This setting prevents possible whistling when valve is open.
*Minimum valve setting**	***0 %****, 5 %, 10 %, 15 %* *20 %, 25 %, 30 %, 35 %* *40 %, 45 %, 50 %*	Minimum permissible valve setting with actuating value < > 0%..
*Maximum valve setting from actuating value**	*0.4 %, 10 %, 20 %, 30 %* *40 %,* ***50 %****, 60 %, 70 %* *80 %, 90 %, 100 %*	Actuating value from which the valve accepts maximum valve setting.
*Maximum valve setting**	*55 %, 60 %, 65 %, 70 %* *75 %, 80 %, 85 %* *90 %, 95 %,* ***100 %***	Maximum permissible valve setting

Continuation:

Designation	Values	Meaning
Time between heating and cooling	***0 min**, 1 min, 2 min, 3 min, 4 min, 5 min, 6 min, 7 min, 8 min, 9 min, 10 min, 15 min, 20 min, 30 min*	Delay when changing from heating to cooling after the heating valve was completely closed. The cooling valve can only be opened again after this time has elapsed. See appendix: Time between heating and cooling and overrun phase.
Transmission of heating status every	***do not send cyclically*** *3 min* *5 min* *10 min* *15 min* *20 min* *30 min* *60 min*	Cyclical transmission time for heating status (object 2).

* Setting of valve characteristic; see appendix: Setting valve characteristic.

3.4.4 Parameter page *Cooling valve*

Table 23

Designation	Values	Meaning
Time for closing the valve	*0 min, 1 min, 2 min,* ***3 min**, 4 min, 5 min,* *6 min, 7 min, 8 min,* *9 min, 10 min, 15 min,* *20 min, 30 min*	Adjustment to the used actuator.
Repositioning at change by	*0 %,* *1 %, 2 %, 3 %,* *4 %, **5 %**, 6 %, 7 %* *8 %, 9 %, 10 %, 11 %* *12 %, 13 %, 14 %, 15 %*	The valve will be repositioned at each change of the actuating value. The valve will only be repositioned if the actuating value has changed by more than the set value, compared to the last positioning. This enables frequent, small positioning increments to be suppressed.
*Open from actuating value**	***0.4 %**,* *5 %, 10 %* *15 %, 20 %, 25 %* *30 %, 35 %, 40 %*	Valve is opened even with minimum actuating value. Valve is only opened once the actuating value has reached the set value. This setting prevents possible whistling when valve is open.
*Minimum valve setting**	***0 %**, 5 %, 10 %, 15 %,* *20 %, 25 %, 30 %, 35 %,* *40 %, 45 %, 50 %*	Minimum permissible valve setting with actuating value < > 0%..
*Maximum valve setting from actuating value**	*0.4 %, 10 %, 20 %, 30 %* *40 %, **50 %**, 60 %, 70 %* *80 %, 90 %, 100 %*	Actuating value from which the valve accepts maximum valve setting.
*Maximum valve setting**	*55 %, 60 %, 65 %, 70 %* *75 %, 80 %, 85 %, 90 %,* *95 %,**100 %***	Maximum permissible valve setting
Transmission of cooling status every	***do not send cyclically*** *3 min, 5 min* *10 min, 15 min* *20 min, 30 min* *60 min*	Cyclical transmission time for cooling status (object 2)

* Setting of valve characteristic, see appendix: Setting valve characteristic.

3.4.5 Parameter page *"Heating/cooling valve"* (only with 2-pipe system)

Table 24

Designation	Values	Meaning
Time for closing the valve	*0 min, 1 min, 2 min,* ***3 min**, 4 min, 5 min,* *6 min, 7 min, 8 min,* *9 min, 10 min, 15 min,* *20 min, 30 min*	Adjustment to the used actuator.
Repositioning at change by	*0 %,* *1 %, 2 %, 3 %,* *4 %, **5 %**, 6 %, 7 %* *8 %, 9 %, 10 %, 11 %* *12 %, 13 %, 14 %, 15 %*	The valve will be repositioned at each change of the actuating value. The valve will only be repositioned if the actuating value has changed by more than the set value, compared to the last positioning. This enables frequent, small positioning increments to be suppressed
*Open from actuating value**	***0.4 %**,* *5 %, 10 %* *15 %, 20 %, 25 %* *30 %, 35 %, 40 %*	Valve is opened even with minimum actuating value. Valve is only opened once the actuating value has reached the set value. This setting prevents possible whistling when valve is open.
*Minimum valve setting**	***0 %**, 5 %, 10 %, 15 %,* *20 %, 25 %, 30 %, 35 %,* *40 %, 45 %, 50 %*	Minimum permissible valve setting with actuating value < > 0%.
*Maximum valve setting from actuating value**	*0.4 %, 10 %, 20 %, 30 %* *40 %, **50 %**, 60 %, 70 %* *80 %, 90 %, 100 %*	Actuating value from which the valve accepts maximum valve setting.
*Maximum valve setting**	*55 %, 60 %, 65 %, 70 %* *75 %, 80 %, 85 %* *90 %, 95 %,* ***100 %***	Maximum defined valve setting
Transmission of heating or cooling status every	***do not send cyclically*** *3 min, 5 min* *10 min, 15 min* *20 min, 30 min* *60 min*	Cyclical transmission time for heating/cooling status (object 2)

* Setting of valve characteristic; see appendix: Setting valve characteristic.

3.4.6 Parameter page *Additional relay*

Table 25

Designation	Values	Meaning
Switching on the additional relay	***Via object***	The additional relay is only controlled from outside via the bus (see object 5)
	If heating is required	The additional relay is switched on as soon as the heating actuating value is above 0 %.
	If cooling is required	The additional relay is switched on as soon as the cooling actuating value is above 0 %.
	Combined with heating valve	The additional relay only switches on when the heating valve is actually opened*.
	Combined with cooling valve	The additional relay only switches on when the cooling valve is actually opened*.
Transmission of additional relay status every	***do not send cyclically*** *3 min* *5 min* *10 min* *15 min* *20 min* *30 min* *60 min*	Cyclical transmission time for the additional relay status. With the setting *Switching on the additional relay= via object*, the status is not transmitted.

* With an adjusted valve characteristic, the valve can remain closed with a low actuating value.

3.4.7 Parameter page *E1*

Table 26

Designation		Values	Meaning
Function of E1		***E1 = Window contact*** *E1 = Actual value sensor*	A window contact is connected to input E1. A temperature sensor is connected to E1 (Order No. 907 0 321)
E1 = Window	*Direction of operation of window contact*	***Contact closed = window closed*** *Contact open = window closed*	Type of connected contact (opening contact or NO contact)
	Transmission of window contact status every	***do not send cyclically*** *3 min, 5 min, 10 min, 15 min, 20 min, 30 min, 60 min*	Cyclical transmission time for window contact
E1 = Actual value sensor	*Actual value adjustment in 0.1 K (-50..50)*	*Manual input – 50 ... 50*	Positive or negative correction of the measured temperature in 1/10K increments. Examples: a) FCA 2 sends 20.3 °C. A room temperature of 21.0 °C is measured using a calibrated thermometer. In order to increase the temperature of FCA 2 to 21 °C, “7” (i.e. 7 x 0.1 K) must be entered. b) FCA 2 sends 21.3 °C. 20.5 ºC is measured. To reduce the transmitted temperature to 20.5 °C, “-8” (i.e. -8 x 0.1 K) must be entered.
	Sending the actual value on change by	*only cyclically* *every 0.2 K* *every 0.3 K* ***every 0.5 K*** *every 1 K*	Should the current room temperature be sent? If yes, from which minimum change should it be resent? This setting keeps the bus load as low as possible.
	Transmission of actual value every	***do not send cyclically*** *3 min, 5 min, 10 min, 15 min* *20 min, 30 min,* *60 min*	Cyclical transmission time for the actual value.

3.4.8 Parameter page *E2*

This page is only available if the *Supported function* parameter is set to *Heating* (General parameter page).

Table 27

Designation	Values	Meaning
Function of E2	***Contact closed = window closed*** *Contact open = window closed*	Type of connected contact (opening contact or NO contact)
Transmission of E2 status every	***do not send cyclically*** *3 min, 5 min, 10 min, 15 min, 20 min, 30 min, 60 min*	Cyclical transmission time for input E2

3.4.9 Parameter page *Condensation monitoring*

Table 28

Designation	Values	Meaning
Source for drip tray monitoring	***E2*** *Object 16*	Condensate is reported to E2 via a contact Condensate is reported to object 16 via the bus.
Direction of action of E2	***Contact closed = Condensate*** *Contact open = Condensate*	Type of connected condensate report contact or condensate telegram.
Behaviour in case of condensate	***Cooling off and fan off*** *Cooling off and fan stage 1* *Cooling off and max. fan stage* *Only report*	Reaction to condensate alarm
Transmission of condensate status every	***do not send cyclically*** *3 min, 5 min, 10 min, 15 min* *20 min, 30 min,* *60 min*	Cyclical transmission time for condensate.

3.4.10 Parameter page *Setpoint adjustment*

The setpoint adjustment is to prevent a too large temperature difference between inside and outside during the summer. For this, the defined setpoint in cooling mode can be raised automatically in proportion to the temperature increase outside.
See the appendix: Setpoint adjustment.

Table 29

Designation	Values	Meaning
Also use setpoint adjustment for internal control	*yes* *no*	The basic control setpoint (= *Basic setpoint after reset* + *dead zone*) should be adjusted step by step in relation to the outdoor temperature. Setpoint adjustment does not influence the internal controller.
Setpoint correction from	***25 °C**, 26 °C, 27 °C* *28 °C, 29 °C, 30 °C* *31 °C, 32 °C, 33 °C* *34 °C, 35 °C, 36 °C* *37 °C , 38 °C,* *39 °C, 40 °C*	Activation threshold for setpoint correction.
Adjustment	*none* *1 K per 1 K outdoor temperature* *1 K per 2 K outdoor temperature* ***1 K per 3 K outdoor temperature*** *1 K per 4 K outdoor temperature* *1 K per 5 K outdoor temperature* *1 K per 6 K outdoor temperature* *1 K per 7 K outdoor temperature*	No temperature adjustment Strength of the setpoint correction: At which change of the outdoor temperature should the setpoint be adjusted by 1 K?

Continuation:

Designation	Values	Meaning
Format of correction value	***relative***	Obj. 19 sends a temperature difference in K, depending on the outdoor temperature. This value can be used as a setpoint offset for additional room thermostats.
	absolute	Obj. 19 sends a setpoint in °C (*base unadjusted setpoint*). This is increased step-by-step depending on the outdoor temperature and serves as setpoint for additional temperature controllers.
Unadjusted base setpoint	*15 °C, 16 °C, 17 °C* *18 °C, 19 °C, 20 °C* ***21 °C**, 22 °C, 23 °C* *24 °C, 25 °C, 26 °C,* *27 °C , 28 °C* *29 °C, 30 °C*	Base setpoint for additional room thermostats. Important: This value should match with the base setpoint of the actuated controller.
Transmission of setpoint correction every	***do not send cyclically*** *3 min, 5 min, 10 min, 15 min* *20 min, 30 min,* *60 min*	Cyclical transmission time for setpoint correction.

