KNX-OT Gateway S

KNX-OT Gateway S	Order No.
8559201	

Contents

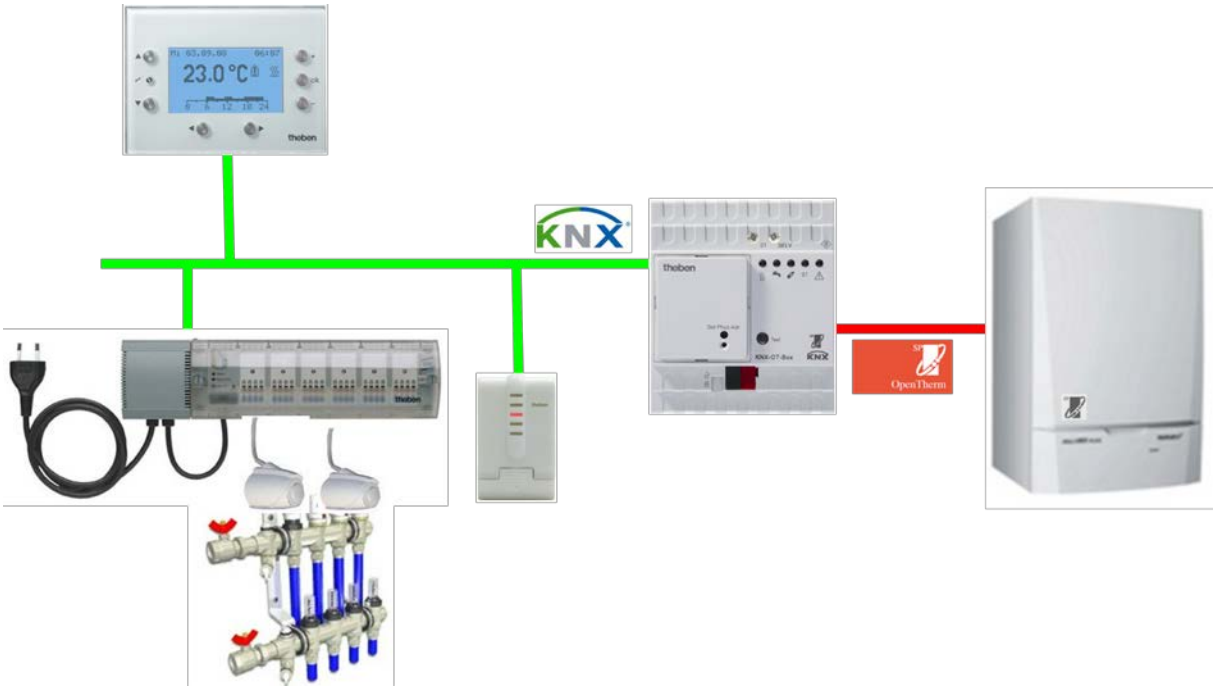
1 Functional characteristics

With the new KNX-OT Gateway, Theben bridges the gap between two worlds: KNX and OpenTherm boilers can be combined using this universal interface. It can be used as the master for the OpenTherm boiler in combination with a KNX individual room control.

- **OpenTherm and KNXT**
  The new interface from Theben links the KNX bus with the OT communication system widely used with gas water heaters. As a master, the KNX-OT Gateway allows the bidirectional exchange of data between the OpenTherm boiler and the heat distribution via the KNX system for individual room control.
- **Simple to use via multi-functional display**
  The VARIA 826 / VARIA 826 S KNX multi-functional display can be used to make and change settings for the boiler control. They are transmitted to the OpenTherm boiler via the KNX-OT Gateway.
- **Pilot room control**
  The new interface now not only enables pilot room control, but also optimises the flow as required for all rooms.
- **Energy saving domestic hot water**
  Heating domestic hot water with a solar power system helps saving energy, as the amount of sunshine expected according to weather forecasts can be taken into account for domestic hot water.
- **Screed drying program**
  The Theben KNX-OT Gateway can be easily and quickly set up using removable bus coupling units and the factory integrated "Screed drying program as per DIN EN 1264-4".
- **The combination** with a Theben OT-Box (Order No. 9070712)
  allows controlling any conventional boiler via the KNX bus.

The KNX-OT Gateway serves as an interface between the OpenTherm communication system (in heating and ventilation technology) and the KNX bus.
It supplies the necessary data for boiler control (heating etc.) and transmits them to the boiler.
The following functions are available with the KNX-OT Gateway:

- Customised flow control
- Weather-dependent flow control
- Control of domestic hot water
- Energy optimisation with solar support of domestic hot water
- Laying readiness heating/screed drying program
- Legionella protection program



The ETS (Engineering Tool) can be used to select application programmes, to assign specific parameters and addresses, and to transfer them to the device.
The device is designed for installation on DIN top hat rails (in accordance with EN 60715). Only to be used in closed, dry rooms.

1.1 Operation

By pressing the Test button, the OpenTherm bus will be short-circuited.
This usually starts the boiler.

Note:
The LEDs always show the actual status of the boiler, and not the status of the KNX objects.
The reaction time of the boiler can cause a perceptible delay between a bus command and the updating of the LEDs.

Example: If object 2 receives the CH enable command, the CH enable LED will only light up if the boiler has accepted and confirmed this status.

2 Technical data

2.1 Technical data

Operating voltage, KNX power consumption	Bus voltage, ≤10 mA
Type of installation	DIN-rail
Width	4 TE
Connection type	KNX bus terminal
Max. cable cross-section	Solid: 0.5 mm² (Ø 0.8) to 4 mm² | strand with crimp terminal: 0.5 mm² to 2.5 mm²
Ambient temperature	0 °C … +45 °C
Protection rating	IP 20 in accordance with EN 60529
Protection class	III in accordance with EN 60730-1

3 The application programme "KNX-OT Gateway S"

3.1 Selection in the product database

Manufacturer	Theben AG
Product family	Gateways
Product type	Boiler control for OpenTherm boiler
Program name	KNX-OT Gateway S

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

Table 1

Number of communication objects:	71
Number of group addresses:	102
Number of associations:	102

3.2 Communication objects

Table 2:

No.	Object name	Function	DPT	C	R	W	T
0	*H1 flow basic set point value in comfort mode*	*Define flow set point value*	2 Byte 9,001	C	R	W	-
1	*H1 manual offset of flow set point value*	*Offset flow set point value*	2 Byte 9,002	C	R	W	-
2	*H1 enable central heating*	*Heating on/off*	1 bit 1,003	C	R	W	-
3	*H1 max. actuating value zone/room 1 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H1 max. actuating value zone/room 1 weather + demand	*Receive actuating value*		C	R	W	-
4	*H1 max. actuating value zone/room 2 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H1 max. actuating value zone/room 2 weather + demand	*Receive actuating value*		C	R	W	-
5	*H1 max. actuating value zone/room 3 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H1 max. actuating value zone/room 3 weather + demand	*Receive actuating value*		C	R	W	-
6	*H1 max. actuating value zone/room 4 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H1 max. actuating value zone/room 4 weather + demand	*Receive actuating value*		C	R	W	-
7	*H1 max. actuating value zone/room 5 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H1 max. actuating value zone/room 5 weather + demand	*Receive actuating value*		C	R	W	-
8	*H1 max. actuating value zone/room 6 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H1 max. actuating value zone/room 6 weather + demand	*Receive actuating value*		C	R	W	-
9	*H1 max. actuating value zone/room 7 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H1 max. actuating value zone/room 7 weather + demand	*Receive actuating value*		C	R	W	-

Continuation:

No.	Object name	Function	DPT	C	R	W	T
10	*H1 max. actuating value zone/room 8 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H1 max. actuating value zone/room 8 weather + demand	*Receive actuating value*		C	R	W	-
11	*H1 max. actuating value zone/room 9 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H1 max. actuating value zone/room 9 weather + demand	*Receive actuating value*		C	R	W	-
12	*H1 max. actuating value zone/room 10 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H1 max. actuating value zone/room 10 weather + demand	*Receive actuating value*		C	R	W	-
13	*Summer mode*	*Summer mode on/off*	1 bit 1,001	C	R	W	-
14	*H1 HVAC operating mode heating*	*Receive HVAC operating mode*	1 Byte 20,102	C	R	W	-
15	*H1 Lock demand control*	*1 = locked/ 0 = enabled*	1 bit 1,003	C	R	W	-
16	*H1 current flow temperature*	*Send current flow temperature*	2 Byte 9,001	C	R	-	T
17	*H1 flow set point value*	*Send current flow set point value*	2 Byte 9,001	C	R	-	T
18	*Flame status*	*Send flame status*	1 bit 1,001	C	R	-	T
19	*General error*	*Report general error*	1 bit 1,001	C	R	-	T
20	*Error code (as per OpenTherm ID 5)*	*Report error code*	1 Byte 5,010	C	R	-	T
21	*H1 heating status*	*Report heating status*	1 bit 1,001	C	R	-	T
22	*Service required*	*Report service requirement*	1 bit 1,001	C	R	-	T
23	*Outdoor temperature*	*Receive outdoor temperature*	2 Byte 9,001	C	R	W	-
	Outdoor temperature	*Send outdoor temperature*	2 Byte 9,001	C	R	-	T

Continuation:

No.	Object name	Function	DPT	C	R	W	T
24	*Outdoor temperature error*	*Outdoor temp. missing or incorrect*	1 bit 1,001	C	R	-	T
25	*Domestic Hot Water (DHW) enable*	*Domestic hot water on/off*	1 bit 1,003	C	R	W	-
26	*Current solar support*	*Solar support option = 1*	1 bit 1,001	C	R	W	-
27	*Expected solar support*	*Solar support option = 1*	1 bit 1,001	C	R	W	-
28	*HVAC operating mode domestic hot water*	*Receive HVAC operating mode*	1 Byte 20,102	C	R	W	-
29	*Forced operation domestic hot water*	*Forced operation = 1*	1 bit 1,001	C	R	W	-
30	*Domestic hot water set point value in forced operation*	*Define set point value*	2 Byte 9,001	C	R	W	-
31	*Domestic water temperature set point value*	*Report domestic hot water set point value*	2 Byte 9,001	C	R	-	T
32	*Current domestic water temperature*	*Send current temperature*	2 Byte 9,001	C	R	-	T
33	*Domestic hot water status*	*Report domestic hot water status*	1 bit 1,001	C	R	-	T
34	*Degree of modulation in %*	*Report degree of modulation*	1 Byte 5,001	C	-	-	T
35	*Lower limit of domestic hot water set point value*	*Report boiler setting*	2 Byte 9,001	C	-	-	T
36	*Upper limit of domestic hot water set point value*	*Report boiler setting*	2 Byte 9,001	C	-	-	T
37	*H1 lower limit of flow set point value*	*Report boiler setting*	2 Byte 9,001	C	-	-	T
38	*H1 upper limit of flow set point value*	*Report boiler setting*	2 Byte 9,001	C	-	-	T
39	*n.a.*	-	-	-	-	-	-
40	*H2 flow basic set point value in comfort mode*	*Define flow set point value*	2 Byte 9,001	C	R	W	-
41	*H2 manual offset of flow set point value*	*Offset flow set point value*	2 Byte 9,002	C	R	W	-

Continuation:

No.	Object name	Function	DPT	C	R	W	T
42	*H2 enable central heating*	*Heating on/off*	1 bit 1,003	C	R	W	-
43	*H2 max. actuating value zone/room 11 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H2 max. actuating value zone/room 11 weather + demand	*Receive actuating value*	1 Byte 5,001	C	R	W	-
44	*H2 max. actuating value zone/room 12 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H2 max. actuating value zone/room 12 weather + demand	*Receive actuating value*	1 Byte 5,001	C	R	W	-
45	*H2 max. actuating value zone/room 13 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H2 max. actuating value zone/room 13 weather + demand	*Receive actuating value*	1 Byte 5,001	C	R	W	-
46	*H2 max. actuating value zone/room 14 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H2 max. actuating value zone/room 14 weather + demand	*Receive actuating value*	1 Byte 5,001	C	R	W	-
47	*H2 max. actuating value zone/room 15 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H2 max. actuating value zone/room 15 weather + demand	*Receive actuating value*	1 Byte 5,001	C	R	W	-
48	*H2 max. actuating value zone/room 16 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H2 max. actuating value zone/room 16 weather + demand	*Receive actuating value*	1 Byte 5,001	C	R	W	-
49	*H2 max. actuating value zone/room 17 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H2 max. actuating value zone/room 17 weather + demand	*Receive actuating value*	1 Byte 5,001	C	R	W	-
50	*H2 max. actuating value zone/room 18 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H2 max. actuating value zone/room 18 weather + demand	*Receive actuating value*	1 Byte 5,001	C	R	W	-

Continuation:

No.	Object name	Function	DPT	C	R	W	T
51	*H2 max. actuating value zone/room 19 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H2 max. actuating value zone/room 19 weather + demand	*Receive actuating value*	1 Byte 5,001	C	R	W	-
52	*H2 max. actuating value zone/room 20 demand-driven*	*Receive actuating value*	1 Byte 5,001	C	R	W	-
	H2 max. actuating value zone/room 20 weather + demand	*Receive actuating value*	1 Byte 5,001	C	R	W	-
53	*H2 HVAC operating mode heating*	*Receive HVAC operating mode*	1 Byte 20,102	C	R	W	-
54	*H2 Lock demand control*	*1 = locked/ 0 = enabled*	1 bit 1,003	C	R	W	-
55	*H2 current flow temperature*	*Send current flow temperature*	2 Byte 9,001	C	R	-	T
56	*H2 flow set point value*	*Send current flow set point value*	2 Byte 9,001	C	R	-	T
57	*H2 heating status*	*Report heating status*	1 bit 1,001	C	R	-	T
58	*Burner starts*	*OT-Box ID 116*	2 Byte 7,001	C	R	-	T
59	*Burner operating hours*	*OT-Box ID 120*	2 Byte 7,007	C	R	-	T
60	*H2 boiler temperature*	*OT-Box ID 151*	2 Byte 9,001	C	R	-	T
61	*H1 flow temperature*	*OT-Box ID 152*	2 Byte 9,001	C	R	-	T
62	*H2 buffer temperature*	*OT-Box ID 153*	2 Byte 9,001	C	R	-	T
63	*Water pressure*	*Send*	2 Byte 9,006	C	R	-	T
64	*Time (DPT 10.001)*	*OT-Box ID 20*	3 Byte 10,001	C	R	W	-
	Time (DPT 19.001)	*OT-Box ID 20*	8 Byte 19,001	C	R	W	-
65	*Room set temperature*	*OT-Box ID 16*	2 Byte 9,001	C	R	W	-

Continuation:

No.	Object name	Function	DPT	C	R	W	T
66	*Room actual temperature*	*OT-Box ID 24*	2 Byte 9,001	C	R	W	-
67	*Time query*	*transmit*	1 bit 1,017	C	R	-	T
68	*Burner starts/hour counter*	*Reset*	1 bit 1,015	C	R	W	-

3.2.1 Description of objects

- **Object 0** "*H1 Flow base set point value in comfort mode*"

This object activates the set channel function (see parameter: *Channel function*).

- **Object 1** "*H1 manual flow set point value offset*"

A received temperature difference causes an offset of the current flow set point value by up to +/- 15 K.
Values outside these limits are automatically restricted.

- **Object 2** "*H1 enable central heating*"

CH-enable function.
0 = Heating off
1 = Heating permitted

- **Objects 3..12** "*H1 max. actuating value zone/room 1..10*"

Receive the actuating value from the room thermostat in the different rooms.

- **Object 13** "*Summer mode*"

1 = Summer mode active
0 = Summer mode inactive

- **Object 14** "*H1 HVAC operating mode heating*"

Receives the required operating mode, e.g. from a time switch.
1 = Comfort
2 = Standby
3 = Night,
4 = Frost protection
Other values are ignored.

- **Object 15** "*H1 lock demand control*"

If this object is set (=1) only the preset *Flow set point value after reset* (*Heating* parameter page) applies.
The actuating values from the rooms are no longer taken into account.

- **Object 16** "*H1 current flow temperature*"

Feedback from the boiler.

- **Object 17** "*H1 flow set point value*"

Feedback from the boiler.

- **Object 18** "*Flame status*"

Feedback from the boiler.
0 = Burner off
1 = Burner on

- **Object 19** "*general error*"

Feedback from the boiler.

- **Object 20** "*Error code (as per OpenTherm ID 5)*"

Feedback from the boiler.
1 = set
0 = deleted

Table 3

Bit no.	Message	Description
0	Service request [service not req'd, service required]	Service request
1	Lockout reset [remote reset disabled, rr enabled]	Lockout mode can be reset (max. 3x)
2	Low water press [no WP fault, water pressure fault]	Low water pressure
3	Gas/flame fault [no G/F fault, gas/flame fault]	Gas/flame fault
4	Air press fault [no AP fault, air pressure fault]	Air pressure fault
5	Water over-temp [no OvT fault, over-temperat. fault]	Water over-temperature error
6	reserved	Reserved
7	reserved	Reserved

- **Object 21 "***H1 heating status***"**

Feedback from the boiler.
0 = The boiler is not heating at the moment.
1 = The boiler is heating at the moment.

- **Object 22 "***Service required***"**

Feedback from the boiler.
1 = Service required

- **Object 23 "***Outdoor temperature***"**

The object can send or receive depending on the source of the outdoor temperature.

Table 4

Parameter *Measuring outdoor temperature*	Function of object 23
Via object	*Receive outdoor temperature*
From boiler	*Send outdoor temperature*

The outdoor temperature is required for determining requirements in summer mode and weather-dependent set point values.

- **Object 24 "***Outdoor temperature error***"**

0 = no error
1 = Outdoor temperature is not received or the received value is beyond the normal range.

- **Object 25 "***Domestic Hot Water (DHW) enable***"**

0 = No domestic hot water
1 = Activate domestic hot water

- **Object 26 "***Current solar support***"**

This object is available when *Energy optimisation with possible solar support* is selected on the *Domestic hot water* parameter page.
The solar device sends a 1 if solar energy is available.

0 = the current domestic hot water set point value applies.
1 = the preset value applies *Set point value for solar support*

- **Object 27 "***Expected solar support***"**

This object is available when *Energy optimisation with possible solar support* is selected on the *Domestic hot water* parameter page.

The weather station sends a 1 if solar energy is expected (EFR report).
0 = the current domestic hot water set point value applies.
1 = the preset value applies *Set point value for solar support*

- **Object 28 "***HVAC operating mode domestic hot water***"**

Receives the desired HVAC operating mode for domestic hot water.

- **Object 29 "***Domestic hot water forced operation***"**

0 = no force
1 = Domestic hot water is heated to set *Domestic hot water set point value in standby mode*.

- **Object 30 "***Domestic hot water set point value in forced operation***"**

A new set point value can be entered here.

- **Object 31 "***Domestic hot water temperature set point value* **"**

Feedback from the boiler.
Sends legionella protection set point value during legionella protection.
When this is reached or exceeded, the object resends the current valid set point value.

- **Object 32 "***Current domestic water temperature***"**

Feedback from the boiler.

- **Object 33 "***Domestic hot water status***"**

0 = no force
1 = Domestic hot water is heated to the set *Domestic hot water set point value in standby mode*.

- **Object 34 "***Degree of modulation in %***"**

Feedback from the boiler.

- **Object 35** "*Lower limit of domestic hot water set point value* "

Feedback from the boiler.

- **Object 36** "*Upper limit of domestic hot water set point value*"

Feedback from the boiler.

- **Object 37** "*H1 lower limit of flow set point value*"

Feedback from the boiler.

- **Object 38** "*H1 Upper limit of flow set point value*"

Feedback from the boiler.

- **Object 39**

Not used..

- **Object 40** "*H2 Flow base set point value in comfort mode*"

This object activates the set channel function (see parameter: *Channel function*).

- **Object 41** "*H2 manual flow set point value offset*"

A received temperature difference causes an offset of the current flow set point value by up to +/- 15 K.
Values outside these limits are automatically restricted.

- **Object 42** "*H2 enable central heating*"

CH-enable function.
0 = Heating off
1 = Heating permitted

- **Objects 43..52** "*H2 max. actuating value zone/room 11..20*"

Receive the actuating value from the room thermostat in the different rooms.

- **Object 53** "*H2 HVAC operating mode heating*"

Receives the required operating mode, e.g. from a time switch.
1 = Comfort
2 = Standby
3 = Night,
4 = Frost protection
Other values are ignored.

- **Object 54** "*H2 lock demand control*"

If this object is set (=1) only the preset *Flow set point value after reset* (*Heating* parameter page) applies.
The actuating values from the rooms are no longer taken into account.

- **Object 55** "*H2 current flow temperature*"

Feedback from the boiler.

- **Object 56** "*H2 flow set point value*"

Feedback from the boiler.

- **Object 57** "*H2 heating status*"

Feedback from the boiler, heating circuit 2.
0 = The boiler is not heating at the moment.
1 = The boiler is heating at the moment.

- **Objekt 58 „***Burner starts***“**

Only available if the interface controls a Theben OT-Box (*General* parameter page).
OT-Box ID 116 feedback.

- **Object 59 „***Burner operating hours***“**

Only available if the interface controls a Theben OT-Box (*General* parameter page).
OT-Box ID 120 feedback.

- **Object 60 „***H2 boiler temperature***“**

Only available if the interface controls a Theben OT-Box (*General* parameter page).
OT-Box ID 151 feedback.

- **Object 61** "*H1 flow temperature*"

Only available if the interface controls a Theben OT-Box (*General* parameter page).
OT-Box ID 152 feedback.

- **Object 62 „***H2 buffer temperature***“**

Only available if the interface controls a Theben OT-Box (*General* parameter page).
OT-Box ID 153 feedback.

- **Object 63 „***Water pressure***“**

Only available if the interface controls a Theben OT-Box (*General* parameter page).
OT-Box ID 153 feedback.

- **Object 64 “***Time***”**

Only available if the interface controls a Theben OT-Box (*General* parameter page).
Receives the time, depending on configuration, as 3 byte or 8 byte telegram (format can be set on the *General* parameter page).

- **Object 65 „***Room set temperature***“**

Only available if the interface controls a Theben OT-Box (*General* parameter page).
Receives the room temperature set point value from the KNX room thermostat.

- **Object 66 „***Room actual temperature***“**

Only available if the interface controls a Theben OT-Box (*General* parameter page).
Receives the actually measured room temperature from the KNX room thermostat.

- **Object 67 „***Time query***“**

Only available if the interface controls a Theben OT-Box (*General* parameter page).
Sends time query to bus clock to receive the current time.

- **Object 68 „***Burner starts/hour counter - Reset***“**

Only available if the interface controls a Theben OT-Box (*General* parameter page).
When receiving a 1, the counter for burner starts and the hour counter will be reset to 0.

