Room temperature controller RAM 713 S

RAM 713 S	713 9 201

Contents

1 Functional characteristics

The RAM 713 S room thermostat is an EIB room thermostat
with 3 binary inputs (see external interface) which can function both in continuous and
2 point operating mode.
It measures the current room temperature (actual value) and sends either a
continuous control variable (0...100%) or a switching command (on/off) to an actuator or.
thermal actuator to achieve the required room temperature (setpoint value).

Using the optimised binary inputs, switches and keys (floating) can be connected to switch,
dim and control blinds.
The blinds and dimmer channels can also be controlled with a single button
An external temperature sensor can be alternatively connected to input 3 (analogue).

Possible actuators are, for instance: Cheops drive, HMT 6, HMT 12, HMG 8

In addition to the heating system, the RAM 713 S can also control a cooling system.

In order to easily adapt to the setpoint values in respect of living comfort and energy saving,
RAM 713 S 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.

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

In **night mode,** the setpoint value is drastically reduced, since 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 ambient 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 timer.
For optimum control, however, presence indicators and/or presence keys and window contacts
are recommended.
See chapter on "Determining the setpoint values ".

1.1 Operation

For operation and display functions, RAM 713 S is fitted with 5 LEDs, a push button and a rotary control.

The left LED shows the status display of the control variable:

Red	Heating control variable	greater 0%
Blue	Cooling control variable	greater 0%
OFF	Both control variables	= 0%

The other 4 LEDs show the current operating mode.

Comfort
Standby

Night
Frost protection

The push button can be used to change the operating mode or to start the party mode (time limited comfort mode)

The rotary control can be used to either **set** or **offset** the setpoint value, depending on the configuration.

1.2 Benefits of RAM 713 S

- Continuous P-/ PI or switching room thermostat
- Change of operating mode by means of presence and window objects
- Heating and cooling operation
- Alternative actuation of a second heating stage with switching or continuous control variable
- Rotary control for setting or offsetting setpoint values
- Infinite regulation through continuous control variable
- 3 optimised binary inputs for conventional keys/switches or to control blinds/dimmer
- 3. Plus input for external temperature sensor to measure the room or floor temperature, thus allowing control of the floor temperature
- Adjustable effect with the binary inputs
- Blinds and dimmers can also be controlled using single button operation

1.2.1 Special features

RAM 713 S has 3 external inputs for keys, switches or an external sensor (to heat floors, for example). Which can be used to control switch, dimmer or blinds actuators.

1.2.2 Comparison of RAM 713 / RAM 713 S

Function	**RAM 713** (713 9.200)	**RAM 713 S** (713 9 201)
Control	Continuous	Continuous and 2 point possible
Floor sensor	Only for limiting temperature	Can be used to control room temperature
	Temperature value cannot be sent using "Floor limit mode"	Temperature value can be sent to the bus in the floor limit mode
Binary inputs	Only function is adjustable	Reaction to opening or closing of contact is also adjustable.
Blinds and dimmer control	2 button operation	Choice of single or 2 button operation.
Sending the control variable Heating/cooling	to 2 separate objects	Also possible to 1 common object.

2 Technical data

2.1 General

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

3 The application program "RAM 713 S V1.0 / V1.1"

3.1 *Selection in the product database*

Manufacturer	Theben AG
Product family	Heating, ventilation, air conditioning
Product type	Continuous and 2 point controller
Program name	RAM 713 S: Continuous, 2 point, switch, dimmer, blinds V1.0 / V1.1

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

3.2 *Parameter pages*

Table 1

Function	Description
Settings	Selection of control functions, Standard and user-defined settings, function of the external interface
Setpoint values	Setpoint value after download, values for night, frost mode etc.
Setpoint values for cooling	Dead zone and temperature increases conditional to the operating mode
Operation	Function of the control elements
Actual value	Mode/function of the sensor, calibration
Heating control	Type of control, heating parameters etc.
Cooling control	Type of control, cooling parameters etc.
Operating mode	Operating mode after reset, presence sensor
Additional stage heating	Control parameters, hysteresis recirculation, bandwidth etc.
Input E1...E3	Function of connected contact, switches, dimmers, blinds.

3.3 Communication objects

3.3.1 Object characteristics

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

Table 2

No.	Function	Object name	Type	Response
0	Defines the setpoint temperature	Basic setpoint value	2 bytes EIS5	Receive
	offset	Manual setpoint value offset	2 bytes EIS5	Receive
1	Report current setpoint value	current setpoint value	2 bytes EIS5	Send
2	Sends actual value	Actual value	2 bytes EIS5	Send
	Actual value input			Receive
3	Pre-selections operating mode	Pre-selected operating mode	1 byte KNX	Receive
	1 = night, 0 = standby	Night < - > Standby	1-bit	
4	Input for presence signal	Presence	1-bit	Receive
	1 = comfort	Comfort	1-bit	Receive
5	Input for window status	Window position	1-bit	Receive
	1 = frost protection	Frost / heat protection	1-bit	Receive
6	Reports current operating mode	Current operating mode	1 byte KNX	Send
7	Send current control variable	Heating control variable	1-byte EIS6	Send
	Send current control variable	Heating control variable	1-bit EIS1	
	Send current control variable	Heating and cooling control variable	1-byte EIS6	
	Send current control variable	Heating and cooling control variable	1-bit EIS1	
8	Send control variable	Cooling control variable	1-byte EIS6	Send
	Send control variable	Cooling control variable	1-bit EIS1	Send
	Send control variable	Control variable for additional heating stage	1-byte EIS6	
	Send control variable	Control variable for additional heating stage	1-bit EIS1	Send

Continued:

No.	Function	Object name	Type	Response
9	Send switch telegram	Switching input 1	1-bit	Send
	Sends ON/OFF telegram	Dimmer E1 On/Off		
	Sends ON/OFF telegram	Dimmer E1E2 On/Off		
	Slats	Blinds E1 Step/Stop		
	Slats	Blinds E1/E2 Step/Stop		
10	Send Up/Down telegram	Blinds E1 Up/Down	1-bit	Send
	Sends dim telegram	Dimmer E1	4-bit	
11	Send switch telegram	Switching input 2	1-bit EIS 1	Send
	Sends 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	Send
	Blinds E1/E2 Up/Down	Send Up/Down telegram		
	Dimmer E2	Sends dim telegram	4-bit EIS2	
	Dimmer E1/E2	Sends dim telegram		
13	Send switch telegram	Switching input 3	1 Bit EIS1	Send
	Sends ON/OFF telegram	Dimmer E3 On/Off		
	Slats	Blinds E3 Step/Stop		
	Send temperature	Floor sensor temperature	2 bytes EIS5	
14	Blinds E2 Up/Down	Send Up/Down telegram	1-bit EIS1	Send
	Dimmer E3	Sends dim telegram	4-bit EIS2	Send
15	Heating = 0, Cooling = 1	Switches between heating and cooling	1-bit EIS1	Receive

Table 3

Number of communication objects	16
Number of group addresses	36
Number of assignments	36

3.3.2 Description of the objects

- **Object 0 “Basic setpoint value” / “Manual setpoint value offset”**

This object can assume 2 different functions.
With it, either a new setpoint temperature can be specified or the current setpoint temperature can be offset by a certain value, depending on the configuration of the rotary control.