3.4.11 Parameter page *Setpoints* (internal controller)

Table 30

Designation	Values	Meaning
Base setpoint after reset	*15 °C, 16 °C, 17 °C* *18 °C, 19 °C, 20 °C* ***21 °C**, 22 °C, 23 °C* *24 °C, 25 °C, 26 °C* *27 °C , 28 °C, 29 °C* *30 °C*	Output setpoint for temperature control.
Reduction in standby mode (during heating)	*0.5 K, 1 K, 1.5 K* ***2 K**, 2.5 K, 3 K* *3.5 K, 4 K*	How much should the temperature be reduced in standby mode?
Reduction in night mode (during heating)	*3 K, 4 K, **5 K*** *6 K, 7 K, 8 K*	How much should the temperature be reduced in night mode?
Setpoint for frost protection mode (during heating)	*3 °C, 4 °C, 5 °C* ***6 °C**, 7 °C, 8 °C* *9 °C, 10 °C*	Preset temperature for frost protection mode in heating mode (Heat protection applies in cooling mode).
Dead zone between heating and cooling	*1 K, **2 K**, 3 K* *4 K, 5 K, 6 K*	Specifies the buffer zone between setpoints for heating and cooling mode. See glossary: dead zone
Increasing in standby mode (during cooling)	*0.5 K, 1 K, 1.5 K* ***2 K**, 2.5 K, 3 K* *3.5 K, 4 K*	How much should the temperature be raised in night mode?
Increase in night mode (during cooling)	*3 K, 4 K, **5 K*** *6 K, 7 K, 8 K*	How much should the temperature be raised in night mode?
Setpoint for heat protection (during cooling)	***42 °C** i.e. virtually no heat protection* *29 °C* *30 °C* *31 °C* *32 °C* *33 °C* *34 °C* *35 °C*	Heat protection represents the maximum permitted temperature for the controlled room. It performs the same function during cooling as the frost protection mode during heating, e.g. saves energy while prohibiting non-permitted temperatures.

Continuation:

Designation	Values	Meaning
Current setpoint in comfort mode	***Sends actual value (heating < > cooling)***	The setpoint actually being used for control is always to be sent (= current setpoint). **Example** with Base setpoint 21°C and dead zone of 2 K: During heating, 21°C is transmitted and during cooling, base setpoint + dead zone is transmitted (21°C + 2K = 23°C
	Send average value between heating and cooling	Same value in comfort mode during both heating and cooling mode, i.e.: Base setpoint + half dead zone is transmitted to prevent occupants from being confused. **Example** with Base setpoint 21°C and dead zone of 2 K: Mean value= 21°+1 K =22°C Although control takes place at 21°C during heating and 23°C during cooling.
Transmission of setpoint every	***do not send cyclically*** *3 min, 5 min, 10 min 15 min, 20 min, 30 min 60 min*	Cyclical transmission time for the current setpoint

3.4.12 Parameter page *Regulation* (internal controller)

Table 31

Designation		Values	Meaning
Setting the control parameters		***Standard***	For standard use. The control parameters are preset.
		User-defined	Professional application: The control parameters can be individually adjusted. See appendix: temperature control
User-defined parameters	*Proportional band of heating controller*	*1 K, 1.5 K, 2 K* *2.5 K, 3 K, 3.5 K* ***4 K**, 4.5 K, 5 K* *5.5 K, 6 K, 6.5 K* *7 K, 7.5 K, 8 K* *8.5 K*	Professional setting to adapt the control response to the room. Small values cause large changes in actuating values, larger values cause finer actuating value adjustment. Standard value: 4 K
	Integrated time of heating control	*pure P controller*	Only proportional controllers. See appendix: temperature control
		*15 min, 30 min, 45 min, 60 min, 75 min, **90 min*** *105 min, 120 min* *135 min, 150 min* *165 min, 180 min* *195 min, 210 min* *225 min*	This time can be adapted to suit particular circumstances. If the heating system is over-dimensioned and therefore too fast, shorter values should be used. On the other side, longer integration times are beneficial for a slightly undersized heating (slow). Standard value: 90 min

Continuation:

Designation		Values	Meaning
User-defined parameters	*Proportional band of the cooling control*	*pure P controller*	Only proportional controllers. See appendix: temperature control
		1 K, 1.5 K, 2 K *2.5 K, 3 K, 3.5 K* ***4 K**, 4.5 K, 5 K* *5.5 K, 6 K, 6.5 K* *7 K, 7.5 K, 8 K* *8.5 K*	Professional setting for adapting control response to the room. Large values cause finer changes to the actuating value with the same control deviation and more precise control than smaller values. Standard value: 4 K
	Integrated time of the cooling control	*pure P controller*	Only proportional controllers. See appendix: temperature control
		*15 min, 30 min, 45 min, 60 min, 75 min, **90 min*** *105 min, 120 min* *135 min, 150 min* *165 min, 180 min* *195 min, 210 min* *225 min*	Only for PI controller: The integrated time determines the response time of the control. This times can be adapted to suit particular circumstances. If the cooling system is over-dimensioned and therefore too fast, shorter values should be used. On the other side, longer integration times are beneficial for a slightly undersized cooling (slow). Standard value: 90 min
Changeover between heating and cooling		***automatic***	FCA 2 automatically switches to cooling mode if the actual temperature is above the setpoint.
		via object	The cooling mode can only be activated on the bus side

Continuation:

Designation	Values	Meaning
Format object heating/cooling	***DPT100 (Heating=1/Cooling=0)*** *Inverted (Heating=0/Cooling=1)*	KNX standard. Inverted (**compatible with RAM 713 Fan Coil**).
Transmission of actuating value	*at change by 1 %* *at change by 2 %* *at change by 3 %* ***at change by 5 %*** *at change by 7 %* *at change by 10 %* *at change by 15 %*	After what percentage change* of the actuating value is the new value to be transmitted?
Transmission of actuating value every	*do not send cyclically* *3 min, 5 min, 10 min* ***15 min**, 20 min, 30 min* *60 min*	Cyclical transmission time for actuating value.
Report, when cooling required but cooling blocked	***Only if object value = 1*** *Always cyclically*	With *Supported function = cooling* Error notification with object 29 if cooling should be activated because of the temperature, but cooling is not enabled (object 1).
Report, if heating required but heating disabled	***Only if object value = 1*** *Always cyclically*	With *Supported function = heating*. Error notification with object 29 if heating should be activated because of the temperature, but heating is blocked via object 1.
Report, when no energy medium	***Only if object value = 1*** *Always cyclically*	With *Supported function = heating and cooling* Error notification if heating or cooling should be activated because of the temperature, but the state of object „*Change over heating/cooling* is conflicting with this (with 2-pipe, object 1, with 4-pipe, object 28 with change over between healing and cooling via object).

Continuation:

Designation	Values	Meaning
Report cyclically	*every 3 min, 5 min, 10 min 15 min, 20 min,* ***30 min*** *60 min*	Cyclical transmission time for energy medium error message

*Change since last transmission

3.4.13 Parameter page *Operating mode and operation* (internal controller)

Table 32

Designation	Values	Meaning
Operating mode after reset	*Frost/heat protection* *Temperature reduction at night* ***Standby*** *Comfort*	Operating mode after start-up or reprogramming
Transmission of current operating mode every	***do not send cyclically*** *3 min, 5 min, 10 min* *15 min, 20 min, 30 min* *60 min*	Cyclical transmission time of operating mode (object 24)
Objects for operating mode selection	***new: operating mode, presence, window status*** *old: Comfort, night, frost (not recommended)*	FCA 2 can switch the operating mode depending on the window and presence contacts. Traditional setting without window and presence status.
Type of presence detector	***Presence detector*** *Presence buttons*	The presence sensor activates the comfort operating mode Comfort operating mode as long as the presence object is set. If the operating mode object (Object 3) is called up again after setting the presence object, the new operating mode will be accepted and the presence object reset. If the presence object is set during night/frost mode, it is reset after the configured comfort extension finishes (see below). The presence object is not reported back on the bus.

Continuation:

Designation	Values	Meaning
Time for comfort extension	*30 min* *1 hour* *1.5 hours* ***2 hours*** *2.5 hours* *3 hours* *3.5 hours*	How long should the controller stay in comfort operating mode after presence has been detected? (Only for presence button).
Manual offset applies	*for comfort, standby and night* *for comfort and standby* *only for comfort*	In which operating modes should the setpoint offset be effective?
Limitation of manual offset	*no offset* *+/- 1 K, +/- 2 K* ***+/- 3 K,*** *+/- 4 K* *+/- 5 K*	The setpoint cannot be offset. The setpoint can maximally be changed by the configured amount (object 25).

3.4.14 Parameter page *Filter monitoring*

This parameter page is only visible if this function has been selected on the *General* parameter page (parameter: *Should a filter change be reported*).

Table 33

Designation	Values	Meaning
Report filter change after fan operation (1..127 weeks)	*manual input: 1..127 (Standard **12**)*	interval between 2 filter changes in weeks.
Cyclical transmission of filter change	***only at filter change***	Object 31 only sends when filter change is required: 1 = Change filter
	always cyclically	Object 31 sends the filter status cyclically: 0 = Filter OK 1 = Change filter
Transmit fan duty time (in hours)*	***send never (reading is possible)***	The fan duty time is counted to the second internally, but not transmitted. The meter reading can be read from object 30.
	only at change	The meter reading is transmitted every time the fan duty time increases by 1 hour.
	cyclically and at change	The meter reading is transmitted at regular intervals and at changes.
Send cyclically	*every 3 min, every 5 min every 10 min, every 15 min every 20 min, every 30 min every 45 min, **every 60 min***	Cyclical transmission time for meter reading.

* To reset the filter status and the meter reading, see object 31.

3.4.15 Parameter page *Actuating value loss*

This parameter page is only visible if an external controller is used and if this function has been selected on the *General* parameter page (parameter: *Should the actuating value be monitored*).

Table 34

Designation	Values	Meaning
Monitoring time for actuating value	*30 min* ***60 min***	If no actuating value is received within the configured time, the substitute activating value applies.
Substitute actuating value in case of actuating value loss (emergency program)	*0 %, 10 %,* ***20 %*** *30 %, 40 %, 50 %, 60 %,* *70 %, 80 %, 90 %, 100 %*	Actuating value for the emergency program as long as no new actuating value is received by the room thermostat
Report actuating value loss (1 = actuating value loss)	***only if object value** = 1* *always cyclically*	Object 20 only transmits at actuating value loss. Object 20 always transmits the status of the actuating value. 0 = OK 1 = actuating value loss
Report cyclically	*every 3 min, every 5 min* *every 10 min, every 15 min* *every 20 min,* ***every 30 min*** *every 45 min, every 60 min*	Cycle time for actuating value status.

4 Start-up

4.1 Test mode

During initial operation (i.e. before the first download) the device is permanently in test mode.
Test mode serves to check the system, e.g. at start-up
or during troubleshooting.
In this mode, the valves and the fans can be set as required using the appropriate keys.
A temperature sensor (Order No. 907 0 321) or the window contacts can also be checked.

Important information about the test mode:

- Both the control and the bus telegrams are ineffective
- All settings are possible without any restriction.
- The valves are actuated until they are switched off again by hand.
- Condensate alarm is not taken into account
- **The prevention of improper operating conditions (e.g. heating and cooling valves are open simultaneously) lies in the responsibility of the user.**

Allow / suppress test mode:

The test mode is allowed or suppressed via the *Test mode after reset* parameter on the *General* parameter page.

Activate test mode:
Trigger **Reset**, i.e. via download or applying bus voltage:
→ The test mode LED flashes for 1 minute.
During this time, the test mode can be started by pressing the valve ❄/ʃʃʃ or fan button ✲.
→ The FCA 2 switches to test mode and the "test" LED is permanently illuminated.

