KNX manual

HU 1, HU 1 RF, HU 1 S RF

flush-mounted heating actuators

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Contents

1 IMPORTANT WARNINGS!

Risk of electric shock!

- The HU 1 RF, HU 1 S RF device does not have basic insulation around the terminals and plug connection!
- The inputs carry mains voltage!
- When connecting the inputs or before any intervention at one of the inputs, interrupt the 230 V supply of the device.
- Protect against accidental contact during installation.
- Maintain a minimum distance of 3 mm from live parts or use additional insulation, e.g. separating strips/walls.
- Do not remove the insulation from the unused inputs.
- Do not cut off the conductors of the unused inputs.
- Do not connect mains voltage (230 V) or other external voltages to the inputs!
- During installation, ensure there is adequate insulation between mains voltage (230 V) and bus or inputs (min. 5.5 mm).

2 Function description

- Heating actuator for controlling thermal actuators, switching 230 V AC
- Flow temperature adjustment to meet requirements: Automatic calculation of the maximum actuating value for adjustment of the flow temperature to actual requirements
- No KNX room thermostat needed: Flexible use as a heating actuator or heating controller
- Flush-mounted installation
- Silent semiconductor switch
- Continuous or switching actuating value selectable

ⓘ **S RF version:** optimised send/receive performance through the use of a new radio chip

3 Operation

Channel H1 can be configured as a heating actuator or as a heating controller.

The device has 2 external inputs for buttons, switches, etc.
Input I2 can also be used as a temperature input.

The inputs can either be used as independent binary inputs or for direct control.

Direct control

If channel H1 is used as a heating controller, the inputs can be used for the window contact and room temperature detection if required.

In this case, the inputs are internally connected directly to the heating controller.
This requires the following settings:
Channel H1: Channel function = heating controller
Input I1: Function = window contact + connect window contact internally with controller = yes[1]
Input I2: Function = temperature input + connect temperature input internally with controller = yes.[2]

The communication objects for I1 and I2 are still available even with direct control.

See chapter *Typical applications*.

Site function

Thermal actuators often have a so-called construction site function ex works and do not close the valve completely in the delivered condition.
The heating actuator automatically deactivates this function after switching on the supply voltage and/or after programming, and switches the output on for 10 minutes.

[1] The window setting object is hidden for the heating controller.
[2] The actual value object is hidden for the heating controller.

4 Technical data

Operating voltage	HU 1: KNX bus voltage HU 1 RF, HU 1 S RF: 230–240 V AC, 50–60 Hz
KNX bus current[3]	5 mA
Valve output	230 V AC max. 1 A
Standby output	HU 1 RF, HU 1 S RF < 0.4 W
L x W x D	HU 1: 44,4 x 48,6 x 31,3 mm HU 1 RF: 48,6 x 46,8 x 22 mm HU 1 S RF: 48,6 x 44,4 x 25 mm
Type of installation	Flush-mounted
Connection type	HU 1: Screw terminals | bus connection: KNX bus terminal HU 1 RF, HU 1 S RF: Screw terminals
Max. cable cross-section	Solid: 0.5 mm² (Ø 0.8 mm) to 4 mm² strand with crimp terminal: 0.5 mm² to 2.5 mm²
Number of channels	1-channel
Drives	1..4
Ambient temperature	-5 °C ... +45 °C
Protection rating	IP 20 in accordance with EN 60529
Protection class	II in accordance with EN 60730-1 subject to designated installation
Radio standard[4]	RF1.R
Transmission frequency	868.3 MHz
Transmission power	< 10 mW
Range in open space	Up to 100 m
Coding	FSK (Frequency Shift Keying)
Transceiver type	bidirectional

[3] HU 1 only
[4] Radio characteristics: HU 1 RF, HU 1 S RF only

5 General information about KNX Secure

ETS5 Version 5.5 and higher support secure communication in KNX systems. A distinction is made between secure communication via the IP medium using KNX IP Secure and secure communication via the TP and RF media using KNX Data Secure. The following information refers to KNX Data Secure.

In the ETS catalogue, KNX products supporting "KNX-Secure" are clearly identified. 

As soon as a "KNX-Secure" device is included in the project, the ETS requests a project password. If no password is entered, the device is included with Secure Mode deactivated. However, the password can also be entered or changed later in the project overview.

5.1 Start-up with "KNX Data Secure"

For secure communication, the FDSK (Factory Device Setup Key) is required. If a KNX product supporting "KNX Data Secure" is included in a line, the ETS requires the input of the FDSK. This device-specific key is printed on the device label and can either be entered by keyboard or read by using a code scanner or notebook camera.

Example of FDSK on device label:

After entering the FDSK, the ETS generates a device-specific tool key. The ETS sends the tool key to the device to be configured via the bus. The transmission is encrypted and authenticated with the original and previously entered FDSK key. Neither the tool key nor the FDSK key are sent in plain text via the bus.
After the previous action, the device only accepts the tool key for further communication with the ETS.
The FDSK key is no longer used for further communication, unless the device is reset to the factory setting: In this case, all set safety-related data will be deleted.
The ETS generates as many runtime keys as needed for the group communication you want to protect. The ETS sends the runtime keys to the device to be configured via the bus.
Transmission takes place by encrypting and authenticating them via the tool key. The runtime keys are never sent in plain text via the bus.

The FDSK is saved in the project and can be viewed in the project overview.
All keys for this project can also be exported (backup).

During project planning, it can be defined subsequently which functions/objects are to communicate securely. All objects with encrypted communication are identified by the "Secure" icon in the ETS.

5.2 Start-up without "KNX Data Secure"

Alternatively, the device can also be put into operation without KNX Data Secure. In this case, the device is unsecured and behaves like any other KNX device without KNX Data Secure function.
To start up the device without KNX Data Secure, select the device in the 'Topology' or 'Devices' section and set the 'Secure start up' option in the 'Properties' area of the 'Settings' tab to 'Disabled'.

6 The HU 1, HU 1 RF, HU 1 (S) RF application programmes

6.1 Selection in the product database

Manufacturer	Theben AG
Product family	Heating, ventilation, air conditioning
Product type	Heating actuators
Programme name	HU 1 HU 1 RF HU 1 (S) RF

Number of communication objects	30
Number of group addresses	254
Number of associations	255

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

6.2 Overview of communication objects

6.2.1 Objects for the heating actuator/controller

No.	Object name	Function	Length	R	W	C	T	DPT
1	Channel H1	Switching actuating value	1 bit	R	W	C	-	1.001
	Channel H1	Continuous actuating value	1 byte	R	W	C	-	5.001
	Channel H1	Base setpoint	2 bytes	R	W	C	-	9.001
2	Channel H1	Manual setpoint offset	2 bytes	R	W	C	-	9.002
3	Channel H1	Actual value	2 bytes	R	W	C	-	9.001
4	Channel H1	Current actuating value	1 byte	R	-	C	T	5.001
	Channel H1	Operating mode preset	1 byte	R	W	C	-	20.102
5	Channel H1	Presence	1 bit	R	W	C	-	1.018
6	Channel H1	Window setting	1 bit	R	W	C	-	1.019
7	Channel H1	Current operating mode	1 byte	R	-	C	T	20.102
8	Channel H1	Heating actuating value	1 byte	R	-	C	T	5.001
	Channel H1	Heating and cooling actuating value	1 byte	R	-	C	T	5.001
9	Channel H1	Cooling actuating value	1 byte	R	-	C	T	5.001
10	Channel H1	Heating = 0, cooling = 1	1 bit	R	-	C	T	1.001
	Channel H1	Heating = 0, cooling = 1	1 bit	-	W	C	-	1.001
	Channel H1	Heating = 1, cooling = 0	1 bit	R	-	C	T	1.100
	Channel H1	Heating = 1, cooling = 0	1 bit	-	W	C	-	1.100
11	Channel H1	current setpoint	2 bytes	R	W	C	T	9.001
12	Channel H1	Report actual value failure	1 bit	R	-	C	T	1.005
	Channel H1	Report actuating value loss	1 bit	R	-	C	T	1.005
13	Channel H1	Forced operation	1 bit	R	W	C	-	1.003
14	Channel H1	Overcurrent/short circuit	1 bit	R	-	C	T	1.005
31	Channel H1	Summer mode ON/OFF	1 bit	R	W	C	-	1.003
32	Channel H1	Highest actuating value	1 byte	R	W	C	T	5.001
34	Channel H1	Pump ON/OFF	1 bit	R	-	C	T	1.001
36	Channel H1	Outdoor temperature	2 bytes	R	W	C	-	9.001
37	Channel H1	Outside temperature failure	1 bit	R	-	C	T	1.005

6.2.2 External inputs: Switch/button function

No.	Object name	Function	Length	R	W	C	T	DPT
41	*Channel I1.1*	*Switching*	1 bit	R	W	C	T	1.001
		Priority	2 bit	R	-	C	T	2.001
		Send percentage value	1 byte	R	-	C	T	5.001
		Send value	1 byte	R	-	C	T	5.010
42	*Channel I1.2*	*Switching*	1 bit	R	W	C	T	1.001
		Priority	2 bit	R	-	C	T	2.001
		Send percentage value	1 byte	R	-	C	T	5.001
		Send value	1 byte	R	-	C	T	5.010
45	*Channel I1*	*Block = 1*	1 bit	-	W	C	-	1.001
		Block = 0	1 bit	-	W	C	-	1.003
51 – 55	Channel I2 (details: see channel I1)							

6.2.3 External inputs: Dimming function

No.	Object name	Function	Length	R	W	C	T	DPT
41	*Channel I1*	*Switching*	1 bit	R	W	C	T	1.001
42	*Channel I1*	*Brighter/darker*	4 bit	R	-	C	T	3.007
		Brighter	4 bit	R	-	C	T	3.007
		Darker	4 bit	R	-	C	T	3.007
43	*Channel I1.1*	*Switching*	1 bit	R	W	C	T	1.001
		Priority	2 bit	R	-	C	T	2.001
		Send percentage value	1 byte	R	-	C	T	5.001
		Send value	1 byte	R	-	C	T	5.010
45	*Channel I1*	*Block = 1*	1 bit	-	W	C	-	1.001
		Block = 0	1 bit	-	W	C	-	1.003
51 – 55	Channel I2 (details: see channel I1)							

6.2.4 External inputs: Blinds function

No.	Object name	Function	Length	R	W	C	T	DPT
41	*Channel I1*	*Step/stop*	1 bit	R	-	C	T	1.010
42	*Channel I1*	*UP/DOWN*	1 bit	R	W	C	T	1.008
		UP	1 bit	R	-	C	T	1.008
		DOWN	1 bit	R	-	C	T	1.008
43	*Channel I1.1*	*Switching*	1 bit	R	W	C	T	1.001
		Priority	2 bit	R	-	C	T	2.001
		Send percentage value	1 byte	R	-	C	T	5.001
		Height % [5]	1 byte	R	-	C	T	5.001
		Send value	1 byte	R	-	C	T	5.010
		2-byte 9.x	2 bytes	R	-	C	T	9.xxx
		4-byte 14.x	4 bytes	R	-	C	T	14.xxx
44	*Channel I1.2*	*Slat %* [6]	1 byte	R	-	C	T	5.001
45	*Channel I1*	*Block = 1*	1 bit	-	W	C	-	1.001
		Block = 0	1 bit	-	W	C	-	1.003
51 – 55	Channel I2 (details: see channel I1)							

6.2.5 External inputs: Temperature input function (I2 only)

No.	Object name	Function	Length	R	W	C	T	DPT
51	*Channel I2*	*Actual value for temperature*	2 byte	R	-	C	T	9.001

6.2.6 External inputs: Window contact function

No.	Object name	Function	Length	R	W	C	T	DPT
41	*Channel I1*	*Window contact 1*	1 bit	R	-	C	T	1.001
45	*Channel I1*	*Block = 1*	1 bit	-	W	C	-	1.001
		Block = 0	1 bit	-	W	C	-	1.003
41	*Channel I2*	*Window contact 2*	1 bit	R	-	C	T	1.001
45	*Channel I2*	*Block = 1*	1 bit	-	W	C	-	1.001
		Block = 0	1 bit	-	W	C	-	1.003

[5] Upon double-click with object type = *height % + slat %*
[6] Upon double-click with object type = *height % + slat %*

6.2.7 Common object

No.	Object name	Function	Length	R	W	C	T	DPT
71	Firmware version	Send	14 bytes	R	-	C	T	16.001

6.3 Description of communication objects

6.3.1 Objects for the heating actuator function

Object 1 "Continuous actuating value, switching actuating value"
The actuating value receives data from the room thermostat for the corresponding valve.
It can either be continuous (0–100%) or switching (ON/OFF) depending on the configuration.

