RAM 713 Fan Coil room thermostat

RAM 713 Fan Coil	713 9 202

Contents

1 Functional characteristics

The RAM 713 FAN COIL room thermostat is a continuous EIB room thermostat for ventilator convectors (fan coil) in 2 and 4 pipe systems.
It measures the current room temperature (actual value) and sends a continuous control variable (0...100%) to a fan coil actuator (FCA 1 order no. 492 0 200) to achieve the desired room temperature (setpoint value).

The RAM 713 fan coil works in both heating and cooling modes.
A fan step can also be selected manually via a button.

3 binary inputs (see external interface) are available for connecting switches or buttons (floating) for switching, dimming or controlling blinds.
The blinds and dimmer channels can also be controlled with a single button (single-surface operation)
An external temperature sensor can alternatively be connected to input 3 (analogue).

In order to easily adapt to the setpoint values in respect of living comfort and energy saving, RAM 713 FAN COIL has four operating modes:

- Comfort
- Standby
- Night mode
- Frost protection mode

A setpoint value is assigned to each operating mode.

comfort mode is used when the room is occupied

The setpoint value is reduced slightly in **standby mode**. This operating mode is used when the room is not occupied but is expected to be shortly.

The setpoint value is drastically reduced in **night mode** as the room is not expected to be occupied for several hours.

In **frost protection mode** , the room is controlled to a temperature that eliminates the risk of damage to the radiators through freezing at low outdoor temperatures.
This can be desirable for 2 reasons:
- The room is not occupied for several days.
- A window has been opened and no further heating is required for the time being.

The operating modes are usually controlled by a time switch.
However, a presence detector and/or presence keys and window contacts are recommended for optimum control.
See determining the setpoint value chapter.

1.1 Operation

The RAM 713 FAN COIL is fitted with a rotary control and 5 LEDs to display the current fan step.
The fan step can also be set manually using the button to the right of the LEDs (forced mode).

1.2 The device LEDs

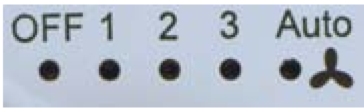


Table 1

LED	Display	Description
Auto	Fan is in automatic mode	Fan step is controlled, as configured, depending on the control variable. See *operation parameter page* .
0	Fan step 0 = fan is off.	Forced mode: Fan step is selected manually by pressing the button.
1	Fan step 1	
2	Fan step 2	
3	Fan step 3	

Depending on the configuration, the rotary control can be used for either setpoint **adjustment** or for setpoint **offset**.

1.3 Benefits of RAM 713 FAN COIL

- Continuous PI room thermostat
- Fan step can be preselected manually
- Operating mode change via presence and window objects
- Heating and cooling operation
- Rotary control for setting or offsetting setpoint value
- Infinite regulation through continuous control variable
- 3 Binary inputs for conventional control of switch, dimmer and blinds actuators
- Third input also for external temperature sensor for determining room temperature
- Adjustable effect with binary inputs
- Blinds and dimmers can also be controlled using single-surface operation

1.3.1 Special features

RAM 713 FAN COIL has 3 external inputs for buttons, switches or an external sensor. These can be used to control switch, dimmer or blinds actuators.

2 Technical data

Power supply:	Bus voltage
Permitted operating temperature:	0°C ...+ 50°C
Protection class:	III
Protection rating:	EN 60529: IP 21
Dimensions:	HxWxD 80x84x28 (mm)

Inputs:

Quantity:	3
Contact voltage:	3.3 V internal provided
Contact current:	1 mA
Maximum line length:	5 m

3 The application program "*RAM 713 FAN COIL V1.3*"

3.1 *Selection in the product database*

Manufacturer	Theben AG
Product family	Heating, ventilation, air conditioning
Product type	Fan coil controller
Program name	*RAM 713 Fan Coil with switching, dimming, blinds V1.2*[(1)] **RAM 713 Fan Coil with switching, dimming, blinds V1.2**[(2)]

[(1)] For devices before Sept. 2011
[(2)] For devices from Sept. 2011, with V1.3 marking.

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

3.2 *Parameter pages*

Table 2

Function	Description
Settings	Device type and activation of external interface.
Setpoint values	Setpoint value after download, values for night, frost mode etc.
Setpoint values for cooling	Dead zone and temperature increases conditional on the operating mode
Operation	Rotary control and button functions.
Actual value	Sensor type/function, calibration
Control	System type, heating/ cooling parameters etc.
Operating mode	Operating mode after reset, presence sensor
Input E1...E3	Function of connected contact, switches, dimmers, blinds.

3.3 Communication objects

3.3.1 Object characteristics

RAM 713 FAN COIL features 12 communication objects.
Some objects can assume various functions depending on their configuration.

Table 3

No	Function	Object name	Type	Flags			
				C	R	W	T
0	*Defining the setpoint temperature*	*Basesetpointvalue*	2 bytes EIS5	✓	✓	✓	
	offset	*Manual setpoint offset*	2 bytes EIS5	✓	✓	✓	
1	*report current setpoint value*	*currents etpointvalue*	2 bytes EIS5	✓	✓		✓
2	*Send actual value*	*Actual value*	2 bytes EIS5	✓	✓		✓
3	*Operating mode preset*	*Operating mode preset*	1 byte KNX	✓	✓	✓	
	1 = night, 0 = standby	*Night < - > Standby*	1-bit EIS1	✓	✓	✓	
4	*Input for presence signal*	*Presence*	1-bit EIS1	✓	✓	✓	
	1 = Comfort	*Comfort*	1-bit EIS1	✓	✓	✓	
5	*Input for windowstatus*	*Window position*	1-bit EIS1	✓	✓	✓	
	1 = Frost protection	*Frost / heat protection*	1-bit EIS1	✓	✓	✓	
6	*report current operating mode*	*current operating mode*	1 byte KNX DTP	✓	✓		✓
7	*Send current control variable*	*Heating control variable*	1-byte EIS6	✓			✓
	Send current control variable	*Heating and cooling control variable*	1-byte EIS6	✓			✓
8	*Send control variable*	*Cooling control variable*	1-byte EIS6	✓			✓
				C	R	W	T

Continuation:

No.	Function	Object name	Type	Flags			
				C	R	W	T
9	*Send switch telegram*	*Switching input 1*	1-bit EIS1	✓	✓	✓	✓
	Send ON/OFF telegram	*Dimmer E1 On/Off*		✓	✓	✓	✓
	Send ON/OFF telegram	*Dimmer E1/E2 On/Off*		✓	✓	✓	✓
	Slats	*Blinds E1 Step/Stop*		✓	✓		✓
	Slats	*Blinds E1/E2 Step/Stop*		✓	✓		✓
10	*Send Up/Down telegram*	*Blinds E1 Up/Down*	1-bit EIS1	✓	✓		✓
	Send dim telegram	*Dimmer E1*	4-bit EIS2	✓	✓		✓
11	*Send switch telegram*	*Switching input 2*	1-bit EIS 1	✓	✓	✓	✓
	Send ON/OFF telegram	*Dimmer E2 On/Off*		✓	✓	✓	✓
	Slats	*Blinds E2 Step/Stop*		✓	✓		✓
12	*Blinds E2 Up/Down*	*Send Up/Down telegram*	1-bit EIS 1	✓	✓		✓
	Blinds E1/E2 Up/Down	*Send Up/Down telegram*		✓	✓		✓
	Dimmer E2	*Send dim telegram*	4-bit EIS2	✓	✓		✓
	Dimmer E1/E2	*Send dim telegram*		✓	✓		✓
13	*Send switch telegram*	*Switching input 3*	1-bit EIS1	✓	✓	✓	✓
	Send ON/OFF telegram	*Dimmer E3 On/Off*		✓	✓	✓	✓
	Slats	*Blinds E3 Step/Stop*		✓	✓		✓
14	*Blinds E2 Up/Down*	*Send Up/Down telegram*	1-bit EIS1	✓	✓		✓
	Dimmer E3	*Send dim telegram*	4-bit EIS2	✓	✓		✓
15	*Heating = 0, Cooling = 1*	*Switchover between heating and cooling*	1-bit EIS1	✓	✓	✓	
16	*send/receive*	*Forced fan step*	1-byte EIS 6	✓	✓	✓	✓
17	*0 = Auto / 1 = Forced*	*Fan forced/auto mode*	1-bit EIS1	✓	✓	✓	✓
				C	R	W	T

Table 4: Communication flags

Flag	Name	Meaning
C	Communication	Object can communicate
R	Read	Object status can be viewed (ETS / display etc.)
W	Write	Object can receive
T	Transmit	Object can transmit

Table 5

Number of communication objects	18
Number of group addresses	34
Number of associations	35

3.3.2 Description of objects

- **Object 0 "*base setpoint value*" / "*manual setpoint value offset*"**

This object can assume 2 different functions.
Depending on the configuration of the rotary control, a new setpoint temperature can be set or the current setpoint temperature offset by a certain value

Table 6.

Parameters: *Rotary control function*	Object function
Manual offset for internal controller *disabled, but base setpoint value object available*	**Defining the setpoint temperature:** The base setpoint value is first specified at start-up and stored in the *base setpoint value* object. It can be reset at any time using object 0 (limited by minimum or maximum valid setpoint value). If the bus voltage fails, this object is backed up and the last value is restored when the bus voltage returns. The object can be described as required.
Base setpoint value for internal controller *disabled, but manual offset object available*	Offset setpoint temperature: The object receives a temperature differential in EIS 5 format. The desired room temperature (current setpoint value) can be adjusted from the base setpoint value by this differential. The following applies in comfort mode (heating): current setpoint value (object 1) = base setpoint value (rotary control) + manual setpoint value offset (object 0) Values outside the configurable range (see *Max. rotary control setpoint value offset*) are limited to the highest or lowest value. Note: The offset always refers to the set base setpoint value and not to the current setpoint value.
Manual offset with report object, e.g. for FCA 1	Object 0 sends the rotary control offset to the fan coil actuator FCA 1.