End test mode
Test mode is ended:

- by simultaneously pressing both buttons (A+B)
- by downloading the application (parameter *Test mode after Reset = blocked*)

If no button is pressed while the test mode LED is flashing, the FCA 2 automatically moves to normal operation after one minute.
At initial operation, i.e. no application program, the LED flashes without time limit.

Operation:

- Fan control:

The following operating conditions are accepted in sequence if button A (fan) is pressed.

Table 35: Standard fan controller

Button push	Function	LED
1	Fan stage 1	S1 on
2	Fan stage 2	S2 on
3	Fan stage 3	S3 on
4	Fan off	S1-S3 off

Table 36: 0-10 V fan controller

Button push	Speed	LED
1	33 %	S1 on
2	66 %	S2 on
3	100 %	S3 on
4	Fan off	S1-S3 off

- Control valves, switch on additional relay:

The following operating conditions are accepted in sequence if button B (valves) is pressed.

Table 37

Button push	LED	Output
1	Cooling LED on	After 2 s [V2+] = 10 V
2	Cooling LED flashes	After 2 s [V2+] = 0 V
3	Heating LED on	After 2 s [V1+] = 10 V
4	Heating LED flashes	After 2 s [V1+] = 0 V
5	LED C1 on	After 2 s C1 on
6	All LEDs off	All outputs off

Via the delayed switching of the outputs, the user can skip the individual modes without altering the valve setting by quickly pressing the buttons.

Figure 3

Table 38: Status display heating and cooling valve.

LED	Status	Meaning
❄	is OFF	Cooling valve is closed (0 V)
	is ON	Cooling valve is open (> 0)
	Flashes	Cooling valve is closed (0 V)
≋	is OFF	Heating valve is closed (0 V)
	is ON	Heating valve is open (> 0 V)
	Flashes	Heating valve is closed (0 V)

Checking the temperature sensor (Order No. 907 0 321):
If a temperature sensor is connected to input E1, and E1 is configured accordingly in the application, the measured room temperature is transmitted by object 14.

A sensor break or short-circuit in the sensor line are reported by the value -60 °C.

Checking the window contacts:
If a window contact is connected to input E1, and E1 is configured accordingly in the application, the window status is sent to the configured group address (object 14).
Also input E2 (object 16, condensation monitoring or window contact) can be checked.

Behaviour in delivery condition:
Before the application software is downloaded for the first time, inputs E1, E2 and the additional relay C1 are connected via a common group address:
E1 = 7/4/100
E2 = 7/4/101
C1 = 7/4/100, 7/4/101
If the contact is connected to E1 or E2, the additional relay C1 is switched on.
This allows both inputs to be checked without bus monitor.

4.2 Device LEDs in automatic mode

Figure 4

LED	Function	Explanation
S1	Fan stage 1	Lights up if fan stage 1 is active, or with fan speed 1 – 32 % (*Starting strategy* is not taken into account).
S2	Fan stage 2	Lights up if fan stage 2 is active, or with fan speed 33 – 65 % (*Starting strategy* is not taken into account).
S3	Fan stage 3	Lights up if fan stage 3 is active, or with fan speed 66 – 100 % (*Starting strategy* is not taken into account).
❄	Cooling	Lights up if the cooling valve is open. Flashes if opening of the cooling valve is delayed, because the heating valve is not completely closed or the *time between heating and cooling* has not elapsed.
≋	Heating	Lights up if the heating valve is open. Flashes if opening of the heating valve is delayed, because the cooling valve is not completely closed or the *time between heating and cooling* has not elapsed.
C1	Additional relay	Lights up if the additional relay is switched on
Test	Test mode	Flashes after reset if *test mode* is selected or if the device has not been programmed yet. Lights up if the device is in *test mode*.
E1	Input 1	When used as a *window contact*: Lights up if contact is closed. When used as an *actual value sensor*: Stays off in normal temperature range (i.e. -10 °C .. 60 °C). Flashes in case of interruption or short-circuit in the sensor line and temperatures outside the normal range.
E2	Input 2	For use as a *window contact* (only with *supported function = heating* or *ventilation*): Lights up if contact is closed. With *supported function = heating and cooling* or *cooling:* Flashes at condensate alarm, regardless of *source for condensation monitoring*.

5 Typical applications

5.1 Base configuration (4-pipe system): Heating and cooling with fan coil with external controller

The FCA 2 is controlled by a RAM 713 FC room thermostat.

5.1.1 Devices:

- FCA 2 (Order No. 4920210)
- RAM 713 FC (Order No. 7139202)

5.1.2 Overview

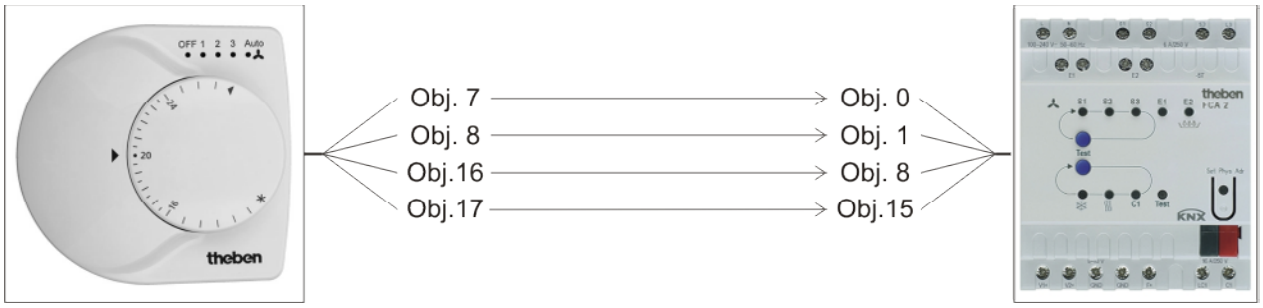


Figure 5

5.1.3 Objects and links

Table 39: Links

No.	RAM 713 FC Object name	No.	FCA 2 Object name	Comment
7	*Heating actuating value*	0	*Heating actuating value*	FCA receives the heating and cooling actuating values
8	*Cooling actuating value*	1	*Cooling actuating value*	
16	*Fan stage in forced operation*	8	*Fan stage in forced operation - fan control via % value*	% value for forced operation
17	*Fan Forced/Auto*	15	*Fan* *Forced = 1 / Auto = 0*	Trigger for forced operation

5.1.4 Important parameter settings

The standard parameter settings apply for unlisted parameters.

Table 40: FCA 2

Parameter page	Parameters	Setting
General	*Supported function*	*Heating and cooling*
	Installation type	*4-pipe system*
	Type of controller used	*external controller*

Table 41: RAM 713 FC

Parameter page	Parameters	Setting
Settings	*Device type*	*RAM 713 Fan Coil*
Control	*Fan coil system used*	*4-pipe system*
Operating mode	*Objects for determining the operating mode*	*old: comfort, night, frost*

5.2 Base configuration (2-pipe system): Heating and cooling with fan coil with external controller

5.2.1 Devices:

- FCA 2 (Order No. 4920210)
- RAM 713 FC (Order No. 7139202)

5.2.2 Overview

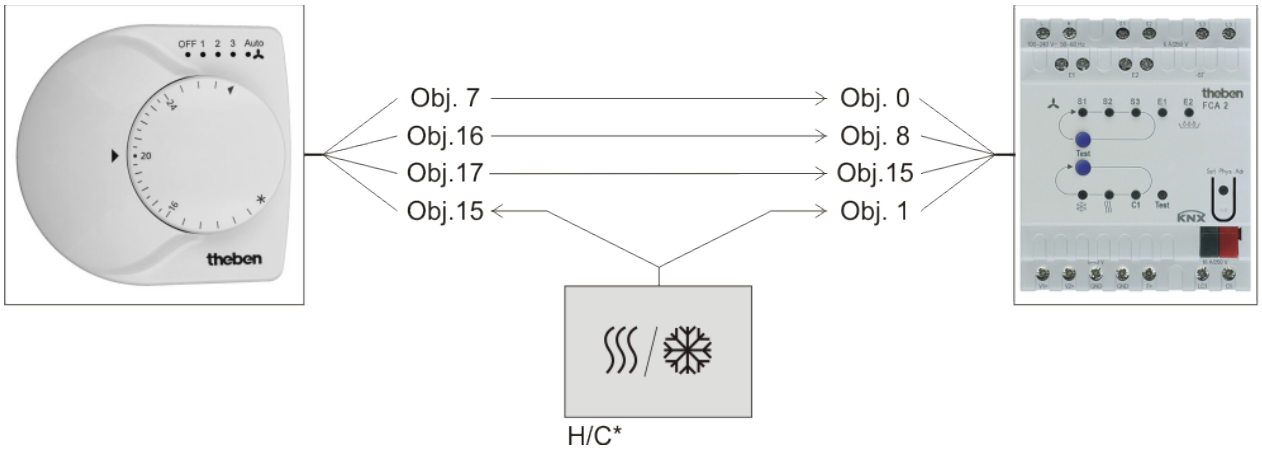


Figure 6 * H/C = heating / cooling system

5.2.3 Objects and links

Table 42: Links

No.	RAM 713 FC Object name	No.	FCA 2 Object name	Comment
7	*Heating and cooling actuating value*	0	*Heating/cooling actuating value*	FCA receives the heating and cooling actuating values from RAM 713 FC
15	*Changeover between heating and cooling*	1	*Changeover between heating and cooling*	Telegram is generated by the heating/cooling system
16	*Fan stage in forced operation*	8	*Fan stage in forced operation - fan control via % value*	% value for forced operation
17	*Fan Forced/Auto*	15	*Fan Forced/Auto*	Trigger for forced operation

5.2.4 Important parameter settings

The standard parameter settings apply for unlisted parameters.

5.2.4.1 FCA 2

Table 43

Parameter page	Parameters	Setting
General	*Supported function*	*Heating and cooling*
	Installation type	*2-pipe system*
	Type of controller used	*external controller*

5.2.4.2 RAM 713 FC

Table 44

Parameter page	Parameters	Setting
Settings	*Device type*	*RAM 713 Fan Coil*
Control	*Fan coil system used*	*2-pipe system*
Operating mode	*Objects for determining the operating mode*	*new: operating mode, presence, window status*

5.3 4-pipe system: Heating and cooling with fan coil, external controller and dew point alarm

A RAM 713 FC room thermostat and a FCA 2 fan coil actuator control a heating/cooling system. Once humidity has reached a defined limit value (80 %), an alarm telegram is sent to prevent further cooling and thus an increase in humidity.