Objects 2–3
Not used.

Object 4 "Current actuating value"
Reports the actual value of the actuating value generated for the channel.
In case of restoration of the mains, 100% will be sent.
In case of restoration of the bus supply, 0% will be sent
In case of simultaneous restoration of the mains and bus supply, 100% will be sent.

Objects 5–11
Not used.

Object 12 "Report actuating value loss"
Present only if, on the Configuration options parameter page, the parameter
Monitor the actuating value = yes.

If monitoring is selected, the room thermostat must receive an actuating value telegram regularly.
Recommendation: To ensure trouble-free operation, the cyclical transmission time to the room thermostat should be no longer than half the monitoring time.
Example: Monitoring time 30 min, cyclical transmission time to thermostat less than or equal to 15 min.

If no new actuating value is received within the configured monitoring time, failure of the room thermostat is assumed and an emergency program is started.
See ***emergency program*** parameter page.

This function can be selected or deactivated individually for each channel.
The monitoring time is set on the ***monitoring*** page.

6.3.2 Objects for the heating controller function

Object 1 "Base setpoint"
The base setpoint is first specified via the application at start-up and stored in the *Base setpoint* object.
It can be reset at any time using *base setpoint* object (limited by minimum or maximum valid setpoint).
The object can be written to without restriction.

Object 2 "Manual setpoint offset"
Offsetting set temperature:
The object receives a temperature difference as DPT 9.002. The desired room temperature (current setpoint) can be adjusted against the base setpoint by this difference.
The following applies in comfort mode (heating):
Current setpoint = base setpoint + manual setpoint offset

Values beyond the configured range (maximum or minimum valid setpoint on the ***setpoints*** parameter page) are limited to the highest or lowest value.

Comment:
The offset always refers to the set base setpoint and not to the current setpoint.
See also: *Determination of the setpoint*

Object 3 "Actual value"
Receives the current room temperature for the control.

Object 4 "Operating mode preset"
1 byte object. Can be used to directly activate one of 4 operating modes.
1 = Comfort, 2 = Standby, 3 = Night,
4 = Frost protection (heat protection)
If another value is received (0 or >4), comfort operating mode is activated.
The details in brackets refer to cooling mode.

Object 5 "Presence"
The status of a presence detector (e.g. push button, motion detector) can be received via this object.
1 on this object activates comfort operating mode.

Object 6 "Window setting"
The status of a window contact can be received via this object.
1 on this object activates frost/heat protection operating mode.

Object 7: "Current operating mode"

Transmits the current operating mode as a 1 byte value (see table).
The transmission behaviour can be set on the ***operating mode*** parameter page.

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

Object 8 "Heating actuating value, heating and cooling actuating value"

Sends the current heating actuating value (0...100%), or heating or cooling if the *Output of cooling actuating value* parameter has been set to *Together with heating actuating value*.
In case of restoration of the mains or bus supply, 0% will be sent.
In case of simultaneous restoration of the mains and bus supply, 100% will be sent.

Object 9 "Cooling actuating value"

Sends the cooling actuating value or switch command to control a cooling surface, fan coil unit etc.
The send format DPT 5.001 or DPT 1.001 depends on the selected *Type of control* (continuous or switching) on the ***cooling control*** page.
In case of restoration of the mains or bus supply, 0% will be sent.
In case of simultaneous restoration of the mains and bus supply, 100% will be sent.

The object is not available:
- With the setting Heating control only (***settings*** parameter page), as cooling function is not available.
- If *Changeover between heating and cooling = via object* is selected and *Output of cooling actuating value* is set to *Together with heating actuating value* (***cooling control*** parameter page).

Object 10 "Heating/cooling"

This object is used in 2-pipe heating/cooling systems or if automatic changeover between heating and cooling is not desired.

The telegram format can be set on the ***Cooling control*** parameter page:

Parameter: *Format of Heating/cooling object*	Telegram format
DPT1.100	Heating = 1, cooling = 0
Inverted	Heating = 0, cooling = 1

Object 11 "Current setpoint"

Sends the current temperature setpoint as DPT 9.001.

Object 12 "Actual value failure"

Sends a 1 if no valid actual value was received during the monitoring time.

Object 13 "Forced operation"
The direction of action of the force telegram is adjustable.
Standard:
1 = activate force
0 = end force.

After reset, the last status of forced operation will be restored.

After download, forced operation is always deactivated.

Object 14 "Overcurrent/short circuit"
Reports overload, short circuit, or defect at output.
1 = Error
0 = No error

Object 31 "Summer mode ON/OFF"
When 1 is set for the object, the channel (if participation = yes) is switched over to summer mode, and heating no longer takes place.
During summer mode, a valve protection program can also be executed optionally.

Object 32 "Highest actuating value"
Enables the device to participate in determining the largest actuating value[7].
The current heat requirement of the system is thus constantly reported to the heating boiler, which then adapts its output to the actual requirement.

Object 33
Not used.

Object 34 "Pump ON/OFF"
Control of the supply pump.

Object 35 "Pump relay status"
Reports the current switching status of the pump.

Object 36 "Outside temperature"
Receives the outside temperature.

Object 37 "Outside temperature failure"
0 = No error
1 = Error: Outside temperature can no longer be received.

[7] See appendix: Determining the maximum actuating value

6.3.3 Objects for the external inputs: Switch function

Object 41: Channel I1.1
First output object of the channel (first telegram).
4 telegram formats can be set:
Switching ON/OFF, priority, send percentage value, send value.

Object 42: Channel I1.2
Second output object of the channel (second telegram).
4 telegram formats can be set:
Switching ON/OFF, priority, send percentage value, send value.

Object 45: Channel I1 block = 1, or block = 0
The channel is blocked via this object.
The acting direction of the block object and behaviour when the block is set or cancelled can be configured.

Objects 51–55
Objects for channel I2

6.3.4 Objects for the external inputs: Button function

Object 41: Channel I1.1
First output object of the channel (first telegram).
4 telegram formats can be set:
Switching ON/OFF, priority, send percentage value, send value.

Object 42: Channel I1.2
Second output object of the channel (second telegram).
4 telegram formats can be set:
Switching ON/OFF, priority, send percentage value, send value.

Object 45: Channel I1 block = 1, or block = 0
The channel is blocked via this object.
The acting direction of the block object and behaviour when the block is set or cancelled can be configured.

Objects 51–55
Objects for channel I2

6.3.5 Objects for the external inputs: Dimming function

Object 41: Channel I1.1 switching
Switches the dimmer on and off.

Object 42: Channel I1.1 brighter, darker, brighter/darker
4-bit dimming commands.

Object 43: Channel I1.1 switching, priority, percentage..
Output object for the additional function with double-click.
4 telegram formats can be set:
Switching ON/OFF, priority, send percentage value, send value.

Object 45: Channel I1 block = 1, or block = 0
The channel is blocked via this object.
The acting direction of the block object and behaviour when the block is set or cancelled can be configured.

Objects 51–55
Objects for channel I2

6.3.6 Objects for the external inputs: Blinds function

Object 41: Channel I1 step/stop
Sends step/stop commands to the blind actuator.

Object 42: Channel I1 UP/DOWN, UP, DOWN
Sends operating commands to the blind actuator.

Object 43: Channel I1.1 switching, priority, percentage.., height %
Output object for the additional function with double-click.
5 telegram formats can be set:
Switching ON/OFF, priority, send percentage value, send value, height %.

Object 44: Channel I1.1 slat %
Slat telegram for positioning the blinds upon double-click (together with object height %, with *object type* = *height* + *slat*).

Object 45: Channel I1 block = 1, or block = 0
The channel is blocked via this object.
The acting direction of the block object and behaviour when the block is set or cancelled can be configured.

Objects 51–55
Objects for channel I2

6.3.7 Objects for the external inputs: Temperature input function

Object 51: Channel I2 actual value for temperature[8]
Sends the temperature measured at input I2 (remote sensor or floor temperature sensor).

6.3.8 Objects for the external inputs: Window contact function

Object 41: Channel I1 window contact 1
First output object of the channel (first telegram).
4 telegram formats can be set:
Switching ON/OFF, priority, send percentage value, send value.

Object 45: Channel I1 block = 1, or block = 0
The channel is blocked via this object.
The acting direction of the block object and behaviour when the block is set or cancelled can be configured.

Objects 51–55
Objects for channel I2

6.3.9 Object for service

Object 71 "Firmware version"

For diagnostic purposes only.

Sends the firmware versions of the device software after reset or download.
Can also be read out directly via the ETS.

The version is issued as an ASCII character string.
Format: **Bxxx Vyyy Vzzz**

Code	Meaning
xxx	Bootloader version
yyy	Firmware version

[8] The temperature input function is only possible with input I2.

6.4 Parameter pages overview

The device consists of one general block and 5 main functional blocks.

Parameter page	Description
General information	LED settings, activation of the temperature sensor inputs.
Channel H1	
Configuration options	Selection as heating controller/heating actuator and activation of additional functions. Parameters for actuator control
Settings	Standard/user-defined control.
Operating mode	Operating mode after reset, presence sensor etc.
Heating control	Control parameters, installation type etc. for heating mode.
Heating setpoints	Base setpoint, lowering, frost protection etc.
Cooling control	Control parameters, installation type etc. for cooling mode.
Cooling setpoints	Dead zone, standby, heat protection etc.
Emergency program	Response to failure of actuating value or actual value.
Force	Response in forced operation.
Monitoring	
Actuating value, actual value, outside temperature	Settings of the monitoring function.
Pump control	
Object	Settings for pump control via object *Pump On/Off*
External inputs I1, I2	
Configuration options	Function of the input, debounce time, number of telegrams, block function, etc. Additionally in the case of I2: Selection of the temperature sensor, temperature calibration, etc.
Switch object 1, 2	Object type, transmission behaviour, etc. can be set for each object individually.
Button object 1, 2	Object type, transmission behaviour, etc. can be set for each object individually.
Dimming	Type of control.
Blinds	Type of control.
Double-click	Additional telegrams for *Dimming* and *Blinds*.
Window contact	Direction of action, cycl. transmission, etc.