- **Object 1 "*current setpoint value*"**

This object sends the current setpoint temperature as a EIS 5 telegram (2 bytes) to the bus.
The send response can be set on the *setpoint values* parameter page.

- **Object 2 *“actual value”***

This object sends the temperature currently being measured by the sensor (if sending via configuration is permitted)

- **Object 3 *"operating mode preset" / "night <-> standby"***

The function of this object depends on the *objects for setting operating mode* parameter on the *operating mode* parameter page.

Table 7

Objects for determining the operating mode	Object function
new: Operating mode, presence, window status	1-byte object for selection of one of 4 operating modes. 1 = Comfort, 2 = Standby, 3 = Night, 4 = Frost protection (heat protection) If another value is received (0 or >4) the comfort operating mode is activated. The details in brackets refer to cooling mode
old: Comfort, night, frost	With this setting, this object is a 1-bit object. Night or standby operating mode can be activated. 0=Standby 1=Night

- **Object 4 *"presence" / "comfort"***

The function of this object depends on the *objects for setting operating mode* parameter on the *operating mode* parameter page.

Table 8

Objects for determining the operating mode	Object function
new: Operating mode, presence, window status	**Presence:** The status of a presence indicator (e.g. sensor, 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 deactivated by sending a 0 to the object.

- **Object 5 “window position” / “frost/heat protection”**

The function of this object depends on the *objects for setting operating mode* parameter on the *operating mode* parameter page.

Table 9

Objects for determining the operating mode	Object function
new: Operating mode, presence, window status	**Window position:** 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. The heat protection mode is activated during cooling. The frost/heat protection operating mode takes top priority. The frost/heat protection mode remains until it is cleared again by entering 0.

- **Object 6 "current operating mode"**

Transmits the current operating mode as a 1 byte value (see below: Coding of operating modes).
The send response can be set on the *operating mode* parameter page.

Table 10: Coding of HVAC operating modes:

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

- **Object 7 *“heating control variable” / “heating and cooling control variable”***

Sends the current heating control variable (0...100%) or heating or cooling with 2-pipe system. See *fan coil system used* parameter on the *control*parameter page.

- **Object 8 *"cooling control variable"***

Sends the cooling control variable in EIS 6 format

- **Objects 9, 10, 11, 12, 13, 14 for inputs *E1*, *E2* and *E3***

These objects are available when the interface on the *settings* parameter page is activated.

Their function is dependent on the *function of E1*, *function of E2* and *function of E3* parameters on the relevant parameter pages (input E1, E2 and E3).

A detailed description can be found in the appendix under the heading: External interface.

- **Object 15 *"switching between heating and cooling"***

This object is used in 2-pipe heating/cooling systems or if automatic switching between heating and cooling is not required.
The cooling operation is forced via 1 and the heating operation via 0.

- **Object 16 *"fan step in forced mode"***

The fan step can be set manually by pressing the button on the device.
This object then sends a percentage value that corresponds to the configured threshold values.

This function can be blocked or time limited or work permanently via a parameter.

See *operation* parameter page and Fan forced mode in the appendix.

- **Object 17** ***"fan forced/ auto "***

Sends when a forced fan step is selected using the button.
This puts the fan coil actuator (FCA 1) in forced mode.

The forced mode is triggered via 0 or 1 depending on the application.
→ See *switch fan between auto and forced* parameter on the *operating* parameter page.
The object status is inverted when automatic mode is restored.

The following settings apply for the fan coil actuator FCA 1: Forced= 1, / Auto = 0

3.4 Parameters

The standard values are **in bold**.

3.4.1 Settings

Table 11

Designation	Values	Meaning
Device type	**RAM 713 Fan Coil**	Fixed setting
Function of external interface	**none** active	Determines whether external interface is being used.

3.4.2 Setpoint values

Table 12

Designation	Values	Meaning
Basesetpoint value after downloading application	*18 °C, 19 °C, 20 °C,* ***21 °C****, 22 °C, 23 °C, 24 °C, 25 °C*	Output setpoint value for temperature control.
Minimum valid base setpoint value	*5°C,* ***6°C****, 7°C, 8°C, 9°C, 10°C, 11°C, 12 °C, 13°C, 14°C, 15°C,16°C 17°C, 18°C, 19 °C, 20 °C*	If a base setpoint value received by object 0 is lower than the set value, it will be limited to this value.
Maximum valid base setpoint value	*20°C, 21°C, 22°C 23°C, 24 °C, 25°C 27 °C, 30 °C,* ***32 °C***	If a base setpoint value received by object 0 is higher than the set value, it will be limited to this value.
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*	Example: with a base setpoint value of 21°C in heating operation and a 2K reduction, RAM 713 FAN COIL controls at a setpoint value of 21 – 2 = 19°C
Reduction in night mode (during heating)	*3 K, 4 K,* ***5 K*** *6 K, 7 K, 8 K*	By what value should the temperature be reduced in night mode?
Setpoint value for frost protection operation (during heating)	*3 °C, 4 °C, 5 °C* ***6°C****, 7 °C, 8 °C 9 °C, 10 °C*	Preset temperature for frost protection operation in heating mode (Heat protection operation applies in cooling mode).
Setpoint value offset only applies	*in comfort mode* *with comfort and standby mode* ***with comfort, standby and night mode***	In which operating modes is setpoint value offset effective? This setting covers offsetting via bus telegram as well as via the rotary control.

Continuation:

Designation	Values	Meaning
current setpoint value in comfort mode		Feedback of current setpoint value via the bus:
	Sends actual value (heating < > cooling)	The setpoint value actually being controlled is always sent (= currelnt setpointvalue). **Example** with basesetpointvalue 21°C and *dead zone* 2K: During heating and cooling, 21°C and base setpoint value + dead zone are sent respectively (21°C + 2K = 23°C)
	Transmits average value between heating and cooling	Same value in comfort operation mode during both heating and cooling operation, i.e.: Base setpoint value + half dead zone are transmitted to prevent occupants being inconvenienced. **Example** with base setpointvalue 21°C and deadzone 2K: Mean value= 21°+1K =22°C Although control takes place at 21°C or 23°C
cyclical transmission of current setpoint value		How often should the currently valid setpoint value be sent?
	not cyclical, only in the event of change	only send in the event of a change.
	every 2 min. *every 3 min.* *every 5 min.* *every 10 min.* *every 15 min.* *every 20 min.* *every 30 min.* *every 45 min.* *every 60 min.*	send cyclically

3.4.3 Cooling setpoint values

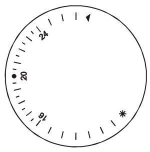
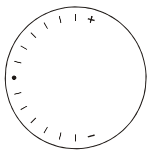
This page is only displayed only if the *“heating and cooling”* control function has been selected on the *settings* parameter page (*user-defined*control).

Table 13

Designation	Values	Meaning
Dead zone between heating and cooling	*1 K* ***2 K*** *3 K* *4 K* *5 K* *6 K*	Specifies the buffer zone between setpoint values in heating and cooling modes. The dead zone is expanded through hysteresis in switching (2 point) control. See glossary: Dead zone
Increase 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*	The temperature is increased in standby mode during cooling operation
Increase in night mode (during cooling)	*3 K, 4 K,* ***5 K*** *6 K, 7 K, 8 K*	See increase in standby mode
Setpoint value for heat protection mode (during cooling)	***42 °C (does not represent 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

3.4.4 Operation

Table 14

Designation	*Values*	Meaning
Function of the rotary control	*Base setpoint value for internal controller* *(please using the following rotary control)* 	The rotary control is used for setting the base setpoint value. Setpoint value offset is possible via object 0 The rotary control with figures is plugged into the device.
	Manual offset for internal controller *(please using the following rotary control)* 	The base setpoint value can be increased or reduced within the configured limits via the rotary control (see next table column). The +/- rotary control is plugged into the device.
	Disabled, but base setpoint value object available	The rotary control does not function (protection from undesired operation). The base setpoint value can be changed in the application or via *object 0*.
	Disabled, but manual offset object available	The rotary control does not function (protection from undesired operation). The base setpoint value is changed in the application and can be increased or decreased via object 0.
	Manual offset with report object, e.g. for FCA 1	Control takes place in fan coil actuator. The RAM 713 Fan Coil only sends (object 0) the entered setpoint value offset to the internal controller of the fan coil actuators (e.g. FCA 1 order no. 4920200)

Continuation:

Designation	Values	Meaning
Maximum setpoint value offset on rotary control	*+/- 1 K,* ***+/- 2 K****, +/- 3 K +/- 4 K, +/- 5 K,*	Limits the possible setting range for the *setpoint value offset* function. Applicable for the received values above object 0 (*manual setpoint value offset*).
LED control	*always off* ***always active*** *Time limit active*	The LEDs are not used The auto LED lights up during automatic mode. The fan steps *Off, 1, 2, 3* are displayed in forced mode. The fan steps *Off, 1, 2, 3* are displayed for 10 seconds after the button is pressed in forced mode.
Switch fans between auto and forced	 ***via object forced/auto, forced = 1*** *via object auto/forced, forced = 0*	Effect of forced object to adapt to the used fan coil actuator. See appendix: Fan forced mode Setting for the Theben Fan Coil Actuator FCA 1 (Order no. 492 0 200) Forced mode is triggered by 1. Forced mode is triggered by 0.