5.3.1 Devices

- Amun 716 KNX (Order No. 716 9 200)
- FCA 2 (Order No. 4920210)
- RAM 713 FC (Order No. 7139202)

5.3.2 Overview

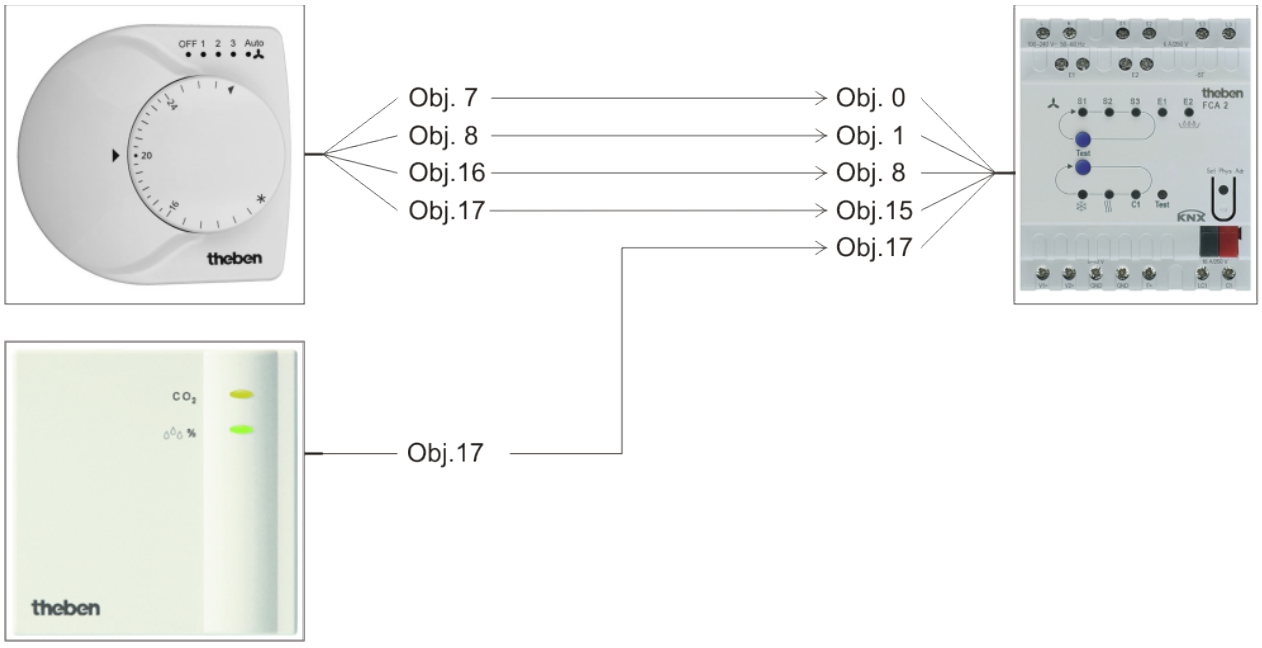


Figure 7

5.3.3 Objects and links

Table 45

No.	Amun 716 KNX Object name	No.	FCA 2 Object name	Comment
17	*Humidity threshold 3*	17	*Dew point alarm*	Do not cool any further, humidity is too high.

Table 46: Links

No.	RAM 713 FC Object name	No.	FCA 2 Object name	Comment
7	*Heating actuating value*	0	*Heating actuating value*	FCA receives the heating and cooling actuating values
8	*Cooling actuating value*	1	*Cooling actuating value*	
16	*Fan stage in forced operation*	8	*Fan stage in forced operation - fan control via % value*	% value for forced operation
17	*Fan Forced/Auto*	15	*Fan* *Forced = 1 / Auto = 0*	Trigger for forced operation

5.3.4 Important parameter settings

Standard or customer-defined parameter settings apply to unlisted parameters.

Table 47: Amun 716

Parameter page	Parameters	Setting
Humidity thresholds	*Relative humidity threshold 3 (in %)*	80 %
	Hysteresis	*5 %*
Humidity threshold 3	*Telegram type for humidity threshold 3*	*Switch command*
	If humidity threshold 3 exceeded	*send following telegram once*
	Telegram	*Switch-on command*
	If fallen below humidity threshold 3	*Switch-off command*

Table 48: FCA 2

Parameter page	Parameters	Setting
General	*Supported function*	*Heating and cooling*
	Installation type	*4-pipe system*
	Type of controller used	*external controller*

Table 49: RAM 713 FC

Parameter page	Parameters	Setting
Settings	*Device type*	*RAM 713 Fan Coil*
Control	*Fan coil system used*	*4-pipe system*
Operating mode	*Objects for determining the operating mode*	*old: comfort, night, frost*

5.4 Typical application (4-pipe system):

5.4.1 Task:

- A heating and cooling system is installed in an office building with separate circuits for hot and cold water.
- The room temperature in the individual offices is controlled according to the time of day and level of occupation.
- On hot summer days, less cooling is to be used to save energy.
  This improves the level of comfort for the office users, as it prevents too extreme a temperature difference when leaving the office.

5.4.2 Devices:

- FCA 2 (Order No. 4920210)
- RAM 713 FC (Order No. 7139202)
- TR 648 top2 RC (Order No. 6489212)
- Presence detector thePrema P360 KNX (Order No. 207900x)
- Meteodata 140 S (Order No. 1409207)

5.4.3 Overview

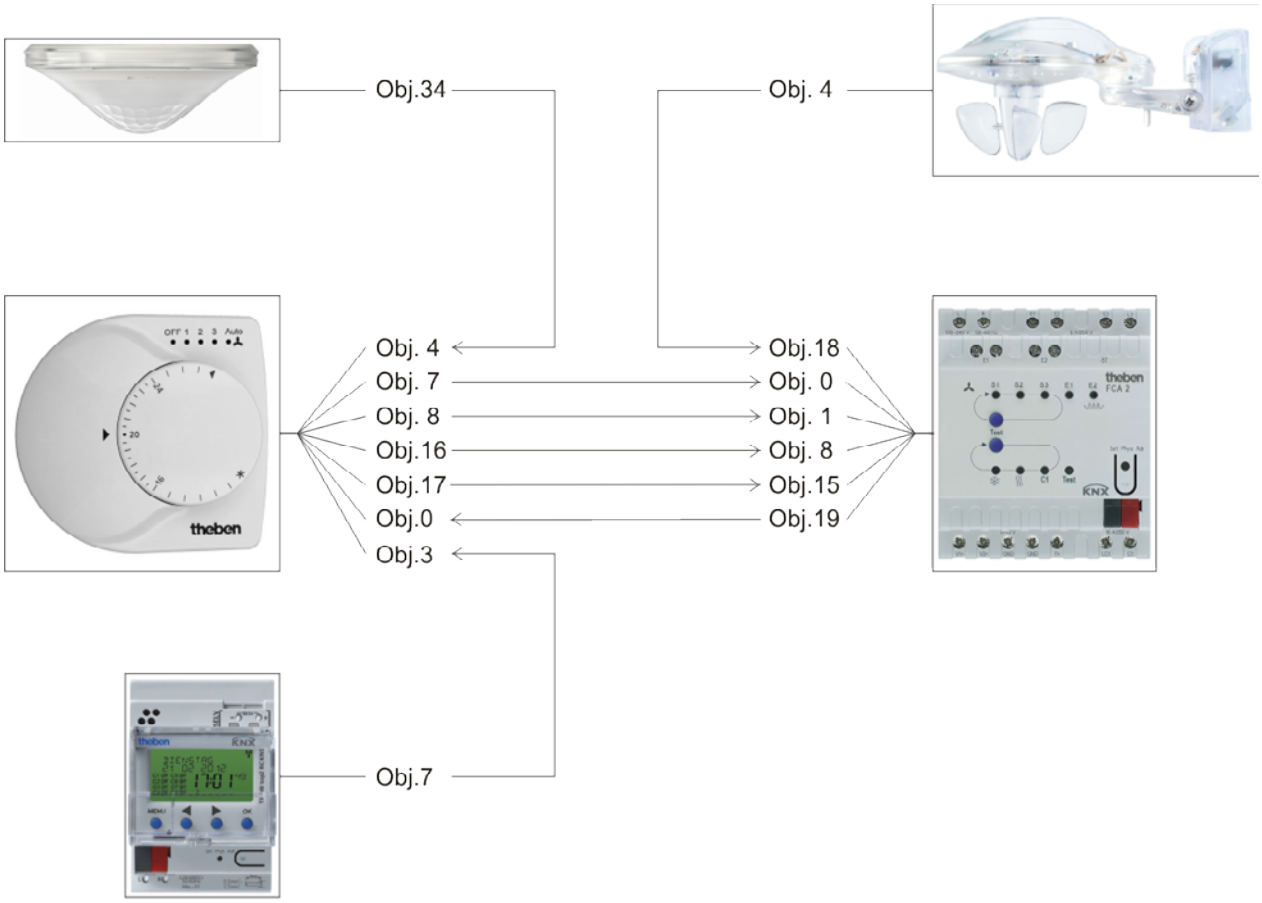


Figure 8

5.4.4 Implementation:

A RAM 713 FC and an FCA 2 are used for room temperature control.

The RAM 713 FC calculates the setpoint based on the selected operating mode and a possibly selected setpoint correction by the room occupants.

The operating mode is specified by a TR 648 top2 RC KNX time switch.

On work days, the time switch switches to *Standby* a little before work, and at the end of the working time to night mode.
For this purpose, one channel of the time switch is connected with the operating mode object of the controller.

A presence detector should activate *comfort mode* if the office is actually occupied.
For this purpose, the presence detector is connected with the presence object of the controller.

The room thermostat is connected to the FCA 2 via the *heating actuating value* and *cooling actuating value* objects.
Via these objects, the FCA 2 controls the valves, and also the fan in *auto* position.

For a manual setting of the fan stages, objects 8 and 15 of the FCA 2 are connected with objects 16 and 17 of the RAM 713 FC.

The outside temperature is sent from a weather station to the FCA 2 (object 18) for adjustment of the setpoint on hot summer days.
This determines, depending on the configuration, the setpoint correction transmitted to the room thermostat.
For this, object 19 (FCA 2) and object 0 (RAM 713 FC) are connected with each other.

Objects and links

Table 50: Temperature controller links with the fan coil actuator.

No.	RAM 713 FC Object name	No.	FCA 2 Object name	Comment
7	*Heating actuating value*	0	*Heating actuating value*	FCA receives the heating actuating value.
8	*Cooling actuating value*	1	*Cooling actuating value*	FCA receives the cooling actuating value.
16	*Fan stage in forced operation*	8	*Fan stage in forced operation - fan control via % value*	% value for forced operation
17	*Fan Forced/Auto*	15	*Fan Forced/Auto*	enables the manual selection of fan stage on the RAM 713 FC
0	*Manual setpoint offset*	19	*Adjust setpoint*	For setpoint adjustment in cooling mode

Table 51: Meteodata weather station links with the fan coil actuator.

No.	Meteodata 140 S Object name	No.	FCA 2 Object name	Comment
4	*Temperature value*	18	*Outdoor temperature*	Outdoor temperature for setpoint adjustment

Table 52: Presence detector links with room thermostat.

No.	thePrema P360 Object name	No.	RAM 713 FC Object name	Comment
31	*Presence channel C4.1 - switching*	4	*Presence*	Presence signal for change over to comfort mode

Table 53: Time switch links with room thermostat.

No.	TR 648 top2 RC KNX Object name	No.	RAM 713 FC Object name	Comment
7	*C1.1 switching channel – HVAC operating mode*	3	*Operating mode preset*	Changes the HVAC operating mode* depending on the time of day.

* 1 = Comfort, 2 = Standby, 3 = Night, 4 = frost/heat protection.

5.4.5 Important parameter settings

The standard parameter settings apply for unlisted parameters.