Table 4.

Parameters: Function of the rotary control	Function of the object
Basic setpoint value / Disabled, but object basic setpoint value available	**Defining the setpoint temperature:** The basic setpoint value is first specified via the application at start-up and stored in the “Basic setpoint value” object. Afterwards it can be specified again at any time using the 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 indefinitely often.
Manual offset / Disabled, but object manual offset available	Offsetting the setpoint temperature The object receives a temperature differential in EIS 5 format. The desired room temperature (current setpoint value) can be adjusted from the basic setpoint value by this differential. The following applies in comfort mode (heating): current setpoint value (Obj. 1) = basic setpoint value (rotary control) + manual setpoint value offset (Obj. 0) Values outside of the programmed range (see “Max. setpoint value offset on the rotary control. ”) are limited to the highest or the lowest value. Note: The offset always refers to the set basic setpoint value and not to the current setpoint value.

- **Object 1 “Current setpoint value”**

This object sends the current setpoint temperature as a EIS 5 telegram (2 bytes) to the bus.
The sending behaviour can be set on the “setpoint values” parameters page.

- **Object 2 "Actual value"**

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

- **Object 3 "Pre-selected operating mode" / "Night <-> Standby"**

The function of this object depends on the "Objects for determining operating mode" parameter on the "operating mode" parameter page.

Table 5

Objects for determining the operating mode	Function of the object
New:operating mode, presence, windowstatus	Here is a 1-byte object. One of 4 operating modes can be directly activated. 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 determining operating mode" parameter on the "operating mode" parameter page.

Table 6

Objects for determining the operating mode	Function of the object
New:operating mode, presence, windowstatus	**Presence:** The status of a presence indicator (e.g. sensor, movement indicator) can be received via this object. A 1 on this object activates the comfort operating mode.
Old: Comfort, night, frost	**Comfort:** A 1 on this object activates the comfort operating mode. This operating mode takes priority over night and standby operation. Comfort mode is deactivated by sending an 0 to the object. Important: Don´t send cyclically to this object. This would clear a running party mode (started with push button) if a 0 is received.

- **Object 5 “Window position” / “Frost/heat protection”**

The function of this object depends on the “Objects for determining operating mode” parameter on the “operating mode” parameter page.

Table 7

Objects for determining the operating mode	Function of the object
New:operating mode, presence, window status	**Window position:** The status of a window contact can be received via this object. A 1 on this object activates the frost / heat protection operating mode.
Old: Comfort, night, frost	**Frost/heat protection:** A 1 on this object activates the frost protection operating mode. During the cooling operation, the heat protection mode is activated. The frost/heat protection operating mode takes top priority. The frost/heat protection mode remains until it is cleared again by a 0.

- **Object 6 "Current operating mode"**

Sends the current operating mode as a 1 byte value (see below: coding of the operating modes).
The sending behaviour can be set on the “Operating mode” parameter page.

Table 8: Coding of the H/AC/V operating modes:

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

- **Object 7 "Heating control variable" / "Control variable for heating and cooling"**

Sends the current heating control variable (0...100%) or. heating or cooling if the "output of cooling control variable" parameter has been set to "together with heating control variable".

- **Object 8 "Cooling control variable" / "Control variable for additional heating stage"**

The function of this object depends on the "Input for actual value" parameter on the "Settings" parameter page.
The send format, EIS6 or EIS1, depends on the type of control selected (continuous or switching) on the "cooling control" side.

Table 9

Used control functions	Function of the object
Heating and cooling	Sends the cooling control variable or switching command to control a cooling surface, fan coil unit etc.
2-stage heating with switching additional stage	Sends the switching command to control the additional stage (on/off)
2-stage heating with continuous additional stage	Sends the continuous control variable to control the additional stage (0…100%)

Note:
In the "Only heating control" setting, the object is not available because neither the cooling function nor the additional stage are available.

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

These objects are available when the interface on the "Settings" parameter page is activated.

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

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

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

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

3.4 Parameters

The standard values are **in bold**.

3.4.1 Settings

Table 10

Designation	Values	Meaning
Device type	RAM 713 S	Fixed setting
Control	**Standard** User-defined	For simple applications For specific settings of the control parameters and special applications such as heating/cooling or 2 stage heating.
Used control functions	 **Heating control only** Heating and cooling 2-stage heating with switching additional stage 2-stage heating with continuous additional stage	User-defined control: Heating operation only An additional cooling system should be controlled (Object 8) . A main stage (typically underfloor heating) and an additional stage (On/Off) should be controlled. A main stage (typically underfloor heating) and an additional stage (radiator) can be controlled (P control).
Function of the external interface	**None** Active	Determines whether external interface is being used.

3.4.2 Setpoint values

Table 11

Designation	Values	Meaning
Basic setpoint value after downloading the application	**18 °C**, 19 °C, 20 °C, **21 °C**, 22 °C, 23 °C, 24 °C, 25 °C	Output setpoint value for the temperature control.
Maximum valid setpoint value offset	+/- 1 K, **+/- 2 K**, +/- 3 K	Limits the possible setting range for the "setpoint offset " function. Applicable for the received values above object 0 (manual setpoint value offset).
Maximum valid basic setpoint value	20°C, 21°C, 22°C 23°C, 24 °C, 25°C 27 °C, 30 °C, **32 °C**	Should a basic setpoint value which is higher than the set value here be received by Object 0, it will be limited to this value.
Minimum valid basic 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	Should a basic setpoint value which is lower than the set value here be received by Object 0, 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 basic setpoint value of 21°C in heating operation and a 2K reduction, RAM 713 S 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 offset is allowed*	only in comfort mode in comfort and standby mode in comfort, standby and night mode	In which operation modes should the setpoint offset work? This setting affects both offset by bus telegram and by the rotary control.

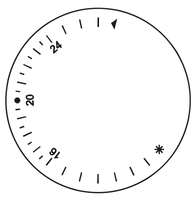
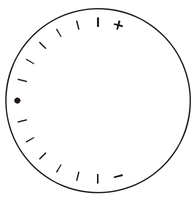
* From version 1.1 of ETS application software.