Continuation:

Designation	Values	Meaning
Button function: Fan step	*disabled* ***continuous selection*** *select for 5 minutes* *select for 15 minutes*	Button is deactivated The fan step can be selected by pushing a button. The Fan Coil Actuator (FCA 1) is moved via a telegram from object 17 for an unlimited length of time to forcedmode. As above, except that forced mode ends when the selected time has expired.
Threshold value for fan step 1	*0,4%, is equivalent to value 1* *0,8%, is equivalent to value 2* *1,2%, is equivalent to value 3* *1,6%, is equivalent to value 4* *2 %, is equivalent to value 5* *0 %, 10 %, 20 %* *30 %, 40 %, 50 %* *60 %, 70 %, 80 %* *90 %, 100 %*	At what control variable should the first fan step switch on? The percentages are used in Fan Coil Aktor FCA 1 and in mostly every ventilation actuators. The values 1..5 are intended for ventilation actuators with EIS 14 command.
Threshold value for fan step 2 (greater than fan step 1 !!)	*0,4%, is equivalent to value 1* *0,8%, is equivalent to value 2* *1,2%, is equivalent to value 3* *1,6%, is equivalent to value 4* *2 %, is equivalent to value 5* *0 %, 10 %, 20 %* *30 %, 40 %, 50 %* *60 %, 70 %, 80 %* *90 %, 100 %*	At what control variable should the first fan step change to the second fan step? **Important:** The value for step 2 must always be greater than the set value for step 1
Threshold value for fan step 3 (higher than fan step 2 !!)	*0,4%, is equivalent to value 1* *0,8%, is equivalent to value 2* *1,2%, is equivalent to value 3* *1,6%, is equivalent to value 4* *2 %, is equivalent to value 5* *0 %, 10 %, 20 %* *30 %, 40 %, 50 %* *60 %, 70 %, 80 %* *90 %, 100 %*	At what control variable should the second fan step change to the third fan step? **Important:** The value for step 3 must always be greater than the values for the steps 1 and 2.

3.4.5 Actual value

Table 15

Designation	Values	Meaning
Use which actual value *or* *function of the external sensor**		Is the room temperature measured via the installed or via an external sensor?
	from internal sensor	The room temperature is measured in the device.
	Sensor for temperature control (flush-mounted housing)	Fixed setting, if E3 is configured for an external sensor. See the *function of E3* parameter on the *input E3*parameter page
Calibration value for internal sensor *In 1/10 K (-64 .. 63)*	*manual input -64 ... 63* *Default value =* ***0***	Positive or negative adjustment of measured temperature in 1/10 K increments. Examples: a) RAM 713 FAN COIL sends 20.3°C. A room temperature of 21.0°C is measured using a calibrated thermometer. In order to increase the temperature of RAM 713 FAN COIL to 21 °C, “7” (i.e. 7 x 0.1K) must be entered. b) RAM 713 FAN COIL sends 21.3°C. 20.5°C is measured. In order to reduce the temperature of RAM 713 FAN COIL to 20.5 °C, "-8" (i.e. -8 x 0.1K) must be entered.
*Calibration value for external sensor**	*manual input -64 ... 63* *Default value =* ***0***	See above, calibration value for internal sensor

Continuation:

Designation	Values	Meaning
Transmission of the actual value *or* *the external actual values**	*not in the event of change* *with change of 0.2 K* *with change of 0.3 K* ***with change of 0.5 K*** *with change of 0.7 K* *with change of 1 K* *with change of 1.5 K* *with change of 2 K*	Is the current room temperature to be transmitted? If yes, from which minimum change should this be resent? This setting keeps the bus load as low as possible.
Cyclical transmission of actual value *or* *cyclical transmission of external actual values**	*do not send cyclically* *every 2 min., every 3 min.* *every 5 min., every 10 min.* *every 15 min., every 20 min.* ***every 30 min**., every 45 min.* *every 60 min.*	How often should the actual value be sent, regardless of the temperature changes?

*If an external sensor is connected to input E3. See *input E3* parameter page. The interface must also be configured as active.
See *settings* parameter page.

3.4.6 Control

Designation	Values	Meaning
Fan coil system used	*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 two separate water circuits for heating and cooling.
*Switchover between heating and cooling**	***automatic*** *via object*	RAM 713 FAN COIL automatically switches to cooling mode when the actual temperature is above the setpoint value. The cooling mode can only be activated on the bus via object 15 (1= Cooling). Cooling mode remains off for as long as this object is not set (=0). Always via an object ⇒ in the 2-pipe system.
Sets the control parameters	***via system type*** *user-defined*	Standard application Professional application: Self-configure P/PI control
Device type for heating system	*Radiator heating* ***Fan coil unit***	PIcontrol with: Integrated time = 90 minutes Bandwidth = 2.5 k Integrated time = 180 minutes Bandwidth = 4 k
Device type for cooling system	*Cooling ceiling* ***Fan coil unit***	PI control with: Integrated time = 90 minutes Bandwidth = 2.5 k Integrated time = 180 minutes Bandwidth = 4 k

* Only available for 4-pipe system.
In the 2-pipe system, switching is always performed via object 15.

** Change since last transmission

Continuation

Designation	Values	Meaning
Transmission of control variable *Heating/cooling*	*with change of 1 %* *with change of 2 %* *with change of 3 %* ***with change of 5 %*** *with change of 7 %* *with change of 10 %* *with change of 15 %*	After what percentage change** in the control variable is the new value to be transmitted? Small values increase both the control accuracy and bus load.
cyclical transmission of heating/cooling control variables	*not cyclical, only in the event of change* *every 2 min., every 3 min.* *every 5 min., every 10 min.* *every 15 min., every 20 min.* *every 30 min., every 45 min.* ***every 60 min.,***	How often is the current heating control variable to be sent (regardless of changes)?
	User-defined control parameters	
Proportional band of heating 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 to adapt the control response to the room. Small values cause large changes in control variables, larger values cause finer control variable adjustment. See appendix: Temperature control
Integrated time of the heating 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.*	The integrated time determines the reaction time of the control. It lays down the increase that the output control variable is raised by, in addition to the P share. The I- share remains active for as long as there is a control deviation. The I share is added to the P share. See appendix: Response of PI control

Continuation

Designation	Values	Meaning
Proportional band of the cooling 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.
Integrated time of the cooling 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*	The integrated time determines the reaction time of the control. It lays down the increase that the output control variable is raised by, in addition to the P share. The I- share remains active for as long as there is a control deviation. The I share is added to the P share. See appendix: Response of the PI control

3.4.7 Operating mode

Table 16

Designation	Values	Meaning
Objects for determining the operating mode	*new: Operating mode, presence, window status* ***old: Comfort, night, frost (not recommended)***	RAM 713 FAN COIL can switch the operating mode depending on the window and presence contacts. Traditional setting without window and presence status.
Operating mode after reset	*Frost protection* *Night-time temperature reduction* ***Standby*** *Comfort*	Operating mode after start-up or reprogramming
*Type of presencesensor ** *(to object 4)*	 ***Presence detector*** *Presence keys*	The presence sensor activates the comfort operating mode Comfort operating mode as long as the presence object is set. 1. 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 state of the presence object ignored. 2. If the presence object is set during night / frost operation, it is reset after the configured comfort extension finishes (see below). 3. The presence object is not reported on the bus.

* See also appendix: Setting the presence object with setpoint value offset
Continuation

Designation	Values	Meaning
Comfort extension by presence keys in night mode	*none* *30 minutes.* *1 hour* *1.5 hours* ***2 hours*** *2.5 hours* *3 hours* *3.5 hours*	- Party switching: RAM 713 FAN COIL can switch again by the presence object from night / frost mode to comfort mode for a limited time. The time limit is omitted if the device was previously in standby mode. Comfort operation is only cleared with the next manual or bus controlled change of operating mode.
cyclical transmission of current operating mode	***not cyclical, only in the event of change*** *every 2 min., every 3 min.* *every 5 min., every 10 min.* *every 15 min., every 20 min.* *every 30 min., every 45 min.* *every 60 min.*	How often should the current operating mode be sent?

3.4.8 Inputs E1, E2, E3

Designation	Values	Meaning
	*Function of E1, E2 or. E3: **Switching***	
Reaction to closing the contact	*Off* ***On*** *By* *none*	Send switch-off command Send switch-on command Reverse last switching command Do not send
Reaction to opening the contact	***Off*** *On* *By* *none*	See above
send cyclically	***not cyclical, only in the event of change*** *every 2 min., every 3 min. … every 45 min, every 60 min*	At what intervals should the switching status of the switching object be sent?
	Function of E1 (+ E2): Blinds up (down)	
Function of E1	*Blinds up*	Short button push: Step/Stop or turn slats (object 9) Long button push: Up telegram (object 12)
Function of E2	*Blinds down*	Short button push: Step/Stop or turn slats (object 9) Long button push: Down telegram (object 12)
	Function of E1, E2, E3: Blinds single-surface operation	
Function of E1 *(or E2, E3)*	*Blinds single-surface operation*	Short button push: Step/Stop or turn slats . The sent value is opposite to the telegram of the last directional command Long button push: Up / Down Pushing the button again reverses the direction of run. Always starts with Down after bus failure or reset.

Continuation:

Designation	*Values*	Meaning
	Function of E1 (+ E2): Dim brighter / darker	
Function of E1	*Dim brighter*	Short button push: On / Off (object 9) Long button push: Brighter darker dimming (object 12)
Function of E2	*Dim darker*	Short button push: On / Off (object 9) Long button push: Darker dimming (object 12)
	Function of E1, E2, E3: Dimming single-surface operation	
Function of E1 *(or E2, E3)*	*Dimming single-surface operation*	Short button push: On/Off. Switching status is reversed with each push of a button. Long button push: Brighter / darker. Dimming direction is reversed with each push of a button. Always starts with Dim up after bus failure or reset. A stop telegram is sent when releasing after long time operation.
	Common parameter for the blinds and dimmer functions	
Long button push starting at	*300 ms* *400 ms* ***500 ms*** *600 ms* *700 ms* *800 ms* *900 ms* *1000 ms*	Limit value in differentiating between a short and long button push (in 1/1000s) 2 different functions can be performed depending on whether a button is pressed briefly or held down.
	Function of E3: Temperature sensor	
See function of external sensor on the *actualvalue* parameter page		

See appendix: External interface

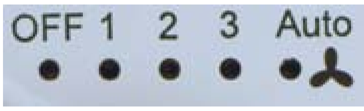
4 Start-up

4.1 Actuators to control heating and cooling

There are several possibilities available for controlling the heating and cooling equipment.

