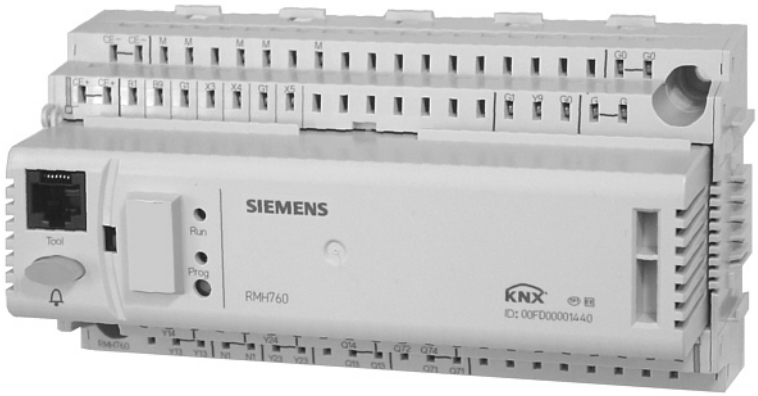
SIEMENS



Synco™ 700
Modular Heating Controller RMH760B

including extension modules RMZ782B, RMZ783B, RMZ787 and RMZ789

Basic Documentation

Edition 1.0
Controller series B
CE1P3133en
05.02.2007

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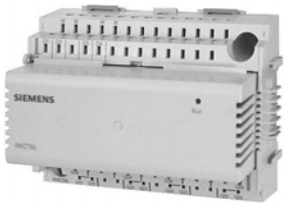
Contents

1 Summary

1.1 Product range

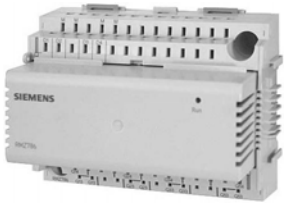
Type of unit	*Name*	*Type reference*
Controller	Heating controller	**RMH760B**
Extension modules	Heating circuit module	**RMZ782B**
	DHW module	**RMZ783B**
	Universal module	**RMZ787**
	Universal module	**RMZ789**
Module connector	For detached extension modules	**RMZ780**
Operator units	Operator unit, plug-in type	**RMZ790**
	Operator unit, detached	**RMZ791**
	Konnex bus operator unit	**RMZ792**
Service unit	Service tool	**OCI700.1**

RMH760B



RMZ782B

RMZ783B



RMZ787

RMZ789

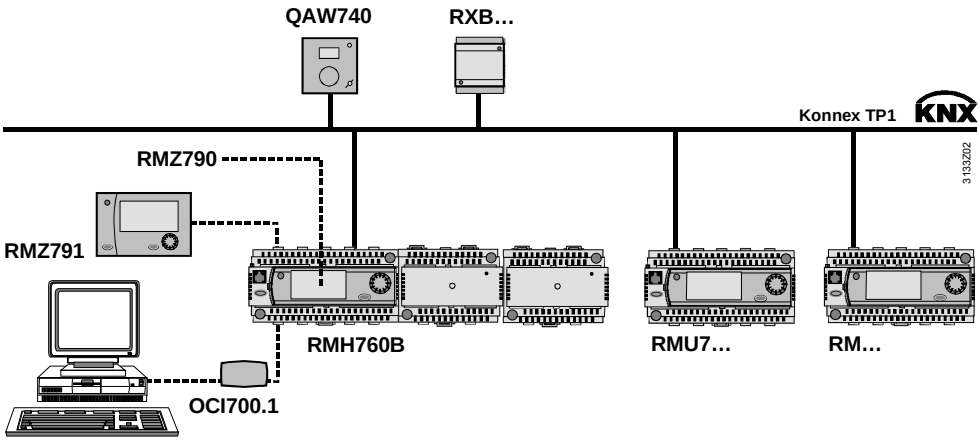
RMZ780

RMZ790

RMZ791

RMZ792

1.2 System topology



1.3 Equipment combinations

Type of unit	*Type reference*	*Data Sheet no.*
Passive sensors	All types of QA… sensors with a sensing element LG-Ni 1000	N1713 and N1721…N1846
Outside sensors	QAC22 with a sensing element LG-Ni 1000 QAC32 with a sensing element NTC 575	N1811 N1811
Solar intensity sensor	QLS60	N1943
Room units	QAA25 QAA27 QAW740	N1721 N1721 N1633
Passive setpoint adjusters	BSG21.1 BSG21.5 QAA25, QAA27	N1981 N1991 N1721
Actuating devices	All types of electromotoric and electrohydraulic actuators • operating on AC 24 V • for 3-position control • for modulating DC 0…10 V control For more detailed information about actuators and valves, refer to:	N4000…N4999

1.4 Product documentation

In addition to this Basic Documentation, the product documents listed below provide detailed information about the safe and correct deployment and operation of Synco™ 700 products in building services plant.

Type of document	*Number*
Product range description "HVAC controllers with Konnex interface”	**S3110**
Data Sheet “Heating controller RMH760B”	**N3133**
Data Sheet “Extension modules RMZ782B and RMZ783B”	**N3136**
Basic Documentation "Universal controllers RMU7…"	**P3150**
Data Sheet “Universal modules RMZ785, RMZ787, RMZ788, RMZ789”	**N3146**
Data Sheet “Module connector RMZ780”	**N3138**
Data Sheet "Konnex bus KNX"	**N3127**
Data Sheet “Service tool OCI700.1”	**N5655**
Installation Instructions for RMH760B and RMK770	**G3133**
Mounting Instructions for extension modules RMZ78…	**M3110**
Mounting Instructions for detached operator unit RMZ791	**M3112**
Mounting Instructions for module connector RMZ780	**M3138**
Operating Instructions for heating controller RMH760B-1 de, fr, it, es	**B3133x1**
Operating Instructions for heating controller RMH760B-2 en, de, fr, nl	**B3133x2**
Operating Instructions for heating controller RMH760B-3 sv, fi, no, da	**B3133x3**
Operating Instructions for heating controller RMH760B-4 pl, cs, sk, hu, ru, bg	**B3133x4**
Operating Instructions for heating controller RMH760B-5 sr, hr, sl, ro, el, tr	**B3133x5**
Basic Documentation "Communication with Konnex bus"	**P3127**
Declaration of CE Conformity, Synco 700	**T3110**
Environmental Declaration for controllers RMH760B, RMU710…730	**E3110…01**
Environmental Declaration for extension modules RMZ78…	**E3110…02**
Environmental Declaration for operator units RMZ79…	**E3110…03**

1.5 Important notes

This symbol shall draw your attention to special safety notes and warnings. If such notes are not observed, personal injury and / or considerable damage to property can occur.

Field of use

Synco™ 700 products may only be used for the control and supervision of heating, ventilation, air conditioning and chilled water plant.

Correct use

Prerequisites for flawless and safe operation of Synco™ 700 products are correct transport, installation, commissioning, and operation.

Electrical installation

Fuses, switches, wiring and earthing must be in compliance with local safety regulations for electrical installations.

Commissioning

Preparation for use and commissioning of Synco™ 700 products must be undertaken by qualified staff who have been appropriately trained by SBT HVAC Products.

Operation

Synco™ 700 products may only be operated by staff who have been instructed by SBT HVAC Products or their delegates and whose attention has been drawn to potential risks.

Wiring

When wiring the system, the AC 23 0V section must be strictly separated from the AC 24 V safety extra low-voltage (SELV) section in order to ensure protection against electric shock!

Storage and transport

For storage and transport, the limits given in the relevant Data Sheets must always be observed.
If in doubt, contact your supplier or SBT HVAC Products.

Maintenance

Synco™ 700 products are maintenance-free, apart from cleaning at regular intervals. System sections accommodated in the control panel should be freed from dust and dirt whenever normal service visits are due.

Faults

Should system faults occur and you are not authorized to make diagnostics and to rectify faults, call SBT service staff.

Only authorized staff are permitted to make diagnostics, to rectify faults and to restart the plant. This also applies to work carried out within the control panel (e.g. safety checks or changing fuses).

Disposal

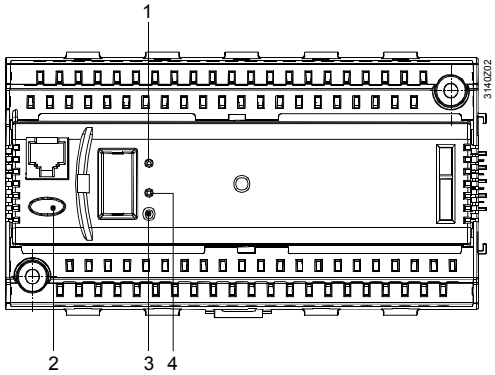
The products contain electrical and electronic components and must not be disposed of together with domestic waste.
Current local legislation must be observed.

2 Operation

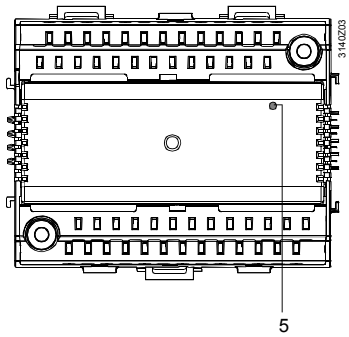
⚠ Synco™ 700 devices may only be operated by staff who have been instructed by SBT HVAC Products or their delegates and whose attention has been drawn to potential risks.

2.1 Operation without operator unit

Without operator unit, the following operating elements on the controller and extension module can be used:



Controller



Extension module

1 LED (Run) for indicating the controller's operating state:
- *LED lit* Power on, correct use and no fault in the peripheral devices
- *LED off:* No power or incorrect use / faulty peripheral devices

2 Button 🔔 with LED (red) for indicating fault status messages and their acknowledgement:
- *LED flashes:* Fault status message ready for acknowledgement
- *LED lit:* Fault status message still present but not yet reset
- *LED off:* No fault status message present
- *Press button:* Acknowledgement of fault or reset

3 Button (Prog) for assigning the device address in Konnex system mode (tool required)

4 LED (Prog) for indicating programming:
- *LED lit:* LED remains lit until addressing is completed

5 LED (Run) for monitoring power supply and addressing:
- *LED lit:* Power on, addressing successful
- *LED flashes:* Power on, controller has not yet a valid Konnex address
- *LED off:* No power

2.2 Operation with operator unit

2.2.1 Functions of the operator unit

The operator unit is used to make all settings and readouts required for operating the controller. All entries made on the operator unit are transmitted to the controller where they are handled and stored; the operator unit itself does not store any data. Information for the user is generated by the controller and forwarded to the operator unit where it is displayed.

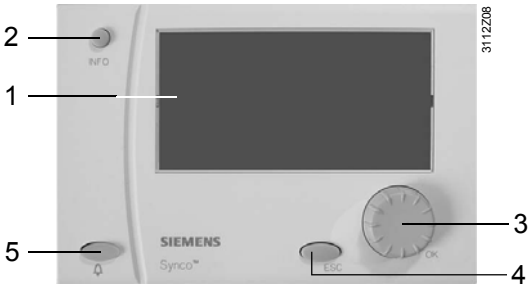
2.2.2 Operating concept

General

On the software side, all setting and readout values are arranged as datapoints of the menu tree. Using the operating elements, every datapoint can be selected, displayed or set. All menus appear on the LCD as clear text.
The controller has several languages preprogrammed; when commissioning the plant, the required language is to be activated. The Operating Instructions for the enduser are included with the controller; they contain the languages with which the controller is supplied.

Operating elements

Plug-in type operator unit RMZ790



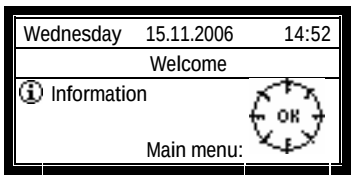
Detached operator unit RMZ791

1 Display
2 INFO button
Function 1: Display of key plant data
Function 2: Display of information about the individual datapoints on the current menu
3 OK select-and-press knob
Turn: Selection of operating line and adjustment of value
Press: Confirmation of operating line or setting
4 ESC button: Going back to the previous menu
5 Fault button with LED
LED: Fault
Press: Acknowledge or reset the fault

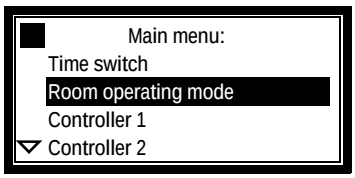
When one of the operating elements is used, the backlit display will automatically be switched on. If there is no action for 30 minutes, the display is switched off and the start page appears.

Display examples

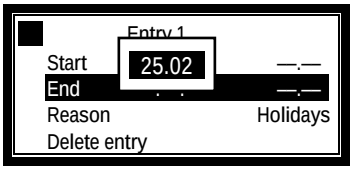
Start display:



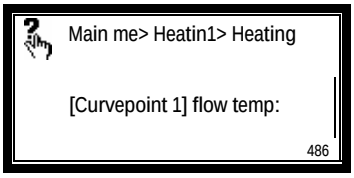
Setting level. Selection of a setting parameter,
e.g. on the ”Main menu“ of the user level:



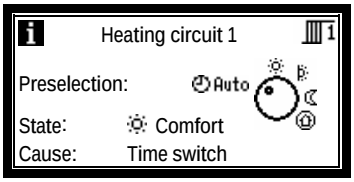
Setting level, pop-up, setting a numerical value:



Setting level, Help picture ”Explanations relating to the selected datapoint”. In the corner at bottom right, the text identification number of the menu tree appears (only service level and password level):



Info level, “Display of key plant data”:



2.2.3 Operating levels

There are 2 operating levels:
- Info level ℹ
- Setting level ■
- These 2 levels are always active, independent of the access level used

Info level ℹ

When on this level, important plant data can be displayed.

Setting level

The setting level is structured like a menu. It provides for reading and adjustment of datapoints.
Using the INFO button, explanations relating to the menus with the individual datapoints can be displayed. The information is displayed as long as the button is kept depressed.

Switching between the operating levels

- Switching from the info level to the setting level:
  1. Select the start page by pressing the ESC button.
  2. Press the OK knob to change to the setting level.
- Switching from the setting level to the info level:
  1. Select the start page with the ESC button. Press the button repeatedly until the start page reappears.
  2. Press the INFO button to change to the info level.

2.2.4 Access rights

An access right is defined for each parameter (operating line). There are 3 access levels:

Level	*Access*	*Symbol*
User level (for the plant operator)	The user level is always accessible. All datapoints visible and alterable here can be changed by the plant operator	■

Level	*Access*	*Symbol*
Service level (for the service engineer)	Press simultaneously the OK knob and the ESC button; then, select Service level and confirm by pressing the OK knob	
Password level (for the heating engineer)	**Commissioning:** Press simultaneously the OK knob and the ESC button; then, select Password level and confirm by pressing the OK knob; enter numeral 7 for the password and confirm by pressing the OK knob	
	District heat parameters: Press simultaneously the OK knob and the ESC button; then, select Password level and confirm by pressing the OK knob; enter numeral 11 for the password and confirm by pressing the OK knob	

Individual menu items or individual datapoints are enabled depending on the access level. On a higher access level, it is always possible to also view all menu items and datapoints of the lower access levels.
There is only one menu (the password level shows the entire menu).

Switching to another access level

- After a time-out (30 minutes with no action on the controller), the controller switches to the user level, unless the controller uses the Commissioning menu
- Switching from the current access level to another access level:
  1. Press simultaneously the OK knob and the ESC button. The Access levels menu appears.
  2. Select the required access level by turning the OK knob and confirm by pressing the knob.
  3. Enter the password to access the password level.

Password

The password can be changed via the ACS7… plant operating software.

District heat parameters

These parameters can be prescribed by the district heating plant.
After entry of the respective password, the settings for maximum limitation of the return temperature and for the pulse limitations can be entered.

3 Commissioning

⚠ Preparations for using and commissioning the Synco™ 700 controllers must be made by qualified staff who have been appropriately trained by SBT HVAC Products.

3.1 Entering the commissioning mode

⚠ During commissioning, both control and the plant's safety functions remain deactivated! The relays are deenergized, which means that their normally open contacts are open.
When supplying power to the controller for the first time, the Language menu appears. Here, the language used for commissioning and operating the plant can be selected. After the language has been selected and confirmed with the OK knob, the time of day, date and year can be set in the same way. Then, the Commissioning menu will appear. The access level is automatically set to Password level.
The Plant type menu offers a number of plant types for selection.

When the controller is commissioned for the first time, follow Installation Instructions G3133; they are enclosed with the controller.

3.2 Basic configuration

A plant is always configured on the password levels and (district heat parameters).

Main menu > Commissioning > Basic configuration

Operating line	*Adjustable values / display / remarks*
Plant type	Basic type H / H0-1…H6-7
Position 1	--- / RMZ782 / RMZ783 / RMZ787 / RMZ789
Position 2	--- / RMZ782 / RMZ783 / RMZ787 / RMZ789
Position 3	--- / RMZ782 / RMZ783 / RMZ787 / RMZ789
Position 4	--- / RMZ782 / RMZ783 / RMZ787 / RMZ789

Plant type

On operating line Plant type, the plant type will be entered or displayed.

Position

On operating lines Position 1 through Position 4, it is selected or displayed which of the extension modules is required. If an extension module is provided for use with the selected plant type, it is already preconfigured.
Display of "---" means that no module has been configured.

3.2.1 Selecting the plant type

Setting

The first setting to be made is always the plant type because when selecting the type of plant, the majority of settings are reset to their default values.
Following will not be reset:

- Texts
- Business card
- Device name
- Terminal types
- Time switch
- Holiday program

Plant types

The RMH760B contains 41 plant types. If required, every type of plant can subsequently be changed or complemented via "Extra configuration".

Basic type H

With basic type H, no configuration is predefined. The plant type is to be selected if the subject plant differs considerably from the preconfigured plant types, so that the effort required for an adaptation would be greater than the effort required for manual configuration.

Designation of plant type

The plant type is made up of the letter “H” and a 2-digit numeral (e.g. H4-5):

- The first digit defines the type of heat generation or heat distribution
- The second digit defines the type and number of internal consumers

First digit of plant type *Heat generation / distribution*		*Second digit of plant type:* *Consumer*	
0	None	0	None
1	Main controller for district heat	1	DHW heating
2	Primary controller for external consumers only	2	Control of one heating circuit
3	Heat source	3	DHW heating and control of one heating circuit
4	Heat source with maintained boiler return temperature	4	Control of 2 heating circuits
5	Consumer connected to district heating with storage tank charging and control of mixing valve as a preselected DHW type	5	DHW heating and control of 2 heating circuits
6	Consumer connected to district heating with direct DHW heating as a preselected DHW type	6	Control of 3 heating circuits
		7	DHW heating and control of 3 heating circuits

By selecting the plant type, the assigned plant functions will automatically be made available.

Plant type and DHW type

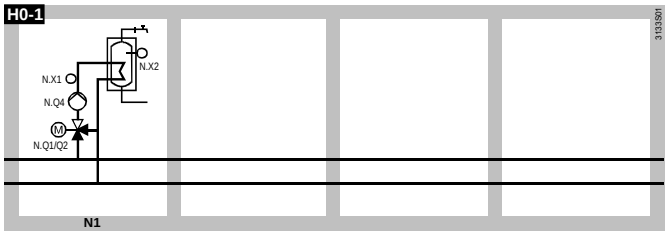
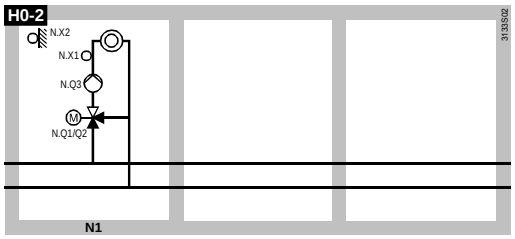
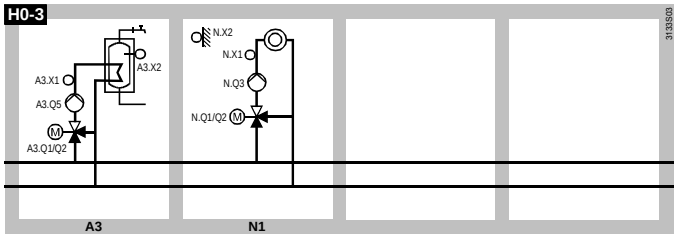
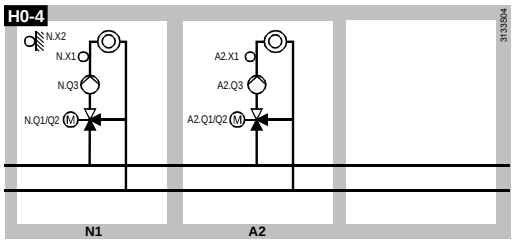
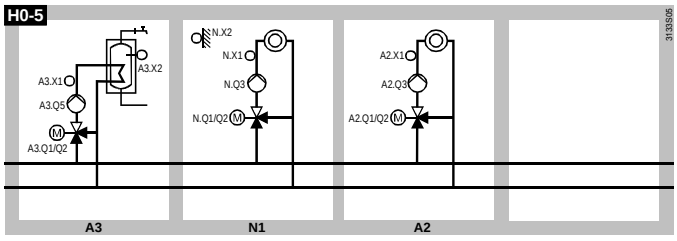
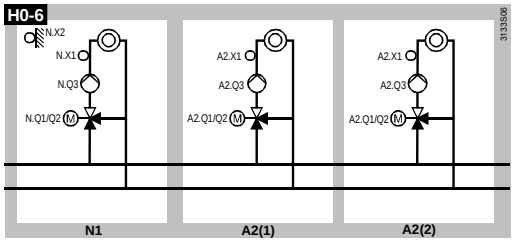
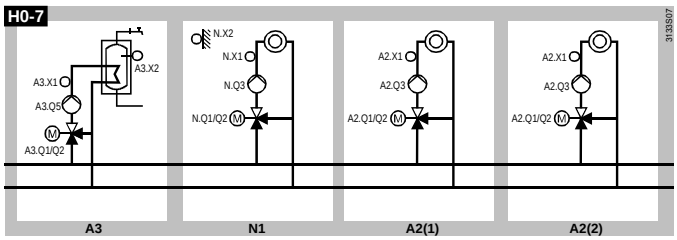
With plant types Hx-1, Hx-3, Hx-5 and Hx-7, DHW heating is activated by default. The default type of DHW heating plant varies depending on the plant type.

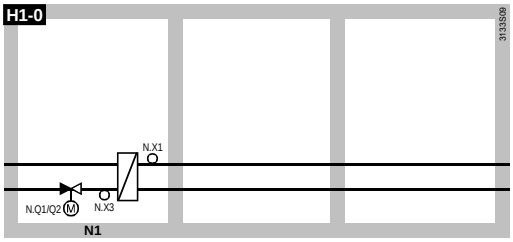
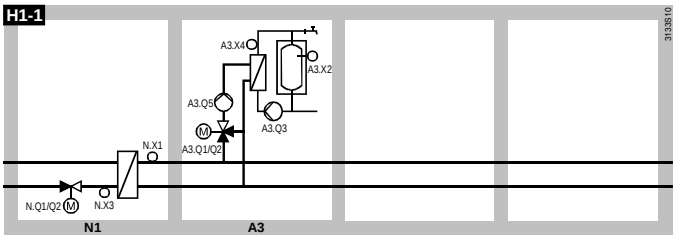
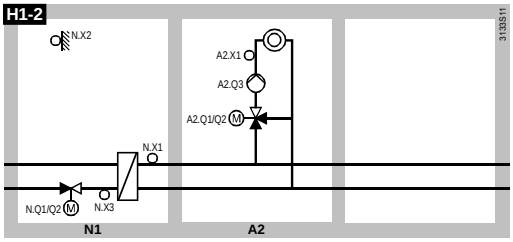
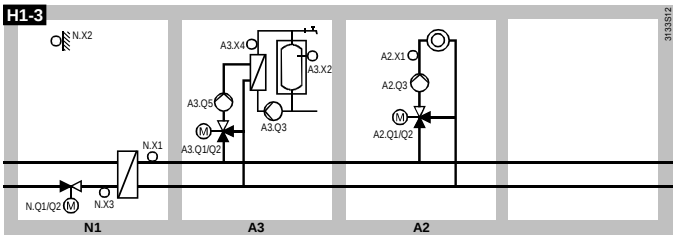
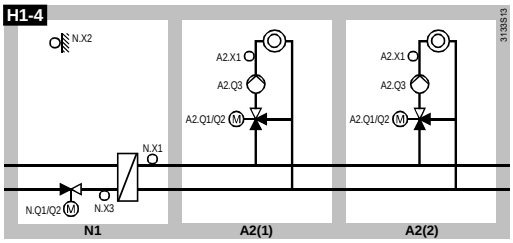
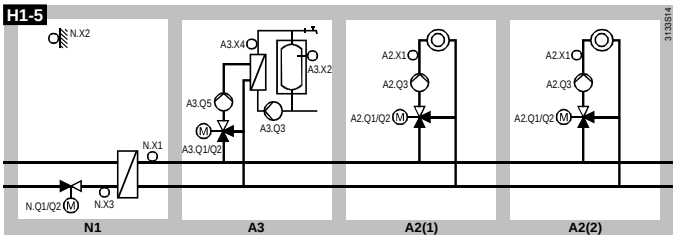
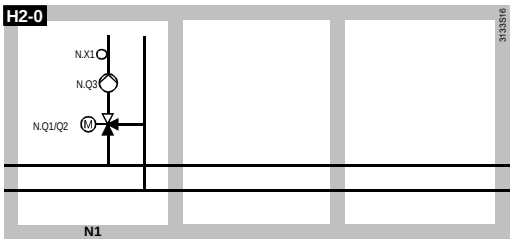
Plant type	*Default type of DHW heating plant*
H0-x, H2-x, H3-x, H4-x	DHW 2
H1-x	DHW 4
H5-x	DHW 3
H6-x	DHW 6

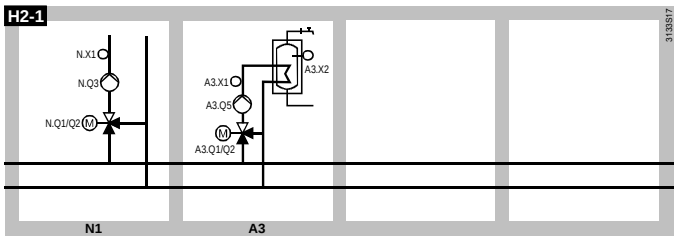
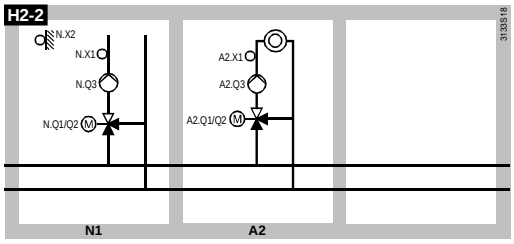
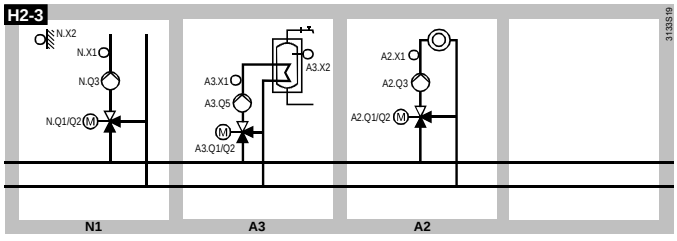
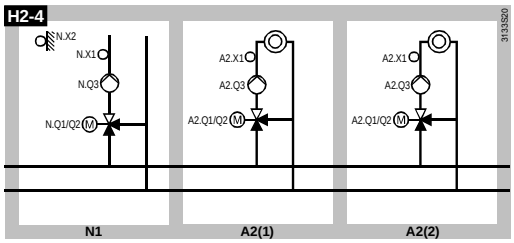
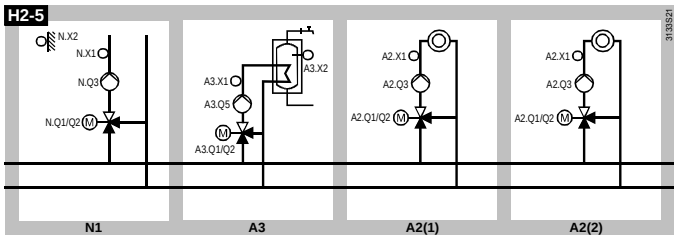
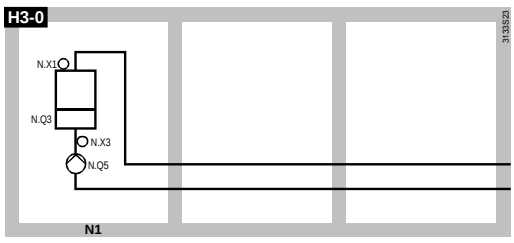
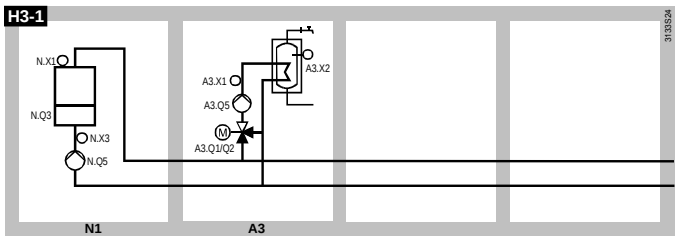
Note

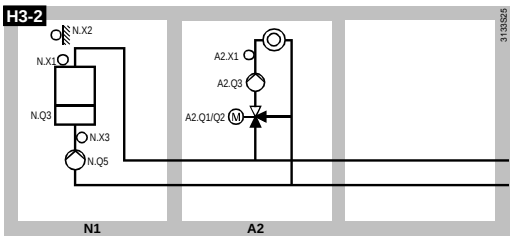
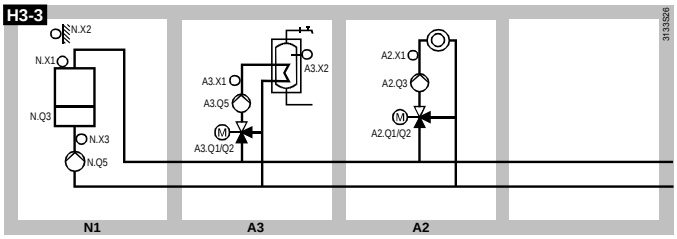
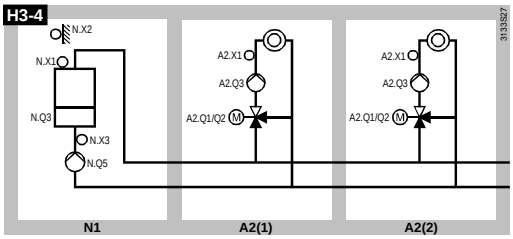
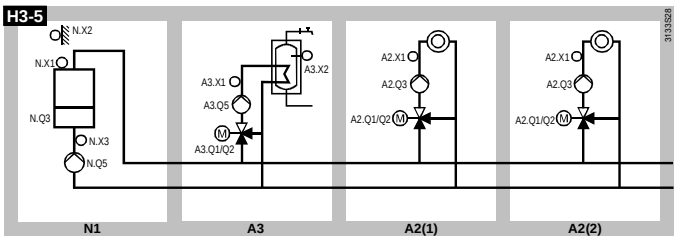
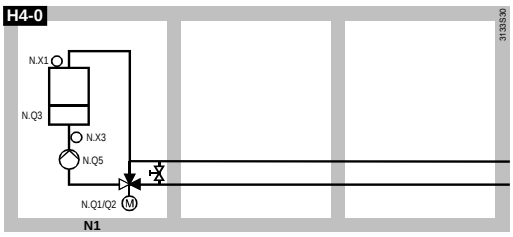
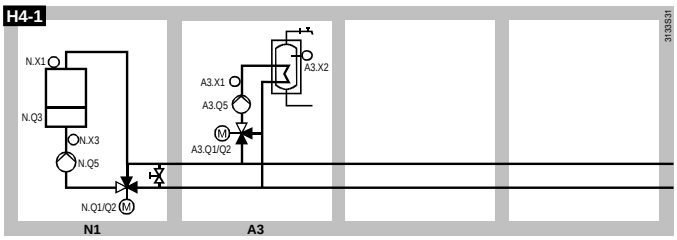
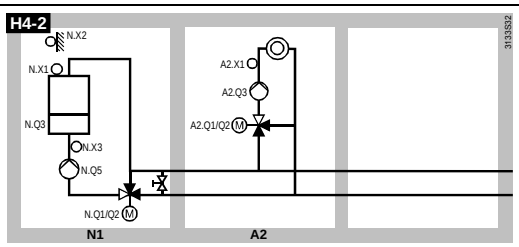
DHW = domestic hot water (used throughout document CE1P3133en)

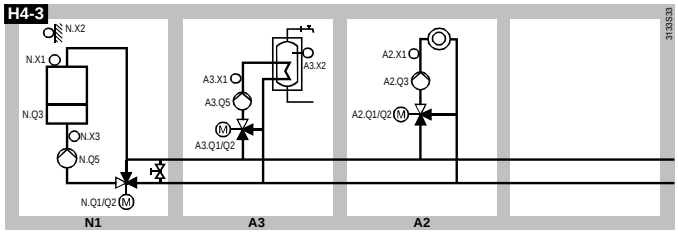
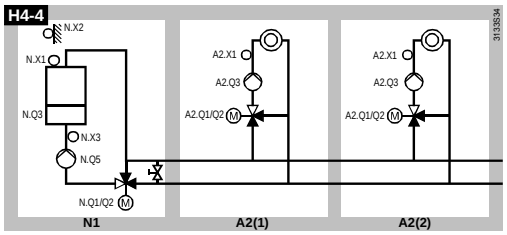
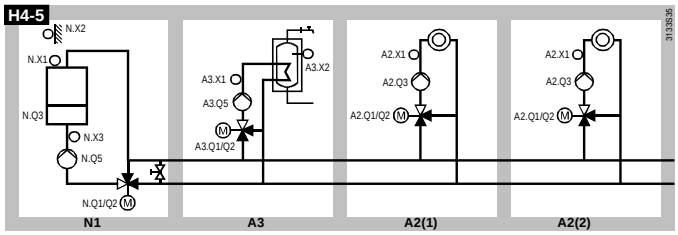
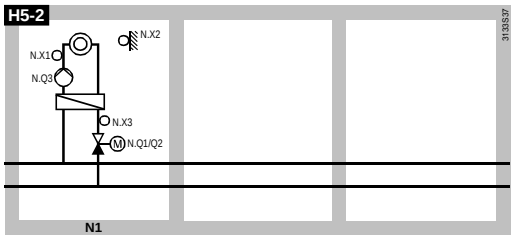
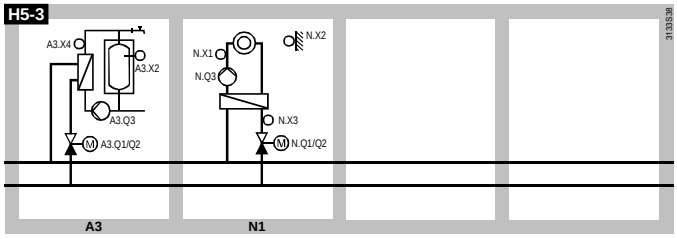
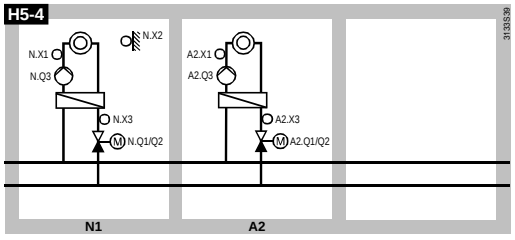
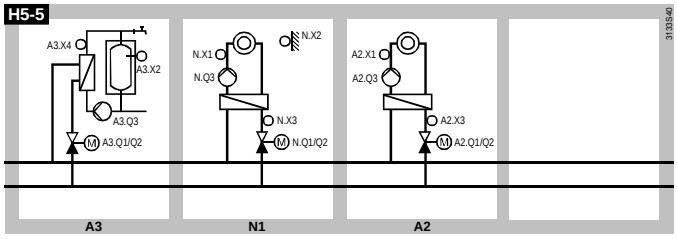
Plant types

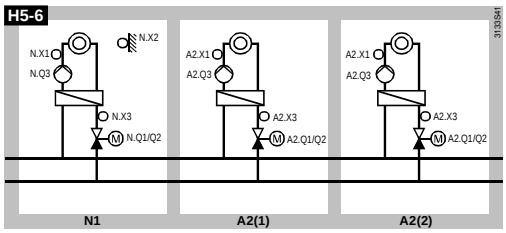
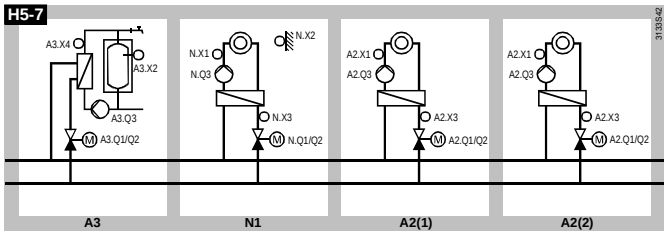
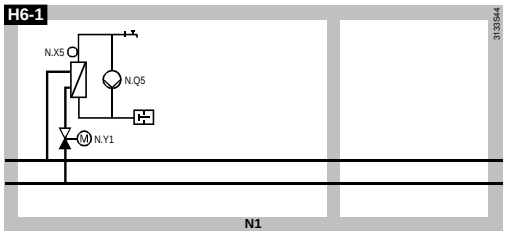
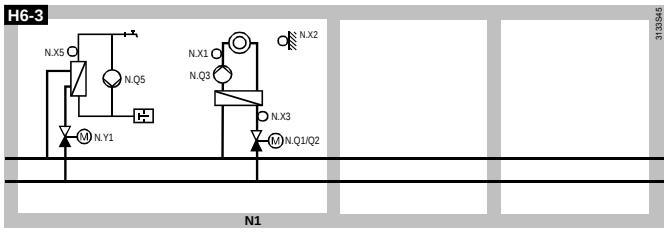
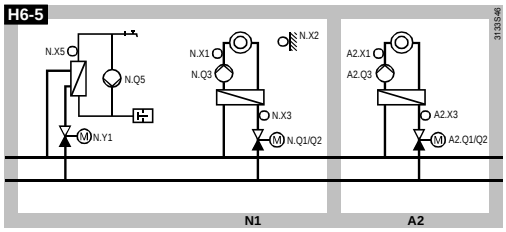
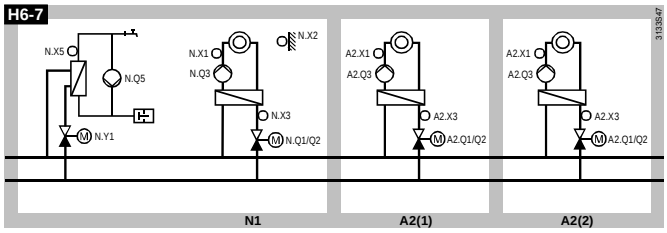
Plant type	*Description*	*Plant diagram*
H	Basic type	No preconfigured inputs and outputs
H0-1	**N1:** DHW circuit with controlled mixing valve in the storage tank flow and charging pump, connected directly to uncontrolled main flow (DHW type DHW 2)	
H0-2	**N1:** Weather-compensated heating circuit control with mixing valve and circulating pump, connected directly to uncontrolled main flow	
H0-3	**A3:** DHW circuit (DHW 2) **N1:** Heating circuit	
H0-4	**N1:** Heating circuit **A2:** Heating circuit	
H0-5	**A3:** DHW circuit (DHW 2) **N1:** Heating circuit **A2:** Heating circuit	
H0-6	**N1:** Heating circuit **A2(1):** Heating circuit **A2(2):** Heating circuit	
H0-7	**A3:** DHW circuit (DHW 2) **N1:** Heating circuit **A2(1):** Heating circuit **A2(2):** Heating circuit	

Plant type	*Description*	*Plant diagram*
H1-0	**N1:** Main controller (district heat connection with heat exchanger), control of secondary flow temperature with 2-port valve in the primary return, supply to internal and external consumers	
H1-1	**N1:** Main controller **A3:** DHW circuit, storage tank charging via heat exchanger with controlled mixing valve, with primary and secondary pump (DHW 4)	
H1-2	**N1:** Main controller **A2:** Weather-compensated heating circuit control with mixing valve and circulating pump, connected to the secondary circuit of the main flow	
H1-3	**N1:** Main controller **A3:** DHW circuit (DHW 4) **A2:** Heating circuit	
H1-4	**N1:** Main controller **A2(1):** Heating circuit **A2(2):** Heating circuit	
H1-5	**N1:** Main controller **A3:** DHW circuit (DHW 4) **A2(1):** Heating circuit **A2(2):** Heating circuit	
H2-0	**N1:** Demand-compensated primary controller with mixing valve and circulating pump, supply to external consumers	

Plant type	*Description*	*Plant diagram*
H2-1	**N1:** Primary controller **A3:** DHW circuit with controlled mixing valve in the storage tank flow and charging pump (DHW 2)	
H2-2	**N1:** Primary controller **A2:** Weather-compensated heating circuit control with mixing valve and circulating pump	
H2-3	**N1:** Primary controller **A3:** DHW circuit (DHW 2) **A2:** Heating circuit	
H2-4	**N1:** Primary controller **A2(1):** Heating circuit **A2(2):** Heating circuit	
H2-5	**N1:** Primary controller **A3:** DHW circuit (DHW 2) **A2(1):** Heating circuit **A2(2):** Heating circuit	
H3-0	**N1:** Boiler temperature control with 1-stage burner and boiler pump	
H3-1	**N1:** Boiler temperature control **A3:** DHW circuit with controlled mixing valve in the storage tank flow and charging pump (DHW 2)	

Plant type	*Description*	*Plant diagram*
H3-2	**N1:** Boiler temperature control **A2:** Weather-compensated heating circuit control with mixing valve and circulating pump	
H3-3	**N1:** Boiler temperature control **A3:** DHW circuit (DHW 2) **A2:** Heating circuit	
H3-4	**N1:** Boiler temperature control **A2(1):** Heating circuit **A2(2):** Heating circuit	
H3-5	**N1:** Boiler temperature control **A3:** DHW circuit (DHW 2) **A2(1):** Heating circuit **A2(2):** Heating circuit	
H4-0	**N1:** Boiler temperature control with 1-stage burner and boiler pump, controlled mixing valve for maintained boiler return temperature	
H4-1	**N1:** Boiler temperature control **A3:** DHW circuit with controlled mixing valve in the storage tank flow and charging pump (DHW 2)	
H4-2	**N1:** Boiler temperature control **A2:** Weather-compensated heating circuit control with mixing valve and circulating pump	

Plant type	*Description*	*Plant diagram*
H4-3	**N1:** Boiler temperature control **A3:** DHW circuit (DHW 2) **A2:** Heating circuit	
H4-4	**N1:** Boiler temperature control **A2(1):** Heating circuit **A2(2):** Heating circuit	
H4-5	**N1:** Boiler temperature control **A3:** DHW circuit (DHW 2) **A2(1):** Heating circuit **A2(2):** Heating circuit	
H5-2	**N1:** Weather-compensated heating circuit control via heat exchanger connected to uncontrolled main flow, with 2-port valve in the primary return	
H5-3	**A3:** DHW circuit with storage tank charging via heat exchanger connected to uncontrolled main flow (DHW 3) **N1:** Heating circuit	
H5-4	**N1:** Heating circuit **A2:** Heating circuit	
H5-5	**A3** DHW circuit (DHW 3) **N1:** Heating circuit **A2:** Heating circuit	

Plant type	*Description*	*Plant diagram*
H5-6	**N1:** Heating circuit **A2(1):** Heating circuit **A2(2):** Heating circuit	
H5-7	**A3:** DHW circuit (DHW 3) **N1:** Heating circuit **A2(1):** Heating circuit **A2(2):** Heating circuit	
H6-1	**N1:** Direct DHW consumption via heat exchanger connected to uncontrolled main flow, with circulating pump (DHW 6)	
H6-3	**N1:** DHW circuit (DHW 6) and weather-compensated heating circuit control via heat exchangers with 2-port valve in the primary return	
H6-5	**N1:** DHW circuit (DHW 6) and heating circuit **A2:** Heating circuit	
H6-7	**N1:** DHW circuit (DHW 6) and heating circuit **A2(1):** Heating circuit **A2(2):** Heating circuit	

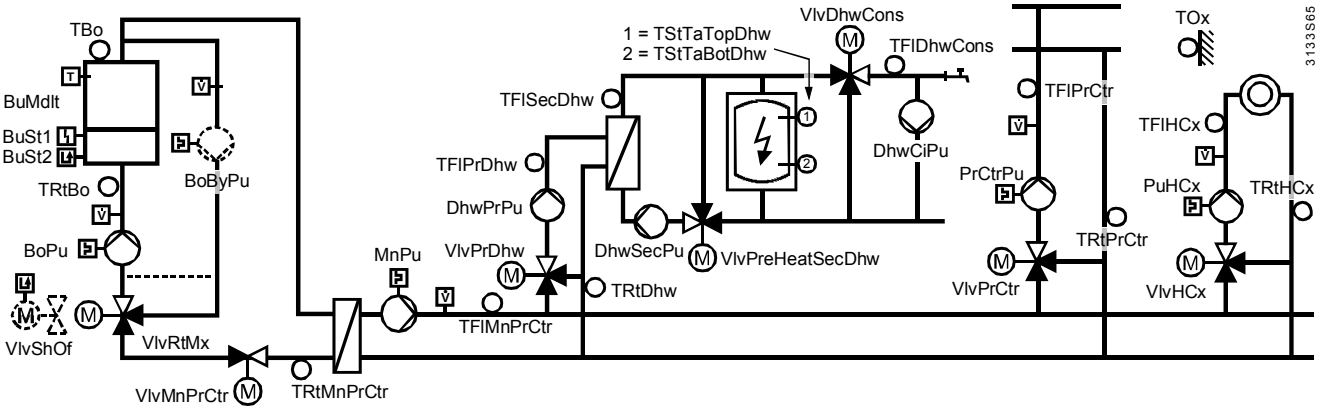
N. Connection terminals of heating controller N1
A2. Connection terminals of heating circuit module RMZ782B
A2(1) Connection terminals of the first heating circuit module RMZ782B, if 2 heating circuit modules are used
A2(2) Connection terminals of the second heating module RMZ782B, if 2 heating circuit modules are used
A3. Connection terminals of the DHW module RMZ783B
Q1 Relay terminals, consisting of Q11, Q12 and Q14 (e.g. actuator)
Q2 Relay terminals, consisting of Q23 and Q24 (e.g. actuator)
Q3 Relay terminals, consisting of Q33 and Q34 (e.g. heating circuit pump)
Q4 Relay terminals, consisting of Q41, Q42 and Q44 (e.g. storage tank charging pump)
Q5 Relay terminals, consisting of Q53 and Q54 (e.g. boiler pump)
X1 Configurable input for main controlled variable (e.g. flow temperature)
X2 Configurable input for auxiliary controlled variable (e.g. outside temperature)
X3 Configurable input for auxiliary controlled variable (e.g. return temperature)
X4 Configurable input for auxiliary controlled variable (e.g. sensor for secondary storage tank flow)
X5 Configurable input for auxiliary controlled variable (e.g. sensor for secondary storage tank flow)

Sensor assignment

When selecting the plant type, the sensors required for the basic functions and standard outputs will automatically be predefined and, for this reason, need not be configured.

Preconfiguration of plant types

Every plant type has several plant components preconfigured. The following summary shows the assignment of the plant components to the connection terminals.



BoByPu	Boiler bypass pump
BoPu	Boiler pump
BuMdlt	Burner modulation
BuSt1	Burner stage 1
BuSt2	Burner stage 2
DhwSecPu	DHW secondary pump
DhwCiPu	DHW circulating pump
DhwPrPu	DHW primary pump
MnPu	Main controller pump
PrCtrPu	Primary controller pump (system pump)
PUHCx	Heating circuit pump x (x =1…3)
TBo	Boiler temperature
TFlDhwCons	DHW flow temperature consumer
TFlSecDhw	DHW flow temperature secondary side
TFlHCx	Flow temperature heating circuit x (x = 1…3)
TFlMnPrCtr	Flow temperature main controller
TFlPrCtr	Flow temperature primary controller
TFlPrDhw	DHW flow temperature primary side
TOx	Outside temperature x (x = 1…3)
TRtBo	Boiler return temperature
TRtHCx	Heating circuit x – return temperature (x = 1…3)
TRtMnPrCtr	Main controller return temperature
TRtPrCtr	Primary controller return temperature
TStTaBotDhw	DHW storage tank temperature at the bottom
TStTaTopDhw	DHW storage tank temperature at the top
VlvMnPrCtr	Valve main controller
VlvPrCtr	Mixing valve primary controller
VlvPrDhw	Primary mixing valve DHW
VlvPreHeatSecDhw	Valve for maintained secondary temperature
VlvHCx	Mixing valve heating circuit x (x = 1…3)
VlvRtMx	Boiler return mixing valve
VlvDhwCons	Consumer mixing valve DHW
VlvShOff	Shut off valve boiler

3.2.2 Terminal assignment and properties of outputs

In principle, all input and output terminals can be freely used. The terminals preassigned when selecting the plant type can also be reconfigured. In that case, however, the special properties of the individual extension modules, and their outputs, must be taken into consideration.

Outputs with changeover contacts

For the control of a shutoff valve, an on / off signal is usually required. For that purpose, a number of relays with changeover contacts are available.
In the case of the RMH760B and RMZ789, these are the outputs Q1 and Q4, in the case of the RMZ783B, outputs Q1 and Q5, in the case of the RMZ782B, output Q1, and in the case of the RMZ787, output Q5.

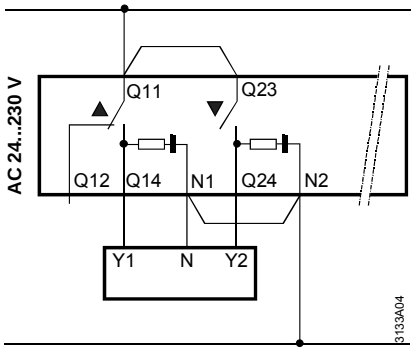
Terminals for 3-position control

The relay outputs for the on / off signal of 3-position control are assigned as pairs. Available for selection are terminals Q1/Q2 and Q3/Q4. For that purpose, special pairs of terminals must be used.

Outputs with RC units

Normally, for 3-position control of a mixing valve or modulating burner with on / off signal, appropriate radio interference suppression measures must be taken. If the mixing valve does not already incorporate such an RC unit, appropriate devices must be provided, either on the controller side or externally.

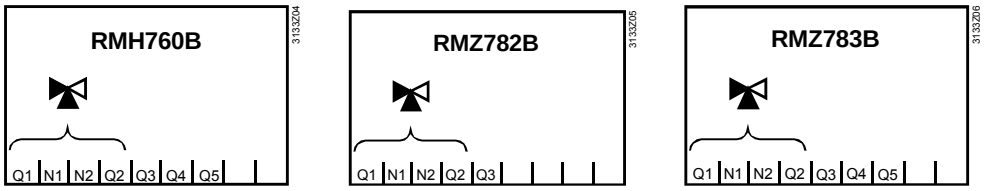
Basic connection diagram



Connection of suppression units

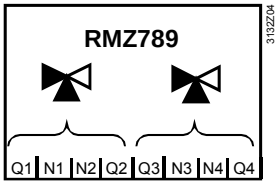
When terminals N1 and N2 or N3 and N4 are interconnected and wired to N, the RC unit for outputs Q1/Q2 or Q3/Q4 is activated.

Controller RMH760B and extension modules RMZ782B and RMZ783B



On the RMH760B basic unit and the RMZ782B and RMZ783B extension modules, terminal pair Q1/Q2 is used for activating an RC unit.

Universal module RMZ789



With the RMZ789 extension module, there are 4 mixing valve outputs available (for 2 mixing valves), where an RC unit can be activated.

Universal module RMZ787

The outputs of the RMZ787 extension module cannot be used as a 3-position output.

3.2.3 Short designations for basic module and extension modules

The following short designations are used for the basic module and the extension modules:

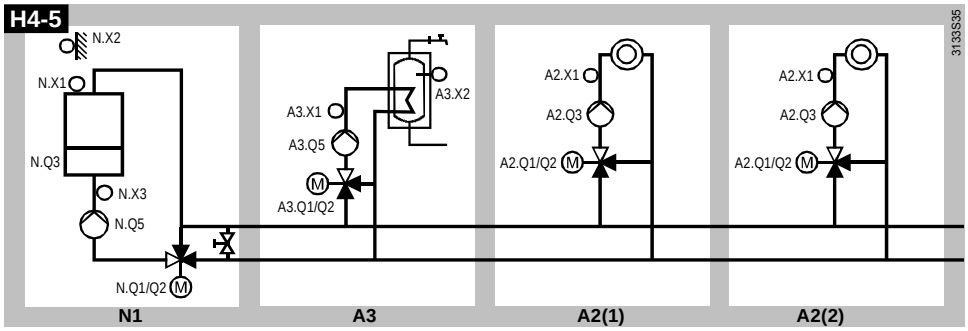
Short designation	*Type of module*
N.	Basic module RMH760B
A2	Extension module RMZ782B
A2(1)	First of 2 extension modules RMZ782B
A2(2)	Second of 2 extension modules RMZ782B
A3	Extension module RMZ783B
A7	Extension module RMZ787
A9	Extension module RMZ789
A9(1)	First extension module RMZ789
A9(2)	Second extension module RMZ789

These short designations also appear on the operator unit.

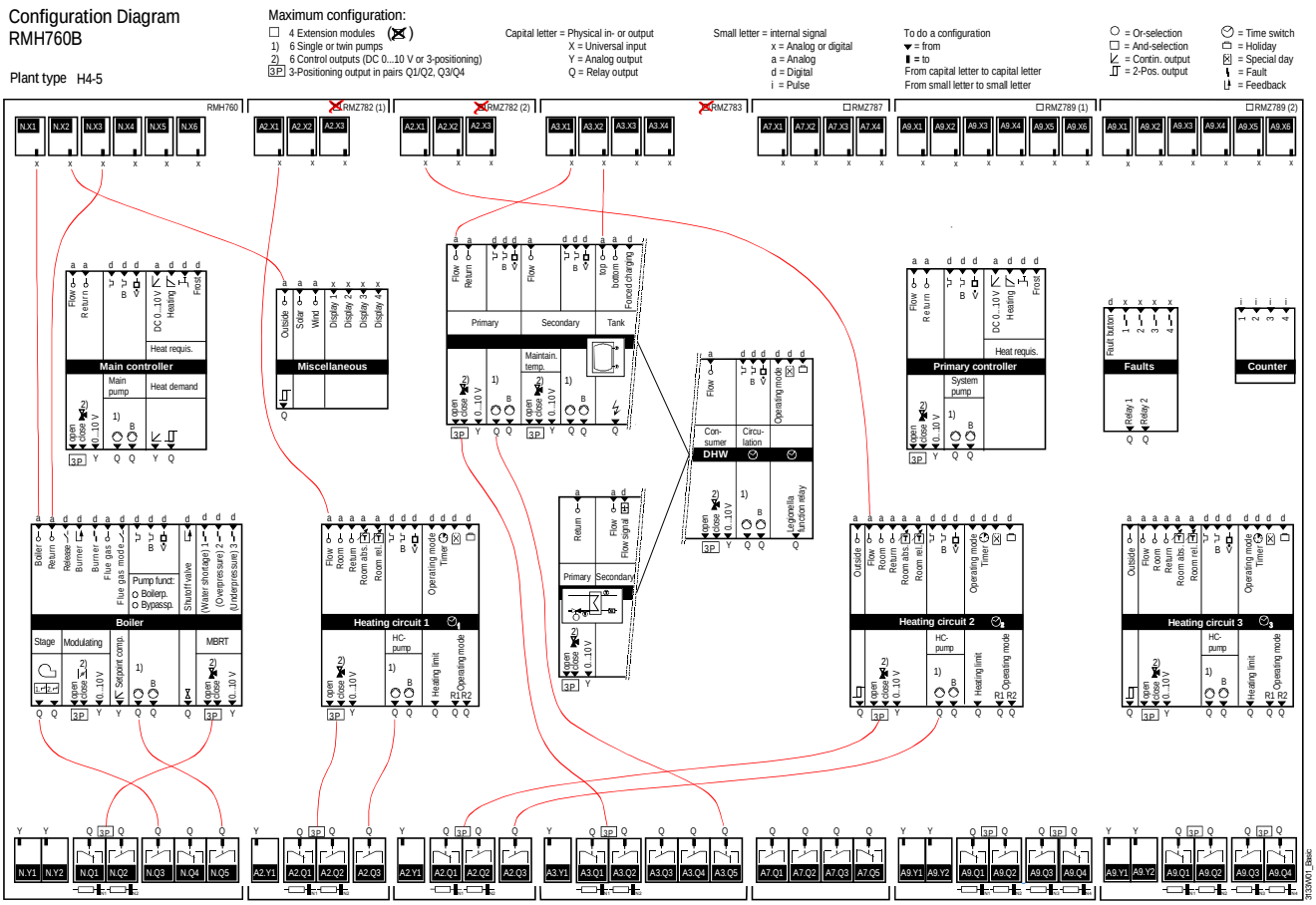
3.2.4 Use of the configuration diagrams

Use of the configuration diagrams is explained on the basis of plant type H4-5.

Plant type H4-5



Configuration diagram for plant type H4-5



Function blocks

The configuration diagram shows all function blocks active in the plant type. In this example, these are the following types of function blocks:

- Boiler control including maintained boiler return temperature controlled via mixing valve
- Miscellaneous
- DHW heating
- Heating circuit 1
- Heating circuit 2

For additional examples, refer to subsection 16.1.4 “Examples”.

Controller

The configuration diagram shows the inputs and outputs preconfigured in the basic module.

This means that for an input variable (e.g. the boiler temperature), an input terminal (e.g. X1) has already been preconfigured per default.

For plant type H4-5, the following inputs and outputs are preconfigured in the boiler temperature controller, that is, in function block “Boiler“:

Inputs

Input variable	*Terminal*	*Designation in diagram*
Boiler temperature	X1	N.X1
Boiler return temperature	X3	N.X3

Outputs

Output variable	*Terminals*	*Designation in diagram*
Actuator maintained boiler return temperature	Q1 and Q2	N.Q1/Q2
1-stage burner	Q3	N.Q3
Boiler pump	Q5	N.Q5

Notes

- "N." in the tables denotes "controller"
- If required, additional inputs and outputs (e.g. flue gas temperature sensor, operating mode relay, circulating pump) can be assigned to the free inputs and outputs via "Extra configuration"
- The inputs and outputs can be checked with the help of menu Extra configuration > ... > Inputs (or Outputs)
- It is possible to reconfigure or remove preconfigured inputs and outputs
  Example: When removing the second burner stage ("---" in place of N.Q4, for example), the 2-stage burner becomes a 1-stage burner.

Extension modules

The configuration diagram shows the types of extension modules required.
Also shown are the inputs and outputs preconfigured in the extension modules. For plant type H4-5, extension modules RMZ782B(1), RMZ782B(2) and RMZ783B are used as standard. This can be viewed on the Basic configuration menu, operating lines Position 1, Position 2 and Position 3.
The type of extension modules used can be changed, but in that case, all inputs and outputs of the changed module must be reconfigured.

Inputs

Type of module	*Input variable*	*Terminal*	*Designation in diagram*
RMZ783B	Primary flow sensor	X1	A3.X1
	Storage tank sensor at the top	X2	A3.X2
RMZ782B(1)	Flow sensor	X1	A2.X1
RMZ782B(2)	Flow sensor	X1	A2.X1

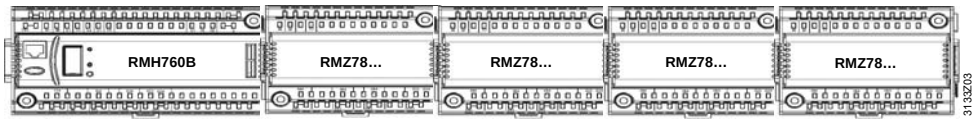
Outputs

Type of module	*Output variable*	*Terminal*	*Designation in diagram*
RMZ783B	3-position primary mixing valve	Q1 and Q2	A3.Q1/Q2
	Primary pump	Q5	A3.Q5
RMZ782B(1)	3-position mixing valve	Q1 and Q2	A2.Q1/Q2
	Heating circuit pump	Q3	A2.Q3
RMZ782B(2)	3-position mixing valve	Q1 and Q2	A2.Q1/Q2
	Heating circuit pump	Q3	A2.Q3

Notes

- "A2." in the table denotes extension module RMZ782B, "A3" denotes extension module RMZ783B.
- If required, additional inputs and outputs can be assigned to the free inputs and outputs via "Extra configuration"
- The inputs and outputs can be checked with the help of menu Extra configuration > ... > Inputs (or Outputs)
- Additional function blocks can be activated via "Extra configuration"

3.2.5 Extension modules



A maximum of 4 extension modules can be connected to the RMH760B.

Note

Prior to attaching an extension module, the plant must be disconnected from power.

Order

The order in which the extension modules are fitted is **not** mandatory but must correspond to the setting made on the controller.

When selecting the plant type, an extension module will automatically be preconfigured, if required. This can be changed in the basic configuration.

Assignment of functions

The assignment of functions to the basic module and the extension modules is not prescribed. Relay outputs for 3-position applications are preconfigured to the controller or the extension module type RMZ782B or RMZ783B.

The following types of extension modules can be connected to each RMH760B:

- Heating circuit module **RMZ782B** with 3 inputs and one modulating output plus 3 relay outputs (one relay with changeover contact). It is also possible to activate 2 relay outputs for the control of 3-position actuators with an RC unit
- DHW module **RMZ783B** with 4 inputs, one modulating output and 5 relay outputs (2 relays with changeover contact). It is also possible to activate 2 relay outputs for the control of 3-position actuators with an RC unit
- Universal module **RMZ787** with 4 inputs and 4 relay outputs (one relay with change-over contact)
- Universal module **RMZ789** with 6 inputs, 2 modulating outputs and 4 relay outputs (2 relays each for the control of 3-position actuators with RC units can be activated)

The extensions can be activated by configuring them at a free position of the controller.

Number of extension modules per type

The controller can accept a maximum of **4** extension modules. Of module types RMZ783B (DHW) and RMZ787 (universal), a maximum of one module can be used, of heating circuit module type RMZ782B and universal module type RMZ789, a maximum of 2 of each.

3.2.6 Basic configuration

Configuration of the controller is always started by defining the plant type. Based on the selected plant type, the required types of extension modules are to be selected and will be displayed on the following lines:

Main menu > Commissioning > Basic configuration

Operating line	*Adjustable values / display / remarks*
Plant type	H / H0-1…H6-7
Position 1	--- / RMZ782 / RMZ783 through RMZ789
Position 2	--- / RMZ782 / RMZ783 through RMZ789
Position 3	--- / RMZ782 / RMZ783 through RMZ789
Position 4	--- / RMZ782 / RMZ783 through RMZ789

--- = no module configured

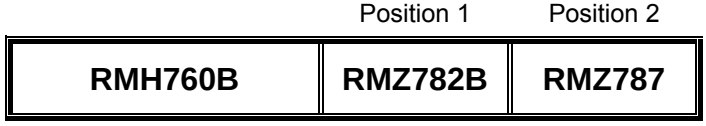
Plant type

On operating line “Plant type”, the plant type is to be entered or will be displayed.

Position …

Operating lines Position 1…Position 4 display the type of extension module required. On these operating lines, the presettings can be changed or complemented. When changing a predefined extension module, all settings relating to these extension modules and made via “Extra configuration” must be adapted.

Configuration example



Main menu > Commissioning > Basic configuration

Operating line	*Adjustable values / display / remarks*
Plant type	Basic type H / H0-1…H6-7
Position 1	RMZ782 (1)
Position 2	RMZ787

Position 1

When using Position 1 in this example, extension module RMZ782B is selected.

Position 2

Then, at position 2, module type RMZ787 is selected.

Positions 3 and 4

Positions 3 and 4 remain blank. They use setting "---" and are confirmed with the OK knob, which means that they are left blank.

⚠

During the configuration, the ESC button can be pressed to return to the previous setting.

Once the configuration is started, it cannot be stopped! Configuration **must** be completed until the following message appears:

Here, the configuration can be aborted.

Additional inputs and outputs

Functions can be assigned to additional inputs and outputs via "Extra configuration". If the maximum number of extension modules do not suffice, parts of the plant must be wired and configured to a second RMH760B.

Fault handling

If the extension modules actually used and their positions do not accord with the values entered, a fault status message Fault extension module will be delivered.
In the case of an incorrectly configured extension module, some other fault status message may also be displayed because that consequential fault has the higher priority than fault status message 7101. It is therefore of advantage to have all pending faults displayed.

Fault status messages

Number	*Text*	*Effect*
7101	Fault extension module	Urgent message; must be acknowledged

In the event of fault, the LEDs on the extension modules flash. If everything works correctly, the LEDs are lit.

3.3 Extra configuration

3.3.1 General

By configuring additional inputs and outputs, adaptations to the hydraulic circuit can be made, and extra functions and function blocks can be activated.
Depending on the selection of plant type, a number of function blocks have already been activated (e.g. boiler, main controller, DHW, heating circuit, etc.).
Also refer to subsection 3.2.4 "Use of the configuration diagrams".
When configuring an output, the relevant function block will automatically be activated.
The plant's hydraulic circuit is determined by the basic configuration and the extra configuration of plant components, such as pumps and mixing valves, etc. In most cases, the configured outputs are decisive for the plant's hydraulics.
Additional inputs and outputs can activate various functions. A description of these functions is given with the relevant function block.

Example of flue gas temperature sensor

Main menu > Commissioning > Extra configuration > Boiler > Inputs

Operating line	*Range*	*Factory setting*
Flue gas temperature sensor	--- / RMH760… etc.*	---

* Here, the free inputs are available for selection

The inputs of the basic module will be termed RMH760.Xn, those of the extension modules RMZ… . If 2 identical extension modules are available, they will be termed RMZ782(1) and RMZ782(2).
After the assignment, following appears: Flue gas temperature sensor N.X4 (N = short designation of basic module RMH760B).
By assigning input terminal RMK770.X4, the flue gas temperature sensor will be activated.
For other settings, refer to chapter 6 “Boiler temperature control”.
Assignments made or preconfigured can be removed again by using setting “---“ (none).

Example:
Maintained boiler return temperature

Main menu > Commissioning > Extra configuration > Boiler > Outputs

Operating line	*Range*	*Factory setting*
Maint boiler return temp 3-pos	--- / RMH760… etc.*	---

* Here, the free 3-position outputs are available for selection

The free pairs of terminals available for selection depend on the configuration made and the configured extension modules (refer to subsection 3.2.2 “Configuration of the universal inputs and outputs”).

Maximum plant size

The maximum plant size is limited by the number of available terminals and the number of plant elements (pumps and actuators or positioning outputs):

Plant element	*Maximum number*
Pumps	6
Positioning outputs	6

Following applies:
- A twin pump is regarded as one pump
- A positioning output is used for an actuator or a modulating burner. If both the modulating output and the 3-position positioning output are configured, the 2 are regarded as one positioning output

3.3.2 Configuration of the universal inputs and outputs

The universal inputs can accept digital signals or passive and active analog signals. The inputs are activated through basic and extra configuration. When activating an input, the respective unit is assigned also. For this reason, input identifiers on the RMH760B cannot be set. Exceptions are the 4 universal display inputs and the 4 fault inputs.
The setting choices depend on the kind of configuration: Analog or digital input.

Analog inputs

In the case of the analog inputs, the following setting choices are available:
- Type reference
- Measuring range
- Measured value correction

The RMH760B is supplied with type Ni 1000 preselected for the temperature sensor.

Type reference

The following types of input signals can be handled:
- Ni 1000
- 2× Ni 1000
- T1
- Pt 1000
- DC 0…10 V
- NTC 575 (for outside temperature only)

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs > ...X...