Continued:

Designation	Values	Meaning
Current setpoint value in comfort mode	 **Sends actual value (Heating < > Cooling)** Sends average value between heating and cooling	Feedback of current setpoint value via the bus: The setpoint value actually being controlled is always sent (= current setpoint value).-{}- **Example** with a basic setpoint value of 21°C and a dead zone of 2K: During heating and cooling, 21°C and basic setpoint value + dead zone are sent respectively (21°C + 2K = 23°C) Same value in comfort operation mode during both heating and cooling operation, i.e.: Basic setpoint value + half dead zone are sent to prevent room users becoming irritated. **Example** with a basic setpoint value of 21°C and a dead zone of 2K: Mean value= 21°+1K =22°C Although control takes place at 21°C or 23°C
Sends the current setpoint value in cycles	 **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 currently valid setpoint value be sent? Send only in the event of a change. Send cyclically

3.4.3 Operation

Table 12

Designation	Values	Meaning
Function of the rotary control	Basic setpoint value (please using the following rotary control) 	The rotary control is used to specify the basic setpoint value. A setpoint value offset is possible via Object 0. The rotary control with the figures is plugged back onto the device.
	Manual offset (please using the following rotary control) 	The basic setpoint value can be increased or decreased using the rotary control within the programmed limits (see next table row). The +/- rotary control is plugged back onto the device.
	Disabled, but object basic setpoint value available	The rotary control does not function (protection from undesired operation). The basic setpoint value can be changed in the application or via Object 0.
	Disabled, but object manual offset available	The rotary control does not function (protection from undesired operation). The basic setpoint value is changed in the application and can be increased or decreased via Object 0.
Minimum setting on the rotary control	10°C, 11°C, 12 °C 13°C, **14°C**, 15°C 16°C, 17°C, 18°C 19 °C, 20 °C	Lowest permissible setting for the basic setpoint value on the rotary control. Prevents unauthorised individuals from adjusting it.
Maximum setting on the rotary control	17°C, 18°C, 19°C 20°C, 21°C, 22°C 23°C, 24°C, 25°C 26°C, 27°C, 28°C	Highest permissible setting for the basic setpoint value on the rotary control. Prevents unauthorised individuals from adjusting it.

Continued:

Designation	Values	Meaning
Max. setpoint offset on the rotary control	+/- 1 K, **+/- 2 K**, +/- 3 K	Permitted offset by user on the rotary control The programmed max. or min. value is always achieved at the stopping point (+ or -).
Function of the key	Disabled Presence keys **Selects operating modes**	Operation not possible. Presence is recognised on pressing the key and RAM 713 S switches to the comfort operating mode. The operating mode can be manually selected at all times.
Function of the LEDs	None **Show operating modes** Shows time-limited operating modes	The 4 operating mode LEDs always remain off. The current operating mode is always shown by the respective LED The current operating mode can, if enabled, be shown by pressing the key for a short time (10s).

3.4.4 Actual value

Table 13

Designation	Values	Meaning
Use which actual value	From internal sensor	Fixed setting if E3 is not used for an external sensor. An external sensor can be selected via the "Function of E3" parameter on the settings parameter page.
Function of the external sensor		This parameter is only visible if E3 is configured as a temperature sensor input.
	Temperature control sensor (flush-mounted housing)	The room temperature is measured using the external sensor. The internal sensor is deactivated.
	Floor sensor for temperature control	The room temperature is measured using the internal sensor. The external sensor monitors the underfloor temperature. (see below: Minimum and maximum floor temperature).
	Floor sensor for temperature control	Only the floor temperature is measured and used as the basis for temperature control.
Minimum floor temperature	No lower limit 10°C, 12°C, 14°C **16°C**, 18°C, 20 °C 22°C, 24°C, 26°C 28°C, 30°C	The floor temperature is controlled by RAM 713 S depending on the room temperature. However, the floor temperature is not exceeded even when the setpoint temperature has reached the set minimum value.* This setting prevents "cold feet."

* Exception: If the setpoint value is exceeded in the heating and cooling operating mode it switches to cooling and stops sending the heating control variable.

Continued:

Designation	Values	Meaning
Maximum floor temperature	24°C, 26°C, 28°C, 30°C, 32°C, **34°C**, 36°C, 38°C, 40°C, 42°C, 44°C, 46°C,	The floor temperature is controlled by RAM 713 S depending on the room temperature. However, the floor temperature is not exceeded even when the setpoint temperature has not reached the set maximum value. This setting prevents, among other things, the floor from becoming deformed through overheating.
Calibration value for internal sensor In 1/10 K (-64 .. 63)	Manual input – 64 ... 63	Positive or negative correction of measured temperature in 1/10 K increments. Examples: a) RAM 713 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 S to 21 °C, “7” (i.e. 7 x 0.1K) must be entered. b) RAM 713 sends 21.3°C. 20.5°C is measured. In order to reduce the temperature of RAM 713 S to 20.5 °C, “8” (i.e. -8 x 0.1K) must be entered.
Calibration value for external sensor	Manual input – 64 ... 63	See above, calibration value for internal sensor
Transmission of the actual value in cycles (internal and external)	Not in the event of change at a change of 0.2 K at a change of 0.3 K **at a change of 0.5 K** at a change of 0.7 K at a change of 1 K at a change of 1.5 K at a change of 2 K	Is the current room temperature to be sent? If so, from which minimum change should this be sent again? This setting keeps the bus load as low as possible.
Cyclical Transmission of the actual value in cycles (internal and external) *or* Cyclical the external actual value in cycles	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 values be sent, regardless of the temperature changes?

3.4.5 Heating control

Table 14

Designation	Values	Meaning
Type of control	Continuous control 2-point control	Infinite control (0 .. 100%). Switching control (On/Off). See Appendix: Continuous and switching control
Sets the control parameters	**Via system type** User-defined	Standard application Prof. application: Self-configure P/PI control
System type	**Radiator heating** Underfloor heating	PI control with: Integrated time = 90 minutes Bandwidth = 2.5 k Integrated time = 180 minutes Bandwidth = 4 k
the heating control variable in cycles	On change by 1% On change by 2 % On change by 3 % **On change by 5 %** On change by 7 % On change by 10 % On change by 15 %	After how much % change* in the control variable is the new value to be sent. Small values increase control accuracy but also the bus load.
Sends the heating control variable in cycles	**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)?
2-point control		
This setting prevents “cold feet.”	0.3 K 0.5 K 0.7 K **1 K** 1.5 K	Interval between the switch-off point (setpoint value) and the re-switch on point (setpoint value – hysteresis). The hysteresis prevents constant switching on/off.

Continued

Designation	Values	Meaning
Recirculation of hysteresis after switching point	**None** 0.1 K/min 0.2 K/min 0.3 K/min	The recirculation causes a gradual decrease in the hysteresis over time, and the control accuracy is increased. The hysteresis is equivalent to the programmed value for each switch-off and is gradually reduced by the recirculation process. The hysteresis can reduce to 0 K over prolonged periods of switch-off. At the next switch-on, it is reset to the configured value.
User-defined 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	prof. 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	Pure P 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	Professional setting: See Appendix: Response of the PI control 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. Conversely, under-dimensioned heating (slow) benefits from longer integrated times.