6.5 General parameters

Designation	Values	Description
Send highest actuating value[9] in cycles (if continuous actuating value is used)	***No, only in the event of change***	Do not send in cycles.
	In the event of change and in cycles	Send in the event of change (ON-OFF, OFF-ON) and in cycles.
Cycle time	*every 2 min, every 3 min every 5 min, every 10 min, every 15 min, every 20 min,* ***every 30 min***	At what interval should the highest actuating value be sent?
Use binary inputs	*No*	No function.
	Yes	2 binary inputs are available.

[9] See appendix: Determining the maximum actuating value.

6.6 Parameters for the heating actuator

6.6.1 Configuration options

Designation	Values	Description
Channel function	***Heating actuator***	Should the channel be used as an actuator or controller? The channel receives its actuating value from an external room thermostat.
	Heating controller	The channel receives the room temperature over the bus and generates the actuating value independently by means of an internal controller. See chapter: Parameters for the heating actuator
Type of actuating value	*Switching..*	The channel processes: ON/OFF telegrams.
	Continuous..	Percent telegrams 0–100%
Include in summer mode	***No*** *Yes*	Should the channel remain off in summer mode?
Activate valve protection		This function prevents the valve from seizing and is executed if the valve position has not changed for 7 days. When this function is executed, the valve is moved to the opposite position for 6 minutes.[10]
	No	No **valve protection.**
	Yes	Valve protection is active.
Monitor actuating value	***No*** *Yes..*	Should whether the room thermostat regularly transmits an actuating value be monitored? In this way, a thermostat malfunction will be detected quickly and an emergency program will be started.
Activate force function	***No***	No force function.
	Yes..	Opens the Force parameter page.
Actuator direction of operation	***Standard:*** ***1 = Open valve***	Standard. Valve closed when de-energised.

[10] Valve protection is not included in the calculation of the current actuating value.

Designation	Values	Description
	Inverted: *0 = Open valve*	Special inverted valve types. Valve open when de-energised.
Time for one actuation cycle[11] *(PWM period)*	*2 min* *3 min* *5 min* *7 min* ***10 min*** *15 min* *20 min* *30 min*	With "continuous" actuating value. One actuation cycle comprises one ON and one OFF process and forms a PWM period. Examples: - Actuating value 20%, - Time = 10 min means: switched on for 2 min during the actuating cycle of 10 min (i.e. 20% of actuating cycle) and switched off for 8 min. - Actuating value = 70%, time = 10 min means: 7 min on/3 min off. See appendix: PWM cycle
Minimum actuating value	**0%**, *5%, 10%, 20%, 30%*	Lowest permissible actuating value
Maximum actuating value	*50%, 60%, 70%, 80%,* **90%**, *100%*	Highest permissible actuating value. A maximum value of 90% extends the service life of thermal actuators. A maximum value of 100% reduces the number of switching cycles.
Actuating value when value violates the min./max. actuating value	*0% or 100%* *Use set actuating values*	Restriction when a room thermostat receives an actuating value that is less than the minimum actuating value: Actuate channel with 0% or 100% Restrict values to maximum and minimum actuating value. For example, maintaining a minimum actuating value of 10% can be practical for the correct base temperature of an underfloor heating.

[11] Also applies to emergency program and forced operation.

Designation	Values	Description
	0 = 0%, otherwise use set actuating values	If the received actuating value is = 0, accept this value and close the valve. Other values are restricted according to the configured minimum and maximum actuating value: Received values > *0%* and < min. *actuating value* are replaced by the minimum actuating value. In the same way, values > max. actuating value are replaced by the set maximum actuating value.
	< min. actuating val. = 0%, otherwise scale.	Actuating values below the minimum actuating value are executed at 0%. Values above are scaled in proportion to the range between min. actuating value and 100%.
Send current actuating value	*At change of 1%, 2%, 3%,* **5%,** *7%, 10%, 15%*	After what percentage change[12] in the actuating value is the new value to be transmitted?
Send current actuating value in cycles	***Not in cycles, 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*	Send when or at what interval?

[12] Change since last transmission.

6.6.2 Emergency program

Designation	Values	Description
Actuating value for emergency program is	***Fixed***	The valve is continuously energised by a fixed actuating value. See below: *Fixed emergency program in winter mode*.
	Outside temperature dependent	Energy saving setting: The valve is energised depending on the outside temperature and only opened if it is really necessary.
Actuating value for emergency program is ***fixed***		
Fixed emergency program in winter mode	*0%, 10%,* ***20%*** *30%, 40%, 50%*	Fixed actuating value that should replace the actuating value of the thermostat until it is available again.
Actuating value for emergency program is ***temperature-dependent***		
Emergency program active when outside temperature below	*5 °C* ***10 °C*** *15 °C*	If the outside temperature drops below the set value, the valve opens.
Max. actuating value in emergency program	*10%, 20%* *30%,* ***40%****, 50%*	What should be the maximum heating level in the emergency program?
Fixed emergency program in case of failure of outside temperature.	*0%, 10%,* ***20%*** *30%, 40%, 50%*	Fixed valve setting if neither actuating value nor outside temperature can be received.

ⓘ Here, the setting on the parameter page ***Configuration options*** also applies to the PWM period.

6.6.3 Force

Designation	Values	Description
Actuating value in the forced operation	**0%** *to 100% in increments of 10%*	Fixed actuating value to control the valve in forced operation. This is not restricted by the minimum or the maximum actuating value.
Forced telegram	***1 = Force (standard)***	Forced operation is activated with an ON telegram.
	0 = Force	Inverted: Forced operation is activated with an OFF telegram.

6.6.4 Monitoring of actuating value, actual value, outside temperature

See below: *Common parameters*.

6.6.5 Pump control

See below: *Common parameters*.

6.7 Parameters for the heating controller

6.7.1 Configuration options

Designation	Values	Description
Channel function		Should the channel be used as an actuator or controller?
	Heating actuator	The channel receives its actuating value from an external room thermostat.
	Heating controller	The channel receives the room temperature over the bus and generates the actuating value independently by means of an internal controller. See chapter: Parameters for the heating actuator
Include in summer mode	***No*** *Yes*	Should the channel remain off in summer mode?
Activate valve protection		This function prevents the valve from seizing and is executed if the valve position has not changed for 7 days. When this function is executed, the valve is moved to the opposite position for 6 minutes.
	No	No valve protection.
	Yes	Valve protection is active.
Execute valve protection		This function prevents the valve from seizing and is executed if the valve position has not changed for 7 days. When this function is executed, the valve is moved to the opposite position for 6 minutes.
	Always	Valve protection is permitted at any time.
	Only in comfort mode *Only in standby mode* *Only in night mode*	Valve protection is permitted only during the operating mode selected here.
Monitor actual value	***No***	No monitoring.
	Yes	The actual value (room temperature) is monitored and an emergency program can be configured.
Activate force function	***No***	No force function.
	Yes..	Activates the Force parameter

Designation	Values	Description
		page.
Actuator direction of operation	***Standard:*** ***1 = Open valve*** *Inverted:* *0 = Open valve*	Standard. Valve closed when de-energised. Special inverted valve types. Valve open when de-energised.
Time for one actuation cycle *(PWM period)*[13]	*2 min* *3 min* *5 min* *7 min* ***10 min*** *15 min* *20 min* *30 min*	With "continuous" actuating value. An actuation cycle consists of a switch-on and a switch-off process and forms a PWM period. Examples: - Actuating value 20%, - Time = 10 min means: switched on for 2 min during the actuating cycle of 10 min (i.e. 20% of actuating cycle) and switched off for 8 min. - Actuating value = 70%, time = 10 min means: 7 min on/3 min off. See appendix: PWM cycle
Channel processes actuating value for[14]	***Heating*** *Cooling*	Channel responds to the heating actuating value Channel responds to the cooling actuating value
Minimum actuating value	**0%**, *5%, 10%, 20%, 30%*	Lowest permissible actuating value
Maximum actuating value	*50%, 60%, 70%, 80%,* **90%**, *100%*	Highest permissible actuating value. A maximum value of 90% extends the service life of thermal actuators. A maximum value of 100% reduces the number of switching cycles

[13] Also applies to emergency program and forced operation.
[14] Only for heating and cooling mode. Not available if *Output of cooling actuating value = together with heating actuating value*.

Designation	Values	Description
Actuating value when value violates the min./max. actuating value		Restriction when a room thermostat receives an actuating value that is less than the minimum actuating value:
	0% or 100%	Actuate channel with 0% or 100%
	Use set actuating values	Restrict values to maximum and minimum actuating value. For example, maintaining a minimum actuating value of 10% can be practical for the correct base temperature of an underfloor heating.
	0 = 0%, otherwise use set actuating values	If the received actuating value is = 0, accept this value and close the valve. Other values are restricted according to the configured minimum and maximum actuating value: Received values > *0%* and < min. *actuating value* are replaced by the minimum actuating value. In the same way, values > max. actuating value are replaced by the set maximum actuating value.
	< min. actuating val. = 0%, otherwise scale.	Actuating values below the minimum actuating value are executed at 0%. Values above are scaled in proportion to the range between min. actuating value and 100%.

If the actuating value is limited by the parameters *Minimum* or *Maximum Actuating Value*, then these limitations are only effective on the output.
The objects send the actuating value that was actually requested by the controller.
Example:
Minimum actuating value 30%
Maximum actuating value 60%
Current heating actuating value e.g. 80%: The outputs are limited to 60%.
80% will be sent to the bus.

6.7.2 Settings

Designation	Values	Description
Control	***Standard***	For simple applications (only heating control).
	User-defined	Enables selection of control functions.
Control functions used[15]	***Only heating control***	Heating mode only.
	Heating and cooling	In addition, a cooling system has to be controlled.

[15] Only for user-defined control.

6.7.3 Operating mode

Designation	Values	Description
Operating mode after reset	*Frost protection* *Temperature reduction at night* ***Standby*** *Comfort*	Operating mode after start-up or reprogramming
Type of presence sensor		The presence sensor activates the comfort operating mode
	Presence detector	Operating type comfort provided the presence object is set.
	Presence button	If the operation mode object is called up again after setting the presence object, the new operating mode will be accepted and the state of the presence object ignored. If the presence object is set during night/frost mode, it is reset after the configured comfort extension has expired[16] (see below). The presence object is not reported back on the bus
Comfort extension by presence button in night mode	*None*	Telegrams from the presence button are not considered.
	30 min *1 hour* *1.5 hours* ***2 hours*** *2.5 hours* *3 hours* *3.5 hours*	Party switching: This allows the controller to change via the presence object from night/frost mode to comfort mode again for a set length of time. The time limit is omitted if the device was previously in standby mode. Comfort mode is only cleared with the next manual or bus controlled change of the operation mode.
Window contact delay	***No***	When opening the window: Change immediately into the frost protection operating mode.