Table 54: FCA 2

Parameter page	Parameters	Setting
General	*Supported function*	*Heating and cooling*
	Heating system	*Fan coil*
	Cooling system	*Fan coil*
	Installation type	*4-pipe system*
	Type of controller used	*external controller*
Setpoint adjustment	*Setpoint correction from*	*25 °C*
	Adjustment	*1 K per 3 K outdoor temperature*
	Format of correction value	*relative*

Table 55: RAM 713 FC

Parameter page	Parameters	Setting
Settings	*Device type*	*RAM 713 Fan Coil*
Operation	*Rotary control function*	*Manual adjustment with report object*
Control	*Fan coil system used*	*4-pipe system*
	Changeover between heating and cooling	*Automatic*
Operating mode	*Objects for determining the operating mode*	*new: operating mode, presence, window status*

Table 56: Meteodata 140 S

Parameter page	Parameters	Setting
Measurement values	*Send temperature in the event of change*	*From 1.0 °C*

Table 57: TR 648 top 2 RC KNX time switch

Parameter page	Parameters	Setting
General	*Activate time switch channel C1*	*Valuator*
Switching channel C1	*Telegram type C1.1*	*HVAC operating mode*
	With clock → ON	*Send following telegram once*
	Telegram	*Standby*
	With clock → OFF	*Send following telegram once*
	Telegram	*Temperature reduction at night*

Table 58: thePrema P360 KNX presence detector

Parameter page	Parameters	Setting
General	*Channel C4 function – Presence*	*active*
Objects (Presence channel C4)	*Telegram type C4.1*	*Switch command*
	Telegram	*On*

6 Appendix

6.1 Monitoring of actuating value

6.1.1 Application

Should the external room thermostat (RTR) fail, despite the last sent actuating value being 0%, all valves remain closed, irrespective of the continued temperature characteristic curve.
This might lead to significant damages, e.g. if cold air enters the room in case of outdoor temperatures below zero.

To avoid this situation, FCA 2 can ensure the following functions:

1. monitoring the proper functioning of the room thermostat
2. starting an emergency program in case of actuating value loss
3. sending the status of the actuating value monitoring

6.1.2 Principle

FCA 2 monitors whether, within the configured time value, at least 1 actuating value telegram is received, and assumes a predefined setpoint in case actuating value loss.

6.1.3 In practice

The room thermostat is configured for the cyclical transmission of the actuating value.

On the FCA 2, the monitoring time is set to a value that is at least twice the cycle time of the room thermostat.
If the room thermostat transmits an actuating value every 15 minutes, the monitoring time must be at least 30 minutes.

After an actuating value loss, normal operation is resumed as soon as a new actuating value is received.

If the block function is activated (object 1: *Block heating* = 1 or *Enable cooling* = 0), only the actuating value loss telegram will be transmitted.
The relevant valve remains/is closed and assumes the configured emergency program actuating value once the block is removed.

6.2 Setting the valve characteristic

The parameters on the *heating valve* and *cooling valve* pages allow an exact adjustment to the available valve type or allow the slight adjustment of the control.

Example for a valve that starts to open from a position of 10 % and is already completely open at 80 %.

Figure 9

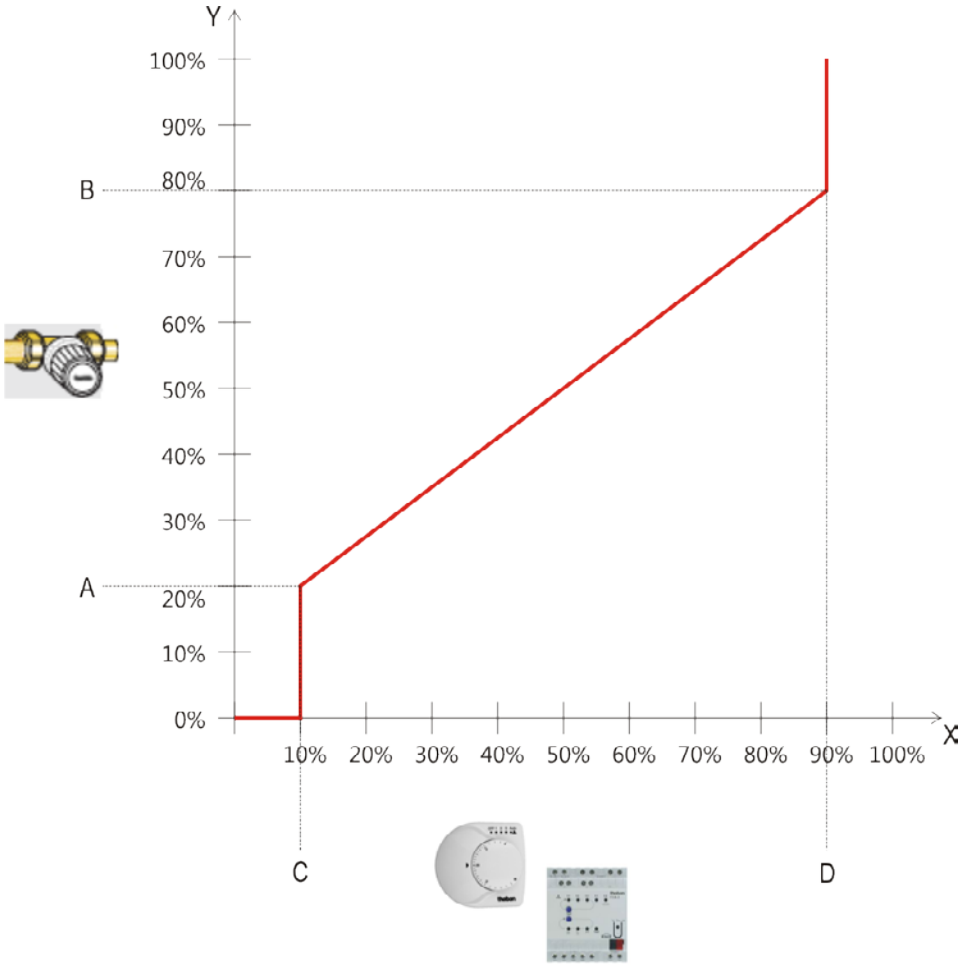


Table 59

	Description	Value
X	Actuating value from the controller	0 .. 100 %
Y	Resulting valve setting	0 .. 100 %
A	Parameter: Minimum valve setting	20 %
B	Parameter: Maximum valve setting	80 %
C	Parameter: Open from actuating value	10 %
D	Parameter: Maximum valve setting from actuating value	90 %

6.3 Setpoint offset

The current setpoint can be offset via object 25 "*Manual adjustment*" by up to +/- 5 K manually.

With every alteration, the adjusted setpoint is transmitted by the *Current setpoint* object (object 27).

The limits of the offset are set on the *Operating mode and operation parameter page* with the *Limitation of manual offset* parameter.
On this parameter page one can also define in which operating mode a setpoint offset should be possible, see parameter *Manual offset is valid*.

6.4 Setpoint adjustment

The setpoint adjustment allows a dynamic adjustment of the setpoint to the outdoor temperature when cooling.

If the outdoor temperature exceeds a set threshold, adjustment is activated and a corresponding increase of the setpoint is calculated.

6.4.1 Use with internal controller

The setpoint adjustment can also be applied to the internal controller, if the *Use setpoint adjustment for control* parameter is set to *yes*.

In this case, the setpoint of the internal controller (*Base setpoint after reset*) is always adjusted relatively, i.e. increased or decreased by the calculated correction value
(see figure 2 below).

Moreover, an independent setpoint can be generated, which makes the adjustment for further controllers in the building available (see below: Format of the setpoint correction: Absolute).

6.4.2 Use with external controller

There are 2 types of setpoint correction available for external controllers, the relative and absolute type.

See also: Parameter page Setpoint adjustment.

6.4.3 Format of setpoint correction: Relative

Setpoint adjustment is sent from object 19 as a temperature difference.
As long as the setpoint correction threshold (*setpoint correction from*) has not been reached, the value 0 is sent.
If the setpoint correction threshold is exceeded, the value is increased each time by 1 K if the outdoor temperature has risen by the configured value (*adjustment*).
Object 19, *Adjust setpoint,* is typically linked with the
Manual setpoint offset object of the room thermostat.

Example: Transmitted adjustment value
Setpoint correction from: 25 °C

Figure 10: Correction value dependent on outdoor temperature

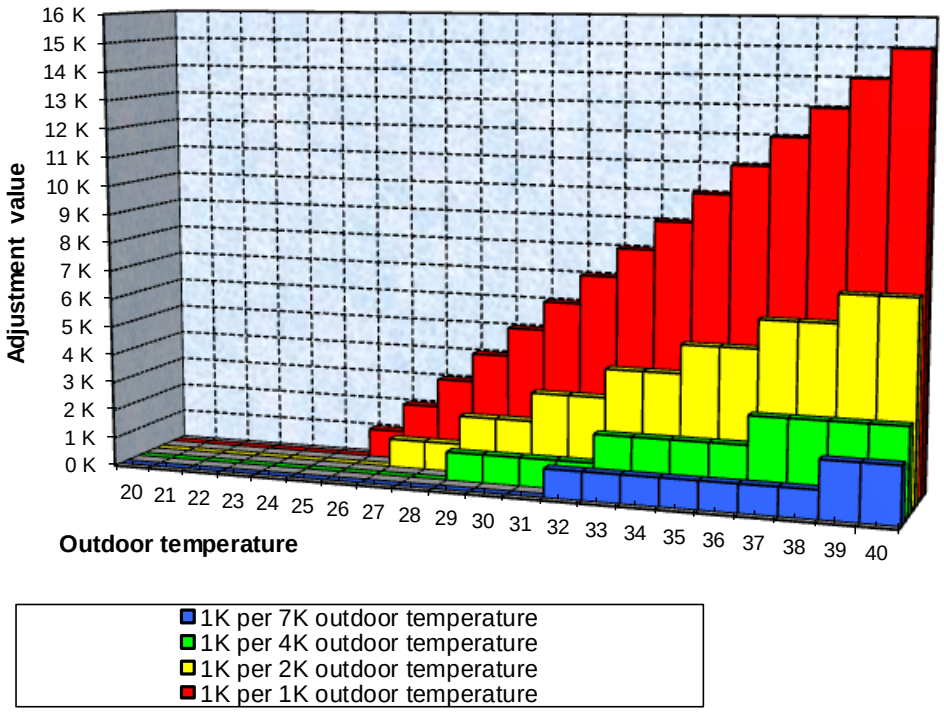


Table 60: Correction values

Outdoor temp.	1K/1K	1K/2K	1K/3K	1K/4K	1K/5K	1K/6K	1K/7K
20	0 K	0 K	0 K	0 K	0 K	0 K	0 K
21	0 K	0 K	0 K	0 K	0 K	0 K	0 K
22	0 K	0 K	0 K	0 K	0 K	0 K	0 K
23	0 K	0 K	0 K	0 K	0 K	0 K	0 K
24	0 K	0 K	0 K	0 K	0 K	0 K	0 K
25	0 K	0 K	0 K	0 K	0 K	0 K	0 K
26	1 K	0 K	0 K	0 K	0 K	0 K	0 K
27	2 K	1 K	0 K	0 K	0 K	0 K	0 K
28	3 K	1 K	1 K	0 K	0 K	0 K	0 K
29	4 K	2 K	1 K	1 K	0 K	0 K	0 K
30	5 K	2 K	1 K	1 K	1 K	0 K	0 K
31	6 K	3 K	2 K	1 K	1 K	1 K	0 K
32	7 K	3 K	2 K	1 K	1 K	1 K	1 K
33	8 K	4 K	2 K	2 K	1 K	1 K	1 K
34	9 K	4 K	3 K	2 K	1 K	1 K	1 K
35	10 K	5 K	3 K	2 K	2 K	1 K	1 K
36	11 K	5 K	3 K	2 K	2 K	1 K	1 K
37	12 K	6 K	4 K	3 K	2 K	2 K	1 K
38	13 K	6 K	4 K	3 K	2 K	2 K	1 K
39	14 K	7 K	4 K	3 K	2 K	2 K	2 K
40	15 K	7 K	5 K	3 K	3 K	2 K	2 K

6.4.4 Format of setpoint correction: Absolute

Object 19 transmits the corrected setpoint to the bus for additional room thermostats.
It is typically linked to the room thermostat *base setpoint* object.