Operating line	*Range*	*Factory setting*
Type reference	Ni 1000 / 2 × Ni 1000 / T1 / Pt 1000 / DC 0…10 V / NTC 575*	Ni 1000

* For outside temperature only

Measuring range

Type of signal	*Type of sensing element / signal*	*Measuring range*
Passive temperature signals	LG-Ni 1000	−50…+250 °C
Passive temperature signals	2 x LG-Ni 1000 / T1	−50…+150 °C
Passive temperature signals	Pt1000	−50…+400 °C
Active signals	DC 0…10 V	Selectable. To be entered are a low and a high limit
Passive temperature signals	NTC575*	−50…+500 °C

* For outside temperature only

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs > ...X...

Operating line	*Range*	*Factory setting*
Value low	Depending on the selected type	Depending on the type
Value high	Depending on the selected type	Depending on the type

Example

Flow temperature with an active signal of DC 0…10 V = 0…100 °C:
Lower limit value: 0 °C
Upper limit value: 100 °C

Measured value correction

With passive temperature sensors, the measured value can be readjusted by −3.0…+3.0 K to compensate for line resistance. It is thus possible to make onsite calibrations with a reference instrument.

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs > ...X...

Operating line	*Range*	*Factory setting*
Correction	−3.0…3.0 K	0.0 K

Fault handling

When the **Commissioning** menu is quit, a check is made to see which sensors are connected. If, later, one of the sensors connected at this point in time is missing, or if there is a short-circuit, a fault status message [...] sensor error will be delivered.
If there is an error on the measuring line, the operator unit will display the measured value as follows:

- Open-circuit = ----
- Short-circuit = oooo

Digital inputs

Potential-free contacts for control functions can be connected to the digital inputs.

Configuration

Main menu > Commissioning > Extra configuration > Miscellaneous > Input identifier

Operating line	*Adjustable values / display / remarks*
Display input 1	Digital

Operating line	*Adjustable values / display / remarks*
Display input 2	Digital
Display input 3	Digital
Display input 4	Digital

The input identifier can only be set for the configured inputs (display inputs and fault inputs).
Fault inputs can also be configured to terminals that are already used. In that case, the automatically set input identifier is always given priority.

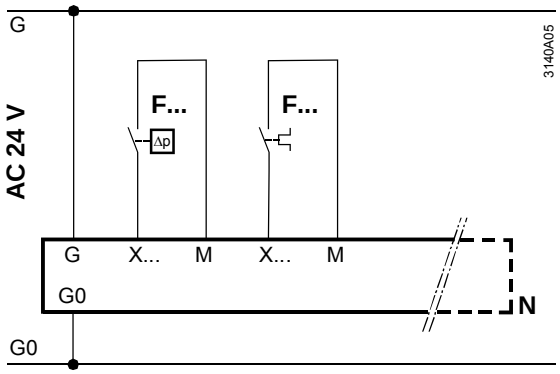
Normal position

The normal position can be predefined for each digital input.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs > ....X...

Operating line	*Range*	*Factory setting*
Normal position	Open / Closed	Open



Fault handling

Digital signals cannot be monitored.

3.4 Wiring test

A wiring test can be made with all connected peripheral devices. We recommend to conduct this test after the configuration and the settings have been made.

Inputs

The current states are indicated at the inputs.

Outputs

The aggregates connected to the outputs (pumps, actuators, etc.) or messages (e.g. for conventional controllers) can be switched on and off.
In the case of modulating outputs, a signal can be delivered in the relevant value range.

⚠ The application is deactivated during the wiring test. The outputs are in a defined off state; safety-related functions are deactivated.

When making the wiring test, the inputs and outputs are to be checked for the following types of errors:

- Connection fault (wires have been mixed up)
- Position fault (wires of sensor or actuator have been mixed up)
- Discrepancy between the actual type of connection and the controller's configuration (e.g. LG-Ni 1000 in place of DC 0…10 V)

Example on the basis of heating circuit 1

Main menu > Commissioning > Wiring test > Heating circuit 1 (or 2 or 3) > Inputs

Operating line	*Adjustable values / display / remarks*
Actual value flow temp	Display of the current measured value

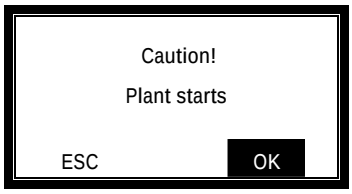
Main menu > Commissioning > Wiring test > Heating circuit 1 (or 2 or 3) > Outputs

Operating line	*Positions*
Heating circuit pump	Off / On

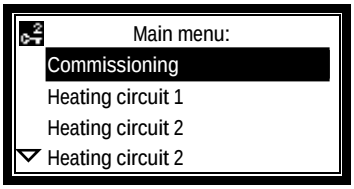
3.5 Completing commissioning

If the application is valid, the **Commissioning** menu can be quit as follows:

1. Press the ESC button. The display shows a menu with the following information:



2. Confirm by pressing the OK knob. Then, the controller starts with the settings made; the plant is started up, and the Main menu appears on the display.



3.6 Data backup

When commissioning is completed, the entire commissioning data set (configuration and all settings) can be saved in the controller. If any time later, an unauthorized person readjusts important values, this function can be used to restore the correct controlled state after commissioning.

Displays

Main menu > Data backup

Operating line	*Adjustable values / display / remarks*
Storage date	Display of the date on which the commissioning data set was downloaded to the controller's memory
Storage year	Display of the year in which the commissioning date set was downloaded to the controller's memory

Setting

Main menu > Data backup

Operating line	*Adjustable values / display / remarks*
Restore	Caution! New configuration
Save	Caution! Stored data will be overwritten.

3.7 Device information

The Device information menu provides information about the controller, shows the software version, etc.

Display values

■ Main menu > Device information > Controller

Operating line	*Adjustable values / display / remarks*
Plant type	Display of plant type
Plant type adapted	Display of intervention in the programmed application (yes, no)
File name	Has a function only in connection with ACS7… Display of file name of the application currently loaded. Can be edited under Settings > Texts > File name.
Device type	RMH760B-1…RMH760B-5
Software version	Display of software version
Hardware version	Display of hardware version

■ Main menu > Device information > Position 1...4

Operating line	*Adjustable values / display / remarks*
Extension module	Display of the module's type reference
Software version	Display of software version
Hardware version	Display of hardware version

3.8 Leaving the password level

On completion of commissioning, select the user level (access level for the plant operator). Proceed as follows:

1. After completing commissioning, you reach the "Main menu" again.
2. Press simultaneously the OK knob and the ESC button.
3. The Access levels menu appears.
4. Select the user level by turning the OK knob.
5. Confirm the selection by pressing the OK knob.

3.9 Marking an intervention

Marking

If the internal standard application has been adapted or if, subsequently, the "Extra configuration" menu has been accessed, an asterisk (*) appears in front of the plant's type reference.
The asterisk denotes that the plant type has been complemented by extra functions. The asterisk is set automatically when leaving the „Extra configuration" menu, even if nothing has been changed. In addition, on the Device information menu, Yes will be set on operating line Plant type adapted.

Resetting the marking

When, on the Basic configuration menu, the former or a new standard application is loaded for the plant type, the asterisk disappears and No will appear on operating line Plant type adapted. A new configuration is made based on the selected application.

4 General settings

4.1 Time of day and date

4.1.1 Operating principle

The controller has a yearly clock with time of day, weekday and date.

Time format

The following time formats are available:

Time format	*Date*	*Example*	*Time of day*	*Example*
24 hours	dd.mm.yyyy (day.month.year)	31.05.2006	hh:mm (hours: minutes)	15:56
am/pm	mm/dd/yy (day/month/year)	05/31/2006	hh:mm am/pm (hours: minutes am/pm)	03:56 PM

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Device

Operating line	*Range*	*Factory setting*
Time format	24 hours / 12 hours (am/pm)	24 hours

Main menu > Time of day/date

Operating line	*Range*	*Factory setting*
Time of day	00:00…23:59	00:00
Date	01.01…31.12	01.01
Year	2000…2100	2000

Summer- / wintertime changeover

The change from summertime to wintertime, and vice versa, is made automatically. The date of the earliest changeover can be readjusted should the relevant regulations change.
The dates set for the change from wintertime to summertime, and vice versa, ensure that on the first Sunday after that date, the time of day will change from 02:00 (wintertime) to 03:00 (summertime), and from 03:00 (summertime) to 02:00 (wintertime).
If both dates are set to coincide, summer- / wintertime changeover will be inactive.

Setting

Main menu > Time of day/date

Operating line	*Range*	*Factory setting*
Summer time start	01.01. …31.12	25.03
Winter time start	01.01. …31.12	25.10

4.1.2 Communication

For the time of day, there are several sources available, depending on the master clock. This can be entered on the controller. Time of day and date can be exchanged via bus.
For clock time operation, the following settings can be made:

- Autonomous (does not send and does not receive)
- Clock time **from** the bus: Clock time slave (receives the synchronization signal from the bus)
- Clock time **to** the bus: Clock time master (sends the synchronization signal to the bus)

Setting values

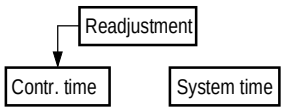
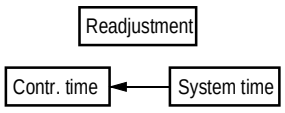
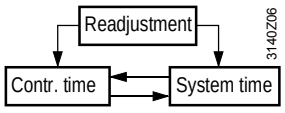
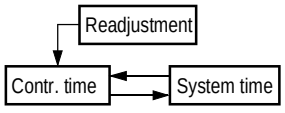
Main menu > Commissioning > Communication > Basic settings

Operating line	*Range*	*Factory setting*
Clock time operation	Autonomous / slave / master	Autonomous
Remote setting clock slave	Yes / No	Yes

If the controller is set as a clock time slave, it can also be selected whether it shall be possible to adjust the master clock's time of day from this controller.
The following settings for the remote clock time slave can be made:

- No (clock time slave with no adjustment facility for the system time)
- Yes (clock time slave with adjustment facility for the system time)

The effect of the individual entries is as follows:

Entry	*Effect*	*Diagram*
Autonomous	• The time of day on the controller can be readjusted • The controller's time of day is not matched to the system time	
Slave, Remote setting clock slave No	• The time of day on the controller cannot be readjusted • The controller's time of day is continuously and automatically matched to the system time	
Slave, Remote setting clock slave Yes	• The time of day on the controller can be readjusted which, at the same time, readjusts the system time • The controller's time of day is continuously and automatically matched to the system time	
Master	• The time of day on the controller can be readjusted and, at the same time, readjusts the system time • The controller's time of day is continuously and automatically matched to the system time	

Only one clock time master per system may be used. If several controllers are parameterized as masters, a fault status message will be delivered.

Recommendation

The plant should always be operated in a synchronized manner.

4.1.3 Fault handling

If the clock on the bus is missing and the local clock is parameterized as the clock time slave, operation continues with the internal clock and a fault status message System time failure will be delivered.
In the event of a power failure, the clock has a reserve (minimum 12 hours, typically 48 hours).
If the controller loses its time of day after a power failure and the time is not retransmitted via bus, fault status message Invalid time of day will be forwarded.
An invalid time of day flashes.

Fault status messages

Number	*Text*	*Effect*
5001	System time failure	Nonurgent message; must not be acknowledged
5002	>1 clock time master	Nonurgent message; must be acknowledged
5003	Invalid time of day	Nonurgent message; must not be acknowledged

4.2 Selecting the language

Every RMH760B controller has a number of languages loaded.
When switching on the controller for the first time, the required language must be entered. But the language can also be changed later during operation.
Depending on the type of controller, the following languages with the relevant instructions are available:

Type ref.	*Language 1*	*Language 2*	*Language 3*	*Language 4*	*Language 5*	*Language 6*
RMH760B-1	German	French	Italian	Spanish		
RMH760B-2	German	English	French	Dutch		
RMH760B-3	Swedish	Finnish	Norwegian	Danish		
RMH760B-4	Polish	Czech	Hungarian	Russian	Slovakian	Bulgarian
RMH760B-5	Greek	Romanian	Slovenish	Serbian	Croatian	Turkish

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Device

Operating line	*Range*	*Factory setting*
Language		English*

* Available with all types of controllers

4.3 Selecting the unit of temperature

On the RMH760B, the unit of temperature can be switched between °C/K and °F.

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Device

Operating line	*Range*	*Factory setting*
Unit	°C / °F	°C

4.4 Contrast of display

The contrast of the display can be matched to ambient conditions, thus improving readability.

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Device

Operating line	*Range*	*Factory setting*
Contrast	0…100 %	50 %

4.5 Text entries

4.5.1 Device name and file name

The text for the device name appears in the welcome picture.

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Texts

Operating line	*Range*	*Factory setting*
Device name	Max. 20 characters	
File name	Max. 20 characters	

Device name

The text of the device name entered here appears on the start page in place of Welcome.

File name

The file name is only of importance in connection with the ACS7… plant operating software; the text can be edited there.

4.5.2 Function block

Specific designations can be assigned to the following types of function blocks: Boiler, main controller, primary controller, DHW, heating circuit, and time switch. The setting is made on the relevant function block.

Setting
(example of main controller)

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller

Operating line	*Range*	*Factory setting*
Main controller	Max. 20 characters	

⚠

A maximum of 20 characters can be entered.
The change of text designation for the boiler only affects the menu headings indicated, but not the fault texts and not the text of operating lines.

4.5.3 Texts for the fault inputs

The texts for the fault inputs are locally displayed and also transmitted via bus.
In addition to the predefined fault inputs, there are 4 universal fault inputs, 3 digital and freely usable boiler-related fault inputs available.

- The text for the universal fault inputs can be edited via Main menu > Settings > Faults.
- The text for the boiler-related faults can be edited where the boiler settings are made: Main menu > Settings > Boiler > Fault settings

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Faults > Fault input 1 (or 2, 3 or 4)

Operating line	*Range*	*Factory setting*
Fault input 1	Max. 20 characters	[Fault inp 1] fault
Fault input 2	Max. 20 characters	[Fault inp 2] fault
Fault input 3	Max. 20 characters	[Fault inp 3] fault
Fault input 4	Max. 20 characters	[Fault inp 4] fault

4.5.4 Electronic business card

The text of the electronic business card is displayed as an info picture. The electronic business card can be deactivated via “Extra configuration“.

Configuration

Main menu > Commissioning > Extra configuration > Miscellaneous > Business card

Operating line	*Range*	*Factory setting*
Business card	Yes / No	Yes

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Texts

Operating line	*Range*	*Factory setting*
Business card line 1	Max. 20 characters	
Business card line 2	Max. 20 characters	
Business card line 3	Max. 20 characters	
Business card line 4	Max. 20 characters	

4.5.5 Resetting text entries

The following datapoints cannot be reset:

- Device name
- File name
- Business card lines 1…4

All other texts, such as menu text, fault text, etc., entered by the user can be reset on the password level.

Main menu > Settings > Texts

Operating line	*Range*	*Factory setting*
Resetting text	No / Yes	

5 General functions, fundamentals

5.1 Time switch

For each of the 3 heating circuits, DHW heating and the DHW circulating pump, there is a time switch available.
In “Automatic“ mode, the respective function block operates according to this time switch. A switching program can be defined for every weekday.
Using the program entered, the time switch controls the change of operating modes and the relevant setpoints.
Operation of the time switch is described in Operating Instructions B3133.

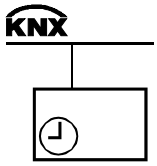
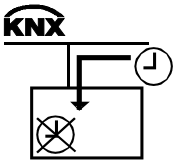
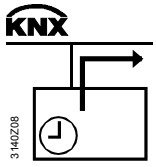
5.1.1 Communication

If the RMH760B is connected to other controllers via communication, the 7-day time switch can be assigned to different controllers, or it can be used by a single controller. This applies to both the time switches for the heating circuits and the time switch for DHW heating. The time switch for the circulating pump cannot be made available to another controller and it cannot be adopted by some other controller.

The following settings must be made, depending on the required operating mode:

Required time switch operation	*Operating line*	*Setting*
Autonomous	Geographical zone (apartm.)	----
	Time switch slave (apartm.)	----
Master	Geographical zone (apartm.)	1…126
	Time switch slave (apartm.)	----
Slave	Geographical zone (apartm.)	Any
	Time switch slave (apartm.)	1…126

The following combinations are possible:

Effect	*Description*	*Diagram*
Autonomous	The time switch only acts locally on this controller. It has no impact on other controllers on the bus.	
Slave	The time switch in this controller is not active. An external time switch is active, which can be selected by setting the time switch reception zone. Every time switch only acts in its own zone, and every zone only has one time switch. The external time switch must be set as the time switch master.	
Master	The time switch in this controller is active. It acts on all other controllers located in the same zone. The zone must be set both at the master and the slaves. The receivers are set as slaves.	

Heating circuit and DHW circuit time switches cannot communicate with one another, which means that they do not operate in master-slave mode.
Also, the master-slave settings of the heating circuits and those of DHW are not the same.

Main menu > Commissioning > Communication > Heating circuit 1 (or 2 or 3)

Operating line	*Range*	*Factory setting*
Geographical zone (apartm.)	---- / 1…126	----
Time switch slave (apartm.)	---- / 1…126	----

Main menu > Commissioning > Communication > DHW

Operating line	*Range*	*Factory setting*
DHW zone	1…31	1
Time switch operation	Autonomous / Slave / Master	Autonomous
Time switch slave DHW	1…31	1

For details on settings regarding time switch communication, refer to chapter 14 ”Communication“.

5.1.2 Entries

For space heating, a specific 24-hour program can be selected for each day:

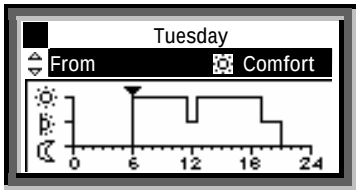
Space heating

Main menu > Heating circuit 1 (or 2 or 3) > Time switch 1 (or 2 or 3)

Operating line	*Range*	*Factory setting*
Monday	Comfort / Precomfort / Economy	From 06:00 Comfort / From 22:00 Economy
up to		
Sunday	Comfort / Precomfort / Economy	From 06:00 Comfort / From 22:00 Economy
Special day	Comfort / Precomfort / Economy	From 06:00 Comfort / From 22:00 Economy

Note

The times are to be entered with the help of a display (using indicator ▼):



DHW heating

For DHW heating, a specific 24-hour program can be selected for each day:

Main menu > DHW > DHW time switch

Operating line	*Range*	*Factory setting*
Monday	Normal / Reduced	From 05:00 Normal From 22:00 Reduced
up to		
Sunday	Normal / Reduced	From 05:00 Normal From 22:00 Reduced

Circulating pump

For the circulating pump, a specific 24-hour program can be selected for each day:

■ Main menu > DHW > Circ pump time switch

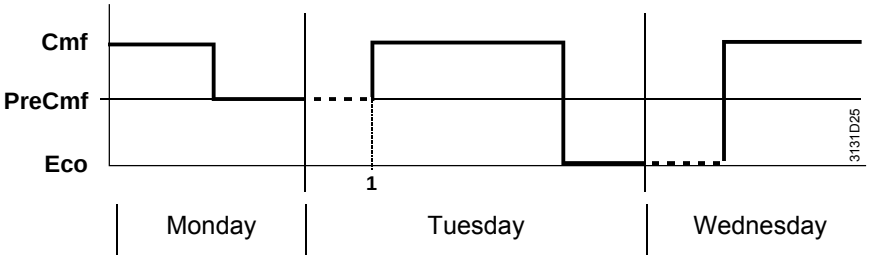
Operating line	*Range*	*Factory setting*
Monday	Off / On	From 05:00 On From 22:00 Off
up to		
Sunday	Off / On	From 05:00 On From 22:00 Off
Special day	Off / On	From 05:00 On From 22:00 Off

Entries

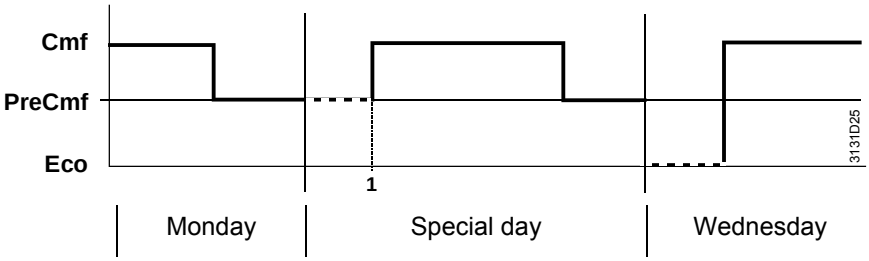
The special day program is a 24-hour program which can be activated either via the holiday program or an external contact.
Activation of the special day is described in section 5.2 “Holidays and special days”.
For each day, a maximum of 6 entries can be made in the 24-hour program.
Every entry must include the following:

- Time of day from which the desired operating mode shall apply
- The desired operating mode

The next day always adopts the operating mode of the previous day until another entry is made.
The operating mode of the previous day is shown in the form of a broken line.



If no entry is made for a specific day, the operating mode of the previous day will be adopted for the whole day and shown as a broken line.
The special day ends with the same operating mode with which it was started.
The day following the special day adopts the operating mode of the previous day’s 24-hour program that would have been valid without the special day.



When all entries for a day have been made, that 24-hour program can be copied to other days. The program can be copied to Monday through Friday, Monday through Sunday, or to individual weekdays.

5.1.3 Fault handling

>1 time switch signal in the heating circuit

Number	*Text*	*Effect*
5102	>1 time switch in heating circuit 1	Nonurgent message; must be acknowledged
5112	>1 time switch in heating circuit 2	Nonurgent message; must be acknowledged
5122	>1 time switch in heating circuit 3	Nonurgent message; must be acknowledged

Number	*Text*	*Effect*
5302	>1 DHW time switch	Nonurgent message; must be acknowledged

For each geographical zone, only one time switch master may be set. If several controllers are parameterized as masters, a fault status message will be delivered. The fault is identified by the time switch master(A) when it receives a time switch signal from some other master(B) in its own zone. Time switch master ”A” will then display and forward a fault, but no more time switch signal, in order to prevent switching back and forth of the slaves.

Failure of system time switch

Number	*Text*	*Effect*
5101	System time switch failure 1	Nonurgent message; must not be acknowledged
5111	System time switch failure 2	Nonurgent message; must not be acknowledged
5121	System time switch failure 3	Nonurgent message; must not be acknowledged
5301	DHW system time switch failure	Nonurgent message; must not be acknowledged

The controller always expects a time switch signal from the bus. If not transmitted, the controller will operate in “Comfort“ mode. In that case, fault status message System time switch failure 1 (or 2 or 3) will be delivered.

5.2 Holidays and special days

Each heating circuit and DHW heating use their own holidays / special day program. Weekdays deviating from the normal 7-day program can be entered by the plant operator as holidays or special days, using the “Holidays / special days“ menu. Entry is described in Operating Instructions B3133.
The operating mode for the holiday period can be separately selected for each individual heating circuit and for DHW heating.

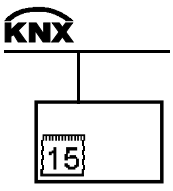
Note

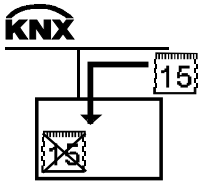
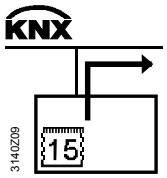
Function “Holidays / special days“ is active only if room operating mode “Auto“ has been selected. The same applies to DHW heating. Here too, DHW operating mode “Auto“ must be selected.

5.2.1 Communication

If the controller is connected to other controllers via bus, the holidays or special day program can be made available to other controllers (master), or it can be adopted from some other controller (slave).

The following combinations are possible:

Entry	*Effect*	*Diagram*
Autonomous	The holidays / special day program only acts in its own heating circuit or DHW and only in the controller. The holidays / special day program has no impact on the holidays / special day zone entered on the “Communication” menu.	

Entry	*Effect*	*Diagram*
Slave	The holidays / special day program of this heating circuit or of DHW is not active; a holidays / special day program selected on the slave will be ignored. Active is some other holidays / special day program assigned to the same holidays / special day zone. This holidays / special day program must be set as the master holidays / special day program.	
Master	The holidays / special day program is set as the master. It acts on all internal and external holidays / special day programs set as slaves and lying in the same holidays / special day zone.	

Main menu > Commissioning > Communication > Room heating circuit 1 (or 2 or 3)

Main menu > Commissioning > Communication > DHW

Operating line	*Range*	*Factory setting*
Holidays/special day operation	Autonomous / Slave / Master	Autonomous
Holidays / special day zone	1…31	1

For details on the settings relating to holidays / special day communication, refer to chapter 5.2.2 „Holidays “.

5.2.2 Holidays

Holidays are periods of time
- during which the building is not occupied
- whose start and duration are known in advance

Examples:
- Works holidays in commercially used spaces and buildings
- School holidays in school buildings
- Public holidays

The operating mode to be used during the holiday period can be set separately for each heating circuit and each DHW heating system. The following operating modes can be selected for the heating circuits:
- Economy
- Protection

Following can be selected for DHW heating:
- Auto
- Normal
- Reduced
- Protection

Circulating pump

For the circulating pump, following applies during the holiday period:
- If “Protection“ has been selected as the DHW operating mode during the holiday period, the circulating pump will be deactivated
- In the other operating modes, the circulating pump will run according to the time program

Legionella function

For the legionella function, following applies during the holiday period:
- If “Protection“ has been selected as the DHW operating mode during the holiday period, the legionella function will be deactivated
- In the other operating modes, the legionella function will remain activated

Settings

■ Main menu > Heating circuit 1 (or 2 or 3) > Room operating mode

Operating line	*Range*	*Factory setting*
Room operating mode holidays	Economy Protection	Economy

■ Main menu > DHW > DHW optg mode

Operating line	*Range*	*Factory setting*
DHW operating mode holidays	Auto Normal Reduced Protection	Protection

5.2.3 Special days

Special days are periods of time during which the building is used for special purposes and whose start and duration are known in advance. Such days are especially public holidays.
The 7-day program can accommodate an additional 24-hour program (special day) as a special day program. The setting is described in section 5.1 “Time switch“.
If the controller (master) is connected to other controllers (slaves) via communication, a specific 7-day program can be entered as a special day on each controller (slaves).
The time of the special day is predefined by the master and applies to all controllers in the same holidays / special day zone.

5.2.4 Calendar entry

A maximum of 16 entries can be made. The entries are sorted in chronological order.
Every entry must include:

- Date, year and start time
- Date and end time
- Reason for entry (holidays or special day)

Setting values

■ Main menu > ... > Holidays/special days

Operating line	*Range*	*Factory setting*
Entry 1… Entry 16	Start / End / Reason	--.-- / --.-- / Holidays

Annually recurring holidays or special days can be entered by setting an asterisk (*) at the annual setting.

Priority

If 2 entries overlap, special days are given priority over holidays. It is thus possible to predefine a special day during the holiday period also.

Note

On completion of the holiday period or the special day, operation according to the normal 7-day program will be resumed. During this transition period, it can occur that optimum start control (e.g. boost heating) cannot be started in due time. It is therefore recommended to bring the end of the holiday period somewhat forward, giving the plant sufficient time to adapt to the respective setpoints.

5.2.5 Control inputs for holidays and special days

Holidays and special days can also be activated via digital inputs. For that, the respective function must be assigned an input. Every holidays / special day program has its own inputs.

Setting

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Inputs

Main menu > Commissioning > Extra configuration > DHW > Inputs

Operating line	*Range*	*Factory setting*
Special day input	--- / RMH760… etc.*	---
Holiday input	--- / RMH760… etc.*	---

* These inputs are only active if holidays/special day operation has been set to “Autonomous“ or “Master”.

Special day

The digital input enables the plant to be switched to the special day program set in the 7-day program. If the configured input is activated, the special day program will become active. This state is maintained until the input becomes inactive. Then, the normal 7-day program will be resumed.

Holidays

The digital input enables the plant to be switched to “Holidays” mode.
When the configured input is activated, the plant switches to “Holidays” mode. This state is maintained until the input becomes inactive. Then, the normal 7-day program will be resumed.

Priority

If, at the same time, a special day or a holiday period is activated via the control switches and an entry in the calendar, the following priority will apply:

1. Control switch ”Special day”
2. Control switch “Holidays”
3. “Special day” entry in the calendar
4. “Holidays” entry in the calendar

Note

If other controllers are also configured as slaves in the same holidays / special day zone, the digital inputs will act on these controllers also.

5.2.6 Fault handling

Only one master may be set per holidays / special day zone. If there is more than one master in a zone, fault status message
>1 hol/sp day prgm HC 1 (or ...HC 2 or ...HC 3 or ...DHW) will be delivered.
The fault is identified by the holidays / special day master (A) when it receives a holidays / special day signal from some other master (B) in its zone. Master ”A” will then display a fault status message and forward it, but no more holidays / special day signal, in order to prevent the slaves from switching back and forth.
If the controller expects a holidays / special day signal from the bus, but same signal is not transmitted, fault status message Hol/sp day prgm failure HC 1 (or ...HC 2 or ...HC 3 or ...DHW) will be delivered.
The operating modes of the 7-day program are used, without giving consideration to the holidays / special day entries.

Fault status messages

Number	*Text*	*Effect*
5201	Hol/sp day prgm failure HC 1	Nonurgent message; must not be acknowledged
5211	Hol/sp day prgm failure HC 2	Nonurgent message; must not be acknowledged
5221	Hol/sp day prgm failure HC 3	Nonurgent message; must not be acknowledged
5231	Hol/sp day prgm failure DHW	Nonurgent message; must not be acknowledged
5202	>1 hol/sp day prgm HC 1	Nonurgent message; must be acknowledged

Number	*Text*	*Effect*
5212	>1 hol/sp day prgm HC 2	Nonurgent message; must be acknowledged
5222	>1 hol/sp day prgm HC 3	Nonurgent message; must be acknowledged
5232	>1 hol/sp day prgm DHW	Nonurgent message; must be acknowledged

When evaluating the priority in the holidays / special day program, only the first 2 entries are taken into consideration. If more than 2 overlapping entries are made, the situation can occur that the special day no longer has priority over holidays.

5.3 Frost protection for the plant

General settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Protective functions

Operating line	*Range*	*Factory setting*
Frost prot for plant ON (cycling)	–5…10 °C	2 °C
Frost prot for plant ON (cont)	–50…2 °C	–5 °C

To protect the water pipes from freezing, frost protection for the plant can activate the respective pump depending on the **actual** outside temperature.
This takes place independent of heat requests. Prerequisite is, however, that “Frost protection for the plant” has been activated for the relevant pump.

Settings per function block

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Limitations

Operating line	*Range*	*Factory setting*
Frost protection for the plant	Off / On	On

Main menu > Settings > DHW > Limitations

Operating line	*Range*	*Factory setting*
Frost prot plant primary pump	Off / On	Off
Frost prot plant secondary pump	Off / On	Off
Frost prot plant circulating pump	Off / On	Off

Main menu > Settings > Primary controller > Limitations

Main menu > Settings > Main controller > Limitations

Operating line	*Range*	*Factory setting*
Frost protection for the plant	Off / On	Off

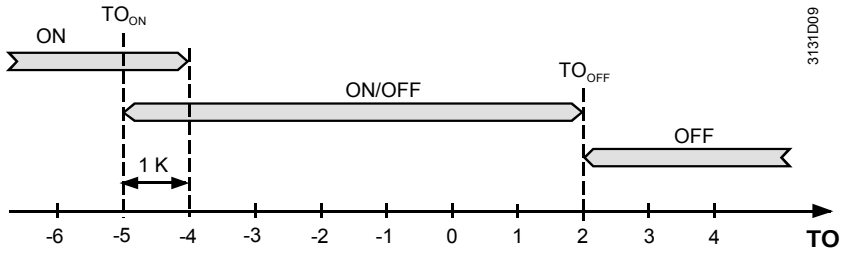
Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Frost prot boiler pump	Off / On	Off

The necessity for activating “Frost protection for the plant” is primarily dependent on the type of hydraulic system and the location of the heating pipes in the building. If the heating pipes are located such that they cannot be affected by frost, frost protection for the plant will not be required.

Sequence of functions

The sequence of frost protection for the plant is as follows:



TO	<–5 °C (TO_{ON})	-4…+2 °C	>2 °C (TO_{OFF})
Pump	Continuously on	On for 10 minutes every 6 hours	Continuously off
Status	ON	ON / OFF	OFF

Adjustable are the following temperatures:

- TO_{ON}: Outside temperature at which “Frost protection for the plant“ switches the pump continuously on (frost protection for the plant continuously ON)
- TO_{OFF}: Outside temperature at which "Frost protection for the plant” lets the pump cycle (frost protection for the plant cycling ON)

Faulty outside sensor

In the event the outside sensor becomes faulty, frost protection for the plant will continue to operate with a constant backup value of 0 °C outside temperature.

5.4 Pump overrun and mixing valve overrun

For all pumps (exception: circulating pump) and all mixing valves, overtemperature protection can become active. Overtemperature protection always becomes active after the burner has been shut down. To ensure that the heat consumers still draw heat for a minimum period of time, an overrun time is enforced on the heat consumers that were switched off within the last minute. During that overrun time, the pumps and mixing valves continue to operate; the pumps continue to run and the mixing valves maintain the “old” setpoint.
The duration of the overrun time is dependent on the type of heat source used and can therefore be set on the boiler.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Consumer overrun time	0…60 min	6 min

In order to also ensure overrun on plant with no system-internal heat exchanger, overrun can also be set on the heat consumers.

Main menu > Settings > Protective functions

Operating line	*Range*	*Factory setting*
Consumer overrun time	0…60 min	6 min

This setting can only be made on plant with **no** boiler.
Every heat consumer has a minimum overrun time of 60 seconds.

With DHW heating, it is to be noted that discharging protection is given priority over pump overrun.
In the case of DHW heating with primary and secondary pump, the secondary pump operates for an additional pump overrun time to prevent the external heat exchanger from reaching excessive temperatures.

Main menu > Settings > DHW > Controller primary circuit

Operating line	*Range*	*Factory setting*
Overrun time secondary pump	0…60 min	1 min

5.5 Pump kick and valve kick

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Protective functions

Operating line	*Range*	*Factory setting*
Kick day	Monday…Sunday	Monday
Kick time	00:00…23:59	10:00
Pump/valve kick	--- / Pump + Valve / Pump / Valve	Pump + valve

The pump kick or valve kick is a protective function that is carried out periodically. It prevents pumps and / or valves from seizing after longer off periods (e.g. summer operation). For the kick function to be performed, the pump or actuator must not have been activated for at least one week.
To prevent the pumps and valves from seizing, a point in time can be defined where the pumps are put into operation and the valves are driven to their fully open and fully closed positions.
To be defined are the kick day and kick time. The function can be deactivated (pump / valve kick = ---).
It can also be selected whether the function shall apply to pumps only, valves only, or to both.
The selected setting will then apply to **all** pumps and valves connected to the RMH760B. If a plant uses several RMH760B, the setting must be made on each of them.

Notes

With the kick day and kick time settings, it is to be noted that these settings are also used for automatic changeover of twin pumps (for more detailed information, refer to section 5.8 “Pump control and twin pumps”).
The kick time for pumps and actuators need not be set; it is fixed at 30 seconds.
If several pumps are present, they will be kicked one after the other. After the end of a kick, the next pump will be kicked after an interval of 30 seconds.
The valve kick does not act on the boiler’s shutoff valve.

5.6 Heat demand and load control

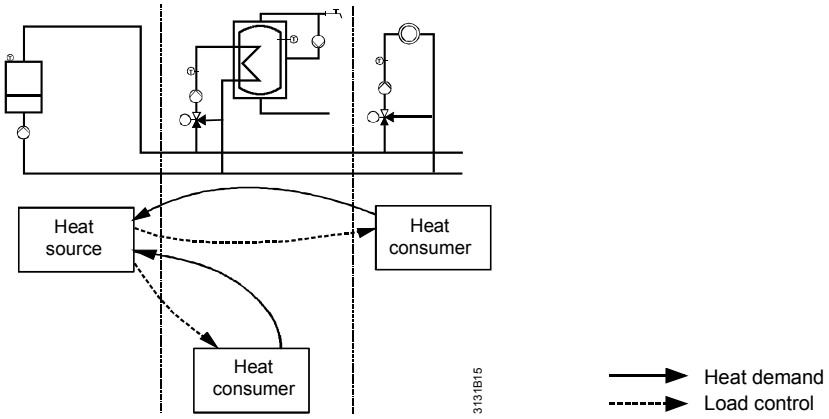
5.6.1 Heat demand

Heat consumers, such as heating circuits and DHW heating, send their heat demand signals to the heat distribution zone “Heat generation”.
A demand transformer converts such signals to appropriate heat demand signals (for details, refer to section 7.3 “Heat demand transformer”.
Heat source or primary controller receive the heat demand signals and evaluate them. Usually, evaluation is a maximum value generation of the temperatures obtained from the heat demand signals.

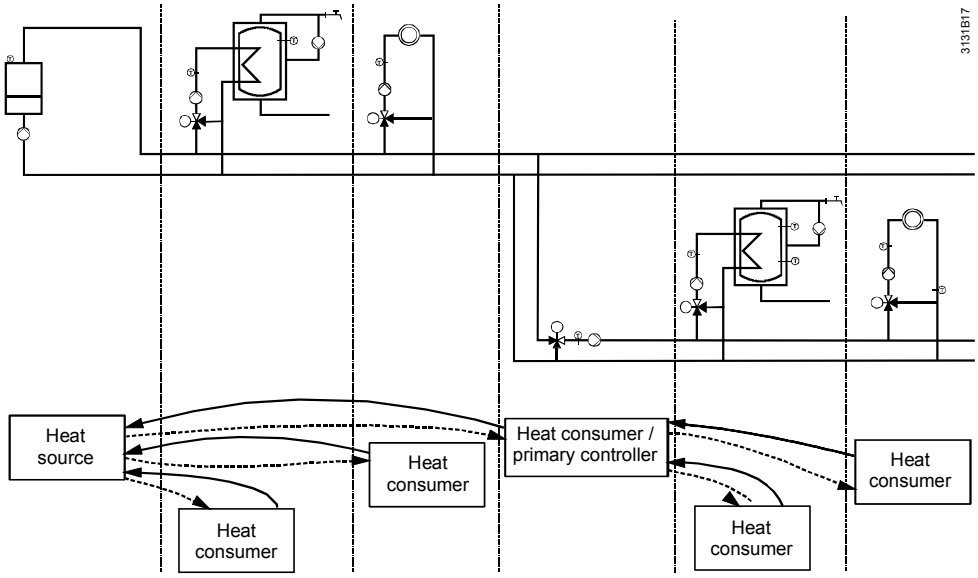
Examples

A heat source (example 1) delivers the heat demanded by the consumers. A primary controller (example 2) also provides this heat but, in addition, sends a heat demand signal to a heat source.

Example 1: Heat source and heat consumer



Example 2: Heat source, primary controller and heat consumer



The heat demand signals can be assigned a priority.
If DHW heating is operated with absolute priority, its heat demand signal must be given priority. This temperature request will therefore be the decisive variable.
For DHW heating, it can also be parameterized whether, during DHW heating, the heat demand shall be evaluated as a maximum value or in the normal way.

5.6.2 Load control

Load control enables heat generation to reduce the amount of heat drawn by the heat consumers (load reduction via locking signals), or to increase it (load increase via forced signals).
In the case of load control via locking signals, a differentiation is made between critical and uncritical locking signals.
In the case of forced signals also, a distinction is made between critical and uncritical signals.
These differentiations allow the heat consumers to respond to load control in different ways.

Examples of load reduction

Examples where a load reduction can be triggered are:

- **Protective boiler startup** (boiler temperature is still below the minimum boiler temperature):
  ⇒ Load reduction via critical locking signals
- **Maintained boiler return temperature** without separate mixing valve (acting on the heating circuits):

⇒ Load reduction via critical or uncritical locking signals
The type of locking signals to be generated can be parameterized

- **Shifting DHW priority** (if the boiler temperature setpoint is not reached during DHW heating, the amount of heat drawn by the heating circuits will be restricted):
  ⇒ Load reduction via uncritical locking signals
- **Absolute DHW priority** (DHW heating is given priority over the heating circuits; the heating circuits will not be allowed to draw any heat):
  ⇒ Load reduction via uncritical locking signals

Example of load increase

An example where load increase is called for is overtemperature protection (pump overrun, mixing valve overrun).
With pump / mixing valve overrun, the heat consumers are requested to draw heat at the same level for a certain period of time (overrun time) although they do not demand more heat. Overrun is typically triggered by a boiler after the burner has been shut down in order to prevent overtemperatures in the boiler.
On the heat consumers, it can be selected if and to what extent they shall respond to the different load control signals.
Heating circuits and DHW circuits always respond to critical locking signals. DHW circuits **never** respond to uncritical locking signals.

Heating circuits

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Mixing circuit controller

Operating line	*Range*	*Factory setting*
Response uncrit locking signals	Yes / No	Yes
Locking signal gain*	0…200 %	100 %

Primary controller

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Controller primary circuit

Main menu > Settings > Main controller > Mixing circuit controller

Main menu > Settings > Primary controller > Mixing circuit controller

Operating line	*Range*	*Factory setting*
Locking signal gain*	0…200 %	100 %

* Locking signal gain applies to both critical and uncritical locking signals

For the main controller and the primary controller, setting “Response to uncritical locking signals” is not required. Both **never** respond to uncritical locking signals because the associated hydraulic actuating devices shall be able to respond depending on the situation.
This locking signal gain is adjustable between 0 and 200 %.

Setting	*Response*
0 %	Locking signal will be ignored
100 %	Locking signal will be adopted 1-to-1
200 %	Locking signal will be doubled

This enables the heat consumer’s responses to be matched to the locking signals.

Setting note

If the heat consumer responds too promptly, the value must be decreased; if it responds too slowly, the value must be increased.

Ventilation controller, individual room control

Ventilation controller and individual room control do not respond to locking signals and forced signals.

Note on DHW priority

With absolute DHW priority, it is to be noted that this signal is always given priority and that it defines the resulting setpoint.

If some other heat consumer without absolute priority is in the same heat distribution zone, its value will be ignored, even if it is greater.
Generally, the function of absolute DHW priority in combination with heating circuits does not pose any problems; nevertheless, the correct plant function must always be kept in mind.
The use of absolute DHW priority poses problems especially in connection with ventilation plants since they often call for low flow temperatures.
In the case of shifting priority or with no priority, DHW heating makes it possible to select whether the heat demand signal shall be evaluated the normal way (maximum selection), or whether the DHW flow temperature setpoint shall be adopted as the resulting setpoint.
Refer to section 10.10 “DHW priority”.

5.7 Mixing valve control

5.7.1 Control

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Mixing circuit controller

Main menu > Settings > DHW > Controller primary circuit

Main menu > Settings > DHW > Controller maint sec temp

Main menu > Settings > DHW > Controller consumers

Main menu > Settings > Primary controller > Mixing circuit controller

Main menu > Settings > Main controller > Mixing circuit controller

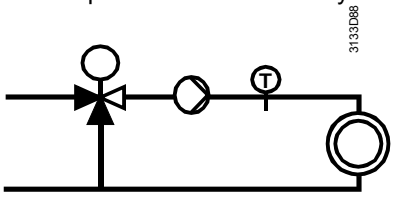
Main menu > Settings > Boiler > Return control

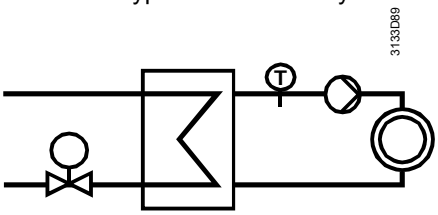
Operating line	*Range*	*Factory setting*
Actuator run time	1…600 s	Depending on various settings
P-band Xp	1…100 K	
Integral action time Tn	0…600 s	

5.7.2 Setting aids

Setting choices

With the help of the P-band (Xp) and the integral action time (Tn), the mixing valve algorithm can be optimally adapted to the relevant controlled system.
The controller is supplied with the control parameters set to values suited for the majority of controlled systems (typically flow temperature control with a 3-port mixing valve).
In the case of difficult controlled systems (e.g. heating circuit with heat exchanger), the control parameters must always be matched to the type of controlled system.



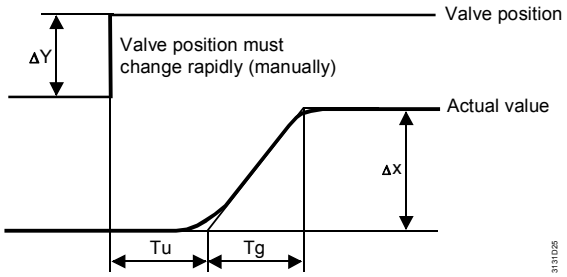


Setting with the help of the step response

A controlled system is usually characterized by the step response. This is explained on the basis of the following example of a mixing heating circuit.

Example

At the point in time t_o, the actuating device (actuator of mixing valve) shall be opened from 40 % to 80 %. As a result, the flow temperature will rise by Δx.



Tu Delay time
Tg Compensating time
Δx Change of actual value
ΔY Change of valve position

The longer the delay time in relation to the system time constant, the more difficult the control of the system. If the position of the actuating device is changed and the temperature sensor can only acquire the result of the change after a certain period of time, control is much more difficult than in the case of fast-acting systems.

Degree of difficulty

The degree of difficulty λ is calculated as follows:

$$\lambda = \frac{Tu}{Tg}$$

For the degree of difficulty of a controlled system, the following guide values can be used:

λ <0.1 = easy
λ 0.1…λ 0.3 = medium
λ >0.3 = difficult

Maximum system gain Ksmax

The maximum system gain Ksmax can be estimated based on the differential of maximum flow temperature upstream of the mixing valve and the minimum return temperature, for example. The value of Ksmax may have to be increased to give consideration to a nonlinear valve characteristic. TVmax = 80 °C and TRmin = 20 °C => Ksmax = 60 K.

Setting rules

P-band: $Xp = 2 \times Tu / Tg \times \Delta x / \Delta y \times 100\ \% \approx 2 \times Tu / Tg \times Ksmax$
Integral action time $Tn = 3 \times Tu$

Example

Change of valve position Δy = 40 %
Change of flow temperature Δx = 18 K
Tu = 6 s
Tg = 18 s

P-band: $Xp = 2 \times 6\ s / 18\ s \times 18\ K / 40\ \% \times 100\ \% = 30\ K$
Integral action time: $Tn = 3 \times 6\ s = 18\ s$

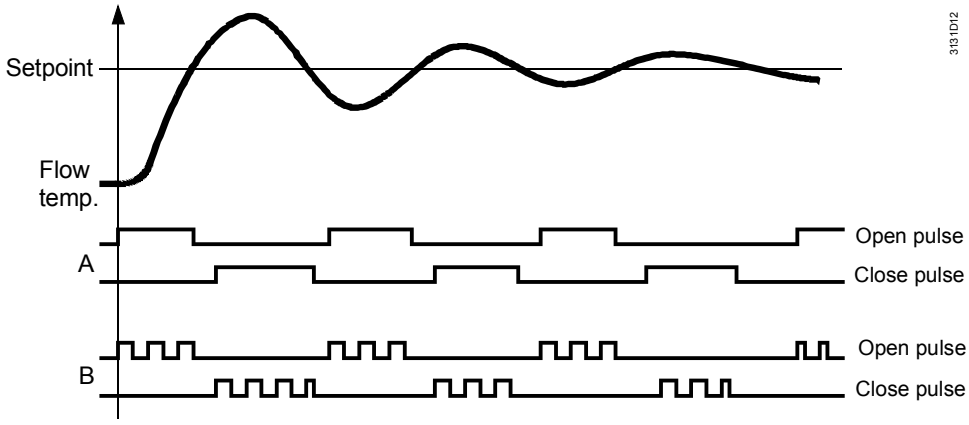
Note

To get a reliable step response, it is important to keep the temperature upstream of the valve and the return temperature (mixing) as constant as possible during the time the measurement is made.
During the measurement, the boiler and return temperatures should reflect winter conditions (relatively low outside temperatures).

Setting without step response

On actual plant, it is not always possible to get a reliable step response.
With no step response, or in the case of unsatisfactory control action after entry of the calculated parameters, the on / off pulses after a setpoint step give hints on setting the parameters.
A distinction is to be made between 2 cases:

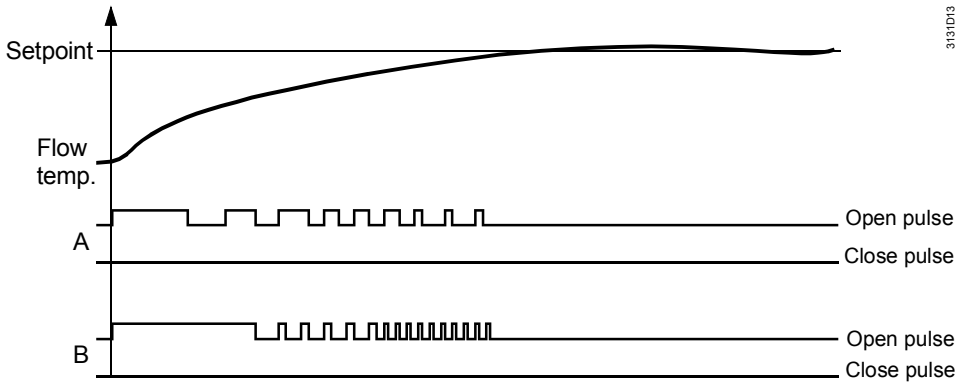
The flow temperature fluctuates about the setpoint



A The control pulses are too long:
Measure the effective valve running time (0…100 % stroke) and enter it. If the pulses are still too long, increase P-band Xp

B Several successive relatively short on or off pulses: Increase integral action time Tn

Flow temperature approaches the setpoint only slowly



A Difference between the first pulse and the following pulses is small:
Measure the effective actuator running time (0…100 % stroke) and enter it. If the control performance does not considerably improve: Decrease P-band Xp

B Long starting pulse followed by many short pulses: Decrease integral action time Tn

Actuator running time

The actuator running time must be matched to the type of actuator used.
This setting is important for both 3-position and DC 0…10 V actuators.
If in doubt with 3-position actuators, the setting is to be increased since otherwise the actuator will not optimally operate in the range between 0 and 100 % stroke (also refer to synchronization pulse in subsection 5.7.3).

Note

It is important to also set the actuator running time with DC 0…10 V actuators. Only this ensures correct operation of the control system.

P-band Xp

The P-band Xp is given in K (Kelvin).
If, after a setpoint step, the control deviation equals the P-band, the valve will be readjusted by 100 %.

Example

With a P-band of 40 K and a setpoint change of 5 K, the valve will be readjusted by 5 / 40 = 12.5 %. Using an actuator with a running time of 150 seconds, for example, this means that it takes the actuator 18.75 seconds to fully open or fully close.
If the P-band is increased, the controller will respond less promptly to the same control deviation. With a P-band of 60 K, for example, the actuator will only require 12.5 seconds to travel to the fully open or fully closed position.

Basic rule

Increase of P-band Xp means: The control responds more slowly and there is less tendency to oscillate.
This means:

- The control action is too slow.
  Decrease P-band Xp in steps of about 25 %
- The control action is too fast.
  Increase P-band Xp in steps of about 25 %

Integral action time Tn

The integral action time Tn is indicated in seconds and amounts to about 3 × Tu (also refer to ”Setting rules” above). Tu is impacted by great filter time constants, especially in the case of fast controlled systems.

The integral action time indicates how long it takes the controller in the event of a constant temperature deviation to deliver the same valve travel as this would be the case with the P-part.
For example, an integral action time of 120 seconds means that in the event of a control deviation of 5 K in the above example (Xp = 40 K), it takes the mixing valve 120 seconds to travel 2 × 12.5 % toward the fully open or fully closed position (12.5 % due to the P-part and 12.5 % due to the I-part).

If the integral action time is increased, the control system will respond more slowly but becomes more stable.

5.7.3 Control signal

Electrothermal actuators

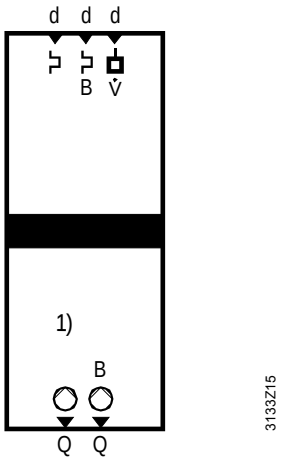
Since the control algorithm uses a stroke model which does not provide control beyond 0 % and 100 % respectively, the use of electrothermal actuators is no longer possible, as this was the case with the RVL47… controllers.

Synchronization pulse

For 3-position control, the actuator’s current position is acquired by a stroke model. As soon as the stroke model reaches 0 % or 100 % respectively, a synchronization signal (continuous on pulse or continuous off pulse for 1.5 times the running time) is delivered to the actuator, thus making certain it has reached the relevant position.
This synchronization pulse is repeated for one minute at 10-minute intervals.
If a position change is called for, the synchronization pulse will immediately be stopped.

5.8 Pump control and twin pumps

Every pump (main pump, boiler pump, system pump, heating circuit pump) can be monitored with a flow switch and an associated fault input.
Also, every pump can be a twin pump.



The decision whether the pump to be installed shall be a single or twin pump is made via “Extra configuration” at the respective function block (heating circuit, DHW, primary controller, main controller, boiler).

Outputs

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Outputs

Main menu > Commissioning > Extra configuration > DHW > Outputs

Main menu > Commissioning > Extra configuration > Primary controller > Outputs

Main menu > Commissioning > Extra configuration > Main controller > Outputs

Main menu > Commissioning > Extra configuration > Boiler > Outputs

Operating line	*Adjustable values / display / remarks*
…pump	Assign terminal
…pump B	Assign terminal

When both outputs (pump and pump B) are configured, the pump used is a twin pump. A fault input is also available for pump B. The flow switch is used by both pumps.

Inputs

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Inputs

Main menu > Commissioning > Extra configuration > DHW > Inputs

Main menu > Commissioning > Extra configuration > Primary controller > Inputs

Main menu > Commissioning > Extra configuration > Main controller > Inputs

Main menu > Commissioning > Extra configuration > Boiler > Inputs

Operating line	*Adjustable values / display / remarks*
[…pump] overload	Assign terminal
[…pump B] overload	Assign terminal
Flow signal pump	Assign terminal

If a twin pump was configured, the relevant function block will show menu item Twin pump.

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Twin pump

Main menu > Settings > DHW > Primary twin pump (or Secondary twin pump or Circulating twin pump)

Main menu > Settings > Primary controller > Twin pump

Main menu > Settings > Main controller > Twin pump

Main menu > Settings > Boiler > Twin pump

Operating line	*Range*	*Factory setting*
Run priority	Auto / Twin pump A / Twin pump B	Auto
Changeover period	–60…0…+60 s	0 s

5.8.1 Changeover logic

Run priority

For pump changeover, there are 3 choices available:

- Automatic changeover once a week; should the working pump become faulty, changeover to the second pump will take place.
  When switching on the next time, the pump that starts is always the pump that was in operation last
- Twin pump A is always the working pump.
  In the event of fault, changeover to pump B will take place. After correction of the fault, a change back to pump A will be made
- Twin pump B is always the working pump.
  In the event of fault, changeover to pump A will take place. After correction of the fault, a change back to pump B will be made

Changeover time

The changeover time used is the same time as that used for the pump / mixing valve kick (kick day and kick time).

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Protective functions

Operating line	*Range*	*Factory setting*
Kick day	Monday…Sunday	Monday
Kick time	00:00…23:59	10:00

Automatic changeover takes place after 168 hours (7 days) or – after a new start of the plant – when kick day and kick time are reached.
Kick day and kick time for pump changeover remain valid even if the pump kick has been deactivated.

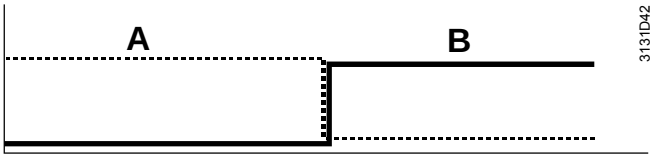
Changeover period

The change from one pump to the other can take place as follows, depending on the application:

- With no interruption
- With overlapping
- With interruption

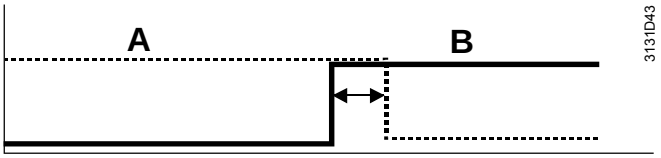
No changeover delay

The change from pump A to pump B takes place instantly:



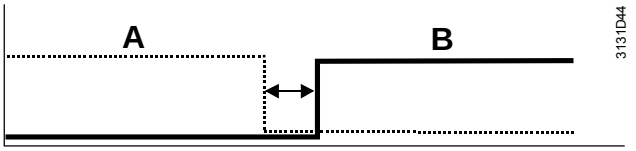
Changeover with negative delay

The change from pump A to pump B is made with temporal overlapping, e.g. to ensure a low noise level during changeover. The pump to be deactivated overruns for the adjusted period of time:



Changeover with positive delay

The change from pump A to pump B is made after a certain pause, e.g. to prevent surge voltages or excessive water pressures:



Pump kick

Depending on the changeover priority, the pump kick will act as follows:

Operating state of the pumps	*Impact of pump kick*	
	With automatic changeover	*With fixed assignment*
Both pumps do not run (summer operation)	Kick first acts on the pump that was in operation last	Kick first acts on the reserve pump and then on the working pump
One of the 2 pumps runs	Not applicable	Kick only acts on the reserve pump

The changeover delay also acts with pump kicks.

5.8.2 Overload message and supervision of flow

As with every digital input, the normal position can also be parameterized for the pump fault inputs and the flow input (... > Settings > Inputs > RM... (controller or module type) > Normal position).
If a twin pump is installed, changeover to the other pump takes place in the event of fault. In any case, a fault status message will be delivered.
For acknowledgement, following applies:

- A fault due to a missing fault status message must be acknowledged and reset
- If there is a pump fault, the respective function block will be stopped

For faults due to overload, the acknowledgement and reset behavior can be parameterized.
In the case of twin pumps, the fault behavior of the respective function block becomes active only should **both** pumps fail.
Flow supervision only becomes active 60 seconds after the pump is switched on.

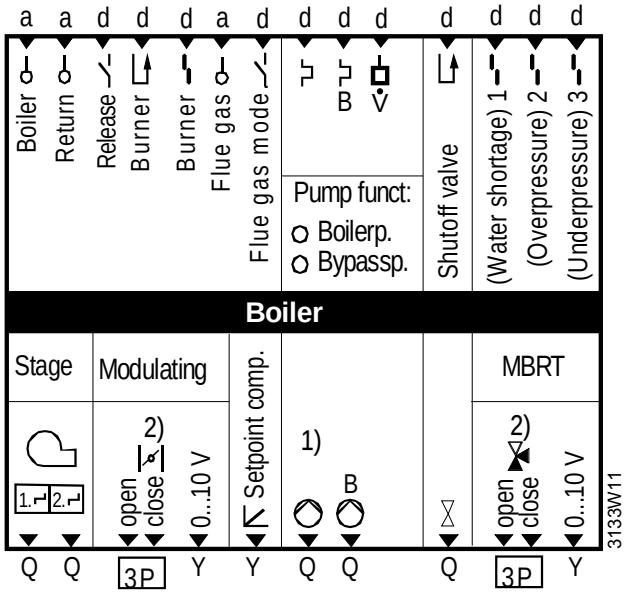
Fault status messages using the example of a heating circuit twin pump

Number	*Text*	*Description*
2526	[Heat circuit 1 pump] overload	Heating circuit pump of heating circuit 1 overloaded
2527	[Heat circuit 1 pump B] overload	Heating circuit pump B of heating circuit 1 overloaded
2528	[Heat circuit 1 pump] no flow	Heating circuit pump of heating circuit 1 with faulty flow
2529	[Heat circuit 1 pump B] no flow	Heating circuit pump B of heating circuit 1 with faulty flow
2530	[Heat circuit 1 pump] fault	Heating circuit pump(s) of heating circuit 1 faulty; partial plant stop

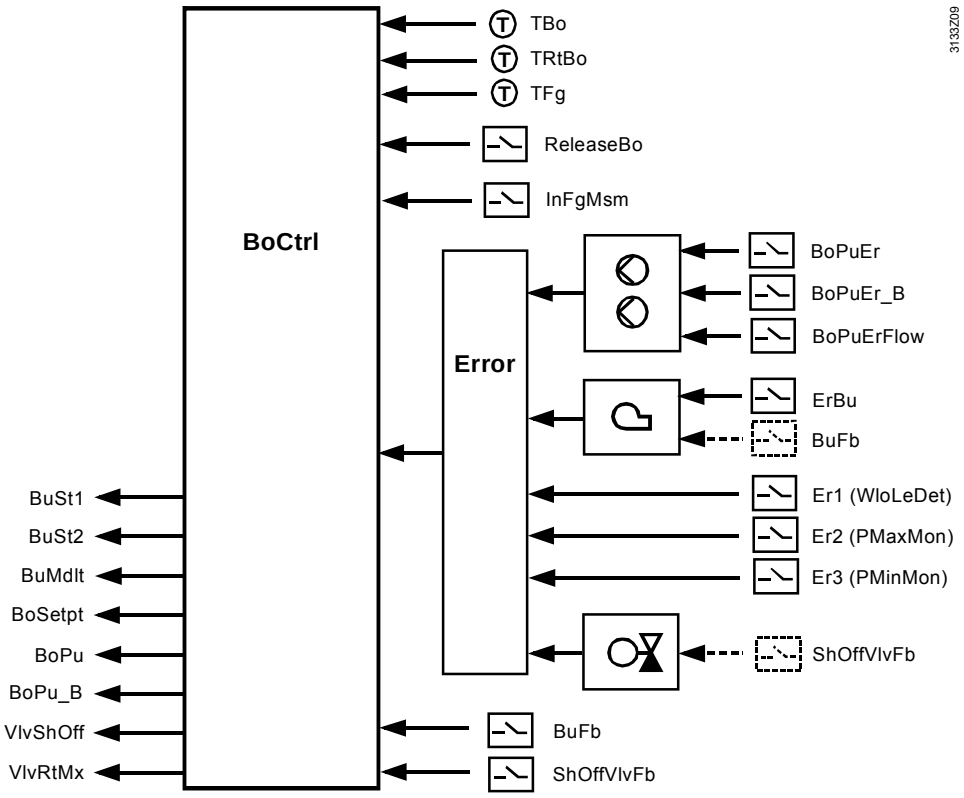
For the complete list of fault status messages, refer to section 15.1 "List of fault numbers".

6 Boiler temperature control

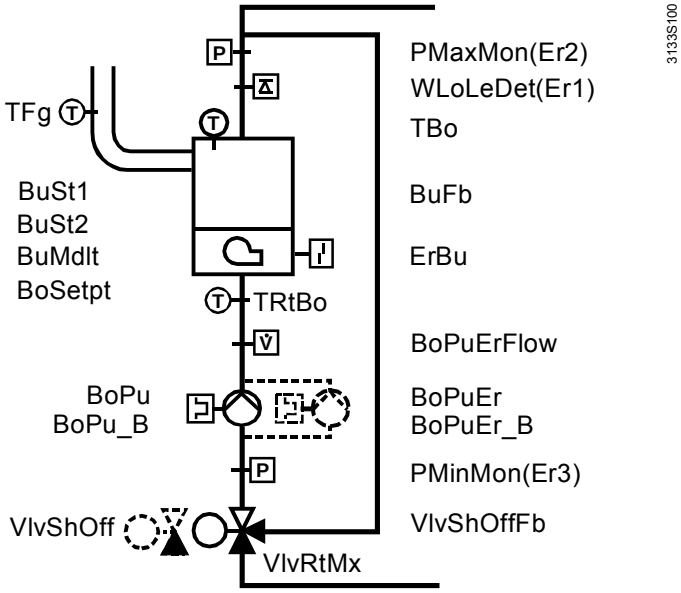
6.1 Overview of function block



Block diagram



Boiler diagram



BoPu	Boiler pump
BoPu_B	Boiler pump B
BoPuEr	Fault input boiler pump
BoPuEr_B	Fault input boiler pump B
BoPuErFlow	Flow supervision boiler pump
BoSetpt	Boiler temperature setpoint DC 0…10 V
BuFb	Checkback signal burner stage 1
BuMdlt	Modulating burner
BuSt1	Burner stage 1
BuSt2	Burner stage 2
WLoLeDet (Er1)	Fault input 1 (water shortage)
PMaxMon (Er2)	Fault input 2 (maximum pressure)
PMinMon (Er3)	Fault input 3 (minimum pressure)
ErBu	Fault input burner fault
TBo	Boiler temperature sensor
TFg	Flue gas temperature sensor
TRtBo	Boiler return temperature sensor
VlvRtMx	Maintained boiler return temperature
VlvShOff	Shutoff valve
VlvShOffFb	Checkback signal shutoff valve

6.2 Configuration

Basic configuration

The function block is activated in the factory for plant types H3-x and H4-x. Always preconfigured is a boiler with a 1-stage burner, boiler pump, boiler temperature and return temperature sensor. For plant types H4-x, a mixing valve with 3-position actuator for the maintained boiler return temperature is also preconfigured.
For more detailed information, refer to section 3.2 “Basic configuration”.

Main menu > Commissioning > Basic configuration

Operating line	*Range*	*Factory setting*
Plant type	H, H0-1…H6-7 Refer to subsection 3.2.1 “Selecting the plant type“	H0-2

Extra configuration

The basic configuration can be complemented and / or changed via “Extra configuration”. Here, the 1-stage burner can be changed to become a 2-stage or modulating burner, and shutoff valve, twin pump, flue gas temperature sensor and various checkback signals and fault status signals can be added. Naturally, plant types H3-x can be complemented by a mixing valve for the maintained boiler temperature.

Inputs

Main menu > Commissioning > Extra configuration > Boiler > Inputs

Operating line	*Adjustable values / display / remarks*
Boiler sensor	
Return sensor	
Release input	
Checkback signal burner	
Fault burner	
Flue gas temperature sensor	
Flue gas meas mode contact	
[Boiler pump] overload	
[Boiler pump B] overload	
Flow signal pump	
Checkb sign shutoff valve	
Fault input 1	
Fault input 2	
Fault input 3	

Outputs

Main menu > Commissioning > Extra configuration > Boiler > Outputs

Operating line	*Adjustable values / display / remarks*
Burner stage 1	
Burner stage 2	
Modulating burner 3-pos	
Modulating burner mod	
Setpoint compensation	
Boiler pump	
Boiler pump B	
Pump function	Boiler pump or bypass pump
Shutoff valve	
Maint boiler return temp 3-pos	
Maint boiler return temp mod	

Boiler sensor

For plant types with boiler, a boiler temperature sensor will automatically be configured. This sensor is mandatory for boiler temperature control, but it also serves for optional functions, such as minimum or maximum limitation of the boiler temperature.

Return sensor

For plant types with boiler, the return temperature sensor will always be configured too. For plant types using maintained boiler return temperature control via the mixing valve, this sensor is mandatory. In all other cases, the return temperature sensor can be used for maintained boiler return temperature via the bypass pump, maintained boiler return temperature with locking signal, or simply for display purposes.

Release input

Using the release input, a boiler can be locked from an external location. The operating action of the input can be parameterized at the respective terminal on Main menu > Settings > Inputs.

Checkback signal burner

The burner checkback signal can be used to provide additional supervision of the burner. If the checkback signal is not received after an adjustable period of time, the burner is considered to have locked out. If the burner checkback signal has been configured, the burner hours run counter is started only after the checkback signal has been received. If no checkback signal is configured, the burner hours run counter is started when stage 1 is switched on. This also gives consideration to the prepurge time, etc. Also refer to section 6.9 “Boiler faults”.