[16] Exception: If a window is opened (window object = 1), the room thermostat switches to frost protection mode

Designation	Values	Description
	Yes	Change only after XXX s. Opening the window for a short time has no effect.
Sends the current operating mode in cycles	*Not in cycles, 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?

6.7.4 Control (heating)

Designation	Values	Description
Setting the control parameters	***Via installation type*** *User-defined*	Standard application Professional use: Configure P/PI controller yourself
Installation type	***Radiator heating system*** *Underfloor heating*	PI controller with: Integration time = 90 minutes Bandwidth = 2.5 K Integration time = 30 h Bandwidth = 4 K
Sending of heating actuating value	*At change of 1%* *At change of 2%* *At change of 3%* ***At change of 5%*** *At change of 7%* *At change of 10%* *At change of 15%*	After what percentage change[17] in the actuating value is the new value to be transmitted. Small values increase control accuracy, but also the bus load.
Sends the heating actuating value in cycles	***Not in cycles, 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 actuating value to be sent (regardless of changes)?
User-defined parameter		
Proportional band of heating controller	*1 K, 1.5 K, 2 K, 2.5 K, 3 K* *3.5 K, 4 K, 4.5 K* *5 K, 5.5 K, 6 K* *6.5 K, 7 K, 7.5 K* *8 K, 8.5 K*	Professional setting for adapting the control response to the room. Small values cause large changes in actuating values, larger values cause finer actuating value adjustment.
Integrated time of the heating controller	*Pure P controller* *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* *4 h, 5 h, 10 h, 15 h,* *20 h, 25 h, 30 h, 35 h*	The integration time determines the response time of the control. It establishes the increase by which the output actuating value is raised 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.

[17] Change since last transmission

6.7.5 Setpoints (heating)

Designation	Values	Description
Base setpoint after loading the application	*18 °C, 19 °C, 20 °C* ***21 °C****, 22 °C, 23 °C, 24 °C, 25 °C*	Output setpoint for temperature control.
Minimum valid base setpoint	*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 received base setpoint (*base setpoint* object) is lower than the value set here, it will be limited to this value.
Maximum valid base setpoint	*20 °C, 21 °C, 22 °C 23 °C, 24 °C, 25 °C 27 °C, 30 °C,* ***32 °C***	If a received base setpoint (*base setpoint* object) is higher than the value set here, 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 mode and a reduction of 2 K, the device controls with a setpoint 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 for frost protection mode (during heating)	*3 °C, 4 °C,* ***5 °C*** *6 °C, 7 °C, 8 °C 9 °C, 10 °C*	Preset temperature for frost protection mode in heating mode (Heat protection applies in cooling mode).
Maximum valid setpoint offset	*+/- 1 K, +/- 2 K, +/- 3 K, +/- 4 K,* ***+/- 5 K***	Limits the possible setting range for the setpoint offset function. Applies to values received via *Manual setpoint value offset* object.
Setpoint offset applies	*Only in comfort mode* *With comfort and standby mode* ***With comfort, standby and night mode***	The setpoint offset: is only considered in the selected modes, and is ineffective in all other modes.
Current setpoint in comfort mode		Feedback of current setpoint via the bus:

Designation	Values	Description
	Sends actual value (heating < > cooling)	The setpoint actually being used for control has always to be sent (= current setpoint). Example with base setpoint of 21 °C and dead zone of 2 K: During heating, 21 °C is sent, and during cooling, base setpoint + dead zone is sent (21 °C + 2 K = 23 °C)
	Send average value between heating and cooling	Same value in comfort mode during both heating and cooling mode, i.e.: Base setpoint + half dead zone is sent, to prevent occupants from being confused. **Example** with base setpoint of 21 °C and dead zone of 2 K: Mean value = 21°+1 K = 22 °C Although control takes place at 21 °C or 23 °C
Sends the current setpoint in cycles		How often should the currently valid setpoint be sent?
	Not in cycles, 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 in cycles

6.7.6 Cooling control

Designation	Values	Description
Setting the control parameters	***Via installation type***	Standard application
	User-defined	Professional use: Configure P/PI controller yourself
Installation type	***Cooling surface***	PI controller with: Integration time = 240 minutes Bandwidth = 5 K
	Fan coil unit	Integration time = 180 minutes Bandwidth = 4 K
User-defined control parameter		
Proportional band of the cooling controller	*1 K, 1.5 K, 2 K, 2.5 K, 3 K* *3.5 K,* ***4 K****, 4.5 K* *5 K, 5.5 K, 6 K* *6.5 K, 7 K, 7.5 K* *8 K, 8.5 K*	Professional setting for adapting the 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.
Integration time of the cooling controller	*Pure P controller*	See appendix: Temperature control
	Pure P controller *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* *4 h, 5 h, 10 h, 15 h,* *20 h, 25 h, 30 h, 35 h*	Only for PI controller: The integration time determines the response time of the control. It establishes the increase by which the output actuating value is raised 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.
Sends cooling actuating value	*At change of 1%* *At change of 2%* *At change of 3%* ***At change of 5%*** *At change of 7%* *At change of 10%* *At change of 15%*	After what percentage change[18] in the actuating value is the new value to be transmitted. Small values increase the control accuracy, but also the bus load.

[18] Change since last transmission.

Designation	Values	Description
Sends the cooling actuating value in cycles	***Not in cycles, 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 actuating value to be sent (regardless of changes)?
Changeover between heating and cooling	***Automatic*** *Via object*	The controller automatically switches to cooling mode if the actual temperature is above the setpoint. The cooling mode can only be activated on the bus via object (heating =../cooling =..). Cooling mode remains off, as long as this object is not set.
Format of heating/cooling object	***DPT1.100 (heating=1/cooling=0)*** *Inverted (heating=0/cooling=1)*	Standard format. Compatible with RAM 713 S, VARIA etc.
Output of the cooling actuating value[19]	*On separate object* *Together with heating actuating value*	For 4-pipe systems: The actuating values for heating and cooling are sent separately by means of 2 objects. For 2-pipe systems: The actuating value is always sent to the *actuating value heating/cooling* object, independent of whether heating or cooling mode is active.

[19] Only when changeover between heating and cooling via object.

6.7.7 Cooling setpoints

Designation	Values	Description
Dead zone between heating and cooling	*0 K* *1 K* ***2 K*** *3 K* *4 K* *5 K* *6 K*	Specifies the buffer zone between setpoints for heating and cooling mode. The dead zone is expanded through hysteresis in switching (2 point) control. See glossary: Dead zone
Increase in standby mode (during cooling)	*0 K, 0.5 K, 1 K,* **1.5 K** *2 K, 2.5 K, 3 K* *3.5 K, 4 K, 5 K*	The standby temperature is increased in cooling mode
Increase in night mode (during cooling)	*3 K, 4 K,* ***5 K*** *6 K, 7 K, 8 K*	See increase in standby mode
Setpoint for heat protection mode (during cooling)	***42 °C (i.e. virtually no heat protection)*** *29 °C, 30 °C, 31 °C* *32 °C, 33 °C, 34 °C* *35 °C*	Heat protection represents the maximum permitted temperature for the controlled room. It performs the same function during cooling as frost protection mode during heating, e.g. saves energy while prohibiting non-permitted temperatures.

6.7.8 Emergency program

Designation	Values	Description
Actuating value for emergency program is	***Fixed***	The valve is continuously energised by a fixed actuating value. See below: *Fixed emergency program in winter mode*.
	Outside temperature dependent	Energy saving setting: The valve is energised depending on the outside temperature and only opened if it is really necessary.
Actuating value for emergency program is ***fixed***		
Fixed emergency program in winter mode	*0%, 10%,* ***20%*** *30%, 40%, 50%*	Fixed actuating value that should replace the actuating value of the thermostat until it is available again.
Actuating value for emergency program is ***temperature-dependent***		
Emergency program active when outside temperature below	*5 °C* ***10 °C*** *15 °C*	If the outside temperature drops below the set value, the valve opens.
Max. actuating value in emergency program	*10%, 20%* *30%,* ***40%****, 50%*	What should be the maximum heating level in the emergency program?
Fixed emergency program in case of failure of outside temperature.	*0%, 10%,* ***20%*** *30%, 40%, 50%*	Fixed valve setting if neither actuating value nor outside temperature can be received.

ⓘ Here, the setting on the parameter page ***Configuration options*** also applies to the PWM period.

6.7.9 Force

Designation	Values	Description
Actuating value in the forced operation	**0%** *to 100% in increments of 10%*	Fixed actuating value to control the valve in forced operation. This is not restricted by the minimum or the maximum actuating value.
Forced telegram	***1 = Force (standard)***	Forced operation is activated with an ON telegram.
	0 = Force	Inverted: Forced operation is activated with an OFF telegram.

6.7.10 Monitoring of actuating value, actual value, outside temperature

See below: *Common parameters*.

6.7.11 Pump control

See below: *Common parameters*.

6.8 Common parameter for the heating actuator and controller

6.8.1 Monitoring of actuating value, actual value, outside temperature

Designation	Values	Description
Monitoring time	*5 min* *10 min* *20 min* ***30 min*** *60 min*	Start emergency program if the relevant data were not received within the configured time.
Status of monitoring	***Report only in the event of malfunction*** *Always report*	Do not send any telegrams during normal operation, only in the event of failure. Status will also be sent when there is no fault.
Send status in cycles	***No*** *Yes*	Send status messages in cycles?
Cycle time	*every 2 min* *every 3 min* *every 5 min* *every 10 min* *every 15 min* *every 20 min* ***every 30 min***	At what interval should the status be sent?

6.8.2 Pump control

Designation	Values	Description
Switch-on telegram only if	***Input variable > 0%***	The pump object sends switch-on telegrams as soon as the input variable of the channel is above 0%.
	Valve is actuated	As above, however, the pump will always be switched off when, due to the PWM cycle, the valve is closed.
Switch-on delay	*No switch-on delay*	Switch on the pump immediately
	10 s, 20 s, 30 s, 1 min, 2 min, 3 min, 5 min, 7 min, ***10 min****, 15 min, 20 min, 30 min*	Only switch on the pump after the delay time has elapsed.
Switch-off delay	*No switch-off delay*	Switch off pump immediately
	2 min, 3 min, 5 min, 7 min, ***10 min****, 15 min, 20 min, 30 min*	Continue running for a set length of time.
Send pump control in cycles	***No, only in the event of change***	How should the current relay status be sent?
	In the event of change and in cycles	
Cycle time	*every 2 min, every 3 min every 5 min, every 10 min, every 15 min, every 20 min,* ***every 30 min***	At what interval should the switch telegram for the pump be sent?

6.9 Parameters for external inputs I1, I2

6.9.1 Input I1, I2: Switch function

Designation	Values	Description
Function	***Switch..*** *Push-button..* *Dimming..* *Blinds..* *Window contact..*	Desired use.
Debounce time	*30 ms,* ***50 ms,*** *80 ms* *100 ms, 200 ms,* *1 s, 5 s, 10 s*	In order to avoid disruptive switching due to bouncing of the contact connected to the input, the new status of the input is only accepted after a delay time. Larger values (≥ 1 s) can be used as a switch-on delay
Activate block function	***No*** *Yes*	No block function. Show parameters for the block function.
Block telegram	***Block with 1 (standard)*** *Block with 0*	0 = cancel block 1 = block 0 = block 1 = cancel block
Send in cycles	*every min* *every 2 min* *every 3 min* ... ***every 30 min*** *every 45 min* *every 60 min*	Common cycle time for all 3 output objects of the channel.
Number of telegrams	***One telegram*** *Two telegrams*	Each channel has 2 output objects and can thus send up to 2 different telegrams.