Function	Actuator	Order no.
Heating and cooling with fan coil	FCA 1	4920200
Heating with radiators Cooling with cooling ceiling	HMG 4 HME 4 HMT 6 HMT 12	4910210 4910211 4900273 4900274

4.2 Control variable display



E D C B A

If the button (top right) is pressed for longer than 2 seconds, the current control variable is displayed on LEDs A, B, C, D and LED E shows whether heating (red)
or cooling (blue) mode is active.
.

LED	Control variable
no LED	0 %
LED A (auto)	1 - 25%
LED B (step 3)	26 - 50%
LED C (step 2)	51 - 75%
LED D (step 1)	76 - 100%

5 Typical applications:

5.1 Base configuration (4-pipe system): Heating and cooling with RAM 713 FC as external control for FCA 1

RAM 713 FC controls the Fan Coil Actuator FCA 1.

5.1.1 Devices:

- RAM 713 FC
- FCA 1

5.1.2 Overview

Figure 1

5.1.3 Objects and links

Table 17: Links

No.	RAM 713 FC Object name	No.	FCA 1 Object name	Comments
7	*Heating control variable*	0	*Heating control variable*	RAM 713 S sends the heating and cooling control variables to FCA 1
8	*Cooling control variable*	1	*Cooling control variable*	
16	*Forced fan step*	8	*Forced fan step*	% value for forced mode
17	*Fan forced/auto mode*	15	*Fan* *Forced = 1 / Auto = 0*	Trigger for forced mode

5.1.4 Important parameter settings

Standard or user-defined parameter settings apply for unlisted parameters.

Table 18: 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*

Table 19: FCA 1

Parameter page	Parameters	Setting
General	*Supported function*	*Heating and cooling*
	System type	*4-pipe system*
	Type of controller used	*remote controller*
Heating valve	*Type of valve*	*2-point*
Cooling valve	*Type of valve*	*2-point*

5.2 Base configuration (2-pipe system): Heating and cooling with RAM 713 FC as external control for FCA 1

5.2.1 Special features

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.
  The cooling and heating control variables are sent to a single, common object (object 7).

- The control variables must not be sent cyclically

- The switchover between heating and cooling mediums is performed by the system and must therefore be transmitted to the room thermostat.
  The heating/cooling system must send a 0 for heating mode and a 1 for cooling mode to RAM 713 FAN COIL object 15 *"switching between heating and cooling"* .

5.2.2 Devices:

- RAM 713 FC
- FCA 1

5.2.3 Overview

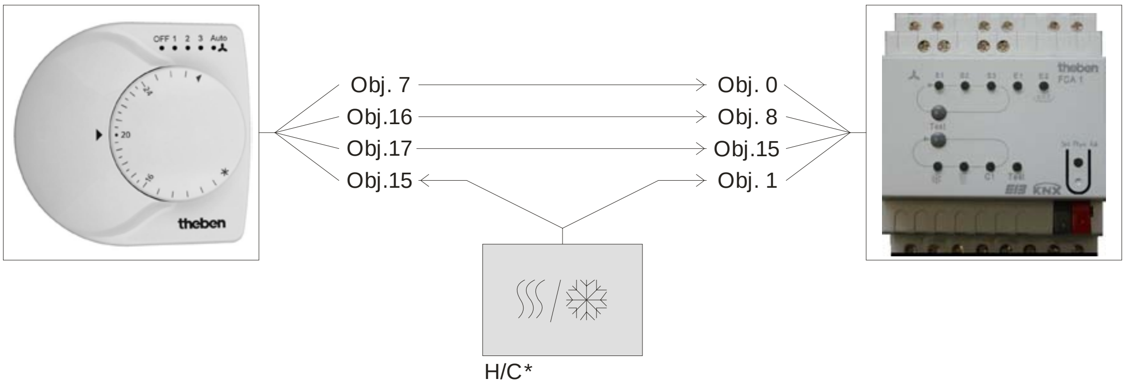


Diagram 2 * H/C = heating / cooling system

5.2.4 Objects and links

Table 20: Links

No.	RAM 713 FC	No.	FCA 1	Comments
	Object name		Object name	
7	*Heating and cooling control variable*	0	*Heating/cooling control variable*	FCA receives the heating and cooling control variables from RAM 713 FC
15	*Switchover between heating and cooling*	1	*Switchover between heating and cooling*	Telegram is produced by the heating/cooling system
16	*Forced fan step*	8	*Forced fan step*	% value for forced mode
17	*Fan forced/auto mode*	15	*Fan forced/auto mode*	Trigger for forced mode

5.2.5 Important parameter settings

Standard or user-defined parameter settings apply for unlisted parameters.

5.2.5.1 FCA 1

Table 21

Parameter page	Parameters	Setting
General	*Supported function*	*Heating and cooling*
	System type	*2-pipe system*
	Type of controller used	*remote controller*
Heating/cooling valve	*Type of valve*	*2-point*

5.2.5.2 RAM 713 FC

Table 22

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 *Typical application (4-pipe system):*

5.3.1 Function:

- 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 this prevents too extreme a temperature difference when leaving the office.

5.3.2 Devices:

- RAM 713 FC
- FCA 1
- TR 644 S
- Presence detector
- Weather station

5.3.3 Overview

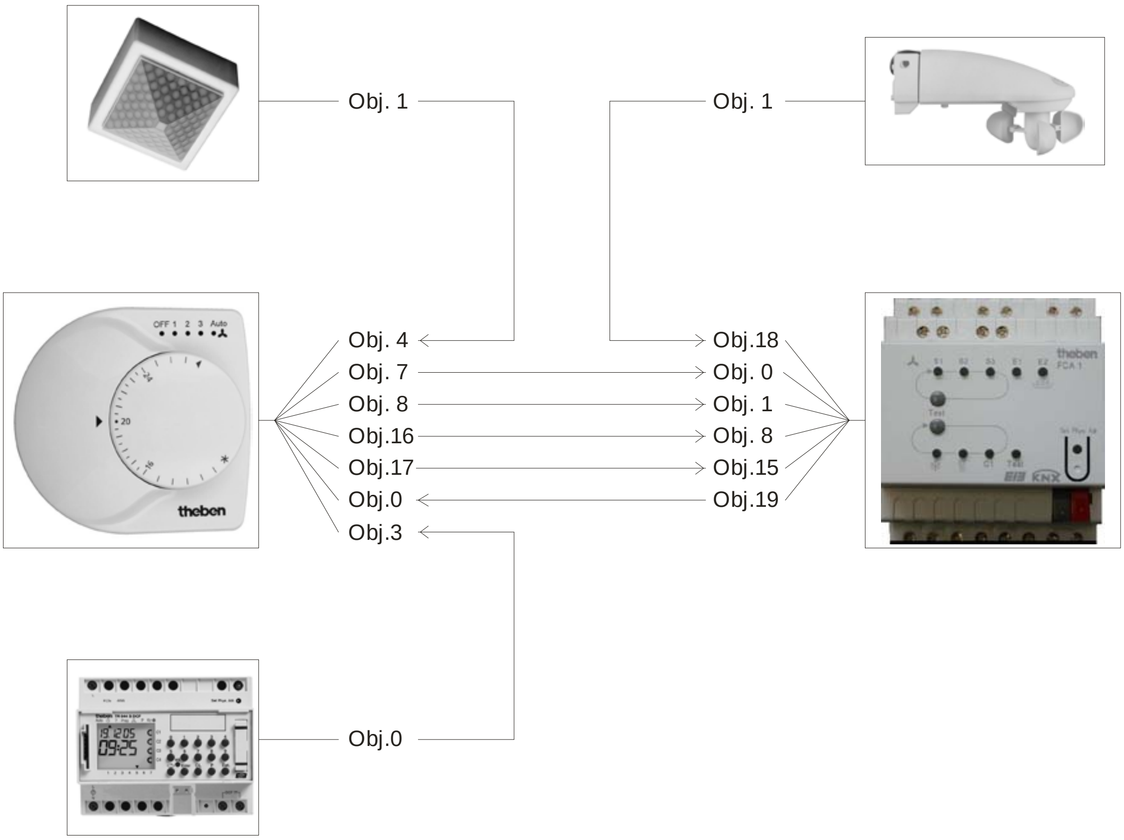


Figure 3

5.3.4 Implementation:

A RAM 713 FC and an FCA 1 are used for room temperature control.

The RAM 713 calculates the setpoint value based on the selected operating mode and a setpoint adjustment by the room occupants.

The operating mode is specified by a TR 644 EIB time switch.

On work days, the time switch moves to standby, just before work starts, and to night mode at the end of the working day.
In addition, one channel on the time switch is connected to the operating mode object of the controller.

A presence detector allows the activation of comfort mode if the office is actually occupied.
In addition, the presence detector is connected to the presence object of the controller.

The room thermostat is connected to the FCA 1 via the *heating control variable* and *cooling control variable* objects.
The FCA 1 controls the valves and the fan in the *auto* position via these objects.

Manual setting of fan steps requires the connection of objects 8 and 15 of FCA 1 with objects 16 and 17 of the RAM 713 FC.

The outside temperature is sent from a weather station to the FCA 1 (object 18) for adjustment of the setpoint value on hot summer days.
This determines, depending on the configuration, the setpoint adjustment transmitted to the room thermostat.
Objects 19 (FCA 1) and object 0 (RAM 713 S) are connected with each other for this purpose.