This setpoint is calculated of:
Base setpoint without correction + dead zone + adjustment.

Example:
Setpoint correction from: 25 °C, *base setpoint without correction*: 21 °C, *dead zone* = 2 K

Figure 11: Setpoint adjustment dependent on outdoor temperature

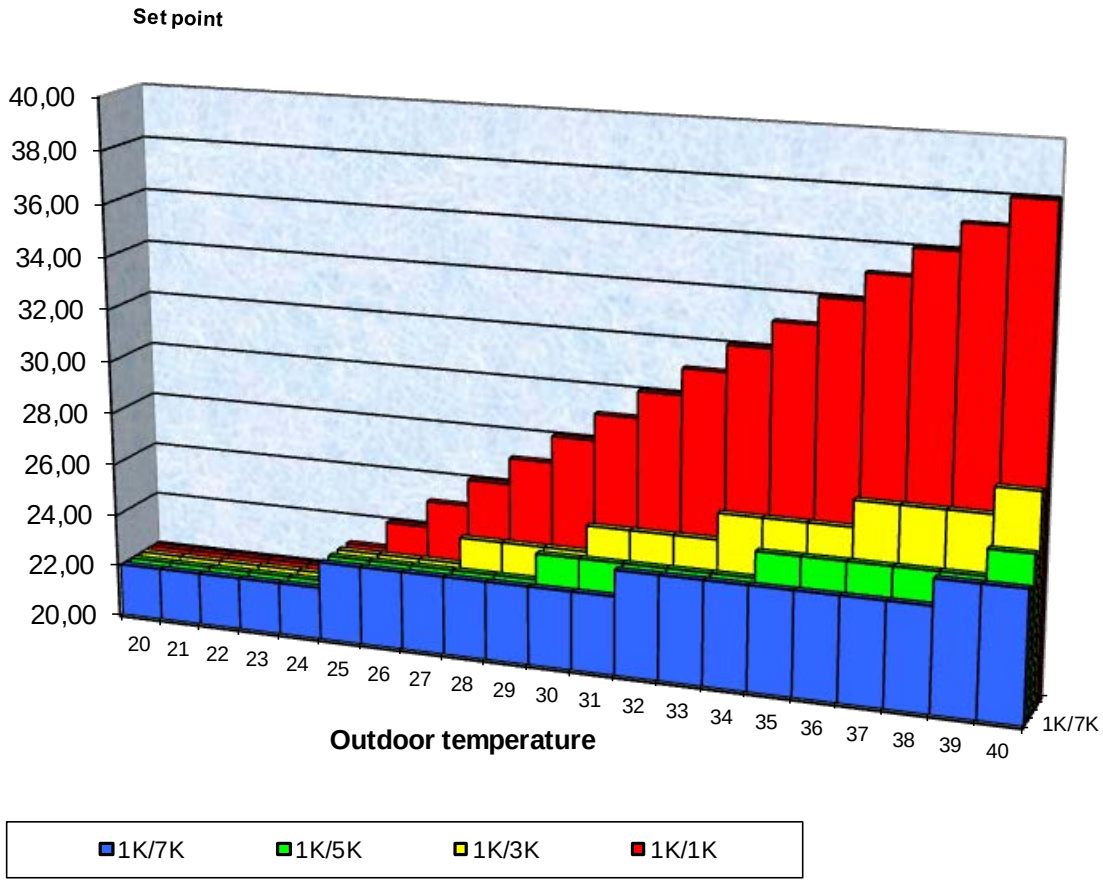


Table 61: Setpoints

Outdoor temp.	1K/1K	1K/2K	1K/3K	1K/4K	1K/5K	1K/6K	1K/7K
20	22.00	22.00	22.00	22.00	22.00	22.00	22.00
21	22.00	22.00	22.00	22.00	22.00	22.00	22.00
22	22.00	22.00	22.00	22.00	22.00	22.00	22.00
23	22.00	22.00	22.00	22.00	22.00	22.00	22.00
24	22.00	22.00	22.00	22.00	22.00	22.00	22.00
25	23.00	23.00	23.00	23.00	23.00	23.00	23.00
26	24.00	23.00	23.00	23.00	23.00	23.00	23.00
27	25.00	24.00	23.00	23.00	23.00	23.00	23.00
28	26.00	24.00	24.00	23.00	23.00	23.00	23.00
29	27.00	25.00	24.00	24.00	23.00	23.00	23.00
30	28.00	25.00	24.00	24.00	24.00	23.00	23.00
31	29.00	26.00	25.00	24.00	24.00	24.00	23.00
32	30.00	26.00	25.00	24.00	24.00	24.00	24.00
33	31.00	27.00	25.00	25.00	24.00	24.00	24.00
34	32.00	27.00	26.00	25.00	24.00	24.00	24.00
35	33.00	28.00	26.00	25.00	25.00	24.00	24.00
36	34.00	28.00	26.00	25.00	25.00	24.00	24.00
37	35.00	29.00	27.00	26.00	25.00	25.00	24.00
38	36.00	29.00	27.00	26.00	25.00	25.00	24.00
39	37.00	30.00	27.00	26.00	25.00	25.00	25.00
40	38.00	30.00	28.00	26.00	26.00	25.00	25.00

6.5 Frost protection (or heat protection) via window contact

6.5.1 with external controller

The window contact is connected to E1. The window status is transmitted to the bus by object 14 as a command to the external controller.
This can change automatically in frost or heat protection mode when a window is opened.

The *function of E1* parameter on the *E1* parameter page must be *E1 = window contact*.

6.5.2 with internal controller

This function is only possible if the *Objects for operating mode selection* parameter on the *Operating mode and operation* parameter page is set to *new: operating mode, presence, window status*.

The information "*window is open*" can be recorded in 2 ways:

- The window contact is connected to a binary input (e.g. BMG 6 *) and the window status is received on object 23.

- The window contact is connected to E2 (only possible with *Supported function = heating*).
  Important: The corresponding switch object (object 16 *Status E2*) has to be linked with object 23 (*Input window contact*) via the group address.
  FCA 2 will recognise when the window is opened and automatically switch to frost protection mode (heat protection mode).
  When the window is closed, the previously set operating mode will be restored.

* Order No.: 491 0 230

6.6 Dead zone

The dead zone is a buffer area between eating and cooling mode.
Within this dead zone neither heating nor cooling occurs.

Without this buffer area, the system would permanently switch between heating and cooling. As soon as the setpoint was fallen below, the heating would be activated. After hardly reaching the setpoint, the cooling would immediately start, the temperature would fall below the setpoint and switch on the heating again.

6.7 Determining the current operating mode

The current setpoint can be adjusted to the relevant requirements via the choice of operating mode.
The operating mode can be set via objects 21...23.
For this, there are two methods:

6.7.1 New operating modes

If New... is selected in the "Determination of operating mode" parameter on the "Operating mode" parameter page, the current operating mode can be defined as follows:

Table 62

Operating mode preset Object 21	Presence Object 22	Window status Object 23	current operating mode (object 24)
any	any	1	Frost/heat protection
any	1	0	Comfort
Comfort	0	0	Comfort
Standby	0	0	Standby
Night	0	0	Night
Frost/heat protection	0	0	Frost/heat protection

Typical application:

In the mornings, object 21 activates "Standby" or "Comfort", and "Night" in the evenings via a time switch (e.g. TR 648).
During holiday periods, frost/heat protection is selected via another channel of the time switch, also via object 21. Object 22 is connected to a presence detector. If presence is detected, FCA 2 switches to comfort operating mode (see table).
Object 23 is connected to a window contact via the bus (binary input).
As soon as a window is opened, FCA 2 switches to frost protection operating mode.

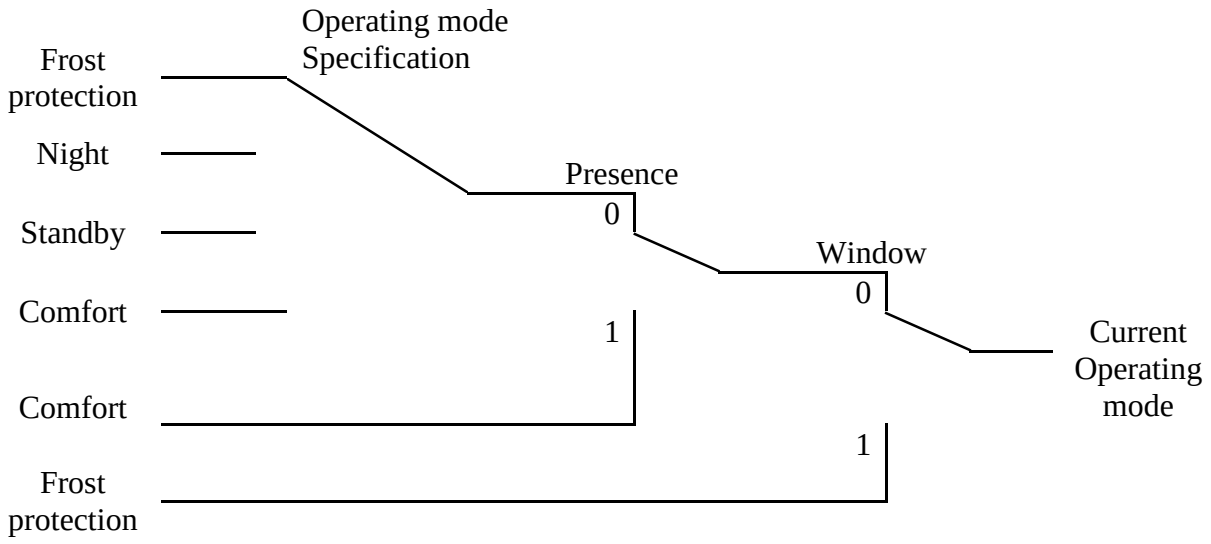


Figure 12

6.7.2 Old operating modes

If Old... is selected in the "Determination of operating mode" parameter on the "Operating mode" parameter page, the current operating mode can be defined as follows:

Table 63

Night Object 21	Comfort Object 22	Frost/heat protection object 23	current operating mode Object 24
any	any	1	Frost/heat protection
any	1	0	Comfort
Standby	0	0	Standby
Night	0	0	Night

Typical application: In the mornings, "standby" mode, and in the evenings "night" mode are activated by a time switch via object 21.

In holiday periods, frost/heat protection is selected via another channel of the time switch via Object 23.
Object 22 (comfort) is connected to a presence detector. If presence is detected, FCA 2 switches to comfort operating mode (see table).
Object 23 is linked with a window contact: As soon as a window is opened, FCA 2 switches to frost protection mode.