6.9.1.1 Switch objects 1, 2

Each of the 2 objects can be configured individually on its own parameter page.

Designation	Values	Description
Object type	***Switching (1 bit)*** *Priority (2 bit)* *Value 0–255* *Percentage value (1 byte)*	Telegram type for this object.
Send if input = 1	*No* ***Yes***	Send if voltage is present at the input?
Telegram	*With object type = switching 1 bit*	
	ON *OFF* *INVERT*	Send switch-on command Send switch-off command Invert current state (ON-OFF-ON etc.)
	With object type = priority 2 bit	
		Function / Value
	Inactive	Priority inactive (no control) / 0 (00_{bin})
	ON	Priority ON (control: enable, on) / 3 (11_{bin})
	OFF	Priority OFF (control: disable, off) / 2 (10_{bin})
	With object type = value 0–255	
	*0–**255***	Any value between 0 and 255 can be sent.
	With object type = percentage value 1 byte	
	*0–**100%***	Any percentage value between 0 and 100% can be sent.
Send if input = 0	*No* ***Yes***	Send if no voltage is present at the input?
Telegram	See above: Same object type as *Send if input = 1*	
Send in cycles	***No*** *Yes, always* *Only if input = 1* *Only if input = 0*	When should cyclical sending take place? The cycle time is set on the main parameter page of the channel.
Response after restoration of the bus supply[20]	***None*** *Update (immediately)* *Update (after 5 s)* *Update (after 10 s)* *Update (after 15 s)*	Do not send. Send update telegram immediately or with delay.
Response when the block is set	***Ignore block*** *No response* *As with input = 1*	The block function is ineffective with this telegram. Do not respond when the block is set. Respond as with rising edge.

[20] HU 1 RF, HU 1 S RF: Mains restoration

Designation	Values	Description
	As with input = 0	Respond as with falling edge.
Response when cancelling the block	***No response***	Do not respond when the block is cancelled.
	Update	Send update telegram.

If a channel is blocked, no telegrams will be sent in cycles.

6.9.2 Input I1, I2: Button function

Designation	Values	Description
Function	*Switch..* *Push-button..* *Dimming..* *Blinds..* *Window contact..*	Desired use.
Debounce time	*30 ms,* ***50 ms,*** *80 ms* *100 ms, 200 ms,* *1 s, 5 s, 10 s*	In order to avoid disruptive switching due to bouncing of the contact connected to the input, the new status of the input is only accepted after a delay time. Larger values (≥ 1 s) can be used as a switch-on delay
Connected button	***NO contact*** *NC contact*	Set the type of connected contact.
Long button push starting at	***300 ms****, 400 ms* *500 ms, 600 ms* *700 ms, 800 ms* *900 ms, 1 s*	Serves to clearly differentiate between long and short button push. If the button is pressed for at least as long as the set time, then a long button push will be registered.
Time for double-click	***300 ms****, 400 ms* *500 ms, 600 ms* *700 ms, 800 ms* *900 ms, 1 s*	Serves to differentiate between a double-click and 2 single clicks. Time period in which the second click must begin, in order to recognise a double-click.
Send in cycles	*every min* *every 2 min* *every 3 min* *...* ***every 30 min*** *every 45 min* *every 60 min*	Common cycle time for all 2 output objects of the channel.
Number of telegrams	***One telegram*** *Two telegrams*	Each channel has 2 output objects and can thus send up to 2 different telegrams.
Activate block function	***No*** *Yes*	No block function. Show parameters for the block function.
Block telegram	***Block with 1 (standard)*** *Block with 0*	0 = cancel block 1 = block 0 = block 1 = cancel block

6.9.2.1 Button objects 1, 2

Designation	Values	Description
Object type	***Switching (1 bit)*** *Priority (2 bit)* *Value 0–255* *Percentage value (1 byte)*	Telegram type for this object.
Send after short operation	***Do not send*** *Send telegram*	Respond to short button push?
Telegram	*With object type = switching 1 bit*	
	ON *OFF* *INVERT*	Send switch-on command Send switch-off command Invert current state (ON-OFF-ON etc.)
	With object type = priority 2 bit	
		Function / Value
	Inactive	Priority inactive (no control) / 0 (00_{bin})
	ON	Priority ON (control: enable, on) / 3 (11_{bin})
	OFF	Priority OFF (control: disable, off) / 2 (10_{bin})
	With object type = value 0–255	
	*0–**255***	Any value between 0 and 255 can be sent.
	With object type = percentage value 1 byte	
	*0–**100%***	Any percentage value between 0 and 100% can be sent.
Send after long operation	***Do not send*** *Send telegram*	Respond to long button push?
Telegram	See above: Same object type as with short operation.	
Send after double-click	***Do not send*** *Send telegram*	Respond to double-click?
Telegram	See above: Same object type as with short operation.	
Send in cycles	***No*** *Yes*	The cycle time is set on the main parameter page of the channel.
Response after restoration of the bus	***None***	Do not send.

Designation	Values	Description
supply[21]	*As with short (immediately)* *As with short (after 5 s)* *As with short (after 10 s)* *As with short (after 15 s)* *As with long (immediately)* *As with long (after 5 s)* *As with long (after 10 s)* *As with long (after 15 s)* *As with double-click (immediately)* *As with double-click (after 5 s)* *As with double-click (after 10 s)* *As with double-click (after 15 s)*	Send update telegram immediately or with delay. The value to be sent depends on the value configured for long button push, short button push or double-click.
Response when the block is set	***Ignore block***	The block function is ineffective with this telegram.
	No response	Do not respond when the block is set.
	As with short	Respond as with a short button push.
	As with long	Respond as with a long button push.
	As with double-click	Respond as with a double-click.
Response when cancelling the block	***No response***	Do not respond when the block is cancelled.
	As with short	Respond as with a short button push.
	As with long	Respond as with a long button push.
	As with double-click	Respond as with a double-click.

[21] HU 1 RF, HU 1 S RF: Mains restoration

6.9.3 Input I1, I2: Dimming function

Designation	Values	Description
Channel function	*Switch..* *Push-button..* ***Dimming..*** *Blinds..* *Window contact..*	The input controls a dimming actuator
Debounce time	*30 ms,* ***50 ms,*** *80 ms* *100 ms, 200 ms,* *1 s, 5 s, 10 s*	In order to avoid disruptive switching due to bouncing of the contact connected to the input, the new status of the input is only accepted after a delay time. Larger values (≥ 1 s) can be used as a switch-on delay
Activate block function	***No*** *Yes*	No block function. Show block function parameter page.
Block telegram	***Block with 1 (standard)*** *Block with 0*	0 = cancel block 1 = block 0 = block 1 = cancel block
Long button push starting at	***300 ms****, 400 ms* *500 ms, 600 ms* *700 ms, 800 ms* *900 ms, 1 s*	Serves to clearly differentiate between long and short button push. If the button is pressed for at least as long as the set time, then a long button push will be registered.
Double-click additional function	***No*** *Yes*	No double-click function The ***double-click*** parameter page is shown.
Time for double-click	***300 ms****, 400 ms* *500 ms, 600 ms* *700 ms, 800 ms* *900 ms, 1 s*	Serves to differentiate between a double-click and 2 single clicks. Time period in which the second click must begin, in order to recognise a double-click.

6.9.3.1 Double-click parameter page

Designation	Values	Description	
Object type	***Switching (1 bit)*** *Priority (2 bit)* *Value 0–255* *Percentage value (1 byte)*	Telegram type for this object.	
Telegram	*With object type = switching* *1 bit*		
	ON *OFF* *INVERT*	Send switch-on command Send switch-off command Invert current state (ON-OFF-ON etc.)	
	With object type = priority 2 bit		
		Function	Value
	Inactive	Priority inactive (no control)	0 (00_{bin})
	ON	Priority ON (control: enable, on)	3 (11_{bin})
	OFF	Priority OFF (control: disable, off)	2 (10_{bin})
	With object type = value 0–255		
	*0–**255***	Any value between 0 and 255 can be sent.	
	With *object type = percentage value 1 byte*		
	*0–**100%***	Any percentage value between 0 and 100% can be sent.	
Send in cycles	***Do not send in cycles*** *every min* *every 2 min* *every 3 min* … *every 45 min* *every 60 min*	How often should it be resent?	
Response after restoration of the bus supply[22]	***None*** *As with double-click (immediately)* *As with double-click (after 5 s)* *As with double-click (after 10 s)* *As with double-click (after 15 s)*	Do not send. Send update telegram immediately or with delay. The value to be sent depends on the value configured for double-click.	
Response when the block is set	***Ignore block*** *No response* *As with double-click*	The block function is ineffective with this telegram. Do not respond when the block is set. Respond as with a double-click.	

[22] HU 1 RF, HU 1 S RF: Mains restoration

Designation	Values	Description
Response when cancelling the block	***No response***	Do not respond when the block is cancelled.
	As with double-click	Respond as with a double-click.

6.9.3.2 Dimming parameter page

Designation	Values	Description
Response to long/short		The input distinguishes between a long and a short button push, and can thus carry out 2 functions.
	One button operation	The dimmer is operated with a single button. Short button push = ON/OFF Long button push = brighter/darker release = stop With the other variants, the dimmer is operated using 2 buttons (rocker).
	Brighter / ON	Short button push = ON Long button push = brighter Release = stop
	Brighter / INVERT	Short button push = ON / OFF Long button push = brighter Release = stop
	Darker / OFF	Short button push = OFF Long button push = darker Release = stop
	Darker / INVERT	Short button push = ON / OFF Long button push = darker Release = stop
Increment for dimming		With a long button push, the dimming value is:
	100%	Increased (or decreased) until the button is released.
	50% *25%* *12.5%* *6%* *3%* *1.5%*	Increased by the selected value (or reduced)
Response after restoration of the bus supply[23]	***None***	Do not respond.

[23] HU 1 RF, HU 1 S RF: Mains restoration

Designation	Values	Description
	ON	Switch on dimmer
	OFF	Switch off dimmer
	ON after 5 s *ON after 10 s* *ON after 15 s*	Switch on dimmer with delay
	OFF after 5 s *OFF after 10 s* *OFF after 15 s*	Switch off dimmer with delay
Response when the block is set	***Ignore block***	The block function is ineffective with this telegram.
	No response	Do not respond when the block is set.
	ON	Switch on dimmer
	OFF	Switch off dimmer
Response when cancelling the block	***No response***	Do not respond when the block is cancelled.
	ON	Switch on dimmer
	OFF	Switch off dimmer

6.9.4 Input I1, I2: Blinds function

Designation	Values	Description
Activate channel	***No*** *Yes*	Use input?
Channel function	*Switch..* *Push-button..* *Dimming..* ***Blinds..*** *Window contact..*	The input controls a blind actuator.
Debounce time	*30 ms,* ***50 ms,*** *80 ms* *100 ms, 200 ms,* *1 s, 5 s, 10 s*	In order to avoid disruptive switching due to bouncing of the contact connected to the input, the new status of the input is only accepted after a delay time. Larger values (≥ 1 s) can be used as a switch-on delay.
Activate block function	***No*** *Yes*	No block function. Show ***block function*** parameter page.
Block telegram	***Block with 1 (standard)*** *Block with 0*	0 = cancel block 1 = block 0 = block 1 = cancel block
Long button push starting at	***300 ms****, 400 ms* *500 ms, 600 ms* *700 ms, 800 ms* *900 ms, 1 s*	Serves to clearly differentiate between long and short button push. If the button is pressed for at least as long as the set time, then a long button push will be registered.
Double-click additional function	*No* ***Yes***	No double-click function The ***double-click*** parameter page is shown.
Time for double-click	***300 ms****, 400 ms* *500 ms, 600 ms* *700 ms, 800 ms* *900 ms, 1 s*	Serves to differentiate between a double-click and 2 single clicks. Time period in which the second click must begin, in order to recognise a double-click.