Objects and links

Table 23: Temperature controller links with the fan coil actuator.

No.	RAM 713 FC Object name	No.	FCA 1 Object name	Comments
7	*Heating control variable*	0	*Heating control variable*	FCA receives the actuating value heating from RAM 713 S
8	*Cooling control variable*	1	*Cooling control variable*	FCA receives the actuating value cooling from RAM 713 S
16	*Forced fan step*	8	*Forced fan step*	% value for forced mode
17	*Fan forced/auto mode*	15	*Fan forced/auto mode*	enables the manual selection of fan step on the RAM 713 FC
0	*Manual setpoint offset*	19	*Adjust setpoint*	For setpoint adjustment in cooling operating mode

Table 24: Weather station links with the fan coil actuator.

No.	Weather station Object name	No.	FCA 1 Object name	Comments
1	*Temperature value*	18	*Outside temperature*	Outdoor temperature for setpoint adjustment

Table 25: Presence detector links with room temperature controller.

No.	ECO-IR Object name	No.	RAM 713 FC Object name	Comments
1	*HVAC switch output*	4	*Presence*	Presence signal for switch to comfort mode

Table 26: Timer links with room temperature controller.

No.	TR 644 S EIB Object name	No.	RAM 713 FC Object name	Comments
0	*Channel 1 - valuator*	3	*Operating mode preset*	Switches to HVAC operating mode* depending on the time of day.

* HVAC operating modes: 1 = Comfort
2 = Standby
3 = Night
4 = Frost / heat protection

5.3.5 Important parameter settings

Standard or user-defined parameter settings apply for unlisted parameters.

Table 27: RAM 713 FC

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

Table 28: FCA 1

Parameter page	Parameters	Setting
General	*Supported function*	*Heating and cooling*
	Heating system	*Fan coil*
	Cooling system	*Fan coil*
	System type	*4-pipe system*
	Type of controller used	*remote controller*
Heating valve	*Type of valve*	*2-point*
Cooling valve	*Type of valve*	*2-point*
Setpoint adjustment	*Setpoint adjustment from*	*25 °C*
	Adjustment	*1 K per1 K outdoor temperature*
	Format of adjustment value	*relative*

Table 29: Weather station

Parameter page	Parameters	Setting
Measured values	*Transmit temperature in the event of change of*	*1.0°C*

Table 30: TR 644 S EIB time switch

Parameter page	Parameters	Setting
Channel 1	*Object type*	*Valuator*
	Value when clock is switched on	*2**
	Value when clock is switched off	*3***

* Standby
** Night

Table 31: Presence detector (e.g. Eco-IR 180, 360 or Compact Office*)

Parameter page	Parameters	Setting
General information	*Normal or test operating mode*	*Normal operation*
	*HVAC switch output**	*Active*
HVAC switch output	*Response at start/end of HVAC requirement*	*Transmit On and Off telegram*

* Presence output

5.4 Switching, blinds control a dimming with devices in the MiX range, in addition to control operating mode

In addition to its role as a temperature control (see above) the
RAM 713 FAN COIL can control a switching actuator, blinds and dimmer via an external interface.

In our example, all three possibilities are mixed and the telegrams sent to a combination of 3 suitable actuator types in the MiX range.
This is just one of the many possible applications of the RAM 713 Fan Coil inputs in combination with devices in the MiX range.

In the following case one channel per MiX module is occupied while the remaining channels are available for other sensors in the system
(EIB button, other RAM 713 devices etc.).

Table 32: Use of RAM 713 inputs

Input	Use	Affects
E1	switches or buttons for the switching channel	RMG 4 S
E2	Button for blinds control (single-surface operation)	JME 4 S
E3*	Button for dimmer control (single-surface operation)	DME 2

* E3 can only be used if an external temperature sensor is required.

5.4.1 Devices:

- RAM 713 FC
- RMG 4 S
- JME 4 S
- DME 2

5.4.2 Overview

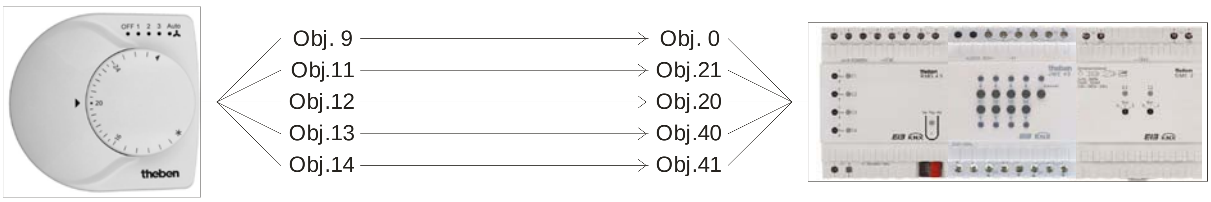


Figure 4

5.4.3 Objects and links

Table 33: Links

<table>
<tr><th rowspan="2">No.</th><th>RAM 713 FC</th><th rowspan="2">No.</th><th>MiX combination</th><th rowspan="2" colspan="2">Comments</th></tr>
<tr><th>Object name</th><th>Object name</th></tr>
<tr><td>9</td><td>Switching input 1</td><td>0</td><td>Switching On/Off
GM RMG4
Channel 1</td><td>E1</td><td>Send switch-on or switch-off telegrams</td></tr>
<tr><td>11</td><td>Blinds E2 Step/Stop</td><td>21</td><td>Step / Stop
EM1 JME4 S C1</td><td rowspan="2">E2</td><td>with each short button push: Stop or turn slats</td></tr>
<tr><td>12</td><td>Blinds E2 Up/Down</td><td>20</td><td>Up / Down
EM1 JME4 S C1</td><td>with a long button push: Move blinds Up or Down</td></tr>
<tr><td>13</td><td>Dimmer E3 On/Off</td><td>40</td><td>Switching On/Off
EM2 DME2
Channel 1</td><td rowspan="2">E3</td><td>with each short button push: Switch dimmer on/off</td></tr>
<tr><td>14</td><td>Dimmer E3</td><td>41</td><td>Brighter / darker
EM2 DME2
Channel 1</td><td>with a long button push: Dimmer turns light up/down</td></tr>
</table>

5.4.4 Important parameter settings

Standard or user-defined parameter settings apply for unlisted parameters.
A button or switch can be connected to one switch input.
Adjustment is made via the *Reaction to closing* or *Opening contact* parameters.

Table 34: RAM 713 FC

Parameter page	Parameters	Setting
Settings	*Device type*	*RAM 713 Fan Coil*
	Function of the external interface	*active*
Input E1	*Function of E1*	*Switching*
	Reaction to closing the contact	With switch: *On* With button: *By*
	Reaction to opening the contact	With switch: *Off* With button: *none*
Input E2	*Function of E2*	*Blinds single-surface operation*
Input E3	*Function of E3*	*Dimming single-surface operation*

Table 35: MiX combination - RMG 4 S with blinds and dimmer upgrades.

Parameter page	Parameters	Setting
General	*Number of upgrade modules*	*2 upgrade modules*
	Type of 1st upgrade module EM1	*EM1 is a JME4 S*
	Type of 2nd upgrade module EM2	*EM2 is a DME 2*
RMG4 Channel 1	*Function*	*Switching On/Off*
EM1 JME4 S C1	*Type of curtain*	*Blinds*
EM2 DME2 channel 1 S1	*Switching on/off with a 4-bit dim telegram*	*no*

5.4.5 Frost protection via window contact

A window contact should cause automatic switching to frost protection mode (heat protection mode).

A contact is mounted on the window. This is connected directly to an input of the external interface, E1 for instance.

The device is programmed as follows:

Operating mode parameter page

Parameters	Value
Objects for determining the operating mode	*new: Operating mode, presence, window status*

The corresponding switch object (object 9 for E1) is linked with object 5 (window position) via the group address.

RAM 713 FAN COIL will recognise when the window opens and automatically switch to frost protection mode (heat protection mode). When the window is closed the previously set operating mode will be restored. See also new Operating modes.

6 Appendix

6.1 Fan forced mode

This function allows the fan step to be set manually, either by using the button on the device or via the bus.
It can be time-controlled or permanently activated or blocked on the *operation* parameter page.

Table 36: Button operation

Button push	Function	LED
1	Fan off	OFF
2	Fan step 1	1
3	Fan step 2	2
4	Fan step 3	3
5	Auto	Auto

Important: Depending on the actuator used, either 1 or 0 is needed to trigger compulsory operation.
This response is adjustable, see *switch fan between auto and forced* parameter on the *operating* parameter page.

Send response in forced mode with fan coil actuator FCA 1 (forced = 1):
Object 17 sends 1 to the fan coil actuator thereby triggering forced mode.
Object 16 sends the control variable for the selected fan step in accordance with the set threshold value.
This control variable (in accordance with the set threshold value) is transferred to the fan coil actuator as a fan step between 0 and 3.

Important: the sent forced control variable should always be higher than the threshold setting of the fan coil actuator.

Example:

Threshold value for Fan step	Set values for RAM 713 Fan Coil	Recommended values for FCA 1
1	20 %	10 %
2	50 %	40 %
3	80 %	70 %

If fan step 2 is selected using the button, object 16 sends control variable 50 %.
As the threshold value for step 2 in the fan coil actuator is set at 40 % , the received control variable of 50 % is clearly allocated to fan step 2 and accepted by the fan.

6.1.1 Forced mode via bus telegrams

Forced mode can also be triggered by telegrams from other bus users.

Table 37: Response with forced mode= 1 and forced mode= 0

Parameters: ***Switch fans between auto and forced***	**Response**
via object forced/auto, forced = 1	If object 17 receives 1, RAM 713 FC switches to forced mode and accepts the fan step (percentage value) set by object 16. Forced mode is ended by 0 on object 17 or via the button on the device.
via object auto/forced, forced = 0	When a percentage value is received on object 16, RAM 713 FC immediately switches to forced mode and object 17 is automatically reset to 0. Forced mode is ended by 1 on object 17 or via the button on the device.