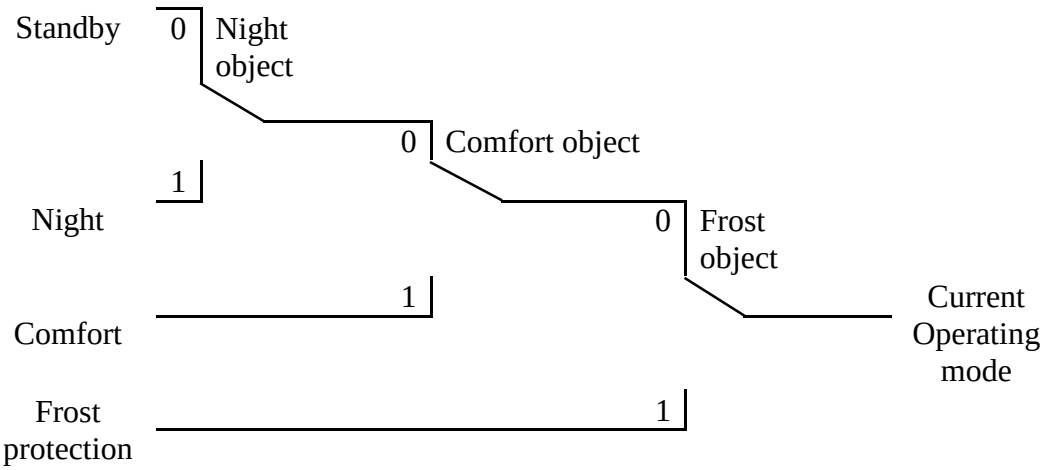


Figure 13

The old method has 2 disadvantages over the new method:

1. To switch from Comfort to Night operating mode, 2 telegrams (2 time switch channels if necessary) are required: Object 4 must be set to "0" and Object 3 to "1".
2. If the window is opened and then closed again during periods when "Frost/heat protection" is selected via the time switch, the "Frost/heat protection" mode is cleared.

6.7.3 Determination of the setpoint

6.7.3.1 Setpoint calculation in heating mode

Table 64: Current setpoint during heating

Operating mode	Current setpoint
Comfort	Base setpoint* +/- setpoint offset
Standby	Base setpoint* +/- setpoint offset – reduction in standby mode
Night	Base setpoint* +/- setpoint offset – reduction in night mode
Frost/heat protection	configured setpoint for frost protection mode

* *Base setpoint after reset*

Example:
Heating in comfort mode.

Table 65: Parameter settings:

Parameter page	Parameters	Setting
Setpoints	Base setpoint after reset	21 °C
	Reduction in standby mode (when heating)	2 K
Operating mode and operation	Limitation of manual offset	+/- 2 K

The setpoint was previously increased via object 25 by 1 K.

Calculation:

Current setpoint = base setpoint + setpoint offset
= 21 °C + 1 K
= 22 °C

If operation is switched to standby mode, the current setpoint is calculated as follows:

Current setpoint = base setpoint + setpoint offset – reduction in standby mode
= 21 °C + 1 K – 2 K
= 20 °C

6.7.3.2 Setpoint calculation in cooling mode

Table 66: Current setpoint during cooling

Operating mode	Current setpoint
Comfort	Base setpoint* + Setpoint offset + dead zone
Standby	Base setpoint* + setpoint offset + dead zone + increase in standby mode
Night	Base setpoint* + setpoint offset + dead zone + increase in night mode
Frost/heat protection	configured setpoint for heat protection mode

* *Base setpoint after reset*

Example:
Cooling in comfort mode.

The room temperature is too high and FCA 2 has switched to cooling mode.

Table 67: Parameter settings:

Parameter page	Parameters	Setting
General	Supported function	Heating and cooling
Setpoints	Base setpoint after reset	21 °C
Cooling setpoints	Dead zone between heating and cooling	2 K
	Increase in standby operation	2 K
Operating mode and operation	Limitation of manual offset	+/- 2 K

The setpoint was previously lowered by 1 K via object 25.

Calculation:

Current setpoint = *base setpoint + setpoint offset + dead zone*
= 21 °C - 1 K + 2 K
= 22 °C

Changing to standby mode causes a further increase in the setpoint (energy saving) and results in the following setpoint.
Setpoint = *base setpoint + setpoint offset + dead zone + increase in standby mode*
= 21 °C - 1 K + 2 K + 2 K
= 24 °C

6.7.4 Heating and cooling in the 2-pipe system

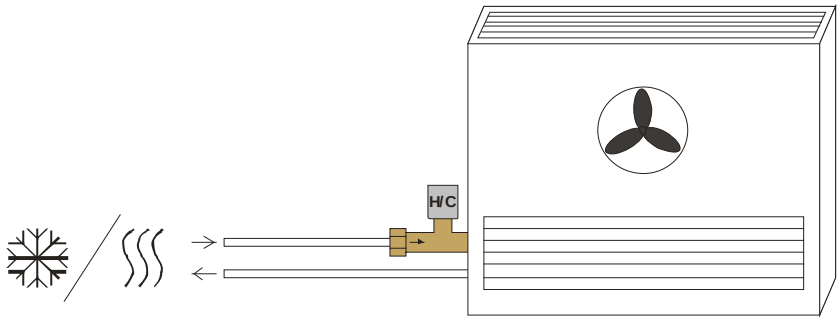


Figure 14

The following points must be observed for use in a 2-pipe heating/cooling system:

- In the 2-pipe system, heating and cooling mediums (depending on the season) are lead through the same lines and controlled via the same valve.
  This is connected to the terminals for valve *V1*.

- The changeover between heating and cooling medium is performed by the system, and must therefore be passed on to the controller.
  The heating/cooling system must send a 0 for heating mode and a 1 for cooling mode to Object 1 "Changeover between heating and cooling" in FCA 2.

6.7.5 Heating and cooling in the 4-pipe system

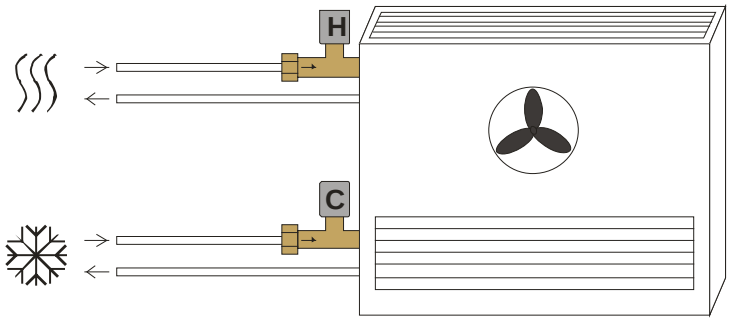


Figure 15

When used in a 4-pipe heating/cooling system, the heating valve is connected to the *V1* terminals, and the cooling valve to the *V2* terminals.

6.8 Fan control

6.8.1 Priorities

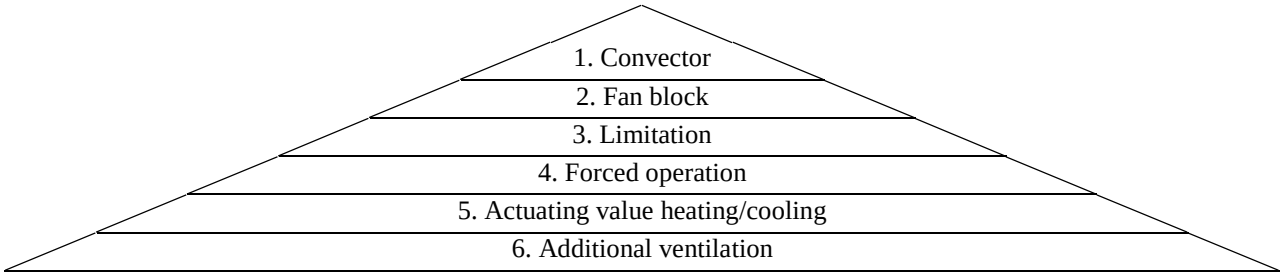


Figure 16

The *heating system = convector / fan coil* and *cooling system = convector / fan coil* parameters have the highest priority (1.). The fan is not actuated with the convector.

The *additional ventilation* parameter has the lowest priority and is only activated if the fan is to be switched off due to the actuating value and *additional ventilation* is permitted via parameters.

Important:
In the standard heating or cooling mode, the *Open from actuating value* parameter is taken into account (*Heating valve, cooling valve* or *heating/cooling valve* parameter page).

Table 68: Example with *Open from actuating value* = 40 % parameter:

Actuating value	Fan behaviour
1 .. 39 %	The fan does not start because the valve has not been opened*.
40 % .. 100 %	The corresponding fan stage is accepted

*The *Additional ventilation* function can still be used.

6.8.2 Fan forced mode with RAM 713 Fan Coil

This function allows the fan stage to be preset manually, either by using the button on the RAM 713 Fan Coil or via the bus.
It can be time-controlled or permanently activated or blocked on the *Operation* (RAM) parameter page.

Table 69: Button operation RAM 713 Fan Coil

Button push	Standard	0-10 V	LED
1	Fan off	Fan off	OFF
2	Fan stage 1	received forced actuating value	1
3	Fan stage 2	received forced actuating value	2
4	Fan stage 3	received forced actuating value	3
5	Auto	Auto	Auto

Comment: Forced operation can be triggered by 1 or 0.
See *Change over fan between auto and forced* parameter on the *General* parameter page.

With fan control = standard:
The receiving forced actuating value (object 8) is taken over as fan stage between 0 and 3.

With fan control = 0-10 V:
The receiving forced actuating value (object 8) is taken over as setpoint.

Transmission behaviour in forced operation = 1:
Object 17 (RAM 713 FC) sends 1 to the fan coil actuator (object 15) thereby triggering forced operation. Object 16 (RAM 713 FC) sends the actuating value (to object 8) for the selected fan stage in accordance with the set threshold.
Forced operation can be ended with a telegram to object 15, and automatic operation can be restored.

Transmission behaviour in forced operation = 0:
Object 16 (RAM 713 FC) sends the actuating value (to object 8) for the selected fan stage in accordance with the set threshold, and thus triggers forced operation.
Object 15 is reset to 0.
Comment: As long as it was not sent to object 15, the reception of a forced actuating value on object 8 is sufficient to trigger forced operation.

Forced operation can be ended with a telegram to object 15, and automatic operation can be restored.

Important with standard fan control: The received forced actuating value should always be higher than the threshold setting of the fan coil actuator.

Table 70: Example for standard fan

Threshold for fan stage	Set values for RAM 713 Fan Coil	Recommended values for FCA 2
1	25 %	10 %
2	55 %	40 %
3	85 %	70 %

If fan stage 2 is selected, object 16 (RAM) sends the actuating value 55 %.
As the threshold for stage 2 in the fan coil actuator is set at 40 %, the received actuating value of 55 % is clearly allocated to fan stage 2 and accepted by the fan.

6.8.3 Time between heating and cooling and overrun phase

When switching between heating and cooling, the heating valve is first closed; the *Overrun time for utilisation of remaining energy* starts simultaneously (if configured).
After the heating valve is closed, the configured *Time between heating and cooling* runs.

The overrun phase can continue during this time. The cooling valve can be opened at the end of the overrun phase.
In this case, the overrun phase will be interrupted if it has not already ended.
If the cooling valve does not have to be opened because the room temperature is in the dead zone, the overrun phase may continue.
The same procedure applies when switching between cooling and heating.
As soon as the heating valve is opened, the *warm start* phase starts if desired.