6.9.4.1 Double-click parameter page

Designation	Values	Description	
Object type	***Switching (1 bit)*** *Priority (2 bit)* *Value 0–255* *Percentage value (1 byte)* *Height % + slat %*	Telegram type for this object.	
Telegram	*With object type = switching 1 bit*		
	ON *OFF* *INVERT*	Send switch-on command Send switch-off command Invert current state (ON-OFF-ON etc.)	
	With object type = priority 2 bit		
		Function	Value
	Inactive	Priority inactive (no control)	0 (00_{bin})
	ON	Priority ON (control: enable, on)	3 (11_{bin})
	OFF	Priority OFF (control: disable, off)	2 (10_{bin})
	With object type = value 0–255		
	*0–**255***	Any value between 0 and 255 can be sent.	
	With object type = percentage value 1 byte		
	*0–**100%***	Any percentage value between 0 and 100% can be sent.	
	With object type = height % + slat %		
	Height	Upon double-click 2 telegrams are sent simultaneously: Required blind height	
	Slat	Required slat position.	
Send in cycles	***Do not send in cycles*** *every min* *every 2 min* *every 3 min* … *every 45 min* *every 60 min*	How often should it be resent?	
Response after restoration of the bus supply[24]	***None*** *As with double-click (immediately)* *As with double-click (after 5 s)* *As with double-click (after 10 s)* *As with double-click (after 15 s)*	Do not send. Send update telegram immediately or with delay. The value to be sent depends on the value configured for double-click.	

[24] HU 1 RF, HU 1 S RF: Mains restoration

Designation	Values	Description
Response when the block is set	***Ignore block***	The block function is ineffective with this telegram.
	No response	Do not respond when the block is set.
	As with double-click	Respond as with a double-click.
Response when cancelling the block	***No response***	Do not respond when the block is cancelled.
	As with double-click	Respond as with a double-click.

6.9.4.2 Blinds parameter page

Designation	Values	Description
Operation		The input distinguishes between a long and a short button push, and can thus carry out 2 functions.
	One button operation	The blinds are operated with a single button. Short button push = step. Long button push = move.
	DOWN	Short button push = step. Long button push = lower.
	UP	Short button push = step. Long button push = raise.
Movement is stopped by	*Releasing the button* ***Short operation***	How is the stop command to be triggered?
Response after restoration of the mains or bus supply	***None***	Do not respond.
	UP	Raise blinds
	DOWN	Lower blinds
	UP after 5 s *UP after 10 s* *UP after 15 s*	Raise blinds with delay
	DOWN after 5 s *DOWN after 10 s* *DOWN after 15 s*	Lower blinds with delay
Response when the block is set	***Ignore block***	The block function is ineffective with this telegram.
	No response	Do not respond when the block is set.
	UP	Raise blinds
	DOWN	Lower blinds
Response when cancelling the block	***No response***	Do not respond when the block is cancelled.
	ON	Raise blinds
	OFF	Lower blinds

6.9.5 Input I1, I2: window contact function

Designation	Values	Description
Function	*Switch..* *Push-button..* *Dimming..* *Blinds..* ***Window contact..***	Desired use.
Connect window contact internally with controller[25]	*No*	The input sends the window contact status to the bus.
	Yes	The input sends the window contact status to the bus. In addition, this status is directly transferred internally to the room temperature controller. No object linking required.
Debounce time	*30 ms,* ***50 ms,*** *80 ms* *100 ms, 200 ms,* *1 s, 5 s, 10 s*	In order to avoid disruptive switching due to bouncing of the contact connected to the input, the new status of the input is only accepted after a delay time. Larger values (≥ 1 s) can be used as a switch-on delay
Send in cycles	*every min* *every 2 min* *every 3 min* ... ***every 30 min*** *every 45 min* *every 60 min*	Common cycle time for all 3 output objects of the channel.
Activate block function	***No*** *Yes*	No block function. Show parameters for the block function.
Block telegram	***Block with 1 (standard)*** *Block with 0*	0 = cancel block 1 = block 0 = block 1 = cancel block

[25] Available for I1 only

6.9.5.1 Window contact

Designation	Values	Description
Telegram when contact closed	***On*** Off	Set switching status.
Telegram when contact open	*On* *Off*	Is set automatically.
Send in cycles	***No*** *Yes, always* *Only if input = 1* *Only if input = 0*	When should cyclical sending take place? The cycle time is set on the main parameter page of the channel.
Response after restoration of the bus supply[26]	***None*** *Update (immediately)* *Update (after 5 s)* *Update (after 10 s)* *Update (after 15 s)*	Do not send. Send update telegram immediately or with delay.
Response when the block is set	***Ignore block*** *No response* *As with input = 1* *As with input = 0*	The block function is ineffective with this telegram. Do not respond when the block is set. Respond as with rising edge. Respond as with falling edge.
Response when cancelling the block	***No response*** *Update*	Do not respond when the block is cancelled. Send update telegram.

[26] HU 1 RF, HU 1 S RF: Mains restoration

6.9.6 Input I2: Temperature input function[27]

Designation	Values	Description
Channel function	*Switch..* *Push-button..* *Dimming..* *Blinds..* ***Temperature input***	The input is connected to a temperature sensor
Sensor type	***Flush-mounted temperature sensor (9070496)***	Flush-mounted temperature sensor Item no. 9070496, for surface-mounted installation.
	Remote sensor IP65 (9070459)	External temperature sensor RAMSES IP65 Item no. 9070459, for surface-mounted installation.
	Floor sensor (9070321)	Temperature sensor for laying in floor, IP65 protection rating.
Temperature calibration	*-64..+64* *(x 0.1 K)*	Correction value for temperature measurement if sent temperature deviates from the actual ambient temperature. **Example:** temperature = 20 °C Sent temperature = 21 °C Correction value = 10 (i.e. 10 x 0.1 °C)
Send temperature in the event of change of	*Not due to a change*	Only send in cycles (if enabled)
	0.2 K *0.3 K* ***0.5 K*** *0.7 K* *1 K* *1.5 K* *2 K*	Send if the value has changed by the selected amount since the last transmission.
Send temperature in cycles	***Do not send in cycles*** *every min,* *every 2 min* *every 3 min* *...* *every 45 min* *every 60 min*	How often should the current measured value be resent?

[27] The temperature input function is only possible with input I2.

7 Typical applications

These application examples are designed to aid planning and are not to be considered an exhaustive list.
They can be extended and updated as required.

For detailed comfort and control functions, the RAMSES 718 P KNX manual can be consulted.

7.1 Simple control with one channel as heating actuator

Channel H1 is configured as heating actuator.

Control is accomplished by a RAMSES 718 P room thermostat.
Summer mode is triggered manually with a switch; presence and window status are sensed by a presence detector and a window contact.

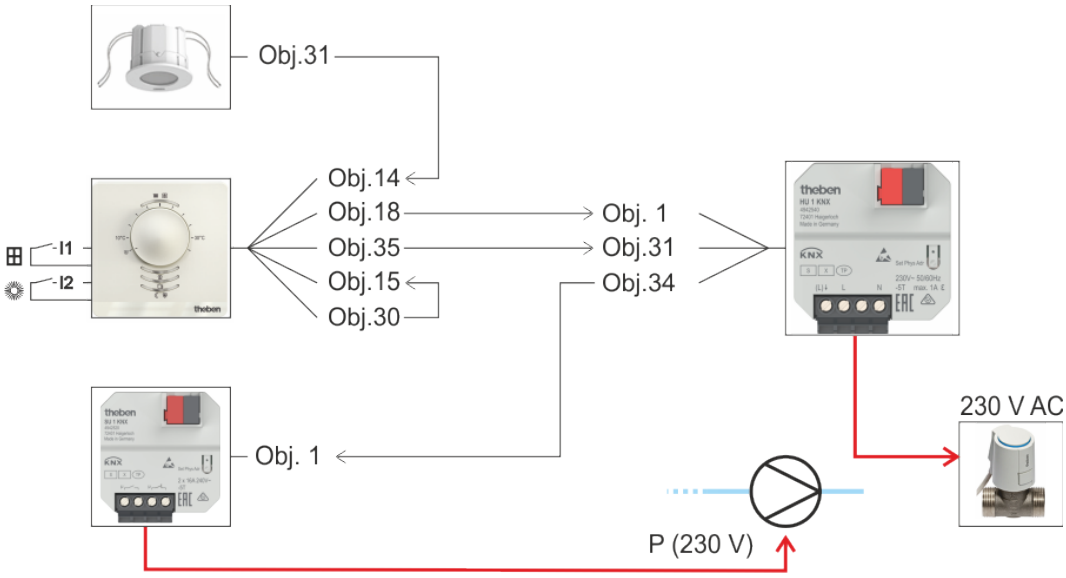
For the window contact and the switch for summer/winter mode, 2 external inputs of the RAMSES 718 P are used.

The heating pump is controlled by a SU 1 switching actuator.

7.1.1 Devices

- HU 1 (Order No. 4942540)
- RAMSES 718 P (Order No. 7189210)
- SU 1 (Order No. 4942520)
- PlanoSpot 360 KNX (Order No. 2039101)

7.1.2 Overview



7.1.3 Objects and links

No.	PlanoSpot 360 Object name	No.	RAMSES 718 P Object name	Comment
31	Channel C4.1 – presence	14	Presence	Presence signal. Starts comfort mode.

No.	RAMSES 718 P Object name	No.	HMT 6 S Object name	Comment
18	Heating actuating value	1	Continuous actuating value	Actuating value for channel H1
35	Channel I2.1 – switching	31	Summer mode ON/OFF	Changeover between summer/winter mode.

No.	RAMSES 718 P Object name	No.	RAMSES 718 P Object name	Comment
30	Channel I1.1 switching	15	Window status	Connect status of window contact at I1 with RTC window status input object.

