Application Descriptions

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HVAC ObIS

Boiler Controller

Summary

This ObIS specifies a boiler supply water temperature control based on the heat demand.

Version 01.00.01 is a KNX Approved Standard.

This document is part of the KNX Specifications v2.1.

Document updates

Version	Date	Modifications
1.0	2002.04.05	Preparation for inclusion in KONNEX Handbook. Document based on EIBA AN 126/99.
1.0	2009.06.15	Editorial update in view of inclusion in the KNX Specifications v2.0.
01.00.01	2013.10.29	Editorial updates for the publication of KNX Specifications 2.1.

References

None.

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Contents

1 ObIS Function Model "Boiler Controller"

1.1 Aims and objectives

Within a house with one heating circuit and with individual electronic room temperature control in several or all rooms (see Figure 1), based on the KNX system technology, the supply water temperature shall be controlled depending on the heat demand of the rooms. The rooms are equipped with an electronic room temperature controller and the radiator valves, which are actuated either by an electromotive or an electrothermal positioner. In case of an electrothermal positioner the KNX switching actuator has to transform the manipulated variable, which is sent from the controller as a %-value, into pulse-width-modulated on/off commands.

For this configuration the boiler controller must be equipped with an KNX-Interface and must contain the following ObIS. In houses with several heating circuits each circuit-controller must contain the ObIS.

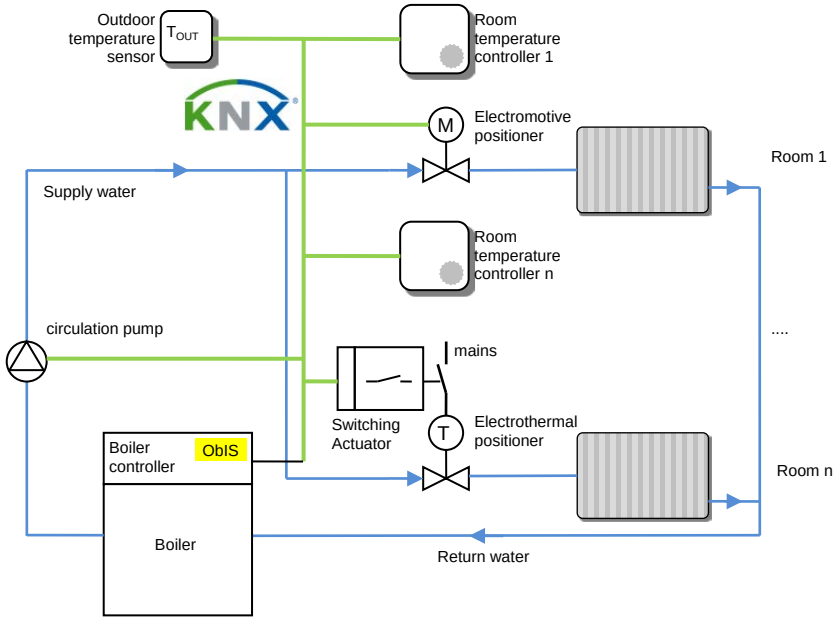

Figure 1 - KNX Installation for with integrated Heat Demand controlled Supply Water Temperature

1.2 Functional specification

The function block diagram for the heat demand controlled supply water temperature by evaluation of the valve positions is shown in Figure 2.