*Change since last sending

3.4.6 Cooling control

Table 15

Designation	Values	Meaning
Type of control	Continuous control 2-point control	Infinite control (0 .. 100%). Switching control (On/Off). See Appendix: Continuous and switching control
Sets the control parameters	**Via system type** User-defined	Standard application Prof. application: Self-configure P/PI control
System type	**Cooling surface** Fan coil unit	PI control with: Integrated time = 90 mins Bandwidth = 2 k Integrated time = 180 minutes Bandwidth = 4 k
Sends the cooling control variable	On change by 1% On change by 2 % On change by 3 % **On change by 5 %** On change by 7 % On change by 10 % On change by 15 %	After how much % change* in the control variable is the new value to be sent. Small values increase control accuracy and also the bus load.
Switches between heating and cooling	**automatic** Via object	RAM 713 S automatically switches to cooling mode when the actual temperature is above the setpoint value. Cooling mode can be activated only on the bus side via Object 15 (1= cooling). Cooling mode remains off for as long as this object is not set (=0).
Output of the cooling control variable *(Only when switching between heating and cooling via object)*	**For separate object (object 8)** Together with heating control variable (object 7)	Cooling control variable is output via object 8 and heating control variable via object 7. Both control variables are sent via object 7. For 2 wire systems with a valve and seasonal change of medium.

Continued:

2-point control		
Hysteresis of 2 wire control for cooling.”	0.3 K 0.5 K 0.7 K **1 K** 1.5 K	Interval between the switch-off point (setpoint value) and the re-switch on point (setpoint value – hysteresis). The hysteresis prevents constant switching on/off.
Recirculation of hysteresis after switching point	**None** 0.1 K/min 0.2 K/min 0.3 K/min	The recirculation causes a gradual decrease in the hysteresis over time, and the control accuracy is increased. The hysteresis is equivalent to the programmed value for each switch-off and is gradually reduced by the recirculation process. The hysteresis can reduce to 0 K over prolonged periods of switch-off. At the next switch-on, it is reset to the configured value.
User-defined control parameters		
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	prof. setting to adapt the control response to the room. Large values cause finer changes to the control variables with the same control deviation and more precise control than smaller values.

Continued

Designation	Values	Meaning
Integrated time of the cooling control	Pure P 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.	See appendix: temperature control For PI control only: The integrated time determines the reaction time of the control. These times can be adapted to suit particular circumstances. If the cooling system is over-dimensioned and therefore too fast, shorter values should be used. Conversely, under-dimensioned cooling (slow) benefits from longer integrated times.
Sends Sends the cooling control variable	**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 cooling control variable to be sent (regardless of changes)?

*Change since last sending

3.4.7 Setpoint values for cooling

This page is displayed only when the control function “Heating and cooling” has been selected (“user-defined” control) on the “Settings” parameter page.

Table 16

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 operations. The dead zone is expanded through hysteresis in switching (2 point) control. See glossary: Dead zone * According to each type of control: "+ Hysteresis heating" or. "+ Hysteresis heating. + hysteresis cooling"
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**	The 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

3.4.8 Additional stage heating

See also Appendix: 2 stage heating

Table 17

Designation	Values	Meaning
Differential between main stage and additional stage	**1 K**, 1.5 K, 2 K, 2.5 K, 3 K, 3.5 K, 4 K	Specifies the negative interval between the current setpoint value and the setpoint value of the additional stage. **Example** with a basic setpoint value of 21°C and a differential of 1K: The main stage controls using the basic setpoint value, and the additional stage controls using the basic setpoint value – 1K = 20°C
Proportional band for additional stage	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	With a continuous additional stage, prof. setting to adapt the control response to the room. Large values cause finer changes to the control variables with the same control deviation and more precise control than smaller values.
Hysteresis	0.3 K 0.5 K 0.7 K **1 K** 1.5 K	With a switching additional stage, Interval between the switch-off point (setpoint value) and the re-switch on point (setpoint value – hysteresis). The hysteresis prevents constant switching on/off.

Continued:

Designation	Values	Meaning
Recirculation of hysteresis after switching point	**None** 0.1 K/min 0.2 K/min 0.3 K/min	For switching additional switching stage. The recirculation causes a gradual decrease in the hysteresis over time, and the control accuracy is increased. The hysteresis is equivalent to the programmed value for each switch-off and is gradually reduced by the recirculation process. The hysteresis can reduce to 0 K over prolonged periods of switch-off. At the next switch-on, it is reset to the configured value.
Sends the control variable for the 2nd heating stage	On change by 1% On change by 2 % On change by 3 % **On change by 5 %** On change by 7 % On change by 10 % On change by 15 %	After how much % change* in the control variable is the new value to be sent? Small values increase control accuracy but also the bus load.
Sends Sending the additional heating	**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.	At what intervals should the switching status of the additional stage be sent?

*Change since last sending

3.4.9 Operating mode

Table 18

Designation	Values	Meaning
Objects for determining the operating mode	New:operating mode, presence, window status **Old: comfort, night, frost (not recommended)**	RAM 713 S 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 re-programming
Type of presence sensor (to Obj. 4)	 **Presence detector** Presence button	The presence sensor activates comfort mode The presence detector sets or clears the presence object. Receiving another operation mode through obj. 3 doesn't influence the presence object. The operating mode won't be updated until obj. 4 will be reset by the presence detector. 1. The presence button sets the presence object. Receiving another operation mode through obj. 3 resets obj. 4. 2. If the presence object is set during night / frost operation, it is reset after the configured comfort extension finishes (see below). The presence object is not reported on the bus.

Continued

Designation	Values	Meaning
Comfort extension by presence keys in night mode	None 30 min 1 hour 1.5 hours **2 hours** 2.5 hours 3 hours 3.5 hours	- Party switching: RAM 713 S 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 ony cleared with the next manual or bus controlled change of operating mode.
Sends the current operating mode in cycles	**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?

3.4.10 Switching 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 keystroke: Step/Stop or. Turn slats- (Object 9) Long keystroke: Up telegram (Object 12)
Function of E2	Blinds down	Short keystroke: Step/Stop or. Turn slats- (Object 9) Long keystroke: Down telegram (Object 12)
Function of E1, E2, E3: Blinds single button operation		
Function of E1 (or. E2, E3)	Blinds single button operation	Short keystroke: Step/Stop or. Turn slats- Turning. The sent value is opposite to the telegram of the last directional command Long keystroke: Up / Down Pressing the key again reverses the direction of run. Always starts with Down after bus failure or reset.

Continued:

Designation	Values	Meaning
Function of E1 (+ E2): Dim brighter / darker		
Function of E1	Dim brighter	Short keystroke: On / Off (Object 9) Long keystroke: Brighter darker dimming (Object 12)
Function of E2	Dim darker	Short keystroke: On / Off (Object 9) Long keystroke: Darker dimming (Object 12)
Function of E1, E2, E3: Dimming single button operation		
Function of E1 (or. E2, E3)	Dimming single button operation	Short keystroke: On/Off. Switching status is reversed with each keystroke. Long keystroke: Brighter / darker. Dimming direction is reversed with each keystroke. 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 keystroke 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 press of the key (in 1/1000s) 2 different functions can be performed depending on whether a key is briefly pressed or held down.
Function of E3: Temperature sensor		
See "Function of external sensor" on the "Actual value" 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.