No.	HU 1 Object name	No.	SU 1 Object name	Comment
34	Pump ON/OFF	1	Channel C1 – switch object	Controls the supply pump

7.1.4 Important parameter settings

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

PlanoSpot 360

Parameter page	Parameter	Setting
General information	*Channel C4 function – presence*	*Active..*
Channel C4 – presence – objects	*Telegram type C4.1*	*Switch command*

RAMSES 718 P

Parameter page	Parameter	Setting
Parameter block RTC		
RTC setting	*Control*	*Only heating control*
Heating control	*Type of control*	*Continuous*
Parameter block External inputs		
Channel 1	*Activate channel*	*On*
	Channel function	*Switch*
Switch object 1	*Object type*	*Switching (1 bit)*
	Send if input = 1	*Yes*
	Telegram	*On*
	Send if input = 0	*Yes*
	Telegram	*Off*
Channel 2	*Activate channel*	*On*
	Channel function	*Switch*
Switch object 1	*Object type*	*Switching (1 bit)*
	Send if input = 1	*Yes*
	Telegram	*On*
	Send if input = 0	*Yes*
	Telegram	*Off*

HU 1, channel H1

Parameter page	Parameter	Setting
Configuration options	*Channel function*	*Heating actuator*
	Type of actuating value	*Continuous*
Channel characteristics	*Actuator direction of operation*	*Standard*

SU 1, channel C1

Parameter page	Parameter	Setting
Configuration options	*Channel function*	*Switching On/Off*
	Activation of function via	*Switch object*

7.2 Simple control with one channel as heating controller

Channel H1 is configured as heating controller.

The channel is used as a heating actuator with integrated room thermostat.

The external inputs of HU 1 are directly connected internally to the controller[28]:
E1 → window contact.
E2 → actual temperature value, e.g. with the flush-mounted temperature sensor UP (Order No. 9070496).

Presence is sensed by a presence detector.

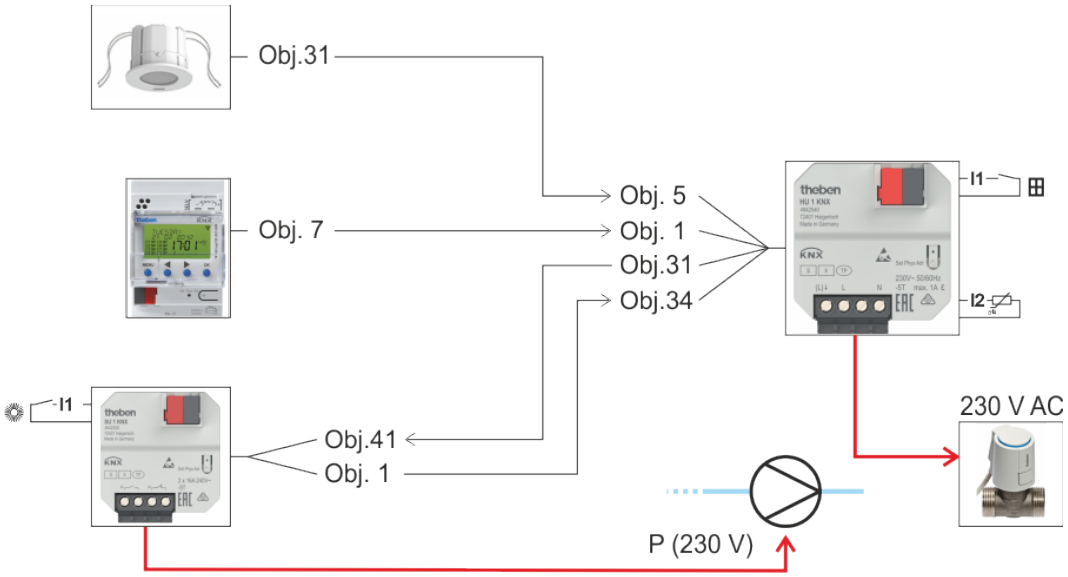
The setpoint is sent from a TR 648 top2 time switch.

The heating pump is controlled by a SU 1 switching actuator.
A switch for summer/winter mode is connected to the external input E1 of the switch actuator.

7.2.1 Devices

- HU 1 (Order No. 4942540)
- PlanoSpot 360 KNX (Order No. 2039101)
- TR 648 top2 RC-DCF (Order No. 6489210)
- SU 1 (Order No. 4942520)
- Temperature sensor, e.g. Order No. 9070496

7.2.2 Overview



[28] No object linking required. See below: *Important parameter settings*

7.2.3 Objects and links

No.	PlanoSpot 360 Object name	No.	HU 1 Object name	Comment
31	Channel C4.1 – presence	5	Presence	Presence signal. Starts comfort mode.

No.	TR 648 top2 Object name	No.	HU 1 Object name	Comment
7	C1.1 switching channel – temperature in °C	1	Base setpoint	Base setpoint

No.	SU 1 Object name	No.	HU 1 Object name	Comment
41	Channel I1.1 – switching	31	Summer mode ON/OFF	Changeover between summer/winter mode.
1	Channel C1 – switch object	34	Pump ON/OFF	Controls the supply pump

7.2.4 Important parameter settings

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

PlanoSpot 360

Parameter page	Parameter	Setting
General information	*Channel C4 function – presence*	*Active..*
Channel C4 – presence – objects	*Telegram type C4.1*	*Switch command*

HU 1

Parameter page	Parameter	Setting
Channel H1		
Configuration options	*Channel function*	*Heating controller*
	Include in summer mode	*Yes*
Channel characteristics	*Actuator direction of operation*	*Standard*
Input I1		
Configuration options	*Function*	*Window contact*
	Connect window contact internally with controller	*Yes*[29]
Input I2		
Configuration options	*Function*	*Temperature input*
	Connect temperature input internally with controller	*Yes*[30]

TR 648 top2

Parameter page	Parameter	Setting
Switching channel C1	*Telegram type C1.1*	*Temperature [°C]*
	With clock -> ON	*20 °C*
	With clock -> OFF	*16 °C*

[29] No object linking required.
[30] No object linking required.

SU 1

Parameter page	Parameter	Setting
Channel C1		
Configuration options	*Channel function*	*Switching On/Off*
	Activation of function via	*Switch object*
Input I1		
Configuration options	*Function*	*Switch*
	Control switch actuator directly	*No*

8 Appendix

8.1 Determining the current operation mode

The current setpoint can be adjusted to the relevant requirements by selecting the operating mode.
The operating mode can be specified via the objects *operating mode preset, presence,* and *window setting*.

The current operating mode can be specified as follows:

Object *Operating mode preset*	Object *Presence*	Object *Window setting*	Current operating mode
User-defined	User-defined	1	Frost/heat protection
User-defined	1	0	Comfort
Comfort	0	0	Comfort
Standby	0	0	Standby
Night	0	0	Night
Frost/heat protection	0	0	Frost/heat protection

8.2 Priorities for operating mode selection

In principle the following applies: The last instruction overwrites the previous one.

Exception: Frost mode via window contact has priority over all other operating modes.

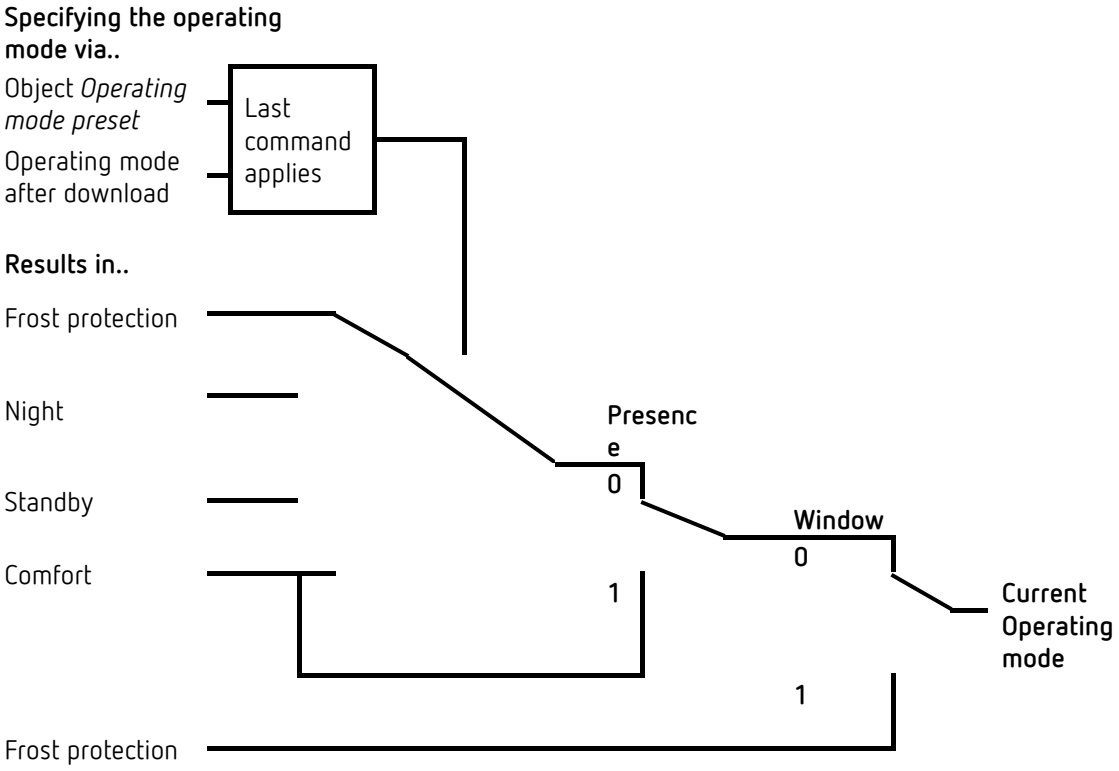
Upon selection of the *presence button* parameter, the following also applies:
If a new operating mode is received on the object with the presence object set (*operating mode preset)*, it will be accepted and the presence object will be reset (only with presence button).

Reception of the same operating mode as prior to the presence status
(e.g. via cycl. sending) is ignored.

If the *presence object* is set during night/frost mode, it will be reset after the configured comfort extension finishes.

If the *presence object* is set during standby mode, the comfort operating mode is accepted without time restriction.

Determining the operating mode when using a presence detector



8.3 Base setpoint and current setpoint

The **base setpoint** is the standard temperature for comfort mode and the reference temperature for reduction in standby and night modes.
The programmed base setpoint (see *base setpoint after downloading the application*) is stored in object *base setpoint* and can be changed via the bus at any time.

The **current setpoint** is the setpoint that is actually used for control. It is the result of all the reductions or increases associated with the operating mode and control function.

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

The current setpoint depends on the operating mode and on the selected control function.

If the setpoint, because of a setpoint offset, is outside the programmed values for frost and heat protection, it is restricted to these values by the safety limits.

8.4 Determination of the setpoint

8.4.1 Setpoint calculation in heating mode

Current setpoint during heating

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

Example:
Heating in comfort mode.

Parameter page	Parameter	Setting
Setpoints	*Base setpoint after loading the application*	*21 °C*
	Reduction in standby mode (during heating)	*2 K*
	Maximum valid setpoint offset	*+/- 2 K*

The setpoint was previously increased by 1 K via object *setpoint offset*.

Calculation:

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

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

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

8.4.2 Setpoint calculation in cooling mode

Current setpoint during cooling

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

Example:
Cooling in comfort mode.

The room temperature is too high, the controller has switched to cooling mode

Parameter page	Parameter	Setting
Setpoints	*Base setpoint after loading the application*	*21 °C*
	Maximum valid setpoint offset	*+/- 2 K*
Cooling setpoints	*Dead zone between heating and cooling*	*2 K*
	Increase in standby mode (during cooling)	*2 K*

The setpoint was previously lowered via object *setpoint offset* by 1 K.