Overrun time for utilisation of remaining energy:

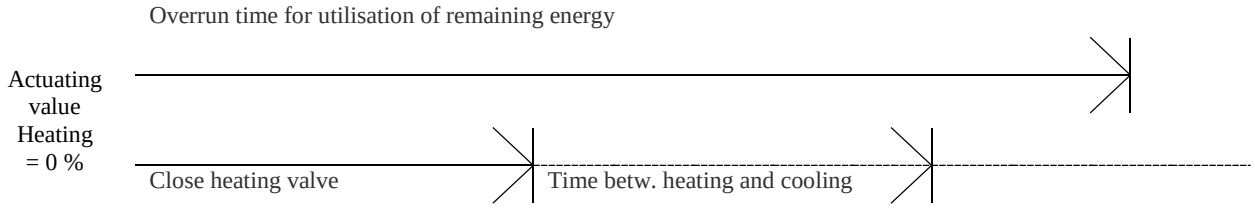


Figure 17

Transition between heating and cooling.

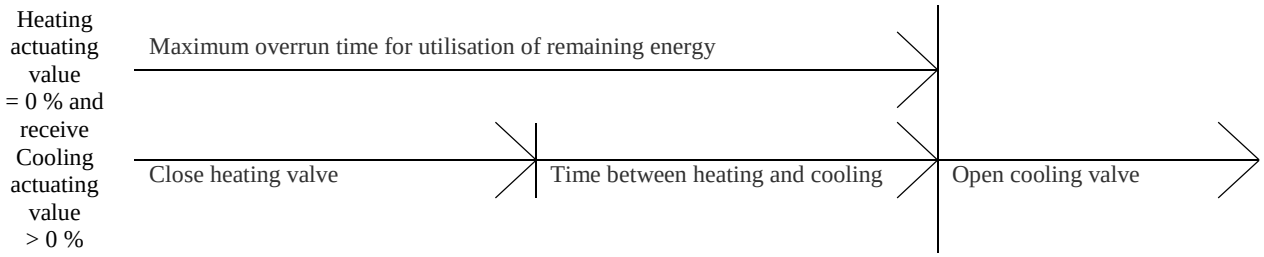


Figure 18

Transition between cooling and heating.

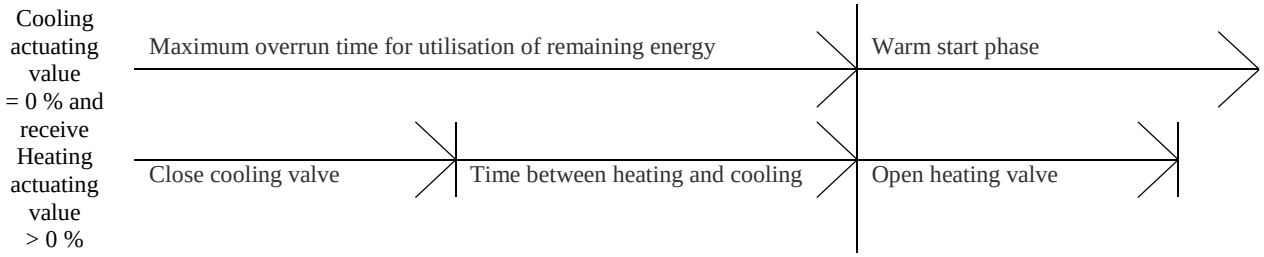


Figure 19

6.8.4 Hysteresis

To avoid unnecessary switching back and to between fan stages they are switched with a fixed hysteresis of 10 %.
The next higher fan stage is assumed when the actuating value has reached the switch-on threshold.
The next lower fan stage is only assumed if the actuating value has reduced by the value of the hysteresis (see figure).

Example:
Switch-on threshold for fan stage 1 = 10 %
Switch-on threshold for fan stage 2 = 40 %
Switch-on threshold for fan stage 3 = 70 %

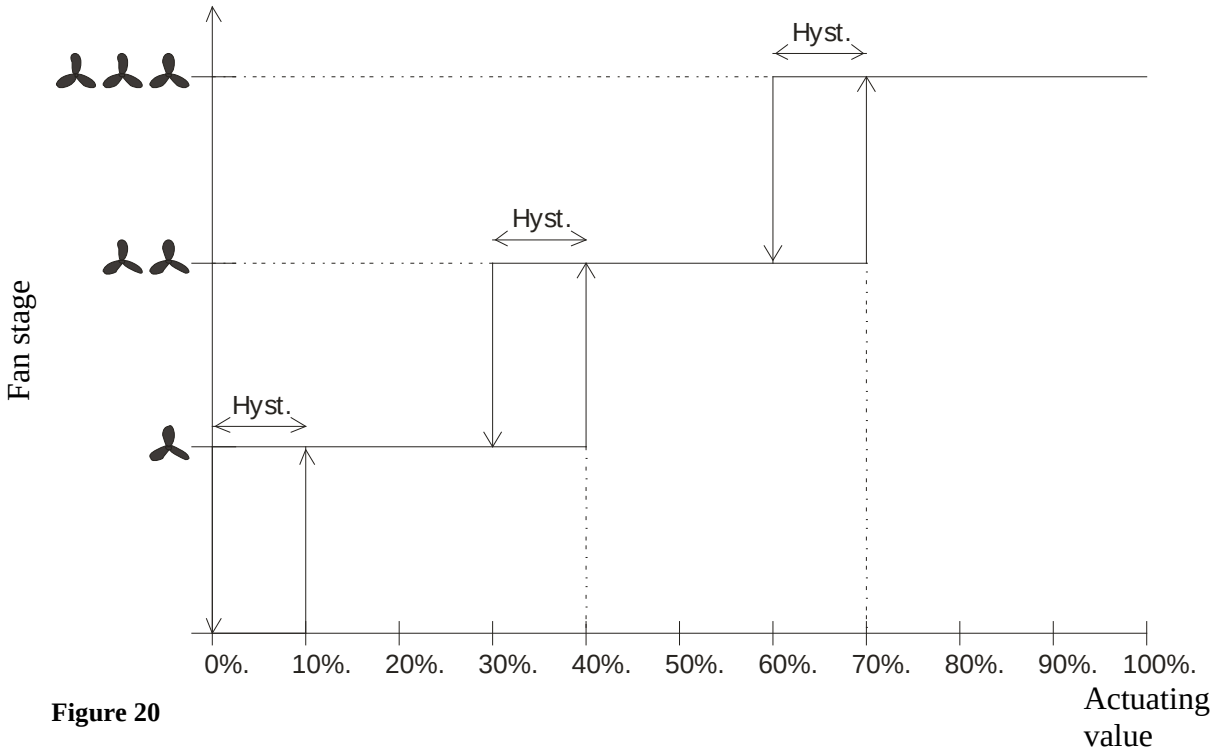


Figure 20

6.9 Temperature control

6.9.1 Introduction

The internal controller can either be used as a P or a PI controller, although the PI control is preferred.

With the proportional controller (P controller), the actuating value is statically adjusted to the control deviation.
The proportional integral controller (PI controller) is far more flexible, i.e. it controls dynamically, i.e. more quickly and more accurately.

To explain the function of both temperature controls, the following example compares the room to be heated with a vessel

The filling level of the vessel denotes the room temperature.
The water feed stands for the radiator output.
The heat losses of the room are shown by a discharge.

In our example, the maximum feed is assumed at 4 litres per minute and at the same time is the maximum heat output of the radiator.
This maximum output is achieved with an actuating value of 100 %.
Accordingly, with an actuating value of 50 % only half of the water volume, i.e. 2 litres per minute, would flow into our vessel.

The bandwidth is 4 l.
This means, the controller will control at 100 %, as long as the actual value will be smaller or equal
(21 l – 4 l) = 17 l.

Task:

- Desired filling volume:
  21 litres (= setpoint)
- When should the feed be reduced, in order to prevent an overflow? :
  4 l below the desired filling volume, i.e. at 21 l – 4 l = 17 l (= bandwidth)
- Original filling volume
  15 l (=actual value)
- The losses are 1 l/minute

6.9.2 Response of the P controller

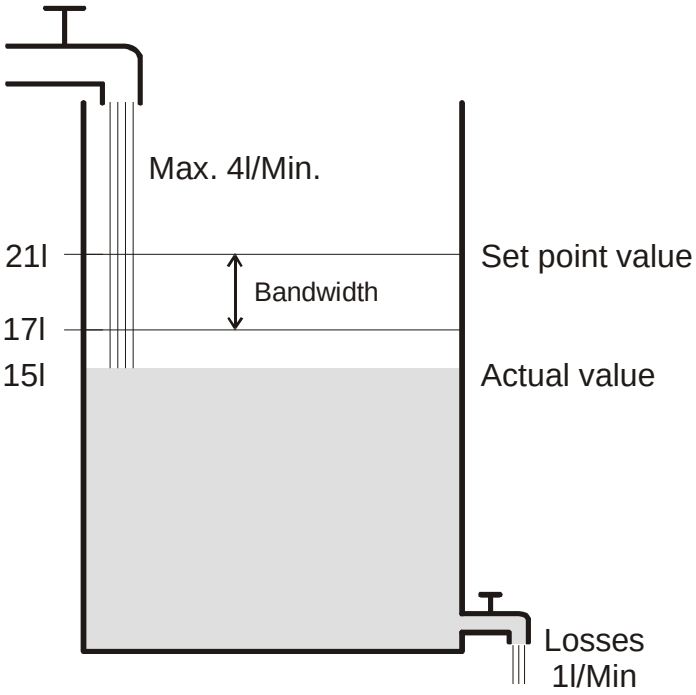


Figure 21

If the filling quantity is 15 l, there is a control deviation of 21 l – 15 l = 6 l
As our actual value lies outside the bandwidth, the control will operate the feed at 100 %, i.e. with 4 l/minute.

The feed quantity (= actuating value) is calculated from the control deviation (setpoint – actual value) und the bandwidth.
Actuating value = (control deviation / bandwidth) x 100

The following table illustrates the behaviour and also the limits of the P controller.

Table 71

Filling level	Actuating value	Feed	Losses	Increase of filling level
15 l	100 %	4 l/min	1 l/min	3 l/min
19 l	50 %	2 l/min		1 l/min
20 l	25 %	1 l/min		0 l/min

The last line shows that the filling level cannot be increased anymore, because the inlet feeds as much water as can be discharged by the losses.
The result is a permanent control deviation of 1 l. The setpoint can never be achieved.
If the losses were increased by 1 l, the permanent control deviation would be increased by the same amount, and the filling level would never exceed the 19 l mark.
In case of a room, this would mean that the control deviation increases with decreasing outdoor temperature.

P controller as temperature controller

Just as in the previous example, the P controller behaves in a heating control.
The setpoint temperature (21 °C) can never be completely reached.

The permanent control deviation is increased the higher the heat losses, i.e. the colder the outdoor temperatures.

6.9.3 Response of the PI controller

In contrast to the pure P controller, the PI controller functions dynamically.
With this type of controller, the actuating value remains unchanged, even at a constant deviation.

At the first moment, the PI controller sends the same actuating value as the P controller.
However, this will be increased further the longer the setpoint will not be reached.
This increase is time-controlled over the so-called integration time.
During this calculation method, the actuating value will not be changed anymore when the setpoint equals the actual value.
In our example, this results in the balance between feed and discharge.

Note on temperature control:

A good control depends on the adjustment of bandwidth and integration time with the room to be heated.
The bandwidth influences the increment of the actuating value change:
Large bandwidth = finer increments for the actuating value change.
The integration time influences the response time to temperature changes:
Long integration time = slow response.
Poor adjustment can result in either the setpoint value being exceeded (overshoot), or the controller taking too long to reach the setpoint value.
The best results are generally achieved using the standard settings.