Checkback signal shut-off valve

If no checkback signal is received, an appropriate fault status message will be delivered. In addition, the burner will be started only if the shutoff valve's checkback signal indicates a fully open valve.
If no checkback signal is received, an appropriate fault status message will be delivered. For more detailed information, refer to section 6.9.

Flue gas temperature sensor

Using the flue gas temperature sensor, the flue gas temperature can be displayed and monitored.
For more detailed information, refer to section 6.7 “Flue gas temperature supervision”.

Flue gas measuring mode contact

With the flue gas measuring mode contact, function “Flue gas measuring mode” can be activated at the boiler.
For more detailed information, refer to section 6.7.

Burner fault

This terminal can be used for the burner’s fault status message.
For more detailed information, refer to section 6.9 “Boiler faults”.

Fault inputs 1…3

For additional fault supervision functions, there are 3 fault inputs available.
For more detailed information, refer to section 6.9.

Overload boiler pump

Fault input for monitoring the boiler pump.

Overload boiler pump B

Fault input for monitoring boiler pump B in the case of twin pumps.

Flow signal

Input for monitoring boiler pump flow.

6.2.1 Burner types

Selection of a plant type with boiler means that a 1-stage burner will be preselected. Using “Extra configuration“, other boiler types can be selected by configuring additional outputs:

- 1-stage burner (factory setting)
- 2-stage burner
- Modulating burner
- Setpoint compensation

Burner stage 1

First burner stage or basic stage of a modulating burner.

Burner stage 2

Second burner stage

Modulating 3-position burner

Configuration of a pair of terminals for a modulating 3-position burner.
Available for selection are the free pairs of terminals with special RC radio interference suppression; for details, refer to subsection 3.2.2 “Terminal assignment and properties of outputs”.

Modulating burner

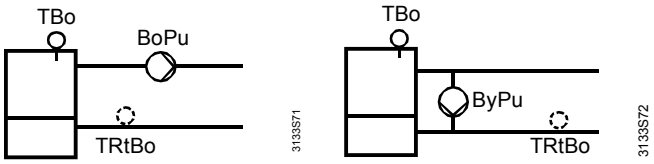
DC 0…10 V output for a modulating burner.

Setpoint compensation

DC 0…10 V output as a boiler temperature setpoint for an external boiler temperature controller.
If no control of the burner is required, the DC 0…10 V output can be used in place of the burner for setpoint compensation of a boiler. In that case, it is not the boiler temperature that is controlled, but the boiler temperature setpoint is shifted as a function of the heat requests.

6.2.2 Boiler hydraulics

Plant types H3-x



TBo	Boiler temperature sensor
TRtBo	Return temperature sensor (optional, for minimum limitation)
BoPu	Boiler pump
ByPu	Bypass pump

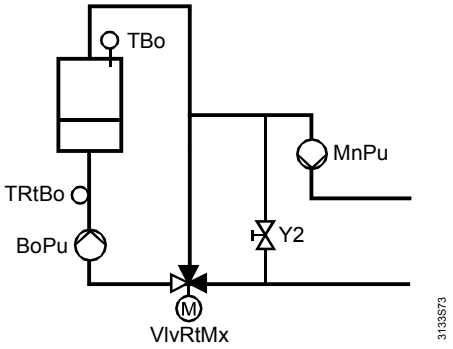
Boiler pump in the flow Boiler pump in the bypass

For plant types with boiler (H3-x and H4-x), a boiler pump is always configured. This boiler pump can also be operated parallel to the boiler, or it can be configured as a boiler bypass pump.

Pump function

When using the pump as a boiler bypass pump, the configuration must be made on the “Extra configuration“ menu.

Plant types H4-x



TBo	Boiler temperature sensor
TRtBo	Boiler return temperature sensor
BoPu	Boiler pump
MnPu	Main pump
VlvRtMx	Maintained return temperature mixing valve
Y2	Balancing valve

With plant types H4-x, the maintained boiler return temperature with 3-position mixing valve is already configured.

Maintained boiler return temperature with 3-position control

Configuration of a terminal pair for a 3-position mixing valve is required. The terminals available for selection are the free terminal pairs (Q1/Q2, Q3/Q4) for the on and the off signal. For that purpose, the special terminal pairs with RC radio interference suppression must be used.
For more detailed information, refer to subsection 3.2.2 “Terminal assignment and properties of outputs“.

Main pump

If, in addition, a main pump shall be configured, this must be done on the “Main controller” block.

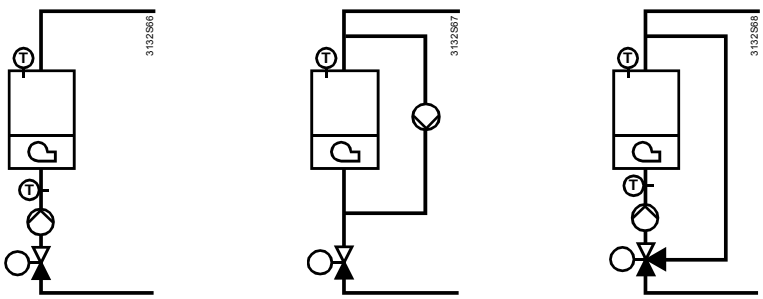
Twin pump

Optionally, a twin pump can be used in place of the boiler pump. In that case, in addition to boiler pump A, an output must also be assigned to boiler pump B via “Extra configuration“.
The single pump or twin pump can be monitored with a fault input and / or a flow switch.
For more detailed information, refer to section 5.8 “Pump control and twin pumps“.

Boiler pump B

Boiler pump B as a boiler twin pump

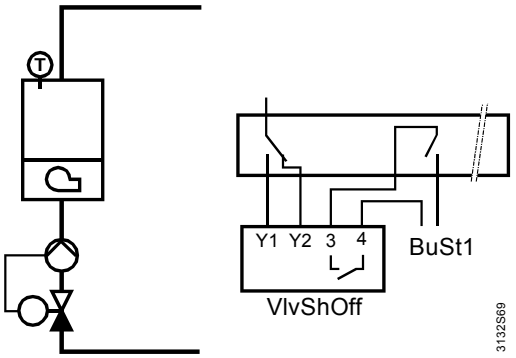
Shutoff valve



In most cases, the boiler can be hydraulically decoupled via a shutoff valve. In the case of plant with a mixing valve for minimum limitation for the return temperature, this function is performed by the mixing valve. If the boiler is not released, the mixing valve is driven to the fully closed position so that the boiler will be hydraulically decoupled from the plant.

Shutoff valve

Shutoff valve for hydraulically decoupling the boiler from the system. It is possible to configure the shutoff valve to terminals with changeover contact so that both an on and an off contact are available.
Often, the shutoff valve is controlled “parallel“ to the boiler pump (common output), or the boiler pump is controlled parallel to the shutoff valve, but activated only when the shutoff valve is fully open.



BuSt1 Burner stage 1
VlvShOff Shutoff valve

If the shutoff valve and the boiler pump are controlled by different outputs, the shutoff valve must be driven to the fully open position before the boiler pump is activated and before the burner is switched on. Complete opening of the shutoff valve is ensured either by the valve’s checkback signal or the selected switch-on delay for the pump.
If a checkback signal shall be delivered, input Checkb sign shutoff valve must be configured for it. If a checkback signal from the shutoff valve is configured and there is no such signal on completion of the adjusted switch-on delay time, a fault status message will be delivered. This fault will lead to a boiler fault.
For more detailed information, refer to section 6.9 “Boiler faults”.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Checkb sign shutoff valve

Operating line	*Range*	*Factory setting*
Signal delay start	00.05…59.55 m.s	02.00 m.s

If the boiler pump is installed in the bypass, there is no need to wait for switching on until the shutoff valve is open. In that case, the pump’s switch-on delay can be set to 0.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Operation settings

Operating line	*Range*	*Factory setting*
Switch-on delay pump	0…255 s	0 s
Switch-on delay burner	0…255 s	0 s
Shutoff valve (MBRT)	Open / Closed	Open

If both the pump’s switch-on delay and the burner’s switch-on delay are parameterized, first the pump will be activated on completion of the pump’s switch-on delay; then, on completion of the burner’s switch-on delay, the burner will be released.
The selected overrun time acts on both the boiler pump and the shutoff valve (for setting the overrun time, refer to subsection 6.6.4 “Boiler shutdown”).

Control of the shutoff valve

Normally, the shutoff valve is fully open when the boiler is released. In the case of the maintained boiler return temperature where the boiler is always kept at the minimum temperature, the behavior of the shutoff valve can be parameterized.
When Open is selected for the shutoff valve (maintained boiler temperature), the valve will always be opened when the burner runs, even if there is no heat request.

Depending on the type of hydraulic system used, this may not be required (e.g. bypass pump).

Maintained boiler return temperature, continuously

DC 0…10 V output for a DC 0…10 V mixing valve actuator.

For more detailed information, refer to subsection 6.6.11 “Maximum limitation of the boiler temperature”.

6.3 Boiler operating modes and boiler setpoints

Plant operation selector

■ Main menu > Boiler > Boiler operating mode

Operating line	*Range*	*Factory setting*
Preselection	Auto / Release DHW / Off	Auto
Setp preselection manual	---- / 8…140 °C	----
State	On / Off	
Cause	Commissioning / Frost protection for consumer / Overtemp protection/overrun / Frost protection for boiler / Operating mode selector / Prot boil startup Boiler / Release delay burner / Outside temperature lock / Minimum limitation boiler / Test mode / Flue gas measuring mode / Request / No request	

Preselection

The user can switch the boiler off via operation.
In operating mode “Release DHW“, only heat requests from DHW (digital input or via Konnex bus) will be taken into consideration.
If “Off” is preselected, the internal frost protection function remains active. Heat requests from an external consumer resulting from frost protection will also be considered.

Manual preselection of setpoint

This setting can be used to preselect a minimum request for the boiler controller, which means that a maximum selection based on the consumers' requests will be maintained.

State

The boiler’s state is indicated (On / Off).

Cause

It is indicated why the current state is active.

Boiler temperature setpoints

The boiler temperature setpoint will be generated based on the temperature requests received from the consumers plus the setpoint increase.
The boiler temperature setpoint and the actual boiler temperature can be called up on the info level.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Operation settings

Operating line	*Range*	*Factory setting*
Setpoint increase	0…50 K	0 K

6.4 Releasing and locking a boiler

Manual switch

A boiler can be released or locked either via the digital input (release input) or operation (boiler operating mode).

Main menu > Commissioning > Settings > ... or

Main menu > Boiler > Boiler operating mode

Operating line	*Range*	*Factory setting*
Preselection	Auto / Release DHW / Off	Auto

With the digital release input, the boiler will stay locked as long as the input is passive.

Frost protection and release input

If the boiler is locked via the release input, setting **Frost prot (release input off)** can be used to select whether or not the boiler shall remain off also when there is a heat request due to frost protection.

- Setting Off: The boiler also remains off in the event of risk of frost
- Setting On: The boiler will be put into operation to ensure protection against frost

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Frost prot (release input off)	Off / On	On

Outside temperature lock

The boiler can also be locked depending on the outside temperature:

- The boiler will be locked when the **attenuated** outside temperature exceeds the selected limit value
- The boiler will be released again when the **composite** outside temperature drops 1 K below the limit value

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Operation settings

Operating line	*Range*	*Factory setting*
Outside temp lock limit value	---- / 5…30 °C	---- °C

6.5 Test mode and commissioning aids

For commissioning and for test purposes, the boiler along with the burner can be put into various operating states via the service level.

Main menu > Boiler > Test mode

Operating line	*Range*	*Factory setting*
Preselection test mode	Auto / Boiler off / Pump on (burner off) / Stage 1 controlled / St 1+2 controlled / Modulating fixed	Auto
Boil setp test mode	10…95 °C	60 °C
Modulation value test mode	0…100 %	0 %
Actual value boiler temperature	Measured value	

Caution

The test mode is **not** automatically ended (no supervision of time-out!).
The inputs should only be overridden by qualified staff and only for a limited period of time!

During test mode, fault status message Boiler test operation active is displayed. It is maintained until preselection “Test mode“ is set back to “Auto“. This is to make certain that the plant will not be quit without ending the test mode.

Auto In the “Auto“ position, the boiler is released and the test mode deactivated.

Boiler off The boiler will be switched off, that is, the burner will be shut down and the pumps deactivated.

Pump on (burner off) The boiler is released. The aggregates (shutoff valve, maintained boiler return temperature with mixing valve, and boiler pump) are active, but the burner is still off.

Stage 1 controlled The boiler is released and the burner with its stage 1 or the basic stage maintains the adjusted test mode setpoint.

Stages 1 + 2 controlled The boiler is released and the burner with its stages 1 and 2 or the basic stage and modulating part maintains the adjusted test mode setpoint.

Modulating, fixed The boiler is released and the modulating burner runs to the modulation level according to the setting made. The burner will be switched off when the maximum boiler temperature limit value is exceeded.

6.5.1 2-position control with 1-stage burner

Adjustable variables for 2-position control with a 1-stage burner:
- Boiler’s switching differential
- Minimum burner running time

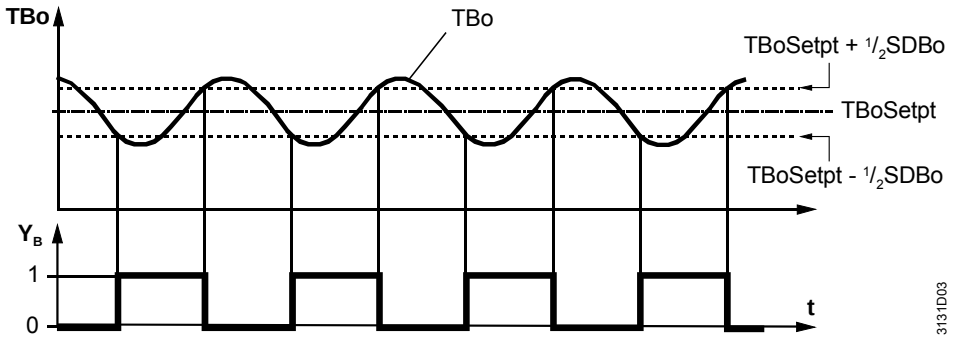
Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Burner

Operating line	*Range*	*Factory setting*
Boiler switching differential	1…20 K	6 K
Burner run time min	0…60 min	4 min

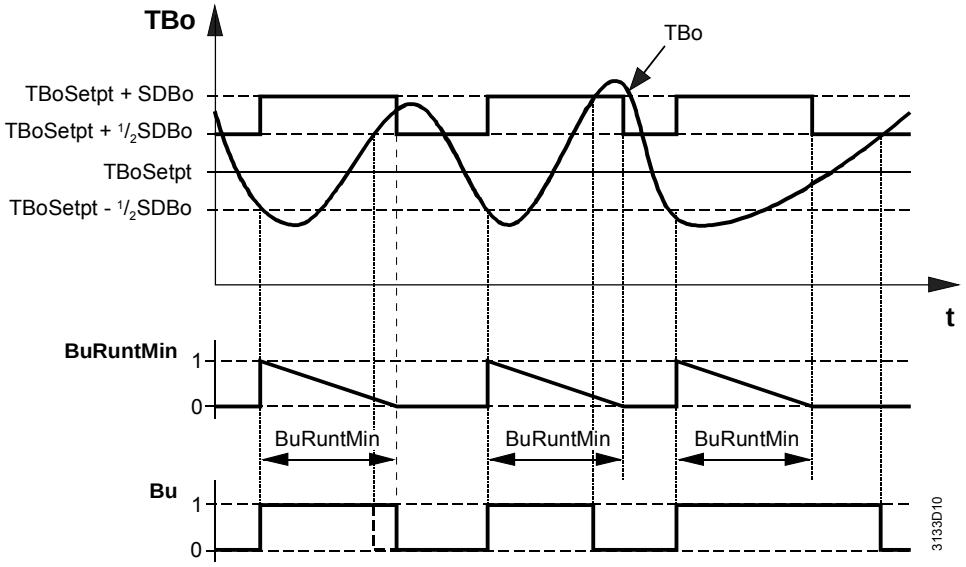
Switching differential The controller compares the actual value of the boiler temperature with the setpoint. If the boiler temperature falls below the setpoint by half the switching differential, the burner will be switched on. If the boiler temperature exceeds the setpoint by half the switching differential, the burner will be switched off.



SDBo	Boiler’s switching differential
t	Time
TBo	Boiler temperature
TBoSetpt	Boiler temperature setpoint
Y_B	Burner control signal

Minimum burner running time, burner cycling protection

If the switch-off point is reached before the minimum burner running time has elapsed, the burner will continue to operate until that time is completed (burner cycling protection). The minimum burner running time is given priority.
The burner's switch-off point will be raised by half the boiler's switching differential. If, within the minimum burner running time, the boiler temperature exceeds the setpoint by more than the full switching differential, the burner will be shut down although the minimum burner running time has not yet elapsed. On completion of the minimum burner running time, the burner's switch-off point will be set to the boiler temperature setpoint plus half the switching differential.



Bu	Burner
BuRuntMin	Minimum burner running time
SDBo	Boiler's switching differential
t	Time
TBo	Boiler temperature
TBoSetpt	Boiler temperature setpoint

6.5.2 2-position control with 2-stage burner

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Burner

Operating line	*Range*	*Factory setting*
Release limit stage 2	0…500 K×m	50 K×m
Reset limit stage 2	0…500 K×m	10 K×m
Locking time stage 2	0…60 min	10 min

6.5.3 Control of burner's basic stage and stage 2

This subsection describes the switching logic of the basic stage and the release and reset criteria for 2-stage burner operation.

Basic stage

As long as stage 2 is locked, the basic stage operates like a 1-stage burner.
As soon as stage 2 is released, the calculated switch-on and switch-off points for stage 2 apply.
Exception: The second burner stage will be switched off as soon as the actual boiler temperature has risen to a level lying the setting value Delta boiler max (stage 2) below the maximum boiler temperature (refer to subsection 6.6.12 "Protection against pressure shocks". If the maximum boiler temperature is exceeded, the basic stage will also be switched off and stage 2 locked.

Burner stage 2

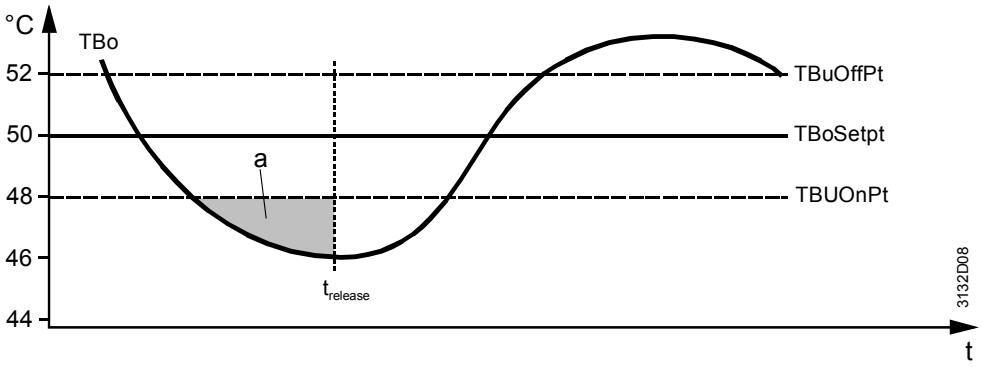
The release logic for 2-stage operation aims at ensuring an optimum switch-on time for stage 2 which, in addition to a time criterion, also considers the amount of heat deficit, calculated with a temperature-time integral.

Time criterion

As soon as the burner's basic stage is switched on, the minimum locking time for burner stage 2 starts to run. This ensures that the burner will always operate with the basic stage for a certain minimum period of time.

Temperature-time integral

The temperature-time integral is a continuous summation of the temperature differential over time. In this case, the decisive criterion is the difference by which the boiler temperature falls below the burner's switch-on setpoint.



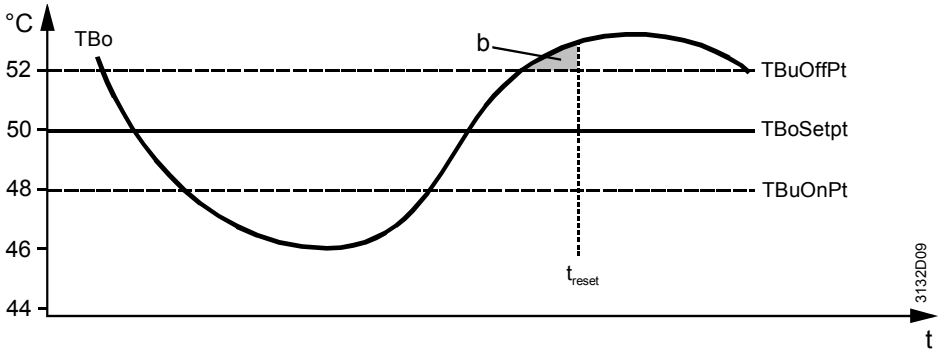
a	Release integral
TBoSetpt	Boiler temperature setpoint
TBuOffPt	Burner's switch-off temperature
TBuOnPt	Burner's switch-on temperature
TBo	Actual value of the boiler temperature
t	Time
$t_{release}$	Time to release

As long as the boiler temperature lies below the switch-on point – after the basic stage has been switched on – the controller will build up the release integral. If the boiler temperature lies above the switch-on point, the controller will reduce the release integral. Through the generation of the temperature-time integral it is not only the period of time that is considered, but also the extent of undershoot. This means that when the undershoot is significant, the release after the integral criterion will be reached earlier than with a small undershoot.

When the release integral (area "a" in the diagram) reaches the set value of the release integral of stage 2 (point in time $t_{release}$) and the minimum locking time has elapsed, stage 2 will be released. During the period of time burner stage 2 is released, the controller will activate and deactivate stage 2 according to the set switching differential.

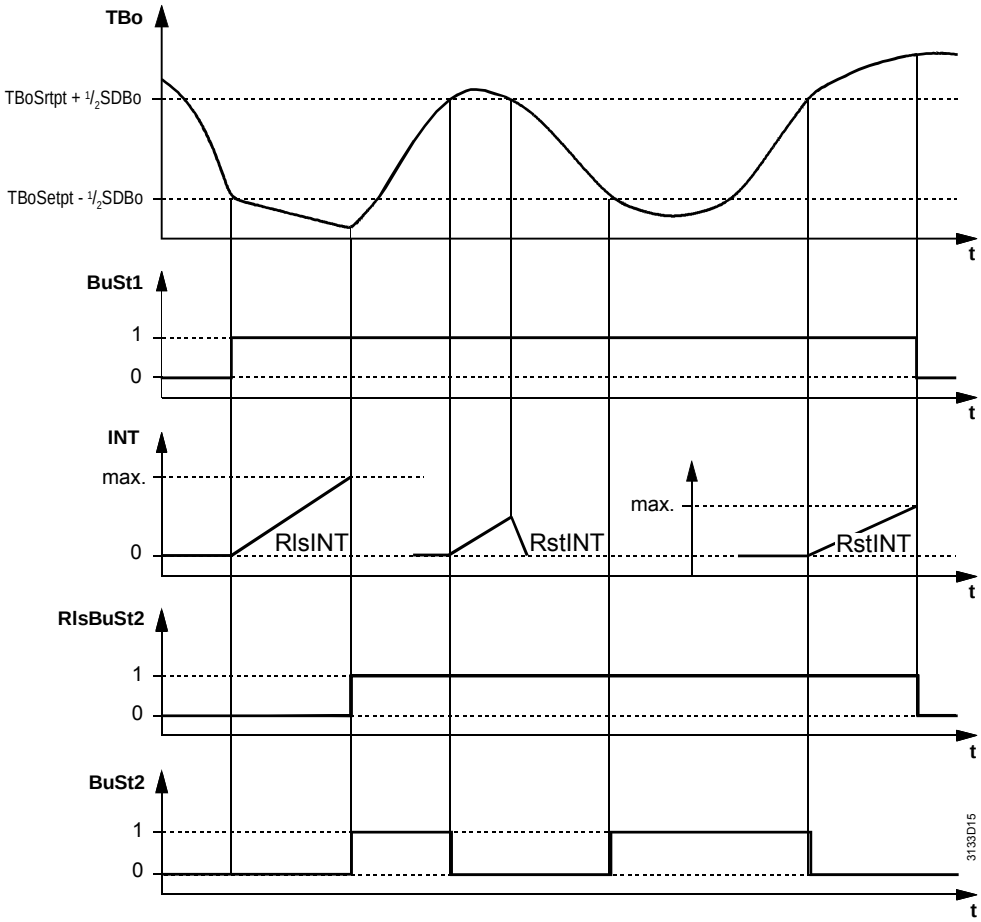
Logic for locking stage 2

The logic for locking burner stage 2 is based on the amount of excess heat, which is also calculated with the help of a temperature-time integral.
As long as the boiler temperature lies above the switch-off point – after the second stage has been switched off – the controller will build up the reset integral. If the boiler temperature lies below the switch-off point, the controller will reduce the reset integral. The duration and the difference between switch-off point and boiler temperature will be summed up.



b	Reset integral	TBo	Actual value of the boiler temperature
TBoSetpt	Boiler temperature setpoint	t	Time
TBuOffPt	Burner's switch-off temperature	t_{reset}	Time to reset
TBuOnPt	Burner's switch-on temperature		

Through the generation of the temperature-time integral it is not only the period of time that is considered, but also the extent of overshoot. This means that when the overshoot is significant, burner stage 2 will be locked earlier.
When the reset integral (area "b" in the diagram) reaches the set value of the reset integral of stage 2 (point in time t_{reset}), stage 2 will be locked and the basic stage switched off.



BuSt1	Burner stage 1	SD	Switching differential
BuSt2	Burner stage 2	Setpt	Setpoint
INT	Integral	t	Time
RlsBuSt2	Release of burner stage 2	TBo	Boiler temperature
Rst	Reset		

Note

If, with stages 1 and 2 released, both stages are locked at the same time, the basic stage will be switched off with a delay of 10 seconds. Switching off in 2 stages also reduces the pressure shocks in the gas supply line. This prevents unnecessary lockout in the case of large boiler outputs.

6.5.4 Control of modulating burners

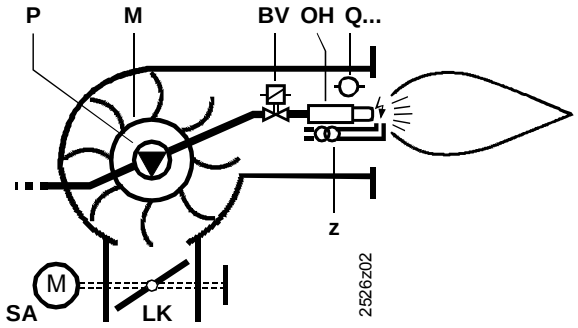
Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Burner modulating

Operating line	*Range*	*Factory setting*
Actuator run time	1…600 s	60 s
P-band Xp	1…200 K	20 K
Integral action time Tn	0…600 s	150 s
Derivative action time Tv	0…30 s	20 s

Modulating burners only modulate above a certain level. For standard forced draft burners, this level is at about 30 to 40 % of the rated capacity.

When the demand for heat is small, the basic stage cycles. When the demand for heat increases, the 3-position output or a DC 0…10 V output is used to control the combustion air damper.
At the same time, the amount of fuel supplied will also be increased, typically via an additional switch on the air damper, or by simultaneous control of the amount of fuel (gas / air ratio).



Basic design of a forced draft burner

BV Fuel valve(s)
ACC Combustion air damper, fixed or motorized
M Fan
OH Oil preheater; located between nozzle and adjustable head with small light-oil burners, separate unit in the case of large heavy-oil burners
P Oil pump, coupled to fan motor
Q… Flame detector
SA Electromotoric air damper actuator
Z Ignition transformer

The functioning with regard to activation and deactivation of the basic stage corresponds to that of 2-stage burner operation. Release of modulation is analogous to the release of the second stage.
The parameters used for the release and reset integral are the same as those used for the 2-stage burner. Compared to the 2-stage burner, the release integral should be selected smaller however (because in this case, it is not the entire capacity of stage 2 that is switched on, but only the modulating part that is released), and the reset integral can be selected greater.

Recommended values for modulating burners

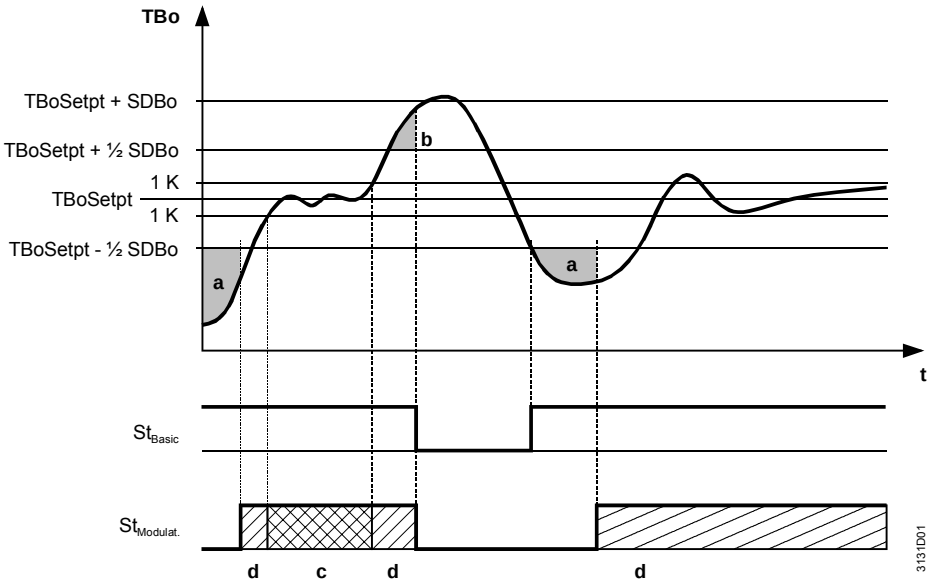
Release integral stage 2 or modulation: 10 K×m
Reset integral stage 2 or modulation 20 K×m
Locking time stage 2 or modulation 10 min

The locking time of stage 2 or modulation must be matched to the type of burner. This ensures that the burner will always run in its basic stage for a minimum period of time.

On burner startup and release of the basic stage, the controller drives the damper actuator towards the fully closed position for a certain period of time. This ensures that, after the burner startup sequence (prepurging, ignition, stabilization of flame, etc.), the

damper actuator will be driven to the start position so that only the basic stage will be used for heating.
Deactivation or locking of modulation occurs at the same moment in time as the change from the basic stage to cycling operation. If not yet done, the controller will again drive the damper actuator to the fully closed position.

Release integral modulation



a Release integral modulation (release integral stage 2 with 2-stage burner)
b Reset integral modulation (reset integral stage 2 with 2-stage burner)
c Neutral zone
d On / off pulses
SDBo Boiler's switching differential
St Basic Burner's basic stage
St Modul. Burner's modulation stage
TBoSetpt Boiler temperature setpoint

Neutral zone

The controller has a neutral zone with a band of ±1 K about the current boiler temperature setpoint. If the boiler temperature stays within the neutral zone for a period of time beyond the adjusted integral action time, no more positioning pulses will be delivered. If the boiler temperature does not stay long enough in the neutral zone, or outside of it, positioning pulses will drive the actuator toward the fully open or fully closed position. Maximum limitation of the boiler temperature and minimum burner running time are handled analogously to 2-stage burner operation.

Settings

Control of the air damper must be matched to the plant's behavior (controlled system) to ensure that if the load changes (e.g. increase of heat demand), the plant will quickly increase heat production in a way that the boiler temperature will only slightly deviate from its setpoint, and for short periods of time only.
The following settings can be made on the controller:

- Air damper running time
- Proportional band (Xp)
- Integral action time (Tn)
- Derivative action time (Tv)

Actuator running time

To ensure correct control of the burner, the effective air damper running time must be set. The modulation range is decisive for the actuator's running time.

Example

Running time of damper actuator (90°) = 15 seconds, minimum position of damper actuator = 20°.
Maximum position of damper actuator = 80°.
Hence, the damper actuator running time effective for the control is as follows:

$$\frac{15\ s * (80° - 20°)}{90°} = 10\ s$$

Proportional band (Xp)

The proportional band has an impact on the controller's P-characteristic.
With a setpoint / actual value deviation of 20 K, a setting of Xp = 20 K produces a manipulated variable corresponding to the damper actuator's running time.

Integral action time (Tn)

The integral action time has an impact on the controller's I-characteristic.

Derivative action time (Tv)

The derivative action time has an impact on the controller's D-characteristic. If Tv = 0, the controller has PI characteristics.

Setting rules for Xp, Tn and Tv

The majority of plants change their behavior depending on the load.
If the setting values are not adequately adjusted, the control system's response is either too slow or too fast. If the control system operates correctly in the upper load range and not satisfactorily in the lower load range (or vice versa), average values must be used, which may lead to a slightly less satisfactory control performance in the load range which previously showed good performance.

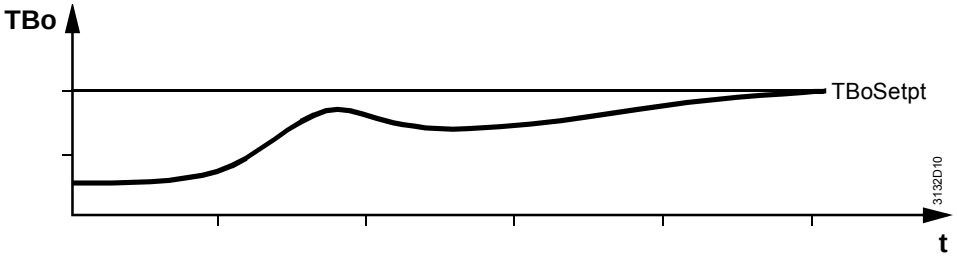
It should be made certain that, when commissioning the modulating burner for the first time, the default parameters for Xp, Tn and Tv will be used. To optimize and check the control parameters, it is recommended to follow the procedure detailed below under "Checking the control function".

Checking the control function

To check the behavior of the control system with the preset control parameters, the following procedure is recommended:
After the controller has reached and held the setpoint for a certain period of time, change the setpoint by 5 to 10 %, either up or down. When making this test, it is of advantage to have the plant operating in the lower load range where, usually, control is more difficult.
In principle, control must be stable, but it can be fast- or slow-acting.
If fast control is required, the boiler temperature must reach the new setpoint fairly quickly.
If fast control of a setpoint change is not a mandatory requirement, the control action can be rather slow. This offers practically non-oscillating control, which reduces wear on the actuator and on other electromechanical controls used in the plant.
If the correcting action does not produce the required result, the control parameters should be adjusted as follows:

Control action is too slow

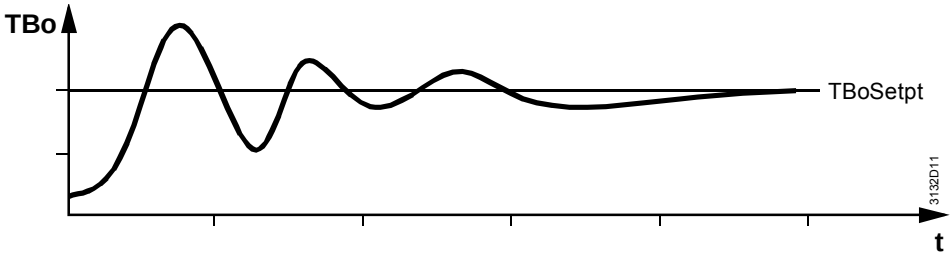
If the control system's response is too slow, setting parameters Xp, Tv and Tn must be decreased in steps. A new readjustment should be made only after the control action resulting from the previous readjustment is completed.



1. Reduce Xp in steps of about 25 % of the previous value.
2. Reduce Tv in steps of 1 to 2 seconds (when the value of 0 is reached, the controller operates as a PI controller).
   If this is not sufficient:
3. Decrease Tn in steps of 10 to 20 seconds.

Control action is too fast

If the control system's response is too prompt so that significant overshoot or even permanent oscillations occur, setting parameters Xp, Tn and Tv must be increased in steps. A new readjustment should be made only after the control action resulting from the previous readjustment is completed.



1. Reduce Xp in steps of about 25 % of the previous value.
2. Increase Tv in steps of 2 to 5 seconds.
   If this is not sufficient:
3. Increase Tn in steps of 10 to 20 seconds.

6.5.5 External boiler temperature control

Setpoint compensation

The RMH760B delivers a DC 0…10 V signal as the boiler temperature setpoint for an external boiler temperature controller.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Setp compensation boiler

Operating line	*Range*	*Factory setting*
Setpoint at 0 Volt	–150…50 °C	0 °C
Setpoint at 10 Volt	50…500 °C	100 °C
Limit value	0…140 °C	10 °C

Using setting parameters, the DC 0…10 V output can be matched to the receiver's input. In the case of setpoints below the limit value, the output indicates DC 0 V.

6.6 Protective boiler functions

Main menu > Commissioning > Settings > ... or

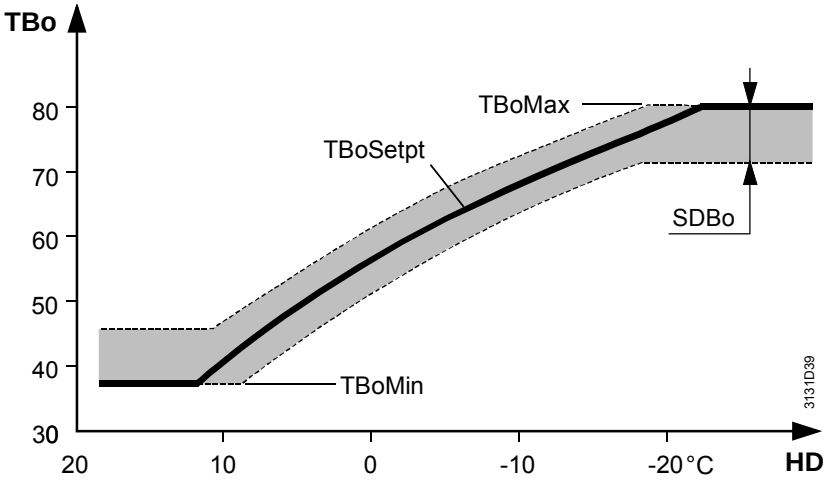
Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Boiler temperature max	25…140 °C	95 °C
Boiler temperature min	8…140 °C	10 °C
Optimization min boiler temp	On / Off	On
Boiler return temperature min	---- / 8…140 °C	---- °C
Bypass pump switching diff	1…20 K	6 K
Lock sig maintained boil ret temp	None / Uncritical / Critical	Critical
Frost prot (release input off)	0…60 min	6 min
Frost prot (release input Off)	On / Off	On
Frost prot (release input off)	On / Off	Off
Protective boiler startup	On / Off	On
Protective boiler startup	Pump on / Pump off	Pump on
Delta boiler temp max (stage 2)	0…10 K	1 K

6.6.1 Maximum limitation of the boiler temperature

This setting is used to provide maximum limitation of the boiler temperature setpoint. For control of the burner, this value represents the switch-off point. In this range, the boiler's switching differential downward is calculated.

⚠ Maximum limitation of the boiler temperature is always active. The only exception is the wiring test.



HD	Heat demand
SDB0	Boiler's switching differential
TBo	Boiler temperature
TBoMax	Maximum limit of the boiler temperature
TBoMin	Minimum limit of the boiler temperature
TBoSetpt	Boiler temperature setpoint

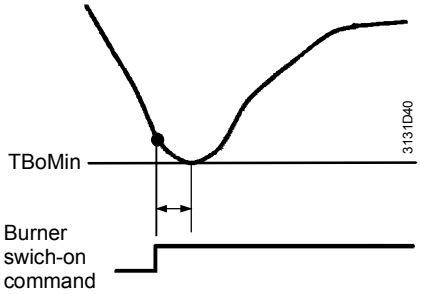
6.6.2 Minimum limitation of the boiler temperature

This setting is used to provide minimum limitation of the boiler temperature. For control of the burner, this value represents the switch-on point. In this range, the boiler's switching differential upward is calculated.
Maintenance of the minimum boiler temperature is dependent on the boiler shutdown setting (see below).
When there is a heat request, the minimum boiler temperature is always active.

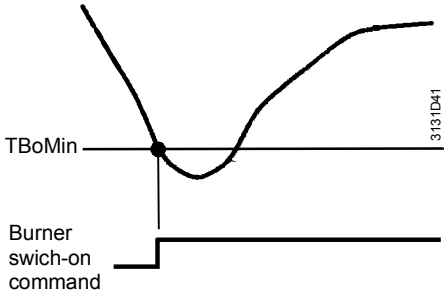
⚠ If a minimum return temperature is required, it must be ensured that the minimum boiler temperature will be set to a level which lies a few K above the minimum return temperature.

6.6.3 Optimization of minimum boiler temperature

If optimization of the minimum boiler temperature is set to On, the control system will select the switch-on point such that, normally, the boiler temperature will not drop below the minimum. Using this function, a load-dependent forward shift of the burner's switch-on point can be achieved. In that case, the minimum boiler temperature need not be determined with an unnecessarily great safety factor since with large loads, the burner switches on earlier and, with small loads, later. Hence, the range in which the boiler temperature can be shifted can be widened.
Based on the boiler temperature gradient, the controller calculates the burner's switch-on point to ensure that the boiler temperature will not drop below the minimum.
When the function is deactivated, the controller switches the burner on at the minimum boiler temperature TBoMin.



Optimization of minimum boiler temperature On



Optimization of minimum boiler temperature Off

6.6.4 Protection against boiler overtemperatures

To protect the boiler against overtemperatures on burner shutdown because, possibly, none of the heat consumers draws heat, a consumer overrun time can be set.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Consumer overrun time	0…60 min	6 min

After the burner has shut down, the overrun time ensures that the heating circuits and DHW heating will still draw heat for that period of time, provided they were consuming heat up to one minute before the burner was shut down. In any case, pumps and mixing valves have an overrun time of 60 seconds. For more detailed information, refer to section 5.4 “Pump overrun and mixing valve overrun”.
The overrun time also applies to boiler pumps and shutoff valves (including mixing valves for the maintained boiler return temperature).

6.6.5 Pump kick and valve kick

The pump kick is a protective function which is performed periodically. It prevents pumps and / or valves from seizing after longer off periods. For more detailed information, refer to section 5.5 “Pump kick and valve kick”.

6.6.6 Frost protection (release input Off)

If an external release input is switched to “Off", it can be determined here whether or not the frost protection function shall be active:

Entry	*Effect*
On	Frost protection active
Off	Frost protection inactive

6.6.7 Frost protection for plant with boiler pump

Set whether plant frost protection acts on boiler pump. For details on plant frost protection, see Section 5.3 "Frost protection for the plant“.

6.6.8 Protective boiler startup

To protect the boiler against condensation, a minimum boiler temperature is usually preset. This ensures that, in normal operation, the boiler temperature will not fall below a minimum level.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Protective boiler startup	On / Off	On

To prevent the boiler temperature from staying below that minimum level for unnecessary lengths of time, the amount of heat drawn by DHW heating and the heating circuits can be restricted until the boiler temperature has again risen above the minimum limit value. Protective boiler startup generates critical locking signals (for more detailed information, refer to subsection 5.6.2 “Load control”).
In the case of plant with mixing valve for the maintained boiler temperature, protective boiler startup is ensured by the mixing valve. In that case, locking signals for protective boiler startup will not be generated.

Boiler pump

It can be selected whether or not the boiler pump shall be switched off (pump off) when protective boiler startup is active.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Protective boiler startup	Pump on / Pump off	Pump on

Protective boiler startup and frost protection for the plant

Protective boiler startup can be interrupted by the controller in order to ensure frost protection for the plant in the event of burner faults, for example.
In the case of protective boiler startup and simultaneous frost protection for the plant, the boiler temperature gradient must turn positive within 15 minutes. Otherwise, the locking signal will become invalid for at least 15 minutes. Protective boiler startup becomes active after 15 minutes as soon as the boiler temperature gradient turns positive.

6.6.9 Boiler shutdown

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Protective boiler startup

Operating line	*Range*	*Factory setting*
Boiler shutdown	Without / Automatic / Summer	Automatic

Here, it can be selected when minimum limitation of the boiler temperature shall be active.

Without boiler shutdown

This setting ensures that the boiler is always maintained at the minimum boiler temperature.

Automatic boiler shutdown

This setting ensures that the boiler is maintained at the minimum boiler temperature when there is a heat request from one of the consumers. If there is no heat request, the boiler temperature may drop below its minimum.

Summer

When using the **Summer** setting, the boiler is not maintained at the minimum boiler temperature only when the boiler has identified summer operation. The change to summer operation takes place at midnight when, previously, the boiler has received no heat request from the heating circuits for 48 hours. A heat request from DHW heating will be accepted, however.
The boiler also identifies summer operation when it has received no valid boiler temperature setpoint for more than 48 hours, or when the composite outside temperature has exceeded the outside temperature limit value.

6.6.10 Frost protection for the boiler

The boiler temperature is monitored to ensure frost protection for the boiler.
If the boiler temperature drops below 5 °C, the burner will be switched on.
When the boiler temperature returns to a level above TBoMin + SD (minimum boiler temperature plus switching differential), the burner will be shut down.

6.6.11 Maintained boiler return temperature

Minimum limitation of the return temperature shall ensure that, in the area of the boiler inlet also, the temperature will not drop below the permissible level.

Main menu > Commissioning > Settings > ... or

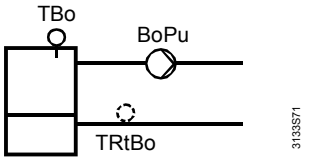
Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Boiler return temperature min	---- / 8…140 °C	----
Lock sig maintained boil ret temp	None / Uncritical / Critical	Critical

Maintained boiler return temperature through lower consumer set-points

In the case of a boiler with the boiler pump connected in series with the boiler, the maintained boiler return temperature is ensured by reducing the amount of heat drawn by the heating circuits. The function is activated as soon as a minimum limit value of the boiler return temperature is set and a return temperature sensor is present.

This function is also available when only a return temperature sensor is configured (that is, no boiler and no pump). It is intended for use in plants with no direct boiler control. In a networked system, only one boiler return sensor may be used since its measured value can generate a locking signal. Locking signals may only have one single source.

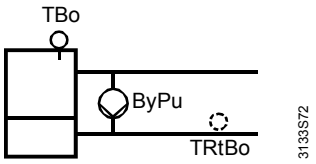


If the boiler return temperature drops below the limit value, a locking signal will be generated and delivered to all consumers. These will then lower their setpoints or switch their pumps off (e.g. the storage tank charging pump).
The type of locking signal can be parameterized. The factory setting generates a critical locking signal. This means that heating circuits, precontrol, DHW charging and, if present, a system pump would be switched off or reduced.
Setting **Uncritical** (uncritical locking signals) ensures that DHW heating, precontrol, and the system pump will not be impacted by the maintained boiler return temperature. For the heating circuits, it can be parameterized whether or not they shall respond to uncritical locking signals.

It is important to check whether the return temperature sensor is exposed to return water in all operating states. If, during DHW charging, the return temperature is not correctly acquired, it must be made certain that the maintained boiler return temperature will have no impact on DHW heating. Also, the maintained boiler return temperature must not act on the main pump if the return temperature is only correctly acquired when the main pump runs.

Maintained boiler return temperature with bypass pump

In the case of a boiler with bypass pump (boiler pump parallel to the boiler), maintained boiler return temperature can be ensured by activating the bypass pump.



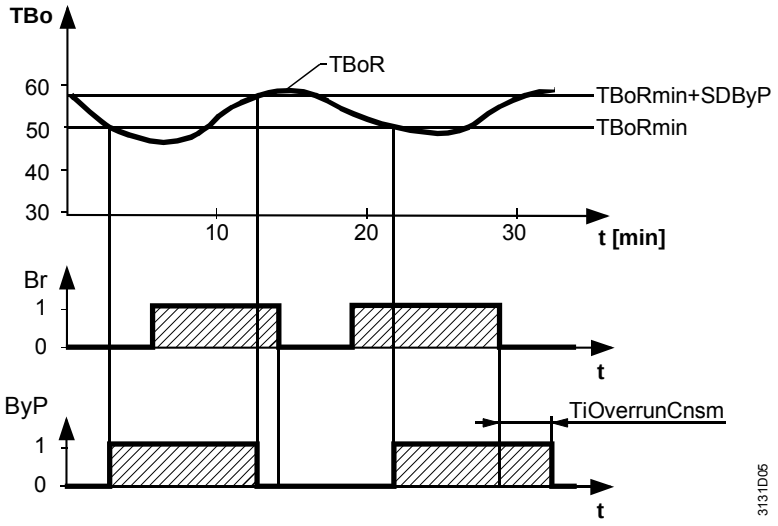
The bypass pump can be controlled either according to the acquired return temperature or, when there is no sensor, parallel to burner operation.
Normally, the return temperature sensor is installed upstream of the bypass pump (on the consumer side) to avoid too frequent switching of the bypass pump.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Bypass pump switching diff	0…20 K	6 K

The return temperature is controlled with the bypass pump in 2-position mode within the adjustable switching differential.
The pump will be activated when there is demand for heat and when the return temperature drops below its minimum limit value.
The pump will be deactivated when the return temperature exceeds its minimum limit value by the switching differential, or when there is no demand for heat.



Br	Burner
ByP	Bypass pump
SDByP	Switching differential of bypass pump
t	Time
TBo	Boiler temperature
TBoR	Boiler return temperature
TBoRmin	Minimum limit value of the boiler return temperature
TiOverrunCnsm	Consumer overrun time

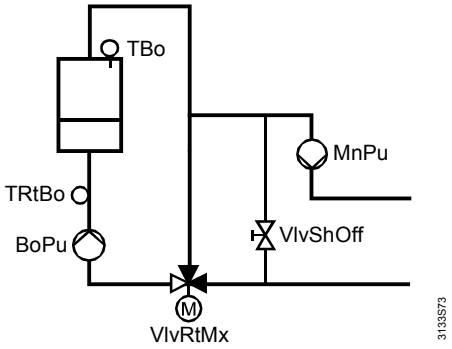
After the burner has been shut down, pump overrun (refer to section 5.4 “Pump overrun and mixing valve overrun”) also acts on the bypass pump.
In addition to activating the bypass pump, locking signals are generated if required and when a return temperature sensor is connected. If this is not required, setting “None“ can be selected for “Lock sig maintained boil ret temp”.

Control of the bypass pump parallel to burner operation

If no return temperature is available, the bypass pump will be controlled parallel to burner operation. The bypass pump always runs when released and when the basic burner stage is on.

Maintained boiler return temperature controlled by mixing valve

When using a boiler with mixing valve in the boiler return (plant type H4-x), maintained boiler return temperature will be ensured by the separate mixing valve.



The 3-port mixing valve ensures both protective boiler startup and maintained boiler return temperature.
The main pump can also be configured, in addition to the boiler pump. In that case, it must be made certain that the main pump will not operate when the mixing valve is fully closed. To prevent this, a bypass or overflow valve can be installed.
In this type of plant, the main pump provides the function of a system pump. And with this type of plant, it must be made certain that the main pump will not operate when the main controller's mixing valve is fully closed. It is recommended not to use a mixing valve in connection with the main controller.
To adapt the control parameters to the type of plant (actuator and controlled system), the same setting parameters as those used with the mixing heating circuit are available. For more detailed information, refer to section 5.7 "Mixing valve control".

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Return control

Operating line	*Range*	*Factory setting*
Actuator run time	1…600 s	120 s
P-band Xp	1…100 K	50 K
Integral action time Tn	0…600 s	60 s

⚠ If a minimum return temperature shall be ensured, the minimum boiler temperature must be selected accordingly. The minimum boiler temperature must be higher than the minimum return temperature.

Faulty return temperature sensor

In the case of plants with mixing valve for the maintained boiler return temperature, the mixing valve will be driven to the fully closed position when the return temperature sensor is faulty and then deenergized to allow manual adjustment.
If no return temperature sensor is configured, a fault status message will appear.
If a return temperature sensor is configured but no return temperature limitation set, the sensor will only be used for display purposes.

6.6.12 Protection against pressure shocks

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Limitations

Operating line	*Range*	*Factory setting*
Delta boiler temp max (stage 2)	0…10 K	1 K

To prevent pressure shocks in the gas network when stages 1 and 2 are simultaneously switched off, stage 2 is switched off before the maximum boiler temperature is reached, the difference being "Delta boiler temp max (stage 2)".
When the boiler is locked, stage 1 is switched off after stage 2, the difference in time being 10 seconds.

6.7 Flue gas temperature supervision

Flue gas temperature supervision offers:

- Display of the current flue gas temperature
- Display of the maximum flue gas temperature acquired after a selected point in time
- Supervision of the flue gas temperature limit including alarm should the limit value be exceeded

An appropriate sensor must always be configured, independent of usage.

Main menu > Commissioning > Extra configuration > Boiler > Inputs

Operating line	*Adjustable values / display / remarks*
Flue gas temperature sensor	Assign input

In contrast to the other temperature inputs, where the default configuration is a Ni1000 sensor, sensor type Pt1000 is used here. The type of sensor can be adapted under Settings > Inputs at the configured terminal.

Through configuration of the sensor, the following functions are made possible:

Slave pointer function

This function is active as soon as a flue gas temperature sensor is configured.

Main menu > Boiler > Inputs/setpoints

Operating line	*Adjustable values / display / remarks*
Flue gas temperature maximum	

It is always the maximum flue gas temperature that is saved and displayed. The displayed value can be adjusted like a setting value (e.g. to 0 °C), whereupon the slave pointer will start at zero again.

The maximum value is filtered to suppress faults. This means that the maximum flue gas temperature rises at a maximum rate of 1 K/s.

Supervision of maximum value

If a flue gas temperature limit value is parameterized, a fault status message will be delivered should the limit value be exceeded.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Flue temp supervision

Operating line	*Range*	*Factory setting*
Flue gas temperature limit value	---- / 0…400 °C	---- °C

When the actual flue gas temperature lies 5 K below the maximum value, the fault status message can be reset by making an acknowledgement. When resetting, the slave pointer value is also reset to the current value.

Supervision of maximum value and boiler stop

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Flue temp supervision

Operating line	*Range*	*Factory setting*
Impact of fault	No stop / Stop	No stop
Fault priority	Urgent / Nonurgent	Nonurgent

When a flue gas limit temperature is monitored, it can also be determined whether crossing of the limit value shall cause the boiler to shut down (No stop / Stop).

Diagnostic values

Main menu > Boiler > Inputs/setpoints

Operating line	*Adjustable values / display / remarks*
Flue gas temperature	
Flue gas temperature maximum	

The current flue gas temperature and the maximum flue gas temperature are available as diagnostic values.

6.8 Flue gas measuring mode

Flue gas measuring mode can be triggered either via a digital input (...Inputs > Flue gas measuring mode) or operation.

Main menu > Boiler > Flue gas measuring mode

Operating line	*Range*	*Factory setting*
Preselection	Off / On	Off
Flue gas meas mode contact	0 / 1	
Release stage 2/modulation	Yes / No	Yes
Actual value boiler temperature		
Flue gas temperature		

When the flue gas measuring mode is activated, boiler pump and peripheral devices will be put into operation. The boiler is assigned a boiler temperature setpoint of 90 °C. This value is limited by the maximum boiler temperature.
During the time the flue gas measuring mode is active, supervision of the maximum permissible flue gas temperature will not lead to a plant stop. However, should the maximum permissible flue gas temperature be exceeded, a fault status message will be displayed.
The function will automatically be ended after 30 minutes.

6.9 Boiler faults

If a boiler initiates lockout, it will be shut down until the fault is rectified.
A boiler is considered faulty if one of the following faults occurred:

- Burner fault
- Boiler pump fault
- Fault of shutoff valve (no checkback signal)
- Maximum permissible flue gas temperature exceeded (if plant stop is required)
- One of the 3 digital fault inputs indicates a fault
- Faulty boiler temperature sensor

Main menu > Commissioning > Extra configuration > Boiler > Inputs

Operating line	*Adjustable values / display / remarks*
Checkback signal burner	
Checkb sign shutoff valve	
Fault burner	
Fault input 1	
Fault input 2	
Fault input 3	
[Boiler pump] overload	
[Boiler pump B] overload	
Flow signal pump	

The type of fault input can be parameterized at menu item ...Settings > Inputs at the relevant terminal.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs

Operating line	*Range*	*Factory setting*
Normal position	Open / Closed	Open

Burner fault

A burner fault can be indicated by the burner fault input, or it can be generated when there is no burner checkback signal from the controller.
The waiting time for the burner's checkback signal can be adjusted (signal delay).

Fault shutoff valve

If there is no checkback signal from the shutoff valve, the boiler is considered faulty also. The waiting time for the checkback signal can be adjusted. If there is no checkback signal on completion of the waiting time, a fault will be signaled.

Maximum flue gas temperature

It can be selected whether or not flue gas temperatures above the maximum permissible level shall lead to a fault with boiler stop.

Digital fault inputs

There are 3 digital fault inputs available having a default parameterization for water shortage, high-pressure and low-pressure. But it is also possible to use other fault text. Depending on the type of fault, the signal delay, fault acknowledgement, priority and / or action can be parameterized. For fault inputs 1, 2 and 3, it is also possible to enter fault text.
For details about the meaning of these settings, refer to chapter 13 “Function block faults”.

Fault settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Checkb sign shutoff valve

Operating line	*Range*	*Factory setting*
Signal delay start	00.05…59.55 m.s	02.00 m.s

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Fault burner

Operating line	*Range*	*Factory setting*
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Checkback signal burner

Operating line	*Range*	*Factory setting*
Signal delay start	00.05…59.55 m.s	04.00 m.s
Signal interruption operation	00.00…59.55 m.s	20.00 m.s
Impact of fault	No stop / Stop	Stop

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Overload pump

Operating line	*Range*	*Factory setting*
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge and reset
Fault acknowledgement B	None / Acknowledge / Acknowledge and reset	Acknowledge and reset

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Fault input 1

Operating line	*Range*	*Factory setting*
Fault text	Max. 20 characters	Water shortage
Impact of fault	No stop / Stop	Stop
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge
Fault priority	Urgent / Not urgent	Urgent
Fault status message delay	00.00…59.55 m.s	00.05 m.s

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Fault input 2

Operating line	*Range*	*Factory setting*
Fault settings	Max. 20 characters	Overpressure
Impact of fault	No stop / Stop	Stop
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge
Fault priority	Urgent / Not urgent	Urgent
Fault status message delay	00.00…59.55 m.s	00.05 m.s

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Fault input 3

Operating line	*Range*	*Factory setting*
Fault settings	Max. 20 characters	Underpressure
Impact of fault	No stop / Stop	Stop
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge
Fault priority	Urgent / Not urgent	Urgent
Fault status message delay	00.00…59.55 m.s	00.05 m.s

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Boiler > Fault settings > Flue temp supervision

Operating line	*Range*	*Factory setting*
Flue gas temperature limit value	---- / 8…400 °C	---- °C
Impact of fault	No stop / Stop	No stop
Fault priority	Urgent / Not urgent	Nonurgent

6.10 Burner hours run counter and burner start counter

For burner stage 1 or the burner's basic stage, a checkback signal can be configured. In addition to burner supervision, this checkback signal is used for the burner hours run counter and the burner start counter.
When there is no checkback signal, the burner hours run counter is started by the output relay for burner stage 1.

Main menu > Commissioning > Extra configuration > Boiler > Inputs

Operating line	*Adjustable values / display / remarks*
Checkback signal burner	Assign input

The number of burner hours run and the number of burner starts are shown on the "Inputs/setpoints" menu. On the user level, they can only be read, on the service level, they can also be readjusted. It is thus possible to set the effective values.

or Main menu > Boiler > Inputs/setpoints

Operating line	*Range*	*Factory setting*
Burner hours run	0…99999 h	0 h
Burner start counter	0…99999	0

6.11 Fault handling

Sensor error

Number	*Text*	*Effect*
40	Boiler sensor error	Urgent message; must be acknowledged. No boiler stop; the burner is shut down
41	Boiler return sensor error	Nonurgent message; must be acknowledged. No boiler stop In the case of plant with mixing valve for the maintained boiler return temperature, the mixing valve will be driven to the fully closed position when the return temperature sensor is faulty and then deenergized to make possible manual adjustment. Otherwise, the control system behaves like a plant without return temperature sensor
321	Flue gas temp sensor error	Nonurgent message; must be acknowledged. No boiler stop

Burner faults

Number	*Text*	*Effect*
2301	Boiler burner fault	Urgent message. Acknowledgement can be parameterized; factory setting: “Acknowledge”. Boiler stop
2311	Burner no checkback signal	Urgent message; must be acknowledged and reset. Effect can be parameterized; factory setting: “Stop”. Boiler stop

Boiler faults

Number	*Text*	*Effect*
2321	Boiler water shortage	Priority, effect and acknowledgement can be parameterized. Factory setting: “Urgent”. Boiler stop, must be acknowledged
2331	Boiler overpressure	Priority, effect and acknowledgement can be parameterized. Factory setting: “Urgent”. Boiler stop, must be acknowledged
2341	Boiler underpressure	Priority, effect and acknowledgement can be parameterized. Factory setting: “Urgent”. Boiler stop, must be acknowledged
2351	Shutoff valve no checkb signal	Urgent message; must be acknowledged and reset. Boiler stop
2361	Flue gas overtemperature	Priority and effect can be parameterized. Factory setting: “Nonurgent”. No boiler stop, must be acknowledged and reset

Faults of the boiler pump

Number	*Text*	*Effect*
2401	[Boiler pump] overload	Nonurgent message. Acknowledgement can be parameterized; factory setting: “Acknowledge and reset“. No boiler stop

Number	*Text*	*Effect*
2411	[Boiler pump] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2421	[Boiler pump B] overload	Nonurgent message. Acknowledgement can be parameterized. Factory setting: “Acknowledge and reset“. No boiler stop
2431	[Main pump B] no flow	Nonurgent message; must be acknowledged and reset. No boiler stop
2441	[Boiler pump] fault	Urgent message; must not be acknowledged. Boiler stop

6.12 Text for boiler designation

Main menu > Commissioning > Settings > ...

Main menu > Settings > Boiler

Operating line	*Range*	*Factory setting*
Boiler	Max. 20 characters	Boiler

If required, specific text can be used to designate the boiler. This text will then appear on the menu and on the info display.

6.13 Diagnostic choices

Inputs/setpoints

Main menu > Boiler > Inputs/setpoints

Operating line	*Adjustable values / display / remarks*
Release input	
Actual value boiler temperature	
Boiler temperature setpoint	
Actual value return temp	
Return temperature min	
Checkb sign shutoff valve	
[Boiler pump] overload	
[Boiler pump B] overload	
Flow signal pump	
Fault burner	
Checkback signal burner	
Burner hours run	
Burner start counter	
Flue gas temperature	
Flue gas temperature maximum	
Flue gas temperature limit value	
Flue gas meas mode contact	
Fault text	Fault text for fault input 1
Fault input 1	
Fault text	Fault text for fault input 2
Fault input 2	
Fault text	Fault text for fault input 3
Fault input 3	
Attenuated outside temp	

Outputs

■ Main menu > Boiler > Outputs

Operating line	*Adjustable values / display / remarks*
Burner stage 1	
Burner stage 2	
Signal modulating burner	
Setpoint compensation	
Boiler pump	
Boiler pump B	
Shutoff valve	
Mix valve pos maint return temp	

Limitations

■ Main menu > Boiler > Limitations

Operating line	*Adjustable values / display / remarks*
Boiler temperature max	
Boiler temperature min	
Protective boiler startup	
Boiler return temperature min	
Burner run time min	

7 Heat demand and heat requests

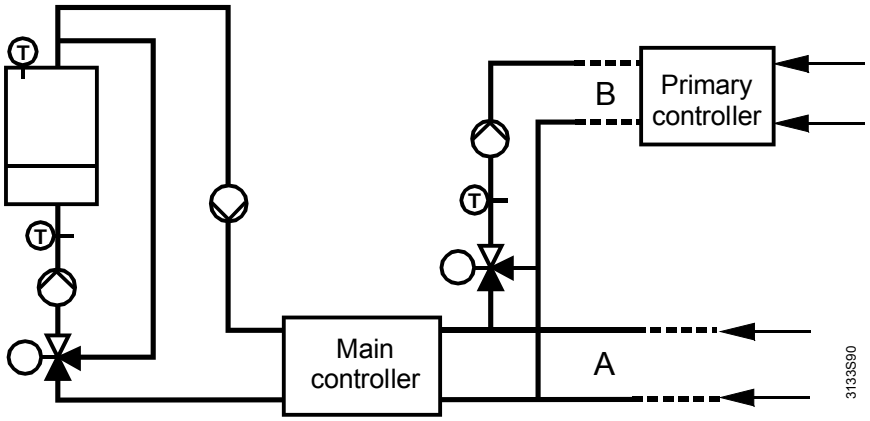
7.1 Heat requests

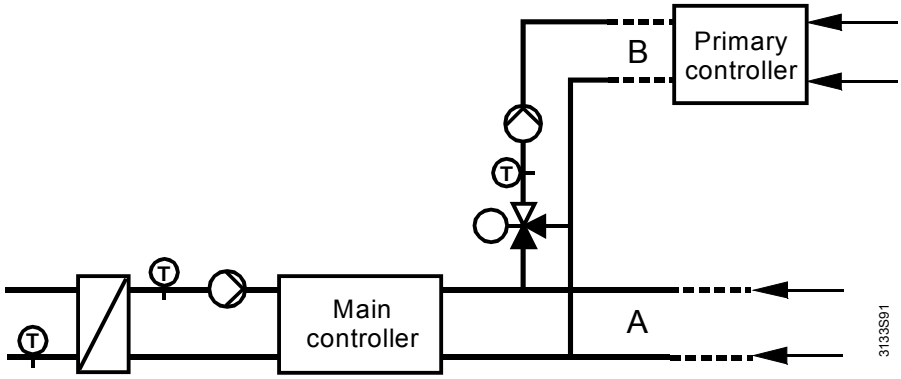
The following sources can deliver heat requests to the controller:

- The internal heating circuit
- The internal DHW circuit
- External controllers via the Konnex bus
- As a continuous DC 0…10 V signal
- As a 2-position signal

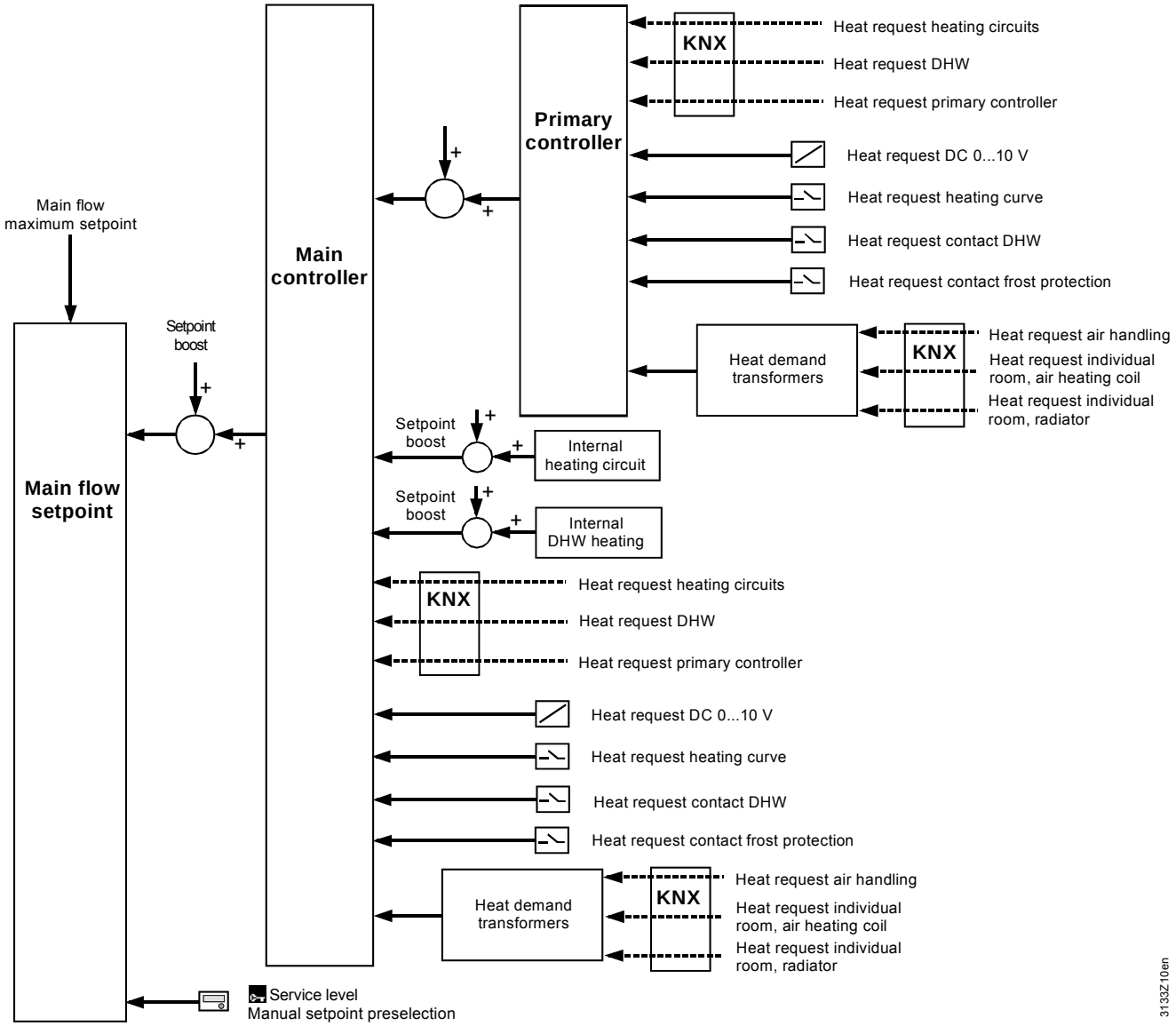
Heat requests can be delivered either via the main controller or the primary controller.