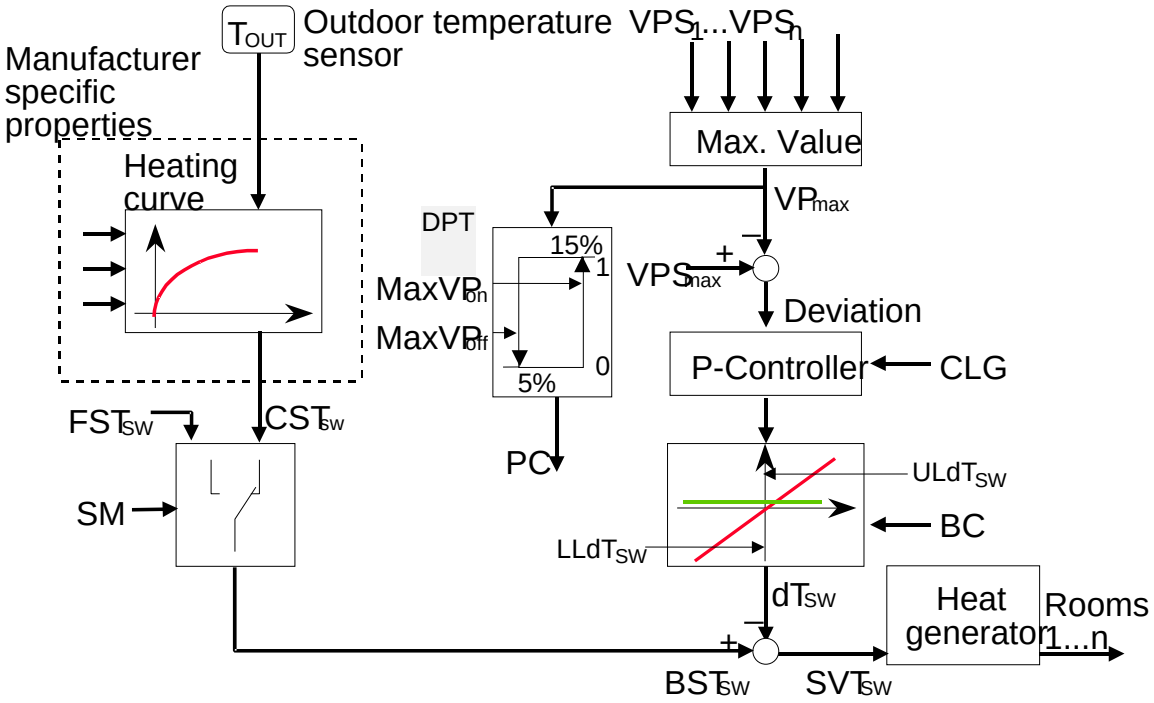

Figure 2.

Figure 2 - ObIS for Heat Demand controlled Supply Water Temperature by Evaluation of the Valve Positions

Determination of the max. position value VP_{max} of all electromotive or electrothermal actuated valves. (If there are more room temperature controllers installed than the manufacturer can handle within his function block for the calculation of the max. valve position, an additional function block is necessary.)

1.3 Constraints

Prior conditions

- The commonly used radiator valves have an extremely non-linear characteristic. In combination with electronic room temperature control the application of valves with a linear or proportional characteristic is recommended.
- The following procedure for heat demand control can also be applied to electrothermal positioners when a KNX switching actuator is used together with a special application program which transforms the received %-value of the positioning command into a corresponding ON-time (e.g. 100%=10 minutes ON; 10%=1 minute ON and 9 minutes OFF).
- In the case of great houses with many rooms several function blocks for the calculation of the actual max. valve position may be needed.

Recommandations for Installation

- At least two electronic room temperature controllers must be installed in a building:
  - in the normally coolest room and
  - in the most frequently used room (e.g. the living room).

- The correponding Room Temperature Controlles from the ObIS Model "Single Room Temperature Control" should be installed in rooms with great potential for energy savings (e.g. bath, kitchen).

A manufacturer should integrate these recommandations in his installation guide.

Advantages of this Procedure

- As the valve position setpoint values are sent from the room temperature controllers to the valve positioners no additional information or telegrams are needed for communication between room temperature controllers and the boiler controller.
- Existing installations with KNX room temperature control can easily be upgraded.
- Flexible influence on the supply water temperature depending on the actual mode of operation.