4.1.1 Heating control variable

- The control variable is sent to a continuous Cheops actuating drive (Order No. 731 9 200), which is plugged onto the valve
- The control variable is sent to one of the following heating actuators which controls one or more thermal positioning actuators..
  - HMG 4 (Order no. 491 0 210)
  - HME 4 (Order no. 491 0 211)
  - HMG 8 (Order no. 490 0 270)
  - HMT 6 (Order no. 490 0 273)
  - HMT 12 (Order no. 490 0 274)

4.1.2 Cooling control variable

- The control variable is sent to a continuous Cheops actuating drive (Order No. 731 9 200), which is plugged onto the valve for the cooling medium.

4.1.3 Continuous additional stage

- The control variable is sent to a continuous Cheops actuating drive (Order No. 731 9 200), which is plugged onto the valve
- The control variable is sent to one of the following heating actuators which controls one or more thermal positioning actuators..
  - HMG 4 (Order no. 491 0 210)
  - HME 4 (Order no. 491 0 211)
  - HMG 8 (Order no. 490 0 270)
  - HMT 6 (Order no. 490 0 273)
  - HMT 12 (Order no. 490 0 274)

4.1.4 Switching additional stage

- The switching commands are sent to an actuator which controls on its part thermal actuators or an electrical additional heating.
- The switching commands are sent to an actuator which controls on its part thermal actuators or an electrical additional heating.
  - HMG 4 (Order no. 491 0 210)
  - HME 4 (Order no. 491 0 211)
  - HMG 8 (Order no. 490 0 270)
  - HMT 6 (Order no. 490 0 273)
  - HMT 12 (Order no. 490 0 274)

4.2 Control variable display

5 4 3 2 1

The current control variable is displayed if the key is held down for more than 2 seconds.

LED	Control variable
No LED	0 %
LED 1 (Frost)	1 - 25%
LED 2 (Night)	26 - 50%
LED 3 (Standby)	51 - 75%
LED 4 (Comfort)	76 - 100%

LED 5 shows whether the heating or cooling operation is running.

4.3 Typical applications:

4.3.1 Heating, blinds and switching

In addition to its function as a heating controller, RAM 713 S can control blinds and room lighting and switch on and off via the external interface.

Parameter page: Settings

Function of external interface	active

Keys for controlling the blinds (Up/Down and Step/Stop) are connected to E1 and E2.
Objects 9 and 10 are linked with the corresponding control objects of the blinds actuator.
The switch is connected to the input E3 and the switch object (Object 13) is connected to the relevant channel of the switch actuator.

Hint: Both functions can be realised with the same actuator if necessary.
RMG 8 as a switching and blinds actuator or JMG 4 (blinds actuator) with a switching actuator upgrade module RME 8 or RMX 4. (See chapter entitled external interface)

4.3.2 Heating and cooling in the 2 wire system

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

- In the 2 wire system, heating and cooling mediums (depending on the season) are – lead through the same lines and controlled via the same valve.
  Über einen Parameter können The cooling control variable and the heating control variable can be sent via a parameter to a single, common object (Object 7) - (see parameter: Output of cooling control variable, chapter on cooling control)

- It is also possible to connect the "heating control variable" and "cooling control variable" objects to the positioning actuator via the same group address.

- The control variables must not be sent cyclically

- The switchover between heating and cooling mediums is performed by the system and must therefore be passed on to the room thermostat.
  The parameter "Switching between heating and cooling" (Parameter page "Cooling control") is set to "via object". The heating/cooling system must send a 0 for heating mode and a 1 for cooling mode to Object 6 "Switching between heating and cooling" in the RAM 713.

4.3.3 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

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

RAM 713 S 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.

5 Appendix

5.1 Determining the current operating mode

The current setpoint value can be adapted in line with certain requirements by selecting the operating mode.
The operating mode can be specified by Objects 3..5.
There are two methods available:

5.1.1 New operating modes

If on the parameter page, new operating mode is selected by the "Determining operating mode" parameter, the current operating mode can be defined as follows:

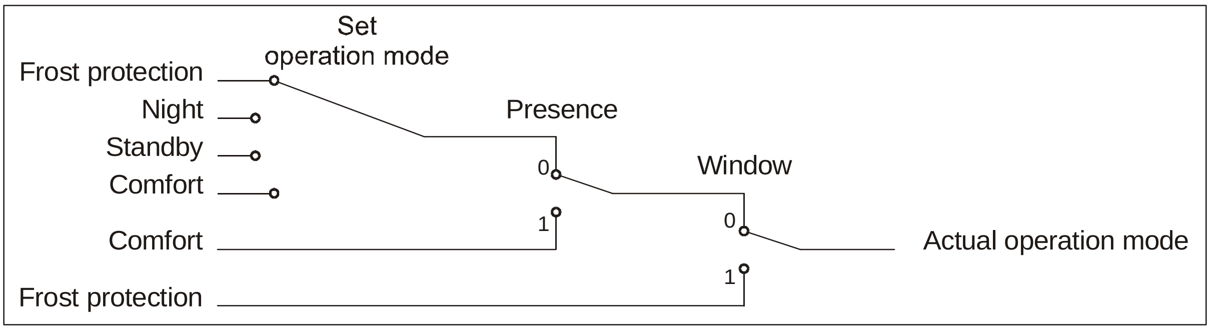
Table 19

Pre-selected operating mode 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" mode and in the evenings "Night" mode via a timer (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 indicator. If a presence is detected, RAM 713 switches to comfort 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 S switches to frost protection mode.



5.1.2 Old operating modes

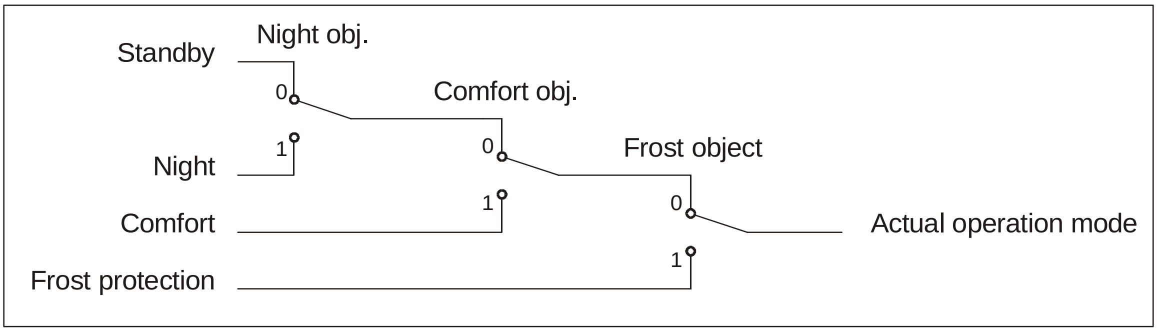
If on the parameter page, old operating mode is selected by the "Determining operating mode" parameter, the current operating mode can be defined as follows:

Table 20

Night Object 3	Comfort Object 4	Frost / heat protection Object 5	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" mode and in the evenings "night" mode is activated via Object 3.

During holiday periods, Object 5 selects frost / heat protection via another channel via Object 5.
Object 4 (comfort) is connected to a presence indicator. If a presence is detected, RAM 713 S switches to comfort mode (see table).
Object 5 is connected to a window contact. As soon as a window is opened, RAM 713 S 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 during periods when "frost / heat protection" is selected via the timer, the window is opened and then closed again, the "frost / heat protection" mode is cleared.