3.3 Parameters

3.3.1 Parameter pages

Table 5

Function	Description
General	Basic device settings
Heating 1	**First heating circuit.** Set point values, reductions, operating modes etc.
Weighting of zones 1	Different heat zone priorities for set point value calculation.
Reports from CH1	Settings for heating data feedback via the boiler.
Heating 2	**Second heating circuit.** Set point values, reductions, operating modes etc.
Weighting of zones 2	Different heat zone priorities for set point value calculation.
Reports from CH2	Settings for heating data feedback via the boiler.
Outdoor temperature	Settings for determining the outdoor temperature.
Domestic hot water	Set point values for domestic hot water and settings for legionella protection.
DHW reports	Settings for domestic hot water data feedback via the boiler.
TSP Parameters	Basic settings for the possibly connected Theben OT-Box.

3.3.2 Parameter description

3.3.2.1 The "*General*" parameter page

Table 6

Designation	Values	Description
Activate laying readiness heating	***No***	Normal operation.
	yes	Screed drying program as per DIN EN 1264-4.See appendix: Laying readiness heating.
Determining the heating set point value	***via heating requirement, without weather***	The flow temperature is calculated based on the current maximum actuating value taking into account the weighting for individual zones.
	according to demand and weather-controlled	The flow temperature is calculated based on the current maximum actuating value (see above) and the outdoor temperature.
	via weather, without heating requirement	The flow temperature is calculated exclusively according to the current outdoor temperature.
Activate domestic hot water	***Yes..***	Is domestic hot water required?
	no	
KNX OT interface controls	***OT boiler***	The KNX-OT Gateway is directly connected with an OpenTherm compatible boiler.
	Theben OT-Box	The KNX-OT Gateway is connected with a Theben OT-Box, which itself controls a conventional boiler.
Format of the time object	*3 byte (DPT 10.001)*	Which format can be used to receive time telegrams in the bus?
	8 byte (DPT 19.001)	

3.3.2.2 The „*Heating 1*“ and „*Heating 2*“ parameter pages

Table 7

Designation	Values	Description
Flow set point value after reset [°C]	*20..90* (Standard = ***50***)	Basis for all set point value increases and reductions (cf. basic set point value).
Base point of characteristic curve [°C]	*20..90* (Standard = ***30***)	Minimum flow temperature for determining demand-driven set point value. See in the Appendix: Calculation of set point value.
End point of characteristic curve: [°C]	*20..90* (Standard = ***80***)	Maximum flow temperature for determining demand-driven set point value. See in the Appendix: Calculation of set point value.
Reduction in standby mode	*0 K, 5 K,* ***10 K,*** *15 K, 20 K, 25 K, 30 K, 35 K, 40 K*	Example: With a basic set point value of 50 °C and a 10 K reduction, the boiler controls with a set point value of 50 – 10 = 40 °C.
Reduction in night mode	*0 K, 5 K,* ***10 K,*** *15 K, 20 K, 25 K, 30 K, 35 K, 40 K*	How much should the flow temperature be reduced by in night mode?
Frost protection temperature [°C]	*6..30* (Standard = ***10***)	Flow temperature in frost protection mode
Operating mode after reset	*Frost protection* *Night mode* *Standby mode* ***Comfort mode***	Operating mode after start-up or reprogramming
CH/CH2 Enable after reset	*Off* *On* ***as before bus failure***	What status should be sent to the boiler after start-up, restoration of the bus supply, or reprogramming?
maximum flow temperature in [°C]	*30..90* (Standard = ***70***)	If a set point value received by object 0 is higher than the set value, it will be limited to this maximum value.
maximum increase of flow temperature based on demand in rooms	*0 K, 5 K, 10 K, 15 K,* ***20 K****, 25 K, 30 K, 35 K, 40 K*	Upper threshold value for increasing the flow temperature via requirement notification.
maximum reduction of flow temperature if there is no requirement	*0 K, 5 K, 10 K, 15 K,* ***20 K****, 25 K, 30 K, 35 K, 40 K*	Lower threshold value for reduction of flow temperature if all rooms do not require heating.

Continuation:

Designation	Values	Description
Delay time for adjusting the set point value	*none* *1 min., 2 min., 3 min., 5 min., 10 min.,* ***15 min.,*** *20 min., 30 min.*	Every set point value adjustment is accepted immediately. Needs-driven set point value adjustments are only accepted after the set delay has expired. This means short-term requirement notifications will be ignored
Targeted maximum actuating value	*30 % 40 % 50 % 60 %* ***70 %*** *80 % 90 %*	Actuating value that is to produce the preset *flow set point value after reset*. Example with *flow set point value after reset = 60 °C* *Targeted max. actuating value = 70 %* → An actuating value of 70 % produces a flow temperature of 60 °C.
*Autom. change over to summer mode**	***no*** *with outdoor temp. over 18 °C,* *with outdoor temp. over 20 °C,* *with outdoor temp. over 22 °C,* *with outdoor temp. over 24 °C*	Summer mode is only set via object 13. The boiler should automatically change over to summer mode depending on the outdoor temperature. If the outdoor temperature is unavailable (timeout object, sensor failure etc.), the normal heating mode (winter mode) is always switched on, and the flow temperature will be set according to the temperature replacement value. In the event that summer mode was active, it is ended. However, summer mode can be manually restored via object at any time.

*Applies to both heating circuits, i.e. H1 and H2.

3.3.2.3 The „*Weighting of zones*“ or „*Weighting of zones 2*“ parameter pages

Per heating circuit, up to 10 heating zones can be included for determining the heating requirement. This determines to what extent each individual zone should be included in the calculation of the flow temperature.

Table 8: For the first heating circuit (H1)

Designation	Values	Description
Weighting factor for zone 1	*0.1* *0.2* *0.3* *0.4* *0.5* *0.6* *0.7* *0.8* *0.9* ***1.0***	0.1 = Zone is unimportant .. .. 1 = Zone must be fully taken into consideration
Weighting factor for zone 2..10	*See above*	See above.

Table 9: For the second heating circuit (H2)

Designation	Values	Description
Weighting factor for zone 11	*0.1* *0.2* *0.3* *0.4* *0.5* *0.6* *0.7* *0.8* *0.9* ***1.0***	0.1 = Zone is unimportant .. .. 1 = Zone must be fully taken into consideration
Weighting factor for zone 12..20	*See above*	See above.

3.3.2.4 The „*Reports from CH1*“ and „*Reports from CH2*“ parameter pages

This is for setting how the "Central heating" feedback from the boiler is to be sent to the bus.

Table 10

Designation	Values	Description
Renewed sending of the flow set point value at change by	*not due to a change* *1 K, 2 K, 3 K, 4 K,* ***5 K****, 6 K, 7 K, 8 K, 9 K, 10 K*	Set point value can only be sent cyclically (if selected) Set point value is sent as soon as it has changed by the selected value. (see below: *Send flow set point value cyclically*)
Send flow set point value cyclically	***No*** *yes*	Send regularly, independent of changes?
Resend current flow temperature in event of change by	*not due to a change* *1 K,* ***2 K****, 3 K, 4 K, 5 K, 6 K, 7 K, 8 K, 9 K, 10 K*	Flow temperature can only be sent cyclically (if selected) Flow temperature is sent as soon as it has changed by the selected value. (see below: *Send current flow temperature cyclically)*
Send current flow temperature cyclically	***No*** *yes*	Send regularly, independent of changes?
Send CH1/CH2 status cyclically	***No*** *yes*	Send regularly, independent of changes?
*Send CH1 pressure cyclically**	***No*** *yes*	Send regularly, independent of changes?
*Send flame status cyclically**	***No*** *yes*	Send regularly, independent of changes?
*Send general error cyclically**	***No*** *yes*	Send regularly, independent of changes?
*Send error code cyclically**	***No*** *yes*	Send regularly, independent of changes?
*Send service required cyclically**	***No*** *yes*	Send regularly, independent of changes?
*Send degree of modulation cyclically**	***No*** *yes*	Send regularly, independent of changes? Only with OT boiler.
*Send burner hours/burner starts cyclically**	***No*** *yes*	Send regularly, independent of changes? Only with OT-Box.

Continuation:

Designation	***Values***	Description
*Send limits of flow set point value cyclically**	***No*** *yes*	Send regularly, independent of changes?
Time for cycl. transmission of all CH1/CH2 reports	*2, 3, 5, 10, 15, 20,* ***30****, 45, 60 minutes*	Common cycle time for all CH reports on this parameter page.

* Reports from CH1 parameter page.

3.3.2.5 The "*Outdoor temperature*" parameter page

Table 11

Designation	Values	Description
Determining the outdoor temperature	***Via object***	Outdoor temperature value is received via the bus (e.g. from a weather station etc.)
	from boiler	The outdoor temperature is determined via the OT boiler or via the Theben OT-Box.
Renewed sending of outdoor temperature at change by	*not due to a change* *1 K,* ***2 K****, 3 K, 4 K, 5 K, 6 K, 7 K, 8 K, 9 K, 10 K*	(With *Measure from boiler*) Should the current outdoor temperature be sent? If yes, from which minimum change should it be resent? This setting keeps the bus load as low as possible.
Send outdoor temperature cyclically (time see "reports central h..)	***No*** *yes*	(With *Measure from boiler*) If yes, *Time for cyclical sending of all CH reports* on the *CH reports* parameter page applies
Monitoring of outdoor temperature	***No***	(With *Measure via object*) No monitoring
	yes	This tests whether the outdoor temperature is regularly received.
Outdoor temperature monitoring time	*Every 30 min.* ***every 60 min.***	Object 23 must receive a temperature value at least every 30 to 60 minutes. If not, object 24 reports a temperature fault.
Replacement value with failure or error in outdoor temperature	*-20..+20* (Standard = ***0***)	This value should provisionally replace the missing or false outdoor temperature value. This enables the boiler to continue functioning with a defined operating status. Measurement values of < -40 °C or > 60 °C are considered to be false (possibility of sensor fault).
Outdoor temperature error or failure	***report in event of change*** *report errors cyclically, and report no error cyclically*	When should an outdoor temperature be sent?

3.3.2.6 The "*Domestic hot water*" parameter page

Table 12

Designation	Values	Description
Domestic hot water set point value in comfort mode [°C]	*5..90* (Standard = ***60***)	Domestic hot water set temperatures for each operating mode. **At higher temperatures, it may be necessary to fit anti-scald protection, depending on the type of system**. Details should be discussed with the plumber installing the system.
Domestic hot water set point value in standby mode [°C]	5..90 (Standard = ***45***)	
Domestic hot water set point value in night mode [°C]	*5..90* (Standard = ***30***)	
Domestic hot water set point value frost protection [°C]	*6..30* (Standard = ***10***)	
Operating mode after reset	*Frost protection* *Night mode* *Standby mode* ***Comfort mode***	Which operating mode should be active after download or restoration of the bus supply?
Enable DHW after reset	*Off* *On* ***as before bus failure***	What status should be sent to the boiler after start-up, restoration of the bus supply, or reprogramming?
Domestic hot water set point value in forced operation if not via object [°C]	*5..90* (Standard = ***85***)	Set point value for domestic water temperature in forced operation. This value can be overwritten with object 30.
Max. domestic hot water set point value [°C]	*30..90* (Standard = ***60***)	Highest permissible temperature. **At higher temperatures, it may be necessary to fit an anti-scald protection, depending on the type of system.** Details should be discussed with the plumber installing the system.
Energy optimisation with potential solar support	***No*** *yes*	Potentially available solar system is not taken into account. Domestic hot water should be heated using solar energy if possible. The objects for solar support (obj. 26 + 27) and the parameter *Domestic hot water set point value with solar*.. are displayed.