Hydraulics of heat requests





⚠ The internal heating circuit and the internal DHW circuit are connected to the main controller. Connection to the primary controller necessitates the use of a second device.



Note

The connection via the main controller and primary controller is described in chapter 8 “Main controller and primary controller”.

7.2 Heat demand outputs

The main flow setpoint (without giving consideration to limitations) can be delivered via an analog output (DC 0…10 V). For that, function “Heat demand modulating“ on the main controller must be activated. The output can be matched to specific situations.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller > Heat demand modulating

Operating line	*Range*	*Factory setting*
Value low	–150…50 °C	0 °C
Value high	50…500 °C	100 °C
Limit value	0…140 °C	10 °C

The heat demand relay (to be configured on the main controller also) can indicate whether there is demand for heat. The switching points can be adjusted.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller > Heat demand relay

Operating line	*Range*	*Factory setting*
Limit value heat demand ON	0…140 °C	20 °C
Limit value heat demand OFF	0…140 °C	15 °C

Both outputs are always available, even if no main controller has been configured.

- If only a boiler is configured, the requests received will be forwarded to the boiler
- If neither a boiler nor a main controller is configured, the requests received from the heat distribution zone will be forwarded

For notes on configuration, refer to section 8.2 “Configuration”.

7.3 Heat demand transformer

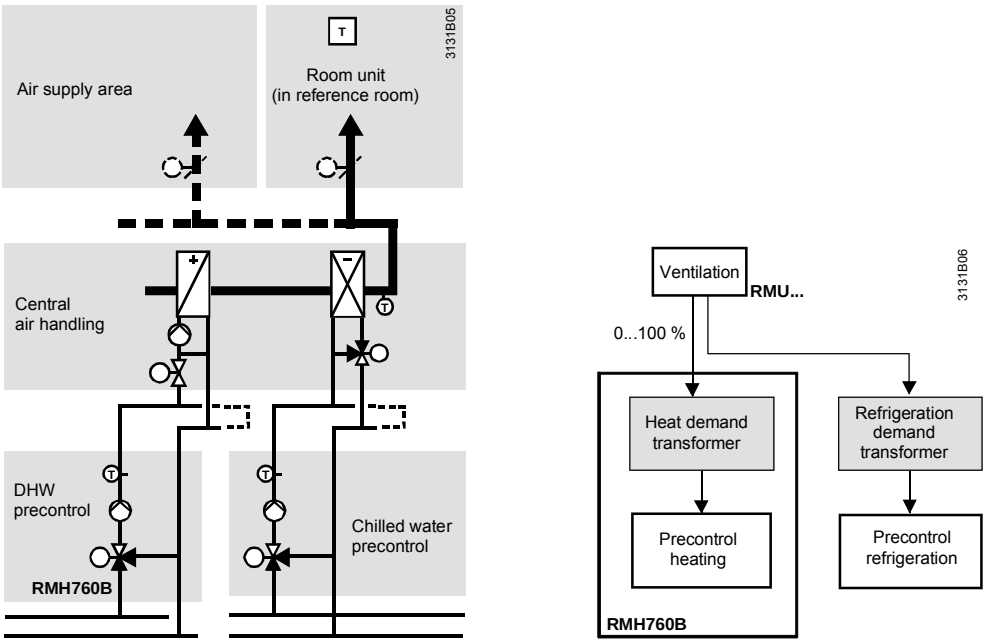
Heat demand transformers are available both with the main controller and the primary controller. They receive and handle the heat request signals from:

- The individual room radiators (RXB…)
- The individual room air heating coils (RXB…)
- Air handling plant (RMU…)

If the main controller is not activated, the boiler can make use of the main controller’s heat demand transformer.

The transformers convert the position heat request signals (in %) into heat demand signals with a flow temperature setpoint.
The following example of an air handling plant shows this.

Example: Air handling plant



The heat demand transformers calculate a flow temperature setpoint based on the valve position of the air handling plant(s).
If the primary controller is capable of delivering an outside temperature signal, the flow temperature setpoint according to the heating curve will be used as the start value. If no outside temperature signal is available, the start value used will be the flow temperature at curvepoint 1.
This flow temperature start value is matched to the actual heat demand in a way that the valve position of the heat consumer with the greatest heat demand is 90 %.

- If the valve position is >90 %, the flow temperature will be increased
- If the valve position is <90 %, the flow temperature will be decreased

The maximum flow temperature readjustment can be parameterized.

To ensure that minimum opening travel of the valve will not generate a demand for heat, a switch-on or switch-off threshold can be defined. The factory settings are as follows:

- A demand for heat will be calculated only when the valve positions are >10 %
- When the valve positions of all consumers are <5 %, the demand for heat will be suppressed again

Main menu > Commissioning > Settings > ... or

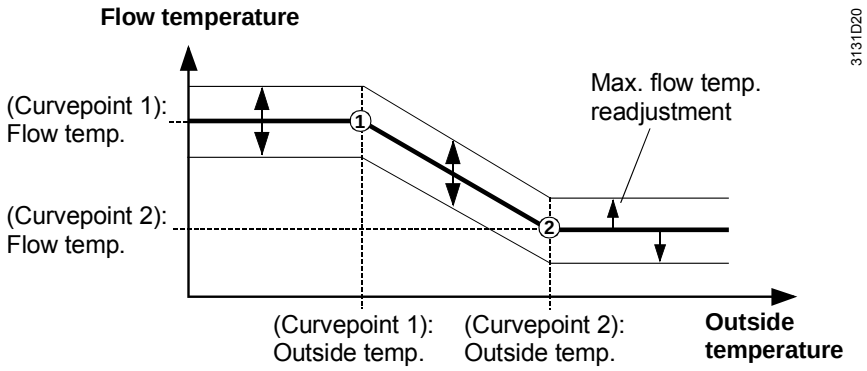
Main menu > Settings > Primary controller > Demand control

Main menu > Settings > Main controller > Demand control

Main menu > Settings > Boiler > Demand control

Operating line	*Range*	*Factory setting*
[Curvepoint 1] outside temp	–50…50 °C	–10 °C
[Curvepoint 1] flow temp	0…140 °C	70 °C
[Curvepoint 2] outside temp	–50…50 °C	20 °C
[Curvepoint 2] flow temp	0…140 °C	70 °C
Flow temp correction max	0…100 K	10 K
Control mode	Slow / Medium / Fast	Medium
Request evaluation	Maximum / Average	Maximum
Limit value request on	Off value…100 %	10 %
Limit value request off	0…On value %	5 %

Adaptation of the flow temperature



Adaptation of the flow temperature can be set as follows:

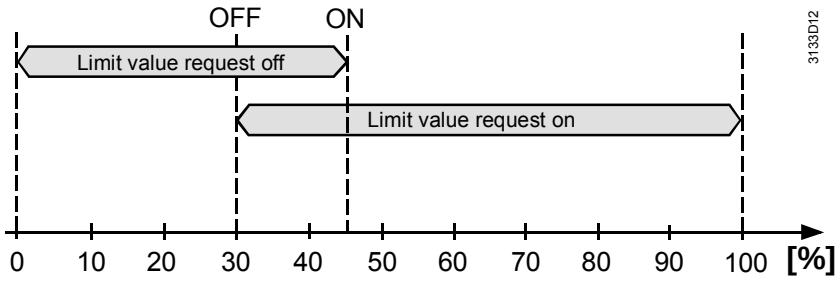
- The rate of change of flow temperature readjustment can be set under > Demand control > Control action
- The kind of evaluation of the consumers' valve positions can be selected under > Demand control > Request evaluation
  - When using the **Maximum** setting, the flow temperature will be readjusted in a way that the valve position of the consumer with the greatest heat demand is 90 %
  - When using the **Average** setting, the flow temperature will be readjusted in a way that the valve positions of the 4 largest consumers will be 90 % on average
    This setting does not ensure that the heat demand of all consumers can be satisfied. It makes certain, however, that an individual consumer cannot force the flow temperature to high levels (e.g. because a window was left open).

Note

The heating curve settings of the heat demand transformers also apply to the heat demand contact of the heating curve (operating line Heating curve request 2-pos).

Setting the limit value request

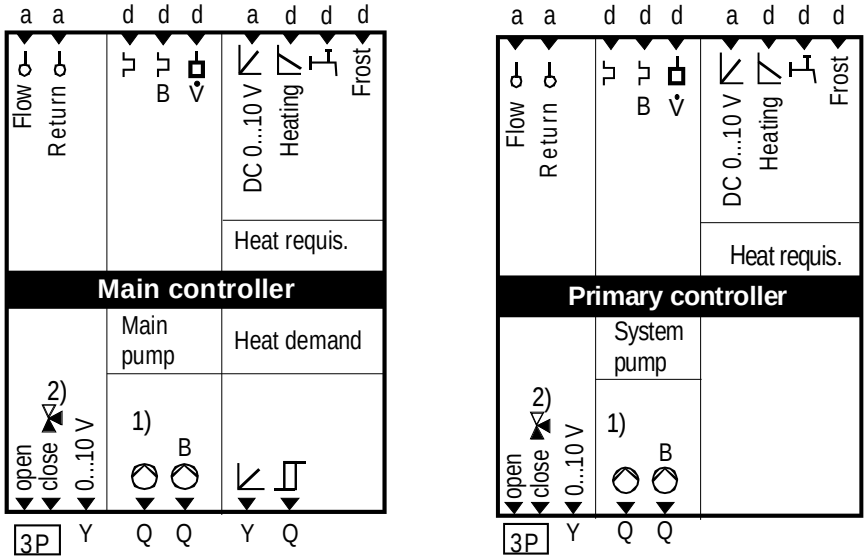
The “On range“ and the “Off range“ depend on the settings made:



OFF…100 Setting range for limit value request On (example with OFF = 30 %)
0… ON Setting range for limit value request Off (example with ON = 45 %)

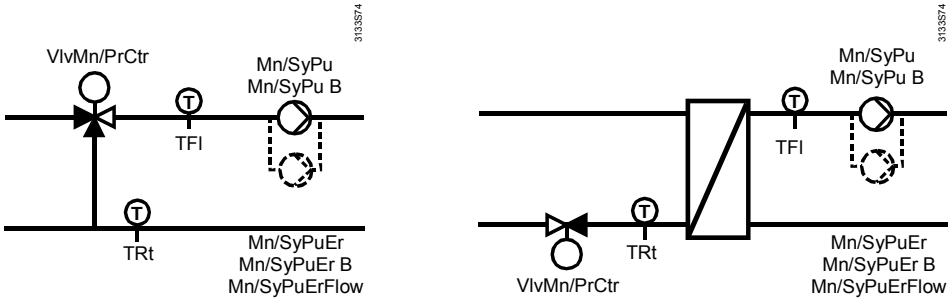
8 Main controller and primary controller

8.1 Overview of function block



In terms of control principle, both function blocks are primary controllers. For this reason, the term “primary controller“ is used for **both** function blocks in the following descriptions, unless specific reference to function block “primary controller” is made.

Controller diagrams



Primary controller (use of mixing valve) Main controller (use of heat exchanger)

Mn/SyPu	Main / system pump
Mn/SyPu B	Main / system pump B
Mn/SyPuEr	Fault input main pump / system pump
Mn/SyPuEr B	Fault input main pump / system pump B
Mn/SyPuErFlow	Flow supervision main pump / system pump
TFl	Flow temperature sensor
TRt	Return temperature sensor
VlvMn/PrCtr	Mixing valve / 2-port valve

8.2 Configuration

Basic configuration

With plant types H1-x, the main controller comes activated per default. In that case, it is always the valve, the flow and return temperature sensor that are preconfigured.
With plant types H2-x, the primary controller comes activated per default. In that case, it is always the mixing valve, a pump and the flow temperature sensor that are preconfigured.
For more detailed information, refer to section 3.2 “Basic configuration”.

Extra configuration

With all the other plant types, the function blocks can be activated via “Extra configuration”. A function block is activated by assigning an output to a terminal.

Outputs

Main menu > Commissioning > Extra configuration > Main controller > Outputs

Main menu > Commissioning > Extra configuration > Primary controller > Outputs

Operating line	*Adjustable values / display / remarks*
Mixing valve 3-pos	
Mixing valve modulating	
Main pump	Only with main controller
Main pump B	Only with main controller
System pump	Only with primary controller
System pump B	Only with primary controller
Heat demand modulating	Only with main controller
Heat demand relay	Only with main controller

Inputs

Main menu > Commissioning > Extra configuration > Main controller > Inputs

Main menu > Commissioning > Extra configuration > Primary controller > Inputs

Operating line	*Adjustable values / display / remarks*
Flow sensor	
Return sensor	
[Main pump] overload	Only with main controller
[Main pump B] overload	Only with main controller
[System pump] overload	Only with primary controller
[System pump B] overload	Only with primary controller
Flow signal pump	
Heat request modulating	
Heating curve request 2-pos	
DHW request 2-pos	
Frost prot request 2-pos	

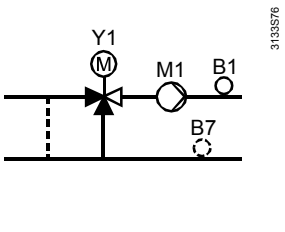
Note on the requests

Heat requests from other devices can be accepted via bus. In addition, one analog and 3 digital inputs per function block are available for signaling heat requests.

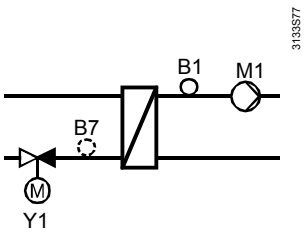
8.3 Controller types

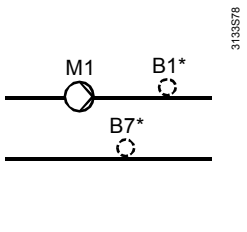
If only a pump or twin pump is configured, the primary controller consists of system pump control. A control loop is only obtained when configuring a mixing valve (or other valve) so that the flow can be controlled.

⚠ If a main controller with mixing valve is used with a boiler, it must be determined whether or not flow through the boiler is to be ensured.



Primary controller type 1:
With mixing valve or 2-port valve





Primary controller type 2:
With pump

B1 Flow temperature sensor (* = optional, for display only)
B7 Return temperature sensor (* = optional, for display only)
M1 Main pump / system pump (can be a twin pump)
Y1 Mixing valve or 2-port valve

Primary controller type 1 with mixing valve or heat exchanger with 2-port valve offers maximum limitation of the return temperature while primary controller type 2 only provides control of a system pump depending on demand.

The flow or return temperature sensor of primary controller type 2 can be used for display purposes.
By configuring the outputs, it is determined whether primary controller type 1 or 2 is used. Without configuration of a mixing valve, primary controller type 2 is automatically used. But a flow temperature increase can also be defined with primary controller type 2 to compensate for temperature losses in the case of long pipes. For more detailed information about flow temperature increase, refer to section 8.7 “Setpoint increase”.

8.3.1 Mixing valve control

For control of the mixing valve, a 3-position or DC 0…10 V actuator can be used. The selection is made by configuring the relevant output.

8.3.2 Pump control

Pump control offers a number of monitoring choices independent of whether the pump is a single pump or twin pump.
For more detailed information about pump control and twin pumps, refer to section 5.8 “Pump control and twin pumps”.

Fault setting primary controller

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller > Fault settings > Overload pump

Operating line	*Range*	*Factory setting*
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge and reset
Fault acknowledgement B	None / Acknowledge / Acknowledge and reset	Acknowledge and reset

Fault setting main controller

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Primary controller > Fault settings > Overload pump

Operating line	*Range*	*Factory setting*
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge and reset
Fault acknowledgement B	None / Acknowledge / Acknowledge and reset	Acknowledge and reset

8.4 Plant operation

Plant operation indicates whether the primary controller is switched on and whether the pump is running.

Plant operation

Main menu > Main controller > Plant operation

Main menu > Primary controller > Plant operation

Operating line	*Range*	*Factory setting*
Preselection	Auto / Off*	Auto
Setp preselection manual**	---- / 8…140 °C	----
State	Off / On	
Cause	Commissioning / Request / Frost protection for consumer / Frost protection for the flow /	

Operating line	*Range*	*Factory setting*
	Frost protection for the plant / Overtemp protection/overrun / Plant operation selector / No request	

* Frost protection functions ensured
** Only with main controller

Preselection (plant operation selector)

The primary controller can be switched off for service purposes. The valve will close and the pump will be deactivated, or valve and pump start their overrun.
When in the “Off” position, the heat demand signal will not be passed on!

⇒ When “Off“ is preselected, the internal frost protection function will remain active and frost protection-related heat requests (frost protection for the flow) from externally will be accepted and handled.

⚠ When service work is completed, the selector must be set back to “Auto”.

Setpoint preselection manual

Using this setting, a minimum request for the main controller can be preselected, which means that maximum selection with the requests from the consumers will be maintained.

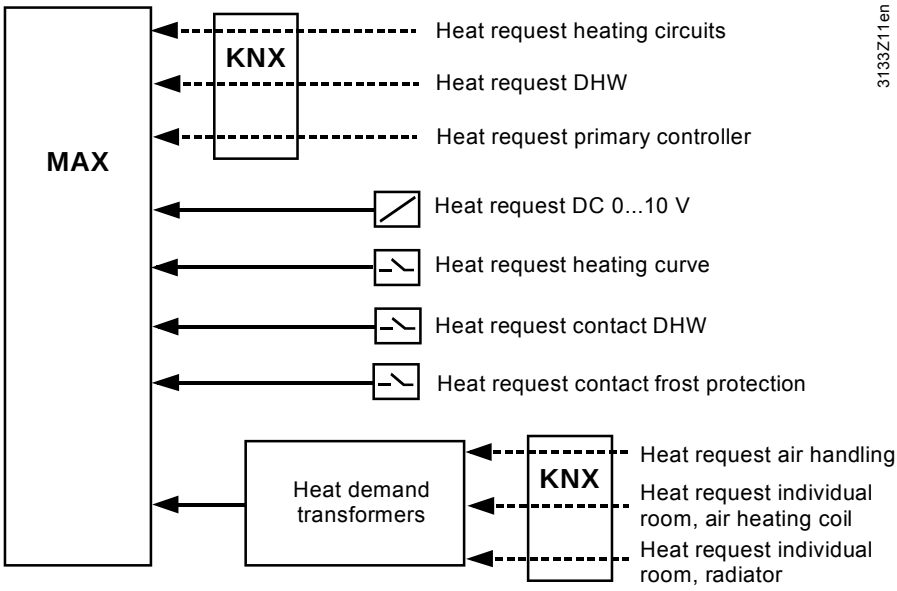
State

The primary controller’s state is indicated (On / Off).

Cause

It is indicated why the current state is active.

8.5 Heat demand and heat request



Function blocks “Main controller” and “Primary controller” collect the heat demand from all consumers. These are:

- Heating circuits
- DHW heating
- Other primary controllers
- Heat demand signals from individual room controllers for radiators
- Heat demand signals from individual room controllers for air heating coils
- Heat demand signals from primary air handling plant

A heat demand transformer converts the last 3 types of signal into a flow temperature setpoint.
In addition, an analog input and up to 3 digital inputs as heat request inputs can be configured on the main controller and on the primary controller. These are always available at the main controller, even if no main controller plant element has been configured. The inputs then act on the boiler and on the heat demand outputs.

Extra configuration

Main menu > Commissioning > Extra configuration > Main controller > Inputs

Main menu > Commissioning > Extra configuration > Primary controller > Inputs

Operating line	*Range*
Heat request modulating	
Heating curve request 2-pos	
DHW request 2-pos	
Frost prot request 2-pos	

From all request signals received, the “Max” block generates the maximum value. This maximum value represents the flow temperature setpoint for the primary controller. The setpoint will be raised by the amount of the setpoint increase and forwarded to a heat source or another primary controller as “Heat demand from precontrol”.

8.5.1 Heat request modulating

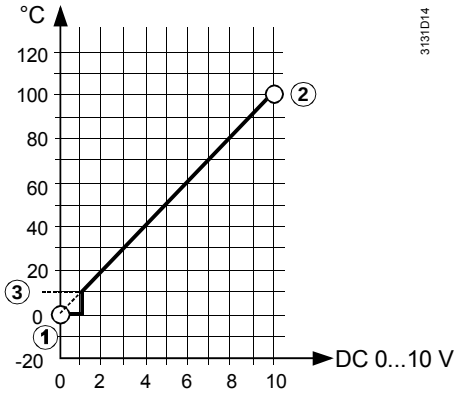
Using a DC 0…10 V signal, a heat request for the main controller or primary controller can be preselected.
The analog input can be matched to the DC 0…10 V signal source:

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller > Heat request

Main menu > Settings > Primary controller > Heat request

Operating line	*Range*	*Factory setting*
[Modulating] setpoint at 0 V	–150…50 °C	0° C
[Modulating] setpoint at 10 V	50…500 °C	100 °C
[Modulating] limit value	0…140 °C	10 °C



① Value in °C at DC 0 V
② Value in °C at DC 10 V
③ Limit value for heat demand (temperatures < limit value = no heat demand)

Example:

The DC 0…10 V input signal shall correspond to a flow temperature setpoint range of 20…120 °C. Below DC 0.5 V, the controller shall shut down.
The following parameters are to be set:

Setpoint at DC 0 V: 20 °C
Setpoint at DC 10 V: 120 °C
Limit value: 25 °C

8.5.2 Heat request 2-position

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller > Heat request

Main menu > Settings > Primary controller > Heat request

Operating line	*Range*	*Factory setting*
[2-pos] setpoint DHW	5…140 °C	70 °C
[2-pos] priority DHW	None [DHW request] / Shifting [DHW request] / Absolute [DHW request] / None [max selection] / Shifting [max selection]	Shifting [DHW request]
[2-pos] setpoint frost prot	5…140 °C	70 °C

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller > Demand control

Main menu > Settings > Primary controller > Demand control

Operating line	*Range*	*Factory setting*
[Curvepoint 1] outside temp	–50…50 °C	–10 °C
[Curvepoint 1] flow temp	0…140 °C	70 °C
[Curvepoint 2] outside temp	–50…50 °C	20 °C
[Curvepoint 2] flow temp	0…140 °C	70 °C

Digital inputs

3 types of digital inputs are available. They are distinguished by different handling of the heat demand signals and by offering different setting choices.

- A signal received at input “Heating curve request 2-pos“ is handled like a heat demand signal from a heating circuit. The setpoint is dependent on the outside temperature and is determined with the same heating curve as that used for demand control. For more detailed information about demand control, refer to section 7.3 “Heat demand transformer”
- A signal received at input “DHW request 2-pos“ is handled like a heat demand signal from DHW heating. A constant setpoint can be preselected. In addition, priority of the resulting DHW request can be set.
  For more detailed information about DHW priority, refer to section 10.10 ”DHW priority”
- A signal received at input “Frost prot request 2-pos“ is handled like a heat request due to risk of frost. A constant setpoint can be preselected

Depending on the plant’s operating state, a heating curve request in the summer can be ignored, for example, while consideration is given to a request for frost protection. Whether the input shall be active when the contact is open or closed can be parameterized for each individual input.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs > RMH760.X... (or RMZ78...)

Operating line	*Range*	*Factory setting*
Normal position	Open / Closed	Open

Normal position ”Open“ means that the input is active when the contact is closed.

8.5.3 Heat demand outputs

In addition, a digital output (relay) and / or analog output (DC 0…10 V) can be configured on the main controller as a heat demand output.
For further information refer to sections 7.2 “Heat demand outputs” and 8.2 ”Configuration”.

8.5.4 Heat demand transformers

The heat demand transformers described in chapter 7 “Heat demand and heat requests”.

8.6 Mixing valve control

8.6.1 General

Load control

The heat output for mixing valve control can be reduced by functions of higher priority (e.g. limitation of the return temperature) or by functions of other plants (boiler, DHW heating) via load control.

The following mixing valve settings are valid for both 3-position and DC 0…10 V actuators.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller > Mixing circuit controller

Main menu > Settings > Primary controller > Mixing circuit controller

Operating line	*Range*	*Factory setting*
Actuator run time	1…600 s	150 s
P-band Xp	1…100 K	50 K
Integral action time Tn	0…600 s	60 s
Locking signal gain	0…200 %	100%

Note

- For more detailed information about mixing valve control and its settings, refer to section 5.7 “Mixing valve control”
- Locking signal gain is used to preselect to what degree the primary controller shall respond to signals received from load control

8.6.2 Load control

Load control signals from a heat source can have an impact on the primary controller:

Load reduction

A load reduction can be triggered by one of the following functions:

- Protective boiler startup
- Minimum limitation of the boiler return temperature

The primary controller does not respond to locking signals triggered by DHW heating.

Load increase

From the consumer’s point of view, a load increase can be effected in the form of pump and / or mixing valve overrun. In that case, the load is only maintained.

8.7 Setpoint increase

Typically, a mixing valve requires a setpoint increase, enabling it to compensate for boiler temperature variations. With system pumps, this setpoint increase is not a basic requirement for compensating boiler temperature variations. However, in the case of long pipes between boiler and consumers, heat losses on the way to the consumers can occur so that a setpoint increase can be desirable in these situations also.

Settings

Main controller

Main menu > Commissioning > Settings > ...

Main menu > Settings > Main controller > Main controller

Operating line	*Range*	*Factory setting*
Setpoint increase	0…50 K	0 K

Primary controller

Main menu > Commissioning > Settings > ...

Main menu > Settings > Primary controller > Primary controller

Operating line	*Range*	*Factory setting*
Setpoint increase	0…50 K	10 K

8.8 Limit and protective functions

8.8.1 Frost protection

Frost protection for the plant

Here, the setting is made whether or not “Frost protection for the plant” shall act on the pump for precontrol.
For more detailed information about frost protection for the plant, refer to section 5.4 “Pump overrun and mixing valve overrun”.

“Frost protection for the plant“ is only available if an outside sensor is present (local sensor or via Konnex bus).
The function can be deactivated.

Frost protection for the flow

The flow temperature is monitored to ensure it will not drop below a minimum level. Should it fall below 5 °C, a heat demand signal is sent to the heat source and the mixing valve will open.
The function will be ended as soon as the flow temperature has risen to 7 °C. It is active for a minimum of 5 minutes.

8.8.2 Limitations

Maximum limitation of the flow temperature

This setting is used to ensure maximum limitation of the flow temperature setpoint.

Minimum limitation of the flow temperature

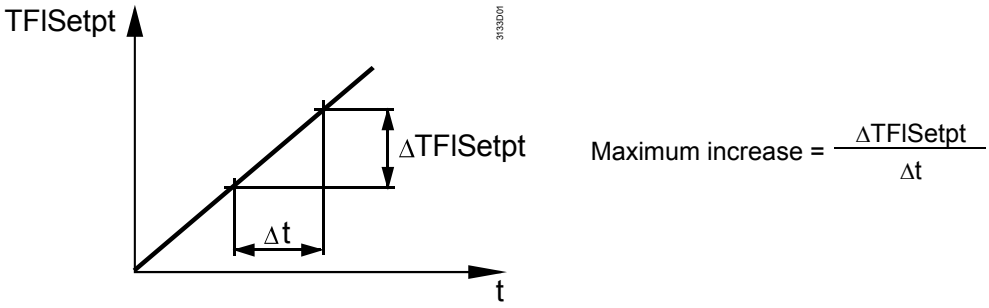
This setting is used to ensure minimum limitation of the flow temperature setpoint. Minimum limitation is only active when there is a demand for heat.
The function can be deactivated by using setting “----“.

Limitation of the rate of flow temperature increase

This function is only available with primary controller type 1. The rate of increase of the flow temperature setpoint can be limited to a maximum (heating up brake). In that case, the maximum possible increase of the flow temperature setpoint is the selected rate of temperature increase per unit of time (K/h).
Limitation of the rate of flow temperature increase effects the following:

- Prevention of cracking noises in the pipework
- Prevention of excessive loads on heat generating equipment

The function can be deactivated by using setting “----“.



t	Time
Δt	Unit of time
TFlSetpt	Flow temperature setpoint
ΔTFlSetpt	Rate of setpoint increase per unit of time

Limitations of the return temperature

Refer to subsection 8.8.3 “Limitation of the return temperature”.

Response of main pump / system pump in the event of locking signals

The respective setting determines whether or not the main pump or the system pump shall respond to locking signals:

Setting	*Effect when a locking signal occurs*
Main pump locking signal = Off	Pump will be deactivated
Main pump locking signal = On	Pump will continue to operate
System pump locking signal = Off	Pump will be deactivated
System pump locking signal = On	Pump will continue to operate

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller > Limitations

Main menu > Settings > Primary controller > Limitations

Operating line	*Range*	*Factory setting*
Flow temperature max	0…140 °C	140 °C
Flow temperature min	---- / 0…140 °C	---- °C
Flow temperature rise max	---- / 1…600 K/h	---- K/h
System pump locking signal	Off / On	Off
Frost protection for the plant	Off / On	On

8.8.3 Limitation of the return temperature

Return sensor

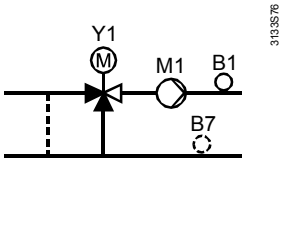
Both the main controller and the primary controller offer maximum limitation of the return temperature depending on the active consumers. The following types of limitation are available:

- Maximum limitation in space heating mode
- Maximum limitation in DHW heating mode

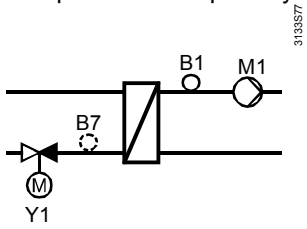
Both have the following in common:

- A return temperature sensor must be configured
- Limitation of the return temperature is only possible with primary controller type 1

Maximum limitation of the return temperature with primary controller type 1:



Primary controller



Main controller

Note

Minimum limitation of the return temperature is not supported.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller > Limitations

Main menu > Settings > Primary controller > Limitations

Operating line	*Range*	*Factory setting*
[Curvepoint 1] outside temp	–50…50 °C	–20 °C
[Curvepoint 1] return temp	---- / 0…140 °C	---- °C
[Curvepoint 2] outside temp	–50…50 °C	10 °C
[Curvepoint 2] return temp	---- / 0…140 °C	---- °C
DHW return temp max	---- / 0…140 °C	---- °C
Legionella return temp max	---- / 0…140 °C	---- °C

Maximum limitation of the return temperature

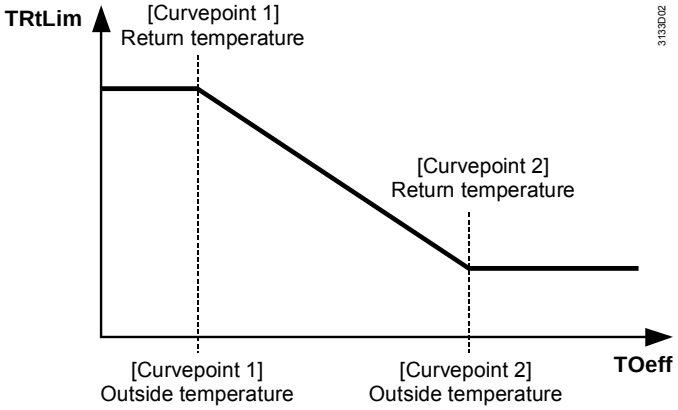
If the return temperature exceeds the limit value, the primary controller's flow temperature setpoint will be lowered. If the return temperature drops below the limit value, reduction of the flow temperature setpoint will be negated again. Limitation is provided in the form of an I-controller whose integral action time can be adjusted.

Main menu > Commissioning > Settings > ... or
Main menu > Settings > Main controller > Mixing circuit controller
Main menu > Settings > Primary controller > Mixing circuit controller

Operating line	*Area*	*Factory setting*
[Tn] return temp limitation max	0…60 min	30 min

Maximum limitation in space heating mode

Maximum limitation will be effective when only heating and ventilation are active at the respective primary controller. It will be deactivated as soon as DHW heating is started. With this limitation, the return temperature limit value changes depending on the outside temperature. Maximum limitation will be activated when a valid value is set for at least one maximum return temperature setpoint.



TRtLim Limit value of return temperature limitation
TOeff Composite (effectively acting) outside temperature
Curvepoint 1 Maximum return temperature limit value, active at low outside temperatures
Curvepoint 2 Minimum return temperature limit value, active at high outside temperatures

Special cases:

Setting	*Effect*
Return temperature curvepoint 1 = return temperature curvepoint 2	Constant limitation of the return temperature. Outside temperature is irrelevant
Outside temperature curvepoint 1 = outside temperature curvepoint 2	Limit value of return temperature changes abruptly at the curvepoints
Return temperature curvepoint 1 = ----	Constant return temperature limitation with curvepoint 2 as the maximum return temperature setpoint. Outside temperature is irrelevant
Return temperature curvepoint 2 = ----	Constant return temperature limitation with curvepoint 1 as the maximum return temperature setpoint. Outside temperature is irrelevant
Return temperature curvepoint 1 and return temperature curvepoint 2 = ----	In space heating mode, limitation of the return temperature is deactivated

Maximum limitation in DHW heating mode

This limitation is effective when DHW heating is active at the primary controller. In that case, maximum limitation in space heating mode will be deactivated.
Maximum limitation in DHW heating mode is constant, that is, independent of the outside temperature.
The limitation can be overridden by maximum limitation in DHW heating mode with the legionella function activated. For more detailed information, refer to the next section.

This limitation too will be activated only when a valid value has been set. If the value is invalid (entry of "----"), there will be no limitation.

Maximum limitation in DHW heating mode with legionella function activated

This limitation is effective when the legionella function of a DHW circuit is active at the primary controller. In that case, the 2 maximum limitations in space heating and DHW heating mode will be deactivated.
Maximum limitation in DHW heating mode with the legionella function activated is constant, that is, independent of the outside temperature. This limitation too will be activated only when a valid value has been set. If the value is invalid (entry of "----"), there will be no limitation.

8.8.4 Pulse limitation

Pulses for load or volume limitation can be fed to both the main controller and the primary controller. Prerequisite for pulse limitation is a main or primary controller plant type with mixing valve or other seat valve.

Meter inputs

The pulses are delivered via the meter inputs of function block "Meter". For more detailed information about function block "Meter", refer to chapter 11 "Function block meter". After one or several meter inputs have been configured, pulse limitation can be set up.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller > Limitations > Pulse limitation

Main menu > Settings > Primary controller > Limitations > Pulse limitation

Operating line	*Range*	*Factory setting*
Meter input	---- / 1…4	----
Type of limitation	Absolute / Scaled	Absolute
Limit value	5…4000 pulses/min	75 pulses/min
Integral action time Tn	0…255 min	60 min

Meter input

The meter input is an input of function block "Meter" which is used for limiting the number of pulses. All inputs selected must be configured to a terminal.

Type of limitation

There are 2 types of limitation to choose from:

- **Absolute:** The limitation takes effect when the limit value is crossed
- **Scaled:** The limit value is fixed at 75 pulses/min. The limit value can be changed, but with no effect.
  If less than 5 pulses/min are received, fault status message No pulse signal meter 1 (or ...2, ...3 or ...4) will be delivered after 20 seconds. Heat meters with a scaled output send 120 pulses/min if there is no supply of heat or no volumetric flow. Together with pulse limitation, this prevents hydraulic creep.

Limit value

From the limit value, pulse limitation starts throttling the actuating device (mixing valve). The setting is only active with absolute limitation. With scaled limitation, the limit value can be set, but the function is performed with 75 pulses/min (fixed value).

Integral action time Tn

The setting value determines the rate at which the flow temperature will be lowered:

- Short integral action times lead to quick reductions
- Long integral action times lead to slow reductions

8.8.5 Pump overrun and mixing valve overrun

To protect the boiler against overtemperatures after the burner has shut down (when there are no more active heat consumers), an overrun time for the consumers can be set on the boiler controller.
After the burner has shut down, the overrun time ensures that the heating circuits and DHW heating will draw heat for that period of time, provided they were consuming heat up to one minute before the burner was shut down. In any case, pumps and mixing valves have an overrun time of 60 seconds.
With primary controller type 1, the mixing valve maintains the former setpoint during the overrun time and the pump continues to run; with primary controller type 2, the pump only operates during the overrun time.

8.8.6 Pump kick and valve kick

The pump and valve kick is a protective function which can be periodically performed. It prevents pumps and / or mixing valves from seizing after longer off periods.
For more detailed information, refer to section 5.5 “Pump kick and valve kick”.

8.9 Text designation

If required, specific text can be assigned to the main controller or the primary controller. This text will then appear on the menu and on the info display.

Main controller

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Main controller

Operating line	*Range*	*Factory setting*
Main controller	Max. 20 characters	Main controller

Primary controller

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Primary controller

Operating line	*Range*	*Factory setting*
Primary controller	Max. 20 characters	Primary controller

8.10 Fault handling

When commissioning is completed (Commissioning menu quit), the system checks whether the required sensors have been connected. In the event of an open-circuit or short-circuit, a fault status message will be delivered.

Faulty flow sensor

Number	*Text*	*Effect*
54	Main contr flow sens error	Nonurgent message; must be acknowledged
57	Prim controller error flow sensor	Nonurgent message; must be acknowledged

In the case of an error of the flow temperature sensor, the mixing valve will be driven to the fully closed position to become inactive (3-position actuator), enabling it to be manually operated.

Faulty return sensor

Number	*Text*	*Effect*
58	Prim controller error ret sensor	Nonurgent message; must be acknowledged

Number	*Text*	*Effect*
59	Main contr return sens error	Nonurgent message; must be acknowledged

Main controller and primary controller behave as if no return temperature sensor was present. Limitation of the return temperature is inactive.

Error in connection with heat requests

Number	*Text*	*Effect*
2202	Main contr h'request mod error	Nonurgent message; must not be acknowledged
2203	P'contr h'req error	Nonurgent message; must not be acknowledged

An error at the input is interpreted as "No heat demand".

Faulty main pump

Number	*Text*	*Effect*
2491	[Main pump] overload	Nonurgent message. Acknowledgement can be parameterized; factory setting: "Acknowledge and reset"
2492	[Main pump B] overload	Nonurgent message. Acknowledgement can be parameterized; factory setting: "Acknowledge and reset"
2493	[Main pump] no flow	Nonurgent message; must be acknowledged and reset
2494	[Main pump B] no flow	Nonurgent message; must be acknowledged and reset
2495	[Main pump B] fault	Urgent message; must not be acknowledged. Plant stop

Faulty system pump

Number	*Text*	*Effect*
2501	[System pump] overload	Nonurgent message. Acknowledgement can be parameterized; factory setting: „Acknowledge and reset"
2502	[System pump B] overload	Nonurgent message. Acknowledgement can be parameterized; factory setting: „Acknowledge and reset"
2503	[System pump] no flow	Nonurgent message; must be acknowledged and reset
2504	[System pump] no flow B	Nonurgent message; must be acknowledged and reset
2505	[System pump] fault	Urgent message; must not be acknowledged. Plant stop

8.11 Diagnostic choices

■ Main menu > Main controller > Inputs/setpoints

■ Main menu > Primary controller > Inputs/setpoints

Operating line	*Range*
Actual value flow temp	…°C
Flow temperature setpoint	…°C
Actual value return temp	…°C
Return temperature max	…°C
Heat request modulating	---- (= not connected) / …°C
Heating curve request 2-pos	0 / 1 (1 = closed)
DHW request 2-pos	0 / 1 (1 = closed)
Frost prot request 2-pos	0 / 1 (1 = closed)

Operating line	*Range*
[Main pump] overload*	0 / 1 (1 = overload)
[Main pump B] overload*	0 / 1 (1 = overload)
[System pump] overload**	0 / 1 (1 = overload)
[System pump B] overload**	0 / 1 (1 = overload)
Flow signal pump	

* Only with main controller

** Only with primary controller

■ Main menu > Main controller > Outputs

■ Main menu > Primary controller > Outputs

Operating line	*Range*
Heat demand modulating*	…°C
Heat demand relay*	Off / On
Main pump*	Off / On
Main pump B*	Off / On
System pump**	Off / On
System pump B**	Off / On
Mixing valve position	0…100 %

* Only with main controller

** Only with primary controller

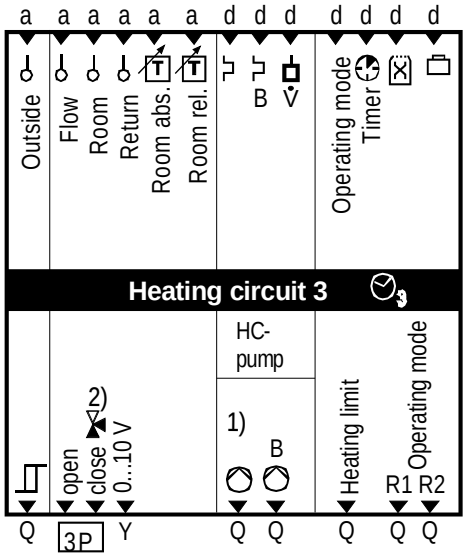
■ Main menu > Main controller > Limitations

■ Main menu > Primary controller > Limitations

Operating line	*Range*
Flow temperature max	Inactive / Active
Flow temperature min	Inactive / Active
Flow temperature rise	Inactive / Active
Return temperature max	Inactive / Active
Pulse limitation	Inactive / Active

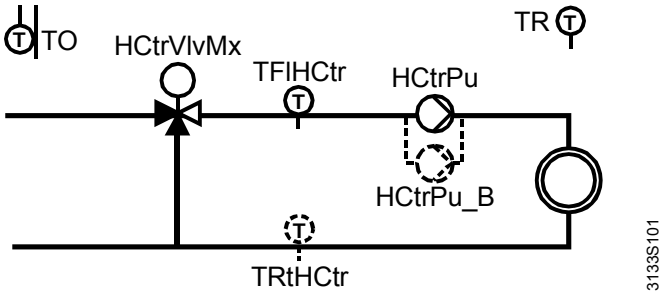
9 Heating circuit control

9.1 Overview of function block



Timer function
Special day input
Holiday input

Heating circuit diagram



HctrPu	Heating circuit pump
HctrPu_B	Heating circuit pump B
HCtrVlvMx	Heating circuit mixing valve
TFlHCtr	Flow temperature sensor
TO	Outside sensor
TR	Room temperature sensor
TRtHCtr	Return temperature sensor

9.2 Configuration

Basic configuration

With the following plant types, the heating circuits are activated per default:

- Heating circuit 1 with plant types Hx-2, Hx-3, Hx-4, Hx-5, Hx-6, and Hx-7
- Heating circuit 2 with plant types Hx-4, Hx-5, Hx-6, and Hx-7
- Heating circuit 3 with plant types Hx-6, and Hx-7

Each heating circuit always has a mixing valve, pump and flow temperature sensor preconfigured. Plant types H5-x and H6-x also have the return temperature sensor preconfigured.

Heating circuit 1 is preconfigured based on the basic module or the RMZ782B heating circuit module. Heating circuits 2 and 3 are always preconfigured on the RMZ782B heating circuit module.

For more detailed information, refer to section 3.2 “Basic configuration”.

The heating circuit can be configured to any type of module. If the RMZ782B is replaced by some other module, all settings using type reference RMZ782B… via “Extra configuration“ must be reconfigured.

Extra configuration

Function blocks can always be activated via “Extra configuration“, independent of the type of plant. A function block is activated by assigning an output to a terminal. Here, the heating circuit can be configured to any terminals that are free. If all outputs of the heating circuit are set invalid, the heating circuit will be deactivated.

Outside sensor

For weather-compensated heating circuit control, the outside temperature is required. It can be configured as follows:

- For heating circuit 1, on the following menu:
  Main menu > Commissioning > Extra configuration > Miscellaneous > Inputs > Outside sensor
- For the 2 other heating circuits, on the following menu:
  Main menu > Commissioning > Extra configuration > Heating circuit 2 (or 3) > Inputs > Outside sensor

The outside temperature can also be transmitted via the Konnex bus.

Solar intensity and wind speed sensor

In addition, a solar intensity sensor and wind speed sensor for common usage by all heating circuits can be configured on the following menu:
Main menu > Commissioning > Extra configuration > Miscellaneous > Inputs The impact on the individual heating circuits can be parameterized.
For more detailed information, refer to section 14.6 “Weather data”.

Inputs

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Inputs

Operating line	*Adjustable values / display / remarks*
Outside sensor*	
Flow sensor	
Room sensor	
Return sensor	Return temperature limitation
Room setpoint adjuster abs	External room temperature setpoint adjuster with absolute room temperature setpoints
Room setpoint adjuster rel	External room temperature setpoint adjuster with room temperature setpoint readjustment of ±3 K
[Heating circuit pump] overload	Fault input heating circuit pump
[Heat circuit pump B] overload	Pump B in the case of twin pumps
Flow signal pump	Flow supervision heating circuit pump(s)
Room operating mode	External preselection
Timer function	Comfort extension
Special day input	
Holiday input	

* Outside sensor:
Only heating circuits 2 and 3 have their own outside temperature. Heating circuit 1 shares the outside temperature with other function blocks in the controller. The outside sensor is to be configured under ... > Miscellaneous > Inputs.

Outputs

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Outputs

Operating line	*Adjustable values / display / remarks*
Outside temperature relay*	
Mixing valve 3-pos	
Mixing valve modulating	
Heating circuit pump	
Heating circuit pump B	

Operating line	*Adjustable values / display / remarks*
Heating limit relay	
Operating mode relay 1	
Operating mode relay 2	

* Outside temperature relay:
Only heating circuits 2 and 3 have their own outside temperature. Heating circuit 1 shares the outside temperature with other function blocks in the controller. The outside temperature relay for the outside temperature of heating circuit 1 is to be configured under Miscellaneous > Outputs.

9.2.1 3-position or modulating mixing valve

Control of the mixing valve can be accomplished either with a 3-position or DC 0…10 V actuator. The type of actuator is to be selected via “Extra configuration“.

Extra configuration

The output is to be activated via “Extra configuration“:

- Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Outputs > Mixing valve 3-pos Assign terminal
- Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Outputs > Mixing valve 3-pos Assign terminal

9.2.2 Pump control

The heating circuit pump offers the same choices as all the other pumps. An individual pump can also be monitored; optionally, a twin pump can be used as a heating circuit pump. For that, the relevant output must be configured.
For more detailed information, refer to section 5.8 “Pump control and twin pumps”.

Fault settings in the heating circuit

- Main menu > Commissioning > Settings > ... or
- Main menu > Settings > Heating circuit 1 (or 2 or 3) > Fault settings > Overload pump

Operating line	*Range*	*Factory setting*
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge and reset
Fault acknowledgement B	None / Acknowledge / Acknowledge and reset	Acknowledge and reset

9.3 Operating modes in the heating circuit

9.3.1 Room operating modes

The room operating mode determines the state of a heated room. A differentiation is to be made between preselected room operating mode and the state of the room operating mode. Room operating mode Auto is only available as a preselection.
The user can preselect the following operating modes for space heating:

Preselection	*Use*
Auto	Factory setting. The room operating mode changes automatically according to the time program
Comfort	The room is constantly maintained at the Comfort setpoint. This operating mode is selected when the room is constantly occupied
Precomfort	The room is constantly maintained at the Precomfort setpoint. This operating mode is selected when occupancy of the room can be expected
Economy	If the room is not used for a number of hours, or if a reduced room temperature is desired, the recommended operating mode is Economy. Normally, this is the operating mode selected for the night
Protection	In Protection mode, the room will be heated only when there is risk of frost, causing water pipes to freeze, etc. The room temperature will be maintained at a level above 0 °C

Depending on the state of the room operating mode, some other room temperature setpoint will apply. The flow temperature setpoint, the heating limit and the optimization functions will be influenced, depending on the current room temperature setpoint.

Room operating mode

■ Main menu > Heating circuit 1 (or 2 or 3) > Room operating mode

Operating line	*Range*	*Factory setting*
Preselection	Auto / Comfort / Precomfort / Economy / Protection	Auto
State	Comfort / Precomfort / Economy / Protection	
Cause	Time switch ⑫ / Holidays ⑩ or ⑪ / Special day ⑨ or ⑪ / Timer function ⑦ or ⑧ / Konnex presence button ⑥ / Room optg mode selector ⑤ / Room optg mode contact ④ / External master ③	

For a description of the control priorities ③…⑫, refer to subsection 9.3.7 “Control priorities in the heating circuit”.

Preselection
Room operation selector

Here, the plant user can select the required operating mode. In Auto mode, the setpoint is determined either by the time program or the plant user. If desired, one of the continuous modes (Comfort, Precomfort, Economy or Protection) with a fixed setpoint can be selected.

⇒ In Protection mode, the heating system shuts down, but safety-related functions, such as frost protection, will stay active.

State

The display shows the heating circuit’s setpoint that is currently maintained.

Cause

Different reasons can have led to the current state. Decisive is the control priority (refer to subsection 9.3.7 “Control priorities in the heating circuit”).

Time switch

In preselected room operating mode Auto, the time switch changes the room operating mode or the room temperature setpoint in accordance with the program entered. During holidays, a fixed preselected setpoint is used:

Operating mode during holidays

Main menu > Heating circuit 1 (or 2 or 3) > Room operating mode

Operating line	*Range*	*Factory setting*
Room operating mode holidays	Economy / Protection	Economy

Note

The holiday function is only active in room operating mode Auto.

9.3.2 User request in the room

Overriding the 24-hour program

The plant user has several choices to override the current 24-hour program and to switch to some other setpoint. Following can be used to override operation from the room:

- Switch or button (directly connected)
- Konnex operator units (e.g. QAW740)
- Bus operator unit RMZ792

Room unit QAW740

On the QAW740 room unit, the plant user can select the room operating mode via the mode button (preselection of operating mode) or the timer button.

3rd-party devices with Konnex interface

User interventions can also take place via a 3rd-party device with Konnex interface (S-Mode). Precondition is that preselection of the room operating mode is set to Auto.

Presence button

In room operating mode Auto, the presence button can be used to change the room operating mode for the period of time until the next switching point of the time switch is reached. Changeover takes place between Comfort or Precomfort and Economy.

Timer function

The timer function is identical with the timer function triggered via a conventional button. For this reason, the setting used for the duration is also the same. The mode of operation of this function is described in subsection 9.3.4 “Timer function”.

Conventional switches and buttons

External switches or buttons for overriding the room operating mode can be connected to inputs “Room operating mode” and “Timer function”. The mode of operation of these inputs is described in the 2 following subsections.
They override the other control interventions in accordance with the control priority.
For a description of the control priorities, refer to subsection 9.3.7 “Control priorities in the heating circuit”.

9.3.3 Room operating mode contact

Using a configurable input, a contact signal for changing the room operating mode can be acquired. Changeover takes place between the current operating mode and a selectable fixed operating mode.

Extra configuration

The input is to be activated via “Extra configuration“:

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Inputs > Room operating mode Assign terminal

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Space heating

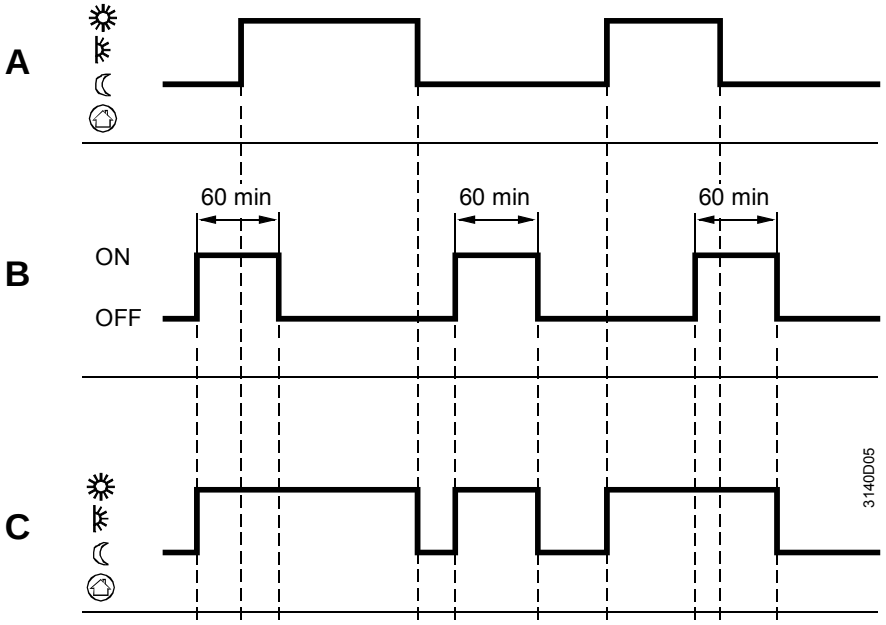
Operating line	*Range*	*Factory setting*
Preselected room optg mode	Comfort / Precomfort / Economy / Protection	Comfort
Heat limit with Comfort preset	Inactive / Active	Inactive

Heating limit with preselected Comfort mode

If Comfort mode is preselected via the room operating mode contact, the heating limit can be activated with these settings.
If, in accordance with the time program, Comfort mode is active, the heating limit always applies, independent of this setting.

9.3.4 Timer function

Using a configurable input, the pulse triggered by a button can be acquired to extend Comfort mode in operating mode Auto. The timer's time can be adjusted.
The timer function starts immediately.



A Room operating mode according to the time switch
B Timer function
C Resulting room operating mode

Extra configuration

The input is to be activated via "Extra configuration":

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Inputs > Timer function Assign terminal

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Space heating

Operating line	*Range*	*Factory setting*
Timer function	0…720 min	60 min

Note on QAW740

This setting does not apply to the QAW740 room unit; in that case, the setting is to be made directly on the room unit.

Tip

The activated timer can be stopped by changing the room operating mode (e.g. via the room operation selector).

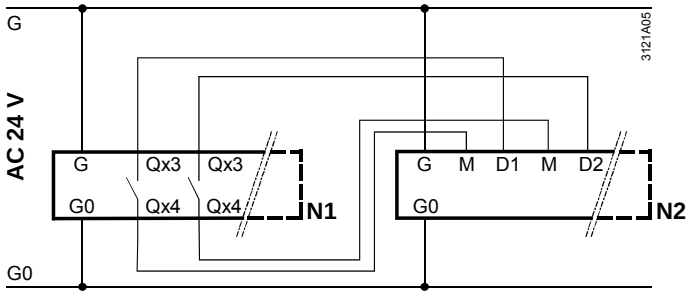
9.3.5 Room operating mode outputs

Purpose

Function block outputs "Operating mode R1" and "Operating mode R2" enable the resulting room operating mode of a heating circuit to be output via one or 2 relays. This is always possible, even if heating circuit control is not used.

Application example

Forwarding the resulting room operating mode from the Qx relay outputs of the RMH760B to a Synco™200 controller:



N1 RMH760B
N2 Synco™200 RLU2…

Configuration of both operating mode relays

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Outputs

Operating line	*Adjustable values / display / remarks*
Operating mode relay 1	--- / N.Q1…, etc. (only free relays) / assignment of operating mode relays
Operating mode relay 2	--- / N.Q1…, etc. (only free relays) / assignment of operating mode relays

Settings

On the “Settings” menu, the operating mode relay to be energized can be defined for each room operating mode.

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Space heating

Operating line	*Range*	*Factory setting*
Comfort relay control	--- / R1 / R2 / R1+R2	---
Precomfort relay control	--- / R1 / R2 / R1+R2	---
Economy relay control	--- / R1 / R2 / R1+R2	R2
Protection relay control	--- / R1 / R2 / R1+R2	R1+R2

Note on factory setting

The factory setting has been chosen such that the digital outputs can be connected directly to the digital inputs of the Synco™200 controller.
Since the Synco™200 controllers do not use the Precomfort mode, an automatic change from Precomfort to Comfort mode will be made. This setting can be changed to suit individual needs.

Meaning of adjustable values

The adjustable values previously listed under "Settings" have the following meaning:

Value set	*State of relay R1*	*State of relay R2*
---	Normal position	Normal position
R1	Operating position	Normal position
R2	Normal position	Operating position
R1+R2	Operating position	Operating position

Display values

The Outputs menu shows the state of the operating mode relays:

Main menu > Heating circuit 1 (or 2 or 3) > Outputs

Operating line	*Current state*
Operating mode relay 1	Off or On
Operating mode relay 2	Off or On

9.3.6 Plant operation

Plant operation indicates whether the heating circuit is switched on and whether the pump operates.

Plant operation

Main menu > Heating circuit 1 (or 2 or 3) > Plant operation

Operating line	*Range*	*Factory setting*
Preselection	Auto / Off*	Auto
State	On / Off	
Cause	Commissioning / Frost protection for the room / Heating limit switch / Cooling active / Room temp limitation max / Optimum stop control / Quick setback / Quick setback + optimum stop / Optimum start control / Boost heating / Boost heating + opt start / User request room / User request external / Overtemperature protection / overrun / Plant operation selector / No request/ Frost protection for the flow / Frost protection for the plant	

* Frost protection functions are ensured

Preselection

The heating circuit can be switched off for service purposes. The mixing valve will close and the heating circuit pump will be deactivated on completion of pump overrun. When preselecting "*Off*", *the internal frost protection function remains active.*

After completion servicing, the selector must be set back to Auto .

State

The boiler's state is indicated (On / Off).

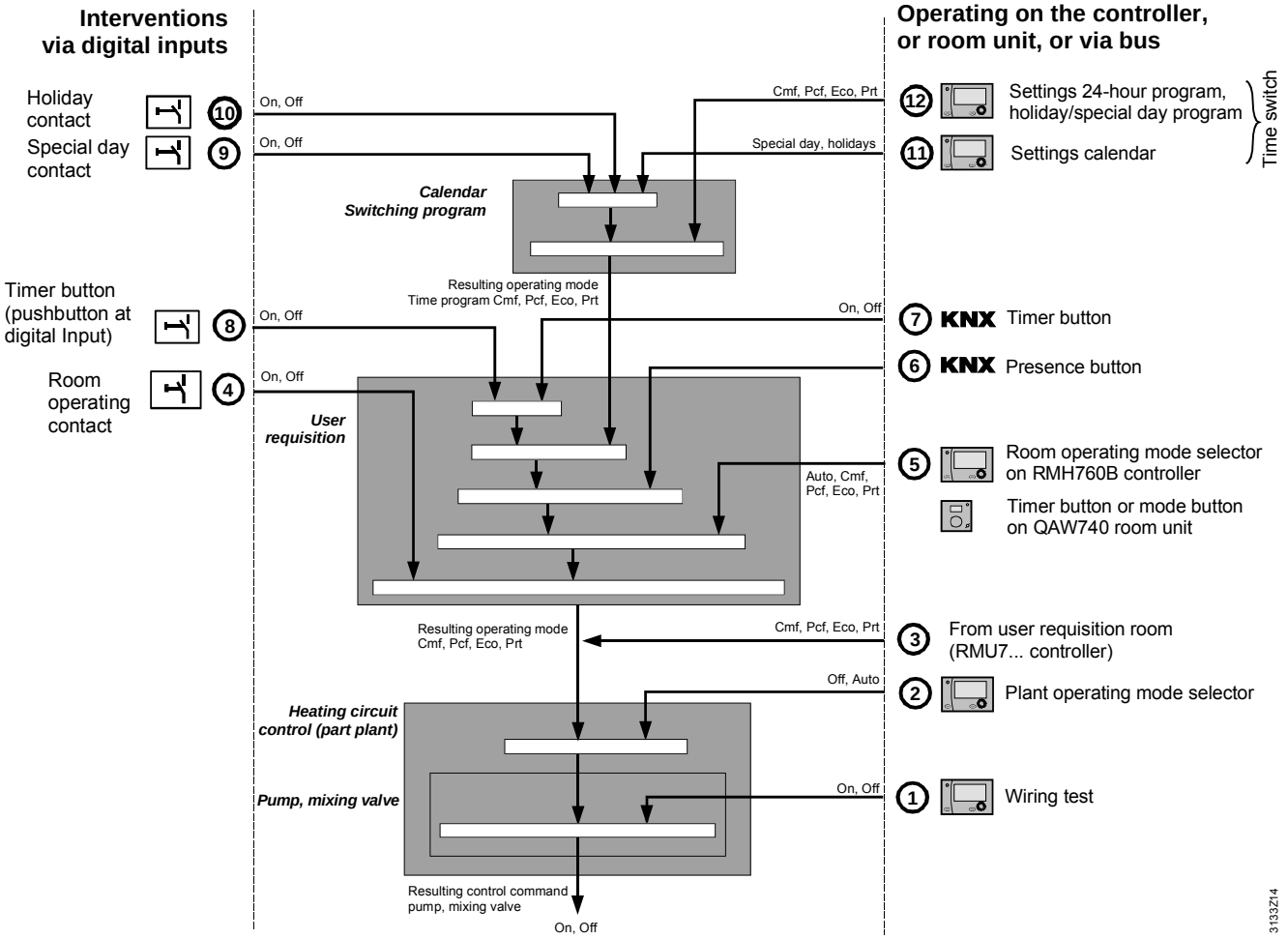
Cause

It is indicated why the current state is active.

9.3.7 Control priorities in the heating circuit

The following illustration shows the priorities of the different interventions via digital inputs and via the Konnex bus as well as operation on the controller or the QAW740 room unit.

⇒ Lower numbers indicate higher priorities.



Priority	*Name*	*Explanation*
①	Wiring test	In the wiring test (highest priority), the plant components can be directly controlled, independent of all other settings ⚠ The controller-internal safety functions will be overridden!
②	External master	The plant operation selector has the second highest priority and can only be overridden by the controller's frost protection function
③	Room optg mode contact	If the heating circuit operates in a room control combination as a slave, the operating mode is preselected by the external master (heating circuit or ventilation). In that case, interventions of priority ④ through ⑫ can only be made on the master
④	Room operating mode selector	Using the room operating contact, a fixed operating mode can be preselected. This operating mode overrides room operation selector ⑤ on the controller
⑤	External master	The room operation selector can be used to switch from operating mode Auto to a continuous operating mode with the respective setpoint. In operating mode Auto, the setpoint is determined by the time switch or the presence button and the timer

Priority	*Name*	*Explanation*
⑥ ⑦ / ⑧	Presence button and timer button	The current time program can be overridden by presence button ⑥ or timer button ⑦. The timer button at digital input ⑧ (or of a 3-party Konnex device) can also override the room operating mode. If 2 or more functions are triggered, the function activated last will prevail
⑨	Special day contact	The current 24-hour program will be overridden by the special day contact. In the time switch, the special day program will be activated
⑩	Holiday contact	The current 7-day program will be overridden by the holiday contact. The room operating mode can be selected
⑪	Calendar	If a special day is active, the associated 24-hour program of the time switch will be activated. Holidays, if entered, will be overridden. If holiday mode is active, the selected room operating mode applies
⑫	Time switch	In the time switch, the associated 24-hour program will be activated in accordance with the current weekday. The 24-hour program forwards the current room operating mode, the next setpoint, and the time up to the next switching point

9.4 Room temperature setpoints

9.4.1 Settings

The setpoints for the 4 room operating modes can be preselected by the plant operator via operation. The setting values limit each other.

■ Main menu > Heating circuit 1 (or 2 or 3) > Room setpoints

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Room setpoints

Operating line	*Range*	*Factory setting*
Comfort	19…35 °C	21 °C
Precomfort	16…21 °C	19 °C
Economy	10…19 °C	16 °C
Protection	1…16 °C	10 °C

Remote setpoint adjuster

The preselected setpoints for Comfort ☼ and Precomfort ☽ mode can be readjusted by ±3 K on the QAW740 room unit.
It is possible to use a conventional room temperature setpoint adjuster (absolute or relative). For more detailed information about this subject, refer to the following 2 sections.
The 4 setpoints are to be readjusted according to the following rules:

- Simultaneous readjustment of Comfort and Precomfort setpoints
- When the Economy setpoint is reached, it will be shifted together with the Precomfort setpoint
- In Protection mode, the Comfort, Precomfort and Economy setpoints are limited

Display of inputs and setpoints

The effective setpoint appears on the **Main menu** and on the info page.

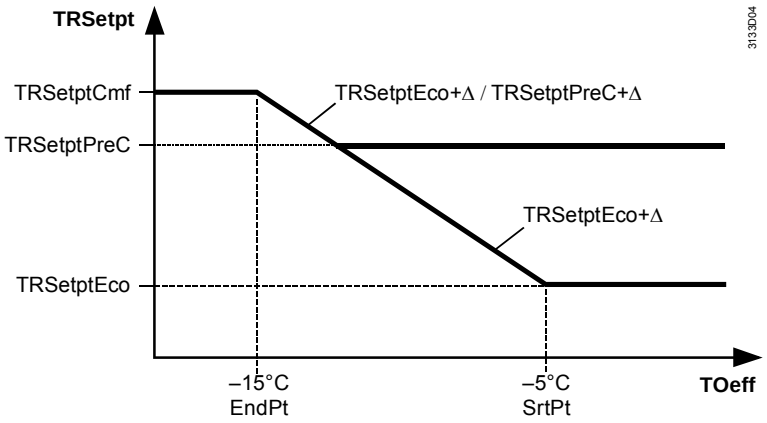
■ Main menu > Heating circuit 1 (or 2 or 3) > Inputs/setpoints

Operating line	*Adjustable values / display / remarks*
Current room temp setpoint	…°C
Room setpoint absolute*	…°C
Room setpoint relative*	…°C

* Only if configured via “Extra configuration“

9.4.2 Raising the Economy setpoint

The room temperature setpoint in Economy mode is increased as a function of the composite outside temperature. The increase is greater at low outside temperatures and reduced to zero at high outside temperatures, whereby starting and end point are adjustable.
The function helps prevent peak loads when changing from Economy to Precomfort or Comfort mode.