5.1.3 Determining the setpoint value

5.1.3.1 Calculating the setpoint value in heating operation

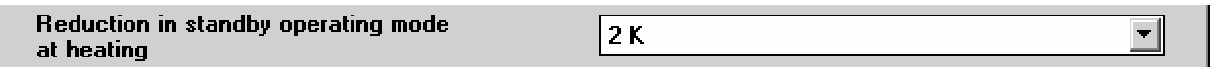
See also: Basic setpoint value and current setpoint value

Table 21: Current setpoint value during heating

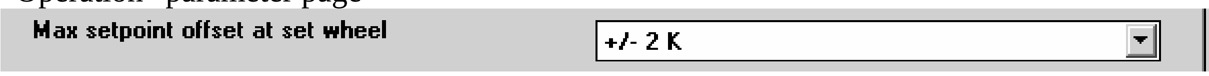
Operating mode	Current setpoint value
Comfort	Basic setpoint value setpoint value +/- setpoint value offset
Standby	Basic setpoint value +/- setpoint value offset – reduction in standby mode
Night	Basic setpoint value +/- setpoint value offset – reduction in night mode
Frost / heat protection	Programmed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

Example:
Heating in comfort mode.

“Setpoint values” parameter page:



“Operation” parameter page



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

Calculation:

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

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

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

5.1.3.2 Calculating the setpoint value in cooling operation

Table 22: Current setpoint value during cooling

Operating mode	Current setpoint value
Comfort	Basic setpoint value + setpoint value offset + dead zone
Standby	Basic setpoint value + setpoint value offset + dead zone + increase in standby mode
Night	Basic setpoint value + setpoint value offset + dead zone + increase in night mode
Frost / heat protection	Programmed setpoint value for heat protection mode

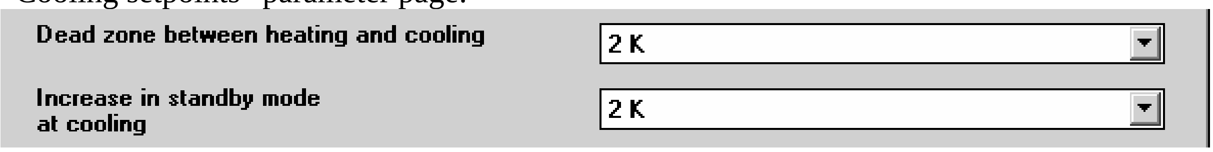
Example:
Cooling in comfort mode.

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

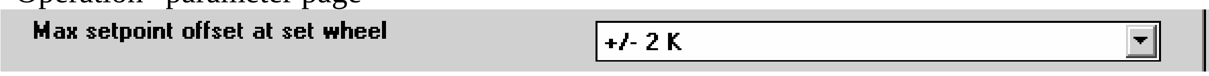
“Settings” parameter page

“Setpoint values” parameter page:

“Cooling setpoints” parameter page:



“Operation” parameter page



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

Calculation:

Current setpoint value = basic 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 = basic setpoint value + setpoint value offset + dead zone
+ increase in standby mode
= 21°C - 1K + 2K + 2K
= 24°C

5.2 Setpoint value offset

For the RAM 713 S, the current setpoint value can be adjusted in two ways.

- In increments using the rotary control (see "Operation" parameter page, function of the rotary control)
- Directly via Object 0 "Manual setpoint value offset"

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

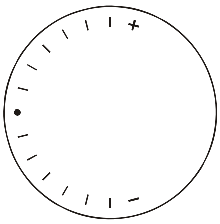
The offset limits are specified on the "Operation" parameter page by the "Maximum setpoint value offset on the rotary control" parameter and apply to both types of setpoint value offset.

5.2.1 Setpoint temperature offset using the rotary control

This option is available when the rotary control has been enabled on the "Operation" parameter page.

Function of set wheel	manual offset

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



In the central position of 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 23

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

5.2.2 Setpoint temperature offset via Object 0

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

Function of set wheel	Base set point value

or

Function of set wheel	disabled, but man. 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 basic setpoint value (as programmed or specified by the rotary control) and not to the current setpoint value.

Example Basic 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 basic setpoint value (here 21°C), in this case 1.00K (21°C+1.00K=22°C)

5.3 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)
- Blinds Up/Down (with 2 keys on E1 + E2)
- Blinds single button operation (with 1 key)
- Dimmer brighter/darker (with 2 keys on E1 + E2)
- Dimmer single button 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 otherand have a common effect on objects 9, 10 und 12.

5.3.1 Overview Function of Objects 9 .. 14.

Table 24: 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 button 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 button operation	Sends On/Off commands to the dimmer	Sends 4-bit dim commands	*Not used*

Table 25: Function of E2

Function of E2	Function	
	Object 11	Object 12
Switching	Sends the switching status of the E2 input	*Not used*
Blinds single button operation	Sends commands for Step/Stop or slat positioning	Sends Up/down command to blinds
Dimming single button 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 26: Function of E3

Function of E3	Function	
	Object 13	Object 14
Switching	Sends the switching status of the E2 input	*Not used*
Blinds single button operation	Sends commands for Step/Stop or slat positioning	Sends Up/down command to blinds
Dimming single button 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.

5.3.2 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 configuration .

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

5.3.3 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).

For both inputs it is differentiated between short time and long time operation. The time difference between a long and a short press of the key 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 key is held down, the other will not operate.

Table 27

Pressing key	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 decision between Step and Stop occurs in the blinds actuator itself depending on the operating position.

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

5.3.4 Blinds single button operation

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

Table 28

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

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

5.3.5 E1 E2 Dim brighter / darker

2 keys can be connected to realise a dimming function.
The objects 9 (Dimming on/of) 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.

For both inputs it is differentiated between short time and long time operation. The time difference between a long and a short press of the key 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 (Obj. 12).

Table 29

Pressing key	E1	E2
long *(Affects Object 12)*	- Pressing the key sends a start telegram for brighter dimming - Letting go sends a stop telegram	- Pressing the key 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.

5.3.6 Dimming single button operation

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

Pressing key	E1
long	- Pressing the key 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.

5.3.7 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 temoerature control (Order No. 907 0 321)

All the settings are entered on the “Actual value” parameter page.

5.3.8 Suitable actuators

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

Table 30

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 for basic device
JMG 4 24VDC	490 0 253	24V DC blinds actuator for basic device
RMG 8	490 0 251	Switching and blinds actuator for 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

5.4 2-stage heating

A 2-stage heating system consists of a slow main stage and a fast additional stage.

RAM 713 S is usually used for underfloor heating (main stage) and for the additional stage for the radiators.

RAM 713 S controls the two stages in parallel, the additional stage being controlled at a lower setpoint value.
The differential between main and additional stage is defined on the “Additional stage heating” parameter page.

Cheops actuating drives (Order No. 731 9 200) can be used for the continuous additional stage (recommended).
. It is also possible to use thermal actuators in connection with a HMT 6/12 or HMG 8 thermal actuator.