Continuation:

Designation	Values	Description
Domestic hot water set point value with solar [°C]	*5..90* *(Standard = **45**)*	This set point value applies if object 26 or obj. 27 report sunlight. If the current set point value for domestic hot water (e.g. based on operating mode) is less than the value set here, the *Domestic hot water set point value with solar* is not taken into account.
Activate legionella protection	*No* ***yes***	This program heats the domestic hot water at regular intervals to a temperature of at least 70 °C (see below) to prevent a microbial contamination of the water with legionella. See in the Appendix: Legionella protection.
Set point value for legionella protection [°C]	*70..90* *(Standard = **80**)*	Desired water temperature during legionella protection.
Energy saving legionella protection (performed during comfort mode)	*every 2 days* ***every 3 days*** *every 4 days* *every 5 days* *every 6 days* *every 7 days* *every 8 days*	Legionella protection is always performed if the heating of the domestic hot water takes place after completion of the set timescale in comfort mode. If that does not apply, then the protection must be performed by the time configured below at the latest (*unconditional legionella protection*).
Unconditional legionella protection (performed with each operating mode)	*every 2 days* *every 3 days* *every 4 days* ***every 5 days*** *every 6 days* *every 7 days* *every 8 days*	If no *energy saving legionella protection* could be performed by the time set here, legionella protection will be performed independent of the current operating mode. **Example:** Energy saving legionella protection every 3 days Unconditional energy saving legionella protection every 5 days. **Scenario 1.** The system is switched to comfort mode after 4 days: → Energy saving legionella protection can be performed ("energy saving" because in comfort mode). **Scenario 2.** The system is to remain in frost protection mode for 2 weeks: → Unconditional legionella protection is performed after 5 days ("unconditional" as independent of operating mode).

3.3.2.7 The "*Reports from DHW*" parameter page

This is for setting how the "Domestic Hot Water" feedback from the boiler is to be sent to the bus.

Table 13

Designation	Values	Description
Sends the domestic hot water set point value on change	*No* ***yes***	
Send domestic hot water set point value cyclically	***No*** *yes*	
Resend current domestic hot water temperature in event of change by	*not due to a change* *1 K, **2 K**, 3 K, 4 K, 5 K, 6 K, 7 K, 8 K, 9 K, 10 K*	Actual value can only be sent cyclically (if selected) Actual value is sent as soon as it has changed by the selected value. (see below: *send curr. domestic hot water temperature cyclically*)
send current domestic water temperature cyclically	***No*** *yes*	Send regularly, independent of changes?
Send limits of domestic hot water set point value cyclically	***No*** *yes*	Send regularly, independent of changes?
Send DHW status cyclically	***No*** *yes*	Send regularly, independent of changes?
Time for cyclical transmission of all DHW reports	*2, 3, 5, 10, 15, 20, **30**, 45, 60 minutes*	Common cycle time for all DHW reports on this parameter page.

3.3.2.8 The „*TSP Parameter*“ parameter page

This parameter page is available if the device is used with a Theben OT-Box.
Here you can make the basic settings of the system using the so-called **T**ransparent **S**lave **P**arameters.
See in the Appendix: Controlling a Theben OT-Box.

Table 14

Designation	Values	Description
TSP 0 system selection	***1***,*2*,*3*,*4* *5* *51.52*	Type of system. KNX-OT interface (8559201) + Theben OT-Box (9070712). KNX-OT interface (8559201) + 2 pieces Theben OT-Box (9070712). KNX-OT interface (8559201) + Theben OT-Box (9070713).
TSP 1 boiler base temperature	***OFF*** *11 ... 50 °C*	Boiler is switched off if there is no heating requirement. The minimum boiler temperature is 10 °C. Minimum permitted boiler temperature
TSP 2 maximum flow temperature in main circuit [°C]	*36 ... 90 °C* Standard = ***80 °C***	Maximum permitted flow temperature in the main heating circuit. If the max. FD main circuit is too close to the base temperature, no control can take place. Rule: The distance must be at least as large as the larger of the two hystereses (hysteresis base temperature = 5 K or TSP 4). **Example:** Base temperature = 40 °C, boiler hysteresis = 10 K → The max. FD main circuit must be 40 °C + 10 K = 50 °C or higher.
TSP 3 maximum flow temperature in auxiliary circuit [°C]	*30 ... 90 °C* Standard = ***40 °C***	Maximum permitted flow temperature in the heating circuit behind the mixer.

Continuation:

Designation	*Values*	Description
TDP 4 boiler temperature hysteresis [K]	*1 ... 15 K* (Standard = ***5 K)***	Negative boiler hysteresis. **Example:** Boiler target temperature = 60 °C, hysteresis = 5 K Burner ON at 60 °C – 5 = 55 °C Burner OFF at 60 °C
TSP 5 Domestic hot water hysteresis [K]	*1 ... 10 K* (Standard = ***5 K)***	Negative hysteresis for control of the domestic water temperature.
TDP 6 domestic hot water priority/parallel operation	***Domestic hot water has priority*** *Parallel operation*	During domestic hot water heating, the heating circuit pump(s) will be switched off, so that all of the energy is available for hot service water. No priority between heating and domestic hot water: Heating circuit pump and domestic hot water storage feed pump can be in operation at the same time.
TSP 7 time delay domestic hot water pump	*none* *1 ... 20 min.* (Standard = ***10 min.)***	Switch-off pump and burner immediately after reaching the domestic hot water set temperature. Time delay of the pump, in order to use the residual heat from the boiler.
TSP 8 domestic hot water for frost protection	***no*** *yes*	Will domestic hot water also be needed if the heater is in frost protection mode?
TSP 9 time for domestic hot water circulation pump [s] *(0 s = temperature-controlled)*	***0*** *1..99*	Temperature-controlled: The pump will be controlled in such a way that the water temperature in the line (TL) never significantly falls below the buffer temperature: Buffer – 6 K = ON Buffer – 3 K = OFF DHW return sensor is installed in the return line. Demand-driven: A short opening of the water tap causes a sudden temperature increase at the temperature sensor. → The pump is switched on for the set time and transports the warm water to the removal point. DHW return sensor is installed directly at the outlet of the domestic hot water buffer.

Continuation:

Designation	*Values*	Description
TSP 10 perform pump protection at	*0 .. 11 p.m.* (Standard = ***12:00 p.m.)***	The pump protection will be carried out at a configurable time (parameter 0 a.m. - 11 p.m.). If the pumps have not been switched on within the last 24 hrs, they will be switched on for the configurable pump protection time (default = 30 s). This prevents the pumps jamming up after being rested for too long.
TSP 11 duration pump protection [min.] *0 = no pump protection*	*0* *1..99* (Standard = ***15)***	No pump protection. Duty cycle of the pumps in minutes, for the pump protection function (see above).
TSP 12 delta T sequence control [K]	*5..25 K* (Standard = ***1.5 K)***	Applies only to 2-stage heating systems (system 2) and defines when the second stage will be switched on in addition to the first (input in increments of 0.1 K). **Example:** Room target temperature = 22 °C, ΔT = 2 K, Room temperature falls below the target value → 1st stage = ON, Room temperature falls further to 20 °C → 2nd stage = ON
TSP 13, delta T1 for pump controls boiler 1 [K]	*5 .. 15 K* (Standard = ***5 K)***	For heating systems with buffer storage and boiler temperature sensor (only system 5). Temperature difference between boiler and buffer at which the boiler pump should switch on. **Example:** Boiler target temperature = 70 °C, ΔT = 7 K, At buffer = 63 °C and boiler = 70 °C → Pump ON.
TSP 14, delta T2 for pump controls boiler 2 [K]	*5 .. 15 K* (Standard = ***5 K)***	For heating systems with a second boiler, e.g. solid fuel boiler or solar collectors (systems 3, 4 and 5). At what temperature difference between 2nd boiler and buffer should the boiler pump switch on? **Example:** Boiler target temperature = 70 °C, ΔT = 7 K, At buffer = 63 °C and boiler = 70 °C → Pump ON.

4 Typical applications

These typical applications are designed to aid planning and are not to be considered an exhaustive list. It can be extended and updated as required.

4.1 Application: Heating 10 zones with demand-driven set point value determination.

10 rooms need to be heated separately.
The 1st room (= Zone 1) is controlled by the VARIA RTR. A RAM 713 S takes over the room temperature regulation for the other zones.

The actuating values for the control of the heating element actuator drives are sent to 3 HMG 4 heating actuators + 2x HME 4.
The individual actuating values also go to objects 3..12 of the KNX-OT Gateway for determining the maximum actuating value of all zones.

The flow set temperature is determined by the KNX-OT Gateway based on the current actuating values in all 10 rooms.
The KNX-OT Gateway controls the boiler via the OpenTherm bus.
The VARIA display shows the current flow temperature and the flame status (burner on/off).

4.1.1 Devices:

- KNX-OT Gateway (Order No. 8559200)
- VARIA 824 / 826 (Order No. 8249200/8269200)
- 9x RAM 713 S (Order No. 7139201)
- HMG 4 (Order No. 4900210)
- 2x HME 4 (Order No. 4900211)

4.1.2 Overview

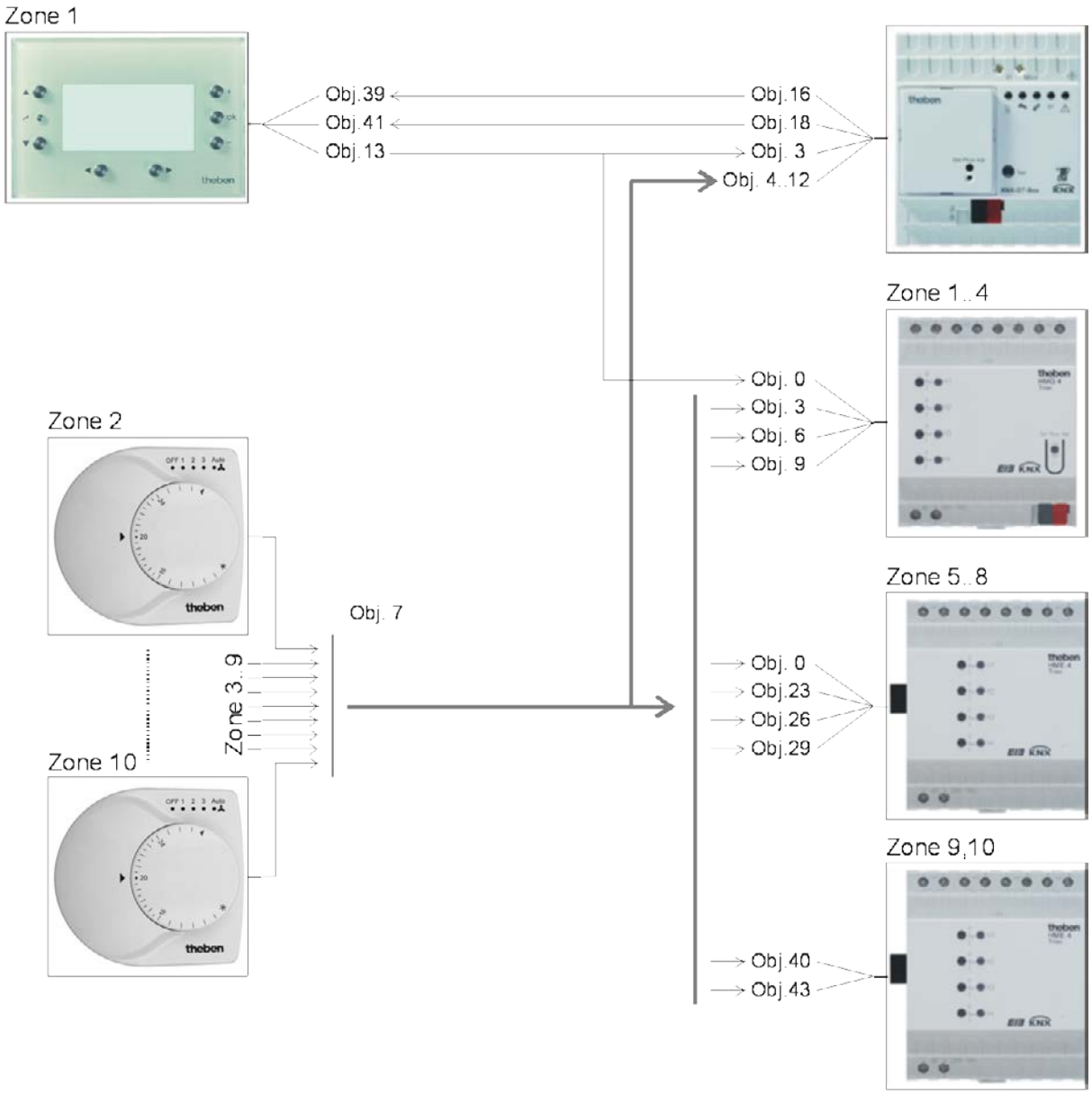


Figure 1

4.1.3 Objects and links

Table 15: Feedback from boiler and max. actuating value zone 1

No.	VARIA Object name	No.	KNX-OT Gateway Object name	Comment
13	*Heating actuating value*	3	*Maximum actuating value zone/room 1 demand-driven*	Actuating value for zone 1
39	*Display page 1, line 1*	16	*Current flow temperature*	Feedback from boiler
41	*Display page 1, line 2*	18	*Flame status*	Is the burner currently turned on?