EndPt	End point of increase (–15 °C in the graph)
SrtPt	Starting point of increase (–5 °C in the graph)
TOeff	Composite (effectively acting) outside temperature
TRSetpt	Room temperature setpoint
TRSetptCmf	Comfort setpoint
TRSetptEco	Economy setpoint
TRSetptEco+Δ	Increased Economy setpoint
TRSetptPreC	Precomfort setpoint
TRSetptPreC+Δ	Increased Precomfort setpoint

Settings

■ Main menu > Settings > Heating circuit 1 (or 2 or 3) > Optimizations/influences

Operating line	*Range*	*Factory setting*
Economy increase starting point	–15…50 °C	–5 °C
Economy increase end point	–50…–5 °C	–15 °C

Display values

The **Inputs/setpoints** menu shows the state of the increase:

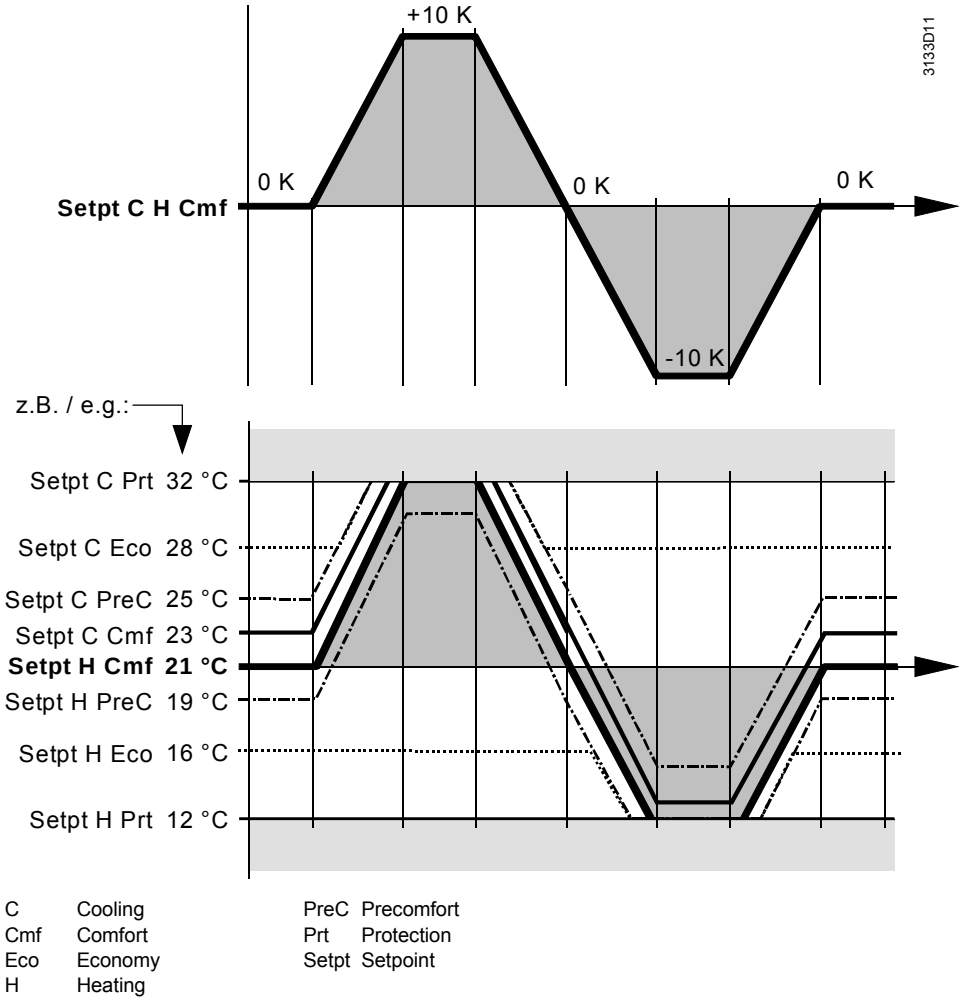
■ Main menu > Heating circuit 1 (or 2 or 3) > Inputs/setpoints

Operating line	*Adjustable values / display / remarks*
Economy increase	Inactive / Active

9.4.3 Room temperature setpoint adjuster, absolute

For the preselected room temperature setpoints Comfort and Precomfort, a remote setpoint adjuster (e.g. BSG21.1) can be configured.
The 4 setpoints will be readjusted according to the following diagram.

The figure at the top shows the difference between the remote setpoint adjuster and the adjusted Comfort setpoint for heating. This difference impacts the other setpoints very differently. This is shown in the figure at the bottom.



C	Cooling	PreC	Precomfort
Cmf	Comfort	Prt	Protection
Eco	Economy	Setpt	Setpoint
H	Heating		

Impact on the Comfort setpoint

The current Comfort setpoint ☼ is the setpoint adjusted with the remote setpoint adjuster.
Although the Comfort setpoint is predefined by the remote setpoint adjuster, a fixed Comfort setpoint for heating need be entered on Main menu > Heating circuit 1 (or 2 or 3) > Room setpoints. From the difference between the fixed Comfort setpoint “Heating“ and the adjustment made with the remote setpoint adjuster, the current Comfort setpoint “Cooling” can be calculated:

Comfort setpoint “Cooling” + (remote setpoint minus Comfort setpoint “Heating”)

Note

The RMH760B has no Comfort setpoint “Cooling”. The impact on the Comfort setpoint “Cooling“ as described above is only possible in connection with a room control combination. For more detailed information, refer to subsection 9.10.3 “Room control combination”.
The setpoint shift is limited by the setpoints for Protection mode. Also refer to the graph above.

Impact on the Precomfort setpoint

The Precomfort setpoints ☽ are shifted also:
Hence, the current Precomfort setpoint “Heating” is calculated as follows:

Precomfort setpoint “Heating“ + (“Remote setpoint” minus Comfort setpoint “Heating“)

And the current Precomfort setpoint “Cooling” is calculated as follows:

Precomfort setpoint “Cooling“ + (“Remote setpoint” minus Comfort setpoint “Heating“)

The note above in paragraph “Comfort ☼“ also applies analogously to the Precomfort setpoint.

Impact on the Economy setpoint

The Economy setpoints ☾ are shifted only if, otherwise, the Precomfort setpoints would lie outside the Economy setpoints. Also refer to the graph above.

Extra configuration

The input is to be activated via “Extra configuration“:

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Inputs > Room setpoint adjuster abs Assign terminal

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs

Operating line	*Range*	*Factory setting*
Value low	0 °C…value high	0 °C
Value high	Value low…50 °C	50 °C

⚠ The range set here must accord with the scale of the remote setpoint adjuster. The factory settings are matched to the BSG21.1 remote setpoint adjuster and must not be changed with this type of setpoint adjuster.

Notes

- It is not recommended to use a QAA25 room temperature setpoint adjuster since its characteristic is not linear so that setpoint deviations of maximum 1 K would occur. Compensation is not possible
- DC 0…10 V setpoint adjusters **cannot** be connected. The input is ready preconfigured for 0…1,000 Ω
- The adjusted setpoint represents the Comfort setpoint. At the same time, the Precomfort setpoint is displaced parallel so that the difference between the 2 setpoints will be maintained

9.4.4 Room temperature setpoint adjuster, relative

For room temperature setpoint readjustments in the Comfort and Precomfort modes, a remote setpoint adjuster (e.g. QAA27 with room temperature sensor) can be configured.

Extra configuration

The input is to be activated via “Extra configuration“:

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Inputs > Room setpoint adjuster rel Assign terminal

Settings

There are no settings required.

9.5 Weather-compensated heating circuit control

The flow temperature setpoint of heating circuit control is determined by the heating curve and other influencing factors.

Outside temperature

The main reference variable of heating circuit control is the outside temperature. It can be acquired by different devices:

- By the locally connected outside sensor
- Via bus from some other device

The controller delivers 3 different types of outside temperatures whereby heating circuits 2 and 3 have access to their own outside temperature. The other applications (heating circuit 1, pumps, boiler, demand transformers, etc.) share a common outside temperature.

Composite outside temperature

Depending on the type of building construction, the outside temperature acts on the space with a certain delay. For this reason, the reference variable used by the heating curve is not the actual but the composite outside temperature.

Attenuated outside temperature

To determine the heating limit (summer / winter operation), the attenuated outside temperature is also required (see below).

Heating curve

The heating curve is determined by the 2 curvepoints at the design temperature and the theoretical heating limit. Heat transmission in the space is not linear, however. When there is a small differential between flow temperature and room temperature, the ability of heat transmission decreases. This is taken into account by the heating curve.

Other influences

The setpoint predefined by the heating curve can also be influenced by the following factors:

- The room temperature setpoint
- The current room temperature (room temperature influence)

For more detailed information, refer to subsection 9.5.3 “Influences on the flow temperature setpoint”.

9.5.1 The composite and the attenuated outside temperature

Identifiers used:

TO	Actual outside temperature
TOeff	Composite (effectively acting) outside temperature
TOfil	Outside temperature filtered with the building time constant
TOstrDmp	Attenuated outside temperature
τBldg	Building time constant
pWindow	Proportion of windows in %

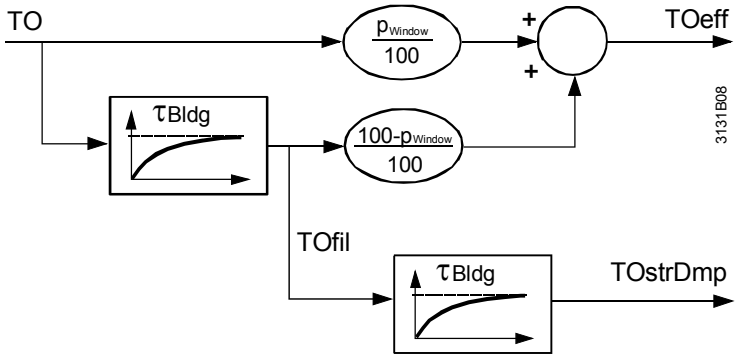
Composite outside temperature

The composite outside temperature is made up of the actual outside temperature To and the outside temperature TOfil filtered with the building time constant τBldg. The proportion of windows p_{Window} (adjustable from 0…100 %) determines the proportions with which the 2 temperatures are considered.

⇒ The composite outside temperature is used for the heating curve and the heating limit.

Attenuated outside temperature

To obtain the attenuated outside temperature, the actual outside temperature TO is filtered twice with the building time constant τBldg.



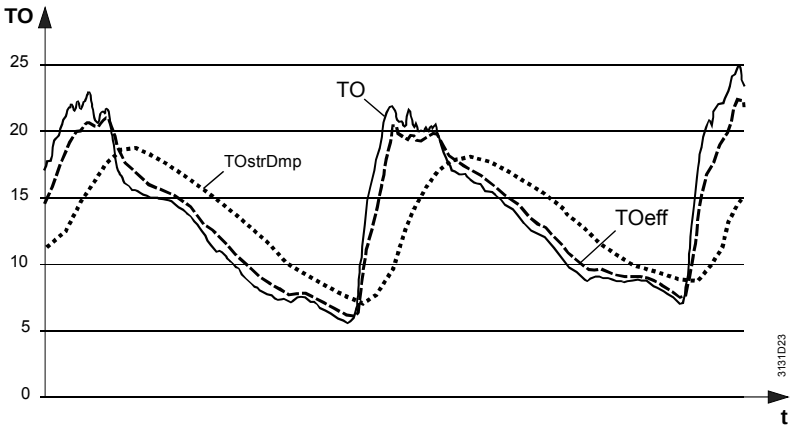
⇒ For the heating limit, the actual, the composite and the attenuated outside temperature are considered.

p_{Window} = 50%

The controller is supplied with the proportion of windows set to 50 % so that the composite outside temperature represents the mean value of the actual and the filtered outside temperature.

It is calculated as follows:

TOeff = (0.5 × TO) + (0.5 × TOfil)



Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Space heating

Operating line	*Range*	*Factory setting*
Building time constant	0…200 h	20 h

Heating curve

Main menu > Heating circuit 1 (or 2 or 3) > Heating curve

Operating line	*Range*	*Factory setting*
Proportion of windows	0…100 %	50 %

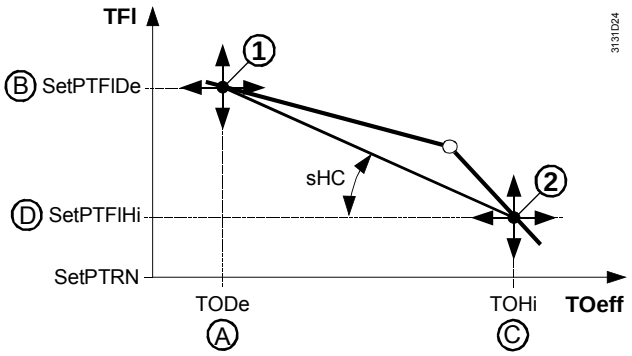
9.5.2 Heating curve

Curvepoints

The heating curve is defined by 2 curvepoints:

①: At the design temperature
- By the outside temperature TODef Ⓐ
- By the flow temperature SetPTFlDef Ⓑ

②: At the theoretical heating limit
- By the outside temperature TOHi Ⓒ
- By the flow temperature SetPTFlHi Ⓓ



Radiator exponent

The nonlinear heat transmission is considered by the radiator exponent nH. The following table gives an overview of the different types of heating systems normally used:

Heat transmission via…	*Radiator exponent nH*
Underfloor heating system	1.05…1.1
Flat radiators	1.26…1.33
Radiators to DIN 4703	1.3
Convectors	1.25…1.45

Inflection point

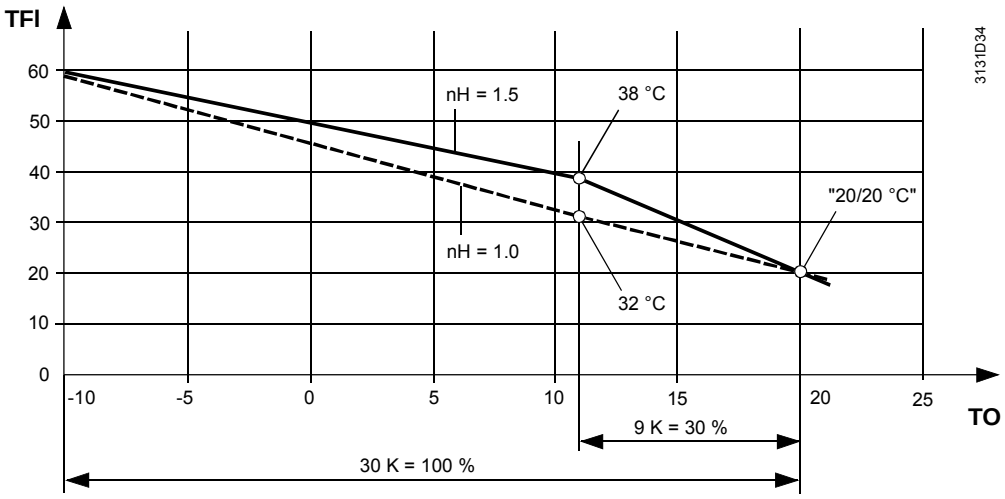
With a radiator exponent between 1…1.5, the heating curve is only slightly deflected and can therefore be replaced by linearized sections. This is achieved by setting another curvepoint, the so-called inflection point.
The inflection point lies 30 % below the outside temperature at which the flow temperature setpoint is 20 °C and the outside temperature Ⓐ at curvepoint ①.
This means that curvepoint ② (usually set at the heating limit) does **not** directly determine the location of the inflection point.

Note

The basic heating curve applies to a room temperature setpoint of 20 °C. At lower or higher setpoints, the heating curve is appropriately displaced (also refer to subsection 9.5.3 “Influences on the flow temperature setpoint”).

Example

Outside temperature at a flow temperature setpoint of 20 °C = 20 °C
Outside temperature Ⓐ = –10 °C
30 % of that range = 9 K
Hence, the inflection point is at an outside temperature of 11 °C.



The lift at the point of inflection is dependent on the flow temperature setpoint and the radiator exponent.

Rule of thumb:

Rule of thumb for calculating the lift at the inflection point:

$$\text{Lift} \approx (\text{Flow temperature setpoint}_{\text{at nH = 1}} - 20\ °C) \times (nH - 1)$$

Example above:

$$\text{Lift} \approx (32\ °C - 20\ °C) \times (1.5 - 1) = 6\ K$$

Heating curve

■ Main menu > Heating circuit 1 (or 2 or 3) > Heating curve

Operating line	*Range*	*Factory setting*
[Curvepoint 1] outside temp	–50…10 °C	–11 °C
[Curvepoint 1] flow temp	25…140 °C	60 °C
[Curvepoint 2] outside temp	5…30 °C	15 °C
[Curvepoint 2] flow temp	5…140 °C	30 °C
Radiator exponent	1.00…2.00	1.30

Notes

- The heating curve is identical to that of the DESIGO system
- Setting of the radiator exponent can be derived from the type of heating system and is based on physical ground

9.5.3 Influences on the flow temperature setpoint

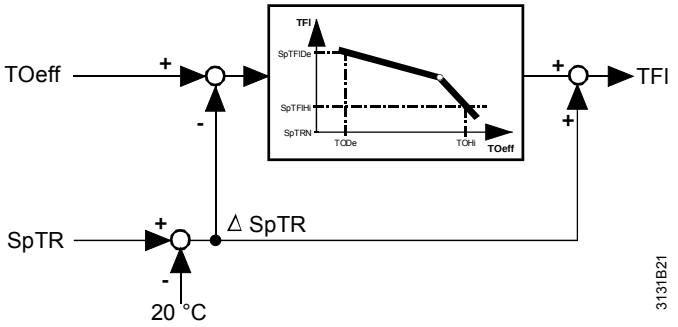
The basis used for the flow temperature setpoint is the heating curve. In addition, the setpoint is influenced by the following variables:

- Room temperature setpoints

- Room temperature
- Boost heating (refer to subsection 9.7.3 “Quick setback and boost heating”)

Impact of the room temperature setpoint

The basic heating curve applies to a room temperature setpoint of 20 °C. A positive room temperature setpoint change ΔTR corresponds to a displacement of the heating curve by the same amount toward the outside temperature and to a displacement by the same amount toward the flow temperature.



Roughly, this corresponds to the value of:

$\Delta TFl = \Delta TRw \times (sHc + 1)$

$$sHc = \frac{SpTFlDe - SpTFlHi}{ToHi - ToDe}$$

Example

Setpoint readjustment ΔTRw = 2 K. ΔTFl = ?

$$sHc = \frac{60 - 30}{(15 - [-5])} = 1.5 \quad \Rightarrow \quad \Delta TFl = 2\ K \times (1{,}5 + 1) = 5\ K$$

Impact of the room temperature

A deviation of the actual room temperature from the room temperature setpoint has an impact on the flow temperature setpoint only when room temperature influence is activated.

⇒ Connection of a room temperature sensor does not automatically activate the room influence.

An analog sensor can be used as a room temperature sensor (Extra configuration), or a room unit transmits the room temperature signal via bus.

⚠ In plants where the heating circuit operates in connection with a ventilation system as a room control combination, the room temperature sensor of the ventilation system must not be located in the extract air!

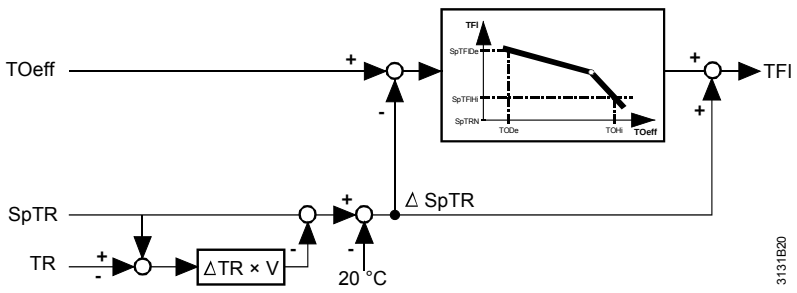
The set room temperature influence defines the gain factor with which the room temperature deviation shall be weighted. The heating curve handles this amplified room temperature as a readjusted room temperature setpoint.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Optimizations/influences

Operating line	*Range*	*Factory setting*
Room influence	---- / 0…10	----



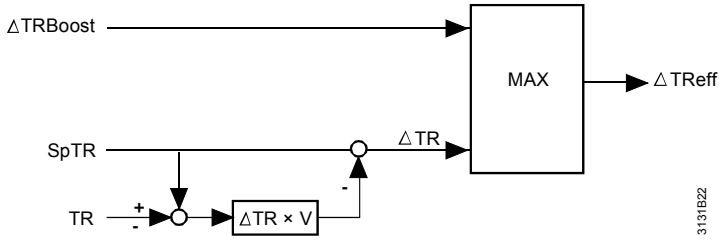
Rule of thumb

Due to the room temperature deviation ΔTV, the change of flow temperature setpoint corresponds roughly to the value of:

$$\Delta TFl = \Delta TR \times V \times (sHc + 1)$$

ΔTFl	Change of flow temperature setpoint	sHc	Heating curve slope
ΔTR	Change of room temperature setpoint	Sp	Setpoint
V	Room temperature influence	TRx	Room temperature

During boost heating, the room temperature setpoint increase also produces an increase of the flow temperature setpoint. In that case, the greatest of the 2 values is used for generating the setpoint.



The resulting room temperature setpoint has a minimum limitation of 5 °C and a maximum limitation of 35 °C.

Impact of solar radiation

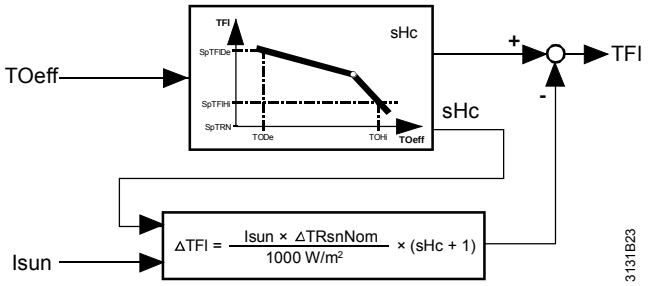
Only one solar intensity sensor can be connected to a controller. For configuration and parameterization, refer to chapter 12 “Function block miscellaneous”.
The impact of solar radiation is to be set individually for each heating circuit. It can be deactivated (setting ”---“).

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Commissioning > Heating circuit 1 (or 2 or 3) > Optimizations/influences

Operating line	*Range*	*Factory setting*
Impact of solar radiation	---- / 0.0…15.0 K	----



ΔTRsnNom	Room temperature increase with 1000 W/m²
Isun	Filtered solar radiation
sHc	Heating curve slope

The solar intensity sensor is to be configured via “Extra configuration”. If required, the controller’s DC 0…10 V input is to be matched to the sensor output.
DC 0…10 V ≅ 0…1,000 W/m² is the factory setting.
Setting of the solar radiation impact must always be matched to the type of building.
The setting to be made is the room temperature increase ΔTRsnNorm resulting from a solar radiation of 1,000 W/m².
Based on this parameter and the current (slightly) attenuated solar radiation, the controller calculates the flow temperature readjustment ΔTFl due to solar radiation (Isun) as follows:

$$\Delta TFl = \frac{Isun \times \Delta TRsnNorm}{1000} \times (sHc + 1)$$

Influence of wind speed

Only one wind speed sensor can be connected to a controller. For configuration and parameterization, refer to chapter 12 “Function block miscellaneous”.

The influence of the wind speed is to be set individually for each heating circuit. It can be deactivated (setting "---").

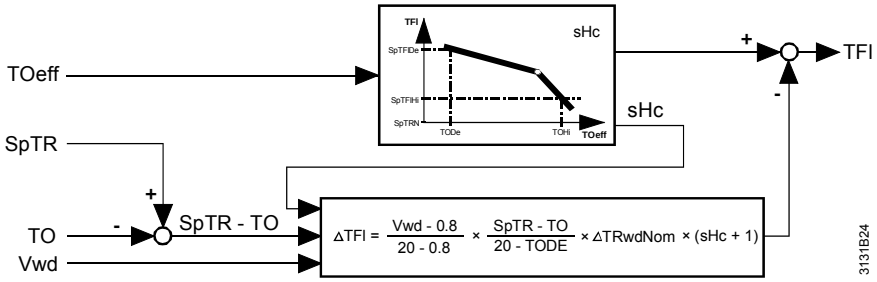
Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Optimizations/influences

Operating line	*Range*	*Factory setting*
Influence of wind speed	---- (none) / 0.0…10.0 K	----

The setting to be made is the room temperature drop resulting from a wind speed of 20 m/s. The influence refers to the design temperature at curvepoint ①.



ΔTRwdNom	Room temperature drop at 20 °C
sHc	Heating curve slope
SpTR	Room temperature setpoint
TODE	Outside temperature at the design temperature
TOeff	Effective outside temperature
Vwd	Filtered wind speed

The wind speed sensor is to be configured via "Extra configuration". If required, the controller's DC 0…10 V input is to be matched to the sensor output.
DC 0…10 V ≅ 0…20 m/s is the factory setting.
Setting of the wind influence must always be matched to the location of the building.
The setting to be made is the room temperature drop ΔTrwdNorm resulting from a wind speed of 20 m/s at a room temperature of 20 °C and the design temperature A, which corresponds to the lower curvepoint.
Based on this parameter and the current (slightly) attenuated wind speed, the controller calculates the flow temperature readjustment ΔTFl due to the wind.

$$\Delta TFl = \frac{Vwd - 0.8}{19.2} \times \frac{SpTR - TO}{20 - TODE} \times \Delta TRwdNorm \times (sHc + 1)$$

9.5.4 Heating limit switch

The heating limit switch is capable of deactivating the heating circuit pump and of shutting down the supply of heat to the heating circuit.
This prevents the waste of heating energy at higher outside temperatures.

To determine the heating limit, the following outside temperature values are taken into consideration (refer to subsection 9.5.1 "The composite and the attenuated outside temperature"):

- The actual outside temperature TO
- The composite (effectively used) outside temperature TOeff
- The attenuated outside temperature TostrDmp

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Space heating

Operating line	*Range*	*Factory setting*
Comfort heating limit	---- / –5…25 °C	17 °C
Economy heating limit	---- / –5…25 °C	5 °C
Heat limit with Comfort preset	Inactive / Active	Inactive

The following applies:

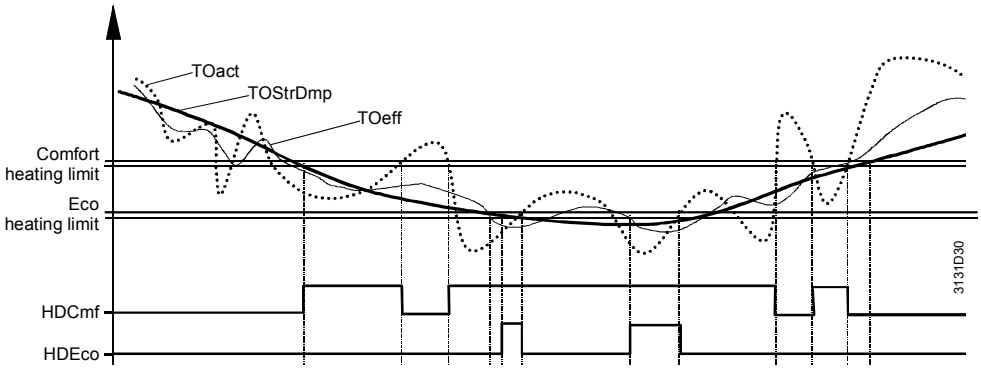
- If the Comfort heating limit is set to "----" (none), a heating limit will only exist in Economy mode ☾ and Protection mode ⌂. There will be no change to summer operation
- If the Economy heating limit is set to "----" (none), the Comfort heating limit will be active in Economy mode ☾ and Protection mode ⌂

Comfort heating limit

- If **all 3** temperatures lie 1 °C **below** the Comfort heating limit, heat will be delivered in Comfort mode ☼ and Precomfort mode ☼
- If **one of the 3** temperatures lies **above** the Comfort heating limit, the delivery of heat will be locked

Economy heating limit

- If **all 3** temperatures lie 1 °C **below** the Economy heating limit, the delivery of heat will be released in Economy mode ☾ and Protection mode ⌂
- If **one of the 3** temperatures lies **above** the Economy heating limit, the delivery of heat will be locked



Heating limit when Comfort is preselected

Whether the heating limit function shall be active in operating mode "Continuously Comfort ☼ " can be selected on the "Space heating" menu.
This setting is always active, independent of whether the operating mode was switched to "Continuously Comfort ☼ " or through the room operating mode contact. Exempted from this is the room control combination with an RMU7… ventilation controller; here, the heating limit is always active.

Summer / winter operation (information for ventilation)

For operation in combination with the ventilation controller, summer / winter operation changeover is used as an overriding function.
When the attenuated outside temperature exceeds the Comfort heating limit, a change to summer operation will take place; this also applies to operating mode "Continuously Comfort ☼ ".

9.6 Mixing valve control

9.6.1 Control

Setpoint

The flow temperature setpoint determined by weather-compensated heating circuit control generates the effectively active setpoint for mixing valve control while giving consideration to load control.

3-position actuator / DC 0…10 V actuator

Mixing valve control can be effected with a 3-position or DC 0…10 V actuator. The type of actuator is to be selected via "Extra configuration".
The following mixing valve settings apply to both the 3-position and the DC 0…10 V actuator:

Main menu > Commissioning > Settings > ... or

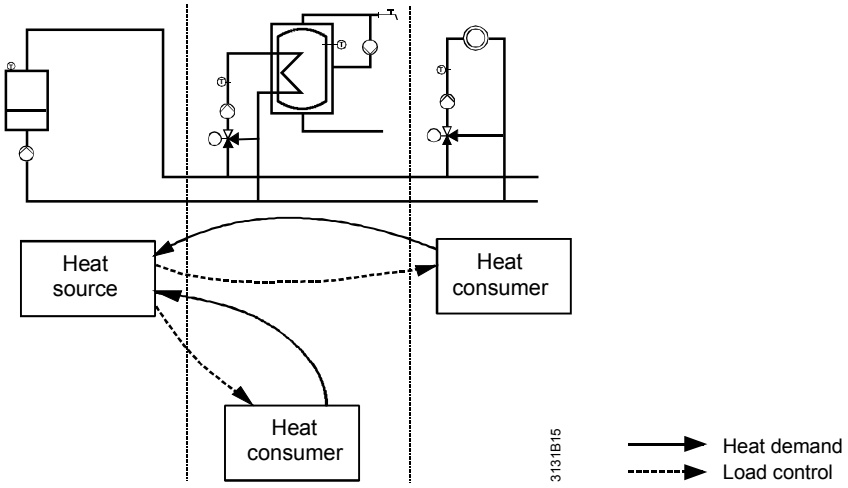
Main menu > Settings > Heating circuit 1 (or 2 or 3) > Mixing circuit controller

Operating line	*Range*	*Factory setting*
Actuator running time	1…600 s	150 s
P-band Xp	1…100 K	50 K
Integral action time Tn	0…600 s	60 s

For more detailed information about mixing valve control and its setting aids, refer to section 5.7 “Mixing valve control”.

9.6.2 Load control

The heat output of mixing valve control can be reduced by functions of higher priority (e.g. by return temperature limitation) or by functions of other plants (boiler, DHW heating). This is accomplished via load control.



Load reduction

Load reduction can be triggered by one of the following functions:

- Protective boiler startup
- Limitation of the return temperature
- DHW heating with shifting priority
- DHW heating with absolute priority

Load increase

From the consumer's point of view, a load increase can be effected in the form of pump and / or mixing valve overrun. In principle, this means load maintenance.

9.7 Optimization functions

The opimization functions are activated or influenced by the following settings:

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Optimizations/influences

Operating line	*Range*	*Factory setting*
Type of optimization	With room model / With room temp sensor	With room model
Forward shift on max	0…48 h	0 h
Early shutdown max	00.00…06.00 h.min	00:00 h.min
Quick setback	Off / On	On
[Boost heating] setpoint increase	0…20 K	5 K
Room temperature rise	1…600 min/K	60 min/K

9.7.1 Type of optimization

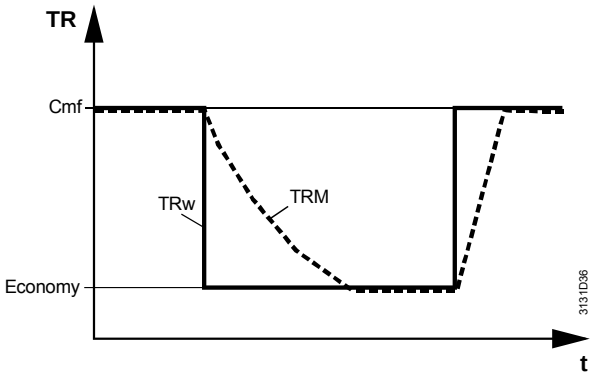
The type of optimization determines whether the optimization functions and boost heating are performed based on the acquired room temperature or whether the room model is used.

Caution

In plants where the heating circuit operates in connection with a ventilation system as a room control combination, the room temperature sensor used for the ventilation plant must **not** be located in the extract air!

Room model

The room model calculates the room temperature based on the outside temperature, the building time constant and the rate of room temperature increase.
If no room temperature sensor is connected, the optimization functions can work with this room model.



T_{RM} Room model temperature
TRw Room temperature setpoint

In the case of sudden positive changes of the room temperature setpoint, the room model temperature will be updated with the rate of room temperature increase. In the case of sudden negative changes, the room model temperature will approach the composite outside temperature at a rate of 3 times the building time constant, whereby the process is stopped as soon as the current room temperature setpoint is reached.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Optimizations/influences

Operating line	*Range*	*Factory setting*
Type of optimization	With room model / With room temp sensor	With room model

9.7.2 Optimum start and stop control

Optimum start control

The purpose of optimum start control is to reach a temperature level 0.25 K below the Comfort or Precomfort setpoint when occupancy according to the time program starts. For that purpose, the heating circuit must be switched on at an earlier point in time. The extent of forward shift depends primarily on the outside temperature.
If a room temperature sensor is installed, the controller also gives consideration to the room temperature when calculating the forward shift. Also, the controller learns the necessary heating up time per K room temperature.
When the required room temperature is reached, the time difference to the target time will be ascertained. Based on the deviation, the controller can readjust the heating up time per K room temperature and calculate the next forward shift with the new value.

With room model

If no room temperature sensor is connected, or when the room model shall be used, the rate of room temperature increase (in min/K) can be set.

The maximum forward shift can also be set. Optimum start control can be deactivated by entering 0 hours as the maximum heating up period.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Optimizations/influences

Operating line	*Range*	*Factory setting*
Forward shift on max	0…48 h	0 h
Room temperature rise	1…600 min/K	60 min/K

Optimum stop control

Optimum stop control switches off the heating circuit at the earliest possible point in time so that the room temperature will lie 0.5 K below the Comfort or Precomfort set-point when the time switch changes from Comfort or Precomfort mode to Economy or Protection mode.

⇒ Optimum stop control is possible only when type of optimization “With room temperature sensor“ has been selected.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Optimizations/influences

Operating line	*Range*	*Factory setting*
Early shutdown max	00.00…06.00 h.min	00.00 h.min

Maximum early shutdown

Maximum early shutdown limits the extent of maximum forward shift. When choosing setting “00:00“, optimum stop control will be deactivated.

9.7.3 Quick setback and boost heating

Quick setback

The purpose of quick setback is to reach the new setpoint as quickly as possible when changing the room operating mode.
During the time quick setback is active, the heating circuit pump is deactivated and the heating circuit’s mixing valve fully closed. The heating circuit remains off until the required room temperature is reached.
The “Quick setback“ function can be deactivated on the service level.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Optimizations/influences

Operating line	*Range*	*Factory setting*
Quick setback	Off / On	On

Quick setback is started when the room operating mode changes from Comfort ☼ or Precomfort ☼ to Economy ☾ or Protection ⊛.
It will be ended when the room temperature has reached the new setpoint or when a change back to Comfort mode ☼ is made.

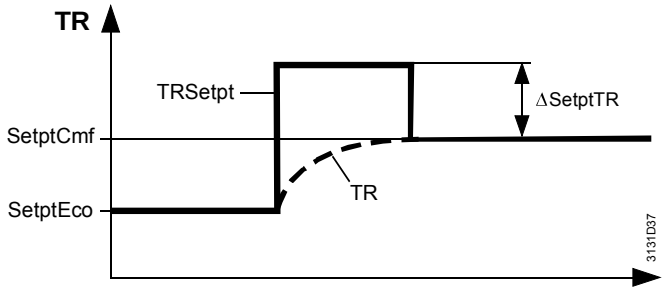
Room temperature

If a room temperature sensor is installed, the actual value of the room temperature will be used for aborting quick setback.
If there is no sensor, the temperature of the room model is used to make the calculation. In that case, the setback time will depend on the outside temperature and the building time constant.

Boost heating

The purpose of the “Boost heating” function is to work with shorter heating up times.
During the time boost heating is active, the room temperature setpoint is raised by an adjustable value.
The room temperature setpoint increase heating due to boost heating and the room influence produce an increase of the flow temperature setpoint. The larger of the 2 influences will prevail.

Boost heating is activated when a change is made from room operating mode Economy or Protection ⏻ to Comfort ☼ or Precomfort ⏩ **and** when the room temperature lies 0.25 K or more below the setpoint.



TR	Room temperature
TRSetpt	Room temperature setpoint
SetptCmf	Setpoint, room operating mode Comfort **or** Precomfort
SetptEco	Setpoint, room operating mode Economy **or** Protection
ΔSetptTR	Setpoint increase

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Optimizations/influences

Operating line	*Range*	*Factory setting*
[Boost heating] setp increase	0…20 K	5 K

9.8 Limit and protective functions

9.8.1 Maximum limitation of the room temperature

If a room temperature sensor is connected, maximum limitation of the room temperature can be activated.
In contrast to room temperature influence with modulating action on the flow temperature setpoint, maximum limitation of the room temperature works with 2-position control.

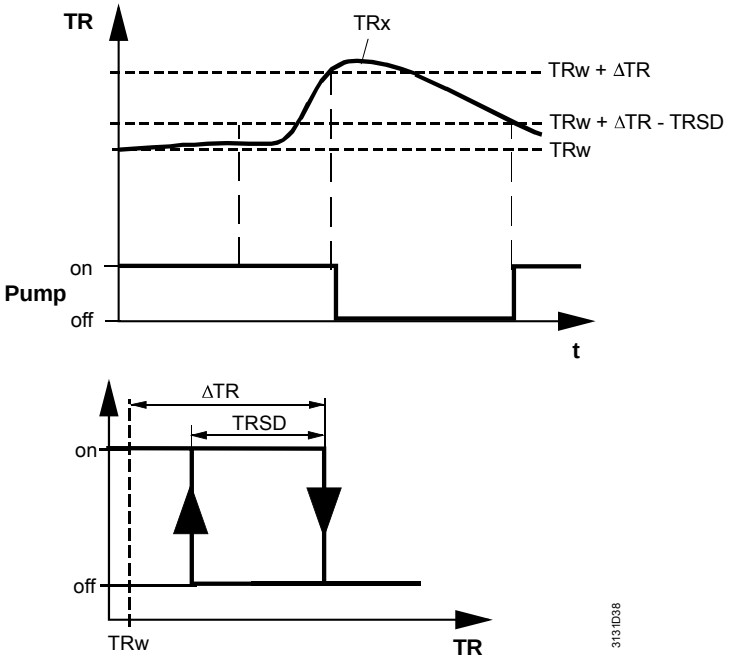
Deactivation

When the actual room temperature exceeds the room temperature setpoint by the adjustable room limitation increase, the heating circuit pump will be deactivated.

⇒ When the pump is deactivated, the heating circuit does not call for heat.

Activation

When the actual room temperature drops below the switch-off point by the room temperature's switching differential, the heating circuit pump will be activated.



t Time
ΔTR Temperature differential for switching the heating circuit off
TR Room temperature
TRSD Temperature differential for switching the heating circuit on
TRw Room temperature setpoint
TRx Actual value of room temperature

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Limitations

Operating line	*Range*	*Factory setting*
Room limitation increase	---- / 0.5…5.0 K	----
Room lim switching differential	0.2…5.0 K	0.2 K

Room limitation increase

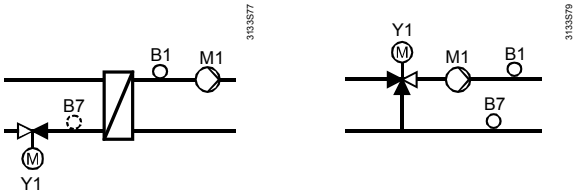
The room limitation increase is used to set the temperature differential for switching off the heating circuit.

Room lim switching differential

The room limitation switching differential is used to set the temperature differential for switching on the heating circuit.

9.8.2 Limitation of the return temperature

The heating circuit's mixing valve can be used to provide maximum limitation of the return temperature. Minimum limitation is not supported. By contrast, the boiler supports minimum limitation with certain restrictions for all consumers. For more detailed information, refer to subsection 9.8.3 "Minimum limitation of the return temperature".



Main controller Primary controller

B1 Flow temperature sensor
B7 Return temperature sensor
M1 Heating circuit pump
Y1 Heating circuit mixing valve

Extra configuration

The function is to be activated via “Extra configuration“:

... > Heating circuit 1 (or 2 or 3) > Inputs > Return sensor

Settings

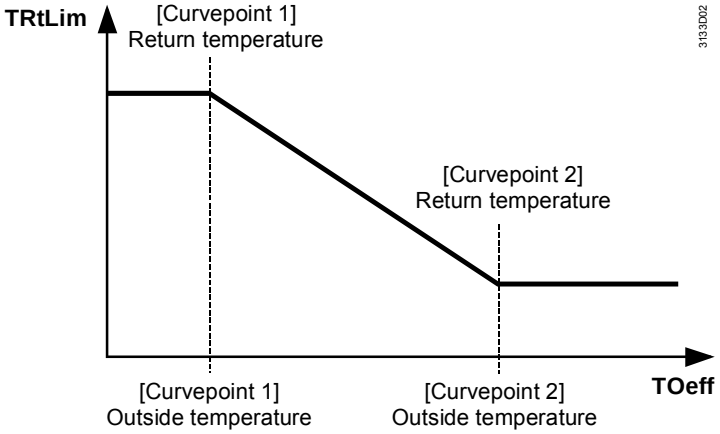
Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 **(**or 2 or 3**)** > Limitations

Operating line	*Range*	*Factory setting*
[Curvepoint 1] outside temp	–50…50 °C	–20 °C
[Curvepoint 1] flow temp	---- / 0…140 °C	---- °C
[Curvepoint 2] outside temp	–50…50 °C	10 °C
[Curvepoint 2] flow temp	---- / 0…140 °C	---- °C

Maximum limitation

The return temperature limit value is either fixed or it changes as a function of the outside temperature. Limitation will be activated when at least one valid maximum return temperature limit is set.



TRtLim	Limit value of return temperature limitation
TOeff	Composite (effectively acting) outside temperature
Curvepoint 1	Maximum return temperature limit value, active at low outside temperatures
Curvepoint 2	Minimum return temperature limit value, active at high outside temperatures

Special cases

Setting	*Effect*
[Curvepoint 1] return temp = [Curvepoint 2] return temp	Constant return temperature limitation. The outside temperature is of no importance
[Curvepoint 1] outside temp = [Curvepoint 2] outside temp	Return temperature limit value, changes abruptly at the curvepoints
[Curvepoint 1] return temp = ---	Constant return temperature limitation with [curvepoint 2] maximum return temperature limit value. The outside temperature is of no importance.
[Curvepoint 2] return temp = ---	Constant return temperature limitation with [curvepoint 1] maximum return temperature limit value. The outside temperature is of no importance
[Curvepoint 1] return temp and [Curvepoint 2] return temp = ---	Return temperature limitation is deactivated

If the return temperature exceeds the limit value, the primary controller’s flow temperature setpoint will be lowered. If the return temperature drops below the limit value, the reduction of the flow temperature setpoint will be negated again.
Limitation works as an I-controller whose integral action time can be adjusted.

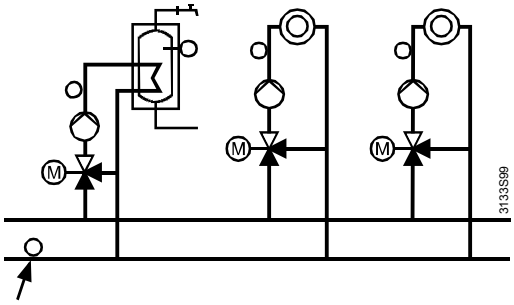
Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 **(**or 2 or 3**)** > Mixing circuit controller

Operating line	*Range*	*Factory setting*
[Tn] return temp limitation max	0…60 min	30 min

9.8.3 Minimum limitation of the return temperature

Using the boiler return temperature sensor, it is possible to implement a common minimum limitation of the return temperature for all consumers (heating circuits and DHW heating) with no need for configuring a boiler. If the boiler return temperature drops below the adjusted minimum limit value, the amount of heat drawn by the consumers will be restricted by locking signals.



For more detailed information about the configuration, refer to subsection 6.6.2 "Minimum limitation of the boiler temperature".
For information about the parameterization of this function, refer to subsection 6.6.1 “Maintained boiler return temperature”.

9.8.4 Frost functions and general protective functions

Frost protection for the plant

It can be selected whether or not frost protection for the plant shall act on the heating circuit pump.

Frost protection for the flow

The flow temperature is monitored for minimum limitation. If the flow temperature falls below 5 °C, a heat demand signal is sent to the heat source and the mixing valve will open. The function will be stopped as soon as the flow temperature has risen to 7 °C. The function is active for a minimum of 5 minutes.

Maximum limitation of the flow temperature

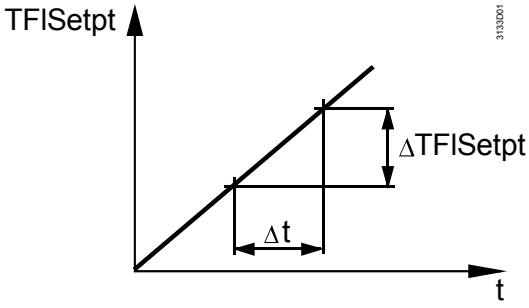
This setting ensures maximum limitation of the flow temperature setpoint.

Minimum limitation of the flow temperature

This setting ensures minimum limitation of the flow temperature setpoint. Minimum limitation is only active when there is a demand for heat.
Setting “---“ (none) deactivates the function.

Heating up brake

The rate of increase of the flow temperature setpoint can be limited to a maximum (called ”heating up brake”). In that case, the maximum the flow temperature setpoint can increase is only the selected temperature per unit of time (K per hour). This function prevents knocking noises in the pipework and excessive loads on the heat source.
Setting “---“ deactivates the function.



Maximum increase: $\frac{\Delta TFlSetpt}{\Delta t}$

t Time
Δt Unit of time
TflSetpt Flow temperature setpoint
ΔTflSetpt Rate of setpoint increase per unit of time

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Limitations

Operating line	*Range*	*Factory setting*
Flow temperature max	0…140 °C	80 °C
Flow temperature min	---- / 0…140 °C	----
Flow temperature rise max	---- / 1…600 K/h	----
Frost protection for the plant	Off / On	On

9.8.5 Pulse limitation

Every heating circuit is capable of handling pulses for limiting the load and the volumetric flow. Prerequisite for the limitation of pulses is a heating circuit plant type with mixing valve.

Meter inputs

The pulses are delivered via the meter inputs of function block “Meter”. For more detailed information about function block "Meter“, refer to chapter 11 “Function block meter“. After one or several meter inputs have been configured, pulse limitation can be set up.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Limitations > Pulse limitation

Operating line	*Range*	*Factory setting*
Meter input	--- / 1…4	---
Type of limitation	Absolute / Scaled	Absolute
Limit value	5…4000 pulse/min	75 pulse/min
Integral action time Tn	0…255 min	60 min

Meter input

The meter input is an input of function block ”Meter“ used for the limitation of pulses. Only inputs configured to a terminal can be selected.

Type of limitation

There are 2 types of limitation to choose from:

- Absolute: Limitation takes effect when the limit value is crossed
- Scaled: The limit value is fixed at 75 pulses/min. It can be adjusted but without having any effect. If less than 5 pulses/min are received, fault status message No signal meter 1 (or ...**2**) will be delivered after 20 seconds. Heat meters with a scaled output deliver 120 pulses/min if there is no supply of heat or no volumetric flow. Used together with pulse limitation, this prevents hydraulic creep.

Limit value

From the limit value, pulse limitation starts throttling the actuating device (mixing valve). The setting is only active when the limitation is absolute. With the scaled limitation, the

limit value can be set, but the function is always performed with 75 pulses/min (fixed value).

Integral action time (Tn)

The setting value determines the rate at which the flow temperature setpoint will be lowered:

- Short integral action times lead to fast reductions
- Long integral action times lead to slow reductions

9.8.6 Pump overrun and mixing valve overrun

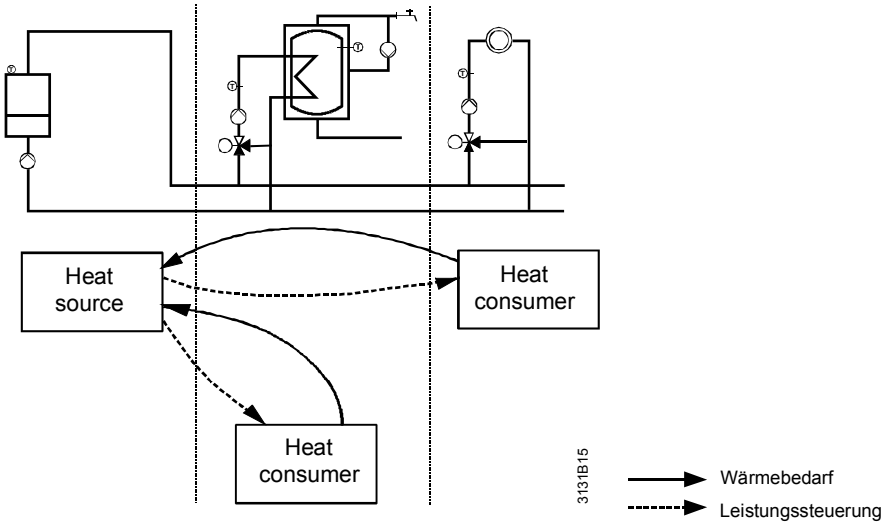
To protect the boiler against overtemperatures after the burner has shut down, a consumer overrun time can be set on the boiler controller.

9.8.7 Pump kick and valve kick

The pump kick is a protective function that is carried out periodically. It prevents pumps and / or mixing valves from seizing after longer off periods.

9.9 Heat demand

The heating circuit sends its heat demand as a temperature request to the heat source.



The temperature request for the current heat demand is calculated based on the flow temperature setpoint of the heating circuit (heating curve, subsection 9.5.2, and influences, subsection 9.5.3) plus an adjustable setpoint increase for the mixing valve.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3) > Mixing circuit controller 1

Operating line	*Range*	*Factory setting*
Setp increase mixing valve	0…50 K	10 K

Setpoint increase mixing valve

The setpoint increase is used to define by what amount the temperature request (to the boiler or the primary controller) shall be raised against the flow temperature setpoint. For detailed information, refer to chapter 14 “Communication“.

9.10 Auxiliary functions

9.10.1 Text designation

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Heating circuit 1 (or 2 or 3)

Operating line	*Range*	*Factory setting*
Heating circuit 1*	Max. 20 characters	Heating circuit 1*
Time switch 1**	Max. 20 characters	Time switch 1**

* Or heating circuit 2 or 3
** Or time switch 2 or 3

The text entered here appears on the menu and on the info display in place of the original text.

9.10.2 Acquisition of the room temperature

The room temperature is required for the optimization functions and for influencing the flow temperature setpoint.

Extra configuration

The input is to be activated via “Extra configuration”:

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3) > Inputs > Room sensor Assign terminal

Averaging

A heating circuit can handle a maximum of 2 room temperatures. In that case, it is of no importance whether the room temperature is acquired locally or via the Konnex bus. The average will be generated from the 2 actual values.

Type of sensor

The type of room temperature sensor can be selected:

Example

Example with input terminal RMH760.X4:

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs > RMH760.X4 > Type

The following choices are available:

- LG-Ni 1000
- 2 × LG-Ni 1000
- T1
- Pt1000
- DC 0…10 V

A maximum of 2 LG-Ni 1000 sensors can be connected to the same terminal. This cannot automatically be identified by the controller. For this reason, in that case, 2 × LG-Ni 1000 sensors must be selected when parameterizing the terminal inputs.

Room temperature via bus

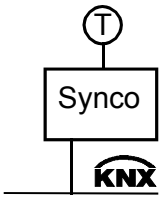
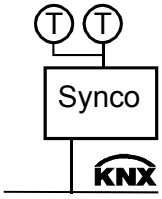
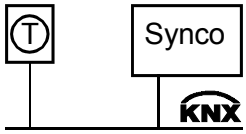
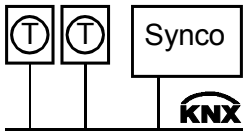
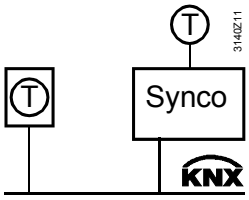
If the controller is connected to the bus, the room temperature can be transmitted and received via bus. In addition to the room zone, the controller must have a valid device address set.
With default address 255, there will be no communication via bus.

Sending

If the room temperature is acquired directly at the device, it will be transmitted in the heating circuit’s room zone (geographical zone (apartm.)) via bus so that it will become available to all devices on the bus.
The room temperature can also be acquired by bus-compatible room sensors or room units (e.g. QAW740) and be sent directly via bus. The associated room zone (geographical zone (apartm.)) is to be set at the sensor or room unit.

Receiving

The room temperature transmitted via bus is received by the heating circuit, provided the room zones (geographical zone (apartm.)) of the transmitter accord with those of the receiver.
The following variants are available:

Variant	*Effect*	*Diagram*
1 room sensor directly connected	The heating circuit operates with its own room temperature. When communication is activated, the room temperature signal will be delivered throughout the heating circuit's geographical zone	
2 room sensors directly connected	The heating circuit operates with the average value of the 2 sensors. When communication is activated, the average value will be delivered throughout the heating circuit's geographical zone as the room temperature	
1 room sensor (or 1 QAW740 room unit)	When communication is activated, the heating circuit receives the room temperature signal of the same geographical zone. The heating circuit operates with the room temperature received	
2 room sensors or 1 Konnex room sensor and 1 QAW740 room unit *	When communication is activated, the heating circuit receives the room temperature signals of the same geographical zone. The heating circuit operates with the average value of the 2 temperature signals received	
1 directly connected room sensor and 1 Konnex room sensor (or 1 QAW740 room unit)	When communication is activated, the heating circuit receives the room temperature signal of the same geographical zone. The heating circuit operates with the average value of the 2 temperatures	

* 2 QAW740 room units are not permitted! Operation in the room can only take place on one device

Important

When using the room control combination with ventilation, special attention must be paid to the sensor's location on the ventilation side.
Mounting the sensor for the room temperature in the extract air in combination with a heating circuit is **not** permitted!
The sensor for room temperature control of the ventilation system must be located in the room. If this is not observed, the heating circuit will work with the wrong temperature when the ventilation plant is shut down.

9.10.3 Room control combination

The heating circuit of the RMH760B can be combined with a heating circuit of some other controller. The combination of 2 room control systems is required when one heating circuit is used for the underfloor heating system and one for the radiators, for example. Another example is the combination of ventilation and heating in a room (e.g. in a hall).

Note

If only the time program shall be commonly used, this can be done without a room control combination. In that case, the time switch of the heating circuit is to be operated as a master or slave. For more detailed information, refer to section 5.1 “Time switch”.

Behavior after a power failure

In the event of a power failure, the slave’s operating mode is Comfort ☼ until the master sends another signal via bus.

For more detailed information about ventilation, refer to the Basic Documentation on the RMU7…B (P3150).

Extra configuration

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3)

Operating line	*Range*	*Factory setting*
Room control combination	Master / Slave external setpoint / Slave internal setpoint	Master

Settings

There are no settings required.
The room operation selector must be operated and the setpoints (if externally) adjusted at the maser.

Communication

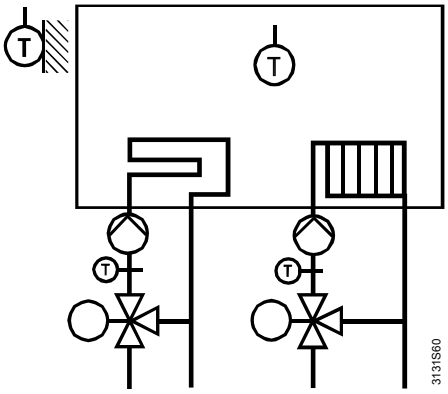
Main menu > Commissioning > Communication > Heating circuit 1 (or 2 or 3)

Operating line	*Range*	*Factory setting*
Geographical zone (apartm.)	---- / 1…126	----

Communication is described in chapter 14 “Communication“.

Example:
2 heating circuits

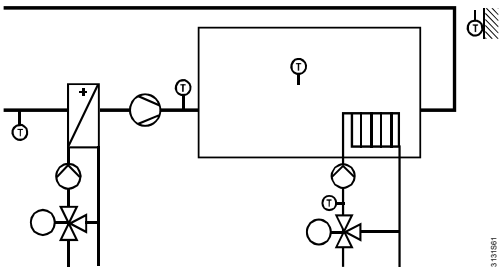
Requirement:
The basic load is covered by a weather-compensated heating circuit and the load-dependent part by a second heating circuit with or without room influence. The 2 heating circuits shall operate parallel and be controlled by a common switching program or room operation selector.



Solution:
Using the extra function “Room control combination“, one of the 2 heating circuits as the master can predefine the operating mode for the second heating circuit, which is configured as the slave.
If required, the setpoints can also be adopted by the master. This is accomplished with the configuration “Slave external setpoint“.

Example:
Ventilation and heating

Requirement:
A heating circuit covers the basic load and a ventilation plant the individual load (heat demand) in the space.
This application can also accommodate a common time switch or common preselected operating modes, if required.



Combination of ventilation and heating

Solution:
Using the extra function “Room control combination“, the heating circuit can be operated as the slave and receives the room operating mode and the time program predefined by the ventilation controller. It can be selected whether the setpoints for the heating circuit shall be adopted externally (to be adjusted on the ventilation controller) or internally (to be adjusted on the heating controller).
Heating circuit and ventilation must be assigned to the same geographical zone. A room unit, if present, must also be assigned to the same geographical zone.

⇒ The ventilation controller **always** assumes the function of the room control master.
A room unit, if present, always acts on the room control master.

Summer operation

During summer operation (heating circuit switched off via the heating limit), the ventilation controller adopts the sustained mode.
Summer / winter operation changeover is ascertained via the heating limit (refer to subsection 9.5.4) and sent to the ventilation controller via bus

Important

The ventilation controller’s room temperature sensor must not be installed in the extract air duct! Otherwise, functions ”Room temperature influence“ and “Optimization with room temperature” are not allowed to be activated.

9.11 Fault handling

As soon as commissioning is completed (by quitting the **Commissioning** menu), a check is made to see if the configured sensors are connected. Should a short-circuit or open-circuit in connection with the sensor or the measuring line occur, a fault status message will be delivered.

The number of the heating circuit or HC in the error text indicates the heating circuit or aggregate where a fault occurred.

Faulty flow temperature sensor

Number	*Text*	*Effect*
50	[HC 1] error flow sensor	Nonurgent message; must be acknowledged
55	[HC 2] error flow sensor	Nonurgent message; must be acknowledged
52	[Heat circuit 3] flow sens error	Nonurgent message; must be acknowledged

In the case of a faulty flow temperature sensor, the mixing valve will be driven to the fully closed position to become inactive (3-position actuator), enabling it to be manually operated.

Faulty return temperature sensor

Number	*Text*	*Effect*
51	[HC 1] error return sensor	Nonurgent message; must be acknowledged
56	[HC 2] error return sensor	Nonurgent message; must be acknowledged
53	[Heat circuit 3] return sens error	Nonurgent message; must be acknowledged

In the event of a faulty return temperature sensor, the heating circuit behaves as if no return temperature sensor was present. Return temperature limitation is deactivated.

Faulty room temperature sensor

Number	*Text*	*Effect*
60	Room temp sensor error HC 1	Nonurgent message; must not be acknowledged
65	Room temp sensor error HC 2	Nonurgent message; must not be acknowledged
68	Room temp sensor error HC 3	Nonurgent message; must not be acknowledged
61	>2 room sensors in heat circuit 1	Urgent message; must be acknowledged. More than 2 room temperature sensors in the same geographical zone
66	>2 room sensors in heat circuit 2	Urgent message; must be acknowledged. More than 2 room temperature sensors in the same geographical zone
69	>2 room sensors in heat circuit 3	Urgent message; must be acknowledged. More than 2 room temperature sensors in the same geographical zone

Faulty room controller combination

Number	*Text*	*Effect*
5401	Room master failure in HC 1	Nonurgent message; must not be acknowledged. No master
5411	Room master failure in HC 2	Nonurgent message; must not be acknowledged. No master
5421	Room master failure in HC 3	Nonurgent message; must not be acknowledged. No master
5402	>1 identical geogr zone [1]	Nonurgent message; must be acknowledged. More than one master in zone of heating circuit 1
5412	>1 identical geogr zone [2]	Nonurgent message; must be acknowledged. More than one master in zone of heating circuit 2
5422	>1 same geogr zone [3]	Nonurgent message; must be acknowledged. More than one master in zone of heating circuit 3

Pump fault in heating circuit 1

Number	*Text*	*Effect*
2521	[Heat circuit 1 pump] overload	Nonurgent message. Acknowledgement can be selected; factory setting: “Acknowledge and reset”. No heating circuit stop

Number	*Text*	*Effect*
2522	[Heat circuit 1 pump B] overload	Nonurgent message. Acknowledgement can be selected; factory setting: “Acknowledge and reset.“. No heating circuit stop
2523	[Heat circuit 1 pump] no flow	Nonurgent message; must be acknowledged and reset. No heating circuit stop
2524	[Heat circuit 1 pump B] no flow	Nonurgent message; must be acknowledged and reset. No heating circuit stop
2525	[Heat circuit 1 pump] fault	Urgent message; must not be acknowledged. Heating circuit stop

Pump fault in heating circuit 2

Number	*Text*	*Effect*
2531	[Heat circuit 2 pump] overload	Nonurgent message. Acknowledgement can be selected; factory setting: “Acknowledge and reset.“. No heating circuit stop
2532	[Heat circuit 2 pump B] overload	Nonurgent message. Acknowledgement can be selected; factory setting: “Acknowledge and reset.” No heating circuit stop
2533	[Heat circuit 2 pump] no flow	Nonurgent message; must be acknowledged and reset. No heating circuit stop
2534	[Heat circuit 2 pump B] no flow	Nonurgent message; must be acknowledged and reset. No heating circuit stop
2535	[Heat circuit 2 pump] fault	Urgent message; must not be acknowledged Heating circuit stops

Pump fault in heating circuit 3

Number	*Text*	*Effect*
2541	[Heat circuit 3 pump] overload	Nonurgent message. Acknowledgement can be selected; factory setting: “Acknowledge and reset.“. No heating circuit stop
2542	[Heat circuit 3 pump B] overload	Nonurgent message. Acknowledgement can be selected; factory setting: “Acknowledge and reset.“. No heating circuit stop
2543	[Heat circuit 3 pump] no flow	Nonurgent message; must be acknowledged and reset. No heating circuit stop
2544	[Heat circuit 3 pump B] no flow	Nonurgent message; must be acknowledged and reset. No heating circuit stop
2545	[Heat circuit 3 pump] fault	Urgent message; must not be acknowledged Heating circuit stops

Note

For description of outside sensor errors, refer to subsection 12.3.2 “Fault handling”.

9.12 Diagnostic choices

Inputs / setpoints

Main menu > Heating circuit 1 (or 2 or 3) > Inputs/setpoints

Operating line	*Adjustable values / display / remarks*
Actual value outside temp	…°C
Simulation outside temperature	…°C
Composite outside temp	…°C
Attenuated outside temp	…°C
Actual value flow temp	…°C
Flow temperature setpoint	According to section 9.6 “Mixing valve control” (load control considered)
Room sensor temp.	…°C
Actual value room temp	…°C
[Room temperature 1] bus	…°C
[Room temperature 2] bus	…°C
Room temperature model value	…°C
Current room temp setpoint	…°C; according to preselection made by the user, current room operating mode and interventions
Room setpoint absolute	…°C
Room setpoint relative	…°C
Actual value return temp	…°C
Return temperature max	…°C
[Heating circuit pump] overload	0 / 1 (1 = overload)
[Heat circuit pump B] overload	0 / 1 (1 = overload)
Flow signal pump	0 / 1 (1 = pump flow in operation)
Room operating mode	0 / 1 (1 = operating mode according to contact)
Timer function	0 / 1 (1 = timer function will be activated)
Special day input	0 / 1 (1 = switching program according to special day is active)
Holiday input	0 / 1 (1 = operation according to holiday settings)

Outputs

Main menu > Heating circuit 1 (or 2 or 3) > Outputs

Operating line	*Adjustable values / display / remarks*
Outside temperature relay	Off / On
Mixing valve position	0…100 % (3-position and modulating)
Heating circuit pump	Off / On
Heating circuit pump B	Off / On
Heating limit relay	Off / On
Operating mode relay 1	Off / On
Operating mode relay 2	Off / On

Limitations

Main menu > Heating circuit 1 (or 2 or 3) > Limitations

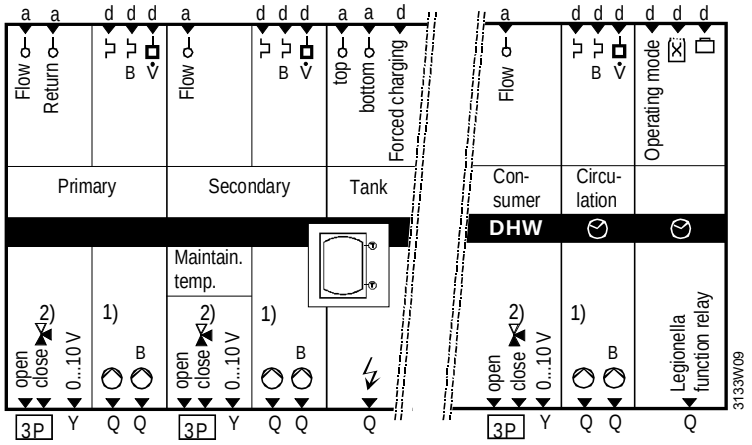
Operating line	*Adjustable values / display / remarks*
Flow temperature max	Inactive/ Active
Flow temperature min	Inactive/ Active
Flow temperature rise	Inactive/ Active
Return temperature max	Inactive/ Active
Pulse limitation	Inactive/ Active

10 DHW heating

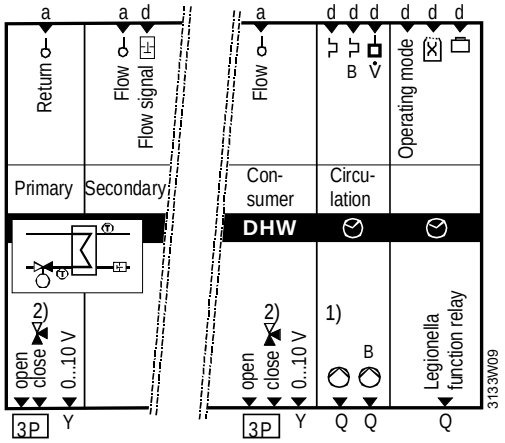
10.1 Overview of function block

Function block

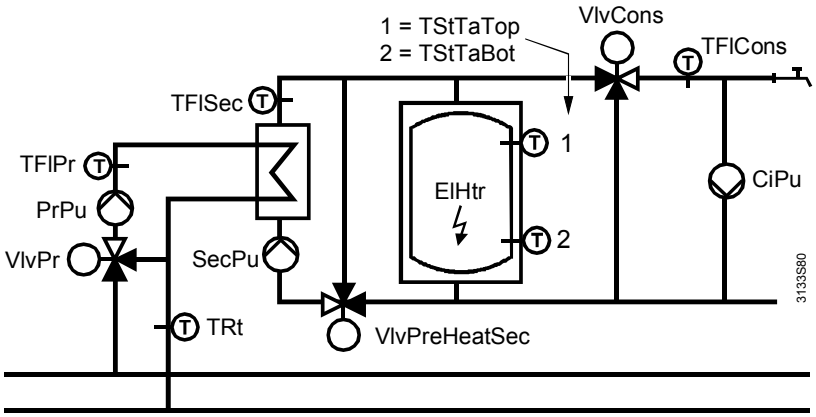
For applications with storage tank (DHW types DHW 0 through DHW 5), the following function block is available:



For application with direct DHW heating (DHW 6), the following function block is available:



DHW plant diagram



TFlPr	Flow temperature sensor, primary	TRt	Return temperature sensor
CiPu	Circulating pump	TStTaBot	Storage tank sensor at the bottom
ElHtr	Electric immersion heater	TStTaTop	Storage tank sensor at the top
PrPu	Primary pump	VlvCons	Consumer mixing valve
SecPu	Secondary pump	VlvPr	Primary mixing valve
TflCons	Flow temperature sensor, consumer	VlvPreHeatSec	Maintained secondary circuit
TFlSec	Flow temperature sensor, secondary		

10.2 Configuration

10.2.1 General

Basic configuration

With plant types x–1, x–3, x–5, x–7, DHW heating is activated per default. The DHW plant type preselected per default depends on the type of plant:

Plant type	*Default DHW plant type*
H0-x, H2-x, H3-x, H4-x	DHW 2
H1-x	DHW 4
H5-x	DHW 3
H6-x	DHW 6

DHW heating with storage tank is always preconfigured to the RMZ783B DHW module. For configuration of plant types, refer to section 3.2 “Basic configuration”.
DHW heating can be configured to any of the modules. If the preselected RMZ783B is replaced by some other module, all settings using type reference RMZ783… via “Extra configuration” must be reconfigured.