1.4 Functional Block

VP = Valve Position

SW = Supply Water

SWT = Supply Water Temperature

Input(s)		**Supply Water Temperature Controller based on Evaluation of Valve Positions**			**Output(s)**
Valve Positions	DPT 5.001 ---------	VP	VP_{MAX}	DPT 5.001 ---------	Maximum Calculated VP
Boiler Control	<tbd> ---------	BC	BS	<tbd> ---------	Boiler Status
Outdoor Temperature	DPT 9.001 ---------	T_{OUT}	dT_{SW}	DPT 9.001 ---------	Delta SW Temperature
Setpoint Mode	DPT 1.014 ---------	SM	CST_{SW}	DPT 9.001 ---------	Calculated Setpoint SWT
			BST_{SW}	DPT 9.001 ---------	Basic Setpoint SWT
			SVT_{SW}	DPT 9.001 ---------	Setpoint Value SWT
			PC	DPT 1.001 ---------	Pump Control
			BA	DPT 1.011 ---------	Boiler Alarm
			BW	DPT 1.011 ---------	Boiler Warning
			BM	DPT 1.011 ---------	Boiler Maintenance
Parameter(s)					
Setpoint maximum Valve Position	DPT 5.001 ---------	VPS_{MAX}			
Closed Loop Gain	DPT 9.001 ---------	CLG			
Lower Limit of dT_{SW}	DPT 9.001 ---------	$LLdT_{SW}$			
Upper Limit of dT_{SW}	DPT 9.001 ---------	$ULdT_{SW}$			
Fixed Setpoint SWT	DPT 9.001 ---------	FST_{SW}			
Maximum Valve Position off	DPT 9.001 ---------	$MaxVP_{off}$			
Maximum Valve Position on	DPT 9.001 ---------	$MaxVP_{on}$			

1.5 Properties

ID	Name	Abbr.	Description	Datapoint Type	M/O
1	PID_OBJECT_TYPE		Object Type	KNX_Prop DataType	M

Input(s)

ID	Name	Abbr.	Description	Datapoint Type	M/O
51	PID_VALVE_POSITIONS	VP	Valve Positions	DPT 5.001	M
55	PID_CTRL_BOILER	BC	Boiler Control	<tbd>	M
60	PID_TEMP_OUTDOOR	T_{OUT}	Outdoor temperature	DPT 9.001	O
<tbd>	PID_SETPOINT_MODE	SM	Setpoint mode	DPT 1.014	M

Output(s)

ID	Name	Abbr.	Description	Datapoint Type	M/O
52	PID_VALVE_POS_MAX_CALC	VP_{max}	Maximum calculated valve positions	DPT 5.001	M
<tbd>	PID_STATUS_BOILER	BS	Boiler status	<tbd>	O
57	PID_TEMP_SUPPLY_WATER_DELTA	dT_{sw}	Delta supply water temperature	DPT 9.001	M
<tbd>	PID_TEMP_SUPPLY_WATER_CALCULATED	CST_{SW}	Calculated setpoint supply water temperature	DPT 9.001	M
<tbd>	PID_TEMP_SUPPLY_WATER_BASIC	BST_{SW}	Basic Setpoint Supply Water Temperature	DPT 9.001	M
62	PID_TEMP_SUPPLY_WATER_SET	SVT_{SW}	Setpoint value supply water temperature	DPT 9.001	M
65	PID_PUMP_CONTROL	PC	Pump control	DPT 1.001	M
<tbd>	PID_BOILER_ALARM	BA	Boiler Alarm	DPT 1.011	O
<tbd>	PID_BOILER_WARNING	BW	Boiler Warning	DPT 1.011	O
<tbd>	PID_BOILER_MAINTENANCE	BM	Boiler Maintenance	DPT 1.011	O

Parameter(s)

ID	Name	Abbr.	Description	Datapoint Type	M/O
53	PID_VALVE_POS_MAX_SET	VPS_{max}	Setpoint maximum valve position	DPT 5.001	M
54	PID_PID_P	CLG	Closed loop gain	DPT 9.001	M
58	PID_TEMP_SUPPLY_WATER_MIN	$LLdT_{sw}$	Lower limit of dT_{sw}	DPT 9.001	O
59	PID_TEMP_SUPPLY_WATER_MAX	$ULdT_{sw}$	Upper limit of dT_{sw}	DPT 9.001	O
56	PID_TEMP_SUPPLY_WATER_FIX	FST_{SW}	Fixed setpoint supply water temperature	DPT 9.001	O
63	PID_PUMP_CONTROL_VALVE_POS_MAX_OFF	$MaxVP_{off}$	Maximum valve position off	DPT 9.001	M
64	PID_PUMP_CONTROL_VALVE_POS_MAX_ON	$MaxVP_{on}$	Maximum valve position on	DPT 9.001	M

The parameters that determine the heating curve are manufacturer specific data and therefore not part of this ObIS for heat demand controlled supply water temperature.