Table 16

No.	VARIA Object name	No.	1. HMG 4 Object name	Comment
13	*Heating actuating value*	0	*GM HMG 4 channel 1*	Control of set point actuator for zone 1

Table 17: Actuating values for the heating actuator

No.	RAM 713 zone 2 Object name	No.	HMG 4 Object name	Comment
7	*Heating actuating value*	3	*GM HMG 4 channel 2*	Control of set point actuators for zones 2..10
	RAM 713 zone 3		HMG 4	
7	*Heating actuating value*	6	*GM HMG 4 channel 3*	
	RAM 713 zone 4		HMG 4	
7	*Heating actuating value*	9	*GM HMG 4 channel 4*	
	RAM 713 zone 5		1st HME 4	
7	*Heating actuating value*	0	*EM1 HME 4 channel 1*	
	RAM 713 zone 6		1st HME 4	
7	*Heating actuating value*	3	*EM1 HME 4 channel 2*	
	RAM 713 zone 7		1st HME 4	
7	*Heating actuating value*	6	*EM1 HME 4 channel 3*	
	RAM 713 zone 8		1st HME 4	
7	*Heating actuating value*	9	*EM1 HME 4 channel 4*	
	RAM 713 zone 9		2nd HME 4	
7	*Heating actuating value*	0	*EM2 HME 4 channel 1*	
	RAM 713 zone 10		2nd HME 4	
7	*Heating actuating value*	3	*EM2 HME 4 channel 2*	

Table 18: Determination of maximum actuating value.

No.	RAM 713 zone 2 Object name	No.	KNX-OT Gateway Object name	Comment
7	*Heating actuating value*	4	*Maximum actuating value zone/room 2 demand-driven*	Feedback of actuating value zones 2-10
	RAM 713 zone 3			
7	*Heating actuating value*	5	*Maximum actuating value zone/room 3 demand-driven*	
	RAM 713 zone 4			
7	*Heating actuating value*	6	*Maximum actuating value zone/room 4 demand-driven*	
	RAM 713 zone 5			
7	*Heating actuating value*	7	*Maximum actuating value zone/room 5 demand-driven*	
	RAM 713 zone 6			
7	*Heating actuating value*	8	*Maximum actuating value zone/room 6 demand-driven*	
	RAM 713 zone 7			
7	*Heating actuating value*	9	*Maximum actuating value zone/room 7 demand-driven*	
	RAM 713 zone 8			
7	*Heating actuating value*	10	*Maximum actuating value zone/room 8 demand-driven*	
	RAM 713 zone 9			
7	*Heating actuating value*	11	*Maximum actuating value zone/room 9 demand-driven*	
	RAM 713 zone 10			
7	*Heating actuating value*	12	*Maximum actuating value zone/room 10 demand-driven*	

4.1.4 Important parameter settings

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

Table 19: KNX-OT Gateway

Parameter page	Parameter	Setting
General	*Determining the heating set point value*	*Via heating requirement, without weather*
Reports from CH	*Resend current flow temperature in event of change by*	*2 K*
	Send current flow temperature cyclically	*Yes*
	Send flame status cyclically	*yes*

Table 20: VARIA

Parameter page	Parameter	Setting
RTR setting	*CONTROL*	*Heating control only*
Heating control	*Number of heating stages*	*Only one heating stage*
	Type of control	*Continuous control*
Selection of display pages	*Show page 1 for display objects*	*yes*
Display objects page 1	*Fade in operating instructions on page 1*	*No*
	Page heading	*Heating*
Page 1, line 1	*Line format*	*Object type: temperature*
	Text for line 1	*Flow*
	Unit for display object	*°C*
	Authorise amendment of object value?	*no*
Page 1, line 2	*Line format*	*Switch object type*
	Text for line 1	*Burner*
	Text at object value = 0	*Off*
	Text at object value = 1	*On*
	Authorise amendment of object value?	*no*

Table 21: HMG / HME 4 (zones 1..10)

Parameter page	Parameter	Setting
General	*Type of basic module*	*GM is an HMG 4*
	Number of extension modules	*2 extension modules*
	Type of 1st extension module	*EM1 is an HME 4*
	Type of 2nd extension module	*EM2 is an HME 4*
GM HMG 4 H2	*Type of actuating value*	*Continuous*
GM HMG 4 H2		
GM HMG 4 H3		
GM HMG 4 H4		
EM1(2) HME 4 H2		
EM1(2) HME 4 H2		
EM1(2) HME 4 H3		
EM1(2) HME 4 H4		

Table 22: RAM 713 S (zones 2..10)

Parameter page	Parameter	Setting
Settings	*CONTROL*	*Standard*

4.2 Application: Determination of set point value demand-driven and weather-controlled

The flow set temperature is determined by the KNX-OT Gateway based on the current outdoor temperature. This is received from the boiler via the OpenTherm bus and shown on the Varia display.

In this example, individual channels are combined for determining the maximum actuating value in groups of 4 (number of channels in heating actuator).
Each group of 4 rooms forms its own zone.

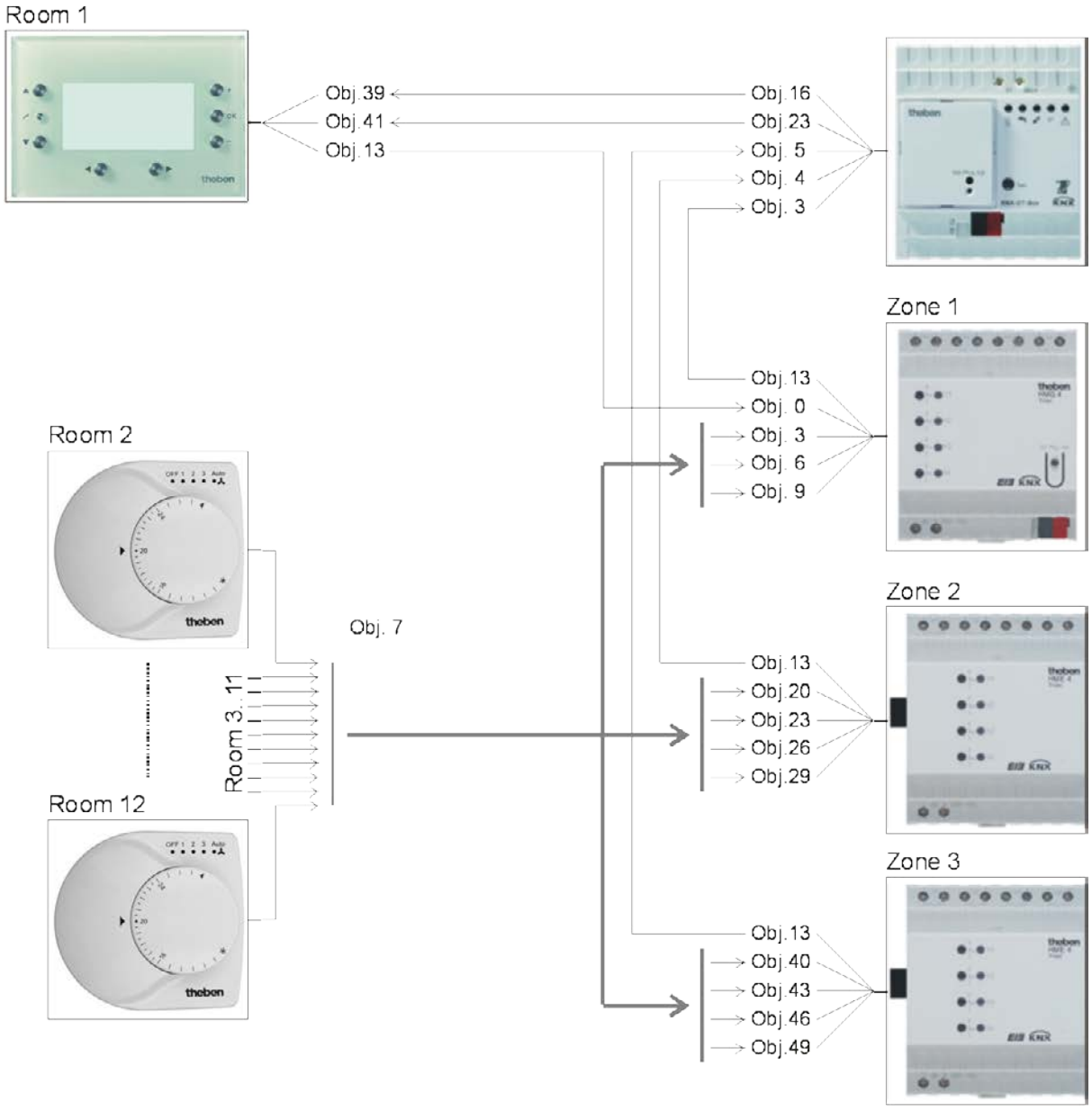
Instead of the individual actuating values (see previous application), the maximum actuating value determined from each heating actuator is sent to the KNX-OT Gateway.
Each actuator thus represents one zone and allows taking into account up to 40 channels/rooms to determine the maximum actuating value.

The heating actuators HMT 6 and HMT 12 (4900273 / 4900274) allow 6 or 12 channels to be combined per zone.
This means the maximum actuating value can be captured from up to 120 rooms (= 12 channels. 10 zones).