Thermal actuators (Order No. 907 0 248) can be used as actuators for the switching additional stage
.
An electrical additional heating can be controlled via the heating actuators HMT 6/12 or HMG 8.

5.5 Temperature control

5.5.1 Introduction

If the RAM 713 S 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.

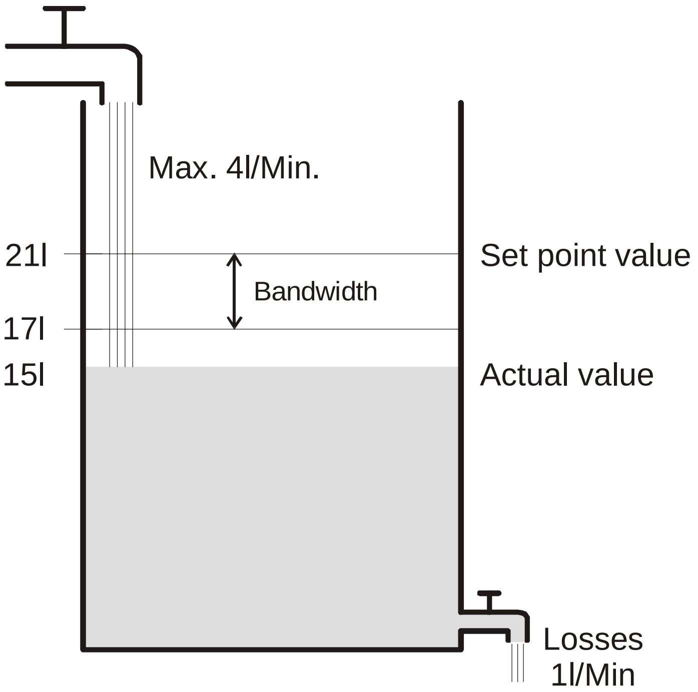
In our example, the maximum supply volume is 4 litres per minute and also denotes the maximum radiator output.
This maximum output is achieved with a control variable of 100%.
Accordingly, at a control variable of 50%, only half the water volume, i.e. 2 litres per minute, would flow into our vessel.

The bandwith is 4l.
This means that the control controls at 100% provided the actual value is smaller than or equal to (211 – 41) = 171.

Function:

- Desired filling quantity:
  21 litres (= setpoint value)
- From when should the supply flow gradually be reduced in order 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

5.5.2 Response of the P-control



A filling volume of 15l gives rise to a control deviation of 211 – 151 = 61
Because our actual value lies outside the bandwidth, the control will control the flow 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 31

Filling level	Control variable	Supply	Loss	Increase in filling level
15l	100%	4 l/min	1 l/min	3 l/min
19l	50%	2 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 flow allows only the same amount of water to flow in as can flow 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 behaves during heating control as shown in the previous example.
The setpoint temperature (21^{o}C) can never quite be reached.

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

5.5.3 Response of the PI-control

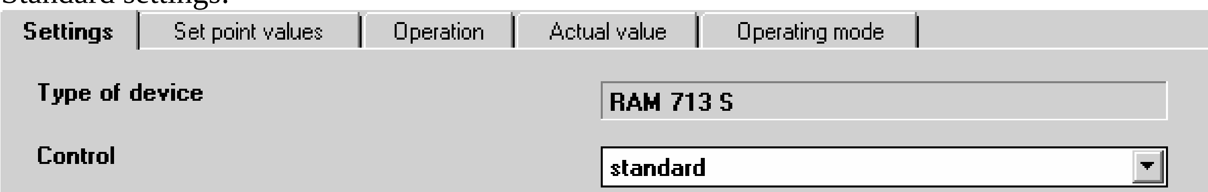
Unlike the pure P-control, the PI-control works dynamically.
With this type of control, the control variable remains unchanged, even at a constant deviation.

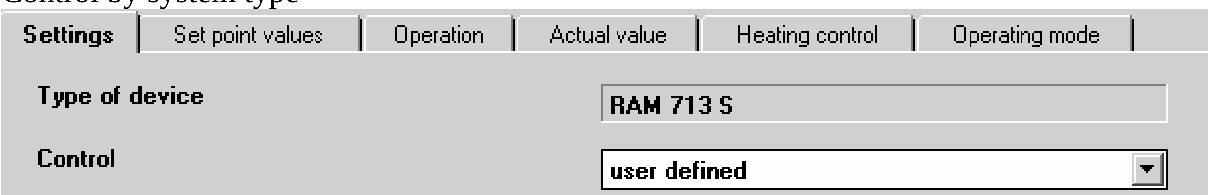
In the first instant, the PI-control sends the same control variable as the P-control, although the longer the setpoint value is not reached, the more this value increases.
This increases is time-controlled over the so-called integrated time.
With this calculation method, the control variable does not 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 control variable 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.

Usually, the best results are achieved with the standard settings or the settings via system type.

Standard settings:


Control by system type


6 Glossary

6.1 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 dose the energy input. This achieves a pleasant and precise control.

Table 32: Overview controller functions

Mode / stage	Type of control	Hysterese
Heating	switching / PI controller	positive
Cooling	switching / PI controller	negative
Additional stage	switching / P controller	negative

6.2 Hysteresis

Hysteresis determines the difference 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.

6.2.1 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.

Example of additional heating stage
Additional stage with a setpoint value of 20 °C, hysteresis 0.5 K and starting temperature 19 °C.
The additional stage is switched on and does not switch off again until the setpoint value (20^{o}) is reached.
The temperature falls and the additional stage does not switch on again until 20 °C-0.5K= 19.5 °C.

Example cooling:
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.

6.2.2 Positive hysteresis

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

Example heating:
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.

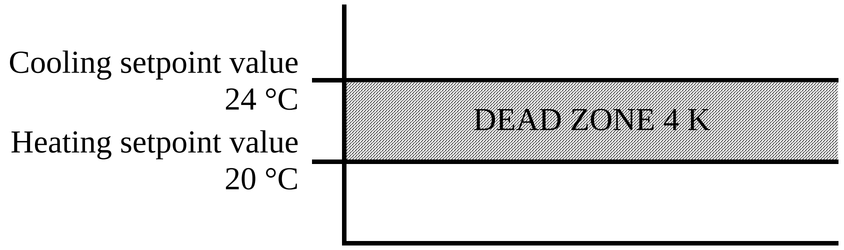
6.3 Dead zone

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 had been under-run, the heating would activate and the setpoint value would not be achieved. If cooling were then to be started immediately, the temperature would fall to below the setpoint value and switch on the heating again.