6.2 Determining the current operating mode

The current setpointvalue can be adapted to to relevant requirements by selecting the operating mode.
The operating mode can be specified by objects 3..5.
There are two methods available:

6.2.1 New operating modes

If new is selected in the *determining operating mode* parameter on the operating mode parameter page, the current operating mode can be defined as follows:

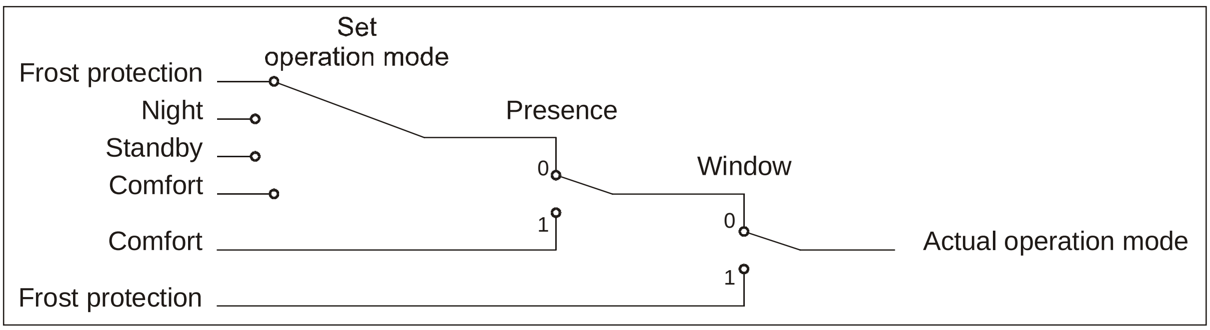
Table 38

Operating mode preset Object 3	Presence Object 4	Window status Object 5	current operating mode (Object 6)
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 3 activates *standby* or *comfort* modes, and *night* mode in the evenings via a time switch (e.g. TR 648).
During holiday periods, object 3 also selects frost / heat protection via another channel on the timer.

Object 4 is connected to a presence detector. If a presence is detected
RAM 713 FAN COIL in the comfort operating mode (see table).
Object 5 is connected to a window contact via the bus (binary inputs).
As soon as a window is opened, RAM 713 FAN COIL switches to frost protection mode.



6.2.2 Old operating modes

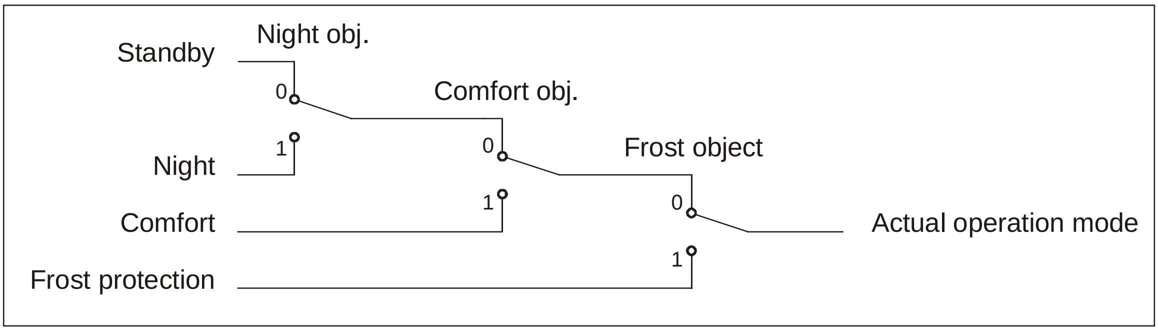
If old is selected in the *determining operating mode* parameter on the operating mode parameter page, the current operating mode can be defined as follows:

Table 39

Night Object 3	Comfort Object 4	Object 5 frost/heat protection	current operating mode Object 6
any	any	1	Frost / heat protection
any	1	0	Comfort
Standby	0	0	Standby
Night	0	0	Night

Typical application: In the mornings standby operating mode is activated by a timer switch via object 3 and in the evenings the *night* mode.

In holiday periods, frost/heat protection is selected on another channel via object 5.
Object 4 (comfort) is connected to a presence detector. If a presence is detected, RAM 713 FAN COIL switches to comfort mode (see table).
Object 5 is connected to a window contact. As soon as a window is opened, RAM 713 FAN COIL switches to frost protection mode.



The old method has two advantages over the new method:

1. To switch from comfort to night operating mode, 2 telegrams (2 timer 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 timer switch, the "Frost / heat protection" mode is cleared.

6.2.3 Determining the setpoint value

6.2.3.1 Calculating the setpoint value in heating operation

See also: Base setpointvalue and current setpoint value

Table 40: Current setpoint value during heating

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

Example:
Heating in comfort mode.

Parameter page	Parameters	Setting
Setpoint values	*Base setpoint after reset*	*21 °C*
	Reduction in standby operating mode (during heating)	*2 K*
Operation	*Maximum setpoint offset on the rotary control*	*+/- 2 K*

The setpoint value was previously increased by 1 K using the control variable.

Calculation:

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

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

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

6.2.3.2 Calculating the setpoint value in cooling operation

Table 41: Current setpoint value during cooling

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

Example:
Cooling in comfort mode.

The room temperature is too high and RAM 713 FAN COIL has switched to cooling operation

Parameter page	Parameters	Setting
Setpoint values	*Base setpoint after reset*	*21 °C*
Cooling setpoint values	*Dead zone between heating and cooling*	*2 K*
	Increase in standby mode (during cooling)	*2 K*
Operation	*Maximum setpoint offset on the rotary control*	*+/- 2 K*

The setpoint value was previously lowered by 1 K using the rotary control.

Calculation:

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

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

6.3 Setpoint offset

The current setpoint value can be adjusted in two ways with the RAM 713 FAN COIL.

- in increments using the rotary control (see *Operation*, *rotary control function*parameter page)
- via object 0 *"Manual setpoint value offset"*

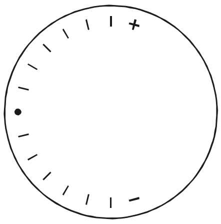
The differential between the setpoint value offset and the base setpointvalue is sent by object 1 at each change (e.g. -1.00).

The offset limits are specified on the *Operation* parameter page by the *maximum setpoint value offset on the rotary control* parameter and apply to both types of setpoint value offset.

6.3.1 Setpoint temperature offset using the rotary control

This option is available when the rotary control has been enabled on the *Operation* parameter page:

The +/- rotary control is plugged onto the device for this function (see illustration).



In the central position on the rotary control, the setpoint value offset is zero.
Should the rotary control be turned to the left (+) until it can be turned no further, the setpoint value will be increased by the programmed maximum setpoint offset.

The offset can be very finely adjusted using the rotary control's notch.
The change in temperature per scale line depends on the maximum setpoint value offset which has been programmed.

Table 42

Maximum setpoint value offset on the rotary control	Kelvin / °C per scale line
+/- 1 K (i.e. +/-1°C)	1/6
+/- 2 K	1/3
+/- 3 K	1/2

6.3.2 Setpoint temperature offset via Object 0

This option is available only when the following settings have been selected on the *Operation* parameter page:

Parameter page	Parameters	Setting
Operation	*Function of the rotary control*	*Base setpoint value for internal controller* **or** *disabled, but manual offset object available*

In this case, the setpoint value is changed by sending the desired offset to object 0.
This involves the differential (may be preceded by a minus sign) being sent to object 0 in EIS5 format.

The offset always refers to the base setpointvalue (as programmed or specified by the rotary control) and not to the current setpoint value.

Example Base setpoint value of 21°C:

If a value of 2.00 is sent to object 0, the new setpoint value is calculated as follows:
21°C + 2.00K = 23.00°C.
To then bring the setpoint value to 22°C, the differential is resent to the programmed base setpoint value (here 21°C), in this case 1.00K (21°C+1.00K=22°C)

6.3.3 Setting the presence object with setpoint value offset

The RAM 713 Fan Coil allows the setting of the presence object just by increasing the setpoint value on the settings control. This switches the device to comfort mode and brings the room temperature to a comfortable level.
This function can be activated by the *Set presence object → by setpoint value increase on rotary control* parameter on the *Operation* parameter page
This does not produce a reset through reduction in the setpoint temperature.

Table 43: Leave comfort mode.

Presence sensor at object 4	Presence object
Presence detector	is reset by the presence detector. If there is no available detector, the presence object (object 4) can be reset every 2 hours during the night via a time switch.
Presence keys	is reset in night mode after a timer* has expired or via a time switch (see above).

* *Comfort extension by presence keys in night mode* parameter
on the *Operating mode*parameter page.

6.4 External interface

The external interface is activated on the *Settings* parameter page.
It consists of the three inputs E1, E2 and E3.

E1 and E2 are pure binary inputs, and E3 can be used as both a binary and an analogue input for an external temperature sensor.
All 3 inputs are connected in the base via the connection terminals.

The following functions can be performed:

- Switching (1 switch or button)
- Blinds Up/Down (with 2 keys on E1 + E2)
- Blinds single-surface operation (with 1 button)
- Dimmer brighter/darker (with 2 keys on E1 + E2)
- Dimmer single-surface operation (with 1 key)
- Temperature (only E3)

If the blinds and dimmer functions are performed on 2 keys, E1 and E2 are automatically connected with each other and have a common effect on objects 9, 10 und 12.