Devices:

- KNX-OT Gateway / KNX-OT Gateway S (Order No. 8559200 / 201)
- VARIA 824 / 826 (Order No. 8249200/8269200)
- 9x RAM 713 S (Order No. 7139201)
- HMG 4 (Order No. 4900210)
- 2x HME 4 (Order No. 4900211)

4.2.1 Overview



4.2.2 Objects and links

Table 23: Feedback from boiler

No.	VARIA Object name	No.	KNX-OT Gateway Object name	Comment
39	*Display page 1, line 1*	16	*Current flow temperature*	Feedback from boiler
41	*Display page 1, line 2*	23	*Outdoor temperature*	Display outdoor temperature

Table 24

No.	VARIA Object name	No.	1. HMG 4 Object name	Comment
13	*Heating actuating value*	0	*GM HMG 4 channel 1*	Control of set point actuator for zone 1

Table 25: Actuating values for the heating actuator

No.	RAM 713 room 2 Object name	No.	HMG 4 Object name	Comment
7	*Heating actuating value*	3	*GM HMG 4 channel 2*	Control of set point actuators for rooms 2-12
	RAM 713 room 3		HMG 4	
7	*Heating actuating value*	6	*GM HMG 4 channel 3*	
	RAM 713 room 4		HMG 4	
7	*Heating actuating value*	9	*GM HMG 4 channel 4*	
	RAM 713 room 5		1st HME 4	
7	*Heating actuating value*	0	*EM1 HME 4 channel 1*	
	RAM 713 room 6		1st HME 4	
7	*Heating actuating value*	3	*EM1 HME 4 channel 2*	
	RAM 713 room 7		1st HME 4	
7	*Heating actuating value*	6	*EM1 HME 4 channel 3*	
	RAM 713 room 8		1st HME 4	
7	*Heating actuating value*	9	*EM1 HME 4 channel 4*	
	RAM 713 room 9		2nd HME 4	
7	*Heating actuating value*	0	*EM2 HME 4 channel 1*	
	RAM 713 room 10		2nd HME 4	
7	*Heating actuating value*	3	*EM2 HME 4 channel 2*	
	RAM 713 room 11		2nd HME 4	
7	*Heating actuating value*	6	*EM2 HME 4 channel 3*	
	RAM 713 room 12		2nd HME 4	
7	*Heating actuating value*	9	*EM2 HME 4 channel 4*	

Table 26: Determination of maximum actuating value.

No.	HMG 4 Object name	No.	KNX-OT Gateway Object name	Comment
13	*Largest actuating value of all channels*	3	*Maximum actuating value zone 1 demand-driven*	Feedback of actuating value zones 1..3
	EM1 HME 4			
33	*Largest actuating value of all channels*	4	*Maximum actuating value zone 2 demand-driven*	
	EM2 HME 4			
53	*Largest actuating value of all channels*	5	*Maximum actuating value zone 3 demand-driven*	

4.2.3 Important parameter settings

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

Table 27: KNX-OT Gateway

Parameter page	Parameter	Setting
General	*Determining the heating set point value*	*According to demand and weather-controlled*
Reports from CH	*Resend current flow temperature in event of change by*	*2 K*
	Send current flow temperature cyclically	*Yes*
Outdoor temperature	*Determining the outdoor temperature*	*From boiler*

Table 28: VARIA

Parameter page	Parameter	Setting
RTR setting	*CONTROL*	*Heating control only*
Heating control	*Number of heating stages*	*Only one heating stage*
	Type of control	*Continuous control*
Selection of display pages	*Show page 1 for display objects*	*yes*
Display objects page 1	*Fade in operating instructions on page 1*	*No*
	Page heading	*Heating*
Page 1, line 1	*Line format*	*Object type: temperature*
	Text for line 1	*Flow*
	Unit for display object	*°C*
	Authorise amendment of object value?	*no*
Page 1, line 2	*Line format*	*Object type: temperature*
	Text for line 2	*Outdoor temp.*
	Unit for display object	*°C*
	Authorise amendment of object value?	*no*

Table 29: HMG / HME 4 (zones 1..10)

Parameter page	Parameter	Setting
General	*Type of basic module*	*GM is an HMG 4*
	Number of extension modules	*2 extension modules*
	Type of 1st extension module	*EM1 is an HME 4*
	Type of 2nd extension module	*EM2 is an HME 4*
GM HMG 4 H2 *GM HMG 4 H2* *GM HMG 4 H3* *GM HMG 4 H4* *EM1(2) HME 4 H2* *EM1(2) HME 4 H2* *EM1(2) HME 4 H3* *EM1(2) HME 4 H4*	*Type of actuating value*	*Continuous*
GM HMG 4 Pump *EM1 HME 4 Pump* *EM2 HME 4 Pump*	*Take into account channel 1 with pump controls and highest actuating value*	*yes*
	Take into account channel 2 with pump controls and highest actuating value	*yes*
	Take into account channel 3 with pump controls and highest actuating value	*yes*
	Take into account channel 4 with pump controls and highest actuating value	*yes*

Table 30: RAM 713 S (room 2..10)

Parameter page	Parameter	Setting
Settings	*CONTROL*	*Standard*

4.3 Application: Determining set point value according to demand with heating actuators and Cheops drive actuators

The use of Cheops drive actuators allows **any number** of rooms or heaters to be covered for each of the 10 zones (see zone 3).

In this example, the maximum actuating value for zones 1 and 2 is determined via the heating actuators.

The maximum actuating value for zone 3 is determined by 6 (or more) Cheops drive actuators. Cheops drive actuators compare their actuating values with each other and send them to a common address.

Devices:

- KNX-OT Gateway / KNX-OT Gateway S (Order No. 8559200 / 201)
- 14x RAM 713 S (Order No. 7139201)
- HMG 4 (Order No. 4900210)
- 1x HME 4 (Order No. 4900211)
- 6x Cheops drive (Order No. 7319201)

4.3.1 Principle and functionality

The actuating values are constantly compared between all Cheops actuators.
Those participants with a higher actuating value than the one received 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 actuator sends.
Thus, the actuator with the highest actuating value sends first and outperforms all others.

The actuating value comparison takes place via Object 3 (*maximum position*).
For this purpose, a common group address for the maximum position for each actuator is set on Object 3.

In order to start the actuating value comparison between the participants, one (and **only one**), participant must send its value to this group address cyclically.
This task is performed by one of the actuators.

On the *Security and forced operation* parameter page, the *Sending of maximum actuating value object (for boiler control)* parameter must be set to any cycle time. This actuator then regularly sends its own actuating value and the others can respond accordingly.

For all other actuators, the *Sending of maximum actuating value object (for boiler control)* parameter must remain set to the default value, i.e. *only when the own actuating value is higher*.

4.3.2 Overview

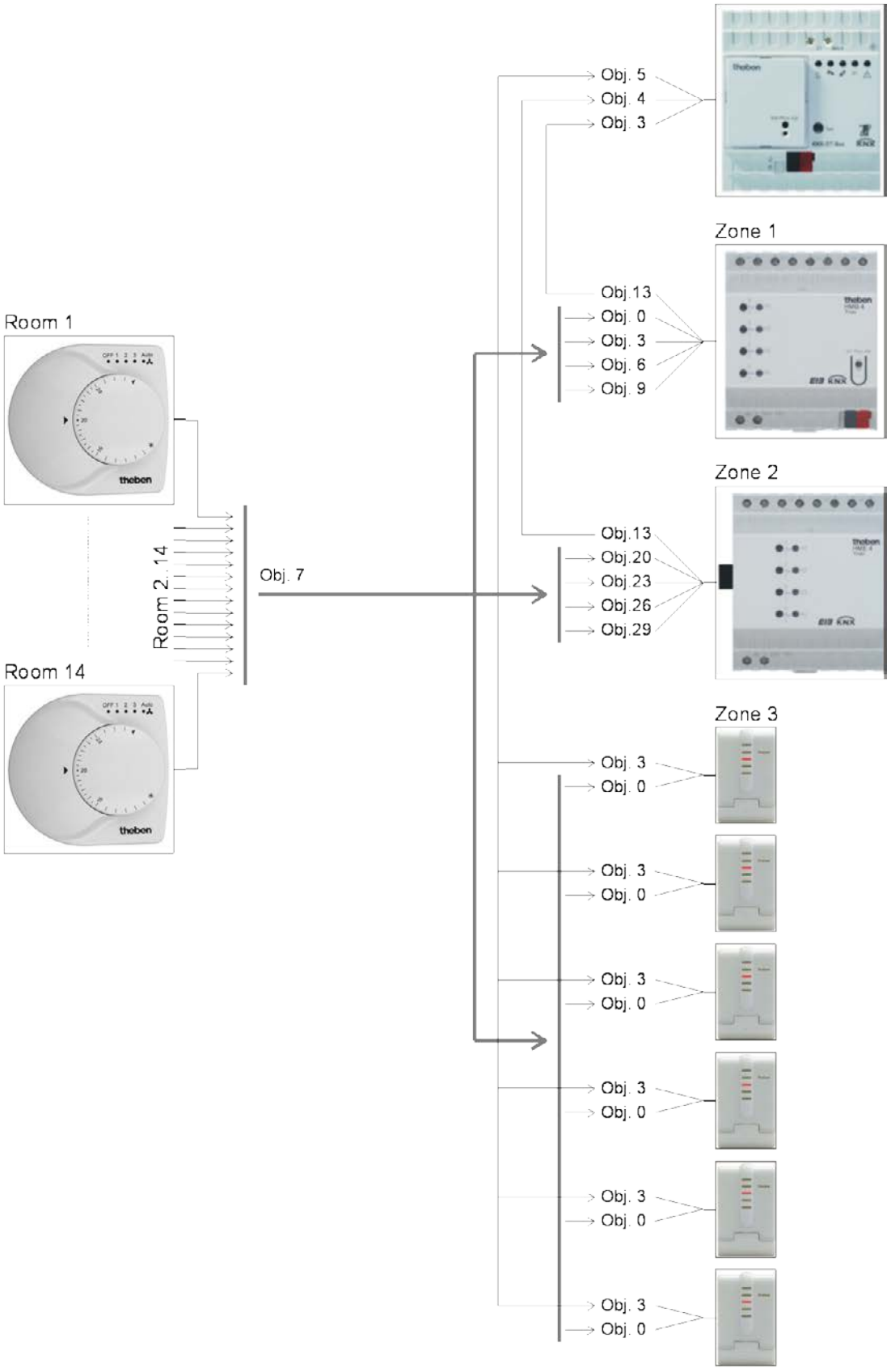


Figure 2

4.3.3 Objects and links

Table 31**: Actuating values for the heating actuator**

No.	RAM 713 room 1 Object name	No.	HMG 4 Object name	Comment
7	*Heating actuating value*	0	*GM HMG 4 channel 1*	Control of set point actuators for rooms 1-8
	RAM 713 room 2		HMG 4	
7	*Heating actuating value*	3	*GM HMG 4 channel 2*	
	RAM 713 room 3		HMG 4	
7	*Heating actuating value*	6	*GM HMG 4 channel 3*	
	RAM 713 room 4		HMG 4	
7	*Heating actuating value*	9	*GM HMG 4 channel 4*	
	RAM 713 room 5		1st HME 4	
7	*Heating actuating value*	0	*EM1 HME 4 channel 1*	
	RAM 713 room 6		1st HME 4	
7	*Heating actuating value*	3	*EM1 HME 4 channel 2*	
	RAM 713 room 7		1st HME 4	
7	*Heating actuating value*	6	*EM1 HME 4 channel 3*	
	RAM 713 room 8		1st HME 4	
7	*Heating actuating value*	9	*EM1 HME 4 channel 4*	

Table 32: Actuating values for the Cheops drive actuators zone 3

No.	RAM 713 room 9 Object name	No.	Cheops drive room 9 Object name	Comment
7	*Heating actuating value*	0	*Actuating value*	Control of actuators for rooms 9..14
	RAM 713 room 10		Cheops drive room 10	
7	*Heating actuating value*	0	*Actuating value*	
	RAM 713 room 11		Cheops drive room 11	
7	*Heating actuating value*	0	*Actuating value*	
	RAM 713 room 12		Cheops drive room 12	
7	*Heating actuating value*	0	*Actuating value*	
	RAM 713 room 13		Cheops drive room 13	
7	*Heating actuating value*	0	*Actuating value*	
	RAM 713 room 14		Cheops drive room 14	
7	*Heating actuating value*	0	*Actuating value*	

Table 33: Determination of maximum actuating value.