1.5.1 Property PID_VALVE_POSITIONS VP

- Max_No_Of_Elem: 32
- array(0) NRTC

  Unit: room temperature controllers count
  Default Value: 2
  Communication Object/Parameter: P
  Input/Output: Input
  Description: This first element of the array which forms the value of an ObIS Object Property always contains the actual number of valid elements in the array.
  For this property the No_Of_Elements value indicates the the actual number Room Temperature Controller (NRTC) Functions from which the Maximum Valve Posistion is processed.
  The Room Temperature Controller Functions are part of the Single Room Temperature Application Model.

- array(1…max_no_of_elem) VPSn

  Unit: %
  Default Value: <to be defined>
  Communication Object/Parameter: CO
  Input/Output: Input
  Description: These elements are the inputs for Valve Positions $VPS_{n.}$ A dedicated communication object per input for a valve position is necessary.

1.5.2 Property PID_VALVE_POS_MAX_CALC VPmax

Unit: %
Default Value: <to be defined>
Communication Object/Parameter: CO
Input/Output: Output
Description: VP_{max}.is the actual value for a proportional controller with the closed loop gain CLG [K/%]. This contoller shall guarantee a given valve position (e.g. VPS_{max}=50%) in the room with the greatest heat demand:

1.5.3 Property PID_VALVE_POS_MAX_SET VPSmax

Unit: %
Default Value: 50 % (7Fh)
Communication Object/Parameter: P
Input/Output: I/O
Description: <to be defined>

1.5.4 Property PID_PID_P CLG

Unit: K/%
Default Value: 0.5
Communication Object/Parameter: P
Input/Output: I/O
Description: <to be defined>

1.5.5 Property PID_CTRL_BOILER BC

Unit: -
Default Value: <to be defined>
Communication Object/Parameter: C
Input/Output: I
Description: <to be defined>

7	6	5	4	3	2	1	0
0	0	0	0	setpoint mode 0=fixed 1=calculated	Mode 2	Mode 1	Mode 0
					Mode of Operation		

Boiler control is a “write only” communication object in which only bits 0 to 3 can be modified. Bits 4 to 7 are always zero.

- Mode of Operation
  - Mode of Operation “0”: the electronic heat demand control is not active (horizontal curve); the supply water temperature is determined by the heating curve, the circulation pump is ON (mode “0” is offered to enable outdoor temperature controlled supply water temperature)
  - Mode of Operation “1”: the electronic heat demand control is active; the negative delta is set to 0, the max. positive delta is a parameter to be entered; the electronic room temperature control determines the supply water temperature in the right (positive) branch of the curve; the heating curve determines the supply water temperature in the left (negative) branch of the curve; the circulation pump is ON (mode “1” is recommended for mixed installations to avoid too low supply water temperature).
  - Mode of Operation “2”: the electronic heat demand control is active; the max. positive and the max. negative delta are parameters to be entered; the supply water temperature is determined by the electronic room temperature control (mode “2” is the standard mode for optimal energy savings).
- Setpoint Mode

  The setpoint mode “0” (fixed) is used when no outdoor temperature sensor is installed or when a fixed setpoint value shall be used as starting value for the supply water temperature calculation.