6.4.1 Overview: Function of Objects 9 .. 14.

Table 44: Function of E1

Function of E1	Function		
	Object 9	Object 10	Object 12
Switching	Sends the switching status of the E1 input	*Not used*	*Not used*
Blinds UP Note: E2 is automatically set to Blinds DOWN.	Sends commands for Step/Stop in upwards direction-or slat positioning	*Not used*	Sends Up command to blinds
Blinds single-surface operation	Sends commands for Step/Stop or slat positioning	Sends Up/down command to blinds	*Not used*
Dim brighter Note: E2 is automatically set to Dim darker .	Sends On/Off commands to the dimmer	*Not used*	Sends 4-bit dim commands
Dimmer single-surface operation	Sends On/Off commands to the dimmer	Sends 4-bit dim commands	*Not used*

Table 45: Function of E2

Function of E2	Function	
	Object 11	Object 12
Switching	Sends the switching status of the E2 input	*Not used*
Blinds single-surface operation	Sends commands for Step/Stop or slat positioning	Sends Up/down command to blinds
Dimming single-surface operation	Sends On/Off commands to the dimmer	Sends 4-bit dim commands
Blinds down	Fixed setting if E1 is configured to *Blinds up*. See previous table:*Function of E1*	
Dim darker	Fixed setting if E1 is configured to *Dim brighter* . See previous table:*Function of E1*	

Table 46: Function of E3

Function of E3	Function	
	Object 13	Object 14
Switching	Sends the switching status of the E2 input	*Not used*
Blinds single-surface operation	Sends commands for Step/Stop or slat positioning	Sends Up/down command to blinds
Dimming single-surface operation	Sends On/Off commands to the dimmer	Sends 4-bit dim commands
Overview	*Not used*	*Not used*

*The measure actual value is sent from object 2.

6.4.2 E1...E3 as switching inputs

If an input is programmed to be a switching input, switches can also be used as keys. The status of the corresponding object (objects 9...11) is switched to the relevant Configuration.

Table 47: ON/OFF by switch

Parameter page	Parameters	Setting
Inputs E1(E2, E3)	*Reaction to closing the contact*	*On*
	Reaction to opening the contact	*Off*

Table 48: ON / OFF by button (cf. surge relay)

Parameter page	Parameters	Setting
Inputs E1(E2, E3)	*Reaction to closing the contact*	*By*
	Reaction to opening the contact	*none*

See above Overview: Function of objects 9 .. 14.

6.4.3 E1…E2 Blinds Up / Down

2 keys are connected to control blinds 9E1 + E2).
In this case the objects 9 (Step/Stop) and 10 (Up/Down) are linked with an EIB blinds actuator (JMG 4, RMG 8, JMG 4 24 VDC).

In both inputs there is a differentiation between short time and long time operation. The time difference between a long and a short button push is set on the *input E1* parameter page.
A short keystroke sends the relevant telegram (ON or OFF) to the slat object (object 9), holding the key down sends a telegram to the drive object (object 12).
Only one of the two objects is operated at a time.
If one button is held down, the other will not operate.

Table 49

Button push	E1	E2
long (Affects object 12)	Up telegram (0)	Down telegram (1)
short (Affects object 9)	Step/Stop telegram in upward direction (0)*	Step/Stop telegram in downward direction (1)*

*The choice between Step and Stop occurs in the blinds actuator itself depending on the operating position.

See above Overview: Function ofobjects 9 .. 14.

6.4.4 Blinds single-surface operation

Benefit: Single-surface operation only needs one button and only occupies one input.
Functionality: Every time the button is pressed the run direction or step direction is reversed.

Table 50

Button push	E1, E2, E3
long	Up or down telegram (0)
short	Step/Stop telegram in upward or downward direction (0)*

See above Overview: Function ofobjects 9 .. 14.

6.4.5 E1 E2 Dim brighter / darker

2 buttons can be connected to provide dimming function.
Objects 9 (dimming on/off) and 12 (dimming up/down) must then be linked with EIB dimming actuator DMG 2 (order no. 491 0 220).

If the *dim brighter* function is selected on E1, the corresponding function, i.e. *dim darker*, is automatically set for E2.

In both inputs there is a differentiation between short time and long time operation. The time difference between a long and a short button push is set on the *input E1* parameter page.
If pressed for a short period of time, the respective telegram (ON or OFF) is sent. If pressed for a longer period of time, the telegram is sent to the dimming object (object 12).

Table 51

Button push	E1	E2
long (Affects object 12)	- Pressing the button sends a start telegram for brighter dimming - Letting go sends a stop telegram	- Pressing the button sends a 4-bit start telegram for dim darker - Letting go sends a stop telegram
short (Affects object 9)	Switch-on telegram	Switch-off telegram

See above Overview: Function of objects 9 .. 14.

6.4.6 Dimming single-surface operation

Benefit: Single-surface operation only needs one button and only occupies one input.
Functionality: Each additional button push changes the dimming direction or switches the light on or off.

Button push	E1
long	- Pressing the button sends a start telegram for brighter or darker dimming - Letting go sends a stop telegram
short	Switch-on/ switch-off telegram

See above Overview: Function of objects 9 .. 14.

6.4.7 E3 as an analogue input for an external sensor

A remote sensor is connected to E3.
The maximum permitted line length is 10m.

The external sensor can be configured in 2 ways.

1. As a sensor for temperature control (order no. 907 0 191),
   i.e. it takes over the function of the fitted sensor.
2. As a sensor for temperature limitation in the underfloor (order no. 907 0 321),
   i.e measures the underfloor temperature, and the devices sees to it that the temperature remains within the programmed maximum and minimum values, thus maintaining a comfortable atmosphere.
3. As a floor sensor for temperature control (order no. 907 0 321)

All settings are entered on the actualvalue parameter page.

6.4.8 Suitable actuators

The following devices can be used as actuators for switching, blinds,or dimmers:

Table 52

Designation	Order no.	Description
DMG 2	491 0 220	MiX series dimmer actuator
DME 2	491 0 221	Upgrade for DMG 2 and all devices in the MiX series
RMG 4 S	491 0 204	MiX series switching actuator
RME 4 S	491 0 205	Upgrade for RMG 4 S and all devices in the MiX series
JMG 4 S	491 0 250	MiX series blinds actuator
JME 4 S	491 0 251	Upgrade for JMG 4 S and all devices in the MiX series
JMG 4	490 0 250	Blinds actuator basic device
JMG 4 24VDC	490 0 253	24V DC blinds actuator basic device
RMG 8	490 0 251	Switching and blinds actuator basic device
RME 8	490 0 252	Upgrade for RMG 8*, JMG 4* and HMG 8**
RMX 4	490 0 256	Upgrade for RMG 8*, JMG 4* and HMG 8**

* May be used as a switching and blinds actuator
** May only be used as a switching actuator
EIB product manuals for the above-mentioned devices are available on our downloads page at www.theben.de .

6.5 Temperature control

6.5.1 Introduction

If the RAM 713 FAN COIL is not configured as a switching controller, it can alternatively be configured as a P or as a PI controller, whereby PI control is preferable.

With the proportional control (P control), the control variable is statically adjusted to the control deviation.
The proportional integral control (PI control) is far more flexible, i.e. controls 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 supply denotes the radiator output.
The heat loss from the room is illustrated by a curve.

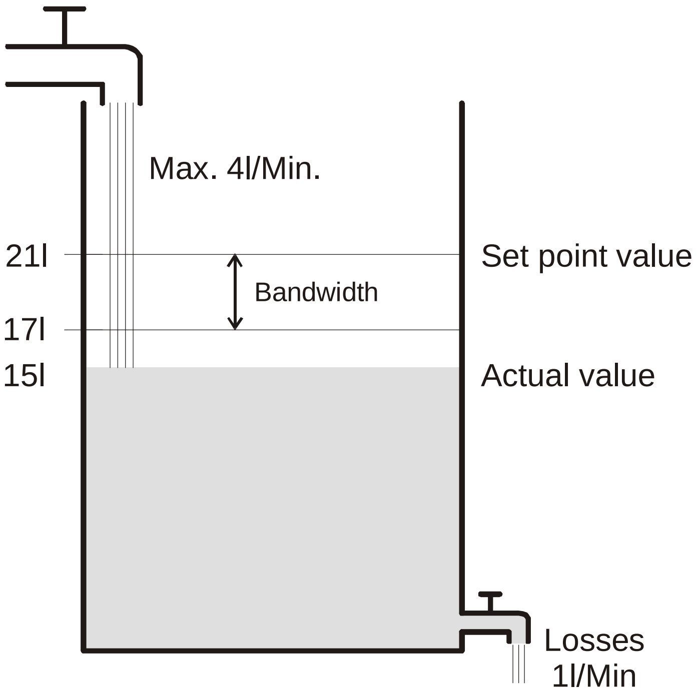
In our example, the maximum supply volume is 4 litres per minute and also denotes the maximum radiator output.
This maximum output is achieved with an actuating value of 100%.
Accordingly, with an actuating value of 50%, only half the water volume, i.e. 2 litres per minute, would flow into our vessel.

The bandwidth is 4l.
This means that the controller operates at 100% provided the actual value is smaller than, or equal, to (211 – 41) = 171.

Function:

- Desired filling volume:
  21 litres (= setpoint)
- From what point should the supply flow gradually be reduced to avoid an overflow? :
  4l below the desired filling volume, i.e. at 21l – 41 = 171 (=bandwidth)
- Original filling volume
  15l (=actual value)
- The loss amounts to 1l/minute

6.5.2 Response of the P-control



A filling volume of 15l gives rise to a control deviation of 211 – 151 = 61
As our actual value lies outside the bandwidth, the control will operate the flow rate at 100% i.e. at 4l / minute

The supply quantity (control variable) is calculated from the control deviation (setpoint value – actual value) and the bandwidth.
Control variable = (control deviation / bandwidth) x 100

The table below shows the response and therefore also the limits of the P-control

Table 53

Filling level	Control variable	Supply	Loss	Increase in filling level
15l	100%	4 l/min		3 l/min
19l	50%	2 l/min	1 l/min	1 l/min
20l	25%	1 l/min		0 l/min

The last line indicates that the filling level cannot increase any further, because the inflow only allows the same amount of water to flow in as flows out through loss.
The result is a permanent control deviation of 11 and the setpoint value can never be reached.
If the loss was 1l higher, the permanent control deviation would increase by the same amount and the filling level would never exceed the 19l mark.
In a room this would mean that the control deviation increases with a decreasing outside temperature.