No.	HMG 4 Object name	No.	KNX-OT Gateway Object name	Comment
13	*Largest actuating value of all channels*	3	*Maximum actuating value zone/room 1 demand-driven*	Feedback of actuating value zones 1..3
	EM1 HME 4			
33	*Largest actuating value of all channels*	4	*Maximum actuating value zone/room 2 demand-driven*	
	All Cheops drives			
3	*Maximum position*	5	*Maximum actuating value zone/room 3 demand-driven*	

4.3.4 Important parameter settings

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

Table 34: KNX-OT Gateway

Parameter page	Parameter	Setting
General	*Determining the heating set point value*	*Via heating requirement, without weather*

Table 35: HMG / HME 4 (zones 1..10)

Parameter page	Parameter	Setting
General	*Type of basic module*	*GM is an HMG 4*
	Number of extension modules	*1 Extension module*
	Type of 1st extension module	*EM1 is an HME 4*
GM HMG 4 H2 *GM HMG 4 H2* *GM HMG 4 H3* *GM HMG 4 H4* *EM1 HME 4 H2* *EM1 HME 4 H2* *EM1 HME 4 H3* *EM1 HME 4 H4*	*Type of actuating value*	*Continuous*
GM HMG 4 Pump *EM1 HME 4 Pump*	*Take into account channel 1 with pump controls and highest actuating value*	*yes*
	Take into account channel 2 with pump controls and highest actuating value	*yes*
	Take into account channel 3 with pump controls and highest actuating value	*yes*
	Take into account channel 4 with pump controls and highest actuating value	*yes*

Table 36: RAM 713 S (room 1..14)

Parameter page	Parameter	Setting
Settings	*CONTROL*	*Standard*

Table 37: Cheops drive (room 9)

Parameter page	Parameter	Setting
Safety and forced operation	*Sending "maximum actuating value" object (for boiler control)*	*Every 5 minutes*

Table 38: Cheops drive (room 10..14)

Parameter page	Parameter	Setting
Safety and forced operation	*Sending "maximum actuating value" object (for boiler control)*	*Only if an own actuating value is greater*

5 Appendix

5.1 Control of a Theben OT-Box

The combination of the KNX-OT interface with a Theben OT-Box (Order No. 9070712) allows controlling any conventional boiler[1] via the KNX bus.

Further information on the configuration of the Theben OT-Box, you can find in the product information booklet of the RAMSES 856 top2 OT at:
http://www.theben.de/var/theben/storage/ilcatalogue/files/pdf/Produktinformationen_RAMSES_856_top2_OT_de.PDF

IMPORTANT: Due to the KNX-OT interface, the RAMSES 850 top2 is no longer required (see Figure).
The Theben OT-Box is only controlled by the KNX-OT interface in combination with the KNX room temperature controller (here VARIA 826 S).

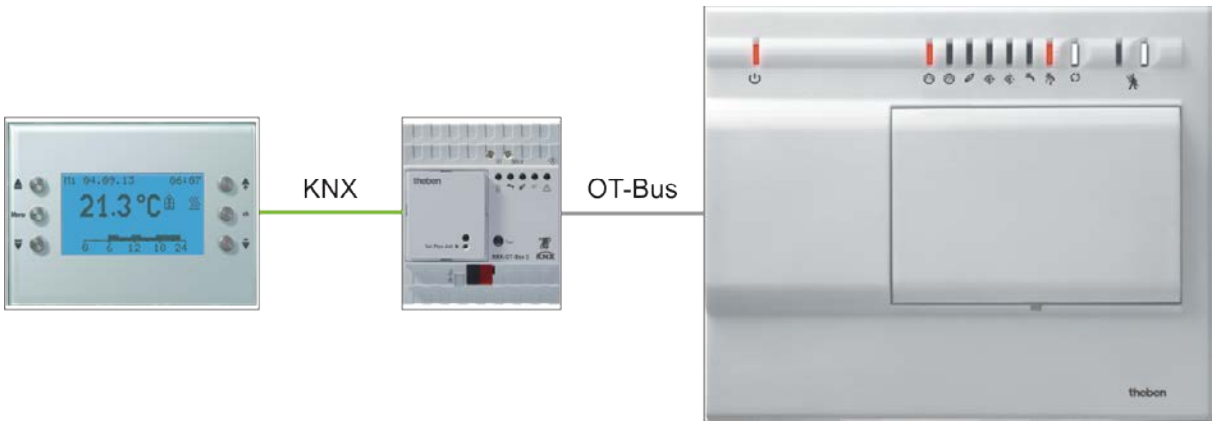


Figure 3

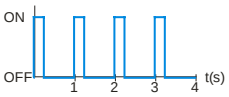
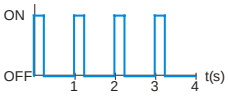
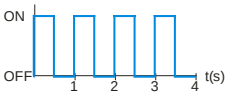
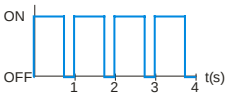
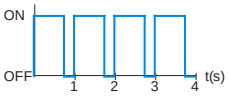
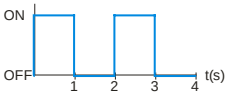
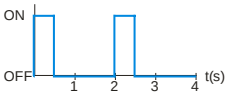
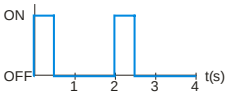
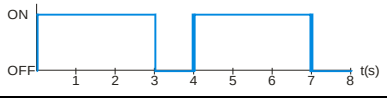
[1]Standard boiler without OpenTherm connection.

5.2 Laying readiness heating/screed drying program

- The device supports laying readiness heating in accordance with DIN EN 1264-4.
- The laying readiness heating function is factory-set and activated after start-up (LED 1 flashes).
- The function can be deactivated via the ETS (laying readiness heating parameter) or reactivated.
- The function can be interrupted until start-up by withdrawal of the KNX bus module.

Laying readiness heating is the preparation for laying floor coverings and serves to dry the screed to enable fast laying of floor*.

Table 39: Program sequence

Time	Temperature	Flashing frequency of LED
1st day	Flow temperature 25 °C	
2nd day	Flow temperature 35 °C	
3rd day	Flow temperature 45 °C	
4th day	Flow temperature 55 °C, highest max. flow temperature.	
5th to 15th day	Flow temperature 55 °C, highest max. flow temperature.	
16th day	Flow temperature 45 °C	
17th day	Flow temperature 35 °C	
18th day	Flow temperature 25 °C	
Afterwards	Set flow temperature	

* This test must be performed by the floor layer.

The program is activated on the *General* parameter page and starts immediately after download..
This deactivates the "normal" function of the device.

In order to continue the program at the right point after bus failure, the time of the program elapsed is regularly saved (permanently).

If bus failure occurs in the first 12 hours of the first day, the program is reset and starts again from the beginning.

This is intended to prevent the program from beginning without the heating system being ready, during initial operation.
In this way, the electrician can temporarily deactivate the program by pulling out the bus module, until start-up by the heating engineer.

5.3 Legionella protection

This is a function to reduce legionella in the DHW storage tank.
Further details on legionella disinfection of the whole DHW system can be found in DVGW worksheet W 551 "*Technical measures for reduction of legionella growth*".

Legionella protection is preferably performed when the system is in comfort mode → Energy saving legionella protection.
This keeps the surmountable temperature difference at a minimum and maximises the energy saving effect.

However, this is not always possible, as the system is not switched to the comfort mode for an extended period, e.g during holidays.
In order to still guarantee legionella protection, the domestic hot water should be heated up to the legionella protection temperature after 8 days at the latest → Unconditional legionella protection.

5.4 Objects for data exchange with OpenTherm:

Table 40

No.	Object name	Data object	OT ID
2 42	*H1 enable central heating* *H2 enable central heating*	Central Heating Enable	ID0-R Bit 0
13	*Summer mode*	Summer/winter mode	ID0-R Bit 5
16 55	*H1 current flow temperature* *H2 current flow temperature*	Boiler water temp.	ID25
17 56	*H1 flow set point value* *H2 flow set point value*	Control set point	ID1
18	*Flame status*	Flame status	ID0-W Bit 3
19	*general error*	fault indication	ID0-W Bit 0
20	*Error code* *(as per OpenTherm ID 5)*	Application-specific fault flags	ID5
21 57	*H1 heating status* *H2 heating status*	Central Heating Mode	ID0-W Bit 1
22	*Service required*	SERVICE	ID0-W Bit 6
23	*Outdoor temperature*	Outdoor temperature *(Limitation -30..60 °C)*	ID 27
25	*Domestic Hot Water (DHW) enable*	DHW enable	ID 0 Bit 1
31	*Domestic water temperature set point value*	DHW set point	ID 56
32	*Current domestic water temperature*	Tdhw	ID 26
33	*Domestic hot water status*	Domestic Hot Water Mode	ID0-W Bit 2
34	*Degree of modulation in %*	Rel.-mod-level	ID 17
35	*Lower limit of domestic hot water set point value*	TdhwSet-LB	ID 48
36	*Upper limit of domestic hot water set point value*	TdhwSet-UB	ID 48

5.5 Calculation of set point value:

Set point value (comfort mode) = Comfort set point value parameter or object (0) +/– manual offset

Set point value (standby) = Comfort mode set point value – reduction in standby mode – manual offset

Set point value (night) = Comfort mode set point value – reduction in night mode – manual offset

Set point value (frost protection) = Frost protection set point value parameter

Note: The set point value via object 0 is only valid if the object has received at least 1x a value since start-up or restoration of the bus supply.

Example:
Flow temperatures of operating modes
Parameter: Comfort set point value = 50 °C, Reduction standby = 10 K
Reduction night = 20 K, Frost protection temp. = 12 °C

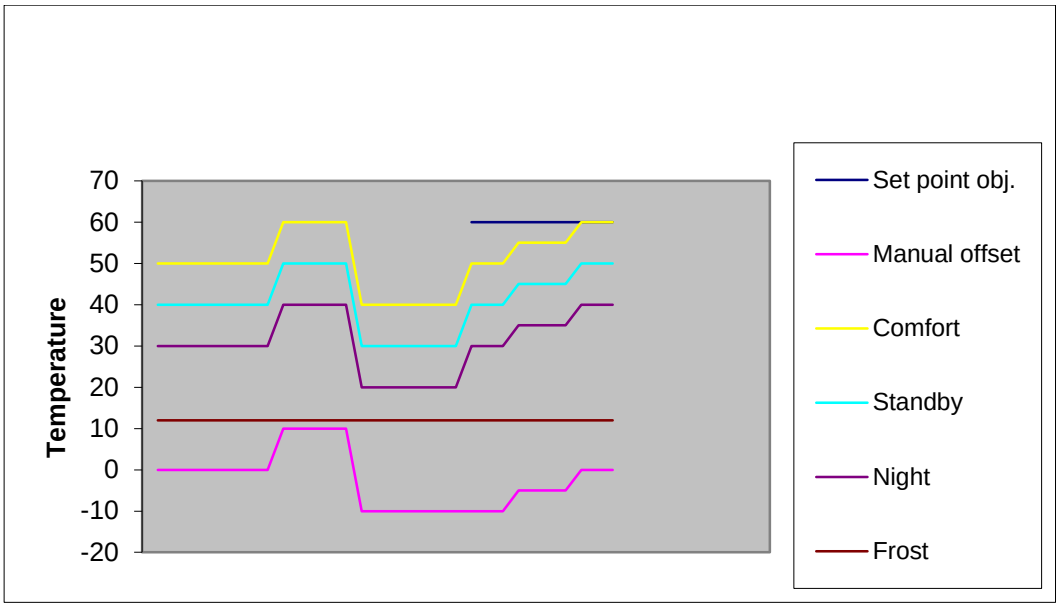


Figure 4

5.5.1 Determination of set point value via heating requirement

The flow temperature is calculated based on the current maximum actuating value of the building (maximum value from objects 3..12 "maximum actuating value 1..10").
For the determination of the relevant zone, the actuating values of the individual zones are multiplied with the related weighting factor (parameter page: Weighting of zones).