1.5.6 Property PID_STATUS_BOILER BS

Unit: -
Default Value: <to be defined>
Communication Object/Parameter: C (read only)
Input/Output: O
Description: <to be defined>

7	6	5	4	3	2	1	0
boiler alarm	boiler warning	boiler maintenance	pump control 0=off 1=on	setpoint mode 0=fixed 1=calculated	Mode 2	Mode 1	Mode 0
					Mode of Operation		

1.5.7 Property PID_TEMP_SUPPLY_WATER_DELTA dTsw

Unit:	K
Default Value:	<to be defined>
Communication Object/Parameter:	CO (read only)
Input/Output:	O
Description:	Calculation of the delta value for the supply water temperature by a function block containing a characteristic curve depending on the actual status of the mode of operation.

1.5.8 Property PID_TEMP_SUPPLY_WATER_MIN LLdTsw

Unit:	K
Default Value:	10
Communication Object/Parameter:	P
Input/Output:	I/O
Description:	<to be defined>

1.5.9 Property PID_TEMP_SUPPLY_WATER_MAX ULdTsw

Unit:	K
Default Value:	30
Communication Object/Parameter:	P
Input/Output:	I/O
Description:	<to be defined>

1.5.10 Property PID_TEMP_OUTDOOR TOUT

Unit:	°C
Default Value:	-
Communication Object/Parameter:	CO
Input/Output:	I or O
Description:	<to be defined>

1.5.11 Property PID_TEMP_SUPPLY_WATER_CALCULATED CSTSW

Unit:	°C
Default Value:	-
Communication Object/Parameter:	CO
Input/Output:	I or O
Description:	<to be defined>

1.5.12 Property PID_TEMP_SUPPLY_WATER_FIX FSTSW

Unit:	°C
Default Value:	50
Communication Object/Parameter:	P
Input/Output:	O
Description:	<to be defined>

1.5.13 Property PID_TEMP_SUPPLY_WATER_BASIC BSTSW

Unit: °C
Default Value: -
Communication Object/Parameter: CO
Input/Output: O
Description: The calculated delta value for the supply water temperature dT_{SW} is added to the basic setpoint value of the supply water temperature BST_{SW}. BST_{SW} depends on the calculated setpoint supply water temperature CSR_{SW} (which is calculated within the function block of the heating curve and depends on the outdoor temperature T_{out}) and the setpoint mode SM.

1.5.14 Property PID_SETPOINT_MODE SM

Unit: 0 = fixed
1 = calculated
Default Value: 1
Communication Object/Parameter: CO
Input/Output: I/O
Description: <to be defined>

1.5.15 Property PID_TEMP_SUPPLY_WATER_SET SVTSW

Unit: °C
Default Value: -
Communication Object/Parameter: CO
Input/Output: O
Description: <to be defined>

1.5.16 Property PID_PUMP_CONTROL_VALVE_POS_MAX_OFF MaxVPoff

Unit: %
Default Value: 5
Communication Object/Parameter: P
Input/Output: I/O
Description: <to be defined>

1.5.17 Property PID_PUMP_CONTROL_VALVE_POS_MAX_ON MaxVPon

Unit: %
Default Value: 15
Communication Object/Parameter: P
Input/Output: I/O
Description: <to be defined>

1.5.18 Property PID_PUMP_CONTROL PC

Unit: 0= off
1= on
Default Value: -
Communication Object/Parameter: CO
Input/Output: O
Description: The operation of the circulation pump is controlled by a function block with a hysteresis, generating the signal ”heat demand from a room” depending on the actual mode of operation. The circulation pump is switched off when there is approximately no heat demand.

1.5.19 Property PID_BOILER_ALARM BA

Unit:	0 = inactive 1 = active
Default Value:	<to be defined>
Communication Object/Parameter:	CO
Input/Output:	O
Description: <to be defined>	

1.5.20 Property PID_BOILER_WARNING BW

Unit:	0 = inactive 1 = active
Default Value:	<to be defined>
Communication Object/Parameter:	CO
Input/Output:	O
Description: <to be defined>	

1.5.21 Property PID_BOILER_MAINTENANCE BM

Unit:	0 = inactive 1 = active
Default Value:	<to be defined>
Communication Object/Parameter:	CO
Input/Output:	O
Description: <to be defined>	