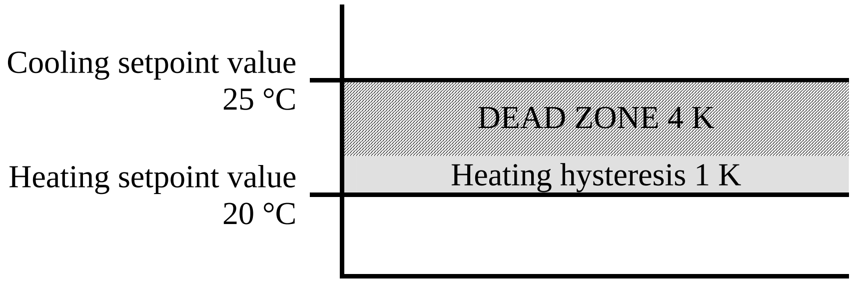
Depending on the type of control the dead zone can be extended by the value of the hysteresis.

6.3.1 Case 1: Heating and cooling with continuous control



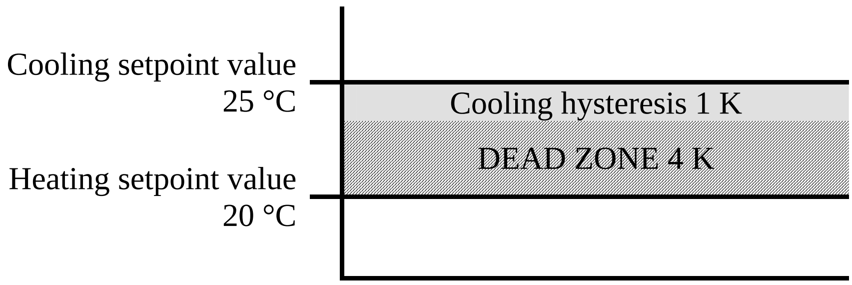
The dead zone (4 K) is not affected

6.3.2 Case 2: Heating with 2-point control and cooling with continuous control



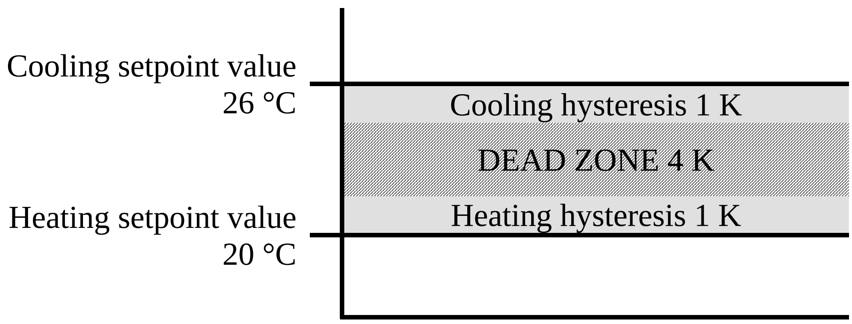
The dead zone (4 K) is inceased by the value of the hysteresis (1K) and offsets the cooling setpoint value to 25 °C.

6.3.3 Case 3: Heating with continuous control and cooling with 2-point control



The dead zone (4 K) is inceased by the value of the hysteresis (1K) and offsets the cooling setpoint value to 25 °C.

6.3.4 Case 4: Heating and cooling with 2-point control



The dead zone (4 K) is inceased by the value of both hystereses (2K) and offsets the cooling setpoint value to 26 °C.

6.4 Basic setpoint value and current setpoint value

The **basic setpoint value** is the standard temperature for comfort mode and the reference temperature for reduction in standby and night modes.
The programmed basic setpoint value (see "Basic setpoint value after downloading the application") is stored in Object 0 and can be changed at all times via the bus by sending a new value to Object 0 (EIS5).
After reset (bus returned), the last used basic setpoint value is restored.

The **current setpoint value** is the setpoint according to which control actually occurs. It is the result of all the operating mode reductions or increases depending on the control function.

Example:
At a basic 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 (insofar as cooling operation is not active).

The formation of the current setpoint value due to the basic setpoint value can be observed in the block diagram on the next page.
The basic setpoint value is on the left, which was 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.

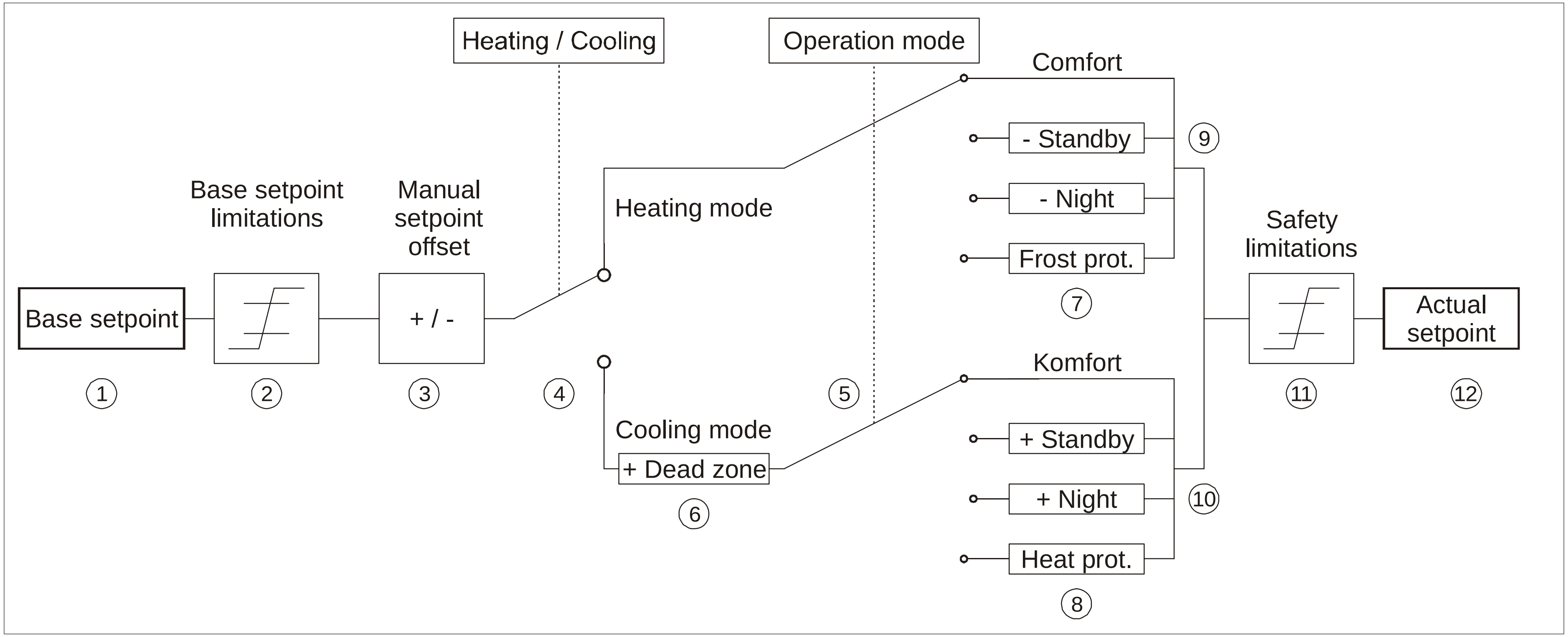
As you can see in the block diagram, the current setpoint value depends on the operating moce (5) and the control function (4) selected.

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

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

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

6.4.1 Setpoint value calculation



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