This does not influence the configured temperature in frost protection mode.

The zone with the largest product (actuating value . factor) determines set point value calculation.
The curve for calculating the flow temperature is primarily oriented on the flow set point value after reset and on the targeted maximum actuating value (see red line in diagram). The required set point value is calculated according to the actual heating requirement.
Base and end points of the curve are determined via the *maximum reduction,* and via the *maximum increase of the flow temperature*.

The increase/reduction of the flow temperature always occurs in 2 K increments only

After reset, download or restoration of the bus supply, the set point adjustment starts with the reception of the first actuating value.
It is recommended to send the actuating values cyclically to the OT-Box.

Due to the maximum set point offset (obj. 1), this curve can be offset up or down, but the end point is limited by the *maximum flow temperature* parameter.

Example:

Flow temperature after reset = 40 °C
Targeted maximum actuating value = 70 %
Max. increase = 20 K
Max. reduction = 20 K

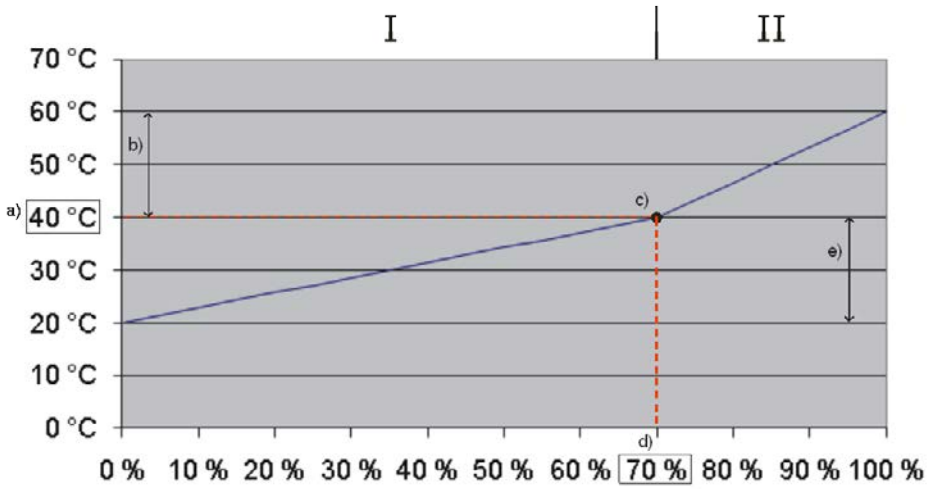


Figure 5

Key:

I = Energy saving range
II = Comfort range for quick heating of cold rooms.

a) Flow temperature specified after reset or via object 0.
b) Max. increase
c) Starting point for calculating the set point value
d) Targeted maximum actuating value
e) Max. reduction

5.5.2 Determination of set point value via weather, without heating requirement

With weather-dependent flow temperature control, the flow temperature is controlled in proportion to the outdoor temperature.

The curve for calculating the flow temperature is oriented towards 2 fixed points:

- Base point of the characteristic curve: flow temperature at an outdoor temperature of 20 °C
- End point of the characteristic curve: flow temperature at an outdoor temperature of -20 °C

In between, linear interpolation is performed depending on the outdoor temperature.

If a value <> 0 is sent to object 0, weather-dependent control ends, and this value, plus manual offset, is assumed as set point value for comfort mode.
In standby and night operating modes, this value is reduced via the configured offset (parallel offset of curve).

This does not influence the configured temperature in frost protection mode.

Example:

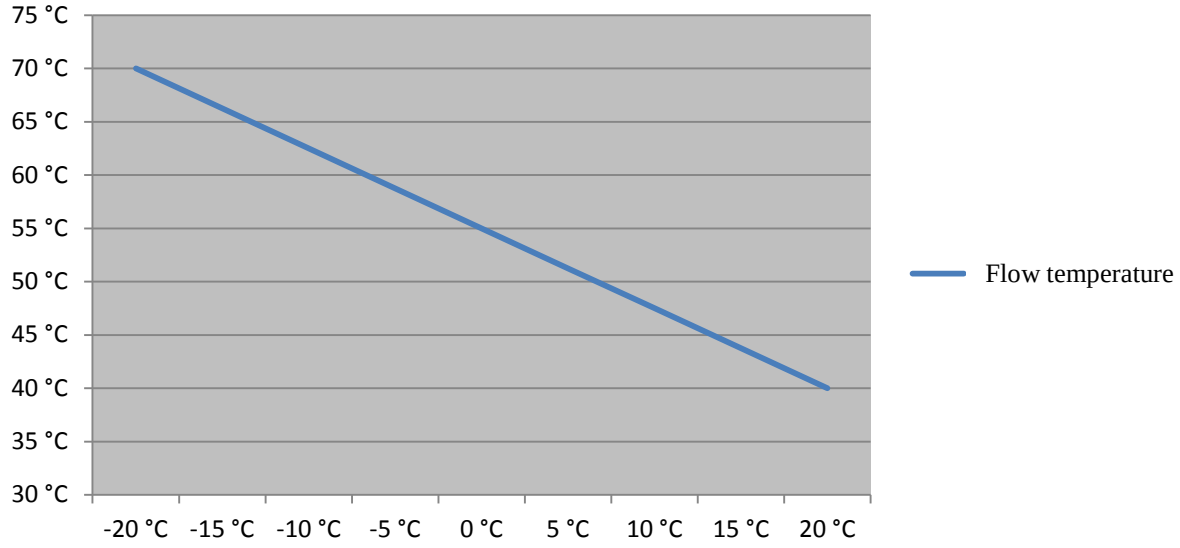


Figure 6

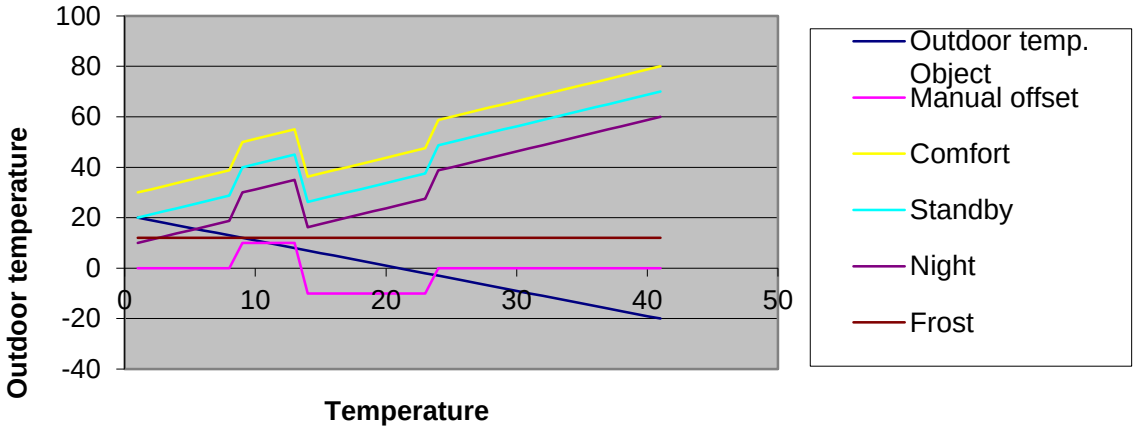


Figure 7: Flow set point value dependent on outdoor temperature with the different HVAC operating modes.

5.5.3 Determination of set point value from requirement and weather-controlled

This method combines the advantages of the previously described procedures.
Both the heating requirement and the outdoor temperature are taken into account.

The calculation of the set point value is performed as with the Determination of set point value via heating requirement (see above), while the starting point for calculating the set point value (c) can move up or down, due to the outdoor temperature.
The ranges for set point value increase and reduction change analogically to point c).

This does not influence the configured temperature in frost protection mode.

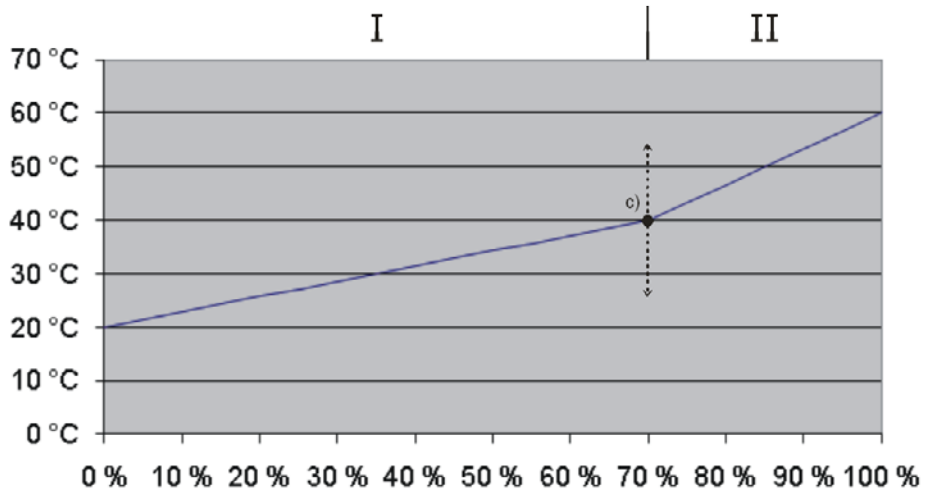


Figure 8

5.6 Troubleshooting

5.6.1 OT communication

During successful OT communication, the bus LED flashes at one second intervals with 500 ms.
During faulty OT communication, the bus LED flashes at one second intervals with 100 ms.
After 90 seconds of faulty OT communication, the bus LED will be permanently switched on, and the internal error 13_{hex} or 19_{dez} will be generated.

5.6.2 Error codes

In case of a fault, the Theben OT-Box reports the corresponding code back to the KNX-OT Gateway. All error codes are sent to the KNX bus by object 20, and can be evaluated with the following table.

Table 41: Internal error codes of the KNX-OT interfaces as hexadecimal- ($_h$) and as decimal value ($_d$).

Code		Error	Possible cause/remedy
13_h	19_d	OT bus error no reception.	Check OpenTherm bus connection.

Table 42: Error codes of the Theben OT-Box as hexadecimal- ($_h$) and as decimal value ($_d$)

Code		Error	Possible cause/remedy
20_h	32_d	Outdoor temperature sensor	Sensor line disconnected, short-circuited or 100 Ω substitute resistor not connected.
21_h	33_d	Flow sensor HK1	
22_h	34_d	Domestic hot water sensor	
23_h	35_d	Flow sensor HK2	
24_h	36_d	Domestic hot water return sensor	
25_h	37_d	Boiler sensor	
26_h	38_d	Second boiler sensor	
27_h	39_d	Storage tank sensor 1 (top)	
28_h	40_d	Storage tank sensor 2 (bottom)	
29_h	41_d	Error reported by fault input	Check burner
30_h	48_d	not used	-
31_h	49_d	Modem reception	Check modem
without		Internal error	Contact Theben customer service