Extra configuration

As a basic rule, function blocks can always be activated via “Extra configuration”, independent of the type of plant. A function block is activated by assigning a pump or mixing valve output to a terminal.

Outputs

Main menu > Commissioning > Extra configuration > DHW > Outputs

Operating line	*Adjustable values / display / remarks*
DHW plant type	Display of the DHW plant type. For further information, see below
Primary mixing valve 3-pos	
Primary mixing valve modulating	DC 0…10 V
Primary pump	
Primary pump B	Primary twin pump
Maintained sec temp 3-pos	For DHW heating with storage tank and external heat exchanger
Maintained sec temp modulating	DC 0…10 V
Secondary pump	For DHW heating with storage tank and external heat exchanger
Secondary pump B	Secondary twin pump
Electric immersion heater	
Consumer mixing valve 3-pos	
Consumer mixing valve mod	DC 0…10 V
Circulating pump	
Circulating pump B	
Legionella function relay	

Inputs

Main menu > Commissioning > Extra configuration > DHW > Inputs

Operating line	*Adjustable values / display / remarks*
Primary flow sensor	
Return sensor	Return temperature limitation
[DHW primary pump] overload	Fault input primary pump
[DHW primary pump B] overload	Fault input primary pump B
Primary pump flow signal	Flow supervision primary pump
Flow sensor secondary	Only with heat exchanger
Flow signal	Only with DHW plant type DHW 6
[DHW sec pump] overload	Fault input secondary pump

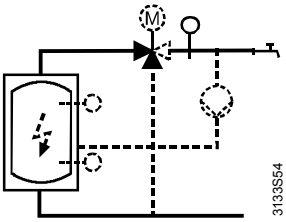
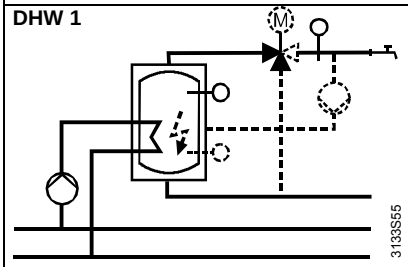
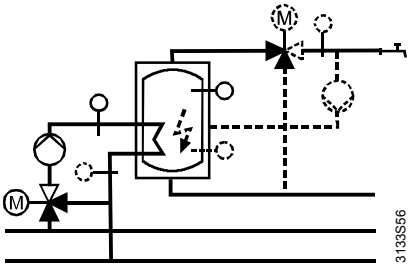
Operating line	*Adjustable values / display / remarks*
[DHW sec pump B] overload	Fault input secondary pump B
Secondary pump flow signal	Flow supervision secondary pump
Storage tank sensor top	
Storage tank sensor bottom	
Forced charging	
Flow sensor consumers	Optionally for consumer control
[DHW circ pump] overload	Fault input circulating pump
[DHW circ pump B] overload	Fault input circulating pump B
Circulating pump flow signal	Flow supervision circulating pump
DHW optg mode	DHW operating mode will be preselected and activated via the input
Special day input	DHW time switches according to special day
Holiday input	DHW heating according to holiday DHW operating mode

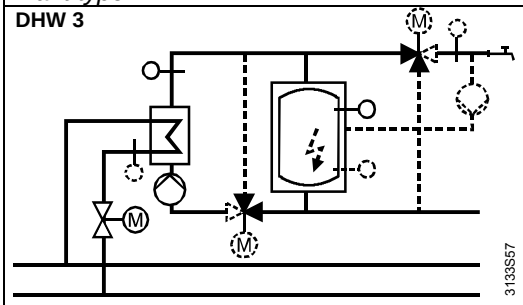
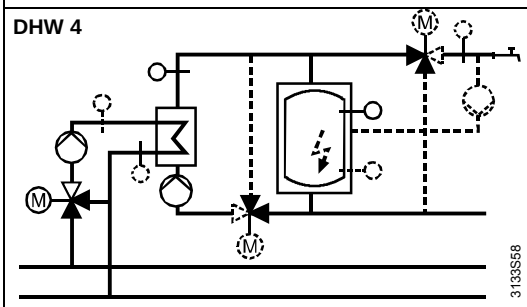
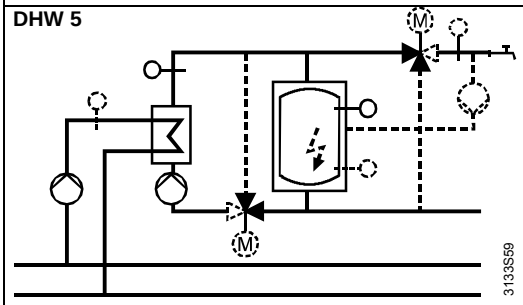
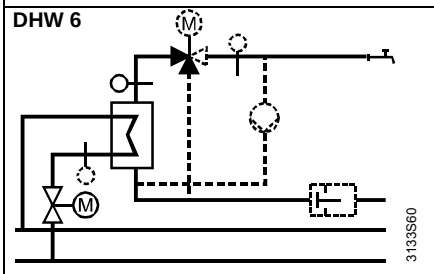
10.2.2 DHW plant types

The DHW plant type results from the configured outputs. It is defined based on the configuration of the outputs and will be displayed on the first line.

Main menu > Commissioning > Extra configuration > DHW > Outputs > DHW plant type

The following types of DHW plant can be configured:

Plant type	*Description*
DHW 0 	Storage tank charging with electric immersion heater (with no impact on the plant's heat generation). Options: • Storage tank sensor at the top • Storage tank sensor at the bottom • Consumer control • Circulating pump
DHW 1 	Storage tank charging with primary pump (controlled via the storage tank temperature). Options: • Storage tank sensor at the bottom • Circulating pump • Consumer control • Electric immersion heater
DHW 2 	Storage tank charging with mixing valve control based on the charging temperature (controlled via the storage tank temperature). Options: • Storage tank sensor at the bottom • Circulating pump • Consumer control • Electric immersion heater • Return temperature limitation

Plant type	*Description*
DHW 3  	Storage tank charging with external heat exchanger and flow control based on the charging temperature (controlled via the storage tank temperature). Options: • Maintained secondary circuit • Storage tank sensor at the bottom • Circulating pump • Consumer control • Electric immersion heater • Return temperature limitation
DHW 4  	Storage tank charging with external heat exchanger, primary pump and mixing valve control based on the charging temperature or the primary flow temperature (controlled via the storage tank temperature). Options: • Primary flow sensor • Maintained secondary circuit • Storage tank sensor at the bottom • Circulating pump • Consumer control • Electric immersion heater • Return temperature limitation
DHW 5  	Storage tank charging with external heat exchanger and primary pump (controlled via the storage tank temperature). Options: • Primary flow sensor • Maintained secondary circuit • Storage tank sensor at the bottom • Circulating pump • Consumer control • Electric immersion heater
DHW 6  	Direct DHW heating (permanent release or optional control with flow switch). Options: • Flow switch (recommended) • Circulating pump • Consumer control • Return temperature limitation

If the DHW plant type is undefined (display showing "---"), the function block will **not** be activated.

10.2.3 3-position or modulating mixing valve

Mixing valve control can be provided either with a 3-position or DC 0…10 V actuator. The type of actuator used is to be selected via "Extra configuration".

Extra configuration

The output is to be activated via “Extra configuration”:

- Main menu > Commissioning > Extra configuration > DHW > Outputs > Mixing valve 3-pos Assign terminal
- Main menu > Commissioning > Extra configuration > DHW > Outputs > Mixing valve modulating Assign terminal

10.2.4 Pump control

All DHW pumps offer the same choices as any other pump in the controller. Supervision is also possible for an individual pump; optionally, every DHW pump can be a twin pump. For that, the respective outputs must be configured.
For more detailed information, refer to section 5.8 “Pump control and twin pumps”.

Fault settings DHW

- Main menu > Commissioning > Settings > ... or
- Main menu > Settings > DHW > Fault settings > Overload primary pump
- Main menu > Settings > DHW > Fault settings > Overload secondary pump
- Main menu > Settings > DHW > Fault settings > Overload circulating pump

Operating line	*Range*	*Factory setting*
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	Acknowledge and reset
Fault acknowledgement B	None / Acknowledge / Acknowledge and reset	Acknowledge and reset

10.3 Operating modes and setpoints

10.3.1 DHW operating modes

The DHW operating mode defines the setpoint at which the storage tank or the flow temperature is maintained.

Note

Consumer control (optional) has a direct impact on the DHW temperature in the consumer network. As a result, the settings made here will probably not be noticed by the DHW consumer, or only with a certain delay.

DHW operating mode

- Main menu > DHW > DHW optg mode

Operating line	*Range*	*Factory setting*
Preselection	Auto / Normal / Reduced / Protection /	Auto
State	Normal / Reduced / Protection /	
Cause	DHW time switch ⑪ / Holidays ⑨ or ⑩ / Special day ⑧ or ⑩ / DHW operation selector ⑦ / DHW operating mode contact ⑥ / Forc charg contact ⑤ / Legionella program ④ / Electric ③	

Operating line	*Range*	*Factory setting*
DHW operating mode holidays	Auto / Normal / Reduced / Protection*	Protection*

④…⑪ Control priorities (refer to subsection 10.3.4)
* The legionella function will not be performed

Preselection (DHW operation selector)

Here, the plant user can select the required operating mode. In operating mode Auto, the current setpoint will be determined by the time program.
If required, it is possible to switch to continuous operation with a fixed setpoint. The selected setpoint can be overridden by a control intervention of higher priority (e.g. by legionella program ④).

⇒ In Protection mode, legionella program ④ will not be performed.

State

It is indicated at what setpoint DHW heating presently operates.

Cause

There may be different reasons for the current state. Decisive is the control priority.

DHW operating mode during holidays

During the holiday period, the setpoint is predefined by this setting. Using the Auto setting, DHW heating can be excluded from the holiday period. In that case, changeover takes place according to the DHW time switch.

For information about the action of the holiday DHW heating mode on the circulating pump, refer to subsection 5.2.2. “Holidays”.

Time switch / calendar

In operating mode “Auto”, the current 24-hour program switches the setpoint between “Normal“ and ”Reduced“.

10.3.2 User request via digital inputs

Overriding the 24-hour program

The 24-hour program can also be overridden by configuring conventional switches or pushbuttons.

Manual forced charging

In the case of DHW plant types with storage tank, the plant user can trigger forced storage tank charging to the normal setpoint via a pushbutton, thus overriding the current 24-hour program.
For more detailed information, refer to subsection 10.4.2 “Forced charging”.

DHW operating mode contact (switch)

Using a switch, the user can switch to continuous operation with a fixed setpoint, thus overriding the current 24-hour program.

Extra configuration

The input is to be activated via “Extra configuration”:

Main menu > Commissioning > Extra configuration > DHW > Inputs > DHW optg mode Assign terminal

Settings

The type of DHW operating mode to be used for overriding the 24-hour program can be selected on the service level.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
Preselected optg mode input	Normal / Reduced / Protection	Normal

10.3.3 Plant operation

Plant operation

Plant operation indicates whether DHW heating is switched on and what its state is.

Main menu > DHW > Plant operation

Operating line	*Range*	*Factory setting*
Preselection	Auto / Off*	Auto
State	Off / DHW ready / Charging active / Electric	
Cause	Plant operation sel / DHW user request / Legionella function / Overtemp protec-tion/overrun / Frost protection storage tank / Frost protection for the flow / Summer operation /	

* The frost protection functions are ensured (according to control priority ②, refer to subsection 10.3.4)

Preselection for the plant operation selector

For service purposes, DHW heating can be switched off. The primary valve will fully close, the pumps start their overrun and will then be deactivated.

⚠ On completion of servicing, the plant operation selector must be set back to “Auto“.

State

The current state of DHW heating is displayed.

Cause

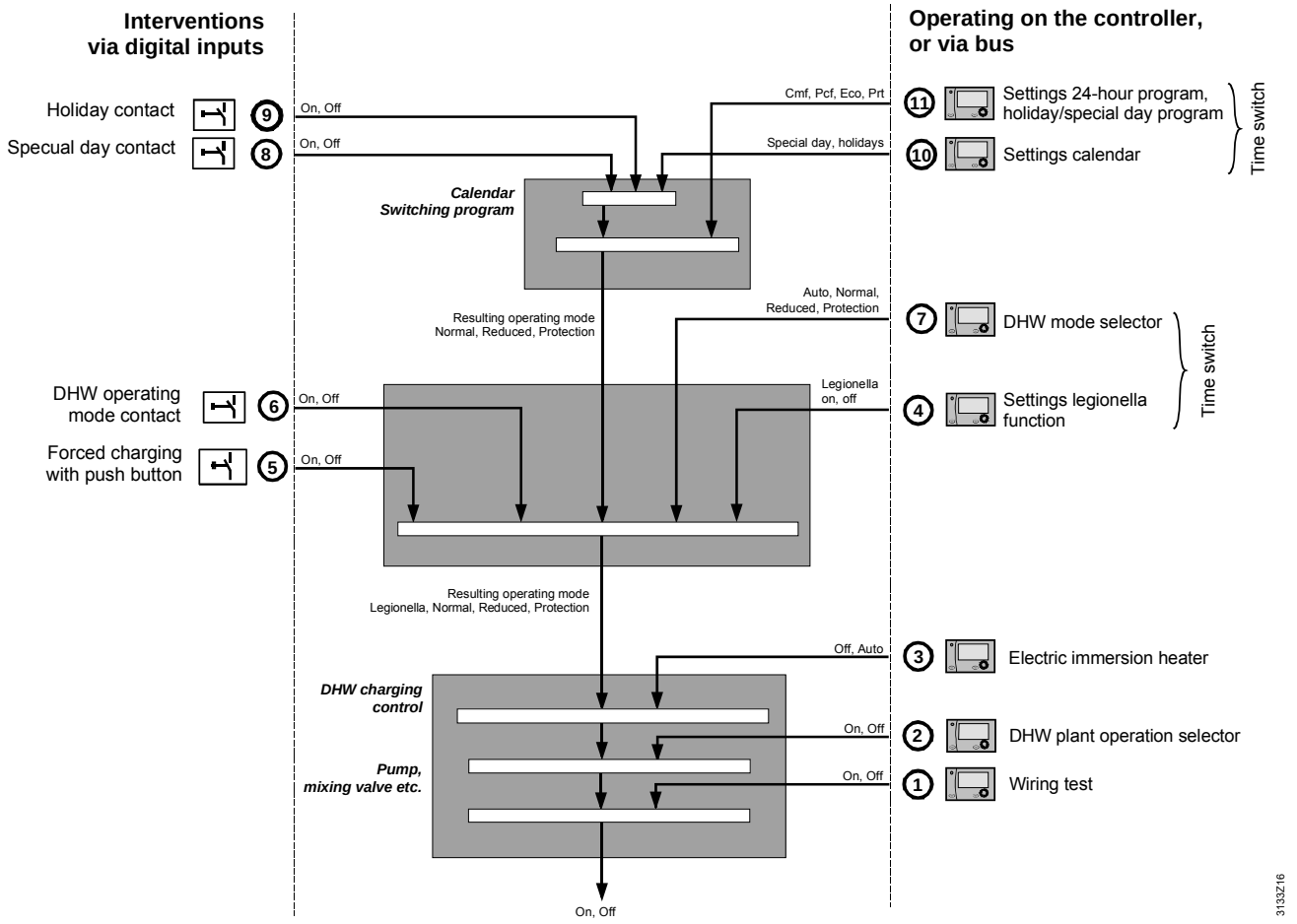
It is indicated why the current state is active.

10.3.4 Control priorities in DHW heating mode

Plant types DHW 0…DHW 5

The following diagram shows the priorities of the different choices of intervention via digital inputs and via operation on the controller.

⇒ Lower numbers indicate higher priorities.



Priority	*Size*	*Explanation*
①	Wiring test	During the wiring test (highest priority), the plant components can be directly controlled, independent of all other settings ⚠ The controller-internal safety functions will be overridden!
②	Plant operation selector	The plant operation selector has the second highest priority and can only be overridden by the controller-internal frost protection functions
③	Electric immersion heater	When the heat source changes to summer operation, DHW heating, if installed, will switch over to the electric immersion heater. The controller-internal frost protection functions continue to be ensured. By contrast, the legionella program will be overridden
④	Legionella protection	The legionella program can be started in any of the operating modes, with the exception of preselected operating mode ⑦ "Protection"
⑤	Forced charging	Using button "Forced charging" (DHW push), recharging to the normal setpoint 🌡 can be triggered in any of the operating modes. Forced charging can also be performed during holiday periods

Priority	*Size*	*Explanation*
⑥	DHW operating mode contact	Using the DHW operating mode contact, a fixed operating mode can be preselected. This operating mode overrides DHW operation selector ⑦ in the controller
⑦	DHW operation selector	Using the DHW operation selector, it is possible to switch from operating mode Auto ◴ to a continuous operating mode with the respective setpoint. In operating mode Auto ◴, the setpoint is determined by the calendar and the time switch
⑧	Special day contact	The current 24-hour program will be overridden by the special day contact. The associated special day program is to be set on the DHW time switch
⑨	Holiday contact	The current 24-hour program can be overridden by the holiday contact with a fixed setpoint
⑩	Calendar Holidays/special days	If a special day is active, the associated 24-hour program of the DHW time switch will be activated. Holidays, if entered, will be overridden. If holiday mode is active, a preselected fixed setpoint can be maintained. When using holiday operating mode Auto ◴, DHW heating during the holiday period will not be affected
⑪	Time switch	In the time switch, the associated 24-hour program will be activated in accordance with the current weekday

Plant type DHW 6 (direct DHW heating)

The control priorities with DHW plant type DHW 6 are analogous to those with DHW 0…DHW 5. Exceptions:

- Forced charging ⑤
- Electric immersion heater ③

10.3.5 DHW setpoints

The setpoints for the operating modes (Normal / Reduced / Protection) can be preselected by the plant user via operation. The setting values limit each other.
In addition, on the service level, the setpoints for the legionella program can be set. The normal setpoint limits the setting range downward.

Setpoints (setting)

■ Main menu > DHW > Setpoints...

Operating line	*Range*	*Factory setting*
Legionella setpoint	55…140 °C	70 °C
Normal setpoint	40…70 °C	55 °C
Reduced setpoint	5…55 °C	40 °C
Frost protection setpoint	5…40 °C	5 °C

Note on consumer control

The setpoints preselected for storage tank charging or direct DHW consumption must be matched to the setpoints of (optional) consumer control; in other words, the settings selected here should at any point in time lie above the setpoints of consumer control. It may be necessary to give consideration to the different time programs.

Consumer setpoints

The setpoints for consumer control are described in subsection 10.11.6 “Consumer control”.

Inputs / setpoints (display)

The setpoint currently active for storage tank charging appears on the Main menu and on the info page.

Main menu > DHW > Inputs/setpoints

Operating line	*Range*	*Factory setting*
Storage tank temp setpoint	5…140 °C	

For detailed information about the generation of the storage tank temperature setpoint, refer to subsection 10.4.1 “Charging control via the storage tank temperature”.

10.4 Storage tank charging

Storage tank charging (DHW 0…DHW 5) and thus primary control (refer to section 10.7 “Primary control“) can be started and / or terminated via different functions:

- Storage tank temperature (according to the current operating mode)
- Maximum charging time
- Forced charging

The following settings enable the functions to be activated or matched to specific needs:

Settings

Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
Switching differential	1…20 K	5 K
Setback DHW setpoint bottom	0…20 K	5 K
Charging time max	---- / 5…250 min	----
Forced charging	Never / With 1st change to normal / With every change to normal	Never

10.4.1 Charging control via the storage tank temperature

Normally, storage tank charging is controlled via the storage tank temperature. Charging is started as soon as the storage tank temperature drops below the switch-on point; it ends when the storage tank temperature setpoint (TStTaSetpt) is reached.

⇒ Charging can also be activated via forced charging and aborted when the maximum charging time is reached (refer to subsections 10.4.2 “Forced charging” and 10.4.3 “Maximum charging time”).

Storage tank sensor at the top

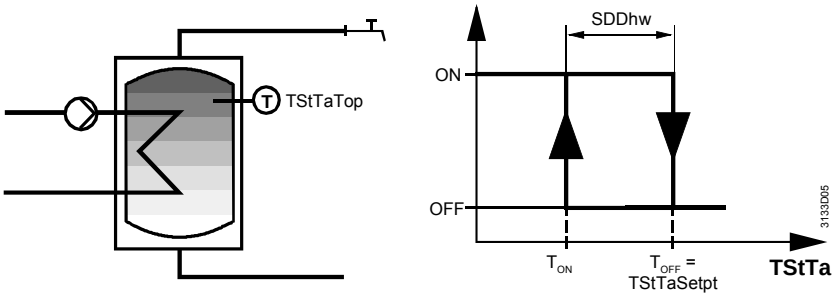
If there is no storage tank sensor at the bottom, charging control is effected via **one** sensor only.

Starting storage tank charging

To start storage tank charging, the storage tank temperature must have dropped below the storage tank temperature setpoint (TStTaSetpt) by the amount of the (adjustable) switching differential (SDDhw).

Ending storage tank charging

Charging is ended as soon as the storage tank temperature has reached the setpoint.



Storage tank sensor at the bottom

An additional storage tank sensor can be configured for storage tank charging control. The storage tank sensor at the bottom allows better usage of the storage tank volume.

Extra configuration

The function is to be activated via “Extra configuration”:
... > Inputs > Storage tank sensor bottom Assign terminal

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
Setback DHW setpoint bottom	0…20 K	5 K

Storage tank sensor at top and bottom

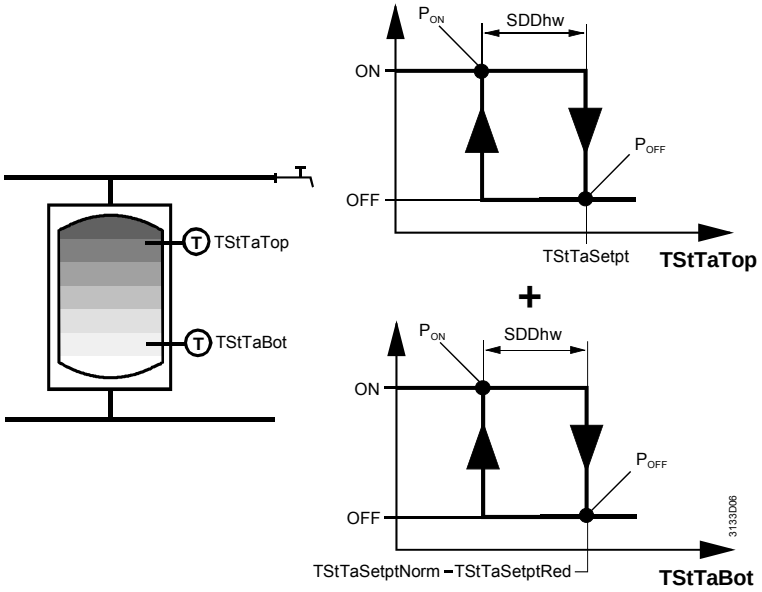
When using an additional storage tank sensor at the bottom of a stratification storage tank, it can be ensured that the tank will be fully charged.
In the case of storage tanks with good stratification, consideration can also be given to the anticipated temperature differential by setting the DHW setpoint drop at the bottom (TStTa SetptRed).

Starting storage tank charging

Storage tank charging is started when both temperatures (TStTaTop and TStTaBot) **drop** below their switch-on points (T_{on}).

Ending storage tank charging

For storage tank charging to end, both temperatures (TStTaTop and TStTaBot) must **exceed** their switch-off point (T_{OFF}).



Example

Type of storage tank = stratification storage tank with 2 storage tank sensors
Storage tank temperature setpoint = 55 °C
Switching differential for storage tank charging = 5 K
Setpoint reduction at the bottom for storage tank charging = 3 K

Starting charging

Charging is started when the **2** following conditions are satisfied:
- Temperature at the top sensor = ≤50 °C **and**
- Temperature at the bottom sensor = ≤47 °C

Ending charging

Charging is ended when the **2** following conditions are satisfied:
- Temperature at the top sensor = >55 °C **and**
- Temperature at the bottom sensor = >52 °C

⇒ Charging would be ended with a stratification of 3 K and a storage tank outlet temperature of 55°C.

Settings

Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
Switching differential	1…20 K	5 K
Setback DHW setpoint bottom	0…20 K	5 K

Storage tank temperature setpoint

In operating modes “Normal” and “Reduced”, the storage tank temperature setpoint corresponds to the adjusted setpoint.
In Protection mode, the storage tank temperature shall not fall below the adjusted setpoint. For this reason, the storage tank temperature setpoint will be raised by the amount of the switching differential.
When the legionella program is active, it must be made certain that the storage tank will be charged up to the legionella protection setpoint. To ensure this, the storage tank temperature setpoint will be increased by the amount of the adjusted reduction of the DHW setpoint at the bottom.

Summary:

Operating state	*Assigned setpoint*
Normal	DHW setpoint = normal setpoint
Reduced	DHW setpoint = reduced setpoint
Protection	DHW setpoint = frost protection setpoint + switching differential
Legionella	DHW setpoint = legionella protection setpoint + reduction of DHW setpoint at the bottom

10.4.2 Forced charging

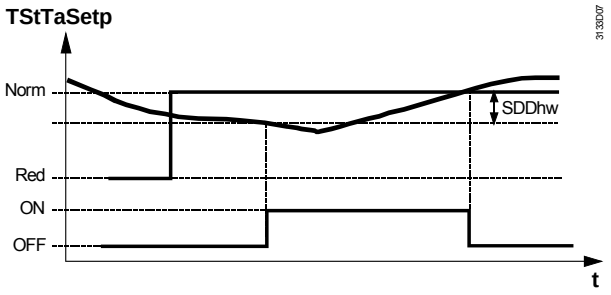
Normally, storage tank charging is started only when the storage tank temperature has fallen below the switch-on point (storage tank temperature setpoint minus switching differential). Forced charging can enforce charging even if this switch-on criterion is not satisfied.

Starting forced charging

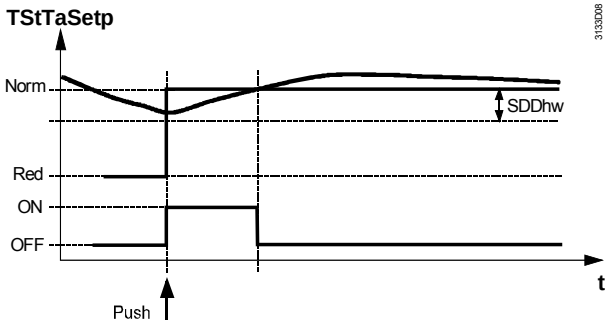
If forced charging is activated and the storage tank temperature lies at least 1 K below the normal setpoint, forced charging will be started.

Ending forced charging

Charging will be ended via the storage tank temperature.



Without forced charging



With forced charging

SDDhw	Switching differential DHW heating	Red	DHW operating mode “Reduced”
Norm	DHW operating mode “Normal”	t	Time
Push	DHW push, forced charging triggered	TstTa	Temperature at the storage tank sensor

Settings

Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
Forced charging	Never / With 1st change to normal / With every change to normal	Never

Forced charging

If the storage tank shall already be fully charged at the beginning of the day (to the normal setpoint 🌡), the setting to be selected is With 1st change to normal.
This setting will initiate forced charging the first time the DHW time switch changes over to the normal setpoint 🌡.

Manual forced charging

Forced charging can also be triggered manually via a pushbutton. For that, a digital input is to be configured.

Extra configuration

Inputs > Forced charging Assign terminal

Settings

No settings are required when triggering forced charging via a pushbutton.

10.4.3 Maximum charging time

To prevent the heating circuits from being locked or limited by DHW priority for extended periods of time, the charging time can be limited.

Aborting

If, on completion of the selected maximum charging time, charging is still active, storage tank charging will be aborted.
In that case, charging will be locked during the maximum charging time. On completion of the waiting time, charging control will again take place via the storage tank temperature.

Settings

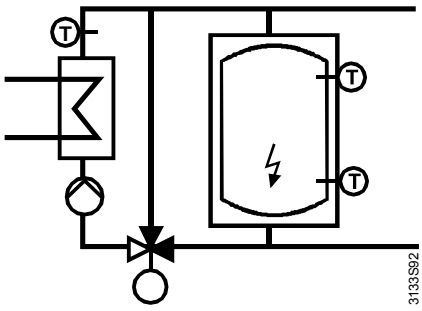
Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
Charging time max	---- / 5…250 min	----min

Charging time limitation is not active in the following cases:
- In Protection mode
- In summer operation
- When there is no DHW priority
- With shifting DHW priority, when the heat source supplies sufficient amounts of heat
- When using setting "----"

Forced charging will stop an active charging time limitation.

10.4.4 Maintained secondary circuit



The maintained secondary circuit protects the storage tank's stratification by supplying to the storage tank only water of higher temperatures (in accordance with the setpoint).

In addition, the maintained secondary circuit serves as an additional discharge protection. But the “Discharge protection“ function remains active because the secondary pump is controlled based on the primary temperatures on the heating side.
The maintained secondary circuit can only be used in connection with DHW plant types DHW 3 through DHW 5.

Extra configuration

The maintained secondary circuit is activated via configuration of the mixing valve.

Main menu > Commissioning > Extra configuration > DHW > Outputs > Maintained sec temp 3-pos > ... or

Main menu > Commissioning > Extra configuration > DHW > Outputs > Maintained sec temp modulating Assign terminal

Settings

For adapting the control parameters to the type of plant (actuator and controlled system), the setting parameters to be used are the same as those used for mixing valve control. They apply to both 3-position and DC 0…10 V actuators.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Controller maint sec temp

Operating line	*Range*	*Factory setting*
Actuator running time	1…600 s	150 s
P-band Xp	1…100 K	50 K
Integral action time Tn	0…600 s	60 s
Maintained sec circuit delta	–20…20 K	0 K

Maintained secondary circuit delta

The maintained secondary circuit controls to the following setpoint:

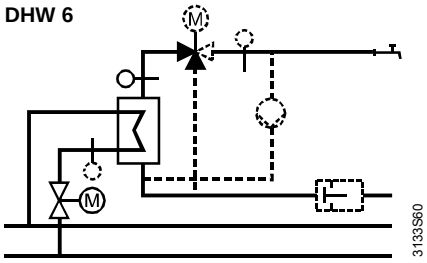
Setpoint maintained secondary circuit = DHW setpoint + maintained secondary circuit delta

Mixing valve function

On completion of storage tank charging, the secondary pump will be deactivated and the mixing valve will fully close. If the secondary sensor is faulty, the mixing valve for the maintained secondary circuit will be opened.

10.5 Direct DHW heating

DHW 6



DHW heating takes place directly via the heat exchanger. Since there is no storage tank so that charging control cannot be provided, control is permanently enabled.
The setpoint to be delivered by the heat source is made up of the current DHW setpoint plus the setpoint increase of the heat exchanger.

Settings

For specific adaptation of the control parameters to the type of plant (actuator and controlled system), additional setting parameters are available for direct DHW heating. They apply to both 3-position and DC 0…10 V actuators.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Controller primary circuit

Operating line	*Range*	*Factory setting*
Heat exchanger setp increase	0…50 K	10 K
Actuator running time opening	1…600 s	15 s

Operating line	*Range*	*Factory setting*
Actuator running time closing	1…600 s	15 s
P-band Xp at min load	1…200 K	100 K
P-band Xp at max load	1…200 K	33 K
Integr action time Tn at min load	0…600 s	30 s
Integr act time Tn at max load	0…600 s	6 s
Deriv act time Tv at min load	0…255 s	8 s
Deriv act time Tv at max load	0…255 s	2 s

10.5.1 Adapting the control parameters

Among other things, the characteristics of the controlled system are affected by the current DHW consumption and the connection conditions on the primary side.

Connection conditions

For the different types of plant, the connection conditions on the primary side can change depending on the time of year.

Example

In the winter, the primary line operates at 6 bar and 120 °C, but in the summer only at 2 bar and 90 °C. This means:
In order to convey constant amounts of energy, the primary valve's stroke in the summer must be different from that in the winter.
The controller acquires these changes and constantly adjusts the control action.

Giving consideration to the load

The velocity of flow on the secondary side has a great impact on the control characteristics. Since this shall not lead to any disadvantages for the user in the case of direct DHW heating, additional setting choices have been made available. These are the following setting parameters:

- The P-band for the minimum load
- The integral action time for the minimum load
- The derivative action time for the minimum load
- The P-band for the maximum load
- The integral action time for the maximum load
- The derivative action time for the maximum load

This means that changing connection conditions need not be considered since the controller makes automatic readjustments.

Actuator running time

For DHW control, the actuator running time must be set. When using asymmetric actuators, the actuator running times for opening and closing can be individually set. In the case of symmetric actuators, the actuator running times to be entered for opening and closing are the same.

Note

It is important to also set the actuator running times when using DC 0…10 V actuators. Only these settings ensure correct functioning of the control system.

Proportional band (Xp)

The proportional band influences the controller's proportional behavior.
With a setpoint / actual value deviation of 20 K, a setting of Xp = 20 produces a manipulated variable corresponding to the actuator's running time.

Integral action time Tn

The integral action time influences the controller's integral behavior.

Derivative action time Tv

The derivative action time influences the controllers D-behavior. If the integral action time is set to 0, the controller produces no PI behavior.

Setting rules for Xp, Tn and Tv

The plant's behavior changes depending on the load. To ensure that the control system will produce satisfactory results both in the upper and lower load range, different values

can be set for both load ranges. For the medium load ranges, the values will be averaged in a continuous process.

Tip

When commissioning direct DHW heating for the first time, the default values of Xp, Tn and Tv should be used. To optimize and check the control parameters, it is recommended to follow the procedure detailed below under ”Checking the control function…”.

Checking the control function with maximum loads

To check the control behavior with the preset control parameters, the following procedure is recommended:

1. With **maximum load,** the controller shall maintain the setpoint for a certain period of time.
2. Then, increase or decrease the setpoint by 5…10 %. During this period of time, the controller ascertains the connection conditions and adjusts the PID controller. For this reason, it is important to start with the maximum load.

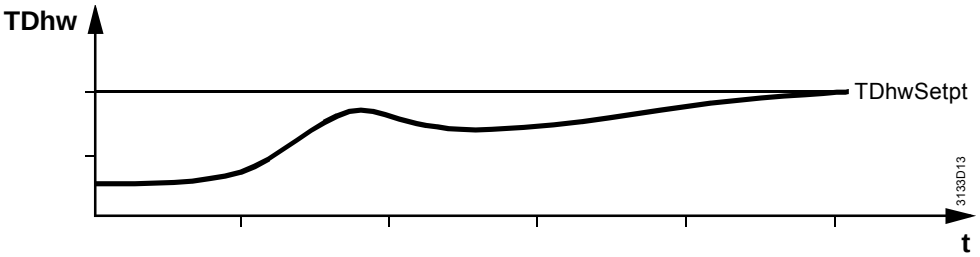
Note on maximum load

- Maximum load means the highest velocity of flow on the DHW side at the highest setpoint (usually, this is the legionella protection setpoint)
- Basically, stable control behavior is called for, which should rather be fast than slow, meaning that the DHW temperature should reach the new setpoint as quickly as possible

If the correcting action does not produce the required result, the control parameters should be readjusted as follows:

Control action is too slow

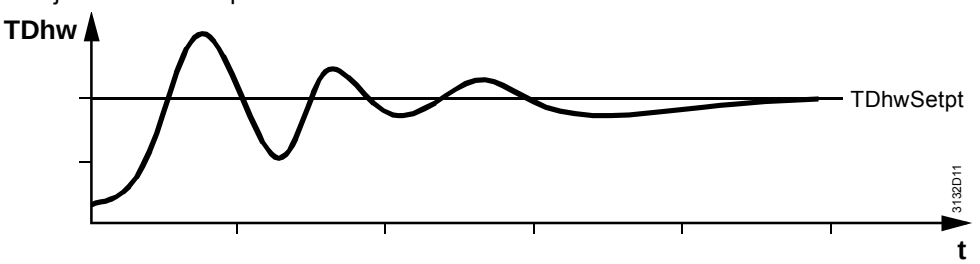
Setting parameters Xp, Tv and Tn must be **decreased** in steps while the load is at its maximum. A new readjustment should be made only after the correcting action resulting from the previous readjustment is completed.



1. Decrease Xp in steps of about 25 % of the previous value while the load is at its maximum.
2. Decrease Tv in steps of 1 to 2 seconds (when the value of 0 is reached, the controller operates as a PI controller).
   If this is not sufficient:
3. Decrease Tn in steps of 10 to 20 seconds while the load is at its maximum.

Control action is too fast

If there is significant overshoot or even continuous oscillations, setting parameters Xp, Tv and Tn must be **increased** in steps while the load is at its maximum. A new readjustment should be made only after the correcting action resulting from the previous readjustment is completed.



1. Decrease Xp in steps of about 25 % of the previous value while the load is at its maximum.

2. Increase Tv in steps of 2 to 5 seconds while the load is at its maximum.
   If this is not sufficient:
3. Increase Tn in steps of 10 to 20 seconds while the load is at its maximum.

Checking the control function at minimum load

To check the control, the start is made again with the preset control parameters, but this time under minimum load conditions.

Notes on minimum load

- Minimum load means the lowest velocity of flow on the DHW side (e.g. circulation load) at the reduced setpoint
- For the control system, the load under frost protection conditions is only of minor importance; for this reason, the frost protection setpoint should not be selected
- Under these minimum load conditions, the controller should maintain the setpoint for a certain period of time. Then, increase or decrease the setpoint by 5…10 %

If the correcting action does not produce the desired result, control parameters Xp, Tv and Tn should be readjusted this time under minimum load conditions according to the above paragraphs “Control action is too slow” and “Control action is too fast”. When readjusting the parameters, “…while the load is at its maximum“ should be replaced here by “… when the load is at its minimum”.

10.5.2 Requirements for the plant

The correct location of the secondary flow sensor is very important! If no flow switch is used, it must be made certain that the flow sensor immerses into the heat exchanger.

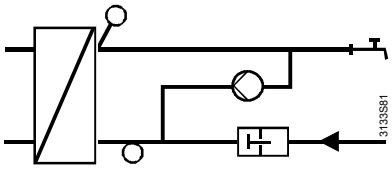
If the flow sensor is not correctly sited, **there is a risk of excessive heat exchanger temperatures**.

Apart from certain hydraulic prerequisites, good control performance can only be achieved under the following conditions:

1. Use of a fast-acting actuator having a running time of ≤15 seconds
2. The time constant of the secondary flow temperature sensor as an immersion sensor should be about 2 seconds
3. The secondary flow temperature sensor should be located about 100 to 200 mm outside the heat exchanger (item 4. must be satisfied; otherwise, refer to items 1. and 2.)
4. Use of a flow switch
5. The circulation pipe joins the DHW supply line by the heat exchanger

10.5.3 Flow switch

When using a flow switch, the controller can detect start and end of DHW consumption at an early stage, enabling it to respond accordingly. This gives the controller a lead over control systems which only use a flow temperature sensor, also preventing excessive water temperatures.



Use of a flow switch proves particularly advantageous in the case of smaller plants, such as single-family homes, but improves plant performance in all other cases as well. Fault status supervision is not possible since short-circuits and open-circuits are permitted states.

Extra configuration

The flow switch is to be activated by assigning a terminal:

Main menu >Commissioning > Extra configuration > DHW > Inputs > Flow signal Assign terminal

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Controller primary circuit

Operating line	*Range*	*Factory setting*
Min stroke with flow signal	0…100 %	25 %

Mode of operation

When DHW consumption starts, the flow switch will open the primary valve up to the set "Min stroke with flow signal“, independent of the flow temperature. The setting is to be made in % of the maximum stroke.
When DHW consumption is finished, the valve will close fully and immediately.

Calculation of the minimum stroke

Normally, in summer operation, the valve opening required for 100 % load is about 80 %. This percentage is called the **design point** and must be included in the calculations. The “Min stroke with flow signal” can be calculated as follows:

$$\text{Minimum stroke with flow signal} = \frac{\text{Heat exchanger volume}_{\text{secondary}}}{\varnothing\ \text{DHW consumption} \times \text{opening time} \times \text{design point}}$$

Example

Example of calculating the load limit to be set for a heat exchanger with the following characteristics:

Water content on the secondary side = 1.0 liter
Average DHW consumption = 0.33 liters / second
Opening time of DHW actuator = 15 seconds
Design point = 80 % (0.8)

$$\text{Minimum stroke with flow signal} = \frac{1.0}{0.33 \times 15 \times 0.8} \times 100 = 25\ \%$$

This value is used as a guide value and can vary depending on the plant’s hydraulic layout. It is recommended to start with the calculated minimum stroke and then proceed as follows:

- Decrease the value if the DHW flow temperature significantly overshoots after consumption
- Increase the value if the DHW flow temperature significantly undershoots

The impact of flow switch and PID controller is matched in a way that the actuator travels to the new position as quickly as possible. After the flow switch has responded, the control system will resume control of the actuator on the primary side.
The end of DHW consumption is also detected by the flow switch, and actuator Y1 on the primary side will be driven to the fully closed position.

Flow switch with circulating pump

In contrast to plant types with storage tank, the circulation losses cannot be compensated here via the storage tank, but must be continuously drawn from the heating network.
When the flow switch indicates the end of DHW consumption, the primary valve will not be fully closed for this reason. If the valve’s position exceeds the set ”Min stroke with flow signal”, it will start to close until the minimum stroke is reached. From this position, valve control is started. For this reason, the controller must be aware of externally operated circulating pumps:

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
External circulating pump	Yes / No	No

The assumption is made that the external circulating pump operates 24 hours a day.

Further setting choices for the circulating pump are described in subsection 10.11.3 “Circulating pump”.

Note

The cold water must join the DHW from the circulation pipe right by the heat exchanger. If, for plant reasons, this is not possible, the “Min stroke with flow signal” must be set to 0 %.

10.5.4 Maximum charging time

The maximum charging time is also active with direct DHW heating. Subsection 10.4.3 “Maximum charging time” contains additional details on this function.
The controller is supplied with the function deactivated.

10.5.5 Legionella protection with direct DHW heating

During the time the legionella program is active, the circulating pump must operate.
For direct DHW heating, the information given in the following section “Legionella protection”.
If no circulating pump is used, it is recommended to deactivate the legionella function. In that case, the legionella protection frequency must be set to “Never“.

10.6 Legionella protection

Notes

The “Legionella protection” function **can be** an important measure aimed at preventing the growth of legionella viruses.

However, the legionella program is **no guarantee** for preventing the growth of legionella viruses because these might occur in plant sections that the function cannot reach.

10.6.1 General

Legionella viruses develop significant growth in the temperature range of 35…45 °C. At temperatures above 50 °C, they stop growing.
Legionella viruses are killed at temperatures above about 55 °C; the higher the temperature, the shorter the time required to kill them.

There are different opinions regarding the effectiveness of thermal disinfection.
Control measures, such as the legionella function, are only effective in connection with other measures (primarily building construction measures, but also chemical disinfection and UV radiation).

Thermal disinfection

The legionella function ensures thermal disinfection of the storage tank. It is important here that the entire DHW storage tank will be brought to the required temperature. This poses problems in connection with certain types of storage tanks (with electric immersion heater or coiled heat exchanger) where cold water accumulates beneath the heat exchanger. These problems can only be solved by taking adequate measures.
In addition to the legionella function, it should be made certain that the DHW setpoint and the switching differential are adjusted such that the switch-on point will not be too low (e.g. 55 °C).

Piping network

It is also important to thermally disinfect not only the storage tank but also the entire piping network. It must be made certain that there are no dead pipes or piping that has not been used for longer periods of time.

Circulating pump

If possible, the circulating pump should run during the legionella program.
Ideally, during the legionella program, the taps are in use.

Practical problems in connection with legionella protection

The legionella protection function contradicts with requirements in terms of energy savings, the formation of scale (the higher the storage tank temperature, the more scale) and protection against scalding (above 60 °C).

⚠ Attention must be drawn to the risk of scalding when opening taps on completion of the legionella function.

10.6.2 Sequence of legionella function

Using the legionella program, the DHW storage tank and, optionally, the circulation piping (with the help of the circulating pump) can be maintained at the legionella protection setpoint for the required period of time.
Legionella protection is also available with direct DHW heating, but a holiday time (period of time legionella protection is provided) is possible only when the circulating pump runs.

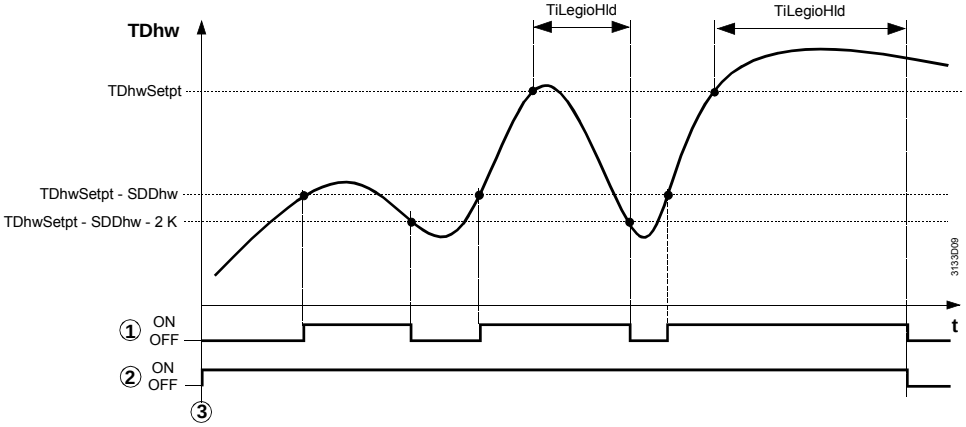
Starting the legionella program

The legionella program can be enabled either daily or weekly at a selectable point in time.
As with forced charging, storage tank charging is started as soon as the storage tank temperature (or one of the 2) lies 1 K below the legionella protection setpoint.
The legionella program will not be performed in the following cases:

- When the DHW operation selector is set to Protection mode
- During holiday mode when the selected DHW holiday mode is Protection
- When the DHW operating mode contact forces DHW heating to Protection mode
- When the plant operation selector is set to “Off“
- When storage tank charging is effected with an electric immersion heater, but without storage tank sensor

Ending the legionella program

If, during the period of time the legionella protection program is performed, the storage tank temperature (or both storage tank temperatures) can be kept at the required setpoint, the legionella function will be ended.
If, in addition, consumer control with a circulating pump has been configured, the consumer’s flow temperature sensor is also required to acquire the legionella protection setpoint for the legionella protection period. If the circulating pump is switched off during the time the legionella function is active, consumer control will be exempted from legionella protection.
The legionella function is ended only when, during the time of legionella protection, all temperatures have been at their legionella protection setpoint, or above it.



SDDhw	Switching differential DHW heating
t	Time
TDhw	DHW temperature
TDhwSetpt	DHW temperature setpoint
TiLegioHld	Holding time of legionella function (period of time legionella protection is provided)
①	Circulating pump
②	Enabling the legionella function
③	Start conditions for legionella function satisfied

During the time the legionella program is active, the circulating pump continues to operate as preselected.
The circulating pump can be specifically activated to become included in the legionella function. For that purpose, parameter “Circulating pump operation legio“ is used. If this parameter is set to “On“, the circulating pump will operate according to characteristic ① in the graph above. Exception is direct DHW heating (plant type DHW 6). With this type of plant, the circulating pump always runs, independent of the flow temperature.
If the circulating pump operates due to the preselection made, it will continue to run during the time the legionella program is performed, independent of the DHW temperature.
During the time the legionella program is active, function “Charging time limitation“ will also be active.

Supervision

The legionella function is monitored to see if it can be successfully completed within 48 hours. Successful means that the legionella protection setpoint (minus switching differential) could be maintained without interruption, also at the optional sensors (storage tank sensor at the bottom, consumer’s flow temperature sensor).
If the legionella protection setpoint cannot be maintained, or not for the required period of time, a fault status message will be delivered:

Number	*Text*	*Effect*
2101	Legionella protection error	Message must be acknowledged. Error disappears only when the legionella program has been successfully completed

In the case of a legionella protection error, the legionella program will be aborted and restarted only when, according to the program, the legionella function will be enabled the next time.
The following settings have an impact on the legionella function:

Setpoints

Legionella protection setpoint

The value set is the setpoint for disinfection that shall be maintained during the time the legionella function is active.

Main menu > DHW > Setpoints

Operating line	*Range*	*Factory setting*
Legionella setpoint	55…140 °C	70 °C

Legionella setpoint with consumer control

The legionella setpoint for consumer control lies below the legionella setpoint for DHW heating, the difference being the legionella setpoint reduction.

Main menu > DHW > Setpoints consumers

Operating line	*Range*	*Factory setting*
Legionella setpoint reduction	0…20 K	2 K

Various settings

Main menu > Settings > DHW > Legionella function

Operating line	*Range*	*Factory setting*
Legionella protection frequency	Never / Daily / Monday…Sunday	Monday
Legionella protection time	00:00…23:59	05:00
Legionella protection period	00.00…06:00 h.min	00.30 h.min
Circulating pump operation legio	Off / On	On

Legionella protection frequency

This defines if and how often the function shall be activated. In the case of a weekly interval, the required weekday can be selected.

Legionella protection time

This defines the time of day the legionella function shall be started.

Legionella protection period

It is defined here for what period of time the DHW temperature shall be maintained at the legionella protection setpoint.

Legionella protection and circulating pump

Using setting “On“ on operating line Circulating pump operation legio, the circulating pump will be activated according to the following rule, independent of the pump’s time program:

In the case of DHW plant types with storage tanks, the circulating pump starts to run as soon as the storage tank temperature has reached the level of “Legionella protection setpoint minus switching differential”. With direct DHW heating, the circulating pump always runs when the legionella function is active.
If the circulating pump operates due to its time program, this setting will have no impact. This means that the setting will activate a stopped pump, but will not deactivate a running pump.

10.6.3 Legionella function relay

The state of the legionella function can be delivered via a configurable output for further handling.
The output changes to “On“ as soon as the legionella function is started and remains on until the function is ended.

Extra configuration

The output is to be activated via “Extra configuration”:

Main menu > Commissioning > Extra configuration > DHW > Outputs > Legionella function relay Assign terminal

Settings

There are no settings required.

10.7 Primary control

Plant types

DHW 1 and DHW 5

With plant types DHW 1 and DHW 5, the charging temperature is not controlled. But it can be indirectly influenced by appropriate selection of DHW priority or by the temperature request.
Charging is effected through control of the secondary pump or primary pump based on the storage tank temperature.

DHW 2, DHW 3 and DHW 4

The other plant types are also controlled via the storage tank temperature but, in addition, the secondary temperature or the primary flow temperature will be controlled.

DHW 6

With plant type DHW 6, primary control is always enabled while the secondary flow temperature is controlled.

Primary control

With plant types DHW 2 and DHW 4, control is accomplished via a mixing valve, with plant types DHW 3 and DHW 6 via a 2-port valve.

Setpoint

The setpoint for primary control is dependent on the operating mode and, according to plant type, on the respective setpoint increase.

3-position or DC 0…10 V actuator

Control can be effected with a 3-position or DC 0…10 V actuator. The type of actuator is to be selected via “Extra configuration”.
The following settings apply to both the 3-position and the DC 0…10 V actuator.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Controller primary circuit

Operating line	*Range*	*Factory setting*
Actuator running time	1…600 s	150 s
P-band Xp	1…100 K	50 K
Integral action time Tn	0…600 s	60 s

10.7.1 Primary temperature setpoint

To be able to bring the DHW storage tank to the required setpoint or, in the case of direct DHW heating, to the required continuous flow temperature, heat generation and transmission and, sometimes, primary control, require a setpoint increase.
The following setpoint increase can be set on the service level depending on the selected plant type.

Settings

Main menu > Settings > DHW > Controller primary circuit

Operating line	*Range*	*Factory setting*
Setp increase DHW charging	0…50 K	10 K
Setp increase mixing valve	0…50 K	10 K
Setp increase heat exchanger	0…50 K	10 K
Setpoint increase storage tank	0…50 K	2 K

Setpoint increase DHW charging

The setpoint increase for DHW charging must be set with plant types using a coiled type storage tank (DHW 1 and DHW 2).

Setpoint increase mixing valve

The setpoint increase for the mixing valve is to be set with plant types using primary mixing valves (DHW 2 and DHW 4).

Setpoint increase heat exchanger

The setpoint increase for the heat exchanger is to be set with plant types using a stratification storage tank (DHW 3, DHW 4, and DHW 5), or with direct DHW heating (DHW 6).

Setpoint increase storage tank

The setpoint increase for the storage tank is to be set with plant types using a stratification storage tank and primary control (DHW 3 and DHW 4). This increase acts on the setpoint of primary control, but not on the request to heat generation.

Control setpoint

The setpoint of primary control is thus generated from the required storage tank temperature setpoint plus a plant type-dependent setpoint increase.

Primary flow sensor

If, with plant type DHW 4, a primary flow sensor is configured, control will be effected according to that sensor. In that case, the heat exchanger's setpoint increase must also be considered for the control setpoint.
The following table shows the generation of the control setpoint:

Plant type	*Control via the …*	
	Primary flow temperature	*Secondary flow temperature*
DHW 2	Storage tank temperature setpoint + setpoint increase DHW charging	
DHW 3		Storage tank temperature setpoint + setpoint increase storage tank
DHW 4	Storage tank temperature setpoint + setpoint increase Heat exchanger setp increase*	Storage tank temperature setpoint + setpoint increase storage tank
DHW 6		DHW temperature setpoint

* Optional sensor:
The primary flow temperature setpoint will automatically be lowered when the secondary flow temperature exceeds the secondary flow temperature setpoint by more than 1 K

Display of setpoints

The effective setpoint appears on the **Main menu** and on the info page.

Main menu > DHW > Inputs/setpoints

Operating line	*Adjustable values / display / remarks*
Storage tank temp setpoint	0…140 °C
Flow temp sec setpoint	0…140 °C
Primary flow temp setpoint	0…140 °C

10.7.2 Load control

DHW charging can be influenced by load control signals from a heat source or primary controller.

Load reduction

Load reduction can be triggered by one of the following functions:

- Protective boiler startup
- Minimum limitation of the boiler return temperature

Settings

Main menu > Settings > DHW > Controller primary circuit

Operating line	*Range*	*Factory setting*
Locking signal gain	0…200 %	100 %

Load increase

From the consumer's point of view, a load increase can be effected in the form of pump and / or mixing valve overrun. This will force the consumer to continue to draw heat. Overrun is not possible with direct DHW heating since there is no pump on the secondary side. Overrun does not act on the circulating pump.

By setting the DHW priority, a load reduction on the heating circuits can be enforced. When the priority is active, there is thus more heat available for DHW heating, and the charging time becomes shorter.
For more detailed information, refer to section 10.10 "DHW priority".

10.8 Limitation and protective functions

10.8.1 DHW discharging protection

The flow temperature is monitored to prevent the storage tank from being discharged. Discharging protection can become active during storage tank charging or during overrun and deactivate the charging pump or primary pump.

Flow temperature

To ensure that the function will also be performed when the charging pump is deactivated (with no flow past the sensor), the flow temperature of the primary controller or that of the boiler is used.
If a primary controller is used without a pump, it is possible that there will be no flow past the flow temperature sensor. For this reason, discharging protection can be deactivated.
In the case of plants with heat exchanger, the primary flow temperature is used, if available.

⇒ The flow temperature must be acquired either locally by the same controller or by some other device which communicates via bus.
For detailed information, refer to chapter 14 "Communication".

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
Discharge protection	Yes / No	Yes

Storage tank charging active

During storage tank charging, discharging protection switches the respective charging pump off if:

DHW plant type	*Condition for switching off*	*Discharging protection with*
DHW 1 DHW 2	Flow temperature **<** [storage tank temperature* + 1/8 setpoint increase of DHW charging]	Primary pump
DHW 3 DHW 4 DHW 5	Primary flow temperature **<** [storage tank temperature** + $1/_8$ setpoint increase of heat exchanger]	Secondary pump

Overrun active

During overrun, discharging protection switches the primary pump off if:

DHW plant type	*Condition for switching off*
DHW 1 DHW 2 DHW 4 DHW 5	Flow temperature < storage tank temperature**

During overrun, discharging protection switches the secondary pump off if:

DHW plant type	*Condition for switching off*
DHW 3	Flow temperature < storage tank temperature**
DHW 4 DHW 5	Flow temperature < storage tank temperature**

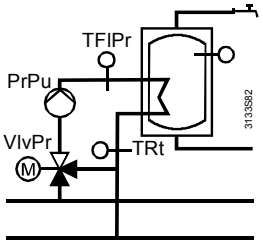
* If 2 storage tank sensors are used, the **lower** value will be considered

** If 2 storage tank sensors are used, the **higher** value will be considered

10.8.2 Limitation of the return temperature

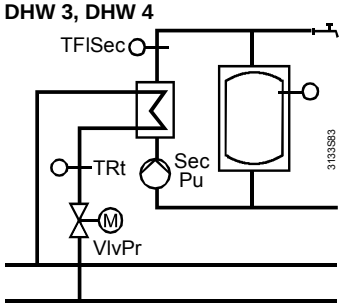
With DHW plant types using a primary mixing valve, return temperature limitation can be configured. This applies to plant types DHW 2, DHW 3, DHW 4 and DHW 6.

DHW 2



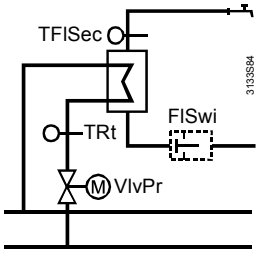
FlSwi Flow switch (optional)
PrPu Primary pump
SecPu Secondary pump
TFlPr Primary flow sensor

DHW 3, DHW 4



TFlSec Secondary flow sensor
TRt Return sensor
VlvPr Primary mixing valve

DHW 6



Maximum limitation of the return temperature

If the return temperature exceeds the limit value, the flow temperature setpoint of the DHW circuit will be lowered. If the return temperature drops below the limit value, the reduction of the flow temperature setpoint will be negated again. Limitation operates as an I-controller whose integral action time can be adjusted.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Controller primary circuit

Operating line	*Range*	*Factory setting*
[Tn] return temp limitation max	0…60 min	30 min

Extra configuration

The return temperature sensor must be assigned a terminal via “Extra configuration”:
Main menu > Commissioning > Extra configuration > DHW > Inputs > Return sensor Assign terminal

Settings

The function is to be activated via “Settings“:
Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Limitations

Operating line	*Range*	*Factory setting*
DHW return temp max	---- / 0…140 °C	---- °C
Legionella return temp max	----/ 0…140 °C	---- °C

Return temperature limitation during DHW heating

This limitation is active provided a valid value has been set and the legionella function is active. The limitation can be overridden by return temperature limitation in connection with the legionella function.
Maximum limitation with DHW heating is constant, that is, independent of the outside temperature.

Return temperature limitation during the time the legionella function is active

Maximum limitation of the return temperature during DHW heating will be deactivated. Maximum limitation of the return temperature is constant during the time the legionella function is active, that is, independent of the outside temperature. This limitation too will be activated only when a valid value has been set. If the value is invalid (“---“), there will be **no** limitation during the time the legionella function is active.

10.8.3 Frost protection functions

Frost protection for the storage tank

Frost protection for the DHW storage tank is ensured in all operating modes and is activated as soon as one of the 2 storage tank sensors acquires a temperature below 5 °C.

A temperature request will then be sent to the heat source, and the storage tank heated up until both storage tank temperatures have reached 5 °C (plus the adjusted switching differential) thereby exceeding 6 °C, independent of the operating mode.

⇒ Frost protection for the storage tank is started when the plant operation selector is set to “Off“ and / or in summer operation the storage tank is charged via the electric immersion heater.

Frost protection for the flow

With plant types DHW 2 through DHW 5, the flow temperature is monitored also.
If it falls below 5 °C, the primary pump will be activated with plant type DHW 2, and the secondary pump with all the other plant types. When the temperature exceeds 6 °C, the pump will be switched off again.
During the time frost protection for the flow is active, no heat request is sent to the heat source.

10.8.4 Pulse limitation

DHW heating can handle pulses for limiting the output or the volumetric flow. Prerequisite for pulse limitation is a DHW plant type with mixing valve, that is, DHW 2, DHW 3, DHW 4, or DHW 6.

Meter inputs

The pulses are delivered via the meter inputs of function block “Meter”. For more detailed information about this function block, refer to chapter 11 “Function block meter”.
After one or several meter inputs have been configured, pulse limitation can be set up.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Limitations > Pulse limitation

Operating line	*Range*	*Factory setting*
Meter input	--- / 1…4	---
Type of limitation	Absolute / Scaled	Absolute
Limit value	5…4000 pulses/min	75 pulses/min
Integral action time Tn	0…255 min	60 min

Meter input

The meter input is an input of function block “Meter” and used for the limitation of pulses. Only inputs configured to a terminal can be selected for pulse limitation.

Type of limitation

2 limitation choices are available:
- Absolute: Limitation will be activated when the limit value is crossed
- Scaled: The limit value is fixed at 75 pulses/min. The limit value can be set, but this has no effect. If less than 5 pulses/min are received, fault status message No signal meter 1 (or ...2) will be delivered. Heat meters with a scaled output deliver 120 pulses/min if there is no supply of heat or no volumetric flow. Together with pulse limitation, this prevents hydraulic creep.

Limit value

From the limit value, pulse limitation starts throttling the actuating device (mixing valve). The setting is only active when the limitation is absolute. In the case of scaled limitation, the limit value can be set, but the function works with 75 pulses/min (fixed value).

Integral action time (Tn)

The setting value determines the rate at which the flow temperature setpoint will be lowered:
- Short integral action times lead to a faster reduction
- Long integral action times lead to a slower reduction

10.8.5 Pump overrun and mixing valve overrun

Consumer overrun

To protect the boiler against overtemperatures on burner shutdown because there may be no more consumers drawing heat, a consumer overrun time can be set on the boiler controller.
When the burner has shut down, overrun ensures that the heating circuits and DHW heating will still draw a certain amount of heat during that period of time, provided they were consuming heat up to one minute before shutdown occurred. In any case, pumps and mixing valves have an overrun time of 60 seconds.
For more detailed information, refer to section 5.4 “Pump overrun and mixing valve overrun”.

Direct DHW heating

In the case of direct DHW heating, overrun is not possible since there is no pump on the secondary side. Overrun does not act on the circulating pump.

Primary pump and secondary pump

Overrun applies to both the primary and the secondary pump.
To carry the residual heat away from the heat exchanger, plant types DHW 4 and DHW 5 (with heat exchanger and primary pump) offer a setting for an additional overrun time of the secondary pump:

Main menu > Settings > DHW > Controller primary circuit

Operating line	*Range*	*Factory setting*
Overrun time secondary pump	0…60 min	1 min

10.8.6 Pump kick and valve kick

Pump kick and valve kick are protective functions that are performed at a certain interval. They prevent pumps and / or actuators from seizing after longer off periods.

10.9 Heat demand

DHW heating sends its heat demand as a temperature request to the heat source.
The temperature request for the current heat demand of DHW heating is dependent on the plant type and calculated as follows:

Plant type	*Temperature request*
DHW 0	DHW heating works autonomously, that is, independent of heat generation. No temperature request will be delivered
DHW 1	Storage tank temperature setpoint + setpoint increase DHW charging
DHW 2	Storage tank temperature setpoint + setpoint increase heat exchanger + setpoint increase mixing valve
DHW 3	Storage tank temperature setpoint + setpoint increase heat exchanger
DHW 4	Storage tank temperature setpoint + setpoint increase heat exchanger + setpoint increase mixing valve
DHW 5	Storage tank temperature setpoint + setpoint increase heat exchanger
DHW 6	DHW temperature setpoint + setpoint increase heat exchanger

Settings

Main menu > Settings > DHW > Controller primary circuit

Operating line	*Range*	*Factory setting*
Setp increase DHW charging	0…50 K	10 K
Setp increase mixing valve	0…50 K	10 K
Setp increase heat exchanger	0…50 K	10 K

Setpoint increase storage tank acts on the control, but not on the temperature request. The amount of heat required for DHW heating can have a considerable impact on the temperature request to the heat source. Here, the selected DHW priority is of great importance. For more detailed information, refer to the following section “DHW priority” and to chapter 14 "Communication".

10.10 DHW priority

Using DHW priority, preference can be given to DHW heating by reducing the output of the heating circuits. The output reduction can be either shifting or absolute.
In addition, the heat request to the heat source can be restricted to the DHW user request.

Settings

Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
Priority	None [DHW request] / Shifting [DHW request] / Absolute [DHW request] / None [max selection] / Shifting [max selection]	Shifting [DHW request]

No priority

During DHW heating, there is no restriction for the heating circuits with regard to heat consumption.
But the heat source provides maximum limitation of the temperature for DHW heating.

Shifting priority

If the heat source does not reach the required flow temperature setpoint, the amount of heat drawn by the heating circuits will be restricted by a load reduction. Apart from that, the heating circuits can draw heat without any restriction.
The heat source provides maximum limitation of the temperature for DHW heating.

Absolute priority

During DHW heating, the heating circuits are not allowed to draw any heat.
The heat source delivers the temperature to satisfy the heat demand for DHW heating.

No priority / maximum selection

With regard to heat consumption during DHW heating, there are no restrictions for the heating circuits.
The heat source delivers the temperature according to maximum selection of DHW heat demand and heat demand from other consumers.