P-control as temperature control

The P-control response during heating control is as shown in the previous example.
The setpoint temperature (21°C) can never quite be reached.

The permanent control deviation increases as the heat loss increases and decreases as the ambient temperature decreases.

6.5.3 Response of the PI control

Unlike the pure P-control, the PI-control works dynamically.
With this type of controller, the actuating value remains unchanged, even at a constant deviation.

In the first instant, the PI-control sends the same actuating value as the P-control, although the longer the setpoint value is not reached, the more this value increases.
This increase is time-controlled over the so-called integrated time.
With this calculation method, the actuating value does not change if the setpoint value and the actual value are the same.
Our example, therefore, shows equivalent in and outflow.

Notes on temperature control:

Effective control depends on agreement of bandwidth and integrated time with the room to be heated.
The bandwidth influences the increment of the actuating value change:
Large bandwidth = finer increment on control variable change.
The integrated time influences the response time to temperature changes:
Long integrated time = slow response.
Poor agreement can result in either the setpoint value being exceeded (overshoot) or the control taking too long to reach the setpoint value.

The best results are generally achieved using the *via device type* setting.

Table 54

Parameter page	Parameters	Setting
Control	*Sets the control parameters*	*via system type*

7 Glossary

7.1 Continuous and switching control

A switching (2 point) control recognises only 2 statuses, On or Off.
A continuous control works with a control variable between 0% and 100% and can thus exactly measure out the energy input. This achieves a pleasant and precise degree of control.

7.2 Hysteresis

Hysteresis determines the difference between a controller's switching on and off temperature.
It can be both positive and negative.
A combination of heating and cooling control influences the amount of the dead zone.

Without hysteresis, the control would switch on and off continuously provided the temperature is within the setpoint value range.

7.2.1 Negative hysteresis:

Heating: Heating is provided until the setpoint value has been reached.
Afterwards, the heating is only switched on again when the temperature falls below the *hysteresis setpoint value* threshold.
Cooling: Cooling lasts until the *hysteresis setpoint value* threshold has been achieved.
Afterwards, it is only switched on again when the temperature rises above the setpoint.

Cooling example:
Cooling with setpoint value 25 °C, hysteresis = 1°C and ambient temperature 27 °C.
The cooling is switched and only switched off again when a temperature of 24C (25 °C – 1 °C) is achieved.
It switches on again when the temperature rises above 25 °C.

7.2.2 Positive hysteresis

Heating lasts until the temperature reaches the *setpoint value + hysteresis* threshold.
The heating is only switched on again when the temperature falls below the setpoint value.

Heating example:
Heating with setpoint value 20°C, hysteresis = 1°C and ambient temperature 19 °C.
The heating is switched on and only switches off again when a temperature of 21C (20 °C + 1 °C) is achieved.
It switches on again when the temperature falls below 20 °C.

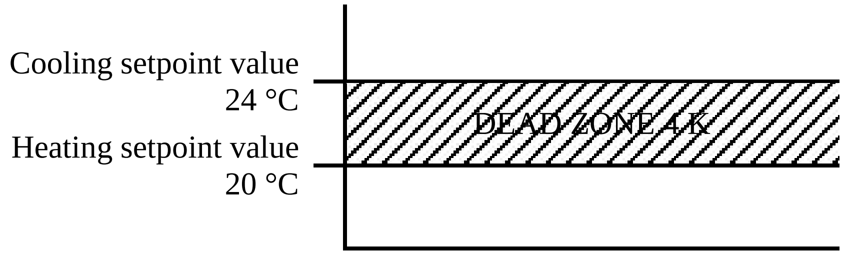
7.3 Dead zone

The dead zone is a buffer area between heating and cooling operation.
Neither heating nor cooling takes place within this dead zone.

Without this buffer zone, the system would switch continuously between heating and cooling. As soon as the setpoint value has been under-run, the heating is activated and the setpoint value would not be achieved. If cooling were then to be started immediately, the temperature would fall below the setpoint value and switch on the heating again..

Depending on the type of control, the dead zone can be extended by the value of the hysteresis.

7.3.1 Heating and cooling with continuous control



The dead zone (4 K) is not affected

7.4 Base setpoint value and current setpoint value

The **basicsetpointvalue** is the standard temperature for the comfort mode and the reference temperature for reduction in standby and night modes.
The configured base setpoint value (see basesetpointvalue afterdownloading the application) is stored in object 0 and be amended at any time via the bus by sending a new value on object 0 (EIS5).
After reset (bus returned), the last used base setpoint value is restored.

The **current setpoint value** is the value that actually determines the control. It is the result of all the operating mode reductions or increases depending on the control function.

Example:
At a base setpoint value of 22°C and a reduction in night mode of 4K, the current setpoint value (in night mode) is: 22°C – 4K = 18°C. During the day (in comfort mode) the current setpoint value is 22°C (providing the cooling operation is not active).

The formation of the current setpoint value relating to the base setpoint value can be observed in the block diagram on the next page:
The base setpoint value on the left is specified via object 0 or set on the rotary control.
The current setpoint value is on the right, i.e. the value upon which the room temperature is effectively controlled.

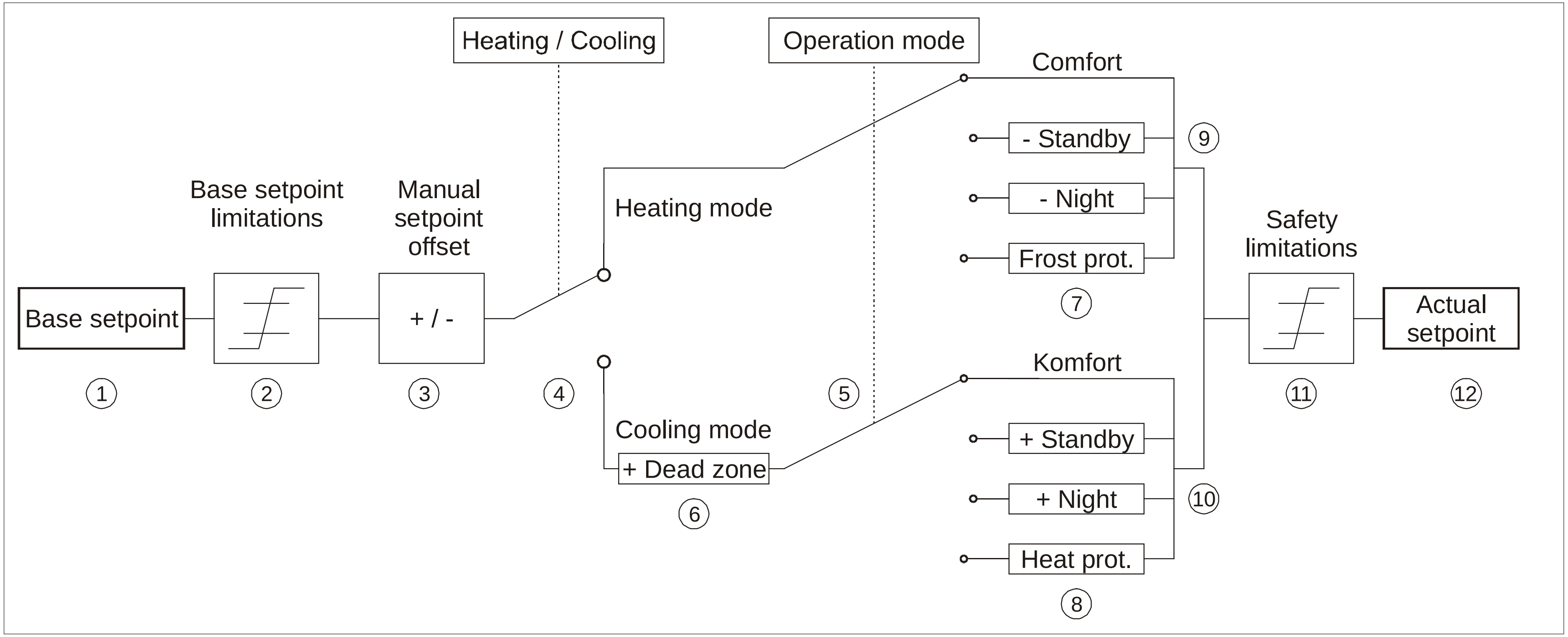
As you can see in the block diagram, the current setpoint value depends on the operating mode (5) and the control function (4) selected.

The base setpoint value limits (2) prevent an incorrect base setpoint value from being specified to
object 0. These are the following parameters:

- Minimum valid base setpoint value
- Maximum valid base setpoint value
- Minimum setting on the rotary control
- Maximum setting on the rotary control

The base setpoint value limits (2) prevent an incorrect base setpoint value from being specified to

7.4.1 Setpoint value calculation



1 Specified base setpoint value from object 0 or rotary control
2 Max. and min. valid base setpoint values / Set-up on the rotary control
3 Manual setpoint offset
4 Switches between heating and cooling: Automatically or via object 6
5 Selects operating mode
6 The setpoint value is increased in cooling mode by the amount of the dead zone
7 The setpoint value is replaced by the setpoint value for frost protection mode
8 The setpoint value is replaced by the setpoint value for heat protection mode
9 Setpoint value after reductions conditional to the operating mode
10 Setpoint value after increases conditional to the operating mode
11 The limits for frost and heat protection must be adhered to.
12 Current setpoint value according to increases, reductions and limits conditional to the operation.