Calculation:

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

Changing to standby mode causes a further increase of the setpoint (energy saving), which results in the following setpoint:
Setpoint
= base setpoint + setpoint offset + dead zone + increase in standby mode
= 21 °C – 1 K + 2 K + 2 K
= 24 °C

8.5 Setpoint offset

The current setpoint can be adjusted via object *manual setpoint offset*.
In this case, the setpoint is changed by sending the desired offset to the object.
For this, the difference (may be preceded by a minus sign) is sent as DPT 9.002 to the object *manual setpoint offset*.

The offset limits are defined on the ***setpoints*** parameter page via the *Maximum valid setpoint offset* parameter.

The offset is always in relation to the Base setpoint and not to the current setpoint.

Example Base setpoint of 21 °C:

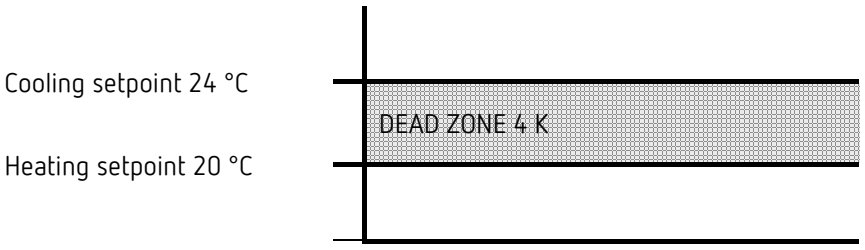
If a value of 2 is received by object *manual setpoint offset*, the new setpoint is calculated as follows:
21 °C + 2 K = 23 °C.
In order to afterwards bring the setpoint to 22 °C, the difference to the programmed base setpoint (here 21 °C) is resent, in this case 1 K (21 °C + 1 K = 22 °C)

8.6 Dead zone

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

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

Heating and cooling with continuous control



In a 2-pipe system, the dead zone can be set to 0 K.

8.7 Valve protection

If configured, the valve protection becomes active if there was no change at the output for 7 days.
The switching status will be inverted for 6 minutes. If there is a switching operation in this time, valve protection will be ended.

8.8 Short-circuit and overcurrent shutdown

Overcurrent monitoring is only active if the channel is configured as a switch output.

As soon as an overcurrent is detected at an output, the affected channel is switched off.
If the channel continues to be controlled, a new attempt is made to switch it on after 5 s. If an overcurrent is detected again, the channel switches off permanently. If there is no more overcurrent, the channel returns to normal after 5 s.

If the channel is no longer controlled after it has been switched off by overcurrent (e.g. because of the PWM off phase), it waits until the next switch-on. If an overcurrent occurs there as well, the system is switched off permanently.

Shutdown due to overcurrent is indicated by a flashing channel LED.

Confirmation:
Resetting is done in case of mains failure and download.

8.9 Determining the maximum actuating value

8.9.1 Application

If in a system all actuators are opened only slightly, e.g. one at 5%, one at 12%, another at 7% etc., the boiler could decrease its output, because not much heating energy is needed.
In order to do so, the boiler has to be informed about the actual energy demand of the system.
This task is performed by the "Detect maximum actuating value" function.

8.9.2 Principle

The heating actuators (HU 1, HMT 6 S/HMT 12 S devices) are constantly compared with each other. Those participants with a higher actuating value than the other heating actuators may send it; those with a smaller one do not send.
In order to accelerate this process: The greater the difference between its own and the received actuating value, the greater the speed at which the heating actuator sends.
Thus, the actuator with the highest actuating value sends first and outperforms all others.

8.9.3 In practice

The actuating value comparison takes place via the object *maximum actuating value*.
For this purpose, all heating actuators are connected via this object with a common group address.

In order to start the actuating value comparison among the participants, one of the participants must send a value to this group address in cycles.

This task can be performed either by the boiler, or by one of the heating actuators.
If it is the boiler, it must send the minimum possible value, i.e. 0%.
If it is one of the heating actuators, on the parameter page ***General***, the parameter *Send maximum actuating value* must be set to *send in cycles*.
This actuator then regularly sends its own maximum actuating value and the others can respond accordingly.

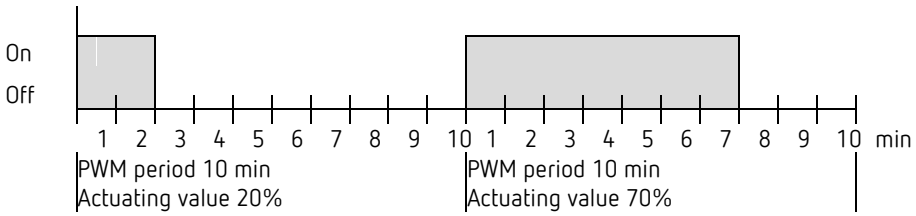
Irrespective of which participant acts as a trigger, for **all other** actuators, the *Send maximum actuating value* parameter must be set to the default value of *Only if own actuating value is greater*.

8.10 PWM cycle

8.10.1 Basic principle

In order to achieve e.g. a heating output of 50%, the 50% actuating value is converted into switch-on/switch-off cycles.
The actuator is switched on for 50% of the time and switched off for 50% of the time over a fixed period (10 minutes in our example).

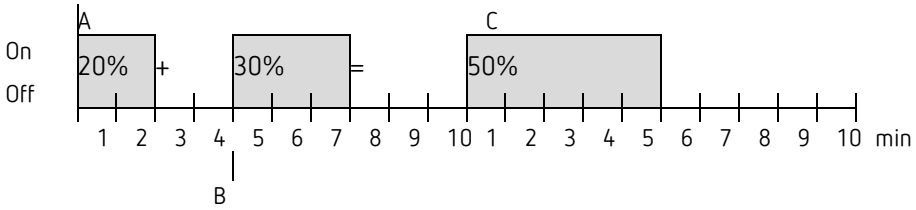
Example: 2 different turn-on times of 2 and 7 minutes indicate the implementation of 2 different actuating values, that is once 20% and once 70% during a PWM period of 10 minutes.



8.10.2 Response to changes in the actuating value

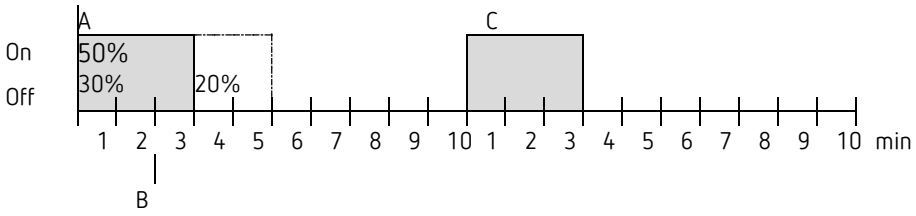
Every change in the actuating value is immediately transferred to the PWM cycle, in order to respond to changes in the quickest possible time.

Example 1:
The last actuating value was 20% (A).
A new actuating value of 50% is received during the cycle (B).
The output is immediately switched on and the missing 30% turn-on time is added.
The next cycle is executed with 50% (C).

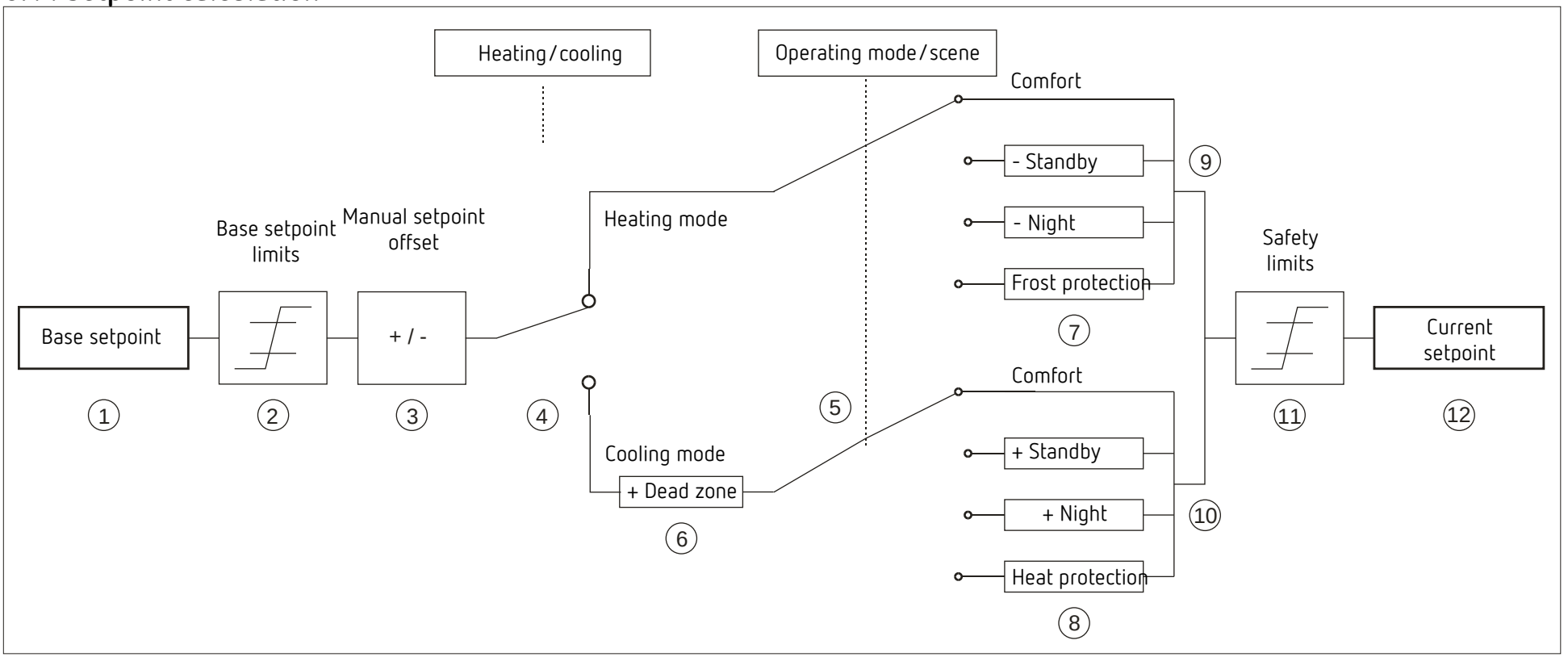


If the rated turn-on time for the current cycle has already been exceeded while receiving the new actuating value, the output is immediately switched off and the new actuating value is executed during the next cycle.

Example 2:
The last actuating value was 50% (A)
A new actuating value of 30% is received during the cycle (B).
The output is switched off after completing 30% of the PWM cycle and thus the new actuating value is already executed.



8.11 Setpoint calculation



1 Preset base setpoint
2 Max. and min. valid base setpoints
3 Manual setpoint offset
4 Change between heating and cooling: Automatically or via object
5 Selection of operating mode by object
6 In cooling mode, the setpoint is increased by the amount of the dead zone
7 The setpoint is replaced by the setpoint for frost protection mode
8 The setpoint is replaced by the setpoint for heat protection mode
9 Setpoint after reductions caused by the operating mode
10 Setpoint after increases caused by the operating mode
11 The limits for frost and heat protection must be adhered to
12 Current setpoint after increases, reductions and limits caused by the operation