Shifting priority / maximum selection

If the heat source does not reach the required flow temperature setpoint, the amount of heat drawn by the heating circuits will be restricted via load reduction. Apart from that, the heating circuits can draw heat without any restriction.
The heat source delivers the temperature according to maximum selection of DHW heat demand and heat demand from other consumers.

Note

The priority function only acts on the heating circuits, not on ventilation systems.

10.11 Auxiliary functions

10.11.1 Text designation for DHW and time switches

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW

Operating line	*Range*	*Factory setting*
DHW	Max. 20 characters	DHW
DHW time switch	Max. 20 characters	DHW time switch
Circ pump time switch	Max. 20 characters	Circ pump time switch

The text entered here appears on the Main menu and on the info display in place of the original text.

10.11.2 Primary flow temperature sensor

With plant types DHW 4 and DHW 5, a primary flow temperature sensor can be configured as an option.
In that case, mixing valve control with plant type DHW 4 is accomplished via the primary flow temperature.
If the primary flow temperature sensor is configured, its temperature will be used during active DHW charging to ensure discharging protection.

Extra configuration

The function is to be activated via “Extra configuration”:

Main menu > Commissioning > Extra configuration > DHW > Inputs > Primary flow sensor Assign terminal

Settings

There are no settings required.

10.11.3 Circulating pump

A circulating pump can be configured for DHW circulation.
The output is to be activated via “Extra configuration”:

Extra configuration

Main menu > Commissioning > Extra configuration > DHW > Outputs... > Circulating pump Assign terminal

Control can take place via a specific time program or depending on user requirements (DHW time switch). Using setting **Acc to DHW time switch**, the circulating pump will run during operating mode “Normal ”.
By activating the circulating pump for the period of time the legionella function is performed, the circulation pipe can also be protected against legionella viruses
For detailed information, refer to subsection 10.6.2 “Sequence of legionella function”.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
Operation circulating pump	Time switch / On	Time switch
Circulating pump time switch	Acc to circ pump time switch / Acc to DHW time switch	Acc to circ pump time switch
Interval operation circ pump	Yes / No	Yes
External circulating pump	Yes / No	No

Operation of circulating pump

The circulating pump can be operated according to the time switch or, using this setting, can be made to run constantly (24-hour operation). This setting will be overridden when preselecting “Off" with the DHW operating mode, which means that the circulating pump will also be deactivated.

Time switch for the circulating pump

The circulating pump can be operated according to its time switch or the DHW time switch. This setting will be active only if “Operation circulating pump" is set to “Time switch".

Interval operation of circulating pump

In interval operation, the circulating pump runs for 10 minutes at 30-minute intervals (every full and every half hour), resulting in off times of 20 minutes. The pump runs only when enabled according to the time switch or parameterization. When enabling is started, the pump always runs for 10 minutes, independent of the time of day. But this does not apply when turning on power or when leaving commissioning.

External circulating pump

Some of the functions require a circulating pump, such as the legionella function in connection with consumer control or direct DHW heating. If a circulating pump is in operation that is independent of the controller, this can be communicated to the controller by making use of this setting.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Legionella function

Operating line	*Range*	*Factory setting*
Circulating pump operation legio	Time switch / On	On

Operation of circulating pump when legionella function is activated

To include the circulating pump in the legionella function, this setting can be used to activate the pump for the period of time the legionella function is performed. When using setting **Time switch**, the legionella function has no influence on the circulating pump.

10.11.4 Electric immersion heater

Plant types

With the exception of DHW plant type DHW 0, which uses exclusively an electric immersion heater, all DHW plant types with storage tank can be switched to electric immersion heater during summer operation. Operation with an electric immersion heater is identical to space heating mode with the same DHW operating modes, set-points, legionella function, etc.
Only DHW plant type DHW 0 can operate without a storage tank sensor. In that case, only the electric immersion heater will be enabled.

Changeover to summer operation

Changeover to summer operation takes place depending on the heating circuits' heat demand. If the heating circuits do not call for heat for a period of 48 hours, changeover to summer operation will take place at midnight. The electric immersion heater receives the release signal and storage tank charging with hot water will be switched off.

⇒ Frost protection for the storage tank will still be ensured (also refer to subsection 10.8.3 "Frost protection functions").
As soon as one of the heating circuits calls for heat, there will be a change to winter operation with hot water.

Changeover in the event the heat source fails

If the heat source reports a fault (e.g. due to a malfunction or user intervention), the electric immersion heater will be enabled and storage tank charging with hot water switched off. For this function to be performed, heat source and DHW heating must be included in a system network. For more detailed information about function block "Meter", refer to chapter 14 "Communication".

Extra configuration

The output is to be activated via "Extra configuration":

Main menu > Commissioning > Extra configuration > Outputs > Electric immersion heater Assign terminal

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > DHW

Operating line	*Range*	*Factory setting*
Changeover el immersion heater	Yes / No	No
Operation el immersion heater	Normal setpoint / Automatically	Automatically

Changeover to electric immersion heater

Using this setting, changeover to the electric immersion heater can be deactivated. In that case, the storage tank is charged with hot water throughout the year.

Operation with electric immersion heater

When using the electric immersion heater, it can be selected whether the storage tank setpoint shall be predefined by the time switch or whether it shall apply permanently. This setting is active only during operation with the electric immersion heater **and** when a storage tank sensor is available

10.11.5 System pump

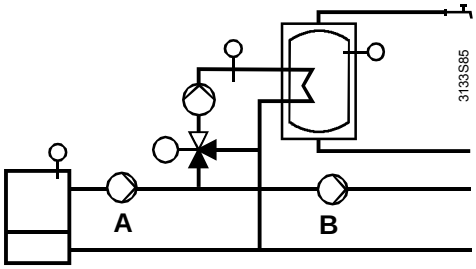
The boiler pump (system pump) for DHW heating must be activated depending on the type of hydraulic circuit.
The required function can be selected on the service level:

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Controller primary circuit

Operating line	*Range*	*Factory setting*
System pump required	Yes / No	Yes

Example

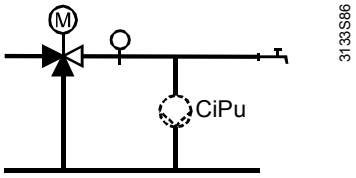


A The boiler pump is located at A and **required** as a system pump for DHW heating.
Input: System pump required = Yes

B The boiler pump is located at B and is **not** required for DHW heating.
Input: System pump required = No

10.11.6 Consumer control

Any DHW plant type can be equipped with consumer control.
This function offers the choice of combining high storage tank setpoints with a reduced risk of scalding by using lower consumer setpoints, for example. This can help to make optimum use of a given storage tank volume.
In that case, consideration must be given to the fact that higher water temperatures lead to the formation of more scale in the plant.



Consumer control always consists of mixing valve and consumer flow temperature sensor.
The circulating pump is an optional plant component, but recommended.
When there is no flow of water, the mixing valve can fully open, which can lead to high outlet temperatures once the flow starts again.

Extra configuration

Consumer control is to be activated via “Extra configuration”:
... > DHW... > Inputs > Flow sensor consumers Assign terminal
... > DHW... > Outputs > Consumer mixing valve 3-pos Assign terminal
... > DHW... > Outputs > Consumer mixing valve mod Assign terminal

Settings

To be able to match the control parameters to the type of plant (actuator and controlled system), the parameters of the PID controller can be set. They apply to both 3-position and DC 0…10 V actuators.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > Controller consumers

Operating line	*Range*	*Factory setting*
Actuator run time	1…600 s	35 s
P-band Xp	1…100 K	50 K
Integral action time Tn	0…600 s	60 s
Derivative action time Tv	0…30 s	0 s

Operating mode

The operating mode is only dependent on the time switch of the circulating pump, whereby operating mode “Normal“ applies during “On”, and operating mode “Reduced“ during “Off”.
The operating mode of consumer control indicates the setpoint at which the consumer temperature is maintained.

Setpoints

Consumer control only uses the 2 setpoints “Normal“ and “Reduced“.
On the service level, it is also possible to set a setpoint reduction against the general legionella setpoint. The legionella setpoint of consumer control is calculated as follows:
Legionella setpoint – Legionella setpoint reduction

Main menu > DHW > Setpoints consumers > ... or

Main menu > Settings > DHW > Setpoints consumers

Operating line	*Range*	*Factory setting*
Legionella setpoint reduction	0…20 K	2 K
Normal setpoint	5…140 °C	55 °C
Reduced setpoint	5…140 °C	40 °C

Legionella protection

Legionella protection of consumer control requires the circulating pump to be running. This can be a pump controlled by the controller or an external pump. In the case of an external pump, the following setting is required:

Main menu > Commissioning > Settings > ... or

Main menu > Settings > DHW > DHW > External circulating pump

The setting to be made is “Yes“.
The user must ensure that the external pump is in operation during the time the legionella function is performed.
For legionella protection, the general settings of the legionella function apply. For detailed information, refer to section 10.6 “Legionella protection”.

Note

The setpoints selected here do not act on the storage tank setpoints or on the setpoints of direct DHW heating. The user must ensure that sufficient amounts of heat are available.

10.12 Fault handling

Configuration errors

Number	*Text*	*Effect*
5601	DHW plant type undefined	Urgent message; must not be acknowledged

This fault status message appears when the plant’s configuration is incomplete so that the controller is not able to make an assignment to a DHW plant type.

Faulty storage tank sensor

Number	*Text*	*Effect*
71	DHW stor tank sensor top error	Nonurgent message; must be acknowledged
72	DHW stor tank sensor bott error	Nonurgent message; must be acknowledged

In the event one of the storage tank sensors is faulty, storage tank charging is controlled according to the second storage tank temperature (if available).
If there is no second storage tank temperature, charging will be aborted, the pump(s) switched off and the mixing valve (if present) driven to the fully closed position.

Faulty primary flow sensor

Number	*Text*	*Effect*
74	DHW flow sensor primary error	Nonurgent message; must be acknowledged

If the sensor is required for control (plant types DHW 2 and DHW 4) and no secondary flow temperature is available (plant type DHW 4), the mixing valve will fully close.

Faulty secondary flow sensor

Number	*Text*	*Effect*
75	DHW flow sensor sec error	Nonurgent message; must be acknowledged

If the sensor is required for control (plant types DHW 3, DHW 4, and DHW 6) and no primary flow temperature is available (plant type DHW 4), the mixing valve will fully close.

Faulty consumer flow sensor

Number	*Text*	*Effect*
76	DHW flow sensor cons error	Nonurgent message; must be acknowledged

The consumer's mixing valve will fully open and no legionella function will be performed in consumer control.

Faulty return sensor

Number	*Text*	*Effect*
77	Faulty DHW return sensor	Nonurgent message; must be acknowledged

Return temperature limitation is no longer possible.

Legionella temperature not reached

Number	*Text*	*Effect*
2101	Legionella protection error	Nonurgent message; must be acknowledged

This error occurs when the legionella function has not been able to reach the legionella setpoint for 48 hours. The legionella function will be aborted and restarted only the next time the legionella program is enabled.

Faulty DHW primary pump

Number	*Text*	*Effect*
2551	[DHW primary pump] overload	Nonurgent message. Acknowledgement can be selected; factory setting: "Acknowledge and reset"
2552	[DHW primary pump B] overload	Nonurgent message. Acknowledgement can be selected; factory setting: "Acknowledge and reset"
2553	[DHW prim pump] no flow	Nonurgent message; must be acknowledged and reset
2554	[DHW prim pump B] no flow	Nonurgent message; must be acknowledged and reset
2555	[DHW primary pump] fault	Urgent message; must not be acknowledged. Plant stop DHW

Faulty DHW secondary pump

Number	*Text*	*Effect*
2561	[DHW sec pump] overload	Nonurgent message. Acknowledgement can be selected; factory setting: "Acknowledge and reset"
2562	[DHW sec pump B] overload	Nonurgent message. Acknowledgement can be selected; factory setting: "Acknowledge and reset"
2563	[DHW sec pump] no flow	Nonurgent message; must be acknowledged and reset
2564	[DHW sec pump B] no flow	Nonurgent message; must be acknowledged and reset
2565	[DHW sec pump] fault	Urgent message; must not be acknowledged. Plant stop DHW

Faulty circulating pump

Number	*Text*	*Effect*
2571	[DHW circ pump] overload	Nonurgent message. Acknowledgement can be selected; factory setting: “Acknowledge and reset“
2572	[DHW circ pump B] overload	Nonurgent message. Acknowledgement can be selected; factory setting: “Acknowledge and reset“
2573	[DHW circ pump] no flow	Nonurgent message; must be acknowledged and reset
2574	[DHW circ pump B] no flow	Nonurgent message; must be acknowledged and reset
2575	[DHW circ pump] fault	Urgent message; must not be acknowledged. Plant stop DHW

10.13 Diagnostic values

Inputs / setpoints

■ Main menu > DHW > Inputs/setpoints

Operating line	*Adjustable values / display / remarks*
Act value prim FT	…°C
Event logger 1	…°C
[DHW primary pump] overload	0 / 1 (1 = overload)
[DHW primary pump B] overload	0 / 1 (1 = overload)
Primary pump flow signal	0 / 1 (1 = flow)
Flow temp sec actual value	…°C
Flow temp sec setpoint	…°C
Flow signal	…°C
[DHW sec pump] overload	0 / 1 (1 = overload)
DHW plant type	0 / 1 (1 = overload)
Secondary pump flow signal	0 / 1 (1 = flow)
Act value strge tank temp top	…°C
Act value strge tank temp bott	…°C
Storage tank temp setpoint	…°C
Actual value return temp	…°C
Return temperature max	…°C
Forced charging	0 / 1 (1 = forced charging input)
Flow temp cons actual value	…°C
Flow temp cons setpoint	…°C
[DHW circ pump] overload	0 / 1 (1 = overload)
[DHW circ pump B] overload	0 / 1 (1 = overload)
Circulating pump flow signal	0 / 1 (1 = flow)
DHW optg mode	0 / 1 (1 = external selection of operating mode)
Special day input	0 / 1 (1 = Special day input active)
Holiday input	0 / 1 (1 = Holiday input active)

Outputs

■ Main menu > DHW > Outputs

Operating line	*Adjustable values / display / remarks*
Mixing valve position primary	0…100 % (3-position and modulating)
	Off / On
Primary pump B	Off / On
Mix valve pos maint sec temp	0…100 % (3-position and modulating)
Secondary pump	Off / On
Secondary pump B	Off / On

Operating line	*Adjustable values / display / remarks*
Electric immersion heater	Off / On
Mix valve pos consumers	0…100 % (3-position and modulating)
Circulating pump	Off / On
Circulating pump B	Off / On
Legionella function relays	Off / On

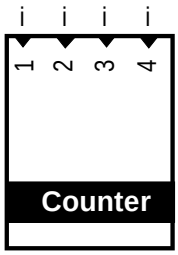
Limitations

■ Main menu > DHW > Limitations

Operating line	*Adjustable values / display / remarks*
Charging time max	Inactive / Active
Discharge protection	Inactive / Active
Interval operation circ pump	Inactive / Active
Return temperature max	Inactive / Active
Pulse limitation	Inactive / Active

11 Function block meter

11.1 Overview of function block



i 1 Meter input 1
i 2 Meter input 2
i 3 Meter input 3
i 4 Meter input 4

11.2 Configuration

Extra configuration

The meters are to be activated via “Extra configuration” by assigning a terminal to the meter input.

Settings

Main menu > Commissioning > Extra configuration > Data acquisition > Meter 1 (or 2, 3 or 4)

Operating line	*Range*	*Factory setting*
Input 1 (etc., through Input 4)	--- / RMH760.X3, etc.	---
Displayed unit	Wh / kWh / MWh / kJ / MJ / GJ / ml / l / m3 / Heat cost unit / No unit / BTU	kWh
Displayed format	0 / 0.0 / 0.00 / 0.000	0

Displays

The unit shown can be selected via datapoint **Displayed unit**.
Datapoint **Displayed format** defines the number of decimal places.

11.3 Types of meters

The meters are used to acquire consumption values.
Pulses from the following types of meters can be handled:

- Gas meters
- Hot water meters
- Cold water meters
- Electricity meters

The pulse values represent:

- Energy in kJ, MJ, GJ, Wh, kWh **and** MWh
- Volume in m^3, l **or** ml
- Variables with no unit (max. 3 decimal places)
- Heat cost unit
- BTU (British Thermal Unit)

The pulses are converted to consumption values according to the setting values and then added; the cumulated values are stored as 15-month values at midnight when the month changes. The monthly values of the last 15 months will be stored.

The meters are used to optimize plant operation. They also serve for limiting the pulses.

Types of meters

The following types of meters can be used:

- Mechanical pulse sources (Reed contact) with no Namur circuitry, having a maximum pulse frequency of 25 Hz and a minimum pulse duration of 20 ms
- Electronic pulse sources having a maximum pulse frequency of 100 Hz and a minimum pulse duration of 5 ms

Electronic pulse sources, such as Open Collector outputs, generate shorter, less bouncing pulses than mechanical pulse sources, such as relays or Reed contacts.
To ensure full flexibility with regard to models, the type of meter can be selected:

Setting

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs > RMH760.X... (or RMZ78....)

Operating line	*Range*	*Factory setting*
Type	Mechanically / Electronically	Mechanically

Note on “Meter 1“

A name can be entered for every meter (refer to section 11.8 “Assignment of text”). If, after assigning a name, the meter is called up, it is no longer “Meter 1“ (or 2, 3, or 4) that appears, but the name entered

Notes

- The pulse meters integrated in the RMB760B are not suited for billing purposes, the reason being insufficient accuracy. To ensure valid billing data, readout must take place directly on the meters (heat meters, electricity meters, etc.)
- Meters using Namur or S0 circuitry are not supported
- 4 independent meters are available

11.4 Pulse valency

Every pulse delivered by a pulse source corresponds to a certain consumption value. The pulse valency is imprinted on the meter. It must be entered as a numerator and denominator.

Example 1

Settings: Pulse valency numerator = 20
Pulse valency denominator = 1
Pulse unit = liter

⇨ Pulse valency = 20 liters / pulse

Example 2

Settings: Pulse valency numerator = 10
Pulse valency denominator = 3
Pulse unit = Wh

⇨ Pulse valency = 3.33 Wh/pulse

Pulse valency

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Data acquisition > Meter 1 (or 2, 3 or 4)

Operating line	*Range*	*Factory setting*
Pulse unit	Wh / kWh / MWh / kJ / MJ / GJ / ml / l / m3 / Heat cost unit / No unit / BTU	kWh
Pulse valency numerator	1…9999	1
Pulse valency denominator	1…9999	1

11.5 Overflow value

The overflow value ensures that both meter and RMH760B show the same display. The value at which the meter's display is reset to 0 can be set.
The unit and the decimal point are dependent on the unit and the format displayed.
The overflow value can only be changed via the OCI700.1 service tool.

Setting

Operating line	*Range*	*Factory setting*
Overflow value	0…999'999'999	99'999'999 kWh

11.6 Setting and resetting meter readings

If there are discrepancies, service staff can readjust meter readings via datapoint **Meter reading current**. This value can only be changed with the OCI700.1 service tool
The last 15 monthly values can be deleted via datapoint **Reset monthly values**. The current meter reading will be maintained.

Setting and resetting meter readings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Data acquisition > Meter 1 (or 2**,** 3 or 4)

Operating line	*Range*	*Factory setting*
Reset monthly values	Yes / No	No

11.7 Displaying meter readings

For each meter, following is displayed:
- The current meter reading
- Of the last 15 months, the meter reading per month and the respective readout date

Display values

Main menu > Data acquisition > Meter 1 (or 2**,** 3 or 4)

Operating line	*Comments*
Meter reading current	0…999'999'999
Unit	According to the configured display format
[Readout 1] date	
[Readout 1] meter reading	
…	
[Readout 15] date	
[Readout 15] meter reading	

The monthly values are stored at the end of the month at midnight.
The 15 monthly values can be deleted on the password level using datapoint "Reset monthly values".

11.8 Assignment of text

Each meter can be assigned specific text. This text will then appear as menu text and datapoint text on the operating pages.

Settings

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Data acquisition > Meter 1 (or 2**,** 3 or 4)

Operating line	*Range*	*Factory setting*
Meter reading 1*	Max. 20 characters	Meter reading 1*

* Or meter reading 2, 3 or 4

11.9 Fault handling

Battery-powered or mechanical meters also continue metering in the event of a power failure. In the event power supply to the RMH760B fails, the pulses will not be counted during that period of time.
When leaving the “Extra configuration” menu, a restart will be made. Pulses received between the last storage operation and the restart (maximum 5 minutes) are counted.
If, in connection with pulse limitation, “Scaled“ is selected as the type of limitation, a fault status message is delivered to the meter’s input if the minimum number of pulses (5 pulses/min) is not reached for more than 20 seconds.

Note

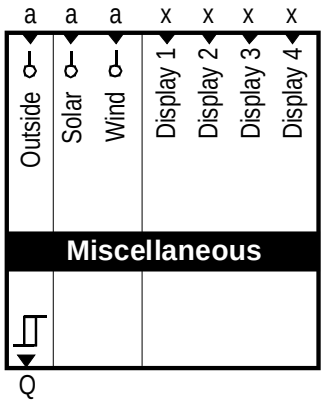
Scaled pulse sources never deliver less than 7.5 pulses/min.

Fault status messages

Number	*Text*	*Effect*
9401	No pulse signal meter 1	Meter input 1 receives no pulses from the heat meter. Nonurgent message; must be acknowledged
9402	No pulse signal meter 2	Meter input 2 receives no pulses from the heat meter. Nonurgent message; must be acknowledged
9403	No pulse signal meter 3	Meter input 3 receives no pulses from the heat meter. Nonurgent message; must be acknowledged
9404	No pulse signal meter 4	Meter input 4 receives no pulses from the heat meter. Nonurgent message; must be acknowledged

12 Function block miscellaneous

12.1 Overview of function block



12.2 Configuration

Function block “Miscellaneous“ is always available. To activate the function block, no special basic configuration is required.

Extra configuration

The common functions required for the plants can be activated via “Extra configuration”.

Inputs

Main menu > Commissioning > Extra configuration > Miscellaneous > Inputs

Operating line	*Adjustable values / display / remarks*
Outside temperature sensor	
Solar radiation	
Wind speed	
Display input 1	
Display input 2	
Display input 3	
Display input 4	

Outputs

Main menu > Commissioning > Extra configuration > Miscellaneous > Outputs

Operating line	*Adjustable values / display / remarks*
Outside temperature relay	

Functions

Main menu > Commissioning > Extra configuration > Miscellaneous

Operating line	*Range*	*Factory setting*
Business card	Yes / No	Yes

Business card

Activation of the business card is described in subsection 4.5.4 “Electronic business card”.

12.3 Outside sensor

A total of 3 outside sensors can be connected to the RMH760B:

- The outside sensor at function block “Miscellaneous“ can be used as follows:
  - As a reference variable for flow temperature control and for other functions in connection with heating circuit 1

- As a reference variable for the heat demand transformers
- For frost protection functions
- For locking the boiler depending on the outside temperature
- For forwarding via data bus. This enables the measured value to be used in heating circuits 2 and 3 also. The factory setting heating circuits 2 and 3 use is the outside sensor at function block "Miscellaneous"

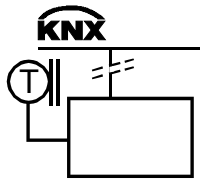
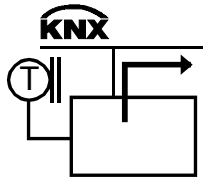
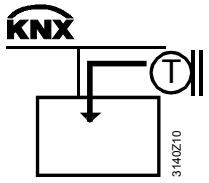
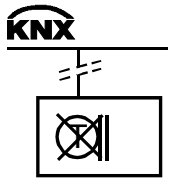
- The outside sensors at function blocks “Heating circuit 2“ and “Heating circuit 3” can be used as follows:
  - As a reference variable for flow temperature control and for other functions in connection with heating circuits 2 and 3
  - For forwarding via data bus

Connection choices

The outside temperature can be delivered by different sources:

- The outside sensor is locally connected to a terminal
- The outside temperature signal is delivered via data bus

The following variants are available:

Variant	*Effect*	*Diagram*
Outside temperature locally at the terminal. Communication outside temperature not active	Plant operates with its own outside temperature. No impact on the bus	
Outside temperature locally at the terminal. Communication outside temperature active	Plant operates with its own outside temperature. The outside temperature is also made available via bus to other controllers or other applications in the same controller	
No outside temperature locally. Communication outside temperature active	Plant operates with the outside temperature delivered via bus by some other controller. Heating circuits 2 and 3 operate per default according to this variant	
No outside temperature locally. Communication outside temperature not active	Controller has no outside temperature	

The type of sensing element of the outside sensor can be selected under ... > Settings > Inputs at the assigned terminal. Default setting is an LG-Ni 1000 sensor.
Connection of an NTC575 sensor (e.g. QAC32) is possible.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs

Operating line	*Range*	*Factory setting*
RMH760.X… (or RMZ78…)	Ni1000 / 2×Ni1000 / T1 / Pt1000 / 0…10 V / NTC575	Ni1000

Outside temperature via bus

The outside temperature can be transmitted to other controllers via bus, or it can be received from the bus. For that purpose, communication must be activated and an

outside temperature zone set. An outside temperature zone identified by "----" means that the outside temperature on the bus is inactive.
To enable different outside temperature signals to be distributed via bus (e.g. outside temperature for heating zone North, outside temperature for heating zone South), they must be assigned to own outside temperature zones. For the required settings, refer to section 14.6 "Weather data".

Configuration

Main menu > Commissioning > Communication > Distribution zones

Operating line	*Range*	*Factory setting*
Outside temperature zone	----/ 1…31	1

Communication per default

The RMH760B is supplied with the outside temperature zones activated. This means that only one outside sensor need be connected and the outside temperature is used throughout the controller.
If heating circuits 2 and 3 shall be operated with their own outside sensors, the sensors must be configured to free terminals and outside temperature zones must be switched inactive or set in different zones.
If 2 or more RMH760B are interconnected via bus and each of them is equipped with an outside sensor, the controllers send per default the outside temperature in the same outside temperature zone. This will lead to a communication error with all controllers:

Number	*Text*	*Effect*
11	>1 outside temp sensor HC 1	Nonurgent message; must not be acknowledged

To solve the problem, the outside temperature zones of the different controllers can be set to different values, or the outside sensors can be removed from all controllers except one so that all controllers will work with one common sensor.

12.3.1 Outside temperature simulation

To test the plant's response, the outside temperature can be simulated and the measured value of the outside temperature can be overridden. Simulation is always possible, independent of whether the outside temperature is received via bus or acquired locally.

Main menu > Miscellaneous > Inputs

Operating line	*Range*	*Factory setting*
Outside temperature simulation	---- / –50.0…50.0 °C	----

Simulation of the outside temperature in heating circuits 1, 2 and 3 is possible under Main menu > Heating circuit 1 (or 2 or 3) > Inputs/setpoints.

During the simulation, the simulated outside temperature is also used for the composite and the attenuated outside temperature.

- The simulation is not automatically ended (no supervision of time-out!)
- The inputs should only be overridden by qualified staff and for a limited period of time only!

During the simulation, fault status message "Outside sensor simulation active" appears. This message is displayed until the outside temperature simulation is reset to "----". This is to make certain that the plant will not be quit without ending the simulation.

Notes

- When leaving the simulation, the attenuated outside temperature will be set to the current outside temperature. Then, it can take one or 2 days for the plant to adapt
- The simulated outside temperature will only be used locally. It is **not** forwarded to other controllers via bus; the temperature transmitted is still the measured value of the connected outside sensor

12.3.2 Fault handling

When leaving the “Commissioning“ menu, a check is made to see if the outside sensor is connected or a sensor value is received via bus. If there is no outside temperature, or in the case of a short-circuit, fault status message “Outside temp sensor error“ will appear. Internally, the controller continues to operate using 0 °C as a backup value.

If outside temperatures from other outside temperature zones are available via bus, they will be used as backup values until the error has been rectified.

Only one outside temperature may be present in the same zone. If several controllers transmit their outside temperature in the same zone, fault status message “>1 outside temp sensor HC 1“ (or HC 2 or HC 3) will be delivered.

Fault status messages

Number	*Text*	*Effect*
10	Outside temp sensor error 1	Nonurgent message; must not be acknowledged
13	Outside temp sensor error 2	Nonurgent message; must not be acknowledged
16	Outside temp sensor error 3	Nonurgent message; must not be acknowledged
11	>1 outside temp sensor HC 1	Urgent message; must be acknowledged. More than one outside sensor in the same outside temperature zone.
14	>1 outside temp sensor HC 2	Urgent message; must be acknowledged. More than one outside sensor in the same outside temperature zone.
17	>1 outside temp sensor HC 3	Urgent message; must be acknowledged. More than one outside sensor in the same outside temperature zone.
12	Outside sensor 1 simul active	Nonurgent message; must not be acknowledged
15	Outside sensor 2 simul active	Nonurgent message; must not be acknowledged
18	Outside sensor 3 simulation active	Nonurgent message; must not be acknowledged
20	Solar intensity sensor error	• Solar intensity sensor not connected • Bus communication interrupted • Solar zone not correctly set (transmitter and receiver must use the same solar zone) Nonurgent message; must not be acknowledged
21	>1 solar intensity sens in zone	More than one solar intensity sensor in the same solar zone. Urgent message; must be acknowledged
30	Wind speed sensor error	• Wind speed sensor not connected • Bus communication interrupted • Wind zone not correctly set (transmitter and receiver must use the same wind zone) Nonurgent message; must not be acknowledged

Number	*Text*	*Effect*
31	>1 wind speed sensor in zone	More than one wind speed sensor in the same wind zone Urgent message; must be acknowledged

12.4 Outside temperature relay

For each outside sensor, an outside temperature relay is available. It is irrelevant here whether the outside temperature is directly acquired or transmitted via bus. The RMH760B has 3 integrated outside temperature relays.

Extra configuration

The function is to be activated via “Extra configuration”:

Main menu > Commissioning > Extra configuration > Miscellaneous > Outputs > Outside temperature relay Assign terminal

The 2 other outside temperature relays can be configured with heating circuit 2 and heating circuit 3 under “Outputs”.

Settings

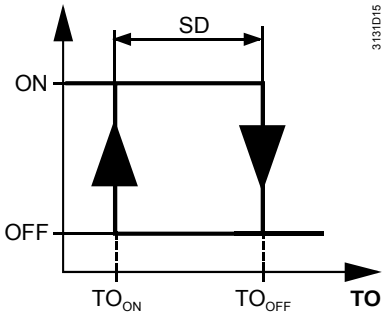
Main menu > Commissioning > Settings > ... or

Main menu > Settings > Outputs > Outside temperature relay

Main menu > Settings > Heating circuit 2 > Outside temperature relay

Main menu > Settings > Heating circuit 3 > Outside temperature relay

Operating line	*Range*	*Factory setting*
Switch-off point	–50…50 °C	5 °C
Switching differential	1…20 K	3 K



OFF Deactivation
ON Activation
SD Switching differential
TO Current outside temperature

The relay contact closes when the current outside temperature falls below the level of Switch-off point minus switching differential. The relay contact will open again when the current outside temperature returns to a level above the switch-off point.

Example

Switch-off point = 5 °C
Switching differential = 3 K
The relay contact will close when the outside temperature drops below 2 °C, it will open when the outside temperature exceeds 5 °C.

12.5 Display inputs

On the RMH760B, universal inputs can be defined for display purposes.

Configuration

Main menu > Commissioning > Extra configuration > Miscellaneous > Inputs

Operating line	*Adjustable values / display / remarks*
Display input 1	Assign terminal
Display input 2	Assign terminal
Display input 3	Assign terminal
Display input 4	Assign terminal

Input identifier

The type or unit of the display input can be selected with the input identifier.

Main menu > Commissioning > Extra configuration > Miscellaneous > Input identifier

Operating line	*Range*	*Factory setting*
Display input 1	°C / % / g/kg / kJ/kg / W/m2 / m/s / bar / mbar / Pa / ppm / Universal 000.0 / Universal 0000 / Digital	°C
Display input 2	Same as display input 1	°C
Display input 3	Same as display input 1	°C
Display input 4	Same as display input 1	°C

Other settings

For other setting choices, such as resolution, type of sensor, etc., refer to subsection 3.3.2 “Configuration of the universal inputs and outputs“.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs > ...X...

Operating line	*Range*	*Factory setting*
Type	Ni1000 / 2xNi1000 / T1 / Pt1000 / DC 0…10 V	Ni1000
Value low	Depending on the selected type	Depending on the type
Value high	Depending on the selected type	Depending on the type
Correction	−3.0…3.0 K	0.0 K
Normal position	Open / Closed	Open

The type only appears with analog inputs, the normal position only with the digital inputs.
Value low and value high as well as corrections only appear with designations and types that support these settings.
For detailed information about the configuration of analog inputs, refer to subsection 3.3.2 “Configuration of the universal inputs and outputs”.
The fault inputs can be assigned free text.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Texts

Operating line	*Range*	*Factory setting*
Display input 1	Max. 20 characters	
Display input 2	Max. 20 characters	
Display input 3	Max. 20 characters	
Display input 4	Max. 20 characters	

12.6 Diagnostic choices

Inputs

■ Main menu > Miscellaneous > Inputs

Operating line	*Range*
Actual value outside temp	…°C
Actual value solar radiation	W/m2
Actual value wind speed	m/s
Display input 1	
Display input 2	
Display input 3	
Display input 4	

Inputs

Main menu > Miscellaneous > Inputs

Operating line	*Range*
Outside temperature simulation	…°C

Outputs

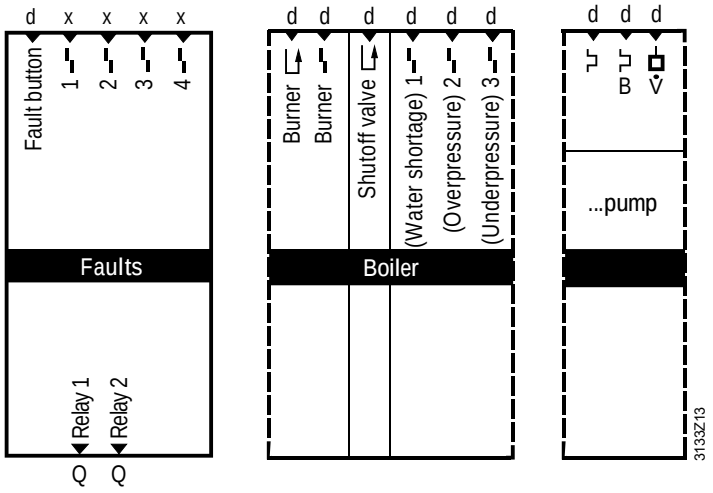
■ Main menu > Miscellaneous > Outputs

Operating line	*Range*
Outside temperature relay	Off / On

13 Function block faults

13.1 Overview of function block

Function block “Faults“ collects all fault status messages that have occurred, sorts them according to their importance for display and stores the last 10 messages in the fault history. The function block signals acknowledgements and resettings made by the user to the application where the fault occurred. The function block is always active for delivering internal fault status messages.
For external signal sources, function block “Faults“ provides 4 universal fault inputs, in addition to the fault inputs of the boiler and the pumps.
It is also possible to monitor inputs, such as flow sensor, room sensor, etc., that have already been configured.
To signal or forward faults, 2 relays can be configured as fault outputs.



13.2 Configuration

Extra configuration

A maximum of 4 universal fault inputs and 2 fault relays can be configured via “Extra configuration”**.**
The inputs can be configured to free inputs, or inputs that are already used can be monitored.

Inputs

Main menu > Commissioning > Extra configuration > Faults > Inputs

Operating line	*Adjustable values / display / remarks*
Fault button external	--- / N.X1 / N.X2 / … (digital only)
Fault input 1	Analog or digital inputs
Fault input 2	Analog or digital inputs
Fault input 3	Analog or digital inputs
Fault input 4	Analog or digital inputs

Outputs

Main menu > Commissioning > Extra configuration > Faults > Outputs

Operating line	*Adjustable values / display / remarks*
Fault relay 1	--- / RMH760.X4 etc. (digital only)
Fault relay 2	--- / RMH760.X4 etc. (digital only)

13.3 Fault button

Fault status messages delivered to the controller are indicated by the LED in the fault button. If a fault status message needs to be acknowledged, the acknowledgement must also be made via the fault button.
There are 3 choices:

Indication	*Cause / procedure*
Button dark	No fault present
Button flashes	• There is a fault which has not yet been acknowledged. After pressing the button, the button remains lit until the fault is rectified • There was a temporary fault which, at the moment, can no longer be detected, demanding an acknowledgement which has not yet been made. After pressing the button, flashing stops
Button lit	There is a fault which has already been acknowledged

Fault relay

A fault relay, if present, remains energized as long as the button flashes. For more detailed information, refer to section 13.10 “Fault relay”.

Note

The LED extinguishes only when the fault is no longer present. If the LED of the fault button is lit and does not extinguish when making acknowledgements, a fault status message is still pending.
The acknowledgement is to be made as follows:
- Acknowledge the fault relay (only, if a fault relay has been configured)
- Acknowledge all fault status messages pending at the controller
- Fault status messages with self-holding can only be reset when the fault is no longer present

Acknowledgement of faults

Faults can only be acknowledged on the controller where the fault is pending.

Resetting the fault relay

Fault relays can only be reset on the controller with the configured fault relays.

13.4 External fault button

The fault block has a connection facility for an external fault button. The external fault button has the same function as fault button on the unit. The 2 buttons can be operated in parallel.

Configuration

Main menu > Commissioning > Extra configuration > Faults > Inputs >

Operating line	*Adjustable values / display / remarks*
Fault button external	--- / RMH760.X4 etc. (digital only)

13.5 Fault properties

Faults are distinguished by properties. There are faults with regard to:
- Acknowledgement and reset
- Signal priority
- Plant behavior

13.5.1 Acknowledgement and reset

Simple fault

No acknowledgement is required for simple faults.

Example

If the outside temperature is missing, a fault status message will be delivered. When the outside temperature is available again, the fault status message automatically disappears and the plant will resume normal operation.

Standard fault

These types of fault require an acknowledgement.

Example

If there is more than one time switch master in the same geographical zone, the fault status message must be acknowledged.

Extended fault

An acknowledgement **and** a reset required for this type of fault.

Example

If the maximum temperature of flue gas temperature supervision at the boiler has been exceeded, the fault status message must be acknowledged and, after rectification of the fault, a reset must be made by pressing the fault button again.

13.5.2 Signal priority

Priority ”Urgent“

Fault status messages are called “urgent” when correct operation of plant can no longer be ensured.

An urgent fault status message is a boiler sensor error, for example.

Priority “Nonurgent“

Nonurgent fault status messages

- do not adversely affect plant operation directly
- allow the plant to operate with restrictions

A nonurgent message is an outside sensor error, for example.

13.5.3 Plant behavior

There are:

- Faults with aggregate stop
- Faults without aggregate stop

A fault only acts on the aggregate to which the fault status message belongs. An exception are the pumps. Failure of a pump also acts on the associated aggregate.
The universal fault inputs only lead to a plant stop in connection with parameterization “Stop“. For more details, refer to section 13.8 “Fault inputs”.

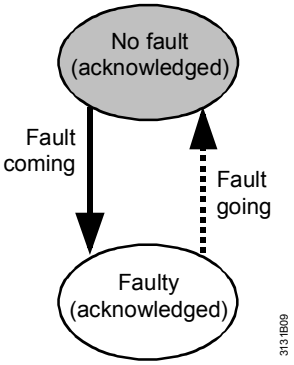
Examples

Number	*Text*	*Effect*
5201	Hol/sp day prgm failure HC 1	Heating circuit 1 performs normal operation. Holidays and special days are not possible
5102	>1 time switch in plant 1	The heating circuit runs in room operating mode Comfort
10	Outside temp sensor error	If available, the outside temperature of some other zone via bus will be used, otherwise the backup value of 0 °C
2491	[Main pump B] overload	Changeover to main pump A will take place, if present, otherwise fault status message [Main pump] fault will be delivered
2492	[Main pump] fault	The main controller will be stopped since there is no flow past the sensor so that control is no longer possible

13.6 State diagrams of the individual types of faults

Simple fault

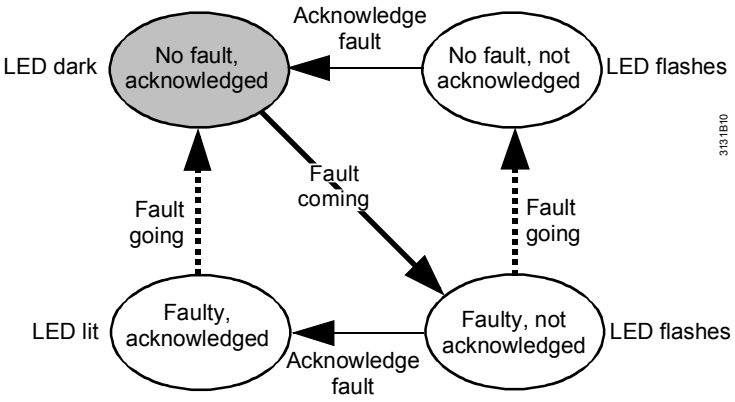
A simple fault need not be acknowledged. If there is a fault relay (see below), it must be reset, however.



When there is a simple fault, the LED is lit. After correction of the fault, the LED will extinguish.
If a fault relay is configured, the LED flashes when the fault occurs and the relay is energized. When the fault button is pressed, the relay drops out and the LED extinguishes. When the fault is corrected, the LED will extinguish.

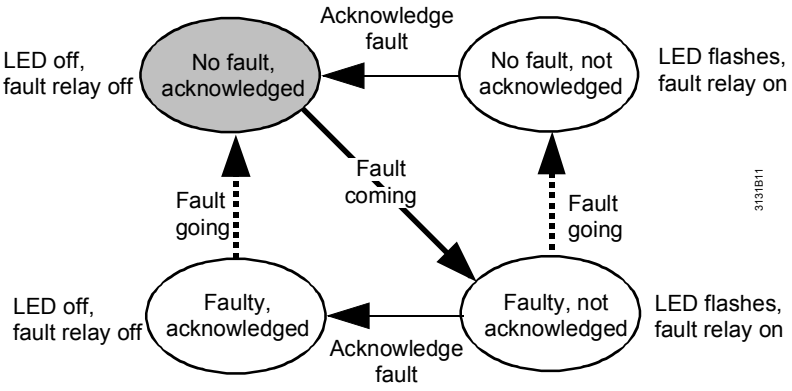
Standard fault

A standard fault must be acknowledged.



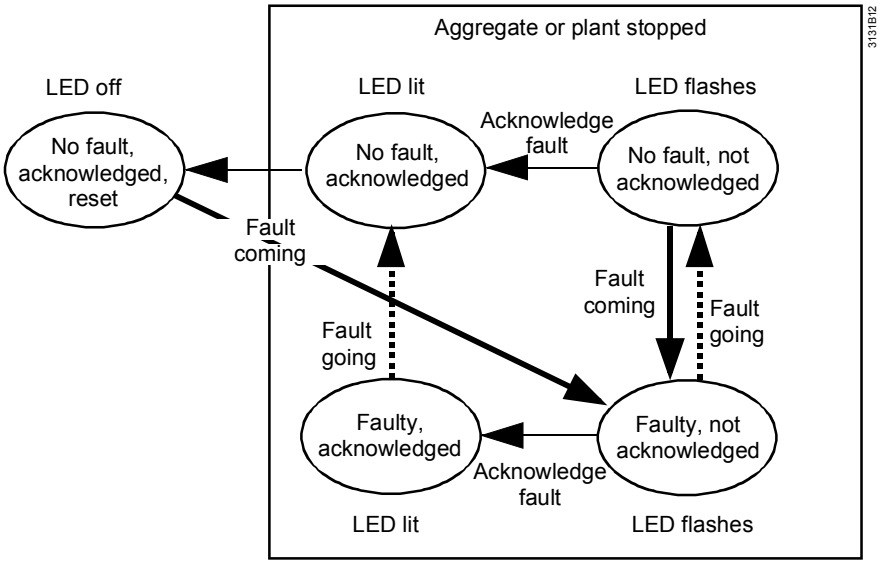
The LED flashes as long as the fault is not acknowledged. If the fault is still present, the LED will be lit after acknowledgement.

Standard fault with configured fault relay



Extended fault

Extended faults are faults that must be acknowledged **and** reset. An example would be a twin pump when both pumps indicate a fault. The pumps will start running only after the fault has been acknowledged, the errors corrected and the fault reset.



13.7 Predefined fault inputs

Function block “Boiler“ and the pump blocks provide predefined fault inputs.
For a description of these fault inputs, refer to the relevant function blocks. These fault inputs are also parameterized at the relevant function blocks.

13.8 Fault inputs

13.8.1 Universal fault inputs

The RMH760B has 4 universal fault inputs. These can be activated via “Extra configuration”.
Either analog or digital inputs can be defined as fault inputs. If the input is not assigned to an input that has already been configured, the input identifier and thus the type of input or the unit can be freely selected.

Main menu > Commissioning > Extra configuration > Faults > Input identifier

Operating line	*Range*	*Factory setting*
Fault input 1	°C / % / g/kg / kJ/kg / W/m2 / m/s / bar / mbar / Pa / ppm / Universal 000.0 / Universal 0000 / Digital	Digital
Fault input 2	Same as fault input 1	Digital
Fault input 3	Same as fault input 1	Digital
Fault input 4	Same as fault input 1	Digital

With a digital input, it is also possible to define the normal position:

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Inputs > RMH760.X... or RMZ78...

Operating line	*Range*	*Factory setting*
Normal position	Open / Closed	Open

Following can be set for each fault status message:

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Faults > Fault input 1 (or 2, 3 or 4)

Operating line	*Range*	*Factory setting*
Fault text	Max. 20 characters	[Fault input 1] fault*
Fault status message delay	00.00…59.55 m.s (minutes.seconds)	00.05 m.s
Fault acknowledgement	None / Acknowledge / Acknowledge and reset	None
Fault priority	Urgent / Not urgent	Not urgent
Effect of fault	No stop / Stop	None
Limit value fault on	0 / 1**	1
Limit value fault off	0 / 1**	0

* Or fault input 2, 3 or 4

** Depending on the input identifier

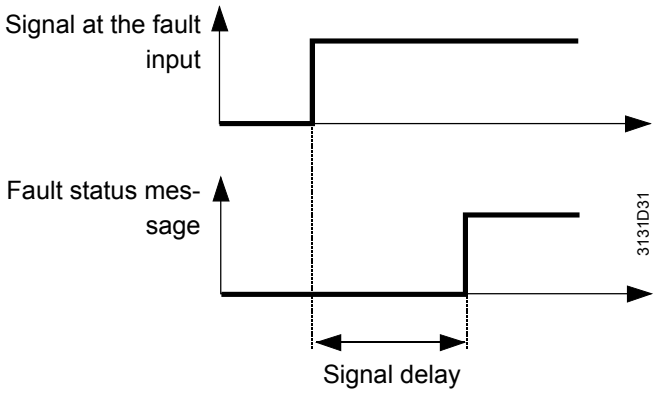
These settings can only be made if the relevant input has previously been activated via "Extra configuration".

For more detailed information, refer to section 13.5 "Fault properties".

Fault text

The text for the fault inputs is predefined as [Fault input 1] fault through [Fault input 4] fault. The text can be edited.

Fault status message delay



The fault status message delay is used to set the period of time to elapse for a fault to be handled as such.

Fault effects

Parameterization "Stop" at the universal fault inputs means that all function blocks (boiler, main controller, primary controller, heating circuits, and DHW) will be switched off by the controller. Frost protection, however, continues to be active.

Fault status messages

Number	*Text*	*Effect*
9001	[Fault input 1] fault*	According to the settings
9002	[Fault input 2] fault*	According to the settings
9003	[Fault input 3] fault*	According to the settings
9004	[Fault input 4] fault*	According to the settings

* Factory setting; text is freely editable

Fault handling

The digital fault inputs cannot be monitored. We recommend to use wiring where the signal drops out when there is a fault pending.

13.8.2 Analog fault input with limit value supervision

An analog input can be monitored for limit value crossings.
An input that is already configured can also be monitored. For example, the main flow temperature sensor can also be monitored to ensure that a maximum flow temperature will not be exceeded.

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Faults > Fault input 1 (or 2, 3 or 4)

Operating line	*Range*	*Factory setting*
Limit value fault on	0 / 1*	1
Limit value fault off	0 / 1*	0

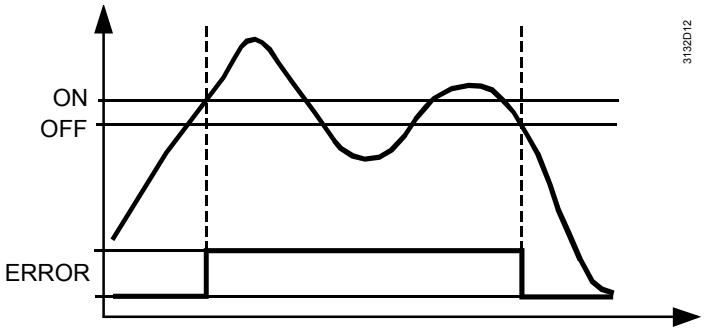
* Depending on the input identifier; the example given here applies to a digital input

If Limit value fault on is greater than Limit value fault off, the input is monitored for overshoot.

Example 1

Limit value fault on: 80 °C
Limit value fault off: 75 °C

If the temperature exceeds 80 °C, a fault is identified; if it drops again to a level below 75 °C, the fault is considered rectified.

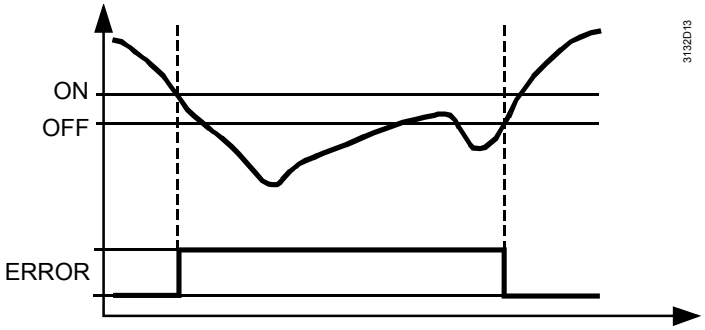


If **Limit value fault off** is greater than **Limit value fault on**, the input is monitored for undershoot.

Example 2

Limit value fault on: 10 °C
Limit value fault off: 12 °C

If the temperature falls below 10 °C, a fault is identified; if it returns to a level above 12 °C, the fault is considered rectified.



13.9 Communication

When communication is activated, the impact on fault handling is as follows:

- Fault status messages are always delivered via bus and can be further handled by other Synco devices
- Fault status messages from other Synco™ 700 devices are shown on the controller
- Fault status messages from other Synco™ 700 devices can be delivered to a fault relay

Fault status messages can be acknowledged from a remote location (e.g. from the operator station using the OCI700.1 service tool).

It can be selected whether fault status messages with self-holding may also be reset from a remote location or whether this must always be made locally.

Setting values

Main menu > Commissioning > Communication > Basic settings

Operating line	*Range*	*Factory setting*
Remote reset of fault	No / Yes	No

Conversely, the controller is not able to acknowledge fault status messages on other controllers.

13.10 Fault relay

Passing on the fault status messages

To pass on the fault status messages, or to optically or audibly indicate them on the control panel, for example, the 2 fault message outputs Fault relay 1 and Fault relay 2 of the function block can be configured to any 2 free outputs N.Q…

Configuration

Main menu > Commissioning > Extra configuration > Faults > Outputs

Operating line	*Adjustable values / display / remarks*
Fault relay 1	--- / N.Q1 … (free relays only) / assignment of fault relay
Fault relay 2	--- / N.Q1… (free relays only) / assignment of fault relay

Settings

For each of the 2 fault relays, the following settings can be made:

- Fault priority:
  Priority at which the relay shall be energized
- Signaling
  The following signaling variants are available:
  - Internal fault (optically): The fault relay only indicates internal faults and remains energized until the faults are no longer present
  - Internal fault (audibly): The fault relay only indicates internal faults and remains energized until the fault is acknowledged
  - Fault via bus (audibly): The fault relay only indicates faults from the bus and remains energized until the fault is acknowledged
- Inversion
  - "No" means: In the event of fault, the relay will be energized
  - "Yes" means: In the event of fault, the relay will be deenergized

Setting values

Main menu > Commissioning > Settings > ... or

Main menu > Settings > Faults > Fault relay 1 (or 2)

Operating line	*Range*	*Factory setting*
Fault priority	Urgent / Not urgent / All	All
Indication of fault*	Fault internally (optically) / Fault internally (audibly) / Fault via bus (audibly)	Fault internally (audibly)**
Inversion	No / Yes	No

* A maximum of one bus fault status message can be handled, even if they are of different priority. Recommendation: Do not configure 2 bus fault relays

** Factory setting at fault relay 2 "Fault via bus (audibly)"

Display values

At menu item **Miscellaneous**, the state of the 2 fault relays can be read.

Main menu > Miscellaneous > Outputs

Operating line	*Current state*
Fault relay 1	Off / On
Fault relay 2	Off / On

13.11 Fault display

The current state of the fault status messages can be interrogated on the operator unit.

Faults current

The current faults contain all faults currently pending. A maximum of 10 faults can be displayed. With each fault, following is displayed:

- Fault text
- Fault number
- Time of day and date the fault occurred

Fault history

The last 10 faults are displayed. Here too, following is displayed with each fault:

- Fault text
- Fault number
- Time of day and date the fault occurred

Fault status message bus

Here, the fault status message with the highest priority on the bus is displayed. In addition to the fault text, the fault number, the time of day and date the fault occurred, and the device address of the faulty device are displayed.
It is to be noted that internal messages can also be displayed here, provided they have the highest priority.

Display values

- Main menu > Faults > Faults current
- Main menu > Faults > Fault history
- Main menu > Faults > Fault status message bus

13.12 Deleting all fault status messages

Using menu item Delete faults, the list with the fault history can be deleted.

Deleting

Main menu > Faults

Operating line	*Adjustable values / display / remarks*
Deleting faults	Current faults will be reset; the fault history will be deleted

When activating this function, all other fault status messages will also be reset. Hence, only pending faults continue to be displayed.

Note

If the kind of acknowledgement with a pending fault is changed, it may happen that the fault status message can neither be acknowledged nor reset. The function can also be used to reset these fault status messages!

13.13 Diagnostic choices

Inputs

Main menu > Miscellaneous > Inputs

Operating line	*Adjustable values / display / remarks*
Fault button external	0 / 1 (0 = inactive, 1 = active)
Fault input 1	0 / 1 (0 = inactive, 1 = active)
Fault input 2	0 / 1 (0 = inactive, 1 = active)
Fault input 3	0 / 1 (0 = inactive, 1 = active)
Fault input 4	0 / 1 (0 = inactive, 1 = active)

In both the diagnostics and the wiring test, logic states are displayed. 1 indicates that the fault input is active. When selecting “Normal position open”, this is the case when the contact is closed; when selecting “Normal position closed”, this is the case when the contact is open.

Outputs

■ Main menu > Miscellaneous > Outputs

Operating line	*Range*
Fault relay 1	Off / On
Fault relay 2	Off / On

Fault display

■ Main menu > Faults > Faults current

Operating line	*Adjustable values / display / remarks*
Fault 1	
up to	
fault 10	

■ Main menu > Faults > Fault history

Operating line	*Adjustable values / display / remarks*
Fault 1	
up to	
fault 10	

■ Main menu > Faults > Fault status message bus

Operating line	*Adjustable values / display / remarks*
Fault status message bus	

Deleting faults

■ Faults > Delete faults

Operating line	*Adjustable values / display / remarks*
Fault history will be deleted	

14 Communication

A detailed description of communication is given in Basic Documentation P3127 (Communication via Konnex bus). In the following, the most important settings are described that are required for commissioning a basic plant.

Activating communication

Communication is activated when the following conditions are satisfied:

- The device address has been entered (every bus user requires its individual device address)
- Bus power supply is available
- The bus device is not in commissioning mode

Exchange of process data

The exchange of data required for heating and ventilation plant takes place in LTE mode (Easy Mode). This mode facilitates straightforward data exchange without requiring a major engineering effort.
Similar data are exchanged within zones. To make possible communication, it is therefore sufficient to create a common zone.
Device addressing has no impact on the plant's functioning. The plants can be on the same RMH760B or on different Konnex controllers interconnected via bus.

14.1 Basic settings

Before the zone assignments for the exchange of process data can be made, the device address must be set.

Communication

Main menu > Commissioning > Communication > Basic settings

Operating line	*Range*	*Factory setting*
Device address	1…253 (1…255)	255
Decentral bus power supply	Off / On	On
Clock time operation	Autonomous / Slave / Master	Autonomous
Remote setting clock slave	Yes / No	Yes
Remote reset of fault	Yes / No	Yes

The settings made here are also shown under:

Main menu > Device information > Communication > Basic settings

Device address

Every bus user requires its individual device address.
Device addresses 254 and 255 are reserved for special functions. With device address 255, communication is deactivated (no exchange of process data).

Decentral bus power supply

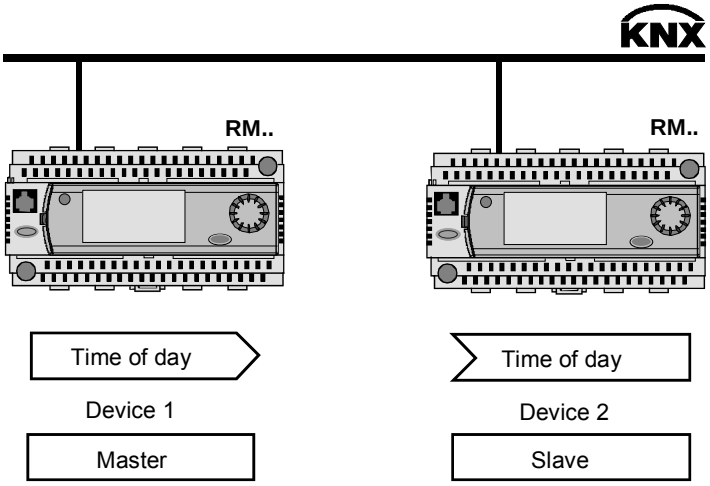
For small plants (maximum 8 devices), decentral power supply is adequate. This represents the factory setting. For detailed information, refer to Data Sheet N3127 (Konnex bus) and Basic Documentation P3127 (Konnex communication).

Clock time operation

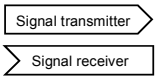
When selecting "Autonomous", the controller does not receive or send the time of day. If a common time of day shall be used in the system, one of the controllers will be defined as the clock time master and the others as slaves.

Remote setting clock slave

Function "Remote setting clock slave" enables the user to set the time of day and the date on a clock time slave.
The new values will be sent to the clock time master via Konnex bus. The master then delivers the new time of day to all bus users. This means that for the user, operation is the same as on the clock master.



Legend for all figures in this chapter:



Remote reset of fault

With communication activated, the actions are the following:

- Fault status messages are always delivered via bus and can be further handled by other Synco devices
- Fault status messages from other Synco™ 700 devices are shown on the display under: Main menu > Faults > Fault status message bus
- Fault status messages from other Synco devices can be delivered to a fault relay (refer to section 13.10 ”Fault relay")

All fault status messages can be acknowledged from a remote location (e.g. from the operator station via OCI700.1; the RMH760B is unable to acknowledge or reset fault status messages of other Synco™ devices from a remote location).
It can be selected whether fault status messages with self-holding may also be reset from a remote location or whether self-holding must always be reset with the local push-button.

14.2 Calendar data (holidays and special days)

Each RMH760B has 4 calendars for holidays and special days. If required, it is also possible to use a calendar of plants (heating circuit, DHW heating, ventilation, etc.) on other controllers.
Or, optionally, the plants in the controller can use one of the 4 internal calendars. This is also effected via the communication settings.

Communication

Main menu > Commissioning > Communication > Room heating circuit 1 (or 2 or 3)

Main menu > Commissioning > Communication > DHW

Operating line	*Range*	*Factory setting*
Holidays/special day operation	Autonomous / Slave / Master	Autonomous
Holidays/special day zone	1…31	1

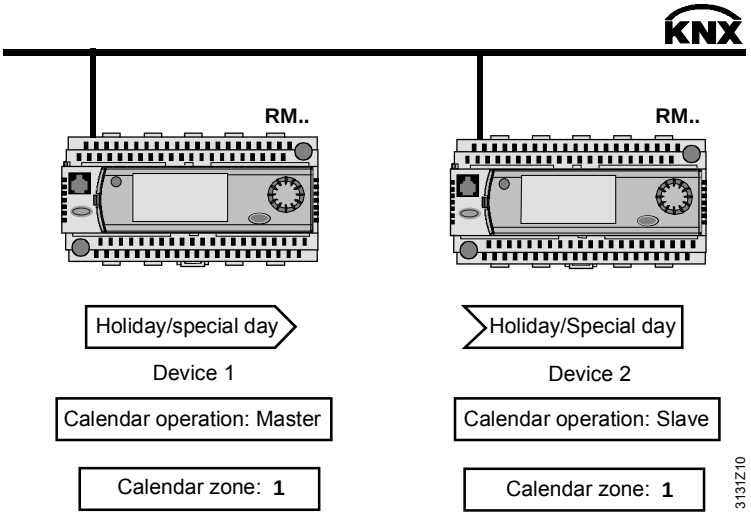
The settings made here are also displayed under:
Main menu > Device information > Communication > ...

Holidays/special day operation

If a common holiday or special day program shall be used, holidays/special day operation is to be defined on one of the controllers as the master and the other(s) as the slave(s). This works analogously with the 4 internal calendars.

Holidays/special day zone

With master / slave operation, this setting is used to make the zone assignment. In that case, the slave devices are given the same holidays/special day zone as the master.
It is possible to define several zones with one master per zone.



14.3 Room data

Every heating circuit belongs to a geographical zone. This zone symbolizes the room to be controlled. Within the zone, all room-related data will be exchanged:

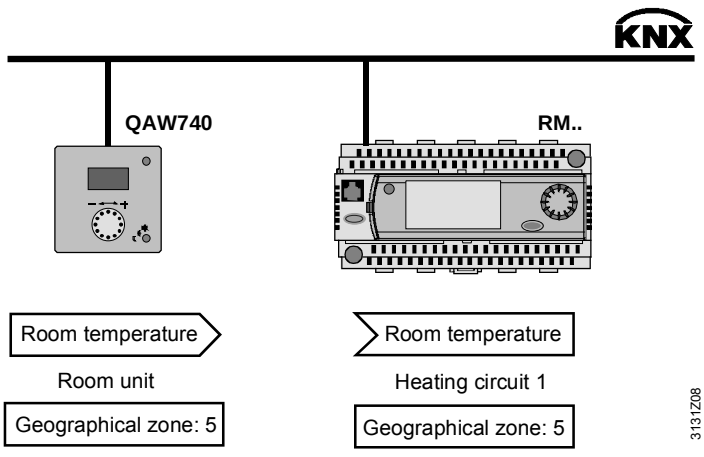
- Room operating mode
- Room temperature
- Setpoints

14.3.1 Communication variants

The requirements (operation, function) placed on the generation of the room operating mode differ significantly, depending on the type of building and its usage. The communication variants described below allow the determination of the room operating mode to be adapted to the requirements.

Individual room usage (variant 1)

Basic variant 1 assumes that a heating circuit has its own individual room operating mode, independent of other plant (heating circuits, ventilation). This means that the exchange of data is restricted to the heating circuit and the rooms in the relevant geographical zone.
If there is a room unit in that zone, the heating circuit will automatically receive its room temperature and setpoint readjustments. In addition, data are exchanged to determine the room operating mode.

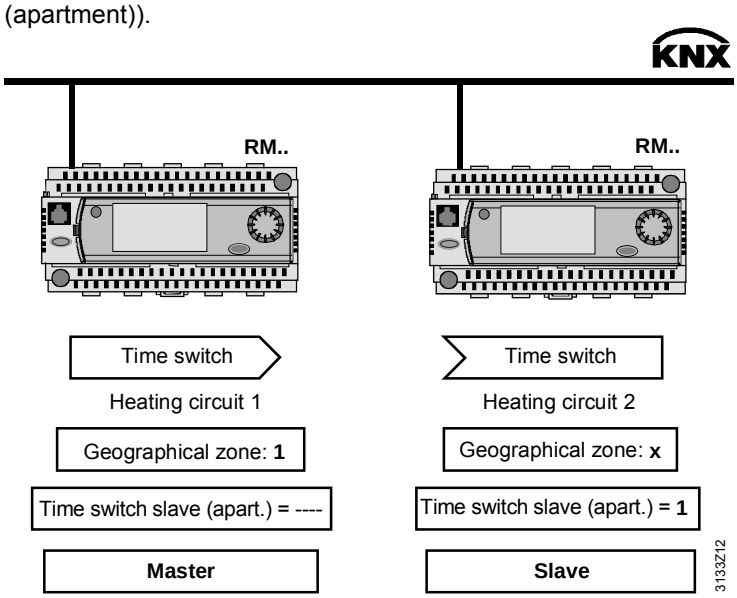


Holidays/special days (variant 2)

The occupancy times (time switches) of the different geographical zones are on an individual basis, but all (or individual) zones use the same holidays and special days. Hence, a common calendar for the common holidays and special days shall be used. The common calendar has an impact on the time switches of the heating circuits.
For more detailed information, refer to section 14.2 “Calendar data (holidays and special days)”.

Same room occupancy times (variant 3)

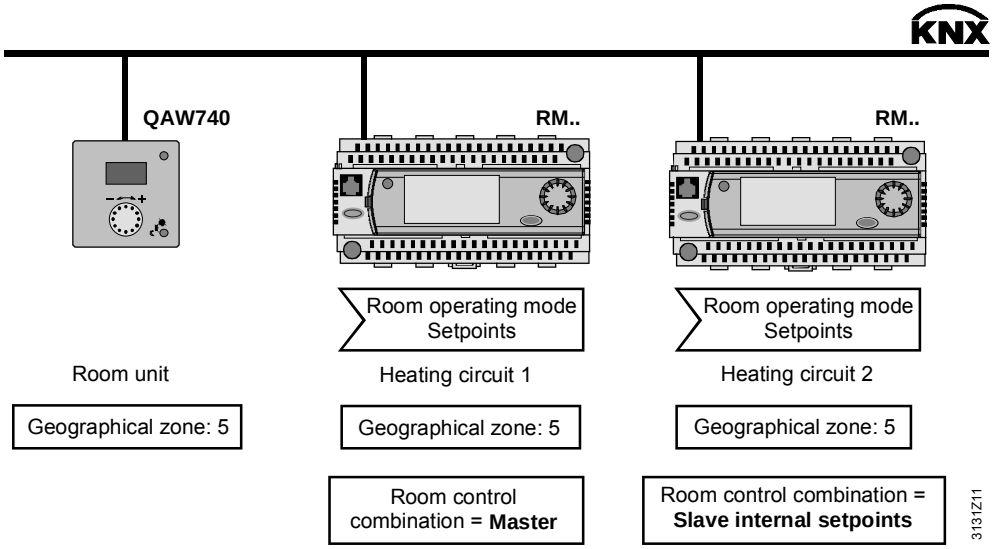
If the room occupancy times of the different geographical zones are identical, a time switch can be defined as the master. The other heating circuits as time switch slaves take care of the master’s occupancy times.
The commonly used time switch acts as a master in the geographical zone of its heating circuit (or ventilation system).
The heating circuits that shall adopt the time switch will be operated as time switch slaves and receive their signals from the master’s zone (setting: Time switch slave (apartment)).



2 plants for the same rooms (variant 4)

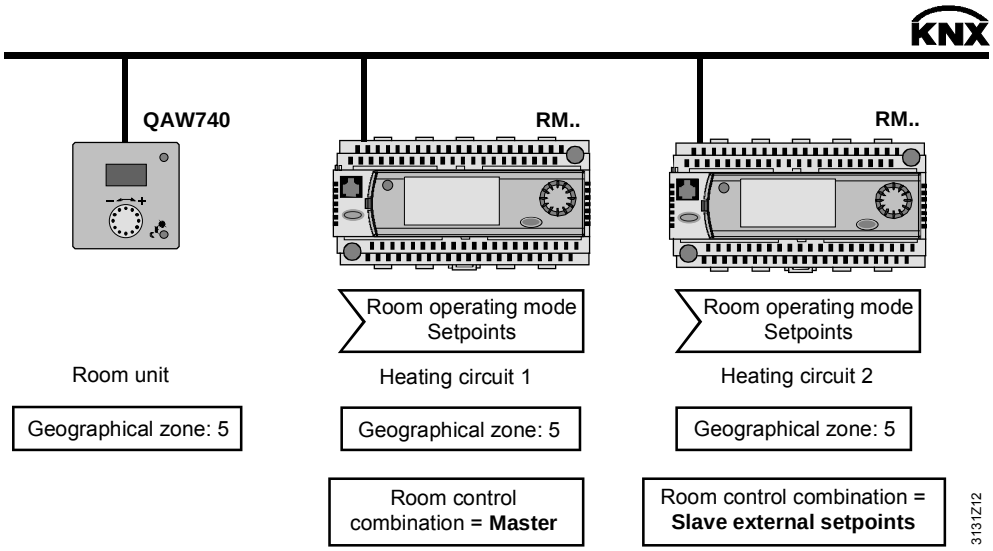
If 2 heating circuits – or one heating circuit and one ventilation circuit – serve the same rooms, they belong to the same geographical zone.
The 2 plants acquire the same room temperature and use the same room occupancy schedule (in other words, the room operating mode is the same).
This is a room control combination where one of the heating circuits (or the ventilation system) adopts the preselection for the room operating mode of the second heating circuit as the master.
If the room operating mode is changed with the occupancy button on the room unit (e.g. on the QAW740), the room control master will adopt that change and forward it to the room control slave.
For detailed information, refer to subsection 9.10.3 “Room control combination”.

⇒ In the case of a room control combination with a ventilation plant, the ventilation plant will **always** adopt the function of the room control master.

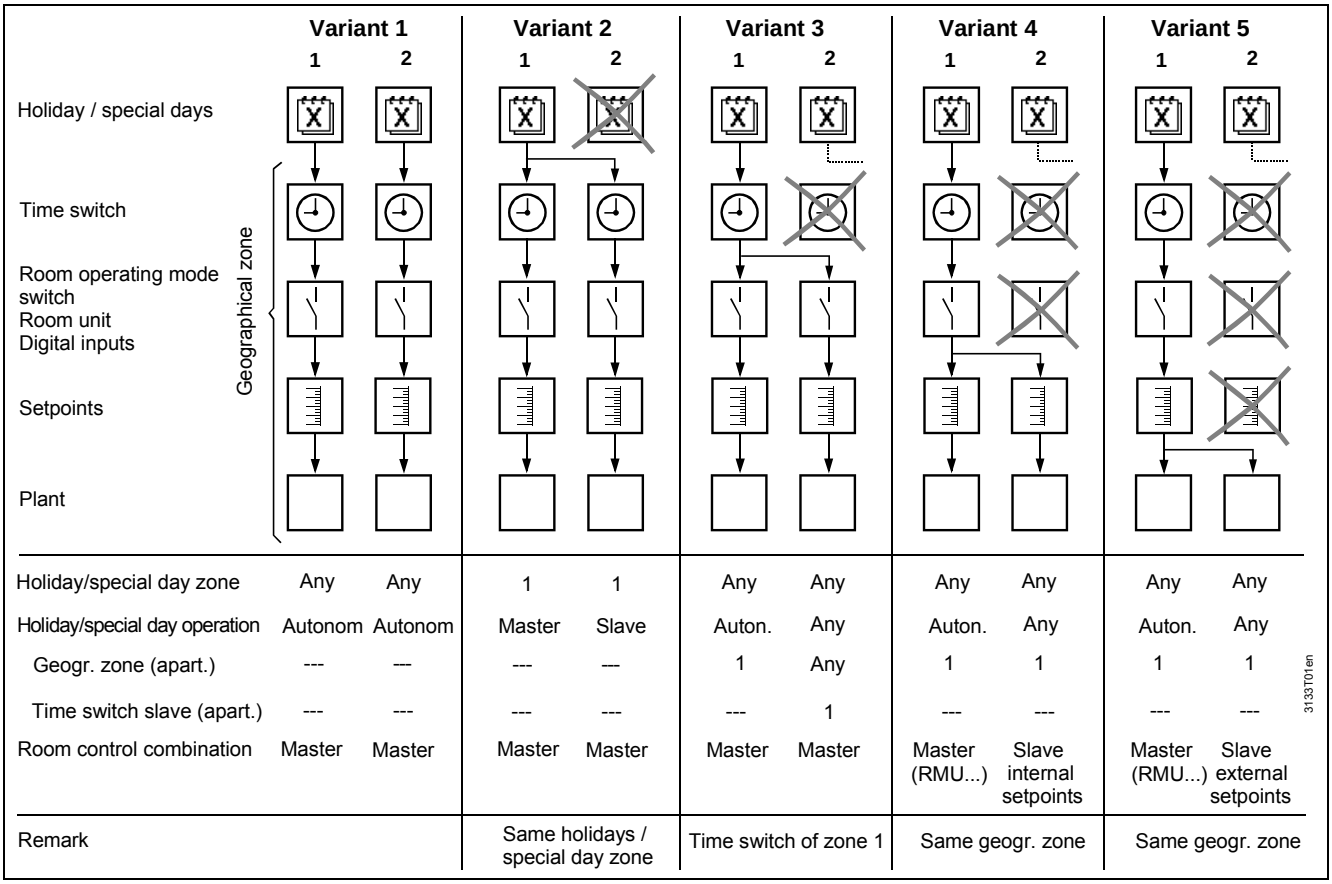


Extension of variant 4 with the same setpoints (variant 5)

In the case of a room control combination, the setpoint can be adopted, in addition to the room operating mode.



The following overview shows the different communication variants described in this subsection. The settings are shown with 2 plants (plants 1 and 2) which can be located on different controllers.
Variants 1 through 3 can also be used with several plants.
For detailed information about the settings, refer to the following subsections.



1 = heating circuit 1 (or ventilation)
2 = heating circuit 2

14.3.2 Settings on the RMH760B

For settings relating to the common calendar, refer to section 14.2 “Calendar data (holidays and special days)“.

Communication

Main menu > Commissioning > Communication > Heating circuit 1 (or 2 or 3)

Operating line	*Range*	*Factory setting*
Geographical zone (apartm.)	---- / 1…126	----
Time switch slave (apartment)	---- / 1…126	----

The settings made here are also displayed under:
Main menu > Device information > Communication > Heating circuit 1 (or 2 or 3)
It is to be set from which geographical zone a value is received, and to which geographical zone a value is sent.

Geographical zone

Within the geographical zone, heating circuits forward the following:

- The room temperature (actual value and setpoint)
- The time switch data
- The room operating mode

If a heating circuit serves other rooms, its assignment to the geographical zone must be appropriately set.

Heating circuits using the setting “Room control combination = Slave” (refer to subsection 9.10.3 “Room control combination“) receive the room temperature (actual value and, possibly, the setpoint) and the room operating mode from the room control master of the same geographical zone.
The time switch data are forwarded only if operating line “Time switch slave (apartm.)” is set to “----“, that is, when the controller is the time switch master.

Time switch slave

If the time switch shall operate as a slave of a master time switch, the geographical zone of the master time switch must be set here.
If that is the case, no more time switch data about the geographical zone will be forwarded. But the geographical zone will still be required to ensure communication with the room unit. The geographical zone must have a different setting value.

Combination choices

From the 2 settings, the following combinations are obtained:

Setting the geographical zone (apartment)	*Setting the time switch slave (apartment)*	*Position of time switch*
----	----	Autonomous
1 (or more; max. 126)	----	Master
----	1 (or more; max. 126)	Slave
1 (or more; max. 126)	1 (or more; max. 126)	Slave

Extra configuration

Main menu > Commissioning > Extra configuration > Heating circuit 1 (or 2 or 3)

Operating line	*Range*	*Factory setting*
Room control combination	Master / Slave external setpoint / Slave internal setpoint	Master

14.3.3 Settings on the room unit

The QAW740 is available as a digital room unit with communication facility. For communication with the associated heating circuit, the same geographical zone and a device address must be set on the room unit.
Also refer to Installation Instructions G1633 covering the QAW740.

14.4 DHW data

As with space heating, 2 or more DHW plants can be operated with one common time switch.

Communication

Main menu > Commissioning > Communication > DHW

Operating line	*Range*	*Factory setting*
DHW zone	1…31	1
Time switch operation	Autonomous / Master / Slave	Autonomous
Time switch slave DHW	1…31	1

The settings made here are also displayed under:
Main menu > Device information > Communication > DHW

DHW zone

Here, the zone for DHW heating is to be set.

Time switch operation and time switch slave

When using the **Master** setting for time switch operation, the time switch data in the DHW zone are forwarded for common usage.
DHW heating that shall make use of this time switch receives the settings.

Operating line	*Adjustable values / display / remarks*
Time switch operation	Slave
Time switch slave DHW	DHW zone of master

Several zones can be defined with one master.

Time switch program in slave controllers

If, on a slave controller, “Autonomous“ is entered as time switch operation plus a time switch program, the latter will be ignored. In any case, the time switch program used is that of the master controller. This also applies to special days.

14.5 Heat demand and load control

Heat demand and the load control signals are exchanged via the heat distribution zones.

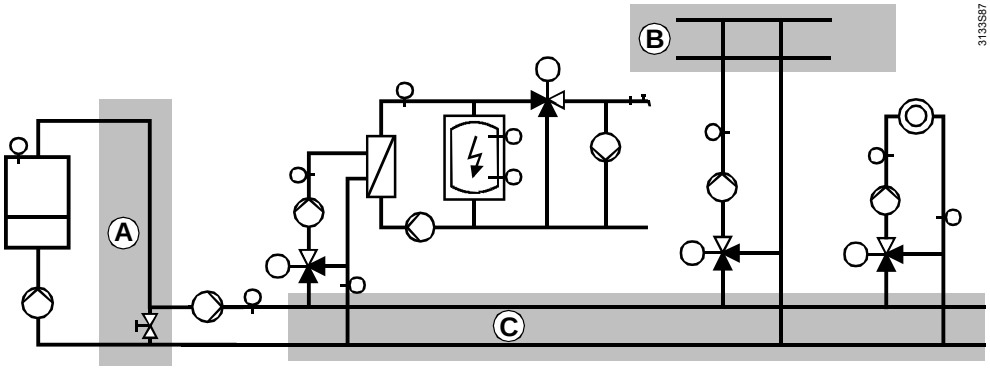
Communication

Main menu > Commissioning > Communication > Distribution zones

Operating line	*Range*	*Factory setting*
Heat distr zone source side*	---- / 1…31	----
Heat distribution zone	1…31	1
Heat distr zone consumer side**	---- / 1…31	2

* The operating line is only displayed on the main controller

** The operating line is only displayed on the primary controller



Ⓐ Heat distribution zone, heat generation side
Ⓑ Heat distribution zone, consumer side
Ⓒ Heat distribution zone

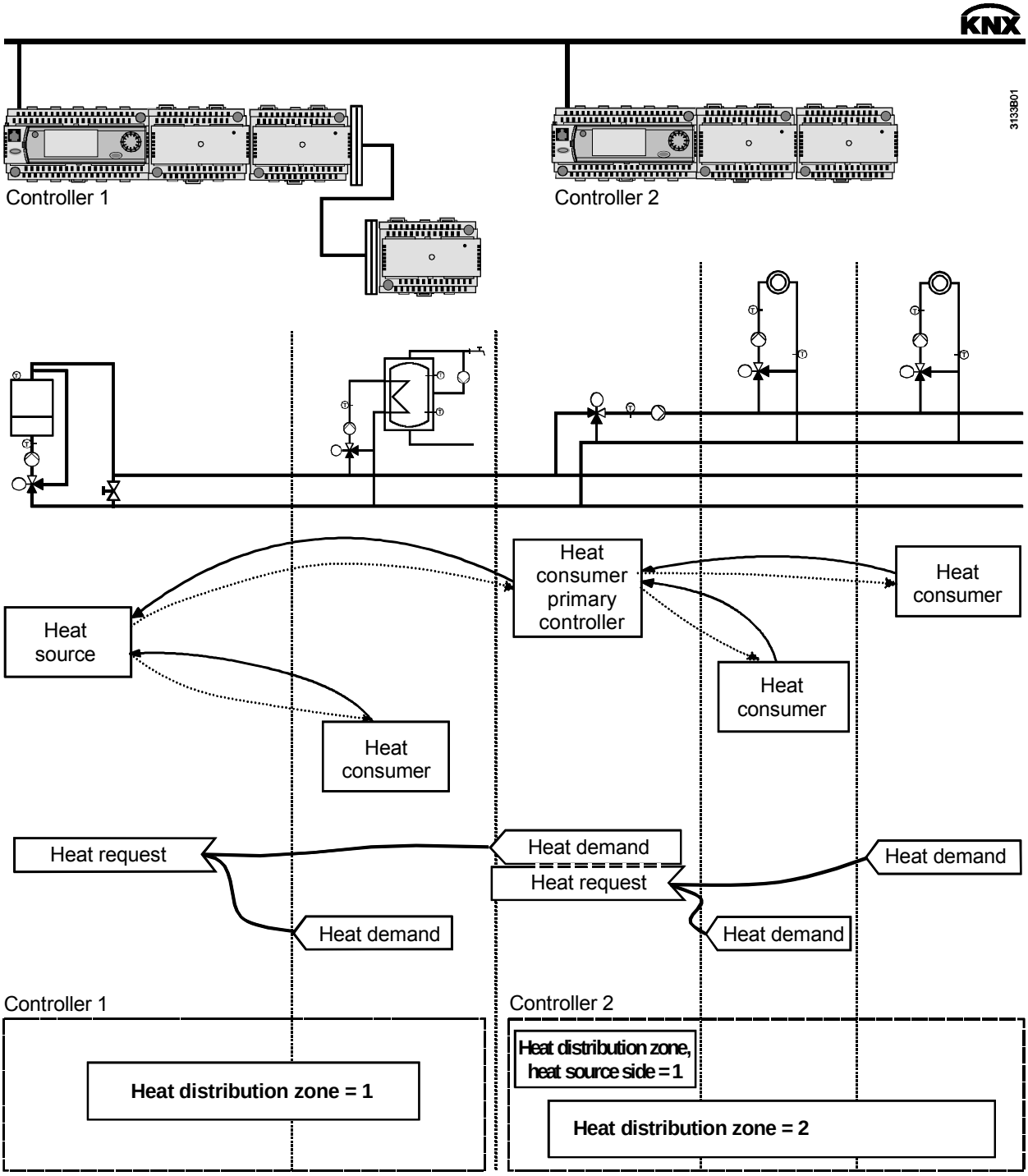
The 3 heating circuits and DHW heating are ready connected to the main controller, which means that they cannot be operated by the primary controller, but only parallel to it. The primary controller also is ready connected to the main controller and cannot be operated parallel to the main controller.
The main controller in turn is ready connected to the boiler. The heat distribution zone on the heat generation side need be set only when there is **no** boiler.
During boiler operation, the heat demand is acquired via the heat distribution zone. If no main controller is used, its plant elements, such as mixing valve and pump, will not be needed.

Note

The heat distribution zone on the heat generation side can only be set when using a main controller **without** boiler. It will not be required when using a boiler.
The heat distribution zone on the consumer side can only be set when used in connection with a primary controller.

Example

In the following plant, boiler and DHW are accommodated in controller 1, and main controller and heating circuits in controller 2. The example shows clearly the role of the main controller as the interface between 2 zones. It receives the heat requests and generates the resulting heat demand, which is forwarded to the boiler.
Boxes “Controller 1“ and ”Controller 2“ at the bottom show the zone settings.



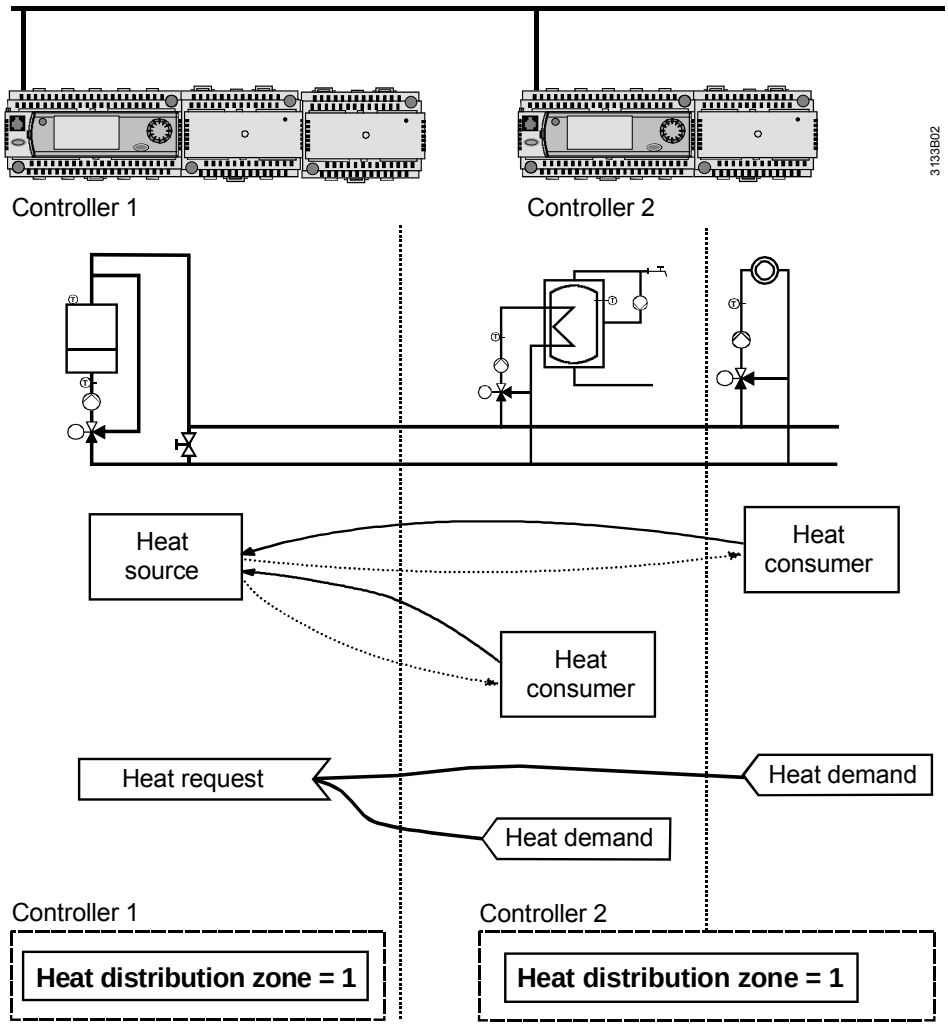
Example without main controller

Requirement:

A boiler controller is controller 1 and shall receive the heat demand from its consumers (controller 2).

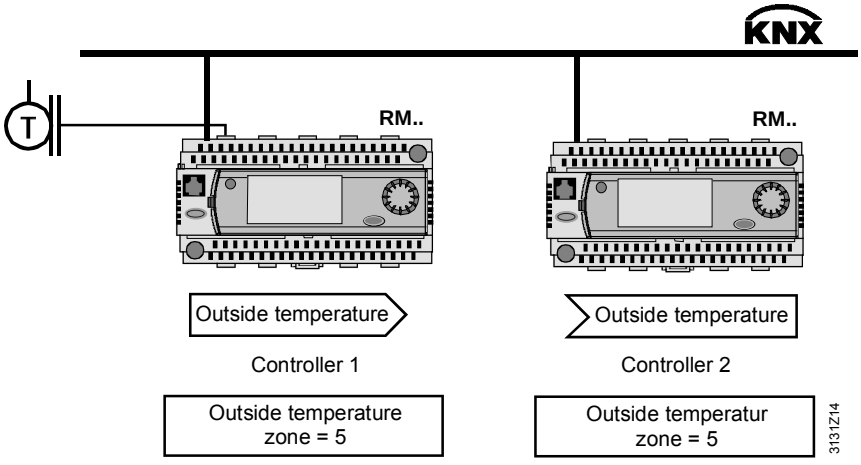
Solution:

- Setting required for controller 1 (boiler) under “Heat distribution zone“: 1
- Setting required for controller 2 (consumer) under “Heat distribution zone“: 1



14.6 Weather data

The outside temperatures are exchanged via the outside temperature zones.
When an outside sensor is connected to the controller with outside temperature zone 1, that controller transmits its outside temperature to all receivers with outside temperature zone 1.



As for the outside temperature, a zone can be defined for solar radiation and wind speed. Controllers with the same zone can receive the respective sensor values.

Communication

Main menu > Commissioning > Communication > Distribution zones

Operating line	*Range*	*Factory setting*
Outside temperature zone	---- / 1…31	1
Solar zone	---- / 1…31	----
Wind zone	---- / 1…31	----

The settings made here are also displayed under:
Main menu > Device information > Communication > Distribution zones

Outside temperature zone

When using setting "----", the controller does not send the outside temperature signal via bus.
Several outside temperature zones are possible:

- Setting "Outside temperature zone" in the communication settings of heating circuit 1 is identical with that under "Distribution zones"
- Those of heating circuits 2 and 3 are set as follows:

Main menu > Commissioning > Communication > Heating circuit 2 **(**or 3**)**

Operating line	*Range*	*Factory setting*
Outside temperature zone	---- / 1…31	1

Solar zone

Every controller has one solar zone.
When using setting "----", the controller does **not** send the solar radiation signal via bus.

Wind zone

Every controller has one wind zone.
When using setting "----", the controller does **not** send the wind speed signal via bus.

14.7 Fault handling

Faulty bus power supply

Number	*Text*	*Effect*
5000	No bus power supply	No bus power supply. Nonurgent message; must not be acknowledged

Time-of-day error

Number	*Text*	*Effect*
5001	System time failure	Clock time master is missing or cannot be received. Nonurgent message; must not be acknowledged
5002	>1 clock time master	There is more than one clock time master. Nonurgent message; must be acknowledged
5003	Invalid time of day	• Time of day on the clock time master must be readjusted • Reserve has elapsed Nonurgent message; must not be acknowledged

Failure of system time switch

Number	*Text*	*Effect*
5101	System time switch failure 1	Time switch master missing or cannot be received. Nonurgent message; must not be acknowledged

Number	*Text*	*Effect*
5111	System time switch failure 2	Time switch master missing or cannot be received. Nonurgent message; must not be acknowledged
5121	System time switch failure 3	DHW time switch master missing or cannot be received. Nonurgent message; must not be acknowledged
5301	DHW system time switch failure	Time switch master missing or cannot be received. Nonurgent message; must not be acknowledged

1 time switch master per heating circuit

Number	*Text*	*Effect*
5102	>1 time switch in HC 1	More than one time switch master in the same geographical zone. Nonurgent message; must be acknowledged
5112	>1 time switch in HC 2	More than one time switch master in the same geographical zone. Nonurgent message; must be acknowledged
5122	>1 time switch in HC 3	More than one time switch master in the same geographical zone. Nonurgent message; must be acknowledged

Error with holiday / special day program

Number	*Text*	*Effect*
5201	Hol/spec day program failure	Holidays / special day program master is missing or cannot be received. Nonurgent message; must not be acknowledged
5202	>1 hol/spec day program	More than one holiday / special day program master. Nonurgent message; must be acknowledged

Error with DHW time switch

Number	*Text*	*Effect*
5301	DHW system time switch failure	DHW time switch master missing or cannot be received. Nonurgent message; must not be acknowledged
5302	>1 DHW time switch	More than one DHW time switch master. Nonurgent message; must be acknowledged

Room master and zone error in heating circuit 1

Number	*Text*	*Effect*
5401	Room master failure in HC 1	Room master for the room control combination is missing or cannot be received. Nonurgent message; must not be acknowledged

Number	*Text*	*Effect*
5402	>1 identical geogr zone [1]	More than one room master for plant 1 in the same geographical zone. Nonurgent message; must be acknowledged

Room master and zone error in heating circuit 2

Number	*Text*	*Effect*
5411	Room master failure in HC 2	Room master for the room control combination for plant 2 is missing or cannot be received. Nonurgent message; must not be acknowledged
5412	>1 identical geogr zone [2]	More than one room master for plant 2 in the same geographical zone. Nonurgent message; must be acknowledged

Room master and zone error in heating circuit 3

Number	*Text*	*Effect*
5421	Room master failure in HC 3	Room master for the room control combination for plant 3 is missing or cannot be received. Nonurgent message; must not be acknowledged
5422	>1 same geogr zone [3]	More than one room master for plant 3 in the same geographical zone. Nonurgent message; must be acknowledged

Addressing error

Number	*Text*	*Effect*
6001	>1 identical device address	More than one controller with the same device address. Urgent message; must be acknowledged

15 Fault tracing aids

If a fault is displayed, it is always practical to select operating line Faults > Faults current and look for any pending fault status messages before starting to rectify faults. In the event of a faulty extension module, that fault must always be rectified first since it may lead to consequential fault status messages.

For a detailed description of the display, the acknowledgement and the reset of faults, refer to chapter 13 “Function block faults”.

15.1 List of fault numbers

Number	*Name*	*For explanation, refer to section / subsection…*
0	No fault	
1	Plant ok	
2	Fault	
10	Outside temp sensor error 1	12.3.2
11	>1 outside temp sensor HC 1	12.3.2
12	Outside sensor 1 simul active	12.3.2
13	Outside temp sensor error 2	12.3.2
14	>1 outside temp sensor HC 2	12.3.2
15	Outside sensor 2 simul active	12.3.2
16	Outside temp sensor error 3	12.3.2
17	>1 outside temp sensor HC 3	12.3.2
18	Outside sensor 3 simul active	12.3.2
20	Solar intensity sensor error	12.3.2
21	>1 solar intensity sens in zone	12.3.2
30	Wind speed sensor error	12.3.2
31	>1 wind speed sensor in zone	12.3.2
40	Boiler sensor error	6.11
41	Boiler return sensor error	6.11
50	[HC 1] error flow sensor	9.11
51	[HC 1] return sensor error	9.11
52	[Heat circuit 3] flow sens error	9.11
53	[Heat circuit 3] return sens error	9.11
54	Main contr flow sens error	8.10
55	[HC 2] error flow sensor	9.11
56	[HC 2] error return sensor	9.11
57	Prim controller error flow sensor	8.10
58	Prim controller error ret sensor	8.10
59	Main contr return sens error	8.10
60	Room temp sensor error HC 1	9.11
61	>2 room sensors in heat circuit 1	9.11
65	Room temp sensor error HC 2	9.11
66	>2 room sensors in heat circuit 2	9.11
68	Room temp sensor error HC 3	9.11
69	>2 room sensors in heat circuit 3	9.11
71	DHW stor tank sensor top error	10.12
72	DHW stor tank sensor bott error	10.12

Number	*Name*	*For explanation, refer to section / subsection…*
74	DHW flow sensor primary error	10.12
75	DHW flow sensor sec error	10.12
76	DHW flow sensor cons error	10.12
77	DHW return sensor error	10.12
321	Flue gas temp sensor error	6.11
2101	Legionella protection error	10.12
2202	Main contr h'request mod error	8.10
2203	Prim contr h'request mod error	8.10
2301	Boiler burner fault	6.11
2311	Burner no checkback signal	6.11
2321	Boiler water shortage	6.11
2331	Boiler overpressure	6.11
2341	Boiler underpressure	6.11
2351	Shutoff valve no checkb signal	6.11
2361	Flue gas overtemperature	6.11
2371	Boiler test operation active	6.11
2401	[Boiler pump] overload	6.11
2411	[Boiler pump] no flow	6.11
2421	[Boiler pump B] overload	6.11
2431	[Boiler pump B] no flow	6.11
2441	[Boiler pump] fault	6.11
2491	[Main pump] overload	8.10
2492	[Main pump B] overload	8.10
2493	[Main pump] no flow	8.10
2494	[Main pump B] no flow	8.10
2495	[Main pump] fault	8.10
2501	[System pump] overload	8.10
2502	[System pump B] overload	8.10
2503	[System pump] no flow	8.10
2504	[System pump B] no flow	8.10
2505	[System pump] fault	8.10
2521	[Heat circuit 1 pump] overload	9.11
2522	[Heat circuit 1 pump B] overload	9.11
2523	[Heat circuit 1 pump] no flow	9.11
2524	[Heat circuit 1 pump B] no flow	9.11
2525	[Heat circuit 1 pump] fault	9.11
2531	[Heat circuit 2 pump] overload	9.11
2532	[Heat circuit 2 pump B] overload	9.11
2533	[Heat circuit 2 pump] no flow	9.11
2534	[Heat circuit 2 pump B] no flow	9.11
2535	[Heat circuit 2 pump] fault	9.11
2541	[Heat circuit 3 pump] overload	9.11
2542	[Heat circuit 3 pump B] overload	9.11
2543	[Heat circuit 3 pump] no flow	9.11
2544	[Heat circuit 3 pump B] no flow	9.11
2545	[Heat circuit 3 pump] fault	9.11
2551	[DHW primary pump] overload	10.12

Number	*Name*	*For explanation, refer to section / subsection…*
2552	[DHW primary pump B] overload	10.12
2553	[DHW prim pump] no flow	10.12
2554	[DHW prim pump B] no flow	10.12
2555	[DHW primary pump] fault	10.12
2561	[DHW sec pump] overload	10.12
2562	[DHW sec pump B] overload	10.12
2563	[DHW sec pump] no flow	10.12
2564	[DHW sec pump B] no flow	10.12
2565	[DHW sec pump] fault	10.12
2571	[DHW circ pump] overload	10.12
2572	[DHW circ pump B] overload	10.12
2573	[DHW circ pump] no flow	10.12
2574	[DHW circ pump B] no flow	10.12
2575	[DHW circ pump] fault	10.12
5000	No bus power supply	14.7
5001	System time failure	4.1.3
5002	>1 clock time master	4.1.3
5003	Invalid time of day	4.1.3
5101	System time switch failure 1	5.1.3
5102	>1 time switch in HC 1	5.1.3
5111	System time switch failure 2	5.1.3
5112	>1 time switch in HC 2	5.1.3
5121	System time switch failure 3	5.1.3
5122	>1 time switch in HC 3	5.1.3
5201	Hol/sp day prgm failure HC 1	5.2.6
5202	>1 hol/sp day prgm HC 1	5.2.6
5211	Hol/sp day prgm failure HC 2	5.2.6
5212	>1 hol/sp day prgm HC 2	5.2.6
5221	Hol/sp day prgm failure HC 3	5.2.6
5222	>1 hol/sp day prgm HC 3	5.2.6
5231	Hol/sp day prgm failure DHW	5.2.6
5232	>1 hol/sp day prgm DHW	5.2.6
5301	DHW system time switch failure	5.1.3
5302	>1 DHW time switch	5.1.3
5401	Room master failure in HC 1	9.11
5402	>1 identical geogr zone [1]	9.11
5411	Room master failure in HC 2	9.11
5412	>1 identical geogr zone [2]	9.11
5421	Room master failure in HC 3	9.11
5422	>1 same geogr zone [3]	9.11
5601	DHW plant type undefined	10.12
6001	>1 identical device address	14.7
7101	Fault extension module	3.2.6
7102	Fault extension module	3.2.6
7103	Fault extension module	3.2.6
7104	Fault extension module	3.2.6
9001	[Fault input 1] fault	13.8

Number	*Name*	*For explanation, refer to section / subsection…*
9002	[Fault input 2] fault	13.8
9003	[Fault input 3] fault	13.8
9004	[Fault input 4] fault	13.8
9401	No pulse signal meter 1	11.9
9402	No pulse signal meter 2	11.9
9403	No pulse signal meter 3	11.9
9404	No pulse signal meter 4	11.9

15.2 Troubleshooting

Question	*Reply*
E.g., fault status message [HC 1] error flow sensor appears although a sensor is connected	Check to see if error Fault extension module also occurred. This fault can bring consequential faults on the display
During commissioning, the wrong language was selected. How do I find “my” language?	1. Press simultaneously the ESC button and the OK knob. 2. Select the password level and enter number **112** as the password (same as international emergency call) and confirm by pressing the OK knob. The language changes to English. 3. Select your language from the Settings > Device > Language menu.
The controller is completely switched off and the display shows: Operation locked Remote operation How do I start the controller again?	Remote operation (OCI700.1) has set the controller to commissioning mode, which has disabled local operation. If the controller is not correctly restarted via remote operation, it will maintain this state. Locally, the controller can only be restarted by disconnecting it from power for a moment
The buttons on the QAW740 room unit do not work	On the controller, the room operating mode is overridden by a higher priority

16 Appendix

16.1 Configuration diagrams

Use

The use of the configuration diagrams is explained in subsection 3.2.4.

16.1.1 Terminal markings

The designations of the signal inputs and outputs and of the assigned connection terminals are structured as follows:

Example	*Explanation*
N.X3	N = controller RMH760B X3 = universal input
A9(2).Y1	A9 = type of extension module (2) = 2nd extension module of same type Y1 = analog output DC 0…10 V
N.Q5	N = controller RMH760B Q5 = relay output

16.1.2 Code letters

Uppercase letters

Physical inputs and outputs are identified by **uppercase** code letters:

Code letter	*Explanation*
N	Heating controller RMH760B
A2	Heating circuit module RMZ782B
A3	DHW module RMZ783B
A7	Universal module RMZ787
A9	Universal module RMZ789
X	Universal input
Q…	Switching load (changeover or NO contact)
Y	Analog output DC 0…10 V
3P	3-position output, pairs

Lowercase letters

Internal signals are identified by **lowercase** code letters:

Code letter	*Explanation*
x	Analog or digital
a	Analog
d	Digital
i	Pulse

16.1.3 Configuration choices

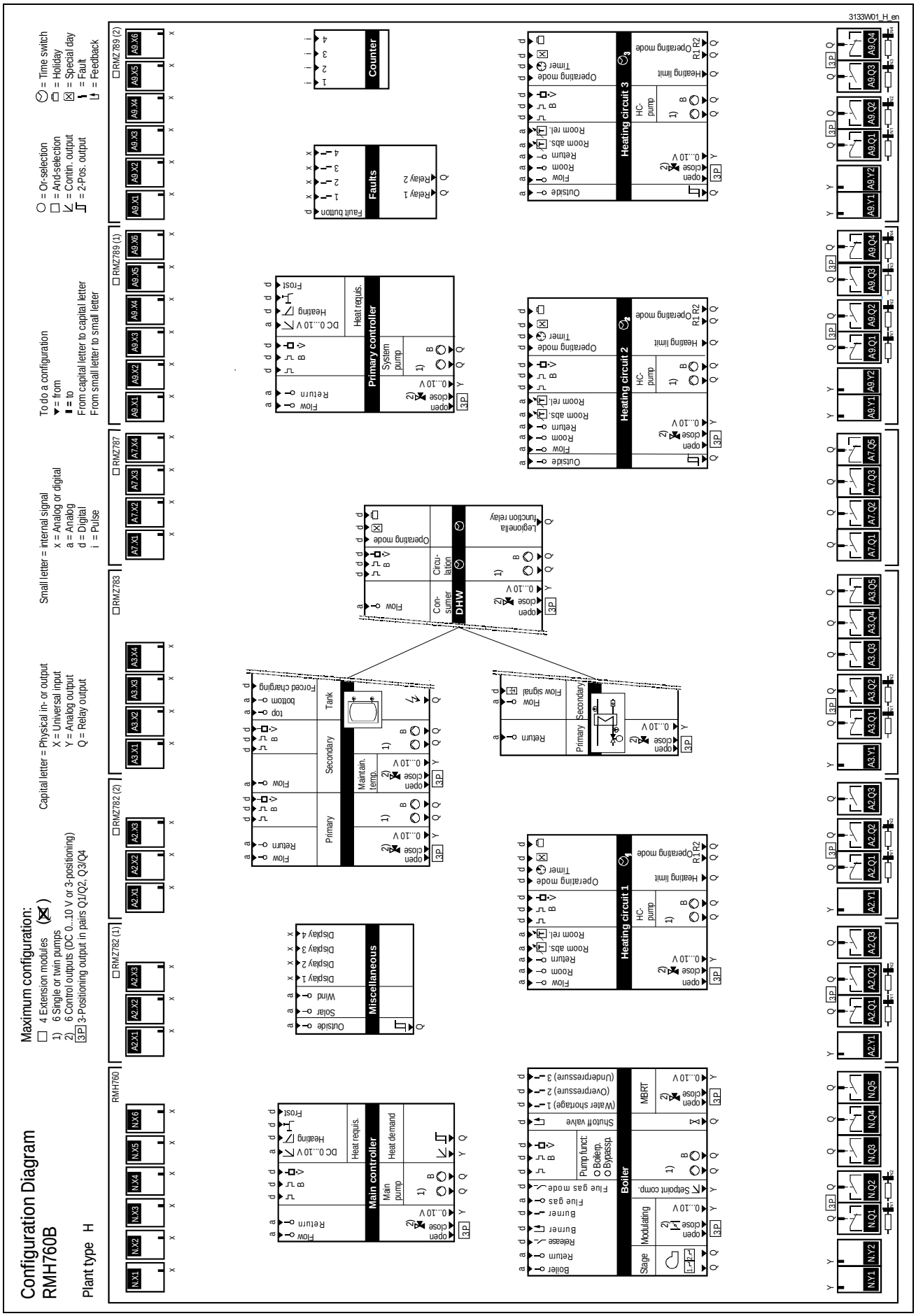
Available are a maximum of 4 extension modules, 6 single or twin pumps, and 6 positioning outputs. Configuration is always made as follows:

- From arrow ▼ to line ▌
- From uppercase to uppercase letter
- From lowercase to lowercase letter

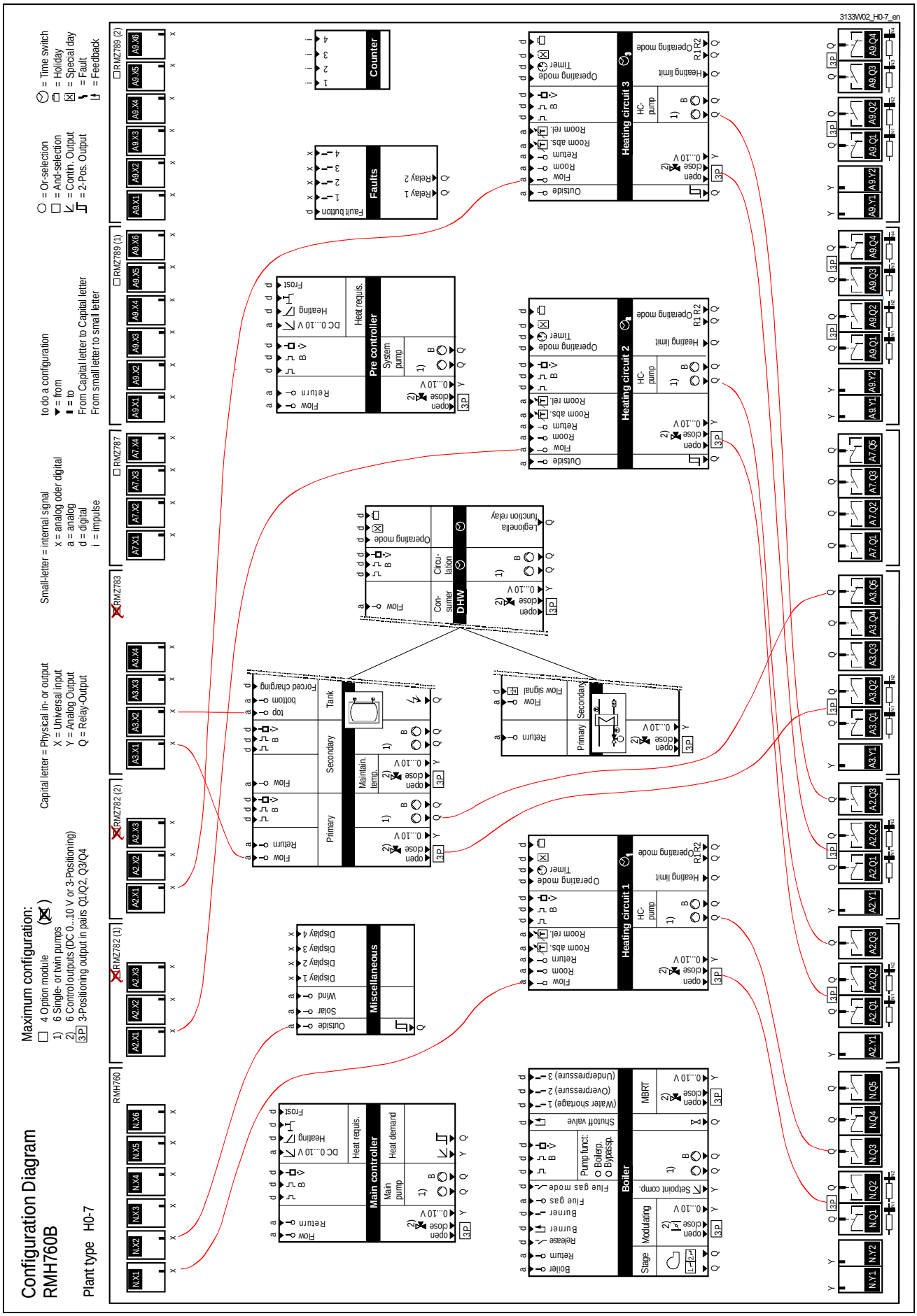
16.1.4 Examples

The following examples show the type of plant of each plant type group (H0, H0-x, H1-x, H2-x, etc.) that contains all possible plant sections (heating circuits, etc.).

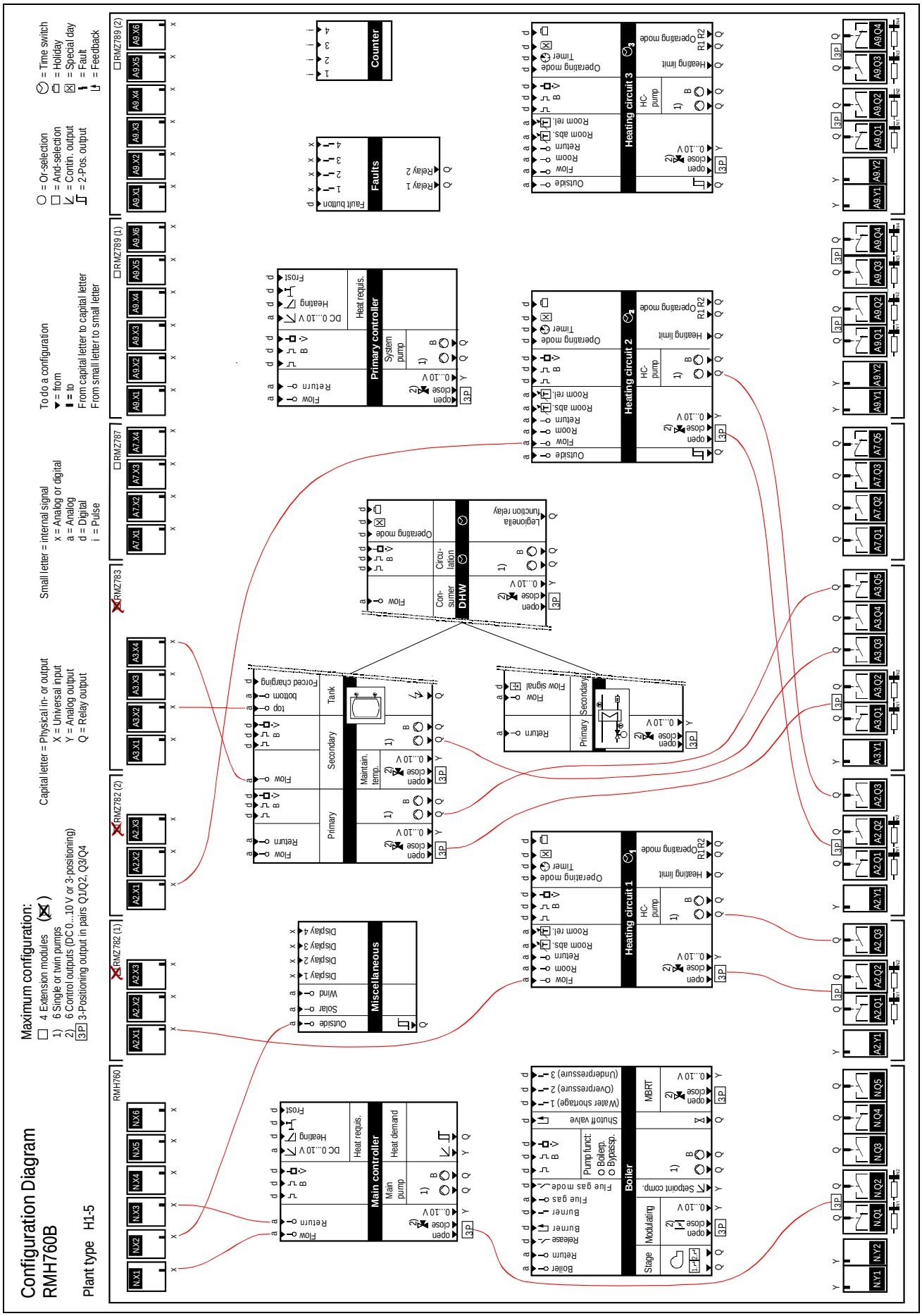
Basic type H


3133W01_H_en
Configuration Diagram
RMH760B
Plant type H
Maximum configuration:
4 Extension modules
1) 6 Single or twin pumps
2) 6 Control outputs (DC 0...10 V or 3-positioning)
3P 3-Positioning output in pairs Q1/Q2, Q3/Q4
Capital letter = Physical in- or output
X = Universal input
Y = Analog output
Q = Relay output
Small letter = internal signal
x = Analog or digital
a = Analog
d = Digital
i = Pulse
To do a configuration
▼= from
■ = to
From capital letter to capital letter
From small letter to small letter
○ = Or-selection
□ = And-selection
= Contin. output
= 2-Pos. output
= Time switch
= Holiday
= Special day
= Fault
= Feedback
RMH760
RMZ782 (1)
RMZ782 (2)
RMZ783
RMZ787
RMZ789 (1)
RMZ789 (2)
Main controller
Boiler
Miscellaneous
Primary
Secondary
Tank
DHW
Primary controller
Heating circuit 1
Heating circuit 2
Heating circuit 3
Faults
Counter

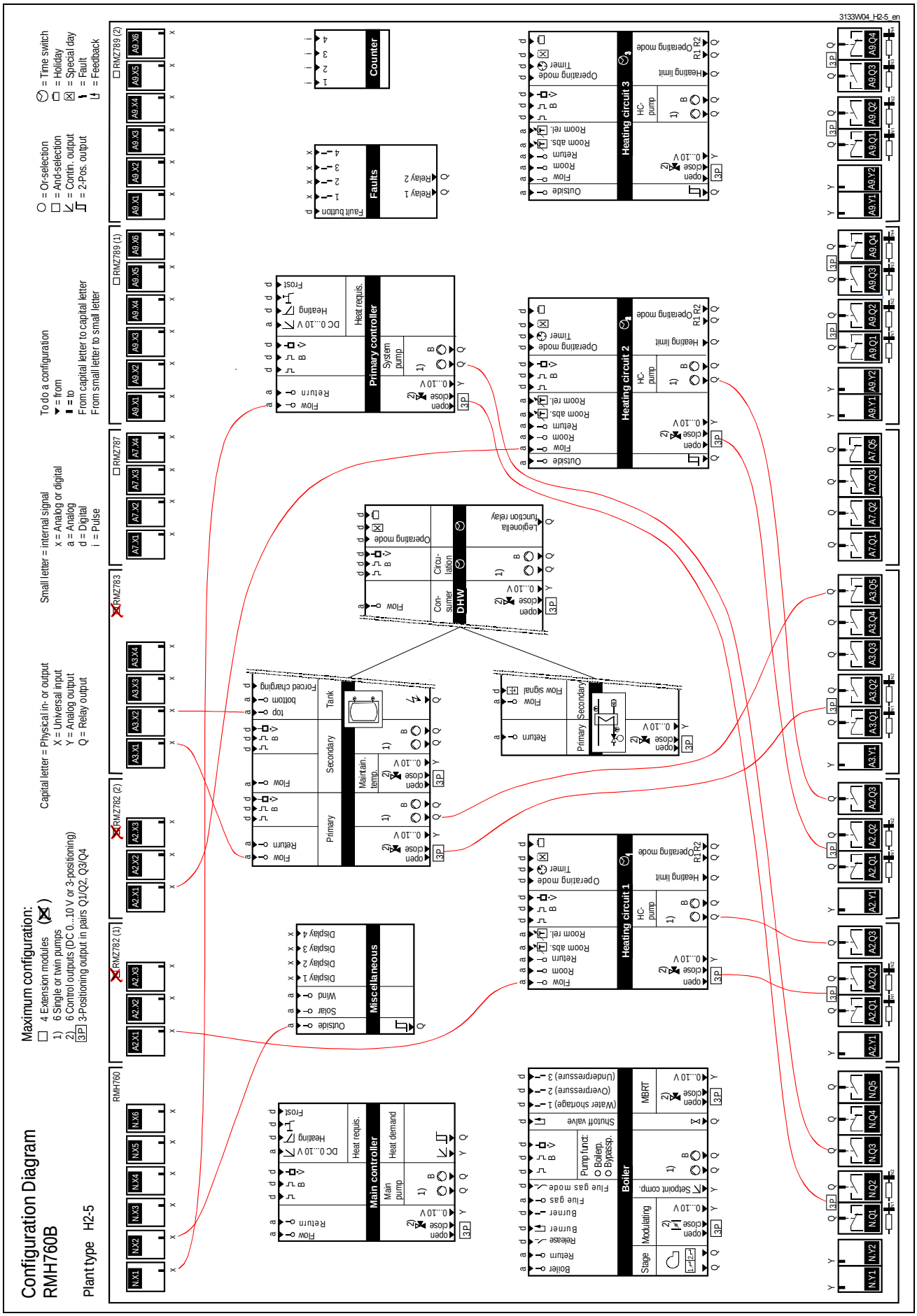
Plant type H0-7



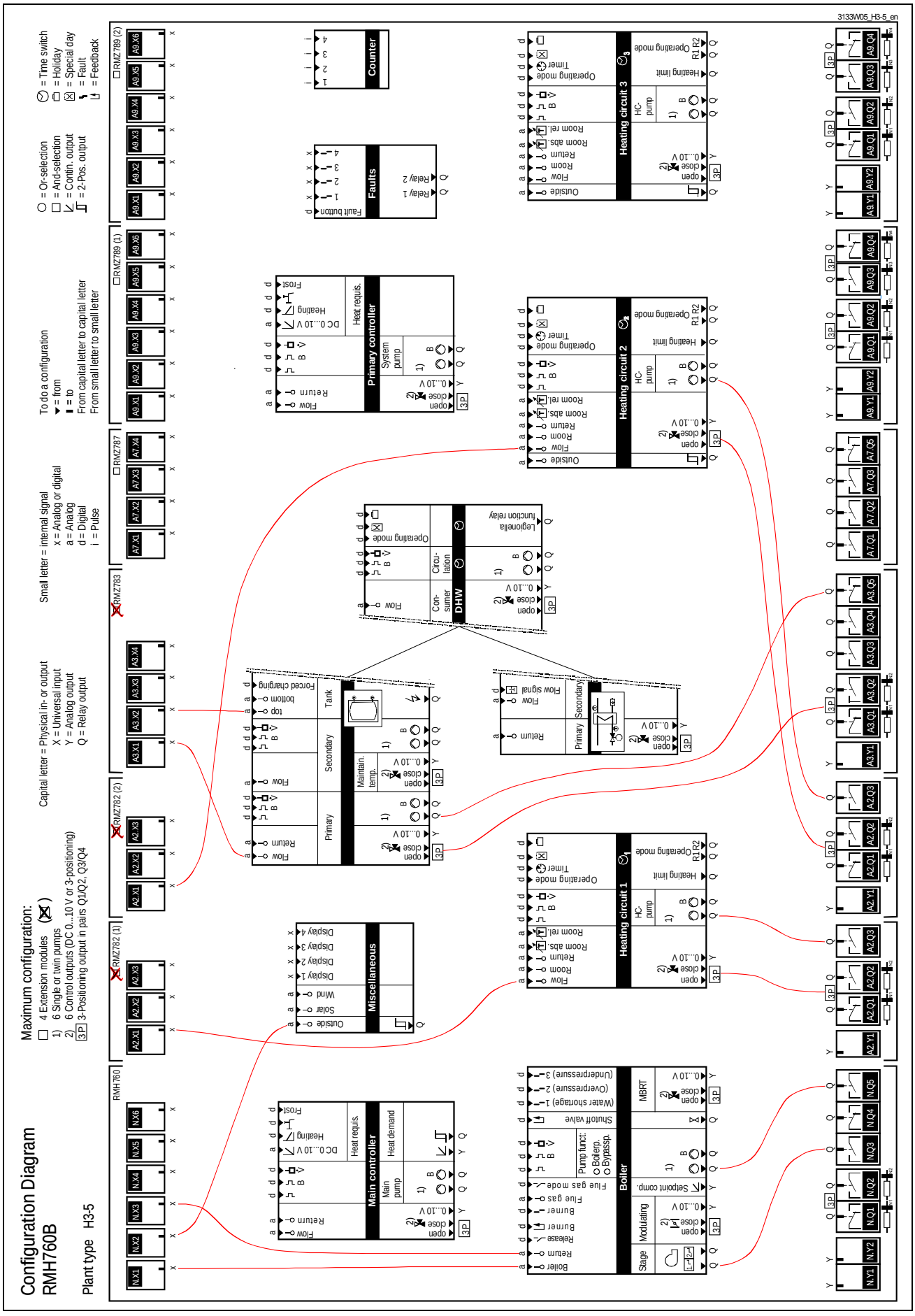
Plant type H1-5



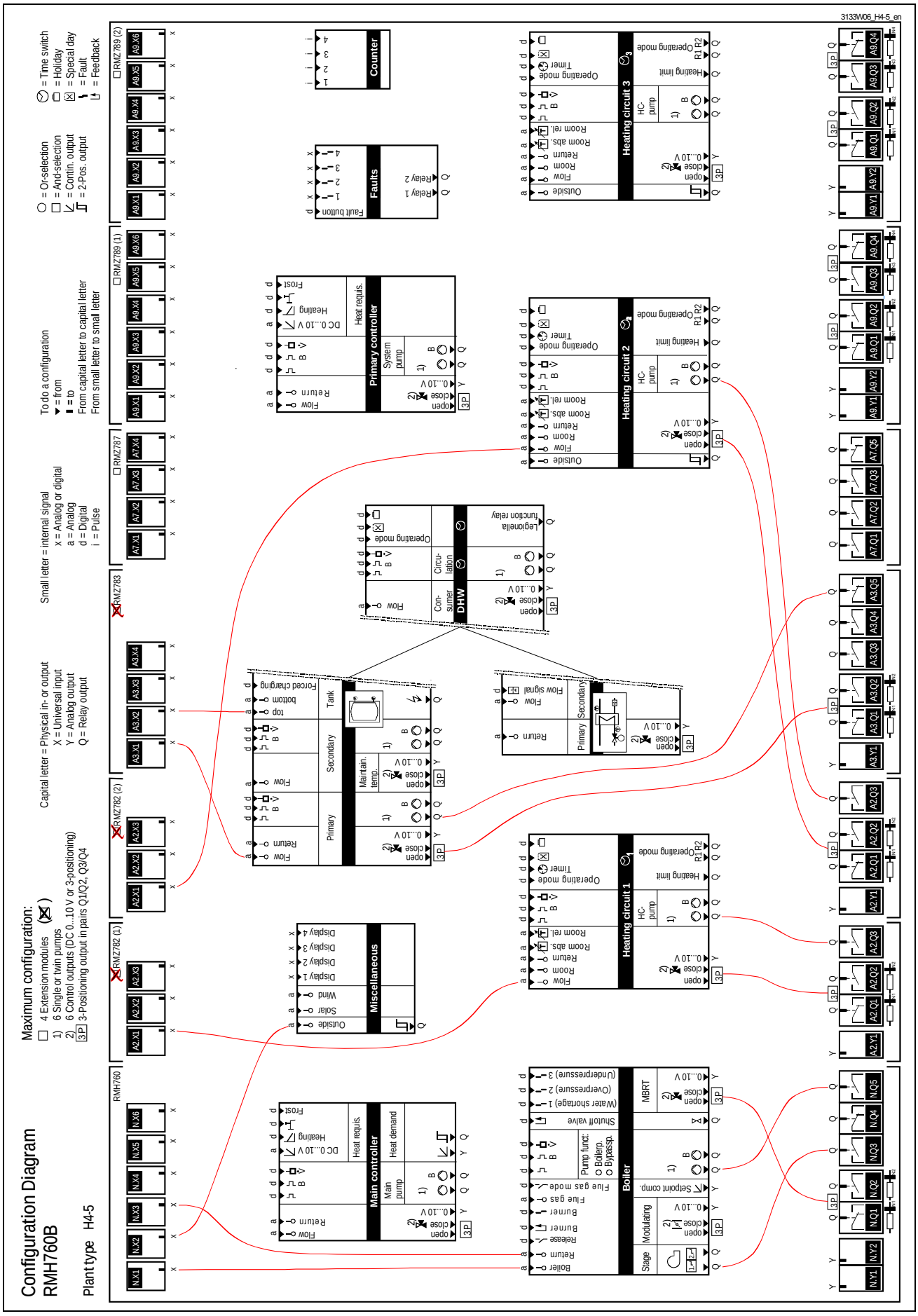
Plant type H2-5



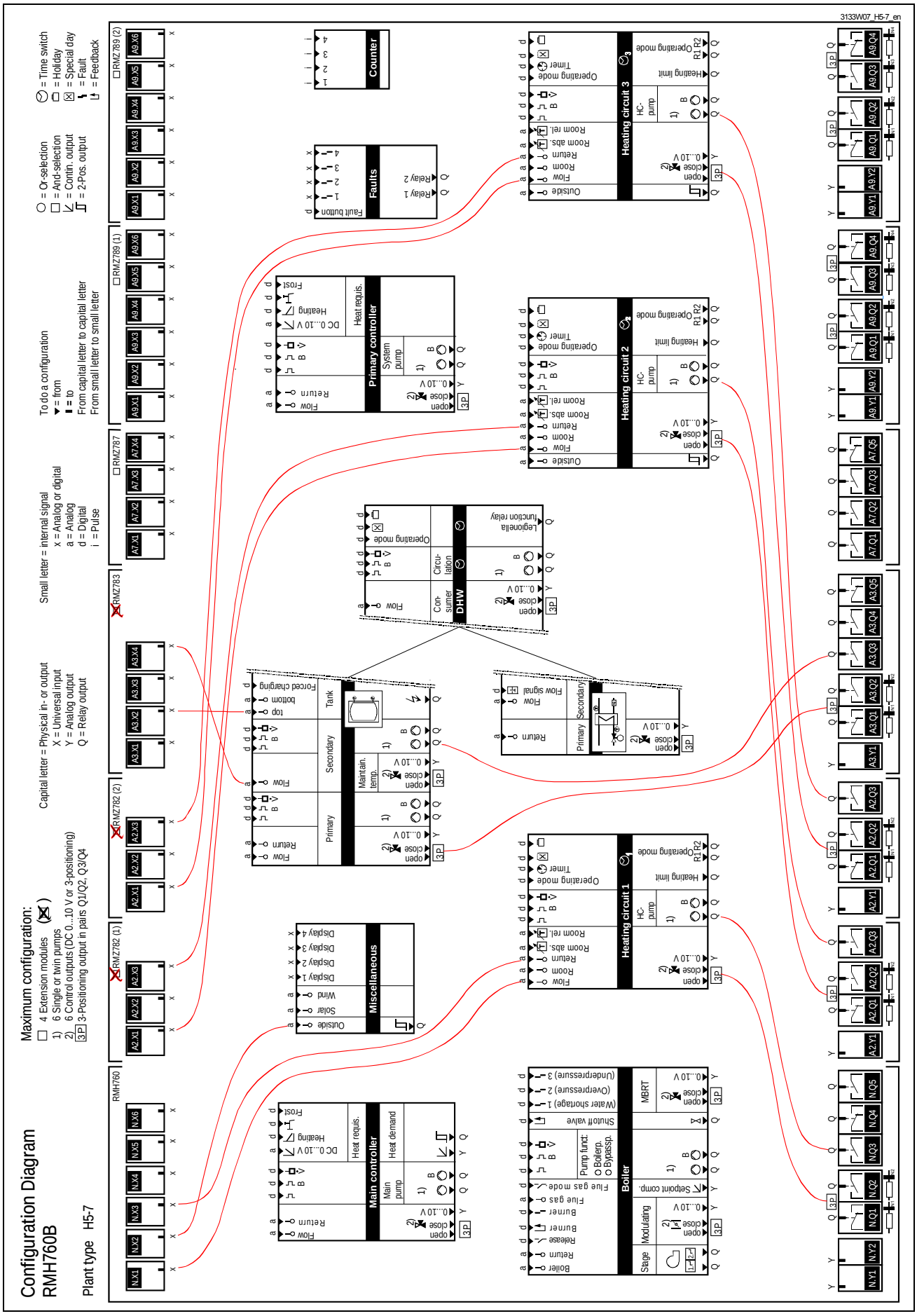
Plant type H3-5



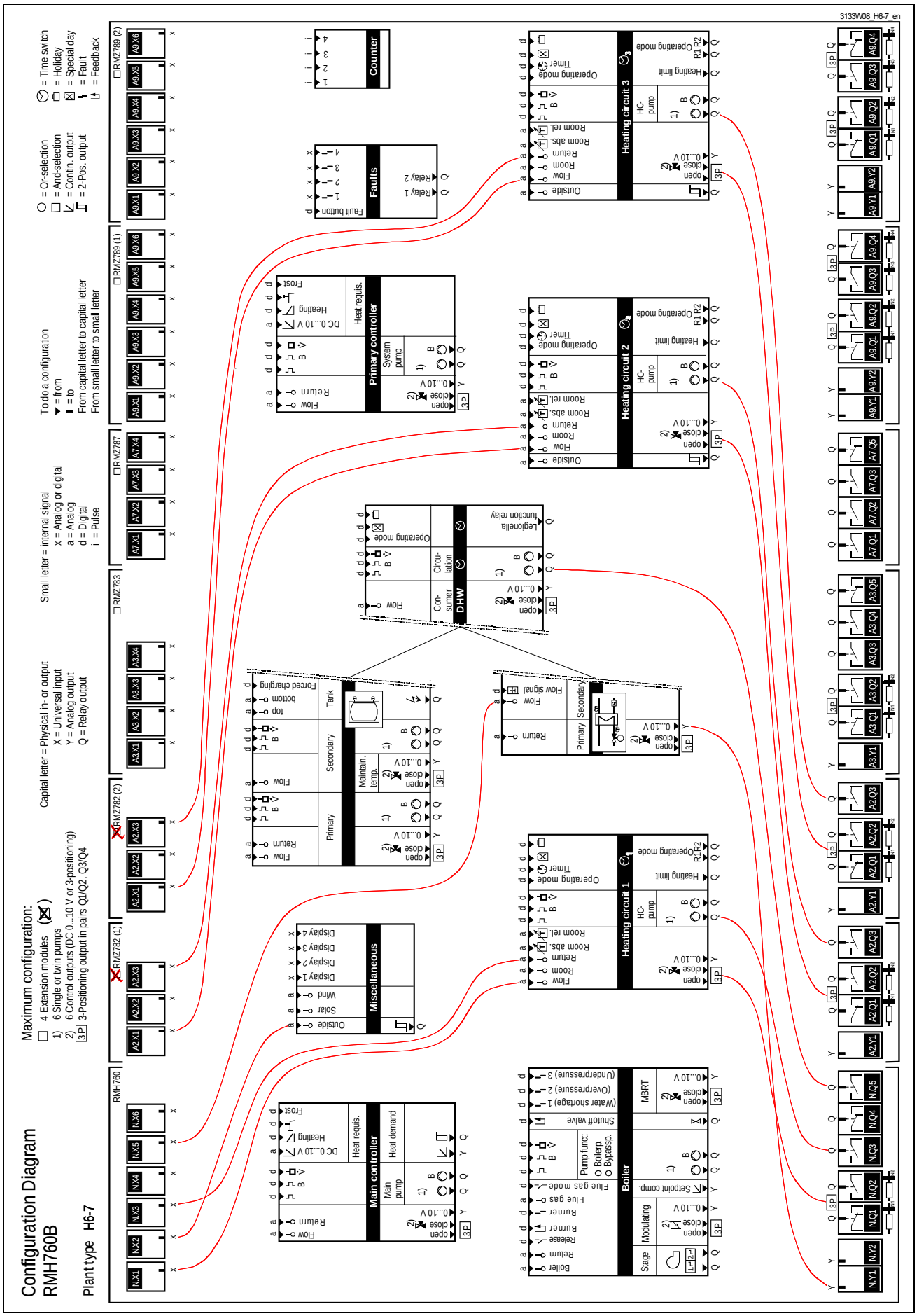
Plant type H4-5



Plant type H5-7



Plant type H6-7



16.2 Editable text

The list with editable text shall serve as an aid for engineering and commissioning.
Maximum length of the text is 20 characters.
On the password level, user text, such as menu text, fault text and datapoint text, can be reset as follows:

Main menu > Settings > Texts

Operating line	*Adjustable values / display / remarks*
Reset	No / Yes

Note

The text of “Device name“, “File name“ and “Business card line 1…4“ on the “Texts“ menu will not be deleted when making a reset.

16.2.1 Heating circuits

Main menu > Settings > Heating circuit 1 (or 2 or 3)

Name of datapoint	*User-defined text*
Heating circuit 1:	
Time switch 1:	
Heating circuit 2:	
Time switch 2:	
Heating circuit 3:	
Time switch 3:	

16.2.2 DHW

Main menu > Settings > DHW

Name of datapoint	*User-defined text*
DHW:	
DHW time switch:	
Circulating pump time switch:	

16.2.3 Primary controller

Main menu > Settings > Primary controller

Name of data point	*User-defined text*
Primary controller:	

16.2.4 Main controller

Main menu > Settings > Main controller

Name of datapoint	*User-defined text*
Main controller:	

16.2.5 Boiler

Main menu > Settings > Boiler

Name of datapoint	*User-defined text*
Boiler:	

Main menu > Settings > Boiler > Fault settings > Fault input 1 (or 2 or 3)

Name of datapoint	*User-defined text*
Fault text:	
Fault text:	
Fault text:	

16.2.6 Faults

Main menu > Settings > Faults > Fault input 1 (or 2, 3 or 4)

Name of datapoint	*User-defined text*
Fault text 1:	
Fault text 2:	
Fault text 3:	
Fault text 4:	

16.2.7 Meters

Main menu > Settings > Data acquisition > Meter 1 (or 2, 3 or 4)

Name of datapoint	*User-defined text*
Meter 1:	
Meter 2:	
Meter 3:	
Meter 4:	

16.2.8 Device

Main menu > Settings > Texts

Name of datapoint	*User-defined text*
Device name	
File name:	
Display input 1:	
Display input 2:	
Display input 3:	
Display input 4:	
Business card line 1:	
Business card line 2:	
Business card line 3:	
Business card line 4:	

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